

**N-channel 600 V, 0.045 Ω typ., 52 A MDmesh™ M2
Power MOSFET in a TO-247 package**

Datasheet - production data

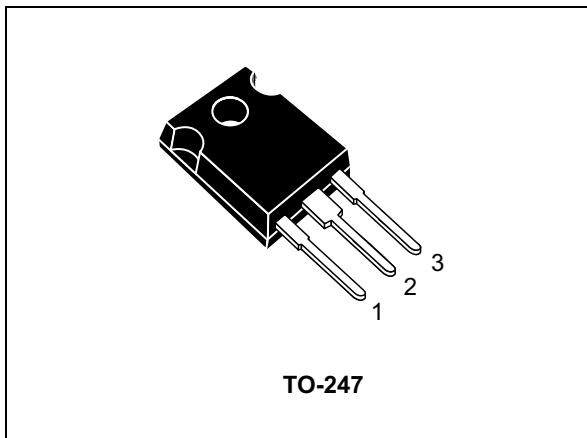
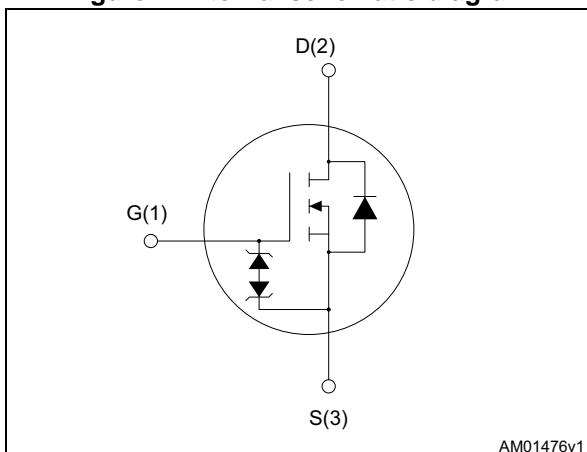


Figure 1. Internal schematic diagram



Features

Order code	$V_{DS} @ T_{Jmax}$	$R_{DS(on)} max$	I_D
STW56N60M2	650 V	0.055 Ω	52 A

- Extremely low gate charge
- Excellent output capacitance (C_{oss}) profile
- 100% avalanche tested
- Zener-protected

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using MDmesh™ M2 technology. Thanks to its strip layout and an improved vertical structure, the device exhibits low on-resistance and optimized switching characteristics, rendering it suitable for the most demanding high efficiency converters.

Table 1. Device summary

Order code	Marking	Package	Packaging
STW56N60M2	56N60M2	TO-247	Tube

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate- source voltage	± 25	V
I_D	Drain current (continuous) at $T_C = 25^\circ\text{C}$	52	A
I_D	Drain current (continuous) at $T_C = 100^\circ\text{C}$	33	A
$I_{DM}^{(1)}$	Drain current (pulsed)	208	A
P_{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	350	W
$dv/dt^{(2)}$	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	$^\circ\text{C}$
T_j	Max. operating junction temperature	150	$^\circ\text{C}$

1. Pulse width limited by safe operating area
2. $I_{SD} \leq 52$ A, $di/dt = 400$ A/ μs , peak $V_{DS} < V_{(BR)DSS}$, $V_{DD} = 400$ V
3. $V_{DS} \leq 480$ V

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-amb}$	Thermal resistance junction-ambient max	50	$^\circ\text{C}/\text{W}$
$R_{thj-case}$	Thermal resistance junction-case max	0.36	$^\circ\text{C}/\text{W}$

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Max current during repetitive or single pulse avalanche (pulse width limited by T_{JMAX})	7.5	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50$ V)	1100	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	$I_D = 1 \text{ mA}, V_{GS} = 0$	600			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 600 \text{ V}$ $V_{DS} = 600 \text{ V}, T_C = 125^\circ\text{C}$			1 100	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 25 \text{ V}$			± 10	nA
$V_{GS(\text{th})}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	2	3	4	V
$R_{DS(\text{on})}$	Static drain-source on-resistance	$V_{GS} = 10 \text{ V}, I_D = 26 \text{ A}$		0.045	0.055	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 100 \text{ V}, f = 1 \text{ MHz},$ $V_{GS} = 0$	-	3750	-	pF
C_{oss}	Output capacitance		-	175	-	pF
C_{rss}	Reverse transfer capacitance		-	6.6	-	pF
$C_{o(er)}^{(1)}$	Equivalent Output Capacitance	$V_{GS} = 0, V_{DS} = 0 \text{ to } 480 \text{ V}$	-	740	-	pF
R_G	Intrinsic gate resistance	$f = 1 \text{ MHz open drain}$	-	4.7	-	Ω
Q_g	Total gate charge	$V_{DD} = 480 \text{ V}, I_D = 52 \text{ A},$ $V_{GS} = 10 \text{ V}, (\text{see })$	-	91	-	nC
Q_{gs}	Gate-source charge		-	13.5	-	nC
Q_{gd}	Gate-drain charge		-	41	-	nC

1. C_{oss} eq. 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}

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300 \text{ V}$, $I_D = 26 \text{ A}$, $R_G = 4.7 \Omega$, $V_{GS} = 10 \text{ V}$	-	18	-	ns
t_r	Rise time		-	26.5	-	ns
$t_{d(off)}$	Turn-off delay time		-	119	-	ns
t_f	Fall time		-	14	-	ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		52	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		208	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 52 \text{ A}$, $V_{GS} = 0$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 52 \text{ A}$, $dI/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 100 \text{ V}$ (see	-	496		ns
Q_{rr}	Reverse recovery charge		-	10		μC
I_{RRM}	Reverse recovery current		-	41		A
t_{rr}	Reverse recovery time	$I_{SD} = 52 \text{ A}$, $dI/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}$, $T_j = 150^\circ\text{C}$	-	632		ns
Q_{rr}	Reverse recovery charge		-	14		μC
I_{RRM}	Reverse recovery current		-	45		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

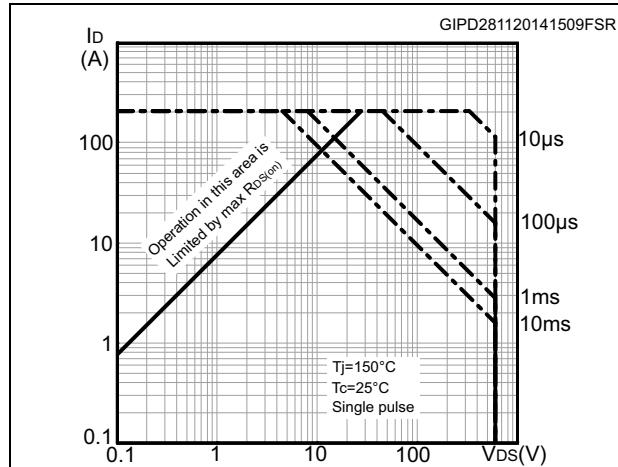


Figure 3. Thermal impedance

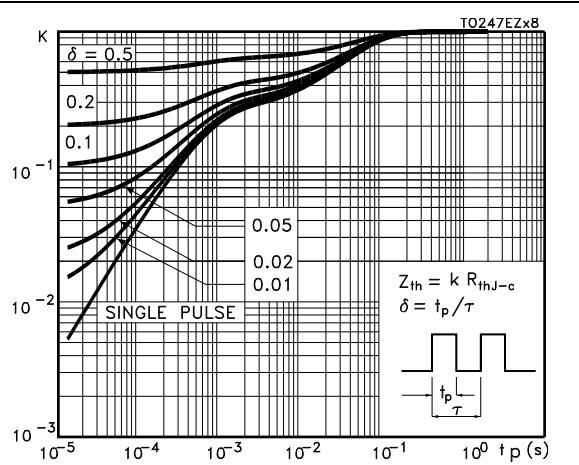


Figure 4. Output characteristics

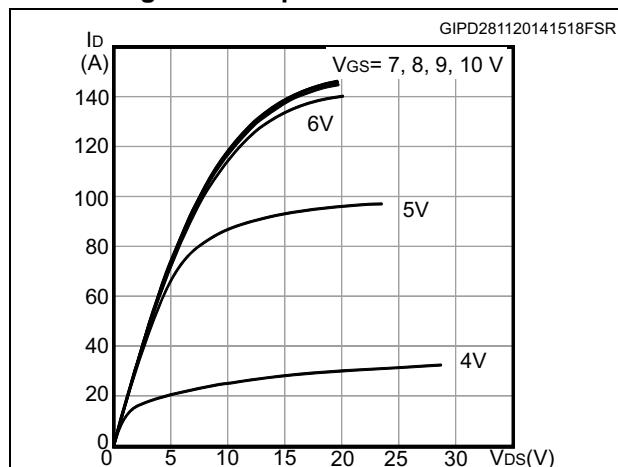


Figure 5. Transfer characteristics

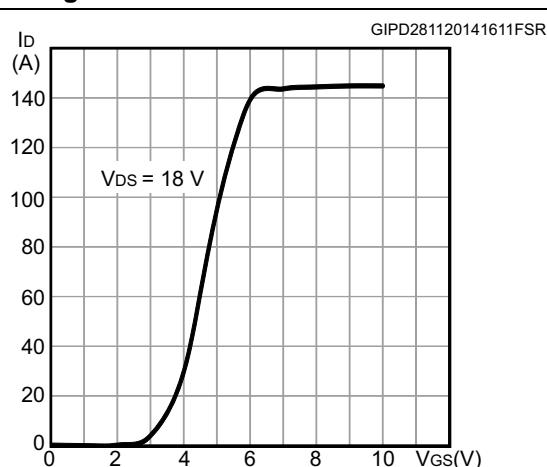


Figure 6. Normalized gate threshold voltage vs. temperature

Figure 7. Normalized $V_{(BR)DSS}$ vs. temperature