

Features

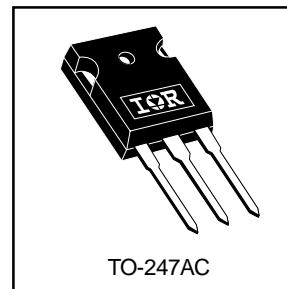
- UltraFast: Optimized for high operating frequencies 8-40 kHz in hard switching, >200 kHz in resonant mode
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency than Generation 3
- Industry standard TO-247AC package



$V_{CES} = 600V$
 $V_{CE(on) typ.} = 1.72V$
 @ $V_{GE} = 15V, I_C = 20A$

Benefits

- Generation 4 IGBT's offer highest efficiency available
- IGBT's optimized for specified application conditions
- Designed to be a "drop-in" replacement for equivalent industry-standard Generation 3 IR IGBT's



Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---------------------------|--|--------------------|-------|
| V_{CES} | Collector-to-Emitter Voltage | 600 | V |
| $I_C @ T_C = 25^\circ C$ | Continuous Collector Current | 40 | A |
| $I_C @ T_C = 100^\circ C$ | Continuous Collector Current | 20 | |
| I_{CM} | Pulsed Collector Current ① | 160 | |
| I_{LM} | Clamped Inductive Load Current ② | 160 | |
| V_{GE} | Gate-to-Emitter Voltage | ± 20 | V |
| E_{ARV} | Reverse Voltage Avalanche Energy ③ | 15 | mJ |
| $P_D @ T_C = 25^\circ C$ | Maximum Power Dissipation | 160 | W |
| $P_D @ T_C = 100^\circ C$ | Maximum Power Dissipation | 65 | |
| T_J | Operating Junction and Storage Temperature Range | -55 to +150 | °C |
| T_{STG} | | | |
| | | | |
| | Mounting torque, 6-32 or M3 screw. | 10 lbf•in (1.1N•m) | |

Thermal Resistance

| | Parameter | Min. | Typ. | Max. | Units |
|-----------------|---|-------|----------|-------|--------|
| $R_{\theta JC}$ | Junction-to-Case | ----- | ----- | 0.77 | °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 | $V_{GE} = 0V, I_C = 1.0A$ See Fig. 2, 5 | |
| $\Delta V_{(BR)CES}/\Delta T_J$ | Temperature Coeff. of Breakdown Voltage | ---- | 0.63 | ---- | V/ $^\circ\text{C}$ | $V_{GE} = 0V, I_C = 1.0mA$ | |
| $V_{CE(on)}$ | Collector-to-Emitter Saturation Voltage | ---- | 1.72 | 2.1 | V | $I_C = 20A, V_{GE} = 15V$ | |
| | | ---- | 2.15 | ---- | | | $I_C = 40A$ |
| | | ---- | 1.7 | ---- | | | $I_C = 20A, T_J = 150^\circ\text{C}$ |
| $V_{GE(th)}$ | 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 | ---- | -13 | ---- | mV/ $^\circ\text{C}$ | $V_{CE} = V_{GE}, I_C = 250\mu A$ | |
| g_{fe} | Forward Transconductance ⑤ | 11 | 18 | ---- | S | $V_{CE} = 100V, I_C = 20A$ | |
| I_{CES} | Zero Gate Voltage Collector Current | ---- | ---- | 250 | μA | $V_{GE} = 0V, V_{CE} = 600V$ | |
| | | ---- | ---- | 2.0 | | $V_{GE} = 0V, V_{CE} = 10V, T_J = 25^\circ\text{C}$ | |
| | | ---- | ---- | 2500 | | $V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$ | |
| 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) | ---- | 100 | 150 | nC | $I_C = 20A$ $V_{CC} = 400V$ See Fig. 8 $V_{GE} = 15V$ |
| Q_{ge} | Gate - Emitter Charge (turn-on) | ---- | 16 | 25 | | |
| Q_{gc} | Gate - Collector Charge (turn-on) | ---- | 40 | 60 | | |
| $t_{d(on)}$ | Turn-On Delay Time | ---- | 34 | ---- | ns | $T_J = 25^\circ\text{C}$ $I_C = 20A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 10\Omega$ Energy losses include "tail" |
| t_r | Rise Time | ---- | 19 | ---- | | |
| $t_{d(off)}$ | Turn-Off Delay Time | ---- | 110 | 175 | | |
| t_f | Fall Time | ---- | 120 | 180 | mJ | See Fig. 10, 11, 13, 14 |
| E_{on} | Turn-On Switching Loss | ---- | 0.32 | ---- | | |
| E_{off} | Turn-Off Switching Loss | ---- | 0.35 | ---- | | |
| E_{ts} | Total Switching Loss | ---- | 0.67 | 1.0 | mJ | $T_J = 150^\circ\text{C},$ $I_C = 20A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 10\Omega$ Energy losses include "tail" |
| $t_{d(on)}$ | Turn-On Delay Time | ---- | 30 | ---- | | |
| t_r | Rise Time | ---- | 19 | ---- | | |
| $t_{d(off)}$ | Turn-Off Delay Time | ---- | 220 | ---- | mJ | See Fig. 13, 14 |
| t_f | Fall Time | ---- | 160 | ---- | | |
| E_{ts} | Total Switching Loss | ---- | 1.4 | ---- | | |
| L_E | Internal Emitter Inductance | ---- | 13 | ---- | nH | Measured 5mm from package |
| C_{ies} | Input Capacitance | ---- | 2100 | ---- | pF | $V_{GE} = 0V$ $V_{CC} = 30V$ See Fig. 7 $f = 1.0MHz$ |
| C_{oes} | Output Capacitance | ---- | 140 | ---- | | |
| C_{res} | Reverse Transfer Capacitance | ---- | 34 | ---- | | |

Notes:

① Repetitive rating; $V_{GE} = 20V$, pulse width limited by max. junction temperature. (See fig. 13b)

② $V_{CC} = 80\%(V_{CES}), V_{GE} = 20V, L = 10\mu H, R_G = 10\Omega,$
(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.

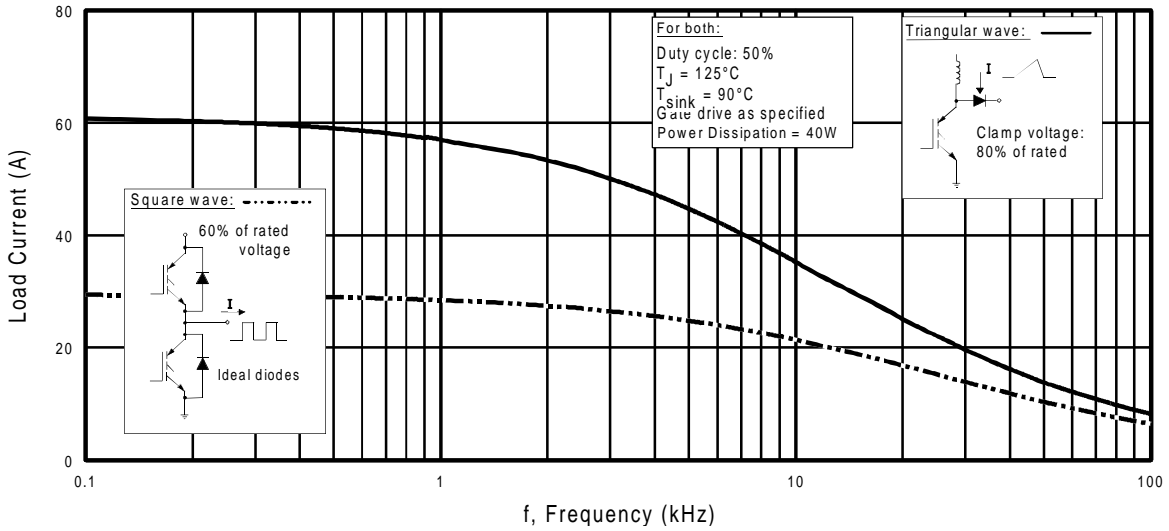


Fig. 1 - Typical Load Current vs. Frequency
 (For square wave, $I = I_{\text{RMS}}$ of fundamental; for triangular wave, $I = I_{\text{PK}}$)

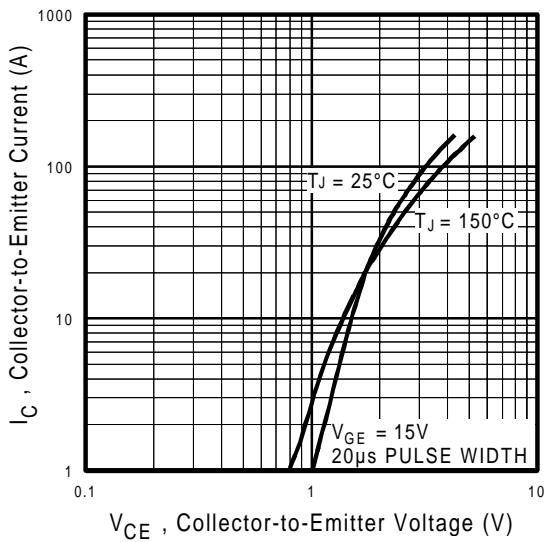


Fig. 2 - Typical Output Characteristics

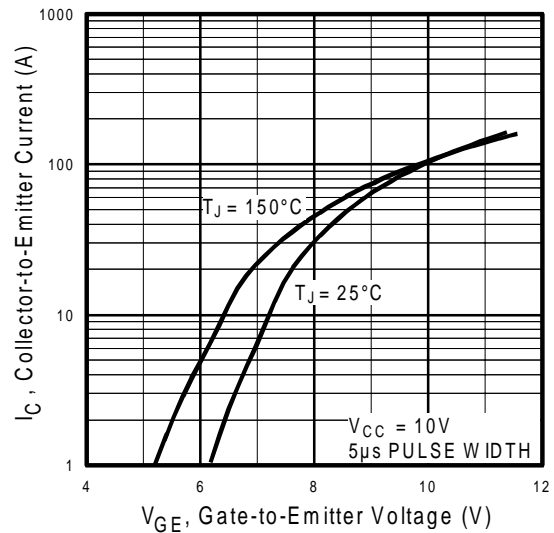


Fig. 3 - Typical Transfer Characteristics

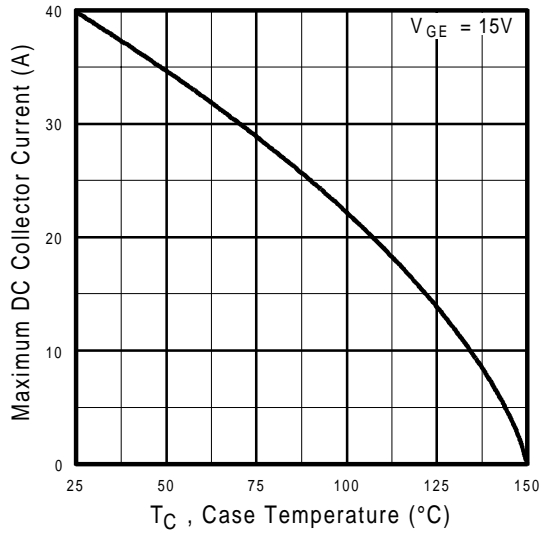


Fig. 4 - Maximum Collector Current vs. Case Temperature

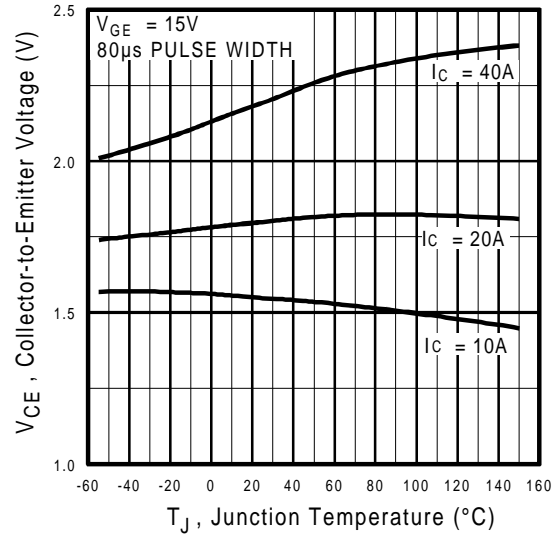


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

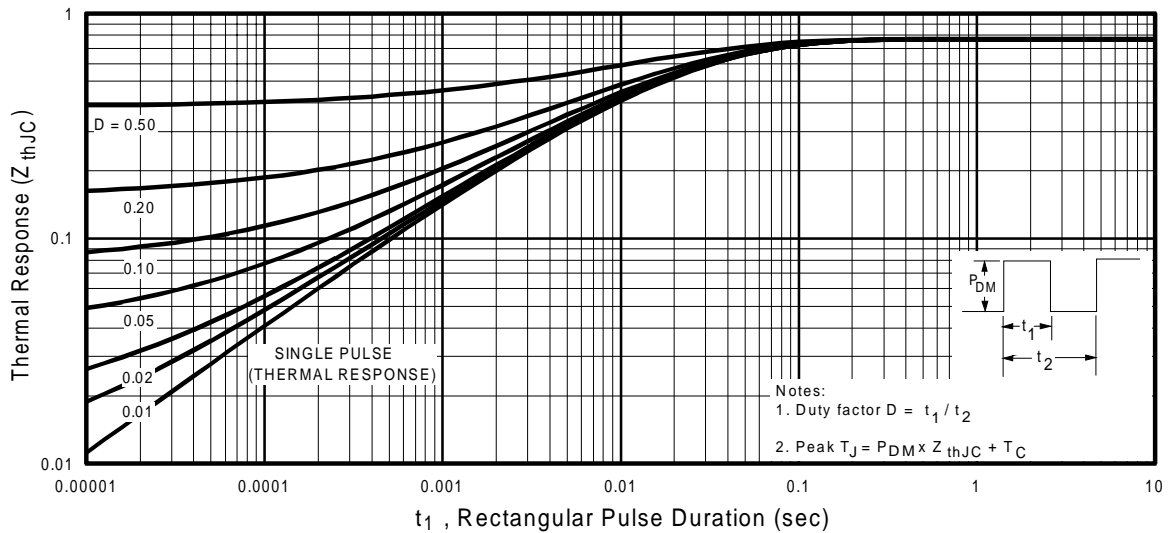


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

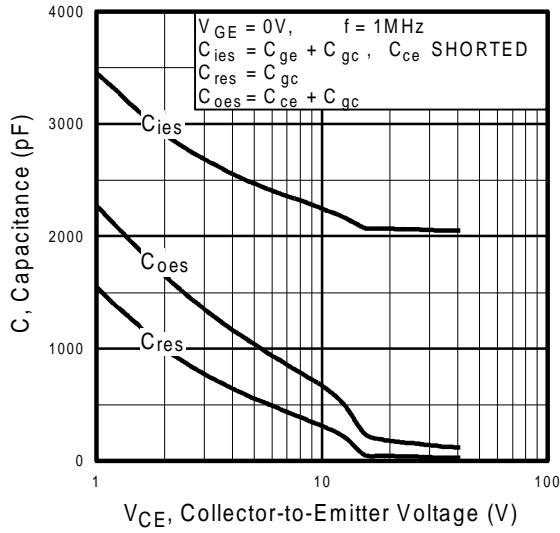


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

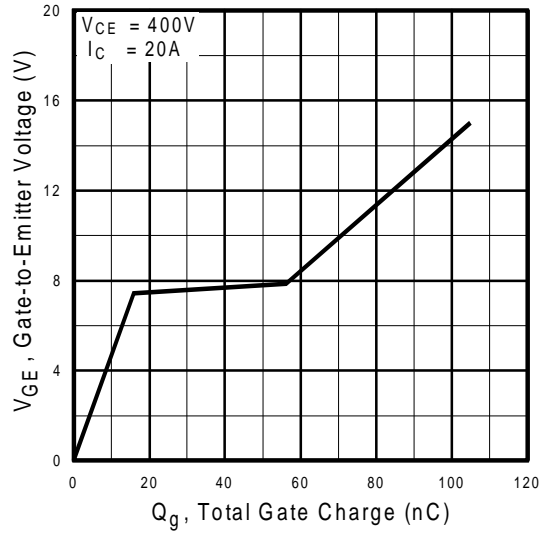


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

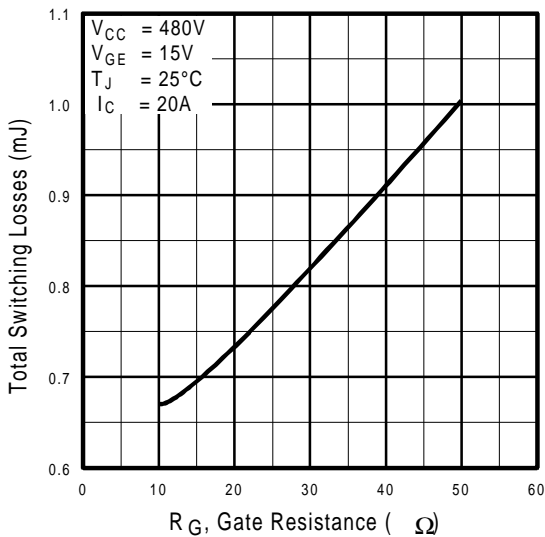


Fig. 9 - Typical Switching Losses vs. Gate Resistance

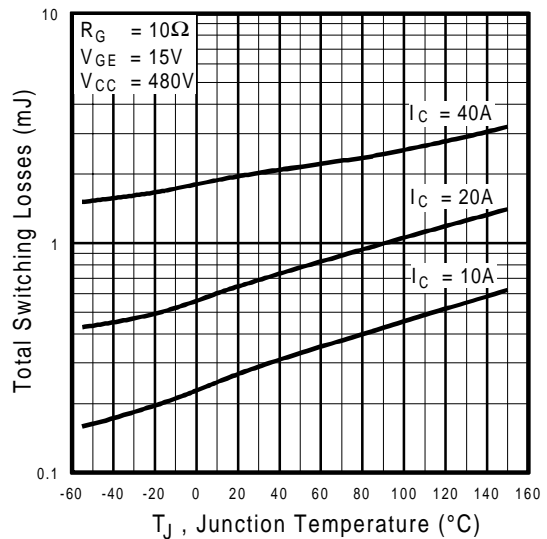


Fig. 10 - Typical Switching Losses vs. Junction Temperature

IRG4PC40U

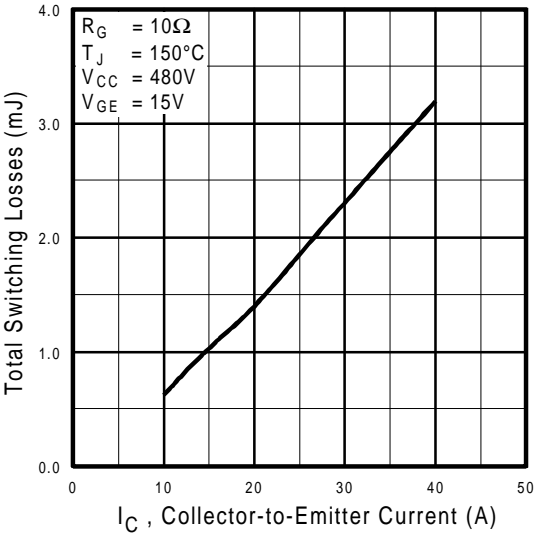


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

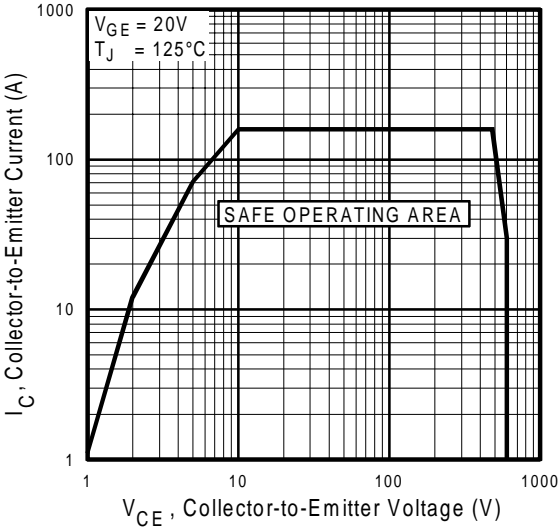


Fig. 12 - Turn-Off SOA



* 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., $V_C = 480V$

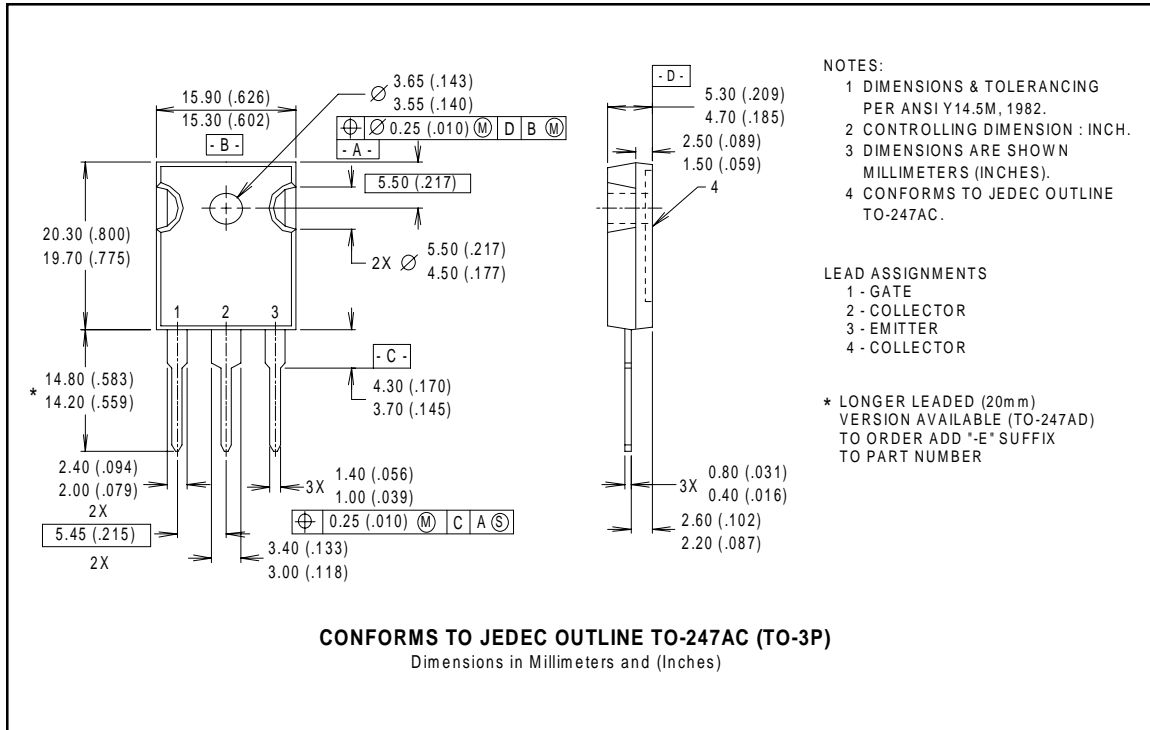


Fig. 14b - Switching Loss Waveforms

IRG4PC40U

International
IR Rectifier

Case Outline and Dimensions — TO-247AC



International
IR Rectifier

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

Visit us at www.irf.com for sales contact information.
Data and specifications subject to change without notice. 12/00