

关键参数 Key Parameters

V_{CES}		1700	V
$V_{CE(sat)}$	(typ)	1.75	V
I_C	(max)	2400	A
$I_{C(RM)}$	(max)	4800	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

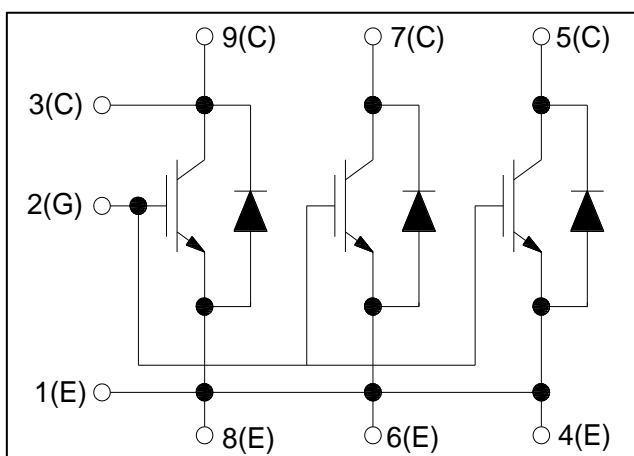
电路结构 Circuit Configuration

 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--12	模块产品编码 Module product code

TIM2400ESM17-TSA000
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	$V_{GE} = 0V, T_{vj} = 25\text{ }^{\circ}\text{C}$	1700	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	$T_{case} = 100\text{ }^{\circ}\text{C}, T_{vj} = 150\text{ }^{\circ}\text{C}$	2400	A
$I_{C(PK)}$	集电极峰值电流 Peak collector current	$t_p = 1ms$	4800	A
P_{max}	晶体管部分最大损耗 Max. transistor power dissipation	$T_{vj} = 150\text{ }^{\circ}\text{C}, T_{case} = 25\text{ }^{\circ}\text{C}$	20.8	kW
I^2t	二极管 I^2t 值 Diode I^2t	$V_R = 0V, t_p = 10ms, T_{vj} = 150\text{ }^{\circ}\text{C}$	TBD	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	4000	V
Q_{PD}	局部放电电荷(模块) Partial discharge – per module	IEC1287. V1 = 1800V, V2 = 1300V, 50Hz 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		6	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		12	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 °C) Mounting torque 5Nm (with mounting grease 1W/m \cdot °C)		6	K / kW
T_{vj}	结温 Junction temperature	IGBT部分 (IGBT)		150	°C
		二极管部分(Diode)		150	°C
T_{stg}	存储温度 Storage temperature range		-40	150	°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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 $T_{\text{case}} = 25\text{ }^{\circ}\text{C}$ unless stated otherwise

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	$V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = V_{\text{CES}}$			1	mA
		$V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = V_{\text{CES}}, T_{\text{case}} = 125\text{ }^{\circ}\text{C}$			40	mA
		$V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = V_{\text{CES}}, T_{\text{case}} = 150\text{ }^{\circ}\text{C}$			60	mA
I_{GES}	栅极漏电流 Gate leakage current	$V_{\text{GE}} = \pm 20\text{V}, V_{\text{CE}} = 0\text{V}$			1	μA
$V_{\text{GE(TH)}}$	栅极-发射极阈值电压 Gate threshold voltage	$I_{\text{C}} = 80\text{mA}, V_{\text{GE}} = V_{\text{CE}}$	5.0	6.0	7.0	V
$V_{\text{CE(sat)}}^{(*1)}$	集电极-发射极饱和电压 Collector-emitter saturation voltage	$V_{\text{GE}} = 15\text{V}, I_{\text{C}} = 2400\text{A}$		1.75		V
		$V_{\text{GE}} = 15\text{V}, I_{\text{C}} = 2400\text{A}, T_{\text{vj}} = 125\text{ }^{\circ}\text{C}$		1.95		V
		$V_{\text{GE}} = 15\text{V}, I_{\text{C}} = 2400\text{A}, T_{\text{vj}} = 150\text{ }^{\circ}\text{C}$		2.05		V
I_{F}	二极管正向直流电流 Diode forward current	DC		2400		A
I_{FRM}	二极管正向重复峰值电流 Diode maximum forward current	$t_{\text{P}} = 1\text{ms}$		4800		A
$V_{\text{F}}^{(*1)}$	二极管正向电压 Diode forward voltage	$I_{\text{F}} = 2400\text{A}$		1.65		V
		$I_{\text{F}} = 2400\text{A}, T_{\text{vj}} = 125\text{ }^{\circ}\text{C}$		1.75		V
		$I_{\text{F}} = 2400\text{A}, T_{\text{vj}} = 150\text{ }^{\circ}\text{C}$		1.75		V
C_{ies}	输入电容 Input capacitance	$V_{\text{CE}} = 25\text{V}, V_{\text{GE}} = 0\text{V}, f = 1\text{MHz}$		400		nF
Q_{g}	栅极电荷 Gate charge	$\pm 15\text{V}$		19		μC
C_{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		nF
L_{M}	模块电感 Module inductance			10		nH
R_{INT}	内阻 Internal transistor resistance			110		$\mu\Omega$
I_{SC}	短路电流 Short circuit current, I_{SC}	$T_{\text{vj}} = 150\text{ }^{\circ}\text{C}, V_{\text{CC}} = 1000\text{V},$ $V_{\text{GE}} \leq 15\text{V}, t_{\text{p}} \leq 10\mu\text{s},$ $V_{\text{CE(max)}} = V_{\text{CES}} - L^{(*2)} \times di/dt,$ IEC 6074-9		12000		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}).

电特性值
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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	$I_C = 2400\text{A}$ $V_{CE} = 900\text{V}$ $L_S \sim 50\text{nH}$ $V_{GE} = \pm 15\text{V}$ $R_{G(ON)} = 0.5\Omega$ $R_{G(OFF)} = 0.5\Omega$		2320		ns	
t_f	下降时间 Fall time			500		ns	
E_{OFF}	关断损耗 Turn-off energy loss				1050		mJ
$t_{d(on)}$	开通延迟时间 Turn-on delay time				450		ns
t_r	上升时间 Rise time				210		ns
E_{ON}	开通损耗 Turn-on energy loss				410		mJ
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	$I_F = 2400\text{A}$ $V_{CE} = 900\text{V}$ $di_F/dt = 10000\text{A/us}$		480		μC	
I_{rr}	二极管反向恢复电流 Diode reverse recovery current				1000		A
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy				320		mJ

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 $T_{case} = 125\text{ }^{\circ}\text{C}$ 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)	
$t_{d(off)}$	关断延迟时间 Turn-off delay time	$I_C = 2400\text{A}$ $V_{CE} = 900\text{V}$ $L_S \sim 50\text{nH}$ $V_{GE} = \pm 15\text{V}$ $R_{G(ON)} = 0.5\Omega$ $R_{G(OFF)} = 0.5\Omega$		2340		ns	
t_f	下降时间 Fall time			510		ns	
E_{OFF}	关断损耗 Turn-off energy loss				1320		mJ
$t_{d(on)}$	开通延迟时间 Turn-on delay time				450		ns
t_r	上升时间 Rise time				220		ns
E_{ON}	开通损耗 Turn-on energy loss				660		mJ
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	$I_F = 2400\text{A}$ $V_{CE} = 900\text{V}$ $di_F/dt = 10000\text{A/us}$		750		μC	
I_{rr}	二极管反向恢复电流 Diode reverse recovery current				1200		A
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy				550		mJ

电特性值
Electrical Characteristics

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 $T_{\text{case}} = 150\text{ }^{\circ}\text{C}$ 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	$I_C = 2400\text{A}$ $V_{CE} = 900\text{V}$ $L_S \sim 50\text{nH}$ $V_{GE} = \pm 15\text{V}$ $R_{G(\text{ON})} = 0.5\Omega$ $R_{G(\text{OFF})} = 0.5\Omega$		2340		ns
t_f	下降时间 Fall time			510		ns
E_{OFF}	关断损耗 Turn-off energy loss			1400		mJ
$t_{d(\text{on})}$	开通延迟时间 Turn-on delay time			450		ns
t_r	上升时间 Rise time			220		ns
E_{ON}	开通损耗 Turn-on energy loss			820		mJ
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	$I_F = 2400\text{A}$ $V_{CE} = 900\text{V}$ $di_F/dt = 12000\text{A/us}$		820		μC
I_{rr}	二极管反向恢复电流 Diode reverse recovery current			1250		A
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy			620		mJ

TIM2400ESM17-TSA000

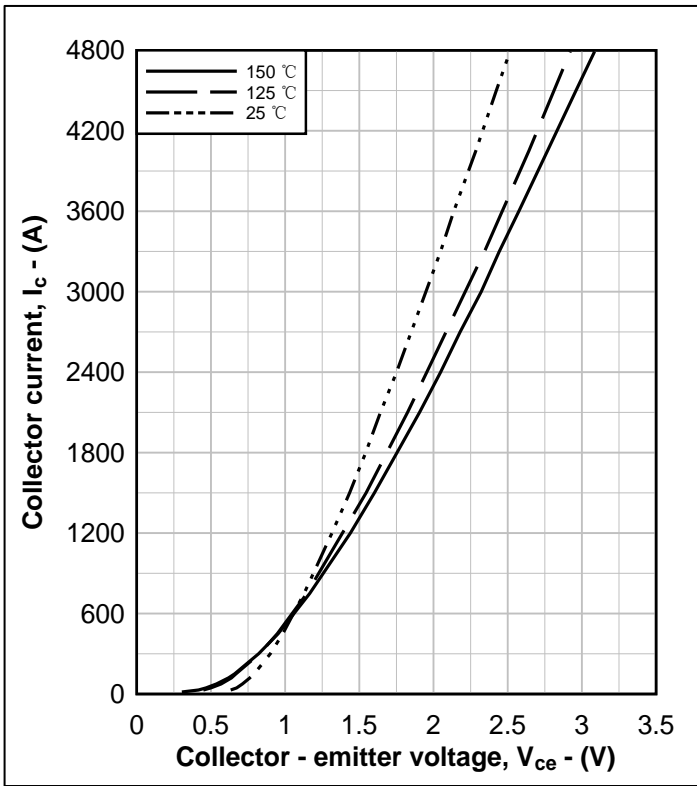


图3. 输出特性典型曲线

Fig.3 Typical output characteristics

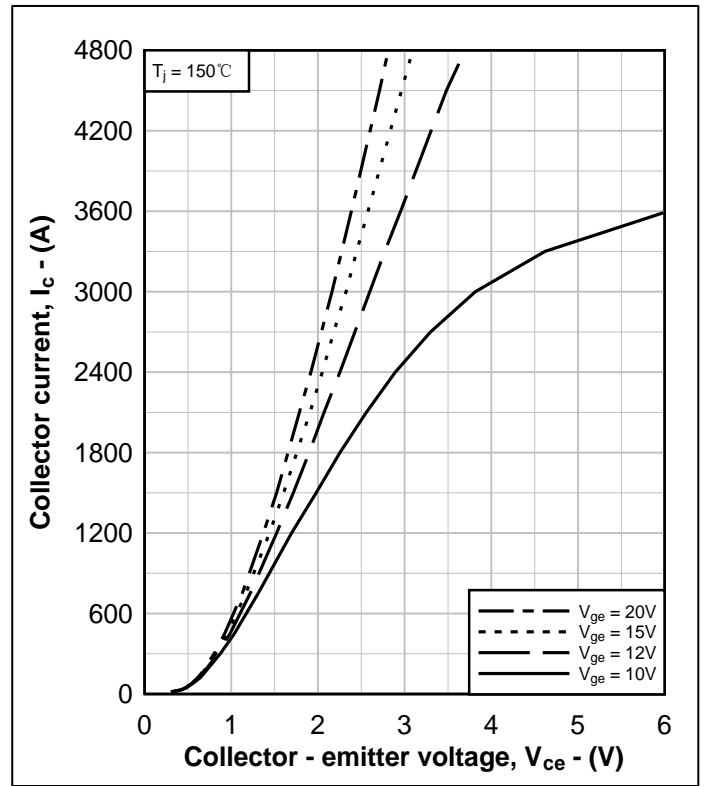


图4. 输出特性典型曲线

Fig.4 Typical output characteristics

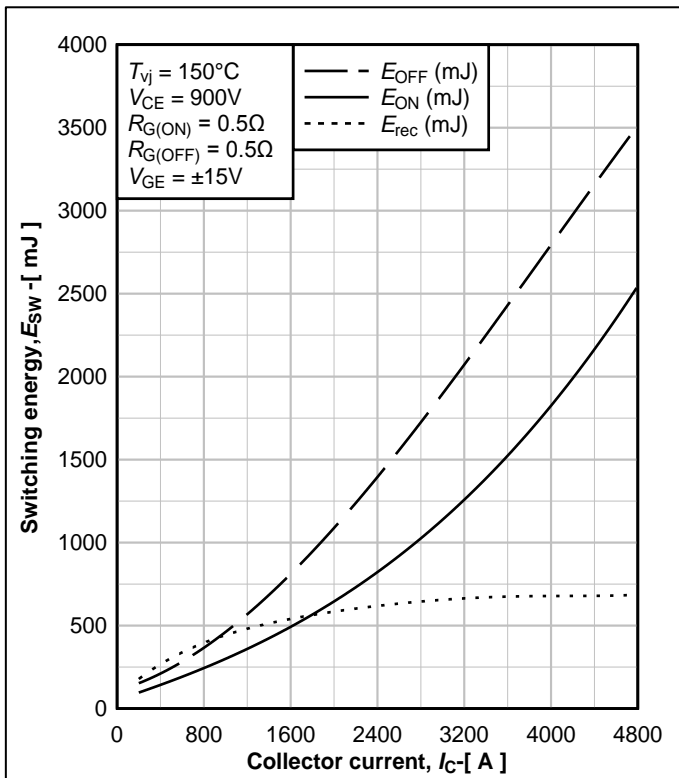


图5. 开关能耗与集电极电流关系曲线

Fig.5 Typical switching energy vs collector current

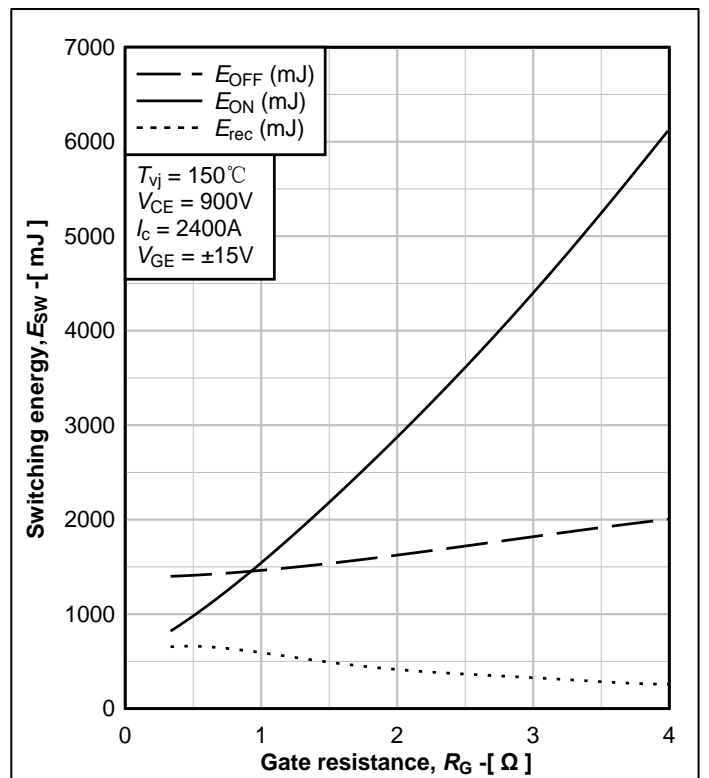


图6. 开关能耗与栅极电阻的关系曲线

Fig. 6 Typical switching energy vs gate resistance

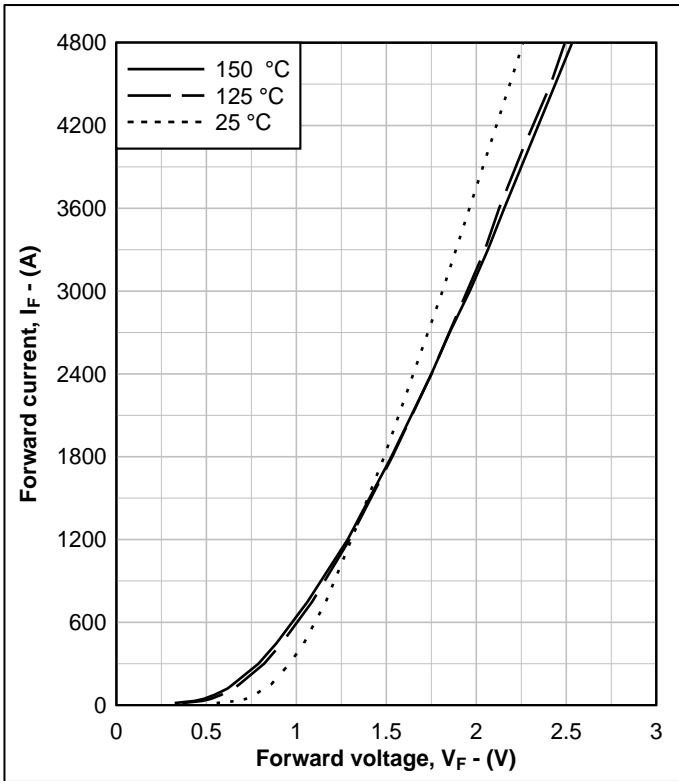


图7. 二极管正向特性典型曲线
Fig.7 Diode typical forward characteristics

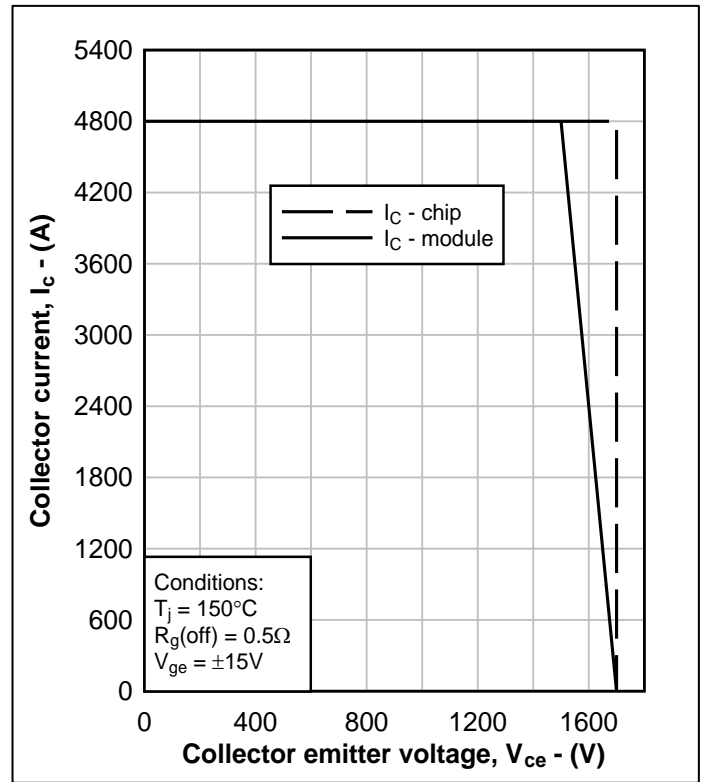
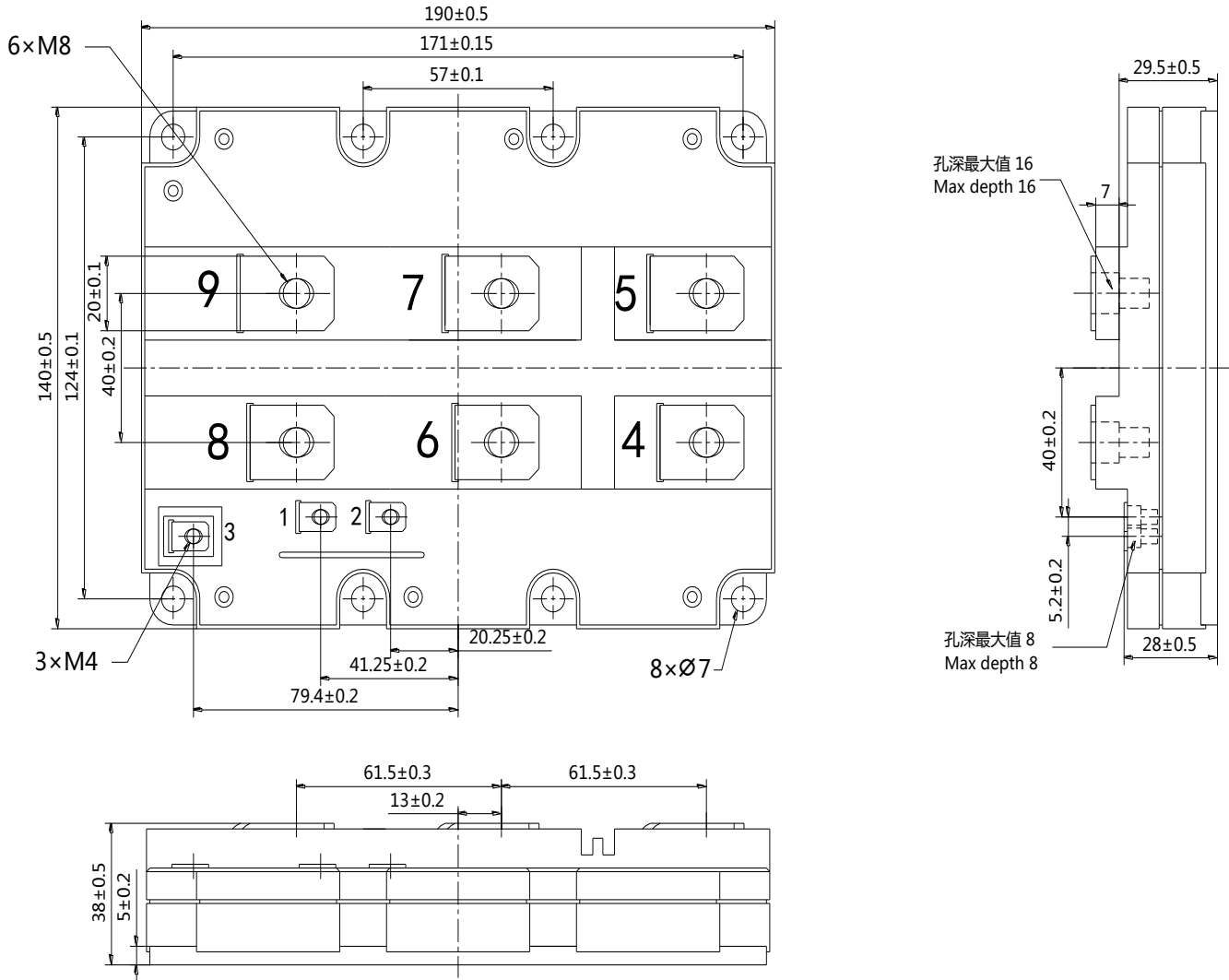


图8. 反偏安全工作区
Fig.8 Reverse bias safe operating area



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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