



## STP60NF06FP

N-channel 60V - 0.014Ω - 30A TO-220FP  
STripFET II™ Power MOSFET

### General features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STP60NF06FP	60V	<0.016Ω	30A

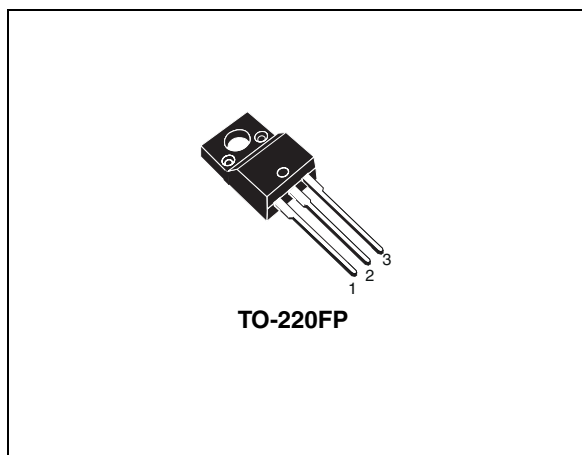
- Exceptional dv/dt capability
- 100% avalanche tested
- Application oriented characterization

### Description

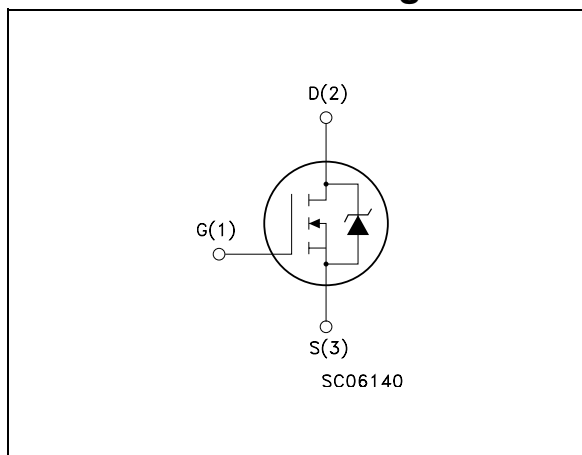
This Power MOSFET series realized with STMicroelectronics unique STripFET process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency isolated DC-DC converters for Telecom and Computer application. It is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

### Applications

- Switching application



### Internal schematic diagram



### Order code

Part number	Marking	Package	Packaging
STP60NF06FP	P60NF06	TO-220FP	Tube

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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	60	V
$V_{GS}$	Gate- source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	30	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	21	A
$I_{DM}^{(1)}$	Drain current (pulsed)	120	A
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	30	W
	Derating factor	0.2	W/ $^\circ\text{C}$
$dv/dt^{(2)}$	Peak diode recovery voltage slope	4	V/ns
$V_{ISO}$	Insulation withstand voltage (RMS) from all three leads to external heat sink ( $t=1\text{s}$ ; $T_C= 25^\circ\text{C}$ )	2500	V
$T_{stg}$	Storage temperature	- 55 to 175	$^\circ\text{C}$
$T_j$	Max. operating junction temperature		

1. Pulse width limited by safe operating area

2.  $I_{SD} \leq 60\text{A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq 24\text{V}$ ,  $T_j \leq T_{jmax}$

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	5	$^\circ\text{C}/\text{W}$
$R_{thj-a}$	Thermal resistance junction-ambient max	62.5	$^\circ\text{C}/\text{W}$
$T_l$	Maximum lead temperature for soldering purpose	300	$^\circ\text{C}$

**Table 3. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AS}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_j$ Max)	30	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j=25^\circ\text{C}$ , $I_d=I_{as}$ , $V_{dd}=30\text{V}$ )	370	mJ

## 2 Electrical characteristics

( $T_{CASE}=25^{\circ}C$  unless otherwise specified)

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown voltage	$I_D = 250 \mu A, V_{GS} = 0$	60			V
$I_{DSS}$	Zero gate voltage Drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating}, T_C = 125^{\circ}C$			1 10	$\mu A$ $\mu A$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20V$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \mu A$	2		4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10V, I_D = 30A$		0.014	0.016	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15V, I_D = 30A$		50		S
$C_{iss}$	Input capacitance			1810		pF
$C_{oss}$	Output capacitance	$V_{DS} = 25V, f = 1 \text{ MHz},$ $V_{GS} = 0$		360		pF
$C_{rss}$	Reverse transfer capacitance			125		pF
$Q_g$	Total gate charge	$V_{DD} = 48V, I_D = 60A,$ $V_{GS} = 10V$		49	66	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10V$		18		nC
$Q_{gd}$	Gate-drain charge	(see Figure 12)		14		nC

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

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30V, I_D = 30A$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see Figure 13)		16		ns
$t_r$	Rise time			108		ns
$t_{d(off)}$	Turn-off-delay time	$V_{DD} = 30V, I_D = 30A,$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see Figure 13)		43		ns
$t_f$	Fall time			20		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$I_{SD}$	Source-drain current				30	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				120	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 60A, V_{GS} = 0$			1.3	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 60A, V_{DD}=25V$ di/dt = 100A/ $\mu$ s, $T_j = 150^\circ C$ (see Figure 13)		75		ns
$Q_{rr}$	Reverse recovery charge			182		nC
$I_{RRM}$	Reverse recovery current			5		A

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

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

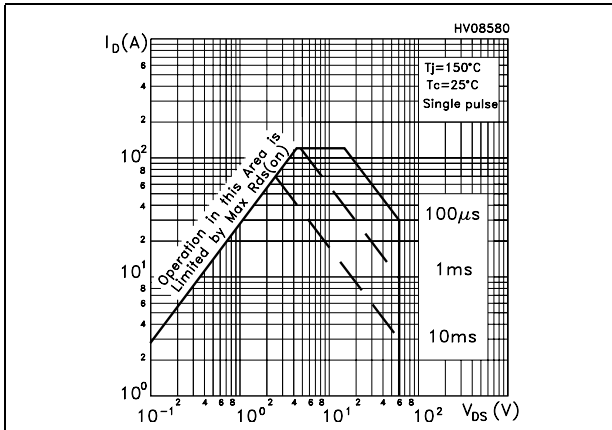


Figure 2. Thermal impedance

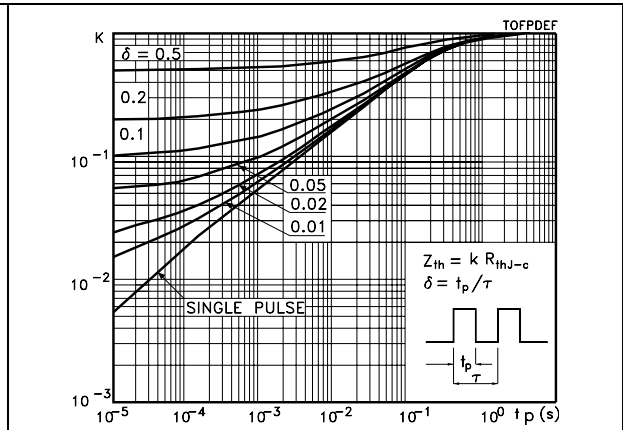


Figure 3. Output characteristics

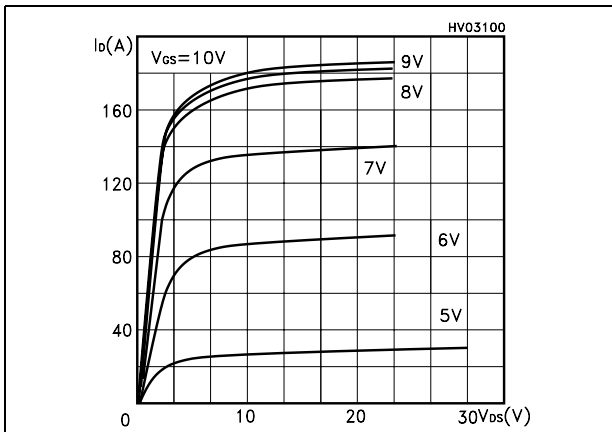


Figure 4. Transfer characteristics

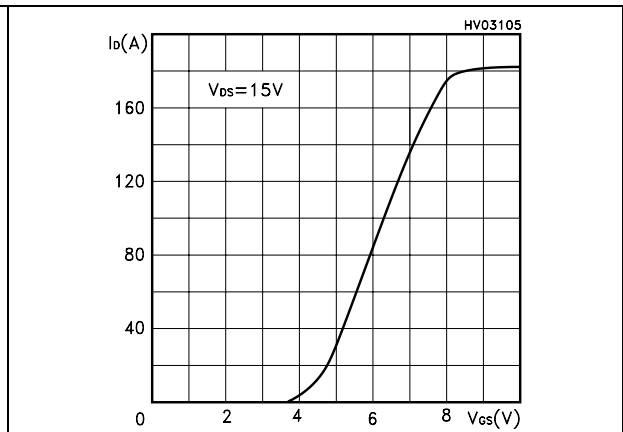


Figure 5. Source-drain diode forward characteristics

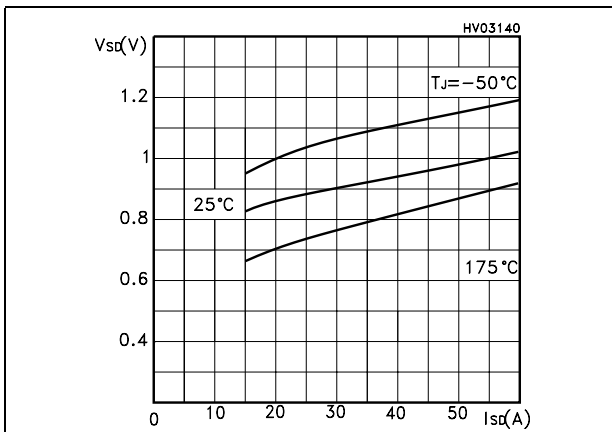


Figure 6. Static drain-source on resistance

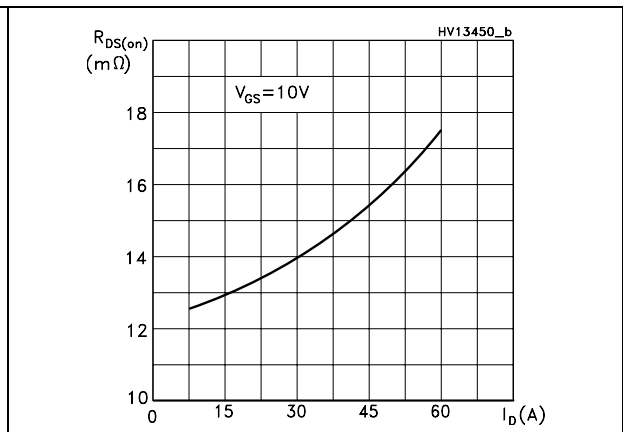


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

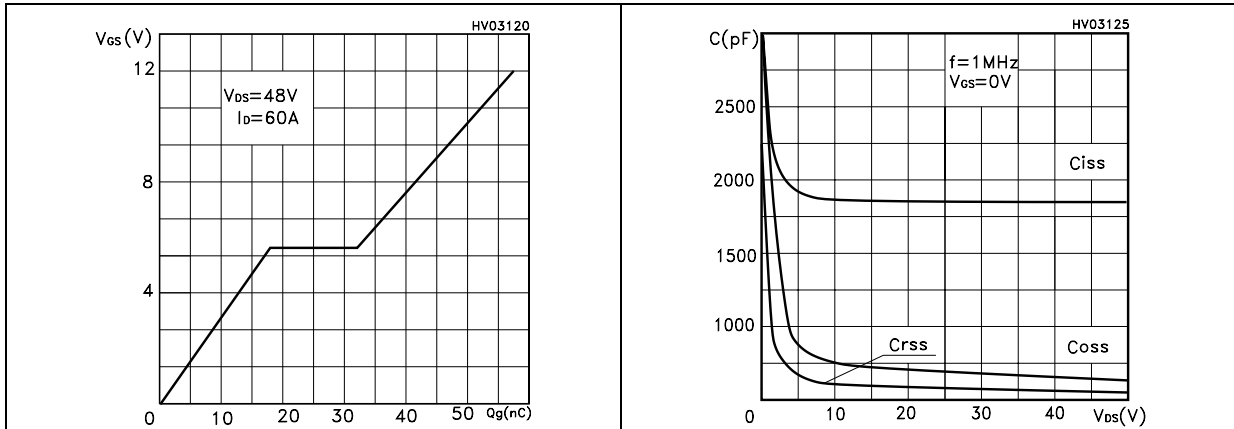
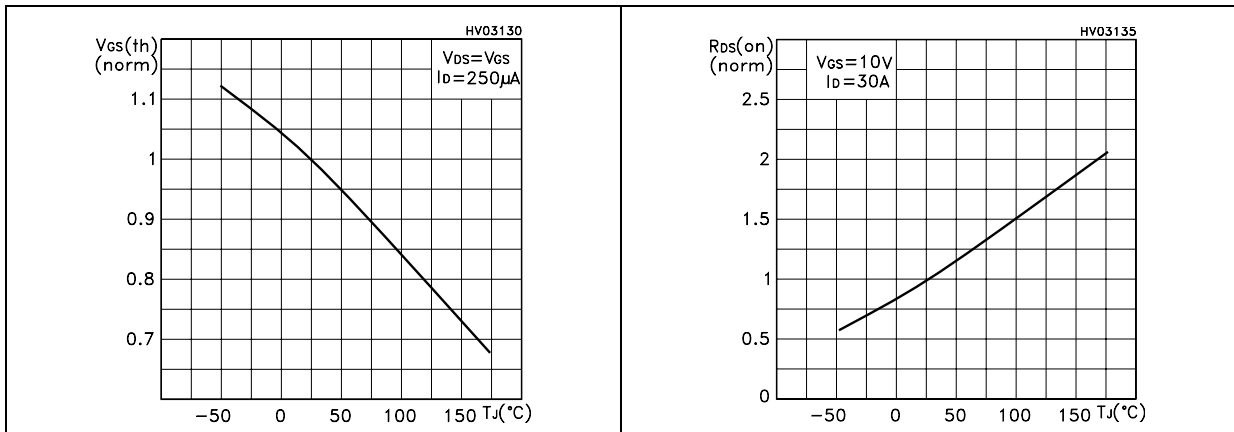


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature



### 3 Test circuit

Figure 11. Switching times test circuit for resistive load



Figure 12. Gate charge test circuit



Figure 13. Test circuit for inductive load switching and diode recovery times



Figure 14. Unclamped Inductive load test circuit



Figure 15. Unclamped inductive waveform

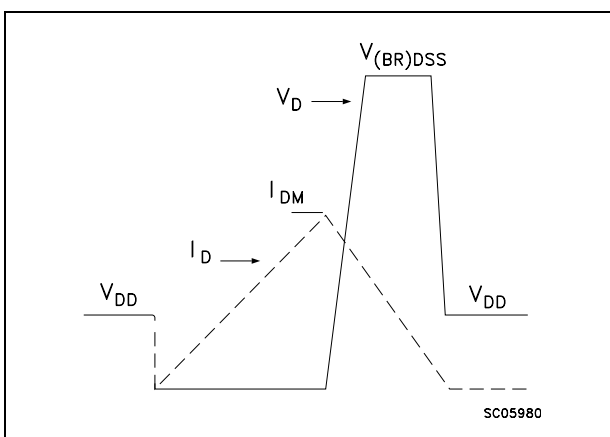
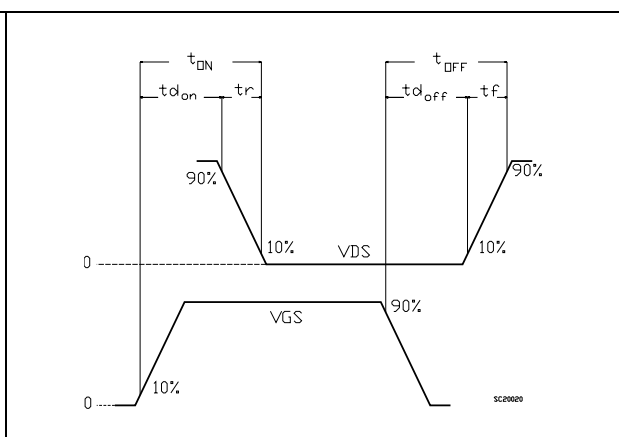


Figure 16. Switching time waveform



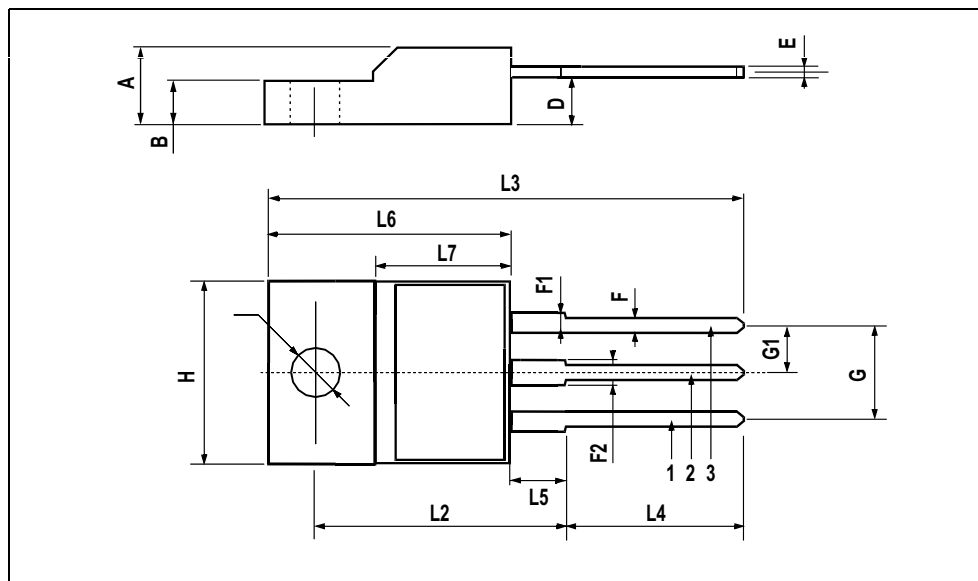


## 4 Package mechanical data

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: [www.st.com](http://www.st.com)

**TO-220FP MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	.0385		0.417
L5	2.9		3.6	0.114		0.141
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
Ø	3		3.2	0.118		0.126



## 5 Revision history

Table 8. Revision history

Date	Revision	Changes
14-Mar-2007	1	First release

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