

Final datasheet
CoolSiC™ 1700 V SiC Trench MOSFET : Silicon Carbide MOSFET

Features

- $V_{DS} = 1700\text{ V}$ at $T_{vj} = 25^{\circ}\text{C}$
- $I_{DC} = 9.8\text{ A}$ at $T_c = 25^{\circ}\text{C}$
- $R_{DS(on)} = 450\text{ m}\Omega$ at $V_{GS} = 18\text{ V}$, $T_{vj} = 25^{\circ}\text{C}$
- Optimized for fly-back topologies
- 12 V / 0 V gate-source voltage compatible with most fly-back controllers
- Very low switching losses
- Benchmark gate threshold voltage, $V_{GS(th)} = 4.5\text{ V}$
- Fully controllable dv/dt for EMI optimization
- Reduction of system complexity
- Directly drive from fly-back controller
- Efficiency improvement and cooling effort reduction
- Enabling higher frequency

Potential applications

- Solar string inverter
- Solar central inverter
- Industrial UPS
- Industrial SMPS
- Charger

Product validation

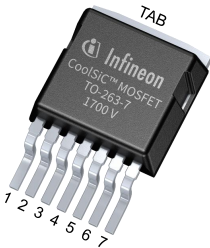
- Qualified for industrial applications according to the relevant tests of JEDEC47/20/22

Description

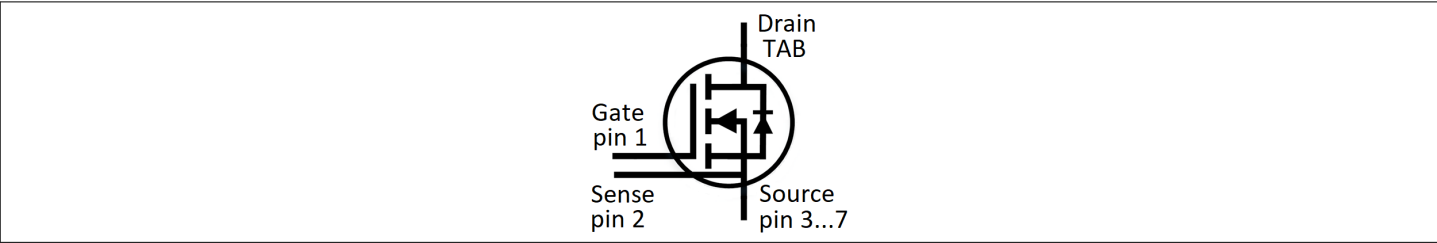
Pin definition:

- 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 recommended for forward operation mode only



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



Type	Package	Marking
IMBF170R450M1	PG-TO263-7-U05	170M1450



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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_{sld}	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	$R_{th(j-c)}$			1.1	1.4	K/W

2 MOSFET

Table 2 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Drain-source voltage	V_{DSS}	$T_{vj} \geq 25\text{ °C}$		1700	V
Continuous DC drain current for $R_{th(j-c, max)}$, limited by $T_{vj(max)}$	I_{DDC}	$V_{GS} = 12\text{ V}$	$T_c = 25\text{ °C}$	9.8	A
			$T_c = 100\text{ °C}$	6.9	
Peak drain current, t_p limited by $T_{vj(max)}$ ¹⁾	I_{DM}	$V_{GS} = 12\text{ V}$		24.8	A
Gate-source voltage, max. transient voltage ²⁾	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
Power dissipation, limited by $T_{vj(max)}$	P_{tot}		$T_c = 25\text{ °C}$	107	W
			$T_c = 100\text{ °C}$	53	

1) Verified by the design/characterization.

2) **Important note:** The selection of positive and negative gate-source voltages impacts the long-term behavior of the device.

Table 3 Recommended values

Parameter	Symbol	Note or test condition	Values	Unit
Recommended turn-on gate voltage	$V_{GS(on)}$		12...18	V
Recommended turn-off gate voltage	$V_{GS(off)}$		0	V

Table 4 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Drain-source on-state resistance	$R_{DS(on)}$	$I_D = 2 \text{ A}$	$T_{vj} = 25 \text{ °C}$, $V_{GS(on)} = 12 \text{ V}$		450		mΩ
			$T_{vj} = 25 \text{ °C}$, $V_{GS(on)} = 15 \text{ V}$		364	390	
			$T_{vj} = 25 \text{ °C}$, $V_{GS(on)} = 18 \text{ V}$		250		
			$T_{vj} = 100 \text{ °C}$, $V_{GS(on)} = 12 \text{ V}$		638		
			$T_{vj} = 175 \text{ °C}$, $V_{GS(on)} = 12 \text{ V}$		917		
Gate-source threshold voltage	$V_{GS(th)}$	$I_D = 2.5 \text{ mA}$, $V_{DS} = V_{GS}$ (tested after 1 ms pulse at $V_{GS} = 20 \text{ V}$)	$T_{vj} = 25 \text{ °C}$	3.5	4.5	5.7	V
			$T_{vj} = 175 \text{ °C}$		3.6		
Zero gate-voltage drain current	I_{DSS}	$V_{DS} = 1700 \text{ V}$, $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ °C}$		0.9	11	μA
			$T_{vj} = 175 \text{ °C}$		10		
Gate leakage current	I_{GSS}	$V_{DS} = 0 \text{ V}$	$V_{GS} = -10 \text{ V}$			-100	nA
			$V_{GS} = 20 \text{ V}$			100	
Forward transconductance	g_{fs}	$I_D = 2 \text{ A}$, $V_{DS} = 20 \text{ V}$			0.9		S
Internal gate resistance	$R_{G,int}$	$f = 1 \text{ MHz}$, $V_{AC} = 25 \text{ mV}$			20		Ω
Input capacitance	C_{iss}	$V_{DS} = 1000 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1000 \text{ kHz}$, $V_{AC} = 25 \text{ mV}$			610		pF
Output capacitance	C_{oss}	$V_{DS} = 1000 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1000 \text{ kHz}$, $V_{AC} = 25 \text{ mV}$			16		pF
Reverse transfer capacitance	C_{rss}	$V_{DS} = 1000 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1000 \text{ kHz}$, $V_{AC} = 25 \text{ mV}$			1.7		pF
C_{oss} stored energy	E_{oss}	$V_{DS} = 1000 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1000 \text{ kHz}$, $V_{AC} = 25 \text{ mV}$			2.9		μJ
Total gate charge	Q_G	$V_{DD} = 1000 \text{ V}$, $I_D = 2 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, turn-on pulse			11		nC
Plateau gate charge	$Q_{GS(pl)}$	$V_{DD} = 1000 \text{ V}$, $I_D = 2 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, turn-on pulse			3.3		nC
Gate-drain charge	Q_{GD}	$V_{DD} = 1000 \text{ V}$, $I_D = 2 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, turn-on pulse			5.9		nC
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 1000 \text{ V}$, $I_D = 2 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, $R_{G,ext} = 22 \text{ Ω}$, $L_\sigma = 40 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ °C}$		27		ns
			$T_{vj} = 175 \text{ °C}$		22		

(table continues...)

Table 4 (continued) **Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rise time	t_r	$V_{DD} = 1000 \text{ V}$, $I_D = 2 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, $R_{G,ext} = 22 \text{ } \Omega$, $L_\sigma = 40 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ } ^\circ\text{C}$	20		ns
			$T_{vj} = 175 \text{ } ^\circ\text{C}$	16		
Turn-off delay time	$t_{d(off)}$	$V_{DD} = 1000 \text{ V}$, $I_D = 2 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, $R_{G,ext} = 22 \text{ } \Omega$, $L_\sigma = 40 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ } ^\circ\text{C}$	32		ns
			$T_{vj} = 175 \text{ } ^\circ\text{C}$	36		
Fall time	t_f	$V_{DD} = 1000 \text{ V}$, $I_D = 2 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, $R_{G,ext} = 22 \text{ } \Omega$, $L_\sigma = 40 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ } ^\circ\text{C}$	24		ns
			$T_{vj} = 175 \text{ } ^\circ\text{C}$	27		
Turn-on energy	E_{on}	$V_{DD} = 1000 \text{ V}$, $I_D = 2 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, $R_{G,ext} = 22 \text{ } \Omega$, $L_\sigma = 40 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ } ^\circ\text{C}$	76		μJ
			$T_{vj} = 175 \text{ } ^\circ\text{C}$	81		
Turn-off energy	E_{off}	$V_{DD} = 1000 \text{ V}$, $I_D = 2 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, $R_{G,ext} = 22 \text{ } \Omega$, $L_\sigma = 40 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ } ^\circ\text{C}$	15		μJ
			$T_{vj} = 175 \text{ } ^\circ\text{C}$	21		
Total switching energy	E_{tot}	$V_{DD} = 1000 \text{ V}$, $I_D = 2 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, $R_{G,ext} = 22 \text{ } \Omega$, $L_\sigma = 40 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ } ^\circ\text{C}$	91		μJ
			$T_{vj} = 175 \text{ } ^\circ\text{C}$	101		
Virtual junction temperature	T_{vj}		-55		175	$^\circ\text{C}$

Note: For optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.

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.

Dynamic test circuit see Fig. F.

3 Body diode (MOSFET)

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Drain-source voltage	V_{DSS}	$T_{vj} \geq 25\text{ °C}$	1700	V
Peak reverse drain current, t_p limited by $T_{vj(max)}$	I_{SM}	$V_{GS} = 0\text{ V}$	24.8	A

Table 6 Characteristic values

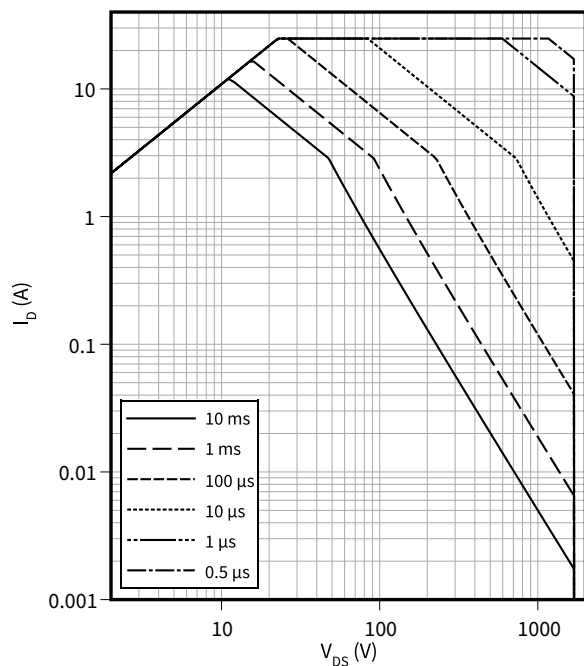
Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Drain-source reverse voltage	V_{SD}	$I_{SD} = 2\text{ A}$, $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$	3.9		V
			$T_{vj} = 175\text{ °C}$	3.5		
MOSFET forward recovery charge	Q_{fr}	$V_{DD} = 1000\text{ V}$, $I_{SD} = 2\text{ A}$, $V_{GS} = 0\text{ V}$, $-di_{SD}/dt = 1000\text{ A}/\mu\text{s}$, Q_{fr} includes also Q_C	$T_{vj} = 25\text{ °C}$	62.4		nC
			$T_{vj} = 175\text{ °C}$	93.2		
MOSFET peak forward recovery current	I_{frm}	$V_{DD} = 1000\text{ V}$, $I_{SD} = 2\text{ A}$, $V_{GS} = 0\text{ V}$, $-di_{SD}/dt = 1000\text{ A}/\mu\text{s}$, Q_{fr} includes also Q_C	$T_{vj} = 25\text{ °C}$	5.9		A
			$T_{vj} = 175\text{ °C}$	6.3		
MOSFET forward recovery energy	E_{fr}	$V_{DD} = 1000\text{ V}$, $I_{SD} = 2\text{ A}$, $V_{GS} = 0\text{ V}$, $-di_{SD}/dt = 1000\text{ A}/\mu\text{s}$, Q_{fr} includes also Q_C	$T_{vj} = 25\text{ °C}$	0.23		μJ
			$T_{vj} = 175\text{ °C}$	0.31		
Virtual junction temperature	T_{vj}		-55		175	$^{\circ}\text{C}$

4 Characteristics diagrams

Safe operating area (SOA)

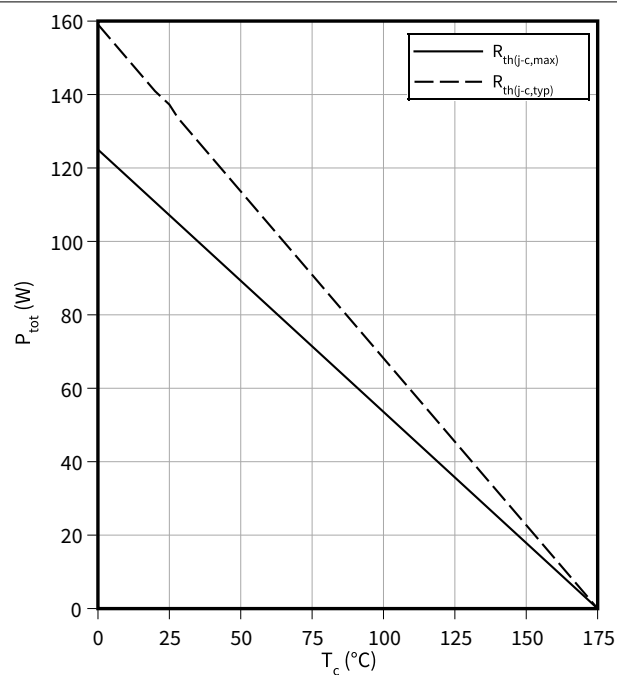
$$I_D = f(V_{DS})$$

$$T_{vj} \leq 175\text{ °C}, T_c = 25\text{ °C}$$



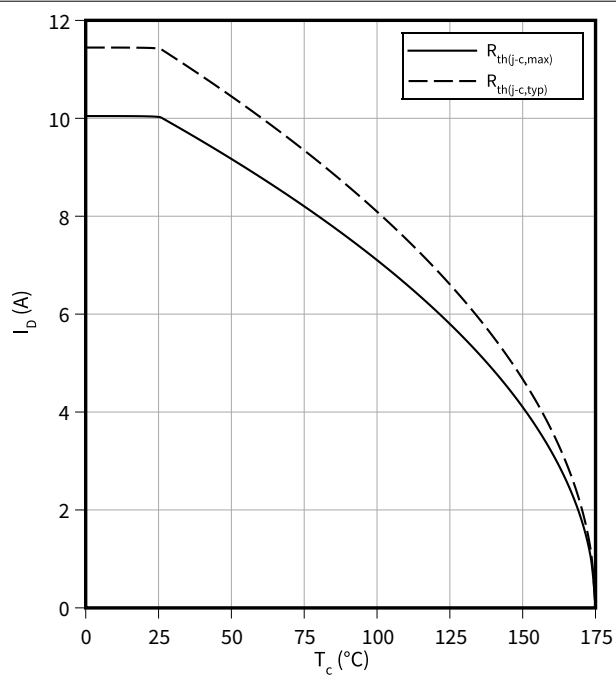
Power dissipation as a function of case temperature limited by bond wire

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



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

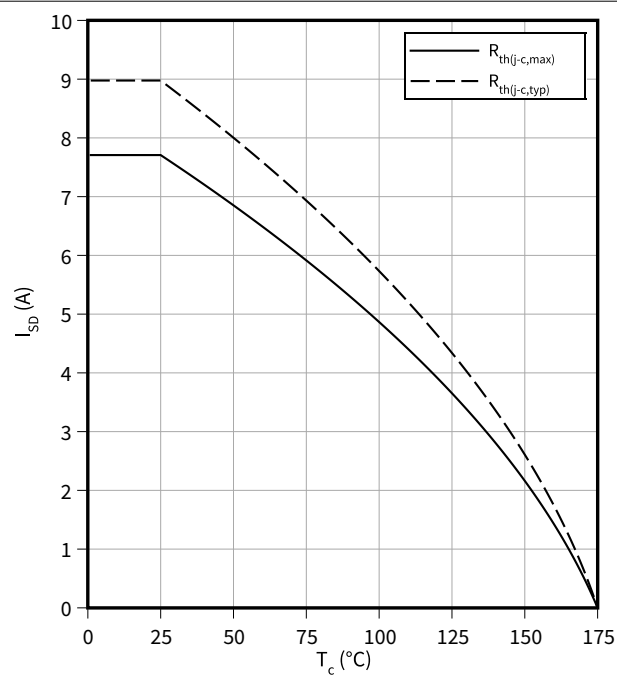
$$I_D = f(T_c)$$



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

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

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

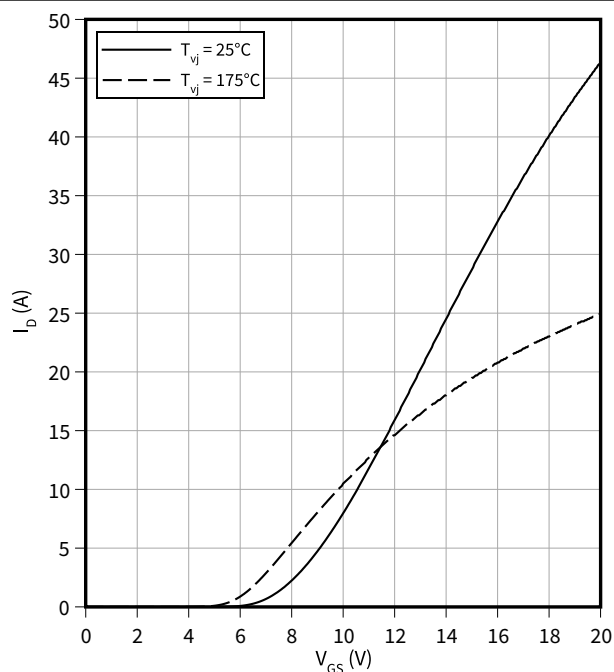


4 Characteristics diagrams

Typical transfer characteristic

$$I_D = f(V_{GS})$$

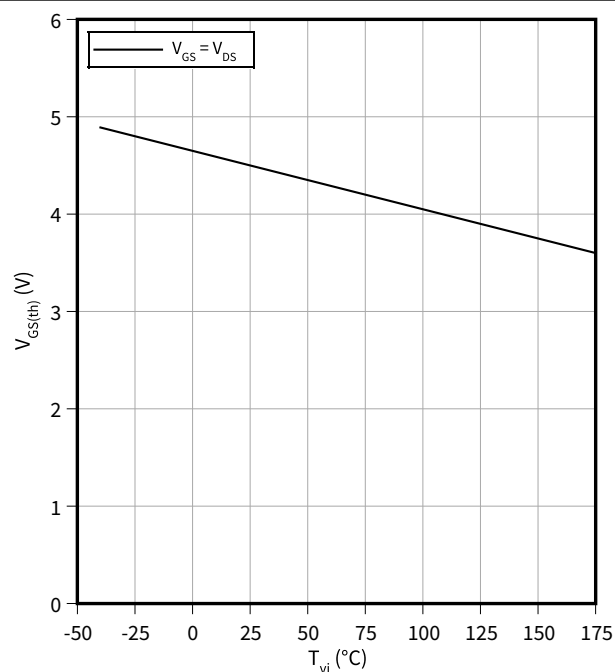
$$V_{DS} = 20 \text{ V}, t_p = 20 \mu\text{s}$$



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

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

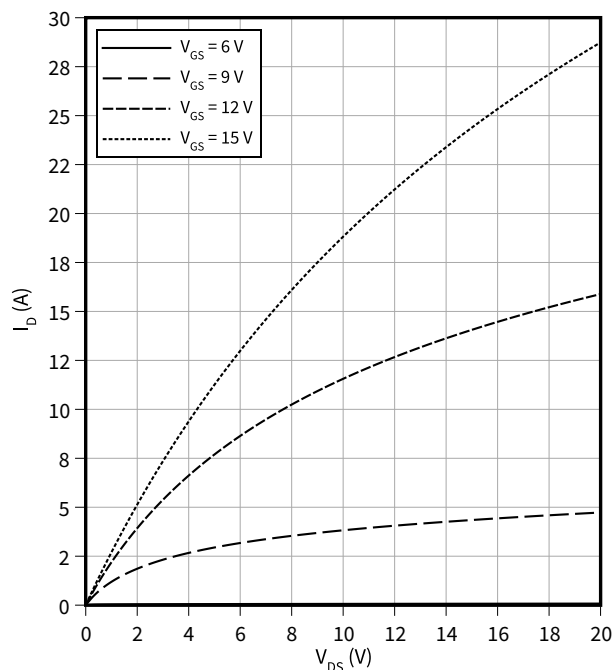
$$I_D = 2.5 \text{ mA}$$



Typical output characteristic, V_{GS} as a parameter

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

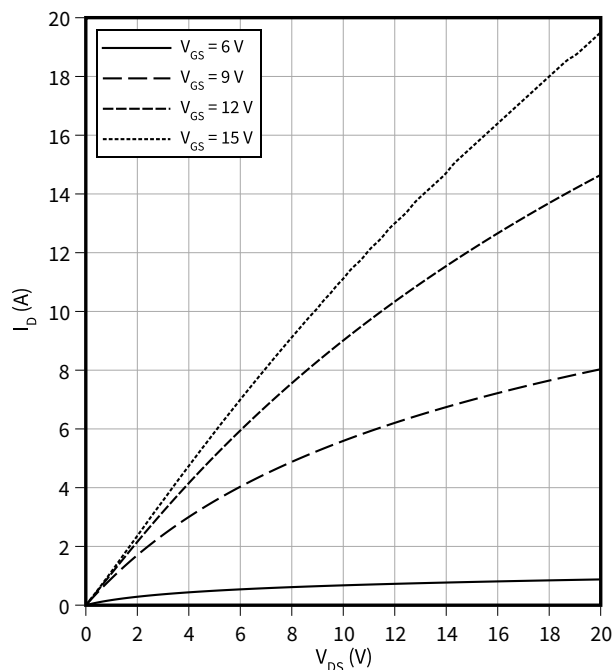
$$T_{vj} = 25^\circ\text{C}, t_p = 20 \mu\text{s}$$



Typical output characteristic, V_{GS} as a parameter

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

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

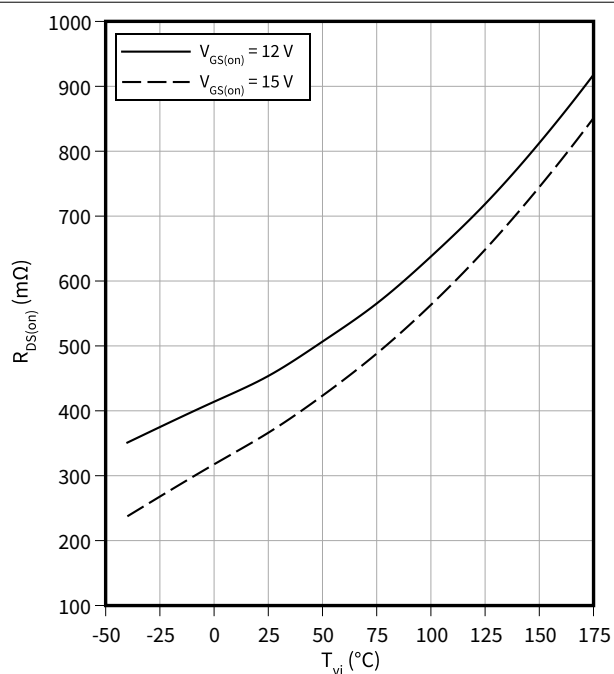


4 Characteristics diagrams

Typical on-state resistance as a function of junction temperature

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

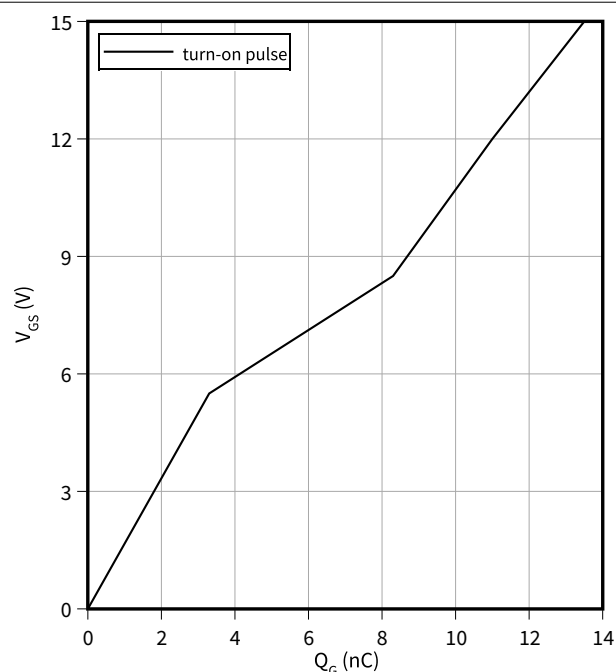
$$I_D = 2 \text{ A}$$



Typical gate charge

$$V_{GS} = f(Q_G)$$

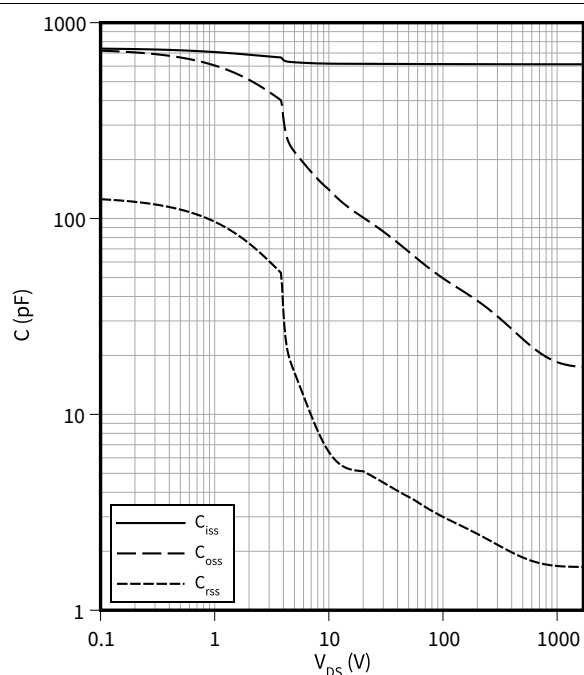
$$I_D = 2 \text{ A}, V_{DS} = 1000 \text{ V}$$



Typical capacitance as a function of drain-source voltage

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

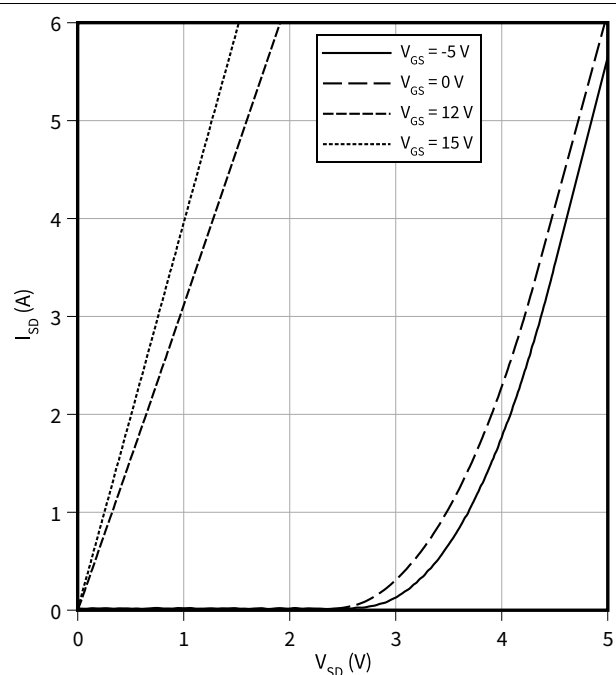
$$f = 1000 \text{ kHz}, V_{GS} = 0 \text{ V}$$



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

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

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

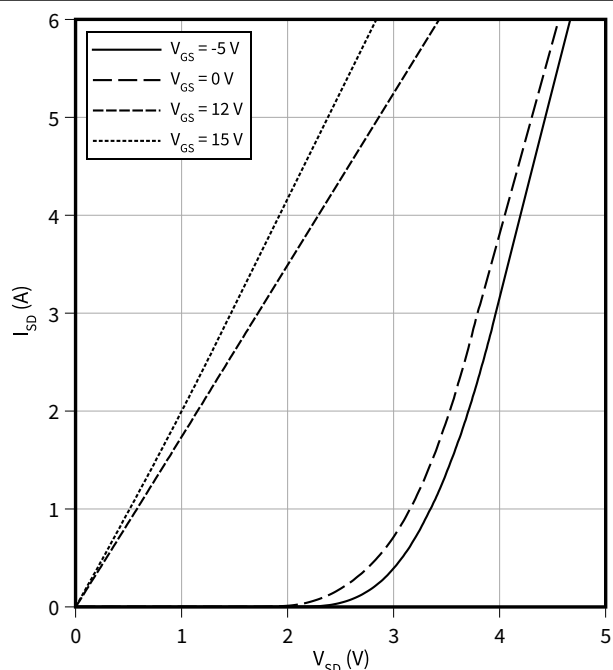


4 Characteristics diagrams

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

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

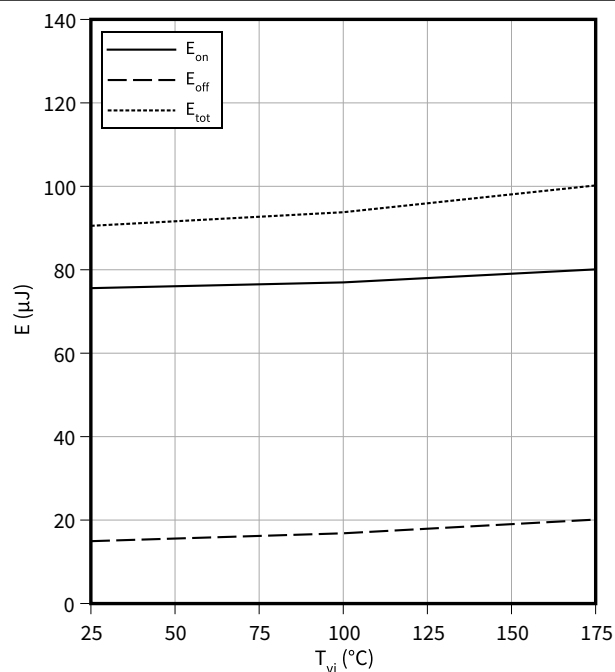
$$T_{vj} = 175\text{ °C}, t_p = 20\text{ }\mu\text{s}$$



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

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

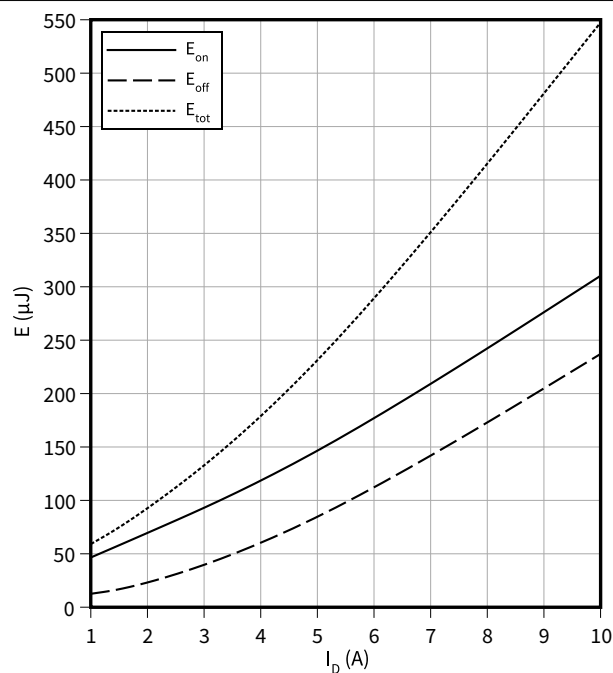
$$V_{GS} = 0/12\text{ V}, I_D = 2\text{ A}, R_{G,ext} = 22\text{ }\Omega, V_{DD} = 1000\text{ V}$$



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

$$E = f(I_D)$$

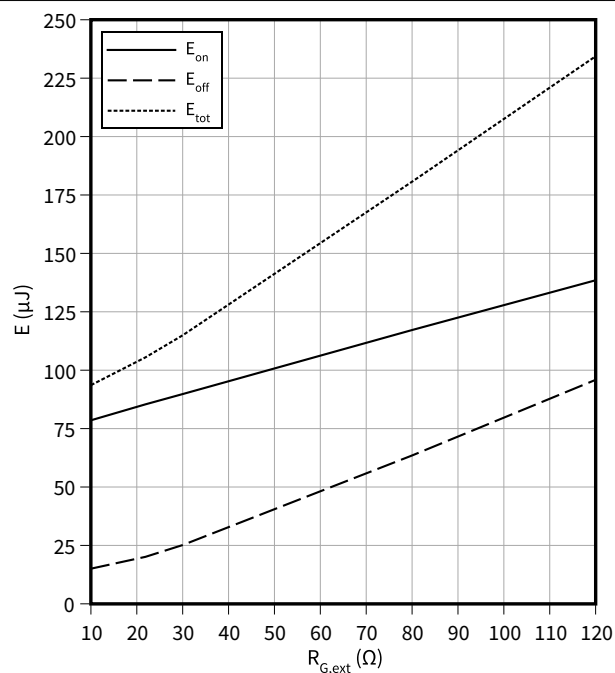
$$V_{GS} = 0/12\text{ V}, T_{vj} = 175\text{ °C}, R_{G,ext} = 22\text{ }\Omega, V_{DD} = 1000\text{ V}$$



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

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

$$V_{GS} = 0/12\text{ V}, I_D = 2\text{ A}, T_{vj} = 175\text{ °C}, V_{DD} = 1000\text{ V}$$

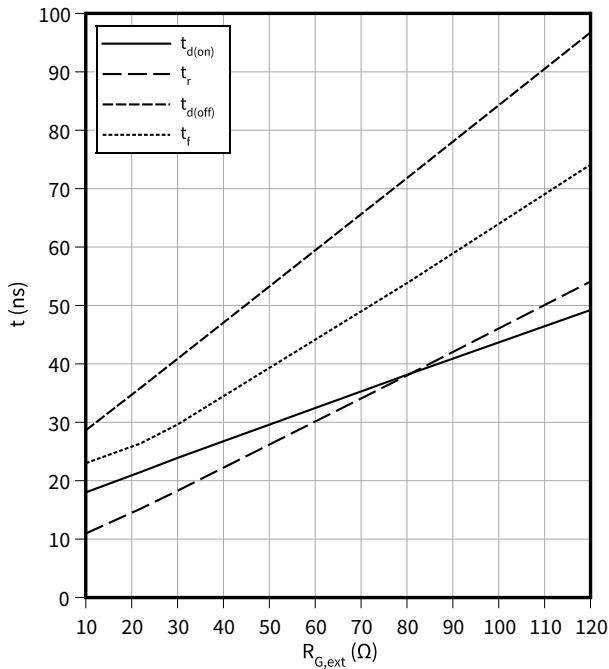


4 Characteristics diagrams

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

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

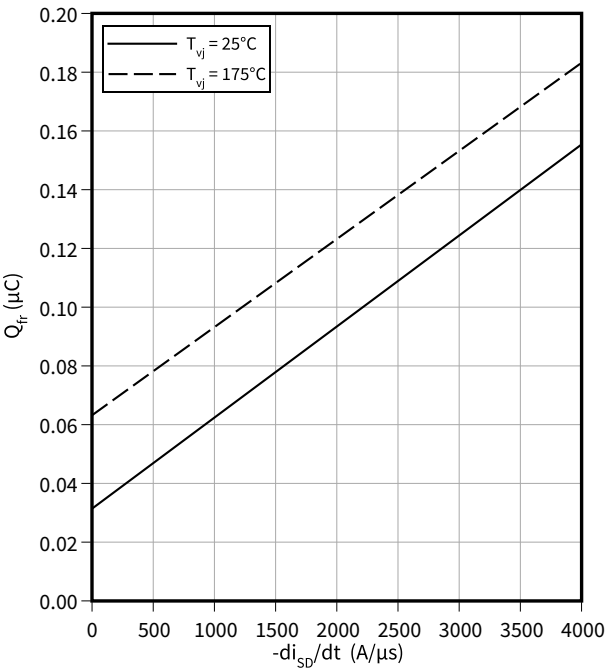
$V_{GS} = 0/12\text{ V}$, $I_D = 2\text{ A}$, $T_{vj} = 175\text{ °C}$, $V_{DD} = 1000\text{ V}$



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

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

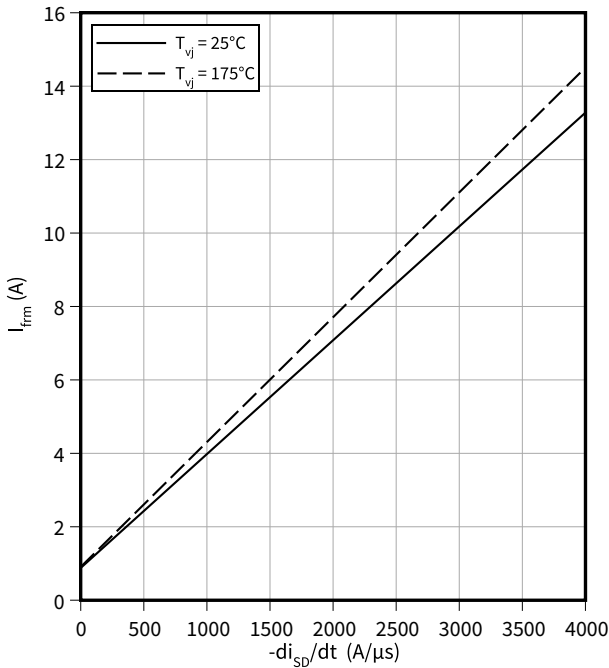
$V_{GS} = 0\text{ V}$, $I_{SD} = 2\text{ A}$, $V_{DD} = 1000\text{ V}$



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

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

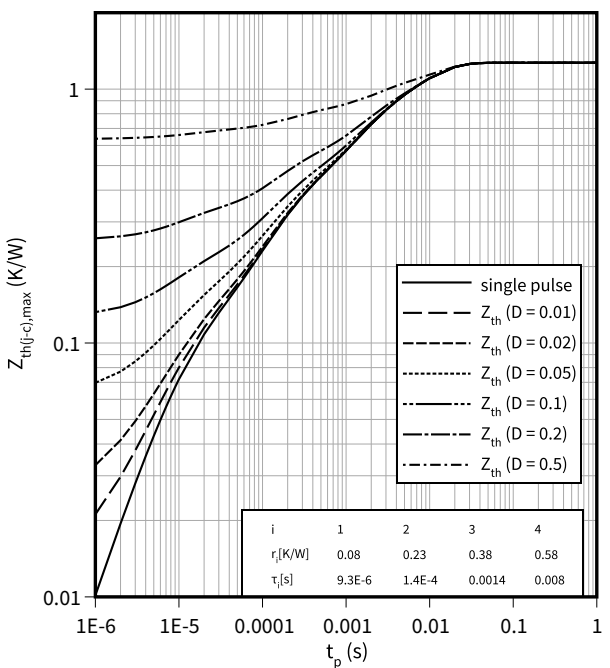
$V_{GS} = 0\text{ V}$, $I_{SD} = 2\text{ A}$, $V_{DD} = 1000\text{ V}$



Max. transient thermal impedance (MOSFET/diode)

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

$D = t_p/T$



5 Package outlines

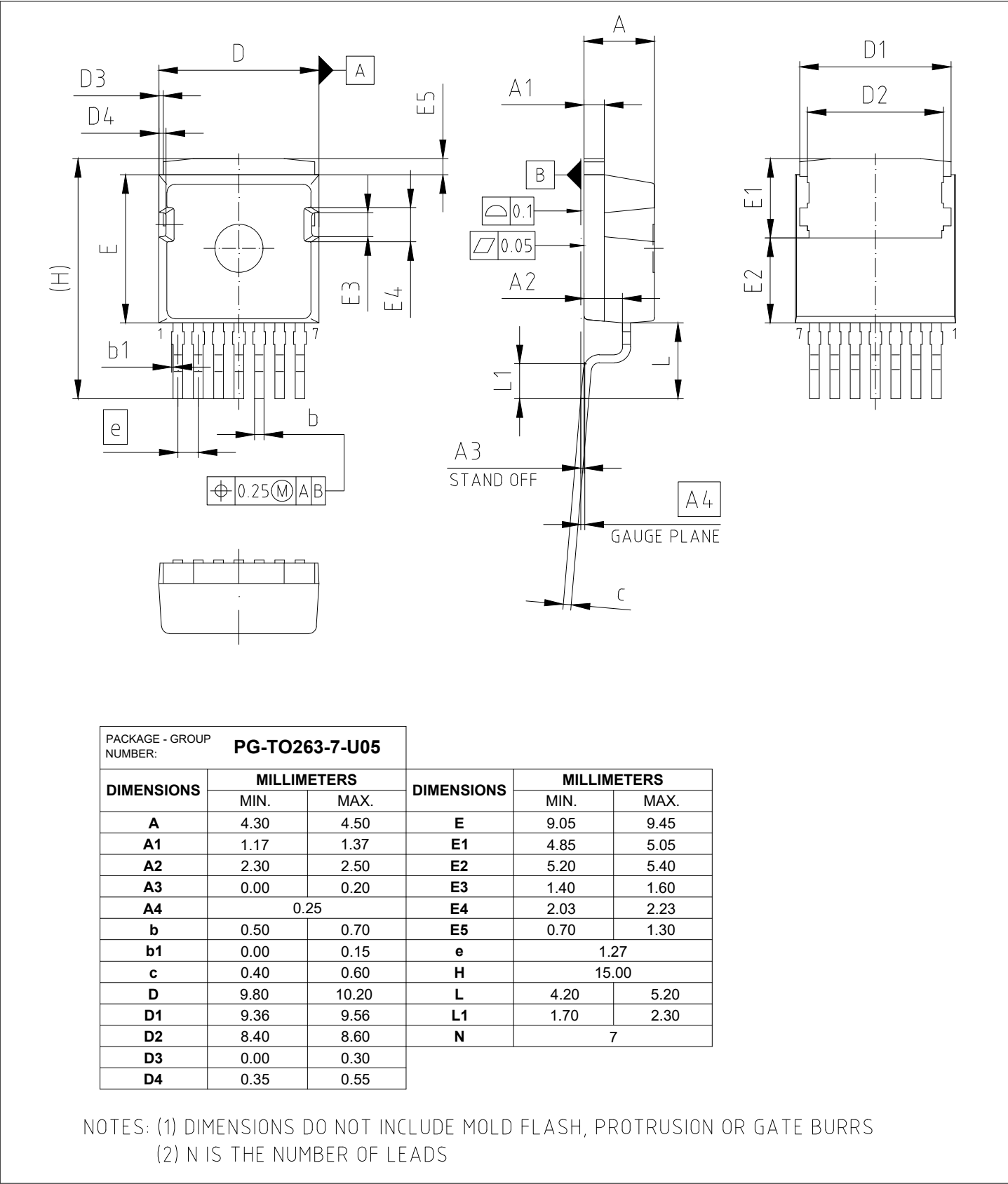


Figure 1

6 Testing conditions

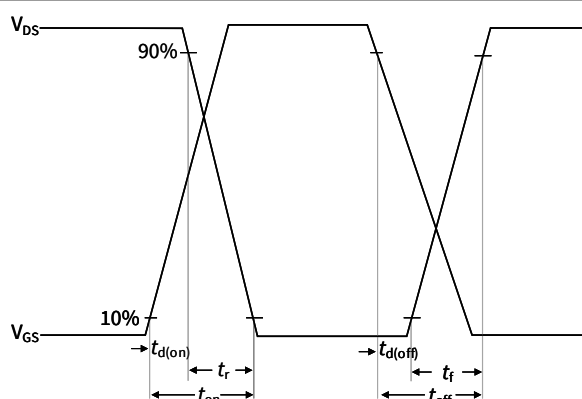


Figure A. Definition of switching times

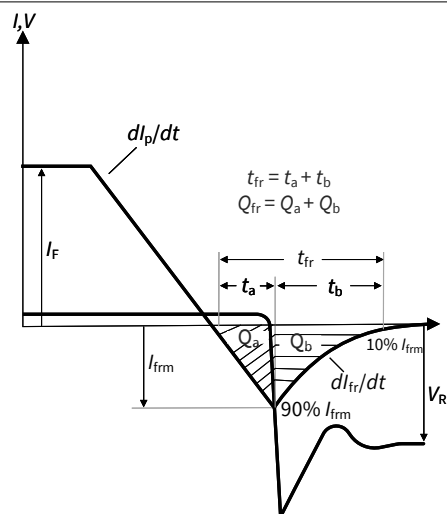


Figure B. Definition of diode switching characteristics

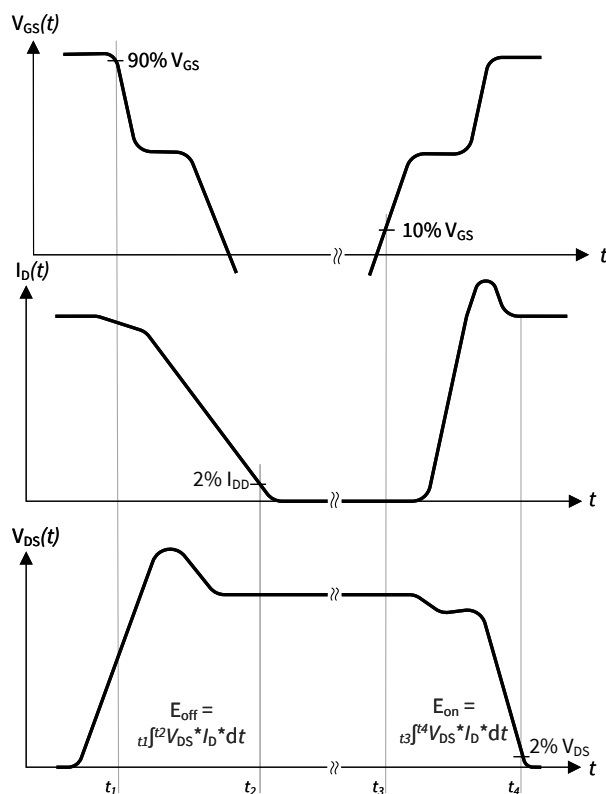


Figure C. Definition of switching losses

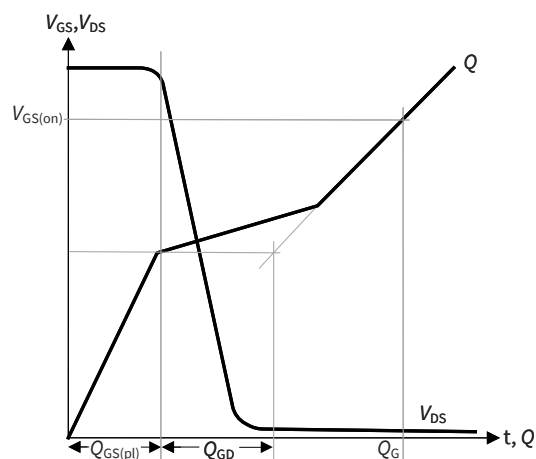


Figure D. Definition of QGD

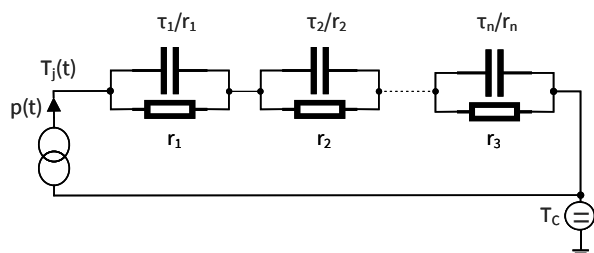


Figure E. Thermal equivalent circuit

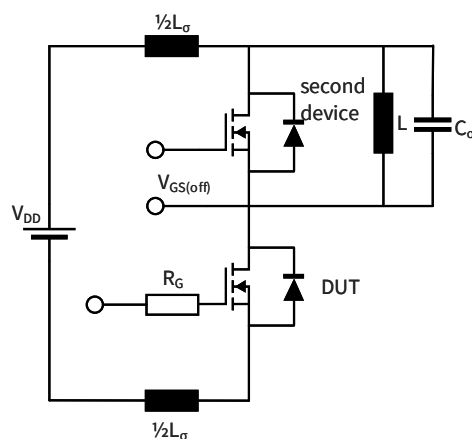


Figure F. Dynamic test circuit

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

Figure 2

Revision history

Document revision	Date of release	Description of changes
1.00	2025-03-22	<p>Changed package name</p> <p>Increased Gate-source voltage, max. transient voltage</p> <p>Added Gate-source voltage, max. static voltage</p> <p>Added diode characteristic parameters in Table 5 and Table 6</p> <p>Corrected legend of diagram $R_{DS(on)} = f(T_{vj})$</p> <p>Added graphs $I_{SD} = f(V_{SD})$, $I_{SD} = f(T_c)$, $Q_{fr} = f(-di_{SD}/dt)$, $I_{frm} = f(-di_{SD}/dt)$</p> <p>Corrected graph $I_{DS} = f(T_c)$</p> <p>Editorial changes</p> <p>***Legacy Revisions***</p> <p>2.1 2020-04-27 Final Datasheet</p> <p>2.2 2020-12-11 Correction of circuit symbol on page 1</p> <p>2.3 2021-04-12 Editorial changes</p>
1.10	2026-10-05	<p>Updated package name</p> <p>Updated recommended turn-on gate voltage</p> <p>Added $R_{DS(on)}$, at $V_{GS(on)} = 18\text{ V}$, $T_{vj} = 25^\circ\text{C}$</p> <p>Replaced RBSOA with FBSOA</p> <p>Updated the package outline</p> <p>Editorial changes</p>

Trademarks

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