

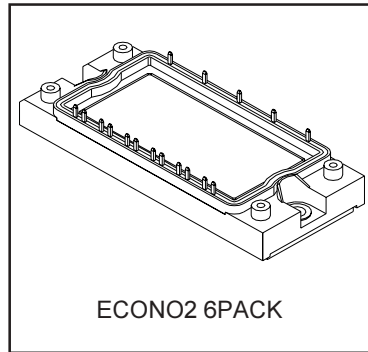
IGBT SIXPACK MODULE

Features

- Low $V_{CE(on)}$ Non Punch Through IGBT Technology
- Low Diode V_F
- 10 μ s 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 

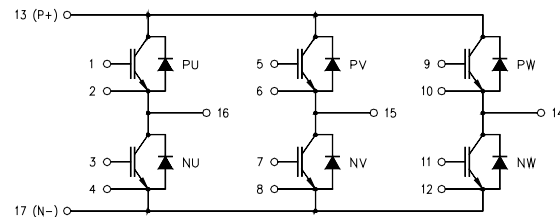


$$V_{CES} = 1200V$$

$$I_C = 13A \quad @ \quad T_C = 80^\circ C$$

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

$$V_{CE(on)} \text{ typ.} = 2.64V$$



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	1200	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	20	A
$I_C @ T_C = 80^\circ C$	Continuous Collector Current	13	
I_{CM}	Pulsed Collector Current (Ref. Fig. C.T.5)	40	
I_{LM}	Clamped Inductive Load Current	40	
$I_F @ T_C = 25^\circ C$	Diode Continuous Forward Current	20	
$I_F @ T_C = 80^\circ C$	Diode Continuous Forward Current	12	
I_{FM}	Diode Maximum Forward Current	40	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation (IGBT and Diode)	151	W
$P_D @ T_C = 80^\circ C$	Maximum Power Dissipation (IGBT and Diode)	85	
T_J	Maximum Operating Junction Temperature	150	$^\circ C$
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	-	-	1.42	$^\circ C/W$
$R_{\theta JC}$ (Diode)	Junction-to-Case Diode	-	-	1.97	
$R_{\theta CS}$ (Module)	Case-to-Sink, flat, greased surface	-	0.05	-	
	Mounting Torque (M5)	2.7	-	3.3	N*m
	Weight	-	170	-	g

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$BV_{(CES)}$	Collector-to-Emitter Breakdown Voltage	1200	-	-	V	$V_{GE} = 0$ $I_C = 500\mu\text{A}$
$\Delta V_{(BR)CES}/\Delta T_J$	Temp. Coefficient of Breakdown Voltage	-	0.87	-	V/ $^\circ\text{C}$	$V_{GE} = 0$ $I_C = 1\text{mA}$ ($25^\circ\text{C} - 125^\circ\text{C}$)
$V_{CE(ON)}$	Collector-to-Emitter Voltage	-	2.64	2.85	V	$I_C = 10\text{A}$ $V_{GE} = 15\text{V}$
		-	3.59	3.94		$I_C = 20\text{A}$ $V_{GE} = 15\text{V}$
		-	3.17	3.46		$I_C = 10\text{A}$ $V_{GE} = 15\text{V}$ $T_J = 125^\circ\text{C}$
		-	4.48	4.97		$I_C = 20\text{A}$ $V_{GE} = 15\text{V}$ $T_J = 125^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	4	-	6		$V_{CE} = V_{GE}$ $I_C = 250\mu\text{A}$
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage temp. coefficient	-	-10.4	-	mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}$ $I_C = 1\text{mA}$ ($25^\circ\text{C} - 125^\circ\text{C}$)
I_{CES}	Zero Gate Voltage Collector Current	-	-	100	μA	$V_{GE} = 0$ $V_{CE} = 1200\text{V}$
		-	750	-		$V_{GE} = 0$ $V_{CE} = 1200\text{V}$ $T_J = 125^\circ\text{C}$
V_{FM}	Diode Forward Voltage Drop	-	2.00	2.28	V	$I_F = 10\text{A}$
		-	2.48	2.90		$I_F = 20\text{A}$
		-	2.16	2.51		$I_F = 10\text{A}$ $T_J = 125^\circ\text{C}$
		-	2.87	3.42		$I_F = 20\text{A}$ $T_J = 125^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current	-	-	± 200	nA	$V_{GE} = \pm 20\text{V}$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_G	Total Gate Charge (turn-on)	-	48	75	nC	$I_C = 10\text{A}$
Q_{GE}	Gate-to-Emitter Charge (turn-on)	-	8	15		$V_{CC} = 600\text{V}$
Q_{GC}	Gate-to-Collector Charge (turn-on)	-	22	33		$V_{GE} = 15\text{V}$
E_{ON}	Turn-On Switching Loss	-	0.84	1.26	mJ	$I_C = 10\text{A}$ $V_{CC} = 600\text{V}$
E_{OFF}	Turn-Off Switching Loss	-	0.36	0.54		$V_{GE} = 15\text{V}$ $R_G = 22\Omega$ $L = 1\text{mH}$
E_{TOT}	Total Switching Loss	-	1.20	1.81		$T_J = 25^\circ\text{C}$ ①
E_{ON}	Turn-On Switching Loss	-	1.14	1.71	mJ	$I_C = 10\text{A}$ $V_{CC} = 600\text{V}$
E_{OFF}	Turn-Off Switching Loss	-	0.64	0.96		$V_{GE} = 15\text{V}$ $R_G = 22\Omega$ $L = 1\text{mH}$
E_{TOT}	Total Switching Loss	-	1.78	2.67		$T_J = 125^\circ\text{C}$ ①
$t_{d(on)}$	Turn-On delay time	-	83	124	ns	$I_C = 10\text{A}$ $V_{CC} = 600\text{V}$
t_r	Risetime	-	21	32		$V_{GE} = 15\text{V}$ $R_G = 22\Omega$ $L = 1\text{mH}$
$t_{d(off)}$	Turn-Off delay time	-	115	172		$T_J = 125^\circ\text{C}$
t_f	Falltime	-	279	420		
C_{ies}	Input Capacitance	-	750	1150	pF	$V_{GE} = 0$
C_{oes}	Output Capacitance	-	190	290		$V_{CC} = 30\text{V}$
C_{res}	Reverse Transfer Capacitance	-	20	35		$f = 1\text{MHz}$
RBSOA	Reverse Bias Safe Operating Area	FULLSQUARE				$T_J = 150^\circ\text{C}$ $I_C = 40\text{A}$ $R_G = 22\Omega$ $V_{GE} = 15\text{V to } 0$
SCSOA	Short Circuit Safe Operating Area	10	-	-	μs	$T_J = 150^\circ\text{C}$ $V_{CC} = 960\text{V}$ $V_P = 1200\text{V}$ $R_G = 22\Omega$ $V_{GE} = 15\text{V to } 0$
I_{rr}	Diode Peak Rev. Recovery Current	-	22	-	A	$T_J = 125^\circ\text{C}$ $V_{CC} = 600\text{V}$ $I_F = 10\text{A}$ $L = 1\text{mH}$ $V_{GE} = 15\text{V}$ $R_G = 22\Omega$

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

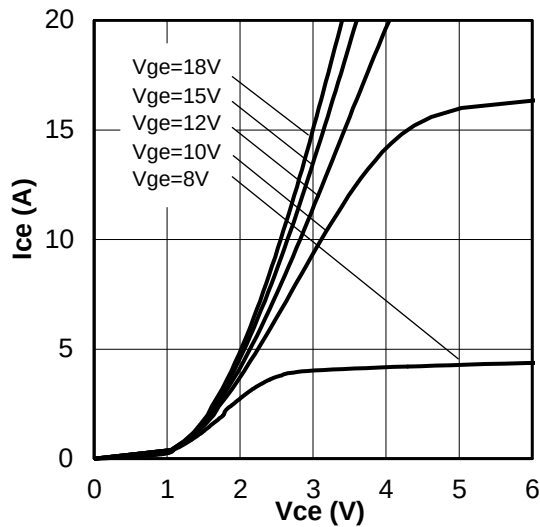


Fig. 1 - Typ. IGBT Output Characteristics
 $T_J = 25^\circ\text{C}$; $t_p = 80\mu\text{s}$

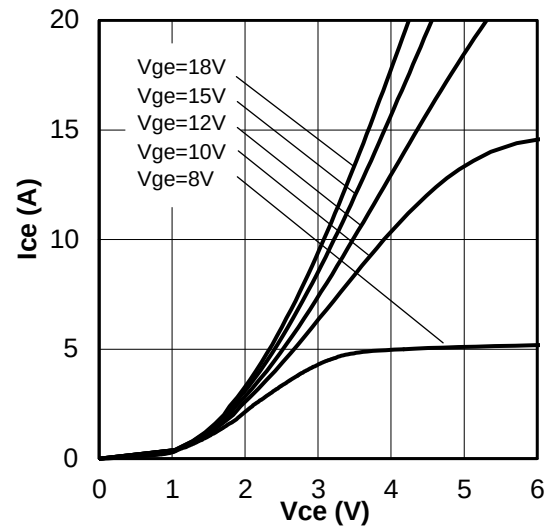


Fig. 2 - Typ. IGBT Output Characteristics
 $T_J = 125^\circ\text{C}$; $t_p = 80\mu\text{s}$

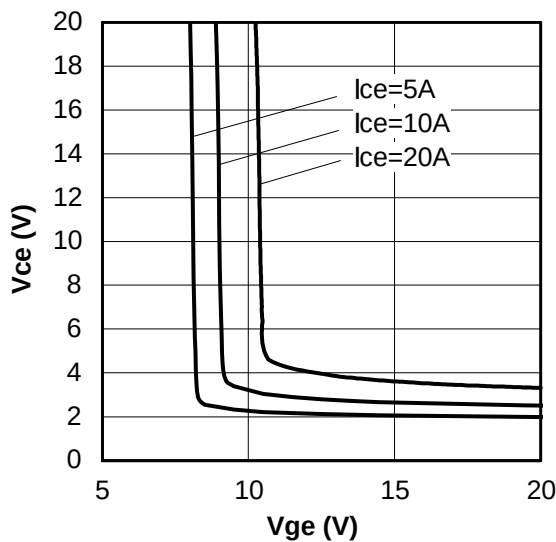


Fig. 3 - Typical V_{CE} vs. V_{GE}
 $T_J = 25^\circ\text{C}$

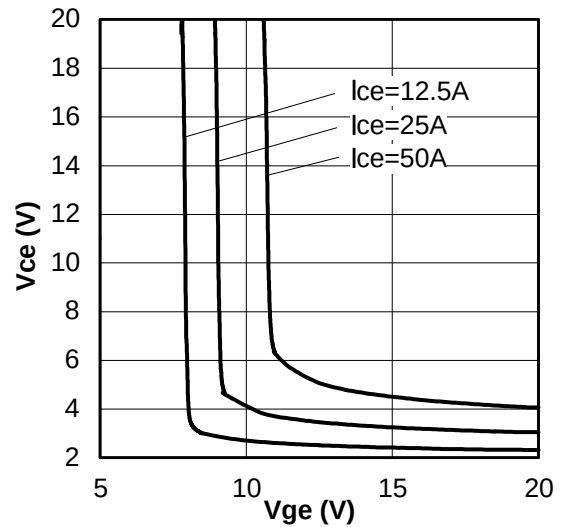


Fig. 4 - Typical V_{CE} vs. V_{GE}
 $T_J = 125^\circ\text{C}$

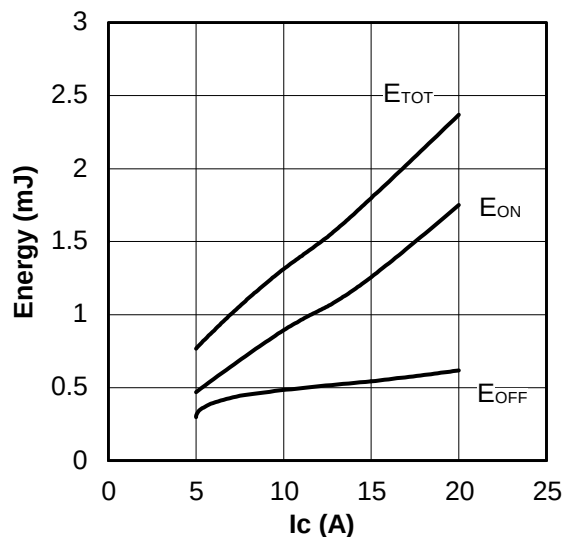


Fig. 5 - Typ. Energy Loss vs. I_C
 $T_J = 125^\circ\text{C}$; $L = 1\text{mH}$; $V_{CE} = 600\text{V}$
 $R_G = 22\Omega$; $V_{GE} = 15\text{V}$

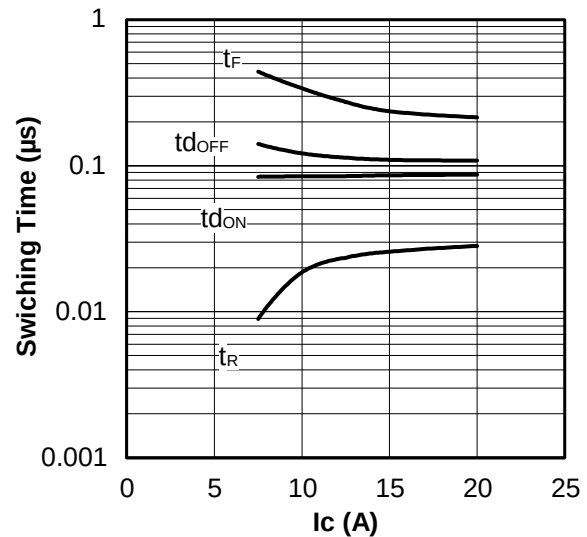


Fig. 6 - Typ. Switching Time vs. I_C
 $T_J = 125^\circ\text{C}$; $L = 1\text{mH}$; $V_{CE} = 600\text{V}$
 $R_G = 22\Omega$; $V_{GE} = 15\text{V}$

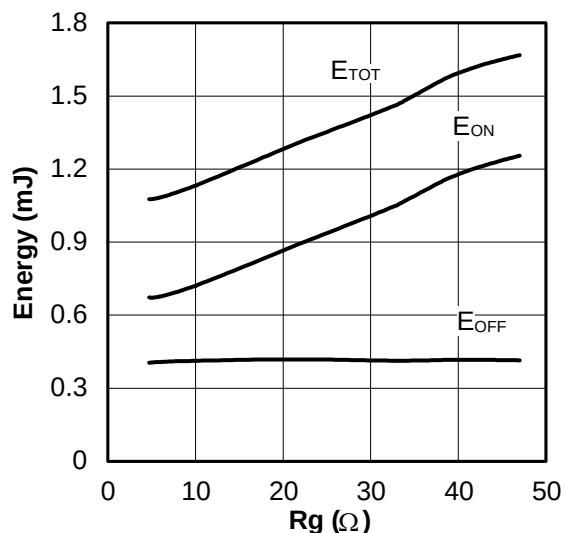


Fig. 7 - Typ. Energy Loss vs. R_G
 $T_J = 125^\circ\text{C}$; $L=1\text{mH}$; $V_{CE}=600\text{V}$
 $I_{CE}=10\text{A}$; $V_{GE}=15\text{V}$

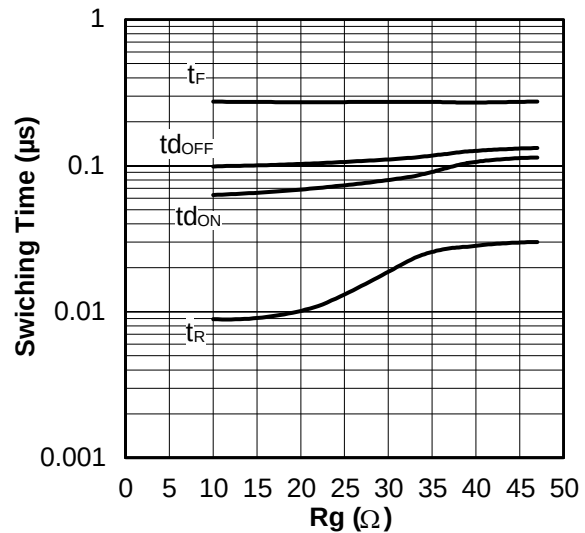


Fig. 8 - Typ. Switching Time vs. R_G
 $T_J = 125^\circ\text{C}$; $L=1\text{mH}$; $V_{CE}=600\text{V}$;
 $I_{CE}=10\text{A}$; $V_{GE}=15\text{V}$

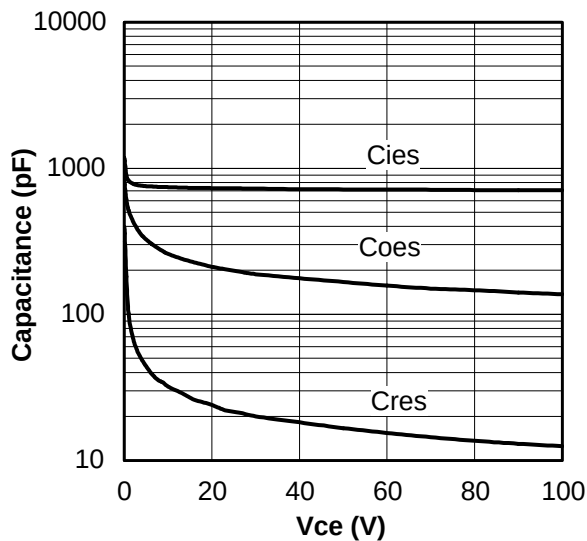


Fig. 9- Typ. Capacitance vs. V_{CE}
 $V_{GE}=0$; $f=1\text{MHz}$

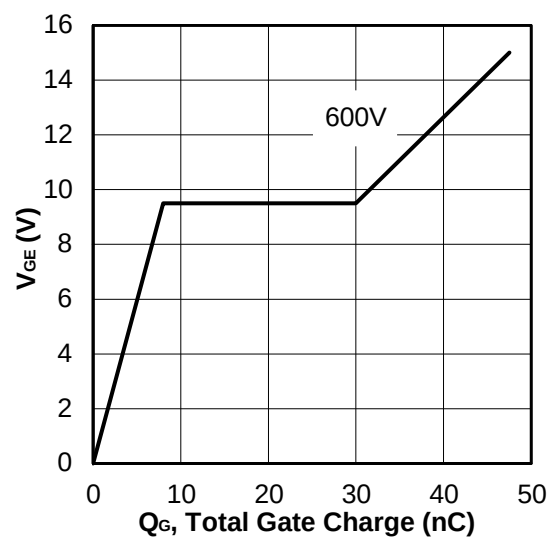


Fig. 10 - Typical Gate Charge vs. V_{GE}
 $I_{CE}=10\text{A}$

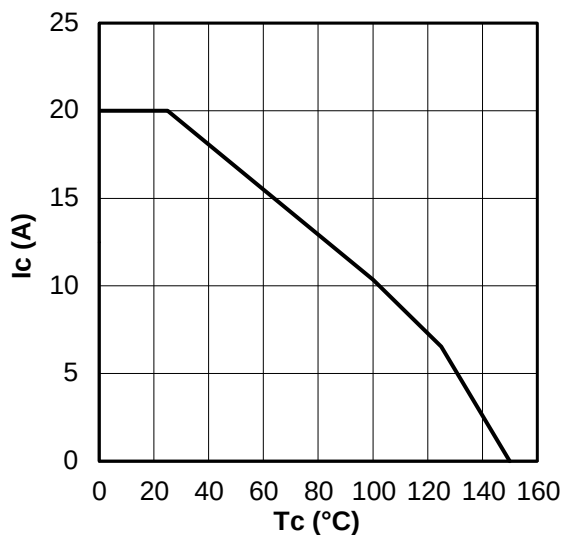


Fig. 11 - Maximum DC Collector Current vs.
Case Temperature

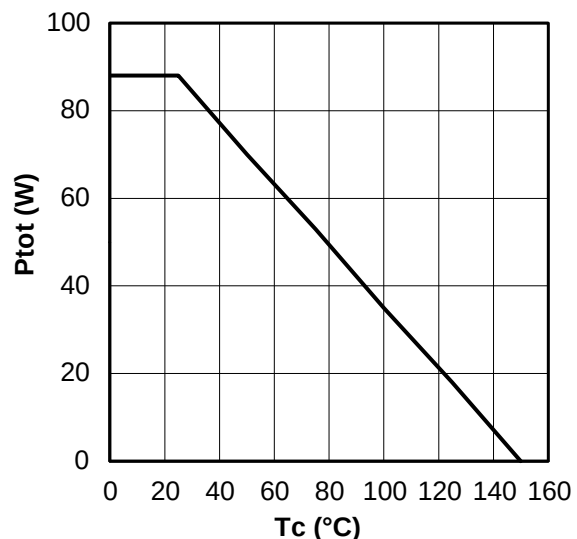


Fig. 12 - Power Dissipation vs.
Case Temperature

Inverter

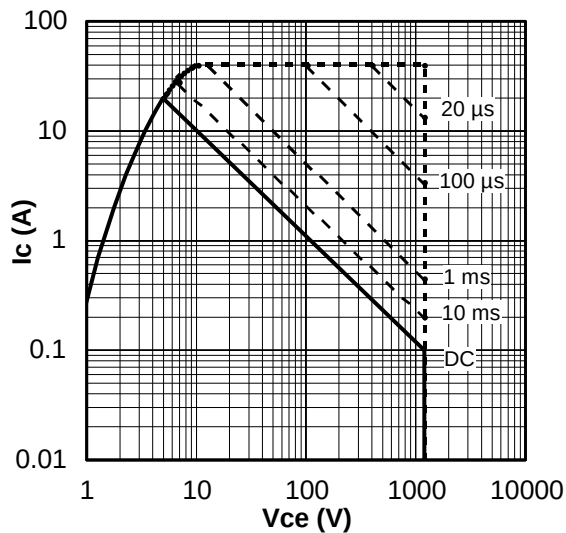


Fig. 13 - Forward SOA
 $T_C = 25^\circ\text{C}; T_J \leq 150^\circ\text{C}$

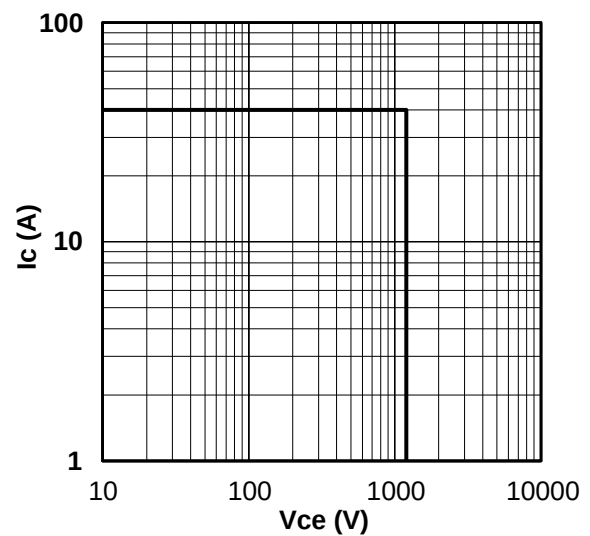


Fig. 14 - Reverse Bias SOA
 $T_J = 150^\circ\text{C}; V_{GE} = 15\text{V}$

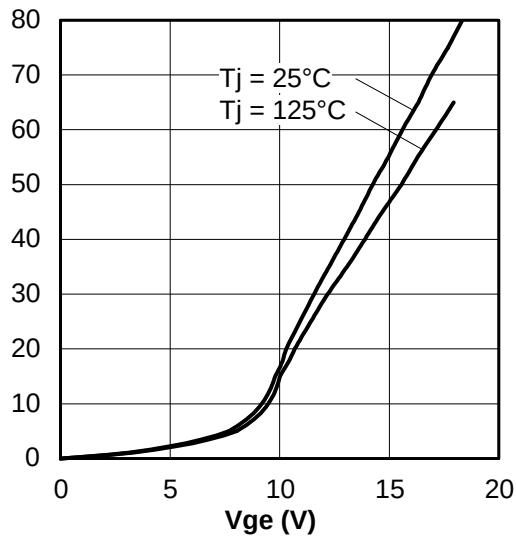


Fig. 15 - Typ. Transfer Characteristics
 $V_{CE} = 50\text{V}; t_p = 10\mu\text{s}$

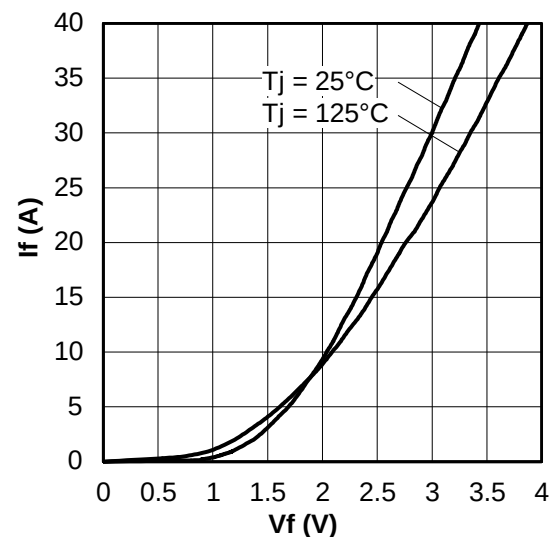


Fig. 16 - Typ. Diode Forward Characteristics
 $t_p = 80\mu\text{s}$

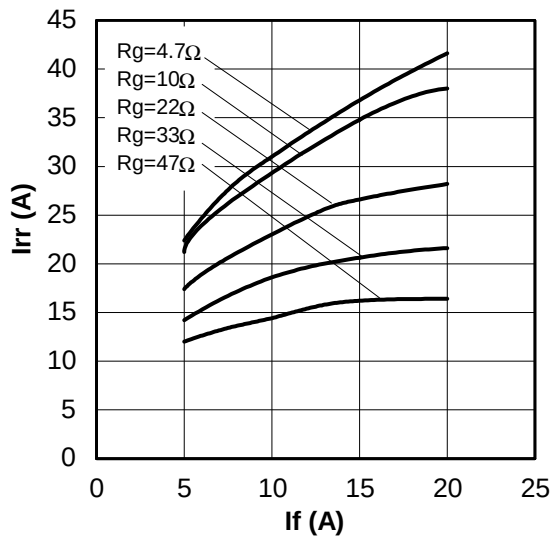


Fig. 17 - Typical Diode I_{RR} vs. I_F
 $T_J = 125^\circ\text{C}$

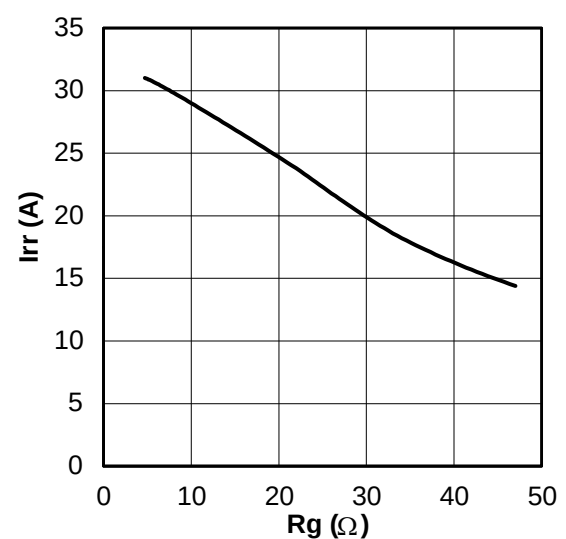


Fig. 18 - Typical Diode I_{RR} vs. R_G
 $T_J = 125^\circ\text{C}; I_F = 10\text{A}$

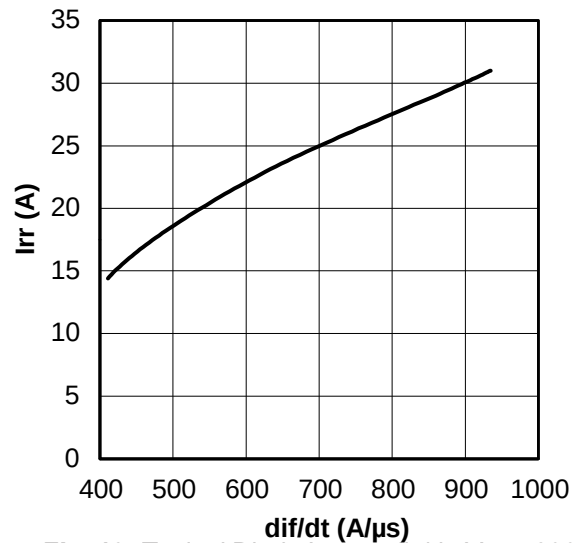


Fig. 19- Typical Diode I_{RR} vs. di_F/dt ; $V_{CC}=600V$;
 $V_{GE}=15V$; $I_{CE}=10A$; $T_J=125^{\circ}C$

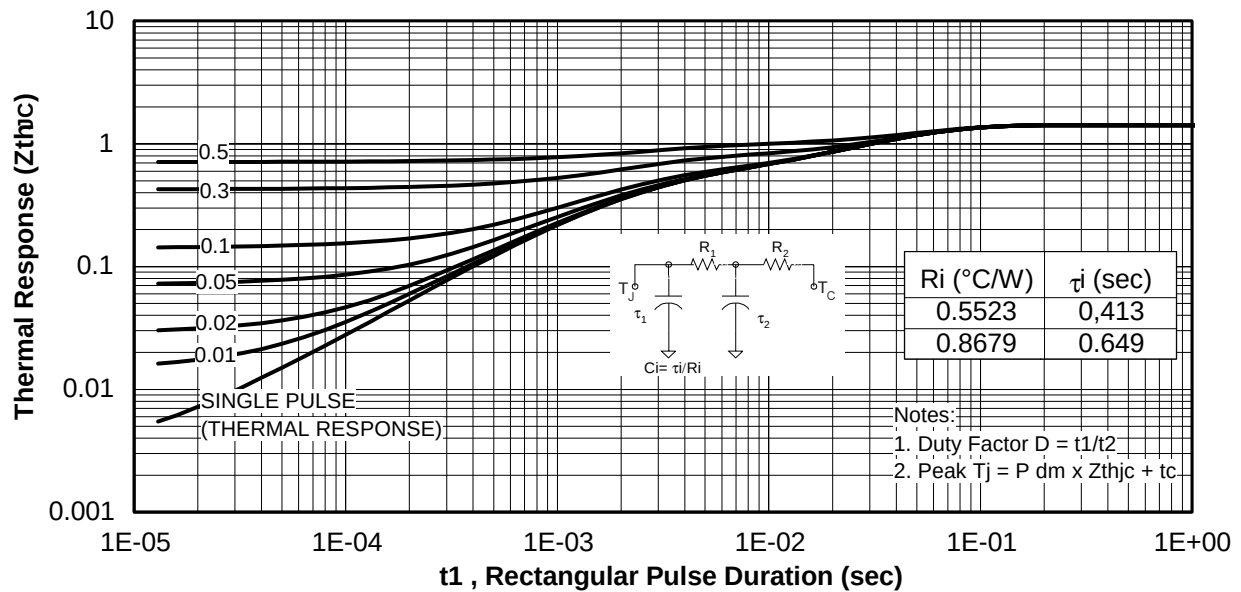


Fig 20. Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

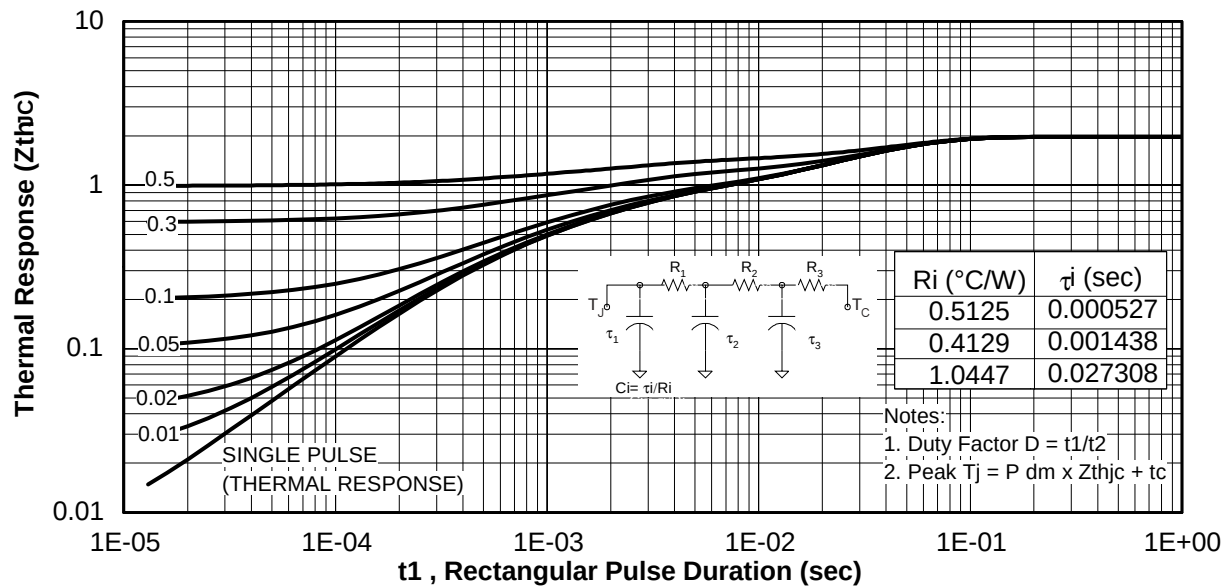


Fig 21. Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

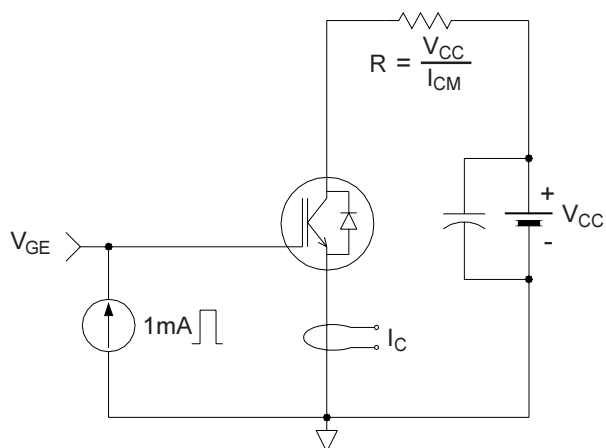


Fig.C.T.1 - Gate Charge Circuit (turn-off)

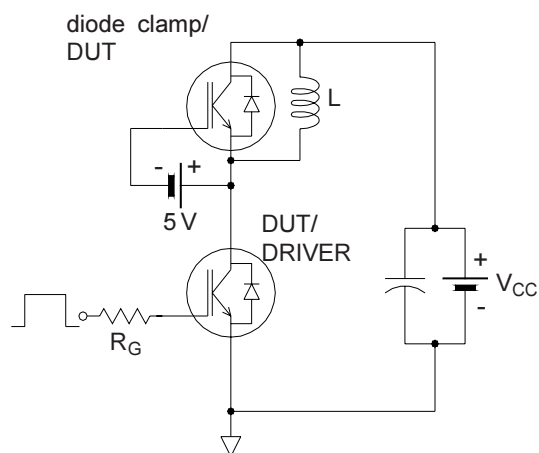


Fig.C.T.2 - RBSOA Circuit

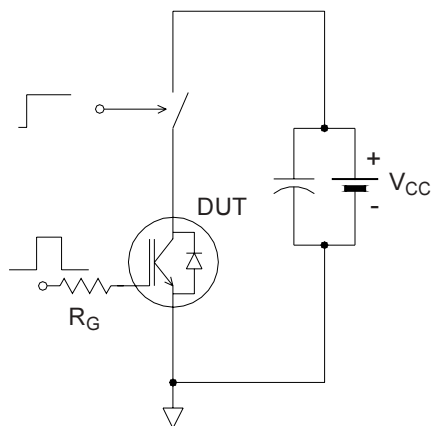


Fig.C.T.3 - S.C. SOA Circuit

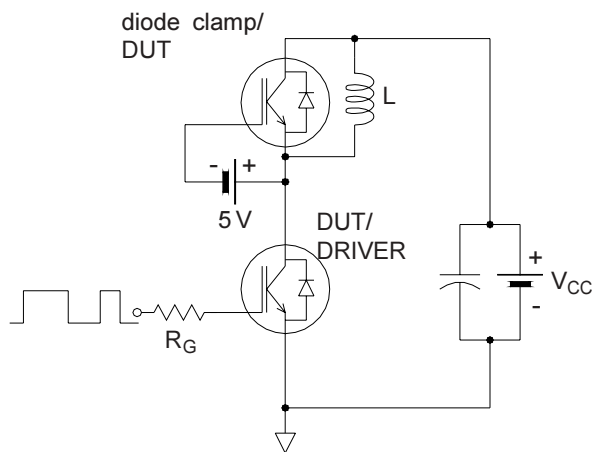


Fig.C.T.4 - Switching Loss Circuit

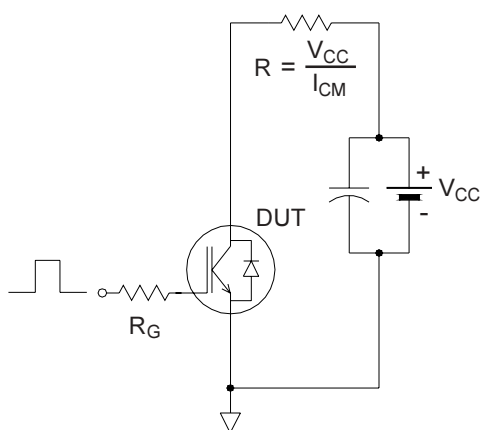
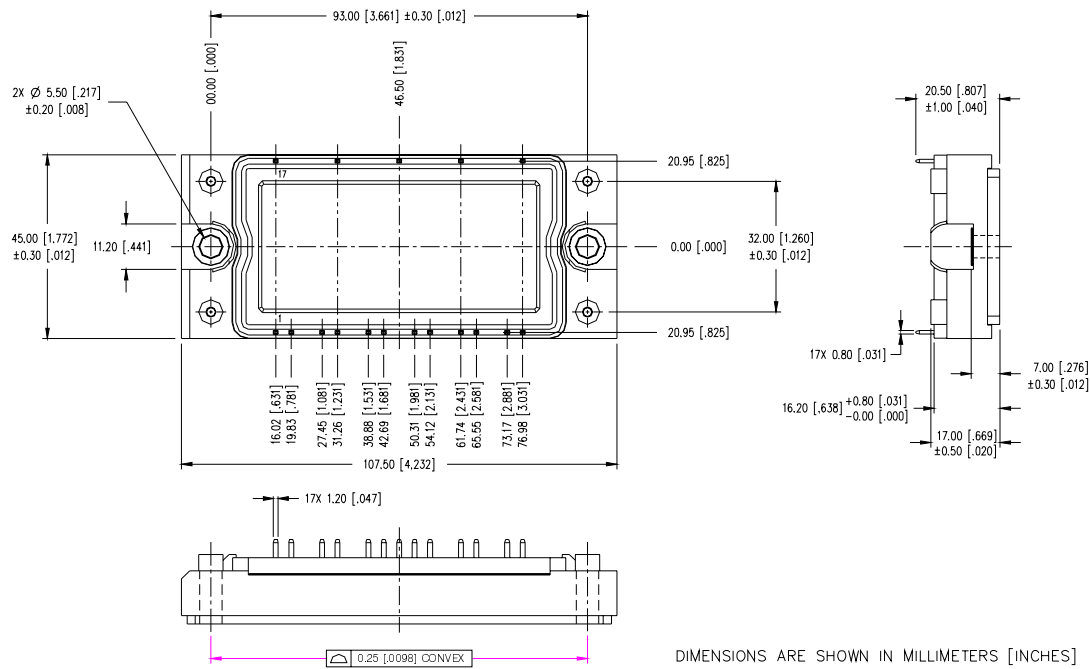


Fig.C.T.5 - Resistive Load Circuit

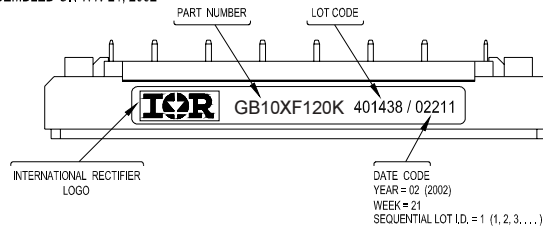
Econo2 6Pak Package Outline

Dimensions are shown in millimeters (inches)



Econo2 6Pak Part Marking Information

EXAMPLE: THIS IS A GB10XF120K
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

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