

MOSFET

Metal Oxide Semiconductor Field Effect Transistor

OptiMOS™

OptiMOS™ Power-MOSFET, 25 V
BSB012NE2LXI

Data Sheet

Rev. 2.1
Final

1 Description

Features

- Optimized SyncFET for high performance Buck converter
- Integrated monolithic Schottky like diode
- Low profile (<0.7 mm)
- 100% avalanche tested
- 100% R_G Tested
- Double-sided cooling
- Compatible with DirectFET® package MX footprint and outline ¹⁾
- Qualified according to JEDEC²⁾ for target applications
- Pb-free lead plating; RoHS compliant

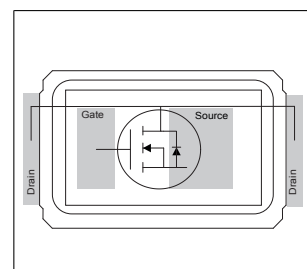


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	25	V
$R_{DS(on),max}$	1.2	mΩ
I_D	170	A
Q_{oss}	39	nC
$Q_g(0V..10V)$	62	nC

Type / Ordering Code	Package	Marking	Related Links
BSB012NE2LXI	MG-WDSO-2	05E2	-

¹⁾ CanPAK™ uses DirectFET® technology licensed from International Rectifier Corporation. DirectFET® is a registered trademark of International Rectifier Corporation.

²⁾ J-STD20 and JESD22

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2 Maximum ratings

at $T_j = 25\text{ °C}$, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current	I_D	-	-	170 107 37	A	$V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$ $V_{GS}=10\text{ V}$, $T_C=100\text{ °C}$ $V_{GS}=10\text{ V}$, $T_A=25\text{ °C}$, $R_{thJA}=45\text{ K/W}^{1)}$
Pulsed drain current ²⁾	$I_{D,pulse}$	-	-	400	A	$T_C=25\text{ °C}$
Avalanche current, single pulse ³⁾	I_{AS}	-	-	40	A	$T_C=25\text{ °C}$
Avalanche energy, single pulse	E_{AS}	-	-	130	mJ	$I_D=40\text{ A}$, $R_{GS}=25\text{ }\Omega$
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	-	-	57 2.8	W	$T_C=25\text{ °C}$ $T_A=25\text{ °C}$, $R_{thJA}=45\text{ K/W}$
Operating and storage temperature	T_j , T_{stg}	-40	-	150	°C	IEC climatic category; DIN IEC 68-1: 40/150/56

3 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case, bottom	R_{thJC}	-	1.0	-	K/W	-
Thermal resistance, junction - case, top	R_{thJC}	-	-	2.2	K/W	-
Device on PCB, 6 cm ² cooling area ¹⁾	R_{thJA}	-	-	45	K/W	-

¹⁾ Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm² (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.

²⁾ See figure 3 for more detailed information

³⁾ See figure 13 for more detailed information

4 Electrical characteristics

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	25	-	-	V	$V_{GS}=0\text{ V}$, $I_D=10\text{ mA}$
Breakdown voltage temperature coefficient	$dV_{(BR)DSS}/dT_j$	-	15	-	mV/K	$I_D=10\text{ mA}$, referenced to 25 °C
Gate threshold voltage	$V_{GS(th)}$	1.2	-	2	V	$V_{DS}=V_{GS}$, $I_D=250\text{ }\mu\text{A}$
Zero gate voltage drain current, $T_j=25\text{ }^\circ\text{C}$	I_{DSS}	-	25	500	μA	$V_{DS}=20\text{ V}$, $V_{GS}=0\text{ V}$
Zero gate voltage drain current, $T_j=125\text{ }^\circ\text{C}$	I_{DSS}	-	4	-	mA	$V_{DS}=20\text{ V}$, $V_{GS}=0\text{ V}$
Gate-source leakage current	I_{GSS}	-	10	100	nA	$V_{GS}=20\text{ V}$, $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	1.3 1.0	1.6 1.2	m Ω	$V_{GS}=4.5\text{ V}$, $I_D=30\text{ A}$ $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$
Gate resistance	R_G	0.3	0.6	1.2	Ω	-
Transconductance	g_{fs}	95	190	-	S	$ V_{DS} >2 I_D /R_{DS(on)max}$, $I_D=30\text{ A}$

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	4400	5900	pF	$V_{GS}=0\text{ V}$, $V_{DS}=12\text{ V}$, $f=1\text{ MHz}$
Output capacitance	C_{oss}	-	1900	2600	pF	$V_{GS}=0\text{ V}$, $V_{DS}=12\text{ V}$, $f=1\text{ MHz}$
Reverse transfer capacitance	C_{rss}	-	190	-	pF	$V_{GS}=0\text{ V}$, $V_{DS}=12\text{ V}$, $f=1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	-	5.4	-	ns	$V_{DD}=12\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Rise time	t_r	-	6.4	-	ns	$V_{DD}=12\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Turn-off delay time	$t_{d(off)}$	-	32	-	ns	$V_{DD}=12\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$
Fall time	t_f	-	4.8	-	ns	$V_{DD}=12\text{ V}$, $V_{GS}=10\text{ V}$, $I_D=30\text{ A}$, $R_{G,ext}=1.6\text{ }\Omega$

Table 6 Gate charge characteristics¹⁾

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	10.5	14	nC	$V_{DD}=12\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge at threshold	$Q_{g(th)}$	-	7.1	-	nC	$V_{DD}=12\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate to drain charge	Q_{gd}	-	7.3	11	nC	$V_{DD}=12\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Switching charge	Q_{sw}	-	10.7	-	nC	$V_{DD}=12\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total	Q_g	-	30	40	nC	$V_{DD}=12\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate plateau voltage	$V_{plateau}$	-	2.4	-	V	$V_{DD}=12\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge total	Q_g	-	62	82	nC	$V_{DD}=12\text{ V}$, $I_D=30\text{ A}$, $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total, sync. FET	$Q_{g(sync)}$	-	26	-	nC	$V_{DS}=0.1\text{ V}$, $V_{GS}=0\text{ to }4.5\text{ V}$
Output charge	Q_{oss}	-	39	52	nC	$V_{DD}=12\text{ V}$, $V_{GS}=0\text{ V}$

Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	57	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{S,pulse}$	-	-	227	A	$T_C=25\text{ °C}$
Diode forward voltage	V_{SD}	-	0.56	-	V	$V_{GS}=0\text{ V}$, $I_F=12\text{ A}$, $T_J=25\text{ °C}$
Reverse recovery charge	Q_{rr}	-	5	-	nC	$V_R=15\text{ V}$, $I_F=I_S$, $di_F/dt=400\text{ A}/\mu\text{s}$

¹⁾ See "Gate charge waveforms" for parameter definition

5 Electrical characteristics diagrams

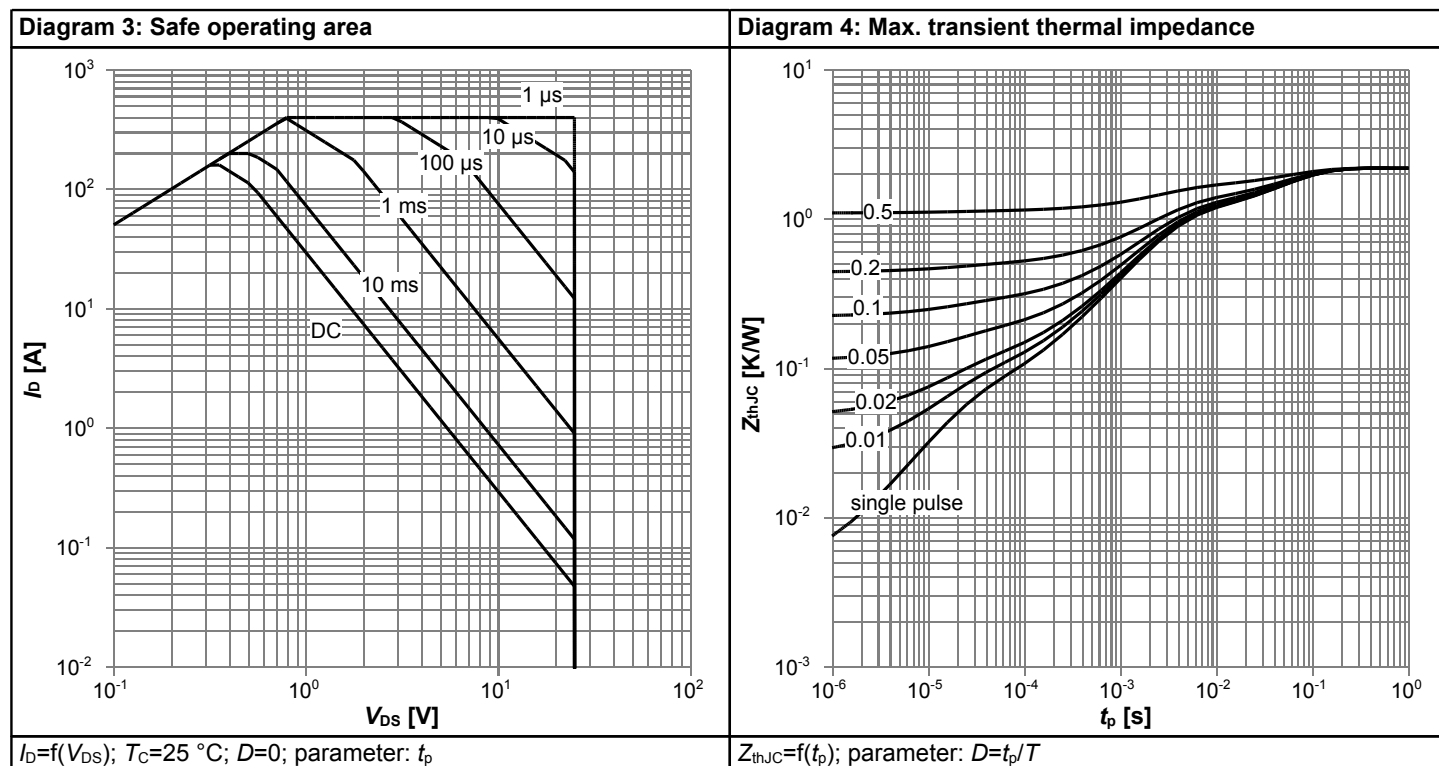
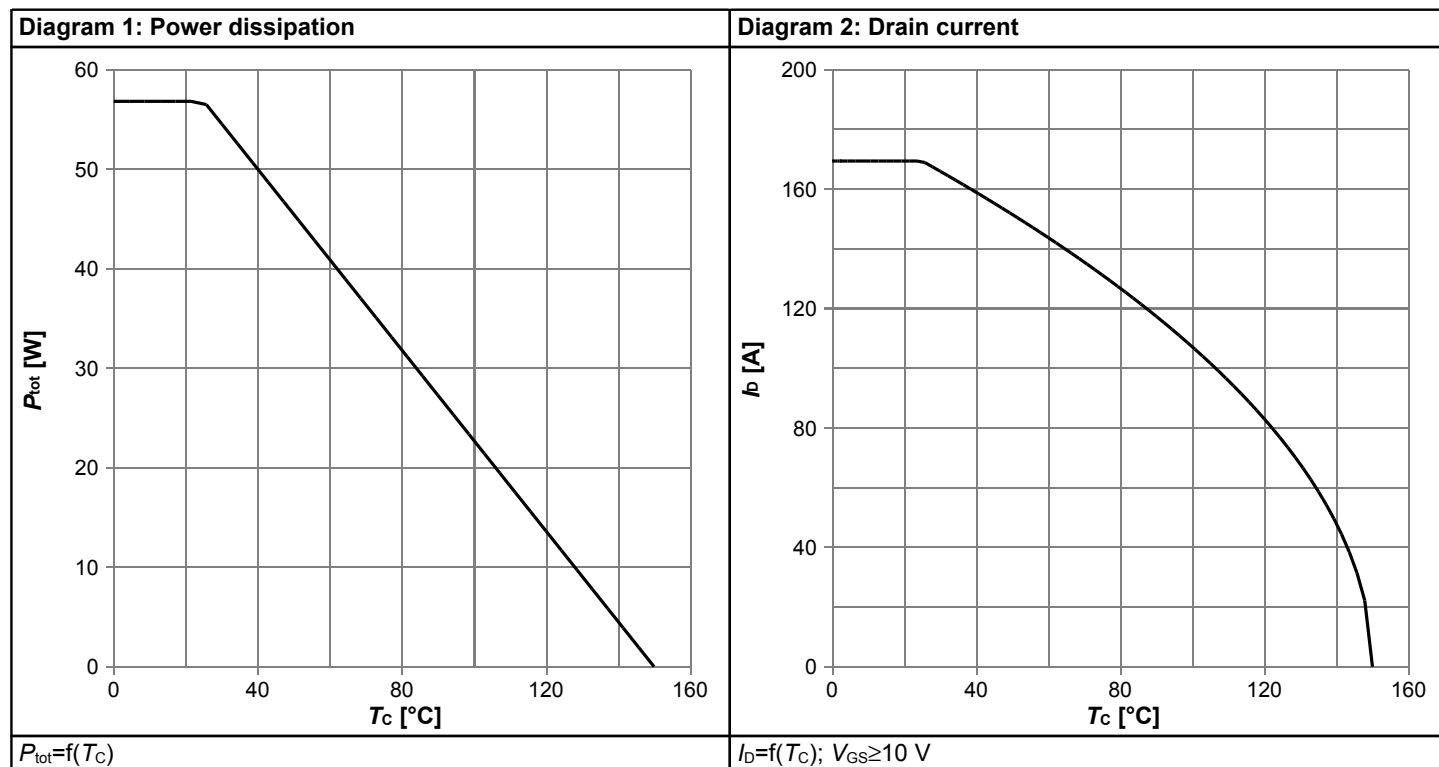


Diagram 5: Typ. output characteristics

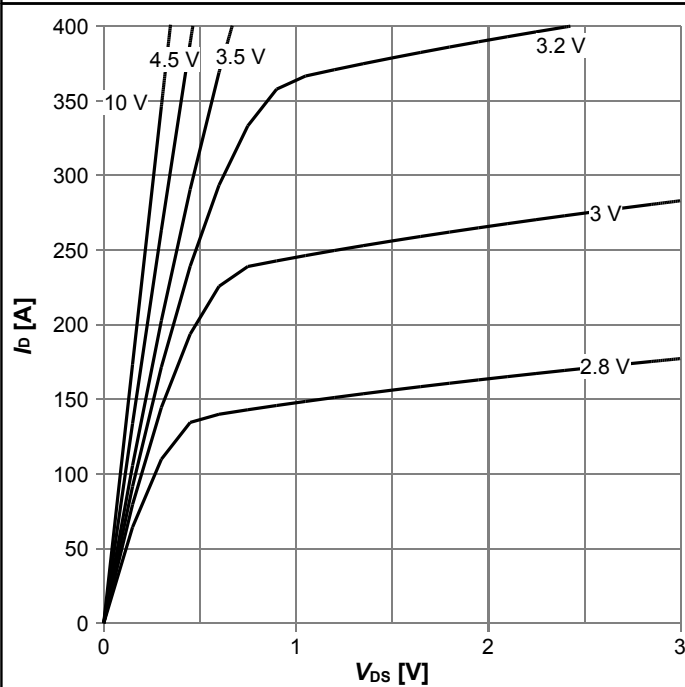

 $I_D = f(V_{DS}); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$

Diagram 6: Typ. drain-source on resistance

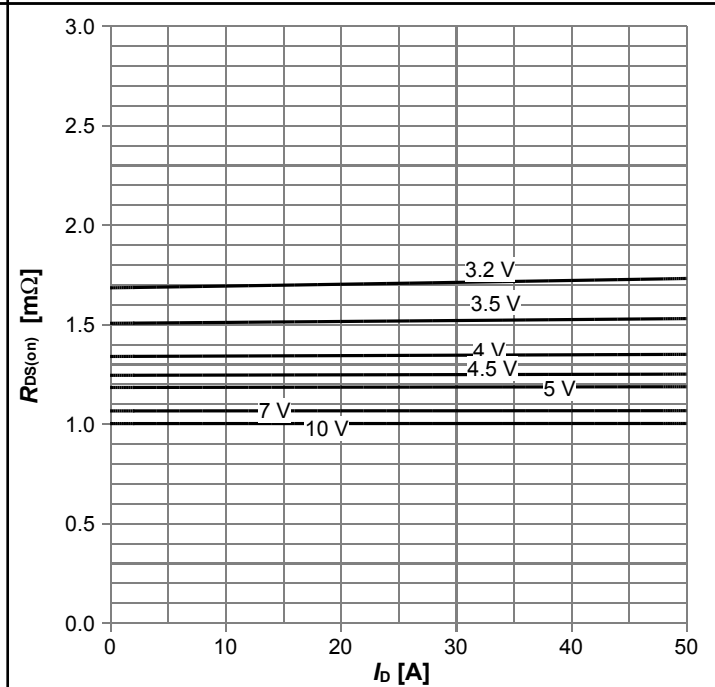

 $R_{DS(on)} = f(I_D); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$

Diagram 7: Typ. transfer characteristics

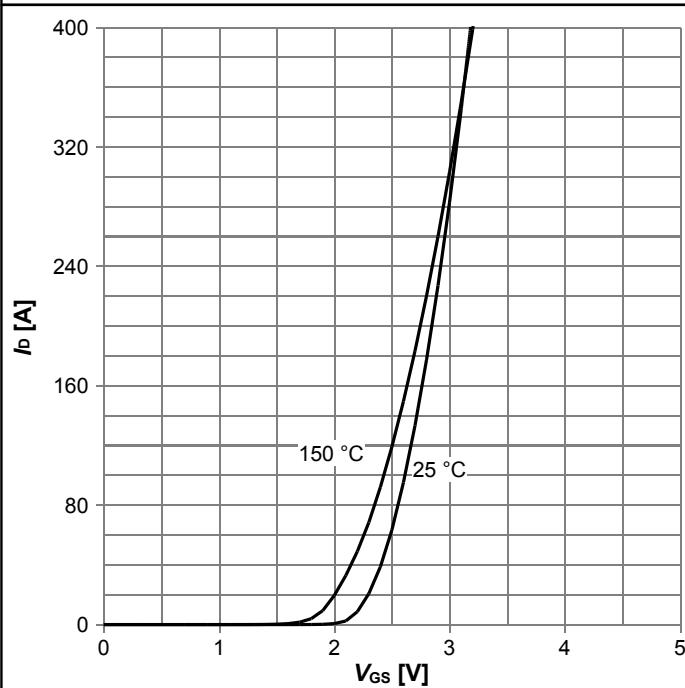

 $I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}; \text{parameter: } T_j$

Diagram 8: Typ. forward transconductance

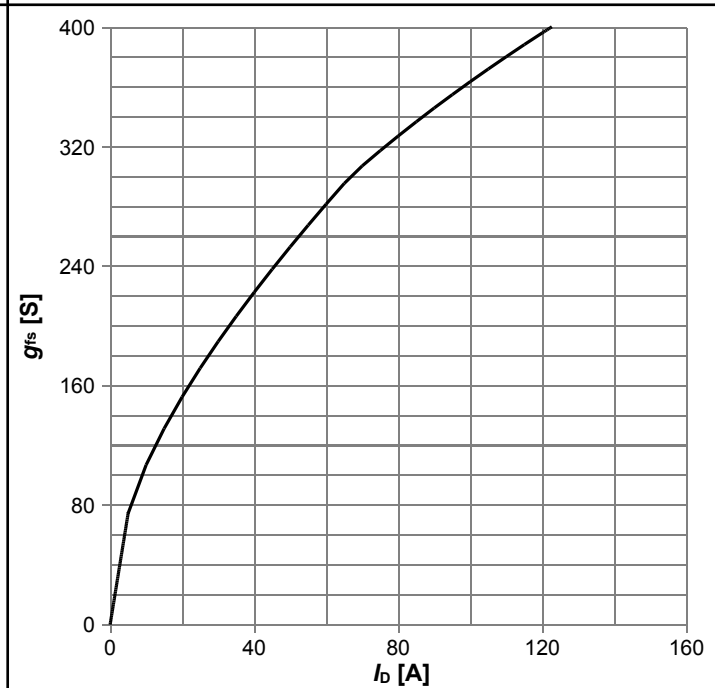
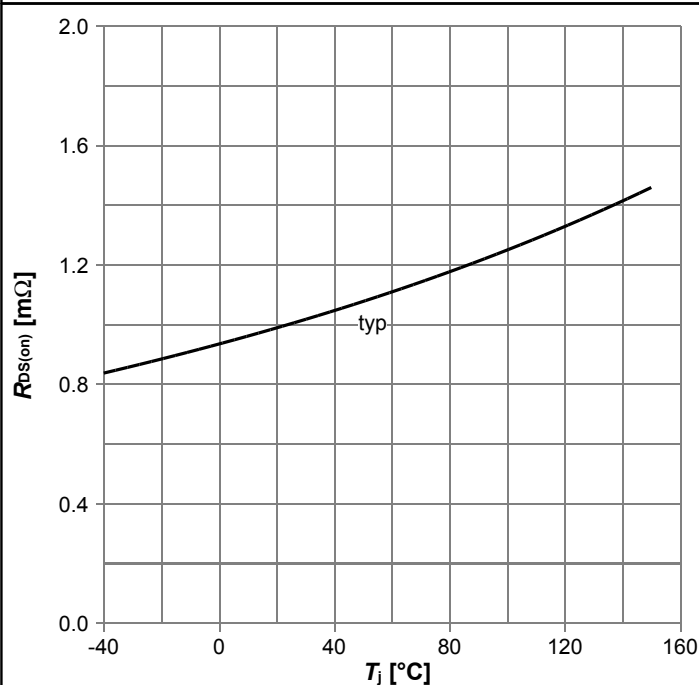
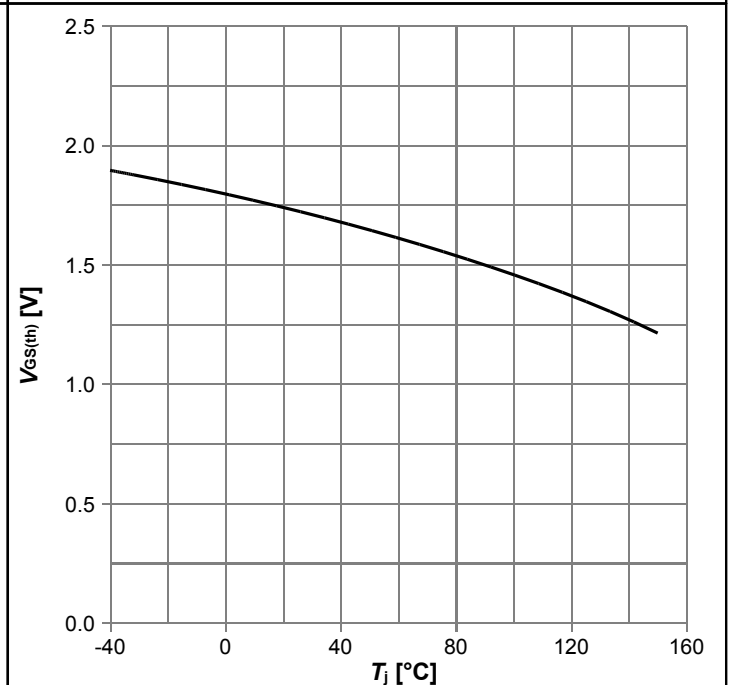

 $g_{fs} = f(I_D); T_j = 25^\circ\text{C}$

Diagram 9: Drain-source on-state resistance



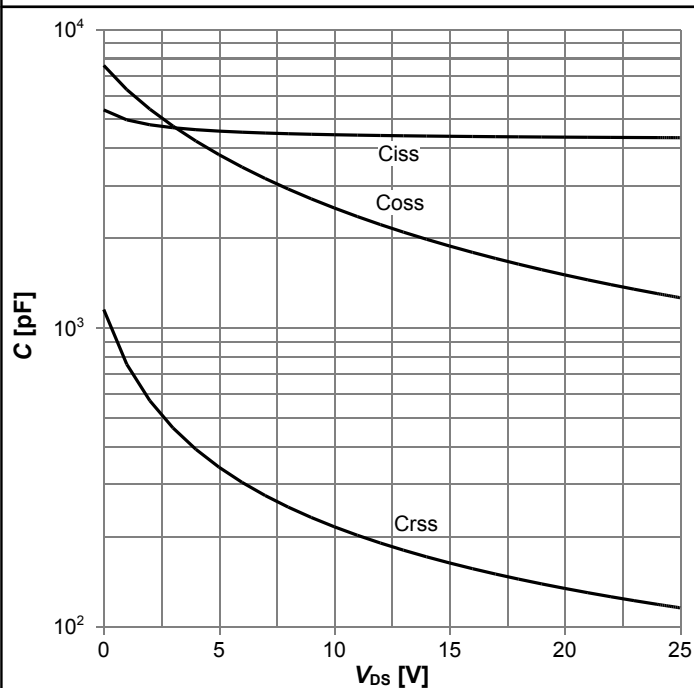
$$R_{DS(on)} = f(T_j); I_D = 30 \text{ A}; V_{GS} = 10 \text{ V}$$

Diagram 10: Typ. gate threshold voltage



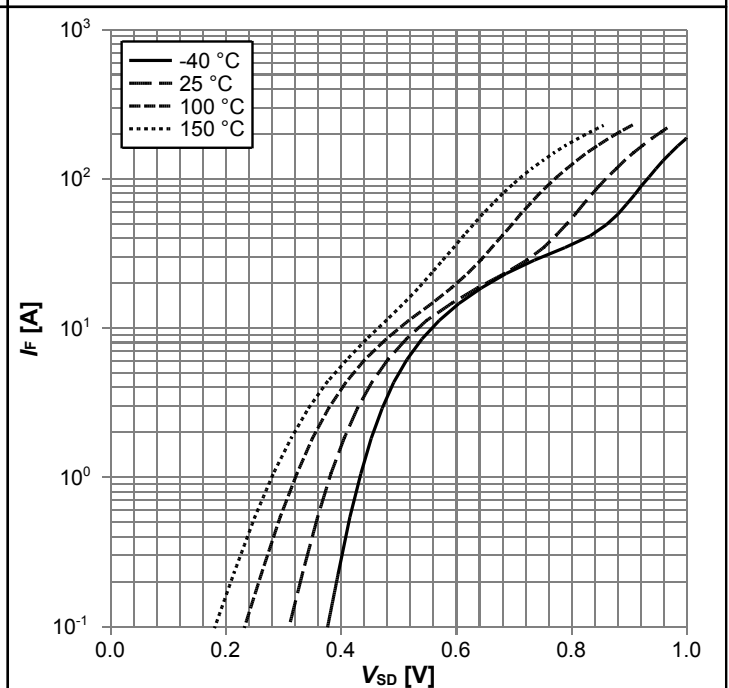
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}; I_D = 10 \text{ mA}$$

Diagram 11: Typ. capacitances



$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$

Diagram 12: Forward characteristics of reverse diode



$$I_F = f(V_{SD}); \text{parameter: } T_j$$

Diagram 13: Avalanche characteristics

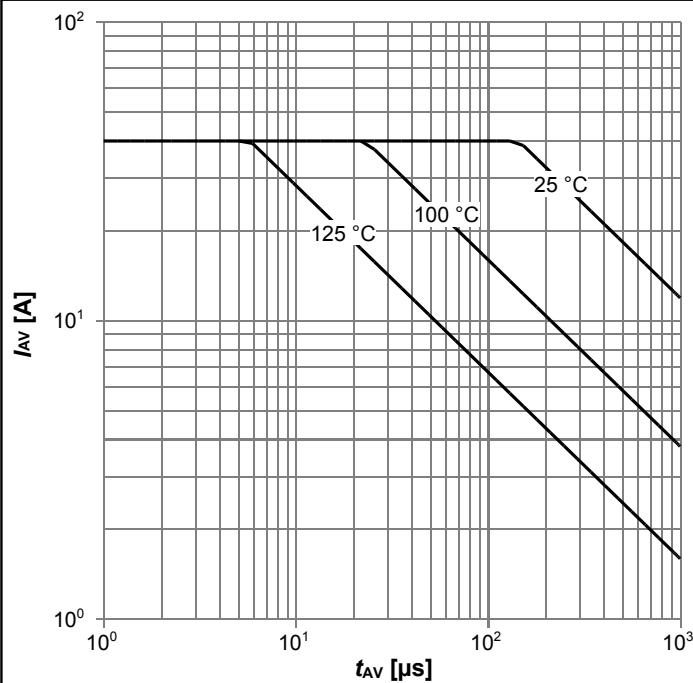

 $I_{AS}=f(t_{AV}); R_{GS}=25\ \Omega$; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge

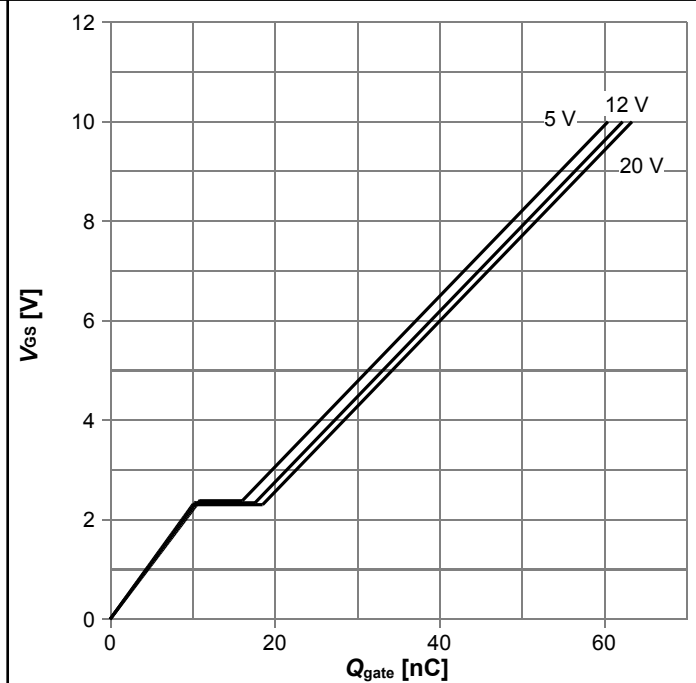
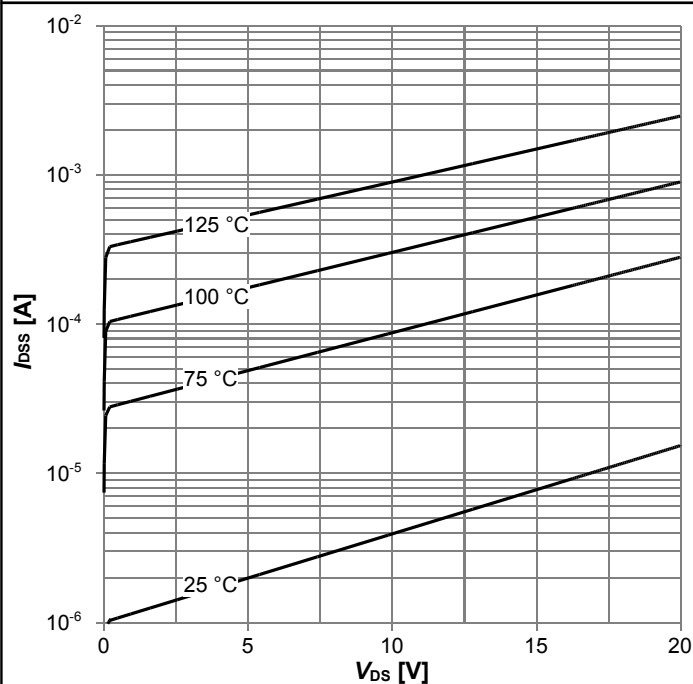
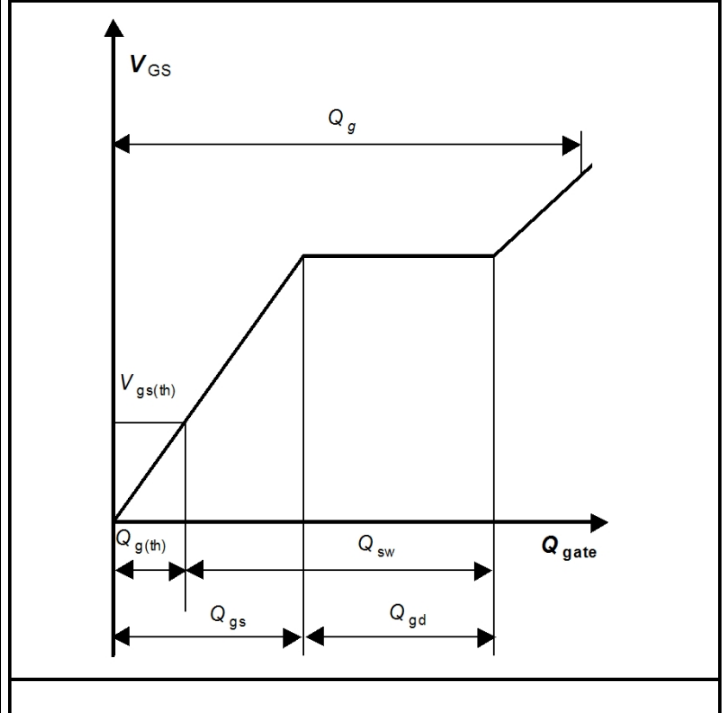

 $V_{GS}=f(Q_{gate}); I_D=30\text{ A pulsed}$; parameter: V_{DD}

Diagram 15: Typ. Drain-source leakage current


 $I_{DSS}=f(V_{DS}); V_{GS}=0\text{ V}$; parameter: T_j

Gate charge waveforms



6 Package Outlines

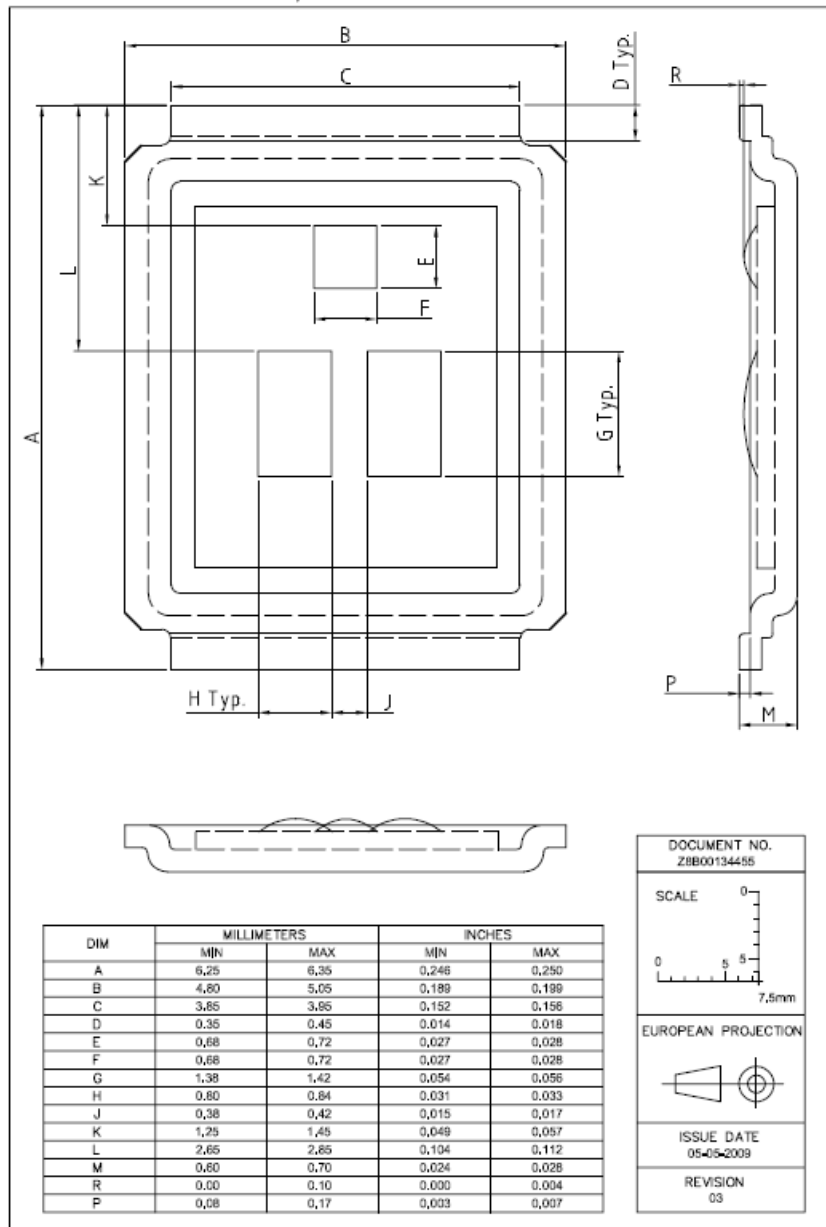


Figure 1 Outline MG-WDSN-2, dimensions in mm/inches

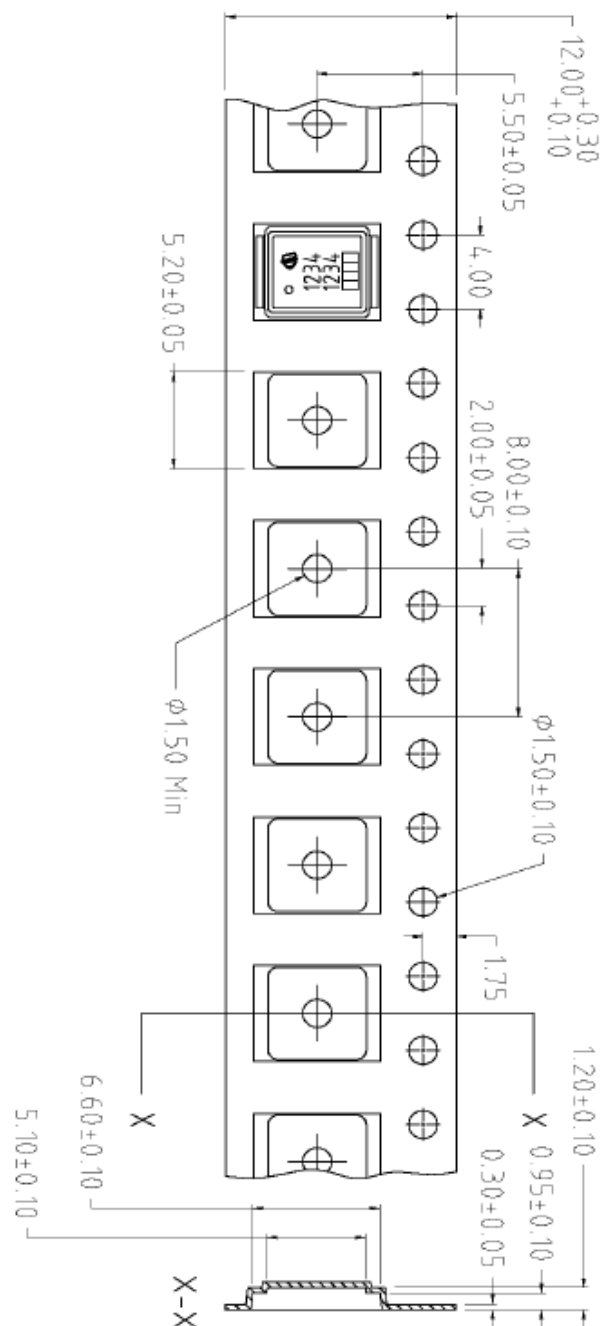


Figure 2 Outline Tape CanPAK MX, dimensions in mm

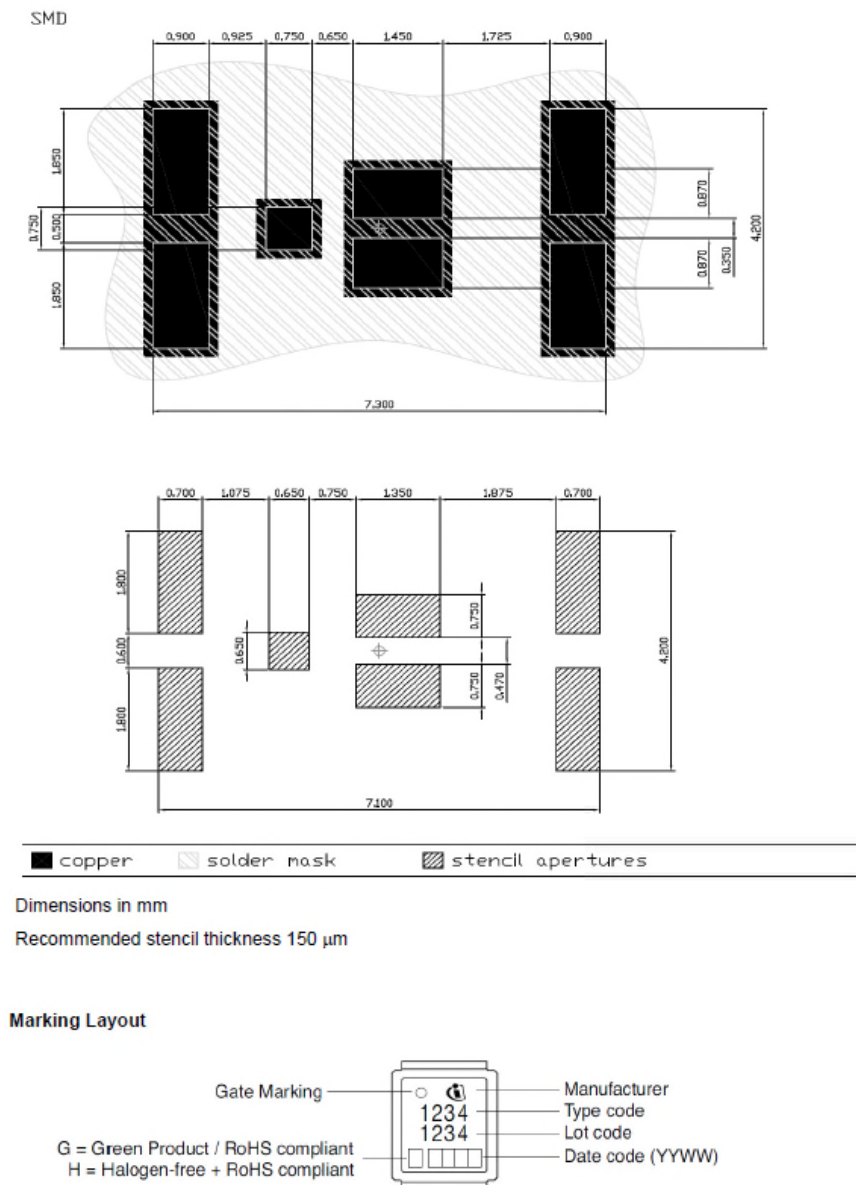


Figure 3 Outline Boardpads and apertures CanPAK MX, dimensions in mm

Revision History

BSB012NE2LXI

Revision: 2015-09-09, Rev. 2.1

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2015-01-20	Release of final version
2.1	2015-09-09	Rev. 2.0

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