


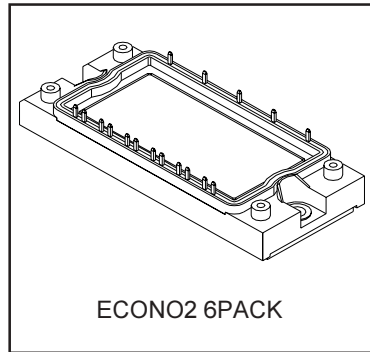
## IGBT SIXPACK MODULE

### Features

- Low V<sub>CE</sub> (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<sub>CE</sub> (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 

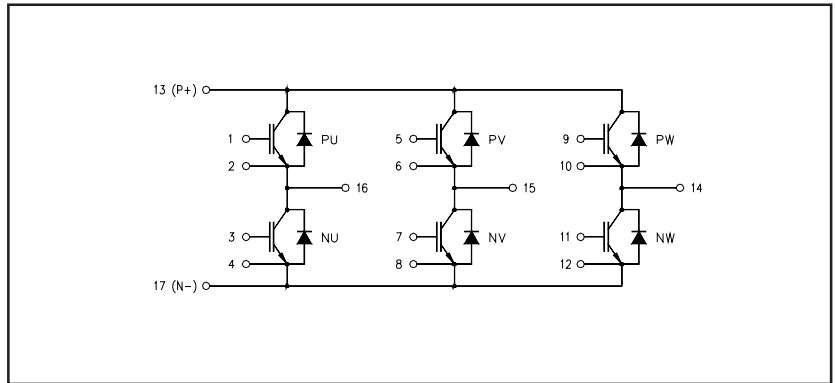


$$V_{CES} = 1200V$$

$$I_C = 25A @ T_C=80^\circ C$$

$$t_{sc} > 10\mu s @ T_J=150^\circ C$$

$$V_{CE(on)} \text{ typ.} = 2.35V$$



### Absolute Maximum Ratings

	Parameter	Max.	Units
V <sub>CES</sub>	Collector-to-Emitter Voltage	1200	V
I <sub>C</sub> @ T <sub>C</sub> =25°C	Continuous Collector Current	40	A
I <sub>C</sub> @ T <sub>C</sub> =80°C	Continuous Collector Current	25	
I <sub>CM</sub>	Pulsed Collector Current (Ref. Fig. C.T.5)	80	
I <sub>LM</sub>	Clamped Inductive Load Current	80	
I <sub>F</sub> @ T <sub>C</sub> =25°C	Diode Continuous Forward Current	40	
I <sub>F</sub> @ T <sub>C</sub> =80°C	Diode Continuous Forward Current	25	
I <sub>FM</sub>	Pulsed Diode Maximum Forward Current	80	
V <sub>GE</sub>	Gate-to-Emitter Voltage	±20	V
P <sub>D</sub> @ T <sub>C</sub> =25°C	Maximum Power Dissipation (IGBT and Diode)	198	W
P <sub>D</sub> @ T <sub>C</sub> =80°C	Maximum Power Dissipation (IGBT and Diode)	111	
T <sub>J</sub>	Maximum Operating Junction Temperature	150	°C
T <sub>STG</sub>	Storage Temperature Range	-40 to +125	
V <sub>ISOL</sub>	Isolation Voltage	AC 2500 (MIN)	V

### Thermal and Mechanical Characteristics

	Parameter	Min	Typical	Maximum	Units
R <sub>θJC</sub> (IGBT)	Junction-to-Case IGBT	-	-	0.63	°C/W
R <sub>θJC</sub> (Diode)	Junction-to-Case Diode	-	-	1.00	
R <sub>θCS</sub> (Module)	Case-to-Sink, flat, greased surface	-	0.05	-	
	Mounting Torque (M5)	2.7	-	3.3	N*m
	Weight	-	170	-	g

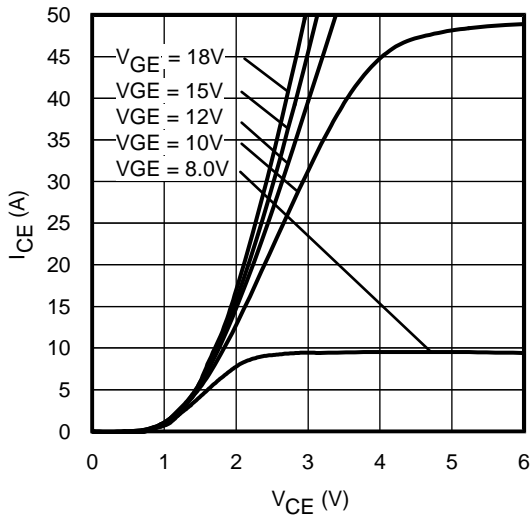
## Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
BV <sub>(CES)</sub>	Collector-to-Emitter Breakdown Voltage	1200	-	-	V	V <sub>GE</sub> = 0 I <sub>C</sub> = 500μA
ΔV <sub>(BR)CES/ΔT<sub>J</sub></sub>	Temp. Coefficient of Breakdown Voltage	-	0.84	-	V/°C	V <sub>GE</sub> = 0 I <sub>C</sub> = 1mA (25°C - 125°C)
V <sub>CE(ON)</sub>	Collector-to-Emitter Voltage	-	2.35	2.50	V	I <sub>C</sub> = 25A V <sub>GE</sub> = 15V
		-	2.80	3.00		I <sub>C</sub> = 40A V <sub>GE</sub> = 15V
		-	2.75	-		I <sub>C</sub> = 25A V <sub>GE</sub> = 15V T <sub>J</sub> = 125°C
		-	3.40	-		I <sub>C</sub> = 40A V <sub>GE</sub> = 15V T <sub>J</sub> = 125°C
V <sub>GE(th)</sub>	Gate Threshold Voltage	4.0	5.0	6.0		V <sub>CE</sub> = V <sub>GE</sub> I <sub>C</sub> = 250μA
ΔV <sub>GE(th)/ΔT<sub>J</sub></sub>	Threshold Voltage temp. coefficient	-	-12	-	mV/°C	V <sub>CE</sub> = V <sub>GE</sub> I <sub>C</sub> = 1mA (25°C-125°C)
I <sub>CES</sub>	Zero Gate Voltage Collector Current	-	-	100	μA	V <sub>GE</sub> = 0 V <sub>CE</sub> = 1200V
		-	500	-		V <sub>GE</sub> = 0 V <sub>CE</sub> = 1200V T <sub>J</sub> = 125°C
V <sub>FM</sub>	Diode Forward Voltage Drop	-	1.90	2.40	V	I <sub>F</sub> = 25A
		-	2.15	2.75		I <sub>F</sub> = 40A
		-	2.00	-		I <sub>F</sub> = 25A T <sub>J</sub> = 125°C
		-	2.35	-		I <sub>F</sub> = 40A T <sub>J</sub> = 125°C
I <sub>GES</sub>	Gate-to-Emitter Leakage Current	-	-	±200	nA	V <sub>GE</sub> = ±20V

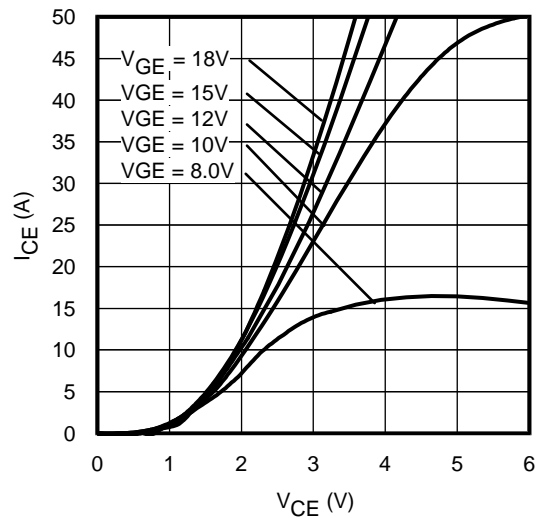
## Switching Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q <sub>G</sub>	Total Gate Charge (turn-on)	-	180	272	nC	I <sub>C</sub> = 25A
Q <sub>GE</sub>	Gate-to-Emitter Charge (turn-on)	-	20	33		V <sub>CC</sub> = 600A
Q <sub>GC</sub>	Gate-to-Collector Charge (turn-on)	-	90	137		V <sub>GE</sub> = 15V
E <sub>ON</sub>	Turn-On Switching Loss	-	2220	4260	μJ	I <sub>C</sub> = 25A V <sub>CC</sub> = 600V
E <sub>OFF</sub>	Turn-Off Switching Loss	-	1850	3100		V <sub>GE</sub> = 15V R <sub>G</sub> = 10Ω L = 400μH
E <sub>TOT</sub>	Total Switching Loss	-	4070	7360		T <sub>J</sub> = 25°C ①
E <sub>ON</sub>	Turn-On Switching Loss	-	3150	5120	μJ	I <sub>C</sub> = 25A V <sub>CC</sub> = 600V
E <sub>OFF</sub>	Turn-Off Switching Loss	-	2720	4260		V <sub>GE</sub> = 15V R <sub>G</sub> = 10Ω L = 400μH
E <sub>TOT</sub>	Total Switching Loss	-	5870	9380		T <sub>J</sub> = 125°C ①
t <sub>d(on)</sub>	Turn-On delay time	-	60	80	ns	I <sub>C</sub> = 25A V <sub>CC</sub> = 600V
t <sub>r</sub>	Rise time	-	30	45		V <sub>GE</sub> = 15V R <sub>G</sub> = 10Ω L = 400μH
t <sub>d(off)</sub>	Turn-Off delay time	-	450	850		T <sub>J</sub> = 125°C
t <sub>f</sub>	Fall time	-	200	320		
C <sub>ies</sub>	Input Capacitance	-	2370	-	pF	V <sub>GE</sub> = 0
C <sub>oes</sub>	Output Capacitance	-	455	-		V <sub>CC</sub> = 30V
C <sub>res</sub>	Reverse Transfer Capacitance	-	60	-		f = 1Mhz
RBSOA	Reverse Bias Safe Operating Area	FULLSQUARE				T <sub>J</sub> = 150°C I <sub>C</sub> = 80A R <sub>G</sub> = 10Ω V <sub>GE</sub> = 15V to 0
SCSOA	Short Circuit Safe Operating Area	10	-	-	μs	T <sub>J</sub> = 150°C V <sub>CC</sub> = 900V V <sub>P</sub> = 1200V R <sub>G</sub> = 10Ω V <sub>GE</sub> = 15V to 0
I <sub>rr</sub>	Diode Peak Rev. Recovery Current	-	55	-	A	T <sub>J</sub> = 125°C V <sub>CC</sub> = 600V I <sub>F</sub> = 25A L = 400μH V <sub>GE</sub> = 15V R <sub>G</sub> = 10Ω

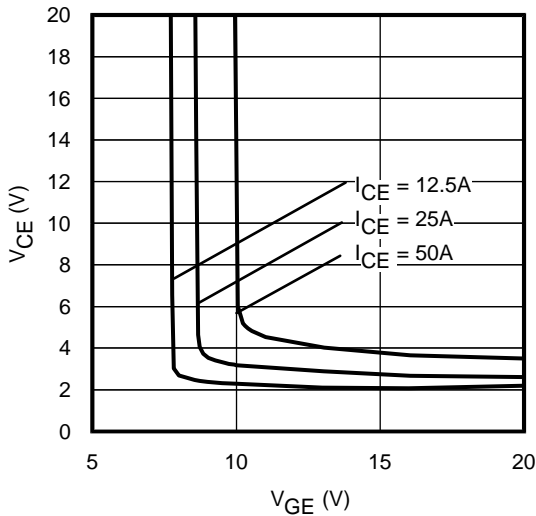
① Energy losses include "tail" and diode reverse recovery.



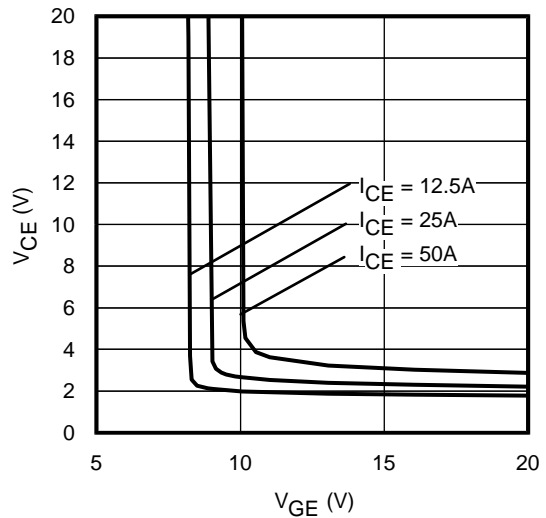
**Fig. 1** - Typ. IGBT Output Characteristics  
 $T_J = 25^\circ\text{C}$ ;  $t_p = 80\mu\text{s}$



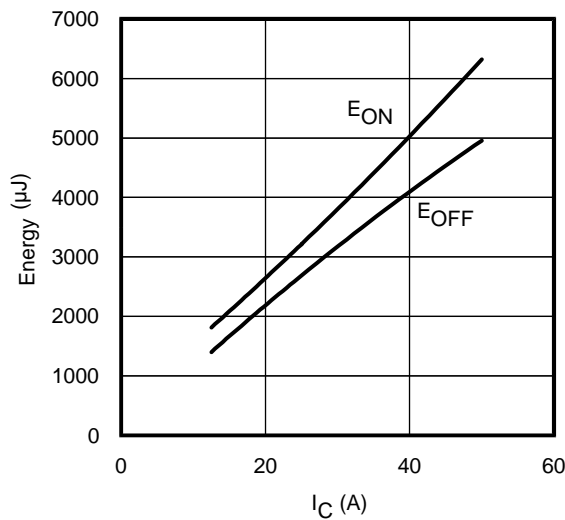
**Fig. 2** - Typ. IGBT Output Characteristics  
 $T_J = 125^\circ\text{C}$ ;  $t_p = 80\mu\text{s}$



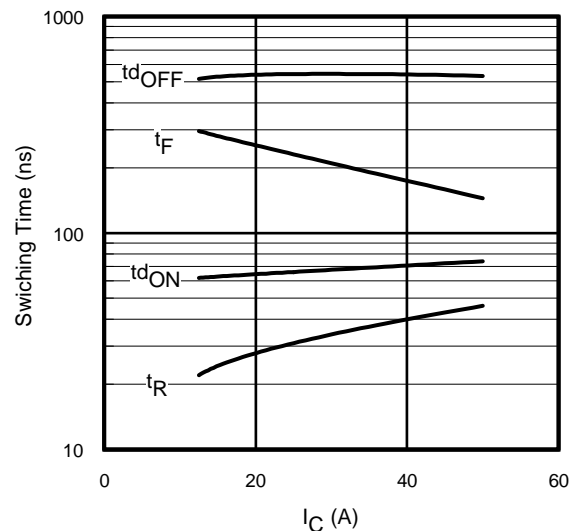
**Fig. 3** - Typical  $V_{CE}$  vs.  $V_{GE}$   
 $T_J = 25^\circ\text{C}$



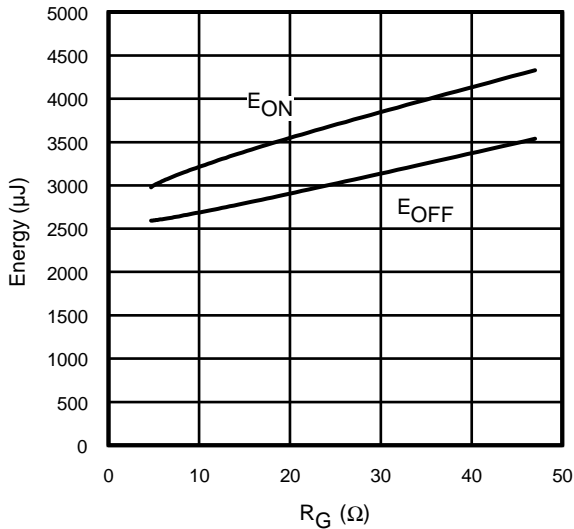
**Fig. 4** - Typical  $V_{CE}$  vs.  $V_{GE}$   
 $T_J = 125^\circ\text{C}$



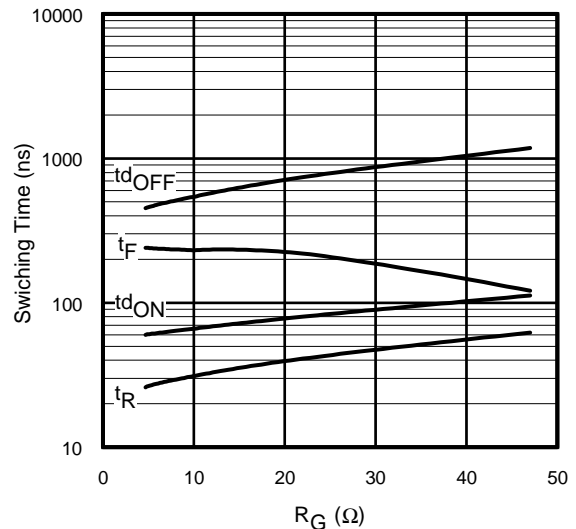
**Fig. 5** - Typ. Energy Loss vs.  $I_C$   
 $T_J = 125^\circ\text{C}$ ;  $L = 400\mu\text{H}$ ;  $V_{CE} = 600\text{V}$   
 $R_G = 10\Omega$ ;  $V_{GE} = 15\text{V}$



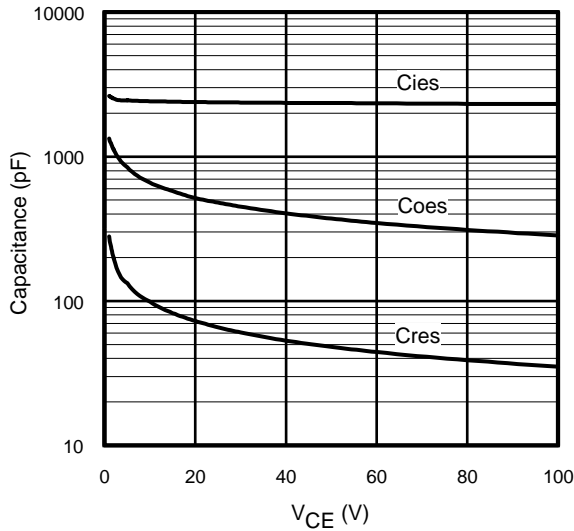
**Fig. 6** - Typ. Switching Time vs.  $I_C$   
 $T_J = 125^\circ\text{C}$ ;  $L = 400\mu\text{H}$ ;  $V_{CE} = 600\text{V}$   
 $R_G = 10\Omega$ ;  $V_{GE} = 15\text{V}$



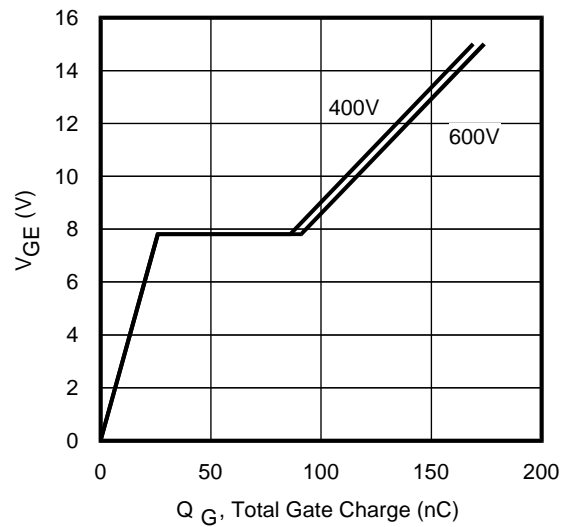
**Fig. 7** - Typ. Energy Loss vs.  $R_G$   
 $T_J = 125^\circ\text{C}$ ;  $L = 400\mu\text{H}$ ;  $V_{CE} = 600\text{V}$   
 $I_{CE} = 25\text{A}$ ;  $V_{GE} = 15\text{V}$



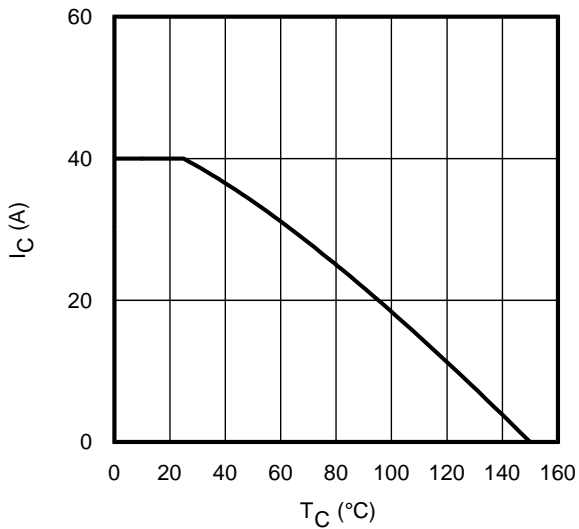
**Fig. 8** - Typ. Switching Time vs.  $R_G$   
 $T_J = 125^\circ\text{C}$ ;  $L = 400\mu\text{H}$ ;  $V_{CE} = 600\text{V}$   
 $I_{CE} = 25\text{A}$ ;  $V_{GE} = 15\text{V}$



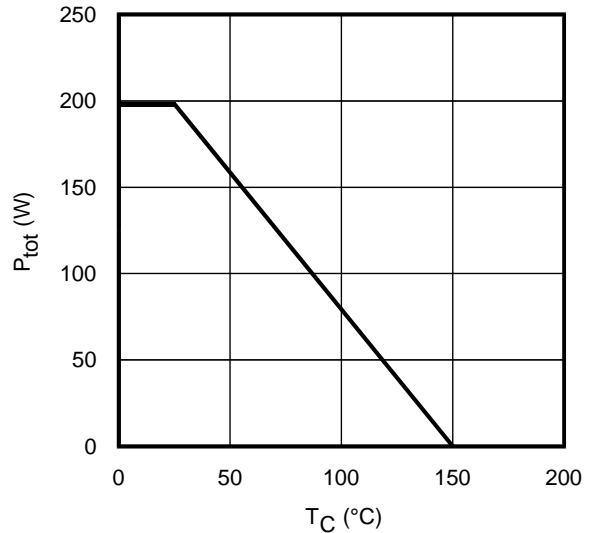
**Fig. 9** - Typ. Capacitance vs.  $V_{CE}$   
 $V_{GE} = 0\text{V}$ ;  $f = 1\text{MHz}$



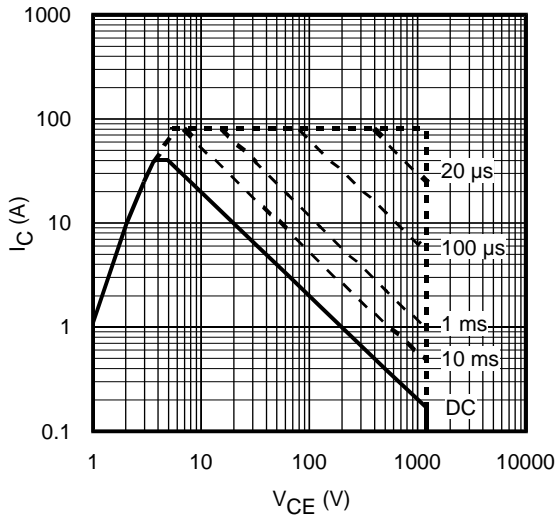
**Fig. 10** - Typical Gate Charge vs.  $V_{GE}$   
 $I_{CE} = 25\text{A}$ ;  $L = 600\mu\text{H}$



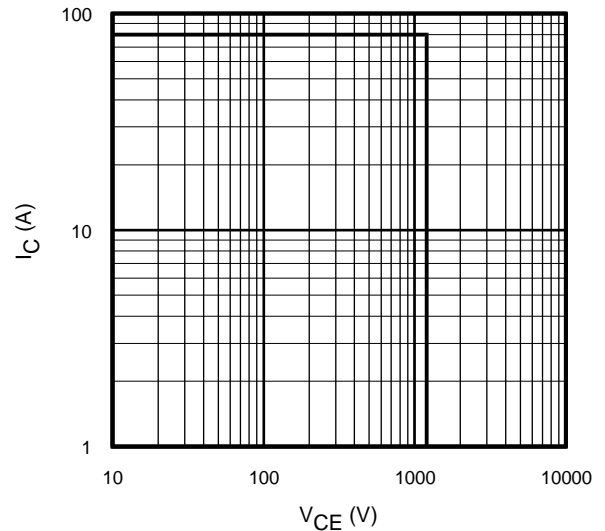
**Fig. 11** - Maximum DC Collector Current vs. Case Temperature



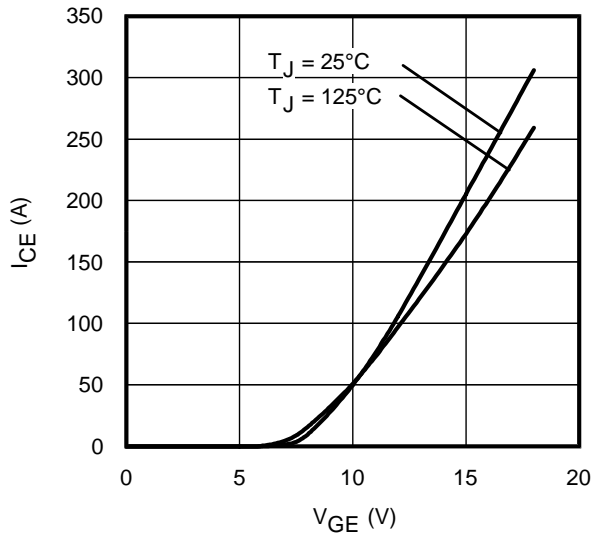
**Fig. 12** - Power Dissipation vs. Case Temperature



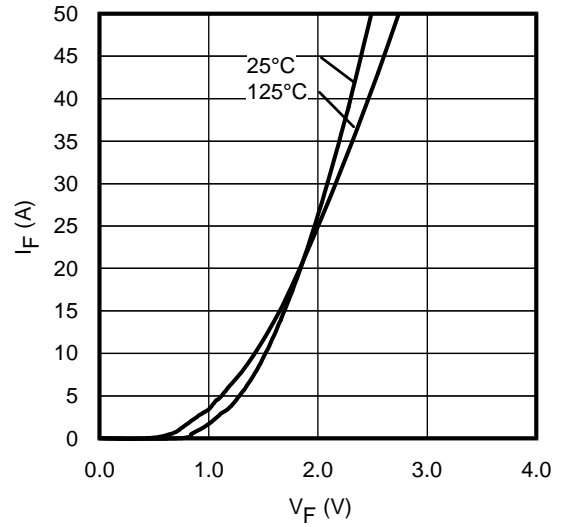
**Fig. 13 - Forward SOA**  
 $T_C = 25^\circ\text{C}; T_J \leq 150^\circ\text{C}$



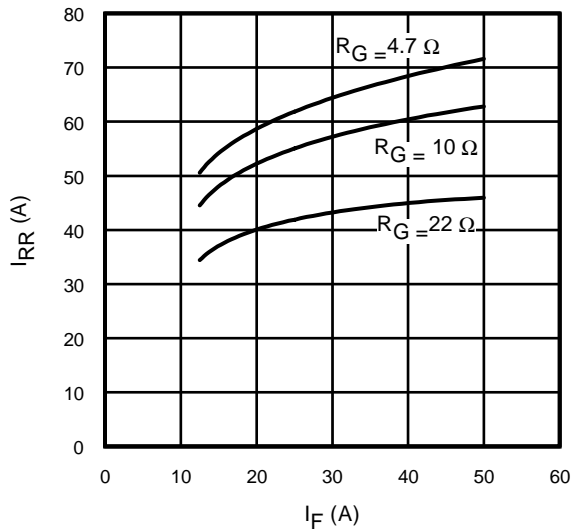
**Fig. 14 - Reverse Bias SOA**  
 $T_J = 150^\circ\text{C}; V_{GE} = 15\text{V}$



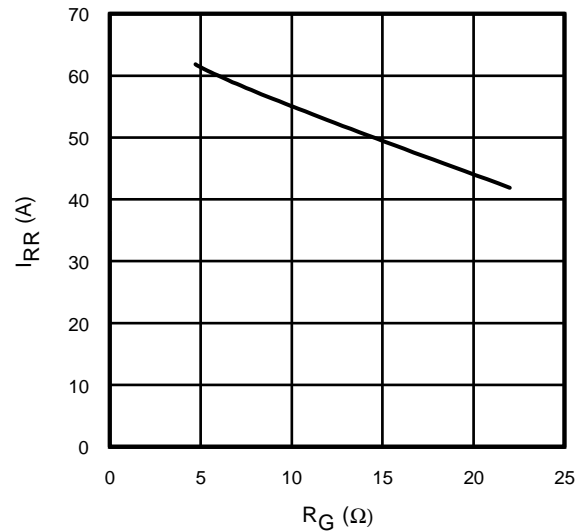
**Fig. 15 - Typ. Transfer Characteristics**  
 $V_{CE} = 50\text{V}; t_p = 10\mu\text{s}$



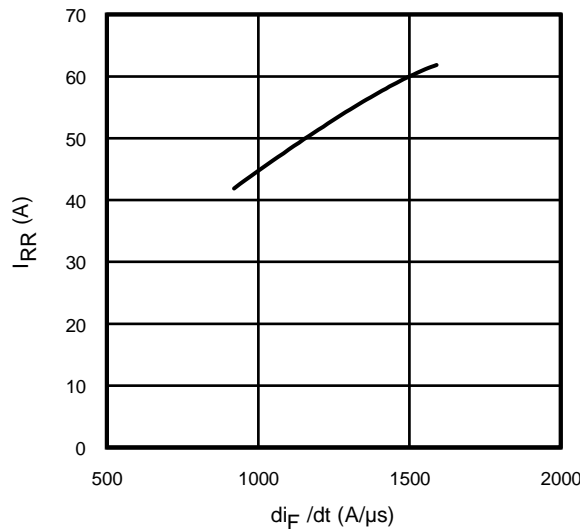
**Fig. 16 - Typ. Diode Forward Characteristics**  
 $t_p = 80\mu\text{s}$



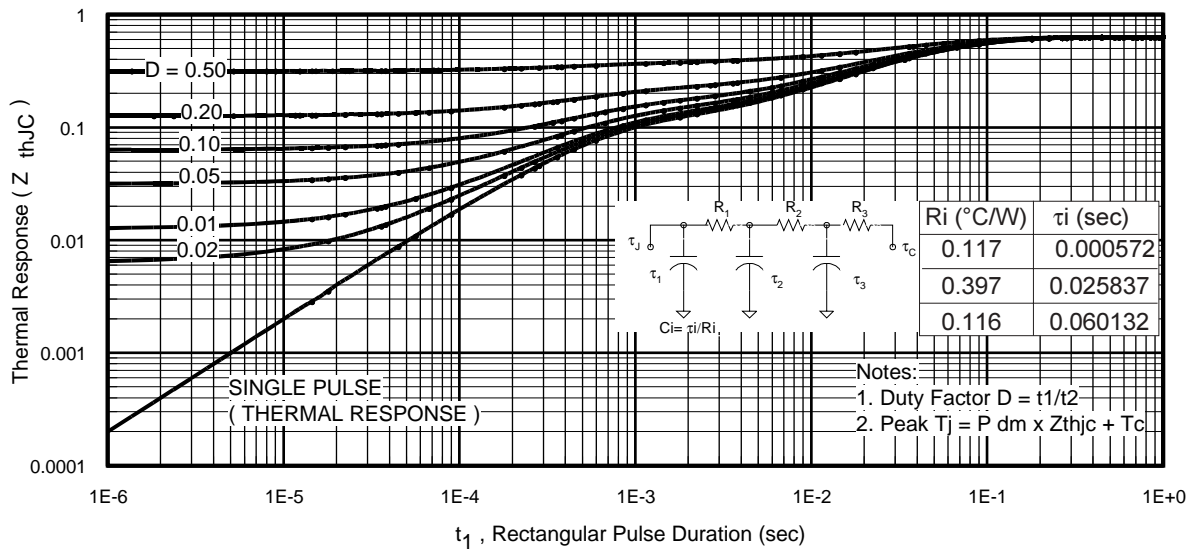
**Fig. 17 - Typical Diode  $I_{RR}$  vs.  $I_F$**   
 $T_J = 125^\circ\text{C}$



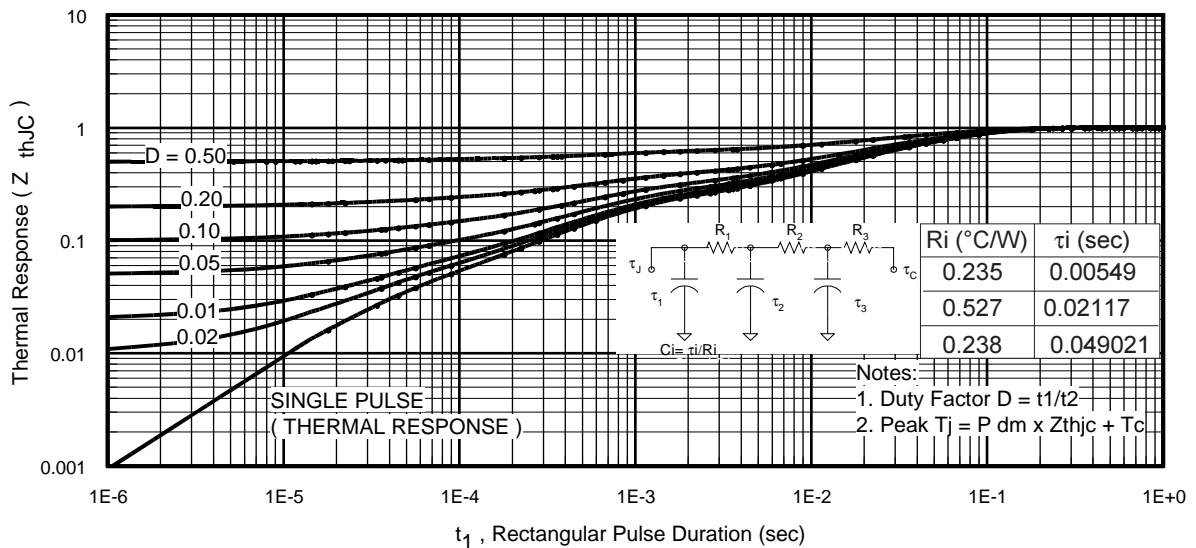
**Fig. 18 - Typical Diode  $I_{RR}$  vs.  $R_G$**   
 $T_J = 125^\circ\text{C}; I_F = 25\text{A}$



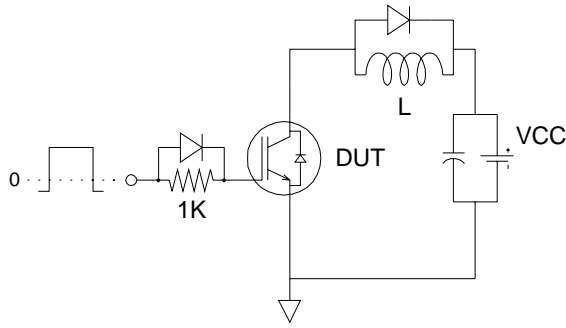
**Fig. 19-** Typical Diode  $I_{RR}$  vs.  $di_F/dt$ ;  $V_{CC}=600V$ ;  $V_{GE}=15V$ ;  $I_{CE}=25A$ ;  $T_J=125^\circ C$



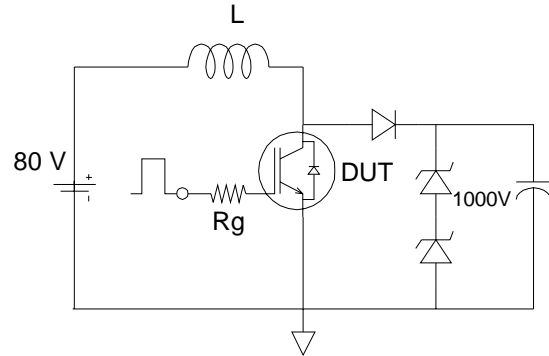
**Fig 20.** Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)



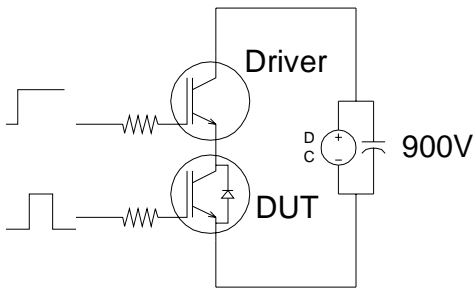
**Fig 21.** Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)



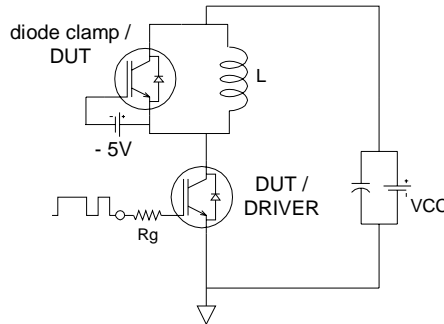
**Fig.C.T.1** - Gate Charge Circuit (turn-off)



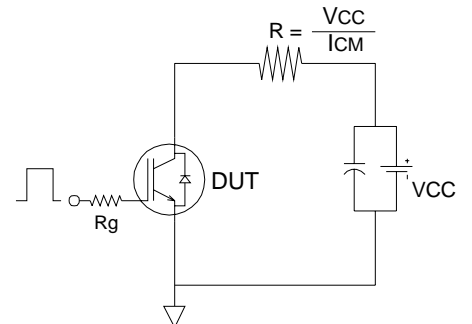
**Fig.C.T.2** - RBSOA Circuit



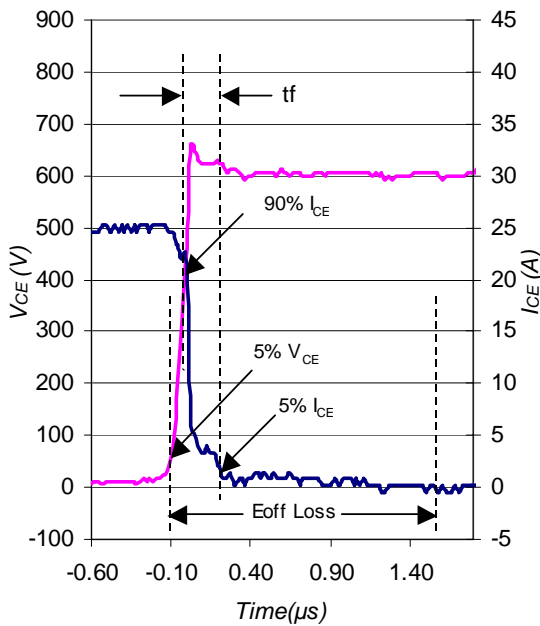
**Fig.C.T.3** - S.C. SOA Circuit



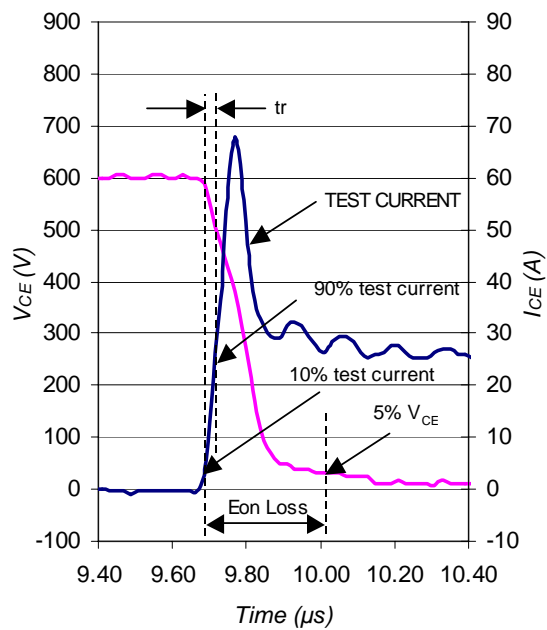
**Fig.C.T.4** - Switching Loss Circuit



**Fig.C.T.5** - Resistive Load Circuit



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



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

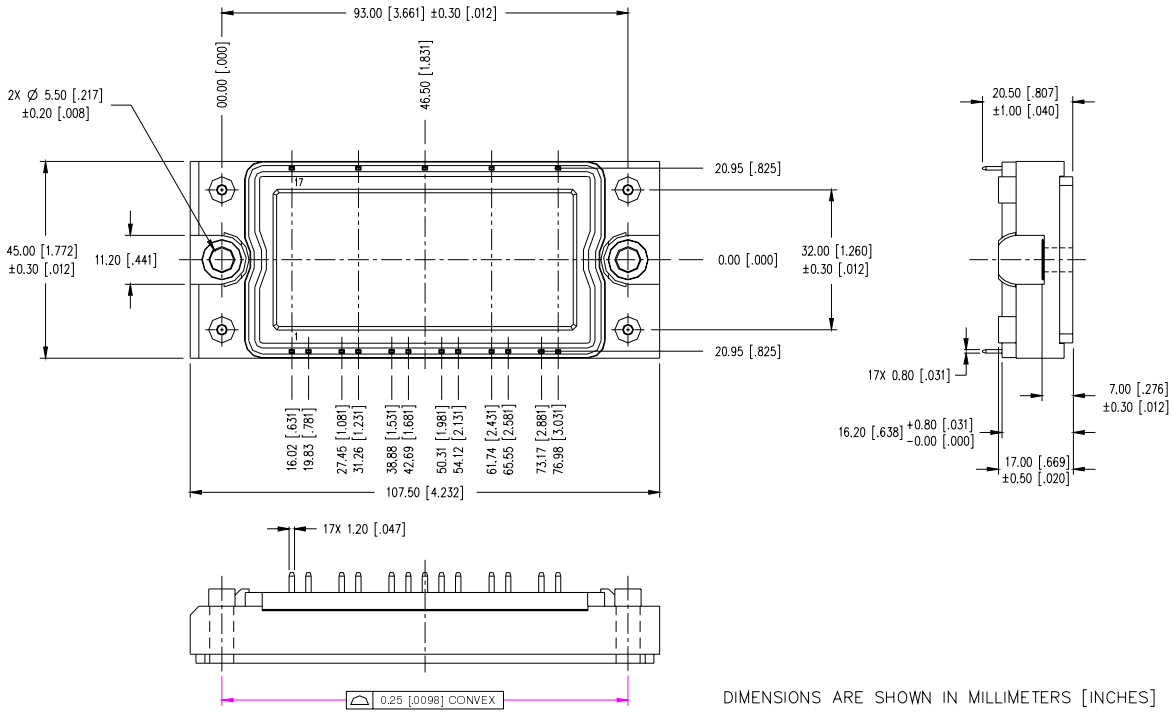
# GB25XF120K

Bulletin PD - 94569 rev.B 08/03

International  
**IR** Rectifier

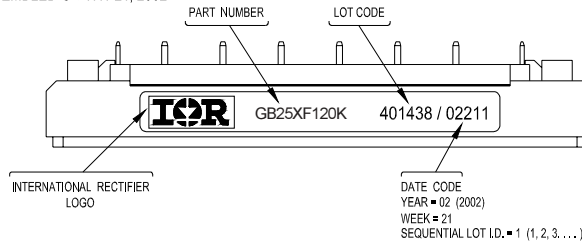
## Econo2 6Pak Package Outline

Dimensions are shown in millimeters (inches)



## Econo2 6Pak Part Marking Information

EXAMPLE: THIS IS A GB25XF120K  
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](http://www.irf.com) for sales contact information. 10/02

[www.irf.com](http://www.irf.com)