STFW69N65M5
STW69N65M5

N-channel 650 V, 0.037 Ω 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 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.

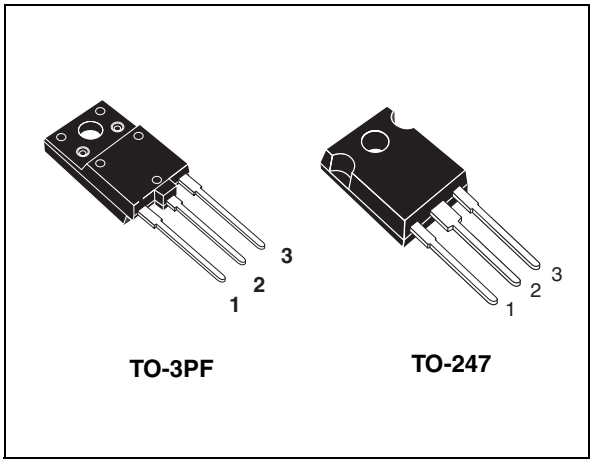

Figure 1. Internal schematic diagram

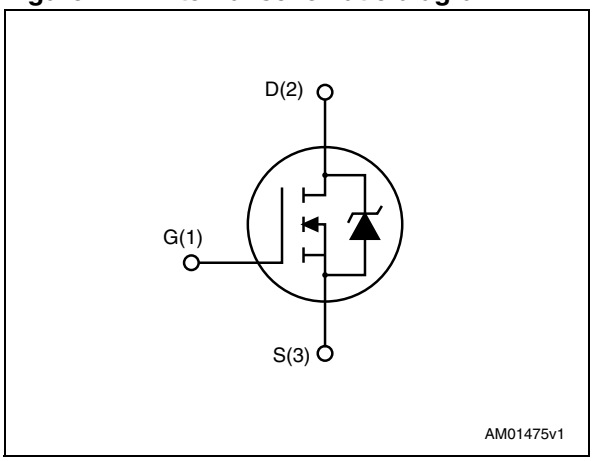

Table 1. Device summary

Order 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	± 25		V
I_D	Drain current (continuous) at T_C = 25 °C	58(1)	58	A
I_D	Drain current (continuous) at T_C = 100 °C	36.5 (1)	36.5	A
I_{DM} (2)	Drain current (pulsed)	232 (1)	232	A
P_{TOT}	Total dissipation at T_C = 25 °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=1s; Tc=25°C)	3500		V
T_{stg}	Storage temperature	- 55 to 150		°C
T_j	Max. operating junction temperature	150		°C

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

Table 3. Thermal data

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

Table 4. Avalanche characteristics

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

2 Electrical characteristics

(T_C = 25 °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 mA, V_{GS} = 0	650			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 650 V V_{DS} = 650 V, T_C=125 °C			1 100	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 25 V			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 29 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 V, f = 1 MHz, V_{GS} = 0	-	6420 170 11	-	pF pF pF
$C_{o(tr)}$(1)	Equivalent capacitance time related	V_{DS} = 0 to 520 V, V_{GS} = 0	-	536	-	pF
$C_{o(er)}$(2)	Equivalent capacitance energy related		-	146	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz open drain	-	1.2	-	Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 520 V, I_D = 29 A, V_{GS} = 10 V	-	143 38 64	-	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 V, I_D = 38 A,	-	102	-	ns
$t_{r(v)}$	Voltage rise time	R_G = 4.7 Ω, V_{GS} = 10 V		13.5		ns
$t_{f(i)}$	Current fall time			10		ns
$t_{c(off)}$	Crossing time			19		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 A, V_{GS} = 0	-		1.5	V
t_{rr}	Reverse recovery time	I_{SD} = 58 A, di/dt = 100 A/µs	-	480		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 100 V (see		11		µC
I_{RRM}	Reverse recovery current			46		A
t_{rr}	Reverse recovery time	I_{SD} = 58 A, di/dt = 100 A/µs	-	592		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 100 V, T_j = 150 °C		16		µC
I_{RRM}	Reverse recovery current			53		A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-3PF

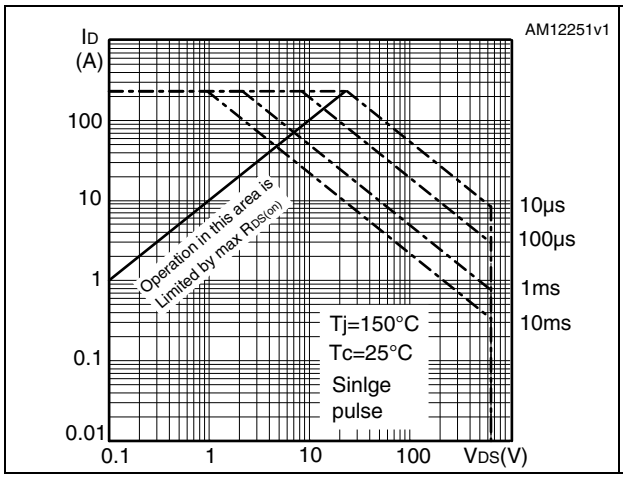

Figure 3. Thermal impedance for TO-3PF

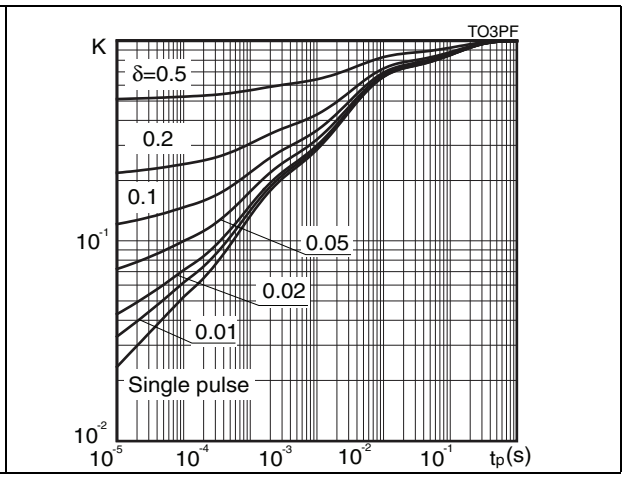

Figure 4. Safe operating area for TO-247

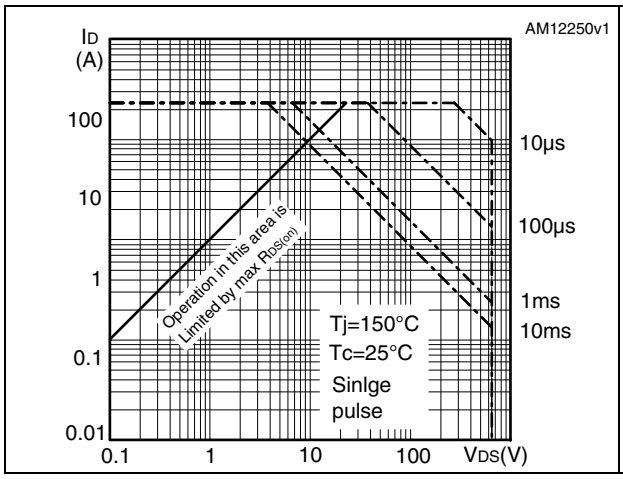

Figure 5. Thermal impedance for TO-247

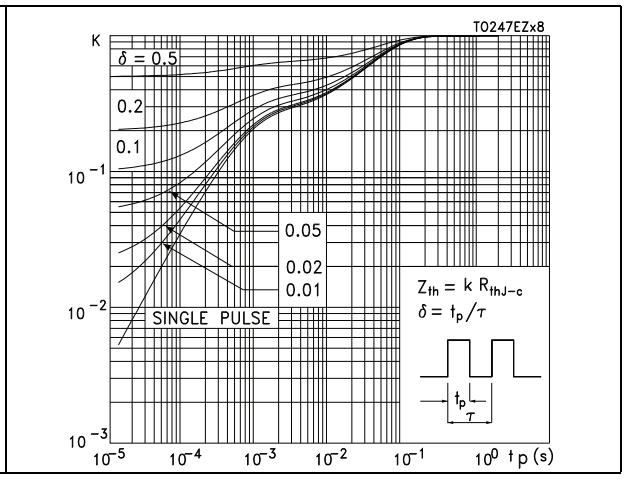

Figure 6. Output characteristics

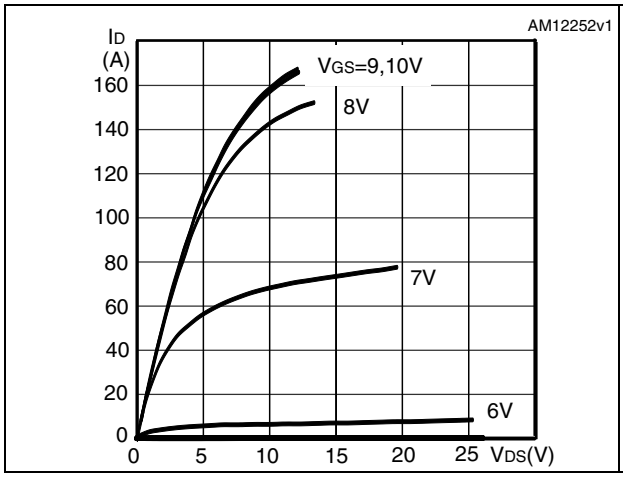

Figure 7. Transfer characteristics