

Complementary Darlington Power Transistors

DPAK For Surface Mount Applications

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

- Lead Formed for Surface Mount Applications in Plastic Sleeves (No Suffix)
- Straight Lead Version in Plastic Sleeves ("–1" Suffix)
- Available on 16 mm Tape and Reel for Automatic Handling ("T4" Suffix)
- Surface Mount Replacements for 2N6034–2N6039 Series
- Monolithic Construction With Built-in Base-Emitter Shunt Resistors
- High DC Current Gain — $h_{FE} = 2500$ (Typ) @ $I_C = 4.0$ Adc
- Complementary Pairs Simplifies Designs

MAXIMUM RATINGS

Rating	Symbol	MJD6036 MJD6039	Unit
Collector-Emitter Voltage	V_{CEO}	80	Vdc
Collector-Base Voltage	V_{CB}	80	Vdc
Emitter-Base Voltage	V_{EB}	5	Vdc
Collector Current — Continuous Peak	I_C	4 8	Adc
Base Current	I_B	100	mAdc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	20 0.16	Watts W/ $^\circ\text{C}$
Total Power Dissipation (1) @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	1.75 0.014	Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–65 to +150	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	6.25	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient (1)	$R_{\theta JA}$	71.4	$^\circ\text{C/W}$

*ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Sustaining Voltage ($I_C = 30$ mAdc, $I_B = 0$)	$V_{CEO(sus)}$	80	—	Vdc
Collector-Cutoff Current ($V_{CE} = 40$ Vdc, $I_B = 0$)	I_{CEO}	—	10	μAdc

(1) These ratings are applicable when surface mounted on the minimum pad sizes recommended.

* Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2\%$.

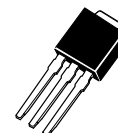
(continued)

NPN
MJD6036
PNP
MJD6039

SILICON
POWER TRANSISTORS
4 AMPERES
80 VOLTS
20 WATTS

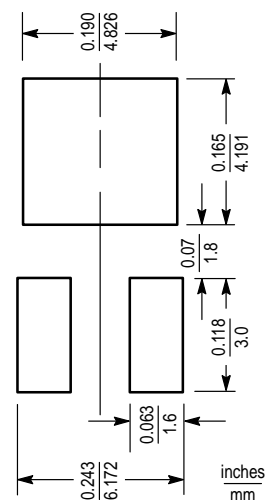


CASE 369A–13



CASE 369–07

MINIMUM PAD SIZES RECOMMENDED FOR SURFACE MOUNTED APPLICATIONS



Preferred devices are Motorola recommended choices for future use and best overall value.

REV 2

ELECTRICAL CHARACTERISTICS — continued ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
ON CHARACTERISTICS (1)				
DC Current Gain ($I_C = 1 \text{ Adc}$, $V_{CE} = 4 \text{ Vdc}$) ($I_C = 2 \text{ Adc}$, $V_{CE} = 4 \text{ Vdc}$)	h_{FE}	1000 500	—	—
Collector–Emitter Saturation Voltage ($I_C = 2 \text{ Adc}$, $I_B = 8 \text{ mAdc}$)	$V_{CE(sat)}$	—	2.5	Vdc
Base–Emitter On Voltage ($I_C = 2 \text{ Adc}$, $V_{CE} = 4 \text{ Vdc}$)	$V_{BE(on)}$	—	2.8	Vdc

DYNAMIC CHARACTERISTICS

Small–Signal Current Gain ($I_C = 0.75 \text{ Adc}$, $V_{CE} = 10 \text{ Vdc}$, $f = 1 \text{ kHz}$)	h_{fe}	25	—	—
Output Capacitance ($V_{CB} = 10 \text{ Vdc}$, $I_E = 0$, $f = 0.1 \text{ MHz}$)	C_{ob}	— —	200 100	pF
	MJD6036 MJD6039			

(1) Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2\%$.

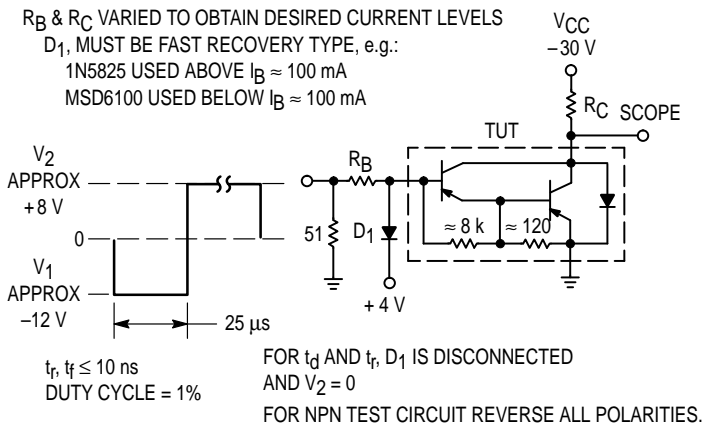


Figure 1. Switching Times Test Circuit

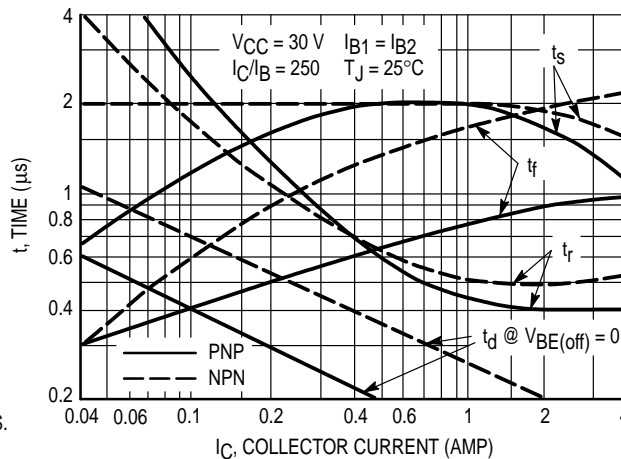


Figure 2. Switching Times

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TYPICAL ELECTRICAL CHARACTERISTICS

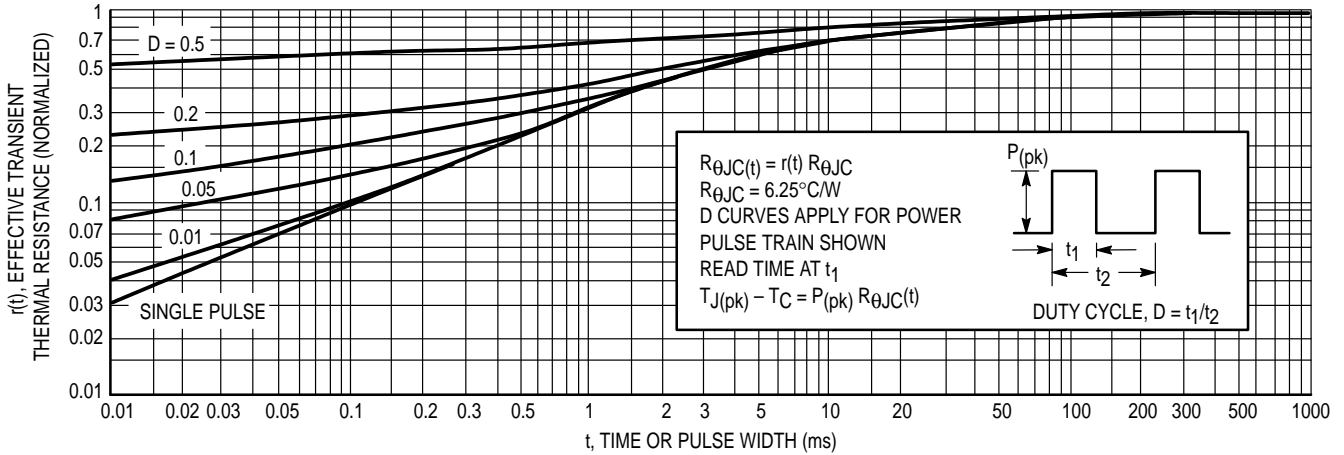


Figure 3. Thermal Response

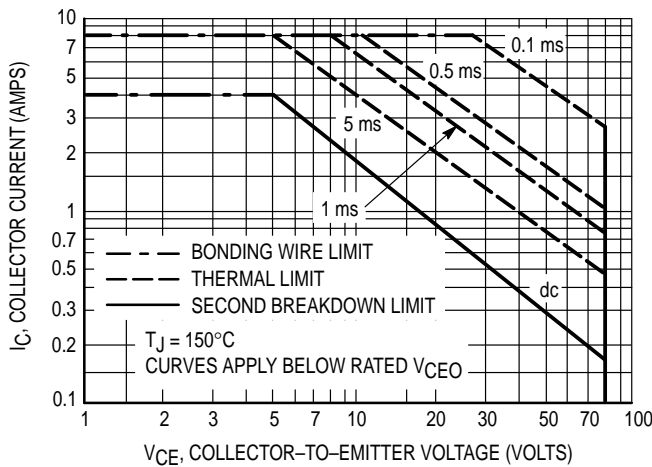


Figure 4. Maximum Rated Forward Biased Safe Operating Area

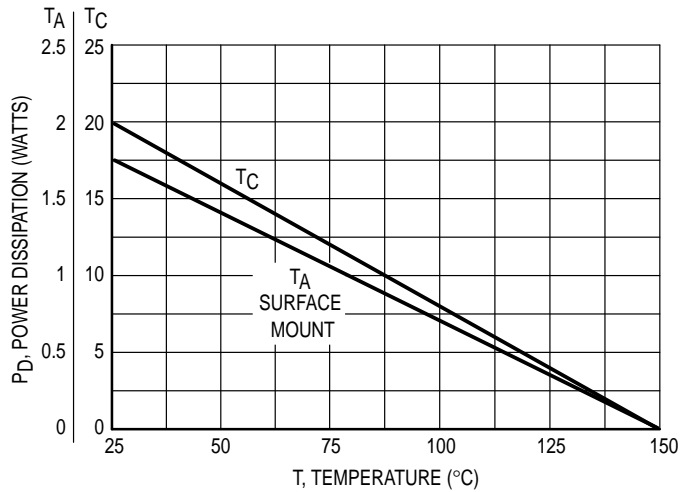


Figure 5. Power Derating

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 6 and 7 is based on $T_{J(pk)} = 150^\circ\text{C}$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} < 150^\circ\text{C}$. $T_{J(pk)}$ may be calculated from the data in Figure 5. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

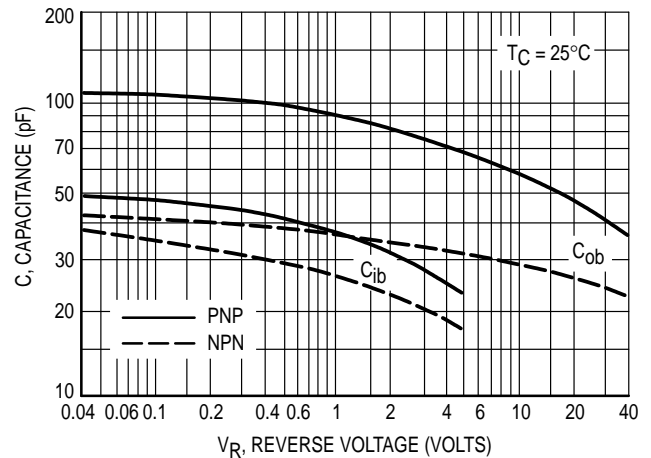


Figure 6. Capacitance

TYPICAL ELECTRICAL CHARACTERISTICS

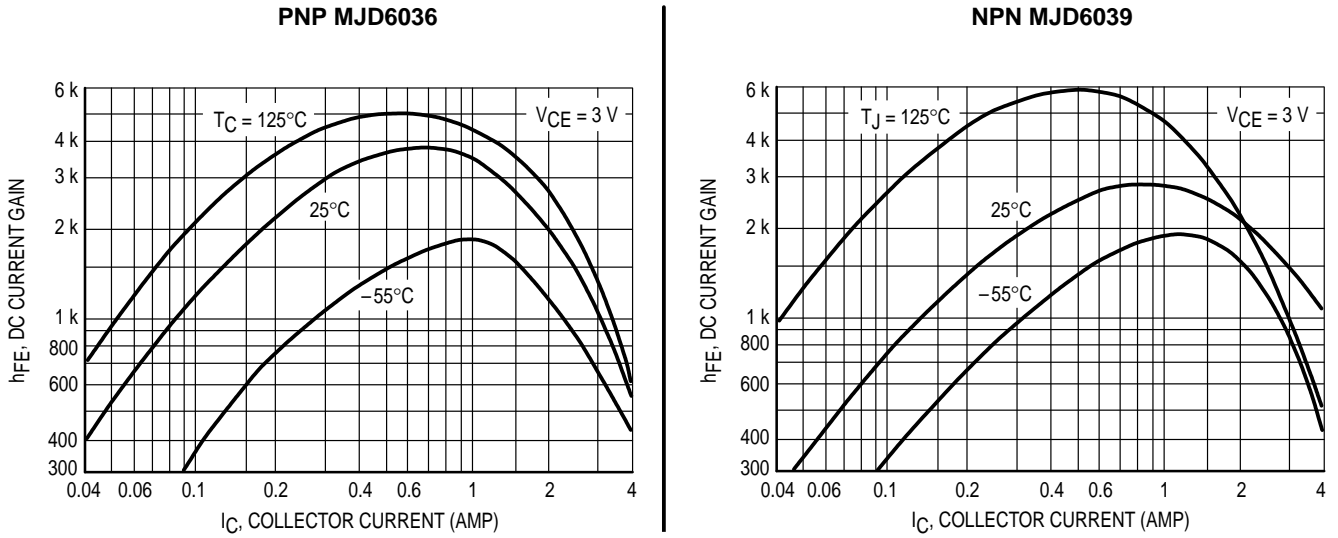


Figure 7. DC Current Gain

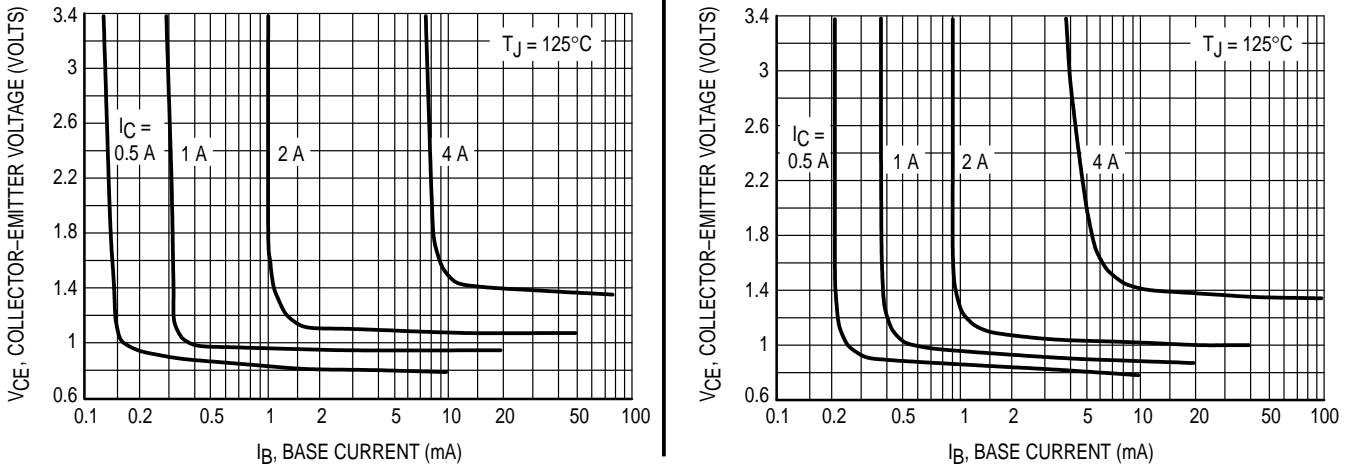


Figure 8. Collector Saturation Region

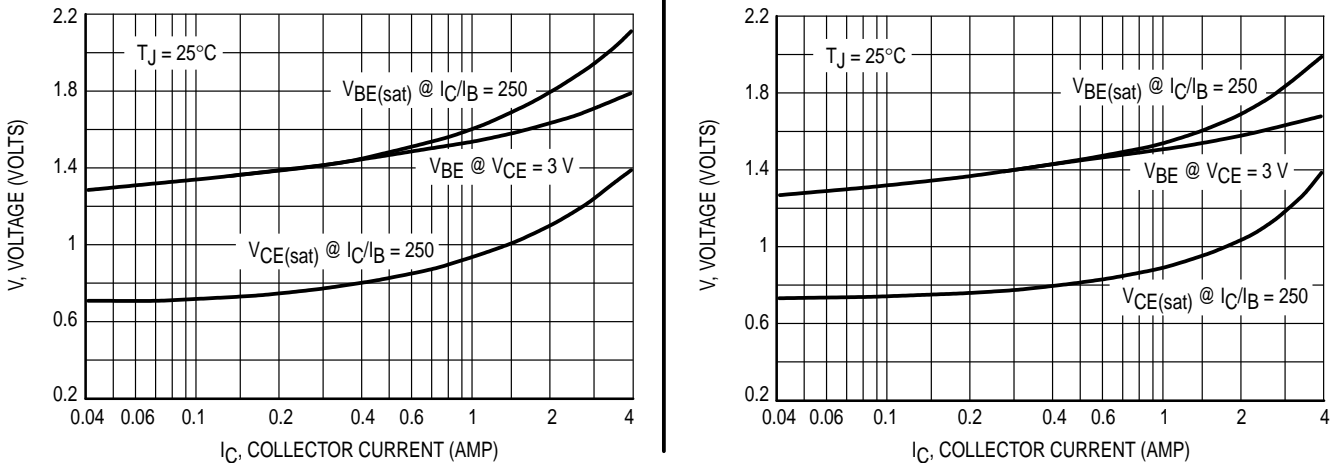


Figure 9. "On" Voltages

PNP MJD6036

NPN MJD6039

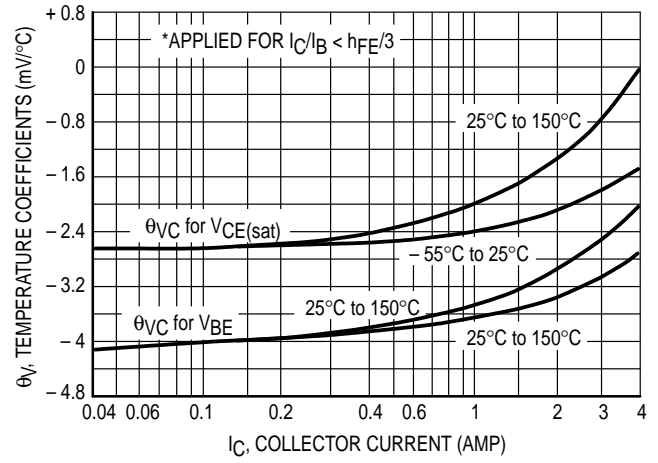
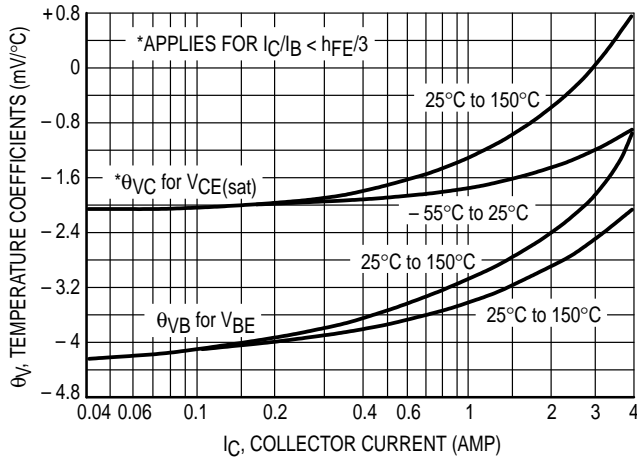


Figure 10. Temperature Coefficients

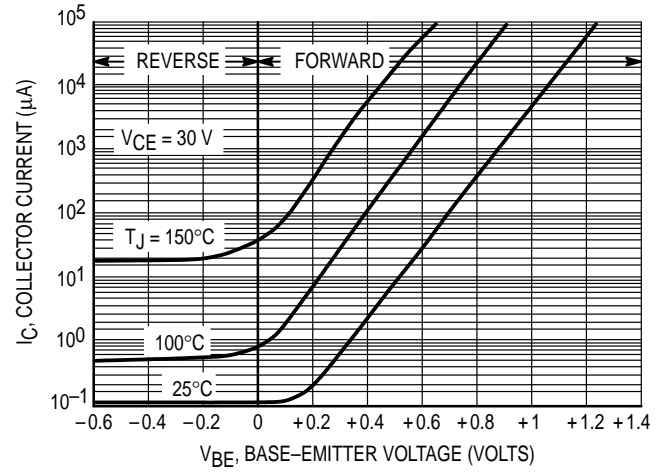
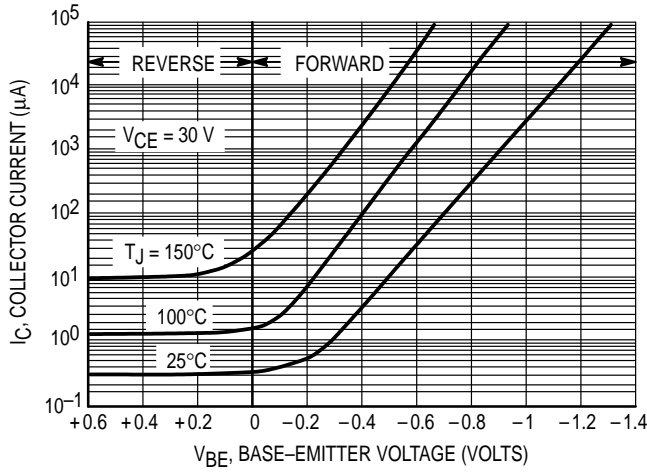


Figure 11. Collector Cut-Off Region

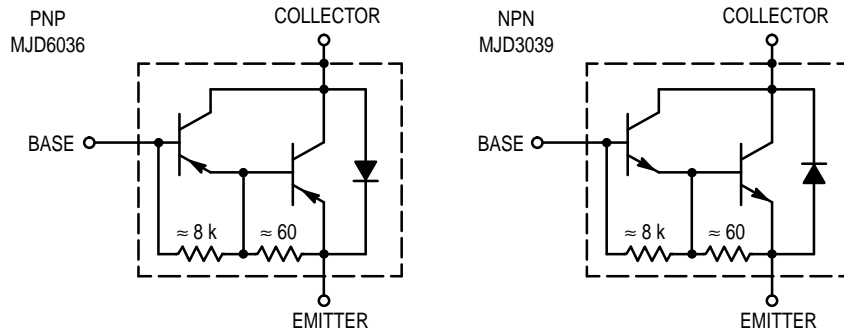
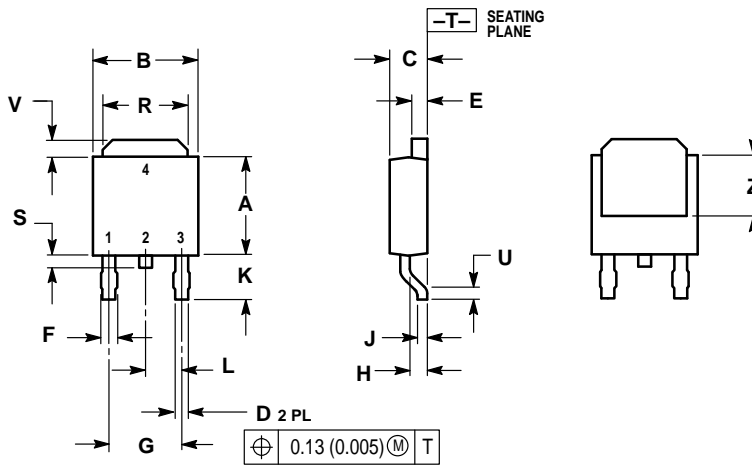


Figure 12. Darlington Schematic

PACKAGE DIMENSIONS

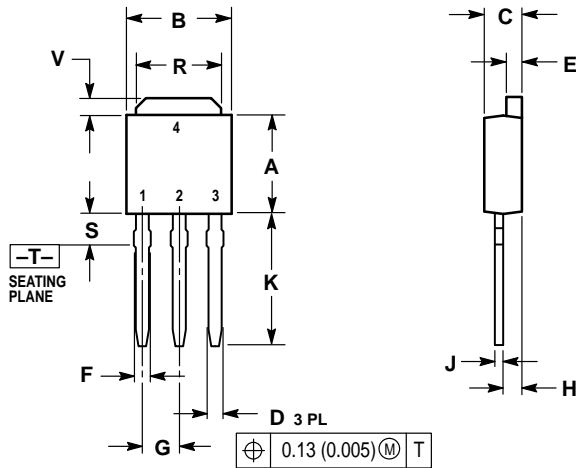


- NOTES:
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.250	5.97	6.35
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.033	0.040	0.84	1.01
F	0.037	0.047	0.94	1.19
G	0.180 BSC		4.58 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.102	0.114	2.60	2.89
L	0.090 BSC		2.29 BSC	
R	0.175	0.215	4.45	5.46
S	0.020	0.050	0.51	1.27
U	0.020	—	0.51	—
V	0.030	0.050	0.77	1.27
Z	0.138	—	3.51	—

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

CASE 369A-13
 ISSUE W



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G	0.090 BSC		2.29 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.350	0.380	8.89	9.65
R	0.175	0.215	4.45	5.46
S	0.050	0.090	1.27	2.28
V	0.030	0.050	0.77	1.27

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

CASE 369-07
 ISSUE K

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