



STW60NM50N

N-channel 500 V, 0.035 Ω , 68 A, MDmesh™ II Power MOSFET in TO-247 package

Datasheet — preliminary data

Features

Type	V _{DSS} (@T _{jmax})	R _{DS(on)} max	I _D
STW60NM50N	550 V	<0.043 Ω	68 A

- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

Application

- Switching applications

Description

This device is an N-channel Power MOSFET developed using the second generation of MDmesh™ technology. This revolutionary Power MOSFET associates a vertical structure to the company's strip layout to yield one of the world's lowest on-resistance and gate charge. It is therefore suitable for the most demanding high efficiency converters.

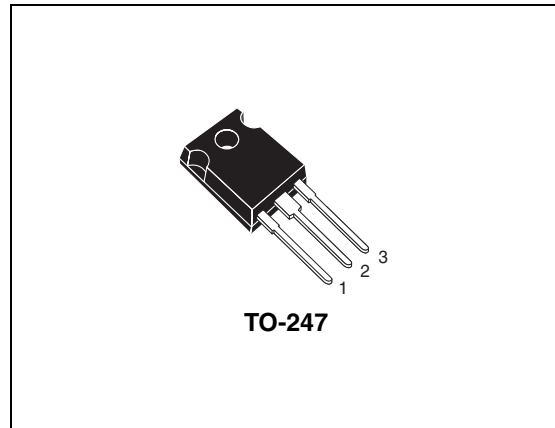


Figure 1. Internal schematic diagram

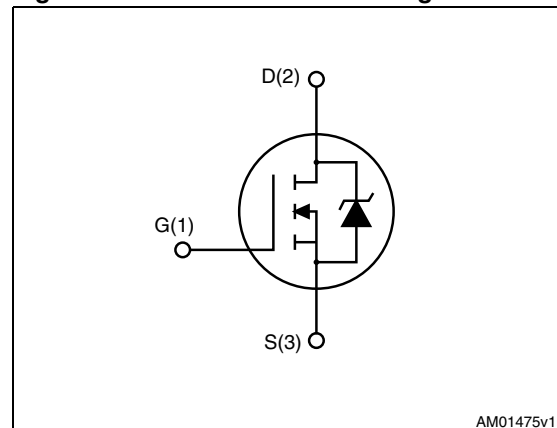


Table 1. Device summary

Order code	Marking	Package	Packaging
STW60NM50N	60NM50N	TO-247	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate- source voltage	± 25	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	68	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	43	A
$I_{DM}^{(1)}$	Drain current (pulsed)	272	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	446	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
T_{stg}	Storage temperature	-55 to 150	$^\circ\text{C}$
T_j	Max. operating junction temperature	150	$^\circ\text{C}$

1. Pulse width limited by safe operating area.
2. $I_{SD} \leq 68\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DD} = 80\% V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.28	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	50	$^\circ\text{C}/\text{W}$

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j Max)	14	A
E_{AS}	Single pulse avalanche energy (starting $T_j=25\text{ }^\circ\text{C}$, $I_D=I_{AS}$, $V_{DD}=50\text{ V}$)	551	mJ

2 Electrical characteristics

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

Table 5. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0, I_D = 1\text{ mA}$	500			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0, V_{DS} = 500\text{ V}$ $V_{GS} = 0, V_{DS} = 500\text{ V}, T_j = 125\text{ °C}$			1 100	μA
I_{GSS}	Gate-body leakage current	$V_{DS} = 0, V_{GS} = \pm 20\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}, I_D = 34\text{ A}$		0.035	0.043	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 100\text{ V}, f = 1\text{ MHz},$ $V_{GS} = 0$	-	5790 365 14	-	pF pF pF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{GS} = 0\text{V}, V_{DS} = 0\text{V to } 480\text{V}$	-	1008	-	pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 480\text{ V}, I_D = 68\text{ A},$ $V_{GS} = 10\text{ V}$ (see Figure 3)	-	178 28 95	-	nC nC nC
R_g	Gate input resistance	$f=1\text{ MHz}$ gate DC bias=0 Test signal level = 20 mV open drain	-	2	-	Ω

1. $C_{oss\text{ eq.}}$ is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DS}

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	$V_{DD} = 300\text{ V}, I_D = 32.5\text{ A}$ $R_G = 4.7\text{ }\Omega, V_{GS} = 10\text{ V}$ (see Figure 2)	-	206 36 40 27.5	-	ns ns ns ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		68	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				272	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 68 \text{ A}, V_{GS} = 0$			1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 68 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$		476		ns
Q_{rr}	Reverse recovery charge	$V_{DD} = 100 \text{ V}$		10.5		nC
I_{RRM}	Reverse recovery current	(see Figure 4)		44		A
t_{rr}	Reverse recovery time	$I_{SD} = 68 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$		586		ns
Q_{rr}	Reverse recovery charge	$V_{DD} = 100 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$		15		nC
I_{RRM}	Reverse recovery current	(see Figure 4)		51		A

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

3 Test circuits

Figure 2. Switching times test circuit for resistive load

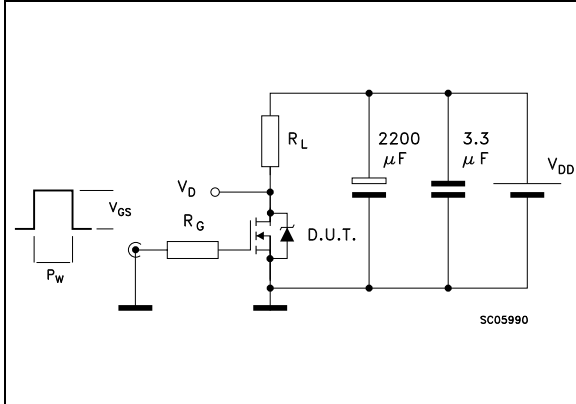


Figure 3. Gate charge test circuit

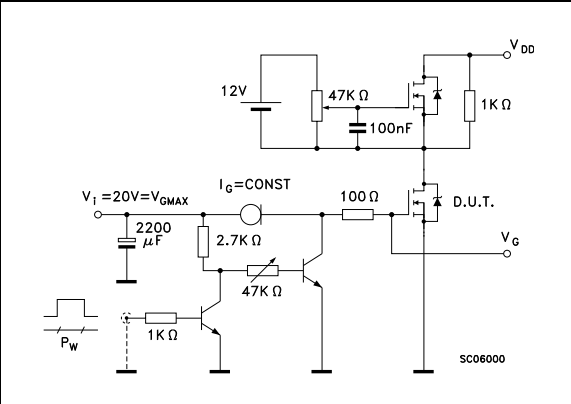


Figure 4. Test circuit for inductive load switching and diode recovery times

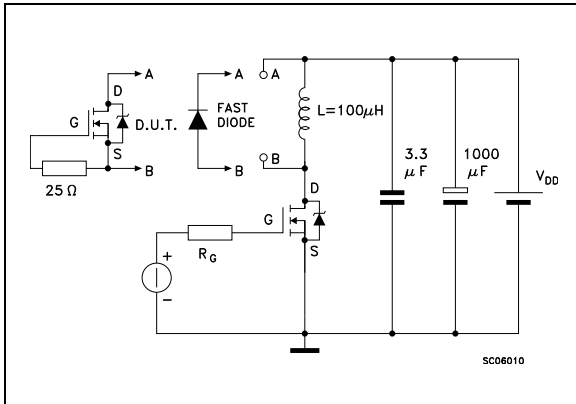


Figure 5. Unclamped Inductive load test circuit

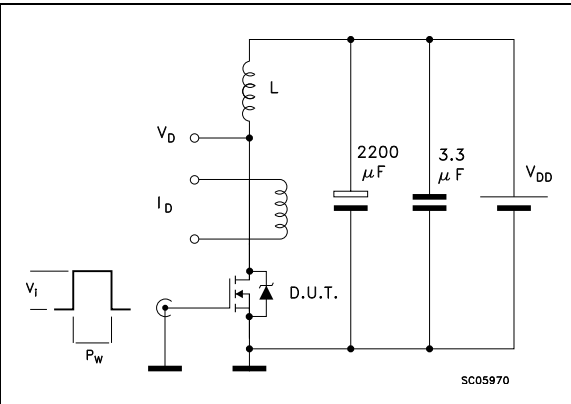


Figure 6. Unclamped inductive waveform

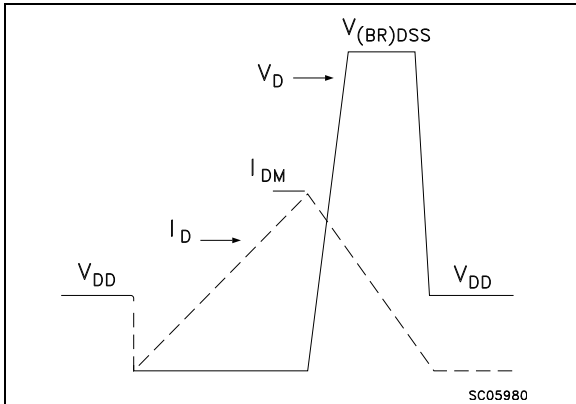
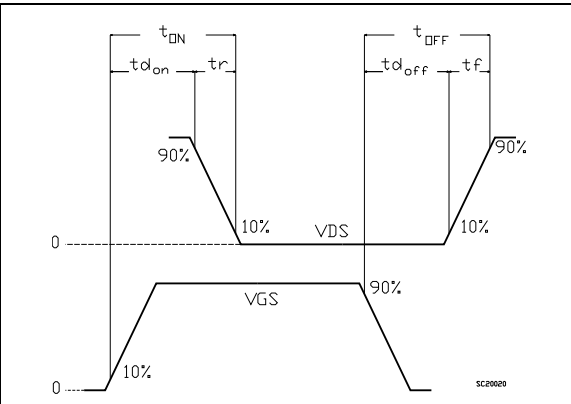


Figure 7. Switching time waveform



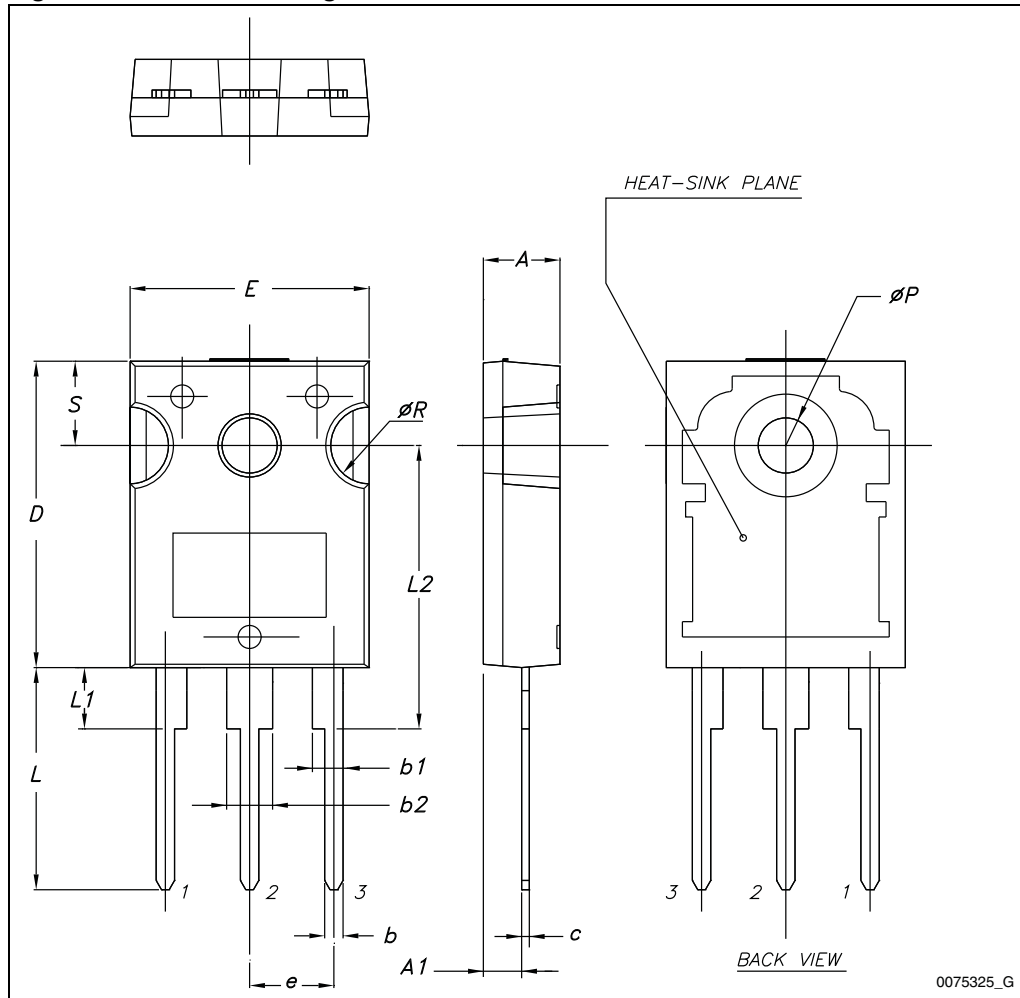
4 Package mechanical data

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.

Table 9. TO-247 mechanical data

Dim.	mm.		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
∅P	3.55		3.65
∅R	4.50		5.50
S	5.30	5.50	5.70

Figure 8. TO-247 drawing



5 Revision history

Table 10. Document revision history

Date	Revision	Changes
26-Apr-2012	1	First release.

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