

IRG4PSH71U

INSULATED GATE BIPOLAR TRANSISTOR

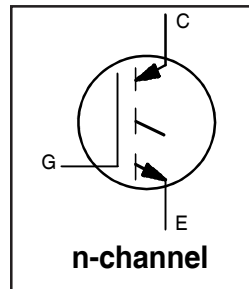
UltraFast Speed IGBT

Features

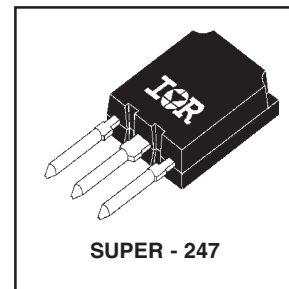
- UltraFast switching speed optimized for operating frequencies 8 to 40kHz in hard switching, 200kHz in resonant mode soft switching
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency (minimum switching and conduction losses) than prior generations
- Industry-benchmark Super-247 package with higher power handling capability compared to same footprint TO-247
- Creepage distance increased to 5.35mm

Benefits

- Generation 4 IGBT's offer highest efficiencies available
- Maximum power density, twice the power handling of the TO-247, less space than TO-264
- IGBTs optimized for specific application conditions
- Cost and space saving in designs that require multiple, paralleled IGBTs



$V_{CES} = 1200V$
$V_{CE(on)} \text{ typ.} = 2.50V$
@ $V_{GE} = 15V, I_C = 50A$



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	1200	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	99	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	50	
I_{CM}	Pulse Collector Current ①	200	
I_{LM}	Clamped Inductive Load current ②	200	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	150	mJ
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	350	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	140	
T_J	Operating Junction and	-55 to +150	$^\circ C$
T_{STG}	Storage Temperature Range		
	Storage Temperature Range, for 10 sec.	300 (0.063 in. (1.6mm) from case)	

Thermal / Mechanical Characteristics

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case- IGBT	—	—	0.36	$^\circ C/W$
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	—	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	—	38	
	Recommended Clip Force	20 (2.0)			N (kgf)
Wt	Weight	—	6 (0.21)	—	g (oz.)

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 ③	1200	—	—	V $V_{GE} = 0V, I_C = 250\mu A$
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage	19	—	—	V $V_{GE} = 0V, I_C = 1.0A$
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.78	—	V/°C $V_{GE} = 0V, I_C = 1mA$
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	2.52	2.70	V $I_C = 70A, V_{GE} = 15V$ $I_C = 140A$ See Fig.2, 5 $I_C = 70A, T_J = 150^\circ\text{C}$
		—	3.17	—	
		—	2.68	—	
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0	V $V_{CE} = V_{GE}, I_C = 250\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage temp. coefficient	—	-9.2	—	mV/°C $V_{CE} = V_{GE}, I_C = 1.0mA$
g_{fe}	Forward Transconductance ④	48	72	—	S $V_{CE} = 100V, I_C = 70A$
I_{CES}	Zero Gate Voltage Collector Current	—	—	500	μA $V_{GE} = 0V, V_{CE} = 1200V$ $V_{GE} = 0V, V_{CE} = 10V$ $V_{GE} = 0V, V_{CE} = 1200V, T_J = 150^\circ\text{C}$
		—	—	2.0	
		—	—	5000	
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)	—	370	560	nC $I_C = 70A, V_{CC} = 400V, V_{GE} = 15V$ See Fig.8
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	61	24	
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	120	50	
$t_{d(on)}$	Turn-On delay time	—	51	—	ns $I_C = 70A, V_{CC} = 960V, V_{GE} = 15V, R_G = 5.0\Omega$ Energy losses include "tail" See Fig. 9, 10, 11, 14
t_r	Rise time	—	70	—	
$t_{d(off)}$	Turn-Off delay time	—	280	390	
t_f	Fall time	—	170	260	
E_{on}	Turn-On Switching Loss	—	4.77	—	
E_{off}	Turn-Off Switching Loss	—	9.54	—	mJ
E_{tot}	Total Switching Loss	—	14.3	15.8	
$t_{d(on)}$	Turn-On delay time	—	49	—	ns $T_J = 150^\circ\text{C}, I_C = 70A, V_{CC} = 960V, V_{GE} = 15V, R_G = 5.0\Omega$ Energy losses include "tail" See Fig. 9, 10, 11, 14
t_r	Rise time	—	70	—	
$t_{d(off)}$	Turn-Off delay time	—	390	—	
t_f	Fall time	—	360	—	
E_{TS}	Total Switching Loss	—	25	—	mJ
L_E	Internal Emitter Inductance	—	13	—	nH Measured 5mm from package
C_{ies}	Input Capacitance	—	7280	—	pF $V_{GE} = 0V, V_{CC} = 30V, f = 1.0MHz$ See Fig.7
C_{oes}	Output Capacitance	—	290	—	
C_{res}	Reverse Transfer Capacitance	—	50	—	

Notes:

- ① Repetitive rating: $V_{GE}=20V$; pulse width limited by maximum junction temperature (figure 20)
- ② $V_{CC}=80\%(V_{CES}), V_{GE}=20V, L=10\mu H, R_G= 5.0 \Omega$ (figure 13a)
- ③ Pulse width $\leq 80\mu s$; duty factor $\leq 0.1\%$.
- ④ Pulse width $5.0\mu s$, single shot.
- ⑤ Repetitive rating; pulse width limited by maximum junction temperature.

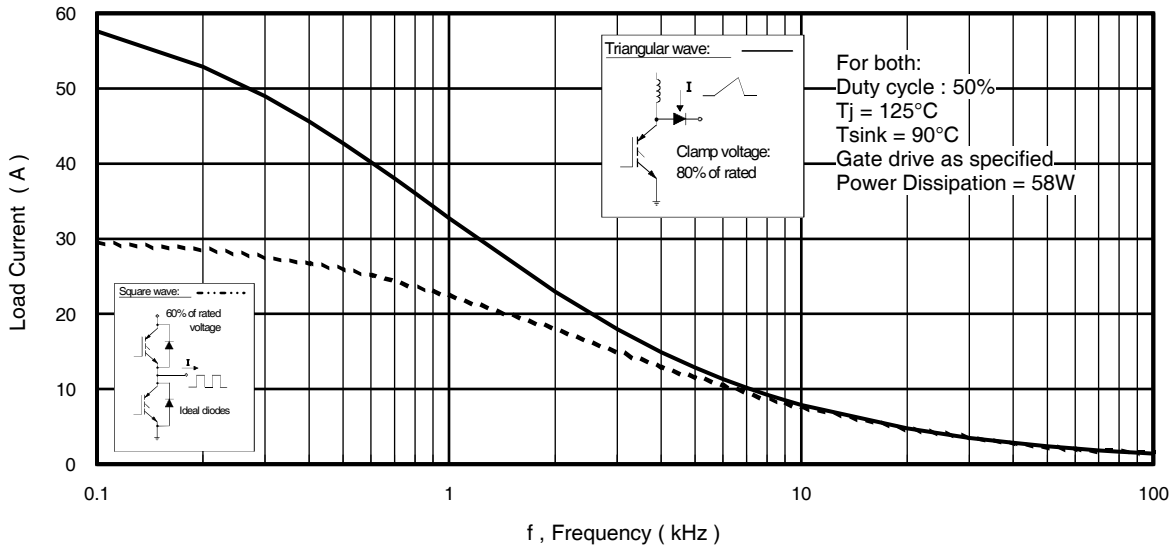


Fig. 1 - Typical Load Current vs. Frequency
(For square wave, $I = I_{\text{RMS}}$ of fundamental; for triangular wave, $I = I_{\text{PK}}$)

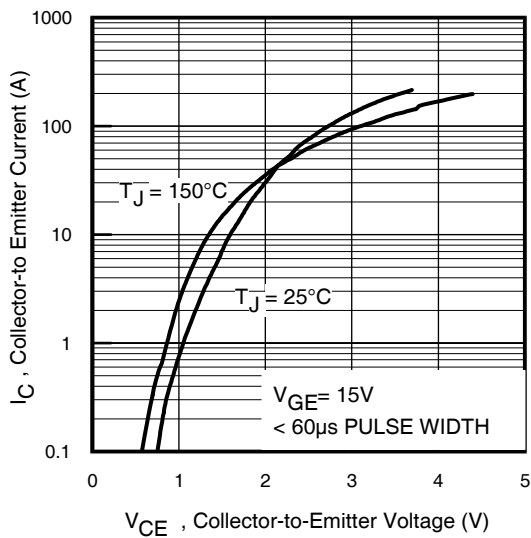


Fig. 2 - Typical Output Characteristics

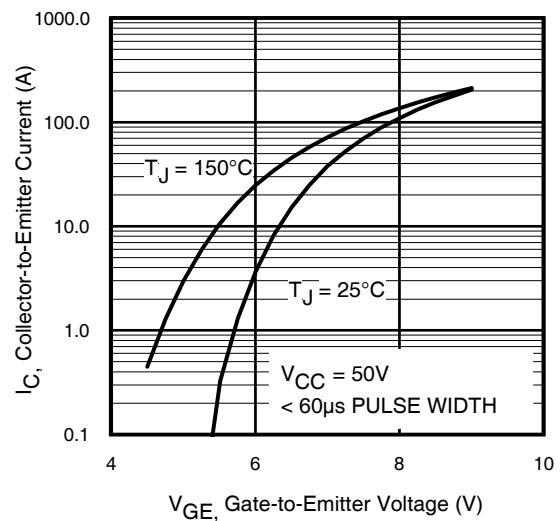


Fig. 3 - Typical Transfer Characteristics

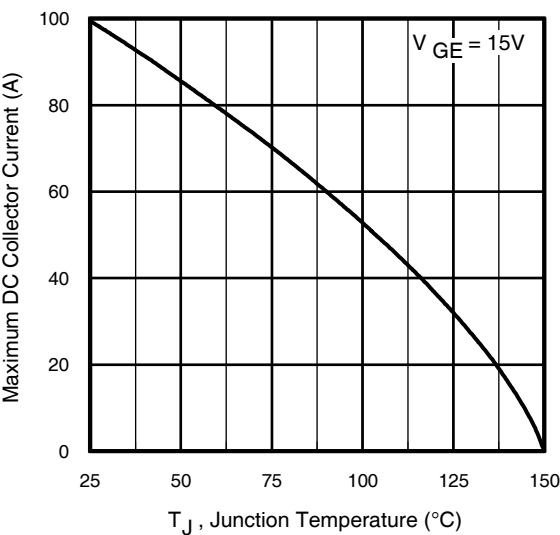


Fig. 4 - Maximum Collector Current vs. Case Temperature

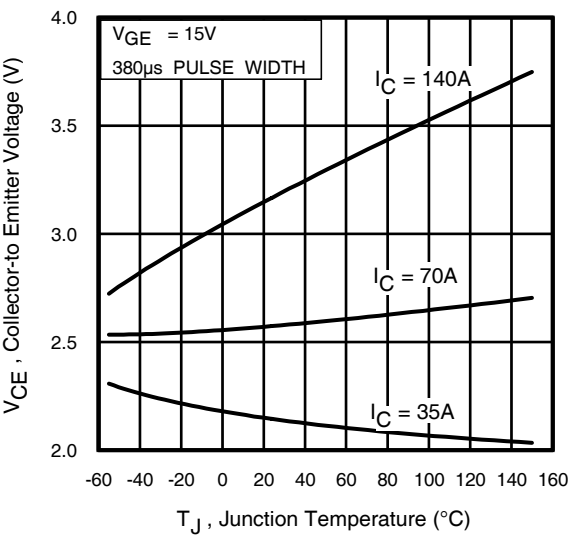


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

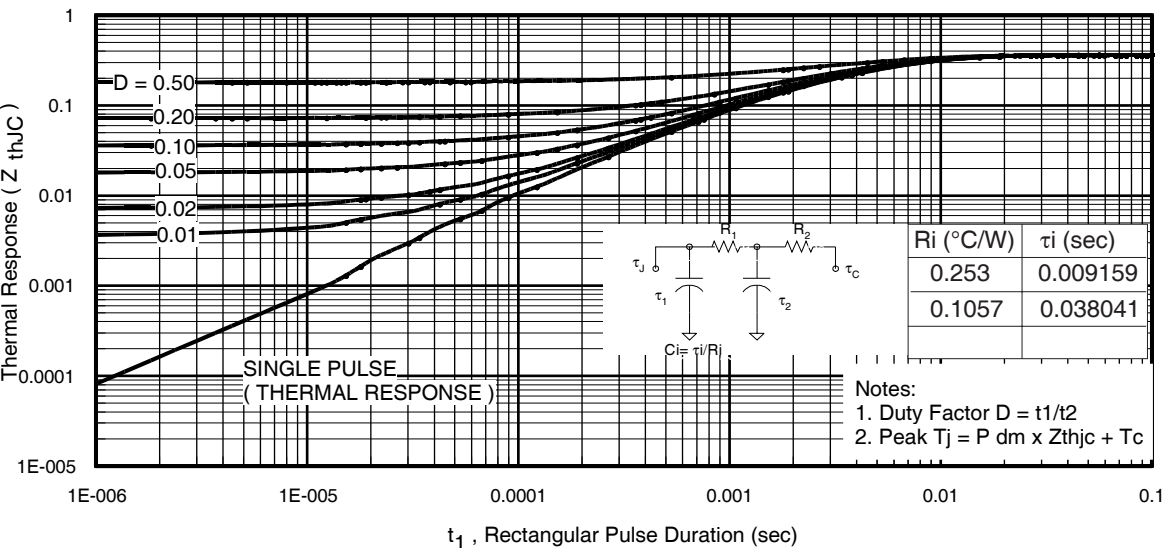


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

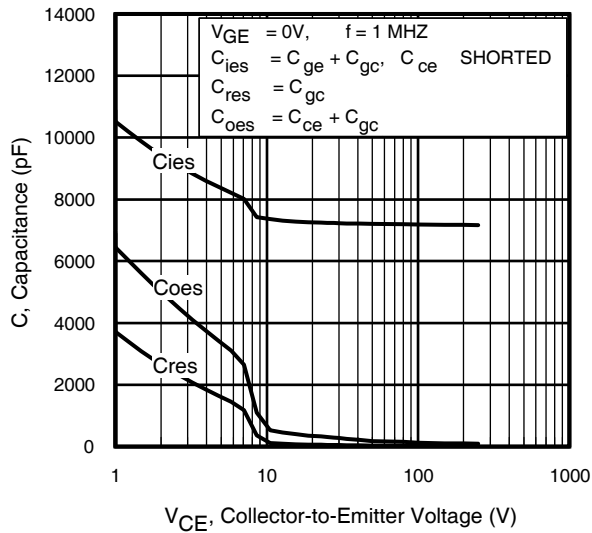


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

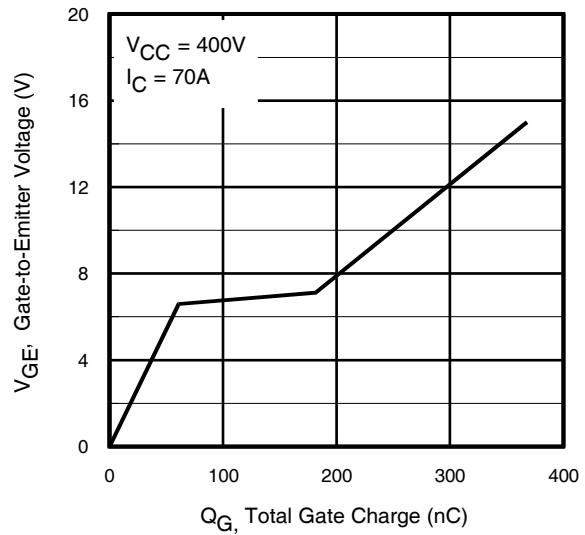


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

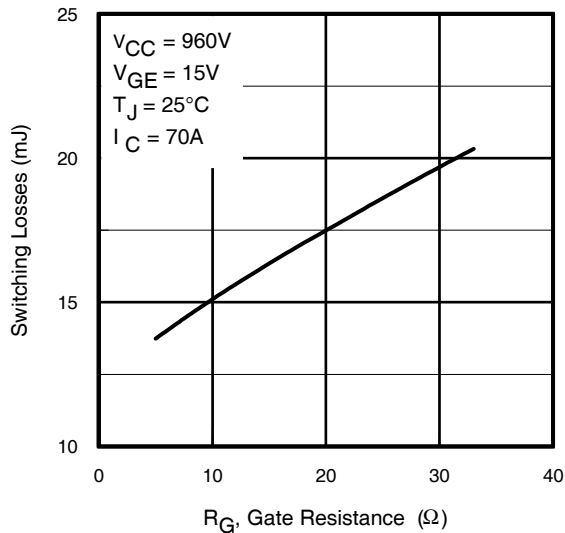


Fig. 9 - Typical Switching Losses vs. Gate Resistance

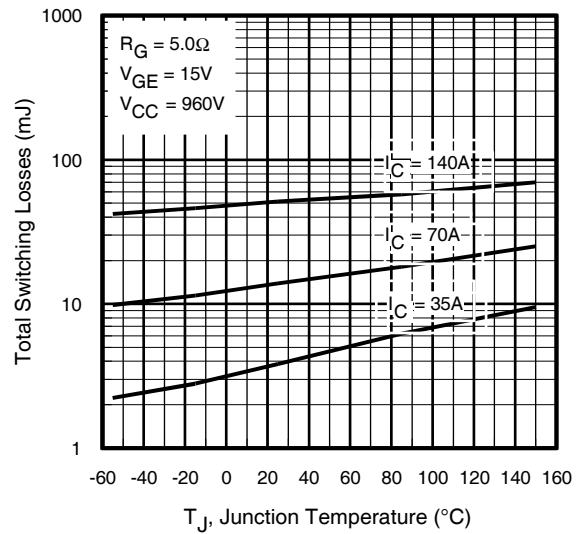


Fig. 10 - Typical Switching Losses vs. Junction Temperature

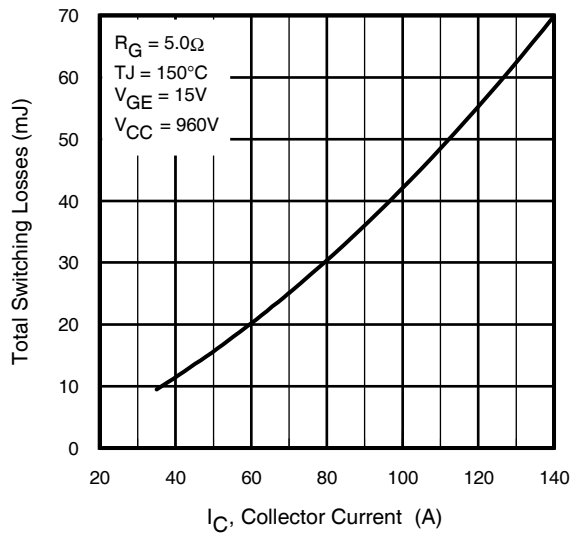


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

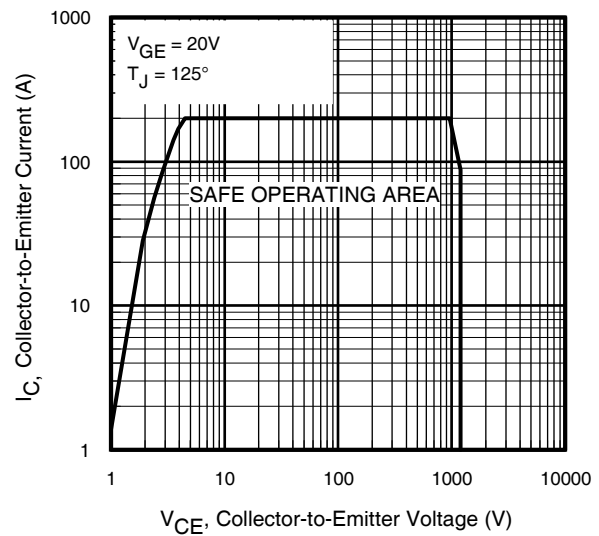


Fig. 12 - Turn-Off SOA

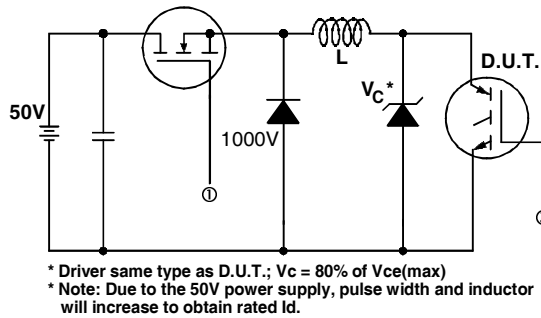


Fig. 13a - Clamped Inductive Load Test Circuit

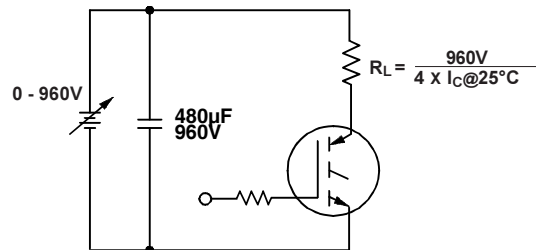


Fig. 13b - Pulsed Collector Current Test Circuit

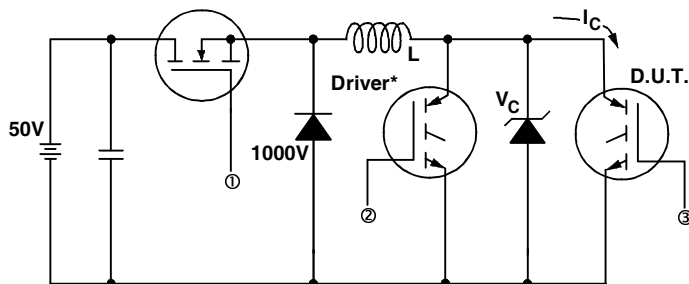


Fig. 14a - Switching Loss Test Circuit

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

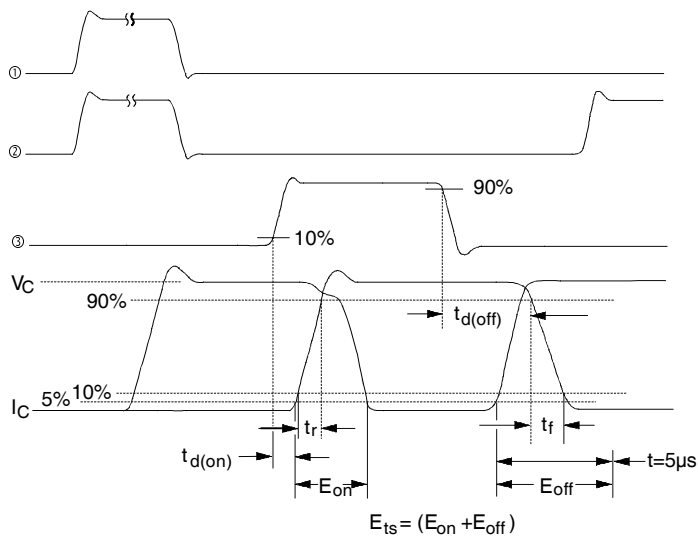


Fig. 14b - Switching Loss Waveforms

International
IOR Rectifier

FRONT VIEW

Dimensions (mm / inches):

- Overall width: 16.10 (.632) / 15.10 (.595)
- Overall height: 20.80 (.818) / 19.80 (.780)
- Pin pitch: 5.45 (.215)
- Pin diameter: 1.60 (.062) / 1.45 (.058)
- Pin length: 14.80 (.582) / 13.80 (.544)
- Lead thickness: 4.25 (.167) / 3.85 (.152)
- Lead width: 2.00 (.079)
- Lead angle: 2X R 3.00 (.118)

SECTION E-E

Dimensions (mm / inches):

- Overall width: 13.90 (.547) / 13.30 (.524)
- Overall height: 16.10 (.633) / 15.50 (.611)
- Pin pitch: 5.45 (.215)
- Pin diameter: 1.60 (.062) / 1.45 (.058)
- Pin length: 14.80 (.582) / 13.80 (.544)
- Pin thickness: 2.35 (.092) / 1.65 (.065)
- Pin width: 1.10 (.044)
- Pin angle: 1.30 (.051) / 0.70 (.028)
- Pin length: 4.25 (.167) / 3.85 (.152)
- Pin width: 2.00 (.079)
- Pin angle: 2X R 3.00 (.118)

LEAD ASSIGNMENTS

MOSFET	IGBT
1 - GATE	1 - GATE
2 - DRAIN	2 - COLLECTOR
3 - SOURCE	3 - EMITTER
4 - DRAIN	4 - COLLECTOR

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
2. DIMENSIONS ARE SHOWN IN MILLIMETERS (INCHES)
3. CONTROLLING DIMENSION: MILLIMETER
4. OUTLINE CONFORMS TO JEDEC OUTLINE TO-274AA

DATE CODE
(YYWW)
YY = YEAR
WW = WEEK

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