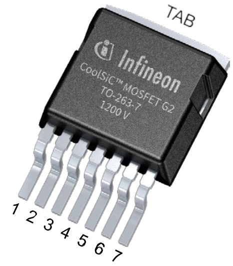
最终数据表

英飞凌CoolSiC ™ 1200 V SiC MOSFET G2：碳化硅 MOSFET



Halogen-free

Green

Lead-free

RoHS

特性

- T_{vj} = 25°C 时 $_{V\,DSS}$ = 1200 V
- $_{TC}$ = 100°C $_{时}$ I DDC = 10.5 A
- $_{RDS(on)}$ = 181.4mΩ （$_{VGS}$ = 18V、Tvj = 25°C 时）
- 开关损耗非常低
- 过载运行最高结温可达 T_{vj} = 200°C
- 短路耐受时间 2 µs
- 基准栅极阈值电压，$V_{GS(th)}$ = 4.2 V
- 具有抗寄生导通能力，可应用 0 V 关断栅极电压
- 坚固的体二极管，适用于硬换向
- .XT 互连技术，实现业界领先的热性能
- 合适的英飞凌栅极驱动器可在 https://www.infineon.com/gdfinder 找到

潜在的应用

- 电动汽车充电桩
- 在线式UPS/工业UPS
- 组串式逆变器
- 通用驱动器 (GPD)

产品认证

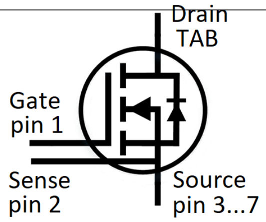
- 符合JEDEC47/20/22相关测试的工业应用要求

描述

引脚定义：

- 引脚 1 - 栅极
- 引脚 2 - 开尔文传感触点
- 引脚 3…7 - 源极
- Tab - 漏极

注意：源极和开尔文传感触点引脚不可互换，互换可能会导致故障（仅适用于 4 pin及TO263-7L封装）



Type	Package	Marking
IMBG120R181M2H	PG-TO263-7-U01	12M2H181

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	$R_{th(j-a)}$				62	K/W
MOSFET/body diode thermal resistance, junction-case	$R_{th(j-c)}$			1.22	1.59	K/W

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		1200	V
Continuous DC drain current for $R_{th(j-c,max)}$, limited by $T_{vj(max)}$	I_{DDC}	$V_{GS} = 18$ V	$T_c = 25$ °C	14.9	A
			$T_c = 100$ °C	10.5	
Peak drain current, t_p limited by $T_{vj(max)}$ [1]	I_{DM}	$V_{GS} = 18$ V		33	A
Gate-source voltage, max. transient voltage	V_{GS}	$t_p \leq 0.5$ µs, $D < 0.01$		-10...25	V
Gate-source voltage, max. static voltage[2]	V_{GS}			-7...23	V
Avalanche energy, single pulse	E_{AS}	$I_D = 3.8$ A, $V_{DD} = 50$ V, $L = 6.6$ mH		48	mJ
Avalanche energy, repetitive	E_{AR}	$I_D = 3.8$ A, $V_{DD} = 50$ V, $L = 33.2$ µH		0.24	mJ
Short-circuit withstand time	t_{SC}	$V_{DD} \leq 800$ V, $V_{DS,peak} < 1200$ V, $V_{GS(on)} = 15$ V, $T_{vj(start)} = 25$ °C		2	µs
Power dissipation, limited by $T_{vj(max)}$	P_{tot}		$T_c = 25$ °C	94	W
			$T_c = 100$ °C	47	

1) 已通过设计验证。
2) 应用设计中的最大栅源电压应符合IPC-9592B的规定。

表 3 建议值

Parameter	Symbol	Note or test condition	Values	Unit
Recommended turn-on gate voltage	$V_{GS(on)}$		15...18	V
Recommended turn-off gate voltage	$V_{GS(off)}$		-5...0	V

表4 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Drain-source on-state resistance	$R_{DS(on)}$	$I_D = 3.8$ A	$T_{vj} = 25$ °C, $V_{GS(on)} = 18$ V		181.4		mΩ
			$T_{vj} = 150$ °C, $V_{GS(on)} = 18$ V		370	482	
			$T_{vj} = 175$ °C, $V_{GS(on)} = 18$ V		429		
			$T_{vj} = 25$ °C, $V_{GS(on)} = 15$ V		226.5		
Gate-source threshold voltage	$V_{GS(th)}$	$I_D = 1.2$ mA, $V_{DS} = V_{GS}$ (tested after 1 ms pulse at $V_{GS} = 20$ V)	$T_{vj} = 25$ °C	3.5	4.2	5.1	V
			$T_{vj} = 175$ °C		3.2		
Zero gate-voltage drain current	I_{DSS}	$V_{DS} = 1200$ V, $V_{GS} = 0$ V	$T_{vj} = 25$ °C			30	µA
			$T_{vj} = 175$ °C		0.6		
Gate leakage current	I_{GSS}	$V_{DS} = 0$ V	$V_{GS} = 23$ V			120	nA
			$V_{GS} = -10$ V			-120	
Forward transconductance	g_{fs}	$I_D = 3.8$ A, $V_{DS} = 20$ V			2.6		S
Internal gate resistance	$R_{G,int}$	$f = 1$ MHz, $V_{AC} = 25$ mV			15		Ω
Input capacitance	C_{iss}	$V_{DS} = 800$ V, $V_{GS} = 0$ V, $f = 100$ kHz, $V_{AC} = 25$ mV			350		pF
Output capacitance	C_{oss}	$V_{DS} = 800$ V, $V_{GS} = 0$ V, $f = 100$ kHz, $V_{AC} = 25$ mV			12		pF
Reverse transfer capacitance	C_{rss}	$V_{DS} = 800$ V, $V_{GS} = 0$ V, $f = 100$ kHz, $V_{AC} = 25$ mV			1		pF
C_{oss} stored energy	E_{oss}	$V_{DS} = 0...800$ V, $V_{GS} = 0$ V, $f = 100$ kHz, $V_{AC} = 25$ mV, Calculated based on C_{oss}			5		µJ
Output charge	Q_{oss}	$V_{DS} = 0...800$ V, $V_{GS} = 0$ V, Calculated based on C_{oss}			18.9		nC
Effective output capacitance, energy related	$C_{o(er)}$	$V_{DS} = 0...800$ V, $V_{GS} = 0$ V			15.6		pF
Effective output capacitance, time related	$C_{o(tr)}$	$I_D =$ constant, $V_{DS} = 0...800$ V, $V_{GS} = 0$ V			23.6		pF

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表 4 （续） 特征值

Parameter	**Symbol**	**Note or test condition**		**Values**			**Unit**
				Min.	**Typ.**	**Max.**	
Total gate charge	Q_G	V_{DD} = 800 V, I_D = 3.8 A, V_{GS} = -2/18 V, turn-on pulse			9.7		nC
Plateau gate charge	$Q_{GS(pl)}$	V_{DD} = 800 V, I_D = 3.8 A, V_{GS} = -2/18 V, turn-on pulse			2.3		nC
Gate-to-drain charge	Q_{GD}	V_{DD} = 800 V, I_D = 3.8 A, V_{GS} = -2/18 V, turn-on pulse			2.3		nC
Turn-on delay time	$t_{d(on)}$	V_{DD} = 800 V, I_D = 3.8 A, V_{GS} = 0/18 V, $R_{GS(on)}$ = 2.3 Ω, $R_{GS(off)}$ = 2.3 Ω, $L_σ$ = 15 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		1		ns
			T_{vj} = 175 °C		0.9		
Rise time	t_r	V_{DD} = 800 V, I_D = 3.8 A, V_{GS} = 0/18 V, $R_{GS(on)}$ = 2.3 Ω, $R_{GS(off)}$ = 2.3 Ω, $L_σ$ = 15 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		12.6		ns
			T_{vj} = 175 °C		12.6		
Turn-off delay time	$t_{d(off)}$	V_{DD} = 800 V, I_D = 3.8 A, V_{GS} = 0/18 V, $R_{GS(on)}$ = 2.3 Ω, $R_{GS(off)}$ = 2.3 Ω, $L_σ$ = 15 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		1.7		ns
			T_{vj} = 175 °C		3		
Fall time	t_f	V_{DD} = 800 V, I_D = 3.8 A, V_{GS} = 0/18 V, $R_{GS(on)}$ = 2.3 Ω, $R_{GS(off)}$ = 2.3 Ω, $L_σ$ = 15 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		0.8		ns
			T_{vj} = 175 °C		1		
Turn-on energy	E_{on}	V_{DD} = 800 V, I_D = 3.8 A, V_{GS} = 0/18 V, $R_{GS(on)}$ = 2.3 Ω, $R_{GS(off)}$ = 2.3 Ω, $L_σ$ = 15 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		20		µJ
			T_{vj} = 175 °C		37		
Turn-off energy	E_{off}	V_{DD} = 800 V, I_D = 3.8 A, V_{GS} = 0/18 V, $R_{GS(on)}$ = 2.3 Ω, $R_{GS(off)}$ = 2.3 Ω, $L_σ$ = 15 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		5.2		µJ
			T_{vj} = 175 °C		5.2		

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表 4 （续） 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Total switching energy[1]	E_{tot}	V_{DD} = 800 V, I_D = 3.8 A, V_{GS} = 0/18 V, $R_{GS(on)}$ = 2.3 Ω, $R_{GS(off)}$ = 2.3 Ω, L_σ = 15 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		39.2		µJ
			T_{vj} = 175 °C		81.3		
Virtual junction temperature	T_{vj}			-55		175	°C
Virtual junction temperature	$T_{vj(over)}$	overload, cumulative max. 100 h[2]				200	°C

1) 包括 E_{fr}
2) 最多 5000 次循环。最大Δ T 限制为 100 K。

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

除非另有规定，*特性均为T_{vj} = 25°C。*

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} ≥ 25 °C	1200	V
Peak reverse drain current, t_p limited by $T_{vj(max)}$	I_{SM}	V_{GS} = 0 V	10	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} = 3.8 A, V_{GS} = 0 V	T_{vj} = 25 °C		4.2	5.5	V
			T_{vj} = 100 °C		4.11		
			T_{vj} = 175 °C		4.05		
MOSFET forward recovery charge	Q_{fr}	V_{DD} = 800 V, I_{SD} = 3.8 A, V_{GS} = 0 V, $-di_{SD}/dt$ = 1000 A/µs, Q_{fr} includes also Q_C	T_{vj} = 25 °C		0.084		µC
			T_{vj} = 175 °C		0.118		
MOSFET peak forward recovery current	I_{frm}	V_{DD} = 800 V, I_{SD} = 3.8 A, V_{GS} = 0 V, $-di_{SD}/dt$ = 1000 A/µs, Q_{fr} includes also Q_C	T_{vj} = 25 °C		3.1		A
			T_{vj} = 175 °C		4.2		

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表 6（续）特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
MOSFET forward recovery energy	E_{fr}	V_{DD} = 800 V, I_{SD} = 3.8 A, V_{GS} = 0 V, $-di_{SD}/dt$ = 1000 A/µs, Q_{fr} includes also Q_C	T_{vj} = 25 °C		14		µJ
			T_{vj} = 175 °C		39.1		
Virtual junction temperature	T_{vj}			-55		175	°C
Virtual junction temperature	$T_{vj(over)}$	overload, cumulative max. 100 h[1)]				200	°C

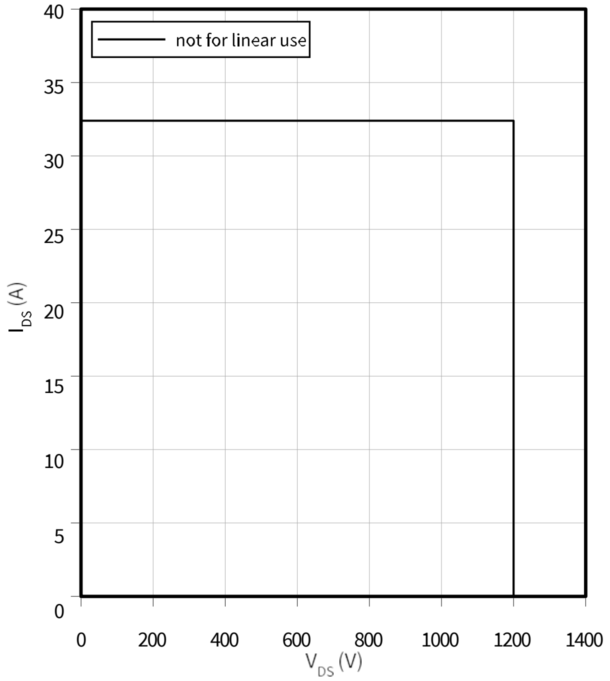
1) 最多 5000 次循环。最大Δ T 限制为 100 K。

4 特性图

Reverse bias safe operating area (RBSOA)

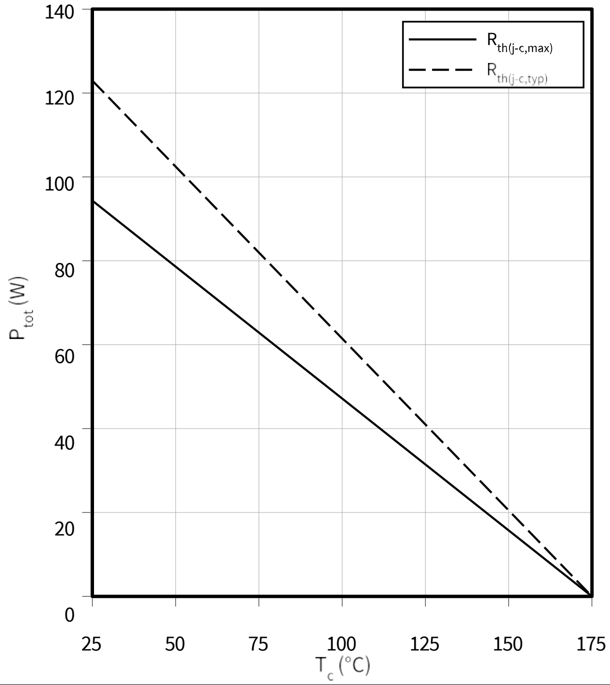
$I_{DS} = f(V_{DS})$

$T_{vj} \leq 200$ °C, $V_{GS} = 0/18$ V, $T_c = 25$ °C



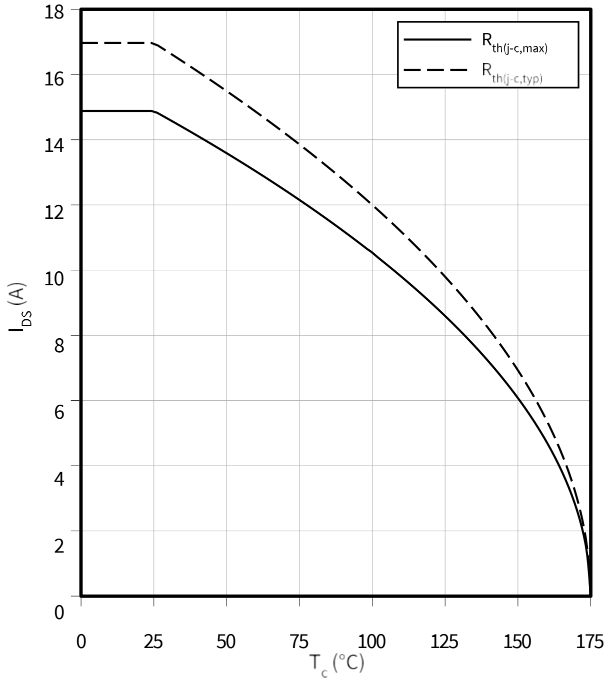
Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$



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

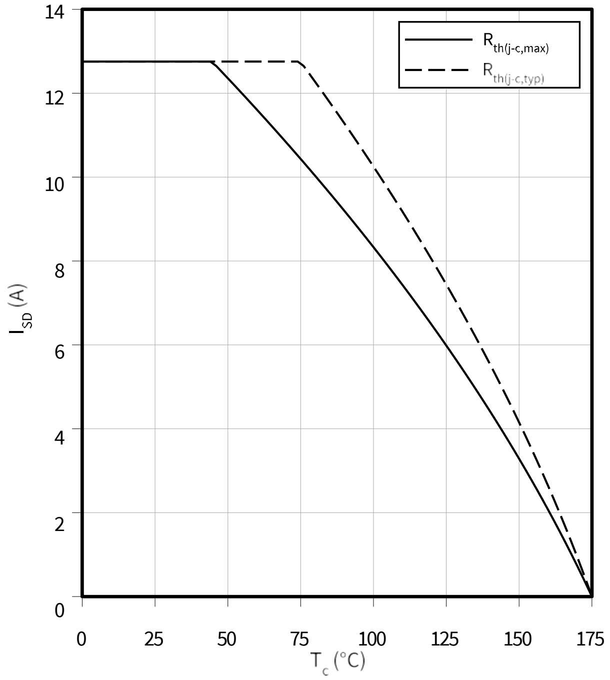
$I_{DS} = f(T_c)$



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

$I_{SD} = f(T_c)$

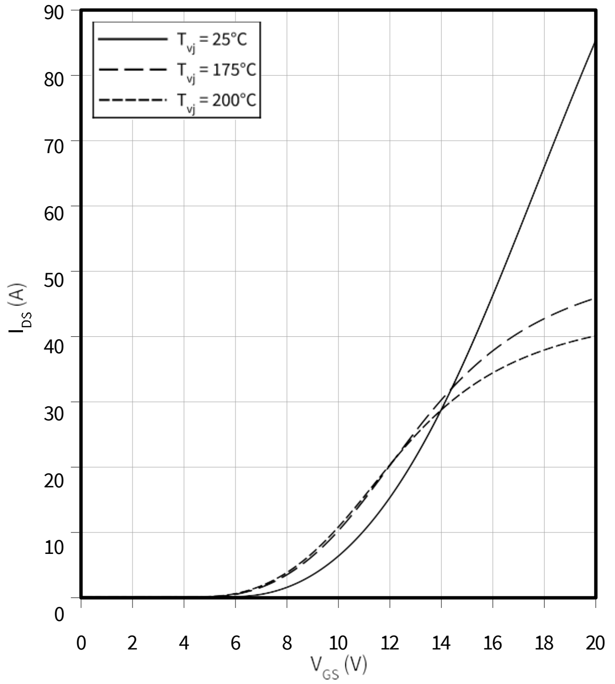
$V_{GS} = 0$ V



Typical transfer characteristic

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

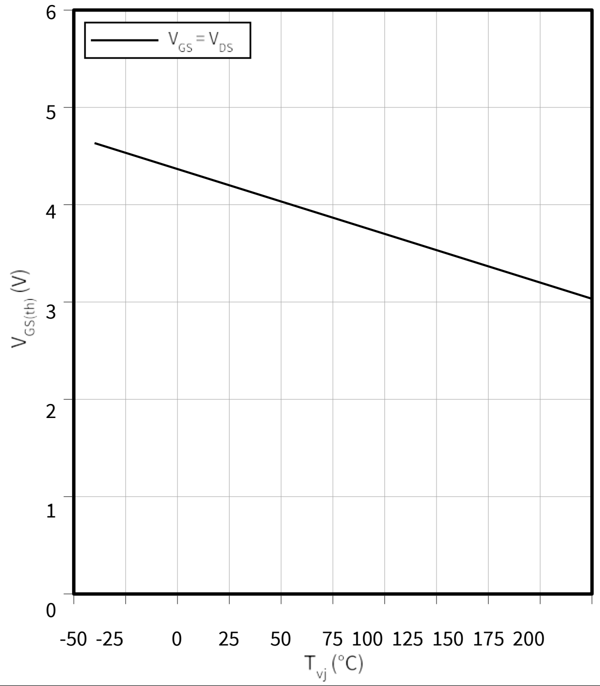
$V_{DS} = 20$ V, $t_p = 20$ µs



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

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

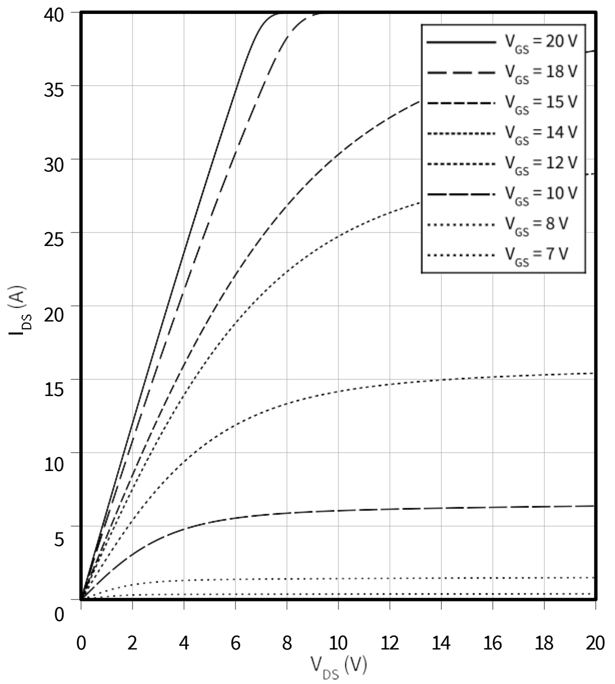
$I_D = 1.2$ mA



Typical output characteristic, V_{GS} as parameter

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

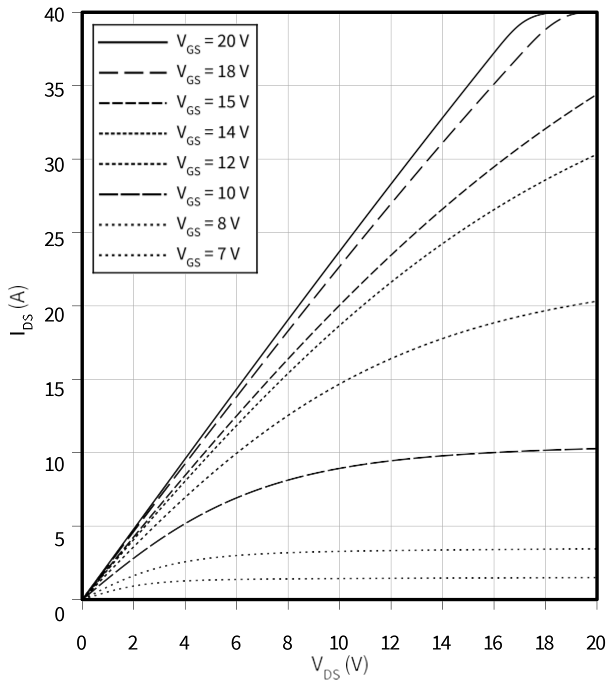
$T_{vj} = 25$ °C, $t_p = 20$ µs



Typical output characteristic, V_{GS} as parameter

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

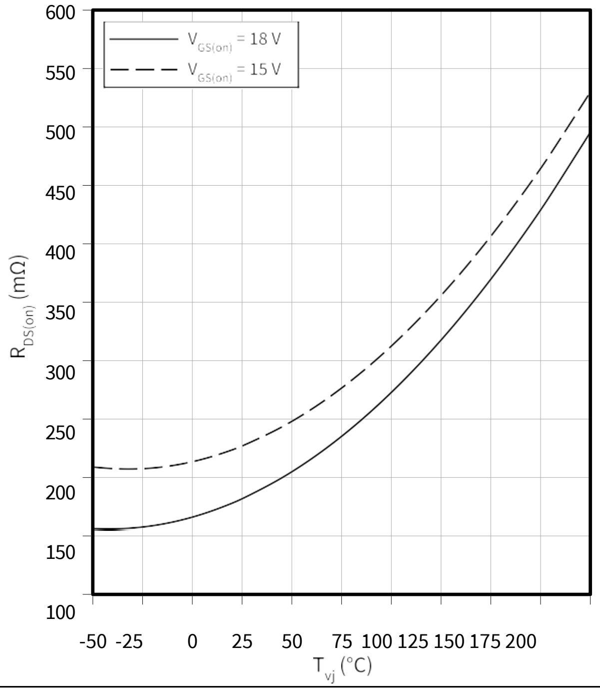
$T_{vj} = 175$ °C, $t_p = 20$ µs



Typical on-state resistance as a function of junction temperature

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

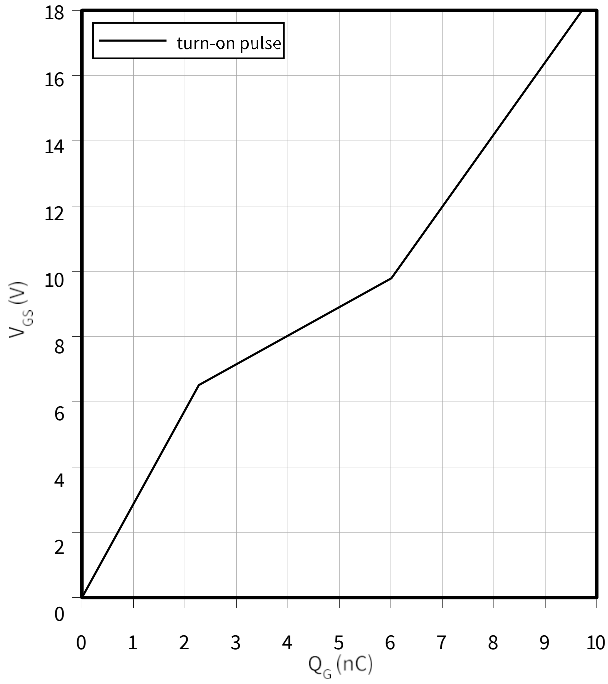
$I_D = 3.8$ A



Typical gate charge

$V_{GS} = f(Q_G)$

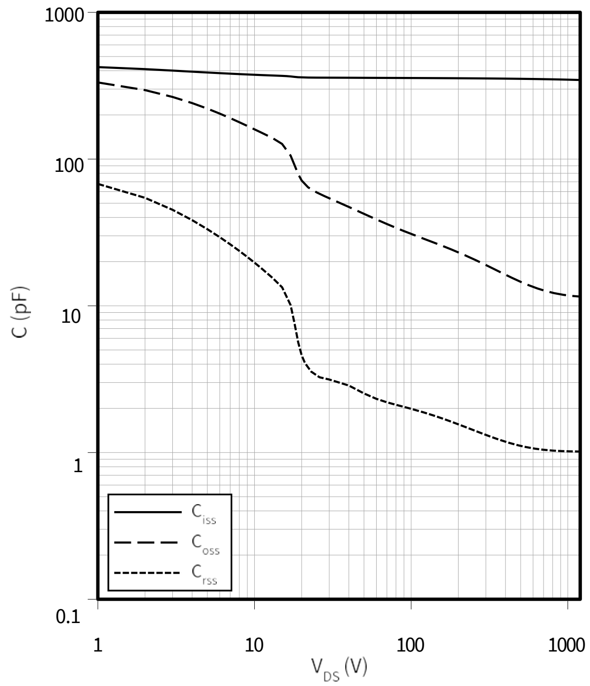
$I_D = 3.8$ A, $V_{DS} = 800$ V



Typical capacitance as a function of drain-source voltage

$C = f(V_{DS})$

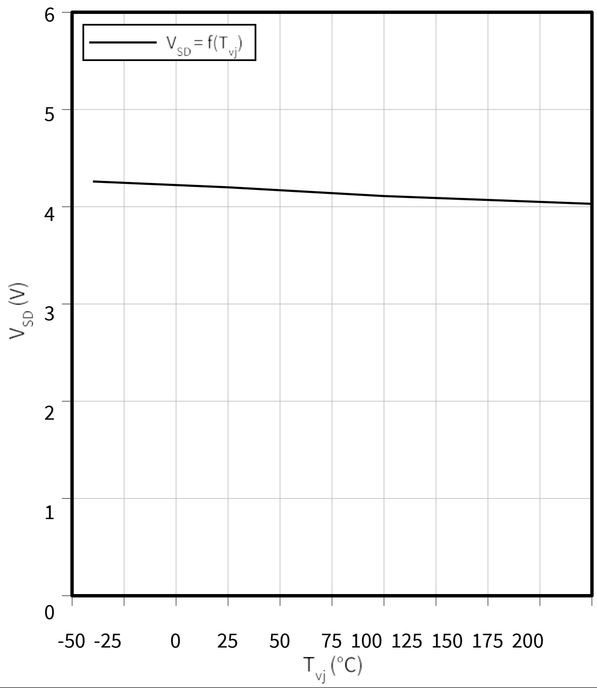
$f = 100$ kHz, $V_{GS} = 0$ V

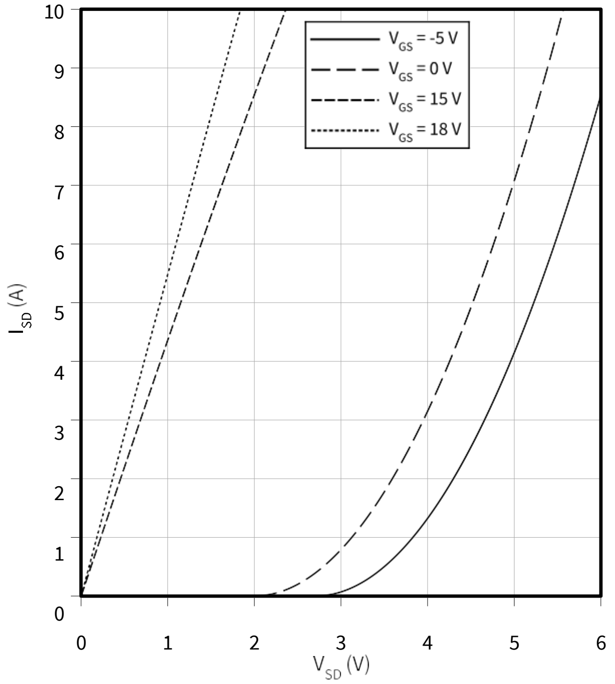
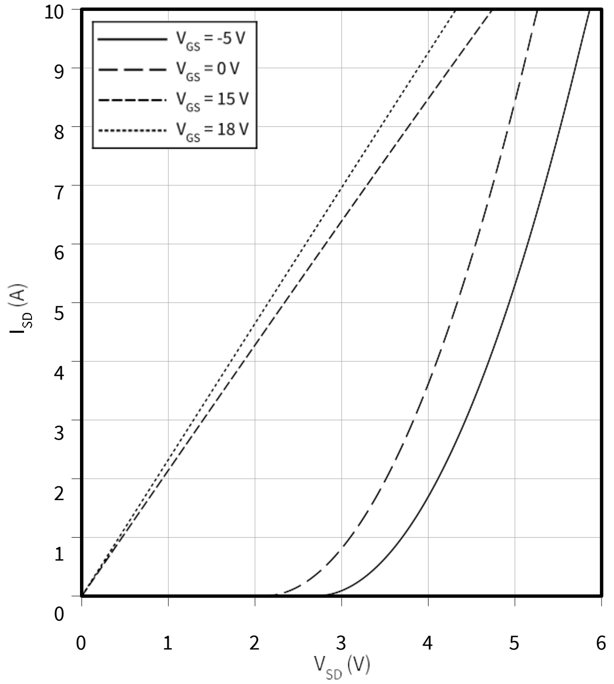
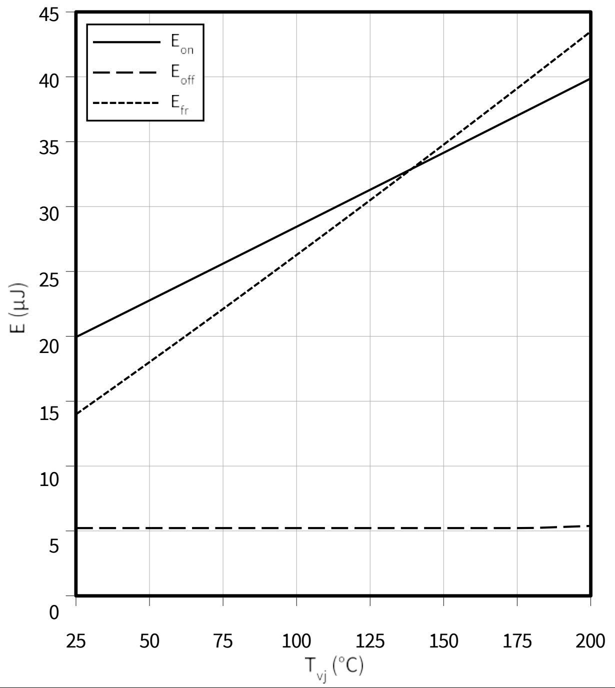
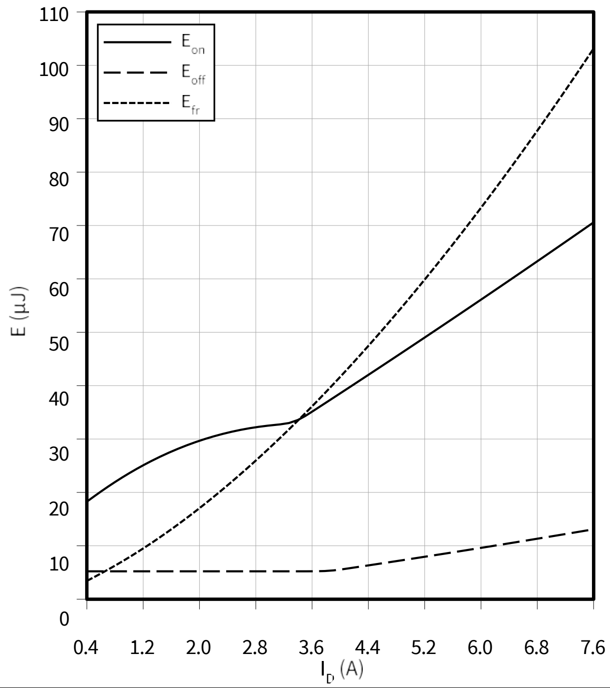


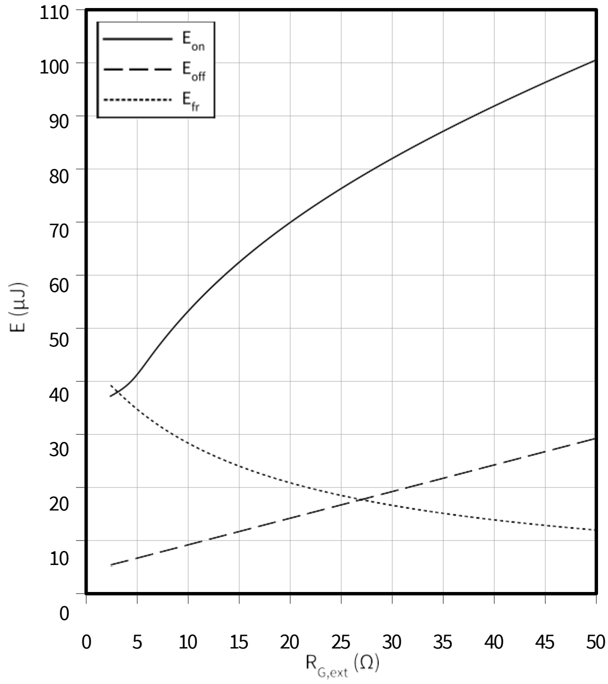
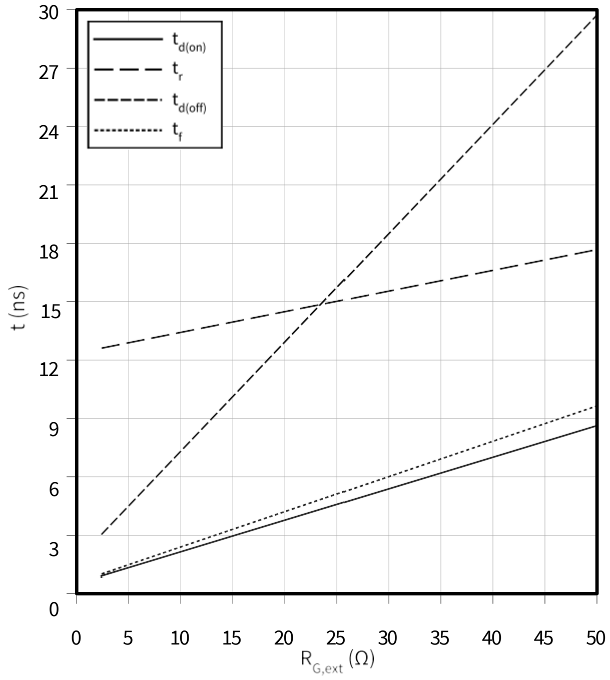
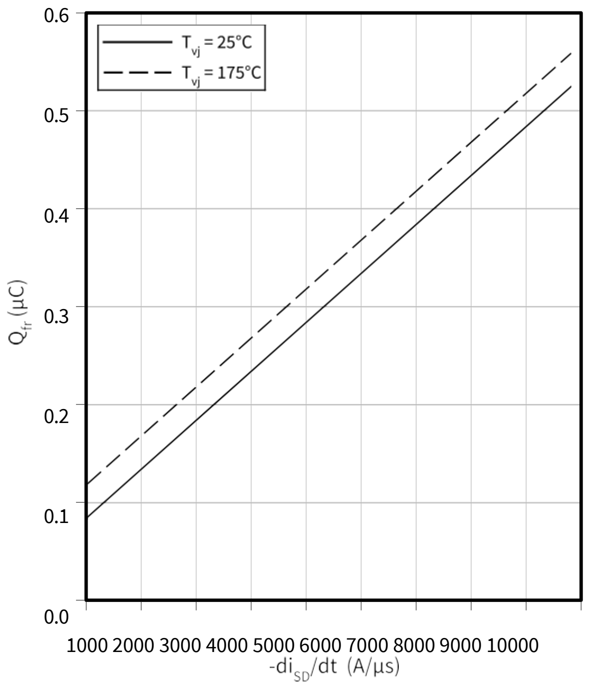
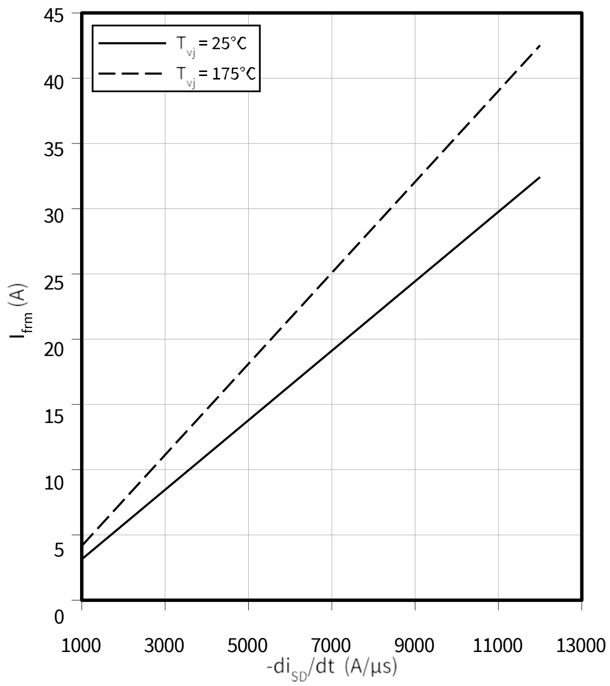
Typical reverse drain voltage as function of junction temperature

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

$I_{SD} = 3.8$ A, $V_{GS} = 0$ V



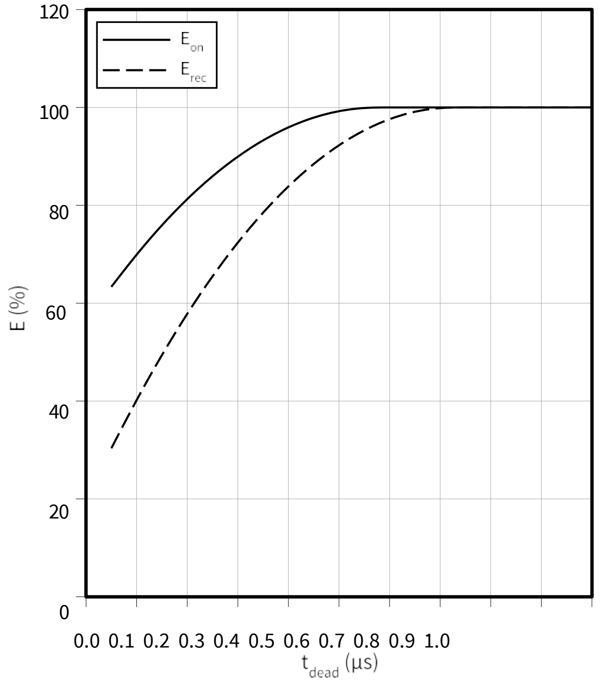
Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter $I_{SD} = f(V_{SD})$ $T_{vj} = 25$ °C, $t_p = 20$ µs	**Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter** $I_{SD} = f(V_{SD})$ $T_{vj} = 175$ °C, $t_p = 20$ µs
	
Typical switching energy as a function of junction temperature, test circuit in Fig. F, 2nd device own body diode: V_{GS} = 0 V $E = f(T_{vj})$ $V_{GS} = 0/18$ V, $I_D = 3.8$ A, $R_{G,ext} = 2.3$ Ω, $V_{DD} = 800$ V	**Typical switching energy as a function of drain current, test circuit in Fig. F, 2nd device own body diode: V_{GS} = 0 V** $E = f(I_D)$ $V_{GS} = 0/18$ V, $T_{vj} = 175$ °C, $R_{G,ext} = 2.3$ Ω, $V_{DD} = 800$ 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} = 0/18 V, I_D = 3.8 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} = 0/18 V, I_D = 3.8 A, T_{vj} = 175 °C, V_{DD} = 800 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} = 0/18 V, I_{SD} = 3.8 A, V_{DD} = 800 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} = 0/18 V, I_{SD} = 3.8 A, V_{DD} = 800 V
	

Typical switching energy as a function of dead time / blanking time, test circuit in Fig. F, 2nd device own body diode: V_{GS} = -5 V

$E = f(t_{dead})$

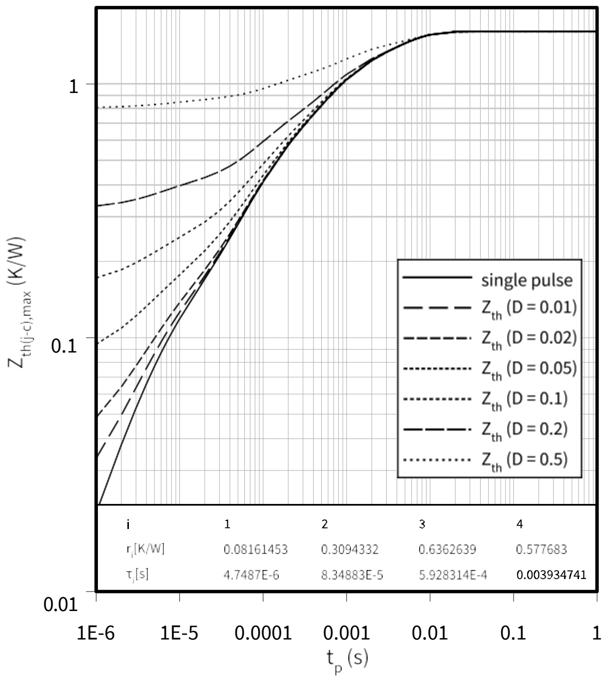
V_{GS} = 0/18 V, I_D = 3.8 A, T_{vj} = 175 °C, $R_{G,ext}$ = 2.3 Ω V_{DD} = 800 V



Max. transient thermal impedance (MOSFET/diode)

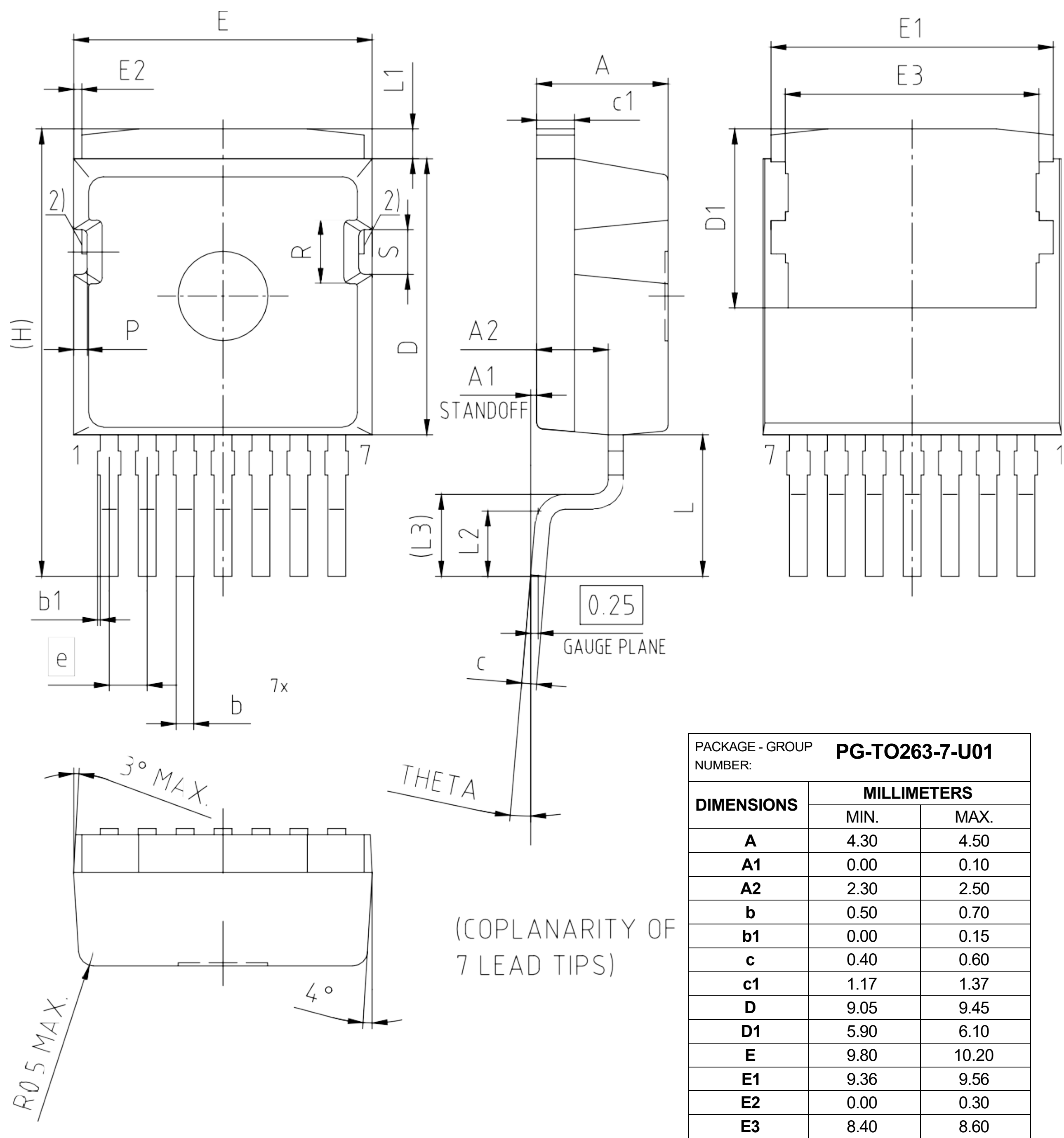
$Z_{th(j-c),max} = f(t_p)$

$D = t_p/T$



i	1	2	3	4
r_i[K/W]	0.08161453	0.3094332	0.6362639	0.577683
τ_i[s]	4.7487E-6	8.34883E-5	5.928314E-4	0.003934741

5 封装外形



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

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

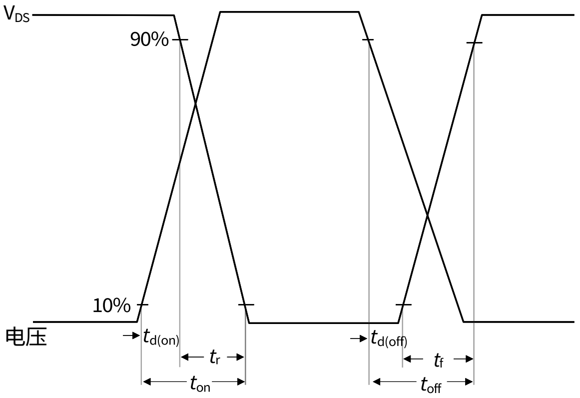
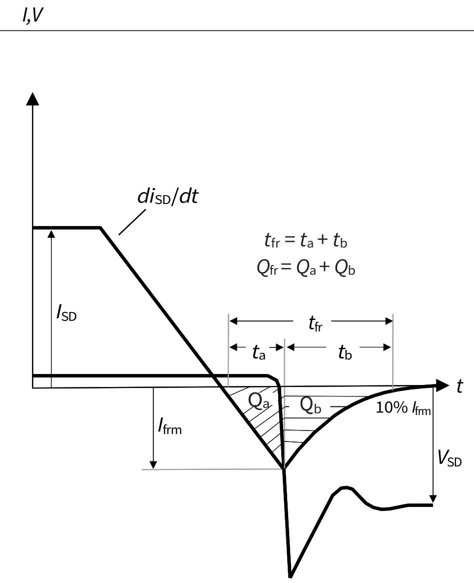


图 A.开关时间的定义



图B.体二极管开关特性的定义

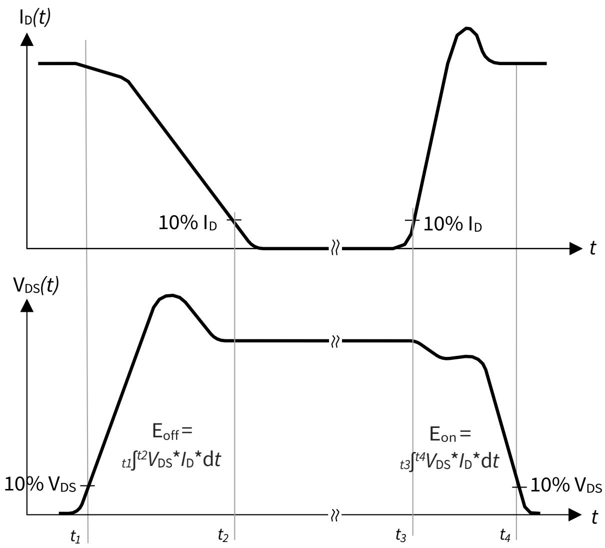


图 C.开关损耗的定义

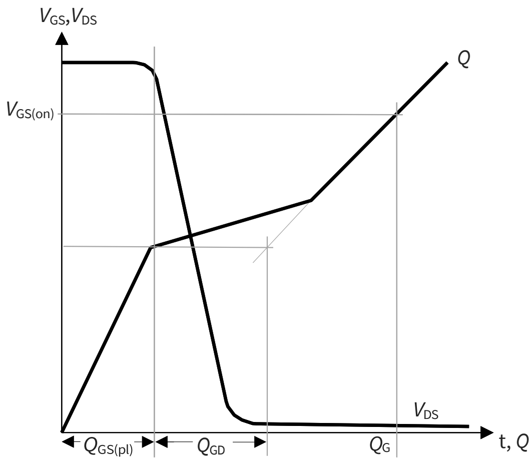
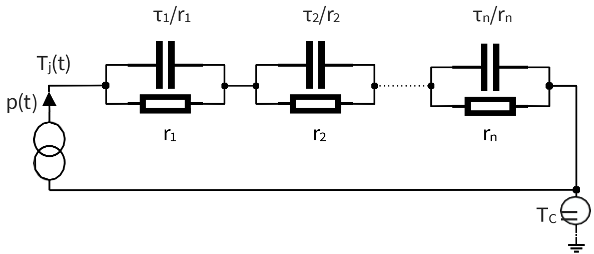
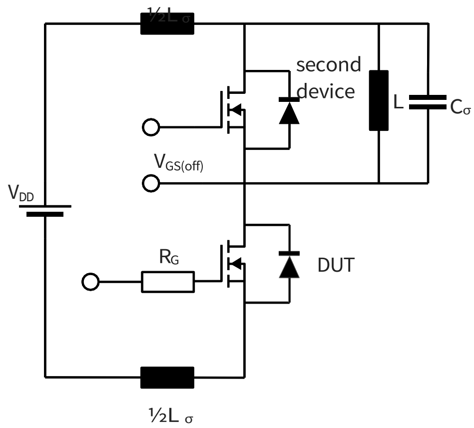


图 D. **QGD 的定义**





图F.动态测试电路寄生电感

图 E.热等效电路

Lσ，寄生电容Cσ，

图 2

修订记录

Document revision	Date of release	Description of changes
0.10	2023-08-10	Preliminary datasheet
1.00	2023-10-05	Final datasheet
1.10	2024-01-16	Negative gate voltage values updated Additional capacitance & charge values added $E = f(t_{dead})$ graph y-axis correction to percentage values Editorial changes
1.20	2024-07-02	Updated „Potential applications“ Corrected package name Corrected static and dynamic gate-source voltage Corrected unit of L to µH for “Avalanche energy, repetitive” Corrected value of g_{fs} in the Table 4 Corrected diagrams "Typical transfer characteristic" and "Max. transient thermal impedance (MOSFET/diode)" Updated Figure D. Definition of QGD
1.30	2024-11-08	Corrected diagram $I_{frm} = f(-$ $di_{SD}/dt)$ Editorial changes

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