



# NXV65UP

20 V, P-channel Trench MOSFET

19 October 2020

Product data sheet

## 1. General description

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

## 2. Features and benefits

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

## 3. Applications

- Relay driver
- High-speed line driver
- High-side load switch
- Switching circuits

## 4. Quick reference data

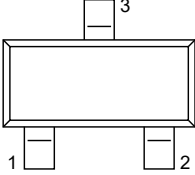
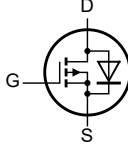
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{DS}$	drain-source voltage	$T_j = 25\text{ °C}$	-	-	-20	V
$V_{GS}$	gate-source voltage		-8	-	8	V
$I_D$	drain current	$V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ °C}$	[1]	-	-2.1	A
<b>Static characteristics</b>						
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = -4.5\text{ V}; I_D = -2.1\text{ A}; T_j = 25\text{ °C}$	-	55	70	m $\Omega$

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm<sup>2</sup>.

## 5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate	 <p style="text-align: center;">SOT23</p>	 <p style="text-align: center;">017aaa257</p>
2	S	source		
3	D	drain		

## 6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
NXV65UP	SOT23	plastic, surface-mounted package; 3 terminals; 1.9 mm pitch; 2.9 mm x 1.3 mm x 1 mm body	SOT23

## 7. Marking

Table 4. Marking codes

Type number	Marking code[1]
NXV65UP	%5L

[1] % = placeholder for manufacturing site code

## 8. Limiting values

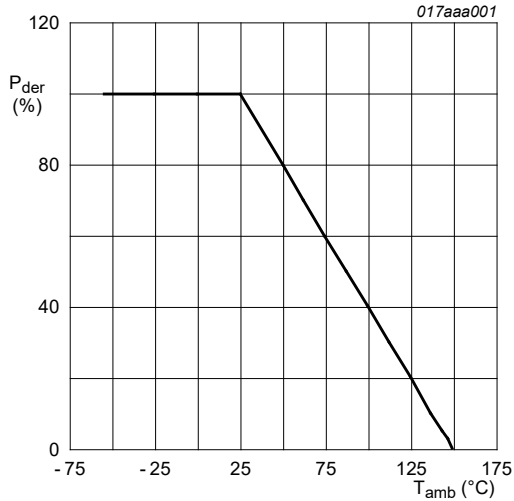
Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DS}$	drain-source voltage	$T_j = 25\text{ }^\circ\text{C}$	-	-20	V
$V_{GS}$	gate-source voltage		-8	8	V
$I_D$	drain current	$V_{GS} = -4.5\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}$	[1]	-2.1	A
		$V_{GS} = -4.5\text{ V}; T_{amb} = 100\text{ }^\circ\text{C}$	[1]	-1.3	A
$I_{DM}$	peak drain current	$T_{amb} = 25\text{ }^\circ\text{C}$ ; single pulse; $t_p \leq 10\text{ }\mu\text{s}$	-	-8.4	A
$P_{tot}$	total power dissipation	$T_{amb} = 25\text{ }^\circ\text{C}$	[2]	340	mW
			[1]	480	mW
		$T_{sp} = 25\text{ }^\circ\text{C}$		2.1	W
$T_j$	junction temperature		-55	150	$^\circ\text{C}$
$T_{amb}$	ambient temperature		-55	150	$^\circ\text{C}$
$T_{stg}$	storage temperature		-65	150	$^\circ\text{C}$
<b>Source-drain diode</b>					
$I_S$	source current	$T_{amb} = 25\text{ }^\circ\text{C}$	[1]	-0.4	A

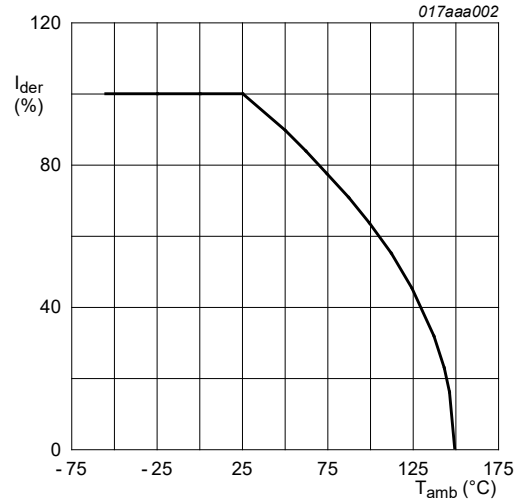
[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated, mounting pad for drain 6 cm<sup>2</sup>.

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



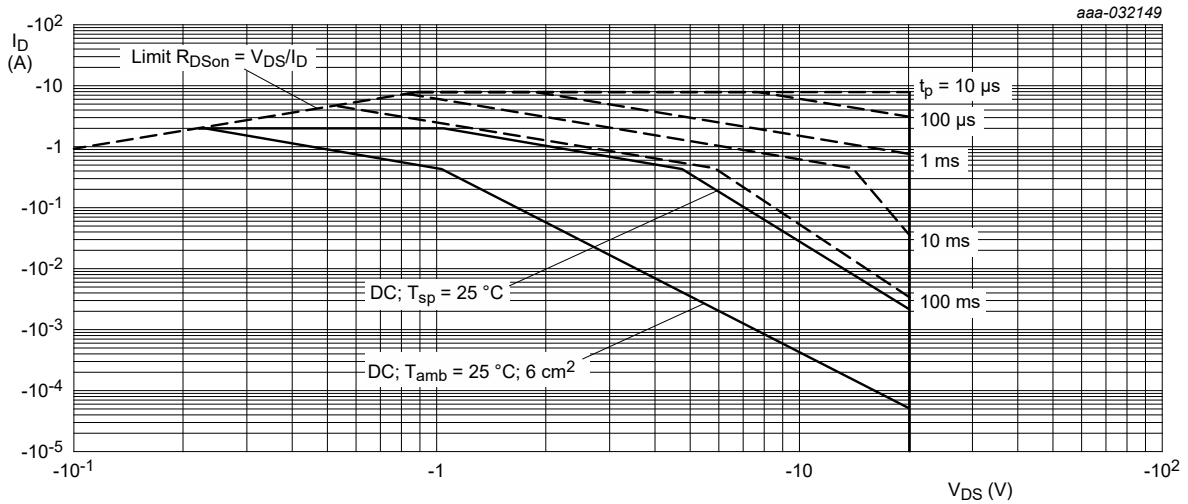
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}\text{C})}} \times 100 \%$$

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



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

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



**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]	-	325	370	K/W
			[2]	-	230	260	K/W
$R_{th(j-sp)}$	thermal resistance from junction to solder point			-	50	60	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 6 cm<sup>2</sup>.

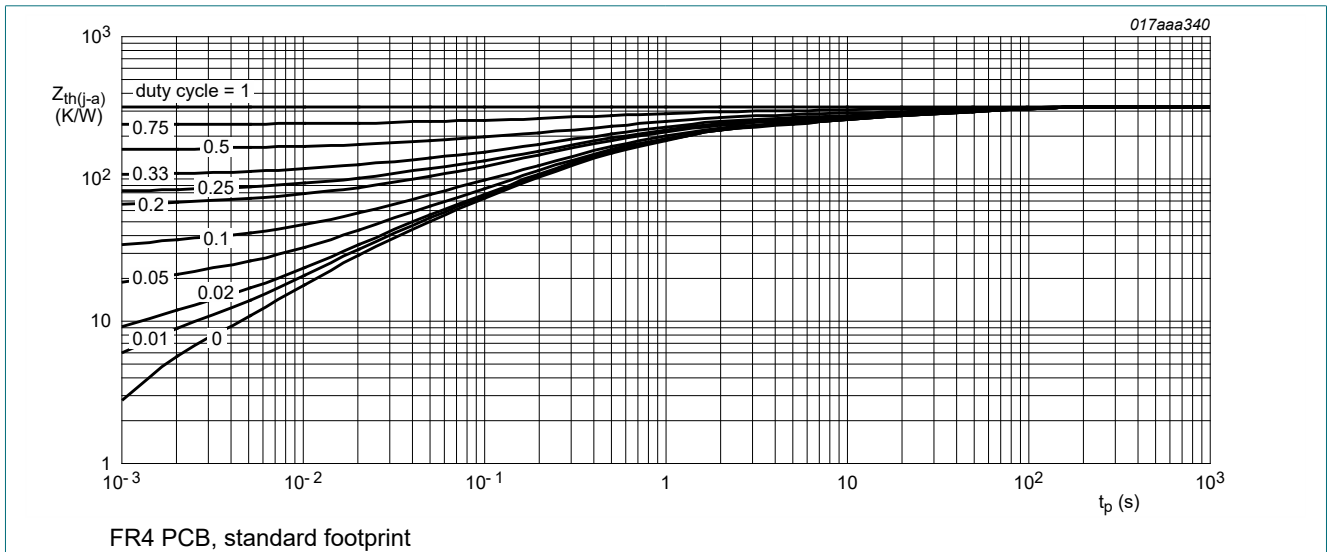


Fig. 4. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

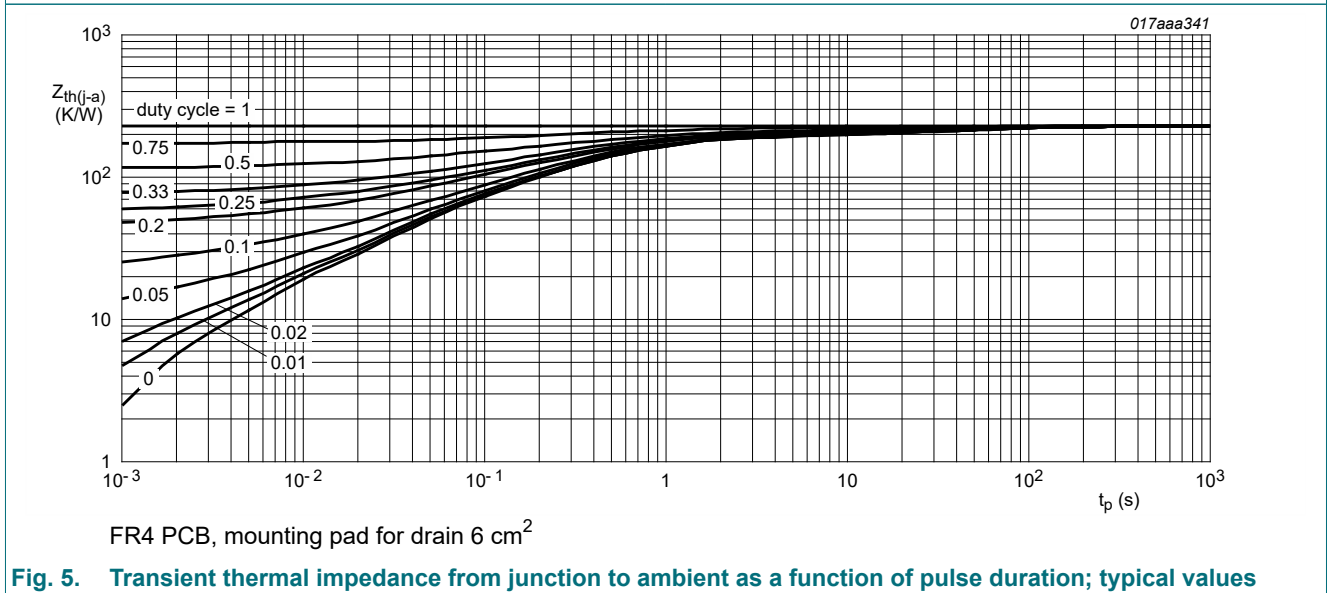


Fig. 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

## 10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = -250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-20	-	-	V
$V_{GSth}$	gate-source threshold voltage	$I_D = -250 \mu\text{A}; V_{DS}=V_{GS}; T_j = 25 \text{ }^\circ\text{C}$	-0.5	-0.7	-1	V
$I_{DSS}$	drain leakage current	$V_{DS} = -20 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	-	-1	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = -8 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	-	-100	nA
		$V_{GS} = 8 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	-	100	nA
$R_{DSon}$	drain-source on-state resistance	$V_{GS} = -4.5 \text{ V}; I_D = -2.1 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$	-	55	70	m $\Omega$
		$V_{GS} = -4.5 \text{ V}; I_D = -2.1 \text{ A}; T_j = 150 \text{ }^\circ\text{C}$	-	86	110	m $\Omega$
		$V_{GS} = -2.5 \text{ V}; I_D = -1.7 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$	-	74	100	m $\Omega$
		$V_{GS} = -1.8 \text{ V}; I_D = -1.4 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$	-	101	150	m $\Omega$
$g_{fs}$	forward transconductance	$V_{DS} = -5 \text{ V}; I_D = -2.1 \text{ A}; T_j = 25 \text{ }^\circ\text{C}$	-	6.6	-	S
$R_G$	gate resistance	$f = 1 \text{ MHz}$	-	8.4	-	$\Omega$
<b>Dynamic characteristics</b>						
$Q_{G(tot)}$	total gate charge	$V_{DS} = -10 \text{ V}; I_D = -2.1 \text{ A}; V_{GS} = -4.5 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	5.8	8.7	nC
$Q_{GS}$	gate-source charge		-	0.7	-	nC
$Q_{GD}$	gate-drain charge		-	1.8	-	nC
$C_{iss}$	input capacitance	$V_{DS} = -10 \text{ V}; f = 1 \text{ MHz}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	458	-	pF
$C_{oss}$	output capacitance		-	70	-	pF
$C_{rss}$	reverse transfer capacitance		-	62	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = -10 \text{ V}; I_D = -2.1 \text{ A}; V_{GS} = -4.5 \text{ V}; R_{G(ext)} = 6 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$	-	6	-	ns
$t_r$	rise time		-	13	-	ns
$t_{d(off)}$	turn-off delay time		-	46	-	ns
$t_f$	fall time		-	18	-	ns
<b>Source-drain diode</b>						
$V_{SD}$	source-drain voltage	$I_S = -0.4 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$	-	-0.7	-1.2	V

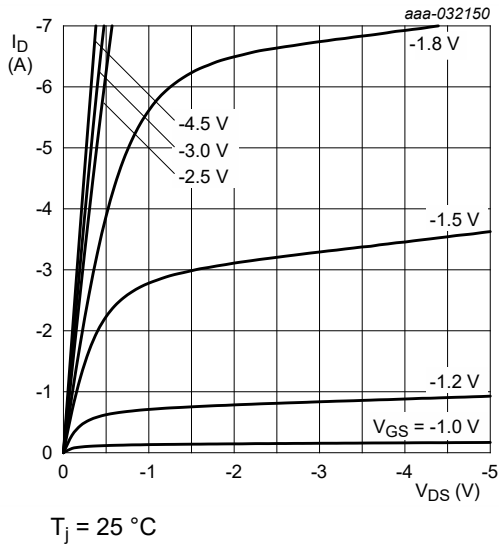


Fig. 6. Output characteristics: drain current as a function of drain-source voltage; typical values

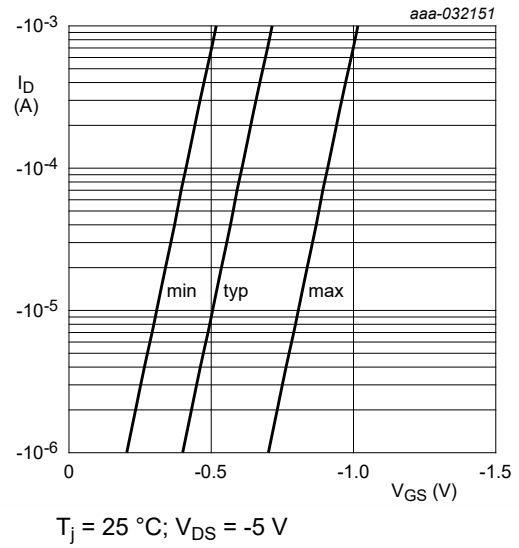


Fig. 7. Sub-threshold drain current as a function of gate-source voltage

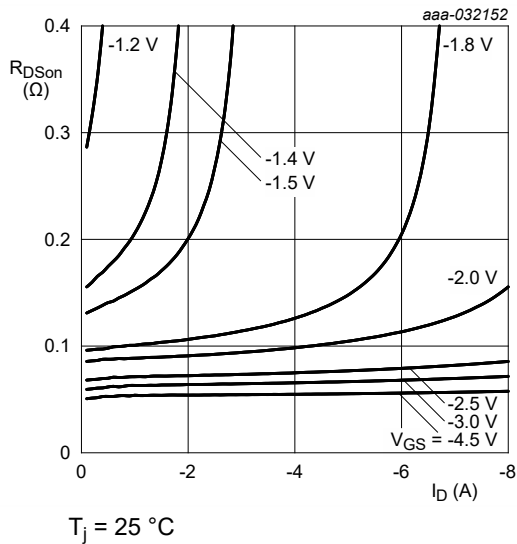


Fig. 8. Drain-source on-state resistance as a function of drain current; typical values

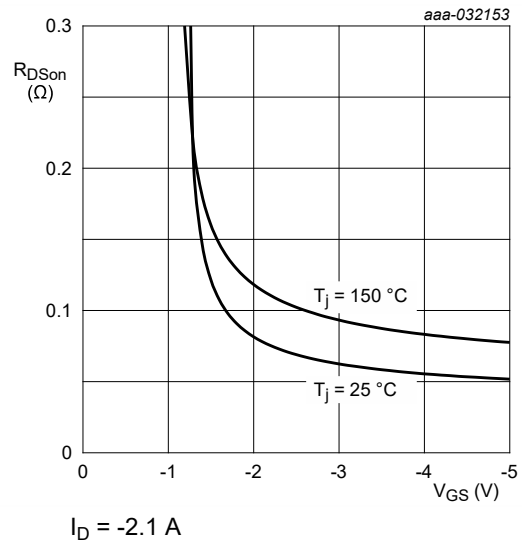


Fig. 9. Drain-source on-state resistance as a function of gate-source voltage; typical values

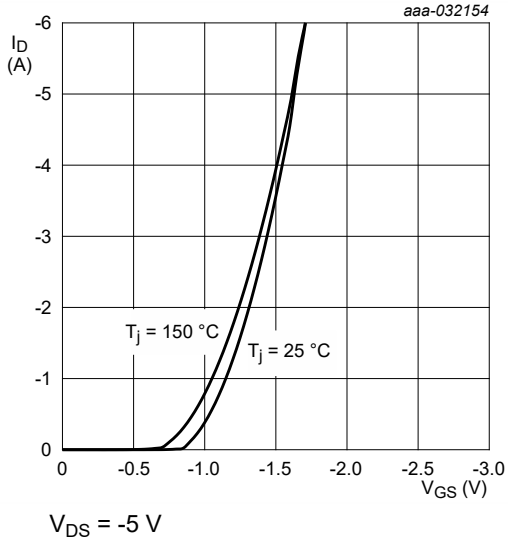
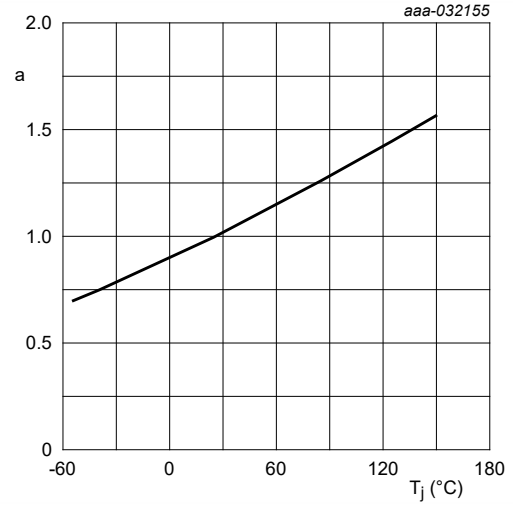


Fig. 10. Transfer characteristics: drain current as a function of gate-source voltage; typical values



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

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

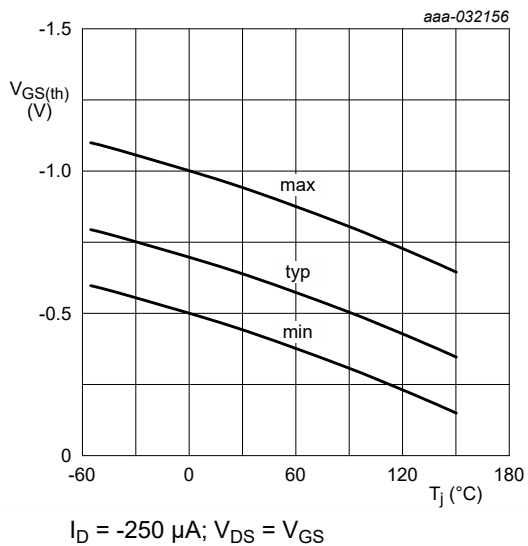


Fig. 12. Gate-source threshold voltage as a function of junction temperature

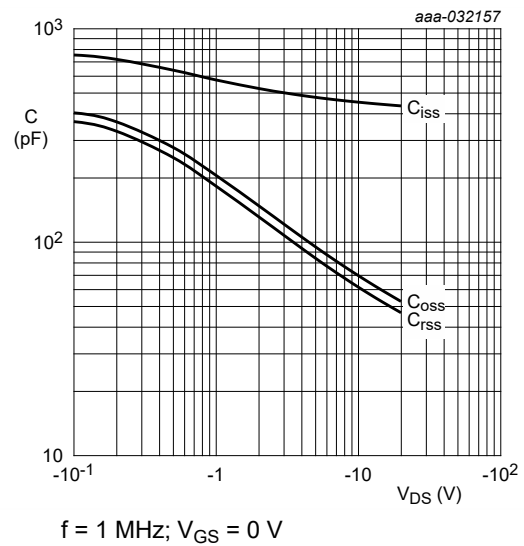
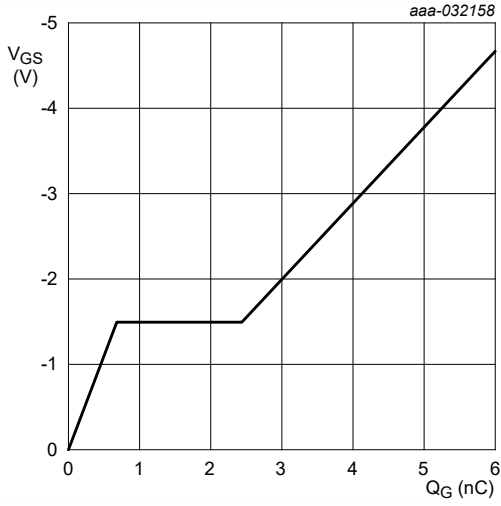
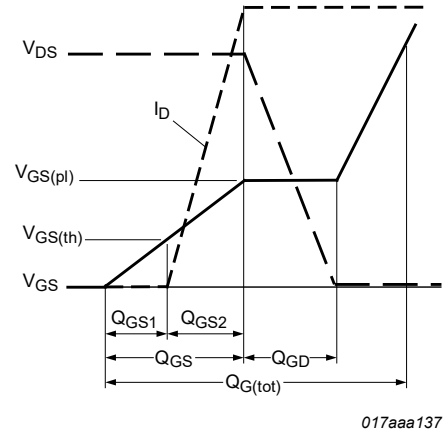


Fig. 13. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

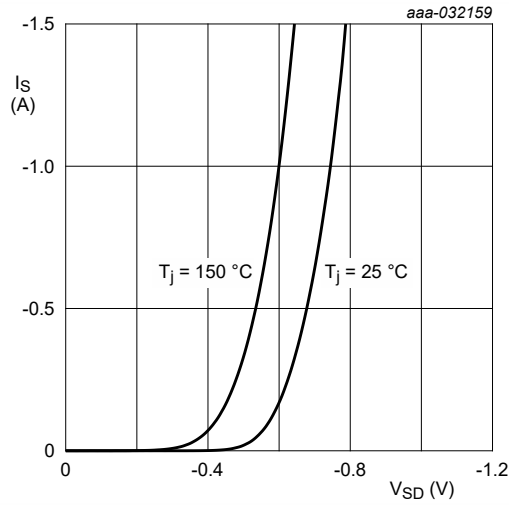


$V_{DS} = -10\text{ V}; I_D = -2.1\text{ A}; T_j = 25\text{ }^\circ\text{C}$

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



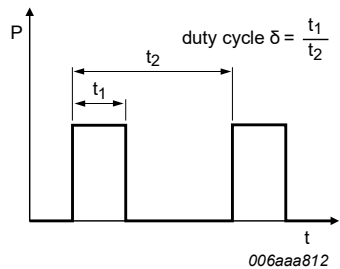
**Fig. 15. Gate charge waveform definitions**



$V_{GS} = 0\text{ V}$

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

## 11. Test information



**Fig. 17. Duty cycle definition**



## 12. Package outline

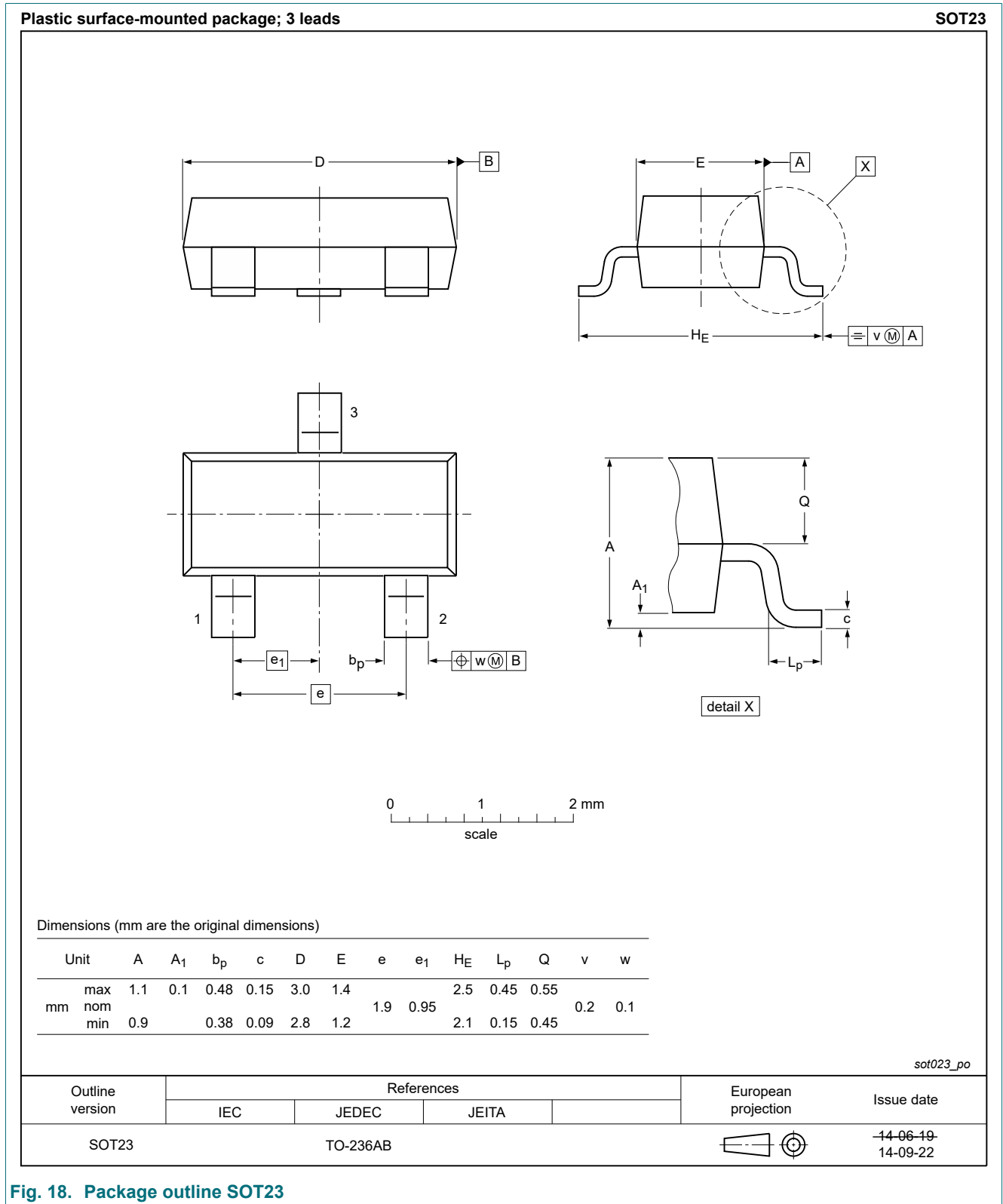


Fig. 18. Package outline SOT23

### 13. Soldering

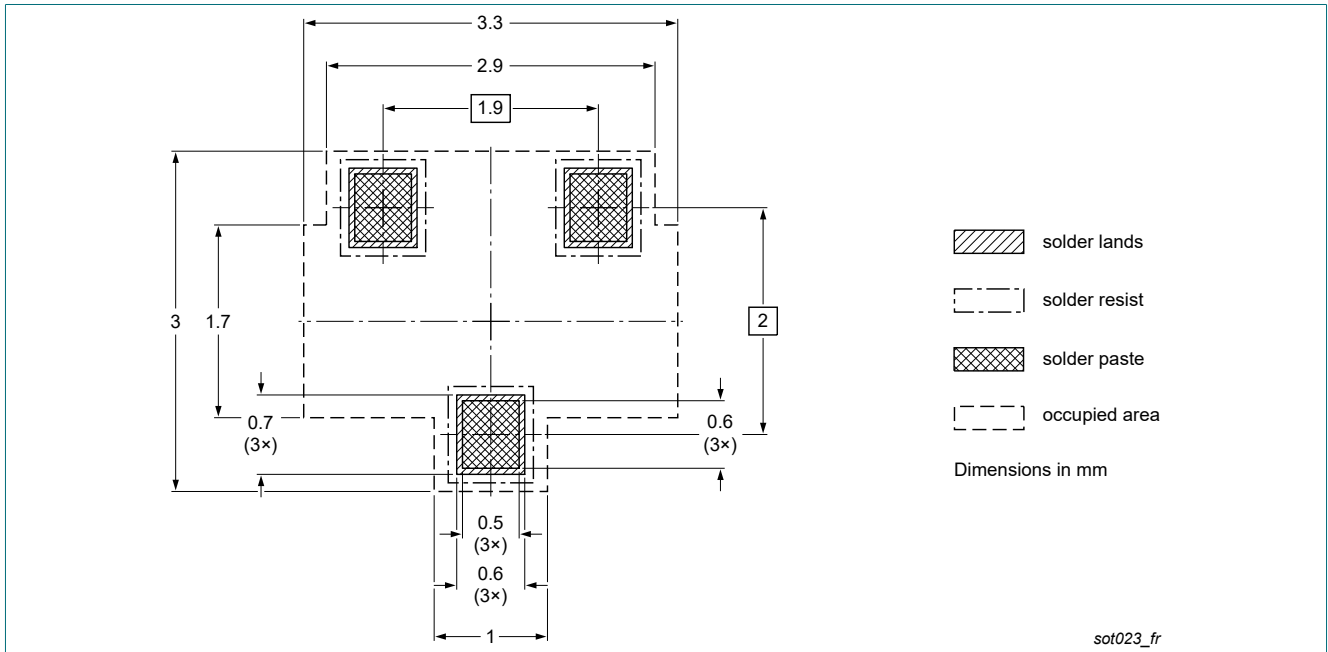


Fig. 19. Reflow soldering footprint for SOT23

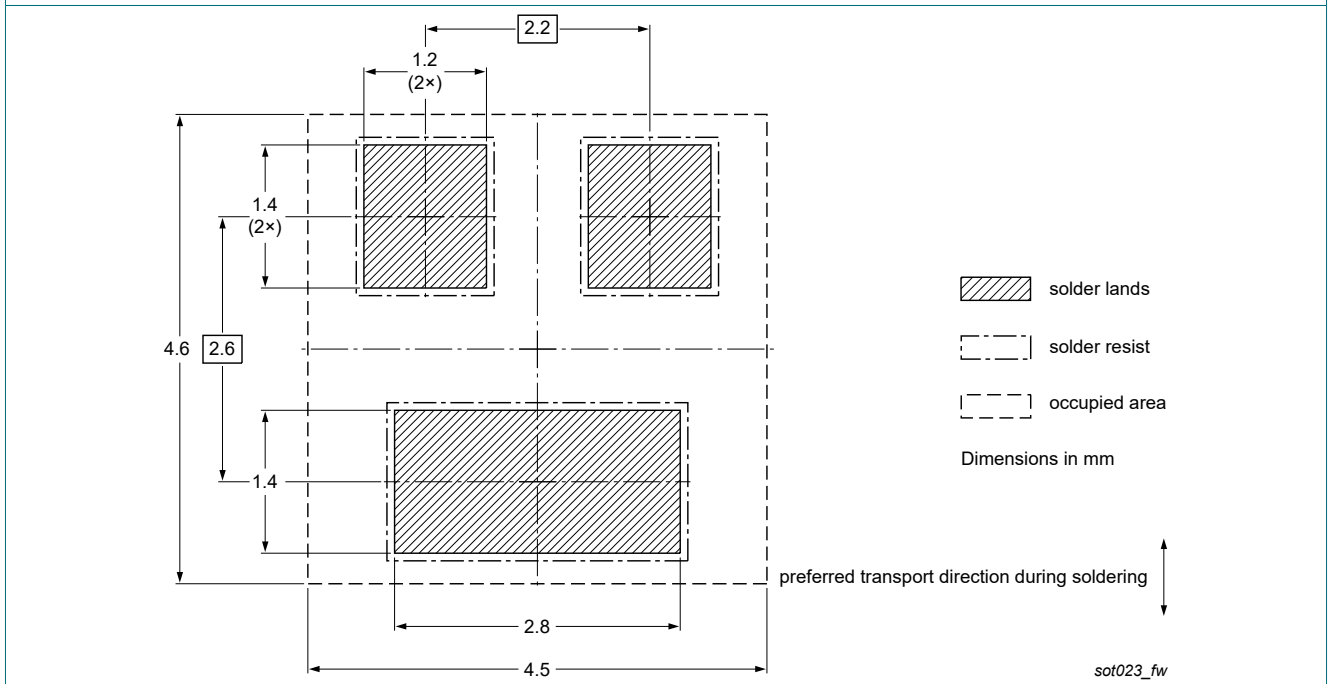


Fig. 20. Wave soldering footprint for SOT23

### 14. Revision history

Table 8. Revision history

Data sheet ID	Release date	Data sheet status	Change notice	Supersedes
NXV65UP v.1	20201019	Product	-	-

## 15. Legal information

### 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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## Contents

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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.....	8
12. Package outline.....	9
13. Soldering.....	10
14. Revision history.....	10
15. Legal information.....	11

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