

## N-channel 650 V, 0.058 $\Omega$ typ., 48 A MDmesh™ DM2 Power MOSFET in a TO-247 package

Datasheet - production data

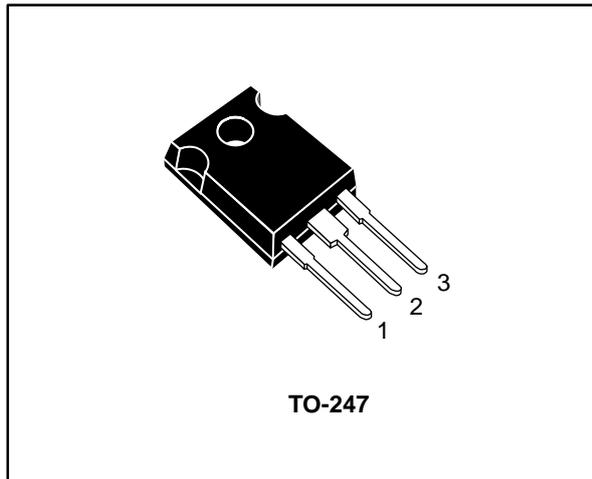
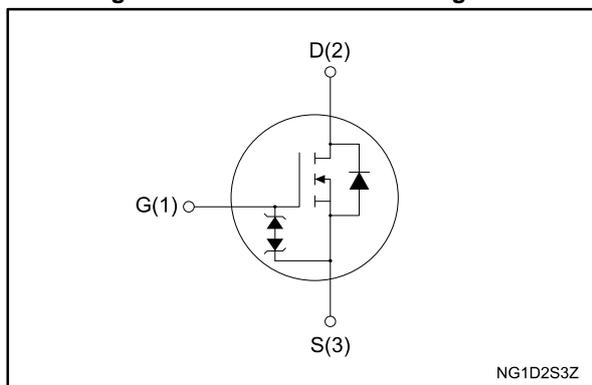


Figure 1: Internal schematic diagram



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>	P <sub>TOT</sub>
STW56N65DM2	650 V	0.065 $\Omega$	48 A	360 W

- Fast-recovery body diode
- Extremely low gate charge and input capacitance
- Low on-resistance
- 100% avalanche tested
- Extremely high dv/dt ruggedness
- Zener-protected

### Applications

- Switching applications

### Description

This high voltage N-channel Power MOSFET is part of the MDmesh™ DM2 fast recovery diode series. It offers very low recovery charge ( $Q_{rr}$ ) and time ( $t_{rr}$ ) combined with low  $R_{DS(on)}$ , rendering it suitable for the most demanding high efficiency converters and ideal for bridge topologies and ZVS phase-shift converters.

Table 1: Device summary

Order code	Marking	Package	Packing
STW56N65DM2	56N65DM2	TO-247	Tube

# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{GS}$	Gate-source voltage	$\pm 25$	V
$I_D$	Drain current (continuous) at $T_{case} = 25\text{ °C}$	48	A
	Drain current (continuous) at $T_{case} = 100\text{ °C}$	30	
$I_{DM}^{(1)}$	Drain current (pulsed)	192	A
$P_{TOT}$	Total dissipation at $T_{case} = 25\text{ °C}$	360	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	50	V/ns
$dv/dt^{(3)}$	MOSFET $dv/dt$ ruggedness	50	
$T_{stg}$	Storage temperature	-55 to 150	°C
$T_j$	Operating junction temperature		

**Notes:**

(1) Pulse width is limited by safe operating area.

(2)  $I_{SD} \leq 48\text{ A}$ ,  $di/dt = 900\text{ A}/\mu\text{s}$ ;  $V_{DS\text{ peak}} < V_{(BR)DSS}$ ,  $V_{DD} = 400\text{ V}$

(3)  $V_{DS} \leq 520\text{ V}$ .

**Table 3: Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.35	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient	50	

**Table 4: Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not repetitive	7	A
$E_{AS}^{(1)}$	Single pulse avalanche energy	1300	mJ

**Notes:**

(1) starting  $T_j = 25\text{ °C}$ ,  $I_D = I_{AR}$ ,  $V_{DD} = 50\text{ V}$ .

## 2 Electrical characteristics

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

**Table 5: Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0\text{ V}$ , $I_{\text{D}} = 1\text{ mA}$	650			V
$I_{\text{DSS}}$	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 650\text{ V}$			10	$\mu\text{A}$
		$V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 650\text{ V}$ , $T_{\text{case}} = 125\text{ °C}$			100	
$I_{\text{GSS}}$	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$ , $V_{\text{GS}} = \pm 25\text{ V}$			$\pm 5$	$\mu\text{A}$
$V_{\text{GS(th)}}$	Gate threshold voltage	$V_{\text{DS}} = V_{\text{GS}}$ , $I_{\text{D}} = 250\text{ }\mu\text{A}$	3	4	5	V
$R_{\text{DS(on)}}$	Static drain-source on-resistance	$V_{\text{GS}} = 10\text{ V}$ , $I_{\text{D}} = 24\text{ A}$		0.058	0.065	$\Omega$

**Table 6: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{\text{iss}}$	Input capacitance	$V_{\text{DS}} = 100\text{ V}$ , $f = 1\text{ MHz}$ , $V_{\text{GS}} = 0\text{ V}$	-	4100	-	$\mu\text{F}$
$C_{\text{oss}}$	Output capacitance		-	160	-	
$C_{\text{riss}}$	Reverse transfer capacitance		-	2.5	-	
$C_{\text{oss eq.}}^{(1)}$	Equivalent output capacitance	$V_{\text{DS}} = 0\text{ to }520\text{ V}$ , $V_{\text{GS}} = 0\text{ V}$	-	375	-	$\mu\text{F}$
$R_{\text{G}}$	Intrinsic gate resistance	$f = 1\text{ MHz}$ , $I_{\text{D}} = 0\text{ A}$	-	4.1	-	$\Omega$
$Q_{\text{g}}$	Total gate charge	$V_{\text{DD}} = 520\text{ V}$ , $I_{\text{D}} = 48\text{ A}$ , $V_{\text{GS}} = 10\text{ V}$ (see	-	88	-	nC
$Q_{\text{gs}}$	Gate-source charge		-	22	-	
$Q_{\text{gd}}$	Gate-drain charge		-	37	-	

**Notes:**

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

**Table 7: Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{\text{d(on)}}$	Turn-on delay time	$V_{\text{DD}} = 325\text{ V}$ , $I_{\text{D}} = 24\text{ A}$ $R_{\text{G}} = 4.7\text{ }\Omega$ , $V_{\text{GS}} = 10\text{ V}$ (see	-	28	-	ns
$t_{\text{r}}$	Rise time		-	31	-	
$t_{\text{d(off)}}$	Turn-off delay time		-	157	-	
$t_{\text{f}}$	Fall time		-	7.7	-	

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		48	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		192	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0\text{ V}$ , $I_{SD} = 48\text{ A}$	-		1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 48\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 100\text{ V}$ (see	-	135		ns
$Q_{rr}$	Reverse recovery charge		-	0.68		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	10		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 48\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 100\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$	-	260		ns
$Q_{rr}$	Reverse recovery charge		-	2.75		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	21		A

**Notes:**

(1) Pulse width is limited by safe operating area.

(2) Pulse test: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

