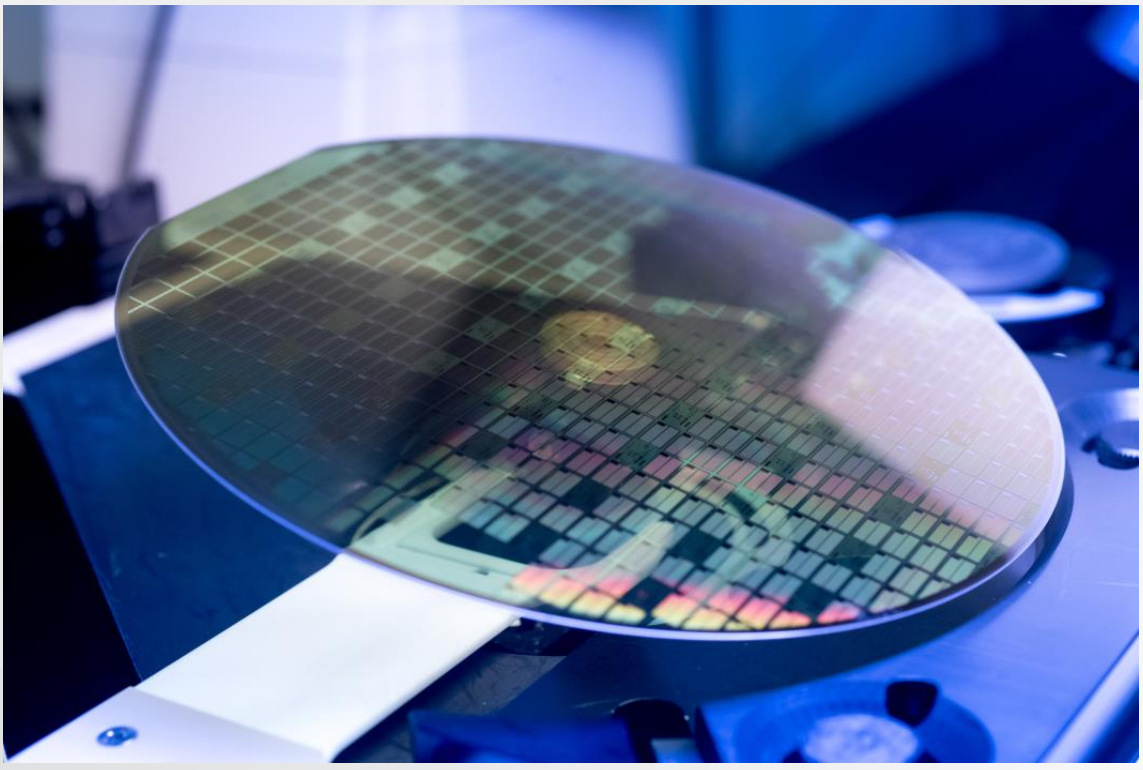
BOSCH
Invented for life

Technical Customer Information
Automotive Power MOSFET

BT2M1200013BOA

N-channel 1200 V SiC MOSFET

Part number: 1277.381.060



© Robert Bosch GmbH 2024. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.

Downloaded from Arrow.com.

Table of contents

1 Product identification 3

2 Product description 3
2.1 Features . . . 3
2.2 Benefits . . . 3
2.3 Applications . . . 3
2.4 Quick reference . . . 3

3 Technical data 4
3.1 Maximum ratings . . . 4
3.2 Static electrical characteristics . . . 5
3.3 Dynamic characteristics . . . 7
3.4 Body diode characteristics . . . 8
3.5 Electrical characteristics diagrams . . . 9

4 Mechanical parameters 14
4.1 Dimensions and metallization . . . 14
4.2 Layout . . . 14
4.3 Packing information . . . 15
4.4 Storage information . . . 15

5 Legal disclaimer 16

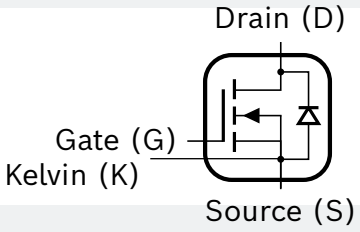
6 History 17

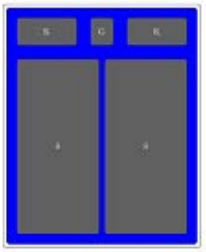
PRELIMINARY

Downloaded from Arrow.com.

1 Product identification

- **Product name:** BT2M1200013BOA
- **Description:** N-channel 1200 V SiC MOSFET
- **Part number:** 1277.381.060





2 Product description

2.1 Features

- Typ. $R_{DS(on)}$ = 13.0 mΩ
- Optimized for low $R_{DS,on}$
- Optimized internal gate resistance
- To be qualified based on AEC-Q101

2.2 Benefits

- Enhanced power density and system efficiency
- Reduced switching losses
- Minimized gate ringing
- Increased system switching frequency

2.3 Applications

The product has been developed, validated, and released exclusively for use in these applications:

- Automotive inverters

2.4 Quick reference

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Maximum ratings						
Drain-source voltage[1]	V_{DS}	-40 °C ≤ T_j ≤ 175 °C	–	–	1200	V
Continuous drain current[1,2]	I_D	T_c = 25 °C, T_j = 175 °C, V_{GS} = 18 V, $R_{th(j\text{-}C,max)}$	–	–	125	A
Total power dissipation[1,2]	P_{tot}	V_{GS} ≥ 18 V, T_c = 25 °C, T_j = 175 °C	–	–	580	W
Operating temperature[1]	T_j	–	–40	–	175	°C
Static characteristics						
Drain-source on-state resistance[1]	$R_{DS(on)}$	V_{GS} = 18 V, I_D = 62.5 A	–	13.0	17.1	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 10 mA	2.80	4.05	–	V

Table 1: Quick reference data for BT2M1200013BOA, given for T_j = 25 °C unless specified otherwise. Maximum ratings given in accordance with the Absolute Maximum Rating System (IEC 60134).

[1]Specified by design. Not subject to production test.
[2]Package dependent, for reference only

PRELIMINARY

© Robert Bosch GmbH 2024. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.

Downloaded from Arrow.com.

3 Technical data

3.1 Maximum ratings

Parameter	Symbol	Conditions	Ref	Value		Unit
				Min	Max	
Drain-source voltage[1]	V_{DS}	-40 °C ≤ T_j ≤ 175 °C	–	–	1200	V
Recommended continuous gate-source voltage	V_{GSS}		–	–5	18	V
Maximum transient gate-source voltage[1]	V_{GSS}	t < 10 hours over lifetime, t_{pulse} < 20 µs	–	–11	23	V
Maximum gate-source voltage[1]	$V_{GSS,max}$		–	–5.5	20	V
Continuous drain current[1,2]	I_D	T_c = 25 °C, limited by $T_{j,max}$, assumed $R_{th(j-C),max}$ = 0.26 K/W	Fig. 2	–	125	A
		T_c = 100 °C, limited by $T_{j,max}$, assumed $R_{th(j-C),max}$ = 0.26 K/W	Fig. 2	–	88	A
Pulsed drain current[1,2]	$I_{D,pulse}$	V_{GS} = 18 V, t_{pulse} limited by $T_{j,max}$	–	–	185	A
Total power dissipation[1,2]	P_{tot}	T_c = 25 °C, T_j = 175 °C, assumed $R_{th(j-C),max}$ = 0.26 K/W	Fig. 1	–	580	W
Junction temperature[1]	T_j	–	–	–40	175	°C
Junction temperature[1] (extended)	T_j	t < 100 h	–	175	200	°C
Solder temperature[1]	T_s	t_{hold} < 1 min.	–	–	240	°C

Table 2: Maximum ratings, given for T_j = 25 °C unless specified otherwise, in accordance with the Absolute Maximum Rating System (IEC 60134).

[1] Specified by design. Not subject to production test.
[2] Package dependent, for reference only

© Robert Bosch GmbH 2024. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.

Downloaded from Arrow.com.

3.2 Static electrical characteristics

Parameter	Symbol	Conditions	Ref	Value			Unit
				Min	Typ	Max	
Breakdown voltage[1]	$V_{(BR)DSS}$	I_D = 1 mA, V_{GS} = 0 V, -40 °C ≤ T_j ≤ 175 °C	–	1200	–	–	V
Gate-source threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 10 mA, T_j = –40 °C[1]	Fig. 5	–	4.70	–	V
		V_{DS} = V_{GS}, I_D = 10 mA, T_j = 25 °C		2.80	4.05	–	V
		V_{DS} = V_{GS}, I_D = 10 mA, T_j = 100 °C[1]		–	3.60	–	V
		V_{DS} = V_{GS}, I_D = 10 mA, T_j = 175 °C[1]		–	3.25	–	V
Zero gate voltage drain current	I_{DSS}	V_{DS} = 1200 V, V_{GS} = 0 V, T_j = 25 °C	–	–	–	30	µA
		V_{DS} = 1200 V, V_{GS} = 0 V, T_j = 175 °C[1]	–	–	–	100	µA
Gate-source leakage current	I_{GSS}	V_{GS} = 20 V, V_{DS} = 0 V, T_j = 25 °C	–	–	–	20	nA
		V_{GS} = 20 V, V_{DS} = 0 V, T_j = 175 °C[1]	–	–	–	100	nA
Transconductance[1]	g_{fs}	V_{DS} = 10 V, I_D = 62.5 A, T_j = 25 °C	–	–	39.2	–	S
		V_{DS} = 10 V, I_D = 62.5 A, T_j = 175 °C	–	–	*tbd*	–	S

Table 3: Static electrical characteristics I, given for T_j = 25 °C unless specified otherwise.

[1] Specified by design. Not subject to production test.

© Robert Bosch GmbH 2024. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.

Downloaded from Arrow.com.

Parameter	Symbol	Conditions	Ref	Value			Unit
				Min	Typ	Max	
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 18\,V$, $I_D = 62.5\,A$, $T_j = -40\,°C$[1,3]	Fig. 7	–	12.0	–	mΩ
		$V_{GS} = 18\,V$, $I_D = 62.5\,A$, $T_j = 25\,°C$[1,3]	Fig. 7	10.4	13.0	–	mΩ
		$V_{GS} = 18\,V$, $I_D = 62.5\,A$, $T_j = 100\,°C$[1,3]	Fig. 7	–	18.0	–	mΩ
		$V_{GS} = 18\,V$, $I_D = 62.5\,A$, $T_j = 175\,°C$[1,3]	Fig. 7	–	27.0	–	mΩ
Reverse drain-source resistance	$R_{DS(on),rev}$	$V_{GS} = 18\,V$, $I_D = -62.5\,A$, $T_j = -40\,°C$[1,3]	Fig. 7	–	10.8	–	mΩ
		$V_{GS} = 18\,V$, $I_D = -62.5\,A$, $T_j = 25\,°C$[1,3]	Fig. 7	–	12.2	–	mΩ
		$V_{GS} = 18\,V$, $I_D = -62.5\,A$, $T_j = 100\,°C$[1,3]	Fig. 7	–	17.3	–	mΩ
		$V_{GS} = 18\,V$, $I_D = -62.5\,A$, $T_j = 175\,°C$[1,3]	Fig. 7	–	26.1	–	mΩ

Table 4: Static electrical characteristics II, given for $T_j = 25\,°C$ unless specified otherwise.

PRELIMINARY

[1] Specified by design. Not subject to production test.
[3] Limits are given as 4 sigma equivalent incl. drift over lifetime.

© Robert Bosch GmbH 2024. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.

Downloaded from Arrow.com.

3.3 Dynamic characteristics

Parameter	Symbol	Conditions	Ref	Value			Unit
				Min	Typ	Max	
Input capacitance[1]	C_{iss}	$V_{GS} = 0\,V$, $V_{DS} = 920\,V$, $f = 0.1\,MHz$	Fig. 11	–	3690	–	pF
Output capacitance[1]	C_{oss}			–	194	–	pF
Reverse transfer capacitance[1]	C_{rss}			–	11	–	pF
C_{OSS} stored energy[1]	E_{oss}			–	100	–	µJ
Internal gate resistance[1]	$R_{G(int)}$	$f = 1\,MHz$		–	5.5	–	Ω
Gate to source charge[1]	Q_{GS}	$V_{DS} = 920\,V$, $I_D = 62.5\,A$, $V_{GS} = -5/18\,V$	Fig. 12	–	53	–	nC
Gate to drain charge[1]	Q_{GD}			–	32	–	nC
Total gate charge[1]	Q_G			–	148	–	nC
Miller ratio[1]	Q_{GD}/Q_{GS}			–	0.6	–	
Gate-source plateau voltage[1]	$V_{plateau}$			–	7.2	–	V

Table 5: Dynamic characteristics, given for $T_j = 25\,°C$ unless specified otherwise.

Parameter	Symbol	Conditions	Ref	Value			Unit
				Min	Typ	Max	
Turn-on energy loss per pulse[1]	E_{on}	$I_D = 62.5\,A$, $R_{G(on)} = 12\,\Omega$, $R_{G(off)} = 5\,\Omega$, $V_{GS} = -5/18\,V$, $V_{DS} = 920\,V$, $T_j = 25\,°C$	Fig. 9	–	2.30	–	mJ
Turn-off energy loss per pulse[1]	E_{off}			–	0.31	–	mJ
Turn-on delay time[1]	$t_{d,on}$		–	–	70	–	ns
Turn-off delay time[1]	$t_{d,off}$			–	75	–	ns
Rise time[1]	t_r			–	15	–	ns
Fall time[1]	t_f			–	20	–	ns

Table 6: Switching characteristics, given for $T_j = 25\,°C$ unless specified otherwise and with inductive load.

[1]Specified by design. Not subject to production test.

PRELIMINARY

© Robert Bosch GmbH 2024. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.

Downloaded from Arrow.com.

3.4 Body diode characteristics

Parameter	Symbol	Conditions		Value			Unit
				Min	Typ	Max	
Diode forward current (pulsed)[1]	$I_{SD,pulse}$	$V_{GS} = -5\,V$, limited by $T_{j,max}$	$T_c = 25\,°C$	–	–	185	A
Diode forward voltage[1]	V_{SD}	$V_{GS} = -5\,V$, $I_{SD} = 62.5\,A$	$T_j = -40\,°C$	–	5.10	–	V
			$T_j = 25\,°C$	–	4.65	5.15	V
			$T_j = 100\,°C$	–	4.30	–	V
			$T_j = 175\,°C$	–	4.00	–	V
Reverse recovery time[1]	t_{rr}	$V_{DS} = 920\,V$, $I_D = 62.5\,A$, $V_{GS} = -5\,V$, $di/dt = 1.89\,kA/\mu s$	$T_j = 25\,°C$	–	18	–	ns
Reverse recovery charge[1]	Q_{rr}			–	280	–	nC
Peak reverse recovery current[1]	I_{rrm}			–	25.2	–	A

Table 7: Body diode characteristics, given for $T_j = 25\,°C$ unless specified otherwise.

[1]Specified by design. Not subject to production test.

PRELIMINARY

© Robert Bosch GmbH 2024. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.

Downloaded from Arrow.com.

3.5 Electrical characteristics diagrams

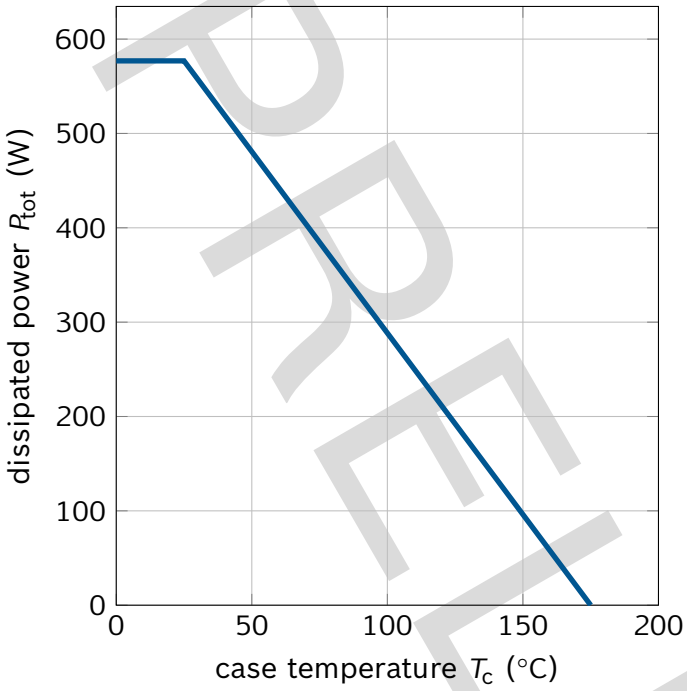


Fig. 1: Dissipated power P_{tot} as a function of case temperature T_c for $V_{GS} = 18\,V$, assumed $R_{th(j\text{-}C),max} = 0.26\,K/W$.

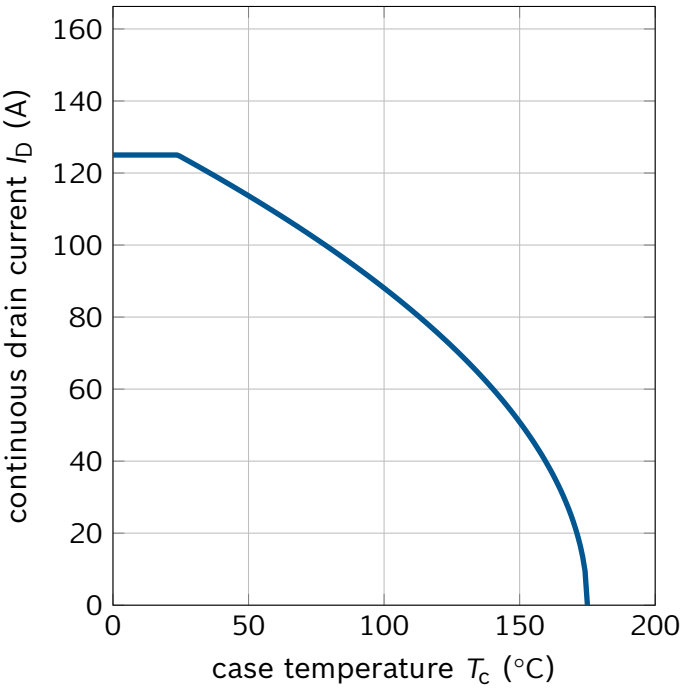


Fig. 2: Continuous drain current I_D as a function of case temperature T_c for $V_{GS} = 18\,V$, assumed $R_{th(j\text{-}C),max} = 0.26\,K/W$.

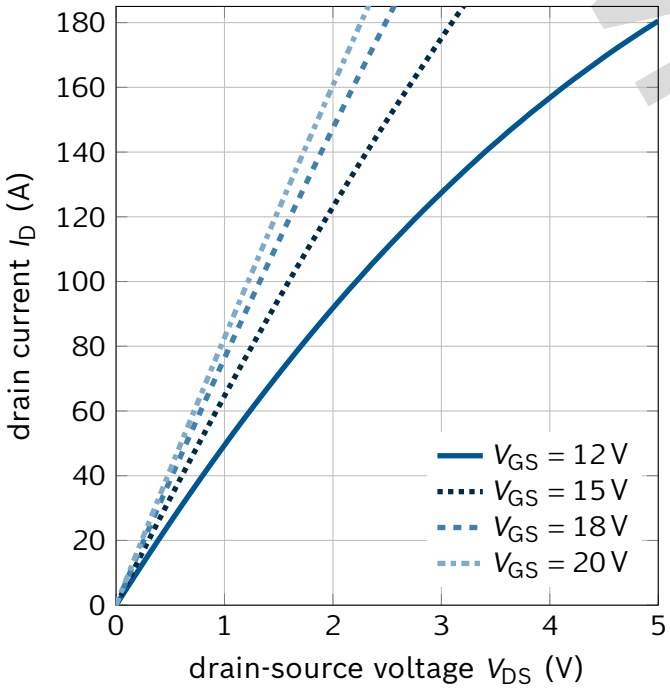


Fig. 3: Typical output characteristics: drain current I_D as a function of drain-source voltage V_{DS} for $T_j = 25\,°C$.

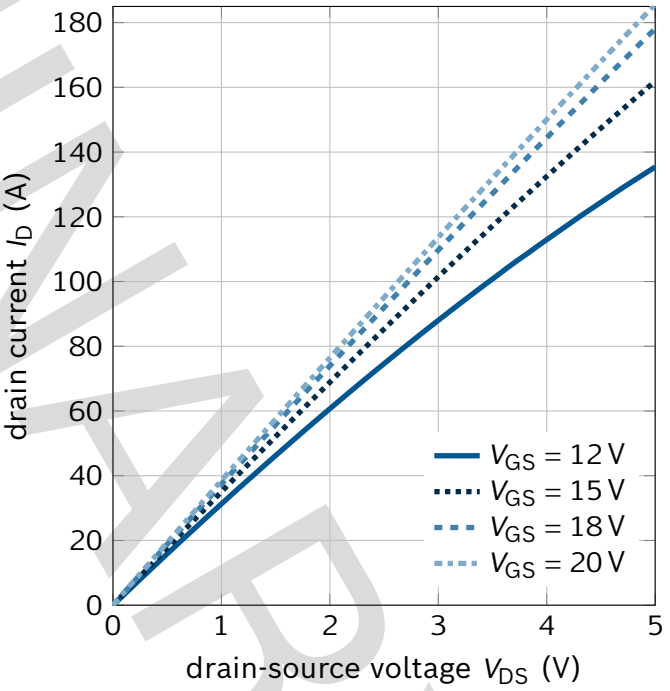


Fig. 4: Typical output characteristics: drain current I_D as a function of drain-source voltage V_{DS} for $T_j = 175\,°C$.

PRELIMINARY

© Robert Bosch GmbH 2024. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.

Downloaded from Arrow.com.

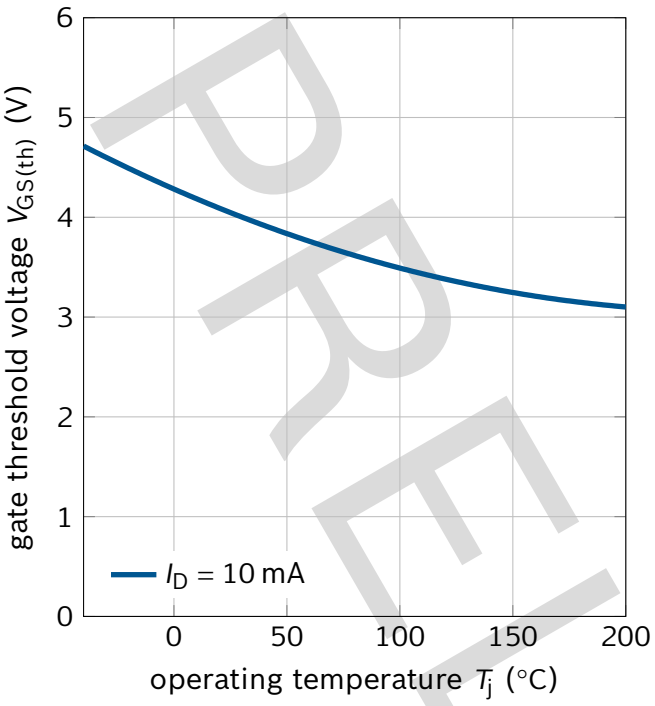


Fig. 5: Typical gate threshold voltage $V_{GS(th)}$ as a function of operating temperature T_j for T_c = 25 °C, V_{GS} = V_{DS} and I_D = 10 mA.

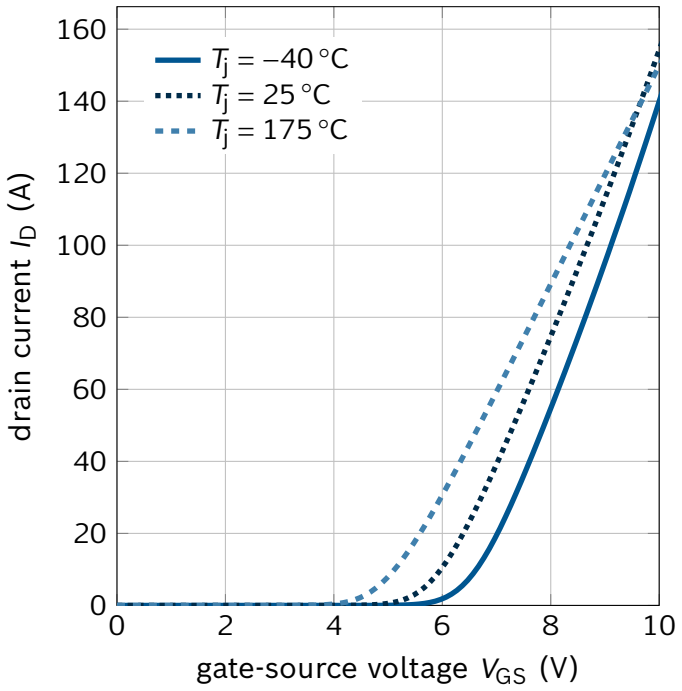


Fig. 6: Typical transfer characteristics: drain current I_D as a function of gate-source voltage V_{GS} for V_{DS} = 10 V.

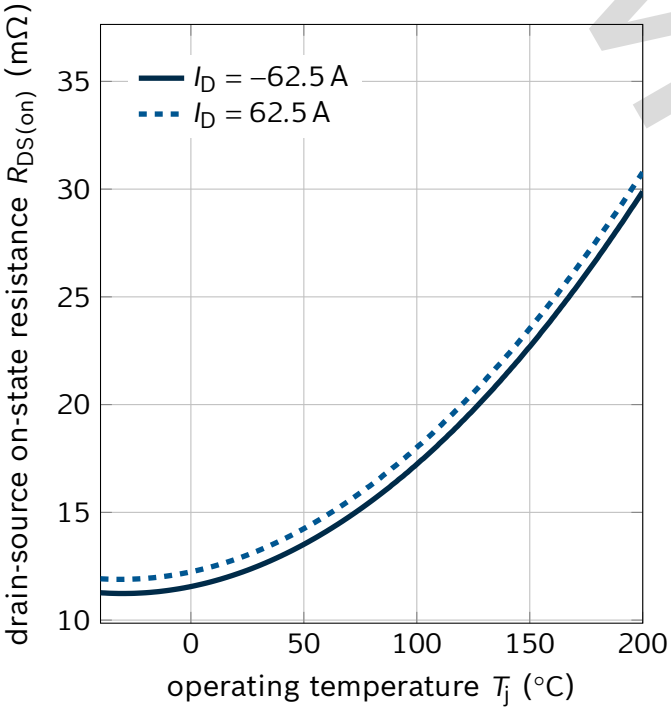


Fig. 7: Typical drain-source on-state resistance $R_{DS(on)}$ as a function of operating temperature T_j for V_{GS} = 18 V.

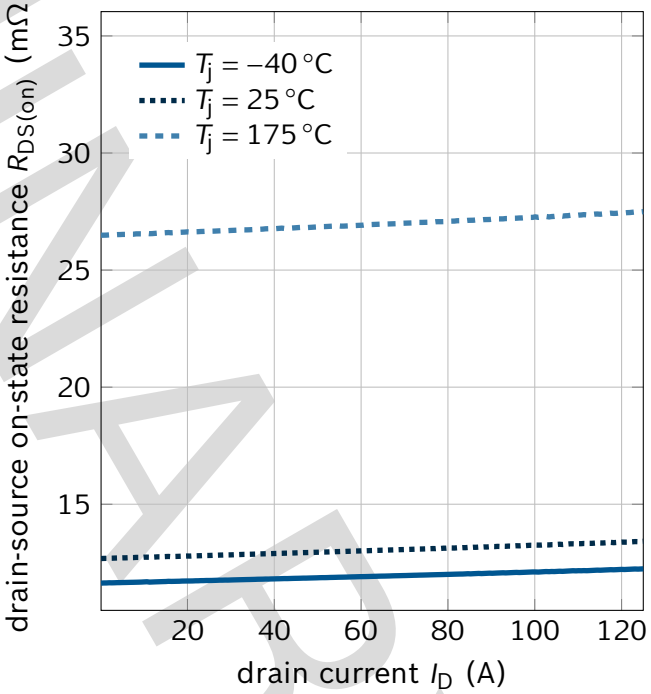


Fig. 8: Typical drain-source on-state resistance $R_{DS(on)}$ as a function of drain current I_D for V_{GS} = 18 V.

PRELIMINARY

© Robert Bosch GmbH 2024. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.

Downloaded from Arrow.com.

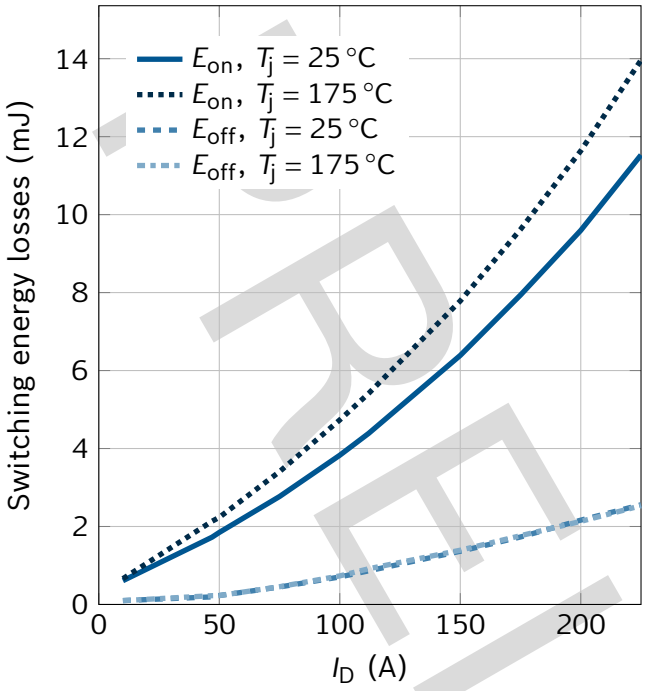


Fig. 9: Switching loss for sweeping I_D when V_{DS} = 920 V, V_{GS} = -5/18 V, R_{Gon} = 12 Ω, R_{Goff} = 5 Ω, L_σ = 23.3 nH

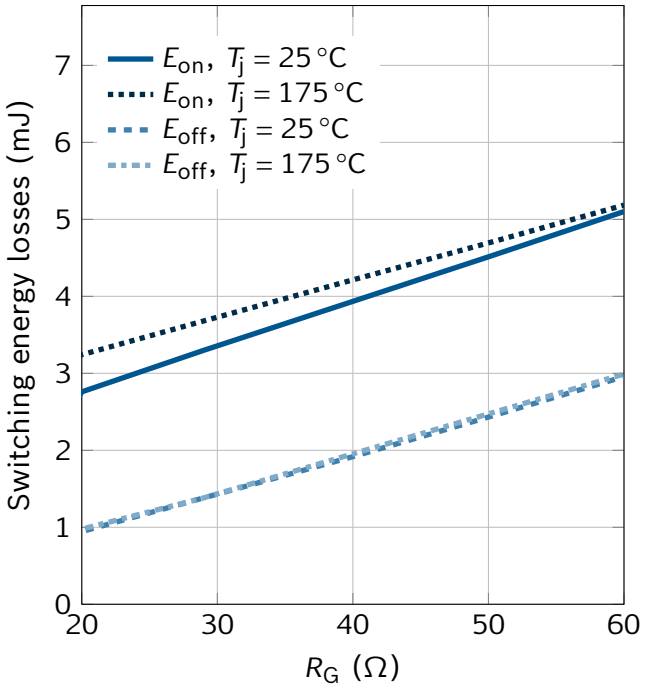


Fig. 10: Switching loss for sweeping R_G when V_{DS} = 920 V, V_{GS} = -5/18 V, I_D = 62.5 A, L_σ = 23.3 nH

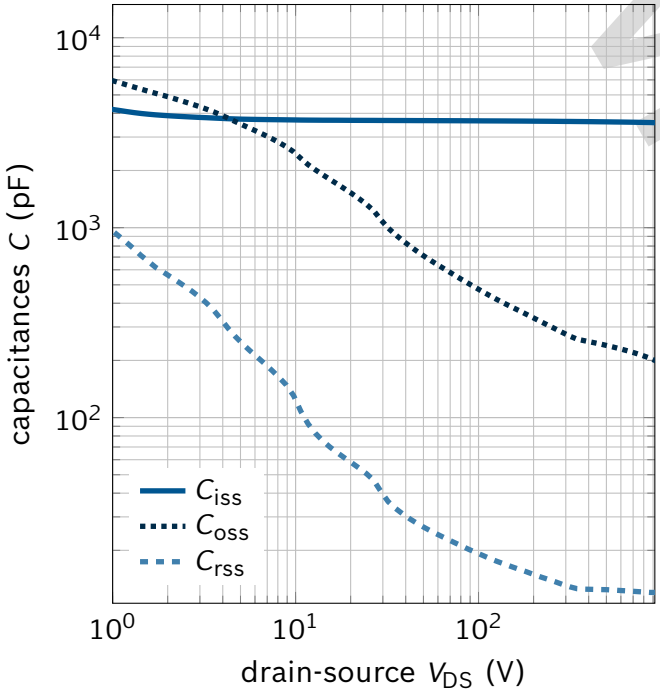


Fig. 11: Typical values of input, output and reverse transfer capacitances as a function of drain-source voltage V_{DS} for V_{GS} = 0 V and f = 0.1 MHz.

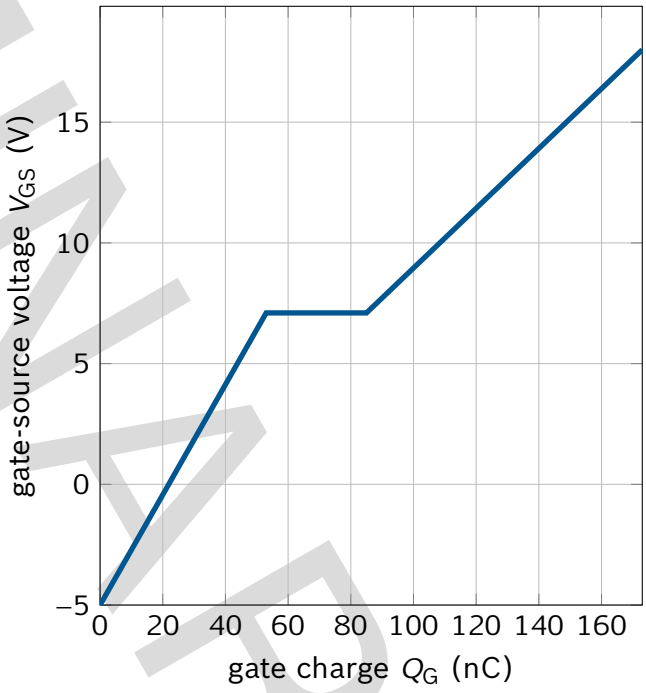


Fig. 12: Typical gate charge: gate-source voltage V_{GS} as a function of gate charge Q_G for T_j = T_c = 25 °C and I_D = 62.5 A.

PRELIMINARY

© Robert Bosch GmbH 2024. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.

Downloaded from Arrow.com.

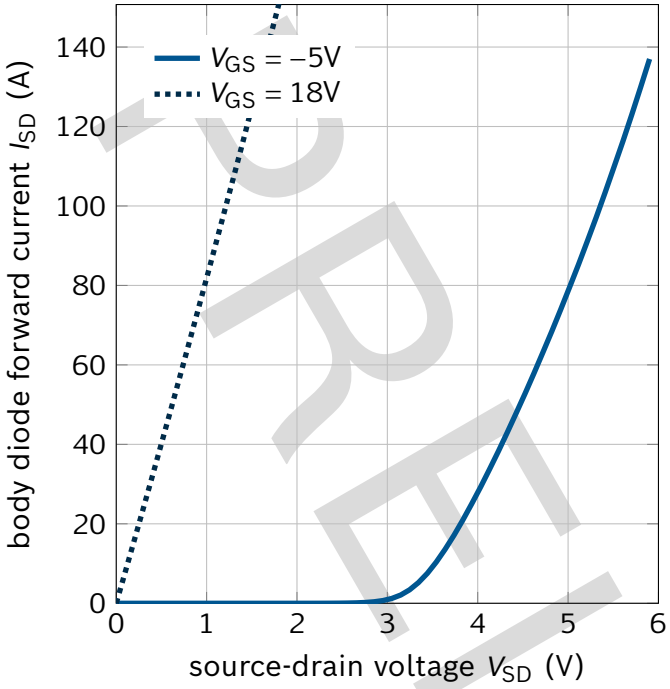


Fig. 13: Typical body diode forward current I_{SD} as a function of diode forward voltage V_{SD} for T_j = 25 °C.

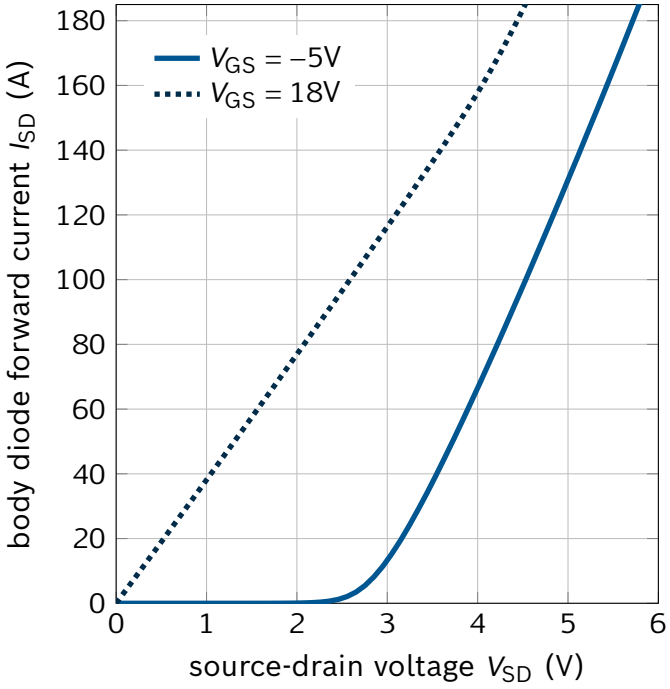


Fig. 14: Typical body diode forward current I_{SD} as a function of diode forward voltage V_{SD} for T_j = 175 °C.

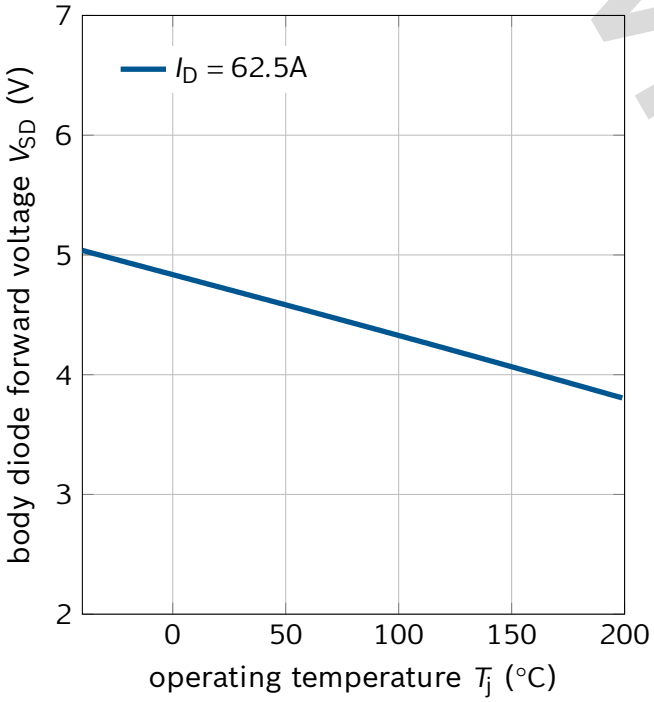


Fig. 15: Typical body diode forward voltage V_{SD} as a function of operating temperature T_j for V_{GS} = −5 V.

PRELIMINARY

© Robert Bosch GmbH 2024. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.

Downloaded from Arrow.com.

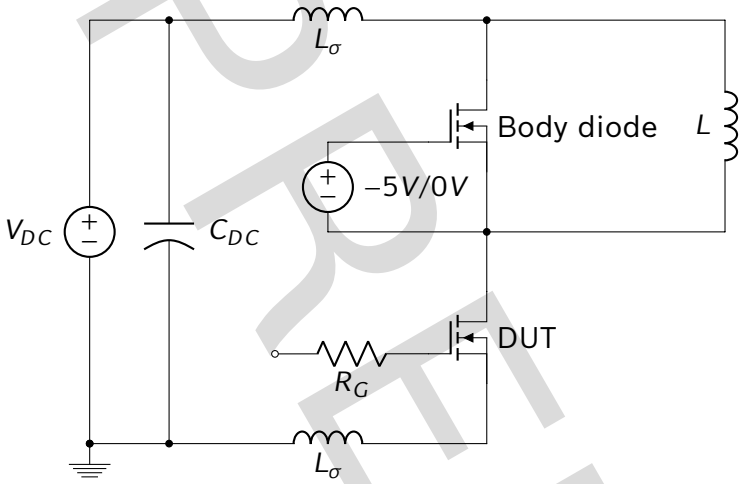


Fig. 16: Measurement circuit: switching event

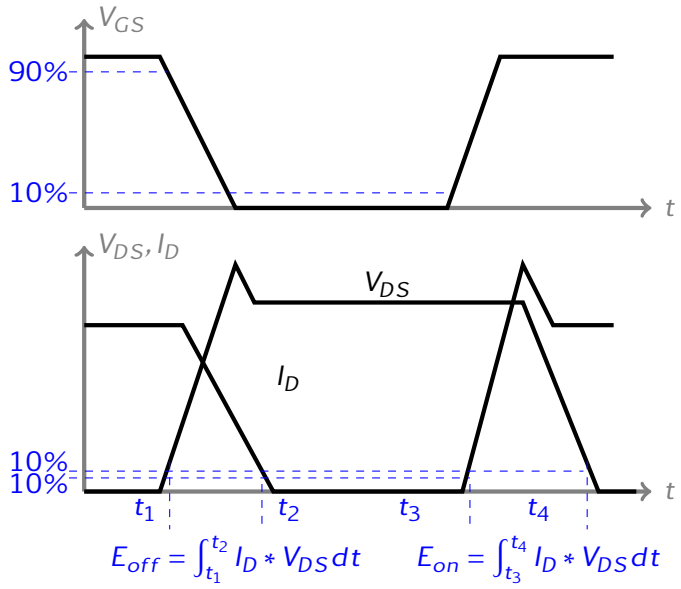


Fig. 17: Definition of switching energy

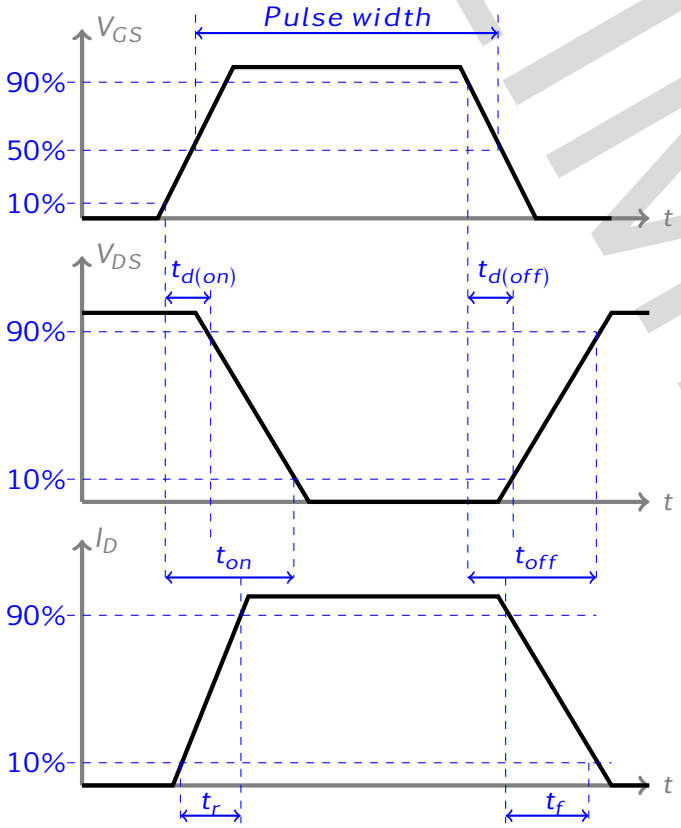


Fig. 18: Definition of switching timing

PRELIMINARY

© Robert Bosch GmbH 2024. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.

Downloaded from Arrow.com.

4 Mechanical parameters

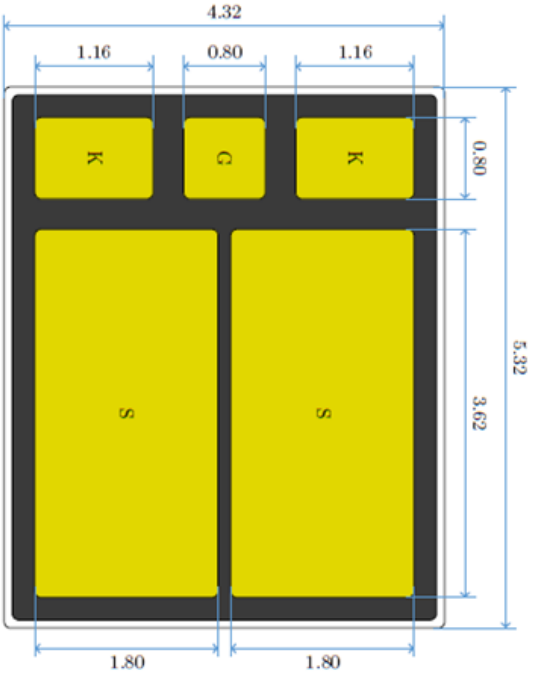
4.1 Dimensions and metallization

Parameter	Typical value	Unit	Metallization	Type
Die size (W x L)	4.32 x 5.32	mm^2		
Gate pad size (W x L)	0.80 x 0.80	mm^2		
Kelvin pad size (W x L)	1.16 x 0.80	mm^2		
Source pad size (W x L)	1.80 x 3.62	mm^2		
Die thickness	180	µm		
Top side (source, gate) metallization	5.85	µm	AlCu/Ni/Pd/Au flash	BT2M1200013BOA
Back side (drain) metallization	630	nm	Ti/NiV/Au	

Table 8: Dimensions and metallization.

4.2 Layout

Note: all dimensions in mm



© Robert Bosch GmbH 2024. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.

Downloaded from Arrow.com.

4.3 Packing information

Tape and reel

tbd

4.4 Storage information

The storage lifetime is shown in the following table.

Delivery from	Environment	Temperature	Humidity	Storage time
Bare dies in tape and reel	N_2	17 °C - 25 °C	7% - 25%	2 years (datacode + 730 days)

Table 9: Storage table.

PRELIMINARY

© Robert Bosch GmbH 2024. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.

Downloaded from Arrow.com.

5 Legal disclaimer

Main functions and properties of the product

Bosch points out that the product has been classified as an "Class I" according to ISO26262-8:2018, clause 13 "Evaluation of hardware elements" and has been developed according to QM. When used in applications that have an ASIL classification, the customer has to ensure that the Bosch deliveries meet any functional safety requirements assigned to the product in the overall system.

Intended use

The product is described by Bosch for the intended automotive applications and released on the basis of the legal and normative requirements relevant to the Bosch product for use in the following target markets as follows:

AT, AU, BE, BG, BR, CA, CH, CN, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HK, HR, HU, IE, ID, IN, IL, IT, IS, JP, KR, LT, LU, LV, MT, MX, MY, NL, PH, NZ, PL, PT, RO, SE, SG, SI, SK, TR, TW, TH, US, VN, ZA (nomenclature according ISO 3166-1, RB/GF182)

The product complies with all statutory regulations regarding restriction of hazardous substances and recyclability which are in the scope of IMDS. Insofar such restrictions of hazardous substances and recyclability are observed in the target markets.

Materials used are documented and provided on customer request by IMDS (International material data sheet). For further information on packaged devices, please refer to the respective chapter. If other or additional regulations are required for marketing the product or marketing is effected outside the named target markets, the customer requests compliance with specific regulations of the target market from Bosch, or ensures these by itself.

Provided that the product is used within the conditions (environment, application, installation, loads) as described in this datasheet and the corresponding agreed upon documents, Bosch ensures that the product complies with the agreed properties. Agreements beyond this require the written approval by Bosch. The product is considered fit for the intended use when the product successfully has passed the tests in accordance with the datasheet and agreed upon documents. It is the responsibility of the customer to ensure the proper application of the product in the overall system/vehicle. Bosch does not assume any responsibility for changes to the environment of the product that deviate from the datasheet and the agreed upon documents.

Any deviation of the environment the product is exposed to, from the agreed upon environment, according to the datasheet and agreed upon documents, as well as all applications not released by Bosch, must be notified to Bosch and require Bosch approval.

Assessment of products returned from field

Products are considered good if they fulfill the specifications/test data for 0-mileage and field listed in this document.

Transport, storage, assembly, start and end of operation

Pay special attention to the safety and warning notes.

Service and repair

Repair of the product is not possible.

Amendments

Unless otherwise expressly agreed in writing Bosch reserves the right, at any time, to change this datasheet.

PRELIMINARY

© Robert Bosch GmbH 2024. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.

Downloaded from Arrow.com.

6 History

Version	Date	Edited by	Release description
0.1	21-Mar-2024	ME-PM/ENG	First release of preliminary technical customer information

PRELIMINARY

© Robert Bosch GmbH 2024. All rights reserved, also regarding any disposal, exploitation, reproduction, editing, distribution, as well as in the event of applications for industrial property rights.

Downloaded from Arrow.com.