

IMBF170R1K0M1XTMA1 Datasheet

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DiGi Electronics Part Number	IMBF170R1K0M1XTMA1-DG
Manufacturer	Infineon Technologies
Manufacturer Product Number	IMBF170R1K0M1XTMA1
Description	SICFET N-CH 1700V 5.2A TO263-7
Detailed Description	N-Channel 1700 V 5.2A (Tc) 68W (Tc) Surface Mount PG-TO263-7-13

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Manufacturer Product Number:

IMBF170R1K0M1XTMA1

Series:

CoolSiC™

FET Type:

N-Channel

Drain to Source Voltage (Vdss):

1700 V

Drive Voltage (Max Rds On, Min Rds On):

12V, 15V

Vgs(th) (Max) @ Id:

5.7V @ 1.1mA

Vgs (Max):

+20V, -10V

FET Feature:

-

Operating Temperature:

-55°C ~ 175°C (Tj)

Supplier Device Package:

PG-T0263-7-13

Base Product Number:

IMBF170

Manufacturer:

Infineon Technologies

Product Status:

Active

Technology:

SiCFET (Silicon Carbide)

Current - Continuous Drain (Id) @ 25°C:

5.2A (Tc)

Rds On (Max) @ Id, Vgs:

1000mOhm @ 1A, 15V

Gate Charge (Qg) (Max) @ Vgs:

5 nC @ 12 V

Input Capacitance (Ciss) (Max) @ Vds:

275 pF @ 1000 V

Power Dissipation (Max):

68W (Tc)

Mounting Type:

Surface Mount

Package / Case:

TO-263-8, D2PAK (7 Leads + Tab), TO-263CA

Environmental & Export classification

RoHS Status:

ROHS3 Compliant

REACH Status:

REACH Unaffected

HTSUS:

8541.29.0095

Moisture Sensitivity Level (MSL):

1 (Unlimited)

ECCN:

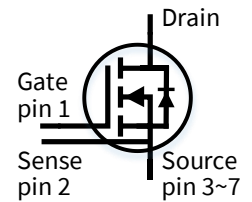
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IMBF170R1K0M1

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 <small>$T_C = 25^\circ C, R_{th(j-c,max)}$</small>	$R_{DS(on)}$ <small>$T_{vj} = 25^\circ C, I_D = 1A, V_{GS} = 12V$</small>	$T_{vj,max}$	Marking	Package
IMBF170R1K0M1	1700V	5.2A	1000m Ω	175°C	170M11K0	PG-TO263-7



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CoolSiC™ 1700V SiC Trench MOSFET

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CoolSiC™ 1700V SiC Trench MOSFET

Maximum ratings

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, $T_{vj} \geq 25^\circ\text{C}$	V_{DSS}	1700	V
DC drain current for $R_{th(j-c,max)}$, limited by $T_{vj,max}$, $V_{GS} = 12\text{V}$, $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	I_D	5.2 3.7	A
Pulsed drain current, t_p limited by $T_{vj,max}$, $V_{GS} = 12\text{V}$	$I_{D,pulse}^1$	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 $T_{vj,max}$ $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	P_{tot}	68 34	W
Virtual junction temperature	T_{vj}	-55... 175	$^\circ\text{C}$
Storage temperature	T_{stg}	-55... 150	$^\circ\text{C}$
Soldering temperature Reflow soldering (MSL1 according to JEDEC J-STD-020)	T_{sold}	260	$^\circ\text{C}$

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.

IMBF170R1K0M1**CoolSiC™ 1700V SiC Trench MOSFET****Thermal resistances****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

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CoolSiC™ 1700V SiC Trench MOSFET

Electrical Characteristics

3 Electrical Characteristics

3.1 Static characteristics

Table 4 Static characteristics (at $T_{vj} = 25^\circ\text{C}$, unless otherwise specified)

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

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CoolSiC™ 1700V SiC Trench MOSFET

Electrical Characteristics

3.2 Dynamic characteristics

Table 5 Dynamic characteristics (at $T_{vj} = 25^{\circ}\text{C}$, unless otherwise specified)

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Input capacitance	C_{iss}	$V_{DD} = 1000\text{V}, V_{GS} = 0\text{V},$ $f = 1\text{MHz}, V_{AC} = 25\text{mV}$	-	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	$V_{DD} = 1000\text{V}, I_D = 1\text{A},$ $V_{GS} = 0/12\text{V}, \text{turn-on pulse}$	-	5	-	nC
Gate to source charge	$Q_{GS,pl}$		-	1.5	-	
Gate to drain charge	Q_{GD}		-	1.6	-	

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CoolSiC™ 1700V SiC Trench MOSFET

Electrical Characteristics

3.3 Switching characteristics

Table 6 Switching characteristics, Inductive load ³

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
MOSFET Characteristics, $T_{vj} = 25^{\circ}\text{C}$						
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 1000\text{V}, I_D = 1\text{A},$ $V_{GS} = 0/12\text{V}, R_{G,ext} = 22\Omega,$ $L_{\sigma} = 40\text{nH},$ diode: body diode at $V_{GS} = 0\text{V}$ 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, $T_{vj} = 175^{\circ}\text{C}$

Turn-on delay time	$t_{d(on)}$	$V_{DD} = 1000\text{V}, I_D = 1\text{A},$ $V_{GS} = 0/12\text{V}, R_{G,ext} = 22\Omega,$ $L_{\sigma} = 40\text{nH},$ diode: body diode at $V_{GS} = 0\text{V}$ 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.

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CoolSiC™ 1700V SiC Trench MOSFET

Electrical characteristic diagrams

4 Electrical characteristic diagrams

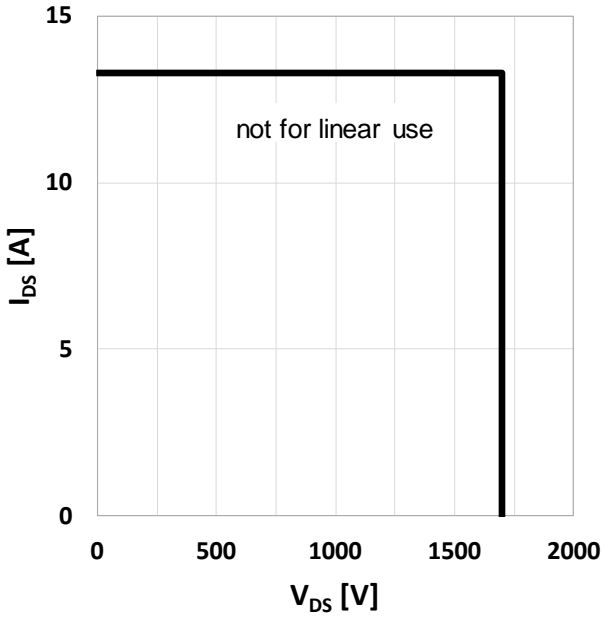


Figure 1 Safe operating area (SOA)
 ($V_{GS} = 0/12V, T_c = 25^\circ C, T_j \leq 175^\circ C$)

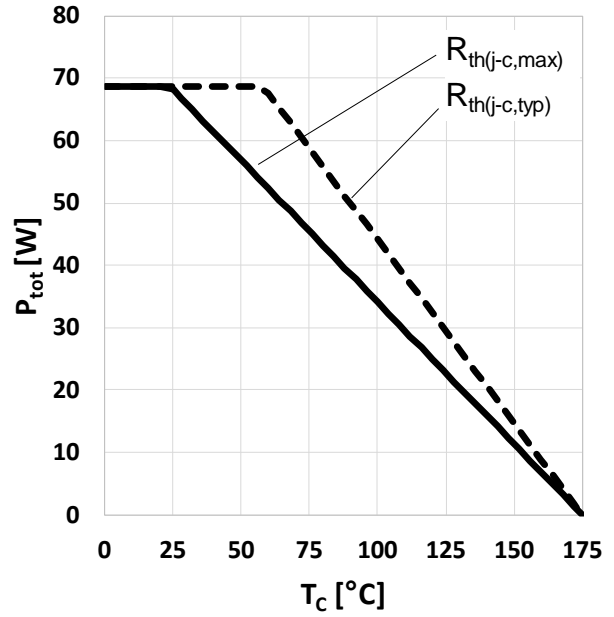


Figure 2 Power dissipation as a function of case temperature limited by bond wire
 ($P_{tot} = f(T_c)$)

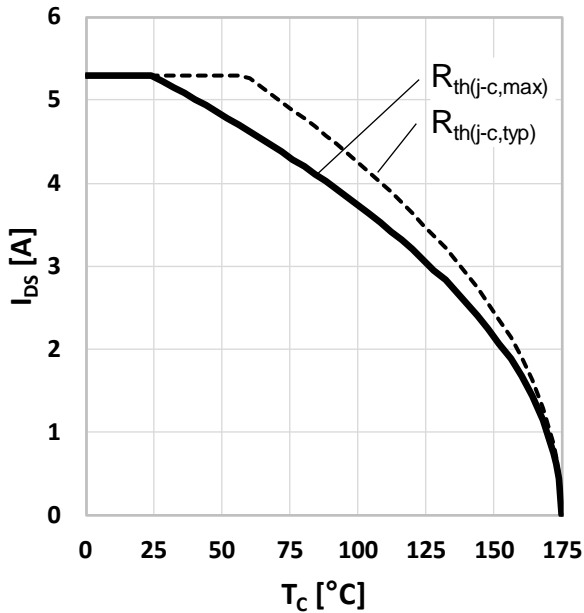


Figure 3 Maximum DC drain to source current as a function of case temperature limited by bond wire
 ($I_{DS} = f(T_c)$)

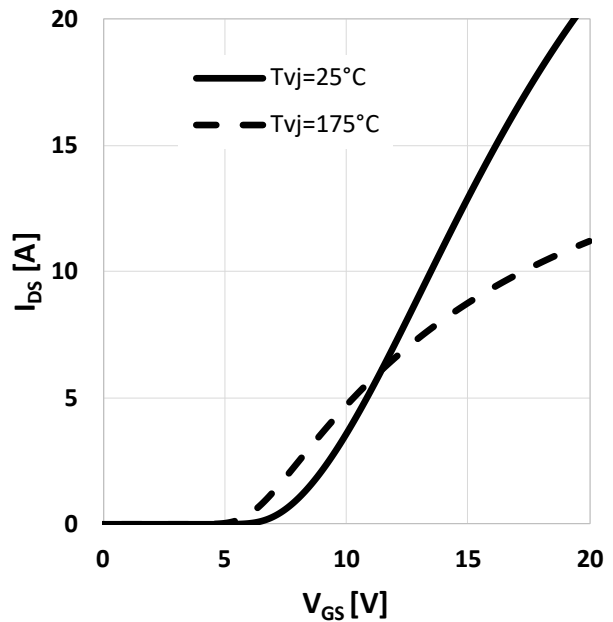


Figure 4 Typical transfer characteristic
 ($I_{DS} = f(V_{GS}), V_{DS} = 20V, t_P = 20\mu s$)

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Electrical characteristic diagrams

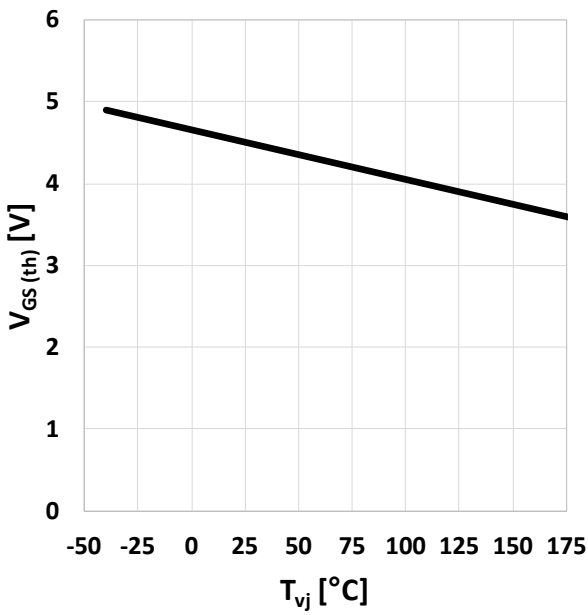


Figure 5 Typical gate-source threshold voltage as a function of junction temperature
 $(V_{GS(th)} = f(T_{vj}), I_{DS} = 1.1\text{mA}, V_{GS} = V_{DS})$

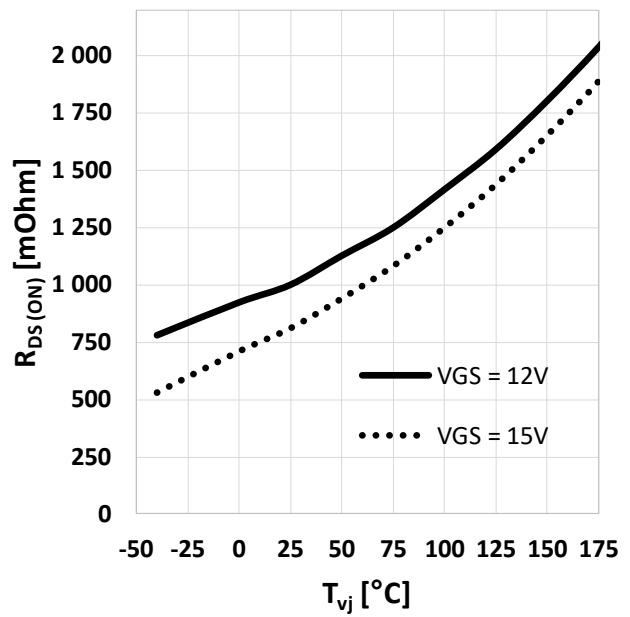


Figure 6 Typical on-resistance as a function of junction temperature
 $(R_{DS(on)} = f(T_{vj}), I_{DS} = 1\text{A})$

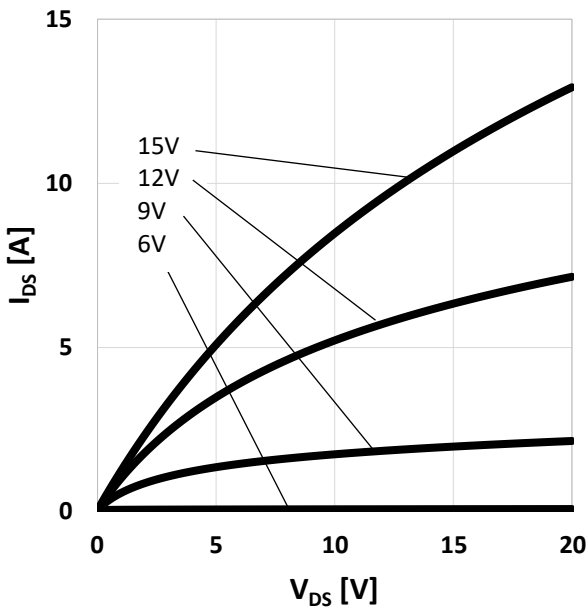


Figure 7 Typical output characteristic, V_{GS} as parameter
 $(I_{DS} = f(V_{DS}), T_{vj} = 25^\circ\text{C}, t_p = 20\mu\text{s})$

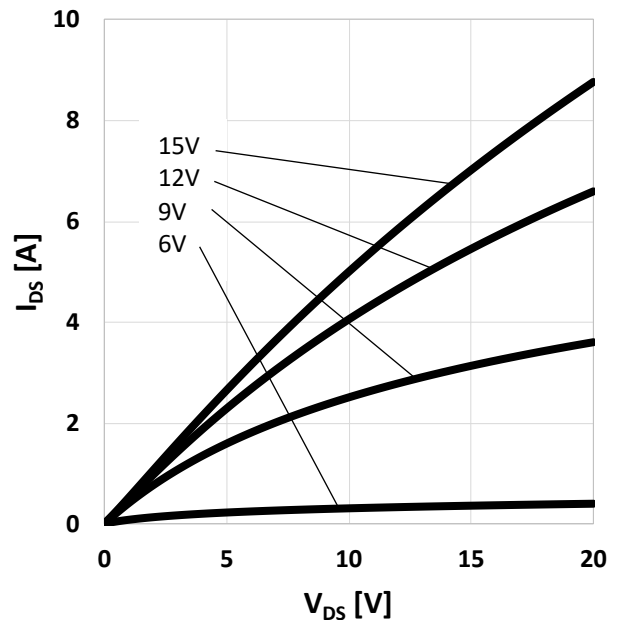


Figure 8 Typical output characteristic, V_{GS} as parameter
 $(I_{DS} = f(V_{DS}), T_{vj} = 175^\circ\text{C}, t_p = 20\mu\text{s})$

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CoolSiC™ 1700V SiC Trench MOSFET

Electrical characteristic diagrams

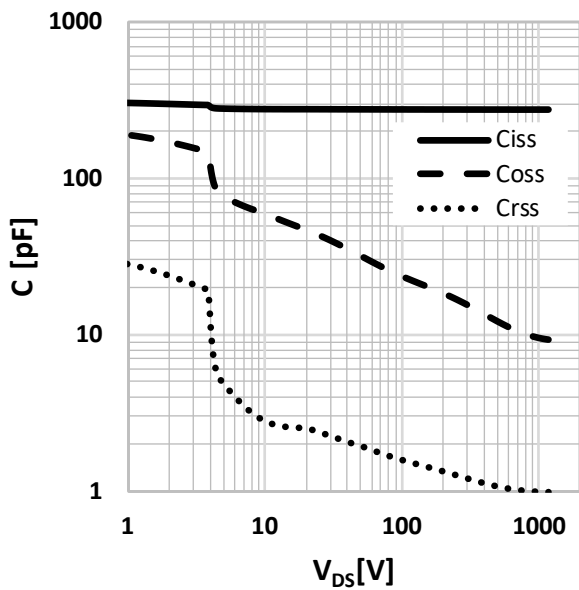


Figure 9 Typical capacitance as a function of drain-source voltage
($C = f(V_{DS}), V_{GS} = 0V, f = 1MHz$)

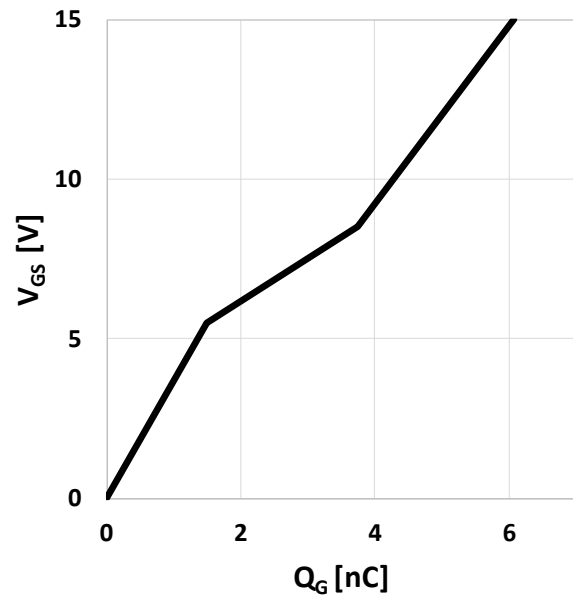


Figure 10 Typical gate charge
($V_{GS} = f(Q_G), I_{DS} = 1A, V_{DS} = 1000V$, turn-on pulse)

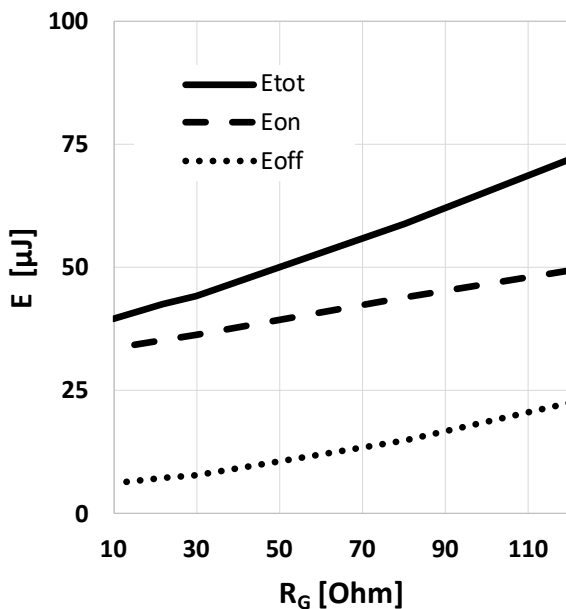


Figure 11 Typical switching energy losses as a function of gate resistance
($E = f(R_{G,ext}), V_{DD} = 1000V, V_{GS} = 0V/12V, I_D = 1A, T_{vj} = 175^\circ C$, ind. load, test circuit in Fig. E, diode: body diode at $V_{GS} = 0V$)

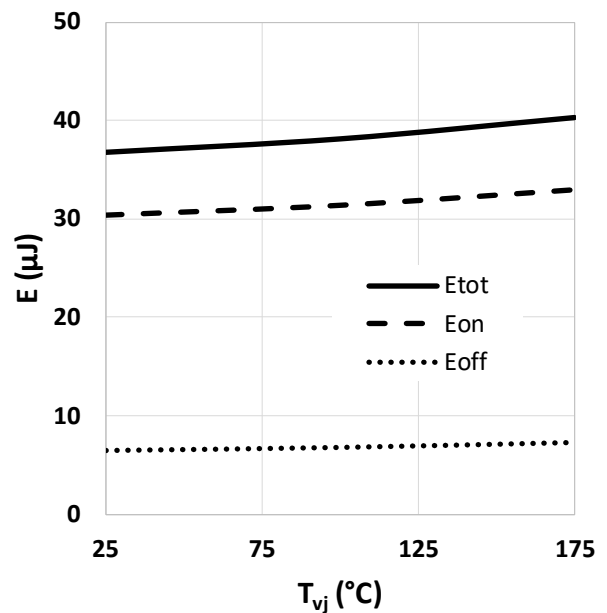


Figure 12 Typical switching energy losses as a function of junction temperature
($E = f(T_{vj}), V_{DD} = 1000V, V_{GS} = 0V/12V, R_{G,ext} = 22\Omega, I_D = 1A$, ind. load, test circuit in Fig. E, diode: body diode at $V_{GS} = 0V$)

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CoolSiC™ 1700V SiC Trench MOSFET

Electrical characteristic diagrams

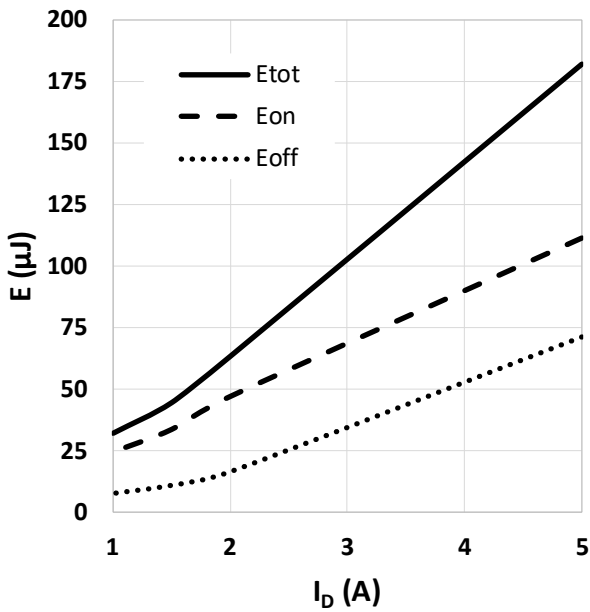


Figure 13 Typical switching energy losses as a function of drain-source current
 ($E = f(I_{DS}), V_{DD} = 1000V, V_{GS} = 0V/12V, R_{G,ext} = 22\Omega, T_{vj} = 175^\circ C, ind. load, test circuit in Fig. E, diode: body diode at V_{GS} = 0V$)

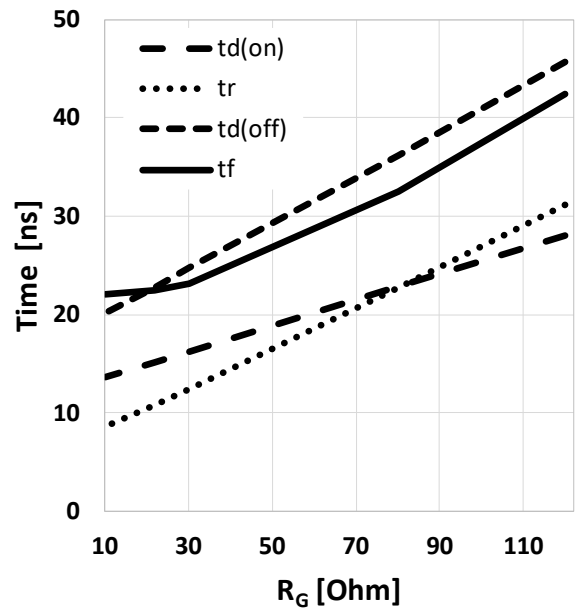


Figure 14 Typical switching times as a function of gate resistor
 ($t = f(R_{G,ext}), V_{DD} = 1000V, V_{GS} = 0V/12V, I_D = 1A, T_{vj} = 175^\circ C, ind. load, test circuit in Fig. E, diode: body diode at V_{GS} = 0V$)

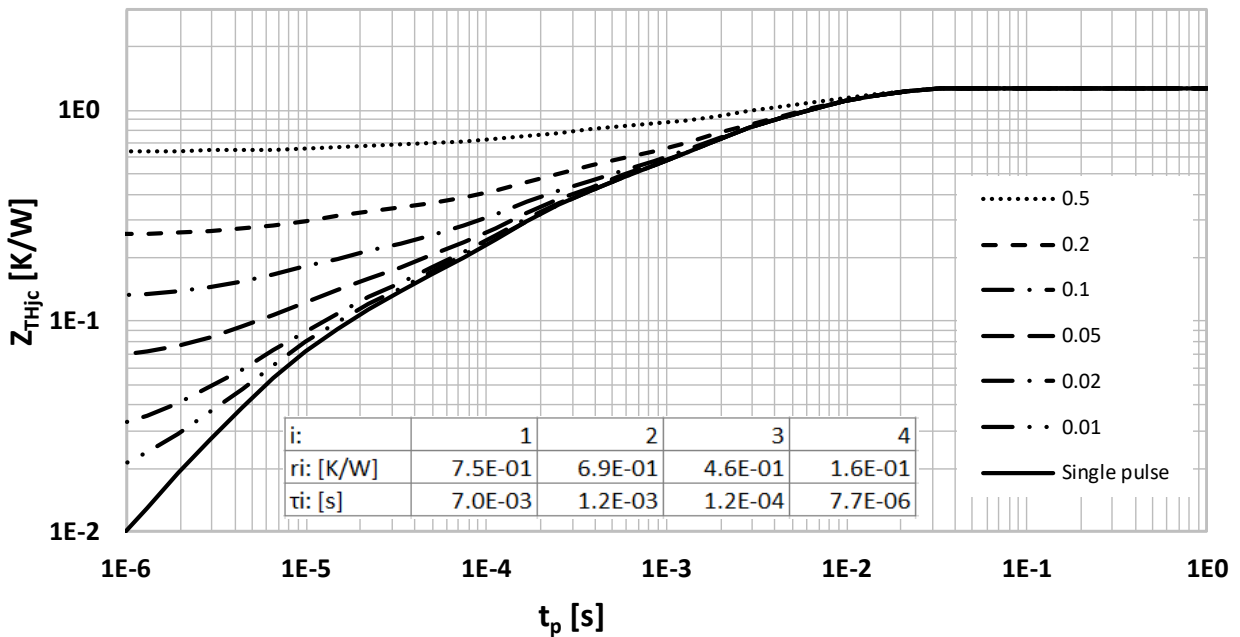


Figure 15 Max. transient thermal resistance (MOSFET)
 ($Z_{th(j-c,max)} = f(t_p), parameter D = t_p/T, thermal equivalent circuit in Fig. D$)

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CoolSiC™ 1700V SiC Trench MOSFET

Package drawing

5 Package drawing

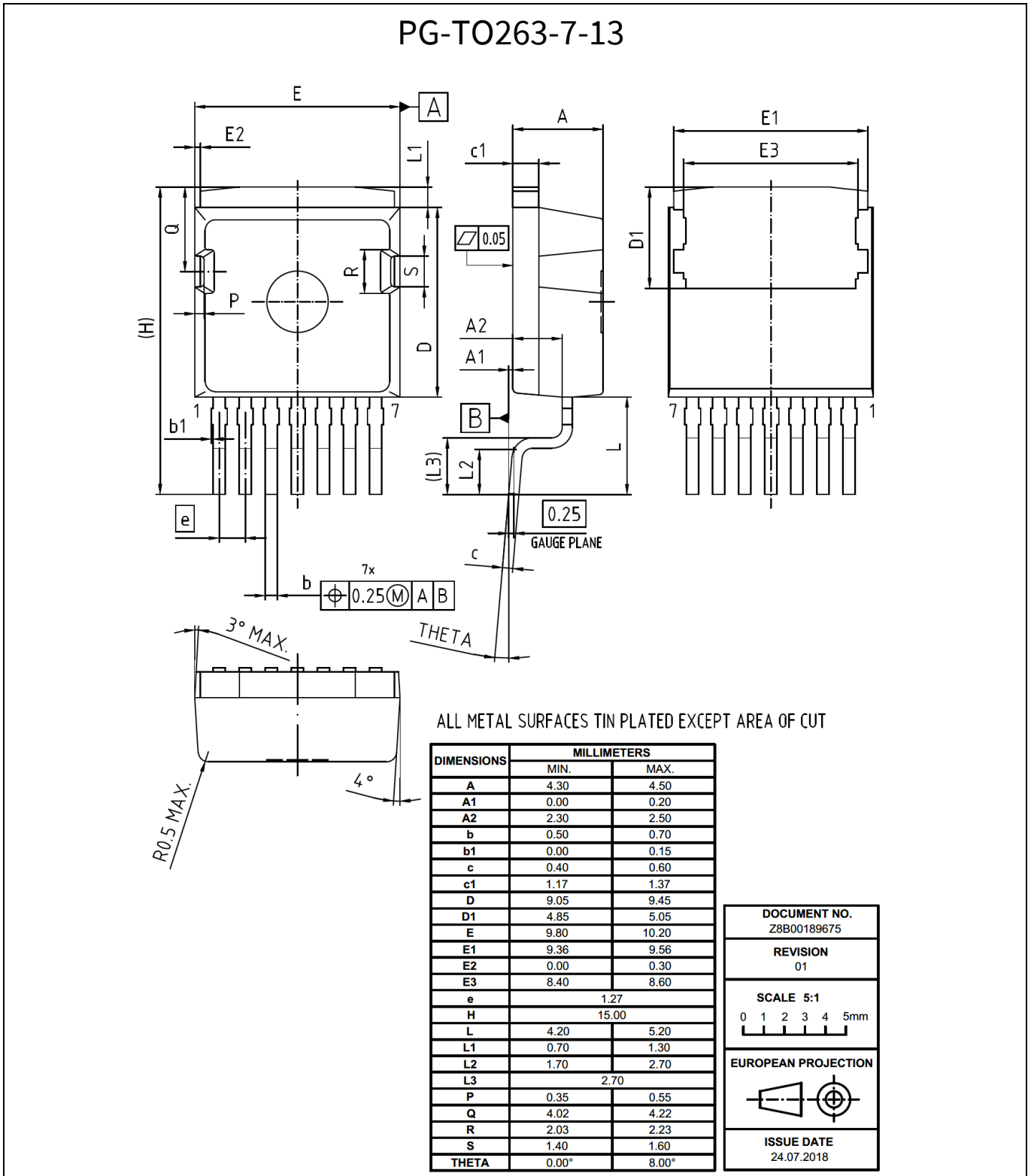


Figure 16 Package drawing

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CoolSiC™ 1700V SiC Trench MOSFET

Test conditions

6 Test conditions

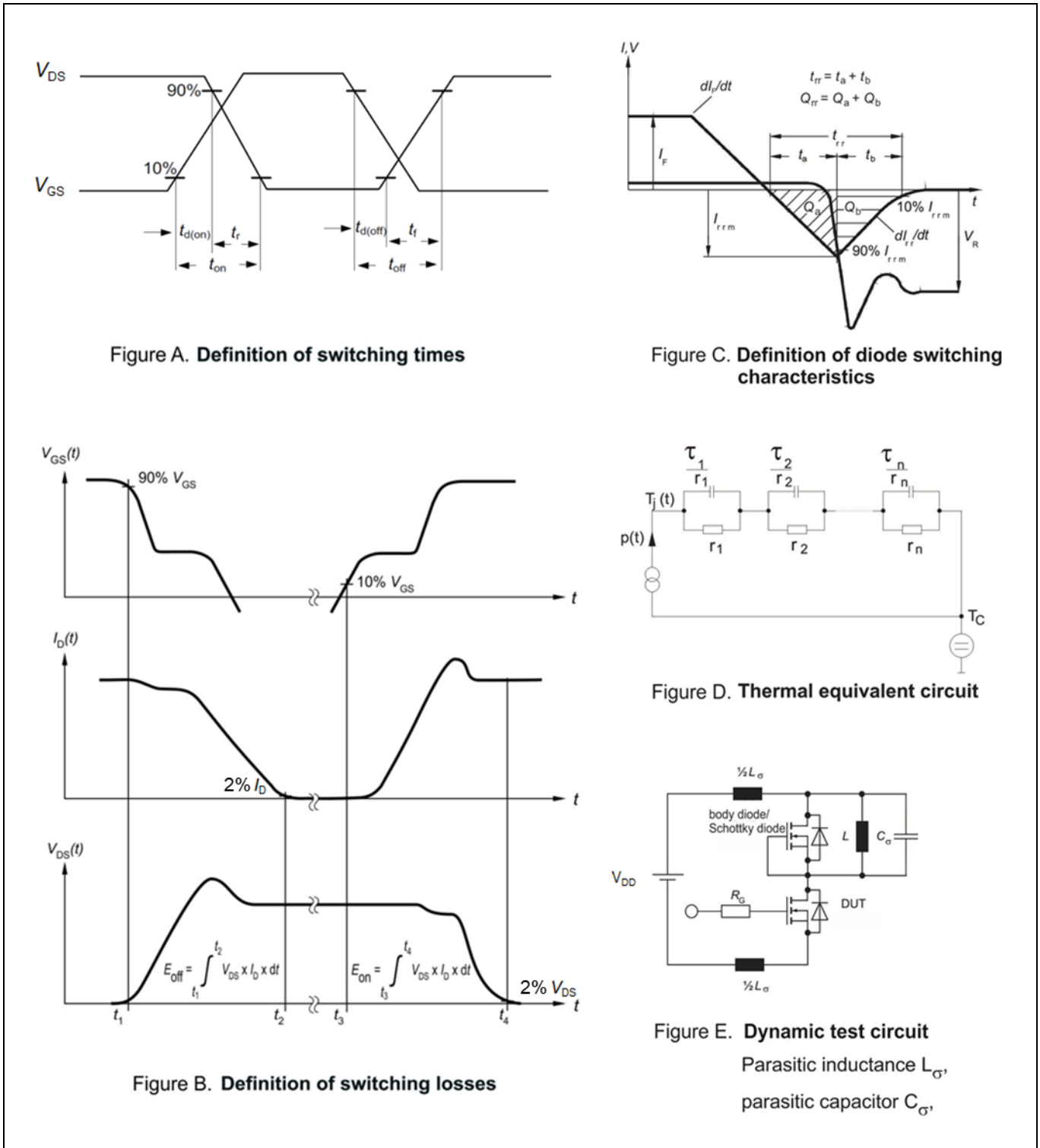


Figure 17 Test conditions

**IMBF170R1K0M1****CoolSiC™ 1700V SiC Trench MOSFET****Revision history****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

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