MJF47

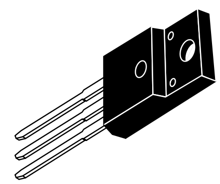
High Voltage Power Transistor

Isolated Package Applications

Designed for line operated audio output amplifiers, switching power supply drivers and other switching applications, where the mounting surface of the device is required to be electrically isolated from the heatsink or chassis.

- Electrically Similar to the Popular TIP47
- 250 $V_{CEO(sus)}$
- 1 A Rated Collector Current
- No Isolating Washers Required
- Reduced System Cost
- UL Recognized, File #E69369, to 3500 V_{RMS} Isolation

NPN SILICON
POWER TRANSISTOR
1 AMPERE
250 VOLTS
28 WATTS



CASE 221D–02
TO–220 TYPE

MAXIMUM RATINGS

Rating		Symbol	Value	Unit
Collector–Emitter Voltage		V_{CEO}	250	Vdc
Collector–Base Voltage		V_{CB}	350	Vdc
Emitter–Base Voltage		V_{EB}	5	Vdc
RMS Isolation Voltage (1) (for 1 sec, R.H. < 30%, T_A = 25°C)	Test No. 1 Per Fig. 10 Test No. 2 Per Fig. 11 Test No. 3 Per Fig. 12	V_{ISOL}	4500 3500 1500	V_{RMS}
Collector Current — Continuous Peak		I_C	1 2	Adc
Base Current		I_B	0.6	Adc
Total Power Dissipation* @ T_C = 25°C Derate above 25°C		P_D	28 0.23	Watts W/°C
Total Power Dissipation @ T_A = 25°C Derate above 25°C		P_D	2 0.016	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 Ambient	$R_{\theta JA}$	62.5	°C/W
Thermal Resistance, Junction to Case*	$R_{\theta JC}$	4.4	°C/W
Lead Temperature for Soldering Purpose	T_L	260	°C

* Measurement made with thermocouple contacting the bottom insulated mounting surface (in a location beneath the die), the device mounted on a heatsink with thermal grease and a mounting torque of ≥ 6 in. lbs.
(1) Proper strike and creepage distance must be provided.

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)	$V_{CEO(sus)}$	250	—	Vdc
Collector Cutoff Current (V_{CE} = 150 Vdc, I_B = 0)	I_{CEO}	—	0.2	mAdc
Collector Cutoff Current (V_{CE} = 350 Vdc, V_{BE} = 0)	I_{CES}	—	0.1	mAdc
Emitter Cutoff Current (V_{BE} = 5 Vdc, I_C = 0)	I_{EBO}	—	1	mAdc
ON CHARACTERISTICS (1)				
DC Current Gain	h_{FE}			—
(I_C = 0.3 Adc, V_{CE} = 10 Vdc)		30	150	
(I_C = 1 Adc, V_{CE} = 10 Vdc)		10	—	
Collector–Emitter Saturation Voltage (I_C = 1 Adc, I_B = 0.2 Adc)	$V_{CE(sat)}$	—	1	Vdc
Base–Emitter On Voltage (I_C = 1 Adc, V_{CE} = 10 Vdc)	$V_{BE(on)}$	—	1.5	Vdc
DYNAMIC CHARACTERISTICS				
Current Gain — Bandwidth Product (I_C = 0.2 Adc, V_{CE} 10 Vdc, f = 2 MHz)	f_T	10	—	MHz

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

TYPICAL CHARACTERISTICS

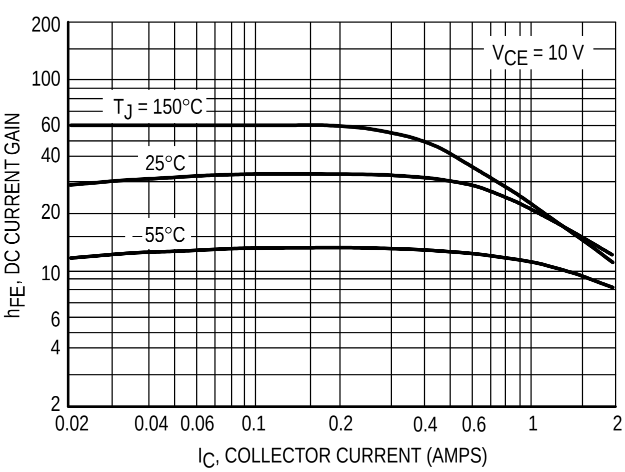


Figure 1. DC Current Gain

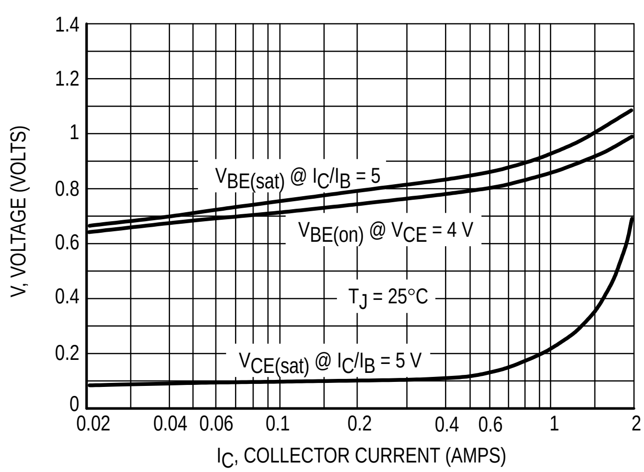


Figure 2. “On” Voltages

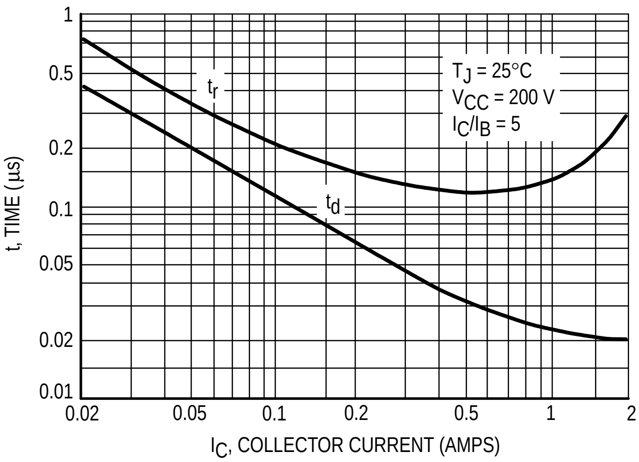


Figure 3. Turn–On Time

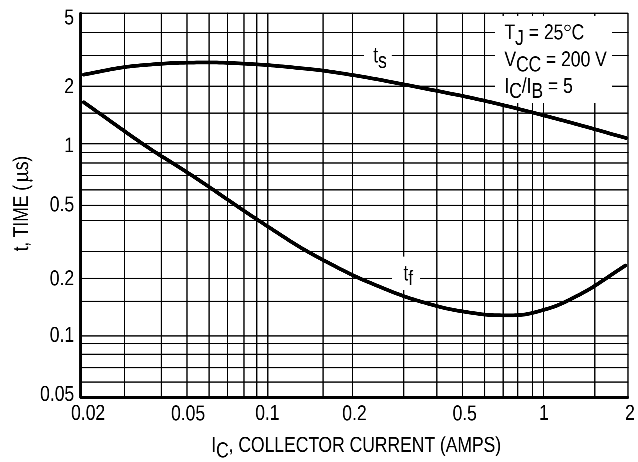


Figure 4. Turn–Off Time

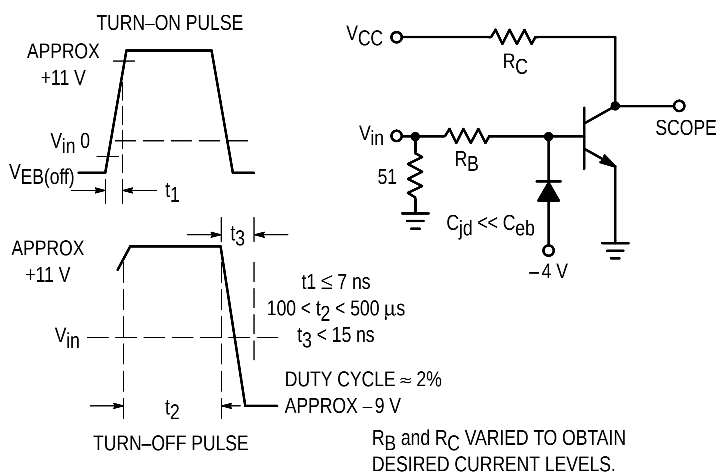


Figure 5. Switching Time Equivalent Circuit

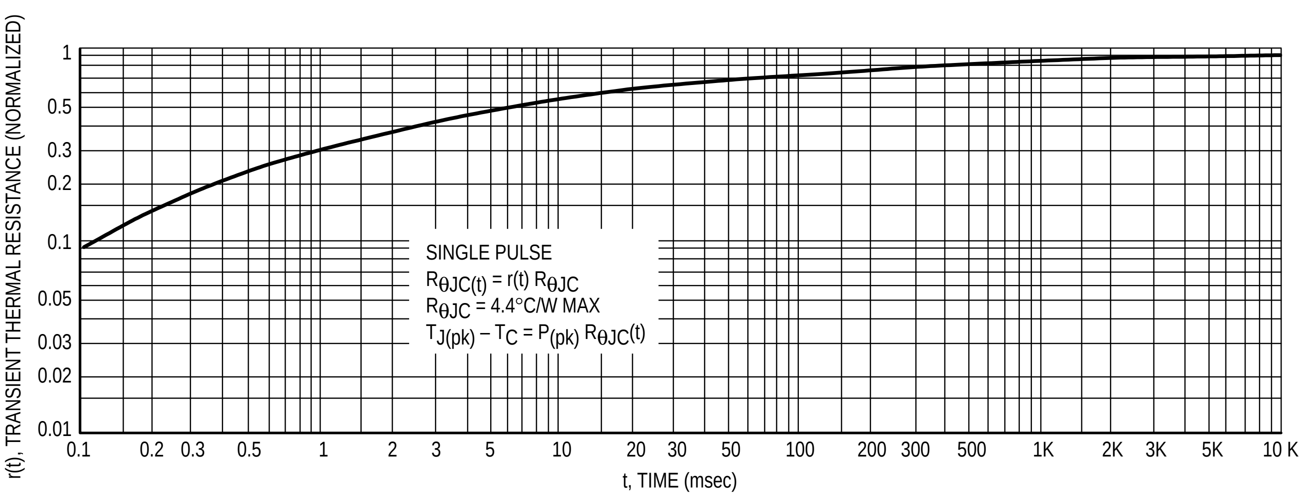


Figure 6. Thermal Response

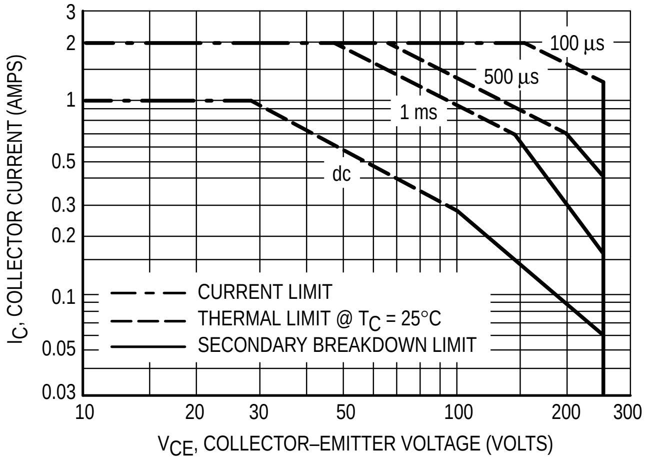


Figure 7. Maximum Forward Bias Safe Operating Area

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 7 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 $T_{J(pk)}$ ≤ 150°C. $T_{J(pk)}$ may be calculated from the data in Figure 6. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

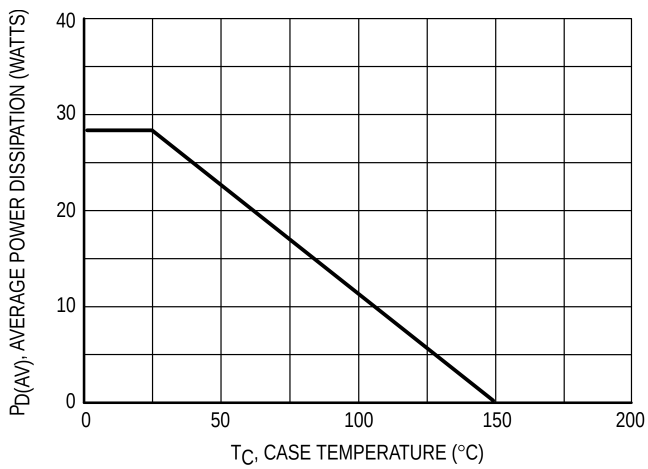


Figure 8. Power Derating

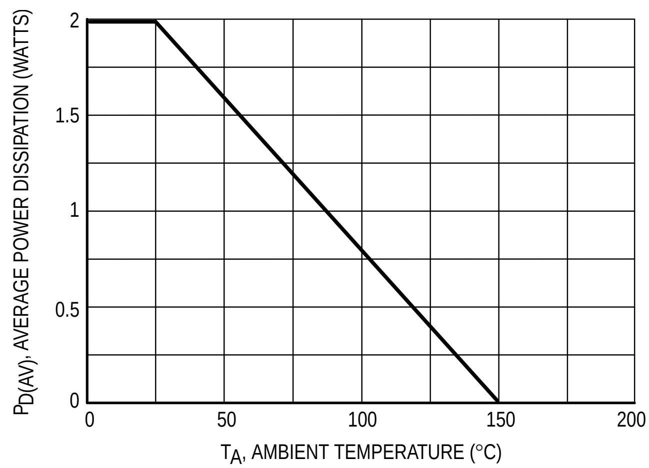


Figure 9. Power Derating

TEST CONDITIONS FOR ISOLATION TESTS*

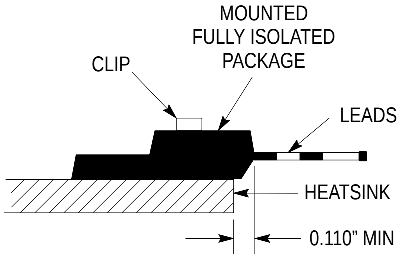


Figure 10. Clip Mounting Position for Isolation Test Number 1

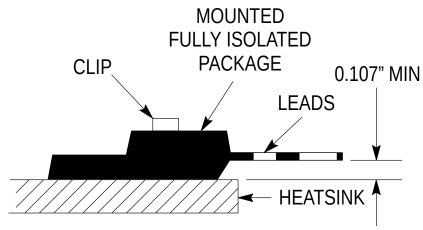


Figure 11. Clip Mounting Position for Isolation Test Number 2

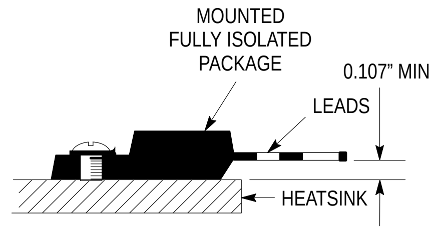


Figure 12. Screw Mounting Position for Isolation Test Number 3

* Measurement made between leads and heatsink with all leads shorted together

MOUNTING INFORMATION

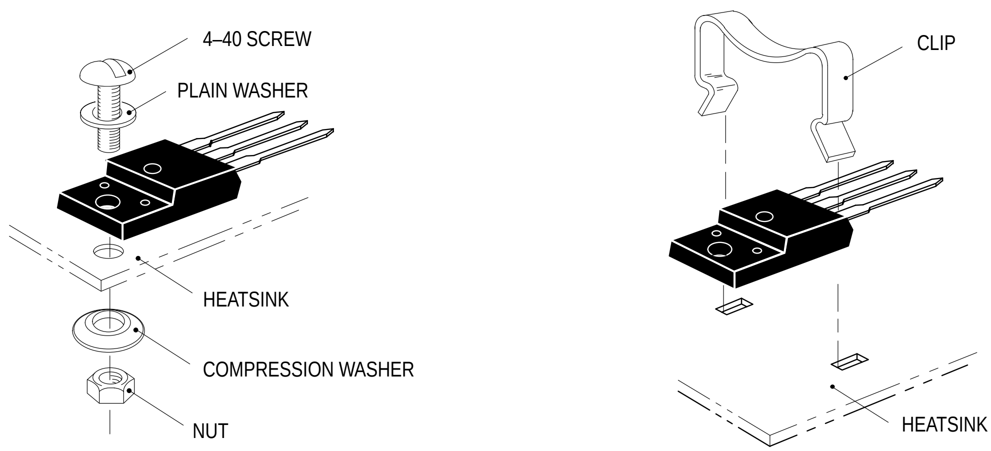


Figure 13. Typical Mounting Techniques*

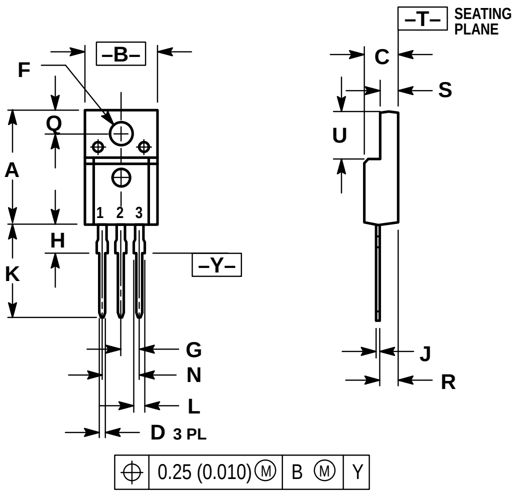
Laboratory tests on a limited number of samples indicate, when using the screw and compression washer mounting technique, a screw torque of 6 to 8 in · lbs is sufficient to provide maximum power dissipation capability. The compression washer helps to maintain a constant pressure on the package over time and during large temperature excursions.

Destructive laboratory tests show that using a hex head 4–40 screw, without washers, and applying a torque in excess of 20 in · lbs will cause the plastic to crack around the mounting hole, resulting in a loss of isolation capability.

Additional tests on slotted 4–40 screws indicate that the screw slot fails between 15 to 20 in · lbs without adversely affecting the package. However, in order to positively ensure the package integrity of the fully isolated device, Motorola does not recommend exceeding 10 in · lbs of mounting torque under any mounting conditions.

** For more information about mounting power semiconductors see Application Note AN1040.

PACKAGE DIMENSIONS



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

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.621	0.629	15.78	15.97
B	0.394	0.402	10.01	10.21
C	0.181	0.189	4.60	4.80
D	0.026	0.034	0.67	0.86
F	0.121	0.129	3.08	3.27
G	0.100 BSC		2.54 BSC	
H	0.123	0.129	3.13	3.27
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.14	1.52
N	0.200 BSC		5.08 BSC	
Q	0.126	0.134	3.21	3.40
R	0.107	0.111	2.72	2.81
S	0.096	0.104	2.44	2.64
U	0.259	0.267	6.58	6.78

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

CASE 221D–02
TO–220 TYPE
ISSUE D

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