

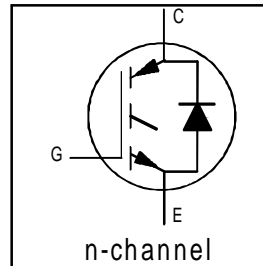
IRG4PC30KD

INSULATED GATE BIPOLAR TRANSISTOR WITH
ULTRAFAST SOFT RECOVERY DIODE

Short Circuit Rated
UltraFast IGBT

Features

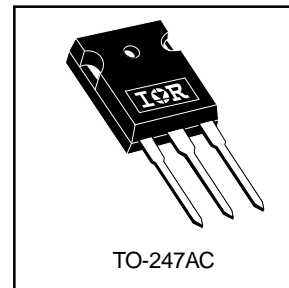
- High short circuit rating optimized for motor control, $t_{sc} = 10\mu s$, @360V V_{CE} (start), $T_J = 125^\circ C$, $V_{GE} = 15V$
- Combines low conduction losses with high switching speed
- Tighter parameter distribution and higher efficiency than previous generations
- IGBT co-packaged with HEXFRED™ ultrafast, ultrasoft recovery antiparallel diodes



| |
|-----------------------------------|
| $V_{CES} = 600V$ |
| $V_{CE(on)} \text{ typ.} = 2.21V$ |
| @ $V_{GE} = 15V, I_C = 16A$ |

Benefits

- Latest generation 4 IGBTs offer highest power density motor controls possible
- HEXFRED™ diodes optimized for performance with IGBTs. Minimized recovery characteristics reduce noise, EMI and switching losses
- This part replaces the IRGBC30KD2 and IRGBC30MD2 products
- For hints see design tip 97003



Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---------------------------|------------------------------------|-----------------------------------|------------|
| V_{CES} | Collector-to-Emitter Voltage | 600 | V |
| $I_C @ T_C = 25^\circ C$ | Continuous Collector Current | 28 | A |
| $I_C @ T_C = 100^\circ C$ | Continuous Collector Current | 16 | |
| I_{CM} | Pulsed Collector Current ① | 58 | |
| I_{LM} | Clamped Inductive Load Current ② | 58 | |
| $I_F @ T_C = 100^\circ C$ | Diode Continuous Forward Current | 12 | |
| I_{FM} | Diode Maximum Forward Current | 58 | |
| t_{sc} | Short Circuit Withstand Time | 10 | μs |
| V_{GE} | Gate-to-Emitter Voltage | ± 20 | V |
| $P_D @ T_C = 25^\circ C$ | Maximum Power Dissipation | 100 | W |
| $P_D @ T_C = 100^\circ C$ | Maximum Power Dissipation | 42 | |
| T_J | Operating Junction and | -55 to +150 | $^\circ C$ |
| T_{STG} | Storage Temperature Range | | |
| | Soldering Temperature, for 10 sec. | 300 (0.063 in. (1.6mm) from case) | |
| | Mounting Torque, 6-32 or M3 Screw. | 10 lbf•in (1.1 N•m) | |

Thermal Resistance

| | Parameter | Min. | Typ. | Max. | Units |
|-----------------|---|------|----------|------|--------------|
| $R_{\theta JC}$ | Junction-to-Case - IGBT | — | — | 1.2 | $^\circ C/W$ |
| $R_{\theta JC}$ | Junction-to-Case - Diode | — | — | 2.5 | |
| $R_{\theta CS}$ | 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) |

IRG4PC30KD

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 ^③ | 600 | — | — | V | $V_{GE} = 0V, I_C = 250\mu A$ |
| $\Delta V_{(BR)CES}/\Delta T_J$ | Temperature Coeff. of Breakdown Voltage | — | 0.54 | — | V/°C | $V_{GE} = 0V, I_C = 1.0mA$ |
| $V_{CE(on)}$ | Collector-to-Emitter Saturation Voltage | — | 2.21 | 2.7 | V | $I_C = 16A, V_{GE} = 15V$ See Fig. 2, 5 |
| | | — | 2.88 | — | | |
| | | — | 2.36 | — | | |
| $V_{GE(th)}$ | 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 ^④ | 5.4 | 8.1 | — | S | $V_{CE} = 100V, I_C = 16A$ |
| I_{CES} | Zero Gate Voltage Collector Current | — | — | 250 | μA | $V_{GE} = 0V, V_{CE} = 600V$ $V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ C$ |
| | | — | — | 2500 | | |
| V_{FM} | Diode Forward Voltage Drop | — | 1.4 | 1.7 | V | $I_C = 12A$ $I_C = 12A, T_J = 150^\circ C$ See Fig. 13 |
| | | — | 1.3 | 1.6 | | |
| 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) | — | 67 | 100 | nC | $I_C = 16A$ $V_{CC} = 400V$ See Fig.8 $V_{GE} = 15V$ |
| Q_{ge} | Gate - Emitter Charge (turn-on) | — | 11 | 16 | | |
| Q_{gc} | Gate - Collector Charge (turn-on) | — | 25 | 37 | | |
| $t_{d(on)}$ | Turn-On Delay Time | — | 60 | — | ns | $T_J = 25^\circ C$ $I_C = 16A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 23\Omega$ |
| t_r | Rise Time | — | 42 | — | | |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 160 | 250 | | |
| t_f | Fall Time | — | 80 | 120 | | |
| E_{on} | Turn-On Switching Loss | — | 0.60 | — | mJ | Energy losses include "tail" and diode reverse recovery See Fig. 9,10,14 |
| E_{off} | Turn-Off Switching Loss | — | 0.58 | — | | |
| E_{ts} | Total Switching Loss | — | 1.18 | 1.6 | | |
| t_{sc} | Short Circuit Withstand Time | 10 | — | — | μs | $V_{CC} = 360V, T_J = 125^\circ C$ $V_{GE} = 15V, R_G = 10\Omega, V_{CPK} < 500V$ |
| $t_{d(on)}$ | Turn-On Delay Time | — | 58 | — | ns | $T_J = 150^\circ C$, See Fig. 11,14 $I_C = 16A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 23\Omega$ Energy losses include "tail" and diode reverse recovery |
| t_r | Rise Time | — | 42 | — | | |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 210 | — | | |
| t_f | Fall Time | — | 160 | — | | |
| E_{ts} | Total Switching Loss | — | 1.69 | — | mJ | |
| L_E | Internal Emitter Inductance | — | 13 | — | nH | Measured 5mm from package |
| C_{ies} | Input Capacitance | — | 920 | — | pF | $V_{GE} = 0V$ $V_{CC} = 30V$ See Fig. 7 $f = 1.0MHz$ |
| C_{oes} | Output Capacitance | — | 110 | — | | |
| C_{res} | Reverse Transfer Capacitance | — | 27 | — | | |
| t_{rr} | Diode Reverse Recovery Time | — | 42 | 60 | ns | $T_J = 25^\circ C$ See Fig. 14 $T_J = 125^\circ C$ |
| | | — | 80 | 120 | | |
| I_{rr} | Diode Peak Reverse Recovery Current | — | 3.5 | 6.0 | A | $T_J = 25^\circ C$ See Fig. 15 $T_J = 125^\circ C$ |
| | | — | 5.6 | 10 | | |
| Q_{rr} | Diode Reverse Recovery Charge | — | 80 | 180 | nC | $T_J = 25^\circ C$ See Fig. 16 $T_J = 125^\circ C$ |
| | | — | 220 | 600 | | |
| $di_{(rec)M}/dt$ | Diode Peak Rate of Fall of Recovery During t_b | — | 180 | — | A/ μs | $T_J = 25^\circ C$ See Fig. 17 $T_J = 125^\circ C$ |
| | | — | 160 | — | | |

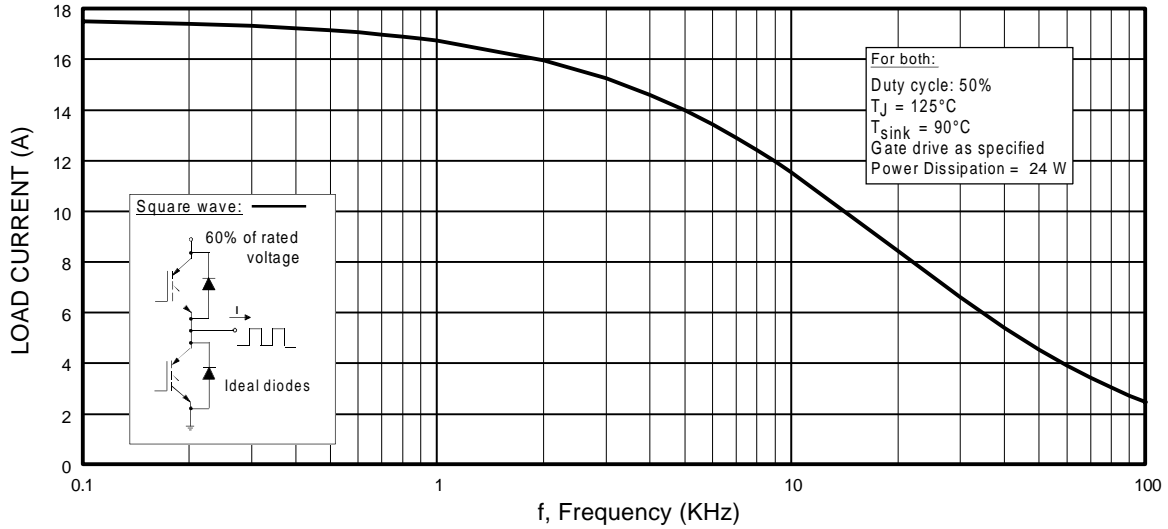


Fig. 1 - Typical Load Current vs. Frequency
 (Load Current = I_{RMS} of fundamental)

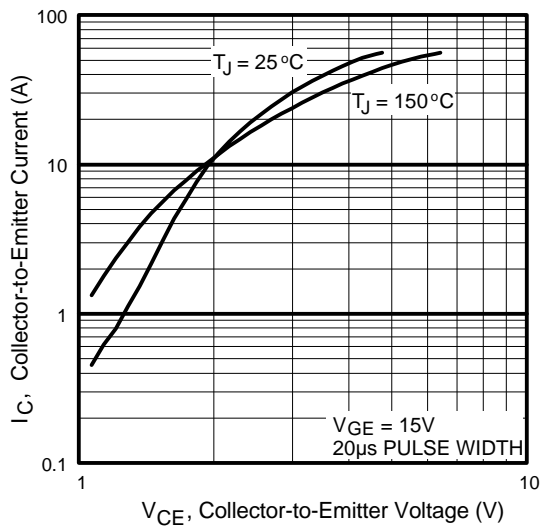


Fig. 2 - Typical Output Characteristics

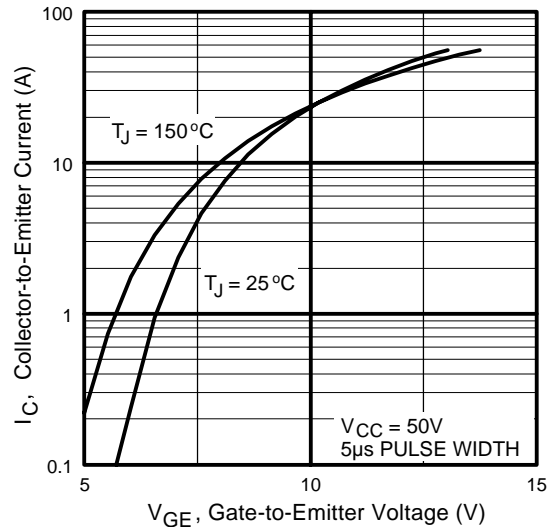


Fig. 3 - Typical Transfer Characteristics

IRG4PC30KD

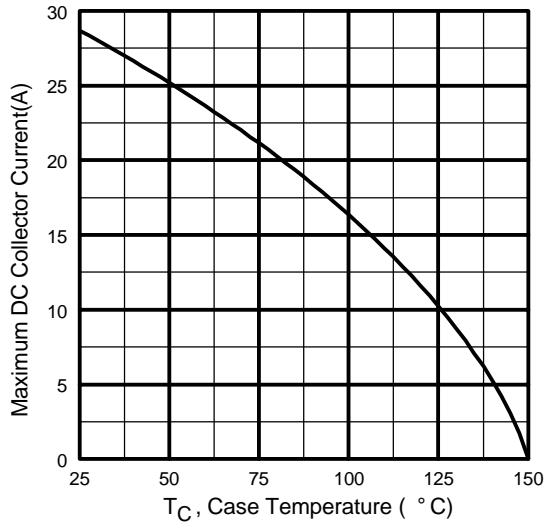


Fig. 4 - Maximum Collector Current vs. Case Temperature

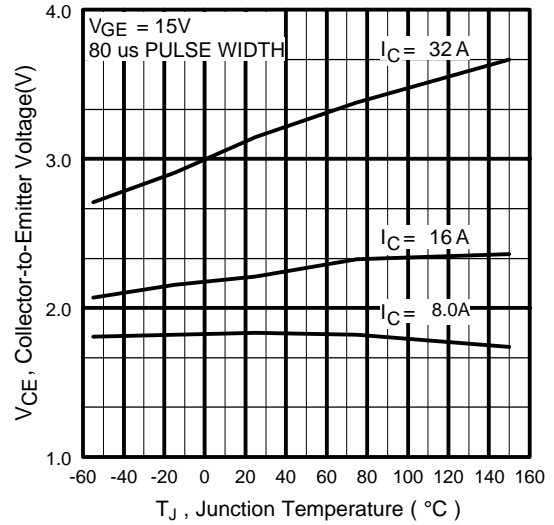


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

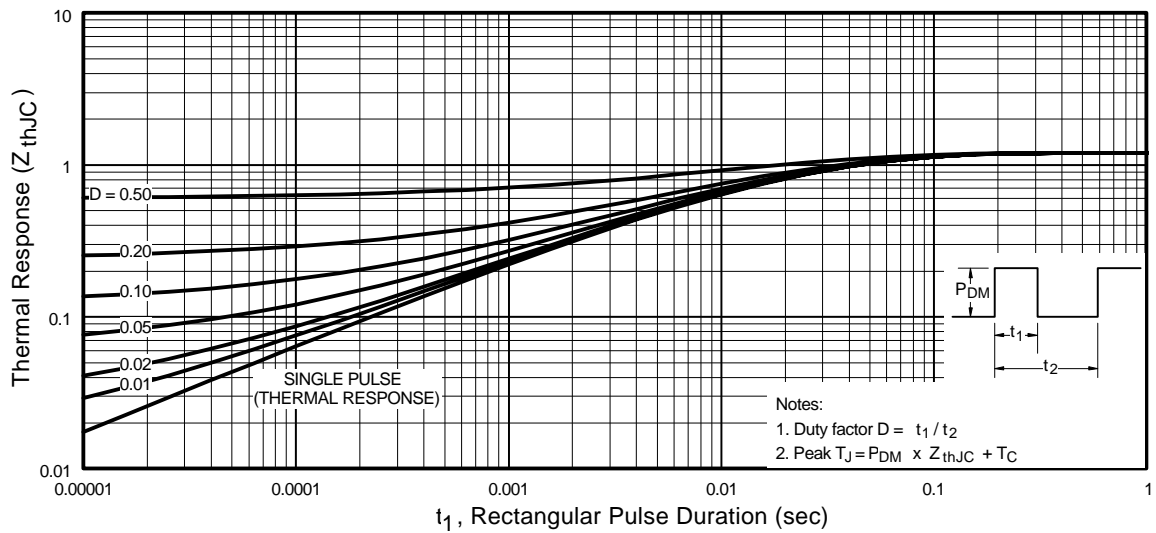


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

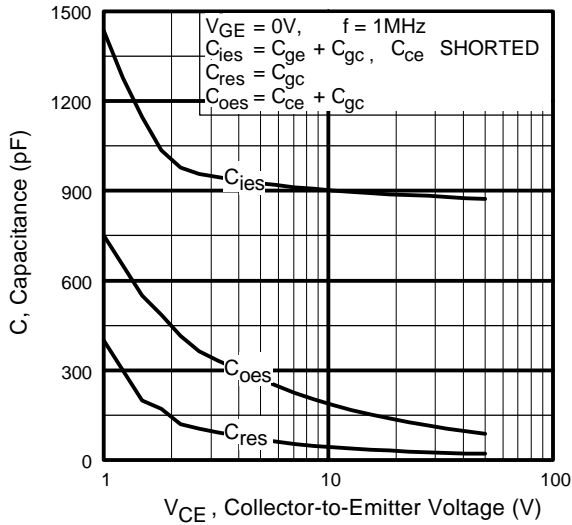


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

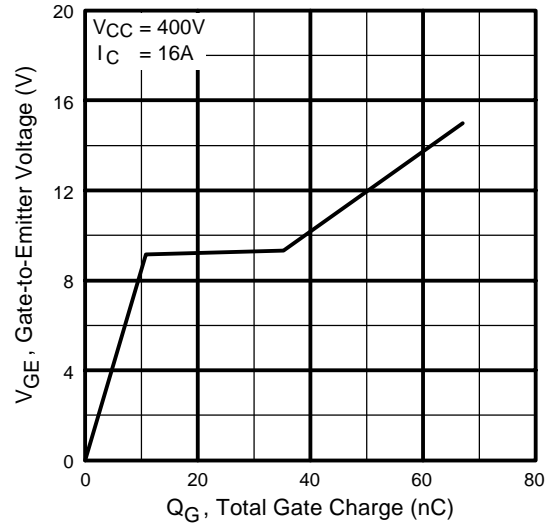


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

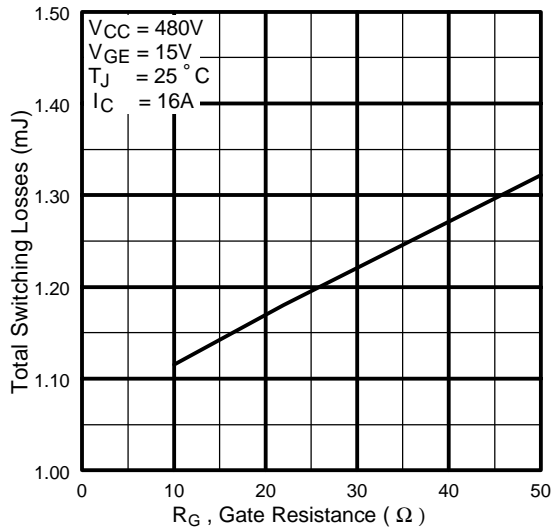


Fig. 9 - Typical Switching Losses vs. Gate Resistance

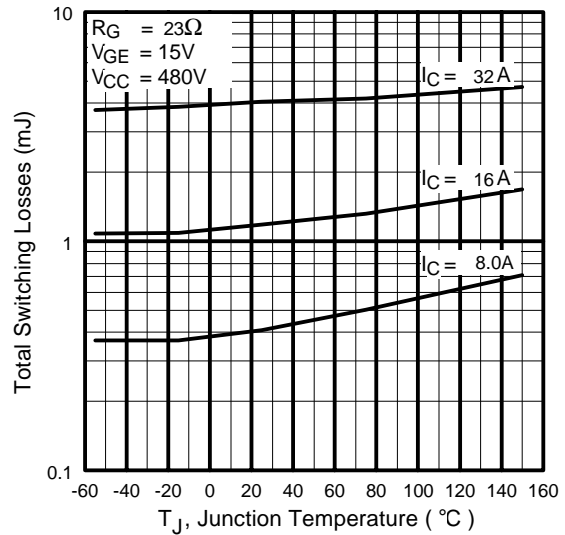


Fig. 10 - Typical Switching Losses vs. Junction Temperature

IRG4PC30KD

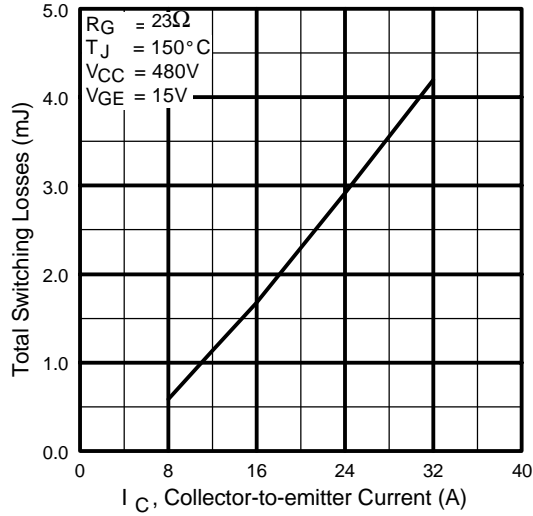


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

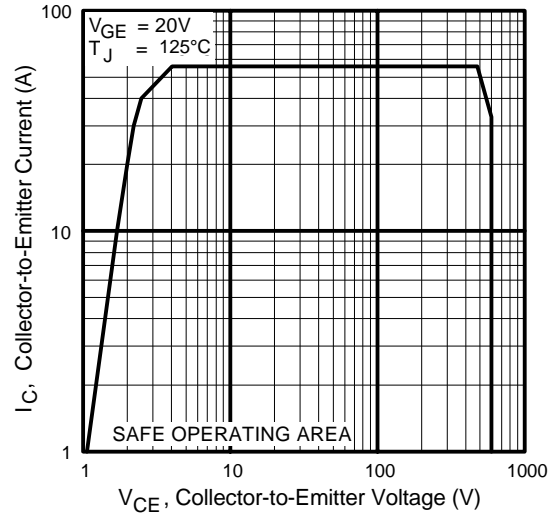


Fig. 12 - Turn-Off SOA

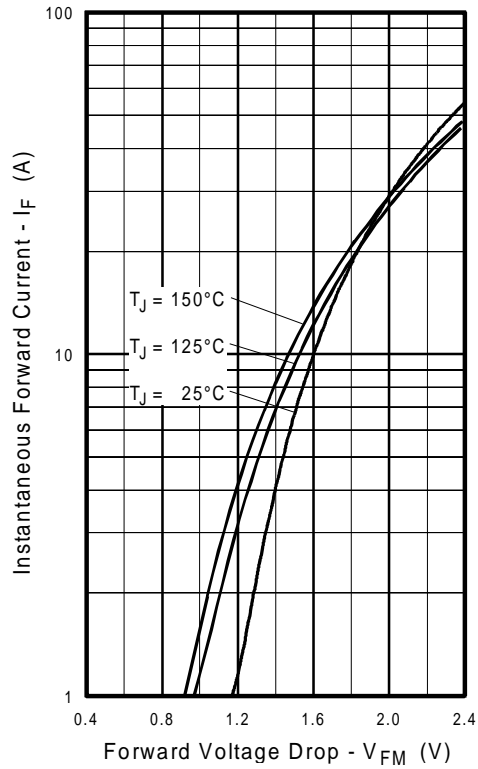


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

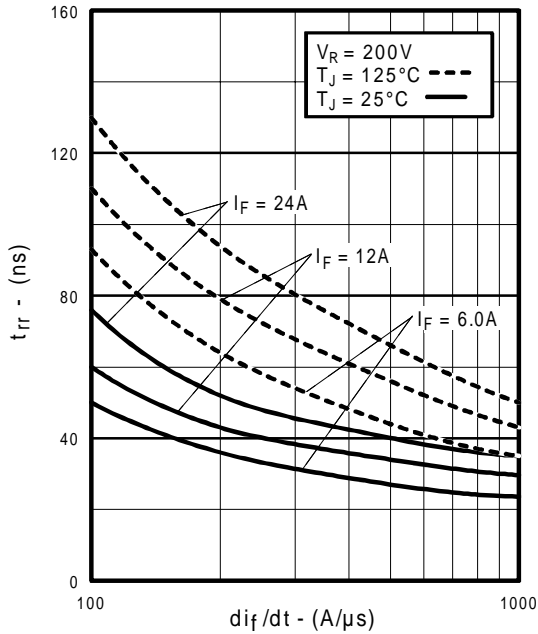


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

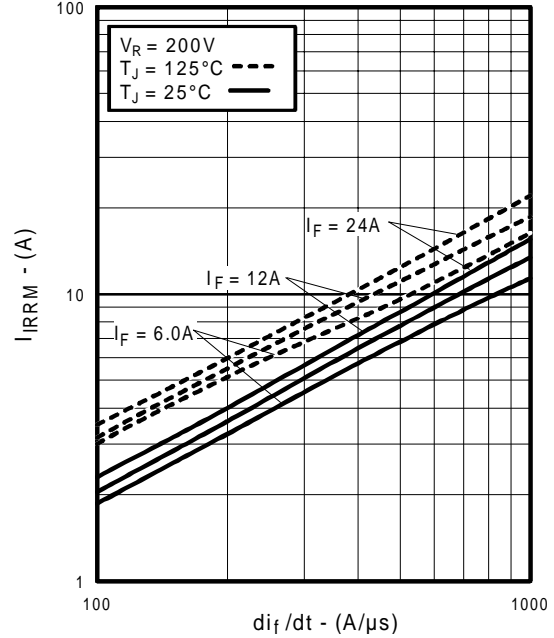


Fig. 15 - Typical Recovery Current vs. di_f/dt

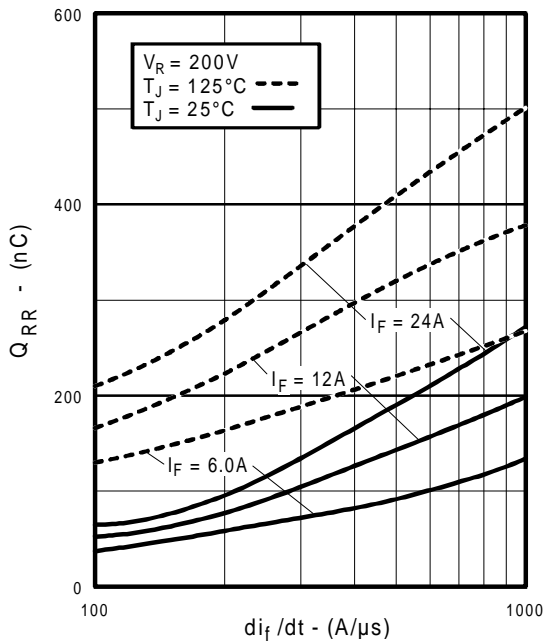


Fig. 16 - Typical Stored Charge vs. di_f/dt

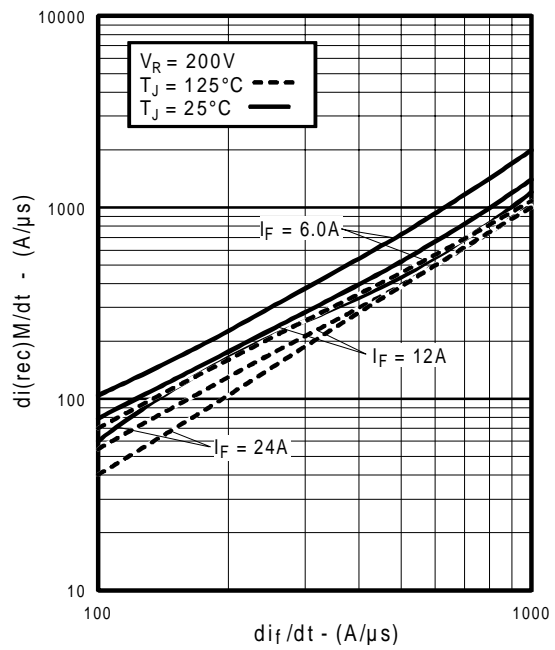


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

IRG4PC30KD

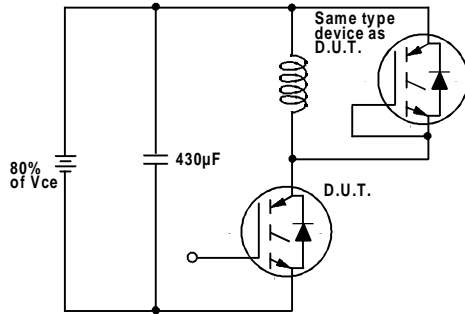


Fig. 18a - Test Circuit for Measurement of I_{LM} , E_{on} , $E_{off}(\text{diode})$, t_{rr} , Q_{rr} , I_{rr} , $t_{d(on)}$, t_r , $t_{d(off)}$, t_f

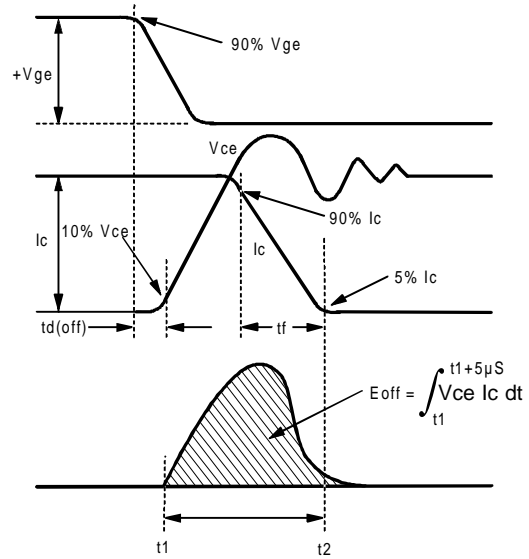


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off} , $t_{d(off)}$, t_f

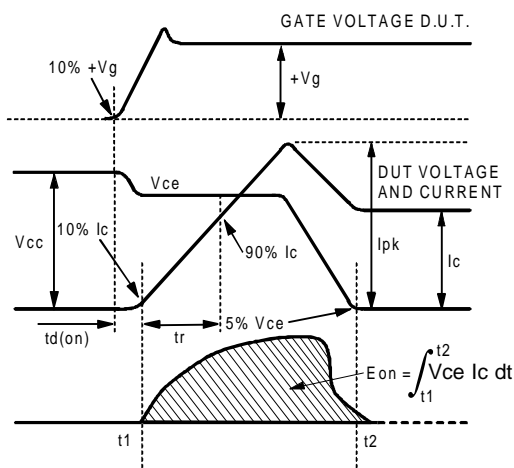


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on} , $t_{d(on)}$, t_r

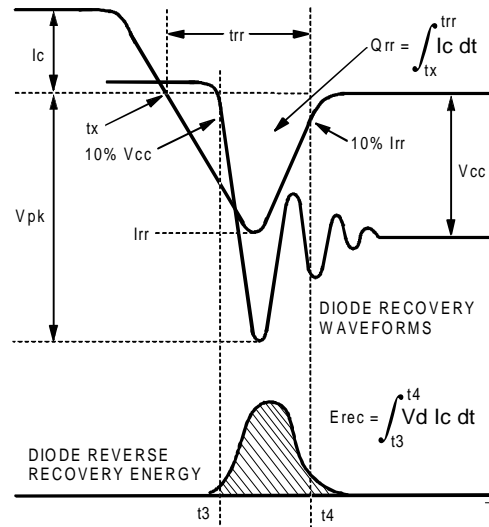


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec} , t_{rr} , Q_{rr} , I_{rr}

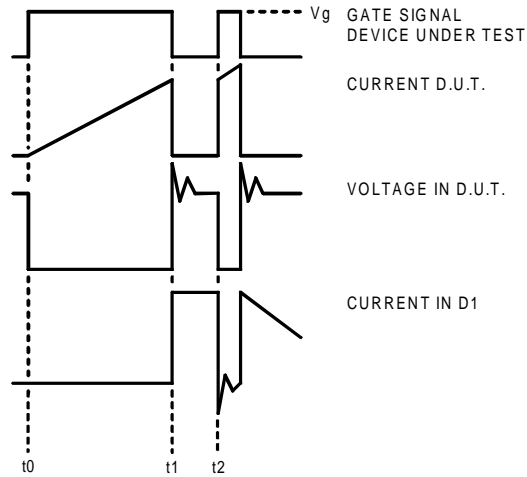


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

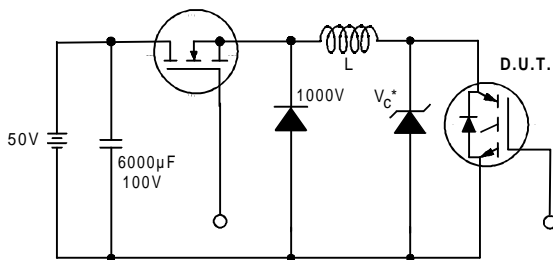


Figure 19. Clamped Inductive Load Test Circuit

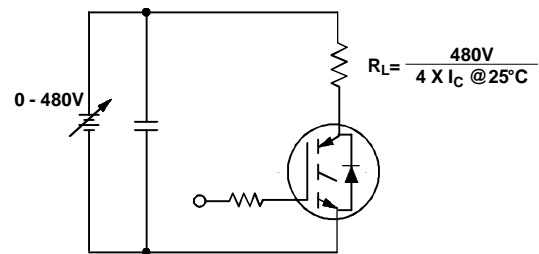


Figure 20. Pulsed Collector Current Test Circuit



LittleDiode supplies new, hard to find or obsolete electronic components and semiconductors all over the world.

With over two million different components listed you are sure to find the part you need.

Feel free to visit us today at our online store:

LittleDiode.com

Looking forward to providing you with the best possible service.