英飞凌 IMZA120R012M2H

CoolSiC™ 1200 V SiC MOSFET G2

采用 .XT 互连技术的碳化硅 MOSFET

Halogen-free

Green

Lead-free

RoHS

特性

- V_{DSS} = 1200 V 时 T_{vj} = 25°C
- I_{DDC} = 91 A 时 T_C = 100°C
- $R_{DS(on)}$ = 12 mΩ 时 V_{GS} = 18 V, T_{vj} = 25°C
- 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、行业领先的热性能
- 合适的英飞凌栅极驱动器可在 https://www.infineon.com/gdfinder 找到

潜在应用

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

产品验证

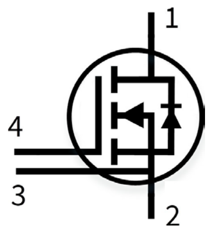
- 符合JEDEC47/20/22相关测试的工业应用要求

描述

引脚定义：

- 引脚 1 – 漏极
- 引脚 2 – 源
- 引脚 3 – 开尔文检测触点
- 引脚 4 – 栅极

注：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
IMZA120R012M2H	PG-TO247-4-U02	12M2H012

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}	Wave soldering 1.6 mm (0.063 in.) from case for 10 s			260	°C
Mounting torque	M	M3 screw, Maximum of mounting processes: 3			0.6	Nm
Thermal resistance, junction-ambient	$R_{th(j-a)}$				62	K/W
MOSFET/body diode thermal resistance, junction-case	$R_{th(j-c)}$			0.24	0.31	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	129	A
			$T_c = 100$ °C	91	
Peak drain current, t_p limited by $T_{vj(max)}$ 1)	I_{DM}	$V_{GS} = 18$ V		455	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}	$I_D = 57$ A, $V_{DD} = 50$ V, $L = 0.4$ mH, $T_{vj(start)} = 25$ °C		712	mJ
Avalanche energy, repetitive	E_{AR}	$I_D = 57$ A, $V_{DD} = 50$ V, $L = 2.2$ µH, $T_{vj(start)} = 25$ °C		3.56	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	480	W
			$T_c = 100$ °C	240	

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		Min.	Typ.	Max.	Unit
Drain-source on-state resistance	$R_{DS(on)}$	I_D = 57 A	T_{vj} = 25 °C, $V_{GS(on)}$ = 18 V		12	16	mΩ
			T_{vj} = 150 °C, $V_{GS(on)}$ = 18 V		25		
			T_{vj} = 175 °C, $V_{GS(on)}$ = 18 V		29		
			T_{vj} = 25 °C, $V_{GS(on)}$ = 15 V		15	21	
Gate-source threshold voltage	$V_{GS(th)}$	I_D = 17.8 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			500	µA
			T_{vj} = 175 °C		9		
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 = 57 A, V_{DS} = 20 V			38		S
Internal gate resistance	$R_{G,int}$	f = 1 MHz, V_{AC} = 25 mV			4		Ω
Input capacitance	C_{iss}	V_{DS} = 800 V, V_{GS} = 0 V, f = 100 kHz, V_{AC} = 25 mV			4050		pF
Output capacitance	C_{oss}	V_{DS} = 800 V, V_{GS} = 0 V, f = 100 kHz, V_{AC} = 25 mV			176		pF
Reverse transfer capacitance	C_{rss}	V_{DS} = 800 V, V_{GS} = 0 V, f = 100 kHz, V_{AC} = 25 mV			15		pF
C_{oss} stored energy	E_{oss}	Calculated based on C_{oss} = f(V_{DD})			74		µJ
Output charge	Q_{oss}	Calculated based on C_{oss} = f(V_{DD})			275		nC
Effective output capacitance, energy related	$C_{o(er)}$	V_{DS} = 0...800 V, V_{GS} = 0 V, Calculated based on E_{oss}			231		pF
Effective output capacitance, time related	$C_{o(tr)}$	I_D = constant, V_{DS} = 0...800 V, V_{GS} = 0 V, Calculated based on Q_{oss}			344		pF
Total gate charge	Q_G	V_{DD} = 800 V, I_D = 57 A, V_{GS} = 0/18 V, turn-on pulse			124		nC

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表 4 （续） 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Plateau gate charge	$Q_{GS(pl)}$	V_{DD} = 800 V, I_D = 57 A, V_{GS} = 0/18 V, turn-on pulse			26		nC
Gate-drain charge	Q_{GD}	V_{DD} = 800 V, I_D = 57 A, V_{GS} = 0/18 V, turn-on pulse			34		nC
Turn-on delay time	$t_{d(on)}$	V_{DD} = 800 V, I_D = 57 A, V_{GS} = 0/18 V, $R_{G,ext}$ = 2.3 Ω, $L_σ$ = 12 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		16		ns
			T_{vj} = 175 °C		12.4		
Rise time	t_r	V_{DD} = 800 V, I_D = 57 A, V_{GS} = 0/18 V, $R_{G,ext}$ = 2.3 Ω, $L_σ$ = 12 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		10.1		ns
			T_{vj} = 175 °C		9		
Turn-off delay time	$t_{d(off)}$	V_{DD} = 800 V, I_D = 57 A, V_{GS} = 0/18 V, $R_{G,ext}$ = 2.3 Ω, $L_σ$ = 12 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		35.2		ns
			T_{vj} = 175 °C		41.2		
Fall time	t_f	V_{DD} = 800 V, I_D = 57 A, V_{GS} = 0/18 V, $R_{G,ext}$ = 2.3 Ω, $L_σ$ = 12 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		15.1		ns
			T_{vj} = 175 °C		17.8		
Turn-on energy	E_{on}	V_{DD} = 800 V, I_D = 57 A, V_{GS} = 0/18 V, $R_{G,ext}$ = 2.3 Ω, $L_σ$ = 12 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		580		µJ
			T_{vj} = 175 °C		900		
Turn-off energy	E_{off}	V_{DD} = 800 V, I_D = 57 A, V_{GS} = 0/18 V, $R_{G,ext}$ = 2.3 Ω, $L_σ$ = 12 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		370		µJ
			T_{vj} = 175 °C		530		
Total switching energy[1)]	E_{tot}	V_{DD} = 800 V, I_D = 57 A, V_{GS} = 0/18 V, $R_{G,ext}$ = 2.3 Ω, $L_σ$ = 12 nH, diode: body diode at V_{GS} = 0 V	T_{vj} = 25 °C		1180		µJ
			T_{vj} = 175 °C		2080		

（表格续下页……）

表 4 （续） 特征值

Parameter	Symbol	Note or test condition		Values Min.	Typ.	Max.	Unit
Turn-on energy at -5 V	E_{on}	V_{DD} = 800 V, I_D = 57 A, V_{GS} = -5/18 V, $R_{G,ext}$ = 2.3 Ω, $L_σ$ = 12 nH, diode: body diode at V_{GS} = -5 V	T_{vj} = 25 °C		557		µJ
			T_{vj} = 175 °C		873		
Turn-off energy at -5 V	E_{off}	V_{DD} = 800 V, I_D = 57 A, V_{GS} = -5/18 V, $R_{G,ext}$ = 2.3 Ω, $L_σ$ = 12 nH, diode: body diode at V_{GS} = -5 V	T_{vj} = 25 °C		167		µJ
			T_{vj} = 175 °C		194		
Total switching energy at -5 V[1)]	E_{tot}	V_{DD} = 800 V, I_D = 57 A, V_{GS} = -5/18 V, $R_{G,ext}$ = 2.3 Ω, $L_σ$ = 12 nH, diode: body diode at V_{GS} = -5 V	T_{vj} = 25 °C		953		µJ
			T_{vj} = 175 °C		1839		
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ΔT 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
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	92	A
			T_c = 100 °C	51	
Peak reverse drain current, t_p limited by $T_{vj(max)}$	I_{SM}	V_{GS} = 0 V		273	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} = 57 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} = 57 A, V_{GS} = 0 V, $R_{GS(on)}$ = 2.3 Ω, Q_{fr} includes also Q_C	T_{vj} = 25 °C		0.43		µC
			T_{vj} = 175 °C		1.36		
MOSFET peak forward recovery current	I_{frm}	V_{DD} = 800 V, I_{SD} = 57 A, V_{GS} = 0 V, $R_{GS(on)}$ = 2.3 Ω, Q_{fr} includes also Q_C	T_{vj} = 25 °C		46.3		A
			T_{vj} = 175 °C		79.6		
MOSFET forward recovery energy	E_{fr}	V_{DD} = 800 V, I_{SD} = 57 A, V_{GS} = 0 V, $R_{GS(on)}$ = 2.3 Ω, Q_{fr} includes also Q_C	T_{vj} = 25 °C		230		µJ
			T_{vj} = 175 °C		650		
MOSFET forward recovery energy at -5 V	E_{fr}	V_{DD} = 800 V, I_{SD} = 57 A, V_{GS} = -5 V, $R_{GS(on)}$ = 2.3 Ω, Q_{fr} includes also Q_C	T_{vj} = 25 °C		229		µJ
			T_{vj} = 175 °C		772		
Virtual junction temperature	T_{vj}			-55		175	°C
Virtual junction temperature	$T_{vj(over)}$	overload, cumulative max. 100 h[1]				200	°C

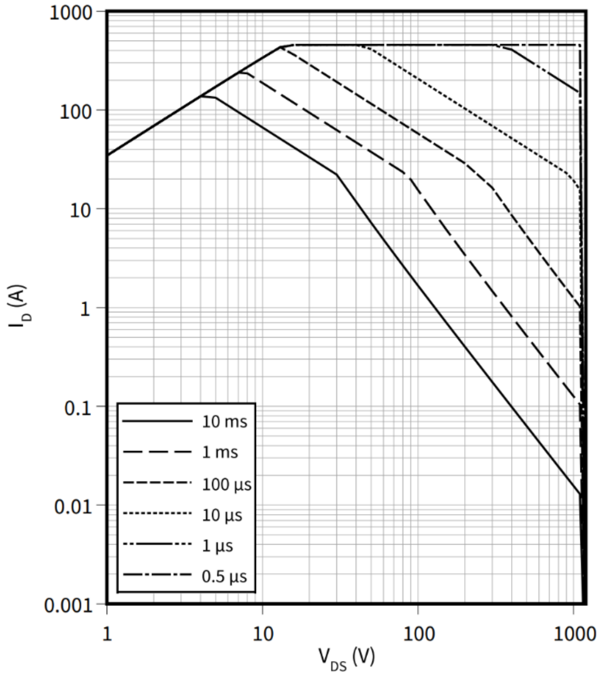
1)　最多 5000 次循环。最大Δ T 限制为 100 K。

4 特性图

Safe operating area (SOA)

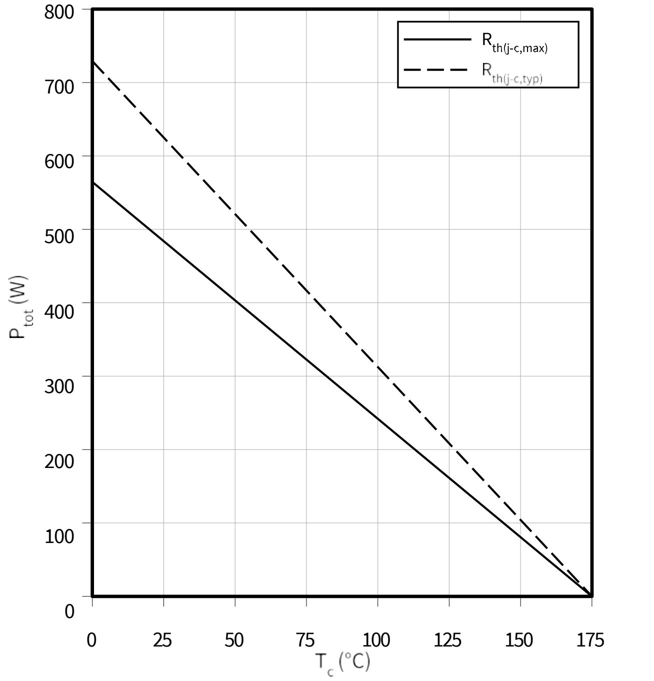
$I_D = f(V_{DS})$

$T_{vj} \leq 175$ °C, $T_c = 25$ °C



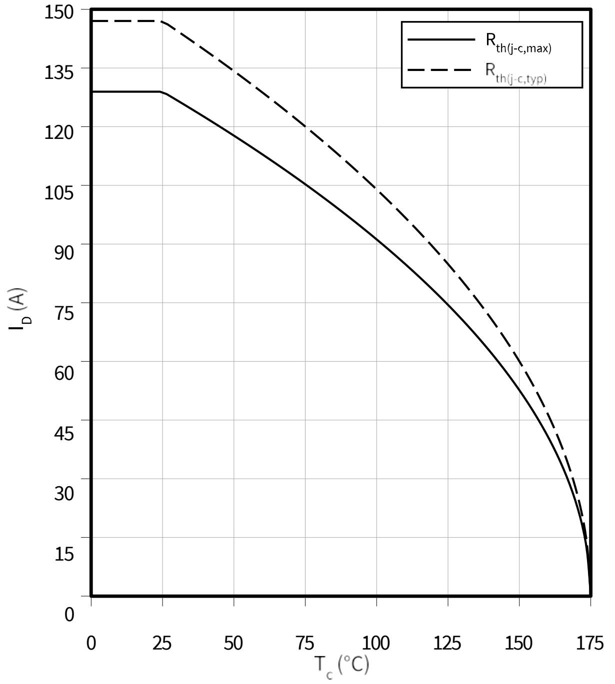
Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$



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

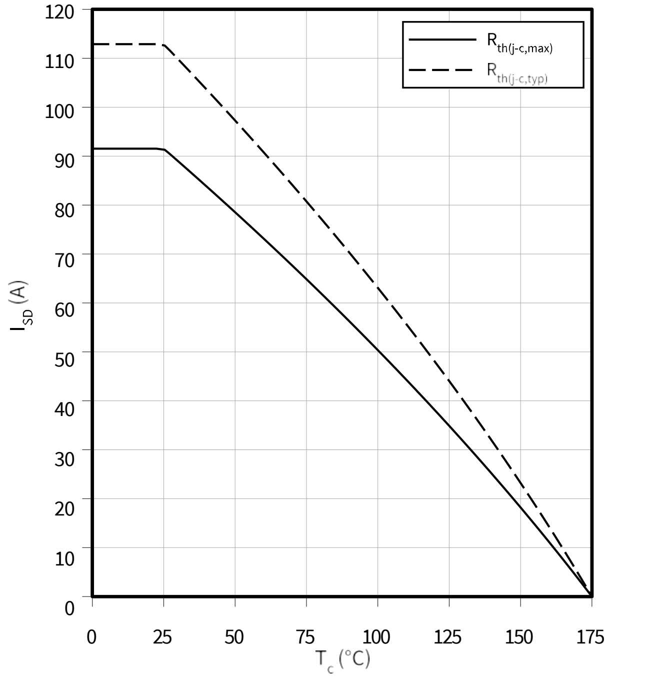
$I_D = f(T_c)$



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

$I_{SD} = f(T_c)$

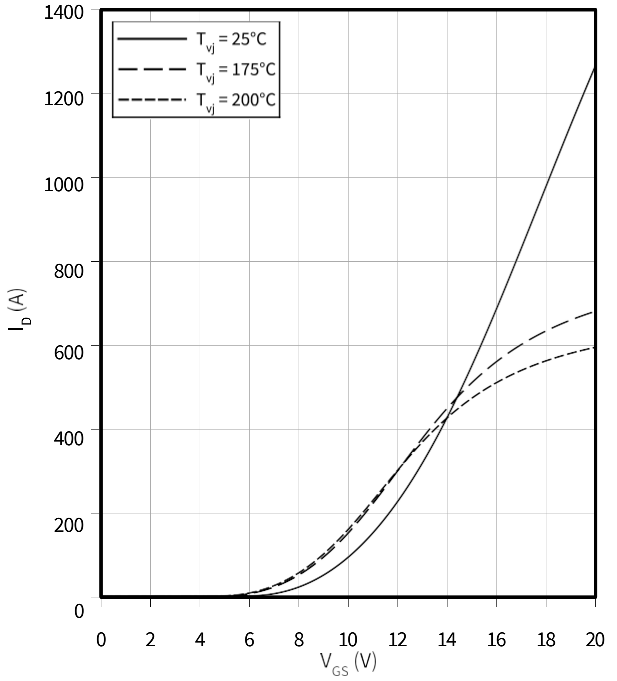
$V_{GS} = 0$ V



Typical transfer characteristic

$I_D = f(V_{GS})$

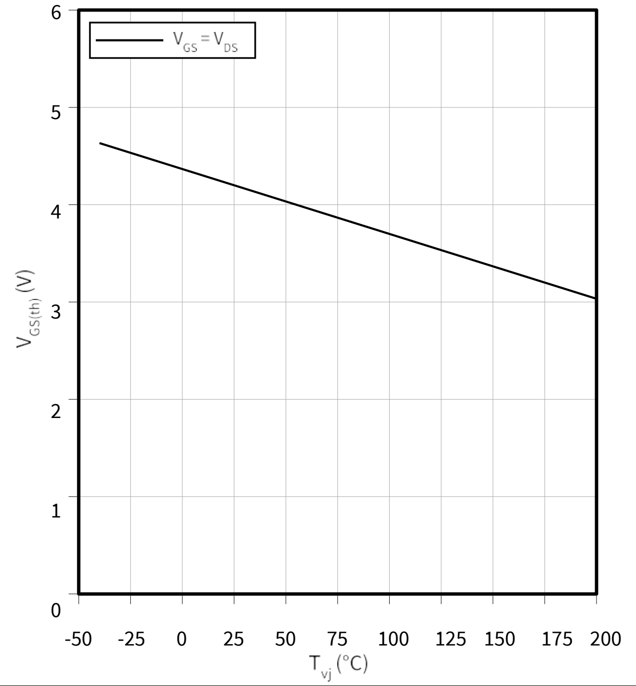
$V_{DS} = 20$ V, $t_p = 20$ µs



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

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

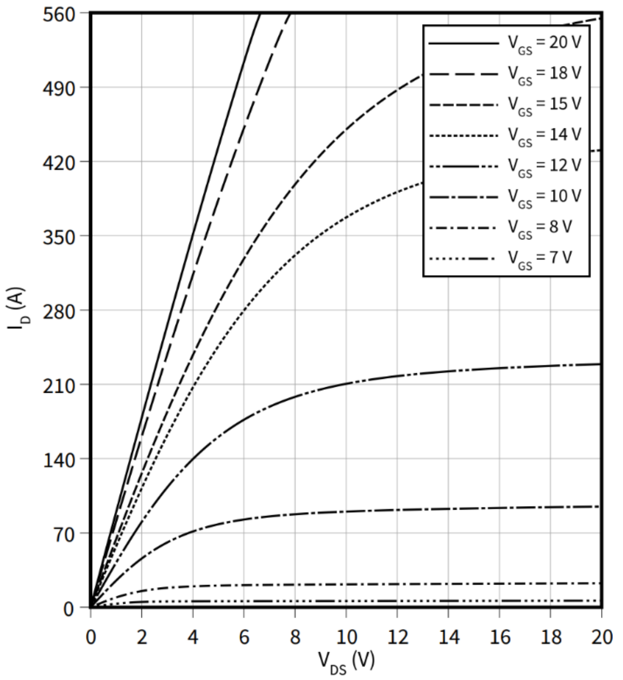
$I_D = 17.8$ mA



Typical output characteristic, V_{GS} as a parameter

$I_D = f(V_{DS})$

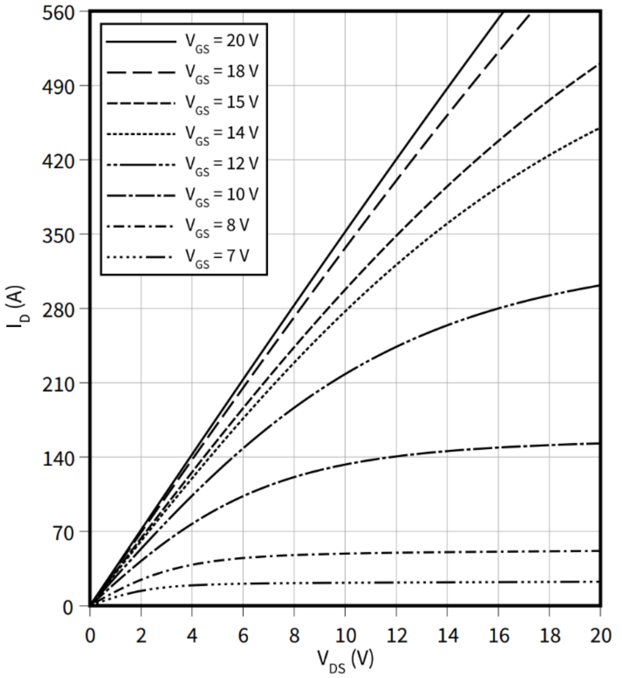
$T_{vj} = 25$ °C, $t_p = 20$ µs

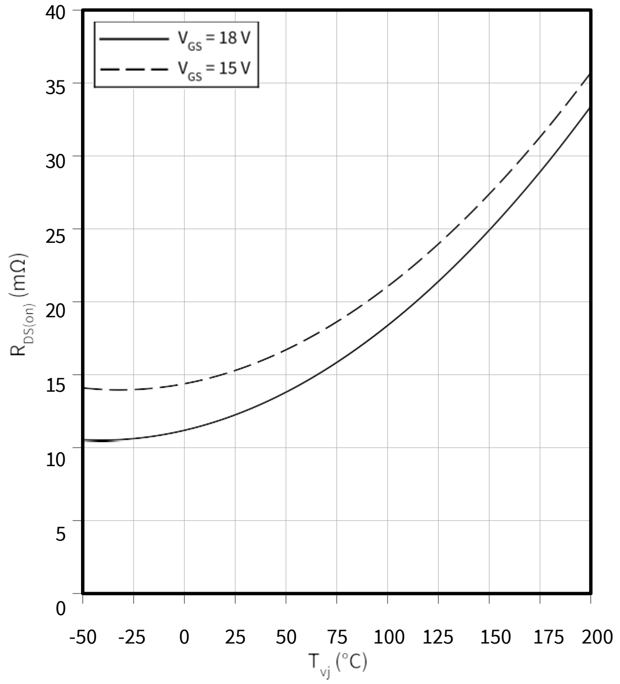
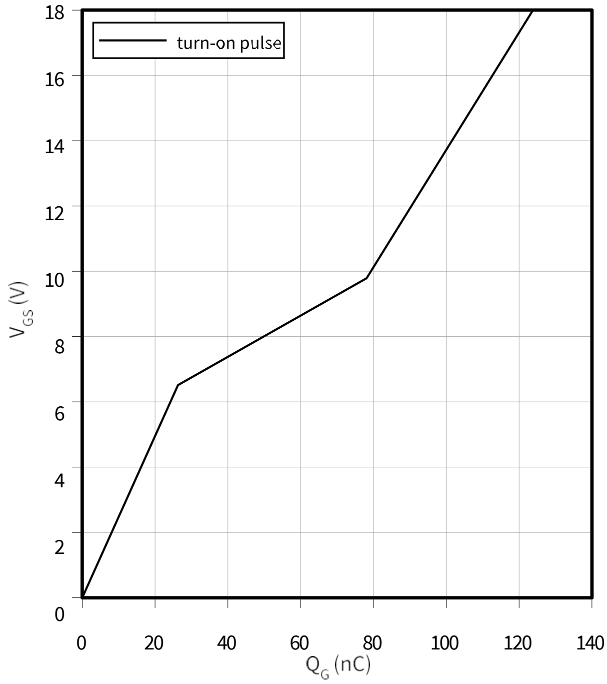
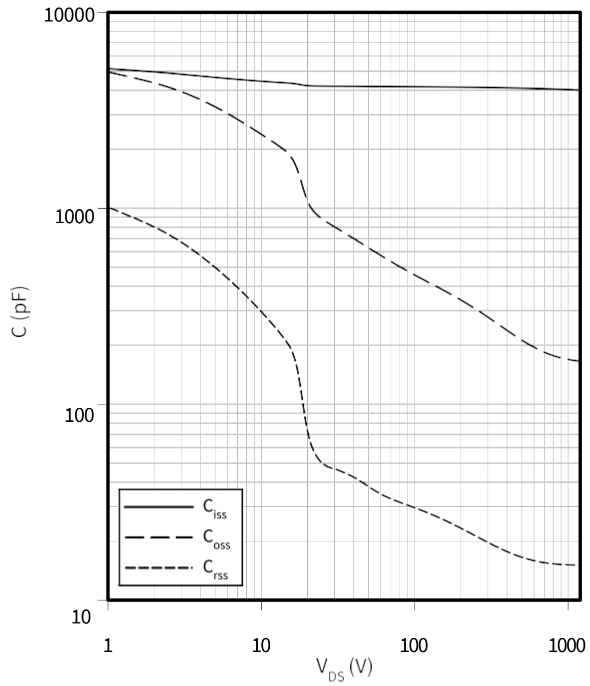
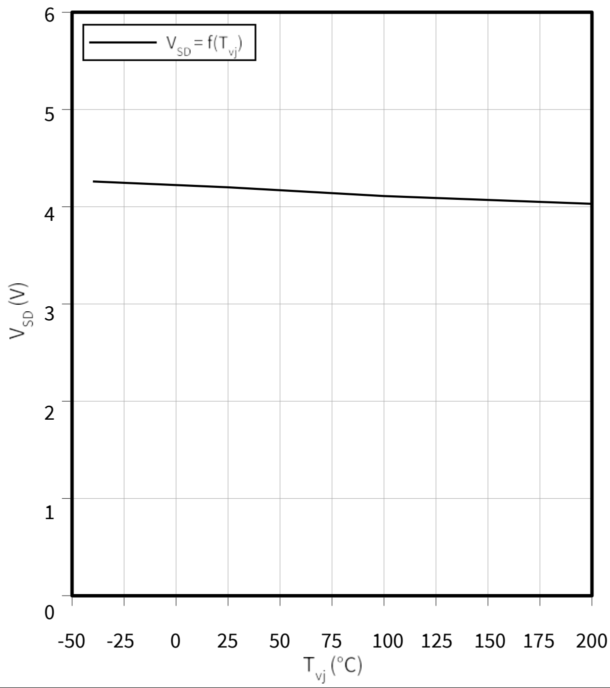


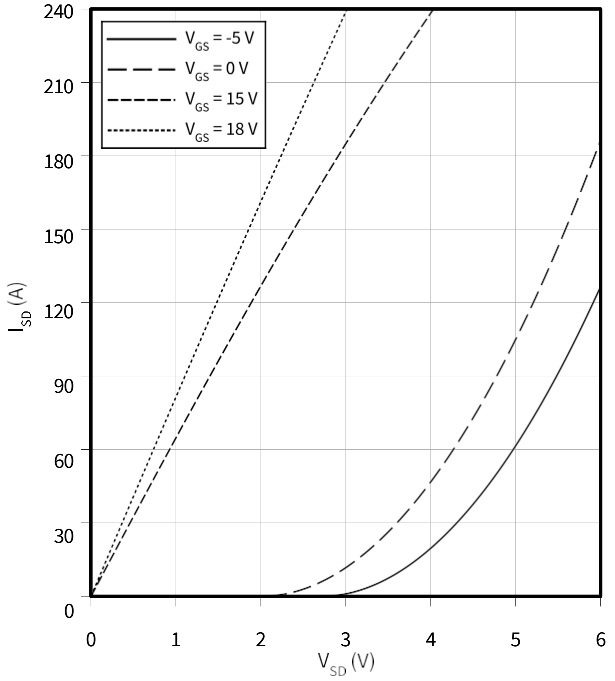
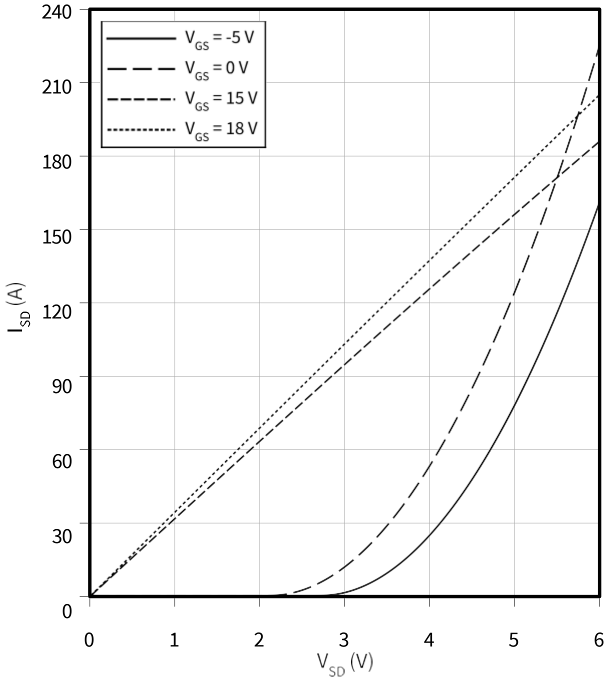
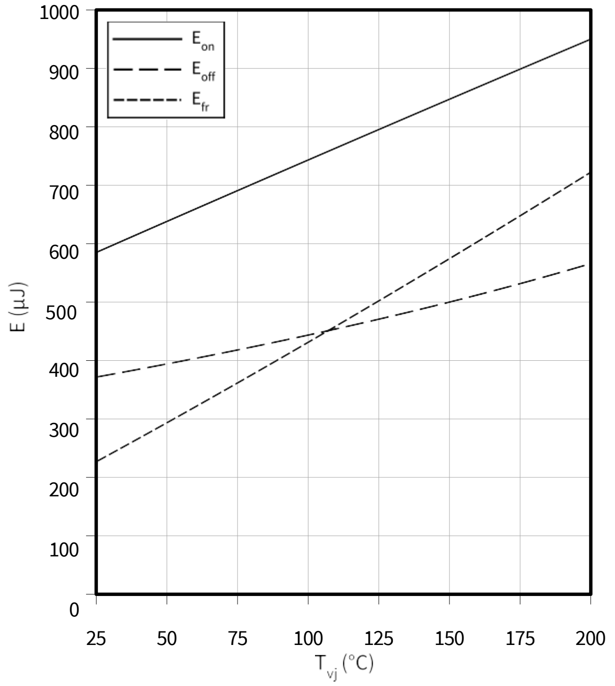
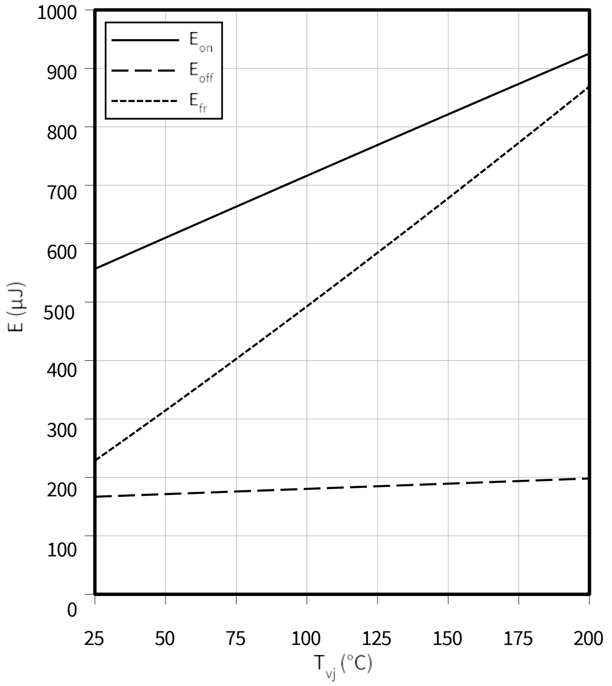
Typical output characteristic, V_{GS} as a parameter

$I_D = f(V_{DS})$

$T_{vj} = 175$ °C, $t_p = 20$ µs



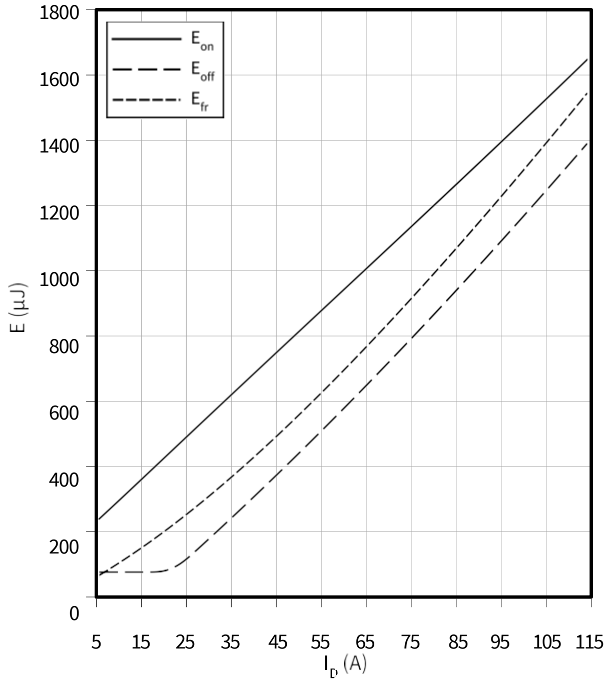
Typical on-state resistance as a function of junction temperature $R_{DS(on)} = f(T_{vj})$ $I_D = 57$ A	**Typical gate charge** $V_{GS} = f(Q_G)$ $I_D = 57$ A, $V_{DS} = 800$ V
	
Typical capacitance as a function of drain-source voltage $C = f(V_{DS})$ f = 100 kHz, $V_{GS} = 0$ V	**Typical reverse drain voltage as a function of junction temperature** $V_{SD} = f(T_{vj})$ $I_{SD} = 57$ A, $V_{GS} = 0$ 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} = 0V $E = f(T_{vj})$ $V_{GS} = 0/18$ V, $I_D = 57$ A, $R_{G,ext} = 2.3$ Ω, $V_{DD} = 800$ V	**Typical switching energy as a function of junction temperature, test circuit in Fig. F, 2nd device own body diode: V_{GS} = -5 V** $E = f(T_{vj})$ $V_{GS} = -5/18$ V, $I_D = 57$ 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

$E = f(I_D)$

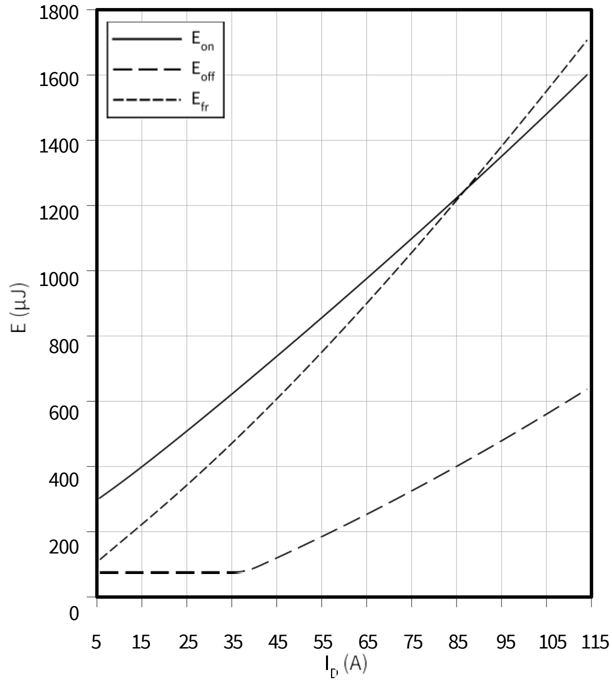
V_{GS} = 0/18 V, T_{vj} = 175 °C, $R_{G,ext}$ = 2.3 Ω, V_{DD} = 800 V



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

$E = f(I_D)$

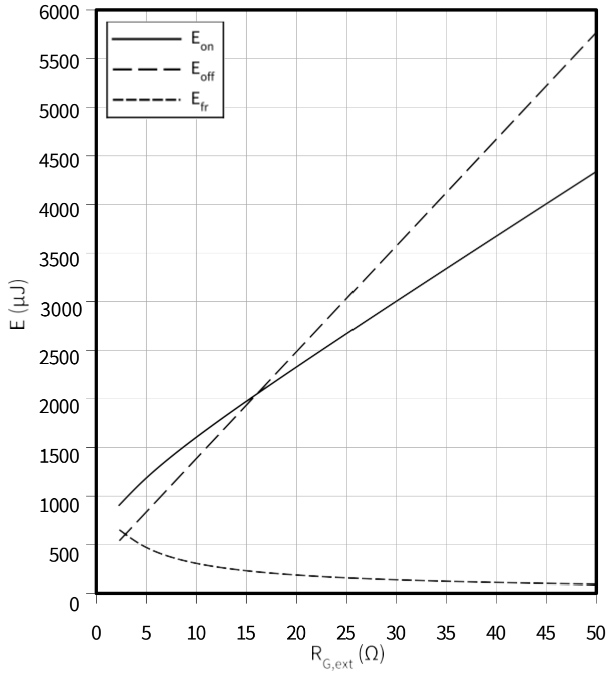
V_{GS} = -5/18 V, T_{vj} = 175 °C, $R_{G,ext}$ = 2.3 Ω, V_{DD} = 800 V



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

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

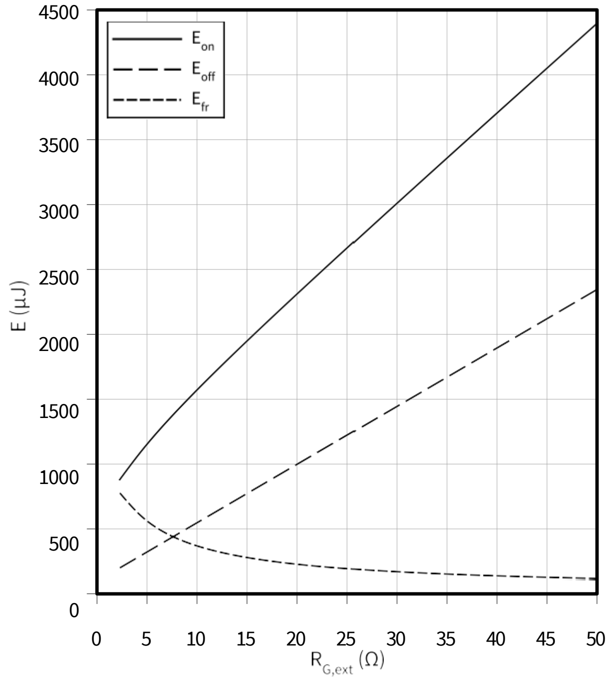
V_{GS} = 0/18 V, I_D = 57 A, T_{vj} = 175 °C, V_{DD} = 800 V



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

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

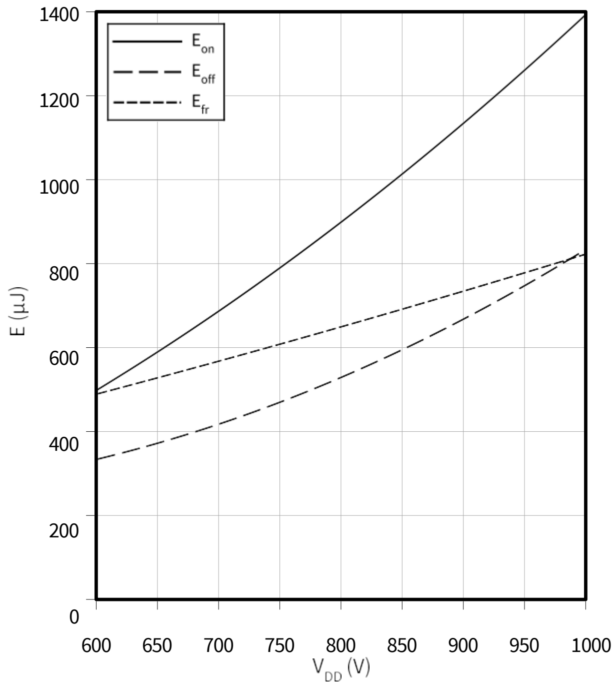
V_{GS} = -5/18 V, I_D = 57 A, T_{vj} = 175 °C, V_{DD} = 800 V



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

$E = f(V_{DD})$

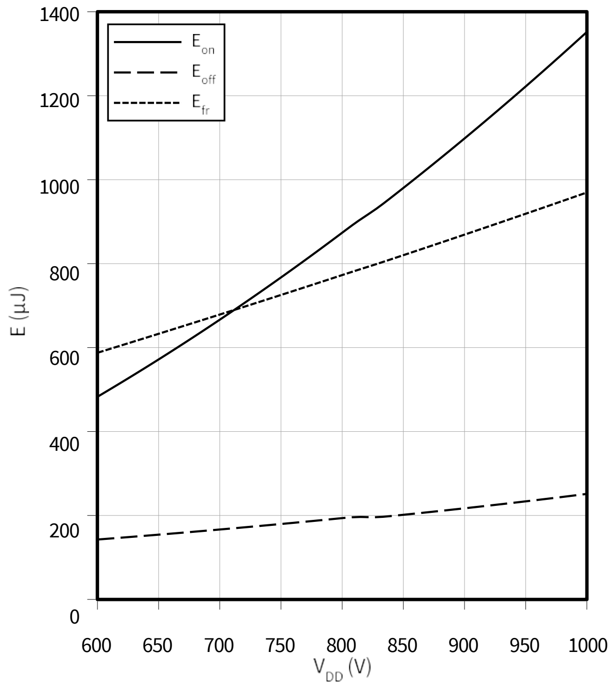
V_{GS} = 0/18 V, I_D = 57 A, T_{vj} = 175 °C, $R_{G,ext}$ = 2.3 Ω



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

$E = f(V_{DD})$

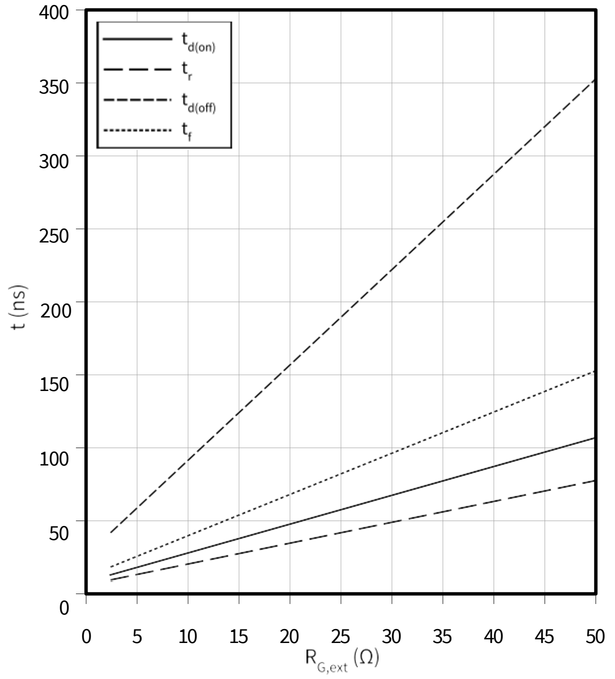
V_{GS} = -5/18 V, I_D = 57 A, T_{vj} = 175 °C, $R_{G,ext}$ = 2.3 Ω



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

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

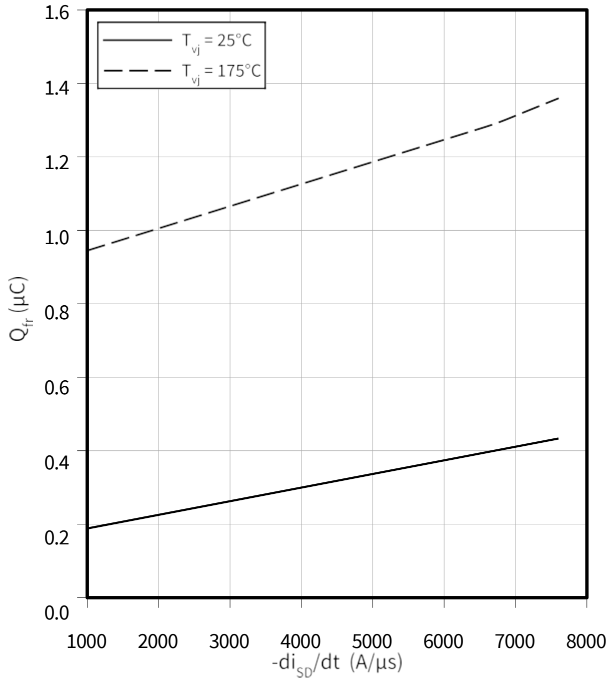
V_{GS} = 0/18 V, I_D = 57 A, T_{vj} = 175 °C, V_{DD} = 800 V



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

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

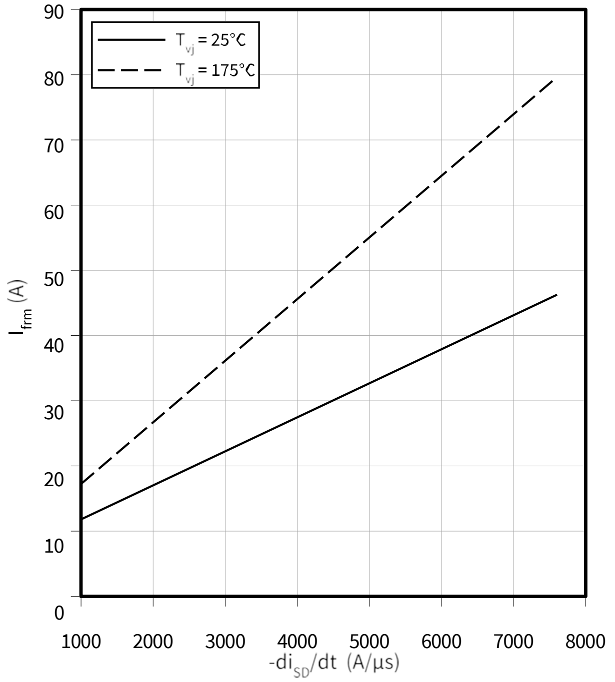
V_{GS} = 0/18 V, I_{SD} = 57 A, V_{DD} = 800 V



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)

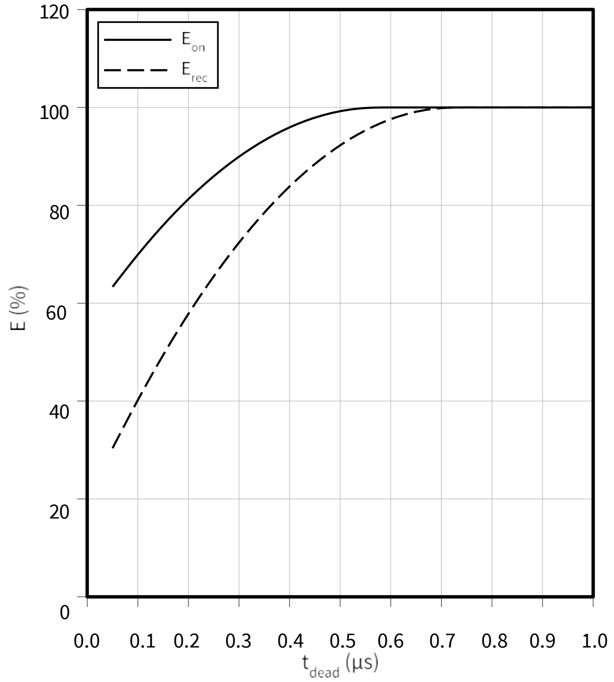
V_{GS} = 0/18 V, I_{SD} = 57 A, V_{DD} = 800 V



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

E = f(t_{dead})

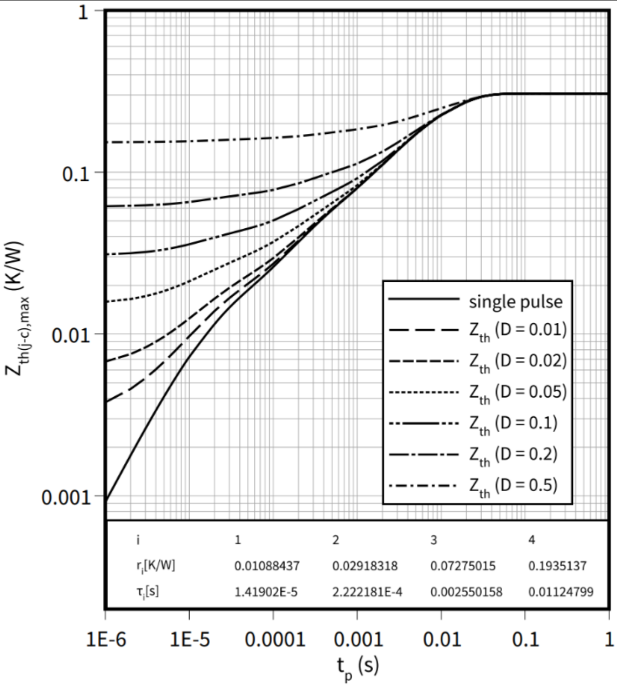
I_D = 57 A, V_{GS} = 0/18 V, T_{vj} = 175 °C, $R_{G,ext}$ = 2.3 Ω V_{DD} = 800 V



Max. transient thermal impedance (MOSFET/diode)

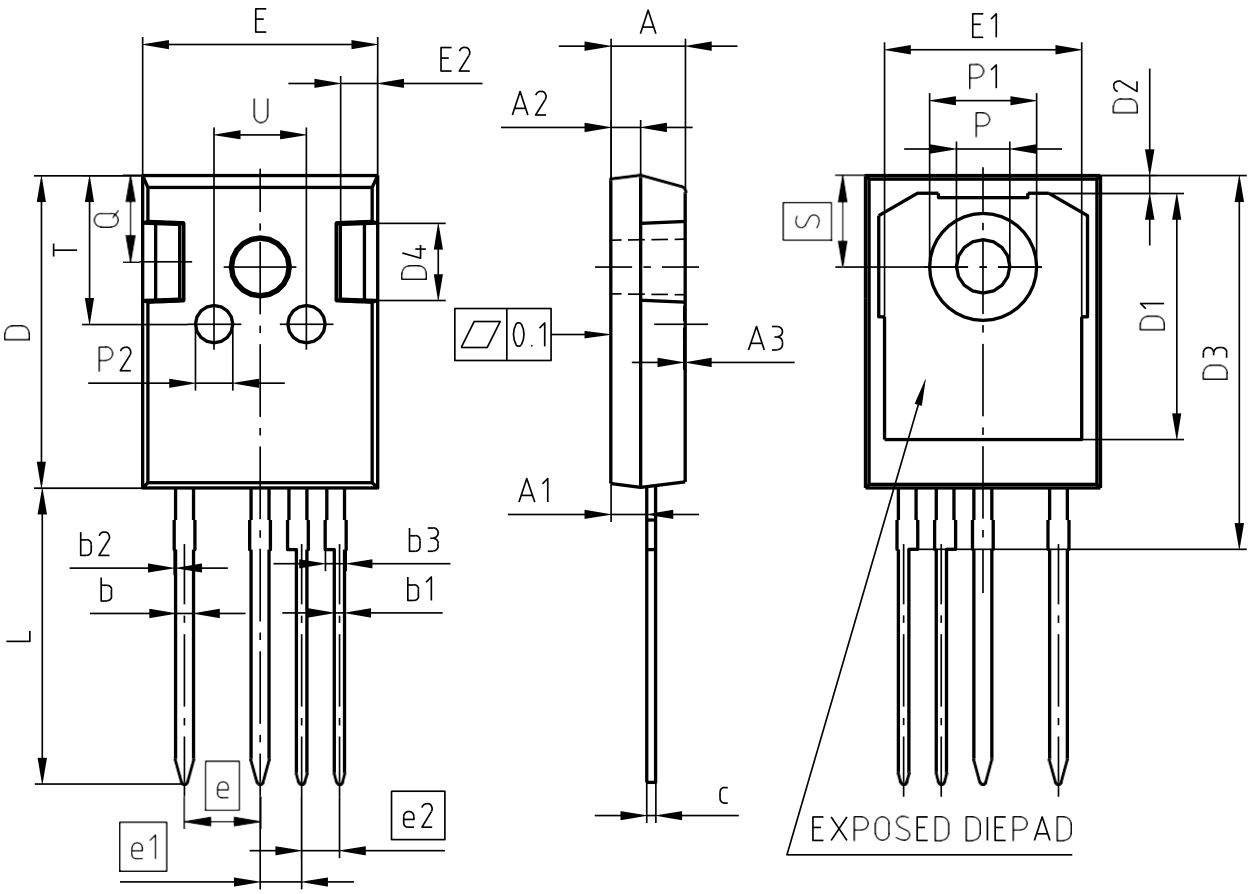
$Z_{th(j-c),max}$ = f(t_p)

D = t_p/T



i	1	2	3	4
r_i[K/W]	0.01088437	0.02918318	0.07275015	0.1935137
$τ_i$[s]	1.41902E-5	2.222181E-4	0.002550158	0.01124799

5 封装外形



NOTES:
ALL DIMENSIONS DO NOT INCLUDE MOLD FLASH
OR PROTRUSIONS.

PACKAGE - GROUP NUMBER:	PG-TO247-4-U02				
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	0.05	0.25	**e**	5.08	
b	1.10	1.30	**e1**	2.79	
b1	0.65	0.79	**e2**	2.54	
b2	---	0.20	**N**	4	
b3	1.34	1.44	**L**	19.80	20.10
c	0.58	0.66	**øP**	3.50	3.70
D	20.90	21.10	**øP1**	7.00	7.40
D1	16.25	16.85	**øP2**	2.40	2.60
D2	1.05	1.35	**Q**	5.60	6.00
D3	24.97	25.27	**S**	6.15	
D4	4.90	5.10	**T**	9.80	10.20
			U	6.00	6.40

图 1

6 测试条件

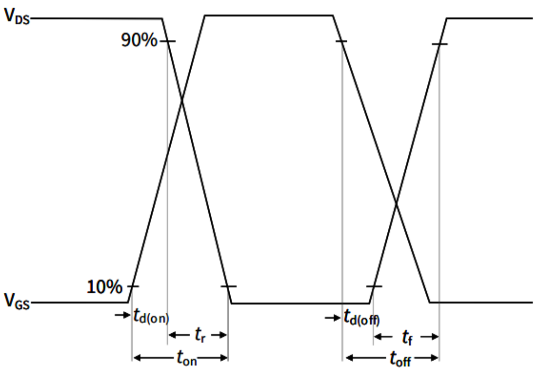


Figure A. **Definition of switching times**

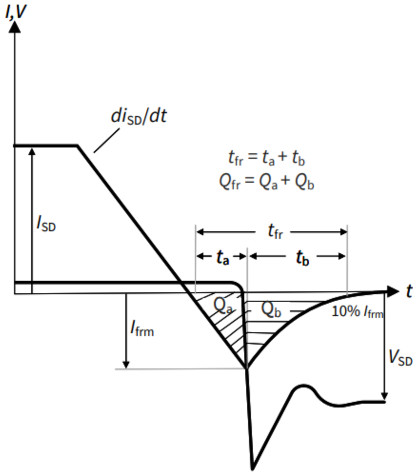


Figure B. **Definition of body diode switching characteristics**

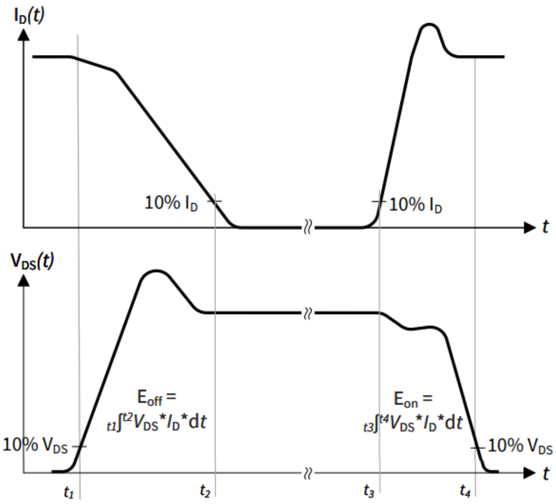


Figure C. **Definition of switching losses**

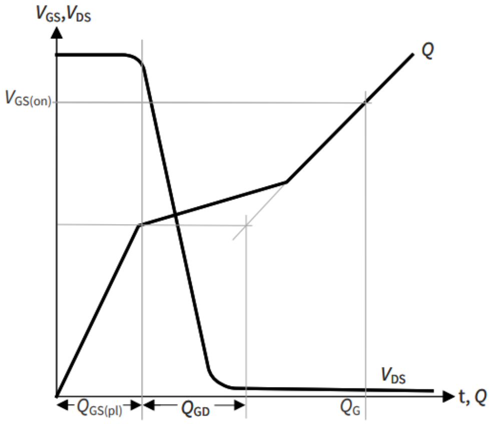


Figure D. **Definition of QGD**

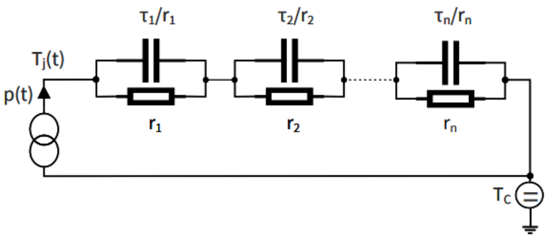


Figure E. **Thermal equivalent circuit**

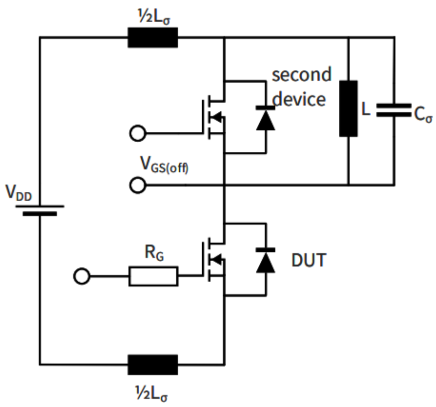


Figure F. **Dynamic test circuit**
Parasitic inductance L_σ,
Parasitic capacitor C_σ,

图 2

修订记录

Document revision	Date of release	Description of changes
0.10	2025-03-24	Preliminary datasheet
1.00	2025-03-25	Final datasheet
1.10	2025-07-04	Increased I_{DM} in Table 2 Added switching information for V_{GS} = -5/18 V in Table 5 and 6 and corresponding diagrams Added I_{SDC} in Table 5 Added SOA diagram on page 8 Added diagram E = f(V_{DD}) @ V_{GS} = 0/18 V Added diagram E = f(V_{DD}) @ V_{GS} = -5/18 V Editorial changes

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