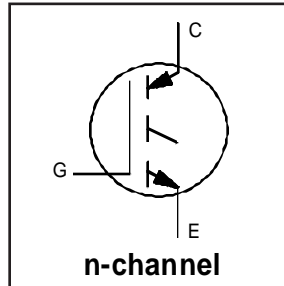


INSULATED GATE BIPOLAR TRANSISTOR

Short Circuit Rated
Fast IGBT

Features

- Short circuit rated - 10 μ s @ 125°C, V_{GE} = 15V
- Switching-loss rating includes all "tail" losses
- Optimized for medium operating frequency (1 to 10kHz) See Fig. 1 for Current vs. Frequency curve

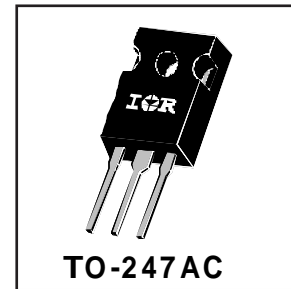


| |
|---|
| V _{CES} = 600V |
| V _{CE(sat)} ≤ 2.3V |
| @V _{GE} = 15V, I _C = 8.0A |

Description

Insulated Gate Bipolar Transistors (IGBTs) from International Rectifier have higher usable current densities than comparable bipolar transistors, while at the same time having simpler gate-drive requirements of the familiar power MOSFET. They provide substantial benefits to a host of high-voltage, high-current applications.

These new short circuit rated devices are especially suited for motor control and other applications requiring short circuit withstand capability.



Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|--|--------------------|-------|
| V _{CES} | Collector-to-Emitter Voltage | 600 | V |
| I _C @ T _C = 25°C | Continuous Collector Current | 13 | A |
| I _C @ T _C = 100°C | Continuous Collector Current | 8.0 | |
| I _{CM} | Pulsed Collector Current ① | 26 | |
| I _{LM} | Clamped Inductive Load Current ② | 26 | |
| t _{sc} | Short Circuit Withstand Time | 10 | μs |
| V _{GE} | Gate-to-Emitter Voltage | ±20 | V |
| E _{ARV} | Reverse Voltage Avalanche Energy ③ | 5.0 | mJ |
| P _D @ T _C = 25°C | Maximum Power Dissipation | 60 | W |
| P _D @ T _C = 100°C | Maximum Power Dissipation | 24 | |
| 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 _{θJC} | Junction-to-Case | ----- | ----- | 2.1 | °C/W |
| R _{θCS} | Case-to-Sink, flat, greased surface | ----- | 0.24 | ----- | |
| R _{θJA} | 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 | 20 | ---- | ---- | V | $V_{GE} = 0V, I_C = 1.0A$ |
| $\Delta V_{(BR)CES}/\Delta T_J$ | Temperature Coeff. of Breakdown Voltage | ---- | 0.42 | ---- | $V/^\circ\text{C}$ | $V_{GE} = 0V, I_C = 1.0mA$ |
| $V_{CE(on)}$ | Collector-to-Emitter Saturation Voltage | ---- | 2.0 | 2.3 | V | $I_C = 8.0A$ |
| | | ---- | 2.7 | ---- | | $I_C = 13A$ |
| | | ---- | 2.5 | ---- | | $I_C = 8.0A, T_J = 150^\circ\text{C}$ |
| $V_{GE(th)}$ | Gate Threshold Voltage | 3.0 | ---- | 5.5 | | $V_{CE} = V_{GE}, I_C = 250\mu A$ |
| $\Delta V_{GE(th)}/\Delta T_J$ | Temperature Coeff. of Threshold Voltage | ---- | -11 | ---- | $mV/^\circ\text{C}$ | $V_{CE} = V_{GE}, I_C = 250\mu A$ |
| g_{fe} | Forward Transconductance ⑤ | 2.7 | 3.8 | ---- | S | $V_{CE} = 100V, I_C = 8.0A$ |
| I_{CES} | Zero Gate Voltage Collector Current | ---- | ---- | 250 | μA | $V_{GE} = 0V, V_{CE} = 600V$ |
| | | ---- | ---- | 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) | ---- | 16 | 24 | nC | $I_C = 8.0A$ |
| Q_{ge} | Gate - Emitter Charge (turn-on) | ---- | 3.6 | 5.2 | | $V_{CC} = 400V$ |
| Q_{gc} | Gate - Collector Charge (turn-on) | ---- | 6.0 | 9.0 | | $V_{GE} = 15V$ |
| $t_{d(on)}$ | Turn-On Delay Time | ---- | 29 | ---- | ns | $T_J = 25^\circ\text{C}$ |
| t_r | Rise Time | ---- | 22 | ---- | | $I_C = 8.0A, V_{CC} = 480V$ |
| $t_{d(off)}$ | Turn-Off Delay Time | ---- | 270 | 400 | | $V_{GE} = 15V, R_G = 50\Omega$ |
| t_f | Fall Time | ---- | 280 | 510 | | Energy losses include "tail" |
| E_{on} | Turn-On Switching Loss | ---- | 0.14 | ---- | | mJ |
| E_{off} | Turn-Off Switching Loss | ---- | 0.86 | ---- | | |
| E_{ts} | Total Switching Loss | ---- | 1.0 | 2.0 | | |
| t_{sc} | Short Circuit Withstand Time | 10 | ---- | ---- | μs | $V_{CC} = 360V, T_J = 125^\circ\text{C}$ $V_{GE} = 15V, R_G = 50\Omega, V_{CPK} < 500V$ |
| $t_{d(on)}$ | Turn-On Delay Time | ---- | 27 | ---- | ns | $T_J = 150^\circ\text{C},$ |
| t_r | Rise Time | ---- | 21 | ---- | | $I_C = 8.0A, V_{CC} = 480V$ |
| $t_{d(off)}$ | Turn-Off Delay Time | ---- | 370 | ---- | | $V_{GE} = 15V, R_G = 50\Omega$ |
| t_f | Fall Time | ---- | 420 | ---- | | Energy losses include "tail" |
| E_{ts} | Total Switching Loss | ---- | 1.4 | ---- | mJ | See Fig. 10, 14 |
| L_E | Internal Emitter Inductance | ---- | 13 | ---- | nH | Measured 5mm from package |
| C_{ies} | Input Capacitance | ---- | 365 | ---- | pF | $V_{GE} = 0V$ |
| C_{oes} | Output Capacitance | ---- | 47 | ---- | | $V_{CC} = 30V$ |
| C_{res} | Reverse Transfer Capacitance | ---- | 4.8 | ---- | | $f = 1.0MHz$ |

Notes:

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

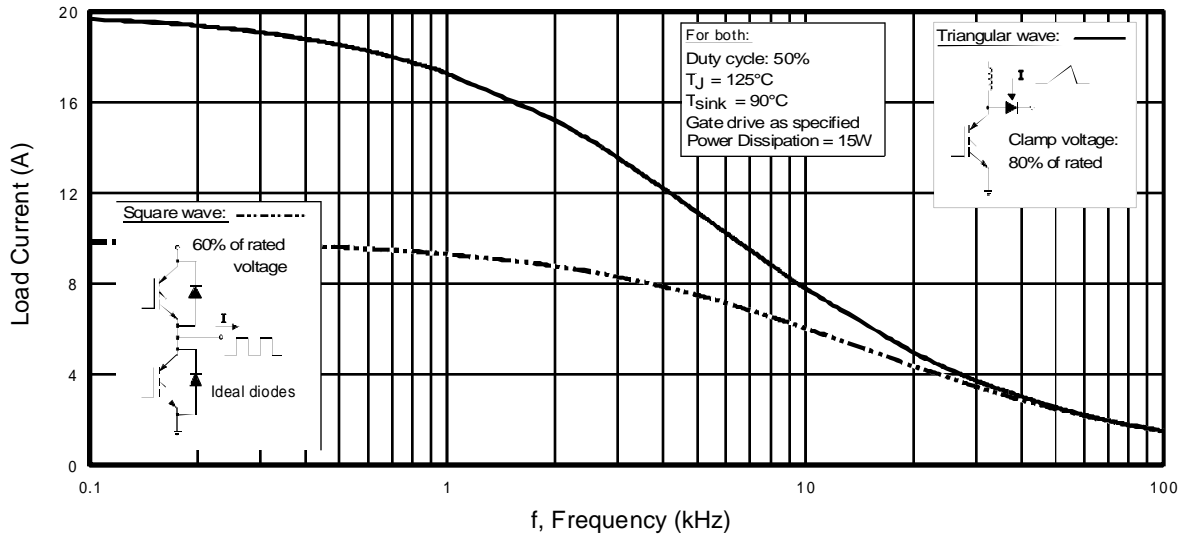


Fig. 1 - Typical Load Current vs. Frequency
 (For square wave, $I = I_{RMS}$ of fundamental; for triangular wave, $I = I_{PK}$)

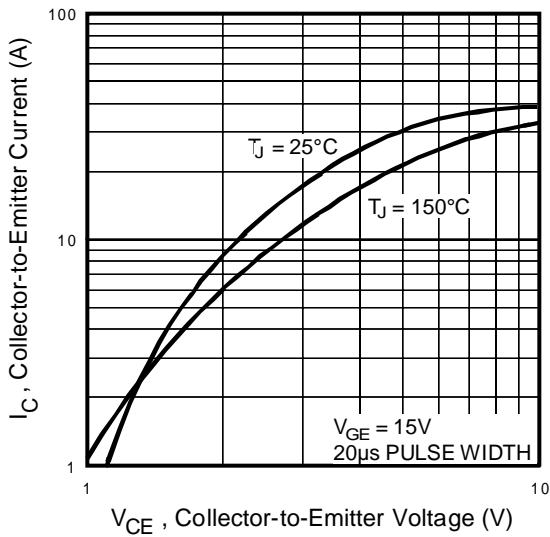


Fig. 2 - Typical Output Characteristics

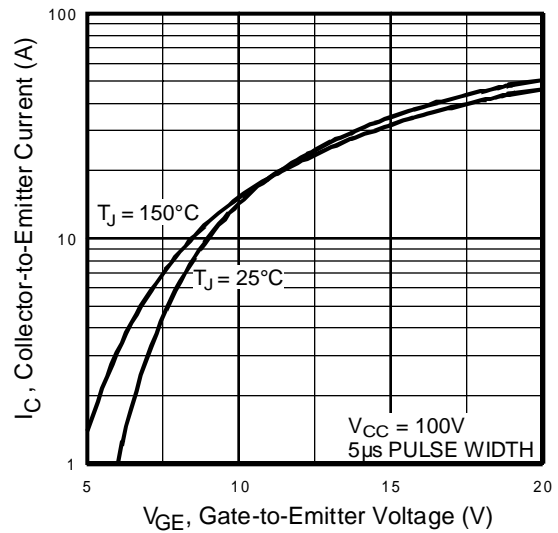


Fig. 3 - Typical Transfer Characteristics

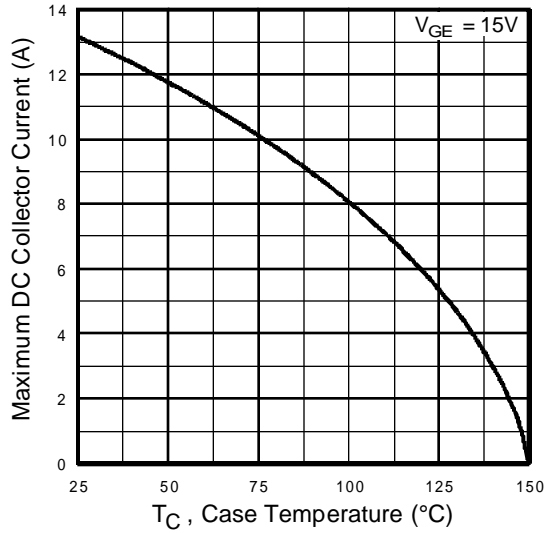


Fig. 4 - Maximum Collector Current vs. Case Temperature

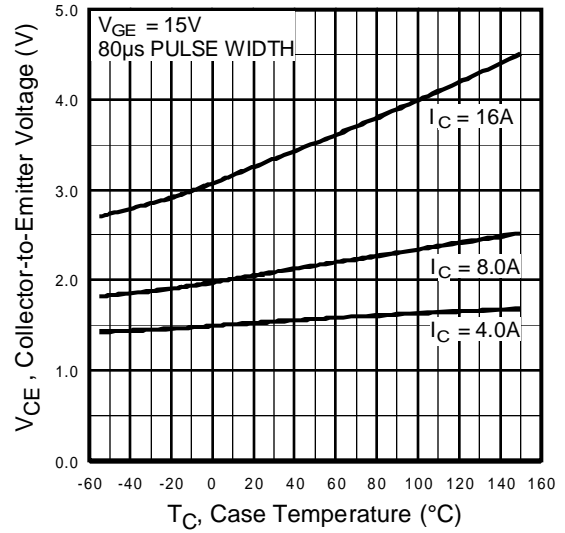


Fig. 5 - Collector-to-Emitter Voltage vs. Case Temperature

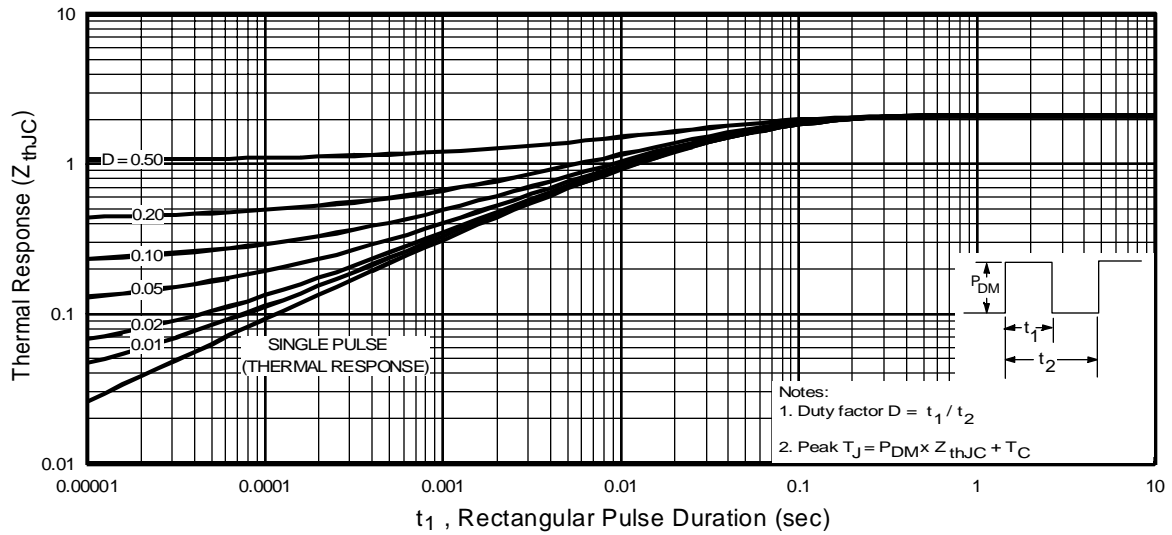


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

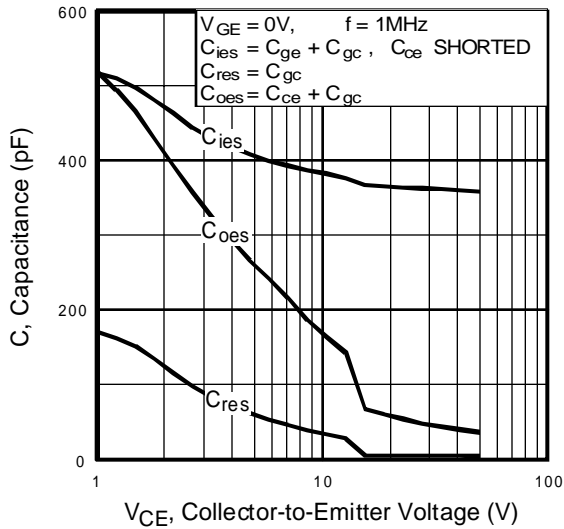


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

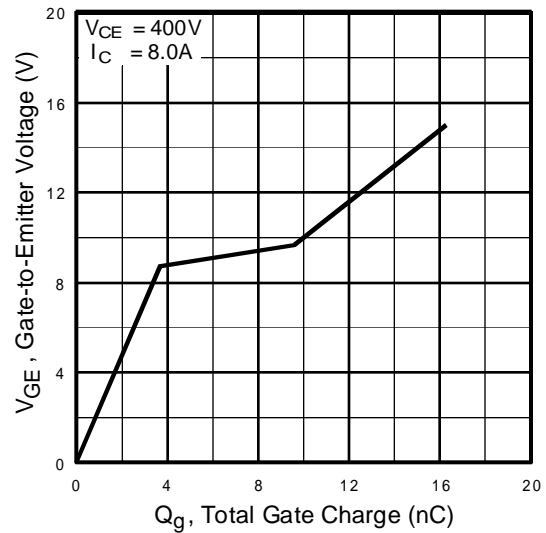


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

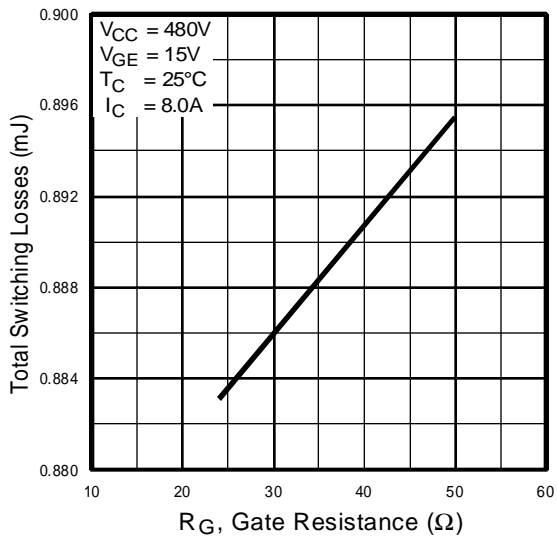


Fig. 9 - Typical Switching Losses vs. Gate Resistance

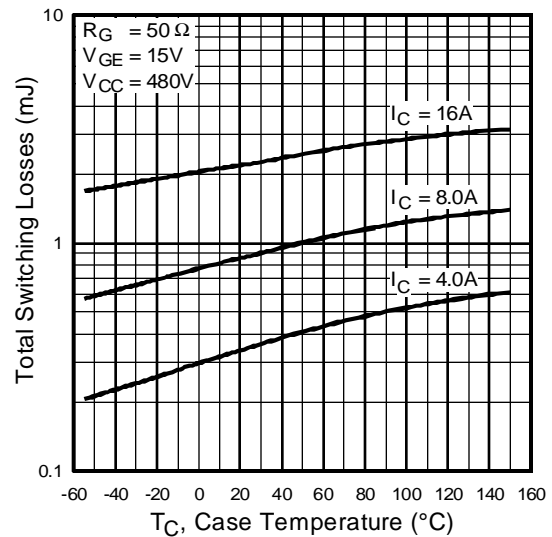


Fig. 10 - Typical Switching Losses vs. Case Temperature

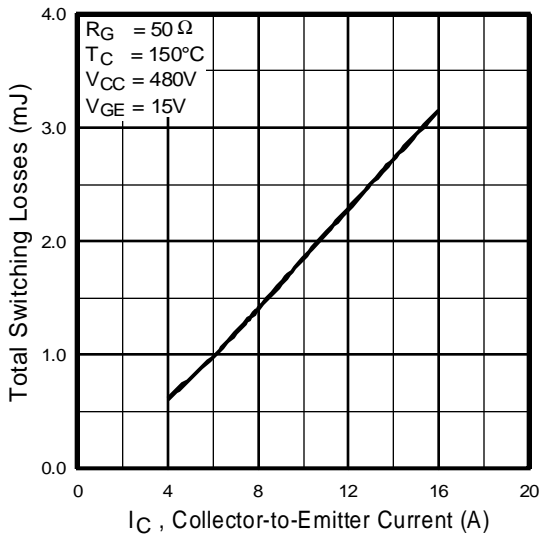


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

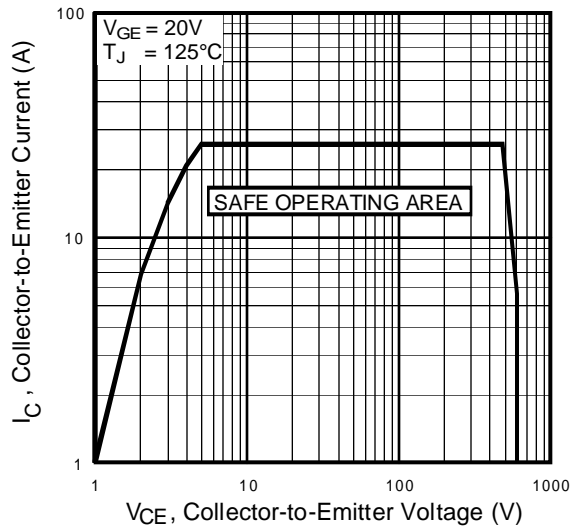
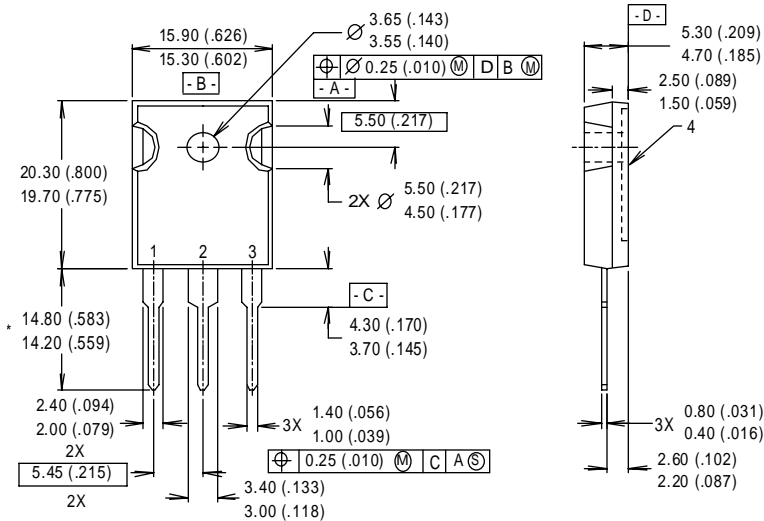


Fig. 12 - Turn-Off SOA



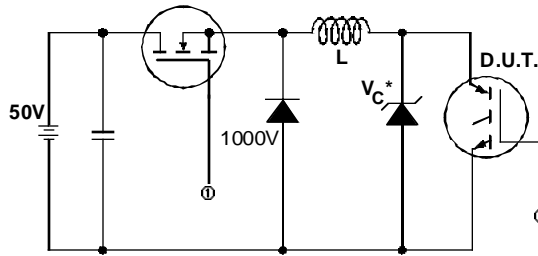
- NOTES:
- 1 DIMENSIONS & TOLERANCING PER ANSI Y14.5M, 1982.
 - 2 CONTROLLING DIMENSION : INCH.
 - 3 DIMENSIONS ARE SHOWN MILLIMETERS (INCHES).
 - 4 CONFORMS TO JEDEC OUTLINE TO-247AC.

- 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)



* 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

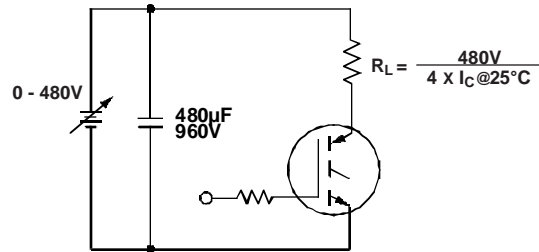


Fig. 13b - Pulsed Collector Current Test Circuit

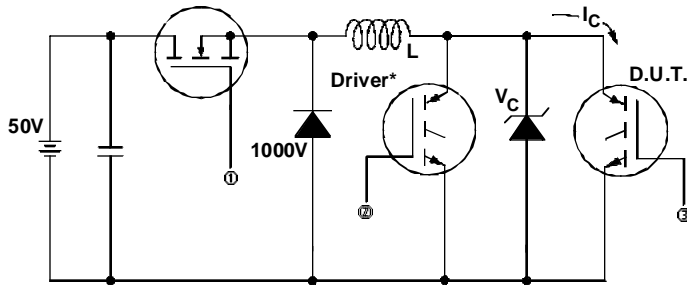


Fig. 14a - Switching Loss Test Circuit

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

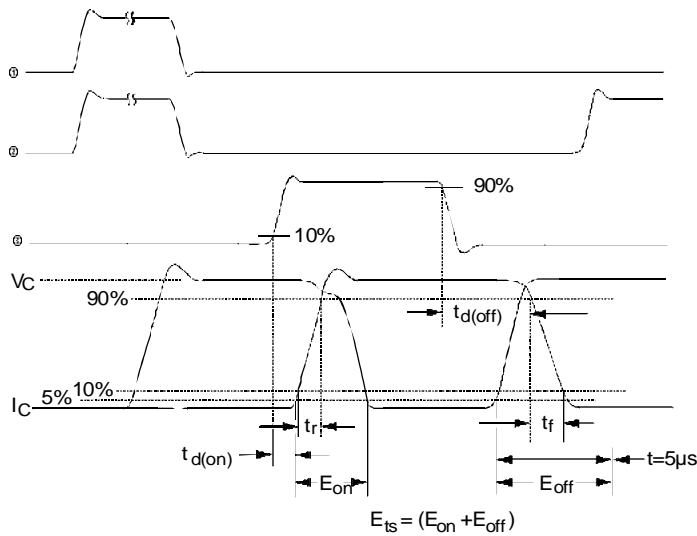


Fig. 14b - Switching Loss Waveforms



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