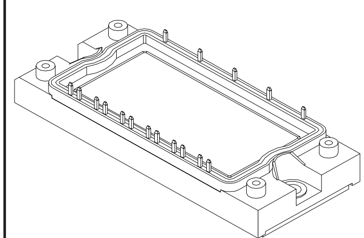
International
IOR Rectifier

Bulletin PD - 94570 rev.B 08/03

GB35XF120K

IGBT SIXPACK MODULE



ECONO2 6PACK

V_{CES} = 1200V

I_C =325A @ T_C=80°C

t_{sc} > 10µs @ T_J=150°C

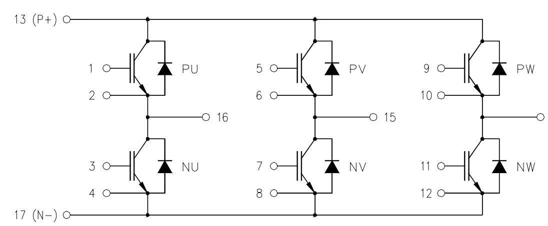
$V_{CE(on)}$ typ. = 2.40V

Features

- Low VCE (on) Non Punch Through IGBT Technology
- Low Diode VF
- 10µs Short Circuit Capability
- Square RBSOA
- HEXFRED Antiparallel Diode with Ultrasoft Reverse Recovery Characteristics
- Positive V_{CE} (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 Approved E78996



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	1200	V
I_C @ Tc=25°C	Continuous Collector Current	50	A
I_C @ Tc=80°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 @ Tc=25°C	Diode Continuous Forward Current	50	
I_F @ Tc=80°C	Diode Continuous Forward Current	35	
I_{FM}	Pulsed Diode Maximum Forward Current	100	
V_{GE}	Gate-to-Emitter Voltage	±20	V
P_D @ Tc=25°C	Maximum Power Dissipation (IGBT and Diode)	284	W
P_D @ Tc=80°C	Maximum Power Dissipation (IGBT and Diode)	159	
T_J	Maximum Operating Junction Temperature	150	°C
T_{STG}	Storage Temperature Range	-40 to +125	
V_{ISOL}	Isolation Voltage	AC 2500 (MIN)	V

Thermal and Mechanical Characteristics

	Parameter	Min	Typical	Maximum	Units
$R_{\theta JC}$ (IGBT)	Junction-to-Case IGBT	-	-	0.44	°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

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$BV_{(CES)}$	Collector-to-Emitter Breakdown Voltage	1200	-	-	V	V_{GE} = 0 IC = 500µA
$\Delta V_{(BR)CES}/\Delta T_J$	Temp. Coefficient of Breakdown Voltage	-	0.7	-	V/°C	V_{GE} = 0 IC = 1mA (25°C - 125°C)
$V_{CE(ON)}$	Collector-to-Emitter Voltage	-	2.40	2.60	V	I_C = 35A V_{GE} = 15V
		-	2.75	3.00		I_C = 50A V_{GE} = 15V
		-	2.80	-		I_C = 35A V_{GE} = 15V T_J = 125°C
		-	3.30	-		I_C =50A V_{GE} = 15V T_J = 125°C
V_{GE}(th)	Gate Threshold Voltage	4.0	5.25	6.0		V_{CE} = V_{GE} IC = 250µA
$\Delta V_{GE}(th)/\Delta T_J$	Thresold Voltage temp. coefficient	-	-11	-	mV/°C	V_{CE} = V_{GE} IC = 1mA (25°C-125°C)
I_{CES}	Zero Gate Voltage Collector Current	-	-	100	µA	V_{GE} = 0 V_{CE} = 1200V
		-	500	-		V_{GE} = 0 V_{CE} = 1200V Tj = 125°C
V_{FM}	Diode Forward Voltage Drop	-	1.90	2.35	V	I_F = 35A
		-	2.15	2.65		I_F = 50A
		-	2.00	-		I_F = 35A Tj = 125°C
		-	2.35	-		I_F = 50A Tj = 125°C
I_{GES}	Gate-to-Emitter Leakage Current	-	-	±200	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)	-	255	385	nC	I_C = 35A
Q_{GE}	Gate-to-Emitter Charge (turn-on)	-	25	40		V_{CC} = 600A
Q_{GC}	Gate-to-Collector Charge (turn-on)	-	125	90		V_{GE} = 15V
E_{ON}	Turn-On Switching Loss	-	2700	4075	µJ	I_C = 35A V_{CC} = 600V
E_{OFF}	Turn-Off Switching Loss	-	2500	3775		V_{GE} = 15V R_G = 10Ω L = 400µH
E_{TOT}	Total Switching Loss	-	5200	7850		Tj = 25°C ①
E_{ON}	Turn-On Switching Loss	-	3750	5450	µJ	I_C = 35A V_{CC} = 600V
E_{OFF}	Turn-Off Switching Loss	-	3675	5100		V_{GE} = 15V R_G = 10Ω L =400µH
E_{TOT}	Total Switching Loss	-	7425	10550		Tj = 125°C ①
$t_{d(on)}$	Turn-On delay time	-	50	65	ns	I_C = 35A V_{CC} = 600V
t_r	Rise time	-	35	50		V_{GE} = 15V R_G = 10Ω L = 400µH
$t_{d(off)}$	Turn-Off delay time	-	415	560		Tj = 125°C
t_f	Fall time	-	230	300		
C_{ies}	Input Capacitance	-	3475	-	pF	V_{GE} = 0
C_{oes}	Output Capacitance	-	615	-		V_{CC} = 30V
C_{res}	Reverse Transfer Capacitance	-	90	-		f = 1Mhz
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				Tj = 150°C I_C = 100A R_G = 10Ω V_{GE} = 15V to 0
SCSOA	Short Circuit Safe Operating Area	10	-	-	µs	Tj = 150°C V_{CC} = 900V V_P = 1200V R_G = 10Ω V_{GE} = 15V to 0
I_{rr}	Diode Peak Rev. Recovery Current	-	73	-	A	Tj = 125°C V_{CC} = 600V I_F = 35A L =400µH V_{GE} = 15V R_G = 10Ω

① Energy losses include "tail" and diode reverse recovery.

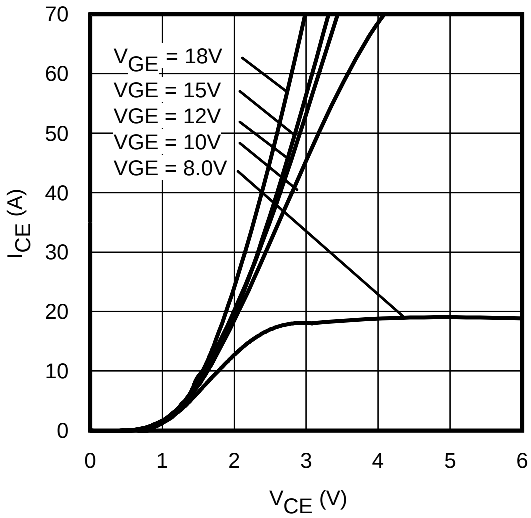


Fig. 1 - Typ. IGBT Output Characteristics
T_J = 25°C; tp = 80µs

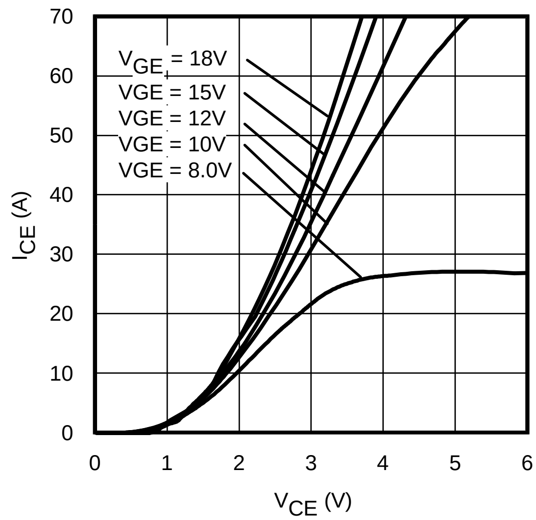


Fig. 2 - Typ. IGBT Output Characteristics
T_J = 125°C; tp = 80µs

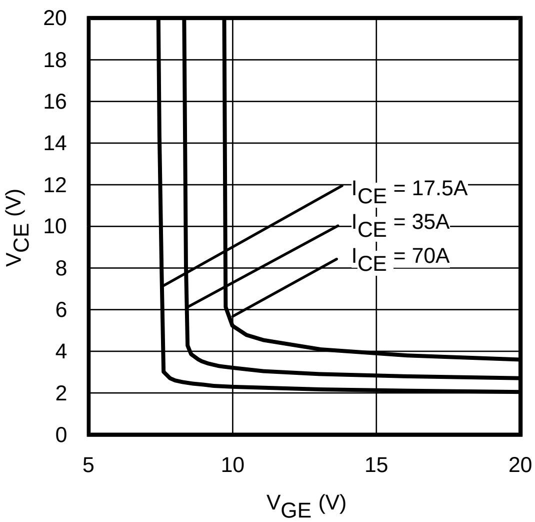


Fig. 3 - Typical V_{CE} vs. V_{GE}
T_J = 25°C

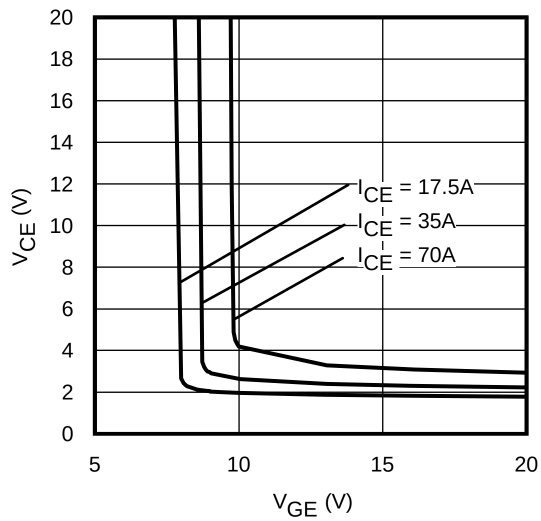


Fig. 4 - Typical V_{CE} vs. V_{GE}
T_J = 125°C

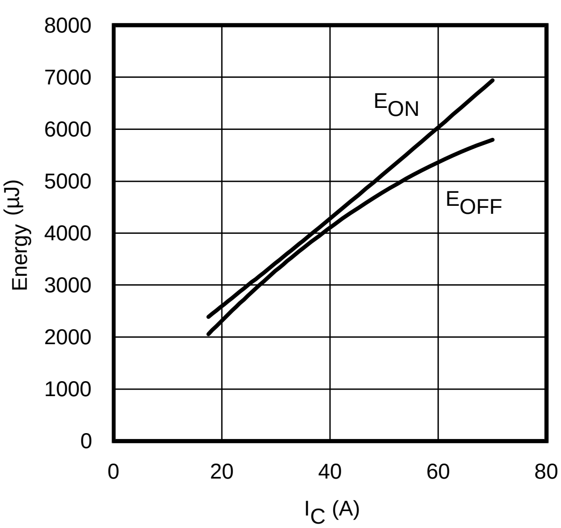


Fig. 5 - Typ. Energy Loss vs. I_C
T_J = 125°C; L=400µH; V_{CE}= 600V
R_G= 10Ω; V_{GE}= 15V

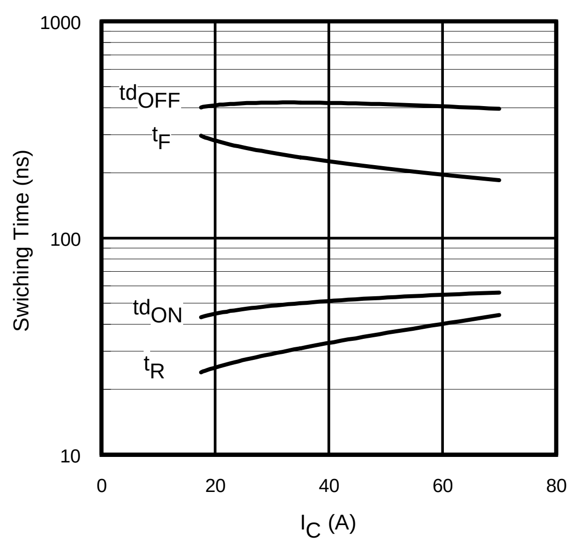


Fig. 6 - Typ. Switching Time vs. I_C
T_J = 125°C; L=400µH; V_{CE}= 600V
R_G= 10Ω; V_{GE}= 15V

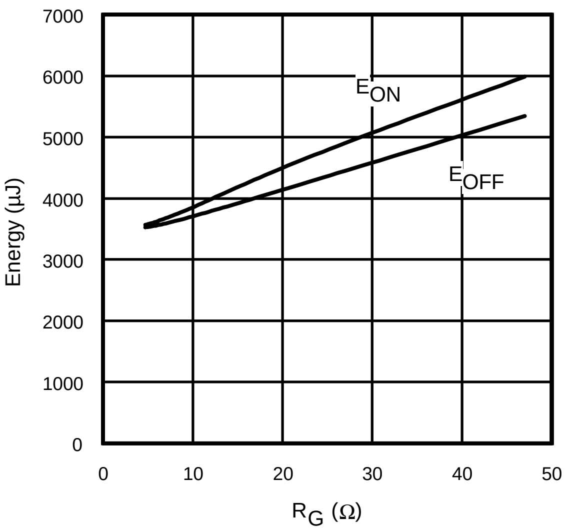


Fig. 7 - Typ. Energy Loss vs. R_G
T_J = 125°C; L=400µH; V_{CE}= 600V
I_{CE}= 35A; V_{GE}= 15V

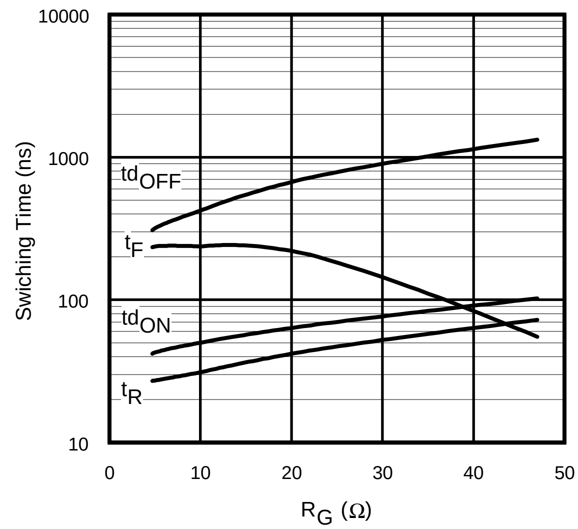


Fig. 8 - Typ. Switching Time vs. R_G
T_J = 125°C; L=400µH; V_{CE}= 600V
I_{CE}= 35A; V_{GE}= 15V

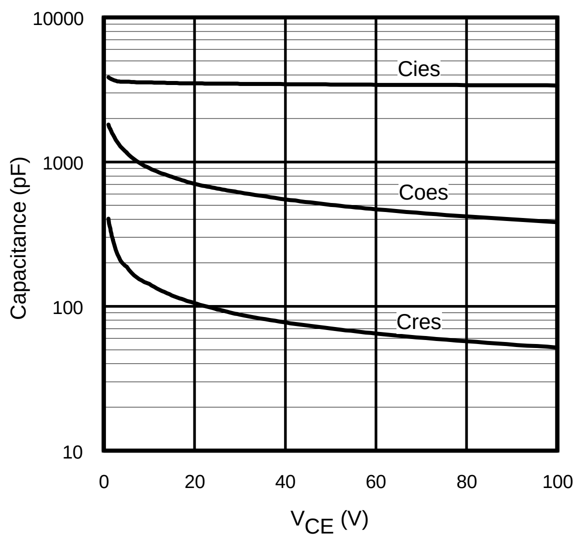


Fig. 9- Typ. Capacitance vs. V_{CE}
V_{GE}= 0V; f = 1MHz

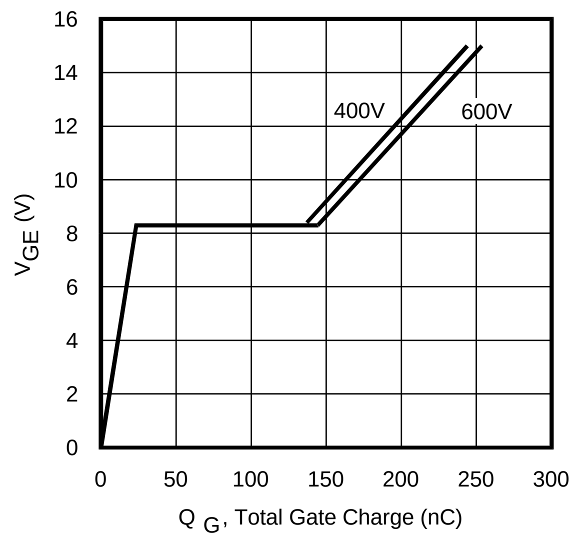


Fig. 10 - Typical Gate Charge vs. V_{GE}
I_{CE} = 35A; L = 600µH

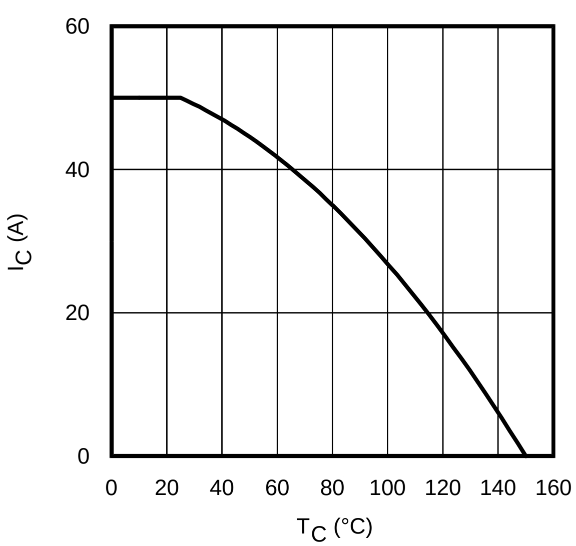


Fig. 11 - Maximum DC Collector Current vs. Case Temperature

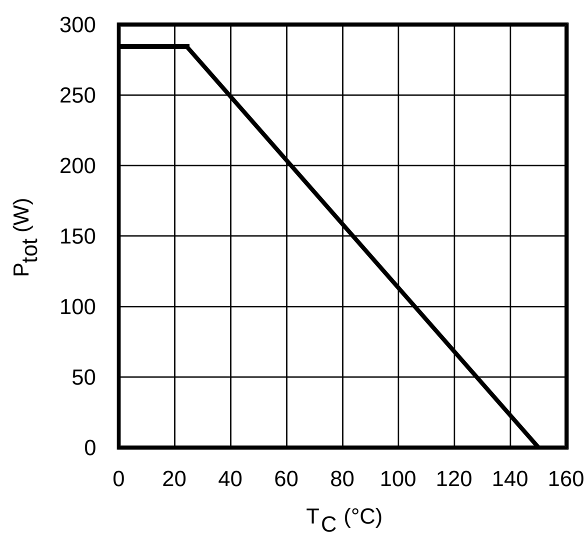


Fig. 12 - Power Dissipation vs. Case Temperature

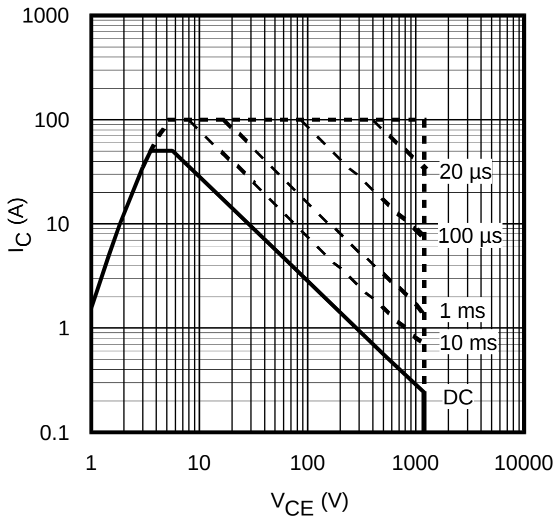


Fig. 13 - Forward SOA
$T_C = 25°C$; $T_J \leq 150°C$

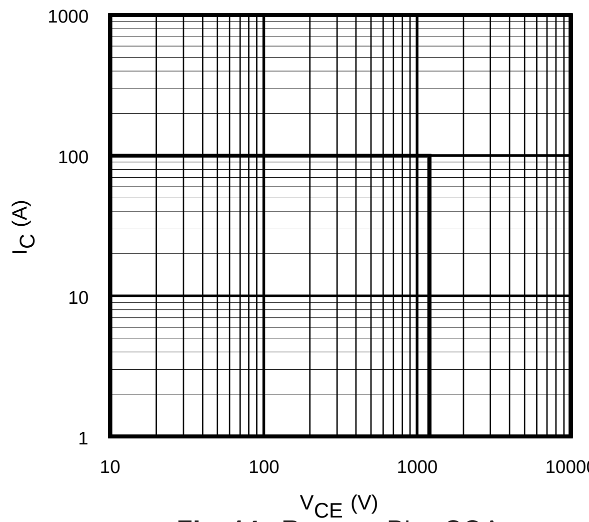


Fig. 14 - Reverse Bias SOA
$T_J = 150°C$; $V_{GE} = 15V$

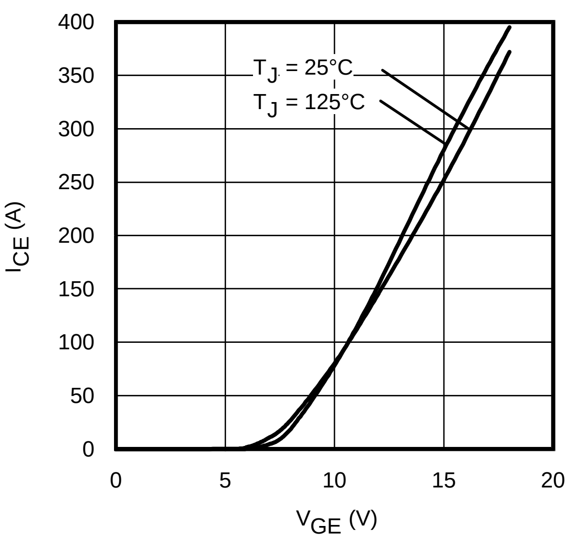


Fig. 15 - Typ. Transfer Characteristics
$V_{CE} = 50V$; tp = 10µs

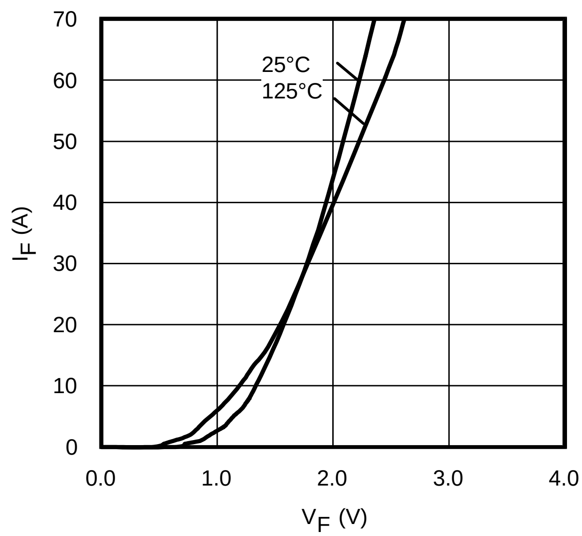


Fig. 16 - Typ. Diode Forward Characteristics
tp = 80µs

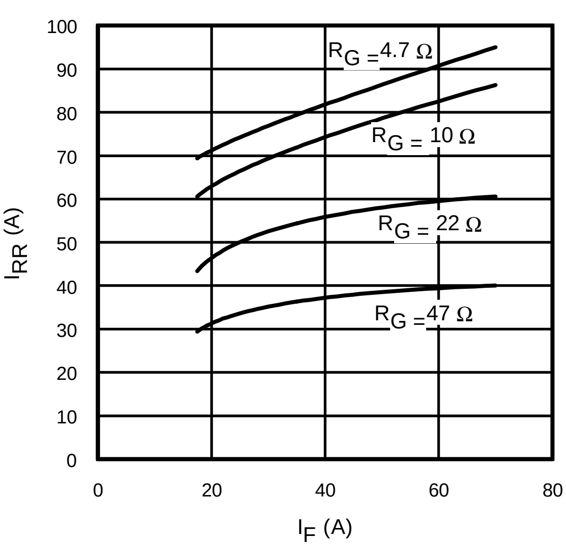


Fig. 17 - Typical Diode I_{RR} vs. I_F
$T_J = 125°C$

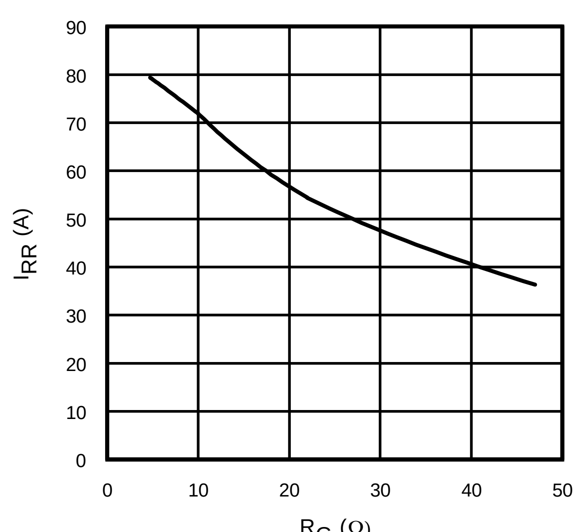


Fig. 18 - Typical Diode I_{RR} vs. R_G
$T_J = 125°C$, $I_F = 35A$

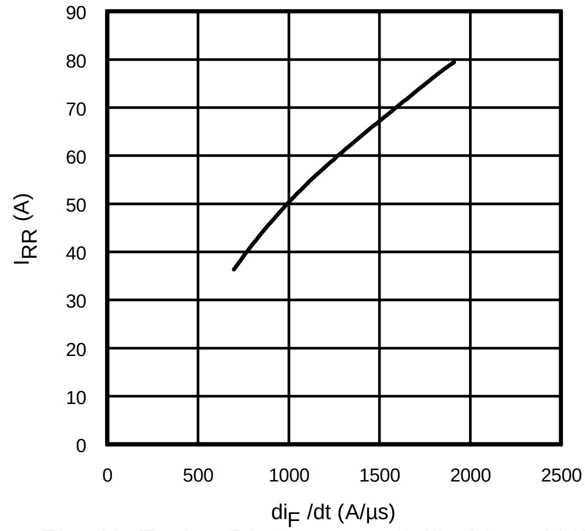


Fig. 19- Typical Diode I_{RR} vs. di_F/dt; V_{CC}= 600V; V_{GE}= 15V; I_{CE}= 35A; T_J = 125°C

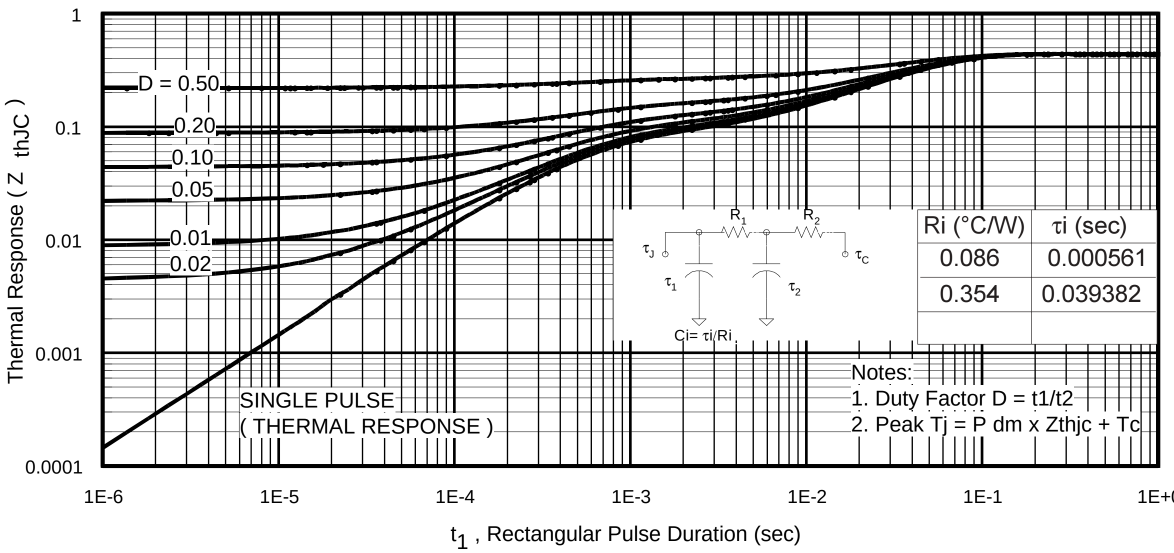


Fig 20. Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

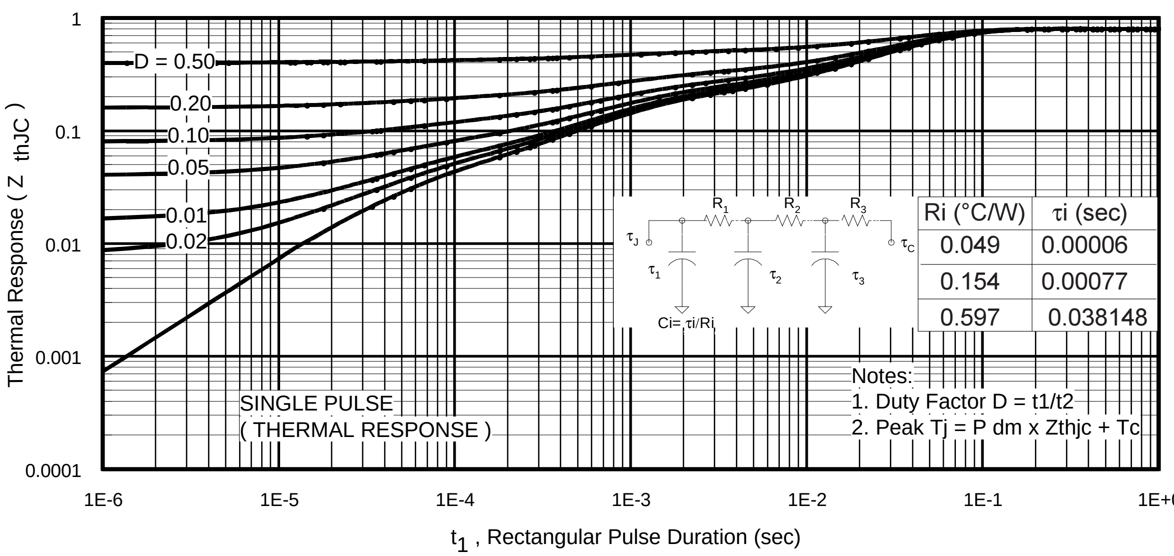


Fig 21. Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

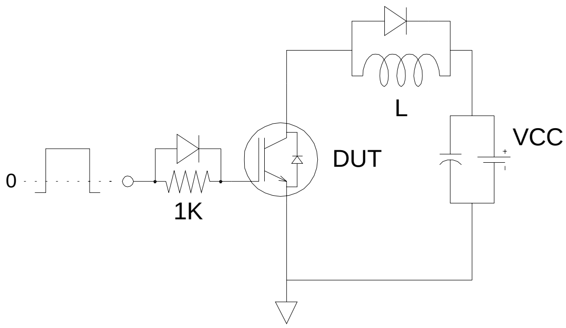


Fig.C.T.1 - Gate Charge Circuit (turn-off)

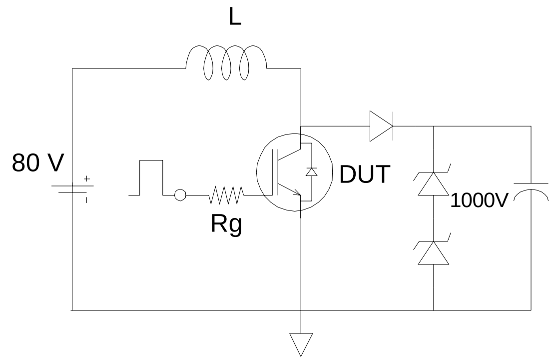


Fig.C.T.2 - RBSOA Circuit

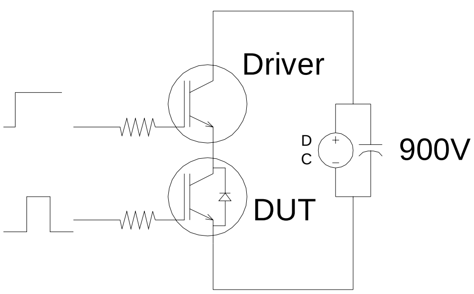


Fig.C.T.3 - S.C. SOA Circuit

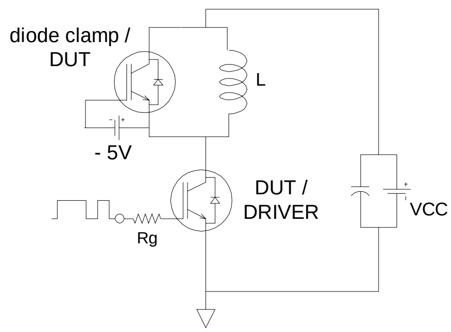


Fig.C.T.4 - Switching Loss Circuit

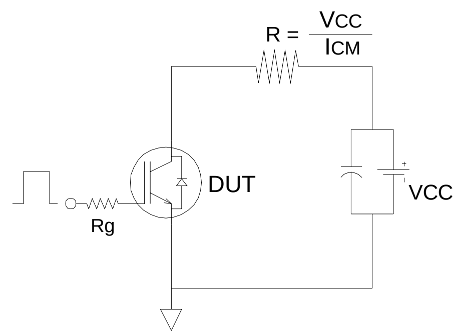


Fig.C.T.5 - Resistive Load Circuit

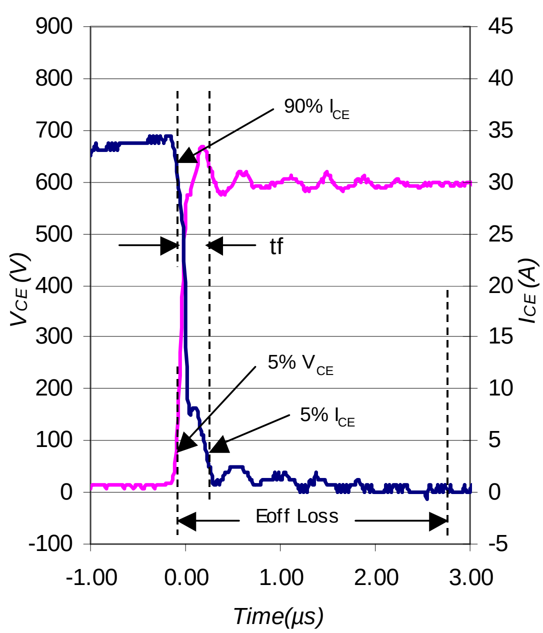


Fig. WF1- Typ. Turn-off Loss Waveform
@ T_J = 125°C using Fig. CT.4

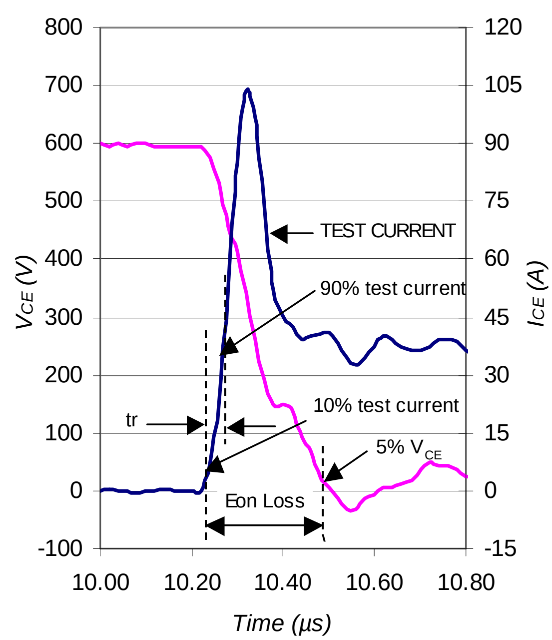
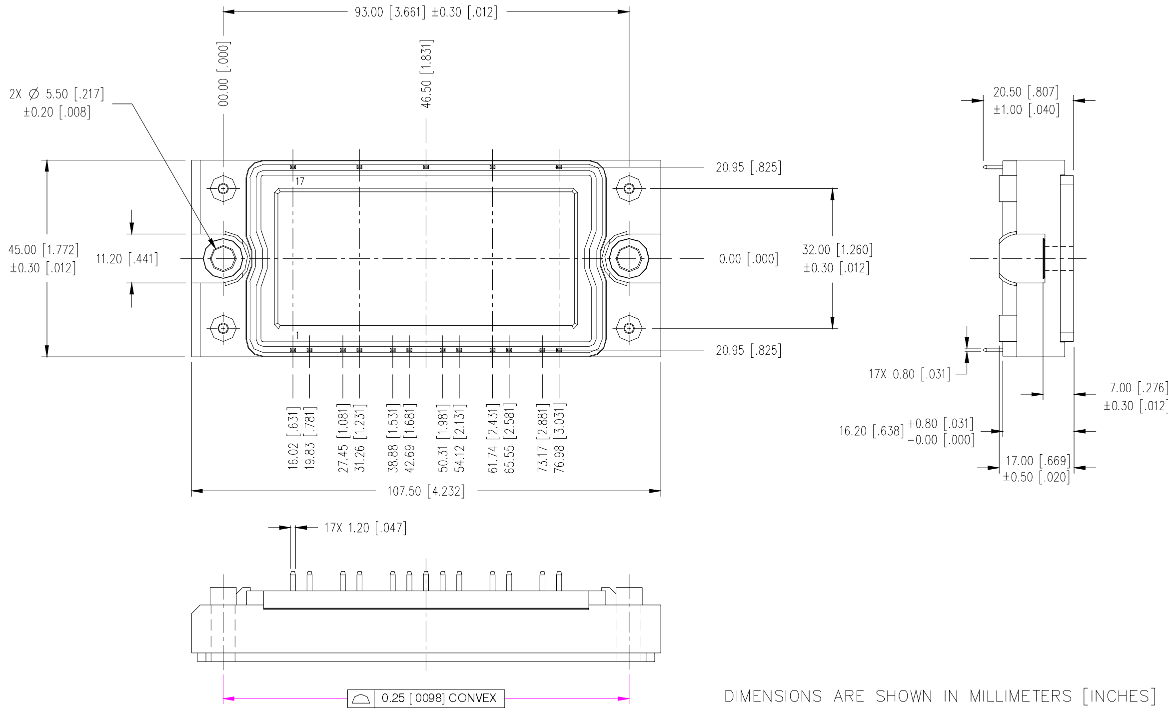


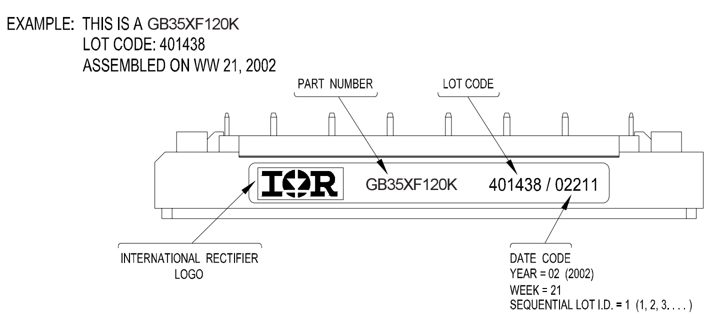
Fig. WF2- Typ. Turn-on Loss Waveform
@ T_J = 125°C using Fig. CT.4

Econo2 6Pak Package Outline

Dimensions are shown in millimeters (inches)



Econo2 6Pak Part Marking Information



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
IOR 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