International
IOR Rectifier

Bulletin I27303 01/07

GB30RF60K

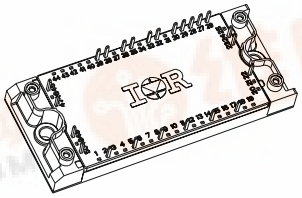
IGBT PIM MODULE

Features

- Low V_{CE} (on) Non Punch Through IGBT Technology
- Low Diode V_F
- 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
- TOTALLY LEAD-FREE

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



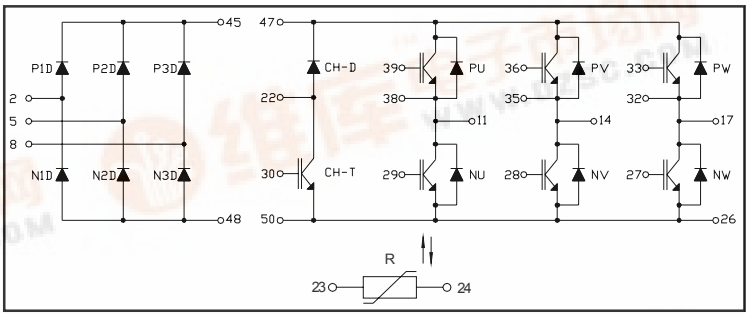
ECONO2 PIM

V_{CES} = 600V

I_C = 27A @ T_C=80°C

t_{sc} > 10µs @ T_J =150°C

$V_{CE(on)}$ typ. = 2.04V



Absolute Maximum Ratings

	Parameter	Symbol	Test Conditions		Ratings	Units
Inverter	Collector-to-Emitter Voltage	V_{CES}			600	V
	Gate-to-Emitter Voltage	V_{GES}			±20	
	Collector Current	I_C	Continuos	25°C / 80°C	50 / 27	A
		I_{CM}	Pulsed	25°C	100	
	Diode Maximum Forward Current	I_{FM}		25°C	100	
	Power Dissipation	P_D	One IGBT	25°C	129	W
Input Rectifier	Repetitive Peak Reverse Voltage	V_{RRM}			800	V
	Average Output Current	$I_{F(AV)}$	50/60Hz sine pulse	80°C	30	A
	Surge Current (Non Repetitive)	I_{FSM}	Rated V_{RRM} applied, 10ms, sine pulse		310	
	I^2t (Non Repetitive)	I^2t			525	A^2s
Brake	Collector-to-Emitter Voltage	V_{CES}			600	V
	Gate-to-Emitter Voltage	V_{GES}			±20	
	Collector Current	I_C	Continuous	25°C / 80°C	30 / 20	A
		I_{CM}	Pulsed	25°C	60	
	Power Dissipation	P_D	One IGBT	25°C	100	W
	Repetitive Peak Reverse Voltage	V_{RRM}			600	V
	Maximum Operating Junction Temperature	T_J			150	°C
	Storage Temperature Range	T_{STG}			-40 to +125	
	Isolation Voltage	V_{ISOL}	AC (1 min)		2500	V

Thermal and Mechanical Characteristics

Parameter	Symbol	Min	Typical	Maximum	Units
Junction-to-Case Inverter IGBT Thermal Resistance	$R_{\theta JC}$	-	-	0.97	°C/W
Junction-to-Case Inverter FRED Thermal Resistance		-	-	1.42	
Junction-to-Case Brake DIODE Thermal Resistance		-	-	2.44	
Junction-to-Case Brake IGBT Thermal Resistance		-	-	1.25	
Junction-to-Case Input Rectifier Thermal Resistance		-	-	1.03	
Case-to-Sink, flat, greased surface	$R_{\theta CS}$	-	0.05	-	
Mounting Torque (M5)		2.7	-	3.3	Nm
Weight			170		g

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

		Parameter	Min.	Typ.	Max.	Units	Conditions
Inverter	$BV_{(CES)}$	Collector-to-Emitter Breakdown Voltage	600	-	-	V	V_{GE} = 0 I_C = 500µA
IGBT	$\Delta V_{(BR)CES}/\Delta T_J$	Temp. Coefficient of Breakdown Voltage	-	0.7	-	V/°C	V_{GE} = 0 I_C = 1mA (25°C - 125°C)
	$V_{CE(ON)}$	Collector-to-Emitter Voltage	-	2.04	2.65	V	I_C = 30A V_{GE} = 15V
			-	2.60	3.62		I_C = 50A V_{GE} = 15V
			-	2.31	2.80		I_C = 30A V_{GE} = 15V T_J = 125°C
			-	3.01	2.77		I_C = 50A V_{GE} = 15V T_J = 125°C
	V_{GE}(th)	Gate Threshold Voltage	3.5	-	5.5		V_{CE} = V_{GE} I_C = 250µA
	ΔV_{GE}(th)/ΔT_J	Thresold Voltage temp. coefficient	-	-10	-	mV/°C	V_{CE} = V_{GE} I_C = 1mA (25°C-125°C)
	I_{CES}	Zero Gate Voltage Collector Current	-	-	100	µA	V_{GE} = 0 V_{CE} = 600V
			-	400	-		V_{GE} = 0 V_{CE} = 600V Tj = 125°C
	I_{GES}	Gate-to-Emitter Leakage Current	-	-	±200	nA	V_{GE} = ±20V
	Q_G	Total Gate Charge (turn-on)	-	105	158		I_C = 30A
	Q_{GE}	Gate-to-Emitter Charge (turn-on)	-	14	21	nC	V_{CC} = 300V
	Q_{GC}	Gate-to-Collector Charge (turn-on)	-	51	76		V_{GE} = 15V
	E_{ON}	Turn-On Switching Loss	-	491	737	µJ	I_C = 30A V_{CC} = 300V
	E_{OFF}	Turn-Off Switching Loss	-	223	335		V_{GE} = 15V R_G = 22Ω L = 200µH
	E_{TOT}	Total Switching Loss	-	714	1072		Tj = 25°C [1]
	E_{ON}	Turn-On Switching Loss	-	613	920	µJ	I_C = 30A V_{CC} = 300V
	E_{OFF}	Turn-Off Switching Loss	-	417	626		V_{GE} = 15V R_G = 22Ω L = 200µH
	E_{TOT}	Total Switching Loss	-	1030	1546		Tj = 125°C [1]
	$t_{d(on)}$	Turn-On delay time	-	132	198	ns	I_C = 30A V_{CC} = 300V
	t_r	Rise time	-	33	50		V_{GE} = 15V R_G = 22Ω L = 200µH
	$t_{d(off)}$	Turn-Off delay time	-	153	229		Tj = 125°C
	t_f	Fall time	-	88	132		
	C_{ies}	Input Capacitance	-	1834	2751	pF	V_{GE} = 0
	C_{oes}	Output Capacitance	-	459	690		V_{CC} = 30V
	C_{res}	Reverse Transfer Capacitance	-	54	81		f = 1Mhz
	RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				Tj = 150°C I_C = 60A R_G = 22Ω V_{GE} = 15V to 0
	SCSOA	Short Circuit Safe Operating Area	10	-	-	µs	I_P = 220A to 310A V_{CC} = 300V R_G = 47Ω V_{GE} = 15V to 0
Inverter	I_{rr}	Diode Peak Rev. Recovery Current	-	43	-	A	Tj = 125°C V_{CC} = 300V I_F = 30A L = 200µH V_{GE} = 15V R_G = 22Ω
Diode	V_{FM}	Diode Forward Voltage Drop	-	1.31	1.81	V	I_F = 30A
			-	1.52	2.40		I_F = 50A
			-	1.25	1.68		I_F = 30A Tj = 125°C
			-	1.47	2.14		I_F = 50A Tj = 125°C

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

		Parameter	Min.	Typ.	Max.	Units	Conditions
Input	V_{FM}	Maximum Forward Voltage Drop	-	-	1.50	V	I_F = 30A
Rectifier	I_{RM}	Maximum Reverse Leakage Current	-	-	0.2	mA	Tj = 25°C V_R = 800V
			-	-	1		Tj = 150°C V_R = 800V
	r_T	Forward Slope Resistance	-	8.8	-	mΩ	Tj = 150°C
	$V_{F(TO)}$	Conduction Thresold Voltage	-	0.79	-	V	
Brake	$BV_{(CES)}$	Collector-to-Emitter Breakdown Voltage	600	-	-	V	V_{GE} = 0 I_C = 500µA
IGBT	$\Delta V_{(BR)CES}/\Delta T_J$	Temp. Coefficient of Breakdown Voltage	-	0.6	-	V/°C	V_{GE} = 0 I_C = 1mA (25°C - 125°C)
	$V_{CE(ON)}$	Collector-to-Emitter Voltage	-	2.07	2.24	V	I_C = 20A V_{GE} = 15V
			-	2.51	2.71		I_C = 30A V_{GE} = 15V
			-	2.49	2.72		I_C = 20A V_{GE} = 15V T_J = 125°C
			-	3.06	3.47		I_C =30A V_{GE} = 15V T_J = 125°C
	$V_{GE}(th)$	Gate Threshold Voltage	4	-	6		V_{CE} = V_{GE} I_C = 250µA
	$\Delta V_{GE}(th)/\Delta T_J$	Thresold Voltage temp. coefficient	-	-10	-	mV/°C	V_{CE} = V_{GE} I_C = 1mA (25°C-125°C)
	I_{CES}	Zero Gate Voltage Collector Current	-	-	100	µA	V_{GE} = 0 V_{CE} = 600V
			-	250	-		V_{GE} = 0 V_{CE} = 600V Tj = 125°C
	I_{GES}	Gate-to-Emitter Leakage Current	-	-	±200	nA	V_{GE} = ±20V
	Q_G	Total Gate Charge (turn-on)	-	48	72		I_C = 15A
	Q_{GE}	Gate-to-Emitter Charge (turn-on)	-	11	16	nC	V_{CC} = 300V
	Q_{GC}	Gate-to-Collector Charge (turn-on)	-	30	44		V_{GE} = 15V
	E_{ON}	Turn-On Switching Loss	-	176	264	µJ	I_C = 15A V_{CC} = 300V
	E_{OFF}	Turn-Off Switching Loss	-	137	207		V_{GE} = 15V R_G = 22Ω L = 200µH
	E_{TOT}	Total Switching Loss	-	313	471		Tj = 25°C [1]
	E_{ON}	Turn-On Switching Loss	-	235	353	µJ	I_C = 15A V_{CC} = 300V
	E_{OFF}	Turn-Off Switching Loss	-	276	416		V_{GE} = 15V R_G = 22Ω L = 200µH
	E_{TOT}	Total Switching Loss	-	512	768		Tj = 125°C [1]
	$t_{d(on)}$	Turn-On delay time	-	87	131	ns	I_C = 15A V_{CC} = 300V
	t_r	Rise time	-	24	36		V_{GE} = 15V R_G = 22Ω L = 200µH
	$t_{d(off)}$	Turn-Off delay time	-	112	169		Tj = 125°C
	t_f	Fall time	-	115	172		
	C_{ies}	Input Capacitance	-	901	1352	pF	V_{GE} = 0
	C_{oes}	Output Capacitance	-	263	395		V_{CC} = 30V
	C_{res}	Reverse Transfer Capacitance	-	29	44		f = 1Mhz
	RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				Tj = 150°C I_C = 20A R_G = 22Ω V_{GE} = 15V to 0
	SCSOA	Short Circuit Safe Operating Area	10	-	-	µs	I_P = 180A to 280A V_{CC} = 300V R_G = 47Ω V_{GE} = 15V to 0
Brake	I_{rr}	Diode Peak Rev. Recovery Current	-	28	-	A	V_{CC} = 300V I_F = 15A L = 200µH
Diode							V_{GE} = 15V to 0 R_G = 22Ω
	V_{FM}	Diode Forward Voltage Drop	-	1.61	1.71	V	I_F = 20A
			-	1.79	1.99		I_F = 30A
			-	1.57	1.66		I_F = 20A Tj = 125°C
			-	1.73	1.83		I_F = 30A Tj = 125°C
NTC	R	Resistance	-	5000	-	Ω	Tj = 25°C
			-	4933	-		Tj = 100°C
	B	B Value	-	3375	-	K	Tj = 25°C / 50°C

[1] Energy Losses include "tail" and diode reverse recovery

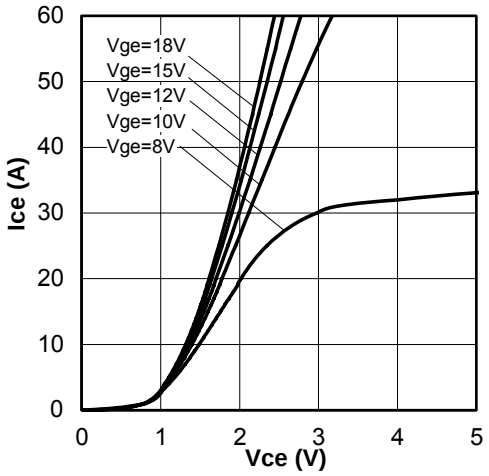


Fig. 1 - Typ. IGBT Output Characteristics
T_J = 25°C; tp = 80µs

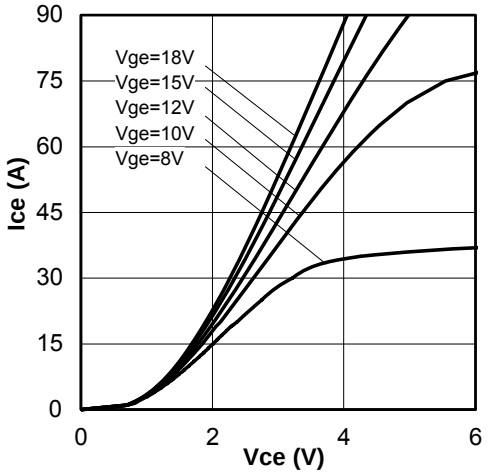


Fig. 2 - Typ. IGBT Output Characteristics
T_J = 125°C; tp = 80µs

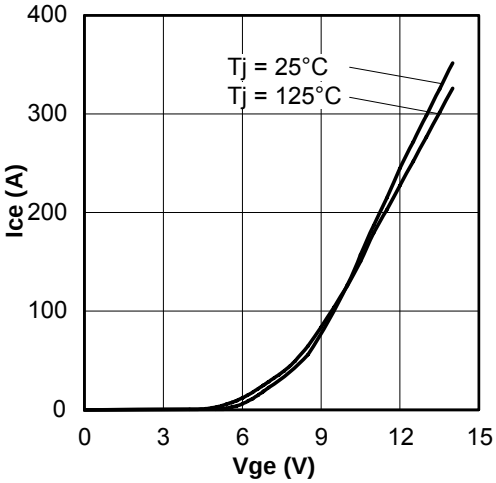


Fig. 3 - Typ. Transfer Characteristics
V_{CE} = 50V; tp = 10µs

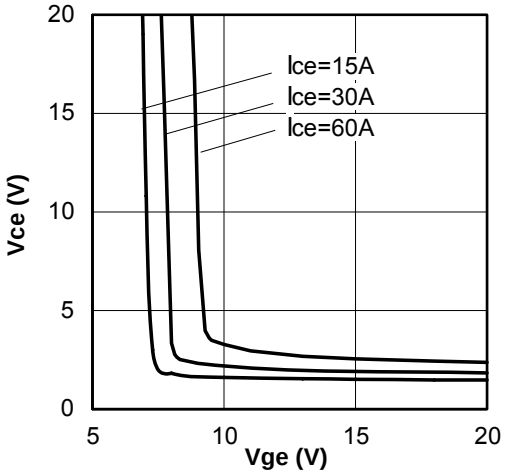


Fig. 4 - Typical V_{CE} vs. V_{GE}
T_J = 25°C

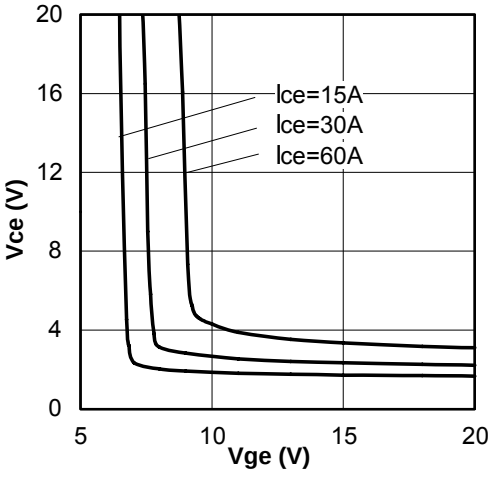


Fig.5 - Typical V_{CE} vs. V_{GE}
T_J = 125°C

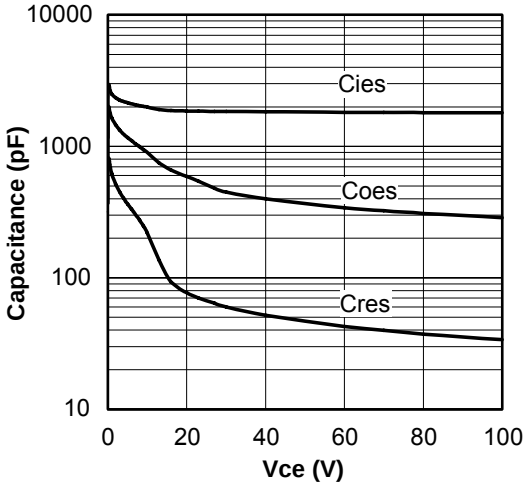


Fig. 6- Typ. Capacitance vs. V_{CE}
V_{GE}= 0; f = 1MHz

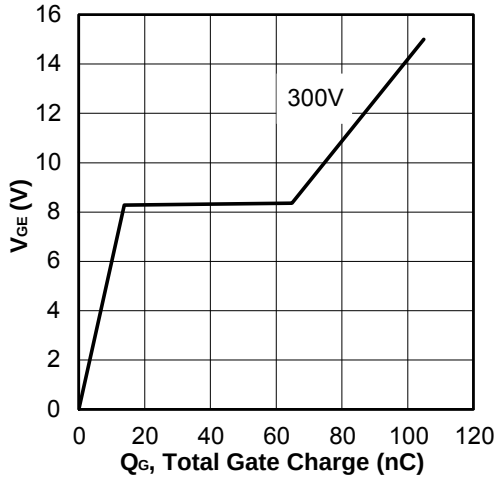


Fig. 7 - Typical Gate Charge vs. V_{GE}
I_{CE} = 30A

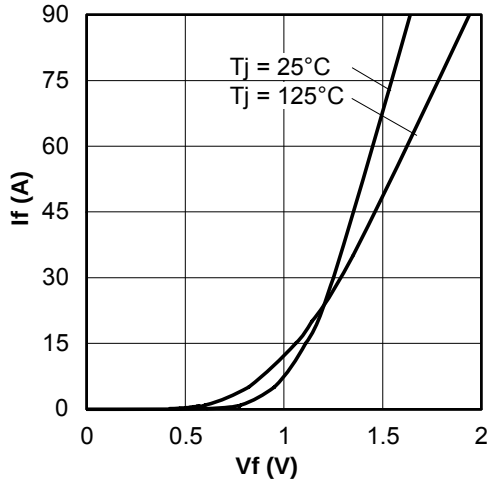


Fig. 8 - Typ. Diode Forward Characteristics
tp = 80µs

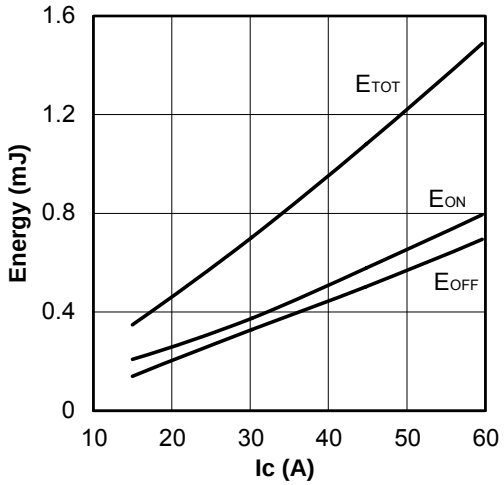


Fig. 9 - Typ. Energy Loss vs. I_C
T_J = 125°C; L=200µH; V_{CE}= 300V,R_G= 22Ω; V_{GE}= 15V

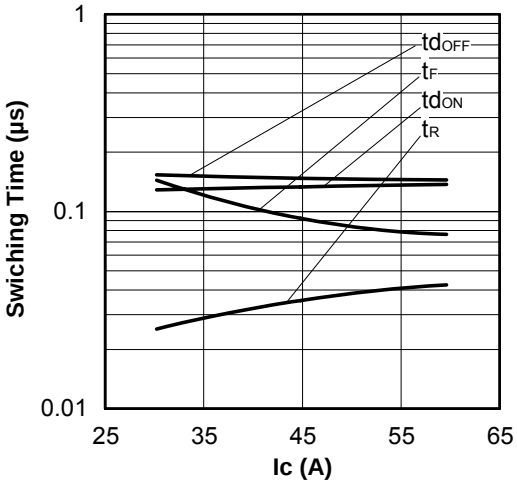


Fig. 10 - Typ. Switching Time vs. I_C
T_J = 125°C; L=200µH; V_{CE}= 300V,R_G= 22Ω;V_{GE}= 15V

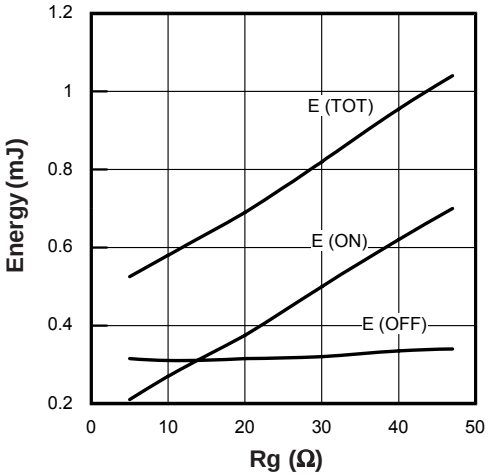


Fig. 11 - Typ. Energy Loss vs. R_G
T_J = 125°C; L=200µH; V_{CE}= 300V, I_{CE}= 30A; V_{GE}= 15V

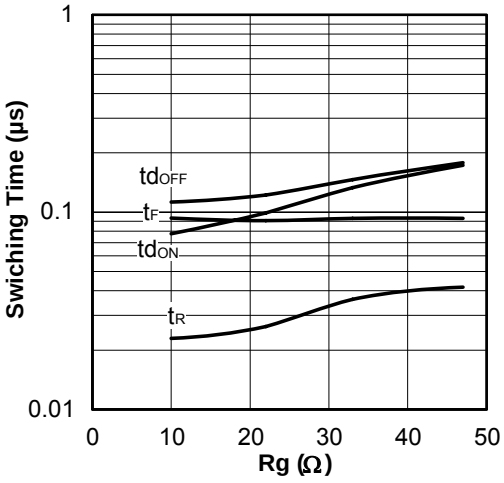


Fig. 12- Typ. Switching Time vs. R_G
T_J = 125°C; L=200µH; V_{CE}= 300V, I_{CE}= 30A; V_{GE}= 15V

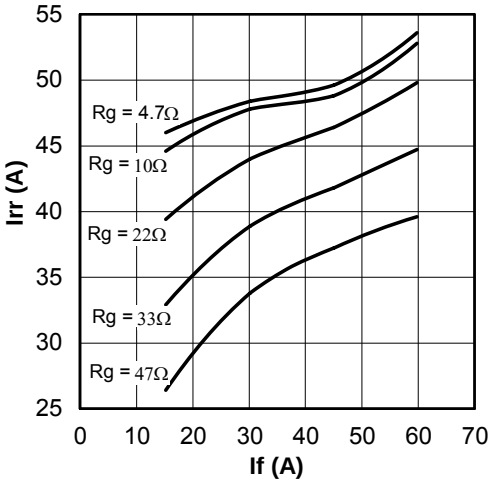


Fig. 13 - Typical Diode I_{RR} vs. I_F
T_J = 125°C

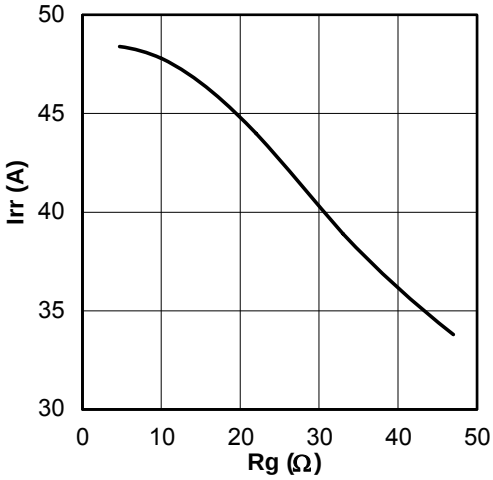


Fig. 14 - Typical Diode I_{RR} vs. R_G
T_J = 125°C; I_F = 30A

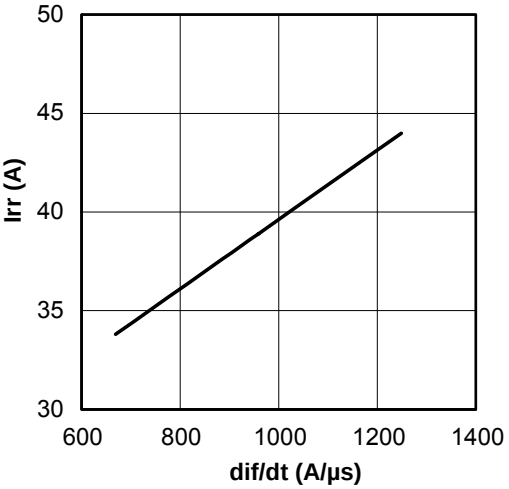


Fig. 15- Typical Diode I_{RR} vs. di_F/dt
V_{CC}= 300V; V_{GE}= 15V; I_{CE}= 30A; T_J = 125°C

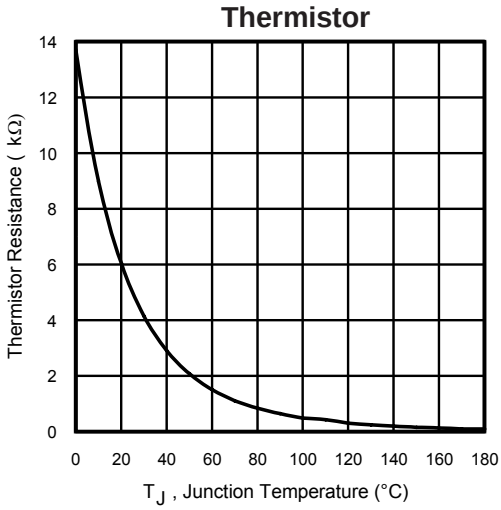


Fig. 16 - Thermistor Resistance vs. Temperature

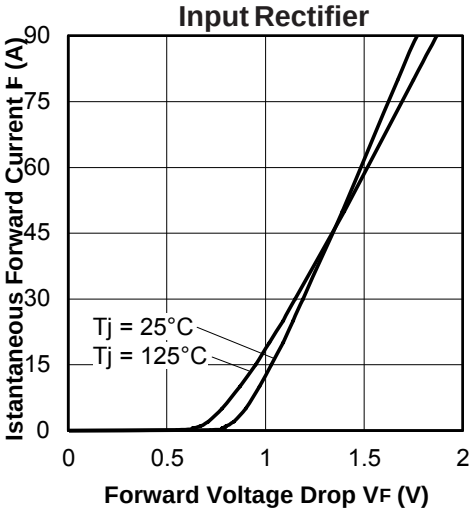


Fig. 17- Typ. Diode Forward Characteristics
tp = 80µs

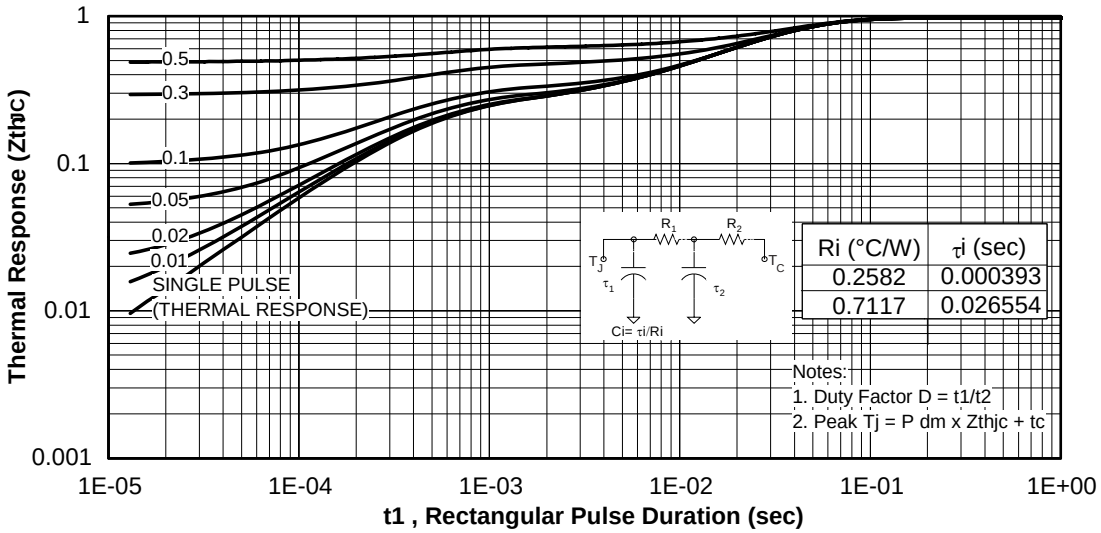


Fig 18. Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

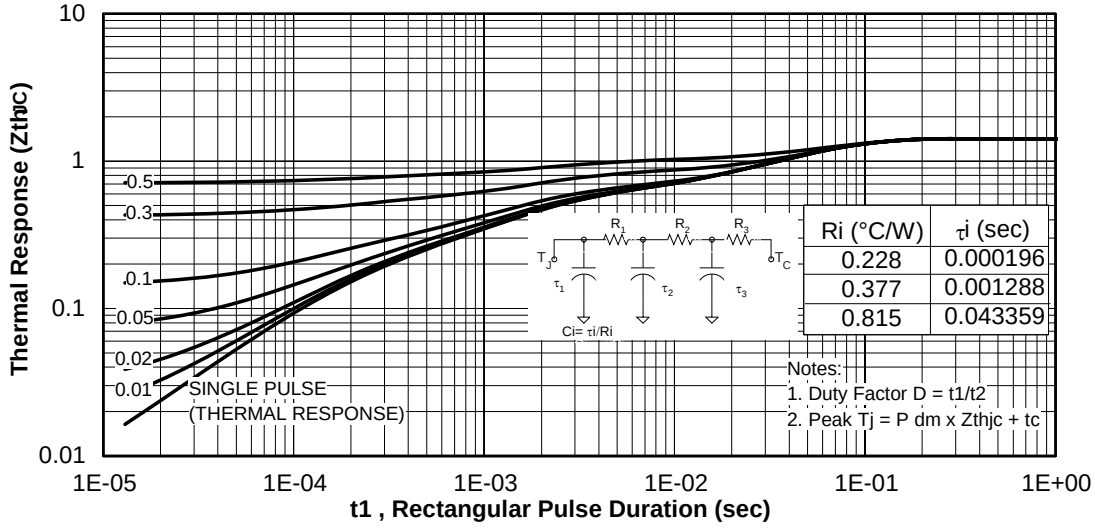


Fig 19. Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

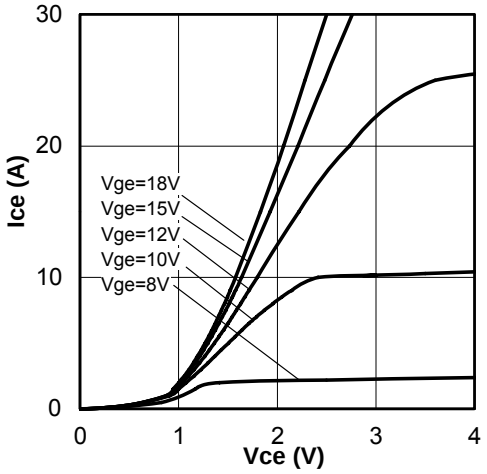


Fig. 20 - Typ. IGBT Output Characteristics
T_J = 25°C; tp = 80µs

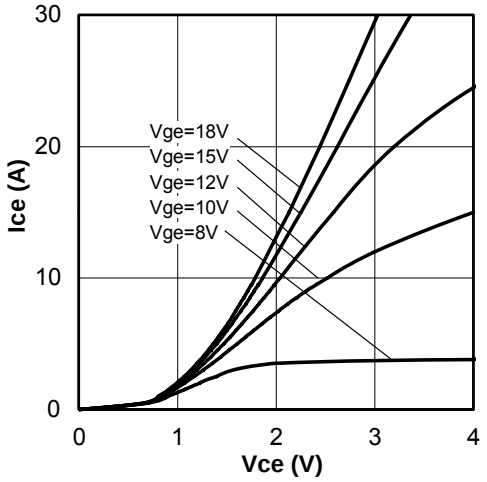


Fig. 21 - Typ. IGBT Output Characteristics
T_J = 125°C; tp = 80µs

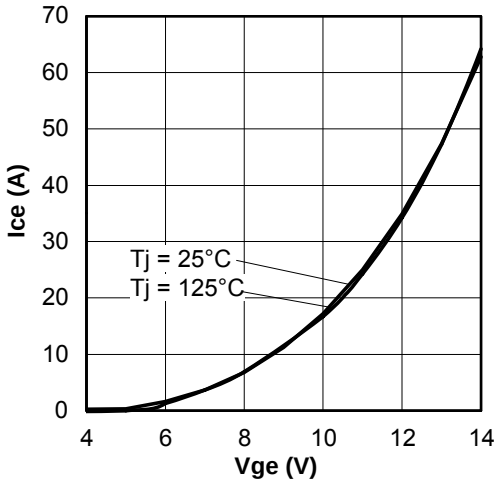


Fig. 22 - Typ. Transfer Characteristics
V_{CE} = 50V; tp = 10µs

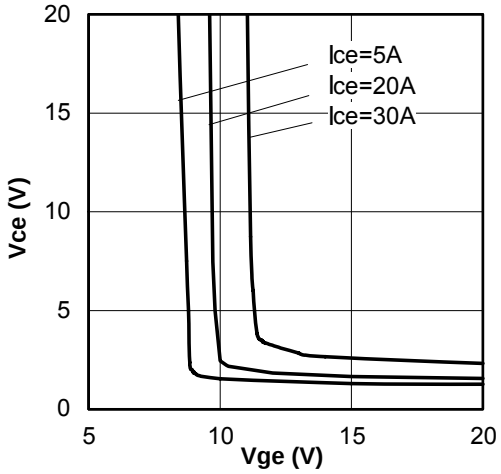


Fig. 23 - Typical V_{CE} vs. V_{GE}
T_J = 25°C

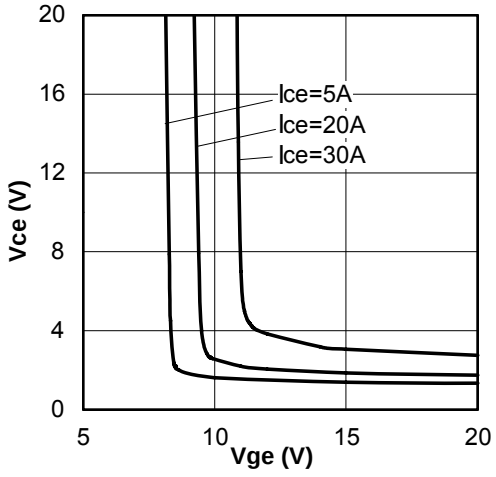


Fig.24- Typical V_{CE} vs. V_{GE}
T_J = 125°C

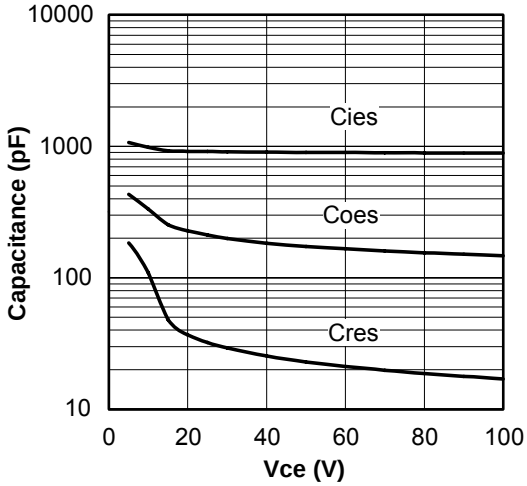


Fig. 25- Typ. Capacitance vs. V_{CE}
V_{GE}= 0; f = 1MHz

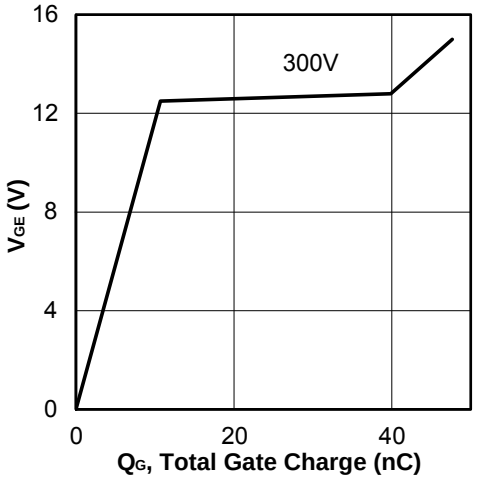


Fig. 26 - Typical Gate Charge vs. V_{GE}
I_{CE} = 15A

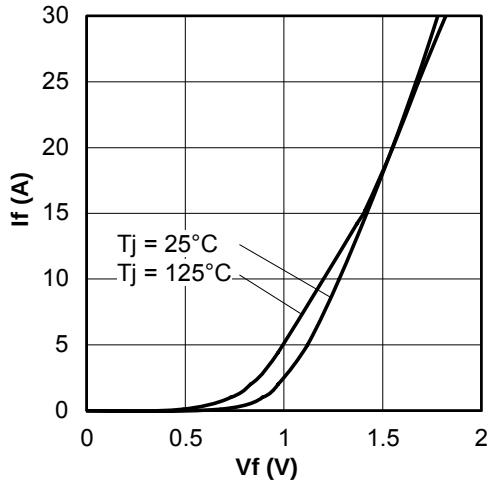


Fig. 27 - Typ. Diode Forward Characteristics
tp = 80µs

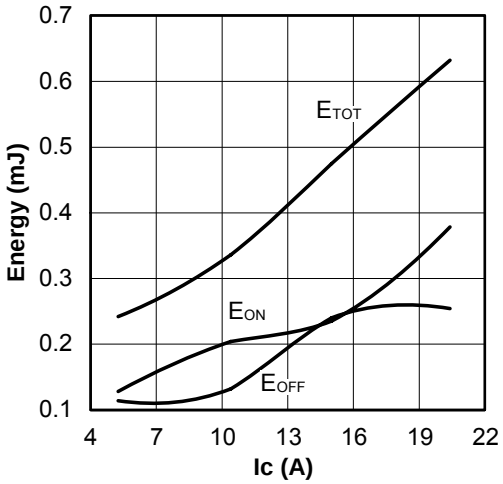


Fig. 28 - Typ. Energy Loss vs. I_C
T_J = 125°C; L=200µH; V_{CE}= 300V,R_G= 22Ω; V_{GE}= 15V

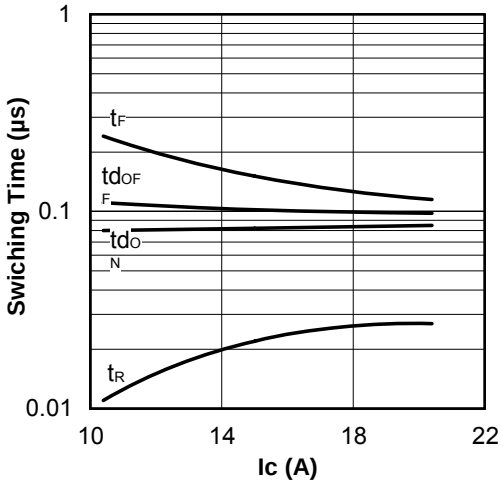


Fig. 29 - Typ. Switching Time vs. I_C
T_J = 125°C; L=200µH; V_{CE}= 300V,R_G= 22Ω;V_{GE}= 15V

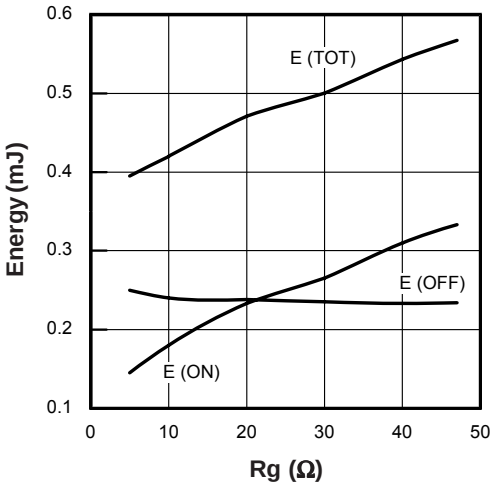


Fig. 30 - Typ. Energy Loss vs. R_G
T_J = 125°C; L=200µH; V_{CE}= 300V, I_{CE}= 15A; V_{GE}= 15V

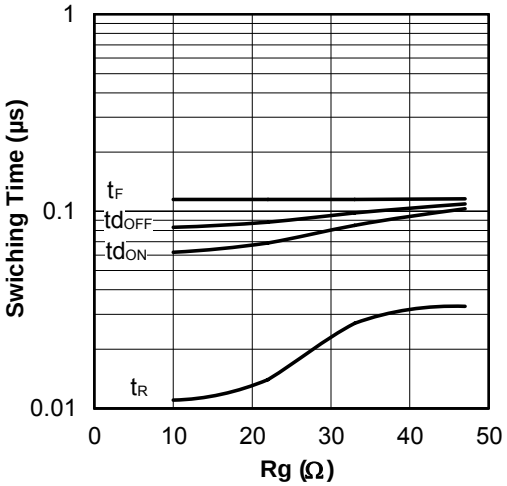


Fig. 31 - Typ. Switching Time vs. R_G
T_J = 125°C; L=200µH; V_{CE}= 300V, I_{CE}= 15A; V_{GE}= 15V

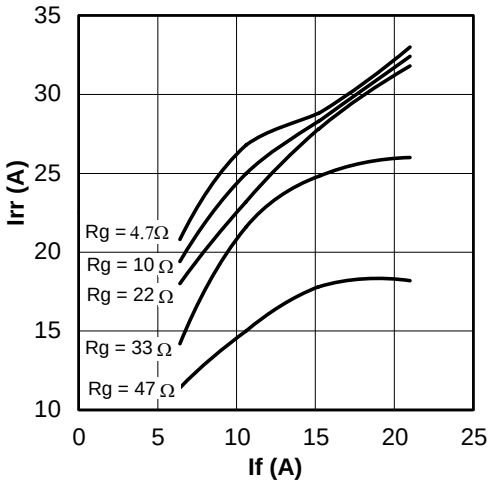


Fig. 32 - Typical Diode I_{RR} vs. I_F
$T_J = 125°C$

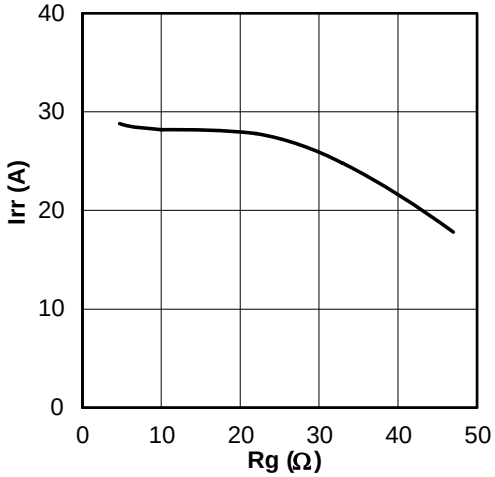


Fig. 33- Typical Diode I_{RR} vs. R_G
$T_J = 125°C$; $I_F = 15A$

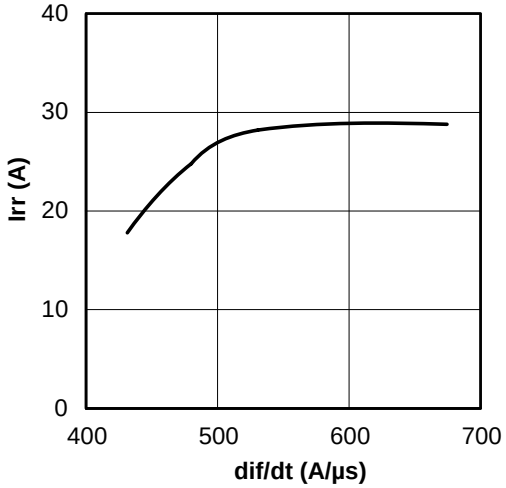


Fig. 34- Typical Diode I_{RR} vs. di_F/dt
V_{CC}= 300V; V_{GE}= 15V; I_{CE}= 15A; T_J = 125°C

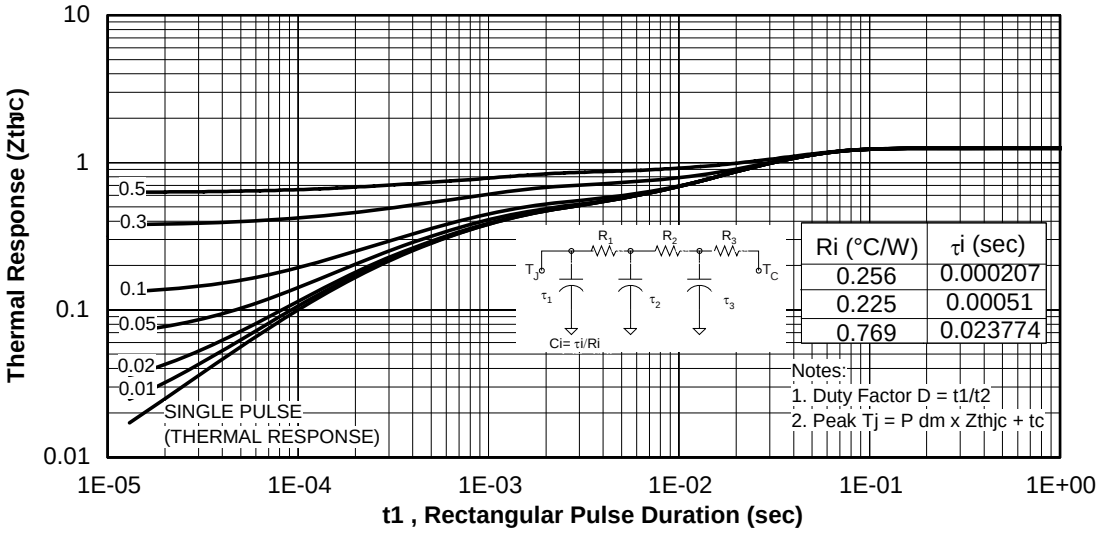


Fig 35. Maximum Transient Thermal Impedance, Junction-to-Case (Brake IGBT)

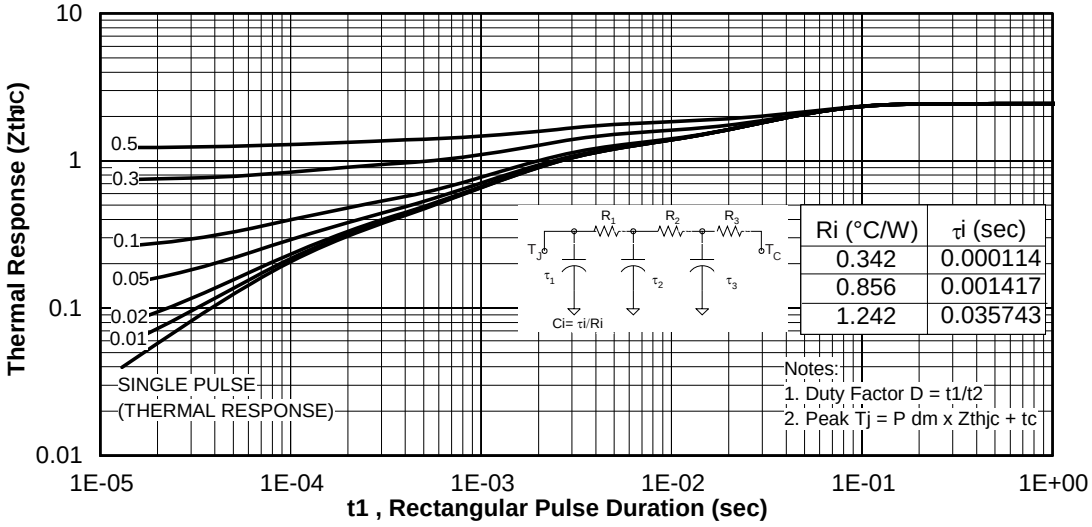


Fig 36. Maximum Transient Thermal Impedance, Junction-to-Case (Brake Diode)

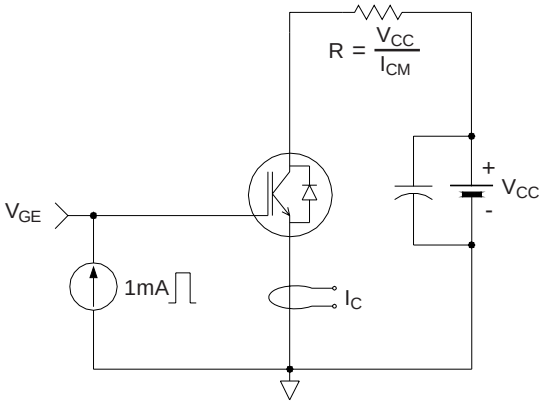


Fig.C.T.1 - Gate Charge Circuit (turn-off)

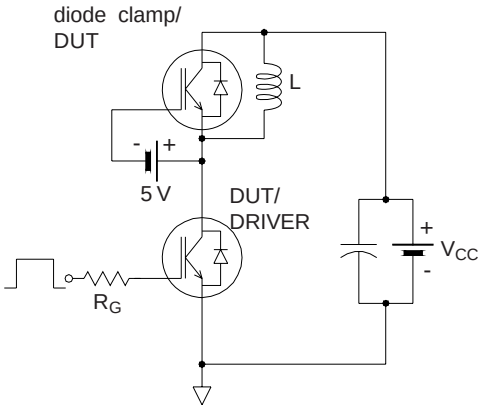


Fig.C.T.2 - RBSOA Circuit

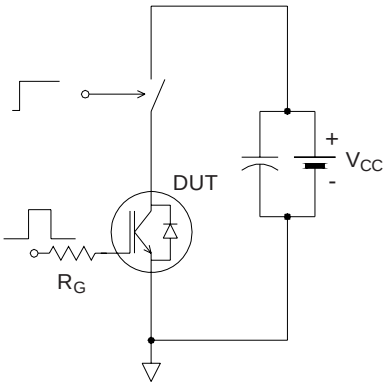


Fig.C.T.3 - S.C. SOA Circuit

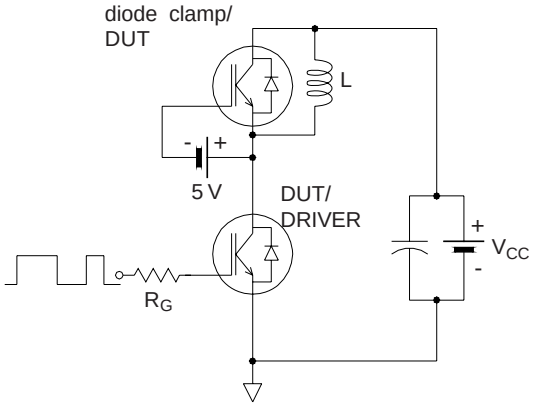


Fig.C.T.4 - Switching Loss Circuit

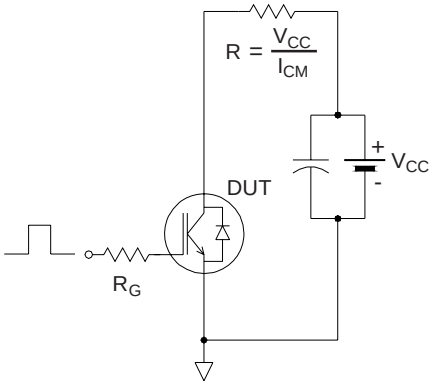
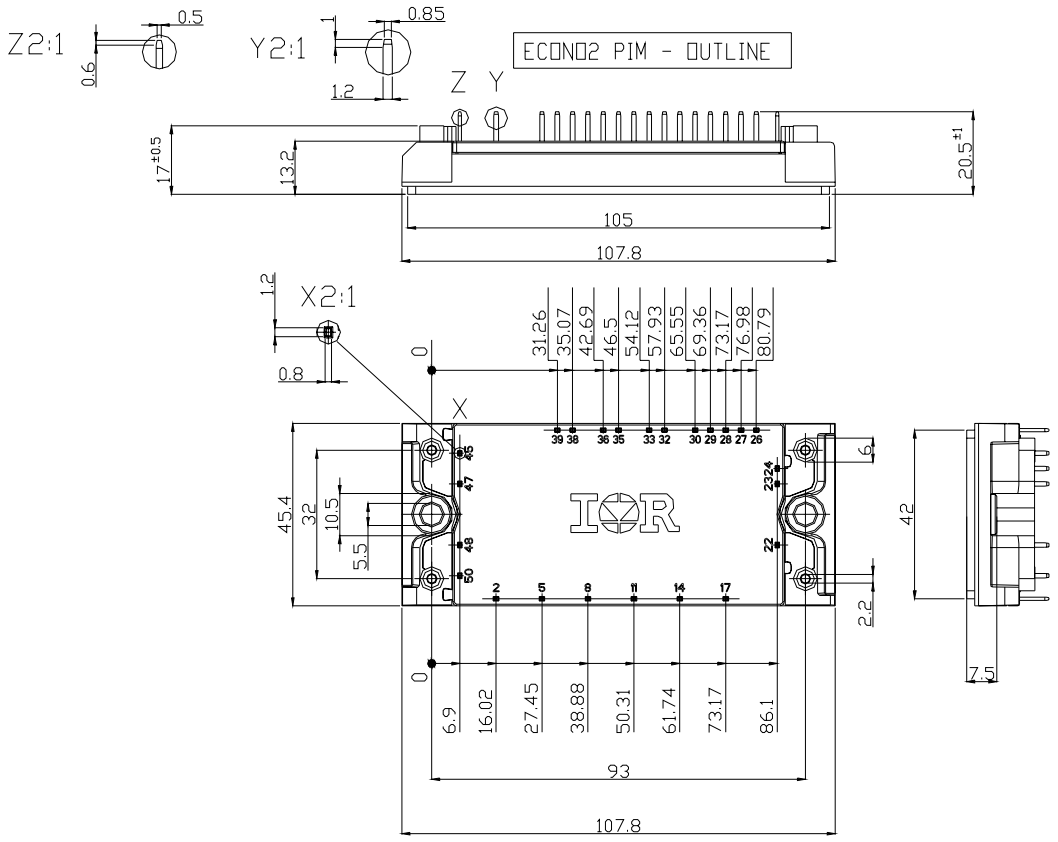


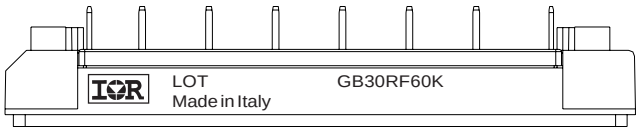
Fig.C.T.5 - Resistive Load Circuit

Econo2 PIM Package Outline

Dimensions are shown in millimeters (inches)



Econo2 PIM 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

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Notice

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