

N-channel 60 V, 0.07 Ω typ., 4 A STripFET™ II Power MOSFET in a SOT-223 package

Datasheet - production data

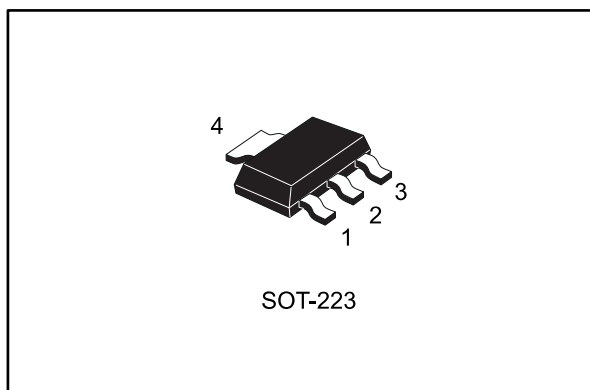
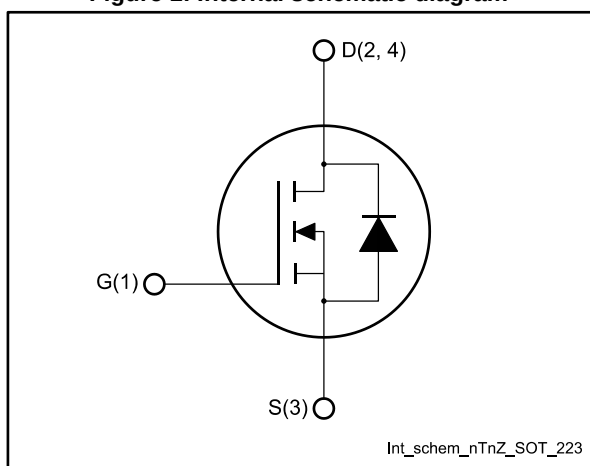


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STN3NF06L	60 V	0.1 Ω	4 A

- Exceptional dv/dt capability
- 100% avalanche tested
- Low threshold drive

Applications

- Switching applications

Description

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

Table 1: Device summary

Order code	Marking	Package	Packing
STN3NF06L	3NF06L	SOT-223	Tape and reel

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	60	V
V_{GS}	Gate-source voltage	± 16	V
$I_D^{(1)}$	Drain current (continuous) at $T_c = 25\text{ }^\circ\text{C}$	4	A
I_D	Drain current (continuous) at $T_c = 100\text{ }^\circ\text{C}$	2.9	A
$I_{DM}^{(2)}$	Drain current (pulsed)	16	A
P_{TOT}	Total dissipation at $T_{pcb} = 25\text{ }^\circ\text{C}$	3.3	W
$dv/dt^{(3)}$	Peak diode recovery voltage slope	10	V/ns
$E_{AS}^{(4)}$	Single pulse avalanche energy	200	mJ
T_j	Operating junction temperature range	- 55 to 150	$^\circ\text{C}$
T_{stg}	Storage temperature range		

Notes:

⁽¹⁾Current limited by the package.

⁽²⁾Pulse width limited by safe operating area.

⁽³⁾ $I_{SD} \leq 3\text{ A}$, $di/dt \leq 150\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$

⁽⁴⁾Starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = 4\text{ A}$, $V_{DD} = 30\text{ V}$

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-pcb}$	Thermal resistance junction-pcb ⁽¹⁾	38	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}$	Thermal resistance junction-pcb ⁽²⁾	100	$^\circ\text{C}/\text{W}$

Notes:

⁽¹⁾When Mounted on FR-4 board 1 inch² pad, 2 oz. of Cu and $t < 10\text{ s}$.

⁽²⁾When mounted on minimum recommended footprint.

2 Electrical characteristics

$T_C = 25\text{ }^{\circ}\text{C}$ unless otherwise specified

Table 4: On/off-state

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$	60			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 60\text{ V}$			1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 60\text{ V}$ $T_C = 125\text{ }^{\circ}\text{C}^{(1)}$			10	μA
I_{GSS}	Gate body leakage current	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 16\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	1		2.8	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 1.5\text{ A}$		0.07	0.10	Ω
		$V_{GS} = 5\text{ V}$, $I_D = 1.5\text{ A}$		0.085	0.12	Ω

Notes:

⁽¹⁾Defined by design, not subject to production test.

Table 5: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	340		pF
C_{oss}	Output capacitance		-	63		pF
C_{rss}	Reverse transfer capacitance		-	30		pF
Q_g	Total gate charge	$V_{DD} = 48\text{ V}$, $I_D = 3\text{ A}$ $V_{GS} = 0\text{ to }5\text{ V}$ (see Figure 14: "Test circuit for gate charge behavior")	-	7	9	nC
Q_{gs}	Gate-source charge		-	1.5		nC
Q_{gd}	Gate-drain charge		-	2.8		nC

Table 6: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30\text{ V}$, $I_D = 1.5\text{ A}$, $R_G = 4.7\text{ }\Omega$ $V_{GS} = 5\text{ V}$ (see Figure 13: "Test circuit for resistive load switching times" and Figure 18: "Switching time waveform")	-	9	-	ns
t_r	Rise time		-	25	-	ns
$t_{d(off)}$	Turn-off delay time		-	20	-	ns
t_f	Fall time		-	10	-	ns

Table 7: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{SD}^{(1)}$	Forward on voltage	$I_{SD} = 4\text{ A}$, $V_{GS} = 0\text{ V}$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 4\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 25\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$ (see Figure 15: "Test circuit for inductive load switching and diode recovery times")	-	50		ns
Q_{rr}	Reverse recovery charge		-	88		nC
I_{RRM}	Reverse recovery current		-	3.5		A

Notes:

⁽¹⁾Pulsed: pulse duration = 300 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

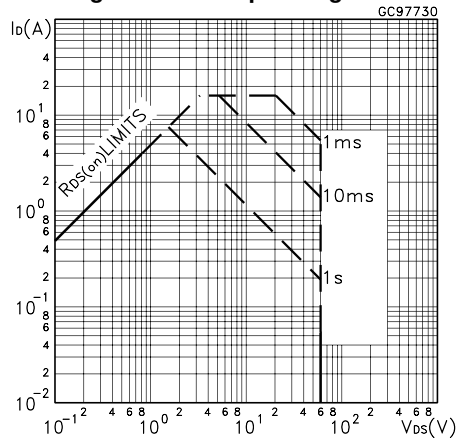


Figure 3: Thermal impedance

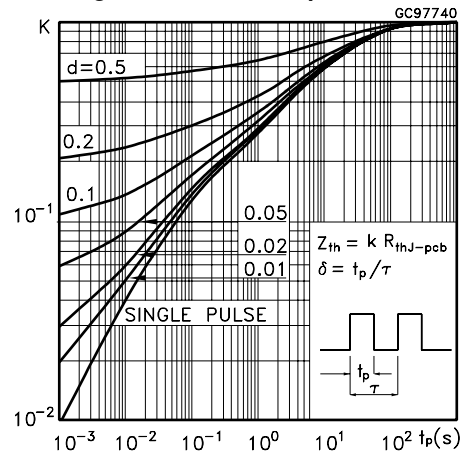


Figure 4: Output characteristics

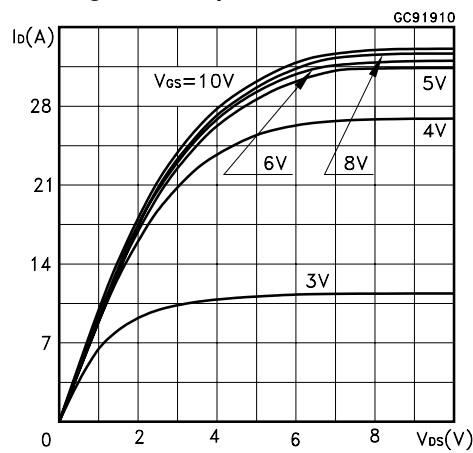


Figure 5: Transfer characteristics

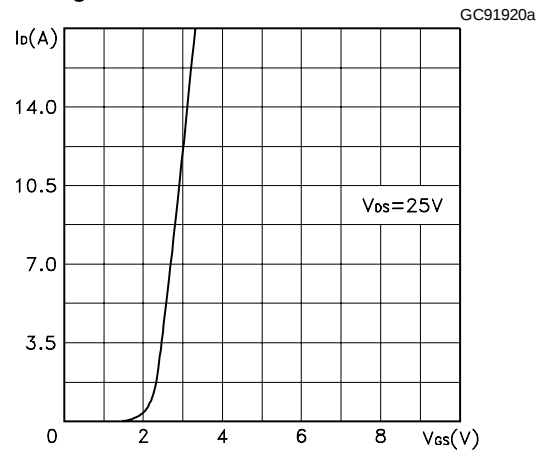


Figure 6: Static drain-source on-resistance

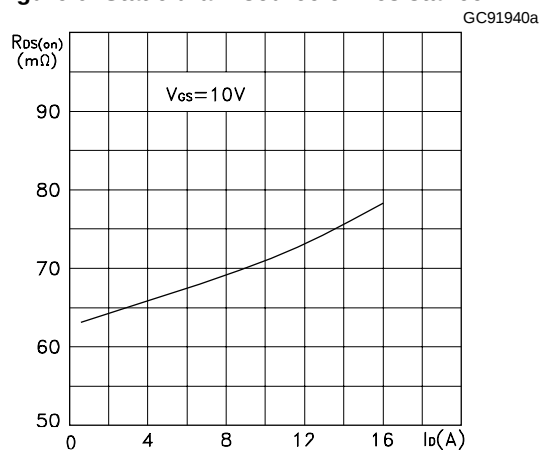


Figure 7: Gate charge vs. gate-source voltage

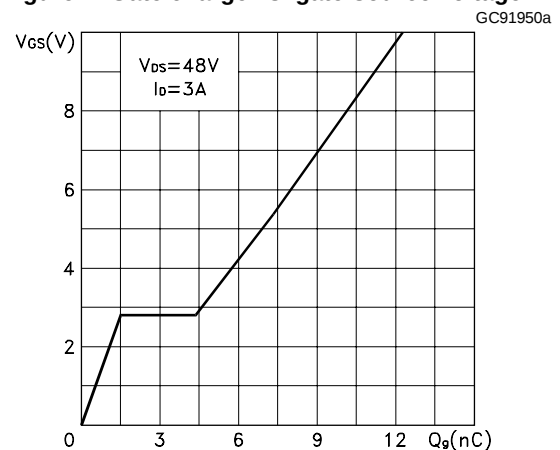


Figure 8: Capacitance variations

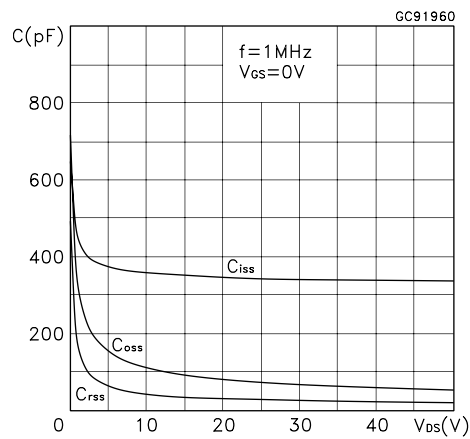


Figure 9: Normalized gate threshold voltage vs temperature

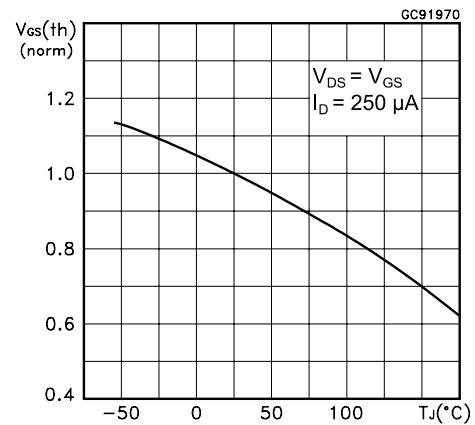


Figure 10: Normalized on-resistance vs temperature

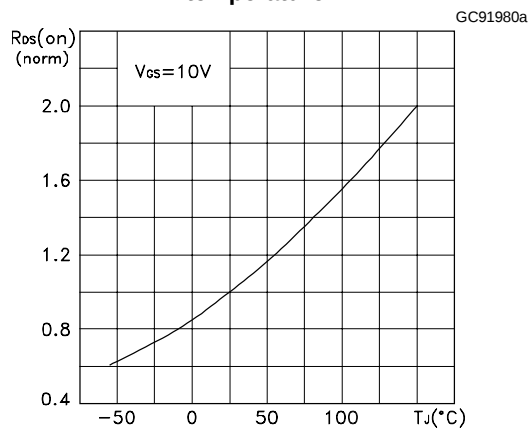
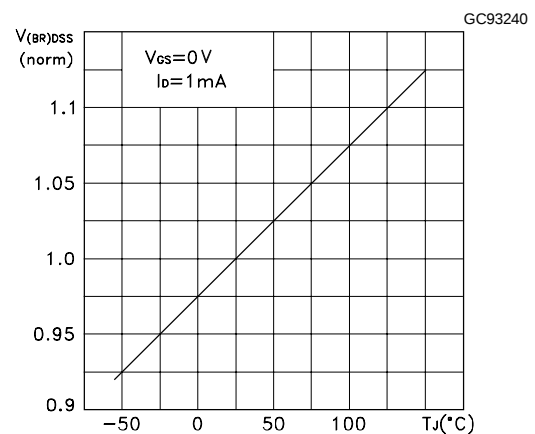
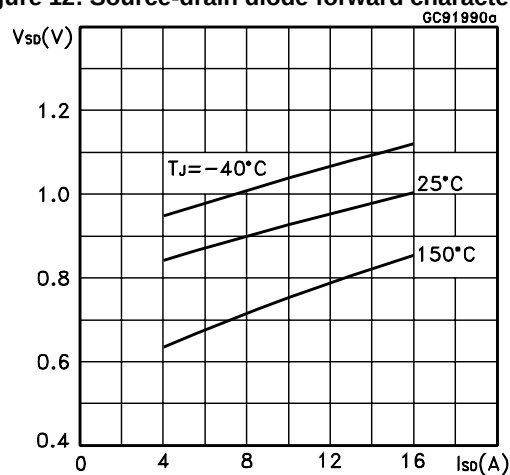
Figure 11: Normalized $V_{(BR)DSS}$ vs temperature

Figure 12: Source-drain diode forward characteristics



3 Test circuits

Figure 13: Test circuit for resistive load switching times



Figure 14: Test circuit for gate charge behavior



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 information

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.

4.1 SOT-223 package information

Figure 19: SOT-223 package outline

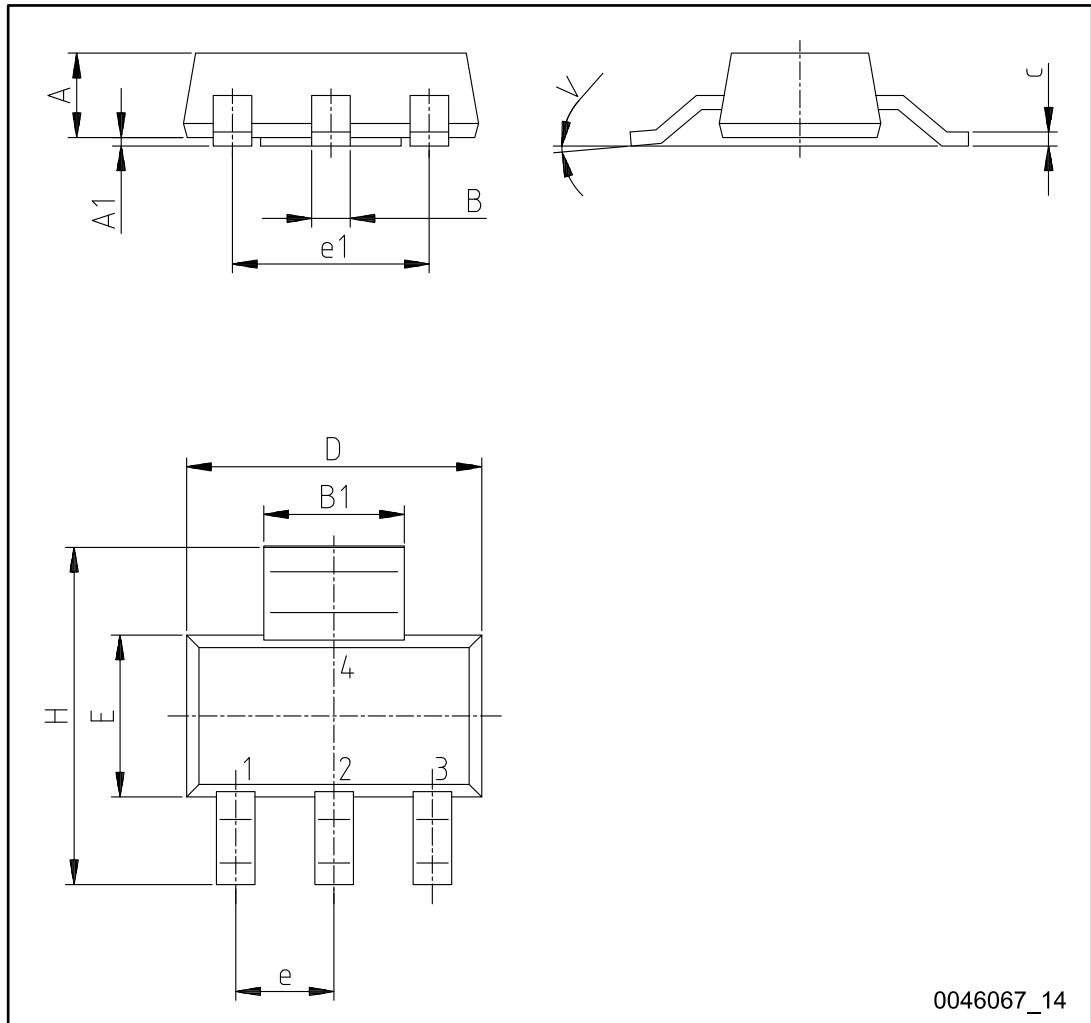
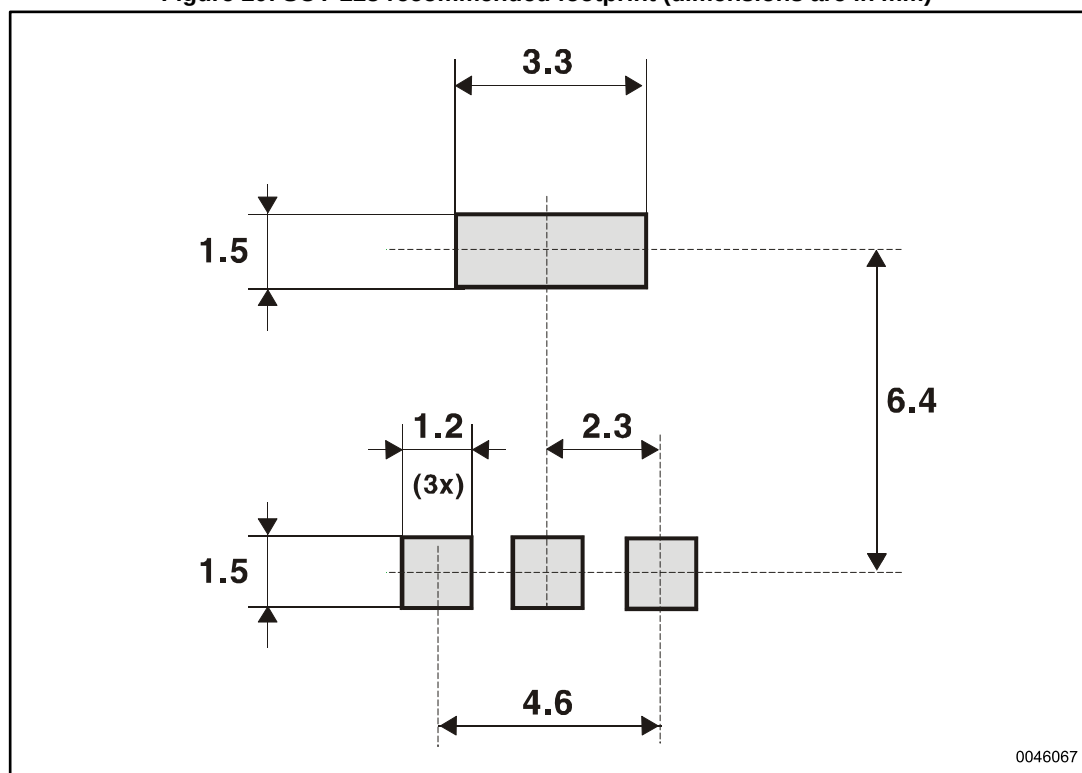


Table 8: SOT-223 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			1.8
A1	0.02		0.1
B	0.6	0.7	0.85
B1	2.9	3	3.15
c	0.24	0.26	0.35
D	6.3	6.5	6.7
e		2.3	
e1		4.6	
E	3.3	3.5	3.7
H	6.7	7.0	7.3
V			10°

Figure 20: SOT-223 recommended footprint (dimensions are in mm)



5 Revision history

Table 9: Document revision history

Date	Revision	Changes
21-Jun-2004	5	Complete version.
04-Oct-2006	6	New template, no content change.
01-Feb-2007	7	Typo mistake on Table 2.
12-Jun-2008	8	Corrected marking on Table 1
03-Jul-2017	9	Modified internal schematic diagram on cover page. Updated Section 4: "Package information" . Minor text changes.

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