ALPHANUMERIC INDEX — CROSS-REFERENCE (Continued)

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MJ804		MJ12004	3-644
MJ8100		2N6193	3-158
MJ8500	MJ8501		3-546
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MJ8502	MJ8502		3-552
MJ8503	MJ8503		3-552
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MJE1092	MJE1092		—
MJE1093	MJE1093		—
MJE1100	MJE1100		—
MJE1101	MJE1101		—
MJE1102	MJE1102		—
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MJE13005	MJE13005		3-944
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MJE16034	MJE16034		3-984
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MJE1661	MJE1661		3-898
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MJE171	MJE171		3-862
MJE172	MJE172		3-862
MJE180	MJE180		3-862
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*Consult Motorola if a direct replacement is necessary.

TABLE 9 — PLASTIC CASE 152 (continued)

I_CCont Amps Max	$V_{CEO(sus)}$ Volts Min	Device Type		h_{FE} Min/Max	@ I_C Amp	Resistive Switching			f_T MHz Min	P_D (Case) Watts @ 25°C
		NPN	PNP			t_s μs Max	t_f μs Max	@ I_C Amp		
2	60	MPS-U05	MPS-U55	60 min	0.25				50	10
	80	MPS-U06	MPS-U56	60 min	0.25				50	10
	100	MPS-U07	MPS-U57	30 min	0.25				50	10

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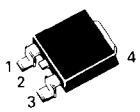
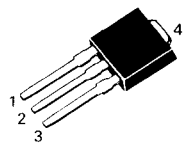
TABLE 10 — DPAK — SURFACE MOUNT POWER PACKAGE



CASE 369A-04



CASE 369-03

STYLE 1:
1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

I_CCont Amps Max	$V_{CEO(sus)}$ Volts Min	Device Type*		h_{FE} Min/Max	@ I_C Amp	Resistive Switching			f_T MHz Min	P_D (Case) Watts @ 25°C
		NPN	PNP			t_s μs Typ	t_f μs Typ	@ I_C Amp		
0.5	300	MJD340	MJD350	30/240	0.05					15
1	250	MJD47		30/150	0.3	2	0.2	0.3	10	15
	400	MJD50		30/150	0.3	2	0.2	0.3	10	20
1.5	400	MJD13003		5/25	1	4 max	0.7 max	1	4	15
2	100	MJD112##	MJD117##	1000 min	2	1.7	1.3	2	25#	20
3	40	MJD31	MJD32	10 min	1	0.6	0.3	1	3	15
	100	MJD31C	MJD32C	10 min	1	0.6	0.3	1	3	15
4	45	MJD148		30 min	4				3	20
	80	MJD6039##	MJD6036##	1k/12k	2	1.7	1.2	2	25	20
5	25	MJD200	MJD210	45/180	2	0.15	0.04	2	65	12.5
6	100	MJD41C	MJD42C	15/75	3	0.4	0.15	3	3	20
8	80	MJD44H11	MJD45H11	40 min	4	0.5	0.14	5	50 typ	20
	100	MJD122##	MJD127##	1k/12k	4	1.5	2	4	4#	20
10	60	MJD3055	MJD2955	20/100	4	1.5	1.5	3	2	20
	80	MJD44E3##		1k min	5	2	0.5	10		20

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* Case 369-03 may be ordered by adding -1 suffix to part number.

TABLE 11 — MILITARY SPECIFIED POWER TRANSISTORS (continued)

I_C Cont Amps Max	$V_{CEO(sus)}$ Volts Min	Device Type		h_{FE} Min/Max	@ I_C Amp	Resistive Switching t_s μs Max	Resistive Switching t_f μs Max	Resistive Switching @ I_C Amp	f_T MHz Min	P_D (Case) Watts @ 25°C	Case JEDEC/MOT
		NPN/#	PNP/#								
15	400	2N6547J,/525 TX		12/60	5	4.7*		10	6	175	TO-204/1
		2N6675J,/537 TX, TXV**		8/20	10	2.5	0.5	10	15	175	TO-204AA/1
20	75	2N5039J,/439 TX, TXV		30/150	2	2*		10	60	140	TO-204/1
	80	2N5303J,/456A TX, TXV	2N5745J,433 TX, TXV	15/60	10	3*		10	2	200	TO-204/1
		2N6283J,/504 TX, TXV	2N6286J,/505 TX, TXV	1250/18k	10	10*		10	8	175	TO-204/1
	90	2N5038J/439 TX, TXV		50/200	2	2*		12	60	140	TO-204/1
	100	2N6284J,/504 TX, TXV	2N6287J,/505 TX, TXV	1250/18k	10	10*		10	8	175	TO-204/1
25	100		2N6437J,/508 TX, TXV	30/120	10	1		10	40	200	TO-204/1
	120		2N6438J,/509 TX, TXV	30/120	10	1		10	40	200	TO-204/1
30	60	2N5302J,/456A TX, TXV	2N4399J,/433 TX, TXV	15/60	15	3*		10	2	200	TO-204/1
50	60	2N5685J,/464 TX, TXV	2N5683J,/466 TX, TXV	15/60	25	3*		25	2	300	TO-204/197
	80	2N5686J,/464 TX, TXV	2N5684J,/466 TX, TXV	15/60	25	3*		25	2	300	TO-204/197
	100	2N6274J,/514 TX, TXV	2N6378J,/515 TX, TXV	30/120	20	1.05*		20	30	250	TO-204/197
	120		2N6379J,/515 TX, TXV	30/120	20	1.05*		20	30	250	TO-204/197
	150	2N6277J,/514 TX, TXV**		30/120	20	1.05*		20	30	250	TO-204/197

MIL-S-19500 Detailed Spec. shown by Device Type

* t_{off}

** Consult Factory for qualification status.

TABLE 12 — POWER DARLINGTONS

I_C Cont Amps Max	$V_{CEO(sus)}$ Volts Min	Device Type		h_{FE} Min/Max	@ I_C Amp	Resistive Switching t_s μs Max	Resistive Switching t_f μs Max	Resistive Switching @ I_C Amp	$\|h_{fe}\|$ @ 1 MHz Min	P_D (Case) Watts @ 25°C	Case JEDEC/MOT
		NPN	PNP								
2	40	MPS-U45	MPS-U95	4k min	1				100	10	/152
	60	TIP110	TIP115	1k min	1	2 typ	1 typ	1	25	50	TO-220/221A
	80	TIP111	TIP116	1k min	1	2 typ	1 typ	1	25	50	TO-220/221A
	100	TIP112	TIP117	1k min	1	2 typ	1 typ	1	25	50	TO-220/221A
		MJD112	MJD117	1000 min	2	1.7 typ	1.3 typ	2	25	20	TO-252/369A-04
		MJE270	MJE271	1.5k min	0.12				6	25	TO-225AA/77

(continued)

Complementary Darlington Power Transistors

DPAK For Surface Mount Applications

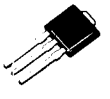
NPN
MJD112
PNP
MJD117

SILICON
POWER TRANSISTORS
2 AMPERES
100 VOLTS
20 WATTS

Designed for general purpose power and switching such as output or driver stages in applications such as switching regulators, convertors, and power amplifiers.

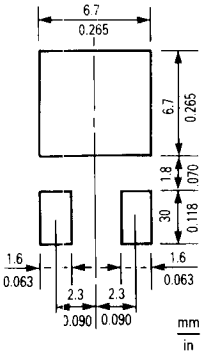
- Lead Formed for Surface Mount Application in Plastic Sleeves (No Suffix)
- Straight Lead Version in Plastic Sleeves ("-1" Suffix)
- Lead Formed Version in 16 mm Tape and Reel ("RL" Suffix)
- Surface Mount Replacements for TIP110–TIP117 Series
- Monolithic Construction With Built-in Base-Emitter Shunt Resistors
- High DC Current Gain — h_{FE} = 2500 (Typ) @ I_C = 2 Adc
- Complementary Pairs Simplifies Designs

CASE 369A-04



CASE 369-03

MINIMUM PAD SIZES RECOMMENDED FOR SURFACE MOUNTED APPLICATIONS



MAXIMUM RATINGS

Rating	Symbol	MJD112 MJD117	Unit
Collector-Emitter Voltage	V_{CEO}	100	Vdc
Collector-Base Voltage	V_{CB}	100	Vdc
Emitter-Base Voltage	V_{EB}	5	Vdc
Collector Current — Continuous Peak	I_C	2 4	Adc
Base Current	I_B	50	mAdc
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	20 0.16	Watts W/°C
Total Power Dissipation* @ T_A = 25°C Derate above 25°C	P_D	1.75 0.014	Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	6.25	°C/W
Thermal Resistance, Junction to Ambient*	$R_{\theta JA}$	71.4	°C/W

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Sustaining Voltage (1) (I_C = 30 mAdc, I_B = 0)	$V_{CEO(sus)}$	100	—	Vdc
Collector Cutoff Current (V_{CE} = 50 Vdc, I_B = 0)	I_{CEO}	—	20	μAdc
Collector Cutoff Current (V_{CB} = 100 Vdc, I_E = 0)	I_{CBO}	—	20	μAdc
Emitter Cutoff Current (V_{BE} = 5 Vdc, I_C = 0)	I_{EBO}	—	2	mAdc

* These ratings are applicable when surface mounted on the minimum pad sizes recommended. (continued)
(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

3

***ELECTRICAL CHARACTERISTICS — continued** (T_C = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS — continued					
Collector-Cutoff Current (V_{CE} = 80 Vdc, $V_{BE(off)}$ = 1.5 Vdc) (V_{CE} = 80 Vdc, $V_{BE(off)}$ = 1.5 Vdc, T_C = 125°C)		I_{CEX}	— —	10 500	μAdc
Collector-Cutoff Current (V_{CB} = 80 Vdc, I_E = 0)		I_{CBO}	—	10	μAdc
Emitter-Cutoff Current (V_{BE} = 5 Vdc, I_C = 0)		I_{EBO}	—	2	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 0.5 Adc, V_{CE} = 3 Vdc) (I_C = 2 Adc, V_{CE} = 3 Vdc) (I_C = 4 Adc, V_{CE} = 3 Vdc)		h_{FE}	500 1000 200	— 12,000 —	—
Collector-Emitter Saturation Voltage (I_C = 2 Adc, I_B = 8 mAdc) (I_C = 4 Adc, I_B = 40 mAdc)		$V_{CE(sat)}$	— —	2 3	Vdc
Base-Emitter Saturation Voltage (I_C = 4 Adc, I_B = 40 mAdc)		$V_{BE(sat)}$	—	4	Vdc
Base-Emitter On Voltage (I_C = 2 Adc, V_{CE} = 3 Vdc)		$V_{BE(on)}$	—	2.8	Vdc
DYNAMIC CHARACTERISTICS					
Current-Gain — Bandwidth Product (I_C = 0.75 Adc, V_{CE} = 10 Vdc, f = 1 MHz)		f_T	25	—	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 0.1 MHz)	MJD117 MJD112	C_{ob}	— —	200 100	pF

*Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

3

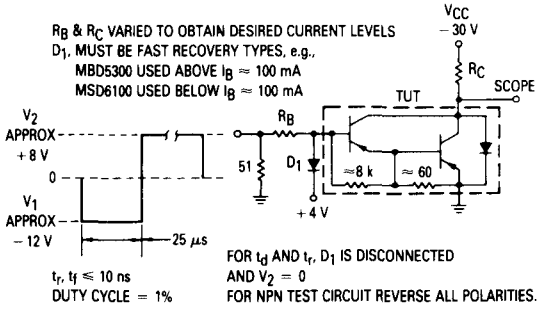


Figure 1. Switching Times Test Circuit

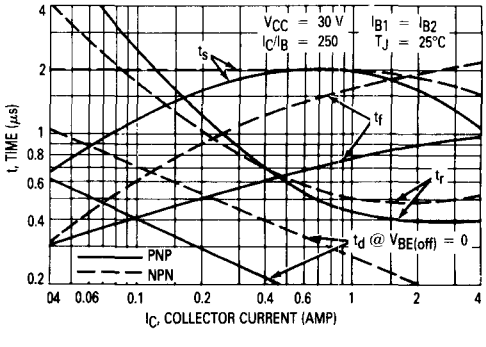


Figure 2. Switching Times

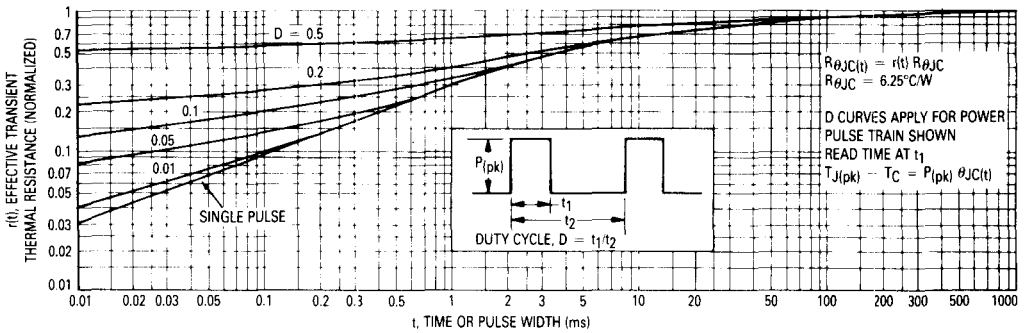


Figure 3. Thermal Response

ACTIVE-REGION SAFE-OPERATING AREA

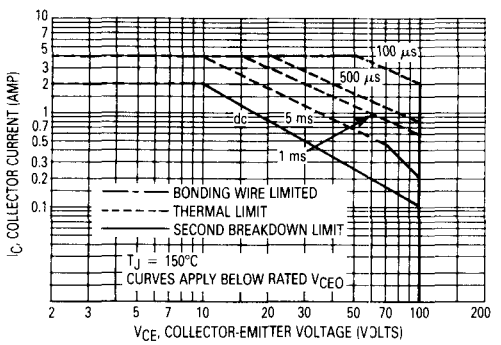


Figure 4. Maximum Rated Forward Biased Safe Operating Area

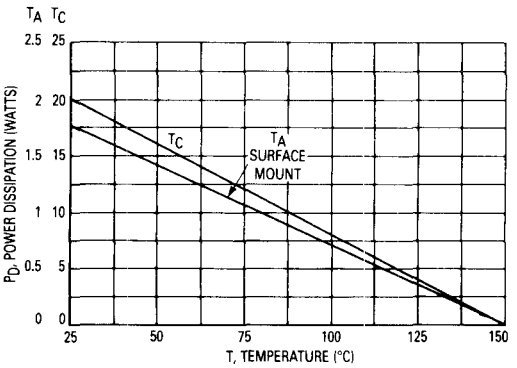


Figure 5. Power Derating

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate I_C-V_{CE} limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figures 5 and 6 is based on $T_{J(pk)}$ = 150°C; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} < 150°C$. $T_{J(pk)}$ may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

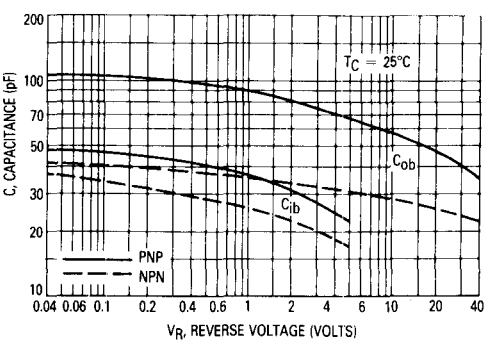
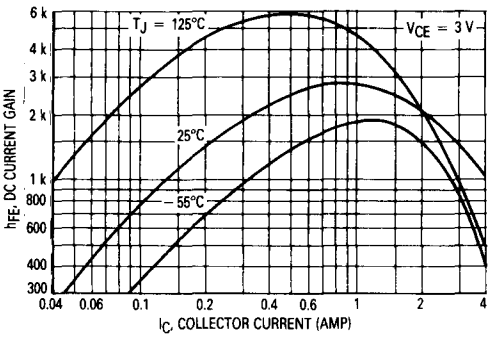


Figure 6. Capacitance

TYPICAL ELECTRICAL CHARACTERISTICS

NPN MJD112



PNP MJD117

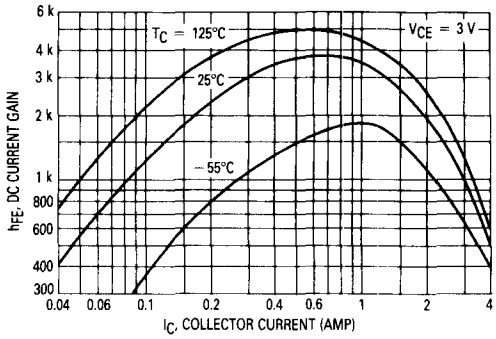
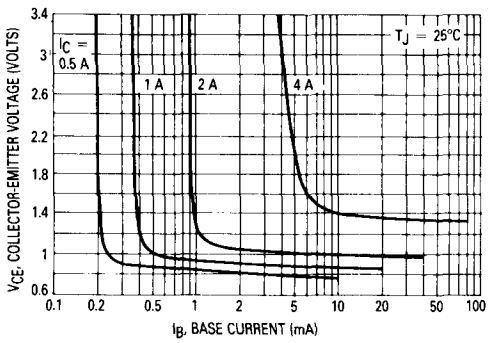


Figure 7. DC Current Gain



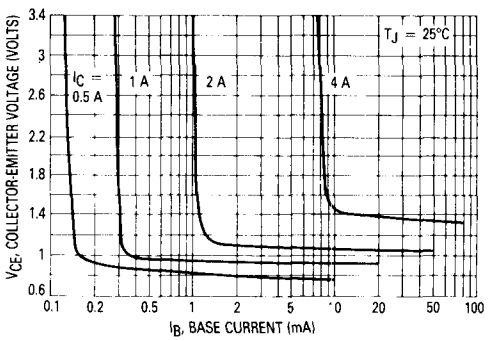
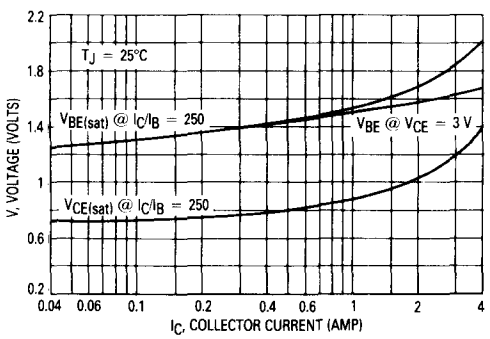


Figure 8. Collector Saturation Region



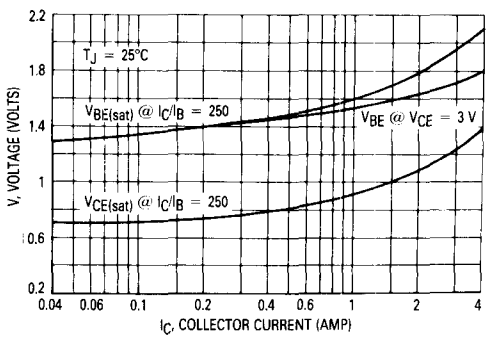


Figure 9. "On" Voltages

3

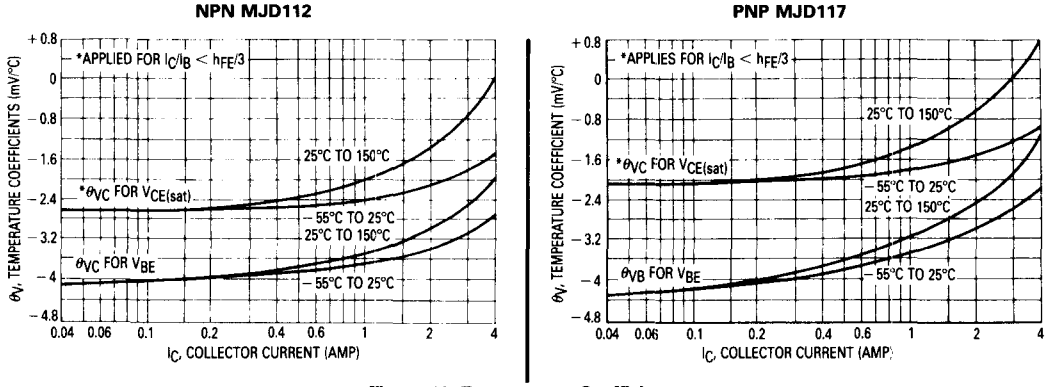


Figure 10. Temperature Coefficients

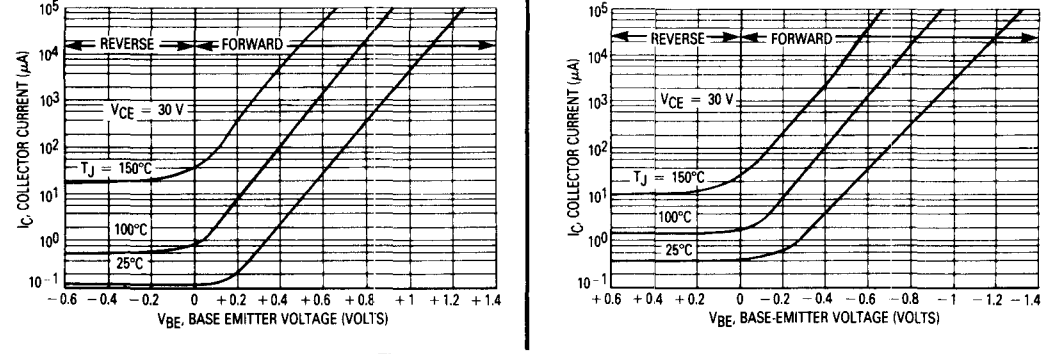
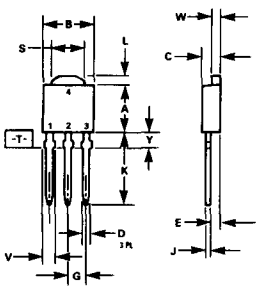


Figure 11. Collector Cut-Off Region

Figure 12. Darlington Schematic

OUTLINE DIMENSIONS

CASE 369-03

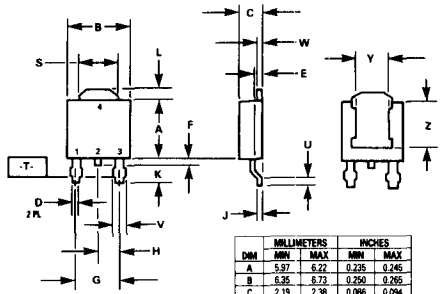


STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	5.97	6.22	0.235	0.245
B	6.35	6.73	0.250	0.265
C	2.19	2.38	0.086	0.094
D	0.64	0.88	0.025	0.035
E	0.97	1.06	0.038	0.042
G	2.29 BSC		0.090 BSC	
J	0.46	0.58	0.018	0.023
K	9.89	9.65	0.350	0.380
L	0.89	1.27	0.035	0.050
S	5.21	5.46	0.205	0.215
V	0.77	1.14	0.030	0.045
W	0.84	0.94	0.033	0.037
Y	1.91	2.28	0.075	0.090

NOTES:
1. SURFACE "T" IS BOTH A DATUM AND A MOUNTING SURFACE.
2. POSITIONAL TOLERANCE FOR "D" DIAMETER:
⌖ | 0.13 (0.005) Ⓜ | T |
3. DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
4. CONTROLLING DIMENSION: INCH.

CASE 369A-04



STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	5.97	6.22	0.235	0.245
B	6.35	6.73	0.250	0.265
C	2.19	2.38	0.086	0.094
D	0.69	0.88	0.027	0.035
E	0.97	1.06	0.038	0.042
F	0.84	0.88	0.025	0.035
G	4.58 BSC		0.180 BSC	
H	2.29 BSC		0.090 BSC	
J	0.46	0.58	0.018	0.023
K	2.59	2.89	0.102	0.114
L	0.89	1.27	0.035	0.050
S	5.21	5.46	0.205	0.215
U	0.51	—	0.020	—
V	0.77	1.14	0.030	0.045
W	0.84	0.94	0.033	0.037
Y	4.32	—	0.170	—
Z	3.68	—	0.145	—

NOTES:
1. SURFACE "T" IS BOTH A DATUM AND A MOUNTING SURFACE.
2. POSITIONAL TOLERANCE FOR "D" DIAMETER:
⌖ | 0.13 (0.005) Ⓜ | T |
3. DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
4. CONTROLLING DIMENSION: INCH.

Case 369-03 may be ordered by adding a "-1" suffix to the device title (i.e. MJD112-1)

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