PD - 91683B

International
IOR Rectifier

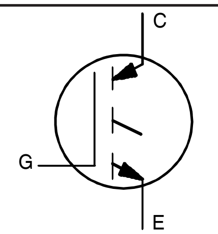
# IRG4PSC71K

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



**n-channel**

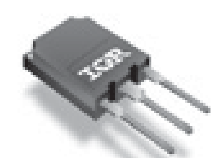
$V_{CES}$ = 600V

$V_{CE(on)\ typ.}$ = 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


**Super-247™**

## Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $V_{CES}$ | Collector-to-Emitter Breakdown Voltage | 600 | V |
| $I_C$ @ $T_C$ = 25°C | Continuous Collector Current | 85⑥ | A |
| $I_C$ @ $T_C$ = 100°C | Continuous Collector Current | 60 | |
| $I_{CM}$ | Pulsed Collector Current ① | 200 | |
| $I_{LM}$ | Clamped Inductive Load Current ① | 200 | |
| $t_{SC}$ | Short Circuit Withstand Time | 10 | µs |
| $V_{GE}$ | Gate-to-Emitter Voltage | ± 20 | V |
| $E_{ARV}$ | Reverse Voltage Avalanche Energy ① | 180 | mJ |
| $P_D$ @ $T_C$ = 25°C | Maximum Power Dissipation | 350 | W |
| $P_D$ @ $T_C$ = 100°C | Maximum Power Dissipation | 140 | |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -55 to + 150 | °C |
| | 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) |



3/18/05

## Electrical Characteristics @ $T_J$ = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)CES}$ | Collector-to-Emitter Breakdown Voltage | 600 | — | — | V | $V_{GE}$ = 0V, $I_C$ = 250µA |
| $V_{(BR)ECS}$ | 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 | — | 0.5 | — | V/°C | $V_{GE}$ = 0V, $I_C$ = 10mA |
| $V_{CE(ON)}$ | Collector-to-Emitter Saturation Voltage | — | 1.83 | 2.3 | V | $I_C$ = 60A, $V_{GE}$ = 15V |
| | | — | 2.20 | — | | $I_C$ = 100A, See Fig.2, 5 |
| | | — | 1.81 | — | | $I_C$ = 60A , $T_J$ = 150°C |
| $V_{GE(th)}$ | Gate Threshold Voltage | 3.0 | — | 6.0 | | $V_{CE}$ = $V_{GE}$, $I_C$ = 250µA |
| $\Delta V_{GE(th)}/\Delta T_J$ | Temperature Coeff. of Threshold Voltage | — | -8.0 | — | mV/°C | $V_{CE}$ = $V_{GE}$, $I_C$ = 1.5mA |
| $g_{fe}$ | Forward Transconductance ⑤ | 31 | 46 | — | S | $V_{CE}$ = 50V, $I_C$ = 60A |
| $I_{CES}$ | Zero Gate Voltage Collector Current | — | — | 500 | µA | $V_{GE}$ = 0V, $V_{CE}$ = 600V |
| | | — | — | 2.0 | | $V_{GE}$ = 0V, $V_{CE}$ = 10V, $T_J$ = 25°C |
| | | — | — | 5.0 | mA | $V_{GE}$ = 0V, $V_{CE}$ = 600V, $T_J$ = 150°C |
| $I_{GES}$ | Gate-to-Emitter Leakage Current | — | — | ±100 | nA | $V_{GE}$ = ±20V |

## Switching Characteristics @ $T_J$ = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge (turn-on) | — | 340 | 510 | nC | $I_C$ = 60A |
| $Q_{ge}$ | Gate - Emitter Charge (turn-on) | — | 44 | 66 | | $V_{CC}$ = 400V See Fig.8 |
| $Q_{gc}$ | Gate - Collector Charge (turn-on) | — | 160 | 240 | | $V_{GE}$ = 15V |
| $t_{d(on)}$ | Turn-On Delay Time | — | 34 | — | ns | |
| $t_r$ | Rise Time | — | 54 | — | | $T_J$ = 25°C |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 251 | 377 | | $I_C$ = 60A, $V_{CC}$ = 480V |
| $t_f$ | Fall Time | — | 89 | 133 | | $V_{GE}$ = 15V, $R_G$ = 5.0Ω |
| $E_{on}$ | Turn-On Switching Loss | — | 0.79 | — | mJ | Energy losses include "tail" |
| $E_{off}$ | Turn-Off Switching Loss | — | 1.98 | — | | and diode reverse recovery |
| $E_{ts}$ | Total Switching Loss | — | 2.77 | 3.1 | | See Fig. 9,10,18 |
| $t_{sc}$ | Short Circuit Withstand Time | 10 | — | — | µs | $V_{CC}$ = 360V, $T_J$ = 125°C<br>$V_{GE}$ = 15V, $R_G$ = 5.0Ω |
| $t_{d(on)}$ | Turn-On Delay Time | — | 37 | — | ns | $T_J$ = 150°C, See Fig. 10,11,18 |
| $t_r$ | Rise Time | — | 56 | — | | $I_C$ = 60A, $V_{CC}$ = 480V |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 356 | — | | $V_{GE}$ = 15V, $R_G$ = 5.0Ω, |
| $t_f$ | Fall Time | — | 177 | — | | Energy losses include "tail" |
| $E_{ts}$ | Total Switching Loss | — | 5.5 | — | mJ | and diode reverse recovery |
| $L_E$ | Internal Emitter Inductance | — | 13 | — | nH | Measured 5mm from package |
| $C_{ies}$ | Input Capacitance | — | 6900 | — | pF | $V_{GE}$ = 0V |
| $C_{oes}$ | Output Capacitance | — | 730 | — | | $V_{CC}$ = 30V See Fig. 7 |
| $C_{res}$ | Reverse Transfer Capacitance | — | 190 | — | | $f$ = 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 = 10µH, $R_G$ = 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)

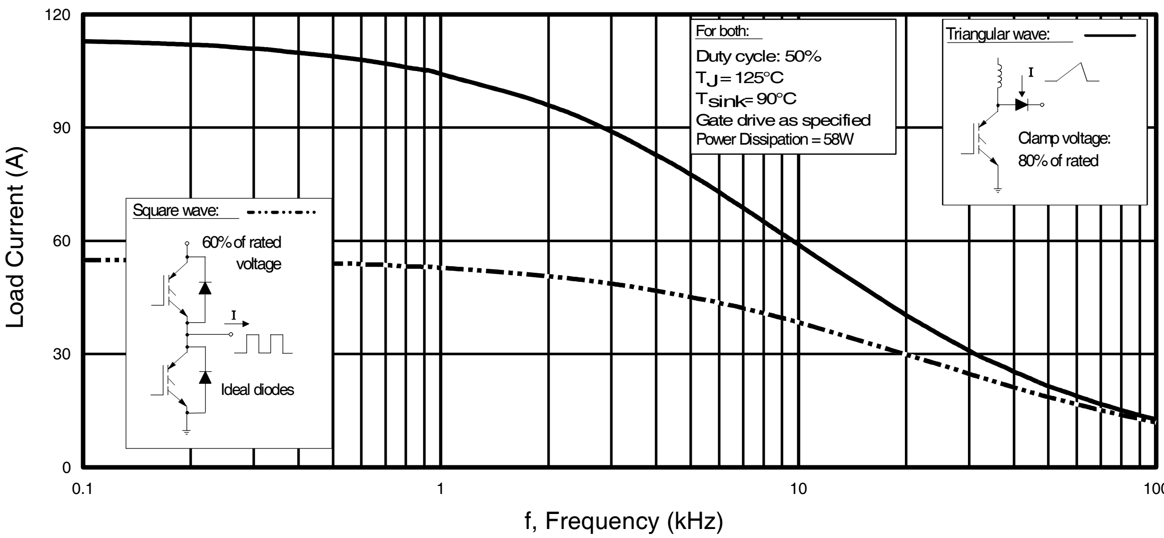



**Fig. 1** - Typical Load Current vs. Frequency
(For square wave, $I=I_{RMS}$ of fundamental; for triangular wave, $I=I_{PK}$)

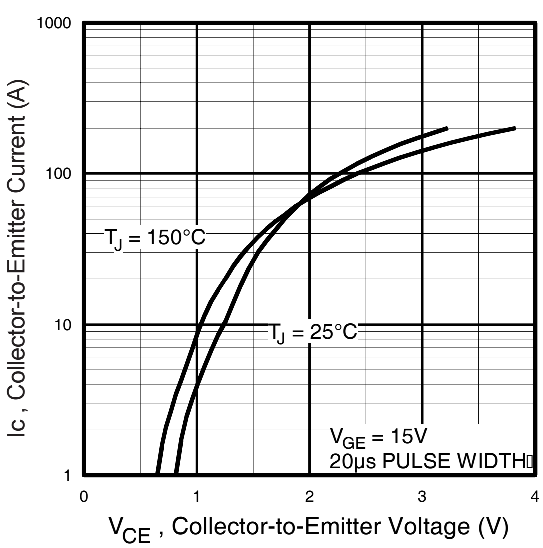



**Fig. 2** - Typical Output Characteristics

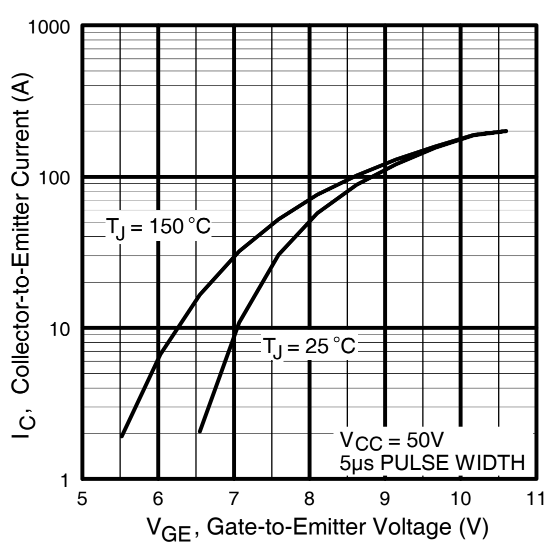



**Fig. 3** - Typical Transfer Characteristics

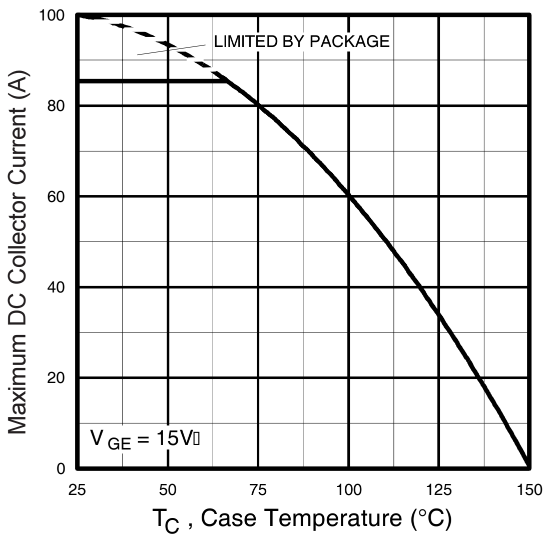



**Fig. 4** - Maximum Collector Current vs. Case Temperature

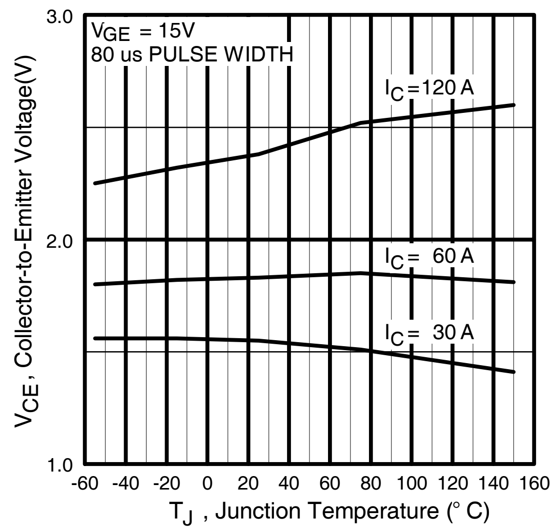



**Fig. 5** - Collector-to-Emitter Voltage vs. Junction Temperature

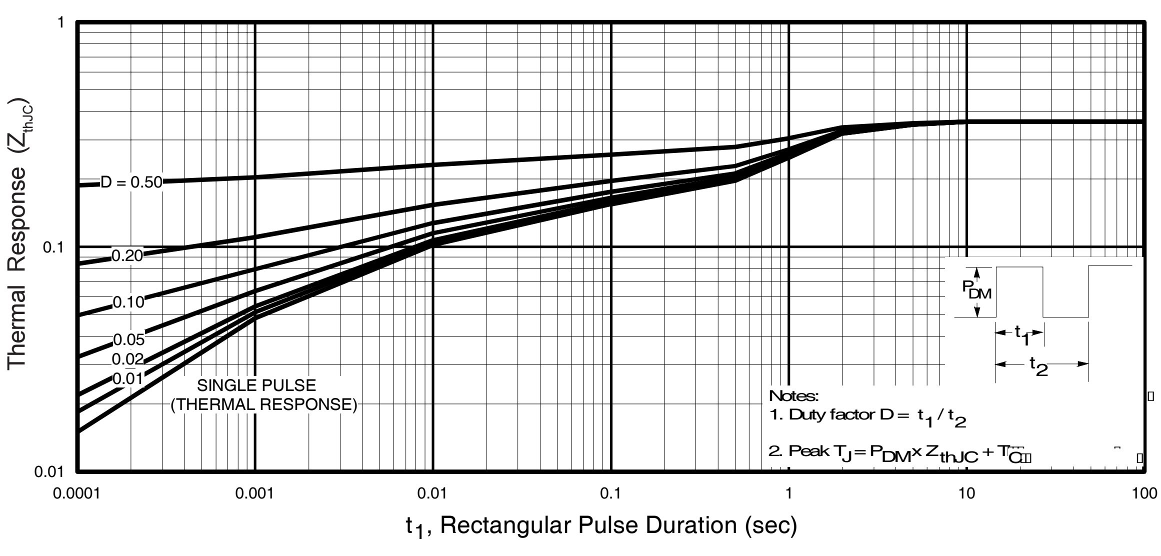



**Fig. 6** - Maximum Effective Transient Thermal Impedance, Junction-to-Case

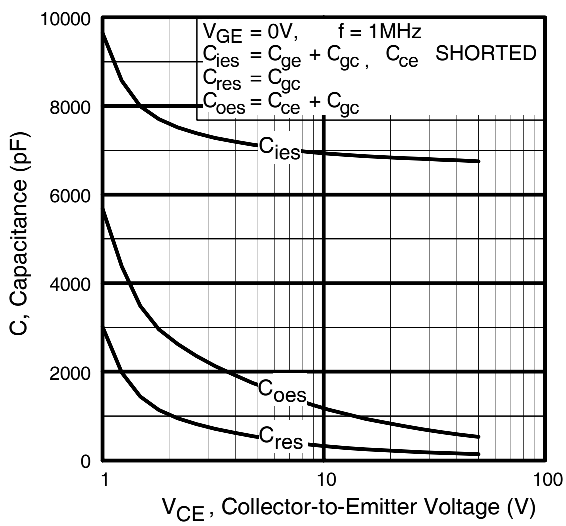



**Fig. 7 -** Typical Capacitance vs. Collector-to-Emitter Voltage

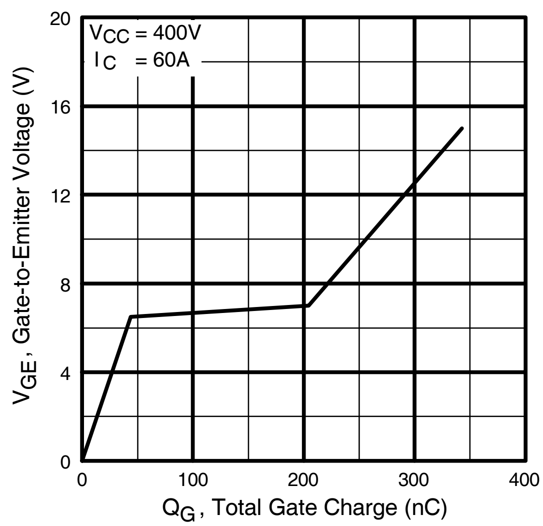



**Fig. 8** - Typical Gate Charge vs. Gate-to-Emitter Voltage

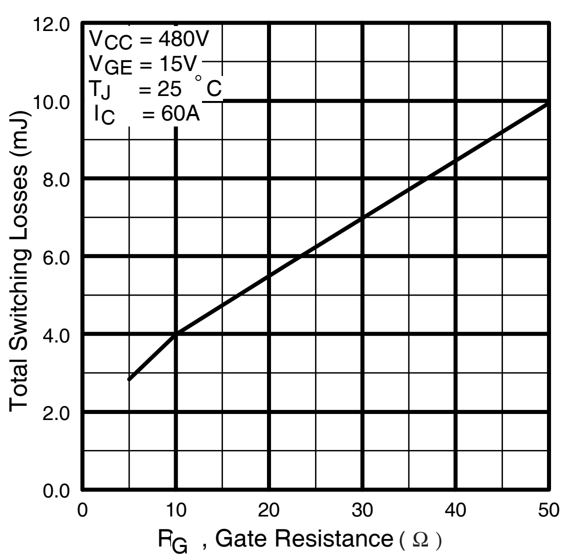



**Fig. 9** - Typical Switching Losses vs. Gate Resistance

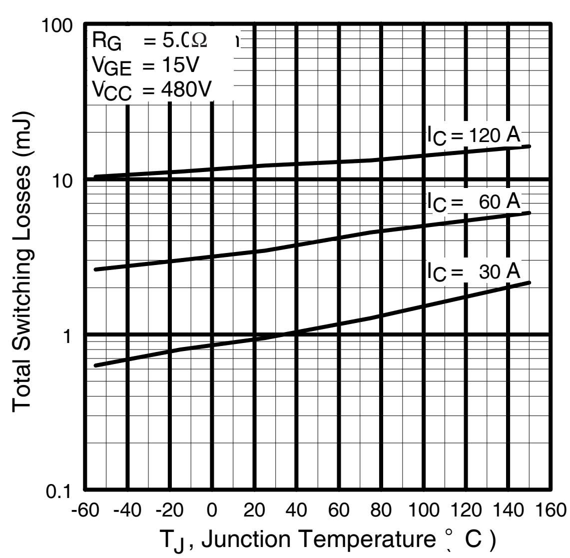



**Fig. 10** - Typical Switching Losses vs. Junction Temperature

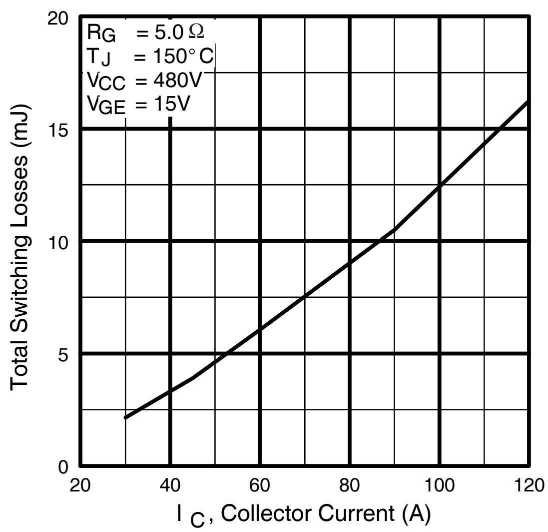



**Fig. 11 -** Typical Switching Losses vs. Collector-to-Emitter Current

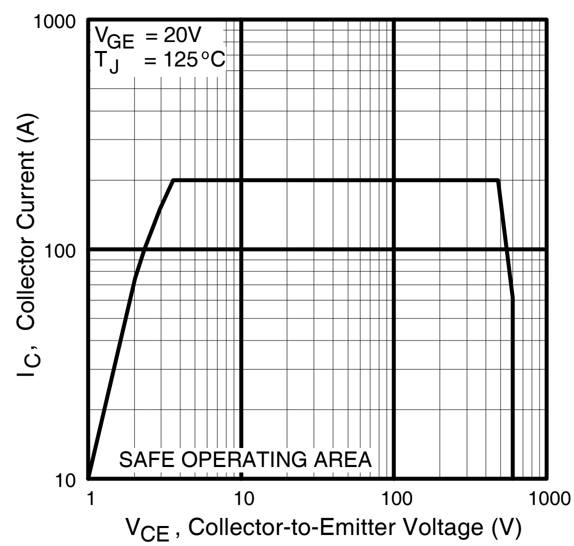
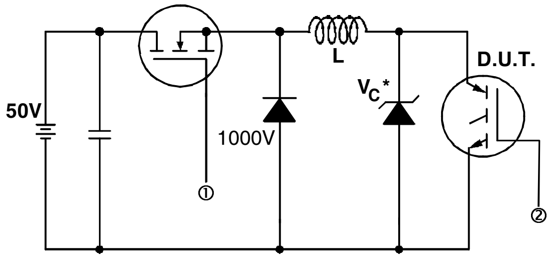



**Fig. 12** - Turn-Off SOA




* Driver same type as D.U.T.; Vc = 80% of Vce(max)
* Note: Due to the 50V power supply, pulse width and inductor will increase to obtain rated Id.

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

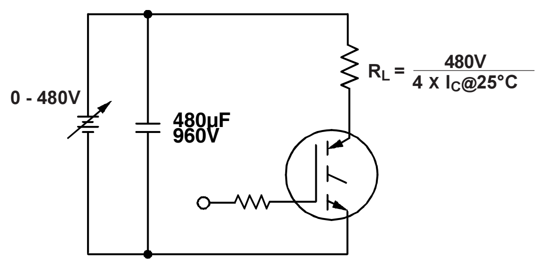



**Fig. 13b** - Pulsed Collector Current Test Circuit

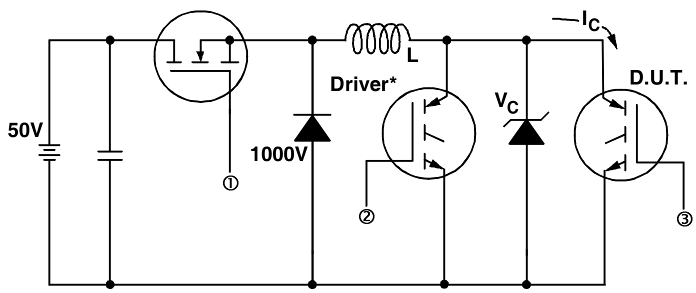



**Fig. 14a** - Switching Loss Test Circuit

* Driver same type as D.U.T., VC = 480V

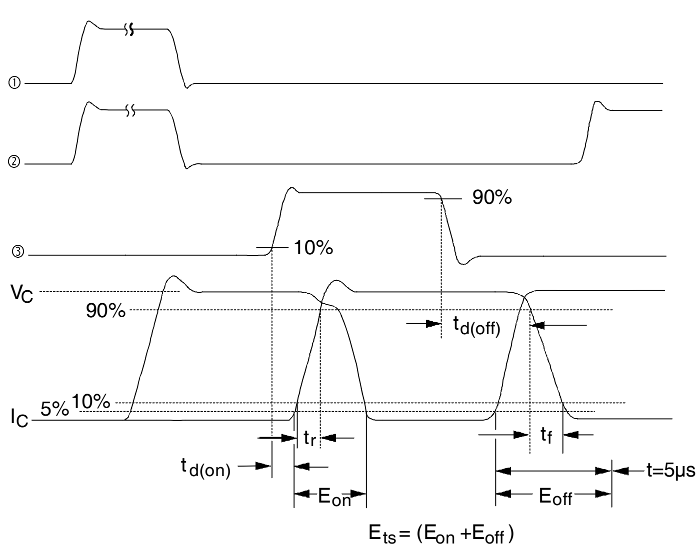
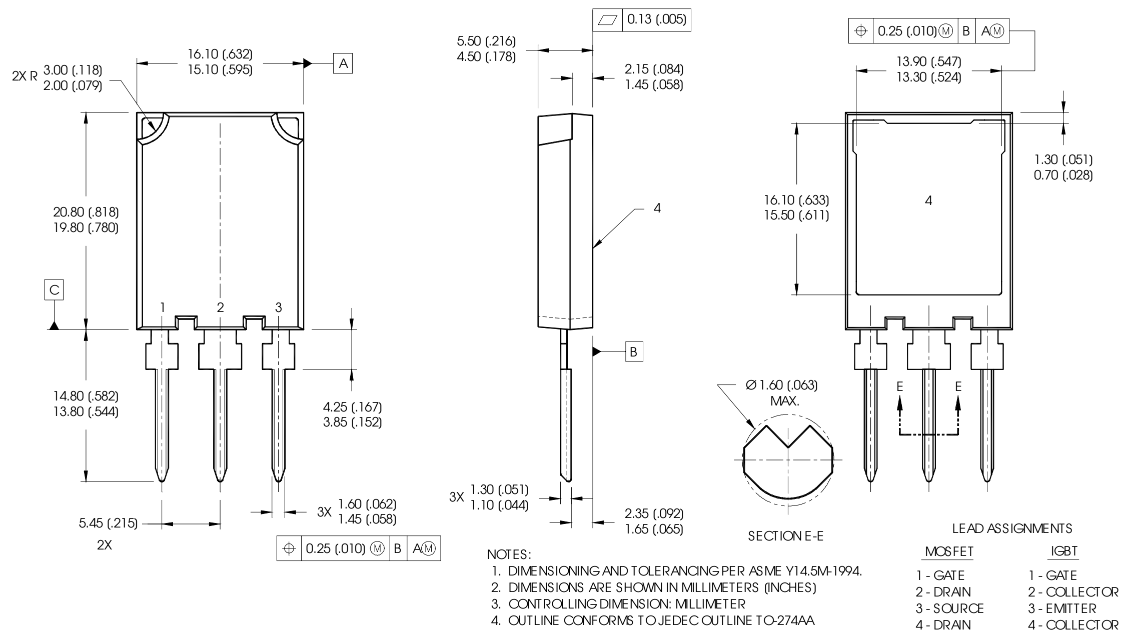



**Fig. 14b** - Switching Loss Waveforms

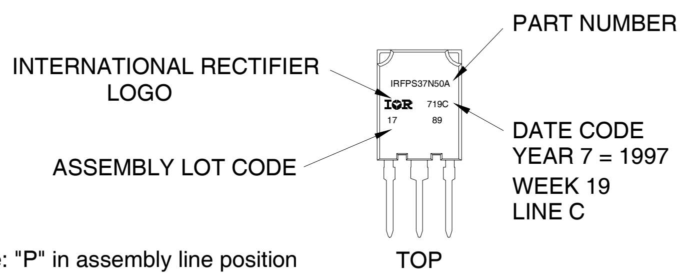
## Super-247™ (TO-274AA) Package Outline

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"

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**IR WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903
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