

# MJD112 (NPN) MJD117 (PNP)

Preferred Device

## 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.

#### Features

- Pb-Free Packages are Available
- Lead Formed for Surface Mount Applications in Plastic Sleeves (No Suffix)
- Straight Lead Version in Plastic Sleeves (“-1” Suffix)
- Lead Formed Version in 16 mm Tape and Reel (“T4” and “RL” Suffix)
- Electrically Similar to Popular TIP31 and TIP32 Series

#### MAXIMUM RATINGS

Rating	Symbol	Max	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 @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	20 0.16	W W/ $^\circ\text{C}$
Total Power Dissipation* @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.75 0.014	W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +150	$^\circ\text{C}$

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

#### THERMAL CHARACTERISTICS

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

\*These ratings are applicable when surface mounted on the minimum pad sizes recommended.

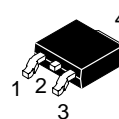


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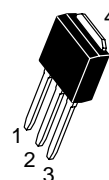
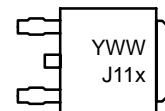
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**SILICON  
POWER TRANSISTORS  
2 AMPERES  
100 VOLTS  
20 WATTS**

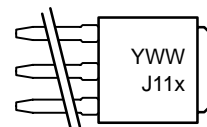
#### MARKING DIAGRAMS



DPAK  
CASE 369C



DPAK-3  
CASE 369D



Y = Year  
WW = Work Week  
x = 2 or 7

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

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

# MJD112 (NPN) MJD117 (PNP)

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Sustaining Voltage (1) (I <sub>C</sub> = 30 mAdc, I <sub>B</sub> = 0)	V <sub>CEO(sus)</sub>	100	–	Vdc
Collector Cutoff Current (V <sub>CE</sub> = 50 Vdc, I <sub>B</sub> = 0)	I <sub>CEO</sub>	–	20	μAdc
Collector Cutoff Current (V <sub>CB</sub> = 100 Vdc, I <sub>E</sub> = 0)	I <sub>CBO</sub>	–	20	μAdc
Emitter Cutoff Current (V <sub>BE</sub> = 5 Vdc, I <sub>C</sub> = 0)	I <sub>EBO</sub>	–	2	mAdc
Collector–Cutoff Current (V <sub>CB</sub> = 80 Vdc, I <sub>E</sub> = 0)	I <sub>CBO</sub>	–	10	μAdc
Emitter–Cutoff Current (V <sub>BE</sub> = 5 Vdc, I <sub>C</sub> = 0)	I <sub>EBO</sub>	–	2	mAdc

## ON CHARACTERISTICS

DC Current Gain (I <sub>C</sub> = 0.5 Adc, V <sub>CE</sub> = 3 Vdc) (I <sub>C</sub> = 2 Adc, V <sub>CE</sub> = 3 Vdc) (I <sub>C</sub> = 4 Adc, V <sub>CE</sub> = 3 Vdc)	h <sub>FE</sub>	500 1000 200	– 12,000 –	–
Collector–Emitter Saturation Voltage (I <sub>C</sub> = 2 Adc, I <sub>B</sub> = 8 mAdc) (I <sub>C</sub> = 4 Adc, I <sub>B</sub> = 40 mAdc)	V <sub>CE(sat)</sub>	– –	2 3	Vdc
Base–Emitter Saturation Voltage (I <sub>C</sub> = 4 Adc, I <sub>B</sub> = 40 mAdc)	V <sub>BE(sat)</sub>	–	4	Vdc
Base–Emitter On Voltage (I <sub>C</sub> = 2 Adc, V <sub>CE</sub> = 3 Vdc)	V <sub>BE(on)</sub>	–	2.8	Vdc

## DYNAMIC CHARACTERISTICS

Current–Gain – Bandwidth Product (I <sub>C</sub> = 0.75 Adc, V <sub>CE</sub> = 10 Vdc, f = 1 MHz)	f <sub>T</sub>	25	–	MHz
Output Capacitance (V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0, f = 0.1 MHz)	C <sub>ob</sub>	– –	200 100	pF
	MJD117 MJD112			

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

\*These ratings are applicable when surface mounted on the minimum pad sizes recommended.

## ORDERING INFORMATION

Device	Package Type	Package	Shipping†
MJD112	DPAK	369C	75 Units / Rail
MJD112–001	DPAK–3	369D	75 Units / Rail
MJD112RL	DPAK	369C	1800 Tape & Reel
MJD112T4	DPAK	369C	2500 Tape & Reel
MJD112T4G	DPAK (Pb–Free)	369C	2500 Tape & Reel
MJD117	DPAK	369C	75 Units / Rail
MJD117G	DPAK (Pb–Free)	369C	75 Units / Rail
MJD117–001	DPAK–3	369D	75 Units / Rail
MJD117T4	DPAK	369C	2500 Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# MJD112 (NPN) MJD117 (PNP)

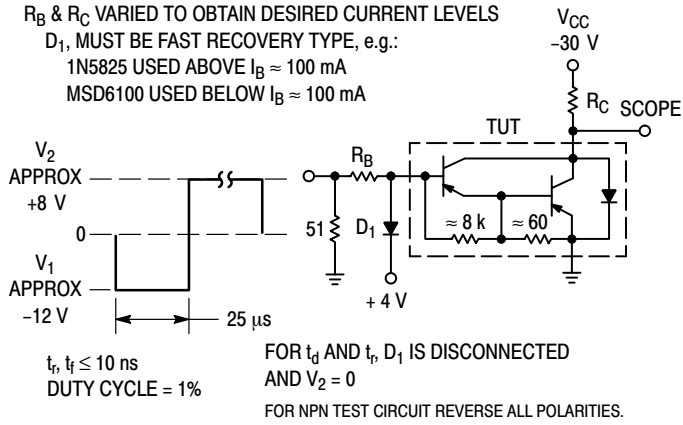


Figure 1. Switching Times Test Circuit

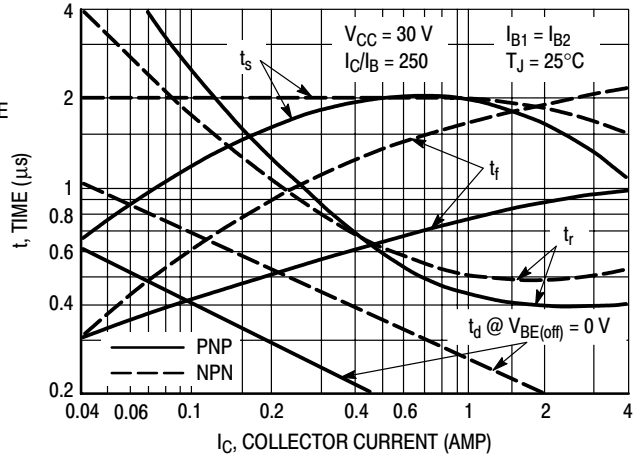


Figure 2. Switching Times

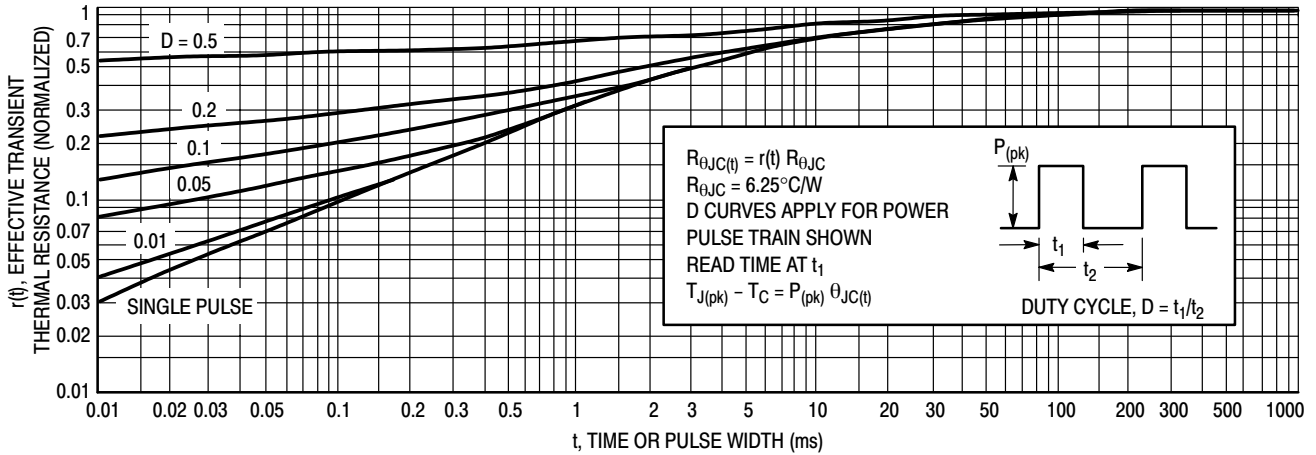
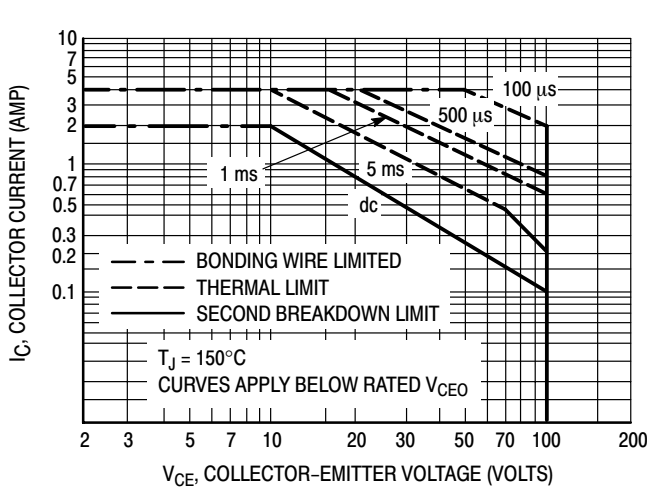


Figure 3. Thermal Response

# MJD112 (NPN) MJD117 (PNP)

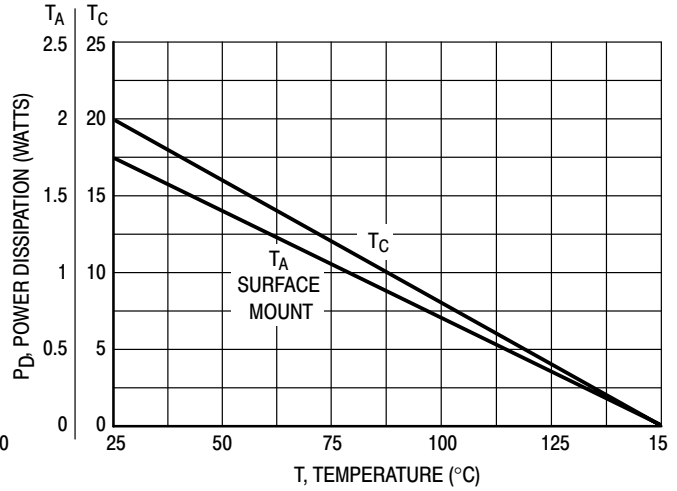
## ACTIVE-REGION SAFE-OPERATING AREA



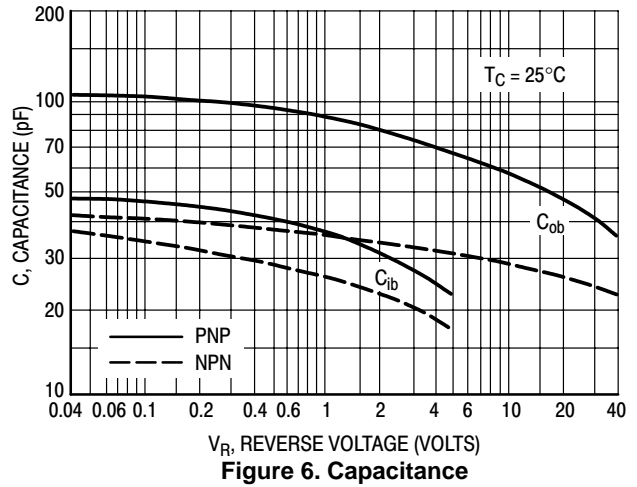
**Figure 4. Maximum Rated Forward Biased Safe Operating Area**

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  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  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 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 5. Power Derating**



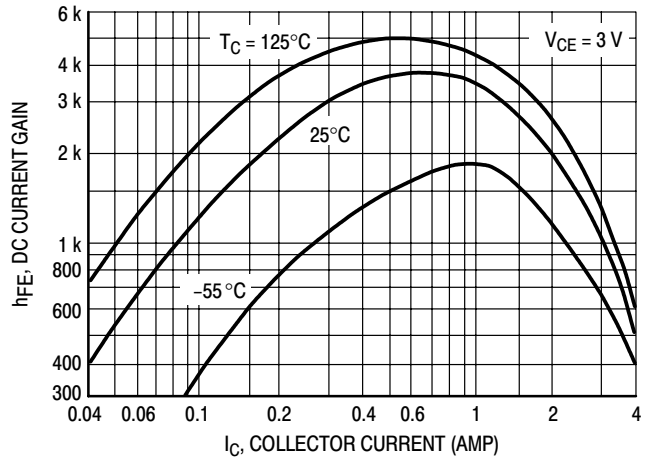
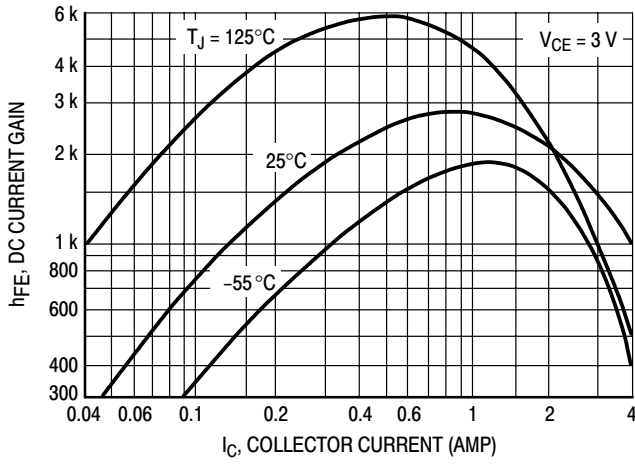
**Figure 6. Capacitance**

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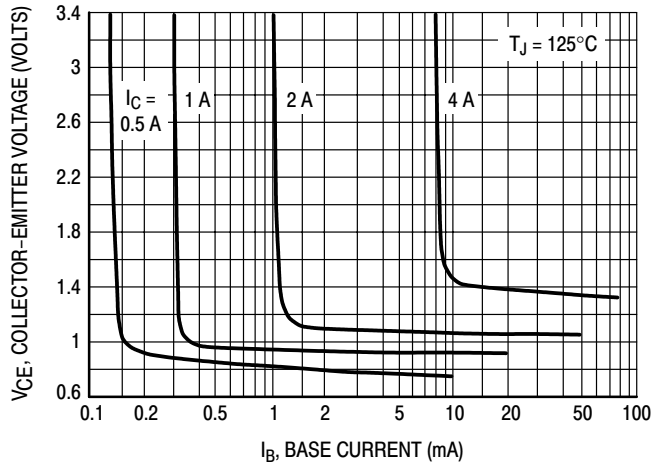
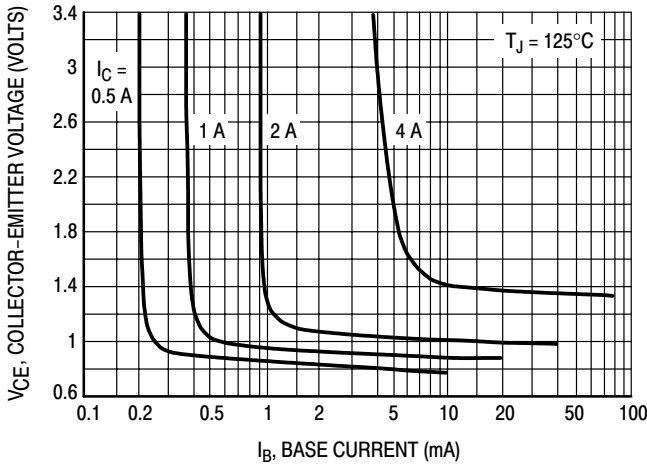
## TYPICAL ELECTRICAL CHARACTERISTICS

**NPN MJD112**

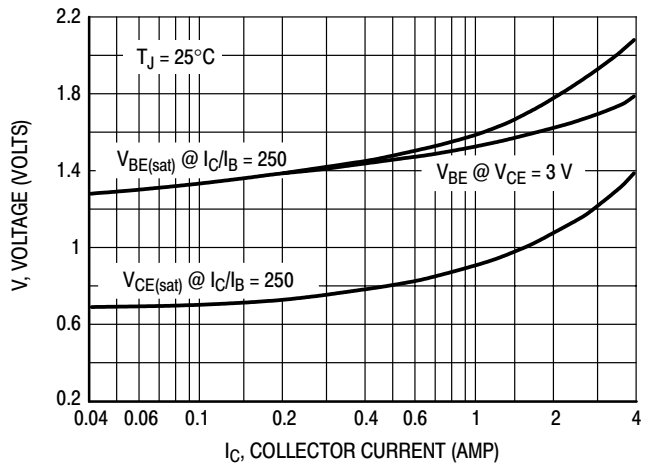
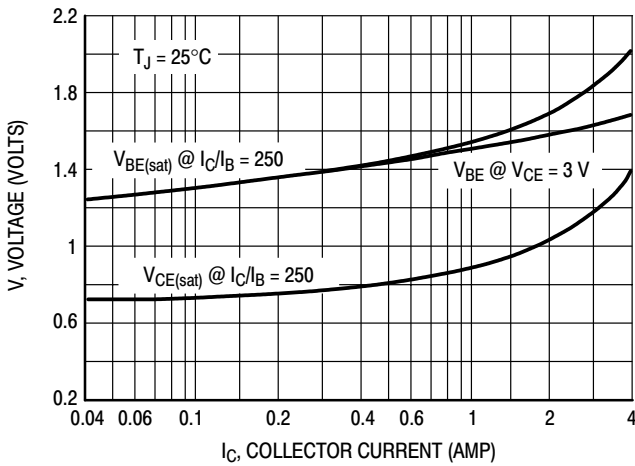
**PNP MJD117**



**Figure 7. DC Current Gain**



**Figure 8. Collector Saturation Region**



**Figure 9. "On Voltages"**

# MJD112 (NPN) MJD117 (PNP)

NPN MJD112

PNP MJD117

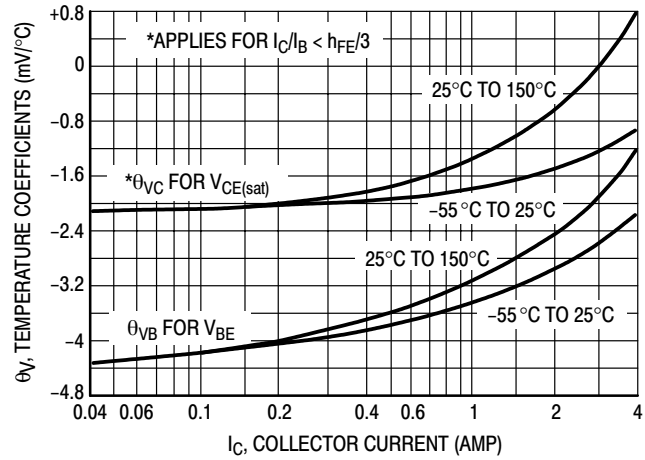
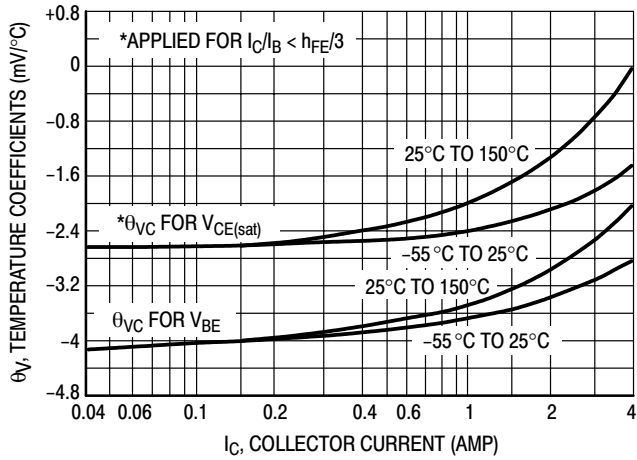


Figure 10. Temperature Coefficients

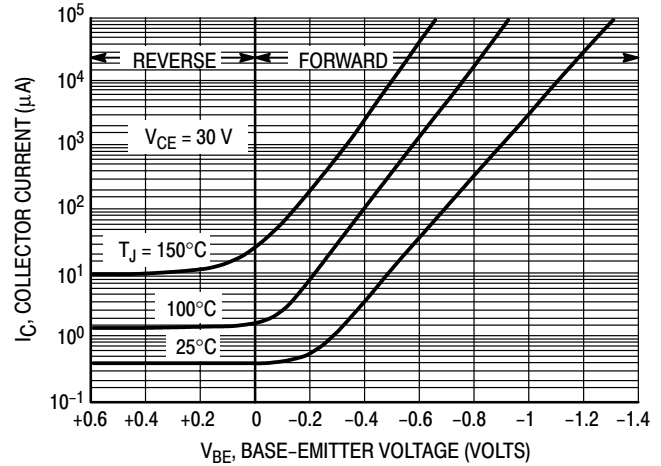
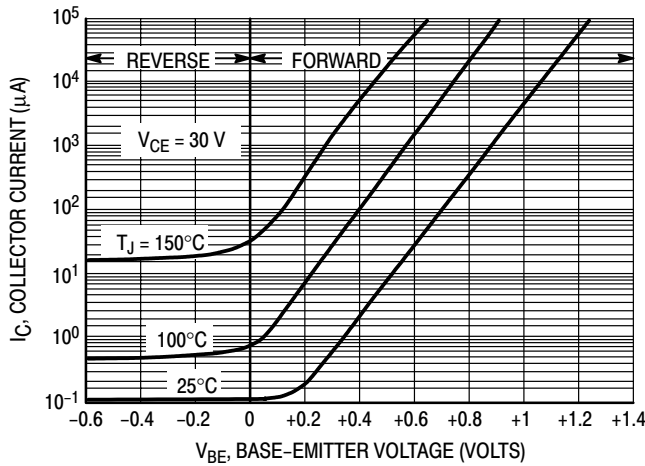


Figure 11. Collector Cut-Off Region

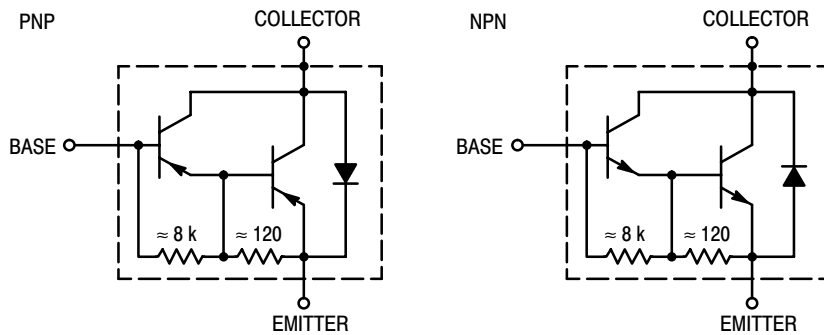
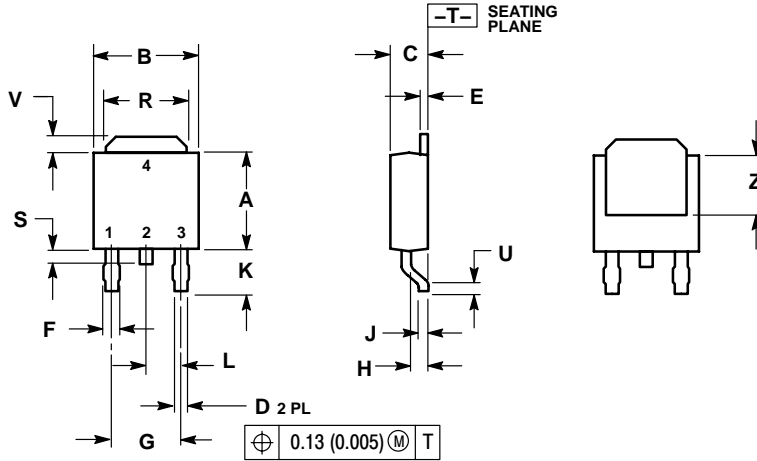


Figure 12. Darlington Schematic

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## PACKAGE DIMENSIONS

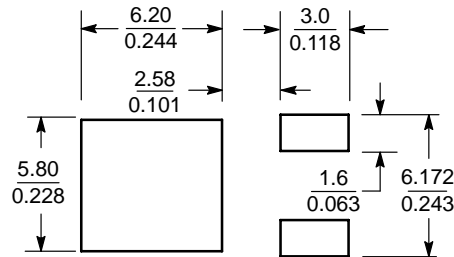
**DPAK**  
CASE 369C  
ISSUE O



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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.245	5.97	6.22
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	0.018	0.023	0.46	0.58
F	0.037	0.045	0.94	1.14
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	0.180	0.215	4.57	5.45
S	0.025	0.040	0.63	1.01
U	0.020	---	0.51	---
V	0.035	0.050	0.89	1.27
Z	0.155	---	3.93	---

### SOLDERING FOOTPRINT\*



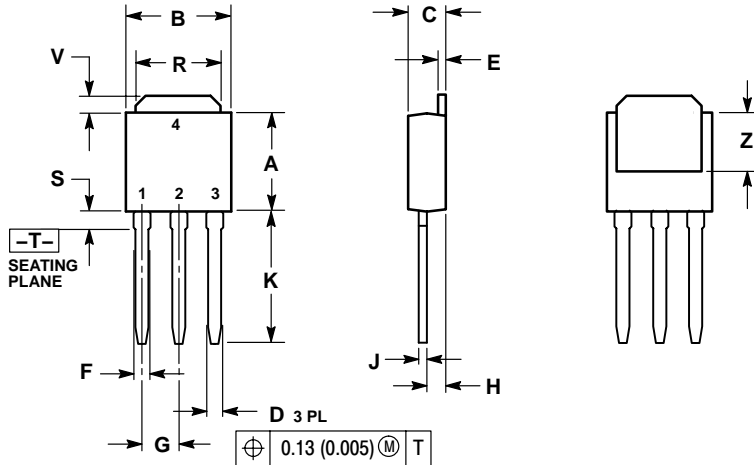
SCALE 3:1  $\left(\frac{\text{mm}}{\text{inches}}\right)$

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# MJD112 (NPN) MJD117 (PNP)

## PACKAGE DIMENSIONS


DKPAK-3  
CASE 369D-01  
ISSUE B



NOTES:

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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.245	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	0.018	0.023	0.46	0.58
F	0.037	0.045	0.94	1.14
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	0.180	0.215	4.45	5.45
S	0.025	0.040	0.63	1.01
V	0.035	0.050	0.89	1.27
Z	0.155	---	3.93	---

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