Never stop thinking

n-Channel Power MOSFET

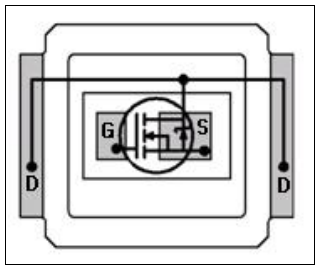
OptiMOS™
BSB015N04NX3 G

Data Sheet

2.4, 2011-05-24
Final

Industrial & Multimarket

1 Description



OptiMOS™40V products are class leading power MOSFETs for highest power density and energy efficient solutions. Ultra low gate- and output charges together with lowest on state resistance in small footprint packages make OptiMOS™ 40V the best choice forthe demanding requirements of voltage regulator solutions in Servers, Datacom and Telecom applications. Super fast switching Control FETs together with low EMI Sync FETs provide solutions that are easy to design in. OptiMOS™ products are available in high performance packages to tackle your most challenging applications giving full flexibility in optimizing space- efficiency and cost. OptiMOS™ products are designed to meet and exceed the energy efficiency and power density requirements of the sharpened next generation voltage regulation standards in computing applications

Features

- Optimized for high switching frequency DC/DC converter
- 100% avalanche tested
- Excellent gate charge x $R_{DS(on)}$ product (FOM)
- Qualified according to JEDEC[1)] for target applications
- Pb-free plating; RoHS compliant
- Very low on-resistance $R_{DS(on)}$
- Low profile (<0.7 mm)
- Low parasitic inductance
- Double.sided cooling
- Compatible with DirectFET® package MX footprint and outline
- 100% Rg Tested

Applications

- On board power for server
- Power managment for high performance computing
- Synchronous rectification
- High power density point of load converters

Table 1 Key Performance Parameters

Parameter	Value	Unit		Related Links
V_{DS}	40	V		IFX OptiMOS webpage
$R_{DS(on),max}$	1.5	mΩ		IFX OptiMOS product brief
I_D	180	A		IFX OptiMOS spice models
Q_{OSS}	86	nC		IFX Design tools
$Q_{g·typ}$	107			

Type	Package	Marking
BSB015N04NX3 G	MG-WDSON-2	0204

1) J-STD20 and JESD22

2 Maximum ratings

at T_j = 25 °C, unless otherwise specified.

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current	I_D	-	-	180	A	V_{GS}=10 V, T_C=25 °C
				124		V_{GS}=10 V, T_C=100 °C
				35		V_{GS}=10 V, T_A=25 °C, R_{thJA}=45 K/W[1])
Pulsed drain current[2]	$I_{D,pulse}$	-	-	400		T_C=25 °C
Avalanche current, single pulse[3]	I_{AS}	-	-	40		
Avalanche energy, single pulse	E_{AS}	-	-	290	mJ	I_D=40 A,R_{GS}=25 Ω
Gate source voltage	V_{GS}	-20	-	20	V	
Power dissipation	P_{tot}	-	-	89	W	T_C=25 °C
				2.8		T_A=25 °C, R_{thJA}=45 K/W
Operating and storage temperature	T_j,T_{stg}	-40	-	150	°C	
IEC climatic category; DIN IEC 68-1		55	150	56	Ncm	

1) J-STD20 and JESD22
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
				1.4		top
Device on PCB	R_{thJA}	-	-	45		6 cm^2 cooling area[1]

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

4 Electrical characteristics

Electrical characteristics, at T_j=25 °C, unless otherwise specified.

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	40	-	-	V	V_{GS}=0 V, I_D=1mA
Gate threshold voltage	$V_{GS(th)}$	2	-	4		V_{DS}=V_{GS}, I_D=250 µA
Zero gate voltage drain current	I_{DSS}	-	0.1	10	µA	V_{DS}=40 V, V_{GS}=0 V, T_j=25 °C
		-	10	100		V_{DS}=40 V, V_{GS}=0 V, T_j=125 °C
Gate-source leakage current	I_{GSS}	-	10	100	nA	V_{GS}=20 V, V_{DS}=0 V
Drain-source on-state resistance	$R_{DS(on)}$	-	1.3	1.5	mΩ	V_{GS}=10V, I_D=30A
Gate resistance	R_G	0.2	0.5	1.0	Ω	
Transconductance	g_{fs}	55	110		S	|V_{DS}|>2|$I_{D\|RDS(on)max}$, I_D=30 A

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	9000	12000	pF	V_{GS}=0 V, V_{DS}=20 V, f=1 MHz
Output capacitance	C_{oss}	-	2300	3100		
Reverse transfer capacitance	C_{rss}	-	91	-		
Turn-on delay time	$t_{d(on)}$	-	23	-	ns	V_{DD}=20V, V_{GS}=10 V, I_D=30 A, R_G= 1.6 Ω
Rise time	t_r	-	6.4	-		
Turn-off delay time	$t_{d(off)}$	-	36	-		
Fall time	t_f	-	7.6	-		

Table 6 Gate charge characteristics[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	41	-	nC	V_{DD}=20 V, I_D=30 A, V_{GS}=0 to 10V
Gate charge at threshold	$Q_{g(th)}$	-	26	-		
Gate to drain charge	Q_{gd}	-	13	-		
Switching charge	Q_{sw}	-	28	-		
Gate charge total	Q_g	-	107	142		
Gate plateau voltage	$V_{plateau}$	-	4.8	-	V	
Gate charge total, sync. FET	$Q_{g(sync)}$	-	101	134		V_{DS}=0.1 V, V_{GS}=0 to 10 V
Output charge	Q_{oss}	-	86	-		V_{DD}=20 V, V_{GS}=0 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			89	A	T_C=25 °C
Diode pulse current	$I_{S,pulse}$			400		
Diode forward voltage	V_{SD}	-	0.81	1.1	V	V_{GS}=0 V, I_F=30 A, T_j=25 °C
Reverse recovery charge	Q_{rr}	-	-	50	nC	V_R=15 V, I_F=I_S, di_F/dt=400 A/µs

5 Electrical characteristics diagrams

Table 8

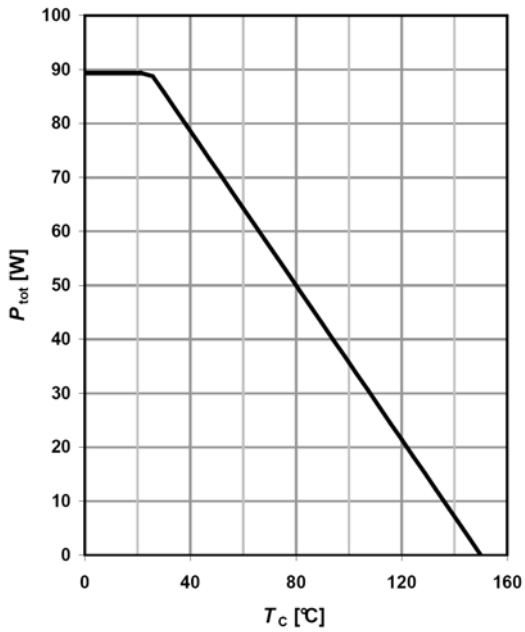
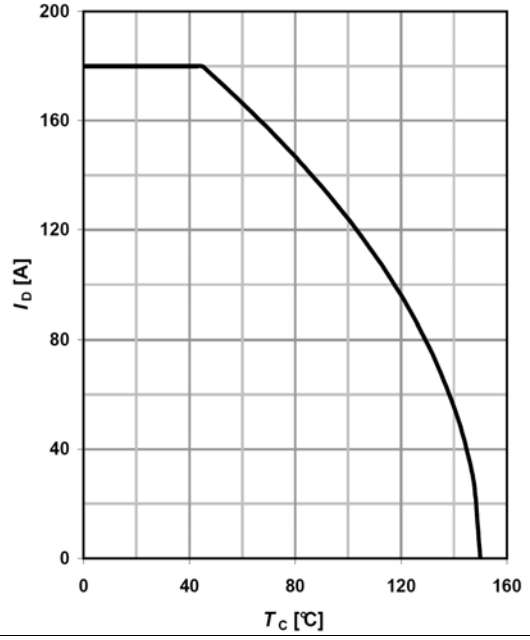
1 Power dissipation	2 Drain current
	
$P_{tot} = f(T_C)$	$I_D=f(T_C)$; parameter:V_{GS}

Table 9

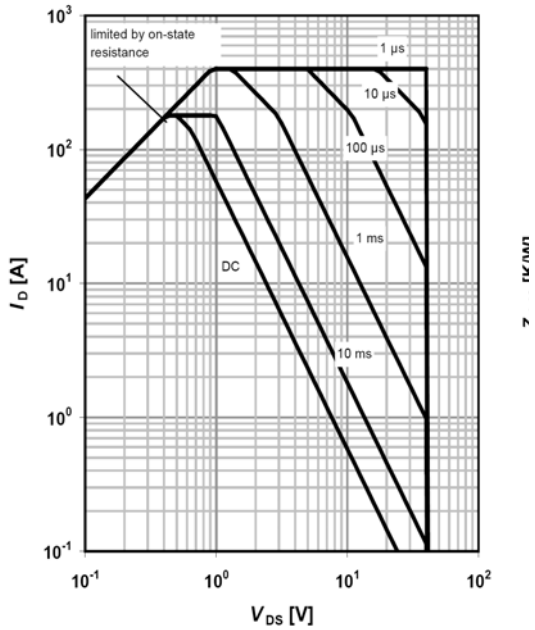
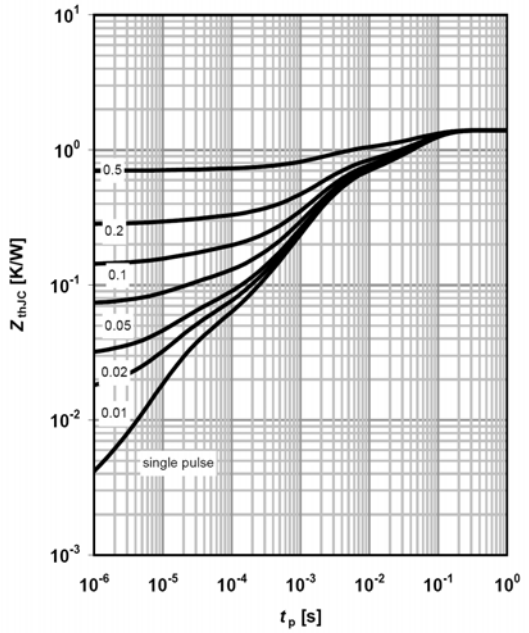
3 Safe operating area T_C=25 °C	4 Max. transient thermal impedance
	
I_D=f(V_{DS}); T_j=25 °C; D=0; parameter: T_p	$Z_{(thJC)}$=f(t_p); parameter: D=t_p/T

Table 10

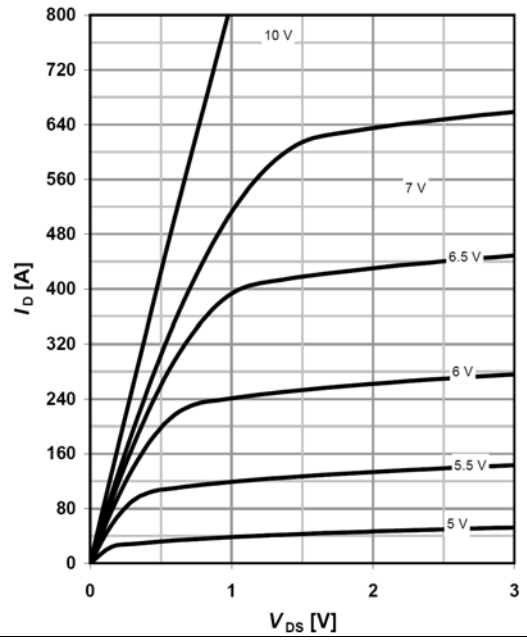
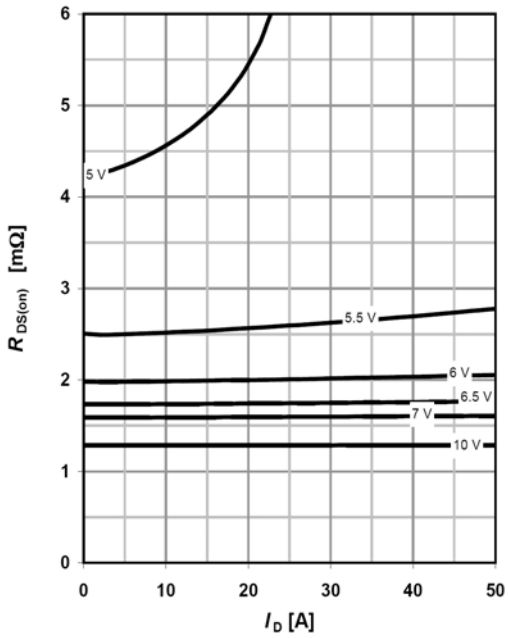
5 Typ. output characteristics T_C=25 °C	6 Typ. drain-source on-state resistance
	
I_D=f(V_{DS}); T_j=25 °C; parameter: V_{GS}	$R_{DS(on)}$=f(I_D); T_j=25 °C; parameter: V_{GS}

Table 11

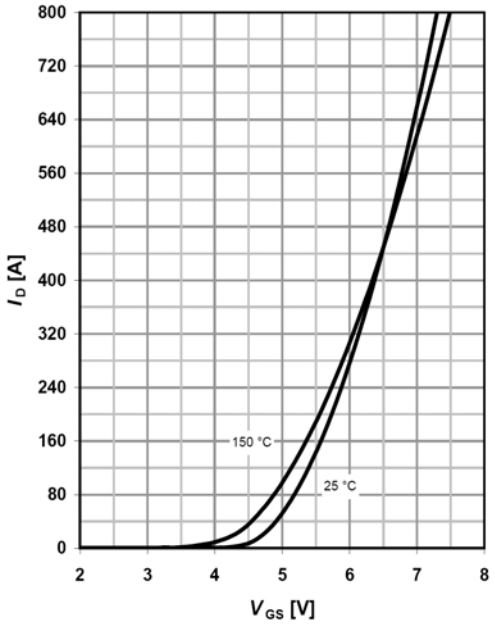
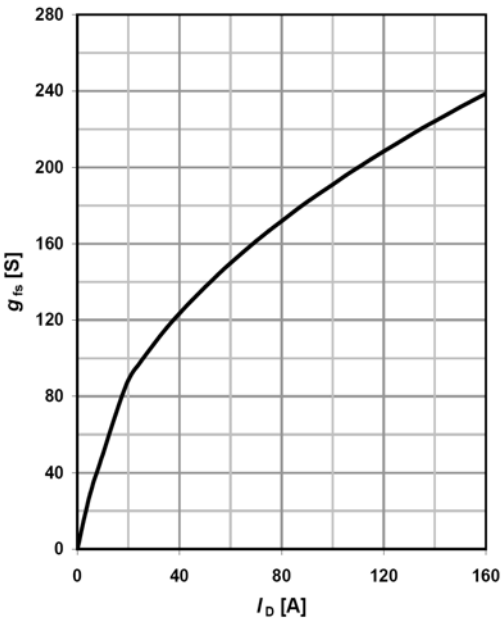
7 Typ. transfer characteristics	8 Typ. forward transconductance
	
I_D=f(VGS); |V_{DS}|>2|I_D|$R_{DS(on)max}$	g_{fs}=f(I_D); T_j=25 °C

Table 12

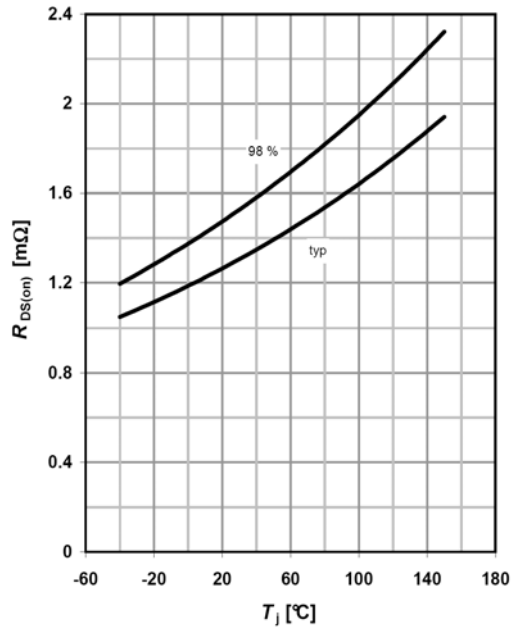
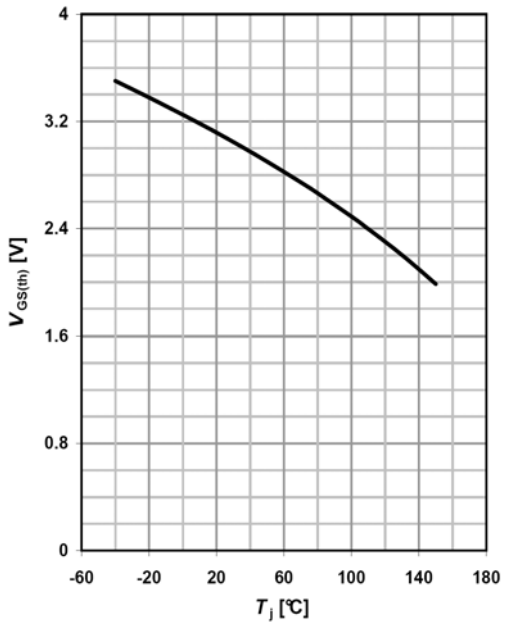
9 Drain-source on-state resistance	10 Typ. gate threshold voltage
	
$R_{DS(on)}=f(T_j)$; I_D=30 A; V_{GS}=10 V	$V_{GS(th)}=f(T_j)$; $V_{GS}=V_{DS}$; I_D=250 µA

Table 13

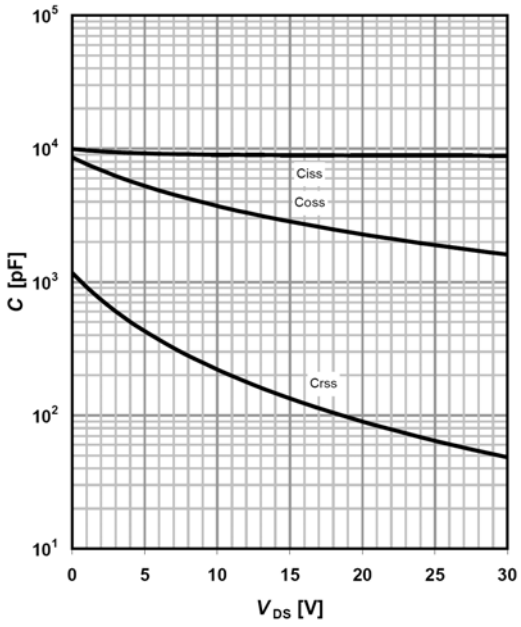
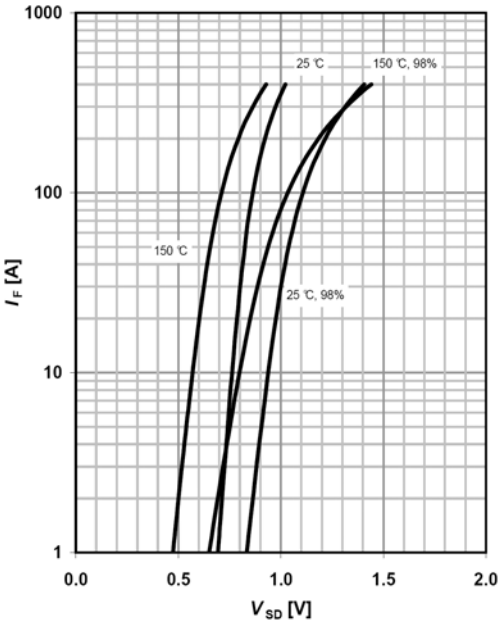
11 Typ. capacitances	12 Forward characteristics of reverse diode
	
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz	$I_F=f(V_{SD})$; parameter: T_j

Table 14

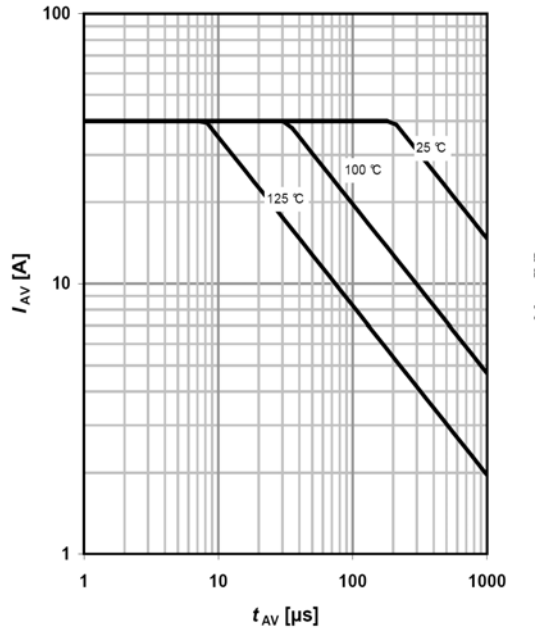
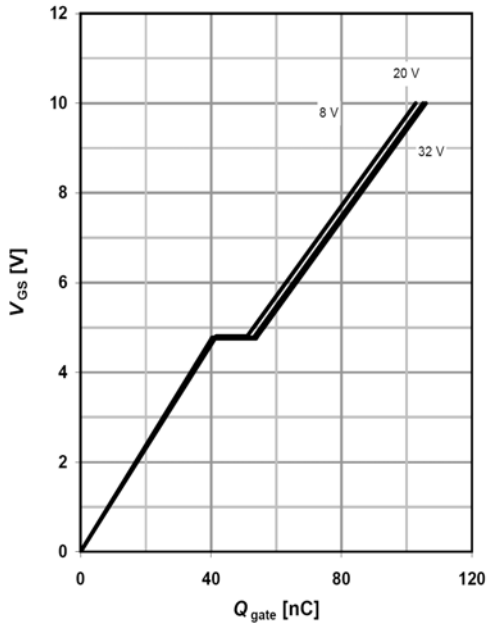
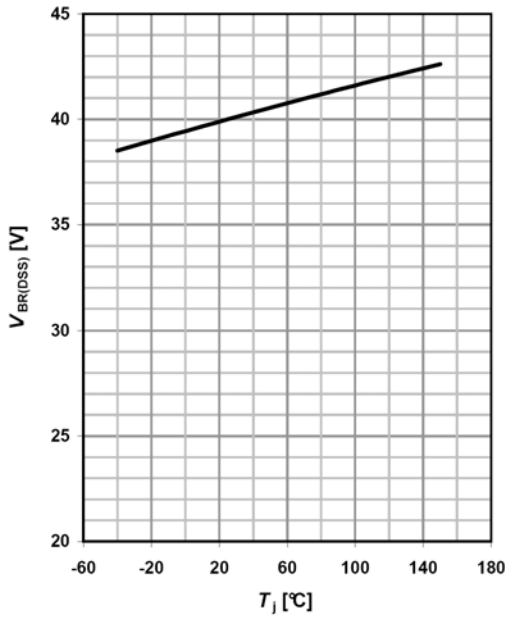
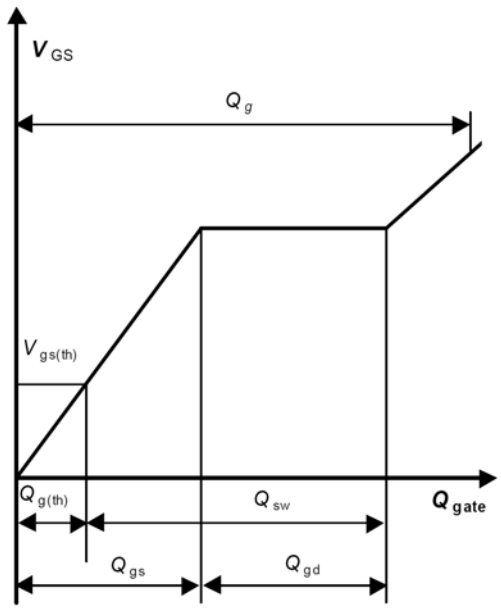
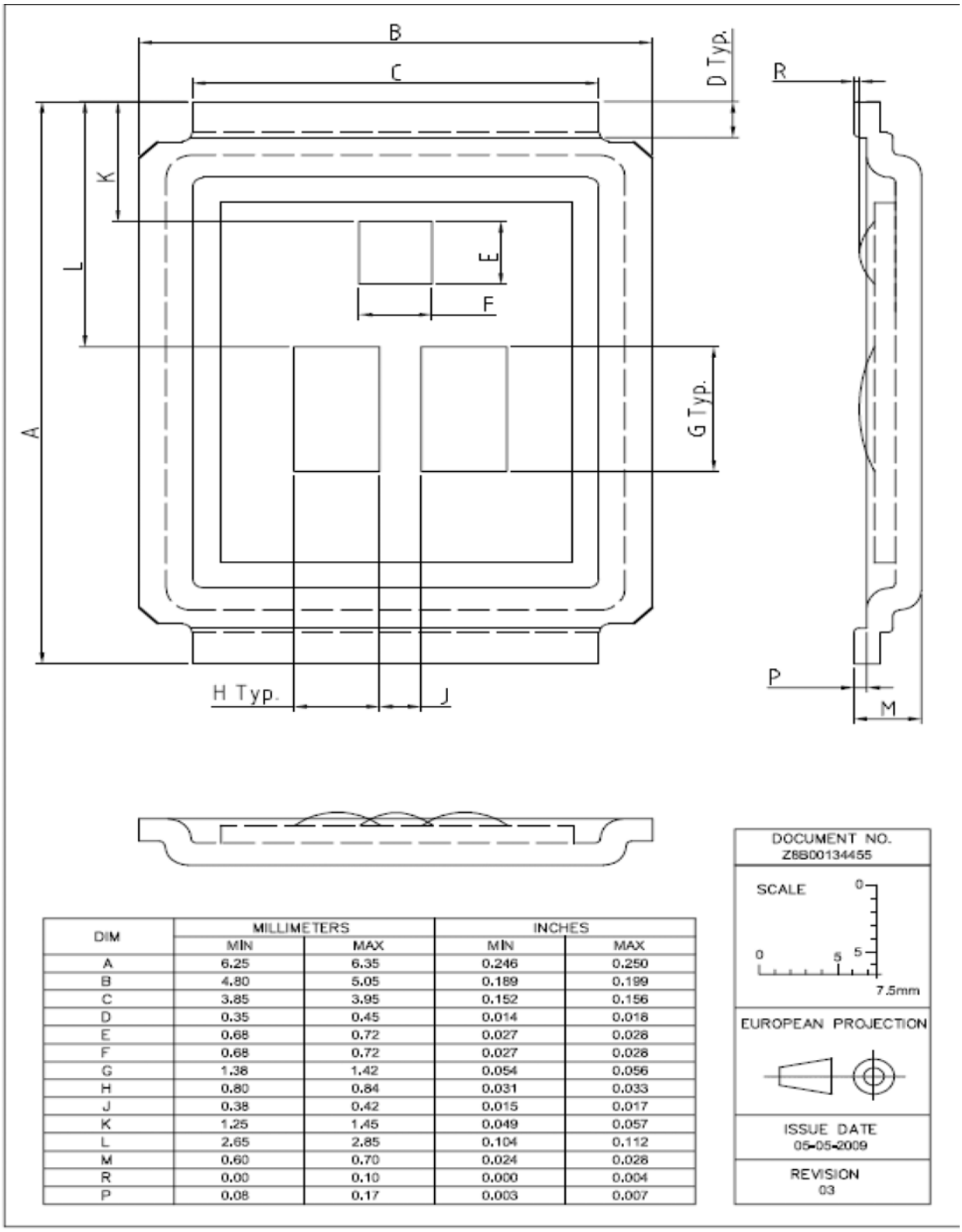
13 Avalanche characteristics	14 Typ. gate charge
	
I_{AS}=f(t_{AV}); R_{GS}=25 Ω; parameter: $T_{j(start)}$	V_{GS}=f(Q_{gate}); I_D=30 A pulsed; parameter: V_{DD}

Table 15

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

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

7 Package outlines

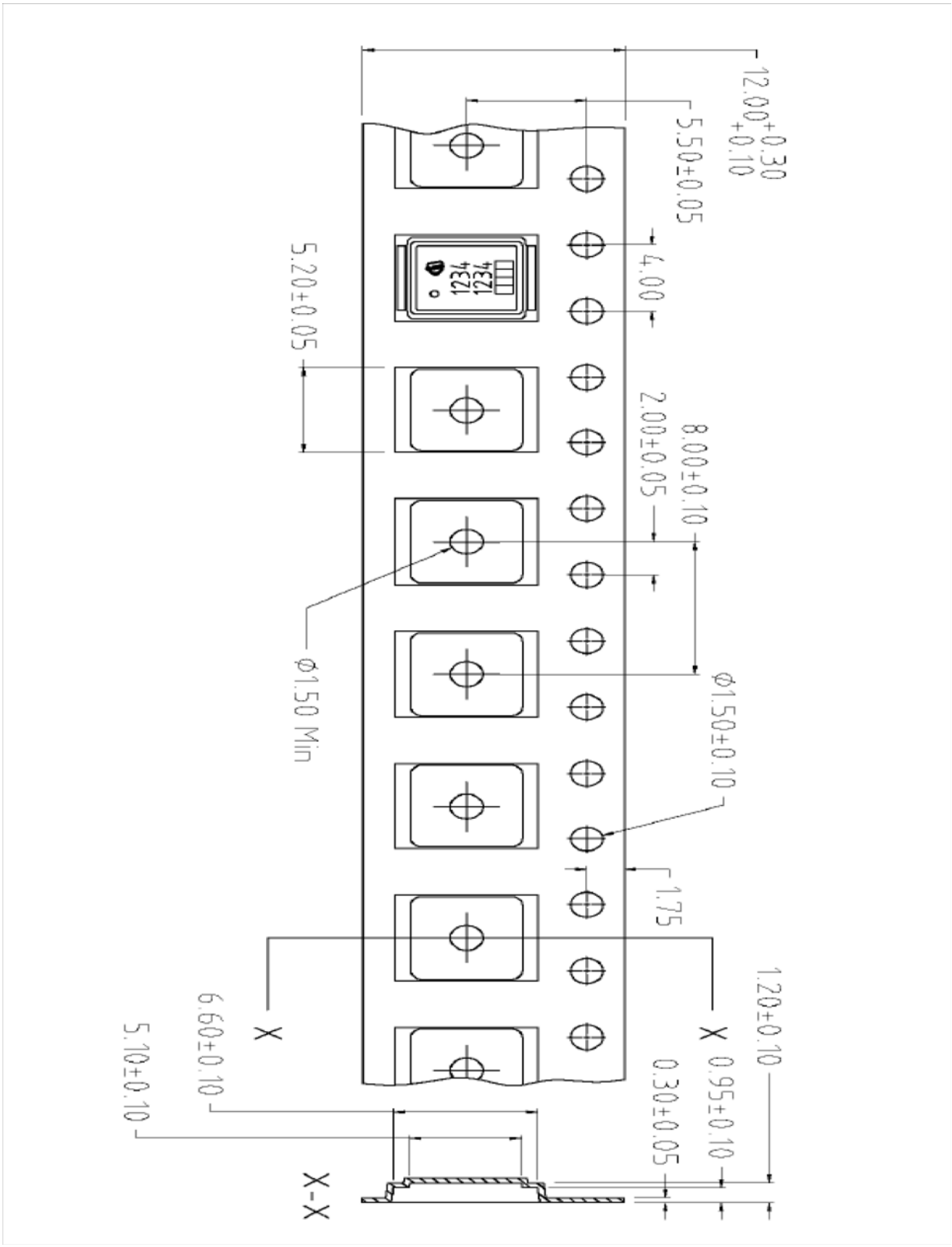


Figure 2 Outlines MG-WDSON-2, dimensions in mm/inches

8 Package outlines

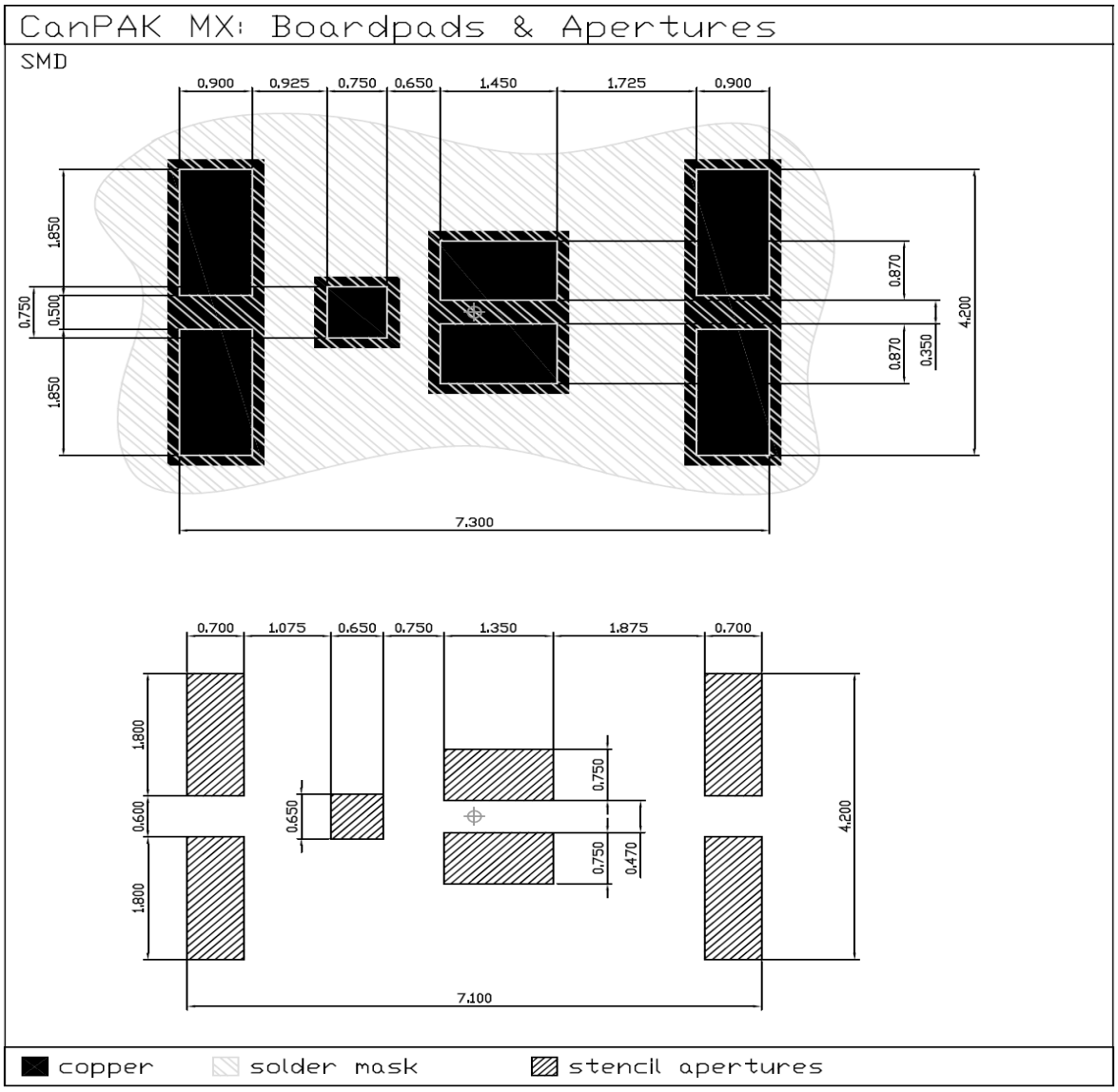
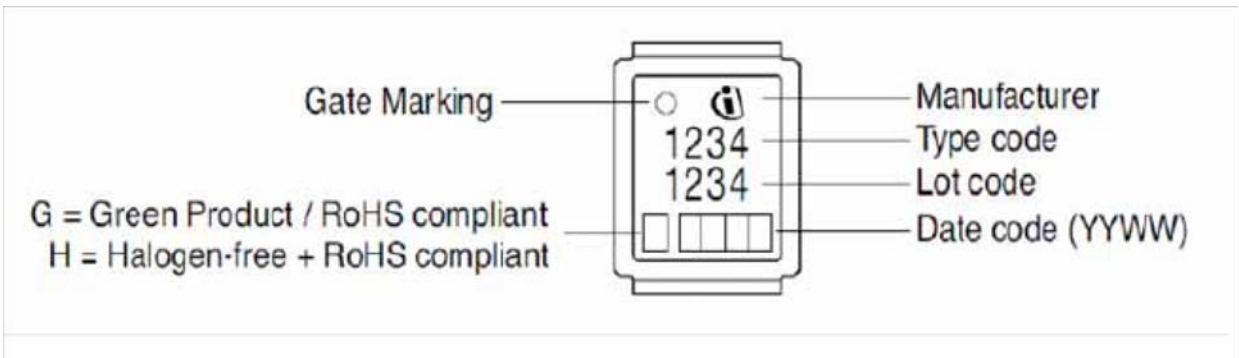


Figure 3 Outlines MG-WDSON-2, dimensions in mm/ Recommended stencil thickness 150µm

9 Marking layout



9 Revision History

Revision History: 2011-05-24, 2.4

Previous Revision:

Revision	Subjects (major changes since last revision)
0.1	Release of target data sheet
2.0	Release Final version
2.3	DirectFET Disclaimer expired
2.4	Insert Marking layout

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