Preliminary datasheet

EasyPACK™ 模块 采用 CoolSiC™ Trench MOSFET 带有 PressFIT 压接管脚和温度检测 NTC

特性


Typical appearance

- 电气特性
  - V_{DSS} = 1200 V
  - I_{DN} = 50 A / I_{DRM} = 100 A
  - 可以从下面链接寻找适合的英飞凌驱动 IC https://www.infineon.com/gdfinder
- 机械特性
  - PressFIT 压接技术
  - 高功率密度
  - 紧凑型设计
  - 低热阻的三氧化二铝 Al_2O_3 衬底
  - 2.5 kV 交流 1 分钟 绝缘

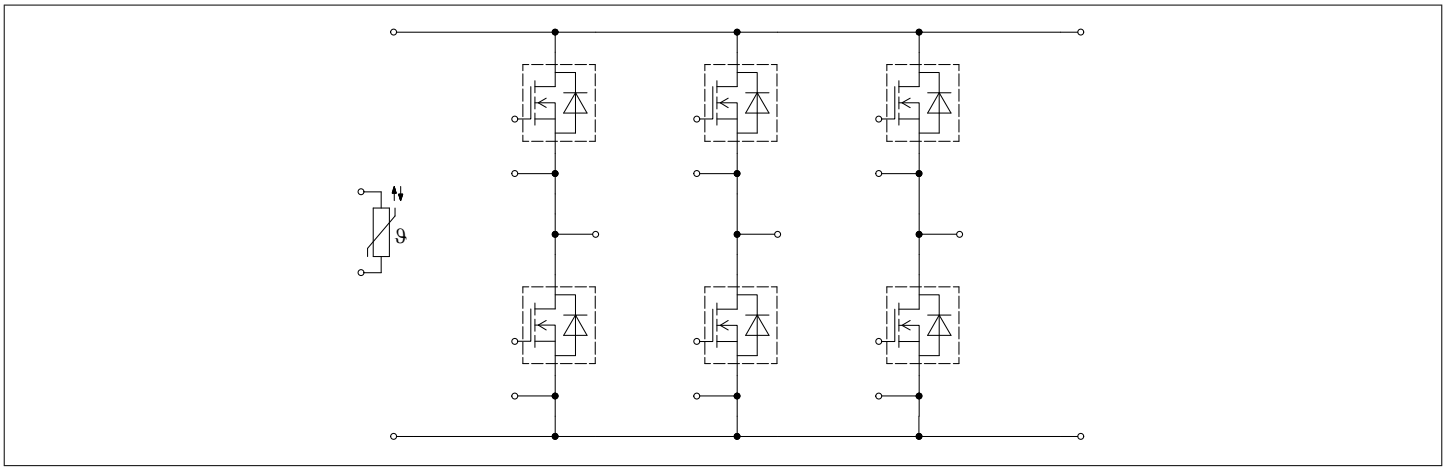
可选应用

- 混合动力汽车
- 辅助逆变器
- EV Auxiliaries

产品认证

- Qualified according to AQG 324, release no.: 03.1/2021

描述



内容

1 封装

表 1 绝缘参数

特征参数	代号	标注或测试条件	数值	单位
绝缘测试电压	V_{ISOL}	RMS, f = 50 Hz, t = 1 min	2.5	kV
NTC 绝缘测试电压	$V_{ISOL(NTC)}$	RMS, f = 50 Hz, t = 1 min	2.5	kV
内部绝缘		基本绝缘 (class 1, IEC 61140)	Al_2O_3	
相对电痕指数	*CTI*		> 200	
相对温度指数 (电)	*RTI*	封装	140	°C

表 2 特征值

特征参数	代号	标注或测试条件	数值			单位
			最小值	典型值	最大值	
杂散电感,模块	L_{sCE}			17		nH
模块引线电阻,端子-芯片	$R_{CC'+EE'}$	T_H = 25 °C, 每个开关		2.7		mΩ
储存温度	T_{stg}		-40		125	°C
Mounting force per clamp	*F*		40		80	N
重量	*G*			39		g

注: The current under continuous operation is limited to 25A rms per connector pin.

2 MOSFET

表 3 最大标定值

特征参数	代号	标注或测试条件		数值	单位
漏源极电压	V_{DSS}		T_{vj} = 25 °C	1200	V
植入漏极电流	I_{DN}			50	A
连续漏极直流电流	I_{DDC}	T_{vj} = 150 °C, V_{GS} = 18 V	T_H = 65 °C	40	A
漏极重复峰值电流	I_{DRM}	verified by design, t_p limited by T_{vjmax}		100	A
栅-源瞬态最大电压	V_{GS}	D < 0.01		-10/23	V
栅-源稳态最大电压	V_{GS}			-7/20	V

表 4 推荐值

特征参数	代号	标注或测试条件	[ZH]Values	单位
通态栅极电压	$V_{GS(on)}$		15...18	V
断态栅极电压	$V_{GS(off)}$		-5...0	V

表 5　　特征值

特征参数	代号	标注或测试条件		数值			单位
				最小值	典型值	最大值	
漏源通态电阻	$R_{DS(on)}$	I_D = 50 A	V_{GS} = 18 V, T_{vj} = 25 °C		16.2	TBD	mΩ
			V_{GS} = 18 V, T_{vj} = 125 °C		26.1		
			V_{GS} = 18 V, T_{vj} = 150 °C		30.1		
			V_{GS} = 15 V, T_{vj} = 25 °C		19.4		
栅极阈值电压	$V_{GS(th)}$	I_D = 20 mA, V_{DS} = V_{GS}, T_{vj} = 25 °C, (tested after 1ms pulse at V_{GS} = +20 V)		3.45	4.3	5.15	V
栅极电荷	Q_G	V_{DD} = 800 V, V_{GS} = -3/18 V, T_{vj} = 25 °C			0.149		µC
内部栅极电阻	R_{Gint}	T_{vj} = 25 °C			4.1		Ω
输入电容	C_{ISS}	f = 100 kHz, V_{DS} = 800 V, V_{GS} = 0 V	T_{vj} = 25 °C		4.4		nF
输出电容	C_{OSS}	f = 100 kHz, V_{DS} = 800 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.21		nF
反向传输电容	C_{rss}	f = 100 kHz, V_{DS} = 800 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.014		nF
C_{OSS} 存储能量	E_{OSS}	V_{DS} = 800 V, V_{GS} = -3/18 V, T_{vj} = 25 °C			86		µJ
漏源泄漏电流	I_{DSS}	V_{DS} = 1200 V, V_{GS} = -3 V	T_{vj} = 25 °C		0.03	210	µA
栅极漏电流	I_{GSS}	V_{DS} = 0 V, T_{vj} = 25 °C	V_{GS} = 20 V			400	nA
开通延迟时间(感性负载)	$t_{d\,on}$	I_D = 50 A, R_{Gon} = 3.3 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V, t_{dead} = 1000 ns	T_{vj} = 25 °C		32		ns
			T_{vj} = 125 °C		32		
			T_{vj} = 150 °C		32		
上升时间(感性负载)	t_r	I_D = 50 A, R_{Gon} = 3.3 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V, t_{dead} = 1000 ns	T_{vj} = 25 °C		29		ns
			T_{vj} = 125 °C		29		
			T_{vj} = 150 °C		29		
关断延迟时间(感性负载)	$t_{d\,off}$	I_D = 50 A, R_{Goff} = 0.22 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V	T_{vj} = 25 °C		39		ns
			T_{vj} = 125 °C		43		
			T_{vj} = 150 °C		44		
下降时间(感性负载)	t_f	I_D = 50 A, R_{Goff} = 0.22 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V	T_{vj} = 25 °C		12		ns
			T_{vj} = 125 °C		12		
			T_{vj} = 150 °C		12		

(待续)

表 5 (续) 特征值

特征参数	代号	标注或测试条件		数值			单位
				最小值	典型值	最大值	
开通损耗能量 (每脉冲)	E_{on}	I_D = 50 A, V_{DD} = 600 V, L_σ = 15 nH, V_{GS} = -3/18 V, R_{Gon} = 3.3 Ω, di/dt = 7.9 kA/µs (T_{vj} = 150 °C), t_{dead} = 1000 ns	T_{vj} = 25 °C		644		µJ
			T_{vj} = 125 °C		763		
			T_{vj} = 150 °C		816		
开通损耗能量 (每脉冲), 优化条件下	$E_{on,o}$	I_D = 50 A, V_{DD} = 600 V, L_σ = 15 nH, V_{GS} = -3/18 V, $R_{Gon,o}$ = 0 Ω, di/dt = 12 kA/µs (T_{vj} = 150 °C), t_{dead} = 100 ns	T_{vj} = 25 °C		397		µJ
			T_{vj} = 125 °C		414		
			T_{vj} = 150 °C		428		
关断损耗能量 (每脉冲)	E_{off}	I_D = 50 A, V_{DD} = 600 V, L_σ = 15 nH, V_{GS} = -3/18 V, R_{Goff} = 0.22 Ω, dv/dt = 40 kV/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		90		µJ
			T_{vj} = 125 °C		91		
			T_{vj} = 150 °C		104		
结－散热器热阻	R_{thJH}	每个 MOSFET, λ_{grease} = 1 W/(m·K)			1.17	1.37	K/W
允许开关的温度范围	$T_{vj\,op}$			-40		150	°C

注: *The selection of positive and negative gate-source voltages impacts losses and the long-term behavior of the MOSFET and body diode. The design guidelines described in Application Notes AN 2018-09 and AN 2021-13 must be considered to ensure sound operation of the device over the planned lifetime.*

EoL criteria see AQG324, verified by characterisation with 4.5 sigma.

3 Body diode (MOSFET)

表 6 最大标定值

特征参数	代号	标注或测试条件		数值	单位
体二极管正向直流电流	I_{SD}	T_{vj} = 150 °C, V_{GS} = -3 V	T_H = 65 °C	16	A

表 7 特征值

特征参数	代号	标注或测试条件		数值			单位
				最小值	典型值	最大值	
正向电压	V_{SD}	I_{SD} = 50 A, V_{GS} = -3 V	T_{vj} = 25 °C		4.2	TBD	V
			T_{vj} = 125 °C		3.9		
			T_{vj} = 150 °C		3.8		

(待续)

表 7 (续) 特征值

特征参数	代号	标注或测试条件		数值			单位
				最小值	典型值	最大值	
反向恢复峰值电流	I_{rrm}	I_{SD} = 50 A, di_s/dt = 7.9 kA/µs, V_{DD} = 600 V, V_{GS} = -3 V, t_{dead} = 1000 ns	T_{vj} = 25 °C		64		A
			T_{vj} = 125 °C		81		
			T_{vj} = 150 °C		87		
恢复电荷	Q_{rr}	I_{SD} = 50 A, di_s/dt = 7.9 kA/µs, V_{DD} = 600 V, V_{GS} = -3 V, t_{dead} = 1000 ns	T_{vj} = 25 °C		0.9		µC
			T_{vj} = 125 °C		1.2		
			T_{vj} = 150 °C		1.3		
反向恢复损耗（每脉冲）	E_{rec}	I_{SD} = 50 A, di_s/dt = 7.9 kA/µs (T_{vj} = 150 °C), V_{DD} = 600 V, V_{GS} = -3 V, t_{dead} = 1000 ns	T_{vj} = 25 °C		119		µJ
			T_{vj} = 125 °C		226		
			T_{vj} = 150 °C		280		
反向恢复损耗（每脉冲），优化条件下	$E_{rec,o}$	I_{SD} = 50 A, di_s/dt = 12 kA/µs (T_{vj} = 150 °C), V_{DD} = 600 V, V_{GS} = -3 V, t_{dead} = 100 ns	T_{vj} = 25 °C		256		µJ
			T_{vj} = 125 °C		313		
			T_{vj} = 150 °C		326		

4 负温度系数热敏电阻

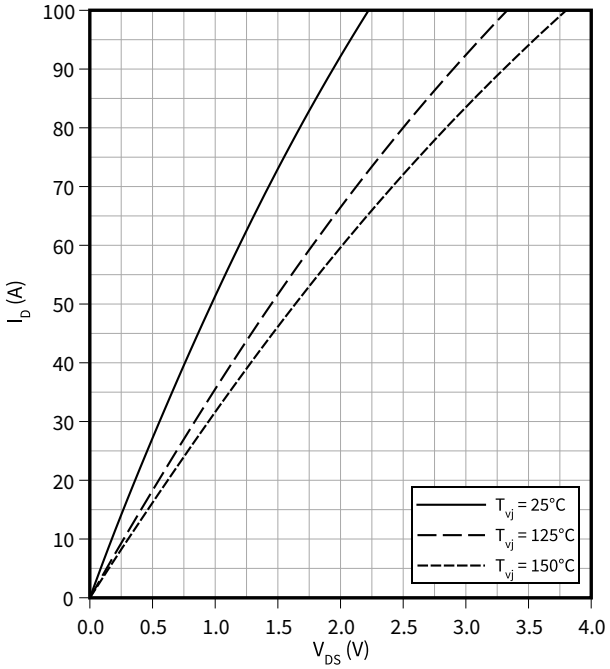
表 8 特征值

特征参数	代号	标注或测试条件	数值			单位
			最小值	典型值	最大值	
额定电阻值	R_{25}	T_{NTC} = 25 °C	9.7	10	10.3	kΩ
耗散功率	P_{25}	T_{NTC} = 25 °C			20	mW
B-值	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2-1/(298,15\ K))]$		3447		K
B-值	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2-1/(298,15\ K))]$		3487		K
B-值	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2-1/(298,15\ K))]$		3510		K

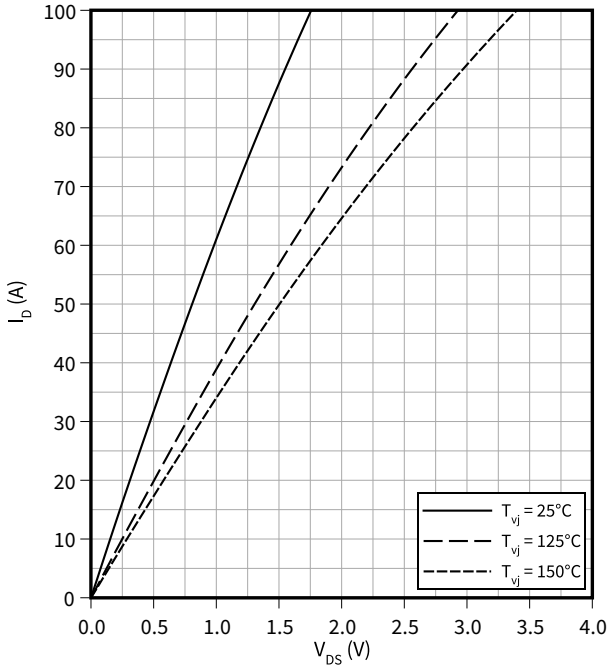
注: NTC 的具体参数分析请见 AN2009-10, 第 4 章

5 特征参数图表

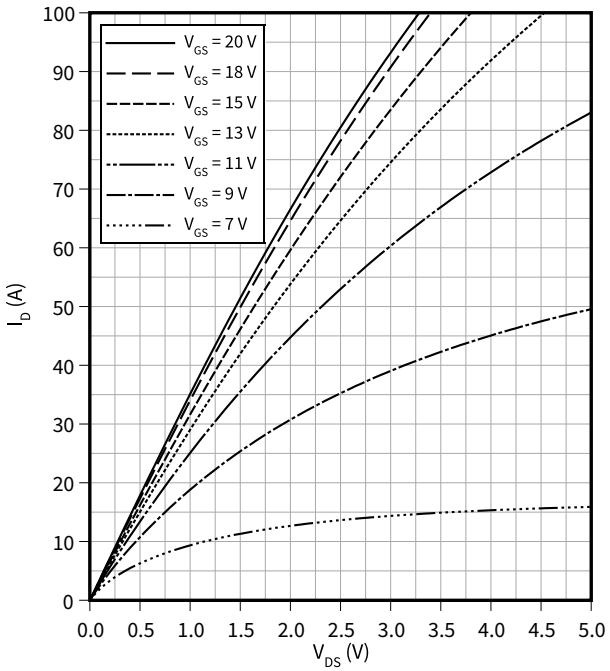
输出特性 （典型), MOSFET
$I_D = f(V_{DS})$
V_{GS} = 15 V



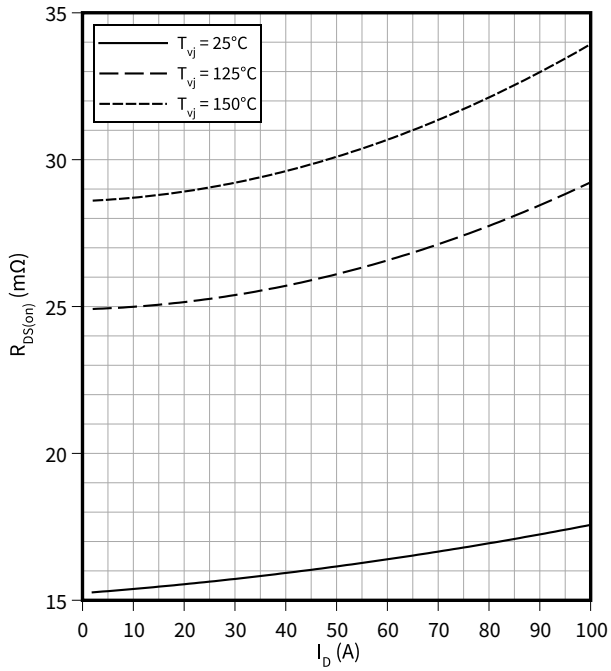
输出特性 （典型), MOSFET
$I_D = f(V_{DS})$
V_{GS} = 18 V



输出特性 （典型), MOSFET
$I_D = f(V_{DS})$
T_{vj} = 150 °C

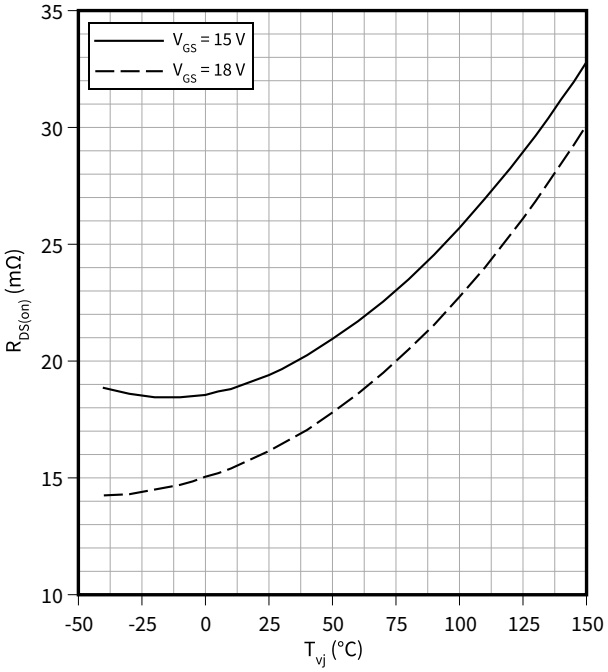


漏源通态电阻 （典型), MOSFET
$R_{DS(on)} = f(I_D)$
V_{GS} = 18 V



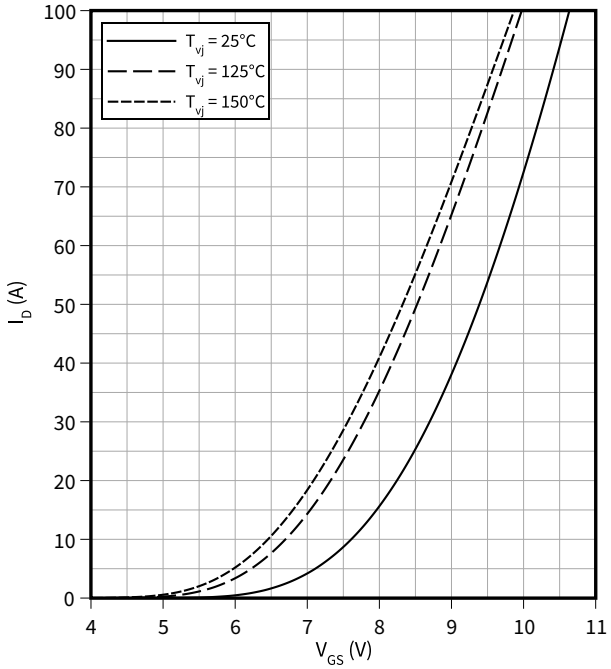
漏源通态电阻 （典型), MOSFET

$R_{DS(on)} = f(T_{vj})$
$V_{GS} = V_{DS}$, $I_D = 50$ A



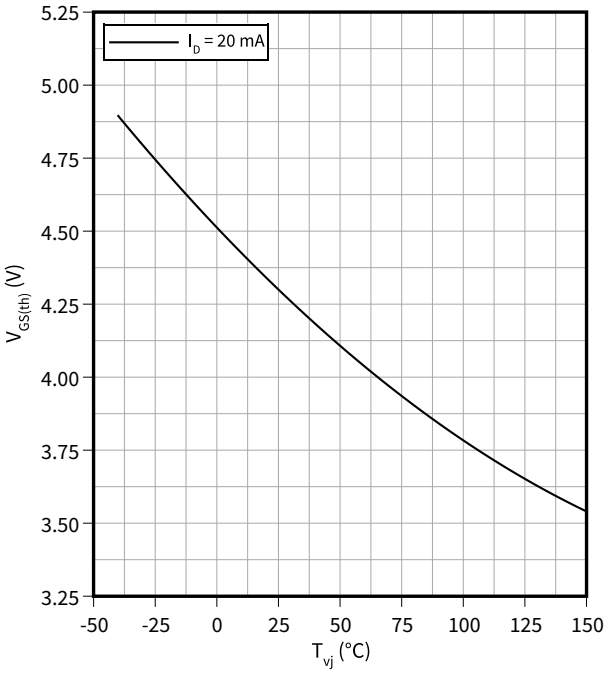
传输特性 （典型), MOSFET

$I_D = f(V_{GS})$
$V_{DS} = 20$ V



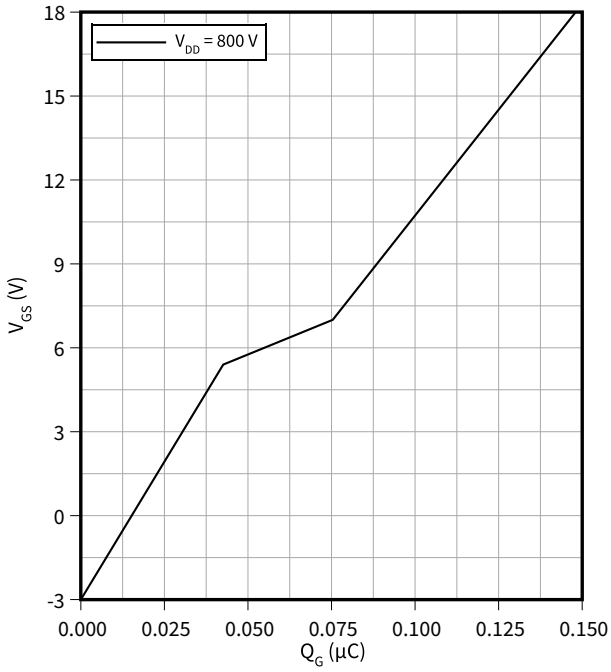
栅-源阈值电压（典型）, MOSFET

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



栅极电荷特性 （典型), MOSFET

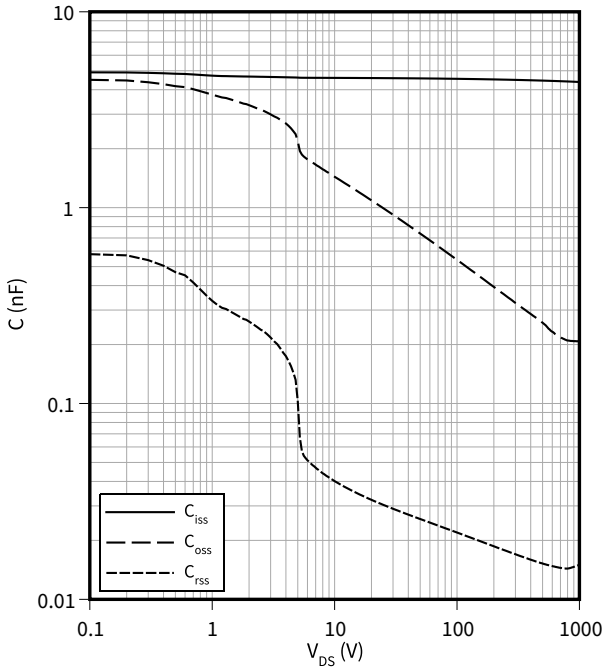
$V_{GS} = f(Q_G)$
$I_D = 50$ A, $T_{vj} = 25$ °C



电容特性 （典型), MOSFET

$C = f(V_{DS})$

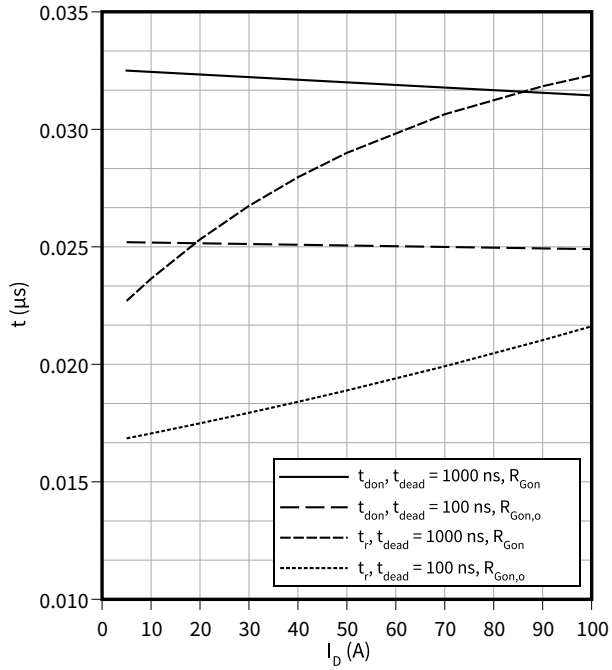
$f = 100\ kHz, T_{vj} = 25\ °C, V_{GS} = 0\ V$



开关时间 （典型), MOSFET

$t = f(I_D)$

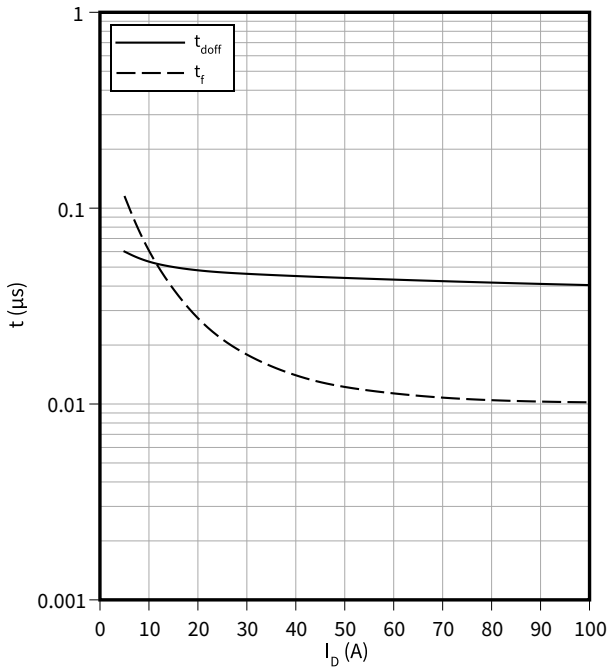
$R_{Gon} = 3.3\ \Omega, V_{DD} = 600\ V, R_{Gon,o} = 0\ \Omega, T_{vj} = 150\ °C, V_{GS} = -3/18\ V$



开关时间 （典型), MOSFET

$t = f(I_D)$

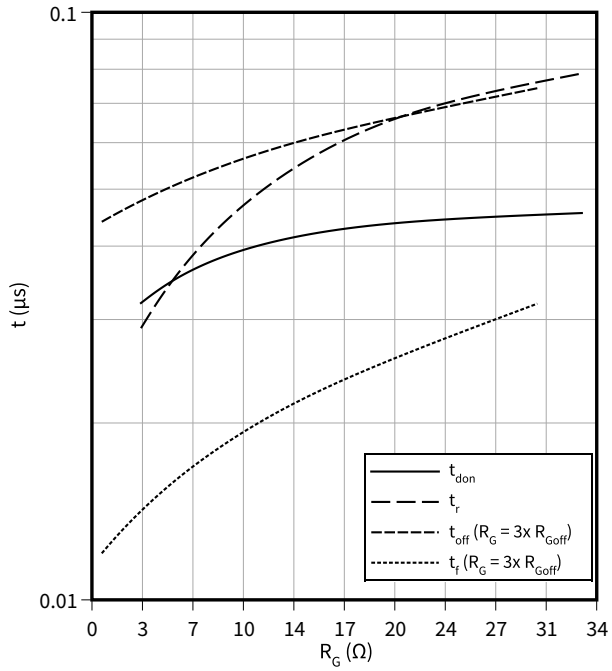
$R_{Goff} = 0.22\ \Omega, V_{DD} = 600\ V, T_{vj} = 150\ °C, V_{GS} = -3/18\ V$



开关时间 （典型), MOSFET

$t = f(R_G)$

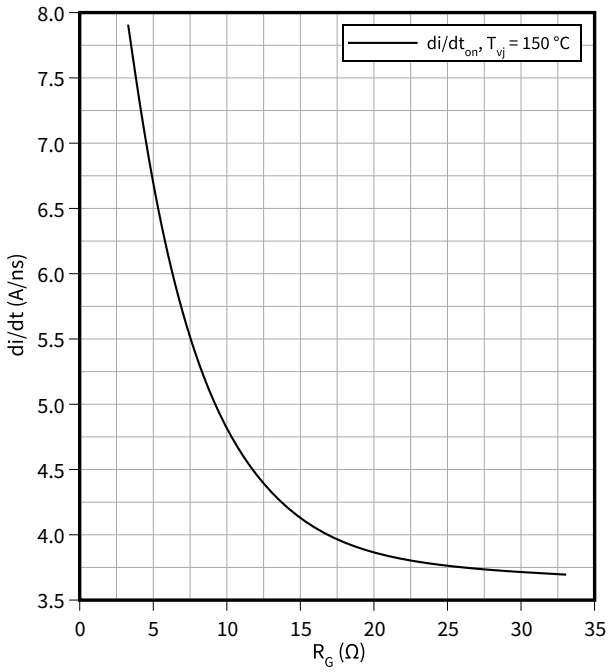
$V_{DD} = 600\ V, t_{dead} = 1000\ ns, I_D = 50\ A, T_{vj} = 150\ °C, V_{GS} = -3/18\ V$



电流变化斜率 （典型), MOSFET

$di/dt = f(R_G)$

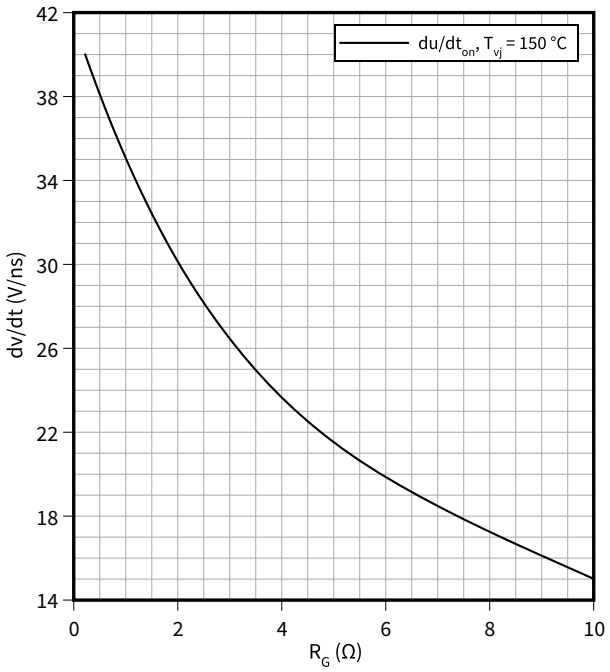
V_{DD} = 600 V, t_{dead} = 1000 ns, I_D = 50 A, V_{GS} = -3/18 V



电压变化斜率 （典型), MOSFET

$dv/dt = f(R_G)$

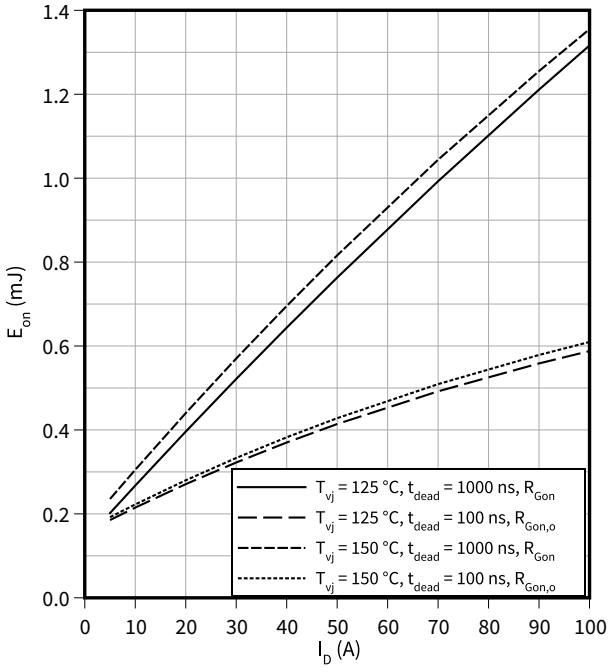
V_{DD} = 600 V, I_D = 50 A, V_{GS} = -3/18 V



开关损耗 （典型), MOSFET

$E_{on} = f(I_D)$

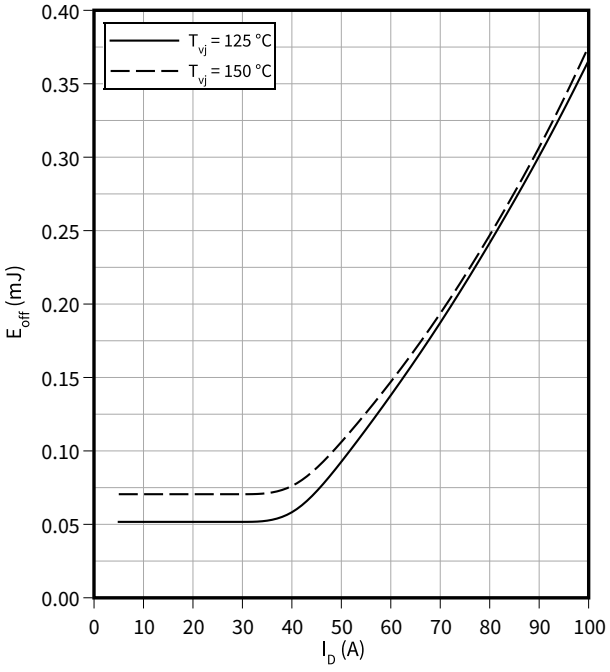
R_{Gon} = 3.3 Ω, V_{DD} = 600 V, $R_{Gon,o}$ = 0 Ω, V_{GS} = -3/18 V



开关损耗 （典型), MOSFET

$E_{off} = f(I_D)$

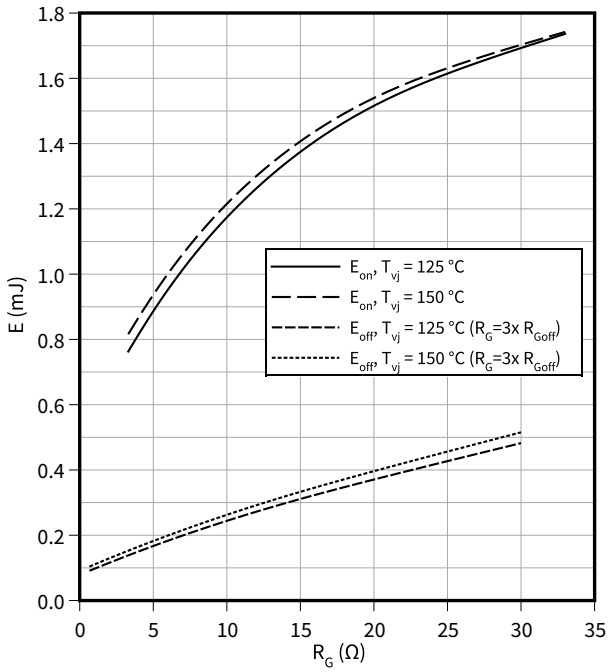
R_{Goff} = 0.22 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V



开关损耗 （典型), MOSFET

$E = f(R_G)$

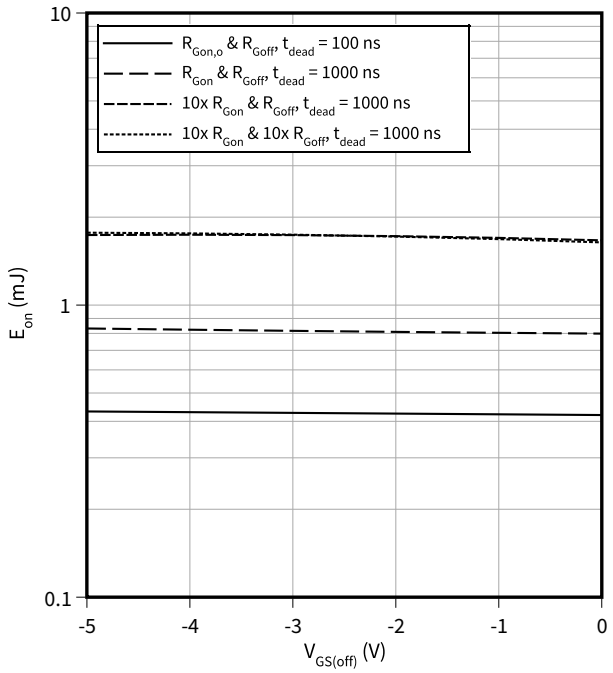
V_{DD} = 600 V, t_{dead} = 1000 ns, I_D = 50 A, V_{GS} = -3/18 V



开关损耗 （典型), MOSFET

$E_{on} = f(V_{GS(off)})$

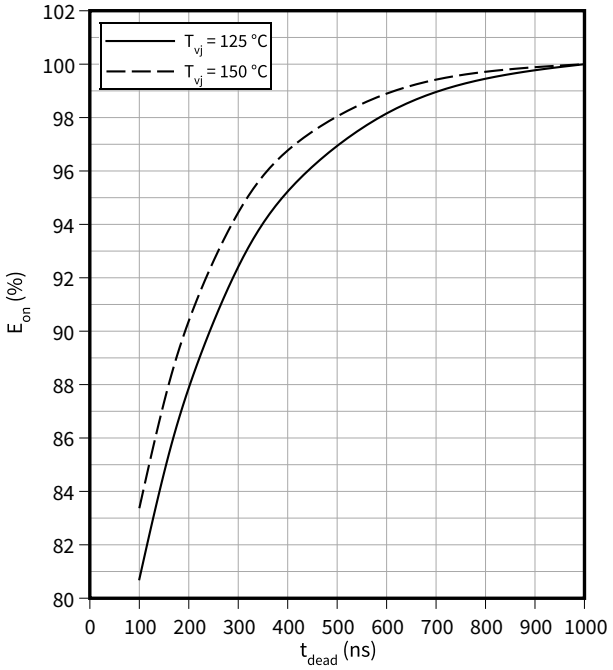
R_{Goff} = 0.22 Ω, V_{DD} = 600 V, R_{Gon} = 3.3 Ω, $V_{GS(on)}$ = 18 V, I_D = 50 A, $R_{Gon,o}$ = 0 Ω, T_{vj} = 150 °C



开关损耗 （典型), MOSFET

$E_{on} = f(t_{dead})$

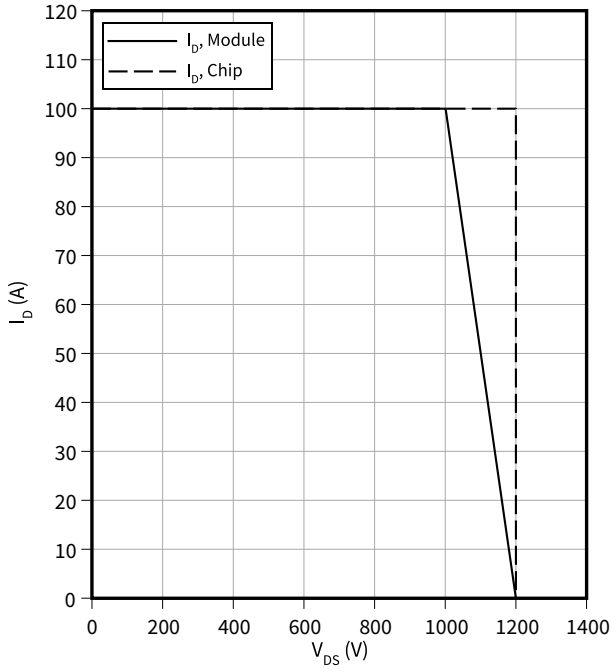
R_{Gon} = 3.3 Ω, I_D = 50 A, V_{DD} = 600 V, V_{GS} = -3/18 V



反偏安全工作区 （RBSOA）, MOSFET

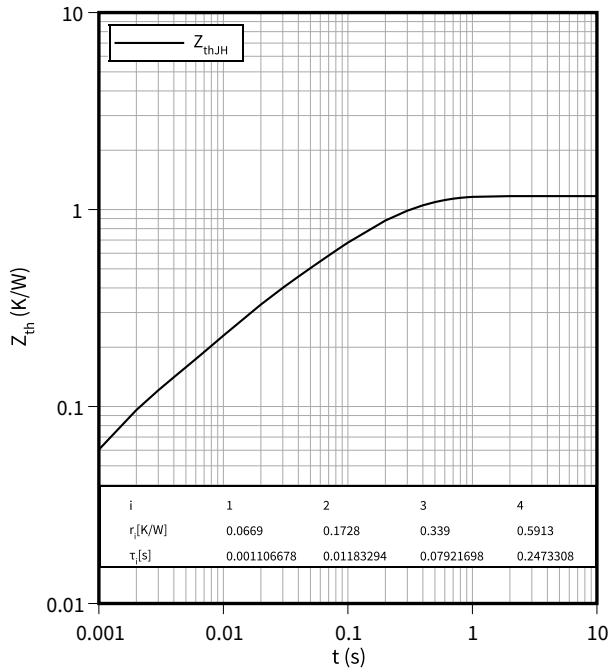
$I_D = f(V_{DS})$

R_{Goff} = 0.22 Ω, T_{vj} = 150 °C, V_{GS} = -3/18 V



瞬态热阻抗, MOSFET

$Z_{th} = f(t)$

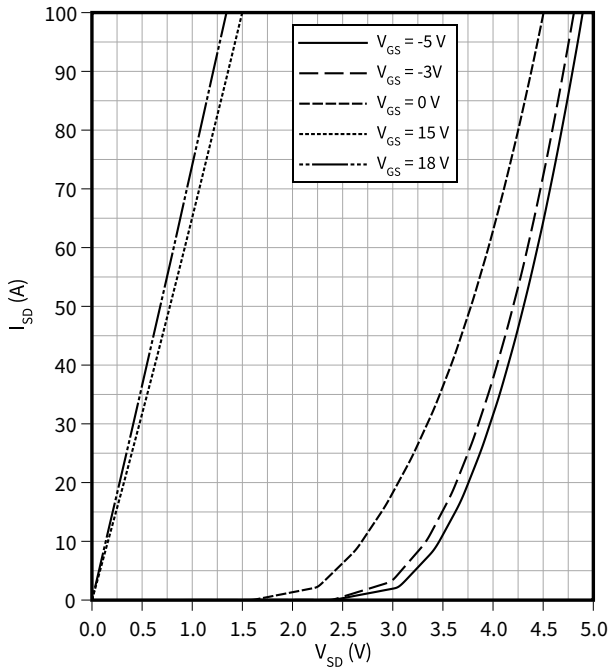


i	1	2	3	4
r_i[K/W]	0.0669	0.1728	0.339	0.5913
τ_i[s]	0.001106678	0.01183294	0.07921698	0.2473308

正向特性 体二极管（典型), MOSFET

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

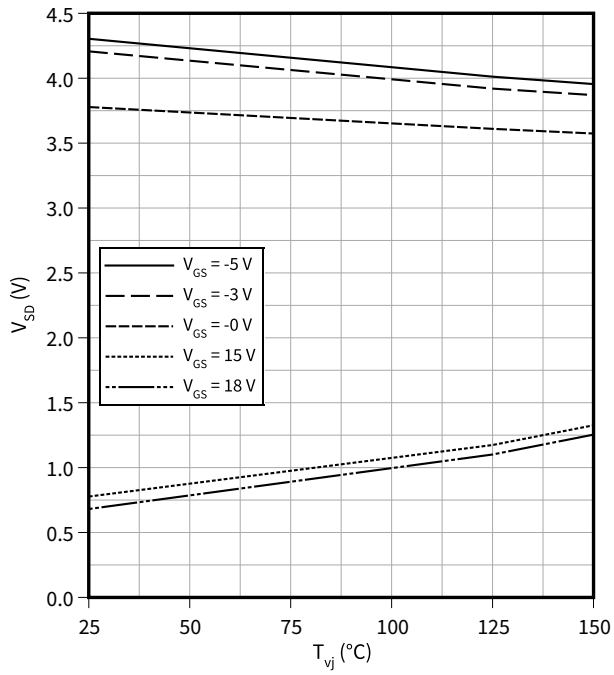
$T_{vj} = 25\ °C$



体二极管正向压降（典型), MOSFET

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

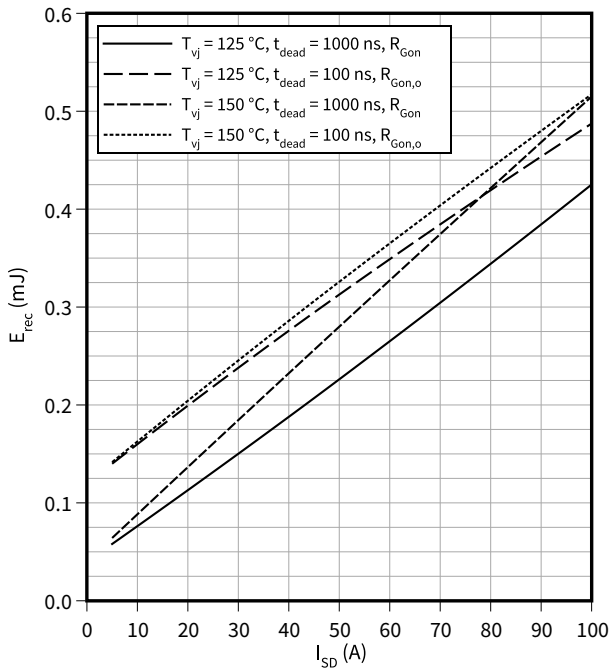
$I_{SD} = 50\ A$



开关损耗 体二极管（典型), MOSFET

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

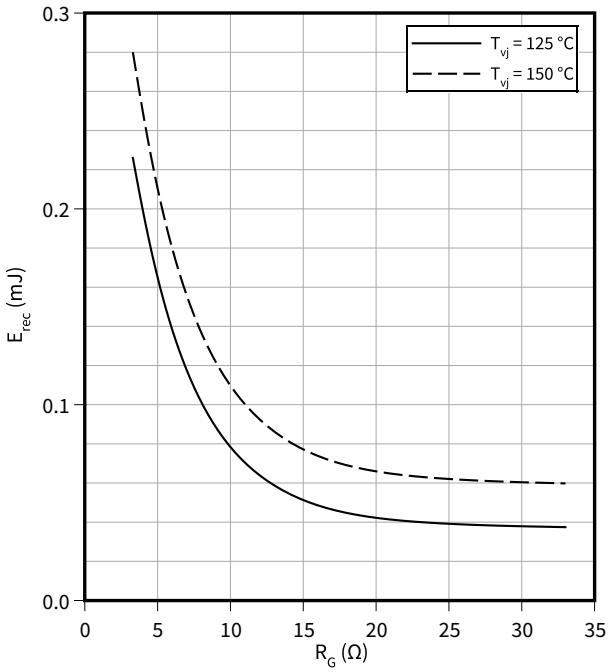
$R_{Gon} = 3.3\ \Omega$, $R_{Gon,o} = 0\ \Omega$, $V_{DD} = 600\ V$



开关损耗 体二极管（典型), MOSFET

$E_{rec} = f(R_G)$

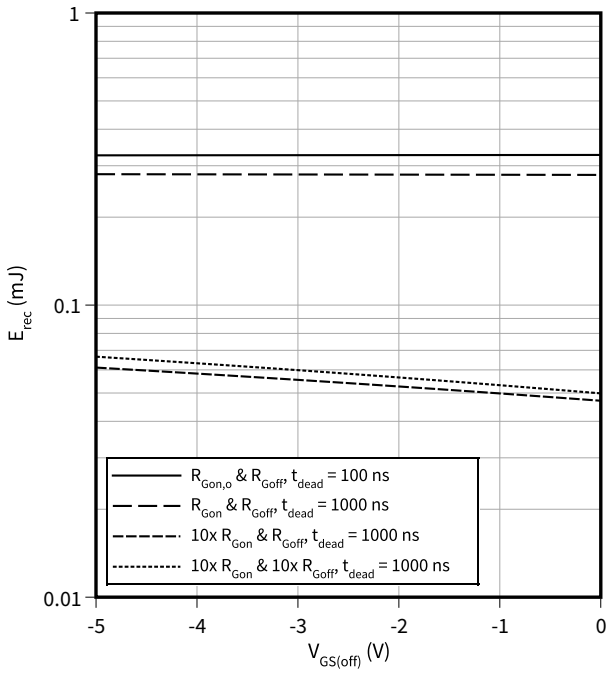
t_{dead} = 1000 ns, I_{SD} = 50 A, V_{DD} = 600 V



开关损耗 体二极管（典型), MOSFET

$E_{rec} = f(V_{GS(off)})$

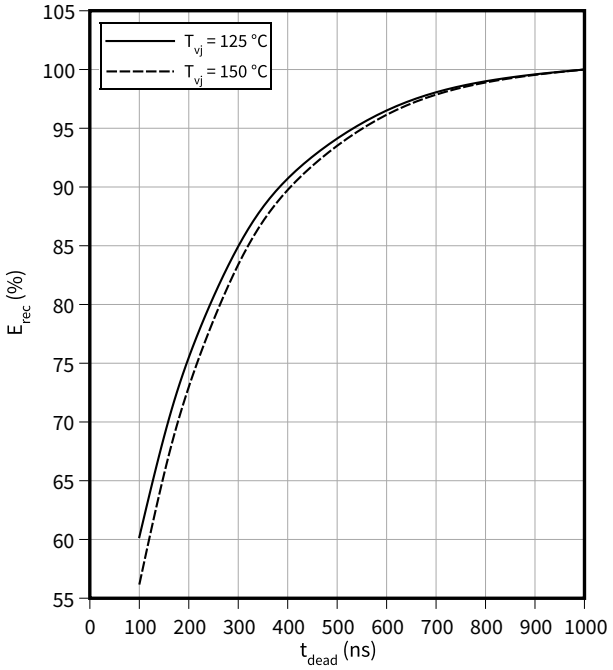
R_{Goff} = 0.22 Ω, R_{Gon} = 3.3 Ω, $V_{GS(on)}$ = 18 V, I_{SD} = 50 A, $R_{Gon,o}$ = 0 Ω, V_{DD} = 600 V, T_{vj} = 150 °C



开关损耗 体二极管（典型), MOSFET

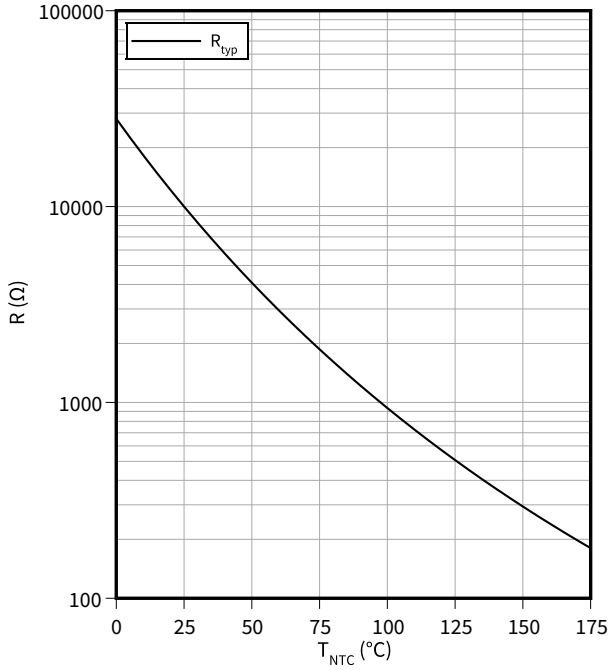
$E_{rec} = f(t_{dead})$

R_{Gon} = 3.3 Ω, I_D = 50 A, V_{DD} = 600 V, V_{GS} = -3/18 V



温度特性, 负温度系数热敏电阻

$R = f(T_{NTC})$



6 电路拓扑图

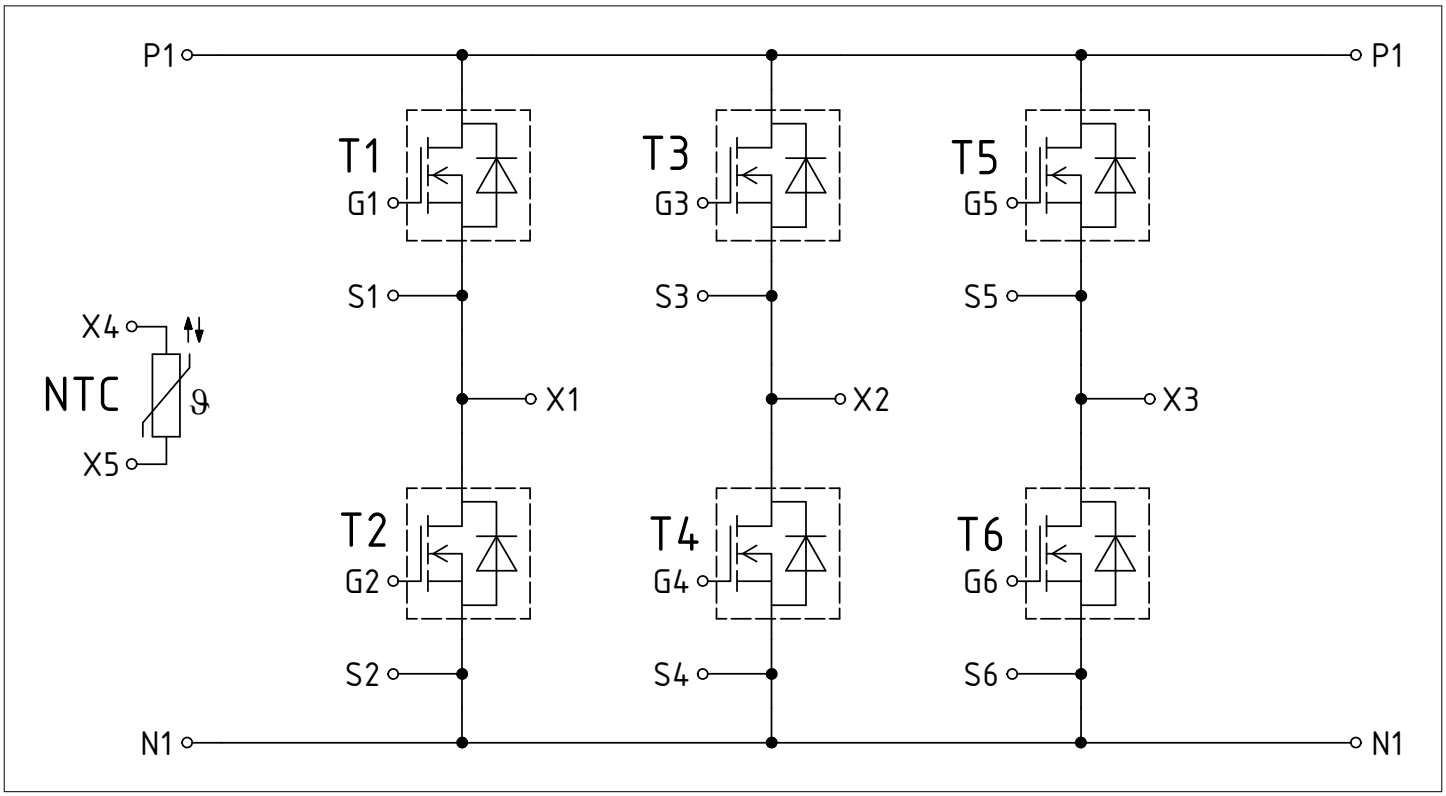

P1
P1
T1
G1
T3
G3
T5
G5
S1
S3
S5
X4
NTC
X5
X1
X2
X3
T2
G2
T4
G4
T6
G6
S2
S4
S6
N1
N1

图 1

7 封装尺寸

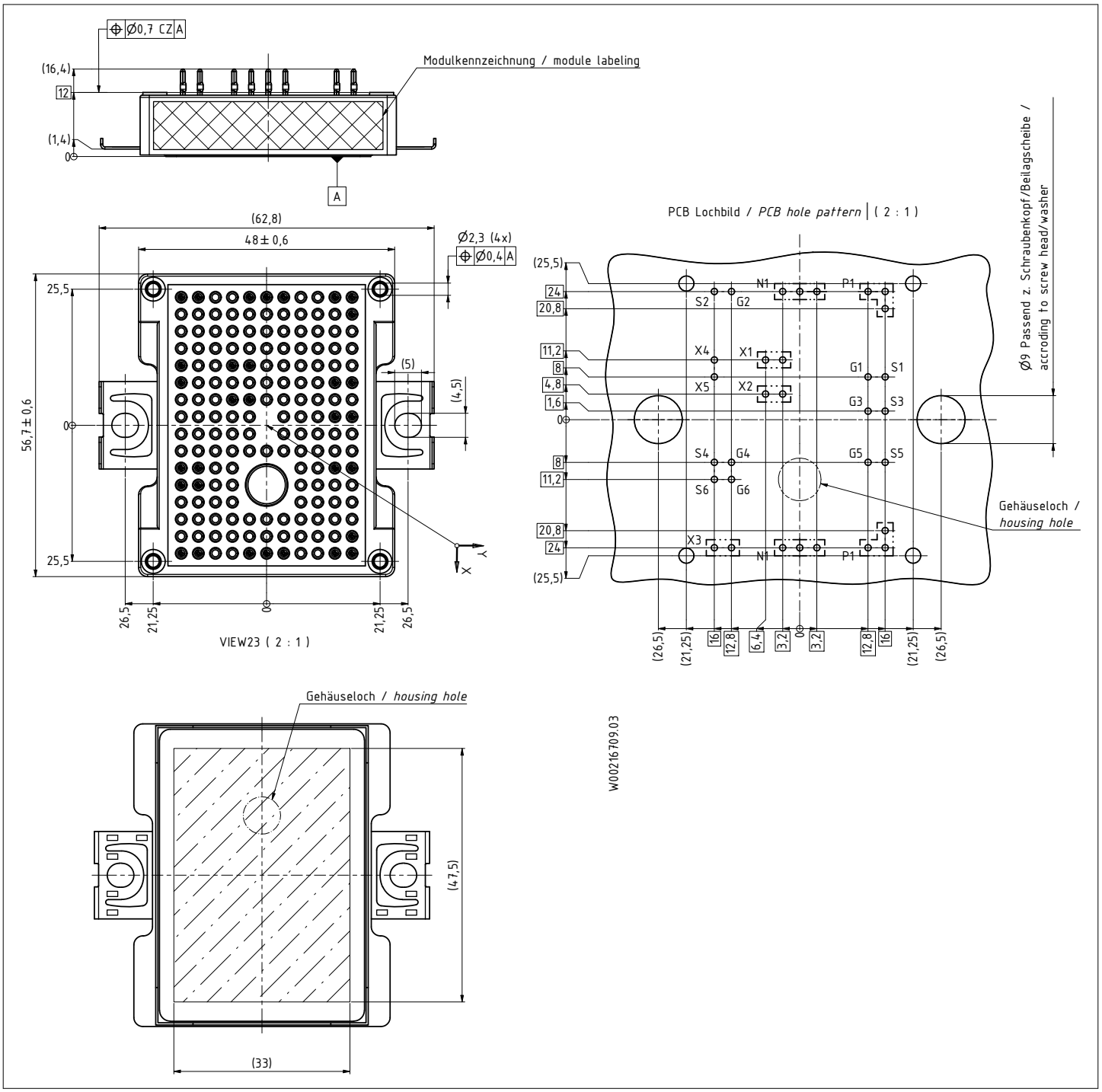

Ø0,7 CZ A
Modulkennzeichnung / module labeling
(16,4)
12
(1,4)
0
A
(62,8)
48 ± 0,6
Ø2,3 (4x)
Ø0,4 A
25,5
56,7 ± 0,6
0
25,5
(5)
(4,5)
26,5
21,25
0
21,25
26,5
VIEW23 (2 : 1)
PCB Lochbild / PCB hole pattern (2 : 1)
(25,5)
24
20,8
11,2
8
4,8
1,6
0
8
11,2
20,8
24
(25,5)
N1
P1
S2
G2
X4
X1
G1
S1
X5
X2
G3
S3
S4
G4
G5
S5
S6
G6
X3
N1
P1
Ø9 Passend z. Schraubenkopf/Beilagscheibe / accroding to screw head/washer
Gehäuseloch / housing hole
(26,5)
(21,25)
16
12,8
6,4
3,2
0
3,2
12,8
16
(21,25)
(26,5)
W00216709.03
Gehäuseloch / housing hole
(47,5)
(33)

图 2

8 模块标签代码

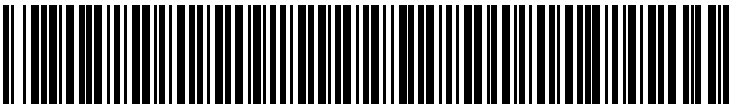
Module label code			
Code format	Data Matrix		Barcode Code128
Encoding	ASCII text		Code Set A
Symbol size	16x16		23 digits
Standard	IEC24720 and IEC16022		IEC8859-1
Code content	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production week)	*Digit* 1 –5 6 - 11 12 - 19 20 –21 22 –23	*Example* 71549 142846 55054991 15 30
Example	 7154914284655054991530	 7154914284655054991530	

图 3

修订历史

修订版本	发布日期	变更说明
0.10	2023-05-08	Initial version
0.20	2025-03-24	Preliminary datasheet

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