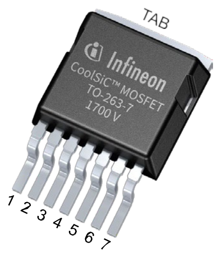
最终数据手册

英飞凌 IMBF170R1K0M1 CoolSiC™ 1700 V SiC 沟槽 MOSFET： 碳化硅MOSFET



特性

- V_{DSS} = 1700 V at T_{vj} = 25°C
- I_{DDC} = 5.2 A at T_C = 25°C
- $R_{DS(on)}$ = 1000 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

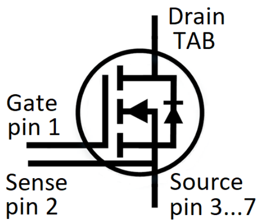
产品验证

- 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
IMBF170R1K0M1	PG-TO263-7-U01	170M11K0

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}	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	$R_{th(j-c)}$			1.7	2.2	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	5.2	A
			$T_c = 100$ °C	3.7	
Peak drain current, t_p limited by $T_{j(max)}$[1)]	I_{DM}	$V_{GS} = 12$ V		13.3	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	68	W
			$T_c = 100$ °C	34	

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 A	T_{vj} = 25 °C, $V_{GS(on)}$ = 12 V		1000		mΩ
			T_{vj} = 100 °C, $V_{GS(on)}$ = 12 V		1416		
			T_{vj} = 175 °C, $V_{GS(on)}$ = 12 V		2037		
			T_{vj} = 25 °C, $V_{GS(on)}$ = 15 V		809	880	
Gate-source threshold voltage	$V_{GS(th)}$	I_D = 1.1 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		0.4	11	µA
			T_{vj} = 175 °C		6		
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 A, V_{DS} = 20 V			0.42		S
Internal gate resistance	$R_{G,int}$	f = 1 MHz, V_{AC} = 25 mV			35		Ω
Input capacitance	C_{iss}	V_{DS} = 1000 V, V_{GS} = 0 V, f = 1000 kHz, V_{AC} = 25 mV			275		pF
Output capacitance	C_{oss}	V_{DS} = 1000 V, V_{GS} = 0 V, f = 1000 kHz, V_{AC} = 25 mV			7.2		pF
Reverse transfer capacitance	C_{rss}	V_{DS} = 1000 V, V_{GS} = 0 V, f = 1000 kHz, V_{AC} = 25 mV			0.7		pF
C_{oss} stored energy	E_{oss}	V_{DS} = 1000 V, V_{GS} = 0 V, f = 1000 kHz, V_{AC} = 25 mV			1.3		µJ
Total gate charge	Q_G	V_{DD} = 1000 V, I_D = 1 A, V_{GS} = 0/12 V, turn-on pulse			5		nC
Plateau gate charge	$Q_{GS(pl)}$	V_{DD} = 1000 V, I_D = 1 A, V_{GS} = 0/12 V, turn-on pulse			1.5		nC
Gate-to-drain charge	Q_{GD}	V_{DD} = 1000 V, I_D = 1 A, V_{GS} = 0/12 V, turn-on pulse			1.6		nC
Turn-on delay time	$t_{d(on)}$	V_{DD} = 1000 V, I_D = 1 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		19		ns
			T_{vj} = 175 °C		16		

(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 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		14		ns
			T_{vj} = 175 °C		11		
Turn-off delay time	$t_{d(off)}$	V_{DD} = 1000 V, I_D = 1 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		20		ns
			T_{vj} = 175 °C		23		
Fall time	t_f	V_{DD} = 1000 V, I_D = 1 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		23		
Turn-on energy	E_{on}	V_{DD} = 1000 V, I_D = 1 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		31		µJ
			T_{vj} = 175 °C		33		
Turn-off energy	E_{off}	V_{DD} = 1000 V, I_D = 1 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		7		µJ
			T_{vj} = 175 °C		8		
Total switching energy	E_{tot}	V_{DD} = 1000 V, I_D = 1 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		37		µJ
			T_{vj} = 175 °C		41		
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	13.3	A

表6 特征值

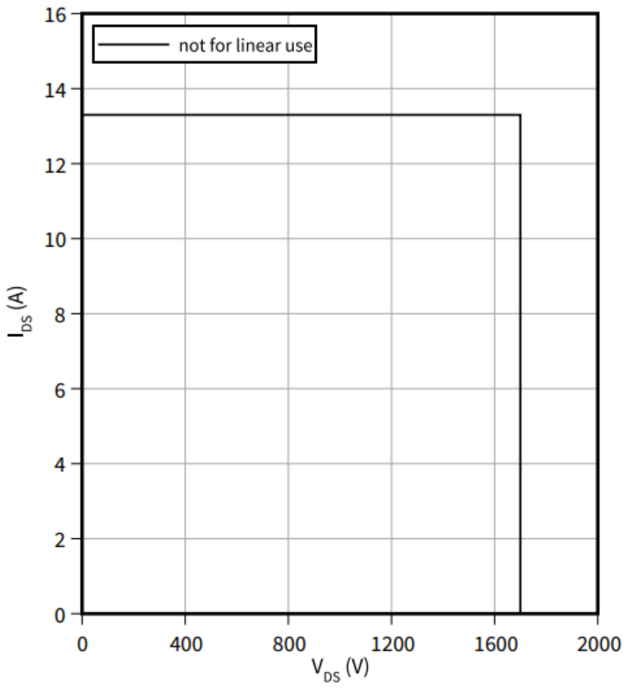
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Drain-source reverse voltage	V_{SD}	$I_{SD} = 1$ A, $V_{GS} = 0$ V	$T_{vj} = 25$ °C		3.8		V
			$T_{vj} = 175$ °C		3.5		
MOSFET forward recovery charge	Q_{fr}	$V_{DD} = 1000$ V, $I_{SD} = 1$ A, $V_{GS} = 0$ V, $-di_{SD}/dt = 1000$ A/µs, Q_{fr} includes also Q_C	$T_{vj} = 25$ °C		45.1		nC
			$T_{vj} = 175$ °C		58.1		
MOSFET peak forward recovery current	I_{frm}	$V_{DD} = 1000$ V, $I_{SD} = 1$ A, $V_{GS} = 0$ V, $-di_{SD}/dt = 1000$ A/µs, Q_{fr} includes also Q_C	$T_{vj} = 25$ °C		3.6		A
			$T_{vj} = 175$ °C		4		
MOSFET forward recovery energy	E_{fr}	$V_{DD} = 1000$ V, $I_{SD} = 1$ A, $V_{GS} = 0$ V, $-di_{SD}/dt = 1000$ A/µs, Q_{fr} includes also Q_C	$T_{vj} = 25$ °C		0.11		µJ
			$T_{vj} = 175$ °C		0.21		
Virtual junction temperature	T_{vj}			-55		175	°C

4 特性图

Reverse bias safe operating area (RBSOA)

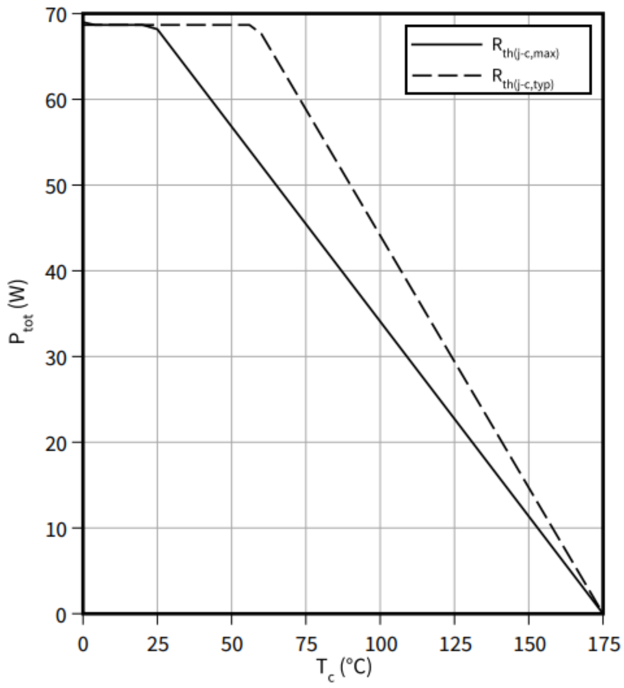
$I_{DS} = f(V_{DS})$

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



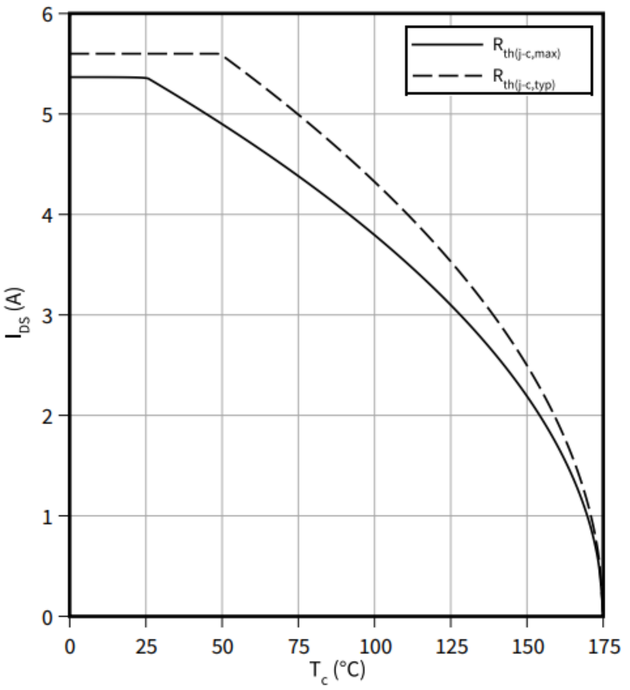
Power dissipation as a function of case temperature limited by bond wire

$P_{tot} = f(T_c)$



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

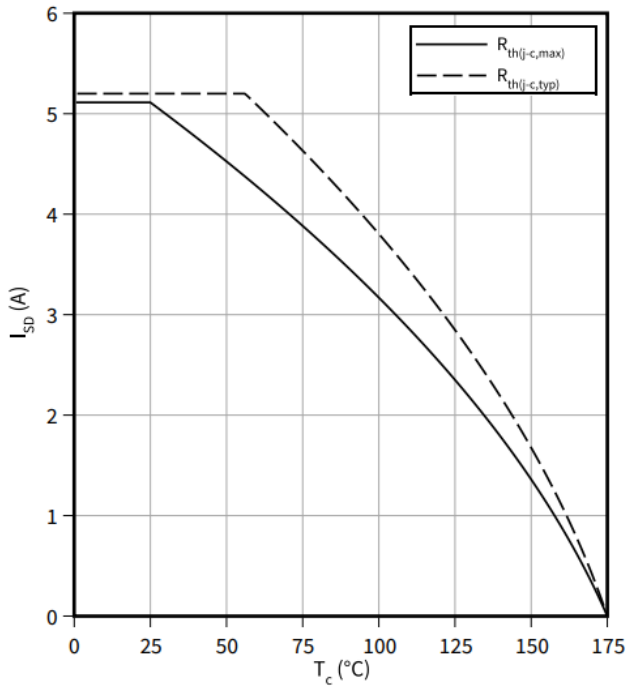
$I_{DS} = f(T_c)$



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

$I_{SD} = f(T_c)$

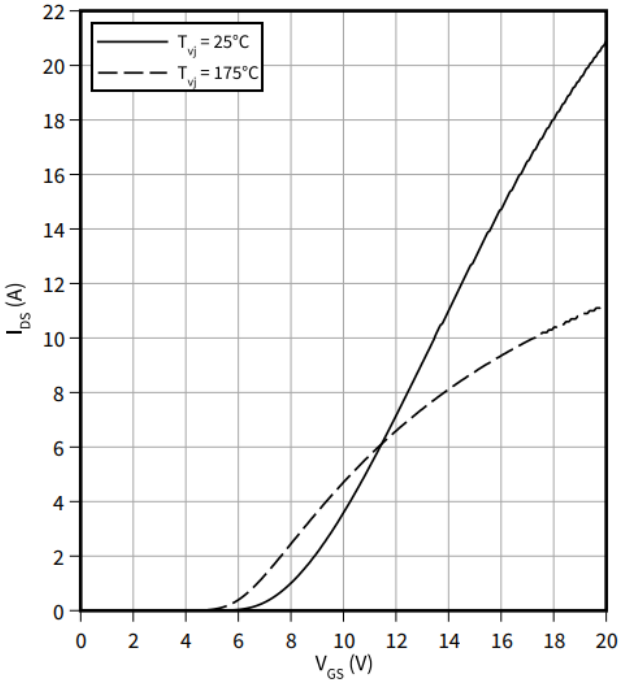
$V_{GS} = 0$ V



Typical transfer characteristic

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

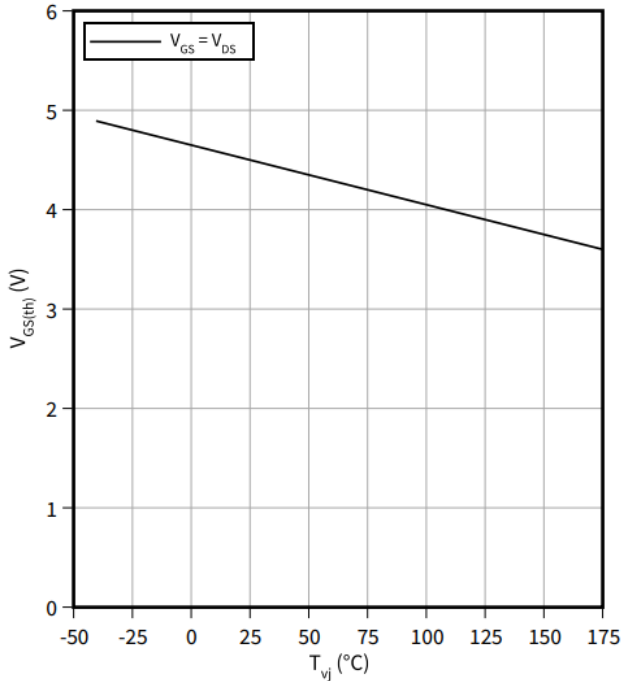
$V_{DS} = 20$ V, $t_p = 20$ µs



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

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

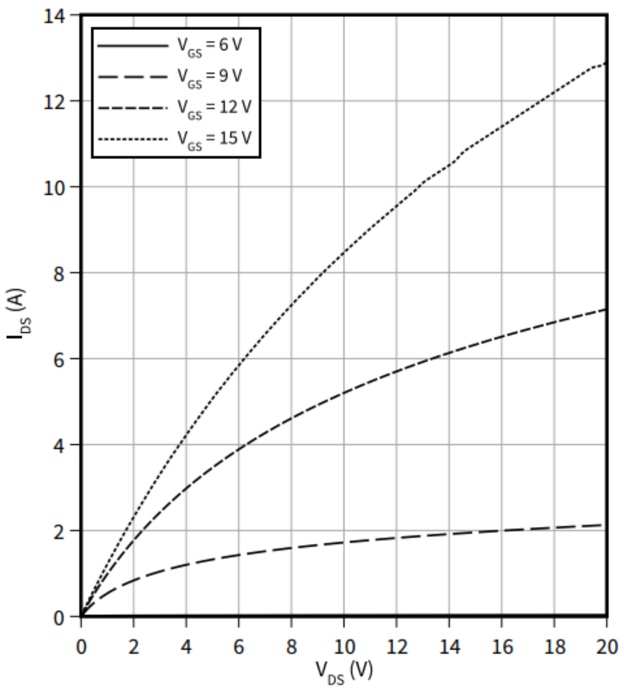
$I_D = 1.1$ mA



Typical output characteristic, V_{GS} as a parameter

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

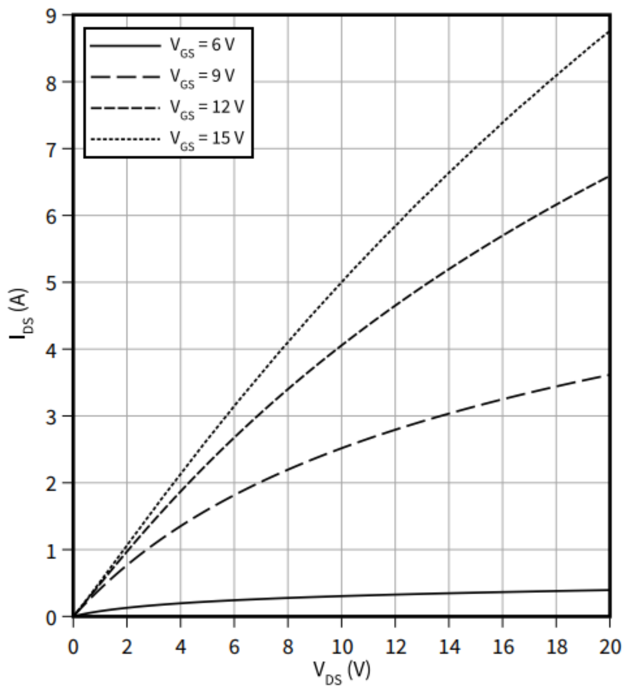
$T_{vj} = 25$ °C, $t_p = 20$ µs



Typical output characteristic, V_{GS} as a parameter

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

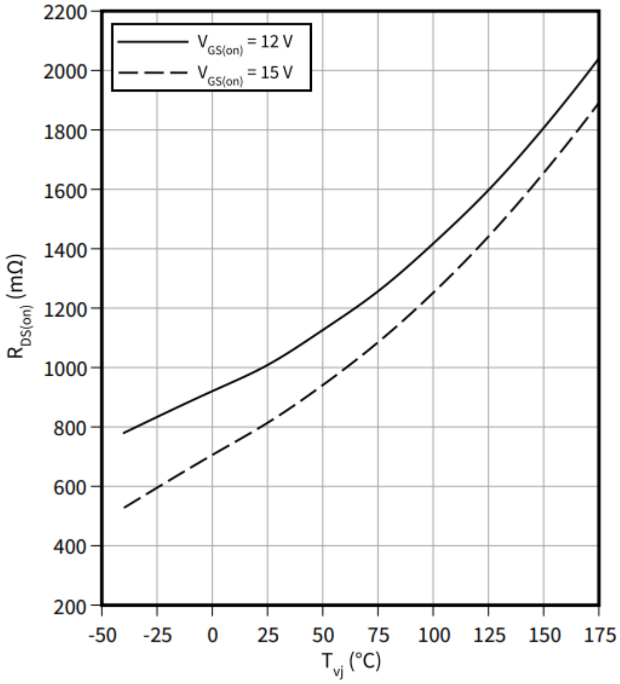
$T_{vj} = 175$ °C, $t_p = 20$ µs



Typical on-state resistance as a function of junction temperature

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

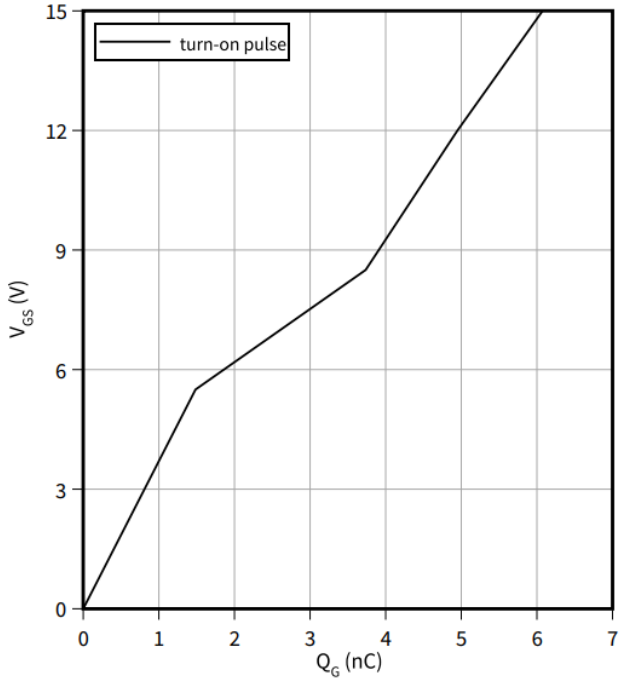
$I_D = 1$ A



Typical gate charge

$V_{GS} = f(Q_G)$

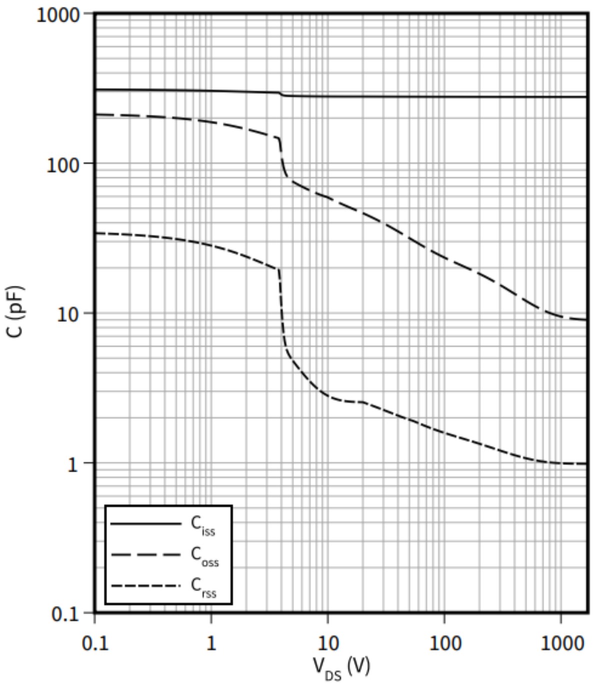
$I_D = 1$ A, $V_{DS} = 1000$ V



Typical capacitance as a function of drain-source voltage

$C = f(V_{DS})$

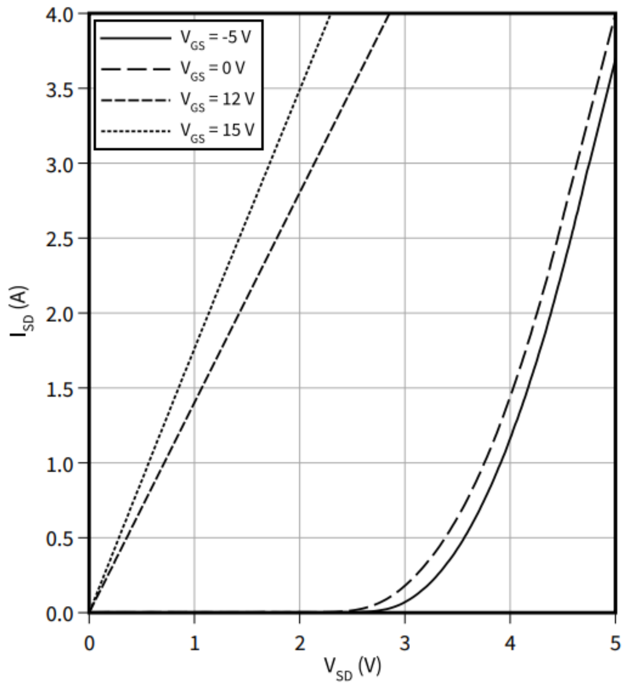
$f = 1000$ kHz, $V_{GS} = 0$ V



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

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

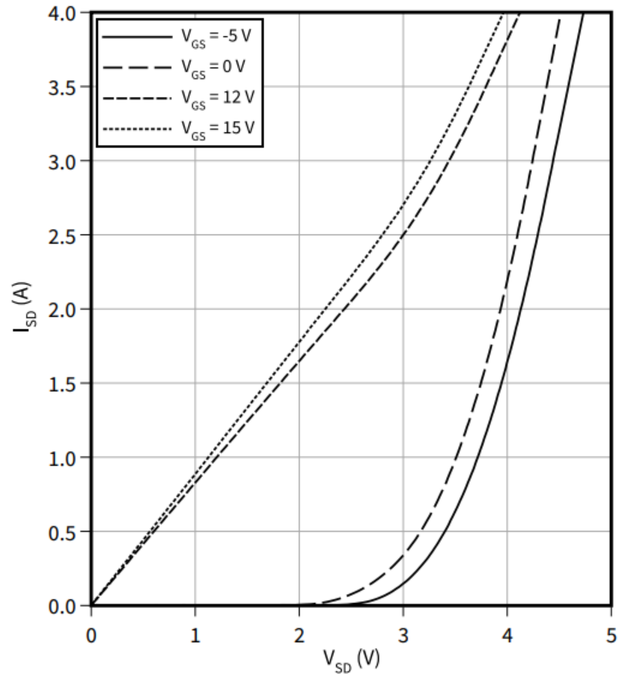
$T_{vj} = 25$ °C, $t_p = 20$ μs



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

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

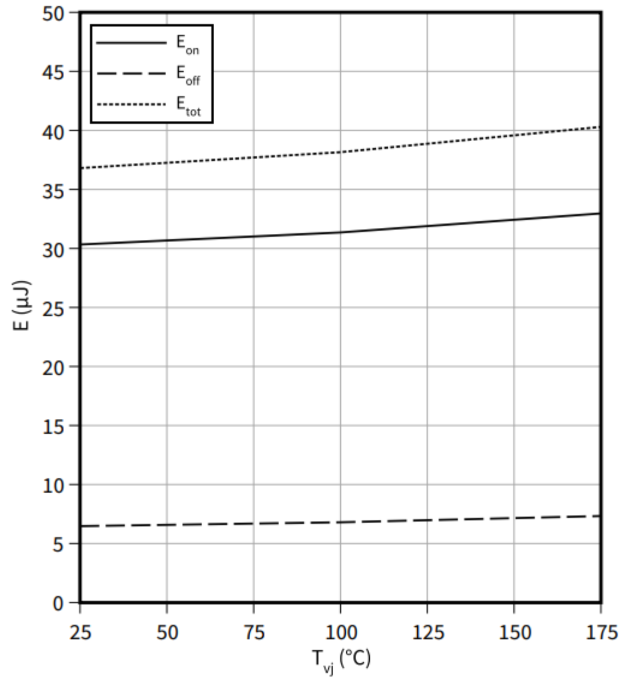
$T_{vj} = 175\ °C$, $t_p = 20\ µs$



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

$E = f(T_{vj})$

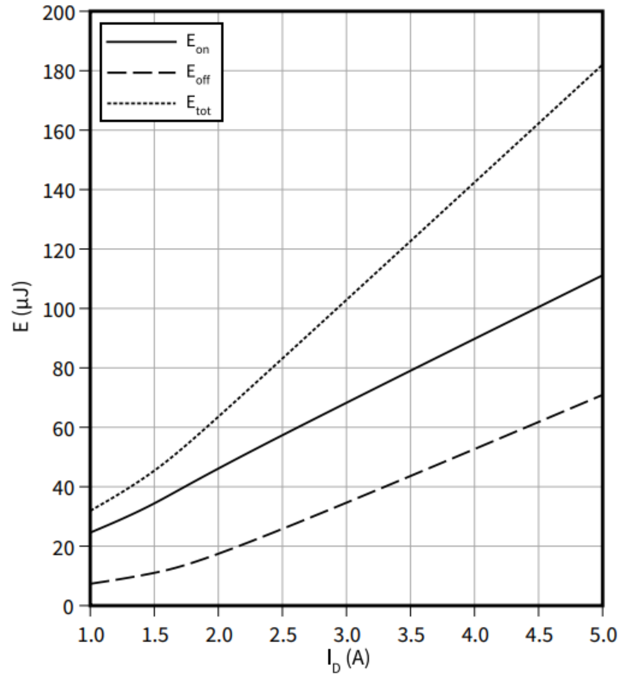
$V_{GS} = 0/12\ V$, $I_D = 1\ A$, $R_{G,ext} = 22\ Ω$, $V_{DD} = 1000\ V$



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

$E = f(I_D)$

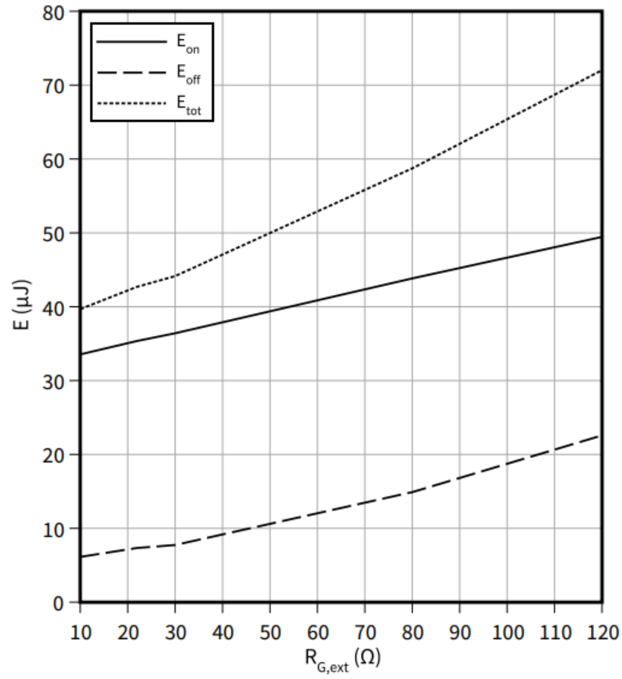
$V_{GS} = 0/12\ V$, $T_{vj} = 175\ °C$, $R_{G,ext} = 22\ Ω$, $V_{DD} = 1000\ V$



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

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

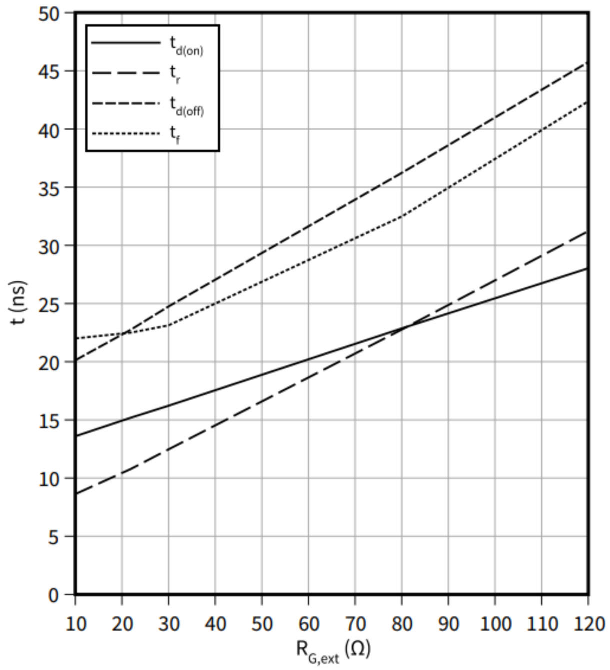
$V_{GS} = 0/12\ V$, $I_D = 1\ A$, $T_{vj} = 175\ °C$, $V_{DD} = 1000\ V$



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

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

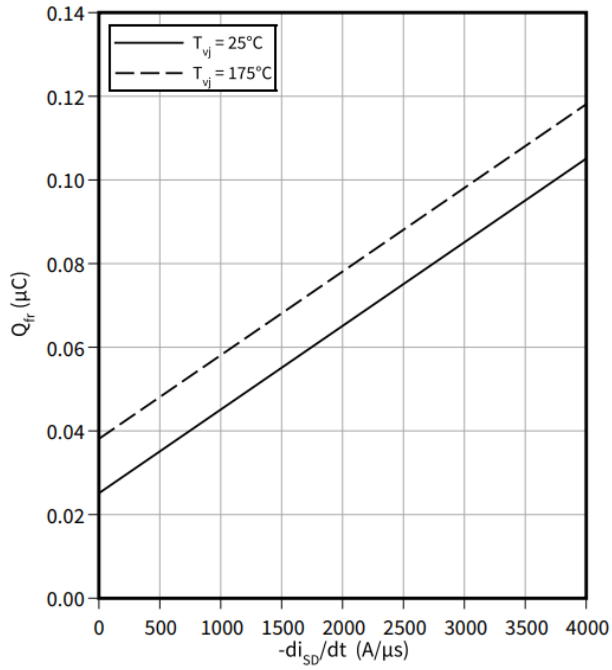
V_{GS} = 0/12 V, I_D = 1 A, T_{vj} = 175 °C, V_{DD} = 1000 V



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

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

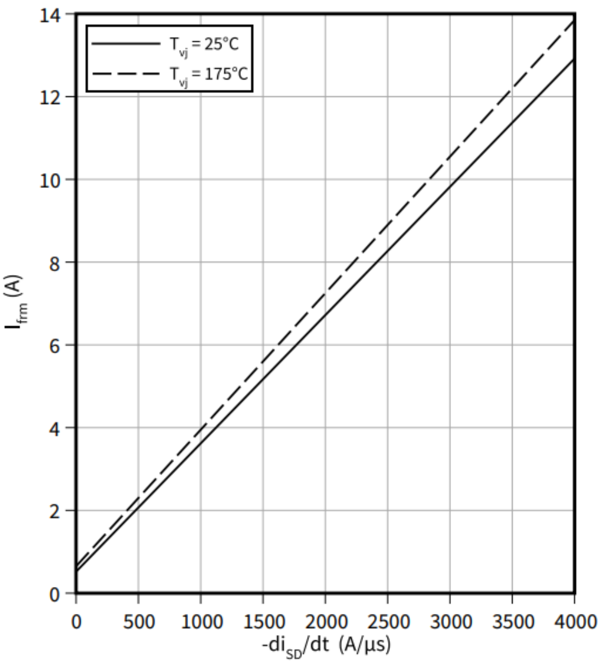
V_{GS} = 0 V, I_{SD} = 1 A, V_{DD} = 1000 V



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

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

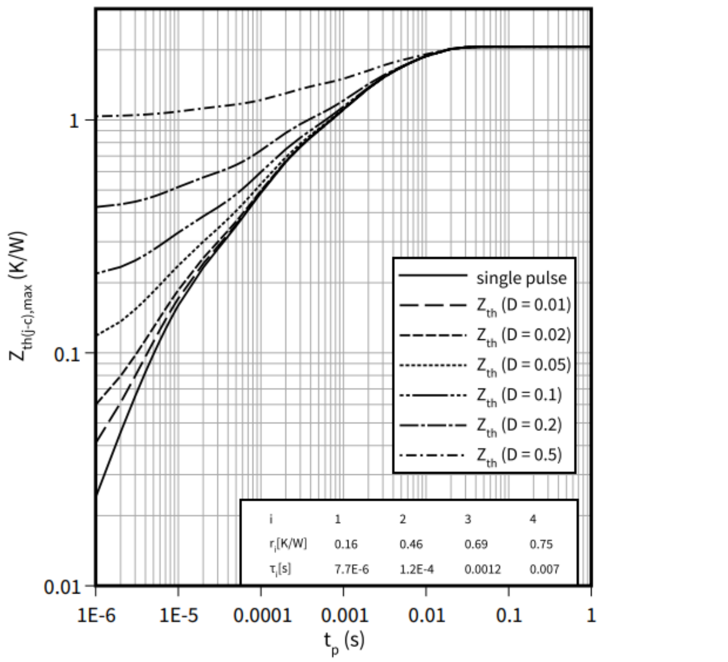
V_{GS} = 0 V, I_{SD} = 1 A, V_{DD} = 1000 V



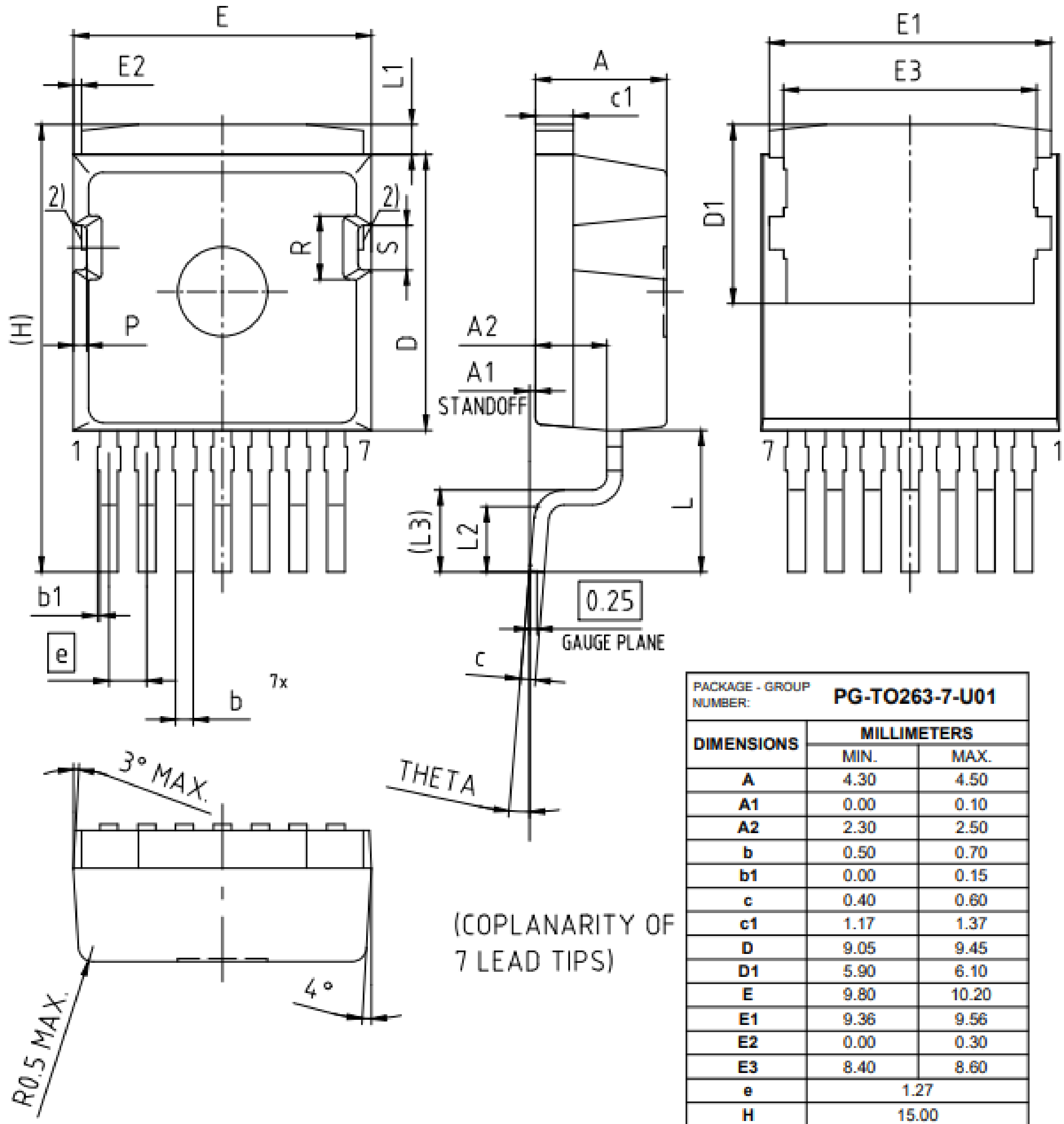
Max. transient thermal impedance (MOSFET/diode)

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

$D = t_p/T$



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°

NOTES:
1) ALL METAL SURFACES TIN PLATED EXCEPT AREA OF CUT
2) MOLD FILLING IS ACCEPTABLE AT THIS AREA

图 1

6 测试条件

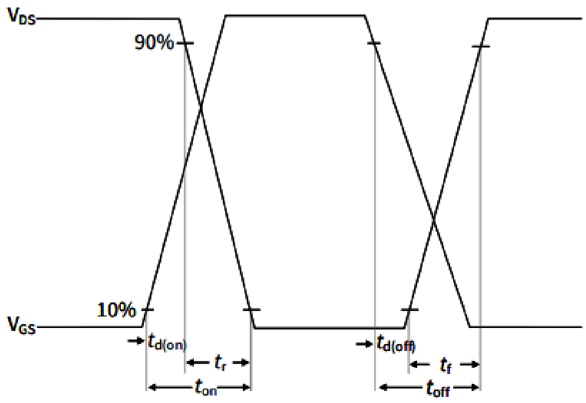


Figure A. **Definition of switching times**

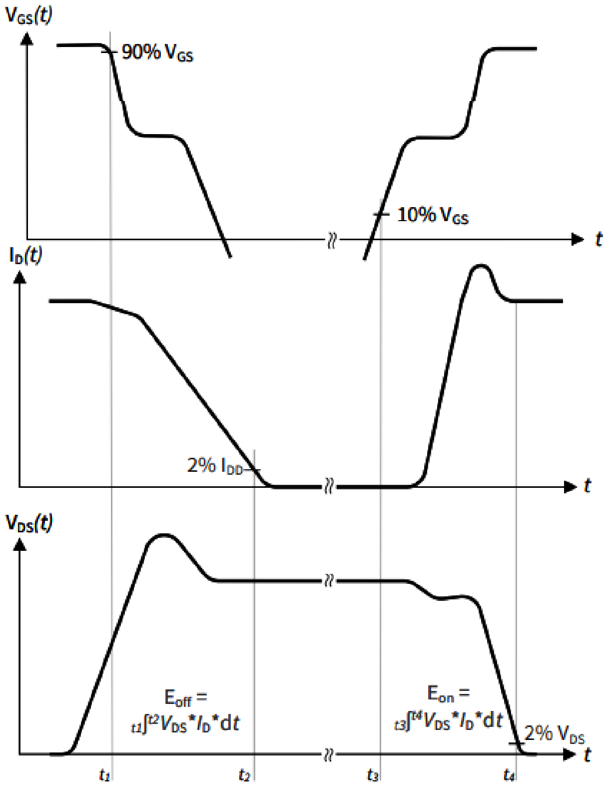


Figure C. **Definition of switching losses**

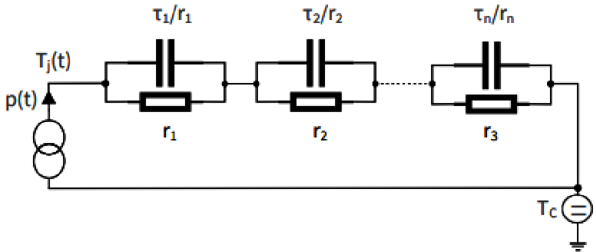


Figure E. **Thermal equivalent circuit**

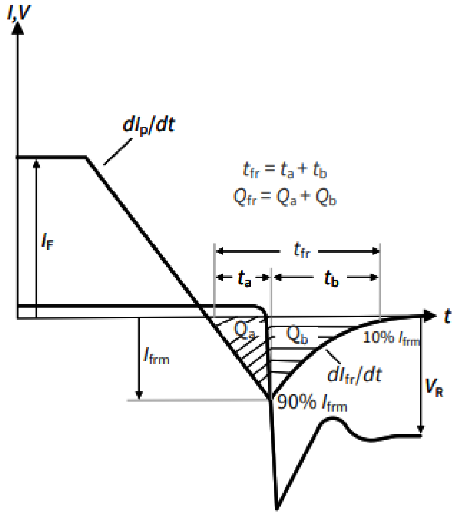


Figure B. **Definition of diode switching characteristics**

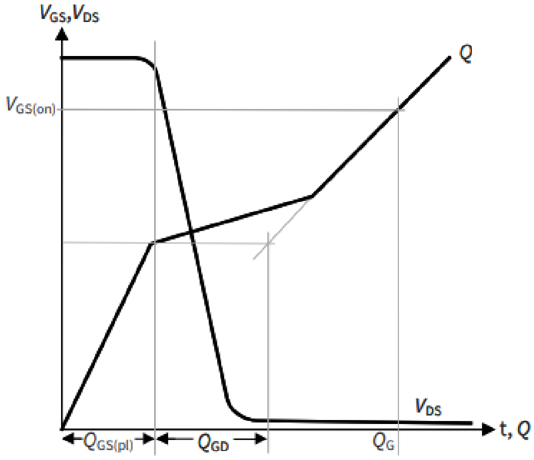


Figure D. **Definition of QGD**

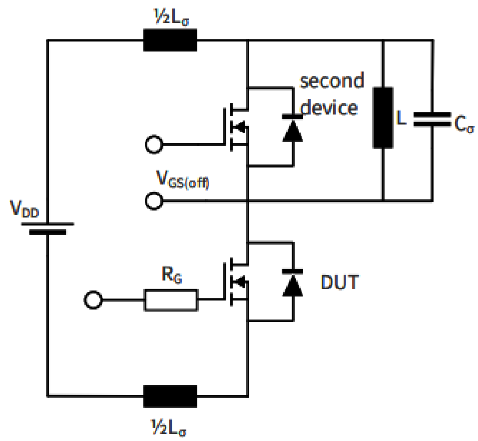


Figure F. **Dynamic test circuit**
Parasitic inductance Lσ,
Parasitic capacitor Cσ,

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

免责声明

请注意，本文件的原文使用英文撰写，为方便客户浏览英飞凌提供了中文译文。该中文译文仅供参考，并不可作为任何论点之依据。
由于翻译过程中可能使用了自动化程序，以及语言翻译和转换过程中的差异，最后的中文译文与最新的英文版本原文含义可能存在不尽相同之处。
因此，我们同时提供该中文译文版本的最新英文原文供您阅读，请参见 http://www.infineon.com
英文原文和中文译文版本之间若存有任何歧异，以最新的英文版本为准，并且仅认可英文版本为正式文件。

您如果使用本文件，即表示您同意并理解上述说明。英飞凌不对因翻译过程中可能存在的任何不完整或不准确信息而产生的任何直接或间接损失或损害负责。英飞凌不承担中文译文版本的完整性和准确性责任。如果您不同意上述说明，请不要使用本文件。

Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Edition 2025-07-28

Published by

Infineon Technologies AG

81726 Munich, Germany

Do you have a question about this document?

Email:

erratum@infineon.com

重要提示

本文档所提供的任何信息绝不应当被视为针对任何条件或者品质而做出的保证（质量保证）。英飞凌对于本文档中所提及的任何事例、提示或者任何特定数值及/或任何关于产品应用方面的信息均在此明确声明其不承担任何保证或者责任，包括但不限于其不侵犯任何第三方知识产权的保证均在此排除。此外，本文档所提供的任何信息均取决于客户履行本文档所载明的义务和客户遵守适用于客户产品以及与客户对于英飞凌产品的应用所相关的任何法律要求、规范和标准。

本文档所含的数据仅供经过专业技术培训的人员使用。客户自身的技术部门有义务对于产品是否适宜于其预期的应用和针对该等应用而言本文档中所提供的信息是否充分自行予以评估。

警告事项

由于技术所需产品可能含有危险物质。如需了解该等物质的类型，请向离您最近的英飞凌科技办公室接洽。

除非由经英飞凌科技授权代表签署的书面文件中做出另行明确批准的情况外，英飞凌科技的产品不应当被用于任何一项一旦产品失效或者产品使用的后果可被合理地预料到可能导致人身伤害的任何应用领域。