

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

Features

- $V_{DS} = 1700\text{ V}$ at $T_{vj} = 25^{\circ}\text{C}$
- $I_{DC} = 7.5\text{ A}$ at $T_C = 25^{\circ}\text{C}$
- $R_{DS(on)} = 650\text{ m}\Omega$ at $V_{GS} = 12\text{ V}$, $T_{vj} = 25^{\circ}\text{C}$
- 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
- .XT interconnection technology for best-in-class thermal performance

Potential applications

- General purpose drives (GPD)
- EV Charging
- Energy storage systems (ESS)
- String inverter
- Uninterruptible power supplies

Product validation

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

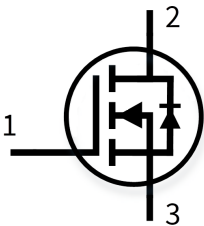
Description

Package pin definition:

- Pin 1 – Gate
- Pin 2 & backside – Drain
- Pin 3 – Source



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



Type	Package	Marking
IMWH170R650M1	PG-TO247-3-U04	170M1650



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1 Package

Table 1 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Internal source inductance measured 5 mm (0.197 in.) from case	L_S			13		nH
Storage temperature	T_{stg}		-55		150	°C
Soldering temperature	T_{sold}	wave soldering 1.6 mm (0.063 in.) from case for 10 s			260	°C
Mounting torque	M	M3 screw, Maximum of mounting processes: 3			0.6	Nm
Thermal resistance, junction-ambient	$R_{th(j-a)}$				62	K/W
MOSFET/body diode thermal resistance, junction-case	$R_{th(j-c)}$			1.3	1.69	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}	$V_{GS} = 12\text{ V}$	$T_c = 25\text{ °C}$	7.5	A
			$T_c = 100\text{ °C}$	5.3	
Peak drain current, t_p limited by $T_{vj(max)}$ ¹⁾	I_{DM}	$V_{GS} = 12\text{ V}$		19	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}	$T_c = 25\text{ °C}$		88	W
		$T_c = 100\text{ °C}$		44	

1) verified by design.

2) **Important note:** The selection of positive and negative gate-source voltages impacts the long-term behavior of the device. The design guidelines described in Application Note AN2018-09 must be considered to ensure sound operation of the device over the planned lifetime.

Table 3 Recommended values

Parameter	Symbol	Note or test condition	Values	Unit
Recommended turn-on gate voltage	$V_{GS(on)}$		12...15	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	$R_{DS(on)}$	$I_D = 1.5 \text{ A}$		$T_{vj} = 25 \text{ °C}$, $V_{GS(on)} = 12 \text{ V}$	650	mΩ
				$T_{vj} = 100 \text{ °C}$, $V_{GS(on)} = 12 \text{ V}$	921	
				$T_{vj} = 175 \text{ °C}$, $V_{GS(on)} = 12 \text{ V}$	1324	
				$T_{vj} = 25 \text{ °C}$, $V_{GS(on)} = 15 \text{ V}$	526 580	
Gate-source threshold voltage	$V_{GS(th)}$	$I_D = 1.7 \text{ mA}$, $V_{DS} = V_{GS}$ (tested after 1 ms pulse at $V_{GS} = 20 \text{ V}$)	3.5	$T_{vj} = 25 \text{ °C}$	4.5	V
				$T_{vj} = 175 \text{ °C}$	3.6	
Zero gate-voltage drain current	I_{DSS}	$V_{DS} = 1700 \text{ V}$, $V_{GS} = 0 \text{ V}$		$T_{vj} = 25 \text{ °C}$	0.6	μA
				$T_{vj} = 175 \text{ °C}$	8	
Gate leakage current	I_{GSS}	$V_{DS} = 0 \text{ V}$		$V_{GS} = 20 \text{ V}$		nA
				$V_{GS} = -10 \text{ V}$	100 -100	
Forward transconductance	g_{fs}	$I_D = 1.5 \text{ A}$, $V_{DS} = 20 \text{ V}$		0.65		S
Internal gate resistance	$R_{G,int}$	$f = 1 \text{ MHz}$, $V_{AC} = 25 \text{ mV}$		25.4		Ω
Input capacitance	C_{iss}	$V_{DS} = 1000 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 100 \text{ kHz}$, $V_{AC} = 25 \text{ mV}$		337		pF
Output capacitance	C_{oss}	$V_{DS} = 1000 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 100 \text{ kHz}$, $V_{AC} = 25 \text{ mV}$		15		pF
Reverse transfer capacitance	C_{rss}	$V_{DS} = 1000 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 100 \text{ kHz}$, $V_{AC} = 25 \text{ mV}$		1		pF
C_{oss} stored energy	E_{oss}	$V_{DS} = 1000 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 100 \text{ kHz}$, $V_{AC} = 25 \text{ mV}$		2.5		μJ
Total gate charge	Q_G	$V_{DD} = 1000 \text{ V}$, $I_D = 1.5 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, turn-on pulse		8.1		nC
Plateau gate charge	$Q_{GS(pl)}$	$V_{DD} = 1000 \text{ V}$, $I_D = 1.5 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, turn-on pulse		2.9		nC
Gate-to-drain charge	Q_{GD}	$V_{DD} = 1000 \text{ V}$, $I_D = 1.5 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, turn-on pulse		1.8		nC

(table continues...)

Table 4 (continued) **Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 1000 \text{ V}$, $I_D = 1.5 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, $R_{G,ext} = 6.9 \text{ } \Omega$, $L_\sigma = 40 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ } ^\circ\text{C}$	18		ns
			$T_{vj} = 175 \text{ } ^\circ\text{C}$	15		
Rise time	t_r	$V_{DD} = 1000 \text{ V}$, $I_D = 1.5 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, $R_{G,ext} = 6.9 \text{ } \Omega$, $L_\sigma = 40 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ } ^\circ\text{C}$	11		ns
			$T_{vj} = 175 \text{ } ^\circ\text{C}$	9		
Turn-off delay time	$t_{d(off)}$	$V_{DD} = 1000 \text{ V}$, $I_D = 1.5 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, $R_{G,ext} = 6.9 \text{ } \Omega$, $L_\sigma = 40 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ } ^\circ\text{C}$	22		ns
			$T_{vj} = 175 \text{ } ^\circ\text{C}$	24		
Fall time	t_f	$V_{DD} = 1000 \text{ V}$, $I_D = 1.5 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, $R_{G,ext} = 6.9 \text{ } \Omega$, $L_\sigma = 40 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ } ^\circ\text{C}$	22		ns
			$T_{vj} = 175 \text{ } ^\circ\text{C}$	22		
Turn-on energy	E_{on}	$V_{DD} = 1000 \text{ V}$, $I_D = 1.5 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, $R_{G,ext} = 6.9 \text{ } \Omega$, $L_\sigma = 40 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ } ^\circ\text{C}$	76		μJ
			$T_{vj} = 175 \text{ } ^\circ\text{C}$	79		
Turn-off energy	E_{off}	$V_{DD} = 1000 \text{ V}$, $I_D = 1.5 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, $R_{G,ext} = 6.9 \text{ } \Omega$, $L_\sigma = 40 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ } ^\circ\text{C}$	19		μJ
			$T_{vj} = 175 \text{ } ^\circ\text{C}$	21		
Total switching energy	E_{tot}	$V_{DD} = 1000 \text{ V}$, $I_D = 1.5 \text{ A}$, $V_{GS} = 0/12 \text{ V}$, $R_{G,ext} = 6.9 \text{ } \Omega$, $L_\sigma = 40 \text{ nH}$, diode: body diode at $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ } ^\circ\text{C}$	95		μJ
			$T_{vj} = 175 \text{ } ^\circ\text{C}$	100		
Virtual junction temperature	T_{vj}		-55		175	$^\circ\text{C}$

3 Body diode (MOSFET)

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}	$T_{vj} \geq 25^{\circ}\text{C}$	1700	V
Peak reverse drain current, t_p limited by $T_{vj(max)}$	I_{SM}	$V_{GS} = 0\text{ V}$	19	A

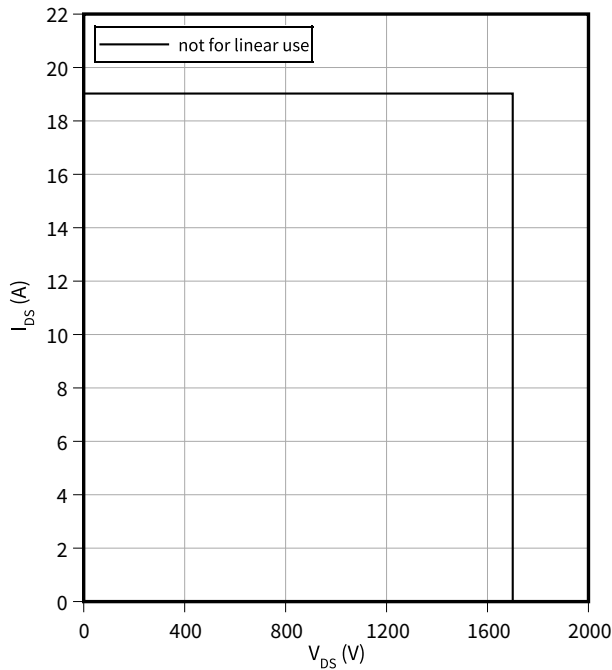
Table 6 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Drain-source reverse voltage	V_{SD}	$I_{SD} = 1.5\text{ A}, V_{GS} = 0\text{ V}$		$T_{vj} = 25^{\circ}\text{C}$	3.9	V
				$T_{vj} = 175^{\circ}\text{C}$	3.7	
MOSFET forward recovery charge	Q_{fr}	$V_{DD} = 1000\text{ V},$ $I_{SD} = 1.5\text{ A}, V_{GS} = 0\text{ V},$ $-di_{SD}/dt = 1000\text{ A}/\mu\text{s}, Q_{fr}$ includes also Q_C		$T_{vj} = 25^{\circ}\text{C}$	64.7	nC
				$T_{vj} = 175^{\circ}\text{C}$	74.8	
MOSFET peak forward recovery current	I_{frm}	$V_{DD} = 1000\text{ V},$ $I_{SD} = 1.5\text{ A}, V_{GS} = 0\text{ V},$ $-di_{SD}/dt = 1000\text{ A}/\mu\text{s}, Q_{fr}$ includes also Q_C		$T_{vj} = 25^{\circ}\text{C}$	4.1	A
				$T_{vj} = 175^{\circ}\text{C}$	4.7	
MOSFET forward recovery energy	E_{fr}	$V_{DD} = 1000\text{ V},$ $I_{SD} = 1.5\text{ A}, V_{GS} = 0\text{ V},$ $-di_{SD}/dt = 1000\text{ A}/\mu\text{s}, Q_{fr}$ includes also Q_C		$T_{vj} = 25^{\circ}\text{C}$	0.17	μJ
				$T_{vj} = 175^{\circ}\text{C}$	0.26	
Virtual junction temperature	T_{vj}		-55		175	$^{\circ}\text{C}$

4 Characteristics diagrams

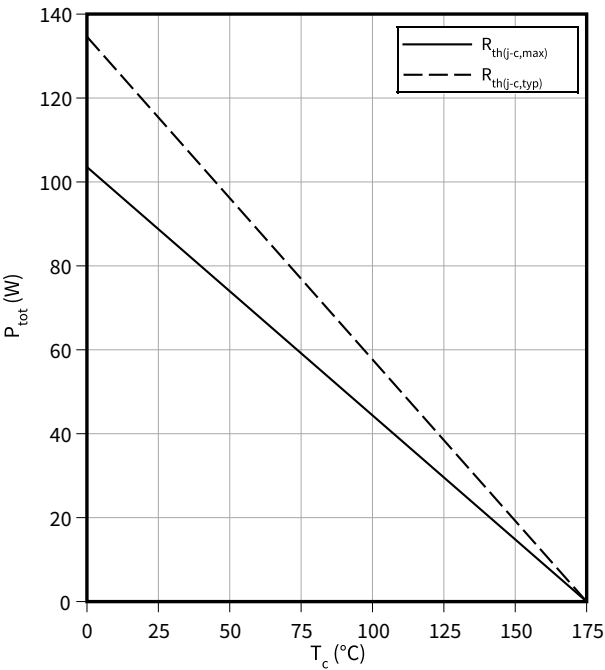
Reverse bias safe operating area (RBSOA)

$I_{DS} = f(V_{DS})$
 $T_{vj} \leq 175\text{ }^{\circ}\text{C}$, $V_{GS} = 0/12\text{ V}$, $T_c = 25\text{ }^{\circ}\text{C}$



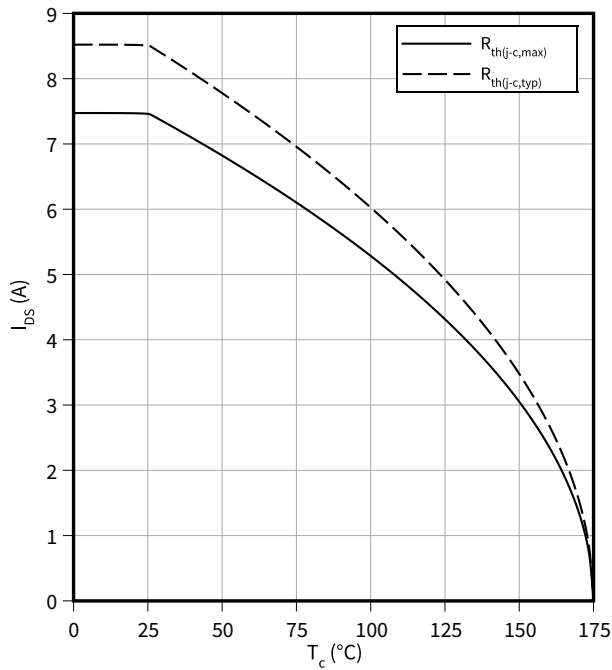
Power dissipation as a function of case temperature limited by bond wire

$P_{tot} = f(T_c)$



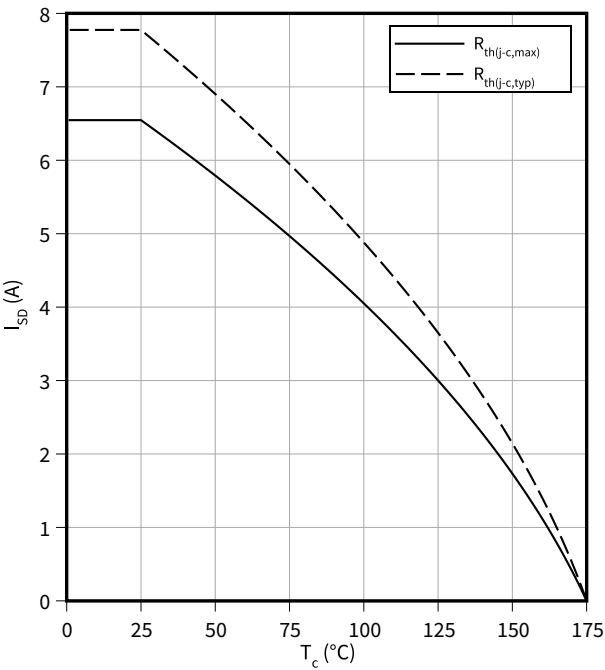
Maximum DC drain to source current as a function of case temperature limited by bond wire

$I_{DS} = f(T_c)$



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

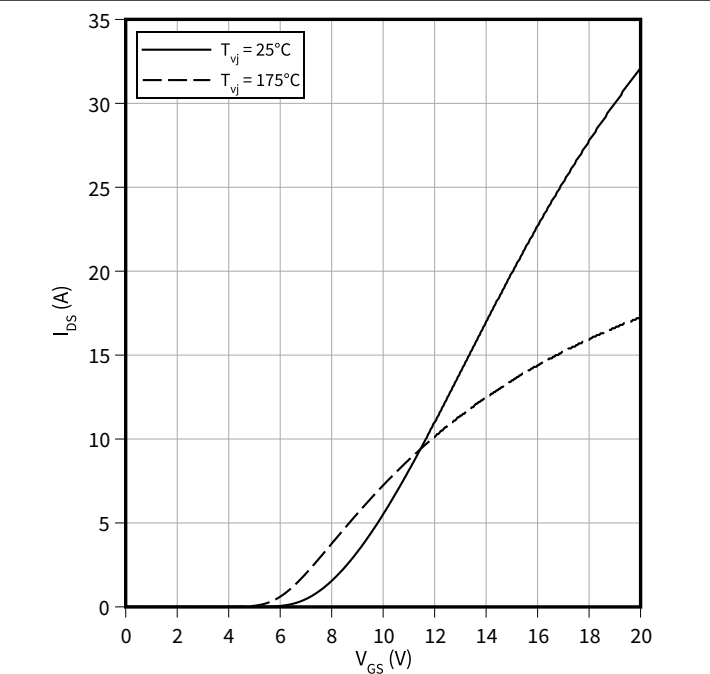
$I_{SD} = f(T_c)$
 $V_{GS} = 0\text{ V}$



4 Characteristics diagrams

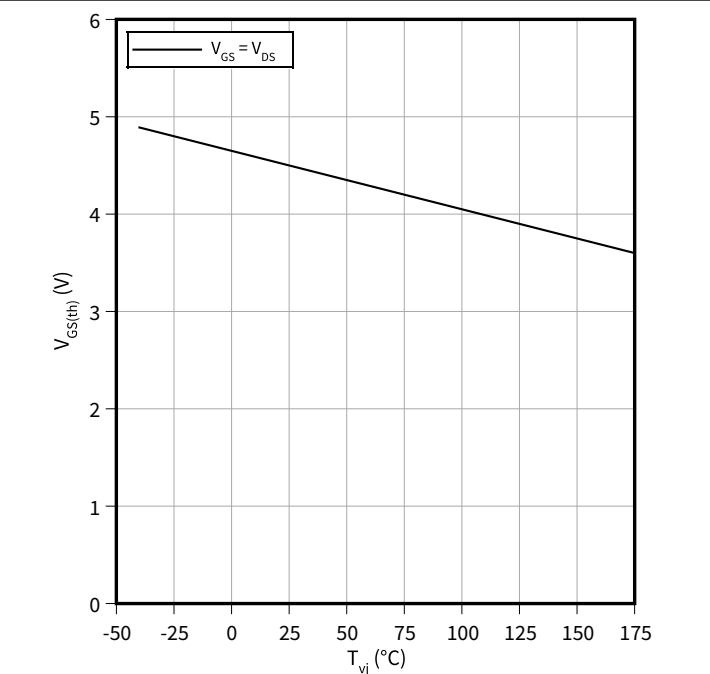
Typical transfer characteristic

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



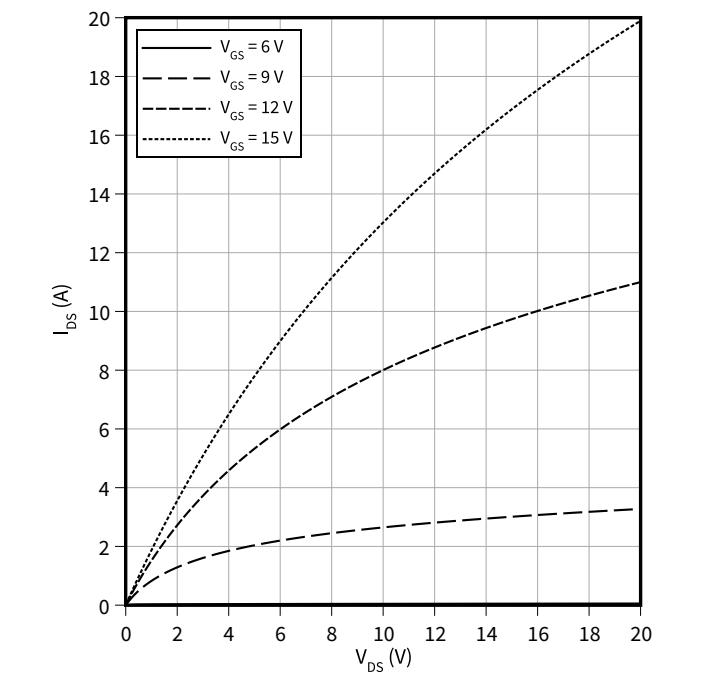
Typical gate-source threshold voltage as a function of junction temperature

$V_{GS(th)} = f(T_{vj})$
 $I_D = 1.5\text{ mA}$



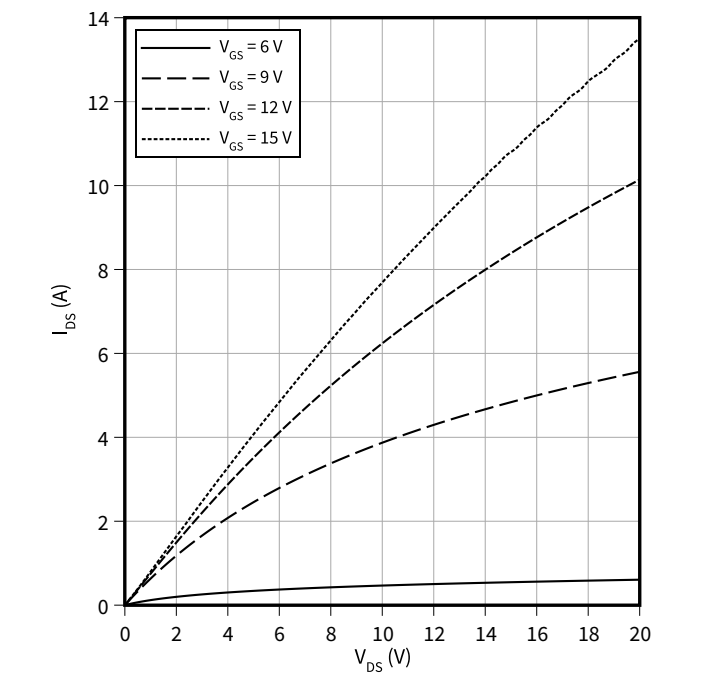
Typical output characteristic, V_{GS} as a parameter

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



Typical output characteristic, V_{GS} as a parameter

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

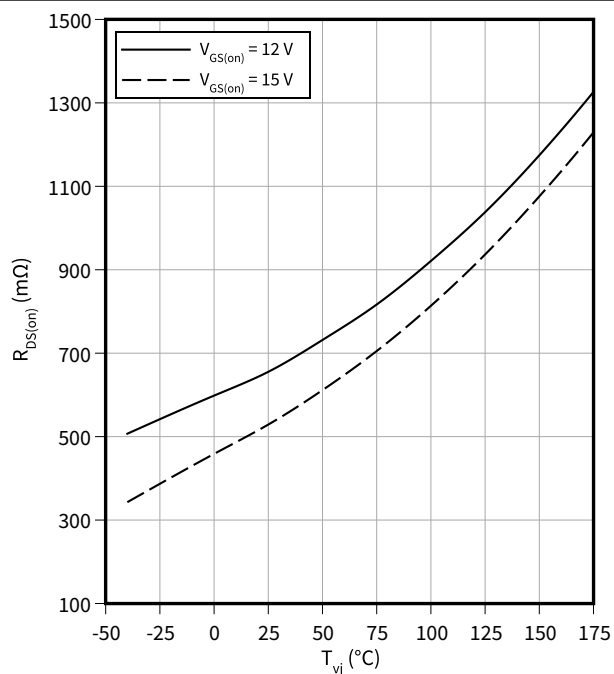


4 Characteristics diagrams

Typical on-state resistance as a function of junction temperature

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

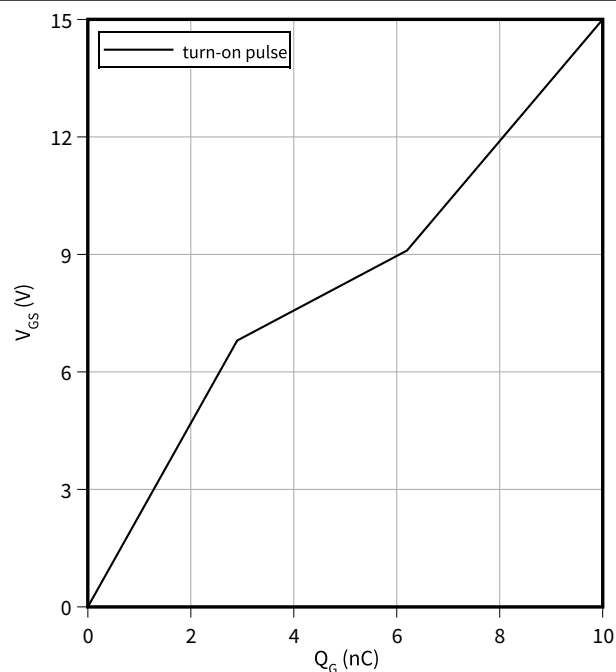
$$I_D = 1.5 \text{ A}$$



Typical gate charge

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

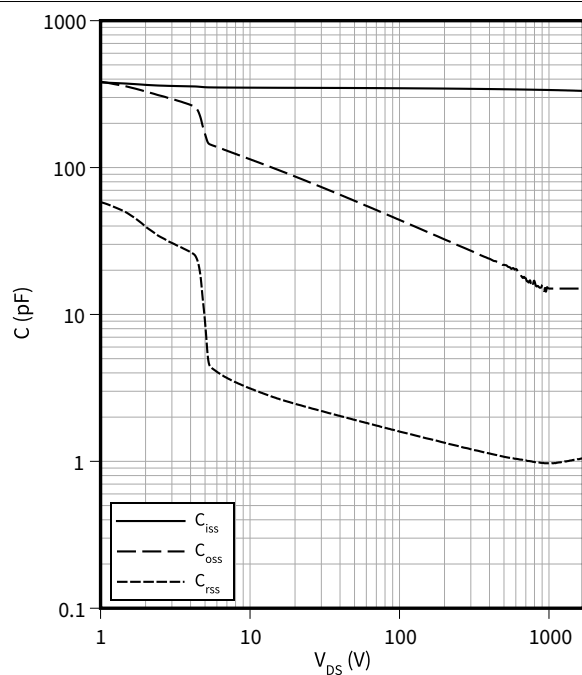
$$I_D = 1.5 \text{ A}, V_{DS} = 1000 \text{ V}$$



Typical capacitance as a function of drain-source voltage

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

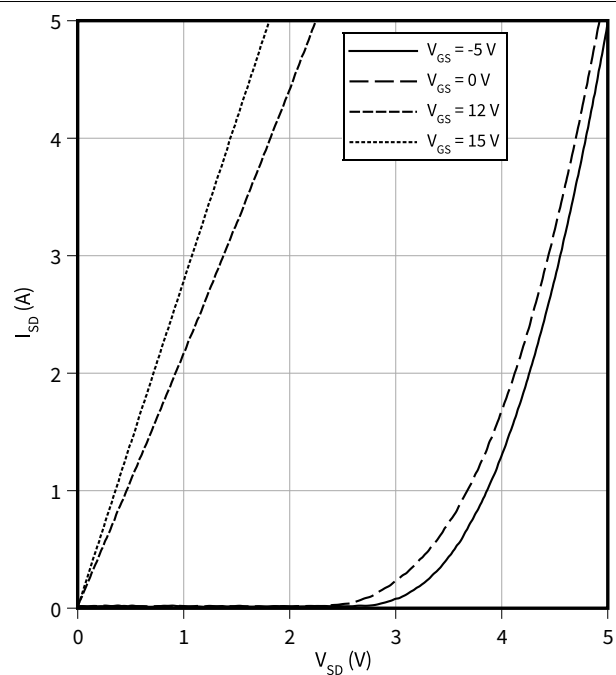
$$f = 100 \text{ kHz}, V_{GS} = 0 \text{ V}$$



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

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

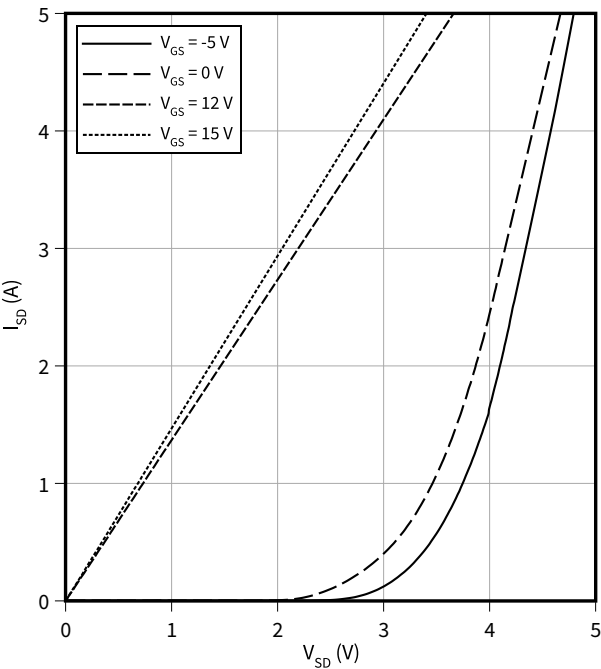
$$T_{vj} = 25 \text{ °C}, t_p = 20 \text{ } \mu\text{s}$$



4 Characteristics diagrams

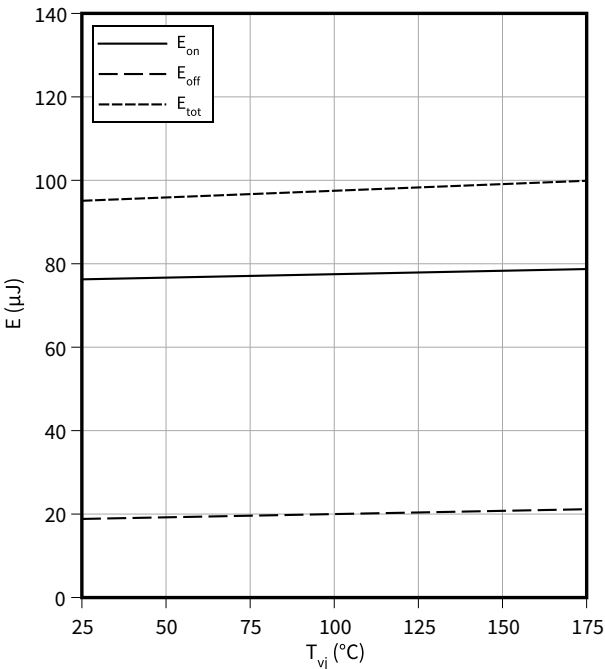
Typical reverse drain current as a function of reverse drain voltage, V_{GS} as a parameter

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



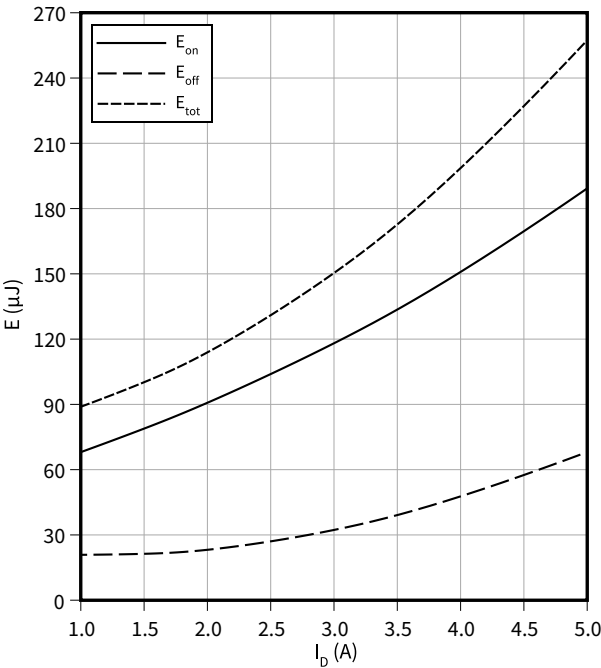
Typical switching energy as a function of junction temperature, test circuit in Fig. F, 2nd device own body diode: $V_{GS} = 0\text{ V}$

$E = f(T_{vj})$
 $V_{GS} = 0/12\text{ V}$, $I_D = 1.5\text{ A}$, $R_{G,ext} = 6.9\text{ }\Omega$, $V_{DD} = 1000\text{ V}$



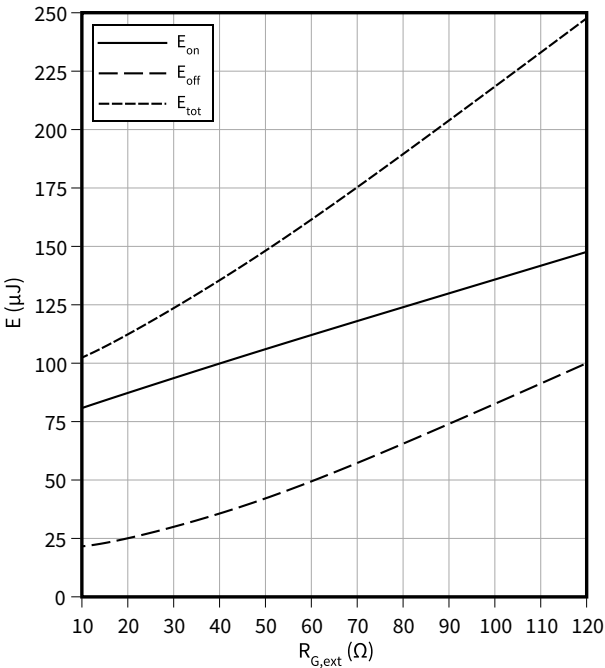
Typical switching energy as a function of drain current, test circuit in Fig. F, 2nd device own body diode: $V_{GS} = 0\text{ V}$

$E = f(I_D)$
 $V_{GS} = 0/12\text{ V}$, $T_{vj} = 175\text{ }^{\circ}\text{C}$, $R_{G,ext} = 6.9\text{ }\Omega$, $V_{DD} = 1000\text{ V}$



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

$E = f(R_{G,ext})$
 $V_{GS} = 0/12\text{ V}$, $I_D = 1.5\text{ A}$, $T_{vj} = 175\text{ }^{\circ}\text{C}$, $V_{DD} = 1000\text{ V}$

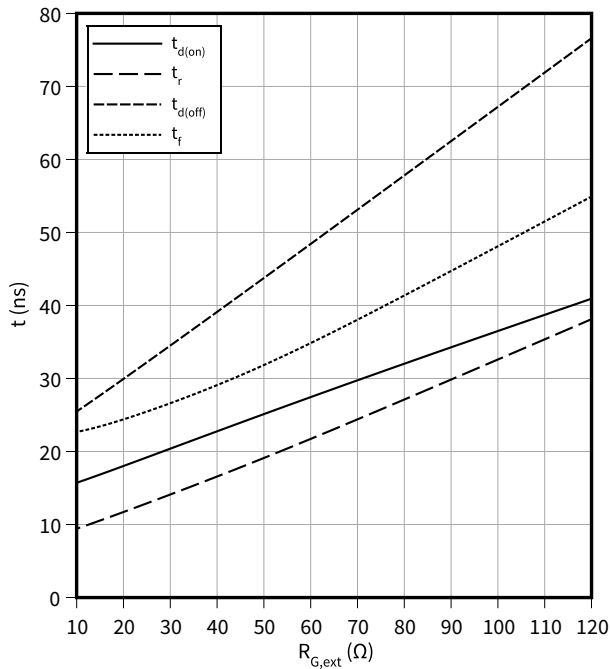


4 Characteristics diagrams

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

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

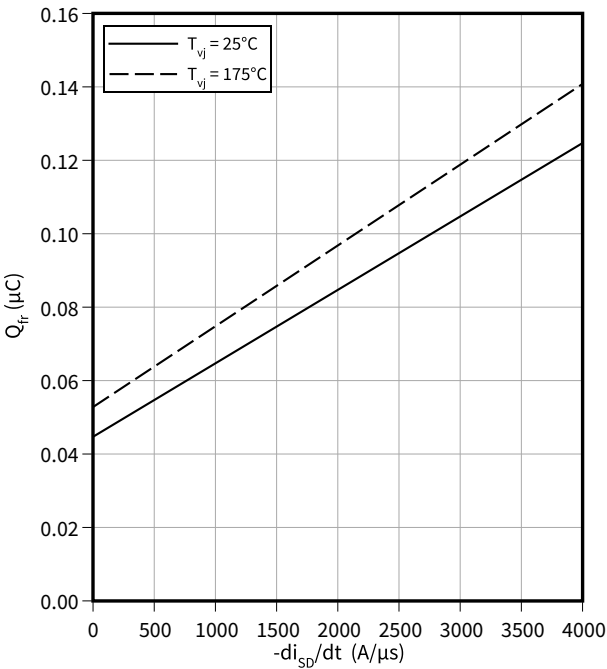
$V_{GS} = 0/12\text{ V}$, $I_D = 1.5\text{ A}$, $T_{vj} = 175\text{ °C}$, $V_{DD} = 1000\text{ V}$



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

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

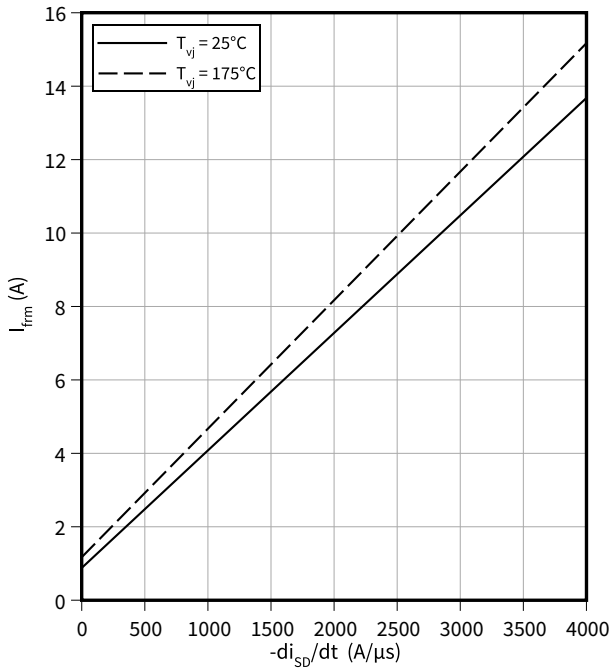
$V_{GS} = 0\text{ V}$, $I_{SD} = 1.5\text{ A}$, $V_{DD} = 1000\text{ V}$



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

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

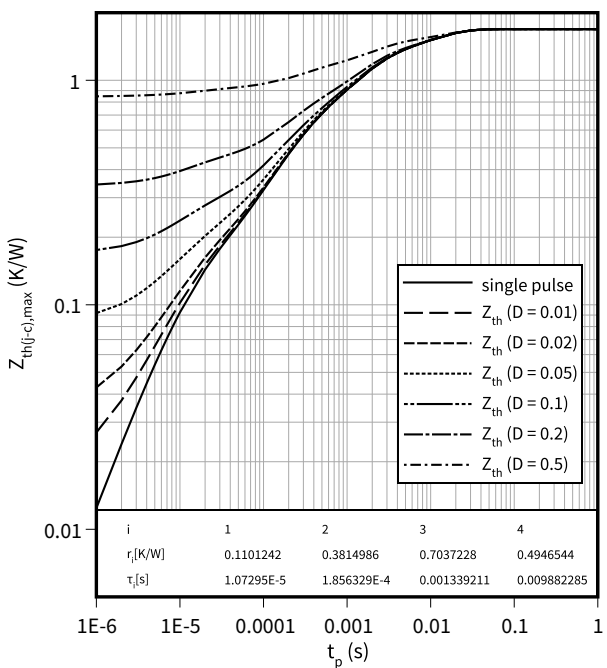
$V_{GS} = 0\text{ V}$, $I_{SD} = 1.5\text{ A}$, $V_{DD} = 1000\text{ V}$



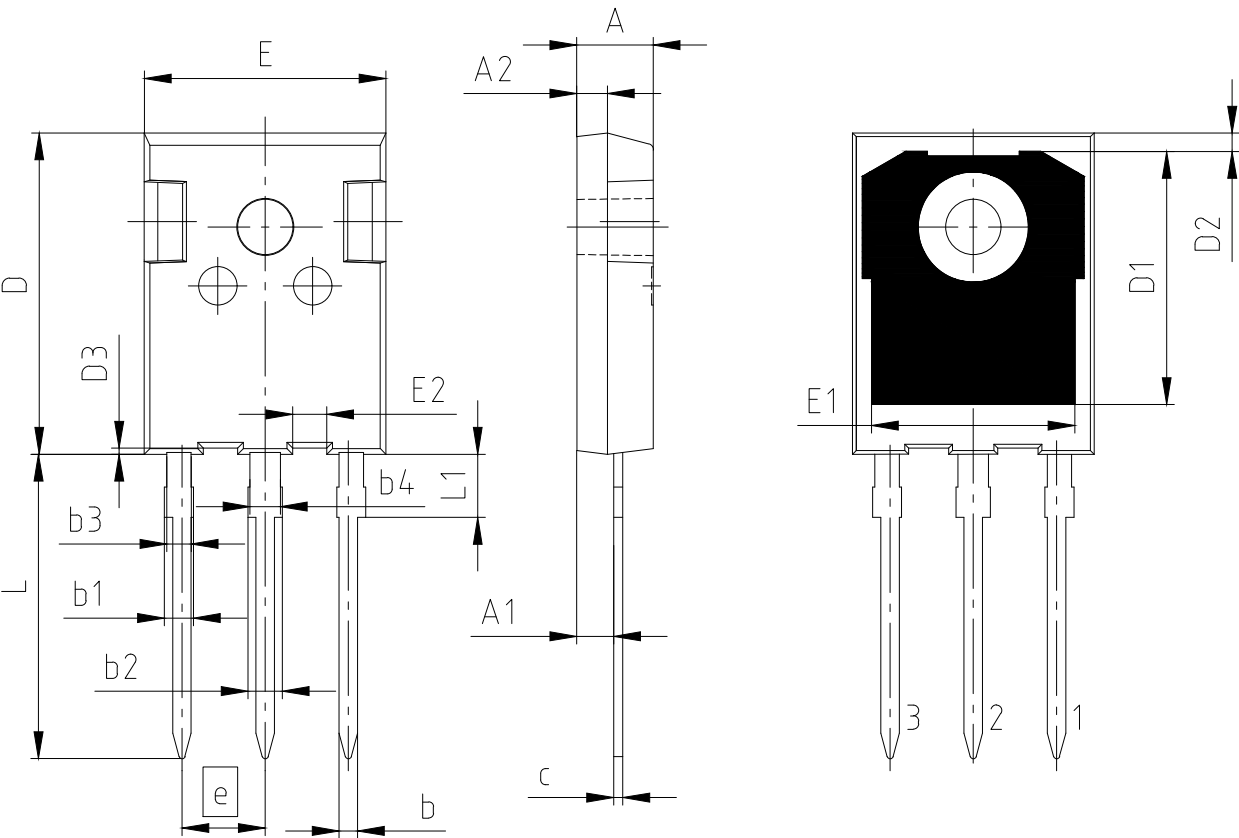
Max. transient thermal impedance (MOSFET/diode)

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

$D = t_p/T$



5 Package outlines



PACKAGE - GROUP NUMBER: PG-TO247-3-U04		
DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	4.90	5.10
A1	2.31	2.51
A2	1.90	2.10
b	1.16	1.26
b1		1.90
b2		2.30
b3	1.55	1.65
b4	1.96	2.06
c	0.59	0.66
D	20.90	21.10
D1	16.25	16.85
D2	1.05	1.35
D3	0.55	0.65
E	15.70	15.90
E1	13.10	13.50
E2	2.14	2.34
e	5.44	
N	3	
L	19.80	20.10
L1	3.95	4.30

Figure 1

6 Testing conditions

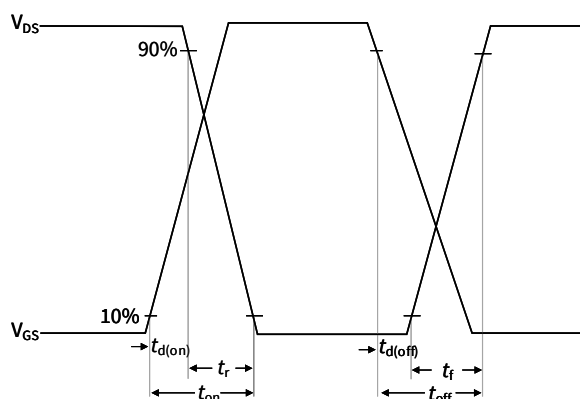


Figure A. Definition of switching times

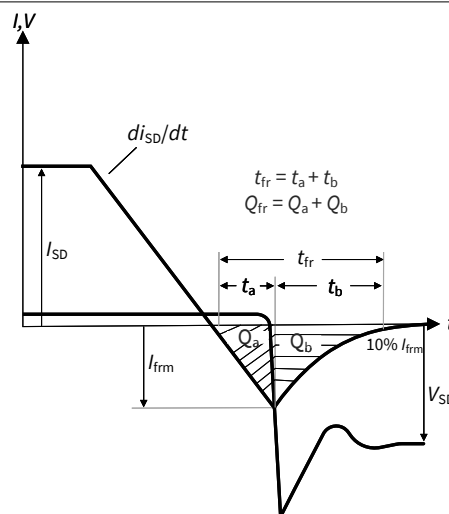


Figure B. Definition of body diode switching characteristics

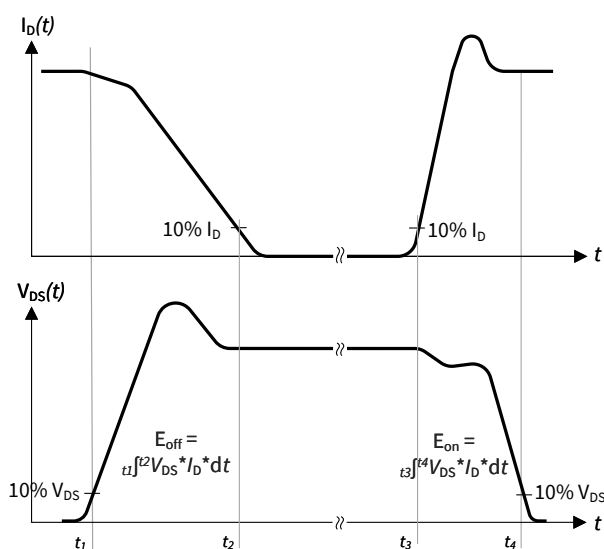


Figure C. Definition of switching losses

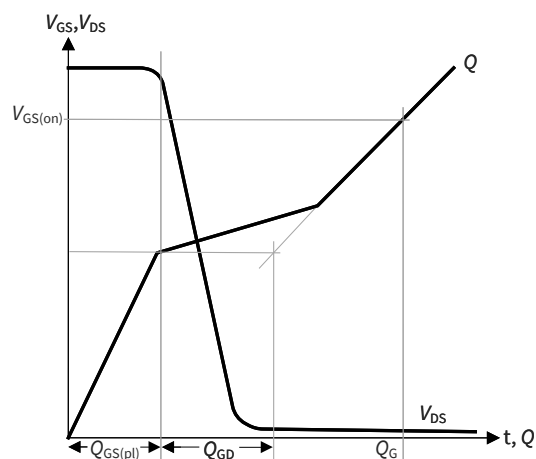


Figure D. Definition of Q_{GD}

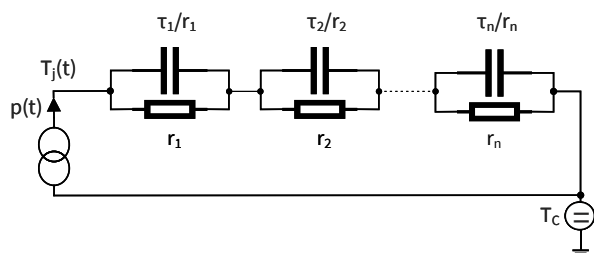


Figure E. Thermal equivalent circuit

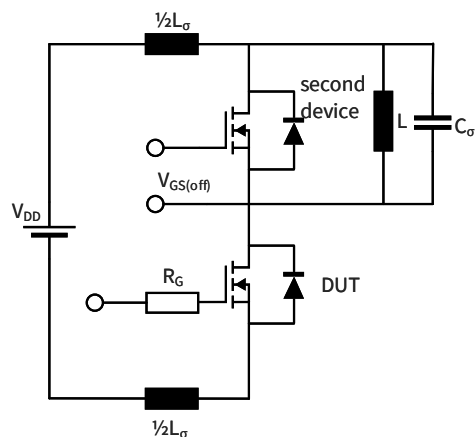


Figure F. Dynamic test circuit

Parasitic inductance L_σ ,
Parasitic capacitor C_σ ,



Revision history

Revision history

Document revision	Date of release	Description of changes
1.00	2024-03-25	Final datasheet
1.10	2025-03-22	Changed package name Increased Gate-source voltage, max. transient voltage Added Gate-source voltage, max. static voltage Added diode characteristic parameters in Table 5 and Table 6 Added graphs $I_{SD} = f(V_{SD})$, $I_{SD} = f(T_c)$, $Q_{fr} = f(-di_{SD}/dt)$, $I_{frm} = f(-di_{SD}/dt)$ Corrected graph $I_{DS} = f(T_c)$ Editorial changes

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