NX3020NAKS

30 V, 180 mA dual N-channel Trench MOSFET

6 July 2012 Product data sheet

1. Product profile

1.1 General description

Dual N-channel enhancement mode Field-Effect Transistor (FET) in a very small SOT363 (SC-88) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

1.2 Features and benefits

- Very fast switching
- Trench MOSFET technology
- ESD protection
- Low threshold voltage

1.3 Applications

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

1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per transistor							
V_{DS}	drain-source voltage	T_j = 25 °C		-	-	30	V
V_{GS}	gate-source voltage			-20	-	20	V
I_D	drain current	V_{GS} = 4.5 V; T_{amb} = 25 °C	[1]	-	-	180	mA
Static characteristics (per transistor)							
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 100 mA; T_j = 25 °C		-	2.7	4.5	Ω

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

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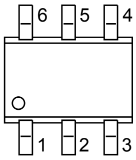
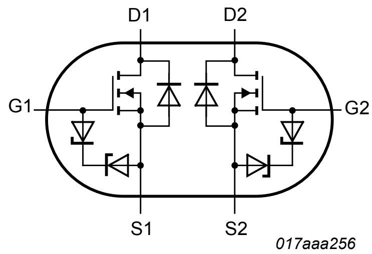
2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S1	source TR1	 TSSOP6 (SOT363)	
2	G1	gate TR1		
3	D2	drain TR2		
4	S2	source TR2		
5	G2	gate TR2		
6	D1	drain TR1		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
NX3020NAKS	TSSOP6	plastic surface-mounted package; 6 leads	SOT363

4. Limiting values

Table 4. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
Per transistor						
V_{DS}	drain-source voltage	T_j = 25 °C		-	30	V
V_{GS}	gate-source voltage			-20	20	V
I_D	drain current	V_{GS} = 4.5 V; T_{amb} = 25 °C	[1]	-	180	mA
		V_{GS} = 4.5 V; T_{amb} = 100 °C	[1]	-	110	mA
I_{DM}	peak drain current	T_{amb} = 25 °C; single pulse; t_p ≤ 10 µs		-	720	mA
P_{tot}	total power dissipation	T_{amb} = 25 °C	[2]	-	260	mW
			[1]	-	280	mW
		T_{sp} = 25 °C		-	1100	mW
Source-drain diode						
I_S	source current	T_{amb} = 25 °C		-	180	mA
Per device						
P_{tot}	total power dissipation	T_{amb} = 25 °C	[2]	-	375	mW
T_j	junction temperature			-55	150	°C
T_{amb}	ambient temperature			-55	150	°C

Symbol	Parameter	Conditions		Min	Max	Unit
T_{stg}	storage temperature			-65	150	°C

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

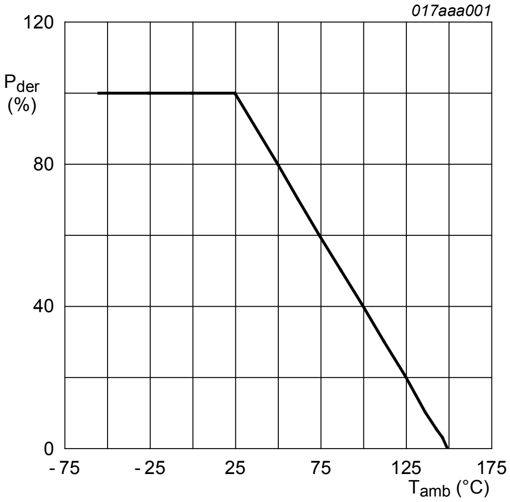


Fig. 1. Normalized total power dissipation as a function of ambient temperature

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

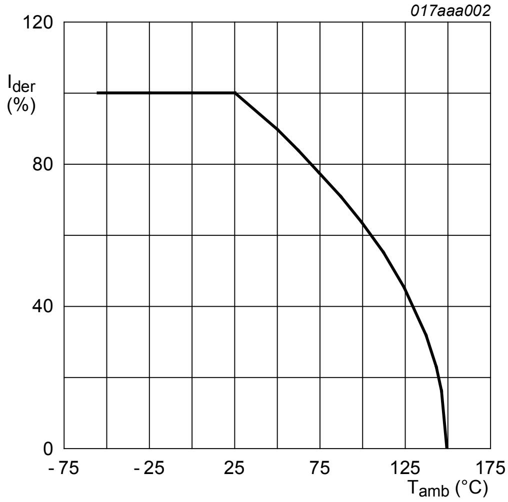
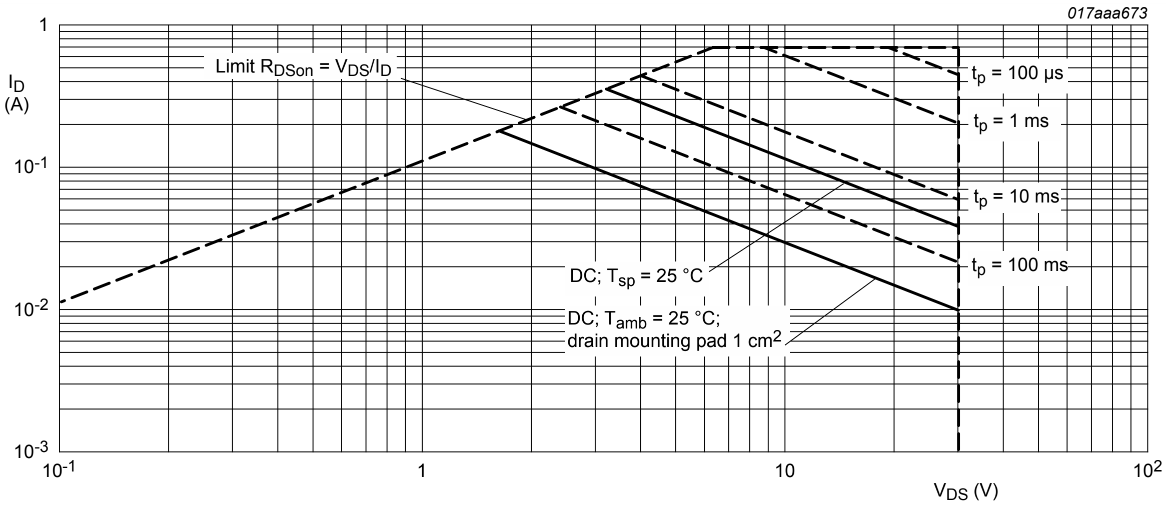


Fig. 2. Normalized continuous drain current as a function of ambient temperature

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



I_{DM} = single pulse

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

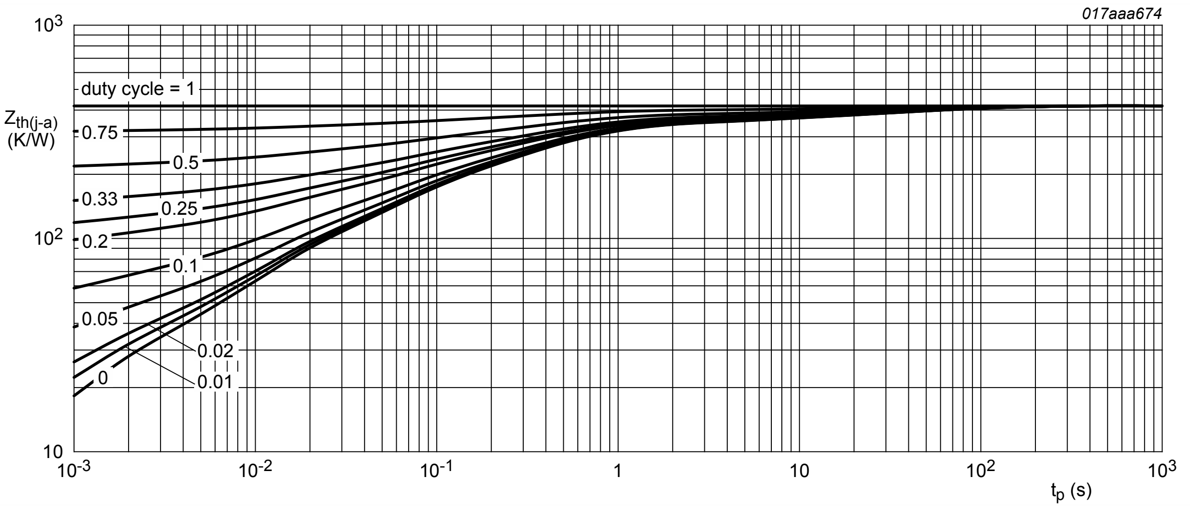
5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per transistor							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	390	480	K/W
			[2]	-	380	430	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	110	K/W

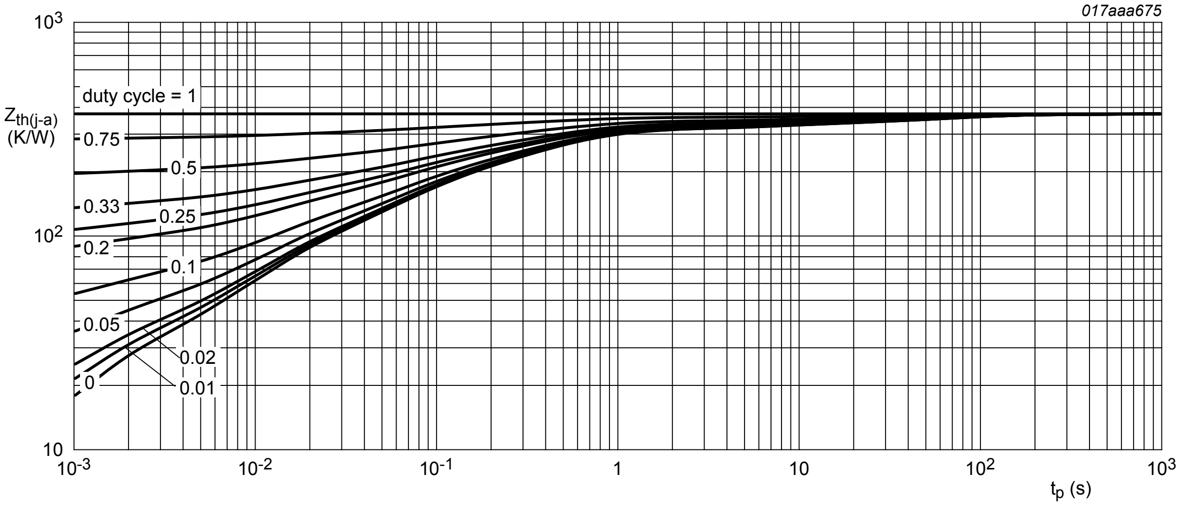
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, 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

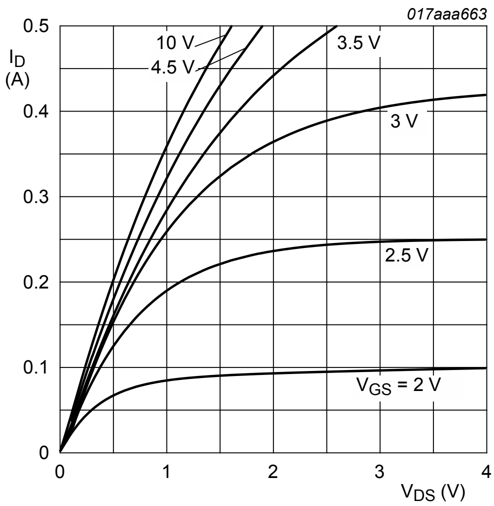
Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

6. Characteristics

Table 6. Characteristics

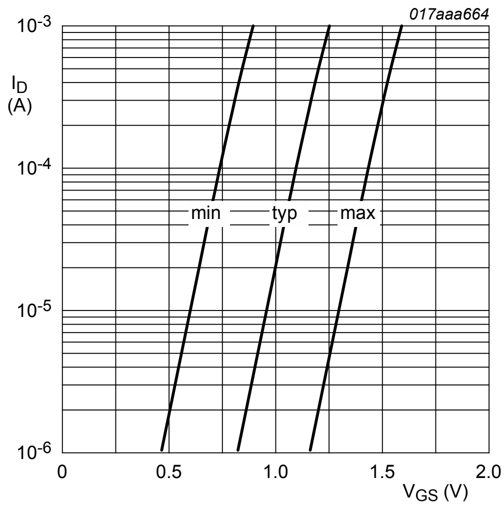
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics (per transistor)							
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V; T_j = 25 °C		30	-	-	V
V_{GSth}	gate-source threshold voltage	I_D = 250 µA; V_{DS} = V_{GS}; T_j = 25 °C		0.8	1.2	1.5	V
I_{DSS}	drain leakage current	V_{DS} = 30 V; V_{GS} = 0 V; T_j = 25 °C		-	-	1	µA
		V_{DS} = 30 V; V_{GS} = 0 V; T_j = 150 °C		-	-	10	µA
I_{GSS}	gate leakage current	V_{GS} = 20 V; V_{DS} = 0 V; T_j = 25 °C		-	-	3.5	µA
		V_{GS} = -20 V; V_{DS} = 0 V; T_j = 25 °C		-	-	3.5	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} = 4.5 V; V_{DS} = 0 V; T_j = 25 °C		-	-	0.5	µA
		V_{GS} = -4.5 V; V_{DS} = 0 V; T_j = 25 °C		-	-	0.5	µA
R_{DSon}	drain-source on-state resistance	V_{GS} = 10 V; I_D = 100 mA; T_j = 25 °C		-	2.7	4.5	Ω
		V_{GS} = 10 V; I_D = 100 mA; T_j = 150 °C		-	5.5	9.2	Ω
		V_{GS} = 4.5 V; I_D = 100 mA; T_j = 25 °C		-	3	5.2	Ω
		V_{GS} = 2.5 V; I_D = 10 mA; T_j = 25 °C		-	4	13	Ω
g_{fs}	forward transconductance	V_{DS} = 10 V; I_D = 150 mA; T_j = 25 °C		-	320	-	mS

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Dynamic characteristics (per transistor)							
$Q_{G(tot)}$	total gate charge	V_{DS} = 15 V; I_D = 150 mA; V_{GS} = 4.5 V; T_j = 25 °C		-	0.34	0.44	nC
Q_{GS}	gate-source charge			-	0.11	-	nC
Q_{GD}	gate-drain charge			-	0.06	-	nC
C_{iss}	input capacitance	V_{DS} = 10 V; f = 1 MHz; V_{GS} = 0 V; T_j = 25 °C		-	32	48	pF
C_{oss}	output capacitance			-	22	-	pF
C_{rss}	reverse transfer capacitance			-	16	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 20 V; R_L = 250 Ω; V_{GS} = 10 V; $R_{G(ext)}$ = 6 Ω; T_j = 25 °C		-	5	10	ns
t_r	rise time			-	5	-	ns
$t_{d(off)}$	turn-off delay time			-	34	68	ns
t_f	fall time			-	17	-	ns
Source-drain diode (per transistor)							
V_{SD}	source-drain voltage	I_S = 115 mA; V_{GS} = 0 V; T_j = 25 °C		0.47	0.7	1.2	V



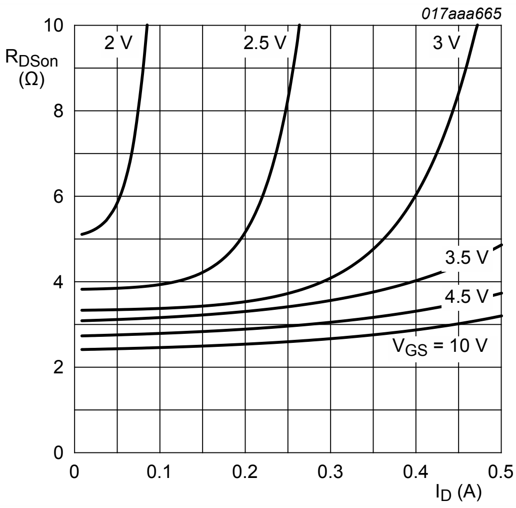
T_j = 25 °C

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



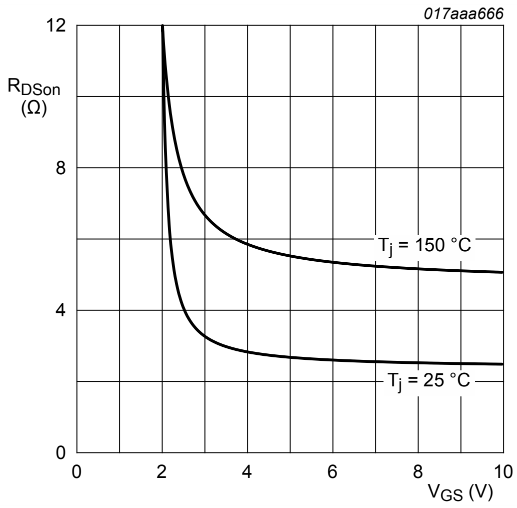
T_j = 25 °C; V_{DS} = 5 V

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



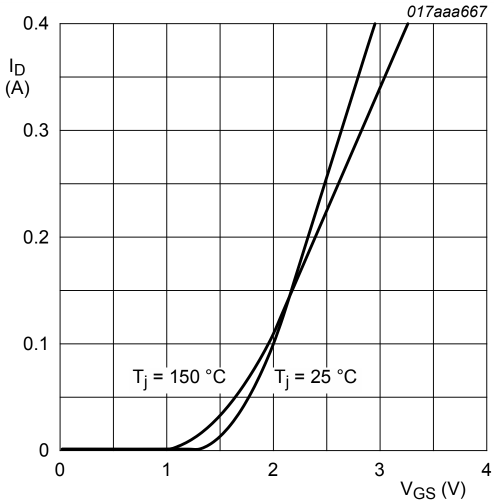
T_j = 25 °C

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



I_D = 0.15 A

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



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

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

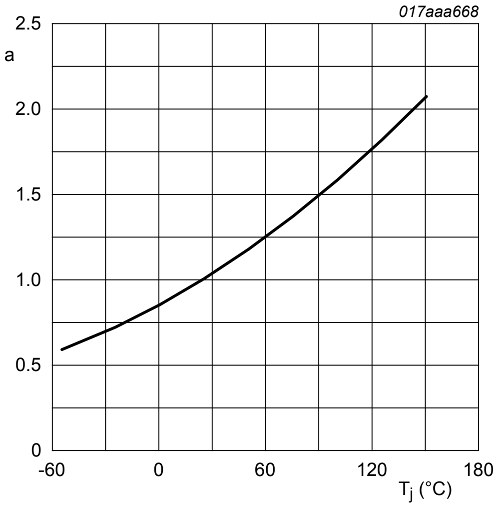
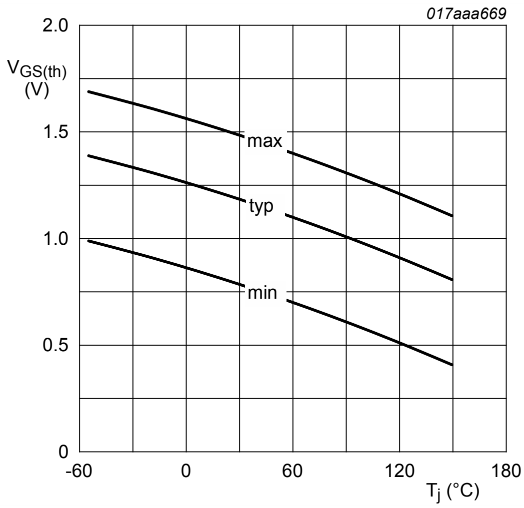


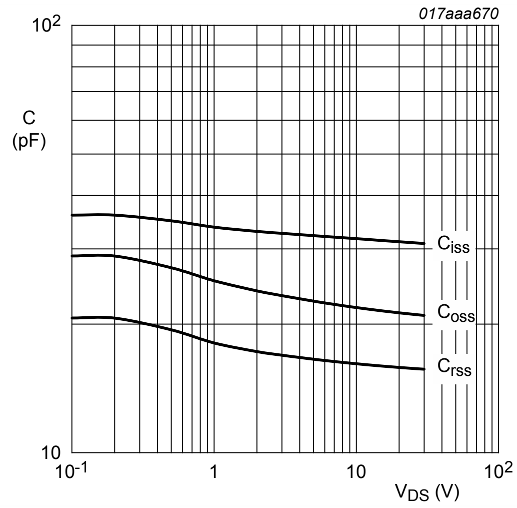
Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

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



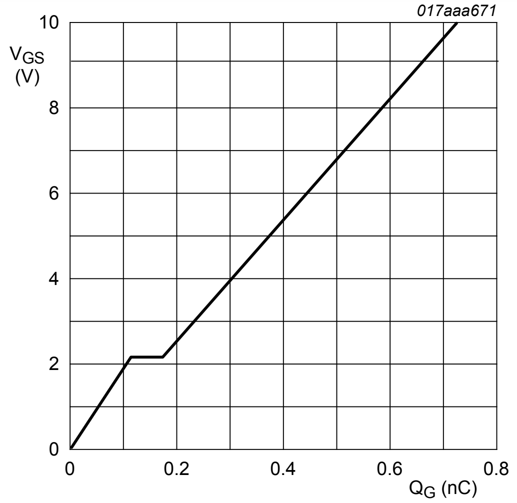
I_D = 0.25 mA; V_{DS} = V_{GS}

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



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

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



I_D = 0.15 A; V_{DS} = 15 V; T_{amb} = 25 °C

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

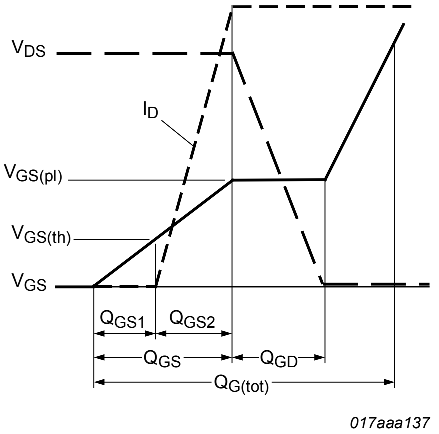
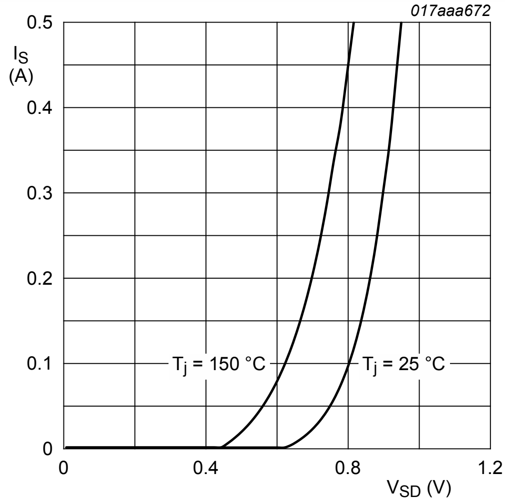


Fig. 15. Gate charge waveform definitions



V_{GS} = 0 V

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

7. Test information

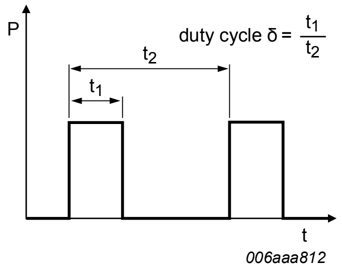
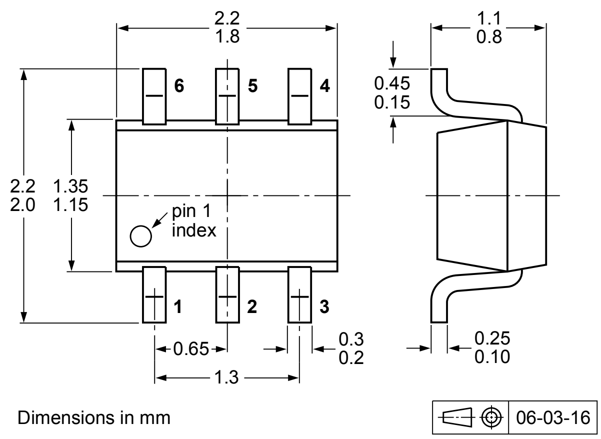


Fig. 17. Duty cycle definition

8. Package outline



Dimensions in mm

Fig. 18. TSSOP6 (SOT363)

9. Soldering

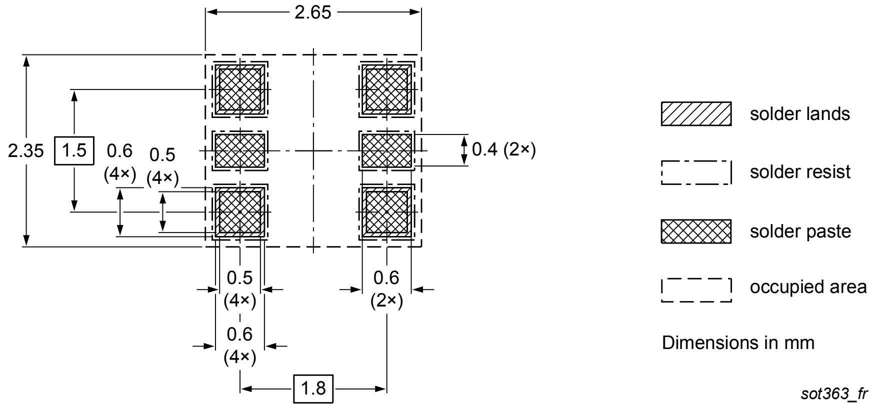


Fig. 19. Reflow soldering footprint for SOT363 (TSSOP6)

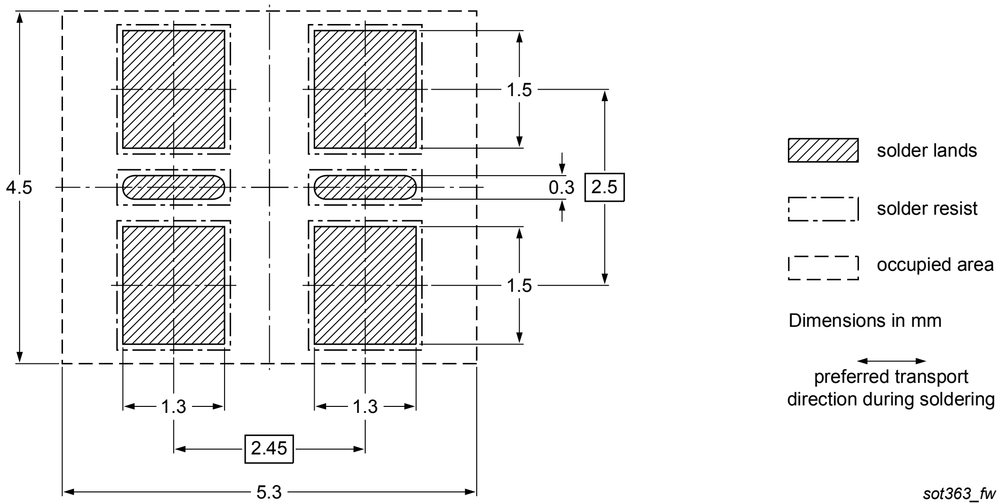


Fig. 20. Wave soldering footprint for SOT363 (TSSOP6)

10. Revision history

Table 7. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
NX3020NAKS v.1	20120706	Product data sheet	-	-

11. Legal information

11.1 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.

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[2] The term 'short data sheet' is explained in section "Definitions".
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