

# MJD6039

## 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, convertors, 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)
- Monolithic Construction With Built-in Base-Emitter Shunt Resistors
- High DC Current Gain –  
 $h_{FE} = 2500$  (Typ) @  $I_C = 4.0$  Adc

#### MAXIMUM RATINGS

Rating	Symbol	Value	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 $25^\circ\text{C}$	$P_D$	20 0.16	Watts W/ $^\circ\text{C}$
Total Power Dissipation (Note 1) @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.75 0.014	Watts W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +150	$^\circ\text{C}$

1. These ratings are applicable when surface mounted on the minimum pad size recommended.

#### THERMAL CHARACTERISTICS

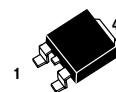
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	6.25	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient (Note 1)	$R_{\theta JA}$	71.4	$^\circ\text{C/W}$



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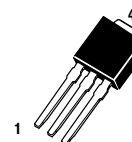
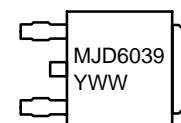
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**SILICON  
POWER TRANSISTORS  
4 AMPERES  
80 VOLTS  
20 WATTS**

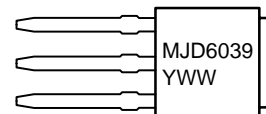


DPAK  
CASE 369A  
STYLE 1

#### MARKING DIAGRAMS



DPAK  
STRAIGHT LEADS  
CASE 369  
STYLE 1



MJD6039 = Specific Device Code  
 Y = Year  
 WW = Work Week

#### ORDERING INFORMATION

Device	Package	Shipping
MJD6039	DPAK	75 Units/Rail
MJD6039-1	DPAK Straight Leads	75 Units/Rail
MJD6039T4	DPAK	2500/Tape & Reel

# MJD6039

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

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector-Emitter Sustaining Voltage ( $I_C = 30\text{ mAdc}$ , $I_B = 0$ )	$V_{CE(sus)}$	80	-	Vdc
Collector-Cutoff Current ( $V_{CE} = 40\text{ Vdc}$ , $I_B = 0$ )	$I_{CEO}$	-	10	$\mu\text{Adc}$

## ON CHARACTERISTICS (Note 2)

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 ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 0.1\text{ MHz}$ )	$C_{ob}$	-	100	pF

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

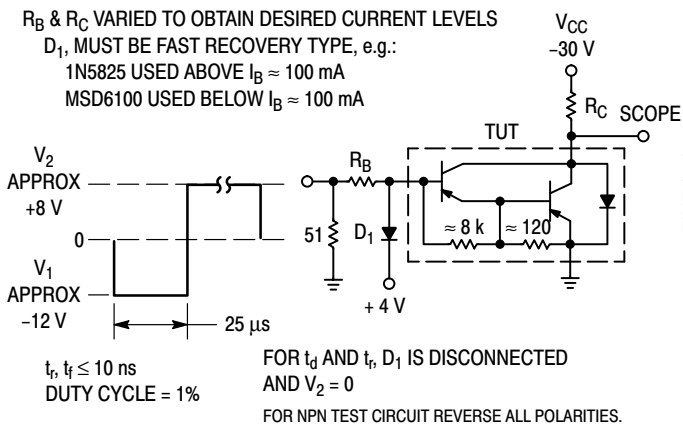


Figure 1. Switching Times Test Circuit

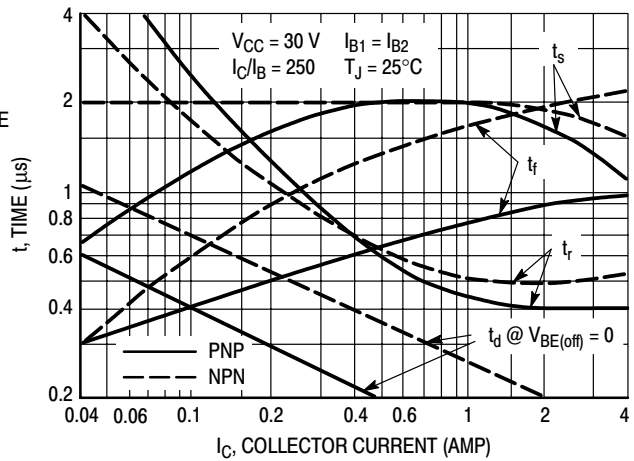


Figure 2. Switching Times

TYPICAL ELECTRICAL CHARACTERISTICS

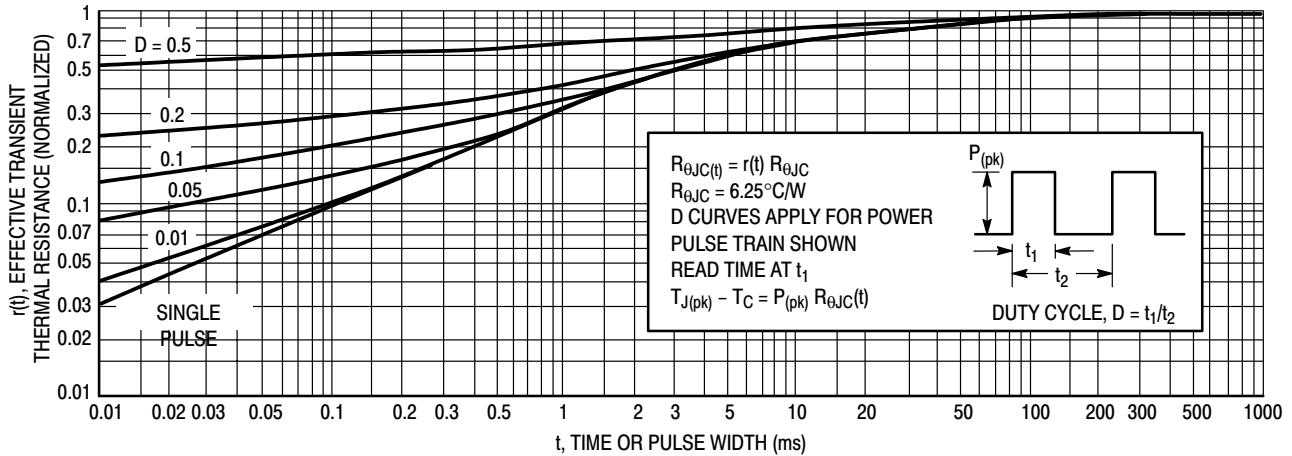


Figure 3. Thermal Response

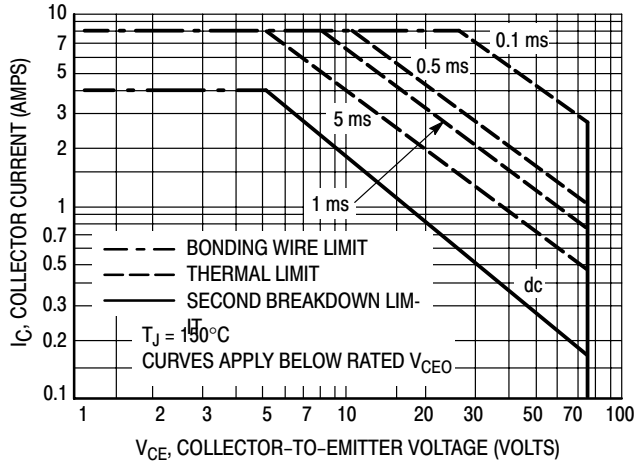


Figure 4. Maximum Rated Forward Biased Safe Operating Area

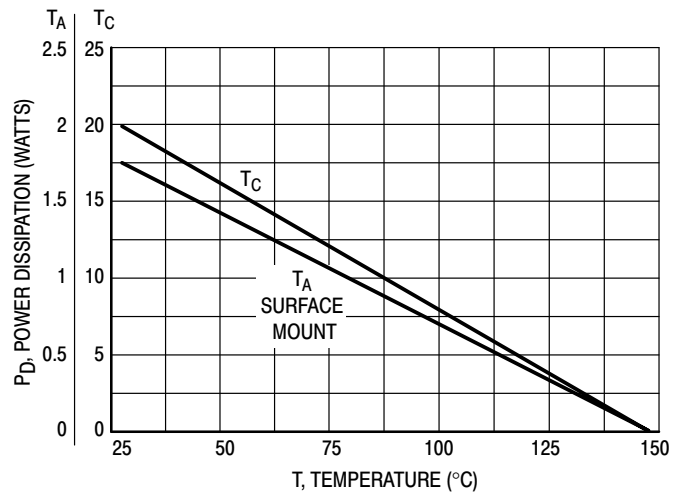


Figure 5. Power Derating

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.

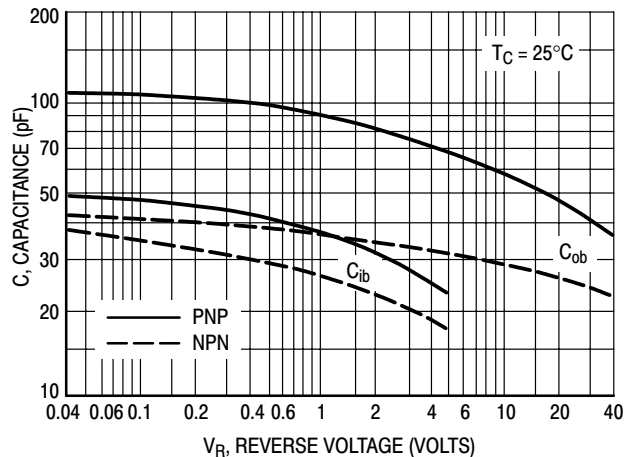


Figure 6. Capacitance

TYPICAL ELECTRICAL CHARACTERISTICS

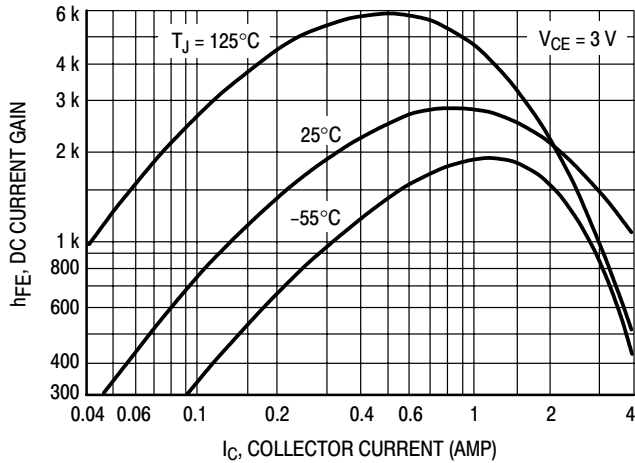


Figure 7. DC Current Gain

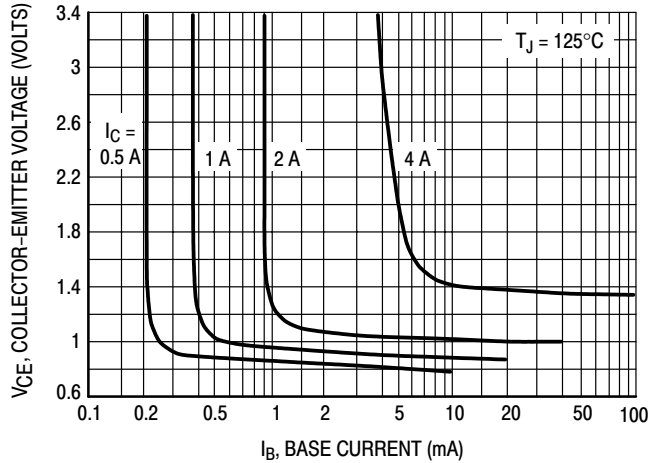


Figure 8. Collector Saturation Region

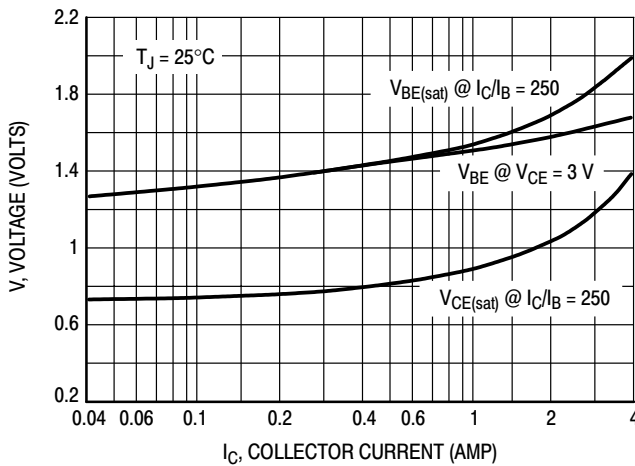


Figure 9. "On" Voltages

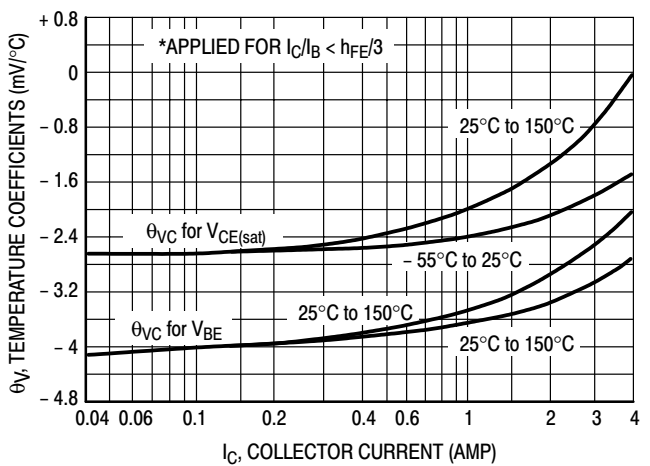


Figure 10. Temperature Coefficients

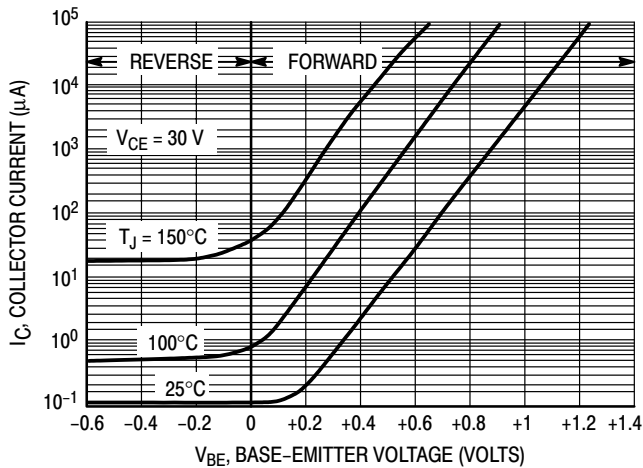


Figure 11. Collector Cut-Off Region

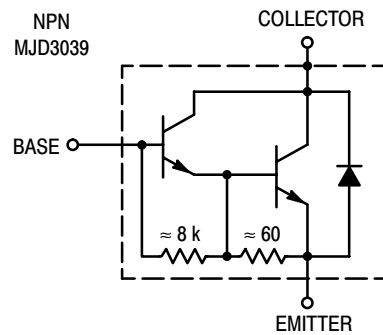
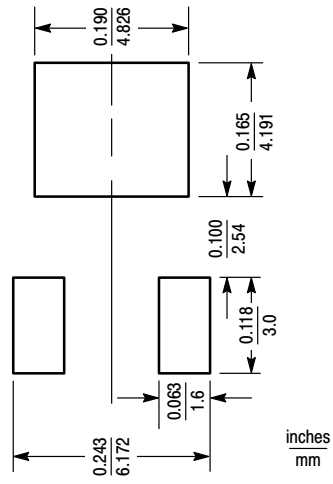


Figure 12. Darlington Schematic

# MJD6039

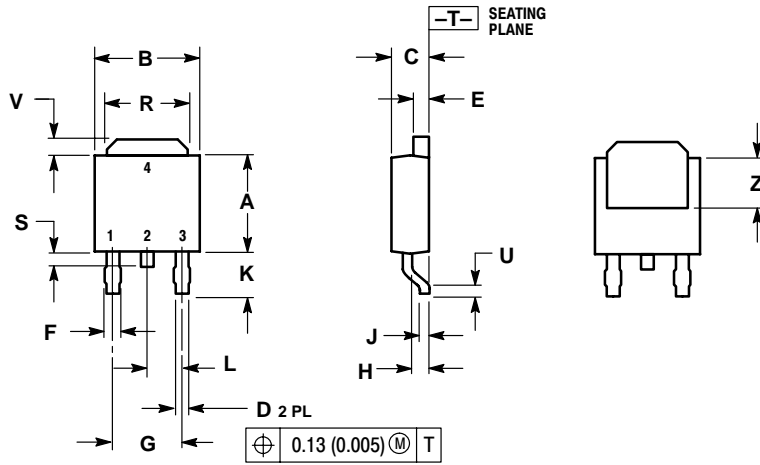
## MINIMUM PAD SIZES RECOMMENDED FOR SURFACE MOUNTED APPLICATIONS



# MJD6039

## PACKAGE DIMENSIONS

DPAK  
CASE 369A-13  
ISSUE AB



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

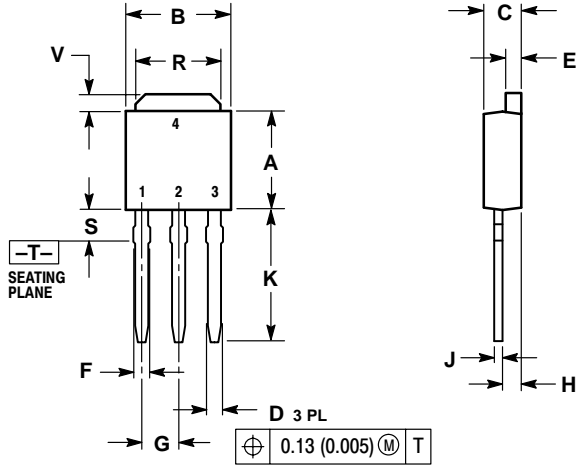
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.250	5.97	6.35
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.033	0.040	0.84	1.01
F	0.037	0.047	0.94	1.19
G	0.180 BSC		4.58 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.102	0.114	2.60	2.89
L	0.090 BSC		2.29 BSC	
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:
1. BASE
  2. COLLECTOR
  3. EMITTER
  4. COLLECTOR

# MJD6039

## PACKAGE DIMENSIONS

### DPAK STRAIGHT LEADS CASE 369-07 ISSUE M



- 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
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E	0.033	0.040	0.84	1.01
F	0.037	0.047	0.94	1.19
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

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