

## STN5PF02V

P-channel 20V -  $0.065\Omega$  - 4.2A - SOT-223 2.5V - Drive STripFET<sup>TM</sup> II Power MOSFET

#### **General features**

Туре	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STN5PF02V	20V	<0.080Ω	4.2A

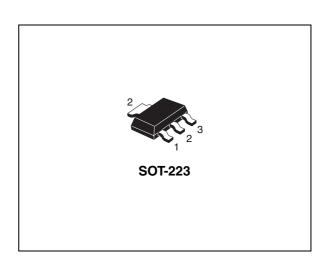
- Ultra low threshold gate drive (2.5V)
- Standard outline for easy automated surface mount assembly

#### **Description**

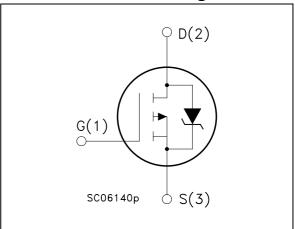
This Power MOSFET is the latest development of STMicroelectronics unique "single feature size™" strip-based process. The resulting transistor shows extremely extremely low on-resistance when driven at 2.5V.

#### **Applications**

■ Switching application



### Internal schematic diagram



#### **Order codes**

Part number	Marking Package		Packaging
STN5PF02V	N5PF02V	SOT-223	Tape & reel

Contents STN5PF02V

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STN5PF02V Electrical ratings

## 1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source voltage (V <sub>GS</sub> = 0)	20	V
V <sub>GS</sub>	Gate- source voltage	± 8	V
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 25°C	4.2	Α
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 100°C	2.6	Α
I <sub>DM</sub> <sup>(1)</sup>	Drain current (pulsed)	17	Α
P <sub>TOT</sub>	Total dissipation at T <sub>C</sub> = 25°C	2.5	W
T <sub>j</sub> T <sub>stg</sub>	Max. operating junction temperature Storage temperature	-55 to 150	°C

<sup>1.</sup> Pulse width limited by safe operating area

Note:

For the p-channel Power MOSFET actual polarity of voltages and current has to be reversed

Table 2. Thermal resistance

Symbol	Parameter	Max value	Unit
Rthj-pcb (1)	Thermal resistance junction-pc board	50	°C/W
Rthj-amb	Thermal resistance junction-ambient	90	°C/W

<sup>1.</sup> When mounted on FR-4 board of 1inch² pad, 2oz Cu and tc< 10sec

Electrical characteristics STN5PF02V

### 2 Electrical characteristics

( $T_{CASE}$ =25°C unless otherwise specified)

Table 3. On/off states

Symbol	Parameter	Test conditions	Min	Тур.	Max	Unit
V <sub>(BR)DSS</sub>	Drain-source breakdown voltage	$I_D = 250 \mu A, V_{GS} = 0$	20			V
I <sub>DSS</sub>	Zero gate voltage drain current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max rating V <sub>DS</sub> = Max rating,@125°C			1 10	μ <b>Α</b> μ <b>Α</b>
I <sub>GSS</sub>	Gate-body leakage current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 8V			±100	nA
V <sub>GS(th)</sub>	Gate threshold voltage	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	0.45			V
R <sub>DS(on)</sub>	Static drain-source on resistance	$V_{GS} = 4.5V, I_D = 2.1A$ $V_{GS} = 2.5V, I_D = 2.1A$		0.065 0.085	0.080 0.10	Ω Ω

Table 4. Dynamic

Symbol	Parameter	Parameter Test conditions Min		Тур.	Max	Unit
9 <sub>fs</sub> <sup>(1)</sup>	Forward transconductance	$V_{DS} = 15V_{,} I_{D} = 2.5A$		6.6		S
C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub>	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 15V, f = 1 \text{ MHz}, $ $V_{GS} = 0$		412 179 42.5		pF pF pF
Q <sub>g</sub> Q <sub>gs</sub> Q <sub>gd</sub>	Total gate charge Gate-source charge Gate-drain charge	$V_{DD}$ = 10V, $I_{D}$ = 4.2A, $V_{GS}$ = 2.5V (see Figure 13)		4.5 0.73 1.75	6	nC nC nC

<sup>1.</sup> Pulsed: Pulse duration = 300  $\mu$ s, duty cycle 1.5 %

Table 5. Switching times

Symbol	Parameter	Test conditions	Min	Тур.	Max	Unit
t <sub>d(on)</sub> t <sub>r</sub> t <sub>d(off)</sub> t <sub>f</sub>	Turn-on delay time Rise time Turn-off-delay time Fall time	$V_{DD}$ = 10V, $I_D$ = 2.1A $R_G$ = 4.7 $\Omega$ , $V_{GS}$ = 2.5V (see Figure 12)		11 47 38 20		ns ns ns ns

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min	Тур.	Max	Unit
I <sub>SD</sub>	Source-drain current Source-drain current (pulsed)				4.2 17	A A
V <sub>SD</sub> <sup>(2)</sup>	Forward on voltage	$I_{SD} = 4.2A, V_{GS} = 0$			1.2	٧
t <sub>rr</sub> Q <sub>rr</sub> I <sub>RRM</sub>	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 4.2A$ , di/dt=100A/ $\mu$ s, $V_{DD} = 16V$ , $T_{j} = 150$ °C (see Figure 14)		32 12.8 0.8		ns nC A

<sup>1.</sup> Pulse width limited by safe operating area

<sup>2.</sup> Pulsed: Pulse duration = 300  $\mu$ s, duty cycle 1.5 %

Electrical characteristics STN5PF02V

#### 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

Figure 2. Thermal inpedance

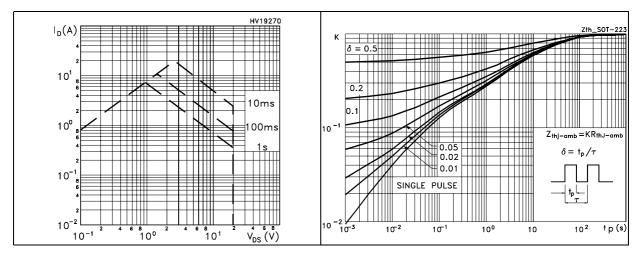


Figure 3. Output characteristics

Figure 4. Transfer characteristics

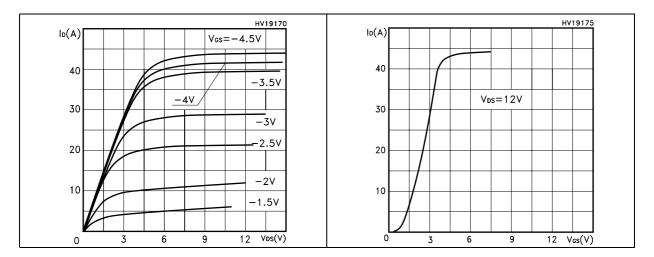
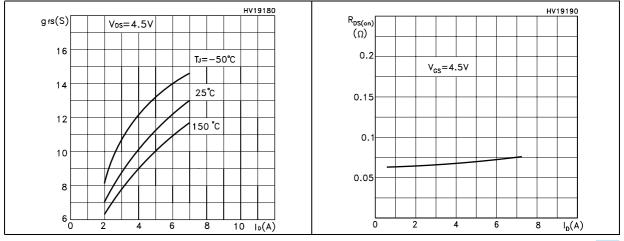


Figure 5. Transconductance

Figure 6. Static drain-source on resistance



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16 V<sub>DS</sub>(V)

4

8

HV19200 HV19210  $V_{GS}(V)$ C(pF) f=1MHz  $V_{GS} = 0V$ V<sub>DS</sub>=-10V 800 -1 ID=-5A -2 600 Ciss -3 400 200

Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

Figure 9. Normalized gate threshold voltage Figure 10. Normalized on resistance vs vs temperature temperature

Qg(nC)

10

6

8

4

2

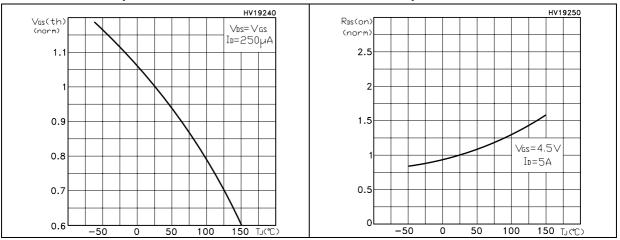
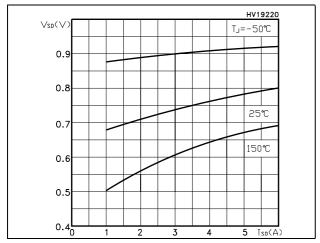


Figure 11. Source-drain diode forward characteristics



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Test circuit STN5PF02V

## 3 Test circuit

Figure 12. Switching times test circuit for resistive load

Figure 13. Gate charge test circuit

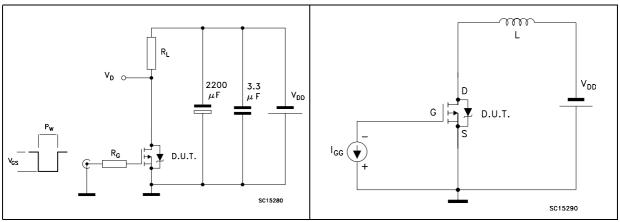
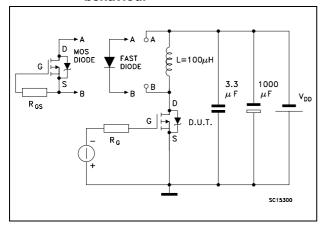


Figure 14. Test circuit for diode recovery behaviour



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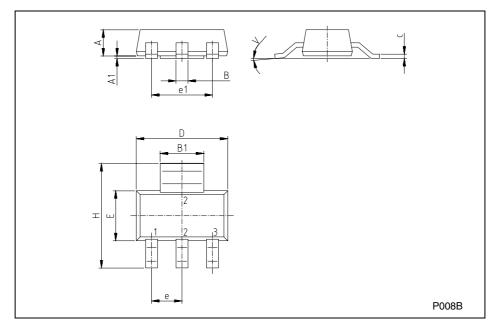
### 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: <a href="https://www.st.com">www.st.com</a>

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#### **SOT-223 MECHANICAL DATA**

DIM	DIM.		mm		inch		
DIWI.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Α			1.80			0.071	
В	0.60	0.70	0.80	0.024	0.027	0.031	
B1	2.90	3.00	3.10	0.114	0.118	0.122	
С	0.24	0.26	0.32	0.009	0.010	0.013	
D	6.30	6.50	6.70	0.248	0.256	0.264	
е		2.30			0.090		
e1		4.60			0.181		
E	3.30	3.50	3.70	0.130	0.138	0.146	
Н	6.70	7.00	7.30	0.264	0.276	0.287	
V			10°			10°	
A1		0.02					



STN5PF02V Revision history

# 5 Revision history

Table 7. Revision history

Date	Revision	Changes
20-Jun-2005	1	First release
13-Dec-2005	2	Final version
04-Aug-2006	3	New template

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