

1200V, 1.4mΩ SiC MOSFET Module

Features

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

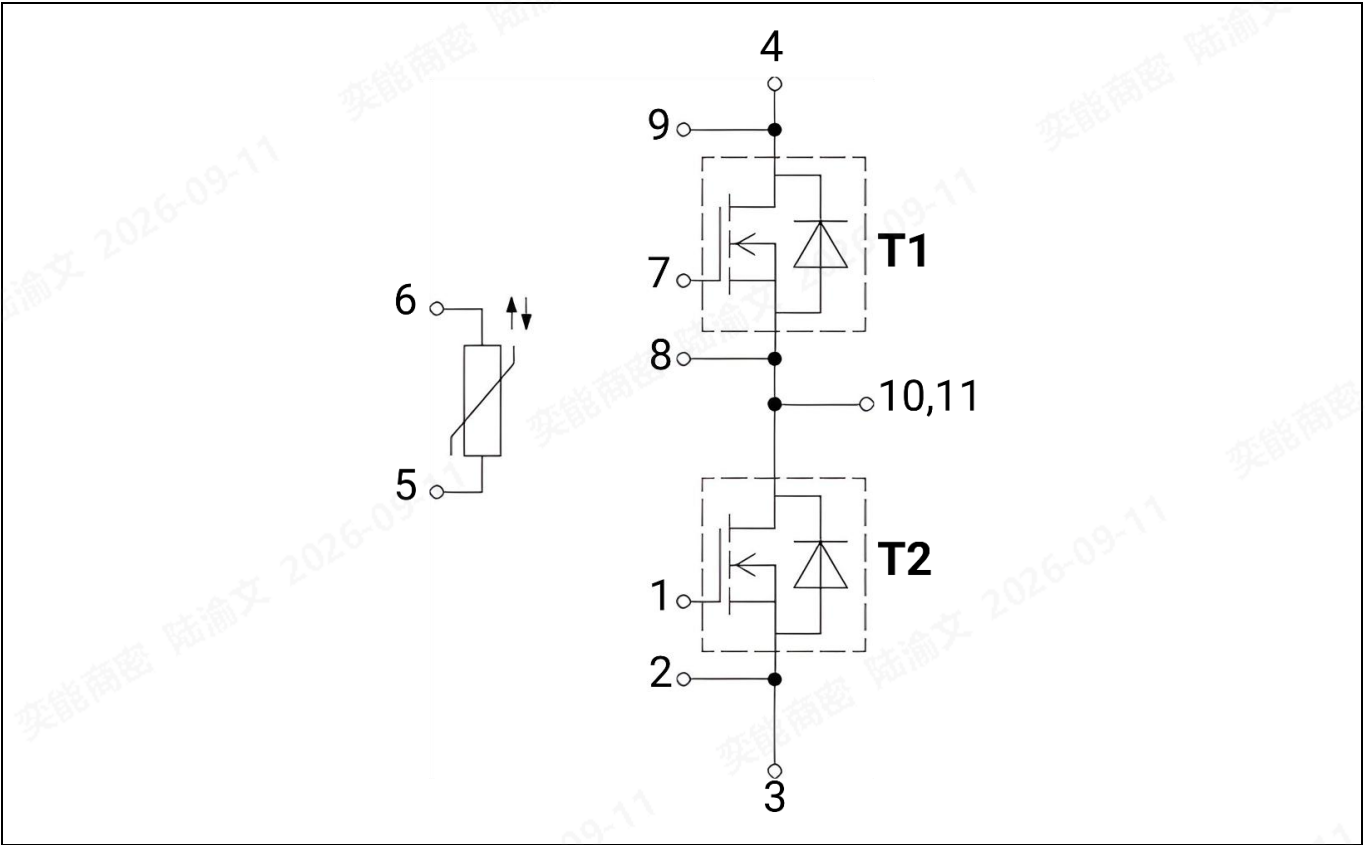
V_{DS}	1200V
$R_{DS(on)}$	1.4mΩ



Typical applications

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

Circuit diagram



Contents

Features 1

Typical applications..... 1

Circuit diagram 1

1 Package..... 3

2 MOSFET, T1/T2 4

3 Body diode (MOSFET, T1/T2)..... 6

4 NTC-Thermistor..... 6

5 Characteristic diagrams 8

6 Package outlines 14

Revision history 15

1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Value	Unit
Isolation Test Voltage	V_{ISOL}	RMS, $f = 50\text{Hz}$, $t = 1\text{min}$	3.4	kV
Isolation Test Voltage NTC	$V_{ISOL(NTC)}$	RMS, $f = 50\text{Hz}$, $t = 1\text{min}$	3.4	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.	>19.3	mm
Creepage Distance	$d_{\text{Creep min}}$	Terminal to terminal, min.	19.3	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			15.6		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 Valid application note	M6, Screw	3	6	Nm
Weight	G			350		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}	$T_{vj} = 175^{\circ}\text{C}$, $V_{GS} = 18\text{V}$ $T_C = 65^{\circ}\text{C}$	900	A
Pulsed drain current	$I_{D,pulse}$	Verified by design, t_p limited by T_{vjmax}	1800	A
Gate-source Voltage, Max. Static Voltage	V_{GS}		-8/19	V

Table 4 Recommended values

Parameter	Symbol	Note or test condition	Value	Unit
On-state Gate Voltage	$V_{GS(on)}$		15	V
Off-state Gate Voltage	$V_{GS(off)}$		-4	V

Table 5 Characteristic values

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
Drain-source On-resistance	$R_{DS(on)}$	$I_D = 900\text{A}$	$V_{GS} = 15\text{V}$, $T_{vj} = 25^{\circ}\text{C}$	1.37		m Ω
			$V_{GS} = 15\text{V}$, $T_{vj} = 125^{\circ}\text{C}$	2.01		
			$V_{GS} = 15\text{V}$, $T_{vj} = 175^{\circ}\text{C}$	2.65		
Gate Threshold Voltage	$V_{GS(th)}$	$I_D = 209\text{mA}$, $V_{DS} = V_{GS}$, $T_{vj} = 25^{\circ}\text{C}$, (Tested after 1ms pulse at $V_{GS} = +19\text{V}$)		3.0		V
Total Gate Charge	Q_G	$V_{DD} = 800\text{V}$, $V_{GS} = -4/15\text{V}$ $T_{vj} = 25^{\circ}\text{C}$		2.39		μC
Internal Gate Resistor	R_{Gint}	$T_{vj} = 25^{\circ}\text{C}$, $f = 1\text{MHz}$, $V_{AC} = 50\text{mV}$		0.8		Ω
Input Capacitance	C_{iss}	$f = 100\text{kHz}$, $V_{DS} = 800\text{V}$, $V_{GS} = 0\text{V}$ $T_{vj} = 25^{\circ}\text{C}$		69.8		nF
Output Capacitance	C_{oss}	$f = 100\text{kHz}$, $V_{DS} = 800\text{V}$, $V_{GS} = 0\text{V}$ $T_{vj} = 25^{\circ}\text{C}$		2.00		nF

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
Reverse Transfer Capacitance	C_{rss}	$f = 100\text{kHz}$, $V_{DS} = 800\text{V}$, $V_{GS} = 0\text{V}$		0.148		nF
C_{oss} Stored Energy	E_{oss}	$V_{DS} = 800\text{V}$, $V_{GS} = -4/15$		1690		μJ
Drain-Source Leakage Current	I_{DSS}	$V_{DS} = 1200\text{V}$, $V_{GS} = 0\text{V}$			320	μA
Gate-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{V}$, $V_{GS} = 19\text{V}$			1	μA
Turn-on Delay Time (Inductive Load)	t_{don}	$I_D = 900\text{A}$, $R_{Gon} = 2.7\Omega$, $V_{DD} = 600\text{V}$, $V_{GS} = -4/15\text{V}$	$T_{vj} = 25^\circ\text{C}$	188		ns
			$T_{vj} = 125^\circ\text{C}$	173		
			$T_{vj} = 175^\circ\text{C}$	168		
Rise Time (Inductive Load)	t_r	$I_D = 900\text{A}$, $R_{Gon} = 2.7\Omega$, $V_{DD} = 600\text{V}$, $V_{GS} = -4/15\text{V}$	$T_{vj} = 25^\circ\text{C}$	105		ns
			$T_{vj} = 125^\circ\text{C}$	98		
			$T_{vj} = 175^\circ\text{C}$	96		
Turn-off Delay Time (Inductive Load)	t_{doff}	$I_D = 900\text{A}$, $R_{Goff} = 1\Omega$, $V_{DD} = 600\text{V}$, $V_{GS} = -4/15\text{V}$	$T_{vj} = 25^\circ\text{C}$	345		ns
			$T_{vj} = 125^\circ\text{C}$	370		
			$T_{vj} = 175^\circ\text{C}$	380		
Fall Time (Inductive Load)	t_f	$I_D = 900\text{A}$, $R_{Goff} = 1\Omega$, $V_{DD} = 600\text{V}$, $V_{GS} = -4/15\text{V}$	$T_{vj} = 25^\circ\text{C}$	73		ns
			$T_{vj} = 125^\circ\text{C}$	107		
			$T_{vj} = 175^\circ\text{C}$	110		
Turn-on Energy Loss per Pulse	E_{on}	$I_D = 900\text{A}$, $V_{DD} = 600\text{V}$, $V_{GS} = -4/15\text{V}$, $R_{Gon} = 2.7\Omega$, $di/dt = 7.5\text{kA}/\mu\text{s}$ ($T_{vj} = 175^\circ\text{C}$)	$T_{vj} = 25^\circ\text{C}$	26.7		mJ
			$T_{vj} = 125^\circ\text{C}$	26.8		
			$T_{vj} = 175^\circ\text{C}$	27.8		
Turn-off Energy Loss per Pulse	E_{off}	$I_D = 900\text{A}$, $V_{DD} = 600\text{V}$, $V_{GS} = -4/15$, $R_{Goff} = 1\Omega$, $dv/dt = 9.4\text{kV}/\mu\text{s}$ ($T_{vj} = 175^\circ\text{C}$)	$T_{vj} = 25^\circ\text{C}$	57		mJ
			$T_{vj} = 125^\circ\text{C}$	57.7		
			$T_{vj} = 175^\circ\text{C}$	58.2		
Thermal Resistance, Junction to Case	R_{thJC}	per MOSFET			0.0428	K/W
Thermal Resistance, Case to Heatsink	R_{thCH}	per MOSFET, $\lambda_{grease} = 1\text{W}/(\text{m}^2\text{K})$		0.05		K/W

3 Body diode (MOSFET, T1/T2)

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
Temperature Under Switching Conditions	$T_{vj\ op}$		-40		175	°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}	$T_{vj} = 175^{\circ}\text{C}$, $V_{GS} = -4\text{V}$ $T_c = 60^{\circ}\text{C}$	480	A

Table 7 Characteristic values

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	V_{SD}	$I_{SD} = 900\text{A}$, $V_{GS} = -4\text{V}$	$T_{vj} = 25^{\circ}\text{C}$	6.38		V
			$T_{vj} = 125^{\circ}\text{C}$	5.77		
			$T_{vj} = 175^{\circ}\text{C}$	5.60		
Peak Reverse Recovery Current	I_{rrm}	$I_{SD} = 900\text{A}$, $di_s/dt = 9.8\text{kA}/\mu\text{s}$, ($T_{vj} = 175^{\circ}\text{C}$) $V_{DD} = 600\text{V}$, $V_{GS} = -4\text{V}$	$T_{vj} = 25^{\circ}\text{C}$	202		A
			$T_{vj} = 125^{\circ}\text{C}$	350		
			$T_{vj} = 175^{\circ}\text{C}$	460		
Recovered Charge	Q_{rr}	$I_{SD} = 900\text{A}$, $di_s/dt = 9.8\text{kA}/\mu\text{s}$, ($T_{vj} = 175^{\circ}\text{C}$) $V_{DD} = 600\text{V}$, $V_{GS} = -4\text{V}$	$T_{vj} = 25^{\circ}\text{C}$	12.1		μC
			$T_{vj} = 125^{\circ}\text{C}$	17.8		
			$T_{vj} = 175^{\circ}\text{C}$	27.5		
Reverse Recovery Energy	E_{rec}	$I_{SD} = 900\text{A}$, $di_s/dt = 9.8\text{kA}/\mu\text{s}$, ($T_{vj} = 175^{\circ}\text{C}$) $V_{DD} = 600\text{V}$, $V_{GS} = -4\text{V}$	$T_{vj} = 25^{\circ}\text{C}$	6.44		mJ
			$T_{vj} = 125^{\circ}\text{C}$	9.79		
			$T_{vj} = 175^{\circ}\text{C}$	15.4		

4 NTC-Thermistor

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
Rated Resistance	R_{25}	$T_{NTC} = 25^{\circ}\text{C}$		5		k Ω
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

IP120R014E3H

INNO ED3 Module



4 NTC-Thermistor

Parameter	Symbol	Note or test condition	Value			Unit
			Min.	Typ.	Max.	
B-value	B _{25/50}	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298,15K))]$		3410		K
B-value	B _{25/85}	$R_2 = R_{25} \exp[B_{25/85}(1/T_2 - 1/(298,15K))]$		3440		K
B-value	B _{25/100}	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298,15K))]$		3448		K

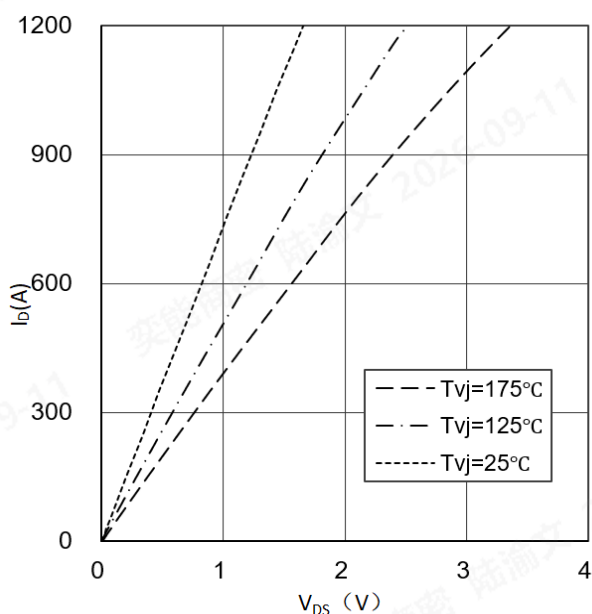
5 Characteristic diagrams

5 Characteristic diagrams

Output characteristic (typical), MOSFET, T1/T2

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

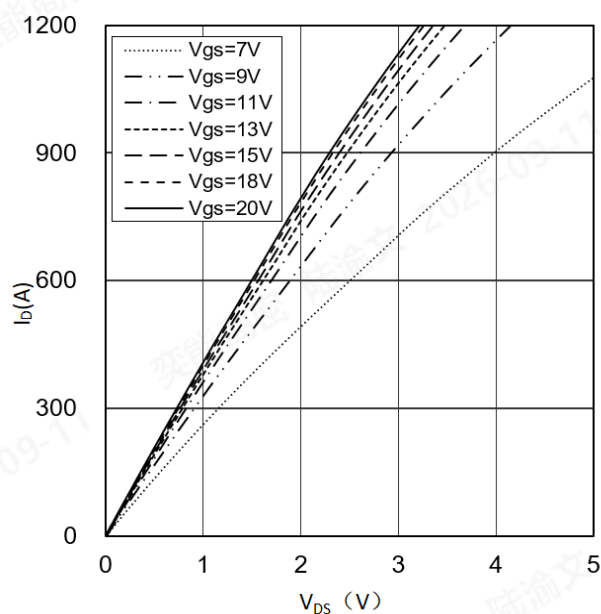
$$V_{GS} = 15V$$



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

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

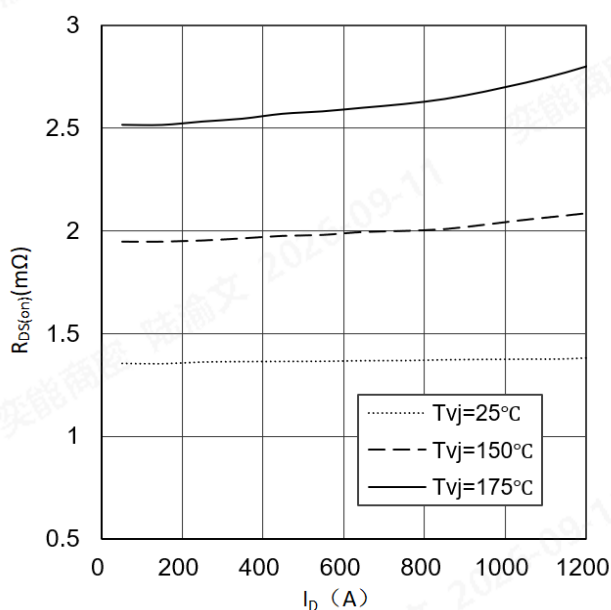
$$T_{vj} = 175^\circ C$$



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

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

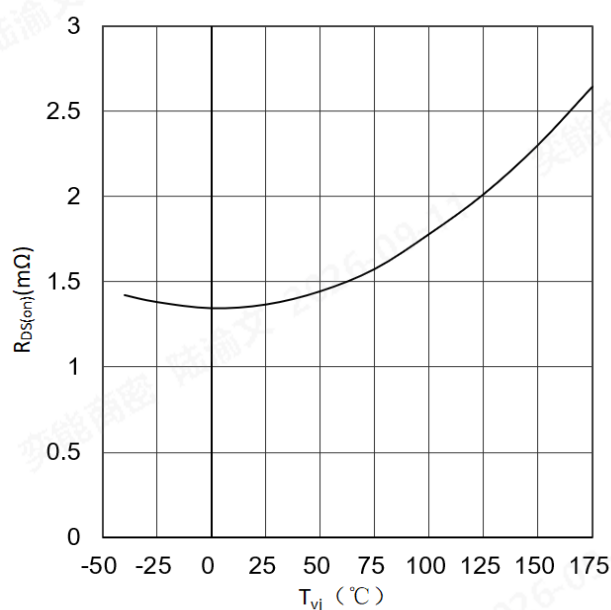
$$V_{GS} = 15V$$



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

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

$$I_D = 900A, V_{GS} = 15V$$

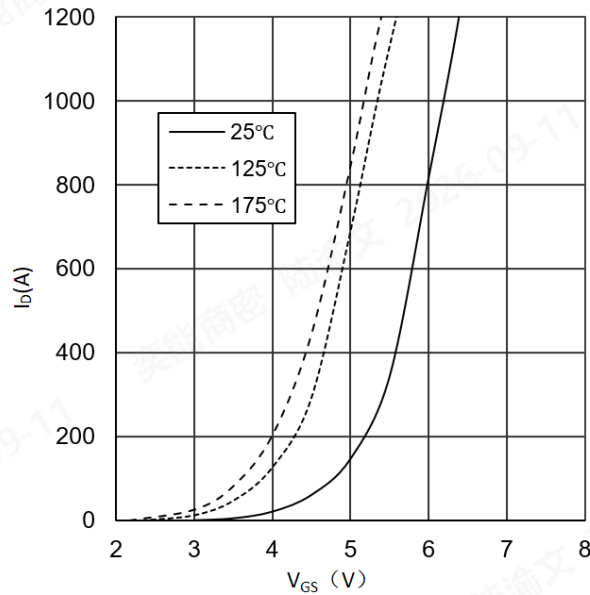


5 Characteristic diagrams

Transfer characteristic (typical), MOSFET, T1/T2

$I_D = f(V_{GS})$

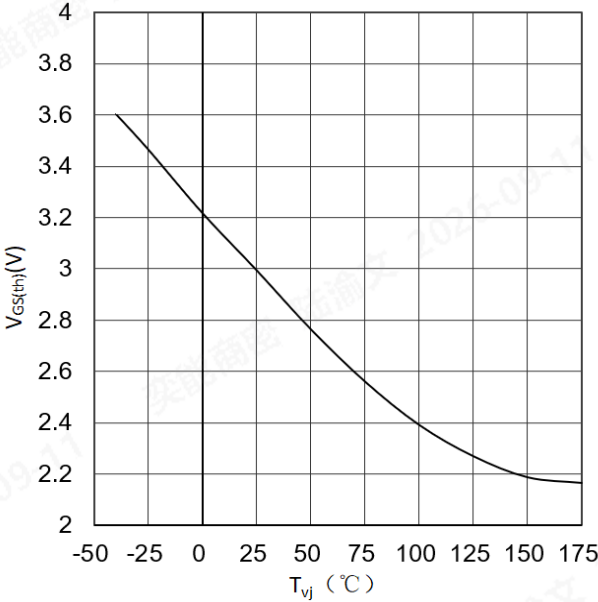
$V_{DS} = 20V$



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

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

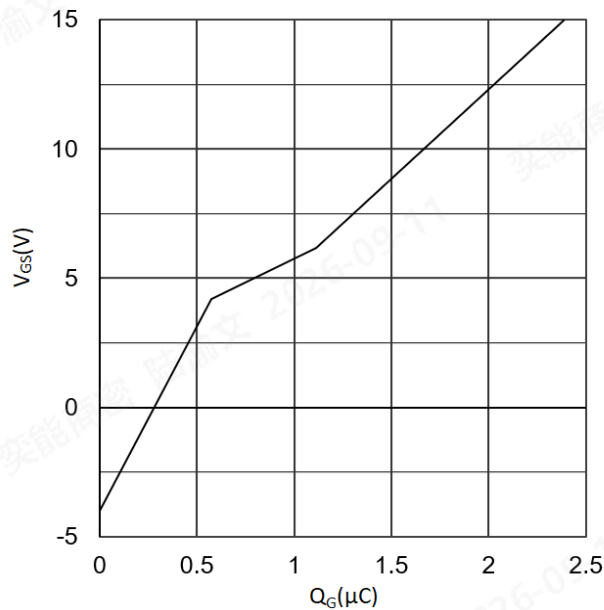
$V_{GS} = V_{DS}, I_D = 209mA$



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

$V_{GS} = f(Q_G)$

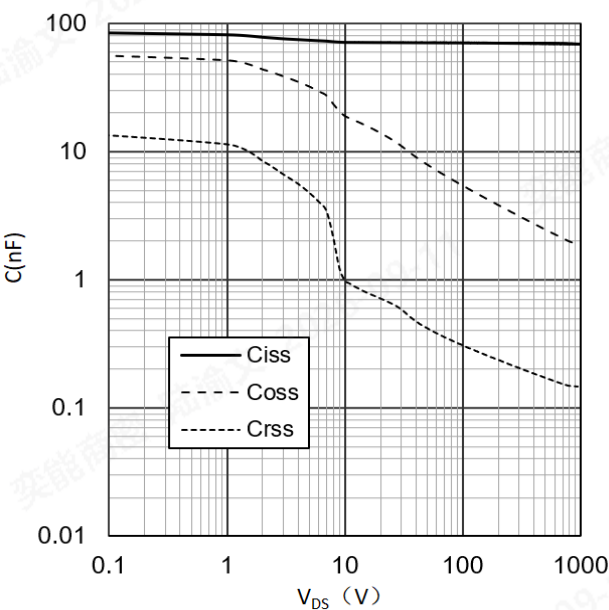
$I_D = 900A, V_{DS} = 600V, T_{vj} = 25^{\circ}C$



Capacity characteristic (typical), MOSFET, T1/T2

$C = f(V_{DS})$

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

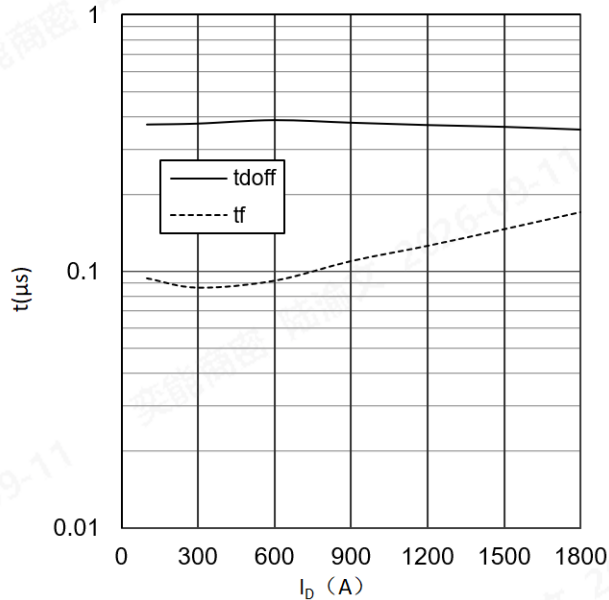


5 Characteristic diagrams

Switching times (typical), MOSFET, T1/T2

$t = f(I_D)$

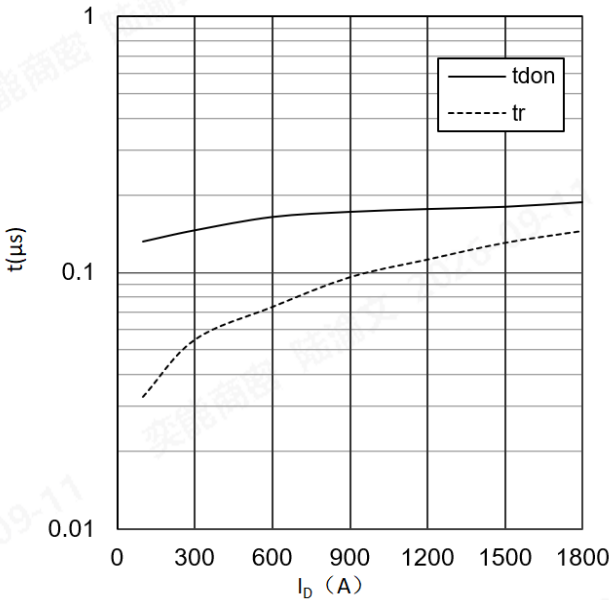
$V_{DD} = 600V, R_{Goff} = 1\Omega, V_{GS} = -4/15V, T_{vj} = 175^\circ C$



Switching times (typical), MOSFET, T1/T2

$t = f(I_D)$

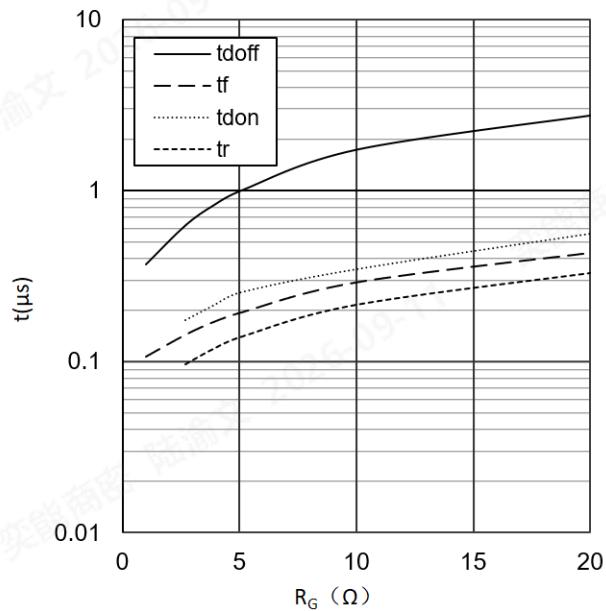
$V_{DD} = 600V, R_{Gon} = 2.7\Omega, V_{GS} = -4/15V, T_{vj} = 175^\circ C$



Switching times (typical), MOSFET, T1/T2

$t = f(R_G)$

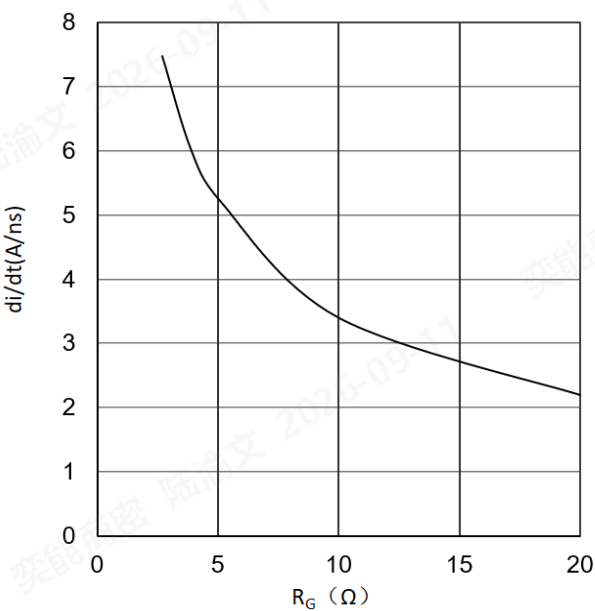
$V_{DD} = 600V, I_D = 900A, V_{GS} = -4/15V, T_{vj} = 175^\circ C$



Current slope (typical), MOSFET, T1/T2

$di/dt = f(R_G)$

$V_{DD} = 600V, I_D = 900A, V_{GS} = -4/15V$

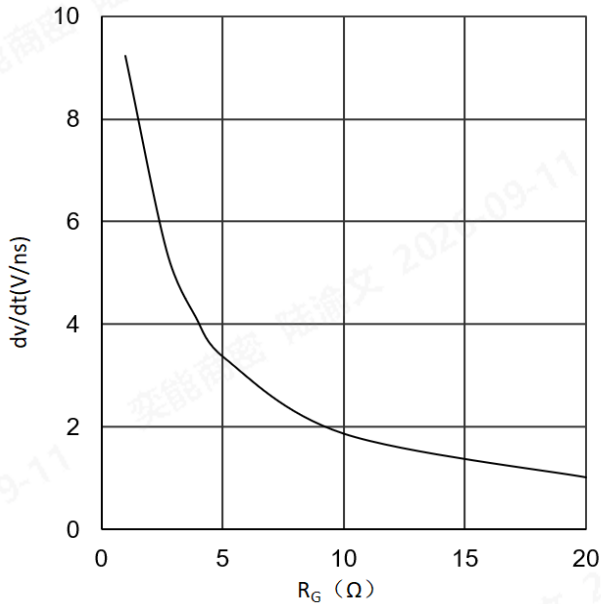


5 Characteristic diagrams

Voltage slope (typical), MOSFET, T1/T2

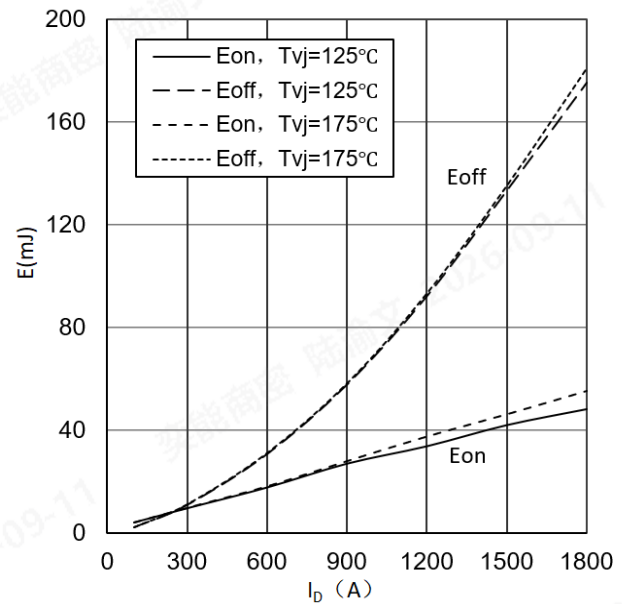
$$dv/dt = f(R_G)$$

$$V_{DD} = 600V, I_D = 900A, V_{GS} = -4/15V$$

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

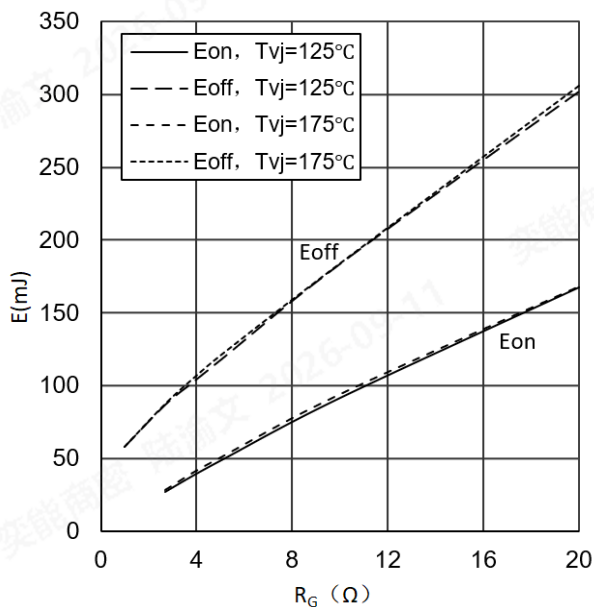
$$E = f(I_D)$$

$$V_{DD} = 600V, R_{Gon} = 2.7\Omega, R_{Goff} = 1\Omega, V_{GS} = -4/15V$$

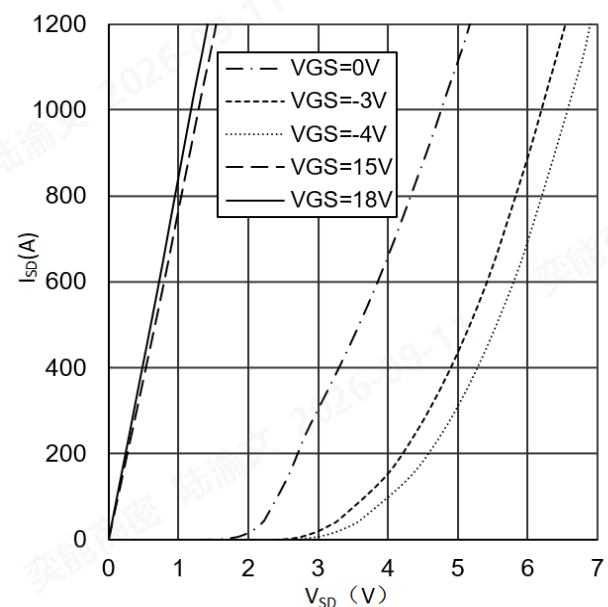
**Switching losses (typical), MOSFET, T1/T2**

$$E = f(R_G)$$

$$V_{DD} = 600V, I_D = 900A, V_{GS} = -4/15V$$

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

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

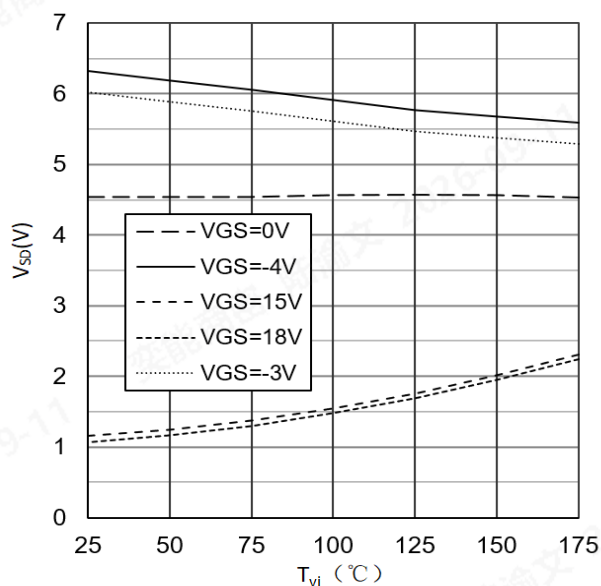


5 Characteristic diagrams

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

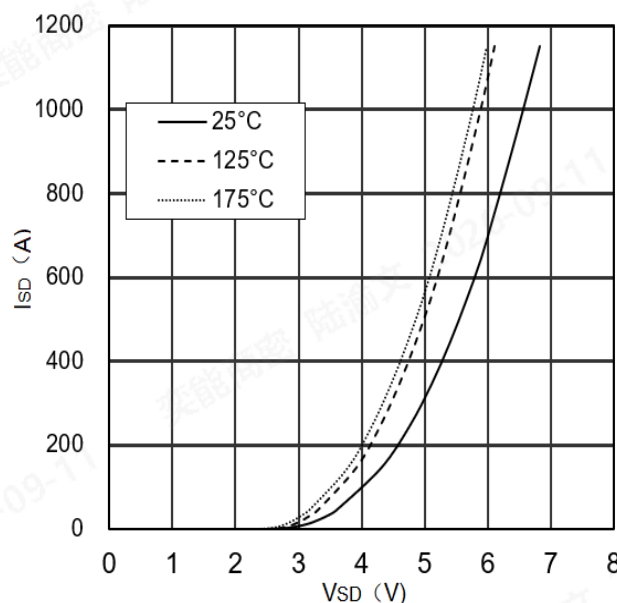
$$V_{DS} = f(T_{vj})$$

$$I_{SD} = 900A$$

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

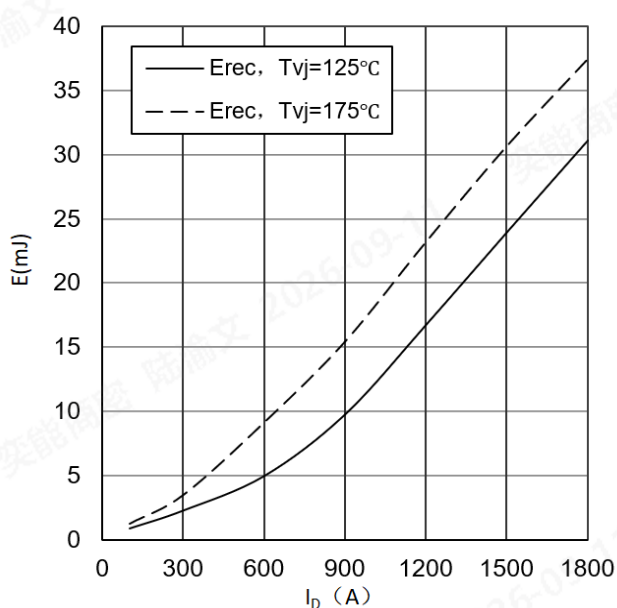
$$I_{SD} = f(V_{SD})$$

$$V_{GS} = -4V$$

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

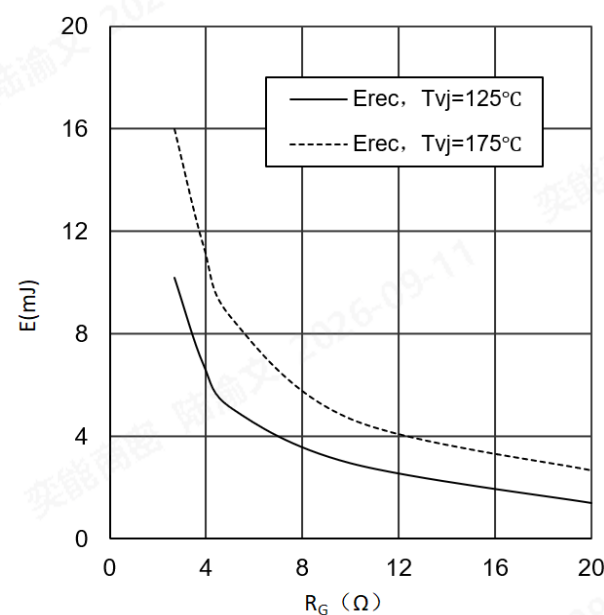
$$E_{rec} = f(I_{SD})$$

$$R_{Gon} = 2.7\Omega, R_{Goff} = 1\Omega, V_{GS} = -4/+15, V_{DD} = 600V$$

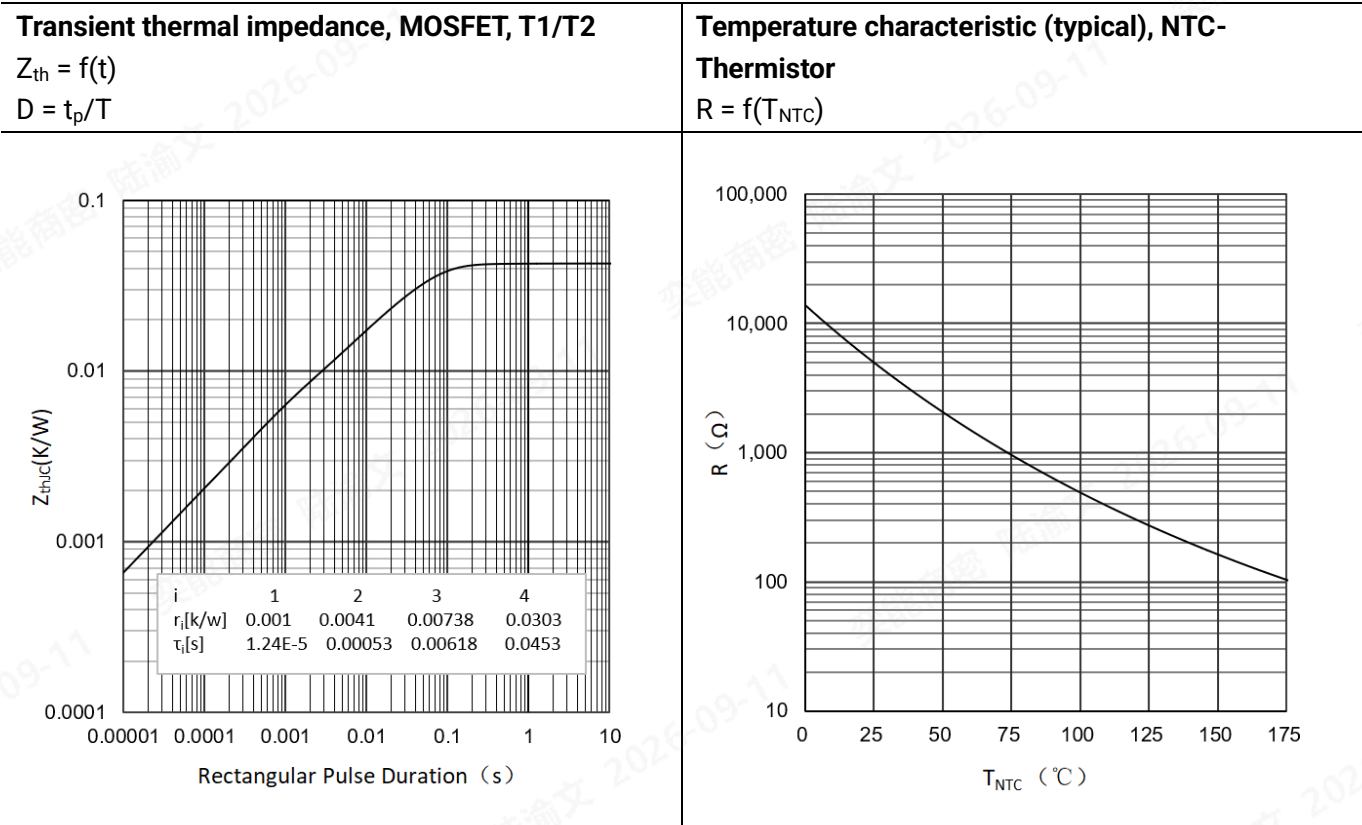
**Switching losses body diode (typical), MOSFET, T1/T2**

$$E_{rec} = f(R_G)$$

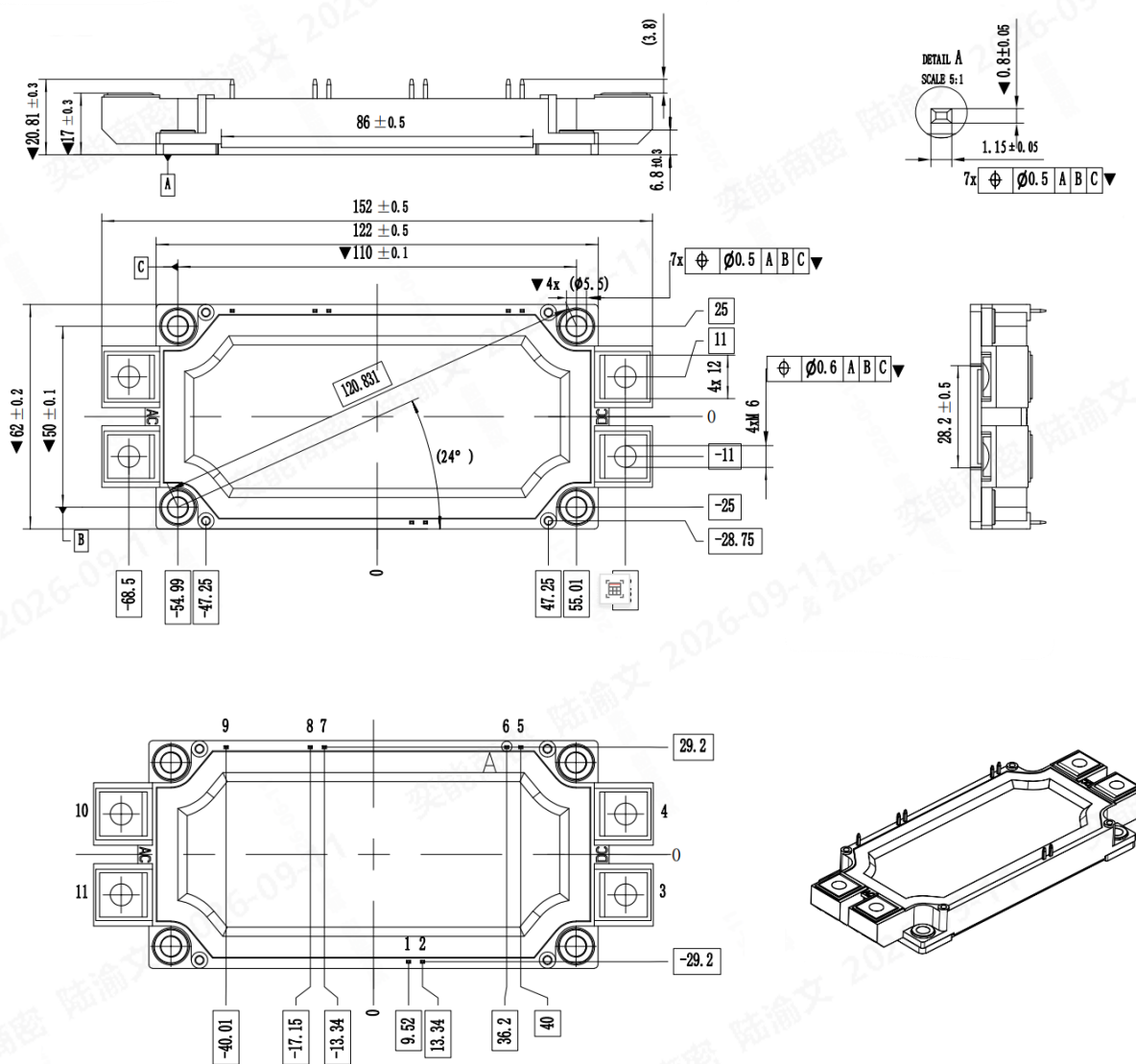
$$V_{GS} = -4/+15, I_{SD} = 900A, V_{DD} = 600V$$



5 Characteristic diagrams



6 Package outlines



Revision history

Document revision	Date of release	Description of changes
1.2	2026-06-23	Change the NTC diagram
1.1	2026-06-11	Optimize content
1.0	2025-06-05	Preliminary version

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