



BYD Microelectronics Co., Ltd.

# BG150B12UY2-I

## IGBT Power Module

$V_{CE}=1200V$   $I_C=150A$

### General Description

BYD IGBT Power Module BG150B12UY2-I provides fast switching characteristic as well as high short circuit capability, which introduce the advanced IGBT chip/FWD and improved connection.

### Features

- High speed IGBT in trench/field stop technology
- Including ultra fast & soft recovery anti-parallel FWD
- Low inductance
- Standard package
- High short circuit capability
- Fast switching and short tail current
- $T_{vjmax}=175^{\circ}C$

### Applications

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



### Characteristic values

Parameter	Symbol	Conditions	Temperature	Value	Unit
<b>Absolute Maximum Ratings</b>					
Collector-emitter voltage	$V_{CES}$	$I_C=5.2mA, V_{GE}=0V$	$T_{vj}=25^{\circ}C$	1200	V
Continuous collector current	$I_C$	—	$T_c=80^{\circ}C$	150	A
Peak collector current	$I_{CRM}$	$I_{CRM} = 2I_C$	—	300	A
Gate-emitter voltage	$V_{GES}$	—	—	+/-20	V
Total power dissipation	$P_{tot}$	per switch (IGBT)	$T_c = 25^{\circ}C$	880	W
IGBT short circuit SOA	$t_{psc}$	$V_{CC}=600V, V_{GE}\leq 15V$ $V_{CEM}\leq 1200V$	$T_{vj}\leq 125^{\circ}C$	10	us
Junction temperature	$T_{vj}$	—	—	-40~175	$^{\circ}C$
Storage temperature range	$T_{stg}$	—	—	-40~125	$^{\circ}C$
Diode DC forward current	$I_F$	—	$T_c=80^{\circ}C$	150	A
Peak forward current	$I_{FRM}$	$I_{FRM}=2I_F$	—	300	A
$I^2t$ -value, Diode	$I^2t$	$V_R=0V, t=10ms$	$T_j=125^{\circ}C$	—	$A^2s$
Isolation voltage	$V_{isol}$	$t=1min, f=50Hz$	—	2500	V



Parameter	Symbol	Conditions	Temperature	Value			Unit	
<b>Characteristics</b>								
<b>IGBT</b>				<b>min.</b>	<b>typ.</b>	<b>max.</b>		
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_c=5.2mA, V_{GE}=V_{CE}$	$T_{vj}=25^{\circ}C$	5.0	5.8	6.5	V	
Collector-emitter cut-off current	$I_{CES}$	$V_{CE}=1200V, V_{GE}=0V$	$T_{vj}=25^{\circ}C$	—	—	1.0	mA	
			$T_{vj}=125^{\circ}C$	—	—	10	mA	
Gate-emitter cut-off current	$I_{GES}$	$V_{CE}=0V, V_{GE}=\pm 20V$	$T_{vj}=25^{\circ}C$	-300	—	300	nA	
Collector-emitter saturation voltage	$V_{CE(sat)}$	$I_c=150A, V_{GE}=15V$	$T_{vj}=25^{\circ}C$	—	2.15	—	V	
			$T_{vj}=125^{\circ}C$	—	2.55	—	V	
Integrated gate resistor	$R_{Gint}$	—	$T_{vj}=25^{\circ}C$	—	5	—	$\Omega$	
Gate Charge	$Q_g$	$V_{CE}=600V, I_c=150A,$ $V_{GE}=\pm 15V,$	—	—	0.7	—	$\mu C$	
Input capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V,$ $f=1MHz$	$T_{vj}=25^{\circ}C$	—	8.8	—	nF	
Output capacitance	$C_{oes}$			—	0.58	—	nF	
Reverse transfer capacitance	$C_{res}$			—	0.47	—	nF	
Turn-on delay time	$t_{d(on)}$	$V_{CC}=600V, I_c=150A,$ $R_{Gon}=R_{Goff}=3.3\Omega,$ $V_{GE}=\pm 15V,$ $L\sigma=80nH,$ Inductive load	$T_{vj}=25^{\circ}C$	—	330	—	ns	
			$T_{vj}=125^{\circ}C$	—	345	—	ns	
Rise time	$t_r$		$T_{vj}=25^{\circ}C$	—	98	—	ns	
			$T_{vj}=125^{\circ}C$	—	101	—	ns	
Turn-off delay time	$t_{d(off)}$		$T_{vj}=25^{\circ}C$	—	385	—	ns	
			$T_{vj}=125^{\circ}C$	—	455	—	ns	
Fall time	$t_f$		$T_{vj}=25^{\circ}C$	—	115	—	ns	
			$T_{vj}=125^{\circ}C$	—	158	—	ns	
Energy dissipation during turn-on time	$E_{on}$		$V_{CC}=600V, I_c=150A,$ $R_{Gon}=3.3\Omega,$ $V_{GE}=\pm 15V, L\sigma=80nH,$ Inductive load	$T_{vj}=25^{\circ}C$	—	12.5	—	mJ
				$T_{vj}=125^{\circ}C$	—	16.8	—	mJ
Energy dissipation during turn-off time	$E_{off}$	$T_{vj}=25^{\circ}C$		—	5.4	—	mJ	
		$T_{vj}=125^{\circ}C$		—	8.2	—	mJ	
<b>Diode</b>				<b>min.</b>	<b>typ.</b>	<b>max.</b>		
Forward voltage	$V_F$	$I_F=150A$		$T_{vj}=25^{\circ}C$	—	1.7	—	V
				$T_{vj}=125^{\circ}C$	—	1.7	—	V
Peak reverse recovery current	$I_{RR}$	$I_F=150A, V_R=600V,$ $di_f/dt=2000A/us$		$T_{vj}=125^{\circ}C$	—	112	—	A
Recovered charge	$Q_{rr}$			$T_{vj}=125^{\circ}C$	—	21	—	$\mu C$
Reverse recovery time	$t_{rr}$			$T_{vj}=125^{\circ}C$	—	230	—	ns
Reverse recovery energy	$E_{rec}$		$T_{vj}=125^{\circ}C$	—	8	—	mJ	

Parameter	Symbol	Conditions	min.	typ.	Max.	Unit	
<b>Thermal-Mechanical Specifications</b>							
IGBT thermal resistance junction to case	$R_{th(j-c)}$	per IGBT	—	0.17	—	K/W	
Diode thermal resistance junction to case	$R_{th(j-c)}$	per diode	—	0.26	—	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 x 61.4 x 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 60664-1 and 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  
 Specification according to the valid application note.

### Characterization curves

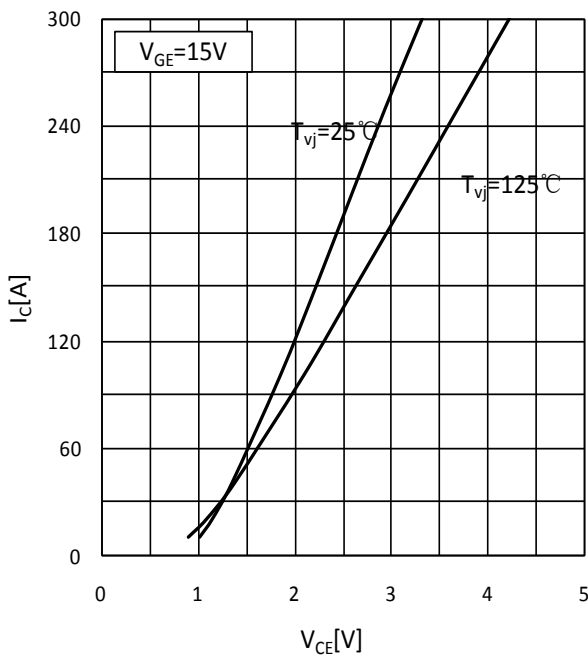


Fig.1 Typ. On-state Characteristics

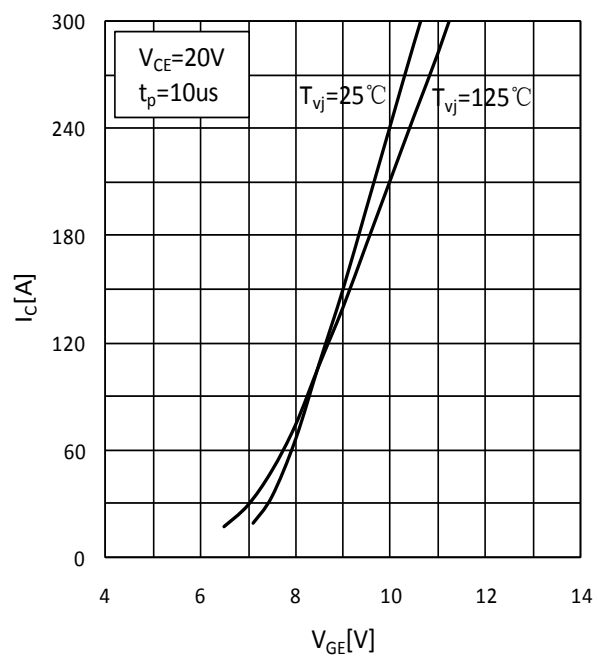


Fig.2 Typ. Transfer Characteristics

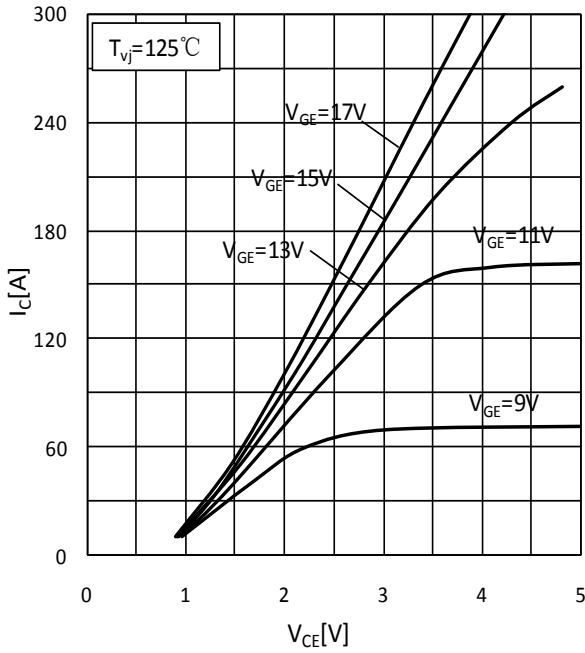


Fig.3 Typ. Output Characteristics

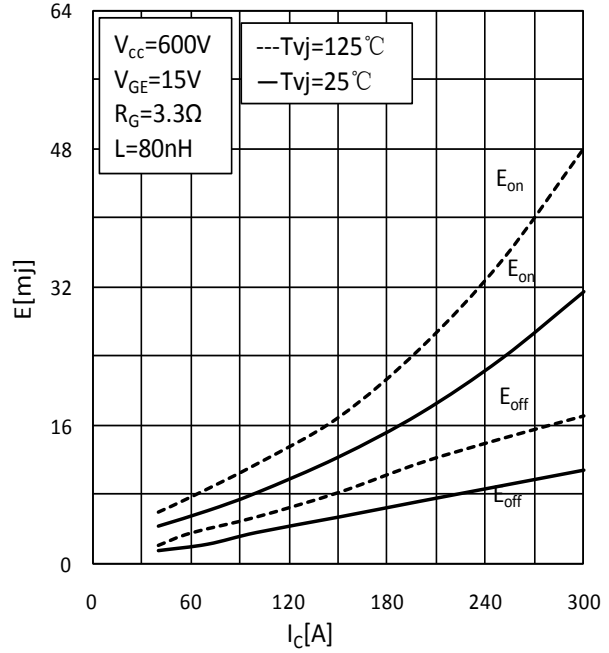


Fig.4 Switching Loss vs. Collector Current

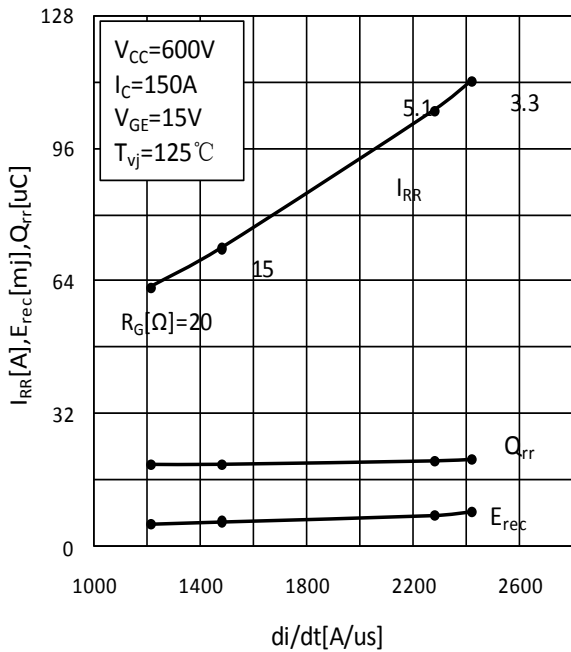


Fig.5 Typ. reverse recovery characteristics vs di/dt

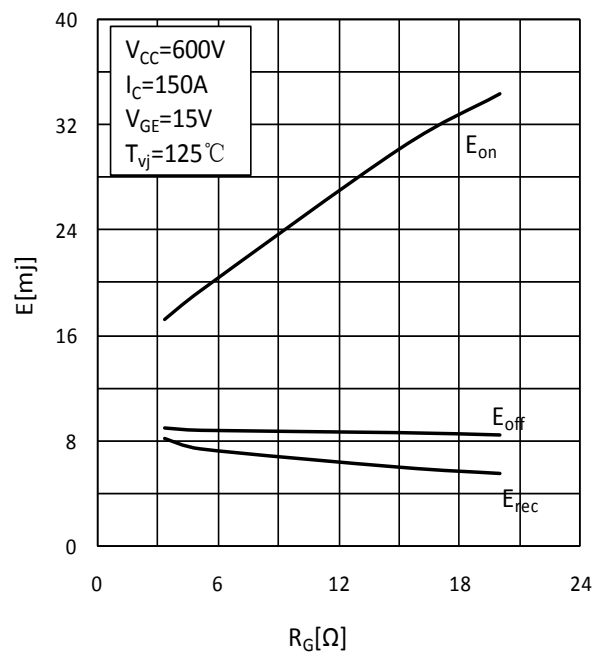


Fig.6 Switching Loss vs. Gate Resistor

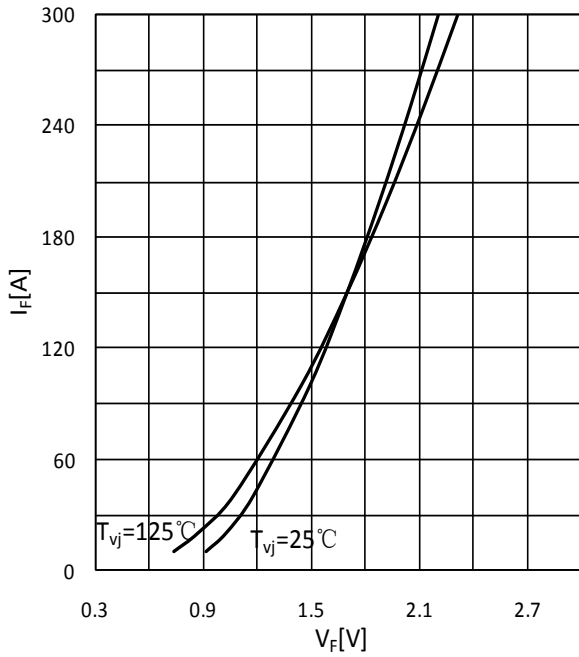


Fig.7 FWD Forward Characteristics.

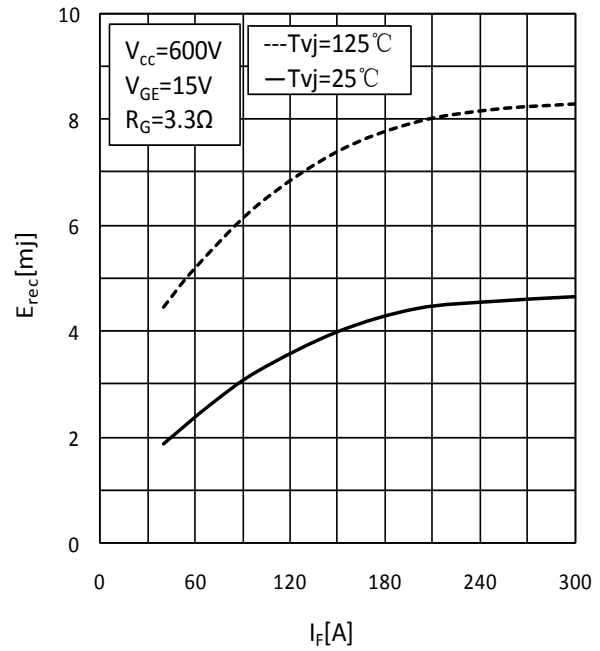


Fig.8 Typ. Switching losses diode-inverter

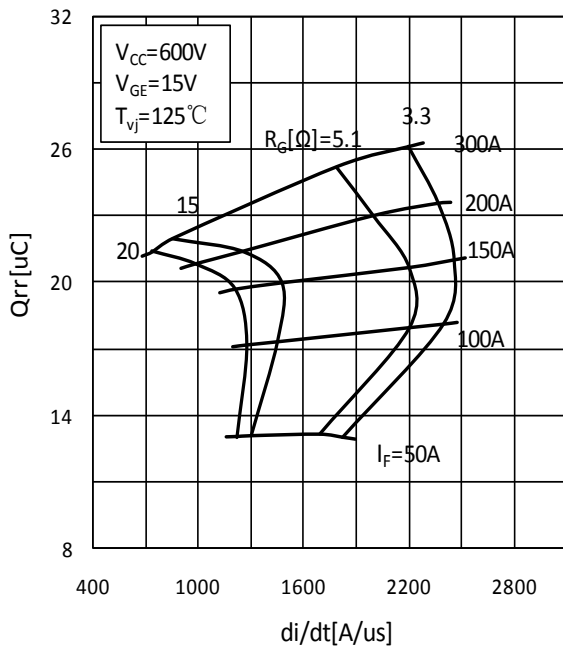


Fig.9 Typ. FRD recovery charge

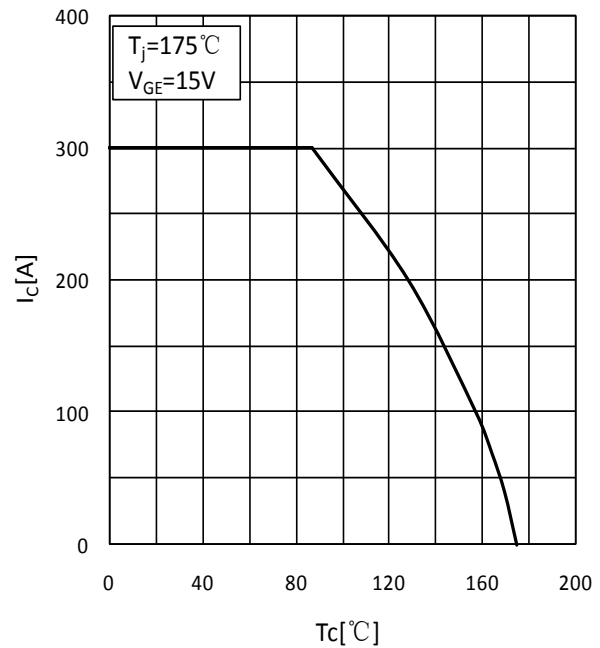


Fig. 10 Rate current vs. temperature ( $T_c$ )

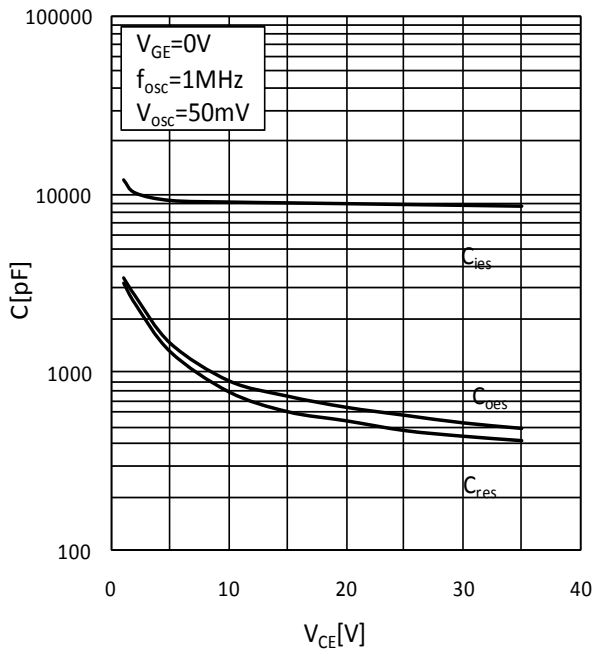


Fig.11 Typ. capacitances vs collector-emitter voltage

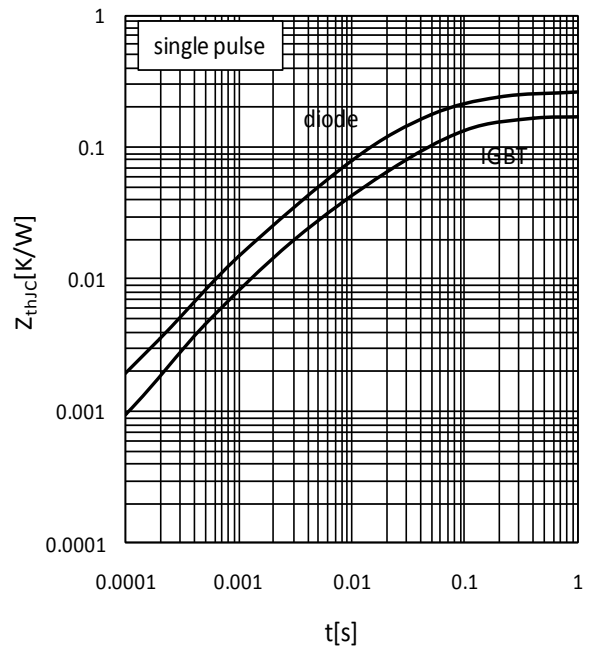


Fig.12 Typ. transient thermal impedance

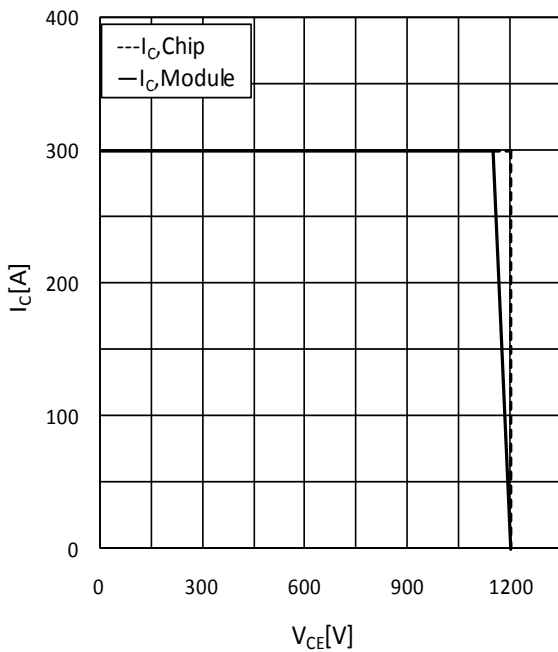
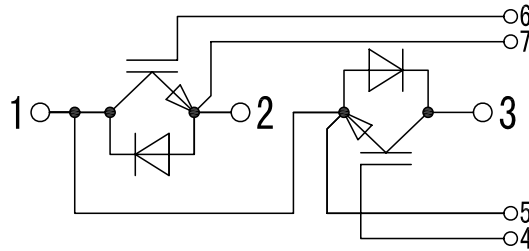


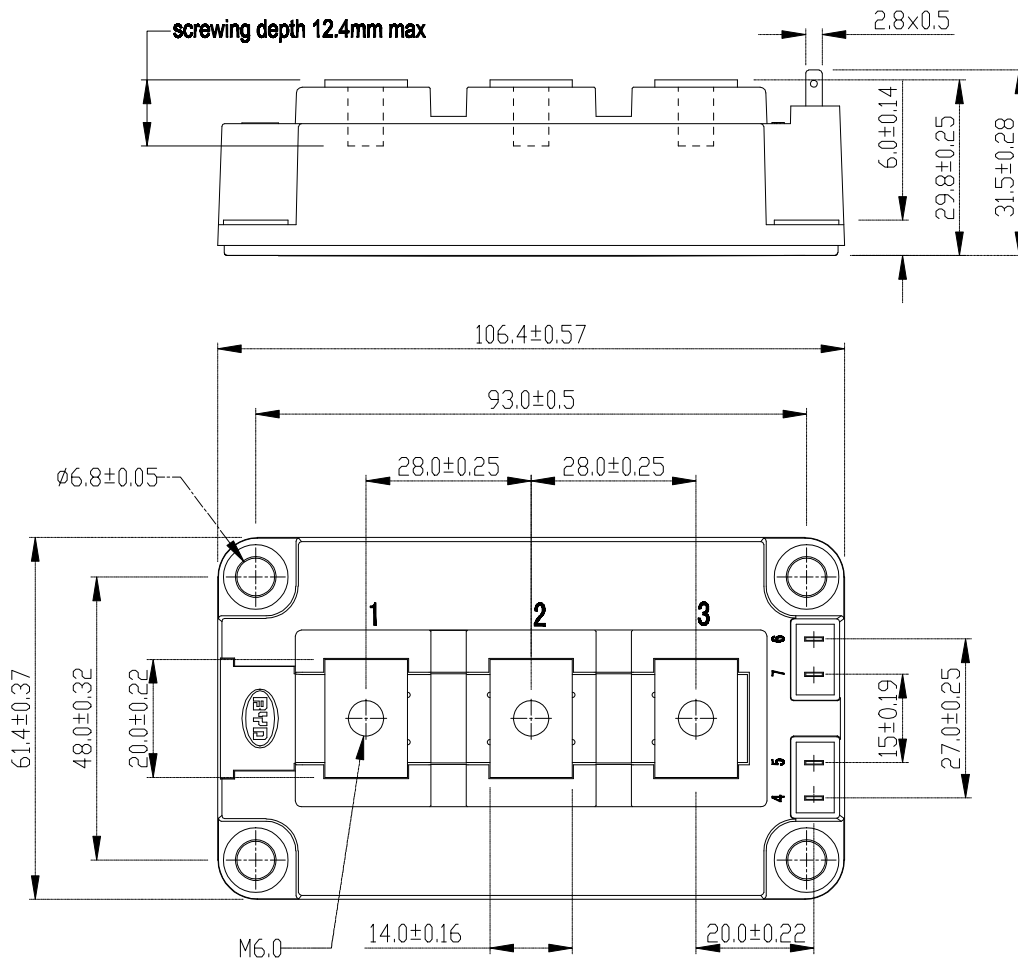
Fig.13 Reverse bias safe operating area IGBT-inv.(RBSOA)

## Circuit Diagram



## Package Outlines

### Dimensions in mm



## Attached (recommended torque):

$M_S$  : (to heat sink M6) 3~6 Nm

$M_t$  : (to terminals M6) 2.5~5 Nm



## 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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