

STW57N65M5-4

Datasheet – production data

N-channel 650 V, 0.056 Ω typ., 42 A, MDmesh[™] V Power MOSFET in a TO247-4 package

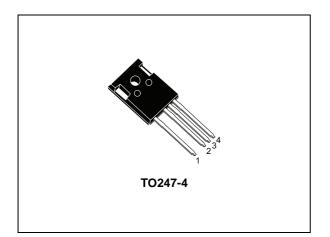
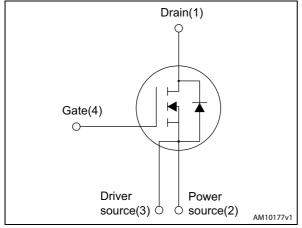


Figure 1. Internal schematic diagram



Features

Order code	V _{DS} @ T _{Jmax}	R _{DS(on)} max	I _D
STW57N65M5-4	710 V	0.063 Ω	42 A

- Higher V_{DS} rating
- Higher dv/dt capability
- Excellent switching performance thanks to the extra driving source pin
- Easy to drive
- 100% avalanche tested

Applications

- High efficiency switching applications:
 - Servers
 - PV inverters
 - Telecom infrastructure
 - Multi kW battery chargers

Description

This device is an N-channel MDmesh[™] V Power MOSFET 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 onresistance, which is unmatched among siliconbased Power MOSFETs, making it especially suitable for applications which require superior power density and outstanding efficiency.

Table 1. Device summary

Order code	Marking	Package	Packaging
STW57N65M5-4	57N65M5	TO247-4	Tube

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This is information on a product in full production.

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1 Electrical ratings

Symbol	Parameter	Value	Unit
V _{GS}	Gate- source voltage	±25	V
I _D	Drain current (continuous) at $T_C = 25 \text{ °C}$	42	А
I _D	Drain current (continuous) at T _C = 100 °C	26.5	А
I _{DM} ⁽¹⁾	Drain current (pulsed)	168	А
P _{TOT}	Total dissipation at $T_C = 25 \text{ °C}$	250	W
I _{AR}	Max current during repetitive or single pulse avalanche (pulse width limited by T_{JMAX})	11	А
E _{AS}	Single pulse avalanche energy (starting $T_j = 25 \text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 50 \text{ V}$)	960	mJ
dv/dt ⁽²⁾	Peak diode recovery voltage slope	15	V/ns
dv/dt ⁽³⁾	MOSFET dv/dt ruggedness	50	V/ns
T _{stg}	Storage temperature	- 55 to 150	°C
Тj	Max. operating junction temperature	150	°C

1. Pulse width limited by safe operating area

2. $~\rm I_{SD}~\leq42$ A, di/dt = 400 A/µs, peak $\rm V_{DS} < \rm V_{(BR)DSS},~\rm V_{DD}$ = 400 V

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

Table 3. Thermal data

Symbol	Parameter	Value	Unit
R _{thj-case}	Thermal resistance junction-case max	0.50	°C/W
R _{thj-amb}	Thermal resistance junction-ambient max	50	°C/W



2 Electrical characteristics

(T_C = 25 °C unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Тур.	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	μΑ μΑ
I _{GSS}	Gate-body leakage current (V _{DS} = 0)	V _{GS} = ± 25 V			± 100	nA
V _{GS(th)}	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \ \mu A$	3	4	5	V
R _{DS(on)}	Static drain-source on- resistance	V _{GS} = 10 V, I _D = 21 A		0.056	0.063	Ω

Table 4. 0	Dn /off	states
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Tahla	5	Dynamic
rapie	э.	Dynamic

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit	
C _{iss}	Input capacitance		-	4200	-	pF	
C _{oss}	Output capacitance	V _{DS} = 100 V, f = 1 MHz,	-	115	-	pF	
C _{rss}	Reverse transfer capacitance	$V_{GS} = 0$	-	9	-	pF	
C _{o(tr)} ⁽¹⁾	Equivalent capacitance time related	$V_{GS} = 0, V_{DS} = 0 \text{ to } 520 \text{ V}$	-	303	-	pF	
C _{o(er)} ⁽²⁾	Equivalent capacitance energy related	$V_{GS} = 0, V_{DS} = 0 \text{ to } 520 \text{ V}$	-	93	-	pF	
R _G	Intrinsic gate resistance	f = 1 MHz open drain	-	1.3	-	Ω	
Qg	Total gate charge	V _{DD} = 520 V, I _D = 21 A,	-	98	-	nC	
Q _{gs}	Gate-source charge	$V_{GS} = 10 \text{ V}$	-	23	-	nC	
Q _{gd}	Gate-drain charge	(see Figure 16)	-	40	-	nC	

1. $C_{o(tr)}$ is a constant capacitance value that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .

2. $C_{o(er)}$ is a constant capacitance value that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .



Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit	
t _{d(V)}	Voltage delay time	$V_{DD} = 400 \text{ V}, \text{ I}_{D} = 28 \text{ A},$ $R_{G} = 4.7 \Omega, V_{GS} = 10 \text{ V}$	-	79	-	ns	
t _{r(V)}	Voltage rise time		-	9	-	ns	
t _{f(i)}	Current fall time	(see Figure 15)	-	8	-	ns	
t _{c(off)}	Crossing time	(see <i>Figure 20</i>)	-	14	-	ns	

Table 6. Switching times

 Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
I _{SD}	Source-drain current		-		42	А
I _{SDM} ⁽¹⁾	Source-drain current (pulsed)		-		168	А
V _{SD} ⁽²⁾	Forward on voltage	$I_{SD} = 42 \text{ A}, V_{GS} = 0$	-		1.5	V
t _{rr}	Reverse recovery time	I _{SD} = 42 A,	-	418		ns
Q _{rr}	Reverse recovery charge	di/dt = 100 A/µs	-	8		μC
I _{RRM}	Reverse recovery current	$V_{DD} = 100 V (see Figure 17)$	-	40		А
t _{rr}	Reverse recovery time	I _{SD} = 42 A,	-	528		ns
Q _{rr}	Reverse recovery charge	di/dt = 100 A/µs V _{DD} = 100 V, T _i = 150 °C	-	12		μC
I _{RRM}	Reverse recovery current	(see <i>Figure 17</i>)	-	44		А

1. Pulse width limited by safe operating area

2. Pulsed: pulse duration = 300 μ s, duty cycle 1.5%



2.1 Electrical characteristics (curves)

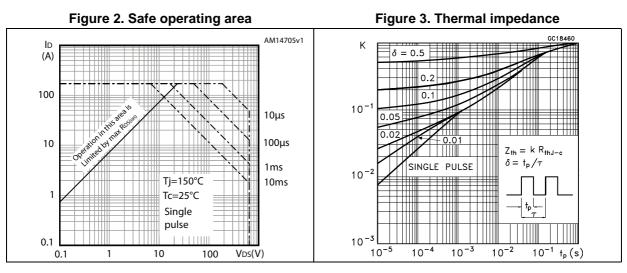
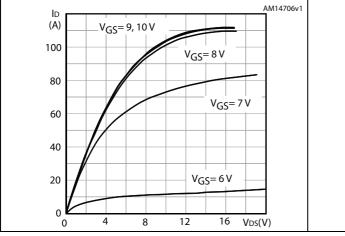


Figure 4. Output characteristics





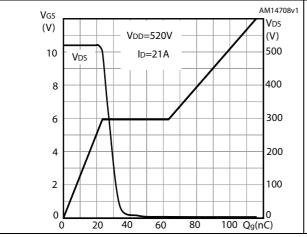


Figure 5. Transfer characteristics

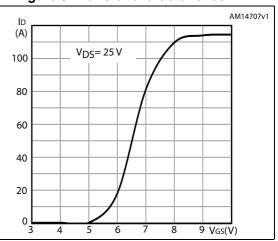
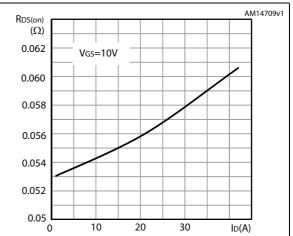
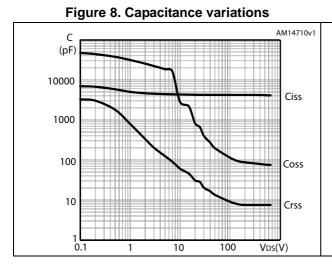


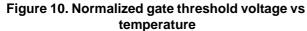
Figure 7. Static drain-source on-resistance



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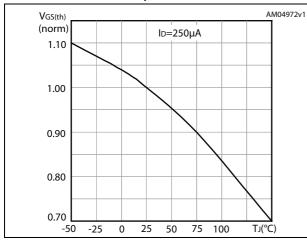


Figure 12. Source-drain diode forward characteristics

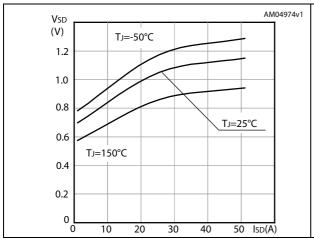
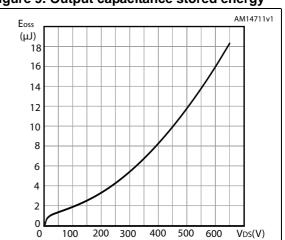
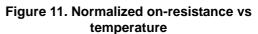


Figure 9. Output capacitance stored energy





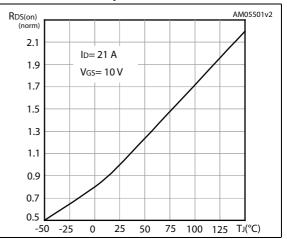
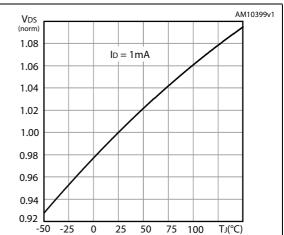


Figure 13. Normalized V_{DS} vs temperature





Electrical characteristics

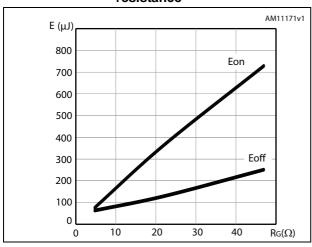


Figure 14. Switching losses vs gate resistance ⁽¹⁾

1. Eon including reverse recovery of a SiC diode.



3 Test circuits

Figure 15. Switching times test circuit for resistive load

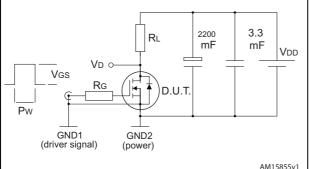


Figure 17. Test circuit for inductive load switching and diode recovery times

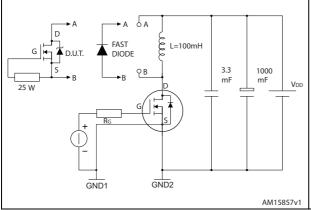


Figure 19. Unclamped inductive waveform

VD

IDM

lр

V(BR)DSS

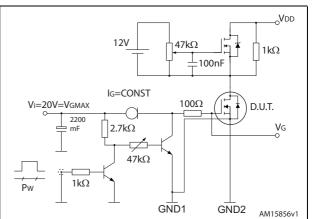
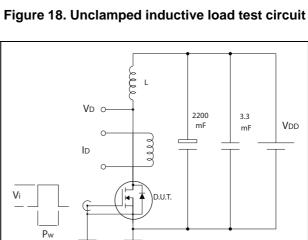
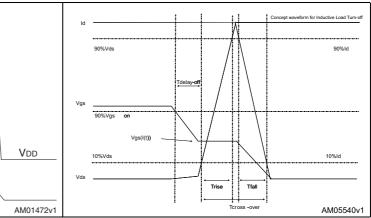


Figure 16. Gate charge test circuit





GND2



GND1



Vdd

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4 Package mechanical data

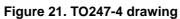
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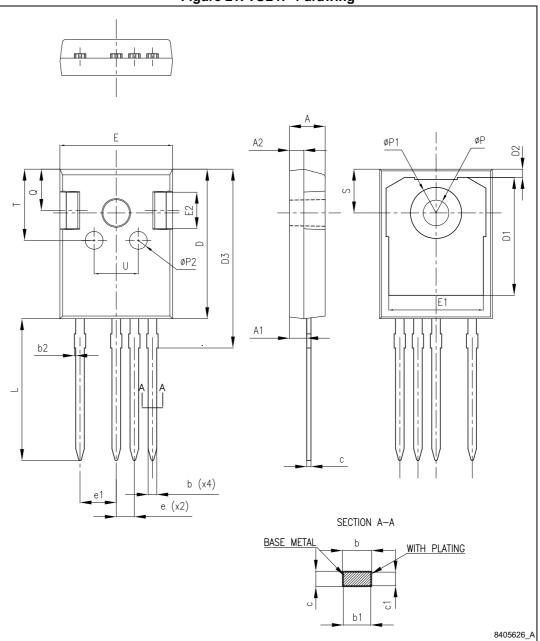


Table 8. TO247-4 mechanical data				
Dim.	mm.			
	Min.	Тур.	Max.	
А	4.90	5.00	5.10	
A1	2.31	2.41	2.51	
A2	1.90	2.00	2.10	
b	1.16		1.29	
b1	1.15	1.20	1.25	
b2	0		0.20	
С	0.59		0.66	
c1	0.58	0.60	0.62	
D	20.90	21.00	21.10	
D1	16.25	16.55	16.85	
D2	1.05	1.20	1.35	
D3	24.97	25.12	25.27	
E	15.70	15.80	15.90	
E1	13.10	13.30	13.50	
E2	4.90	5.00	5.10	
E3	2.40	2.50	2.60	
е	2.44	2.54	2.64	
e1	4.98	5.08	5.18	
L	19.80	19.92	20.10	
Р	3.50	3.60	3.70	
P1			7.40	
P2	2.40	2.50	2.60	
Q	5.60		6.00	
S		6.15		
Т	9.80		10.20	
U	6.00		6.40	

Table 8. TO247-4 mechanical data







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5 Revision history

Date	Revision	Changes
17-Apr-2013	1	First release.
28-Jun-2013	2	Modified: Figure 1, 15, 16, 17, 18Minor text changes

Table 9. Document revision history



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