



STFW69N65M5 STW69N65M5

N-channel 650 V, 0.037 Ω , 58 A MDmesh™ V Power MOSFET
in TO-3PF and TO-247 packages

Datasheet — preliminary data

Features

Order code	V _{DSS} @ T _{Jmax}	R _{DS(on)} max	I _D
STFW69N65M5	710 V	< 0.045 Ω	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.

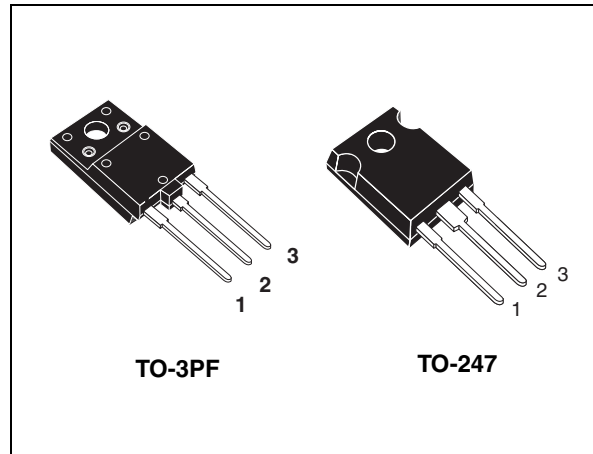


Figure 1. Internal schematic diagram

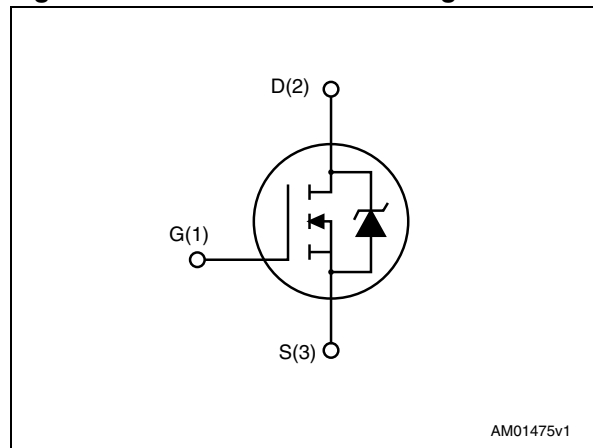


Table 1. Device summary

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

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
3	Test circuits	6
4	Package mechanical data	7
5	Revision history	11

1 Electrical ratings

Table 2. Absolute maximum ratings

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

1. $I_{SD} \leq 58\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$; $V_{DD} < 80\% V_{(BR)DSS}$

Table 3. Thermal data

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

Table 4. Avalanche characteristics

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

2 Electrical characteristics

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

Table 5. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0$	650			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 650\text{ V}$ $V_{DS} = 650\text{ V}$, $T_C = 125\text{ °C}$			1 100	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 25\text{ V}$			± 100	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	$V_{GS} = 10\text{ V}$, $I_D = 29\text{ A}$		0.037	0.045	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	$V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	6130 1550 11	-	pF pF pF
$C_{o(tr)}^{(1)}$	Equivalent capacitance time related	$V_{DS} = 0\text{ to }520\text{ V}$, $V_{GS} = 0$	-	TBD	-	pF
$C_{o(er)}^{(2)}$	Equivalent capacitance energy related		-	TBD	-	pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	1.5	-	Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 520\text{ V}$, $I_D = 29\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 3)	-	153 37 62	-	nC nC nC

1. Time related is defined as a constant equivalent capacitance giving the same charging time as C_{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_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(v)}$	Voltage delay time	$V_{DD} = 400\text{ V}$, $I_D = 38\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 4 and Figure 7)	-	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 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
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	$I_{SD} = 58\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ (see Figure 7)	-	TBD		ns
Q_{rr}	Reverse recovery charge			TBD		μC
I_{RRM}	Reverse recovery current			TBD		A
t_{rr}	Reverse recovery time	$I_{SD} = 58\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 7)	-	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

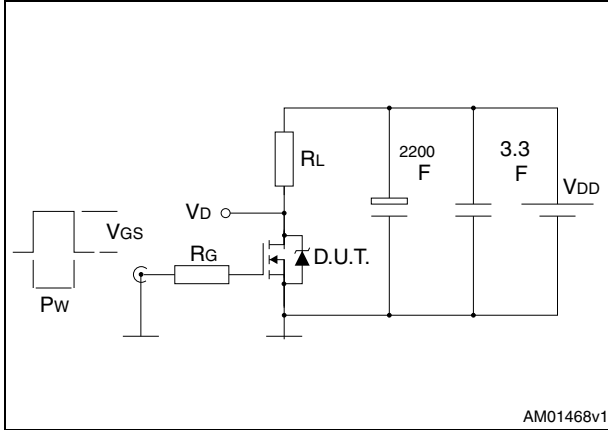


Figure 3. Gate charge test circuit

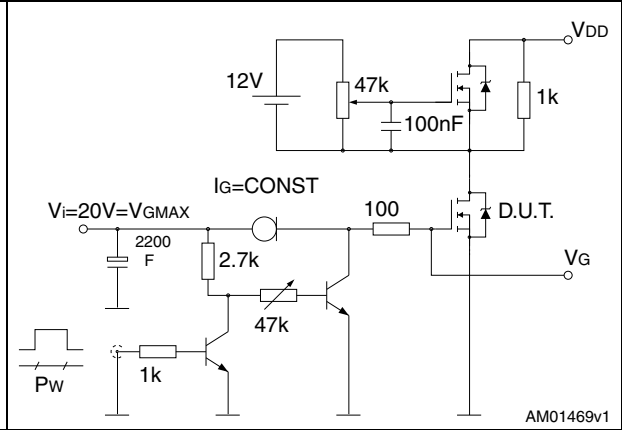


Figure 4. Test circuit for inductive load switching and diode recovery times

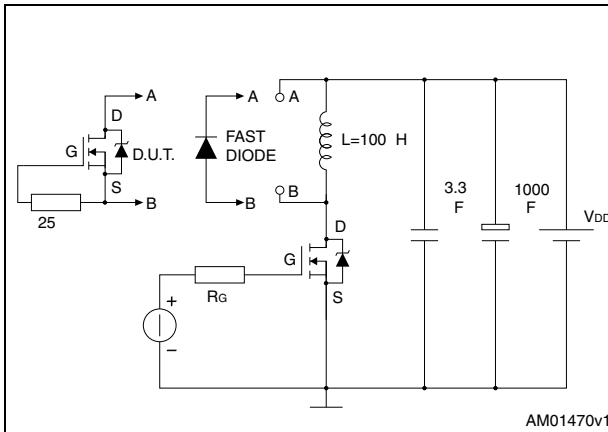


Figure 5. Unclamped inductive load test circuit

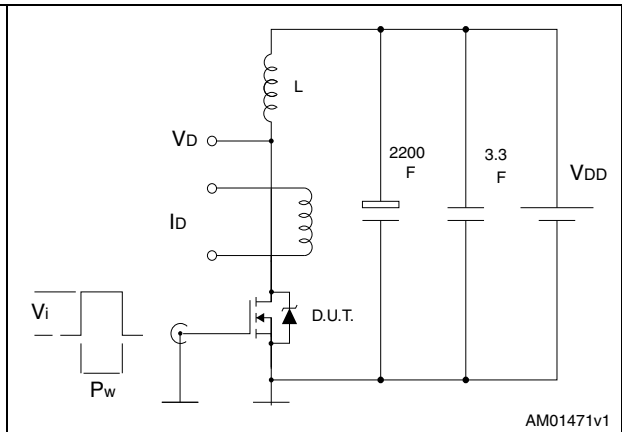


Figure 6. Unclamped inductive waveform

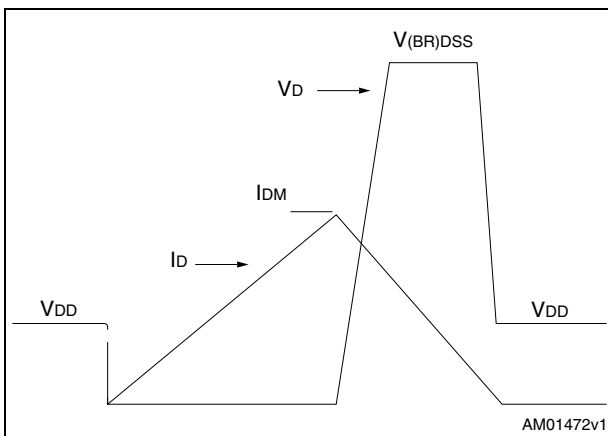
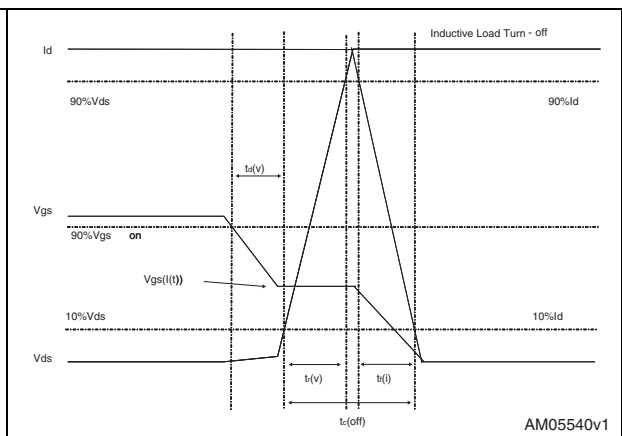


Figure 7. Switching time waveform



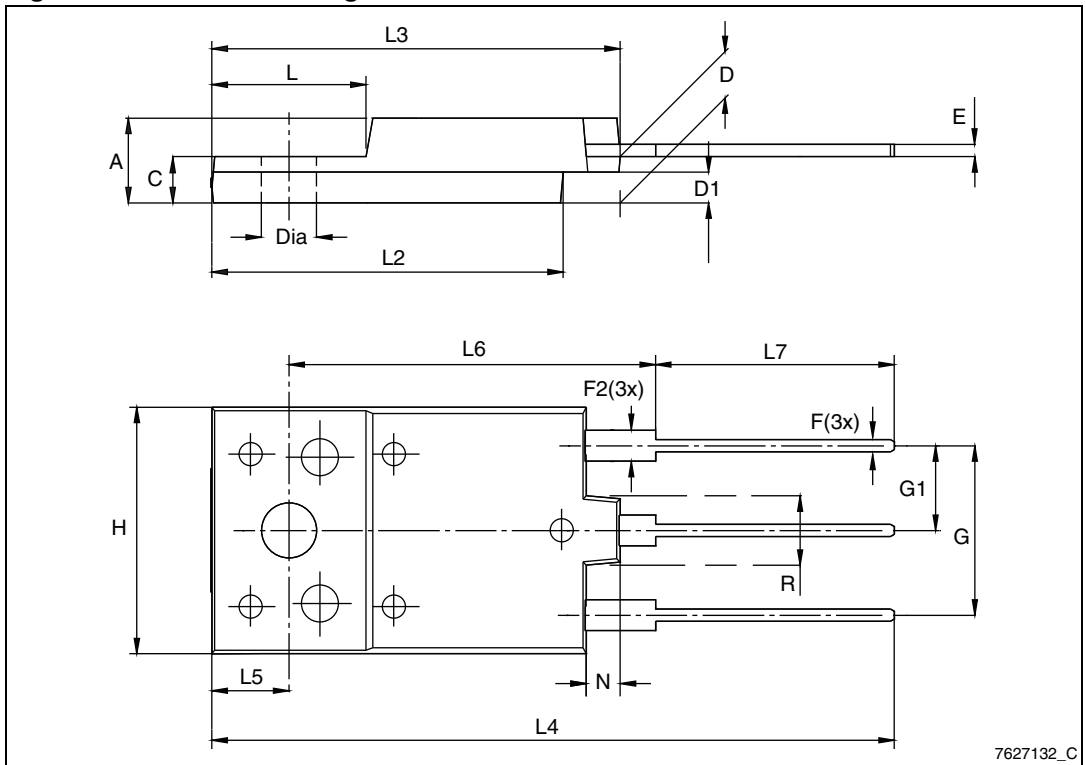
4 Package mechanical data

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-3PF mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	5.30		5.70
C	2.80		3.20
D	3.10		3.50
D1	1.80		2.20
E	0.80		1.10
F	0.65		0.95
F2	1.80		2.20
G	10.30		11.50
G1		5.45	
H	15.30		15.70
L	9.80	10	10.20
L2	22.80		23.20
L3	26.30		26.70
L4	43.20		44.40
L5	4.30		4.70
L6	24.30		24.70
L7	14.60		15
N	1.80		2.20
R	3.80		4.20
Dia	3.40		3.80

Figure 8. TO-3PF drawing

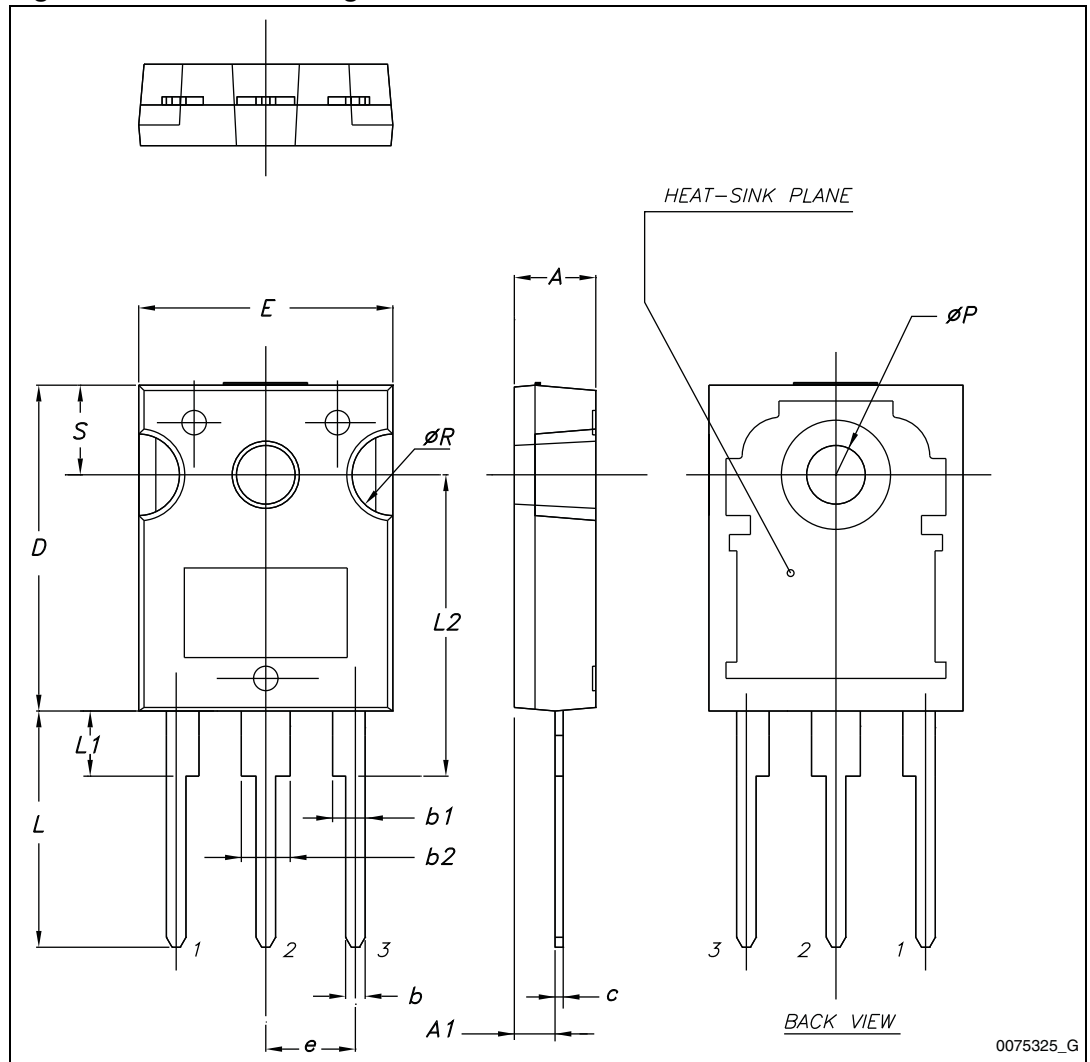


7627132_C

Table 10. 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	
ØP	3.55		3.65
ØR	4.50		5.50
S	5.30	5.50	5.70

Figure 9. TO-247 drawing



5 Revision history

Table 11. Document revision history

Date	Revision	Changes
27-Feb-2012	1	First release.

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