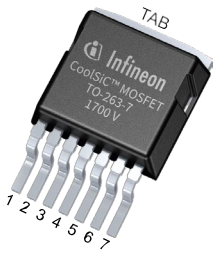
最终数据手册

英飞凌 CoolSiC™ 1700 V SiC 沟槽 MOSFET： 碳化硅MOSFET

特性



- V_{DSS} = 1700 V at T_{vj} = 25°C
- I_{DDC} = 7.4 A at T_C = 25°C
- $R_{DS(on)}$ = 650 mΩ at V_{GS} = 12 V, T_{vj} = 25°C
- 针对反激式拓扑进行了优化
- 12 V / 0 V 栅极源电压与大多数反激式控制器兼容
- 开关损耗非常低
- 基准栅极阈值电压，$V_{GS(th)}$ = 4.5 V
- 完全可控的 dv/dt，用于 EMI 优化
- 降低系统复杂性
- 直接由反激式控制器驱动
- 提高效率并减少冷却工作量
- 实现更高的频率

Halogen-free

Green

Lead-free

RoHS

潜在应用

- 光伏组串逆变器
- 太阳能集中逆变器
- 工业级不间断电源（UPS）
- 工业开关电源
- 充电器

产品验证

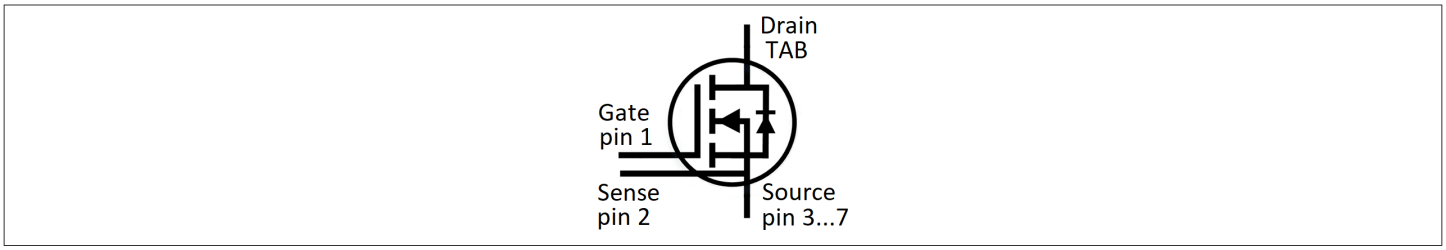
- 符合JEDEC47/20/22相关测试的工业应用要求

描述

引脚定义：

- Pin 1 - 栅极
- Pin 2 - 开尔文检测触点
- Pin 3…7 - 源极
- Tab – 漏极

注意：源引脚和感测引脚不可互换，互换可能会导致故障，建议仅用于正向操作模式



Type	Package	Marking
IMBF170R650M1	PG-TO263-7-U01	170M1650

本数据手册的原文使用英文撰写。为方便起见，英飞凌提供了译文；由于翻译过程中可能使用了自动化工具，英飞凌不保证译文的准确性。 为确认准确性，请务必访问 infineon.com 参考最新的英文版本（控制文档）。

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目录

描述 1
特性 1
潜在应用 1
产品验证 1
目录 2
1 封装 3
2 MOSFET 3
3 体二极管（MOSFET） 6
4 特性图 7
5 封装外形 12
6 测试条件 13
修订记录 14
免责声明 15

1 封装

表 1 特征值

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Storage temperature	T_{stg}		-55		150	°C
Soldering temperature	T_{sold}	reflow soldering (MSL1 according to JEDEC J-STD-020)			260	°C
Thermal resistance, junction-ambient[1)]	$R_{th(j-a)}$				62	K/W
MOSFET/body diode thermal resistance, junction-case	$R_{th(j-c)}$			1.3	1.7	K/W

1) 含铅

2 MOSFET

表 2 最大额定值

Parameter	Symbol	Note or test condition		Values	Unit
Drain-source voltage	V_{DSS}	$T_{vj} \geq 25$ °C		1700	V
Continuous DC drain current for $R_{th(j-c,max)}$, limited by $T_{vj(max)}$	I_{DDC}	$V_{GS} = 12$ V	$T_c = 25$ °C	7.4	A
			$T_c = 100$ °C	5.2	
Peak drain current, t_p limited by $T_{vj(max)}$[1)]	I_{DM}	$V_{GS} = 12$ V		18.7	A
Gate-source voltage, max. transient voltage[2)]	V_{GS}	$t_p \leq 0.5$ µs, $D < 0.01$		-10...23	V
Gate-source voltage, max. static voltage	V_{GS}			-7...20	V
Power dissipation, limited by $T_{vj(max)}$	P_{tot}		$T_c = 25$ °C	88	W
			$T_c = 100$ °C	44	

1) 已通过设计验证。
2) **重要提示：**正、负栅极源电压的选择会影响器件的长期行为。

表 3 建议值

Parameter	Symbol	Note or test condition	Values	Unit
Recommended turn-on gate voltage	$V_{GS(on)}$		12...15	V
Recommended turn-off gate voltage	$V_{GS(off)}$		0	V

表4　　特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Drain-source on-state resistance	$R_{DS(on)}$	I_D = 1.5 A	T_{vj} = 25 °C, $V_{GS(on)}$ = 12 V		650		mΩ
			T_{vj} = 100 °C, $V_{GS(on)}$ = 12 V		921		
			T_{vj} = 175 °C, $V_{GS(on)}$ = 12 V		1324		
			T_{vj} = 25 °C, $V_{GS(on)}$ = 15 V		526	580	
Gate-source threshold voltage	$V_{GS(th)}$	I_D = 1.7 mA, V_{DS} = V_{GS} (tested after 1 ms pulse at V_{GS} = 20 V)	T_{vj} = 25 °C	3.5	4.5	5.7	V
			T_{vj} = 175 °C		3.6		
Zero gate-voltage drain current	I_{DSS}	V_{DS} = 1700 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.6	11	µA
			T_{vj} = 175 °C		8		
Gate leakage current	I_{GSS}	V_{DS} = 0 V	V_{GS} = 20 V			100	nA
			V_{GS} = -10 V			-100	
Forward transconductance	g_{fs}	I_D = 1.5 A, V_{DS} = 20 V			0.65		S
Internal gate resistance	$R_{G,int}$	f = 1 MHz, V_{AC} = 25 mV			25.4		Ω
Input capacitance	C_{iss}	V_{DS} = 1000 V, V_{GS} = 0 V, f = 1000 kHz, V_{AC} = 25 mV			422		pF
Output capacitance	C_{oss}	V_{DS} = 1000 V, V_{GS} = 0 V, f = 1000 kHz, V_{AC} = 25 mV			12		pF
Reverse transfer capacitance	C_{rss}	V_{DS} = 1000 V, V_{GS} = 0 V, f = 1000 kHz, V_{AC} = 25 mV			1.1		pF
C_{oss} stored energy	E_{oss}	V_{DS} = 1000 V, V_{GS} = 0 V, f = 1000 kHz, V_{AC} = 25 mV			2		µJ
Total gate charge	Q_G	V_{DD} = 1000 V, I_D = 1.5 A, V_{GS} = 0/12 V, turn-on pulse			8		nC
Plateau gate charge	$Q_{GS(pl)}$	V_{DD} = 1000 V, I_D = 1.5 A, V_{GS} = 0/12 V, turn-on pulse			2.3		nC
Gate-to-drain charge	Q_{GD}	V_{DD} = 1000 V, I_D = 1.5 A, V_{GS} = 0/12 V, turn-on pulse			3.3		nC
Turn-on delay time	$t_{d(on)}$	V_{DD} = 1000 V, I_D = 1.5 A, V_{GS} = 0/12 V, $R_{G,ext}$ = 22 Ω, L_σ = 40 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		22		ns
			T_{vj} = 175 °C		19		

（表格续下页……）

表 4（续） 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Rise time	t_r	V_{DD} = 1000 V, I_D = 1.5 A, V_{GS} = 0/12 V, $R_{G,ext}$ = 22 Ω, L_σ = 40 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		16		ns
			T_{vj} = 175 °C		13		
Turn-off delay time	$t_{d(off)}$	V_{DD} = 1000 V, I_D = 1.5 A, V_{GS} = 0/12 V, $R_{G,ext}$ = 22 Ω, L_σ = 40 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		24		ns
			T_{vj} = 175 °C		28		
Fall time	t_f	V_{DD} = 1000 V, I_D = 1.5 A, V_{GS} = 0/12 V, $R_{G,ext}$ = 22 Ω, L_σ = 40 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		22		ns
			T_{vj} = 175 °C		24		
Turn-on energy	E_{on}	V_{DD} = 1000 V, I_D = 1.5 A, V_{GS} = 0/12 V, $R_{G,ext}$ = 22 Ω, L_σ = 40 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		50		µJ
			T_{vj} = 175 °C		54		
Turn-off energy	E_{off}	V_{DD} = 1000 V, I_D = 1.5 A, V_{GS} = 0/12 V, $R_{G,ext}$ = 22 Ω, L_σ = 40 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		10		µJ
			T_{vj} = 175 °C		13		
Total switching energy	E_{tot}	V_{DD} = 1000 V, I_D = 1.5 A, V_{GS} = 0/12 V, $R_{G,ext}$ = 22 Ω, L_σ = 40 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		60		µJ
			T_{vj} = 175 °C		66		
Virtual junction temperature	T_{vj}			-55		175	°C

注: 为了获得最佳的使用寿命和可靠性，英飞凌建议运行条件不超过本数据手册中所述最大额定值的80%。

该芯片技术的特征高达200 kV/µs。测量的dV/dt受到测量测试设置和封装的限制。

除非另有说明，*特性曲线均为T_{vj} = 25°C时的数据。动态测试电路见图F。*

3 体二极管（MOSFET）

表5 最大额定值

Parameter	Symbol	Note or test condition	Values	Unit
Drain-source voltage	V_{DSS}	$T_{vj} \geq 25$ °C	1700	V
Peak reverse drain current, t_p limited by $T_{vj(max)}$	I_{SM}	$V_{GS} = 0$ V	18.7	A

表6 特征值

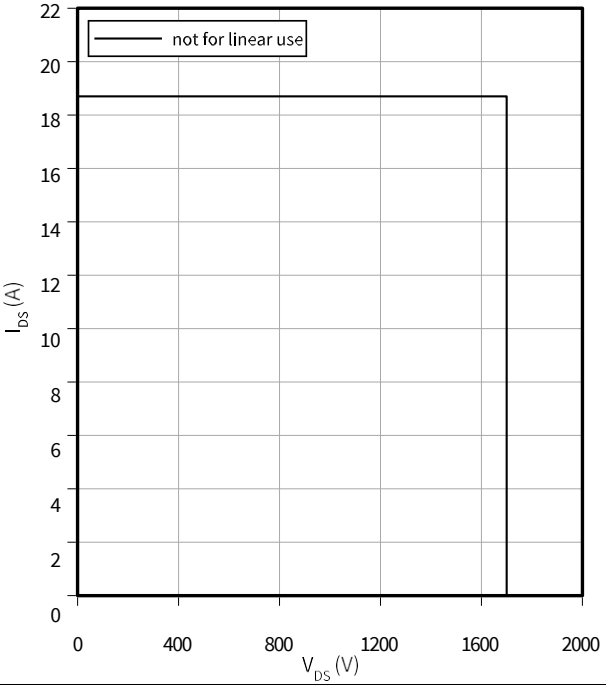
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Drain-source reverse voltage	V_{SD}	$I_{SD} = 1.5$ A, $V_{GS} = 0$ V	$T_{vj} = 25$ °C		3.9		V
			$T_{vj} = 175$ °C		3.7		
MOSFET forward recovery charge	Q_{fr}	$V_{DD} = 1000$ V, $I_{SD} = 1.5$ A, $V_{GS} = 0$ V, $-di_{SD}/dt = 1000$ A/µs, Q_{fr} includes also Q_C	$T_{vj} = 25$ °C		64.7		nC
			$T_{vj} = 175$ °C		74.8		
MOSFET peak forward recovery current	I_{frm}	$V_{DD} = 1000$ V, $I_{SD} = 1.5$ A, $V_{GS} = 0$ V, $-di_{SD}/dt = 1000$ A/µs, Q_{fr} includes also Q_C	$T_{vj} = 25$ °C		4.1		A
			$T_{vj} = 175$ °C		4.7		
MOSFET forward recovery energy	E_{fr}	$V_{DD} = 1000$ V, $I_{SD} = 1.5$ A, $V_{GS} = 0$ V, $-di_{SD}/dt = 1000$ A/µs, Q_{fr} includes also Q_C	$T_{vj} = 25$ °C		0.17		µJ
			$T_{vj} = 175$ °C		0.26		
Virtual junction temperature	T_{vj}			-55		175	°C

4 特性图

Reverse bias safe operating area (RBSOA)

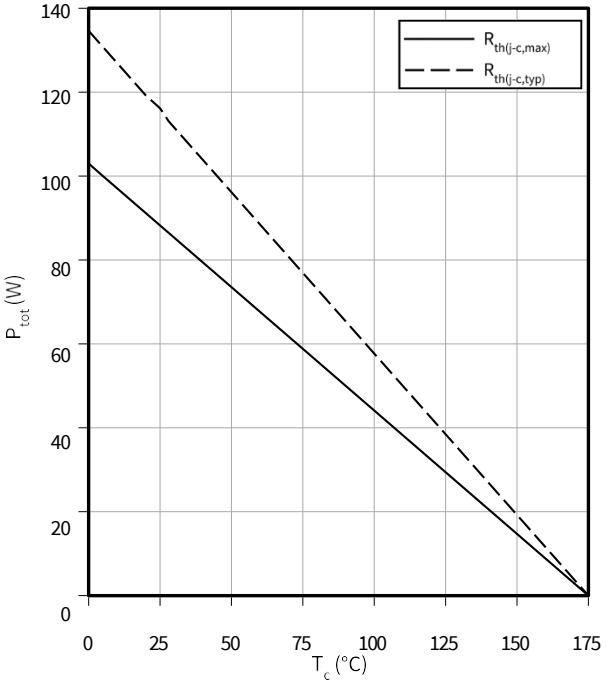
$I_{DS} = f(V_{DS})$

$T_{vj} \leq 175$ °C, $V_{GS} = 0/12$ V, $T_c = 25$ °C



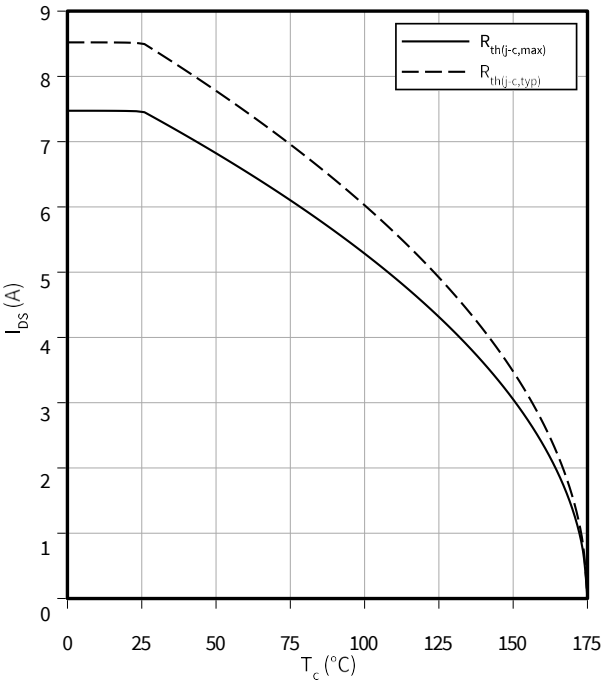
Power dissipation as a function of case temperature limited by bond wire

$P_{tot} = f(T_c)$



Maximum DC drain to source current as a function of case temperature limited by bond wire

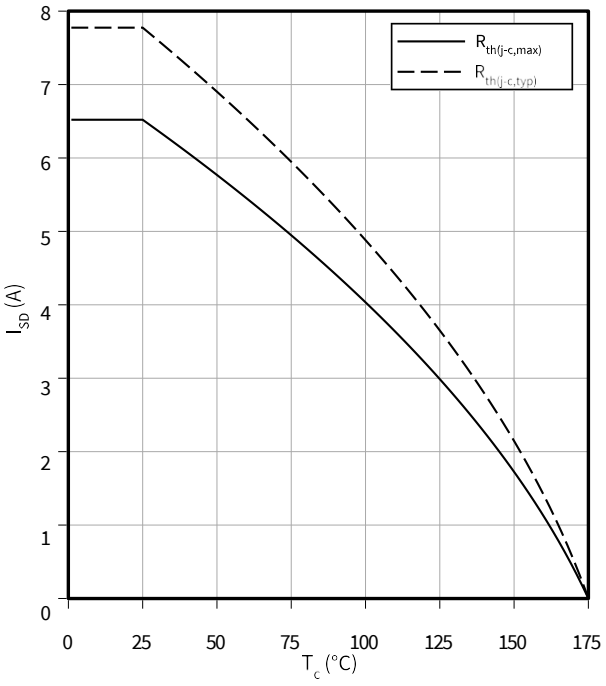
$I_{DS} = f(T_c)$



Maximum source to drain current as a function of case temperature limited by bond wire

$I_{SD} = f(T_c)$

$V_{GS} = 0$ V

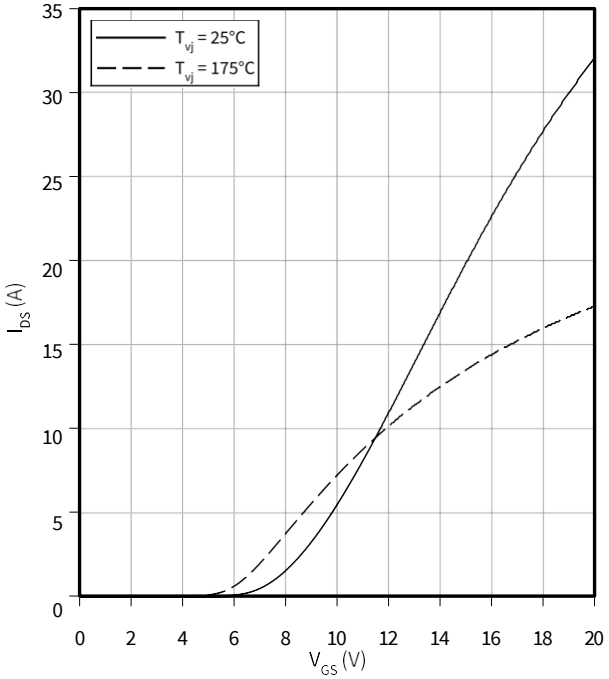


4 特征图

Typical transfer characteristic

$I_{DS} = f(V_{GS})$

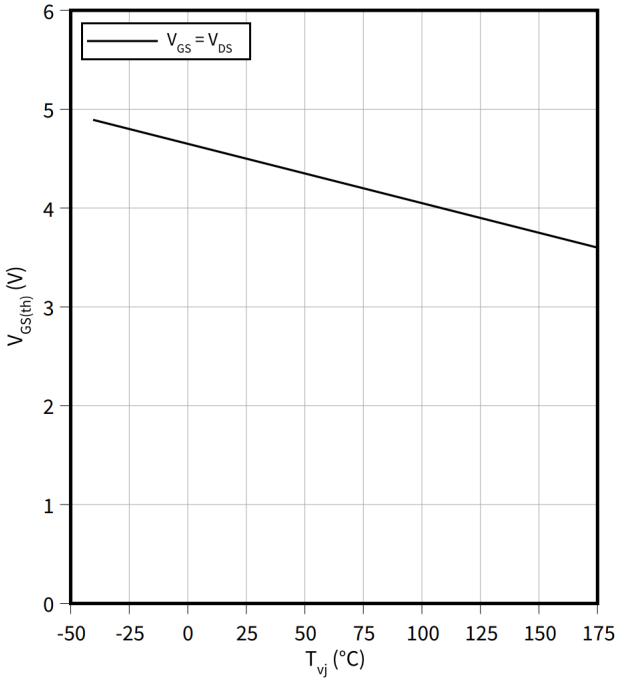
$V_{DS} = 20$ V, $t_p = 20$ µs



Typical gate-source threshold voltage as a function of junction temperature

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

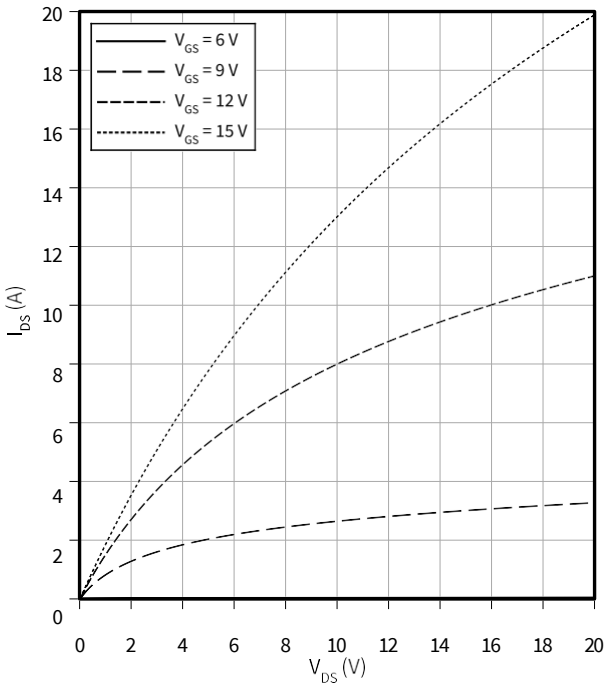
$I_D = 1.7$ mA



Typical output characteristic, V_{GS} as a parameter

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

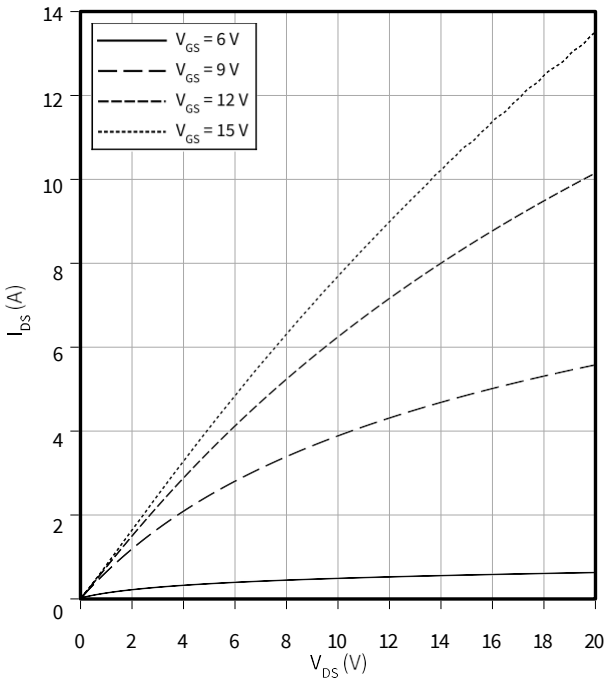
$T_{vj} = 25$ °C, $t_p = 20$ µs



Typical output characteristic, V_{GS} as a parameter

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

$T_{vj} = 175$ °C, $t_p = 20$ µs

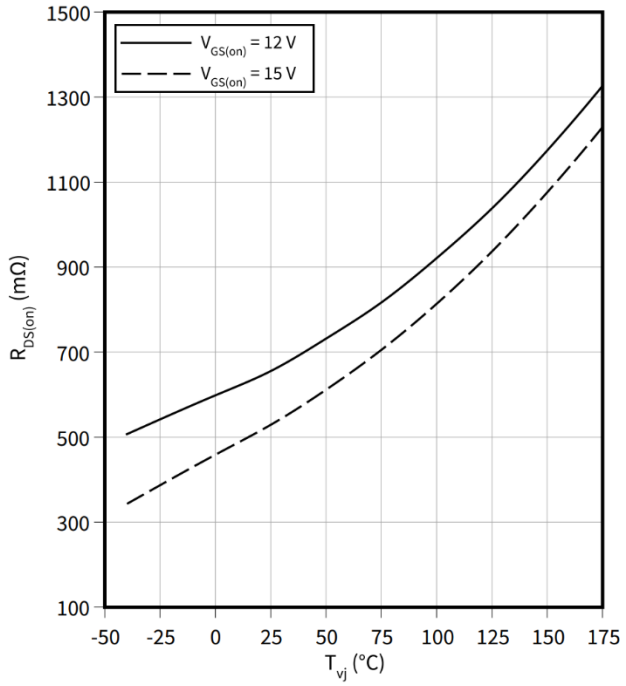


4 特征图

Typical on-state resistance as a function of junction temperature

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

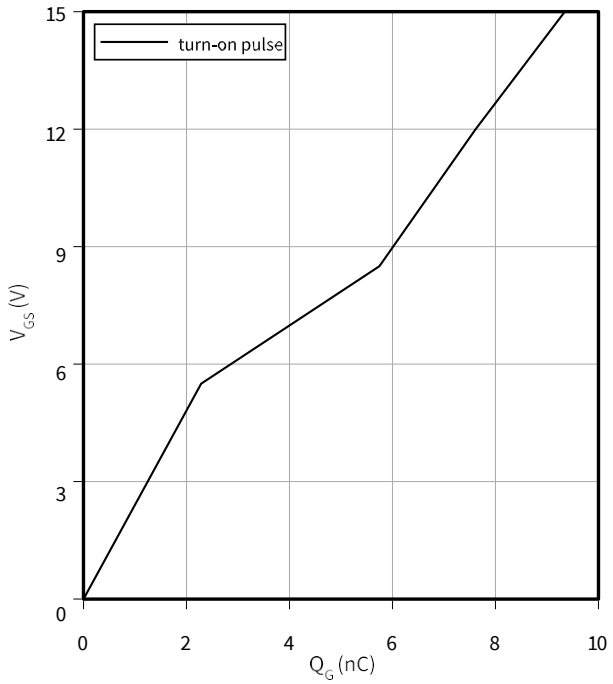
$I_D = 1.5$ A



Typical gate charge

$V_{GS} = f(Q_G)$

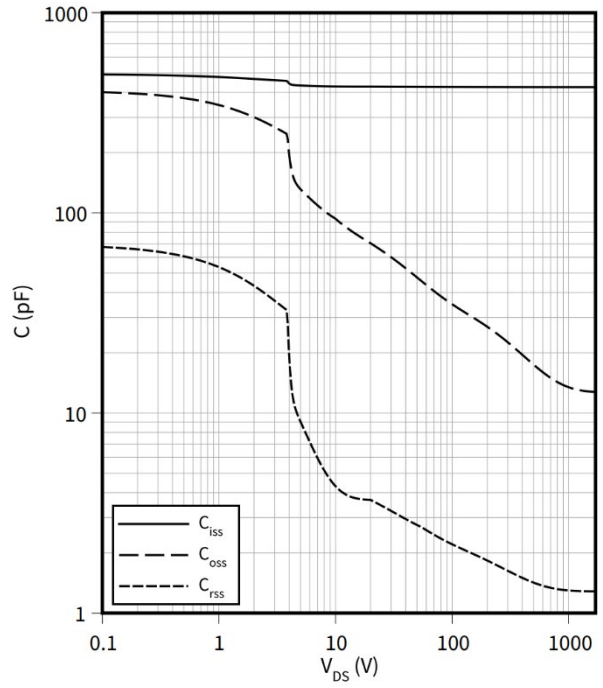
$I_D = 1.5$ A, $V_{DS} = 1000$ V



Typical capacitance as a function of drain-source voltage

$C = f(V_{DS})$

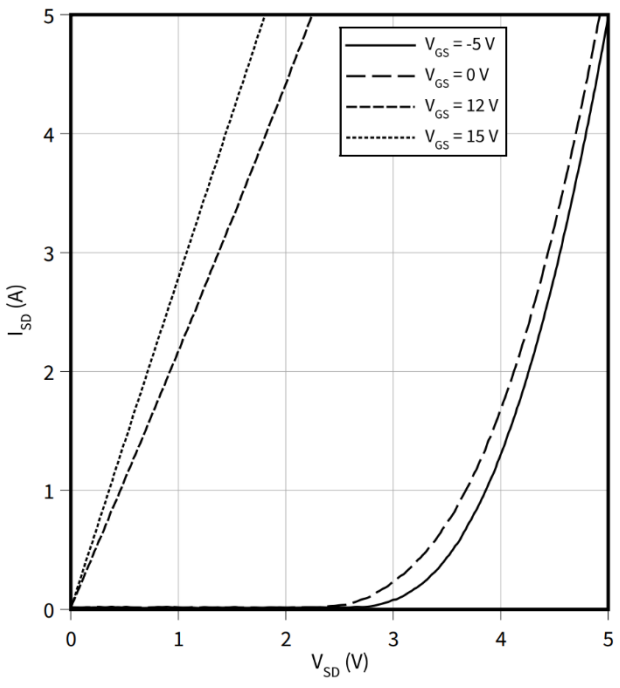
$f = 1000$ kHz, $V_{GS} = 0$ V



Typical reverse drain current as a function of reverse drain voltage, V_{GS} as a parameter

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

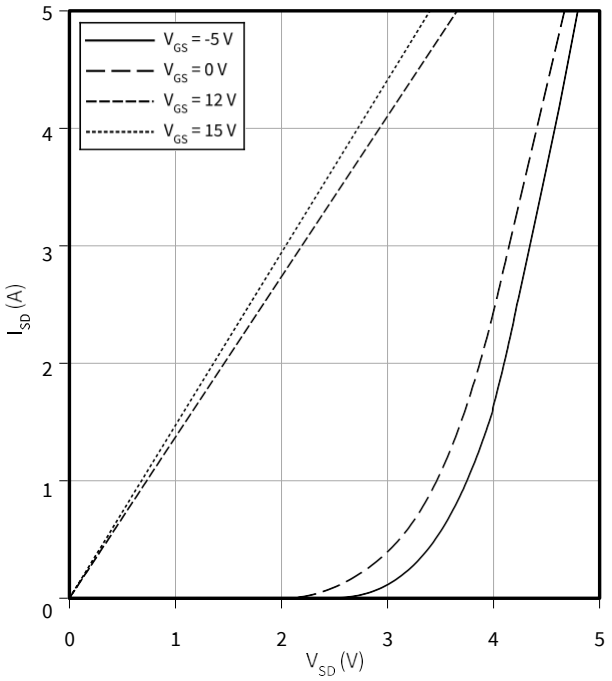
$T_{vj} = 25$ °C, $t_p = 20$ µs



Typical reverse drain current as a function of reverse drain voltage, V_{GS} as a parameter

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

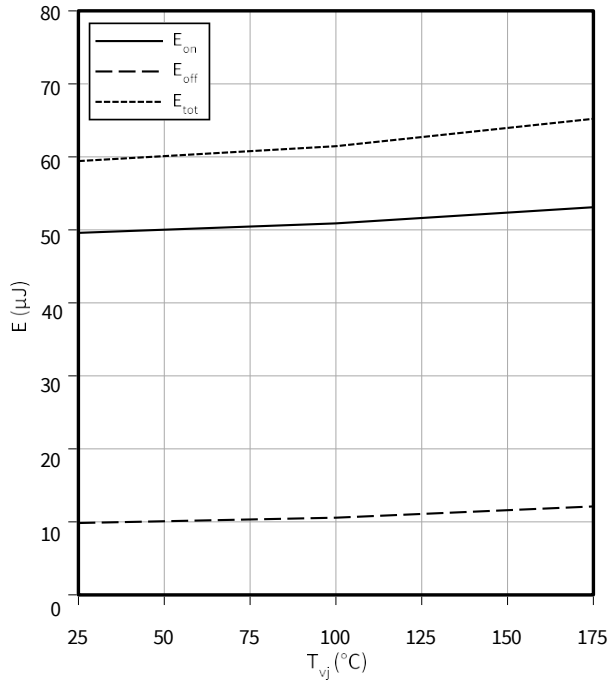
$T_{vj} = 175\ °C$, $t_p = 20\ µs$



Typical switching energy as a function of junction temperature, test circuit in Fig. F, 2nd device own body diode: V_{GS} = 0 V

$E = f(T_{vj})$

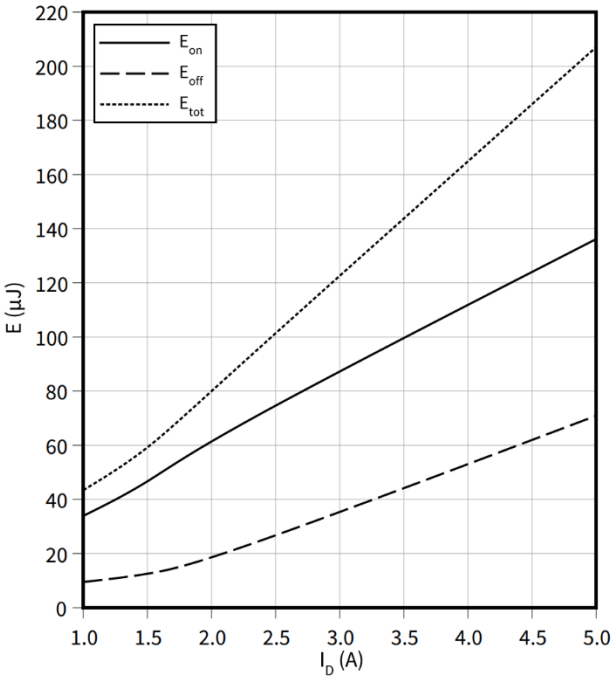
$V_{GS} = 0/12\ V$, $I_D = 1.5\ A$, $R_{G,ext} = 22\ Ω$, $V_{DD} = 1000\ V$



Typical switching energy as a function of drain current, test circuit in Fig. F, 2nd device own body diode: V_{GS} = 0 V

$E = f(I_D)$

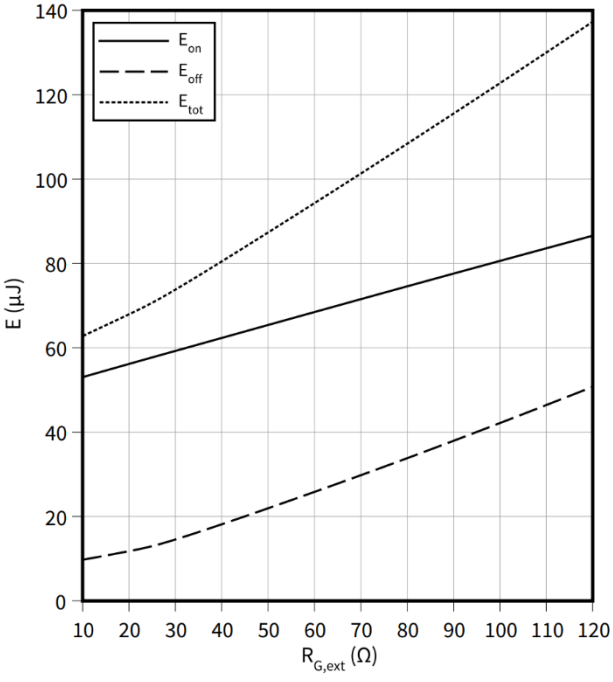
$V_{GS} = 0/12\ V$, $T_{vj} = 175\ °C$, $R_{G,ext} = 22\ Ω$, $V_{DD} = 1000\ V$



Typical switching energy as a function of gate resistance, test circuit in Fig. F, 2nd device own body diode: V_{GS} = 0 V

$E = f(R_{G,ext})$

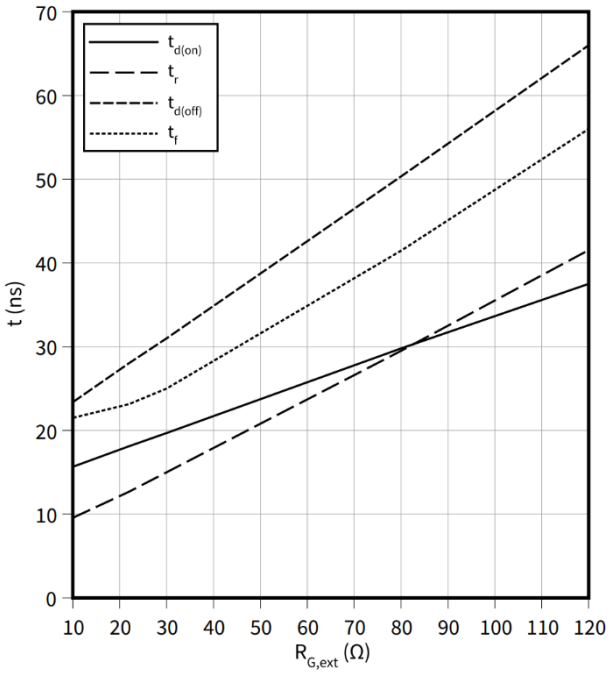
$V_{GS} = 0/12\ V$, $I_D = 1.5\ A$, $T_{vj} = 175\ °C$, $V_{DD} = 1000\ V$



Typical switching times as a function of gate resistance, test circuit in Fig. F, 2nd device own body diode: V_{GS} = 0 V

$t = f(R_{G,ext})$

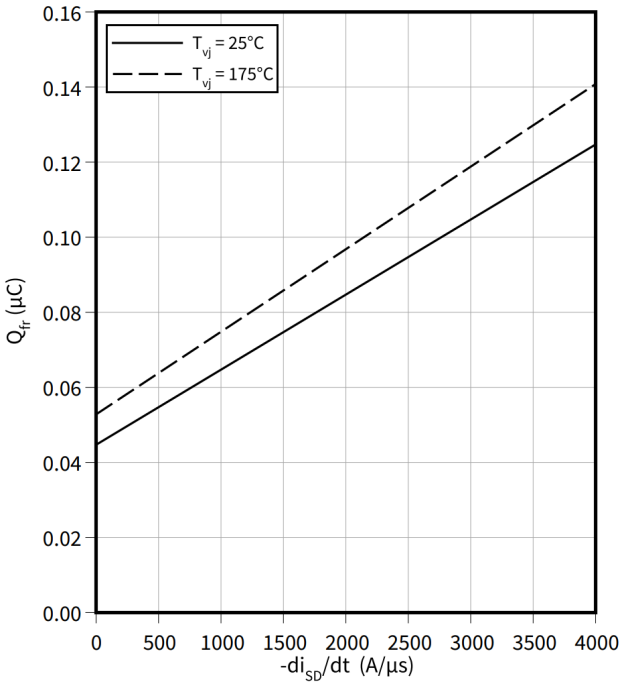
V_{GS} = 0/12 V, I_D = 1.5 A, T_{vj} = 175 °C, V_{DD} = 1000 V



Typical reverse recovery charge as a function of reverse drain current slope, test circuit in Fig. F, 2nd device own body diode: V_{GS} = 0 V

$Q_{fr} = f(-di_{SD}/dt)$

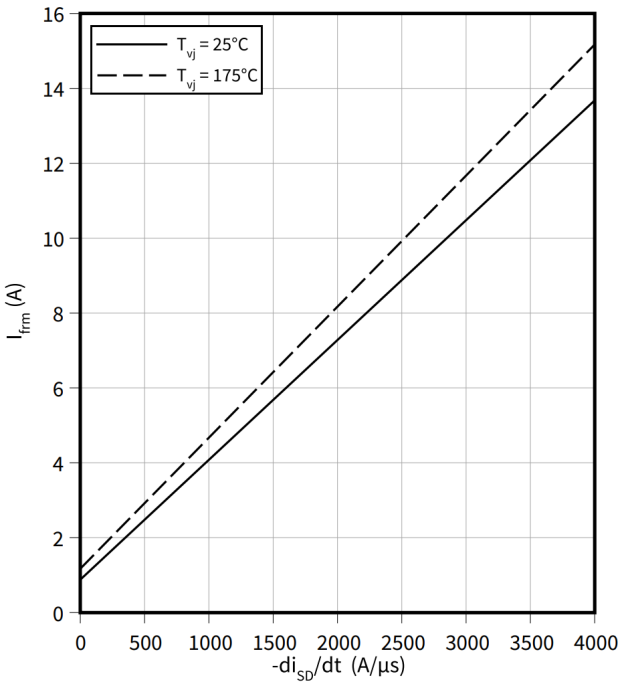
V_{GS} = 0 V, I_{SD} = 1.5 A, V_{DD} = 1000 V



Typical reverse recovery current as a function of reverse drain current slope, test circuit in Fig. F, 2nd device own body diode: V_{GS} = 0 V

$I_{frm} = f(-di_{SD}/dt)$

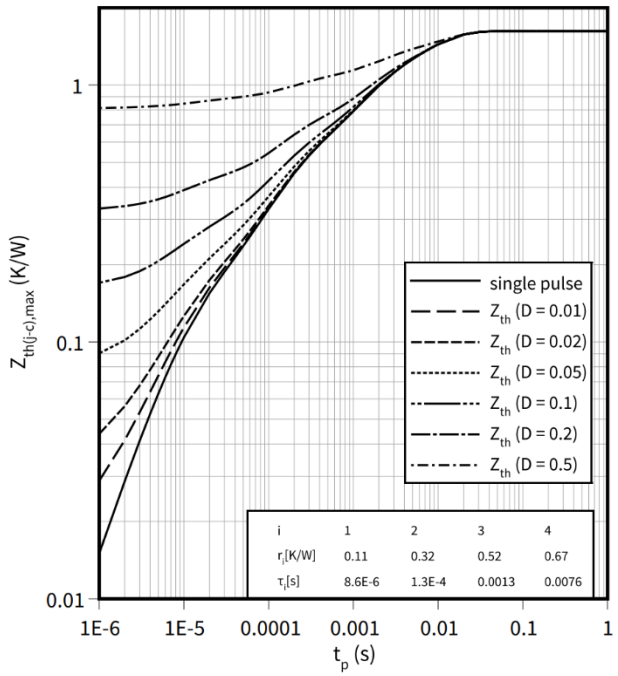
V_{GS} = 0 V, I_{SD} = 1.5 A, V_{DD} = 1000 V



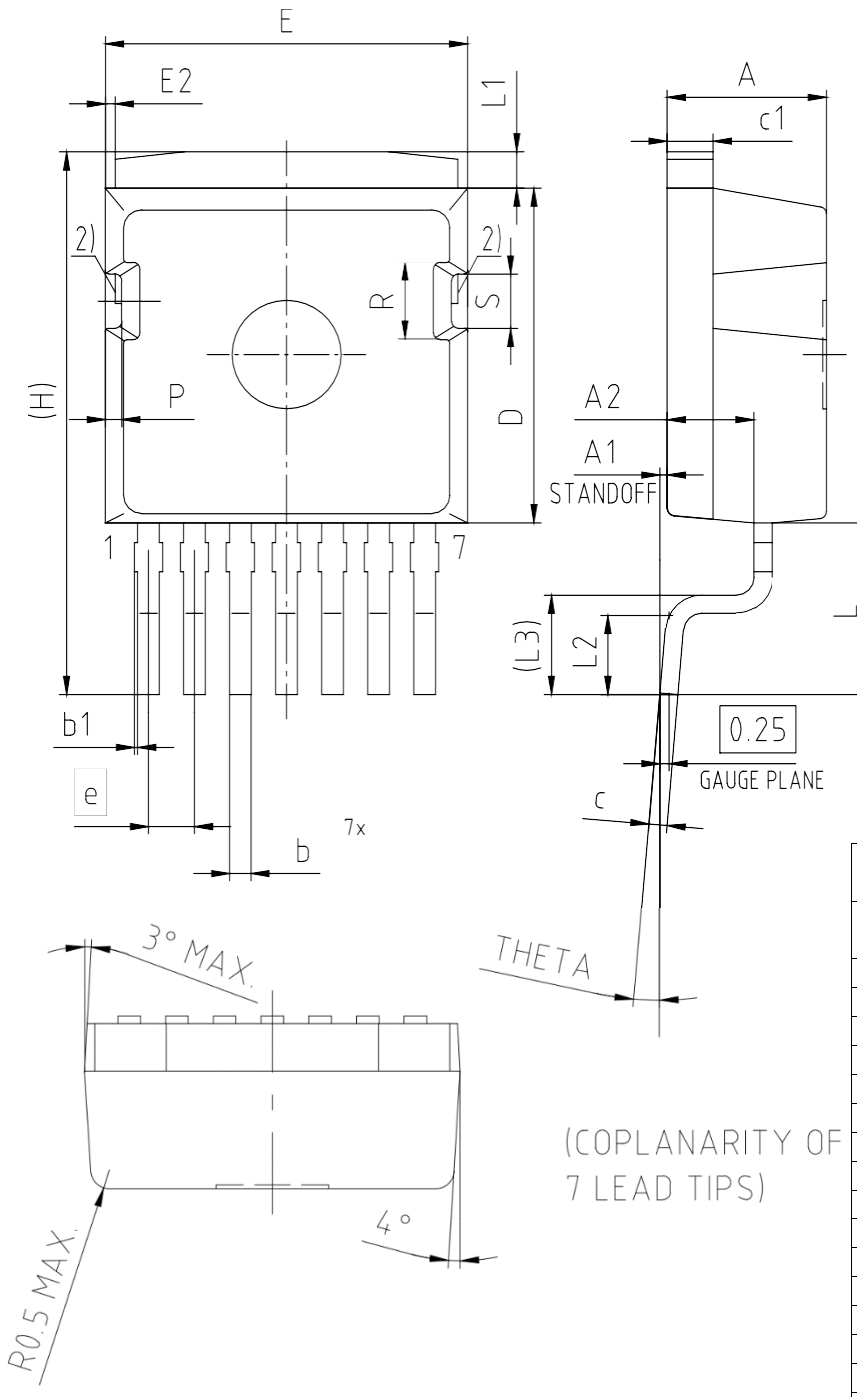
Max. transient thermal impedance (MOSFET/diode)

$Z_{th(j-c),max} = f(t_p)$

$D = t_p/T$



5 封装外形



PACKAGE - GROUP NUMBER:	PG-TO263-7-U01	
DIMENSIONS	**MILLIMETERS**	
	MIN.	MAX.
A	4.30	4.50
A1	0.00	0.10
A2	2.30	2.50
b	0.50	0.70
b1	0.00	0.15
c	0.40	0.60
c1	1.17	1.37
D	9.05	9.45
D1	5.90	6.10
E	9.80	10.20
E1	9.36	9.56
E2	0.00	0.30
E3	8.40	8.60
e	1.27	
H	15.00	
L	4.20	5.20
L1	0.70	1.30
L2	1.70	2.30
L3	2.70	
P	0.35	0.55
R	2.03	2.23
S	1.40	1.60
THETA	0.00°	8.00°

图 1

6 测试条件

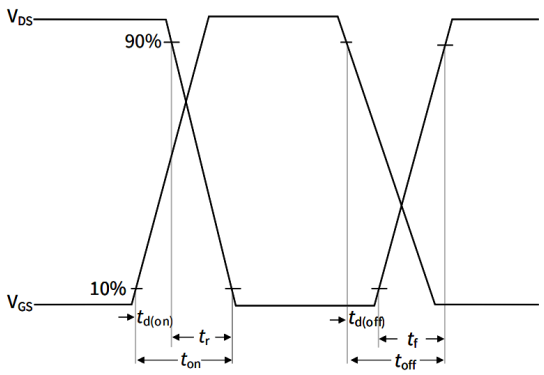


Figure A. **Definition of switching times**

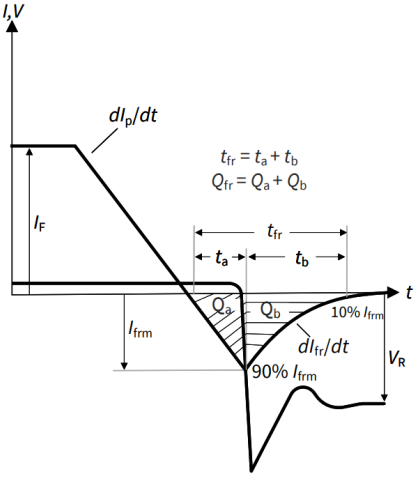


Figure B. **Definition of diode switching characteristics**

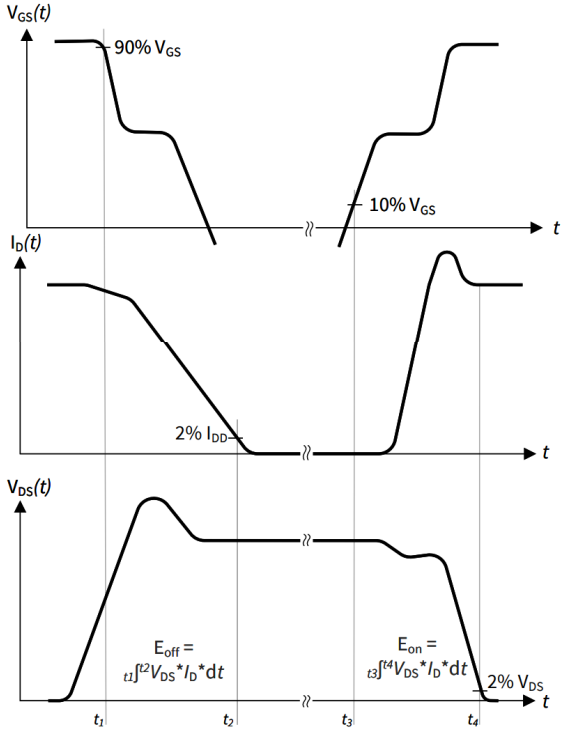


Figure C. **Definition of switching losses**

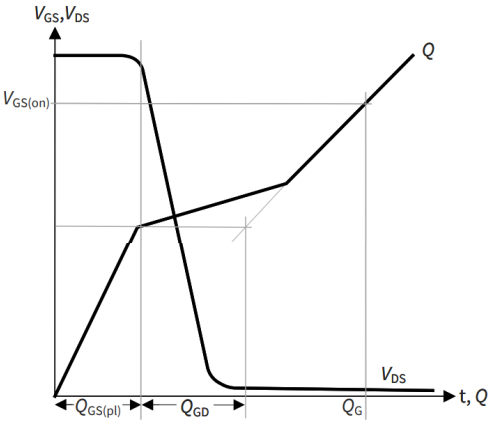


Figure D. **Definition of QGD**

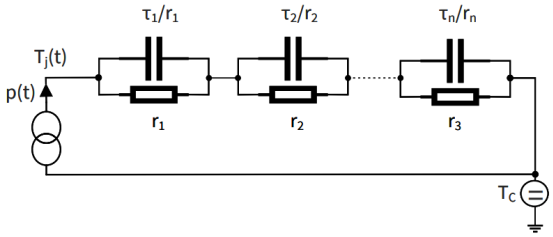


Figure E. **Thermal equivalent circuit**

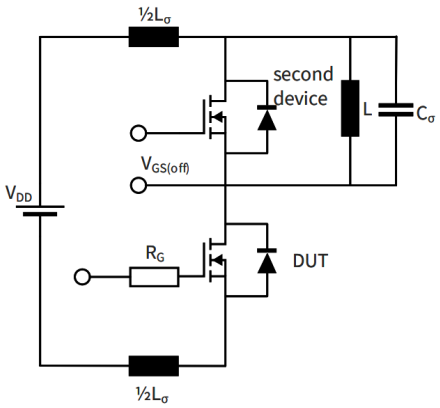


Figure F. **Dynamic test circuit**
Parasitic inductance L_σ,
Parasitic capacitor C_σ,

图 2

修订记录

Document revision	Date of release	Description of changes
1.00	2025-03-22	Changed package name Increased Gate-source voltage, max. transient voltage Added Gate-source voltage, max. static voltage Added diode characteristic parameters in Table 5 and Table 6 Added graphs $I_{SD} = f(V_{SD})$, $I_{SD} = f(T_c)$, $Q_{fr} = f(-di_{SD}/dt)$, $I_{frm} = f(-di_{SD}/dt)$ Corrected graph $I_{DS} = f(T_c)$ Editorial changes ***Legacy Revisions*** 2.1 2020-04-27 Final Datasheet 2.2 2020-12-11 Correction of circuit symbol on page 1 2.3 2021-04-12 Editorial changes

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