THE DATASHEET OF

IMBF170R1K0M1XTMA1

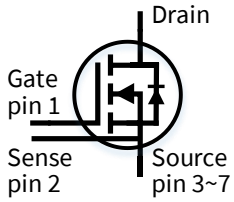
www.win-source.net 0086-755-83957316

IMBF170R1K0M1

CoolSiC™ 1700V SiC Trench MOSFET
Silicon Carbide MOSFET

Features

- Revolutionary semiconductor material - Silicon Carbide
- Optimized for fly-back topologies
- 12V/0V gate-source voltage compatible with most fly-back controllers
- Very low switching losses
- Benchmark gate threshold voltage, $V_{GS(th)}$ = 4.5V
- Fully controllable dV/dt for EMI optimization



Benefits

- Reduction of system complexity
- Directly drive from fly-back controller
- Efficiency improvement and cooling effort reduction
- Enabling higher frequency

Potential applications

- Energy generation
  - Solar string inverter
  - Solar Central inverter
- Industrial power supplies
  - Industrial UPS
  - Industrial SMPS
- Infrastructure – Charger
  - Charger

Product validation

Qualified for industrial applications according to the relevant tests of JEDEC 47/20/22

Note: *the source and sense pins are not exchangeable, their exchange might lead to malfunction recommended for forward operation mode only*

Table 1 Key Performance and Package Parameters

Type	V_{DS}	I_D T_C = 25°C, $R_{th(j\text{-}c,max)}$	$R_{DS(on)}$ T_{vj} = 25°C, I_D = 1A, V_{GS} = 12V	$T_{vj,max}$	Marking	Package
IMBF170R1K0M1	1700V	5.2A	1000mΩ	175°C	170M11K0	PG-TO263-7

Table of contents

1 Maximum ratings

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

Table 2 Maximum ratings

Parameter	Symbol	Value	Unit
Drain-source voltage, $T_{vj} \geq 25°C$	V_{DSS}	1700	V
DC drain current for $R_{th(j-c,max)}$, limited by T_{vjmax}, V_{GS} = 12V, T_C = 25°C T_C = 100°C	I_D	 5.2 3.7	A
Pulsed drain current, t_p limited by T_{vjmax}, V_{GS} = 12V	$I_{D,pulse}$[1]	13.3	A
Gate-source voltage[2] Max transient voltage, < 1% duty cycle Recommended turn-on gate voltage Recommended turn-off gate voltage	 V_{GS} $V_{GS,on}$ $V_{GS,off}$	 -10… 20 12… 15 0	V
Power dissipation, limited by T_{vjmax} T_C = 25°C T_C = 100°C	P_{tot}	 68 34	W
Virtual junction temperature	T_{vj}	-55… 175	°C
Storage temperature	T_{stg}	-55… 150	°C
Soldering temperature Reflow soldering (MSL1 according to JEDEC J-STD-020)	T_{sold}	260	°C

[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.

2 Thermal resistances

Table 3

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
MOSFET thermal resistance, junction – case	$R_{th(j-c)}$		-	1.7	2.2	K/W
Thermal resistance, junction – ambient	$R_{th(j-a)}$	leaded	-	-	62	K/W

3 Electrical Characteristics

3.1 Static characteristics

Table 4 Static characteristics (at T_{vj} = 25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS} = 12V, I_D = 1A, T_{vj} = 25°C T_{vj} = 100°C T_{vj} = 175°C V_{GS} = 15V, I_D = 1A, T_{vj} = 25°C	 - - - -	 1000 1416 2037 809	 - - - 880	mΩ
Gate-source threshold voltage	$V_{GS(th)}$	*(tested after 1 ms pulse at* V_{GS} = 20V*)* I_D = 1.1mA, V_{DS} = V_{GS} T_{vj} = 25°C T_{vj} =175°C	 3.5 -	 4.5 3.6	 5.7 -	V
Zero gate voltage drain current	I_{DSS}	V_{GS} = 0V, V_{DS} = 1700V T_{vj} = 25°C T_{vj} = 175°C	 - -	 0.4 6	 11 -	µA
Gate-source leakage current	I_{GSS}	V_{GS} = 20V, V_{DS} = 0V	-	-	100	nA
		V_{GS} = -10V, V_{DS} = 0V	-	-	-100	nA
Transconductance	g_{fs}	V_{DS} = 20V, I_D = 1A	-	0.42	-	S
Internal gate resistance	$R_{G,int}$	f = 1MHz, V_{AC} = 25mV	-	35	-	Ω

3.2 Dynamic characteristics

Table 5 Dynamic characteristics (at T_{vj} = 25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Input capacitance	C_{iss}	V_{DD} = 1000V, V_{GS} = 0V, f = 1MHz, V_{AC} = 25mV	-	275	-	pF
Output capacitance	C_{oss}		-	7.2	-	
Reverse capacitance	C_{rss}		-	0.7	-	
C_{oss} stored energy	E_{oss}		-	1.3	-	µJ
Total gate charge	Q_G	V_{DD} = 1000V, I_D = 1A, V_{GS} = 0/12V, turn-on pulse	-	5	-	nC
Gate to source charge	$Q_{GS,pl}$		-	1.5	-	
Gate to drain charge	Q_{GD}		-	1.6	-	

3.3 Switching characteristics

Table 6 Switching characteristics, Inductive load [3]

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
MOSFET Characteristics, T_{vj} = 25°C						
Turn-on delay time	$t_{d(on)}$	V_{DD} = 1000V, I_D = 1A, V_{GS} = 0/12V, $R_{G,ext}$ = 22Ω, L_σ = 40nH, diode: body diode at V_{GS} = 0V see Fig. E	-	19	-	ns
Rise time	t_r		-	14	-	
Turn-off delay time	$t_{d(off)}$		-	20	-	
Fall time	t_f		-	22	-	
Turn-on energy	E_{on}		-	31	-	µJ
Turn-off energy	E_{off}		-	7	-	
Total switching energy	E_{tot}		-	37	-	
MOSFET Characteristics, T_{vj} = 175°C						
Turn-on delay time	$t_{d(on)}$	V_{DD} = 1000V, I_D = 1A, V_{GS} = 0/12V, $R_{G,ext}$ = 22Ω, L_σ = 40nH, diode: body diode at V_{GS} = 0V see Fig. E	-	16	-	ns
Rise time	t_r		-	11	-	
Turn-off delay time	$t_{d(off)}$		-	23	-	
Fall time	t_f		-	23	-	
Turn-on energy	E_{on}		-	33	-	µJ
Turn-off energy	E_{off}		-	8	-	
Total switching energy	E_{tot}		-	41	-	

[3] The chip technology was characterized up to 200 kV/µs. The measured dV/dt was limited by measurement test setup and package. In applications, e.g. fly-back topology, the switching behavior highly depends on the circuitry (transformer, snubber…), the switching loss in the application will be different from the datasheet value.

4 Electrical characteristic diagrams

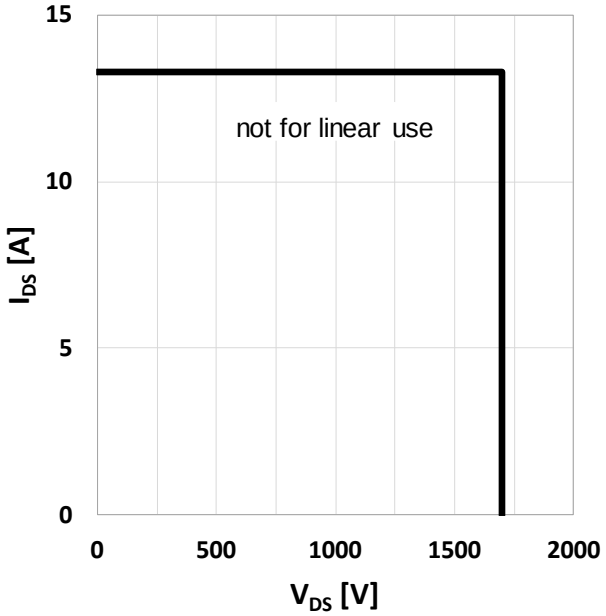


Figure 1 **Safe operating area (SOA)**
(V_{GS} = 0/12V, T_c = 25°C, T_j ≤ 175°C)

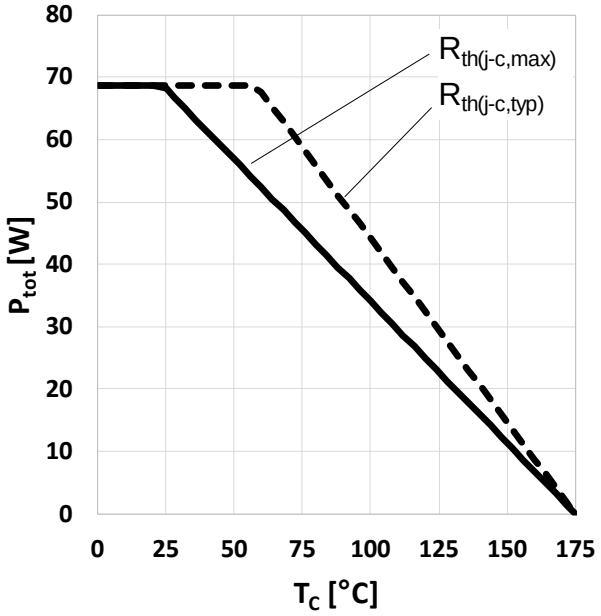


Figure 2 **Power dissipation as a function of case temperature limited by bond wire**
(P_{tot} = f(T_C))

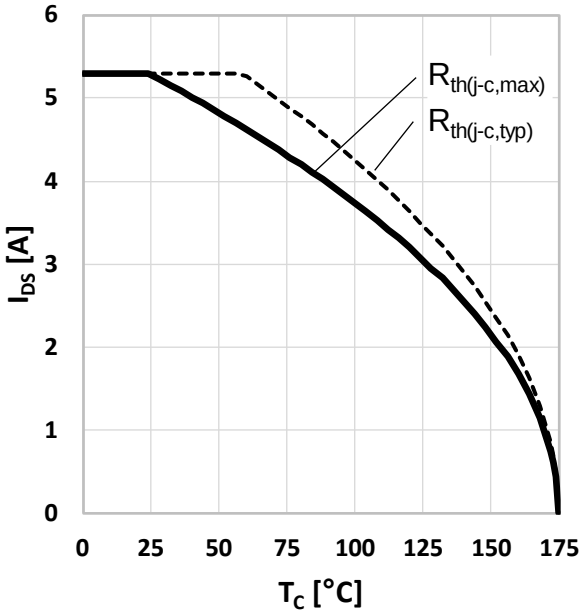


Figure 3 **Maximum DC drain to source current as a function of case temperature limited by bond wire** (I_{DS} = f(T_C))

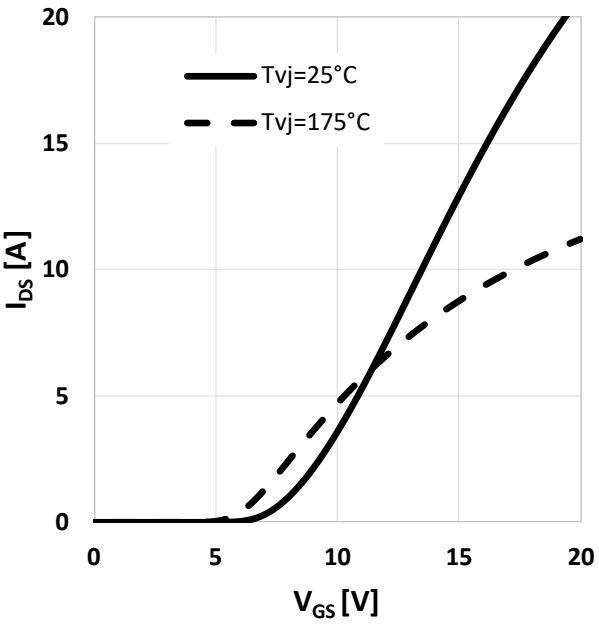


Figure 4 **Typical transfer characteristic**
(I_{DS} = f(V_{GS}), V_{DS} = 20V, t_P = 20µs)

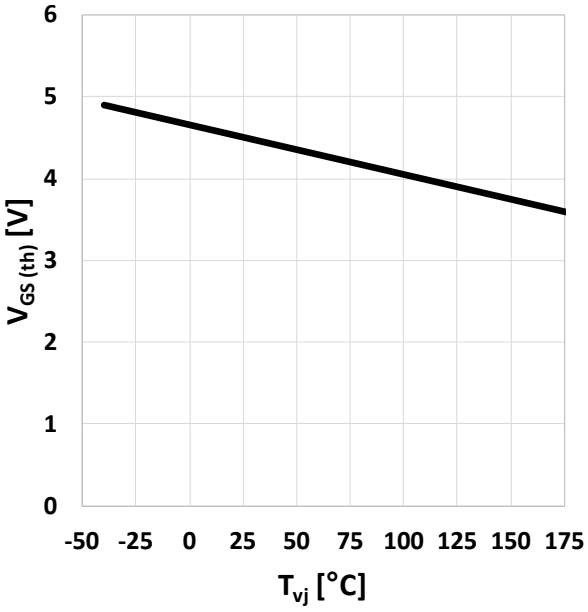


Figure 5 **Typical gate-source threshold voltage as a function of junction temperature**
($V_{GS(th)} = f(T_{vj})$, I_{DS} = 1.1mA, $V_{GS} = V_{DS}$)

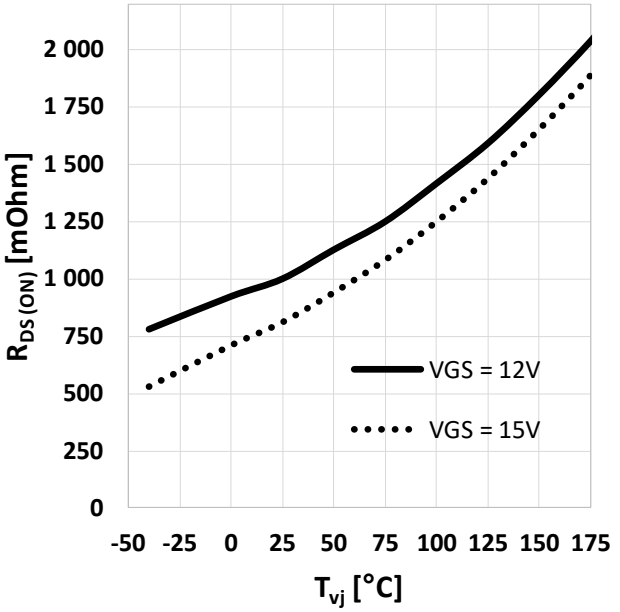


Figure 6 **Typical on-resistance as a function of junction temperature**
($R_{DS(on)} = f(T_{vj})$, I_{DS} = 1A)

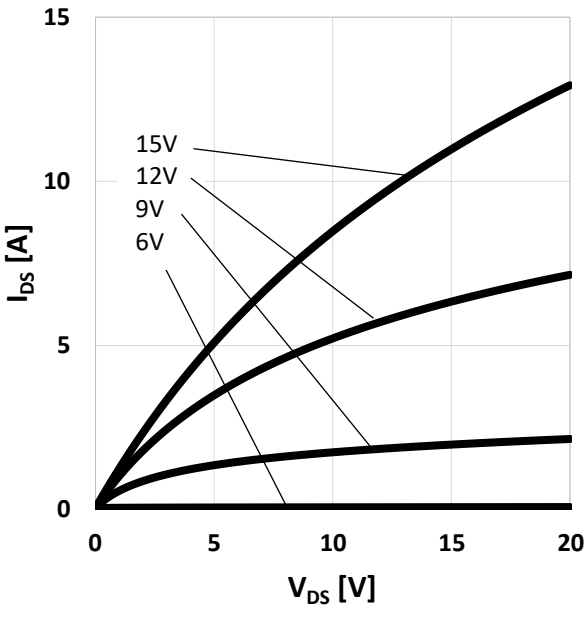


Figure 7 **Typical output characteristic, V_{GS} as parameter**
($I_{DS} = f(V_{DS})$, T_{vj}=25°C, t_P = 20µs)

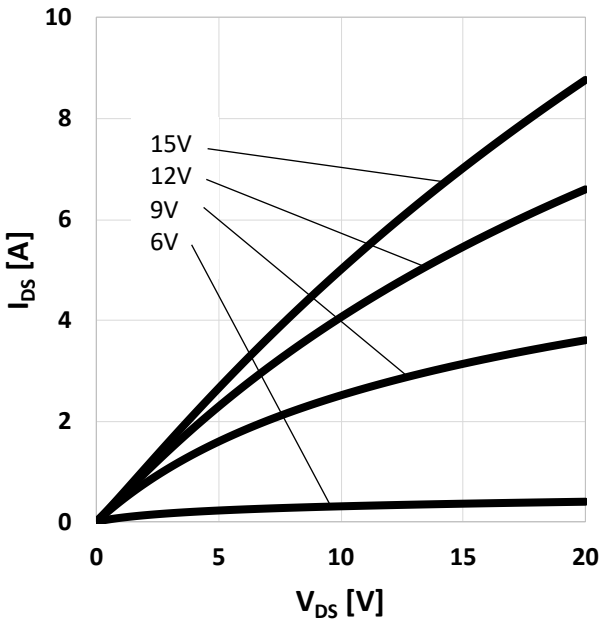


Figure 8 **Typical output characteristic, V_{GS} as parameter**
($I_{DS} = f(V_{DS})$, T_{vj}=175°C, t_P = 20µs)

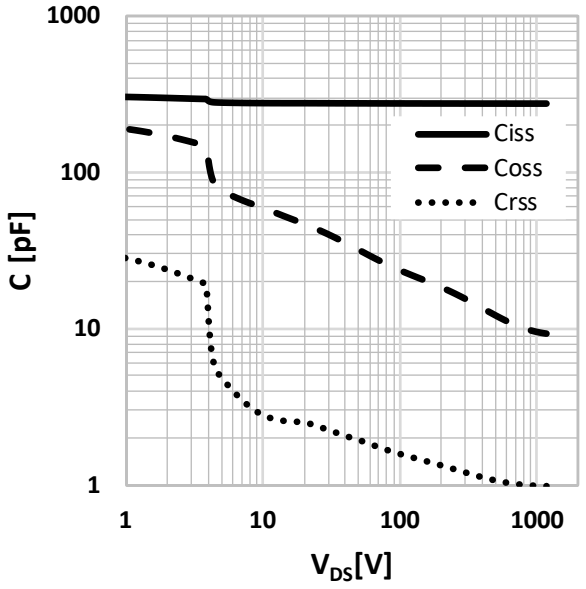


Figure 9 **Typical capacitance as a function of drain-source voltage**
($C = f(V_{DS})$, $V_{GS} = 0V$, $f = 1MHz$)

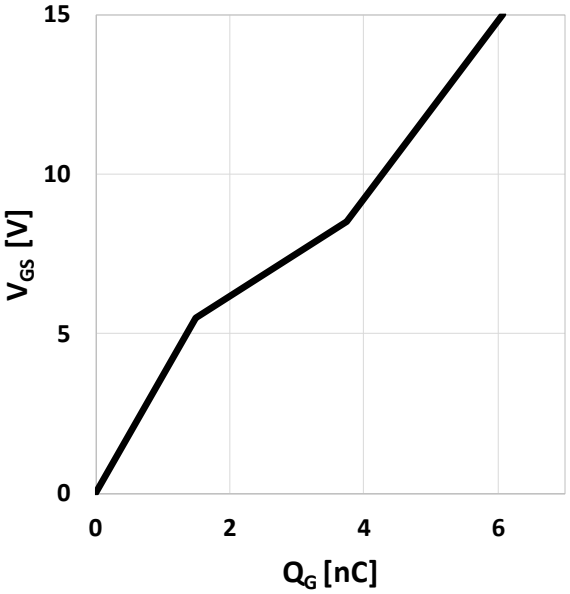


Figure 10 **Typical gate charge**
($V_{GS} = f(Q_G)$, $I_{DS} = 1A$, $V_{DS} = 1000V$, turn-on pulse)

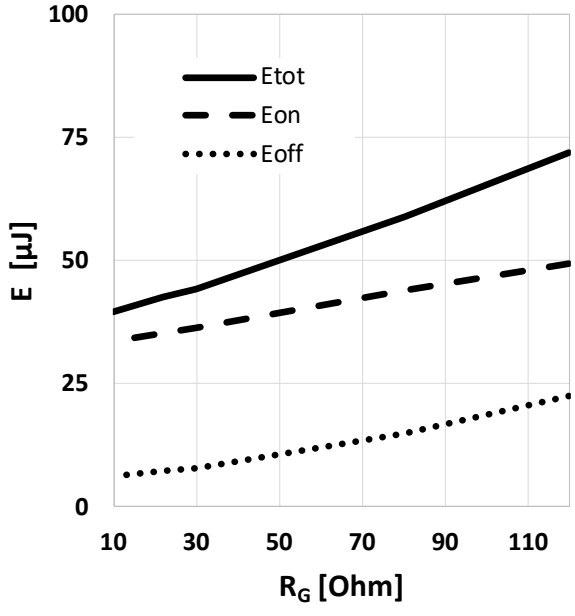


Figure 11 **Typical switching energy losses as a function of gate resistance**
($E = f(R_{G,ext})$, $V_{DD} = 1000V$, $V_{GS} = 0V/12V$, $I_D = 1A$, $T_{vj} = 175°C$, ind. load, test circuit in Fig. E, diode: body diode at $V_{GS} = 0V$)

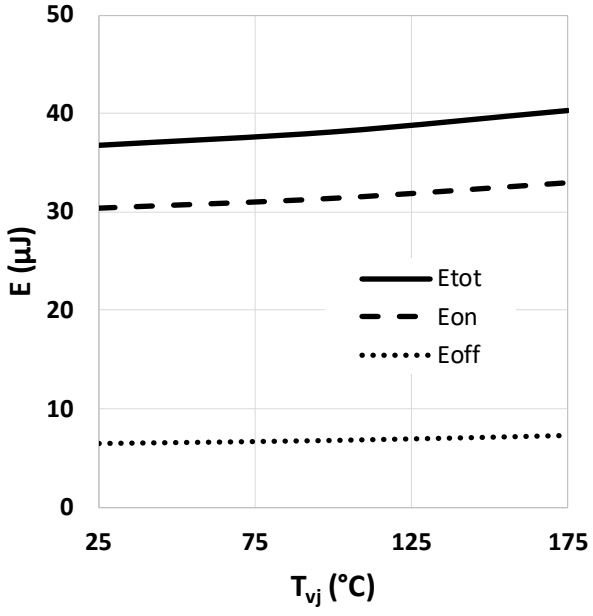


Figure 12 **Typical switching energy losses as a function of junction temperature**
($E = f(T_{vj})$, $V_{DD} = 1000V$, $V_{GS} = 0V/12V$, $R_{G,ext} = 22\Omega$, $I_D = 1A$, ind. load, test circuit in Fig. E, diode: body diode at $V_{GS} = 0V$)

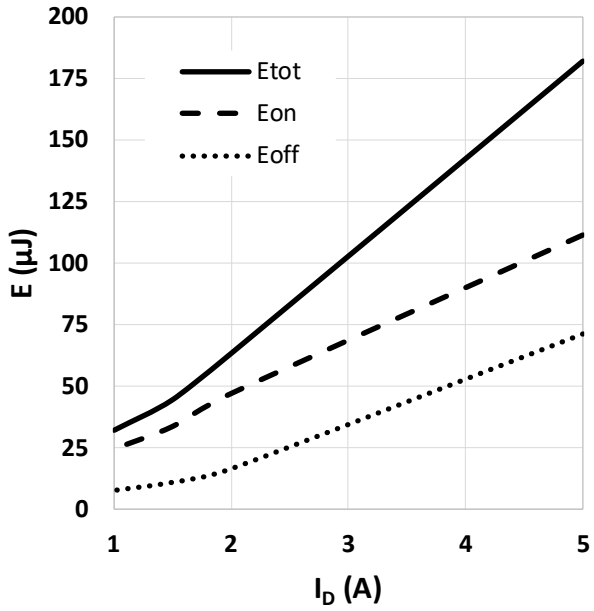


Figure 13 **Typical switching energy losses as a function of drain-source current**
($E = f(I_{DS})$, V_{DD} = 1000V, V_{GS} = 0V/12V, $R_{G,ext}$ = 22Ω, T_{vj} = 175°C, ind. load, test circuit in Fig. E, diode: body diode at V_{GS} = 0V)

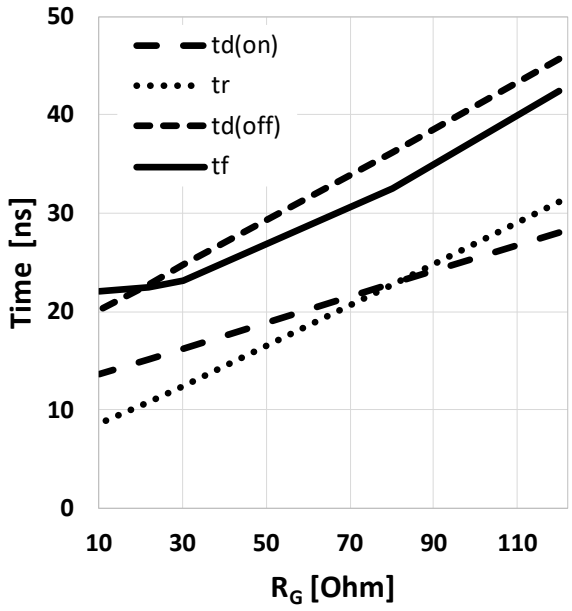


Figure 14 **Typical switching times as a function of gate resistor**
($t = f(R_{G,ext})$, V_{DD} = 1000V, V_{GS} = 0V/12V, I_D = 1A, T_{vj} = 175°C, ind. load, test circuit in Fig. E, diode: body diode at V_{GS} = 0V)

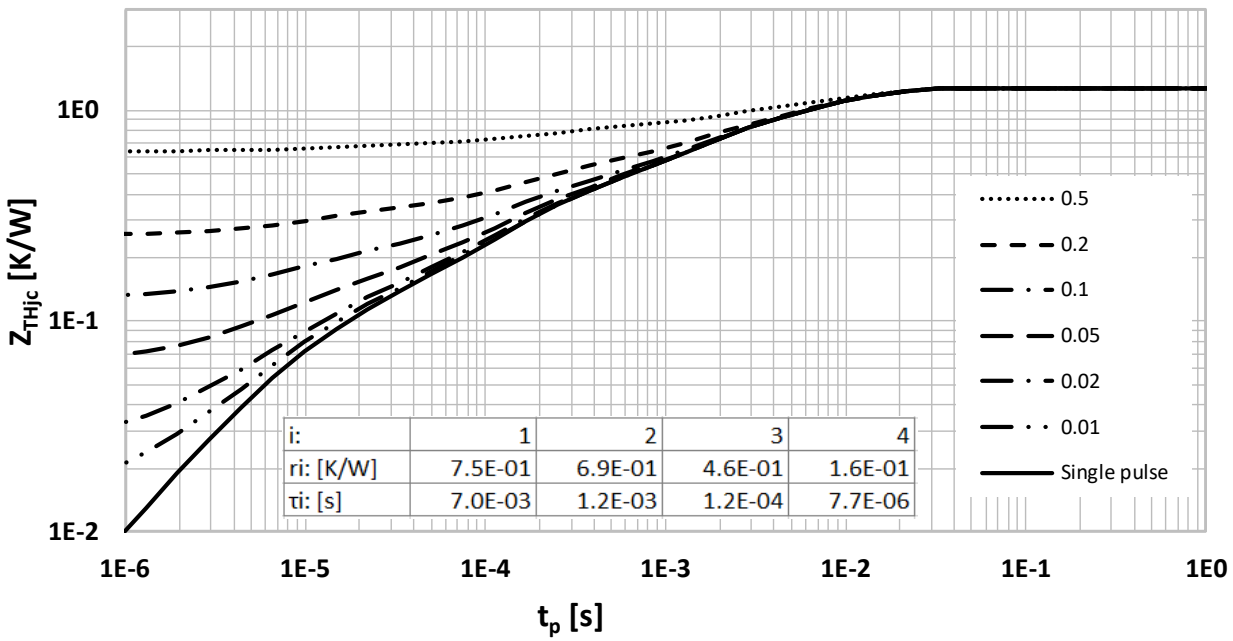
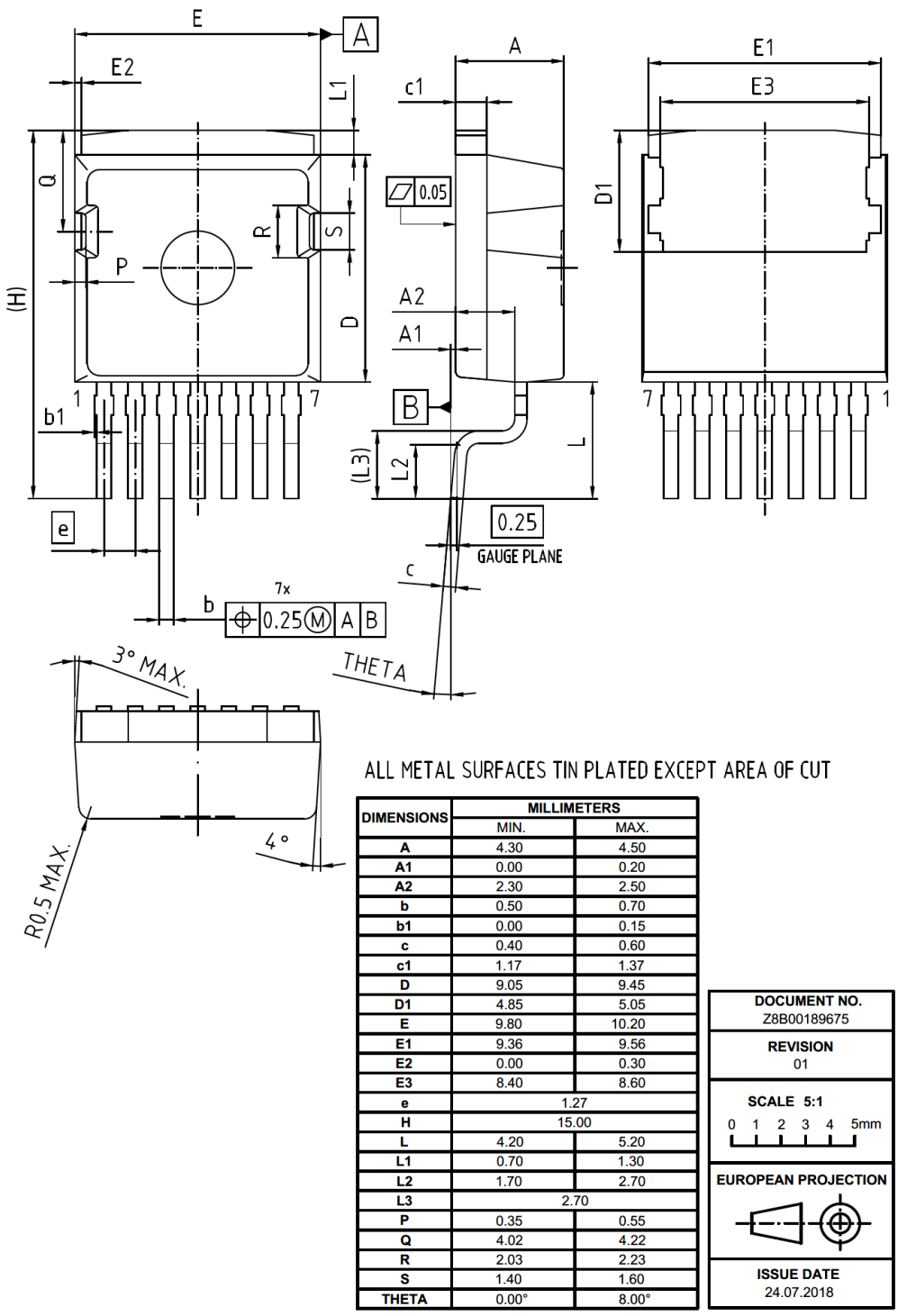


Figure 15 **Max. transient thermal resistance (MOSFET)**
($Z_{th(j-c,max)} = f(t_P)$, parameter $D = t_p/T$, thermal equivalent circuit in Fig. D)

5 Package drawing



DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	4.30	4.50
A1	0.00	0.20
A2	2.30	2.50
b	0.50	0.70
b1	0.00	0.15
c	0.40	0.60
c1	1.17	1.37
D	9.05	9.45
D1	4.85	5.05
E	9.80	10.20
E1	9.36	9.56
E2	0.00	0.30
E3	8.40	8.60
e	1.27	
H	15.00	
L	4.20	5.20
L1	0.70	1.30
L2	1.70	2.70
L3	2.70	
P	0.35	0.55
Q	4.02	4.22
R	2.03	2.23
S	1.40	1.60
THETA	0.00°	8.00°

DOCUMENT NO. Z8B00189675
REVISION 01
SCALE 5:1 0 1 2 3 4 5mm
EUROPEAN PROJECTION
ISSUE DATE 24.07.2018

Figure 16 Package drawing

6 Test conditions

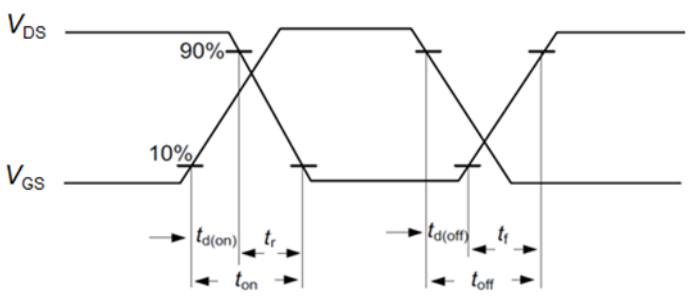


Figure A. **Definition of switching times**

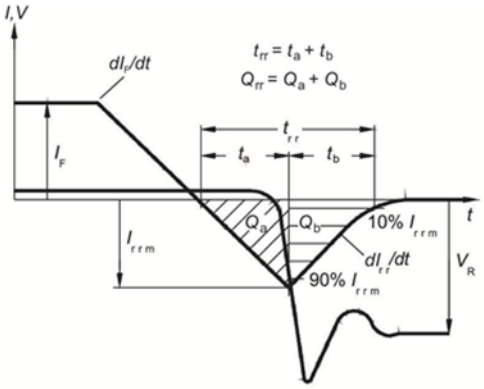


Figure C. **Definition of diode switching characteristics**

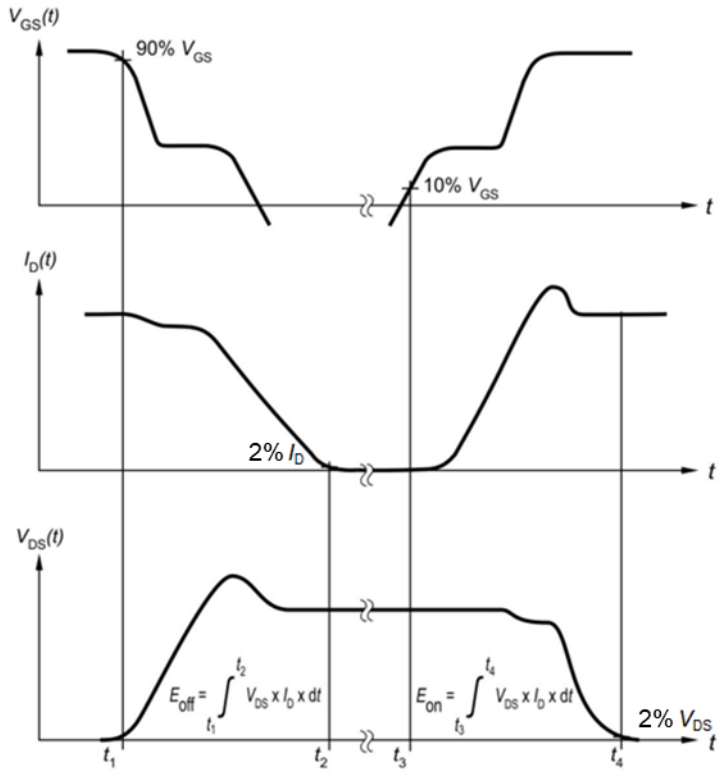


Figure B. **Definition of switching losses**

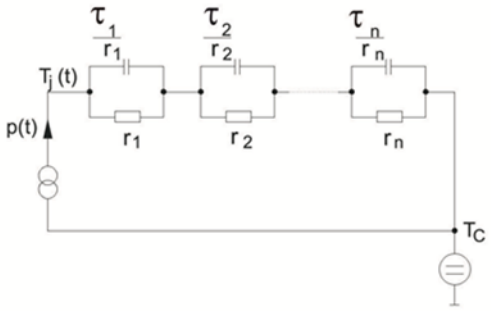


Figure D. **Thermal equivalent circuit**

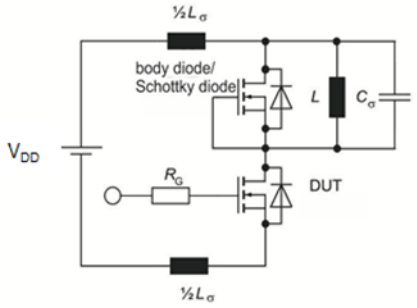


Figure E. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,

Figure 17 Test conditions

Revision history

Document version	Date of release	Description of changes
2.1	2020-04-27	Final Datasheet
2.2	2020-12-11	Correction of circuit symbol on page 1
2.3	2021-04-12	Editorial changes

Trademarks

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

Published by

Infineon Technologies AG

81726 München, Germany

© Infineon Technologies AG 2021.

All Rights Reserved.

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.

For further information on the product, technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies office (www.infineon.com).

Please note that this product is not qualified according to the AEC Q100 or AEC Q101 documents of the Automotive Electronics Council.

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.

Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

- View IMBF170R1K0M1XTMA1 on WIN SOURCE
- Infineon Technologies Information

Optimize Your Supply Chain with WIN SOURCE Solutions

- Global Sourcing Solution
- Obsolete Management
- Cost Control Management
- Shortage Management
- Alternative Solution
- Excess Inventory Management