PD -90719B

International
IOR Rectifier

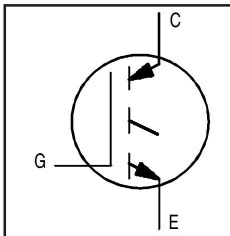
IRGMC50U

INSULATED GATE BIPOLAR TRANSISTOR

Ultra Fast Speed IGBT

Features

- Electrically Isolated and Hermetically Sealed
- Simple Drive Requirements
- Latch-proof
- Fast Speed operation > 10 kHz
- Switching-loss rating includes all "tail" losses



n-channel

$V_{CES} = 600V$

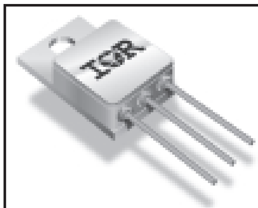
$V_{CE(on)\ max} = 3.0V$

$@V_{GE} = 15V, I_C = 20A$

Description

Insulated Gate Bipolar Transistors (IGBTs) from International Rectifier have higher usable current densities than comparable bipolar transistors, while at the same time having simpler gate-drive requirements of the familiar power MOSFET. They provide substantial benefits to a host of high-voltage, high-current applications.

The performance of various IGBTs varies greatly with frequency. Note that IR now provides the designer with a speed benchmark ($f_{Ic/2}$, or the "half-current frequency "), as well as an indication of the current handling capability of the device.


TO-254AA

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Breakdown Voltage	600	V
I_C @ T_C = 25°C	Continuous Collector Current	35*	A
I_C @ T_C = 100°C	Continuous Collector Current	20	
I_{CM}	Pulsed Collector Current ①	160	
I_{LM}	Clamped Inductive Load Current ②	160	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
P_D @ T_C = 25°C	Maximum Power Dissipation	150	W
P_D @ T_C = 100°C	Maximum Power Dissipation	60	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	Lead Temperature	300 (0.063in./1.6mm from case for 10s)	
	Weight	9.3 (typical)	g

*Current is limited by pin diameter

Thermal Resistance

	Parameter	Min	Typ	Max	Units	Test Conditions
R_{thJC}	Junction-to-Case	—	—	0.83	°C/W	
R_{thCS}	Case-to-Sink	—	0.12	—		
R_{thJA}	Junction-to-Ambient	—	—	48		

For footnotes refer to the last page

02/20/02

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions	
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	V_{GE} = 0V, I_C = 1.0 mA	
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ③	23	—	—	V	V_{GE} = 0V, I_C = 1.0 A	
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.6	—	V/°C	V_{GE} = 0V, I_C = 1.0 mA	
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	—	3.0	V	I_C = 20A	V_{GE} = 15V
		—	2.4	—		I_C = 35A	See Fig.5
		—	1.9	—		I_C = 20A , T_J = 125°C	
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	5.5		$V_{CE} = V_{GE}$, I_C = 250 µA	
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-13	—	mV/°C	$V_{CE} = V_{GE}$, I_C = 250 µA	
g_{fe}	Forward Transconductance ④	16	—	—	S	$V_{CE} \geq$ 15V, I_C = 20A	
I_{CES}	Zero Gate Voltage Collector Current	—	—	50	µA	V_{GE} = 0V, V_{CE} = 480V	
		—	—	5000		V_{GE} = 0V, V_{CE} = 480V, T_J = 125°C	
I_{GES}	Gate-to-Emitter Leakage Current	—	—	±500	nA	V_{GE} = ±20V	

Switching Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	115	140	nC	I_C = 20A
Q_{ge}	Gate - Emitter Charge (turn-on)	—	15	35		V_{CC} = 300V See Fig. 8
Q_{gc}	Gate - Collector Charge (turn-on)	—	35	70		V_{GE} = 15V
$t_{d(on)}$	Turn-On Delay Time	—	—	50	ns	I_C = 20A, V_{CC} = 480V
t_r	Rise Time	—	—	75		V_{GE} = 15V, R_G = 2.35Ω
$t_{d(off)}$	Turn-Off Delay Time	—	—	300		Energy losses include "tail"
t_f	Fall Time	—	—	210		See Fig. 9, 10 & 13
E_{on}	Turn-On Switching Loss	—	0.12	—	mJ	
E_{off}	Turn-off Switching Loss	—	1.6	—		
E_{ts}	Total Switching Loss	—	1.7	2.8		
$t_{d(on)}$	Turn-On Delay Time	—	24	—	ns	T_J = 125°C
t_r	Rise Time	—	27	—		I_C = 20A, V_{CC} = 480V
$t_{d(off)}$	Turn-Off Delay Time	—	180	—		V_{GE} = 15V, R_G = 2.35Ω
t_f	Fall Time	—	130	—		Energy losses include "tail"
E_{ts}	Total Switching Loss	—	2.7	—	mJ	See Fig. 11, 13
L_C+L_E	Total Inductance	—	6.8	—	nH	Measured from Collector lead (6mm/ 0.25in. from package) to Emitter lead (6mm / 0.25in. from package)
C_{ies}	Input Capacitance	—	2900	—	pF	V_{GE} = 0V
C_{oes}	Output Capacitance	—	330	—		V_{CC} = 30V See Fig. 7
C_{res}	Reverse Transfer Capacitance	—	41	—		f = 1.0MHz

Note: Corresponding Spice and Saber models are available on the Website.

For footnotes refer to the last page

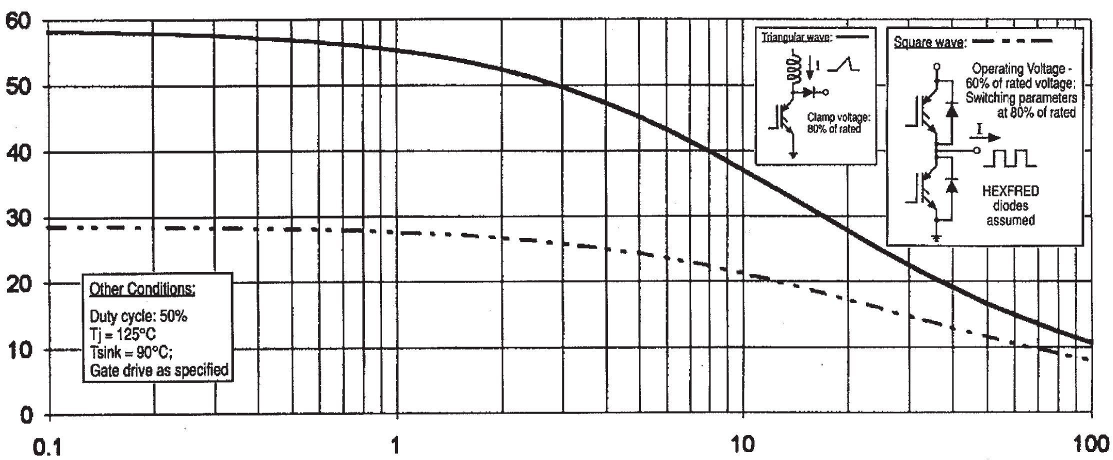


Fig. 1 - Typical Load Current vs. Frequency
(For square wave, $I=I_{RMS}$ of fundamental; for triangular wave, $I=I_{PK}$)

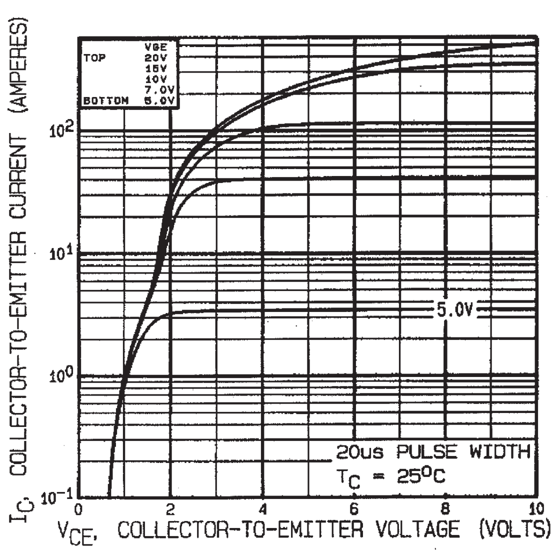


Fig. 2 - Typical Output Characteristics

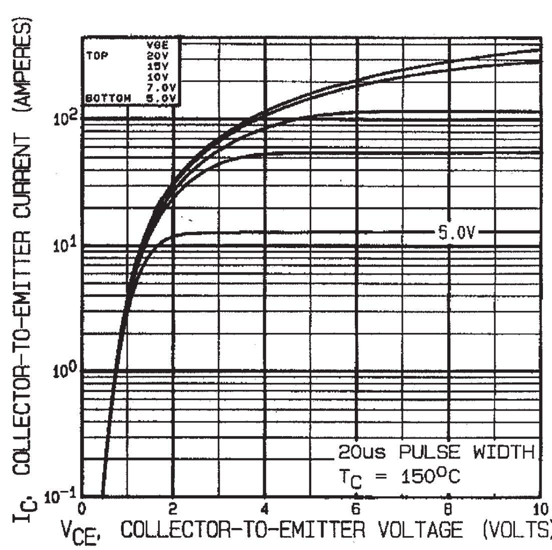


Fig. 3 - Typical Transfer Characteristics

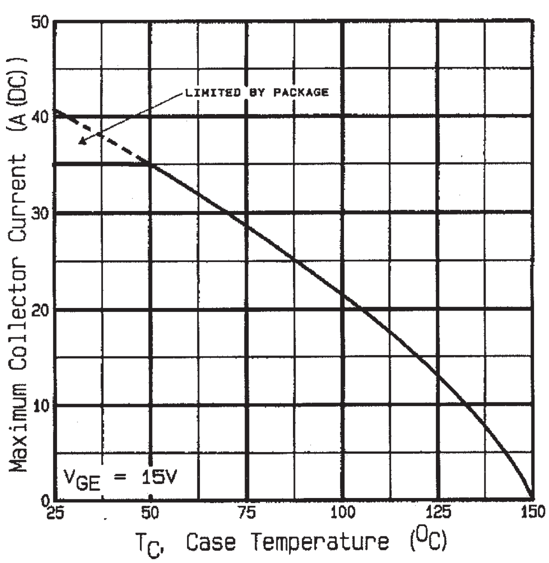


Fig. 4 - Maximum Collector Current vs. Case Temperature

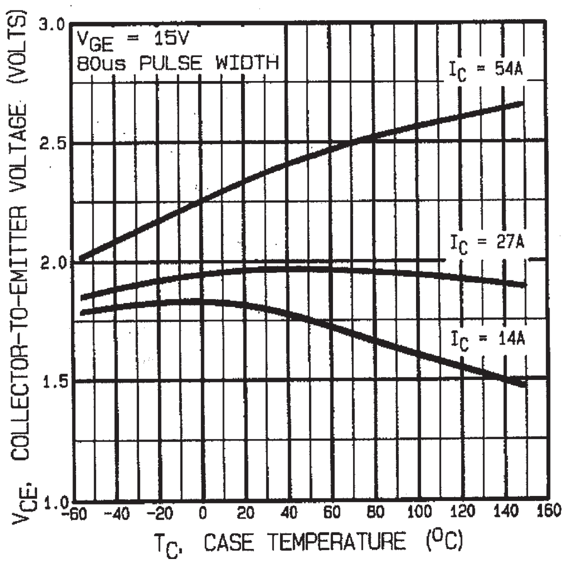


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

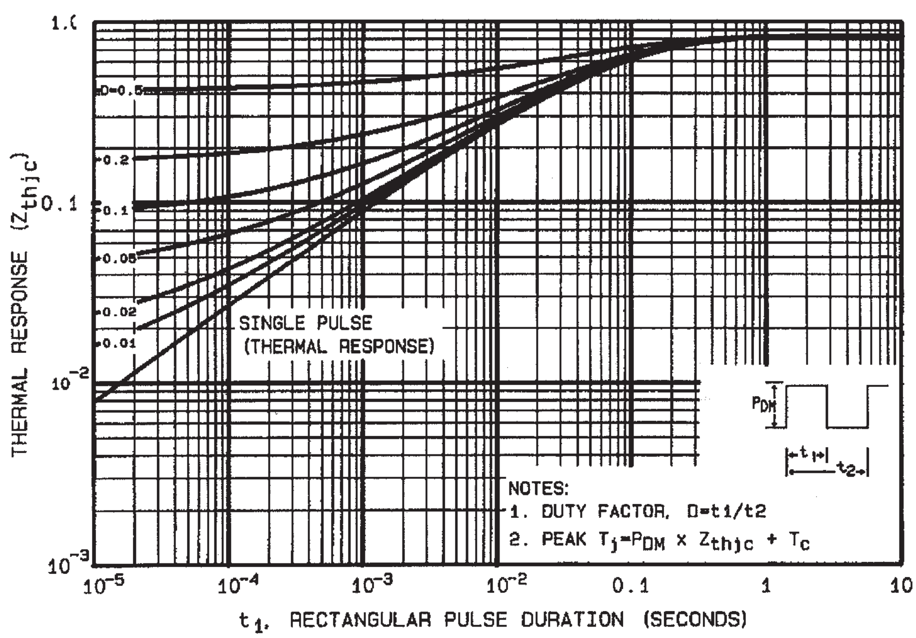


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

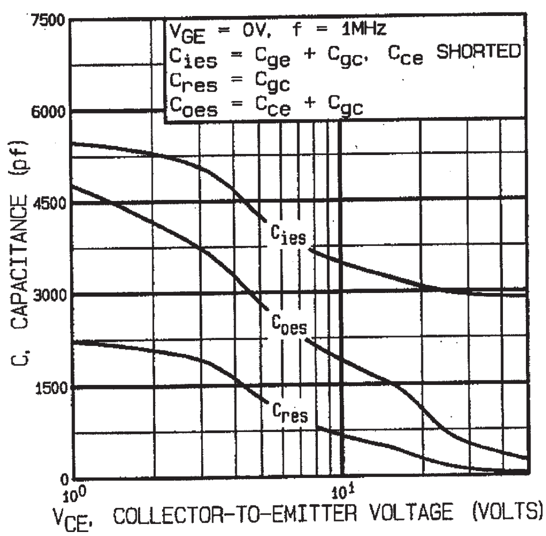


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

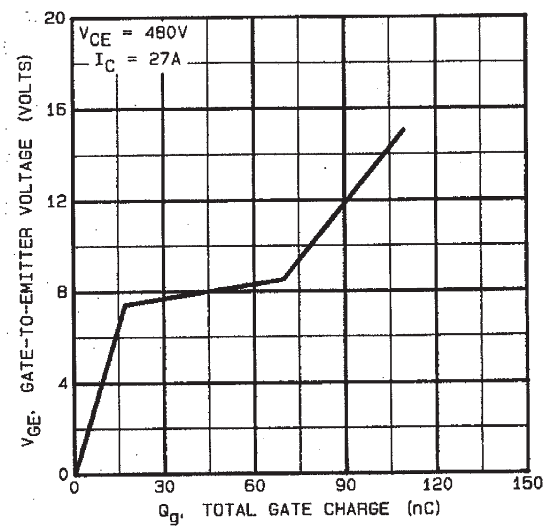


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

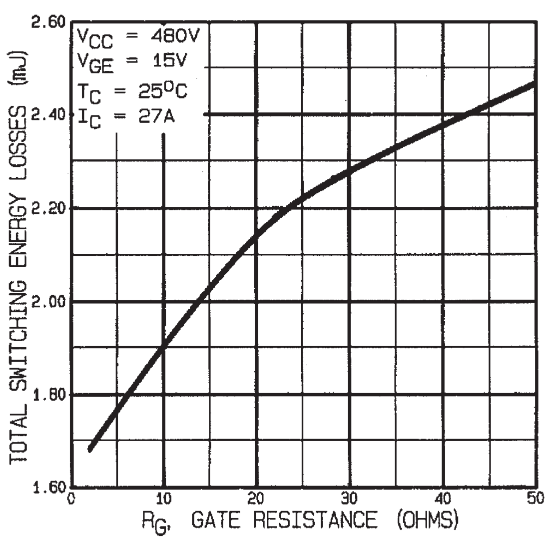


Fig. 9 - Typical Switching Losses vs. Gate Resistance

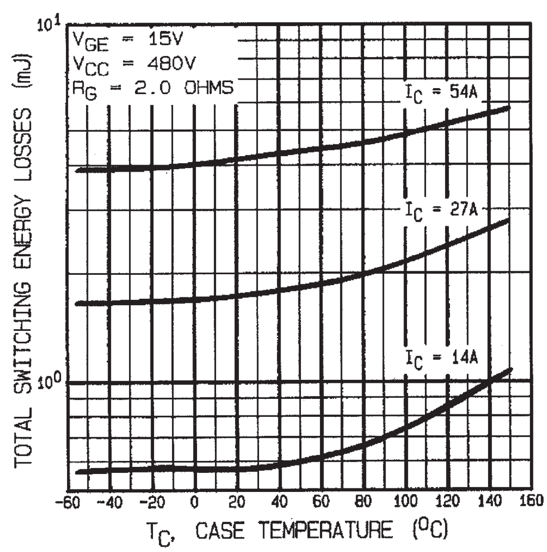


Fig. 10 - Typical Switching Losses vs. Junction Temperature

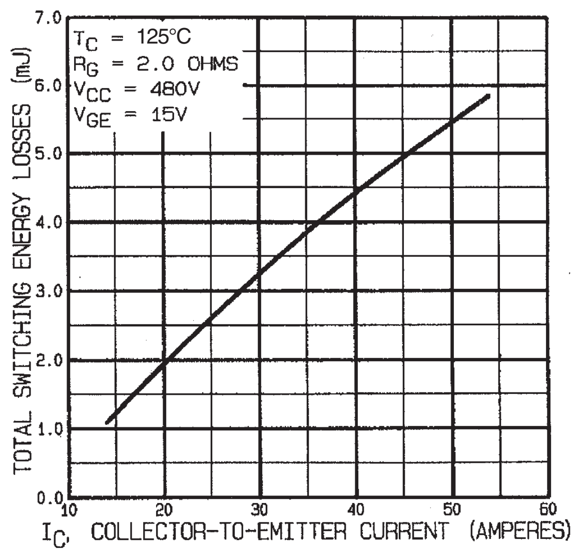
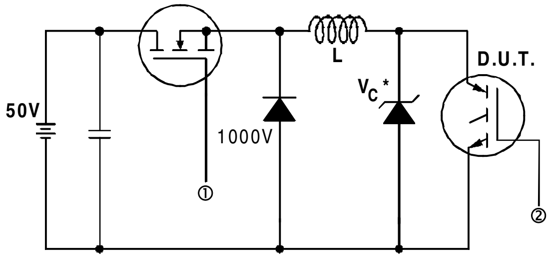


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current



* Driver same type as D.U.T.; Vc = 80% of Vce(max)
* Note: Due to the 50V power supply, pulse width and inductor will increase to obtain rated Id.

Fig. 12a - Clamped Inductive Load Test Circuit

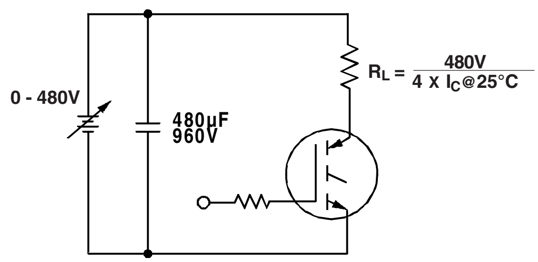


Fig. 12b - Pulsed Collector Current Test Circuit

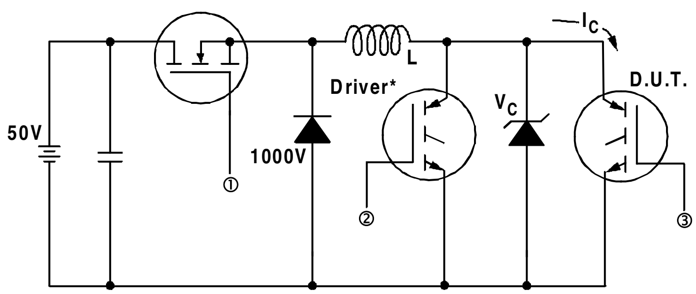


Fig. 13a - Switching Loss Test Circuit

* Driver same type as D.U.T., VC = 480V

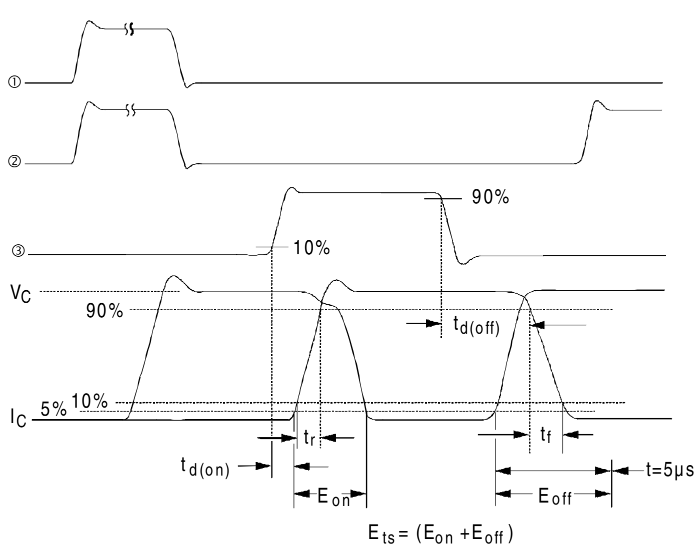


Fig. 13b - Switching Loss Waveforms

Notes:

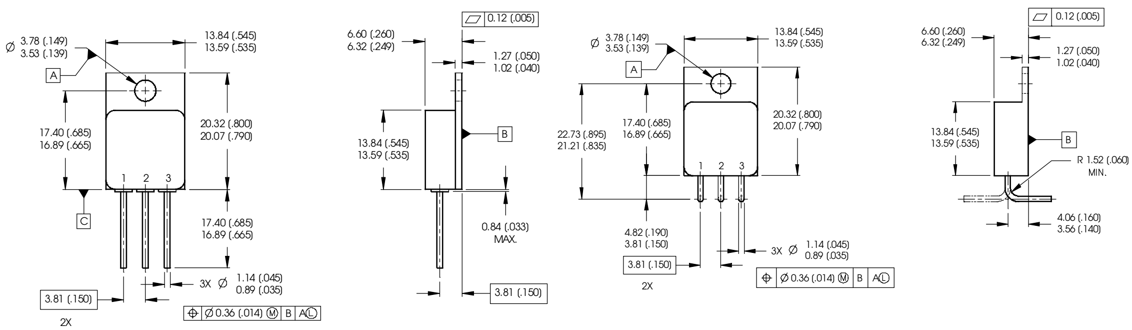
① Repetitive rating; V_{GE} = 20V, pulse width limited by max. junction temperature.

② V_{CC} = 80%(V_{CES}), V_{GE} = 20V, L = 10µH, R_G = 10Ω

③ Pulse width ≤ 80µs; duty factor ≤ 0.1%.

④ Pulse width 5.0µs, single shot.

Case Outline and Dimensions — TO-254AA



NOTES:
1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES).
3. CONTROLLING DIMENSION: INCH.
4. CONFORMS TO JEDEC OUTLINE TO-254AA.

LEGEND
1 = COLLECTOR
2 = EMITTER
3 = GATE

CAUTION
BERYLLIA WARNING PER MIL-PRF-19500

Packages containing beryllia shall not be ground, sandblasted, machined or have other operations performed on them which will produce beryllia or beryllium dust. Furthermore, beryllium oxide packages shall not be placed in acids that will produce fumes containing beryllium.

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