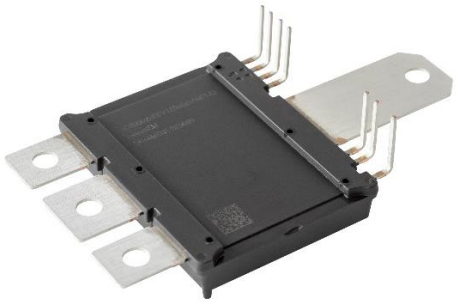
TARGET DATASHEET

SCSD002HEEV120mS

HEEV phase leg SiC module



V_{DSS} = 1200 V
$R_{DS(on)}$ = 2.1 mΩ

- Extremely low loss SiC MOSFET
- Ultra-high power density package with lowest internal resistance and inductance
- Baseless direct water-cooled design for highest power cycling reliability and lowest thermal resistance
- Transfer molded package for optimal protection against environmental impact

Maximum ratings[1]

PARAMETER	SYMBOL	CONDITIONS	MIN	MAX	UNIT
Drain – source voltage	V_{DSS}	V_{GS} </= 0 V, T_{vj} = 25 °C		1200	V
Continous drain and source current	I_D, I_S	T_F = 60 °C, V_{GS} = 18 V, T_{vj} = 175 °C		520	A
Peak drain and source current	I_{DM}, I_{SM}	t_p = 1 ms, limited by T_{vjmax}		1500	A
Gate-source voltage (DC)	V_{GSS}		-10	22	V
Gate-source surge voltage	$V_{GSS\ surge}$	t_{surge} < 300ns	-11	25	V
Recommended Gate voltage	V_{GS}		-2	18	V
Surge current				TBD	A
MOSFET SCSOA	t_{psc}	V_{DS} = 800 V, V_{GSon} = 18 V, T_{vj} < 175 °C		0	µs
Isolation voltage	V_{isol}	1 s, f = 50 Hz		4000	V
Junction operating temperature	$T_{vj(op)}$		-40	175	°C
Storage temperature	T_{stg}		-40	125	°C
Mounting torques	M_S	Clamp bridge, M4 screws	2.6	3.1	Nm
Max pressure in cooling circuit	p			2	bar

[1] Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747

MOSFET[2]

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Drain-source breakdown voltage	$V_{(BR)DSS}$	V_{GS} </= 0 V, I_D= 10 mA, T_{vj} = -40 .. 25°C		1200			V
Static drain-source on-state resistance[3]	$R_{DS(on)}$	I_D = 600 A, V_{GS} = 18 V	T_{vj} = 25 °C		2.05	2.7	mΩ
			T_{vj} = 175 °C		3.8		mΩ
Zero gate voltage drain current	I_{DSS}	V_{DS} = 1200 V, V_{GS} = 0 V	T_{vj} = 25 °C			60	µA
			T_{vj} = 175 °C				µA
Gate leakage current	I_{GSS}	V_{GS} = +22 / -10 V		-500		500	nA
Gate threshold voltage[4]	$V_{GS(th)}$	V_{GS} = V_{DS}, I_D = 60 mA	T_{vj} = 25°C	1.9		3.9	V
			T_{vj} = 175°C		2		
Total gate charge	Q_G	I_D = 500 A, V_{DS} = 800 V, V_{GS} = -4 V ... 18 V			1		µC
Input capacitance	C_{iss}	V_{DS} = 1000 V, V_{GS} = 0 V, f = 1 MHz, T_{vj} = 25 °C			29.8		nF
Output capacitance	C_{oss}				1.2		nF
Reverse tansfer capacitance	C_{rss}				0.12		nF
Internal gate resistor	R_{Gint}	Per switch			0.2		Ω
Turn-on delay time	$t_{d(on)}$	V_{CC} = 800 V, I_D = 500 A, R_G = 3 Ω, V_{GS} = -4 / +18 V, L_s = 20 nH, inductive load	T_{vj} = 25 °C		50		ns
			T_{vj} = 125 °C		46		ns
			T_{vj} = 175 °C		44		ns
Rise time	t_r		T_{vj} = 25 °C		35		ns
			T_{vj} = 125 °C		33		ns
			T_{vj} = 175 °C		32		ns
Turn-off delay time	$t_{d(off)}$	V_{CC} = 800 V, I_D = 500 A, R_G = 4 Ω, V_{GS} = -4 / +18 V, L_s = 20 nH, inductive load	T_{vj} = 25 °C		255		ns
			T_{vj} = 125 °C		270		ns
			T_{vj} = 175 °C		280		ns
Fall time	t_f		T_{vj} = 25 °C		55		ns
			T_{vj} = 125 °C		59		ns
			T_{vj} = 175 °C		62		ns
Turn-on switching energy	E_{on}	V_{CC} = 800 V, I_D = 520 A, R_G = 3 Ω, V_{GS} = -4 / +18 V, L_s = 20 nH, inductive load	T_{vj} = 25 °C		18		mJ
			T_{vj} = 125 °C		14		mJ
			T_{vj} = 175 °C		13		mJ
Turn-off switching energy	E_{off}	V_{CC} = 800 V, I_D = 520 A, R_G = 4 Ω, V_{GS} = -4 / +18 V, L_s = 20 nH, inductive load	T_{vj} = 25 °C		21		mJ
			T_{vj} = 125 °C		20		mJ
			T_{vj} = 175 °C		20		mJ
Short circuit current	I_{SC}	t_{pcs} ≤ 0 µs, V_{GE} = 18 V, T_{vj} = 175 °C, V_{CC} = 800 V, $V_{DSM\ Chip}$ ≤ 1200 V			-		A

[2] Characteristic values according to IEC 60747-8
[3] Given at Chip level
[4] Tested after applying V_{GS} = 21 V for 100 ms

Body diode[5]

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Forward voltage[6]	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	I_{rr}	V_R = 800 V, I_{SD} = 500 A, dI/dt = 15 kA/µs (175°C), R_G = 3 Ω, V_{GS} = -4 / +18 V, L_s = 20 nH, inductive load	T_{vj} = 25 °C		245		A
			T_{vj} = 125 °C		265		A
			T_{vj} = 175 °C		360		A
Recovery charge	Q_{rr}		T_{vj} = 25 °C		13.5		µC
			T_{vj} = 125 °C		15.5		µC
			T_{vj} = 175 °C		21.2		µC
Reverse recovery time	t_{rr}		T_{vj} = 25 °C		51		ns
			T_{vj} = 125 °C		45		ns
			T_{vj} = 175 °C		54		ns
Reverse recovery energy	E_{rec}		T_{vj} = 25 °C		6.7		mJ
			T_{vj} = 125 °C		8.4		mJ
			T_{vj} = 175 °C		10.9		mJ

Package properties[7]

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Thermal resistance junction to fluid	$R_{th(j-f)}$	Per switch, Coolant 50% glycol, 50% water, 10 l/min, dp < 100 mbar (3 modules)				0.110	K/W
Comparative tracking index	CTI			400			
Module stray inductance	$L_{s\,CE}$	Per switch			4.5		nH
Resistance, terminal chip	$R_{DD'+SS'}$	Per switch	T_{vj} = 25 °C		0.24		mΩ
			T_{vj} = 125 °C		0.325		mΩ
			T_{vj} = 175 °C		0.375		mΩ
Maximum RMS Terminal current (AC)	$I_{Terminal\ RMS}$		$T_{Terminal}$ = 90°C			700	A

[5] Characteristic values according to IEC 60747-8
[6] Forward voltage is given at chip-level
[7] Package and mechanical properties according to IEC 60747-15

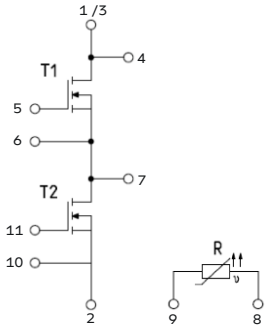
Mechanical properties

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Dimensions	L x W x H	Mold body		58.25 x 46.1 x 9.15			mm^3
Clearance distance in air	da	According to IEC 60664-1 and EN 50124-1	Terminal to base:	7.1			mm
			Terminal to terminal:	4			mm
Surface creepage distance	ds	According to IEC 60664-1 and EN 50124-1	Terminal to base:	8			mm
			Terminal to terminal:	8			mm
Mass	m				65		g

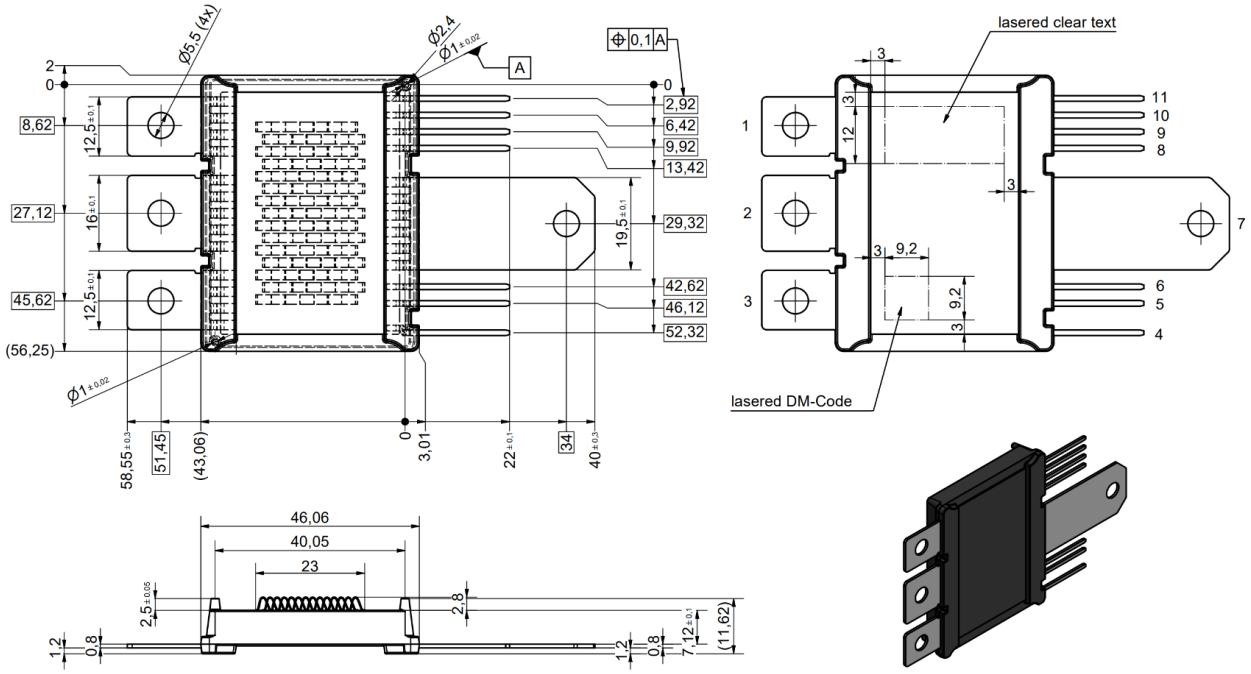
NTC Thermistor

PARAMETER	SYMBOL	CONDITIONS		TYP	MAX	UNIT
Rated resistance	R_{25}	T_C = 25 °C		4.7		kΩ
R100	R_{100}	T_C = 100 °C	443	463	530	Ω
B-value	$B_{25/85}$	$R_2 = R_{25} \exp [B_{25/50}(1/T2 - 1/(298.15K))]$		3435		K

Electrical configuration



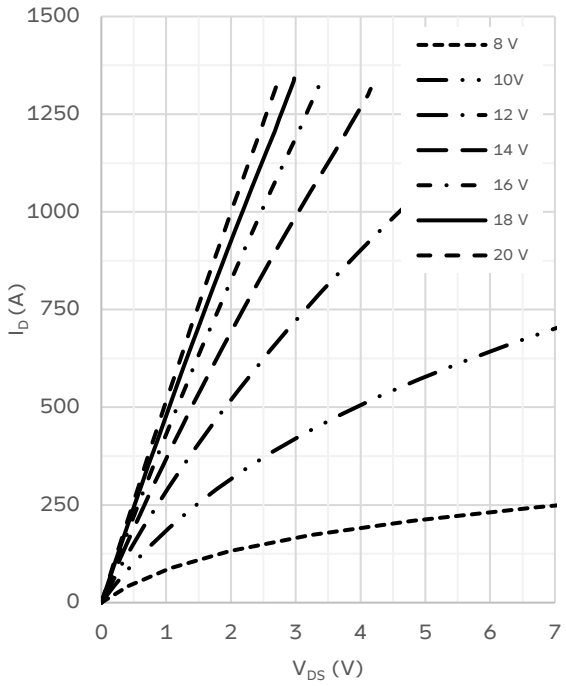
Outline drawing



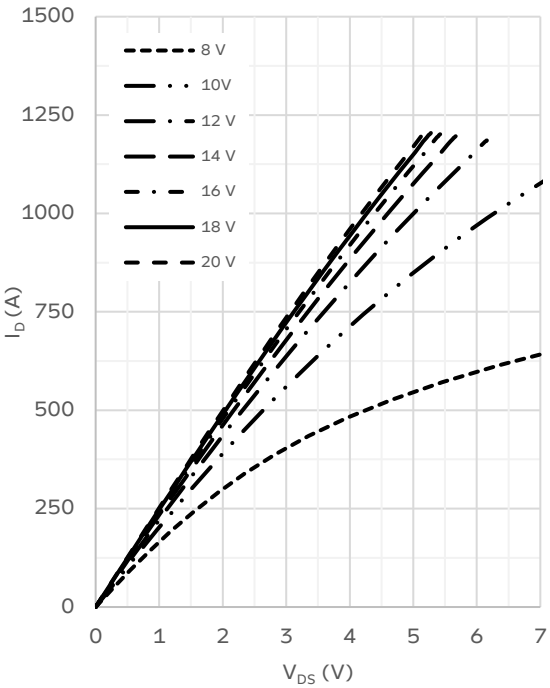
This is an electrocstatic sensitive device.

Characteristics 特性曲线

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

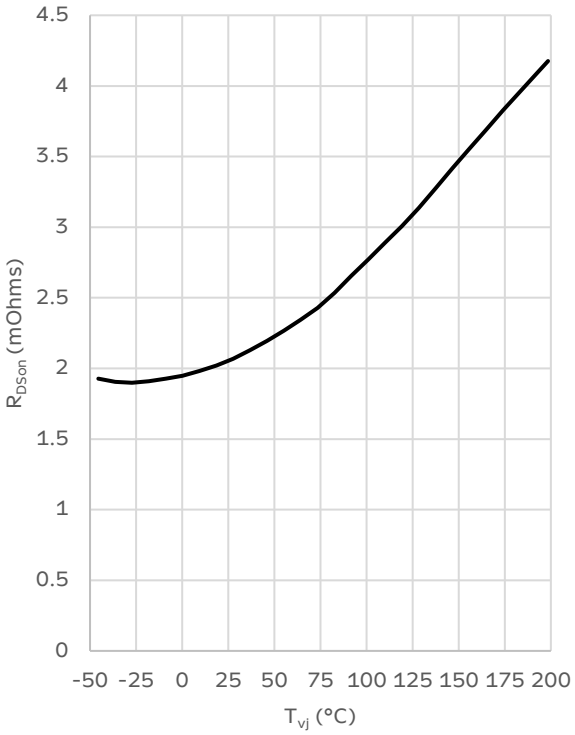


Output characteristics (typical)
输出特性曲线（典型）
$I_C = f(V_{CE})$
$T_{vj} = 175°C$

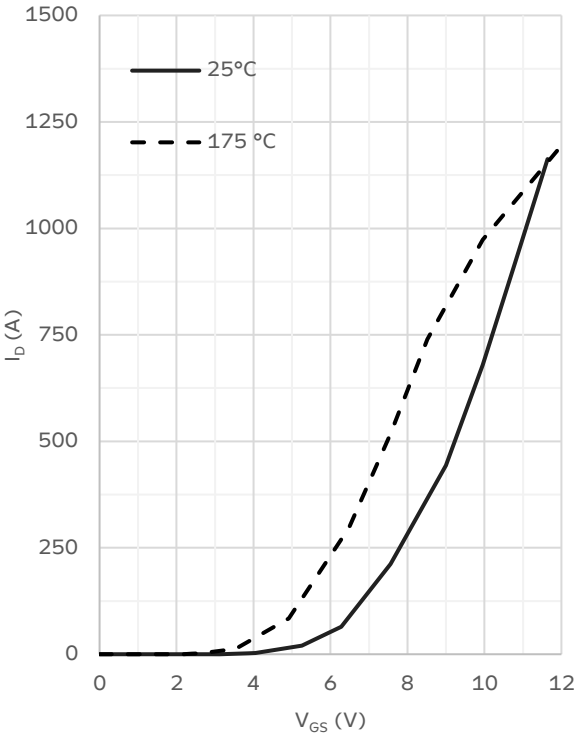


R_{DSon} *versus junction temperature* (typical)

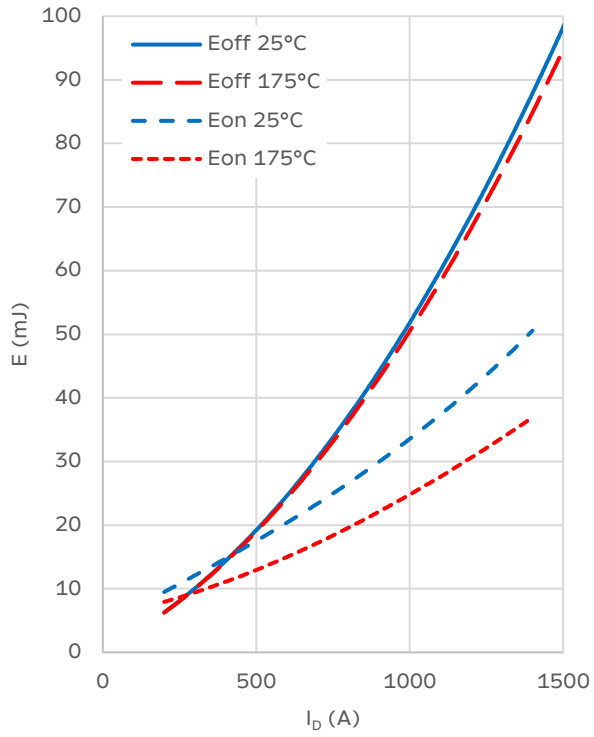
$R_{DSon} = f(T_{vj})$
$I_D = 600$ A, VGS = 18V



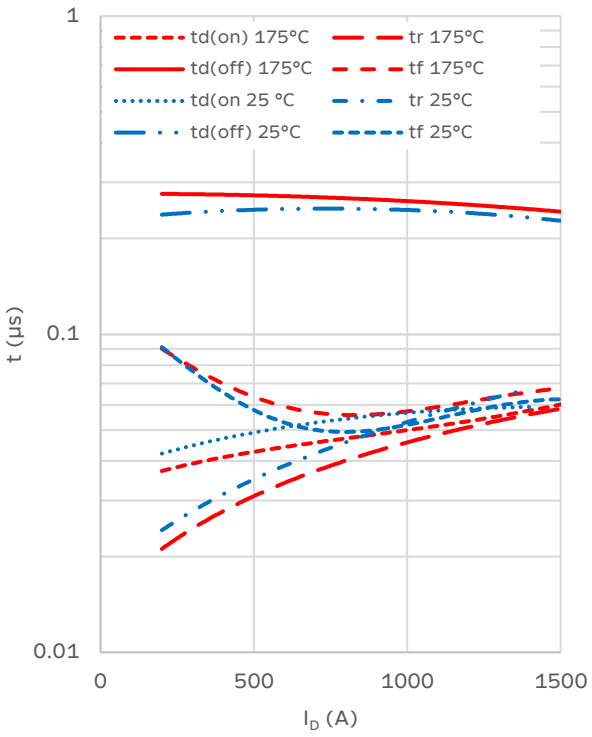
Transfer characteristics (typical)
转移特性曲线（典型）
$I_D = f(V_{GS})$
$V_{DS} = 6$ V



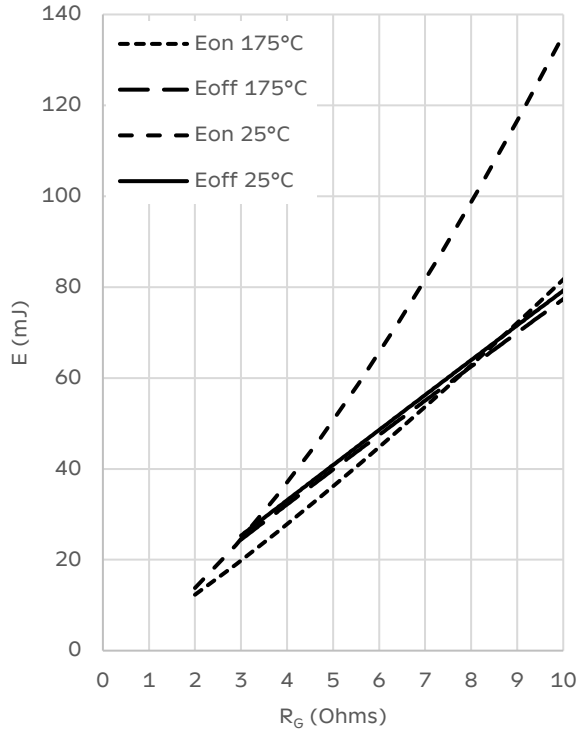
Switching losses (typical)
开关损耗曲线（典型）
$E = f(I_D)$
V_{DS} =800 V, R_{Gon} =3 Ω, R_{Goff} =4 Ω, V_{GE} =-4/+18 V



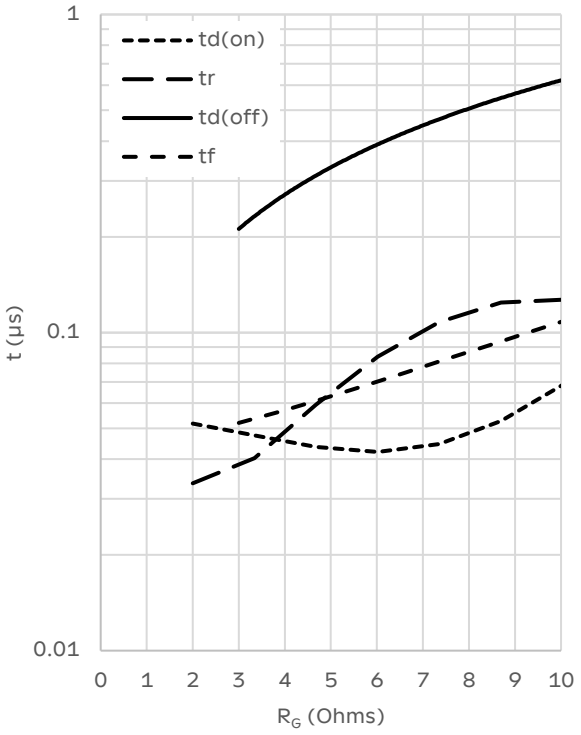
Switching times (typical)
开关时间曲线（典型）
$t = f(I_D)$
V_{DS} = 800 V, R_{Gon} =3 Ω, R_{Goff} =4 Ω, V_{GE} =-4/+18 V



Switching losses (typical)
开关损耗曲线（典型）
$E = f(R_G)$
V_{DS} =800 V, I =750 A, V_{GS} =-4/+18 V

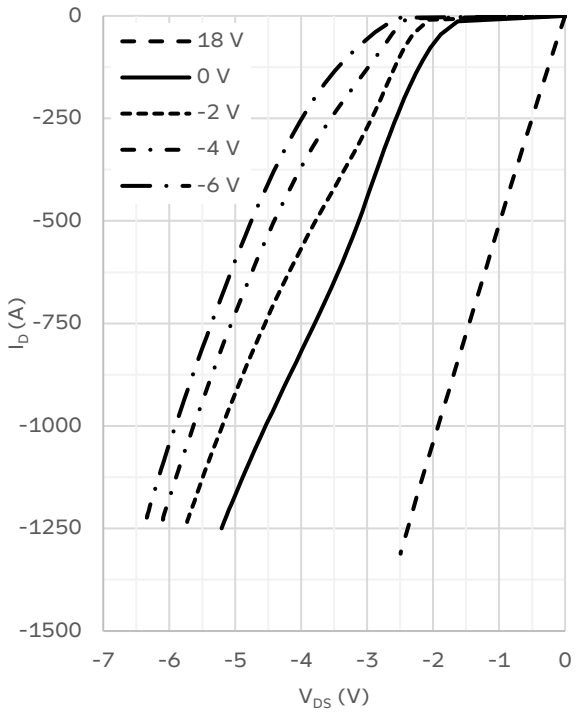


Switching times (typical)
开关时间曲线（典型）
$t = f(R_G)$, T_{vj} = 175 °C
V_{DS} =800 V, I =750 A, V_{GS} =-4/+18 V



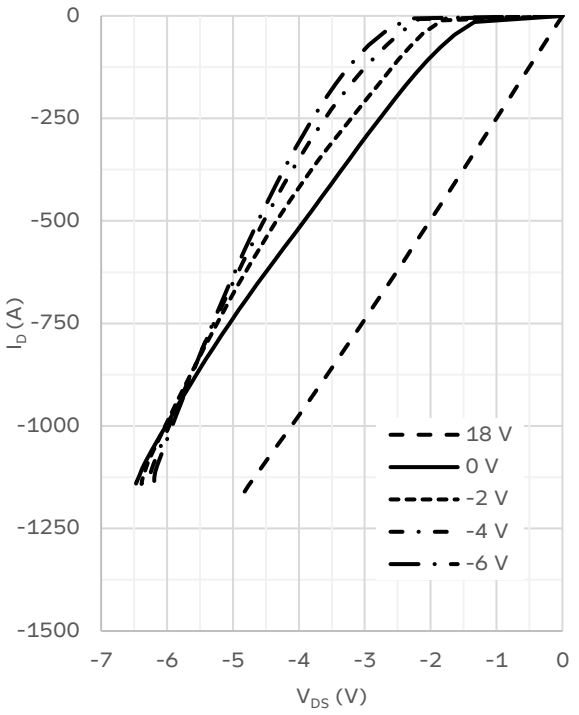
Reverser conduction characteristics (typical)

$I_D = f(V_{DS})$
$T_{vj} = 25°C$

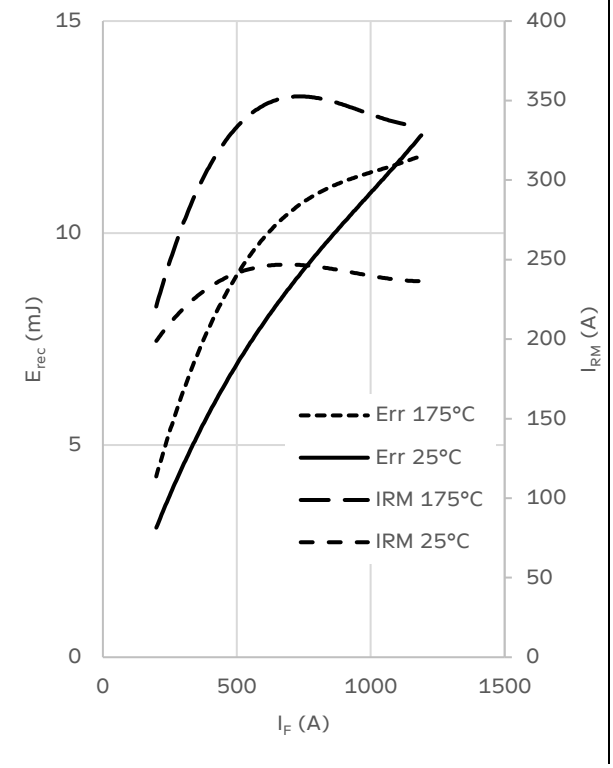


Reverser conduction characteristics (typical)

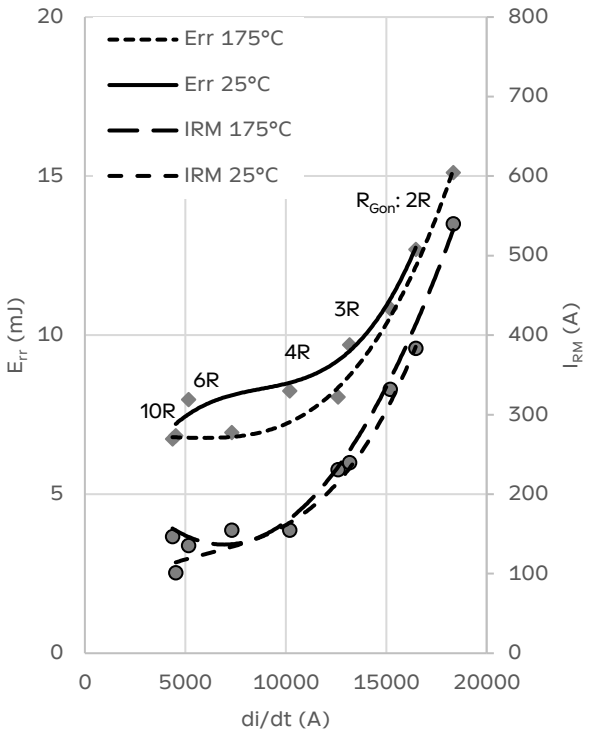
$I_D = f(V_{DS})$
$T_{vj} = 175°C$



Diode switching characteristics (typical)
二极管开关特性（典型）
$E_{rr} = f(I_F)$, $I_{RM} = f(I_F)$
$V_{DC} = 800$ V, $R_{Gon} = 3\ \Omega$ (MOSFET), $V_{GS} = -4/+18$ V

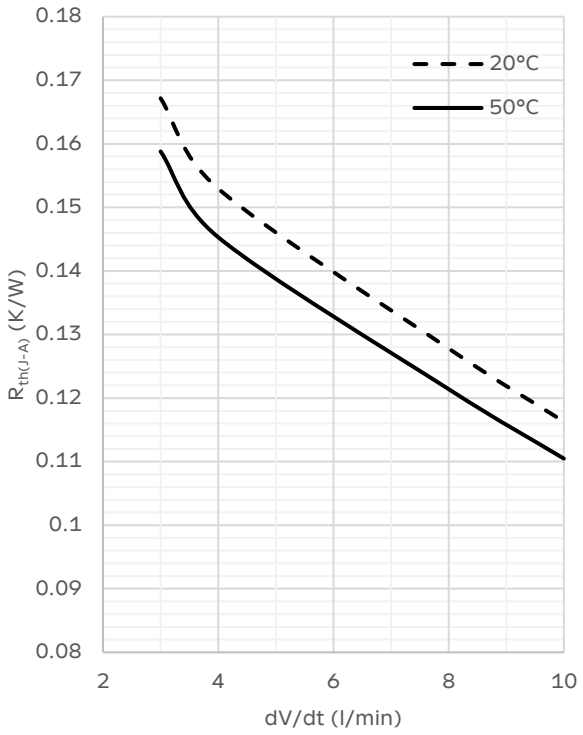


Diode switching characteristics (typical)
二极管开关特性（典型）
$E_{rr} = f(di/dt)$, $I_{RM} = f(di/dt)$
$V_{DC} = 800$ V, $I_D = -750$ A, $V_{GS} = -4/+18$ V (MOSFET)



Thermal resistance versus flow rate

$R_{th(J-A)} = f(dv/dt)$



Transient thermal impedance

$Z_{th(J-A)} = f(t)$
$T_F = 50°C$