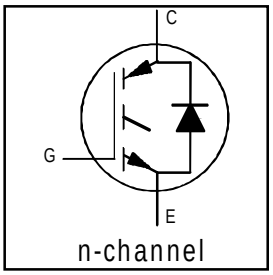
PD -91594C

International
IOR Rectifier

IRG4BC30KD-S

INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFAST SOFT RECOVERY DIODE

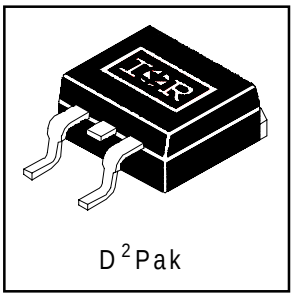
Short Circuit Rated
UltraFast IGBT



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

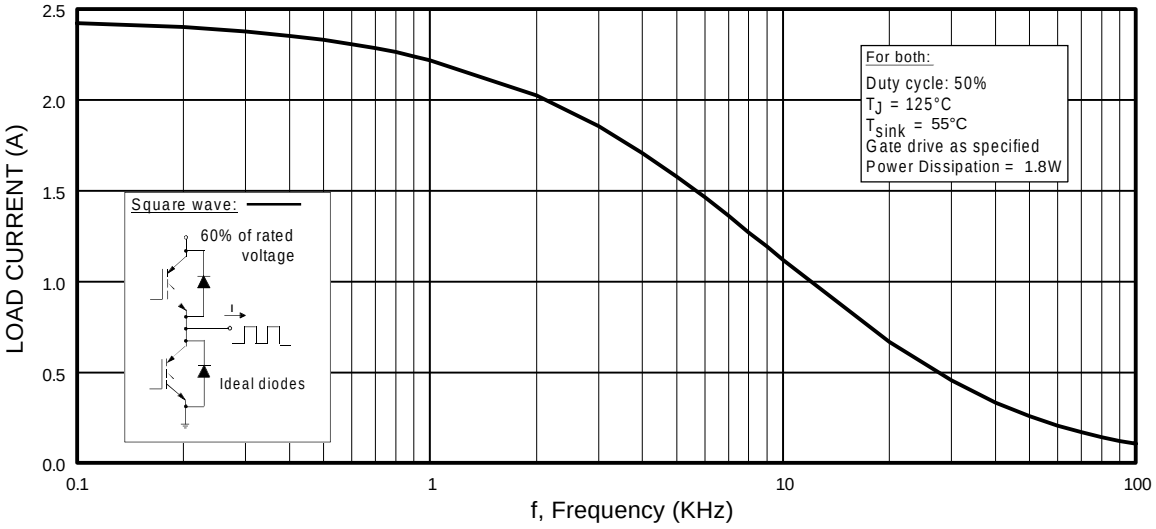


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

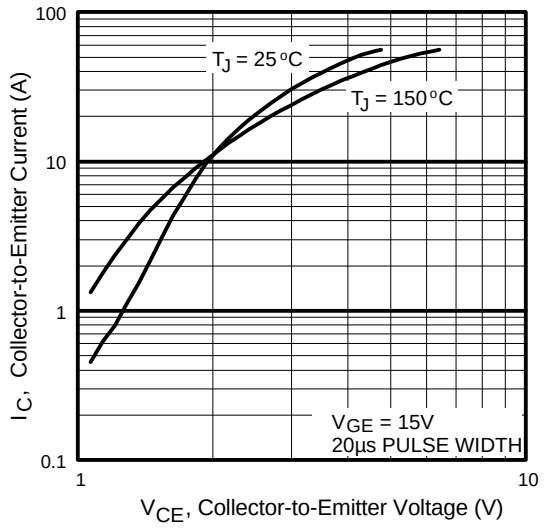


Fig. 2 - Typical Output Characteristics

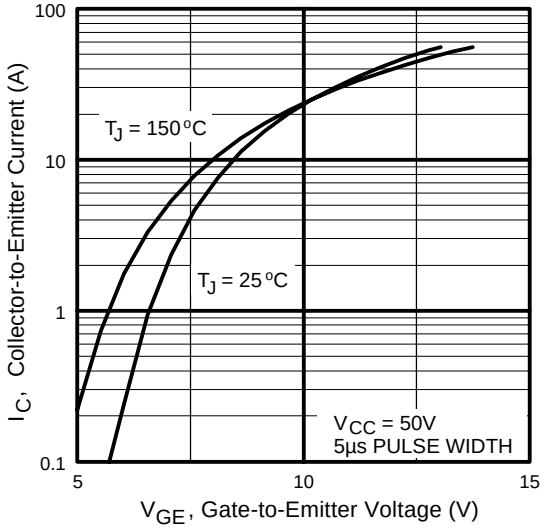


Fig. 3 - Typical Transfer Characteristics

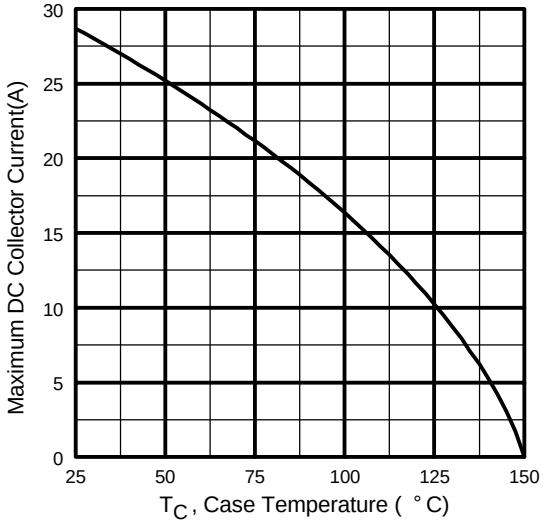


Fig. 4 - Maximum Collector Current vs. Case Temperature

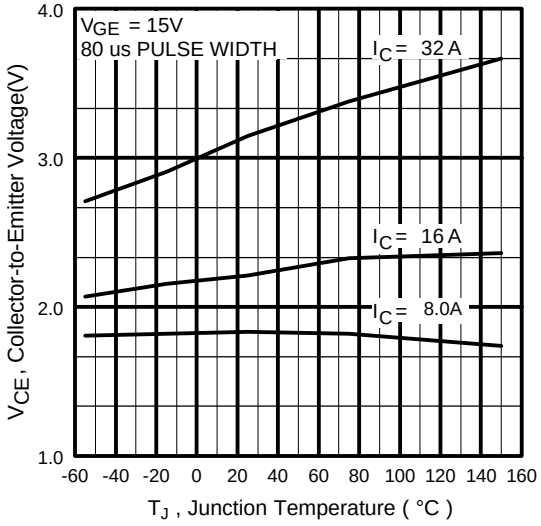


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

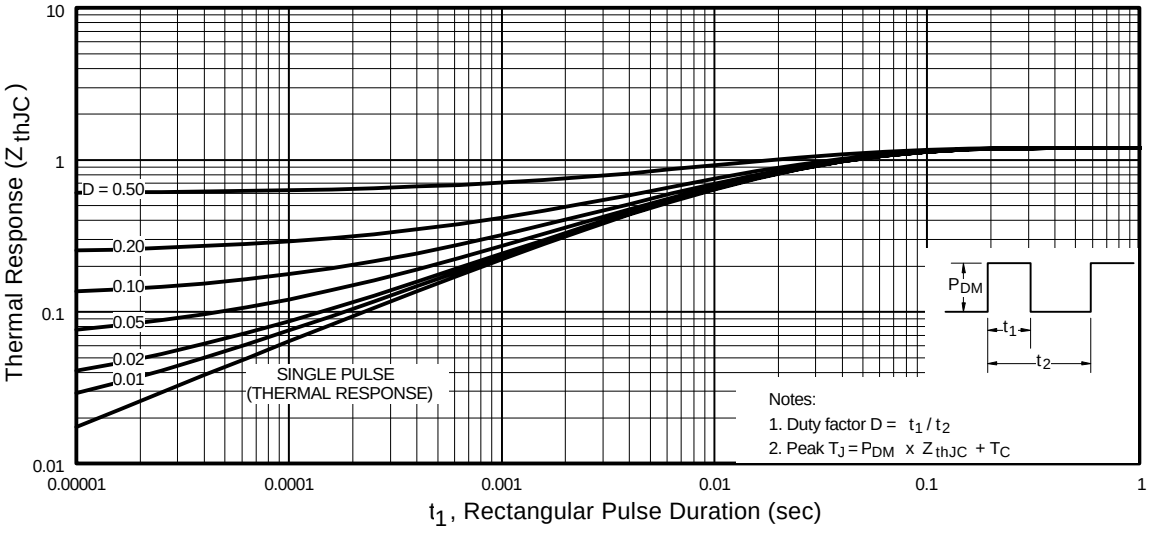


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

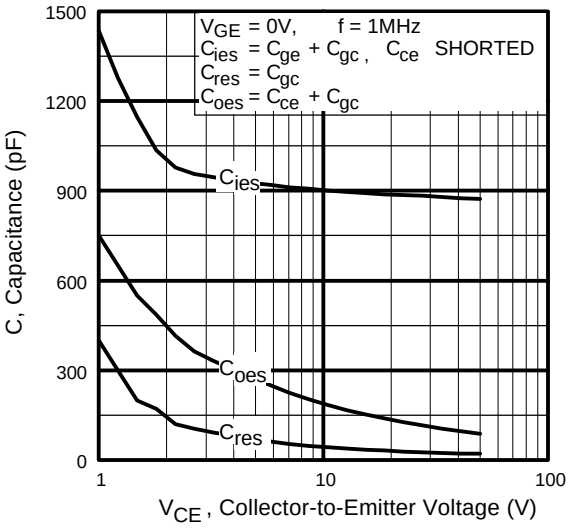


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

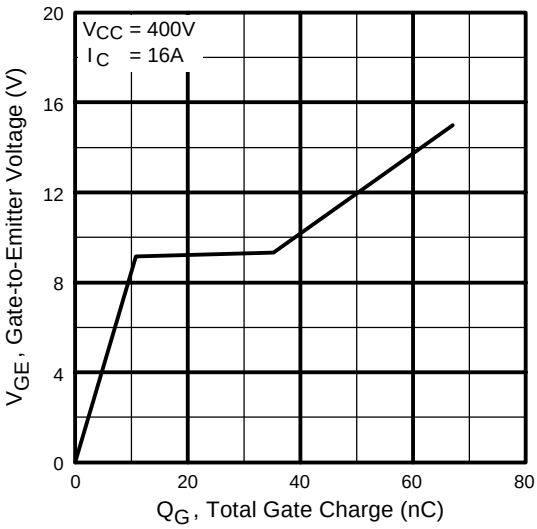


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

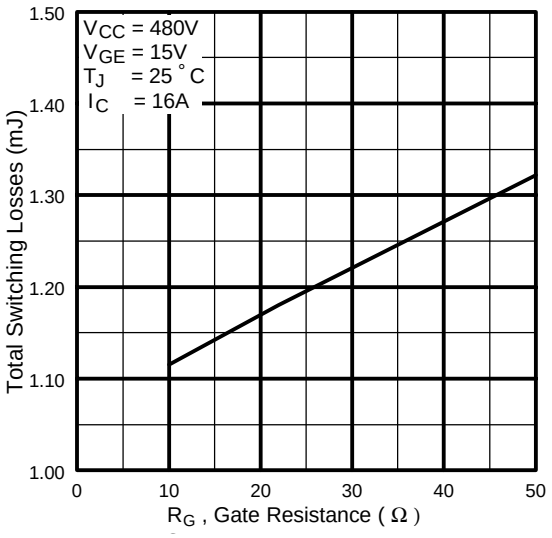


Fig. 9 - Typical Switching Losses vs. Gate Resistance

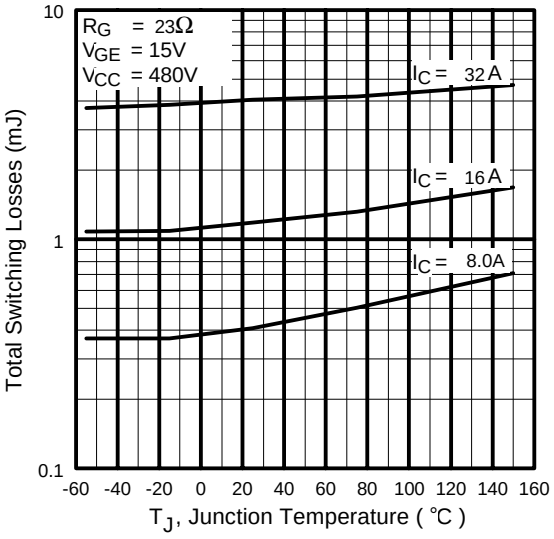


Fig. 10 - Typical Switching Losses vs. Junction Temperature

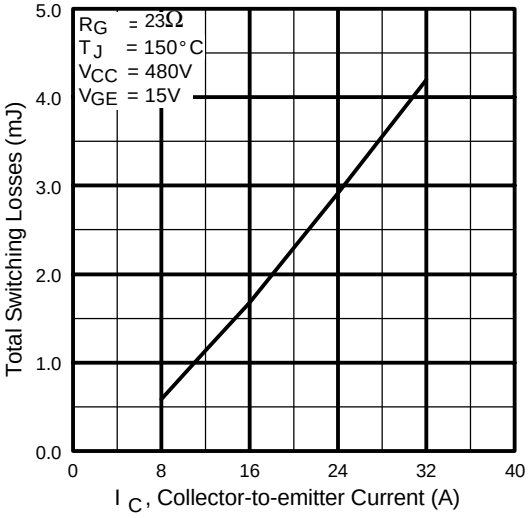


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

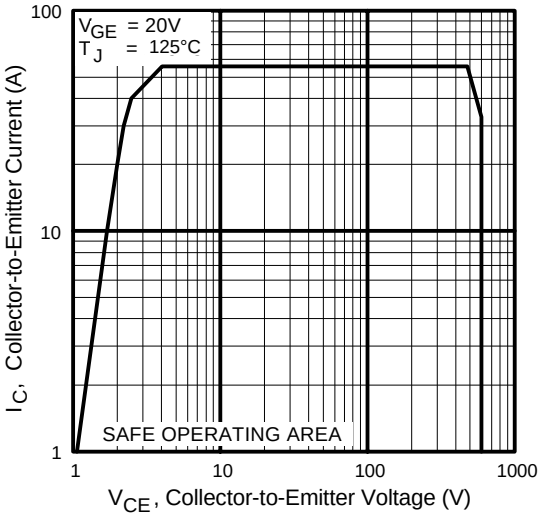


Fig. 12 - Turn-Off SOA

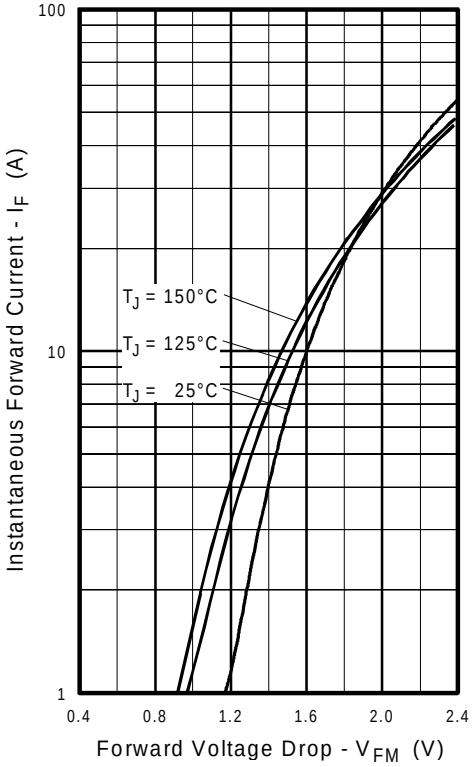


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

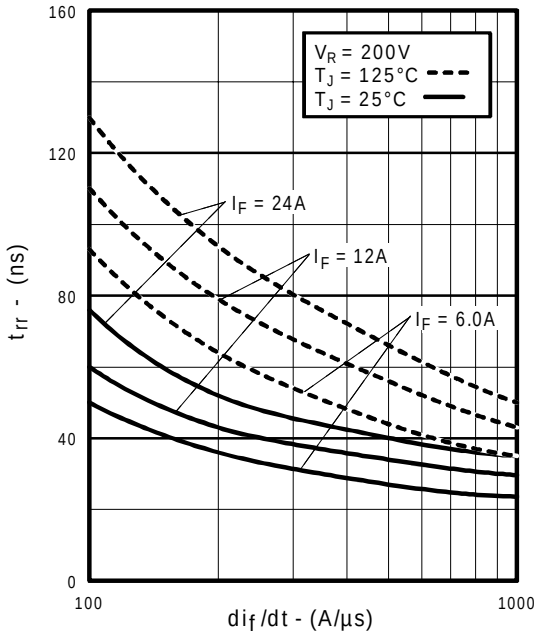


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

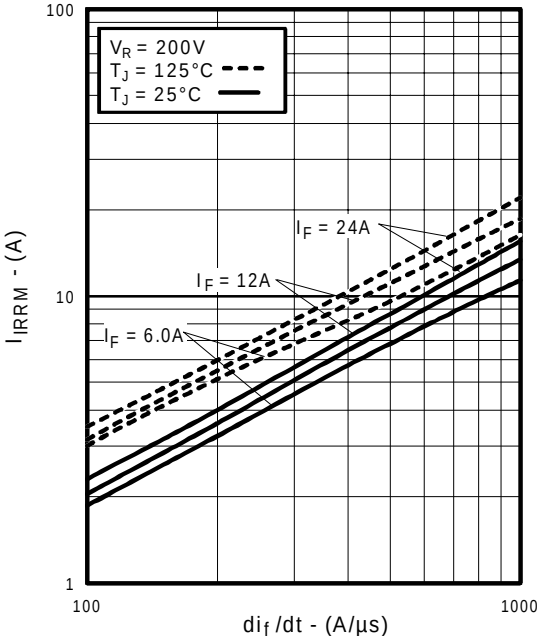


Fig. 15 - Typical Recovery Current vs. di_f/dt

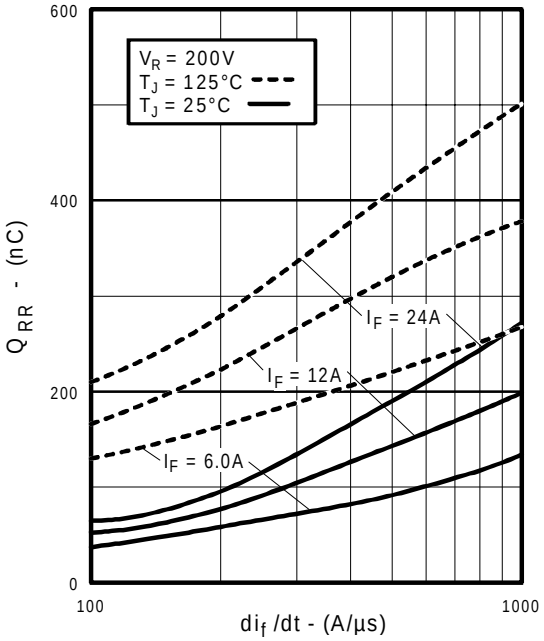


Fig. 16 - Typical Stored Charge vs. di_f/dt

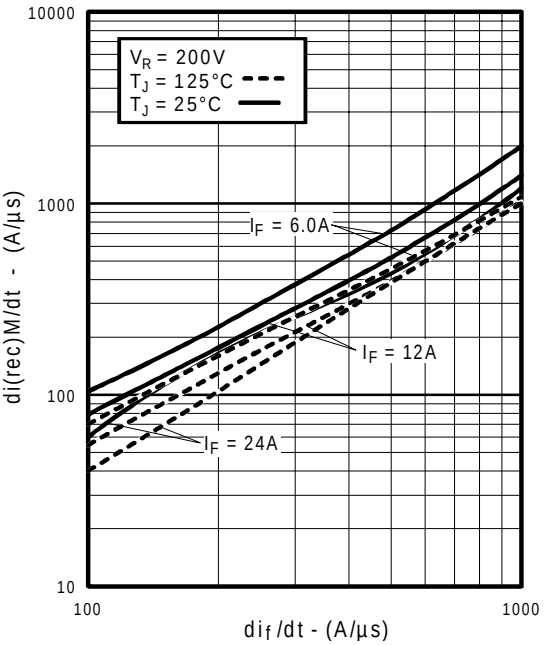


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

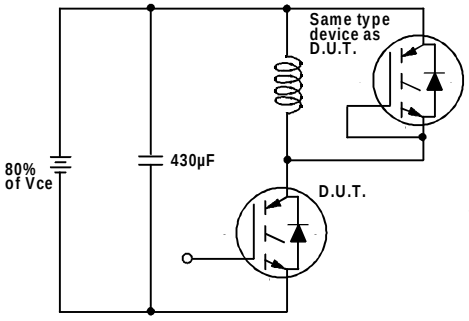


Fig. 18a - Test Circuit for Measurement of I_{LM}, E_{on}, $E_{off(diode)}$, t_{rr}, Q_{rr}, I_{rr}, $t_{d(on)}$, t_r, $t_{d(off)}$, t_f

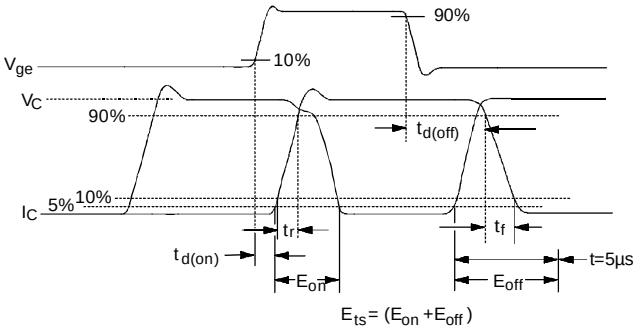


Fig. 18b - Test Waveforms for Circuit of Fig. 18a, Defining E_{off}, $t_{d(off)}$, t_f

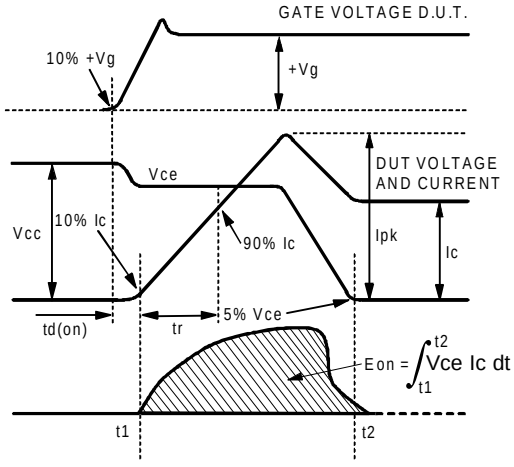


Fig. 18c - Test Waveforms for Circuit of Fig. 18a, Defining E_{on}, $t_{d(on)}$, t_r

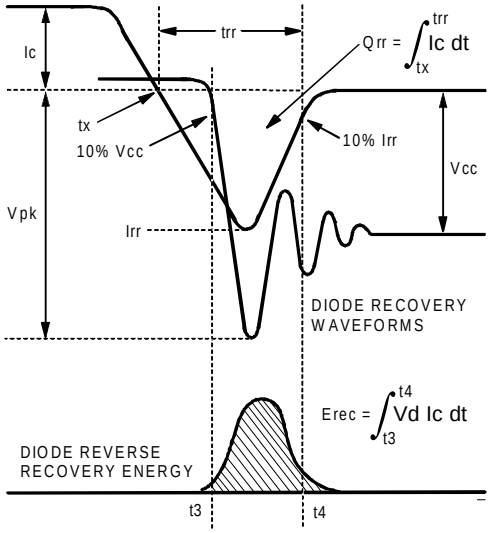


Fig. 18d - Test Waveforms for Circuit of Fig. 18a, Defining E_{rec}, t_{rr}, Q_{rr}, I_{rr}

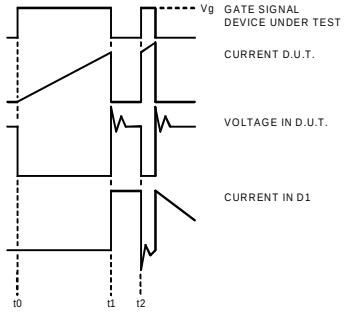


Figure 18e. Macro Waveforms for Figure 18a's Test Circuit

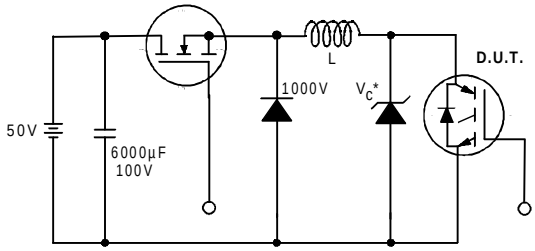


Figure 19. Clamped Inductive Load Test Circuit

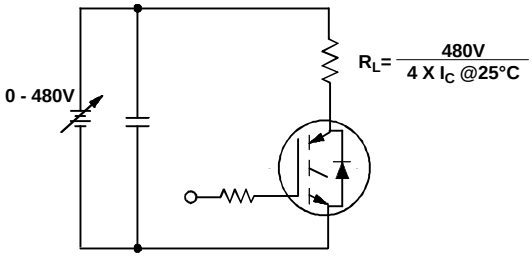
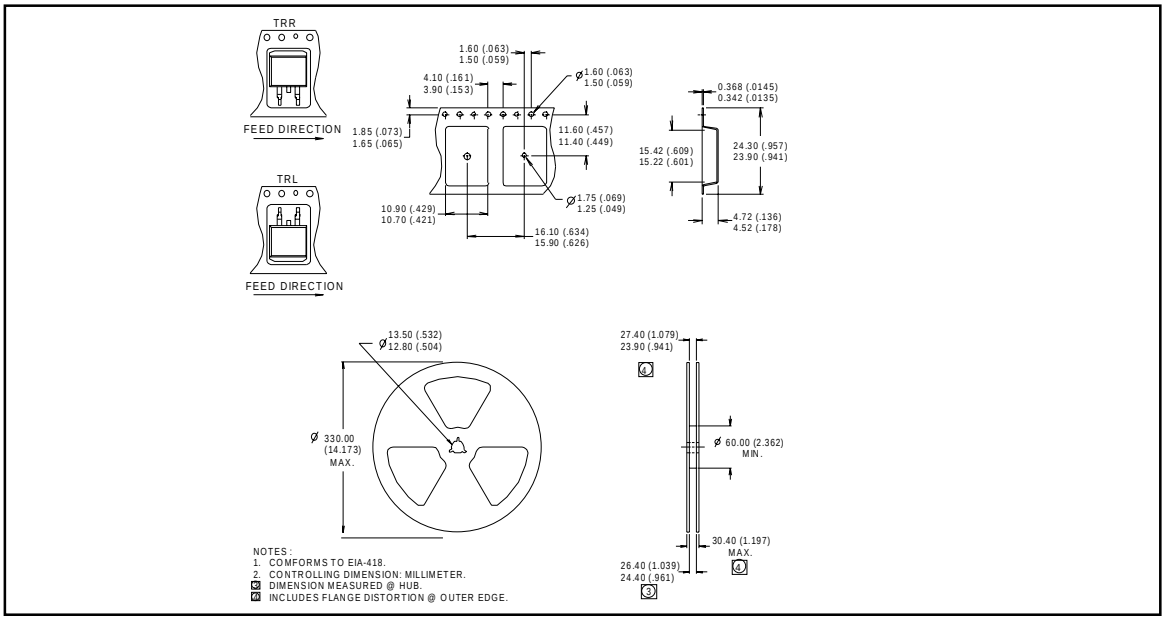


Figure 20. Pulsed Collector Current Test Circuit

Tape & Reel Information

D^2Pak



Notes:

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

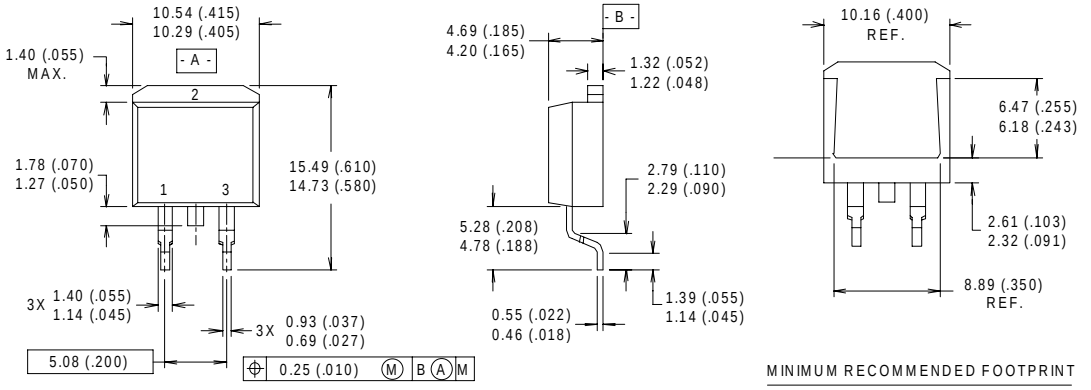
② V_{CC}=80%(V_{CES}), V_{GE}=20V, L=10µH, R_G= 23Ω (figure 19)

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.

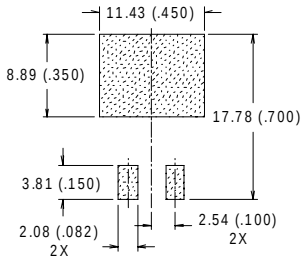
D²Pak Package Outline



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 EUROPEAN REGIONAL CENTRE: 439/445 Godstone Rd, Whyteleafe, Surrey CR3 OBL, UK Tel: ++ 44 (0)20 8645 8000
IR CANADA: 15 Lincoln Court, Brampton, Ontario L6T3Z2, Tel: (905) 453 2200
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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
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ООО «НИОКР СИТЕМС»
Москва, 125362, Россия, ул. Вишневая, д. 9, к. 1, Блок 104 а и 104 в

Телефон: 8 (495) 268-14-82
Email: n@nsistems.ru

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