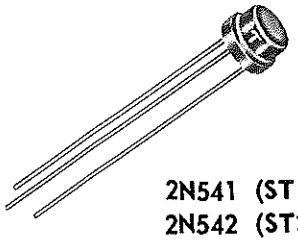
Transitron NPN SILICON TRANSISTORS

HIGH GAIN TYPES (80-200)



2N541 (ST14)
2N542 (ST34)
2N543 (ST44)

200 MILLIWATTS

Transitron's high gain NPN silicon transistors are designed for low level signal applications up to 200 °C.

High temperature reliability is insured through close process control which results in a stable and low I_{co} up to the maximum voltage rating. Extensive temperature cycling and storage, as well as mechanical and hermetic seal tests, are included as a regular part of the manufacturing process.

ABSOLUTE MAXIMUM RATINGS

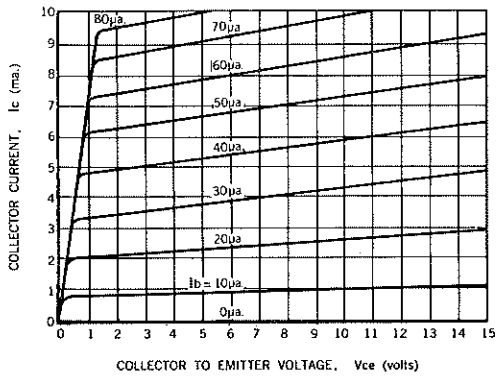
		2N541	2N542	2N543	
Collector to Emitter Voltage	V_{CE}	15	30	45	Volts
Collector to Base Voltage	V_{CB}	15	30	45	Volts
Emitter to Base Voltage	V_{EB}	2	2	2	Volts
Total Power Dissipation	at 25 °C ambient	200	200	200	mw
	at 150 °C ambient	60	60	60	mw
Storage and Operating Ambient Temperature Range			−65 to +200 °C		

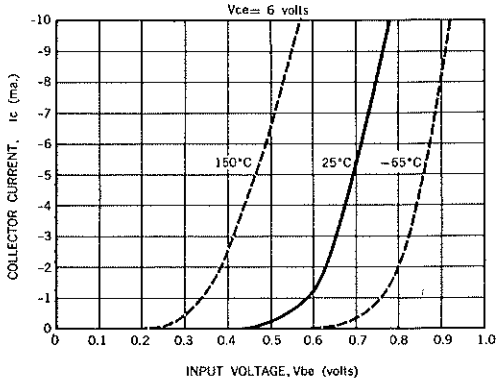
SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25 °C

Common Emitter Parameters:		Min	Typical	Max	
Current Gain at 1 Kc	h_{fe}	80	130	200	
Current Gain at 1 Mc	h_{fe}	10	15		
Power Gain ①	P.G.		41		db
Noise Figure ①	N.F.		19		db
Common Base Parameters:					
Collector Cutoff Current, I_{CO}, at Rated Max. V_{CB}	at 25 °C		.02	0.5	μa
	at 150 °C		10	50	μa
Collector Cutoff Current, I_{CO} at V_{CB} = 6 volts	at 25 °C		.005		μa
	at 150 °C		6		μa
Emitter Cutoff Current, at V_{EB} = 2 volts	I_{EO}		.01	0.5	μa
Input Impedance	h_{ib}	30	55	90	ohms
Output Admittance	h_{ob}	0.1	0.3	1.5	μmhos
Voltage Feedback Ratio	h_{rb}		6.0		x10−4
Output Capacitance at 1 Mc	C_{ob}		7	20	μμf
D.C. Collector Saturation Resistance	R_{cs}		150	300	ohms

① R_S = 1000 ohms, R_L = 30K, f = 1 Kc. NOTE: Small signal parameters measured at V_c = 6V, I_e = −1 ma

TYPICAL COMMON EMITTER CHARACTERISTICS

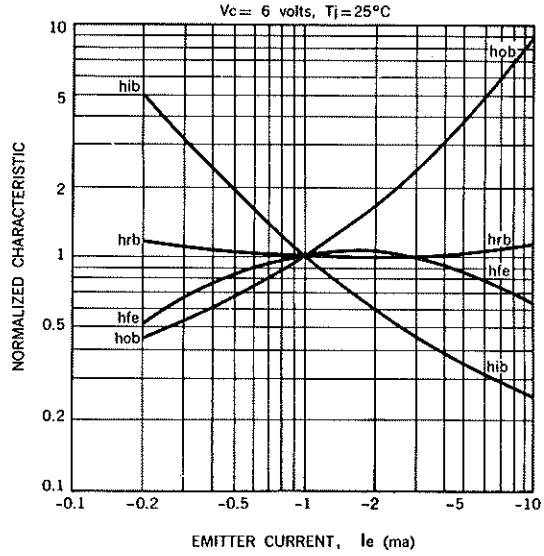




TE-1353A
7-58

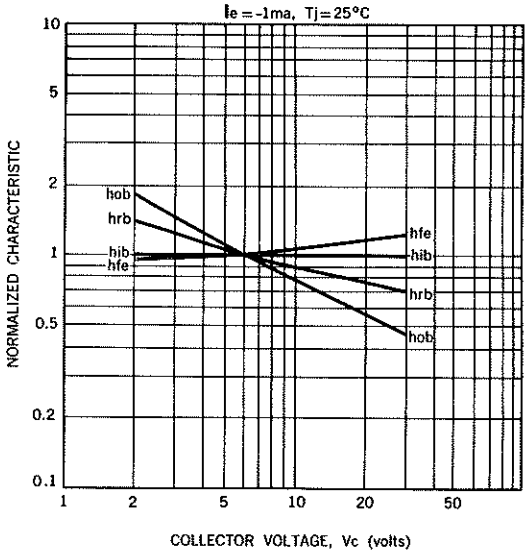
SMALL SIGNAL CHARACTERISTICS vs. EMITTER CURRENT

Vc = 6 volts, Tj = 25°C



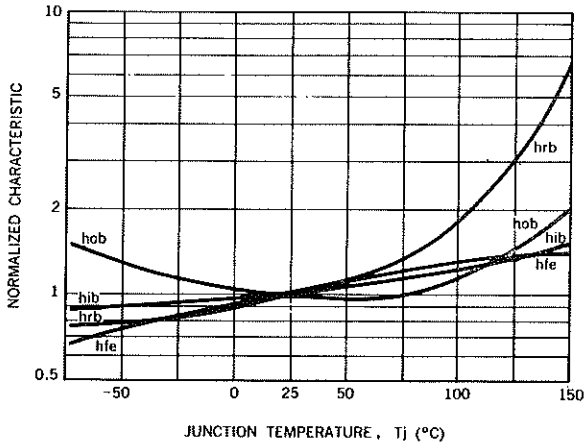
SMALL SIGNAL CHARACTERISTICS vs. COLLECTOR VOLTAGE

Ie = -1ma, Tj = 25°C



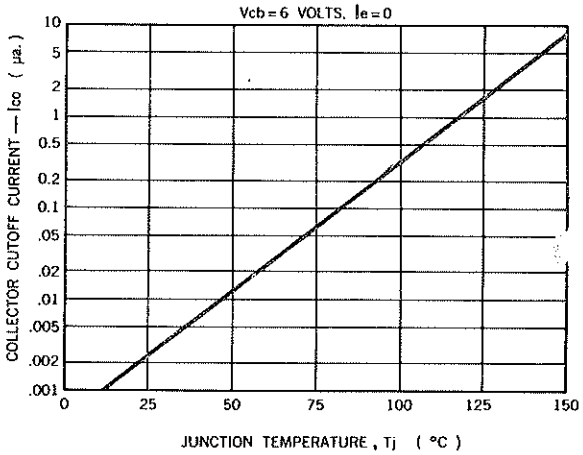
SMALL SIGNAL CHARACTERISTICS vs. TEMPERATURE

Vc = 6 VOLTS, Ie = -1ma.

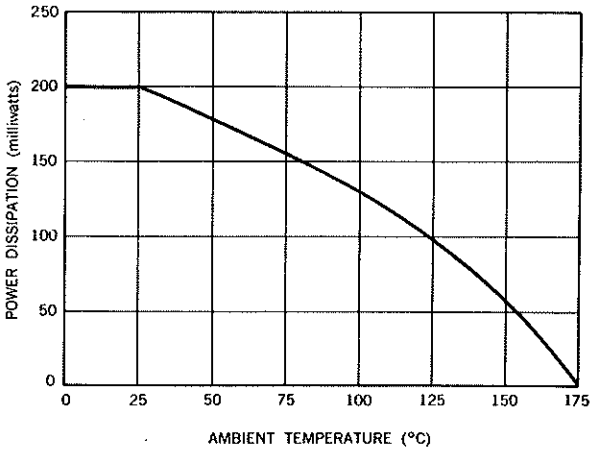


COLLECTOR CUTOFF CURRENT vs. JUNCTION TEMPERATURE

Vcb = 6 VOLTS, Ie = 0

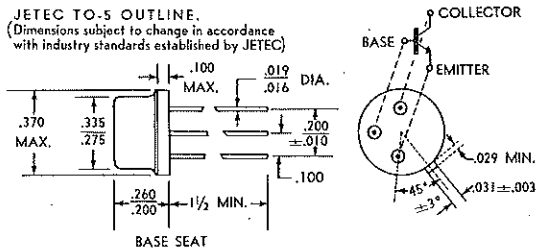


POWER DISSIPATION vs. AMBIENT TEMPERATURE



MECHANICAL DATA

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)



ENCAPSULATION: Welded hermetic seal.

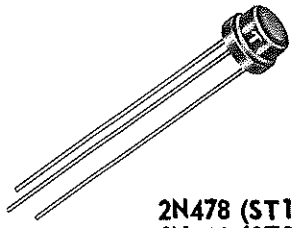
MOUNTING POSITION: Any.

NOTE: Case isolated from all leads.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

Transitron NPN SILICON TRANSISTORS

MEDIUM GAIN TYPES (40-100)



2N478 (ST12)
2N479 (ST32)
2N480 (ST42)

200 MILLIWATTS

Transitron's medium gain NPN silicon transistors are designed for low level signal applications up to 200 °C.

High temperature reliability is insured through close process control which results in a stable and low I_{co} up to the maximum voltage rating. Extensive temperature cycling and storage, as well as mechanical and hermetic seal tests, are included as a regular part of the manufacturing process.

ABSOLUTE MAXIMUM RATINGS

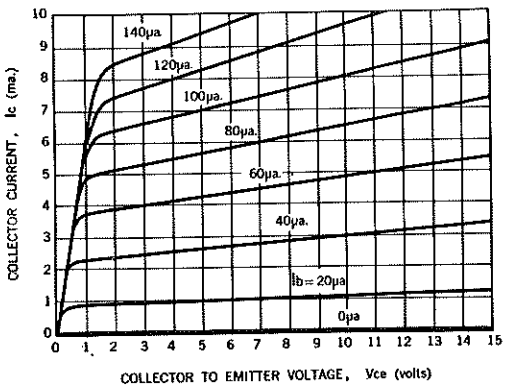
		2N478	2N479	2N480	
Collector to Emitter Voltage	V_{CE}	15	30	45	Volts
Collector to Base Voltage	V_{CB}	15	30	45	Volts
Emitter to Base Voltage	V_{EB}	2	2	2	Volts
Total Power Dissipation	at 25 °C ambient	200	200	200	mw
	at 150 °C ambient	60	60	60	mw
Storage and Operating Ambient Temperature Range			−65 to +200 °C		

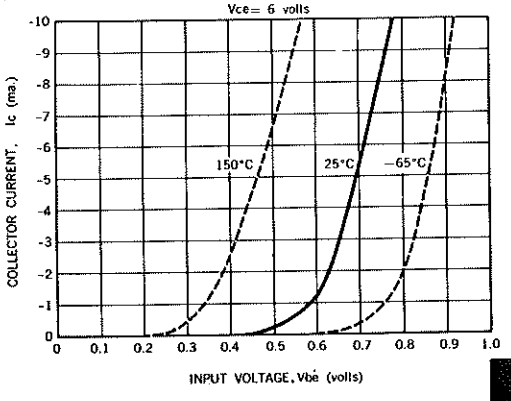
SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25 °C

		Min	Typical	Max	
Common Emitter Parameters:					
Current Gain at 1 Kc	h_{fe}	40	60	100	
Current Gain at 1 Mc	h_{fe}	8	11		
Power Gain (1)	P.G.		40		db
Noise Figure (1)	N.F.		19		db
Common Base Parameters:					
Collector Cutoff Current, I_{CO}, at Rated Max. V_{CB}	at 25 °C		.02	0.5	μa
	at 150 °C		10	50	μa
Collector Cutoff Current, I_{CO} at V_{CB} = 6 volts	at 25 °C		.005		μa
	at 150 °C		6		μa
Emitter Cutoff Current, at V_{EB} = 2 volts	I_{EO}		.01	0.5	μa
Input Impedance	h_{ib}	30	60	90	ohms
Output Admittance	h_{ob}	0.1	0.4	1.5	μmhos
Voltage Feedback Ratio	h_{rb}		5.0		x10−4
Output Capacitance at 1 Mc	C_{ob}		7	20	μμf
D.C. Collector Saturation Resistance	R_{cs}		150	300	ohms

(1) R_s = 1000 ohms, R_L = 30K, f = 1 Kc. NOTE: Small signal parameters measured at V_c = 6V, I_e = −1 ma

TYPICAL COMMON EMITTER CHARACTERISTICS

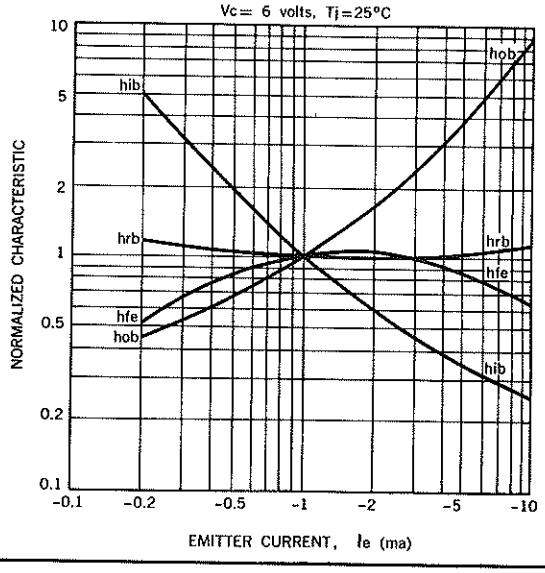




TE-1353B
7-58

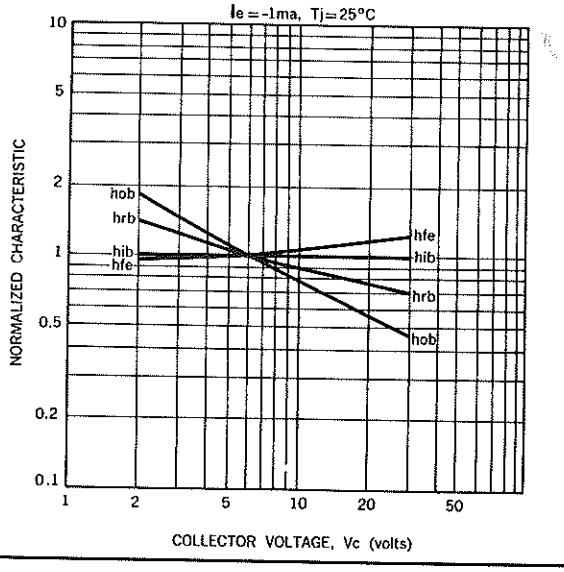
SMALL SIGNAL CHARACTERISTICS vs. EMITTER CURRENT

Vc= 6 volts, Tj=25°C



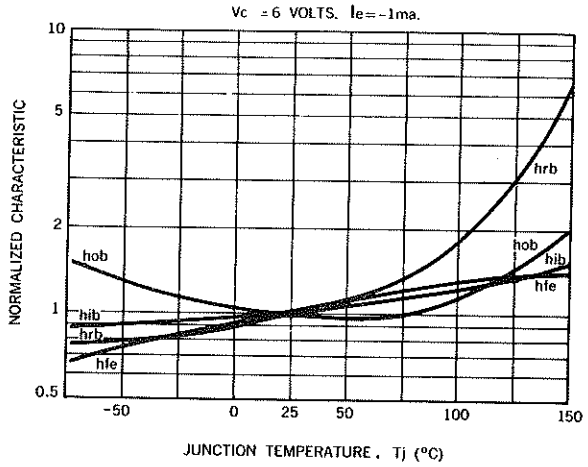
SMALL SIGNAL CHARACTERISTICS vs. COLLECTOR VOLTAGE

Ie=-1ma, Tj=25°C



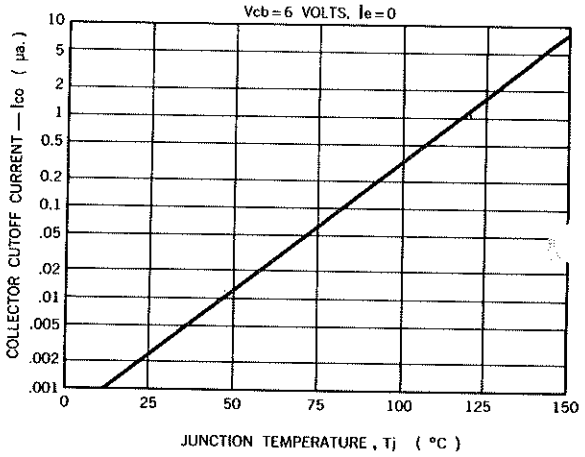
SMALL SIGNAL CHARACTERISTICS vs. TEMPERATURE

Vc =6 VOLTS, Ie=-1ma.

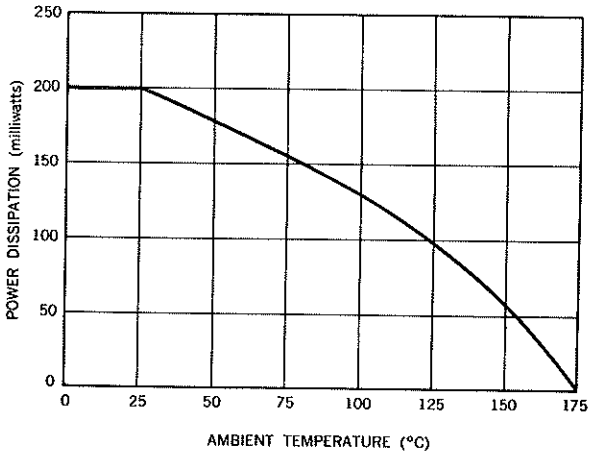


COLLECTOR CUTOFF CURRENT vs. JUNCTION TEMPERATURE

Vcb=6 VOLTS, Ie=0

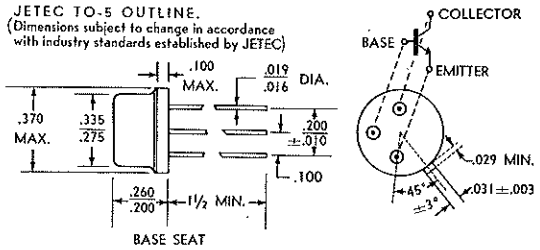


POWER DISSIPATION vs. AMBIENT TEMPERATURE



MECHANICAL DATA

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)



ENCAPSULATION: Welded hermetic seal.

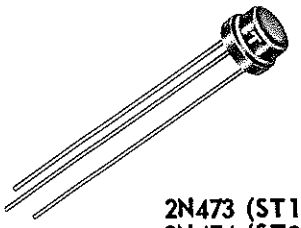
MOUNTING POSITION: Any.

NOTE: Case isolated from all leads.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

Transitron NPN SILICON TRANSISTORS

MEDIUM GAIN TYPES (20-50)



2N473 (ST11)
2N474 (ST31)
2N475 (ST41)

200 MILLIWATTS

Transitron's medium gain NPN silicon transistors are designed for low level signal applications up to 200 °C.

High temperature reliability is insured through close process control which results in a stable and low I_{co} up to the maximum voltage rating. Extensive temperature cycling and storage, as well as mechanical and hermetic seal tests, are included as a regular part of the manufacturing process.

ABSOLUTE MAXIMUM RATINGS

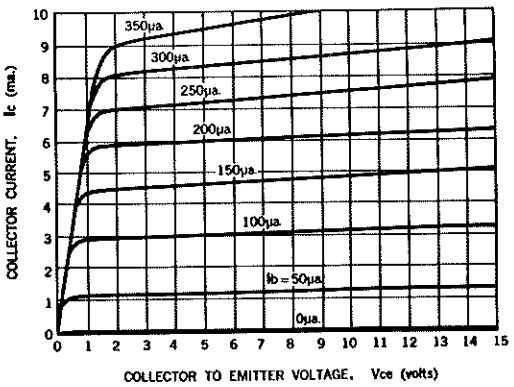
		2N473	2N474	2N475	
Collector to Emitter Voltage	V_{CE}	15	30	45	Volts
Collector to Base Voltage	V_{CB}	15	30	45	Volts
Emitter to Base Voltage	V_{EB}	2	2	2	Volts
Total Power Dissipation	at 25 °C ambient	200	200	200	mw
	at 150 °C ambient	60	60	60	mw
Storage and Operating Ambient Temperature Range			−65 to +200 °C		

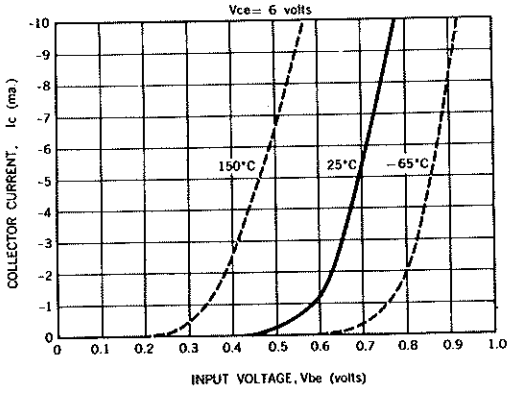
SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25 °C

		Min	Typical	Max	
Common Emitter Parameters:					
Current Gain at 1 Kc	h_{fe}	20	30	50	
Current Gain at 1 Mc	h_{fe}	8	10		
Power Gain (1)	P.G.		39		db
Noise Figure (1)	N.F.		20		db
Common Base Parameters:					
Collector Cutoff Current, I_{CO}, at Rated Max. V_{CB}	at 25 °C		.02	0.5	μa
	at 150 °C		10	50	μa
Collector Cutoff Current, I_{CO} at V_{CB} = 6 volts	at 25 °C		.005		μa
	at 150 °C		6		μa
Emitter Cutoff Current at V_{EB} = 2 volts	I_{EO}		.01	0.5	μa
Input Impedance	h_{ib}	30	60	90	ohms
Output Admittance	h_{ob}	0.1	0.5	1.5	μmhos
Voltage Feedback Ratio	h_{rb}		4.0		x10−4
Output Capacitance at 1 Mc	C_{ob}		7	20	μμf
D.C. Collector Saturation Resistance	R_{cs}		150	300	ohms

(1) R_S = 1000 ohms, R_L = 30K, f = 1 Kc. NOTE: Small signal parameters measured at V_c = 6V, I_e = −1 ma

TYPICAL COMMON EMITTER CHARACTERISTICS

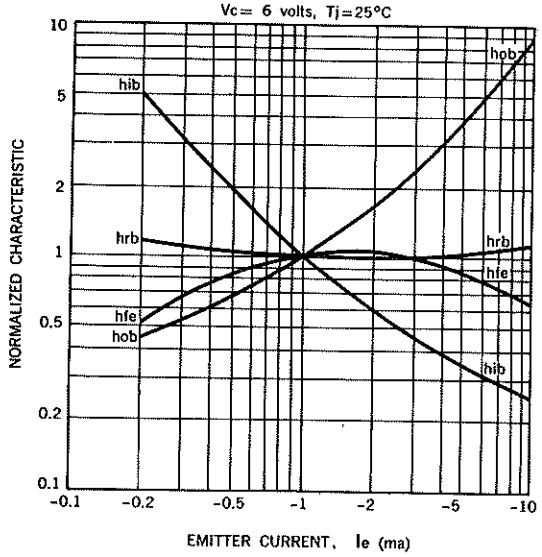




TE-1353C
7-58

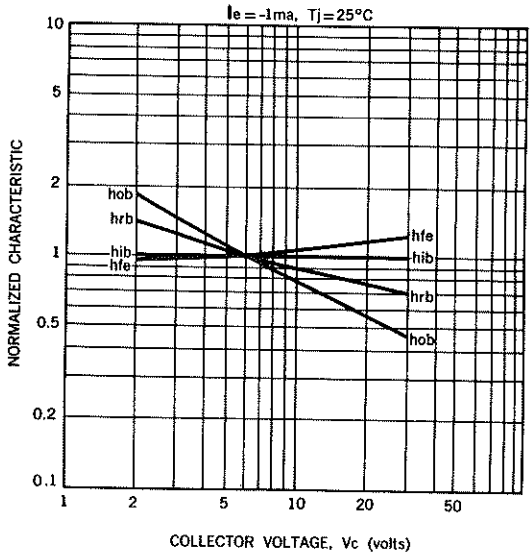
SMALL SIGNAL CHARACTERISTICS vs. EMITTER CURRENT

Vc = 6 volts, Tj = 25°C



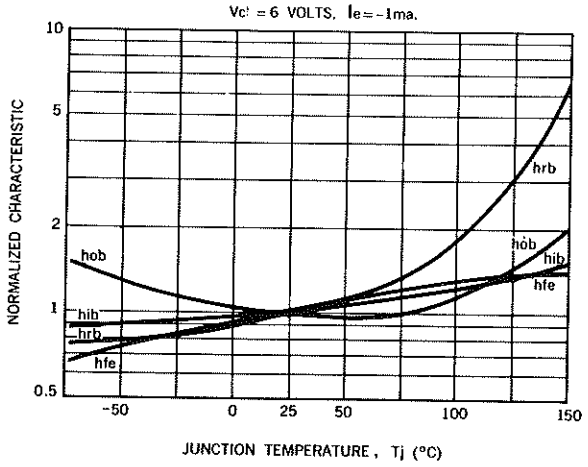
SMALL SIGNAL CHARACTERISTICS vs. COLLECTOR VOLTAGE

Ie = -1ma, Tj = 25°C



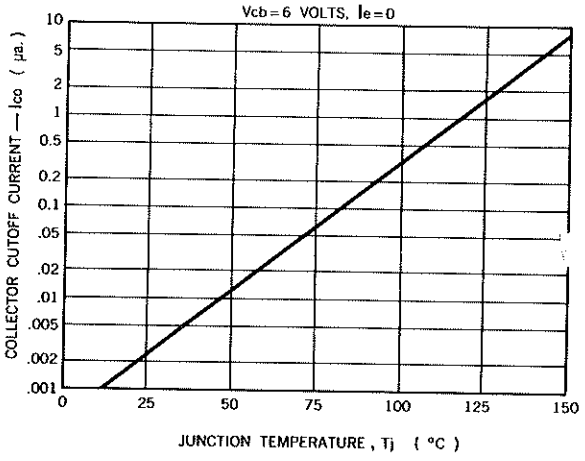
SMALL SIGNAL CHARACTERISTICS vs. TEMPERATURE

Vc = 6 VOLTS, Ie = -1ma.

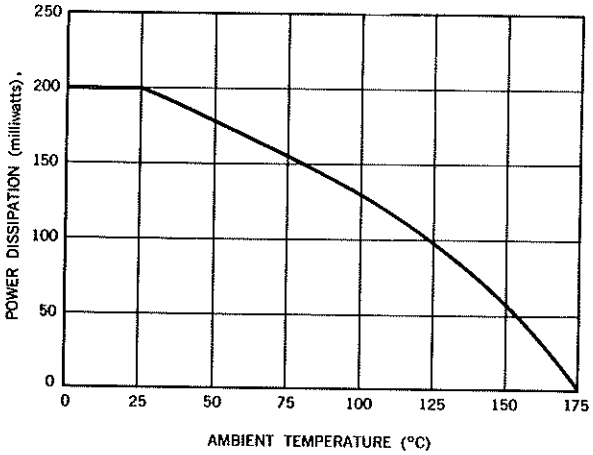


COLLECTOR CUTOFF CURRENT vs. JUNCTION TEMPERATURE

Vcb = 6 VOLTS, Ie = 0

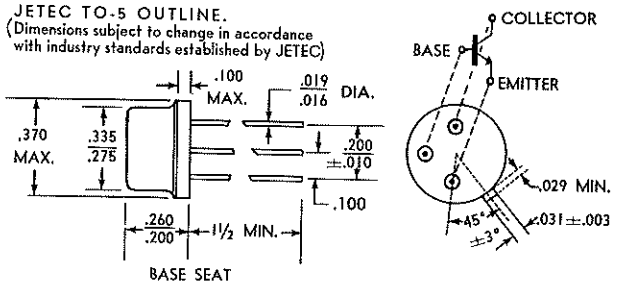


POWER DISSIPATION vs. AMBIENT TEMPERATURE



MECHANICAL DATA

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)



ENCAPSULATION: Welded hermetic seal.

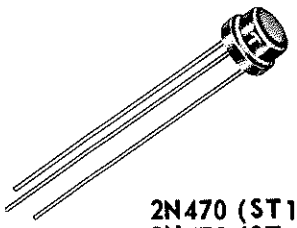
MOUNTING POSITION: Any.

NOTE: Case isolated from all leads.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

Transitron NPN SILICON TRANSISTORS

GENERAL PURPOSE TYPES



2N470 (ST10)
2N471 (ST30)
2N472 (ST40)

200 MILLIWATTS

Transitron's general purpose NPN silicon transistors are designed for low level signal applications up to 200 °C.

High temperature reliability is insured through close process control which results in a stable and low I_{CO} up to the maximum voltage rating. Extensive temperature cycling and storage, as well as mechanical and hermetic seal tests, are included as a regular part of the manufacturing process.

ABSOLUTE MAXIMUM RATINGS

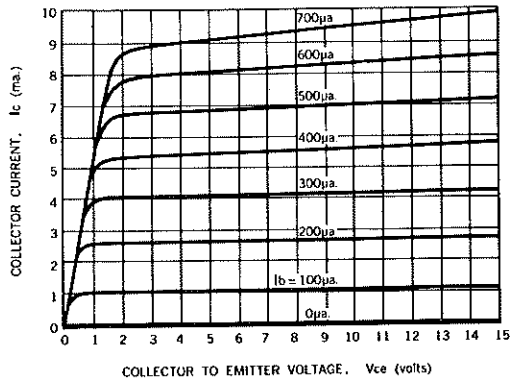
		2N470	2N471	2N472	
Collector to Emitter Voltage	V_{CE}	15	30	45	Volts
Collector to Base Voltage	V_{CB}	15	30	45	Volts
Emitter to Base Voltage	V_{EB}	2	2	2	Volts
Total Power Dissipation	at 25 °C ambient	200	200	200	mw
	at 150 °C ambient	60	60	60	mw
Storage and Operating Ambient Temperature Range			−65 to +200 °C		

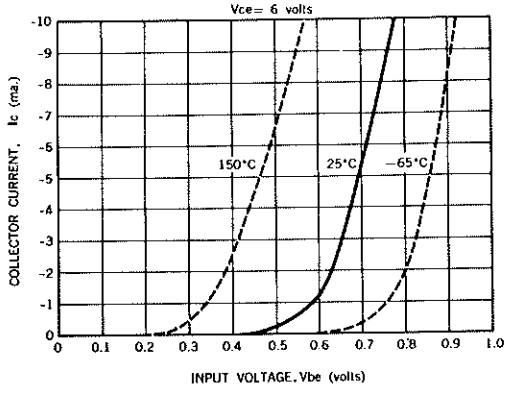
SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25 °C

		Min	Typical	Max	
Common Emitter Parameters:					
Current Gain at 1 Kc	h_{fe}	10	16	25	
Current Gain at 1 Mc	h_{fe}	4	8		
Power Gain (1)	P.G.		37		db
Noise Figure (1)	N.F.		22		db
Common Base Parameters:					
Collector Cutoff Current, I_{CO}, at Rated Max. V_{CB}	at 25 °C		.02	0.5	μa
	at 150 °C		10	50	μa
Collector Cutoff Current, I_{CO} at V_{CB} = 6 volts	at 25 °C		.005		μa
	at 150 °C		6		μa
Emitter Cutoff Current at V_{EB} = 2 volts	I_{EO}		.01	0.5	μa
Input Impedance	h_{ib}	30	65	90	ohms
Output Admittance	h_{ob}	0.1	0.6	1.5	μmhos
Voltage Feedback Ratio	h_{rb}		3.0		x10−4
Output Capacitance at 1 Mc	C_{ob}		7	20	μμf
D.C. Collector Saturation Resistance	R_{cs}		150	300	ohms

(1) R_S = 1000 ohms, R_L = 30K, f = 1 Kc. NOTE: Small signal parameters measured at V_c = 6V, I_e = −1 ma

TYPICAL COMMON EMITTER CHARACTERISTICS

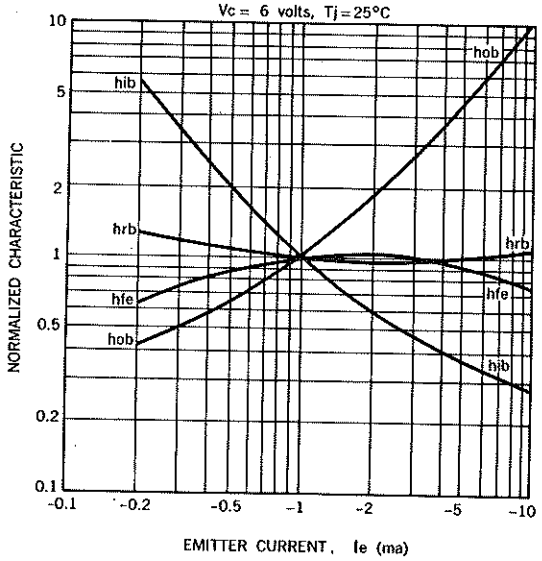




TE-1353D
7-58

SMALL SIGNAL CHARACTERISTICS vs. EMITTER CURRENT

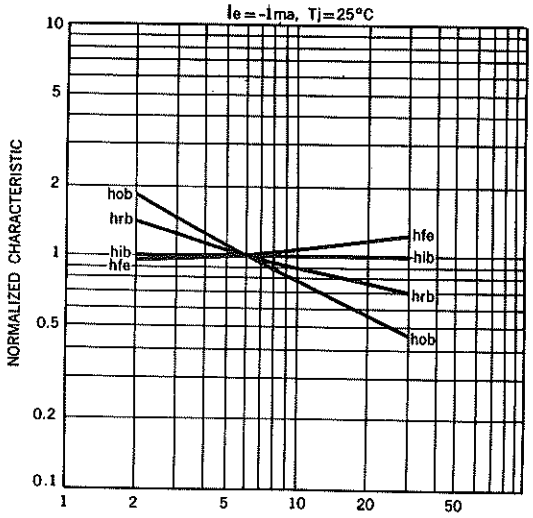
Vc = 6 volts, Tj = 25°C



EMITTER CURRENT, Ie (ma)

SMALL SIGNAL CHARACTERISTICS vs. COLLECTOR VOLTAGE

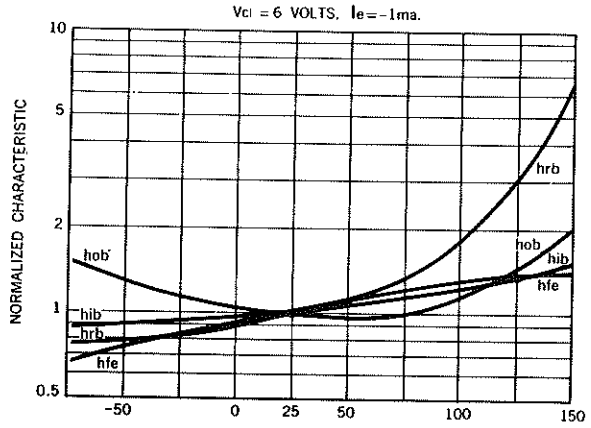
Ie = -1ma, Tj = 25°C



COLLECTOR VOLTAGE, Vc (volts)

SMALL SIGNAL CHARACTERISTICS vs. TEMPERATURE

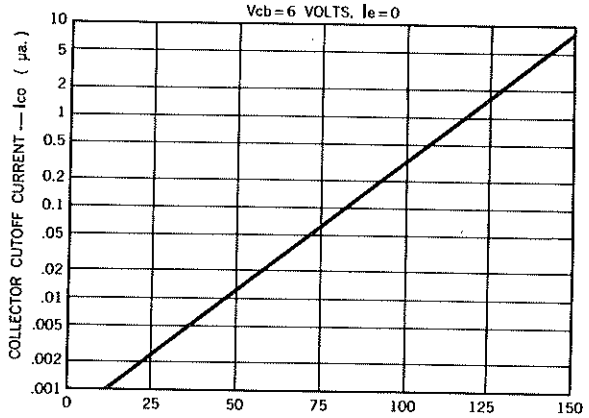
Vcl = 6 VOLTS, Ie = -1ma.



JUNCTION TEMPERATURE, Tj (°C)

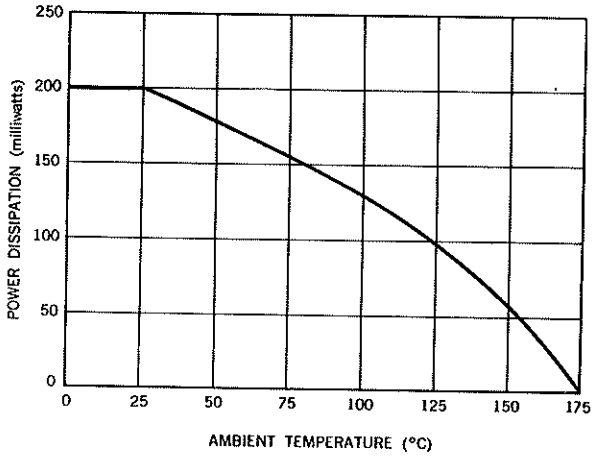
COLLECTOR CUTOFF CURRENT vs. JUNCTION TEMPERATURE

Vcb = 6 VOLTS, Ie = 0



JUNCTION TEMPERATURE, Tj (°C)

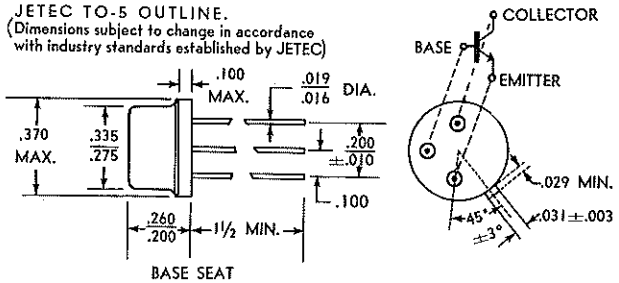
POWER DISSIPATION vs. AMBIENT TEMPERATURE



AMBIENT TEMPERATURE (°C)

MECHANICAL DATA

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)



ENCAPSULATION: Welded hermetic seal.

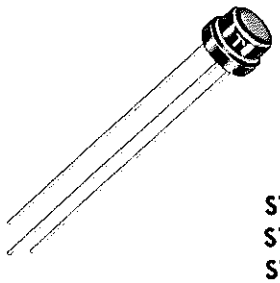
MOUNTING POSITION: Any.

NOTE: Case isolated from all leads.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

Transitron NPN SILICON TRANSISTORS

GENERAL PURPOSE TYPES



ST15
ST35
ST45

200 MILLIWATTS

Transitron's Wide Range Silicon Transistors combine the high reliability of the 2N470 series with a high average current gain, resulting in an economical transistor with characteristics superior to the 2N332. Amplifiers designed around this series will consistently average a higher gain than amplifiers using the 2N332.

Extensive temperature cycling and storage, as well as mechanical and hermetic seal tests, are included as a regular part of the manufacturing process.

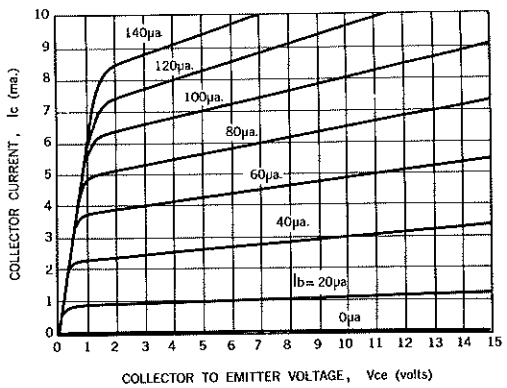
ABSOLUTE MAXIMUM RATINGS

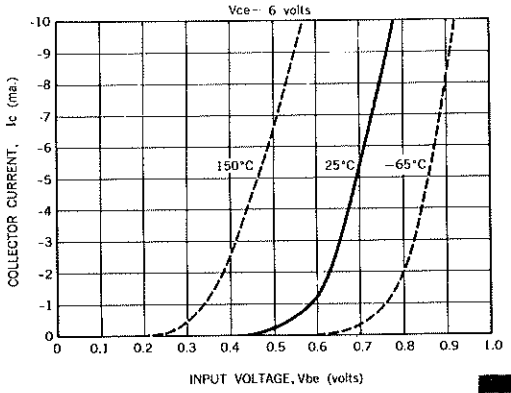
		ST15	ST35	ST45	
Collector to Emitter Voltage	V_{CE}	15	30	45	Volts
Collector to Base Voltage	V_{CB}	15	30	45	Volts
Emitter to Base Voltage	V_{EB}	2	2	2	Volts
Total Power Dissipation	at 25°C ambient	200	200	200	mw
	at 150°C ambient	60	60	60	mw
Storage and Operating Ambient Temperature Range			−65 to +200°C		

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		Min	Typical	Max		Test Conditions
Common Emitter Parameters:						
Current Gain	h_{fe}	10	50	100		V_c=6V, I_e=−1ma, f=1Kc
Current Gain	h_{fe}	4	11			V_c=6V, I_e=−1ma, f=1Mc
Power Gain (1)	P.G.		39		db	R_s=1000 ohms,
Noise Figure (1)	N.F.		22		db	R_L=30K f=1Kc
Common Base Parameters:						
Collector Cutoff Current	I_{CO}		.02 10	0.5 50	μa μa	V_{CB}=Rating, T=25°C V_{CB}=Rating, T=150°C
Collector Cutoff Current	I_{CO}		.005 6		μa μa	V_{CB}=6V, T=25°C V_{CB}=6V, T=150°C
Emitter Cutoff Current	I_{EO}		.01	0.5	μa	V_{EB}=2V
Input Impedance	h_{ib}	30	65	90	ohms	V_c=6V I_e=−1ma
Output Admittance	h_{ob}		0.6	1.5	μmhos	
Voltage Feedback Ratio	h_{rb}		5.0		x10−4	
Output Capacitance at 1 Mc	C_{ob}		7	20	μμf	
D.C. Collector Saturation Resistance	R_{cs}		150	300	ohms	I_c=5ma, I_B=2.2ma

TYPICAL COMMON EMITTER CHARACTERISTICS

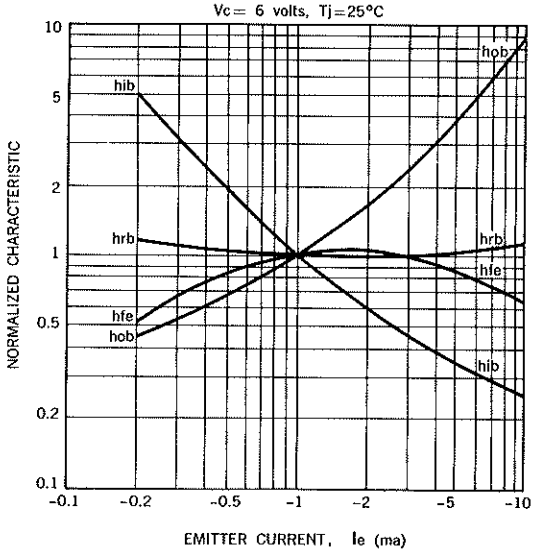




TE-1353D-1
12-58

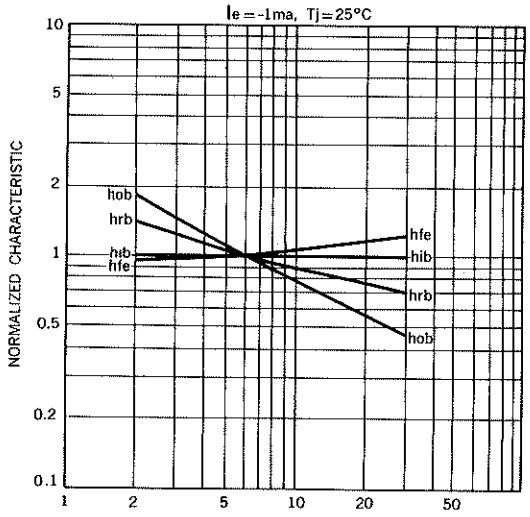
SMALL SIGNAL CHARACTERISTICS vs. EMITTER CURRENT

Vc = 6 volts, Tj = 25°C



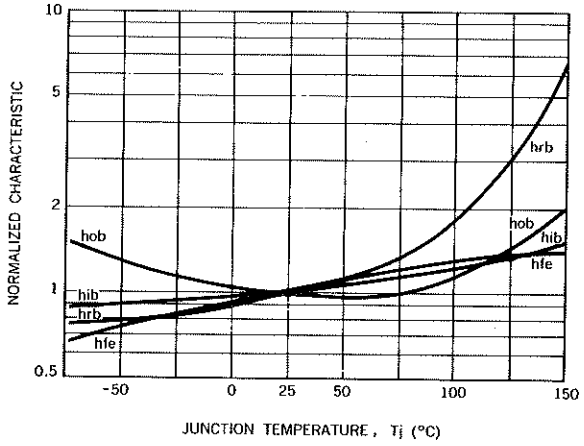
SMALL SIGNAL CHARACTERISTICS vs. COLLECTOR VOLTAGE

Ie = -1ma, Tj = 25°C



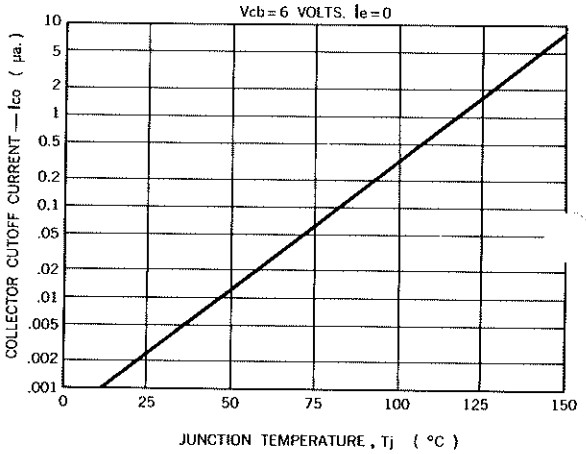
SMALL SIGNAL CHARACTERISTICS vs. TEMPERATURE

Vcb = 6 VOLTS. Ie = -1ma.

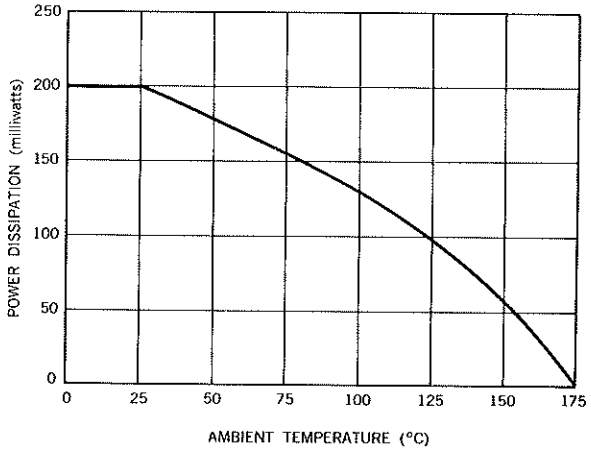


COLLECTOR CUTOFF CURRENT vs. JUNCTION TEMPERATURE

Vcb = 6 VOLTS. Ie = 0

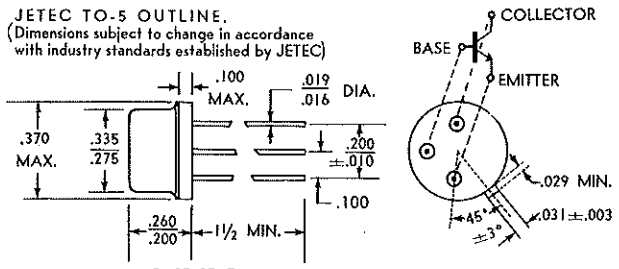


POWER DISSIPATION vs. AMBIENT TEMPERATURE



MECHANICAL DATA

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)



ENCAPSULATION: Welded hermetic seal.

MOUNTING POSITION: Any.

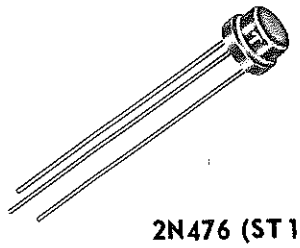
NOTE: Case isolated from all leads.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

Transitron

NPN SILICON TRANSISTORS

HIGH FREQUENCY TYPES



2N476 (ST13)
2N477 (ST33)

200 MILLIWATTS

Transitron's high frequency NPN silicon transistors are designed for low level signal applications up to 200 °C.

High temperature reliability is insured through close process control which results in a stable and low I_{co} up to the maximum voltage rating. Extensive temperature cycling and storage, as well as mechanical and hermetic seal tests, are included as a regular part of the manufacturing process.

ABSOLUTE MAXIMUM RATINGS

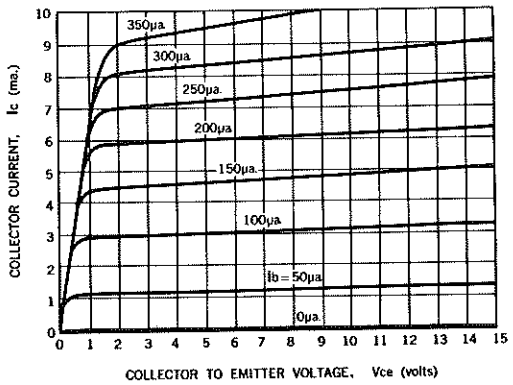
		2N476	2N477	
Collector to Emitter Voltage	V_{CE}	15	30	Volts
Collector to Base Voltage	V_{CB}	15	30	Volts
Emitter to Base Voltage	V_{EB}	2	2	Volts
Total Power Dissipation	at 25 °C ambient	200	200	mw
	at 150 °C ambient	60	60	mw
Storage and Operating Ambient Temperature Range		−65 to +200 °C		

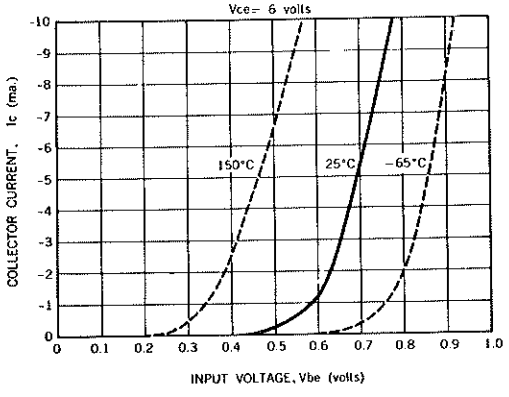
SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25 °C

		Min	Typical	Max	
Common Emitter Parameters:					
Current Gain at 1 Kc	h_{fe}	30	45	60	
Current Gain at 1 Mc	h_{fe}	12	17		
Power Gain ①	P.G.		40		db
Noise Figure ①	N.F.		19		db
Common Base Parameters:					
Collector Cutoff Current, I_{CO}, at Rated Max. V_{CB}	at 25 °C		.02	0.5	μa
	at 150 °C		10	50	μa
Collector Cutoff Current, I_{CO} at V_{CB} = 6 volts	at 25 °C		.005		μa
	at 150 °C		6		μa
Emitter Cutoff Current at V_{EB} = 2 volts	I_{EO}		.01	0.5	μa
Input Impedance	h_{ib}	30	60	90	ohms
Output Admittance	h_{ob}	0.1	0.4	1.5	μmhos
Voltage Feedback Ratio	h_{rb}		5.0		x10−4
Output Capacitance at 1 Mc	C_{ob}	6	8	10	μμf
D.C. Collector Saturation Resistance	R_{cs}		200	450	ohms

① R_s = 1000 ohms, R_L = 30K, f = 1 Kc. NOTE: Small signal parameters measured at V_c = 6V, I_e = −1 ma

TYPICAL COMMON EMITTER CHARACTERISTICS

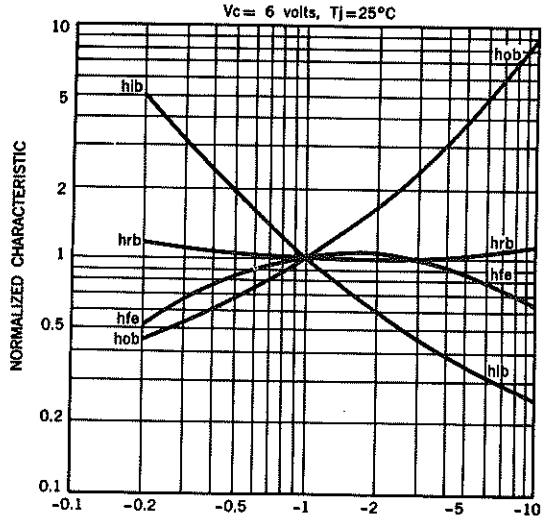




TE-1353E
7-58

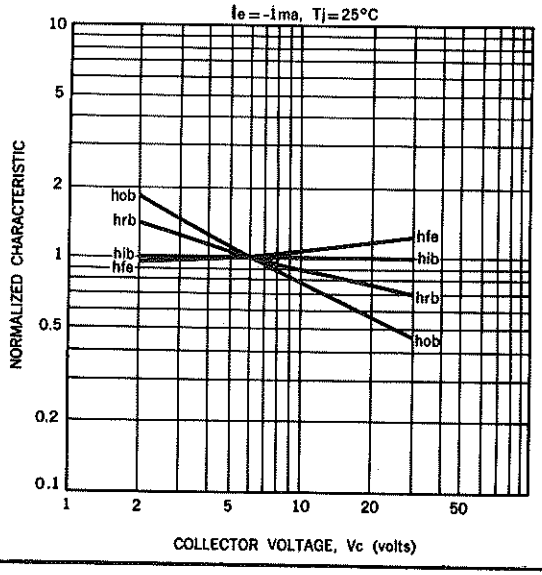
SMALL SIGNAL CHARACTERISTICS vs. EMITTER CURRENT

Vc= 6 volts, Tj=25°C



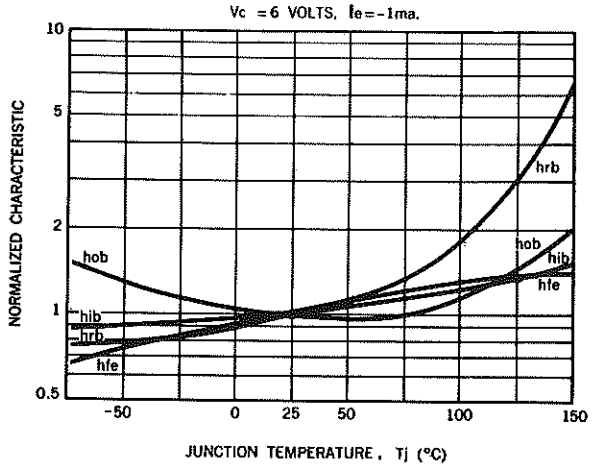
SMALL SIGNAL CHARACTERISTICS vs. COLLECTOR VOLTAGE

Ie=-1ma, Tj=25°C



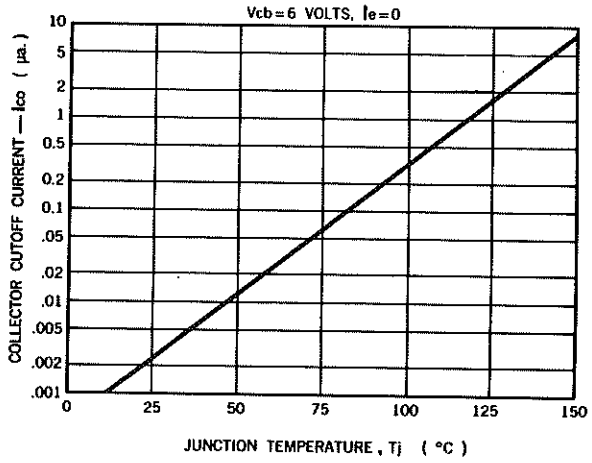
SMALL SIGNAL CHARACTERISTICS vs. TEMPERATURE

Vc =6 VOLTS, Ie=-1ma.

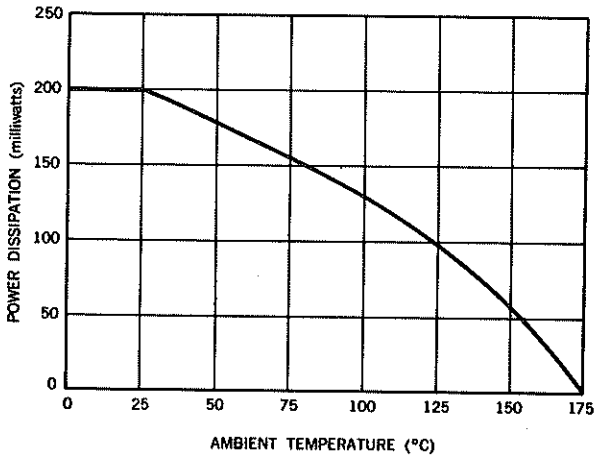


COLLECTOR CUTOFF CURRENT vs. JUNCTION TEMPERATURE

Vcb=6 VOLTS, Ie=0

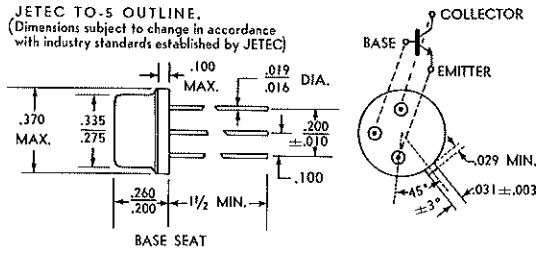


POWER DISSIPATION vs. AMBIENT TEMPERATURE



MECHANICAL DATA

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)



ENCAPSULATION: Welded hermetic seal.

MOUNTING POSITION: Any.

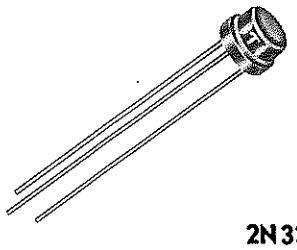
NOTE: Case isolated from all leads.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

Transitron

NPN SILICON TRANSISTORS

GENERAL PURPOSE TYPES



2N332
2N333

150 MILLIWATTS

Transitron's 2N332 and 2N333 NPN silicon transistors are designed for low level signal applications up to 175°C.

High temperature reliability is insured through close process control which results in a stable and low I_{co} up to the maximum voltage rating. Extensive temperature cycling and storage, as well as mechanical and hermetic seal tests, are included as a regular part of the manufacturing process.

ABSOLUTE MAXIMUM RATINGS

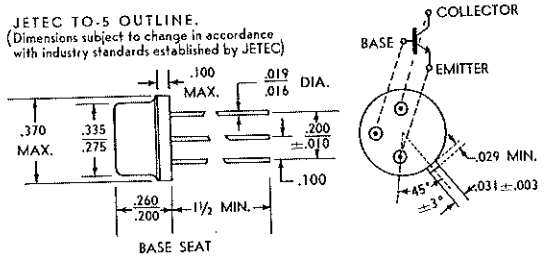
Collector to Base Voltage	V_{CB}	45	Volts
Emitter to Base Voltage	V_{EB}	1	Volt
Total Power Dissipation:	at 25°C	150	mw
	at 100°C	100	mw
	at 150°C	50	mw
Storage and Operating Ambient Temperature Range		−65°C to +175°C	

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		2N332			2N333			
		Min.	Typical	Max.	Min.	Typical	Max.	
Common Emitter Parameters:								
Current Gain	h_{fe}	9	14	20	18	28	41	
Power Gain ①	P.G.		36			39		db
Noise Figure ①	N.F.		22			20		db
Common Base Parameters:								
Collector Cutoff Current I_{CO}:	at 45 Volts		0.2	50		0.2	50	μa
	at 30 Volts		0.1	4		0.1	4	μa
	at 5 Volts, 100°C		0.5	10		0.5	10	μa
	at 5 Volts, 150°C		10	50		10	50	μa
Input Impedance	h_{ib}	30	65	90	30	60	90	ohms
Output Admittance	h_{ob}	0.1	0.4	1.5	0.1	0.4	1.5	μmhos
Voltage Feedback Ratio	h_{rb}	.25	2	5	.25	3	10	x10−4
Frequency Cutoff	f_{co}		7			9		Mc
Output Capacitance at 1 Mc	C_{ob}		7			7		μμf
DC Collector Saturation Resistance	R_{cs}		150	300		150	300	ohms

① R_s = 1000 ohms, R_L = 30K, f = 1 Kc. NOTE: Small signal parameters measured at V_c = 6V, I_e = 1 ma.

MECHANICAL DATA



ENCAPSULATION: Welded hermetic seal.

MOUNTING POSITION: Any.

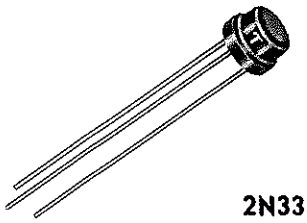
NOTE: Case isolated from all leads.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

TE-1353F
7-58

Transitron NPN SILICON TRANSISTORS

GENERAL PURPOSE TYPES



2N334
2N335
2N336

150 MILLIWATTS

Transitron's general purpose NPN silicon transistors are designed for low level signal applications up to 175°C.

High temperature reliability is insured through close process control which results in a stable and low I_{co} up to the maximum voltage rating. Extensive temperature cycling and storage, as well as mechanical and hermetic seal tests, are included as a regular part of the manufacturing process.

ABSOLUTE MAXIMUM RATINGS

Collector to Base Voltage	V_{CB}	45	Volts
Emitter to Base Voltage	V_{EB}	1	Volt
Total Power Dissipation:	at 25°C	150	mw
	at 100°C	100	mw
	at 150°C	50	mw
Storage and Operating Ambient Temperature Range		−65°C to +175°C	

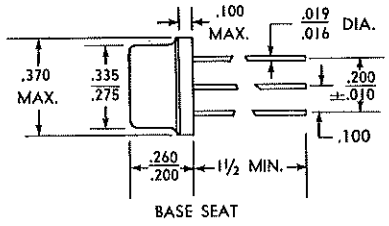
SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

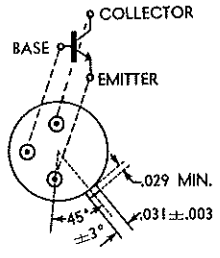
		2N334			2N335			2N336			
Common Emitter Parameters:		Min.	Typical	Max.	Min.	Typical	Max.	Min.	Typical	Max.	
Current Gain	h_{fe}	18	45	90	37	60	90	78	100		
Power Gain ①	P.G.		40			41			42		db
Noise Figure ①	N.F.		19			19			19		db
Common Base Parameters:											
Collector Cutoff Current I_{CO}: at 45 Volts			0.2	50		0.2	50		0.2	50	μa
at 30 Volts			0.1	4		0.1	4		0.1	4	μa
at 5 Volts, 100°C			0.5	10		0.5	10		0.5	10	μa
at 5 Volts, 150°C			10	50		10	50		10	50	μa
Input Impedance	h_{ib}	30	60	90	30	60	90	30	60	90	ohms
Output Admittance	h_{ob}	0.1	0.4	1.5	0.1	0.4	1.5	0.1	0.4	1.5	μmhos
Voltage Feedback Ratio	h_{rb}	0.5	4	15	0.5	4	15	0.5	4	15	x 10−4
Frequency Cutoff	f_{co}	8	11			10			13		Mc
Output Capacitance	C_{ob} at 1 Mc		7			7			7		μμf
DC Collector Saturation Resistance	R_{cs}		150	300		150	300		150	300	ohms

① R_s = 1000 ohms, R_L = 30K, f = 1 Kc. NOTE: Small signal parameters measured at V_c = 6V, I_e = 1 ma.

MECHANICAL DATA

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)





ENCAPSULATION: Welded hermetic seal.

MOUNTING POSITION: Any.

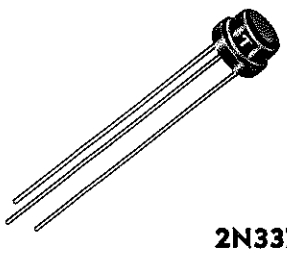
NOTE: Case isolated from all leads.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

TE-1353G
7-58

Transitron NPN SILICON TRANSISTORS

HIGH FREQUENCY TYPES



2N337
2N338

125 MILLIWATTS

Transistors 2N337 and 2N338 are high frequency NPN silicon transistors that are designed for use in low level rf amplifying and switching applications.

High temperature reliability is insured through close process control which results in a stable and low Ico up to the maximum voltage rating. Extensive temperature cycling and storage, as well as mechanical and hermetic seal tests, are included as a regular part of the manufacturing process.

ABSOLUTE MAXIMUM RATINGS

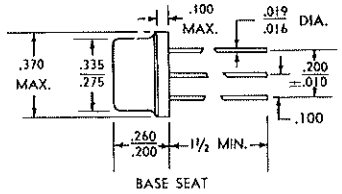
Collector to Base Voltage	V_{CB}	45	Volts
Emitter to Base Voltage	V_{EB}	1	Volt
Total Power Dissipation:	at 25°C	125	mw
	at 100°C	50	mw
Storage and Operating Ambient Temperature Range		−65°C to + 150° C	

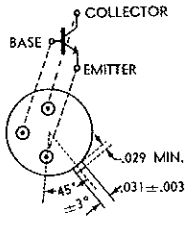
SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		2N337			2N338				
Common Emitter Parameters:		Min.	Typ.	Max.	Min.	Typ.	Max.		Test Conditions
D.C. Current Gain	h_{FE}	20		55	45		150		$V_{CE} = 5V$, $I_C = 10$ ma
A.C. Current Gain	h_{fe}	19	65		39	99			$V_C = 20V$, $I_e = 1$ ma
High Frequency Current Gain	h_{fe}	5	12.5		10	16			$V_C = 20V$, $I_e = 1$ ma F = 2.5 mc
Common Base Parameters:									
Collector Cutoff Current	I_{CO}		.2	50		.2	50	μa	$V_{CB} = 45V$
	I_{CO}		.1	1		.1	1	μa	$V_{CB} = 20V$
	I_{CO}		10	100		10	100	μa	$V_{CB} = 20V$, T = 150°C
Emitter Cutoff Current	I_{EO}			50			50	μa	$V_{EB} = 1V$
Input Impedance	h_{ib}	30	50	80	30	50	80	ohm	
Output Admittance	h_{ob}		.2	1		.2	1	μmhos	$V_{CB} = 20V$, $I_e = 1$ ma
Voltage Feedback Ratio	h_{rb}		2	20		3	20	x10—4	
Frequency Cutoff	F_{co}	10	20		20	30		mc	
Output Capacitance	C_{ob}		1.2	3		1.2	3	$\mu\mu$f	$V_{CB} = 20V$, $I_e = 1$ ma f = 1mc
D.C. Collector Saturation Resistance	R_{cs}		75	150		75	150	ohms	$I_C = 10$ ma, $I_b = 1$ ma
Rise Time	T_r		.05			.06		μsec	
Storage Time	T_s		.02			.02		μsec	$I_c = 10$ ma
Fall Time	T_f		.08			.14		μsec	I_b = Ic/DC Beta Min.

MECHANICAL DATA

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)





ENCAPSULATION: Welded hermetic seal.

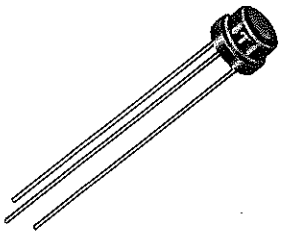
MOUNTING POSITION: Any.

NOTE: Case isolated from all leads.
A heat sink (long nose pliers) should be used when soldering leads within ¼ inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C ⅛ inch from the base.

TE-1353G-1
3-59

Transitron NPN SILICON TRANSISTORS

HIGH FREQUENCY TYPE



2N1205

4.3 MC 20 VOLTS

Transitron's 2N1205 is a high frequency transistor designed for use in I.F. and Video amplifiers. The 2N1205 is characterized by power gains in excess of 20 db at 4.3 megacycles.

High temperature reliability is insured through close process control which results in a stable and low Ico up to the maximum voltage rating. Extensive temperature cycling and storage as well as mechanical seal tests are included as a regular part of the manufacturing process.

ABSOLUTE MAXIMUM RATINGS

Collector to Emitter Voltage	V_{CE}	20	Volts
Collector to Base Voltage	V_{CB}	20	Volts
Emitter to Base Voltage	V_{EB}	1	Volt
Total Power Dissipation	at 25°C ambient	150	mw
Storage and Operating Ambient Temperature Range		−65 to + 150°C	

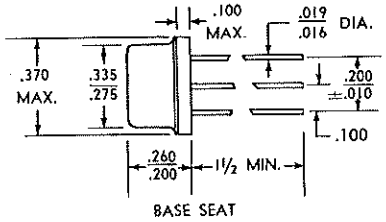
SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

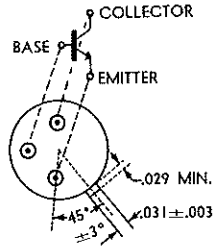
		Min.	Typ.	Max.		
Common Emitter Parameters:						
Power Gain at 4.3 mc [1]	P.G.	20	30		db	$V_{CE} = 10V$, $I_e = 2$ ma
AC Current Gain at 4.3 mc	h_{fe}	4	6			$V_{CE} = 10V$, $I_e = 2$ ma
AC Current Gain at 1 Kc	h_{fe}	10				$V_{CE} = 10V$, $I_e = 2$ ma
Noise Figure at 4.3 Mc	N.F		12		db	$V_{CE} = 10V$, $I_e = 2$ ma
Common Base Parameters:						
Collector Cutoff Current	I_{co}		.05	.5	μa	$V_{CB} = 20V$
Collector Cutoff Current	I_{co}		20	150	μa	$V_{CB} = 20V$, T = 150°C
Emitter Cutoff Current	I_{co}			100	μa	$V_{EB} = 1V$
Output Capacitance	C_{ob}		3	5	$\mu\mu$f	$V_{CB} = 10V$

1 Power gain measured with source resistance of 1000 ohms and a load resistance of 4000 ohms.

MECHANICAL DATA

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)





ENCAPSULATION: Welded hermetic seal.

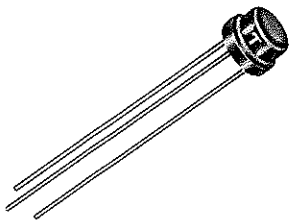
MOUNTING POSITION: Any.

NOTE: Case isolated from all leads.
A heat sink (long nose pliers) should be used when soldering leads within ¼ inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C ⅛ inch from the base.

TE-1353G-2
3-59

Transitron NPN SILICON TRANSISTORS

LOW LEVEL TYPE



ST1026

INPUT TRANSISTOR FOR D.C. AMPLIFIERS

Transitron's ST1026 transistor provides adequate gain at very low currents in d.c. amplifier input stages. It has particularly small collector leakage current at typical operating voltages, and is tested for operation over the temperature range −65° to +150° C.

Absolute ratings given are extremely conservative to ensure that the low level features of the unit are not affected.

Recommended operating conditions are from 2 to 200μa collector current, with 1 to 3 volts from collector to emitter.

For further information see our applications bulletin on Low Drift Straight D.C. Amplifiers.

ABSOLUTE MAXIMUM RATINGS

Collector to Emitter Voltage	V_{ce}	6	Volts
Collector to Base Voltage	V_{cb}	6	Volts
Emitter to Base Voltage	V_{eb}	2	Volts
Power Dissipation: at 25° C Ambient		30	mw
at 100° C Ambient		12	mw
Collector Current	I_c	5	ma
Storage and Operating Ambient Temperature Range		−65 to +150	°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS

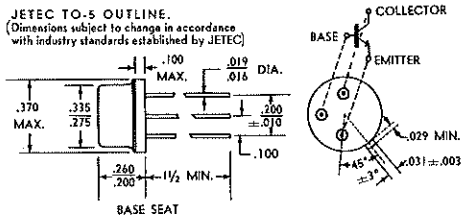
(at 25° C, V_{cb} = 3V unless otherwise stated)

		Min.	Typ.	Max.		Test Conditions
D.C. Common emitter current gain	β_{dc}	15	25			I_c = 5μa
			70			I_c = 100μa
		15	30			T = −65° C, I_c = 100μa
Per cent increase in d.c. beta per °C			0.65		%	I_c = 5μa
rise in ambient, in range 25° to 150° C			0.45		%	I_c = 100μa
Ratio of a.c. beta to d.c. beta			1.6			I_c = 5 to 100μa
Collector leakage current	I_{co}		0.8	5	mμa(millimicroamperes)	T = 25° C
			1	10	μa	T = 150° C
Emitter leakage current	I_{eo}		0.8	30	mμa(millimicroamperes)	V_{eb} = 2V
A.C. Common emitter input impedance			250		kilohms.	I_c = 5μa
			35		kilohms.	I_c = 100μa
Collector capacitance ①	C_c		9	20	μμf	I_c = Ima, V_{ce} = 6V.
			27		μμf	f = Imc/s, V_{ce} = 1V.
Common base cut-off frequency ①	f_α		5		mc/s	I_c = ImA, V_{ce} = 6V
Recommended range of collector current	I_c	2		200	μa	T = 25° to 150° C
		100②		200	μa	T = −65° C
Recommended level of collector to emitter voltage	V_{ce}	1		3	Volts	T = −65° to +150° C

① In many circuits employing these units the stage bandwidth is determined primarily by the source and load impedances, together with the transistor input impedance and collector capacitance. This applies particularly at the lower end of the recommended ranges of collector current and voltage, where the product of collector capacitance and impedances in the order of megohms can limit the bandwidth to very much less than the inherent alpha or beta cut-off frequencies. In the most extreme cases the stage bandwidth can be as low as 500 cycles per second.

② See the specification for d.c. common emitter current gain at −65° C.

MECHANICAL DATA



ENCAPSULATION: Welded hermetic seal.
MOUNTING POSITION: Any:
NOTE: All leads isolated from the case.
A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230° C 1/8 inch from the base.

TE-1353H
7-58

Transitron

NPN SILICON TRANSISTOR

2N471A

(Replaces 2N117)

Complete specifications
in MIL-T-19500A form

TE-1353J
7-58

Transitron electronic corporation • wakefield, massachusetts

CATALOG NO. 81.34.16A

2N471A

NPN SILICON TRANSISTOR

Description: This specification covers the detail requirements for a small signal, medium frequency, NPN silicon transistor. The tests specified herein are performed in accordance with referenced sections of MIL-T-19500A.

Ratings:

	VCB Vdc	VCE Vdc	VEB Vdc	P mW	TA °C
Absolute Maximum	+30	+30	+2	200	Min.: -65 Max.: +175

Maximum Operating Altitude: Pressure = 15 mm. Hg.

Dimensions: Industry standard JETEC 30 package (see Figure 1).

Operating Position: Any.

Standard Test Conditions: VCB = +6 Vdc, IE = - 1.0 mAdc, unless otherwise specified herein.

The following tests shall be performed at an ambient temperature (TA) = 25°±3°C, unless otherwise specified herein.

Ref.	Test	Conditions	AQL(%)	Insp. Level	Sym.	Limits Min.	Limits Max.	Units
4.5.4	Group A Acceptance Tests Subgroup 1, Notes 2 and 3					Production Tests		
---	Collector Cutoff Current:	VCB = 30 Vdc VEB = 1/2 Vdc Note 4	.65	II	ICO	---	0.5	uAdc
---	Collector Cutoff Current:	VCB = 30 Vdc VEB = 1/2 Vdc TA = 150°C min. Note 4	.65	II	ICO	----	50	uAdc
4.6.3	Emitter Cutoff Current:	VEB = 2 Vdc IC = 0	.65	II	IEO	---	0.5	uAdc
4.6.18	Current Gain:		.65	II	hfe	10	25	----
4.6.13	Input Impedance:		.65	II	hib	30	90	ohms
4.6.9	Output Admittance:		.65	II	hob	---	1.5	umhos
4.6.18	High Frequency Current Gain:	F = 1.0 Mc.	.65	II	hfe	4	---	----
---	Collector Saturation Voltage:	IC = 5 mAdc IB = 1 mAdc Note 4	.65	II	VCE	---	1.5	Vdc
	Group A Acceptance Tests Subgroup 2, Notes 2 and 5					Design Tests		
4.6.20	Output Capacitance:	F = 1.0 Mc	4.0	L6	Cob	---	20	uuf
4.6.21	Noise Figure:	F = 1000 cps	4.0	L6	NF	---	35	db
4.6.1	Visual Inspection:	Note 1	4.0	L6	---	---	---	----
4.5.5	Group B Acceptance Tests, Notes 2,5,6					Design Tests		
4.6.23	Soldering	Note 7	4.0	L6				
4.6.24	Temperature Cycling:	-65°C to +175°C Note 7	4.0	L6	---	5	---	cycles
4.6.25	Glass Strain	Notes 7 and 8	4.0	L6	---	5	---	cycles
4.6.26	Moisture Resistance:	Note 7	4.0	L6	---	10	---	cycles
4.6.28	Shock:	Non-operating Note 7	4.0	L6	---	500	---	G
4.6.29	Centrifuge:	Note 7	4.0	L6	---	10,000	---	G
4.6.30	Vibration Fatigue:	Note 7	4.0	L6	---	96	---	hours
4.6.31	Vibration, Noise:	Non-operating Notes 7 and 9	4.0	L6	---	10	---	G
4.6.36	Lead Fatigue:	Note 10	4.0	L6	---	3	---	arcs

Ref.	Test	Conditions	AQL(%)	Insp. Level	Sym.	Limits Min.	Limits Max.	Units
---	Post Mechanical Test End Points:							
---	Collector Cutoff Current:	VCB = 30 Vdc VEB = 1/2 Vdc Note 4	---	---	ICO	----	1.0 —	uAdc
4.6.3	Emitter Cutoff Current:	VEB = 2 Vdc IC = 0	---	---	IEO	---	1.0	uAdc
4.6.18	Current Gain:		---	---	hfe	8	30 —	----
	Group C Acceptance Tests						Life Tests	
4.6.37	Storage Life:	T stg = 175°C min. Note 11, Table I						
4.6.38	Operation Life:	VCB = 30 Vdc P = 200 mW Note 11, Table I						
	Operation and Storage Life Test End Points:							
	Collector Cutoff Current:	VCB = 30 Vdc VEB = 1/2 Vdc Note 4	---	---	ICO	---	1.0	uAdc
4.6.3	Emitter Cutoff Current:	VEB = 2 Vdc IC = 0	---	---	IEO	---	1.0	uAdc
4.6.18	Current Gain:		---	---	hfe	8	30	---

Note 1: In addition to the requirements of Standard MIL-STD-130, the transistor shall be legibly marked with the manufacturer's name or symbol, the type designation, and a date code. All other information may be printed on the packing material.

Note 2: If it is desired to check quality subsequent to lot acceptance, the conditions and acceptance limits set forth in this specification shall apply. When 100 per cent testing is performed and the results indicate that the percentage of defectives is equal to or less than the AQL values specified herein, the lot is deemed to comply with this specification.

Note 3: The AQL for the combined defectives for attributes in Group A, Subgroup 1 tests shall be 1.5 percent. The transistor having one or more defects shall be counted as one defective.

Note 4: With voltages and currents specified applied to the electrodes, the parameter measured shall be within the limits specified.

Note 5: For reduced inspection procedure use procedure R-1, inspection level L4. See Appendix to MIL-STD-105.

Note 6: For group B acceptance tests, separate samples may be used at the discretion of the manufacturer.

Note 7: At the conclusion of this test, the transistor shall be tested in accordance with the conditions under Post Mechanical test, and shall meet the indicated test end point requirements.

Note 8: At the end of the number of cycles specified herein, there shall be no evidence of mechanical damage to the transistor.

Note 9: The vibration frequency range shall be covered at least four times.

Note 10: This shall be considered a destructive test, and transistors subjected to this test shall not be accepted under this specification.

Note 11: Storage life and operation life. Storage-life and operation-life tests shall be performed on sample units which have been subjected to and have passed the Group A Acceptance Tests, Subgroup 1. Reduced-inspection sampling procedure for life tests shall not be instituted at any time.

(1) 1,000-hour life tests.

(a) 1,000-hour life tests shall be in effect initially and shall continue in effect until the eligibility criteria for reduced-hour life tests have been met.

(b) The measurements listed under "end points" shall be made at 0 hours, 250 $^{+72}_{-24}$ hours, 500 $^{+72}_{-24}$ hours, and 1,000 $^{+72}_{-24}$ hours. Additional readings may be taken at the discretion of the manufacturer.

(c) Sample units shall meet the criteria specified herein, at the applicable AQL and inspection level shown in table I, at 250, 500, and 1,000 hours. If a life test sample fails either the 250-hour or 500-hour acceptance criteria for operation life or storage life, the lot shall be rejected. The tests may be terminated at the discretion of the manufacturer; however, the results of either of these tests shall not be used at a future date for acceptance of the same lot.

(2) Reduced-hours life tests (500 hours or 250 hours.)

To qualify for reduced-hours life tests, the following criteria shall be met:

(a) The immediately preceding 10 lots have been accepted.

(b) The estimated process average is less than the applicable lower limit specified in the appendix to Standard MIL-STD-105.

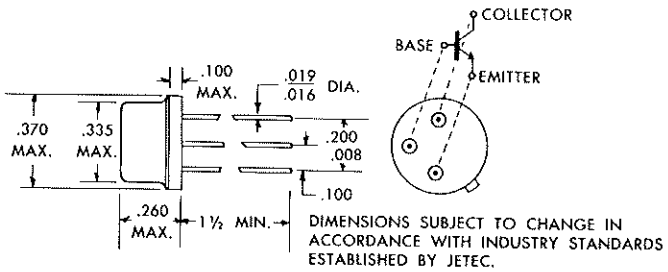
(c) There has been no unusual discontinuity in production in the immediately preceding 10 lots.

The manufacturer shall qualify for 500 hours first; thence, he shall meet the criteria of (a), (b), and (c) above at 500 hours to qualify for 250-hour life tests. Lots which are accepted under the reduced-hours life test may be shipped; however, the storage-life test shall continue through 1,000 hours, and the samples shall meet the acceptance number at the 1,000-hour AQL value for the number of sample units being tested. In the event a sample fails the storage-life test after a lot has been shipped, the manufacturer shall immediately lose eligibility for reduced-hours life tests. Loss of eligibility for reduced-hours life tests also occurs if a lot is rejected or the estimated process average is greater than the applicable lower limit shown in the appendix to Standard MIL-STD-105. Loss of eligibility during 500-hour life tests shall result in institution of 1,000-hour life tests; loss of eligibility during 250-hour life tests shall result in institution of 500-hour life tests.

Table I

Test	AQL (Combined Percent Defective)					Inspection Level		
	1,000-hour life test			Reduced-hours life tests		1,000-hour life test	Reduced-hours life tests	
	250 hr	500 hr	1,000 hr	500 hr	250 hr		500 hr	250 hr
Storage life	6.5	6.5	6.5	4.0	2.5	L6	L6	L6
Operation life	6.5	6.5	6.5	4.0	2.5	L4	L4	L4

Figure 1



Transitron

NPN SILICON TRANSISTOR

2N474A

(Replaces 2N118)

Complete specifications
in MIL-T-19500A form

TE-1353K
7-58

Transitron electronic corporation • wakefield, massachusetts

CATALOG NO. 81.34.16B

2N474A

NPN SILICON TRANSISTOR

Description: This specification covers the detail requirements for a small signal, medium frequency, NPN silicon transistor. The tests specified herein are performed in accordance with referenced sections of MIL-T-19500A.

Ratings:

	VCB Vdc	VCE Vdc	VEB Vdc	P mW	T_A °C
Absolute Maximum	+30	+30	+2	200	Min.: -65 Max.: +175

Maximum Operating Altitude: Pressure = 15 mm. Hg.

Dimensions: Industry standard JETEC 30 package (see Figure 1).

Operating Position: Any.

Standard Test Conditions: VCB = +6 Vdc, IE = - 1.0 mAdc, unless otherwise specified herein.

The following tests shall be performed at an ambient temperature (TA) = 25°±3°C, unless otherwise specified herein.

Ref.	Test	Conditions	AQL(%)	Insp. Level	Sym.	Limits Min.	Limits Max.	Units
4.5.4	Group A Acceptance Tests Subgroup 1, Notes 2 and 3					Production Tests		
---	Collector Cutoff Current:	VCB = 30 Vdc VEB = 1/2 Vdc Note 4	.65	II	ICO	---	0.5	uAdc
---	Collector Cutoff Current:	VCB = 30 Vdc VEB = 1/2 Vdc TA = 150°C min. Note 4	.65	II	ICO	----	50	uAdc
4.6.3	Emitter Cutoff Current:	VEB = 2 Vdc IC = 0	.65	II	IEO	---	0.5	uAdc
4.6.18	Current Gain:		.65	II	hfe	20	50	----
4.6.13	Input Impedance:		.65	II	hib	30	90	ohms
4.6.9	Output Admittance:		.65	II	hob	---	1.5	umhos
4.6.18	High Frequency Current Gain:	F = 1.0 Mc.	.65	II	hfe	8	---	----
---	Collector Saturation Voltage:	IC = 5 mAdc IB = 1 mAdc Note 4	.65	II	VCE	---	1.5	Vdc
	Group A Acceptance Tests Subgroup 2, Notes 2 and 5					Design Tests		
4.6.20	Output Capacitance:	F = 1.0 Mc	4.0	L6	Cob	---	20	uuf
4.6.21	Noise Figure:	F = 1000 cps	4.0	L6	NF	---	35	db
4.6.1	Visual Inspection:	Note 1	4.0	L6	---	---	---	----
4.5.5	Group B Acceptance Tests, Notes 2,5,6					Design Tests		
4.6.23	Soldering	Note 7	4.0	L6				
4.6.24	Temperature Cycling:	-65°C to +175°C Note 7	4.0	L6	---	5	---	cycles
4.6.25	Glass Strain	Notes 7 and 8	4.0	L6	---	5	---	cycles
4.6.26	Moisture Resistance:	Note 7	4.0	L6	---	10	---	cycles
4.6.28	Shock:	Non-operating Note 7	4.0	L6	---	500	---	G
4.6.29	Centrifuge:	Note 7	4.0	L6	---	10,000	---	G
4.6.30	Vibration Fatigue:	Note 7	4.0	L6	---	96	---	hours
4.6.31	Vibration, Noise:	Non-operating Notes 7 and 9	4.0	L6	---	10	---	G
4.6.36	Lead Fatigue:	Note 10	4.0	L6	---	3	---	arcs

Ref.	Test	Conditions	AQL(%)	Insp. Level	Sym.	Limits Min.	Limits Max.	Units
---	Post Mechanical Test End Points:							
---	Collector Cutoff Current:	VCB = 30 Vdc VEB = 1/2 Vdc Note 4	---	---	ICO	---	1.0	uAdc
4.6.3	Emitter Cutoff Current:	VEB = 2 Vdc IC = 0	---	---	IEO	---	1.0	uAdc
4.6.18	Current Gain:		---	---	hfe	16	60	----
	Group C Acceptance Tests						Life Tests	
4.6.37	Storage Life:	T stg = 175°C min. Note 11, Table I						
4.6.38	Operation Life:	VCB = 30 Vdc P = 200 mW Note 11, Table I						
	Operation and Storage Life Test End Points:							
	Collector Cutoff Current:	VCB = 30 Vdc VEB = 1/2 Vdc Note 4	---	---	ICO	---	1.0	uAdc
4.6.3	Emitter Cutoff Current:	VEB = 2 Vdc IC = 0	---	---	IEO	---	1.0	uAdc
4.6.18	Current Gain:		---	---	hfe	16	60	---

Note 1: In addition to the requirements of Standard MIL-STD-130, the transistor shall be legibly marked with the manufacturer's name or symbol, the type designation, and a date code. All other information may be printed on the packing material.

Note 2: If it is desired to check quality subsequent to lot acceptance, the conditions and acceptance limits set forth in this specification shall apply. When 100 per cent testing is performed and the results indicate that the percentage of defectives is equal to or less than the AQL values specified herein, the lot is deemed to comply with this specification.

Note 3: The AQL for the combined defectives for attributes in Group A, Subgroup 1 tests shall be 1.5 percent. The transistor having one or more defects shall be counted as one defective.

Note 4: With voltages and currents specified applied to the electrodes, the parameter measured shall be within the limits specified.

Note 5: For reduced inspection procedure use procedure R-1, inspection level L4. See Appendix to MIL-STD-105.

Note 6: For group B acceptance tests, separate samples may be used at the discretion of the manufacturer.

Note 7: At the conclusion of this test, the transistor shall be tested in accordance with the conditions under Post Mechanical test, and shall meet the indicated test end point requirements.

Note 8: At the end of the number of cycles specified herein, there shall be no evidence of mechanical damage to the transistor.

Note 9: The vibration frequency range shall be covered at least four times.

Note 10: This shall be considered a destructive test, and transistors subjected to this test shall not be accepted under this specification.

Note 11: Storage life and operation life. Storage-life and operation-life tests shall be performed on sample units which have been subjected to and have passed the Group A Acceptance Tests, Subgroup 1. Reduced-inspection sampling procedure for life tests shall not be instituted at any time.

(1) 1,000-hour life tests.

(a) 1,000-hour life tests shall be in effect initially and shall continue in effect until the eligibility criteria for reduced-hour life tests have been met.

(b) The measurements listed under "end points" shall be made at 0 hours, 250 $^{+72}_{-24}$ hours, 500 $^{+72}_{-24}$ hours, and 1,000 $^{+72}_{-24}$ hours. Additional readings may be taken at the discretion of the manufacturer.

(c) Sample units shall meet the criteria specified herein, at the applicable AQL and inspection level shown in table I, at 250, 500, and 1,000 hours. If a life test sample fails either the 250-hour or 500-hour acceptance criteria for operation life or storage life, the lot shall be rejected. The tests may be terminated at the discretion of the manufacturer; however, the results of either of these tests shall not be used at a future date for acceptance of the same lot.

(2) Reduced-hours life tests (500 hours or 250 hours.)

To qualify for reduced-hours life tests, the following criteria shall be met:

(a) The immediately preceding 10 lots have been accepted.

(b) The estimated process average is less than the applicable lower limit specified in the appendix to Standard MIL-STD-105.

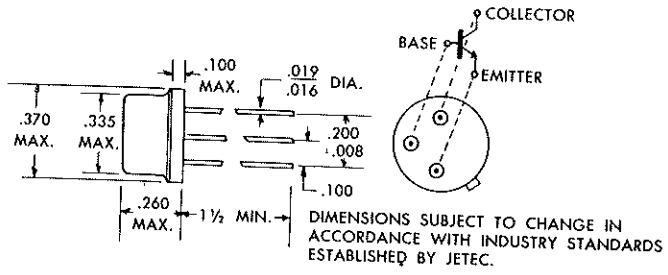
(c) There has been no unusual discontinuity in production in the immediately preceding 10 lots.

The manufacturer shall qualify for 500 hours first; thence, he shall meet the criteria of (a), (b), and (c) above at 500 hours to qualify for 250-hour life tests. Lots which are accepted under the reduced-hours life test may be shipped; however, the storage-life test shall continue through 1,000 hours, and the samples shall meet the acceptance number at the 1,000-hour AQL value for the number of sample units being tested. In the event a sample fails the storage-life test after a lot has been shipped, the manufacturer shall immediately lose eligibility for reduced-hours life tests. Loss of eligibility for reduced-hours life tests also occurs if a lot is rejected or the estimated process average is greater than the applicable lower limit shown in the appendix to Standard MIL-STD-105. Loss of eligibility during 500-hour life tests shall result in institution of 1,000-hour life tests; loss of eligibility during 250-hour life tests shall result in institution of 500-hour life tests.

Table I

Test	AQL (Combined Percent Defective)					Inspection Level		
	1,000-hour life test			Reduced-hours life tests		1,000-hour life test	Reduced-hours life tests	
	250 hr	500 hr	1,000 hr	500 hr	250 hr		500 hr	250 hr
Storage life	6.5	6.5	6.5	4.0	2.5	L6	L6	L6
Operation life	6.5	6.5	6.5	4.0	2.5	L4	L4	L4

Figure 1



Transitron

NPN SILICON TRANSISTOR

2N479A

(Replaces 2N119)

Complete specifications
in MIL-T-19500A form

TE-1353L
7-58

Transitron electronic corporation • wakefield, massachusetts

CATALOG NO. 81.94.16C

2N479A

NPN SILICON TRANSISTOR

Description: This specification covers the detail requirements for a small signal, medium frequency, NPN silicon transistor. The tests specified herein are performed in accordance with referenced sections of MIL-T-19500A.

Ratings:

	VCB Vdc	VCE Vdc	VEB Vdc	P mW	TA °C
Absolute Maximum	+30	+30	+2	200	Min.: -65 Max.: +175

Maximum Operating Altitude: Pressure = 15 mm. Hg.

Dimensions: Industry standard JETEC 30 package (see Figure 1).

Operating Position: Any.

Standard Test Conditions: VCB = +6 Vdc, IE = - 1.0 mAdc, unless otherwise specified herein.

The following tests shall be performed at an ambient temperature (TA) = 25°±3°C, unless otherwise specified herein.

Ref.	Test	Conditions	AQL(%)	Insp. Level	Sym.	Limits Min.	Limits Max.	Units
4.5.4	Group A Acceptance Tests Subgroup 1, Notes 2 and 3					Production Tests		
---	Collector Cutoff Current:	VCB = 30 Vdc VEB = 1/2 Vdc Note 4	.65	II	ICO	---	0.5	uAdc
---	Collector Cutoff Current:	VCB = 30 Vdc VEB = 1/2 Vdc TA = 150°C min. Note 4	.65	II	ICO	----	50	uAdc
4.6.3	Emitter Cutoff Current:	VEB = 2 Vdc IC = 0	.65	II	IEO	---	0.5	uAdc
4.6.18	Current Gain:		.65	II	hfe	40	100	----
4.6.13	Input Impedance:		.65	II	hib	30	90	ohms
4.6.9	Output Admittance:		.65	II	hob	---	1.5	umhos
4.6.18	High Frequency Current Gain:	F = 1.0 Mc.	.65	II	hfe	8	---	----
---	Collector Saturation Voltage:	IC = 5 mAdc IB = 1 mAdc Note 4	.65	II	VCE	---	1.5	Vdc
	Group A Acceptance Tests Subgroup 2, Notes 2 and 5					Design Tests		
4.6.20	Output Capacitance:	F = 1.0 Mc	4.0	L6	Cob	---	20	uuf
4.6.21	Noise Figure:	F = 1000 cps	4.0	L6	NF	---	35	db
4.6.1	Visual Inspection:	Note 1	4.0	L6	---	---	---	----
4.5.5	Group B Acceptance Tests, Notes 2,5,6					Design Tests		
4.6.23	Soldering	Note 7	4.0	L6				
4.6.24	Temperature Cycling:	-65°C to +175°C Note 7	4.0	L6	---	5	---	cycles
4.6.25	Glass Strain	Notes 7 and 8	4.0	L6	---	5	---	cycles
4.6.26	Moisture Resistance:	Note 7	4.0	L6	---	10	---	cycles
4.6.28	Shock:	Non-operating Note 7	4.0	L6	---	500	---	G
4.6.29	Centrifuge:	Note 7	4.0	L6	---	10,000	---	G
4.6.30	Vibration Fatigue:	Note 7	4.0	L6	---	96	---	hours
4.6.31	Vibration, Noise:	Non-operating Notes 7 and 9	4.0	L6	---	10	---	G
4.6.36	Lead Fatigue:	Note 10	4.0	L6	---	3	---	arcs

Ref.	Test	Conditions	AQL(%)	Insp. Level	Sym.	Limits Min.	Limits Max.	Units
---	Post Mechanical Test End Points:							
---	Collector Cutoff Current:	VCB = 30 Vdc VEB = 1/2 Vdc Note 4	---	---	ICO	---	1.0	uAdc
4.6.3	Emitter Cutoff Current:	VEB = 2 Vdc IC = 0	---	---	IEO	---	1.0	uAdc
4.6.18	Current Gain:		---	---	hfe	32	120	----
	Group C Acceptance Tests					Life Tests		
4.6.37	Storage Life:	T stg = 175°C min Note 11, Table I						
4.6.38	Operation Life:	VCB = 30 Vdc P = 200 mW Note 11, Table I						
	Operation and Storage Life Test End Points:							
	Collector Cutoff Current:	VCB = 30 Vdc VEB = 1/2 Vdc Note 4	---	---	ICO	---	1.0	uAdc
4.6.3	Emitter Cutoff Current:	VEB = 2 Vdc IC = 0	---	---	IEO	---	1.0	uAdc
4.6.18	Current Gain:		---	---	hfe	32	120	---

Note 1: In addition to the requirements of Standard MIL-STD-130, the transistor shall be legibly marked with the manufacturer's name or symbol, the type designation, and a date code. All other information may be printed on the packing material.

Note 2: If it is desired to check quality subsequent to lot acceptance, the conditions and acceptance limits set forth in this specification shall apply. When 100 per cent testing is performed and the results indicate that the percentage of defectives is equal to or less than the AQL values specified herein, the lot is deemed to comply with this specification.

Note 3: The AQL for the combined defectives for attributes in Group A, Subgroup 1 tests shall be 1.5 percent. The transistor having one or more defects shall be counted as one defective.

Note 4: With voltages and currents specified applied to the electrodes, the parameter measured shall be within the limits specified.

Note 5: For reduced inspection procedure use procedure R-1, inspection level L4. See Appendix to MIL-STD-105.

Note 6: For group B acceptance tests, separate samples may be used at the discretion of the manufacturer.

Note 7: At the conclusion of this test, the transistor shall be tested in accordance with the conditions under Post Mechanical test, and shall meet the indicated test end point requirements.

Note 8: At the end of the number of cycles specified herein, there shall be no evidence of mechanical damage to the transistor.

Note 9: The vibration frequency range shall be covered at least four times.

Note 10: This shall be considered a destructive test, and transistors subjected to this test shall not be accepted under this specification.

Note 11: Storage life and operation life. Storage-life and operation-life tests shall be performed on sample units which have been subjected to and have passed the Group A Acceptance Tests, Subgroup 1. Reduced-inspection sampling procedure for life tests shall not be instituted at any time.

(1) 1,000-hour life tests.

(a) 1,000-hour life tests shall be in effect initially and shall continue in effect until the eligibility criteria for reduced-hour life tests have been met.

(b) The measurements listed under "end points" shall be made at 0 hours, 250 $^{+72}_{-24}$ hours, 500 $^{+72}_{-24}$ hours, and 1,000 $^{+72}_{-24}$ hours. Additional readings may be taken at the discretion of the manufacturer.

(c) Sample units shall meet the criteria specified herein, at the applicable AQL and inspection level shown in table I, at 250, 500, and 1,000 hours. If a life test sample fails either the 250-hour or 500-hour acceptance criteria for operation life or storage life, the lot shall be rejected. The tests may be terminated at the discretion of the manufacturer; however, the results of either of these tests shall not be used at a future date for acceptance of the same lot.

(2) Reduced-hours life tests (500 hours or 250 hours.)

To qualify for reduced-hours life tests, the following criteria shall be met:

(a) The immediately preceding 10 lots have been accepted.

(b) The estimated process average is less than the applicable lower limit specified in the appendix to Standard MIL-STD-105.

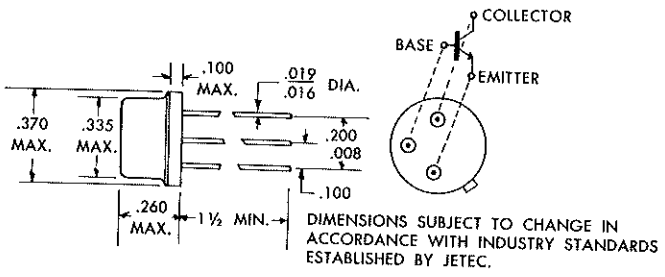
(c) There has been no unusual discontinuity in production in the immediately preceding 10 lots.

The manufacturer shall qualify for 500 hours first; thence, he shall meet the criteria of (a), (b), and (c) above at 500 hours to qualify for 250-hour life tests. Lots which are accepted under the reduced-hours life test may be shipped; however, the storage-life test shall continue through 1,000 hours, and the samples shall meet the acceptance number at the 1,000-hour AQL value for the number of sample units being tested. In the event a sample fails the storage-life test after a lot has been shipped, the manufacturer shall immediately lose eligibility for reduced-hours life tests. Loss of eligibility for reduced-hours life tests also occurs if a lot is rejected or the estimated process average is greater than the applicable lower limit shown in the appendix to Standard MIL-STD-105. Loss of eligibility during 500-hour life tests shall result in institution of 1,000-hour life tests; loss of eligibility during 250-hour life tests shall result in institution of 500-hour life tests.

Table I

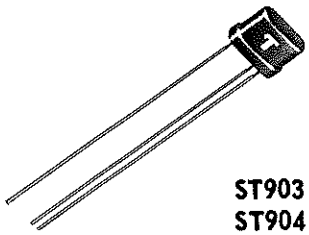
Test	AQL (Combined Percent Defective)					Inspection Level		
	1,000-hour life test			Reduced-hours life tests		1,000-hour life test	Reduced-hours life tests	
	250 hr	500 hr	1,000 hr	500 hr	250 hr		500 hr	250 hr
Storage life	6.5	6.5	6.5	4.0	2.5	L6	L6	L6
Operation life	6.5	6.5	6.5	4.0	2.5	L4	L4	L4

Figure 1



Transitron NPN SILICON TRANSISTORS

FLAT CASE TYPES



ST903
ST904
ST904A

150 MILLIWATTS

Transitron's ST903, ST904 and ST904A NPN silicon transistors are designed for low level signal applications up to 150°C.

The flat case series is recommended for use in equipment which, for mechanical reasons, cannot use the JETEC 30 (TO-5 Outline) package. For all new equipment design, transistors in the industry-standard JETEC 30 package are recommended.

ABSOLUTE MAXIMUM RATINGS

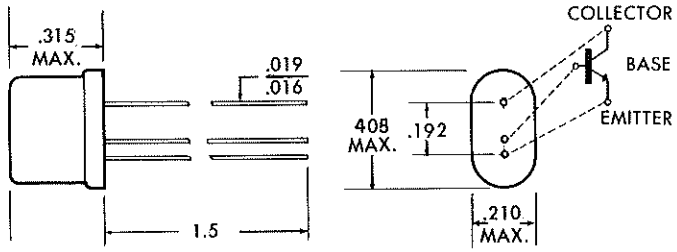
Collector to Base Voltage	V_{cb}	30	Volts
Emitter to Base Voltage	V_{eb}	1	Volt
Total Power Dissipation:	at 25°C	150	mw
	at 100°C	100	mw
	at 150°C	50	mw
Storage and Operating Ambient Temperature Range		−65°C to +150°C	

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		ST903			ST904			ST904A			
Common Emitter Parameters:		Min.	Typical	Max.	Min.	Typical	Max.	Min.	Typical	Max.	
Current Gain	h_{fe}	9	16	20	18	31	40	18	60	90	db
Power Gain ①	P.G.		30.5			34			35		db
Noise Figure ①	N.F.		25			25			25		
Common Base Parameters:											
Collector Cutoff Current - I_{co}: at 30 Volts			0.1	10		0.1	10		0.1	10	μa
at 5 Volts				1			1			1	μa
at 5 Volts, 150°C				50			50			50	μa
Input Impedance	h_{ib}	30	65	90	30	60	90	30	60	90	ohms
Output Admittance	h_{ob}	0.1	0.4	1.5	0.1	0.4	1.5	0.1	0.4	1.5	μmhos
Voltage Feedback Ratio	h_{rb}	.25	1.2	5.0	.25	2.5	10.0	.5	4.0	15.0	x10⁻⁴
Frequency Cutoff	f_{co}	1	7		2	9		8	11		Mc
Output Capacitance at 1 Mc	C_{ob}		7			7			7		μμf
DC Collector Saturation Resistance	R_{cs}		150	300		150	300		150	300	ohms

① R_s = 1000 ohms, R_L = 30K, f = 1 Kc. NOTE: Small signal parameters measured at V_c = 5V, I_e = −1 ma

MECHANICAL DATA



ENCAPSULATION: Flat solder seal case.

MOUNTING POSITION: Any.

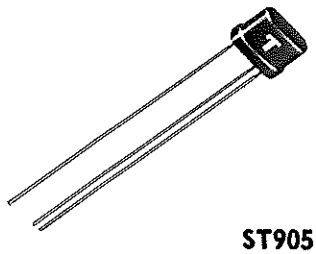
NOTE: Case isolated from all leads.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

TE-1353M
7-58

Transitron NPN SILICON TRANSISTORS

FLAT CASE TYPES



ST905
ST910

150 MILLIWATTS

Transitron's ST905 and ST910 NPN silicon transistors are designed for low level signal applications up to 150°C.

The flat case series is recommended for use in equipment which, for mechanical reasons, cannot use the JETEC 30 (TO-5 Outline) package. For all new equipment design, transistors in the industry-standard JETEC 30 package are recommended.

ABSOLUTE MAXIMUM RATINGS

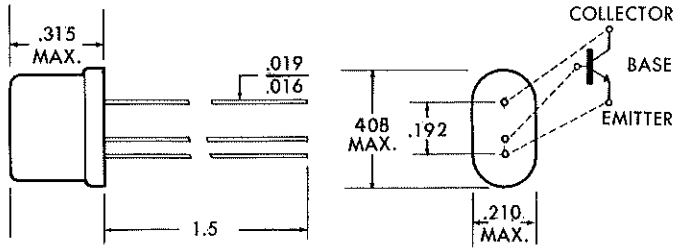
Collector to Base Voltage	V_{cb}	30	Volts
Emitter to Base Voltage	V_{eb}	1	Volt
Total Power Dissipation:			
	at 25°C	150	mw
	at 100°C	100	mw
	at 150°C	50	mw
Storage and Operating Ambient Temperature Range		−65°C to +150°C	

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

			ST905			ST910			
			Min.	Typical	Max.	Min.	Typical	Max.	
Common Emitter Parameters:									
Current Gain		h_{fe}	36	65	90	76	140	333	
Power Gain ①		P.G.		36.5			42.5		db
Noise Figure ①		N.F.		25			20		db
Common Base Parameters:									
Collector Cutoff Current – I_{co}:	at 30 Volts			0.1	10		0.1	10	μa
	at 5 Volts				1			1	μa
	at 5 Volts, 150°C				50			50	μa
Input Impedance		h_{ib}	30	60	90	30	55	90	ohms
Output Admittance		h_{ob}	0.1	0.4	1.5	0.1	0.4	1.5	μmhos
Voltage Feedback Ratio		h_{rb}	.5	4.0	15.0	.5	4.0	15.0	x10−4
Frequency Cutoff		f_{co}	2	10			11		Mc
Output Capacitance at 1 M_c		C_{ob}		7			7		μμf
DC Collector Saturation Resistance		R_{cs}		150	300		150	300	ohms

① R_x = 1000 ohms, R_L = 30K, f = 1 Kc. NOTE: Small signal parameters measured at V_c = 5V, I_e = −1 ma

MECHANICAL DATA



ENCAPSULATION: Flat solder seal case.

MOUNTING POSITION: Any.

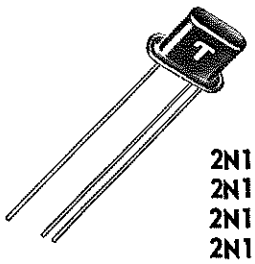
NOTE: Case isolated from all leads.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

TE-1353N
7-58

Transitron NPN SILICON TRANSISTORS

FLAT CASE TYPES



2N117
2N118
2N118A
2N119

150 MILLIWATTS

Transitron's 2N117, 2N118, 2N118A and 2N119NPN silicon transistors are designed for low level signal applications up to 150°C.

High temperature reliability is insured through close process control which results in a stable and low I_{co} up to the maximum voltage rating. Extensive temperature cycling and storage, as well as mechanical and hermetic seal tests, are included as a regular part of the manufacturing process.

ABSOLUTE MAXIMUM RATINGS

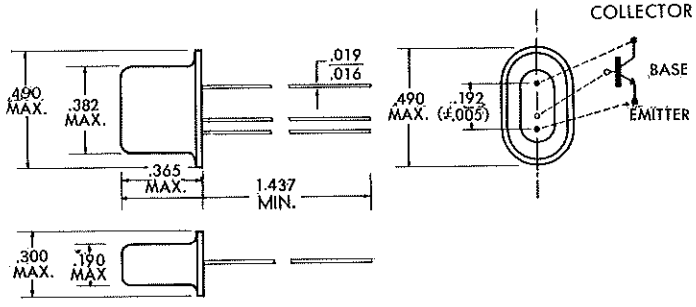
Collector to Base Voltage	V_{cb}	30	Volts
Emitter to Base Voltage	V_{eb}	1	Volt
Total Power Dissipation:	at 25°C	150	mw
Storage and Operating Ambient Temperature Range		−55 to +175°C	

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		2N117			2N118			2N118A			2N119			
Common Emitter Parameters:		Min.	Typical	Max.	Min.	Typical	Max.	Min.	Typical	Max.	Min.	Typical	Max.	
Current Gain	h_{fe}	9	15	19	19	30	39	19	50	90	38	60	–	
Power Gain ① (V_C = 20V I_E = −1.85ma)	P.G.	–	–	–	–	–	–	–	35	–	–	–	–	db
Noise Figure ①	N.F.	–	20	30	–	20	30	–	25	–	–	20	30	db
Common Base Parameters:														
Collector Cutoff Current	I_{co}													
at 15 Volts		–	–	1	–	–	1	–	–	1	–	–	1	μa
at 30 Volts		–	0.1	10	–	0.1	10	–	0.1	10	–	0.1	10	μa
at 5 Volts, 100°C		–	–	10	–	–	10	–	–	10	–	–	10	μa
at 5 Volts, 150°C		–	–	50	–	–	50	–	–	50	–	–	50	μa
Input Impedance	h_{ib}	30	65	90	30	60	90	30	60	90	30	60	90	ohms
Output Admittance	h_{ob}	0.1	0.4	1.5	0.1	0.4	1.5	0.1	0.4	1.5	0.1	0.4	1.5	μmhos
Voltage Feedback Ratio	h_{rb}	.25	1.2	5.0	.25	2.5	10.0	.5	4.0	15.0	.5	4.0	15.0	x 10⁻⁴
Frequency Cutoff	f_{co}	1	8	–	2	10	–	8	11	–	2	11	–	Mc
Output Capacitance at 1Mc	C_{ob}	–	7	20	–	7	20	–	7	20	–	7	20	μμf
DC Collector Saturation Resistance	R_{cs}	–	140	300	–	140	300	–	140	300	–	140	300	ohms

① R_s = 1000 ohms, R_L = 30K, f = 1 Kc. NOTE: Small signal parameters measured at V_C = 5V, I_e = −1ma.

MECHANICAL DATA



ENCAPSULATION: Welded hermetic seal.

MOUNTING POSITION: Any.

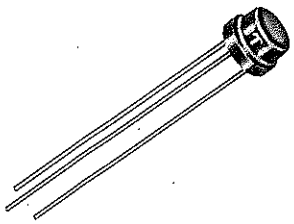
NOTE: Case isolated from all leads.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

TE-1353P
7-58

Transitron NPN SILICON TRANSISTORS

FAST SWITCHING TYPE



2N545

MEDIUM POWER, 500 ma, 60 VOLTS

Transitron's 2N547 medium power NPN silicon transistors are designed for switching and amplifying applications and feature low collector saturation voltage, high current gain and fast switching time at 500ma. These applications include output stages, servo-motor control, magnetic core switching, solenoid operation, DC to DC converters, and medium power oscillators.

Manufactured by diffusion, these units have closely controlled electrical characteristics plus a high degree of mechanical ruggedness. They can be used with confidence in the most exacting military applications.

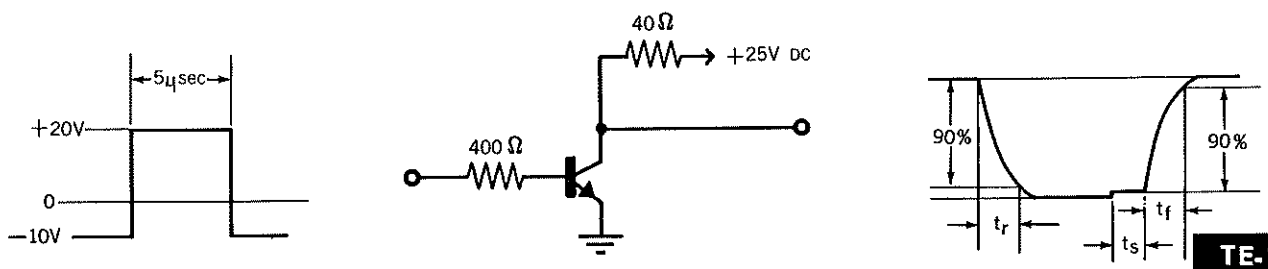
ABSOLUTE MAXIMUM RATINGS

Collector to Emitter Voltage		V_{CE}	60	Volts
Collector to Base Voltage		V_{CB}	60	Volts
Emitter to Base Voltage		V_{EB}	10	Volts
Total Power Dissipation:	at 100°C Case Temperature		5	Watts
	at 200°C Case Temperature		0.5	Watts
	at 100°C Amb. Temperature		0.6	Watts
	at 200°C Amb. Temperature		.05	Watts
Storage and Operating Temperature Range			−65 to + 200	°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		Min.	Typical	Max.		Test Conditions
D.C. Current Gain	h_{FE}	15	25	–		I_C = 500ma, V_{CE} = 6V
D.C. Input Voltage	V_{BE}	–	3.5	6	V	I_C = 500ma, I_B = 50ma
D.C. Collector Saturation Voltage	V_{CE}	–	3	5	V	
Collector Cutoff Current	I_{CO}	–	1.2	15	μa	V_{CB} = 60V
Collector Cutoff Current	I_{CO}	–	70	200	μa	V_{CB} = 60V, 150°C
Emitter Cutoff Current	I_{EO}	–	1	100	μa	V_{EB} = 10V
Output Capacitance	C_{ob}	–	130	–	μμf	V_{CB} = 20V, I_E = −100ma,
High Frequency Current Gain	h_{fe}	–	6	–		F = 1Mc
Rise Time	t_r ①	–	0.3	0.5	μsec	I_{B1} = 50ma,
Storage Time	t_s ①	–	0.1	–	μsec	I_{B2} = −25ma,
Storage and Fall Time	$t_s + t_f$ ①	–	0.5	0.8	μsec	I_C = 500ma

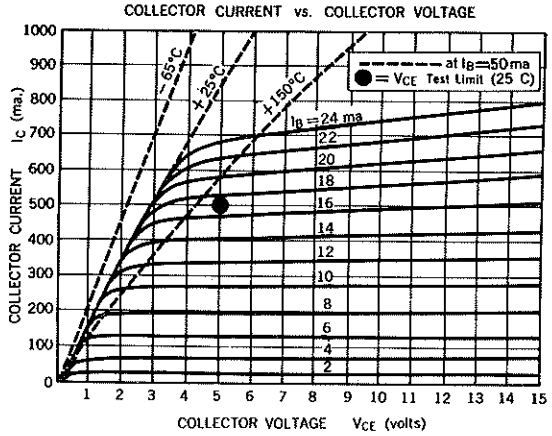
① Measured in the following test circuit:



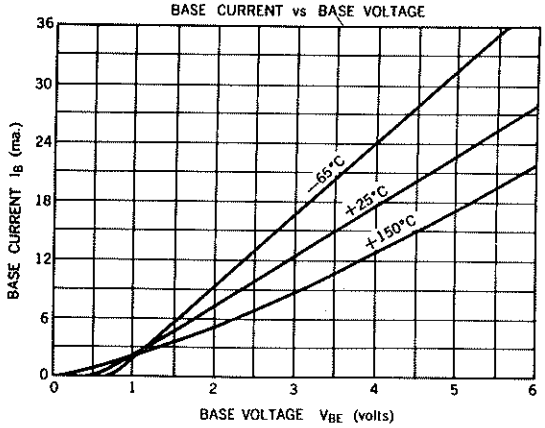
TE-1355A
7-58

TYPICAL CHARACTERISTICS

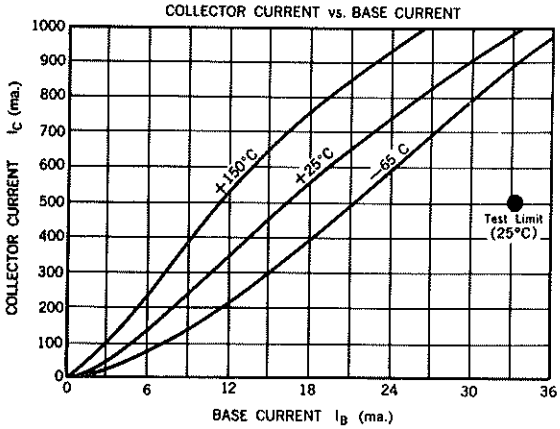
COLLECTOR CURRENT vs. COLLECTOR VOLTAGE



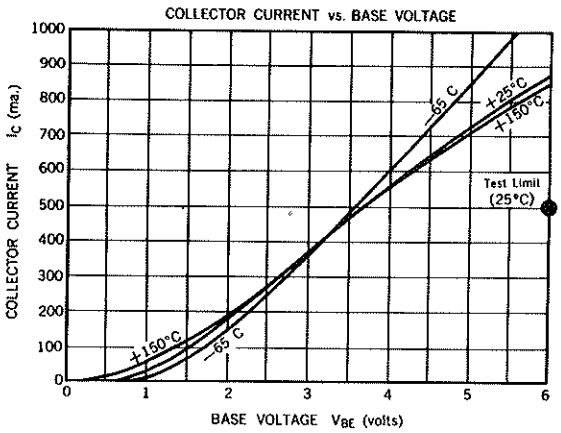
BASE CURRENT vs BASE VOLTAGE



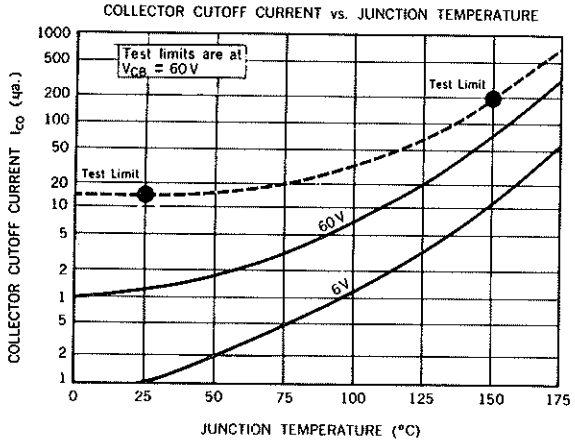
COLLECTOR CURRENT vs. BASE CURRENT



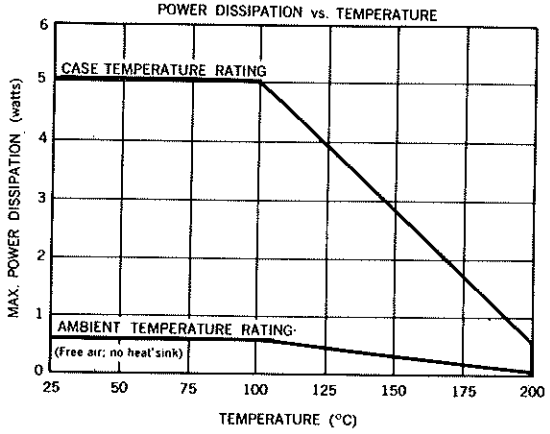
COLLECTOR CURRENT vs. BASE VOLTAGE



COLLECTOR CUTOFF CURRENT vs. JUNCTION TEMPERATURE

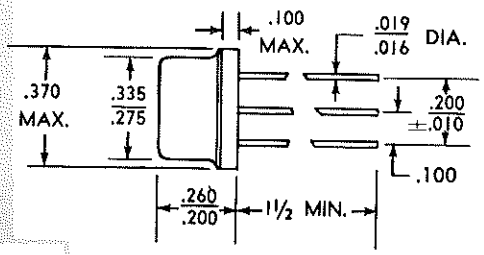


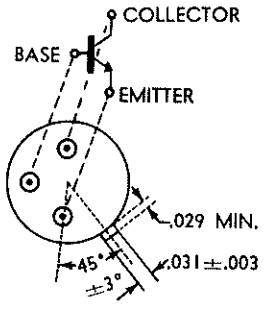
POWER DISSIPATION vs. TEMPERATURE



MECHANICAL DATA

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)





ENCAPSULATION: Welded hermetic seal.

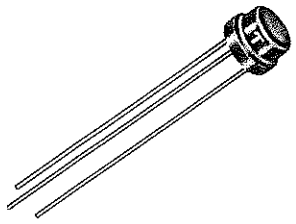
MOUNTING POSITION: Any.

NOTE: collector is connected to the case.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

Transitron NPN SILICON TRANSISTORS

FAST SWITCHING TYPE



2N546

MEDIUM POWER, 500 ma, 30 VOLTS

Transitron's 2N546 medium power NPN silicon transistors are designed for switching and amplifying applications and feature low collector saturation voltage, high current gain and fast switching time at 500ma. These applications include output stages, servo-motor control, magnetic core switching, solenoid operation, DC to DC converters, and medium power oscillators.

Manufactured by diffusion, these units have closely controlled electrical characteristics plus a high degree of mechanical ruggedness. They can be used with confidence in the most exacting military applications.

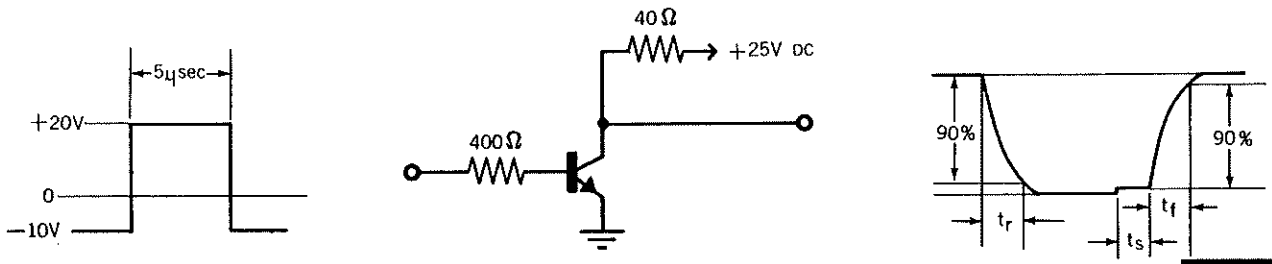
ABSOLUTE MAXIMUM RATINGS

Collector to Emitter Voltage	V_{CE}	30	Volts
Collector to Base Voltage	V_{CB}	30	Volts
Emitter to Base Voltage	V_{EB}	10	Volts
Total Power Dissipation: at 100°C Case Temperature		5	Watts
at 200°C Case Temperature		0.5	Watts
at 100°C Amb. Temperature		0.6	Watts
at 200°C Amb. Temperature		.05	Watts
Storage and Operating Temperature Range		−65 + 200	°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

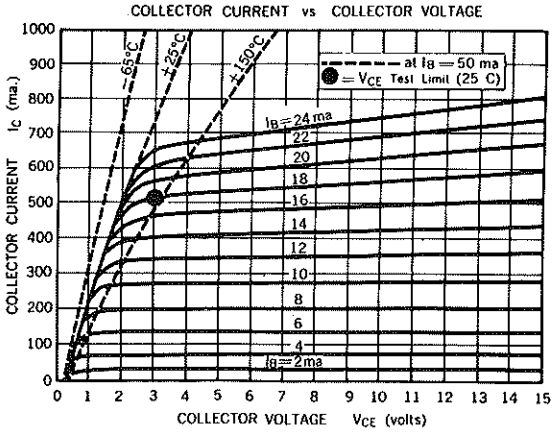
		Min.	Typical	Max.		Test Conditions
D.C. Current Gain	h_{FE}	15	25	–		I_C = 500ma, V_{CE} = 6V
D.C. Input Voltage	V_{BE}	–	2.5	4	V	I_C = 500ma, I_B = 50ma
D.C. Collector Saturation Voltage	V_{CE}	–	2	3	V	
Collector Cutoff Current	I_{CO}	–	0.5	15	μa	V_{CB} = 30V
Collector Cutoff Current	I_{CO}	–	50	200	μa	V_{CB} = 30V, 150°C
Emitter Cutoff Current	I_{EO}	–	1	100	μa	V_{EB} = 10V
Output Capacitance	C_{ob}	–	130	–	μμf	V_{CB} = 20V, I_E = −100ma
High Frequency Current Gain	h_{fe}	–	6	–		F = 1 mc
Rise Time	t_r (1)	–	0.3	0.5	μsec	I_{B1} = 50ma,
Storage Time	t_s (1)	–	0.1	–	μsec	I_{B2} = −25ma,
Storage and Fall Time	$t_s + t_f$ (1)	–	0.5	0.8	μsec	I_C = 500ma

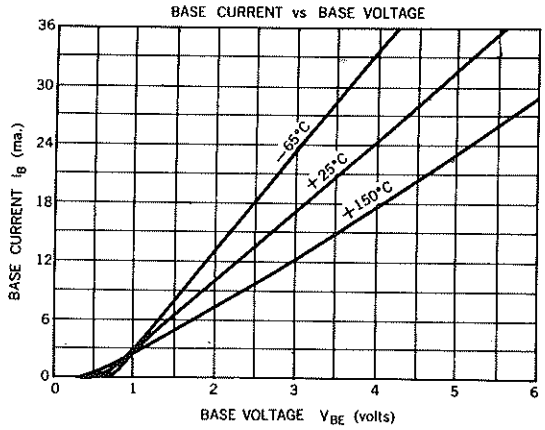
(1) Measured in the following test circuit:

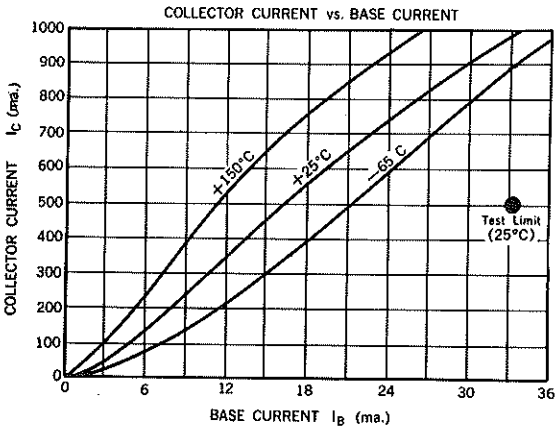


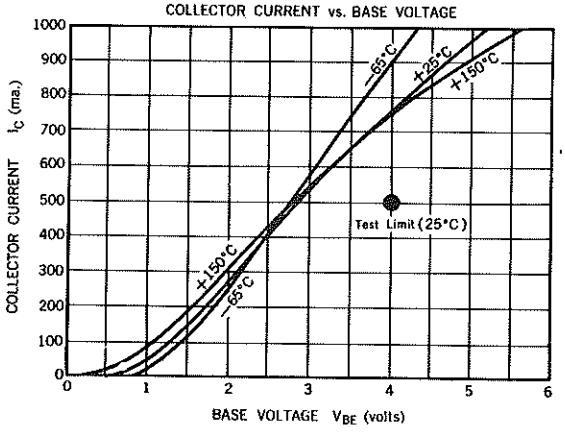
TE-1355B
7-58

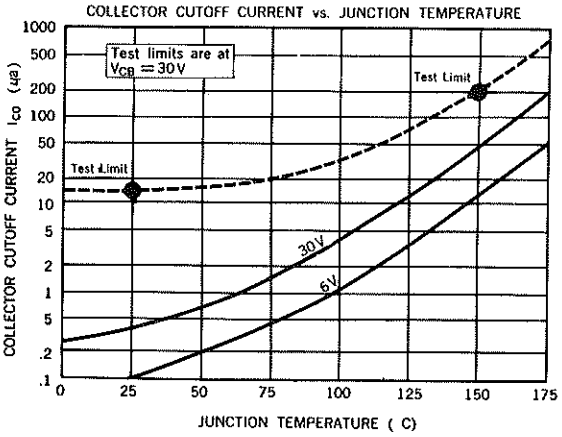
TYPICAL CHARACTERISTICS

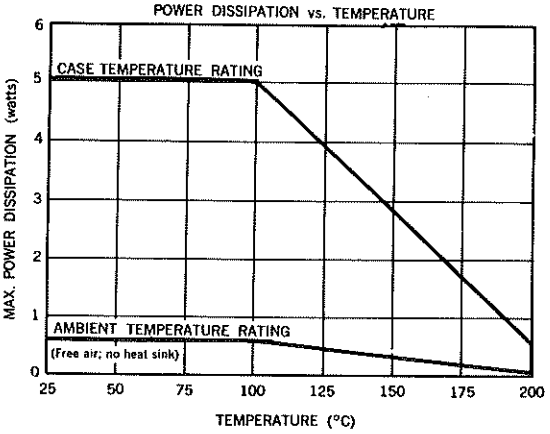






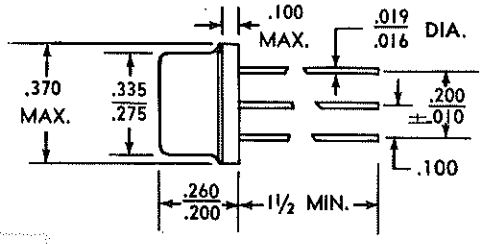


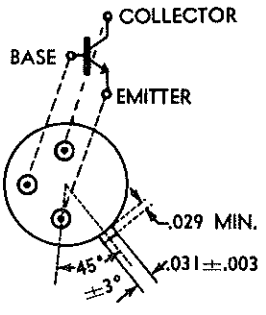




MECHANICAL DATA

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)





ENCAPSULATION: Welded hermetic seal.

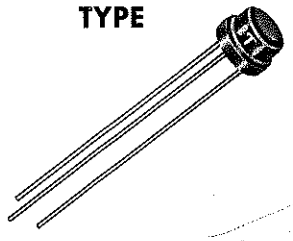
MOUNTING POSITION: Any.

NOTE: collector is connected to the case.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

Transitron NPN SILICON TRANSISTORS

FAST SWITCHING MEDIUM POWER TYPE



2N1140

40 VOLT, 35 mc, 1 WATT

Transitron's 2N1140 is a fast switching medium power transistor that features low capacitance and low saturation voltage in the range of 10 to 100 milliamperes. The 2N1140 is designed for use as a drum memory driver, core driver and high level multi-vibrator.

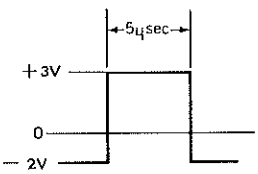
High temperature reliability is assured by extensive environmental conditioning that is performed as a regular part of the manufacturing process.

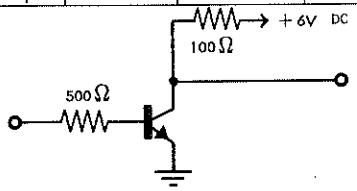
ABSOLUTE MAXIMUM RATINGS

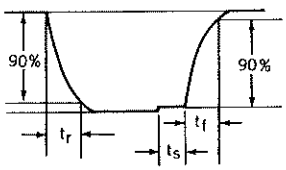
Collector to Emitter Voltage	V_{CE}	40	Volts
Collector to Base Voltage	V_{CB}	40	Volts
Emitter to Base Voltage	V_{EB}	5	Volts
Total Power Dissipation: at 100°C Case Temperature		1	Watt
at 100°C Amb. Temperature		.5	Watts
Storage and Operating Temperature Range		−65 to + 200	°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

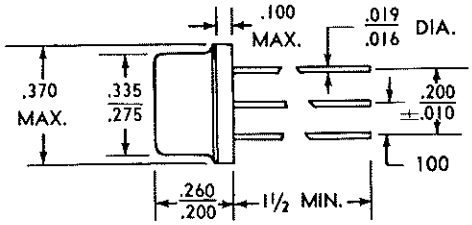
		Min.	Typical	Max.		Test Conditions
D.C. Current Gain	h_{FE}	20	50	—		$I_C = 50$ ma, $V_{CE} = 6V$
A.C. Current Gain 1kc	h_{fe}	20	—	—		$I_C = 1$ mA, $V_{CE} = 6V$
D.C. Input Voltage	V_{BE}	—	—	2.5	V	$I_C = 50$ ma, $I_B = 5$ ma
D.C. Collector Saturation Voltage	V_{CE}	—	—	2.5	V	
Collector Cutoff Current	I_{CO}	—	—	15	μa	V_{CB} = Rating
Collector Cutoff Current	I_{CO}	—	—	200	μa	V_{CB} = Rating, 150°C
Emitter Cutoff Current	I_{EO}	—	—	50	μa	$V_{EB} = 5V$
Output Capacitance	C_{ob}	—	—	20	$\mu\mu$f	$V_{CB} = 10V$, $I_E = 0$ ma
High Frequency Current Gain	h_{fe}	3.5	6	—		F = 10mc $V_{CE} = 6V$, $I_E = 20$ ma
Delay Time	t_d	—	0.06		μ sec.	Measured in test circuit illustrated below.
Rise Time	t_r	—	0.2		μ sec.	
Storage Time	t_s	—	0.08		μ sec.	
Fall Time	t_f	—	0.1		μ sec.	

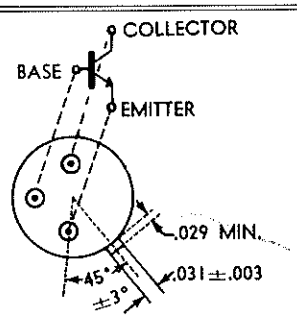






JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)





ENCAPSULATION: Welded hermetic seal.

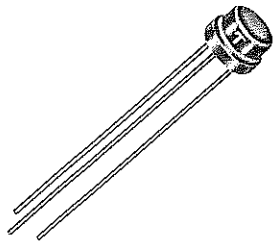
MOUNTING POSITION: Any.

NOTE: collector is connected to the case.
A heat sink (long nose pliers) should be used when soldering leads within ¼ inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C ⅛ inch from the base.

TE1355B-1
3-59

Transitron NPN SILICON TRANSISTORS

FAST LOGIC TYPE



2N1139

150 mc DIFFUSED MESA

Transitron's 2N1139 fast logic transistor is specifically designed for high speed computer applications operating under severe environmental conditions. Optimum performance in SCTL and TRL logic circuits will be obtained by using the 2N1139 at collector currents between 1 and 20 milliamps.

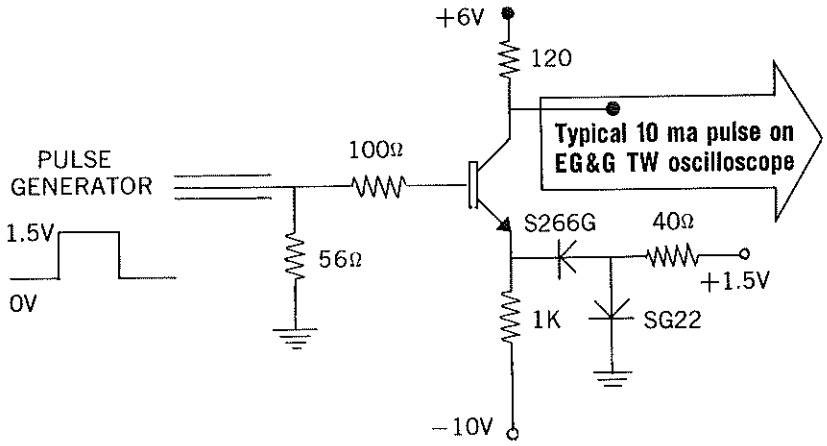
Manufactured by diffusion and Mesa techniques, these transistors are securely mounted to the case to provide best heat transfer and freedom from mechanical problems.

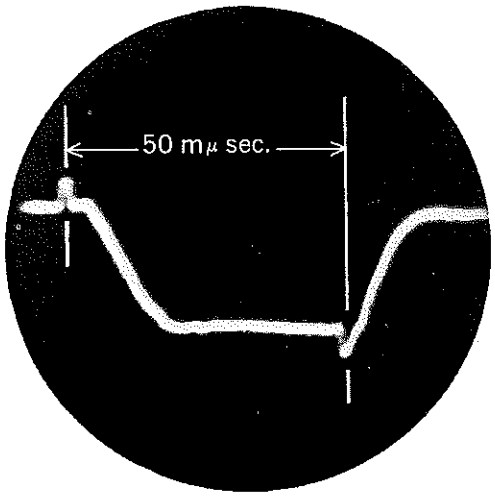
ABSOLUTE MAXIMUM RATINGS

Collector to Emitter Voltage	V_{CE}	15	Volts
Collector to Base Voltage	V_{CB}	15	Volts
Emitter to Base Voltage	V_{EB}	3	Volts
Total Power Dissipation: at 125°C Case Temperature		.5	Watts
at 100°C Amb. Temperature		.5	Watts
Storage and Operating Temperature Range		−65 to + 175	°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		Min.	Typical	Max.		Test Conditions
D.C. Current Gain	h_{FE}	20	40	—		$I_C = 10$ ma, $V_{CE} = 6V$
D.C. Input Voltage	V_{BE}	—	.8	1.0	V	$I_C = 10$ ma, $I_B = 1$ ma
D.C. Collector Saturation Voltage	V_{CE}	—	.4	0.7	V	$I_C = 10$ ma, $I_B = 1$ ma
Collector Cutoff Current	I_{CO}	—	.25	5	μa	V_{CB} = Rating
Collector Cutoff Current	I_{CO}	—	25	60	μa	V_{CB} = Rating, 150°C
Emitter Cutoff Current	I_{EO}	—	.5	5	μa	$V_{EB} = 3V$
Output Capacitance	C_{ob}	—	8	12	$\mu\mu f$	$V_{CB} = 10V$, $I_E = 0$ ma
High Frequency Current Gain	h_{fe}	5	7.5	—		$V_{CE} = 10V$, $I_E = 10$ ma, F = 20mc
Delay Time	t_d	—	6		mμsec.	Measured in test circuit illustrated below.
Rise Time	t_r	—	12		mμsec.	
Storage + Fall Time	$t_s + t_f$	—	10		mμsec.	





TE-1355B-2
6-59

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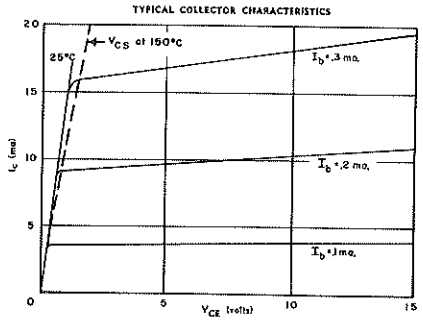
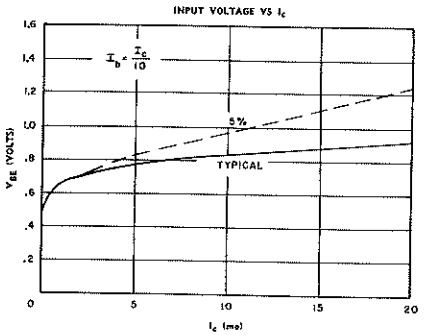
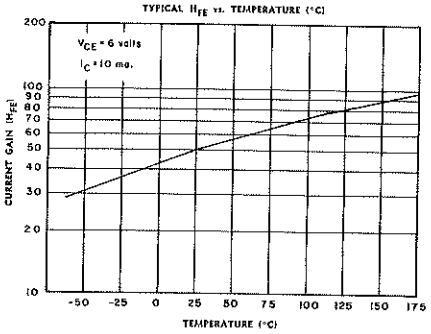
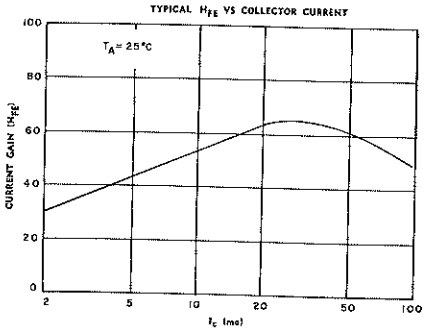
CATALOG NO. 85.34.10H

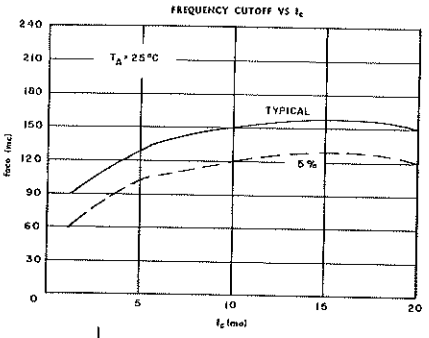
TYPICAL CHARACTERISTICS

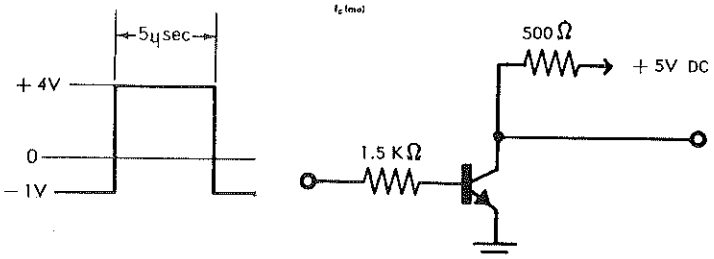












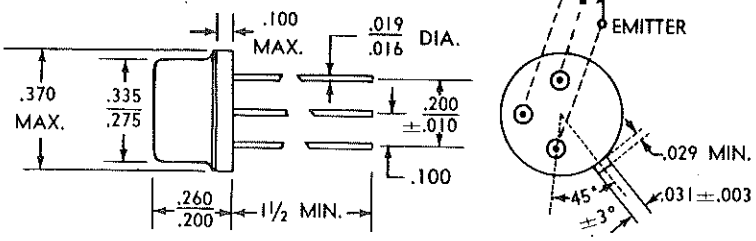
Delay Time	(td)	30	mμsec
Rise Time	(tr)	100	mμsec
Storage Time	(ts)	50	mμsec
Fall Time	(tf)	100	mμsec

SWITCHING CHARACTERISTICS

The switching speed of very high frequency transistors is heavily dependent on the circuit conditions. The switching speeds shown on the front of this data sheet are typical of the non-saturating controlled current switching circuits, with which excellent high speed results are obtained.

The circuit at left shows the typical speeds obtained in the saturating-type grounded emitter switching circuits. Note the extremely short storage time obtained when switching with a circuit beta of 5. The 2N1139 will provide very low storage time under even more severe overdrive conditions.

JETEC TO-5 OUTLINE.



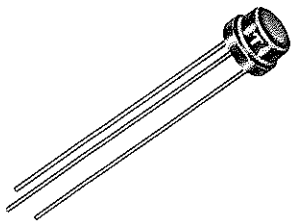
ENCAPSULATION: Welded hermetic seal.

MOUNTING POSITION: Any.

NOTE: Collector is connected to the case.
A heat sink (long nose pliers) should be used when soldering leads within ¼ inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C ⅛ inch from the base.

Transitron NPN SILICON TRANSISTORS

GENERAL PURPOSE TYPE



2N547

MEDIUM POWER, 500 ma, 60 VOLTS

Transitron's 2N547 medium power NPN silicon transistors are designed for switching and amplifying applications and feature low collector saturation voltage, high current gain and fast switching time at 500ma. These applications include output stages, servo-motor control, magnetic core switching, solenoid operation, DC to DC converters, and medium power oscillators.

Manufactured by diffusion, these units have closely controlled electrical characteristics plus a high degree of mechanical ruggedness. They can be used with confidence in the most exacting military applications.

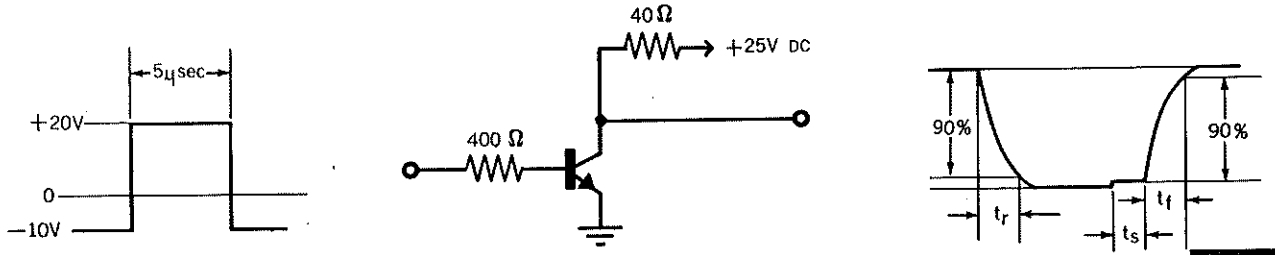
ABSOLUTE MAXIMUM RATINGS

Collector to Emitter Voltage	V_{CE}	60	Volts
Collector to Base Voltage	V_{CB}	60	Volts
Emitter to Base Voltage	V_{EB}	10	Volts
Total Power Dissipation: at 100°C Case Temperature		5	Watts
at 200°C Case Temperature		0.5	Watts
at 100°C Amb. Temperature		0.6	Watts
at 200°C Amb. Temperature		.05	Watts
Storage and Operating Temperature Range		−65 to + 200	°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		Min.	Typical	Max.		Test Conditions
D.C. Current Gain	h_{FE}	20	35	80		I_C = 500ma, V_{CE} = 6V
D.C. Input Voltage	V_{BE}	–	3.5	6	V	I_C = 500ma, I_B = 50ma
D.C. Collector Saturation Voltage	V_{CE}	–	3	5	V	
Collector Cutoff Current	I_{CO}	–	1.2	15	μa	V_{CB} = 60V
Collector Cutoff Current	I_{CO}	–	70	200	μa	V_{CB} = 60V, 150°C
Emitter Cutoff Current	I_{EO}	–	1	100	μa	V_{EB} = 10V
Output Capacitance	C_{ob}	–	130	–	μμf	V_{CB} = 20V, I_E = −100ma
High Frequency Current Gain	h_{fe}	–	4	–		F = 1 mc
Rise Time	t_r ①	–	0.7	–	μsec	I_{B1} = 50ma,
Storage Time	t_s ①	–	0.2	–	μsec	I_{B2} = −25ma,
Fall Time	t_f ①	–	1	–	μsec	I_C = 500ma

① Measured in the following test circuit:



TE-1355C
7-58

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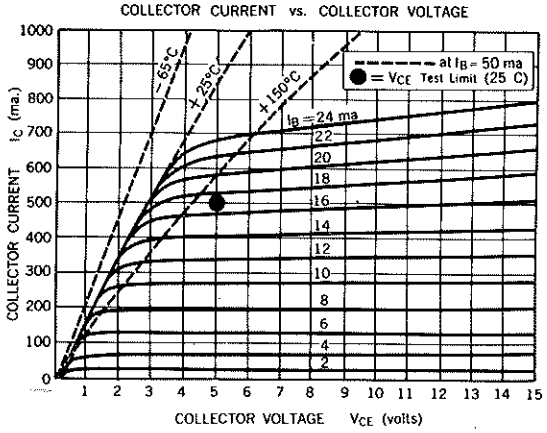
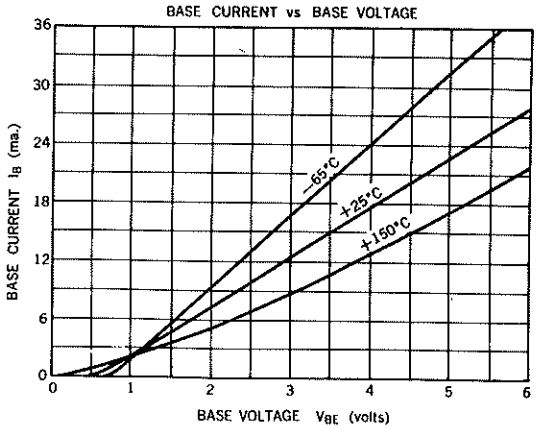
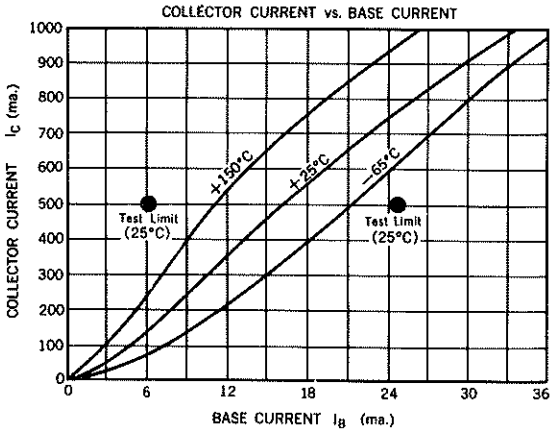
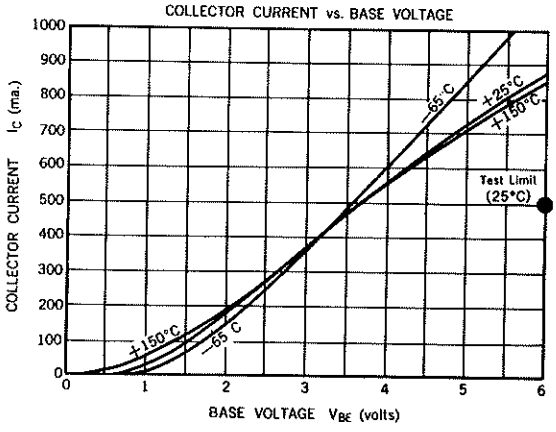
CATALOG NO. 85.34.10 A

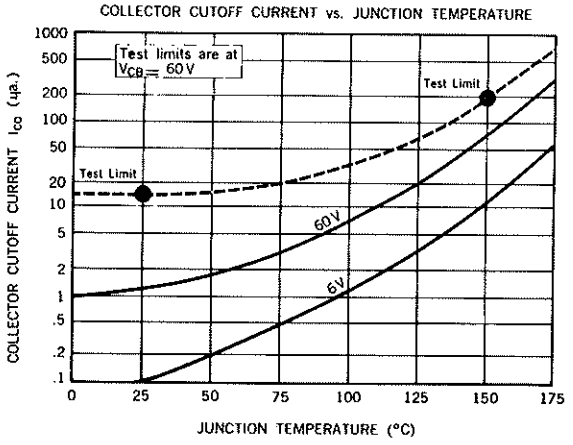
TYPICAL CHARACTERISTICS

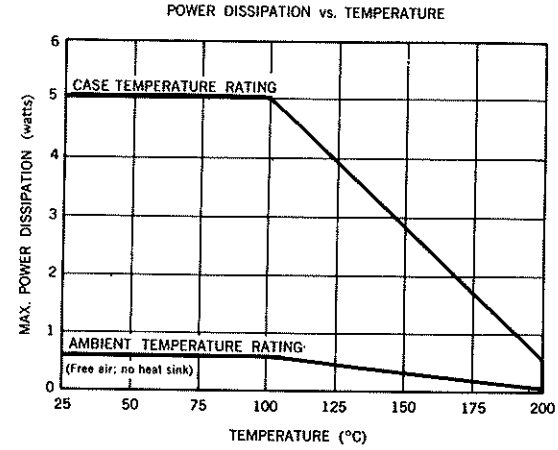






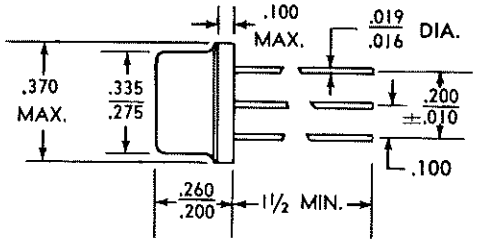


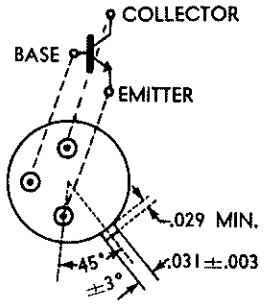




MECHANICAL DATA

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)





ENCAPSULATION: Welded hermetic seal.

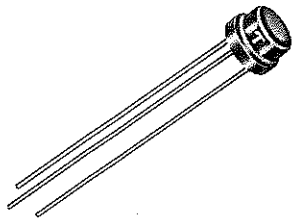
MOUNTING POSITION: Any.

NOTE: collector is connected to the case.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

Transitron NPN SILICON TRANSISTORS

GENERAL PURPOSE TYPE



2N548

MEDIUM POWER, 500 ma, 30 VOLTS

Transitron's 2N548 medium power NPN silicon transistors are designed for switching and amplifying applications and feature low collector saturation voltage, high current gain and fast switching time at 500ma. These applications include output stages, servo-motor control, magnetic core switching, solenoid operation, DC to DC converters, and medium power oscillators.

Manufactured by diffusion, these units have closely controlled electrical characteristics plus a high degree of mechanical ruggedness. They can be used with confidence in the most exacting military applications.

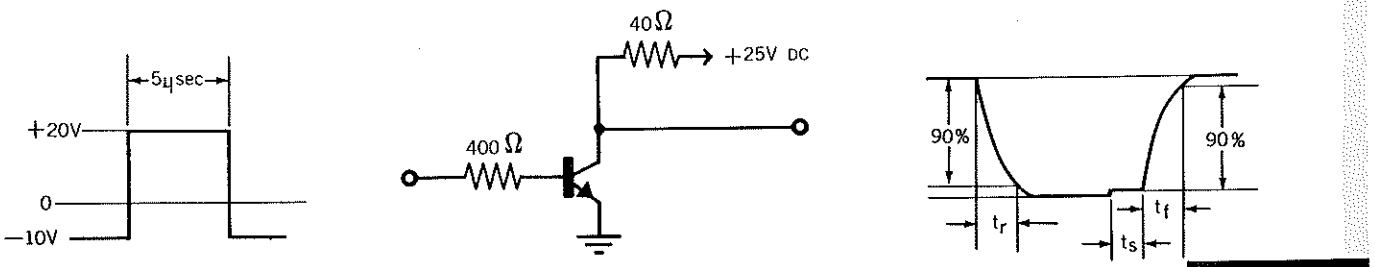
ABSOLUTE MAXIMUM RATINGS

Collector to Emitter Voltage	V_{CE}	30	Volts
Collector to Base Voltage	V_{CB}	30	Volts
Emitter to Base Vdtage	V_{EB}	10	Volts
Total Power Dissipation: at 100°C Case Temperature		5	Watts
at 200°C Case Temperature		0.5	Watts
at 100°C Amb. Temperature		.05	Watts
at 200°C Amb. Temperature		.05	Watts
Storage and Operating Temperature Range		−65 to + 200	°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

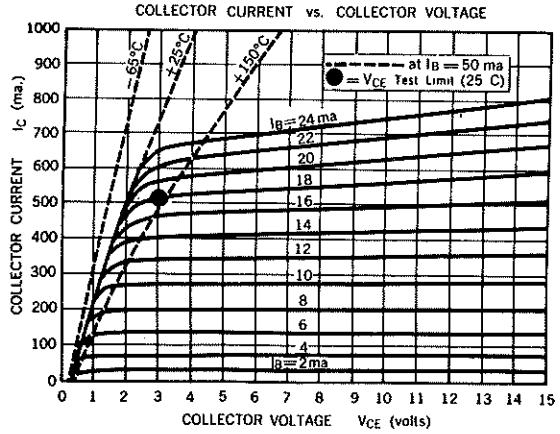
		Min.	Typical	Max.		Test Conditions
D.C. Current Gain	h_{FE}	20	35	80		I_C = 500ma, V_{CE} = 6V
D.C. Input Voltage	V_{BE}	–	2.5	4	V	I_C = 500ma, I_B = 50ma
D.C. Collector Saturation Voltage	V_{CE}	–	2	3	V	
Collector Cutoff Current	I_{CO}	–	0.5	15	μa	V_{CB} = 30V
Collector Cutoff Current	I_{CO}	–	50	200	μa	V_{CB} = 30V, 150°C
Emitter Cutoff Current	I_{EO}	–	1	100	μa	V_{EB} = 10V
Output Capacitance	C_{ob}	–	130	–	μμf	V_{CB} = 20V, I_E = 100ma
High Frequency Current Gain	h_{fe}	–	4	–		F = 1M$_c$
Rise Time	t_r (1)	–	0.7	–	μsec	I_{B1} = 50ma,
Storage Time	t_s (1)	–	0.2	–	μsec	I_{B2} = −25ma,
Fall Time	t_f (1)	–	1	–	μsec	I_C = 500ma

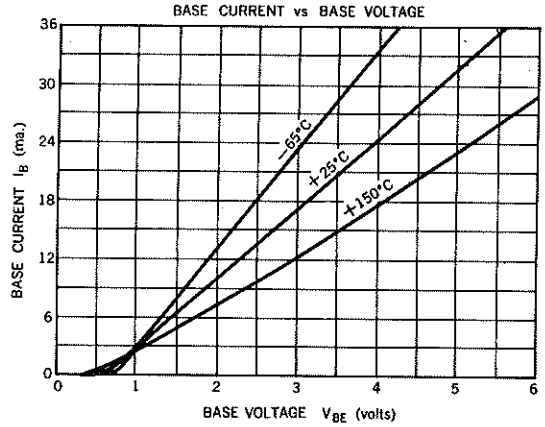
(1) Measured in the following test circuit:

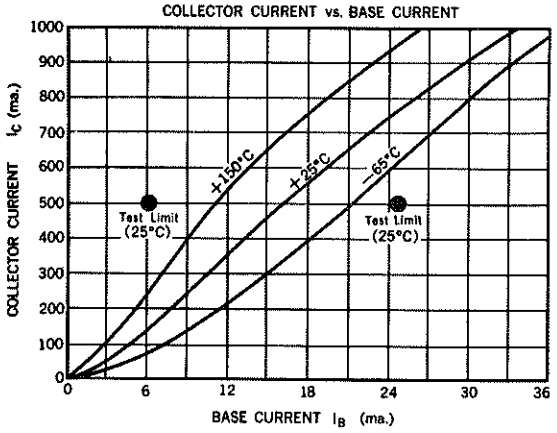


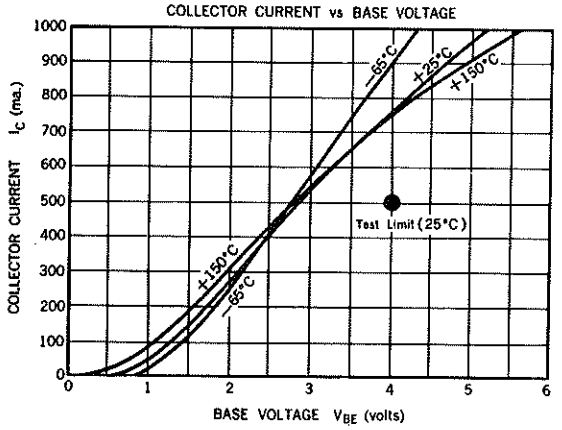
TE-1355D
7-58

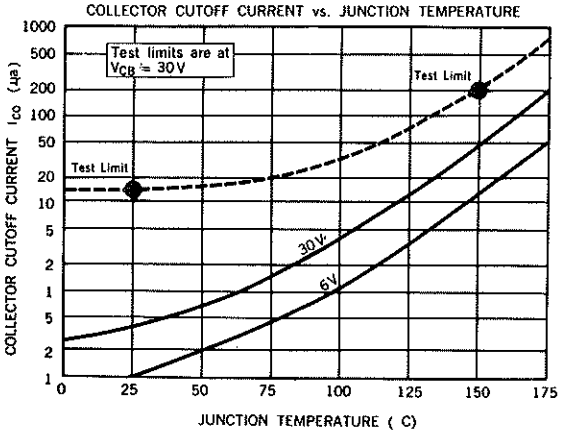
TYPICAL CHARACTERISTICS

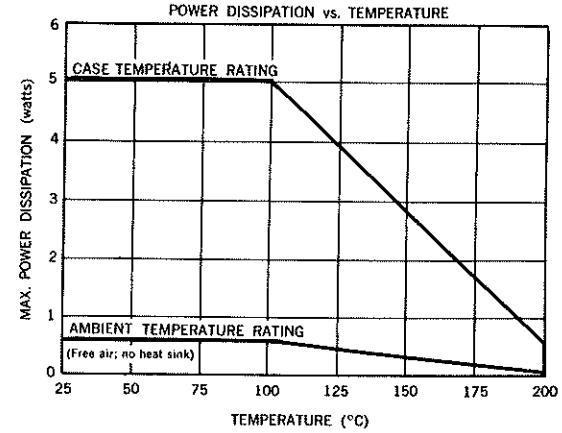






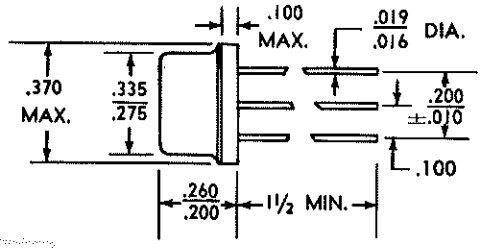


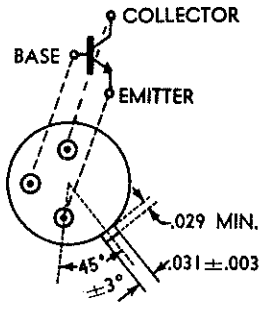




MECHANICAL DATA

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)





ENCAPSULATION: Welded hermetic seal.

MOUNTING POSITION: Any.

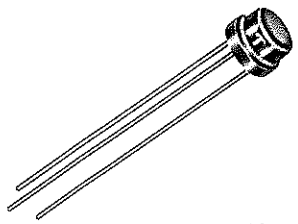
NOTE: collector is connected to the case.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

Transitron

NPN SILICON TRANSISTORS

GENERAL PURPOSE TYPES



2N549
2N550

MEDIUM POWER, 200 ma

Transitron's 2N549 and 2N550 medium power NPN silicon transistors are designed for switching and amplifying applications and feature low collector saturation voltage, high current gain and fast switching time at 200ma. These applications include output stages, servo-motor control, magnetic core switching, solenoid operation, DC to DC converters, and medium power oscillators.

Manufactured by diffusion, these units have closely controlled electrical characteristics plus a high degree of mechanical ruggedness. They can be used with confidence in the most exacting military applications.

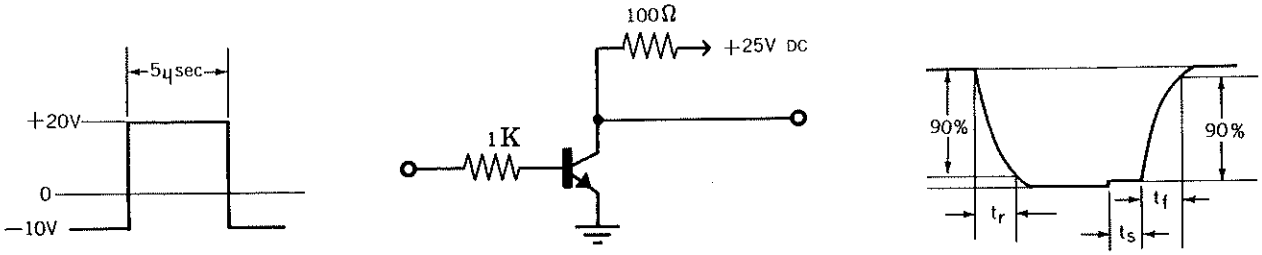
ABSOLUTE MAXIMUM RATINGS

		2N549	2N550	
Collector to Emitter Voltage	V_{CE}	60	30	Volts
Collector to Base Voltage	V_{CB}	60	30	Volts
Emitter to Base Voltage	V_{EB}	10	10	Volts
Total Power Dissipation: at 100°C Case Temperature		5		Watts
at 200°C Case Temperature		0.5		Watts
at 100°C Amb. Temperature		0.6		Watts
at 200°C Amb. Temperature		.05		Watts
Storage and Operating Temperature Range		−65 to + 200		°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

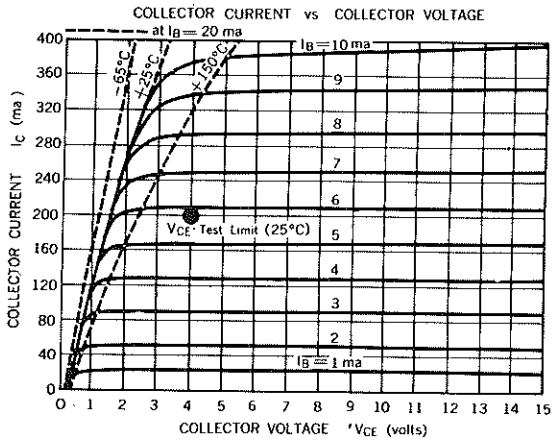
		Min.	Typical	Max.		Test Conditions
D.C. Current Gain	h_{FE}	20	35	80		I_C = 200ma, V_{CE} = 6V
D.C. Input Voltage	V_{BE}	–	2	5	V	I_C = 200ma, I_B = 20ma
D.C. Collector Saturation Voltage	V_{CE}	–	1.5	4	V	
Collector Cutoff Current	I_{CO}	–	0.4	3	μa	V_{CB} = Rating
Collector Cutoff Current	I_{CO}	–	50	200	μa	V_{CB} = Rating, 150°C
Emitter Cutoff Current	I_{EO}	–	1	100	μa	V_{EB} = 10V
Output Capacitance	C_{ob}	–	130	–	μμf	V_{CB} = 20V, I_E = −100ma
High Frequency Current Gain	h_{fe}	–	4	–		F = 1 M_c
Rise Time	t_r ①	–	0.7	–	μsec	I_{B1} = 20ma,
Storage Time	t_s ①	–	0.2	–	μsec	I_{B2} = −10ma,
Fall Time	t_f ①	–	1.0	–	μsec	I_C = 200ma

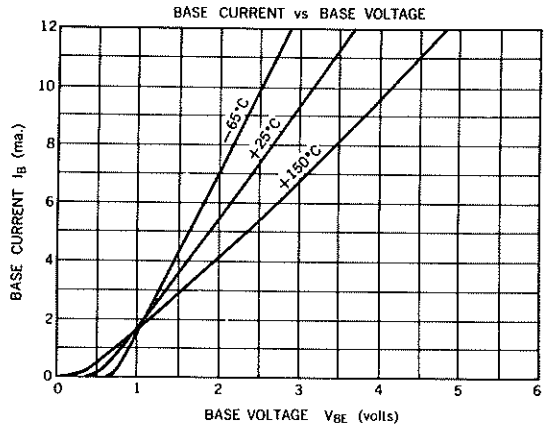
① Measured in the following test circuit:

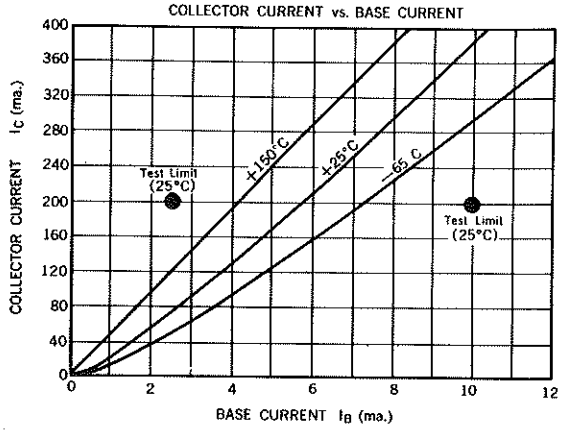


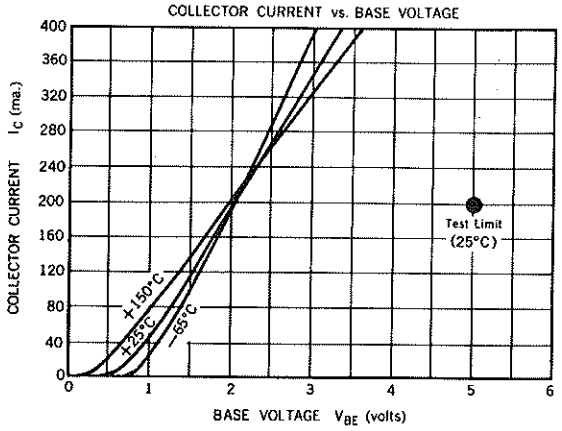
TE-1355E
7-58

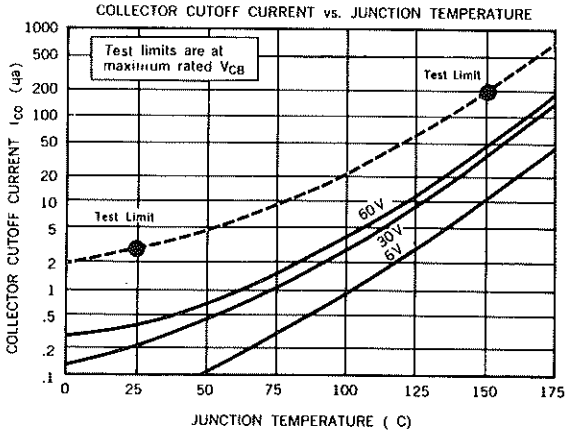
TYPICAL CHARACTERISTICS

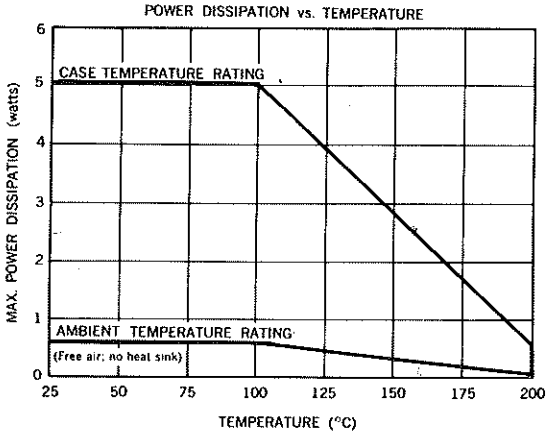






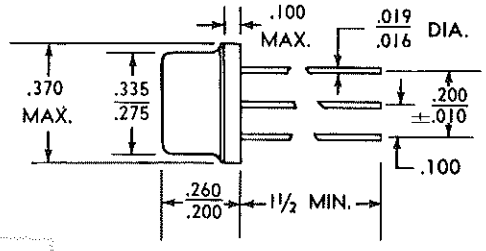


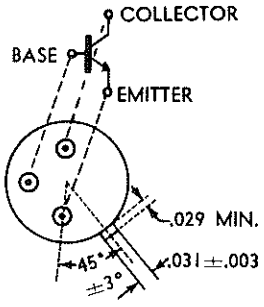




MECHANICAL DATA

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)





ENCAPSULATION: Welded hermetic seal.

MOUNTING POSITION: Any.

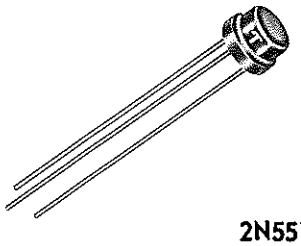
NOTE: collector is connected to the case.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

Transitron

NPN SILICON TRANSISTORS

GENERAL PURPOSE TYPES



2N551
2N552

MEDIUM POWER, 50 ma

Transitron's 2N551 and 2N552 medium power NPN silicon transistors are designed for switching and amplifying applications and feature low collector saturation voltage, high current gain and fast switching time at 50ma. These applications include output stages, servo-motor control, solenoid operation, DC to DC converters, and medium power oscillators.

Manufactured by diffusion, these units have closely controlled electrical characteristics plus a high degree of mechanical ruggedness. They can be used with confidence in the most exacting military applications.

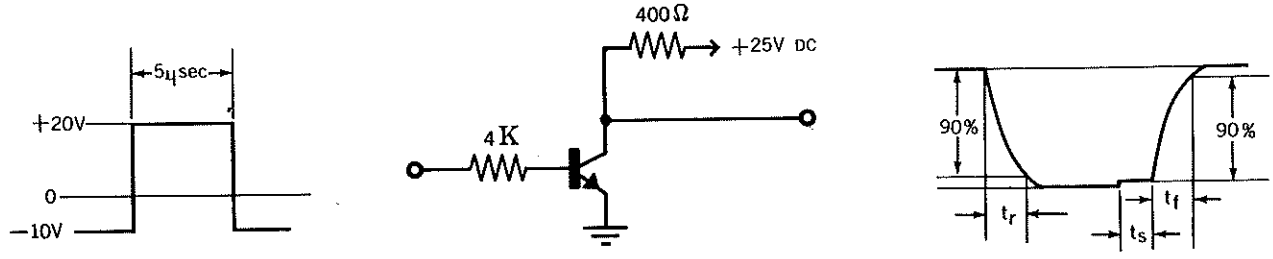
ABSOLUTE MAXIMUM RATINGS

		2N551	2N552	
Collector to Emitter Voltage	V_{CE}	60	30	Volts
Collector to Base Voltage	V_{CB}	60	30	Volts
Emitter to Base Voltage	V_{EB}	10	10	Volts
Total Power Dissipation: at 100°C Case Temperature		5		Watts
at 200°C Case Temperature		0.5		Watts
at 100°C Amb. Temperature		0.6		Watts
at 200°C Amb. Temperature		.05		Watts
Storage and Operating Temperature Range		−65 to + 200		°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

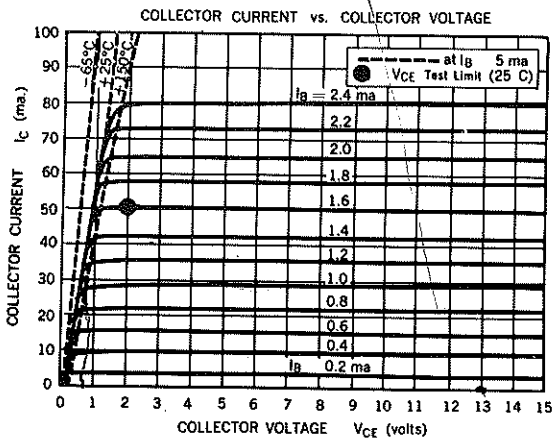
		Min.	Typical	Max.		Test Conditions
D.C. Current Gain	h_{FE}	20	30	80		I_C = 50ma, V_{CE} = 6V
D.C. Input Voltage	V_{BE}	–	1.0	2.5	V	I_C = 50ma, I_B = 5ma
D.C. Collector Saturation Voltage	V_{CE}	–	0.9	2	V	
Collector Cutoff Current	I_{CO}	–	1.2	15	μa	V_{CB} = Rating
Collector Cutoff Current	I_{CO}	–	70	200	μa	V_{CB} = Rating, 150°C
Emitter Cutoff Current	I_{EO}	–	1	100	μa	V_{EB} = 10V
Output Capacitance	C_{ob}	–	100	–	μμf	V_{CB} = 20V, I_E = −50ma
High Frequency Current Gain	h_{fe}	–	3	–		F = 1 mc
Rise Time	t_r ①	–	1.2	–	μsec	I_{B1} = 5ma,
Storage Time	t_s ①	–	0.3	–	μsec	I_{B2} = −25ma,
Fall Time	t_f ①	–	1.3	–	μsec	I_C = 50ma

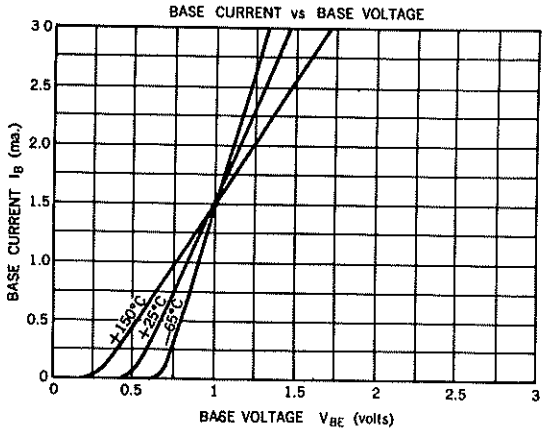
① Measured in the following test circuit:

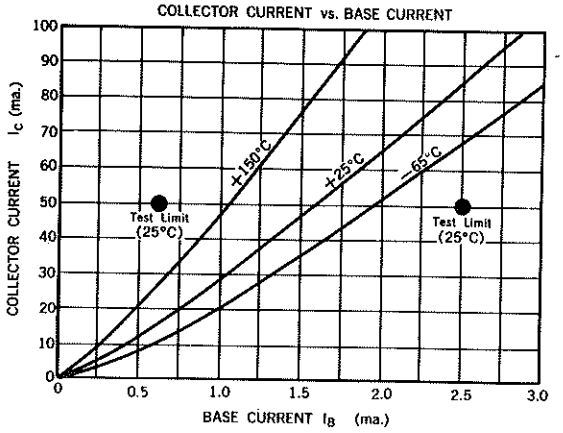


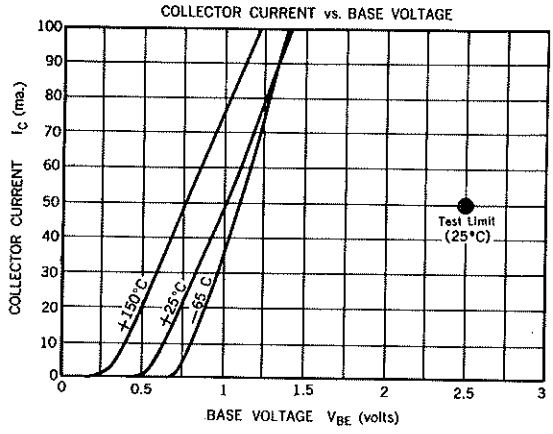
TE-1355F
7-58

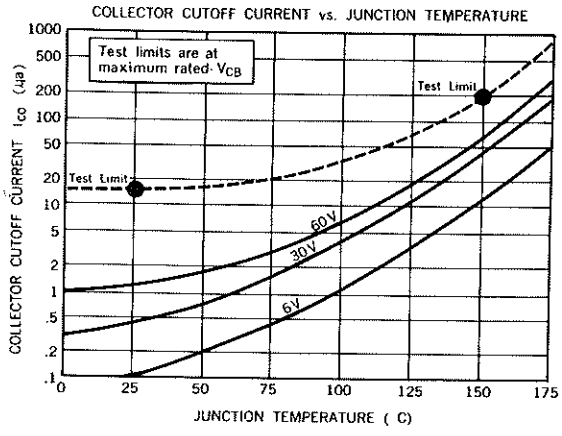
TYPICAL CHARACTERISTICS

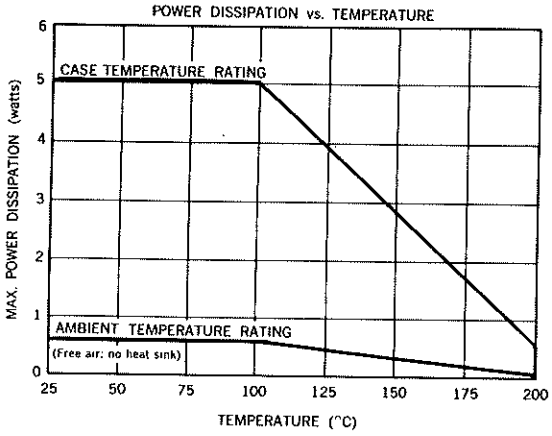






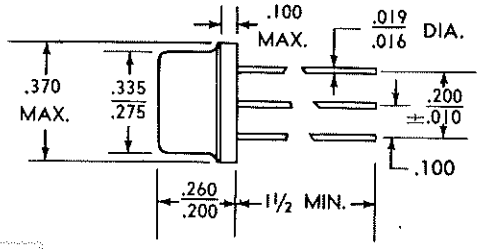


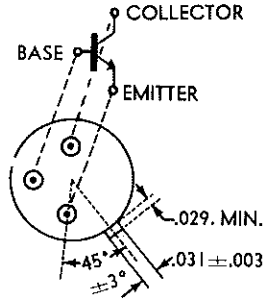




MECHANICAL DATA

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)





ENCAPSULATION: Welded hermetic seal.

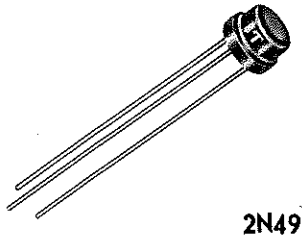
MOUNTING POSITION: Any.

NOTE: collector is connected to the case.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

Transitron NPN SILICON TRANSISTORS

GENERAL PURPOSE TYPES



2N497
2N498

MEDIUM POWER, 200 ma

Transitron's 2N497 and 2N498 medium power NPN silicon transistors are designed for switching and amplifying applications and feature low collector saturation voltage, high current gain and fast switching time at 200ma. These applications include output stages, servo-motor control, magnetic core switching, solenoid operation, DC to DC converters, and medium power oscillators.

Manufactured by diffusion, these units have closely controlled electrical characteristics plus a high degree of mechanical ruggedness. They can be used with confidence in the most exacting military applications.

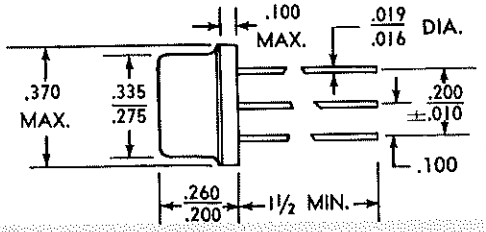
ABSOLUTE MAXIMUM RATINGS

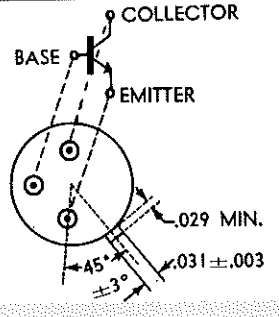
		2N497	2N498		
Collector to Emitter Voltage	V_{CE}	60	100	Volts	(I_C = 250 ua)
Collector to Base Voltage	V_{CB}	60	100	Volts	(I_C = 100 ua)
Emitter to Base Voltage	V_{EB}	8	8	Volts	(I_E = 250 ua)
Total Power Dissipation: at 25°C Case Temperature		4	4	Watts	
at 150°C Case Temperature		1	1	Watts	
Storage and Operating Temperature Range		−65 to + 200		°C	

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		Min.	Typical	Max.		Test Conditions
D.C. Current Gain	h_{FE}	12	20	36		I_C = 200ma, V_{CE} = 10V
D.C. Input Resistance	h_{IE}	–	–	500	Ohm	I_B = 8ma, V_{CE} = 10V
Common Emitter Saturation Resistance	R_{CS}	–	20	30	Ohm	I_C = 200ma, I_B = 40ma
Collector Cutoff Current	I_{CO}	–	0.2	15	μa	V_{CB} = 30V
Collector Cutoff Current	I_{CO}	–	100	200	μa	V_{CB} = 30V, 150°C
Emitter Cutoff Current	I_{EO}	–	.01	0.1	μa	V_{EB} = 5V
Output Capacitance	C_{ob}	–	130	–	μμf	V_{CB} = 20V, I_C = −100ma
High Frequency Current Gain	h_{fe}	–	4	–		F = 1 mc

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)





ENCAPSULATION: Welded hermetic seal.

MOUNTING POSITION: Any.

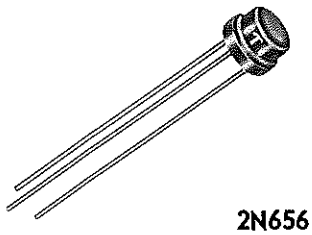
NOTE: Collector is connected to the case.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

TE-1355G
7-58

Transitron NPN SILICON TRANSISTORS

GENERAL PURPOSE TYPES



2N656
2N657

MEDIUM POWER, 200 ma

Transitron's 2N656 and 2N657 medium power NPN silicon transistors are designed for switching and amplifying applications and feature low collector saturation voltage, high current gain and fast switching time at 200ma. These applications include output stages, servo-motor control, magnetic core switching, solenoid operation, DC to DC converters, and medium power oscillators.

Manufactured by diffusion, these units have closely controlled electrical characteristics plus a high degree of mechanical ruggedness. They can be used with confidence in the most exacting military applications.

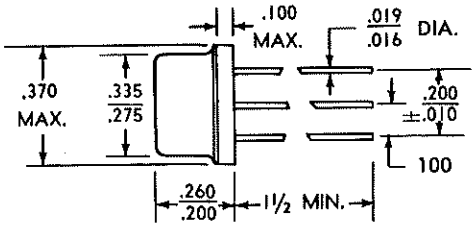
ABSOLUTE MAXIMUM RATINGS

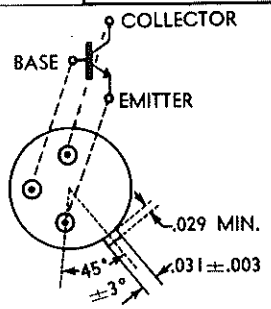
		2N656	2N657		
Collector to Emitter Voltage	V_{CE}	60	100	Volts	I_C = 250 ua
Collector to Base Voltage	V_{CB}	60	100	Volts	I_C = 100 ua
Emitter to Base Voltage	V_{EB}	8	8	Volts	I_E = 250 ua
Total Power Dissipation: at 25°C Case Temperature		4	4	Watts	
at 150°C Case Temperature		1	1	Watts	
Storage and Operating Temperature Range		−65 to + 200		°C	

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		Min.	Typical	Max.		Test Conditions
D.C. Current Gain	h_{FE}	30	50	90		I_C = 200ma, V_{CE} = 10V
D.C. Input Resistance	h_{IE}	–	–	500	Ohm	I_B = 8ma, V_{CE} = 10V
Common Emitter Saturation Resistance	R_{CS}	–	20	30	Ohm	I_C = 200ma, I_B = 40ma
Collector Cutoff Current	I_{CO}	–	0.2	15	μa	V_{CB} = 30V
Collector Cutoff Current	I_{CO}	–	100	200	μa	V_{CB} = 30V, 150°C
Emitter Cutoff Current	I_{EO}	–	.01	0.1	μa	V_{EB} = 5V
Output Capacitance	C_{ob}	–	130	–	μμf	V_{CB} = 20V, I_C = −100ma
High Frequency Current Gain	h_{fe}	–	4	–		F = 1 mc

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)





ENCAPSULATION: Welded hermetic seal.

MOUNTING POSITION: Any.

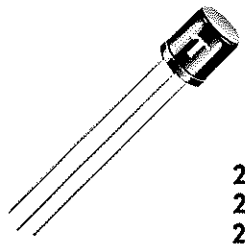
NOTE: Collector is connected to the case.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

TE-1355H
7-58

Transitron NPN SILICON TRANSISTORS

GENERAL PURPOSE TYPES



2N339
2N340
2N341

1 WATT

Transitron's 2N339, 2N340 and 2N341 NPN silicon transistors are designed for low level signal applications up to 175°C.

High temperature reliability is insured through close process control which results in a stable and low I_{CO} up to the maximum voltage rating. Extensive temperature cycling and storage, as well as mechanical and hermetic seal tests, are included as a regular part of the manufacturing process.

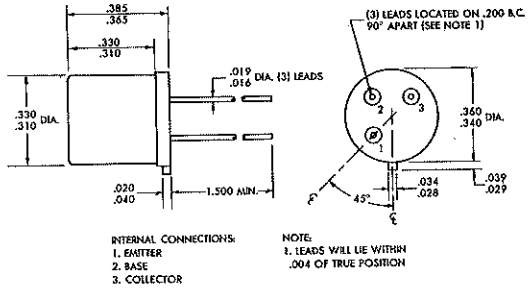
ABSOLUTE MAXIMUM RATINGS

		2N339	2N340	2N341	
Collector to Emitter Voltage	V_{CE}	55	85	125	Volts
Collector to Base Voltage	V_{CB}	55	85	125	Volts
Emitter to Base Voltage	V_{EB}	1	1	1	Volts
Total Power Dissipation:	at 25°C	1000	1000	1000	mw
	at 100°C	400	400	400	mw
	at 125°C	200	200	200	mw
Storage and Operating Ambient Temperature Range		−65°C to +150°C			

ABSOLUTE MAXIMUM RATINGS

Common Emitter Parameters:		2N339 Min.	2N339 Max.	2N340 Min.	2N340 Max.	2N341 Min.	2N341 Max.	Test Conditions
Current Gain	h_{fe}	9	90	9	90	9	90	V_c = 10V, I_e = 5ma
Power Gain	P.G.	30		30		30		db; V_{CE}: 28 / 45 / 67.5 (volts); I_C: 20 / 15 / 10 (mA); R_L: 1K / 2K / 4K (ohms)
Common Base Parameters								
Breakdown Voltages								
Collector to Emitter	V_{CE}	55		85		85		V; I_C = 100 μa
Collector to Base	V_{CB}	55		85		125		V; I_C = 50 μa
Emitter to Base	V_{EB}	1		1		1		V; I_E = 100 μa
Common Base Parameters:								
Collector Cutoff Current	I_{CO}		1		1		1	μa; V_{CB} = 30V
	I_{CO}		250		250		250	μa; V_{CB} = 30V, 150°C
Input Impedance	h_{ib}		30		30		30	ohm; V_c = 10V, I_e = 5ma
Output Admittance	h_{ob}		2		2		2	μmhos; V_c = 10V, I_e = 5ma
Voltage Feedback Ratio	h_{rb}		3		3		3	$\times 10^{-4}$; V_c = 10V, I_e = 5ma
DC Collector Saturation Resistance	R_{cs}		300		350		400	ohm; I_c = 20ma I_b = 3ma

MECHANICAL DATA



ENCAPSULATION: Welded hermetic seal.

MOUNTING POSITION: Any.

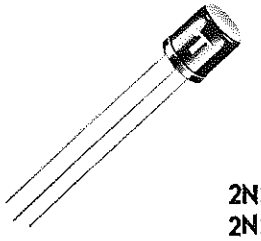
NOTE: Transistors supplied all leads isolated, collector grounded or emitter grounded. Unless otherwise specified all leads will be isolated.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

TE-1355J
7-58

Transitron NPN SILICON TRANSISTORS

GENERAL PURPOSE TYPES



2N342
2N343

1 WATT

Transitron's 2N342 and 2N343 NPN silicon transistors are designed for low level signal applications up to 150 °C.

High temperature reliability is insured through close process control which results in a stable and low I_{CO} up to the maximum voltage rating. Extensive temperature cycling and storage, as well as mechanical and hermetic seal tests, are included as a regular part of the manufacturing process.

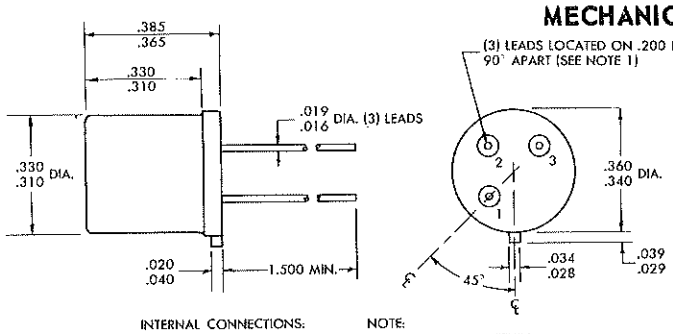
ABSOLUTE MAXIMUM RATINGS

Collector to Emitter Voltage	V_{CE}	60	Volts
Collector to Base Voltage	V_{CB}	60	Volts
Emitter to Base Voltage	V_{EB}	1	Volt
Total Power Dissipation:	at 25 °C	1000	mw
	at 100 °C	400	mw
	at 125 °C	200	mw
Storage and Operating Ambient Temperature Range		−65 °C to +150 °C	

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25 °C

		2N342		2N343			
Common Emitter Parameters:		Min.	Max.	Min.	Max.		Test Conditions
Current Gain	h_{fe}	9	32	29	90		V_c = 10V, I_e = 5 ma
Power Gain	P.G.	30		30		db	V_{CE} = 28V R_L = 1K, I_C = 20ma
Common Base Parameters							
Breakdown Voltages							
Collector to Emitter	V_{CE}	60		60		V	I_C = 100 μa
Collector to Base	V_{CB}	60		60		V	I_C = 50 μa
Emitter to Base	V_{EB}	1		1		V	I_E = 100 μa
Collector Cutoff Current	I_{CO}		1		1	μa	V_{CB} = 30V
	I_{CO}		250		250	μa	V_{CB} = 30V, 150 °C
Input Impedance	h_{ib}		30		30	ohm	V_c = 10V, I_e = 5ma
Output Admittance	h_{ob}		2		2	μmhos	V_c = 10V, I_e = 5ma
Voltage Feedback Ratio	h_{rb}		3		3	x10−4	V_c = 10V, I_e = 5ma
DC Collector Saturation Resistance	R_{cs}		350		350	ohm	I_C = 20ma, I_B = 3ma

MECHANICAL DATA



INTERNAL CONNECTIONS:
1. EMITTER
2. BASE
3. COLLECTOR

NOTE:
1. LEADS WILL LIE WITHIN .004 OF TRUE POSITION

ENCAPSULATION: Welded hermetic seal.

MOUNTING POSITION: Any.

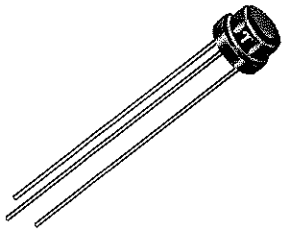
NOTE: Transistors supplied all leads isolated, collector grounded or emitter grounded. Unless otherwise specified all leads will be isolated.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230 °C 1/8 inch from the base.

TE-1355K
7-58

Transitron NPN SILICON TRANSISTORS

GENERAL PURPOSE TYPE



2N1206
2N1207

1 WATT

The 2N1206 and 2N1207 provide a superior medium power transistor for operation in amplifying applications from one to 100 milliamperes. Improved beta linearity, lower saturation voltage and better high frequency characteristics make this transistor preferred over the 2N342 and 2N343 for critical applications.

High temperature reliability is assured by extensive environmental conditioning that is performed as a regular part of the manufacturing process.

ABSOLUTE MAXIMUM RATINGS

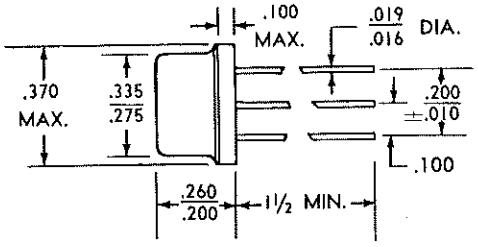
Collector to Emitter Voltage	V_{CE}	60	Volts
Collector to Base Voltage	V_{EB}	60	Volts
Emitter to Base Voltage	V_{CB}	3	Volts
Total Power Dissipation: at 100°C Case Temperature		1.2	Watts
at 100°C Ambient Temperature		.5	Watts
Storage and Operating Ambient Temperature Range		−65°C to + 200°C	

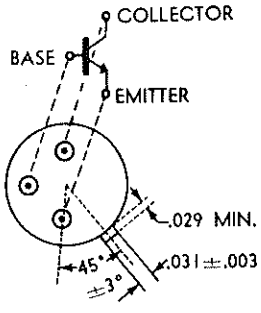
SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		2N1206			2N1207				
Common Emitter Parameters:		Min.	Typ.	Max.	Min.	Typ.	Max.		Test Conditions
AC Current Gain	h_{fe}	20	35	50	30	50	90		$V_{CE} = 10V, I_C = 10$ ma
Common Base Parameters:									
			1	15		1	15	μa	$V_{EB} = 60V$
Collector Cutoff Current	I_{CO}		50	200		50	200	μa	$V_{CB} = 60V, T = 150°C$
Emitter Cutoff Current	I_{eo}		5	50		5	50	μa	$V_{EB} = 3V$
Input Impedance	h_{ib}							ohm	$V_{CE} = 10V, I_C = 10$ ma
Output Admittance	h_{ob}							μmhos	$V_{CE} = 10V, I_C = 10$ ma
DC Collector Saturation Voltage	V_{CE}		1	2		1	2	V	$I_{CE} = 20$ ma, $I_b = 3$ ma

MECHANICAL DATA

JETEC TO-5 OUTLINE.
(Dimensions subject to change in accordance with industry standards established by JETEC)





ENCAPSULATION: Welded hermetic seal.

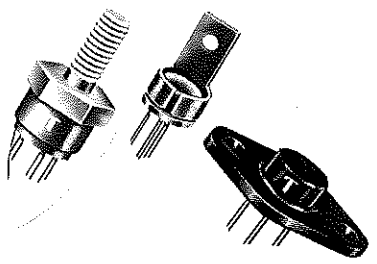
MOUNTING POSITION: Any.

NOTE: collector is connected to the case.
A heat sink (long nose pliers) should be used when soldering leads within ¼ inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C ⅛ inch from the base.

TE-1355K-1
3-59

Transitron NPN SILICON TRANSISTORS

HEAT SINK MOUNTING

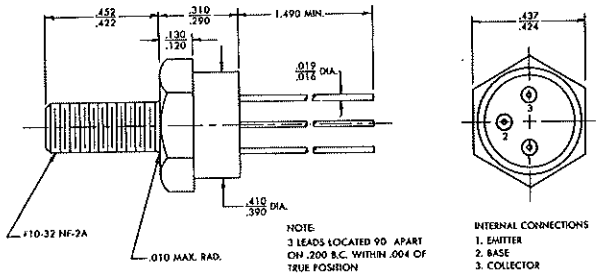


DESIGNED FOR MEDIUM POWER TRANSISTORS

Transitron now offers three heat sink mountings, factory-fitted on silicon transistors in the TO-5 Outline package.

Easy to mount on any chassis, these efficient units bring thermal derating down as low as 20°C/Watt.

STUD MOUNTED

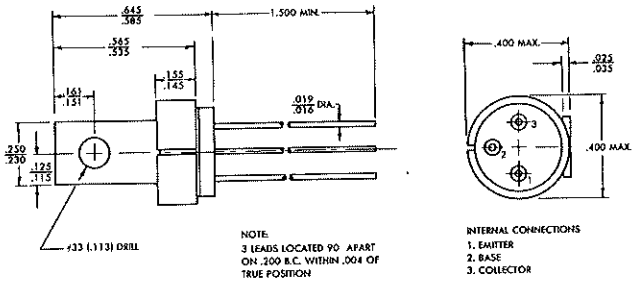


Derating:* 20°C/Watt

Designation: Add "/A" to transistor type number.
Example: 2N551/A

Hardware supplied with this unit.

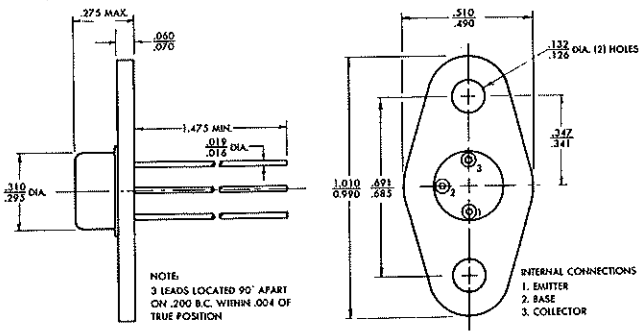
CLIP MOUNTED



Derating:* 30°C/Watt

Designation: Add "/B" to transistor type number.
Example: 2N551/B

FLANGE MOUNTED



Derating:* 20°C/Watt

Designation: Add "/C" to transistor type number.
Example: 2N551/C

Mica washer supplied with this unit.

*DERATING is defined as maximum temperature rise from heat sink to transistor junction, using a Transitron medium power transistor. When determining the transistor power rating assume a junction temperature no greater than the maximum operating temperature of the transistor. For example –

CONDITIONS:

Maximum junction temperature = 200°C
Derating = 20°C/Watt
Heat sink temperature = 100°C

RATING =

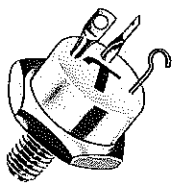
$$\frac{\text{Junction temp.} - \text{Ambient temp.}}{\text{Derating}}$$

$$= \frac{200 - 100}{20} = 5 \text{ Watts}$$

TE-1355L
7-58

Transitron NPN SILICON TRANSISTORS

HIGH CURRENT TYPES



2N1208
2N1209

HIGH POWER, 5 Ampere

Transitron's 2N1208 and 2N1209 high power silicon transistors feature low saturation voltage, good input and high frequency characteristics making them the preferred transistors for power supply and DC to AC converter applications.

High temperature reliability is assured by extensive conditioning that is performed as a regular part of the manufacturing process.

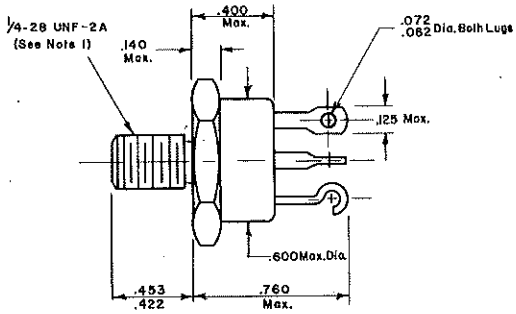
ABSOLUTE MAXIMUM RATINGS

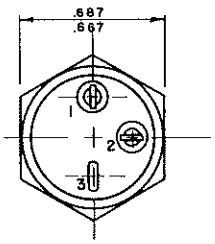
		2N1208	2N1209	
Collector to Emitter Voltage	V_{CE}	60	45	Volts
Collector to Base Voltage	V_{CB}	60	45	Volts
Emitter to Base Voltage	V_{EB}	10	5	Volts
Total Power Dissipation: at 25°C Case Temperature		85		Watts
at 100°C Case Temperature		45		Watts
at 150°C Case Temperature		22.5		Watts
Storage and Operating Temperature Range		−65 to + 200		°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		2N1208			2N1209				Test Conditions
		Min.	Typ.	Max.	Min.	Typ.	Max.		
D.C. Current Gain	H_{FE}	15			20				I_C = 2 amps, V_{CE} = 12V
D.C. Input Voltage	V_{BE}		2.5	4		2.5	4	V	I_C = 2 amps, V_{CE} = 12V
D.C. Collector Saturation Voltage	V_{CE}		3	5		3	5	V	I_C = 2 amps, I_B = 250 ma
Collector Cutoff Current	I_{CO}			10			20	ma	V_{CB} = rating
	I_{CO}			20			20	ma	V_{CB} = rating, T = 150°C V_{EB} = + 1V
Emitter Cutoff Current	I_{EO}			10			10	ma	V_{EB} = rating
High Frequency Current Gain	h_{fe}		12			12			I_C = 300 ma V_{CE} = 30V, F = 1 mc
Rise Time	t_r		0.25			0.25		μsec	I_C = 2 Amperes Circuit B = 12
Storage and Fall Time	$t_s + tf$		0.5			0.5		μsec	R_L = 5 ohms

MECHANICAL DATA





ENCAPSULATION: Glass to metal hermetic seal.

MOUNTING POSITION: Any.

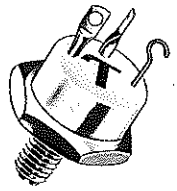
NOTE: collector is connected to the case.
Lugs and hook located on 375BC 90°C apart.

Do not apply more than 50LB-IN. of torque to hex or nut.

TE-1355M
3-59

Transitron NPN SILICON TRANSISTORS

GENERAL PURPOSE TYPE



2N1212

HIGH POWER, 3 Amperes

Transitron's 2N1212 high power silicon transistor combines the electrical characteristics of the 2N389 with the "easy-to-mount" stud-type package used for military-type silicon rectifiers.

Complete insulating hardware is furnished for applications that require electrical isolation of collector from heat sink.

Each 2N1212 is subjected to environmental and electrical tests as part of the manufacturing operations to assure high reliability.

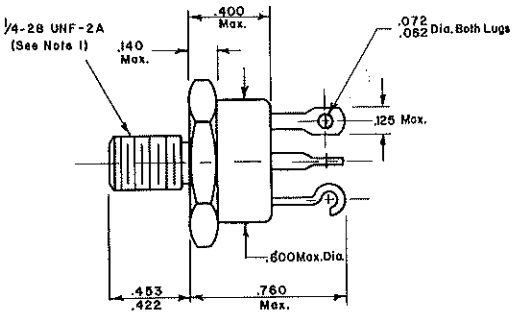
ABSOLUTE MAXIMUM RATINGS

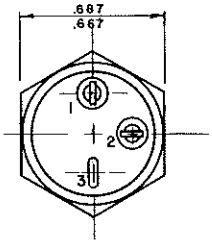
Collector to Emitter Voltage	V_{CE}	60	Volts
Collector to Base Voltage	V_{CB}	60	Volts
Emitter to Base Voltage	V_{EB}	10	Volts
Total Power Dissipation: at 100°C Case Temperature		45	Watts
Storage and Operating Temperature Range		— 65 + 200	°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C
2N1212

		Min.	Typ.	Max.		Test Conditions
D.C. Current Gain	H_{FE}	12	30	60		I_C = 1 amp, V_{CE} = 15V
	H_{FE}	8				I_C = 1 amp, V_{CE} = 15V T = −55°C
D.C. Input Voltage	V_{BE}			8	V	I_C = 1.5A, V_{CE} = 15V
D.C. Collector Saturation Voltage	V_{CE}		3.5	5	V	I_C = 1 amp, I_B = 200 ma
Collector Cutoff Current	I_C			10	ma	V_{CB} = 60V, R_{BE} = 33 ohms
	I_C			10	ma	V_{CB} = 60V, Ta = 100°C R_{BE} = 33 ohms
Emitter Cutoff Current	I_{EO}			10	ma	V_{EB} = 10V
High Frequency Current Gain	h_{fe}		10			V_{CE} = 30V, I_C = 300 ma F = 1 mc

MECHANICAL DATA





ENCAPSULATION: Glass to metal hermetic seal.

MOUNTING POSITION: Any.

NOTE: collector is connected to the case. Lugs and hook located on 375BC 90°C apart. Do not apply more than 50LB-IN. of torque to hex or nut.

TE-1355N
3-59

October 15, 1958

TRANSITRON

SMALL SIGNAL TRANSISTORS WITH HIGH V_{EB}

The Transitron series of small signal transistors is available in "A" versions with higher Emitter to Base breakdown voltages. This improvement in V_{EB}, at no sacrifice to other characteristics, eliminates the need for series diodes in many applications and protects against transients in pulse and digital circuitry.

Typical I_{EO} = .05 μa (V_{EB} =5V, T = 25°C)

Maximum I_{EO} = 2.0 μa (V_{EB} = 5V, T= 25°C)

SPECIFICATIONS AT 25°C

TYPE	MINIMUM h_{fe}	V_{CB}	V_{EB}@ 2 μa I_{EO}	OTHER DATA IN TE-1353 SHEET
2N541A	80	15	5	A
2N542A	80	30	5	A
2N543A	80	45	5	A
2N478A	40	15	5	B
2N479A	40	30	5	B
2N480A	40	45	5	B
2N473A	20	15	5	C
2N474A	20	30	5	C
2N475A	20	45	5	C

PRELIMINARY BULLETIN
PB-8
November 3, 1958

TRANSITRON

MEDIUM POWER HIGH BETA NPN SILICON TRANSISTOR

500ma type **2N1116** (ST4044)

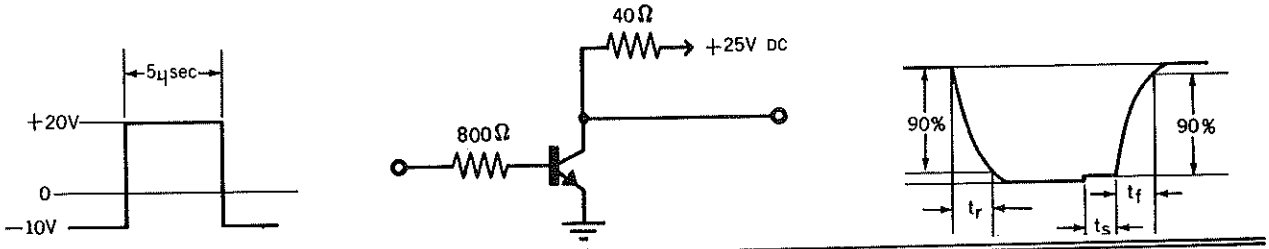
ABSOLUTE MAXIMUM RATINGS

Collector to Emitter Voltage	V_{CE}	60	Volts
Collector to Base Voltage	V_{CB}	60	Volts
Emitter to Base Voltage	V_{EB}	10	Volts
Total Power Dissipation: at 100°C Case Temperature		5	Watts
at 200°C Case Temperature		0.5	Watts
at 100°C Amb. Temperature		0.6	Watts
at 200°C Amb. Temperature		.05	Watts
Storage and Operating Temperature Range		−65 to + 200	°C

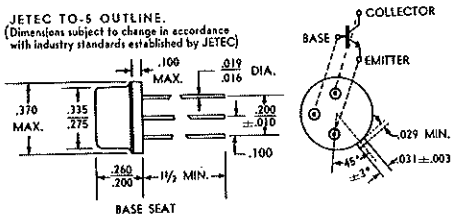
SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		Min.	Typical	Max.		Test Conditions
D.C. Current Gain	h_{FE}	40	85	〃		I_C = 500ma, V_{CE} = 6V
D.C. Input Voltage	V_{BE}	–	3.5	6	V	I_C = 500ma, I_B = 50ma
D.C. Collector Saturation Voltage	V_{CE}	–	3	5	V	
Collector Cutoff Current	I_{CO}	–	1.2	15	μa	V_{CB} = 60V
Collector Cutoff Current	I_{CO}	–	70	200	μa	V_{CB} = 60V, 150°C
Emitter Cutoff Current	I_{EO}	–	1	100	μa	V_{EB} = 10V
Output Capacitance	C_{ob}	–	130	–	μμf	V_{CB} = 20V, I_E = −100ma
High Frequency Current Gain	h_{fe}	–	4	–		F = 1 mc
Rise Time	t_r ①	–	0.7	–	μsec	I_{B1} = 25ma,
Storage Time	t_s ①	–	0.2	–	μsec	I_{B2} = −12.5ma
Fall Time	t_f ①	–	1	–	μsec	I_C = 500ma

① Measured in the following test circuit:



MECHANICAL DATA



ENCAPSULATION: Welded hermetic seal.
MOUNTING POSITION: Any:
NOTE: collector is connected to the case.
A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

Catalog No. 84.34.10B-1

PRELIMINARY BULLETIN
PB-9
November 3, 1958

TRANSITRON

MEDIUM POWER HIGH BETA NPN SILICON TRANSISTOR

200ma type **2N1117** (ST4045)

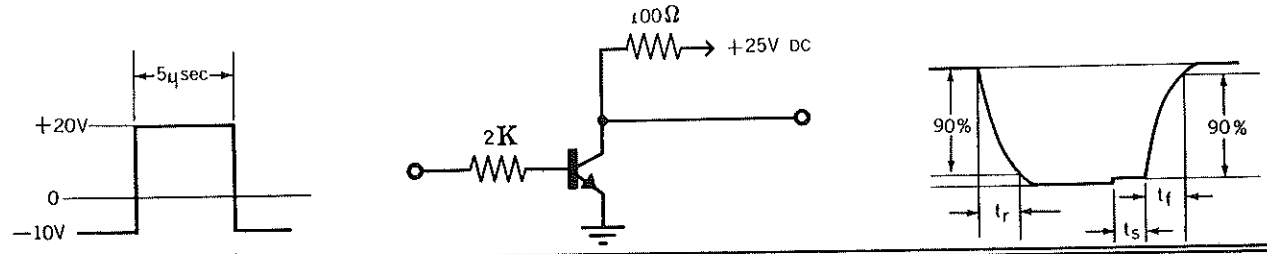
ABSOLUTE MAXIMUM RATINGS

Collector to Emitter Voltage	V_{CE}	60	Volts
Collector to Base Voltage	V_{CB}	60	Volts
Emitter to Base Voltage	V_{EB}	10	Volts
Total Power Dissipation: at 100°C Case Temperature		5	Watts
at 200°C Case Temperature		0.5	Watts
at 100°C Amb. Temperature		0.6	Watts
at 200°C Amb. Temperature		.05	Watts
Storage and Operating Temperature Range		−65 to + 200	°C

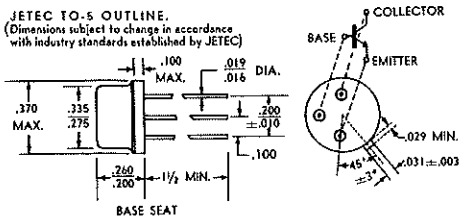
SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		Min.	Typical	Max.		Test Conditions
D.C. Current Gain	h_{FE}	40	85			I_C = 200ma, V_{CE} = 6V
D.C. Input Voltage	V_{BE}	–	2	5	V	I_C = 200ma, I_B = 20ma
D.C. Collector Saturation Voltage	V_{CE}	–	1.5	4	V	
Collector Cutoff Current	I_{CO}	–	0.4	15	μa	V_{CB} = Rating
Collector Cutoff Current	I_{CO}	–	50	200	μa	V_{CB} = Rating, 150°C
Emitter Cutoff Current	I_{EO}	–	1	100	μa	V_{EB} = 10V
Output Capacitance	C_{ob}	–	130	–	μμf	V_{CB} = 20V, I_E = −100ma
High Frequency Current Gain	h_{fe}	–	4	–		F = 1 Mc
Rise Time	t_r ①	–	0.7	–	μsec	I_{B1} = 10ma,
Storage Time	t_s ①	–	0.2	–	μsec	I_{B2} = − 5ma,
Fall Time	t_f ①	–	1.0	–	μsec	I_C = 200ma

① Measured in the following test circuit:



MECHANICAL DATA



ENCAPSULATION: Welded hermetic seal.
MOUNTING POSITION: Any.

NOTE: collector is connected to the case.

A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

Catalog No. 84.34.10D-1

TRANSITRON

PB-20 (rev.)
July 30, 1958

HIGH POWER NPN SILICON TRANSISTOR

5 Ampere Type

ABSOLUTE MAXIMUM RATINGS

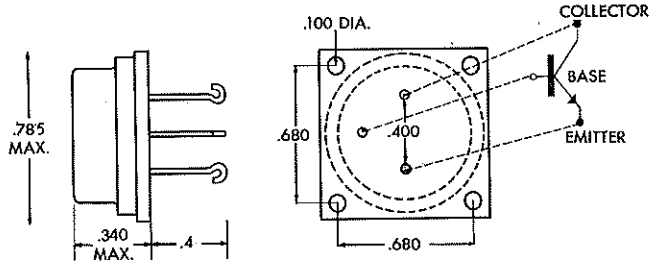
		ST400	
Collector to Emitter Voltage	V_{CE}	60	Volts
Collector to Base Voltage	V_{CB}	60	Volts
Emitter to Base Voltage	V_{EB}	5	Volts

Total Power Dissipation: at 150°C Case Temp. 22.5 Watts
at 100°C Case Temp. 45 Watts
at 25°C Case Temp. 85 Watts

Storage & Operating Temperature Range - 65 to + 200°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		Min.	Typical	Max.	Unit	Test Conditions
D.C. Current Gain	H_{FE}	15				I_C = 2 amps V_{CE} = 12 V
D.C. Input Voltage	V_{BE}		2.5	4	V	I_C = 2 Amps I_B = 250 ma
D.C. Collector Saturation Voltage	V_{CE}		3	5	V	
Collector Cutoff Current	I_{CO}			20	ma	V_{CB}= 60 V @ 150°C VEB = + 1V
Emitter Cutoff Current	I_{EO}			10	ma	V_{EB} = 5V
High Frequency Current Gain	h_{fe}		6			I_C = 300ma V_{CE} = 30V F = 1Mc
Switching Speed	t_r		0.25		usec	I_C = 2 Amperes
	t_s + t_f		0.5		usec	Circuit B = 12 R_L= 5 ohms



MECHANICAL DATA

Collector is connected to the case.

Catalog No. 87.16.9A (7-58)

PB-21 (rev.)
July 30, 1958

TRANSITRON

HIGH POWER NPN SILICON TRANSISTOR

5 Ampere Type

ABSOLUTE MAXIMUM RATINGS

		ST401	
Collector to Emitter Voltage	V_{CE}	45	Volts
Collector to Base Voltage	V_{CB}	45	Volts
Emitter to Base Voltage	V_{EB}	5	Volts

Total Power Dissipation: at 150°C Case Temperature 22.5 watts
at 25°C Case Temperature 85 watts
at 100°C Case Temperature 45 watts

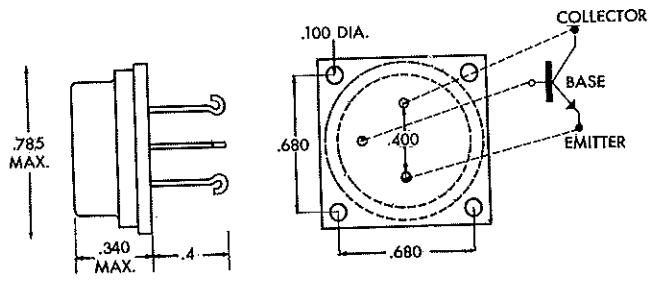
Storage and Operating Temperature Range - 65 to + 200°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		Min.	Typical	Max.	Unit	Test Conditions
D.C. Current Gain	H_{FE}	20				I_C = 2 ampere V_{CE} = 12V
D.C. Input Voltage	V_{BE}		2.5	4	V	
D.C. Collector Saturation Voltage	V_{CE}		3	5	V	I_C = 2 Ampere I_B = 250 ma
Collector Cut-off Current	I_{CO}			20	ma	V_{CB}= 45V at 150°C VEB = + 1V
Emitter Cutoff Current	I_{EO}			10	ma	V_{EB}= 5V
High Frequency Current Gain	h_{fe}		6			V_{CE}=30V, F=1Mc I_C=300ma
Switching Speed	t_r t_s + t_f		0.25 0.5		usec usec	I_C=2A, R_L=5 ohms Circuit Beta=12

MECHANICAL DATA

Collector is connected to the case



Catalog No. 87.16.9B (7-58)

PB-22 (rev.)
July 30, 1958

TRANSITRON

HIGH POWER NPN SILICON TRANSISTOR

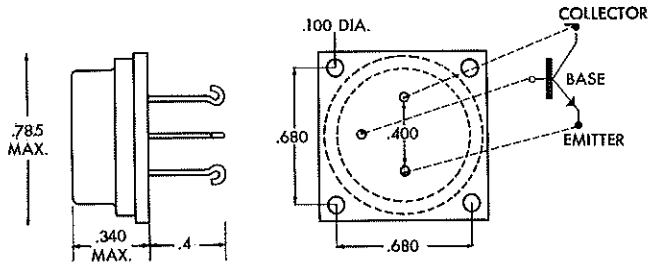
3 Ampere Type

ABSOLUTE MAXIMUM RATINGS

		ST402	
Collector to Emitter Voltage	V_{CE}	60	Volts
Collector to Base Voltage	V_{CB}	60	Volts
Emitter to Base Voltage	V_{EB}	5	Volts
Total Power Dissipation: at 150°C Case Temp.		15	Watts
at 25°C Case Temp.		50	Watts
at 100°C Case Temp.		25	Watts
Storage and Operating Temperature Range		-65 to + 200°C	

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		Min.	Typical	Max.	Unit	Test Conditions
D.C. Current Gain	H_{FE}	15				I_C = 2 Ampere V_{CE} = 12V
D.C. Input Voltage	V_{BE}		5	6	V	I_C = 2 Ampere I_B = 250 ma
D.C. Collector Saturation Voltage	V_{CE}		6	8	V	
Collector Cut-off Current	I_{CO}			20	ma	V_{CB} = 60V at 150°C VEB = + 1V
Emitter Cutoff Current	I_{EO}			10	ma	V_{EB} = 5 V
High Frequency Current Gain	h_{fe}		6			V_{CE}=30V, F=1Mc I_C=300ma
Switching Speed	t_r		0.25		usec	I_C=2A, R_L=5 ohms Circuit Beta =12
	t_s + t_f		0.5		usec	



MECHANICAL DATA

Collector is connected to the case

Catalog No. 87.16.9C (7-58)

PB-23 (rev.)
July 30, 1958

TRANSITRON

HIGH POWER NPN SILICON TRANSISTOR

3 Ampere Type

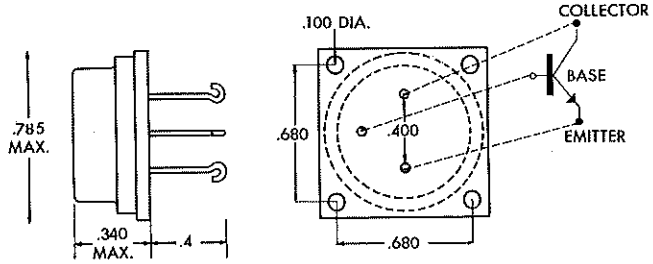
ABSOLUTE MAXIMUM RATINGS

		ST403	
Collector to Emitter Voltage	V_{CE}	45	Volts
Collector to Base Voltage	V_{CB}	45	Volts
Emitter to Base Voltage	V_{EB}	5	Volts
Total Power Dissipation:	at 150°C Case Temp.	15	Watts
	at 25°C Case Temp.	50	Watts
	at 100°C Case Temp.	25	Watts

Storage and Operating Temperature Range -65 to + 200°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		Min.	Typical	Max.	Unit	Test Conditions
D.C. Current Gain	H_{FE}	15				I_C = 2 Ampere V_{CE} = 12V
D.C. Input Voltage	V_{BE}		4	5	V	
D.C. Collector Saturation Voltage	V_{CE}		5	6	V	I_C = 2 Ampere I_B = 250 ma
Collector Cut-off Current	I_{CO}			20	ma	V_{CB} = 45V at 150°C VEB= + 1V
Emitter Cutoff Current	I_{EO}			10	ma	V_{EB} = 5V
High Frequency Current Gain	h_{fe}		6			V_{CE}=30V, F=1Mc I_C = 300ma
Switching Speed	t_r		0.25		usec	I_C=2A, R_L=5 ohms
	t_s + t_f		0.5		usec	Circuit Beta =12



MECHANICAL DATA

Collector is connected to the case.

Catalog No. 87.16.9D (7-58)

PB-24 (rev.)
October 24, 1958

TRANSITRON

HIGH POWER NPN SILICON TRANSISTOR

ABSOLUTE MAXIMUM RATINGS

		2N389	
Collector to Emitter Voltage	V_{CE}	60	Volts
Collector to Base Voltage	V_{CB}	60	Volts
Emitter to Base Voltage	V_{EB}	10	Volts

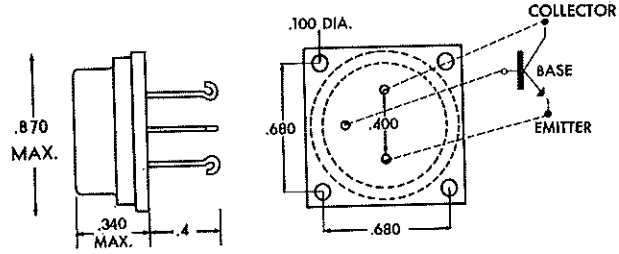
Total Power Dissipation: at 25°C Case Temperature 85 Watts
at 100°C Case Temperature 45 Watts

Storage and Operating Temperature Range -65 to + 200°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		Min.	Typical	Max.		Test Conditions
D.C. Current Gain	h_{FE}	12		60		I_C=1 Ampere, V_{CE}=15V
D.C. Current Gain	h_{FE}	8				I_C=1A, V_{CE}=15V, T=-55°C
D.C. Input Voltage	V_{BE}			8	V	I_C=1.5A, V_{CE}=15V
D.C. Collector Saturation Voltage	V_{CE}			5	V	I_C=1 Ampere, I_B=200ma
Current Gain	h_{fe}	30				V_{CE}=30V, I_C= 0.3A, F = 1 kc, I_c= 0.1A
Collector Current (R_{BE} = 33 ohms)	I_C			10	ma	V_{CB} = 60V
Collector Current (R_{BE} = 33 ohms)	I_C			10	ma	V_{CB}=60V at 100°C
Emitter Cutoff Current	I_{EO}			10	ma	V_{EB} = 10V
High Frequency Current Gain	h_{fe}	8.5				V_{CE}=30V, I_C = 300 ma F = 1 mc

MECHANICAL DATA



Collector is connected to the case.

Catalog No. 87.16.9E (10-58)

PB-25
October 24, 1958

TRANSITRON

HIGH POWER NPN SILICON TRANSISTOR

ABSOLUTE MAXIMUM RATINGS

		2N424	
Collector to Emitter Voltage	V_{CE}	80	Volts
Collector to Base Voltage	V_{CB}	80	Volts
Emitter to Base Voltage	V_{EB}	10	Volts

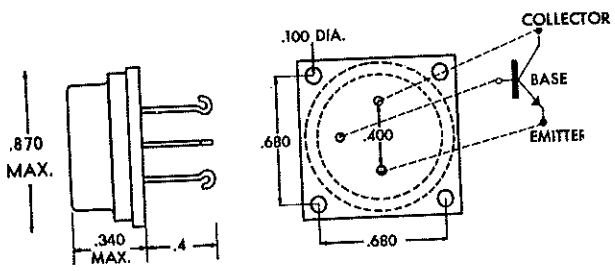
Total Power Dissipation: at 25°C Case Temperature 85 watts
at 100°C Case Temperature 45 watts

Storage and Operating Temperature Range -65 to + 200°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS AT 25°C

		Min.	Typical	Max.		Test Conditions
D.C. Current Gain	h_{FE}	12	60			I_C=1 Ampere, V_{CE}=15V
D.C. Current Gain	h_{FE}	8				I_C=1A, V_{CE}=15V, T=-55°C
D.C. Input Voltage	V_{BE}			8	V	I_C=0.75A, V_{CE}=15V
D.C. Collector Saturation Voltage	V_{CE}			10	V	I_C=1 Ampere, I_B= 200 ma
Current Gain	H_{fe}	30				V_{CE}=30V, I_C=0.3A, F= 1 kc, I_c=0.1A
Collector Current (R_{BE} =33 ohms)	I_C			10	ma	V_{CB} = 80V
Collector Current (R_{BE} = 33 ohms)	I_C			10	ma	V_{CB} = 60V at 100°C
Emitter Cutoff Current	I_{EO}			10	ma	V_{EB} = 10V
High Frequency Current Gain	h_{fe}	6.0				V_{CE}= 30V, I_C = 300 ma F = 1 mc

MECHANICAL DATA



Collector is connected to the case.

Catalog No. 87.16.9F (10-58)

October 15, 1958

TRANSITRON

SMALL SIGNAL TRANSISTORS WITH HIGH V_{EB}

The Transitron series of small signal transistors is available in "A" versions with higher Emitter to Base breakdown voltages. This improvement in V_{EB}, at no sacrifice to other characteristics, eliminates the need for series diodes in many applications and protects against transients in pulse and digital circuitry.

Typical I_{EO} = .05 μa (V_{EB} =5V, T = 25°C)

Maximum I_{EO} = 2.0 μa (V_{EB} = 5V, T= 25°C)

SPECIFICATIONS AT 25°C

TYPE	MINIMUM h_{fe}	V_{CB}	V_{EB}@ 2 μa I_{EO}	OTHER DATA IN TE-1353 SHEET
2N541A	80	15	5	A
2N542A	80	30	5	A
2N543A	80	45	5	A
2N478A	40	15	5	B
2N479A	40	30	5	B
2N480A	40	45	5	B
2N473A	20	15	5	C
2N474A	20	30	5	C
2N475A	20	45	5	C

TRANSITRON

LOW NOISE VOLTAGE NPN SILICON TRANSISTOR, ST1050

ABSOLUTE MAXIMUM RATINGS

Collector to Emitter Voltage	V_{ce}	6	Volts
Collector to Base Voltage	V_{cb}	6	Volts
Emitter to Base Voltage	V_{eb}	2	Volts
Power Dissipation: at 25°C Ambient		30	mw
at 100°C Ambient		12	mw
Collector Current	I_c	5	ma

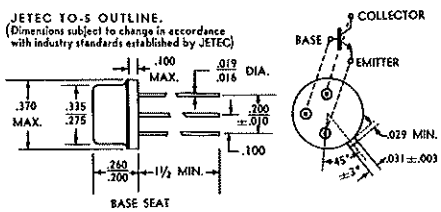
Storage and Operating Ambient Temperature Range -65 to + 150°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS

(AT 25°C, I_c = 100 uA, V_{cb} = 3V, UNLESS OTHERWISE STATED)

			Min.	Typ.	Max.		Test Conditions
Equivalent Input Noise Voltage				1.1	2.0	uV RMS	Bandwidth 1-50 c/s. input short circuited to A.C. in the common emitter configuration.
D.C. Common Emitter Current Gain		h_{FE}	20	30			
Ratio of A.C. Current Gain to D.C. Current Gain				1.5			
Collector Leakage Current		I_{co}		2 4	10 20	muA uA	T = 25°C T = 150°C
Emitter Leakage Current		I_{eo}		2	30	muA	V_{eb} = 2V.
A.C. Common Emitter Input Impedance		h_{ie}		20		K	
Collector Capacitance		C_c		9 27	20	uuF uuF	V_{ce} = 6V. V_{ce} = 1V. I_c = 1mA, f = 1mc/s.
Common Base Cut-Off Frequency		$f_{\alpha c}$		5		mc/s	V_{ce} = 6V, I_c = 1mA
Recommended Operating Conditions	Collector Current	I_c	100		500	uA	
	Collector Voltage	V_{ce}	1		6	V	
	Source Impedance	R_s			5	K	

MECHANICAL DATA



Encapsulation: Welded hermetic seal.
Mounting Position: Any:
Note: All leads isolated from the case. A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

Catalog No. 81.20.10J

TRANSITRON

PB-11
November 7, 1958

LOW NOISE CURRENT NPN SILICON TRANSISTOR, ST1051

ABSOLUTE MAXIMUM RATINGS

Collector to Emitter Voltage	V_{ce}	6	Volts
Collector to Base Voltage	V_{cb}	6	Volts
Emitter to Base Voltage	V_{eb}	2	Volts
Power Dissipation: at 25°C Ambient		30	mw
at 100°C Ambient		12	mw
Collector Current	I_c	5	ma

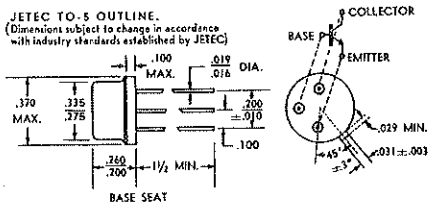
Storage and Operating Ambient Temperature Range -65 to + 150°C

SPECIFICATIONS AND TYPICAL CHARACTERISTICS

(AT 25°C, I_c = 20 uA, V_{cb} = 3V, UNLESS OTHERWISE STATED)

			Min.	Typ.	Max.		Test Conditions
Equivalent Input Noise Current				50	120	uuA RMS	Bandwidth 1-50 c/s. input open circuited to A.C. in the common emitter configuration.
D.C. Common Emitter Current Gain		h_{FE}	15	25			
Ratio of A.C. Current Gain to D.C. Current Gain				1.5			
Collector Leakage Current		I_{co}		2 4	10 20	muA uA	T = 25°C T = 150°C
Emitter Leakage Current		I_{eo}		2	30	muA	V_{eb} = 2V.
A.C. Common Emitter Input Impedance		h_{ie}		50		K	
Collector Capacitance		C_c		9 27	20	uuF uuF	V_{ce} = 6V V_{ce} = 1V, I_c = 1mA, f = 1mc/s.
Common Base Cut-Off Frequency		$f_{\alpha c}$		5		mc/s	V_{ce} = 6V, I_c = 1mA
Recommended Operating Conditions	Collector Current	I_c	20		100	uA	
	Collector Voltage	V_{ce}	1		6	V	
	Source Impedance	R_s	200			K	

MECHANICAL DATA



ENCAPSULATION: Welded hermetic seal.
MOUNTING POSITION: Any:
NOTE: All leads isolated from the case.
A heat sink (long nose pliers) should be used when soldering leads within 1/4 inch of the glass seals, although the transistors are designed to withstand dip soldering for 8 seconds at 230°C 1/8 inch from the base.

Catalog No. 81.20.10K

Transitron

ALL REPRESENTATIVES
AND FIELD ENGINEERS

August 24, 1959

Transistor Type 2N702

The above transistor was announced recently by Texas Instrument as a presumed competition for Transitron's 2N1139. The 2N702 does not measure up to the 2N1139, however, (see T.A.P #3 for details).

Also recently we have announced that the 2N702 will be available from Transitron. This may have been a bit premature, however, since the 2N702 is not supplied in the same encapsulation as the 2N1139. The TO-5 package is used for our transistor while the 2N702 is encapsulated in the TO-18 package. The two packages are similar in structure but the TO-18 is considerably smaller than the TO-5.

At the present time, Transitron is in the process of introducing the TO-18 package into our high frequency switching transistor line, and in the very near future the 2N702 will be available and in addition the electrical characteristics of the 2N1139 will become available in the TO-18 package. The only change necessary in the specifications for the 2N1139 will be the reduction of the ambient air dissipation capabilities.

As an interim measure we have set up transistor type ST702. The basic purpose of this transistor is to provide our customers with some transistors with the electrical characteristics of the 2N702 while the line is being converted to the TO-18 package. When offering this transistor to customers be sure that they understand that the ST702 meets only the electrical requirements and that the fully interchangeable 2N702 will be available in the near future.

In addition to the TO-18 package we are also doing development work on a considerably smaller package and it is hoped that within a few months, transistors of similar characteristics will also be available in this package. The time schedule for introduction of the TO-18 package to the public is four to six weeks and as soon as these transistors are available for sampling you will be advised.

Sincerely yours,

Peter Demner

pd:am