

International IOR Rectifier

PD - 95445

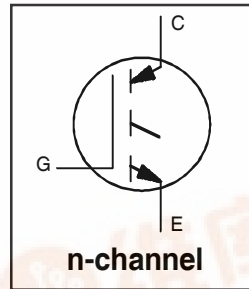
IRG4BC20UPbF

INSULATED GATE BIPOLAR TRANSISTOR

UltraFast Speed IGBT

Features

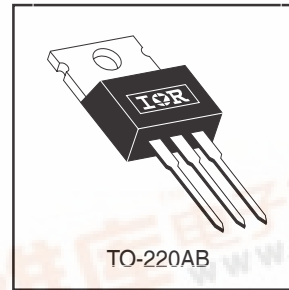
- UltraFast: optimized for high operating frequencies 8-40 kHz in hard switching, >200 kHz in resonant mode
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency than Generation 3
- Industry standard TO-220AB package
- Lead-Free



| |
|------------------------------|
| $V_{CES} = 600V$ |
| $V_{CE(on) typ.} = 1.85V$ |
| @ $V_{GE} = 15V, I_C = 6.5A$ |

Benefits

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



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 | 13 | A |
| $I_C @ T_C = 100^\circ C$ | Continuous Collector Current | 6.5 | |
| I_{CM} | Pulsed Collector Current ① | 52 | |
| I_{LM} | Clamped Inductive Load Current ② | 52 | |
| V_{GE} | Gate-to-Emitter Voltage | ± 20 | V |
| E_{ARV} | Reverse Voltage Avalanche Energy ③ | 5.0 | mJ |
| $P_D @ T_C = 25^\circ C$ | Maximum Power Dissipation | 60 | W |
| $P_D @ T_C = 100^\circ C$ | Maximum Power Dissipation | 24 | |
| T_J | Operating Junction and Storage Temperature Range | -55 to + 150 | $^\circ C$ |
| T_{STG} | | | |
| | Soldering Temperature, for 10 seconds | 300 (0.063 in. (1.6mm from case) | |
| | 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 | --- | 2.1 | $^\circ C/W$ |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.50 | --- | |
| $R_{\theta JA}$ | Junction-to-Ambient, typical socket mount | --- | 80 | |
| Wt | Weight | 2.0 (0.07) | --- | g (oz) |



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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 | — | 0.69 | — | V/°C | $V_{GE} = 0V, I_C = 1.0mA$ |
| $V_{CE(ON)}$ | Collector-to-Emitter Saturation Voltage | — | 1.85 | 2.1 | V | $I_C = 6.5A, V_{GE} = 15V$ |
| | | — | 2.27 | — | | $I_C = 13A$ |
| | | — | 1.87 | — | | $I_C = 6.5A, T_J = 150^\circ\text{C}$ |
| $V_{GE(th)}$ | 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 | — | -11 | — | mV/°C | $V_{CE} = V_{GE}, I_C = 250\mu A$ |
| g_{fe} | Forward Transconductance ⑤ | 1.4 | 4.3 | — | S | $V_{CE} = 100V, I_C = 6.5A$ |
| I_{CES} | Zero Gate Voltage Collector Current | — | — | 250 | μA | $V_{GE} = 0V, V_{CE} = 600V$ |
| | | — | — | 2.0 | | $V_{GE} = 0V, V_{CE} = 10V, T_J = 25^\circ\text{C}$ |
| | | — | — | 1000 | | $V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$ |
| 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) | — | 27 | 41 | nC | $I_C = 6.5A$ |
| Q_{ge} | Gate - Emitter Charge (turn-on) | — | 4.5 | 6.8 | | $V_{CC} = 400V$ |
| Q_{gc} | Gate - Collector Charge (turn-on) | — | 10 | 16 | | $V_{GE} = 15V$ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 21 | — | ns | $T_J = 25^\circ\text{C}$ $I_C = 6.5A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 50\Omega$ |
| t_r | Rise Time | — | 13 | — | | |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 86 | 130 | | |
| t_f | Fall Time | — | 120 | 180 | | |
| E_{on} | Turn-On Switching Loss | — | 0.10 | — | mJ | Energy losses include "tail" See Fig. 10, 11, 13, 14 |
| E_{off} | Turn-Off Switching Loss | — | 0.12 | — | | |
| E_{ts} | Total Switching Loss | — | 0.22 | 0.4 | | |
| $t_{d(on)}$ | Turn-On Delay Time | — | 20 | — | ns | $T_J = 150^\circ\text{C}$, $I_C = 6.5A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 50\Omega$ |
| t_r | Rise Time | — | 14 | — | | |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 190 | — | | |
| t_f | Fall Time | — | 140 | — | | |
| E_{ts} | Total Switching Loss | — | 0.42 | — | mJ | See Fig. 13, 14 |
| L_E | Internal Emitter Inductance | — | 7.5 | — | nH | Measured 5mm from package |
| C_{ies} | Input Capacitance | — | 530 | — | pF | $V_{GE} = 0V$ $V_{CC} = 30V$ |
| C_{oes} | Output Capacitance | — | 39 | — | | |
| C_{res} | Reverse Transfer Capacitance | — | 7.4 | — | | |

Notes:

- ① Repetitive rating; $V_{GE} = 20V$, pulse width limited by max. junction temperature. (See fig. 13b)
- ② $V_{CC} = 80\%(V_{CES})$, $V_{GE} = 20V$, $L = 10\mu H$, $R_G = 50\Omega$, (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.

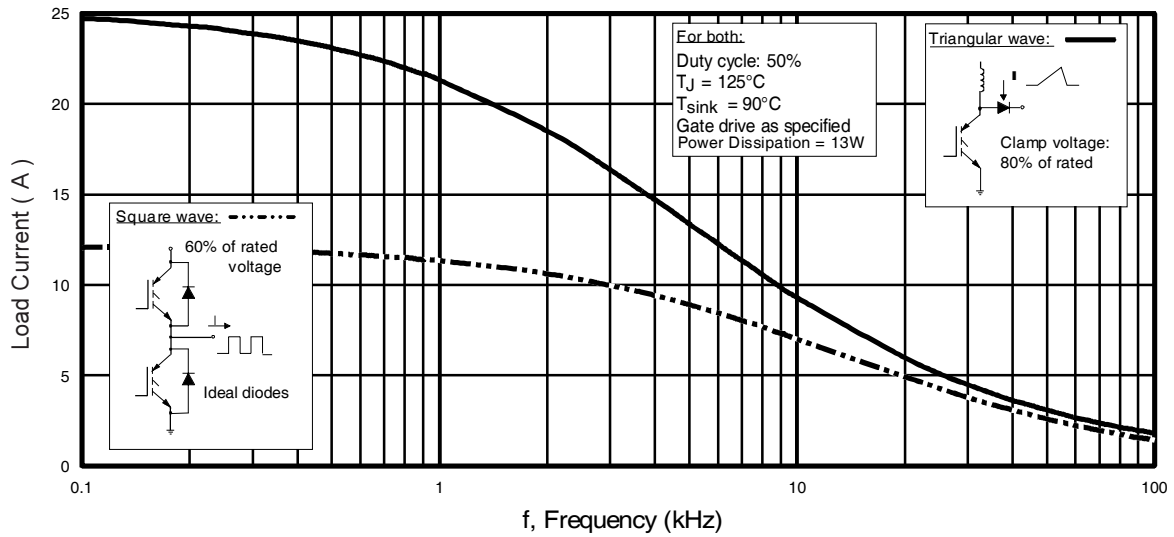


Fig. 1 - Typical Load Current vs. Frequency
(For square wave, $I = I_{RMS}$ of fundamental; for triangular wave, $I = I_{PK}$)

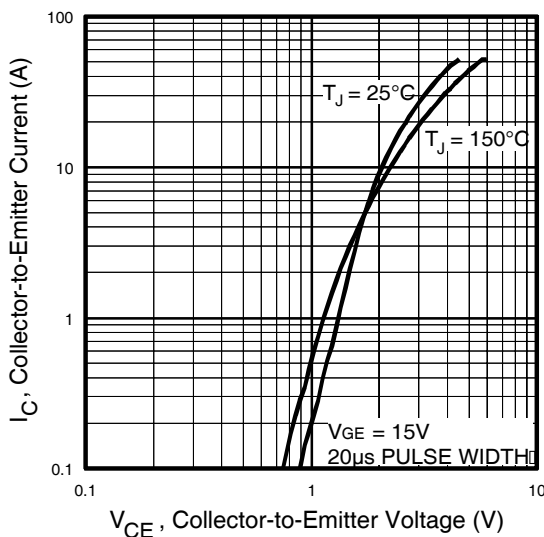


Fig. 2 - Typical Output Characteristics

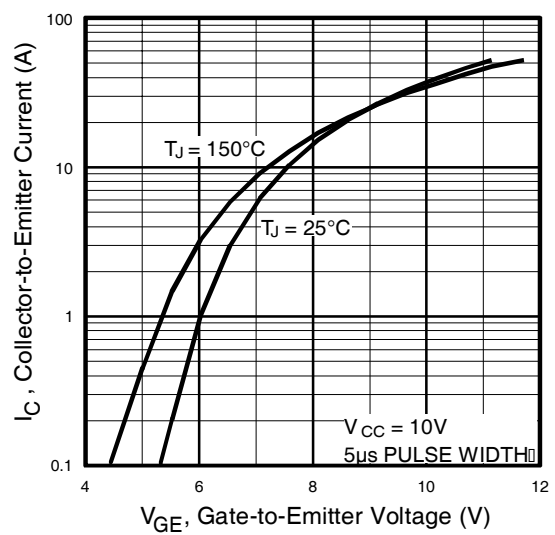


Fig. 3 - Typical Transfer Characteristics

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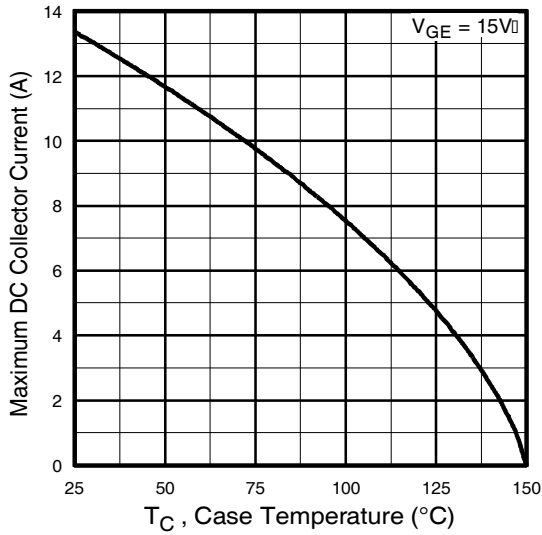


Fig. 4 - Maximum Collector Current vs. Case Temperature

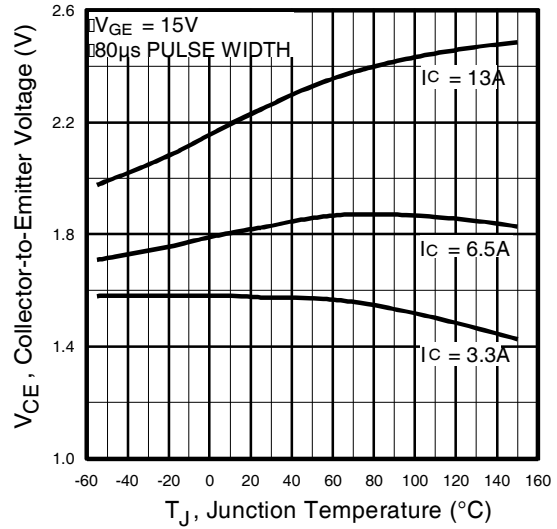


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

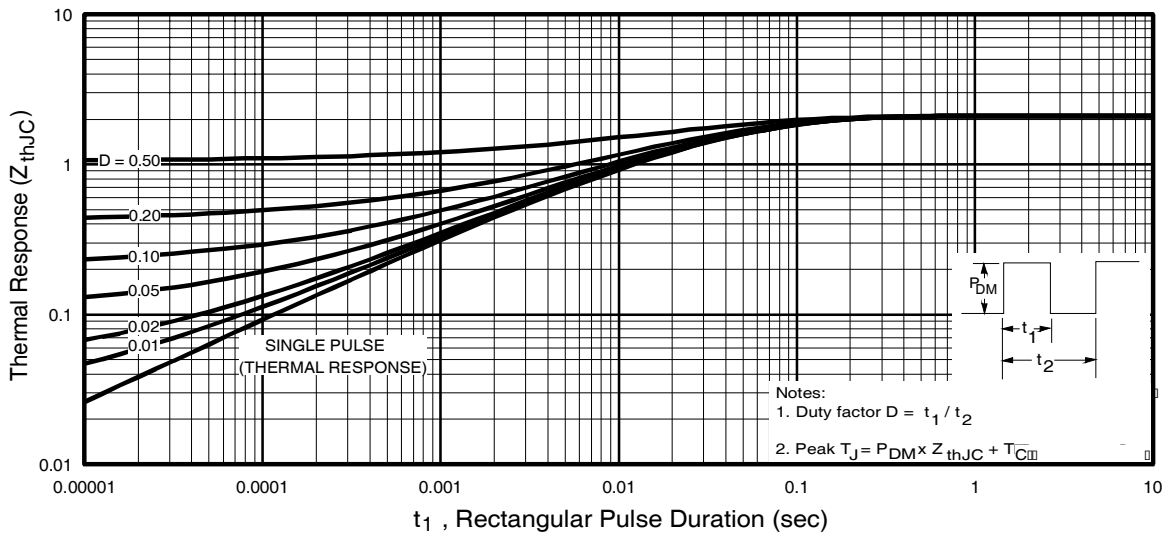


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

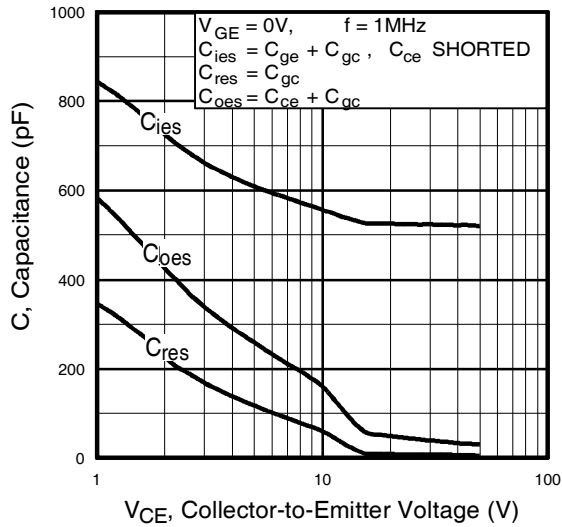


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

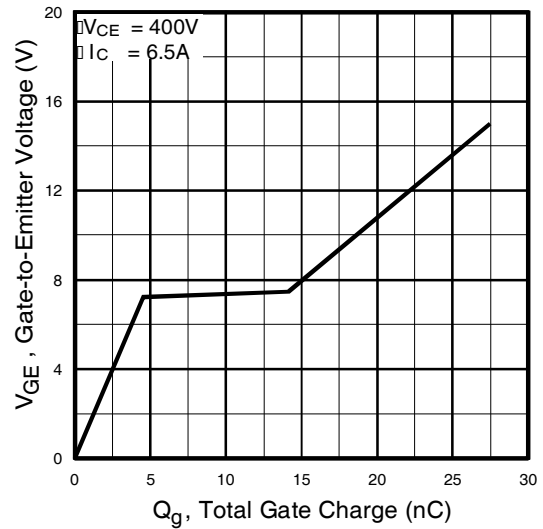


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

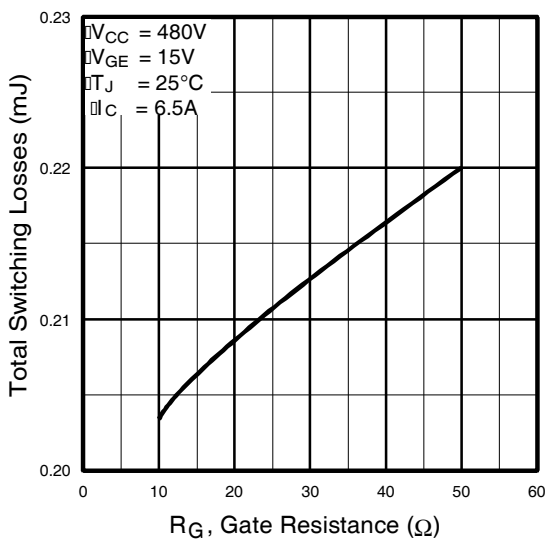


Fig. 9 - Typical Switching Losses vs. Gate Resistance

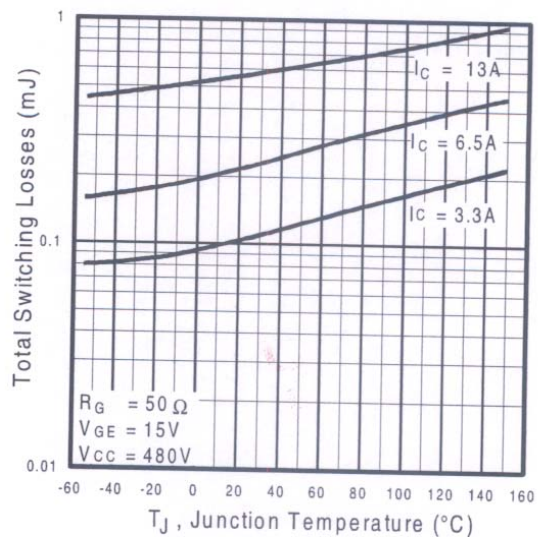


Fig. 10 - Typical Switching Losses vs. Junction Temperature

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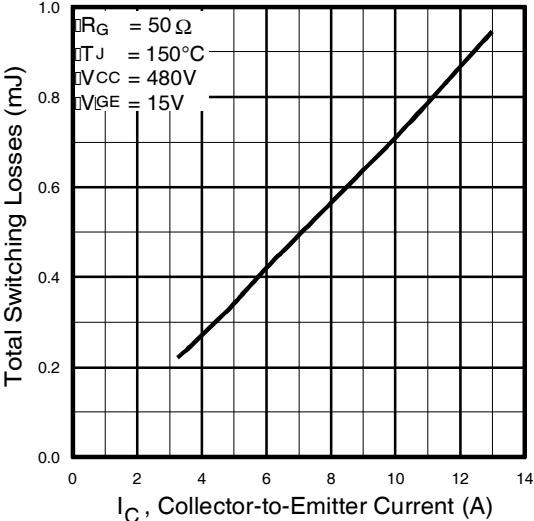


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

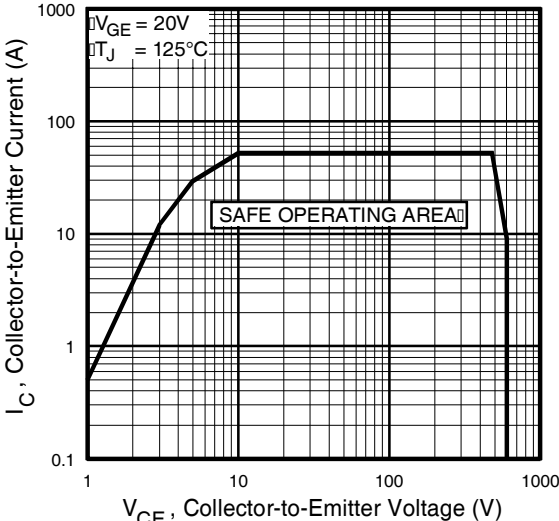


Fig. 12 - Turn-Off SOA

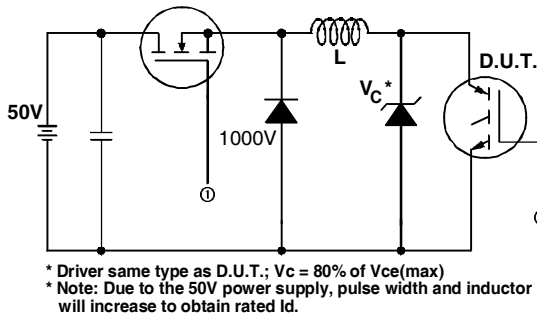


Fig. 13a - Clamped Inductive Load Test Circuit

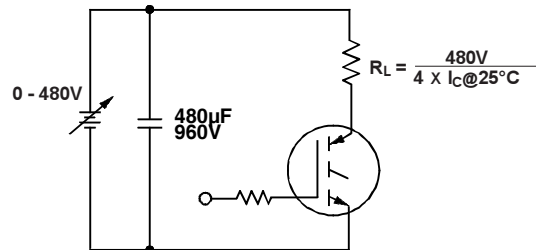


Fig. 13b - Pulsed Collector Current Test Circuit

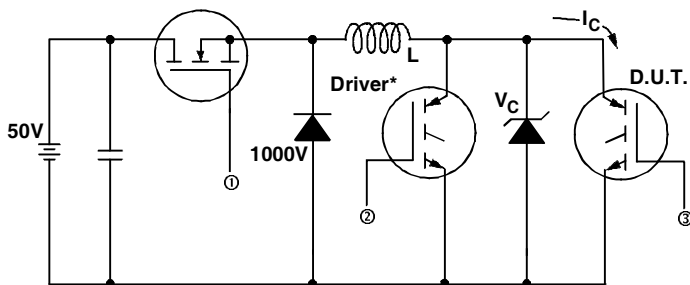


Fig. 14a - Switching Loss Test Circuit

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

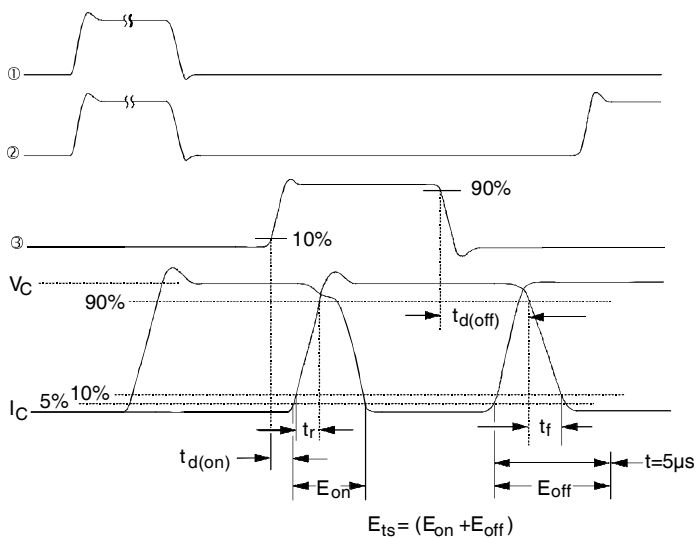


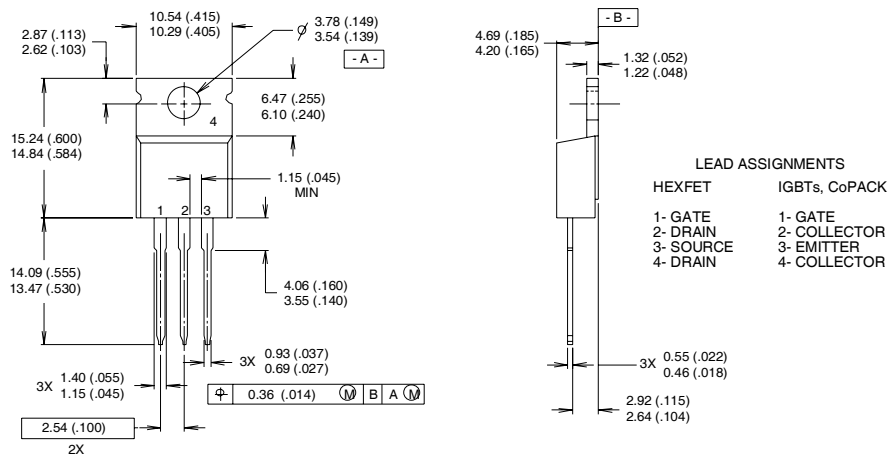
Fig. 14b - Switching Loss Waveforms

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TO-220AB Package Outline

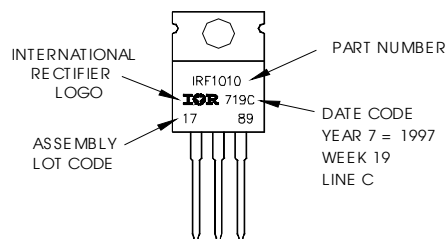
Dimensions are shown in millimeters (inches)



- NOTES:
- 1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
 - 2 CONTROLLING DIMENSION : INCH
 - 3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.
 - 4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
 LOT CODE 1789
 ASSEMBLED ON WW 19, 1997
 IN THE ASSEMBLY LINE "C"
Note: "P" in assembly line position indicates "Lead-Free"



Data and specifications subject to change without notice.



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Note: For the most current drawings please refer to the IR website at:
<http://www.irf.com/package/>