

N-channel 650 V, 0.037  $\Omega$  typ., 58 A MDmesh™ V Power MOSFET  
in TO-3PF and TO-247 packages

Datasheet – production data

## Features

Order codes	$V_{DSS}$ @ $T_{Jmax}$	$R_{DS(on)}$ max	$I_D$
STFW69N65M5	710 V	< 0.045 $\Omega$	58 A
STW69N65M5			

- Worldwide best  $R_{DS(on)}$  \* area
- Higher  $V_{DSS}$  rating and high dv/dt capability
- Excellent switching performance
- 100% avalanche tested

## Applications

- Switching applications

## Description

These devices are N-channel MDmesh™ V Power MOSFETs based on an innovative proprietary vertical process technology, which is combined with STMicroelectronics' well-known PowerMESH™ horizontal layout structure. The resulting product has extremely low on-resistance, which is unmatched among silicon-based Power MOSFETs, making it especially suitable for applications which require superior power density and outstanding efficiency.

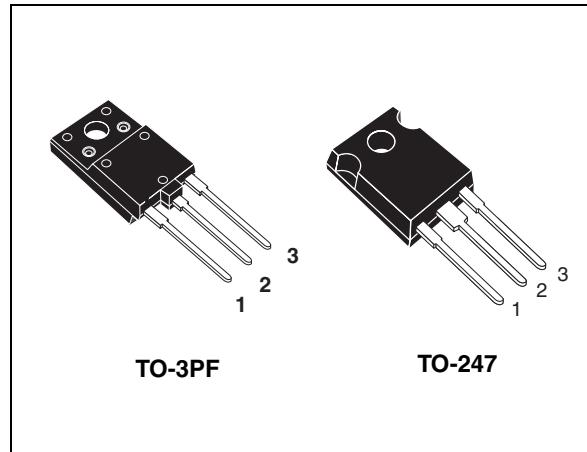
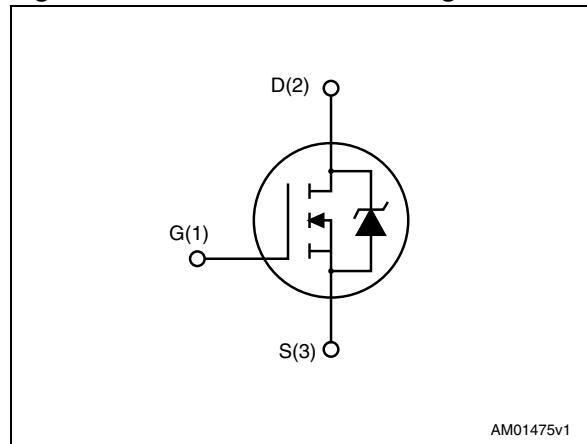


Figure 1. Internal schematic diagram



AM01475v1

Table 1. Device summary

Order codes	Marking	Package	Packaging
STFW69N65M5	69N65M5	TO-3PF	Tube
STW69N65M5		TO-247	

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		TO-3PF	TO-247	
$V_{GS}$	Gate-source voltage	$\pm 25$		V
$I_D$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	58 <sup>(1)</sup>	58	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	36.5 <sup>(1)</sup>	36.5	A
$I_{DM}^{(2)}$	Drain current (pulsed)	232 <sup>(1)</sup>	232	A
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	79	330	W
$dv/dt^{(3)}$	Peak diode recovery voltage slope	15		V/ns
$V_{ISO}$	Insulation withstand voltage (RMS) from all three leads to external heat sink ( $t=1\text{s}; T_c=25^\circ\text{C}$ )	3500		V
$T_{stg}$	Storage temperature	- 55 to 150		$^\circ\text{C}$
$T_j$	Max. operating junction temperature	150		$^\circ\text{C}$

1. Limited by maximum junction temperature.
2. Pulse width limited by safe operating area
3.  $I_{SD} \leq 58 \text{ A}$ ,  $di/dt \leq 400 \text{ A}/\mu\text{s}$ ;  $V_{DS \text{ peak}} < V_{(\text{BR})DSS}$ ,  $V_{DD}=400 \text{ V}$

**Table 3. Thermal data**

Symbol	Parameter	Value		Unit
		TO-3PF	TO-247	
$R_{thj-case}$	Thermal resistance junction-case max	1.58	0.38	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	50		$^\circ\text{C}/\text{W}$

**Table 4. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not repetitive (pulse width limited by $T_{jmax}$ )	12	A
$E_{AS}$	Single pulse avalanche energy (starting $t_j=25^\circ\text{C}$ , $I_d=I_{AR}$ ; $V_{dd}=50$ )	1410	mJ

## 2 Electrical characteristics

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

**Table 5. On /off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$I_D = 1 \text{ mA}, V_{GS} = 0$	650			V
$I_{\text{DSS}}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 650 \text{ V}$ $V_{DS} = 650 \text{ V}, T_C = 125^\circ\text{C}$			1 100	$\mu\text{A}$ $\mu\text{A}$
$I_{\text{GSS}}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 25 \text{ V}$			$\pm 100$	nA
$V_{GS(\text{th})}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	3	4	5	V
$R_{\text{DS(on)}}$	Static drain-source on-resistance	$V_{GS} = 10 \text{ V}, I_D = 29 \text{ A}$		0.037	0.045	$\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{\text{iss}}$	Input capacitance			6420		pF
$C_{\text{oss}}$	Output capacitance		-	170	-	pF
$C_{\text{rss}}$	Reverse transfer capacitance	$V_{DS} = 100 \text{ V}, f = 1 \text{ MHz}, V_{GS} = 0$		11		pF
$C_{o(\text{tr})}^{(1)}$	Equivalent capacitance time related		-	536	-	pF
$C_{o(\text{er})}^{(2)}$	Equivalent capacitance energy related	$V_{DS} = 0 \text{ to } 520 \text{ V}, V_{GS} = 0$	-	146	-	pF
$R_G$	Intrinsic gate resistance	$f = 1 \text{ MHz open drain}$	-	1.2	-	$\Omega$
$Q_g$	Total gate charge	$V_{DD} = 520 \text{ V}, I_D = 29 \text{ A}, V_{GS} = 10 \text{ V}$		143		nC
$Q_{gs}$	Gate-source charge		-	38	-	nC
$Q_{gd}$	Gate-drain charge			64		nC

1. Time related is defined as a constant equivalent capacitance giving the same charging time as  $C_{\text{oss}}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DSS}$
2. Energy related is defined as a constant equivalent capacitance giving the same stored energy as  $C_{\text{oss}}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DSS}$

**Table 7. Switching times**

<b>Symbol</b>	<b>Parameter</b>	<b>Test conditions</b>	<b>Min.</b>	<b>Typ.</b>	<b>Max</b>	<b>Unit</b>
$t_{d(v)}$	Voltage delay time	$V_{DD} = 400 \text{ V}$ , $I_D = 38 \text{ A}$ ,		102		ns
$t_{r(v)}$	Voltage rise time	$R_G = 4.7 \Omega$ , $V_{GS} = 10 \text{ V}$	-	13.5	-	ns
$t_{f(i)}$	Current fall time			10		ns
$t_{c(off)}$	Crossing time			19		ns

**Table 8. Source drain diode**

<b>Symbol</b>	<b>Parameter</b>	<b>Test conditions</b>	<b>Min.</b>	<b>Typ.</b>	<b>Max.</b>	<b>Unit</b>
$I_{SD}$	Source-drain current			58		A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-	232		A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 58 \text{ A}$ , $V_{GS} = 0$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 58 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$		480		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 100 \text{ V}$ (see )		11		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	46		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 58 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$		592		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 100 \text{ V}$ , $T_j = 150 \text{ }^\circ\text{C}$		16		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	53		A

1. Pulse width limited by safe operating area.

2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-3PF

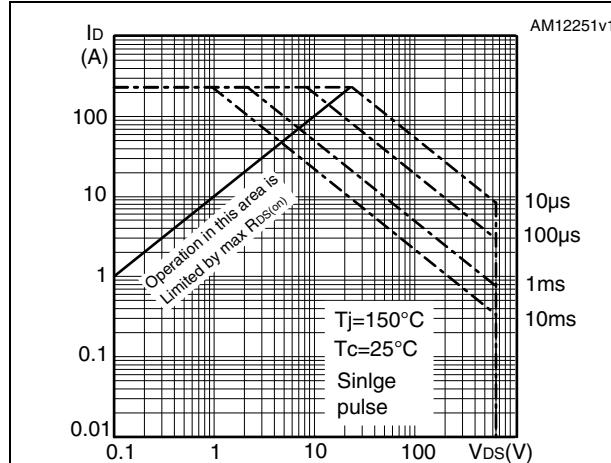


Figure 3. Thermal impedance for TO-3PF

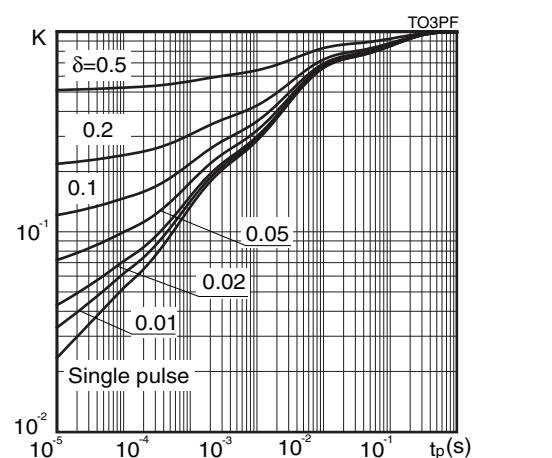


Figure 4. Safe operating area for TO-247

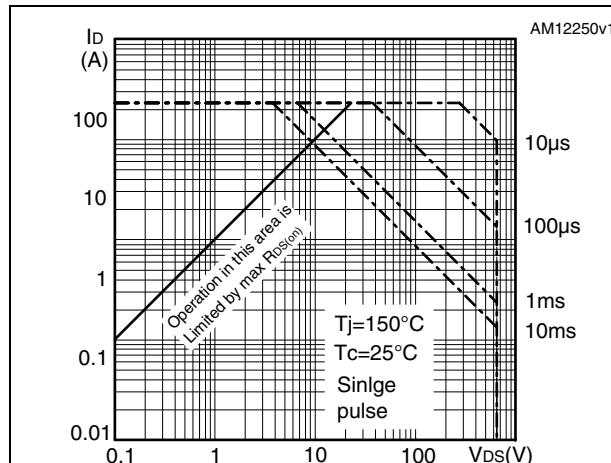


Figure 5. Thermal impedance for TO-247

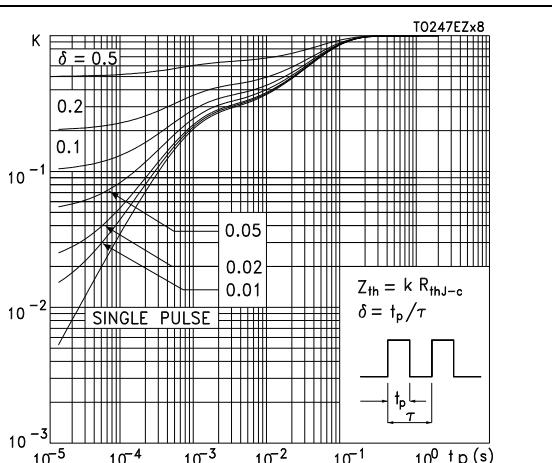


Figure 6. Output characteristics

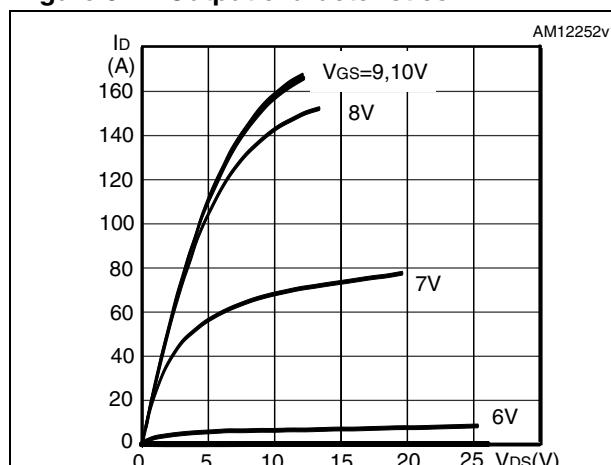


Figure 7. Transfer characteristics

