

ON5520 N-channel TrenchMOS FET Rev. 01 — 24 March 2009

Product data sheet

Product profile

1.1 General description

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

This type is a selection of the 2N7002 by the parameter $V_{GS(th)}$.

1.2 Features

- Logic level threshold compatible
- Surface-mounted package
- Very fast switching
- TrenchMOS technology

1.3 Applications

Logic level translator

High-speed line driver

1.4 Quick reference data

- V_{DS} ≤ 60 V
- $\blacksquare \quad \mathsf{R}_{\mathsf{DSon}} \leq 5 \; \Omega$

- I_D \leq 300 mA
- $P_{tot} \le 0.83 \text{ W}$

2. Pinning information

Table 1.	Pinning		
Pin	Description	Simplified outline	Graphic symbol
1	gate (G)	—-	
2	source (S)	3	D
3	drain (D)	1 2	G



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3. Ordering information

Table 2. Ordering information

Type number	Package		
	Name	Description	Version
ON5520	TO-236AB	plastic surface-mounted package; 3 leads	SOT23

4. Marking

Table 3. Marking codes

Type number	Marking code ^[1]
ON5520	RN*

^{[1] * = -:} made in Hong Kong

5. Limiting values

Table 4. Limiting values

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

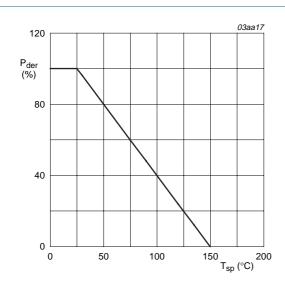
Symbol	Parameter	Conditions	Min	Max	Unit
V_{DS}	drain-source voltage	25 °C \leq T $_{j}$ \leq 150 °C	-	60	V
V_{DGR}	drain-gate voltage	25 °C \leq T _j \leq 150 °C; R _{GS} = 20 k Ω	-	60	V
V_{GS}	gate-source voltage		-	±30	V
V_{GSM}	peak gate-source voltage	$t_p \le 50 \ \mu s; \ pulsed; \ duty \ cycle = 25 \ \%$	-	±40	V
I _D	drain current	$T_{sp} = 25 ^{\circ}\text{C}; V_{GS} = 10 \text{V};$ see Figure 2 and 3	-	300	mA
		$T_{sp} = 100 ^{\circ}\text{C};$ $V_{GS} = 10 \text{V}; \text{see } \frac{\text{Figure 2}}{\text{Figure 2}}$	-	190	mA
I _{DM}	peak drain current	T_{sp} = 25 °C; pulsed; $t_p \le 10 \mu s$; see Figure 3	-	1.2	Α
P _{tot}	total power dissipation	T _{sp} = 25 °C; see <u>Figure 1</u>	-	0.83	W
T _{stg}	storage temperature		-65	+150	°C
T _j	junction temperature		-65	+150	°C
Source-di	rain diode				
Is	source current	T _{sp} = 25 °C	-	300	mA
I _{SM}	peak source current	T_{sp} = 25 °C; pulsed; $t_p \le 10 \mu s$	-	1.2	Α

^{* =} p: made in Hong Kong

^{* =} t: made in Malaysia

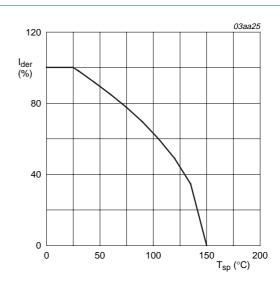
^{* =} W: made in China

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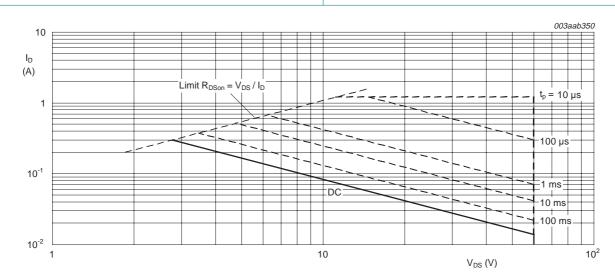
$$P_{der} = \frac{P_{tot}}{P_{tot(25\ ^{\circ}C)}} \times 100\ \%$$

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



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

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



 T_{sp} = 25 °C; I_{DM} is single pulse

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

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6. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
$R_{th(j\text{-sp})}$	thermal resistance from junction to solder point	see Figure 4	-	-	150	K/W
R _{th(j-a)}	thermal resistance from junction to ambient		[1] -	-	350	K/W

^[1] Mounted on a Printed-Circuit Board (PCB); minimum footprint; vertical in still air.

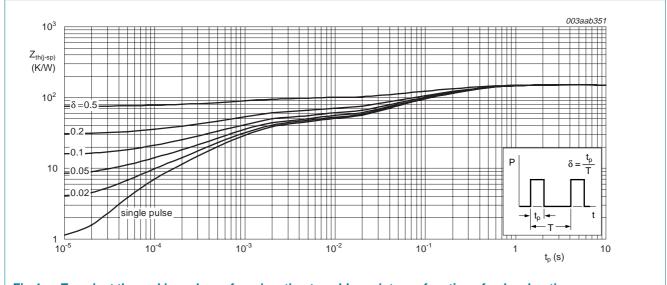


Fig 4. Transient thermal impedance from junction to solder point as a function of pulse duration

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7. Characteristics

Table 6. Characteristics

 $T_i = 25 \,^{\circ}C$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
Static cha	aracteristics					
V _{(BR)DSS}	drain-source breakdown voltage	$I_D = 10 \mu A; V_{GS} = 0 V$				
		T _j = 25 °C	60	-	-	V
		T _j = −55 °C	55	-	-	V
V _{GS(th)}	gate-source threshold voltage	$I_D = 0.25$ mA; $V_{DS} = V_{GS}$; see <u>Figure 9</u> and <u>10</u>				
		T _j = 25 °C	1.6	2	2.1	V
		T _j = 150 °C	0.6	-	-	V
		T _j = −55 °C	-	-	2.75	V
I _{DSS}	drain leakage current	$V_{DS} = 48 \text{ V}; V_{GS} = 0 \text{ V}$				
		T _j = 25 °C	-	0.01	1	μΑ
		T _j = 150 °C	-	-	10	μΑ
I _{GSS}	gate leakage current	$V_{GS} = \pm 15 \text{ V}; V_{DS} = 0 \text{ V}$	-	10	100	nΑ
R _{DSon}	drain-source on-state resistance	$V_{GS} = 10 \text{ V};$ $I_D = 500 \text{ mA};$ see Figure 6 and 8				
		T _j = 25 °C	-	2.8	5	Ω
		T _j = 150 °C	-	-	9.25	Ω
		$V_{GS} = 4.5 \text{ V}; I_D = 75 \text{ mA};$ see Figure 6 and 8	-	3.8	5.3	Ω
Dynamic	characteristics					
C _{iss}	input capacitance	$V_{GS} = 0 \text{ V}; V_{DS} = 10 \text{ V};$	-	31	50	pF
Coss	output capacitance	f = 1 MHz; see Figure 12	-	6.8	30	pF
C _{rss}	reverse transfer capacitance		-	3.5	10	pF
t _{on}	turn-on time	$V_{DS} = 50 \text{ V}; R_L = 250 \Omega;$	-	2.5	10	ns
t _{off}	turn-off time	V_{GS} = 10 V; R_G = 50 Ω ; R_{GS} = 50 Ω	-	11	15	ns
Source-d	rain diode					
V_{SD}	source-drain voltage	$I_S = 300 \text{ mA}$; $V_{GS} = 0 \text{ V}$; see Figure 11	-	0.85	1.5	V
t _{rr}	reverse recovery time	$I_S = 300 \text{ mA};$	-	30	-	ns
Q _r	recovered charge	$dI_S/dt = -100 A/\mu s;$ $V_{GS} = 0 V$	-	30	-	nC

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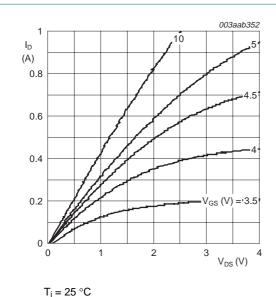
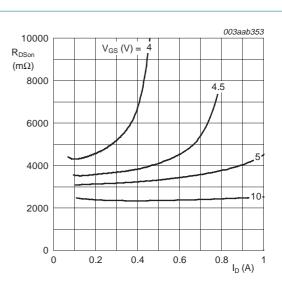
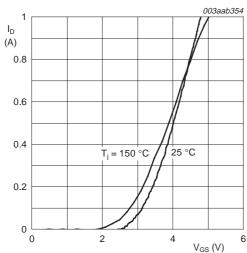


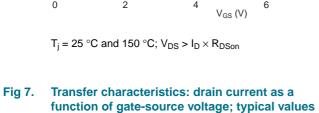
Fig 5. Output characteristics: drain current as a function of drain-source voltage; typical values

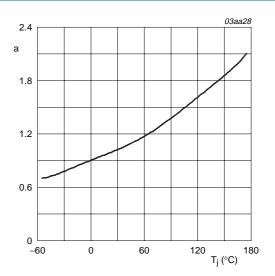


 $T_j = 25$ °C

Fig 6. Drain-source on-state resistance as a function of drain current; typical values







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

Fig 8. Normalized drain-source on-state resistance factor as a function of junction temperature

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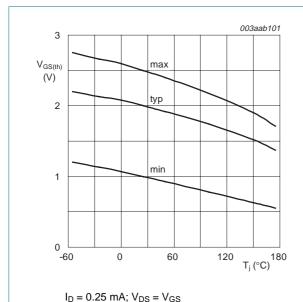
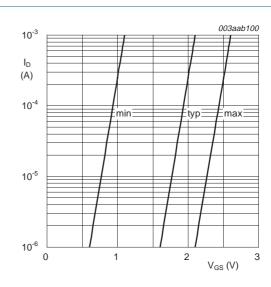
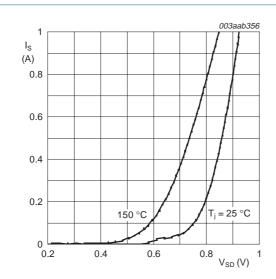


Fig 9. Gate-source threshold voltage as a function of junction temperature



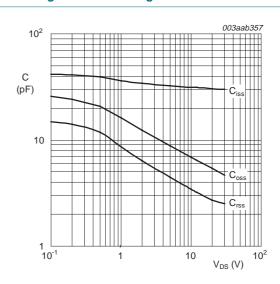
 $T_i = 25 \,^{\circ}C; \, V_{DS} = 5 \,^{\circ}V$

Fig 10. Sub-threshold drain current as a function of gate-source voltage



 $T_j = 25~^{\circ}C~and~150~^{\circ}C;~V_{GS} = 0~V$ Fig 11. Source current as a function of source-drain

voltage; typical values



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

Fig 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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8. Package outline

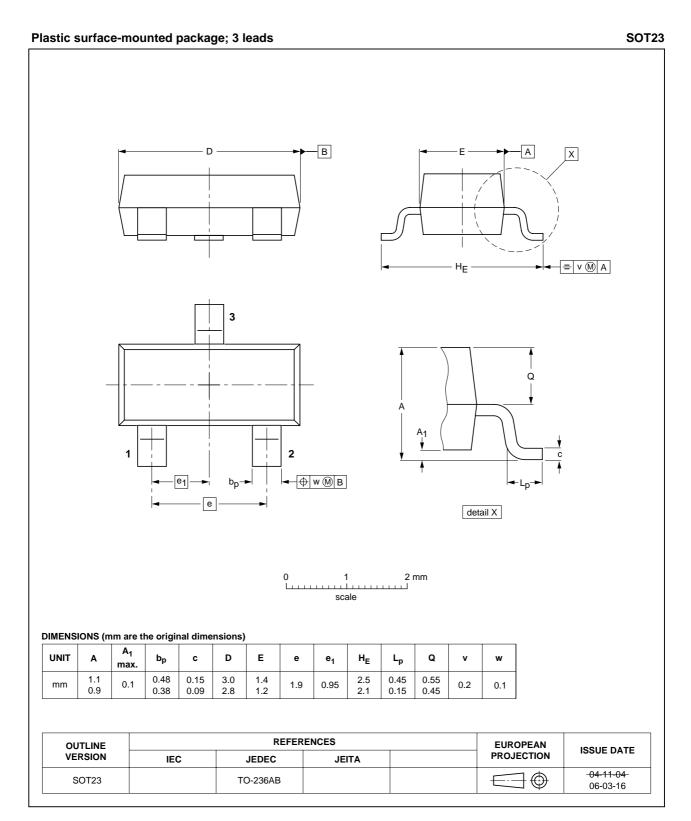


Fig 13. Package outline SOT23

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9. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
ON5520_1	20090324	Product data sheet	-	-

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10. Legal information

10.1 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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