

STF40NF03L STP40NF03L

N-channel 30 V, 0.018 Ω 40 A TO-220, TO-220FP STripFET™ Power MOSFET

Features

Туре	V _{DSS}	R _{DS(on)} max	I _D
STF40NF03L	30 V	0.022 Ω	23 A
STP40NF03L	30 V	0.022 Ω	40 A

■ Low threshold device

Application

■ Switching applications

Description

This Power MOSFET is the latest development of STMicroelectronics unique "single feature size" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

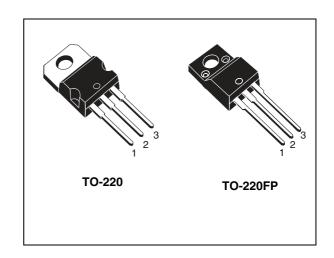


Figure 1. Internal schematic diagram

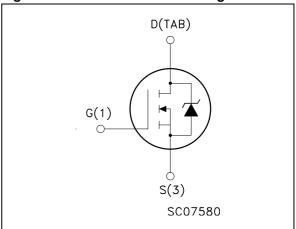


Table 1. Device summary

Order codes	Marking	Package	Packaging
STF40NF03L	F40NF03L	TO-220FP	Tube
STP40NF03L	TP40NF03L P40NF03L TO-220		Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Va	lue	Unit
Symbol	Parameter	TO-220	TO-220FP	Oille
V _{DS}	Drain-source voltage (V _{GS} = 0)	3	0	V
V _{GS}	Gate- source voltage	±	16	V
I _D	Drain current (continuous) at T _C = 25 °C	40	23	Α
I _D	Drain current (continuous) at T _C = 100 °C	28	16	Α
I _{DM} ⁽¹⁾	Drain current (pulsed)	160	92	Α
P _{tot}	Total dissipation at T _C = 25 °C	70	25	W
	Derating factor	0.46		W/°C
V _{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1 s;T _C =25 °C)		2500	٧
E _{AS} (2)	Single pulse avalanche energy	25	50	mJ
T _{stg}	Storage temperature	-55 to 175		°C
T _j	Max. operating junction temperature	-55 (J 173	

^{1.} Pulse width limited by safe operating area.

Table 3. Thermal data

Symbol Parameter		Package	Va	Unit		
Symbol	Farameter	Package	Тур.	Max.		
Dthi o	Thermal registance junction case	TO-220	1.8	2.1	°C/W	
Rthj-c	Thermal resistance junction-case	TO-220FP		6	C/VV	
Rthj-amb	Thermal resistance junction-ambient max			62.5	°C/W	
T _J	Maximum lead temperature for soldering purpose			300	°C	

^{2.} Starting $T_j = 25$ °C, $I_D = 20$ A, $V_{DD} = 15$ V

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
V _{(BR)DSS}	Drain-source breakdown voltage	$I_D = 250 \mu A, V_{GS} = 0$	30			٧
I _{DSS}	Zero gate voltage drain current (V _{GS} = 0)	V_{DS} = max ratings V_{DS} = max ratings, T_{C} = 125 °C			1 10	μ Α μ Α
I _{GSS}	Gate-body leakage current (V _{DS} = 0)	V _{GS} = ±16 V			±100	nA
V _{GS(th)}	Gate threshold voltage	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	1	1.7	2.5	V
R _{DS(on)}	Static drain-source on resistance	$V_{GS} = 10 \text{ V}, I_D = 20 \text{ A}$ $V_{GS} = 4.5 \text{ V}, I_D = 20 \text{ A}$		0.018 0.028	0.022 0.035	Ω Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
9 _{fs} (1)	Forward transconductance	V _{DS} = 10 V, I _D = 20 A	-	20	-	S
C _{iss} C _{oss} C _{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V _{DS} = 25 V, f = 1 MHz, V _{GS} = 0	-	770 255 60	-	pF pF pF
$\begin{array}{c} t_{d(on)} \\ t_{r} \\ t_{d(off)} \\ t_{f} \end{array}$	Turn-on delay time Rise time Turn-off delay time Fall time	$V_{DD} = 15 \text{ V}, I_{D} = 20 \text{ A}$ $R_{G} = 4.7 \Omega V_{GS} = 4.5 \text{ V}$ (see <i>Figure 16</i>)	-	14 80 25 16		ns ns ns
Q _g Q _{gs} Q _{gd}	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 15 \text{ V}, I_{D} = 40 \text{ A},$ $V_{GS} = 4.5 \text{ V}$ (see <i>Figure 17</i>)	-	10.5 4 4.5	15	nC nC nC

^{1.} Pulsed: Pulse duration = 300 μ s, duty cycle 1.5%.

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
I _{SD}	Source-drain current Source-drain current (pulsed)		-		40 160	A A
V _{SD} ⁽²⁾	Forward on voltage	I _{SD} = 40 A, V _{GS} = 0	-		1.5	V
t _{rr} Q _{rr} I _{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 40 \text{ A},$ $di/dt = 100 \text{ A/}\mu\text{s},$ $V_{DD} = 15 \text{ V}, T_j = 150 ^{\circ}\text{C}$ (see <i>Figure 18</i>)	-	34.5 30 2		ns nC A

- 1. Pulse width limited by safe operating area.
- 2. Pulsed: Pulse duration = 300 μ s, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220

Figure 3. Thermal impedance for TO-220

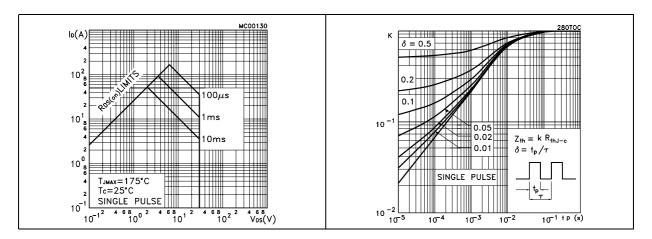


Figure 4. Safe operating area for TO-220FP

Figure 5. Thermal impedance for TO-220FP

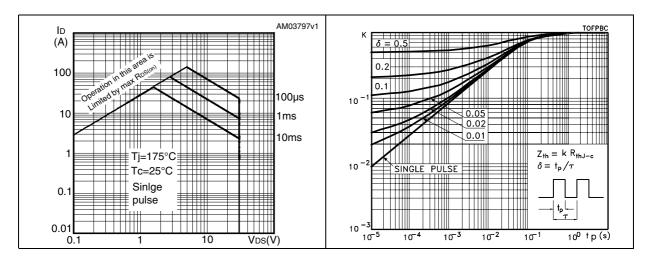
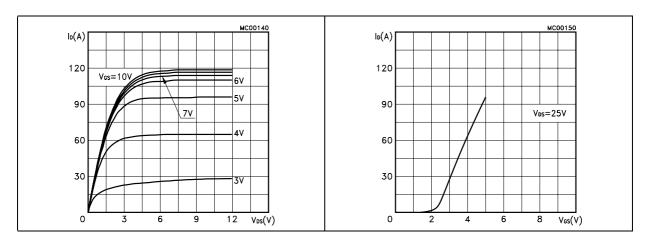


Figure 6. Output characteristics

Figure 7. Transfer characteristics



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Figure 8. Transconductance

Figure 9. Static drain-source on resistance

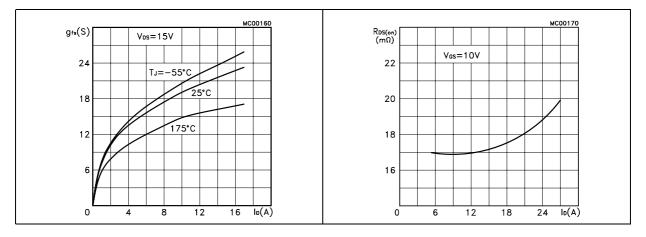


Figure 10. Gate charge vs. gate-source voltage Figure 11. Capacitance variations

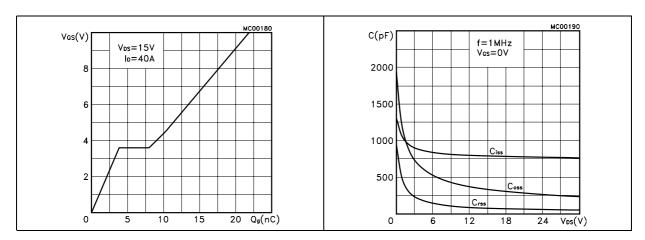
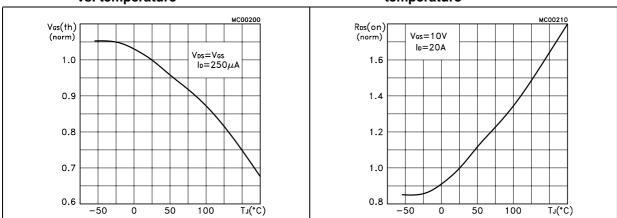


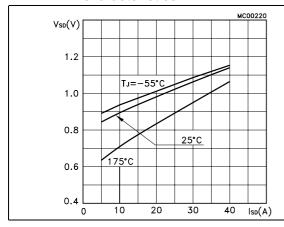
Figure 12. Normalized gate threshold voltage Figure 13. Normalized on resistance vs. vs. temperature temperature

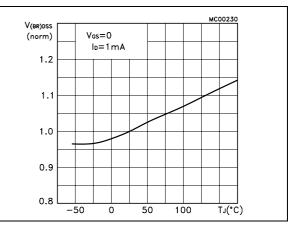


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Figure 14. Source-drain diode forward characteristics

Figure 15. Normalized \mathbf{B}_{VDSS} vs. temperature





3 Test circuits

Figure 16. Switching times test circuit for resistive load

Figure 17. Gate charge test circuit

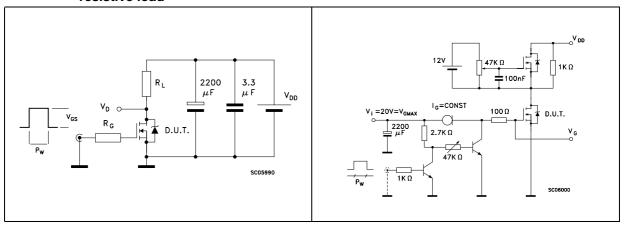


Figure 18. Test circuit for inductive load switching and diode recovery times

Figure 19. Unclamped inductive load test circuit

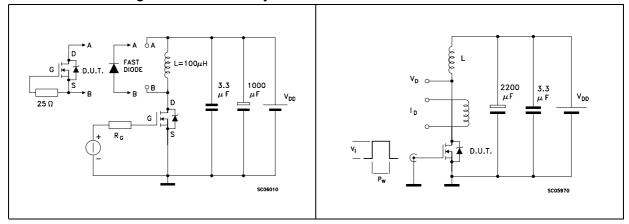
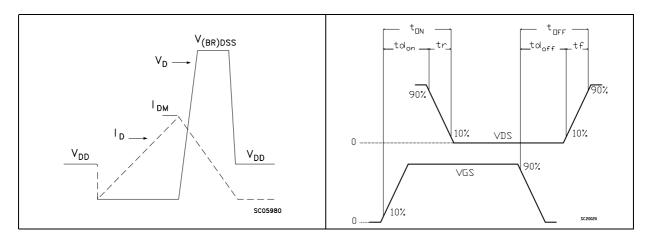


Figure 20. Unclamped inductive waveform

Figure 21. Switching time waveform



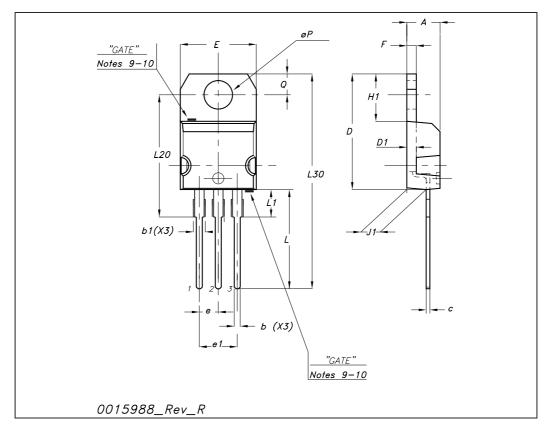
4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK[®] packages, depending on their level of environmental compliance. ECOPACK[®] specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

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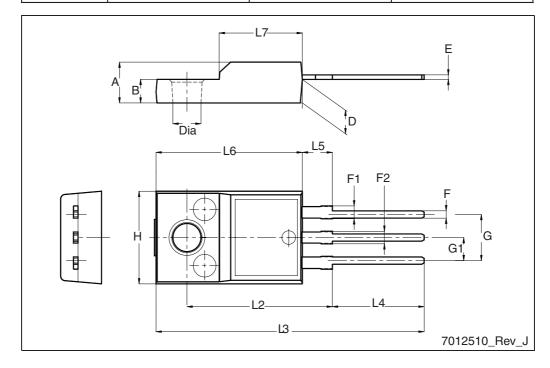
TO-220 mechanical data

Dim		mm			inch	
Dim	Min	Тур	Max	Min	Тур	Max
А	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
С	0.48		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
E	10		10.40	0.393		0.409
е	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.051
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90		İ	1.137	
ØP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104	İ	0.116



TO-220FP mechanical data

Dim.		mm	
Dilli.	Min.	Тур.	Max.
А	4.4		4.6
В	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.5
G	4.95		5.2
G1	2.4		2.7
Н	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2



5 Revision history

Table 7. Document revision history

Date	Revision	Changes
09-Sep-2004	1	Preliminary version
21-Jun-2005	2	Complete version with curves
16-Aug-2006	3	New template, no content change
21-Feb-2007	4	Typo mistake on page 1
20-Nov-2008	5	Figure 9: Static drain-source on resistance has been corrected.
14-Apr-2009	6	The device in TO-220FP has been added
03-Feb-2010	7	Updated Table 3: Thermal data.
22-Feb-2010	8	Updated Table 3: Thermal data.

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