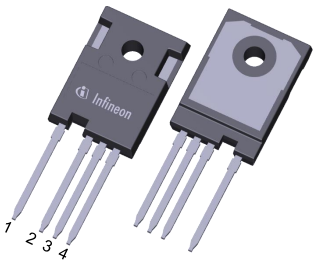
Final datasheet
CoolSiC™ 1200 V SiC Trench MOSFET

Features



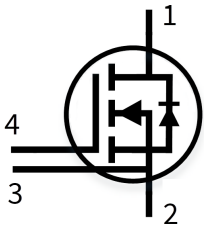
- V_{DSS} = 1200 V at T_{vj} = -55...175°C
- I_{DDC} = 55 A at T_C = 25°C
- $R_{DS(on)}$ = 40 mΩ at V_{GS} = 20 V, T_{vj} = 25°C
- New performance-optimized chip technology (Gen1p) with improved R_{DSon}* A FOM
- Increased recommended turn-on voltage ($V_{GS(on)}$ = 20 V) for lower $R_{DS(on)}$
- Best in class switching energy for lower switching losses and reduced cooling efforts
- Lowest device capacitances for higher switching speeds and higher power density
- A combination of low C_{rss}/C_{iss} ratio and high $V_{GS(th)}$ to avoid parasitic turn-on and enable unipolar gate driving
- Reduced total gate charge Q_{Gtot} for lower driving power and losses
- .XT die attach technology for best in class thermal performance
- Sense pin for optimized switching performance
- Suitable for HV creepage requirements

Halogen-free
Green
Lead-free
RoHS
AEC Qualified

Potential applications
- On-board charger
- DC/DC converter
- Auxiliary drives

Product validation
- Qualified for Automotive Applications. Product Validation according to AEC-Q100/101

Description
Pin definition:
1 – drain
2 – source
3 – Kelvin sense contact
4 – gate



Type	Package	Marking
AIMZHN120R040M1T	PG-TO247-4-STD-NN6.7	A12M1N040

Table of contents

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}				260	°C
MOSFET/body diode thermal resistance, junction-case	$R_{th(j-c)}$			0.43	0.56	K/W

***Note**: Not subject to production test. Parameter verified by design/characterization.*

2 MOSFET

Table 2 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Drain-source voltage	V_{DSS}	T_{vj} = -55...175 °C		1200	V
Continuous DC drain current for $R_{th(j-c,max)}$, limited by $T_{vj(max)}$	I_{DDC}	V_{GS} = 20 V	T_c = 25 °C	55	A
			T_c = 100 °C	39	
Peak drain current, t_p limited by $T_{vj(max)}$	I_{DM}	V_{GS} = 20 V		140	A
Gate-source voltage, max. transient voltage[1)]	V_{GS}	$t_p \leq 0.5$ µs, $D < 0.01$		-10...25	V
Gate-source voltage, max. static voltage	V_{GS}			-5...23	V
Avalanche energy, single pulse	E_{AS}	I_D = 15 A, V_{DD} = 50 V, L = 2.41 mH		269	mJ
Power dissipation, limited by $T_{vj(max)}$	P_{tot}		T_c = 25 °C	268	W
			T_c = 100 °C	134	

1) **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	$V_{GS(on)}$		20	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 = 20 A	T_{vj} = 25 °C, $V_{GS(on)}$ = 20 V		40	50	mΩ
			T_{vj} = 100 °C, $V_{GS(on)}$ = 20 V		56		
			T_{vj} = 175 °C, $V_{GS(on)}$ = 20 V		80		
			T_{vj} = 25 °C, $V_{GS(on)}$ = 18 V		44		
Gate-source threshold voltage	$V_{GS(th)}$	I_D = 6.4 mA, V_{DS} = V_{GS} (tested after 1 ms pulse at V_{GS} = 20 V)	T_{vj} = 25 °C	3.5	4.3	5.1	V
			T_{vj} = 175 °C		3.8		
Zero gate-voltage drain current	I_{DSS}	V_{DS} = 1200 V, V_{GS} = 0 V	T_{vj} = 25 °C		0.3	19	µA
			T_{vj} = 175 °C		50		
Gate leakage current	I_{GSS}	V_{DS} = 0 V	V_{GS} = 25 V			100	nA
			V_{GS} = -10 V			-100	
Forward transconductance	g_{fs}	I_D = 20 A, V_{DS} = 20 V			12		S
Short-circuit withstand time[1)]	t_{SC}	V_{DD} ≤ 800 V, $V_{DS,peak}$ ≤ 1200 V, $T_{vj(start)}$ = 25 °C, $R_{G,ext}$ = 2 Ω	$V_{GS(on)}$ = 20 V		1.5		µs
			$V_{GS(on)}$ = 18 V		2		
			$V_{GS(on)}$ = 15 V		2.5		
Internal gate resistance	$R_{G,int}$	f = 1 MHz, V_{AC} = 25 mV			3.7		Ω
Input capacitance	C_{iss}	V_{DD} = 800 V, V_{GS} = 0 V, f = 100 kHz, V_{AC} = 25 mV			1264		pF
Output capacitance	C_{oss}	V_{DD} = 800 V, V_{GS} = 0 V, f = 100 kHz, V_{AC} = 25 mV			63		pF
Reverse transfer capacitance	C_{rss}	V_{DD} = 800 V, V_{GS} = 0 V, f = 100 kHz, V_{AC} = 25 mV			3.6		pF
C_{oss} stored energy	E_{oss}	V_{DD} = 800 V, V_{GS} = 0 V, f = 100 kHz, V_{AC} = 25 mV			40		µJ
Total gate charge	Q_G	V_{DD} = 800 V, I_D = 20 A, V_{GS} = 0/20 V, turn-on pulse			43		nC
Plateau gate charge	$Q_{GS(pl)}$	V_{DD} = 800 V, I_D = 20 A, V_{GS} = 0/20 V, turn-on pulse			12		nC
Gate-to-drain charge	Q_{GD}	V_{DD} = 800 V, I_D = 20 A, V_{GS} = 0/20 V, turn-on pulse			7		nC
Turn-on delay time	$t_{d(on)}$	V_{DD} = 800 V, I_D = 20 A, V_{GS} = 0/20 V, $R_{GS(on)}$ = 2 Ω, $R_{GS(off)}$ = 2 Ω, L_σ = 15 nH	T_{vj} = 25 °C		10		ns
			T_{vj} = 175 °C		10		

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Rise time	t_r	V_{DD} = 800 V, I_D = 20 A, V_{GS} = 0/20 V, $R_{GS(on)}$ = 2 Ω, $R_{GS(off)}$ = 2 Ω, L_σ = 15 nH	T_{vj} = 25 °C		7		ns
			T_{vj} = 175 °C		10		
Turn-off delay time	$t_{d(off)}$	V_{DD} = 800 V, I_D = 20 A, V_{GS} = 0/20 V, $R_{GS(on)}$ = 2 Ω, $R_{GS(off)}$ = 2 Ω, L_σ = 15 nH	T_{vj} = 25 °C		20		ns
			T_{vj} = 175 °C		22		
Fall time	t_f	V_{DD} = 800 V, I_D = 20 A, V_{GS} = 0/20 V, $R_{GS(on)}$ = 2 Ω, $R_{GS(off)}$ = 2 Ω, L_σ = 15 nH	T_{vj} = 25 °C		8		ns
			T_{vj} = 175 °C		8		
Turn-on energy	E_{on}	V_{DD} = 800 V, I_D = 20 A, V_{GS} = 0/20 V, $R_{GS(on)}$ = 2 Ω, $R_{GS(off)}$ = 2 Ω, L_σ = 15 nH	T_{vj} = 25 °C		112		µJ
			T_{vj} = 175 °C		181		
Turn-off energy	E_{off}	V_{DD} = 800 V, I_D = 20 A, V_{GS} = 0/20 V, $R_{GS(on)}$ = 2 Ω, $R_{GS(off)}$ = 2 Ω, L_σ = 15 nH	T_{vj} = 25 °C		56		µJ
			T_{vj} = 175 °C		64		
Total switching energy	E_{tot}	V_{DD} = 800 V, I_D = 20 A, V_{GS} = 0/20 V, $R_{GS(on)}$ = 2 Ω, $R_{GS(off)}$ = 2 Ω, L_σ = 15 nH	T_{vj} = 25 °C		168		µJ
			T_{vj} = 175 °C		245		
Virtual junction temperature	T_{vj}			-55		175	°C

1) verified by the design/characterization

***Note**: 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} = -55...175 °C		1200	V
Continuous reverse drain current for $R_{th(j-c,max)}$, limited by $T_{vj(max)}$	I_{SDC}	V_{GS} = 0 V	T_c = 25 °C	45	A
			T_c = 100 °C	29	
Peak reverse drain current, t_p limited by $T_{vj(max)}$	I_{SM}	V_{GS} = 0 V		45	A

Table 6 Characteristic values

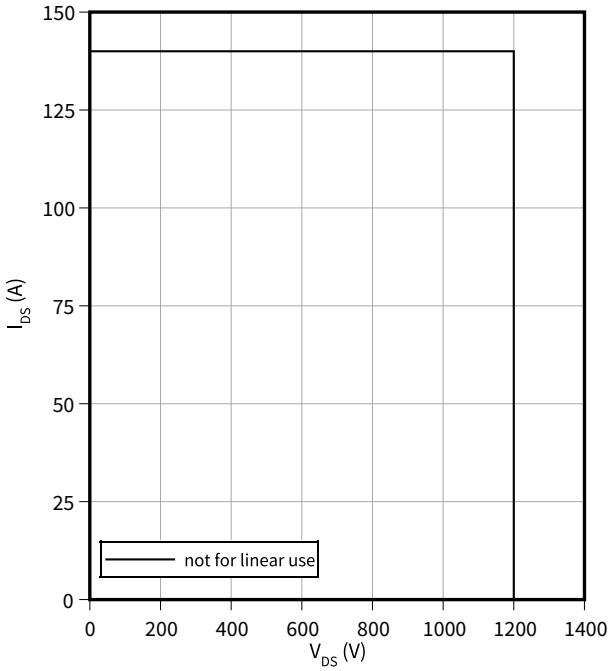
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Drain-source reverse voltage	V_{SD}	I_{SD} = 20 A, V_{GS} = 0 V	T_{vj} = 25 °C		3.9	5	V
			T_{vj} = 100 °C		3.8		
			T_{vj} = 175 °C		3.7		
MOSFET forward recovery charge	Q_{fr}	V_{DD} = 800 V, I_{SD} = 20 A, V_{GS} = 0 V, di_{SD}/dt = 3000 A/µs, Q_{fr} includes also Q_C	T_{vj} = 25 °C		135		nC
			T_{vj} = 175 °C		350		
MOSFET peak forward recovery current	I_{frm}	V_{DD} = 800 V, I_{SD} = 20 A, V_{GS} = 0 V, di_{SD}/dt = 3000 A/µs, Q_{fr} includes also Q_C	T_{vj} = 25 °C		9		A
			T_{vj} = 175 °C		17		
Virtual junction temperature	T_{vj}			-55		175	°C

4 Characteristics diagrams

Reverse bias safe operating area (RBSOA)

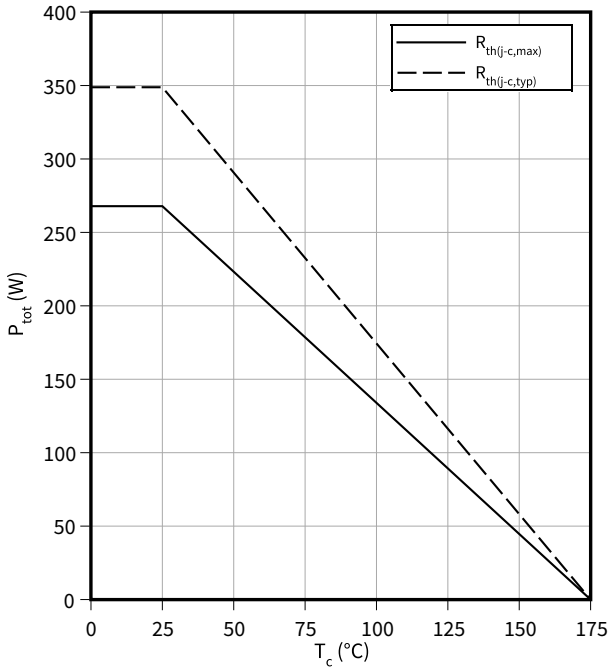
$I_{DS} = f(V_{DS})$

$T_{vj} \leq 175\ °C$, $V_{GS} = 0/20\ V$, $T_c = 25\ °C$



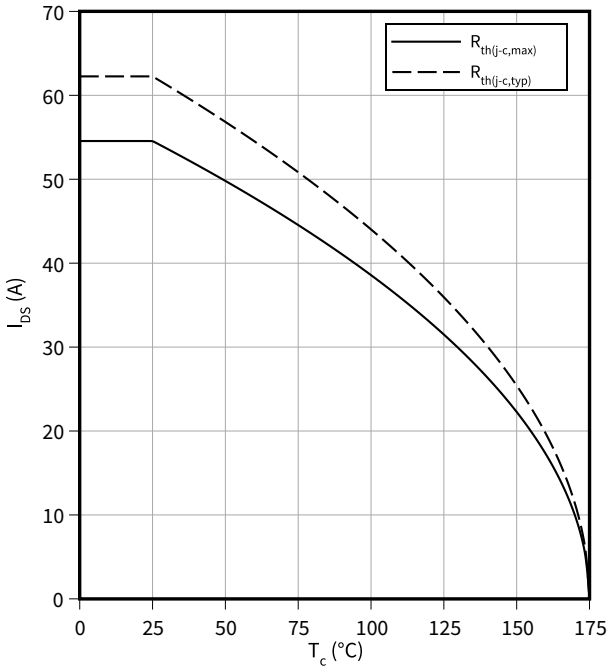
Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$



Maximum DC drain to source current as a function of case temperature

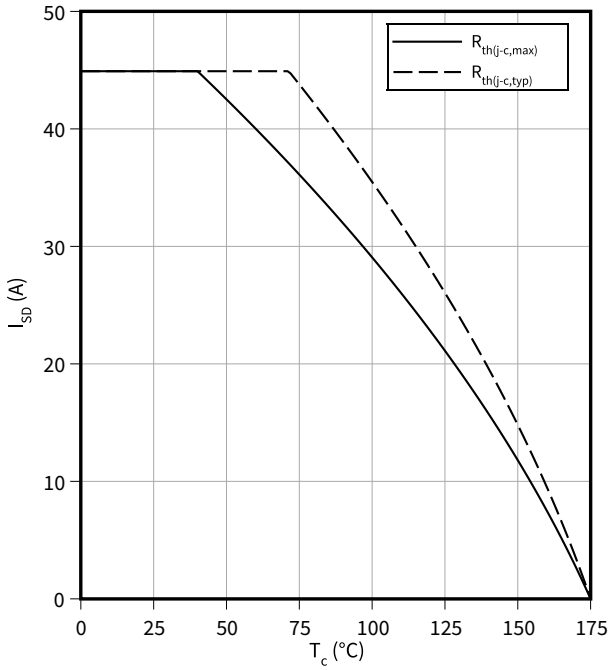
$I_{DS} = f(T_c)$



Maximum source to drain current as a function of case temperature

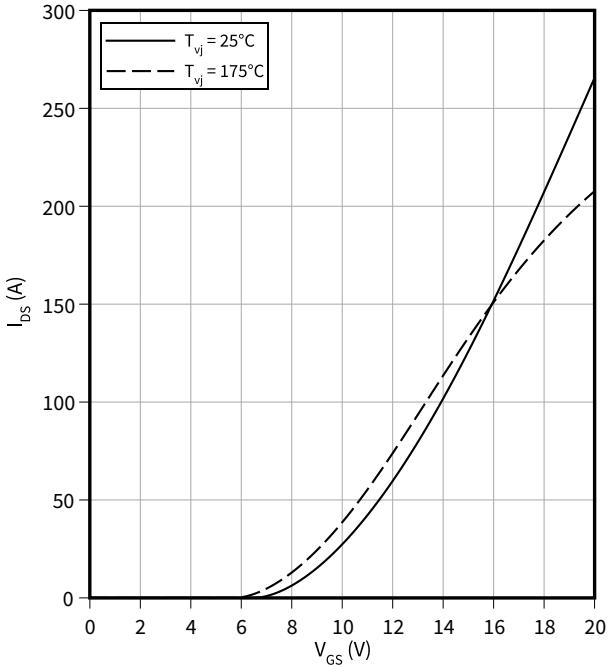
$I_{SD} = f(T_c)$

$V_{GS} = 0\ V$



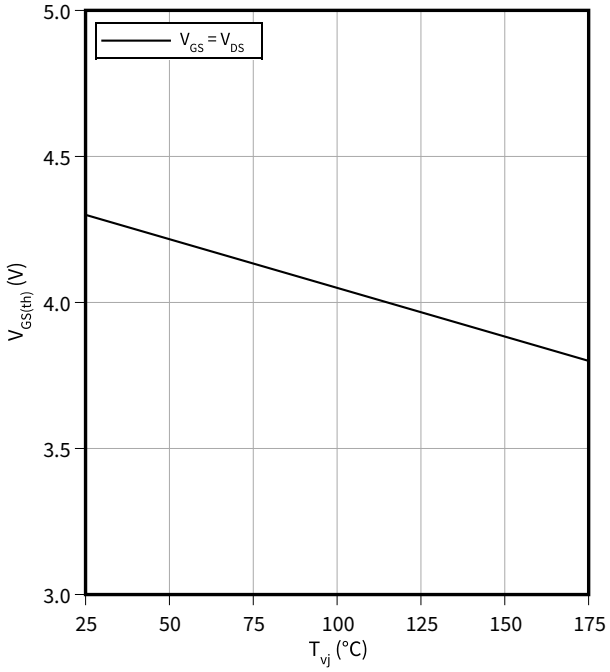
Typical transfer characteristic

$I_{DS} = f(V_{GS})$
$V_{DS} = 20$ V



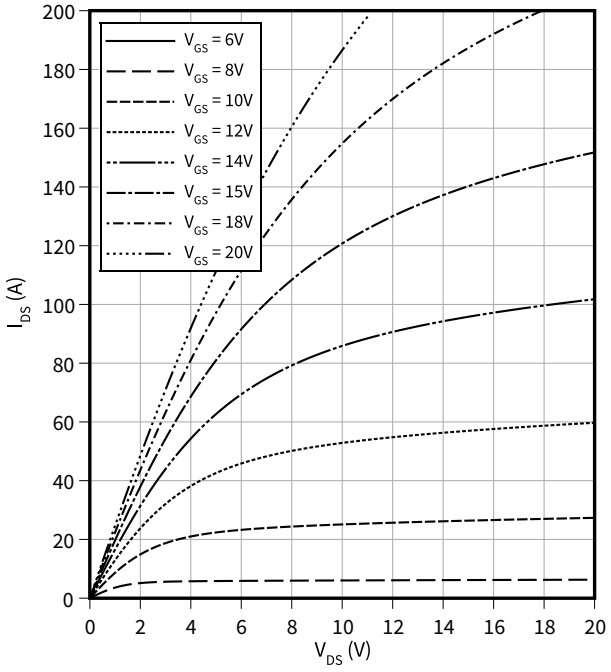
Typical gate-source threshold voltage as a function of junction temperature

$V_{GS(th)} = f(T_{vj})$
$I_D = 6.4$ mA



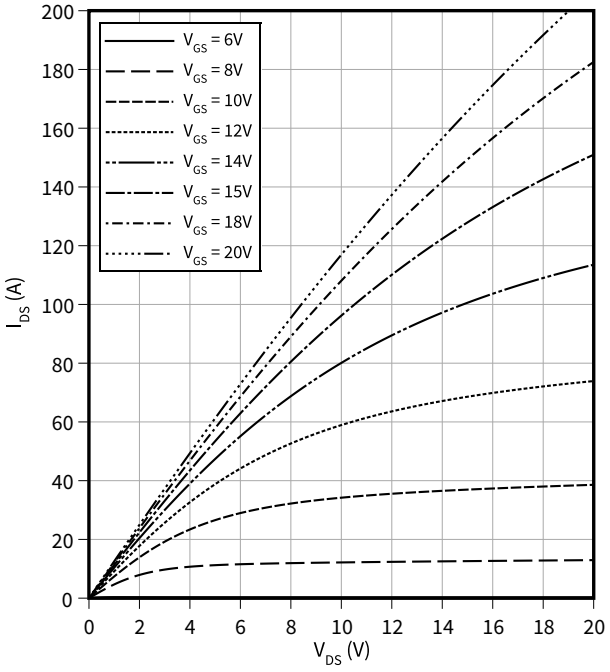
Typical output characteristic, V_{GS} as parameter

$I_{DS} = f(V_{DS})$
$T_{vj} = 25$ °C



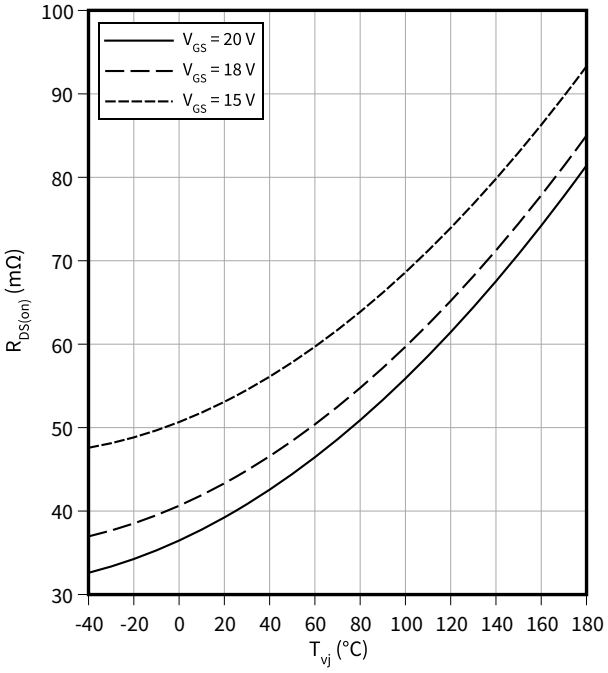
Typical output characteristic, V_{GS} as parameter

$I_{DS} = f(V_{DS})$
$T_{vj} = 175$ °C



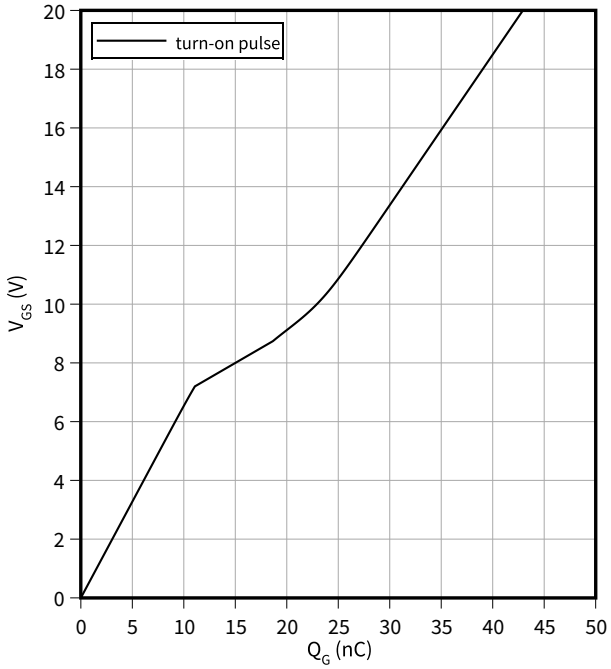
Typical on-state resistance as a function of junction temperature

$R_{DS(on)} = f(T_{vj})$
$I_D = 20$ A



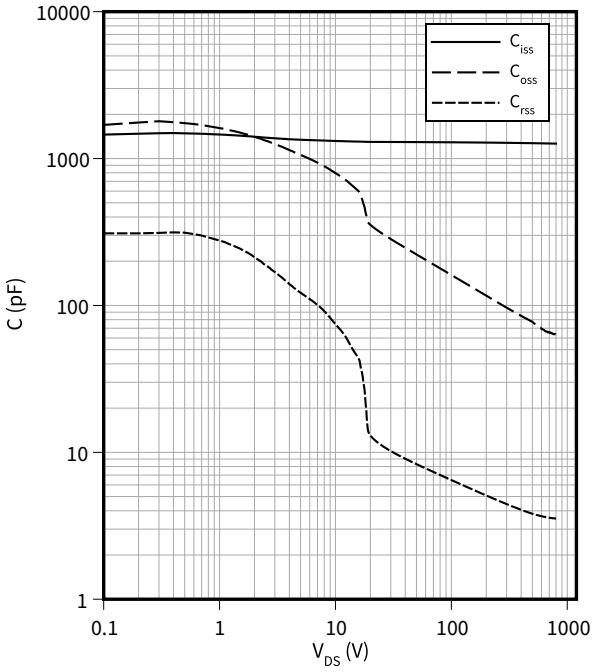
Typical gate charge

$V_{GS} = f(Q_G)$
$I_D = 20$ A, $V_{DS} = 800$ V



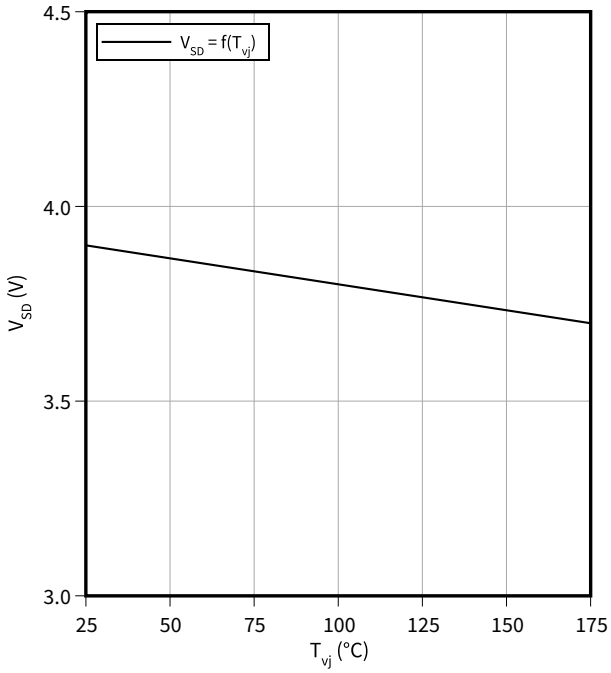
Typical capacitance as a function of drain-source voltage

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



Typical reverse drain voltage as function of junction temperature

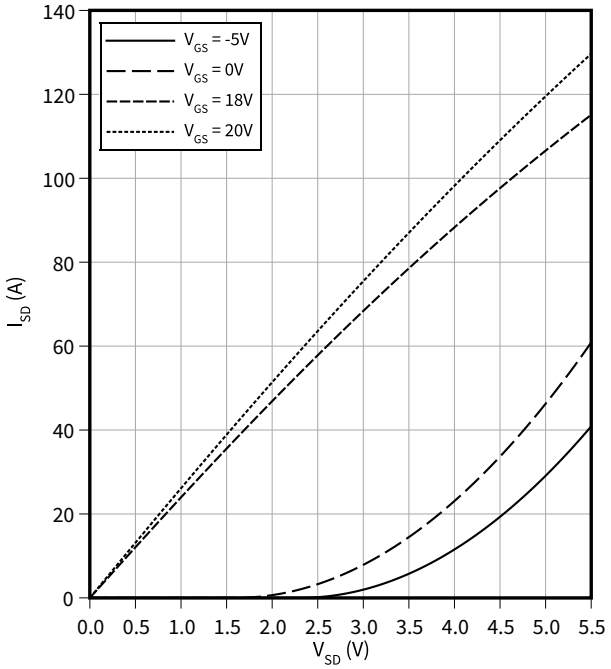
$V_{SD} = f(T_{vj})$
$I_{SD} = 20$ A, $V_{GS} = 0$ V



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

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

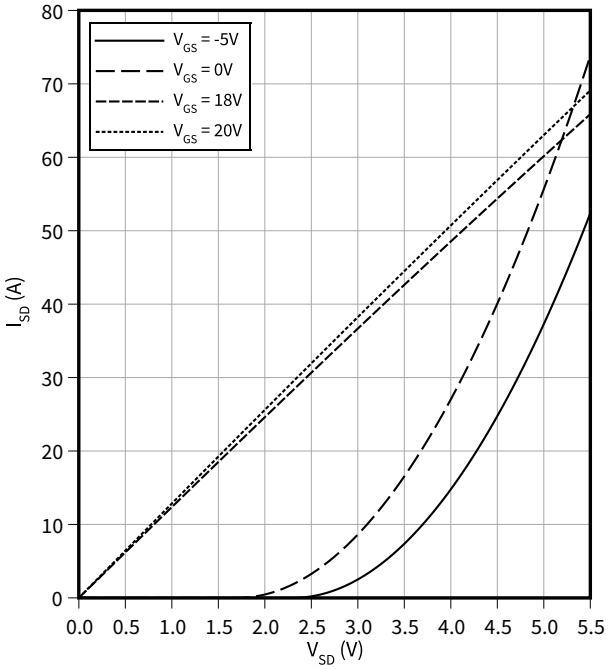
$T_{vj} = 25$ °C



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

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

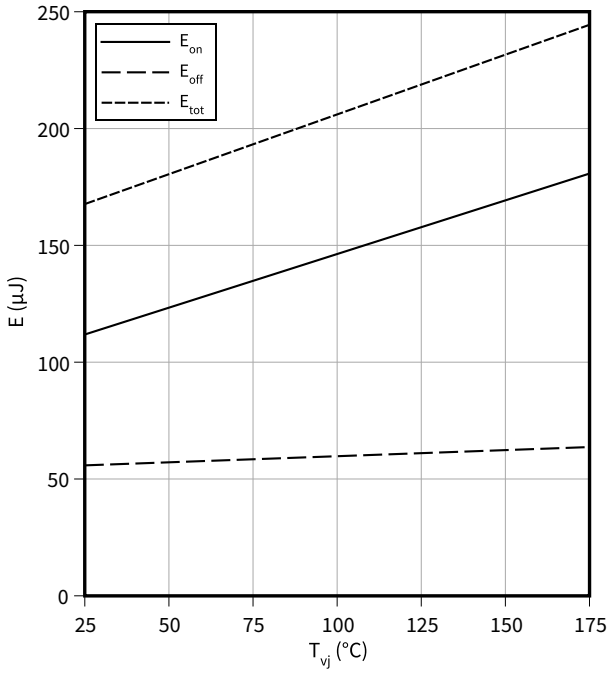
$T_{vj} = 175$ °C



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

$E = f(T_{vj})$

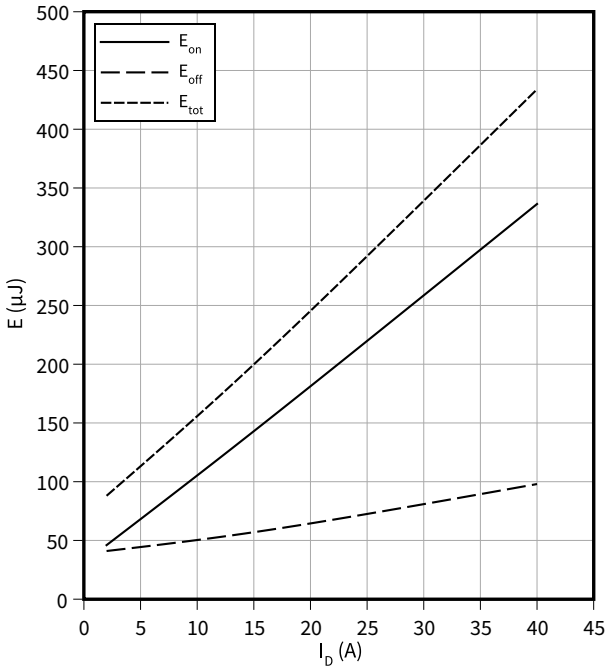
$V_{GS} = 0/20$ V, $I_D = 20$ A, $R_{G,ext} = 2\ \Omega$, $V_{DD} = 800$ V



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

$E = f(I_D)$

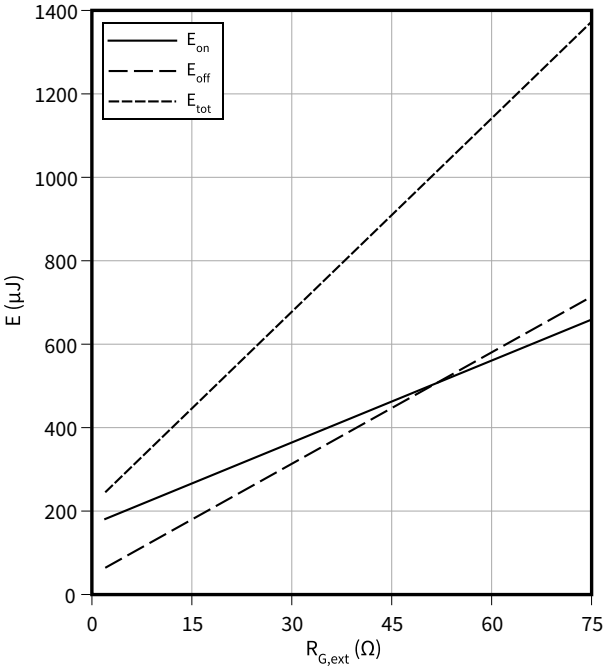
$V_{GS} = 0/20$ V, $T_{vj} = 175$ °C, $R_{G,ext} = 2\ \Omega$, $V_{DD} = 800$ V



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

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

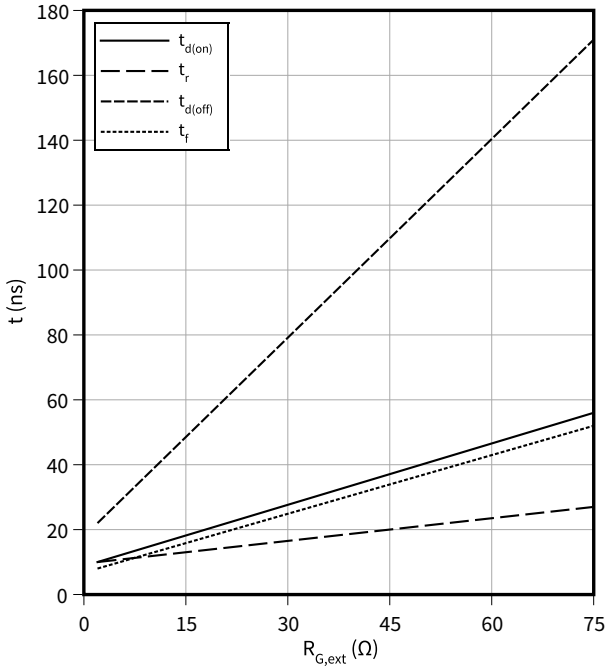
V_{GS} = 0/20 V, I_D = 20 A, T_{vj} = 175 °C, V_{DD} = 800 V



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

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

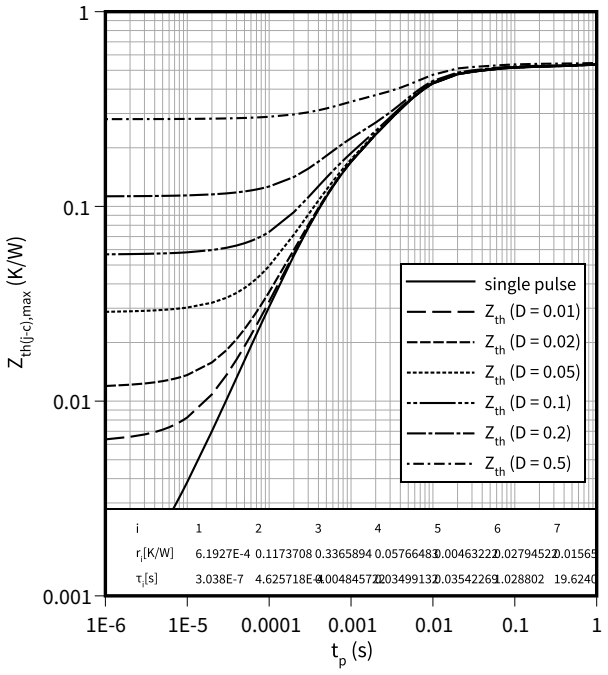
V_{GS} = 0/20 V, I_D = 20 A, T_{vj} = 175 °C, V_{DD} = 800 V



Max. transient thermal impedance (MOSFET/diode)

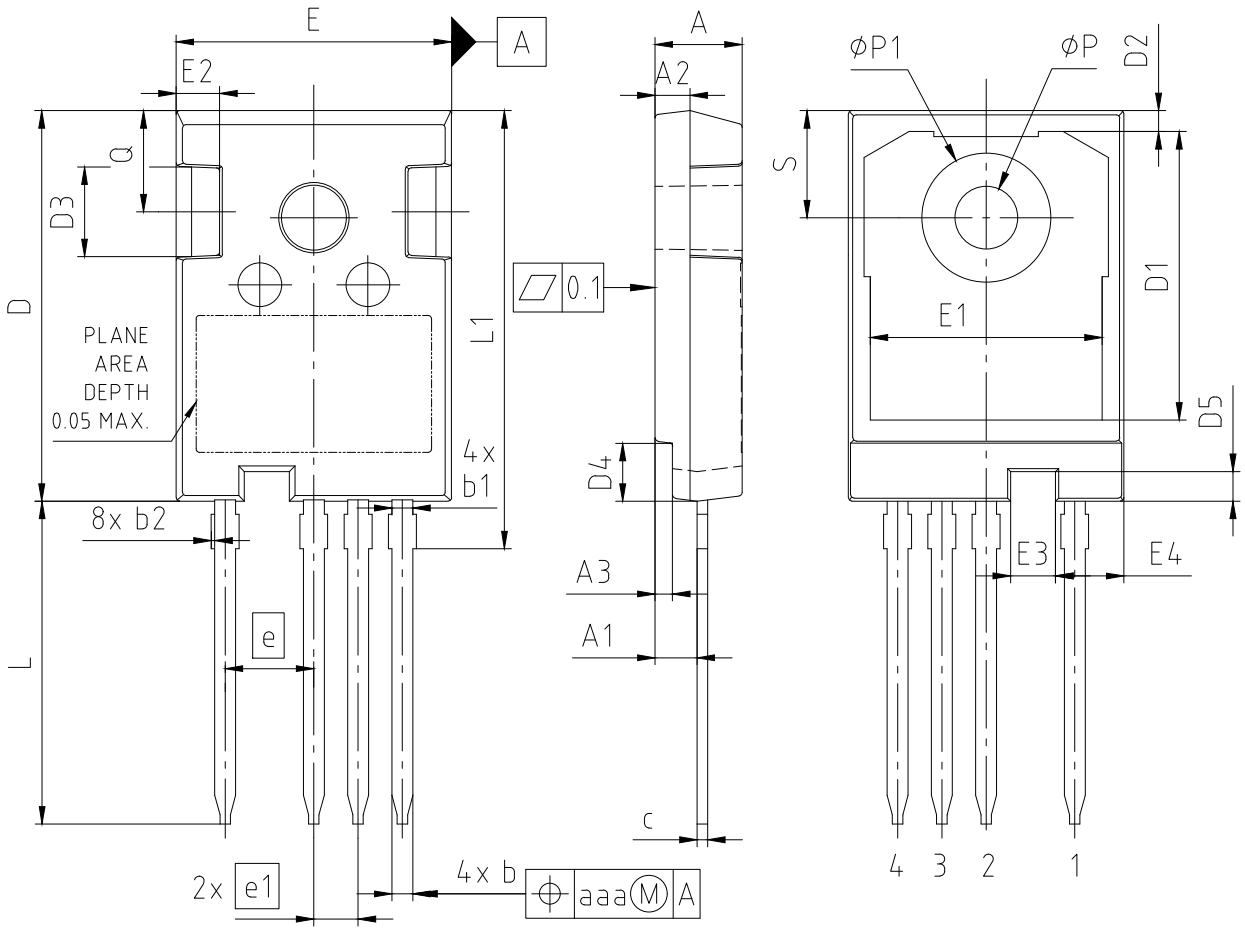
$Z_{th(j-c),max} = f(t_p)$

$D = t_p/T$



5 Package outlines

PG-TO247-4-STD-NN6.7



PACKAGE - GROUP NUMBER:	PG-TO247-4-U05				
DIMENSIONS	**MILLIMETERS**		**DIMENSIONS**	**MILLIMETERS**	
	MIN.	MAX.		MIN.	MAX.
A	4.90	5.10	**E**	15.70	15.90
A1	2.31	2.51	**E1**	13.10	13.50
A2	1.90	2.10	**E2**	2.40	2.60
A3	0.90	1.10	**E3**	2.48	2.68
b	1.16	1.29	**E4**	3.82	4.02
b1	1.16	1.29	**e**	5.08	
b2		0.20	**e1**	2.54	
c	0.59	0.66	**N**	4	
D	22.30	22.50	**L**	18.40	18.70
D1	16.25	16.85	**L1**	24.97	25.27
D2	1.05	1.35	**øP**	3.50	3.70
D3	5.00	5.20	**øP1**		7.40
D4	3.22	3.42	**Q**	5.60	6.00
D5	1.60	1.80	**S**	6.00	6.30
			aaa	0.25	

NOTE: DIMENSIONS DO NOT INCLUDE MOLDFLASH; PROTRUSION OR GARE BURRS

Figure 1

6 Testing conditions

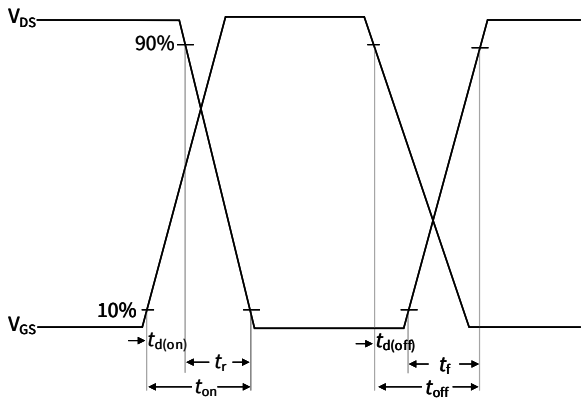


Figure A. **Definition of switching times**

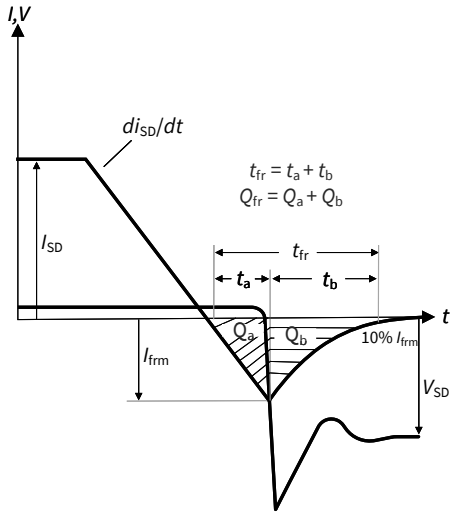


Figure B. **Definition of body diode switching characteristics**

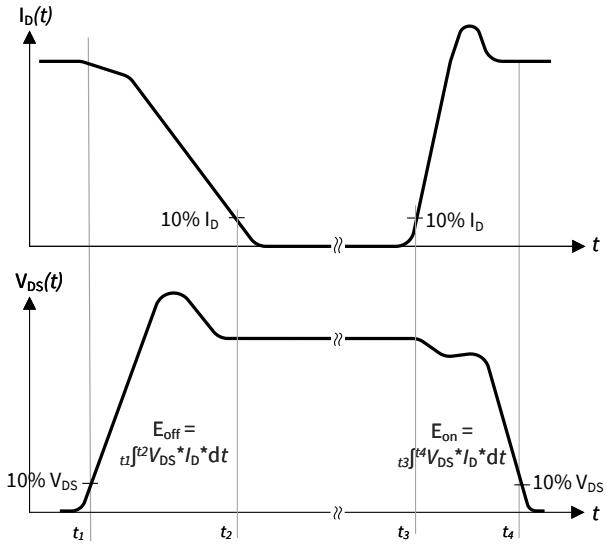


Figure C. **Definition of switching losses**

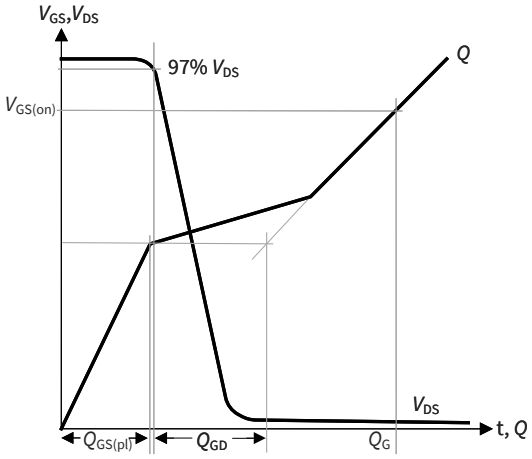


Figure D. **Definition of QGD**

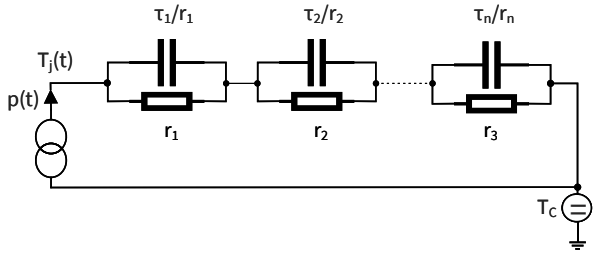


Figure E. **Thermal equivalent circuit**

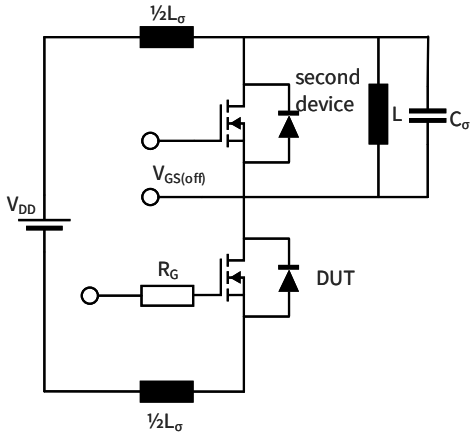


Figure F. **Dynamic test circuit**
Parasitic inductance L_σ,
Parasitic capacitor C_σ,

Figure 2

Revision history

Document revision	Date of release	Description of changes
0.10	2022-04-19	Target datasheet
0.20	2023-08-03	Preliminary datasheet
1.00	2023-11-30	Final datasheet

Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Edition 2023-11-30

Published by

Infineon Technologies AG

81726 Munich, Germany

Do you have a question about any aspect of this document?

Email: erratum@infineon.com

Document reference
IFX-ABE579-003

Important notice

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie").

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

Warnings

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for SiC MOSFETs ***category:***

Click to view products by Infineon ***manufacturer:***

Other Similar products are found below :

SCT055W65G3-4AG SCT040W120G3-4AG SCT027W65G3-4AG CI72N170SM IMZ120R090M1H YJD212080NCTG1 SCT3080ALGC11 C3M0120100K C2M1000170J C3M0120090J C3M0065090J C3M0280090J SCT2750NYTB SCT2H12NYTB C3M0021120D CDMS24783-120 SL C3M0016120K C3M0045065D C3M0045065K E3M0120090J C3M0120100J C3M0075120J DMWS120H100SM4 DMWSH120H28SM4 DMWSH120H90SM4 DMWSH120H90SM4Q DMWSH120H28SM4Q DMWSH120H90SCT7 DMWSH120H90SCT7Q DMWSH120H28SM3 DMWSH120H90SM3 DMWSH120H28SM3Q DMWSH120H90SM3Q DIF065SIC020 DIF120SIC022-AQ DIF065SIC030 DIF120SIC022 DIF120SIC028 DIF120SIC053-AQ DIW120SIC023-AQ DIW120SIC022-AQ DIW120SIC059-AQ DIW065SIC015 DIW065SIC049 DIW065SIC080 DIW170SIC049 DIW120SIC028 G3R60MT07K G2R50MT33K G3F34MT12J-TR