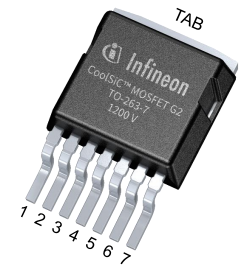


### Final datasheet

### CoolSiC™ 1200 V SiC MOSFET G2 : Silicon Carbide MOSFET

#### Features

- $V_{DSS} = 1200\text{ V}$  at  $T_{vj} = 25^\circ\text{C}$
- $I_{DC} = 29\text{ A}$  at  $T_C = 100^\circ\text{C}$
- $R_{DS(on)} = 52.6\text{ m}\Omega$  at  $V_{GS} = 18\text{ V}$ ,  $T_{vj} = 25^\circ\text{C}$
- Very low switching losses
- Overload operation up to  $T_{vj} = 200^\circ\text{C}$
- Short circuit withstand time  $2\text{ }\mu\text{s}$
- Benchmark gate threshold voltage,  $V_{GS(th)} = 4.2\text{ V}$
- Robust against parasitic turn on,  $0\text{ V}$  turn-off gate voltage can be applied
- Robust body diode for hard commutation
- .XT interconnection technology for best-in-class thermal performance
- Suitable Infineon gate drivers can be found under <https://www.infineon.com/gdfinder>



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

#### Potential applications

- EV Charging
- Online UPS/Industrial UPS
- String inverter
- General purpose drives (GPD)

#### Product validation

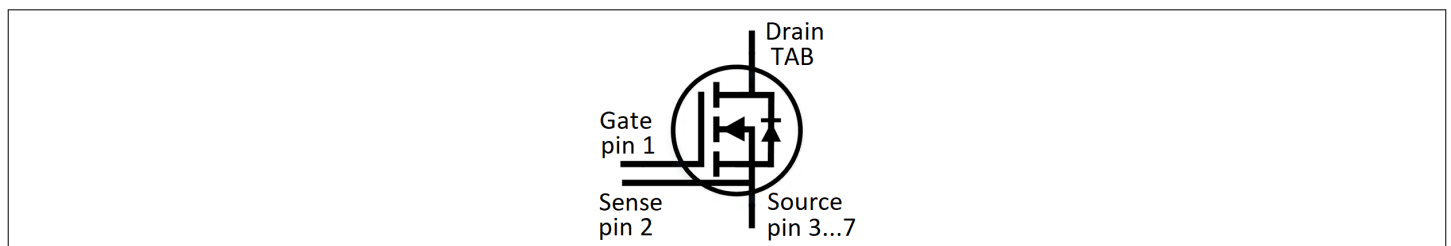
- Qualified for industrial applications according to the relevant tests of JEDEC47/20/22

#### Description

Pin definition:

- Pin 1 - Gate
- Pin 2 - Kelvin sense contact
- Pin 3...7 - Source
- Tab - Drain

Note: the source and sense pins are not exchangeable, their exchange might lead to malfunction (only for 4pin, TO263-7L)



Type	Package	Marking
IMBG120R053M2H	PG-TO263-7-U01	12M2H053

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## 1 Package

**Table 1** Characteristic values

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	$R_{th(j-c)}$			0.56	0.73	K/W

## 2 MOSFET

**Table 2** Maximum rated values

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 $T_{vj(max)}$	$I_{DDC}$	$V_{GS} = 18 \text{ V}$	$T_c = 25 \text{ °C}$	41	A
			$T_c = 100 \text{ °C}$	29	
Peak drain current, $t_p$ limited by $T_{vj(max)}$ <sup>1)</sup>	$I_{DM}$	$V_{GS} = 18 \text{ V}$	87	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 <sup>2)</sup>	$V_{GS}$		-7...23	V	
Avalanche energy, single pulse	$E_{AS}$	$I_D = 13.2 \text{ A}$ , $V_{DD} = 50 \text{ V}$ , $L = 1.9 \text{ mH}$	166	mJ	
Avalanche energy, repetitive	$E_{AR}$	$I_D = 13.2 \text{ A}$ , $V_{DD} = 50 \text{ V}$ , $L = 9.5 \text{ }\mu\text{H}$	0.83	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	$\mu\text{s}$	
Power dissipation, limited by $T_{vj(max)}$	$P_{tot}$		$T_c = 25 \text{ °C}$	205	W
			$T_c = 100 \text{ °C}$	103	

1) verified by design.

2) The maximum gate-source voltage in the application design should be in accordance to IPC-9592B.

**Table 3 Recommended values**

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

**Table 4 Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit	
			Min.	Typ.	Max.		
Drain-source on-state resistance	$R_{DS(on)}$	$I_D = 13.2\text{ A}$	$T_{vj} = 25\text{ °C}$ , $V_{GS(on)} = 18\text{ V}$	52.6		mΩ	
			$T_{vj} = 150\text{ °C}$ , $V_{GS(on)} = 18\text{ V}$	107	137		
			$T_{vj} = 175\text{ °C}$ , $V_{GS(on)} = 18\text{ V}$	124			
			$T_{vj} = 25\text{ °C}$ , $V_{GS(on)} = 15\text{ V}$	65.6			
Gate-source threshold voltage	$V_{GS(th)}$	$I_D = 4.1\text{ mA}$ , $V_{DS} = V_{GS}$ (tested after 1 ms pulse at $V_{GS} = 20\text{ V}$ )	$T_{vj} = 25\text{ °C}$	3.5	4.2	5.1	V
			$T_{vj} = 175\text{ °C}$		3.2		
Zero gate-voltage drain current	$I_{DSS}$	$V_{DS} = 1200\text{ V}$ , $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$			110	μA
			$T_{vj} = 175\text{ °C}$		1.9		
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	$g_{fs}$	$I_D = 13.2\text{ A}$ , $V_{DS} = 20\text{ V}$		8.8		S	
Internal gate resistance	$R_{G,int}$	$f = 1\text{ MHz}$ , $V_{AC} = 25\text{ mV}$		8.5		Ω	
Input capacitance	$C_{iss}$	$V_{DD} = 800\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 100\text{ kHz}$ , $V_{AC} = 25\text{ mV}$		1010		pF	
Output capacitance	$C_{oss}$	$V_{DD} = 800\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 100\text{ kHz}$ , $V_{AC} = 25\text{ mV}$		41		pF	
Reverse transfer capacitance	$C_{rss}$	$V_{DD} = 800\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 100\text{ kHz}$ , $V_{AC} = 25\text{ mV}$		3.2		pF	
$C_{oss}$ stored energy	$E_{oss}$	$V_{DD} = 800\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 100\text{ kHz}$ , $V_{AC} = 25\text{ mV}$		17		μJ	
Output charge	$Q_{oss}$	Calculated by $C_{oss}(f)V_{DS}$ @100 kHz		64.2		nC	
Effective output capacitance, energy related	$C_{o(er)}$	$V_{DD} = 0...800\text{ V}$ , $V_{GS} = 0\text{ V}$		53.1		pF	
Effective output capacitance, time related	$C_{o(tr)}$	$I_D = \text{constant}$ , $V_{DD} = 0...800\text{ V}$ , $V_{GS} = 0\text{ V}$		80.3		pF	
Total gate charge	$Q_G$	$V_{DD} = 800\text{ V}$ , $I_D = 13.2\text{ A}$ , $V_{GS} = -2/18\text{ V}$ , turn-on pulse		30		nC	

(table continues...)

**Table 4 (continued) Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Plateau gate charge	$Q_{GS(pl)}$	$V_{DD} = 800\text{ V}$ , $I_D = 13.2\text{ A}$ , $V_{GS} = -2/18\text{ V}$ , turn-on pulse		6.5		nC
Gate-to-drain charge	$Q_{GD}$	$V_{DD} = 800\text{ V}$ , $I_D = 13.2\text{ A}$ , $V_{GS} = -2/18\text{ V}$ , turn-on pulse		7.8		nC
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 800\text{ V}$ , $I_D = 13.2\text{ A}$ , $V_{GS} = 0/18\text{ V}$ , $R_{GS(on)} = 2.3\ \Omega$ , $R_{GS(off)} = 2.3\ \Omega$ , $L_\sigma = 15\text{ nH}$ , diode: body diode at $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ }^\circ\text{C}$	2		ns
			$T_{vj} = 175\text{ }^\circ\text{C}$	2.5		
Rise time	$t_r$	$V_{DD} = 800\text{ V}$ , $I_D = 13.2\text{ A}$ , $V_{GS} = 0/18\text{ V}$ , $R_{GS(on)} = 2.3\ \Omega$ , $R_{GS(off)} = 2.3\ \Omega$ , $L_\sigma = 15\text{ nH}$ , diode: body diode at $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ }^\circ\text{C}$	14		ns
			$T_{vj} = 175\text{ }^\circ\text{C}$	13.9		
Turn-off delay time	$t_{d(off)}$	$V_{DD} = 800\text{ V}$ , $I_D = 13.2\text{ A}$ , $V_{GS} = 0/18\text{ V}$ , $R_{GS(on)} = 2.3\ \Omega$ , $R_{GS(off)} = 2.3\ \Omega$ , $L_\sigma = 15\text{ nH}$ , diode: body diode at $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ }^\circ\text{C}$	4.9		ns
			$T_{vj} = 175\text{ }^\circ\text{C}$	8.6		
Fall time	$t_f$	$V_{DD} = 800\text{ V}$ , $I_D = 13.2\text{ A}$ , $V_{GS} = 0/18\text{ V}$ , $R_{GS(on)} = 2.3\ \Omega$ , $R_{GS(off)} = 2.3\ \Omega$ , $L_\sigma = 15\text{ nH}$ , diode: body diode at $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ }^\circ\text{C}$	3		ns
			$T_{vj} = 175\text{ }^\circ\text{C}$	3.5		
Turn-on energy	$E_{on}$	$V_{DD} = 800\text{ V}$ , $I_D = 13.2\text{ A}$ , $V_{GS} = 0/18\text{ V}$ , $R_{GS(on)} = 2.3\ \Omega$ , $R_{GS(off)} = 2.3\ \Omega$ , $L_\sigma = 15\text{ nH}$ , diode: body diode at $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ }^\circ\text{C}$	79		$\mu\text{J}$
			$T_{vj} = 175\text{ }^\circ\text{C}$	154		
Turn-off energy	$E_{off}$	$V_{DD} = 800\text{ V}$ , $I_D = 13.2\text{ A}$ , $V_{GS} = 0/18\text{ V}$ , $R_{GS(on)} = 2.3\ \Omega$ , $R_{GS(off)} = 2.3\ \Omega$ , $L_\sigma = 15\text{ nH}$ , diode: body diode at $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ }^\circ\text{C}$	24		$\mu\text{J}$
			$T_{vj} = 175\text{ }^\circ\text{C}$	31		

(table continues...)

**Table 4 (continued) Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Total switching energy <sup>1)</sup>	$E_{tot}$	$V_{DD} = 800\text{ V}$ , $I_D = 13.2\text{ A}$ , $V_{GS} = 0/18\text{ V}$ , $R_{GS(on)} = 2.3\ \Omega$ , $R_{GS(off)} = 2.3\ \Omega$ , $L_\sigma = 15\text{ nH}$ , diode: body diode at $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$		144.5	$\mu\text{J}$
			$T_{vj} = 175\text{ °C}$		301.6	
Virtual junction temperature	$T_{vj}$		-55		175	$^{\circ}\text{C}$
Virtual junction temperature	$T_{vj(over)}$	overload, cumulative max. 100 h <sup>2)</sup>			200	$^{\circ}\text{C}$

1) including  $E_{fr}$

2) up to 5000 cycles. Maximum  $\Delta T$  limited to 100 K.

**Note:** The chip technology was characterized up to 200 kV/ $\mu\text{s}$ . The measured  $dV/dt$  was limited by measurement test setup and package.

Characteristics at  $T_{vj} = 25^{\circ}\text{C}$ , unless otherwise specified.

### 3 Body diode (MOSFET)

**Table 5 Maximum rated values**

Parameter	Symbol	Note or test condition	Values	Unit
Drain-source voltage	$V_{DSS}$	$T_{vj} \geq 25\text{ °C}$	1200	V
Peak reverse drain current, $t_p$ limited by $T_{vj(max)}$	$I_{SM}$	$V_{GS} = 0\text{ V}$	34	A

**Table 6 Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Drain-source reverse voltage	$V_{SD}$	$I_{SD} = 13.2\text{ A}$ , $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$		4.2	V
			$T_{vj} = 100\text{ °C}$		4.11	
			$T_{vj} = 175\text{ °C}$		4.05	
MOSFET forward recovery charge	$Q_{fr}$	$V_{DD} = 800\text{ V}$ , $I_{SD} = 13.2\text{ A}$ , $V_{GS} = 0\text{ V}$ , $-di_{SD}/dt = 1000\text{ A}/\mu\text{s}$ , $Q_{fr}$ includes also $Q_C$	$T_{vj} = 25\text{ °C}$		0.17	$\mu\text{C}$
			$T_{vj} = 175\text{ °C}$		0.28	
MOSFET peak forward recovery current	$I_{frm}$	$V_{DD} = 800\text{ V}$ , $I_{SD} = 13.2\text{ A}$ , $V_{GS} = 0\text{ V}$ , $-di_{SD}/dt = 1000\text{ A}/\mu\text{s}$ , $Q_{fr}$ includes also $Q_C$	$T_{vj} = 25\text{ °C}$		5.7	A
			$T_{vj} = 175\text{ °C}$		6.8	

(table continues...)

**Table 6** (continued) **Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
MOSFET forward recovery energy	$E_{fr}$	$V_{DD} = 800\text{ V}$ , $I_{SD} = 13.2\text{ A}$ , $V_{GS} = 0\text{ V}$ , $-di_{SD}/dt = 1000\text{ A}/\mu\text{s}$ , $Q_{fr}$ includes also $Q_C$	$T_{vj} = 25\text{ °C}$		41.5	$\mu\text{J}$
			$T_{vj} = 175\text{ °C}$		116.6	
Virtual junction temperature	$T_{vj}$		-55		175	$^{\circ}\text{C}$
Virtual junction temperature	$T_{vj(over)}$	overload, cumulative max. 100 h <sup>1)</sup>			200	$^{\circ}\text{C}$

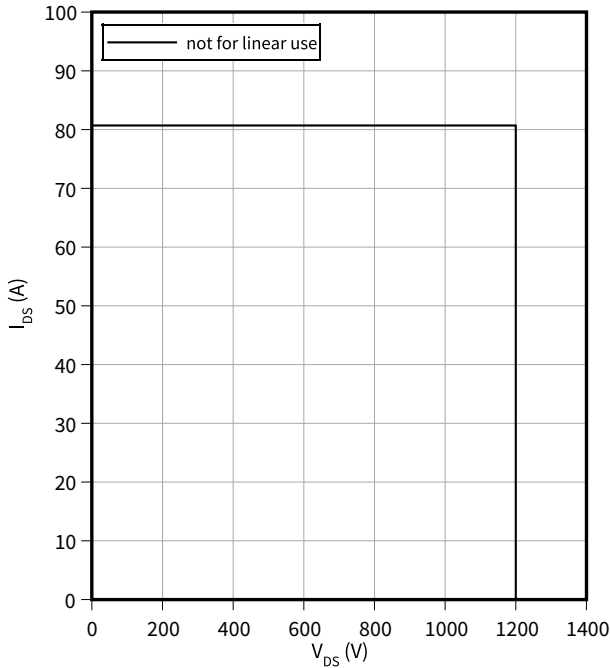
1) up to 5000 cycles. Maximum  $\Delta T$  limited to 100 K.

## 4 Characteristics diagrams

### Reverse bias safe operating area (RBSOA)

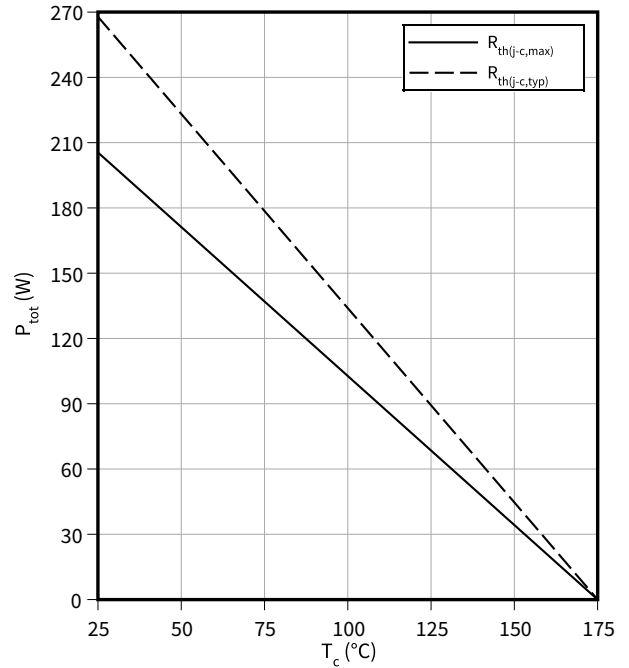
$$I_{DS} = f(V_{DS})$$

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



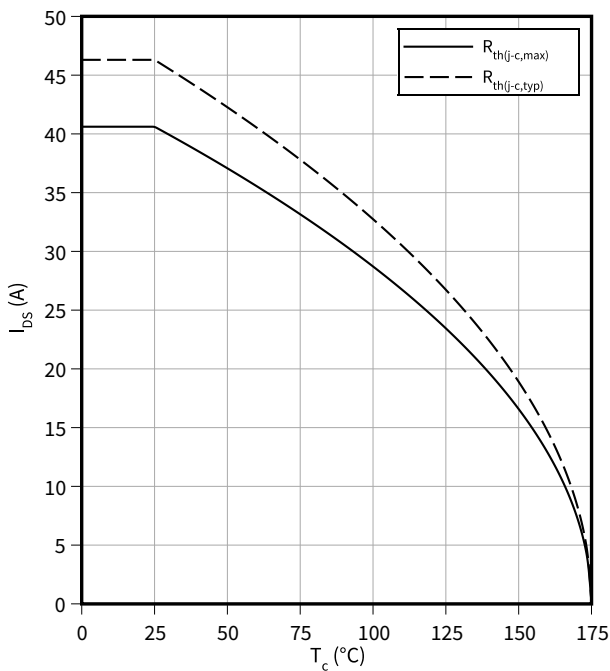
### Power dissipation as a function of case temperature

$$P_{tot} = f(T_c)$$



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

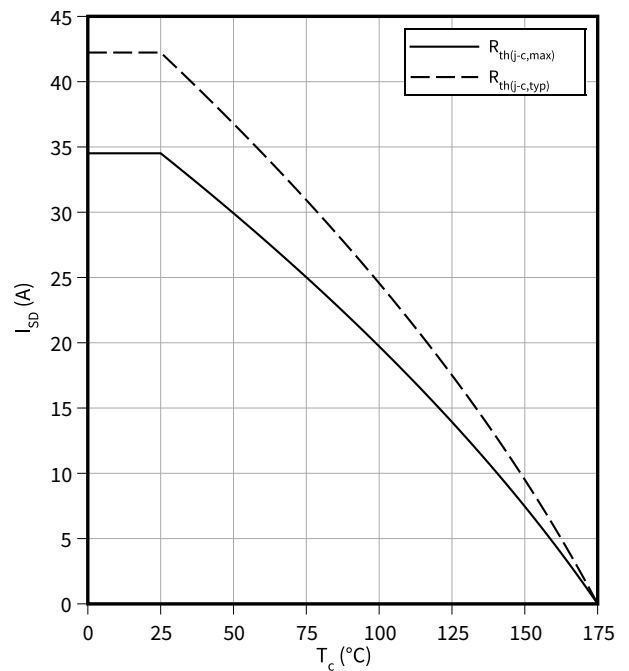
$$I_{DS} = f(T_c)$$



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

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

$$V_{GS} = 0 \text{ V}$$

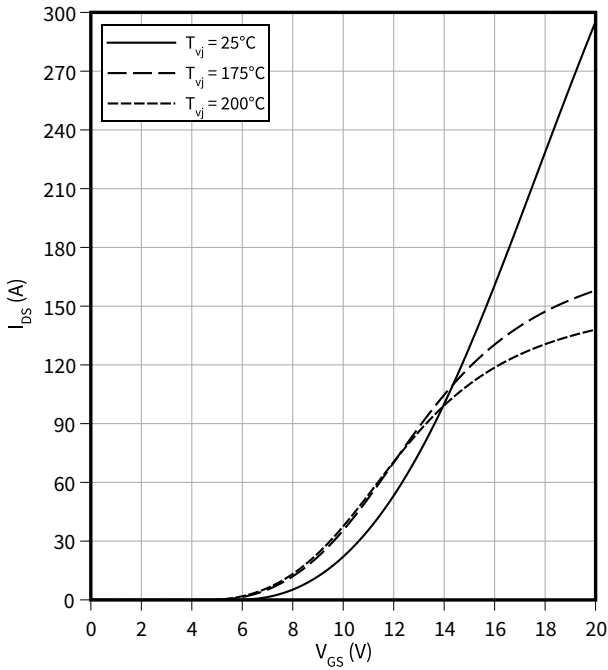




4 Characteristics diagrams

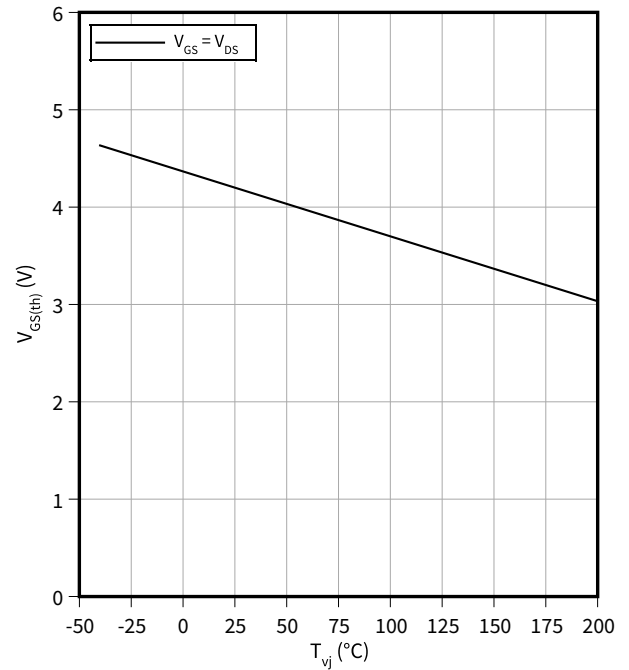
**Typical transfer characteristic**

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



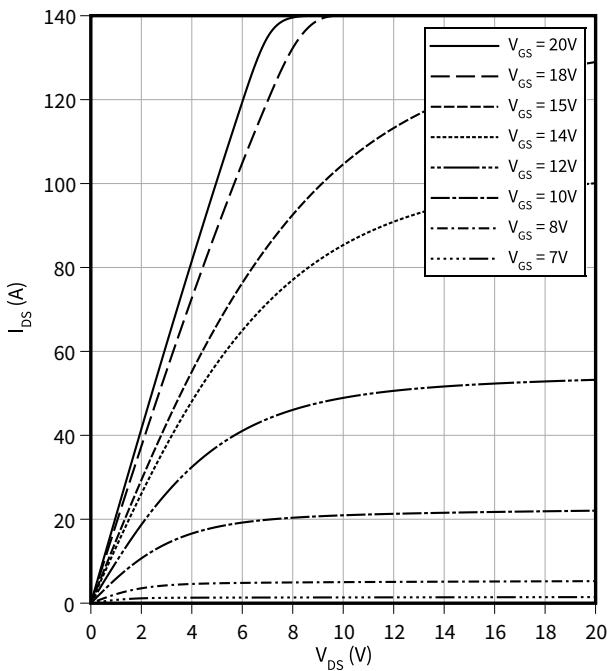
**Typical gate-source threshold voltage as a function of junction temperature**

$V_{GS(th)} = f(T_{vj})$   
 $I_D = 4.1\ \text{mA}$



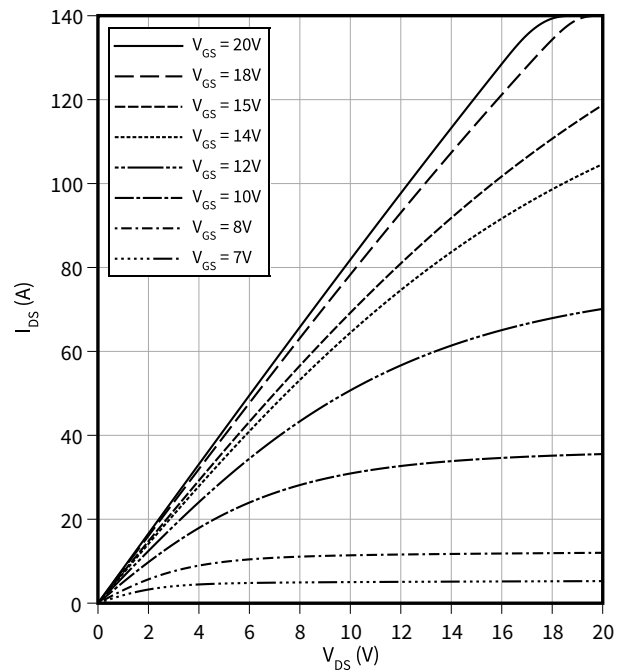
**Typical output characteristic,  $V_{GS}$  as parameter**

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



**Typical output characteristic,  $V_{GS}$  as parameter**

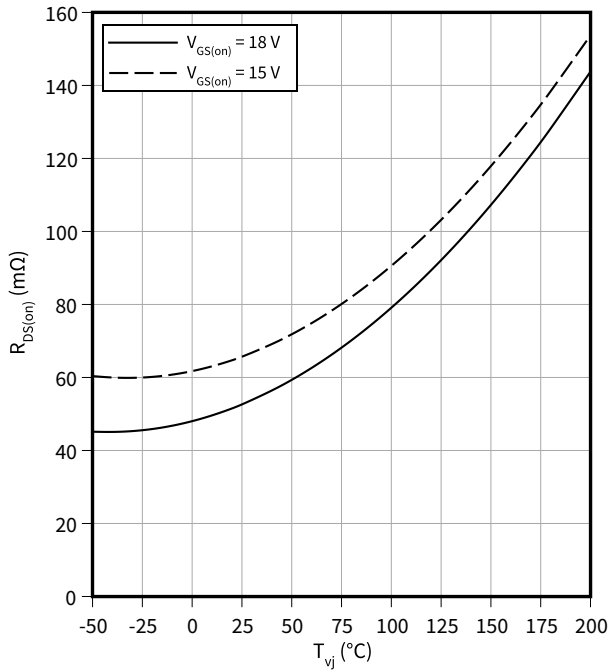
$I_{DS} = f(V_{DS})$   
 $T_{vj} = 175\ ^\circ\text{C}$ ,  $t_p = 20\ \mu\text{s}$



4 Characteristics diagrams

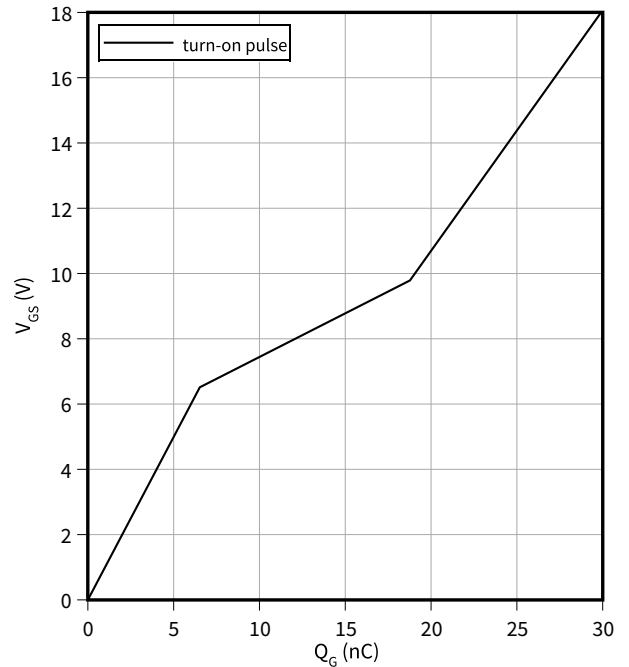
**Typical on-state resistance as a function of junction temperature**

$R_{DS(on)} = f(T_{vj})$   
 $I_D = 13.2 \text{ A}$



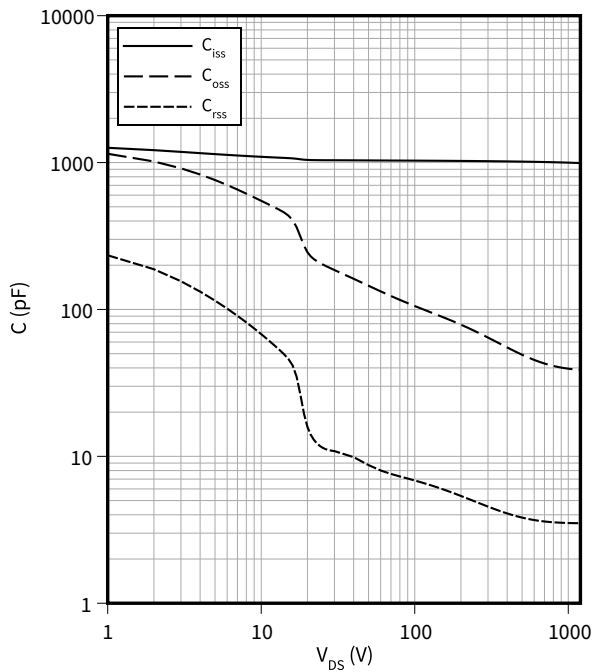
**Typical gate charge**

$V_{GS} = f(Q_G)$   
 $I_D = 13.2 \text{ A}, V_{DS} = 800 \text{ V}$



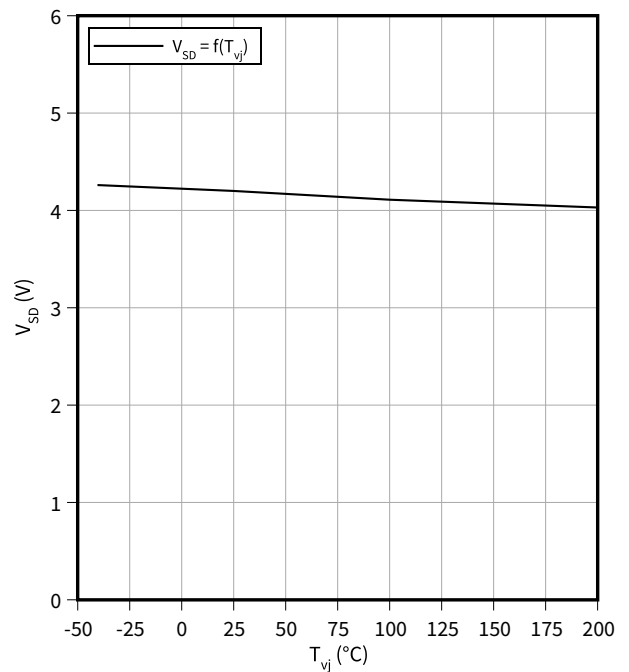
**Typical capacitance as a function of drain-source voltage**

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



**Typical reverse drain voltage as function of junction temperature**

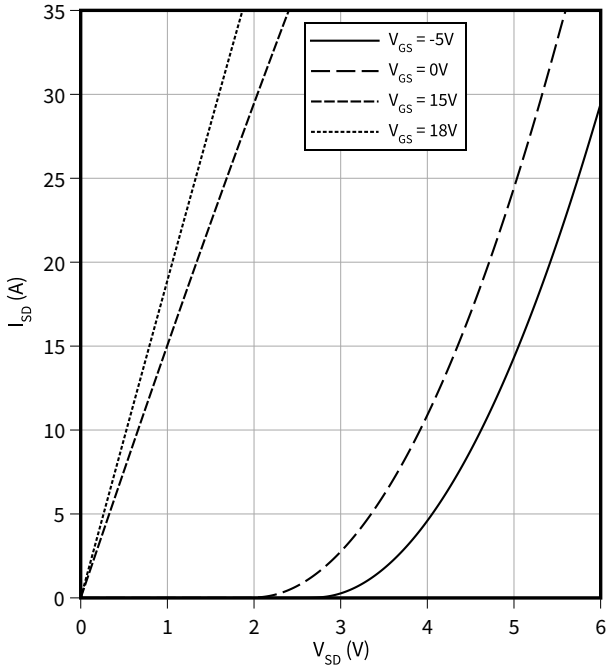
$V_{SD} = f(T_{vj})$   
 $I_{SD} = 13.2 \text{ A}, V_{GS} = 0 \text{ V}$



4 Characteristics diagrams

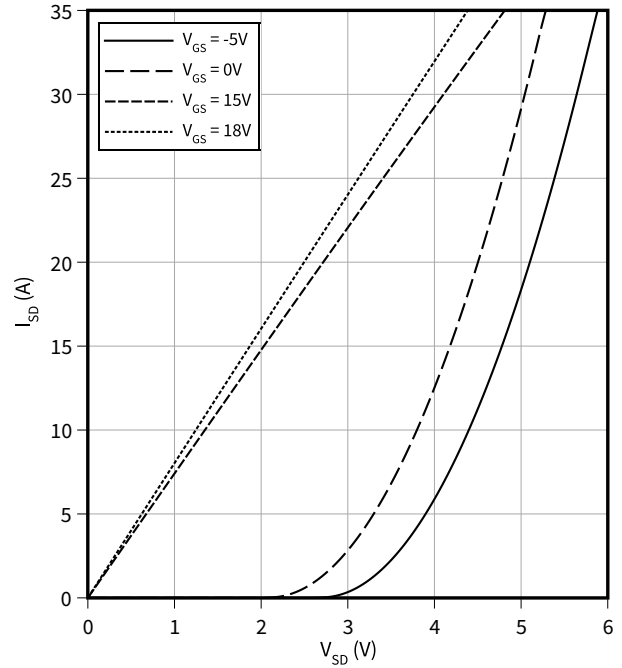
**Typical reverse drain current as function of reverse drain voltage,  $V_{GS}$  as parameter**

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



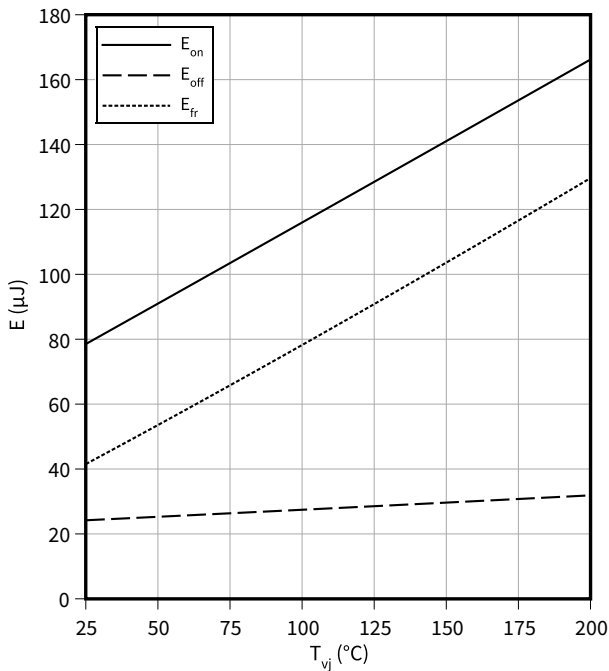
**Typical reverse drain current as function of reverse drain voltage,  $V_{GS}$  as parameter**

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



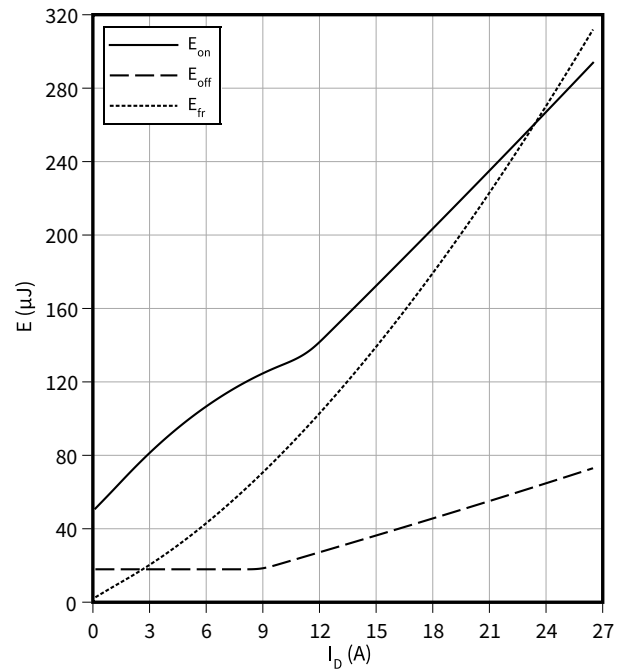
**Typical switching energy as a function of junction temperature, test circuit in Fig. F, 2nd device own body diode:  $V_{GS} = 0\text{ V}$**

$E = f(T_{vj})$   
 $V_{GS} = 0/18\text{ V}$ ,  $I_D = 13.2\text{ A}$ ,  $R_{G,ext} = 2.3\text{ }\Omega$ ,  $V_{DD} = 800\text{ V}$



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

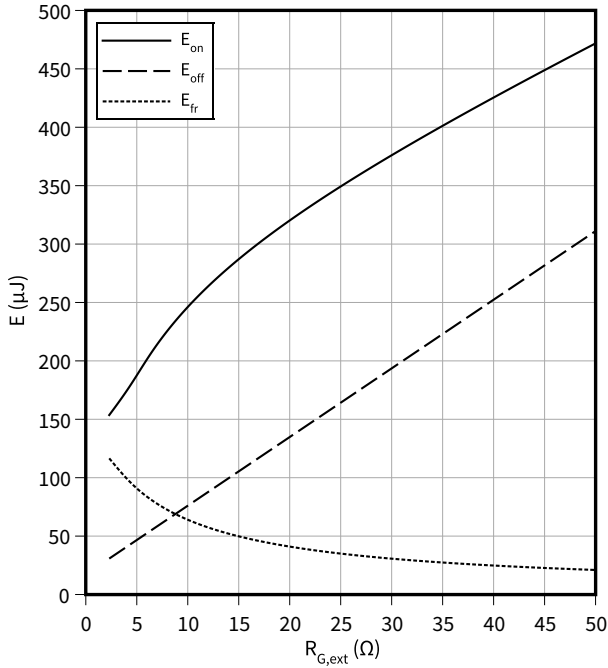
$E = f(I_D)$   
 $V_{GS} = 0/18\text{ V}$ ,  $T_{vj} = 175\text{ °C}$ ,  $R_{G,ext} = 2.3\text{ }\Omega$ ,  $V_{DD} = 800\text{ V}$



4 Characteristics diagrams

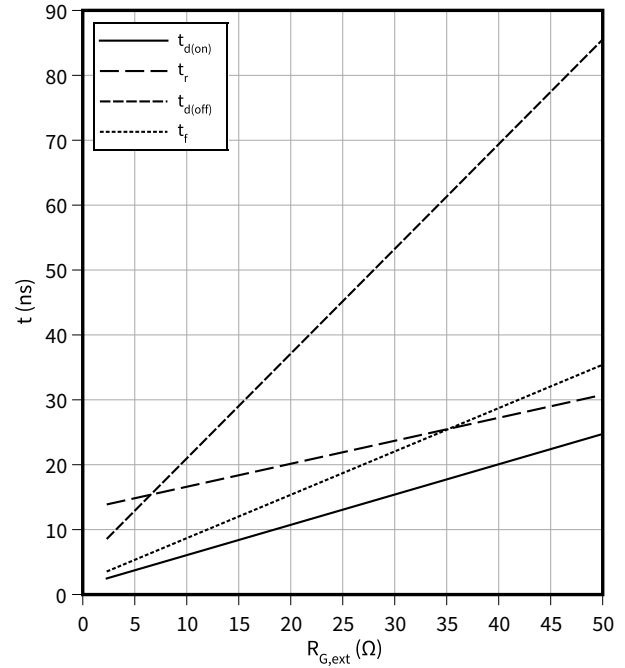
**Typical switching energy as a function of gate resistance, test circuit in Fig. F, 2nd device own body diode:  $V_{GS} = 0\text{ V}$**

$E = f(R_{G,ext})$   
 $V_{GS} = 0/18\text{ V}$ ,  $I_D = 13.2\text{ A}$ ,  $T_{vj} = 175\text{ °C}$ ,  $V_{DD} = 800\text{ V}$



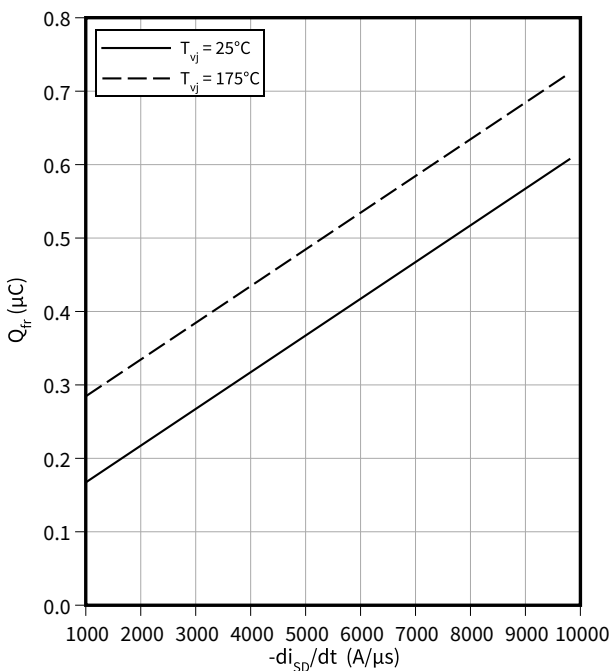
**Typical switching times as a function of gate resistance, test circuit in Fig. F, 2nd device own body diode:  $V_{GS} = 0\text{ V}$**

$t = f(R_{G,ext})$   
 $I_D = 13.2\text{ A}$ ,  $T_{vj} = 175\text{ °C}$ ,  $V_{DD} = 800\text{ V}$ ,  $V_{GS} = 0/18\text{ V}$



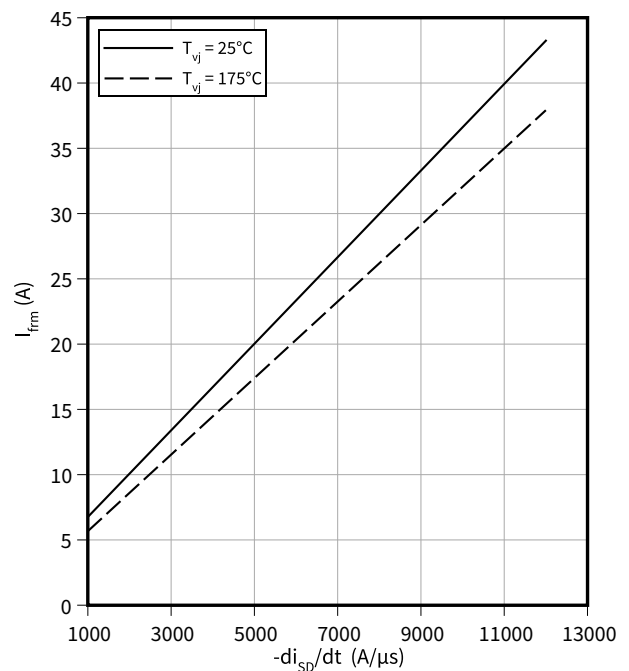
**Typical reverse recovery charge as a function of reverse drain current slope, test circuit in Fig. F, 2nd device own body diode:  $V_{GS} = 0\text{ V}$**

$Q_{fr} = f(-di_{SD}/dt)$   
 $V_{GS} = 0/18\text{ V}$ ,  $I_{SD} = 13.2\text{ A}$ ,  $V_{DD} = 800\text{ V}$



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

$I_{frm} = f(-di_{SD}/dt)$   
 $V_{GS} = 0/18\text{ V}$ ,  $I_{SD} = 13.2\text{ A}$ ,  $V_{DD} = 800\text{ V}$



4 Characteristics diagrams

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

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

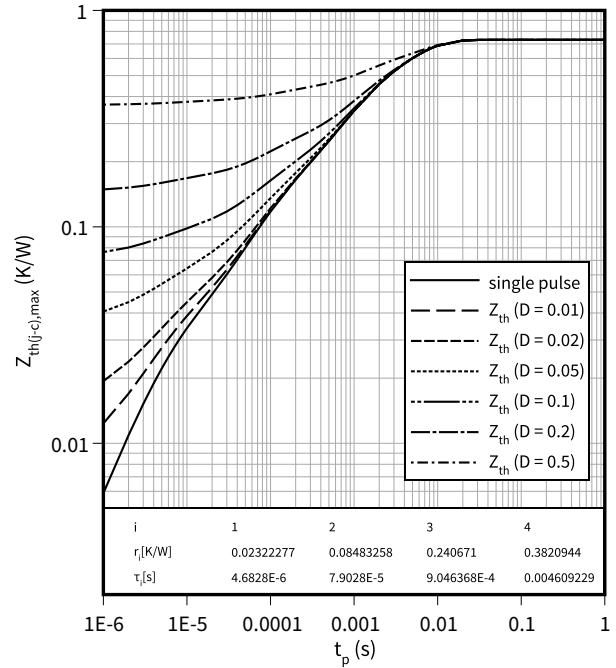
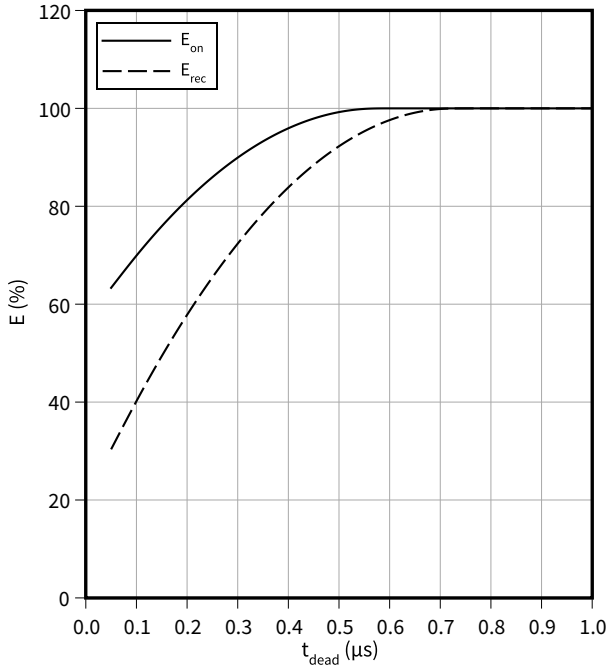
$V_{GS} = 0/18\text{ V}$ ,  $I_D = 13.2\text{ A}$ ,  $T_{vj} = 175\text{ °C}$ ,  $R_{G,\text{ext}} = 2.3\text{ }\Omega$

$V_{DD} = 800\text{ V}$

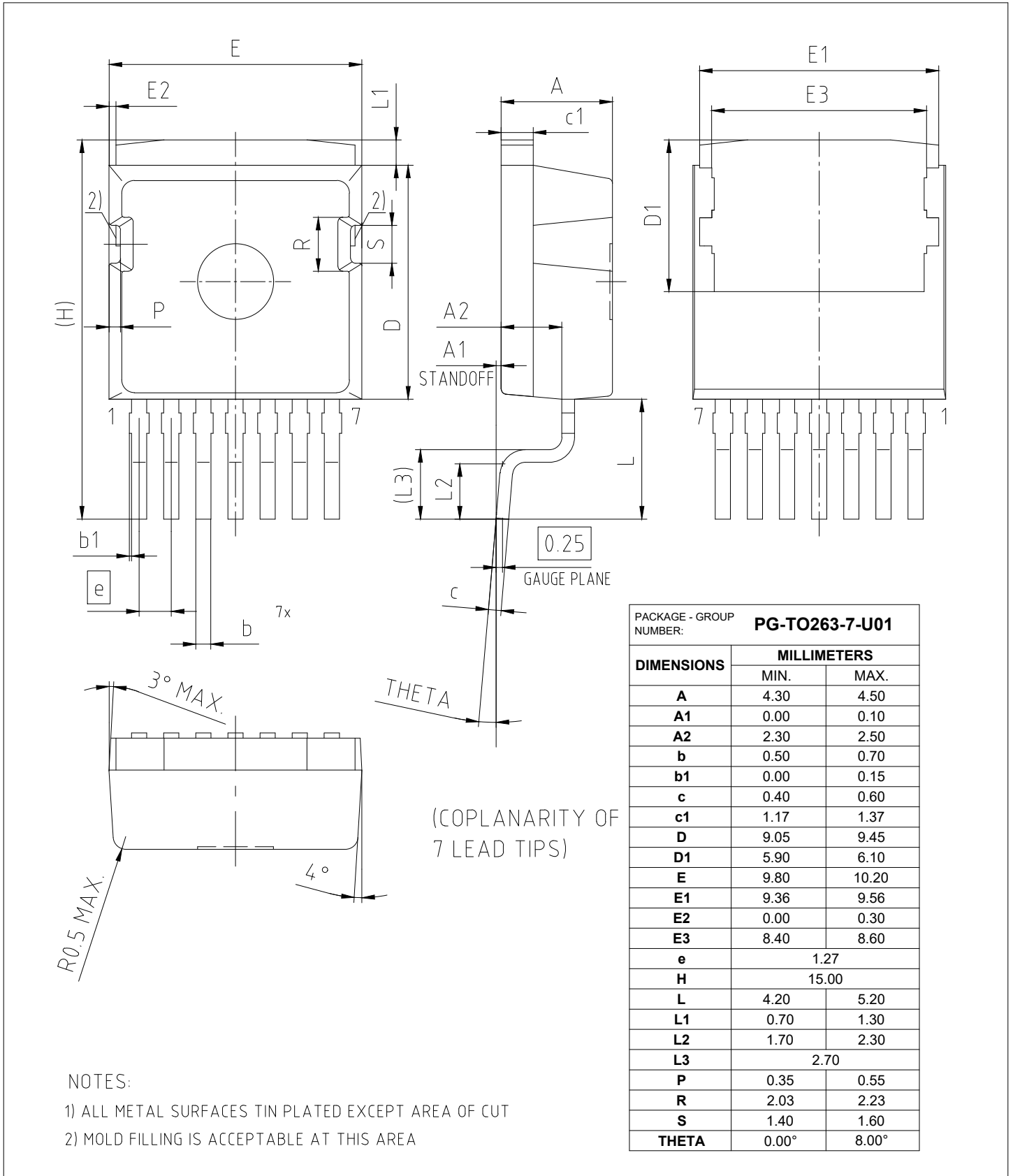
**Max. transient thermal impedance (MOSFET/diode)**

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

$$D = t_p/T$$



**5 Package outlines**



**Figure 1**

## 6 Testing conditions

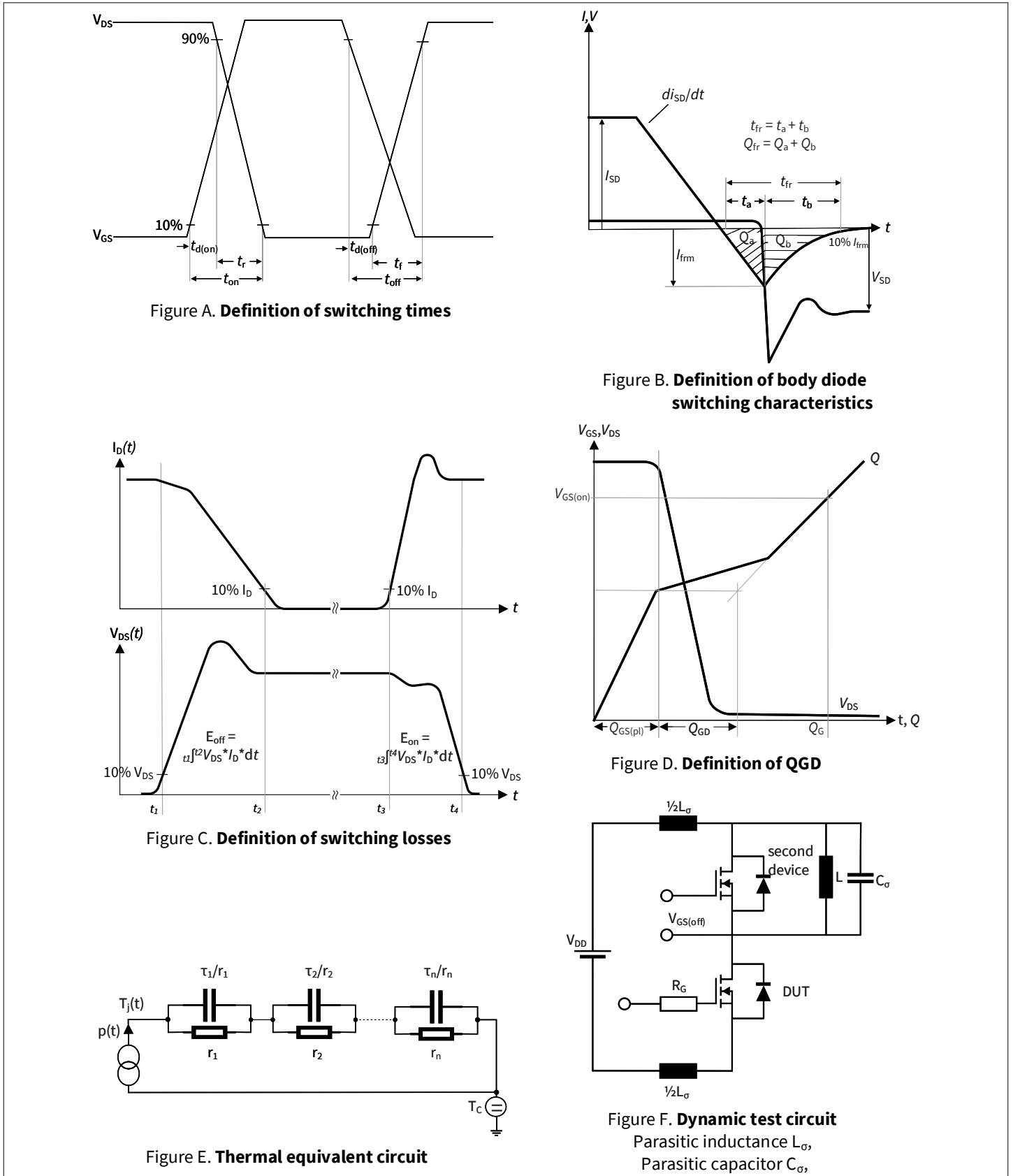


Figure 2

## Revision history

Document revision	Date of release	Description of changes
0.10	2023-08-09	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 <sub>dead</sub> ) graph y-axis correction to percentage values Editorial changes
1.20	2024-06-26	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 <sub>fs</sub> in the Table 4 Corrected diagrams "Typical transfer characteristic" and "Max. transient thermal impedance (MOSFET/diode)" Updated Figure D. Definition of QGD



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