

# n-Channel Power MOSFET

OptiMOS™  
BSB029P03NX3

## Data Sheet

1.92, 2011-03-21  
Preliminary

Industrial & Multimarket

## 1 Description

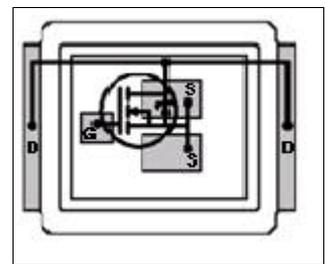
OptiMOS™ P3 -30V products are class leading power P-Channel MOSFETs for highest power density and energy efficient solutions. Lowest on state resistance in small footprint packages make OptiMOS™ P3 -30V the best choice for the demanding requirements of load switch, high-side switch and battery management applications. OptiMOS™ P3 products are available in high performance packages to tackle your most challenging applications giving full flexibility in optimizing space, efficiency and cost.

### Features

- **P-Channel MOSFET**
- Very low on-resistance  $R_{DS(on)}$
- Qualified for consumer level application
- Pb-free plating; RoHS compliant
- Halogen-free according to IEC61249-2-21
- Double sided cooling
- Compatible with DirectFET® package MX footprint and outline<sup>1)</sup>
- 100% avalanche tested
- Low parasitic inductance
- Low profile (<0.7 mm)

### Applications

- Load switch
- High-side switch
- Battery management



**Table 1 Key Performance Parameters**

Parameter	Value	Unit	Related Links
$V_{DS}$	-30	V	 <a href="#">IFX OptiMOS webpage</a> <a href="#">IFX OptiMOS product brief</a> <a href="#">IFX OptiMOS spice models</a> <a href="#">IFX Design tools</a>
$R_{DS(on),max}$	2.9	mΩ	
$I_D$	137	A	
$Q_{OSS}$	106	nC	
$Q_{g,typ}$	66		

Type	Package	Marking
BSB029P03LX3 G	MG-WDSO-2	5103

1) DirectFET® is a trademark of International Rectifier Corporation. BSB027P03LX3 G uses DirectFET® technology licensed from International Rectifier Corporation

## 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	$I_D$	-	-	137	A	$V_{GS}=10\text{ V}, T_C=25\text{ °C}$
				87		$V_{GS}=10\text{ V}, T_C=100\text{ °C}$
				26		$V_{GS}=10\text{ V}, T_A=25\text{ °C}, R_{thJA}=45\text{ K/W})^1)$
Pulsed drain current <sup>2)</sup>	$I_{D,pulse}$	-	-	400		$T_C=25\text{ °C}$
Avalanche current, single pulse <sup>3)</sup>	$I_{AS}$			40		$T_C=25\text{ °C}$
Avalanche energy, single pulse	$E_{AS}$	-	-	290	mJ	$I_D=40\text{ A}, R_{GS}=25\text{ }\Omega$
Gate source voltage	$V_{GS}$	-20	-	20	V	
Power dissipation	$P_{tot}$	-	-	78	W	$T_C=25\text{ °C}$
				2.8		$T_A=25\text{ °C}, R_{thJA}=45^1)\text{ K/W}$
Operating and storage temperature	$T_j, T_{stg}$	-40	-	150	°C	
IEC climatic category; DIN IEC 68-1		55/150/56				

1) Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6cm<sup>2</sup> (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

## 3 Thermal characteristics

**Table 3 Thermal characteristics**

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

1) Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm<sup>2</sup> (one layer, 70μm thick) copper area for drain connection. PCB is vertical in still air.

## 4 Electrical characteristics

Electrical characteristics, at  $T_J=25\text{ °C}$ , unless otherwise specified.

**Table 4 Static characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	30	-	-	V	$V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	-1.9	-2.5	-3.1		$V_{DS}=V_{GS}$ , $I_D=250\text{ }\mu\text{A}$
Zero gate voltage drain current	$I_{DSS}$	-	0.1	10	$\mu\text{A}$	$V_{DS}=30\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_J=25\text{ °C}$
		-	10	100		$V_{DS}=30\text{ V}$ , $V_{GS}=0\text{ V}$ , $T_J=125\text{ °C}$
Gate-source leakage current	$I_{GSS}$	-	10	100	nA	$V_{GS}=20\text{ V}$ , $V_{DS}=0\text{ V}$
Drain-source on-state resistance	$R_{DS(on)}$	-	3.4	4.2	$\text{m}\Omega$	$V_{GS}=6\text{ V}$ , $I_D=20\text{ A}$
		-	2.4	2.9		$V_{GS}=10\text{ V}$ , $I_D=30\text{ A}$
Gate resistance	$R_G$	-	2.5	-	$\Omega$	
Transconductance	$g_{fs}$	48	95		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	$C_{iss}$	-	10000	15000	$\text{pF}$	$V_{GS}=0\text{ V}$ , $V_{DS}=15\text{ V}$ , $f=1\text{ MHz}$
Output capacitance	$C_{oss}$	-	4600	6100		
Reverse transfer capacitance	$C_{rss}$	-	340	510		
Turn-on delay time	$t_{d(on)}$	-	27	41	ns	$V_{DD}=15\text{ V}$ , $V_{GS}=10\text{ V}$ , $I_D=30\text{ A}$ , $R_G=1.6\text{ }\Omega$
Rise time	$t_r$	-	10	15		
Turn-off delay time	$t_{d(off)}$	-	62	93		
Fall time	$t_f$	-	12	18		

**Table 6 Gate charge characteristics<sup>1)</sup>**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	$Q_{gs}$	-	40	53	nC	$V_{DD}=15\text{ V}$ , $I_D=30\text{ A}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Gate charge at threshold	$Q_{g(th)}$		16	22		
Gate to drain charge	$Q_{gd}$	-	18	30		
Switching charge	$Q_{sw}$	-	41	61		
Gate charge total	$Q_g$		66	88		
Gate plateau voltage	$V_{plateau}$	-	3.9	-	V	
Gate charge total	$Q_g$		138	183	nC	$V_{DD}=15\text{ V}$ , $I_D=30\text{ A}$ , $V_{GS}=0\text{ to }10\text{ V}$
Gate charge total, sync. FET	$Q_{g(sync)}$		56	75		$V_{DS}=0.1\text{ V}$ , $V_{GS}=0\text{ to }4.5\text{ V}$
Output charge	$Q_{oss}$		106	142		$V_{DD}=15\text{ V}$ , $V_{GS}=0\text{ V}$

1) See figure 16 for gate charge parameter definition

**Table 7 Reverse diode characteristics**

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	$I_s$			78	A	$T_C=25\text{ °C}$
Diode pulse current	$I_{s,pulse}$			400		
Diode forward voltage	$V_{SD}$	-	0.8	1.0	V	$V_{GS}=0\text{ V}$ , $I_F=30\text{ A}$ , $T_j=25\text{ °C}$
Reverse recovery charge	$Q_{rr}$	-	116	145	nC	$V_R=15\text{ V}$ , $I_F=I_s$ , $di_F/dt=400\text{ A}/\mu\text{s}$

## 5 Electrical characteristics diagrams

Table 8

1 Power dissipation	2 Drain current
$P_{\text{tot}} = f(T_c)$	$I_D = f(T_c)$ ; parameter: $V_{GS}$

Table 9

3 Safe operating area $T_c = 25^\circ\text{C}$	4 Max. transient thermal impedance
$I_D = f(V_{DS})$ ; $T_J = 25^\circ\text{C}$ ; $D = 0$ ; parameter: $T_p$	$Z_{\text{th(jc)}} = f(t_p)$ ; parameter: $D = t_p / T$

Table 10

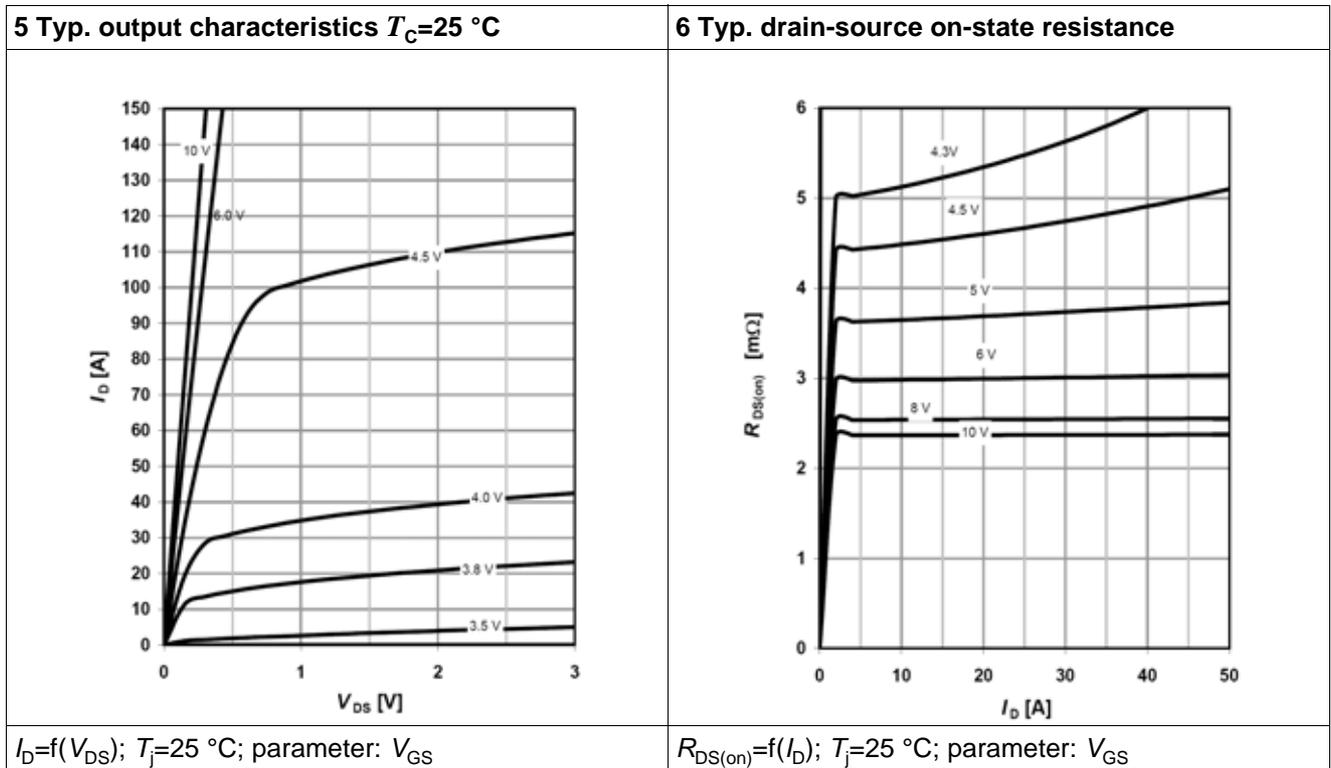


Table 11

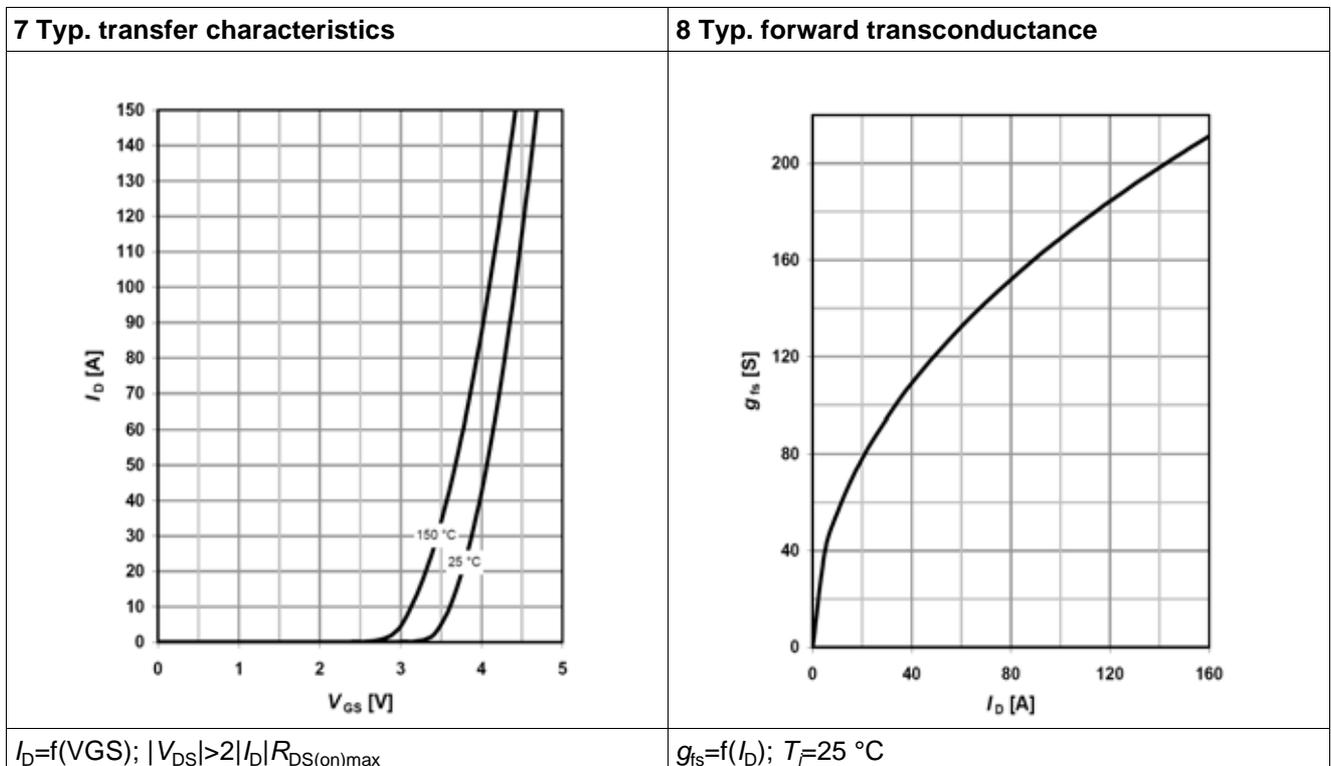


Table 12

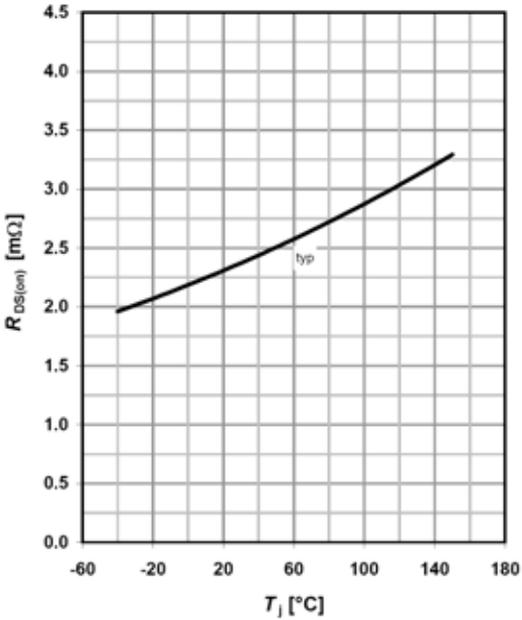
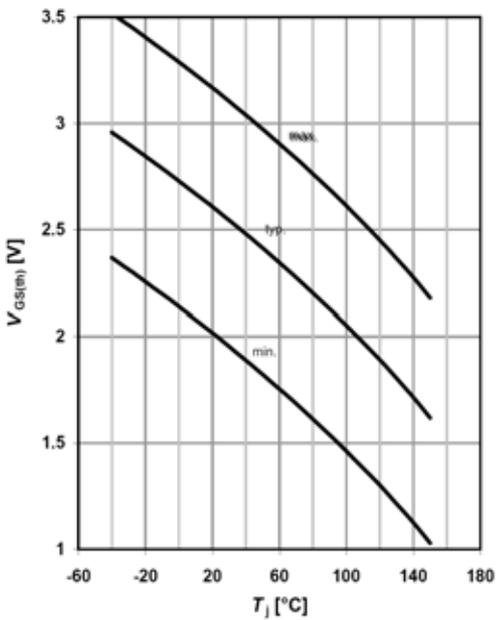
<p><b>9 Drain-source on-state resistance</b></p>  <p><math>R_{DS(on)} = f(T_j)</math>; <math>I_D = 30 \text{ A}</math>; <math>V_{GS} = 10 \text{ V}</math></p>	<p><b>10 Typ. gate threshold voltage</b></p>  <p><math>V_{GS(th)} = f(T_j)</math>; <math>V_{GS} = V_{DS}</math>; <math>I_D = 250 \mu\text{A}</math></p>
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Table 13

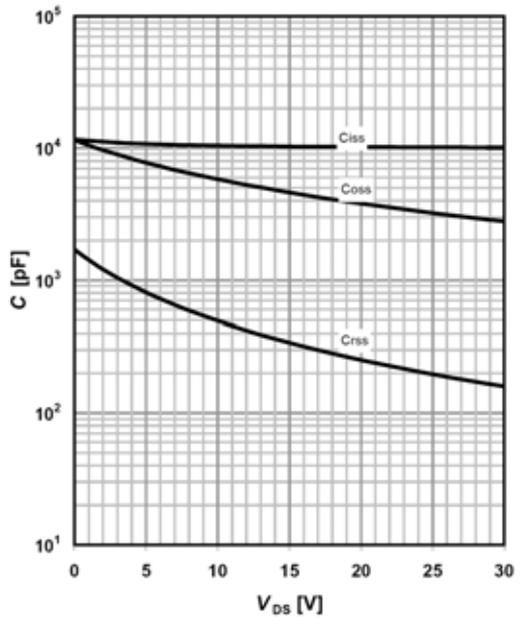
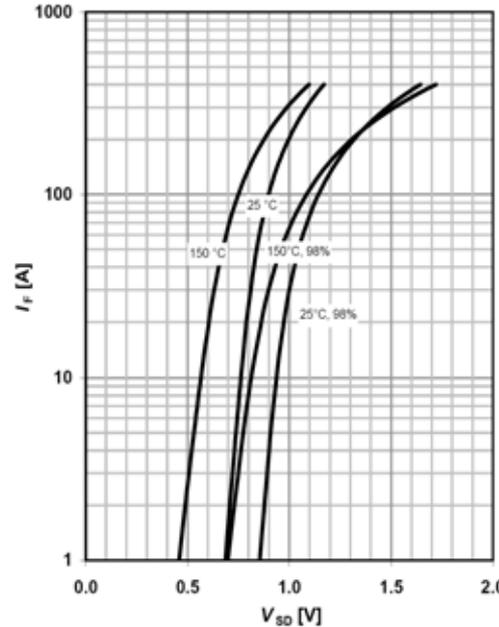
<p><b>11 Typ. capacitances</b></p>  <p><math>C = f(V_{DS})</math>; <math>V_{GS} = 0 \text{ V}</math>; <math>f = 1 \text{ MHz}</math></p>	<p><b>12 Forward characteristics of reverse diode</b></p>  <p><math>I_F = f(V_{SD})</math>; parameter: <math>T_j</math></p>
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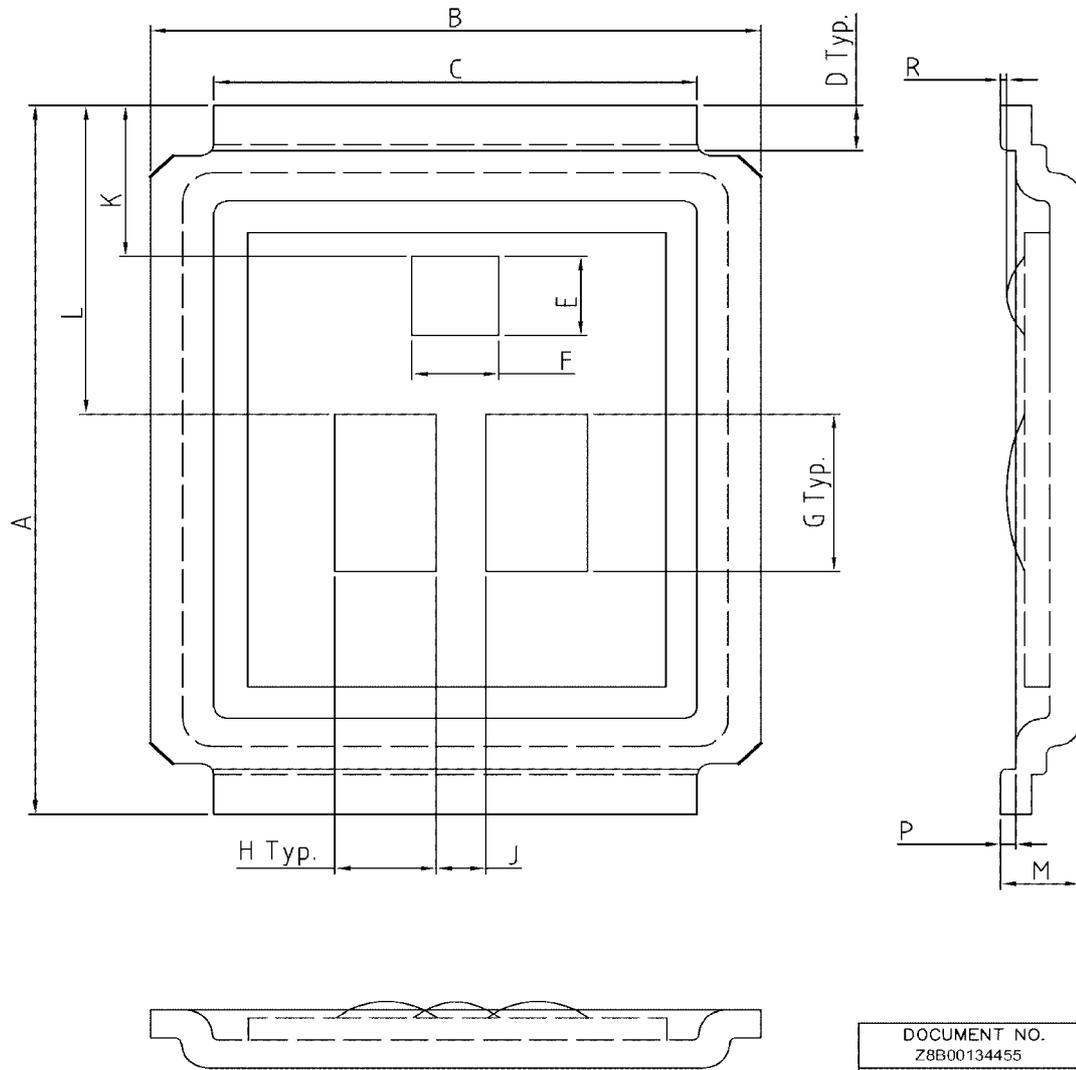
Table 14

13 Avalanche characteristics	14 Typ. gate charge
$I_{AS}=f(t_{AV}); R_{GS}=25 \Omega; \text{parameter: } T_{j(\text{start})}$	$V_{GS}=f(Q_{\text{gate}}); I_D=30 \text{ A pulsed}; \text{parameter: } V_{DD}$

Table 15

15 Drain-source breakdown voltage	16 Gate charge waveforms
$V_{BR(DSS)}=f(T_j); I_D=1 \text{ mA}$	

6 Package outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	6.25	6.35	0.246	0.250
B	4.80	5.05	0.189	0.199
C	3.85	3.95	0.152	0.156
D	0.35	0.45	0.014	0.018
E	0.68	0.72	0.027	0.028
F	0.68	0.72	0.027	0.028
G	1.38	1.42	0.054	0.056
H	0.80	0.84	0.031	0.033
J	0.38	0.42	0.015	0.017
K	1.25	1.45	0.049	0.057
L	2.65	2.85	0.104	0.112
M	0.60	0.70	0.024	0.028
R	0.00	0.10	0.000	0.004
P	0.08	0.17	0.003	0.007

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Z8B00134455

SCALE

7.5mm

EUROPEAN PROJECTION

ISSUE DATE  
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REVISION  
03

Figure 1 Outlines MG-WDSO-2, dimensions in mm/inches

7 Package outlines

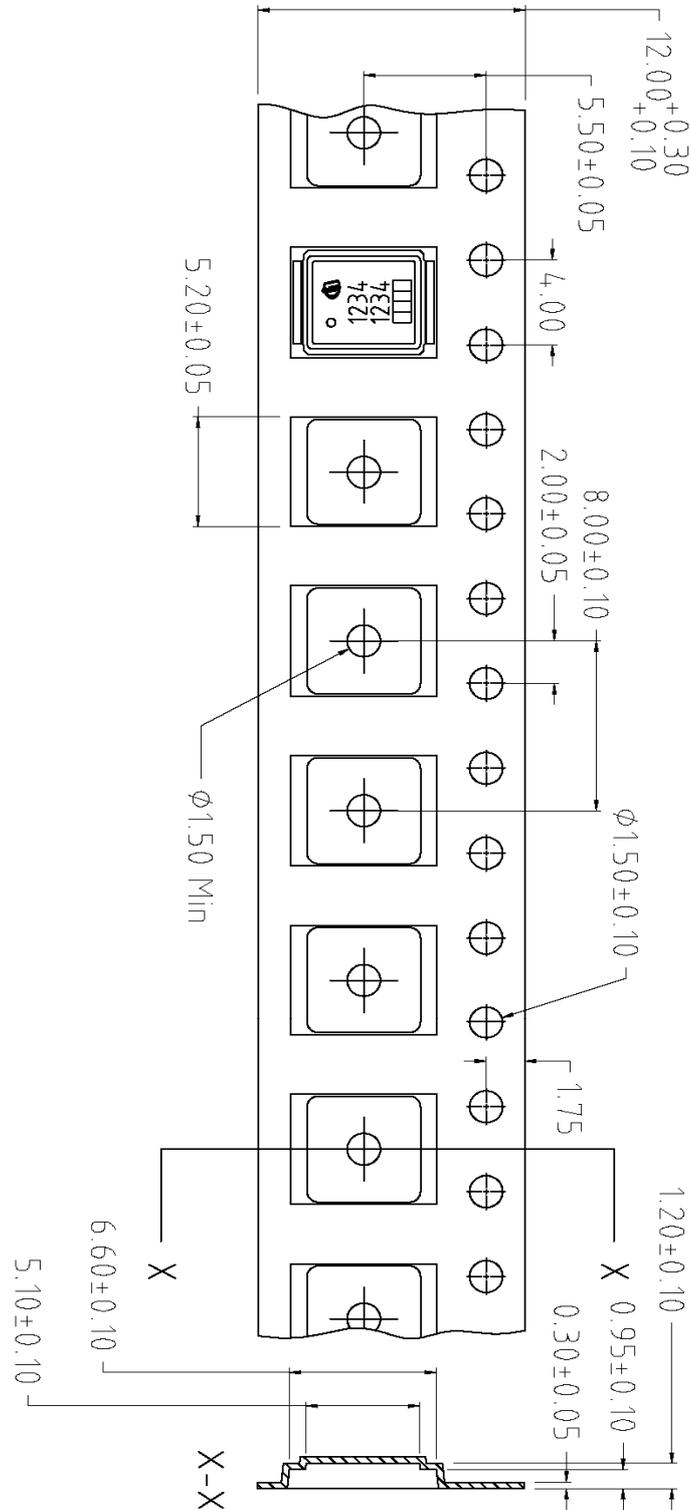
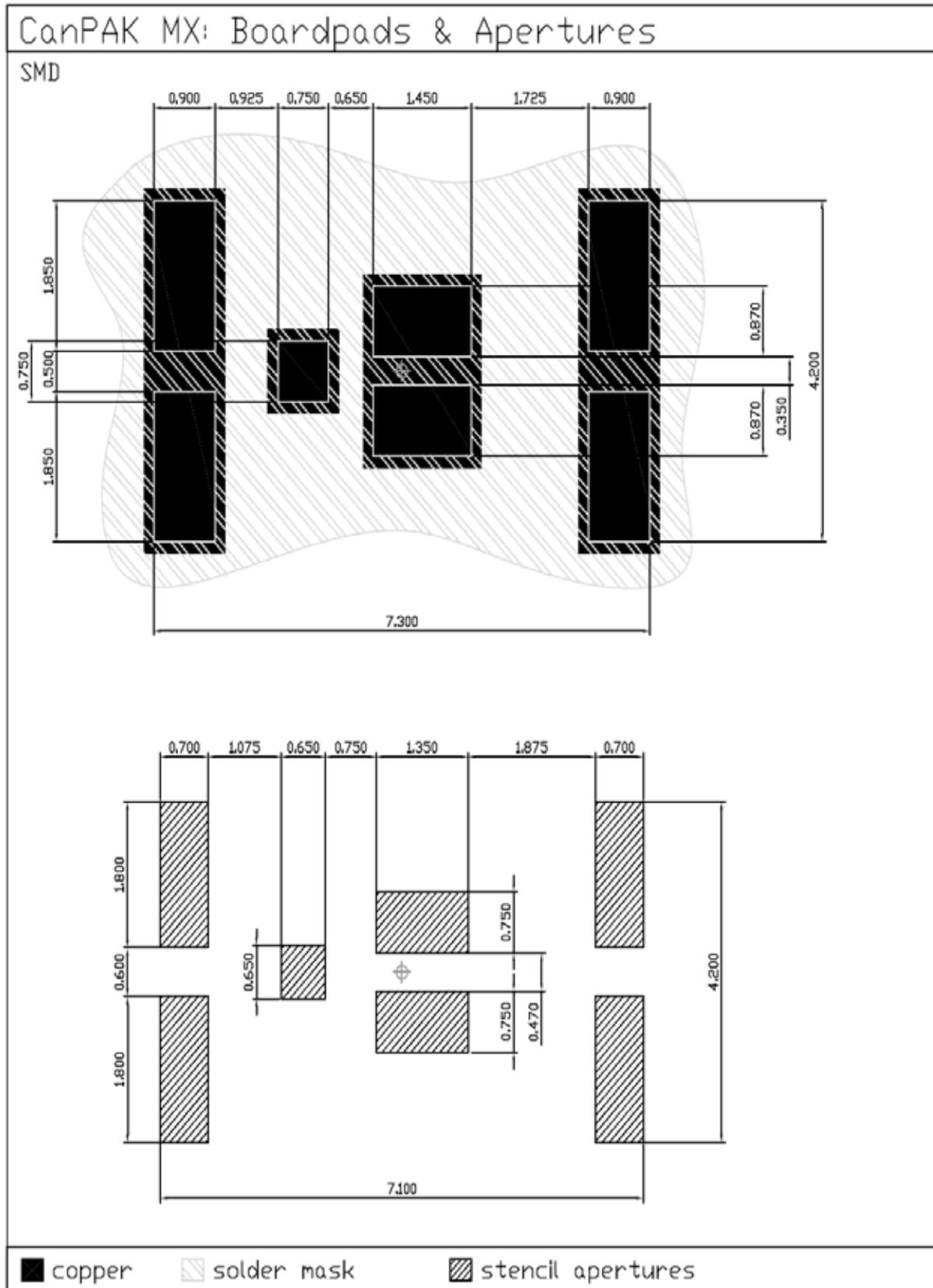


Figure 2 Outlines MG-WDSO-2, dimensions in mm/inches

## 8 Package outlines



## 9 Revision History

Revision History: 2011-03-21, 1.92

Previous Revision:

Revision	Subjects (major changes since last revision)
0.1	Release of target data sheet
1.9	Release of preliminary data sheet

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