

关键参数 Key Parameters

V_{CES}		3300	V
$V_{CE(sat)}$	(typ)	2.40	V
I_C	(max)	500	A
$I_{C(RM)}$	(max)	1000	A

典型应用 Typical Applications

● 牵引传动	Traction drives
● 电机控制	Motor Controllers
● 智能电网	Smart Grid
● 高可靠性逆变器	High Reliability Inverter

特点 Features

● AISiC基板	AISiC Base
● AIN衬板	AIN Substrates
● 高热循环能力	High Thermal Cycling Capability
● 10 μ s短路承受能力	10 μ s Short Circuit Withstand
● 低 $V_{ce(sat)}$ 型器件	Low $V_{ce(sat)}$ device
● 高电流密度	High current density

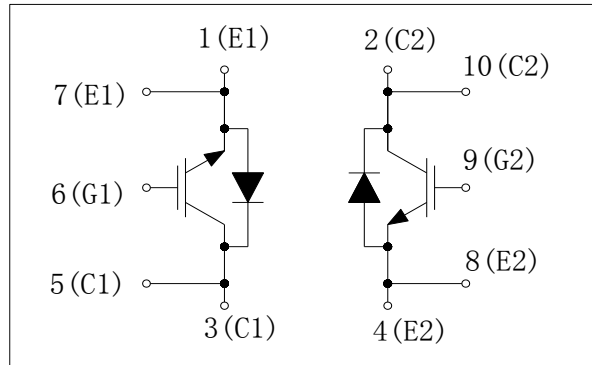
电路结构 Circuit Configuration

 图1. 电路结构
 Fig. 1 Circuit configuration

 图2. 模块外形
 Fig. 2 Module appearance

模块标签说明

ab1234567890
Module Label code

数据位置 Data position	数据内容 Content of data
1--8	模块批次号 Module batch number
9--12	模块序列号 Module serial number

TIM500GDM33-PSA011
额定值

 除非特别声明，否则 $T_{case} = 25\text{ }^{\circ}\text{C}$
Absolute Maximum Rating
 $T_{case} = 25\text{ }^{\circ}\text{C}$ unless stated otherwise

符号 (Symbol)	参数名称 (Parameter)	测试条件 (Test Conditions)	数值 (value)	单位 (Unit)
V_{CES}	集电极-发射极电压 Collector-emitter voltage	$V_{GE} = 0V, T_{vj} = 25\text{ }^{\circ}\text{C}$	3300	V
V_{GES}	栅极-发射极电压 Gate-emitter voltage		± 20	V
I_C	集电极电流 Collector-emitter current	$T_{case} = 100\text{ }^{\circ}\text{C}, T_{vj} = 150\text{ }^{\circ}\text{C}$	500	A
$I_{C(PK)}$	集电极峰值电流 Peak collector current	1ms, $T_{case} = 140\text{ }^{\circ}\text{C}$	1000	A
P_{max}	晶体管部分最大损耗 Max. transistor power dissipation	$T_{vj} = 150\text{ }^{\circ}\text{C}, T_{case} = 25\text{ }^{\circ}\text{C}$	5.2	kW
I^2t	二极管 I^2t 值 Diode I^2t	$V_R = 0V, t_p = 10\text{ms}, T_{vj} = 150\text{ }^{\circ}\text{C}$	80	kA^2s
V_{isol}	绝缘电压(模块) Isolation voltage – per module	短接所有端子，端子与基板间施加电压 (Commoned terminals to base plate), AC RMS, 1 min, 50Hz	6000	V
Q_{PD}	局部放电电荷(模块) Partial discharge – per module	IEC1287. $V_1 = 3500V, V_2 = 2600V,$ 50Hz RMS, $T_C = 25\text{ }^{\circ}\text{C}$	10	pC

热和机械数据
Thermal & Mechanical Data

爬电距离	Creepage distance	33mm
绝缘间隙	Clearance	20mm
耐漏电起痕指数	CTI (Critical Tracking Index)	>600

符号 (Symbol)	参数名称 (Parameter)	测试条件 (Test Conditions)	最小 (Min)	最大 (Max)	单位 (Unit)
$R_{th(J-C) IGBT}$	IGBT结壳热阻 Thermal resistance – IGBT	结壳恒定功耗 Continuous dissipation - junction to case		24	K / kW
$R_{th(J-C) Diode}$	二极管结壳热阻 Thermal resistance – diode	结壳恒定功耗 Continuous dissipation - junction to case		48	K / kW
$R_{th(C-H)}$	接触热阻(模块) Thermal resistance – case to heatsink (per module)	安装力矩5Nm (导热脂 $1W/m\cdot^{\circ}\text{C}$) Mounting torque 5Nm (with mounting grease $1W/m\cdot^{\circ}\text{C}$)		8	K / kW
T_{vj}	结温 Junction temperature	IGBT部分 (IGBT) 二极管部分 (Diode)		150	$^{\circ}\text{C}$
T_{stg}	存储温度 Storage temperature range		-40	150	$^{\circ}\text{C}$
M	安装力矩 Screw torque	安装紧固用 - M6 Mounting – M6		5	Nm
		电路互连用 - M4 Electrical connections – M4		2	Nm
		电路互连用 - M8 Electrical connections – M8		10	Nm

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电特性值
Electrical Characteristics

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符号 (Symbol)	参数名称 (Parameter)	条件 (Test Conditions)	最小 (Min)	典型 (Typ)	最大 (Max)	单位 (Unit)
I_{CES}	集电极截止电流 Collector cut-off current	$V_{GE} = 0V, V_{CE} = V_{CES}$			1	mA
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{case} = 125\text{ }^{\circ}\text{C}$			30	mA
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{case} = 150\text{ }^{\circ}\text{C}$			50	mA
I_{GES}	栅极漏电流 Gate leakage current	$V_{GE} = \pm 20V, V_{CE} = 0V$			1	μA
$V_{GE(TH)}$	栅极-发射极阈值电压 Gate threshold voltage	$I_C = 40\text{mA}, V_{GE} = V_{CE}$	5.50	6.10	7.00	V
$V_{CE(sat)}^{(*1)}$	集电极-发射极饱和电压 Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 500\text{A}$		2.40	2.90	V
		$V_{GE} = 15V, I_C = 500\text{A}, T_{vj} = 125\text{ }^{\circ}\text{C}$		2.95	3.40	V
		$V_{GE} = 15V, I_C = 500\text{A}, T_{vj} = 150\text{ }^{\circ}\text{C}$		3.10	3.60	V
I_F	二极管正向直流电流 Diode forward current	DC		500		A
I_{FRM}	二极管正向重复峰值电流 Diode maximum forward current	$t_P = 1\text{ms}$		1000		A
$V_F^{(*1)}$	二极管正向电压 Diode forward voltage	$I_F = 500\text{A}$		2.10	2.60	V
		$I_F = 500\text{A}, T_{vj} = 125\text{ }^{\circ}\text{C}$		2.25	2.70	V
		$I_F = 500\text{A}, T_{vj} = 150\text{ }^{\circ}\text{C}$		2.25	2.70	V
C_{ies}	输入电容 Input capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 1\text{MHz}$		90		nF
Q_g	栅极电荷 Gate charge	$\pm 15V$		9		μC
C_{res}	反向传输电容 Reverse transfer capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 1\text{MHz}$		2		nF
L_M	模块电感 Module inductance			25		nH
R_{INT}	内阻 Internal transistor resistance			310		$\mu\Omega$
I_{SC}	短路电流 Short circuit current, I_{SC}	$T_{vj} = 150\text{ }^{\circ}\text{C}, V_{CC} = 2500V,$ $V_{GE} \leq 15V, t_p \leq 10\mu\text{s},$ $V_{CE(max)} = V_{CES} - L^{(*2)} \times di/dt,$ IEC 6074-9		1800		A

注意: 1.(*1) 表示该参数的测试点为辅助母排端子 (*1) indicates it is measured at the auxiliary busbar terminal);

 2.(*2) 表示L是电路杂散电感加上 L_M (*2) indicates L is the circuit stray inductance plus L_M).

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符号 (Symbol)	参数名称 (Parameter)	测试条件 (Test Conditions)	最小 (Min)	典型 (Typ)	最大 (Max)	单位 (Unit)
$t_{d(off)}$	关断延迟时间 Turn-off delay time	$I_C = 500\text{A}$ $V_{CE} = 1800\text{V}$ $C_{ge} = 100\text{nF}$ $L \sim 150\text{nH}$ $V_{GE} = \pm 15\text{V}$ $R_{G(ON)} = 3.0\Omega$ $R_{G(OFF)} = 4.5\Omega$		1720		ns
t_f	下降时间 Fall time			520		ns
E_{OFF}	关断损耗 Turn-off energy loss			780		mJ
$t_{d(on)}$	开通延迟时间 Turn-on delay time			650		ns
t_r	上升时间 Rise time			260		ns
E_{ON}	开通损耗 Turn-on energy loss			730		mJ
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	$I_F = 500\text{A}$ $V_{CE} = 1800\text{V}$ $di_F/dt = 2100\text{A/us}$		390		μC
I_{rr}	二极管反向恢复电流 Diode reverse recovery current			420		A
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy			480		mJ

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符号 (Symbol)	参数名称 (Parameter)	测试条件 (Test Conditions)	最小 (Min)	典型 (Typ)	最大 (Max)	单位 (Unit)
$t_{d(off)}$	关断延迟时间 Turn-off delay time	$I_C = 500\text{A}$ $V_{CE} = 1800\text{V}$ $C_{ge} = 100\text{nF}$ $L \sim 150\text{nH}$ $V_{GE} = \pm 15\text{V}$ $R_{G(ON)} = 3.0\Omega$ $R_{G(OFF)} = 4.5\Omega$		1860		ns
t_f	下降时间 Fall time			550		ns
E_{OFF}	关断损耗 Turn-off energy loss			900		mJ
$t_{d(on)}$	开通延迟时间 Turn-on delay time			630		ns
t_r	上升时间 Rise time			280		ns
E_{ON}	开通损耗 Turn-on energy loss			880		mJ
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	$I_F = 500\text{A}$ $V_{CE} = 1800\text{V}$ $di_F/dt = 2100\text{A/us}$		620		μC
I_{rr}	二极管反向恢复电流 Diode reverse recovery current			460		A
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy			760		mJ

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符号 (Symbol)	参数名称 (Parameter)	测试条件 (Test Conditions)	最小 (Min)	典型 (Typ)	最大 (Max)	单位 (Unit)
$t_{d(off)}$	关断延迟时间 Turn-off delay time	$I_C = 500\text{A}$ $V_{CE} = 1800\text{V}$ $C_{ge} = 100\text{nF}$ $L \sim 150\text{nH}$ $V_{GE} = \pm 15\text{V}$ $R_{G(ON)} = 3.0\Omega$ $R_{G(OFF)} = 4.5\Omega$		1920		ns
t_f	下降时间 Fall time			560		ns
E_{OFF}	关断损耗 Turn-off energy loss			1020		mJ
$t_{d(on)}$	开通延迟时间 Turn-on delay time			620		ns
t_r	上升时间 Rise time			280		ns
E_{ON}	开通损耗 Turn-on energy loss			930		mJ
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge		$I_F = 500\text{A}$ $V_{CE} = 1800\text{V}$ $di_F/dt = 2100\text{A}/\mu\text{s}$		720	
I_{rr}	二极管反向恢复电流 Diode reverse recovery current			490		A
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy			900		mJ

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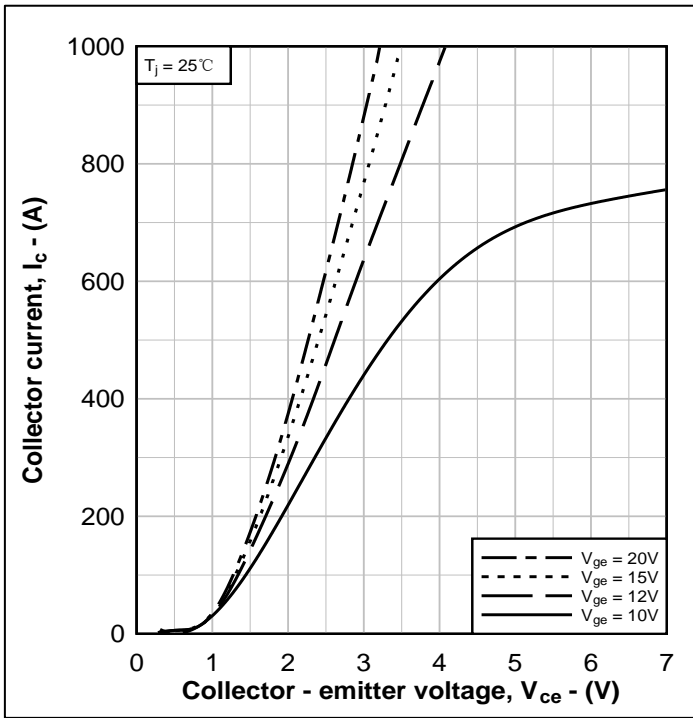


图3. 输出特性典型曲线

Fig.3 Typical output characteristics

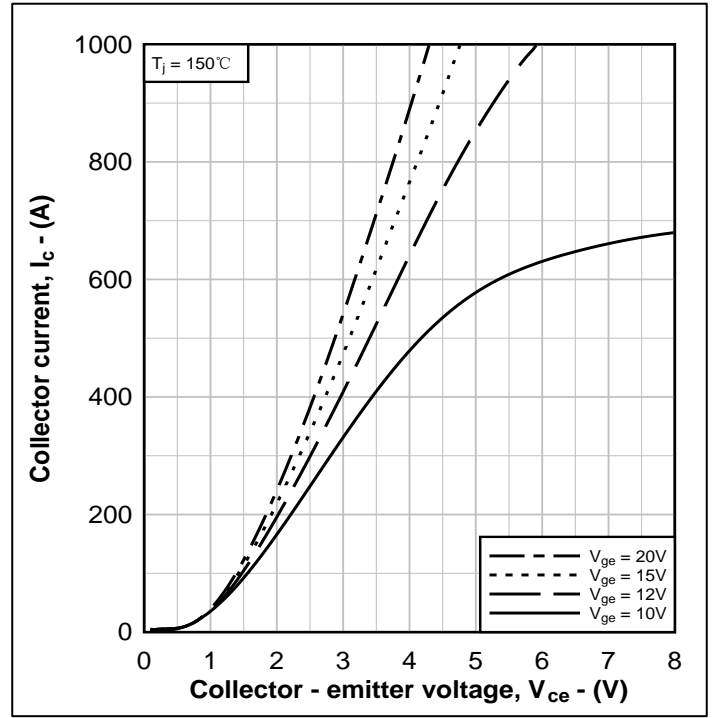


图4. 输出特性典型曲线

Fig.4 Typical output characteristics

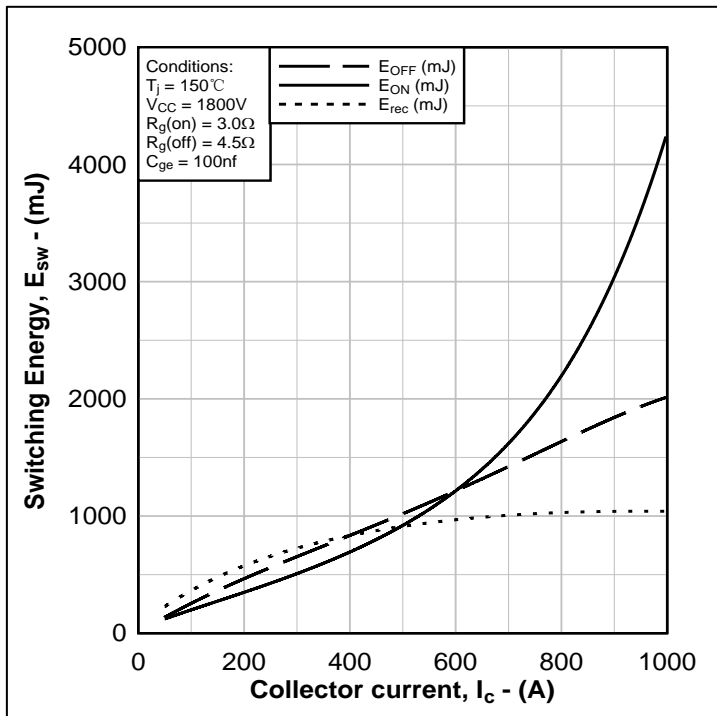


图5. 开关能耗与集电极电流关系曲线

Fig.5 Typical switching energy vs collector current

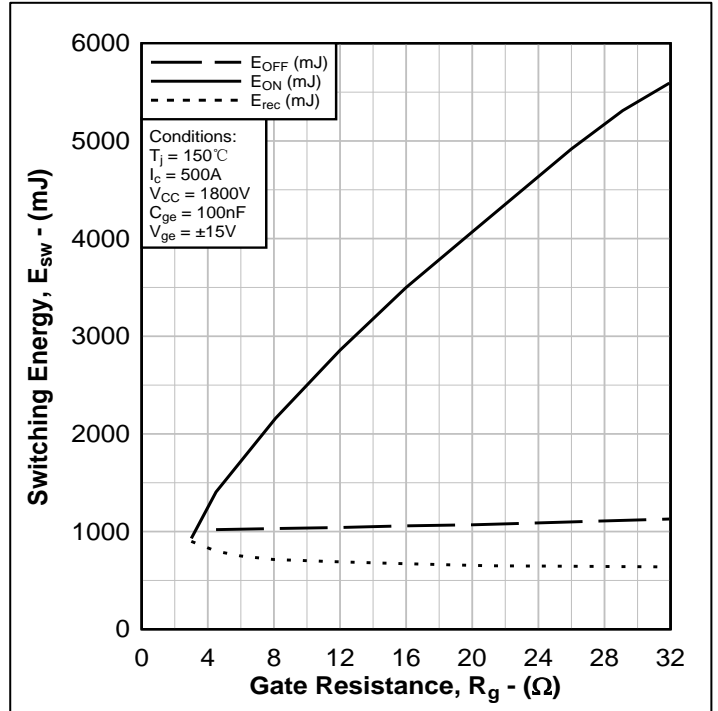


图6. 开关能耗与栅极电阻的关系曲线

Fig. 6 Typical switching energy vs gate resistance

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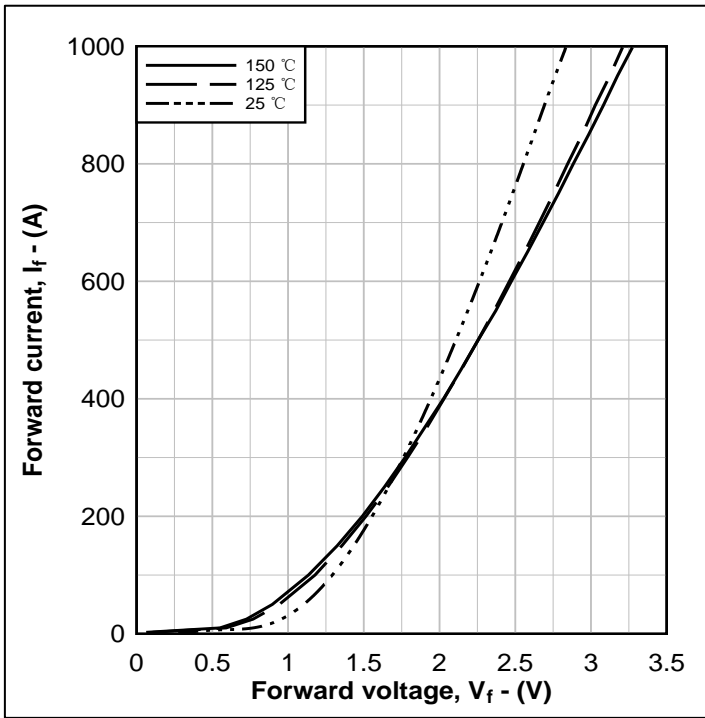


图7. 二极管正向特性典型曲线
Fig.7 Diode typical forward characteristics

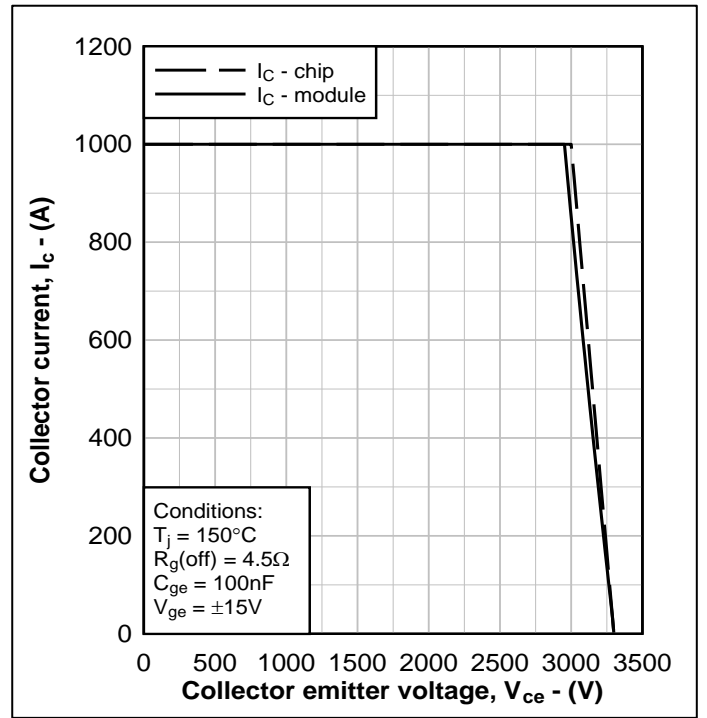


图8. 反偏安全工作区
Fig.8 Reverse bias safe operating area

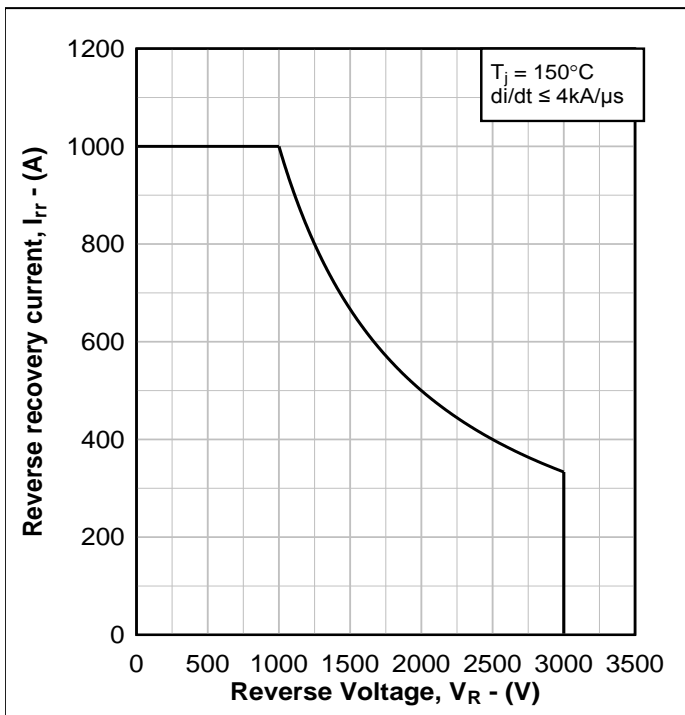


图9. 二极管反偏安全工作区
Fig.9 Diode reverse bias safe operating area

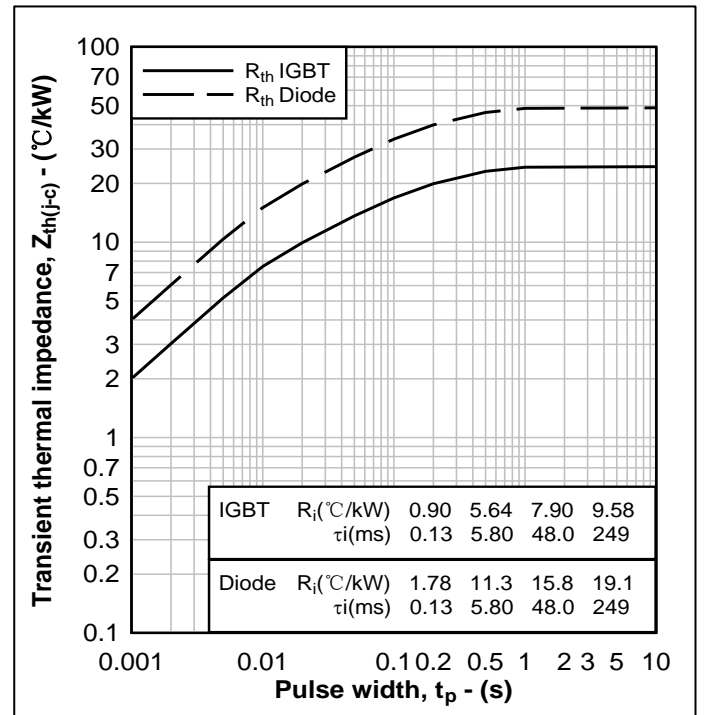
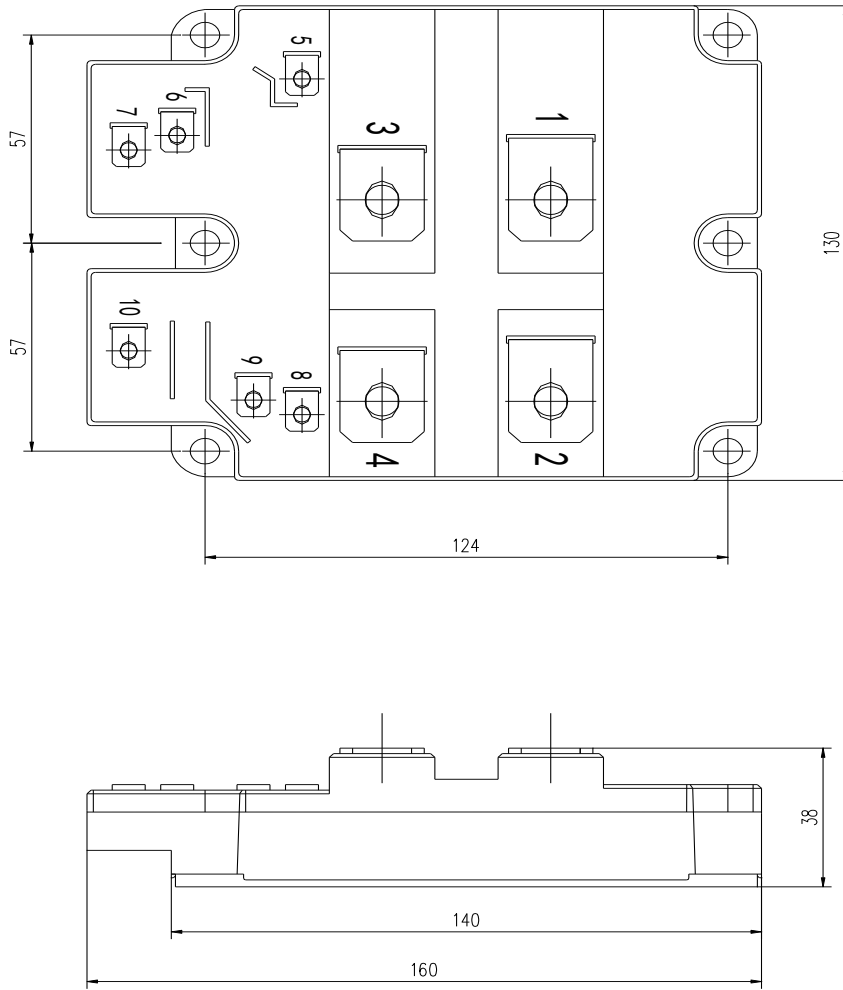


图10. 瞬态热阻抗曲线
Fig. 10 Transient thermal impedance



重量Weight: 1000g

模块外观类型 Module outline code: G

图11. 模块外观尺寸

Fig. 11 Module outline drawing

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