

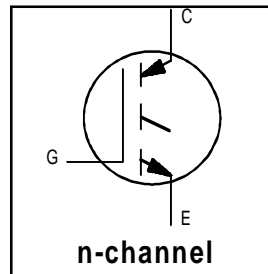
IRG4PC50K

Short Circuit Rated
 UltraFast IGBT

INSULATED GATE BIPOLAR TRANSISTOR

Features

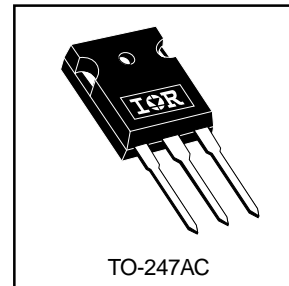
- High short circuit rating optimized for motor control, $t_{sc} = 10\mu s$, @360V V_{CE} (start), $T_J = 125^\circ C$, $V_{GE} = 15V$
- Combines low conduction losses with high switching speed
- Latest generation design provides tighter parameter distribution and higher efficiency than previous generations



| |
|-----------------------------|
| $V_{CES} = 600V$ |
| $V_{CE(on) typ.} = 1.84V$ |
| @ $V_{GE} = 15V, I_C = 30A$ |

Benefits

- As a Freewheeling Diode we recommend our HEXFRED™ ultrafast, ultrasoft recovery diodes for minimum EMI / Noise and switching losses in the Diode and IGBT
- Latest generation 4 IGBTs offer highest power density motor controls possible
- This part replaces the IRGPC50K and IRGPC50M devices



Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---------------------------|------------------------------------|--------------------|------------|
| V_{CES} | Collector-to-Emitter Voltage | 600 | V |
| $I_C @ T_C = 25^\circ C$ | Continuous Collector Current | 52 | A |
| $I_C @ T_C = 100^\circ C$ | Continuous Collector Current | 30 | |
| I_{CM} | Pulsed Collector Current ① | 104 | |
| I_{LM} | Clamped Inductive Load Current ② | 104 | |
| t_{sc} | Short Circuit Withstand Time | 10 | μs |
| V_{GE} | Gate-to-Emitter Voltage | ± 20 | V |
| E_{ARV} | Reverse Voltage Avalanche Energy ③ | 170 | mJ |
| $P_D @ T_C = 25^\circ C$ | Maximum Power Dissipation | 200 | W |
| $P_D @ T_C = 100^\circ C$ | Maximum Power Dissipation | 78 | |
| T_J | Operating Junction and | -55 to +150 | $^\circ C$ |
| T_{STG} | Storage Temperature Range | | |
| | Soldering Temperature, for 10 sec. | | |
| | Mounting torque, 6-32 or M3 screw. | 10 lbf•in (1.1N•m) | |

Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|-----------------|---|----------|------|--------------|
| $R_{\theta JC}$ | Junction-to-Case | — | 0.64 | $^\circ C/W$ |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.24 | — | |
| $R_{\theta JA}$ | Junction-to-Ambient, typical socket mount | — | 40 | |
| 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 | 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 | — | 0.47 | — | V/°C | $V_{GE} = 0V, I_C = 1.0mA$ |
| $V_{CE(ON)}$ | Collector-to-Emitter Saturation Voltage | — | 1.84 | 2.2 | V | $I_C = 30A$ $I_C = 52A$ $I_C = 30A, T_J = 150^\circ\text{C}$ $V_{GE} = 15V$ See Fig.2, 5 |
| | | — | 2.19 | — | | |
| | | — | 1.79 | — | | |
| $V_{GE(th)}$ | 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 | — | -12 | — | mV/°C | $V_{CE} = V_{GE}, I_C = 250\mu A$ |
| g_{fe} | Forward Transconductance ⑤ | 17 | 24 | — | S | $V_{CE} = 100V, I_C = 30A$ |
| I_{CES} | Zero Gate Voltage Collector Current | — | — | 250 | μA | $V_{GE} = 0V, V_{CE} = 600V$ |
| | | — | — | 2.0 | | $V_{GE} = 0V, V_{CE} = 10V, T_J = 25^\circ\text{C}$ |
| | | — | — | 5000 | | $V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$ |
| 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) | — | 200 | 300 | nC | $I_C = 30A$ $V_{CC} = 400V$ $V_{GE} = 15V$ See Fig.8 |
| Q_{ge} | Gate - Emitter Charge (turn-on) | — | 25 | 38 | | |
| Q_{gc} | Gate - Collector Charge (turn-on) | — | 85 | 130 | | |
| $t_{d(on)}$ | Turn-On Delay Time | — | 38 | — | ns | $T_J = 25^\circ\text{C}$ $I_C = 30A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 5.0\Omega$ |
| t_r | Rise Time | — | 34 | — | | |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 160 | 240 | | |
| t_f | Fall Time | — | 79 | 120 | | |
| E_{on} | Turn-On Switching Loss | — | 0.49 | — | mJ | Energy losses include "tail" See Fig. 9,10,14 |
| E_{off} | Turn-Off Switching Loss | — | 0.68 | — | | |
| E_{is} | Total Switching Loss | — | 1.12 | 1.4 | | |
| t_{sc} | Short Circuit Withstand Time | 10 | — | — | μs | $V_{CC} = 400V, T_J = 125^\circ\text{C}$ $V_{GE} = 15V, R_G = 10\Omega, V_{CPK} < 500V$ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 37 | — | ns | $T_J = 150^\circ\text{C}$ $I_C = 30A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 5.0\Omega$ Energy losses include "tail" See Fig. 11,14 |
| t_r | Rise Time | — | 35 | — | | |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 260 | — | | |
| t_f | Fall Time | — | 170 | — | | |
| E_{is} | Total Switching Loss | — | 2.34 | — | mJ | |
| L_E | Internal Emitter Inductance | — | 13 | — | nH | Measured 5mm from package |
| C_{ies} | Input Capacitance | — | 3200 | — | pF | $V_{GE} = 0V$ $V_{CC} = 30V$ $f = 1.0MHz$ See Fig. 7 |
| C_{oes} | Output Capacitance | — | 370 | — | | |
| C_{res} | Reverse Transfer Capacitance | — | 95 | — | | |

Notes:

- ① Repetitive rating; $V_{GE} = 20V$, pulse width limited by max. junction temperature. (See fig. 13b)
- ② $V_{CC} = 80\%(V_{CES}), V_{GE} = 20V, L = 10\mu H, R_G = 5.0\Omega$
- 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.

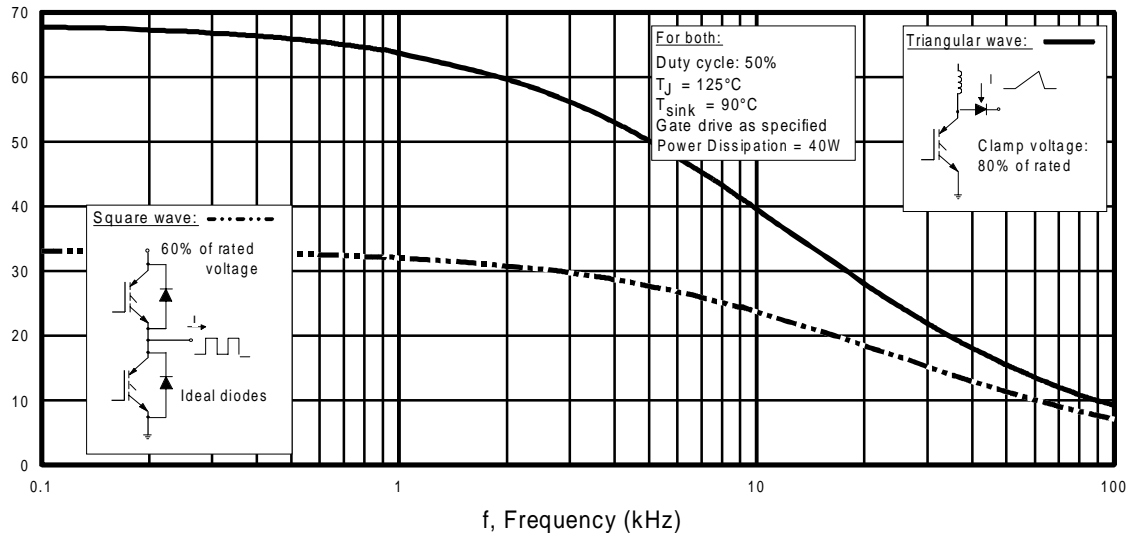


Fig. 1 - Typical Load Current vs. Frequency
 (Load Current = I_{RMS} of fundamental)

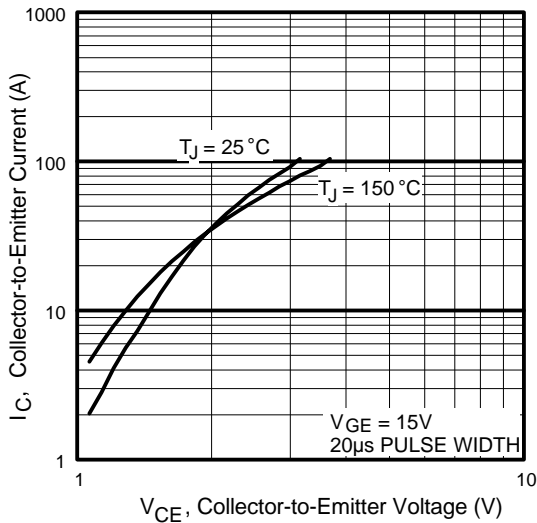


Fig. 2 - Typical Output Characteristics

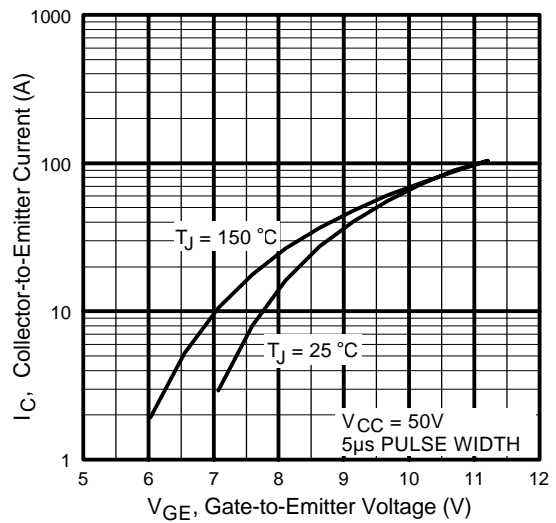


Fig. 3 - Typical Transfer Characteristics

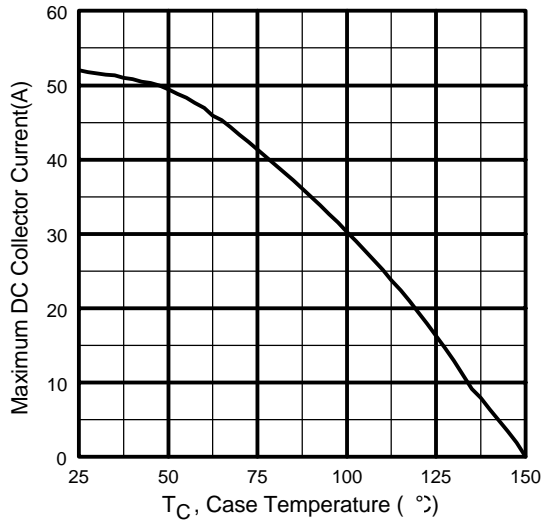


Fig. 4 - Maximum Collector Current vs. Case Temperature

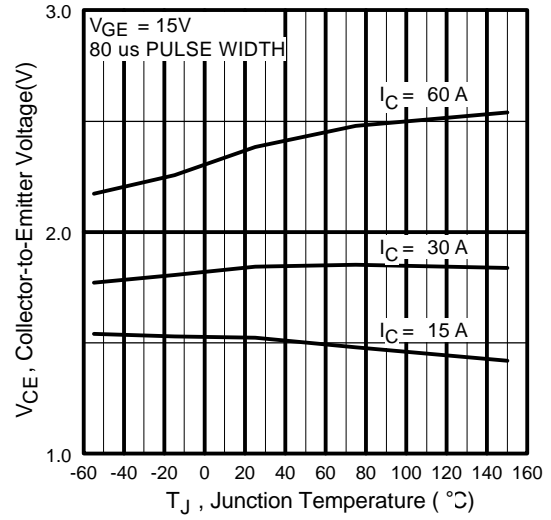


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

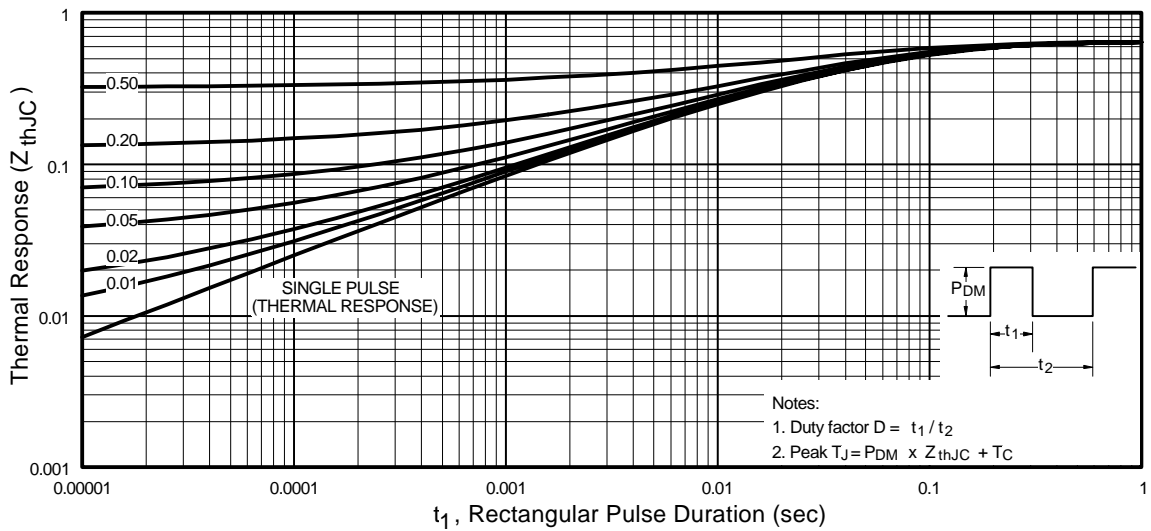


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

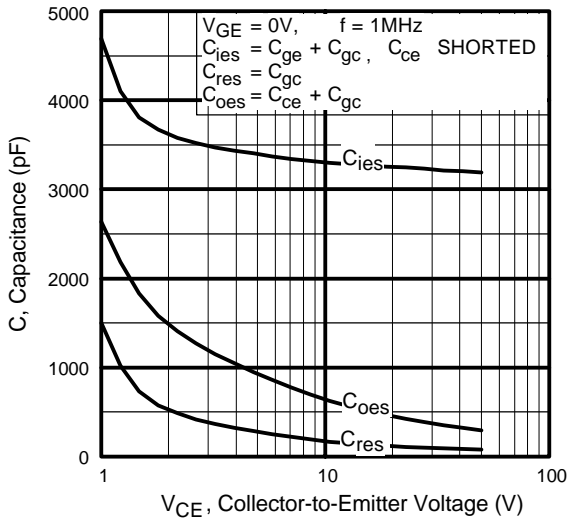


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

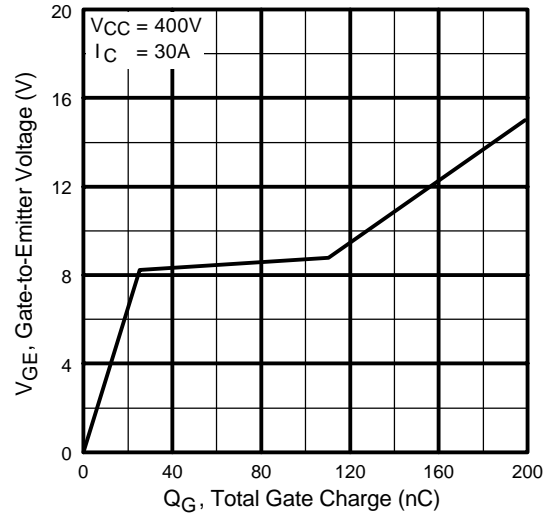


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

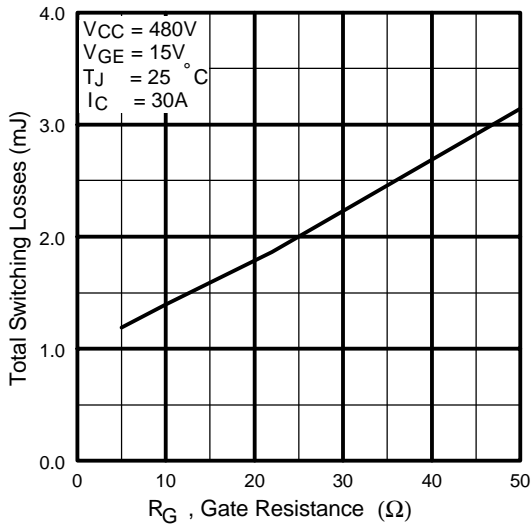


Fig. 9 - Typical Switching Losses vs. Gate Resistance

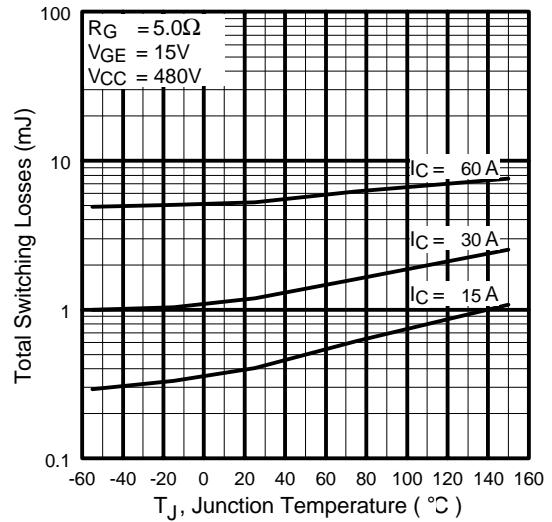


Fig. 10 - Typical Switching Losses vs. Junction Temperature

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International
IR Rectifier

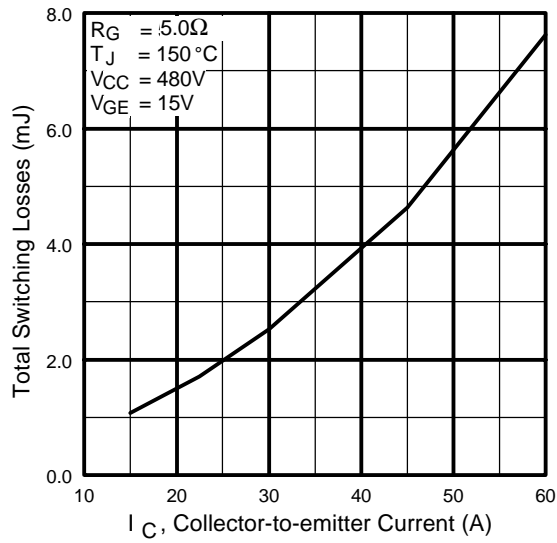


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

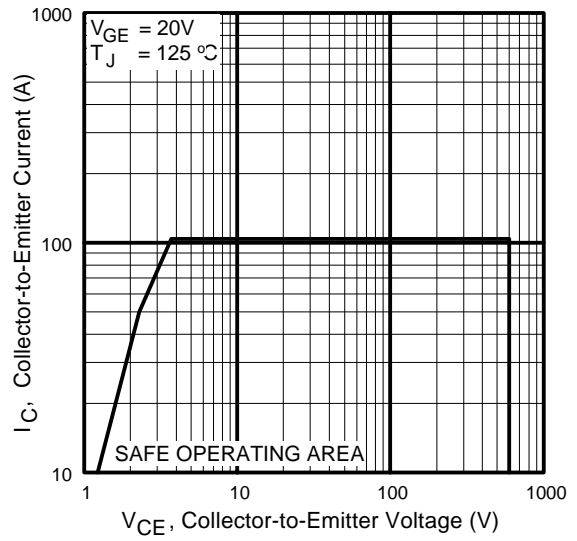


Fig. 12 - Turn-Off SOA



* 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

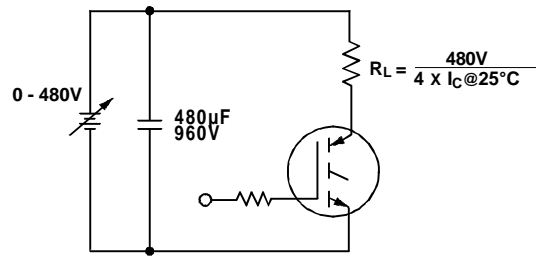


Fig. 13b - Pulsed Collector Current Test Circuit



Fig. 14a - Switching Loss Test Circuit

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

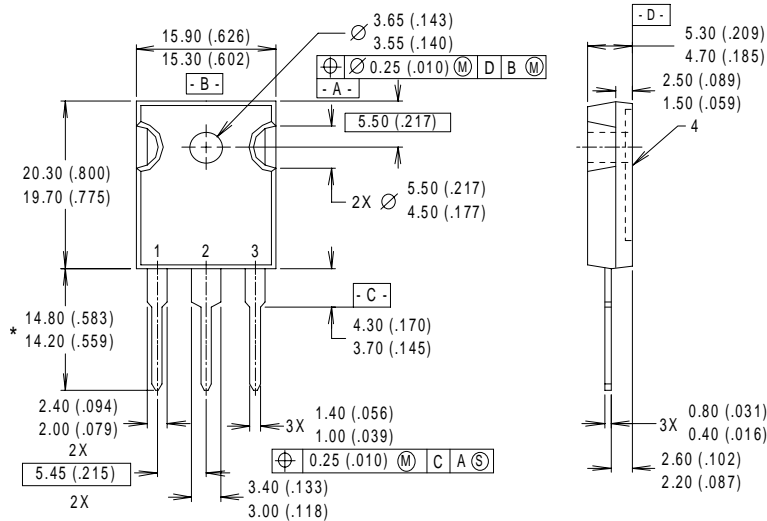


Fig. 14b - Switching Loss Waveforms

IRG4PC50K

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Case Outline and Dimensions — TO-247AC



- NOTES:
- 1 DIMENSIONS & TOLERANCING PER ANSI Y14.5M, 1982.
 - 2 CONTROLLING DIMENSION : INCH.
 - 3 DIMENSIONS ARE SHOWN MILLIMETERS (INCHES).
 - 4 CONFORMS TO JEDEC OUTLINE TO-247AC.

- LEAD ASSIGNMENTS
- 1 - GATE
 - 2 - COLLECTOR
 - 3 - EMITTER
 - 4 - COLLECTOR

* LONGER LEADED (20mm)
VERSION AVAILABLE (TO-247AD)
TO ORDER ADD "-E" SUFFIX
TO PART NUMBER

CONFORMS TO JEDEC OUTLINE TO-247AC (TO-3P)

Dimensions in Millimeters and (Inches)

International
IR Rectifier

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IR CANADA: 15 Lincoln Court, Brampton, Ontario L6T3Z2, Tel: (905) 453 2200

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Data and specifications subject to change without notice. 4/00