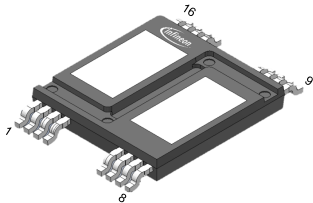


Final datasheet
CoolSiC™ 1200 V SiC MOSFET G2 : Silicon Carbide MOSFET with top side cooling and .XT technology

Features

- $V_{DS} = 1200\text{ V}$ at $T_{vj} = 25^{\circ}\text{C}$
- $I_{DC} = 32\text{ A}$ at $T_C = 100^{\circ}\text{C}$
- $R_{DS(on)} = 53\text{ m}\Omega$ at $V_{GS} = 18\text{ V}$, $T_{vj} = 25^{\circ}\text{C}$
- Internal layout optimized for fast switching
- 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 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

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

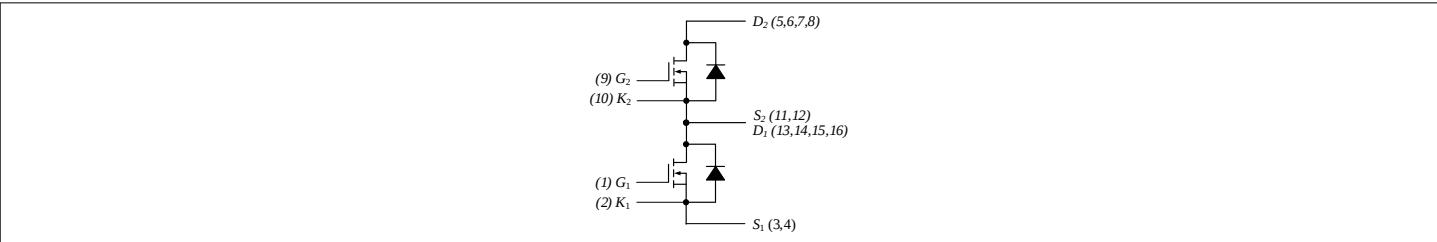
Product validation

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

Description

- 13-16 (5-8) – case 1(2) and drain D1(D2)
- 3,4 (11,12) – source S1(S2)
- 2(10) – kelvin sense K1(K2)
- 1(9)– gate G1(G2)

Note: the source and sense pins are not exchangeable, their exchange might lead to malfunction



Type	Package	Marking
IMSQ120R053M2HH	PG-HDSOP-16-U03	12M2H053



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1 Package

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 (MSL2 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	$R_{th(j-c)}$			0.49	0.64	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}	$V_{GS}=18\text{ V}$	$T_c = 25\text{ °C}$	45	A
			$T_c = 100\text{ °C}$	32	
Peak drain current, t_p limited by $T_{vj(max)}$ ¹⁾	I_{DM}	$V_{GS}=18\text{ V}$		96	A
Gate-source voltage, max. transient voltage ²⁾	V_{GS}	$t_p \leq 0.5\text{ }\mu\text{s}$, $D < 0.01$		-10...25	V
Gate-source voltage, max. static voltage	V_{GS}			-7...23	V
Avalanche energy, single pulse	E_{AS}	$I_D = 13\text{ A}$, $V_{DD} = 50\text{ V}$, $L = 1.9\text{ mH}$, $T_{vj(start)} = 25\text{ °C}$		166	mJ
Avalanche energy, repetitive	E_{AR}	$I_D = 13\text{ A}$, $V_{DD} = 50\text{ V}$, $L = 9.5\text{ }\mu\text{H}$, $T_{vj(start)} = 25\text{ °C}$		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	μs
Power dissipation, limited by $T_{vj(max)}$	P_{tot}		$T_c = 25\text{ °C}$	234	W
			$T_c = 100\text{ °C}$	117	

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	$R_{DS(on)}$	$I_D = 13\text{ A}$		$T_{vj} = 25\text{ °C}$, $V_{GS(on)} = 18\text{ V}$	53	mΩ
				$T_{vj} = 150\text{ °C}$, $V_{GS(on)} = 18\text{ V}$	107	
				$T_{vj} = 175\text{ °C}$, $V_{GS(on)} = 18\text{ V}$	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	V
				$T_{vj} = 175\text{ °C}$	4.2	
Zero gate-voltage drain current	I_{DSS}	$V_{DS} = 1200\text{ V}$, $V_{GS} = 0\text{ V}$		$T_{vj} = 25\text{ °C}$		μA
				$T_{vj} = 175\text{ °C}$	110	
Gate leakage current	I_{GSS}	$V_{DS} = 0\text{ V}$		$V_{GS} = 23\text{ V}$		nA
				$V_{GS} = -10\text{ V}$	120	
Forward transconductance	g_{fs}	$I_D = 13\text{ A}$, $V_{DS} = 20\text{ V}$			9	S
Internal gate resistance	$R_{G,int}$	$f = 1\text{ MHz}$, $V_{AC} = 25\text{ mV}$			8.5	Ω
Input capacitance	C_{iss}	$V_{DS} = 800\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 100\text{ kHz}$, $V_{AC} = 25\text{ mV}$			1010	pF
Output capacitance	C_{oss}	$V_{DS} = 800\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 100\text{ kHz}$, $V_{AC} = 25\text{ mV}$			41	pF
Reverse transfer capacitance	C_{rss}	$V_{DS} = 800\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 100\text{ kHz}$, $V_{AC} = 25\text{ mV}$			4	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}			17	μJ
Output charge	Q_{oss}	$V_{DS} = 0...800\text{ V}$, $V_{GS} = 0\text{ V}$, Calculated based on C_{oss}			64.2	nC
Effective output capacitance, energy related	$C_{o(er)}$	$V_{DS} = 0...800\text{ V}$, $V_{GS} = 0\text{ V}$			53	pF
Effective output capacitance, time related	$C_{o(tr)}$	$I_D = \text{constant}$, $V_{DS} = 0...800\text{ V}$, $V_{GS} = 0\text{ V}$			80	pF

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_G	$V_{DD} = 800 \text{ V}$, $I_D = 13 \text{ A}$, $V_{GS} = 0 \text{ V}$, turn-on pulse		28		nC
Plateau gate charge	$Q_{GS(pl)}$	$V_{DD} = 800 \text{ V}$, $I_D = 13 \text{ A}$, $V_{GS} = 0 \text{ V}$, turn-on pulse		6.5		nC
Gate-to-drain charge	Q_{GD}	$V_{DD} = 800 \text{ V}$, $I_D = 13 \text{ A}$, $V_{GS} = 0 \text{ V}$, turn-on pulse		6.9		nC
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 800 \text{ V}$, $I_D = 13 \text{ A}$, $V_{GS} = 0/18 \text{ V}$, $R_{GS(on)} = 2.3 \Omega$, $R_{GS(off)} = 2.3 \Omega$, $L_\sigma = 9 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	7		ns
			$T_{vj} = 175 \text{ }^\circ\text{C}$	5.6		
Rise time	t_r	$V_{DD} = 800 \text{ V}$, $I_D = 13 \text{ A}$, $V_{GS} = 0/18 \text{ V}$, $R_{GS(on)} = 2.3 \Omega$, $R_{GS(off)} = 2.3 \Omega$, $L_\sigma = 9 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	4.6		ns
			$T_{vj} = 175 \text{ }^\circ\text{C}$	4.1		
Turn-off delay time	$t_{d(off)}$	$V_{DD} = 800 \text{ V}$, $I_D = 13 \text{ A}$, $V_{GS} = 0/18 \text{ V}$, $R_{GS(on)} = 2.3 \Omega$, $R_{GS(off)} = 2.3 \Omega$, $L_\sigma = 9 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	14.8		ns
			$T_{vj} = 175 \text{ }^\circ\text{C}$	17.3		
Fall time	t_f	$V_{DD} = 800 \text{ V}$, $I_D = 13 \text{ A}$, $V_{GS} = 0/18 \text{ V}$, $R_{GS(on)} = 2.3 \Omega$, $R_{GS(off)} = 2.3 \Omega$, $L_\sigma = 9 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	6.2		ns
			$T_{vj} = 175 \text{ }^\circ\text{C}$	7.3		
Turn-on energy	E_{on}	$V_{DD} = 800 \text{ V}$, $I_D = 13 \text{ A}$, $V_{GS} = 0/18 \text{ V}$, $R_{GS(on)} = 2.3 \Omega$, $R_{GS(off)} = 2.3 \Omega$, $L_\sigma = 9 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	101		μJ
			$T_{vj} = 175 \text{ }^\circ\text{C}$	192		
Turn-off energy	E_{off}	$V_{DD} = 800 \text{ V}$, $I_D = 13 \text{ A}$, $V_{GS} = 0/18 \text{ V}$, $R_{GS(on)} = 2.3 \Omega$, $R_{GS(off)} = 2.3 \Omega$, $L_\sigma = 9 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	36		μJ
			$T_{vj} = 175 \text{ }^\circ\text{C}$	48		

(table continues...)

3 Body diode (MOSFET)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Total switching energy ¹⁾	E_{tot}	$V_{\text{DD}} = 800 \text{ V}$, $I_{\text{D}} = 13 \text{ A}$, $V_{\text{GS}} = 0/18 \text{ V}$, $R_{\text{GS(on)}} = 2.3 \Omega$, $R_{\text{GS(off)}} = 2.3 \Omega$, $L_{\sigma} = 9 \text{ nH}$, diode: body diode at $V_{\text{GS}} = 0 \text{ V}$	$T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$	176		μJ
			$T_{\text{vj}} = 175 \text{ }^{\circ}\text{C}$	352		
Virtual junction temperature	$T_{\text{vj(min ... max)}}$		-55		175	$^{\circ}\text{C}$
Virtual junction temperature	$T_{\text{vj(over)}}$	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 $T_{\text{vj}} = 25^{\circ}\text{C}$, 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}	$T_{\text{vj}} \geq 25 \text{ }^{\circ}\text{C}$	1200	V
Peak reverse drain current, t_{p} limited by $T_{\text{vj(max)}}$	I_{SM}	$V_{\text{GS}} = 0 \text{ V}$	96	A

Table 6 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Drain-source reverse voltage	V_{SD}	$I_{\text{SD}} = 13 \text{ A}$, $V_{\text{GS}} = 0 \text{ V}$	$T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$	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}	$V_{\text{DD}} = 800 \text{ V}$, $I_{\text{SD}} = 13 \text{ A}$, $V_{\text{GS}} = 0 \text{ V}$, $R_{\text{GS(on)}} = 2.3 \Omega$, Q_{f} includes also Q_{C}	$T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$	110		nC
			$T_{\text{vj}} = 175 \text{ }^{\circ}\text{C}$	400		
MOSFET peak forward recovery current	I_{frm}	$V_{\text{DD}} = 800 \text{ V}$, $I_{\text{SD}} = 13 \text{ A}$, $V_{\text{GS}} = 0 \text{ V}$, $R_{\text{GS(on)}} = 2.3 \Omega$, Q_{f} includes also Q_{C}	$T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$	15.9		A
			$T_{\text{vj}} = 175 \text{ }^{\circ}\text{C}$	28.5		

(table continues...)

Table 6 (continued) Characteristic values

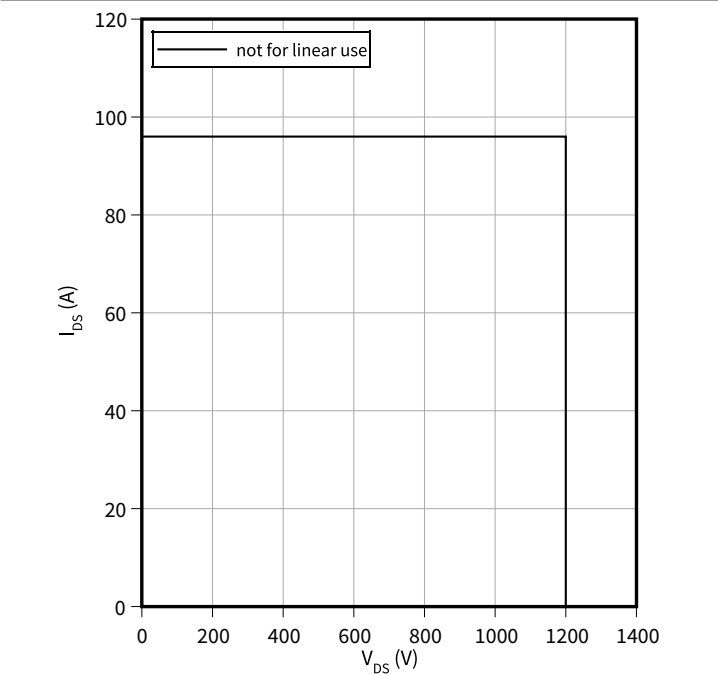
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
MOSFET forward recovery energy	E_{fr}	$V_{DD} = 800 \text{ V}$, $I_{SD} = 13 \text{ A}$, $V_{GS} = 0 \text{ V}$, $R_{GS(on)} = 2.3 \Omega$, Q_f includes also Q_C	$T_{vj} = 25 \text{ °C}$		39		μJ
			$T_{vj} = 175 \text{ °C}$		112		
Virtual junction temperature	$T_{vj(\text{min} \dots \text{max})}$			-55		175	$^{\circ}\text{C}$
Virtual junction temperature	$T_{vj(\text{over})}$	overload, cumulative max. 100 h ¹⁾				200	$^{\circ}\text{C}$

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

4 Characteristics diagrams

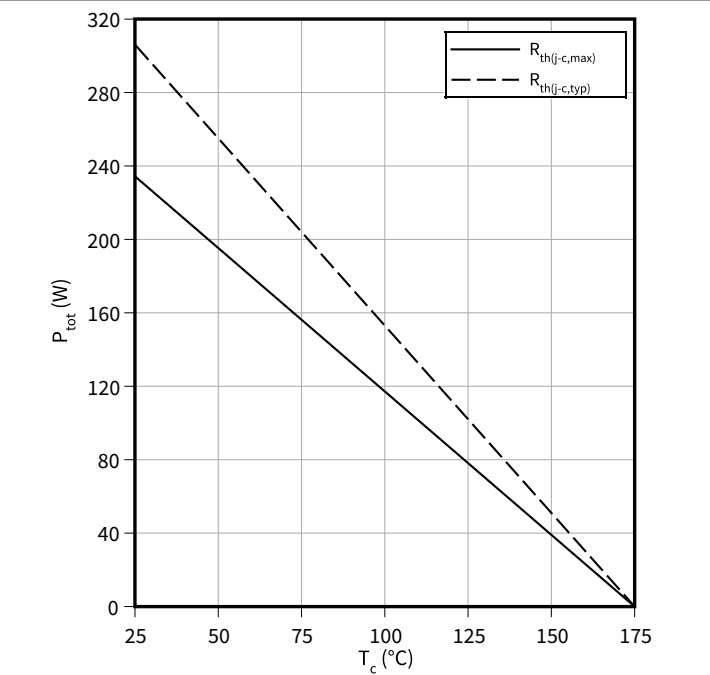
Reverse bias safe operating area (RBSOA)

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



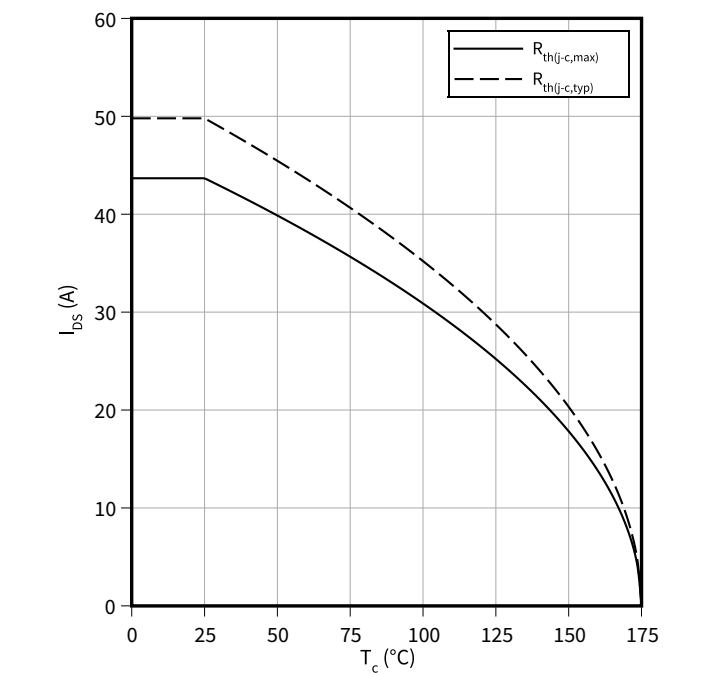
Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$



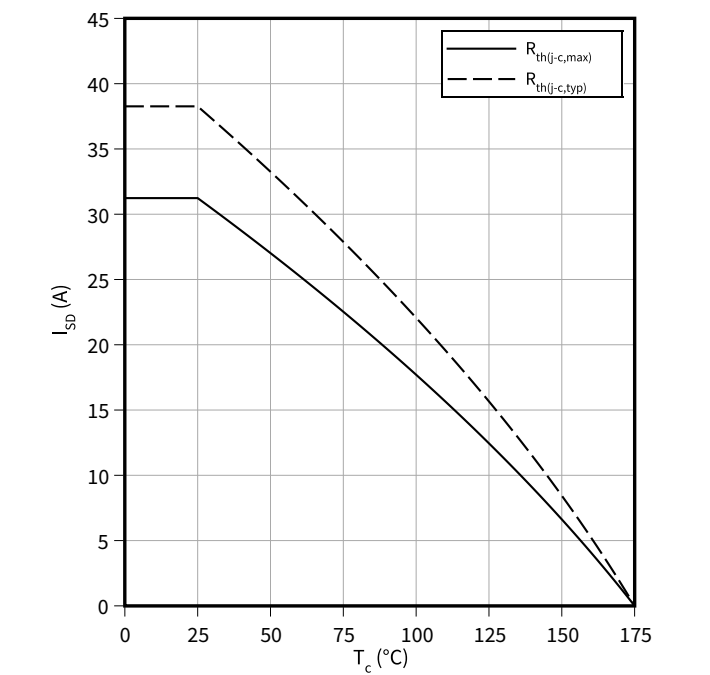
Maximum DC drain to source current as a function of case temperature limited by bond wire

$I_{DS} = f(T_c)$



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

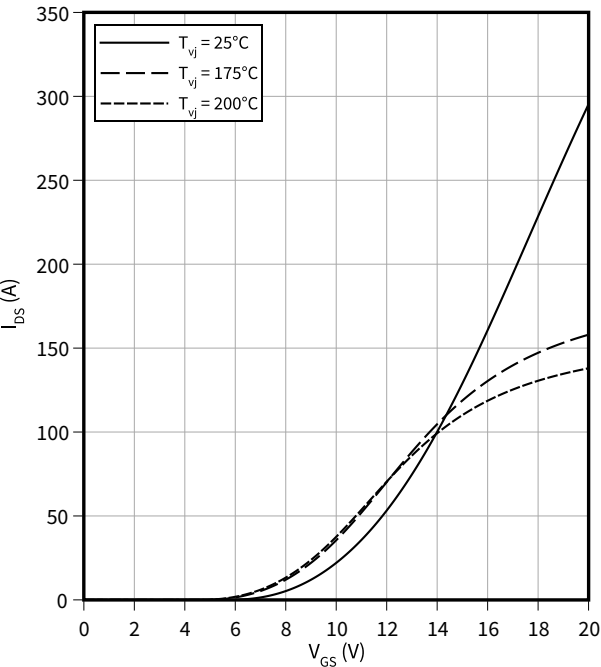
$I_{SD} = f(T_c)$
 $V_{GS} = 0\text{ V}$



4 Characteristics diagrams

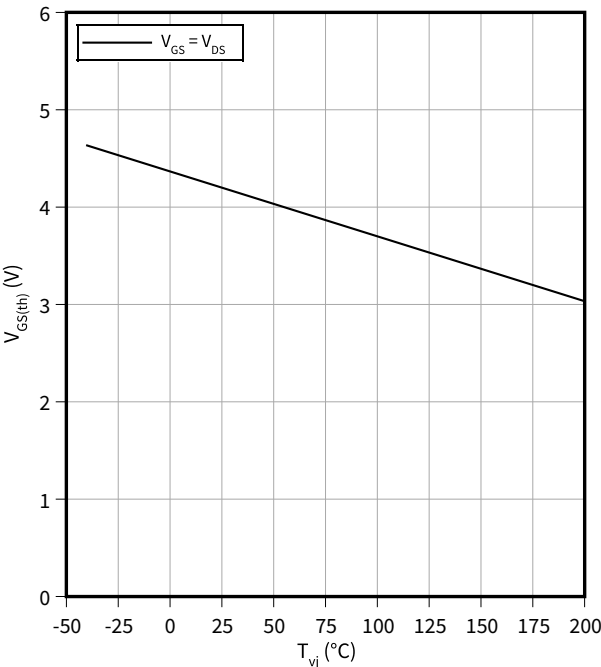
Typical transfer characteristic

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



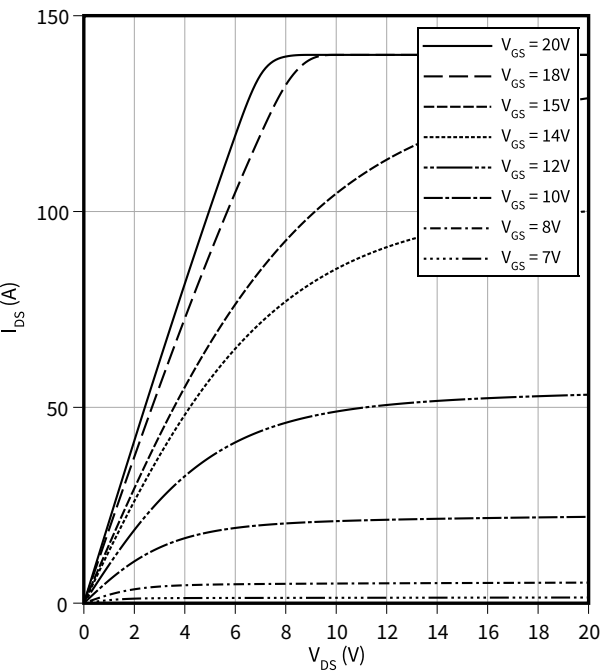
Typical gate-source threshold voltage as a function of junction temperature

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



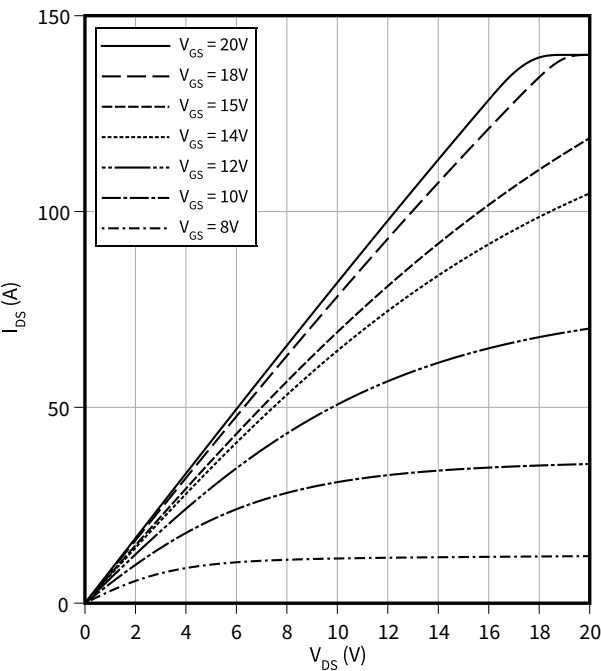
Typical output characteristic, V_{GS} as parameter

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



Typical output characteristic, V_{GS} as parameter

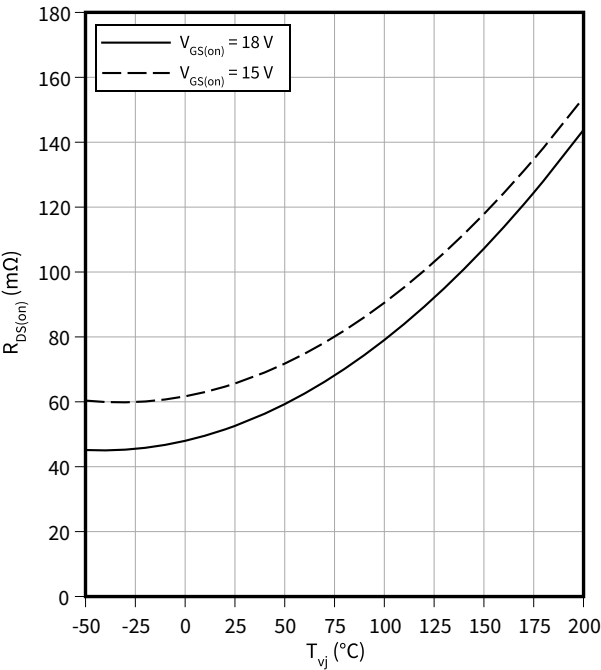
$I_{DS} = f(V_{DS})$
 $T_{vj} = 175\text{ }^\circ\text{C}$, $t_p = 20\text{ }\mu\text{s}$



4 Characteristics diagrams

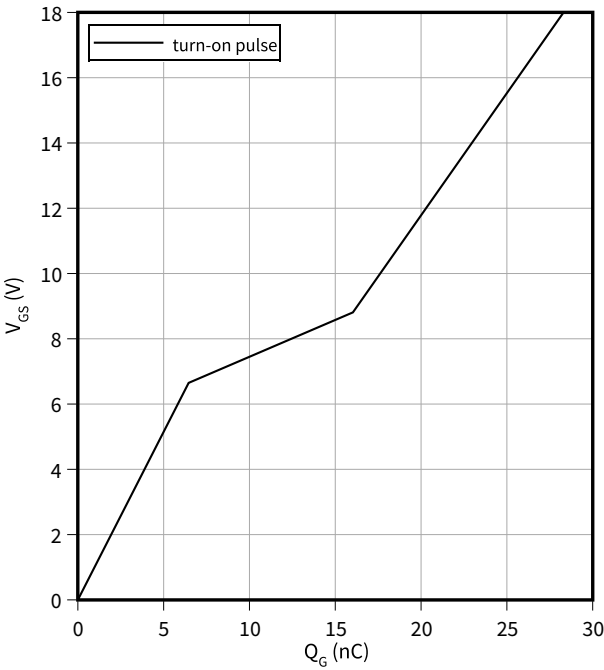
Typical on-state resistance as a function of junction temperature

$R_{DS(on)} = f(T_{vj})$
 $I_D = 13\text{ A}$



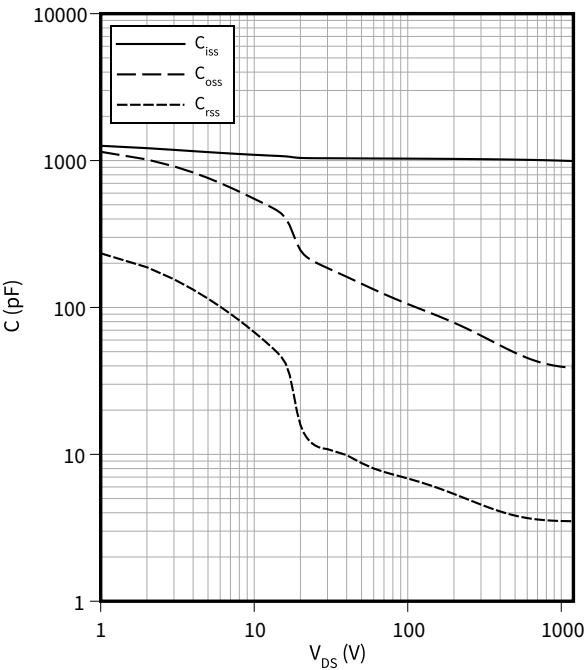
Typical gate charge

$V_{GS} = f(Q_G)$
 $I_D = 13\text{ A}, V_{DS} = 800\text{ V}$



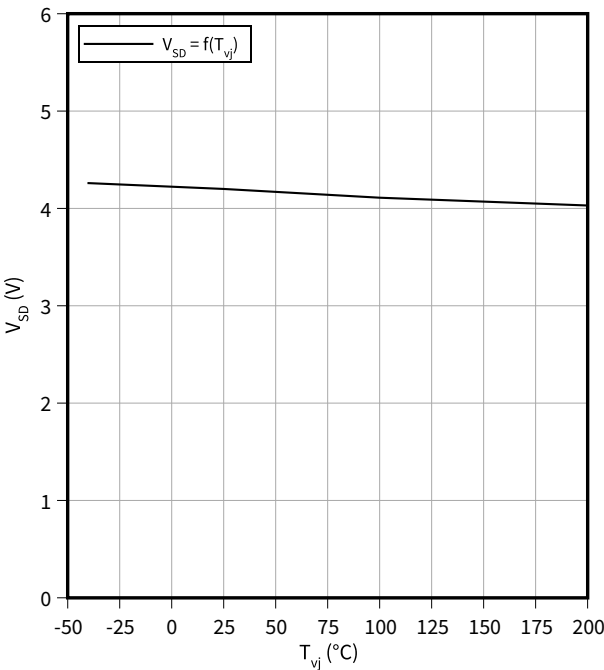
Typical capacitance as a function of drain-source voltage

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



Typical reverse drain voltage as function of junction temperature

$V_{SD} = f(T_{vj})$
 $I_{SD} = 13\text{ A}, V_{GS} = 0\text{ V}$

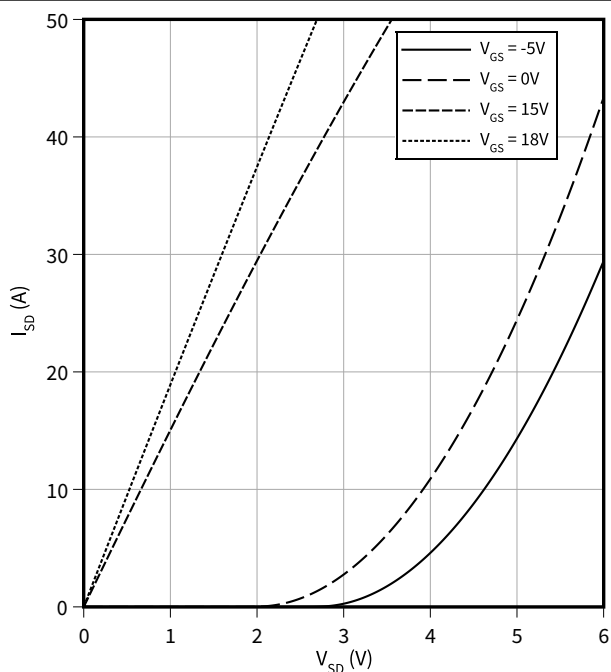


4 Characteristics diagrams

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

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

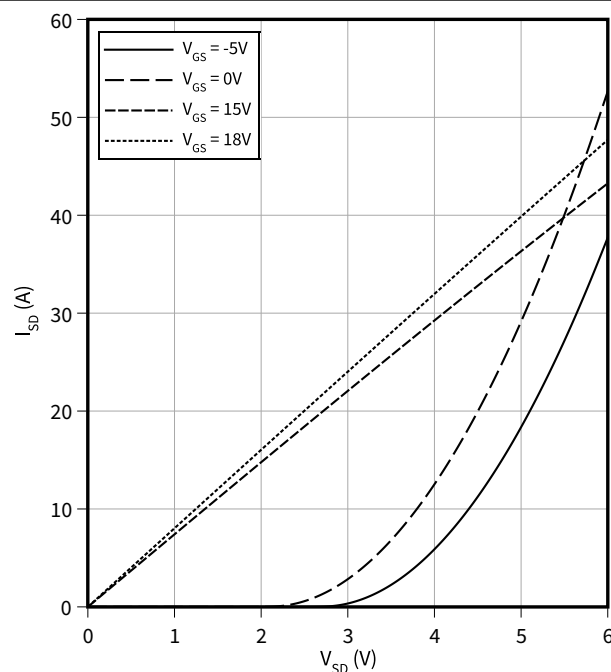
$T_{vj} = 25\text{ °C}$, $t_p = 20\text{ }\mu\text{s}$



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

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

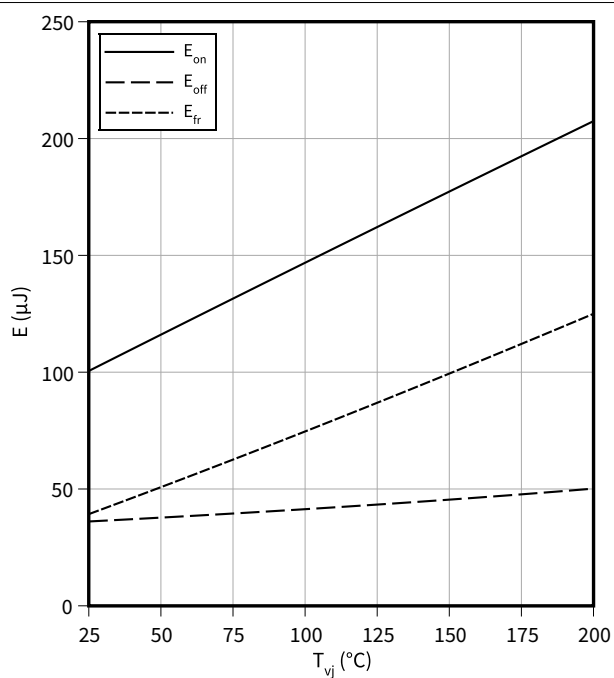
$T_{vj} = 175\text{ °C}$, $t_p = 20\text{ }\mu\text{s}$



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

$$E = f(T_{vj})$$

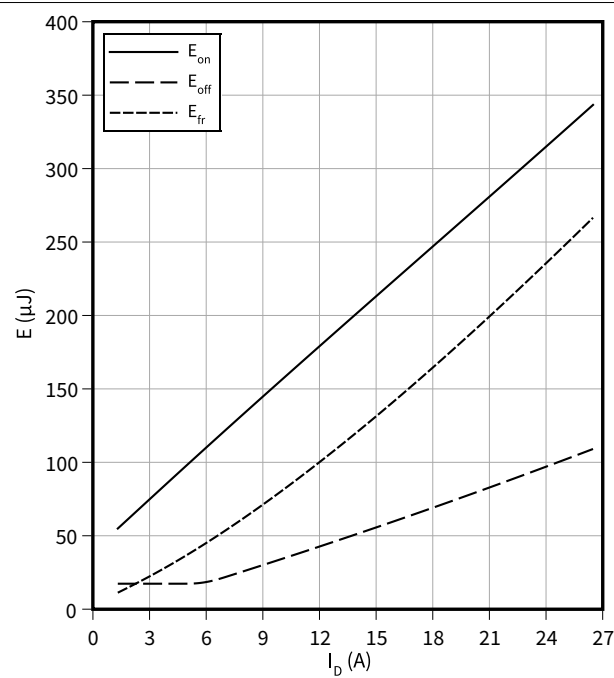
$V_{GS} = 0/18\text{ V}$, $I_D = 13\text{ A}$, $R_{G,ext} = 2.3\text{ }\Omega$, $V_{DD} = 800\text{ V}$



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

$$E = f(I_D)$$

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

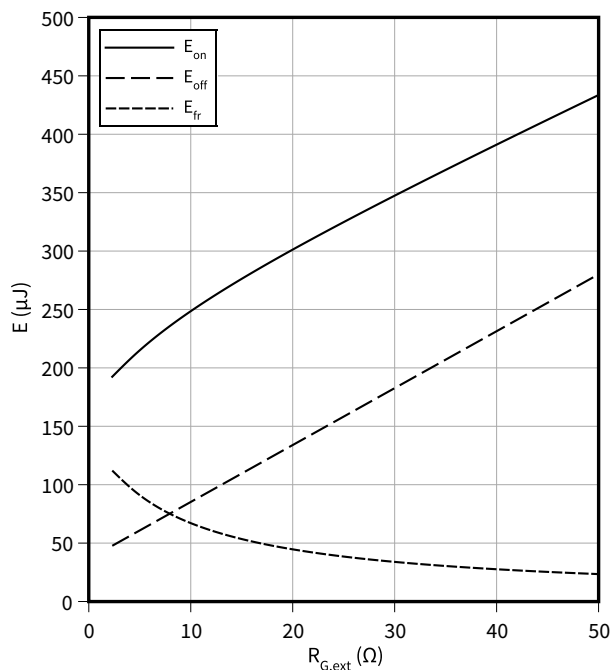


4 Characteristics diagrams

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

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

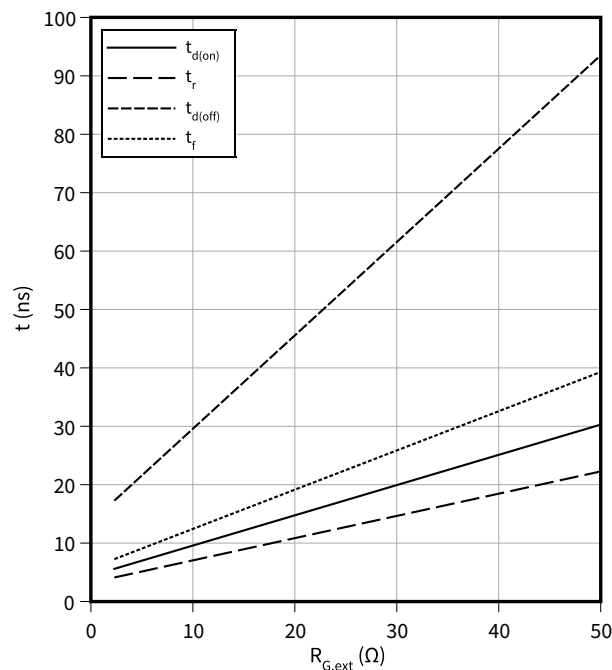
$V_{GS} = 0/18$ V, $I_D = 13$ A, $T_{vj} = 175$ °C, $V_{DD} = 800$ V



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

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

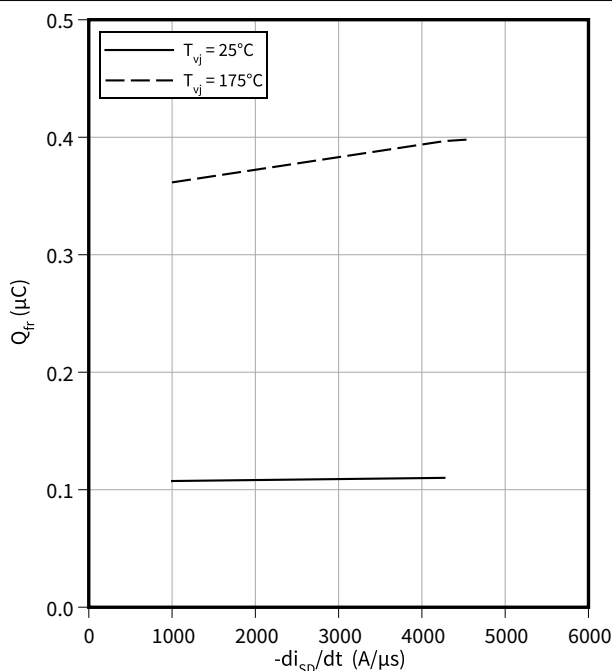
$V_{GS} = 0/18$ V, $I_D = 13$ A, $T_{vj} = 175$ °C, $V_{DD} = 800$ V



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

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

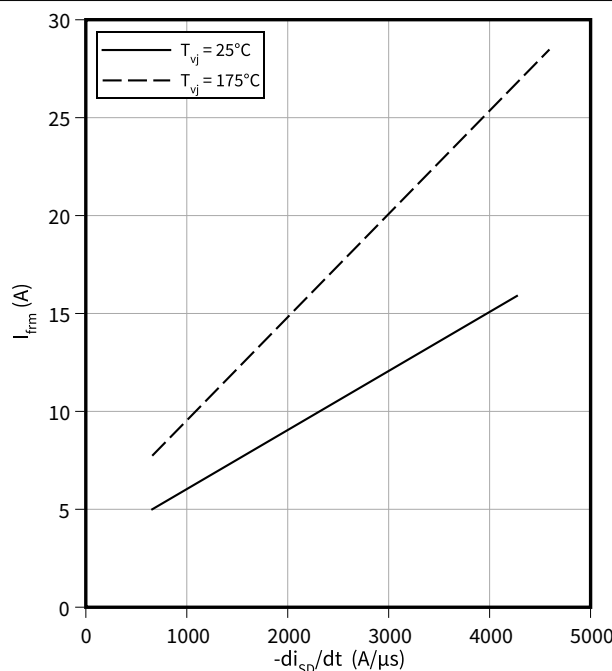
$V_{GS} = 0/18$ V, $I_{SD} = 13$ A, $V_{DD} = 800$ V



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

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

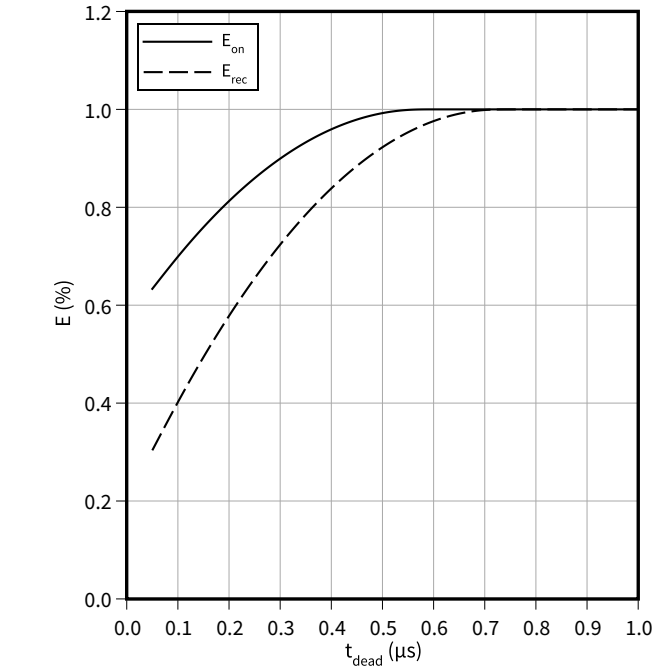
$V_{GS} = 0/18$ V, $I_{SD} = 13$ A, $V_{DD} = 800$ V



4 Characteristics diagrams

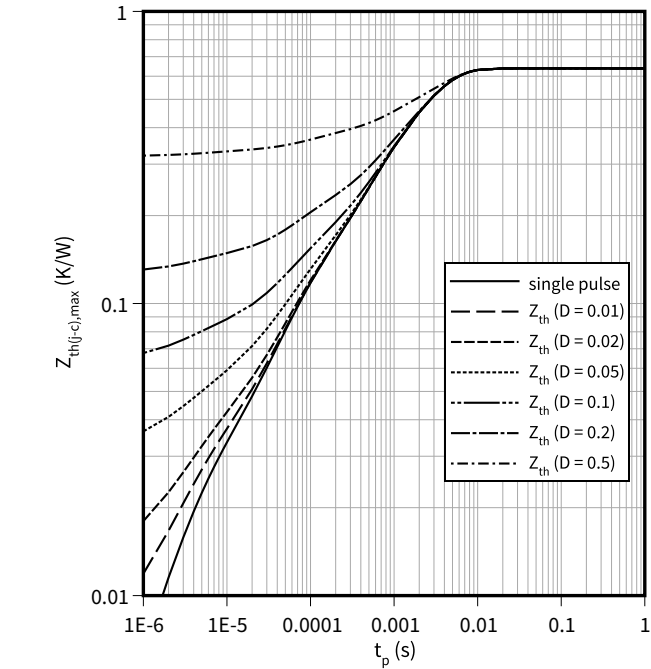
Typical switching energy as a function of dead time / blanking time, test circuit in Fig. F, 2nd device own body diode: $V_{GS} = -5\text{ V}$

$E = f(t_{dead})$
 $V_{GS} = 0/18\text{ V}$, $I_D = 13\text{ A}$, $T_{vj} = 175\text{ °C}$, $R_{G,ext} = 2.3\text{ }\Omega$, $V_{DD} = 800\text{ V}$
 $V_{DD} = 800\text{ V}$



Max. transient thermal impedance (MOSFET/diode)

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





NOTES:
ALL METAL SURFACES TIN PLATED EXCEPT AREA OF CUT
DIMENSIONS DO NOT INCLUDE MOLD FLASH,
PROTRUSION OR GATE BURRS

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6 Testing conditions

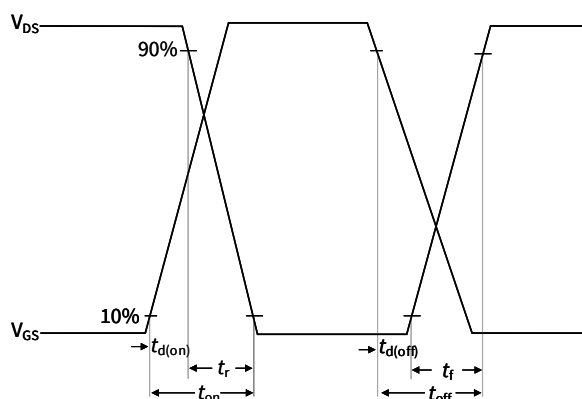


Figure A. Definition of switching times

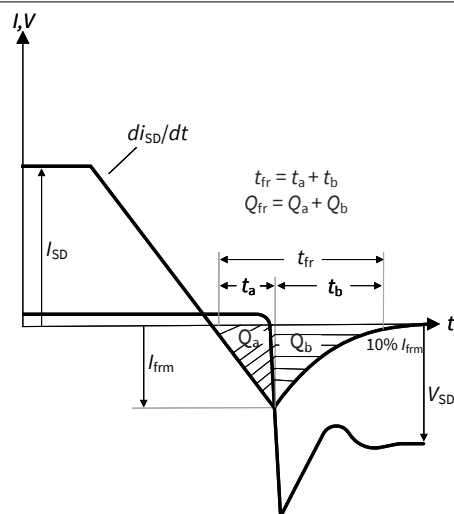


Figure B. Definition of body diode switching characteristics

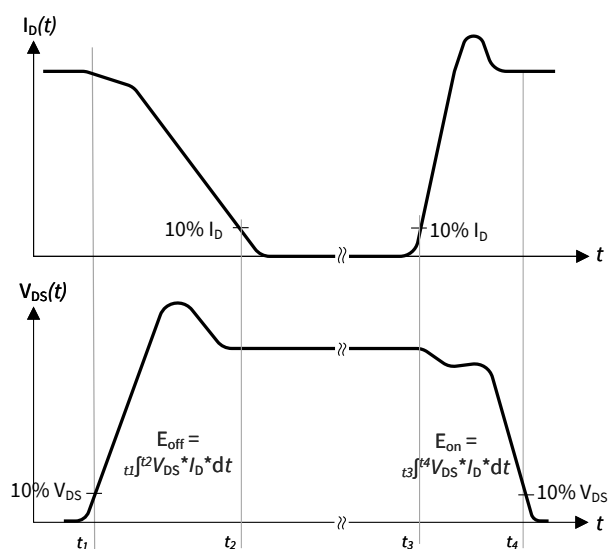


Figure C. Definition of switching losses

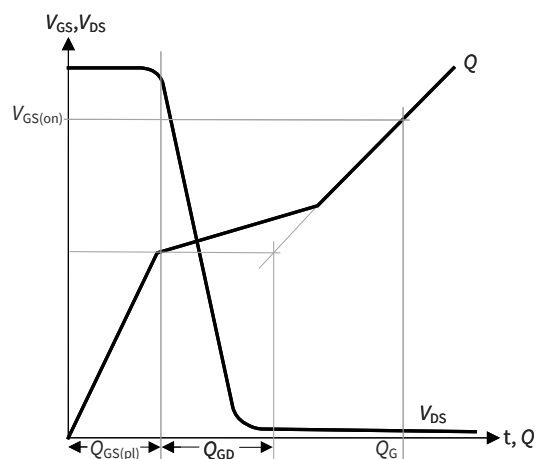


Figure D. Definition of QGD



Figure E. Thermal equivalent circuit

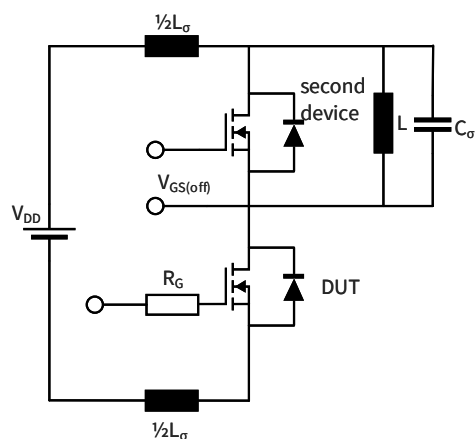


Figure F. Dynamic test circuit

Parasitic inductance L_{σ} ,
Parasitic capacitor C_{σ} ,



Revision history

Revision history

Document revision	Date of release	Description of changes
0.10	2022-10-28	Target datasheet
0.20	2023-11-24	Preliminary datasheet
1.00	2025-02-13	Final datasheet

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