Final datasheet

英飞凌 CoolSiC™ 1400 V SiC MOSFET G2：采用 .XT 互连技术的碳化硅 MOSFET

特性



- T_{vj} = 25°C 时 V_{DSS} = 1400 V
- T_C = 100°C 时 I_{DDC} = 188 A
- $R_{DS(on)}$ = 5.8 mΩ（V_{GS} = 18V、T_{vj} = 25°C 时）
- 开关损耗非常低
- 封装背面可在 260°C 下回流焊接达3 次
- 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
- 适用于大电流能力的宽电源引脚 (2 mm)
- 用于直接母线连接的阻性焊接引脚
- TO247PLUS 封装，具有 10.8 mm 的高爬电距离和 CTI ≥ 600 V
- 合适的英飞凌栅极驱动器可在 https://www.infineon.com/gdfinder 找到

Halogen-free

Green

Lead-free

RoHS

潜在应用

- 商用、建筑和农用车辆（CAV）
- 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）
- 通用驱动器（GPD）

产品验证

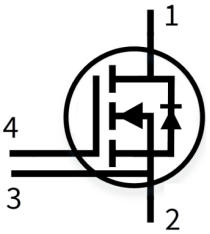
- 符合 JEDEC47/20/22 相关测试的工业应用要求

描述

引脚定义：

- 引脚 1 – 漏极
- 引脚 2 – 源极
- 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
IMYR140R006M2H	PG-TO247-4-U08	14M2H006

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）。

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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
		Reflow soldering (MSL2 according to JEDEC J-STD-020)			260	
Thermal resistance, junction-ambient	$R_{th(j-a)}$				62	K/W
MOSFET/body diode thermal resistance, junction-case	$R_{th(j-c)}$			0.12	0.15	K/W
Comparative Tracking Index	*CTI*	IEC 60112 (material group 1 according to IEC 60664-1)	600			V

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		1400	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	246	A
			$T_c = 100$ °C	188	
Peak drain current, t_p limited by $T_{vj(max)}$ 1)	I_{DM}	$V_{GS} = 18$ V		935	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 voltage2)	V_{GS}			-7...23	V
Avalanche energy, single pulse	E_{AS}	$I_D = 138.2$ A, $V_{DD} = 50$ V, $L = 0.2$ mH, $T_{vj(start)} = 25$ °C		865	mJ
Avalanche energy, repetitive	E_{AR}	$I_D = 138.2$ A, $V_{DD} = 50$ V, $L = 0.9$ µH, $T_{vj(start)} = 25$ °C		4.3	mJ
Short-circuit withstand time	t_{SC}	$V_{DD} \leq 800$ V, $V_{DS,peak} < 1400$ 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	974	W
			$T_c = 100$ °C	487	

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　　推荐值

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 = 138.2 A	T_{vj} = 25 °C, $V_{GS(on)}$ = 18 V		5.8		mΩ
			T_{vj} = 150 °C, $V_{GS(on)}$ = 18 V		12	15.7	
			T_{vj} = 175 °C, $V_{GS(on)}$ = 18 V		14		
			T_{vj} = 25 °C, $V_{GS(on)}$ = 15 V		7		
Gate-source threshold voltage	$V_{GS(th)}$	I_D = 43.5 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} = 1400 V, V_{GS} = 0 V	T_{vj} = 25 °C			1030	µA
			T_{vj} = 175 °C		17.6		
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 = 138.2 A, V_{DS} = 20 V			94		S
Internal gate resistance	$R_{G,int}$	f = 1 MHz, V_{AC} = 25 mV			2.3		Ω
Input capacitance	C_{iss}	V_{DS} = 1000 V, V_{GS} = 0 V, f = 100 kHz, V_{AC} = 25 mV			9590		pF
Output capacitance	C_{oss}	V_{DS} = 1000 V, V_{GS} = 0 V, f = 100 kHz, V_{AC} = 25 mV			336		pF
Reverse transfer capacitance	C_{rss}	V_{DS} = 1000 V, V_{GS} = 0 V, f = 100 kHz, V_{AC} = 25 mV			31		pF
C_{oss} stored energy	E_{oss}	Calculated based on C_{oss} = f(V_{DD})			213		µJ
Output charge	Q_{oss}	Calculated based on C_{oss} = f(V_{DD})			588		nC
Effective output capacitance, energy related	$C_{o(er)}$	V_{DS} = 0...1000 V, V_{GS} = 0 V, Calculated based on E_{oss}			666		pF
Effective output capacitance, time related	$C_{o(tr)}$	I_D = constant, V_{DS} = 0...1000 V, V_{GS} = 0 V, Calculated based on Q_{oss}			735		pF

（表格续下页……）

表 4　　（续）特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Total gate charge	Q_G	V_{DD} = 1000 V, I_D = 138.2 A, V_{GS} = 0/18 V, turn-on pulse			302		nC
Plateau gate charge	$Q_{GS(pl)}$	V_{DD} = 1000 V, I_D = 138.2 A, V_{GS} = 0/18 V, turn-on pulse			100		nC
Gate-drain charge	Q_{GD}	V_{DD} = 1000 V, I_D = 138.2 A, V_{GS} = 0/18 V, turn-on pulse			60		nC
Turn-on delay time	$t_{d(on)}$	V_{DD} = 1000 V, I_D = 138.2 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		31		ns
			T_{vj} = 175 °C		27		
Rise time	t_r	V_{DD} = 1000 V, I_D = 138.2 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		17		ns
			T_{vj} = 175 °C		16		
Turn-off delay time	$t_{d(off)}$	V_{DD} = 1000 V, I_D = 138.2 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		73		ns
			T_{vj} = 175 °C		80		
Fall time	t_f	V_{DD} = 1000 V, I_D = 138.2 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		31		ns
			T_{vj} = 175 °C		34		
Turn-on energy	E_{on}	V_{DD} = 1000 V, I_D = 138.2 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		4040		µJ
			T_{vj} = 175 °C		6010		
Turn-off energy	E_{off}	V_{DD} = 1000 V, I_D = 138.2 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		2950		µJ
			T_{vj} = 175 °C		3400		
Total switching energy[1)]	E_{tot}	V_{DD} = 1000 V, I_D = 138.2 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		7820		µJ
			T_{vj} = 175 °C		12110		

（表格续下页……）

表 4　　（续）特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Turn-on energy at -5 V	E_{on}	V_{DD} = 1000 V, I_D = 138.2 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		4107		µJ
			T_{vj} = 175 °C		6414		
Turn-off energy at -5 V	E_{off}	V_{DD} = 1000 V, I_D = 138.2 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		2148		µJ
			T_{vj} = 175 °C		2261		
Total switching energy at -5 V[1]	E_{tot}	V_{DD} = 1000 V, I_D = 138.2 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		6808		µJ
			T_{vj} = 175 °C		11476		
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，特性均在T_{vj} = 25°C 的条件下测得。

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		1400	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	190	A
			T_c = 100 °C	104.1	
Peak reverse drain current, t_p limited by $T_{vj(max)}$	I_{SM}	V_{GS} = 0 V		564	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} = 138.2 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} = 1000 V, I_{SD} = 138.2 A, V_{GS} = 0 V, $R_{G,ext}$ = 2.3 Ω, Q_{fr} includes also Q_C	T_{vj} = 25 °C		0.84		µC
			T_{vj} = 175 °C		4.36		
MOSFET peak forward recovery current	I_{frm}	V_{DD} = 1000 V, I_{SD} = 138.2 A, V_{GS} = 0 V, $R_{G,ext}$ = 2.3 Ω, Q_{fr} includes also Q_C	T_{vj} = 25 °C		97		A
			T_{vj} = 175 °C		201		
MOSFET forward recovery energy	E_{fr}	V_{DD} = 1000 V, I_{SD} = 138.2 A, V_{GS} = 0 V, $R_{G,ext}$ = 2.3 Ω, Q_{fr} includes also Q_C	T_{vj} = 25 °C		830		µJ
			T_{vj} = 175 °C		2700		
MOSFET forward recovery energy at -5 V	E_{fr}	V_{DD} = 1000 V, I_{SD} = 138.2 A, V_{GS} = -5 V, $R_{G,ext}$ = 2.3 Ω, Q_{fr} includes also Q_C	T_{vj} = 25 °C		553		µJ
			T_{vj} = 175 °C		2801		
Virtual junction temperature	T_{vj}			-55		175	°C
Virtual junction temperature	$T_{vj(over)}$	overload, cumulative max. 100 h[1)]				200	°C

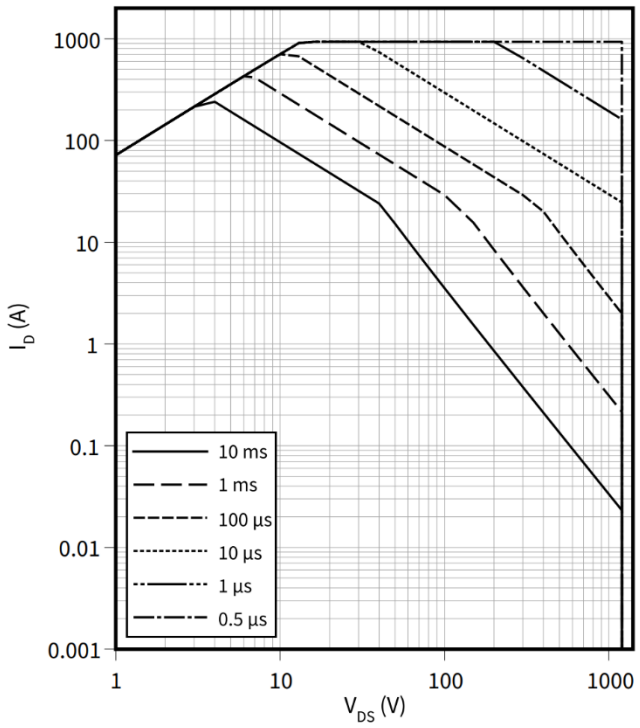
1)　最多 5000 次循环。最大Δ T 限制为 100 K。

4 特性图

Safe operating area (SOA)

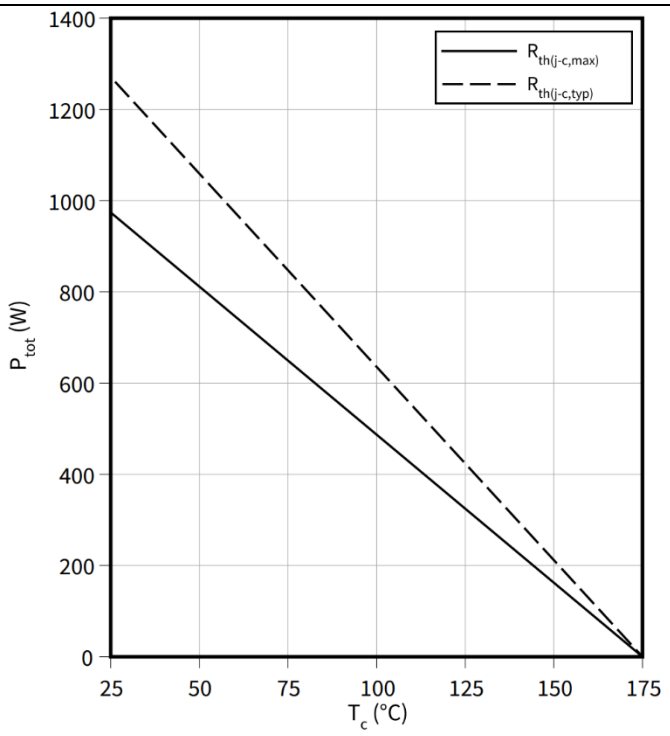
$I_D = f(V_{DS})$

$T_{vj} \leq 175\ °C$, $T_c = 25\ °C$



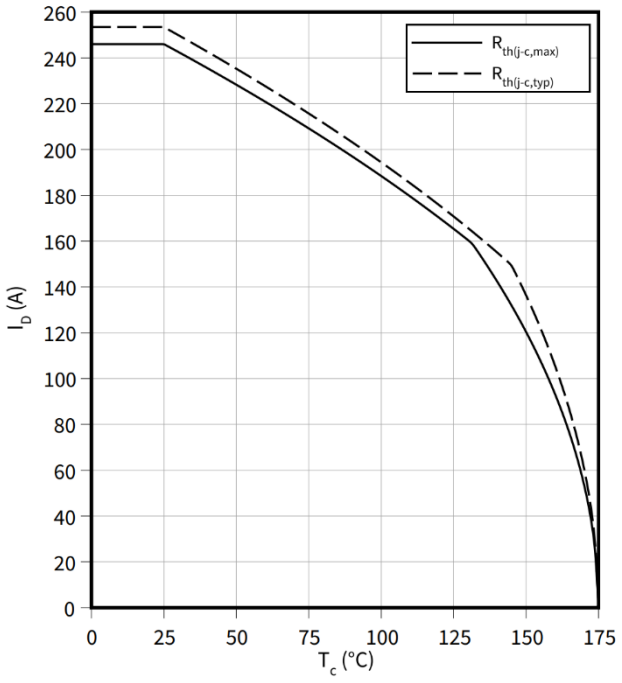
Power dissipation as a function of case temperature limited by bond wire

$P_{tot} = f(T_c)$



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

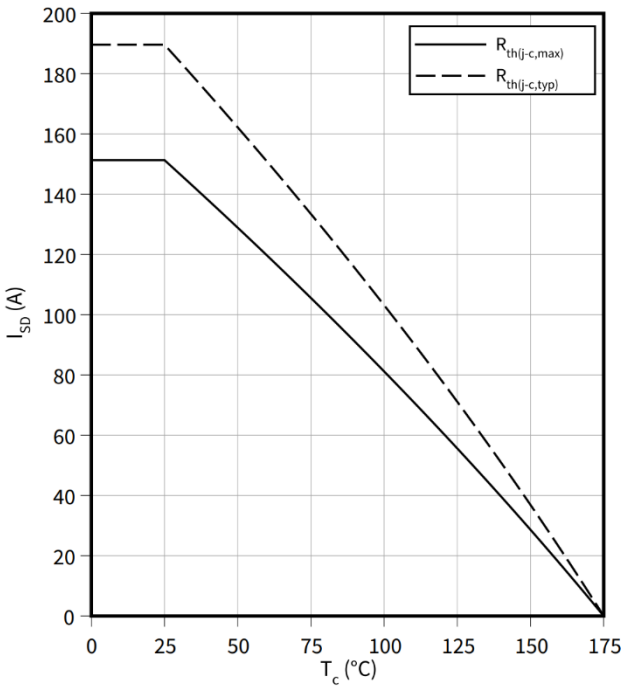
$I_D = f(T_c)$



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

$I_{SD} = f(T_c)$

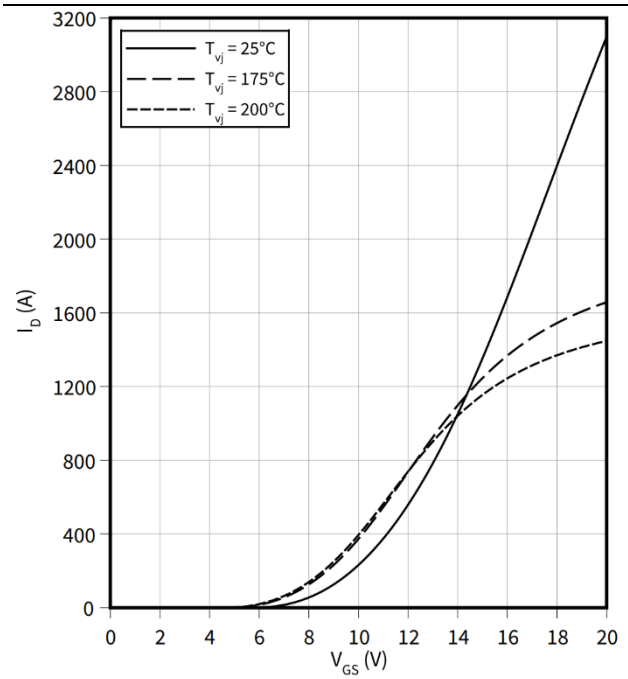
$V_{GS} = 0\ V$



Typical transfer characteristic

$I_D = f(V_{GS})$

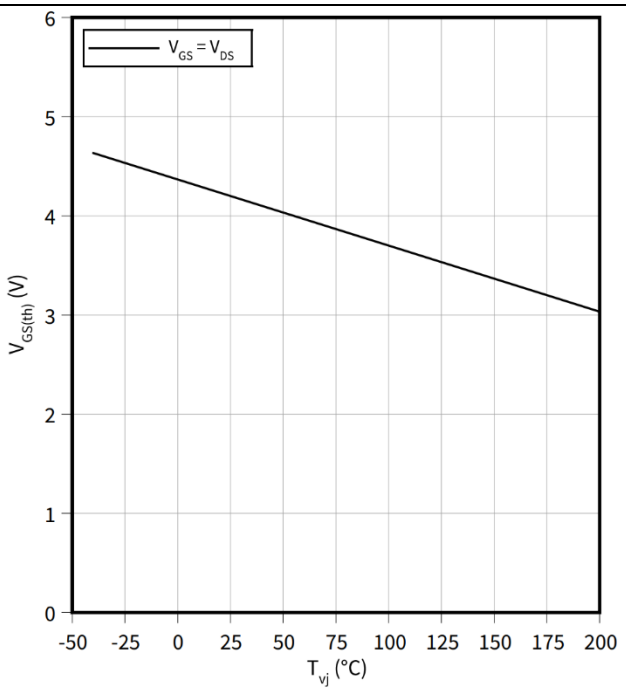
$V_{DS} = 20$ V, $t_p = 20$ µs



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

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

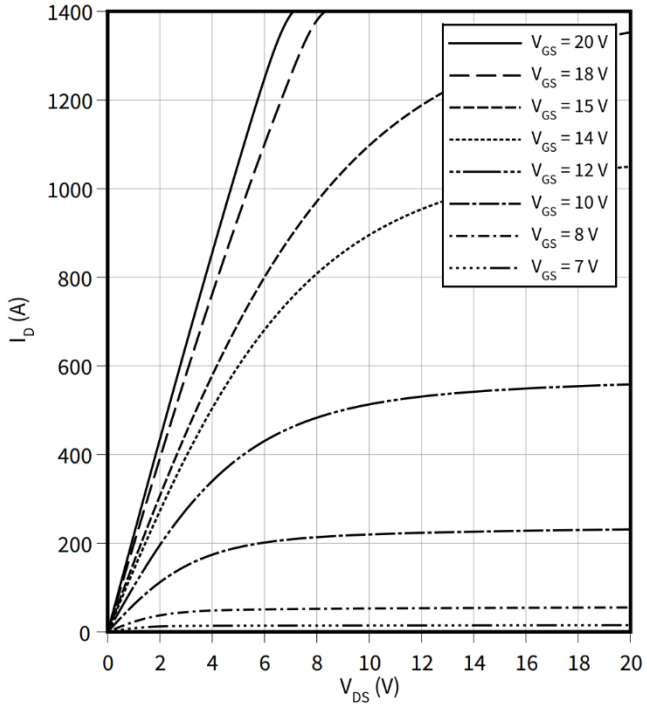
$I_D = 43.5$ mA



Typical output characteristic, V_{GS} as a parameter

$I_D = f(V_{DS})$

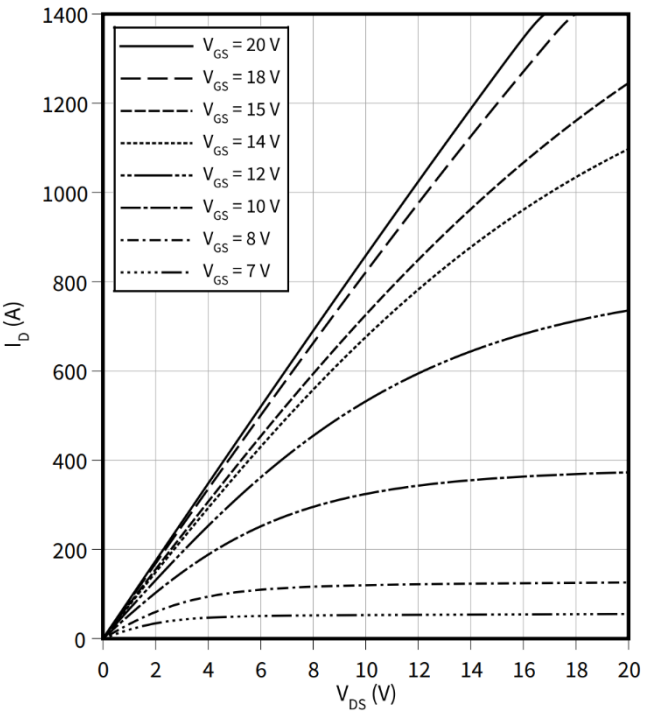
$T_{vj} = 25$ °C, $t_p = 20$ µs



Typical output characteristic, V_{GS} as a parameter

$I_D = f(V_{DS})$

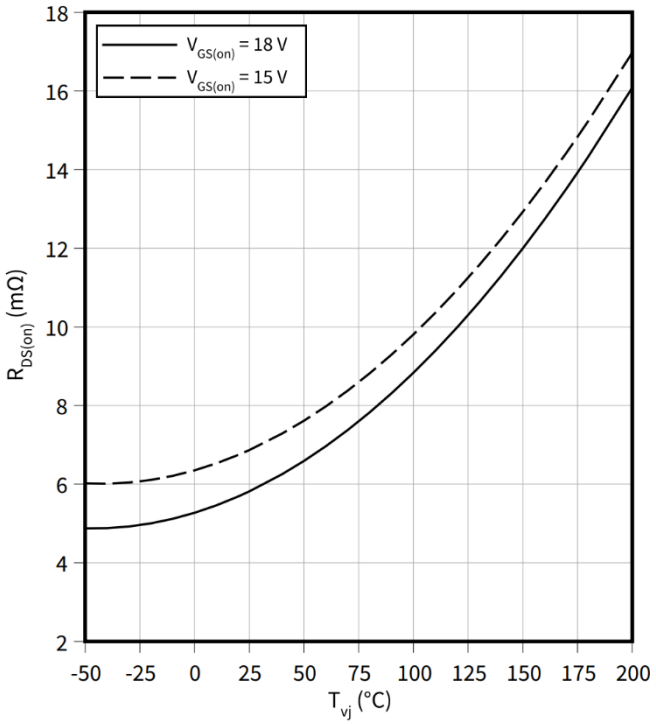
$T_{vj} = 175$ °C, $t_p = 20$ µs



Typical on-state resistance as a function of junction temperature

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

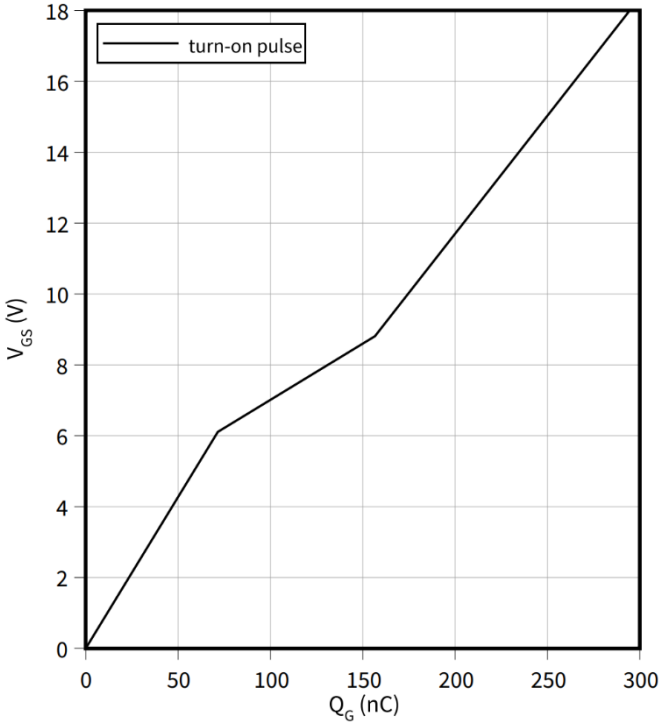
$I_D = 138.2$ A



Typical gate charge

$V_{GS} = f(Q_G)$

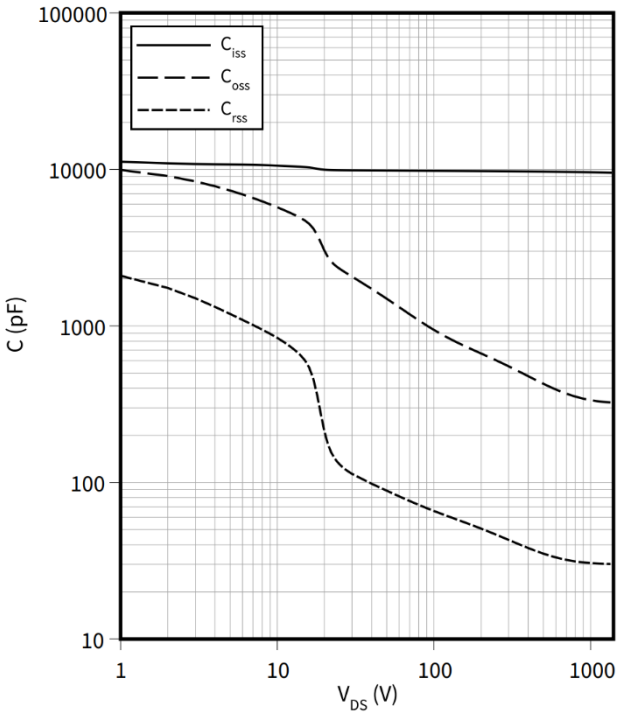
$I_D = 138.2$ A, $V_{DS} = 1000$ V



Typical capacitance as a function of drain-source voltage

$C = f(V_{DS})$

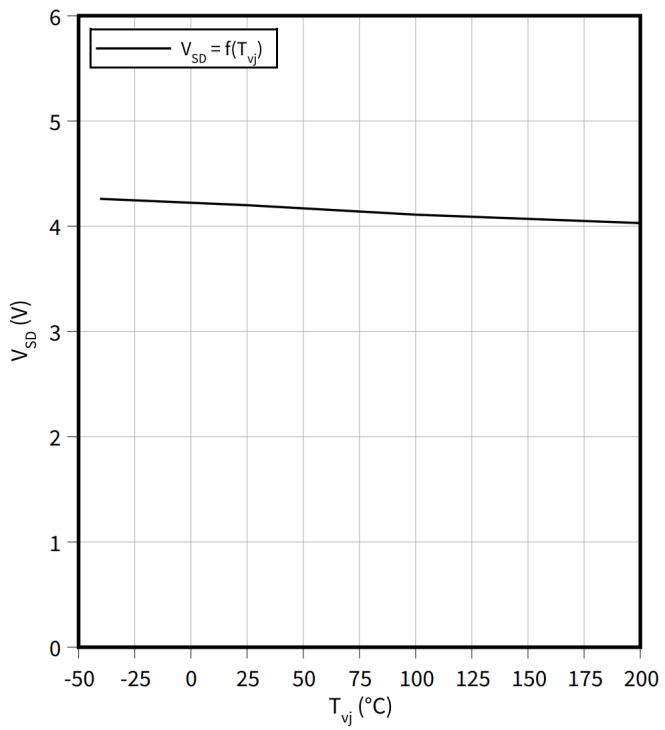
$f = 100$ kHz, $V_{GS} = 0$ V



Typical reverse drain voltage as a function of junction temperature

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

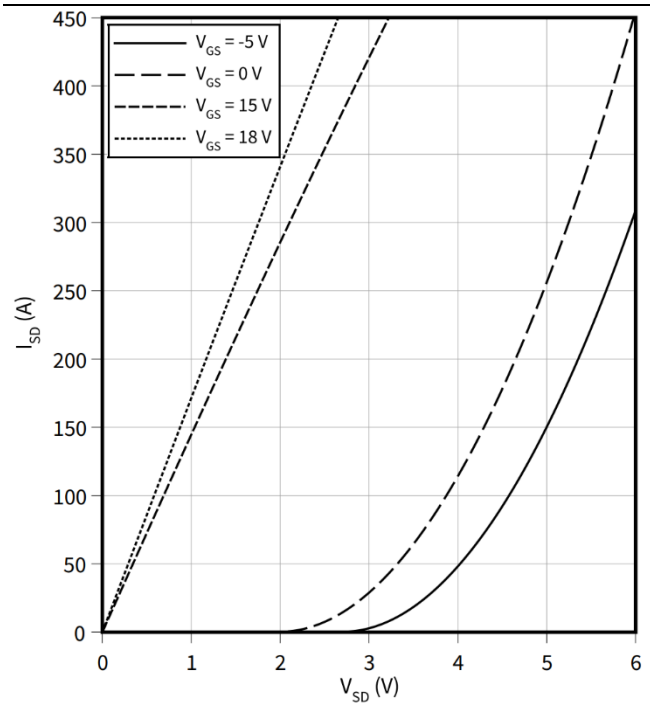
$I_{SD} = 138.2$ A, $V_{GS} = 0$ V



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

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

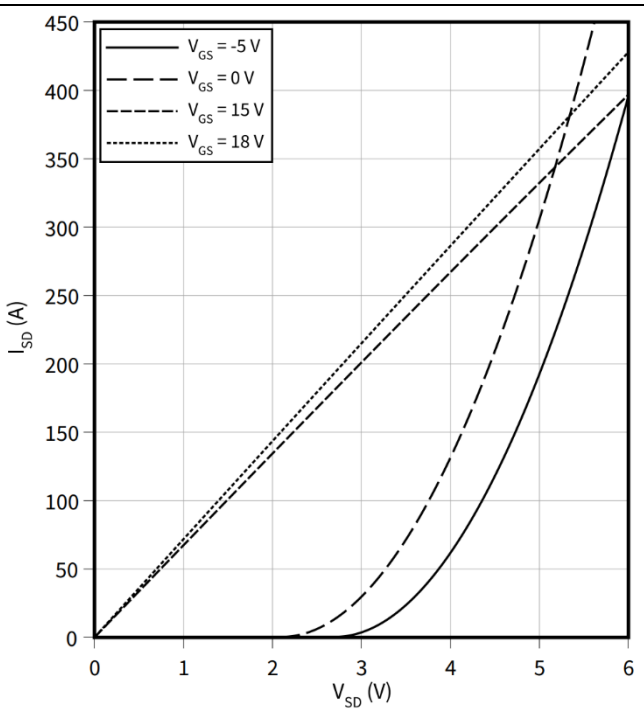
$T_{vj} = 25\ °C$, $t_p = 20\ µs$



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

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

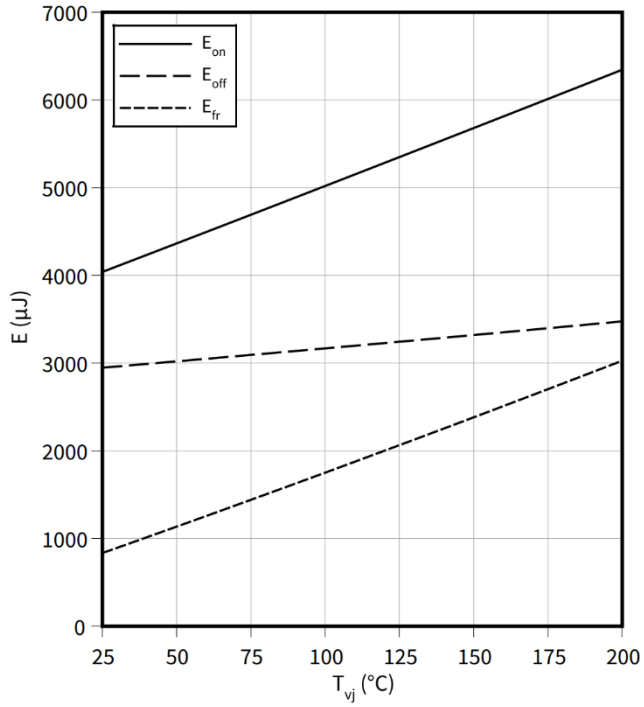
$T_{vj} = 175\ °C$, $t_p = 20\ µs$



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

$E = f(T_{vj})$

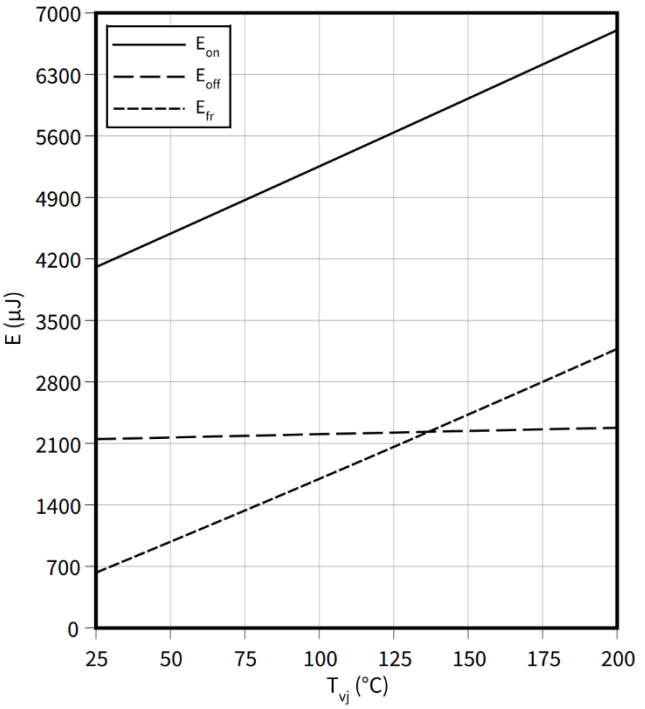
$V_{GS} = 0/18\ V$, $I_D = 138.2\ A$, $R_{G,ext} = 2.3\ Ω$, $V_{DD} = 1000\ V$



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

$E = f(T_{vj})$

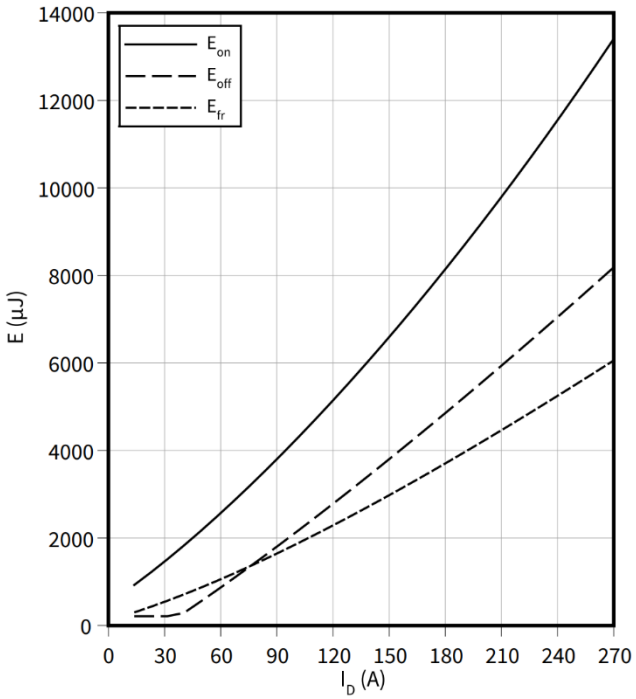
$V_{GS} = -5/18\ V$, $I_D = 138.2\ A$, $R_{G,ext} = 2.3\ Ω$, $V_{DD} = 1000\ V$



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

$E = f(I_D)$

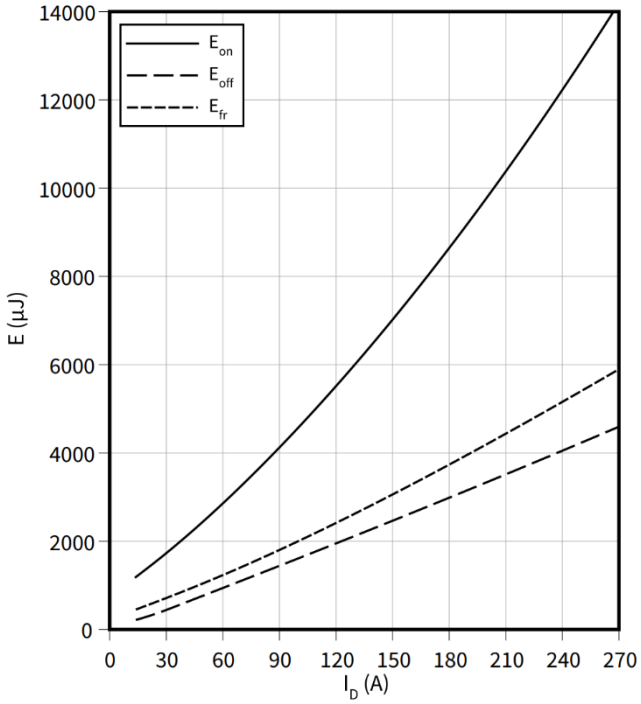
V_{GS} = 0/18 V, T_{vj} = 175 °C, $R_{G,ext}$ = 2.3 Ω, V_{DD} = 1000 V



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

$E = f(I_D)$

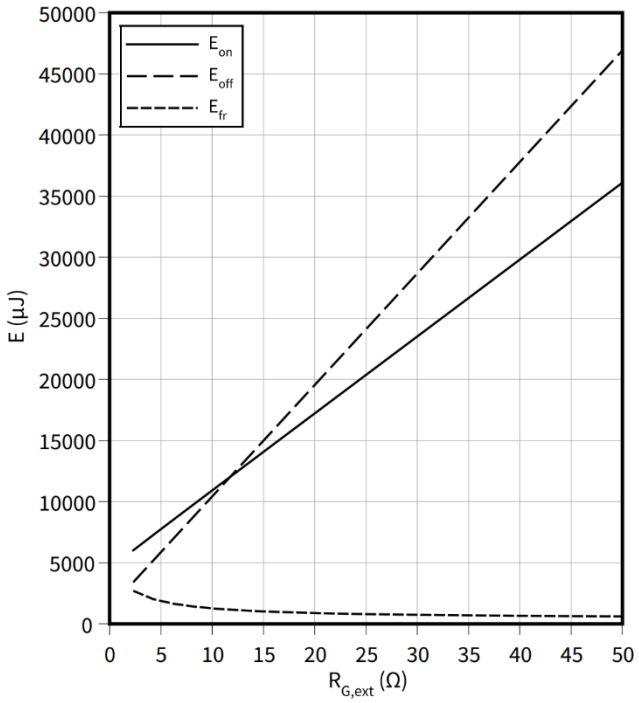
V_{GS} = -5/18 V, T_{vj} = 175 °C, $R_{G,ext}$ = 2.3 Ω, V_{DD} = 1000 V



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

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

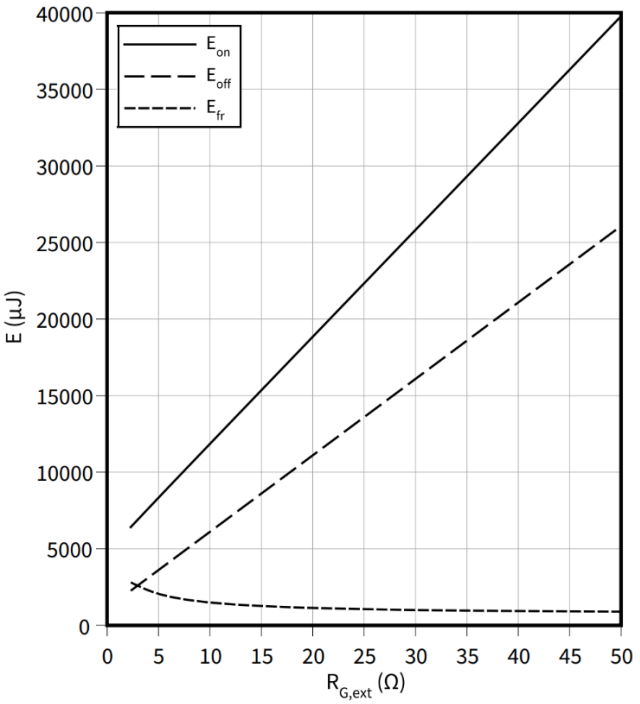
V_{GS} = 0/18 V, I_D = 138.2 A, T_{vj} = 175 °C, V_{DD} = 1000 V



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

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

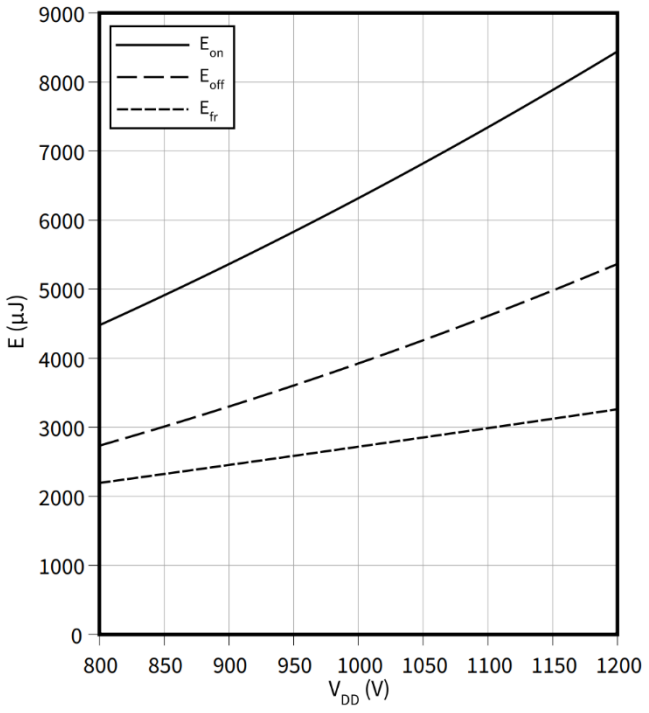
V_{GS} = -5/18 V, I_D = 138.2 A, T_{vj} = 175 °C, V_{DD} = 1000 V



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})

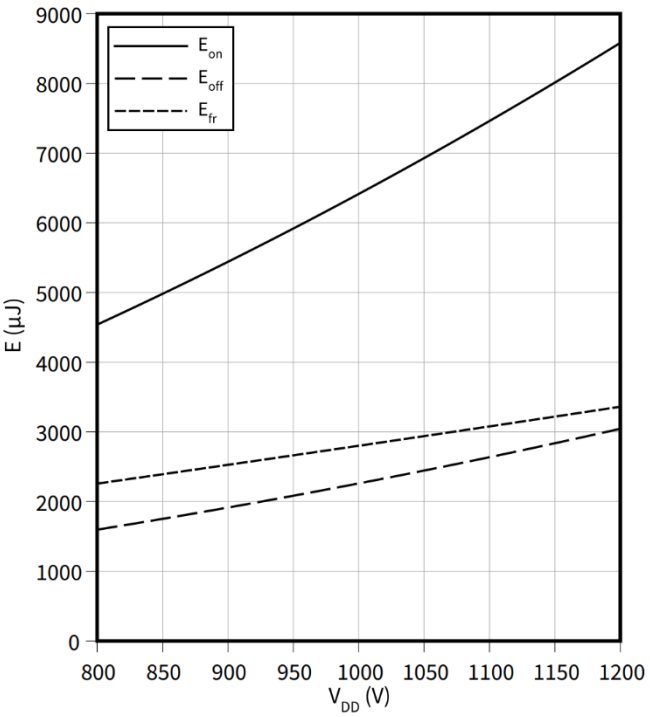
V_{GS} = 0/18 V, I_D = 138.2 A, T_{vj} = 175 °C, $R_{G,ext}$ = 2.3 Ω



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})

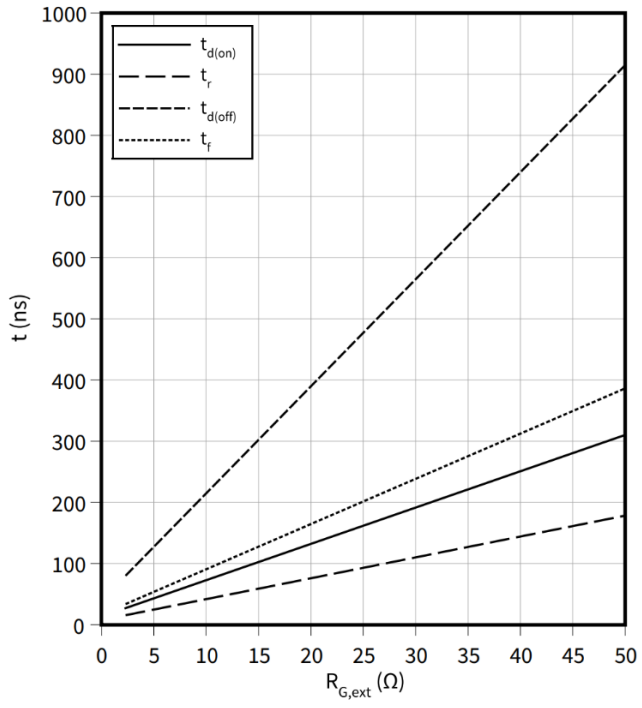
V_{GS} = -5/18 V, I_D = 138.2 A, T_{vj} = 175 °C, $R_{G,ext}$ = 2.3 Ω



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($R_{G,ext}$)

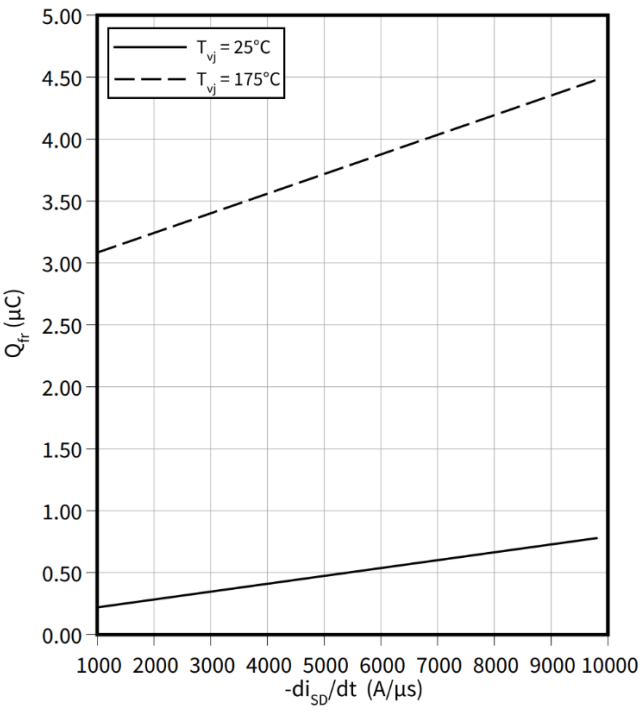
V_{GS} = 0/18 V, I_D = 138.2 A, T_{vj} = 175 °C, V_{DD} = 1000 V



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)

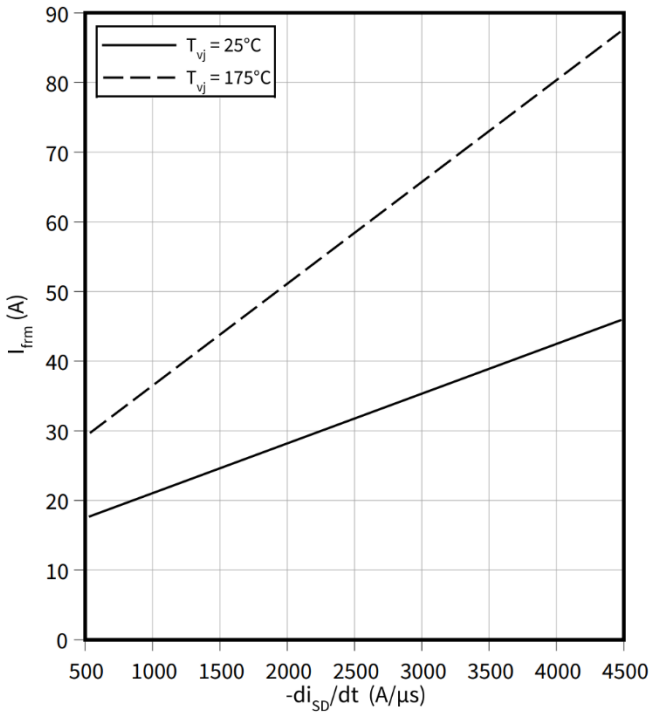
V_{GS} = 0/18 V, I_{SD} = 138.2 A, V_{DD} = 1000 V



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

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

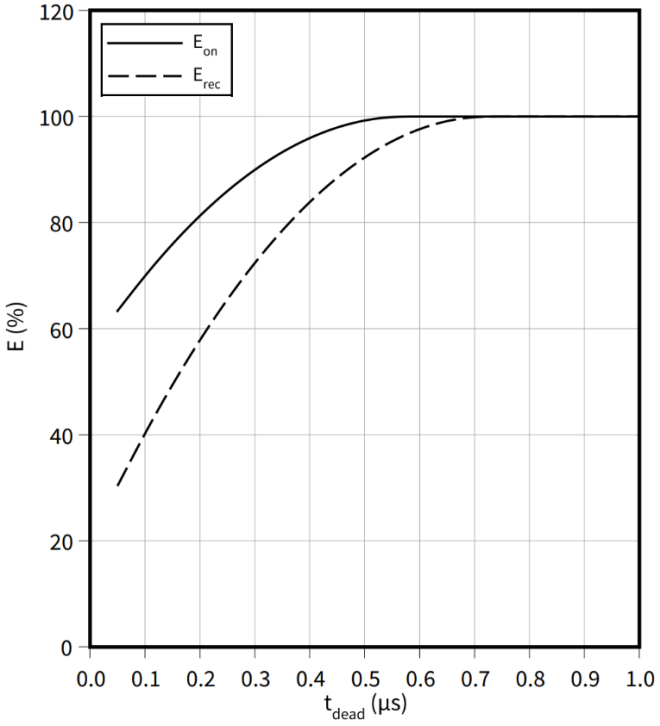
V_{GS} = 0/18 V, I_{SD} = 138.2 A, V_{DD} = 1000 V



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

$E = f(t_{dead})$

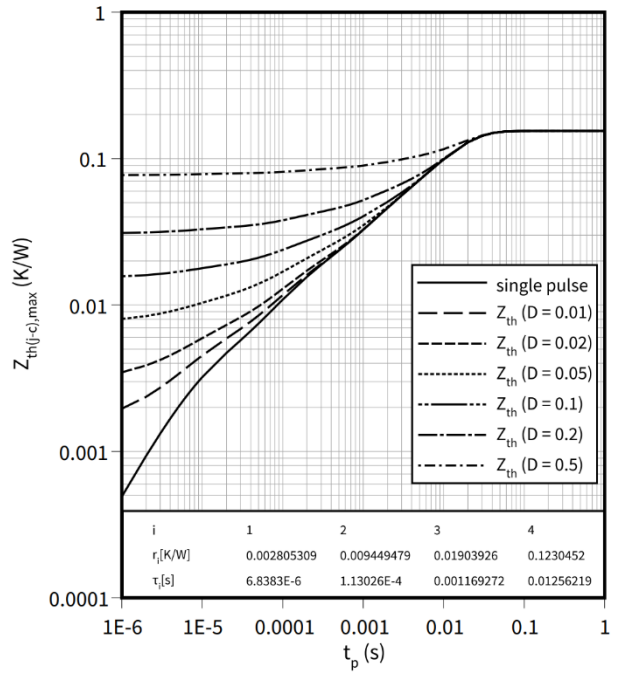
V_{GS} = 0/18 V, I_D = 138.2 A, T_{vj} = 175 °C, $R_{G,ext}$ = 2.3 Ω V_{DD} = 1000 V



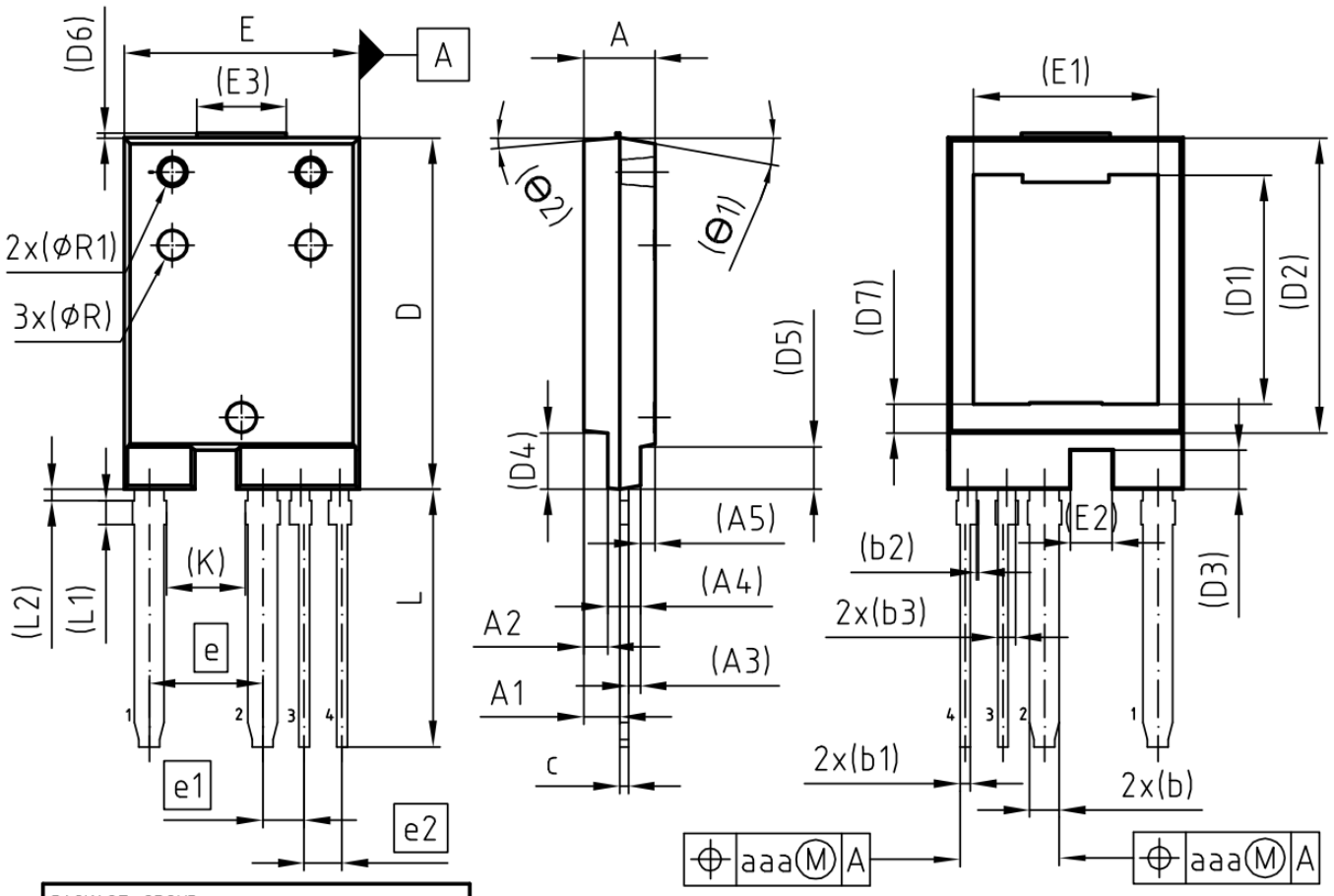
Max. transient thermal impedance (MOSFET/diode)

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

$D = t_p/T$



5 封装外形



PACKAGE - GROUP NUMBER:	PG-TO247-4-U08				
DIMENSIONS	MILLIMETERS		DIMENSIONS	MILLIMETERS	
	MIN.	MAX.		MIN.	MAX.
A	4.70	4.90	E	15.60	16.00
A1	2.23	2.59	E1	12.38	
A2	1.51	1.71	E2	2.80	
A3	0.80		E3	6.00	
A4	2.20		e	7.62	
A5	0.99		e1	2.79	
b	2.00		e2	2.54	
b1	0.70		K	5.32	
b2	—	0.15	L	17.00	17.60
b3	1.20		L1	1.60	
c	0.50	0.70	L2	0.76	
D	23.40	23.80	N	4	
D1	15.39		Θ1	10°	
D2	19.82		Θ2	5°	
D3	2.60		R	2.00	
D4	3.78		R1	2.00	
D5	2.85		aaa	0.25	
D6	—	0.30			
D7	1.92				

NOTES: DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURRS
N IS THE NUMBER OF LEADS

图 1

6 测试条件

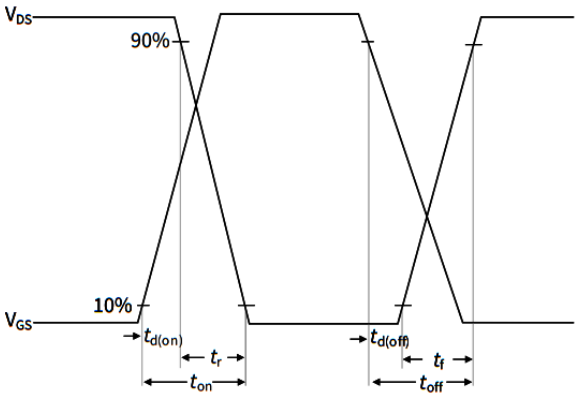


Figure A. **Definition of switching times**

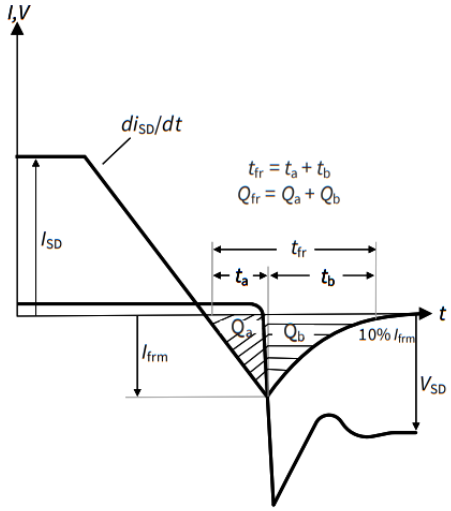


Figure B. **Definition of body diode switching characteristics**

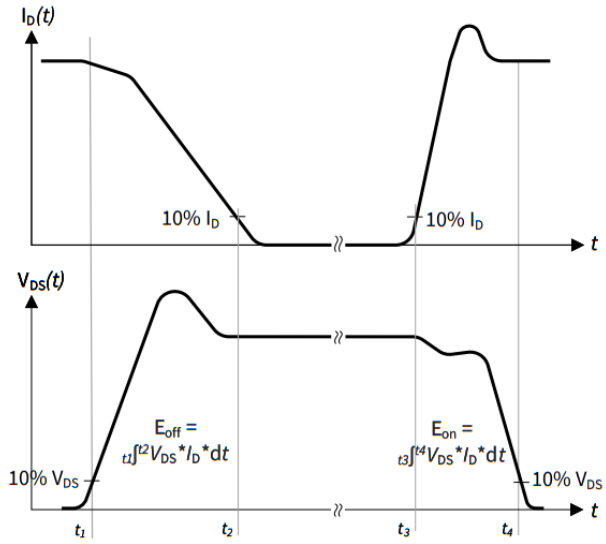


Figure C. **Definition of switching losses**

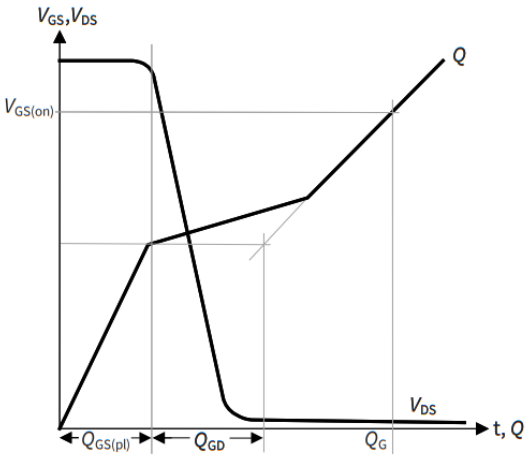


Figure D. **Definition of QGD**

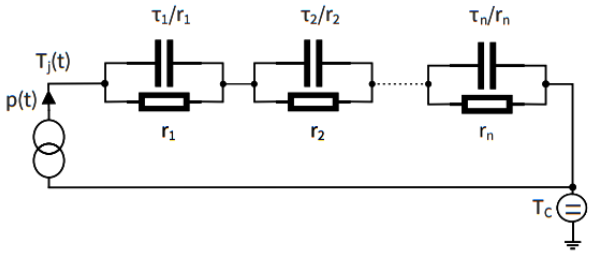


Figure E. **Thermal equivalent circuit**

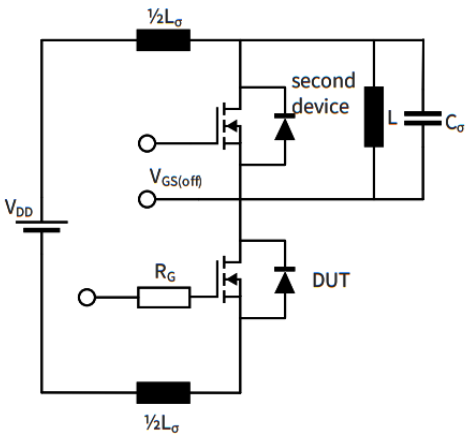


Figure F. **Dynamic test circuit**
Parasitic inductance L_σ,
Parasitic capacitor C_σ,

图 2

修订记录

Document revision	Date of release	Description of changes
1.00	2025-02-27	Final datasheet
1.10	2025-10-13	Added note for CTI information in Table 1 Increased I_{DM} in Table 2 Added switching information for V_{GS} = -5/18 V in Table 4 and 6 and corresponding diagrams Added I_{SDC} in Table 5 Corrected test conditions and adapt values of the body diode in Table 6 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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