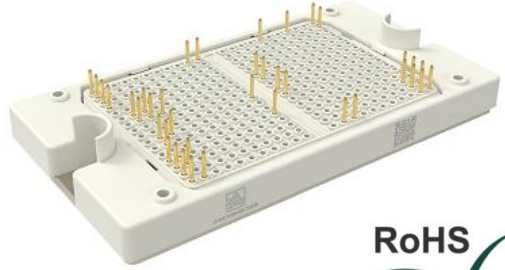

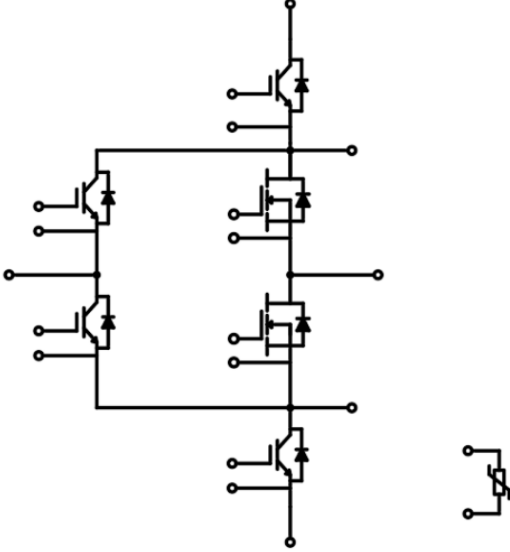


ACP-3S I型三电平ANPC逆变模块
ACP-3S I Type 3-Level ANPC Inverter Module

特性	Features
<ul style="list-style-type: none"> 中性点三电平逆变模块 Neutral Point Clamped Three-level Inverter Module 低电感布局 Low Inductive Layout 低$R_{DS(on)}$/低开关损耗 Low $R_{DS(on)}$ / Low Switching Losses 紧凑型设计 Compact Design 带铜基板 With Copper Baseplate 	

模块外观	Module Appearance
	
	

应用	Application
<ul style="list-style-type: none"> 三电平应用/3-Level-Applications 储能/PCS 太阳能系统/Solar Applications 	

电路拓扑	Circuit Topology
	

关键参数[M2&M3]		Key Parameters		
Parameter	Symbol	Value	Unit	
漏极-源极电压 Drain-Source Voltage	V_{DSS}	1200	V	
漏极电流 Continuous Drain Current	I_{DN}	580	A	
漏极重复峰值电流 Drain Repeat Peak Current	I_{DRM}	1160	A	
导通电阻 Static Drain-source On Resistance	$T_{vj}=25^{\circ}C$	$R_{DS(on)}$	2.4	mΩ
	$T_{vj}=150^{\circ}C$		3.8	
结-散热器热阻 Thermal resistance	R_{thJH}	0.184	K/W	
开通损耗能量 Turn-on energy	$T_{vj}=25^{\circ}C$	E_{on}	6.49	mJ
	$T_{vj}=150^{\circ}C$		5.71	
关断损耗能量 Turn-off energy	$T_{vj}=25^{\circ}C$	E_{off}	6.75	mJ
	$T_{vj}=150^{\circ}C$		8.18	

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封装/Package

表 1 绝缘参数/Insulation coordination

Parameter	Conditions	Symbol	Value	Unit
绝缘测试电压 Isolation test voltage	DC, t = 3s	V_{ISOL}	4.2	kV
	RMS, f = 50Hz, t = 60s		3.2	
模块基板材料 Material of module baseplate			Cu	
内部绝缘 Internal isolation	基本绝缘 (class 1, IEC 61140) Basic insulation (class 1, IEC 61140)		Al ₂ O ₃	
爬电距离 Creepage distance		d_{Creep}	> 12.7	mm
电气间隙 Clearance		d_{Clear}	> 12.7	mm
相对电痕指数 Comparative tracking index		CTI	≥ 600	

表 2 特征值/Characteristic values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
杂散电感, 模块 Stray inductance module		L_{sCE}		39		nH
储存温度 Storage temperature		T_{stg}	-40		125	°C
允许开关的温度范围 Temperature under switching conditions		$T_{vj(op)}$	-40		150	°C
重量 Weight		G		260		g

IGBT/ T1&T4&T5&T6

表 3 最大标定值/Maximum rated values

Parameter	Conditions	Symbol	Value	Unit
集电极-发射极电压 Collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{CES}	1050	V
连续集电极直流电流 Continuous DC collector current	$T_H = 80^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	I_{CDC}	180	A
集电极重复峰值电流 Repetitive peak collector current	t_p limited by $T_{vj\max}$	I_{CRM}	400	A
总耗散功率 Total Power dissipation	$T_H = 80^{\circ}\text{C}, T_{vj} = T_{vj\max}$	P_{tot}	218	W
栅极-发射极电压 Gate-emitter peak voltage		V_{GES}	+30/-20	V

表 4 特征值/Characteristic values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
集电极-发射极饱和电压 Collector-emitter saturation voltage	$I_C = 200\text{A}, V_{GE} = 15\text{V}$	$V_{CE(sat)}$		1.31		V
				1.40		
				1.43		
栅极阈值电压 Gate threshold voltage	$I_C = 1.0\text{mA}, V_{GE} = V_{CE}, T_{vj} = 25^{\circ}\text{C}$	V_{GEth}		4.80		V
栅极电荷 Gate charge	$V_{GE} = +15/-8\text{V}, V_{CE} = 600\text{V}$	Q_G		1460		nC
输入电容 Input capacitance	$f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$	C_{ies}		55.7		nF
输出电容 Output capacitance	$f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$	C_{oes}		0.98		nF
反向传输电容 Reverse transfer capacitance	$f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$	C_{res}		0.025		nF
集电极-发射极截止电流 Collector-emitter cut-off current	$V_{CE} = 1050\text{V}, V_{GE} = 0\text{V}, T_{vj} = 25^{\circ}\text{C}$	I_{CES}			200	μA
栅极-发射极漏电流 Gate-emitter leakage current	$V_{CE} = 0\text{V}, V_{GE} = 20\text{V}, T_{vj} = 25^{\circ}\text{C}$	I_{GES}			500	nA
结-散热器热阻 Thermal resistance, junction to heatsink	每个IGBT, $\lambda_{grease} = 3.4\text{W}/(\text{m}^{\circ}\text{K})$ Per IGBT, $\lambda_{grease} = 3.4\text{W}/(\text{m}^{\circ}\text{K})$	R_{thJH}		0.434		K/W
最高结温 $T_{vj\max}$		$T_{vj\max}$		175		$^{\circ}\text{C}$

MOSFET/ M2&M3

表 5 最大标定值/Maximum rated values

Parameter	Conditions	Symbol	Value	Unit
漏极-源极电压 Drain-Source Voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{DSS}	1200	V
漏极电流 Continuous Drain Current		I_{DN}	580	A
连续漏极直流电流 Continuous Drain Forward Current	$T_H = 80^{\circ}\text{C}, T_{vj\ max} = 175^{\circ}\text{C}$	I_{DDC}	360	A
漏极重复峰值电流 Drain Repeat Peak Current	t_p limited by $T_{vj\ max}$	I_{DRM}	1160	A
最大栅极-源极电压 Maximum Gate-Source Voltage		$V_{GS\ max}$	-8/+22	V
通态栅极电压 On-state Gate Voltage		$V_{GS\ on}$	+18	V
断态栅极电压 Off-state Gate Voltage		$V_{GS\ off}$	-4	V
总耗散功率 Total Power dissipation	$T_H = 80^{\circ}\text{C}, T_{vj} = T_{vj\ max}$	P_{tot}	516	W

表 6 特征值/Characteristic values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
零栅极电压漏极电流 Zero Gate Voltage Drain Current	$V_{DS} = 1200\text{V}, V_{GS} = 0\text{V}, T_{vj} = 25^{\circ}\text{C}$	I_{DSS}			0.5	mA
栅极-源极漏电流 Gate-Source Leakage Current	$V_{DS} = 0\text{V}, V_{GS} = 18\text{V}, T_{vj} = 25^{\circ}\text{C}$	I_{GSS}			500	nA
栅极阈值电压 Gate Threshold Voltage	$I_D = 140\text{mA}, V_{DS} = V_{GS}, T_{vj} = 25^{\circ}\text{C}$	V_{GSth}		2.9		V
导通电阻 Static Drain-source On Resistance	$I_D = 240\text{A}, V_{GS} = 18\text{V}$	$R_{DS(on)}$	$T_{vj} = 25^{\circ}\text{C}$		2.4	mΩ
			$T_{vj} = 125^{\circ}\text{C}$		3.4	
			$T_{vj} = 150^{\circ}\text{C}$		3.8	
输入电容 Input capacitance	$f = 100\text{KHz}, T_{vj} = 25^{\circ}\text{C}, V_{DS} = 1000\text{V}$ $V_{AC} = 25\text{mV}, V_{GS} = 0\text{V}$	C_{iss}		28.4		nF
输出电容 Output capacitance		C_{oss}		1.28		nF
反向传输电容 Reverse transfer capacitance		C_{rss}		0.06		nF
Coss存储能量 Coss stores energy		E_{oss}		0.95		mJ
总栅极电荷 Total Gate Charge	$V_{DS} = 800\text{V}, I_D = 240\text{A}, V_{GS} = +18/-4\text{V}$	Q_g		1090		nC
栅极-漏极电荷 Gate-Drain Charge		Q_{gd}		220		nC

栅极-源极电荷 Gate-source Charge		Q_{gs}		470		nC
内部栅极电阻 Internal Gate Resistance	$f = 1\text{MHz}$	R_{Gint}		0.5		Ω
开通延迟时间（感性负载） Turn-on delay time (inductive load)		$t_{d(on)}$	$T_{vj} = 25^{\circ}\text{C}$		90	ns
			$T_{vj} = 125^{\circ}\text{C}$		85	
			$T_{vj} = 150^{\circ}\text{C}$		83	
上升时间（感性负载） Rise time (inductive load)		t_r	$T_{vj} = 25^{\circ}\text{C}$		49	ns
			$T_{vj} = 125^{\circ}\text{C}$		46	
			$T_{vj} = 150^{\circ}\text{C}$		44	
关断延迟时间（感性负载） Turn-off delay time (inductive load)	$V_{DS} = 600\text{V}$ $I_D = 240\text{A}$ $V_{GS} = +18/-4\text{V}$ $R_{gon} = 4.7\Omega$	$t_{d(off)}$	$T_{vj} = 25^{\circ}\text{C}$		320	ns
			$T_{vj} = 125^{\circ}\text{C}$		360	
			$T_{vj} = 150^{\circ}\text{C}$		380	
下降时间（感性负载） Fall time (inductive load)	$R_{goff} = 4.7\Omega$ $C_{ge} = 10\text{nF}$ $L_s = 15\text{nH}$ Inductive Load	t_f	$T_{vj} = 25^{\circ}\text{C}$		85	ns
			$T_{vj} = 125^{\circ}\text{C}$		97	
			$T_{vj} = 150^{\circ}\text{C}$		100	
开通损耗能量（每脉冲） Turn-on energy loss per pulse		E_{on}	$T_{vj} = 25^{\circ}\text{C}$		6.49	mJ
			$T_{vj} = 125^{\circ}\text{C}$		6.26	
			$T_{vj} = 150^{\circ}\text{C}$		5.71	
关断损耗能量（每脉冲） Turn-off energy loss per pulse		E_{off}	$T_{vj} = 25^{\circ}\text{C}$		6.75	mJ
			$T_{vj} = 125^{\circ}\text{C}$		7.83	
			$T_{vj} = 150^{\circ}\text{C}$		8.18	
结-散热器热阻 Thermal resistance, junction to heatsink	每个IGBT, $\lambda_{grease} = 3.4\text{W}/(\text{m}^{\circ}\text{K})$ Per IGBT, $\lambda_{grease} = 3.4\text{W}/(\text{m}^{\circ}\text{K})$	R_{thJH}		0.184		K/W
最高结温 $T_{vj\ max}$		$T_{vj\ max}$		175		$^{\circ}\text{C}$

Body Diode/ M2&M3

表 7 最大标定值/Maximum rated values

Parameter	Conditions	Symbol	Value	Unit
体二极管正向直流电流 Body Diode forward direct current	$T_H = 80^\circ\text{C}, T_{vj\max} = 175^\circ\text{C}, V_{GS} = -4\text{V}$	I_{SD}	95	A

表 8 特征值/Characteristic values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward Voltage	$I_{SD} = 240\text{A}, V_{GS} = -4\text{V}$	V_{SD}		3.80		V
				3.44		
				3.36		
反向恢复电荷 Recovered charge	$V_{DD} = 600\text{V}$	Q_r		2.5		μC
				3.3		
				3.8		
反向恢复峰值电流 Peak reverse recovery current	$I_{SD} = 240\text{A}$ $V_{GS} = -4\text{V}$ $R_{gon} = 4.7\Omega$ $C_{ge} = 10\text{nF}$ $L_s = 15\text{nH}$	I_{RM}		90		A
				125		
				130		
反向恢复损耗 Reverse recovery energy	Inductive Load	E_{rec}		0.88		mJ
				1.97		
				2.34		

Diode/ D1&D4

表 9 最大标定值/Maximum rated values

Parameter	Conditions	Symbol	Value	Unit
反向重复峰值电压 Repetitive peak reverse voltage	$T_{vj} = 25^\circ\text{C}$	V_{RRM}	1200	V
连续正向直流电流 Continuous DC forward current	$T_H = 80^\circ\text{C}, T_{vj\max} = 175^\circ\text{C}$	I_F	268	A
总耗散功率 Total Power dissipation	$T_H = 80^\circ\text{C}, T_{vj} = T_{vj\max}$	P_{tot}	340	W
正向重复峰值电流 Repetitive peak forward current	t_p limited by $T_{vj\max}$	I_{FRM}	600	A

表 10 特征值/Characteristic values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
正向电压 Forward voltage	$I_F = 300A, V_{GE} = 0V$	$T_{vj} = 25^\circ C$	V_F		1.50		V
		$T_{vj} = 125^\circ C$			1.45		
		$T_{vj} = 150^\circ C$			1.43		
结—散热器热阻 Thermal resistance, junction to heatsink	每个二极管, $\lambda_{grease} = 3.4W/(m^*K)$ Per diode, $\lambda_{grease} = 3.4W/(m^*K)$		R_{thJH}		0.280		K/W
最高结温 $T_{vj\ max}$			$T_{vj\ max}$	175			$^\circ C$

Diode/ D5&D6

表 11 最大标定值/Maximum rated values

Parameter	Conditions	Symbol	Value	Unit
反向重复峰值电压 Repetitive peak reverse voltage	$T_{vj} = 25^\circ C$	V_{RRM}	1200	V
连续正向直流电流 Continuous DC forward current	$T_H = 80^\circ C, T_{vj\ max} = 175^\circ C$	I_F	185	A
总耗散功率 Total Power dissipation	$T_H = 80^\circ C, T_{vj} = T_{vj\ max}$	P_{tot}	272	W
正向重复峰值电流 Repetitive peak forward current	t_p limited by $T_{vj\ max}$	I_{FRM}	400	A

表 12 特征值/Characteristic values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
正向电压 Forward voltage	$I_F = 200A, V_{GE} = 0V$	$T_{vj} = 25^\circ C$	V_F		1.50		V
		$T_{vj} = 125^\circ C$			1.45		
		$T_{vj} = 150^\circ C$			1.43		
结—散热器热阻 Thermal resistance, junction to heatsink	每个二极管, $\lambda_{grease} = 3.4W/(m^*K)$ Per diode, $\lambda_{grease} = 3.4W/(m^*K)$		R_{thJH}		0.349		K/W
最高结温 $T_{vj\ max}$			$T_{vj\ max}$	175			$^\circ C$

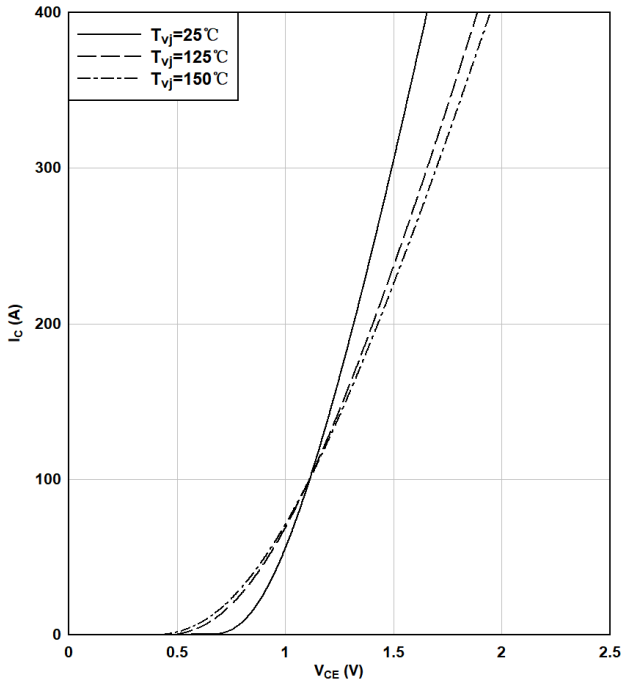
负温度系数热敏电阻/NTC-Thermistor

表 13 特征值/Characteristic values

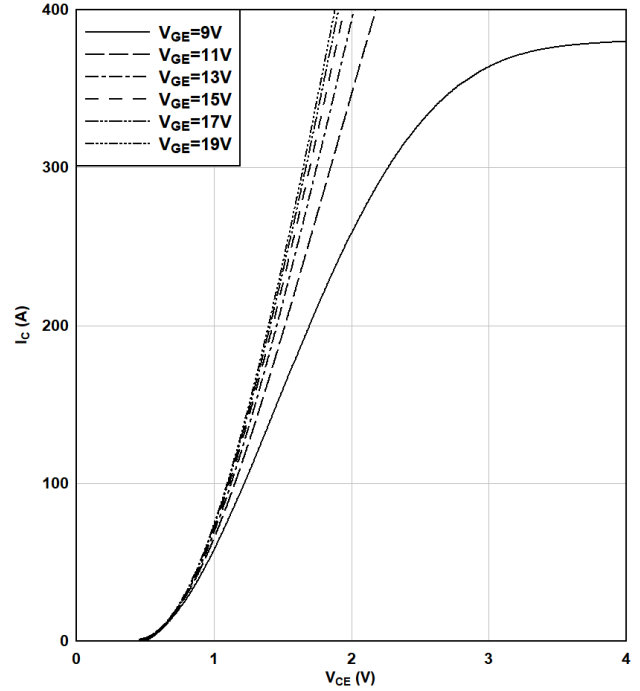
Parameter	Conditions	Symbol	Value	Unit
额定电阻值 Rated resistance	$T_{NTC} = 25\text{ }^{\circ}\text{C}$	R_{25}	5	kΩ
R ₁₀₀ 偏差 Deviation of R ₁₀₀	$T_{NTC} = 100\text{ }^{\circ}\text{C}, R_{100} = 493\text{ }^{\circ}\Omega$	$\Delta R/R$	±5	%
耗散功率 Power dissipation	$T_{NTC} = 25\text{ }^{\circ}\text{C}$	P_{25}	20.0	mW
B-值 B-value	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298,15\text{ K}))]$	$B_{25/50}$	3375	K
B-值 B-value	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298,15\text{ K}))]$	$B_{25/100}$	3433	K

特征参数图表/Characteristics Diagrams

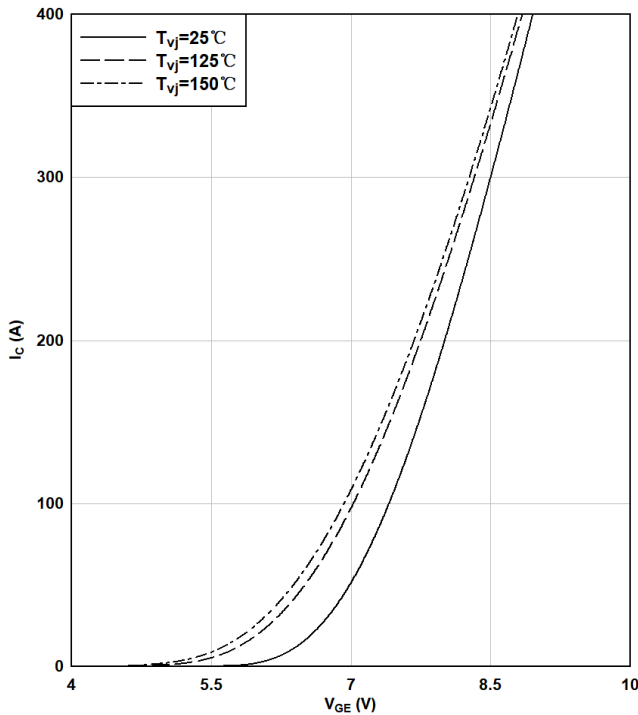
输出特性（典型），IGBT (T1/T4/T5/T6)
Output characteristic (typical), IGBT(T1/T4/T5/T6)
 $I_C = f(V_{CE})$
 $V_{GE} = 15V$



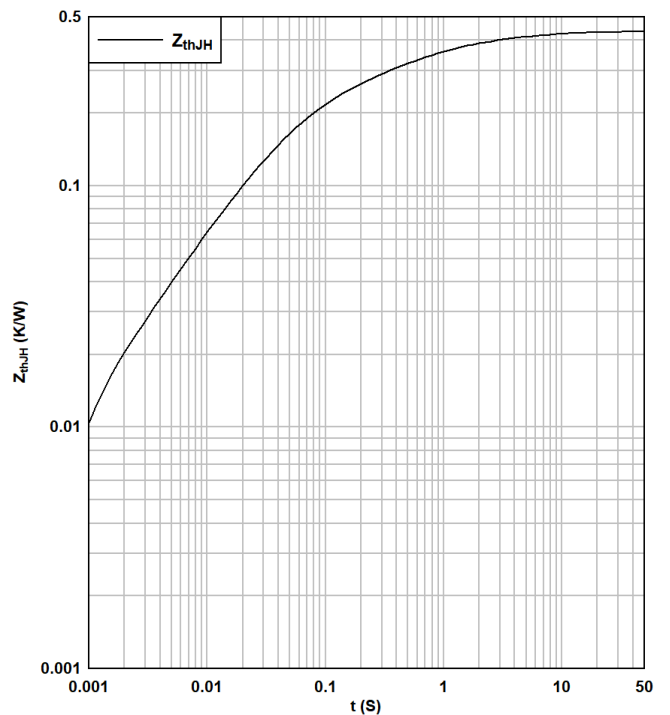
输出特性（典型），IGBT(T1/T4/T5/T6)
Output characteristic field (typical), IGBT(T1/T4/T5/T6)
 $I_C = f(V_{CE})$
 $T_{vj}=150^{\circ}C$



传输特性（典型），IGBT(T1/T4/T5/T6)
Transfer characteristic (typical), IGBT(T1/T4/T5/T6)
 $I_C = f(V_{GE})$
 $V_{CE} = 20V$

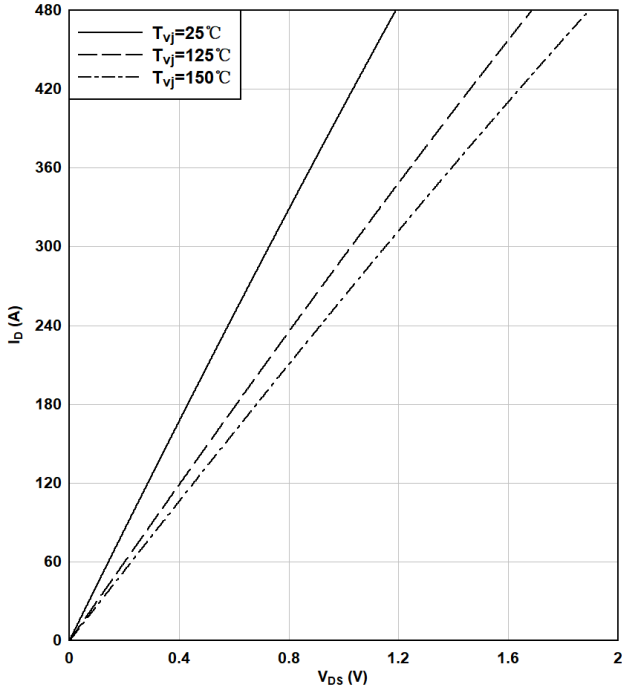


瞬态热阻抗, IGBT(T1/T4/T5/T6)
Transient thermal impedance, IGBT(T1/T4/T5/T6)
 $Z_{thJH} = f(t)$

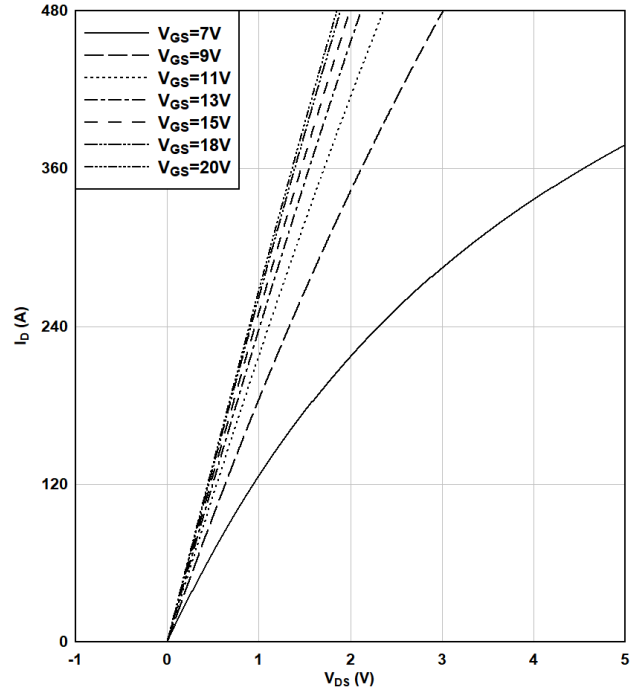


(续) 特征参数图表/Characteristics Diagrams

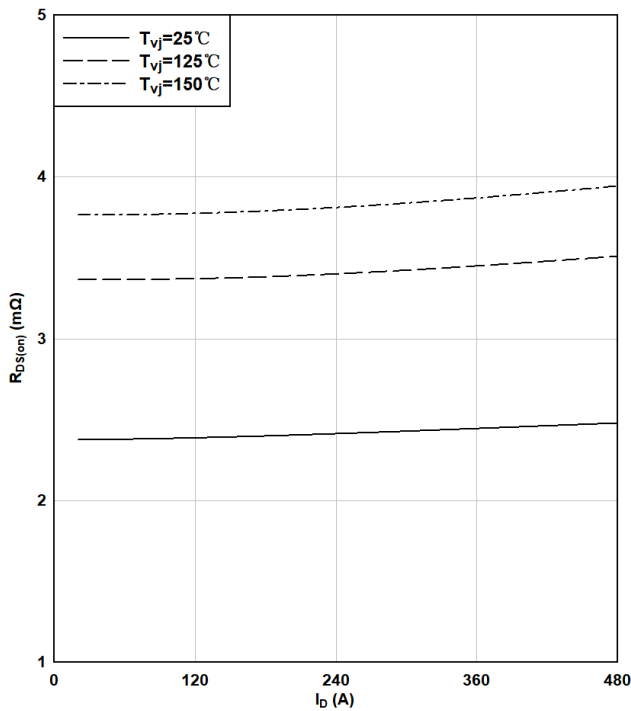
输出特性 (典型), MOSFET(M2/M3)
Output characteristic (typical), MOSFET(M2/M3)
 $I_D = f(V_{DS})$
 $V_{GS} = 18V$



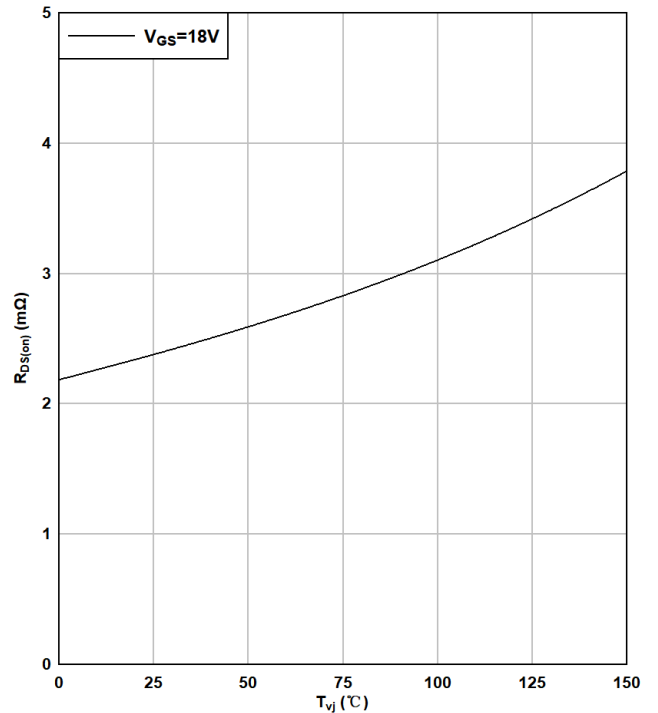
输出特性 (典型), MOSFET(M2/M3)
Output characteristic (typical), MOSFET(M2/M3)
 $I_D = f(V_{DS})$
 $T_{vj}=150^{\circ}C$



漏-源通态电阻 (典型), MOSFET(M2/M3)
Drain-source On Resistance (typical), MOSFET(M2/M3)
 $R_{DS(on)} = f(I_D)$
 $V_{GS} = 18V$

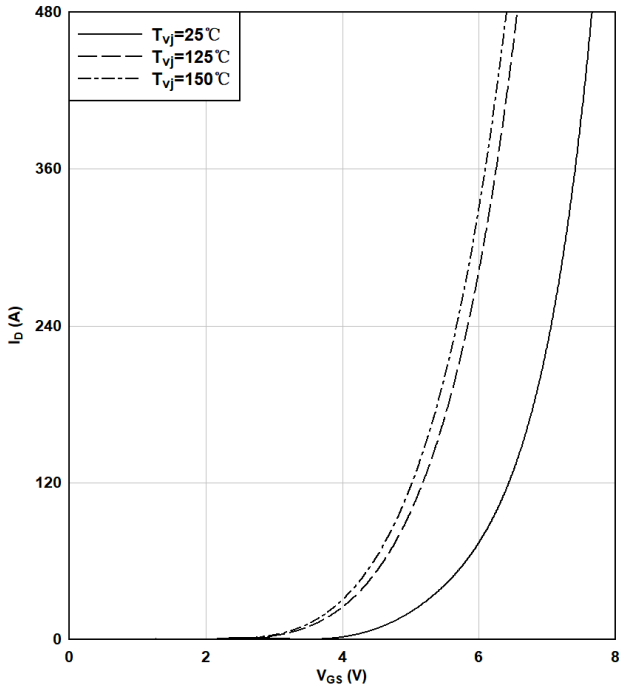


漏源通态电阻 (典型), MOSFET(M2/M3)
Drain-source On Resistance (typical), MOSFET(M2/M3)
 $R_{DS(on)} = f(T_{vj})$
 $I_D = 240A$

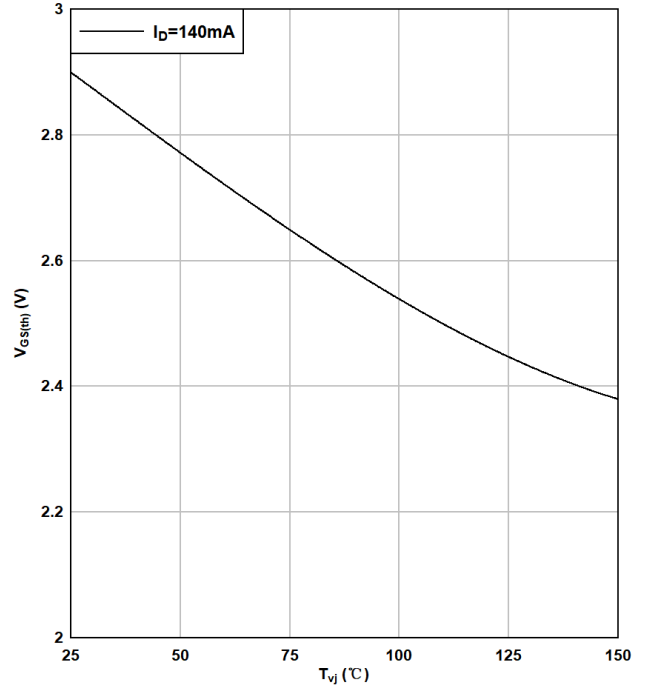


(续) 特征参数图表/Characteristics Diagrams

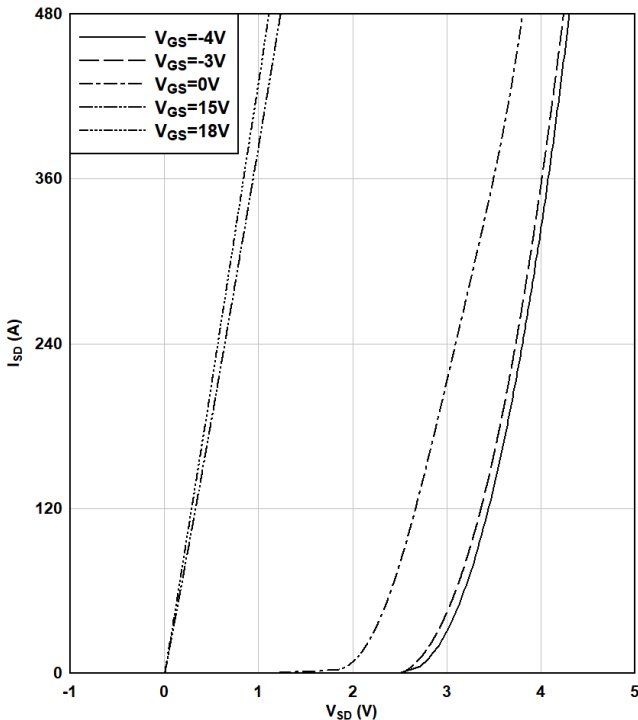
传输特性 (典型), MOSFET(M2/M3)
Transfer characteristic (typical), MOSFET(M2/M3)
 $I_D = f(V_{GS})$
 $V_{DS} = 20V$



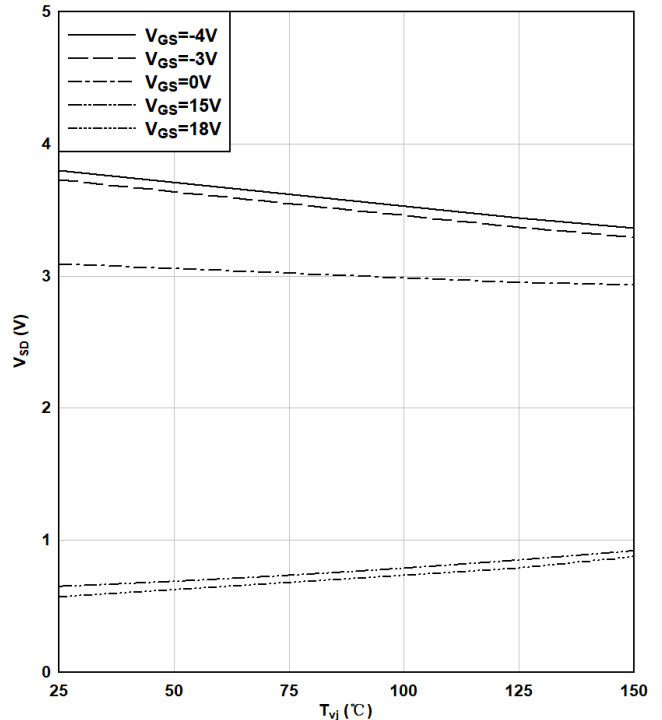
栅-源阈值电压 (典型), MOSFET(M2/M3)
Gate-source threshold voltage(typical), MOSFET(M2/M3)
 $V_{GS(th)} = f(T_{vj})$
 $V_{GS} = V_{DS}, I_D = 140mA$



正向特性 (典型), Body Diode (M2/M3)
Forward characteristic (typical), Body Diode (M2/M3)
 $I_{SD} = f(V_{SD})$
 $T_{vj} = 25°C$



正向特性 (典型), Body Diode (M2/M3)
Forward characteristic (typical), Body Diode (M2/M3)
 $V_{SD} = f(T_{vj})$
 $I_{SD} = 240A$



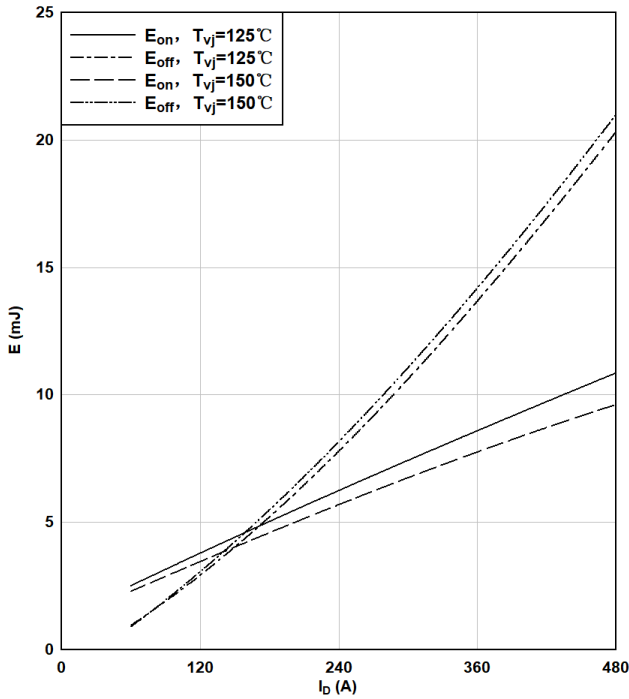
(续) 特征参数图表/Characteristics Diagrams

开关损耗 (典型), MOSFET(M2/M3)

Switching losses (typical), MOSFET(M2/M3)

$E = f(I_D)$

$V_{DS} = 600V, R_{Gon}=4.7\Omega, R_{Goff}=4.7\Omega, C_{GS} = 10nF, V_{GS} = +18/-4V$

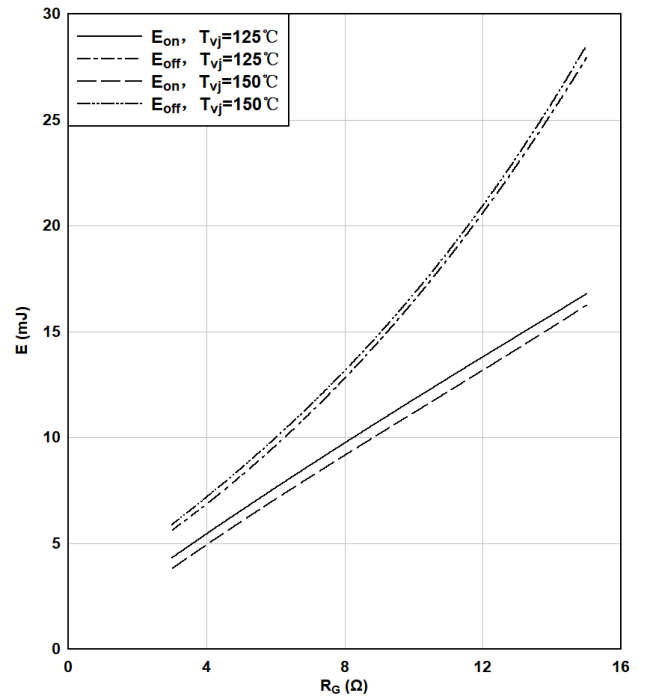


开关损耗 (典型), MOSFET(M2/M3)

Switching losses (typical), MOSFET(M2/M3)

$E = f(R_G)$

$V_{DS} = 600V, I_D = 240A, C_{GS} = 10nF, V_{GS} = +18/-4V$

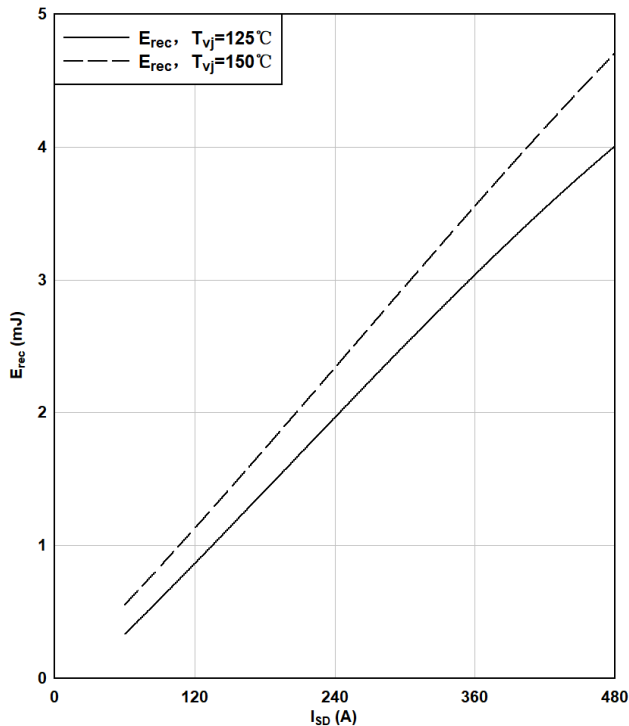


开关损耗 (典型), 体二极管(M2/M3)

Switching losses (typical), Body Diode(M2/M3)

$E_{rec} = f(I_{SD})$

$V_{DS} = 600V, R_{Gon} = 4.7\Omega, C_{GS} = 10nF$

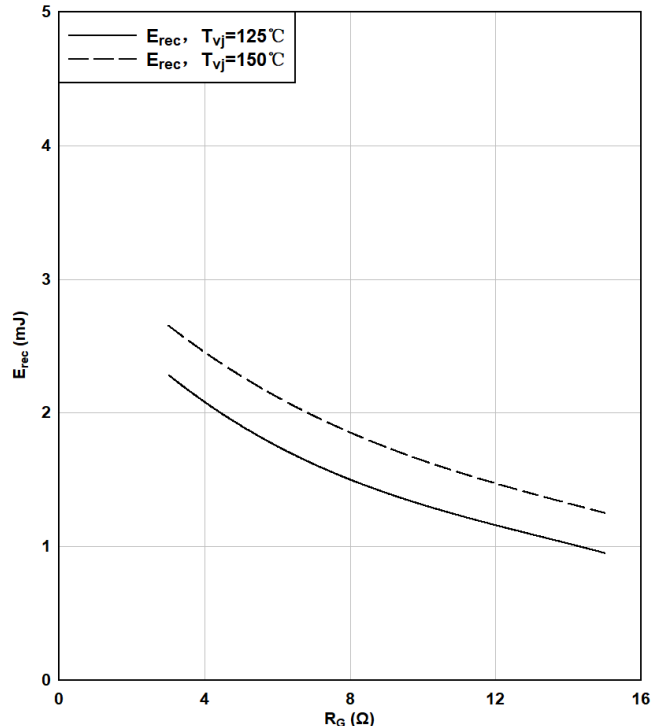


开关损耗 (典型), 体二极管(M2/M3)

Switching losses (typical), Body Diode(M2/M3)

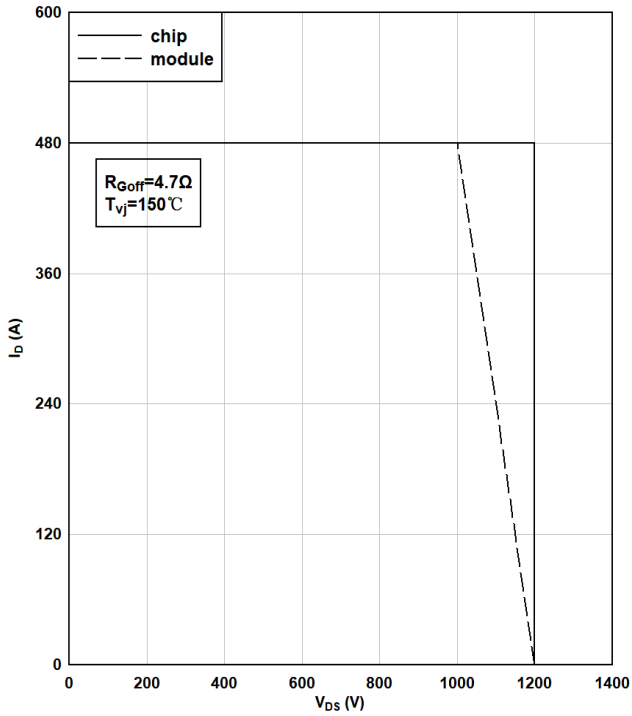
$E_{rec} = f(R_G)$

$V_{DS} = 600V, I_{SD} = 240A, C_{GS} = 10nF$

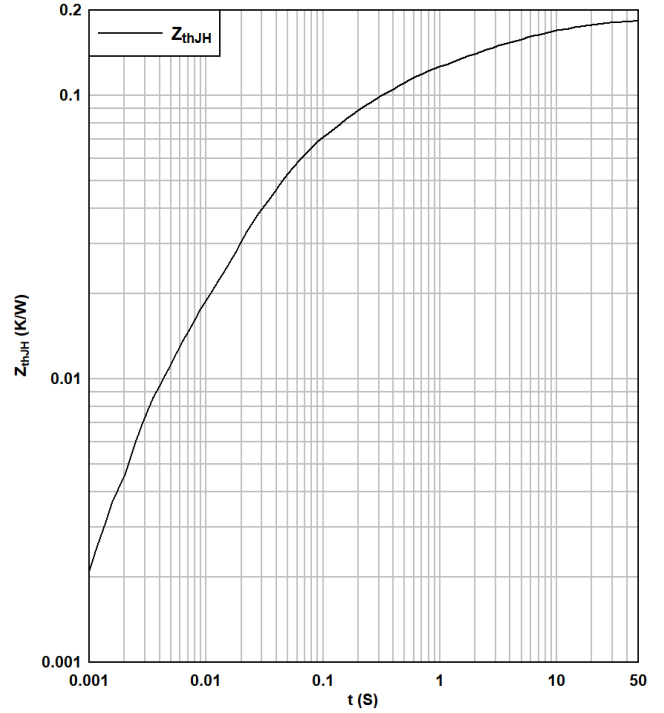


(续) 特征参数图表/Characteristics Diagrams

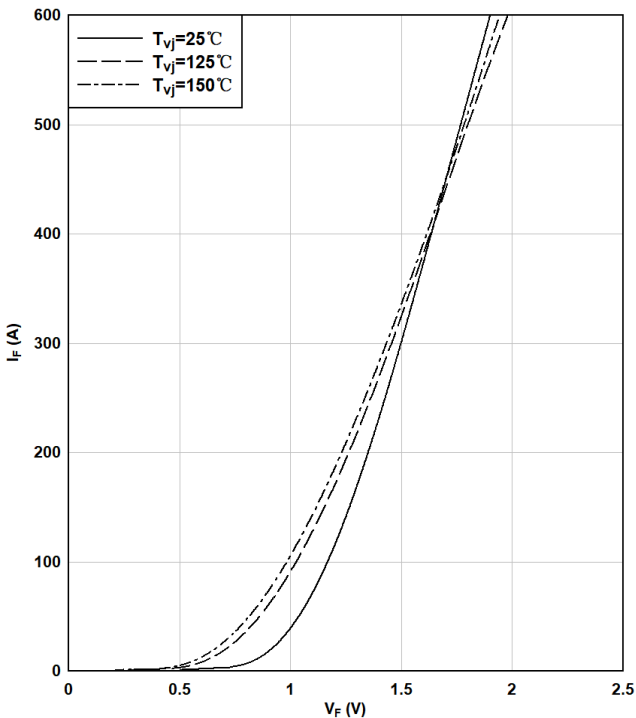
反偏安全工作区, MOSFET(M2/M3)
Reverse bias safe operating area, MOSFET(M2/M3)
 $I_D = f(V_{DS})$



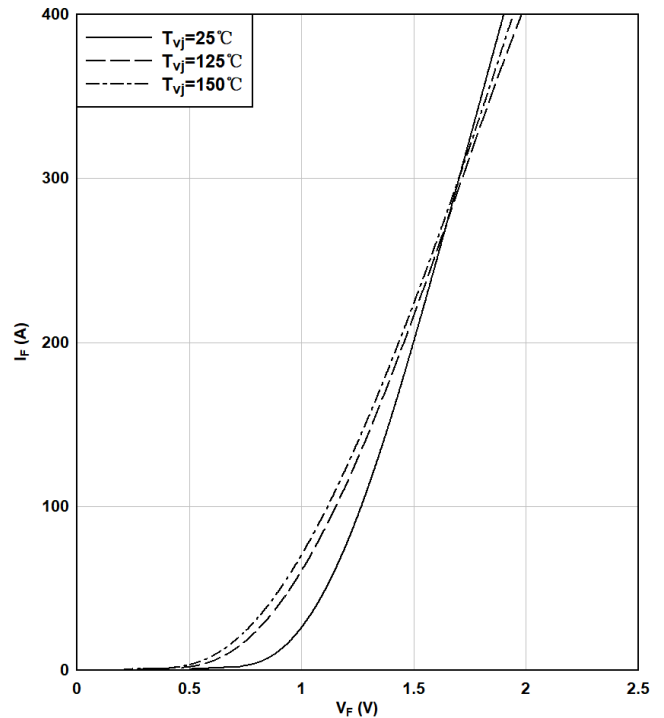
瞬态热阻抗, MOSFET(M2/M3)
Transient thermal impedance, MOSFET(M2/M3)
 $Z_{thJH} = f(t)$



正向特性 (典型), 二极管(D1/D4)
Forward characteristic (typical), Diode(D1/D4)
 $I_F = f(V_F)$

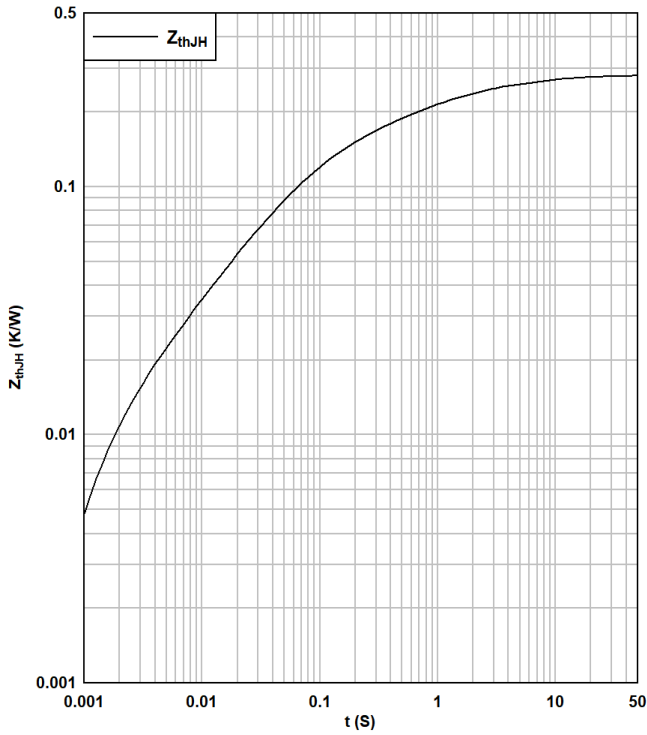


正向特性 (典型), 二极管(D5/D6)
Forward characteristic (typical), Diode(D5/D6)
 $I_F = f(V_F)$

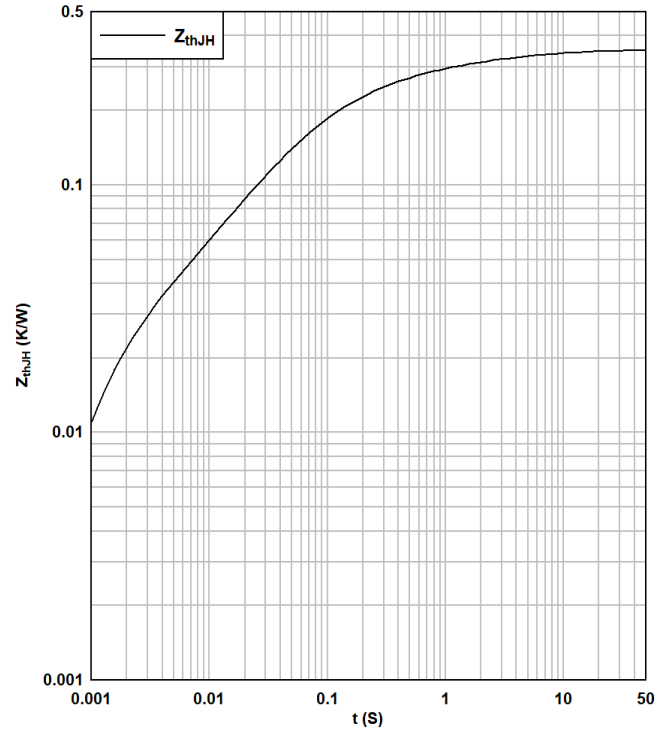


(续) 特征参数图表/Characteristics Diagrams

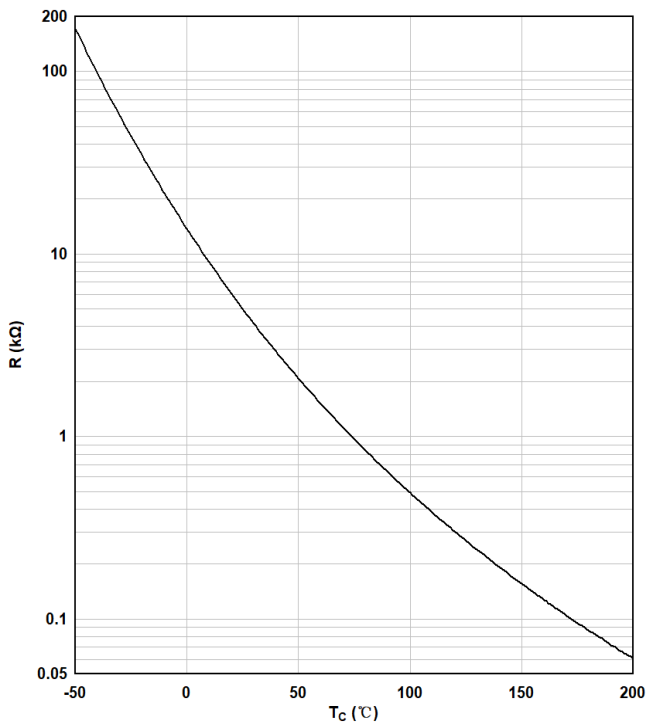
瞬态热阻抗, 二极管(D1/D4)
Transient thermal impedance, Diode (D1/D4)
 $Z_{thJH} = f(t)$



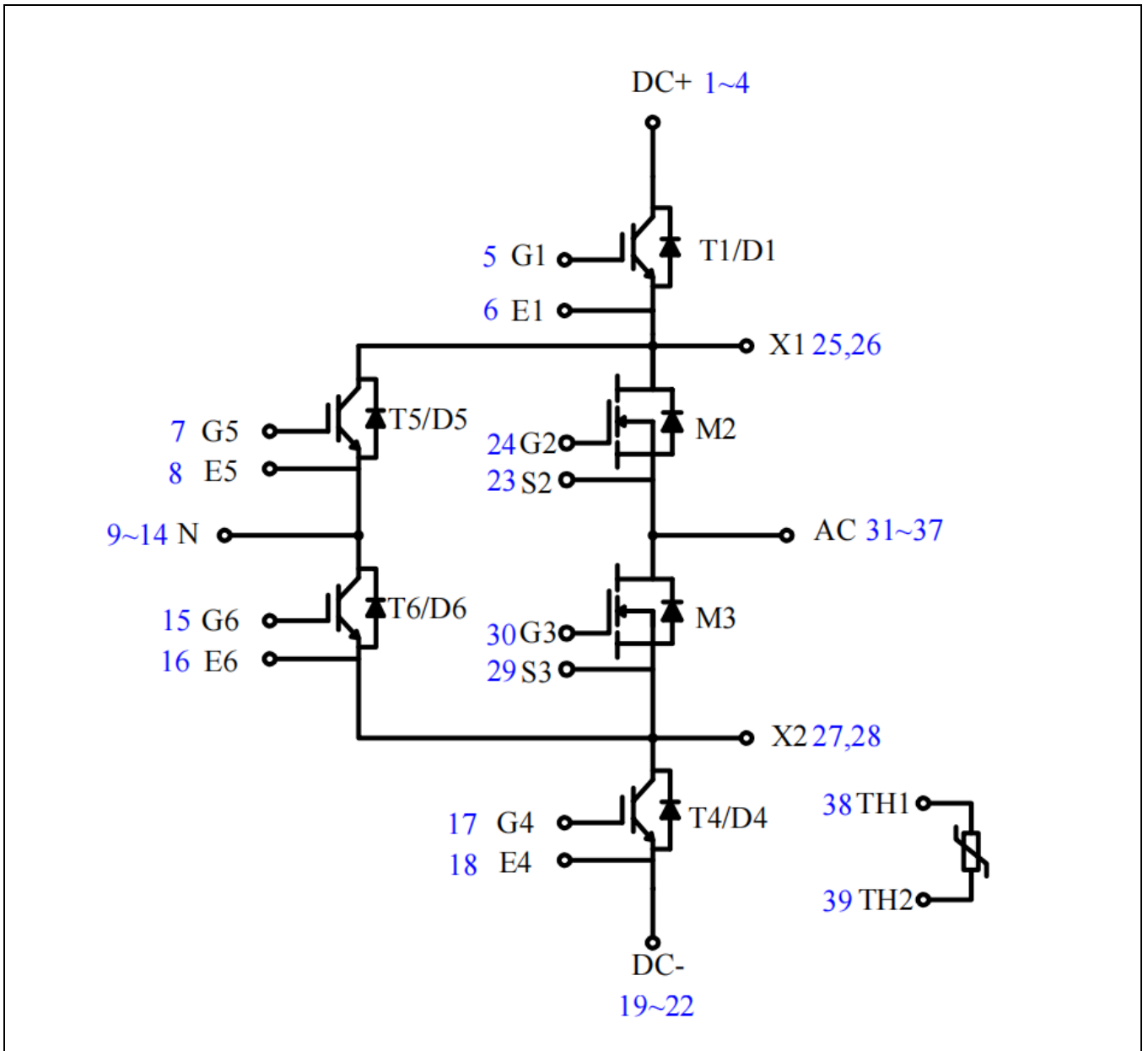
瞬态热阻抗, 二极管(D5/D6)
Transient thermal impedance, Diode (D5/D6)
 $Z_{thJH} = f(t)$



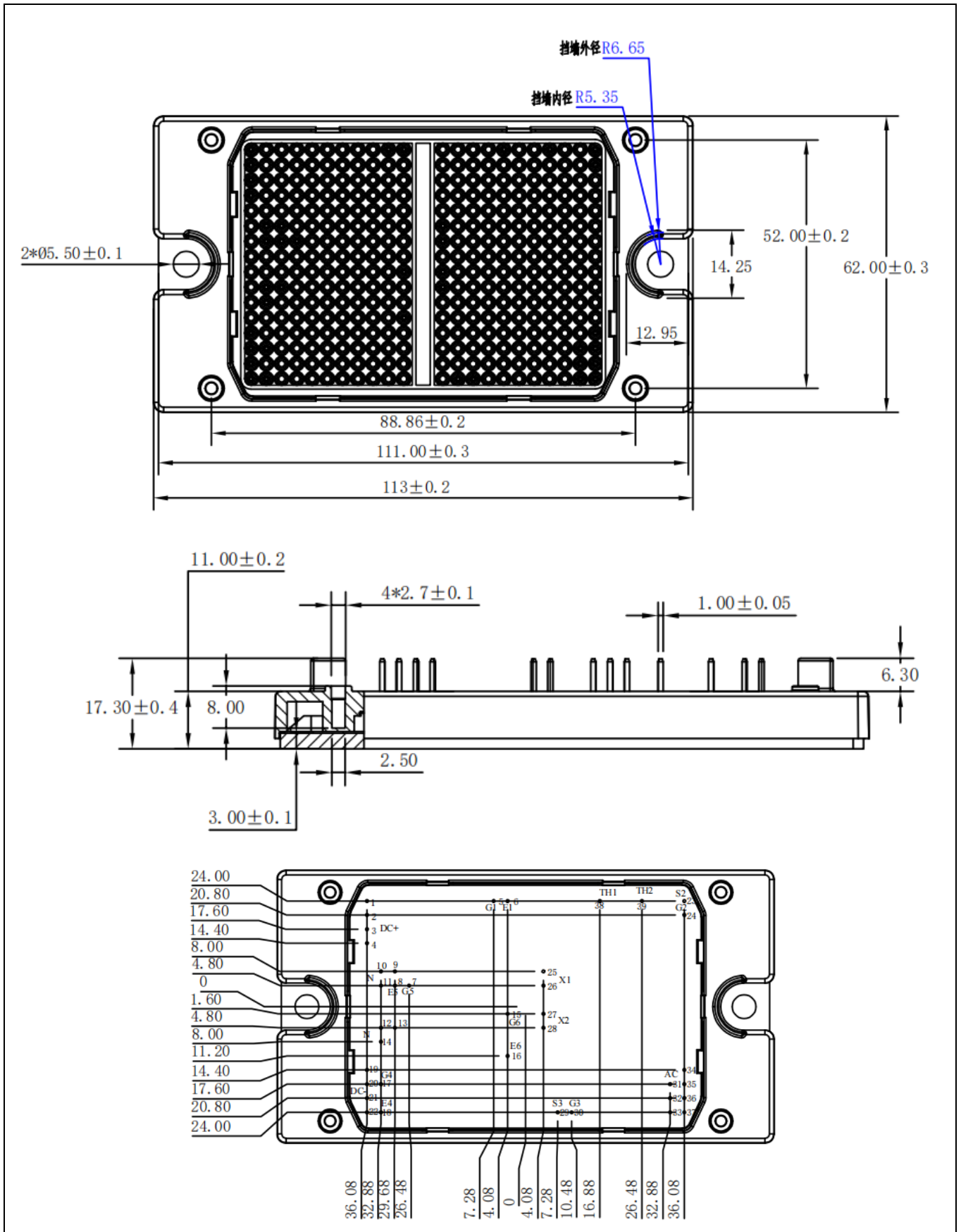
负温度系数热敏电阻温度特性
NTC-Thermistor-temperature characteristic(typical)
 $R = f(T_c)$



电路拓扑图 / Circuit Diagram



封装尺寸 / Package Outlines



模块标签信息/ Module Marking Information

Marking Diagram

AMG003L12P4C3RD = Specific Device
P4CQ22420010001 = Lot Traceability
ACP-3S = Package Type

声明与使用条件/ Notices and conditions of use

1. 阿基米德保留手册的更改权；

Archimedes reserves the right to change the manual；

2. 本手册中提供的数据一部分为产品的典型值，实际出厂测试的数据与典型值略有差异，但我司保证这些差异不会影响产品的正常使用，如果产品信息发生变更，我司会及时更新手册，请随时关注；

Part of the data provided in this manual is the typical value of the product, the actual factory test data and the typical value are slightly different, but our company guarantees that these differences will not affect the normal use of the product, if the product information changes, our company will update the manual in time, please pay attention at any time；

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4. 产品在使用时，严禁触碰，断电后确认无残余电荷且产品已完全冷却后，才可以在有静电防护措施下触碰产品；

When the product is in use, it is strictly forbidden to touch the product. After power off, it is confirmed that there is no residual charge and the product has been completely cooled, and it can only be touched under electrostatic protection measures；

5. 购买产品时请认准我司商标，如有疑问请与本司联系。

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