Complementary Power Transistors

DPAK For Surface Mount Applications

NPN
MJD31,C*
PNP
MJD32,C*

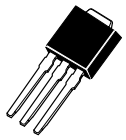
*Motorola Preferred Device

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

SILICON
POWER TRANSISTORS
3 AMPERES
40 AND 100 VOLTS
15 WATTS

CASE 369A–13



CASE 369–07

MAXIMUM RATINGS

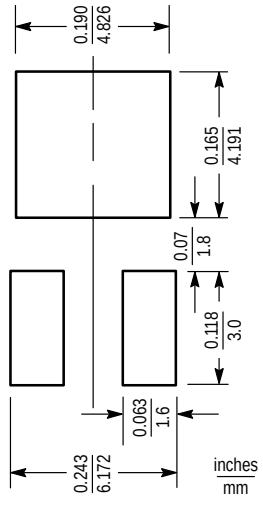
Rating	Symbol	MJD31 MJD32	MJD31C MJD32C	Unit
Collector–Emitter Voltage	V_{CEO}	40	100	Vdc
Collector–Base Voltage	V_{CB}	40	100	Vdc
Emitter–Base Voltage	V_{EB}	5		Vdc
Collector Current — Continuous Peak	I_C	3 5		Adc
Base Current	I_B	1		Adc
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	15 0.12		Watts W/°C
Total Power Dissipation* @ T_A = 25°C Derate above 25°C	P_D	1.56 0.012		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	$R_{\theta JC}$	8.3	°C/W
Thermal Resistance, Junction to Ambient*	$R_{\theta JA}$	80	°C/W
Lead Temperature for Soldering Purposes	T_L	260	°C

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

MINIMUM PAD SIZES RECOMMENDED FOR SURFACE MOUNTED APPLICATIONS



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

REV 1

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)	 MJD31, MJD32 MJD31C, MJD32C	$V_{CEO(sus)}$	 40 100	 — —	Vdc
Collector Cutoff Current (V_{CE} = 40 Vdc, I_B = 0) (V_{CE} = 60 Vdc, I_B = 0)	 MJD31, MJD32 MJD31C, MJD32C	I_{CEO}	—	50	μAdc
Collector Cutoff Current (V_{CE} = Rated V_{CEO}, V_{EB} = 0)		ICES	—	20	μAdc
Emitter Cutoff Current (V_{BE} = 5 Vdc, I_C = 0)		I_{EBO}	—	1	mAdc
ON CHARACTERISTICS (1)					
DC Current Gain (I_C = 1 Adc, V_{CE} = 4 Vdc) (I_C = 3 Adc, V_{CE} = 4 Vdc)		h_{FE}	 25 10	 — 50	—
Collector–Emitter Saturation Voltage (I_C = 3 Adc, I_B = 375 mAdc)		$V_{CE(sat)}$	—	1.2	Vdc
Base–Emitter On Voltage (I_C = 3 Adc, V_{CE} = 4 Vdc)		$V_{BE(on)}$	—	1.8	Vdc
DYNAMIC CHARACTERISTICS					
Current Gain — Bandwidth Product (2) (I_C = 500 mAdc, V_{CE} = 10 Vdc, f_{test} = 1 MHz)		f_T	3	—	MHz
Small–Signal Current Gain (I_C = 0.5 Adc, V_{CE} = 10 Vdc, f = 1 kHz)		h_{fe}	20	—	—

(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
(2) $f_T = |h_{fe}| \bullet f_{test}$.

TYPICAL CHARACTERISTICS

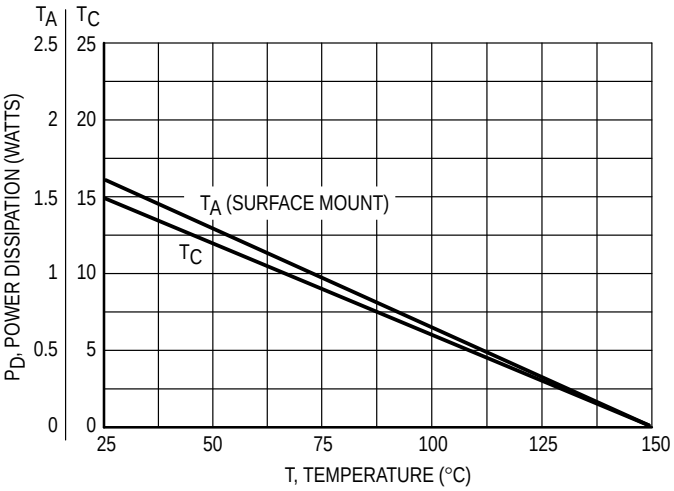
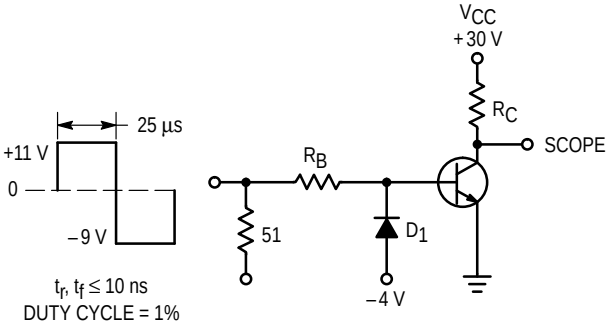


Figure 1. Power Derating



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

Figure 2. Switching Time Test Circuit

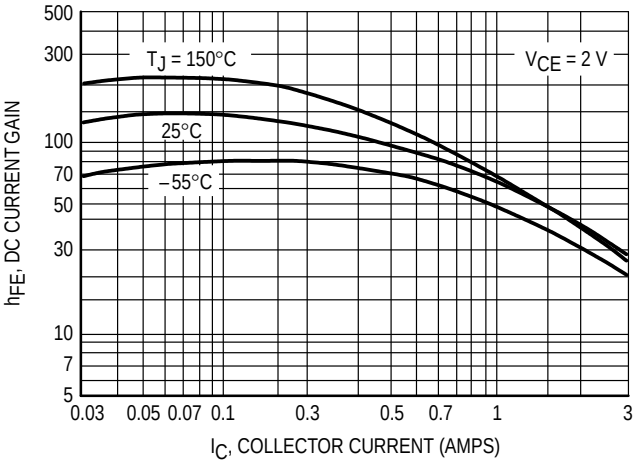


Figure 3. DC Current Gain

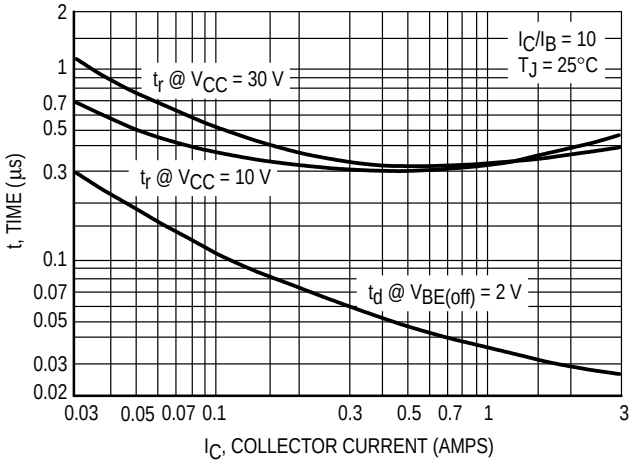


Figure 4. Turn–On Time

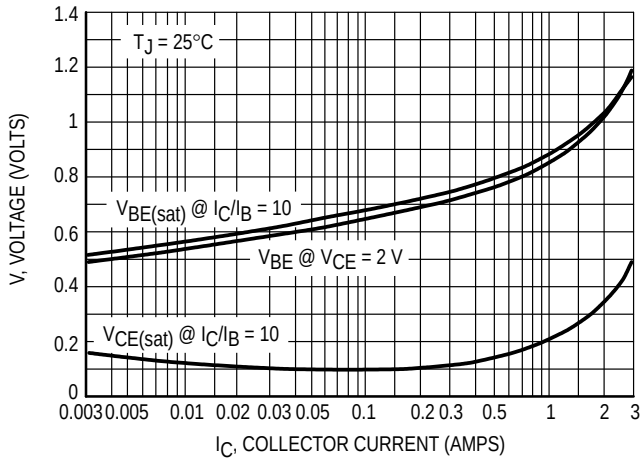


Figure 5. “On” Voltages

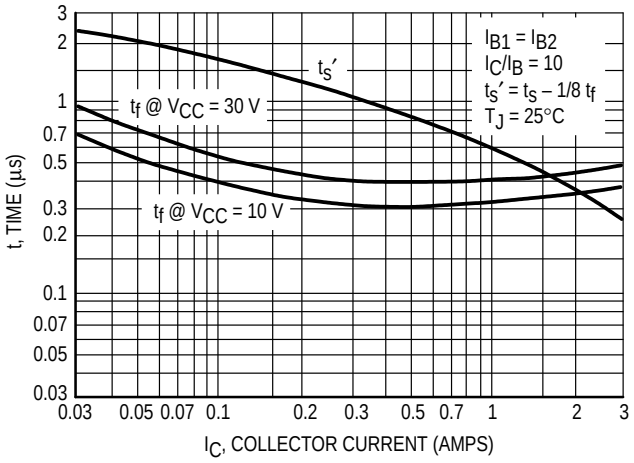


Figure 6. Turn–Off Time

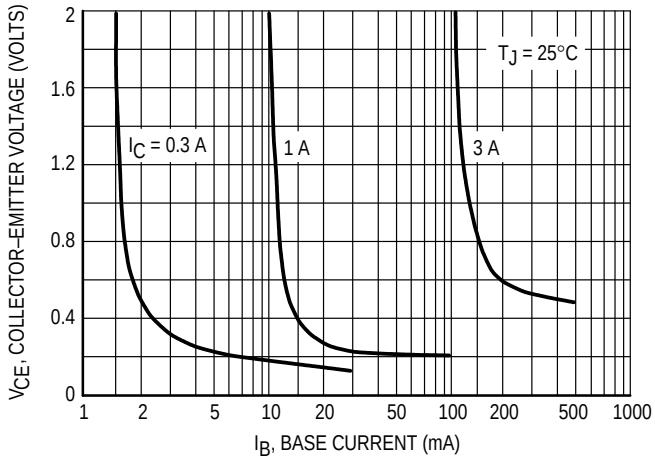


Figure 7. Collector Saturation Region

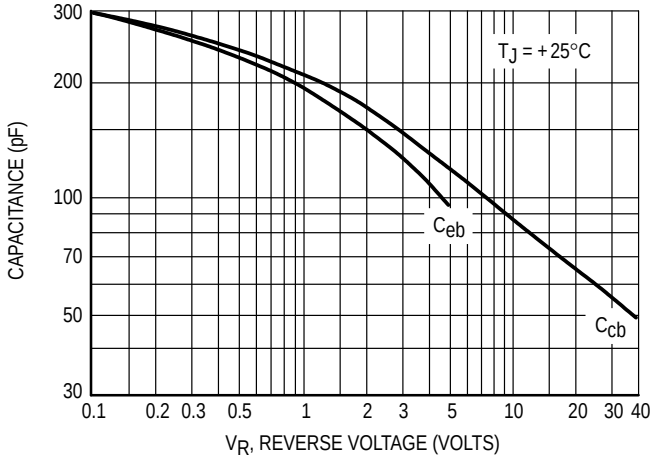


Figure 8. Capacitance

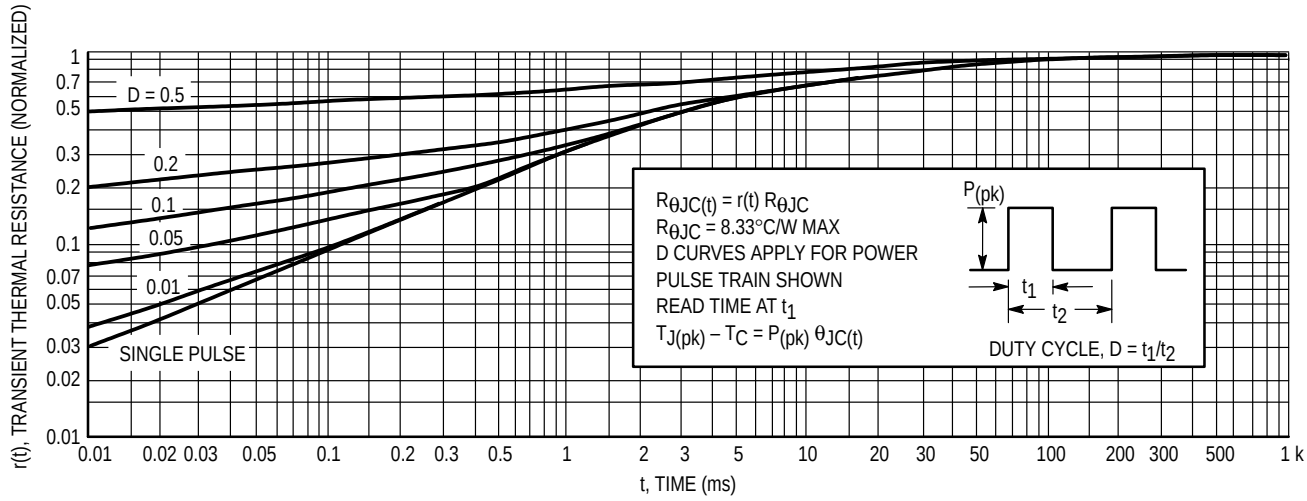


Figure 9. Thermal Response

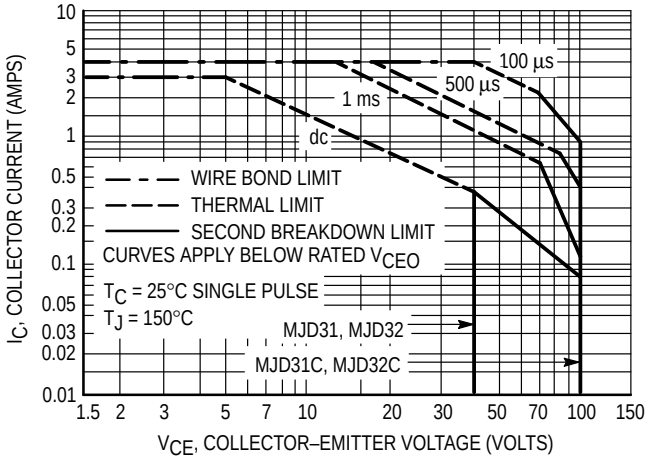
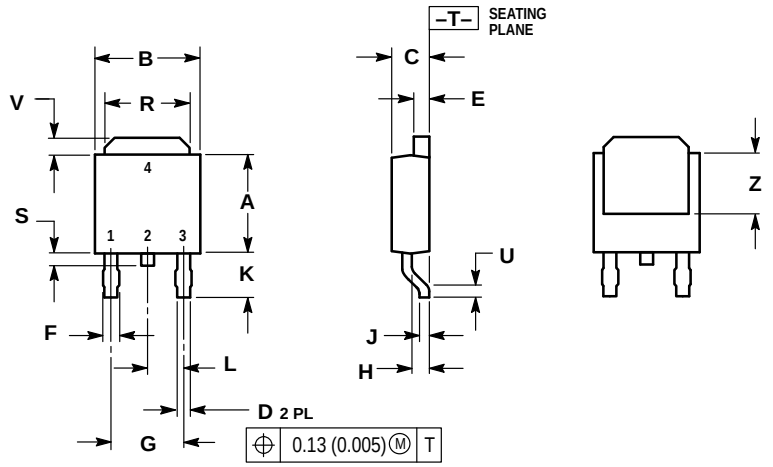


Figure 10. Active Region Safe Operating Area

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°C; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 150°C$. $T_{J(pk)}$ 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

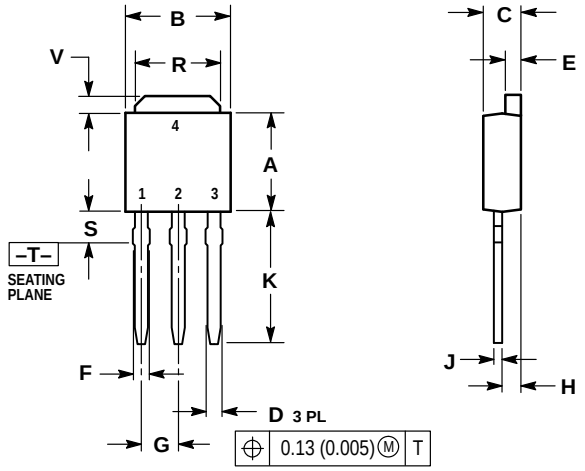


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	INCHES		MILLIMETERS	
DIM	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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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

CASE 369–07
ISSUE K

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