

International IOR Rectifier

IGBT 6PACK MODULE

PD - 94570

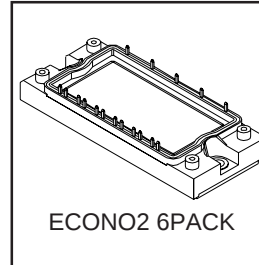
GB35XF120K

Features

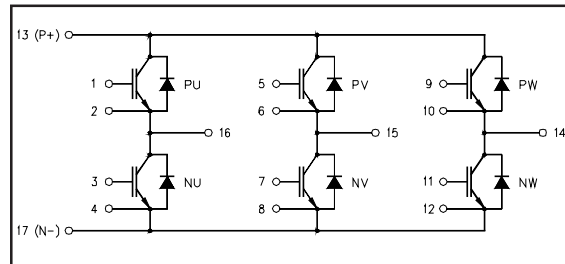
- Low VCE (on) Non Punch Through IGBT Technology
- Low Diode VF
- 10μs Short Circuit Capability
- Square RBSOA
- HEXFRED Antiparallel Diode with Ultrasoft Diode Reverse Recovery Characteristics
- Positive VCE (on) Temperature Coefficient
- Ceramic DBC Substrate
- Low Stray Inductance Design

Benefits

- Benchmark Efficiency for Motor Control
- Rugged Transient Performance
- Low EMI, Requires Less Snubbing
- Direct Mounting to Heatsink
- PCB Solderable Terminals
- Low Junction to Case Thermal Resistance
- UL Listed ①



$V_{CES} = 1200V$
 $I_C = 35A, T_C = 80^\circ C$
 $t_{sc} > 10\mu s, T_J = 150^\circ C$
 $V_{CE(on)} \text{ typ.} = 2.40V$



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	1200	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	50	A
$I_C @ T_C = 80^\circ C$	Continuous Collector Current	35	
I_{CM}	Pulsed Collector Current (Ref.Fig.C.T.5)	100	
I_{LM}	Clamped Inductive Load current	100	
$I_F @ T_C = 25^\circ C$	Diode Continuous Forward Current	50	
$I_F @ T_C = 80^\circ C$	Diode Continuous Forward Current	35	
I_{FM}	Diode Maximum Forward Current	100	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	284	W
$P_D @ T_C = 80^\circ C$	Maximum Power Dissipation	159	
T_J	Maximum Operating Junction Temperature	150	$^\circ C$
T_{STG}	Storage Temperature Range	-40 to +125	
V_{ISOL}	Isolation Voltage	AC 2500 (1min)	V

Thermal and Mechanical Characteristics

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$ (IGBT)	Junction-to-Case- IGBT	—	—	0.44	$^\circ C/W$
$R_{\theta JC}$ (Diode)	Junction-to-Case- Diode	—	—	0.80	
$R_{\theta CS}$ (Module)	Case-to-Sink, flat, greased surface	—	0.05	—	
	Mounting Torque (M5)	2.7	—	3.3	N·m
	Weight	—	170	—	g

GB35XF120K

Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

International
IR Rectifier

	Parameter	Min.	Typ.	Max.	Units	Conditions	Ref.Fig
BV_{CES}	Collector-to-Emitter Breakdown Voltage	1200	—	—	V	$V_{GE} = 0V, I_C = 500\mu A$	
$\Delta V_{(BR)CES}/\Delta T$	Temperature Coeff. of Breakdown Voltage	—	0.7	—	V/ $^\circ\text{C}$	$V_{GE} = 0V, I_C = 1mA (25^\circ\text{C}-125^\circ\text{C})$	
$V_{CE(on)}$	Collector-to-Emitter Voltage	—	2.40	2.60	V	$I_C = 35A, V_{GE} = 15V$	1,2
		—	2.75	3.00		$I_C = 50A, V_{GE} = 15V$	3,4
		—	2.80	—		$I_C = 35A, V_{GE} = 15V, T_J = 125^\circ\text{C}$	
		—	3.30	—		$I_C = 50A, V_{GE} = 15V, T_J = 125^\circ\text{C}$	
$V_{GE(th)}$	Gate Threshold Voltage	4.0	5.25	6.0		$V_{CE} = V_{GE}, I_C = 250\mu A$	3,4
$\Delta V_{GE(th)}$	Threshold Voltage temp. coefficient	—	-11	—	mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 1mA (25^\circ\text{C}-125^\circ\text{C})$	
I_{CES}	Zero Gate Voltage Collector Current	—	5	40	μA	$V_{GE} = 0V, V_{CE} = 1200V$	
		—	500	—		$V_{GE} = 0V, V_{CE} = 1200V, T_J = 125^\circ\text{C}$	
V_{FM}	Diode Forward Voltage Drop	—	1.90	2.35	V	$I_F = 35A$	16
		—	2.15	2.65		$I_F = 50A$	
		—	2.00	—		$I_F = 35A, T_J = 125^\circ\text{C}$	
		—	2.35	—		$I_F = 50A, T_J = 125^\circ\text{C}$	
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 200	nA	$V_{GE} = \pm 20V$	

Switching Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions	Ref.Fig
Q_g	Total Gate Charge (turn-on)	—	255	385	nC	$I_C = 35A$	10
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	25	40		$V_{CC} = 600V$	CT1
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	125	190		$V_{GE} = 15V$	
E_{on}	Turn-On Switching Loss	—	2700	4075	μJ	$I_C = 35A, V_{CC} = 600V$	CT4
E_{off}	Turn-Off Switching Loss	—	2500	3775		$V_{GE} = 15V, R_G = 10\Omega, L = 400\mu H$	
E_{tot}	Total Switching Loss	—	5200	7850		$T_J = 25^\circ\text{C} \text{ } \textcircled{2}$	
E_{on}	Turn-On Switching Loss	—	3750	5450	μJ	$I_C = 35A, V_{CC} = 600V$	5,7
E_{off}	Turn-Off Switching Loss	—	3675	5100		$V_{GE} = 15V, R_G = 10\Omega, L = 400\mu H$	CT4
E_{tot}	Total Switching Loss	—	7425	10550		$T_J = 125^\circ\text{C} \text{ } \textcircled{2}$	WF1,2
$t_{d(on)}$	Turn-On delay time	—	50	65	ns	$I_C = 35A, V_{CC} = 600V$	6,8
t_r	Rise time	—	35	50		$V_{GE} = 15V, R_G = 10\Omega, L = 400\mu H$	CT4
$t_{d(off)}$	Turn-Off delay time	—	415	560		$T_J = 125^\circ\text{C}$	WF1
t_f	Fall time	—	230	300			WF2
C_{ies}	Input Capacitance	—	3475	—	pF	$V_{GE} = 0V$	9
C_{oes}	Output Capacitance	—	615	—		$V_{CC} = 30V$	
C_{res}	Reverse Transfer Capacitance	—	90	—		$f = 1Mhz$	
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				$T_J = 150^\circ\text{C}, I_C = 100A$ $R_G = 10\Omega, V_{GE} = +15V \text{ to } 0V$	CT2 14
SCSOA	Short Circuit Safe Operating Area	10	—	—	μs	$T_J = 150^\circ\text{C}$ $V_{CC} = 900V, V_P = 1200V$ $R_G = 10\Omega, V_{GE} = +15V \text{ to } 0V$	CT3
I_{rr}	Peak Reverse Recovery Current	—	73	—	A	$T_J = 125^\circ\text{C}$ $V_{CC} = 600V, I_F = 35A, L = 400\mu H$ $V_{GE} = 15V, R_G = 10\Omega$	17,18,19 CT4

① For UL Applications, T_J is limited to $+125^\circ\text{C}$ (See File E78996).

② Energy losses include "tail" and diode reverse recovery.

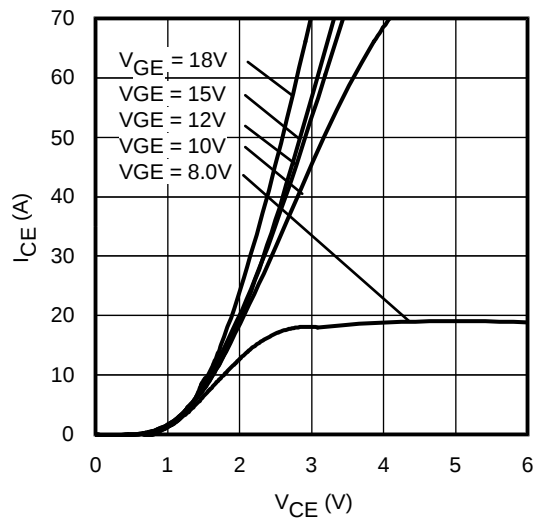


Fig. 1 - Typ. IGBT Output Characteristics
 $T_J = 25^\circ\text{C}$; $t_p = 80\mu\text{s}$

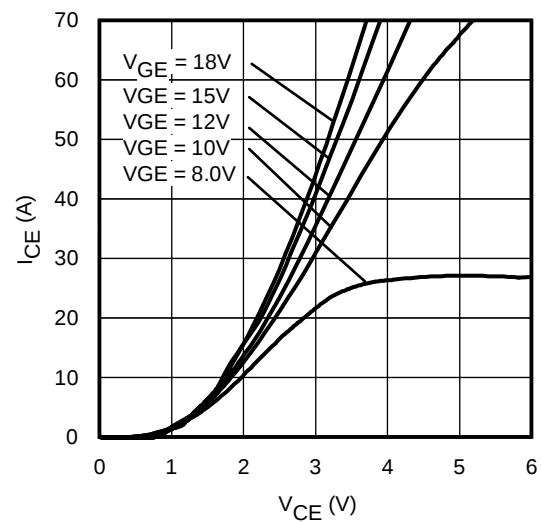


Fig. 2 - Typ. IGBT Output Characteristics
 $T_J = 125^\circ\text{C}$; $t_p = 80\mu\text{s}$

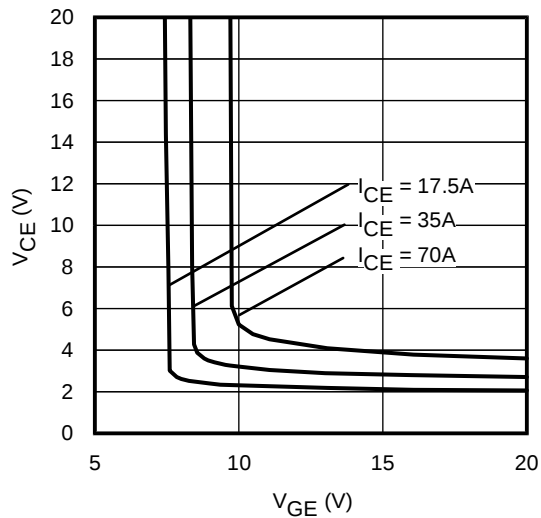


Fig. 3 - Typical V_{CE} vs. V_{GE}
 $T_J = 25^\circ\text{C}$

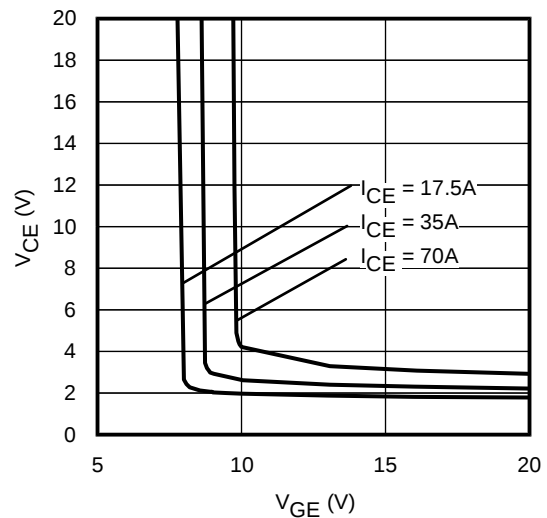


Fig. 4 - Typical V_{CE} vs. V_{GE}
 $T_J = 125^\circ\text{C}$

GB35XF120K

International
IRF Rectifier

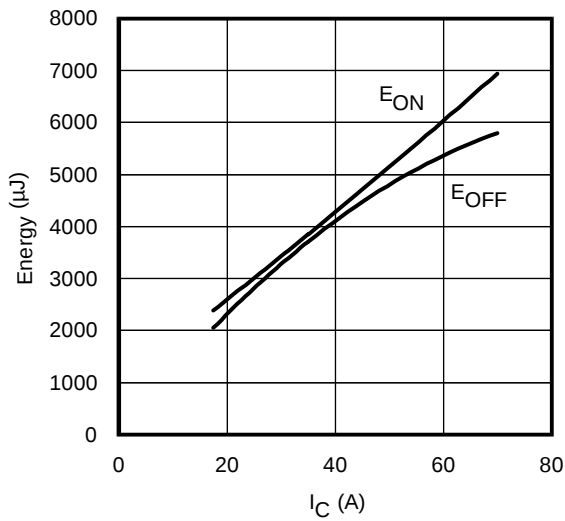


Fig. 5 - Typ. Energy Loss vs. I_C
 $T_J = 125^\circ\text{C}$; $L=400\mu\text{H}$; $V_{CE}= 600\text{V}$
 $R_G= 10\Omega$; $V_{GE}= 15\text{V}$

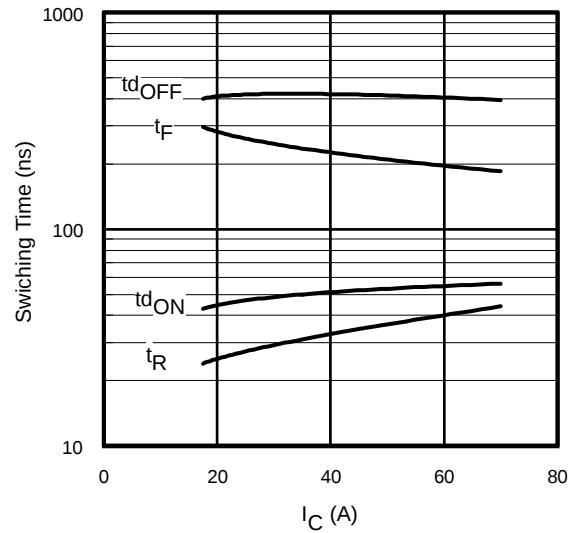


Fig. 6 - Typ. Switching Time vs. I_C
 $T_J = 125^\circ\text{C}$; $L=400\mu\text{H}$; $V_{CE}= 600\text{V}$
 $R_G= 10\Omega$; $V_{GE}= 15\text{V}$

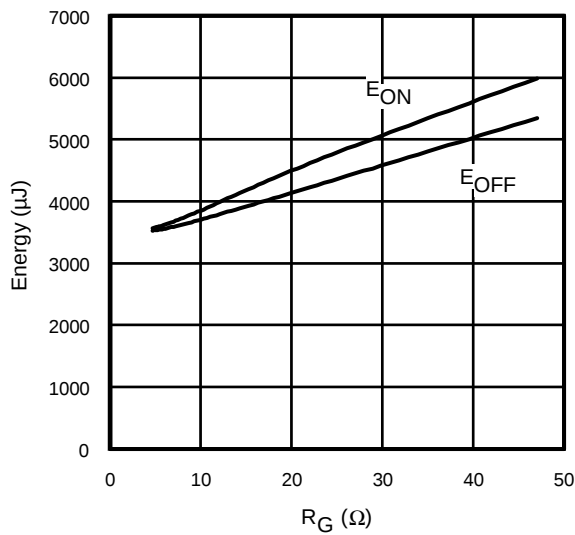


Fig. 7 - Typ. Energy Loss vs. R_G
 $T_J = 125^\circ\text{C}$; $L=400\mu\text{H}$; $V_{CE}= 600\text{V}$
 $I_{CE}= 35\text{A}$; $V_{GE}= 15\text{V}$

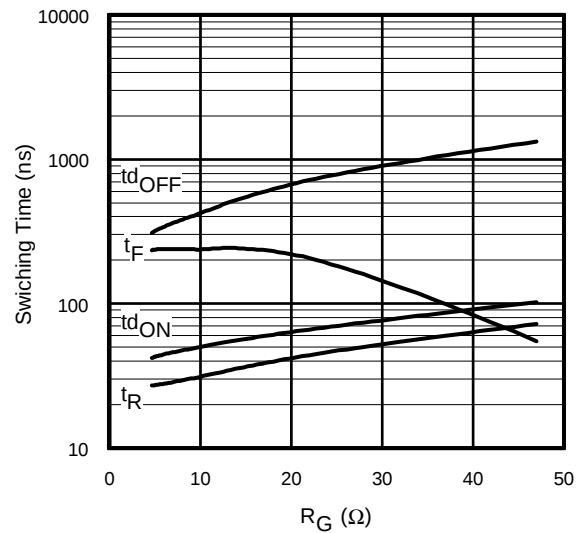


Fig. 8 - Typ. Switching Time vs. R_G
 $T_J = 125^\circ\text{C}$; $L=400\mu\text{H}$; $V_{CE}= 600\text{V}$
 $I_{CE}= 35\text{A}$; $V_{GE}= 15\text{V}$

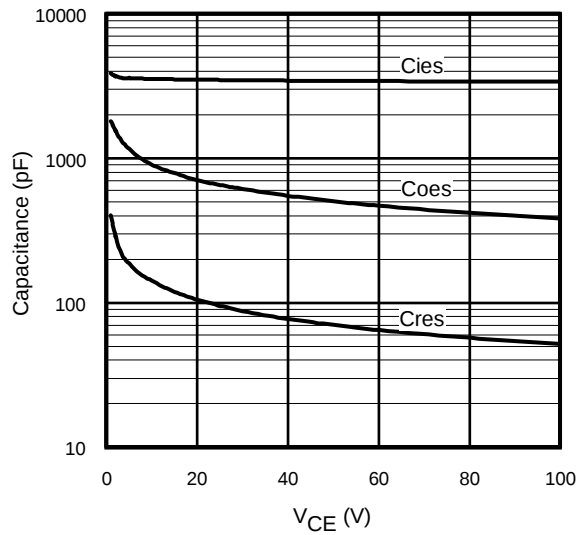


Fig. 9- Typ. Capacitance vs. V_{CE}
 $V_{GE} = 0V$; $f = 1MHz$

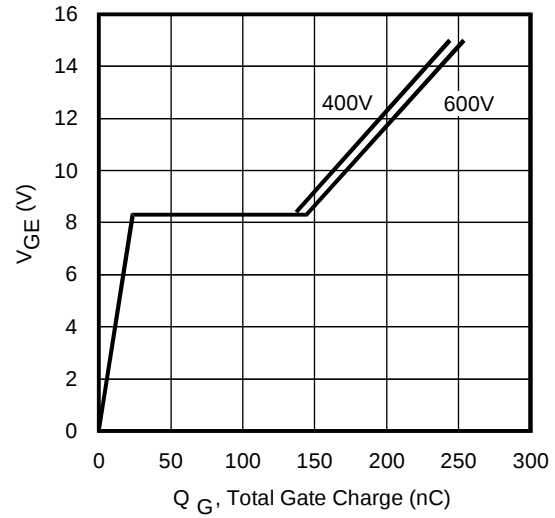


Fig. 10 - Typical Gate Charge vs. V_{GE}
 $I_{CE} = 35A$; $L = 600\mu H$

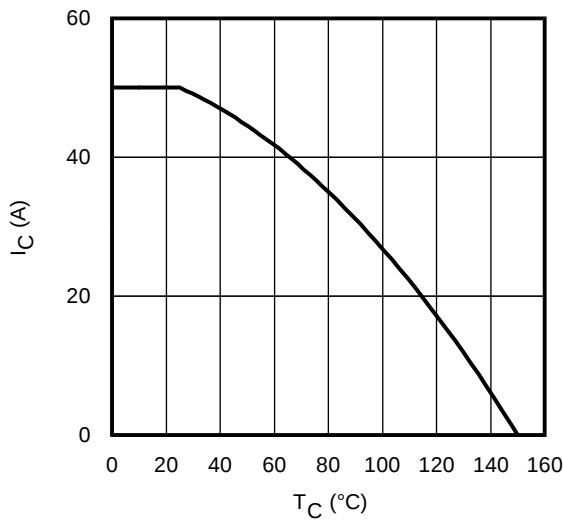


Fig. 11 - Maximum DC Collector Current vs.
Case Temperature

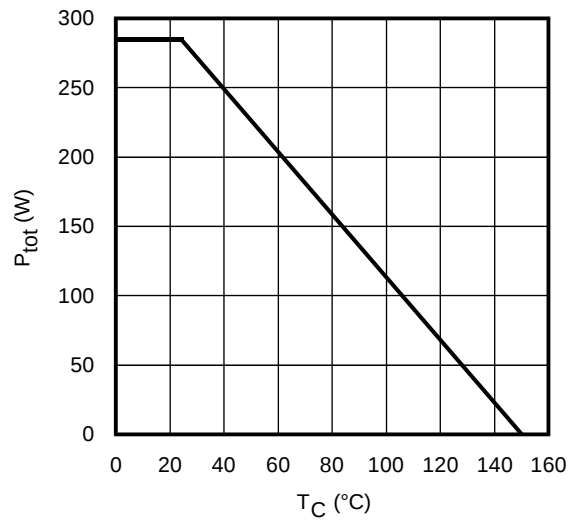


Fig. 12 - Power Dissipation vs. Case
Temperature

GB35XF120K

International
IR Rectifier

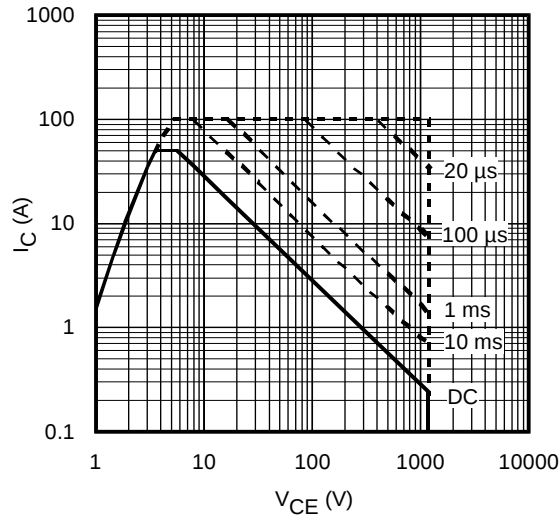


Fig. 13 - Forward SOA
 $T_C = 25^\circ\text{C}$; $T_J \leq 150^\circ\text{C}$

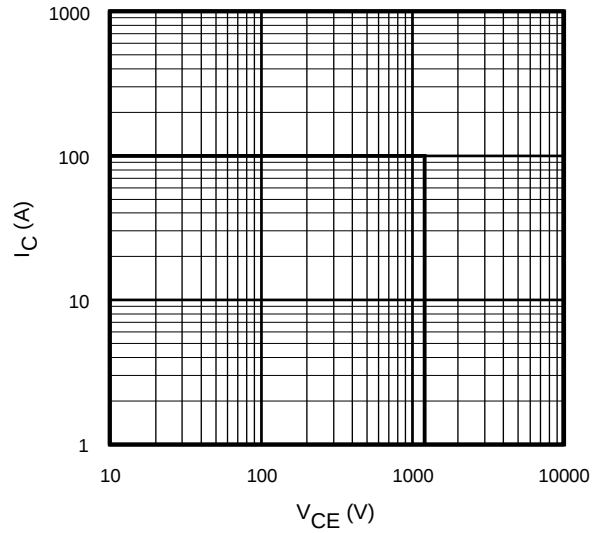


Fig. 14 - Reverse Bias SOA
 $T_J = 150^\circ\text{C}$; $V_{GE} = 15\text{V}$

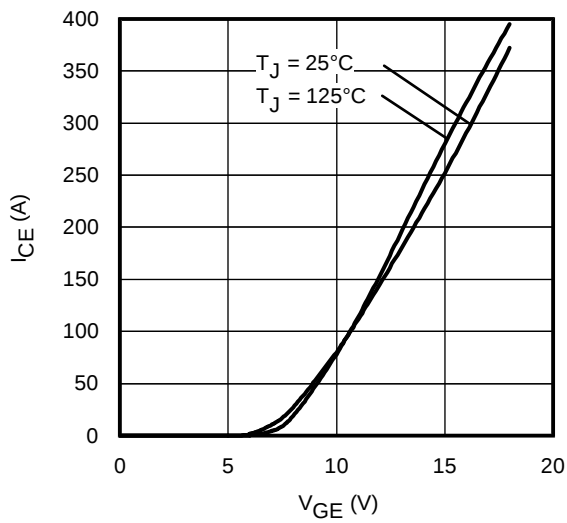


Fig. 15 - Typ. Transfer Characteristics
 $V_{CE} = 50\text{V}$; $t_p = 10\mu\text{s}$

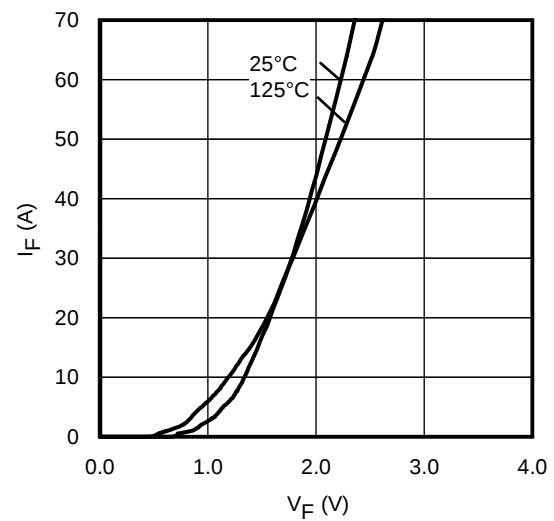


Fig. 16 - Typ. Diode Forward Characteristics
 $t_p = 80\mu\text{s}$

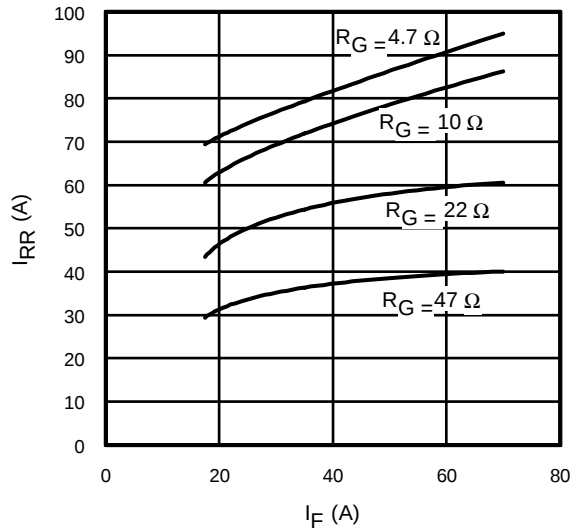


Fig. 17 - Typical Diode I_{RR} vs. I_F
 $T_J = 125^\circ\text{C}$

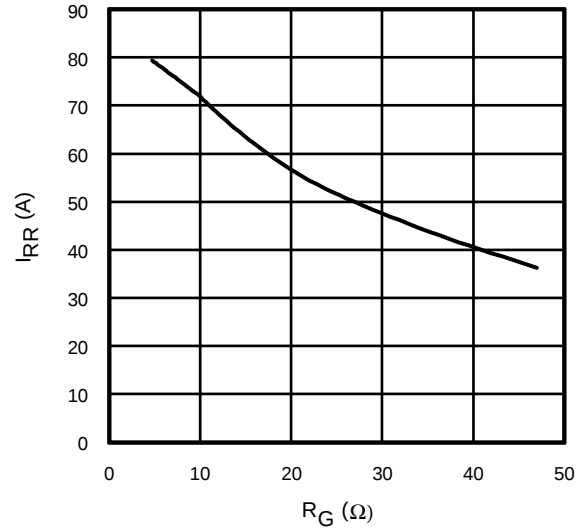


Fig. 18 - Typical Diode I_{RR} vs. R_G
 $T_J = 125^\circ\text{C}$, $I_F = 35\text{A}$

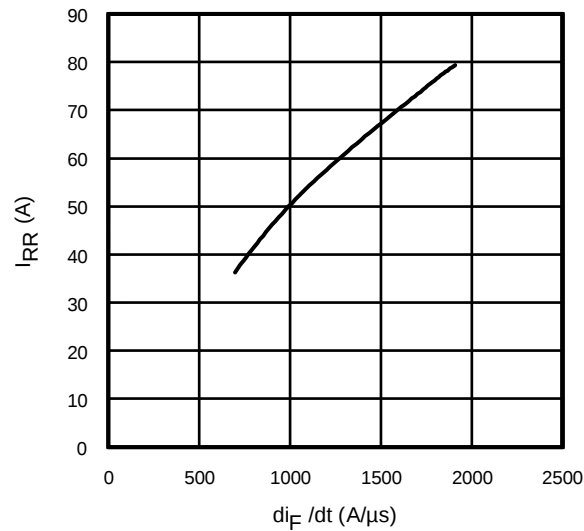


Fig. 19 - Typical Diode I_{RR} vs. di_F/dt
 $V_{CC} = 600\text{V}$; $V_{GE} = 15\text{V}$;
 $I_{CE} = 35\text{A}$; $T_J = 125^\circ\text{C}$

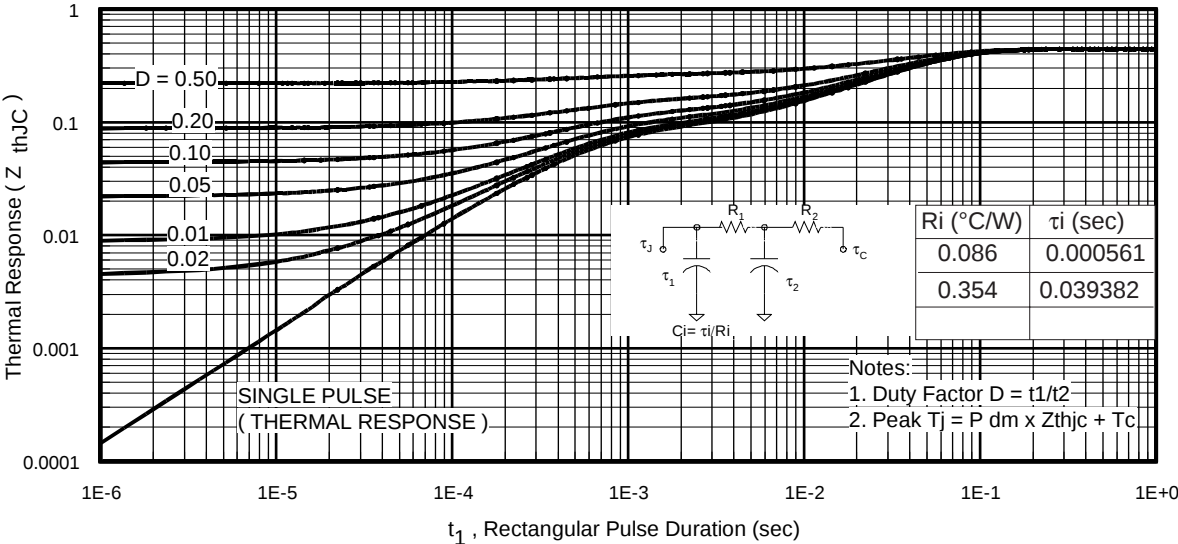


Fig 20. Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

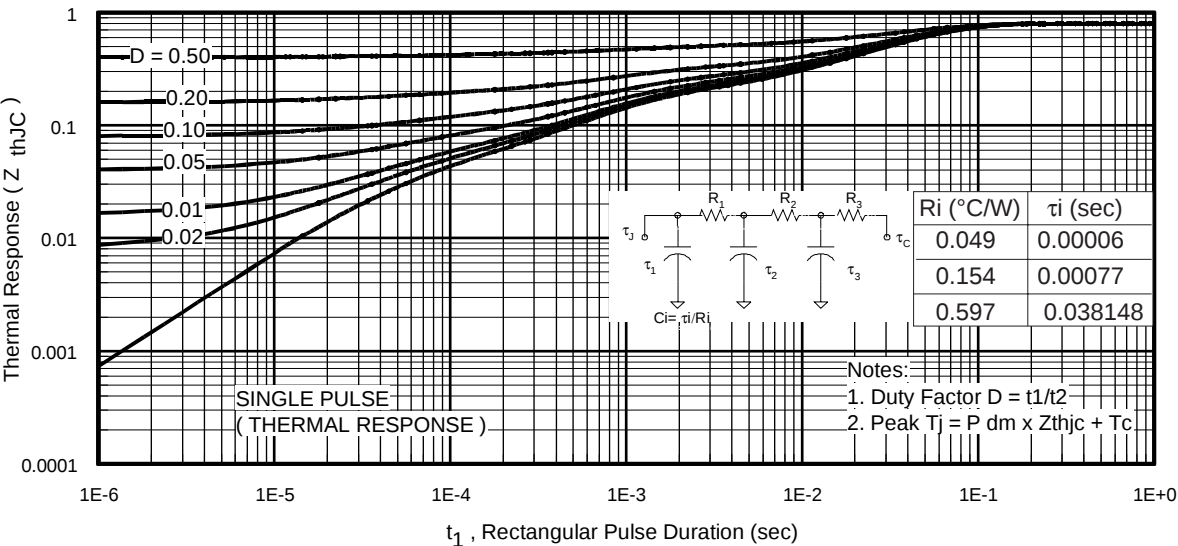


Fig 21. Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

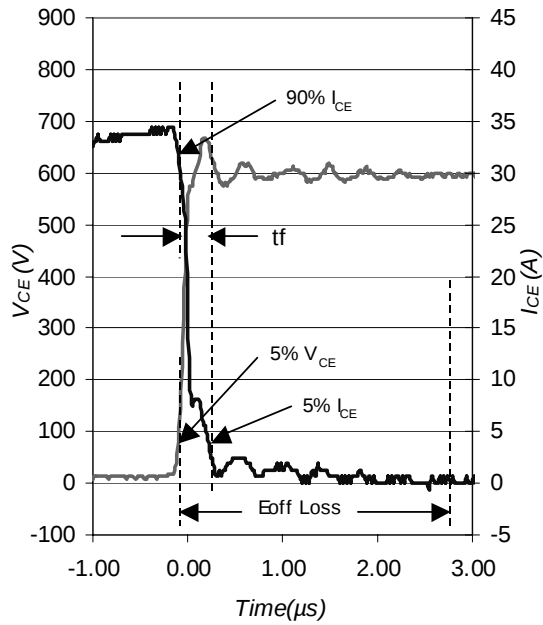


Fig. WF1- Typ. Turn-off Loss Waveform
@ $T_J = 125^\circ\text{C}$ using Fig. CT.4

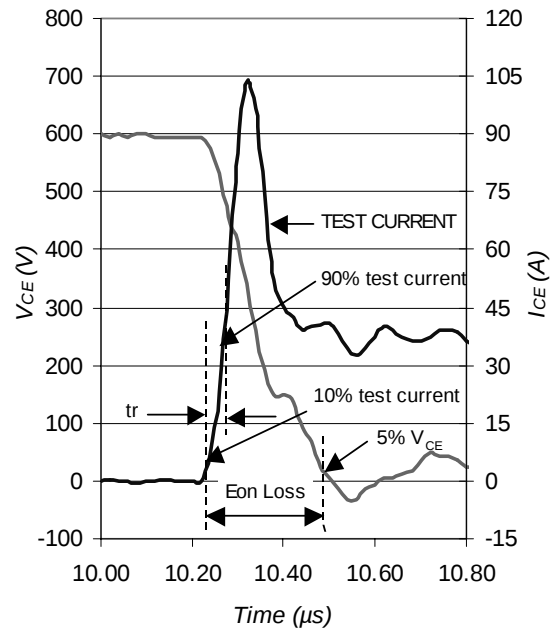


Fig. WF2- Typ. Turn-on Loss Waveform
@ $T_J = 125^\circ\text{C}$ using Fig. CT.4

GB35XF120K

International
IR Rectifier

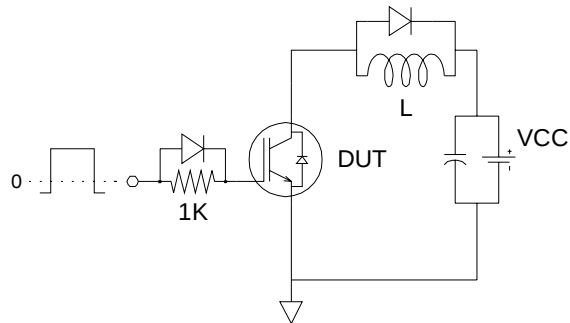


Fig.C.T.1 - Gate Charge Circuit (turn-off)

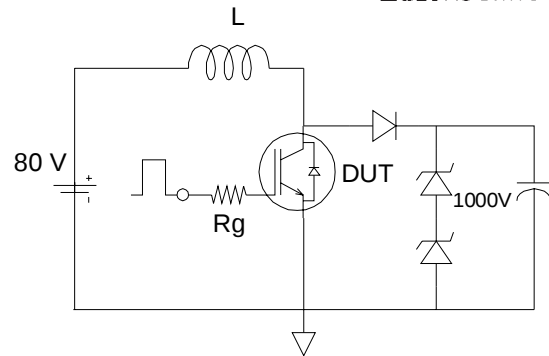


Fig.C.T.2 - RBSOA Circuit

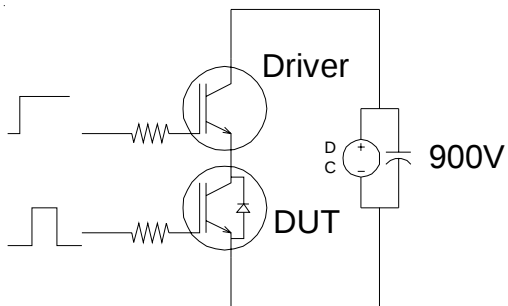


Fig.C.T.3 - S.C. SOA Circuit

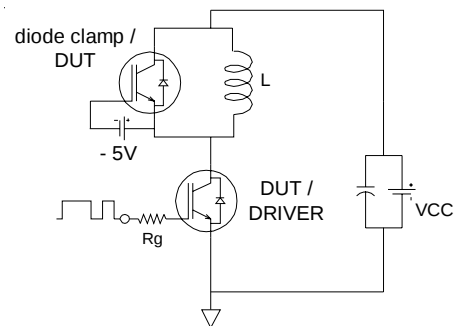


Fig.C.T.4 - Switching Loss Circuit

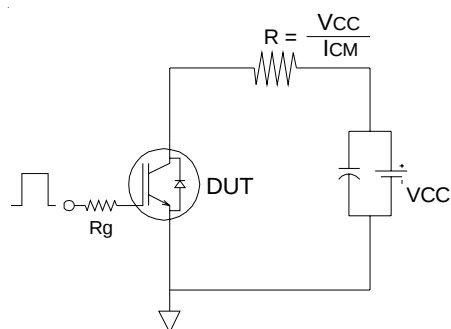
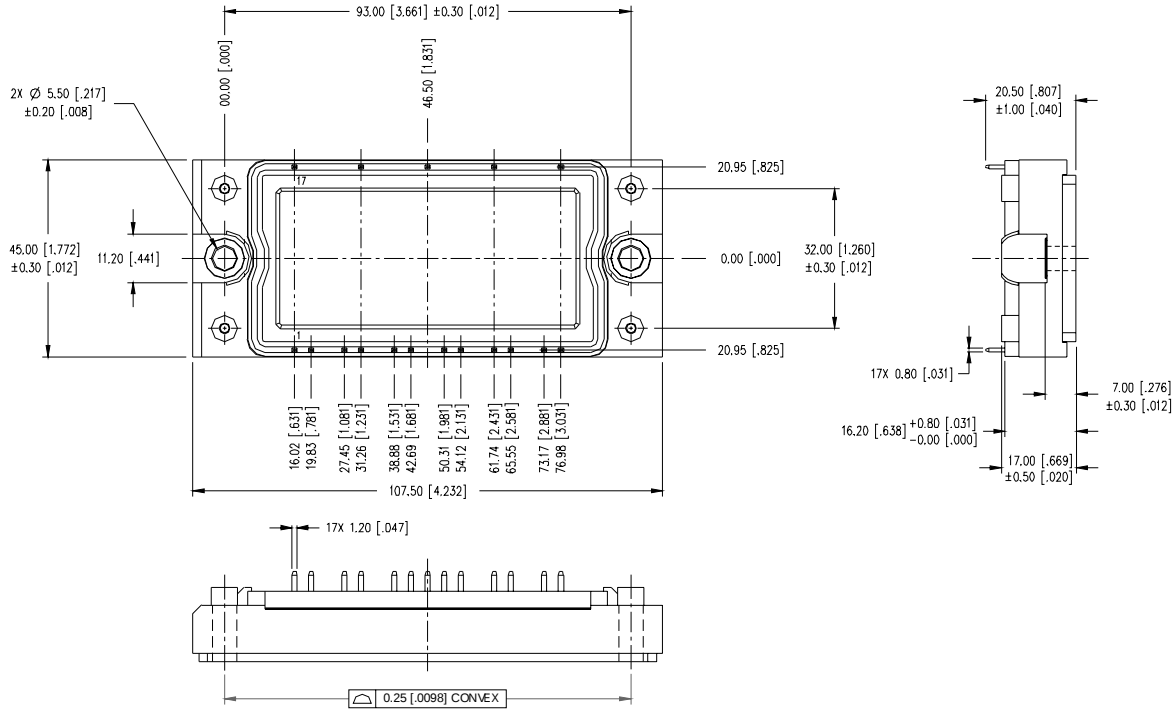


Fig.C.T.5 - Resistive Load Circuit

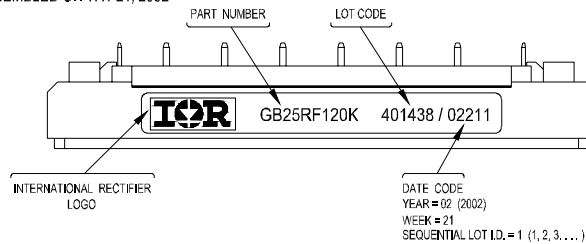
Econo2 6Pack Package Outline

Dimensions are shown in millimeters (inches)



Econo2 6Pack Part Marking Information

EXAMPLE: THIS IS A GB25RF120K
LOT CODE: 401438
ASSEMBLED ON WW 21, 2002



Data and specifications subject to change without notice.
This product has been designed and qualified for Industrial market.
Qualification Standards can be found on IR's Web site.

International
IR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903

Visit us at www.irf.com for sales contact information. 10/02