

OptiMOS™ Power-MOSFET

Features

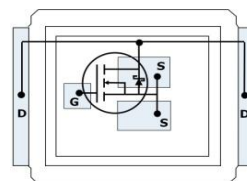
- Optimized SyncFET for high performance Buck converter
- Integrated monolithic Schottky like diode
- Low profile (<0.7 mm)
- 100% avalanche tested
- 100% R_G Tested
- Double-sided cooling
- Compatible with DirectFET® package MX footprint and outline ¹⁾
- Qualified according to JEDEC ²⁾ for target applications
- Pb-free lead plating; RoHS compliant



Product Summary

V_{DS}	25	V
$R_{DS(on),max}$	1.3	mΩ
I_D	163	A
Q_{oss}	39	nC
$Q_g(0V..10V)$	62	nC

CanPAK™ M
MG-WDSO-2



Type	Package	Outline	Marking
BSB013NE2LXI	MG-WDSO-2	MX	02E2

Maximum ratings, at $T_J=25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Continuous drain current	I_D	$V_{GS}=10\text{ V}$, $T_C=25\text{ °C}$	163	A
		$V_{GS}=10\text{ V}$, $T_C=100\text{ °C}$	103	
		$V_{GS}=10\text{ V}$, $T_A=25\text{ °C}$, $R_{thJA}=45\text{ K/W}^{3)}$	36	
Pulsed drain current ⁴⁾	$I_{D,pulse}$	$T_C=25\text{ °C}$	400	
Avalanche current, single pulse ⁵⁾	I_{AS}	$T_C=25\text{ °C}$	40	
Avalanche energy, single pulse	E_{AS}	$I_D=40\text{ A}$, $R_{GS}=25\text{ Ω}$	130	mJ
Gate source voltage	V_{GS}		±20	V

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

²⁾ J-STD20 and JESD22

³⁾ 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.

⁴⁾ See figure 3 for more detailed information

⁵⁾ See figure 13 for more detailed information

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

Parameter	Symbol	Conditions	Value	Unit
Power dissipation	P_{tot}	$T_C=25\text{ °C}$	57	W
		$T_A=25\text{ °C}$, $R_{\text{thJA}}=45\text{ K/W}$	2.8	
Operating and storage temperature	T_j, T_{stg}		-40 ... 150	°C
IEC climatic category; DIN IEC 68-1				

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Thermal characteristics

Thermal resistance, junction - case	R_{thJC}	bottom	-	1.0	-	K/W
		top	-	-	2.2	
Device on PCB	R_{thJA}	6 cm ² cooling area ³⁾	-	-	45	

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

Static characteristics

Drain-source breakdown voltage	$V_{(\text{BR})\text{DSS}}$	$V_{\text{GS}}=0\text{ V}$, $I_{\text{D}}=10\text{ mA}$	25	-	-	V
Breakdown voltage temperature coeff	$\frac{dV_{(\text{BR})\text{DSS}}}{dT_j}$	$I_{\text{D}}=10\text{ mA}$, referenced to 25 °C	-	15	-	mV/K
Gate threshold voltage	$V_{\text{GS(th)}}$	$V_{\text{DS}}=V_{\text{GS}}$, $I_{\text{D}}=250\text{ }\mu\text{A}$	1.2	-	2	V
Zero gate voltage drain current	I_{DSS}	$V_{\text{DS}}=20\text{ V}$, $V_{\text{GS}}=0\text{ V}$, $T_j=25\text{ °C}$	-	25	500	μA
		$V_{\text{DS}}=20\text{ V}$, $V_{\text{GS}}=0\text{ V}$, $T_j=125\text{ °C}$	-	4	-	mA
Gate-source leakage current	I_{GSS}	$V_{\text{GS}}=20\text{ V}$, $V_{\text{DS}}=0\text{ V}$	-	10	100	nA
Drain-source on-state resistance	$R_{\text{DS(on)}}$	$V_{\text{GS}}=4.5\text{ V}$, $I_{\text{D}}=30\text{ A}$	-	1.4	1.8	m Ω
		$V_{\text{GS}}=10\text{ V}$, $I_{\text{D}}=30\text{ A}$	-	1.1	1.3	
Gate resistance	R_{G}		0.3	0.6	1.2	Ω
Transconductance	g_{fs}	$ V_{\text{DS}} >2 I_{\text{D}} R_{\text{DS(on)max}}$, $I_{\text{D}}=30\text{ A}$	85	170	-	S

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	

Dynamic characteristics

Input capacitance	C_{iss}	$V_{GS}=0\text{ V}, V_{DS}=12\text{ V},$ $f=1\text{ MHz}$	-	4400	5900	pF
Output capacitance	C_{oss}		-	1900	2500	
Reverse transfer capacitance	C_{rss}		-	190	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=12\text{ V}, V_{GS}=10\text{ V},$ $I_D=30\text{ A}, R_G=1.6\ \Omega$	-	5.4	-	ns
Rise time	t_r		-	6.4	-	
Turn-off delay time	$t_{d(off)}$		-	32	-	
Fall time	t_f		-	4.8	-	

Gate Charge Characteristics⁶⁾

Gate to source charge	Q_{gs}	$V_{DD}=12\text{ V}, I_D=30\text{ A},$ $V_{GS}=0\text{ to }4.5\text{ V}$	-	10.5	14.0	nC
Gate charge at threshold	$Q_{g(th)}$		-	7.1	9.4	
Gate to drain charge	Q_{gd}		-	7.3	10.9	
Switching charge	Q_{sw}		-	10.7	15.5	
Gate charge total	Q_g		-	30	40	
Gate plateau voltage	$V_{plateau}$		-	2.4	-	V
Gate charge total	Q_g	$V_{DD}=12\text{ V}, I_D=30\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	62	83	nC
Gate charge total, sync. FET	$Q_{g(sync)}$	$V_{DS}=0.1\text{ V},$ $V_{GS}=0\text{ to }4.5\text{ V}$	-	26	35	
Output charge	Q_{oss}	$V_{DD}=12\text{ V}, V_{GS}=0\text{ V}$	-	39	52	

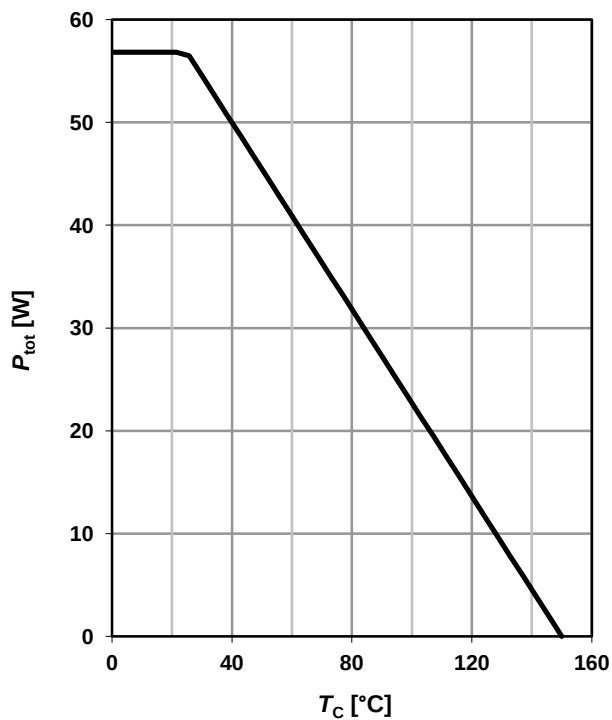
Reverse Diode

Diode continuous forward current	I_S	$T_C=25\text{ °C}$	-	-	57	A
Diode pulse current	$I_{S,pulse}$		-	-	228	
Diode forward voltage	V_{SD}	$V_{GS}=0\text{ V}, I_F=12\text{ A},$ $T_J=25\text{ °C}$	-	0.55	0.7	V
Reverse recovery charge	Q_{rr}	$V_R=15\text{ V}, I_F=I_S,$ $di_F/dt=400\text{ A}/\mu\text{s}$	-	5	-	nC

⁶⁾ See figure 16 for gate charge parameter definition

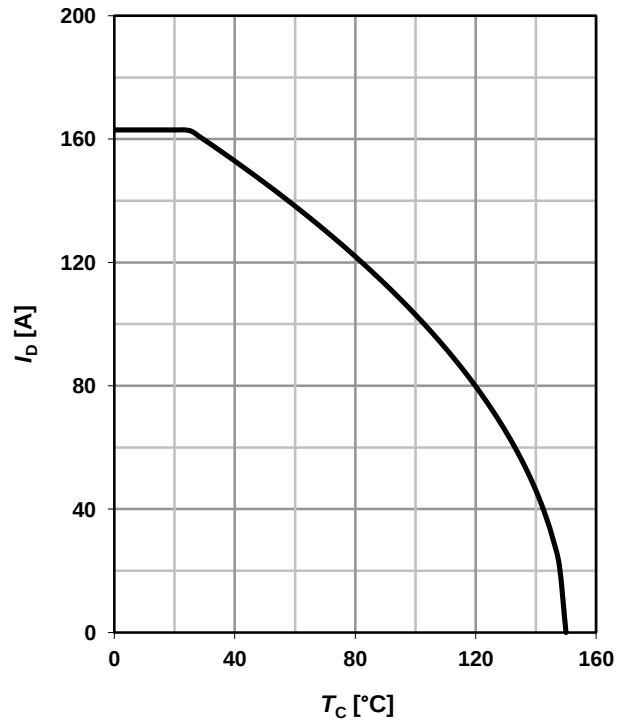
1 Power dissipation

$$P_{\text{tot}} = f(T_C)$$



2 Drain current

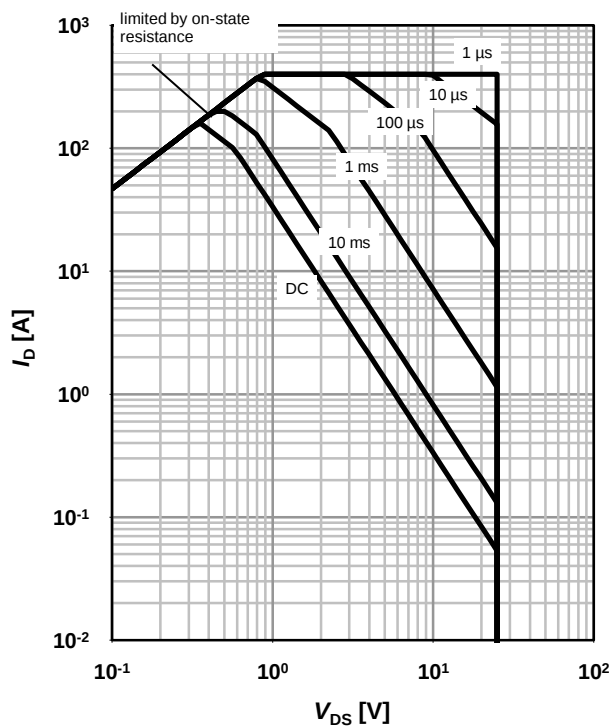
$$I_D = f(T_C); V_{GS} \geq 10 \text{ V}$$



3 Safe operating area

$$I_D = f(V_{DS}); T_C = 25^\circ\text{C}; D = 0$$

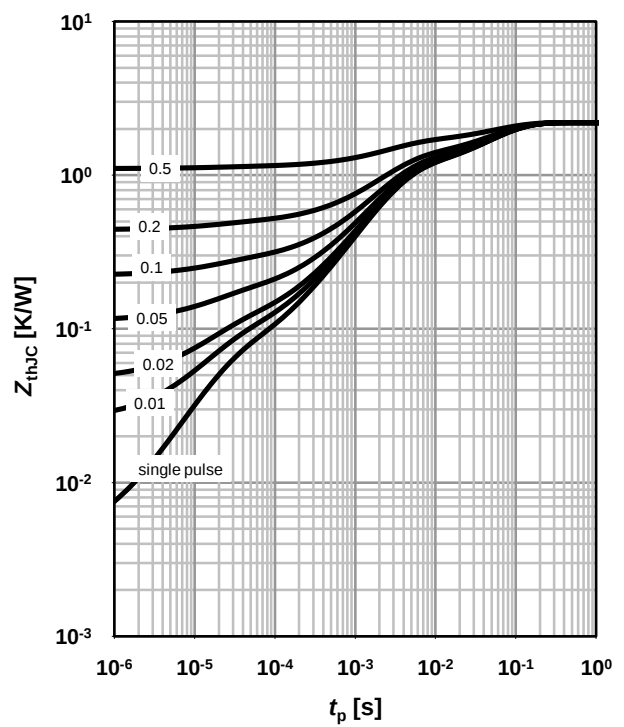
parameter: t_p



4 Max. transient thermal impedance

$$Z_{\text{thJC}} = f(t_p)$$

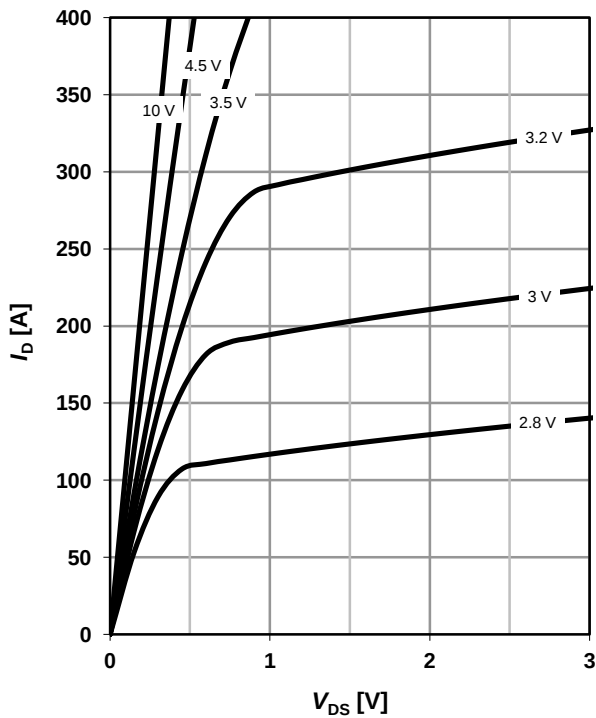
parameter: $D = t_p/T$



5 Typ. output characteristics

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

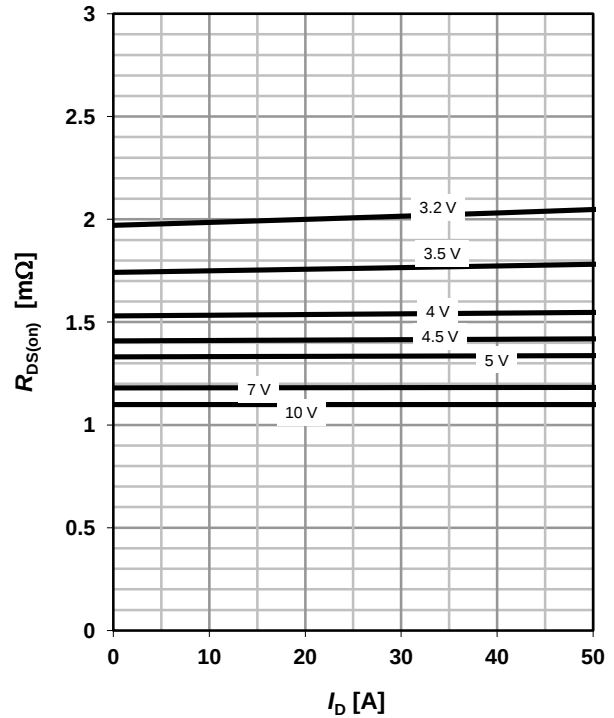
parameter: V_{GS}



6 Typ. drain-source on resistance

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

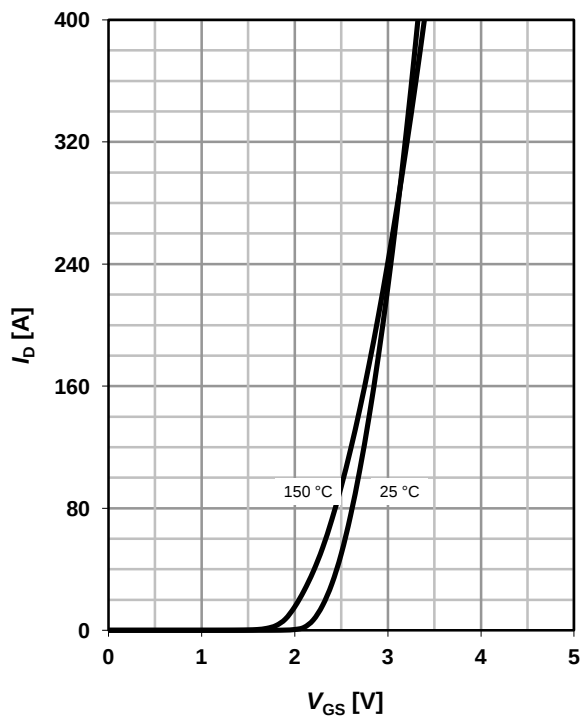
parameter: V_{GS}



7 Typ. transfer characteristics

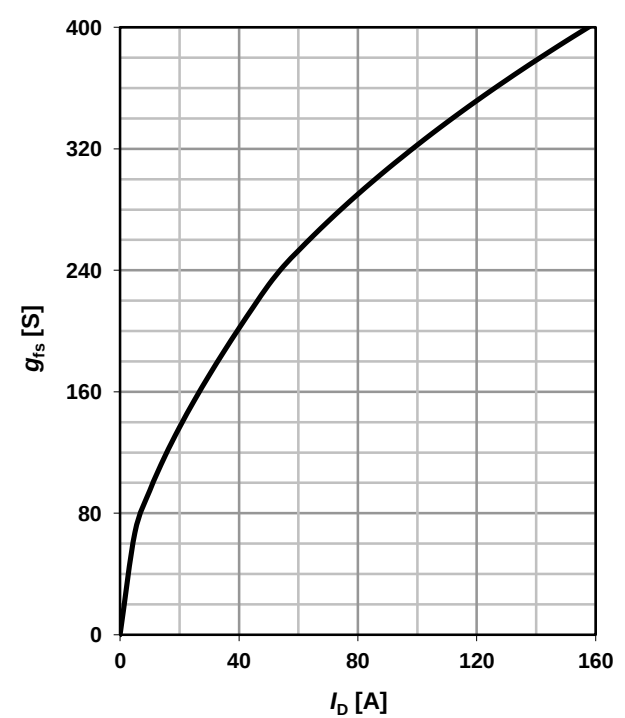
$$I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)\max}$$

parameter: T_j



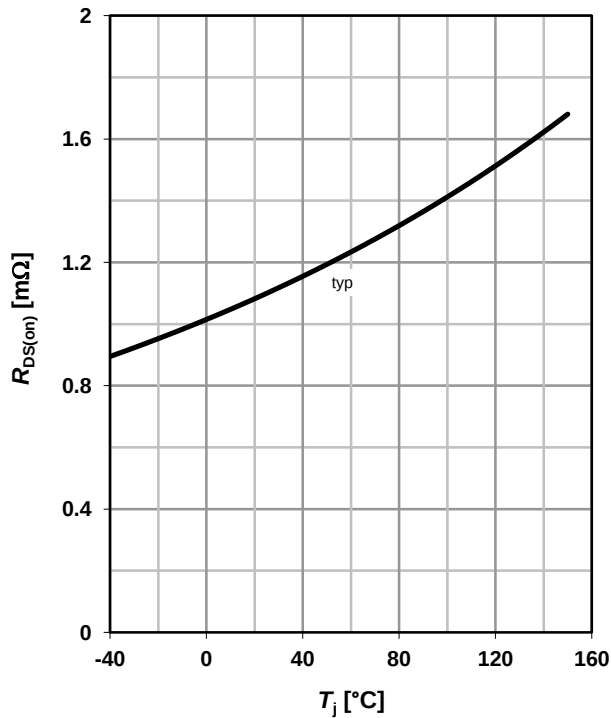
8 Typ. forward transconductance

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



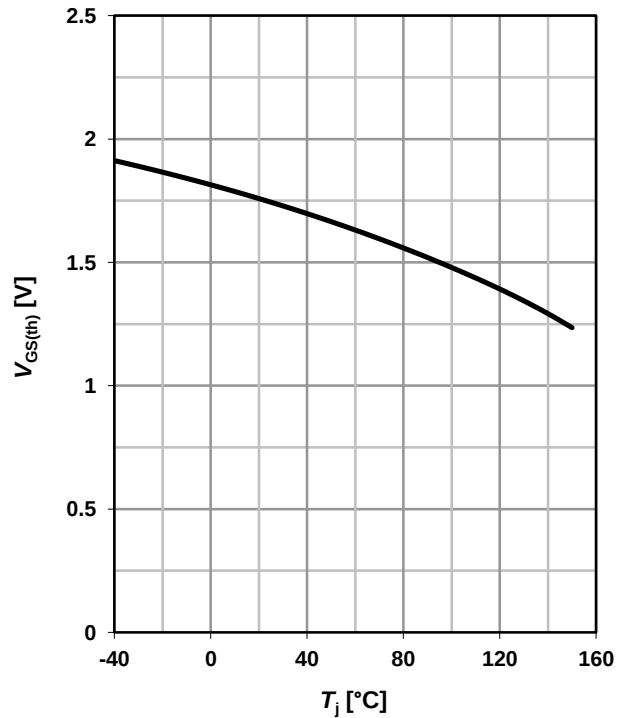
9 Drain-source on-state resistance

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



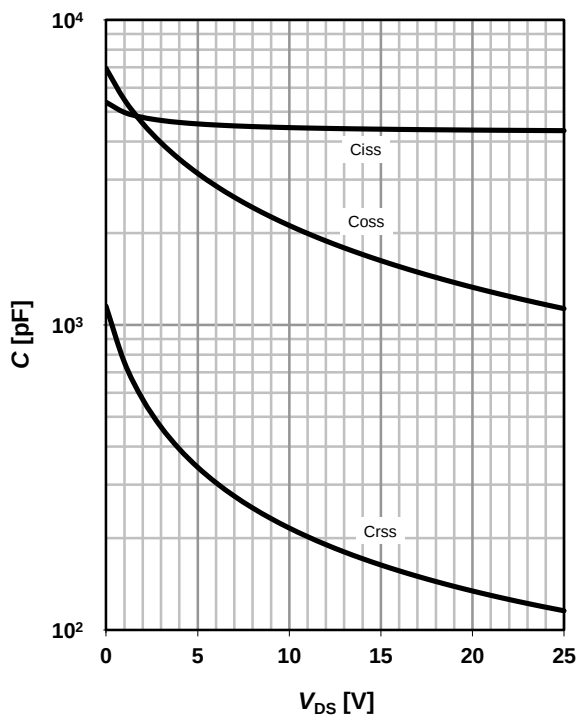
10 Typ. gate threshold voltage

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



11 Typ. capacitances

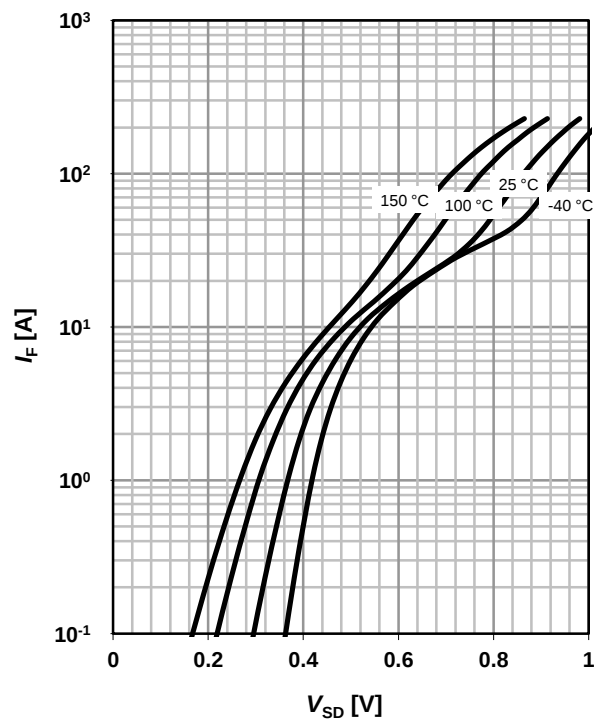
$$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$$



12 Forward characteristics of reverse diode

$$I_F = f(V_{SD})$$

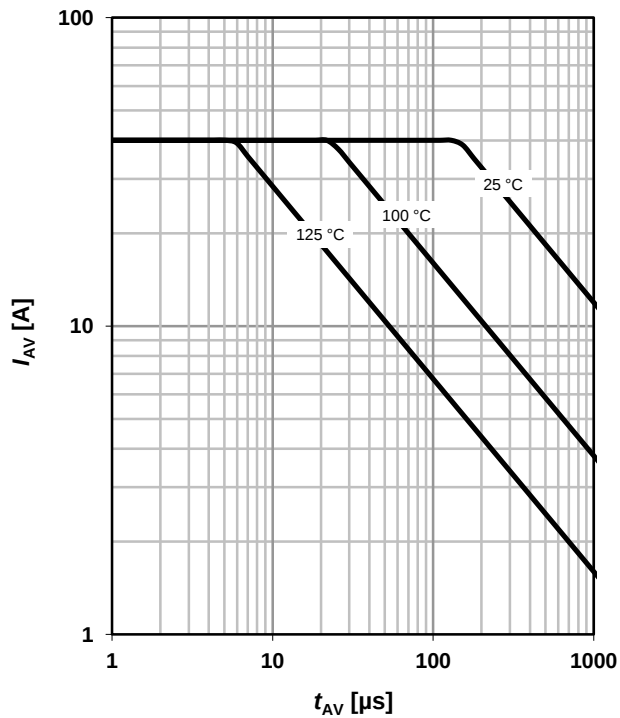
parameter: T_j



13 Avalanche characteristics

$$I_{AS}=f(t_{AV}); R_{GS}=25\ \Omega$$

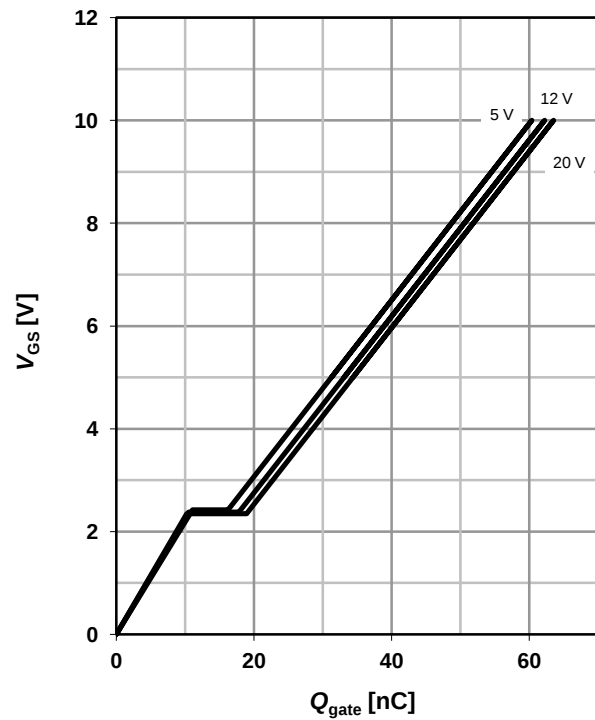
parameter: $T_{j(\text{start})}$



14 Typ. gate charge

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

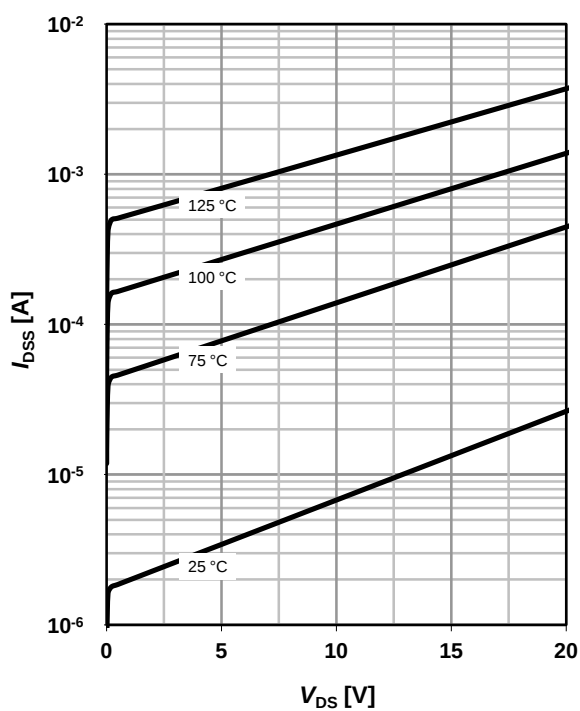
parameter: V_{DD}



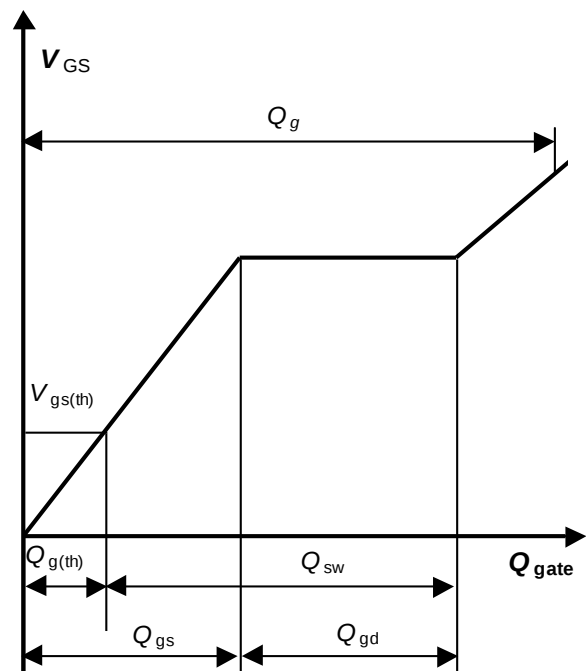
15 Typ. Drain-source leakage current

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

parameter: T_j

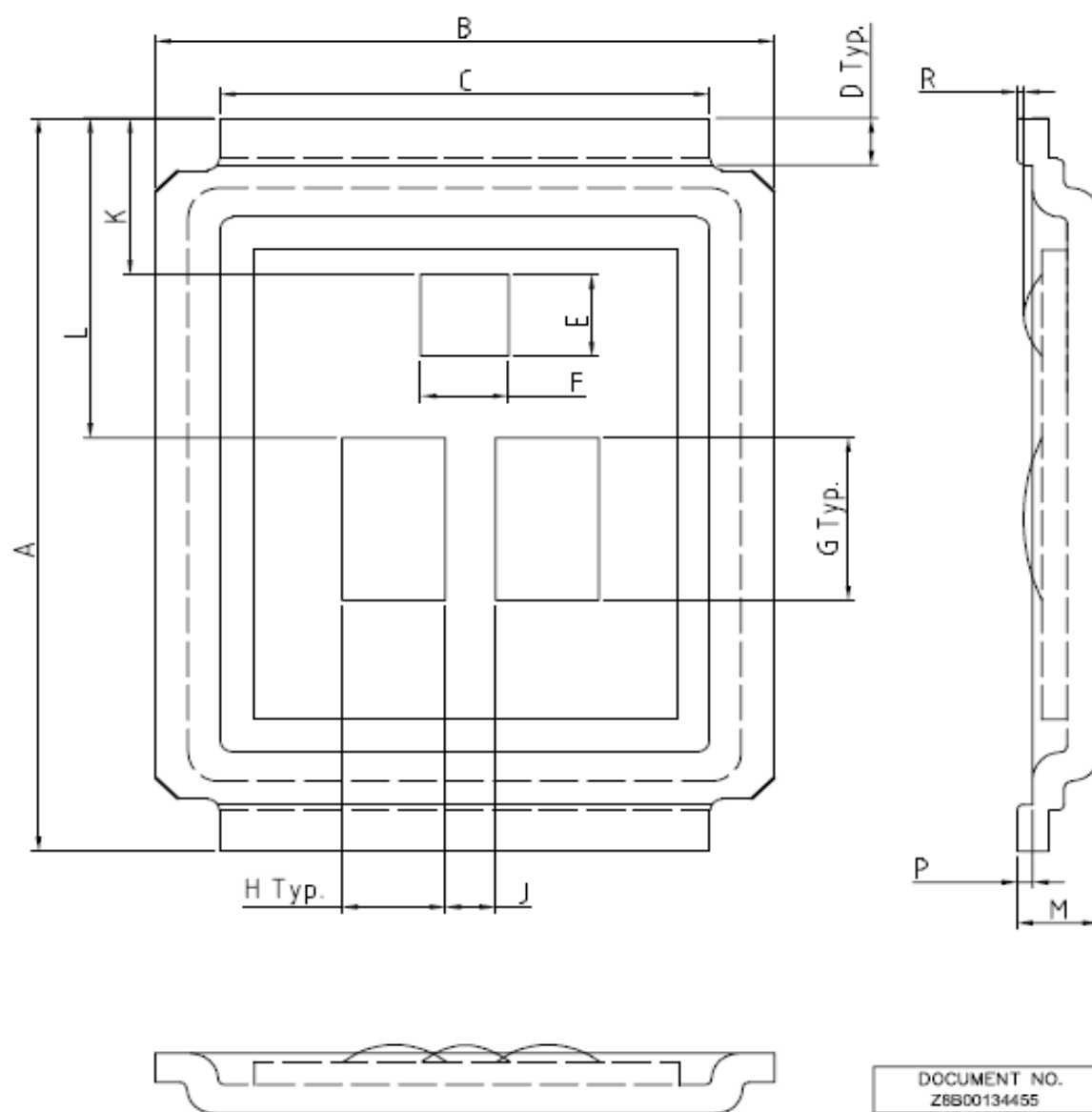


16 Gate charge waveforms



Package Outline

MG-WDSO-2

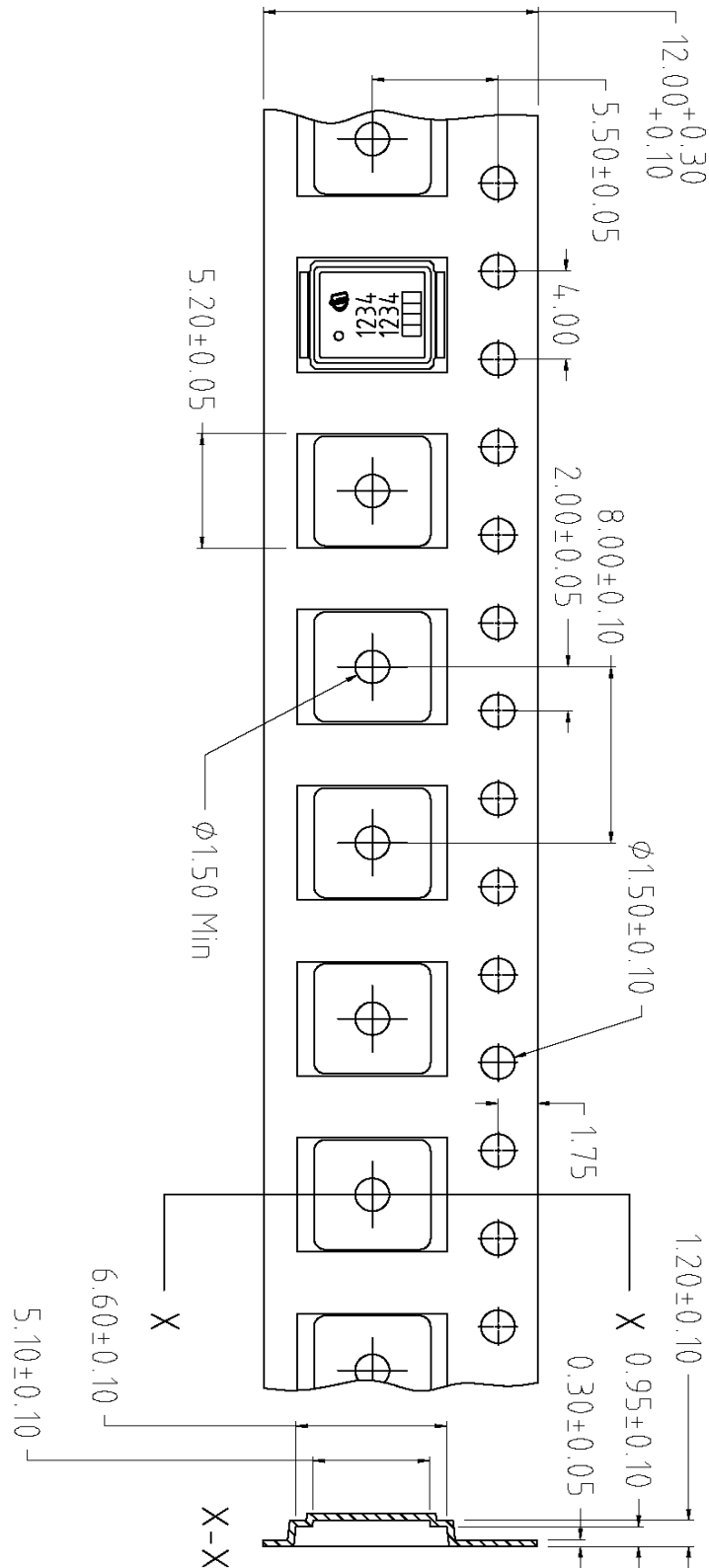


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	6.25	6.35	0.246	0.250
B	4.80	5.05	0.189	0.199
C	3.85	3.95	0.152	0.156
D	0.35	0.45	0.014	0.018
E	0.68	0.72	0.027	0.028
F	0.68	0.72	0.027	0.028
G	1.38	1.42	0.054	0.056
H	0.80	0.84	0.031	0.033
J	0.38	0.42	0.015	0.017
K	1.25	1.45	0.049	0.057
L	2.65	2.85	0.104	0.112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

DOCUMENT NO. Z8B00134455	
SCALE	0 5 5 7.5mm
EUROPEAN PROJECTION	
	
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REVISION 03	

Package Outline

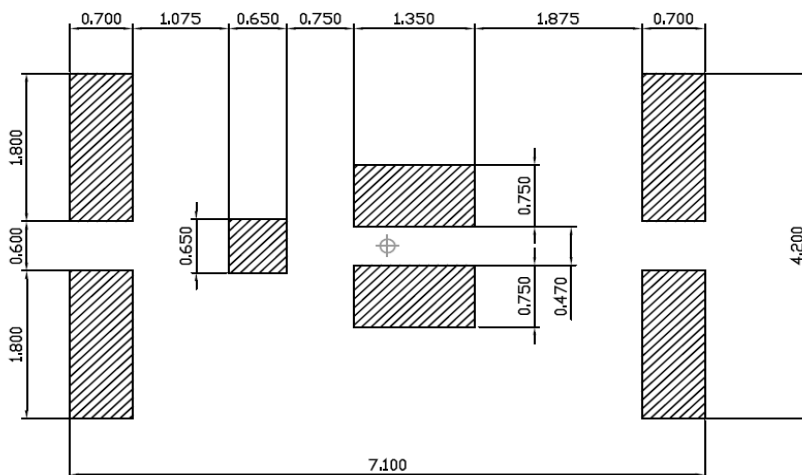
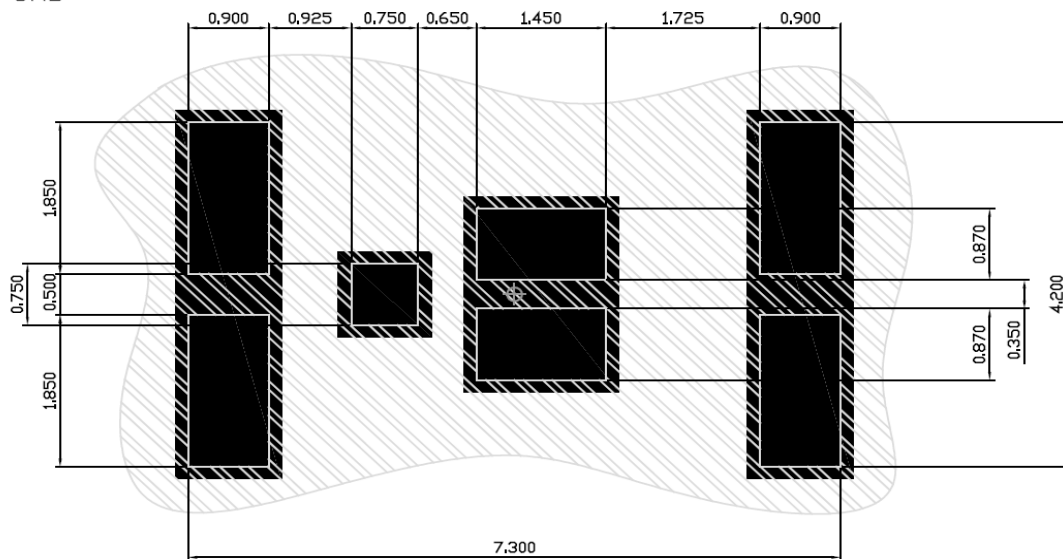
MG-WDSO-2



Dimensions in mm

CanPAK MX: Boardpads & Apertures

SMD

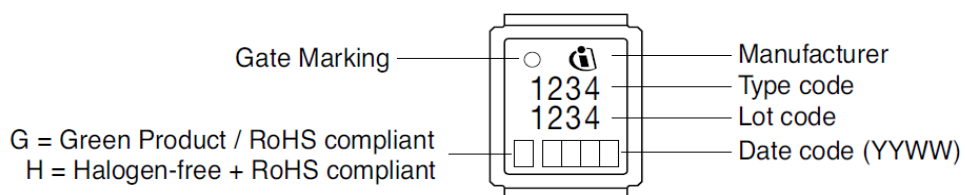


■ copper □ solder mask ▨ stencil apertures

Dimensions in mm

Recommended stencil thickness 150 µm

Marking Layout



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