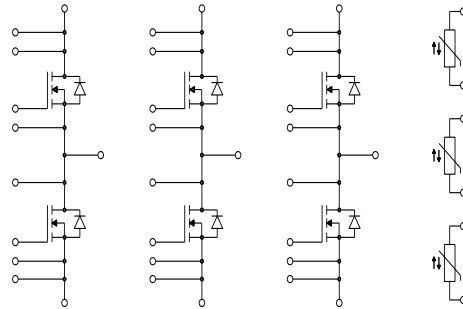
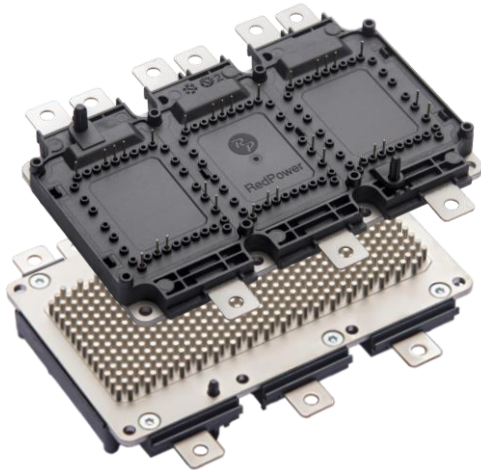


A6 package: 1200V 1.83 mΩ SiC MOSFET module



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 <sup>1)</sup>	A
pulsed drain current 漏极脉冲电流	$t_p$ limited by $T_{vj\text{ max}}$	$I_{D\text{ pulse}}$	1100 <sup>1)</sup>	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	m $\Omega$	
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			$\Omega$
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			$\mu\text{C}$
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	$\mu\text{A}$
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

<sup>1)</sup>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			$\mu s$
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 <sup>1)</sup>	A
Pulsed body diode Current 体二极管脉冲电流	$t_p$ limited by $T_{vjmax}$	$I_{SD pulse}$	1100 <sup>1)</sup>	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	

<sup>1)</sup> 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	$\mu C$
		$T_{vj}=125^{\circ}C$			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 <sup>1)</sup>	
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 <sup>2)</sup>	

1) 铜底板表面镀镍

2) CTI 约为 200

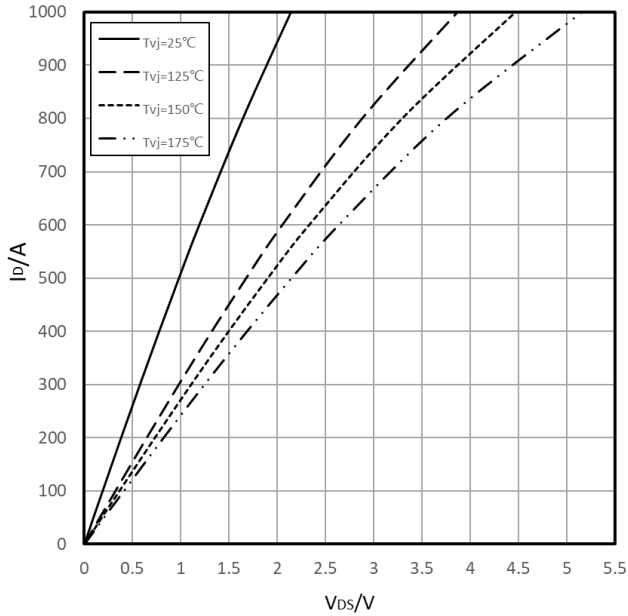
		min. typ. max.				
Stray Inductance Module 模块杂散电感		$L_{sCE}$		8.5		nH
Pressure drop in cooling circuit 冷却回路中的水压降	$\Delta V/\Delta t = 10 \text{ dm}^3/\text{min}$ , $T_F = 60 \text{ }^\circ\text{C}$ 50% water/50% ethylenglycol,	$\Delta p$		64		mbar
Maximum pressure in cooling circuit 冷却回路中最大压力值		$p$			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 $\Omega$
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

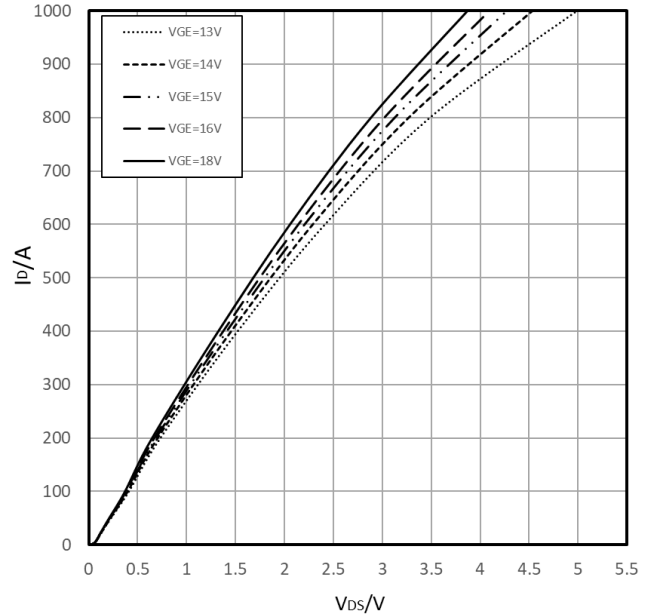
$I_D=f(V_{DS}), V_{GS}=18V$  (Inclusive  $R_{CC+EE}$ )



Output characteristic , MOSFET(typical)

输出特性, MOSFET(典型)

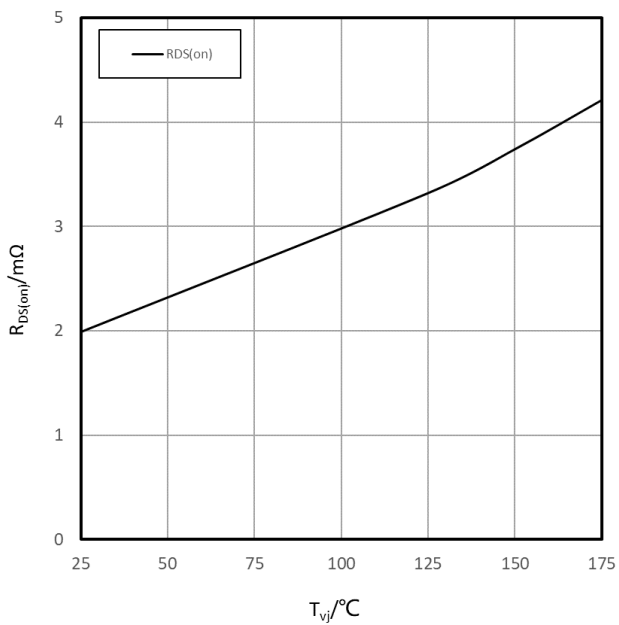
$I_D=f(V_{DS}), T_{vj}=125^\circ C$



Drain source on-resistance (typical), MOSFET

源漏极导通电阻(典型), MOSFET

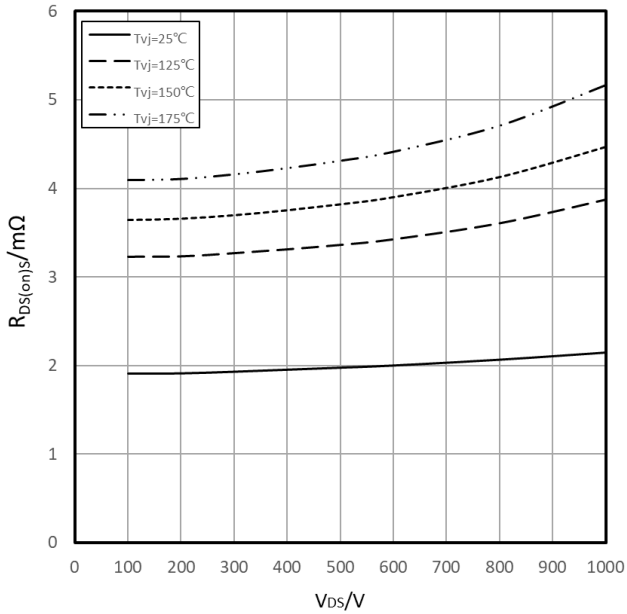
$R_{DS(on)}=f(T_{vj}), I_D=400A, V_{GS}=18V$



**Drain source on-resistance (typical), MOSFET**

**漏源极导通电阻(典型), MOSFET**

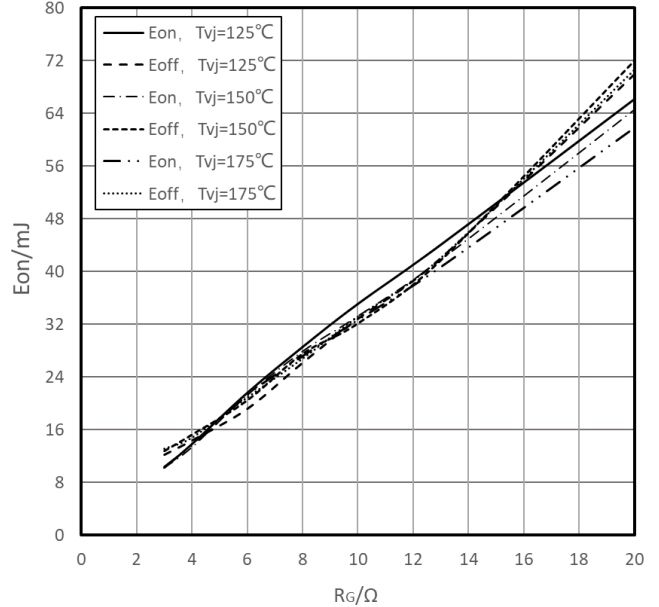
$R_{DS(on)}=f(I_D)$ ,  $V_{GS}=18V$  (Inclusive  $R_{CC'+EE'}$ )



**Switching losses (typical), MOSFET**

**开关损耗(典型), MOSFET**

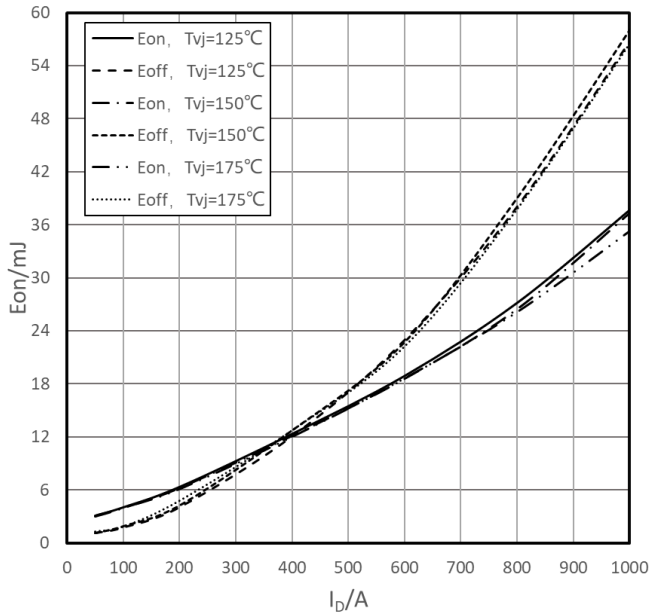
$E_{on}=f(R_g)$ ,  $E_{off}=f(R_g)$   
 $V_{GS}=+18V/-1V$ ,  $I_D=450A$ ,  $V_{DS}=600V$



**Switching losses (typical), MOSFET**

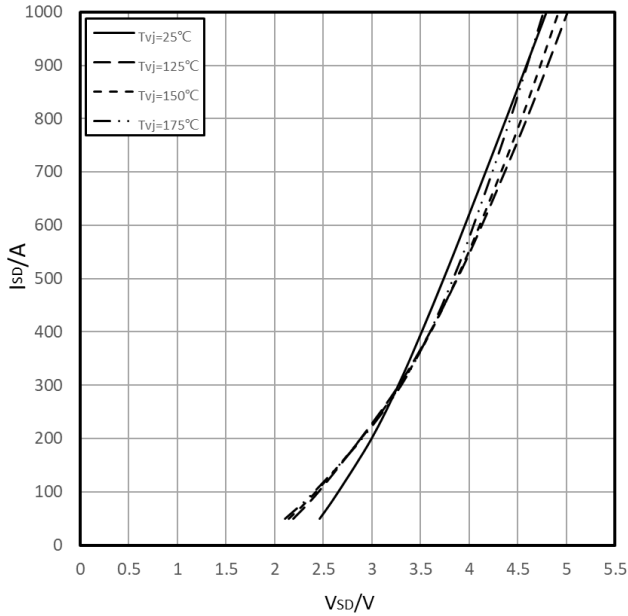
**开关损耗(典型), MOSFET**

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



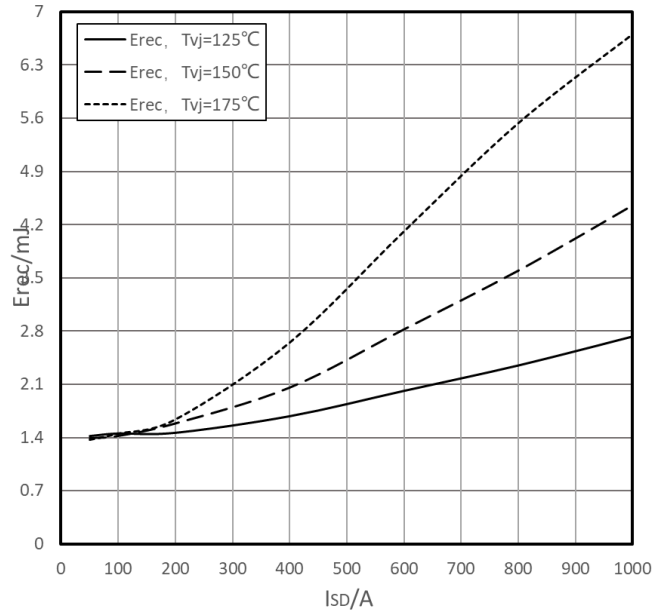
**Forward characteristic body diode (typical), MOSFET**  
**体二极管正向偏压特性(典型), MOSFET**

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



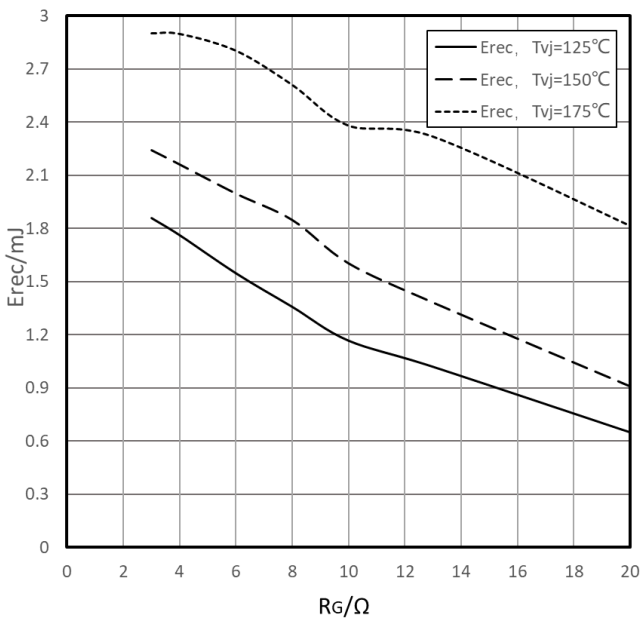
**Switching losses body diode (typical), MOSFET**  
**体二极管开关损耗(典型), MOSFET**

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



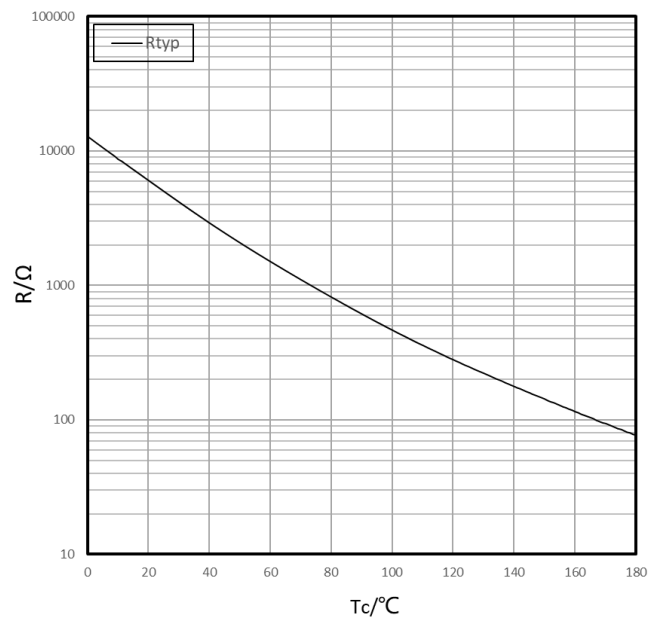
**Switching losses body diode (typical), MOSFET**  
**体二极管开关损耗(典型), MOSFET**

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



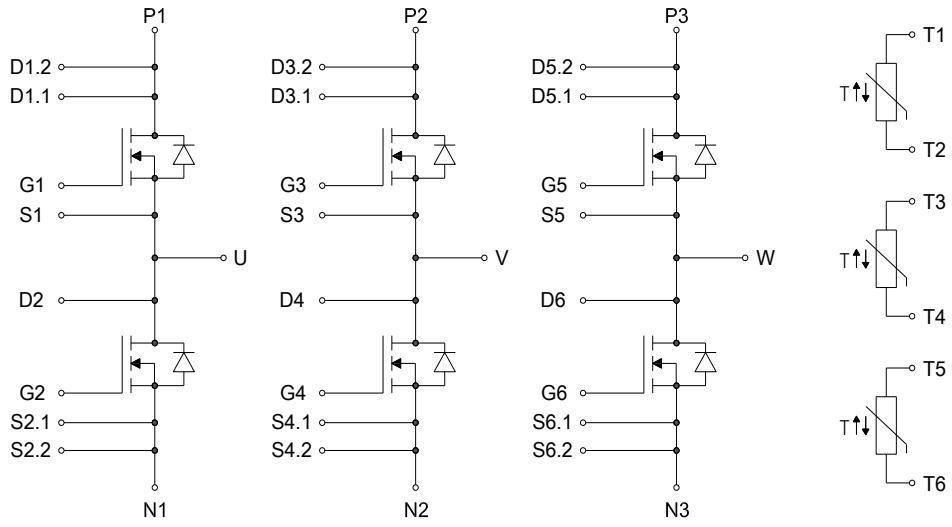
**NTC-Thermistor-temperature characteristic**  
**负温度系数热敏电阻 温度特性**

$R=f(T)$





Internal Circuit / 内部电路



**Package Dimension / 封装尺寸**

**Dimensions in Millimeters / 毫米为单位**

