

# STB60NF10 STB60NF10-1 - STP60NF10

N-channel 100V - 0.019Ω - 80A - TO-220 - D<sup>2</sup>PAK - I<sup>2</sup>PAK STripFET™ II Power MOSFET

#### **General features**

Туре	V <sub>DSS</sub> (@Tjmax)	R <sub>DS(on)</sub>	I <sub>D</sub>
STB60NF10	100V	<0.023Ω	80A
STB60NF10-1	100V	<0.023Ω	80A
STP60NF10	100V	<0.023Ω	80A

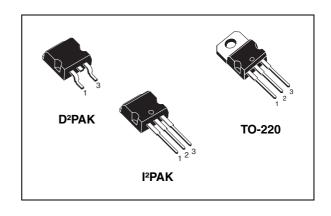
- Exceptional dv/dt capability
- 100% avalanche tested

## **Description**

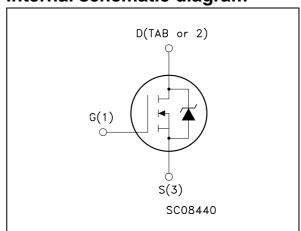
This Power MOSFET series realized with STMicroelectronics unique STripFET™ process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced highefficiency, high-frequency isolated DC-DC converters for Telecom and Computer applications. It is also intended for any applications with low gate drive requirements.

## **Applications**

■ Switching application



#### Internal schematic diagram



#### **Order codes**

Part number	Part number Marking		Packaging
STB60NF10T4	B60NF10	D²PAK	Tape & reel
STB60NF10-1	B60NF10	I <sup>2</sup> PAK	Tube
STP60NF10	P60NF10	TO-220	Tube

September 2006 Rev 4 1/15

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# 1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source voltage (V <sub>GS</sub> = 0)	100	V
V <sub>GS</sub>	Gate-source voltage	± 20	V
I <sub>D</sub> <sup>(1)</sup>	Drain current (continuous) at T <sub>C</sub> = 25°C	80	Α
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> =100°C	66	Α
I <sub>DM</sub> <sup>(2)</sup>	Drain current (pulsed)	320	Α
P <sub>TOT</sub>	Total dissipation at T <sub>C</sub> = 25°C	300	W
	Derating factor	2	W/°C
dv/dt (3)	Peak diode recovery voltage slope	16	V/ns
E <sub>AS</sub> (4)	Single pulse avalanche energy	485	J
T <sub>stg</sub>	Storage temperature	-55 to 175	°C

- 1. Current limited by package
- 2. Pulse width limited by safe operating area
- 3.  $I_{SD} \leq 80A$ , di/dt  $\leq 300A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_{J} \leq T_{JMAX}$
- 4. Starting  $T_J = 25$  °C,  $I_D = 40A$ ,  $V_{DD} = 30V$

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R <sub>thJC</sub>	Thermal resistance junction-case max	0.5	°C/W
R <sub>thJA</sub>	Thermal resistance junction-ambient max	62.5	°C/W
T <sub>I</sub>	Maximum lead temperature for soldering purpose	300	°C

# 2 Electrical characteristics

(T<sub>CASE</sub>=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	$I_D = 250 \mu A, V_{GS} = 0$	100			٧
I <sub>DSS</sub>	Zero gate voltage drain current (V <sub>GS</sub> = 0)	$V_{DS} = Max rating,$ $V_{DS} = Max rating @ 125°C$			1 10	μA μA
I <sub>GSS</sub>	Gate body leakage current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ±20V			±100	nA
V <sub>GS(th)</sub>	Gate threshold voltage	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	2	3	4	٧
R <sub>DS(on)</sub>	Static drain-source on resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 40A		0.019	0.023	Ω

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
g <sub>fs</sub> (1)	Forward transconductance	V <sub>DS</sub> = 25V, I <sub>D</sub> = 40A		78		S
C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub>	Input capacitance Output capacitance Reverse transfer capacitance	V <sub>DS</sub> =25V, f = 1 MHz, V <sub>GS</sub> = 0		4270 470 140		pF pF pF
Q <sub>g</sub> Q <sub>gs</sub> Q <sub>gd</sub>	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 50V, I_{D} = 80A$ $V_{GS} = 10V$		104 20 32		nC nC nC

<sup>1.</sup> Pulsed: pulse duration=300µs, duty cycle 1.5%

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
$t_{d(on)}$ $t_{r}$ $t_{d(off)}$ $t_{f}$	Turn-on delay time Rise time Turn-off delay time Fall time	$V_{DD}$ = 50V, $I_{D}$ = 40A, $R_{G}$ =4.7 $\Omega$ , $V_{GS}$ =10V Figure 13 on page 8		17 56 82 23		ns ns ns

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min	Тур.	Max	Unit
I <sub>SD</sub>	Source-drain current				80	Α
I <sub>SDM</sub> <sup>(1)</sup>	Source-drain current (pulsed)			320	Α	
V <sub>SD</sub> <sup>(2)</sup>	Forward on voltage	$I_{SD} = 80A, V_{GS} = 0$			1.3	V
t <sub>rr</sub> Q <sub>rr</sub> I <sub>RRM</sub>	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD}$ = 80A, di/dt = 100A/ $\mu$ s, $V_{DD}$ = 25V, $T_{J}$ = 150°C Figure 15 on page 8		92 340 7.4		ns nC A

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

<sup>2.</sup> Pulsed: pulse duration=300µs, duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

Figure 2. Thermal impedance

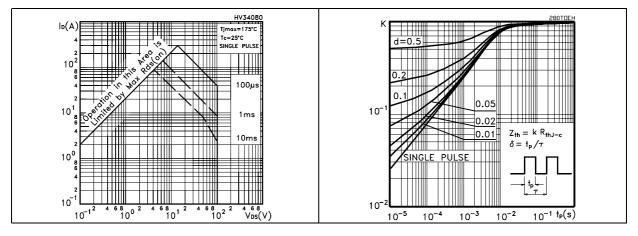


Figure 3. Output characterisics

Figure 4. Transfer characteristics

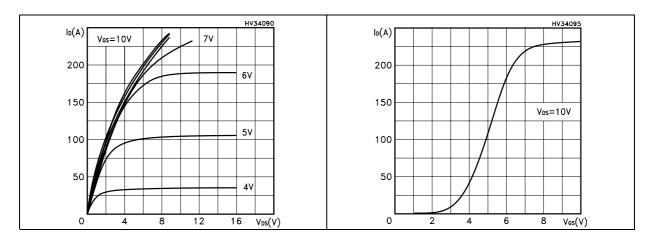
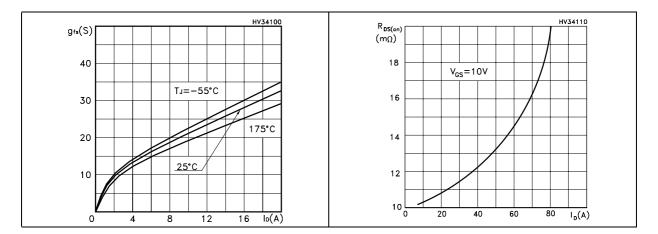


Figure 5. Transconductance

Figure 6. Static drain-source on resistance



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

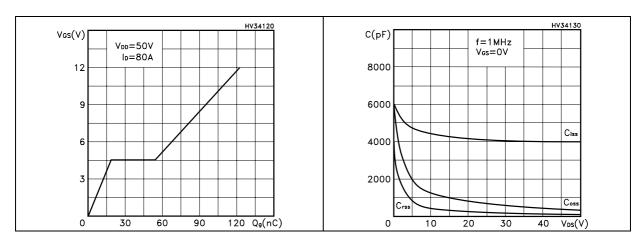


Figure 9. Normalized gate threshold voltage vs temperature

Figure 10. Normalized on resistance vs temperature

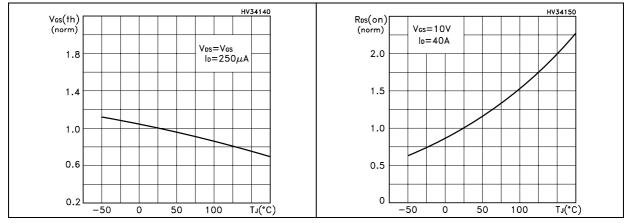
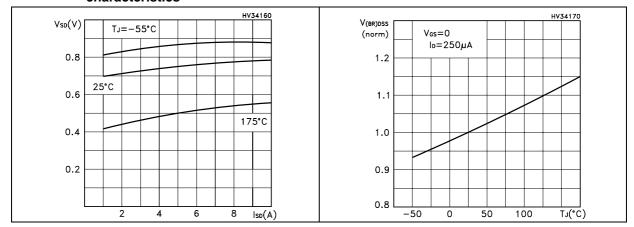


Figure 11. Source-drain diode forward characteristics

Figure 12. Normalized B<sub>VDSS</sub> vs temperature



## 3 Test circuit

Figure 13. Switching times test circuit for resistive load

Figure 14. Gate charge test circuit

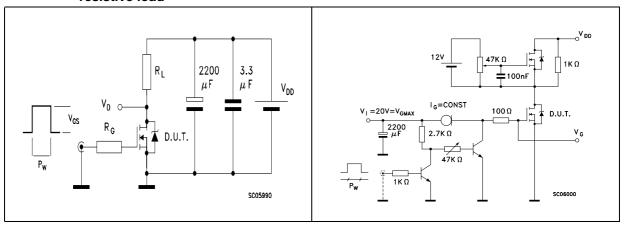


Figure 15. Test circuit for inductive load switching and diode recovery times

Figure 16. Unclamped Inductive load test circuit

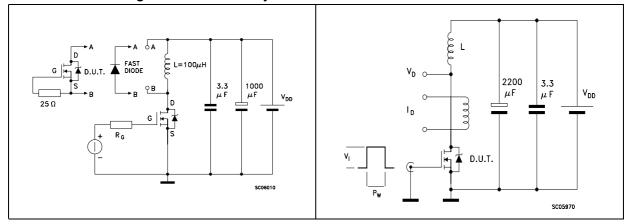
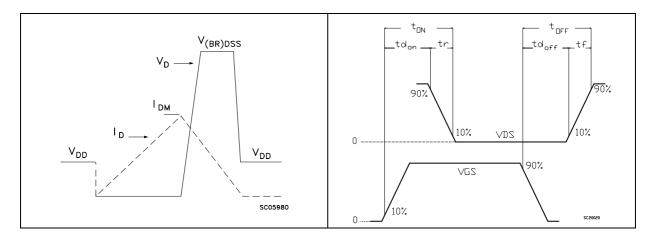


Figure 17. Unclamped inductive waveform

Figure 18. Switching time waveform



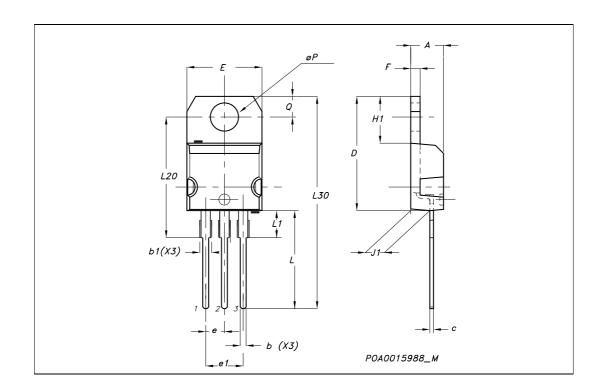
## 4 Package mechanical data

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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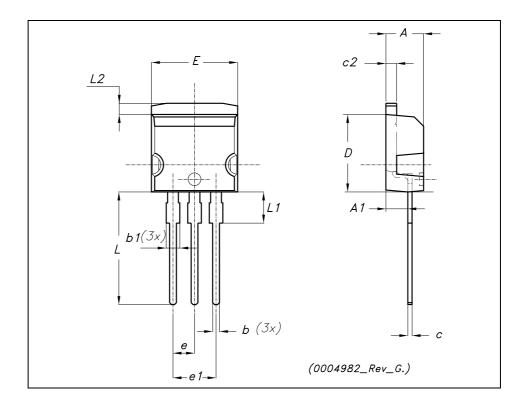
#### **TO-220 MECHANICAL DATA**

DIM		mm.				
DIM.	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
Α	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.15		1.70	0.045		0.066
С	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
Е	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		0.052
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			1.137	
øΡ	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



## TO-262 (I<sup>2</sup>PAK) MECHANICAL DATA

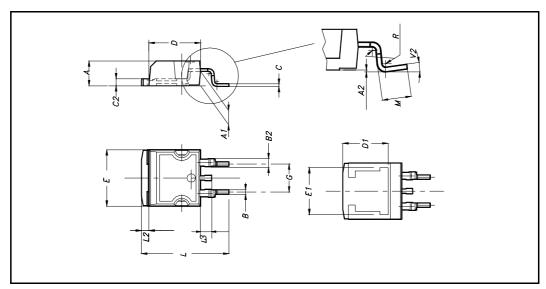
DIM		mm.			inch			
DIM.	MIN.	TYP	MAX.	MIN.	TYP.	MAX.		
Α	4.40		4.60	0.173		0.181		
A1	2.40		2.72	0.094		0.107		
b	0.61		0.88	0.024		0.034		
b1	1.14		1.70	0.044		0.066		
С	0.49		0.70	0.019		0.027		
c2	1.23		1.32	0.048		0.052		
D	8.95		9.35	0.352		0.368		
е	2.40		2.70	0.094		0.106		
e1	4.95		5.15	0.194		0.202		
E	10		10.40	0.393		0.410		
L	13		14	0.511		0.551		
L1	3.50		3.93	0.137		0.154		
L2	1.27		1.40	0.050		0.055		



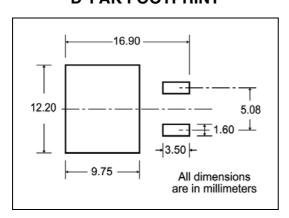
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## D<sup>2</sup>PAK MECHANICAL DATA

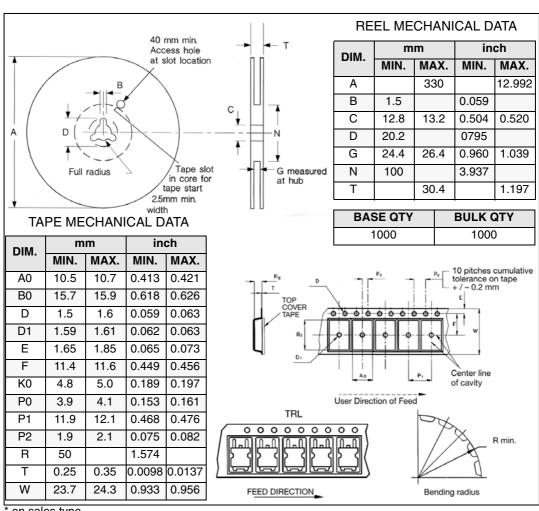
DIM.		mm.			inch	
DIW.	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
Α	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
В	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
С	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.625
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068
М	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0º		4º			



# 5 Packaging mechanical data D<sup>2</sup>PAK FOOTPRINT



#### TAPE AND REEL SHIPMENT



# 6 Revision history

Table 7. Revision history

Date	Revision	Changes
30-May-2005	1	First release
30-Nov-2005	2	Added package D <sup>2</sup> PAK
28-Jul-2006	3	New template, SOA updated
18-Sep-2006	4	Added I <sup>2</sup> PAK

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