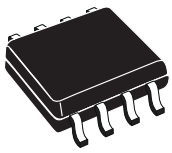
STS4DNF60L

N-channel 60 V, 0.045 Ω, 4 A, SO-8 STripFET™ Power MOSFET

Features

Type	V_{DSS}	$R_{DS(on)}$	I_D
STS4DNF60L	60V	<0.055Ω	4A

- Standard outline for easy automated surface mount assembly
- Low threshold drive



SO-8

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

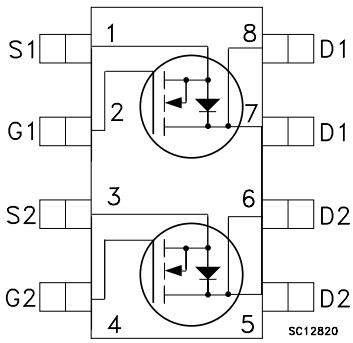


Table 1. Device summary

Order code	Marking	Package	Packaging
STS4DNF60L	4DF60L	SO-8	Tape & reel

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (V_{GS} = 0)	60	V
V_{GS}	Gate- source voltage	± 15	V
I_D	Drain current (continuous) at T_C = 25 °C	4	A
I_D	Drain current (continuous) at T_C = 100 °C	2.5	A
I_{DM} (1)	Drain current (pulsed)	16	A
P_{TOT}(2)	Total dissipation at T_C = 25 °C	2	W
E_{AS}(3)	Single pulse avalanche energy	80	mJ
T_j T_{stg}	Operating junction temperature Storage temperature	- 55 to 150	°C

1. Pulse width limited by safe operating area
2. P_{TOT}=1.6 W for single operation
3. Starting T_J = 25 °C, I_D = 4 A, V_{DD} = 30 V

Table 3. Thermal data

Symbol	Parameter	Value	Unit
Rthj-pcb	Thermal resistance junction-pcb D.O.(1)	62.5	°C/W

1. When mounted on inch² FR-4 board, 2 Oz Cu, t ≤ 10sec, dual operation

2 Electrical characteristics

(T_C = 25 °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 µA, V_{GS} = 0	60			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0) V_{DS} = Max rating V_{DS} = Max rating, T_C=125 °C				1 10	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 15 V			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	1	1.7	2.5	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 2 A V_{GS} = 4.5 V, I_D = 2 A		0.045 0.050	0.055 0.065	Ω Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs}	Forward transconductance	V_{DS} =25 V, I_D =2 A	-	25	-	S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0	-	1030 140 40	-	pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 48 V, I_D = 4 A, V_{GS} = 4.5 V (see *Figure 13*)	-	15 4 4	-	nC nC nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	V_{DD} = 30 V, I_D = 2.2 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 12*)	-	15 28	-	ns ns
$t_{d(off)}$ t_f	Turn-off delay time Fall time		-	45 10	-	ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)		-		4 16	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 4 A, V_{GS} = 0	-		1.2	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 4 A, di/dt = 100 A/µs V_{DD} = 20 V (see *Figure 17*)	-	85 85 2		ns nC A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

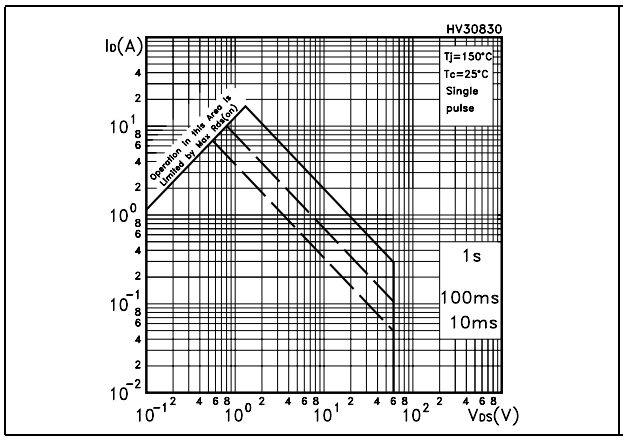


Figure 3. Thermal impedance

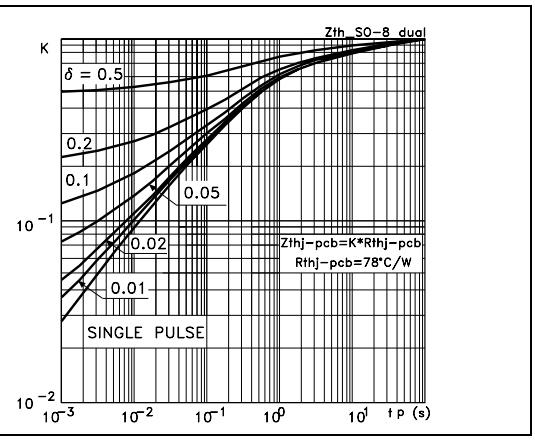


Figure 4. Output characteristics

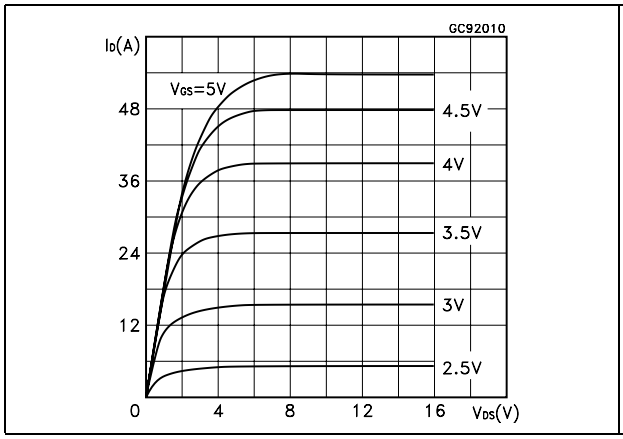


Figure 5. Transfer characteristics

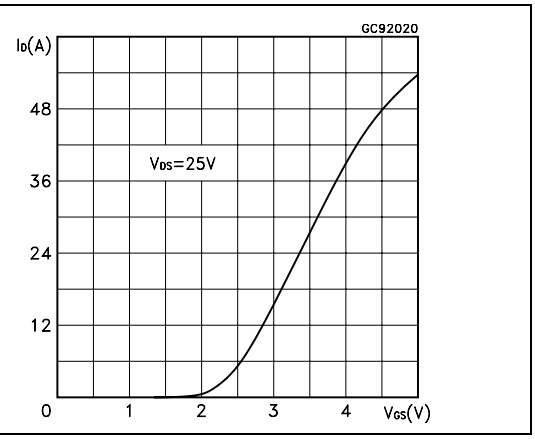


Figure 6. Source-drain diode forward characteristics

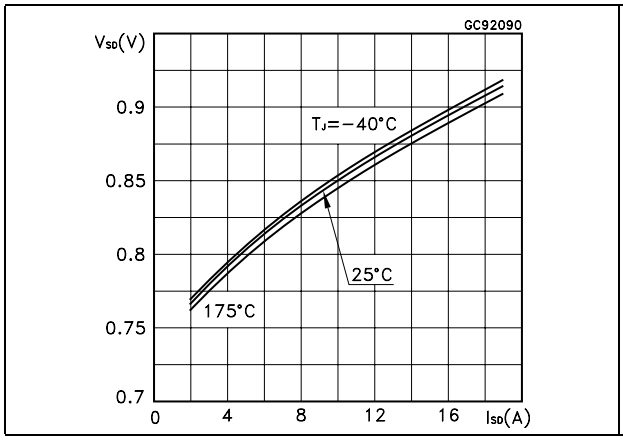


Figure 7. Static drain-source on resistance

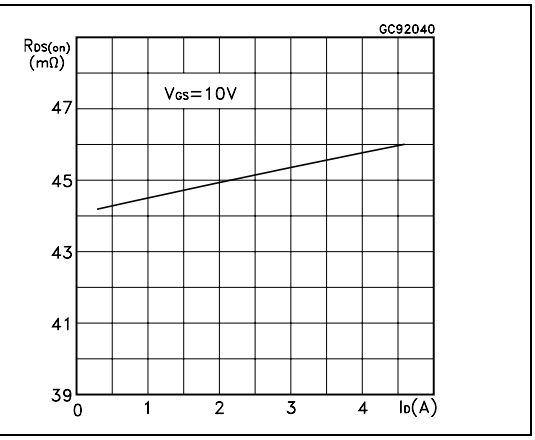


Figure 8. Gate charge vs gate-source voltage

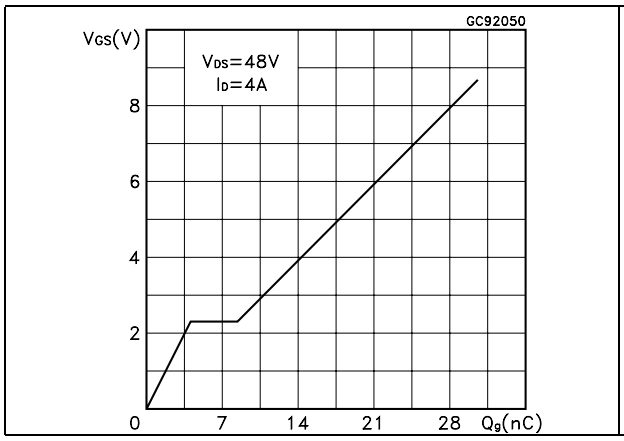


Figure 9. Capacitance variations

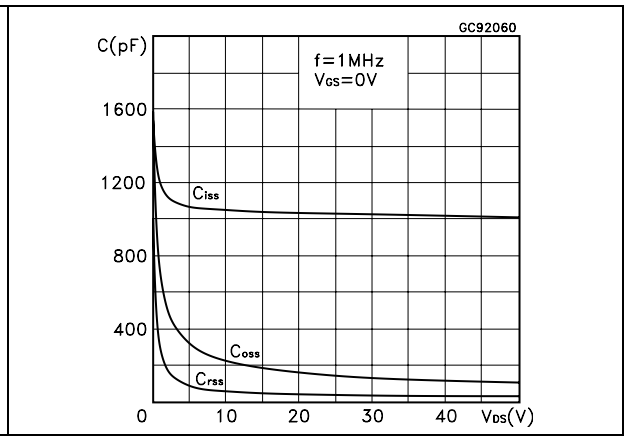


Figure 10. Normalized gate threshold voltage vs temperature

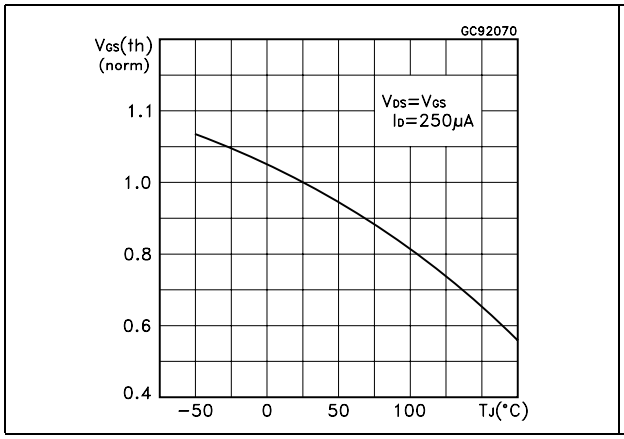
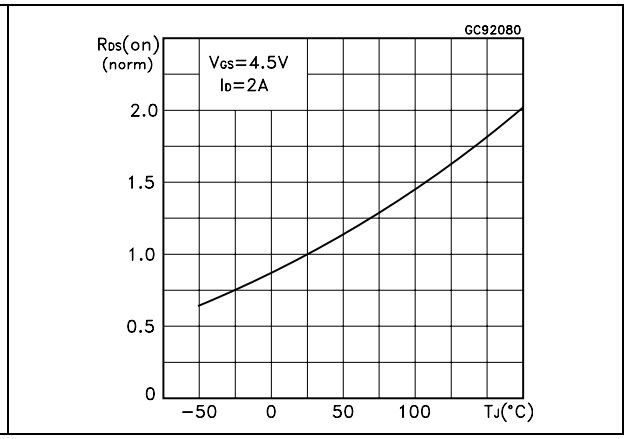


Figure 11. Normalized on resistance vs temperature



3 Test circuits

Figure 12. Switching times test circuit for resistive load

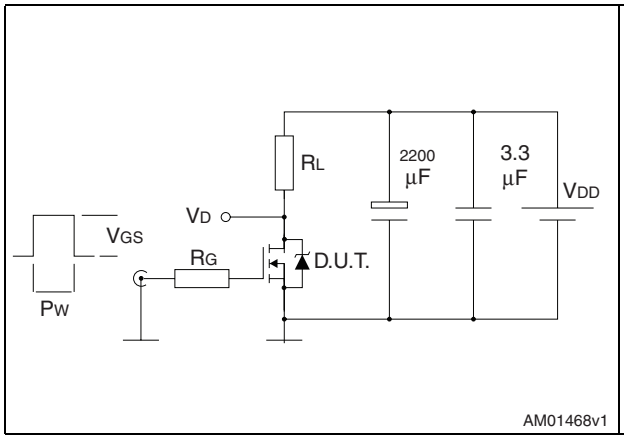


Figure 13. Gate charge test circuit

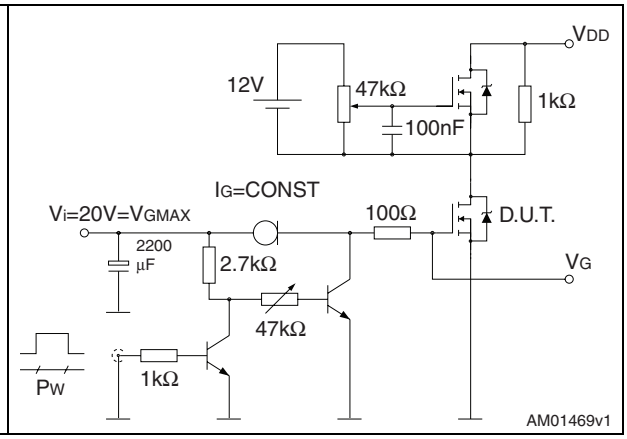


Figure 14. Test circuit for inductive load switching and diode recovery times

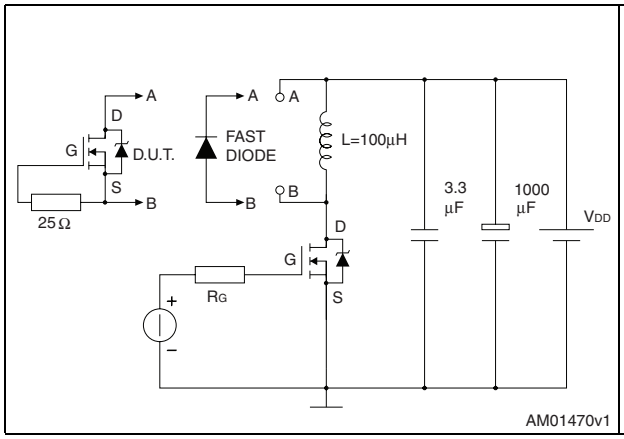


Figure 15. Unclamped Inductive load test circuit

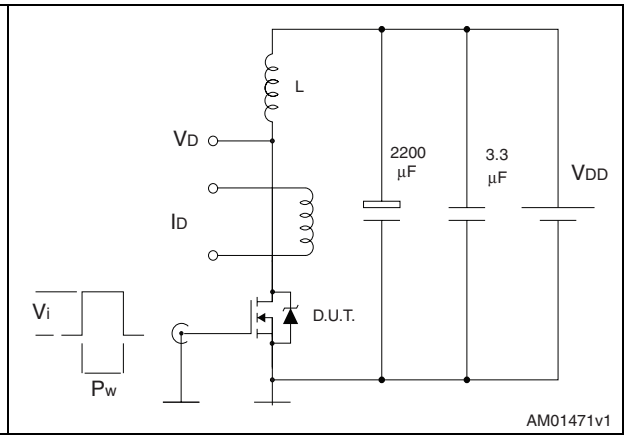


Figure 16. Unclamped inductive waveform

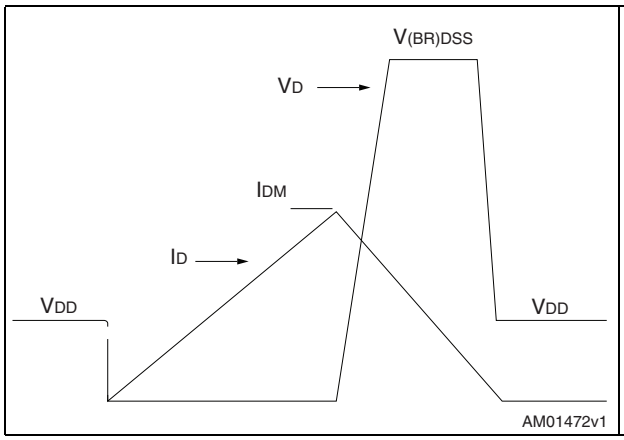
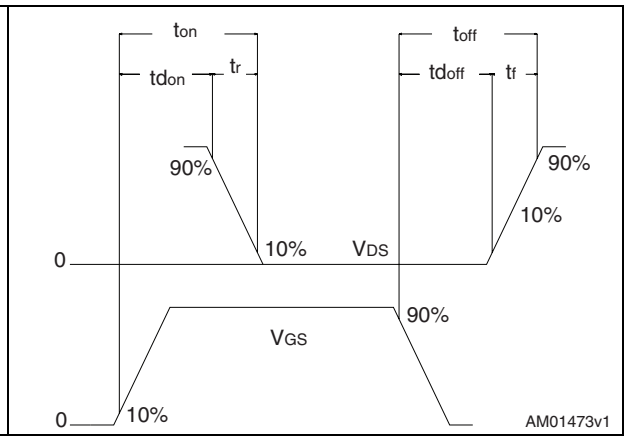


Figure 17. Switching time waveform

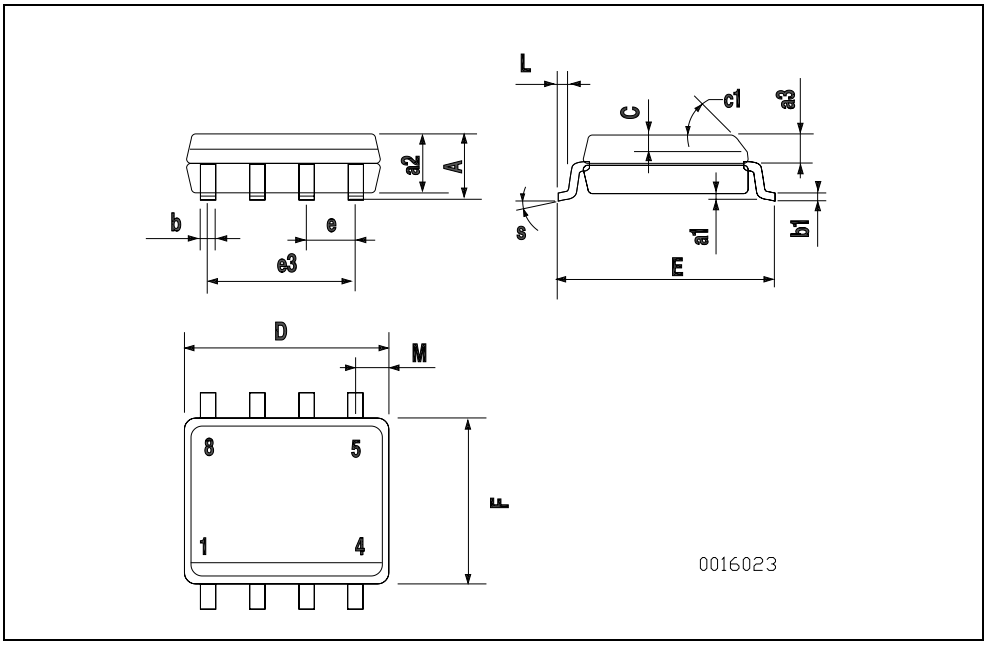


4 Package mechanical data

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.

SO-8 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.25	0.003		0.009
a2			1.65			0.064
a3	0.65		0.85	0.025		0.033
b	0.35		0.48	0.013		0.018
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.019
c1	45 (typ.)					
D	4.8		5.0	0.188		0.196
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F	3.8		4.0	0.14		0.157
L	0.4		1.27	0.015		0.050
M			0.6			0.023
S	8 (max.)					



5 Revision history

Table 8. Document revision history

Date	Revision	Changes
30-May-2005	5	Initial electronic version
29-Mar-2006	6	Modified *Figure 2* and *Figure 3*
16-May-2006	7	Modified internal schematic diagram
29-Aug-2007	8	Marking has been updated
30-Mar-2010	9	Inserted E_{AS} value in *Table 2: Absolute maximum ratings*

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