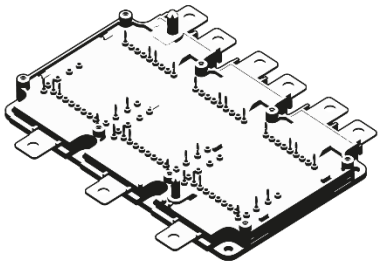
PRELIMINARY DATASHEET 初版规格书

SCSS002EVD120MS

EVD-Type three-phase 1.2kV SiC module; EVD封装半桥SiC模块

V_{DSS} = 1200 V

R_{DSon} = 2.1 m Ohm @ I_D = 520 A



- *3rd generation SiC MOSFET chips; 第三代 SiC MOSFET 芯片*
- *Ultra-low R_{DSon}; 超低 R_{DSon}*
- *Low switching losses, Qg and Crss; 开关损耗低*
- *Low inductance module < 9nH; 低电感模块 < 9nH*
- *T_{vj_op} = 175°C*
- *4.2kV DC 1 sec insulation*
- *Compact design; 设计紧凑*
- *Direct cooled PinFin baseplate;直接冷却 PinFin 底板*
- *High performance Si_3N_4 ceramic substrates*
- *Guiding elements for PCB and cooler assembly*
- *Integrated NTC temperature sensor; 集成式 NTC 温度传感器*
- *Press-fit contact technology*
- *RoHS compliant; 符合 RoHS 标准*

Maximum ratings 最大额定值[1]

PARAMETER 参数	SYMBOL 符号	CONDITIONS 工作条件	MIN 最小值	MAX 最大值	UNIT 单位
Drain – source voltage 漏极 – 源极电压	V_{DSS}	V_{GS} </= 0 V, T_{vj} = 25 °C		1200	V
Continuous drain and source current 漏极和源极连续电流	I_D, I_S	T_F = 60 °C, V_{GS} = 18 V, T_{vj} = 175 °C		520	A
Peak drain and source current 漏极和源极峰值电流	I_{DM}, I_{SM}	t_p = 1 ms, limited by T_{vjmax}		1500	A
Gate-source voltage (DC) 栅源电压（直流）	V_{GSS}		-10	22	V
Gate-source surge voltage 栅源浪涌电压	$V_{GSS\ surge}$	t_{surge} < 300ns	-11	25	V
Recommended gate voltage 建议栅极电压	V_{GS}		-2	18	V
Surge current 浪涌电流				TBD	A
MOSFET SCSOA	t_{psc}	V_{DS} = 800 V, V_{GSon} = 18 V, T_{vj} < 175 °C		0	µs
Isolation voltage绝缘电压	V_{isol}	RMS, 1 s, f = 50 Hz		4200	V
Junction operating temperature 运行结温	$T_{vj(op)}$		-40	175	°C
Storage temperature 存储温度	T_{stg}		-40	125	°C
Mounting torques for module mounting 紧固力矩[2]	M	Screw M4 baseplate to heatsink	1.8	2.2	Nm
Max pressure in cooling circuit **冷却回路最大压力**	p	$T_{baseplate}$ < 40°C		2.5	bar
		$T_{baseplate}$ > 40°C		2.0	bar

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[1] Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747; 根据标准IEC 60747要求，最大额定值表示超过该限值可能会对器件造成损坏

[2] For details, please refer to the mounting instructions. 详细信息，请参考安装说明书

MOSFET[3]

PARAMETER 参数	SYMBOL 符号	CONDITIONS 工作条件		MIN 最小值	TYP 典型	MAX 最大值	UNIT 单位
Drain-source breakdown voltage 漏极–源极击穿电压	$V_{(BR)DSS}$	V_{GS} </= 0 V, I_D= 10 mA, T_{vj} = -40 .. 25°C		1200			V
Static drain-source on-state resistance[4] 静态漏极–源极导通电阻	$R_{DS(on)}$	I_D = 600 A, V_{GS} = 18 V	T_{vj} = 25 °C		2.1	2.7	mΩ
			T_{vj} = 175 °C		3.8		mΩ
Zero gate voltage drain current 零栅极电压漏极电流	I_{DSS}	V_{DS} = 1200 V, V_{GS} = 0 V	T_{vj} = 25 °C			60	µA
			T_{vj} = 175 °C				µA
Gate leakage current 栅极漏电流	I_{GSS}	V_{GS} = +22 / -10 V		-500		500	nA
Gate-emitter threshold voltage 栅极–发射极阈值电压	$V_{GS(th)}$	V_{GS} = V_{DS}, I_D = 60 mA	T_{vj} = 25°C	1.9		3.9	V
			T_{vj} = 175°C		2		V
Gate charge 栅极电荷	Q_G	I_D = 500 A, V_{DS} = 800 V, V_{GS} = -2 V ... 18 V			1		µC
Input capacitance 输入电容	C_{iss}	V_{DS} = 800 V, V_{GS} = 0 V, f = 100 kHz, T_{vj} = 25 °C			29.8		nF
Output capacitance 输出电容	C_{oss}				1.2		nF
Reverse tansfer capacitance 反向传输电容	C_{rss}				0.12		nF
Internal gate resistor 栅极内阻	R_{Gint}	Per switch			0.2		Ω
Turn-on delay time 开通延迟	$t_{d(on)}$	V_{CC} = 800 V, I_D = 500 A, R_G = 5 Ω, V_{GS} = -4 / +18 V, L_s =30 nH, inductive load	T_{vj} = 25 °C		56		ns
			T_{vj} = 125 °C		50		ns
			T_{vj} = 175 °C		47		ns
Rise time 上升时间	t_r		T_{vj} = 25 °C		58		ns
			T_{vj} = 125 °C		48		ns
			T_{vj} = 175 °C		44		ns
Turn-off delay time 关断延迟	$t_{d(off)}$	V_{CC} = 800 V, I_D = 500 A, R_G = 7 Ω, V_{GS} = -4 / +18 V, L_s =30 nH, inductive load	T_{vj} = 25 °C		400		ns
			T_{vj} = 125 °C		445		ns
			T_{vj} = 175 °C		465		ns
Fall time 下降时间	t_f		T_{vj} = 25 °C		57		ns
			T_{vj} = 125 °C		59		ns
			T_{vj} = 175 °C		61		ns
Turn-on switching energy 开通损耗	E_{on}	V_{CC} = 800 V, I_D = 500 A, R_G = 5 Ω, V_{GS} = -4 / +18 V, L_s = 30 nH, inductive load	T_{vj} = 25 °C		26		mJ
			T_{vj} = 125 °C		19		mJ
			T_{vj} = 175 °C		18		mJ
Turn-off switching energy 关断损耗	E_{off}	V_{CC} = 800 V, I_D = 500 A, R_G = 7 Ω, V_{GS} = -4 / +18 V, L_s = 30 nH, inductive load	T_{vj} = 25 °C		39		mJ
			T_{vj} = 125 °C		39		mJ
			T_{vj} = 175 °C		39		mJ
Short circuit current 短路电流	I_{SC}	t_{pcs} ≤ 0 µs, V_{GE} = 18 V, T_{vj} = 175 °C, V_{CC} = 800 V, $V_{DSM\ Chip}$ ≤ 1200 V			-		A

[3] Characteristic values according to IEC 60747-9
[4] Given at chip level

Body diode[5]

PARAMETER 参数	SYMBOL 符号	CONDITIONS 工作条件		MIN 最小值	TYP 典型	MAX 最大值	UNIT 单位
Forward voltage[6] 正向压降	V_{SD}	I_D = -500 A, V_{GS} = 18 V	T_{vj} = 25 °C		1		V
			T_{vj} = 175 °C		2.5		V
							V
Peak reverse recovery current 反向恢复电流峰值	I_{rr}	V_R = 800 V, I_{SD} = 500 A, dI/dt = 11.5 kA/µs, R_G = 5 Ω, V_{GS} = -4 / +18 V, L_s =30 nH, inductive load	T_{vj} = 25 °C		185		A
			T_{vj} = 125 °C		220		A
			T_{vj} = 175 °C		275		A
Recovery charge 恢复电荷	Q_{rr}		T_{vj} = 25 °C		16.5		µC
			T_{vj} = 125 °C		15		µC
			T_{vj} = 175 °C		21		µC
Reverse recovery time 反向恢复时间	t_{rr}		T_{vj} = 25 °C		65		ns
			T_{vj} = 125 °C		70		ns
			T_{vj} = 175 °C		76		ns
Reverse recovery energy 反向恢复能量	E_{rec}		T_{vj} = 25 °C		6.2		mJ
			T_{vj} = 125 °C		7.4		mJ
			T_{vj} = 175 °C		10.8		mJ

Package properties 封装特性[7]

PARAMETER 参数	SYMBOL 符号	CONDITIONS 工作条件		MIN 最小值	TYP 典型	MAX 最大值	UNIT 单位
Thermal resistance junction to fluid 热阻 结点至流体	$R_{th(j-f)}$	Per switch, Coolant 50% glycol, 50% water, 10 l/min, dp < 90 mbar			0.11		K/W
Comparative tracking index 相对漏电起痕指数	CTI			400			
Module stray inductance 模块自身杂散电感	$L_{s\,CE}$	Per switch			8.5		nH
Resistance, terminal chip 端子到芯片之间的阻抗	$R_{CC'+EE'}$	Per switch	T_{vj} = 25 °C		0.5		mΩ
			T_{vj} = 125 °C				mΩ
			T_{vj} = 175 °C				mΩ
Material of module baseplate 模块底板材料		Ni + Cu Nickel plated Cu baseplate					
Internal isolation 内部绝缘		Si_3N_4 Basic insulation (class 1, IEC 61140)					

[5] Characteristic values according to IEC 60747-2
[6] Forward voltage is given at chip-level正向压降是芯片两端的电压值。
[7] Package and mechanical properties according to IEC 60747-15

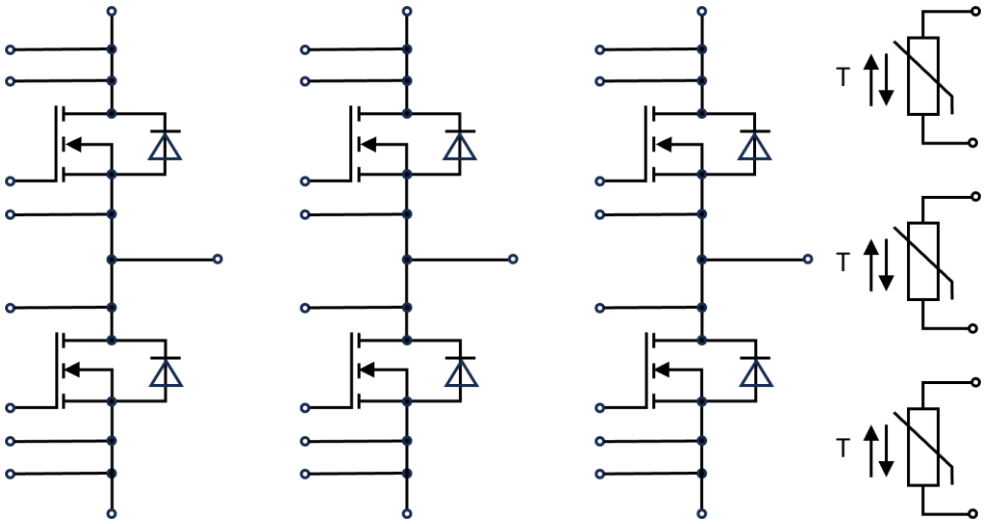
Mechanical properties 机械特性

PARAMETER 参数	SYMBOL 符号	CONDITIONS 工作条件		MIN 最小值	TYP 典型	MAX 最大值	UNIT 单位
Dimensions	L x W x H	Typical		152 x 62 x 17			mm^3
Clearance distance in air 电气间隙	da	According to IEC 60664-1 and EN 50124-1	Terminal to base:	4.5			mm
			Terminal to terminal:	4.5			mm
Surface creepage distance 爬电距离	ds	According to IEC 60664-1 and EN 50124-1	Terminal to base:	9.0			mm
			Terminal to terminal:	9.0			mm
Mass重量	m				720		g

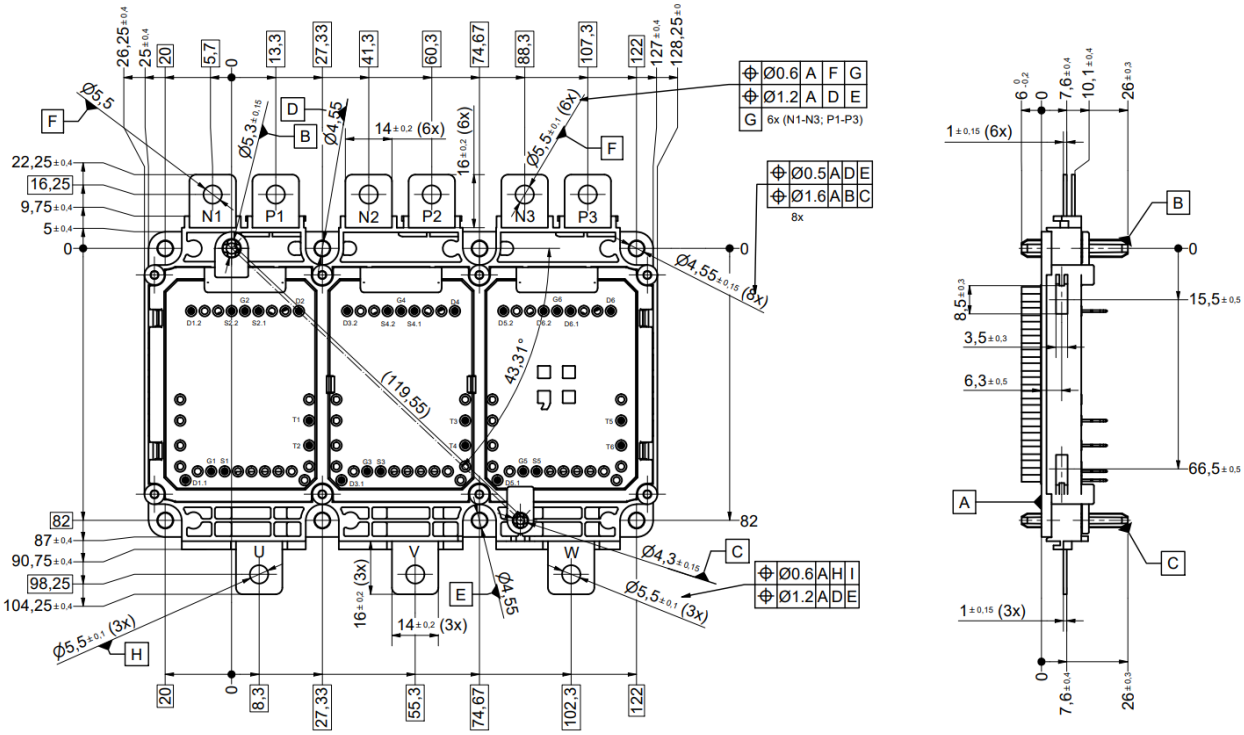
NTC Thermistor

PARAMETER 参数	SYMBOL 符号	CONDITIONS 工作条件	MIN 最小值	TYP 典型	MAX 最大值	UNIT 单位
Rated resistance 额定电阻	R_{25}	T_C = 25 °C		5		kΩ
R100	R_{100}	T_C = 100 °C	468		518	Ω
B-value B值	$B_{25/50}$	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15K))]$		3375		K
B-value B值	$B_{25/50}$	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298.15K))]$		3411		K
Rated resistance 额定电阻	$B_{25/100}$	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298.15K))]$		3433		K

Electrical configuration 电气图



Outline drawing 外形图

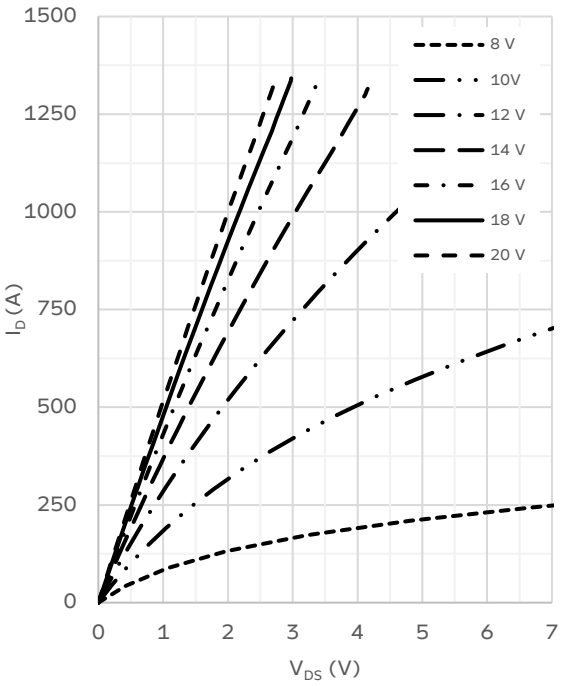


This is an electrostatic sensitive device. 本产品对静电特别敏感

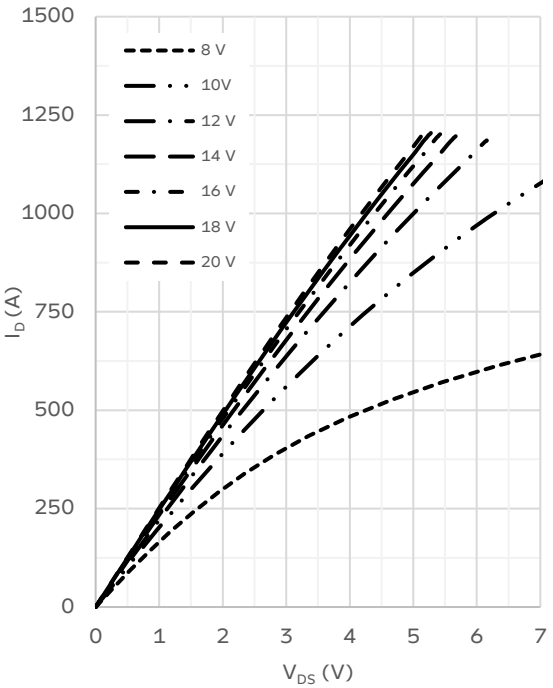
This product has been designed and qualified for automotive level. 本产品的设计和认证符合汽车级标准

Characteristics 特性曲线

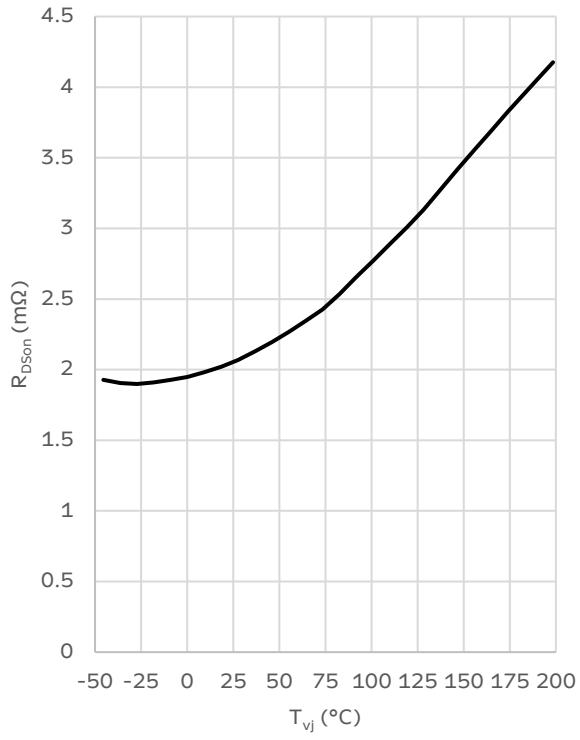
Output characteristics (typical)
输出特性曲线（典型）
$I_D = f(V_{DS})$
$T_{vj} = 25°C$



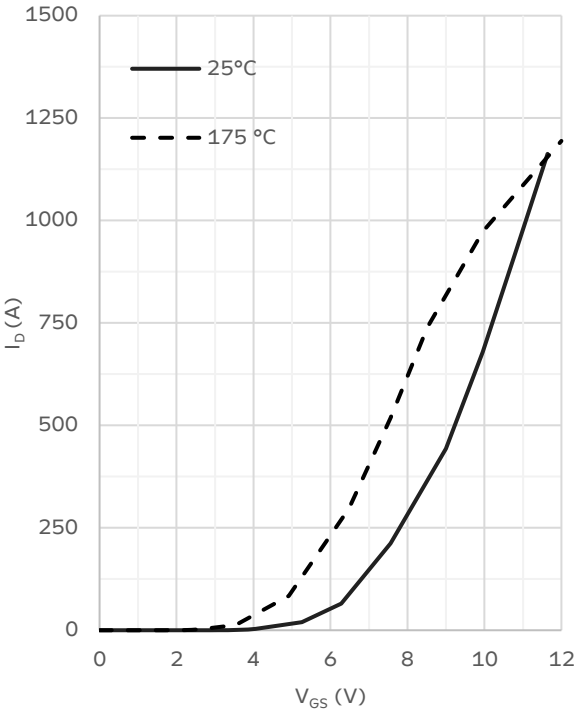
Output characteristics (typical)
输出特性曲线（典型）
$I_D = f(V_{DS})$
$T_{vj} = 175°C$



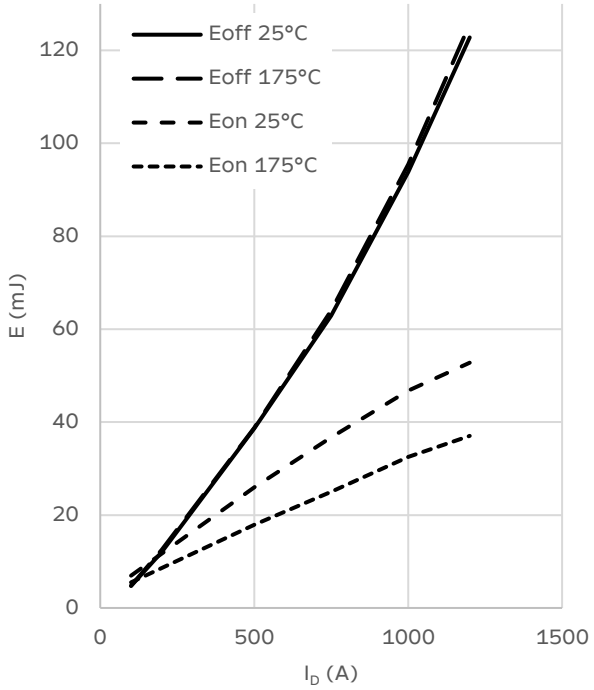
R_{DSon} *versus junction temperature* (typical)
R_{DSon} 与结温关系（典型值）
$R_{DSon} = f(T_{vj})$
$I_D = 600$ A, VGS = 18V



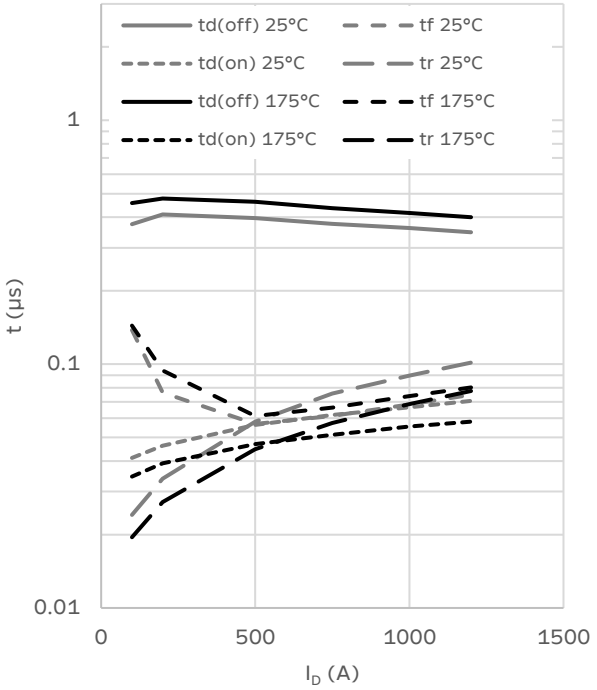
IGBT transfer characteristics (typical)
MOSFET转移特性曲线（典型）
$I_D = f(V_{GS})$
$V_{DS} = 6$ V



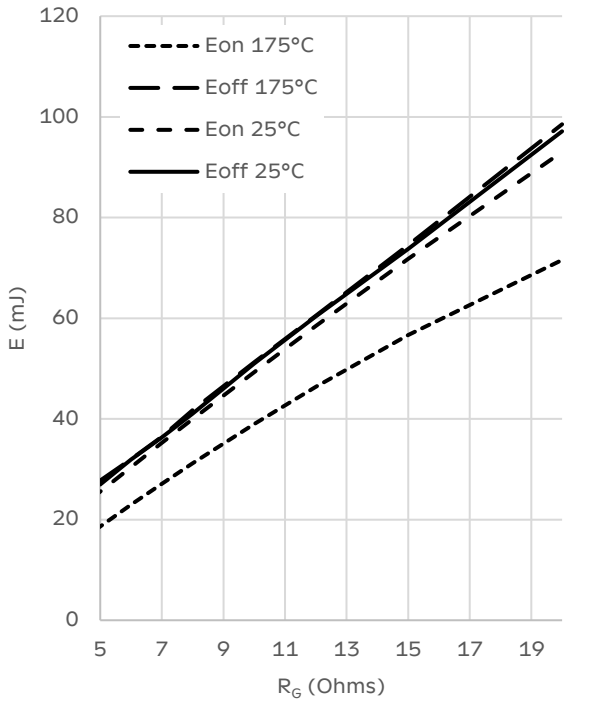
Switching losses (typical)
开关损耗曲线（典型）
$E = f(I_D)$
V_{DS} =800 V, R_{Gon} =5 Ω, R_{Goff} =7 Ω, V_{GE} =-4/+18 V



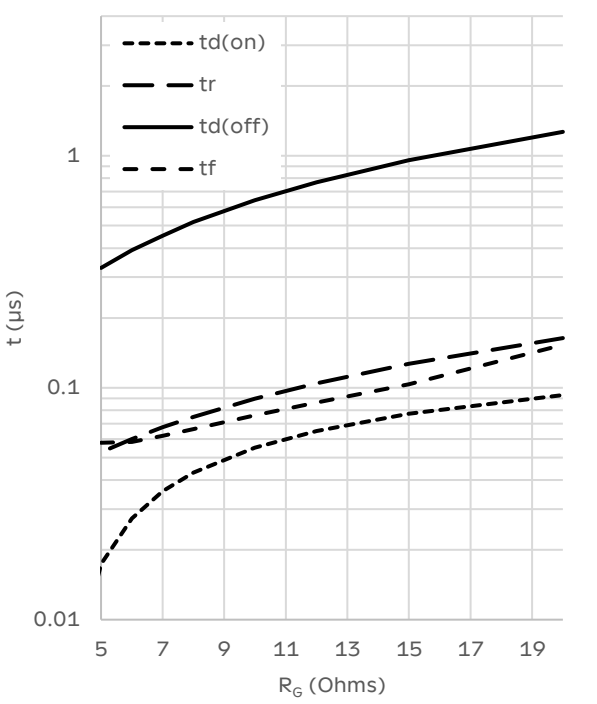
Switching times (typical)
开关时间曲线（典型）
$t = f(I_D)$
V_{DS} = 800 V, R_{Gon} =5 Ω, R_{Goff} =7 Ω, V_{GE} =-4/+18 V



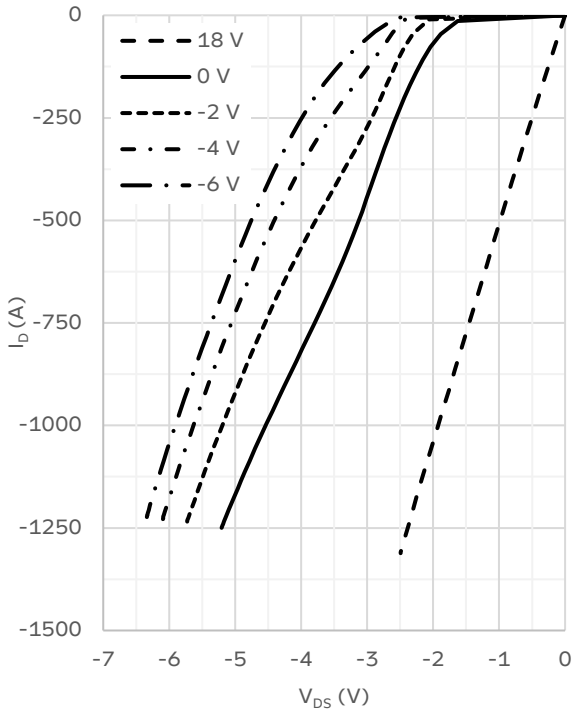
Switching losses (typical)
开关损耗曲线（典型）
$E = f(R_G)$
V_{DS} =800 V, I =5000 A, V_{GS} =-4/+18 V



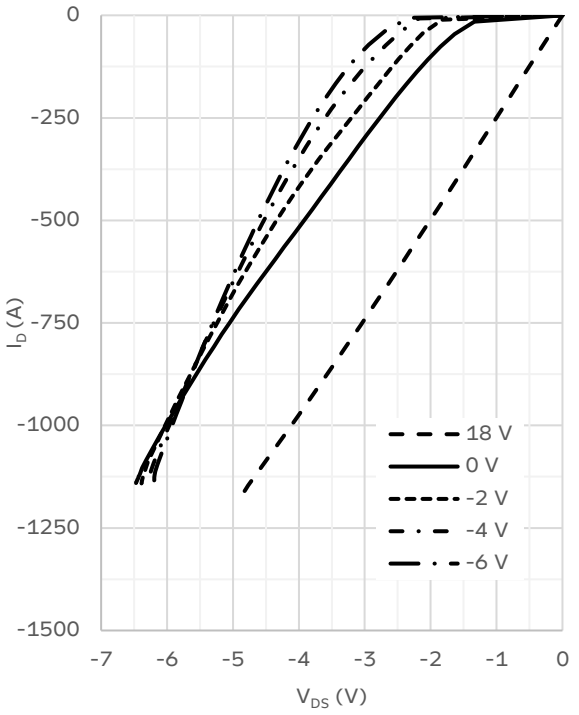
Switching times (typical)
开关时间曲线（典型）
$t = f(R_G)$, T_{vj} = 175 °C
V_{DS} =800 V, I =500 A, V_{GS} =-4/+18 V



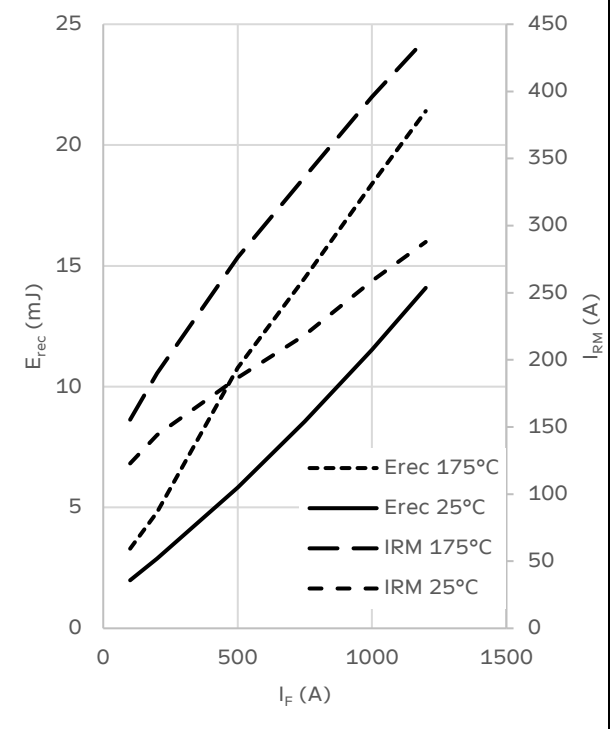
Reverse conduction characteristics (typical)
反向传导特性（典型值）
$I_D = f(V_{DS})$
$T_{vj} = 25°C$



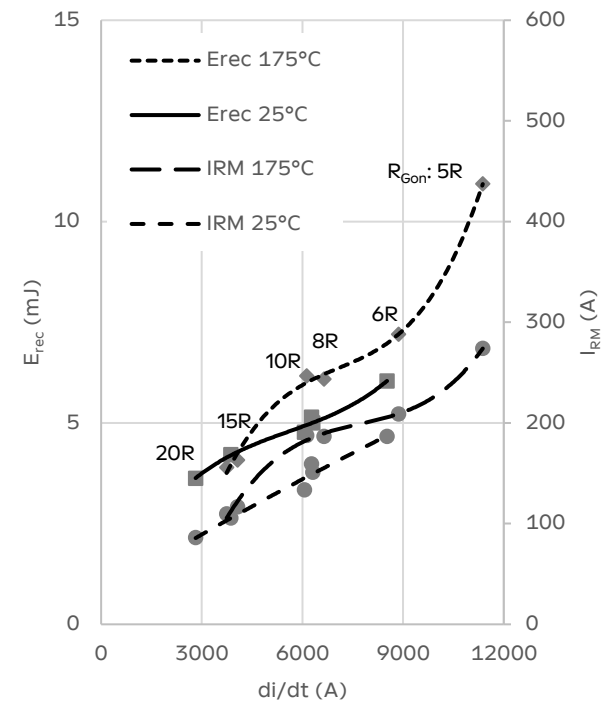
Reverse conduction characteristics (typical)
反向传导特性（典型值）
$I_D = f(V_{DS})$
$T_{vj} = 175°C$



Diode switching characteristics (typical)
二极管开关特性（典型）
$E_{rec} = f(I_F)$, $I_{RM} = f(I_F)$
$V_{DC} = 800$ V, $R_{Gon} = 5\ \Omega$ (MOSFET), $V_{GS} = -4/+18$ V



Diode switching characteristics (typical)
二极管开关特性（典型）
$E_{rec} = f(di/dt)$, $I_{RM} = f(di/dt)$
$V_{DC} = 800$ V, $I_D = -50$ A, $V_{GS} = -4/+18$ V (MOSFET)



Thermal resistance versus flow rate 热阻与流速的关系 $R_{th(J-A)}$ =f(dv/dt)	**Transient thermal impedance** 瞬态热阻抗 $Z_{th(J-A)}$ =f(t) T_F =50°C
tbd	*tbd*