

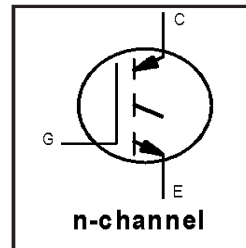
# IRG4PSC71UPbF

INSULATED GATE BIPOLAR TRANSISTOR

UltraFast Speed IGBT

## Features

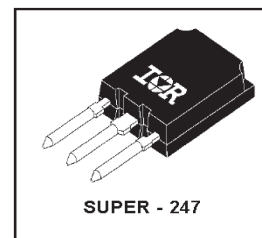
- UltraFast switching speed optimized for operating frequencies 8 to 40kHz in hard switching, 200kHz in resonant mode soft switching
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency (minimum switching and conduction losses) than prior generations
- Industry-benchmark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



$V_{CES} = 600V$
$V_{CE(on)} \text{ typ.} = 1.67V$
@ $V_{GE} = 15V, I_C = 60A$

## 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



## Absolute Maximum Ratings

	Parameter	Max.	Units
$V_{CES}$	Collector-to-Emitter Breakdown Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	85 <sup>⑥</sup>	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	60	
$I_{CM}$	Pulsed Collector Current <sup>①</sup>	200	
$I_{LM}$	Clamped Inductive Load Current <sup>②</sup>	200	
$V_{GE}$	Gate-to-Emitter Voltage	$\pm 20$	V
$E_{ARV}$	Reverse Voltage Avalanche Energy <sup>③</sup>	180	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 Storage Temperature Range	-55 to + 150	°C
$T_{STG}$			
	Soldering Temperature, for 10 seconds	300 (0.063 in. (1.6mm from case )	

## Thermal Resistance\ Mechanical

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	---	---	0.36	°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	20.0(2.0)	---	---	N (kgf)
	Weight	---	6 (0.21)	---	g (oz)

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

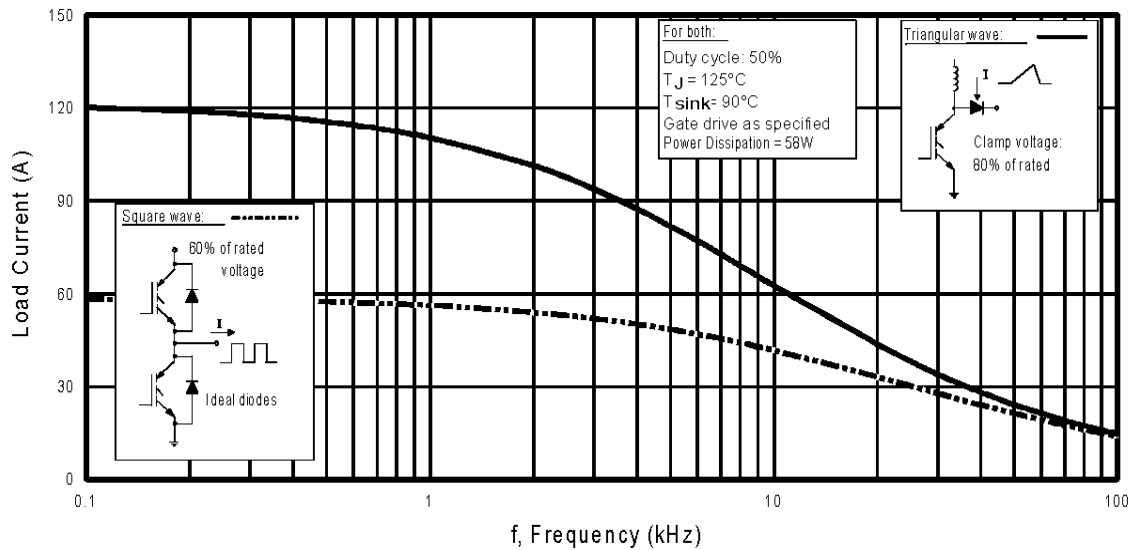
	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	$V_{GE} = 0V, I_C = 250\mu A$
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ④	18	—	—	V	$V_{GE} = 0V, I_C = 1.0A$
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.45	—	V/°C	$V_{GE} = 0V, I_C = 5.0mA$
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	1.67	2.0	V	$I_C = 60A, V_{GE} = 15V$
		—	1.95	—		$I_C = 100A$
		—	1.71	—		$I_C = 60A, T_J = 150^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		$V_{CE} = V_{GE}, I_C = 250\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-10	—	mV/°C	$V_{CE} = V_{GE}, I_C = 1.0mA$
$g_{fe}$	Forward Transconductance ⑤	47	70	—	S	$V_{CE} = 50V, I_C = 60A$
$I_{CES}$	Zero Gate Voltage Collector Current	—	—	500	$\mu A$	$V_{GE} = 0V, V_{CE} = 600V$
		—	—	2.0		$V_{GE} = 0V, V_{CE} = 10V, T_J = 25^\circ\text{C}$
		—	—	5.0	mA	$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$
$I_{GES}$	Gate-to-Emitter Leakage Current	—	—	$\pm 100$	nA	$V_{GE} = \pm 20V$

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

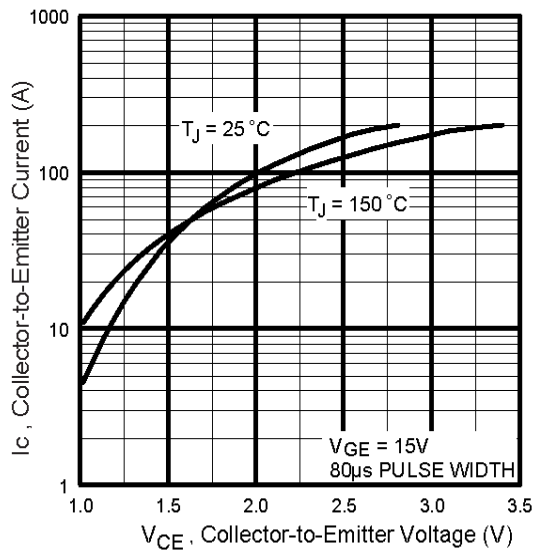
	Parameter	Min.	Typ.	Max.	Units	Conditions
$Q_g$	Total Gate Charge (turn-on)	—	340	520	nC	$I_C = 60A$
$Q_{ge}$	Gate - Emitter Charge (turn-on)	—	44	66		$V_{CC} = 400V$
$Q_{gc}$	Gate - Collector Charge (turn-on)	—	160	240		$V_{GE} = 15V$
$t_{d(on)}$	Turn-On Delay Time	—	34	—	ns	$T_J = 25^\circ\text{C}$ $I_C = 60A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 5.0\Omega$
$t_r$	Rise Time	—	50	—		
$t_{d(off)}$	Turn-Off Delay Time	—	56	84		
$t_f$	Fall Time	—	86	130		
$E_{on}$	Turn-On Switching Loss	—	0.42	—	mJ	Energy losses include "tail" See Fig. 10, 11, 13, 14
$E_{off}$	Turn-Off Switching Loss	—	1.99	—		
$E_{ts}$	Total Switching Loss	—	2.41	3.2		
$t_{d(on)}$	Turn-On Delay Time	—	30	—	ns	$T_J = 150^\circ\text{C}$ , $I_C = 60A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 5.0\Omega$ Energy losses include "tail" See Fig. 13, 14
$t_r$	Rise Time	—	49	—		
$t_{d(off)}$	Turn-Off Delay Time	—	129	—		
$t_f$	Fall Time	—	175	—		
$E_{ts}$	Total Switching Loss	—	4.5	—	mJ	
$L_E$	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
$C_{ies}$	Input Capacitance	—	7500	—	pF	$V_{GE} = 0V$
$C_{oes}$	Output Capacitance	—	720	—		$V_{CC} = 30V$
$C_{res}$	Reverse Transfer Capacitance	—	93	—		$f = 1.0MHz$

### Notes:

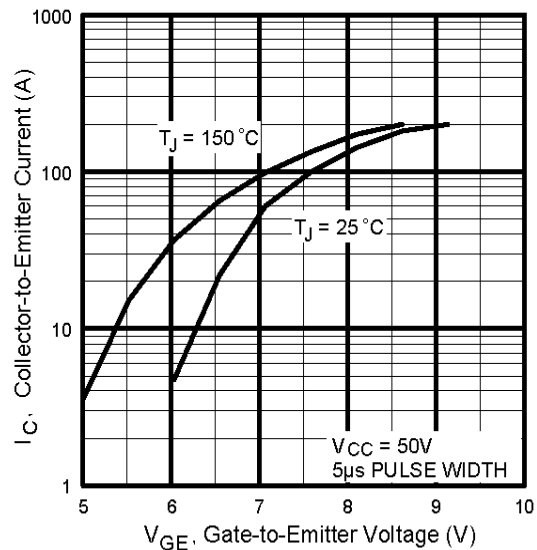
- ① Repetitive rating;  $V_{GE} = 20V$ , pulse width limited by max. junction temperature. ( See fig. 13b )
- ②  $V_{CC} = 80\%(V_{CES}), V_{GE} = 20V, L = 10\mu H, R_G = 5.0\Omega$ , (See fig. 13a)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width  $\leq 80\mu s$ ; duty factor  $\leq 0.1\%$ .
- ⑤ Pulse width  $5.0\mu s$ , single shot.
- ⑥ Current limited by the package, (Die current = 100A)



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



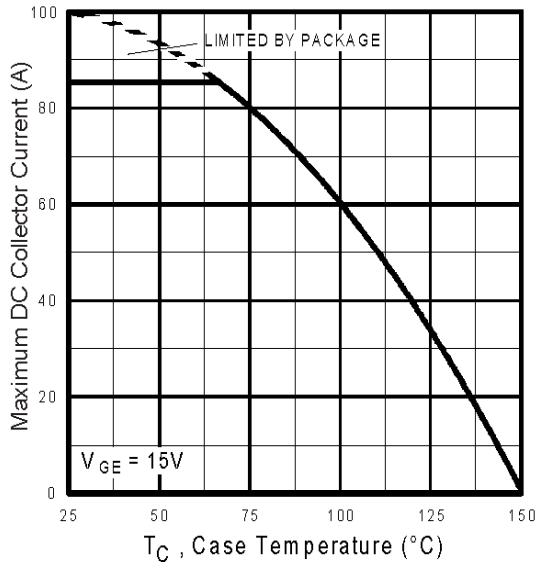
**Fig. 2** - Typical Output Characteristics



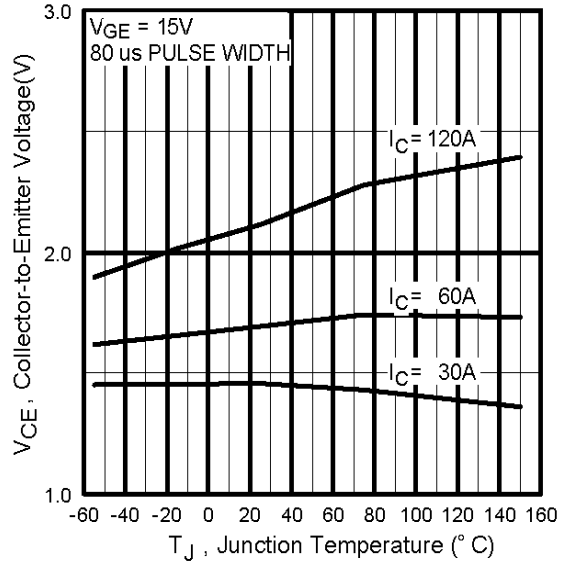
**Fig. 3** - Typical Transfer Characteristics

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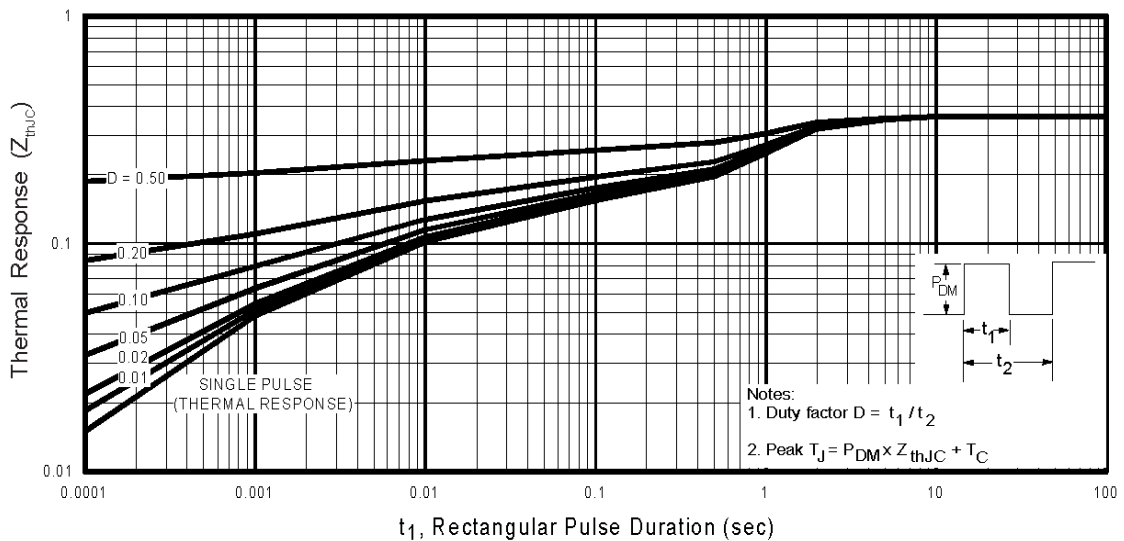
International  
**IR** Rectifier



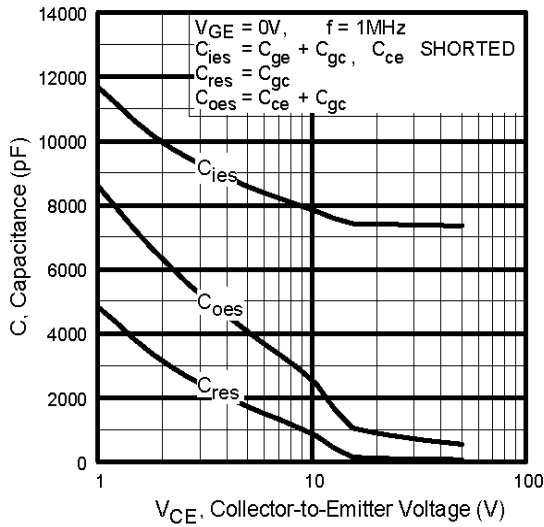
**Fig. 4** - Maximum Collector Current vs. Case Temperature



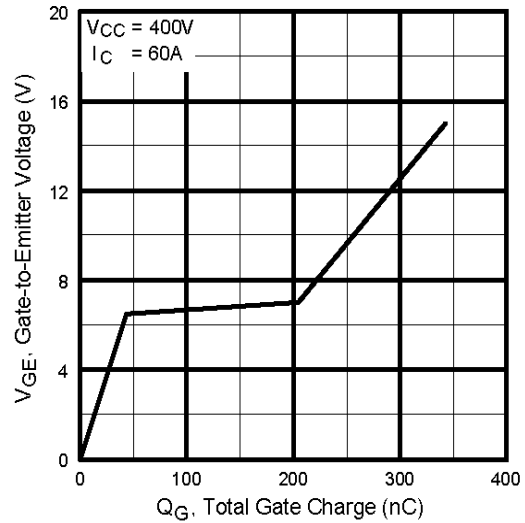
**Fig. 5** - Collector-to-Emitter Voltage vs. Junction Temperature



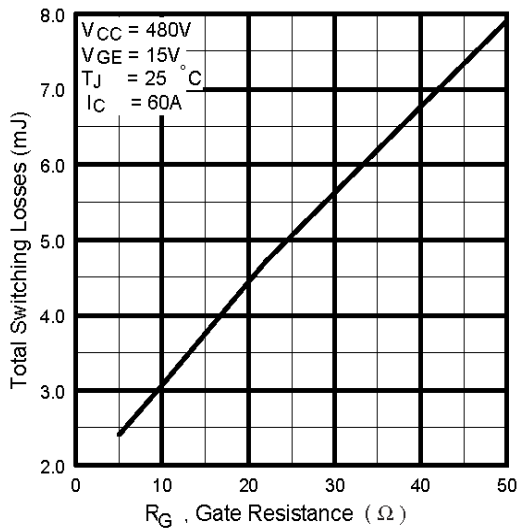
**Fig. 6** - Maximum Effective Transient Thermal Impedance, Junction-to-Case



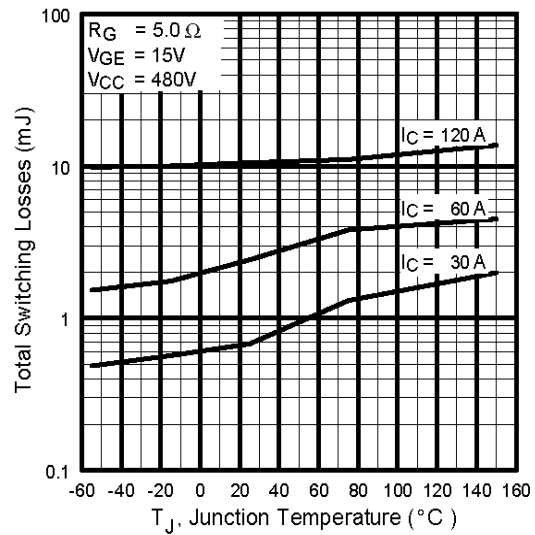
**Fig. 7** - Typical Capacitance vs. Collector-to-Emitter Voltage



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



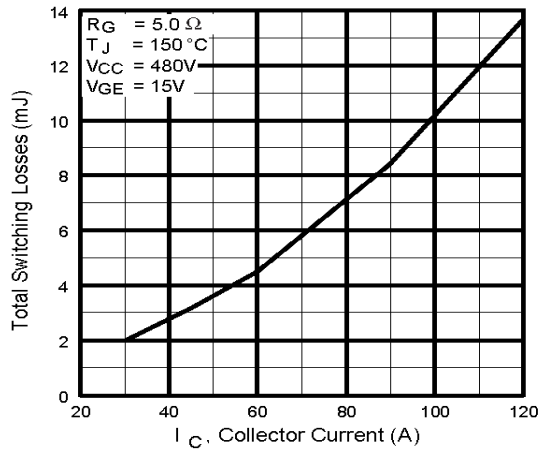
**Fig. 9** - Typical Switching Losses vs. Gate Resistance



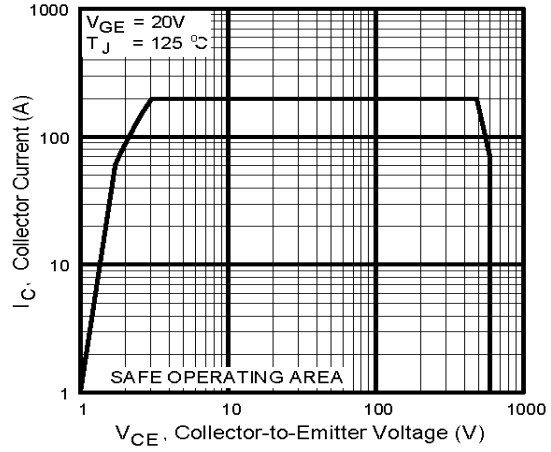
**Fig. 10** - Typical Switching Losses vs. Junction Temperature

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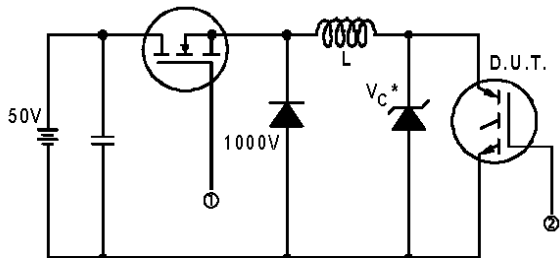
International  
**IR** Rectifier



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

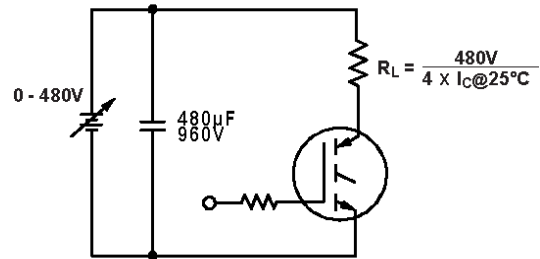


**Fig. 12** - Turn-Off SOA

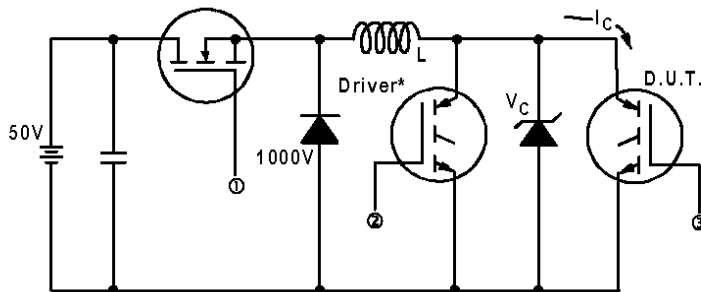


\* Driver same type as D.U.T.;  $V_c = 80\%$  of  $V_{ce(max)}$   
 \* Note: Due to the 50V power supply, pulse width and inductor will increase to obtain rated  $I_d$ .

**Fig. 13a** - Clamped Inductive Load Test Circuit

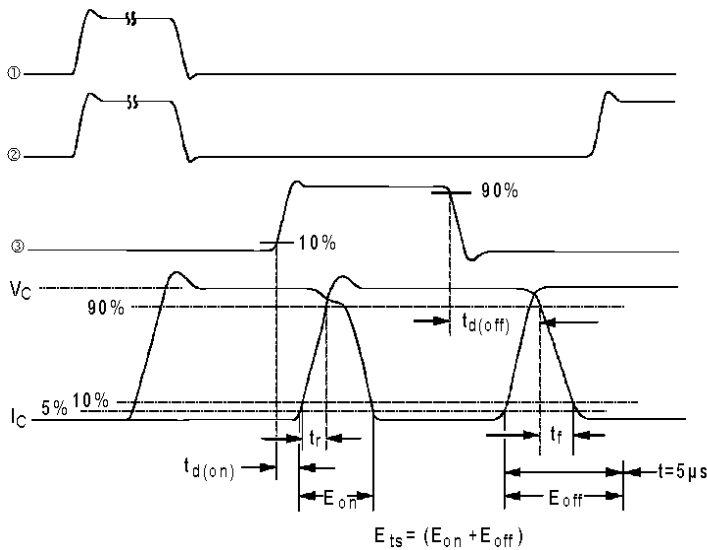


**Fig. 13b** - Pulsed Collector Current Test Circuit



**Fig. 14a** - Switching Loss Test Circuit

\* Driver same type as D.U.T.,  $V_c = 480V$

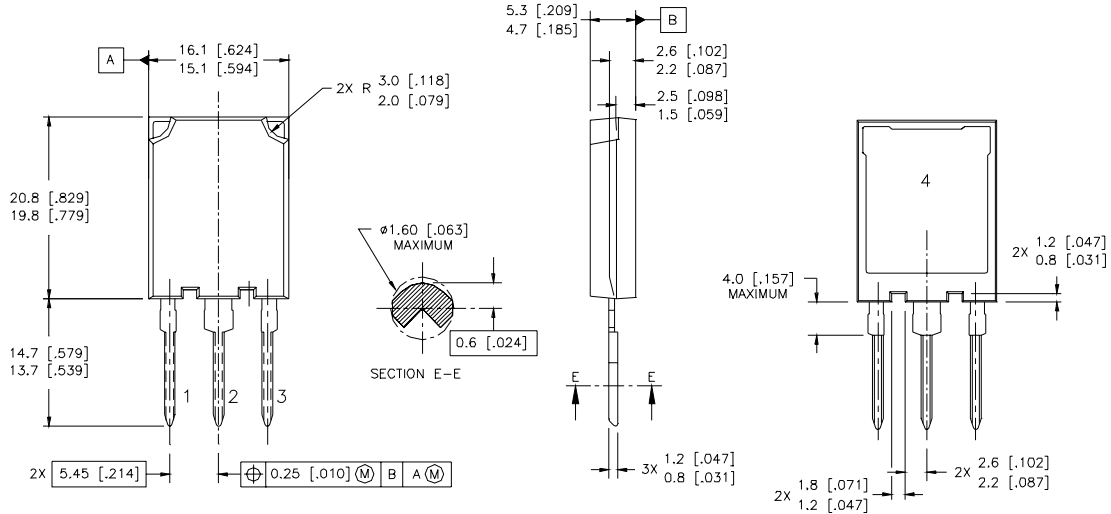


**Fig. 14b** - Switching Loss Waveforms

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## Case Outline and Dimensions — Super-247



**NOTES:**

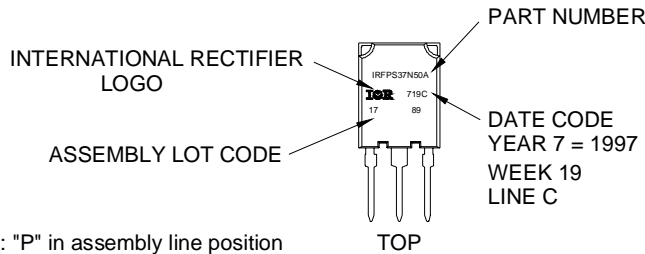
1. DIMENSIONS & TOLERANCING PER ASME Y14.5M-1994
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETRES [INCHES]

**LEAD ASSIGNMENTS**

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

## Super-247 (TO-274AA) Part Marking Information

EXAMPLE: THIS IS AN IRFPS37N50A WITH  
ASSEMBLY LOT CODE 1789  
ASSEMBLED ON WW 19, 1997  
IN THE ASSEMBLY LINE "C"



Note: "P" in assembly line position indicates "Lead-Free"

Data and specifications subject to change without notice.

International  
**IR** Rectifier

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TAC Fax: (310) 252-7903

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