

最终数据表

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

特性

- $T_{vj} = 25^{\circ}\text{C}$ 时 $V_{DSS} = 1200\text{ V}$
- $T_C = 100^{\circ}\text{C}$ 时 $I_{DDC} = 62\text{ A}$
- $R_{DS(on)} = 21.6\text{ m}\Omega$ $V_{GS} = 18\text{ V}$ 、 $T_{vj} = 25^{\circ}\text{C}$ 时
- 开关损耗非常低
- 过载运行最高结温可达 $T_{vj} = 200^{\circ}\text{C}$
- 短路耐受时间 $2\text{ }\mu\text{s}$
- 基准栅极阈值电压, $V_{GS(th)} = 4.2\text{ V}$
- 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

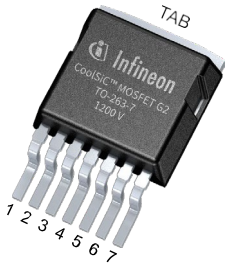
- 符合JEDEC47/20/22相关测试的工业应用要求

描述

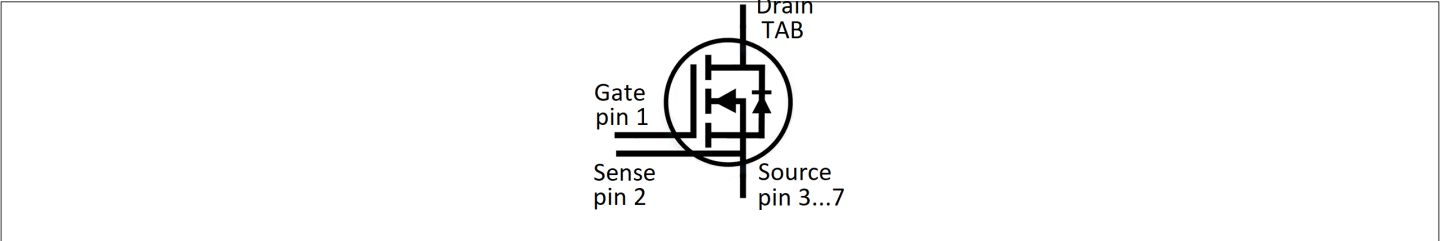
引脚定义:

- 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)



- Halogen-free
- Green
- Lead-free
- RoHS



Type	Package	Marking
IMBG120R022M2H	PG-TO263-7-U01	12M2H022



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1封装

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	$R_{th(j-c)}$			0.3	0.39	K/W

2 MOSFET

表2 最大额定值

Parameter	Symbol	Note or test condition		Values	Unit
Drain-source voltage	V_{DSS}	$T_{vj} \geq 25\text{ °C}$		1200	V
Continuous DC drain current for $R_{th(j-c, max)}$, limited by $T_{vj(max)}$	I_{DDC}	$V_{GS} = 18\text{ V}$	$T_c = 25\text{ °C}$	87	A
			$T_c = 100\text{ °C}$	62	
Peak drain current, t_p limited by $T_{vj(max)}$ ¹⁾	I_{DM}	$V_{GS} = 18\text{ V}$		186	A
Gate-source voltage, max. transient voltage	V_{GS}	$t_p \leq 0.5\text{ }\mu\text{s}$, $D < 0.01$		-10...25	V
Gate-source voltage, max. static voltage ²⁾	V_{GS}			-7...23	V
Avalanche energy, single pulse	E_{AS}	$I_D = 32.1\text{ A}$, $V_{DD} = 50\text{ V}$, $L = 0.8\text{ mH}$		403	mJ
Avalanche energy, repetitive	E_{AR}	$I_D = 32.1\text{ A}$, $V_{DD} = 50\text{ V}$, $L = 3.9\text{ }\mu\text{H}$		2.02	mJ
Short-circuit withstand time	t_{SC}	$V_{DD} \leq 800\text{ V}$, $V_{DS, peak} < 1200\text{ V}$, $V_{GS(on)} = 15\text{ V}$, $T_{vj(start)} = 25\text{ °C}$		2	μs
Power dissipation, limited by $T_{vj(max)}$	P_{tot}		$T_c = 25\text{ °C}$	385	W
			$T_c = 100\text{ °C}$	192	

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	$R_{DS(on)}$	$I_D = 32.1 \text{ A}$		$T_{vj} = 25 \text{ }^\circ\text{C}$, $V_{GS(on)} = 18 \text{ V}$	21.6	mΩ
				$T_{vj} = 150 \text{ }^\circ\text{C}$, $V_{GS(on)} = 18 \text{ V}$	44 59	
				$T_{vj} = 175 \text{ }^\circ\text{C}$, $V_{GS(on)} = 18 \text{ V}$	51	
				$T_{vj} = 25 \text{ }^\circ\text{C}$, $V_{GS(on)} = 15 \text{ V}$	27	
Gate-source threshold voltage	$V_{GS(th)}$	$I_D = 10.1 \text{ mA}$, $V_{DS} = V_{GS}$ (tested after 1 ms pulse at $V_{GS} = 20 \text{ V}$)	3.5	$T_{vj} = 25 \text{ }^\circ\text{C}$	4.2 5.1	V
				$T_{vj} = 175 \text{ }^\circ\text{C}$	3.2	
Zero gate-voltage drain current	I_{DSS}	$V_{DS} = 1200 \text{ V}$, $V_{GS} = 0 \text{ V}$		$T_{vj} = 25 \text{ }^\circ\text{C}$	280	μA
				$T_{vj} = 175 \text{ }^\circ\text{C}$	4.7	
Gate leakage current	I_{GSS}	$V_{DS} = 0 \text{ V}$		$V_{GS} = 23 \text{ V}$	120	nA
				$V_{GS} = -10 \text{ V}$	-120	
Forward transconductance	g_{fs}	$I_D = 32.1 \text{ A}$, $V_{DS} = 20 \text{ V}$		21.5		S
Internal gate resistance	$R_{G,int}$	$f = 1 \text{ MHz}$, $V_{AC} = 25 \text{ mV}$		4.5		Ω
Input capacitance	C_{iss}	$V_{DS} = 800 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 100 \text{ kHz}$, $V_{AC} = 25 \text{ mV}$		2330		pF
Output capacitance	C_{oss}	$V_{DS} = 800 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 100 \text{ kHz}$, $V_{AC} = 25 \text{ mV}$		100		pF
Reverse transfer capacitance	C_{rss}	$V_{DS} = 800 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 100 \text{ kHz}$, $V_{AC} = 25 \text{ mV}$		9		pF
C_{oss} stored energy	E_{oss}	$V_{DS} = 0...800 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 100 \text{ kHz}$, $V_{AC} = 25 \text{ mV}$, Calculated based on C_{oss}		42		μJ
Output charge	Q_{oss}	$V_{DS} = 0...800 \text{ V}$, $V_{GS} = 0 \text{ V}$, Calculated based on C_{oss}		196.3		nC
Effective output capacitance, energy related	$C_{o(er)}$	$V_{DS} = 0...800 \text{ V}$, $V_{GS} = 0 \text{ V}$		131.3		pF
Effective output capacitance, time related	$C_{o(tr)}$	$I_D = \text{constant}$, $V_{DS} = 0...800 \text{ V}$, $V_{GS} = 0 \text{ V}$		245.3		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	$V_{DD} = 800 \text{ V}$, $I_D = 32.1 \text{ A}$, $V_{GS} = -2/18 \text{ V}$, turn-on pulse		71		nC
Plateau gate charge	$Q_{GS(pl)}$	$V_{DD} = 800 \text{ V}$, $I_D = 32.1 \text{ A}$, $V_{GS} = -2/18 \text{ V}$, turn-on pulse		15.1		nC
Gate-to-drain charge	Q_{GD}	$V_{DD} = 800 \text{ V}$, $I_D = 32.1 \text{ A}$, $V_{GS} = -2/18 \text{ V}$, turn-on pulse		19		nC
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 800 \text{ V}$, $I_D = 32.1 \text{ A}$, $V_{GS} = 0/18 \text{ V}$, $R_{GS(on)} = 2.3 \Omega$, $R_{GS(off)} = 2.3 \Omega$, $L_\sigma = 15 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	6		ns
			$T_{vj} = 175 \text{ }^\circ\text{C}$	5.7		
Rise time	t_r	$V_{DD} = 800 \text{ V}$, $I_D = 32.1 \text{ A}$, $V_{GS} = 0/18 \text{ V}$, $R_{GS(on)} = 2.3 \Omega$, $R_{GS(off)} = 2.3 \Omega$, $L_\sigma = 15 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	16.9		ns
			$T_{vj} = 175 \text{ }^\circ\text{C}$	16.5		
Turn-off delay time	$t_{d(off)}$	$V_{DD} = 800 \text{ V}$, $I_D = 32.1 \text{ A}$, $V_{GS} = 0/18 \text{ V}$, $R_{GS(on)} = 2.3 \Omega$, $R_{GS(off)} = 2.3 \Omega$, $L_\sigma = 15 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	11.3		ns
			$T_{vj} = 175 \text{ }^\circ\text{C}$	19.8		
Fall time	t_f	$V_{DD} = 800 \text{ V}$, $I_D = 32.1 \text{ A}$, $V_{GS} = 0/18 \text{ V}$, $R_{GS(on)} = 2.3 \Omega$, $R_{GS(off)} = 2.3 \Omega$, $L_\sigma = 15 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	7.4		ns
			$T_{vj} = 175 \text{ }^\circ\text{C}$	8.7		
Turn-on energy	E_{on}	$V_{DD} = 800 \text{ V}$, $I_D = 32.1 \text{ A}$, $V_{GS} = 0/18 \text{ V}$, $R_{GS(on)} = 2.3 \Omega$, $R_{GS(off)} = 2.3 \Omega$, $L_\sigma = 15 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	267		μJ
			$T_{vj} = 175 \text{ }^\circ\text{C}$	510		
Turn-off energy	E_{off}	$V_{DD} = 800 \text{ V}$, $I_D = 32.1 \text{ A}$, $V_{GS} = 0/18 \text{ V}$, $R_{GS(on)} = 2.3 \Omega$, $R_{GS(off)} = 2.3 \Omega$, $L_\sigma = 15 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	64		μJ
			$T_{vj} = 175 \text{ }^\circ\text{C}$	94		

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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}	$V_{\text{DD}} = 800 \text{ V}$, $I_{\text{D}} = 32.1 \text{ A}$, $V_{\text{GS}} = 0/18 \text{ V}$, $R_{\text{GS(on)}} = 2.3 \Omega$, $R_{\text{GS(off)}} = 2.3 \Omega$, $L_{\sigma} = 15 \text{ nH}$, diode: body diode at $V_{\text{GS}} = 0 \text{ V}$	$T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$ $T_{\text{vj}} = 175 \text{ }^{\circ}\text{C}$		401 794		μJ
Virtual junction temperature	T_{vj}			-55		175	$^{\circ}\text{C}$
Virtual junction temperature	$T_{\text{vj(over)}}$	overload, cumulative max. 100 h ²⁾				200	$^{\circ}\text{C}$

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 $T_{\text{vj}} = 25^{\circ}\text{C}$ 。

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}	$T_{\text{vj}} \geq 25 \text{ }^{\circ}\text{C}$	1200	V
Peak reverse drain current, t_{p} limited by $T_{\text{vj(max)}}$	I_{SM}	$V_{\text{GS}} = 0 \text{ V}$	82	A

表6 特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Drain-source reverse voltage	V_{SD}	$I_{\text{SD}} = 32.1 \text{ A}$, $V_{\text{GS}} = 0 \text{ V}$	$T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$		4.2	5.5	V
			$T_{\text{vj}} = 100 \text{ }^{\circ}\text{C}$		4.11		
			$T_{\text{vj}} = 175 \text{ }^{\circ}\text{C}$		4.05		
MOSFET forward recovery charge	Q_{fr}	$V_{\text{DD}} = 800 \text{ V}$, $I_{\text{SD}} = 32.1 \text{ A}$, $V_{\text{GS}} = 0 \text{ V}$, $-di_{\text{SD}}/dt = 1000 \text{ A}/\mu\text{s}$, Q_{fr} includes also Q_{C}	$T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$		0.34		μC
			$T_{\text{vj}} = 175 \text{ }^{\circ}\text{C}$		0.62		
MOSFET peak forward recovery current	I_{frm}	$V_{\text{DD}} = 800 \text{ V}$, $I_{\text{SD}} = 32.1 \text{ A}$, $V_{\text{GS}} = 0 \text{ V}$, $-di_{\text{SD}}/dt = 1000 \text{ A}/\mu\text{s}$, Q_{fr} includes also Q_{C}	$T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$		9.1		A
			$T_{\text{vj}} = 175 \text{ }^{\circ}\text{C}$		13		

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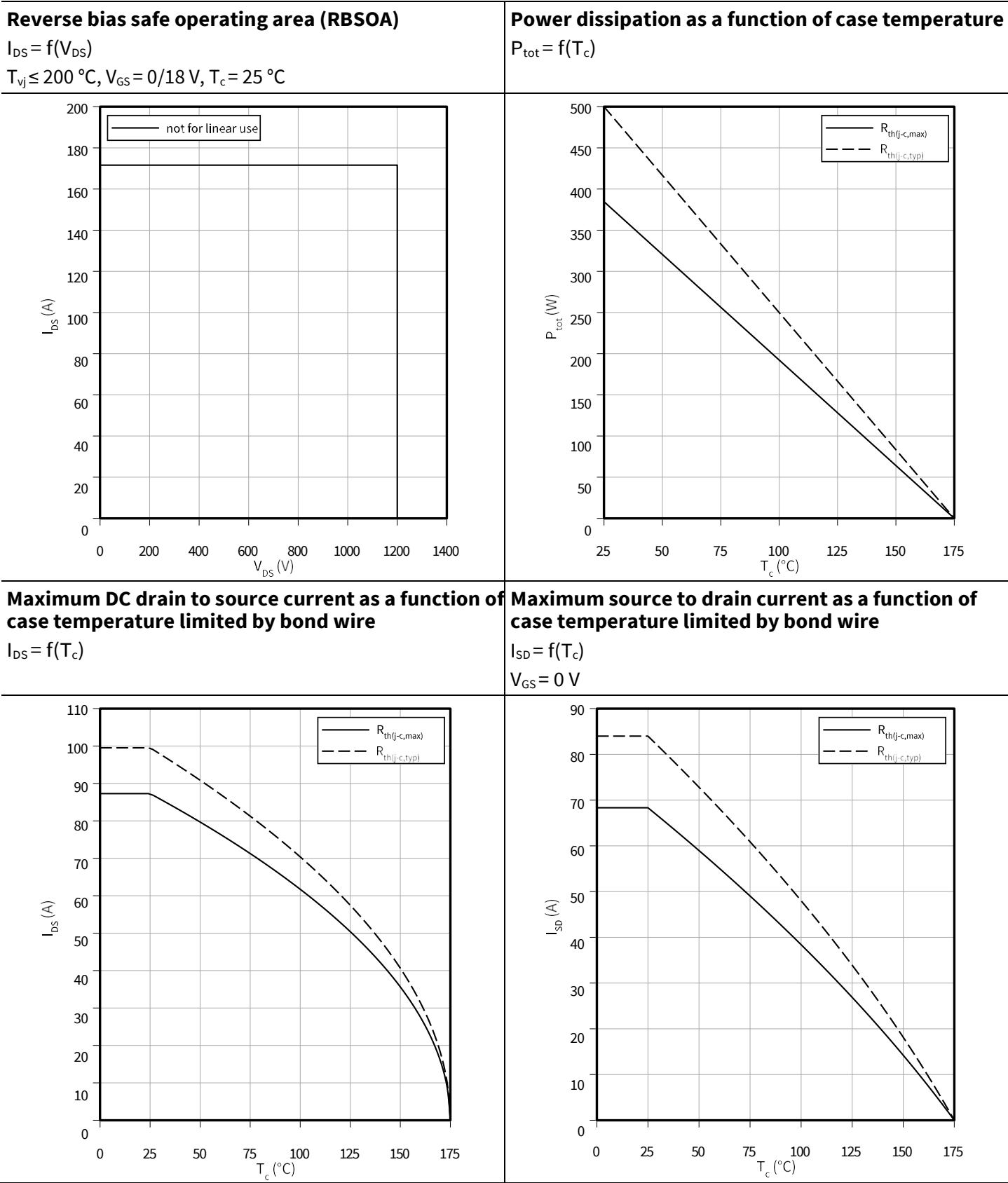


表 6（续）特征值

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
MOSFET forward recovery energy	E_{fr}	$V_{DD} = 800\text{ V}$, $I_{SD} = 32.1\text{ A}$, $V_{GS} = 0\text{ V}$, $-di_{SD}/dt = 1000\text{ A}/\mu\text{s}$, Q_{fr} includes also Q_C	$T_{vj} = 25\text{ °C}$		70		μJ
			$T_{vj} = 175\text{ °C}$		190		
Virtual junction temperature	T_{vj}			-55		175	$^{\circ}\text{C}$
Virtual junction temperature	$T_{vj(over)}$	overload, cumulative max. 100 h ¹⁾				200	$^{\circ}\text{C}$

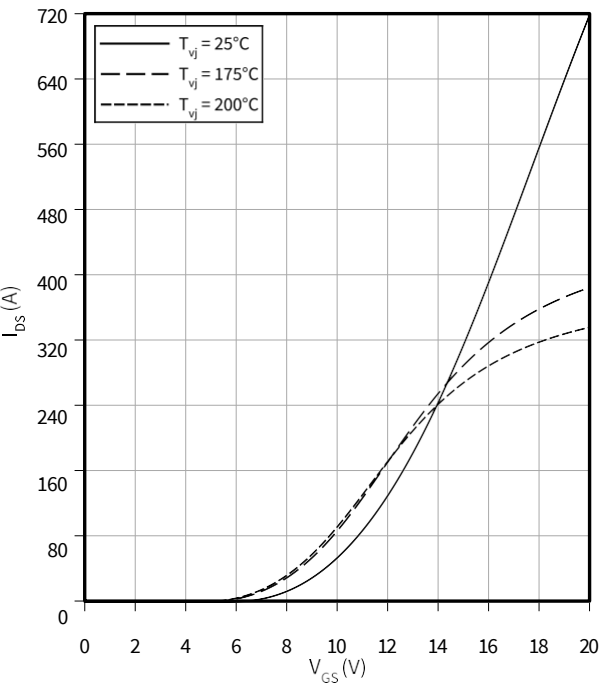
1) 最多 5000 次循环。最大Δ T 限制为 100 K。

4 特性图



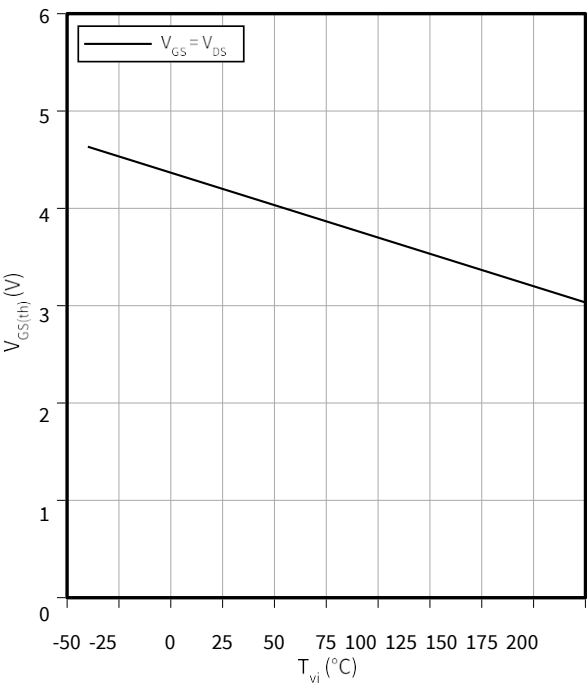
Typical transfer characteristic

$I_{DS} = f(V_{GS})$
 $V_{DS} = 20\text{ V}$, $t_p = 20\text{ }\mu\text{s}$



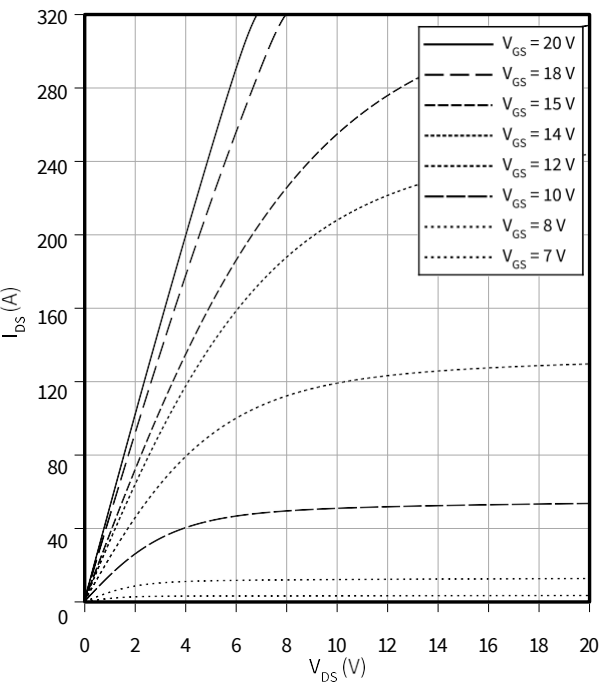
Typical gate-source threshold voltage as a function of junction temperature

$V_{GS(th)} = f(T_{vj})$
 $I_D = 10.1\text{ mA}$



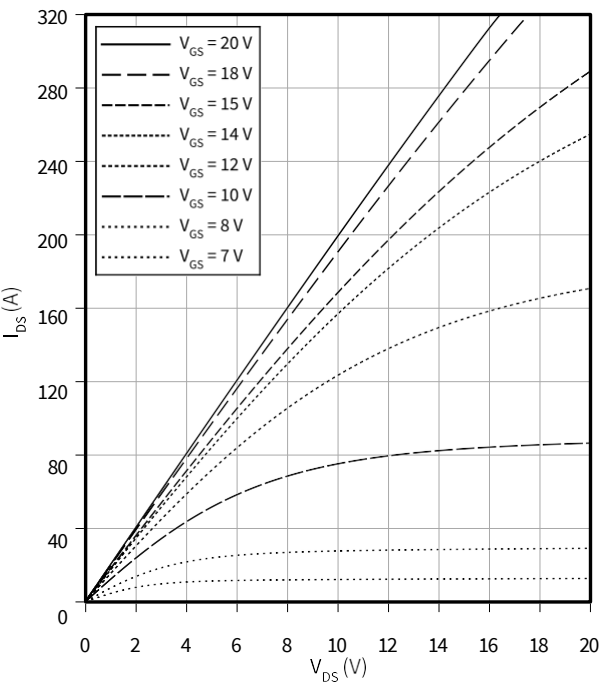
Typical output characteristic, V_{GS} as parameter

$I_{DS} = f(V_{DS})$
 $T_{vj} = 25\text{ }^\circ\text{C}$, $t_p = 20\text{ }\mu\text{s}$



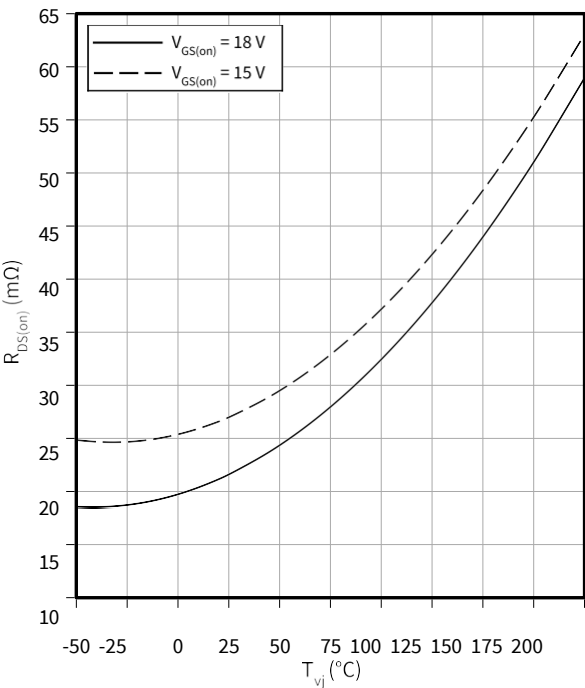
Typical output characteristic, V_{GS} as parameter

$I_{DS} = f(V_{DS})$
 $T_{vj} = 175\text{ }^\circ\text{C}$, $t_p = 20\text{ }\mu\text{s}$



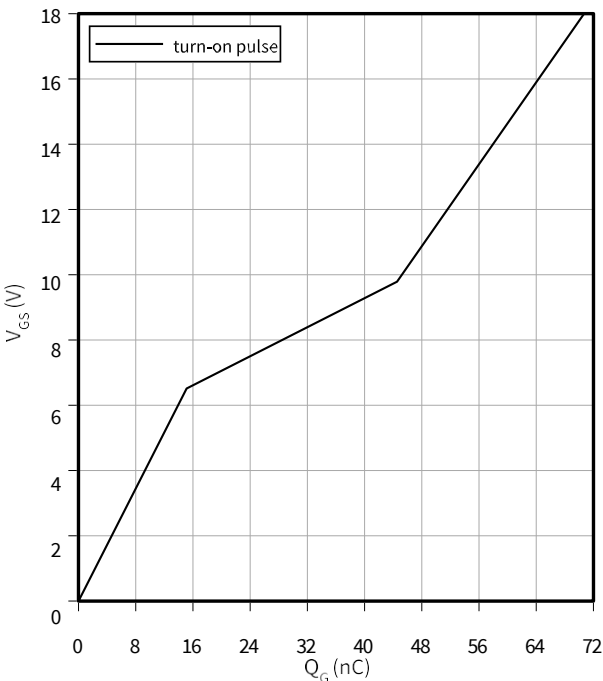
Typical on-state resistance as a function of junction temperature

$R_{DS(on)} = f(T_{vj})$
 $I_D = 32.1\text{ A}$



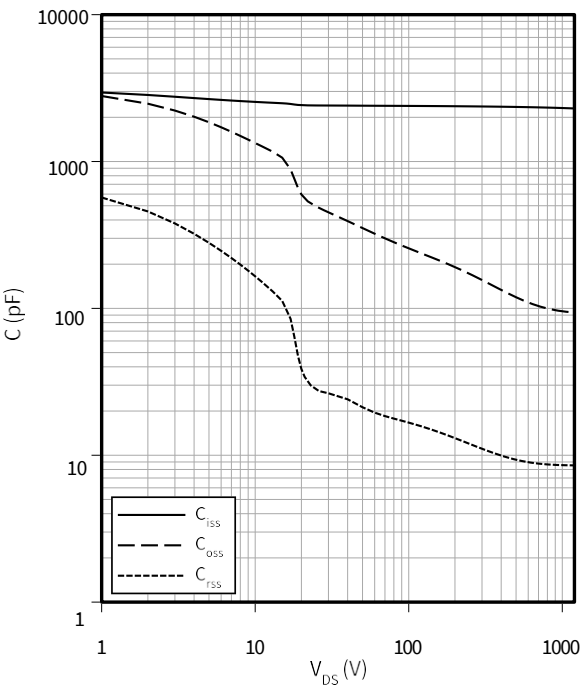
Typical gate charge

$V_{GS} = f(Q_G)$
 $I_D = 32.1\text{ A}, V_{DS} = 800\text{ V}$



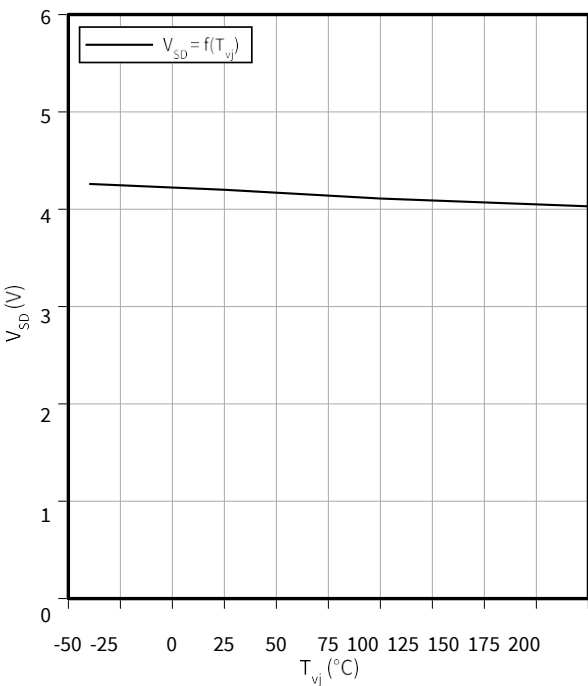
Typical capacitance as a function of drain-source voltage

$C = f(V_{DS})$
 $f = 100\text{ kHz}, V_{GS} = 0\text{ V}$



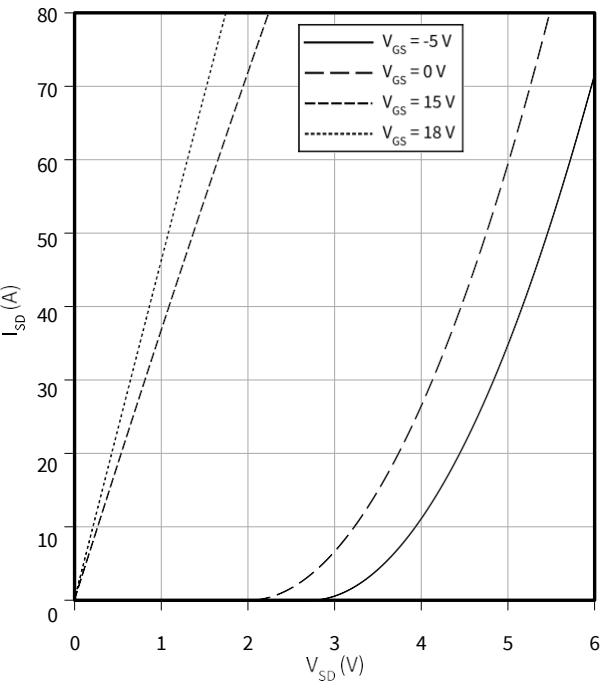
Typical reverse drain voltage as function of junction temperature

$V_{SD} = f(T_{vj})$
 $I_{SD} = 32.1\text{ A}, V_{GS} = 0\text{ V}$



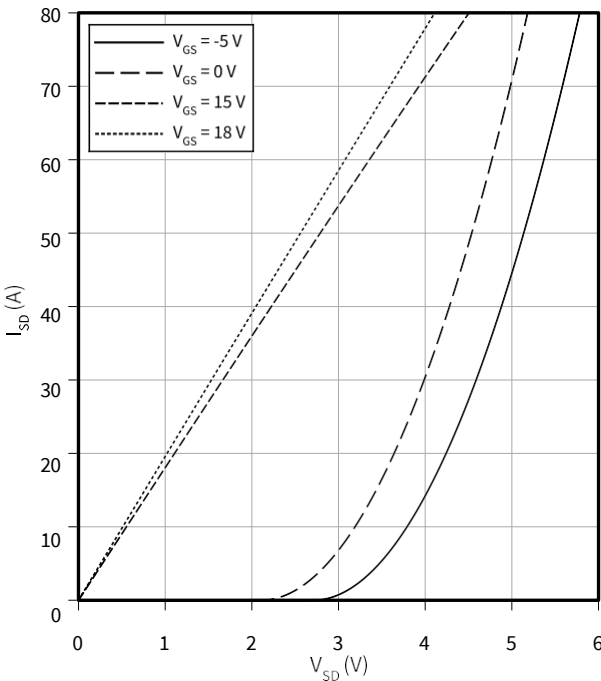
Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter

$I_{SD} = f(V_{SD})$
 $T_{vj} = 25\text{ }^{\circ}\text{C}$, $t_p = 20\text{ }\mu\text{s}$



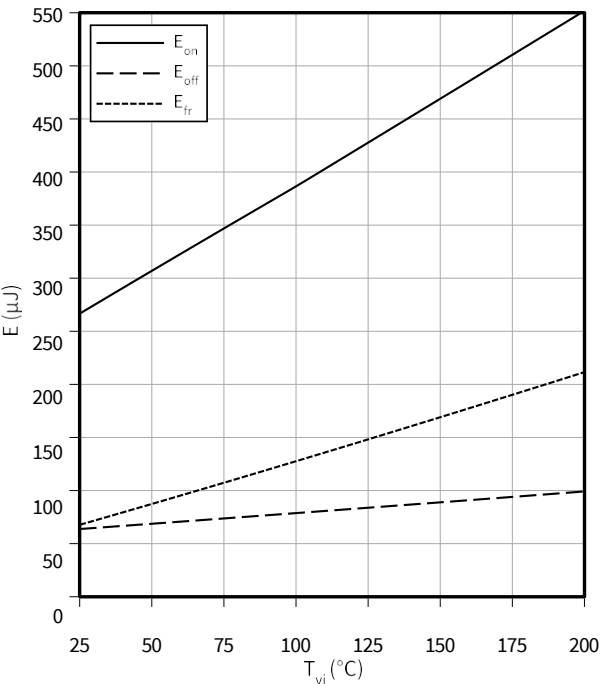
Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter

$I_{SD} = f(V_{SD})$
 $T_{vj} = 175\text{ }^{\circ}\text{C}$, $t_p = 20\text{ }\mu\text{s}$



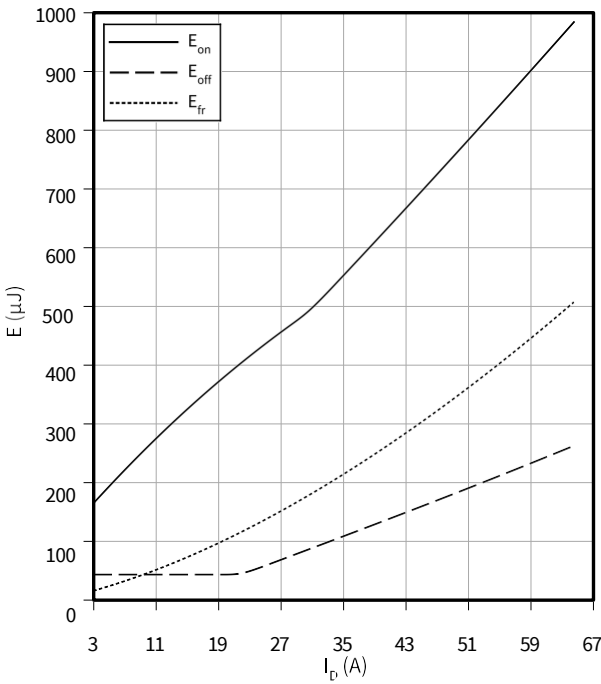
Typical switching energy as a function of junction temperature, test circuit in Fig. F, 2nd device own body diode: $V_{GS} = 0\text{ V}$

$E = f(T_{vj})$
 $V_{GS} = 0/18\text{ V}$, $I_D = 32.1\text{ A}$, $R_{G,ext} = 2.3\text{ }\Omega$, $V_{DD} = 800\text{ V}$



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

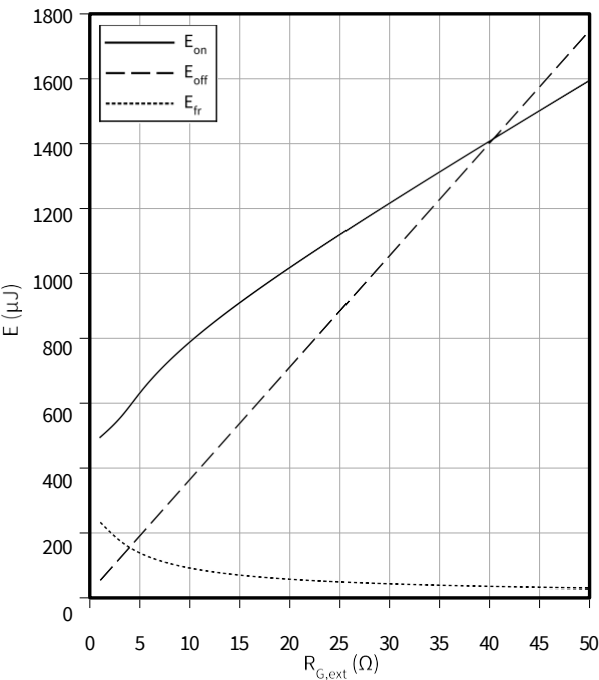
$E = f(I_D)$
 $V_{GS} = 0/18\text{ V}$, $T_{vj} = 175\text{ }^{\circ}\text{C}$, $R_{G,ext} = 2.3\text{ }\Omega$, $V_{DD} = 800\text{ V}$



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

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

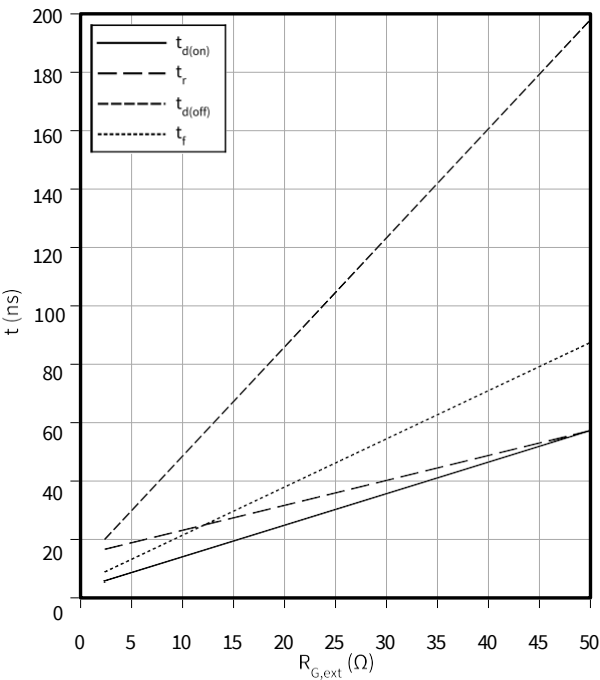
$V_{GS} = 0/18\text{ V}$, $I_D = 32.1\text{ A}$, $T_{vj} = 175\text{ °C}$, $V_{DD} = 800\text{ V}$



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

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

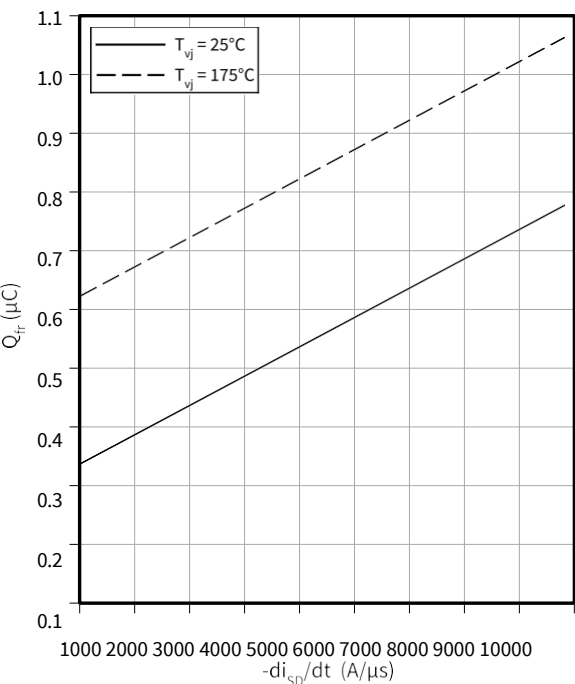
$V_{GS} = 0/18\text{ V}$, $I_D = 32.1\text{ A}$, $T_{vj} = 175\text{ °C}$, $V_{DD} = 800\text{ V}$



Typical reverse recovery charge as a function of reverse drain current slope, test circuit in Fig. F, 2nd device own body diode: $V_{GS} = 0\text{ V}$

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

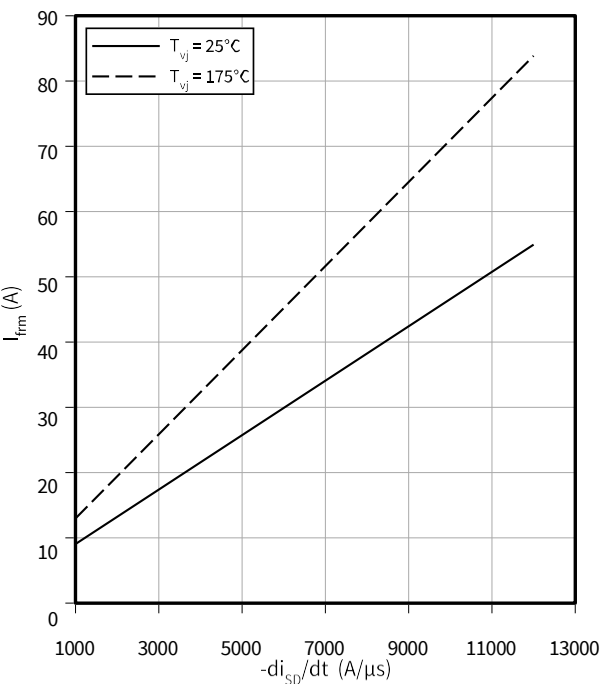
$V_{GS} = 0/18\text{ V}$, $I_{SD} = 32.1\text{ A}$, $V_{DD} = 800\text{ V}$



Typical reverse recovery current as a function of reverse drain current slope, test circuit in Fig. F, 2nd device own body diode: $V_{GS} = 0\text{ V}$

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

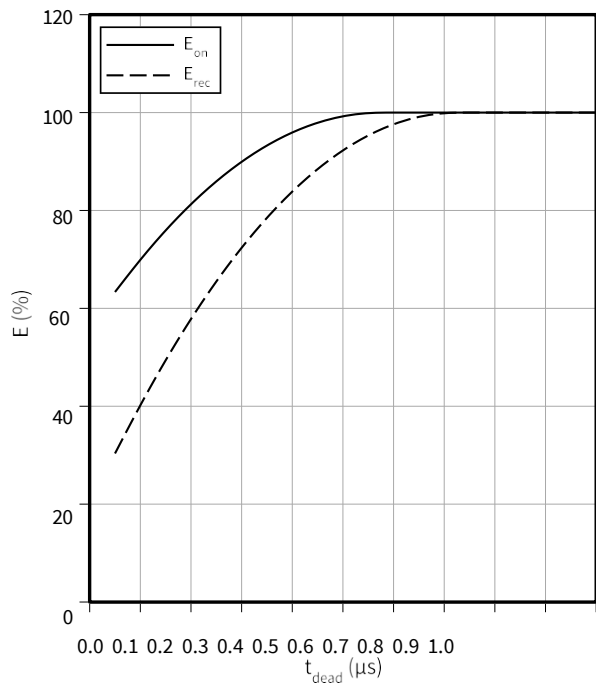
$V_{GS} = 0/18\text{ V}$, $I_{SD} = 32.1\text{ A}$, $V_{DD} = 800\text{ V}$



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

$$E = f(t_{\text{dead}})$$

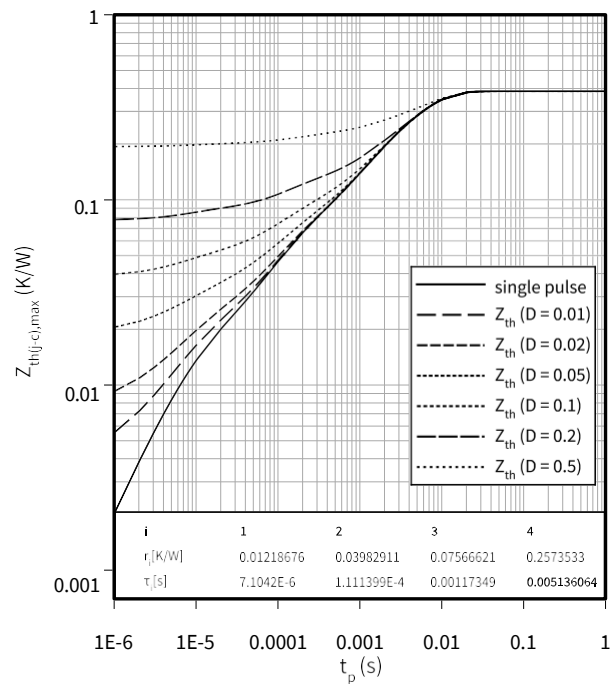
$V_{GS} = 0/18\text{ V}$, $I_D = 32.1\text{ A}$, $T_{vj} = 175\text{ °C}$, $R_{G,\text{ext}} = 2.3\text{ }\Omega$ $V_{DD} = 800\text{ V}$



Max. transient thermal impedance (MOSFET/diode)

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

$$D = t_p/T$$



5 封装外形

5 封装外形

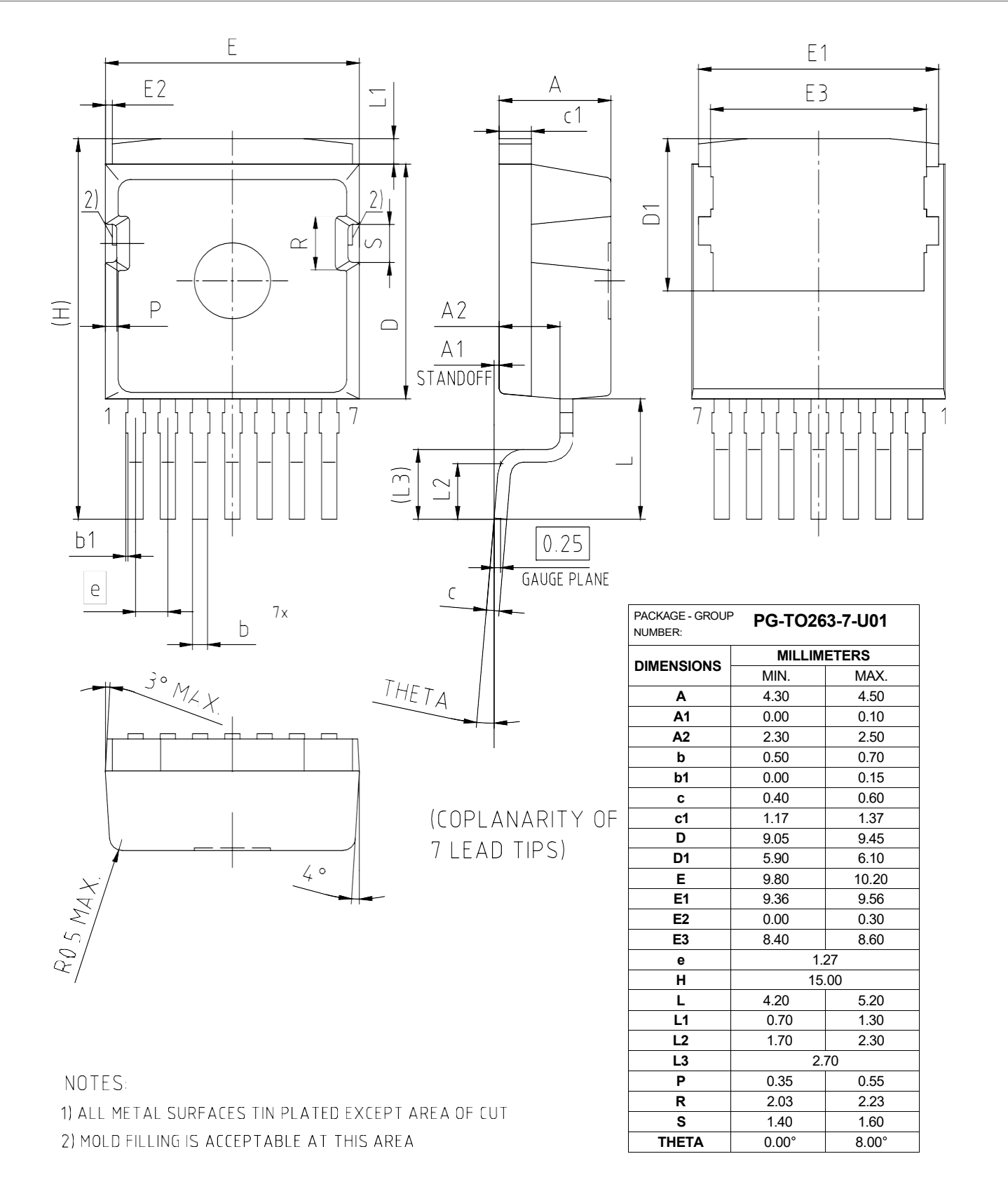


图 1

6 测试条件

6 测试条件

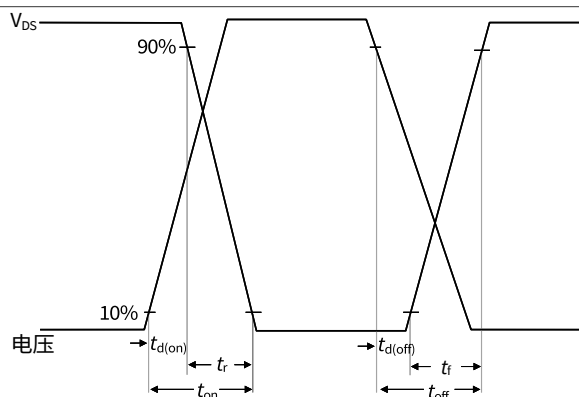
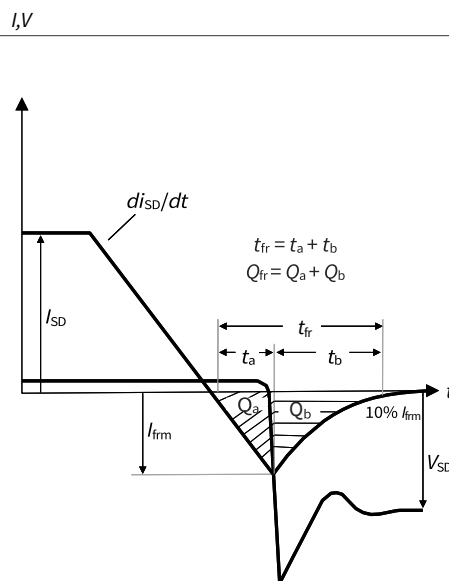


图 A.开关时间的定义



图B.体二极管开关特性的定义

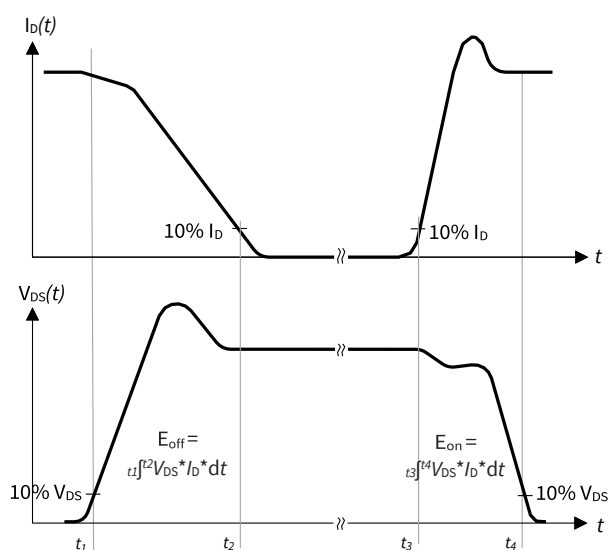


图 C.开关损耗的定义

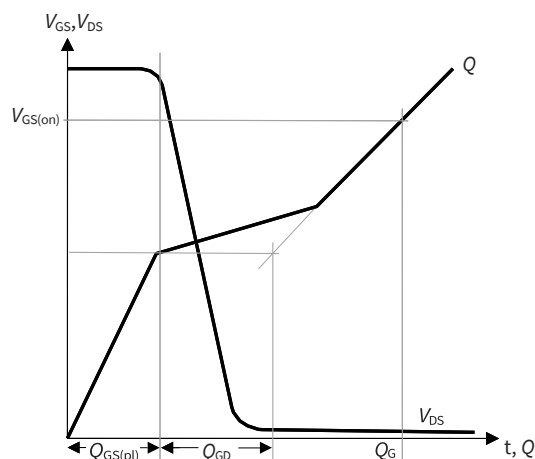


图 D. QGD 的定义

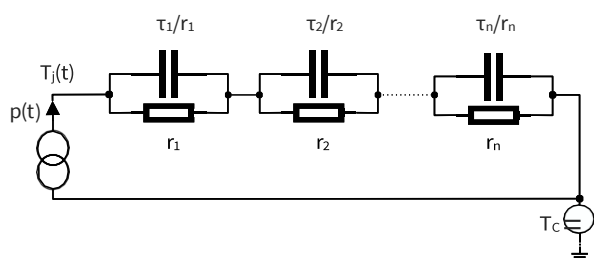
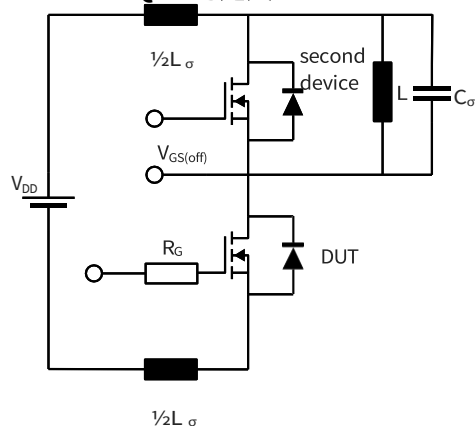


图 E.热等效电路



图F.动态测试电路寄生电感

L_σ , 寄生电容 C_σ ,



修订记录

修订记录

Document revision	Date of release	Description of changes
0.10	2023-08-08	Preliminary datasheet
1.00	2023-09-29	Final datasheet
1.10	2024-01-12	Negative gate voltage values updated Additional capacitance & charge values added $E = f(t_{\text{dead}})$ 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 $I_{\text{frm}} = f(-di_{\text{sd}}/dt)$ Editorial changes



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erratum@infineon.com

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