BYD Microelectronics Co., Ltd.

BG400B12LY2-I

IGBT Power Module

V_{CE}=1200V I_C=400A

General Description

BYD IGBT Power Module BG400B12LY2-I provides low switching loss as well as high short circuit capability, which introduce the advanced IGBT chip/FWD and improved connection, it is able to take on a perfect performance in various applications up to 20KHz.

Features

- Half-bridge
- Low inductance
- Standard package
- High short circuit capability
- Ultra low conduction and switching loss
- Including ultra fast & soft recovery anti-parallel FWD

Applications

- AC motor control
- Inverters
- Servo
- UPS (Uninterruptible Power Supplies)
- Electric welding

Characteristic values

Parameter	Symbol	Conditions	Temperature	Value	Unit
Absolute Maximum Ratings					
Collector-emitter voltage	V_{CES}	V_{GE}=0V	T_{vj}=25℃	1200	V
Continuous collector current	I_C	—	T_c=80℃	400	A
Peak collector current	I_{CRM}	I_{CRM}=2I_C	T_c=80℃	800	A
Gate-emitter voltage	V_{GES}	—	—	+/-20	V
Total power dissipation	P_{tot}	per switch (IGBT)	T_c = 25 °C	1660	W
IGBT short circuit SOA	t_{psc}	V_{CC}=900V, V_{GE}≤15V V_{CEM}≤1200V	T_{vj}≤125℃	10	us
Junction temperature	T_{vj}	—	—	-40~150	℃
Storage temperature range	T_{stg}	—	—	-40~125	℃
Diode DC forward current	I_F	—	T_c=80℃	400	A
Peak forward current	I_{FRM}	I_{FRM}=2I_F	—	800	A
I^2t-value, Diode	I^2t	V_R=0V,t=10ms	T_j=125℃	—	kA^2s
Isolation voltage	V_{isol}	t=1min,f=50Hz	—	2500	V

Parameter	Symbol	Conditions	Temperature	Value min.	Value typ.	Value max.	Unit
Characteristics							
IGBT				min.	typ.	max.	
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}$	T_{vj}=25℃	5.0	5.8	6.5	V
Collector-emitter cut-off current	I_{CES}	V_{CE}=1200V, V_{GE}=0V	T_{vj}=25℃	—	—	0.2	mA
			T_{vj}=125℃	—	—	—	mA
Gate-emitter cut-off current	I_{GES}	V_{CE}=0V, V_{GE}=±20V,	T_{vj}=25℃	-400	—	400	nA
Collector-emitter saturation voltage	$V_{CE(sat)}$	I_C=400A, V_{GE}=15V	T_{vj}=25℃	—	2.1	—	V
			T_{vj}=125℃	—	2.4	—	V
Integrated gate resistor	R_{Gint}	—	T_{vj}=25℃	—	1.75	—	Ω
Input capacitance	C_{ies}	V_{CE}=25V, V_{GE} =0V, f=1MHz	T_{vj}=25℃	—	25	—	nF
Output capacitance	C_{oes}			—	1.54	—	nF
Reverse transfer capacitance	C_{res}			—	1.36	—	nF
Turn-on delay time	$t_{d(on)}$	V_{CC}=600V, I_C=400A, $R_{Gon}=R_{Goff}$=3.3Ω, V_{GE}=±15V, Lσ=80nH, Inductive load	T_{vj}=25℃	—	570	—	ns
			T_{vj}=125℃	—	580	—	ns
Rise time	t_r		T_{vj}=25℃	—	140	—	ns
			T_{vj}=125℃	—	150	—	ns
Turn-off delay time	$t_{d(off)}$		T_{vj}=25℃	—	650	—	ns
			T_{vj}=125℃	—	725	—	ns
Fall time	t_f		T_{vj}=25℃	—	100	—	ns
			T_{vj}=125℃	—	160	—	ns
Energy dissipation during turn-on time	E_{on}	V_{CC}=600V, I_C=400A, R_{GON} =3.3Ω, V_{GE}=+15V, Lσ=80nH, inductive load	T_{vj}=25℃	—	20	—	mJ
			T_{vj}=125℃	—	32	—	mJ
Energy dissipation during turn-off time	E_{off}	V_{CC}=600V, I_C=400A, R_{Goff}=3.3Ω, V_{GE}=-15V Lσ=80nH, Inductive load	T_{vj}=25℃	—	30	—	mJ
			T_{vj}=125℃	—	41	—	mJ
Diode				min.	typ.	max.	
Forward voltage	V_F	I_F=400A	T_{vj}=25℃	—	1.8	—	V
			T_{vj}=125℃	—	1.9	—	V
Peak reverse recovery current	I_{RR}	I_F=400A, V_R=600V, di_F/dt=2500A/us	T_{vj}=125℃	—	300	—	A
Recovered charge	Q_{rr}		T_{vj}=125℃	—	64	—	uC
Reverse recovery time	t_{rr}		T_{vj}=125℃	—	360	—	ns
Reverse recovery energy	E_{rec}		T_{vj}=125℃	—	30	—	mJ

Parameter	Symbol	Conditions		min.	typ.	max.	Unit
Thermal-Mechanical Specifications							
IGBT thermal resistance junction to case	$R_{th(j-c)}$	per IGBT		—	0.09	—	K/W
Diode thermal resistance junction to case	$R_{th(j-c)}$	per diode		—	0.12	—	K/W
Thermal resistance case to heat-sink	$R_{th(c-s)}$	per module		—	0.03	—	K/W
Dimensions	L x W x H	Typical , see outline drawing		106.4×61.4×31.5			mm
Clearance distance in air	da	according to IEC 60664-1 and EN 50124-1	Term. to base:	—	28.3	—	mm
			Term. to term:	—	6.0	—	
Surface creepage distance	ds	according to IEC 60664-1and EN 50124-1	Term. to base:	—	24	—	mm
			Term. to term:	—	14	—	
Mass	m	—	—	—	320	—	g

Thermal and mechanical properties according to IEC 60747 – 15

Electrical characteristics according to IEC 60747 – 9

Specification according to the valid application note.

Characterization curves

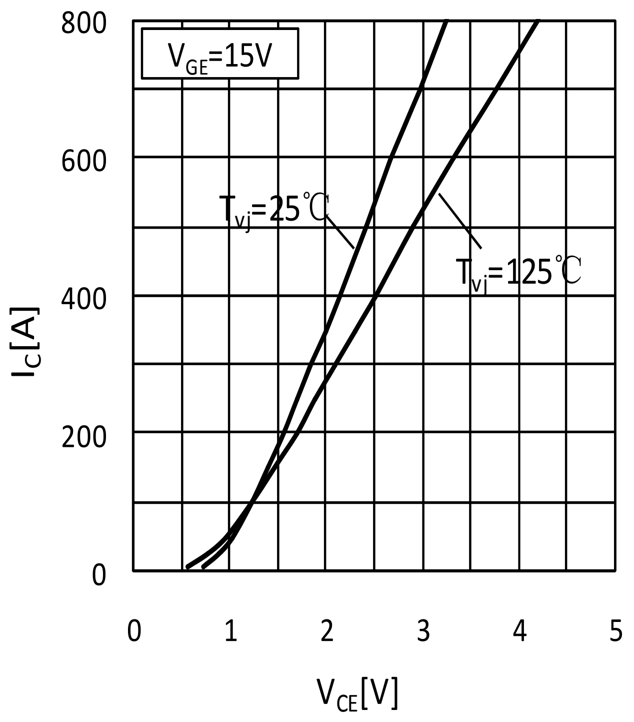


Fig.1 Typ. On-state Characteristics

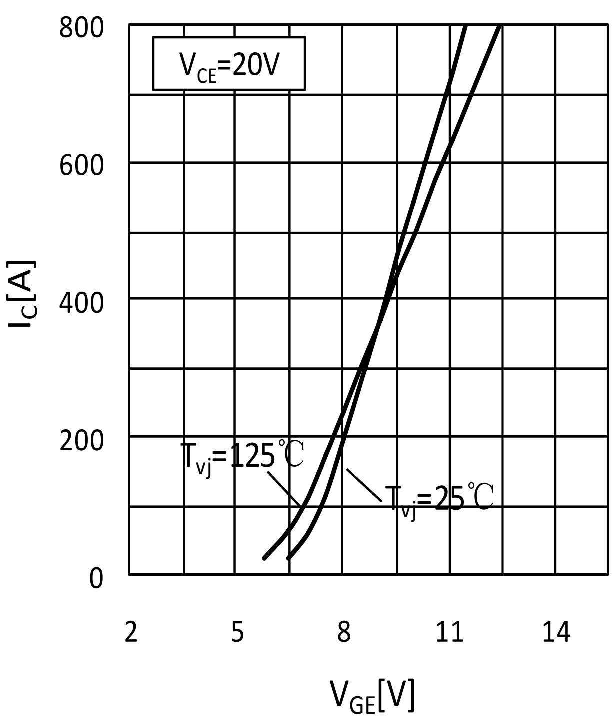


Fig.2 Typ. Transfer Characteristics

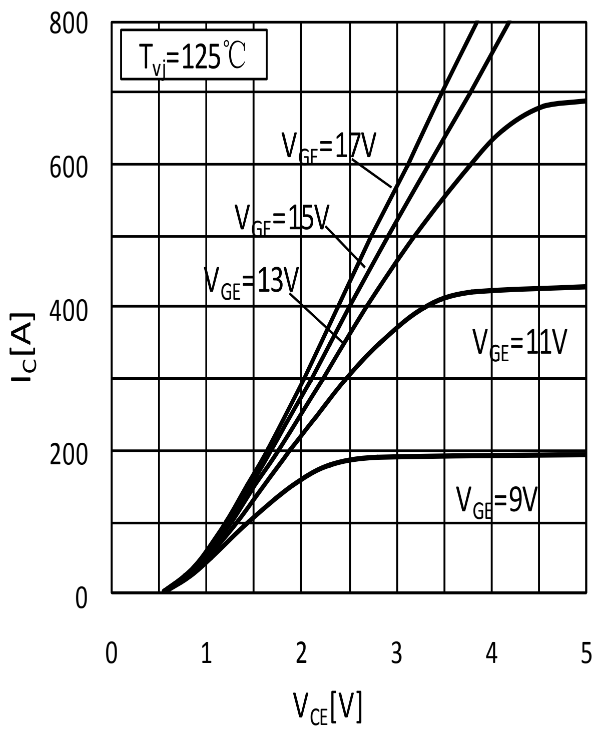


Fig.3 Typ. Output Characteristics

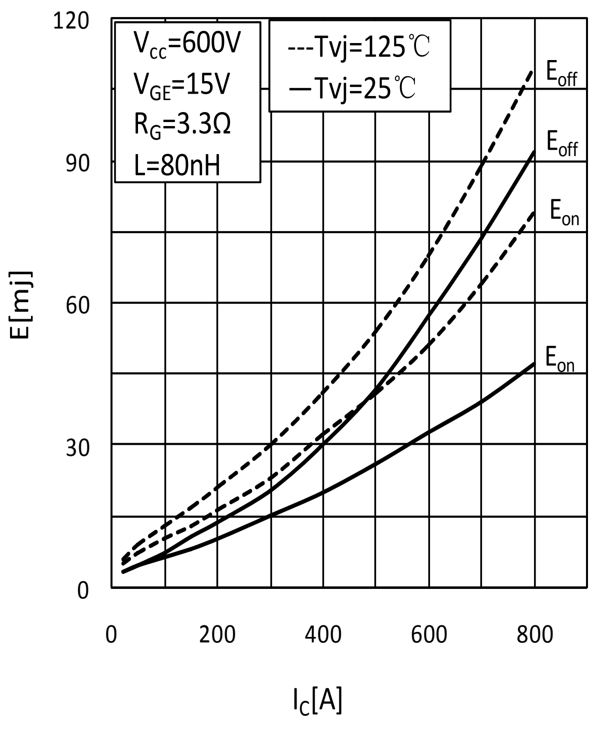


Fig.4 Switching Loss vs. Collector Current

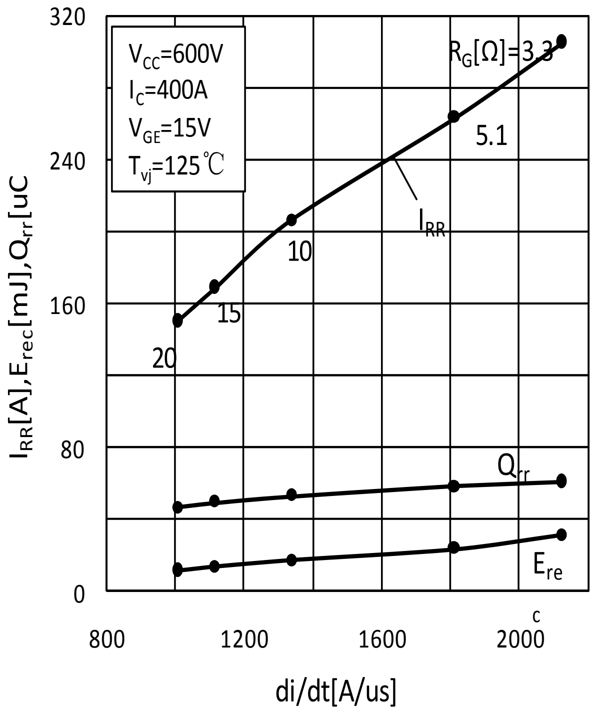


Fig.5 Typ. Reverse Recovery Characteristics

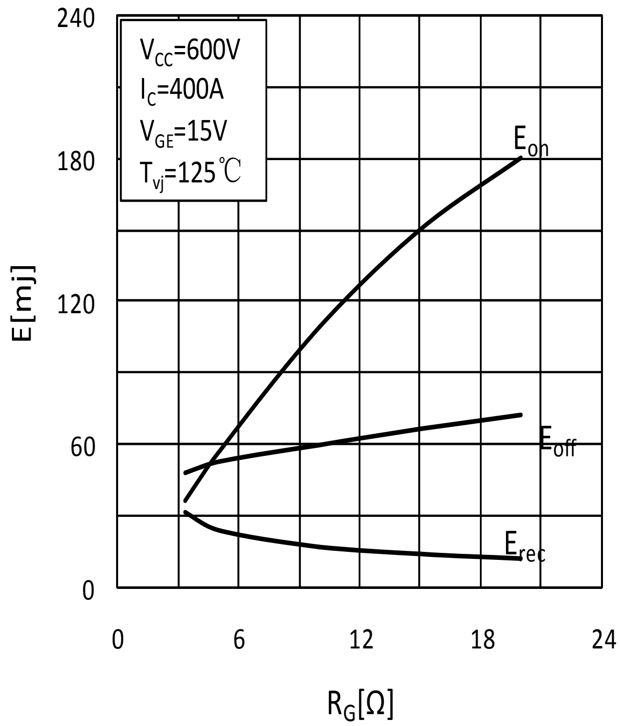


Fig.6 Switching Loss vs. Gate Resistor

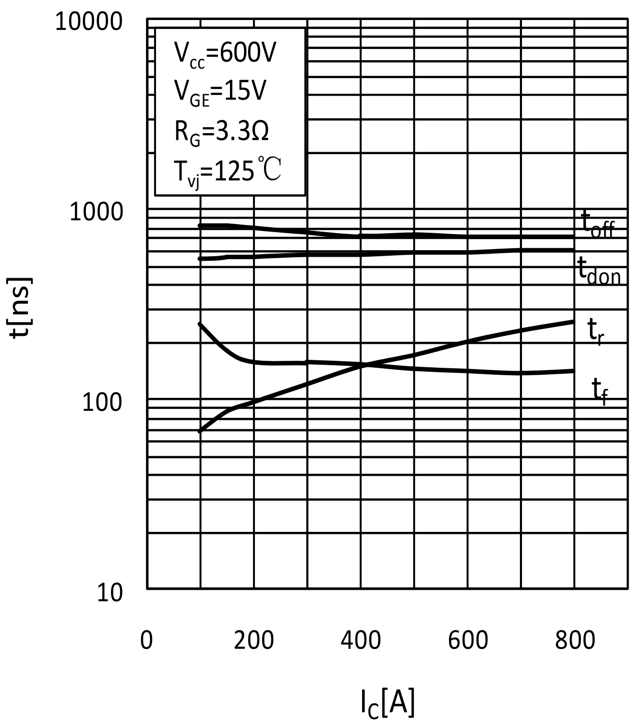


Fig.7 Typ. Switching Times vs. I_c

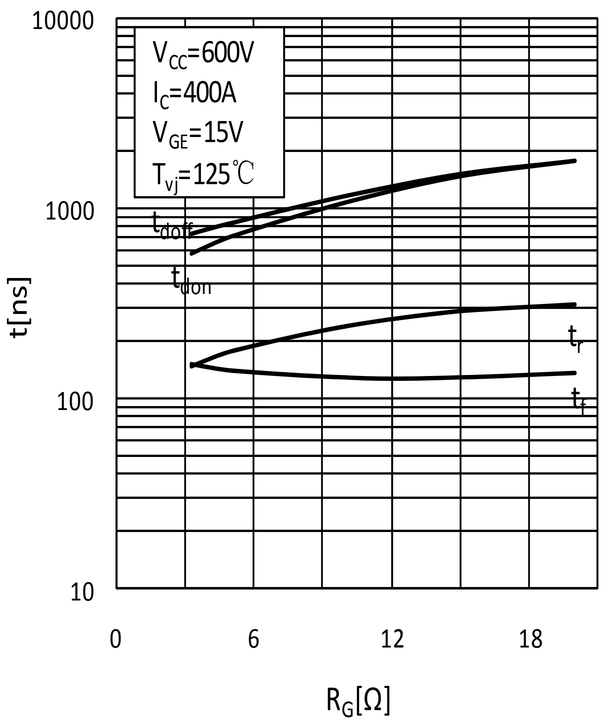


Fig.8 Typ. Switching Times vs. Gate Resistor

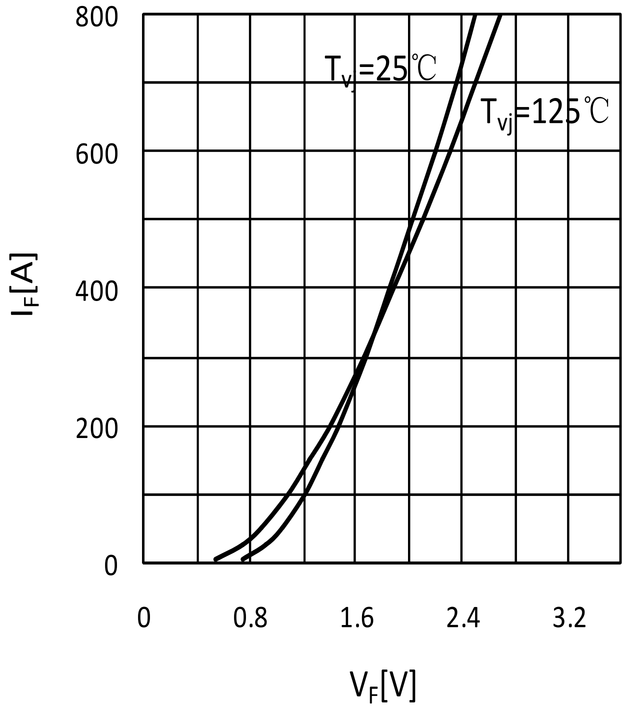


Fig.9 FWD Forward Characteristics.

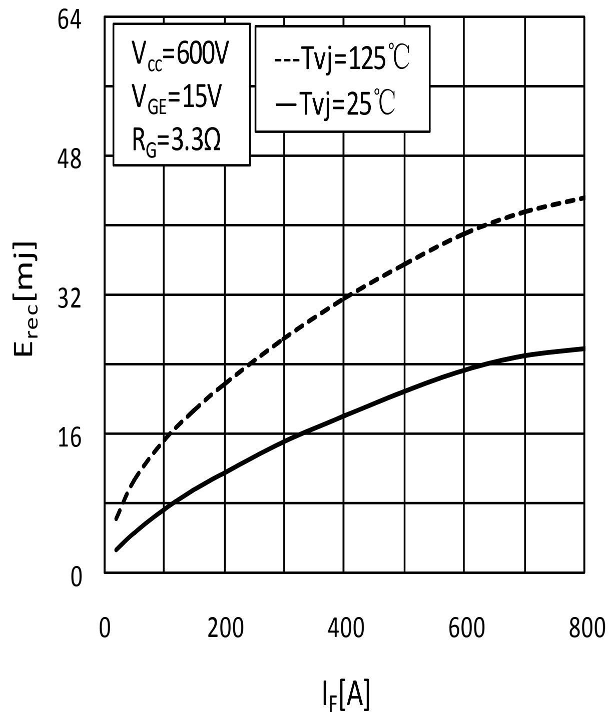


Fig.10 Typ. Switching Losses Diode-Inverter

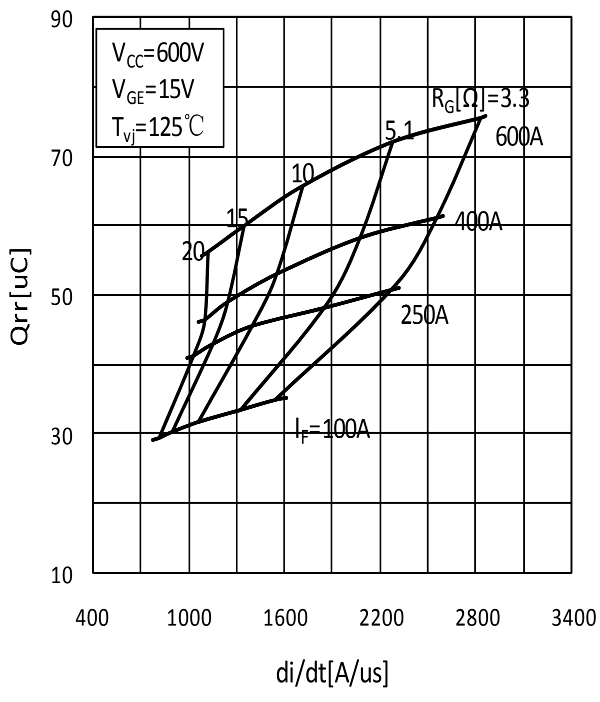


Fig.11 Typ. FRD Recovery Charge

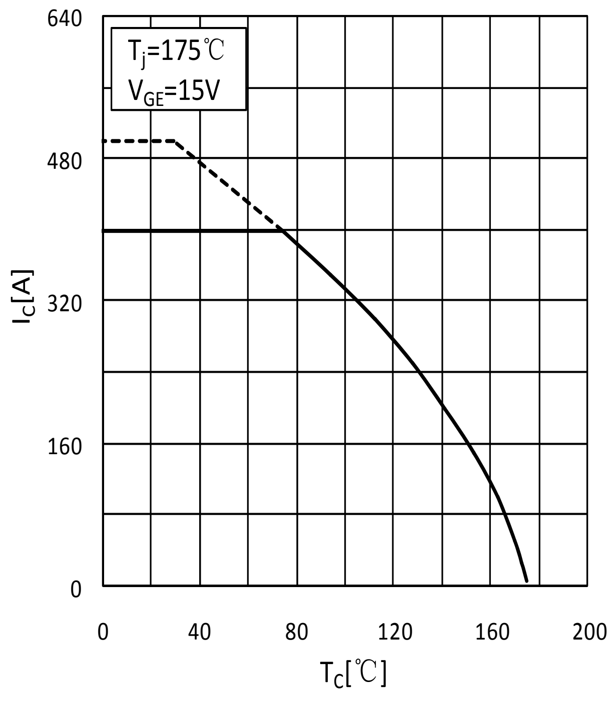


Fig. 12 Rate Current vs. Temperature（T_C）

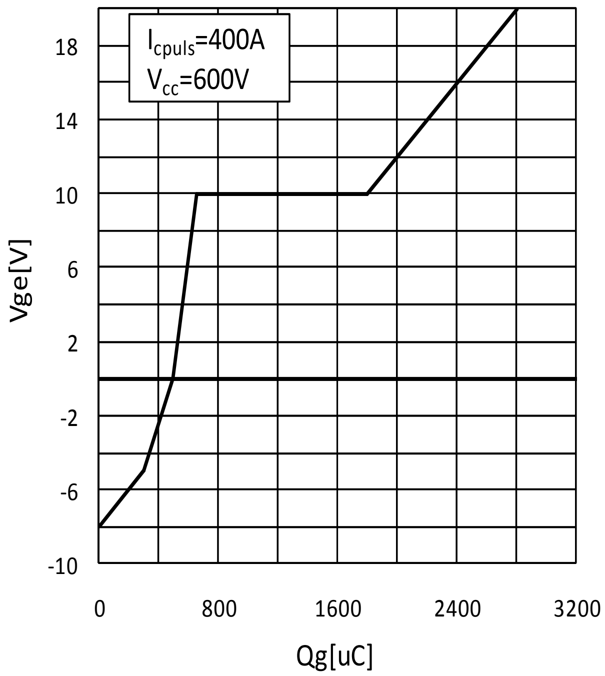


Fig.13 Typ. Gate Charge Characteristics

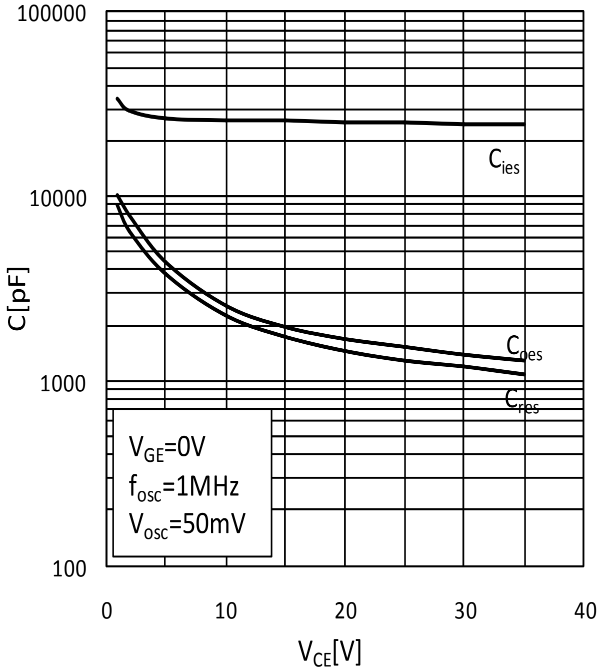


Fig.14 Typ. capacitances vs collector-emitter voltage

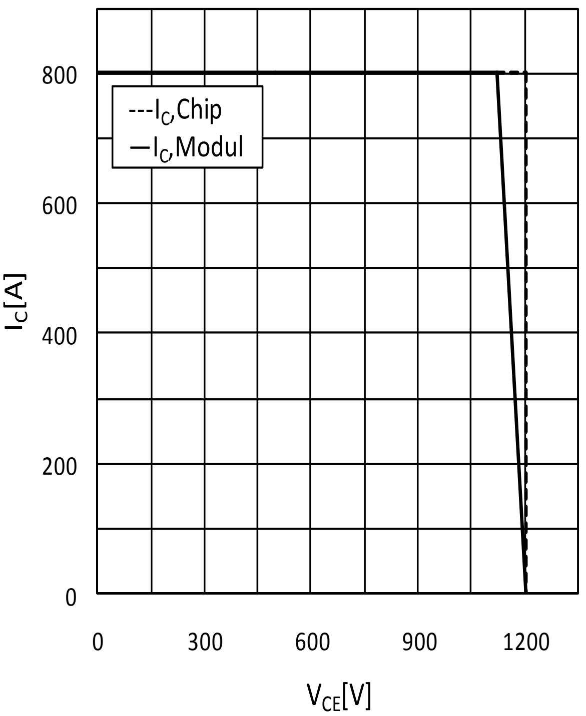


Fig.15 Reverse bias safe operating area IGBT-inv.(RBSOA)

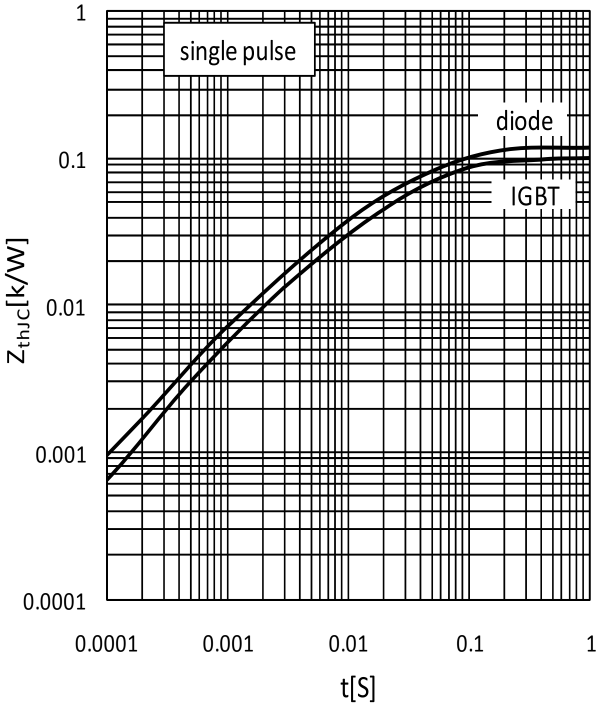
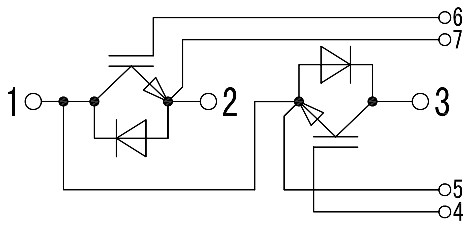


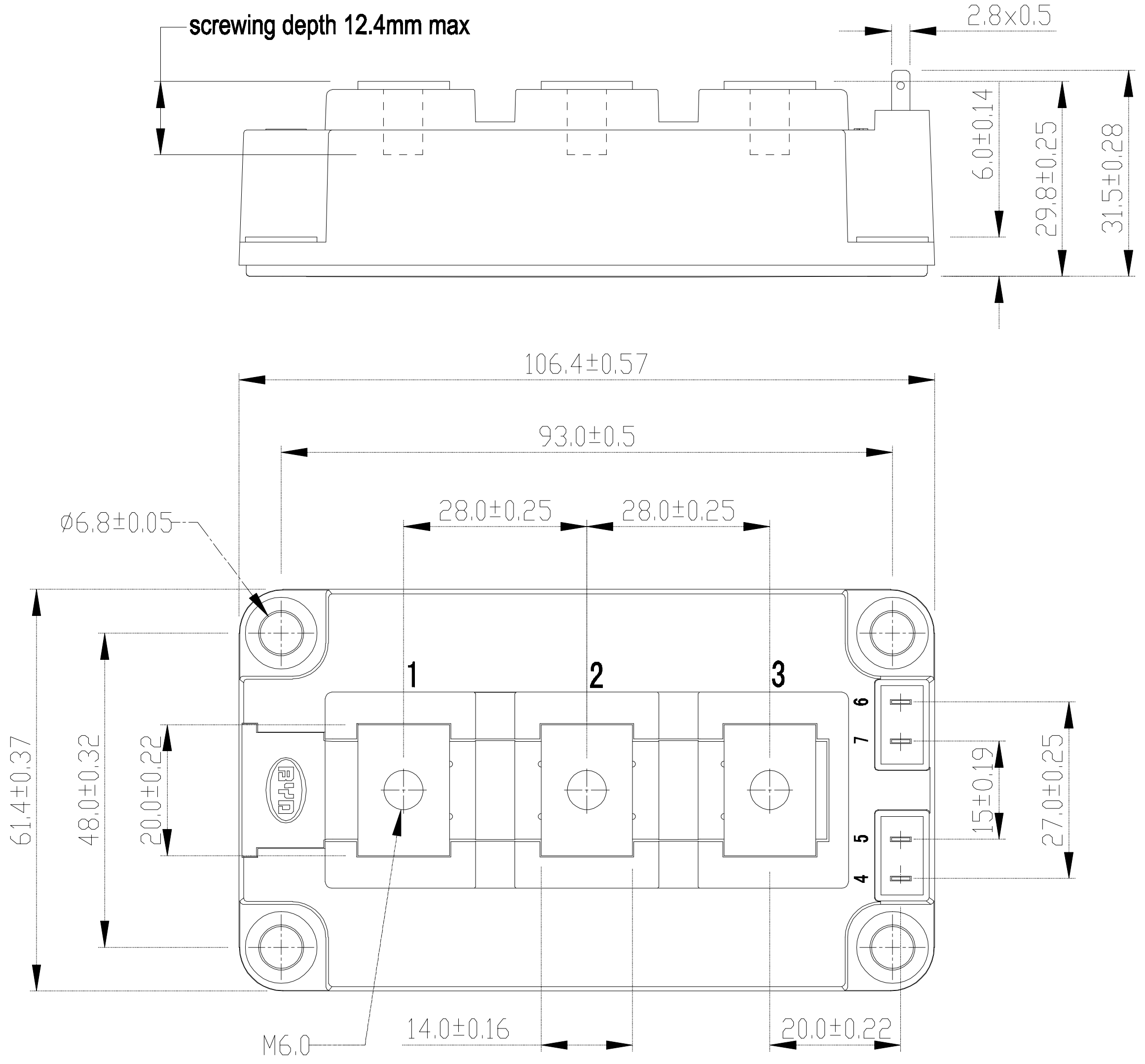
Fig.16 Typ. transient thermal impedance

Circuit Diagram



Package Outlines

Dimensions in mm



Attached (recommended torque):

M_S : (to heat sink M6) 3~6 Nm M_t : (to terminals M6) 2.5~5Nm

Attention

1. In order to reduce the contact resistance, we suggest add thermal grease between base and heat-sink, which thickness is about 0.1mm.
2. When installing the module, please wear a electrostatic bracelet to prevent the gate breakdown and the imbalance power may damage the internal chip, even to damage the module.
3. This is an electrostatic sensitive device, please observe the international standard IEC 60747-1, chap. IX.

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