

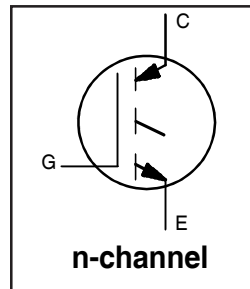
# IRG4PSC71K

INSULATED GATE BIPOLAR TRANSISTOR

Short Circuit Rated  
 UltraFast IGBT

## Features

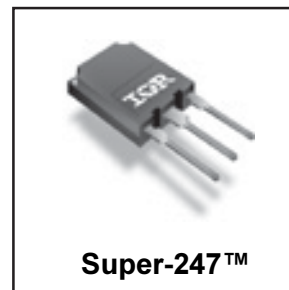
- Hole-less clip/pressure mount package compatible with TO-247 and TO-264, with reinforced pins
- High abort circuit rating IGBTs, optimized for motorcontrol
- Minimum switching losses combined with low conduction losses
- Tightest parameter distribution
- Creepage distance increased to 5.35mm



$V_{CES} = 600V$
$V_{CE(on)} \text{ typ.} = 1.83V$
@ $V_{GE} = 15V, I_C = 60A$

## Benefits

- Highest current rating IGBT
- Maximum power density, twice the power handling of the TO-247, less space than TO-264



## 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>Ⓞ</sup>	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	60	
$I_{CM}$	Pulsed Collector Current <sup>Ⓞ</sup>	200	
$I_{LM}$	Clamped Inductive Load Current <sup>Ⓞ</sup>	200	
$t_{SC}$	Short Circuit Withstand Time	10	$\mu s$
$V_{GE}$	Gate-to-Emitter Voltage	$\pm 20$	V
$E_{ARV}$	Reverse Voltage Avalanche Energy <sup>Ⓞ</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	-55 to + 150	$^\circ C$
$T_{STG}$	Storage Temperature Range		
	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	$^\circ C/W$
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	—	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	—	38	
	Recommended Clip Force	20.0(2.0)	—	—	N (kgf)
	Weight	—	6 (0.21)	—	g (oz)

**Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

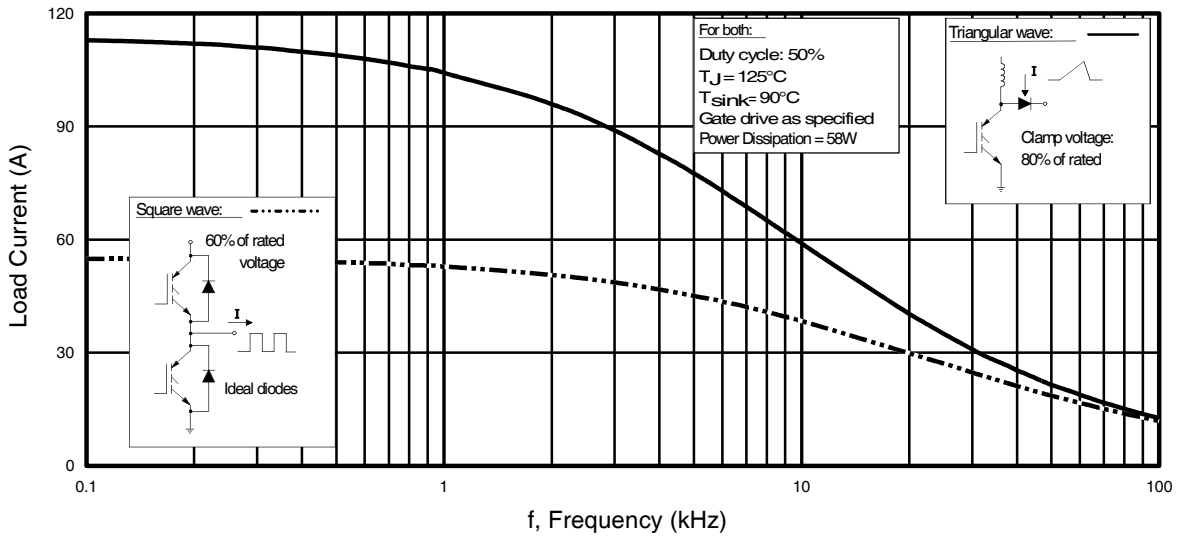
	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)CES</sub>	Collector-to-Emitter Breakdown Voltage	600	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 250μA
V <sub>(BR)ECS</sub>	Emitter-to-Collector Breakdown Voltage $\nabla$	18	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 1.0A
ΔV <sub>(BR)CES</sub> /ΔT <sub>J</sub>	Temperature Coeff. of Breakdown Voltage	—	0.5	—	V/°C	V <sub>GE</sub> = 0V, I <sub>C</sub> = 10mA
V <sub>CE(ON)</sub>	Collector-to-Emitter Saturation Voltage	—	1.83	2.3	V	I <sub>C</sub> = 60A I <sub>C</sub> = 100A I <sub>C</sub> = 60A, T <sub>J</sub> = 150°C V <sub>GE</sub> = 15V See Fig.2, 5
		—	2.20	—		
		—	1.81	—		
V <sub>GE(th)</sub>	Gate Threshold Voltage	3.0	—	6.0		V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA
ΔV <sub>GE(th)</sub> /ΔT <sub>J</sub>	Temperature Coeff. of Threshold Voltage	—	-8.0	—	mV/°C	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 1.5mA
g <sub>fe</sub>	Forward Transconductance $\nabla$	31	46	—	S	V <sub>CE</sub> = 50V, I <sub>C</sub> = 60A
I <sub>CES</sub>	Zero Gate Voltage Collector Current	—	—	500	μA	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V
		—	—	2.0		V <sub>GE</sub> = 0V, V <sub>CE</sub> = 10V, T <sub>J</sub> = 25°C
		—	—	5.0	mA	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V, T <sub>J</sub> = 150°C
I <sub>GES</sub>	Gate-to-Emitter Leakage Current	—	—	±100	nA	V <sub>GE</sub> = ±20V

**Switching Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

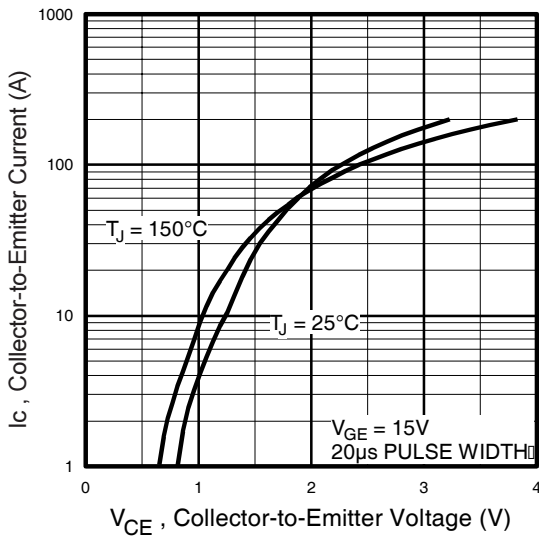
	Parameter	Min.	Typ.	Max.	Units	Conditions
Q <sub>g</sub>	Total Gate Charge (turn-on)	—	340	510	nC	I <sub>C</sub> = 60A V <sub>CC</sub> = 400V V <sub>GE</sub> = 15V See Fig.8
Q <sub>ge</sub>	Gate - Emitter Charge (turn-on)	—	44	66		
Q <sub>gc</sub>	Gate - Collector Charge (turn-on)	—	160	240		
t <sub>d(on)</sub>	Turn-On Delay Time	—	34	—	ns	T <sub>J</sub> = 25°C I <sub>C</sub> = 60A, V <sub>CC</sub> = 480V V <sub>GE</sub> = 15V, R <sub>G</sub> = 5.0Ω
t <sub>r</sub>	Rise Time	—	54	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	251	377		
t <sub>f</sub>	Fall Time	—	89	133		
E <sub>on</sub>	Turn-On Switching Loss	—	0.79	—	mJ	Energy losses include "tail" and diode reverse recovery See Fig. 9,10,18
E <sub>off</sub>	Turn-Off Switching Loss	—	1.98	—		
E <sub>ts</sub>	Total Switching Loss	—	2.77	3.1		
t <sub>sc</sub>	Short Circuit Withstand Time	10	—	—	μs	V <sub>CC</sub> = 360V, T <sub>J</sub> = 125°C V <sub>GE</sub> = 15V, R <sub>G</sub> = 5.0Ω
t <sub>d(on)</sub>	Turn-On Delay Time	—	37	—	ns	T <sub>J</sub> = 150°C, See Fig. 10,11,18 I <sub>C</sub> = 60A, V <sub>CC</sub> = 480V V <sub>GE</sub> = 15V, R <sub>G</sub> = 5.0Ω, Energy losses include "tail" and diode reverse recovery
t <sub>r</sub>	Rise Time	—	56	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	356	—		
t <sub>f</sub>	Fall Time	—	177	—		
E <sub>ts</sub>	Total Switching Loss	—	5.5	—	mJ	
L <sub>E</sub>	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
C <sub>ies</sub>	Input Capacitance	—	6900	—	pF	V <sub>GE</sub> = 0V V <sub>CC</sub> = 30V f = 1.0MHz See Fig. 7
C <sub>oes</sub>	Output Capacitance	—	730	—		
C <sub>res</sub>	Reverse Transfer Capacitance	—	190	—		

**Notes:**

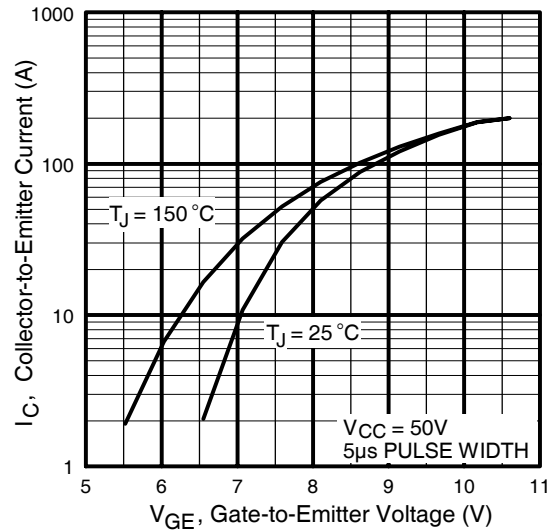
- ① Repetitive rating; V<sub>GE</sub> = 20V, pulse width limited by max. junction temperature. ( See fig. 13b )
- ② V<sub>CC</sub> = 80%(V<sub>CES</sub>), V<sub>GE</sub> = 20V, L = 10μH, R<sub>G</sub> = 5.0Ω, (See fig. 13a)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width ≤ 80μs; duty factor ≤ 0.1%.
- ⑤ Pulse width 5.0μs, 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**

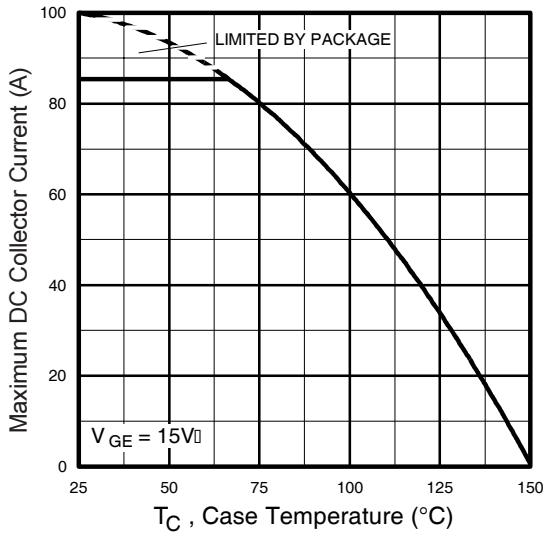


Fig. 4 - Maximum Collector Current vs. Case Temperature

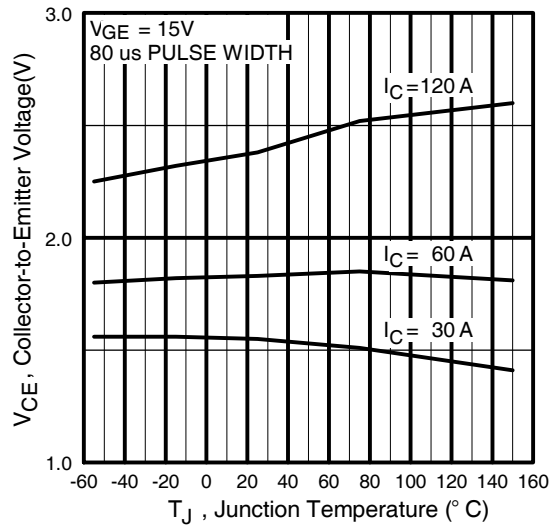


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

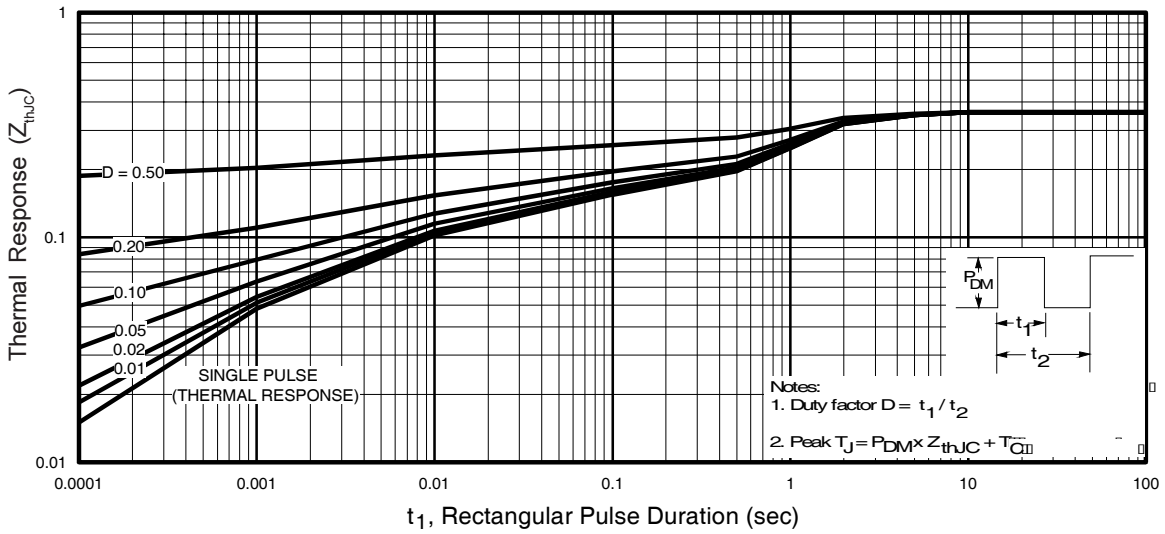


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

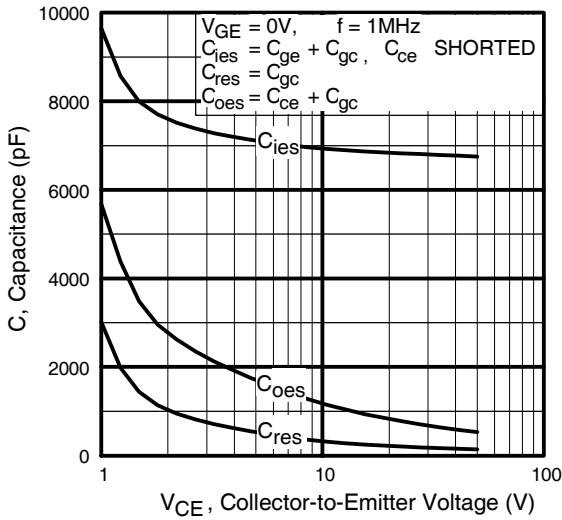


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

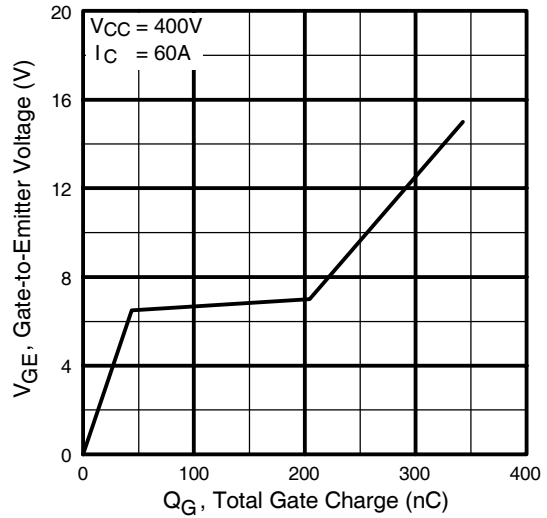


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

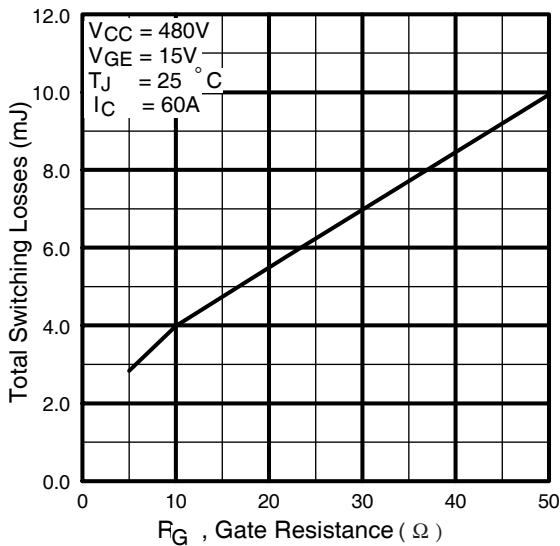


Fig. 9 - Typical Switching Losses vs. Gate Resistance

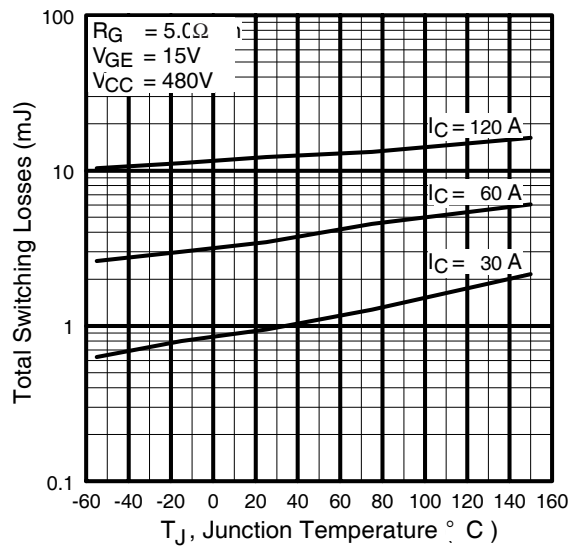


Fig. 10 - Typical Switching Losses vs. Junction Temperature

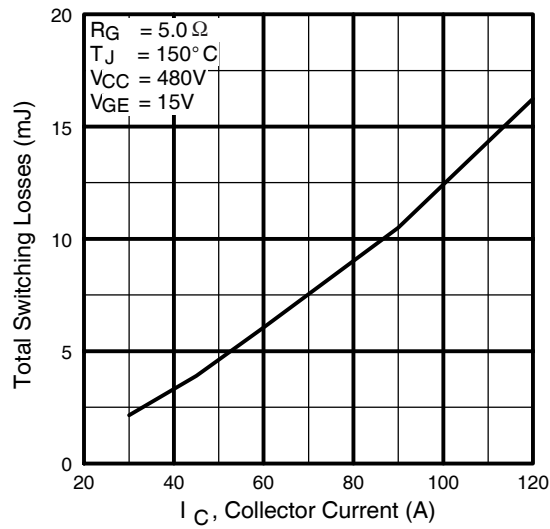


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

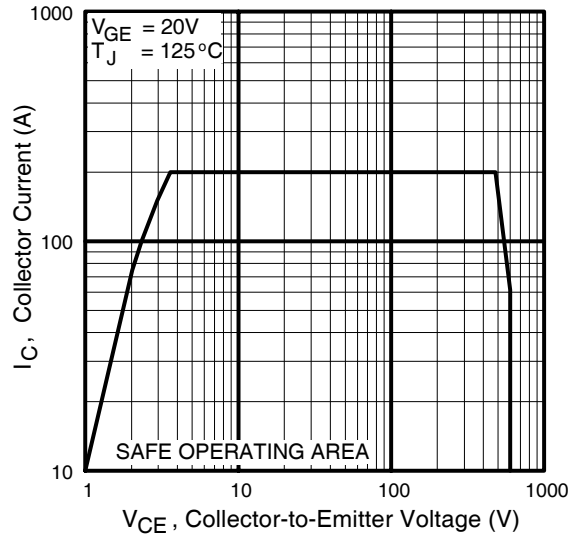


Fig. 12 - Turn-Off SOA

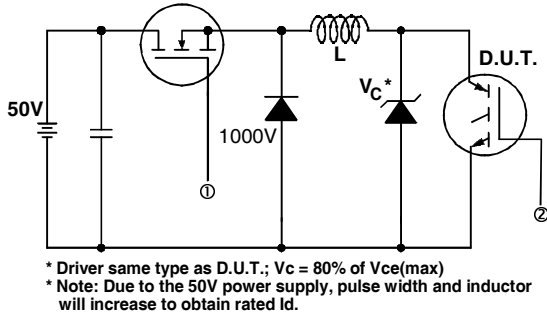


Fig. 13a - Clamped Inductive Load Test Circuit

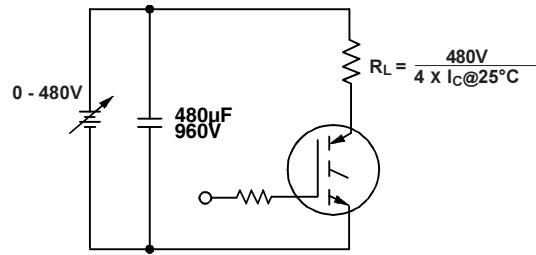


Fig. 13b - Pulsed Collector Current Test Circuit

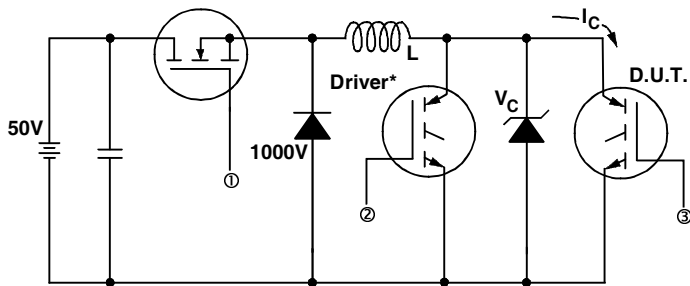


Fig. 14a - Switching Loss Test Circuit

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

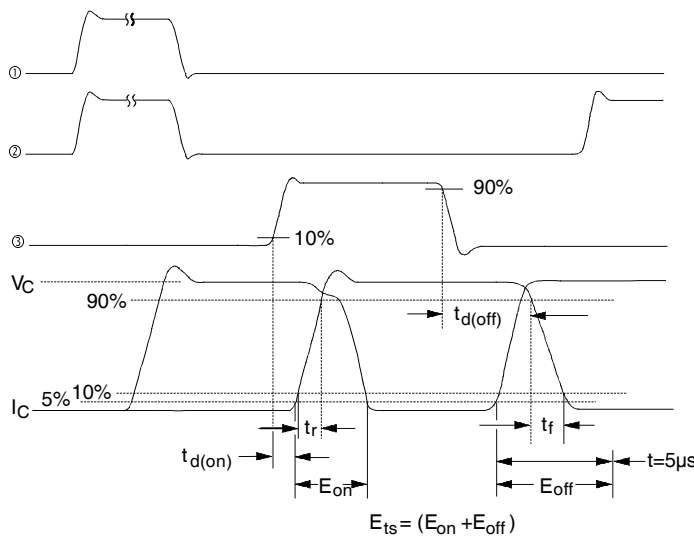


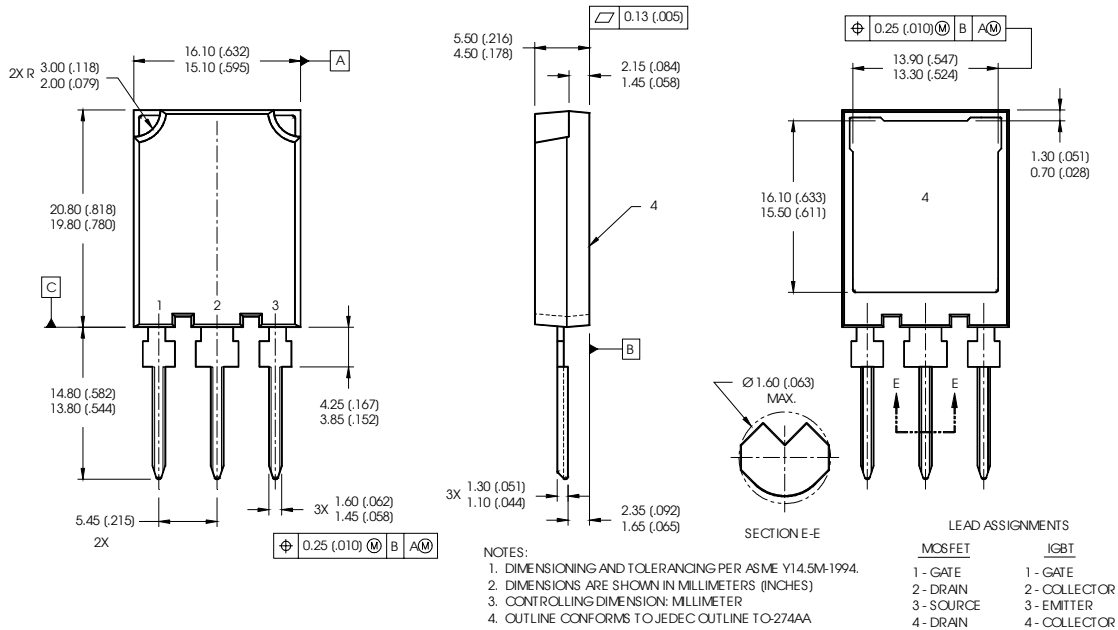
Fig. 14b - Switching Loss Waveforms

# IRG4PSC71K

International  
**IR** Rectifier

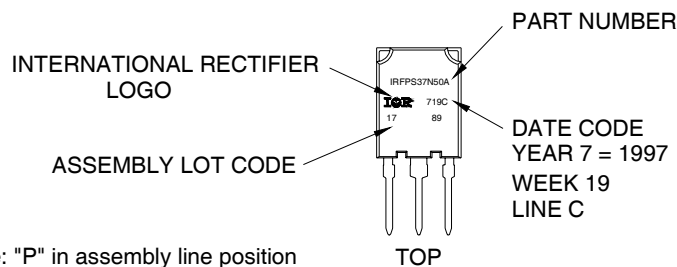
## Super-247™ (TO-274AA) Package Outline

Dimensions are shown in millimeters



## 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"

International  
**IR** Rectifier

**IR WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105  
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