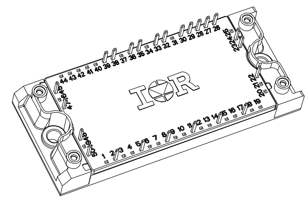
International
IOR Rectifier

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



ECONO2 PIM

V_{CES} = 600V

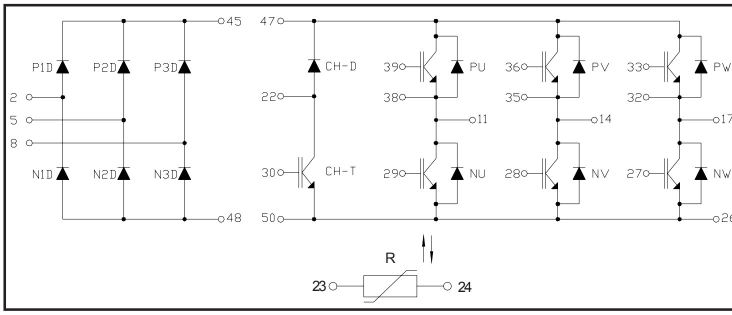
I_C = 27A @ T_C=80°C

t_{sc} > 10µs @ T_J =150°C

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

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



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^2 t (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 IGBT	$BV_{(CES)}$	Collector-to-Emitter Breakdown Voltage	600	-	-	V	V_{GE} = 0 I_C = 500µA
	$\Delta V_{(BR)CES}/\Delta T_J$	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
	$\Delta V_{GE(th)}/\Delta T_J$	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
			-	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	nC	I_C = 30A
	Q_{GE}	Gate-to-Emitter Charge (turn-on)	-	14	21		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 Diode	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
	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 Rectifier	V_{FM}	Maximum Forward Voltage Drop	-	-	1.50	V	I_F = 30A
	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 IGBT	$BV_{(CES)}$	Collector-to-Emitter Breakdown Voltage	600	-	-	V	V_{GE} = 0 I_C = 500μA
	$\Delta V_{(BR)CES}/\Delta T_J$	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	nC	I_C = 15A
	Q_{GE}	Gate-to-Emitter Charge (turn-on)	-	11	16		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 Diode	I_{rr}	Diode Peak Rev. Recovery Current	-	28	-	A	V_{CC} = 300V I_F = 15A L = 200μH 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

Inverter

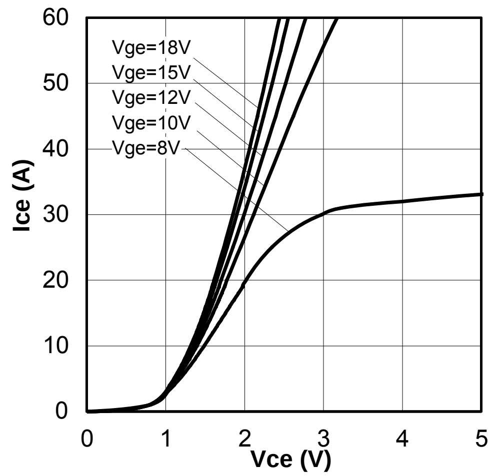


Fig. 1 - Typ. IGBT Output Characteristics
T_J = 25°C; tp = 80µs

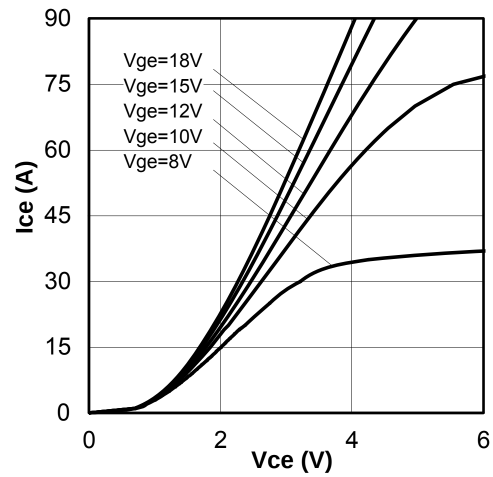


Fig. 2 - Typ. IGBT Output Characteristics
T_J = 125°C; tp = 80µs

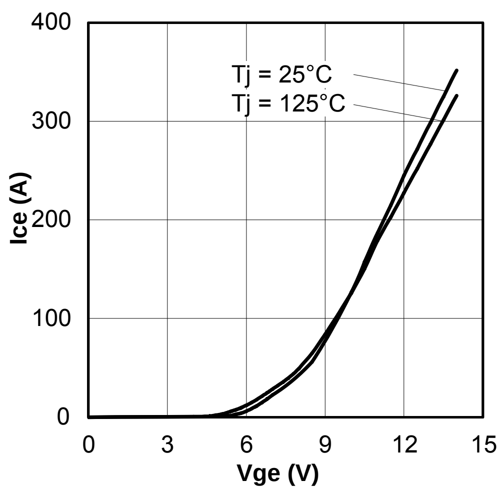


Fig. 3 - Typ. Transfer Characteristics
V_{CE} = 50V; tp = 10µs

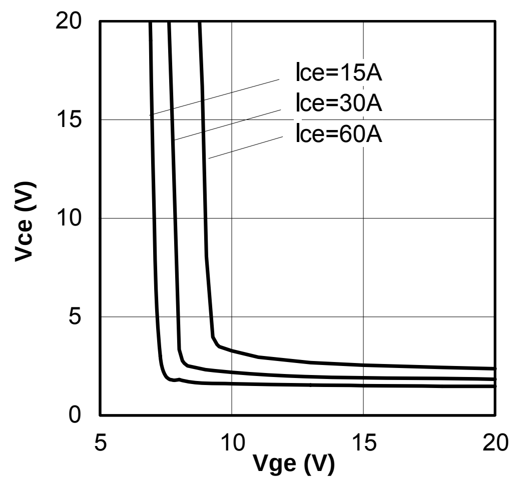


Fig. 4 - Typical V_{CE} vs. V_{GE}
T_J = 25°C

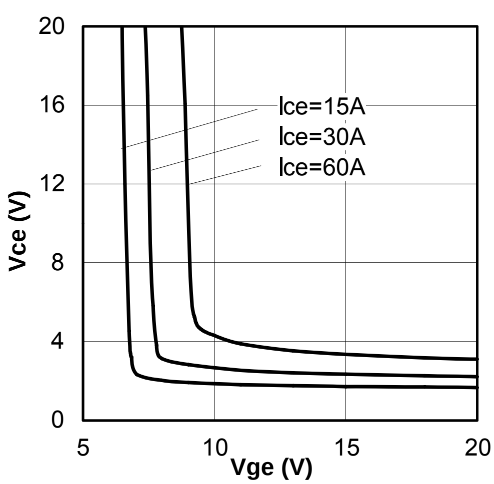


Fig.5 - Typical V_{CE} vs. V_{GE}
T_J = 125°C

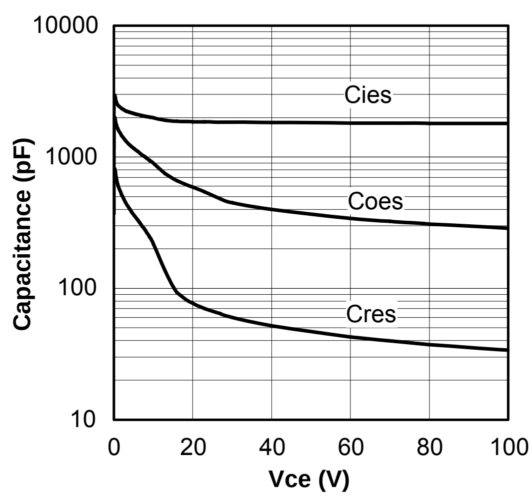


Fig. 6- Typ. Capacitance vs. V_{CE}
V_{GE}= 0; f = 1MHz

Inverter

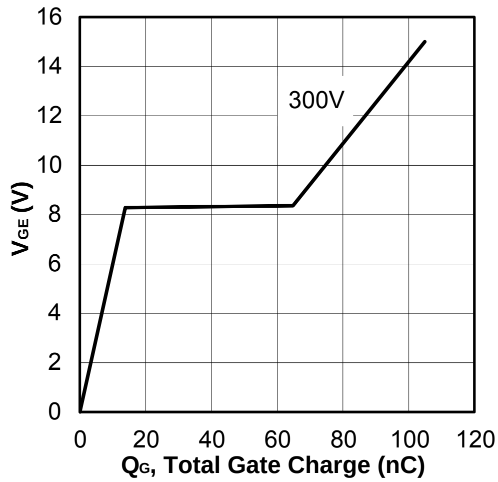


Fig. 7 - Typical Gate Charge vs. V_{GE}
I_{CE} = 30A

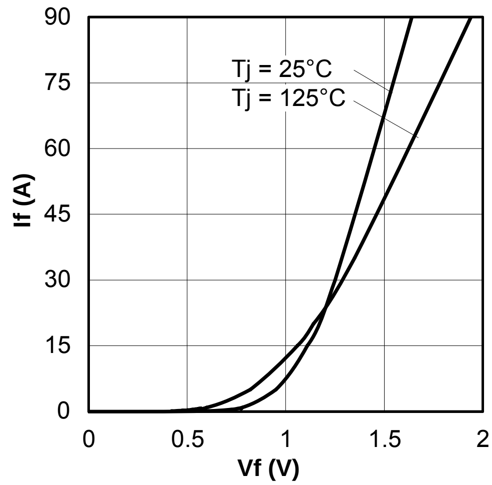


Fig. 8 - Typ. Diode Forward Characteristics
tp = 80µs

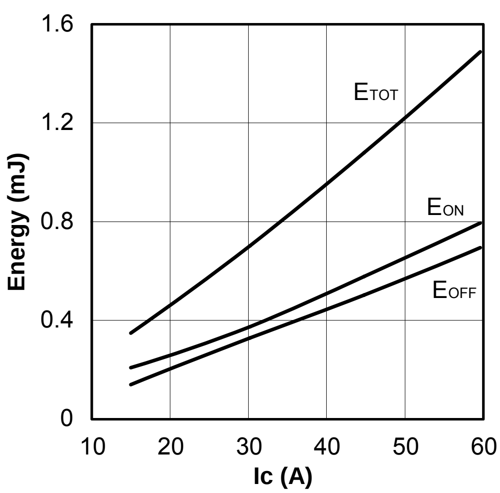


Fig. 9 - Typ. Energy Loss vs. I_C
T_J = 125°C; L=200µH; V_{CE}= 300V,R_G= 22Ω; V_{GE}= 15V

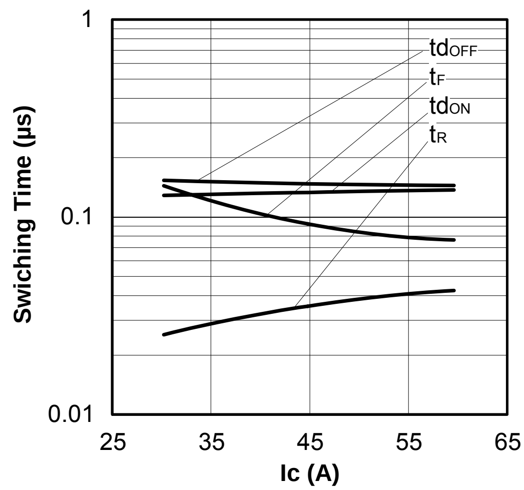


Fig. 10 - Typ. Switching Time vs. I_C
T_J = 125°C; L=200µH; V_{CE}= 300V,R_G= 22Ω;V_{GE}= 15V

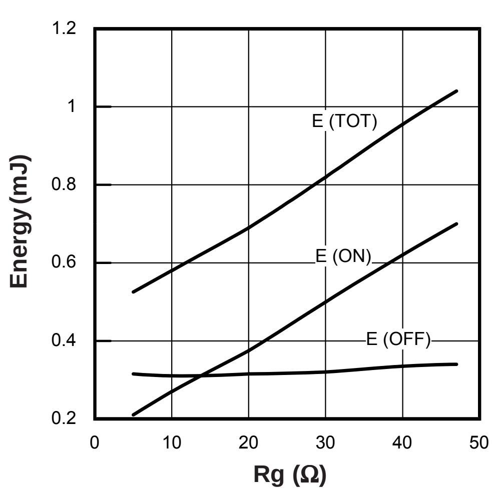


Fig. 11 - Typ. Energy Loss vs. R_G
T_J = 125°C; L=200µH; V_{CE}= 300V, I_{CE}= 30A; V_{GE}= 15V

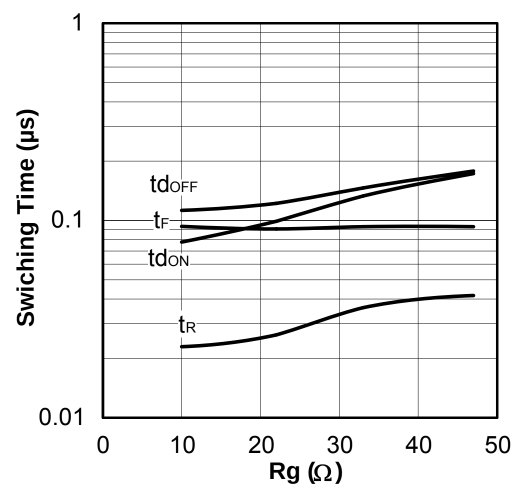


Fig. 12- Typ. Switching Time vs. R_G
T_J = 125°C; L=200µH; V_{CE}= 300V, I_{CE}= 30A; V_{GE}= 15V

Inverter

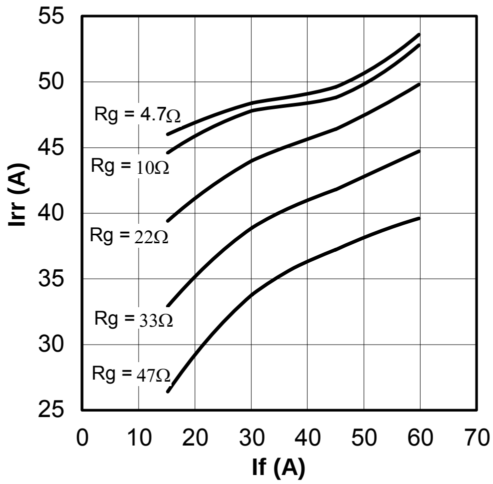


Fig. 13 - Typical Diode I_{RR} vs. I_F
T_J = 125°C

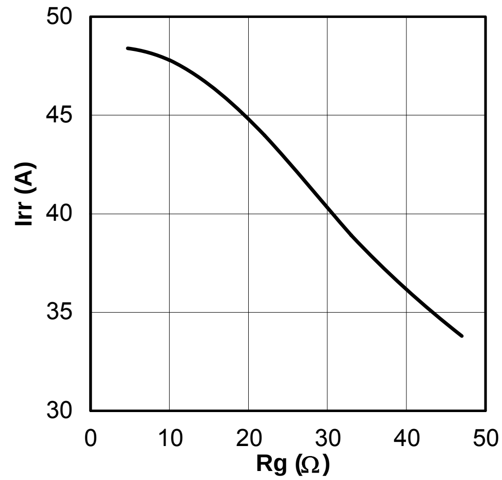


Fig. 14 - Typical Diode I_{RR} vs. R_G
T_J = 125°C; I_F = 30A

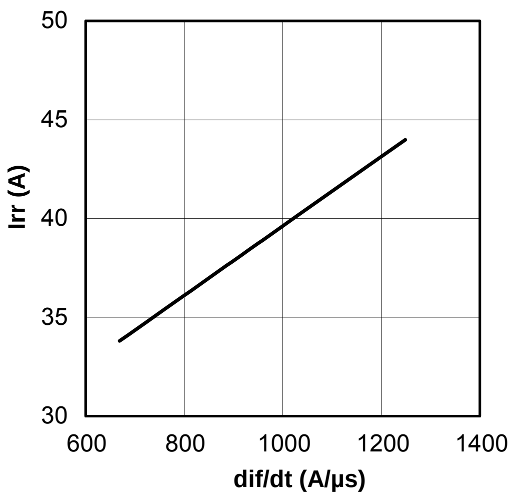


Fig. 15- Typical Diode I_{RR} vs. di_F/dt
V_{CC}= 300V; V_{GE}= 15V; I_{CE}= 30A; T_J = 125°C

Thermistor

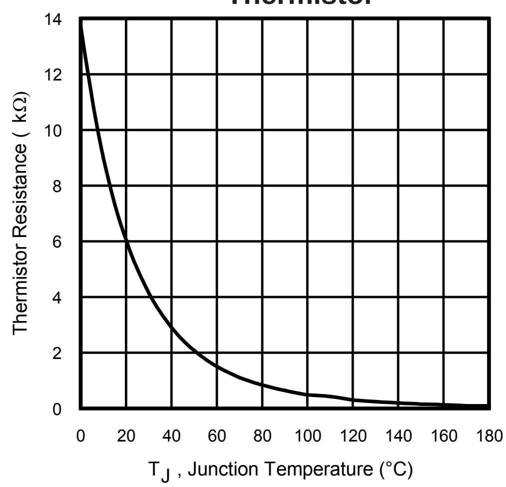


Fig. 16 - Thermistor Resistance vs. Temperature

Input Rectifier

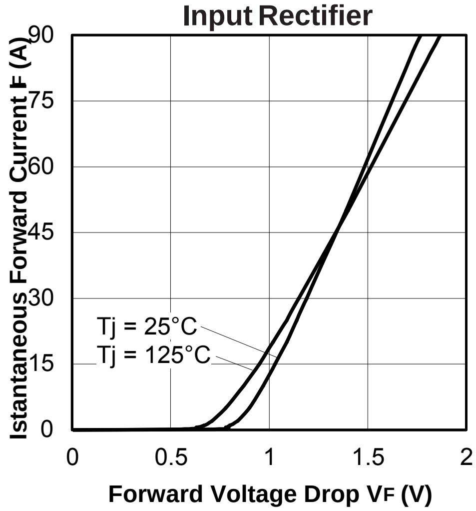


Fig. 17- Typ. Diode Forward Characteristics
tp = 80μs

Inverter

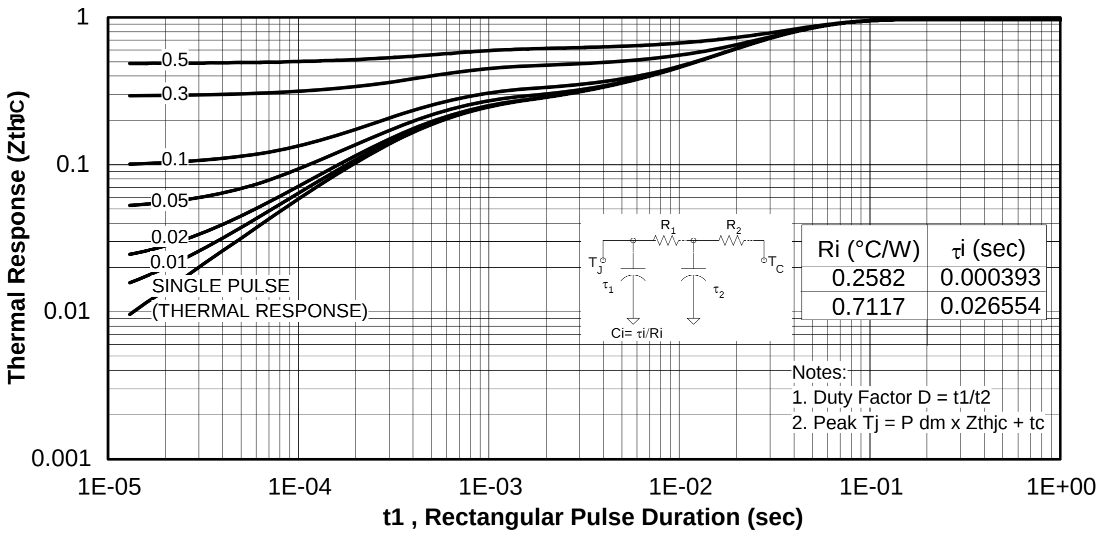


Fig 18. Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

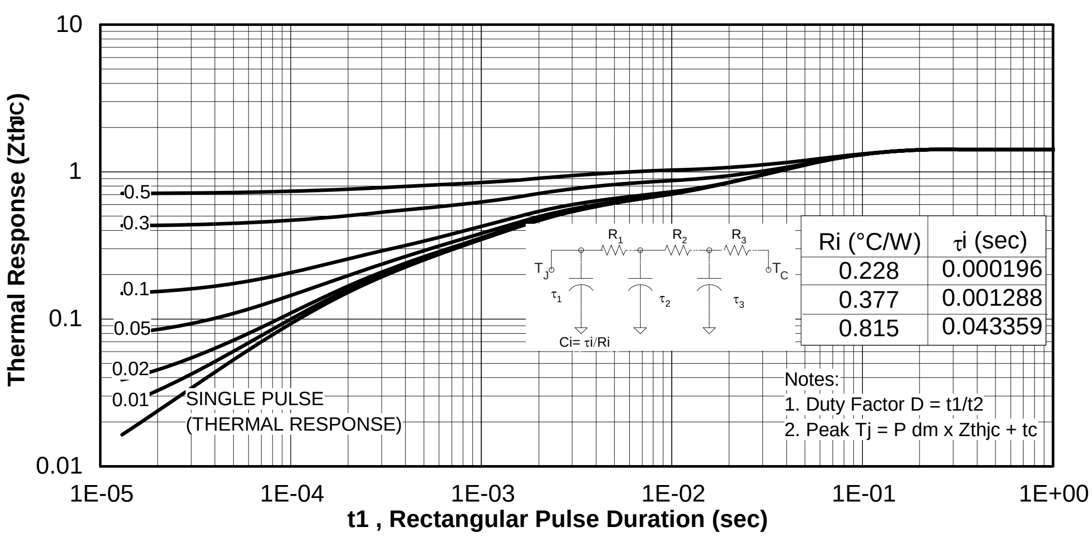


Fig 19. Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

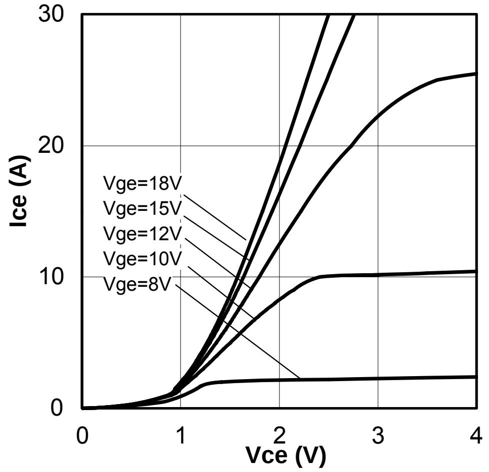


Fig. 20 - Typ. IGBT Output Characteristics
T_J = 25°C; tp = 80µs

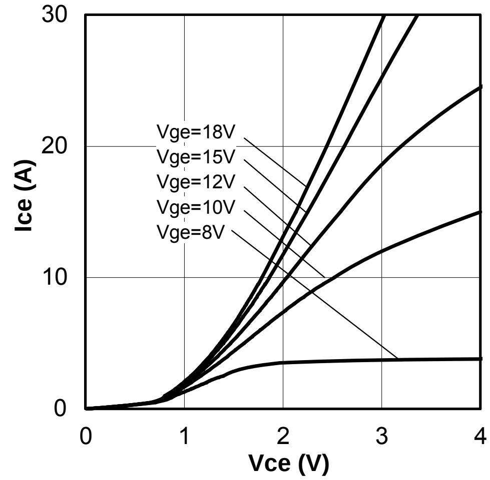


Fig. 21 - Typ. IGBT Output Characteristics
T_J = 125°C; tp = 80µs

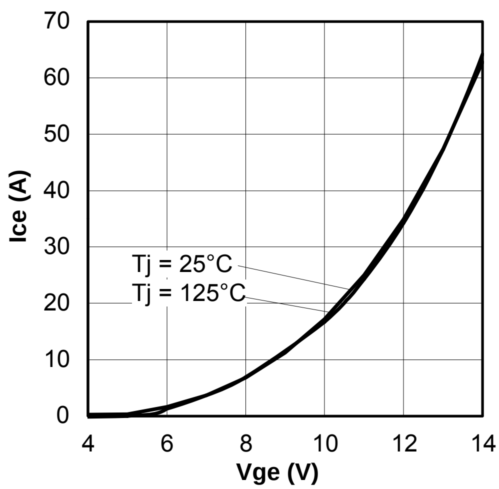


Fig. 22 - Typ. Transfer Characteristics
V_{CE} = 50V; tp = 10µs

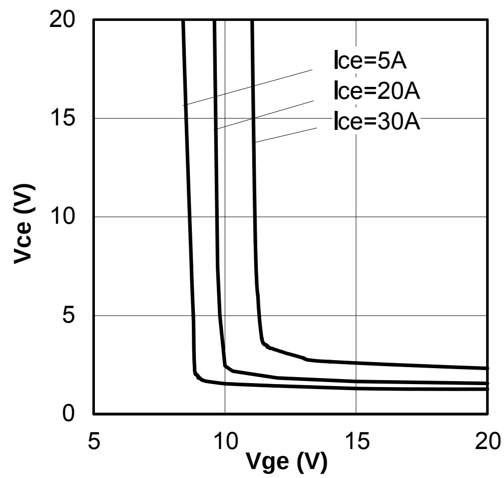


Fig. 23 - Typical V_{CE} vs. V_{GE}
T_J = 25°C

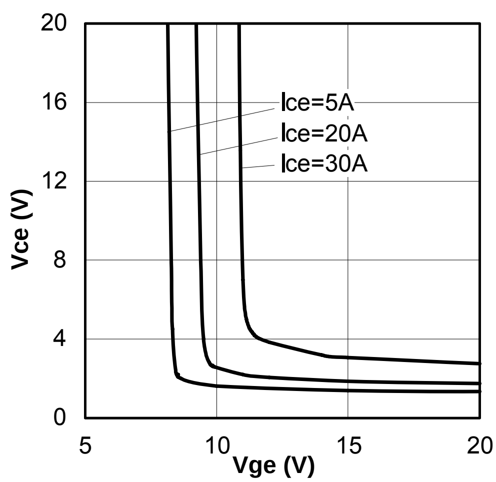


Fig.24- Typical V_{CE} vs. V_{GE}
T_J = 125°C

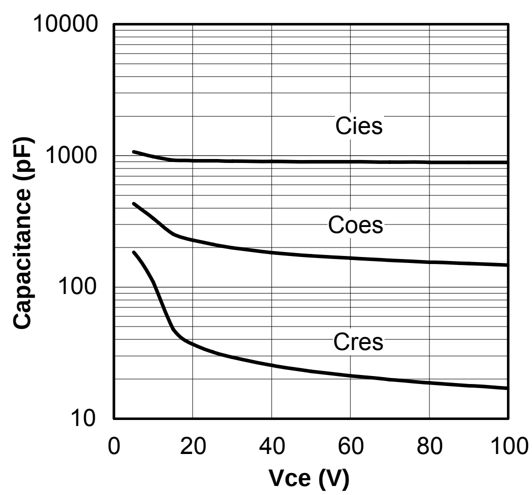


Fig. 25- Typ. Capacitance vs. V_{CE}
V_{GE}= 0; f = 1MHz

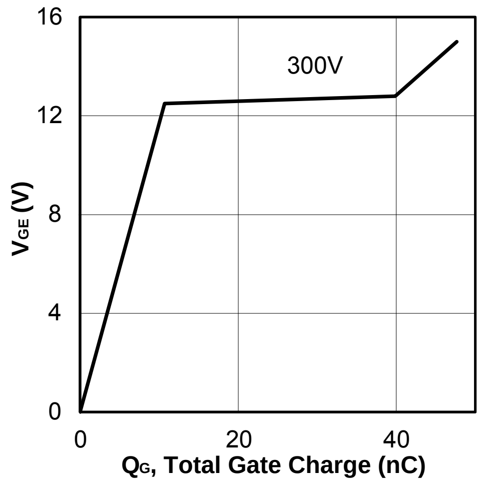


Fig. 26 - Typical Gate Charge vs. V_{GE}
I_{CE} = 15A

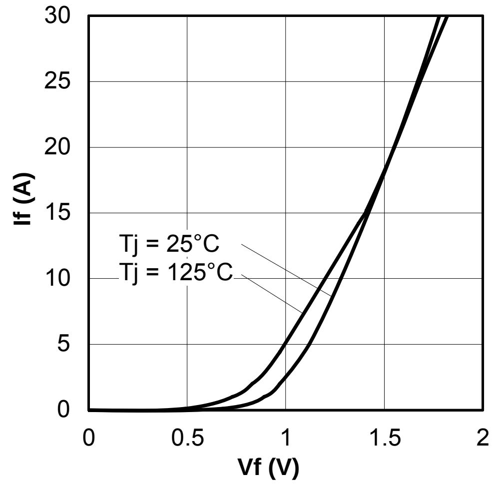


Fig. 27 - Typ. Diode Forward Characteristics
tp = 80µs

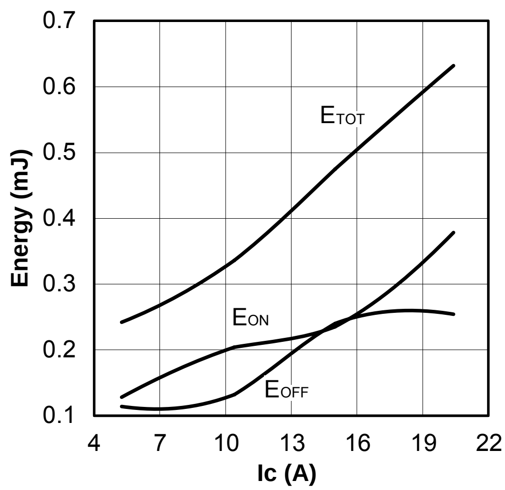


Fig. 28 - Typ. Energy Loss vs. I_C
T_J = 125°C; L=200µH; V_{CE}= 300V,R_G= 22Ω; V_{GE}= 15V

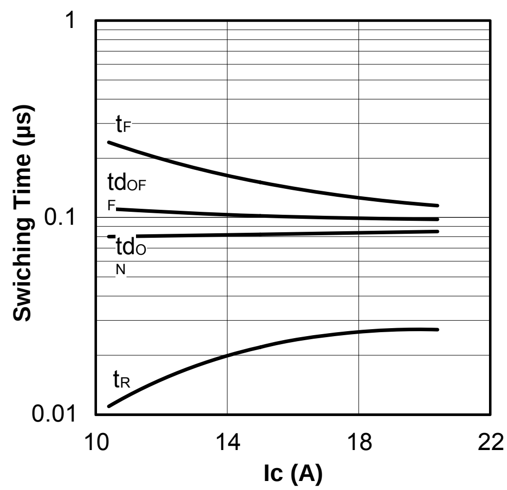


Fig. 29 - Typ. Switching Time vs. I_C
T_J = 125°C; L=200µH; V_{CE}= 300V,R_G= 22Ω;V_{GE}= 15V

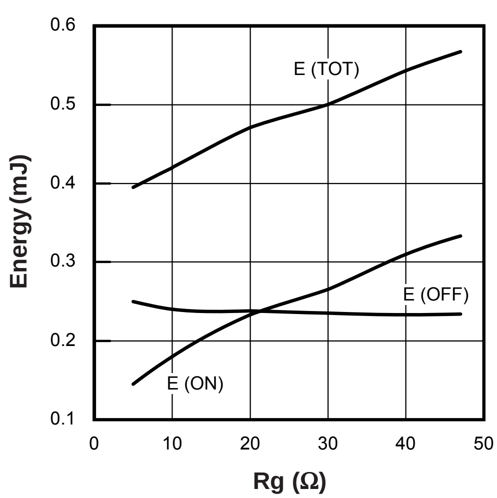


Fig. 30 - Typ. Energy Loss vs. R_G
T_J = 125°C; L=200µH; V_{CE}= 300V, I_{CE}= 15A; V_{GE}= 15V

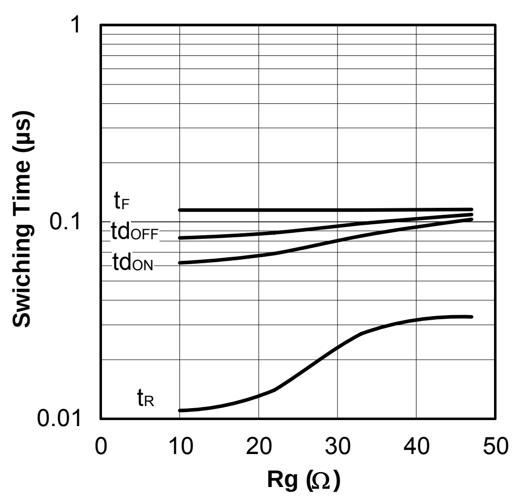


Fig. 31 - Typ. Switching Time vs. R_G
T_J = 125°C; L=200µH; V_{CE}= 300V, I_{CE}= 15A; V_{GE}= 15V

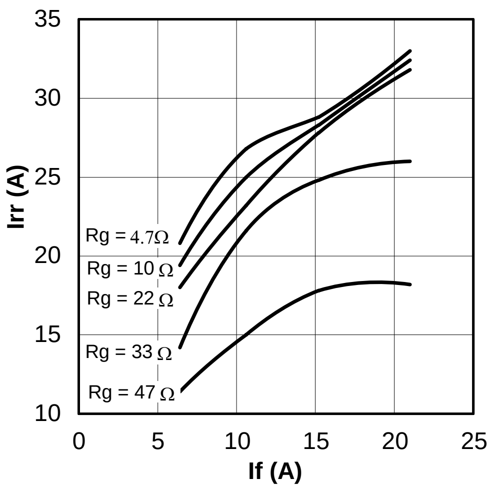


Fig. 32 - Typical Diode I_{RR} vs. I_F
$T_J = 125°C$

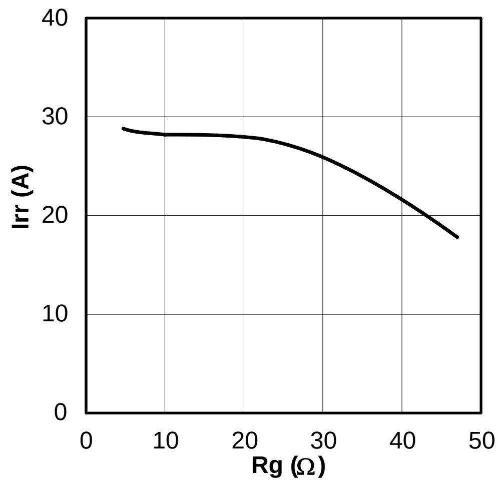


Fig. 33- Typical Diode I_{RR} vs. R_G
$T_J = 125°C$; $I_F = 15A$

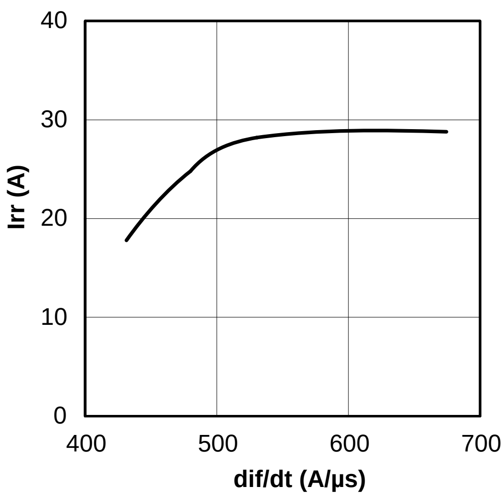


Fig. 34- Typical Diode I_{RR} vs. di_F/dt
$V_{CC}= 300V$; $V_{GE}= 15V$; $I_{CE}= 15A$; $T_J = 125°C$

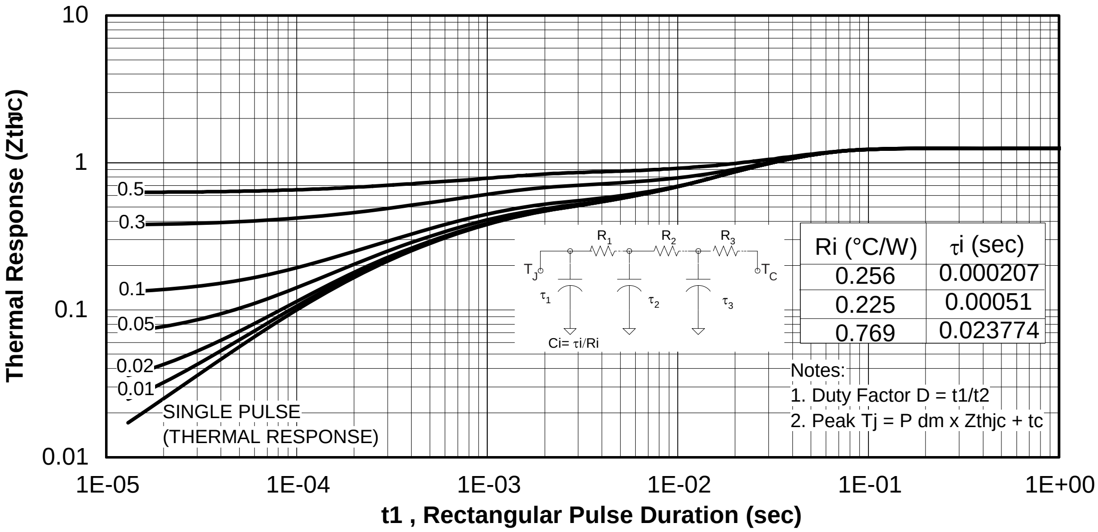


Fig 35. Maximum Transient Thermal Impedance, Junction-to-Case (Brake IGBT)

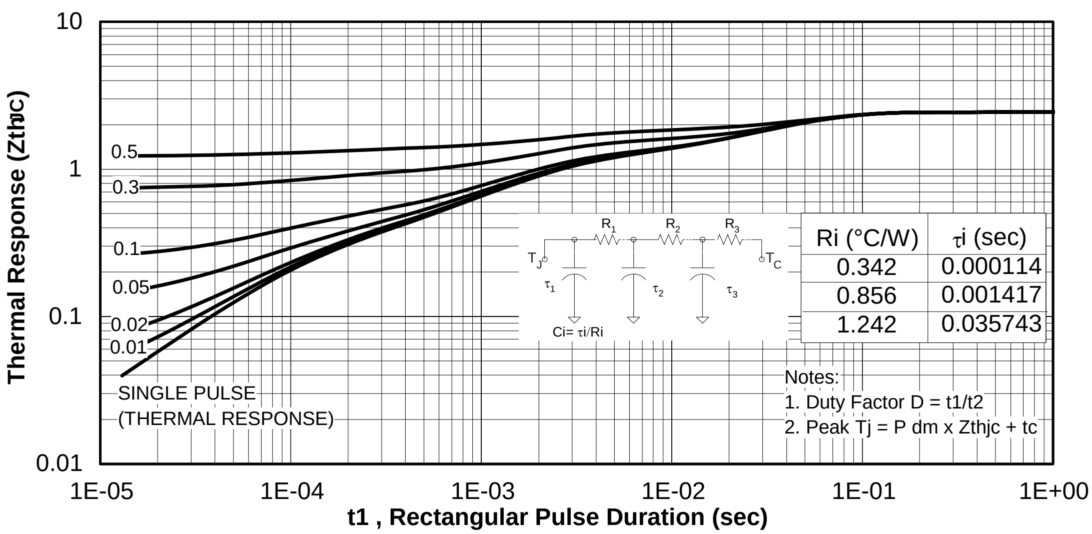


Fig 36. Maximum Transient Thermal Impedance, Junction-to-Case (Brake Diode)

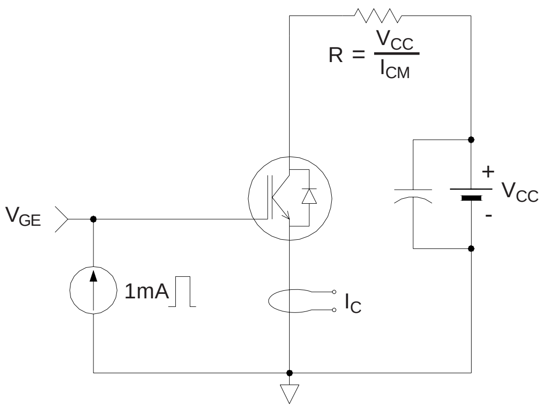


Fig.C.T.1 - Gate Charge Circuit (turn-off)

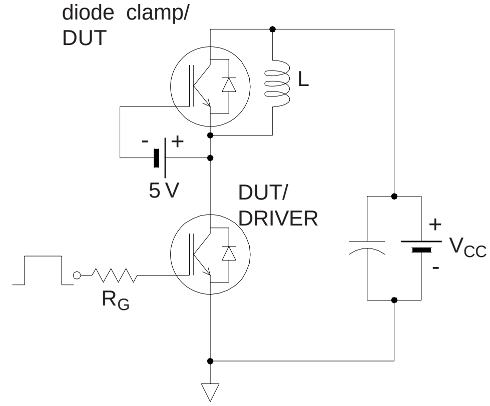


Fig.C.T.2 - RBSOA Circuit

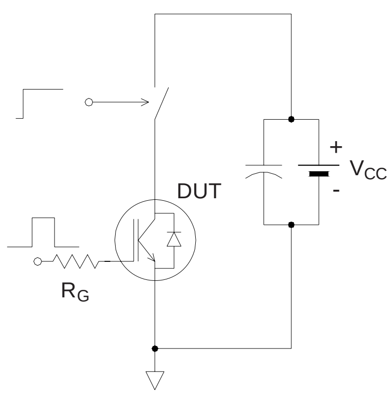


Fig.C.T.3 - S.C. SOA Circuit

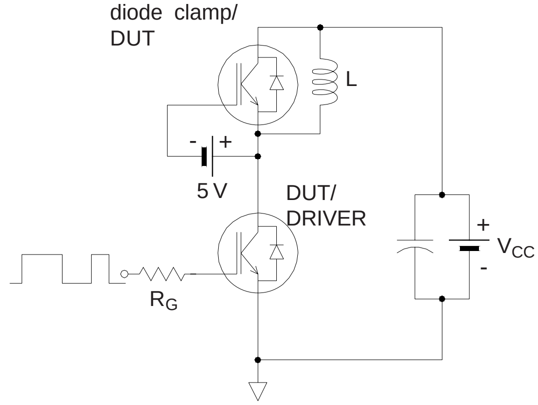


Fig.C.T.4 - Switching Loss Circuit

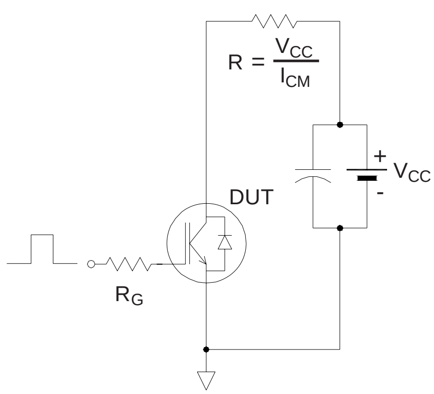
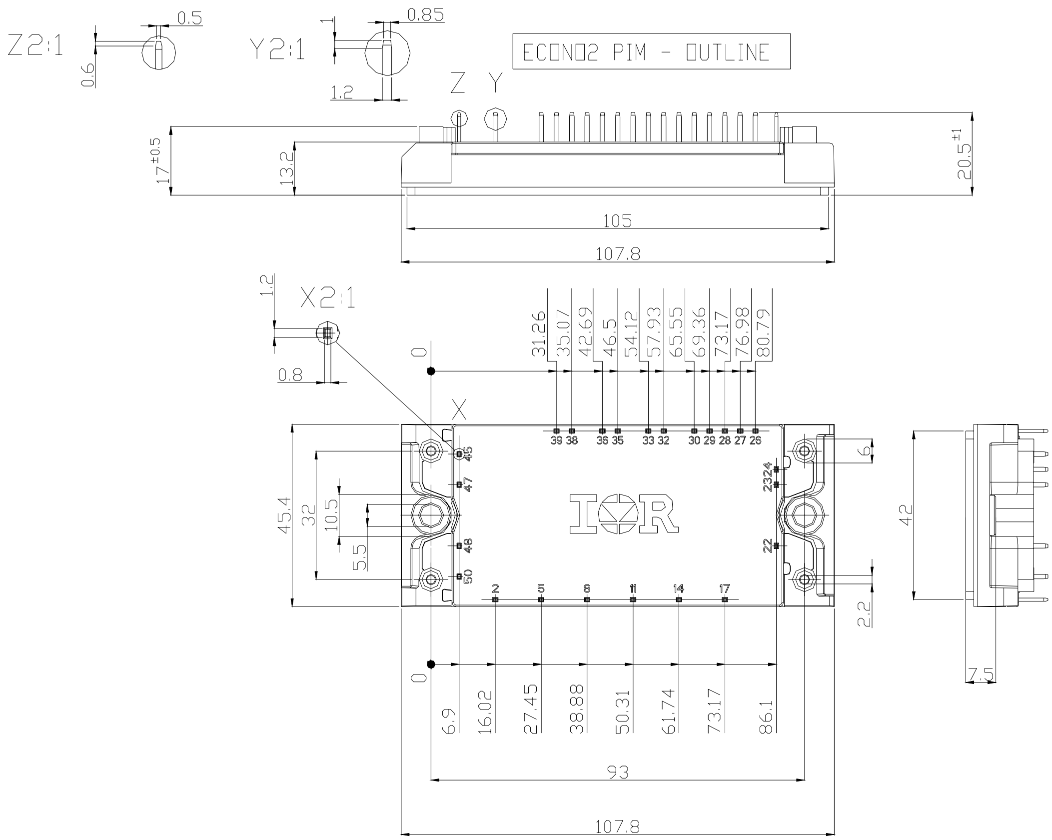


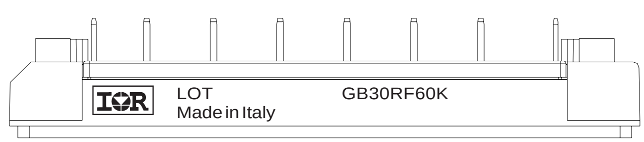
Fig.C.T.5 - Resistive Load Circuit

Econo2 PIM Package Outline

Dimensions are shown in millimeters (inches)



Econo2 PIM Part Marking Information



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