

Complementary Power Transistors

DPAK For Surface Mount Applications

Designed for general purpose amplifier and low speed switching applications.

- 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" 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	3 5	Adc
Base Current	I_B	1	Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	15 0.12	Watts W/ $^\circ\text{C}$
Total Power Dissipation* @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	1.56 0.012	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	$R_{\theta JC}$	8.3	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient*	$R_{\theta JA}$	80	$^\circ\text{C/W}$
Lead Temperature for Soldering Purposes	T_L	260	$^\circ\text{C}$

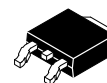
* These ratings are applicable when surface mounted on the minimum pad size recommended.

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

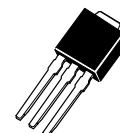
NPN
MJD31C
PNP
MJD32C

Motorola Preferred Devices

SILICON
POWER TRANSISTORS
3 AMPERES
100 VOLTS
15 WATTS

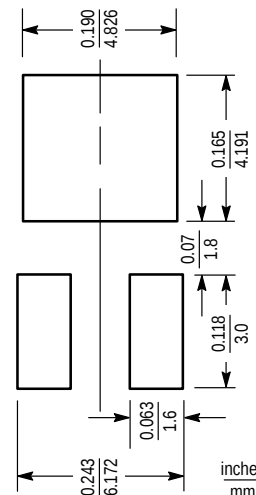


CASE 369A-13



CASE 369-07

MINIMUM PAD SIZES RECOMMENDED FOR SURFACE MOUNTED APPLICATIONS



MJD31C MJD32C**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 (1) ($I_C = 30\text{ mAdc}$, $I_B = 0$)	$V_{CEO(sus)}$	100	—	Vdc
Collector Cutoff Current ($V_{CE} = 60\text{ Vdc}$, $I_B = 0$)	I_{CEO}	—	50	μAdc
Collector Cutoff Current ($V_{CE} = \text{Rated } V_{CEO}$, $V_{EB} = 0$)	I_{CES}	—	20	μAdc
Emitter Cutoff Current ($V_{BE} = 5\text{ Vdc}$, $I_C = 0$)	I_{EBO}	—	1	mAdc

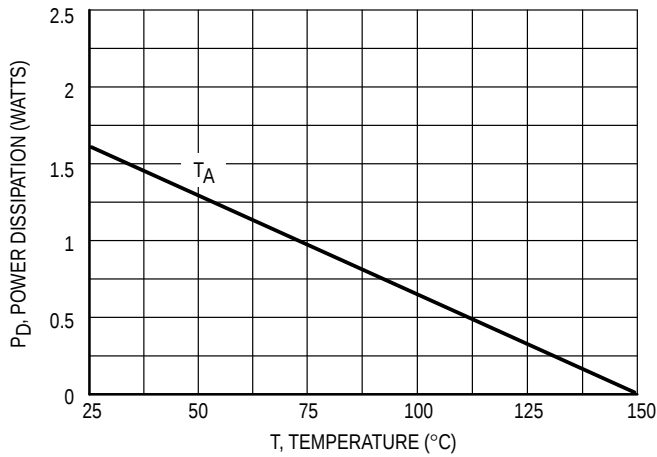
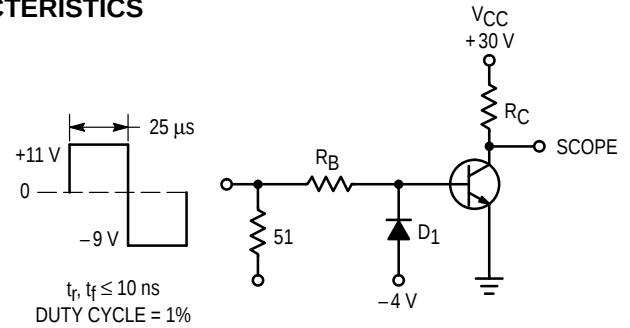
ON CHARACTERISTICS (1)

DC Current Gain ($I_C = 1\text{ Adc}$, $V_{CE} = 4\text{ Vdc}$) ($I_C = 3\text{ Adc}$, $V_{CE} = 4\text{ Vdc}$)	h_{FE}	25 10	— 50	—
Collector–Emitter Saturation Voltage ($I_C = 3\text{ Adc}$, $I_B = 375\text{ mAdc}$)	$V_{CE(sat)}$	—	1.2	Vdc
Base–Emitter On Voltage ($I_C = 3\text{ Adc}$, $V_{CE} = 4\text{ Vdc}$)	$V_{BE(on)}$	—	1.8	Vdc

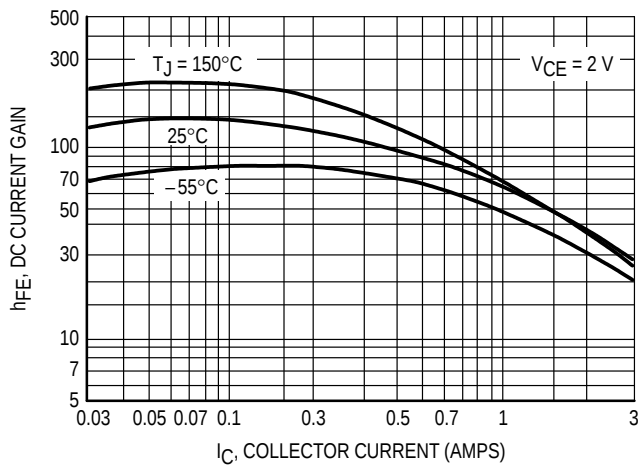
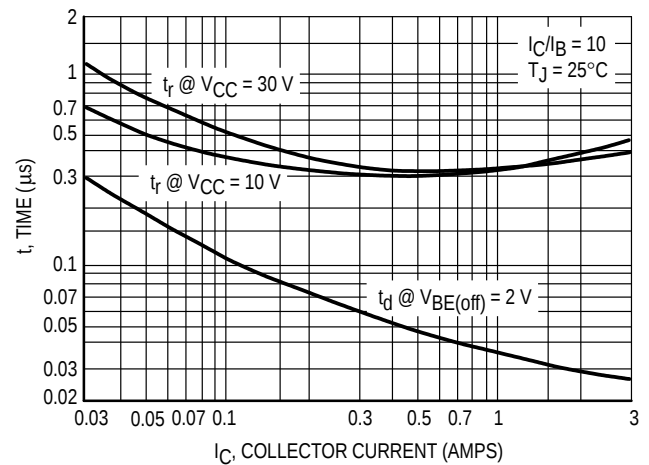
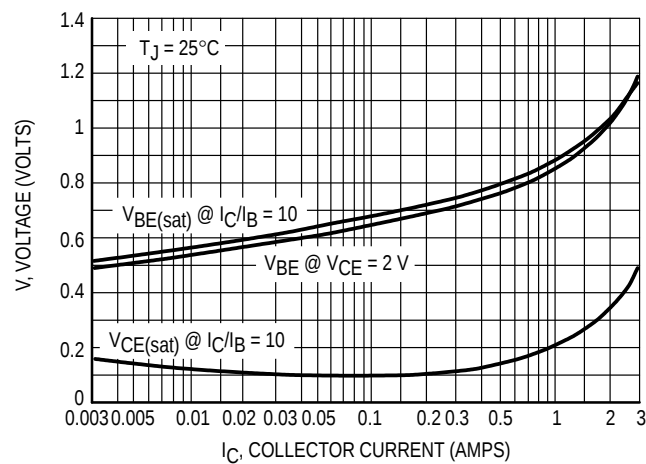
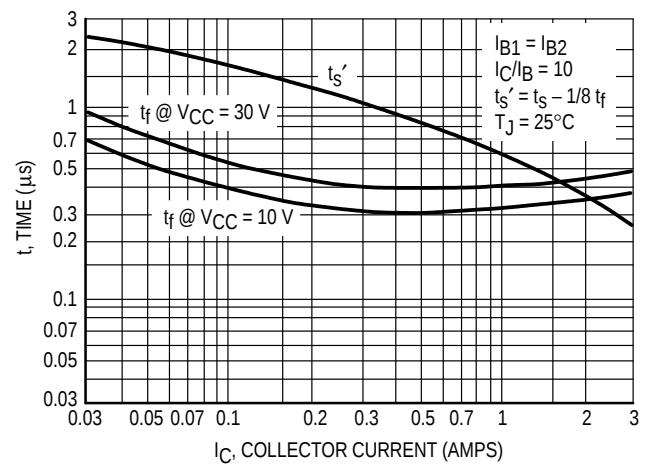
DYNAMIC CHARACTERISTICS

Current Gain — Bandwidth Product (2) ($I_C = 500\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f_{test} = 1\text{ MHz}$)	f_T	3	—	MHz
Small–Signal Current Gain ($I_C = 0.5\text{ Adc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1\text{ kHz}$)	h_{fe}	20	—	—

(1) Pulse Test: Pulse Width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2\%$.(2) $f_T = |h_{fe}| \cdot f_{test}$.

TYPICAL CHARACTERISTICS

Figure 1. Power Derating


R_B and R_C VARIED TO OBTAIN DESIRED CURRENT LEVELS
 D_1 MUST BE FAST RECOVERY TYPE, e.g.:
 1N5825 USED ABOVE $I_B \approx 100\text{ mA}$
 MSD6100 USED BELOW $I_B \approx 100\text{ mA}$
 REVERSE ALL POLARITIES FOR PNP.

Figure 2. Switching Time Test Circuit

Figure 3. DC Current Gain

Figure 4. Turn-On Time

Figure 5. "On" Voltages

Figure 6. Turn-Off Time

MJD31C MJD32C

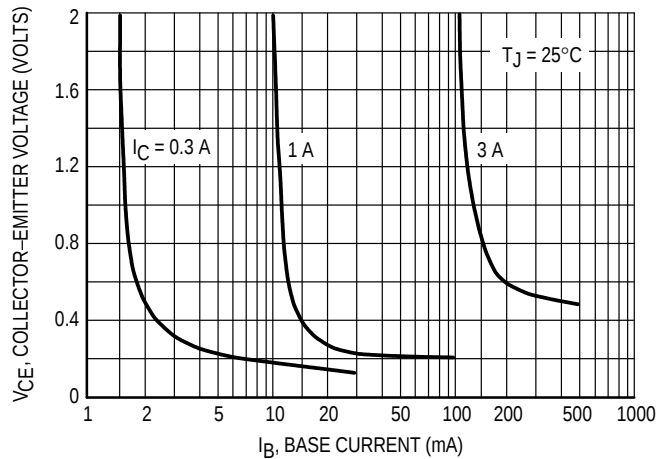


Figure 7. Collector Saturation Region

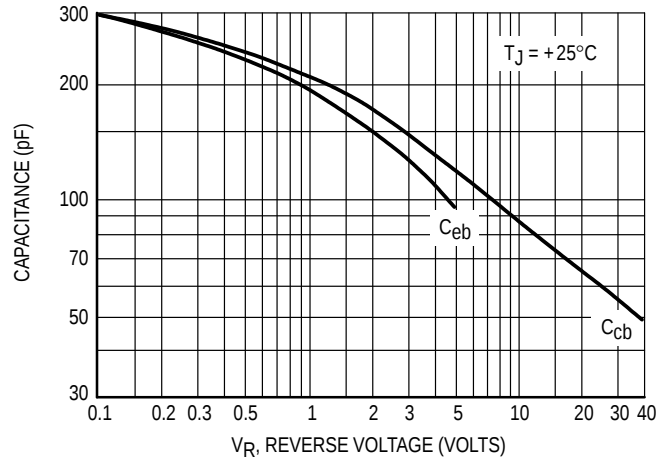


Figure 8. Capacitance

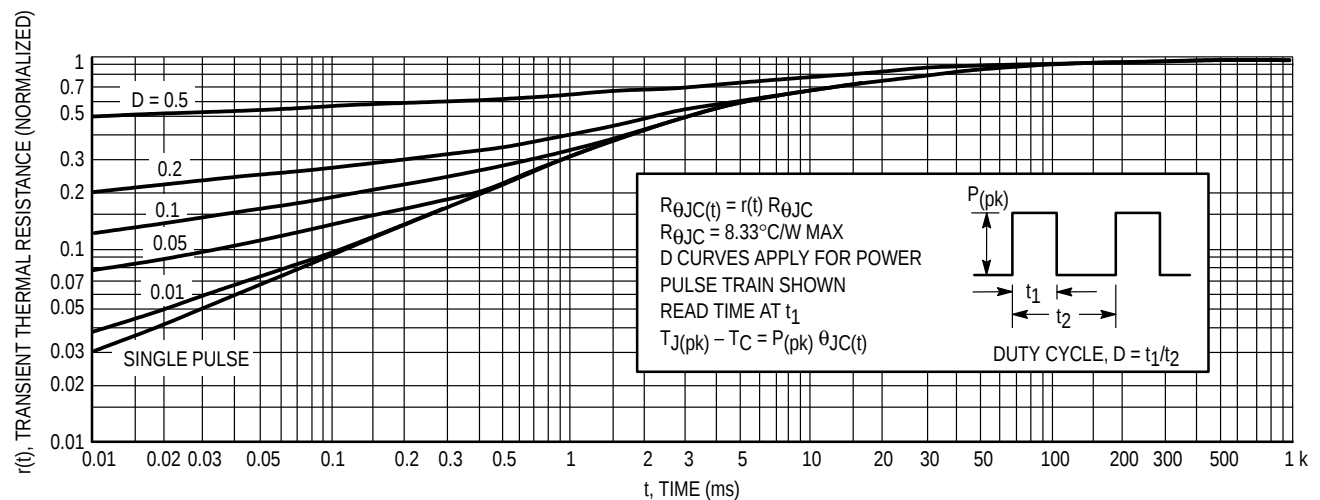


Figure 9. Thermal Response

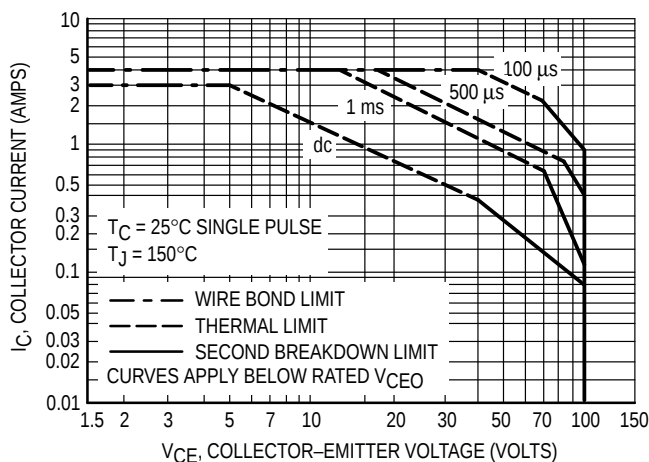
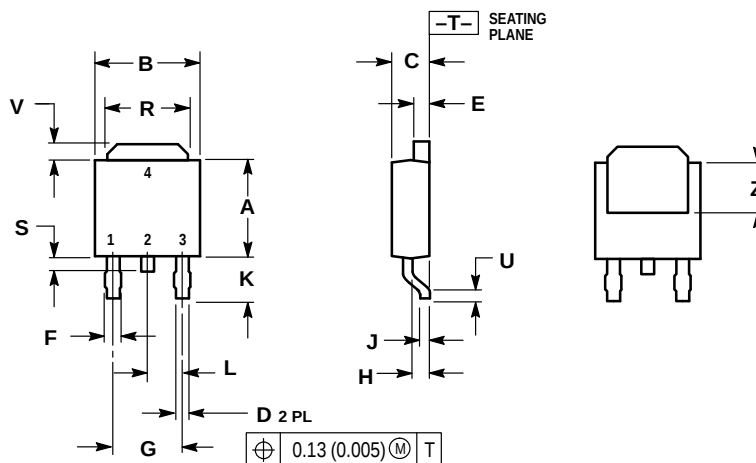


Figure 10. Active Region Safe Operating Area

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 Figure 10 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 $T_{J(pk)} \leq 150^\circ\text{C}$. $T_{J(pk)}$ may be calculated from the data in Figure 9. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

PACKAGE DIMENSIONS



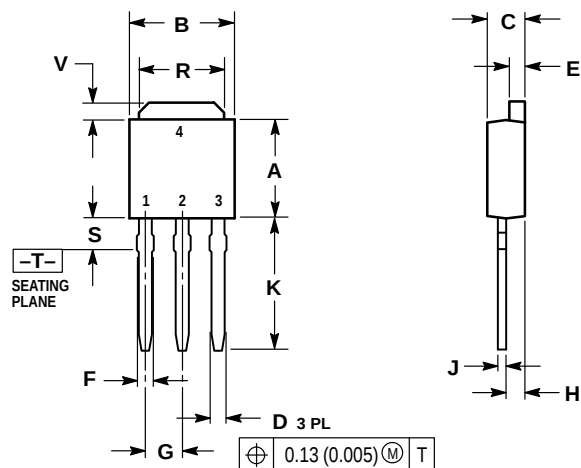
NOTES:

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 Z

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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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