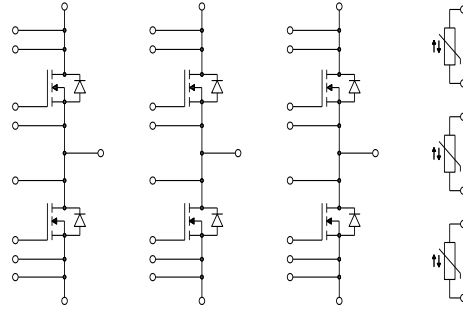
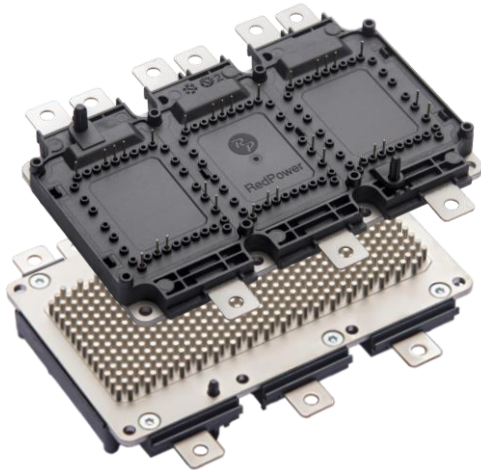


A6 package: 1200V 1.83 mΩ SiC MOSFET module



等效电路图
Equivalent Circuit Schematic

Features:

- 1200V 400A, $R_{DS(on)} = 1.83\text{m}\Omega @ 25^\circ\text{C}$
- Direct cooled PinFin Base Plate
- Trench gate Technology
- Low switching losses
- Chip double-sided sintering
- Copper wire bonding

产品特性:

- 1200V 400A, $R_{DS(on)} = 1.83\text{m}\Omega @ 25^\circ\text{C}$
- PinFin 直接液冷散热底板
- 沟槽栅技术
- 低开关损耗
- 芯片双面烧结技术
- 铜线键合

Typical Applications:

- Hybrid and Electric Vehicles
- Motor Drives

典型应用:

- (混合)电动汽车
- 电机驱动

MOSFET
Maximum Rated Values / 最大标称参数

Drain-source Voltage 漏极-源极电压	$T_{vj}=25^{\circ}\text{C}$	V_{DSS}	1200	V
DC drain current 漏极直流电流		$I_{D\text{ nom}}$	730	A
DC drain current 漏极直流电流	$T_F=65^{\circ}\text{C}$, $T_{vj\text{ max}}=175^{\circ}\text{C}$	I_D	550 ¹⁾	A
pulsed drain current 漏极脉冲电流	t_p limited by $T_{vj\text{ max}}$	$I_{D\text{ pulse}}$	1100 ¹⁾	A
Gate-source peak voltage 栅极-源极峰值电压		V_{GSS}	-6/+23	V
Continuous Gate-source voltage 栅极-源极工作电压		V_{GSS}	-2/+21	V

Characteristic Values / 性能参数

		min.	typ.	max.		
Drain-source on resistance 漏极-源极导通电阻	$I_D=400\text{A}$, $V_{GS}=18\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	$R_{DS(on)}$	1.83 3.35 3.77 4.25	2.3	mΩ	
Gate Threshold Voltage 栅极阈值电压	$I_D=218\text{mA}$, $V_{GS}=V_{DS}$ (tested after 1ms pulse at $V_{GS}=+18\text{V}$) $T_{vj}=25^{\circ}\text{C}$	$V_{GS(th)}$	2.8	3.9	4.8	V
Internal Gate Resistor 内置栅极电阻	$T_{vj}=25^{\circ}\text{C}$	R_{Gint}	0.167			Ω
Input Capacitance 输入电容	$V_{GS}=0\text{V}$, $V_{DS}=800\text{V}$, $f=1\text{MHz}$, $T_{vj}=25^{\circ}\text{C}$	C_{iss}	43.4			nF
Output Capacitance 输出电容	$V_{GS}=0\text{V}$, $V_{DS}=800\text{V}$, $f=1\text{MHz}$, $T_{vj}=25^{\circ}\text{C}$	C_{oss}	1.19			nF
Reverse Transfer Capacitance 反向传输电容	$V_{GS}=0\text{V}$, $V_{DS}=800\text{V}$, $f=1\text{MHz}$, $T_{vj}=25^{\circ}\text{C}$	C_{rss}	0.08			nF
Gate Charge 门极电荷	$V_{GS}=18\text{V}$, $V_{DS}=800\text{V}$	Q_G	1.56			μC
Drain-source Leakage Current 漏极-源极漏电流	$V_{DS}=1200\text{V}$, $V_{GS}=0\text{V}$, $T_{vj}=25^{\circ}\text{C}$	I_{DSS}			500	uA
Gate-source Leakage Current 栅极-源极漏电流	$V_{DS}=0\text{V}$, $V_{GS}=18\text{V}$, $T_{vj}=25^{\circ}\text{C}$	I_{GSS}			600	nA
Turn-on Delay Time, Inductive Load 开通延迟时间, 感性负载	$I_D=400\text{A}$, $V_{DS}=600\text{V}$ $V_{GS}=-1\text{V}/18\text{V}$ $R_{Gon}=4\Omega$ $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	t_{don}	85 70 65 60			ns
Rise Time, Inductive Load 上升时间, 感性负载	$I_D=400\text{A}$, $V_{DS}=600\text{V}$ $V_{GS}=-1\text{V}/18\text{V}$ $R_{Gon}=4\Omega$ $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	t_r	72 60 56 53			ns
Turn-off Delay Time, Inductive Load 关断延迟时间, 感性负载	$I_D=400\text{A}$, $V_{DS}=600\text{V}$ $V_{GS}=-1\text{V}/18\text{V}$ $R_{Goff}=4\Omega$ $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	t_{doff}	440 495 510 515			ns
Fall Time, Inductive Load 下降时间, 感性负载	$I_D=400\text{A}$, $V_{DS}=600\text{V}$ $V_{GS}=-1\text{V}/18\text{V}$ $R_{Goff}=4\Omega$ $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	t_f	50 56 56 56			ns

¹⁾非测试值, 设计计算所得

Turn-on energy loss per pulse 开通损耗	$I_D=400A$, $V_{DS}=600V$, $V_{GS}=-1V/18V$, $R_{Gon}=4\Omega$, $L_\sigma=32nH$	$T_{vj}=25^\circ C$, $di/dt=4.5kA/us$	E_{on}		14.9		mJ
		$T_{vj}=125^\circ C$, $di/dt=5.4kA/us$			12.4		
		$T_{vj}=150^\circ C$, $di/dt=5.8kA/us$			12.2		
		$T_{vj}=175^\circ C$, $di/dt=6.1kA/us$			12		
Turn-off energy loss per pulse 关断损耗	$I_D=400A$, $V_{DS}=600V$, $V_{GS}=-1V/18V$, $R_{Goff}=4\Omega$, $L_\sigma=32nH$	$T_{vj}=25^\circ C$, $dv/dt=9.8kV/us$	E_{off}		12.5		mJ
		$T_{vj}=125^\circ C$, $dv/dt=10.1kV/us$			12.1		
		$T_{vj}=150^\circ C$, $dv/dt=10.2kV/us$			12.8		
		$T_{vj}=175^\circ C$, $dv/dt=10.2kV/us$			12.8		
Short Circuit Data 短路耐量	$V_{GS}=-1V/18V$, $V_{DD}=600V$, $R_{Goff}=10\Omega$ $V_{DSmax} \leq V_{DSS}-L_{sDS} \cdot di/dt$	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	t_{sc}	2.5 2			μs
Thermal Resistance, Junction to Cooling fluid 结-冷却液热阻	Per MOSFET, $\Delta V/\Delta t=10dm^3/min$ Cooling fluid=water, $T_F=25^\circ C$		R_{thJF}		tbd		K/W
Temperature under switching conditions 工作温度			$T_{vj op}$	-40		175	$^\circ C$

Body Diode / 体二极管

Maximum Rated Values / 最大标称参数

DC body diode forward current 体二极管正向直流电流	$T_{vjmax}=175^\circ C$, $V_{GS}=-5V$, $T_F=65^\circ C$	I_{SD}	295 ¹⁾	A
Pulsed body diode Current 体二极管脉冲电流	t_p limited by T_{vjmax}	$I_{SD pulse}$	1100 ¹⁾	A

Characteristic Values / 性能参数

		min.	typ.	max.	
Forward Voltage 正向通态压降	$I_{SD}=400A$, $V_{GS}=0V$	$T_{vj}=25^\circ C$		3.30	V
		$T_{vj}=125^\circ C$		3.60	
		$T_{vj}=150^\circ C$		3.60	
		$T_{vj}=175^\circ C$		3.60	
Peak Reverse Recovery Current 反向恢复峰值电流	$I_{SD}=400A$, $V_r=600V$ $V_{GS}=-1V$	$T_{vj}=25^\circ C$		120	A
		$T_{vj}=125^\circ C$		145	
		$T_{vj}=150^\circ C$		165	
		$T_{vj}=175^\circ C$		195	

¹⁾ 非测试值，设计计算所得

Recovery Charge 反向恢复电荷	$I_{SD}=400A, V_f=600V$ $V_{GS}=-1V$	$T_{vj}=25^{\circ}C$	Q_{rr}		2.1	μC
		$T_{vj}=125^{\circ}C$			3.2	
		$T_{vj}=150^{\circ}C$			4.0	
		$T_{vj}=175^{\circ}C$			5.3	
Reverse Recovery Energy 反向恢复损耗	$I_{SD}=400A,$ $V_f=600V$ $V_{GS}=-1V$	$T_{vj}=25^{\circ}C,$ $-di/dt=7.9kA/us$	E_{rec}		1.16	mJ
		$T_{vj}=125^{\circ}C,$ $-di/dt=9.1kA/us$			1.68	
		$T_{vj}=150^{\circ}C,$ $-di/dt=9.4kA/us$			2.06	
		$T_{vj}=175^{\circ}C,$ $-di/dt=9.9kA/us$			2.65	

NTC-Thermistor/ NTC-热敏电阻

Characteristic Values / 性能参数

			min.	typ.	max.	
Rated Resistance 标称电阻	$T_C=25^{\circ}C$	R_{25}		5.00		$k\Omega$
Deviation of R100 R100 偏移值	$T_C=100^{\circ}C, R_{100}=493.3\Omega$	$\Delta R/R$	-5		5	%
Power Dissipation 功率耗散	$T_C=25^{\circ}C$	P_{25}			20	mW
B-Value B 值	$R_2=R_{25} \exp[B_{25/50}(1/T_2-1/(298.15K))]$	$B_{25/50}$		3375		K
B-Value B 值	$R_2=R_{25} \exp[B_{25/80}(1/T_2-1/(298.15K))]$	$B_{25/80}$		3414		K
B-Value B 值	$R_2=R_{25} \exp[B_{25/100}(1/T_2-1/(298.15K))]$	$B_{25/100}$		3436		K

Module / 模块

Isolation Test Voltage 绝缘测试电压	RMS, f=50Hz, t=1min	V_{ISOL}	3.0	KV
Material of Module Baseplate 模块底板材料			Cu+Ni ¹⁾	
Internal Isolation 内部绝缘			Si3N4	
Creepage Distance 爬电距离	Terminal to heatsink Terminal to terminal		9.0 9.0	mm
Clearance 电气间隙	Terminal to heatsink Terminal to terminal		4.5 4.5	mm
Comparative Tracking Index 相对漏电起痕指数		CTI	200 ²⁾	

1) 铜底板表面镀镍

2) CTI 约为 200

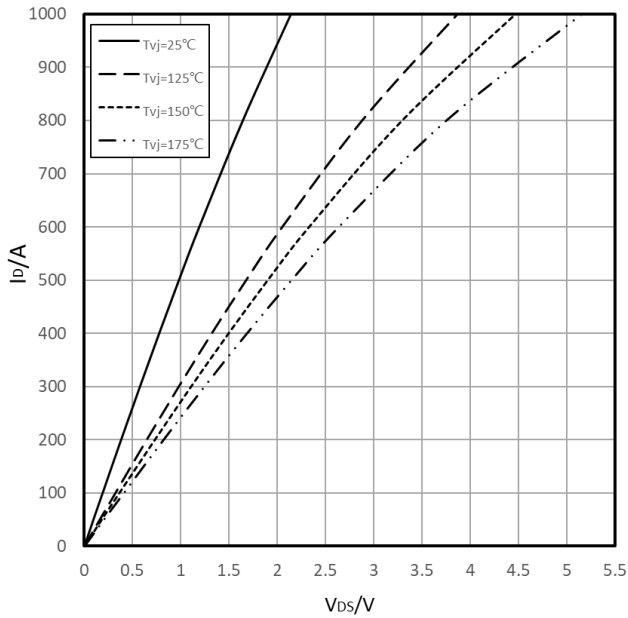
		min. typ. max.				
Stray Inductance Module 模块杂散电感		L_{sCE}		8.5		nH
Pressure drop in cooling circuit 冷却回路中的水压降	$\Delta V/\Delta t = 10 \text{ dm}^3/\text{min}$, $T_F = 60 \text{ }^\circ\text{C}$ 50% water/50% ethylenglycol,	Δp		64		mbar
Maximum pressure in cooling circuit 冷却回路中最大压力值		p			2.5	bar
Module Lead Resistance, Terminals-Chip 模块引脚电阻, 端子-芯片	$T_C=25^\circ\text{C}$, Per Switch	$R_{CC'+EE'}$		0.75		m Ω
Storage Temperature 贮存温度		T_{stg}	-40		125	$^\circ\text{C}$
Mounting Torque for Module Mounting 模块安装力矩	Baseplate to heatsink, Screw M4	M	1.8		2.2	Nm
	Terminal connection, Screw M5		3.5		5.5	
	PCB to frame		0.5		0.8	
Weight 重量		G		715		g

Circuit Diagram / 曲线图

Output characteristic (typical), MOSFET

输出特性(典型), MOSFET

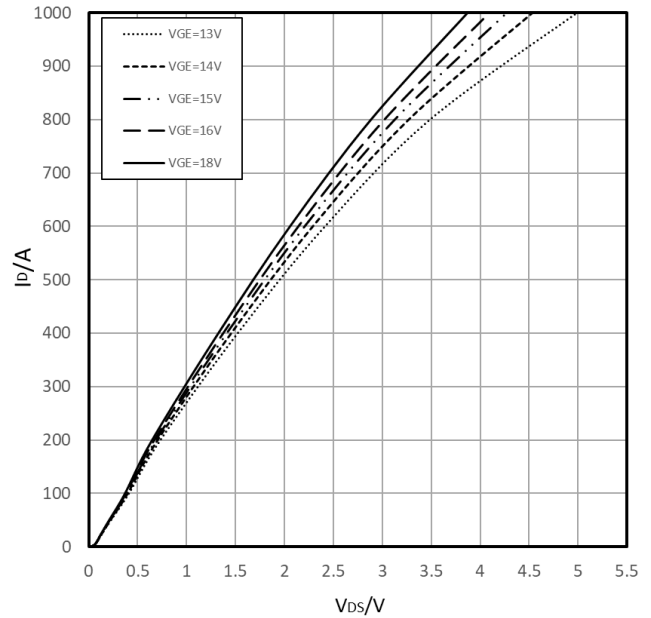
$I_D=f(V_{DS}), V_{GS}=18V$ (Inclusive R_{CC+EE})



Output characteristic , MOSFET(typical)

输出特性, MOSFET(典型)

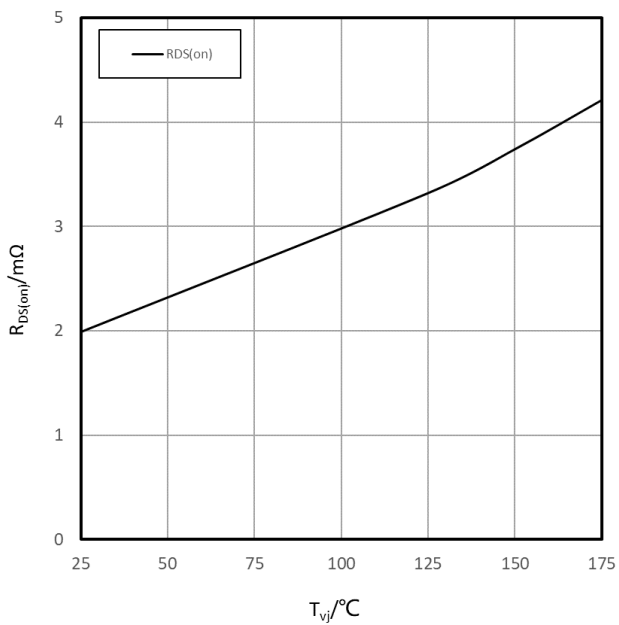
$I_D=f(V_{DS}), T_{vj}=125^{\circ}C$



Drain source on-resistance (typical), MOSFET

源漏极导通电阻(典型), MOSFET

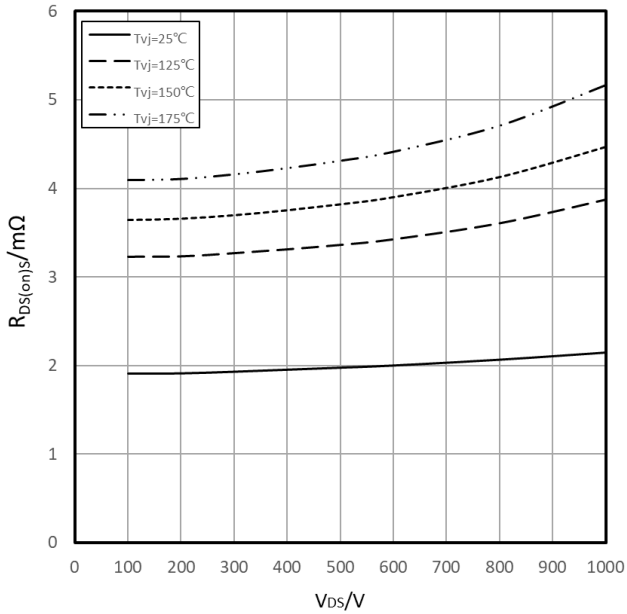
$R_{DS(on)}=f(T_{vj}), I_D=400A, V_{GS}=18V$



Drain source on-resistance (typical), MOSFET

漏源极导通电阻(典型), MOSFET

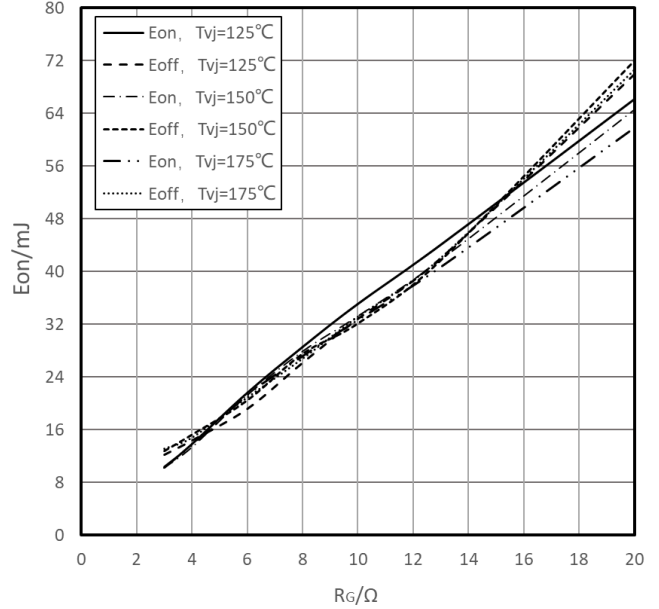
$R_{DS(on)}=f(I_D)$, $V_{GS}=18V$ (Inclusive $R_{CC'+EE'}$)



Switching losses (typical), MOSFET

开关损耗(典型), MOSFET

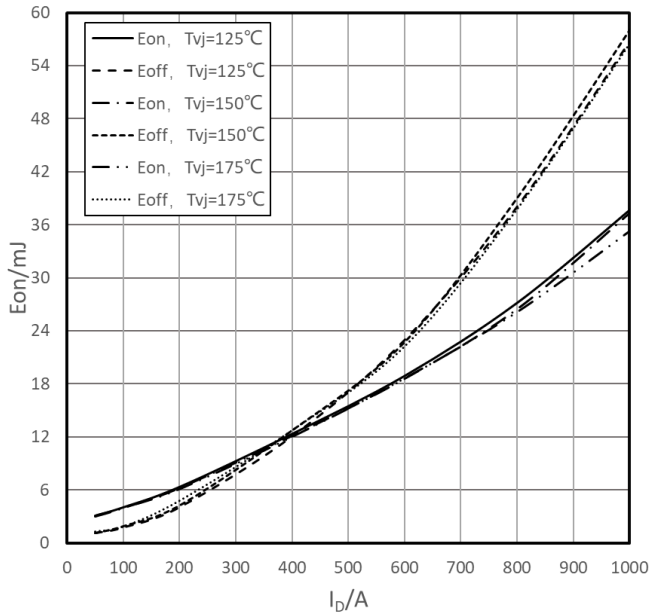
$E_{on}=f(R_g)$, $E_{off}=f(R_g)$
 $V_{GS}=+18V/-1V$, $I_D=450A$, $V_{DS}=600V$



Switching losses (typical), MOSFET

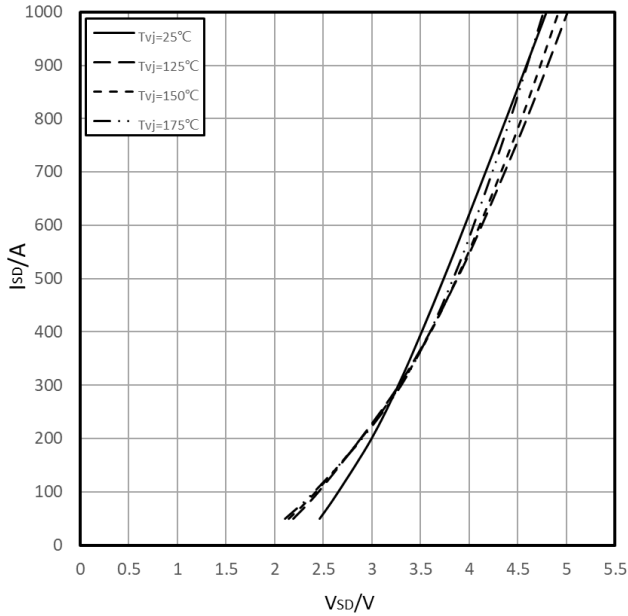
开关损耗(典型), MOSFET

$E_{on}=f(I_D)$, $E_{off}=f(I_D)$
 $V_{GS}=+18V/-1V$, $R_{gon}=4.0\Omega$, $R_{goff}=4.0\Omega$, $V_{DS}=600V$



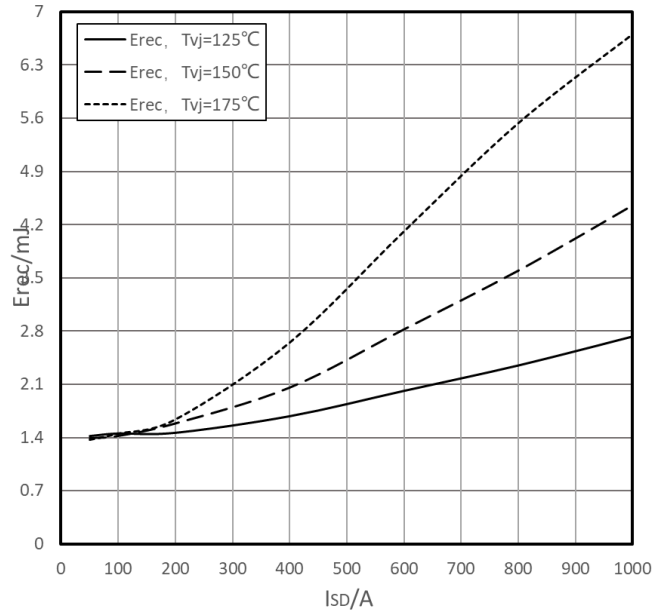
Forward characteristic body diode (typical), MOSFET
体二极管正向偏压特性(典型), MOSFET

$I_{SD}=f(V_{SD}), V_{GS}=0V$ (Inclusive $R_{CC+EE'}$)



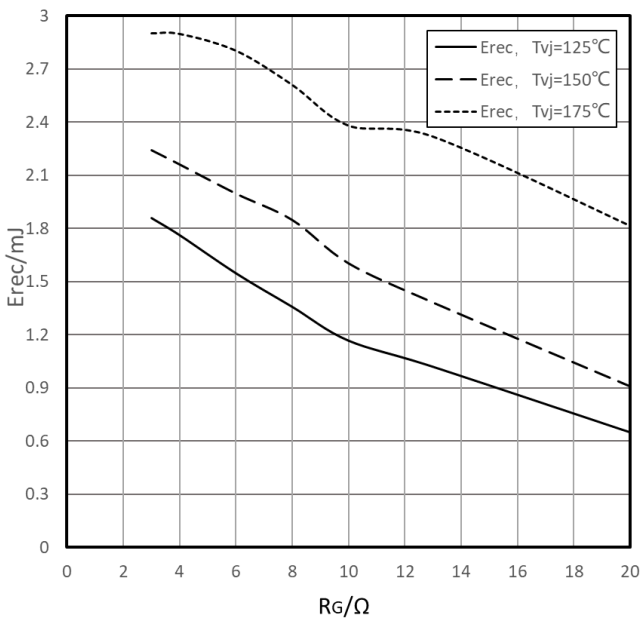
Switching losses body diode (typical), MOSFET
体二极管开关损耗(典型), MOSFET

$E_{rec}=f(I_{SD}), R_{gon}=4.0\Omega, V_r=600V, V_{GS}=+18V/-1V$



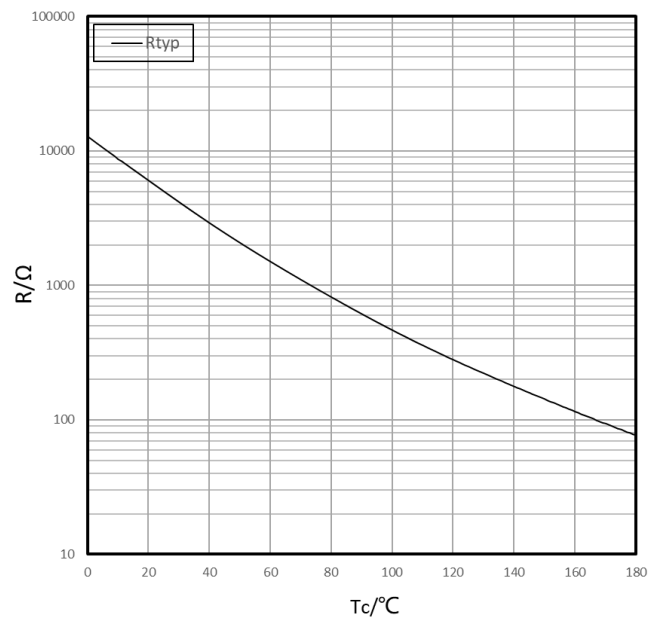
Switching losses body diode (typical), MOSFET
体二极管开关损耗(典型), MOSFET

$E_{rec}=f(R_G), I_{SD}=450A, V_r=600V, V_{GS}=+18V/-1V$

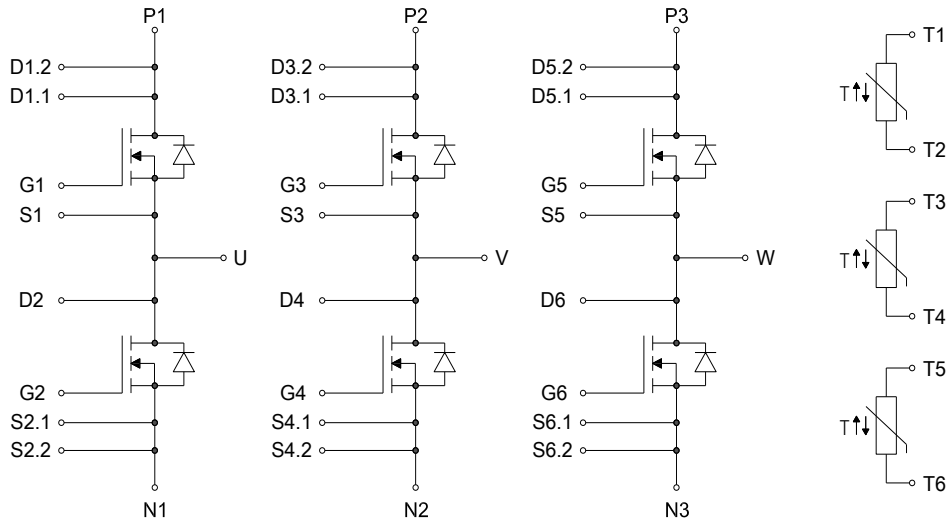


NTC-Thermistor-temperature characteristic
负温度系数热敏电阻 温度特性

$R=f(T)$



Internal Circuit / 内部电路



Package Dimension / 封装尺寸

Dimensions in Millimeters / 毫米为单位

