

# NX3020NAKV

30 V, 200 mA dual N-channel Trench MOSFET

29 October 2013

Product data sheet

## 1. General description

Dual N-channel enhancement mode Field-Effect Transistor (FET) in a ultra small and flat lead SOT666 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
<b>Per transistor</b>							
$V_{DS}$	drain-source voltage	$T_j = 25\text{ }^{\circ}\text{C}$		-	-	30	V
$V_{GS}$	gate-source voltage			-20	-	20	V
$I_D$	drain current	$V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ }^{\circ}\text{C}$	[1]	-	-	200	mA
<b>Static characteristics (per transistor)</b>							
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 100\text{ mA}; T_j = 25\text{ }^{\circ}\text{C}$		-	2.7	4.5	$\Omega$

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

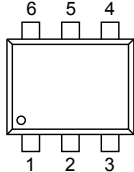
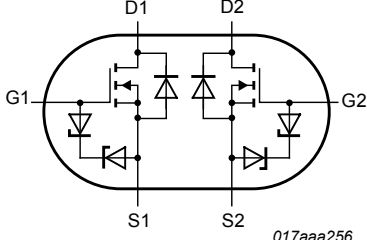


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## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	S1	source TR1	 SOT666	 017aaa256
2	G1	gate TR1		
3	D2	drain TR2		
4	S2	source TR2		
5	G2	gate TR2		
6	D1	drain TR1		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
NX3020NAKV	SOT666	plastic surface-mounted package; 6 leads	SOT666

## 7. Marking

Table 4. Marking codes

Type number	Marking code
NX3020NAKV	GB

## 8. Limiting values

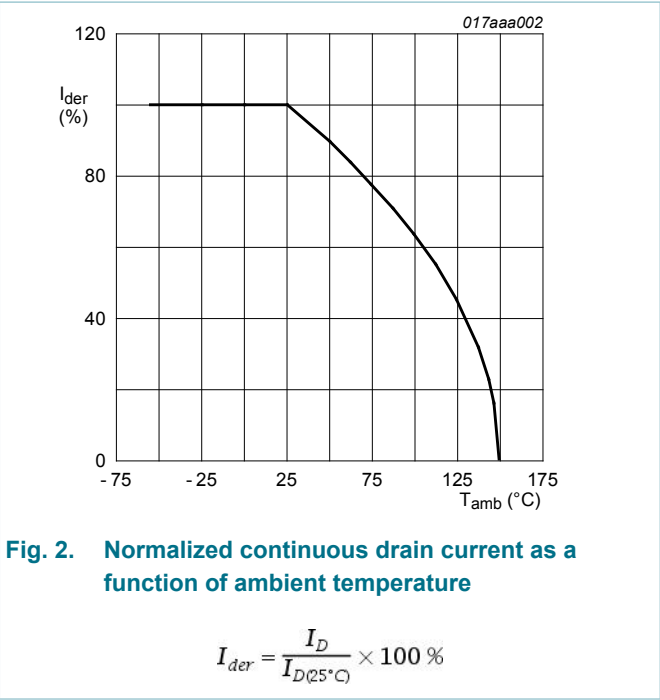
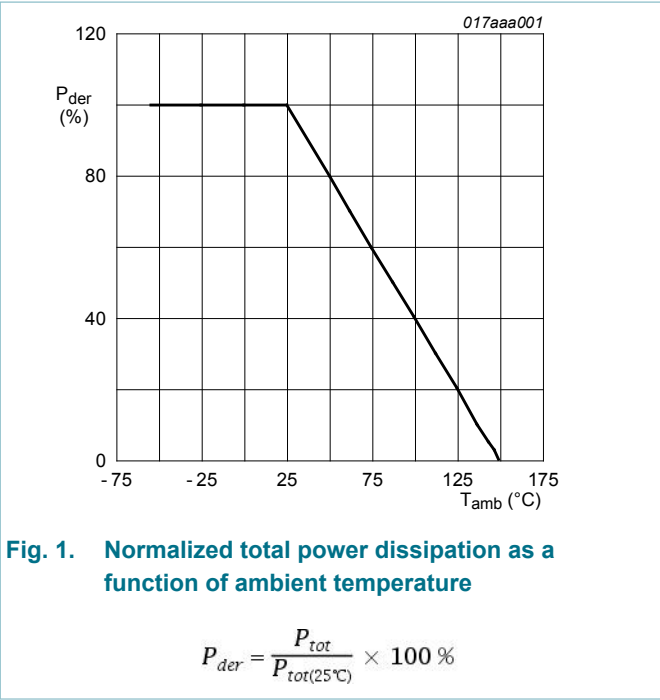
Table 5. Limiting values

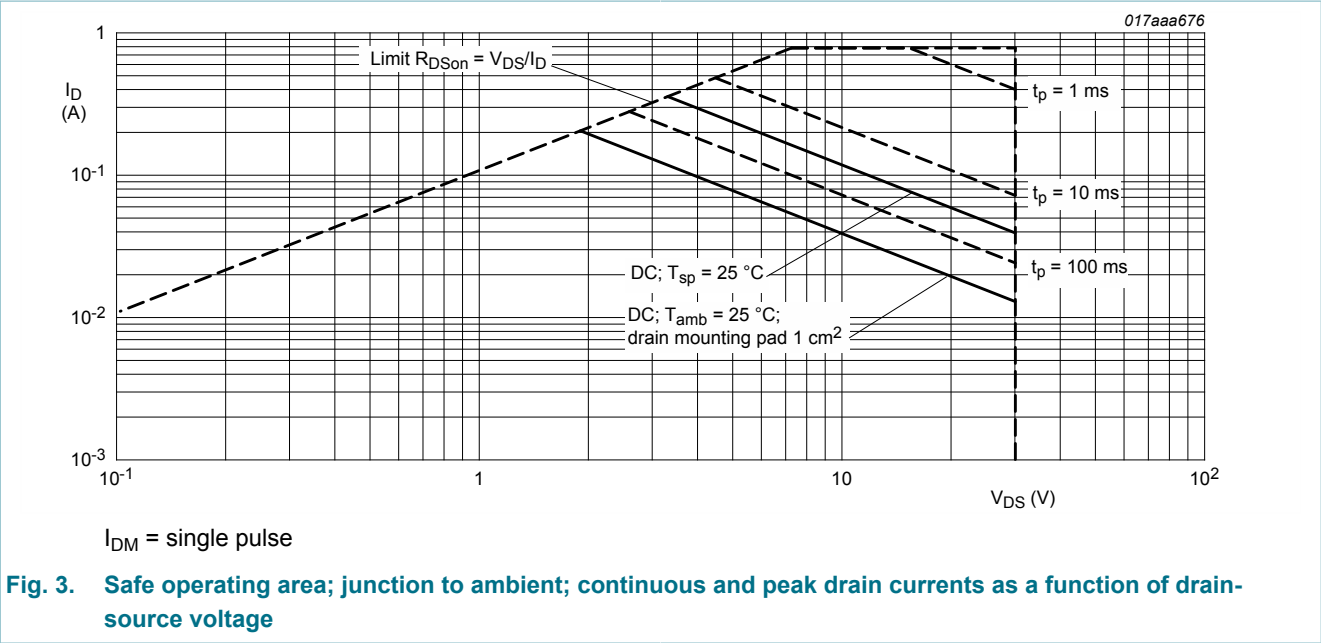
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
<b>Per transistor</b>					
$V_{DS}$	drain-source voltage	$T_j = 25\text{ °C}$	-	30	V
$V_{GS}$	gate-source voltage		-20	20	V
$I_D$	drain current	$V_{GS} = 4.5\text{ V}; T_{amb} = 25\text{ °C}$	[1]	200	mA
		$V_{GS} = 4.5\text{ V}; T_{amb} = 100\text{ °C}$	[1]	120	mA
$I_{DM}$	peak drain current	$T_{amb} = 25\text{ °C}; \text{single pulse}; t_p \leq 10\text{ }\mu\text{s}$	-	800	mA
$P_{tot}$	total power dissipation	$T_{amb} = 25\text{ °C}$	[2]	260	mW
			[1]	370	mW
		$T_{sp} = 25\text{ °C}$	-	1100	mW

Symbol	Parameter	Conditions		Min	Max	Unit
Source-drain diode						
I <sub>S</sub>	source current	T <sub>amb</sub> = 25 °C		-	200	mA
Per device						
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = 25 °C	[2]	-	375	mW
T <sub>j</sub>	junction temperature			-55	150	°C
T <sub>amb</sub>	ambient temperature			-55	150	°C
T <sub>stg</sub>	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<sup>2</sup>.
- [2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.





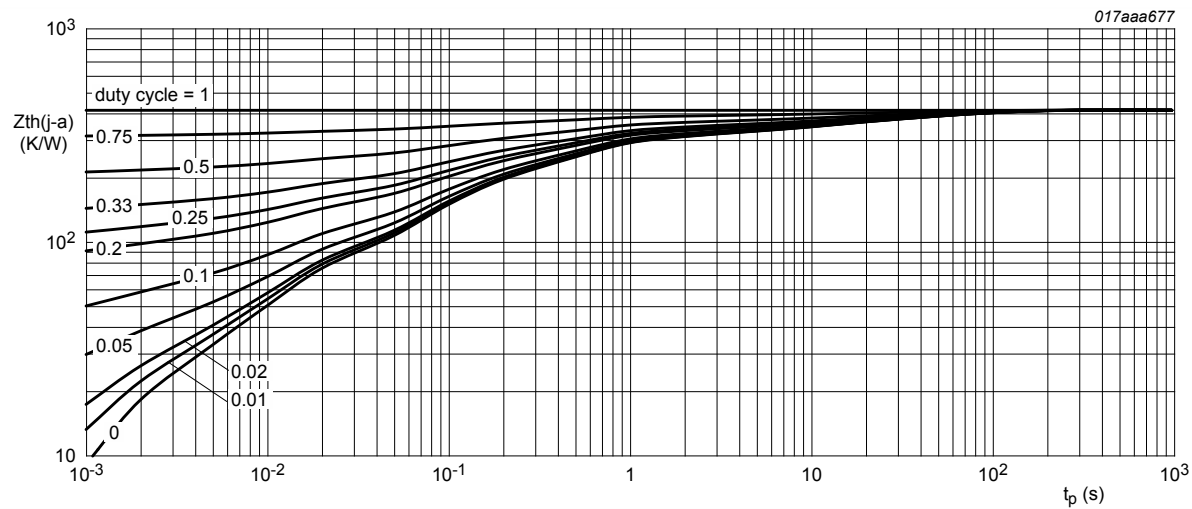
9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per transistor							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	410	480	K/W
			[2]	-	290	340	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	-	105	K/W

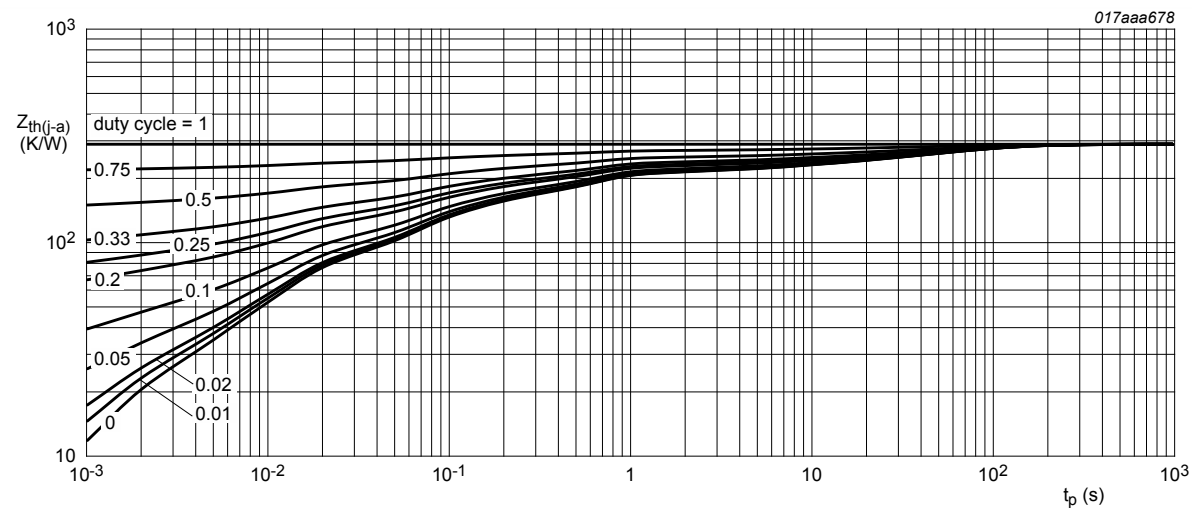
[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.

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



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<sup>2</sup>

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 (per transistor)						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 250\text{ }\mu\text{A}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$	30	-	-	V
$V_{GSth}$	gate-source threshold voltage	$I_D = 250\text{ }\mu\text{A}$ ; $V_{DS} = V_{GS}$ ; $T_j = 25\text{ }^\circ\text{C}$	0.8	1.2	1.5	V
$I_{DSS}$	drain leakage current	$V_{DS} = 30\text{ V}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 30\text{ V}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 150\text{ }^\circ\text{C}$	-	-	10	$\mu\text{A}$

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I <sub>GSS</sub>	gate leakage current	V <sub>GS</sub> = 20 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	-	3.5	μA
		V <sub>GS</sub> = -20 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	-	3.5	μA
		V <sub>GS</sub> = 10 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	-	1	μA
		V <sub>GS</sub> = -10 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	-	1	μA
		V <sub>GS</sub> = 4.5 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	-	0.5	μA
		V <sub>GS</sub> = -4.5 V; V <sub>DS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	-	0.5	μA
R <sub>DSon</sub>	drain-source on-state resistance	V <sub>GS</sub> = 10 V; I <sub>D</sub> = 100 mA; T <sub>j</sub> = 25 °C		-	2.7	4.5	Ω
		V <sub>GS</sub> = 10 V; I <sub>D</sub> = 100 mA; T <sub>j</sub> = 150 °C		-	5.5	9.2	Ω
		V <sub>GS</sub> = 4.5 V; I <sub>D</sub> = 100 mA; T <sub>j</sub> = 25 °C		-	3	5.2	Ω
		V <sub>GS</sub> = 2.5 V; I <sub>D</sub> = 10 mA; T <sub>j</sub> = 25 °C		-	4	13	Ω
g <sub>fs</sub>	forward transconductance	V <sub>DS</sub> = 10 V; I <sub>D</sub> = 150 mA; T <sub>j</sub> = 25 °C		-	320	-	mS
Dynamic characteristics (per transistor)							
Q <sub>G(tot)</sub>	total gate charge	V <sub>DS</sub> = 15 V; I <sub>D</sub> = 150 mA; V <sub>GS</sub> = 4.5 V; T <sub>j</sub> = 25 °C		-	0.34	0.44	nC
Q <sub>GS</sub>	gate-source charge			-	0.11	-	nC
Q <sub>GD</sub>	gate-drain charge			-	0.06	-	nC
C <sub>iss</sub>	input capacitance	V <sub>DS</sub> = 10 V; f = 1 MHz; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C		-	13	20	pF
C <sub>oss</sub>	output capacitance			-	2.6	-	pF
C <sub>rss</sub>	reverse transfer capacitance			-	1.1	-	pF
t <sub>d(on)</sub>	turn-on delay time	V <sub>DS</sub> = 20 V; R <sub>L</sub> = 250 Ω; V <sub>GS</sub> = 10 V; R <sub>G(ext)</sub> = 6 Ω; T <sub>j</sub> = 25 °C		-	5	10	ns
t <sub>r</sub>	rise time			-	5	-	ns
t <sub>d(off)</sub>	turn-off delay time			-	34	68	ns
t <sub>f</sub>	fall time			-	17	-	ns
Source-drain diode (per transistor)							
V <sub>SD</sub>	source-drain voltage	I <sub>S</sub> = 115 mA; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C		0.47	0.7	1.2	V

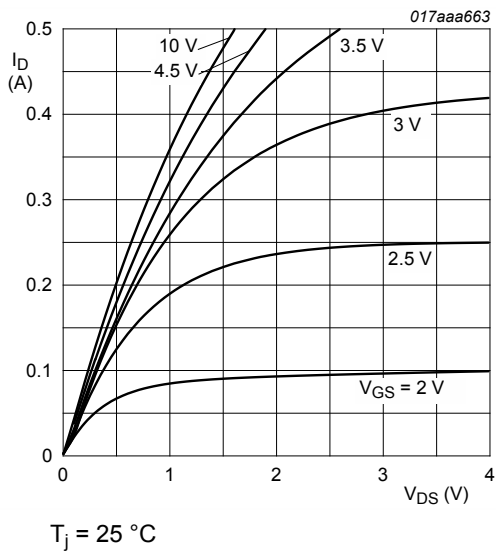


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

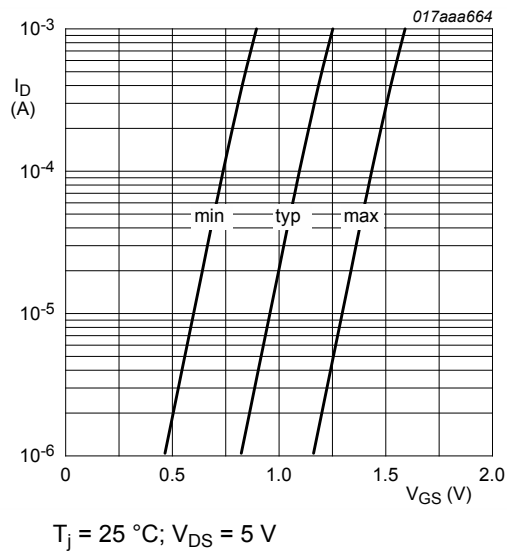


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

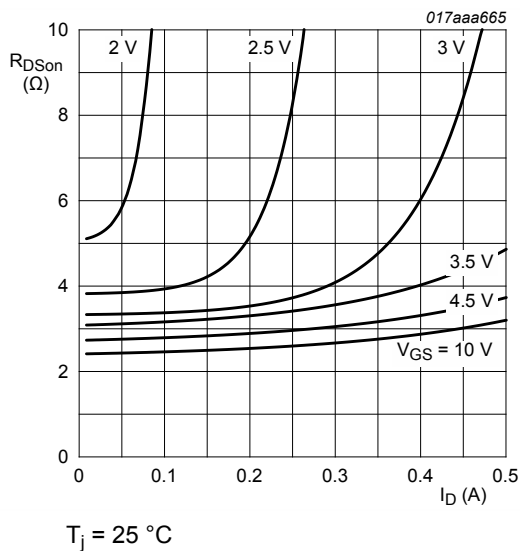


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

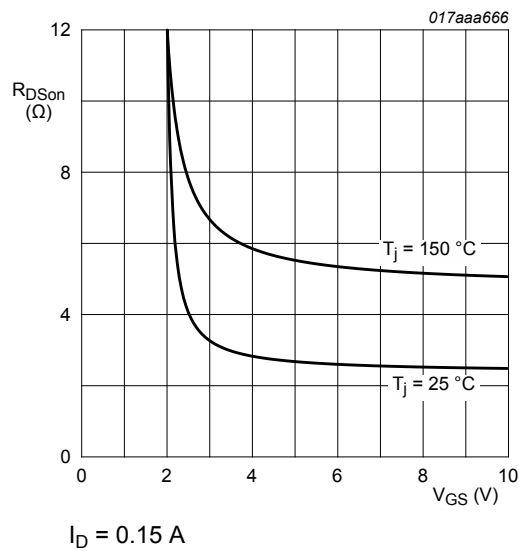


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

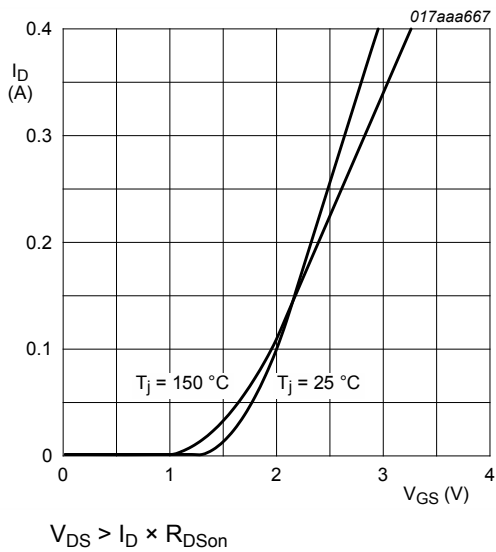


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values

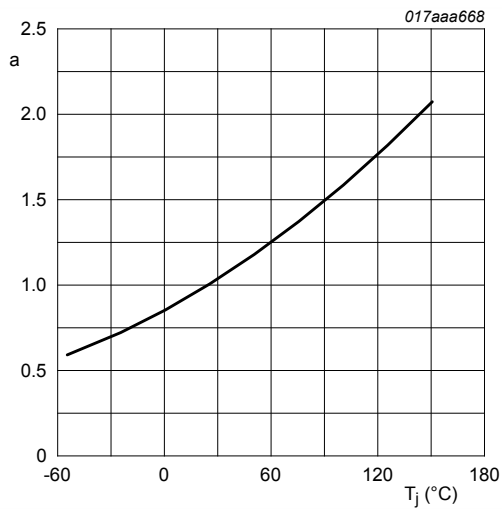


Fig. 11. Normalized drain-source on-state resistance as a function of junction temperature; typical values

$$a = \frac{R_{DS(on)}}{R_{DS(on)(25^{\circ}\text{C})}}$$

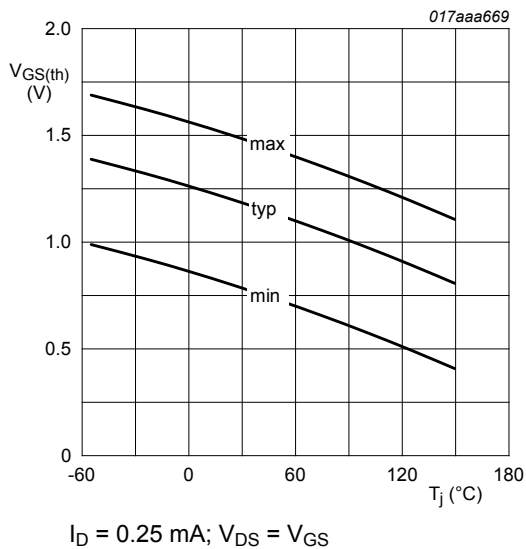


Fig. 12. Gate-source threshold voltage as a function of junction temperature

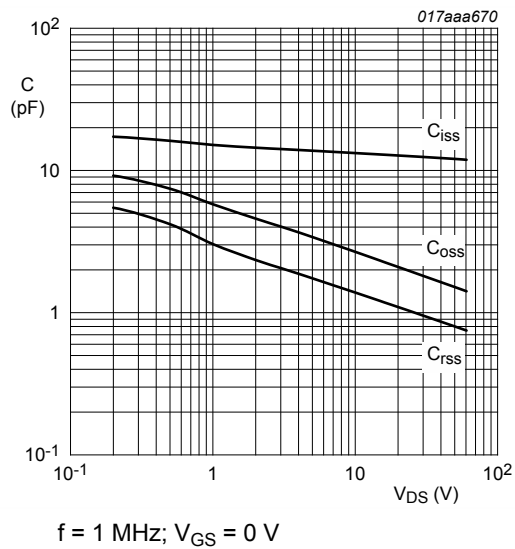


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values



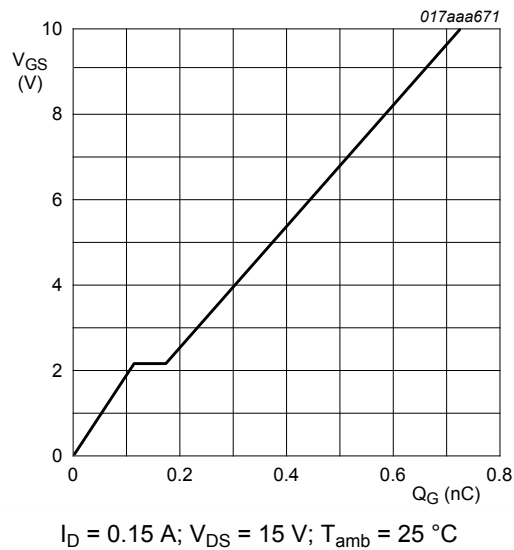


Fig. 14. Gate-source voltage as a function of gate charge; typical values

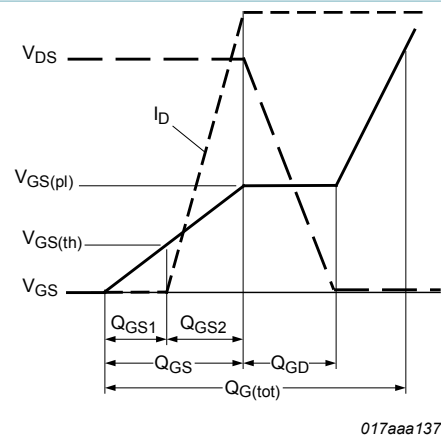


Fig. 15. Gate charge waveform definitions

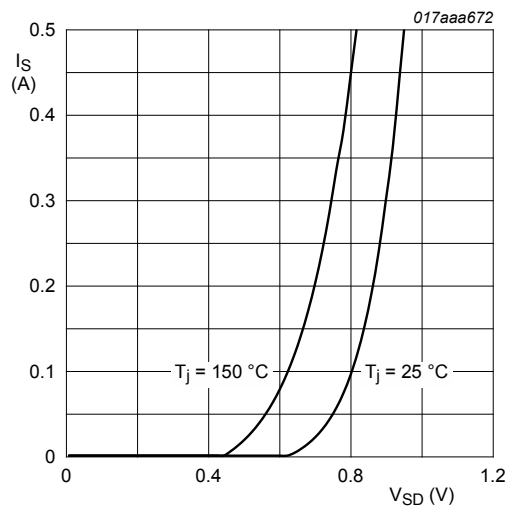


Fig. 16. Source current as a function of source-drain voltage; typical values

11. Test information

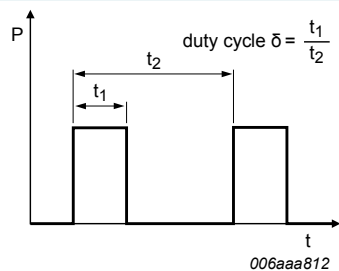
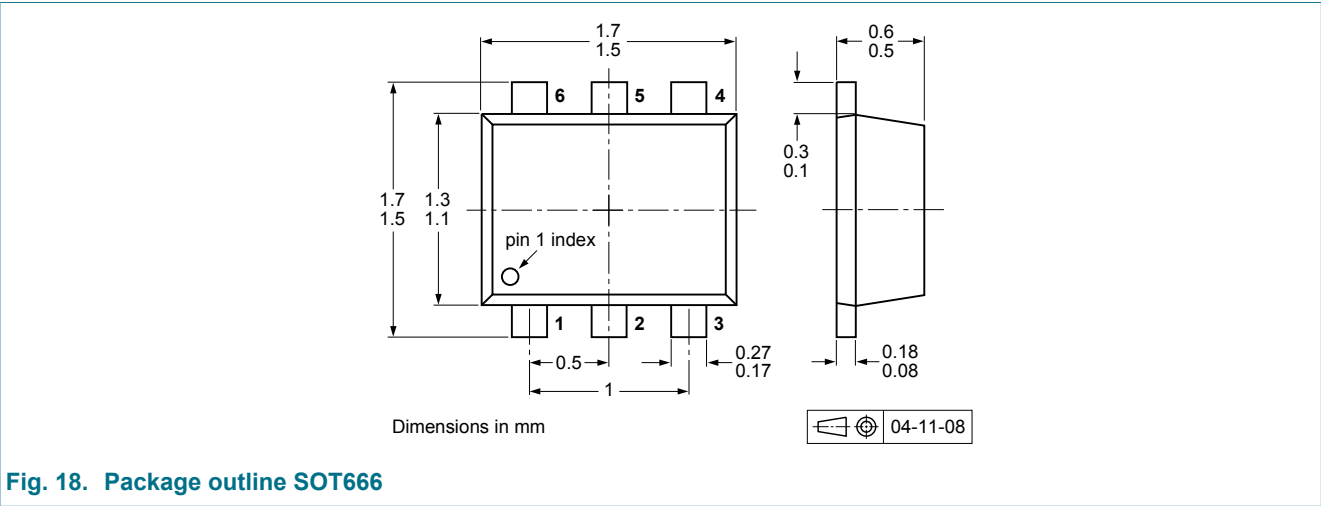
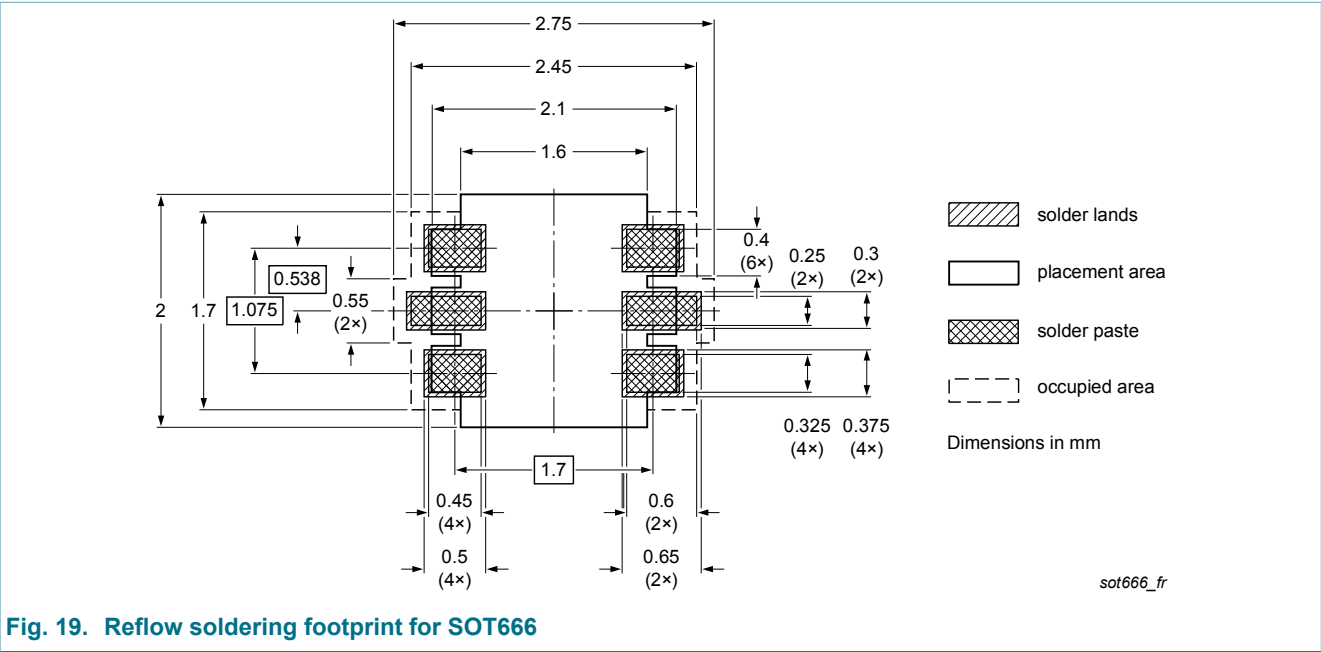


Fig. 17. Duty cycle definition

12. Package outline



13. Soldering



## 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
NX3020NAKV v.2	20131029	Product data sheet	-	NX3020NAKV v.1
Modifications:	<ul style="list-style-type: none"><li>• 3D package outline added</li><li>• Table 7 values of capacitance parameters corrected</li><li>• Figure 13 corrected</li></ul>			
NX3020NAKV v.1	20120706	Product data sheet	-	-

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### 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.

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

1	General description .....	1
2	Features and benefits .....	1
3	Applications .....	1
4	Quick reference data .....	1
5	Pinning information .....	2
6	Ordering information .....	2
7	Marking .....	2
8	Limiting values .....	2
9	Thermal characteristics .....	4
10	Characteristics .....	5
11	Test information .....	9
12	Package outline .....	10
13	Soldering .....	10
14	Revision history .....	11
15	Legal information .....	12
15.1	Data sheet status .....	12
15.2	Definitions .....	12
15.3	Disclaimers .....	12
15.4	Trademarks .....	13

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