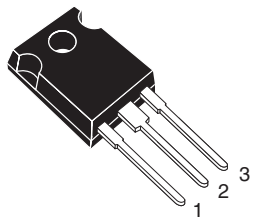
STW54NM65ND

N-channel 650 V, 0.055 Ω, 49 A TO-247
FDmesh™ II Power MOSFET (with fast diode)

Features

Order code	V_{DSS} (@Tjmax)	$R_{DS(on)}$ max.	I_D
STW54NM65ND	710 V	< 0.065 Ω	49 A

- The worldwide best $R_{DS(on)}$ * area amongst the fast recovery diode devices
- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance
- Extremely high dv/dt and avalanche capabilities



TO-247

Application

Switching applications

Description

The device is an N-channel FDmesh™ II Power MOSFET that belongs to the second generation of MDmesh™ technology. This revolutionary Power MOSFET associates a new vertical structure to the company's strip layout and associates all advantages of reduced on-resistance and fast switching with an intrinsic fast-recovery body diode. It is therefore strongly recommended for bridge topologies, in particular ZVS phase-shift converters.

Figure 1. Internal schematic diagram

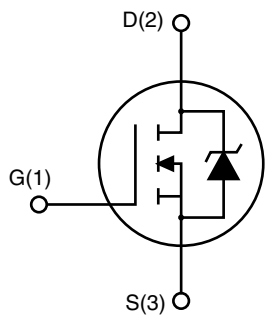


Table 1. Device summary

Order code	Marking	Package	Packaging
STW54NM65ND	54NM65ND	TO-247	Tube

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (V_{GS} = 0)	650	V
V_{GS}	Gate- source voltage	± 25	V
I_D	Drain current (continuous) at T_C = 25 °C	49	A
I_D	Drain current (continuous) at T_C = 100 °C	31	A
I_{DM} (1)	Drain current (pulsed)	196	A
P_{TOT}	Total dissipation at T_C = 25 °C	350	W
dv/dt (2)	Peak diode recovery voltage slope	40	V/ns
T_{stg}	Storage temperature	- 55 to 150	°C
T_j	Max. operating junction temperature	150	°C

1. Pulse width limited by safe operating area
2. $I_{SD} \leq 49$ A, di/dt ≤ 600 A/µs, V_{DD} = 80% $V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	0.36	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max	50	°C/W
T_l	Maximum lead temperature for soldering purpose	300	°C

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	15	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, I_D= I_{AS}, V_{DD} = 50 V)	850	mJ

2 Electrical characteristics

(T_{CASE} = 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} = Max rating V_{DS} = Max rating, @125 °C			10 100	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 20 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 = 24.5 A		0.055	0.065	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} = 50 V, f = 1 MHz, V_{GS} = 0	-	6200 218 10	-	pF pF pF
$C_{oss\ eq.}$ (1)	Output equivalent capacitance	V_{DS}=0 to 200 V V_{GS}=0	-	850	-	pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 520 V, I_D = 49 A, V_{GS} = 10 V,	-	188 32 100	-	nC nC nC
t_c t_r $t_{d(off)}$ t_f	Crossing time Rise time Turn-off delay time Fall time	V_{DD} = 520 V, I_D = 49 A, R_G = 4.7 Ω, V_{GS} = 10 V	-	33 59 152 98	-	ns ns ns ns
R_g	Gate input resistance	f=1 MHz gate DC bias=0 Test signal level = 20 mV open drain	-	1.9	-	Ω

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_{DS}.

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)		-		49 196	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 49 A, V_{GS} = 0	-		1.3	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 49 A, di/dt = 100 A/µs V_{DD} = 60 V	-	212 2 19		ns µC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 49 A, di/dt = 100 A/µs V_{DD} = 60 V, T_j = 150 °C	-	296 4 28		ns µC 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

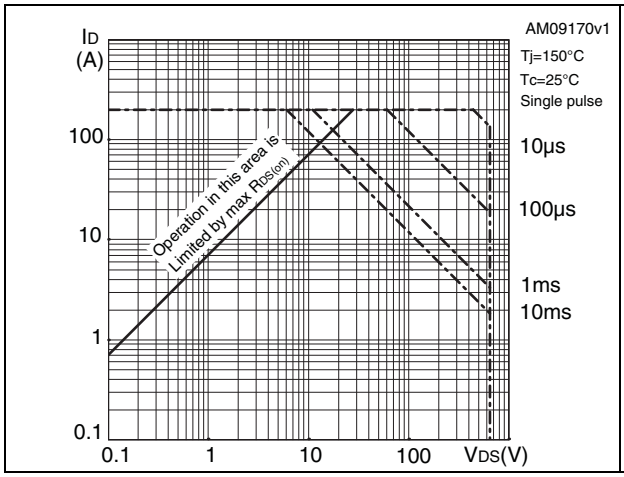


Figure 3. Thermal impedance

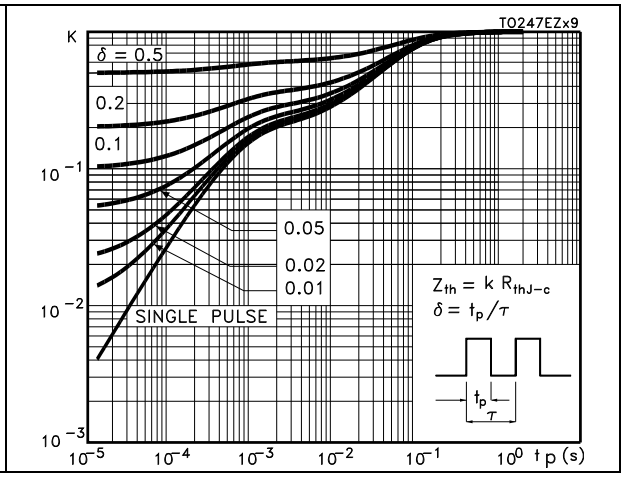


Figure 4. Output characteristics

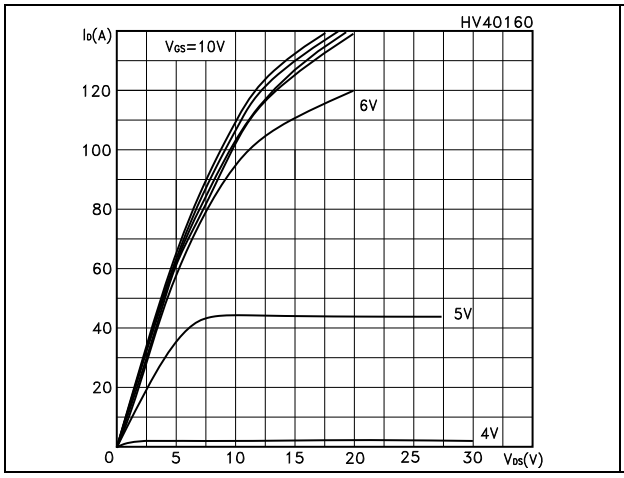


Figure 5. Transfer characteristics

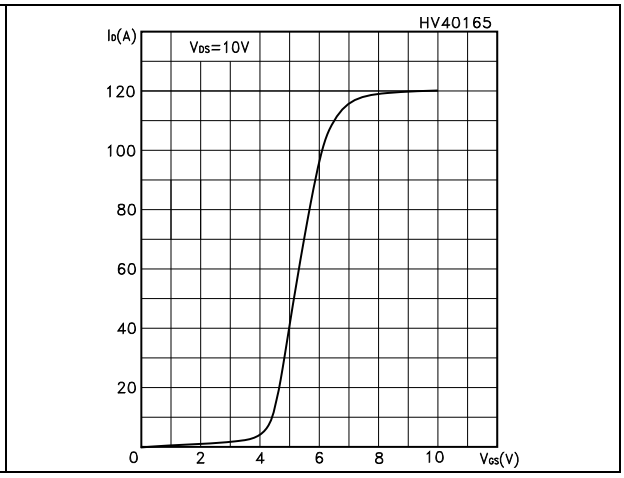


Figure 6. Normalized B_{VDSS} vs temperature

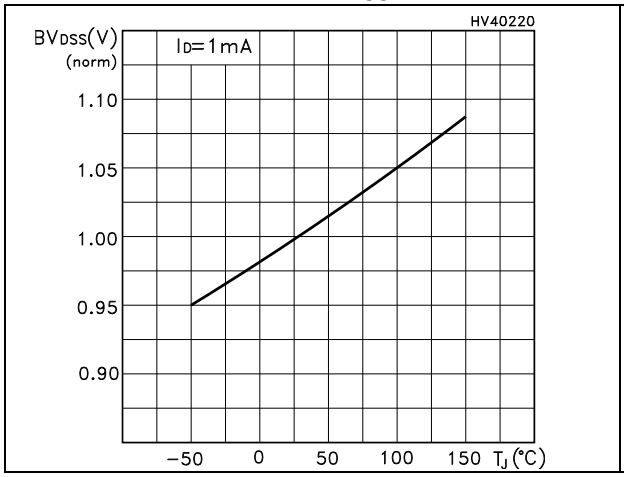


Figure 7. Static drain-source on resistance