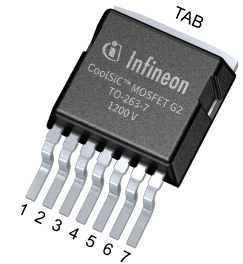


Final datasheet

CoolSiC™ 1200 V SiC MOSFET G2 : Silicon Carbide MOSFET

Features

- $V_{DSS} = 1200\text{ V}$ at $T_{vj} = 25^\circ\text{C}$
- $I_{DC} = 102\text{ A}$ at $T_C = 100^\circ\text{C}$
- $R_{DS(on)} = 12.2\text{ m}\Omega$ 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 $2\ \mu\text{s}$
- Benchmark gate threshold voltage, $V_{GS(th)} = 4.2\text{ V}$
- Robust against parasitic turn on, 0 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
- Solar power optimizer
- String inverter
- General purpose drives (GPD)

Product validation

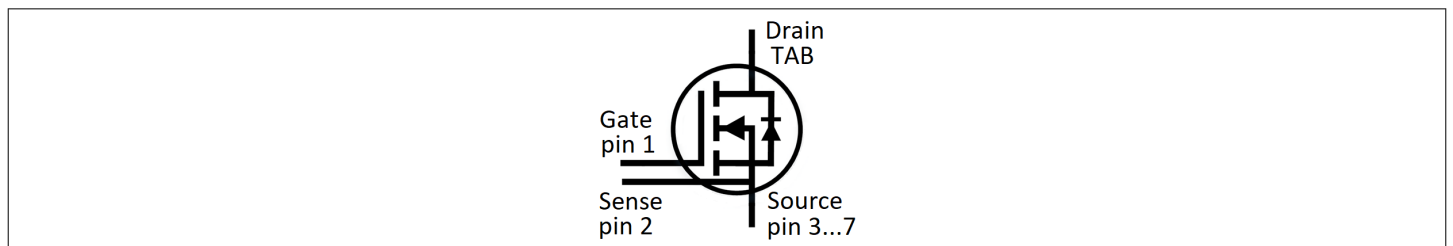
- Qualified for industrial applications according to the relevant tests of JEDEC47/20/22

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
IMBG120R012M2H	PG-TO263-7-HV-ND5.8	12M2H012

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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-STA-020)			260	°C
Thermal resistance, junction-ambient	$R_{th(j-a)}$				62	K/W
MOSFET/body diode thermal resistance, junction-case	$R_{th(j-c)}$			0.19	0.25	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}	$V_{GS} = 18 \text{ V}$	$T_c = 25 \text{ °C}$	144	A
			$T_c = 100 \text{ °C}$	102	
Peak drain current, t_p limited by $T_{vj(max)}$ ¹⁾	I_{DM}	$V_{GS} = 18 \text{ V}$	306	A	
Gate-source voltage, max. transient voltage	V_{GS}	$t_p \leq 0.5 \text{ }\mu\text{s}$, $D < 0.01$	-10...23	V	
Gate-source voltage, max. static voltage	V_{GS}		-7...20	V	
Avalanche energy, single pulse	E_{AS}	$I_D = 56.7 \text{ A}$, $V_{DD} = 50 \text{ V}$, $L = 0.4 \text{ mH}$	712	mJ	
Avalanche energy, repetitive	E_{AR}	$I_D = 56.7 \text{ A}$, $V_{DD} = 50 \text{ V}$, $L = 2.2 \text{ mH}$	3.56	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}		$T_c = 25 \text{ °C}$	600	W
			$T_c = 100 \text{ °C}$	300	

1) verified by design.

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	$R_{DS(on)}$	$I_D = 56.7 \text{ A}$	$T_{vj} = 25 \text{ °C}$, $V_{GS(on)} = 18 \text{ V}$	12.2		mΩ
			$T_{vj} = 150 \text{ °C}$, $V_{GS(on)} = 18 \text{ V}$	25	33	
			$T_{vj} = 175 \text{ °C}$, $V_{GS(on)} = 18 \text{ V}$	28.9		
			$T_{vj} = 25 \text{ °C}$, $V_{GS(on)} = 15 \text{ V}$	15.3		
Gate-source threshold voltage	$V_{GS(th)}$	$I_D = 17.8 \text{ mA}$, $V_{DS} = V_{GS}$ (tested after 1 ms pulse at $V_{GS} = 20 \text{ V}$)	$T_{vj} = 25 \text{ °C}$	3.5	4.2	V
			$T_{vj} = 175 \text{ °C}$		3.2	
Zero gate-voltage drain current	I_{DSS}	$V_{DS} = 1200 \text{ V}$, $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ °C}$		490	μA
			$T_{vj} = 175 \text{ °C}$		8.4	
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}	$I_D = 56.7 \text{ A}$, $V_{DS} = 20 \text{ V}$		26.1		S
Internal gate resistance	$R_{G,int}$	$f = 1 \text{ MHz}$, $V_{AC} = 25 \text{ mV}$		4		Ω
Input capacitance	C_{iss}	$V_{DD} = 800 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 100 \text{ kHz}$, $V_{AC} = 25 \text{ mV}$		4050		pF
Output capacitance	C_{oss}	$V_{DD} = 800 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 100 \text{ kHz}$, $V_{AC} = 25 \text{ mV}$		176		pF
Reverse transfer capacitance	C_{rss}	$V_{DD} = 800 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 100 \text{ kHz}$, $V_{AC} = 25 \text{ mV}$		15		pF
C_{oss} stored energy	E_{oss}	$V_{DD} = 800 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 100 \text{ kHz}$, $V_{AC} = 25 \text{ mV}$		74		μJ
Output charge	Q_{oss}	Calculated by $C_{oss}(f)V_{DS}$ @100 kHz		275.3		nC
Effective output capacitance, energy related	$C_{o(er)}$	$V_{DD} = 0...800 \text{ V}$, $V_{GS} = 0 \text{ V}$		231.3		pF
Effective output capacitance, time related	$C_{o(tr)}$	$I_C = \text{constant}$, $V_{DD} = 0...800 \text{ V}$, $V_{GS} = 0 \text{ V}$		344.1		pF
Total gate charge	Q_G	$V_{DD} = 800 \text{ V}$, $I_D = 56.7 \text{ A}$, $V_{GS} = -2/18 \text{ V}$, turn-on pulse		124		nC

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Plateau gate charge	$Q_{GS(pl)}$	$V_{DD} = 800\text{ V}$, $I_D = 56.7\text{ A}$, $V_{GS} = -2/18\text{ V}$, turn-on pulse		26		nC
Gate-to-drain charge	Q_{GD}	$V_{DD} = 800\text{ V}$, $I_D = 56.7\text{ A}$, $V_{GS} = -2/18\text{ V}$, turn-on pulse		34		nC
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 800\text{ V}$, $I_D = 56.7\text{ A}$, $V_{GS} = 0/18\text{ V}$, $R_{GS(on)} = 2.3\ \Omega$, $R_{GS(off)} = 2.3\ \Omega$, $L_\sigma = 15\text{ nH}$, diode: body diode at $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ }^\circ\text{C}$	10		ns
			$T_{vj} = 175\text{ }^\circ\text{C}$	10		
Rise time	t_r	$V_{DD} = 800\text{ V}$, $I_D = 56.7\text{ A}$, $V_{GS} = 0/18\text{ V}$, $R_{GS(on)} = 2.3\ \Omega$, $R_{GS(off)} = 2.3\ \Omega$, $L_\sigma = 15\text{ nH}$, diode: body diode at $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ }^\circ\text{C}$	20.6		ns
			$T_{vj} = 175\text{ }^\circ\text{C}$	20		
Turn-off delay time	$t_{d(off)}$	$V_{DD} = 800\text{ V}$, $I_D = 56.7\text{ A}$, $V_{GS} = 0/18\text{ V}$, $R_{GS(on)} = 2.3\ \Omega$, $R_{GS(off)} = 2.3\ \Omega$, $L_\sigma = 15\text{ nH}$, diode: body diode at $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ }^\circ\text{C}$	19.7		ns
			$T_{vj} = 175\text{ }^\circ\text{C}$	34.5		
Fall time	t_f	$V_{DD} = 800\text{ V}$, $I_D = 56.7\text{ A}$, $V_{GS} = 0/18\text{ V}$, $R_{GS(on)} = 2.3\ \Omega$, $R_{GS(off)} = 2.3\ \Omega$, $L_\sigma = 15\text{ nH}$, diode: body diode at $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ }^\circ\text{C}$	13.2		ns
			$T_{vj} = 175\text{ }^\circ\text{C}$	15.5		
Turn-on energy	E_{on}	$V_{DD} = 800\text{ V}$, $I_D = 56.7\text{ A}$, $V_{GS} = 0/18\text{ V}$, $R_{GS(on)} = 2.3\ \Omega$, $R_{GS(off)} = 2.3\ \Omega$, $L_\sigma = 15\text{ nH}$, diode: body diode at $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ }^\circ\text{C}$	620		μJ
			$T_{vj} = 175\text{ }^\circ\text{C}$	1160		
Turn-off energy	E_{off}	$V_{DD} = 800\text{ V}$, $I_D = 56.7\text{ A}$, $V_{GS} = 0/18\text{ V}$, $R_{GS(on)} = 2.3\ \Omega$, $R_{GS(off)} = 2.3\ \Omega$, $L_\sigma = 15\text{ nH}$, diode: body diode at $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ }^\circ\text{C}$	270		μJ
			$T_{vj} = 175\text{ }^\circ\text{C}$	350		

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Total switching energy ¹⁾	E_{tot}	$V_{DD} = 800\text{ V}$, $I_D = 56.7\text{ A}$, $V_{GS} = 0/18\text{ V}$, $R_{GS(on)} = 2.3\ \Omega$, $R_{GS(off)} = 2.3\ \Omega$, $L_\sigma = 15\text{ nH}$, diode: body diode at $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$	970		μJ
			$T_{vj} = 175\text{ °C}$	1750		
Virtual junction temperature	T_{vj}		-55		175	$^{\circ}\text{C}$
Virtual junction temperature	$T_{vj(over)}$	overload, cumulative max. 100 h ²⁾			200	$^{\circ}\text{C}$

1) including E_{fr}

2) up to 5000 cycles. Maximum ΔT limited to 100 K.

Note: The chip technology was characterized up to 200 kV/ μs . 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}	$V_{GS} = 0\text{ V}$	145	A

Table 6 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Drain-source reverse voltage	V_{SD}	$I_{SD} = 56.7\text{ A}$, $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$	4.2	5.5	V
			$T_{vj} = 100\text{ °C}$	4.11		
			$T_{vj} = 175\text{ °C}$	4.05		
MOSFET forward recovery charge	Q_{fr}	$V_{DD} = 800\text{ V}$, $I_{SD} = 56.7\text{ A}$, $V_{GS} = 0\text{ V}$, $di_{SD}/dt = 1000\text{ A}/\mu\text{s}$, Q_{fr} includes also Q_C	$T_{vj} = 25\text{ °C}$	0.55		μC
			$T_{vj} = 175\text{ °C}$	1.06		
MOSFET peak forward recovery current	I_{frm}	$V_{DD} = 800\text{ V}$, $I_{SD} = 56.7\text{ A}$, $V_{GS} = 0\text{ V}$, $di_{SD}/dt = 1000\text{ A}/\mu\text{s}$, Q_{fr} includes also Q_C	$T_{vj} = 25\text{ °C}$	10.1		A
			$T_{vj} = 175\text{ °C}$	15.9		

(table continues...)

Table 6 (continued) **Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
MOSFET forward recovery energy	E_{fr}	$V_{DD} = 800\text{ V}$, $I_{SD} = 56.7\text{ A}$, $V_{GS} = 0\text{ V}$, $di_{SD}/dt = 1000\text{ A}/\mu\text{s}$, Q_{fr} includes also Q_C	$T_{vj} = 25\text{ °C}$	80		μJ
			$T_{vj} = 175\text{ °C}$	240		
Virtual junction temperature	T_{vj}		-55		175	$^{\circ}\text{C}$
Virtual junction temperature	$T_{vj(over)}$	overload, cumulative max. 100 h ¹⁾			200	$^{\circ}\text{C}$

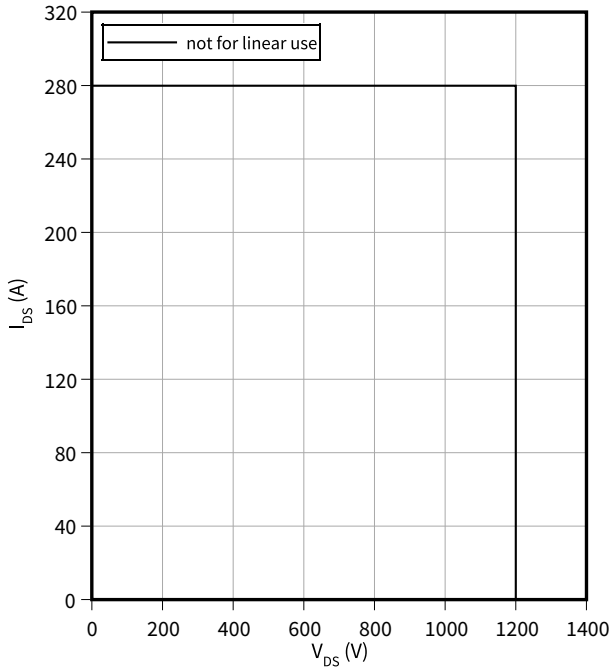
1) up to 5000 cycles. Maximum ΔT limited to 100 K.

4 Characteristics diagrams

Reverse bias safe operating area (RBSOA)

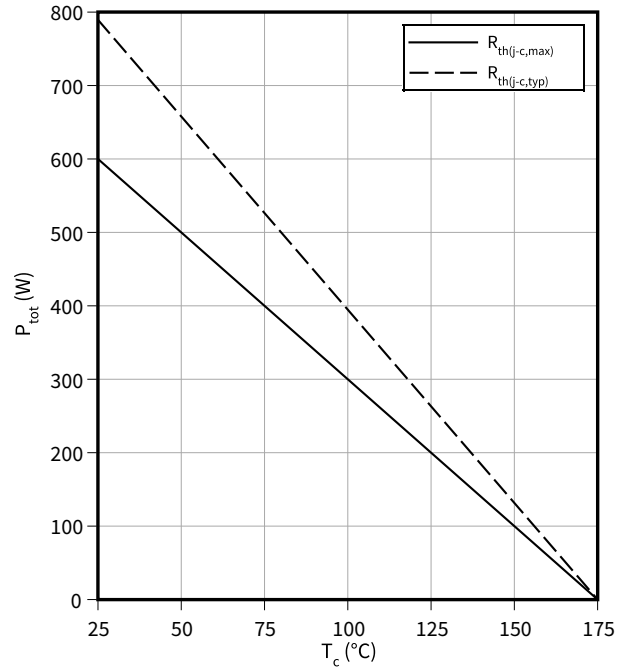
$$I_{DS} = f(V_{DS})$$

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



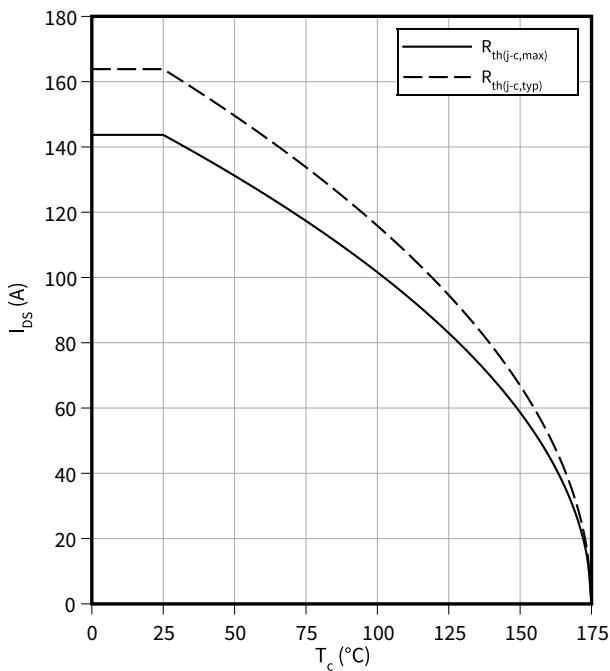
Power dissipation as a function of case temperature

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



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

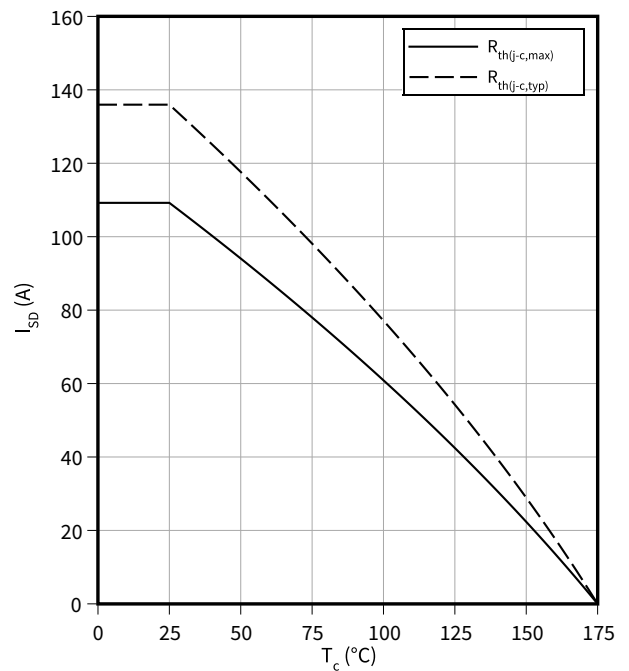
$$I_{DS} = f(T_c)$$



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

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

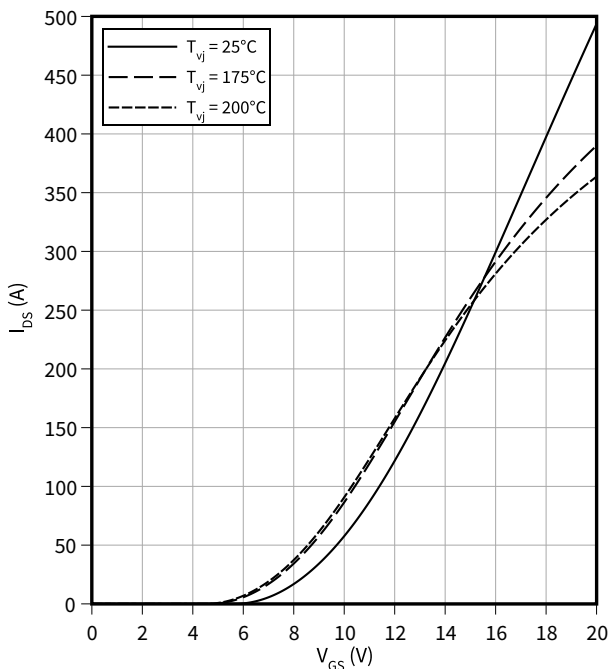
$$V_{GS} = 0\text{ V}$$



4 Characteristics diagrams

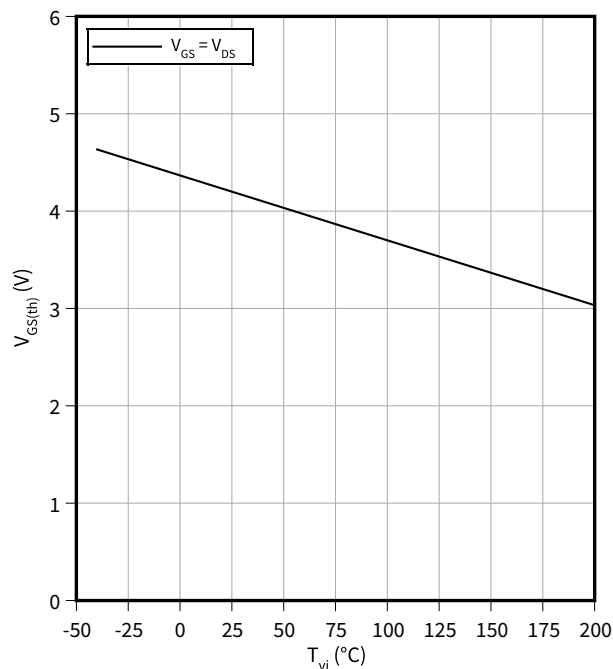
Typical transfer characteristic

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



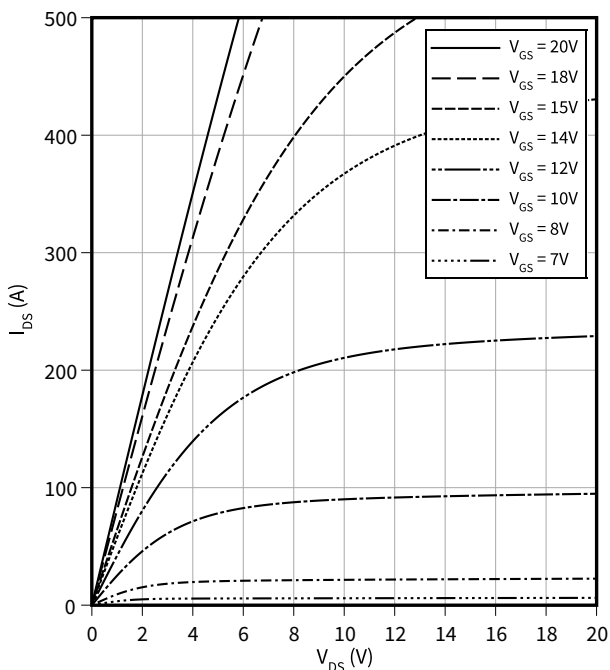
Typical gate-source threshold voltage as a function of junction temperature

$V_{GS(th)} = f(T_{vj})$
 $I_D = 17.8\text{ mA}$



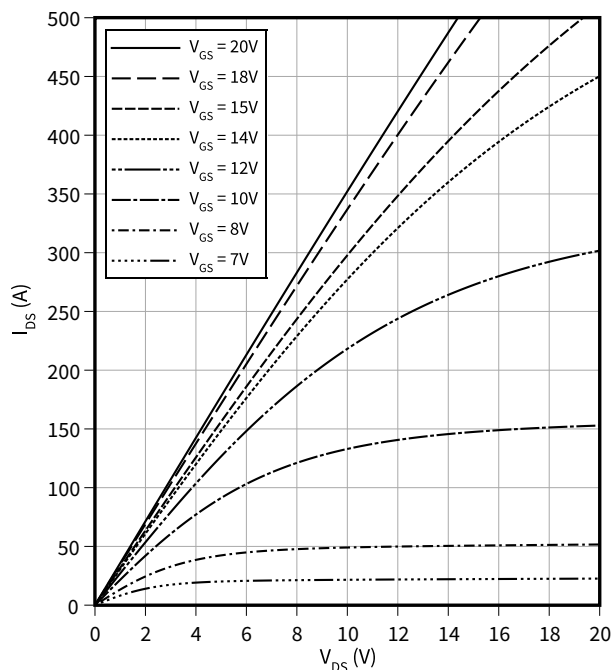
Typical output characteristic, V_{GS} as parameter

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



Typical output characteristic, V_{GS} as parameter

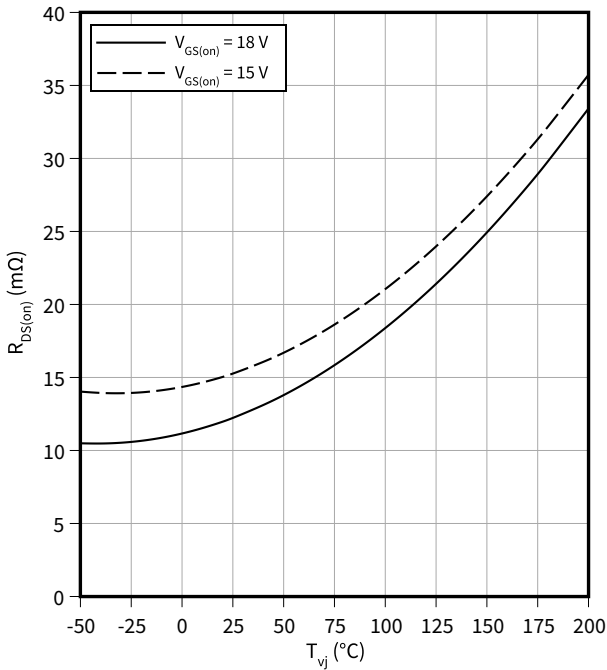
$I_{DS} = f(V_{DS})$
 $T_{vj} = 175\ ^\circ\text{C}, t_p = 20\ \mu\text{s}$



4 Characteristics diagrams

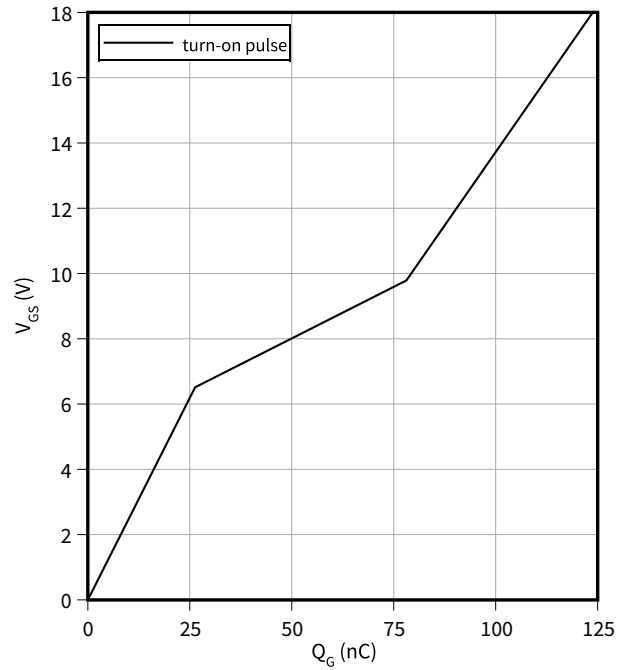
Typical on-state resistance as a function of junction temperature

$R_{DS(on)} = f(T_{vj})$
 $I_D = 56.7 \text{ A}$



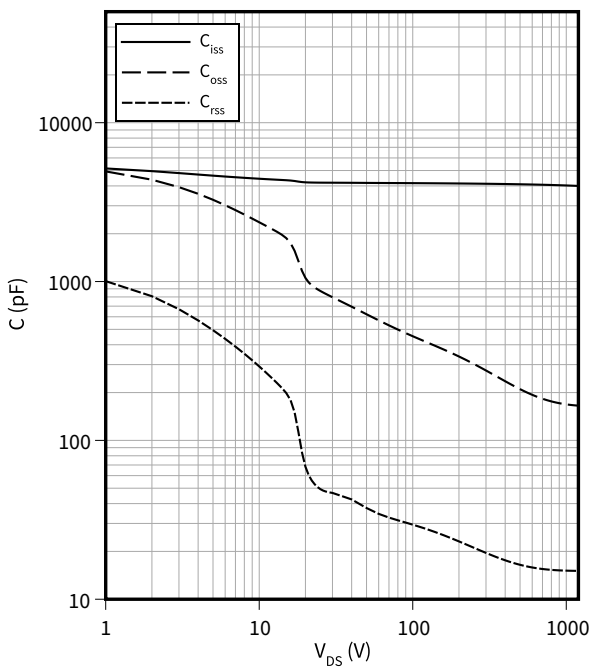
Typical gate charge

$V_{GS} = f(Q_G)$
 $I_D = 56.7 \text{ A}, V_{DS} = 800 \text{ V}$



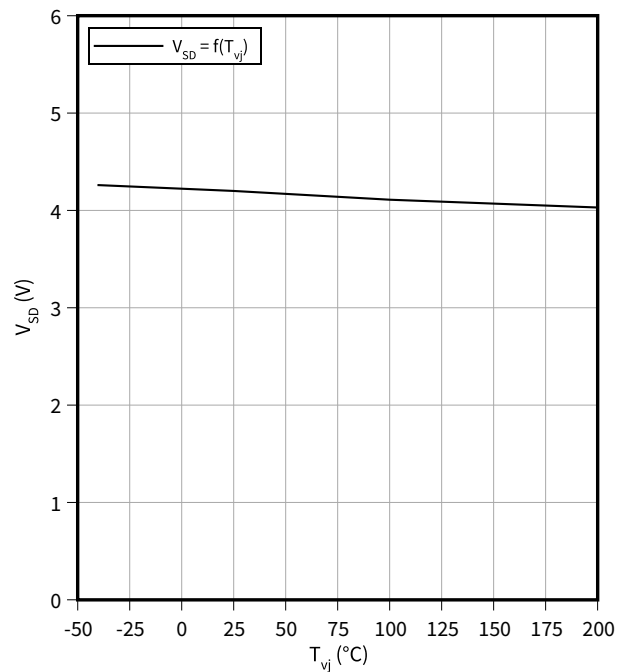
Typical capacitance as a function of drain-source voltage

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



Typical reverse drain voltage as function of junction temperature

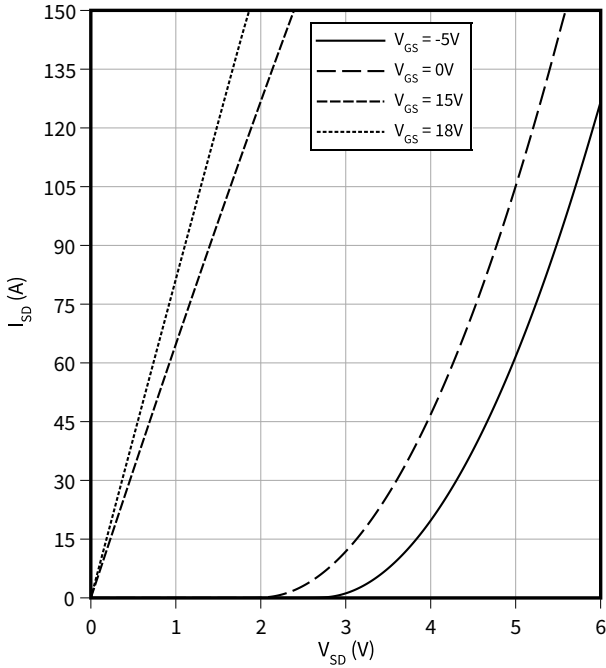
$V_{SD} = f(T_{vj})$
 $I_{SD} = 56.7 \text{ A}, V_{GS} = 0 \text{ V}$



4 Characteristics diagrams

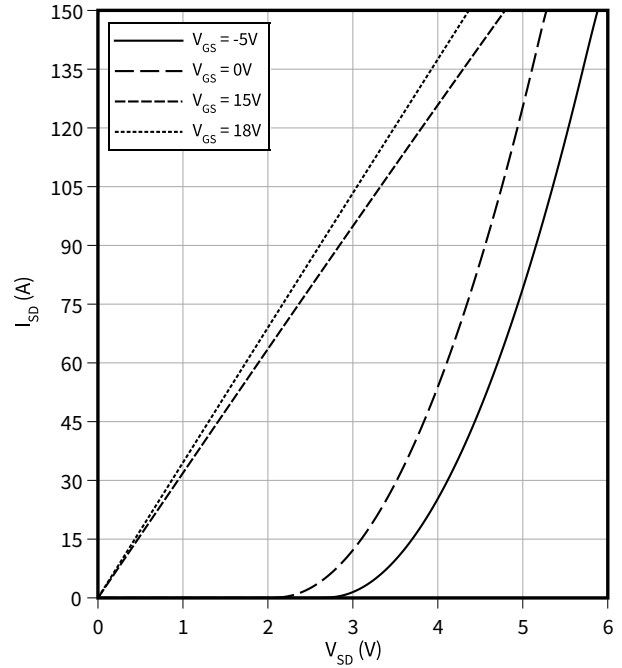
Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter

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



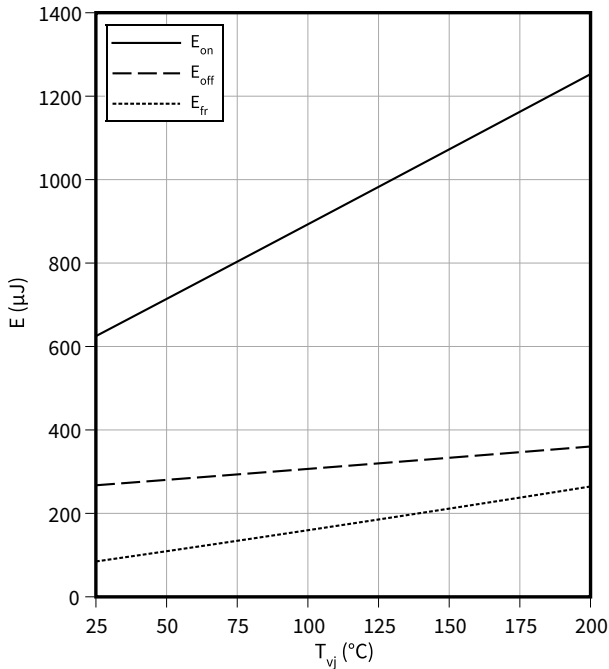
Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter

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



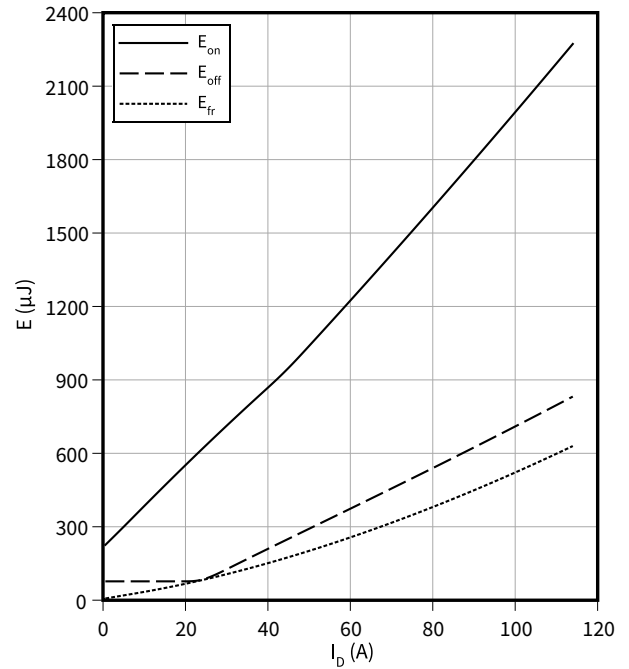
Typical switching energy as a function of junction temperature, test circuit in Fig. F, 2nd device own body diode: $V_{GS} = 0\text{ V}$

$E = f(T_{vj})$
 $V_{GS} = 0/18\text{ V}$, $I_D = 56.7\text{ A}$, $R_{G,ext} = 2.3\ \Omega$, $V_{DD} = 800\text{ V}$



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

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

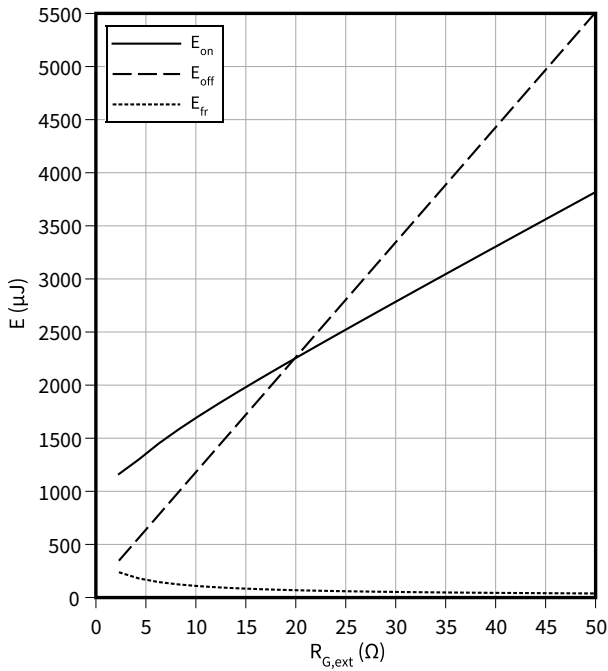


4 Characteristics diagrams

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

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

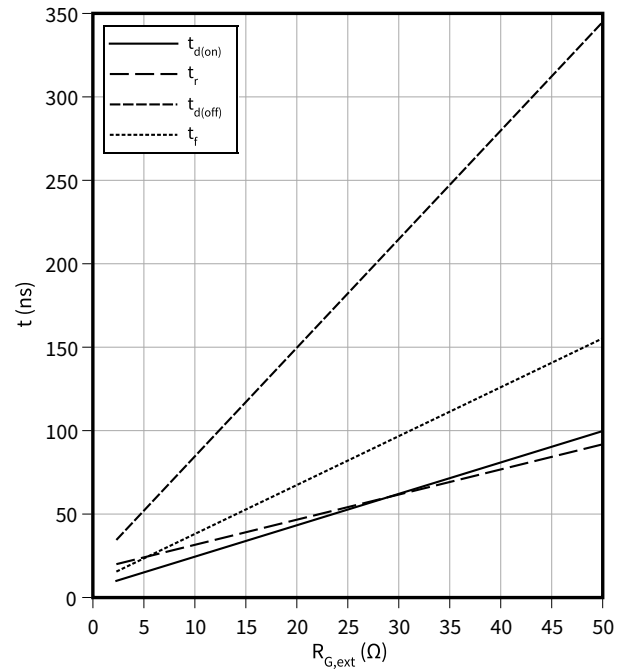
$V_{GS} = 0/18\text{ V}$, $I_D = 56.7\text{ A}$, $T_{vj} = 175\text{ °C}$, $V_{DD} = 800\text{ V}$



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

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

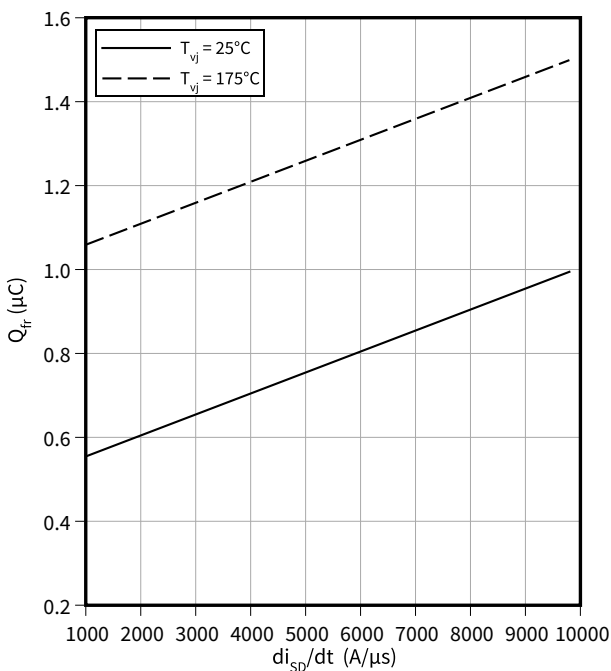
$V_{GS} = 0/18\text{ V}$, $I_D = 56.7\text{ A}$, $T_{vj} = 175\text{ °C}$, $V_{DD} = 800\text{ V}$



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

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

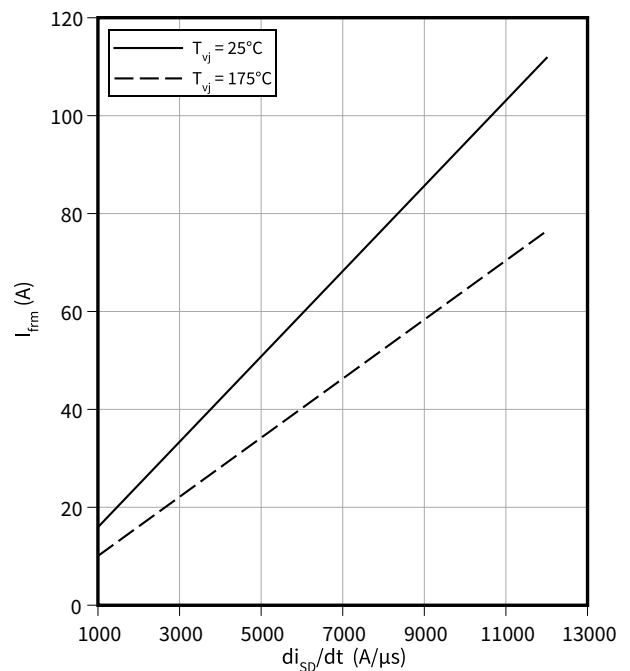
$V_{GS} = 0/18\text{ V}$, $I_{SD} = 56.7\text{ A}$, $V_{DD} = 800\text{ V}$



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

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

$V_{GS} = 0/18\text{ V}$, $I_{SD} = 56.7\text{ A}$, $V_{DD} = 800\text{ V}$



4 Characteristics diagrams

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

$E = f(t_{dead})$

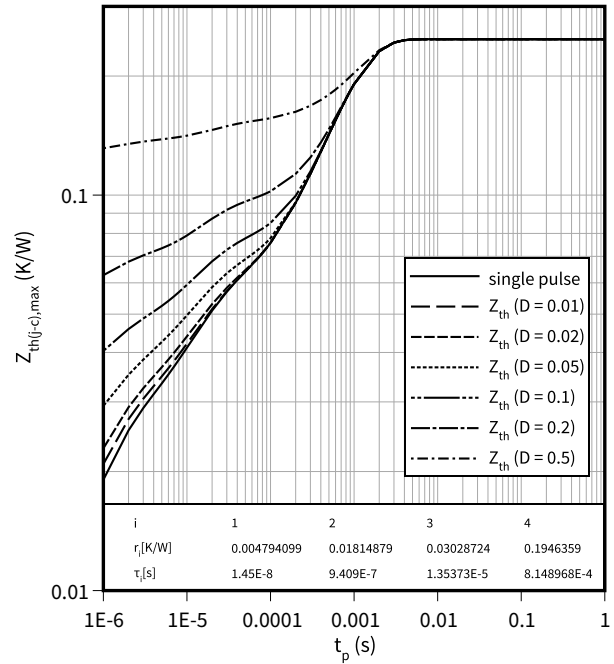
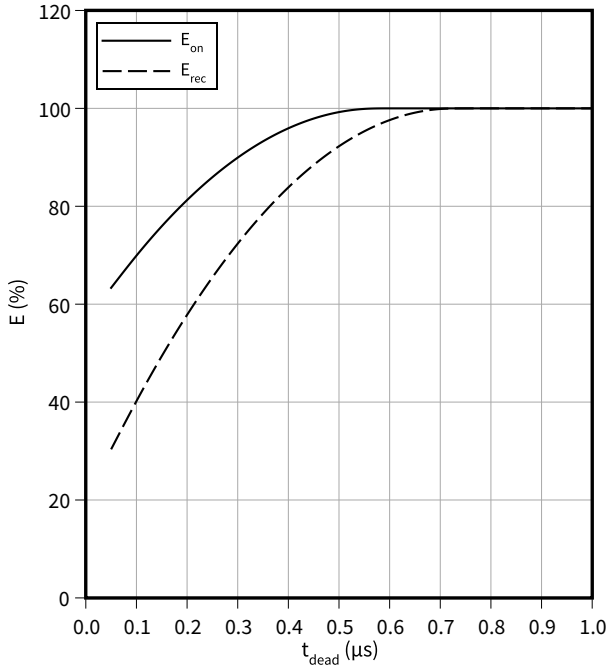
$V_{GS} = 0/18\text{ V}$, $I_D = 56.7\text{ A}$, $T_{vj} = 175\text{ °C}$, $R_{G,ext} = 2.3\text{ }\Omega$

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

Max. transient thermal impedance (MOSFET/diode)

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

$D = t_p/T$



5 Package outlines

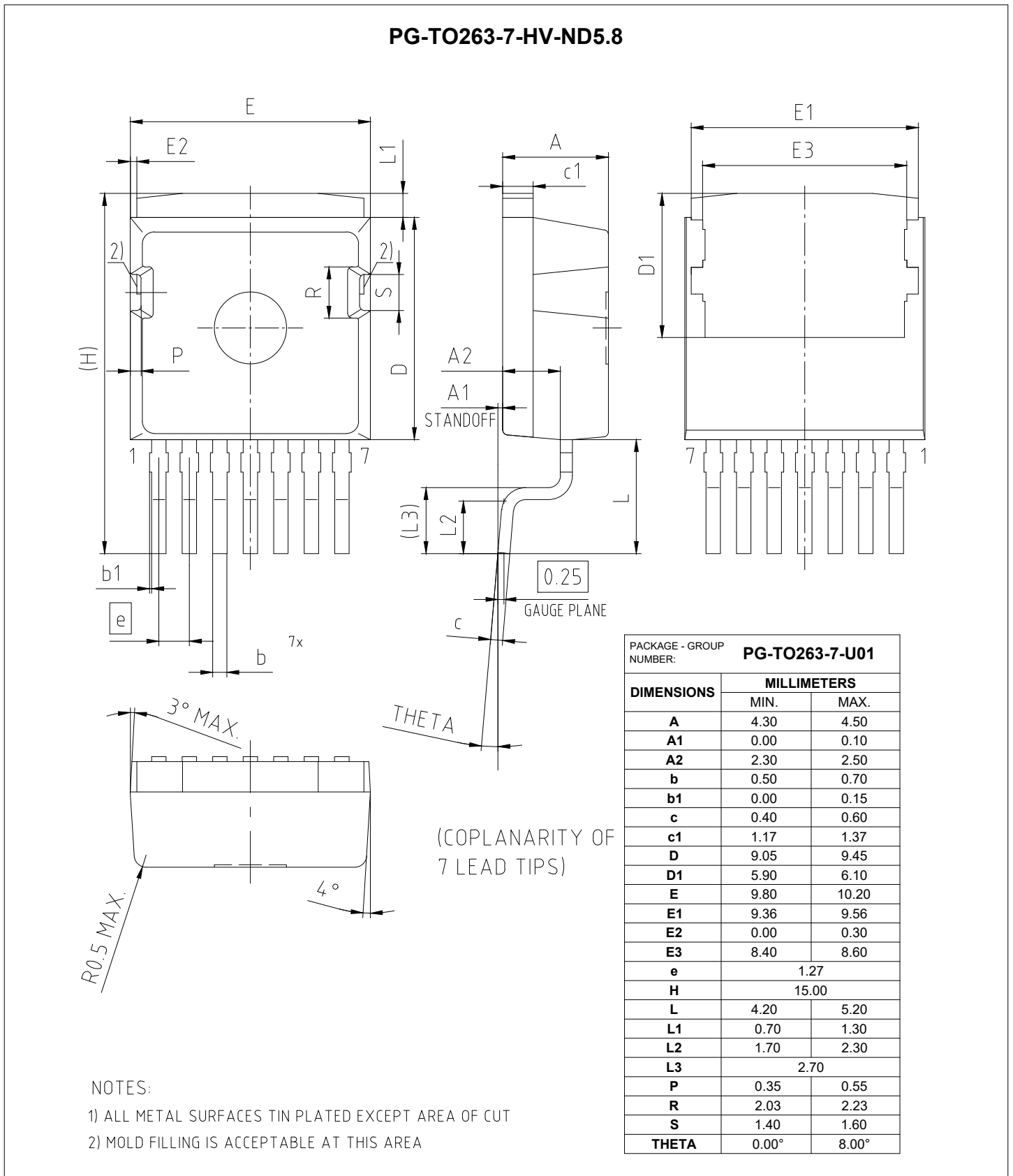


Figure 1

6 Testing conditions

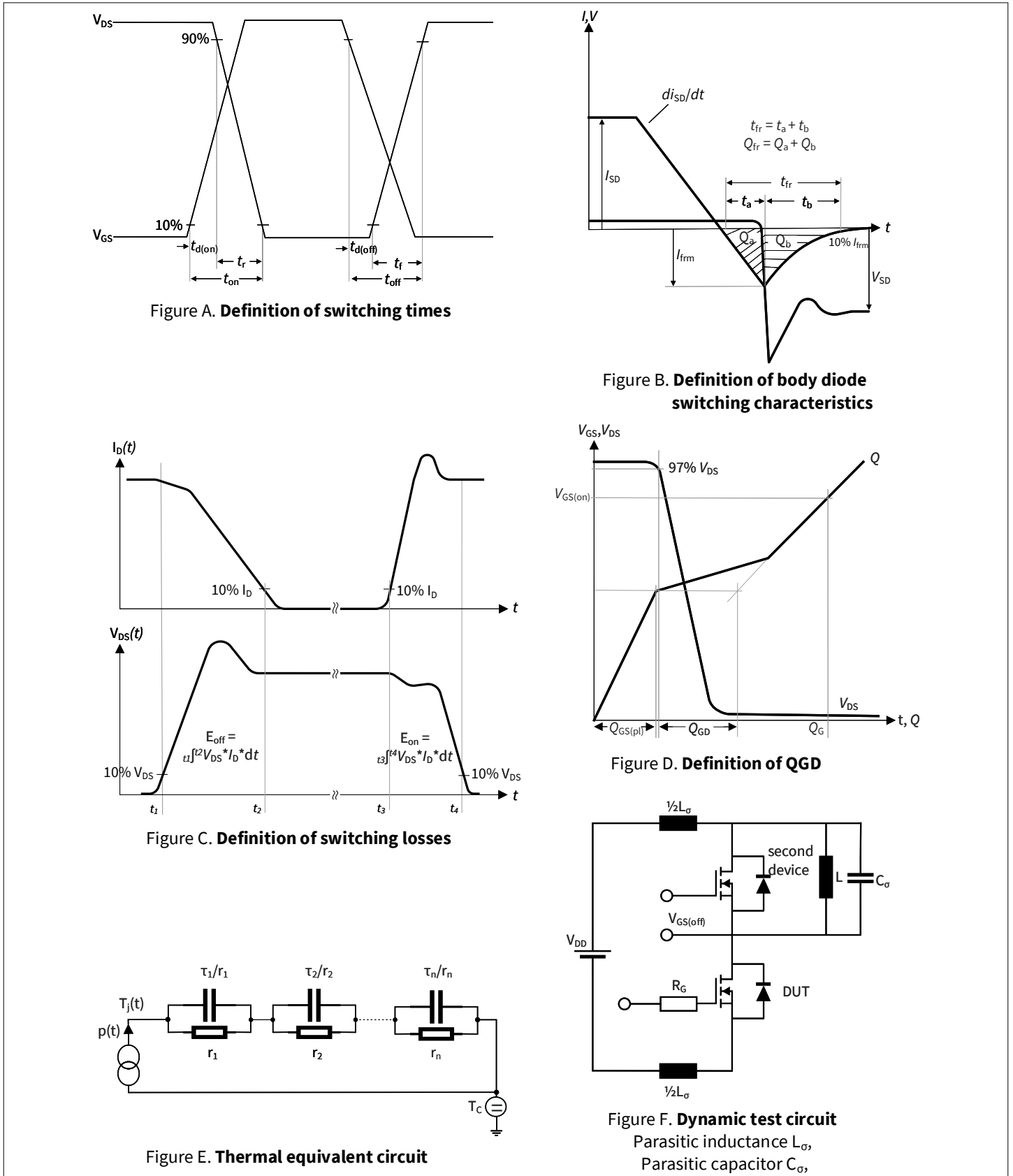


Figure 2

Revision history

Document revision	Date of release	Description of changes
0.10	2023-08-08	Preliminary datasheet
1.00	2023-09-29	Final datasheet
1.10	2024-01-11	Negative gate voltage values updated Additional capacitance & charge values added E = f(t _{dead}) graph y-axis correction to percentage values Editorial changes

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