

1200V, 1.5mΩ SiC MOSFET Module

Features

- Electrical features
 - $V_{DS} = 1200V$
 - $I_{DN} = 900A / I_{D,pulse}^* = 1800A$
- Mechanical features
 - Standard housing
 - Si_3N_4 material
 - Isolated base plate
 - High power density

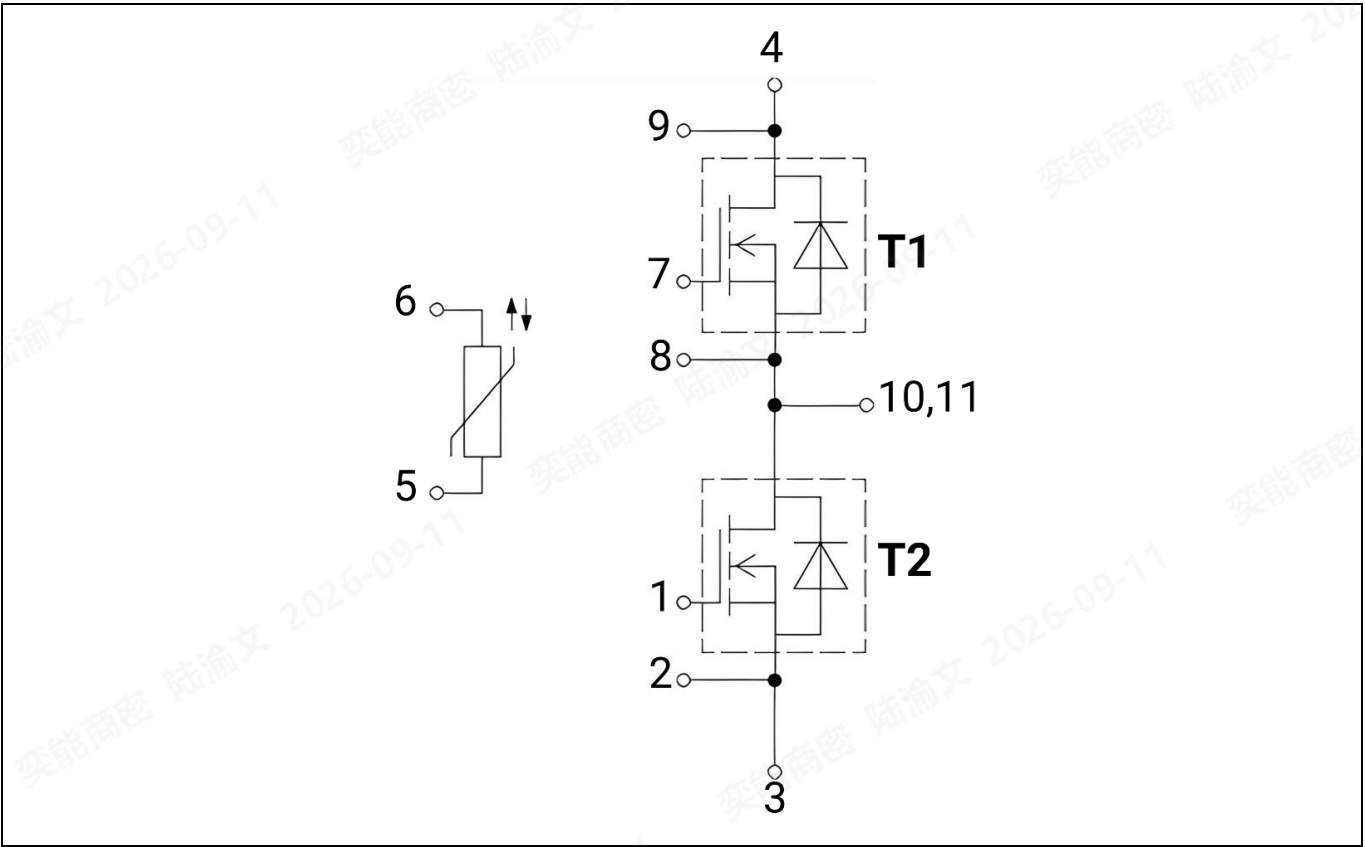
V_{DS}	1200V
$R_{DS(on)}$	1.5mΩ



Typical applications

- Construction, commercial, and agriculture vehicles
- Wind turbines
- UPS systems
- Solar application

Circuit diagram



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1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Value	Unit
Isolation Test Voltage	V_{ISOL}	RMS, $f = 50\text{Hz}$, $t = 1\text{min}$	3.5	kV
Material of Module Baseplate			Cu	
Internal Isolation		Basic insulation (class 1, IEC 61140)	Si_3N_4	
Creepage Distance	$d_{\text{Creep nom}}$	terminal to baseplate, nom.	>15	mm
Creepage Distance	$d_{\text{Creep min}}$	Terminal to baseplate, min.	14.7	mm
Creepage Distance	$d_{\text{Creep nom}}$	Terminal to terminal, nom.	>13	mm
Creepage Distance	$d_{\text{Creep min}}$	Terminal to terminal, min.	13	mm
Clearance	$d_{\text{Clear nom}}$	Terminal to baseplate, nom.	>12.5	mm
Clearance	$d_{\text{Clear min}}$	Terminal to baseplate, min.	12.5	mm
Clearance	$d_{\text{Clear nom}}$	Terminal to terminal, nom.	>10	mm
Clearance	$d_{\text{Clear min}}$	Terminal to terminal, min.	9.6	mm
Comparative Tracking Index	CTI		>200	

Table 2 Characteristic values

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
Stray Inductance Module	$L_{s,DS}$			14		nH
Module Lead Resistance, terminals - chip	$R_{DD'+SS'}$	$T_C = 25^\circ\text{C}$, per switch		0.9		m Ω
Storage Temperature	T_{stg}		-40		125	$^\circ\text{C}$
Mounting Torque for Module Mounting	M	Mounting according to valid application note M5, Screw	3		6	Nm
Terminal Connection Torque	M	Mounting according to M6, Screw	3		6	Nm

Parameter	Symbol	Note or test condition		Value			Unit
				Min.	Typ.	Max.	
		Valid application note					
Weight	G				338		g

2 MOSFET, T1/T2

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Value	Unit
Drain-source Voltage	V_{DS}		$T_{vj} = 25^{\circ}\text{C}$	1200	V
Implemented Drain Current	I_{DN}	Current rating based on chip rating times number of chips		900	A
Continuous DC Drain Current	I_{DDC}	$T_{vj} = 175^{\circ}\text{C}$, $V_{GS} = 18\text{V}$	$T_C = 65^{\circ}\text{C}$	700	A
Pulsed drain current	I_{DRM}	Verified by design, t_p limited by T_{vjmax}		1800	A
Gate-source Voltage, Max. Static Voltage	V_{GS}			-5.5/20	V

Table 4 Recommended values

Parameter	Symbol	Note or test condition	Value	Unit
On-state Gate Voltage	$V_{GS(on)}$		18	V
Off-state Gate Voltage	$V_{GS(off)}$		-5	V

Table 5 Characteristic values

Parameter	Symbol	Note or test condition		Value			Unit
				Min.	Typ.	Max.	
Drain-source On-resistance	$R_{DS(on)}$	$I_D = 900\text{A}$	$V_{GS} = 15\text{V}$, $T_{vj} = 25^{\circ}\text{C}$		1.77		mΩ
			$V_{GS} = 18\text{V}$, $T_{vj} = 25^{\circ}\text{C}$		1.50		
			$V_{GS} = 18\text{V}$, $T_{vj} = 125^{\circ}\text{C}$		2.81		
			$V_{GS} = 18\text{V}$, $T_{vj} = 175^{\circ}\text{C}$		3.97		

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
Gate Threshold Voltage	$V_{GS(th)}$	$I_D = 80mA$, $V_{DS} = V_{GS}$, $T_{vj} = 25^{\circ}C$, (Tested after 1ms pulse at $V_{GS} = +20V$)		3.4		V
Total Gate Charge	Q_G	$V_{DD} = 800V$, $V_{GS} = -5/18V$, $T_{vj} = 25^{\circ}C$		1.34		μC
Internal Gate Resistor	R_{Gint}	$V_{DD} = 800V$, $V_{GS} = -5/18V$, $T_{vj} = 25^{\circ}C$		0.9		Ω
Input Capacitance	C_{iss}	$f = 100kHz$, $V_{DS} = 800V$, $V_{GS} = 0V$, $T_{vj} = 25^{\circ}C$		29.5		nF
Output Capacitance	C_{oss}	$f = 100kHz$, $V_{DS} = 800V$, $V_{GS} = 0V$, $T_{vj} = 25^{\circ}C$		1.86		nF
Reverse Transfer Capacitance	C_{rss}	$f = 100kHz$, $V_{DS} = 800V$, $V_{GS} = 0V$, $T_{vj} = 25^{\circ}C$		0.113		nF
C_{oss} Stored Energy	E_{oss}	$V_{DS} = 800V$, $V_{GS} = -5/18V$, $T_{vj} = 25^{\circ}C$		1272		μJ
Drain-Source Leakage Current	I_{DSS}	$V_{DS} = 1200V$, $V_{GS} = 0V$, $T_{vj} = 25^{\circ}C$			240	μA
Gate-Source Leakage Current	I_{GSS}	$V_{DS} = 0V$, $V_{GS} = 20V$, $T_{vj} = 25^{\circ}C$			800	nA
Turn-on Delay Time (Inductive Load)	$t_{d on}$	$I_D = 900 A$, $R_{Gon} = 5.1\Omega$, $V_{DD} = 600V$, $V_{GS} = -5/18V$	$T_{vj} = 25^{\circ}C$	163		ns
			$T_{vj} = 125^{\circ}C$	162		
			$T_{vj} = 175^{\circ}C$	156		
Rise Time (Inductive Load)	t_r	$I_D = 900A$, $R_{Gon} = 5.1\Omega$, $V_{DD} = 600V$, $V_{GS} = -5/18$	$T_{vj} = 25^{\circ}C$	108		ns
			$T_{vj} = 125^{\circ}C$	96		
			$T_{vj} = 175^{\circ}C$	93		
Turn-off Delay Time (Inductive Load)	$t_{d off}$	$I_D = 900A$, $R_{Goff} = 5.1\Omega$, $V_{DD} = 600V$, $V_{GS} = -5/18$	$T_{vj} = 25^{\circ}C$	436		ns
			$T_{vj} = 125^{\circ}C$	458		
			$T_{vj} = 175^{\circ}C$	470		
Fall Time (Inductive Load)	t_f	$I_D = 900A$, $R_{Goff} = 5.1\Omega$	$T_{vj} = 25^{\circ}C$	79		ns
			$T_{vj} = 125^{\circ}C$	86		

3 Body diode (MOSFET, T1/T2)

Parameter	Symbol	Note or test condition		Value			Unit
				Min.	Typ.	Max.	
		$V_{DD} = 600V$, $V_{GS} = -5/18V$	$T_{vj} = 175^{\circ}C$		88		
Turn-on Energy Loss per Pulse	E_{on}	$I_D = 900A$, $V_{DD} = 600V$, $V_{GS} = -5/18V$, $R_{Gon} = 5.1\Omega$	$T_{vj} = 25^{\circ}C$		63.9		mJ
			$T_{vj} = 125^{\circ}C$		64.3		
			$T_{vj} = 175^{\circ}C$		65.1		
Turn-off Energy Loss per Pulse	E_{off}	$I_D = 900A$, $V_{DD} = 600V$, $V_{GS} = -5/18V$, $R_{Goff} = 5.1\Omega$	$T_{vj} = 25^{\circ}C$		57		mJ
			$T_{vj} = 125^{\circ}C$		57.7		
			$T_{vj} = 175^{\circ}C$		58.2		
Thermal Resistance, Junction to Case	R_{thJC}	per MOSFET				0.0567	K/W
Thermal Resistance, Case to Heatsink	R_{thCH}	per MOSFET, $\lambda_{grease} = 1W/(m^{\circ}K)$			0.06		K/W
Temperature Under Switching Conditions	$T_{vj\ op}$			-40		175	$^{\circ}C$

3 Body diode (MOSFET, T1/T2)

Table 6 Maximum rated values

Parameter	Symbol	Note or test condition		Value	Unit
DC Body Diode Forward Current	I_{SD}	$T_{vj} = 175^{\circ}C$, $V_{GS} = -5V$	$T_C = 65^{\circ}C$	450	A

Table 7 Characteristic values

Parameter	Symbol	Note or test condition		Value			Unit
				Min.	Typ.	Max.	
Forward Voltage	V_{SD}	$I_{SD} = 900A$, $V_{GS} = -5V$	$T_{vj} = 25^{\circ}C$		5.23		V
			$T_{vj} = 125^{\circ}C$		4.60		
			$T_{vj} = 175^{\circ}C$		4.41		
Peak Reverse Recovery Current	I_{rrm}	$I_{SD} = 900A$, $V_{DD} = 600V$, $V_{GS} = -5V$	$T_{vj} = 25^{\circ}C$		130		A
			$T_{vj} = 125^{\circ}C$		238		
			$T_{vj} = 175^{\circ}C$		324		
Recovered Charge	Q_{rr}	$I_{SD} = 900A$, $di/dt =$ $9.7kA/\mu s$,	$T_{vj} = 25^{\circ}C$		2.28		μC
			$T_{vj} = 125^{\circ}C$		6.86		
			$T_{vj} = 175^{\circ}C$		11.22		

Parameter	Symbol	Note or test condition		Value			Unit
				Min.	Typ.	Max.	
		($T_{vj} = 175^{\circ}\text{C}$) $V_{DD} = 600\text{V}$, $V_{GS} = -5\text{V}$					
Reverse Recovery Energy	E_{rec}	$I_{SD} = 900\text{A}$, $di_s/dt = 9.7\text{kA}/\mu\text{s}$, ($T_{vj} = 175^{\circ}\text{C}$) $V_{DD} = 600\text{V}$, $V_{GS} = -5\text{V}$	$T_{vj} = 25^{\circ}\text{C}$		1.04		mJ
			$T_{vj} = 125^{\circ}\text{C}$		3.58		
			$T_{vj} = 175^{\circ}\text{C}$		7.15		

4 NTC-Thermistor

Table 8 NTC-Thermistor

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
Rated Resistance	R_{25}	$T_{NTC} = 25^{\circ}\text{C}$		5		$\text{k}\Omega$
Deviation of R_{100}	$\Delta R/R$	$T_{NTC} = 100^{\circ}\text{C}$, $R_{100} = 488\Omega$	-5		5	%
Power Dissipation	P_{25}	$T_{NTC} = 25^{\circ}\text{C}$			20	mW
β -value	$\beta_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298,15\text{K}))]$		3410		K
β -value	$\beta_{25/85}$	$R_2 = R_{25} \exp[B_{25/85}(1/T_2 - 1/(298,15\text{K}))]$		3440		K
β -value	$\beta_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298,15\text{K}))]$		3448		K

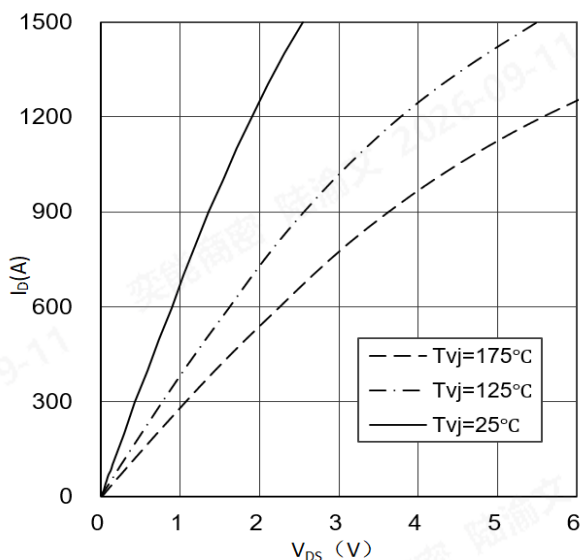
5 Characteristic diagrams

5 Characteristic diagrams

Output characteristic (typical), MOSFET,
T1/T2

$$I_D = f(V_{DS}),$$

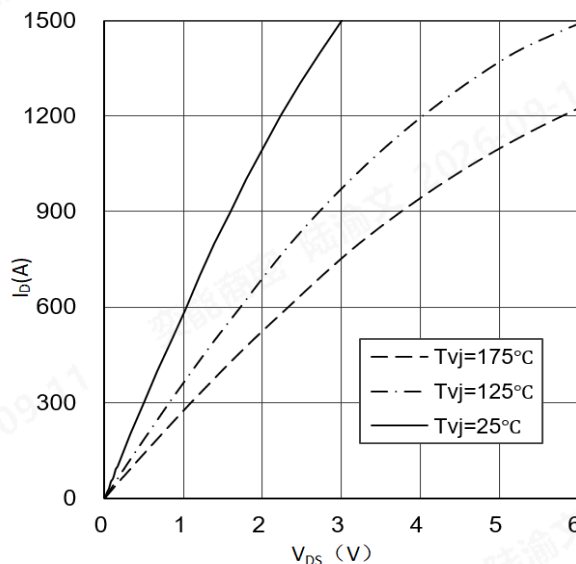
$$V_{GS} = 18V$$



Output characteristic (typical), MOSFET,
T1/T2

$$I_D = f(V_{DS})$$

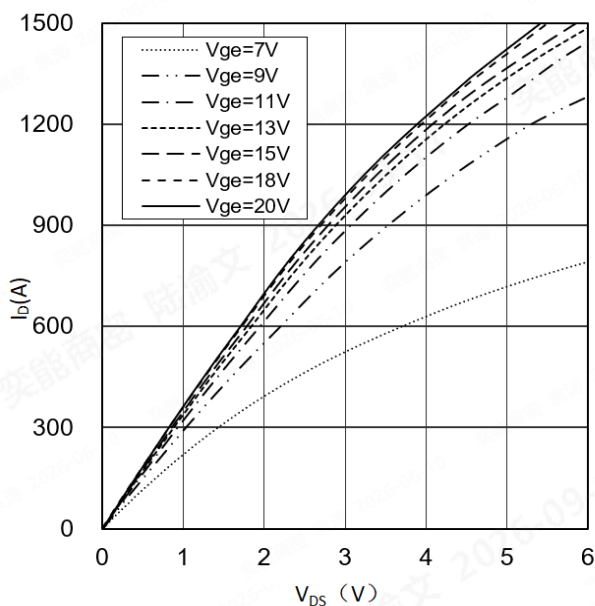
$$V_{GS} = 15V$$



Output characteristic field (typical), MOSFET,
T1/T2

$$I_D = f(V_{DS})$$

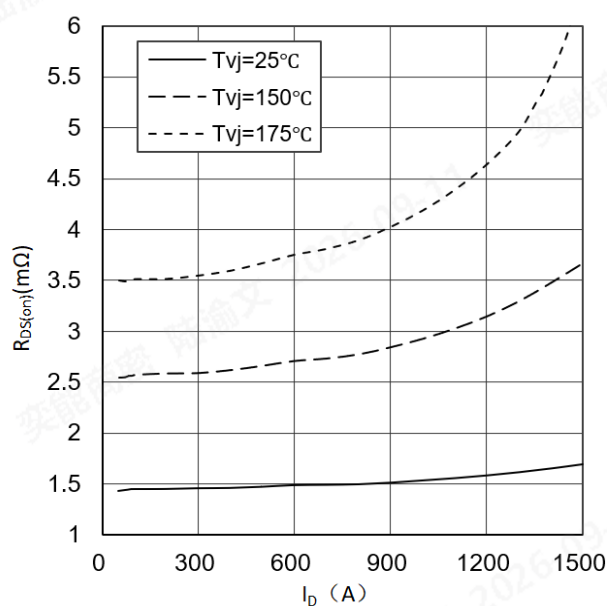
$$T_{vj} = 175^{\circ}C$$



Drain source on-resistance (typical), MOSFET,
T1/T2

$$R_{DS(on)} = f(I_D)$$

$$V_{GS} = 18V$$

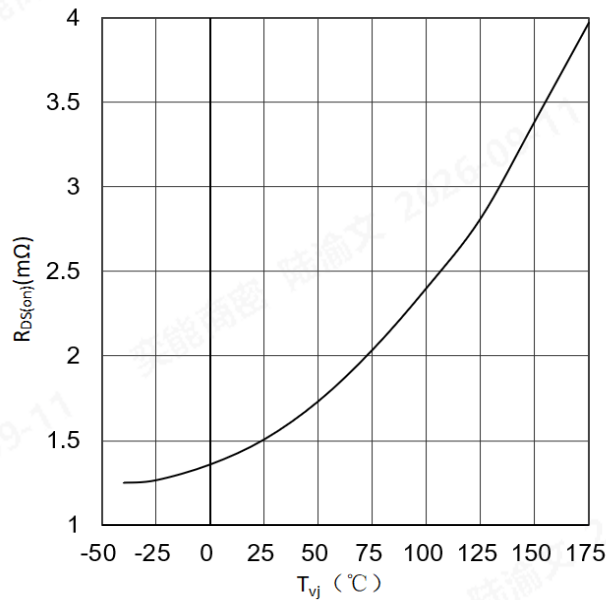


5 Characteristic diagrams

Drain source on-resistance (typical), MOSFET, T1/T2

$R_{DS(on)} = f(T_{vj})$

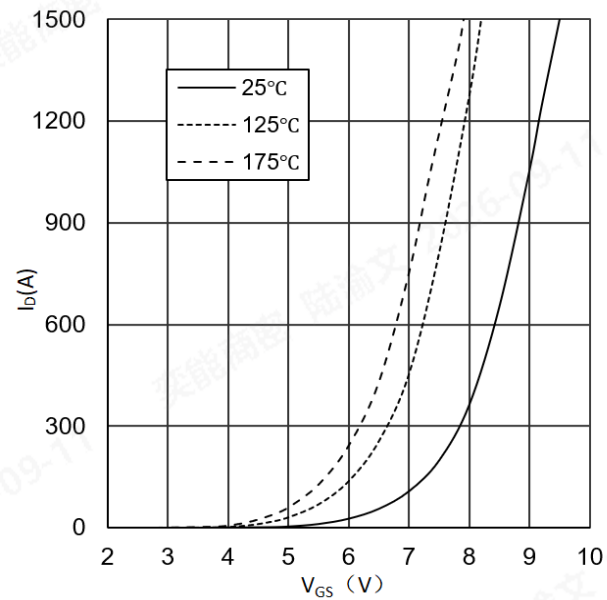
$I_D = 900A, V_{GS} = 18V$



Transfer characteristic (typical), MOSFET, T1/T2

$I_D = f(V_{GS})$

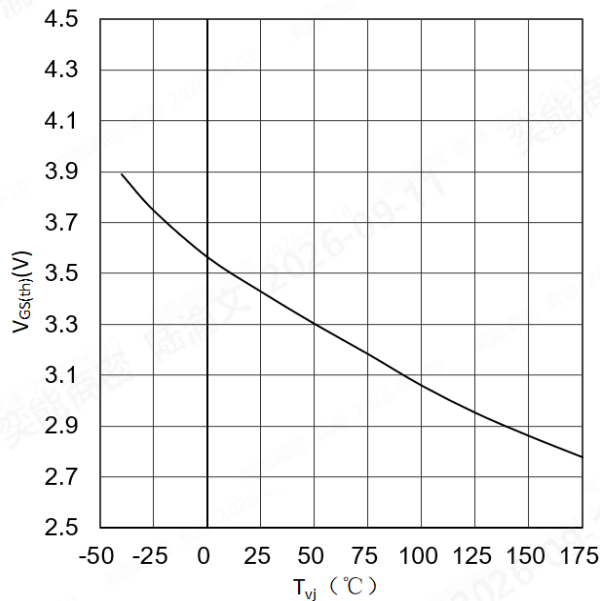
$V_{DS} = 20V$



Gate-source threshold voltage (typical), MOSFET, T1/T2

$V_{GS(th)} = f(T_{vj})$

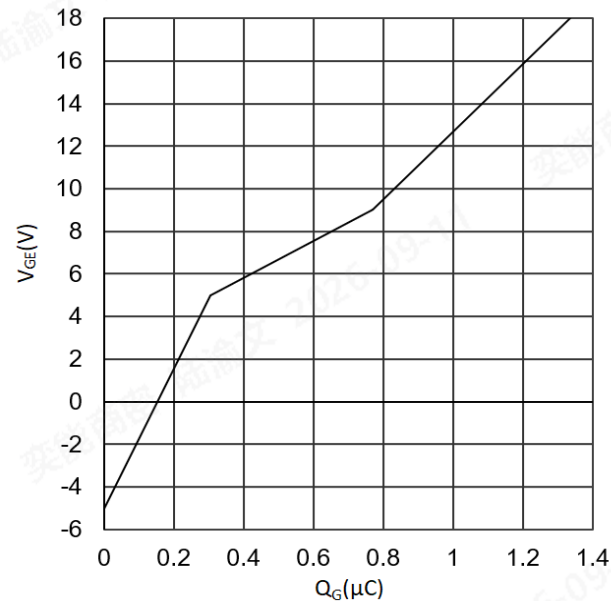
$V_{GS} = V_{DS}, I_D = 80mA$



Gate charge characteristic (typical), MOSFET, T1/T2

$V_{GS} = f(Q_G)$

$I_D = 900A, V_{DS} = 600V, T_{vj} = 25^\circ C$

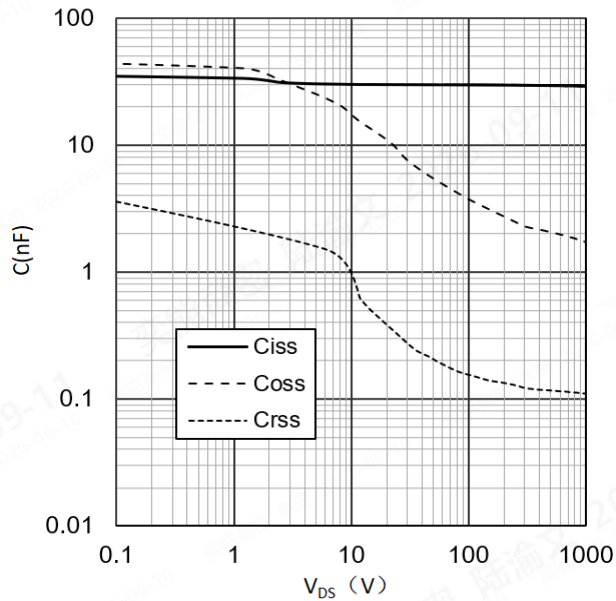


5 Characteristic diagrams

Capacity characteristic (typical), MOSFET, T1/T2

$$C = f(V_{DS})$$

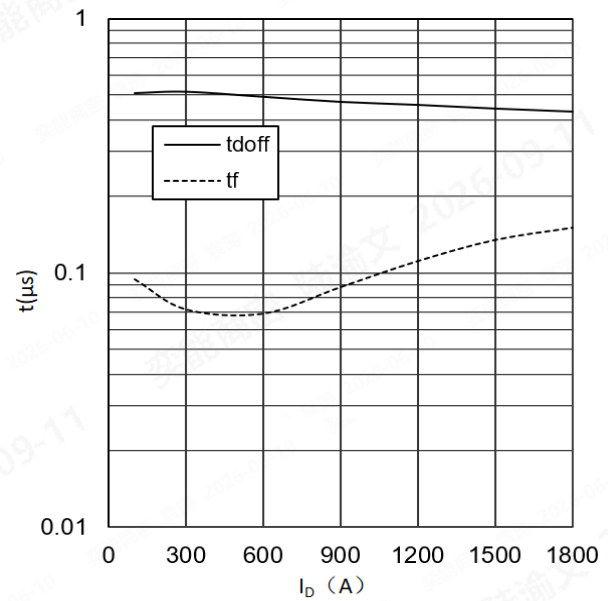
$$V_{GS} = 0V, f = 100kHz, T_{vj} = 25^{\circ}C$$

**Switching times (typical), MOSFET, T1/T2**

$$t = f(I_D)$$

$$V_{DD} = 600V, R_{Goff} = 5.1\Omega, V_{GS} = -4/18V,$$

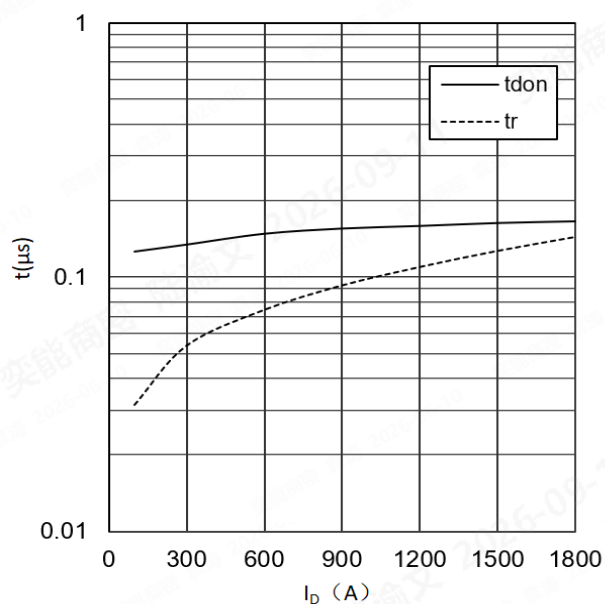
$$T_{vj} = 175^{\circ}C$$

**Switching times (typical), MOSFET, T1/T2**

$$t = f(I_D)$$

$$V_{DD} = 600V, R_{Gon} = 5.1\Omega, V_{GS} = -5/18V,$$

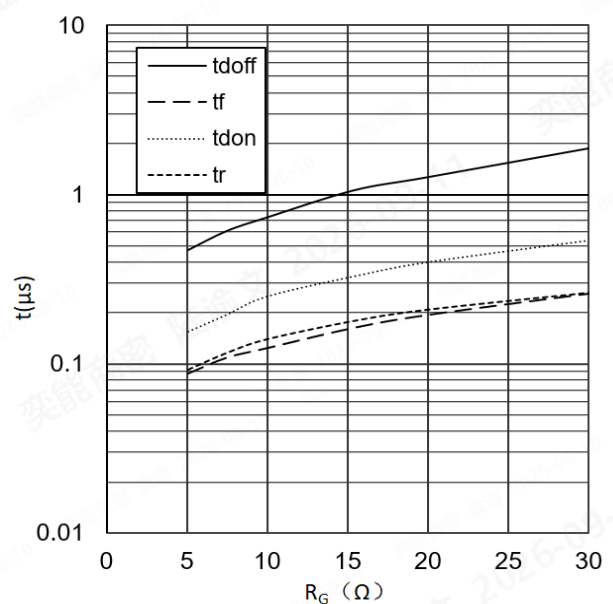
$$T_{vj} = 175^{\circ}C$$

**Switching times (typical), MOSFET, T1/T2**

$$t = f(R_G)$$

$$V_{DD} = 600V, I_D = 900A, V_{GS} = -5/18V,$$

$$T_{vj} = 175^{\circ}C$$

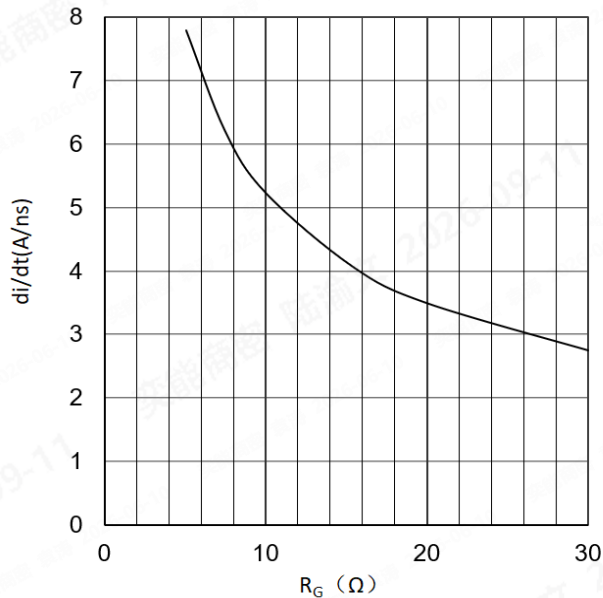


5 Characteristic diagrams

Current slope (typical), MOSFET, T1/T2

$$di/dt = f(R_G)$$

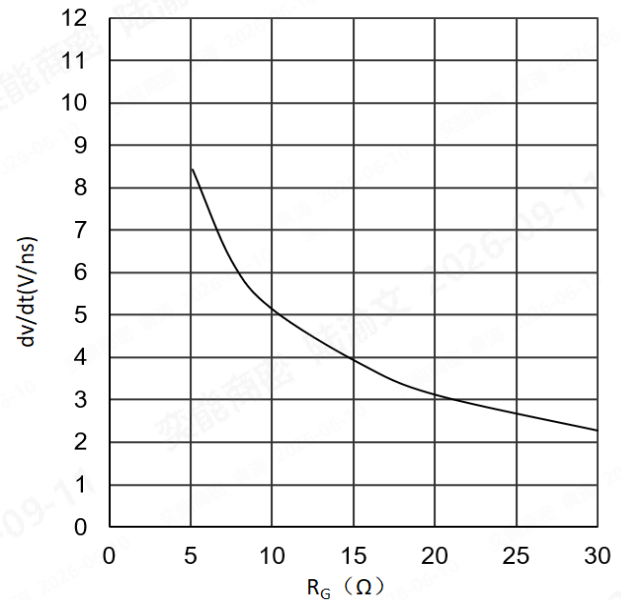
$$V_{DD} = 600V, I_D = 900A, V_{GS} = -5/18V$$



Voltage slope (typical), MOSFET, T1/T2

$$dv/dt = f(R_G)$$

$$V_{DD} = 600V, I_D = 900A, V_{GS} = -5/18V$$

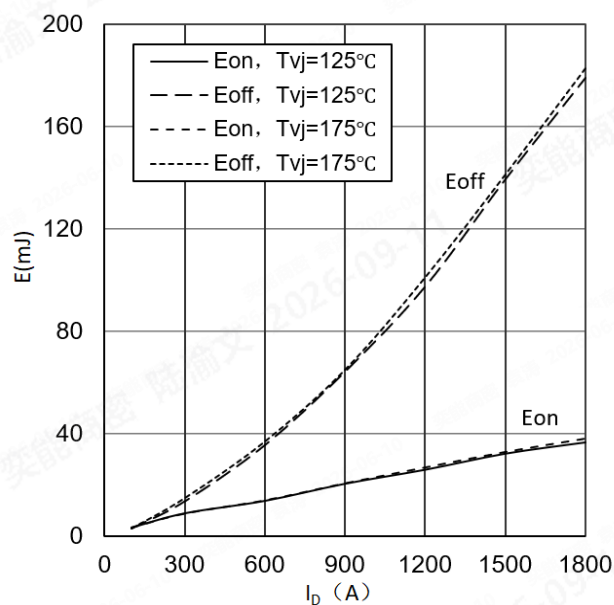


Switching losses (typical), MOSFET, T1/T2

$$E = f(I_D)$$

$$V_{DD} = 600V, R_{Gon} = 5.1\Omega, R_{Goff} = 5.1\Omega,$$

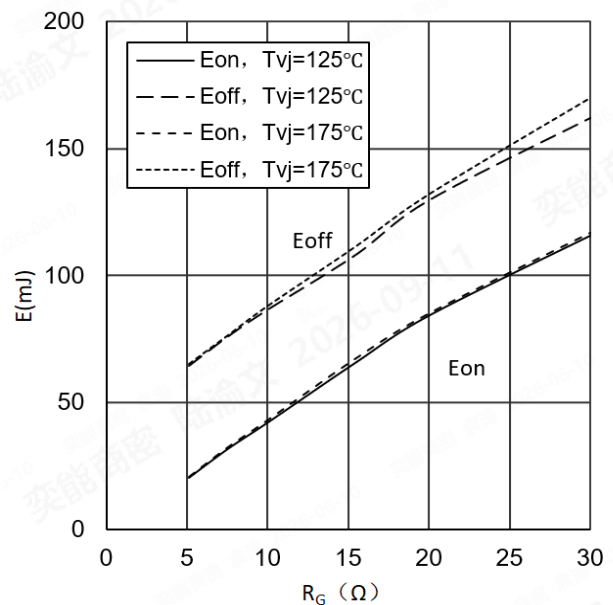
$$V_{GS} = -5/18V$$



Switching losses (typical), MOSFET, T1/T2

$$E = f(R_G)$$

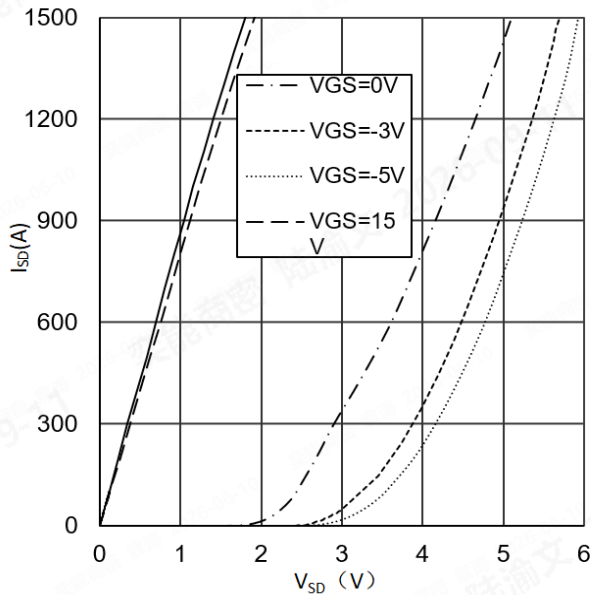
$$V_{DD} = 600V, I_D = 900A, V_{GS} = -5/18V$$



5 Characteristic diagrams

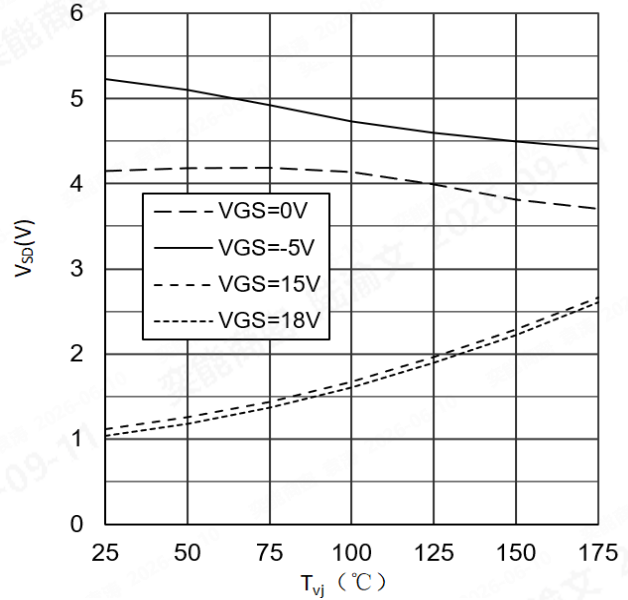
**Forward characteristic body diode (typical),
MOSFET, T1/T2**

$$I_{SD} = f(V_{SD}), T_{vj} = 25^{\circ}\text{C}$$

**Forward voltage of body diode (typical),
MOSFET, T1/T2**

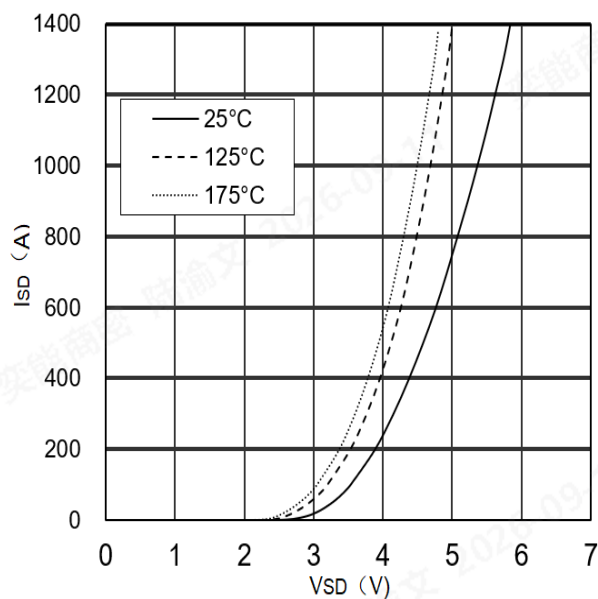
$$V_{DS} = f(T_{vj})$$

$$I_{SD} = 900\text{A}$$

**Forward characteristic body diode (typical),
MOSFET**

$$I_{SD} = f(V_{SD})$$

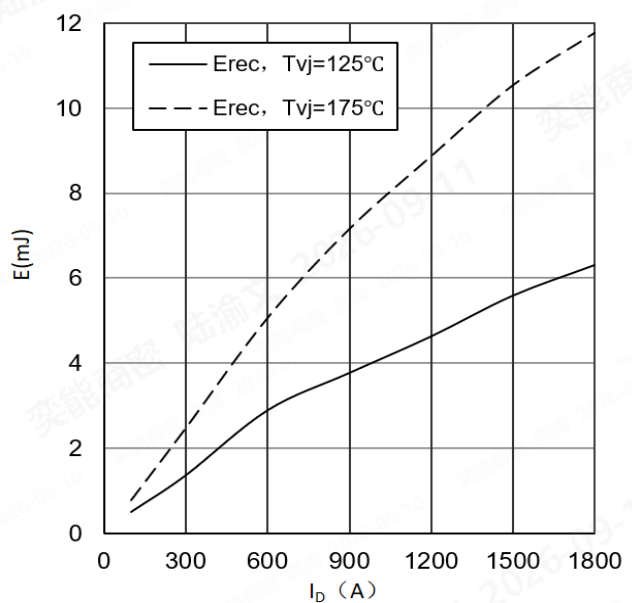
$$V_{GS} = -5\text{V}$$

**Switching losses body diode (typical),
MOSFET, T1/T2**

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

$$R_{Gon} = 5.1\Omega, R_{Goff} = 5.1\Omega, V_{GS} = -5/+18,$$

$$V_{DD} = 600\text{V}$$

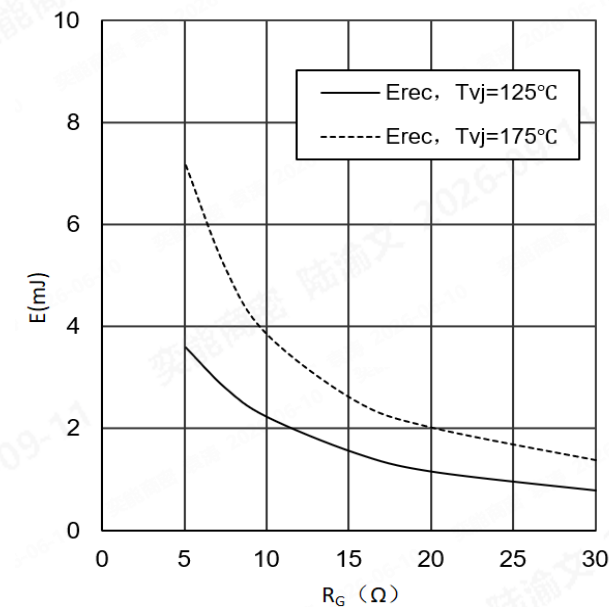


5 Characteristic diagrams

Switching losses body diode (typical),
MOSFET, T1/T2

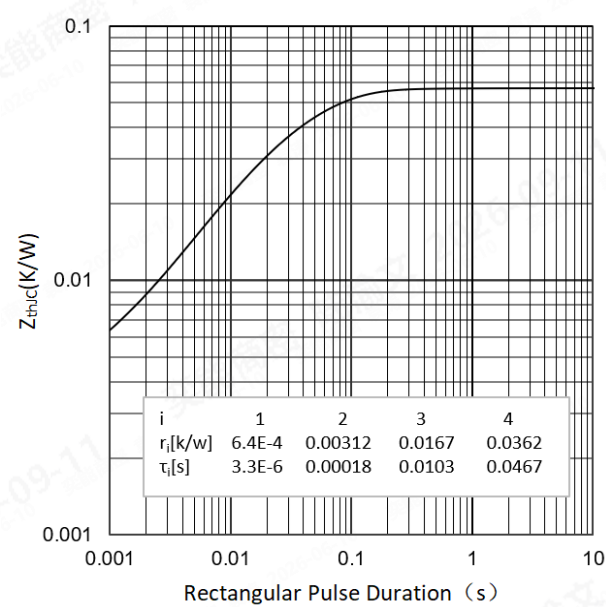
$E_{rec} = f(R_G)$

$V_{GS} = -5/+18, I_{SD} = 900A, V_{DD} = 600V$



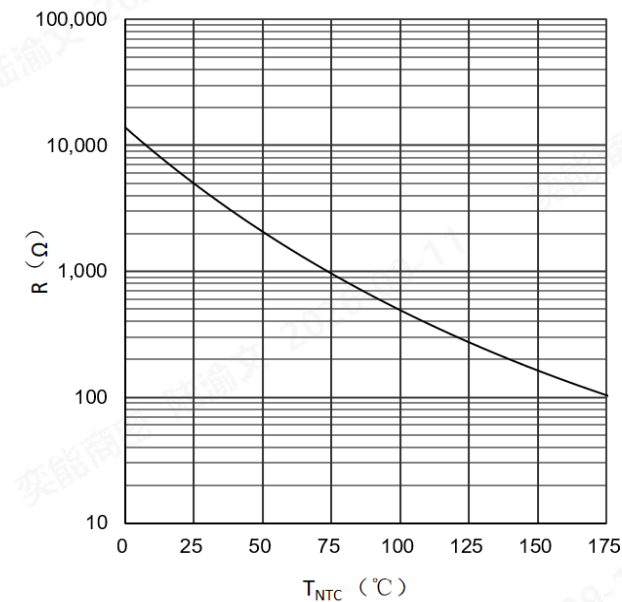
Transient thermal impedance, MOSFET, T1/T2

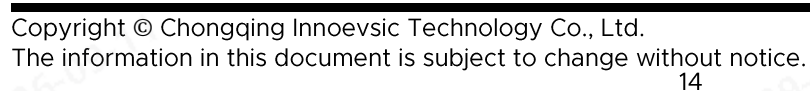
$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-
Thermistor

$R = f(T_{NTC})$





Revision history

Document revision	Date of release	Description of changes
1.2	2026-07-21	Update mechanical outline
1.1	2026-06-23	Change the NTC diagram
1.0	2025-06-05	Preliminary version

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