

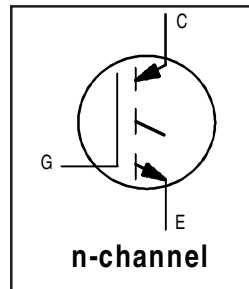
IRGIH50F

INSULATED GATE BIPOLAR TRANSISTOR

Fast Speed IGBT

Features

- Electrically Isolated and Hermetically Sealed
- Simple Drive Requirements
- Latch-proof
- Fast Speed operation 3 kHz - 8 kHz
- High operating frequency
- Switching-loss rating includes all "tail" losses



$V_{CES} = 1200V$
$V_{CE(on) \max} = 2.9V$
@ $V_{GE} = 15V, I_C = 25A$

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.



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Breakdown Voltage	1200	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	45	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	25	
I_{CM}	Pulsed Collector Current ①	180	
I_{LM}	Clamped Inductive Load Current ②	90	
V_{GE}	Gate-to-Emitter Voltage	± 20	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	200	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	80	
T_J	Operating Junction and Storage Temperature Range	-55 to + 150	°C
T_{STG}			
	Lead Temperature	300 (0.063in./1.6mm from case for 10s)	
	Weight	10.5 (typical)	g

Thermal Resistance

	Parameter	Min	Typ	Max	Units	Test Conditions
R_{thJC}	Junction-to-Case	—	—	0.625	°C/W	
R_{thCS}	Case-to-Sink	—	0.21	—		
R_{thJA}	Junction-to-Ambient	—	—	30		

For footnotes refer to the last page
www.irf.com

Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	1200	—	—	V	$V_{GE} = 0V, I_C = 100 \mu A$
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ③	22	—	—	V	$V_{GE} = 0V, I_C = 1.0 A$
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	1.1	—	$V/^\circ\text{C}$	$V_{GE} = 0V, I_C = 1.0 mA$
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	2.1	2.9	V	$I_C = 25A$ $V_{GE} = 15V$
		—	2.5	—		$I_C = 45A$ See Fig.2, 5
		—	2.4	—		$I_C = 25A, T_J = 125^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	5.5		$V_{CE} = V_{GE}, I_C = 250 \mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-14	—	$mV/^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 250 \mu A$
g_{fe}	Forward Transconductance ④	7.5	—	—	S	$V_{CE} = 100V, I_C = 25A$
I_{CES}	Zero Gate Voltage Collector Current	—	—	100	μA	$V_{GE} = 0V, V_{CE} = 960V$
		—	—	1200		$V_{GE} = 0V, V_{CE} = 960V, T_J = 125^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 100	nA	$V_{GE} = \pm 20V$

Switching Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	—	100	nC	$I_C = 25A$
Q_{ge}	Gate - Emitter Charge (turn-on)	—	—	21		$V_{CC} = 400V$ See Fig. 8 ⑤
Q_{gc}	Gate - Collector Charge (turn-on)	—	—	43		$V_{GE} = 15V$
$t_{d(on)}$	Turn-On Delay Time	—	—	68	ns	$I_C = 25A, V_{CC} = 400V$
t_r	Rise Time	—	—	26		$V_{GE} = 15V, R_G = 2.35\Omega$ ⑤
$t_{d(off)}$	Turn-Off Delay Time	—	—	480		Energy losses include "tail"
t_f	Fall Time	—	—	330		See Fig. 9, 10, 14
E_{on}	Turn-On Switching Loss	—	1.4	—		mJ
E_{off}	Turn-off Switching Loss	—	4.5	—		
E_{ts}	Total Switching Loss	—	5.9	8.2		
$t_{d(on)}$	Turn-On Delay Time	—	33	—	ns	$T_J = 125^\circ\text{C}$
t_r	Rise Time	—	15	—		$I_C = 25A, V_{CC} = 400V$
$t_{d(off)}$	Turn-Off Delay Time	—	590	—		$V_{GE} = 15V, R_G = 2.35\Omega$ ⑤
t_f	Fall Time	—	500	—		Energy losses include "tail"
E_{ts}	Total Switching Loss	—	13	—		See Fig. 11, 14
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	—	2400	—	pF	$V_{GE} = 0V$
C_{oes}	Output Capacitance	—	140	—		$V_{CC} = 30V$ See Fig. 7
C_{res}	Reverse Transfer Capacitance	—	28	—		$f = 1.0MHz$

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

For footnotes refer to the last page

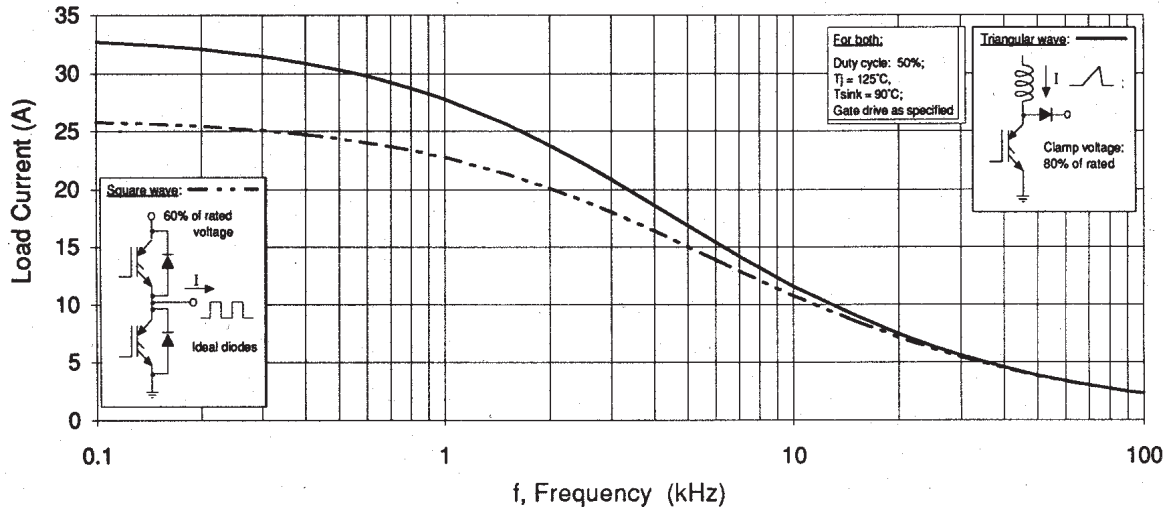


Fig. 1 - Typical Load Current vs. Frequency
(For square wave, $I = I_{RMS}$ of fundamental; for triangular wave, $I = I_{PK}$)

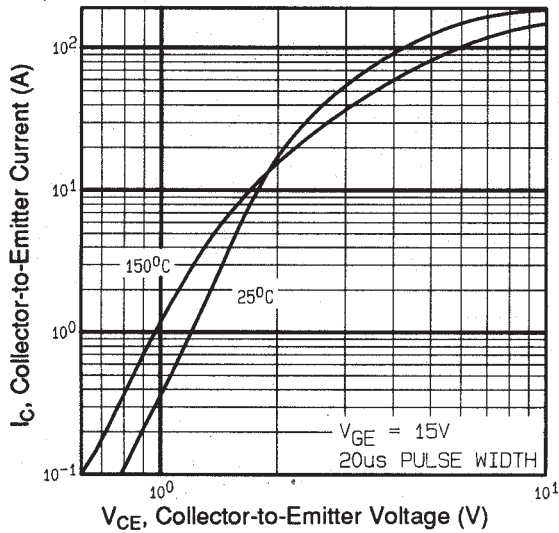


Fig. 2 - Typical Output Characteristics

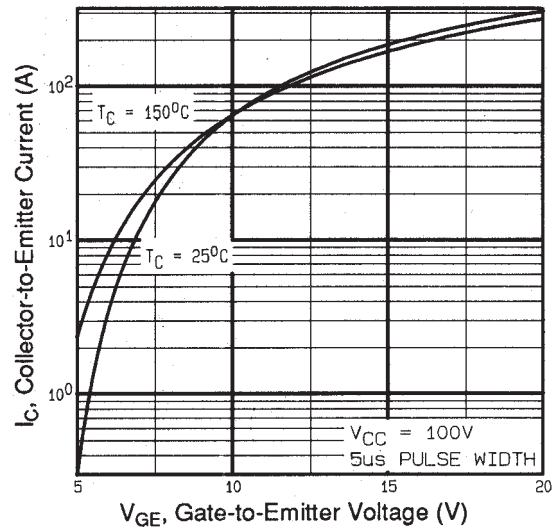


Fig. 3 - Typical Transfer Characteristics

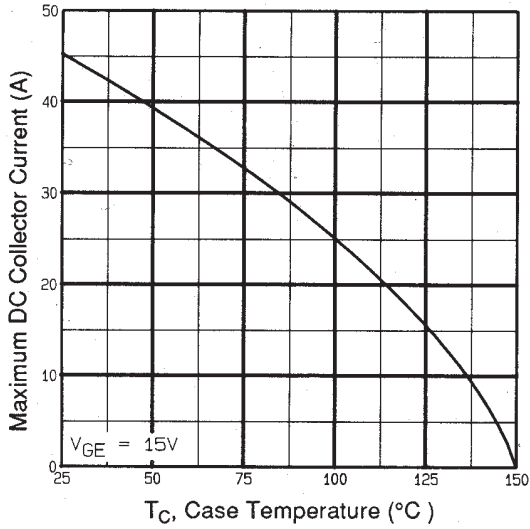


Fig. 4 - Maximum Collector Current vs. Case Temperature

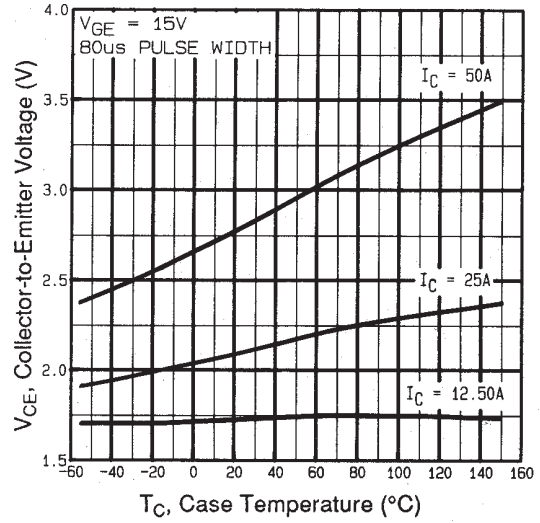


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

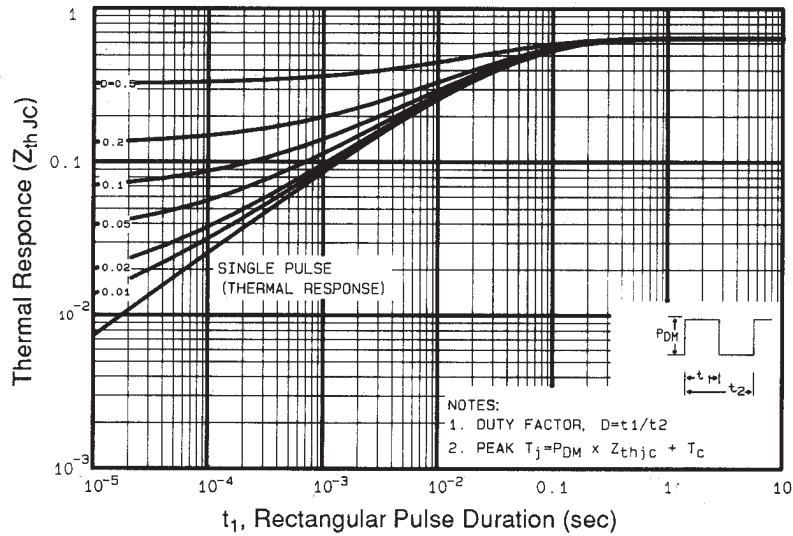


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

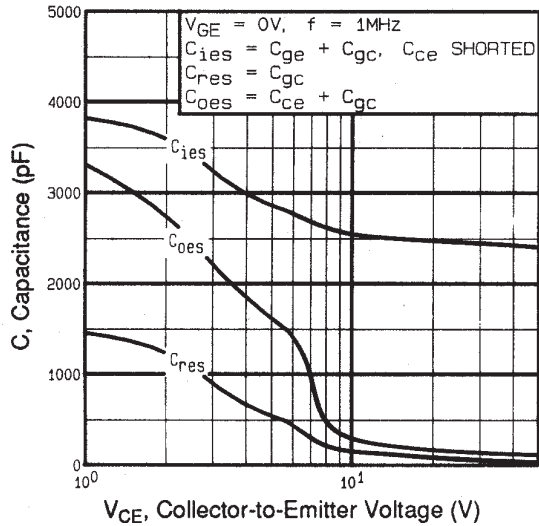


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

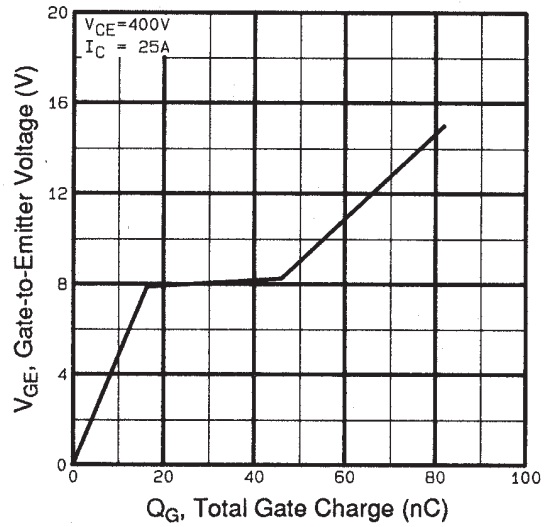


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

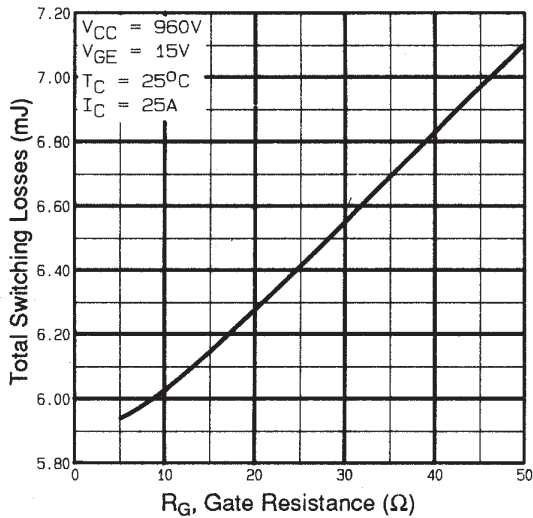


Fig. 9 - Typical Switching Losses vs. Gate Resistance

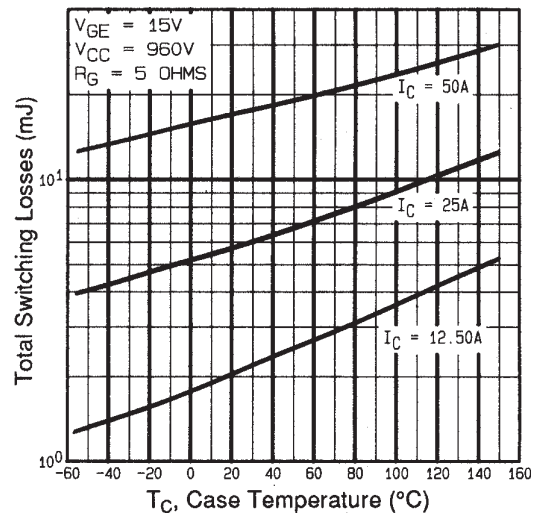


Fig. 10 - Typical Switching Losses vs. Junction Temperature

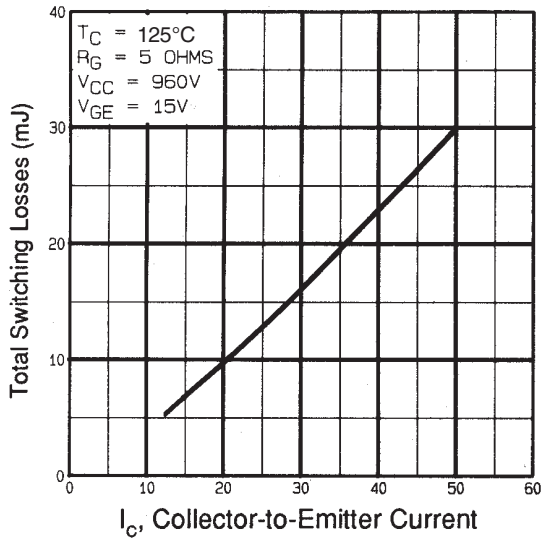


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

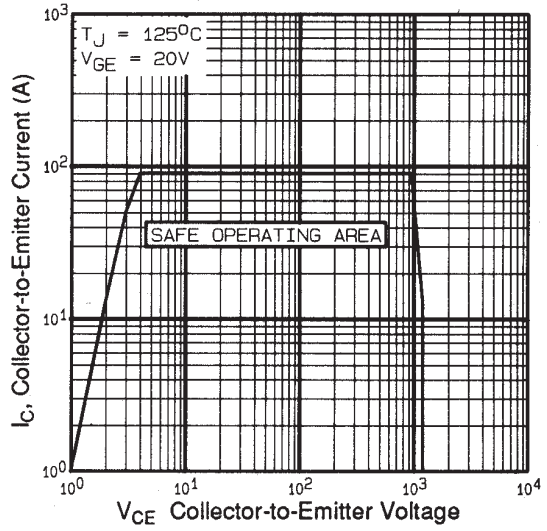
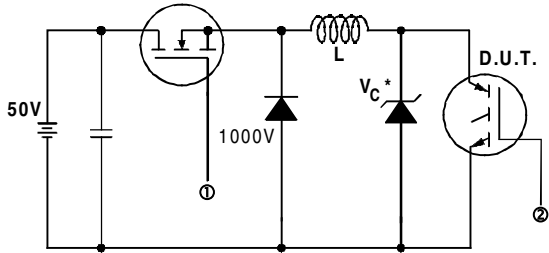


Fig. 12 - Turn-Off SOA



* Driver same type as D.U.T.; $V_c = 80\%$ of $V_{ce(max)}$
 * Note: Due to the 50V power supply, pulse width and inductor will increase to obtain rated I_d .

Fig. 13a - Clamped Inductive Load Test Circuit

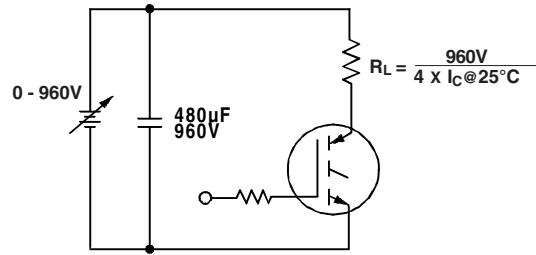


Fig. 13b - Pulsed Collector Current Test Circuit

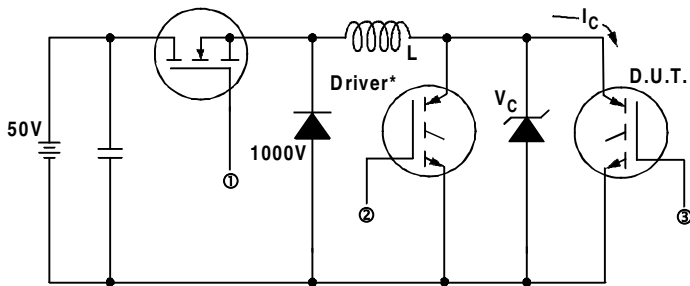


Fig. 14a - Switching Loss Test Circuit

* Driver same type as D.U.T., $V_C = 960V$



Fig. 14b - Switching Loss Waveforms

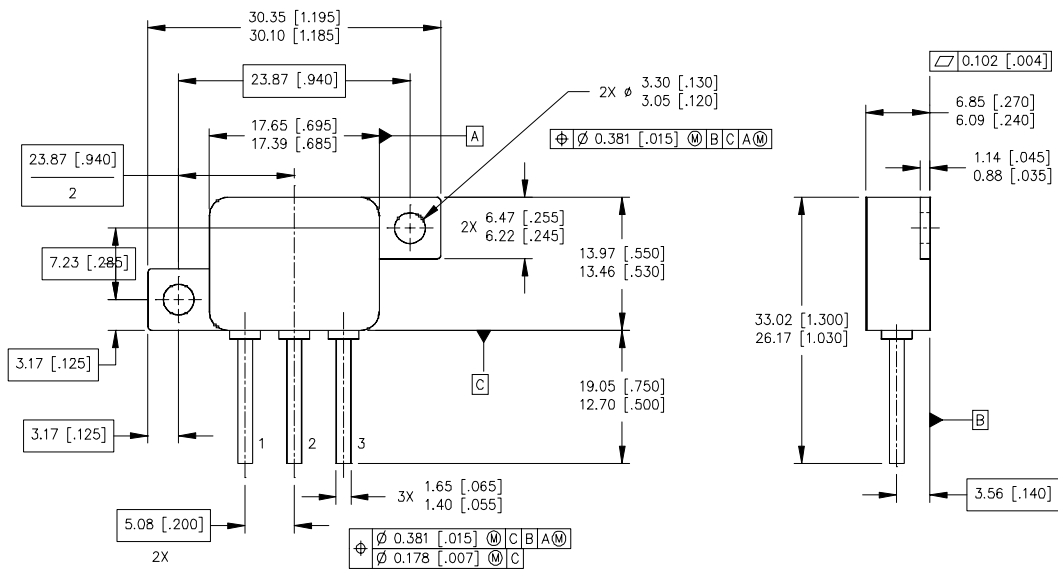
IRGIH50F

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Notes:

- ① Repetitive rating; $V_{GE} = 20V$, pulse width limited by max. junction temperature.
- ② $V_{CC} = 80\%(V_{CES})$, $V_{GE} = 20V$, $L = 10\mu H$, $R_G = 5.0\Omega$
- ③ Pulse width $\leq 80\mu s$; duty factor $\leq 0.1\%$.
- ④ Pulse width $5.0\mu s$, single shot.
- ⑤ Equipment limitation.

Case Outline and Dimensions — TO-259AA



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME 14.5M-1994.
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. CONTROLLING DIMENSION: INCH
4. CONFORMS TO JEDEC OUTLINE TO-259AA.

LEGEND

- 1 = COLLECTOR
- 2 = EMITTER
- 3 = GATE

International
IR Rectifier

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Data and specifications subject to change without notice. 02/02