

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 $\mu$ 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

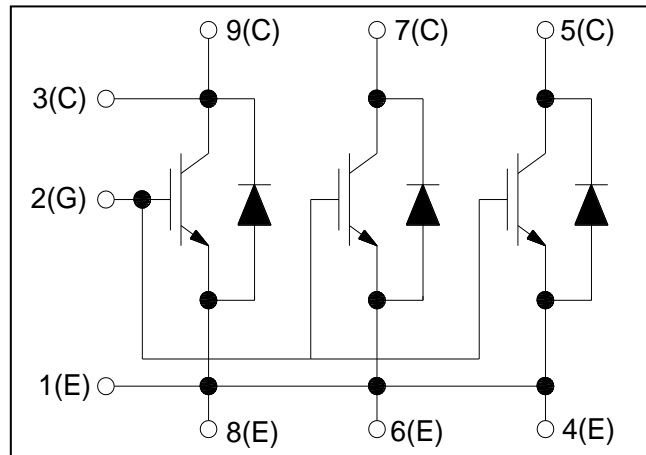
**电路结构 Circuit Configuration**

 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**

**ab1234567890**
**Module Label code**

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

**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		$\pm 20$	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	$T_{vj} = 150\text{ }^{\circ}\text{C}, T_{case} = 25\text{ }^{\circ}\text{C}$	19.2	kW
$I^2t$	二极管 $I^2t$ 值 Diode $I^2t$	$V_R = 0V, t_p = 10ms, T_{vj} = 150\text{ }^{\circ}\text{C}$	1170	$\text{kA}^2\text{s}$
$V_{isol}$	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	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		6.5	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		13	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)		150	$^{\circ}\text{C}$
		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

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

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 $T_{case} = 25\text{ }^{\circ}\text{C}$  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	$V_{GE} = 0V, V_{CE} = V_{CES}$			1	mA
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{case} = 125\text{ }^{\circ}\text{C}$			40	mA
		$V_{GE} = 0V, V_{CE} = V_{CES}, T_{case} = 150\text{ }^{\circ}\text{C}$			60	mA
$I_{GES}$	栅极漏电流 Gate leakage current	$V_{GE} = \pm 20V, V_{CE} = 0V$			1	$\mu\text{A}$
$V_{GE(TH)}$	栅极-发射极阈值电压 Gate threshold voltage	$I_C = 80\text{mA}, V_{GE} = V_{CE}$	5.0	6.0	7.0	V
$V_{CE(sat)}^{(*1)}$	集电极-发射极饱和电压 Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 2400A$		1.75		V
		$V_{GE} = 15V, I_C = 2400A, T_{vj} = 125\text{ }^{\circ}\text{C}$		1.95		V
		$V_{GE} = 15V, I_C = 2400A, T_{vj} = 150\text{ }^{\circ}\text{C}$		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	$t_P = 1\text{ms}$		4800		A
$V_F^{(*1)}$	二极管正向电压 Diode forward voltage	$I_F = 2400A$		1.65		V
		$I_F = 2400A, T_{vj} = 125\text{ }^{\circ}\text{C}$		1.75		V
		$I_F = 2400A, T_{vj} = 150\text{ }^{\circ}\text{C}$		1.75		V
$C_{ies}$	输入电容 Input capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 1\text{MHz}$		400		nF
$Q_g$	栅极电荷 Gate charge	$\pm 15V$		19		$\mu\text{C}$
$C_{res}$	反向传输电容 Reverse transfer capacitance	$V_{CE} = 25V, V_{GE} = 0V, f = 1\text{MHz}$		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, $I_{SC}$	$T_{vj} = 150\text{ }^{\circ}\text{C}, V_{CC} = 1000V,$ $V_{GE} \leq 15V, t_p \leq 10\mu\text{s},$ $V_{CE(max)} = V_{CES} - L^{(*2)} \times di/dt,$ 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  $L_M$ ).

**TIM2400ESM17-TSA000**
**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	$I_C = 2400\text{A}$ $V_{CE} = 900\text{V}$ $L_S \sim 50\text{nH}$ $V_{GE} = \pm 15\text{V}$ $R_{G(\text{ON})} = 0.5\Omega$ $R_{G(\text{OFF})} = 0.5\Omega$		2320		ns	
$t_f$	下降时间 Fall time			500		ns	
$E_{\text{OFF}}$	关断损耗 Turn-off energy loss				1050		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				210		ns
$E_{\text{ON}}$	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		$\mu\text{C}$	
$I_{rr}$	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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 $T_{\text{case}} = 125\text{ }^{\circ}\text{C}$  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	$I_C = 2400\text{A}$ $V_{CE} = 900\text{V}$ $L_S \sim 50\text{nH}$ $V_{GE} = \pm 15\text{V}$ $R_{G(\text{ON})} = 0.5\Omega$ $R_{G(\text{OFF})} = 0.5\Omega$		2340		ns	
$t_f$	下降时间 Fall time			510		ns	
$E_{\text{OFF}}$	关断损耗 Turn-off energy loss				1320		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
$E_{\text{ON}}$	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		$\mu\text{C}$	
$I_{rr}$	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)
$t_{\text{d(off)}}$	关断延迟时间 Turn-off delay time	$I_{\text{C}} = 2400\text{A}$ $V_{\text{CE}} = 900\text{V}$ $L_{\text{S}} \sim 50\text{nH}$ $V_{\text{GE}} = \pm 15\text{V}$ $R_{\text{G(ON)}} = 0.5\Omega$ $R_{\text{G(OFF)}} = 0.5\Omega$		2340		ns
$t_{\text{f}}$	下降时间 Fall time			510		ns
$E_{\text{OFF}}$	关断损耗 Turn-off energy loss			1400		mJ
$t_{\text{d(on)}}$	开通延迟时间 Turn-on delay time			450		ns
$t_{\text{r}}$	上升时间 Rise time			220		ns
$E_{\text{ON}}$	开通损耗 Turn-on energy loss			820		mJ
$Q_{\text{rr}}$	二极管反向恢复电荷 Diode reverse recovery charge		$I_{\text{F}} = 2400\text{A}$ $V_{\text{CE}} = 900\text{V}$ $di_{\text{F}}/dt = 12000\text{A}/\mu\text{s}$		820	
$I_{\text{rr}}$	二极管反向恢复电流 Diode reverse recovery current			1250		A
$E_{\text{rec}}$	二极管反向恢复损耗 Diode reverse recovery energy			620		mJ

TIM2400ESM17-TSA000

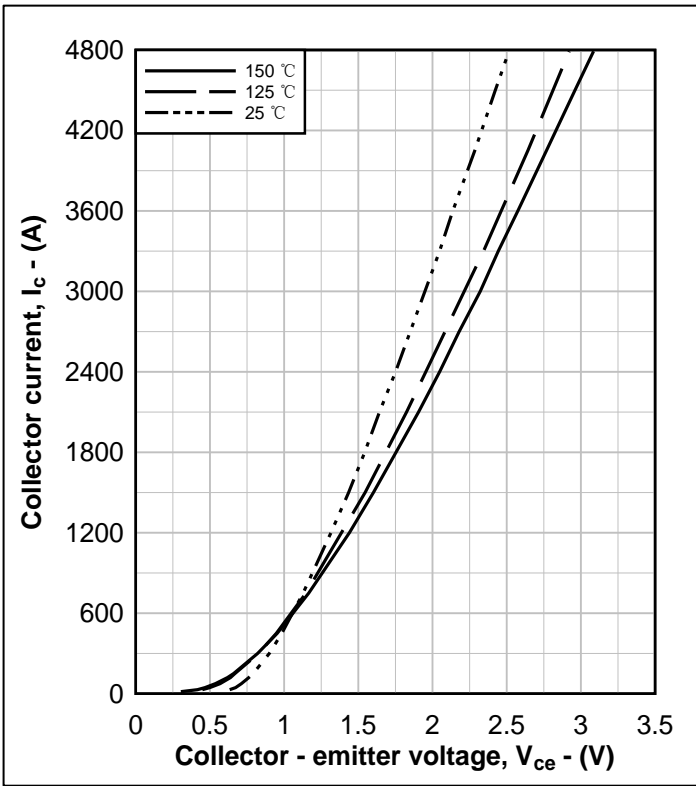


图3. 输出特性典型曲线

Fig.3 Typical output characteristics

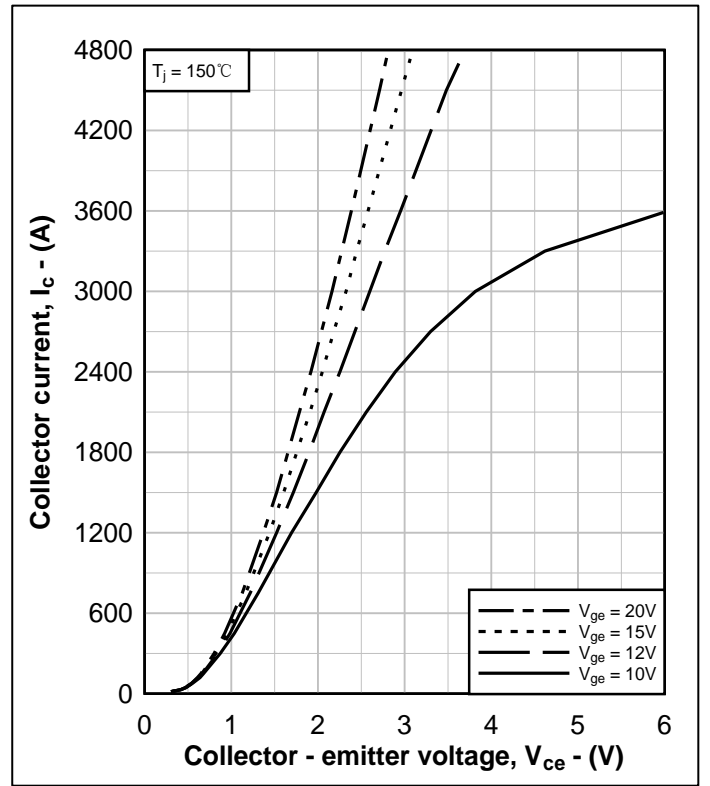


图4. 输出特性典型曲线

Fig.4 Typical output characteristics

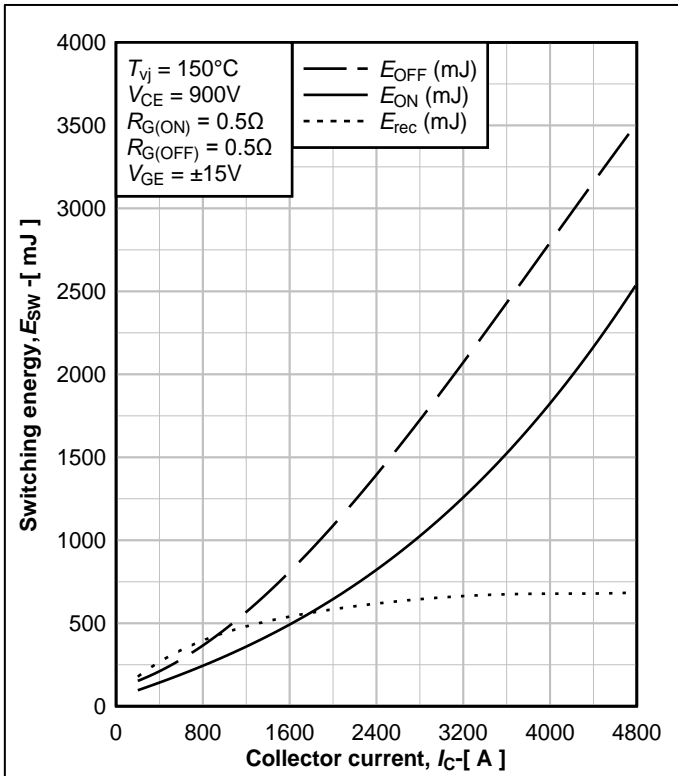


图5. 开关能耗与集电极电流关系曲线

Fig.5 Typical switching energy vs collector current

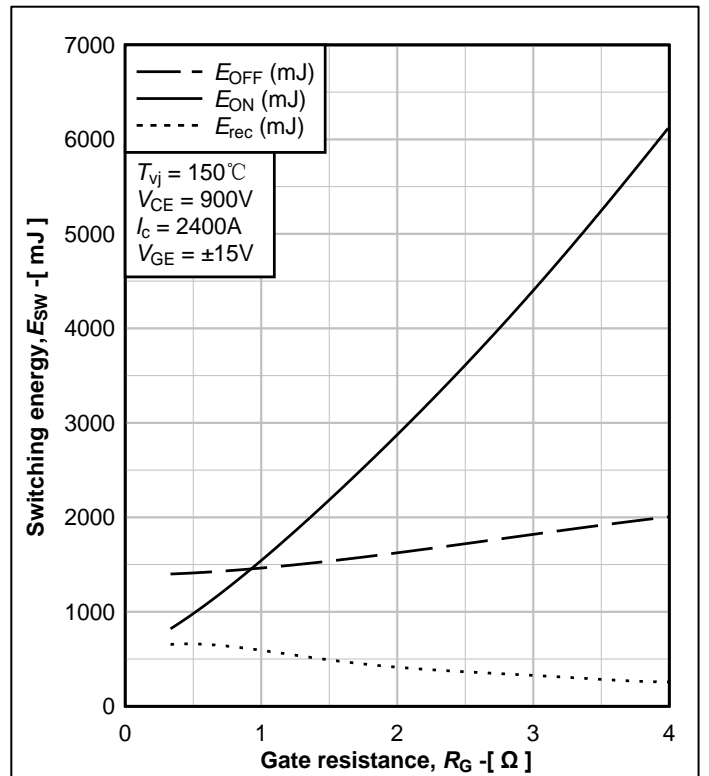


图6. 开关能耗与栅极电阻的关系曲线

Fig. 6 Typical switching energy vs gate resistance

TIM2400ESM17-TSA000

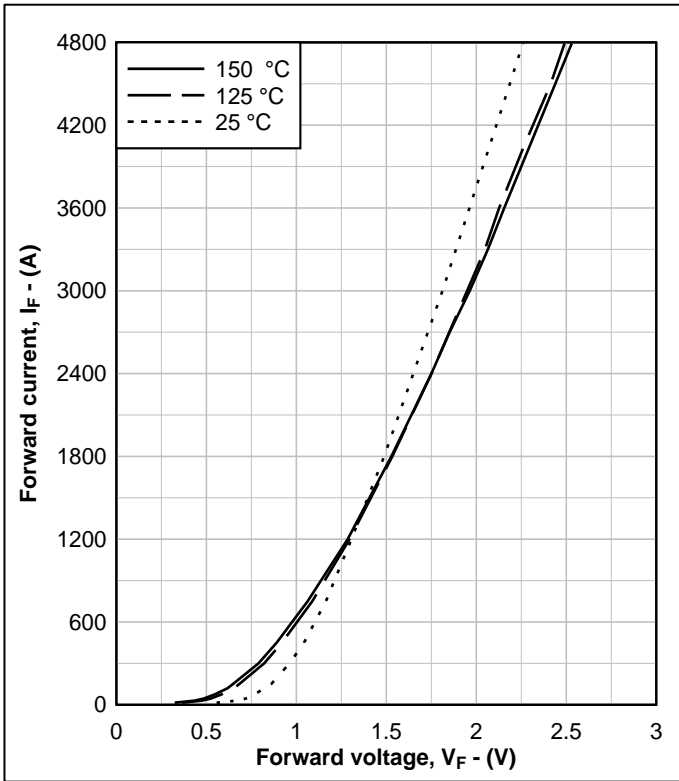


图7. 二极管正向特性典型曲线

Fig.7 Diode typical forward characteristics

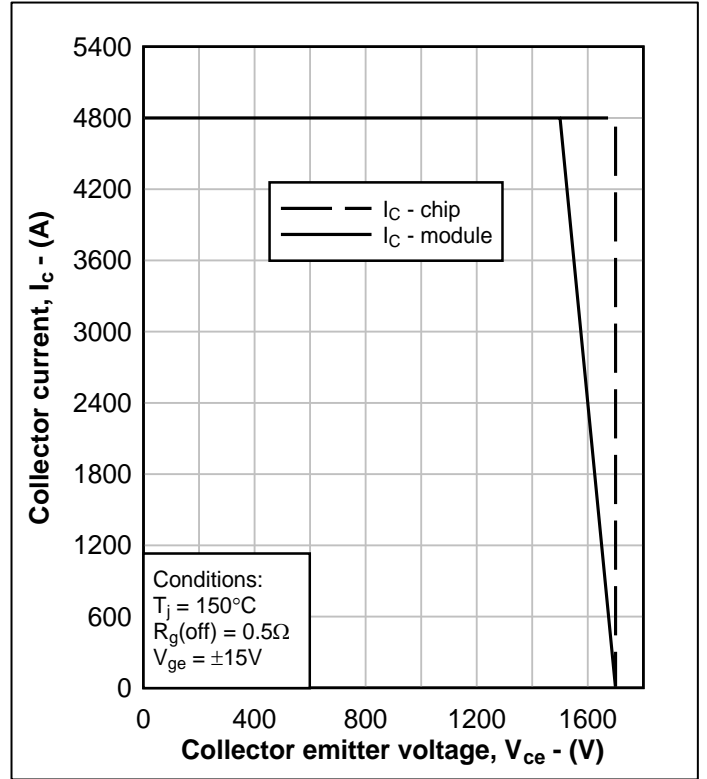


图8. 反偏安全工作区

Fig.8 Reverse bias safe operating area

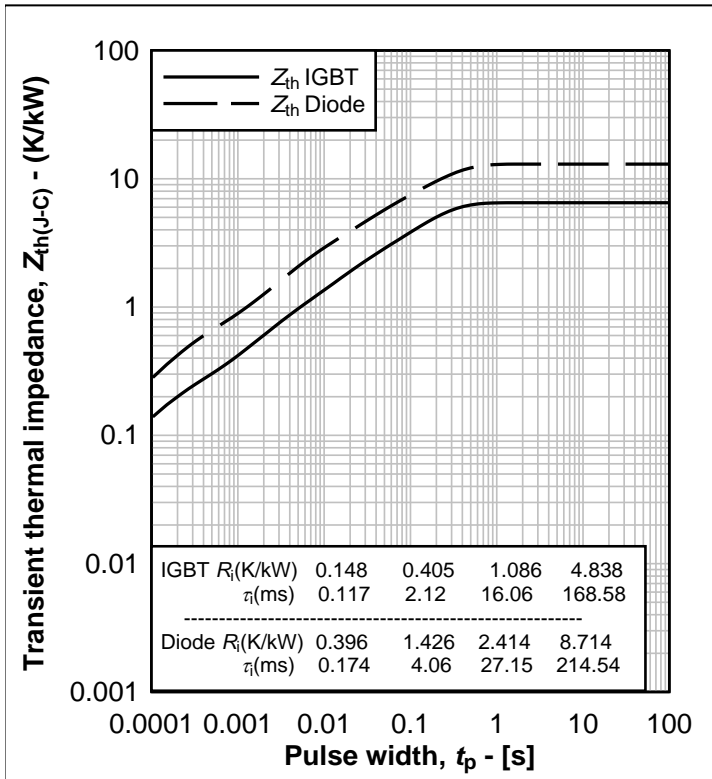
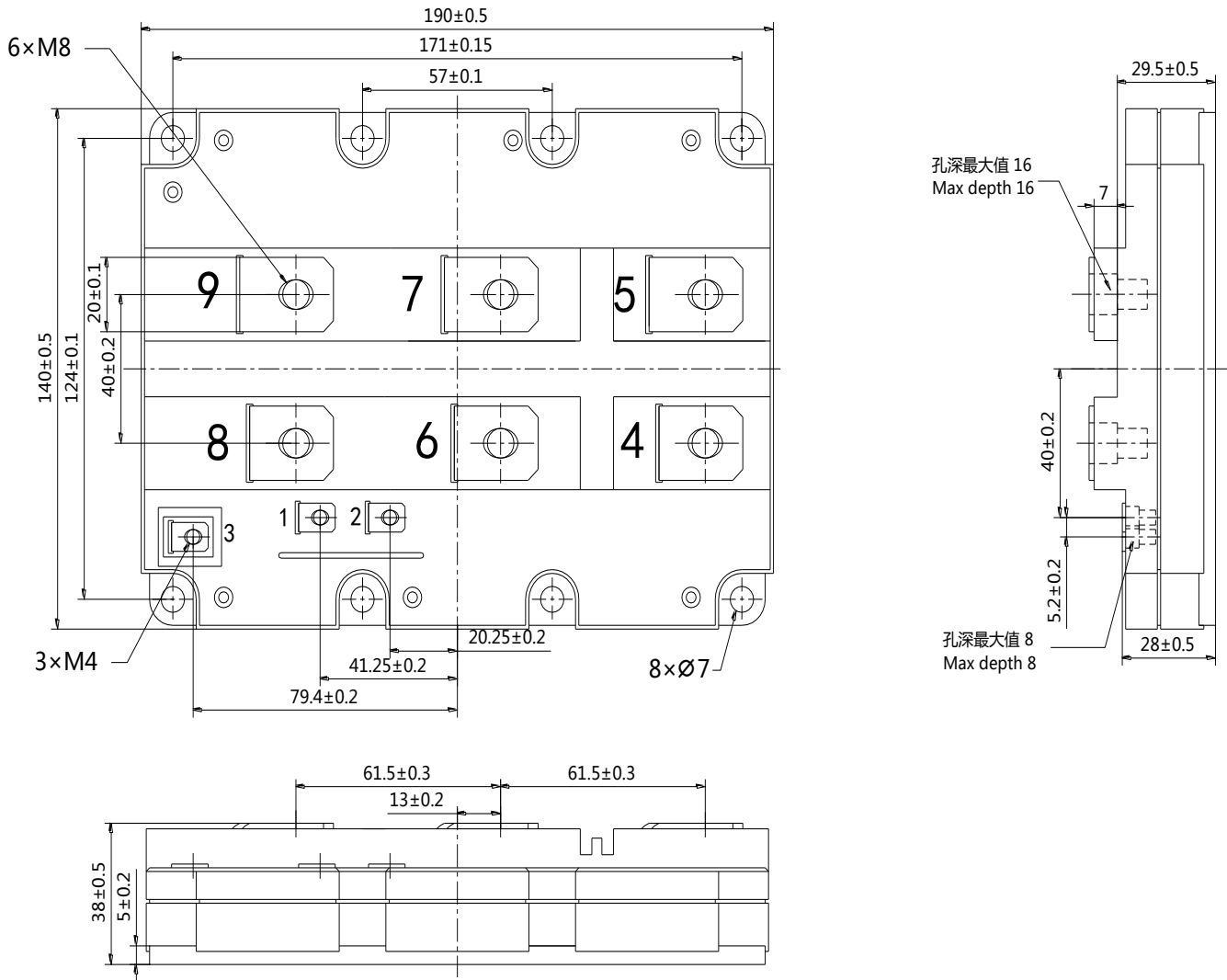


图9. 瞬态热阻抗曲线

Fig. 9 Transient thermal impedance



重量Weight: 1400g

模块外观类型 Module outline code: E

图10. 模块外观尺寸

Fig. 10 Module outline drawing

株洲中车时代半导体有限公司

ZHUZHOU CRRC TIMES SEMICONDUCTOR CO., LTD

地 址	Address	湖南省株洲市石峰区田心工业园	Tianxin Industrial Park, Shifeng District, ZhuZhou City, Hunan Province, China
邮 编	Zipcode	412001	
电 话	Telephone	0731-28498268, 28498238, 28493472	
传 真	Fax	0731-28498851, 28498494	
电子邮箱	Email	pebu@csrzc.com	
网 址	Web Site	http://www.pebu.csrzc.com	



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