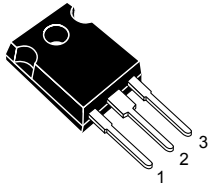
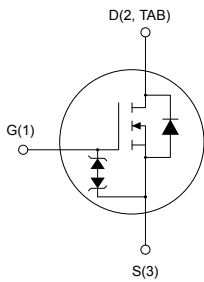


N-channel 900 V, 670 mΩ typ., 11 A SuperMESH Power MOSFET in a TO-247 package



TO-247



AM15572V1_TAB



Product status link

[STW12NK90Z](#)

Product summary

Order code	STW12NK90Z
Marking	W12NK90Z
Package	TO-247
Packing	Tube

Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STW12NK90Z	900 V	880 mΩ	11 A

- 100% avalanche tested
- Extremely high dv/dt capability
- Gate charge minimized
- Zener-protected

Applications

- Switching applications

Description

This high-voltage device is a Zener-protected N-channel Power MOSFET developed using the SuperMESH technology by STMicroelectronics, an optimization of the well-established PowerMESH. In addition to a significant reduction in on-resistance, this device is designed to ensure a high level of dv/dt capability for the most demanding applications.

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	900	V
V_{GS}	Gate-source voltage	±30	V
I_D	Drain current (continuous) at $T_C = 25\text{ °C}$	11	A
	Drain current (continuous) at $T_C = 100\text{ °C}$	7	
$I_{DM}^{(1)}$	Drain current (pulsed)	44	A
P_{TOT}	Total power dissipation at $T_C = 25\text{ °C}$	230	W
ESD	Gate-source human body model ($R = 1.5\text{ k}\Omega$, $C = 100\text{ pF}$)	6	kV
$dv/dt^{(2)}$	Peak diode recovery voltage slope	4.5	V/ns
T_{stg}	Storage temperature range	-55 to 150	°C
T_J	Operating junction temperature range		

1. Pulse width is limited by safe operating area.
2. $I_{SD} \leq 11\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DS}(\text{peak}) < V_{(BR)DSS}$.

Table 2. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance, junction-to-case	0.54	°C/W
R_{thJA}	Thermal resistance, junction-to-ambient	50	°C/W

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_J max.)	11	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	500	mJ

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0\text{ V}$	900	-	-	V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0\text{ V}$, $V_{DS} = 900\text{ V}$	-	-	1	μA
		$V_{GS} = 0\text{ V}$, $V_{DS} = 900\text{ V}$, $T_C = 125\text{ °C}^{(1)}$	-	-	50	
I_{GSS}	Gate body leakage current	$V_{GS} = \pm 20\text{ V}$, $V_{DS} = 0\text{ V}$	-	-	± 10	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 100\text{ }\mu\text{A}$	3	3.75	4.5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 5.5\text{ A}$	-	670	880	m Ω

1. Specified by design, not tested in production.

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0\text{ V}$	-	3500	-	pF
C_{oss}	Output capacitance		-	280	-	pF
C_{rss}	Reverse transfer capacitance		-	58	-	pF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{GS} = 0\text{ V}$, $V_{DS} = 0\text{ to }800\text{ V}$	-	117	-	pF
Q_g	Total gate charge	$V_{DD} = 720\text{ V}$, $I_D = 10\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$ (see the Figure 13. Test circuit for gate charge behavior)	-	113	152 ⁽²⁾	nC
Q_{gs}	Gate-source charge		-	19	-	nC
Q_{gd}	Gate-drain charge		-	60	-	nC

1. $C_{oss\text{ eq.}}$ 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} .

2. Specified by design, not tested in production.

Table 6. Switching times

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 450\text{ V}$, $I_D = 5\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$	-	31	-	ns
t_r	Rise time		-	20	-	ns
$t_{d(off)}$	Turn-off delay time	(see the Figure 12. Test circuit for resistive load switching times and Figure 17. Switching time waveform)	-	88	-	ns
t_f	Fall time		-	55	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-	-	11	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-	-	44	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 11\text{ A}$, $V_{GS} = 0\text{ V}$	-	-	1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 10\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 50\text{ V}$	-	728	-	ns
Q_{rr}	Reverse recovery charge		-	7.8	-	μC
I_{RRM}	Reverse recovery current	(see the Figure 14. Test circuit for inductive load switching and diode recovery times)	-	21.6	-	A
t_{rr}	Reverse recovery time	$I_{SD} = 10\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 50\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$	-	964	-	ns
Q_{rr}	Reverse recovery charge		-	11	-	μC
I_{RRM}	Reverse recovery current		(see the Figure 14. Test circuit for inductive load switching and diode recovery times)	-	23	-

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

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

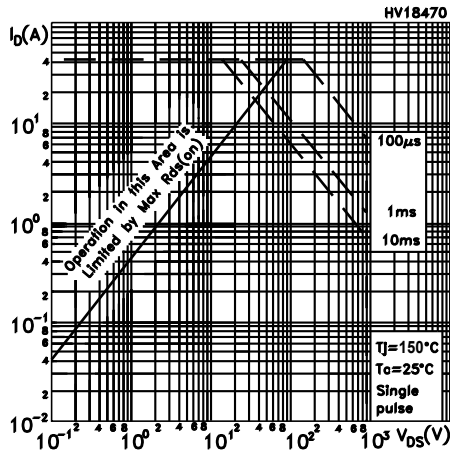


Figure 2. Normalized transient thermal impedance

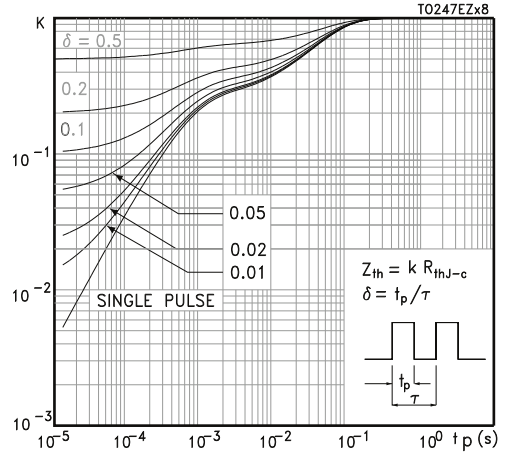


Figure 3. Typical output characteristics

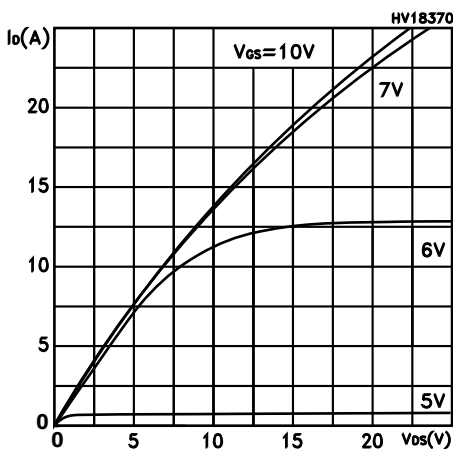


Figure 4. Typical transfer characteristics

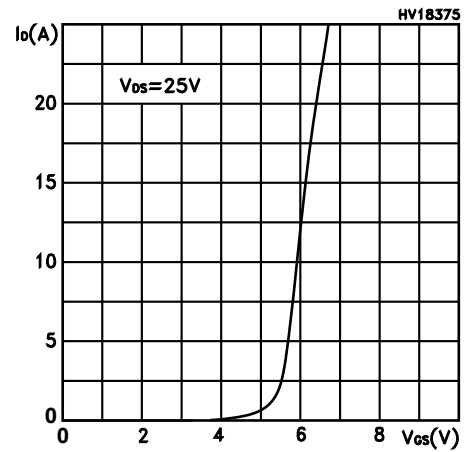


Figure 5. Typical gate charge characteristics

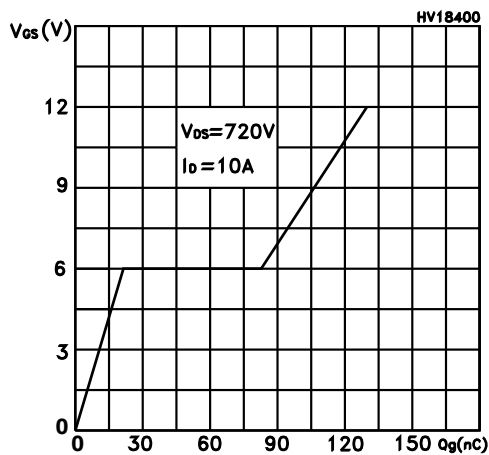


Figure 6. Typical drain-source on-resistance

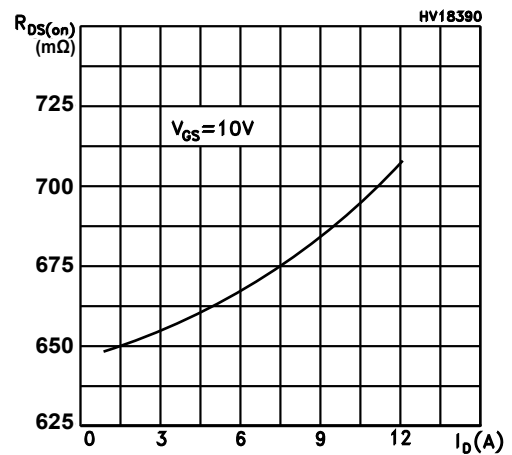


Figure 7. Typical capacitance characteristics

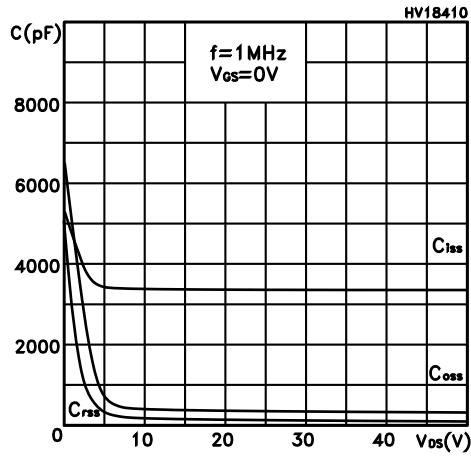


Figure 8. Normalized gate threshold vs temperature

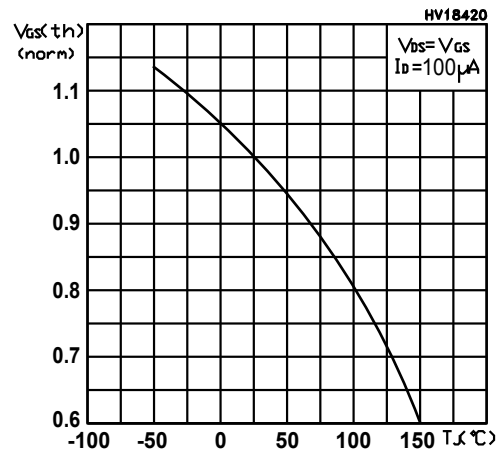


Figure 9. Normalized on-resistance vs temperature

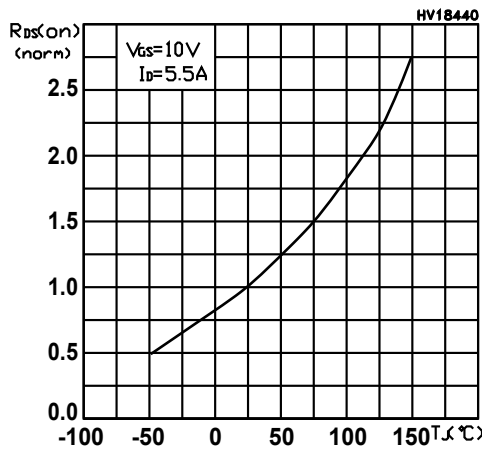


Figure 10. Normalized breakdown voltage vs temperature

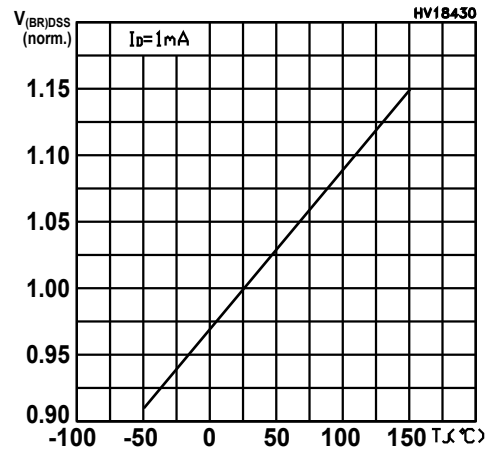
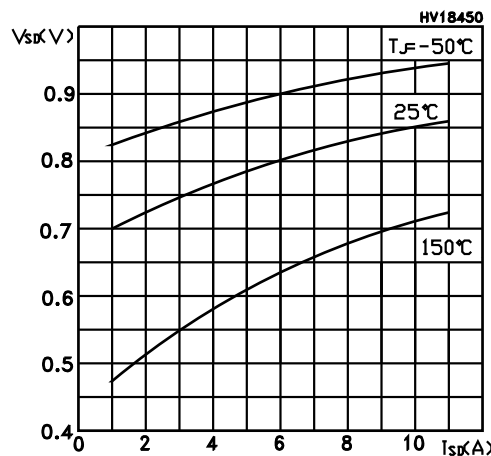
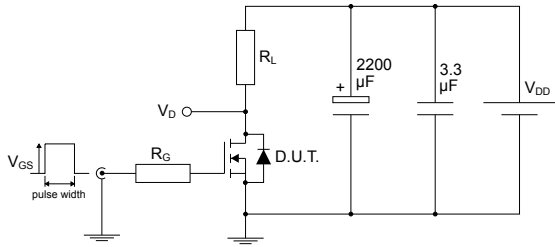


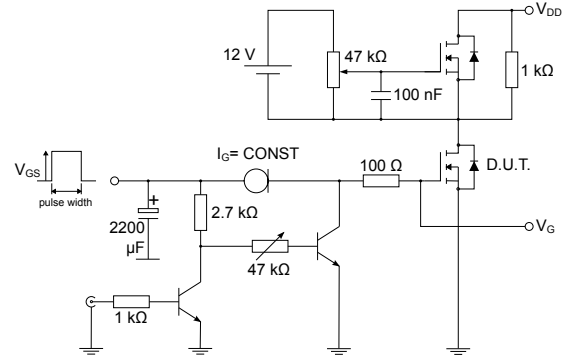
Figure 11. Typical reverse diode forward characteristics



3 Test circuits

Figure 12. Test circuit for resistive load switching times


AM01468v1

Figure 13. Test circuit for gate charge behavior


AM01469v1

Figure 14. Test circuit for inductive load switching and diode recovery times


AM01470v1

Figure 15. Unclamped inductive load test circuit


AM01471v1

Figure 16. Unclamped inductive waveform


AM01472v1

Figure 17. Switching time waveform

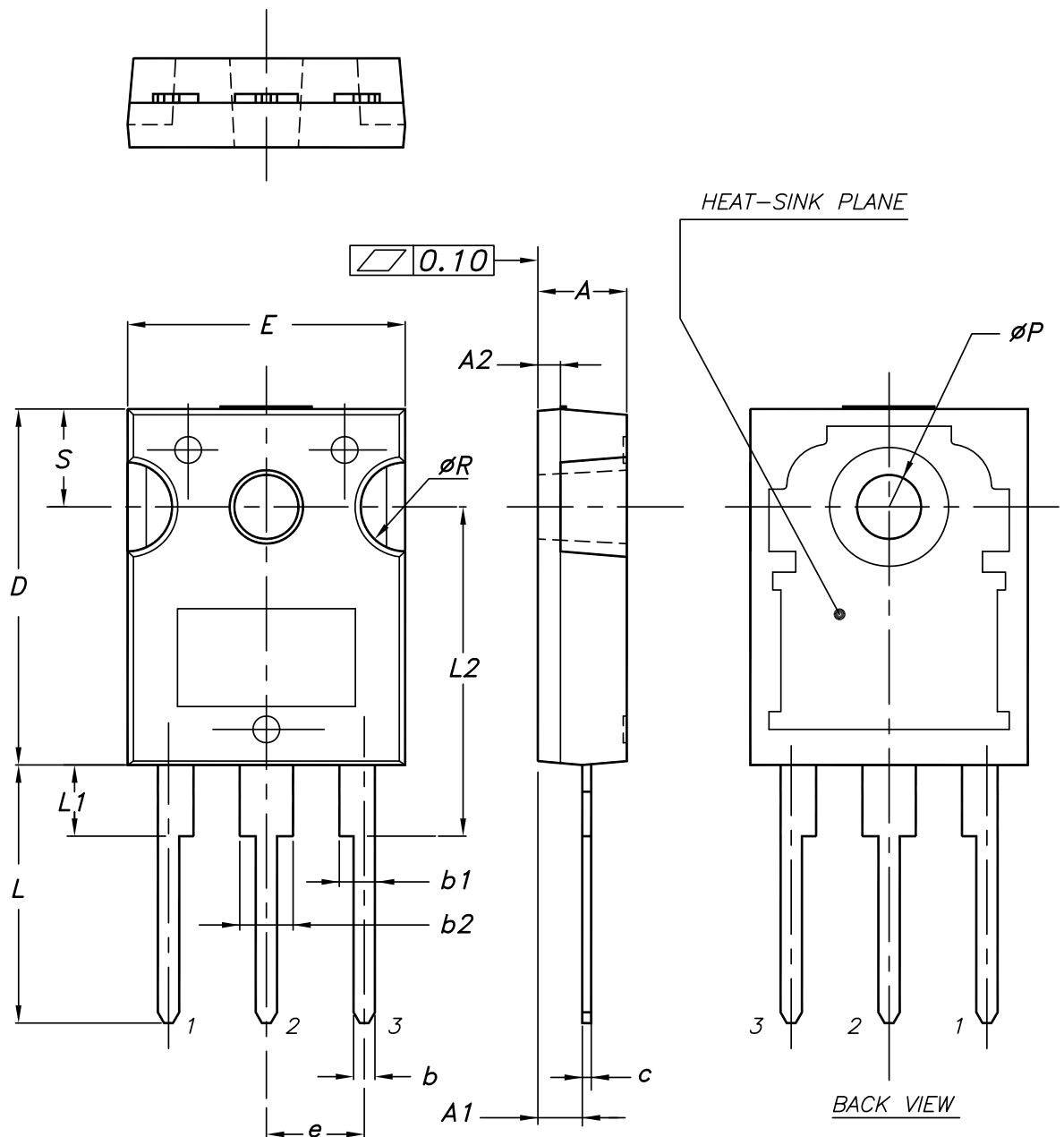

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4 Package information

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.

4.1 TO-247 package information

Figure 18. TO-247 package outline



0075325_11

Table 8. TO-247 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
A2		1.27	
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

Revision history

Table 9. Document revision history

Date	Revision	Changes
21-Jun-2004	4	Complete version.
17-Oct-2006	5	New template, no content change.
29-Apr-2011	6	<i>Table 2: Absolute maximum ratings</i> has been updated.
20-Jan-2026	7	Updated Section 4: Package information . Minor text changes.

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