



STW56NM60ND

N-channel 600 V, 0.047 Ω typ., 50 A FDmesh™ II
Power MOSFET in TO-247 package

Datasheet — preliminary data

Features

Order code	V _{DSS} @ T _{JMAX}	R _{DS(on)} max	I _D
STW56NM60ND	650 V	< 0.06 Ω	50 A

- The worldwide best R_{DS(on)} * area amongst the fast recovery diode devices
- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance
- Extremely high dv/dt and avalanche capabilities

Applications

- Switching applications

Description

This FDmesh™ II Power MOSFET with intrinsic fast-recovery body diode is produced using the second generation of MDmesh™ technology. Utilizing a new strip-layout vertical structure, this revolutionary device features extremely low on-resistance and superior switching performance. It is ideal for bridge topologies and ZVS phase-shift converters.

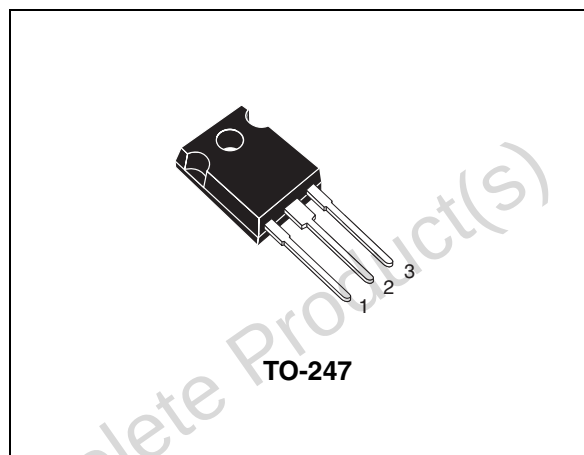


Figure 1. Internal schematic diagram

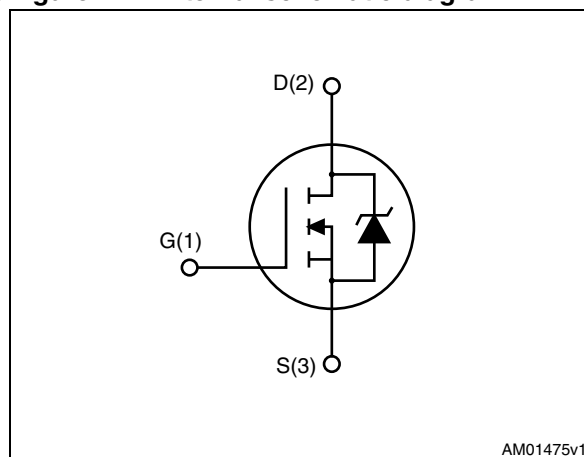


Table 1. Device summary

Order code	Marking	Package	Packaging
STW56NM60ND	56NM60ND	TO-247	Tube

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Obsolete Product(s) - Obsolete Product(s)



1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	600	V
V_{GS}	Gate-source voltage	± 25	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	50	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	32	A
$I_{DM}^{(1)}$	Drain current (pulsed)	200	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	390	W
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_J max)	10	A
E_{AS}	Single pulse avalanche energy (starting $T_J=25\text{ }^{\circ}\text{C}$, $I_D=I_{AS}$, $V_{DD}=50\text{ V}$)	TBD	mJ
$dv/dt^{(2)}$	Peak diode recovery voltage slope	40	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. $I_{SD} \leq 50\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DS\text{ peak}} \leq V_{(BR)DSS}$, $V_{DD} = 80\% V_{(BR)DSS}$.

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.32	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	50	$^{\circ}\text{C}/\text{W}$
T_l	Maximum lead temperature for soldering purpose	300	$^{\circ}\text{C}$

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ($V_{GS} = 0$)	$I_D = 1\text{ mA}$,	600			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 600\text{ V}$ $V_{DS} = 600\text{ V}$, $T_C = 125\text{ }^{\circ}\text{C}$			1 150	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 25\text{ V}$			± 150	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 25\text{ A}$		0.047	0.06	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 50\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	5000	-	pF
C_{oss}	Output capacitance			245		pF
C_{rss}	Reverse transfer capacitance			10		pF
$C_{oss\text{ eq.}}^{(1)}$	Output capacitance	$V_{GS} = 0$, $V_{DS} = 0\text{ to }480\text{ V}$	-	TBD	-	pF
R_g	Gate input resistance	$f = 1\text{ MHz}$ Gate DC Bias = 0 Test signal level = 20 mV Open drain	-	1.7	-	Ω
Q_g	Total gate charge	$V_{DD} = 200\text{ V}$, $I_D = 25\text{ A}$,	-	TBD	-	nC
Q_{gs}	Gate-source charge	$V_{GS} = 10\text{ V}$,		TBD		nC
Q_{gd}	Gate-drain charge	(see Figure 3)		TBD		nC

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 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(v)}$	Voltage delay time	$V_{DD} = 325 \text{ V}$, $I_D = 25 \text{ A}$ $R_G = 4.7 \text{ } \Omega$ $V_{GS} = 10 \text{ V}$ (see Figure 2)	-	TBD	-	ns
$t_{r(v)}$	Voltage rise time			TBD		ns
$t_{f(i)}$	Current fall time			TBD		ns
$t_{c(off)}$	Crossing time			TBD		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
I_{SD}	Source-drain current		-		50	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				200	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 50 \text{ A}$, $V_{GS} = 0$	-		1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 50 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}$ (see Figure 4)	-	TBD		ns
Q_{rr}	Reverse recovery charge			TBD		μC
I_{RRM}	Reverse recovery current			TBD		A
t_{rr}	Reverse recovery time	$I_{SD} = 50 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}$, $T_J = 150 \text{ } ^\circ\text{C}$ (see Figure 4)	-	TBD		ns
Q_{rr}	Reverse recovery charge			TBD		μC
I_{RRM}	Reverse recovery current			TBD		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

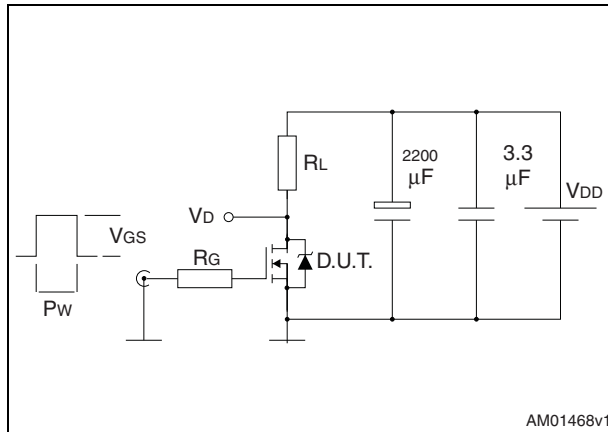


Figure 3. Gate charge test circuit

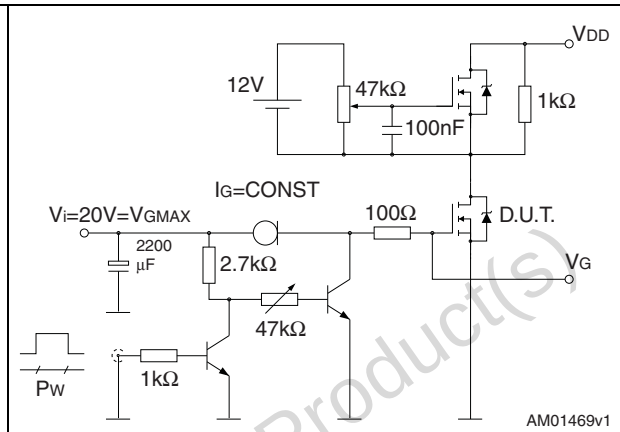


Figure 4. Test circuit for inductive load switching and diode recovery times

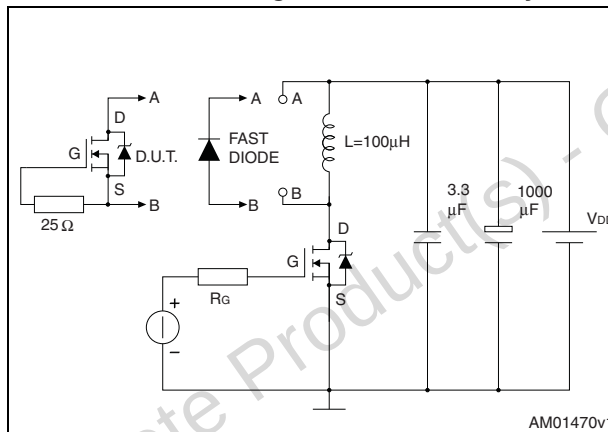


Figure 5. Unclamped inductive load test circuit

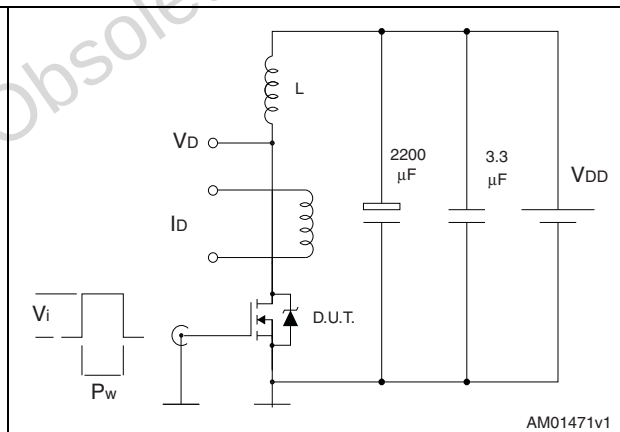


Figure 6. Unclamped inductive waveform

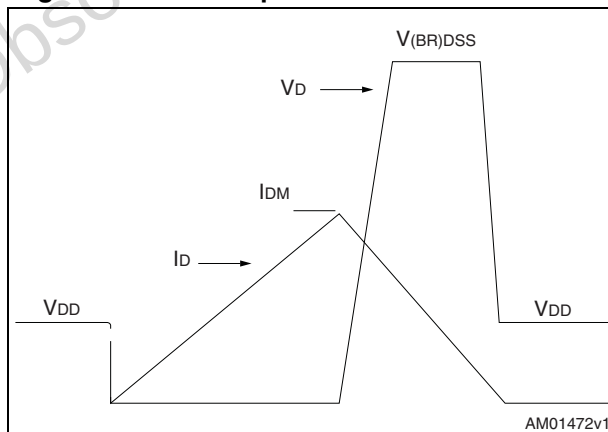
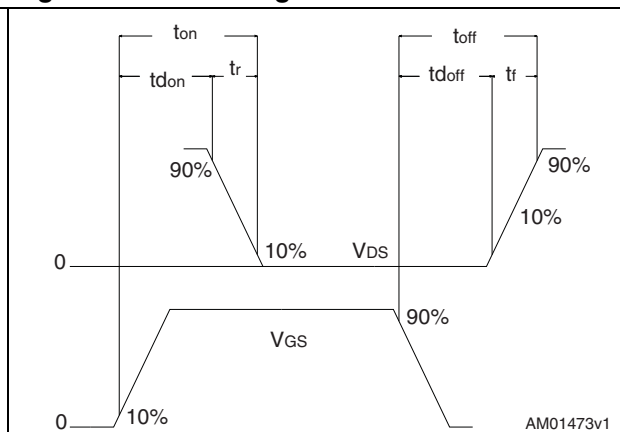


Figure 7. Switching time waveform



4 Package mechanical data

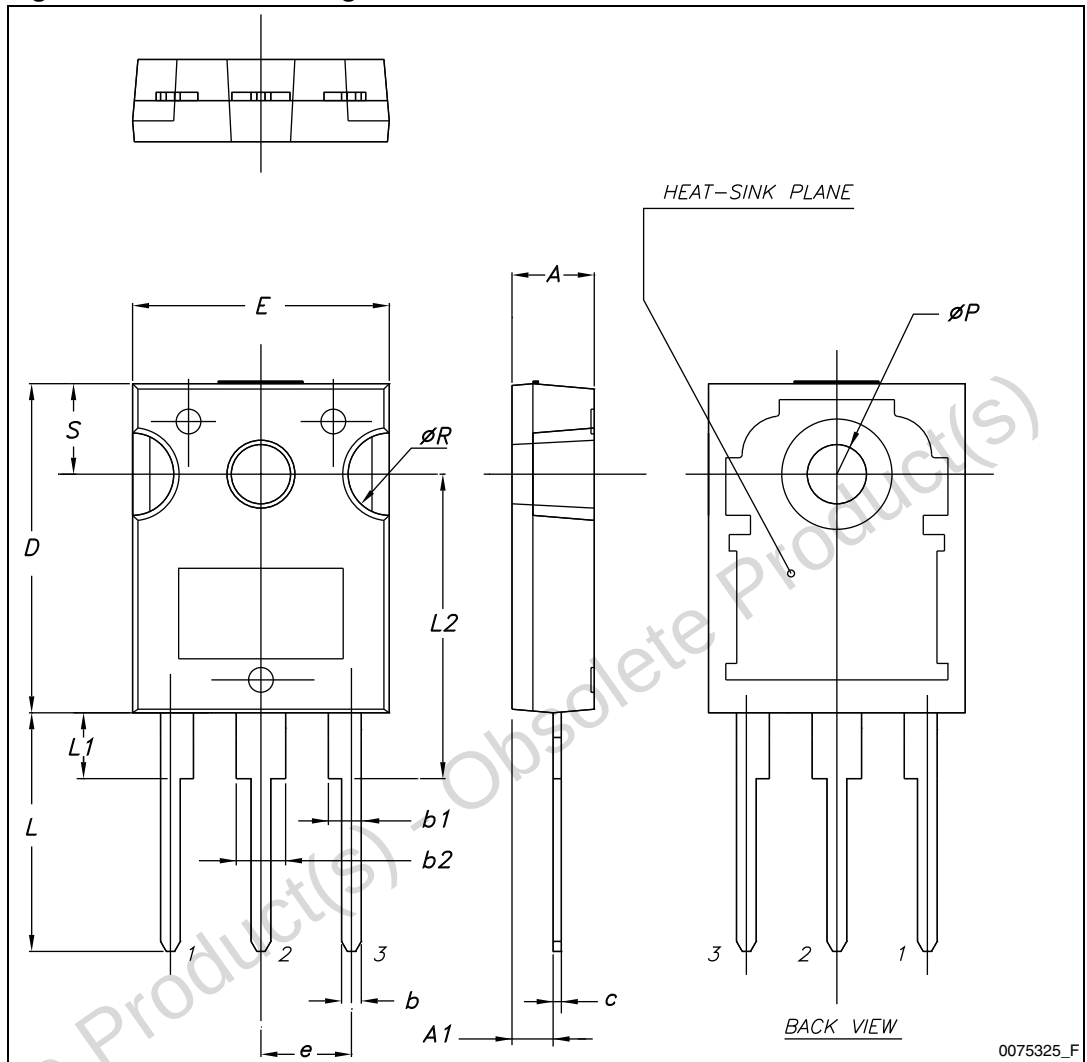
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Obsolete Product(s) - Obsolete Product(s)

Table 8. 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		5.45	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
ØP	3.55		3.65
ØR	4.50		5.50
S		5.50	

Figure 8. TO-247 drawing



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
13-Jul-2012	1	First release

Obsolete Product(s) - Obsolete Product(s)

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