



**THE DATASHEET OF  
IRG4PSC71KPBF**



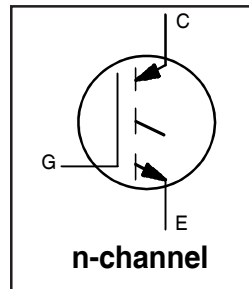
# IRG4PSC71K

INSULATED GATE BIPOLAR TRANSISTOR

Short Circuit Rated  
 UltraFast IGBT

## Features

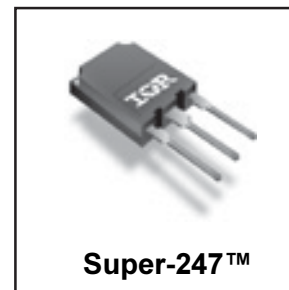
- Hole-less clip/pressure mount package compatible with TO-247 and TO-264, with reinforced pins
- High abort circuit rating IGBTs, optimized for motorcontrol
- Minimum switching losses combined with low conduction losses
- Tightest parameter distribution
- Creepage distance increased to 5.35mm



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

## 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)**

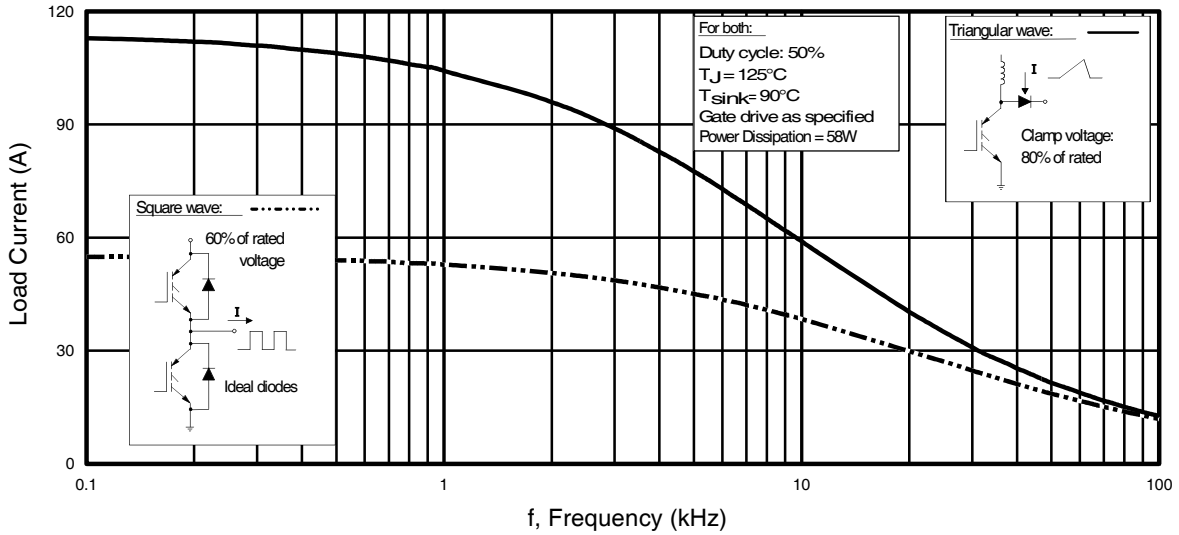
|  | Parameter                                       | Min. | Typ. | Max. | Units | Conditions   |
|--|---|------|------|------|-------|--|
| V <sub>(BR)CES</sub>                   | Collector-to-Emitter Breakdown Voltage          | 600  | —    | —    | V     | V <sub>GE</sub> = 0V, I <sub>C</sub> = 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<br>I <sub>C</sub> = 100A<br>I <sub>C</sub> = 60A, T <sub>J</sub> = 150°C<br>V <sub>GE</sub> = 15V<br>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)**

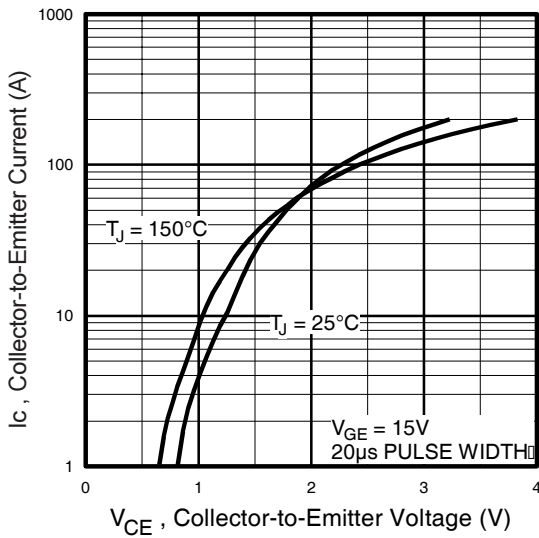
|                     | Parameter                         | Min. | Typ. | Max. | Units | Conditions  |
|---------------------|-----------------------------------|------|------|------|-------|---|
| Q <sub>g</sub>      | Total Gate Charge (turn-on)       | —    | 340  | 510  | nC    | I <sub>C</sub> = 60A<br>V <sub>CC</sub> = 400V<br>V <sub>GE</sub> = 15V<br>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<br>I <sub>C</sub> = 60A, V <sub>CC</sub> = 480V<br>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<br>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<br>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<br>I <sub>C</sub> = 60A, V <sub>CC</sub> = 480V<br>V <sub>GE</sub> = 15V, R <sub>G</sub> = 5.0Ω,<br>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<br>V <sub>CC</sub> = 30V<br>f = 1.0MHz<br>See Fig. 7   |
| C <sub>oes</sub>    | Output Capacitance                | —    | 730  | —    |       |   |
| C <sub>res</sub>    | Reverse Transfer Capacitance      | —    | 190  | —    |       |   |

**Notes:**

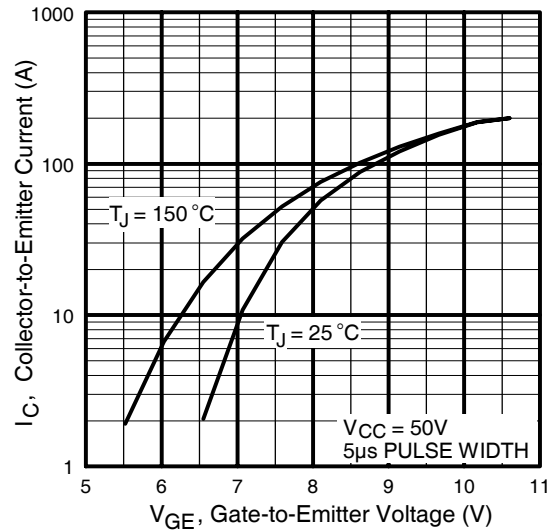
- ① Repetitive rating; V<sub>GE</sub> = 20V, pulse width limited by max. junction temperature. ( See fig. 13b )
- ② V<sub>CC</sub> = 80%(V<sub>CES</sub>), V<sub>GE</sub> = 20V, L = 10μH, R<sub>G</sub> = 5.0Ω, (See fig. 13a)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
-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

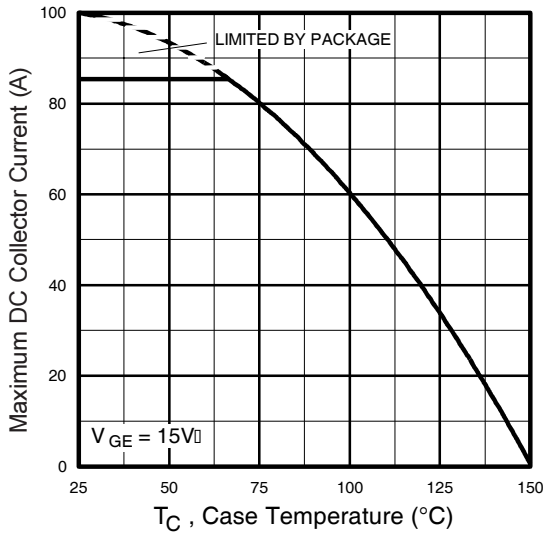


Fig. 4 - Maximum Collector Current vs. Case Temperature

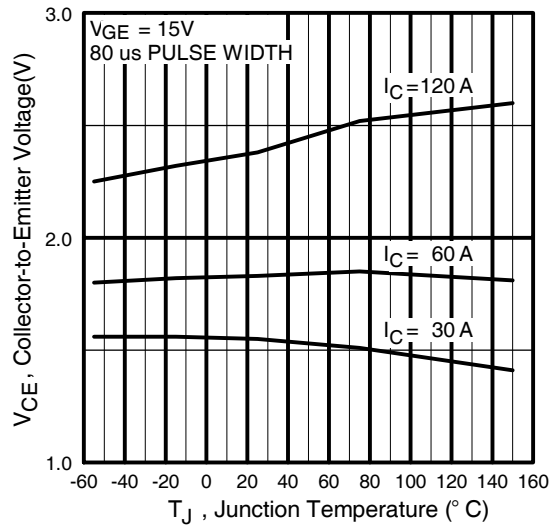


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

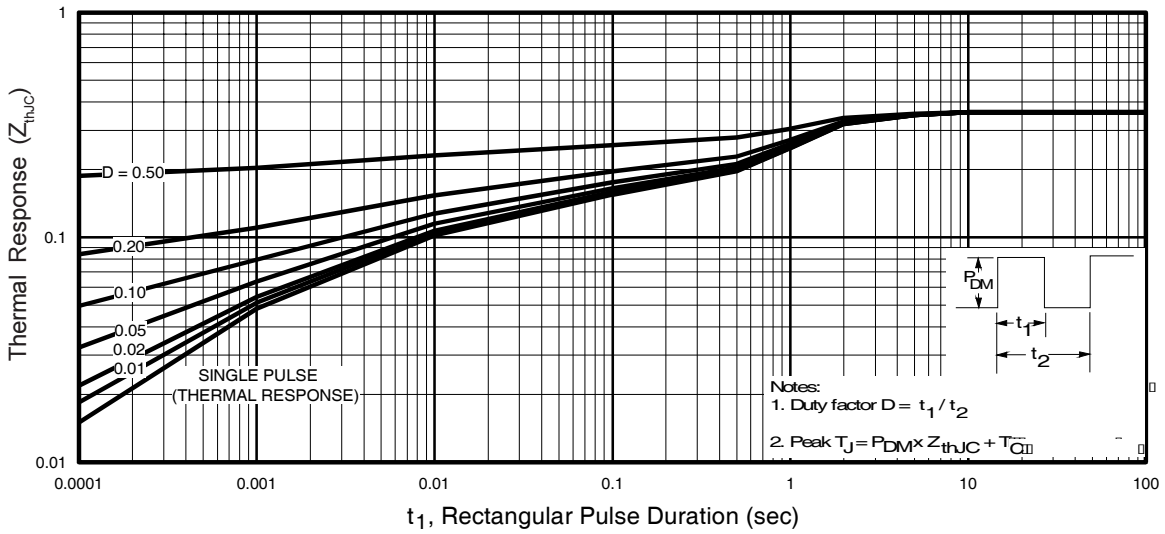


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

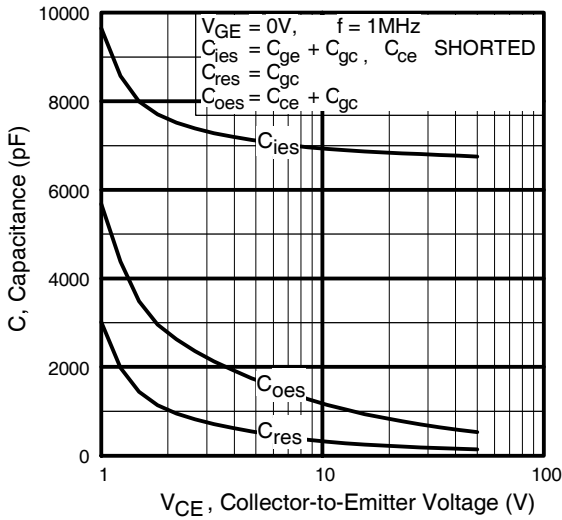


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

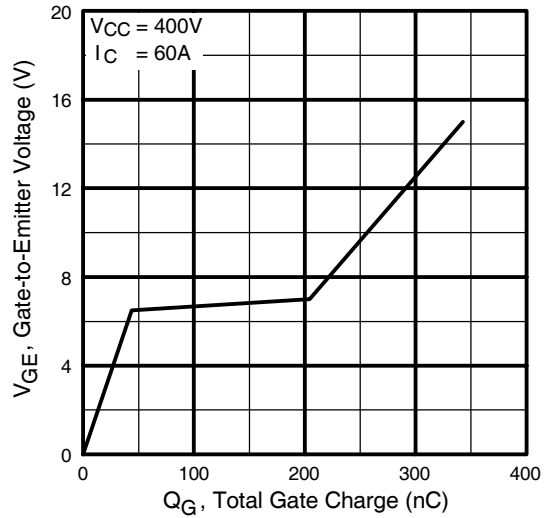


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

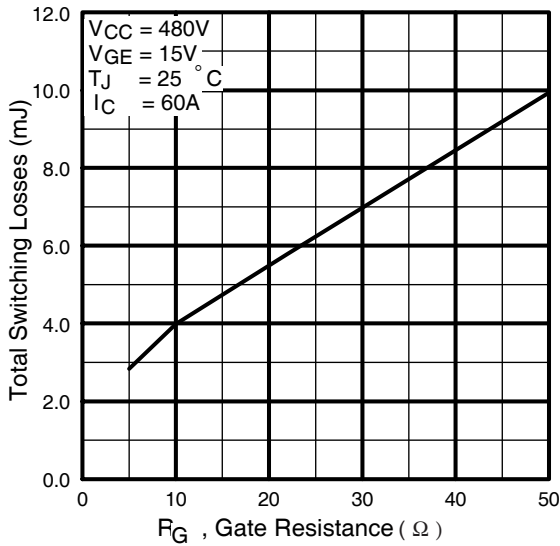


Fig. 9 - Typical Switching Losses vs. Gate Resistance

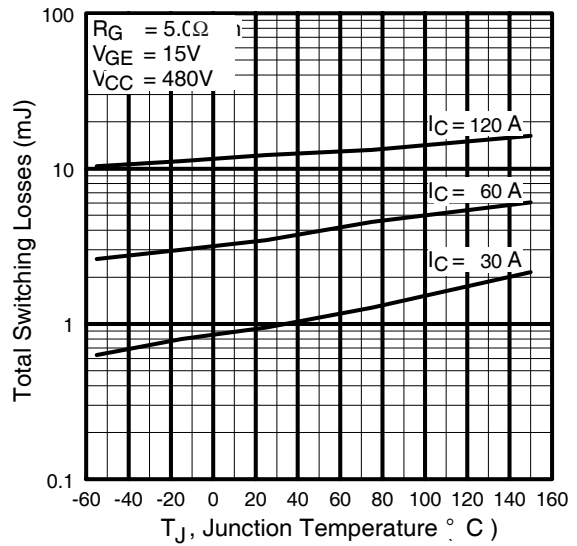


Fig. 10 - Typical Switching Losses vs. Junction Temperature

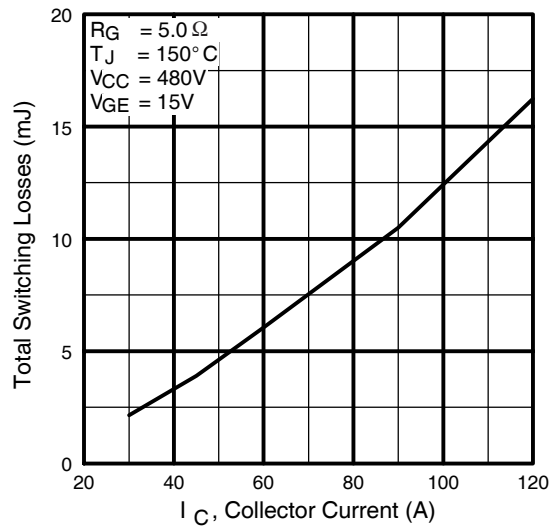


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

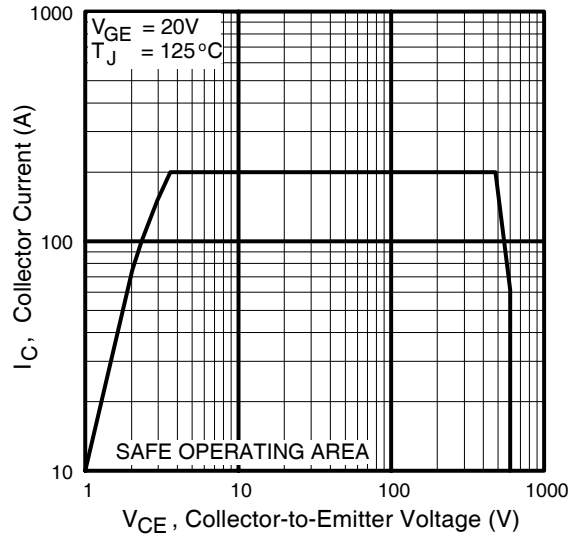
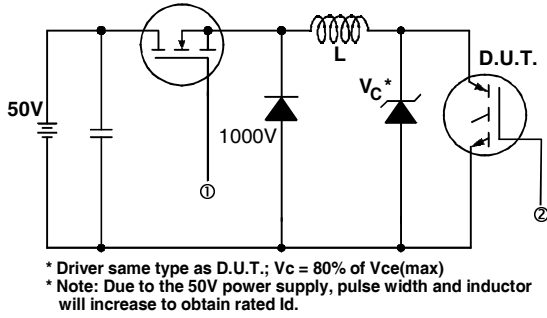
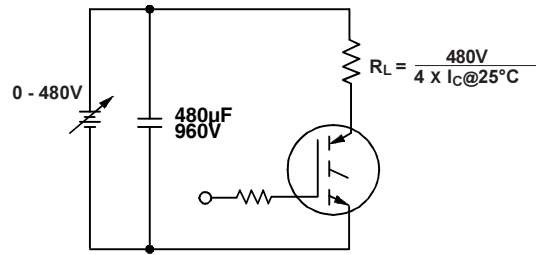


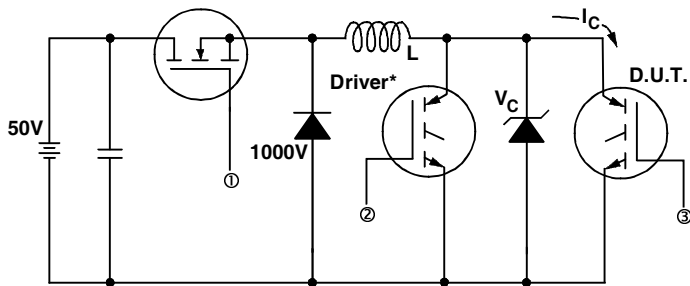
Fig. 12 - Turn-Off SOA



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

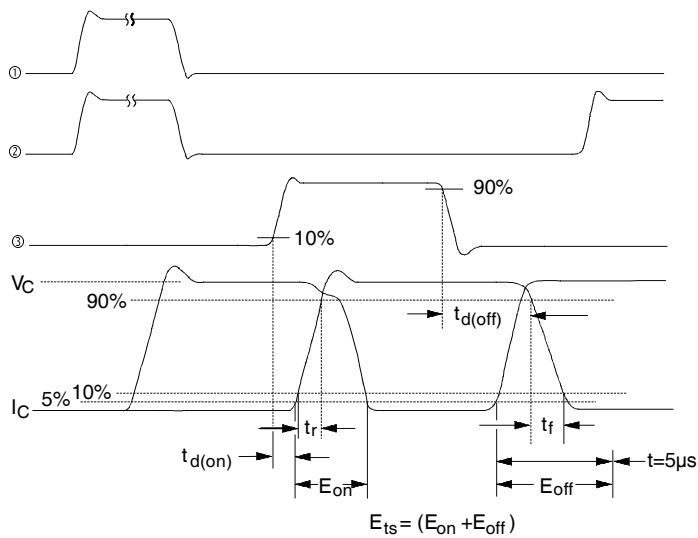


**Fig. 13b** - Pulsed Collector Current Test Circuit



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

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



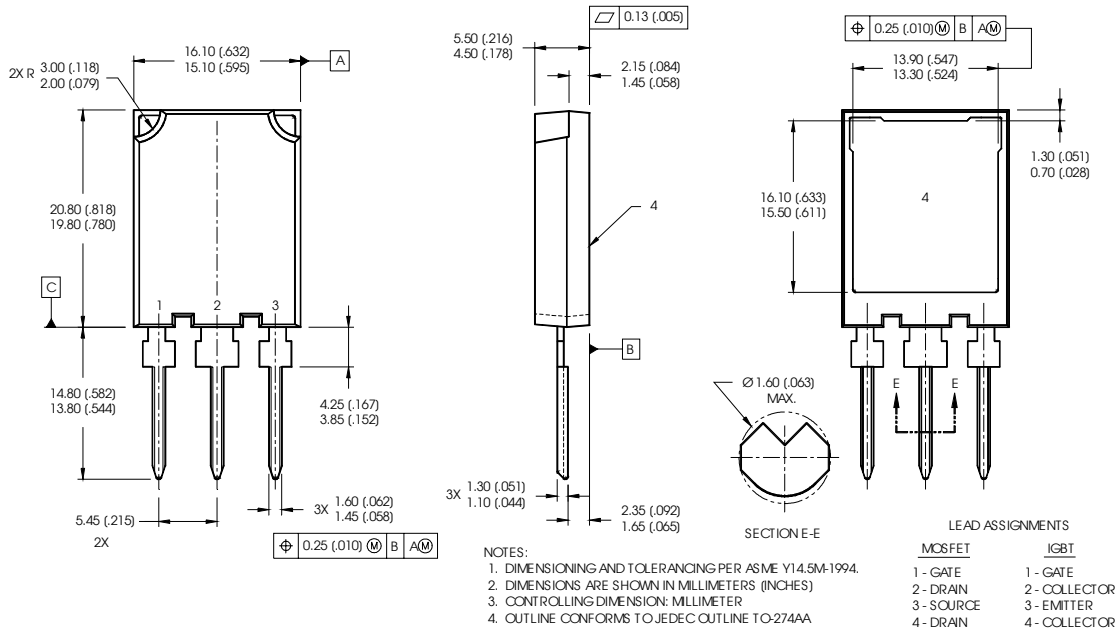
**Fig. 14b** - Switching Loss Waveforms

# IRG4PSC71K

International  
**IR** Rectifier

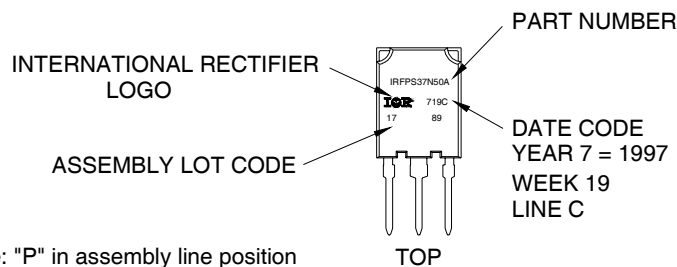
## Super-247™ (TO-274AA) Package Outline

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  
TAC Fax: (310) 252-7903

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