



NX3020NAKT

30 V, 180 mA N-channel Trench MOSFET

29 October 2013

Product data sheet

1. General description

N-channel enhancement mode Field-Effect Transistor (FET) in a small SOT416 (SC-75) Surface-Mounted Device (SMD) plastic package using Trench MOSFET technology.

2. Features and benefits

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

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	$T_j = 25\text{ °C}$	-	-	30	V
V_{GS}	gate-source voltage		-20	-	20	V
I_D	drain current	$V_{GS} = 10\text{ V}; T_{amb} = 25\text{ °C}$	[1]	-	180	mA
Static characteristics						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 100\text{ mA}; T_j = 25\text{ °C}$	-	2.7	4.5	Ω

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 1 cm².

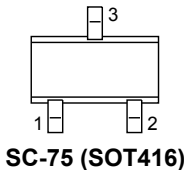
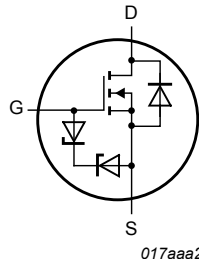


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5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p>SC-75 (SOT416)</p>	 <p>017aaa255</p>
2	S	source		
3	D	drain		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
NX3020NAKT	SC-75	plastic surface-mounted package; 3 leads	SOT416

7. Marking

Table 4. Marking codes

Type number	Marking code
NX3020NAKT	VB

8. Limiting values

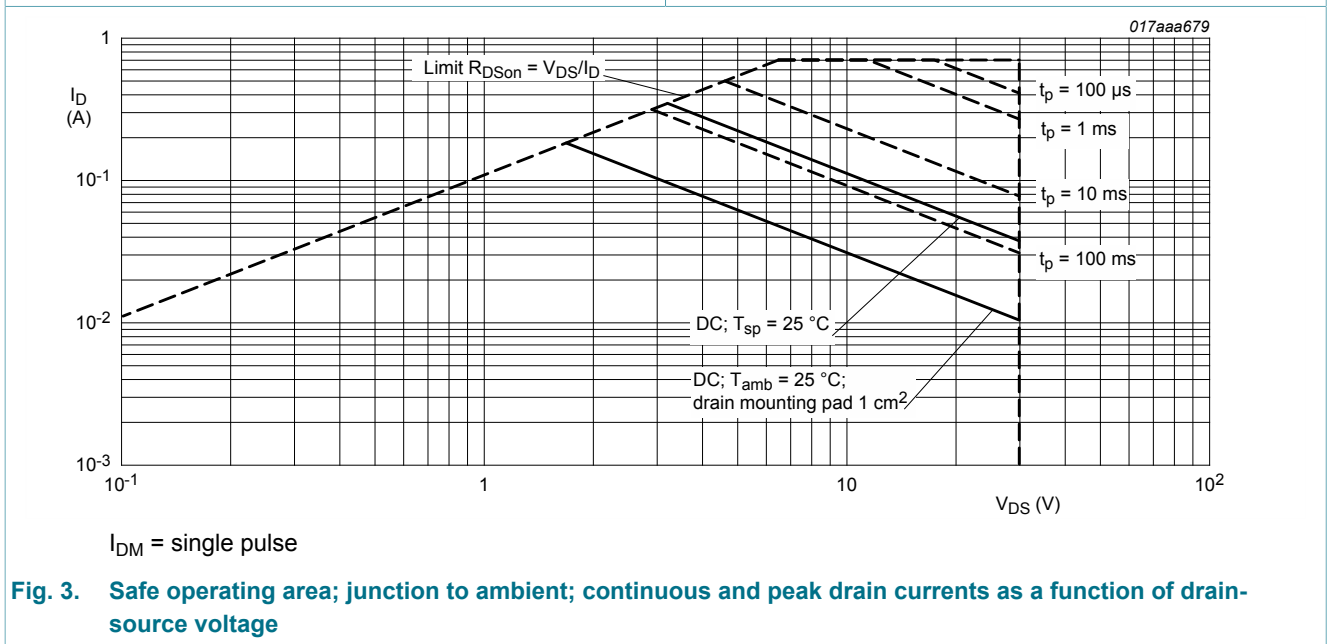
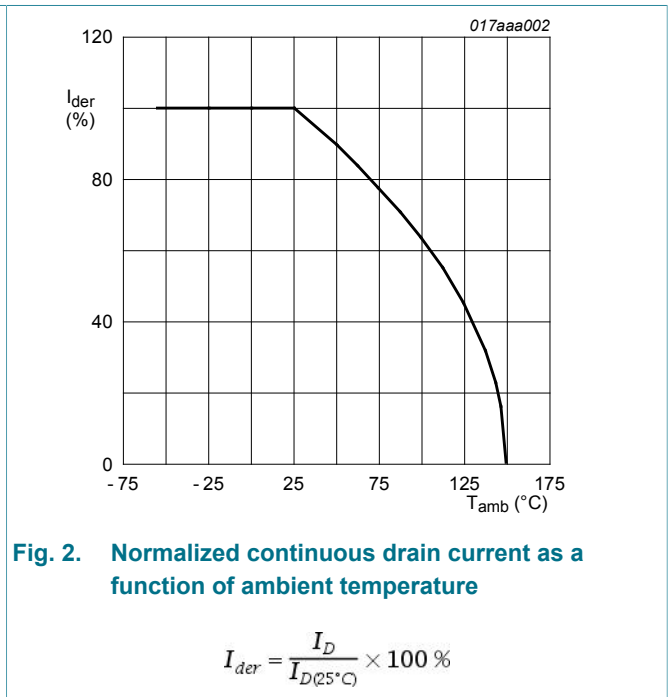
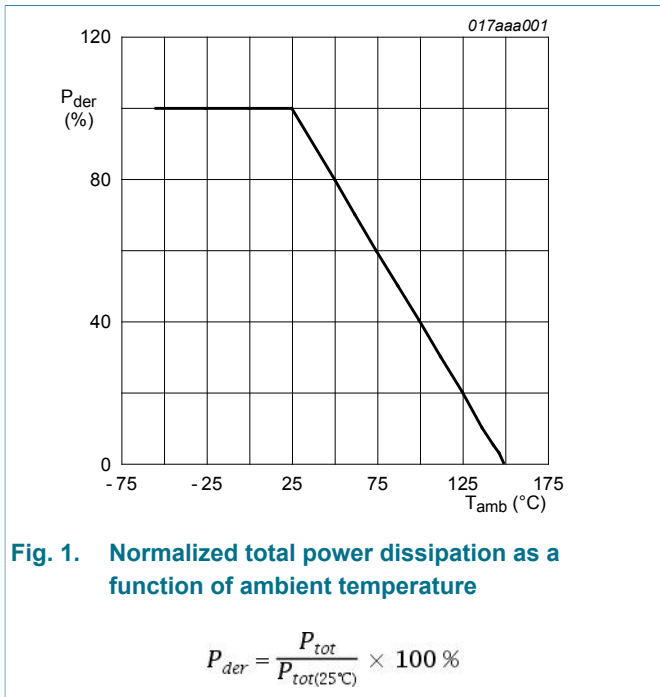
Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V_{DS}	drain-source voltage	$T_j = 25\text{ }^\circ\text{C}$		-	30	V
V_{GS}	gate-source voltage			-20	20	V
I_D	drain current	$V_{GS} = 10\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}$	[1]	-	180	mA
		$V_{GS} = 10\text{ V}; T_{amb} = 100\text{ }^\circ\text{C}$	[1]	-	110	mA
I_{DM}	peak drain current	$T_{amb} = 25\text{ }^\circ\text{C}; \text{single pulse}; t_p \leq 10\text{ }\mu\text{s}$		-	720	mA
P_{tot}	total power dissipation	$T_{amb} = 25\text{ }^\circ\text{C}$	[2]	-	230	mW
			[1]	-	285	mW
		$T_{sp} = 25\text{ }^\circ\text{C}$		-	1060	mW
T_j	junction temperature			-55	150	$^\circ\text{C}$

Symbol	Parameter	Conditions	Min	Max	Unit
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]	180	mA

- [1] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 1 cm².
- [2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.



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]	-	460	530	K/W
			[2]	-	370	430	K/W
R _{th(j-sp)}	thermal resistance from junction to solder point			-	-	115	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 cm².

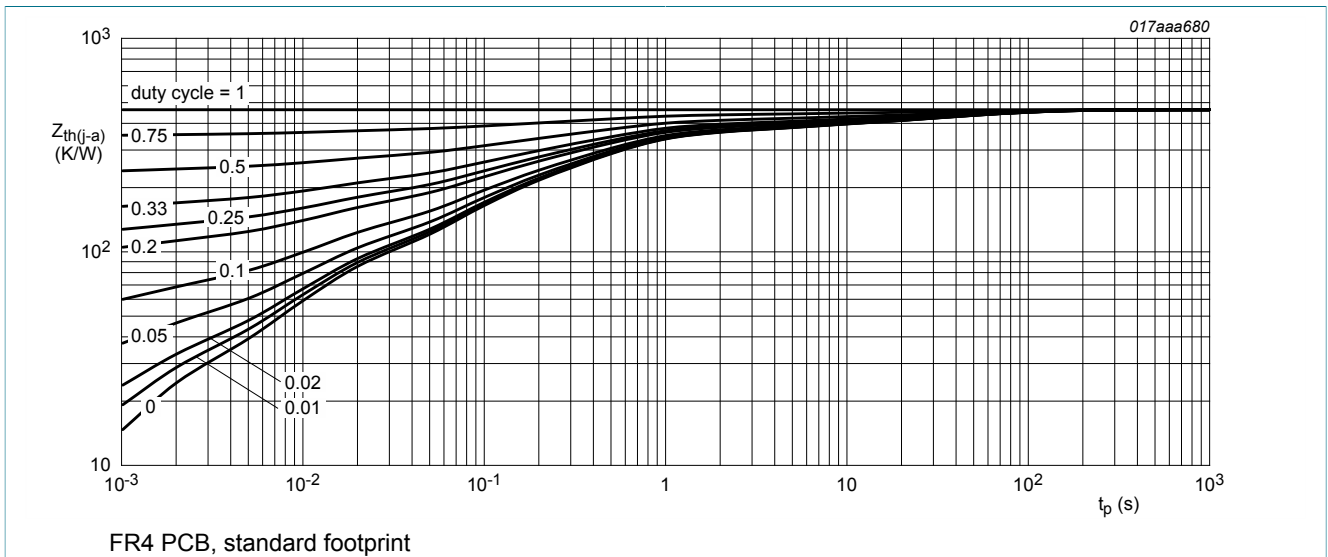


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

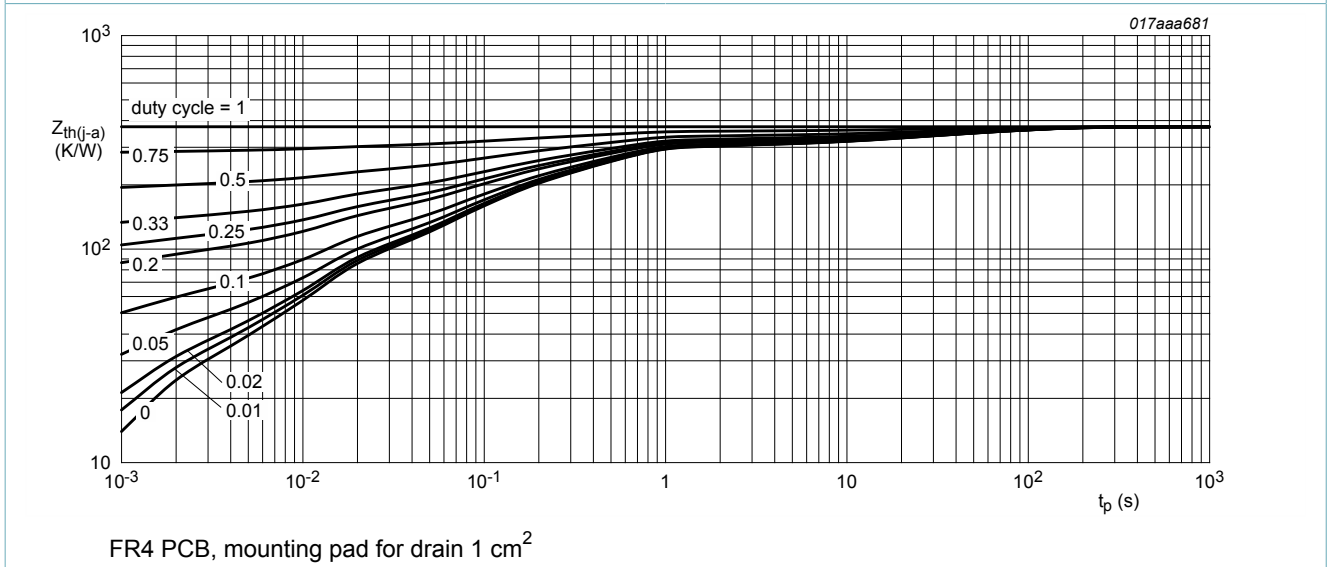


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250 \mu A$; $V_{GS} = 0 V$; $T_j = 25 \text{ }^\circ C$	30	-	-	V
V_{GSth}	gate-source threshold voltage	$I_D = 250 \mu A$; $V_{DS} = V_{GS}$; $T_j = 25 \text{ }^\circ C$	0.8	1.2	1.5	V
I_{DSS}	drain leakage current	$V_{DS} = 30 V$; $V_{GS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	-	1	μA
		$V_{DS} = 30 V$; $V_{GS} = 0 V$; $T_j = 150 \text{ }^\circ C$	-	-	10	μA
I_{GSS}	gate leakage current	$V_{GS} = 20 V$; $V_{DS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	-	3.5	μA
		$V_{GS} = -20 V$; $V_{DS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	-	3.5	μA
		$V_{GS} = 10 V$; $V_{DS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	-	1	μA
		$V_{GS} = -10 V$; $V_{DS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	-	1	μA
		$V_{GS} = 4.5 V$; $V_{DS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	-	0.5	μA
		$V_{GS} = -4.5 V$; $V_{DS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	-	0.5	μA
		$V_{GS} = 10 V$; $I_D = 100 \text{ mA}$; $T_j = 25 \text{ }^\circ C$	-	2.7	4.5	Ω
R_{DSon}	drain-source on-state resistance	$V_{GS} = 10 V$; $I_D = 100 \text{ mA}$; $T_j = 150 \text{ }^\circ C$	-	5.5	9.2	Ω
		$V_{GS} = 4.5 V$; $I_D = 100 \text{ mA}$; $T_j = 25 \text{ }^\circ C$	-	3	5.2	Ω
		$V_{GS} = 2.5 V$; $I_D = 10 \text{ mA}$; $T_j = 25 \text{ }^\circ C$	-	4	13	Ω
		$V_{GS} = 10 V$; $I_D = 150 \text{ mA}$; $T_j = 25 \text{ }^\circ C$	-	320	-	S
g_{fs}	forward transconductance	$V_{DS} = 10 V$; $I_D = 150 \text{ mA}$; $T_j = 25 \text{ }^\circ C$	-	320	-	S
Dynamic characteristics						
$Q_{G(tot)}$	total gate charge	$V_{DS} = 15 V$; $I_D = 150 \text{ mA}$; $V_{GS} = 4.5 V$; $T_j = 25 \text{ }^\circ C$	-	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	$V_{DS} = 10 V$; $f = 1 \text{ MHz}$; $V_{GS} = 0 V$; $T_j = 25 \text{ }^\circ C$	-	13	20	pF
C_{oss}	output capacitance		-	2.6	-	pF
C_{rss}	reverse transfer capacitance		-	1.1	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 20 V$; $R_L = 250 \Omega$; $V_{GS} = 10 V$; $R_{G(ext)} = 6 \Omega$; $T_j = 25 \text{ }^\circ C$	-	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						
V_{SD}	source-drain voltage	$I_S = 115 \text{ mA}$; $V_{GS} = 0 V$; $T_j = 25 \text{ }^\circ C$	0.47	0.7	1.2	V

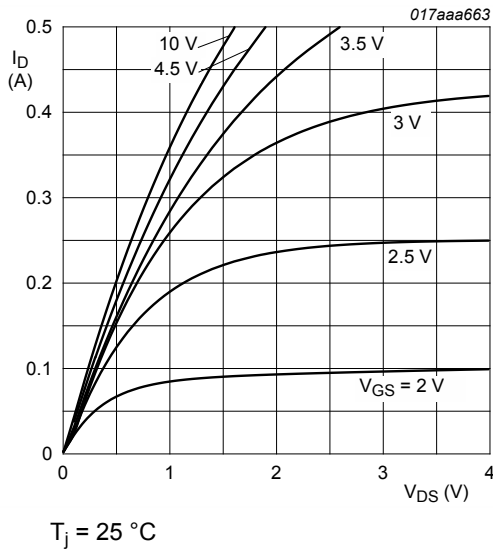


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

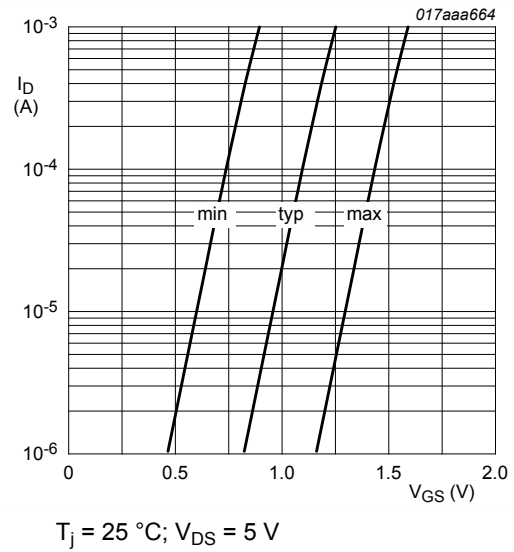


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

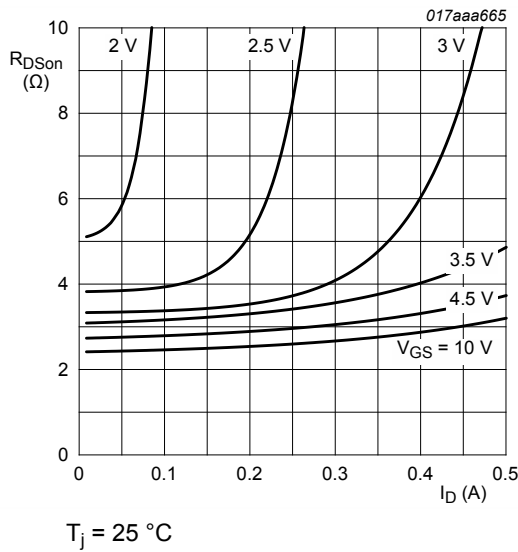


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

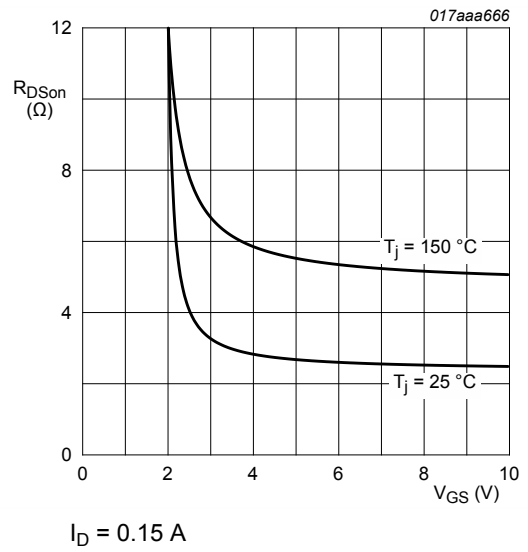
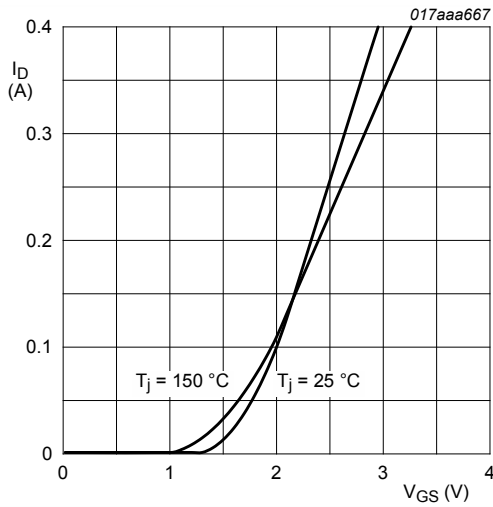


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values



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

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

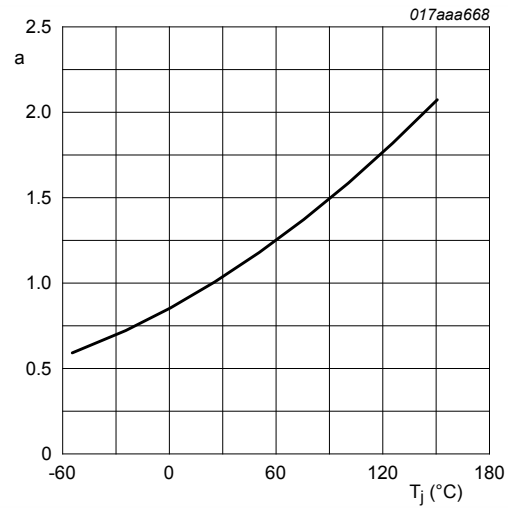
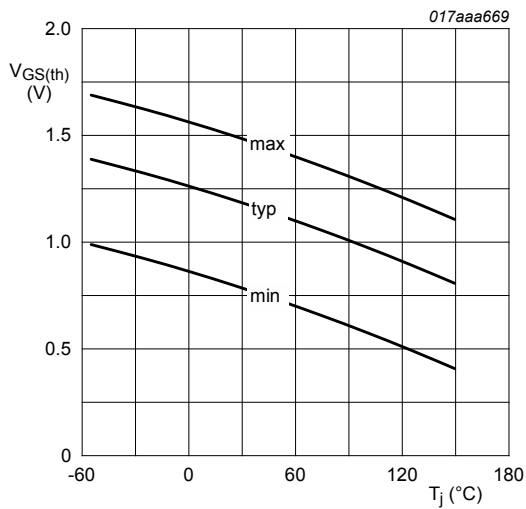


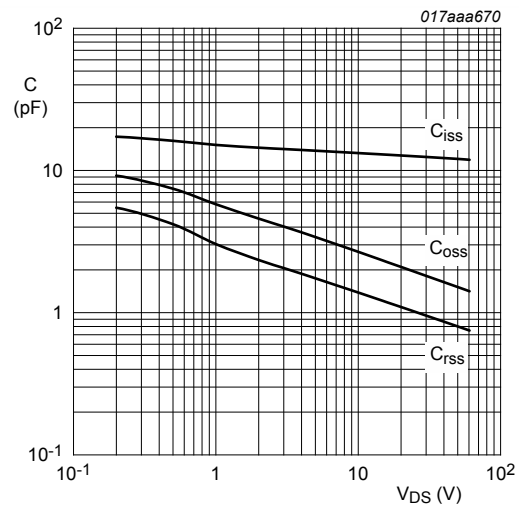
Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

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



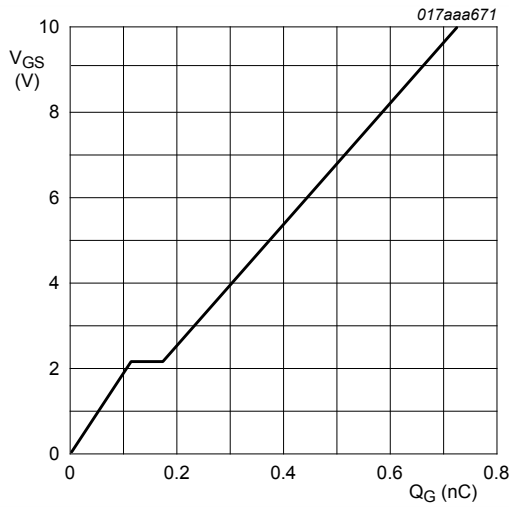
$$I_D = 0.25 \text{ mA}; V_{DS} = V_{GS}$$

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



$$f = 1 \text{ MHz}; V_{GS} = 0 \text{ V}$$

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

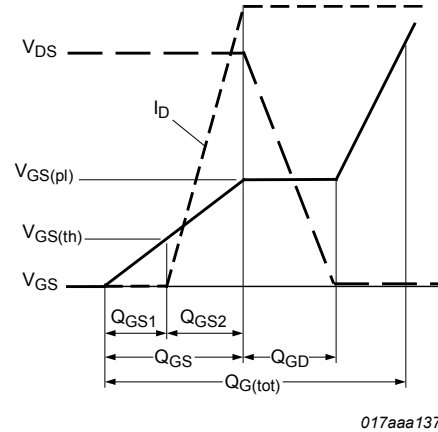
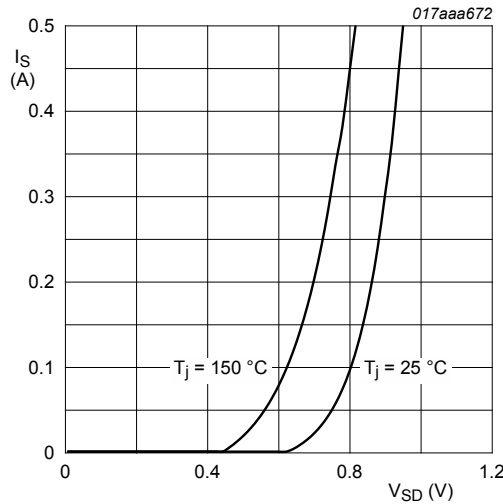


Fig. 15. Gate charge waveform definitions



$V_{GS} = 0$ V

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

11. Test information

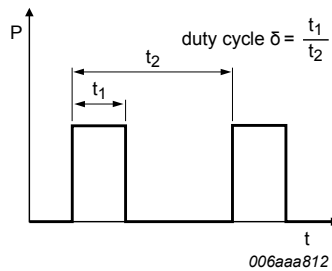


Fig. 17. Duty cycle definition

12. Package outline

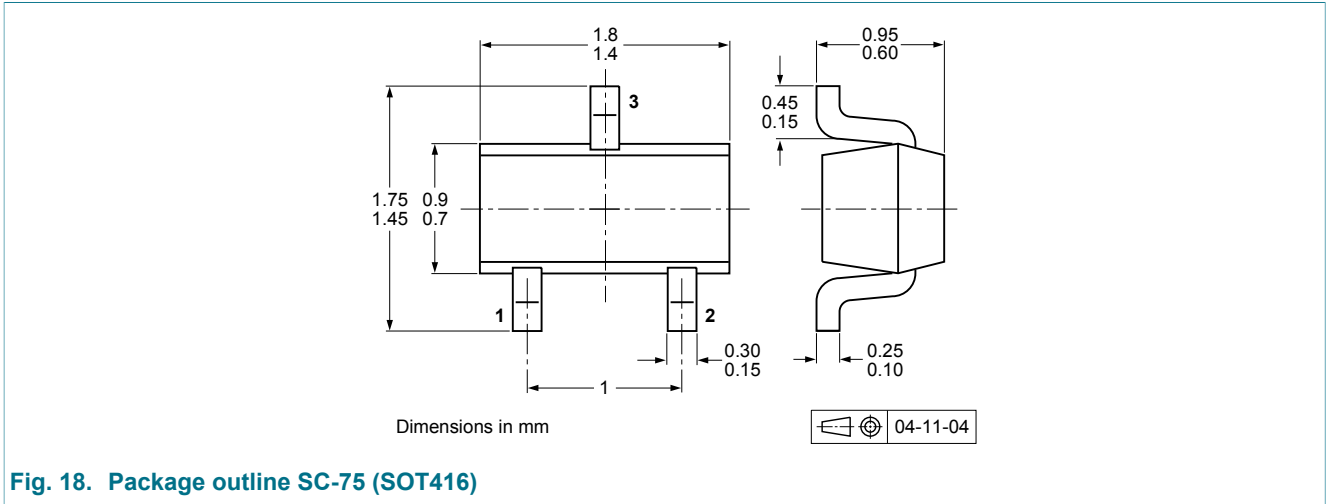


Fig. 18. Package outline SC-75 (SOT416)

13. Soldering

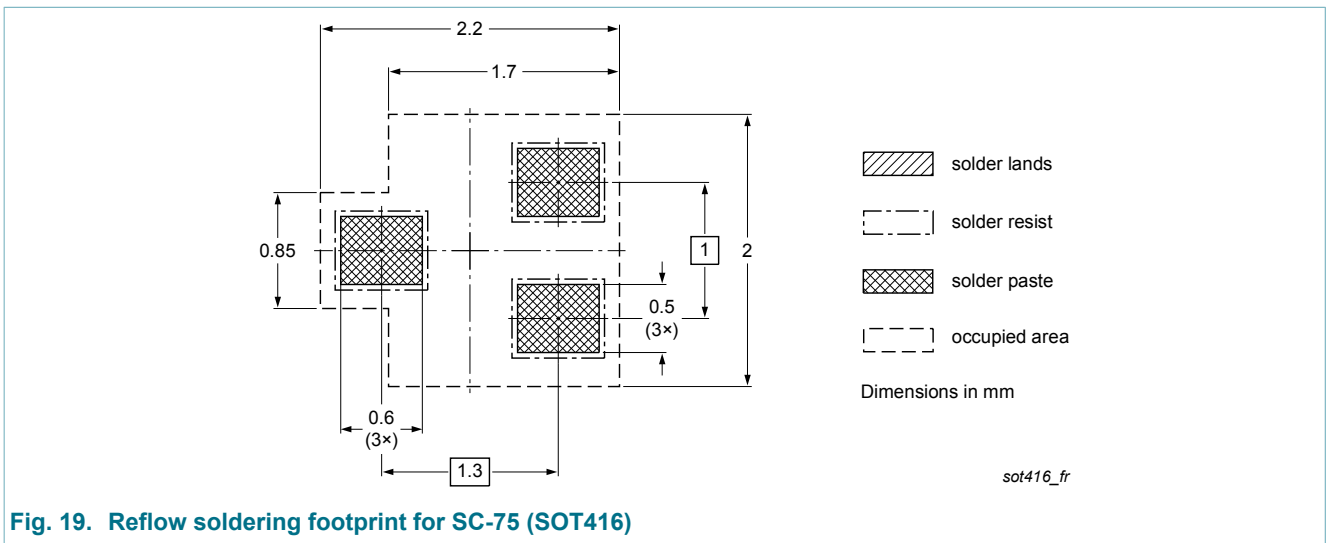


Fig. 19. Reflow soldering footprint for SC-75 (SOT416)

14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
NX3020NAKT v.2	20131029	Product data sheet	-	NX3020NAKT v.1
Modifications:	<ul style="list-style-type: none">• 3D package outline added• Table 7 values of capacitance parameters corrected• Figure 13 corrected			
NX3020NAKT v.1	20120830	Product data sheet	-	-

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Document status [1][2]	Product status [3]	Definition
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Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
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