最终数据手册

英飞凌CoolSiC ™ 1200 V SiC 沟道MOSFET

Halogen-free
Green
Lead-free
RoHS
AEC Qualified

特性

- T_{vj} = -55...175°C 时 V_{DSS} = 1200 V
- T_C = 25°C时I_{DDC} = 17 A
- $R_{DS\ (on)}$ = 160mΩ （V_{GS} = 20V、T_{vj} = 25°C 时）
- 新的性能优化芯片技术 (Gen1p)，改善了 R_{DSon} * A FOM
- 提高了建议开启电压 ($V_{GS(on)}$ = 20 V) 以降低 $R_{DS(on)}$
- 业界领先的开关能量特性，可降低开关损耗并减少冷却需求
- 最低的器件电容值，可实现更高的开关速度和更高的功率密度
- 低 C_{rss} /C_{iss} 电容比值和高 $V_{GS(th)}$ 的组合，可避免寄生导通并实现单极性栅极驱动
- 降低了总栅极电荷 Q_G, 可降低驱动功率和损耗
- .XT 芯片粘接技术，实现业界领先的热性能
- 用于优化开关性能的检测引脚
- 适合高压爬电要求

潜在应用

- 车载充电器
- 直流/直流转换器
- 辅助驱动

产品验证

- 适合汽车应用。根据 AEC-Q100/101 进行产品验证

描述

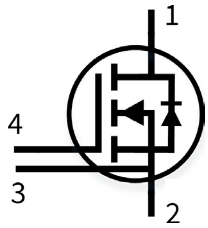
引脚定义：

1 - 漏极

2 - 来源

3 - 开尔文检测

4 – 栅极



Type	Package	Marking
AIMZHN120R160M1T	PG-TO247-4-STD-NN6.7	A12M1N160

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目录

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}				260	°C
MOSFET/body diode thermal resistance, junction-case	$R_{th(j-c)}$			1.05	1.37	K/W

注： 无需经过生产测试- 经过设计/特性验证。

2 MOSFET

表2 最大额定值

Parameter	Symbol	Note or test condition		Values	Unit
Drain-source voltage	V_{DSS}	T_{vj} = -55...175 °C		1200	V
Continuous DC drain current for $R_{th(j-c,max)}$, limited by $T_{vj(max)}$	I_{DDC}	V_{GS} = 20 V	T_c = 25 °C	17	A
			T_c = 100 °C	12	
Peak drain current, t_p limited by $T_{vj(max)}$	I_{DM}	V_{GS} = 20 V		43	A
Gate-source voltage, max. transient voltage[1)]	V_{GS}	$t_p \leq 0.5$ µs, $D < 0.01$		-10...25	V
Gate-source voltage, max. static voltage	V_{GS}			-5...23	V
Avalanche energy, single pulse	E_{AS}	I_D = 3.6 A, V_{DD} = 50 V, L = 10 mH		65	mJ
Power dissipation, limited by $T_{vj(max)}$	P_{tot}		T_c = 25 °C	109	W
			T_c = 100 °C	55	

1) **重要注释：**正负栅极源电压的选择会影响器件的长期行为。为了确保器件在计划使用寿命内的正常运行，必须考虑应用说明AN2018-09中描述的设计指南。

表 3 建议值

Parameter	Symbol	Note or test condition	Values	Unit
Recommended turn-on gate voltage	$V_{GS(on)}$		20	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 = 5 A	T_{vj} = 25 °C, $V_{GS(on)}$ = 20 V		160	200	mΩ
			T_{vj} = 100 °C, $V_{GS(on)}$ = 20 V		227		
			T_{vj} = 175 °C, $V_{GS(on)}$ = 20 V		327		
			T_{vj} = 25 °C, $V_{GS(on)}$ = 18 V		173		
Gate-source threshold voltage	$V_{GS(th)}$	I_D = 1.5 mA, V_{DS} = V_{GS} (tested after 1 ms pulse at V_{GS} = 20 V)	T_{vj} = 25 °C	3.5	4.3	5.1	V
			T_{vj} = 175 °C		3.8		
Zero gate-voltage drain current	I_{DSS}	V_{DS} = 1200 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.1	4.5	µA
			T_{vj} = 175 °C		50		
Gate leakage current	I_{GSS}	V_{DS} = 0 V	V_{GS} = 25 V			100	nA
			V_{GS} = -10 V			-100	
Forward transconductance	g_{fs}	I_D = 5 A, V_{DS} = 20 V			3		S
Short-circuit withstand time[1)]	t_{SC}	V_{DD} ≤ 800 V, $V_{DS,peak}$ < 1200 V, $T_{vj(start)}$ = 25 °C, $R_{G,ext}$ = 2 Ω	$V_{GS(on)}$ = 20 V		1.5		µs
			$V_{GS(on)}$ = 18 V		2		
			$V_{GS(on)}$ = 15 V		2.5		
Internal gate resistance	$R_{G,int}$	f = 1 MHz, V_{AC} = 25 mV			4.3		Ω
Input capacitance	C_{iss}	V_{DD} = 800 V, V_{GS} = 0 V, f = 100 kHz, V_{AC} = 25 mV			350		pF
Output capacitance	C_{oss}	V_{DD} = 800 V, V_{GS} = 0 V, f = 100 kHz, V_{AC} = 25 mV			20		pF
Reverse transfer capacitance	C_{rss}	V_{DD} = 800 V, V_{GS} = 0 V, f = 100 kHz, V_{AC} = 25 mV			1		pF
C_{oss} stored energy	E_{oss}	V_{DD} = 800 V, V_{GS} = 0 V, f = 100 kHz, V_{AC} = 25 mV			8.1		µJ
Total gate charge	Q_G	V_{DD} = 800 V, I_D = 5 A, V_{GS} = 0/20 V, turn-on pulse			14		nC
Plateau gate charge	$Q_{GS(pl)}$	V_{DD} = 800 V, I_D = 5 A, V_{GS} = 0/20 V, turn-on pulse			4		nC
Gate-to-drain charge	Q_{GD}	V_{DD} = 800 V, I_D = 5 A, V_{GS} = 0/20 V, turn-on pulse			2		nC
Turn-on delay time	$t_{d(on)}$	V_{DD} = 800 V, I_D = 5 A, V_{GS} = 0/20 V, $R_{GS(on)}$ = 2 Ω, $R_{GS(off)}$ = 2 Ω, L_σ = 15 nH	T_{vj} = 25 °C		7		ns
			T_{vj} = 175 °C		7		

（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} = 800 V, I_D = 5 A, V_{GS} = 0/20 V, $R_{GS(on)}$ = 2 Ω, $R_{GS(off)}$ = 2 Ω, L_σ = 15 nH	T_{vj} = 25 °C		4		ns
			T_{vj} = 175 °C		5		
Turn-off delay time	$t_{d(off)}$	V_{DD} = 800 V, I_D = 5 A, V_{GS} = 0/20 V, $R_{GS(on)}$ = 2 Ω, $R_{GS(off)}$ = 2 Ω, L_σ = 15 nH	T_{vj} = 25 °C		11		ns
			T_{vj} = 175 °C		12		
Fall time	t_f	V_{DD} = 800 V, I_D = 5 A, V_{GS} = 0/20 V, $R_{GS(on)}$ = 2 Ω, $R_{GS(off)}$ = 2 Ω, L_σ = 15 nH	T_{vj} = 25 °C		20		ns
			T_{vj} = 175 °C		22		
Turn-on energy	E_{on}	V_{DD} = 800 V, I_D = 5 A, V_{GS} = 0/20 V, $R_{GS(on)}$ = 2 Ω, $R_{GS(off)}$ = 2 Ω, L_σ = 15 nH	T_{vj} = 25 °C		28		µJ
			T_{vj} = 175 °C		53		
Turn-off energy	E_{off}	V_{DD} = 800 V, I_D = 5 A, V_{GS} = 0/20 V, $R_{GS(on)}$ = 2 Ω, $R_{GS(off)}$ = 2 Ω, L_σ = 15 nH	T_{vj} = 25 °C		34		µJ
			T_{vj} = 175 °C		35		
Total switching energy	E_{tot}	V_{DD} = 800 V, I_D = 5 A, V_{GS} = 0/20 V, $R_{GS(on)}$ = 2 Ω, $R_{GS(off)}$ = 2 Ω, L_σ = 15 nH	T_{vj} = 25 °C		62		µJ
			T_{vj} = 175 °C		88		
Virtual junction temperature	T_{vj}			-55		175	°C

*1)*通过设计/特性验证

注： *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} = -55...175 °C		1200	V
Continuous reverse drain current for $R_{th(j-c,max)}$, limited by $T_{vj(max)}$	I_{SDC}	V_{GS} = 0 V	T_c = 25 °C	11	A
			T_c = 100 °C	10	

Peak reverse drain current, t_p limited by $T_{vj(max)}$	I_{SM}	V_{GS} = 0 V	11	A

表6 **特征值**

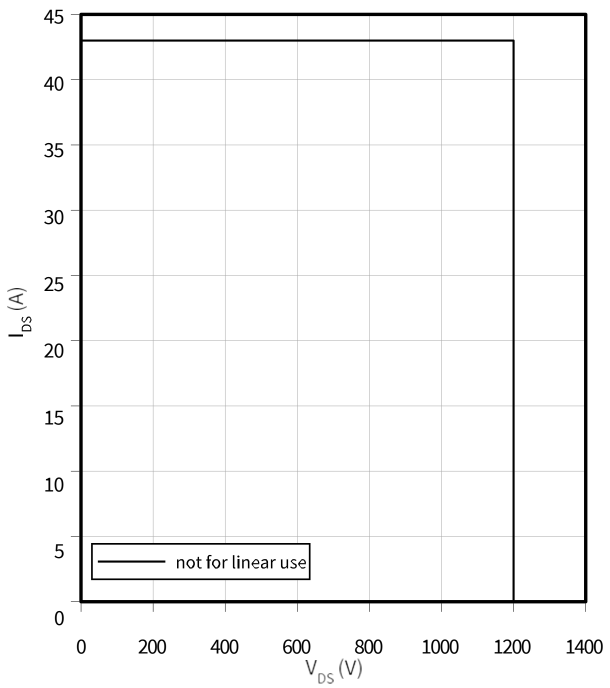
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Drain-source reverse voltage	V_{SD}	I_{SD} = 5 A, V_{GS} = 0 V	T_{vj} = 25 °C		3.9	5	V
			T_{vj} = 100 °C		3.8		
			T_{vj} = 175 °C		3.7		
MOSFET forward recovery charge	Q_{fr}	V_{DD} = 800 V, I_{SD} = 5 A, V_{GS} = 0 V, di_{SD}/dt = 3000 A/µs, Q_{fr} includes also Q_C	T_{vj} = 25 °C		60		nC
			T_{vj} = 175 °C		120		
MOSFET peak forward recovery current	I_{frm}	V_{DD} = 800 V, I_{SD} = 5 A, V_{GS} = 0 V, di_{SD}/dt = 3000 A/µs, Q_{fr} includes also Q_C	T_{vj} = 25 °C		8		A
			T_{vj} = 175 °C		11		
Virtual junction temperature	T_{vj}			-55		175	°C

4 特性图

Reverse bias safe operating area (RBSOA)

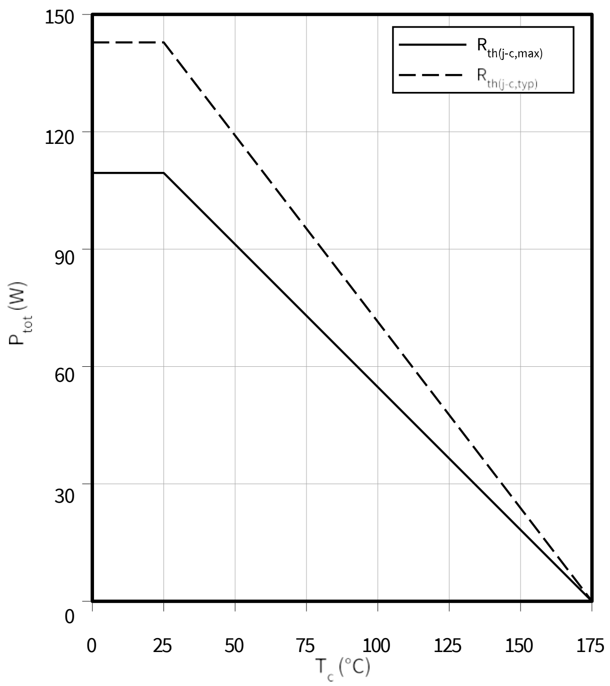
$I_{DS} = f(V_{DS})$

$T_{vj} \leq 175$ °C, $V_{GS} = 0/20$ V, $T_c = 25$ °C



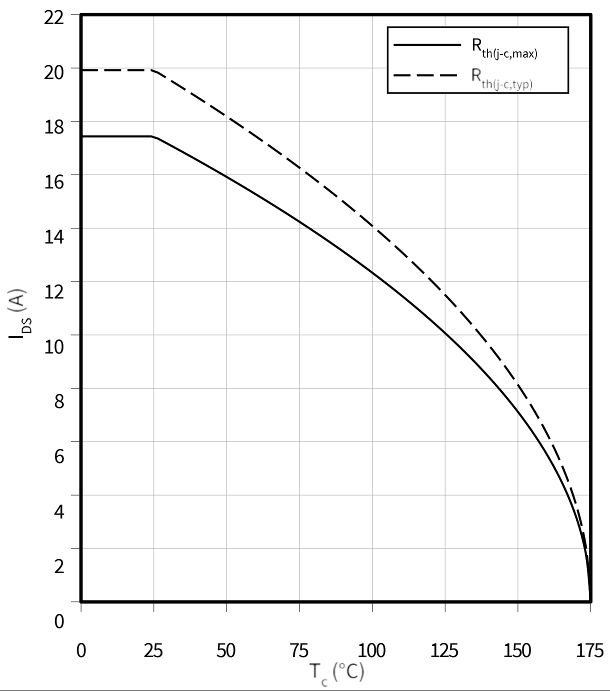
Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$



Maximum DC drain to source current as a function of case temperature

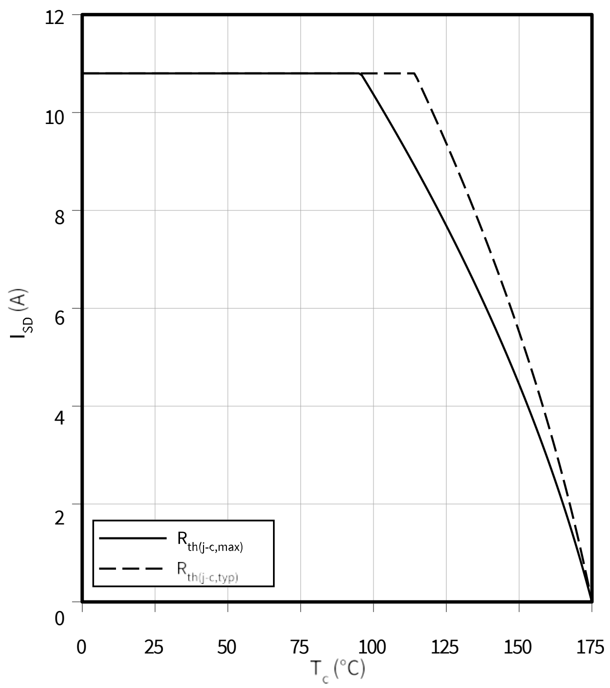
$I_{DS} = f(T_c)$



Maximum source to drain current as a function of case temperature

$I_{SD} = f(T_c)$

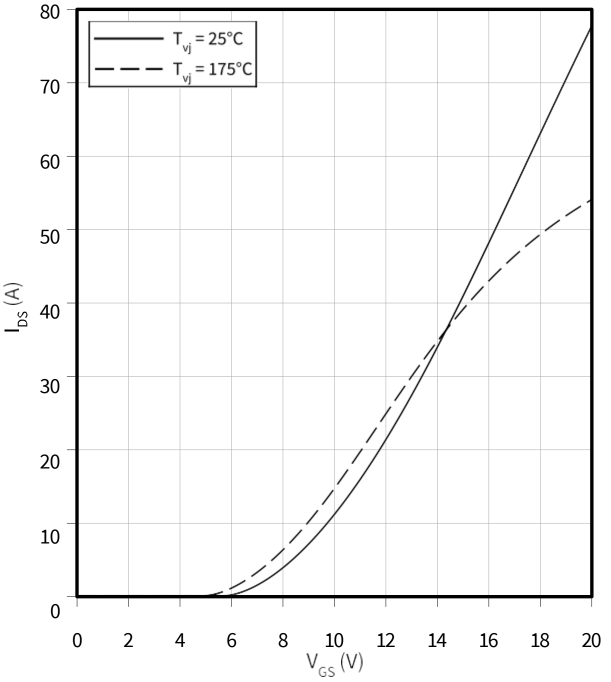
$V_{GS} = 0$ V



Typical transfer characteristic

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

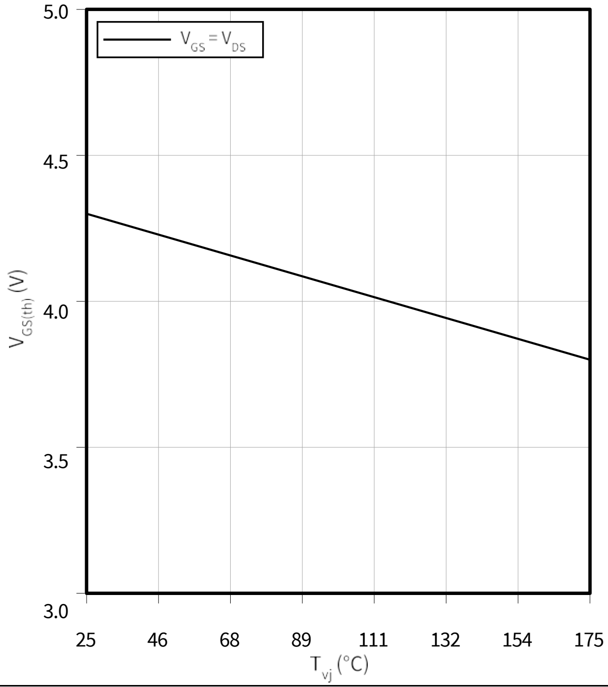
$V_{DS} = 20$ V



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

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

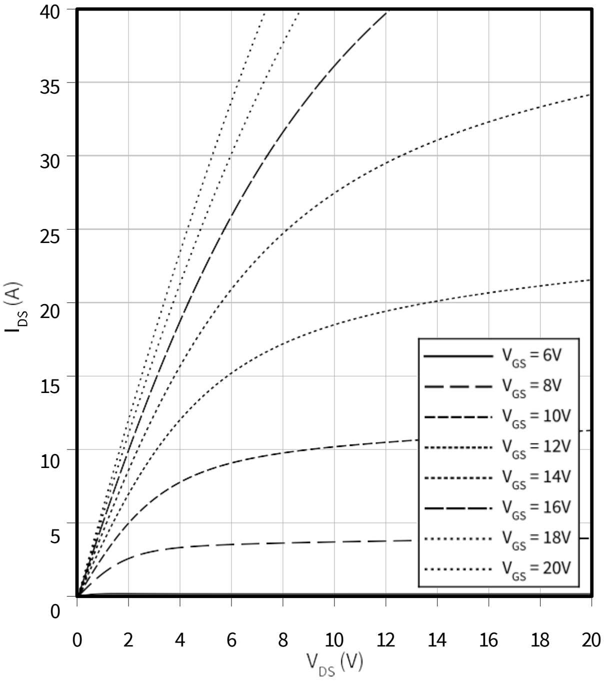
$I_D = 1.5$ mA



Typical output characteristic, V_{GS} as parameter

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

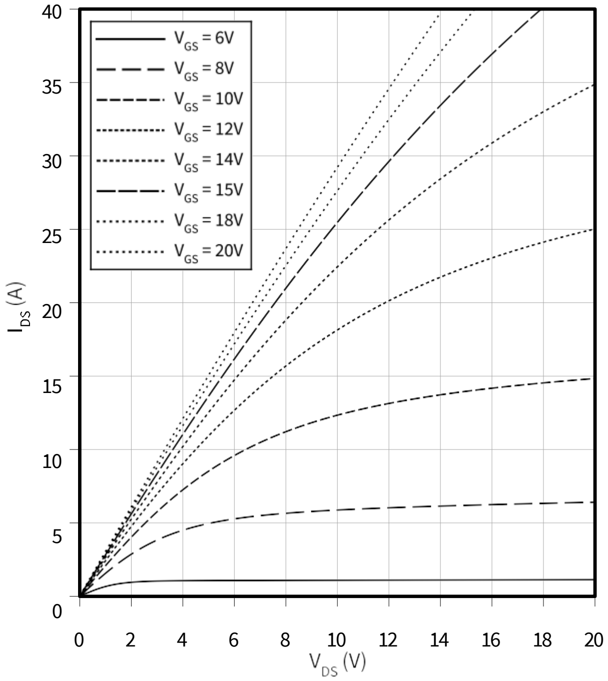
$T_{vj} = 25$ °C



Typical output characteristic, V_{GS} as parameter

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

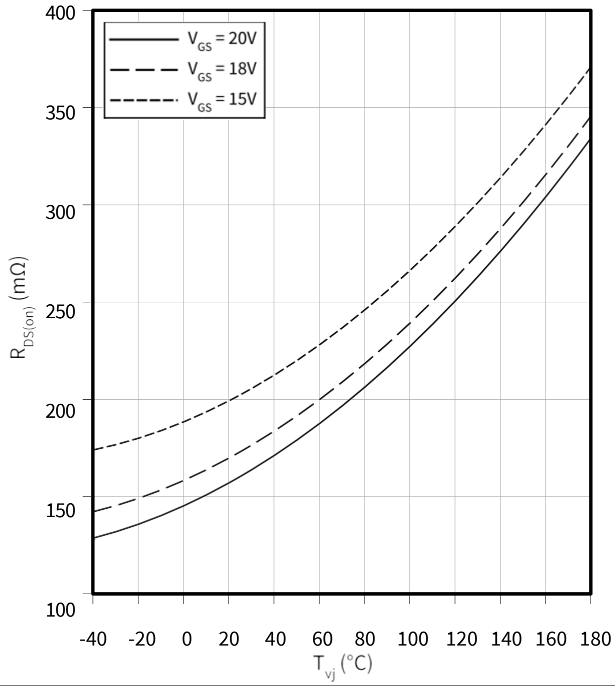
$T_{vj} = 175$ °C



Typical on-state resistance as a function of junction temperature

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

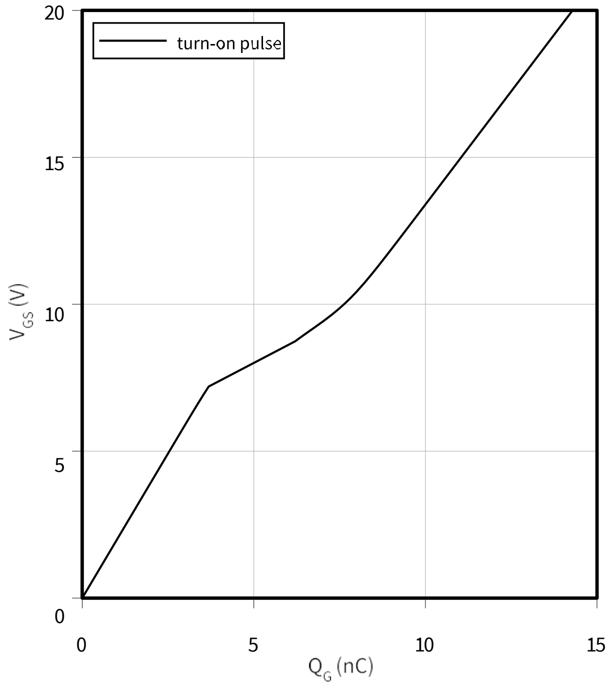
$I_D = 5$ A



Typical gate charge

$V_{GS} = f(Q_G)$

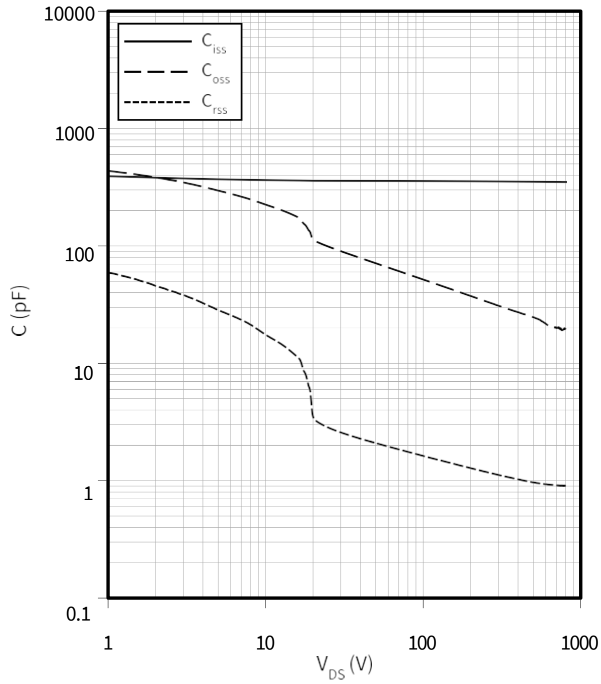
$I_D = 5$ A, $V_{DS} = 800$ V



Typical capacitance as a function of drain-source voltage

$C = f(V_{DS})$

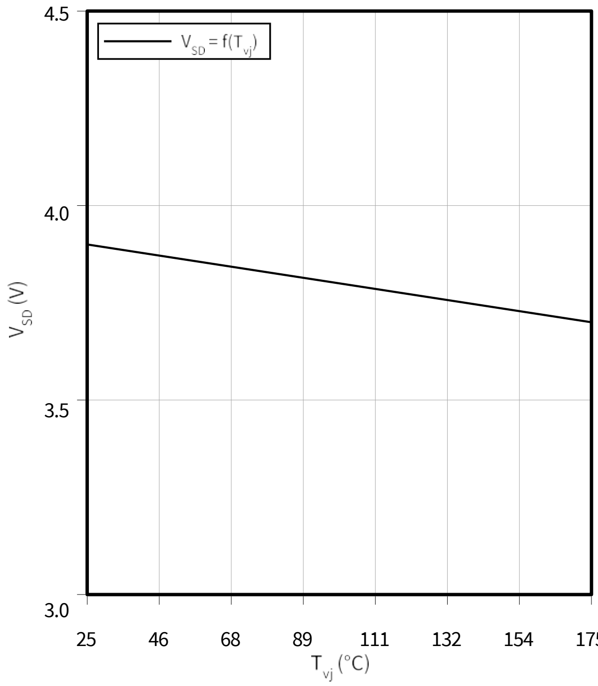
f = 100 kHz, $V_{GS} = 0$ V



Typical reverse drain voltage as function of junction temperature

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

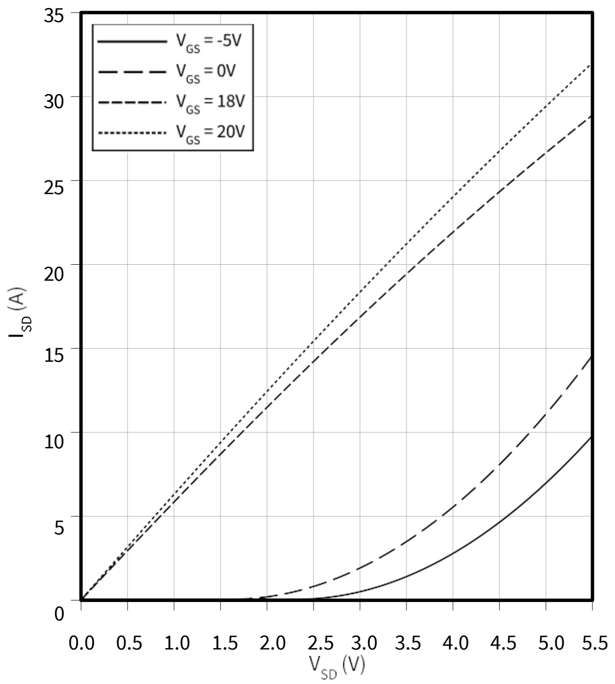
$I_{SD} = 5$ A, $V_{GS} = 0$ V



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

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

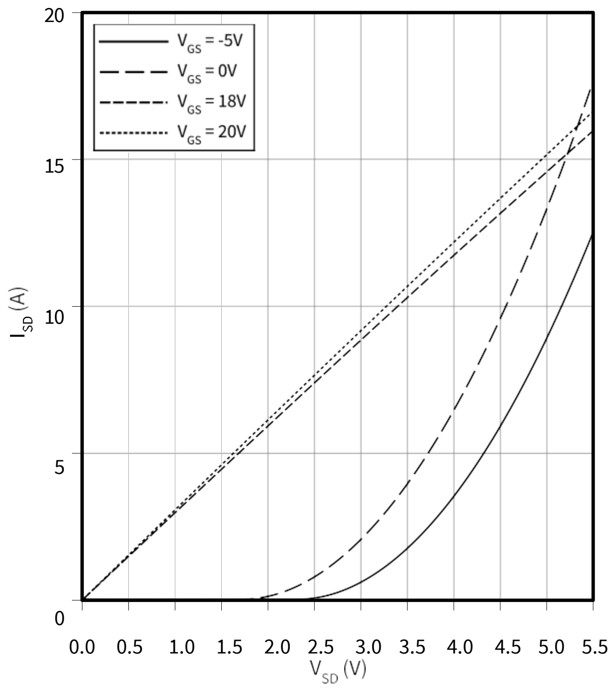
$T_{vj} = 25\ °C$



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

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

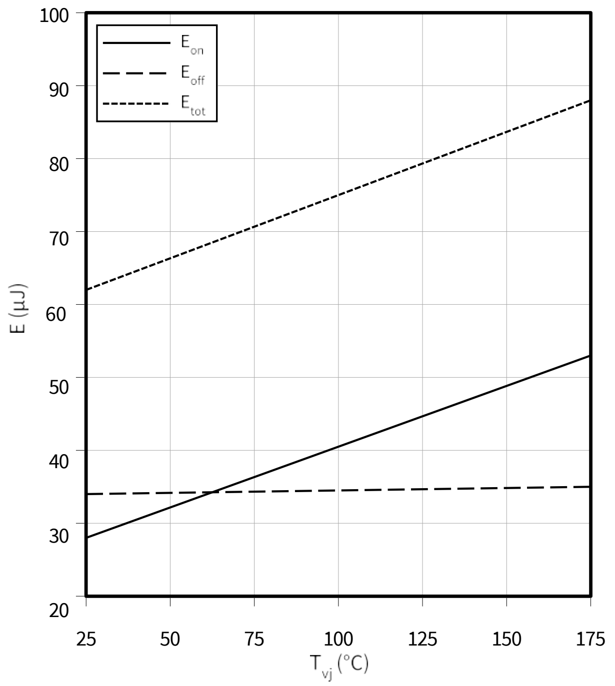
$T_{vj} = 175\ °C$



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

$E = f(T_{vj})$

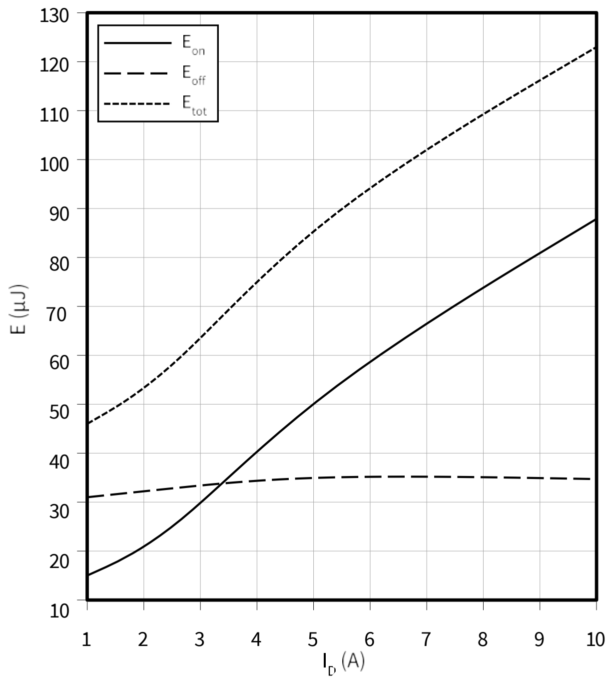
$V_{GS} = 0/20$ V, $I_D = 5$ A, $R_{G,ext} = 2\ \Omega$, $V_{DD} = 800$ V



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

$E = f(I_D)$

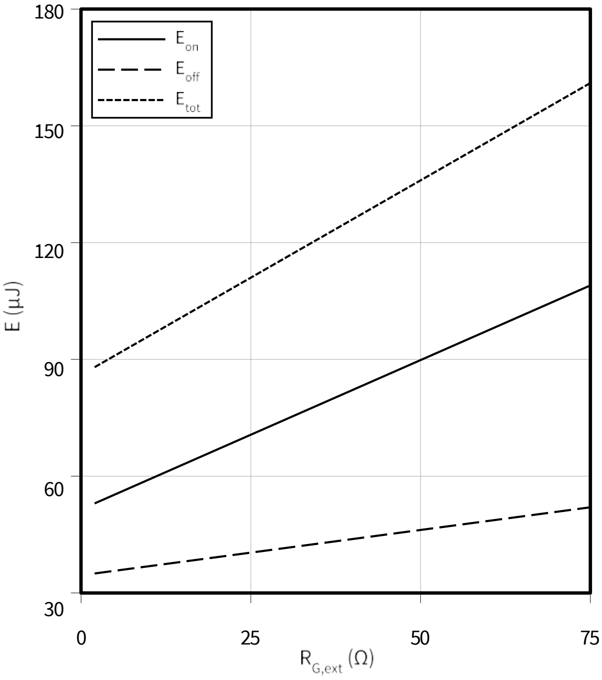
$V_{GS} = 0/20$ V, $T_{vj} = 175\ °C$, $R_{G,ext} = 2\ \Omega$, $V_{DD} = 800$ V



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

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

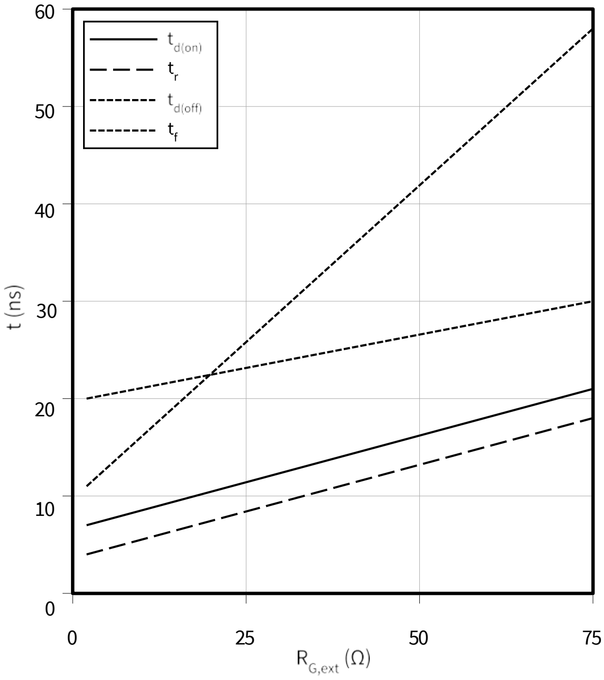
V_{GS} = 0/20 V, I_D = 5 A, T_{vj} = 175 °C, V_{DD} = 800 V



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

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

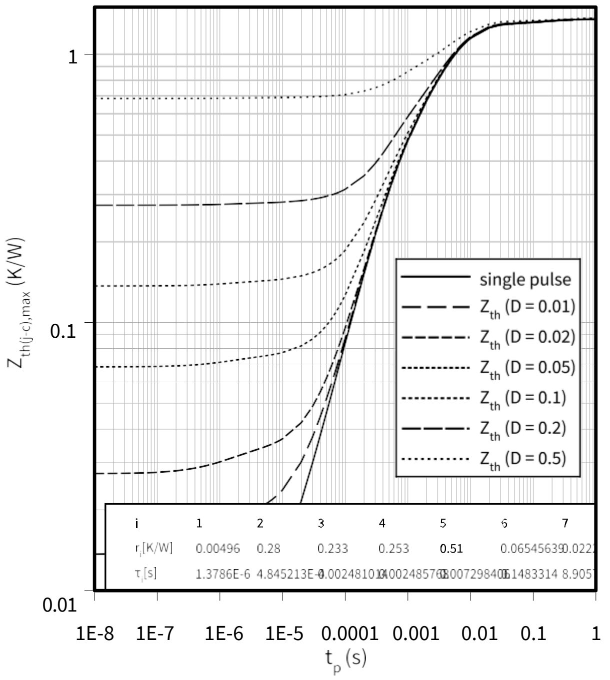
V_{GS} = 0/20 V, I_D = 5 A, T_{vj} = 175 °C, V_{DD} = 800 V



Max. transient thermal impedance (MOSFET/diode)

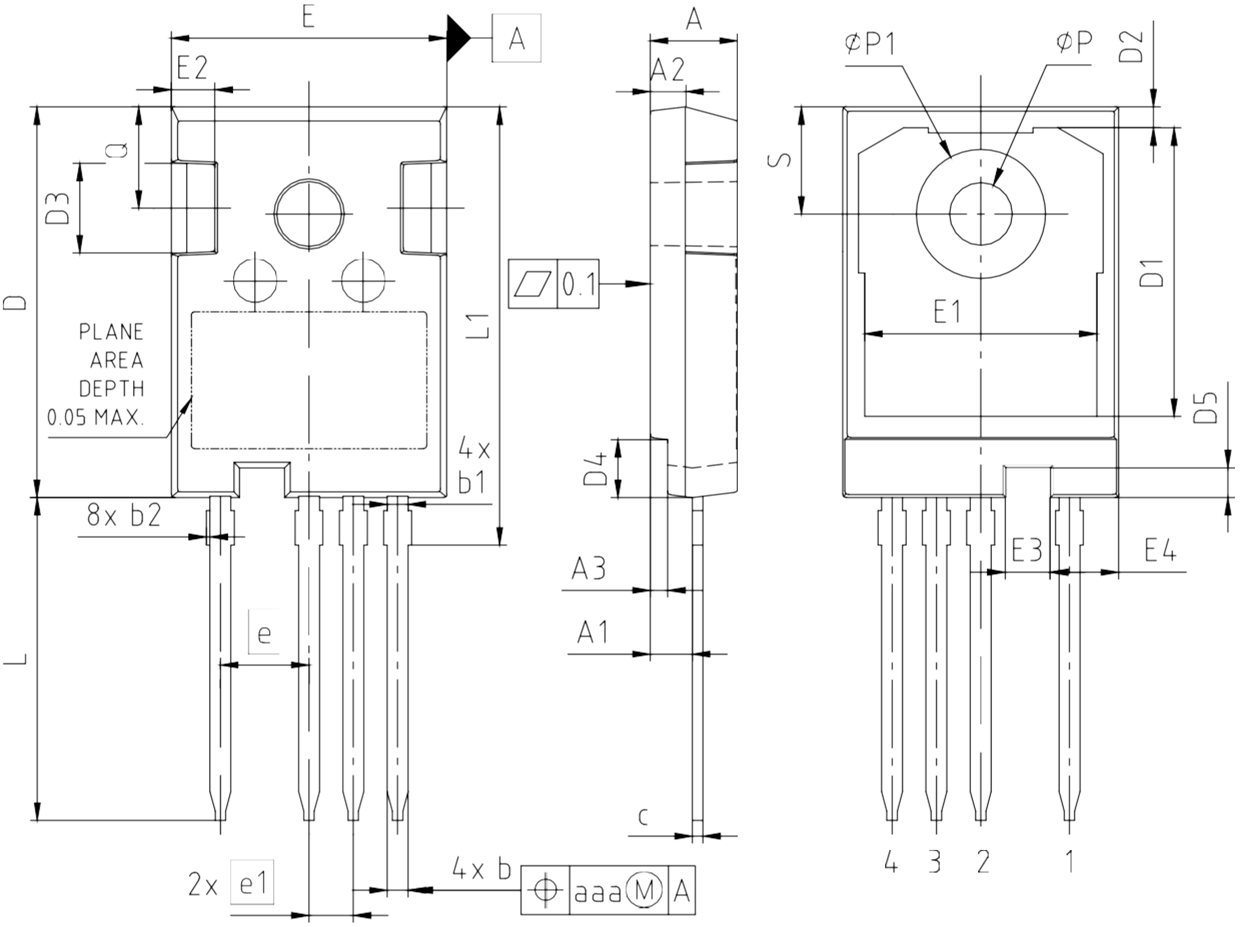
$Z_{th(j\text{-}c),max} = f(t_p)$

$D = t_p/T$



5 封装外形

PG-TO247-4-STD-NN6.7



PACKAGE - GROUP NUMBER:	PG-TO247-4-U05				
DIMENSIONS	**MILLIMETERS**		**DIMENSIONS**	**MILLIMETERS**	
	MIN.	MAX.		MIN.	MAX.
A	4.90	5.10	**E**	15.70	15.90
A1	2.31	2.51	**E1**	13.10	13.50
A2	1.90	2.10	**E2**	2.40	2.60
A3	0.90	1.10	**E3**	2.48	2.68
b	1.16	1.29	**E4**	3.82	4.02
b1	1.16	1.29	**e**	5.08	
b2		0.20	**e1**	2.54	
c	0.59	0.66	**N**	4	
D	22.30	22.50	**L**	18.40	18.70
D1	16.25	16.85	**L1**	24.97	25.27
D2	1.05	1.35	**øP**	3.50	3.70
D3	5.00	5.20	**øP1**		7.40
D4	3.22	3.42	**Q**	5.60	6.00
D5	1.60	1.80	**S**	6.00	6.30
			aaa	0.25	

NOTE: DIMENSIONS DO NOT INCLUDE MOLDFLASH, PROTRUSION OR GARE BURRS

图 1

6 测试条件

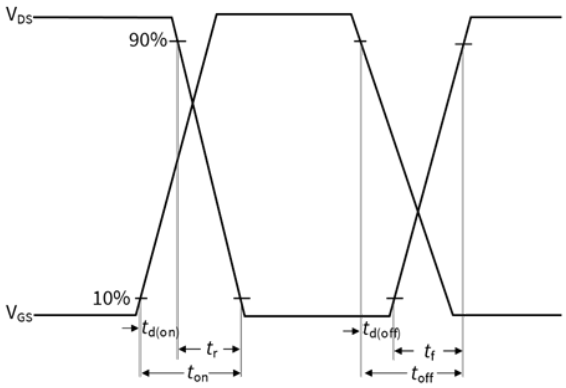


Figure A. **Definition of switching times**

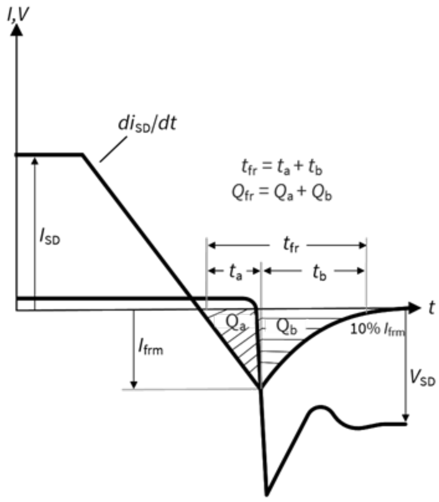


Figure B. **Definition of body diode switching characteristics**

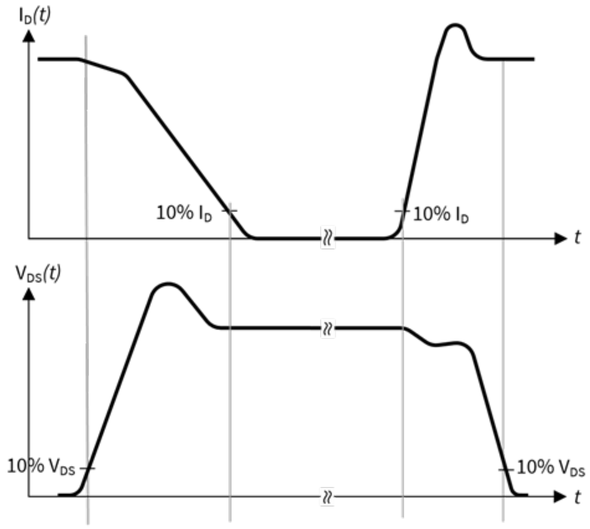


Figure C. **Definition of switching losses**

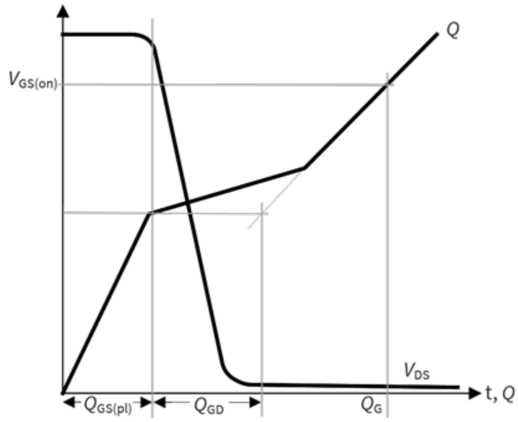


Figure D. **Definition of QGD**

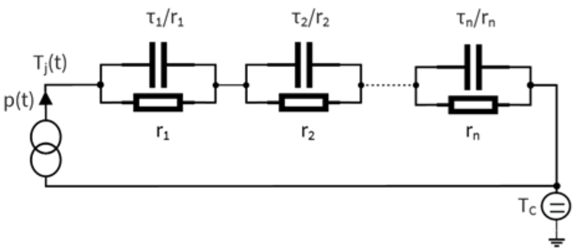


Figure E. **Thermal equivalent circuit**

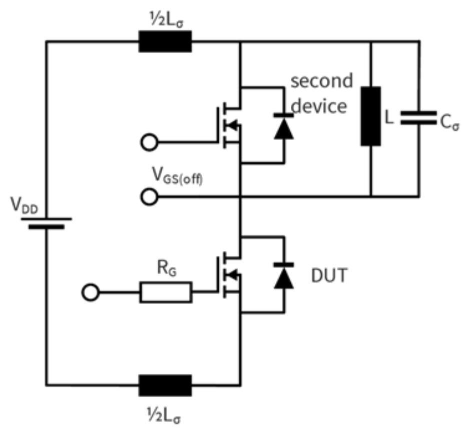


Figure F. **Dynamic test circuit**
Parasitic inductance L_σ,
Parasitic capacitor C_σ,

图 2

修订记录

Document revision	Date of release	Description of changes
0.10	2022-04-19	Target datasheet
0.20	2023-08-03	Preliminary datasheet
1.00	2023-11-30	Final datasheet

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