

## **STW47NM60**

## N-CHANNEL 600V - 0.075Ω - 47A TO-247

## MDmesh™Power MOSFET

#### ADVANCED DATA

TYPE	V <sub>DSS</sub> R <sub>DS(on)</sub> R <sub>ds(on)</sub> *Q <sub>g</sub>		I <sub>D</sub>	
STW47NM60	600V	< 0.09Ω	7.2 Ω*nC	47 A

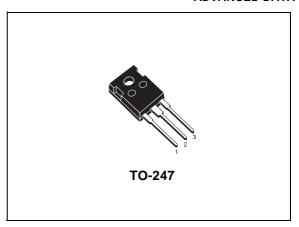
- TYPICAL  $R_{DS}(on) = 0.075\Omega$
- HIGH dv/dt AND AVALANCHE CAPABILITIES
- 100% AVALANCHE TESTED
- LOW INPUT CAPACITANCE AND GATE CHARGE
- LOW GATE INPUT RESISTANCE
- TIGHT PROCESS CONTROL AND HIGH MANUFACTURING YIELDS

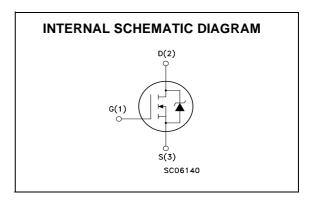


This improved version of MDmesh<sup>TM</sup> which is based on Multiple Drain process represents the new benchmark in high voltage MOSFETs. The resulting product exhibits even lower on-resistance, impressively high dv/dt and excellent avalanche characteristics. The adoption of the Company's proprietary strip technique yields overall performances that are significantly better than that of similar competition's products.



The MDmesh<sup>™</sup> family is very suitable for increasing power density of high voltage converters allowing system miniaturization and higher efficiencies.





#### **ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	600	V
V <sub>DGR</sub>	Drain-gate Voltage ( $R_{GS} = 20 \text{ k}\Omega$ )	600	V
V <sub>GS</sub>	Gate- source Voltage	±30	V
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 25°C	47	А
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 100°C	28	A
I <sub>DM</sub> (•)	Drain Current (pulsed)	180	А
Ртот	Total Dissipation at T <sub>C</sub> = 25°C	417	W
	Derating Factor	3.33	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	15	V/ns
T <sub>stg</sub>	Storage Temperature	-65 to 150	°C
Tj	Max. Operating Junction Temperature	150	°C

(•)Pulse width limited by safe operating area

(1)  $I_{SD} \le 47A$ ,  $di/dt \le 400A/\mu s$ ,  $V_{DD} \le V_{(BR)DSS}$ ,  $T_j \le T_{JMAX}$ .

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#### THERMAL DATA

Rthj-case	Thermal Resistance Junction-case Max	0.3	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	30	°C/W
T <sub>I</sub>	Maximum Lead Temperature For Soldering Purpose	300	°C

## **AVALANCHE CHARACTERISTICS**

Symbol	Parameter	Max Value	Unit
I <sub>AR</sub>	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max)	15	А
E <sub>AS</sub>	Single Pulse Avalanche Energy (starting $T_j = 25$ °C, $I_D = I_{AR}$ , $V_{DD} = 35$ V)	850	mJ

## **ELECTRICAL CHARACTERISTICS** (T<sub>CASE</sub> = 25 °C UNLESS OTHERWISE SPECIFIED)

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source Breakdown Voltage	$I_D = 250 \mu A, V_{GS} = 0$	600			V
I <sub>DSS</sub>	Zero Gate Voltage	V <sub>DS</sub> = Max Rating			10	μΑ
	Drain Current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max Rating, T <sub>C</sub> = 125 °C			100	μΑ
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ±30 V			±100	nA

## ON (1)

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	3	4	5	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 23.5 A		0.075	0.09	Ω

## **DYNAMIC**

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
g <sub>fs</sub> (1)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max},$ $I_{D} = 23.5 \text{ A}$		15		S
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V, f = 1 MHz, V <sub>GS</sub> = 0		3800		pF
Coss	Output Capacitance			1250		рF
C <sub>rss</sub>	Reverse Transfer Capacitance			46		pF
C <sub>oss eq.</sub> (2)	Equivalent Output Capacitance	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 0 V to 480 V		340		pF
R <sub>G</sub>	Gate Input Resistance	f=1 MHz Gate DC Bias = 0 Test Signal Level = 20 mV Open Drain		1.4		Ω

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Pulsed: Pulse duration = 300 μs, duty cycle 1.5 %.
 C<sub>oss eq.</sub> is defined as a constant equivalent capacitance giving the same charging time as C<sub>oss</sub> when V<sub>DS</sub> increases from 0 to 80% V<sub>DSS</sub>

# **ELECTRICAL CHARACTERISTICS** (CONTINUED) SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DD</sub> = 250 V, I <sub>D</sub> = 23.5 A		30		ns
t <sub>r</sub>	Rise Time	$R_G = 4.7\Omega V_{GS} = 10 V$ (see test circuit, Figure 3)		20		ns
Qg	Total Gate Charge	$V_{DD} = 400 \text{ V}, I_D = 47 \text{ A},$		96	134	nC
Q <sub>gs</sub>	Gate-Source Charge	V <sub>GS</sub> = 10 V		31		nC
$Q_{gd}$	Gate-Drain Charge			43		nC

## **SWITCHING OFF**

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	$V_{DD} = 400 \text{ V}, I_D = 47 \text{ A},$		16		ns
t <sub>f</sub>	Fall Time	$R_G = 4.7\Omega$ , $V_{GS} = 10 \text{ V}$ (see test circuit, Figure 5)		23		ns
t <sub>c</sub>	Cross-over Time	(See test sheart, Figure 5)		40		ns

## SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
I <sub>SD</sub>	Source-drain Current				47	Α
I <sub>SDM</sub> (2)	Source-drain Current (pulsed)				180	Α
V <sub>SD</sub> (1)	Forward On Voltage	I <sub>SD</sub> = 47 A, V <sub>GS</sub> = 0			1.5	V
t <sub>rr</sub> Q <sub>rr</sub> I <sub>RRM</sub>	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD}$ = 47 A, di/dt = 100 A/ $\mu$ s, $V_{DD}$ = 100 V, $T_j$ = 25°C (see test circuit, Figure 5)		508 10 40		ns µC A
t <sub>rr</sub> Q <sub>rr</sub> I <sub>RRM</sub>	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 47 \text{ A}$ , di/dt = 100 A/ $\mu$ s, $V_{DD} = 100 \text{ V}$ , $T_j = 150 ^{\circ}\text{C}$ (see test circuit, Figure 5)		650 14 43		ns µC A

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

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Fig. 1: Unclamped Inductive Load Test Circuit

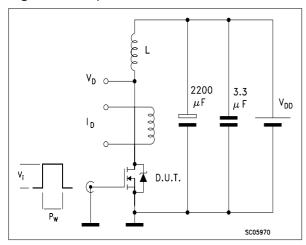


Fig. 3: Switching Times Test Circuit For Resistive Load

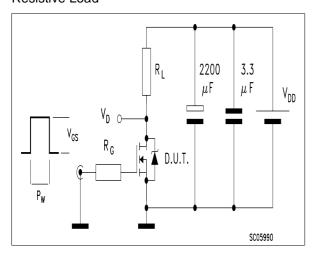


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times

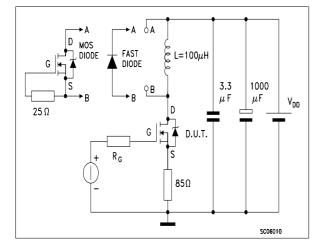


Fig. 2: Unclamped Inductive Waveform

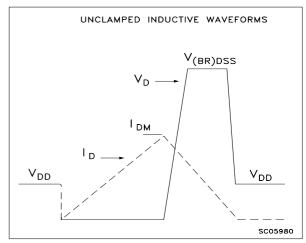
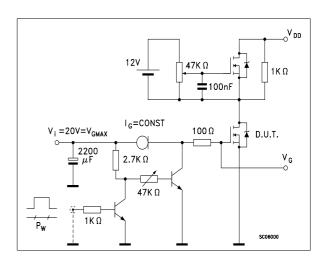


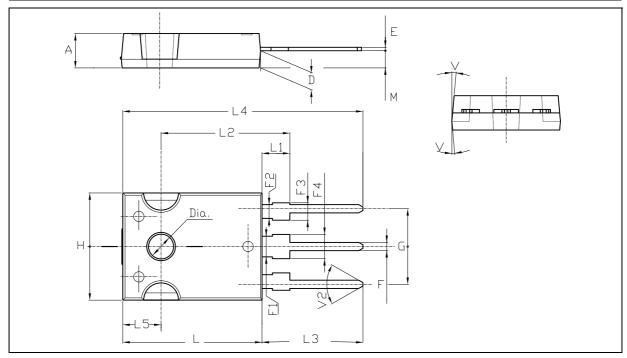
Fig. 4: Gate Charge test Circuit



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## **TO-247 MECHANICAL DATA**

DIM	mm. inch			inch		
DIM.	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
Α	4.85		5.15	0.19		0.20
D	2.20		2.60	0.08		0.10
Е	0.40		0.80	0.015		0.03
F	1		1.40	0.04		0.05
F1		3			0.11	
F2		2			0.07	
F3	2		2.40	0.07		0.09
F4	3		3.40	0.11		0.13
G		10.90			0.43	
Н	15.45		15.75	0.60		0.62
L	19.85		20.15	0.78		0.79
L1	3.70		4.30	0.14		0.17
L2		18.50			0.72	
L3	14.20		14.80	0.56		0.58
L4		34.60			1.36	
L5		5.50			0.21	
М	2		3	0.07		0.11
V		5°			5°	
V2		60°			60°	
Dia	3.55		3.65	0.14		0.143



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