

**关键参数 Key Parameters**

$V_{CES}$		<b>4500</b>	<b>V</b>
$V_{CE(sat)}$	(typ)	<b>2.30</b>	<b>V</b>
$I_C$	(max)	<b>1200</b>	<b>A</b>
$I_{C(RM)}$	(max)	<b>2400</b>	<b>A</b>

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

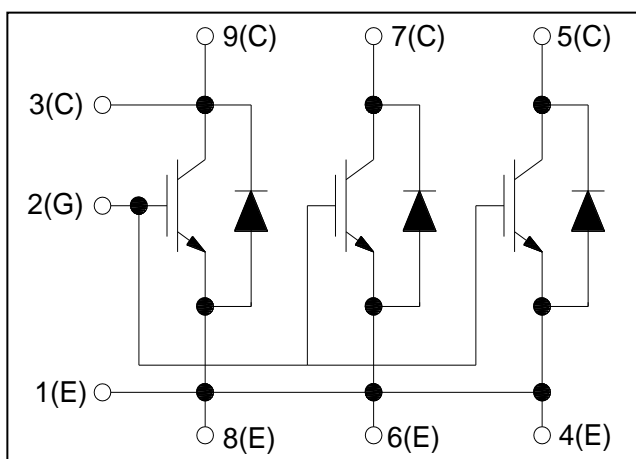
**电路结构 Circuit Configuration**

 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**
**Module Label code**


ab1234567890/123456781234

数据位置 Data position	数据内容 Content of data
1--12	模块产品编码 Module product code
13	分隔符 virgule
14--21	模块批次号 Module batch number
22--25	模块序列号 Module serial number

**TIM1200ESM45-PSA011**
**最大额定值**
**Absolute Maximum Rating**

 除非特别声明，否则  $T_{case} = 25\text{ }^{\circ}\text{C}$ 
 $T_{case} = 25\text{ }^{\circ}\text{C}$  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	$V_{GE} = 0V, T_{vj} = 25\text{ }^{\circ}\text{C}$	4500	V
$V_{GES}$	栅极-发射极电压 Gate-emitter voltage		$\pm 20$	V
$I_C$	集电极电流 Collector-emitter current	$T_{vj} = 125\text{ }^{\circ}\text{C}, T_{case} = 85\text{ }^{\circ}\text{C}$	1200	A
$I_{C(PK)}$	集电极峰值电流 Peak collector current	1ms	2400	A
$P_{max}$	晶体管部分最大损耗 Max. transistor power dissipation	$T_{vj} = 125\text{ }^{\circ}\text{C}, T_{case} = 25\text{ }^{\circ}\text{C}$	12.5	kW
$I^2t$	二极管 $I^2t$ 值 Diode $I^2t$	$V_R = 0V, t_P = 10ms, T_{vj} = 125\text{ }^{\circ}\text{C}$	530	$\text{kA}^2\text{s}$
$V_{isol}$	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. $V = 3500V, 50\text{Hz RMS}$	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		8	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		16	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 $1W/m\cdot^{\circ}\text{C}$ )		6	K / kW
$T_{vj}$	结温 Junction temperature	IGBT部分 ( IGBT )		125	$^{\circ}\text{C}$
		二极管部分( Diode )		125	$^{\circ}\text{C}$
$T_{stg}$	存储温度 Storage temperature range		-40	125	$^{\circ}\text{C}$
$M$	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

**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)
$I_{\text{CES}}$	集电极截止电流 Collector cut-off current	$V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = V_{\text{CES}}$			1	mA
		$V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = V_{\text{CES}}, T_{\text{case}} = 125\text{ }^{\circ}\text{C}$			90	mA
$I_{\text{GES}}$	栅极漏电流 Gate leakage current	$V_{\text{GE}} = \pm 20\text{V}, V_{\text{CE}} = 0\text{V}$			1	$\mu\text{A}$
$V_{\text{GE}}(\text{TH})$	栅极-发射极阈值电压 Gate threshold voltage	$I_{\text{C}} = 120\text{mA}, V_{\text{GE}} = V_{\text{CE}}$	5.0	6.0	7.0	V
$V_{\text{CE}}(\text{sat})^{(*1)}$	集电极-发射极饱和电压 Collector-emitter saturation voltage	$V_{\text{GE}} = 15\text{V}, I_{\text{C}} = 1200\text{A}$		2.3	2.8	V
		$V_{\text{GE}} = 15\text{V}, I_{\text{C}} = 1200\text{A}, T_{\text{vj}} = 125\text{ }^{\circ}\text{C}$		3.0	3.5	V
$I_{\text{F}}$	二极管正向直流电流 Diode forward current	DC		1200		A
$I_{\text{FRM}}$	二极管正向重复峰值电流 Diode maximum forward current	$t_{\text{P}} = 1\text{ms}$		2400		A
$V_{\text{F}}^{(*1)}$	二极管正向电压 Diode forward voltage	$I_{\text{F}} = 1200\text{A}$		2.4	2.9	V
		$I_{\text{F}} = 1200\text{A}, T_{\text{vj}} = 125\text{ }^{\circ}\text{C}$		2.7	3.2	V
$C_{\text{ies}}$	输入电容 Input capacitance	$V_{\text{CE}} = 25\text{V}, V_{\text{GE}} = 0\text{V}, f = 1\text{MHz}$		135		nF
$Q_{\text{g}}$	栅极电荷 Gate charge	$\pm 15\text{V}$		11.9		$\mu\text{C}$
$C_{\text{res}}$	反向传输电容 Reverse transfer capacitance	$V_{\text{CE}} = 25\text{V}, V_{\text{GE}} = 0\text{V}, f = 1\text{MHz}$		3.4		nF
$L_{\text{M}}$	模块电感 Module inductance			10		nH
$R_{\text{INT}}$	内阻 Internal transistor resistance			90		$\mu\Omega$
$I_{\text{sc}}$	短路电流 Short circuit current, $I_{\text{SC}}$	$T_{\text{vj}} = 125\text{ }^{\circ}\text{C}, V_{\text{CC}} = 3400\text{V},$ $V_{\text{GE}} \leq 15\text{V}, t_{\text{p}} \leq 10\mu\text{s},$ $V_{\text{CE}(\text{max})} = V_{\text{CES}} - L^{(*2)} \times di/dt,$ IEC 60747-9		5300		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 $L_{\text{M}}$ (\*2) indicates L is the circuit stray inductance plus  $L_{\text{M}}$ ).

**电特性值**
**Electrical Characteristics**

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 $T_{\text{case}} = 25\text{ }^{\circ}\text{C}$  unless stated otherwise

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)	
$t_{d(\text{off})}$	关断延迟时间 Turn-off delay time	$I_C = 1200\text{A}$ $V_{CE} = 2800\text{V}$ $C_{ge} = 220\text{nF}$ $L \sim 180\text{nH}$ $V_{GE} = \pm 15\text{V}$ $R_{G(\text{ON})} = 1.5\Omega$ $R_{G(\text{OFF})} = 2.7\Omega$		2700		ns	
$t_f$	下降时间 Fall time			700		ns	
$E_{\text{OFF}}$	关断损耗 Turn-off energy loss				5800		mJ
$t_{d(\text{on})}$	开通延迟时间 Turn-on delay time				720		ns
$t_r$	上升时间 Rise time				270		ns
$E_{\text{ON}}$	开通损耗 Turn-on energy loss				3200		mJ
$Q_{rr}$	二极管反向恢复电荷 Diode reverse recovery charge	$I_F = 1200\text{A}$ $V_{CE} = 2800\text{V}$ $di_F/dt = 5000\text{A/us}$		1200		$\mu\text{C}$	
$I_{rr}$	二极管反向恢复电流 Diode reverse recovery current			1350		A	
$E_{\text{rec}}$	二极管反向恢复损耗 Diode reverse recovery energy				1750		mJ

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 $T_{\text{case}} = 125\text{ }^{\circ}\text{C}$  unless stated otherwise

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)	
$t_{d(\text{off})}$	关断延迟时间 Turn-off delay time	$I_C = 1200\text{A}$ $V_{CE} = 2800\text{V}$ $C_{ge} = 220\text{nF}$ $L \sim 180\text{nH}$ $V_{GE} = \pm 15\text{V}$ $R_{G(\text{ON})} = 1.5\Omega$ $R_{G(\text{OFF})} = 2.7\Omega$		2650		ns	
$t_f$	下降时间 Fall time			720		ns	
$E_{\text{OFF}}$	关断损耗 Turn-off energy loss				6250		mJ
$t_{d(\text{on})}$	开通延迟时间 Turn-on delay time				740		ns
$t_r$	上升时间 Rise time				290		ns
$E_{\text{ON}}$	开通损耗 Turn-on energy loss				4560		mJ
$Q_{rr}$	二极管反向恢复电荷 Diode reverse recovery charge	$I_F = 1200\text{A}$ $V_{CE} = 2800\text{V}$ $di_F/dt = 5000\text{A/us}$		1980		$\mu\text{C}$	
$I_{rr}$	二极管反向恢复电流 Diode reverse recovery current			1720		A	
$E_{\text{rec}}$	二极管反向恢复损耗 Diode reverse recovery energy				3250		mJ

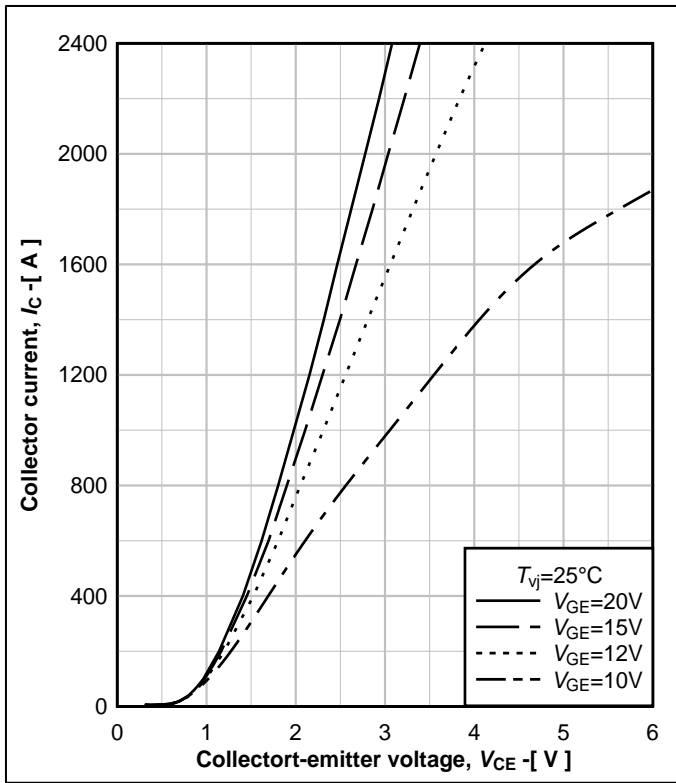


图3. 输出特性典型曲线

Fig.3 Typical output characteristics

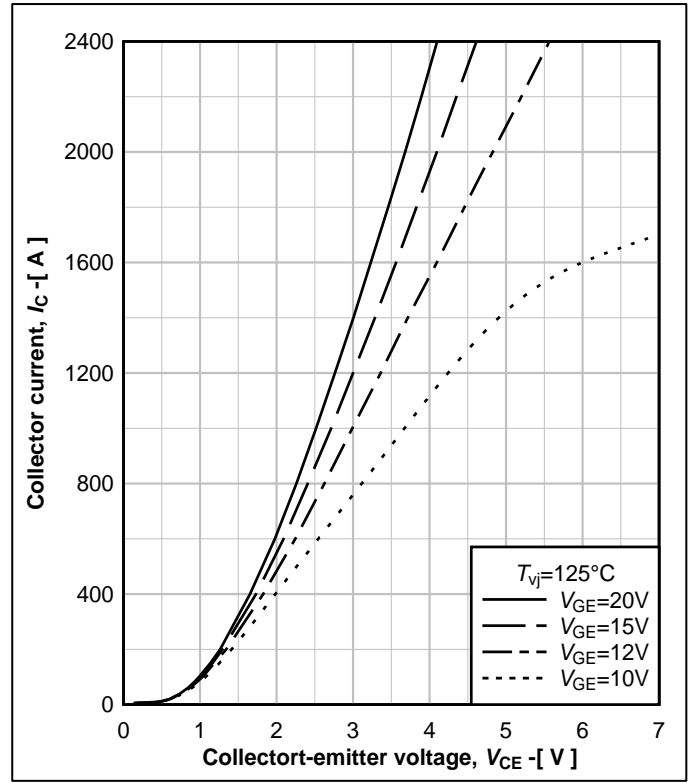


图4. 输出特性典型曲线

Fig.4 Typical output characteristics

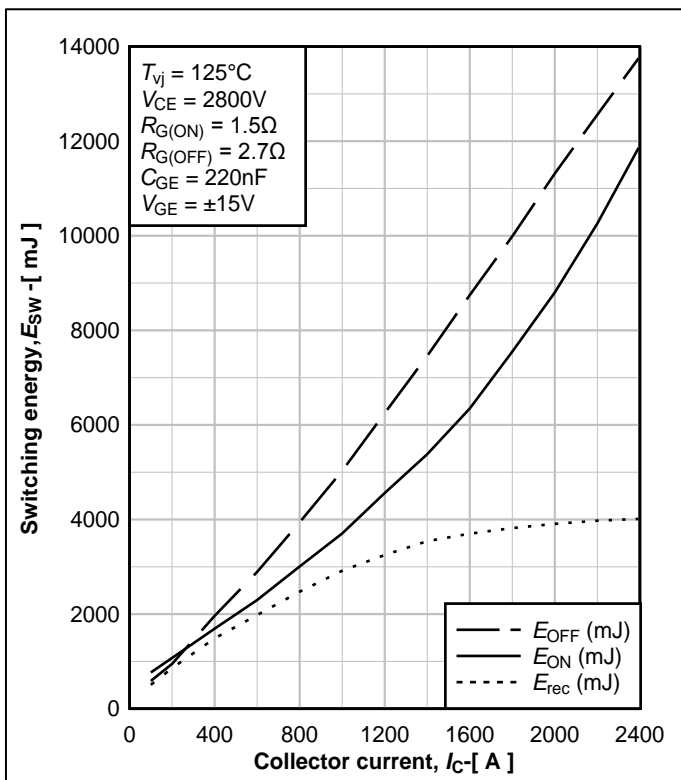


图5. 开关能耗与集电极电流关系曲线

Fig.5 Typical switching energy vs collector current

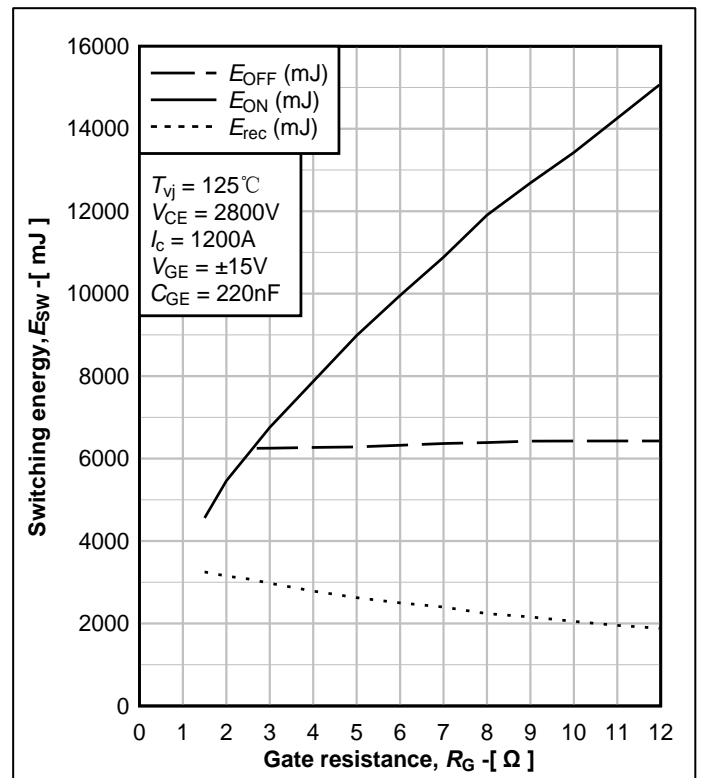


图6. 开关能耗与栅极电阻的关系曲线

Fig. 6 Typical switching energy vs gate resistance

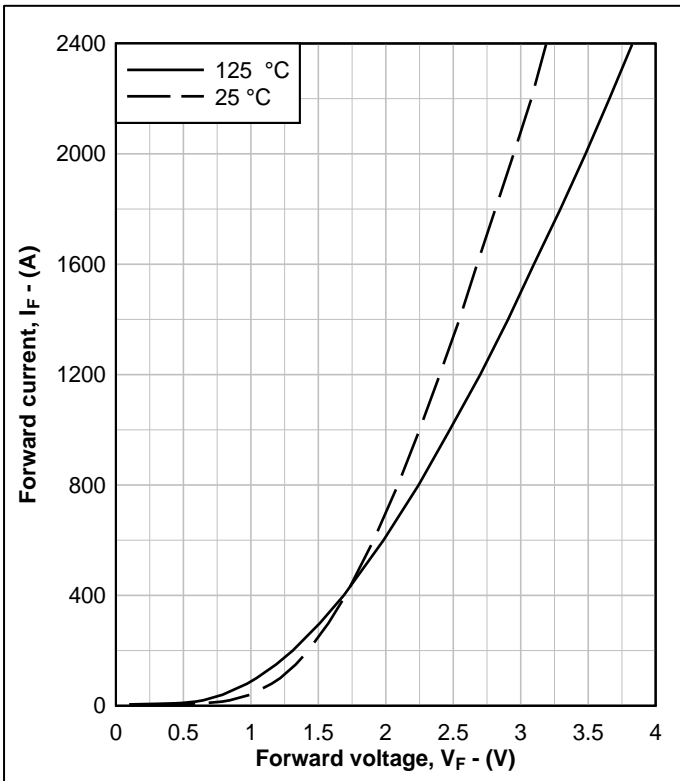


图7. 二极管正向特性典型曲线

Fig.7 Diode typical forward characteristics

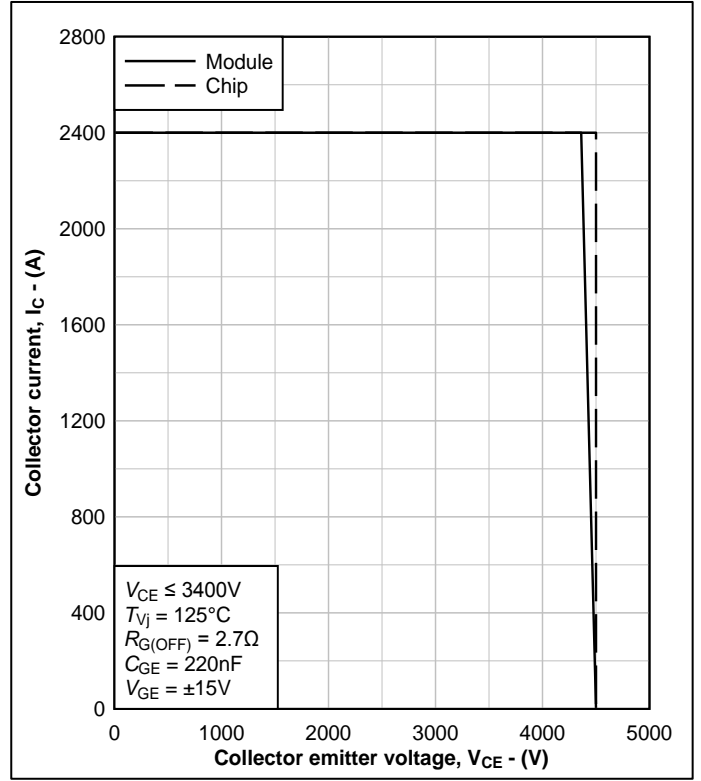


图8. 反偏安全工作区

Fig.8 Reverse bias safe operating area

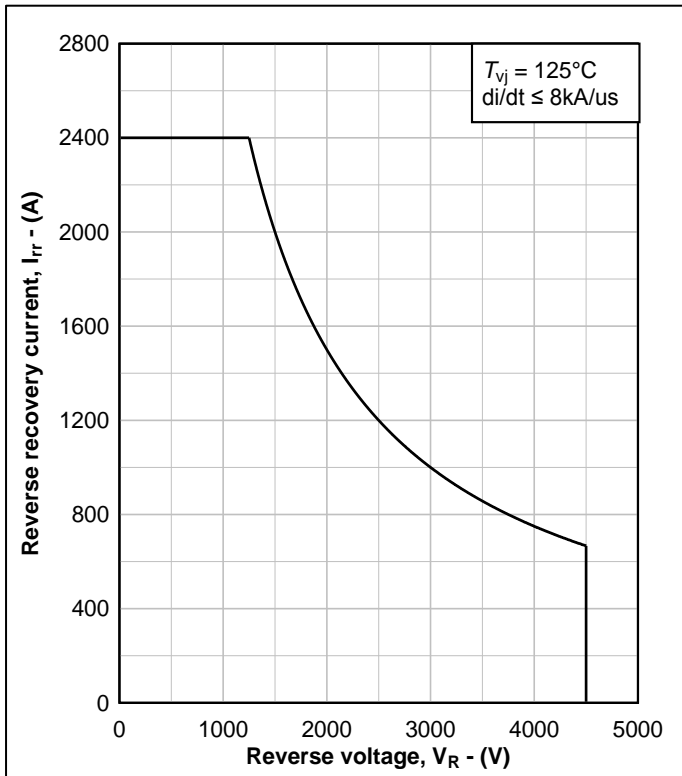


图9. 二极管反偏安全工作区

Fig.9 Diode reverse bias safe operating area

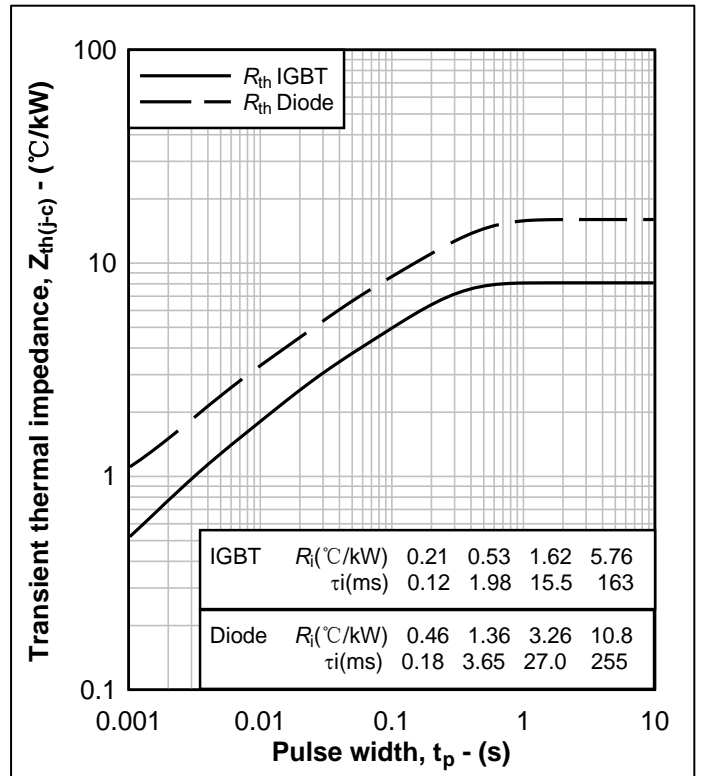
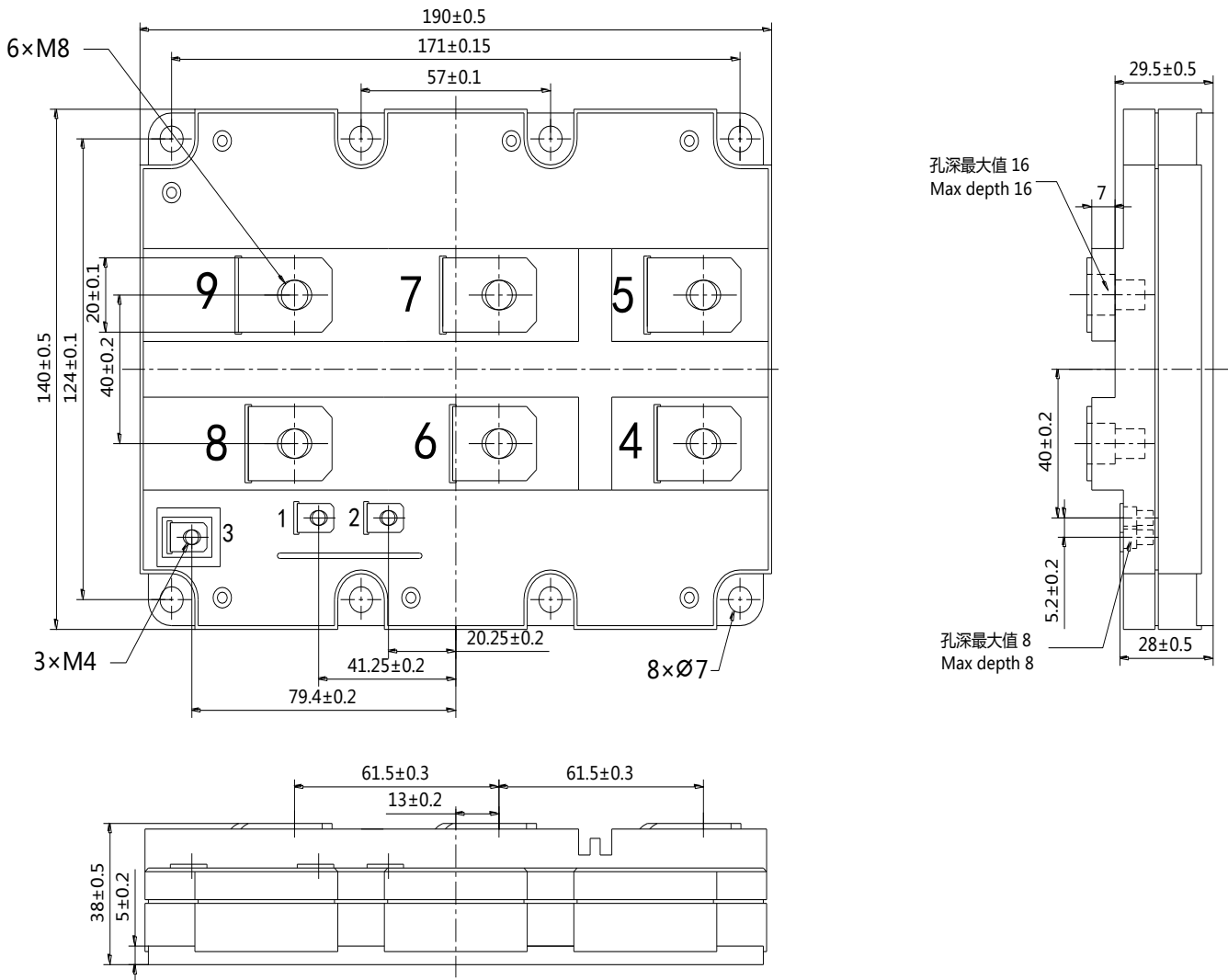


图10. 瞬态热阻抗曲线

Fig. 10 Transient thermal impedance



重量Weight: 1400g

模块外观类型 Module outline code: E

图11. 模块外观尺寸

Fig. 11 Module outline drawing

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