NX138BKVL Datasheet

https://www.DiGi-Electronics.com

DiGi Electronics Part Number	NX138BKVL-DG
Manufacturer	Nexperia USA Inc.
Manufacturer Product Number	NX138BKVL
Description	MOSFET N-CH 60V 265MA TO236AB
Detailed Description	N-Channel 60 V 265mA (Ta) 310mW (Ta) Surface Mount TO-236AB

Purchase and inquiry

Manufacturer Product Number:	Manufacturer:
NX138BKVL	Nexperia USA Inc.
Series:	Product Status:
TrenchMOS™	Active
FET Type:	Technology:
N-Channel	MOSFET (Metal Oxide)
Drain to Source Voltage (Vdss):	Current - Continuous Drain (Id) @ 25°C:
60 V	265mA (Ta)
Drive Voltage (Max Rds On, Min Rds On):	Rds On (Max) @ Id, Vgs:
2.5V, 10V	3.5Ohm @ 200mA, 10V
Vgs(th) (Max) @ Id:	Gate Charge (Qg) (Max) @ Vgs:
1.5V @ 250µA	0.49 nC @ 30 V
Vgs (Max):	Input Capacitance (Ciss) (Max) @ Vds:
±20V	20.2 pF @ 30 V
FET Feature:	Power Dissipation (Max):
-	310mW (Ta)
Operating Temperature:	Mounting Type:
-55°C ~ 150°C (TJ)	Surface Mount
Supplier Device Package:	Package / Case:
TO-236AB	TO-236-3, SC-59, SOT-23-3
Base Product Number:	
NX138	

Environmental & Export classification

RoHS Status:	Moisture Sensitivity Level (MSL):
ROHS3 Compliant	1 (Unlimited)
REACH Status:	ECCN:
REACH Unaffected	EAR99
HTSUS:	
8541.21.0095	

NX138BK

60 V, single N-channel Trench MOSFET

29 January 2016 — Product data sheet

1. General description

N-channel enhancement mode Field-Effect Transistor (FET) in a small SOT23 (TO-236AB) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

2. Features and benefits

- Low threshold voltage
- Very fast switching
- Trench MOSFET technology
- ElectroStatic Discharge (ESD) protection > 2 kV HBM

3. Applications

- Relay driver
- High-speed line driver
- Low-side loadswitch
- Switching circuits

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DS}	drain-source voltage	T_j = 25 °C		-	-	60	V
V_{GS}	gate-source voltage			-20	-	20	V
I_D	drain current	V_{GS} = 10 V; T_{amb} = 25 °C	[1]	-	-	265	mA
Static characteristics							
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 200 mA; T_j = 25 °C		-	2.1	3.5	Ω

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 1 cm^2.

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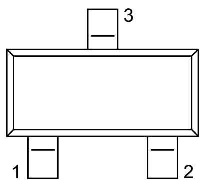
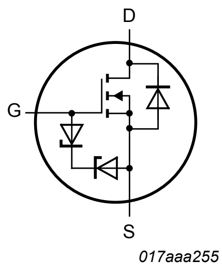
5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 TO-236AB (SOT23)	
2	S	source		
3	D	drain		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
NX138BK	TO-236AB	plastic surface-mounted package; 3 leads	SOT23

7. Marking

Table 4. Marking codes

Type number	Marking code [1]
NX138BK	BX%

[1] % = placeholder for manufacturing site code

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	T_j = 25 °C		-	60	V
V_{GS}	gate-source voltage			-20	20	V
I_D	drain current	V_{GS} = 10 V; T_{amb} = 25 °C	[1]	-	265	mA
		V_{GS} = 10 V; T_{amb} = 100 °C	[1]	-	170	mA
		V_{GS} = 10 V; T_{sp} = 25 °C		-	330	mA
I_{DM}	peak drain current	T_{amb} = 25 °C; single pulse; t_p ≤ 10 µs		-	0.9	A
P_{tot}	total power dissipation	T_{amb} = 25 °C	[2]	-	310	mW
			[1]	-	400	mW
		T_{sp} = 25 °C		-	1.67	W
T_j	junction temperature			-55	150	°C
T_{amb}	ambient temperature			-55	150	°C
T_{stg}	storage temperature			-65	150	°C
Source-drain diode						
I_S	source current	T_{amb} = 25 °C	[1]	-	200	mA

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 1 cm^2.

[2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

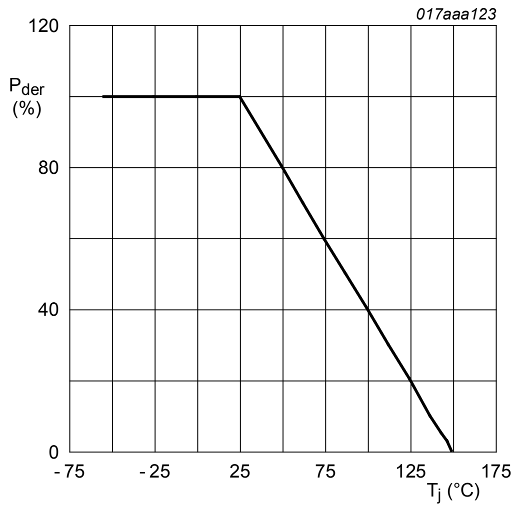


Fig. 1. Normalized total power dissipation as a function of junction temperature

$$P_{der} = \frac{P_{tot}}{P_{tot(25°C)}} \times 100\ \%$$

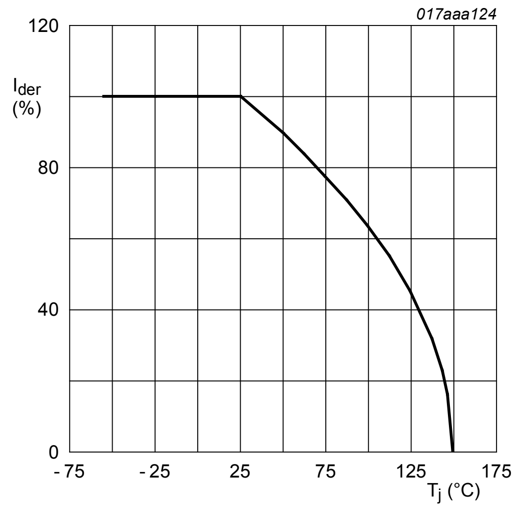
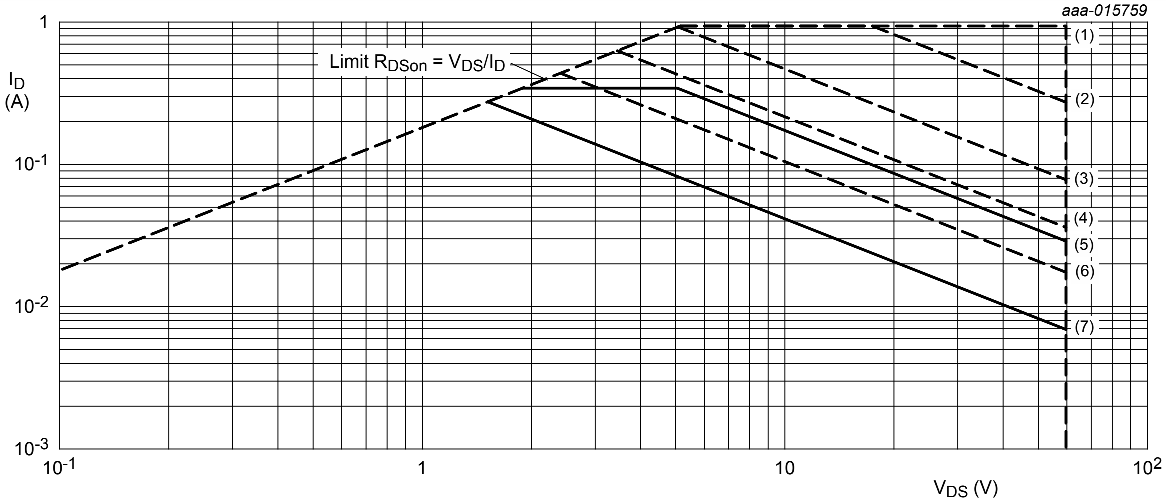


Fig. 2. Normalized continuous drain current as a function of junction temperature

$$I_{der} = \frac{I_D}{I_{D(25°C)}} \times 100\ \%$$



I_{DM} = single pulse

(1) t_p = 10 µs

(2) t_p = 100 µs

(3) t_p = 1 ms

(4) t_p = 10 ms

(5) DC; T_{sp} = 25 °C

(6) t_p = 100 ms

(7) DC; T_{amb} = 25 °C; drain mounting pad 1 cm^2

Fig. 3. Safe operating area; junction to ambient; continuous and peak drain currents as a function of drain-source voltage

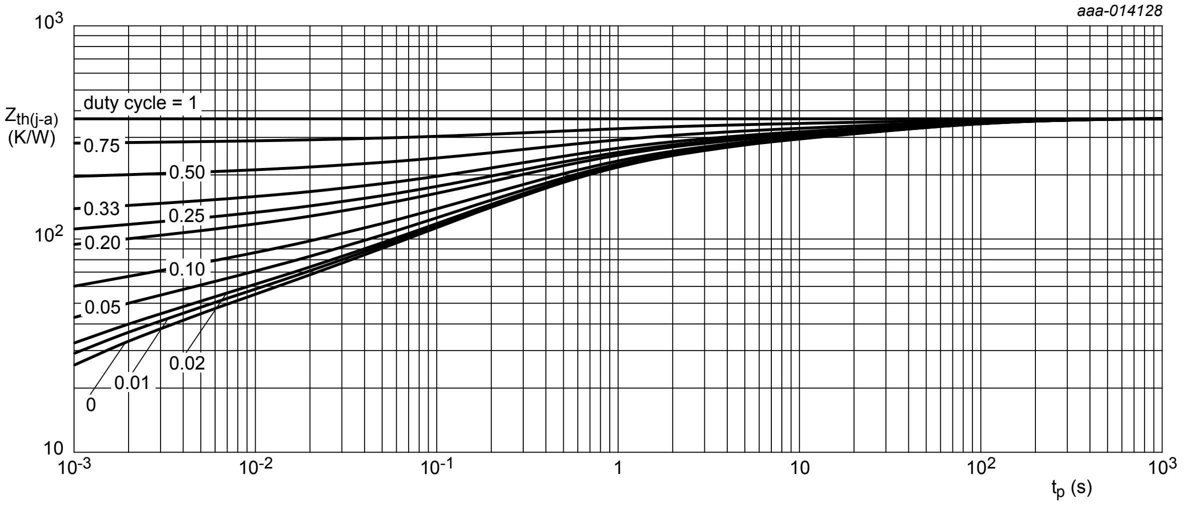
9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	350	400	K/W
			[2]	-	270	310	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	65	75	K/W

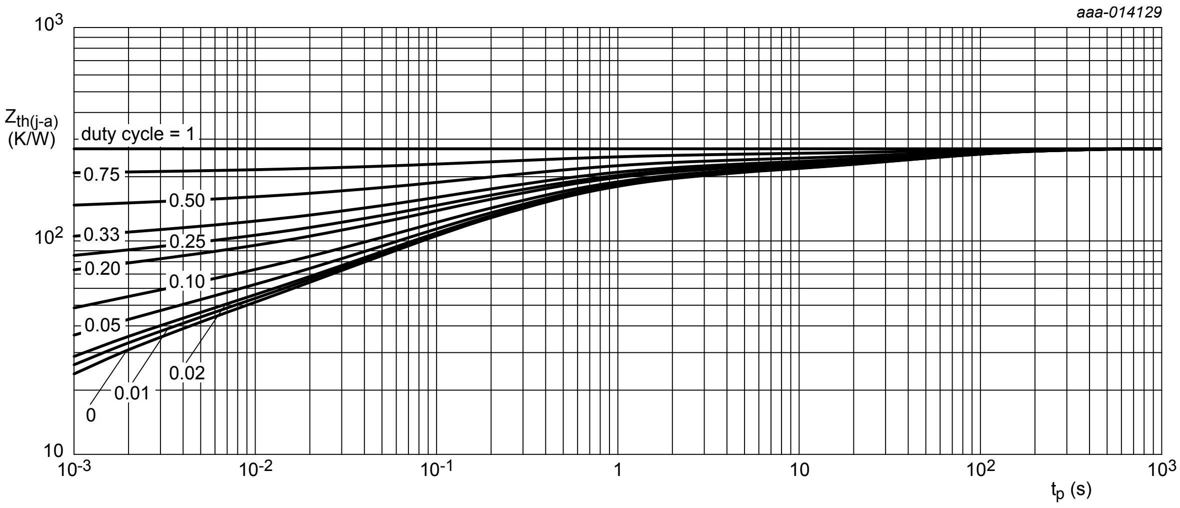
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated and mounting pad for drain 1 cm^2.



FR4 PCB, standard footprint

Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values



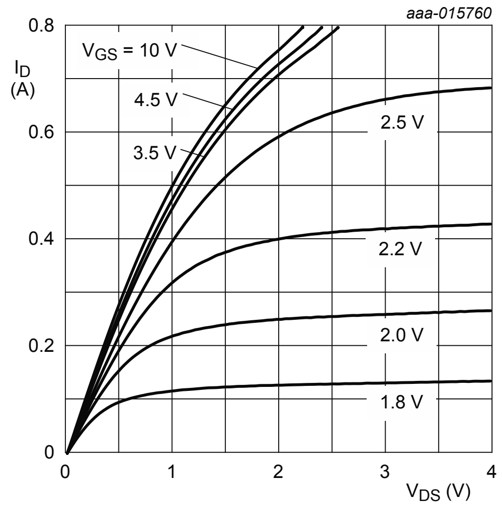
FR4 PCB, mounting pad for drain 1 cm^2

Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

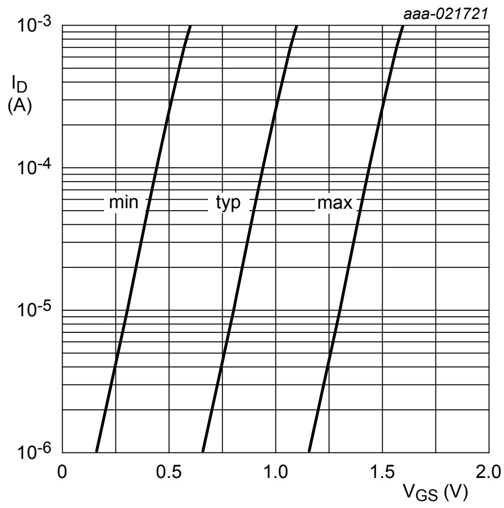
Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 μA; V_{GS} = 0 V; T_j = 25 °C		60	-	-	V
V_{GSth}	gate-source threshold voltage	I_D = 250 μA; V_{DS}=V_{GS}; T_j = 25 °C		0.5	1	1.5	V
I_{DSS}	drain leakage current	V_{DS} = 60 V; V_{GS} = 0 V; T_j = 25 °C		-	-	1	μA
I_{GSS}	gate leakage current	V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 °C		-	-	10	μA
		V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25 °C		-	-	-10	μA
		V_{GS} = 10 V; V_{DS} = 0 V; T_j = 25 °C		-	-	1	μA
		V_{GS} = -10 V; V_{DS} = 0 V; T_j = 25 °C		-	-	-1	μA
		V_{GS} = 5 V; V_{DS} = 0 V; T_j = 25 °C		-	-	0.3	μA
		V_{GS} = -5 V; V_{DS} = 0 V; T_j = 25 °C		-	-	-0.3	μA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 200 mA; T_j = 25 °C		-	2.1	3.5	Ω
		V_{GS} = 10 V; I_D = 200 mA; T_j = 150 °C		-	4.3	7.2	Ω
		V_{GS} = 5 V; I_D = 200 mA; T_j = 25 °C		-	2.2	3.8	Ω
		V_{GS} = 2.5 V; I_D = 75 mA; T_j = 25 °C		-	2.6	5	Ω
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 200 mA; T_j = 25 °C		-	0.71	-	S
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	V_{DS} = 30 V; I_D = 200 mA; V_{GS} = 4.5 V; T_j = 25 °C		-	0.49	-	nC
Q_{GS}	gate-source charge			-	0.12	-	nC
Q_{GD}	gate-drain charge			-	0.12	-	nC
C_{iss}	input capacitance	V_{DS} = 30 V; f = 1 MHz; V_{GS} = 0 V; T_j = 25 °C		-	20.2	-	pF
C_{oss}	output capacitance			-	3.1	-	pF
C_{rss}	reverse transfer capacitance			-	2	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 30 V; I_D = 200 mA; V_{GS} = 4.5 V; $R_{G(ext)}$ = 6 Ω; T_j = 25 °C		-	7.9	-	ns
t_r	rise time			-	8.4	-	ns
$t_{d(off)}$	turn-off delay time			-	12.5	-	ns
t_f	fall time			-	5.1	-	ns
Source-drain diode							
V_{SD}	source-drain voltage	I_S = 200 mA; V_{GS} = 0 V; T_j = 25 °C		-	0.86	1.2	V



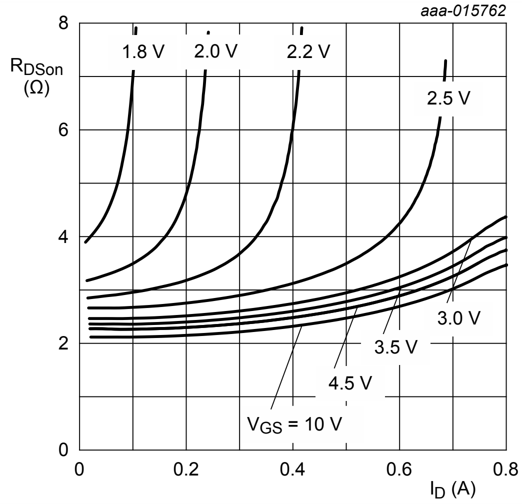
T_j = 25 °C

Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values



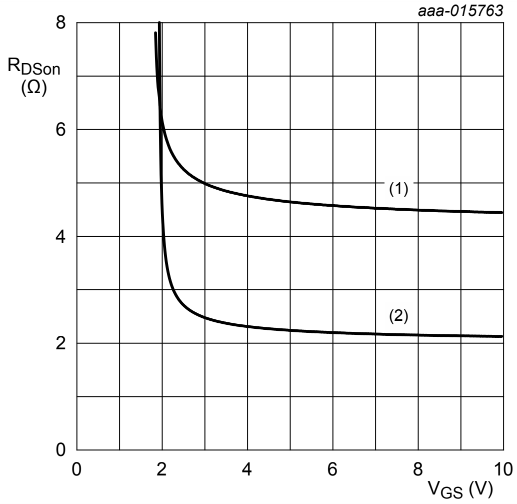
T_j = 25 °C; V_{DS} = 5 V

Fig. 7. Sub-threshold drain current as a function of gate-source voltage



T_j = 25 °C

Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

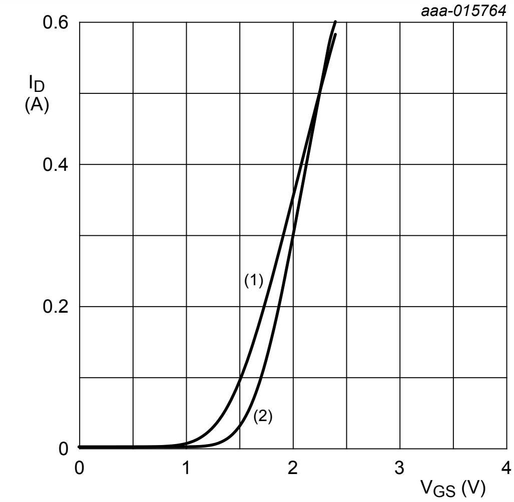


I_D = 0.2 A

(1) T_j = 150 °C

(2) T_j = 25 °C

Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values



$V_{DS} > I_D \times R_{DSon}$

(1) T_j = 150 °C

(2) T_j = 25 °C

Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

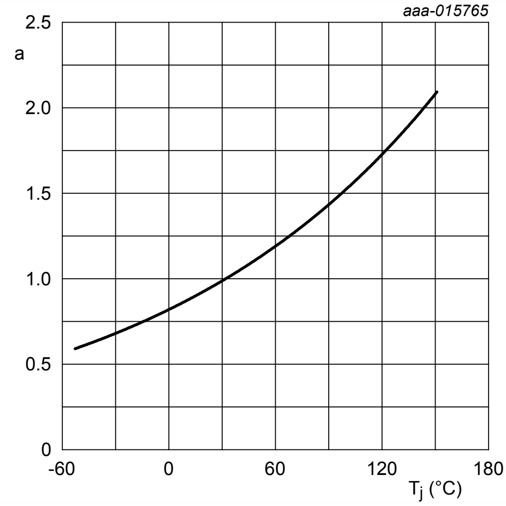
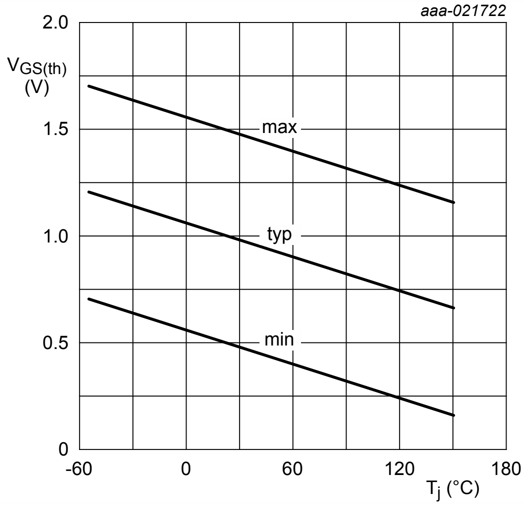


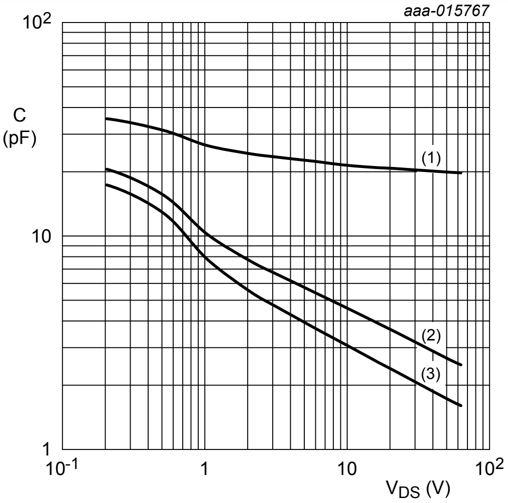
Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$



I_D = 250 µA; $V_{DS} = V_{GS}$

Fig. 12. Gate-source threshold voltage as a function of junction temperature



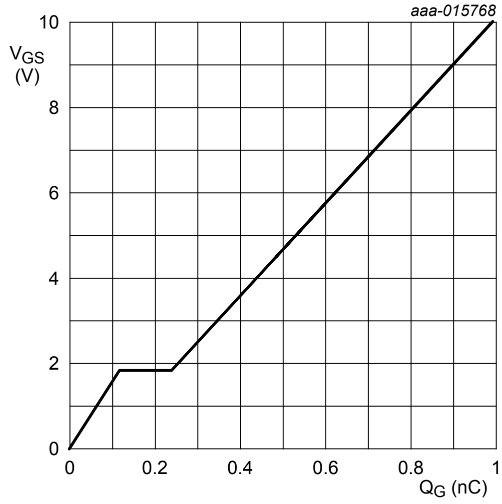
f = 1 MHz; V_{GS} = 0 V

(1) C_{iss}

(2) C_{oss}

(3) C_{rss}

Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



I_D = 0.2 A; V_{DS} = 30 V; T_{amb} = 25 °C

Fig. 14. Gate-source voltage as a function of gate charge; typical values

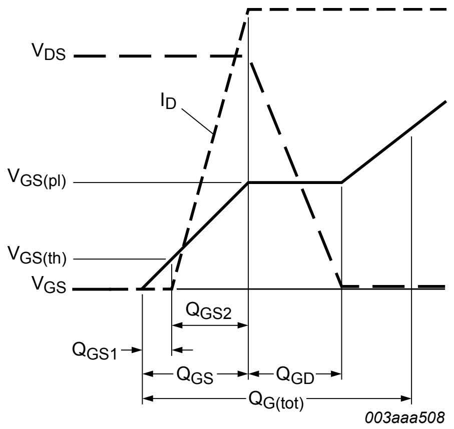
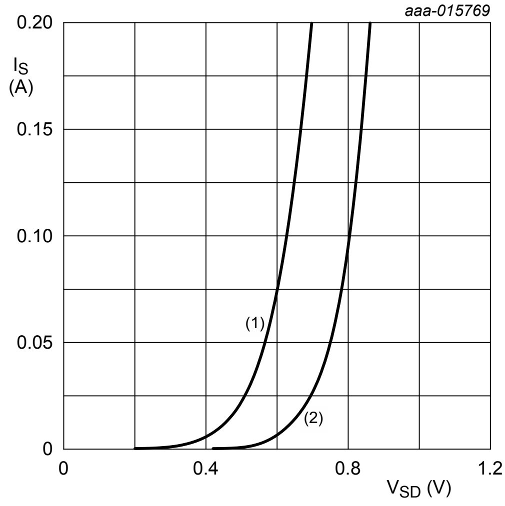


Fig. 15. MOSFET transistor: Gate charge waveform definitions



V_{GS} = 0 V

(1) T_j = 150 °C

(2) T_j = 25 °C

Fig. 16. Source current as a function of source-drain voltage; typical values

11. Test information

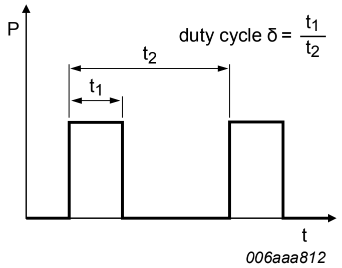


Fig. 17. Duty cycle definition

12. Package outline

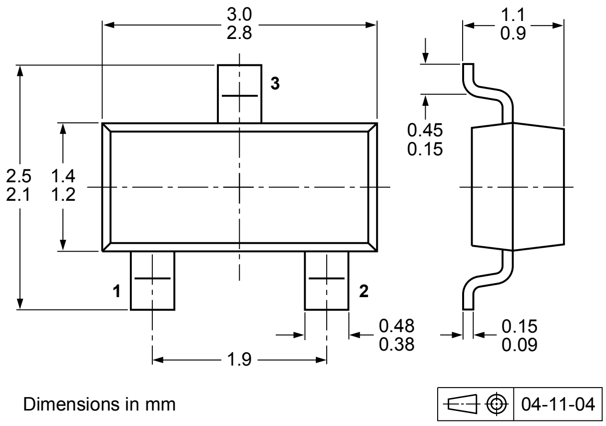


Fig. 18. Package outline TO-236AB (SOT23)

13. Soldering

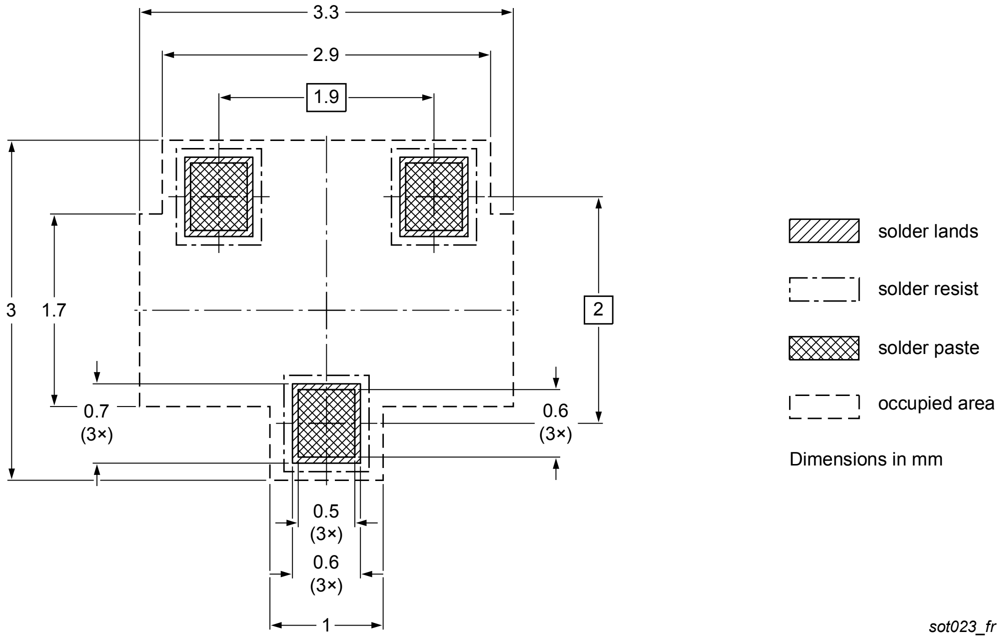


Fig. 19. Reflow soldering footprint for TO-236AB (SOT23)

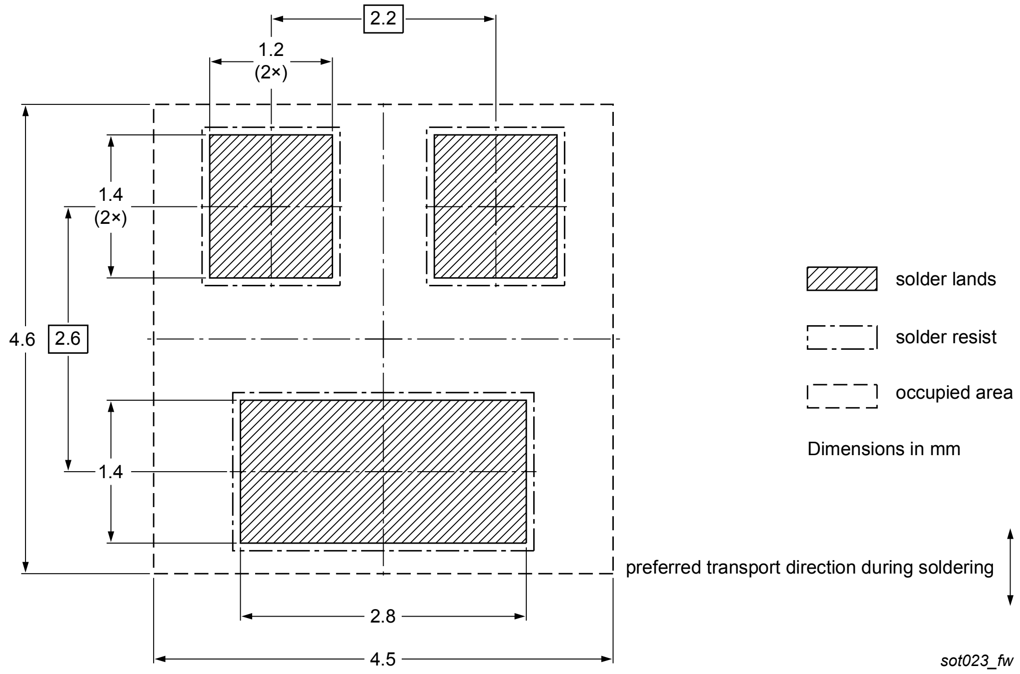


Fig. 20. Wave soldering footprint for TO-236AB (SOT23)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
NX138BK v.1	20160129	Product data sheet	-	-

15. Legal information

15.1 Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
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16. Contents

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For sales office addresses, please send an email to: salesaddresses@nexperia.com
Date of release: 29 January 2016

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