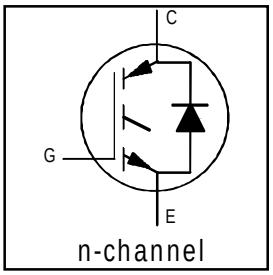
PD -91594C

International
IOR Rectifier

# IRG4BC30KD-S

INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFAST SOFT RECOVERY DIODE

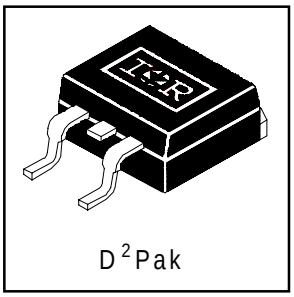
Short Circuit Rated
UltraFast IGBT




$V_{CES}$ = 600V

$V_{CE(on)\ typ.}$ = 2.21V

@$V_{GE}$ = 15V, $I_C$ = 16A




## Features

- High short circuit rating optimized for motor control, $t_{sc}$ =10µs, @360V $V_{CE}$ (start), $T_J$ = 125°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

## Benefits

- Latest generation 4 IGBTs offer highest power density motor controls possible
- HEXFRED™ diodes optimized for performance with IGBTs. Minimized recovery characteristic reduce noise, EMI and switching losses
- This part replaces the IRGBC30KD2-S and IRGBC30MD2-S 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°C | Continuous Collector Current | 28 | A |
| $I_C$ @ $T_C$ = 100°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°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°C | Maximum Power Dissipation | 100 | W |
| $P_D$ @ $T_C$ = 100°C | Maximum Power Dissipation | 42 | |
| $T_J$ | Operating Junction and | -55 to +150 | °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 | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case - IGBT | — | 1.2 | °C/W |
| $R_{\theta JC}$ | Junction-to-Case - Diode | | 2.5 | |
| $R_{\theta CS}$ | Case-to-Sink, Flat, Greased Surface | 0.5 | — | |
| $R_{\theta JA}$ | Junction-to-Ambient ( PCB Mounted,steady-state)⑤ | — | 40 | |
| Wt | Weight | 1.44 | — | g |



4/24/2000

## Electrical Characteristics @ $T_J$ = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)CES}$ | Collector-to-Emitter Breakdown Voltage③ | 600 | — | — | V | $V_{GE}$ = 0V, $I_C$ = 250µA |
| $\Delta V_{(BR)CES}/\Delta T_J$ | 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 |
| | | — | 2.88 | — | | $I_C$ = 28A See Fig. 2, 5 |
| | | — | 2.36 | — | | $I_C$ = 16A, $T_J$ = 150°C |
| $V_{GE(th)}$ | Gate Threshold Voltage | 3.0 | — | 6.0 | | $V_{CE}$ = $V_{GE}$, $I_C$ = 250µA |
| $\Delta V_{GE(th)}/\Delta T_J$ | Temperature Coeff. of Threshold Voltage | — | -12 | — | mV/°C | $V_{CE}$ = $V_{GE}$, $I_C$ = 250µA |
| $g_{fe}$ | 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 |
| | | — | — | 2500 | | $V_{GE}$ = 0V, $V_{CE}$ = 600V, $T_J$ = 150°C |
| $V_{FM}$ | Diode Forward Voltage Drop | — | 1.4 | 1.7 | V | $I_C$ = 12A See Fig. 13 |
| | | — | 1.3 | 1.6 | | $I_C$ = 12A, $T_J$ = 150°C |
| $I_{GES}$ | Gate-to-Emitter Leakage Current | — | — | ±100 | nA | $V_{GE}$ = ±20V |

## Switching Characteristics @ $T_J$ = 25°C (unless otherwise specified)

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge (turn-on) | — | 67 | 100 | nC | $I_C$ = 16A |
| $Q_{ge}$ | Gate - Emitter Charge (turn-on) | — | 11 | 16 | | $V_{CC}$ = 400V See Fig.8 |
| $Q_{gc}$ | Gate - Collector Charge (turn-on) | — | 25 | 37 | | $V_{GE}$ = 15V |
| $t_{d(on)}$ | Turn-On Delay Time | — | 60 | — | ns | |
| $t_r$ | Rise Time | — | 42 | — | | $T_J$ = 25°C |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 160 | 250 | | $I_C$ = 16A, $V_{CC}$ = 480V |
| $t_f$ | Fall Time | — | 80 | 120 | | $V_{GE}$ = 15V, $R_G$ = 23Ω |
| $E_{on}$ | Turn-On Switching Loss | — | 0.60 | — | mJ | Energy losses include "tail" |
| $E_{off}$ | Turn-Off Switching Loss | — | 0.58 | — | | and diode reverse recovery |
| $E_{ts}$ | Total Switching Loss | — | 1.18 | 1.6 | | See Fig. 9,10,14 |
| $t_{sc}$ | Short Circuit Withstand Time | 10 | — | — | µs | $V_{CC}$ = 360V, $T_J$ = 125°C |
| | | | | | | $V_{GE}$ = 15V, $R_G$ = 10Ω , $V_{CPK}$ < 500V |
| $t_{d(on)}$ | Turn-On Delay Time | — | 58 | — | ns | $T_J$ = 150°C, See Fig. 11,14 |
| $t_r$ | Rise Time | — | 42 | — | | $I_C$ = 16A, $V_{CC}$ = 480V |
| $t_{d(off)}$ | Turn-Off Delay Time | — | 210 | — | | $V_{GE}$ = 15V, $R_G$ = 23Ω |
| $t_f$ | Fall Time | — | 160 | — | | Energy losses include "tail" |
| $E_{ts}$ | Total Switching Loss | — | 1.69 | — | mJ | and diode reverse recovery |
| $L_E$ | Internal Emitter Inductance | — | 7.5 | — | nH | Measured 5mm from package |
| $C_{ies}$ | Input Capacitance | — | 920 | — | pF | $V_{GE}$ = 0V |
| $C_{oes}$ | Output Capacitance | — | 110 | — | | $V_{CC}$ = 30V See Fig. 7 |
| $C_{res}$ | Reverse Transfer Capacitance | — | 27 | — | | $f$ = 1.0MHz |
| $t_{rr}$ | Diode Reverse Recovery Time | — | 42 | 60 | ns | $T_J$ = 25°C See Fig. 14 — $I_F$ = 12A |
| | | — | 80 | 120 | | $T_J$ = 125°C |
| $I_{rr}$ | Diode Peak Reverse Recovery Current | — | 3.5 | 6.0 | A | $T_J$ = 25°C See Fig. 15 — $V_R$ = 200V |
| | | — | 5.6 | 10 | | $T_J$ = 125°C |
| $Q_{rr}$ | Diode Reverse Recovery Charge | — | 80 | 180 | nC | $T_J$ = 25°C See Fig. 16 — di/dt = 200Aµs |
| | | — | 220 | 600 | | $T_J$ = 125°C |
| $di_{(rec)M}/dt$ | Diode Peak Rate of Fall of Recovery | — | 180 | — | A/µs | $T_J$ = 25°C See Fig. 17 |
| | During $t_b$ | — | 160 | — | | $T_J$ = 125°C |

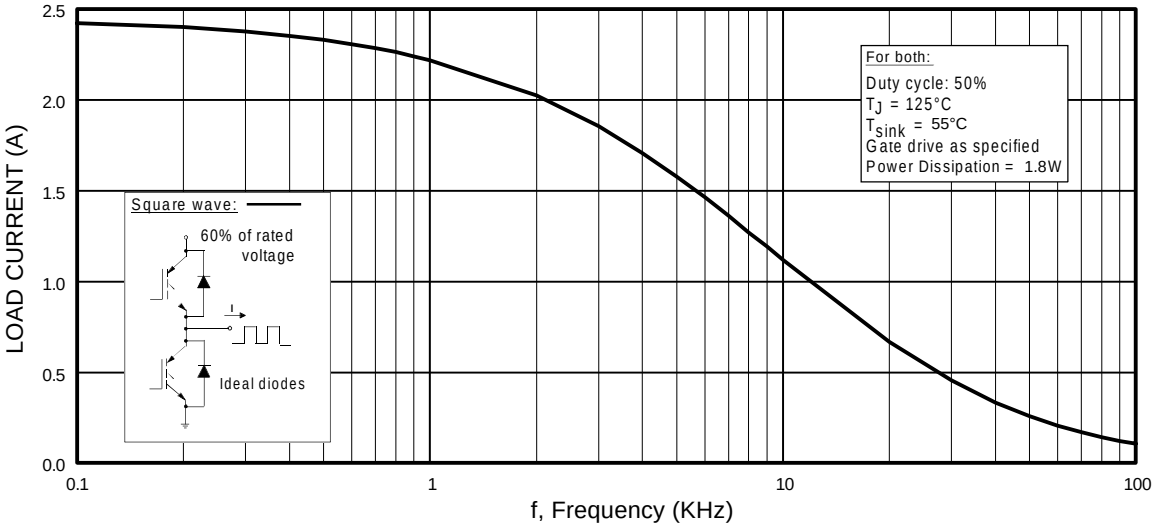



**Fig. 1** - Typical Load Current vs. Frequency
(Load Current = $I_{RMS}$ of fundamental)

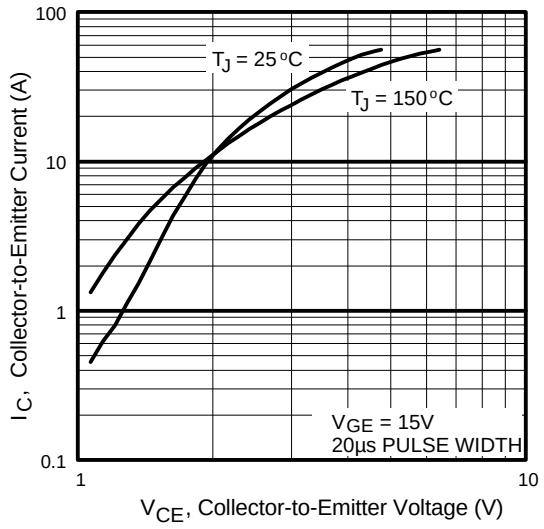



**Fig. 2** - Typical Output Characteristics

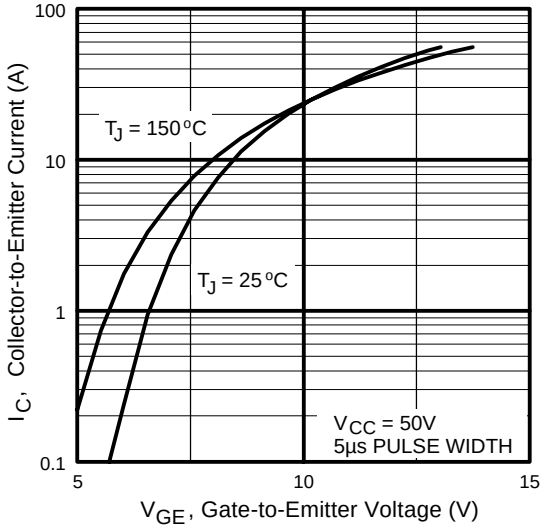



**Fig. 3** - Typical Transfer Characteristics

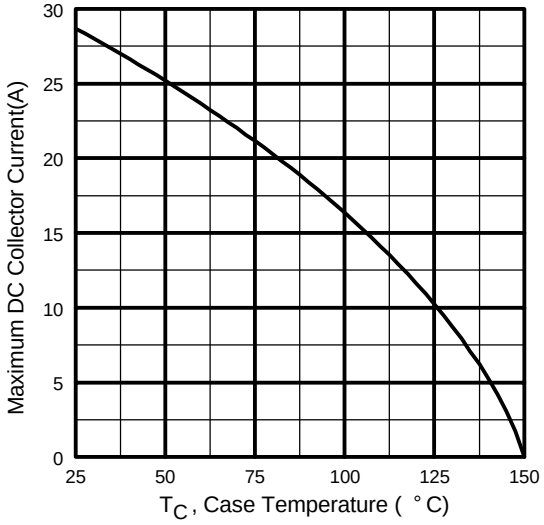



**Fig. 4** - Maximum Collector Current vs. Case Temperature

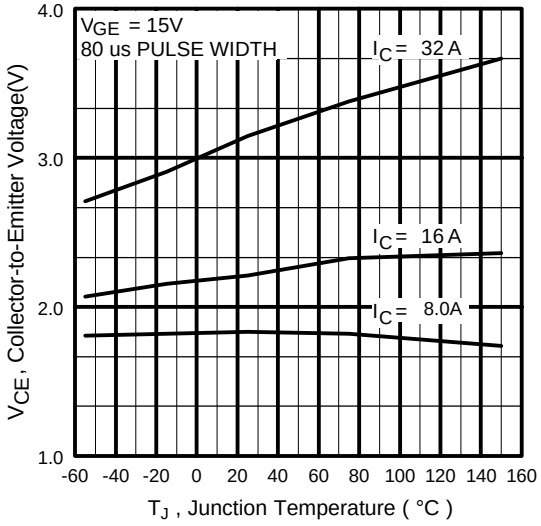



**Fig. 5** - Typical Collector-to-Emitter Voltage vs. Junction Temperature

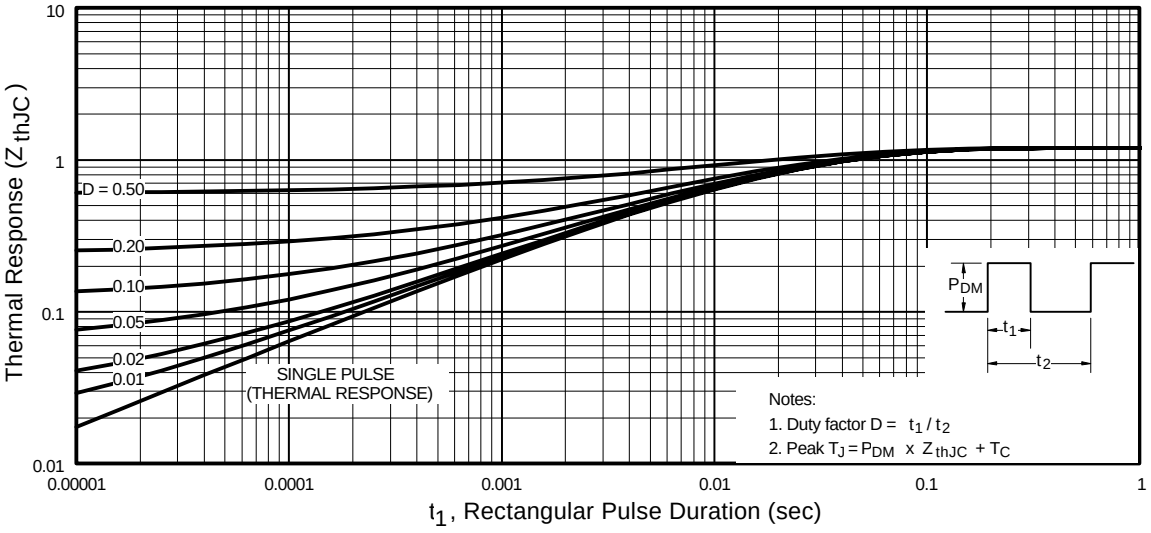



**Fig. 6** - Maximum Effective Transient Thermal Impedance, Junction-to-Case

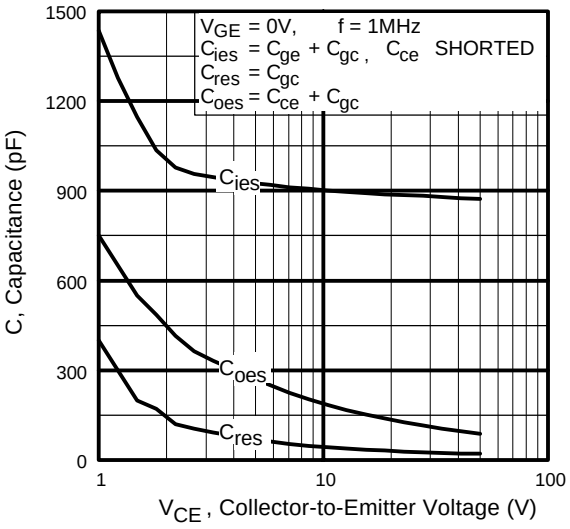



**Fig. 7 -** Typical Capacitance vs. Collector-to-Emitter Voltage

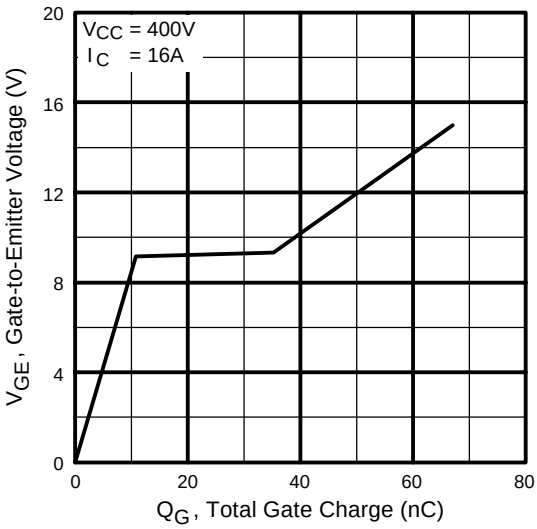



**Fig. 8** - Typical Gate Charge vs. Gate-to-Emitter Voltage

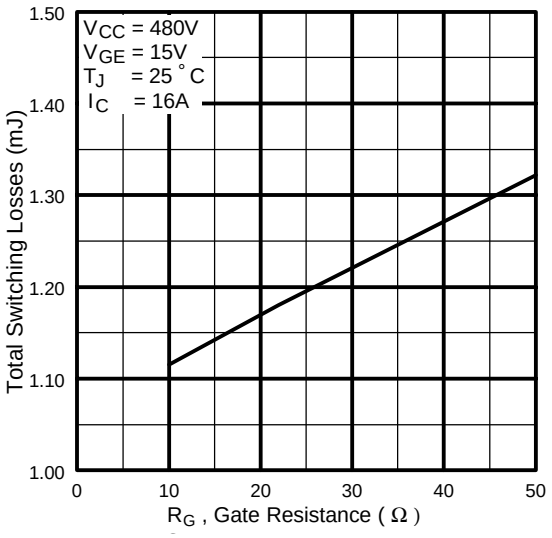



**Fig. 9** - Typical Switching Losses vs. Gate Resistance

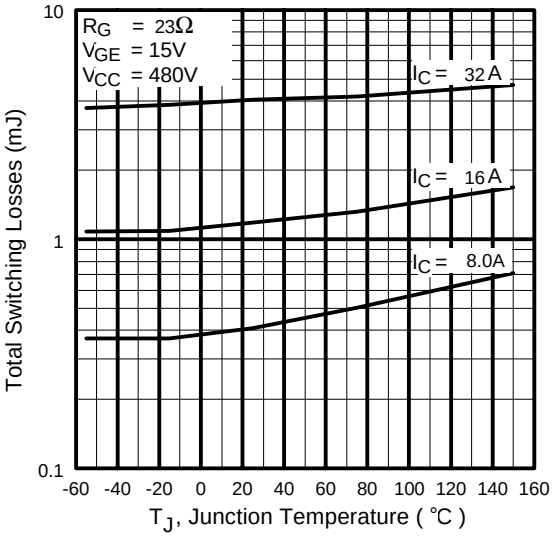



**Fig. 10** - Typical Switching Losses vs. Junction Temperature

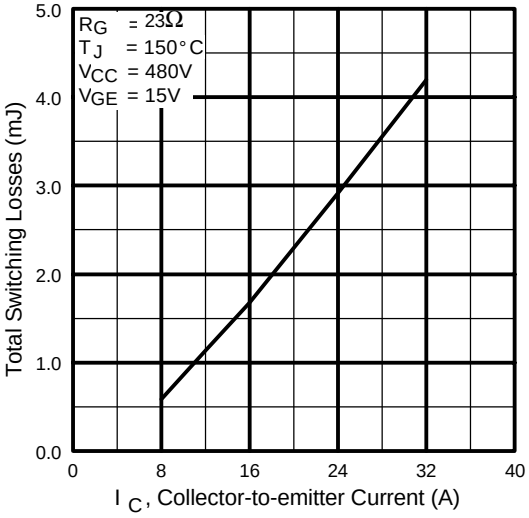



**Fig. 11 -** Typical Switching Losses vs. Collector-to-Emitter Current

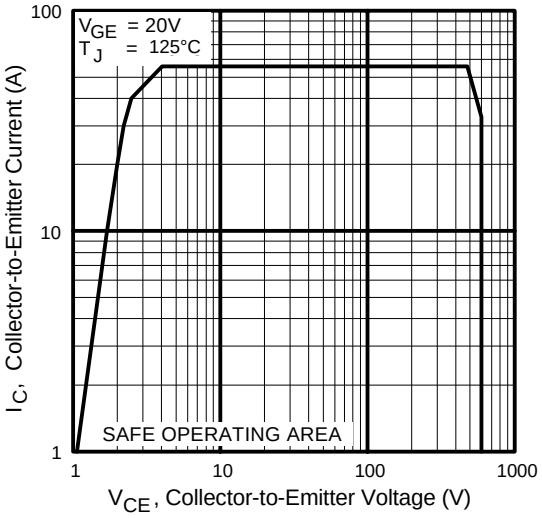



**Fig. 12** - Turn-Off SOA

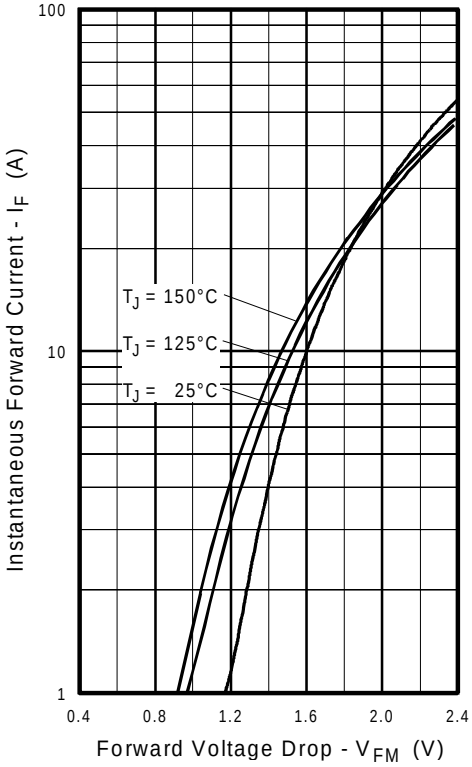



**Fig. 13** - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

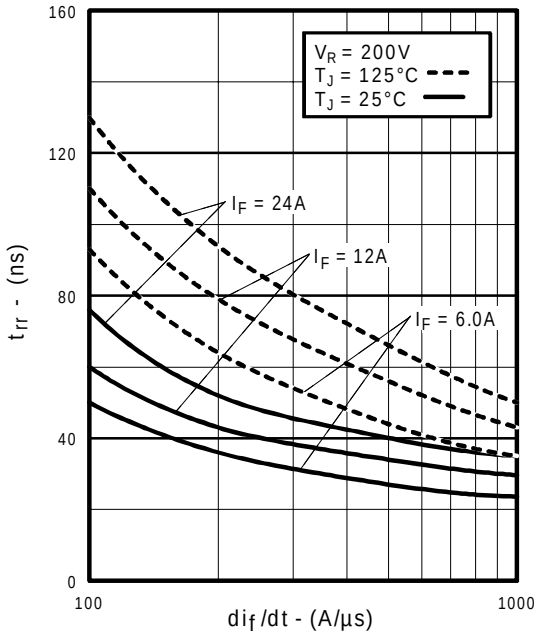



**Fig. 14** - Typical Reverse Recovery vs. $di_f/dt$

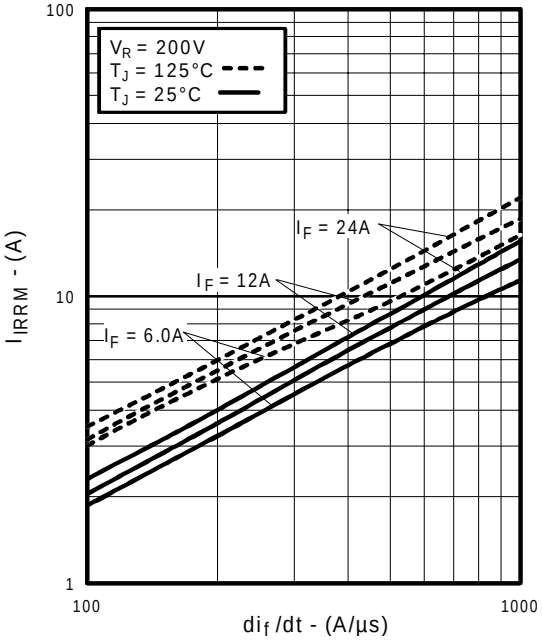



**Fig. 15** - Typical Recovery Current vs. $di_f/dt$

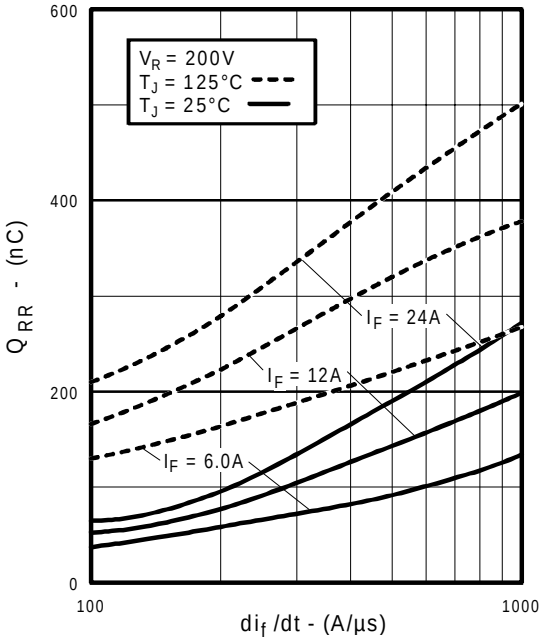



**Fig. 16** - Typical Stored Charge vs. $di_f/dt$

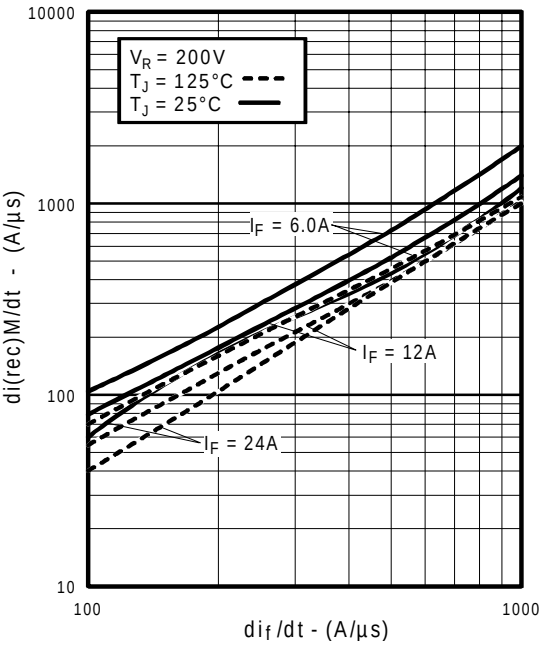



**Fig. 17** - Typical $di_{(rec)M}/dt$ vs. $di_f/dt$

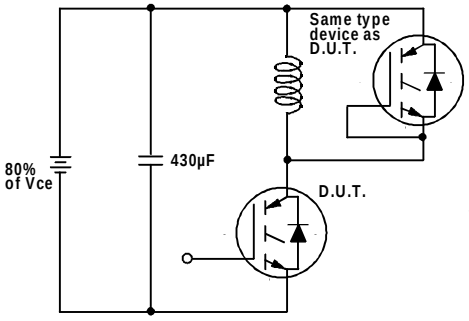



**Fig. 18a** - Test Circuit for Measurement of $I_{LM}$, $E_{on}$, $E_{off(diode)}$, $t_{rr}$, $Q_{rr}$, $I_{rr}$, $t_{d(on)}$, $t_r$, $t_{d(off)}$, $t_f$

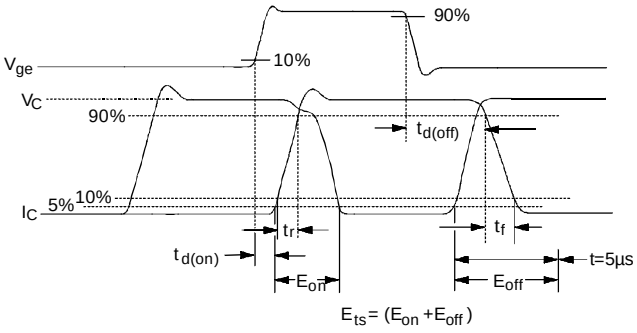



**Fig. 18b** - Test Waveforms for Circuit of Fig. 18a, Defining $E_{off}$, $t_{d(off)}$, $t_f$

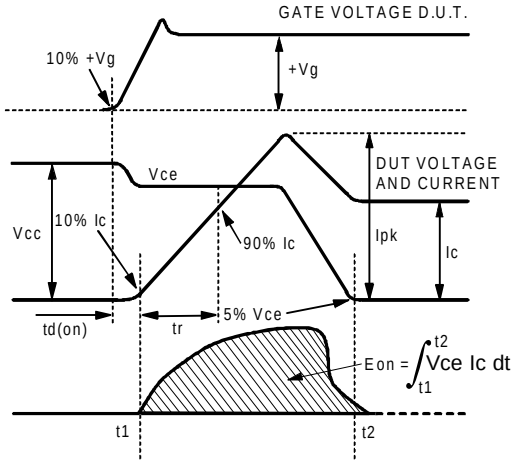



**Fig. 18c** - Test Waveforms for Circuit of Fig. 18a, Defining $E_{on}$, $t_{d(on)}$, $t_r$

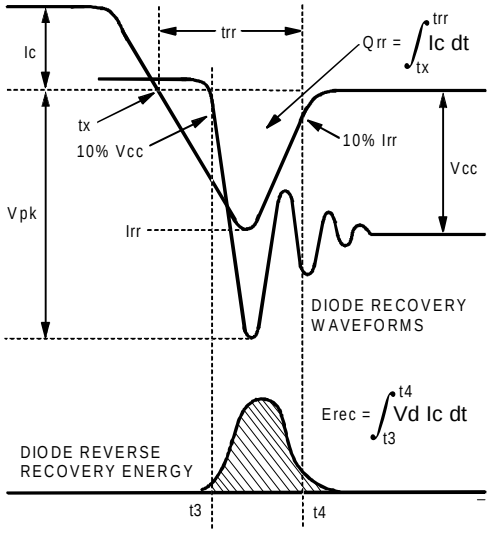



**Fig. 18d** - Test Waveforms for Circuit of Fig. 18a, Defining $E_{rec}$, $t_{rr}$, $Q_{rr}$, $I_{rr}$

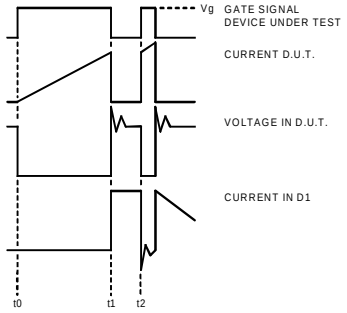



**Figure 18e.** Macro Waveforms for Figure 18a's Test Circuit

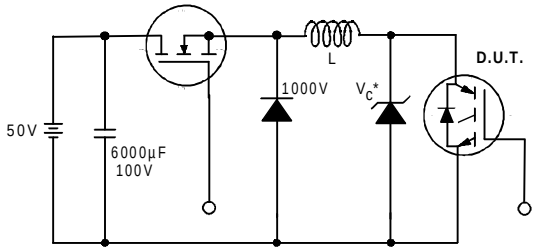



**Figure 19.** Clamped Inductive Load Test Circuit

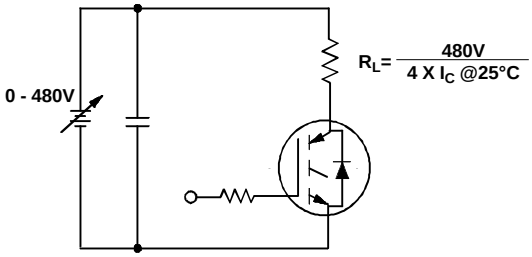
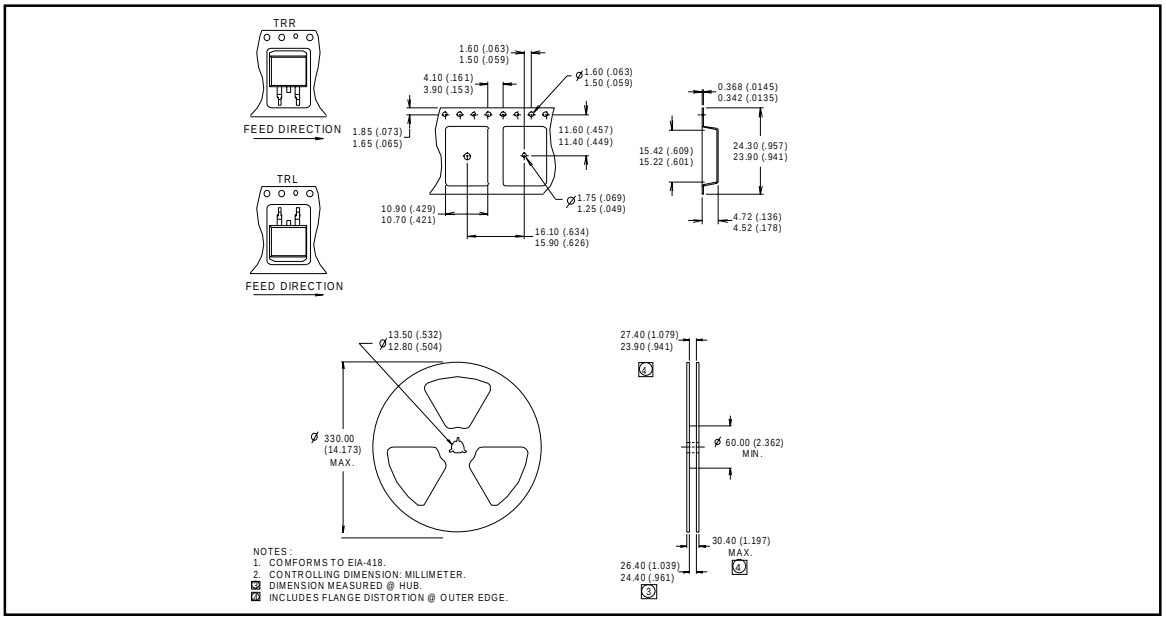



**Figure 20.** Pulsed Collector Current Test Circuit

## Tape & Reel Information

**$D^2$Pak**



## Notes:

① Repetitive rating: $V_{GE}$=20V; pulse width limited by maximum junction temperature (figure 20)

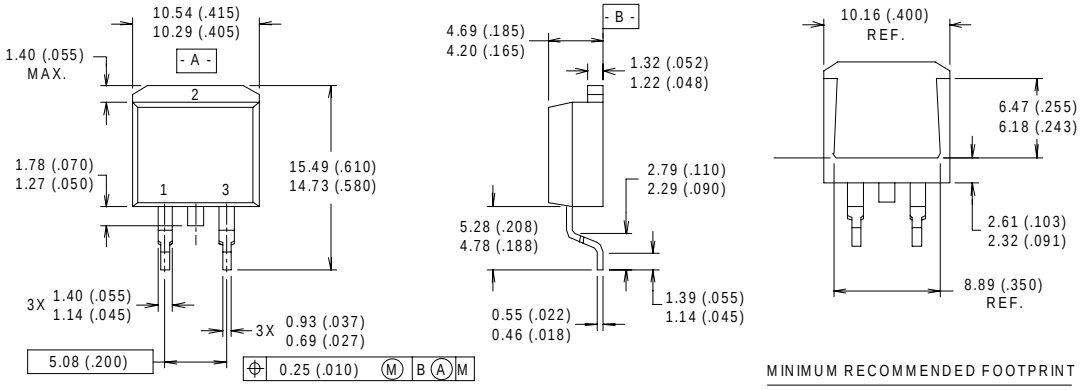
② $V_{CC}$=80%($V_{CES}$), $V_{GE}$=20V, L=10µH, $R_G$= 23Ω (figure 19)

③ Pulse width ≤ 80µs; duty factor ≤ 0.1%.

④ Pulse width 5.0µs, single shot.

⑤ When mounted on 1" square PCB (FR-4 or G-10 Material ).
For recommended footprint and soldering techniques refer to application note #AN-994.

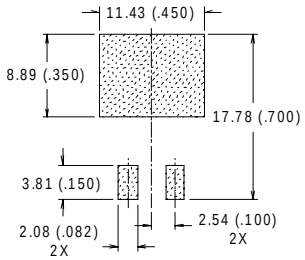
## D²Pak Package Outline




NOTES:
1 DIMENSIONS AFTER SOLDER DIP.
2 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
3 CONTROLLING DIMENSION : INCH.
4 HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

LEAD ASSIGNMENTS
1 - GATE
2 - DRAIN
3 - SOURCE

MINIMUM RECOMMENDED FOOTPRINT




International
IOR Rectifier

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**IR CANADA:** 15 Lincoln Court, Brampton, Ontario L6T3Z2, Tel: (905) 453 2200
**IR GERMANY:** Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 (0) 6172 96590
**IR ITALY:** Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 011 451 0111
**IR JAPAN:** K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo 171 Tel: 81 (0)3 3983 0086
**IR SOUTHEAST ASIA:** 1 Kim Seng Promenade, Great World City West Tower, 13-11, Singapore 237994 Tel: ++ 65 (0)838 4630
**IR TAIWAN:**16 Fl. Suite D. 207, Sec. 2, Tun Haw South Road, Taipei, 10673 Tel: 886-(0)2 2377 9936
*Data and specifications subject to change without notice. 10/00*

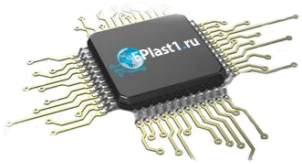
Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.




**Как с нами связаться**

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