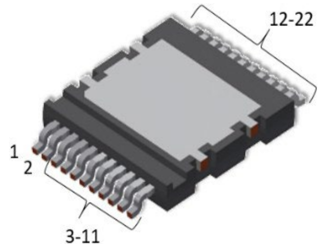
最终数据表

英飞凌CoolSiC™ 汽车 MOSFET 1200 V，采用 HDSOP-22-3 封装



Halogen-free
AEC Qualified
Lead-free
RoHS

特性

- T_{vj} = -55...175°C 时 V_{DSS} = 1200 V
- T_C = 25°C 时 I_{DDC} = 18.6 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
- 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
- 提高了建议开启电压 ($V_{GS(on)}$ = 20 V) 以降低 $R_{DS(on)}$
- 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
- 低封装杂散电感，可实现更快、更干净的开关动作
- 带有开尔文（Kelvin) 源极引脚，实现更好的栅极控制并降低开关损耗
- 爬电距离 > 4.75 毫米接头 $V_{rms\,(最大值)}$ > 950 V，基于 IEC60664 材料组 I、污染等级 2
- SMT 封装，便于自动化装配并降低系统成本
- 低等级 $R_{顶}$侧冷却封装，可实现最佳热性能和功率密度

潜在应用

- 车载充电器
- 直流/直流转换器

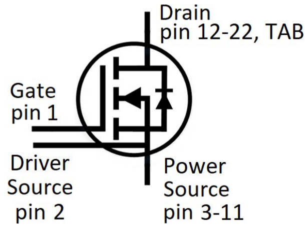
产品验证

- 适合汽车应用。根据 AEC-Q100/101 进行产品验证

描述

引脚定义：
- Pin 1 - 栅极
- 引脚 2 - 驱动源
- 引脚 3...11 - 乘方 来源
- 引脚 12...22，TAB - 漏极

注意：源极引脚和检测引脚不可互换，互换可能会导致故障



Type	Package	Marking
AIMCQ120R160M1T	PG-HDSOP-22-3	12A160M1

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）。

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[1)]	$R_{th(j-c)}$			0.92	1.2	K/W

1) 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[1)]	V_{DSS}	T_{vj} = -55...175 °C		1200	V
Continuous DC drain current for $R_{th(j-c,max)}$, limited by $T_{vj(max)}$[2)]	I_{DDC}	V_{GS} = 20 V	T_c = 25 °C	18.6	A
			T_c = 100 °C	13	
Peak drain current, t_p limited by $T_{vj(max)}$[2)]	I_{DM}	V_{GS} = 20 V		47	A
Gate-source voltage, max. transient voltage[3)]	V_{GS}	$t_p \leq 0.5$ µs, $D < 0.01$		-10/25	V
Gate-source voltage, max. static voltage[3)]	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	125	W
			T_c = 100 °C	63	

1) 在 Tvj=25°C 下进行测试，并通过全温度范围内的设计/特性验证
2) 无需经过生产测试 - 经过设计/特性验证
3) **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	3.7	4.4	5.1	V
			$T_{vj} = 175$ °C		3.6		
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		10		
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			3.1		S
Short-circuit withstand time[1)]	t_{SC}	$V_{DD} \leq 800$ V, $V_{DS,peak} < 1200$ V, $T_{vj(start)} = 25$ °C, $R_{G,ext} = 5$ 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			4.8		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, $R_{G,ext} = 5$ Ω, $L_\sigma = 13$ nH, diode: body diode at $V_{GS} = 0$ V	$T_{vj} = 25$ °C		6		ns
			$T_{vj} = 175$ °C		5.8		

（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, $R_{G,ext}$ = 5 Ω, L_σ = 13 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		3.5		ns
			T_{vj} = 175 °C		4		
Turn-off delay time	$t_{d(off)}$	V_{DD} = 800 V, I_D = 5 A, V_{GS} = 0/20 V, $R_{G,ext}$ = 5 Ω, L_σ = 13 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		9.5		ns
			T_{vj} = 175 °C		10.3		
Fall time	t_f	V_{DD} = 800 V, I_D = 5 A, V_{GS} = 0/20 V, $R_{G,ext}$ = 5 Ω, L_σ = 13 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		20.4		ns
			T_{vj} = 175 °C		22.1		
Turn-on energy	E_{on}	V_{DD} = 800 V, I_D = 5 A, V_{GS} = 0/20 V, $R_{G,ext}$ = 5 Ω, L_σ = 13 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		44.3		µJ
			T_{vj} = 175 °C		53		
Turn-off energy	E_{off}	V_{DD} = 800 V, I_D = 5 A, V_{GS} = 0/20 V, $R_{G,ext}$ = 5 Ω, L_σ = 13 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		22		µJ
			T_{vj} = 175 °C		25		
Total switching energy	E_{tot}	V_{DD} = 800 V, I_D = 5 A, V_{GS} = 0/20 V, $R_{G,ext}$ = 5 Ω, L_σ = 13 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		66.3		µJ
			T_{vj} = 175 °C		78		
Virtual junction temperature	T_{vj}			-55		175	°C

1) 无需经过生产测试 - 经过设计/特性验证

注释： 特征参数在Tvj = 25°C下测定，除非另有说明。

3 体二极管（MOSFET）

表5 最大额定值

Parameter	Symbol	Note or test condition		Values	Unit
Drain-source voltage[1]	V_{DSS}	T_{vj} = -55...175 °C		1200	V
Continuous reverse drain current for $R_{th(j-c,max)}$, limited by $T_{vj(max)}$ [2]	I_{SDC}	V_{GS} = 0 V	T_c = 25 °C	10.8	A
			T_c = 100 °C	10.8	
Peak reverse drain current, t_p limited by $T_{vj(max)}$ [2]	I_{SM}	V_{GS} = 0 V		10.8	A

1) 在 Tvj=25°C 下进行测试，并通过全温度范围内的设计/特性验证

2) 无需经过生产测试 - 经过设计/特性验证

表6　　　　特征值

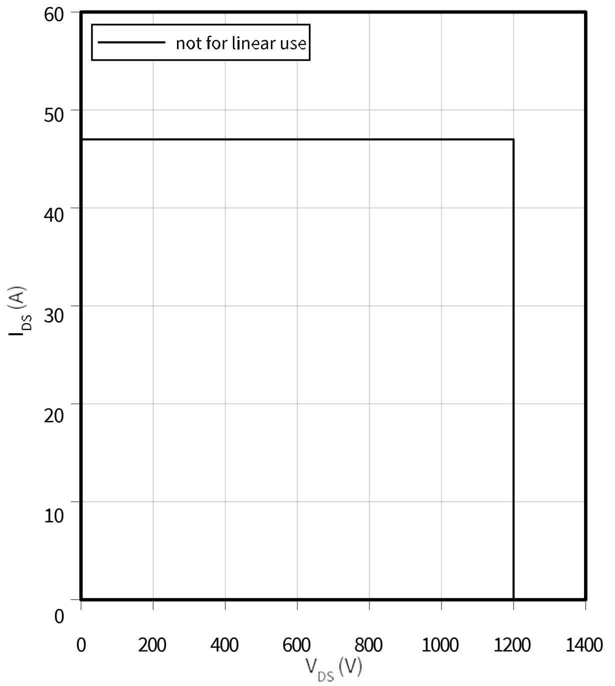
Parameter	Symbol	Note or test condition		Values Min.	Typ.	Max.	Unit
Drain-source reverse voltage	V_{SD}	I_{SD} = 5 A, V_{GS} = 0 V	T_{vj} = 25 °C		3.9	5	V
			T_{vj} = 100 °C		3.8		
			T_{vj} = 175 °C		3.7		
MOSFET forward recovery charge	Q_{fr}	V_{DD} = 800 V, I_{SD} = 5 A, V_{GS} = 0 V, $-di_{SD}/dt$ = 1000 A/µs, Q_{fr} includes also Q_C	T_{vj} = 25 °C		101		nC
			T_{vj} = 175 °C		122		
MOSFET peak forward recovery current	I_{frm}	V_{DD} = 800 V, I_{SD} = 5 A, V_{GS} = 0 V, $-di_{SD}/dt$ = 1000 A/µs, Q_{fr} includes also Q_C	T_{vj} = 25 °C		6.6		A
			T_{vj} = 175 °C		9		
Virtual junction temperature	T_{vj}			-55		175	°C

4 特性图

Reverse bias safe operating area (RBSOA)

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

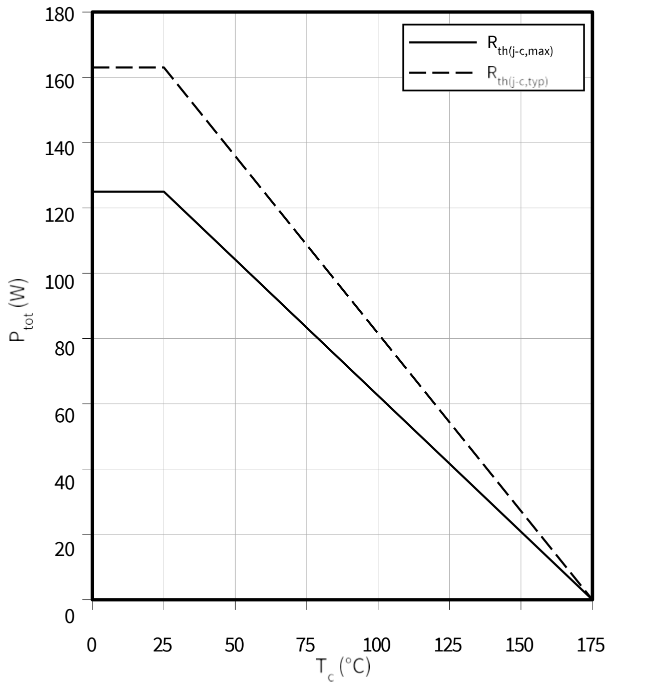
$T_{vj} \leq 175\ °C$, $V_{GS} = 0/20\ V$, $T_c = 25\ °C$



Power dissipation as a function of case temperature

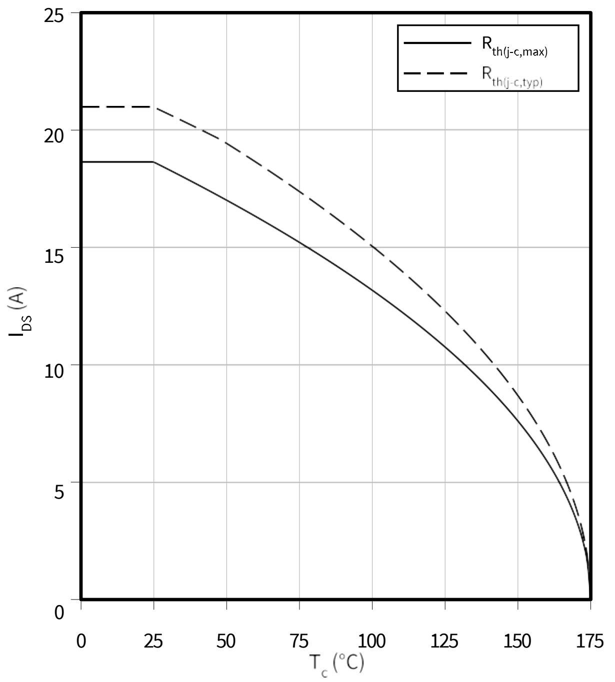
$P_{tot} = f(T_c)$

$T_{vj} \leq 175\ °C$



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

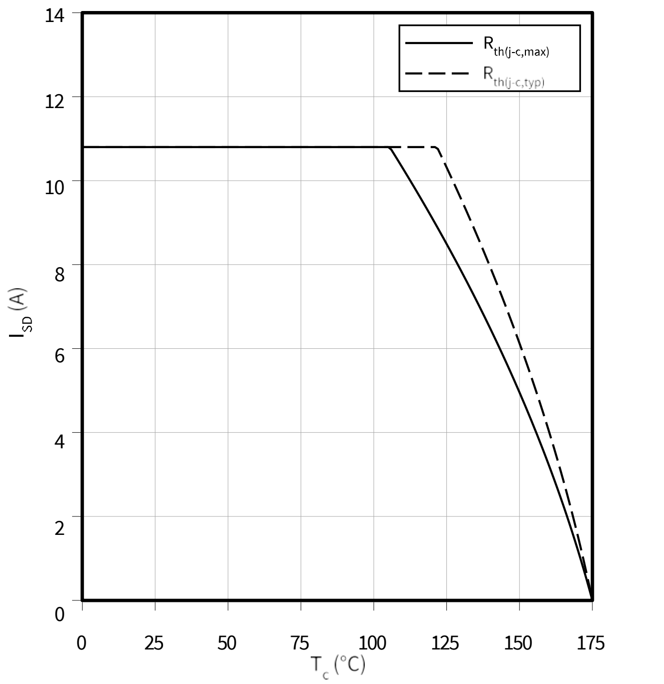
$I_{DS} = f(T_c)$

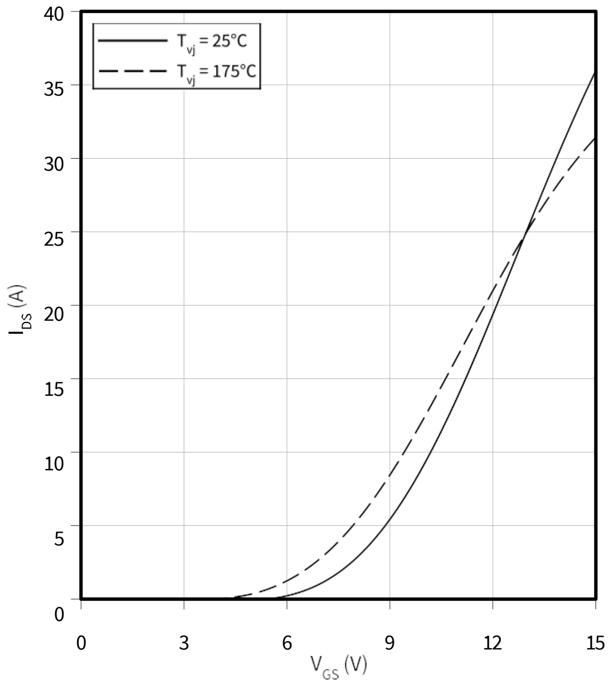
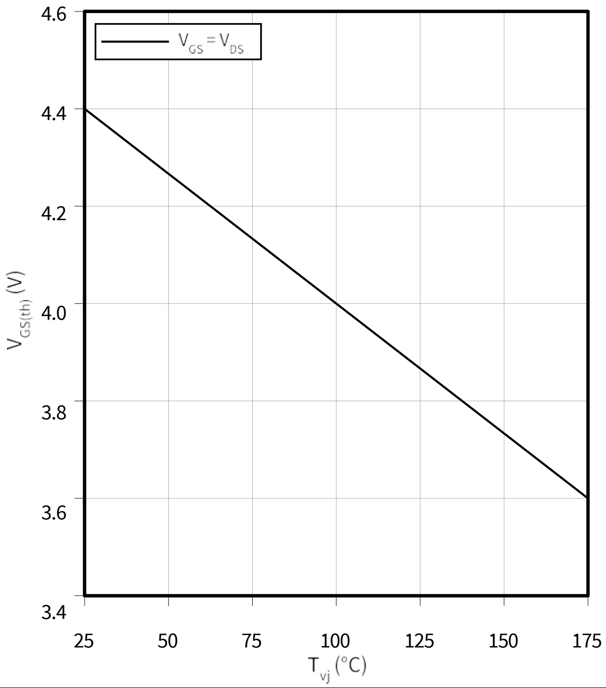
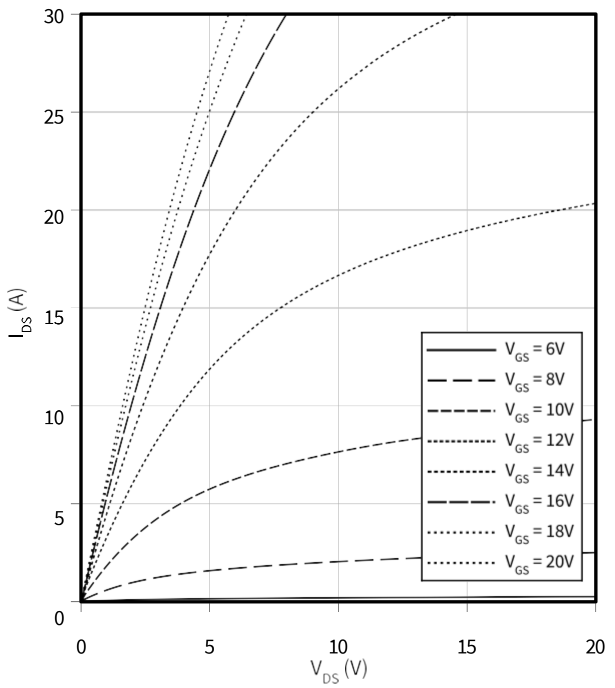
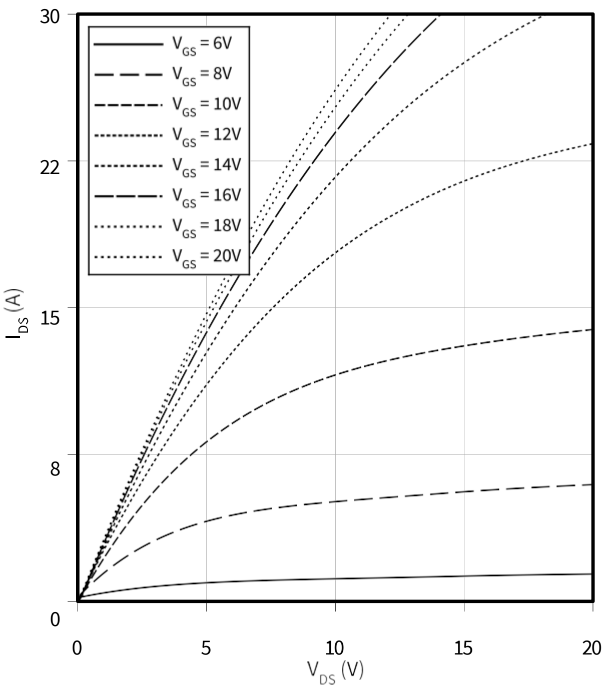


Maximum source to drain current as a function of case temperature

$I_{SD} = f(T_c)$

$V_{GS} = 0\ V$

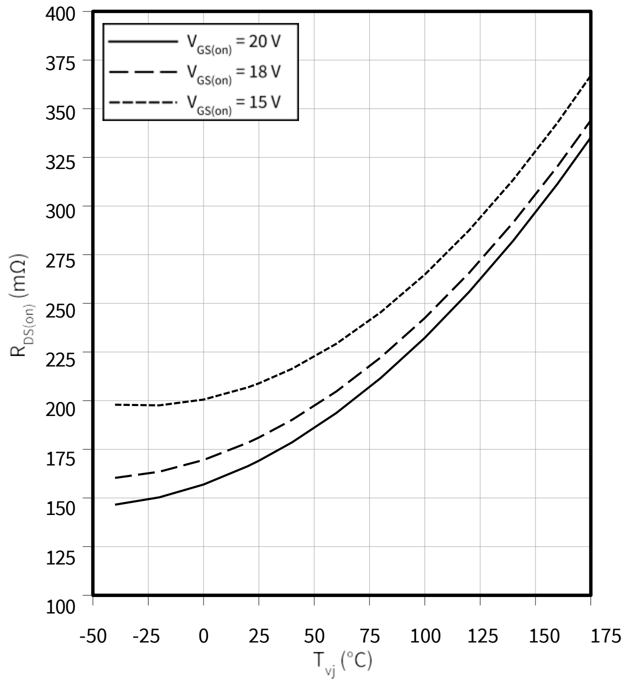


Typical transfer characteristic $I_{DS} = f(V_{GS})$ $V_{DS} = 20$ V, $t_p = 20$ µs	**Typical gate-source threshold voltage as a function of junction temperature** $V_{GS(th)} = f(T_{vj})$ $I_D = 1.5$ mA
	
Typical output characteristic, V_{GS} as parameter $I_{DS} = f(V_{DS})$ $T_{vj} = 25$ °C, $t_p = 20$ µs	**Typical output characteristic, V_{GS} as parameter** $I_{DS} = f(V_{DS})$ $T_{vj} = 175$ °C, $t_p = 20$ µs
	

Typical on-state resistance as a function of junction temperature

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

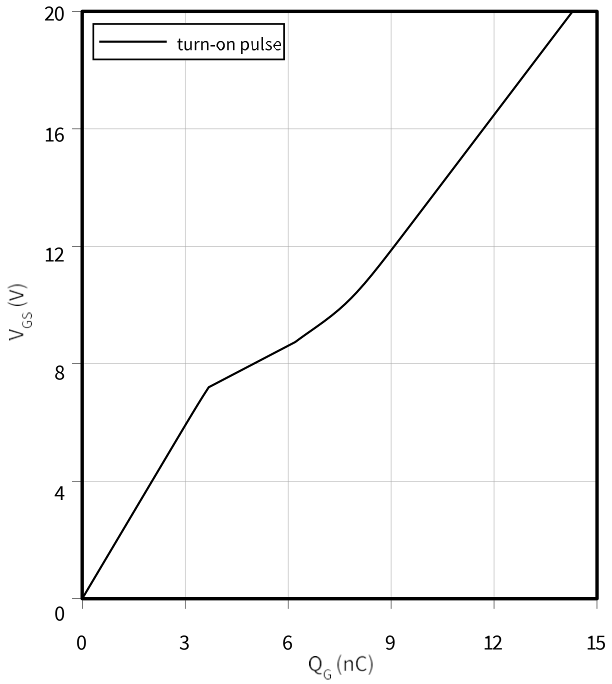
$I_D = 5$ A



Typical gate charge

$V_{GS} = f(Q_G)$

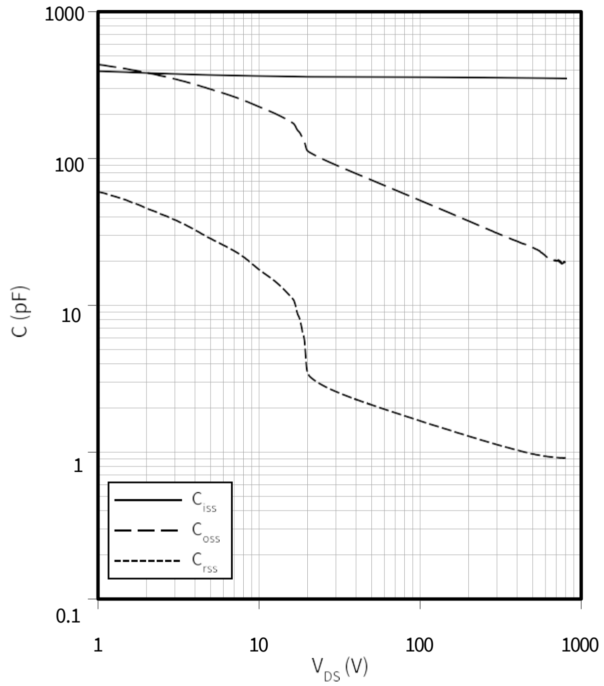
$I_D = 5$ A, $V_{DS} = 800$ V



Typical capacitance as a function of drain-source voltage

$C = f(V_{DS})$

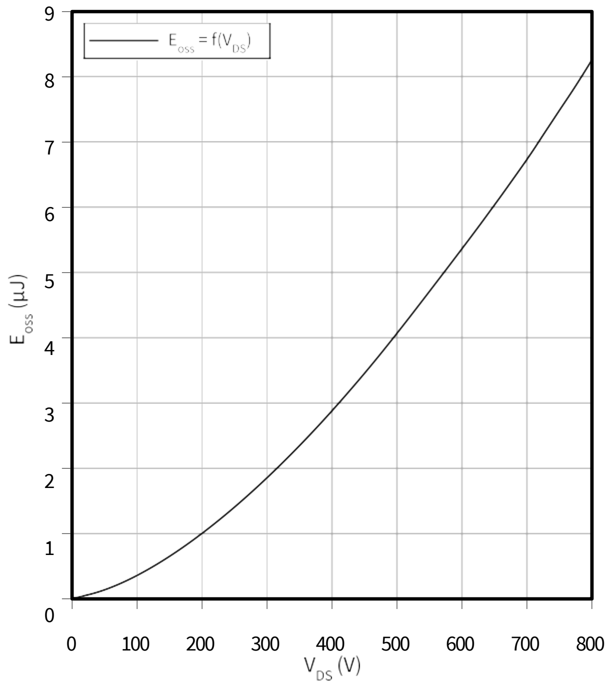
$f = 100$ kHz, $V_{GS} = 0$ V



Typical C_{oss} stored energy

$E_{oss} = f(V_{DS})$

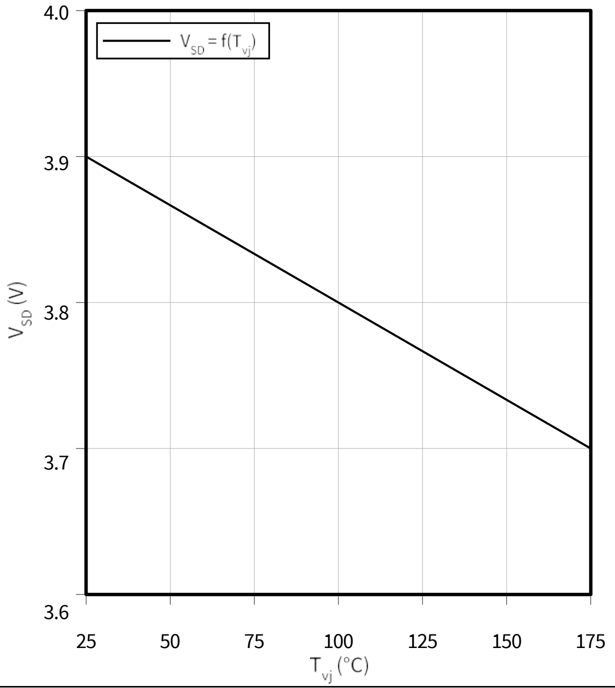
$f = 100$ kHz, $V_{GS} = 0$ V



Typical reverse drain voltage as function of junction temperature

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

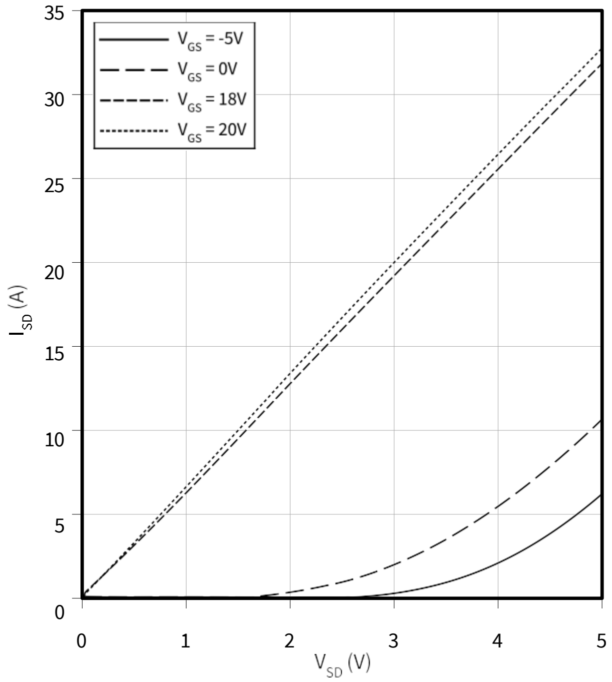
$I_{SD} = 5$ A, $V_{GS} = 0$ V



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

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

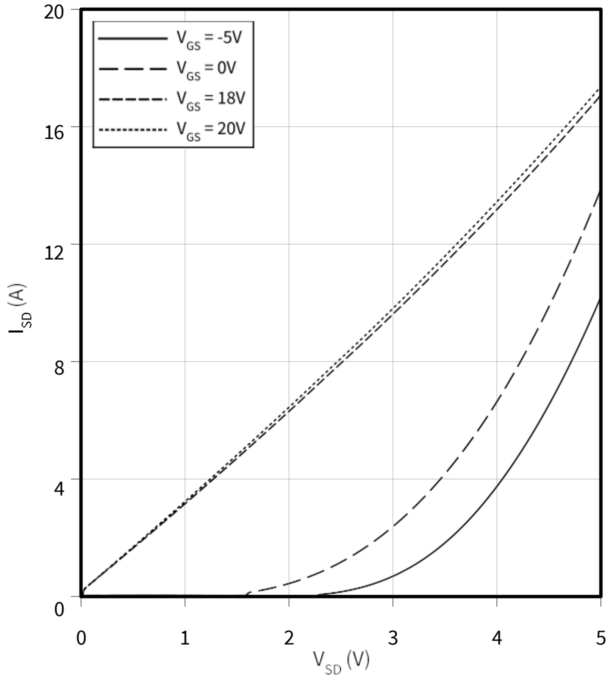
$T_{vj} = 25$ °C, $t_p = 20$ µs



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

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

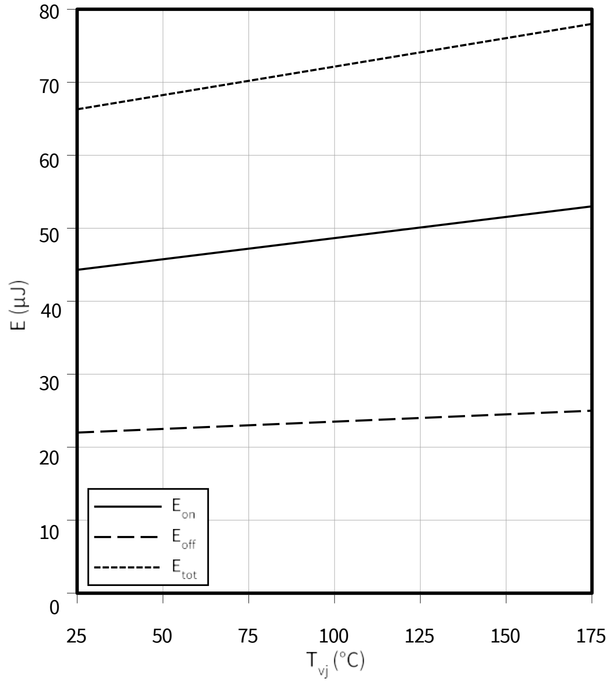
$T_{vj} = 175$ °C, $t_p = 20$ µs



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

$E = f(T_{vj})$

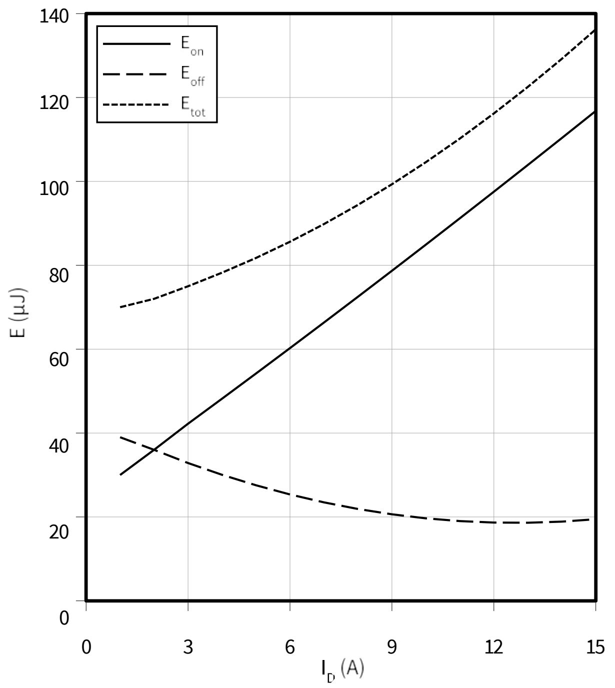
$V_{GS} = 0/20$ V, $I_D = 5$ A, $R_{G,ext} = 5\ \Omega$, $V_{DD} = 800$ V



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

$E = f(I_D)$

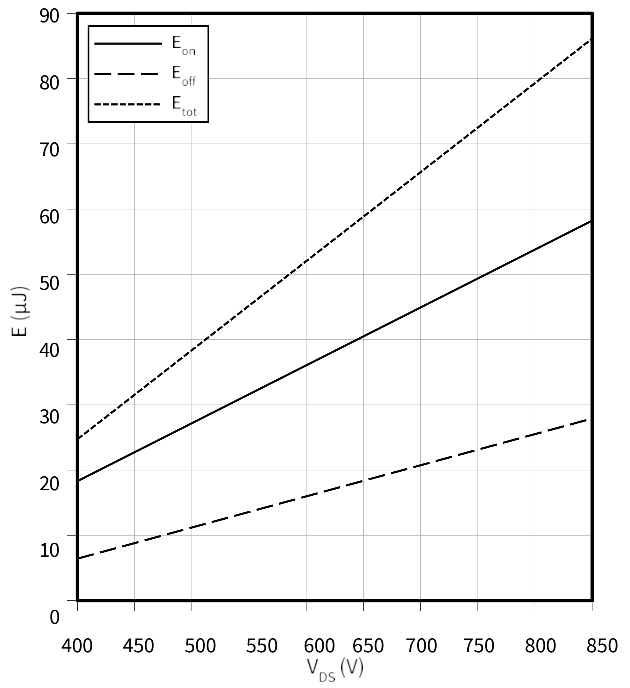
V_{GS} = 0/20 V, T_{vj} = 175 °C, $R_{G,ext}$ = 5 Ω, V_{DD} = 800 V



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

$E = f(V_{DS})$

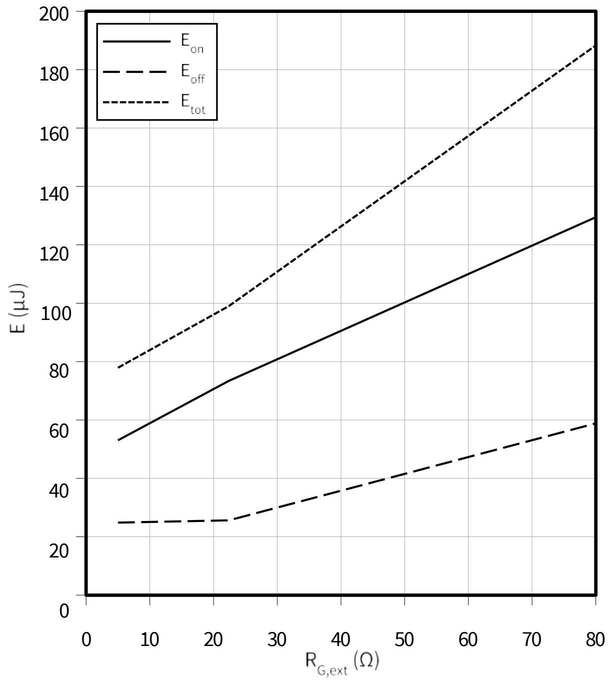
V_{GS} = 0/20 V, I_D = 5 A, T_{vj} = 175 °C, $R_{G,ext}$ = 5 Ω



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

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

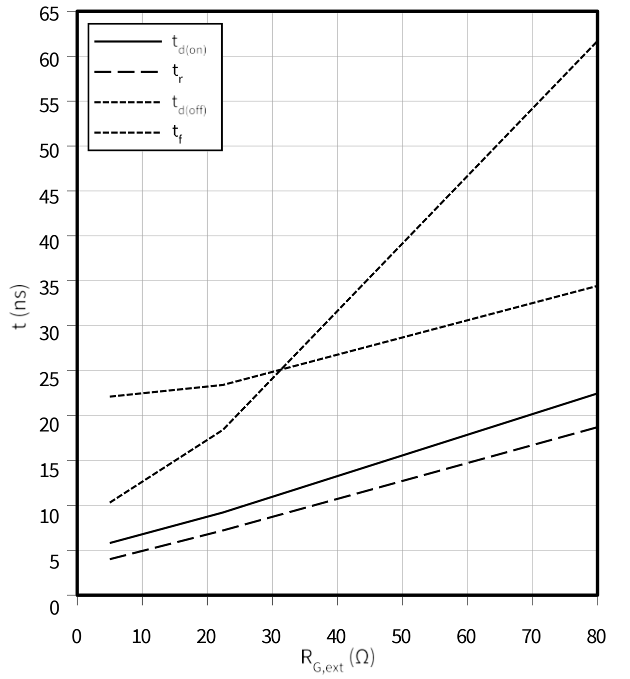
V_{GS} = 0/20 V, I_D = 5 A, T_{vj} = 175 °C, V_{DD} = 800 V



Typical switching times as a function of gate resistance

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

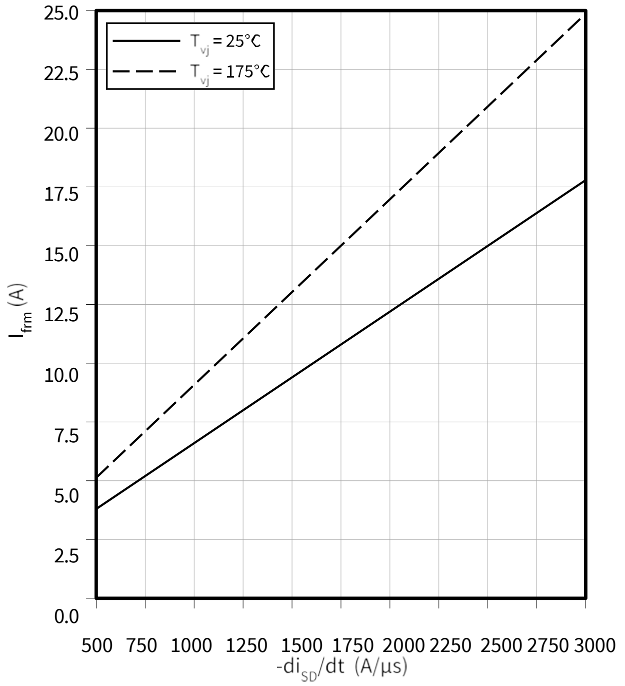
V_{GS} = 0/20 V, I_D = 5 A, T_{vj} = 175 °C, V_{DD} = 800 V



Typical MOSFET peak forward recovery current as a function of reverse drain current slope

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

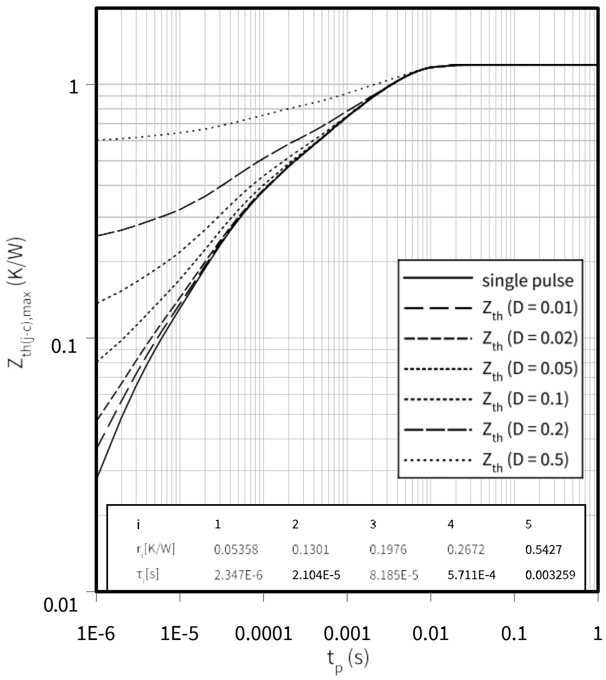
$V_{GS} = 0/20\ V$, $I_{SD} = 5\ A$, $V_{DD} = 800\ V$



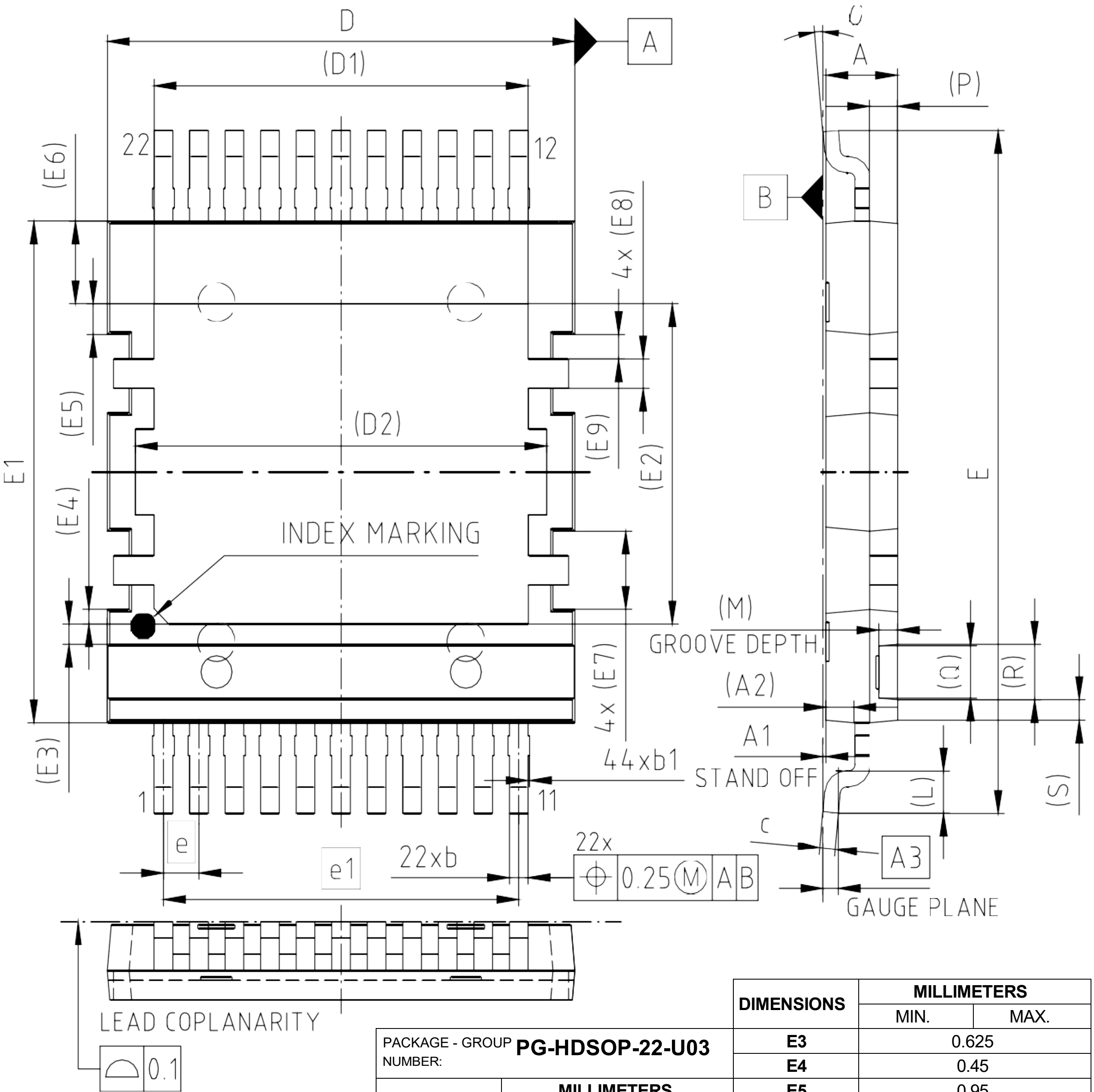
Max. transient thermal impedance (MOSFET/diode)

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

$D = t_p/T$



5 封装外形



PACKAGE - GROUP NUMBER:	PG-HDSOP-22-U03	
DIMENSIONS	**MILLIMETERS**	
	MIN.	MAX.
A	2.25	2.35
A1	0.00	0.15
A2	0.90	
A3	0.50	
b	0.50	0.70
b1	---	0.15
c	0.46	0.58
D	14.90	15.10
D1	12.00	
D2	13.20	
E	20.81	21.11
E1	15.30	15.50
E2	9.83	

DIMENSIONS	**MILLIMETERS**	
	MIN.	MAX.
E3	0.625	
E4	0.45	
E5	0.95	
E6	2.53	
E7	2.40	
E8	0.90	
E9	0.75	
e	1.14	
e1	11.4	
L	1.30	
M	0.60	
N	22	
O	0°	8°
P	0.90	
Q	1.60	
R	1.70	
S	0.631	

NOTES:

ALL METAL SURFACES TIN PLATED EXCEPT AREA OF CUT

DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURRS

图 1

6 测试条件

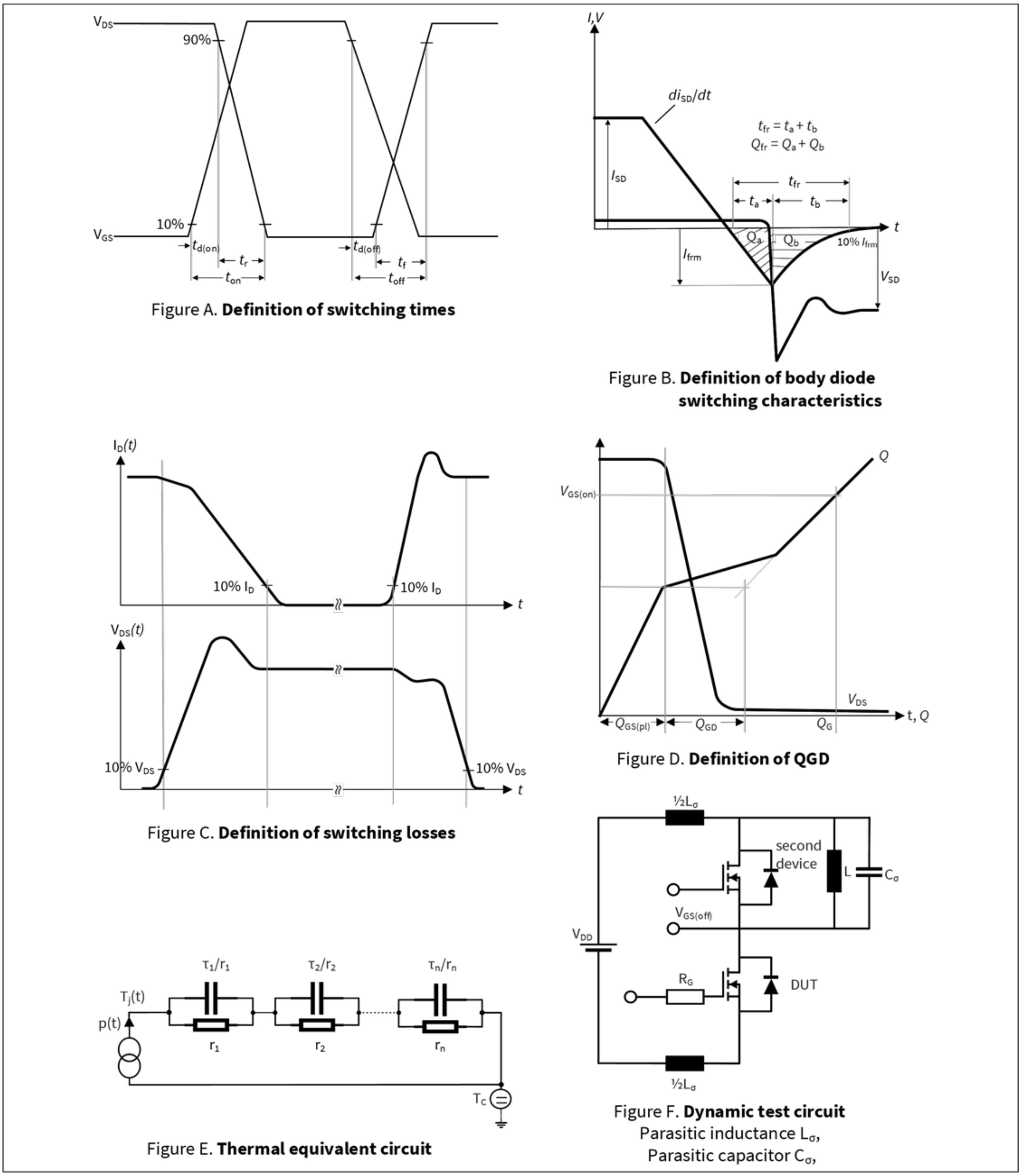


Figure A. **Definition of switching times**

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	2023-01-17	Target datasheet
0.20	2024-07-01	Preliminary datasheet
1.00	2024-07-22	Final datasheet

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