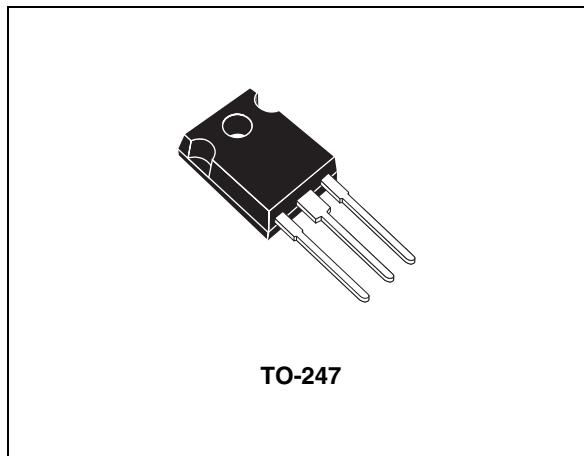


N-channel 800V - 0.53Ω - 12A - TO-247
 Zener-protected SuperMESH™ Power MOSFET

General features

Type	V_{DSS}	$R_{DS(on)}$	I_D	P_W
STW13NK80Z	800V	<0.65Ω	12A	230W

- Extremely high dv/dt capability
- 100% avalanche tested
- Gate charge minimized
- Very low intrinsic capacitances
- Very good manufacturing repeatability



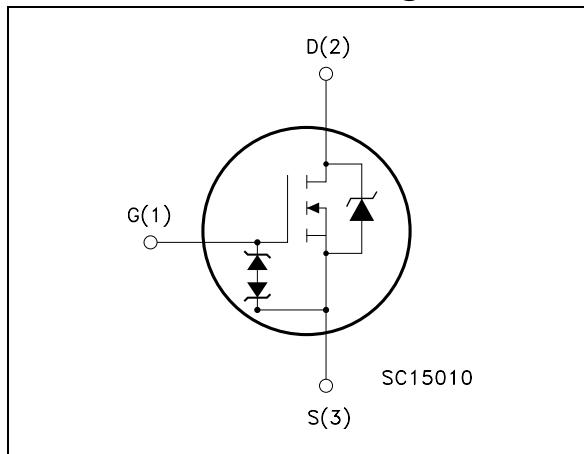
Description

The SuperMESH™ series is obtained through an extreme optimization of ST's well established strip-based PowerMESH™ layout. In addition to pushing on-resistance significantly down, special care is taken to ensure a very good dv/dt capability for the most demanding applications. Such series complements ST full range of high voltage MOSFETs including revolutionary MDmesh™ products.

Applications

- Switching application

Internal schematic diagram



Order codes

Part number	Marking	Package	Packaging
STW13NK80Z	W13NK80Z	TO-247	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	800	V
V_{GS}	Gate- source voltage	± 30	V
I_D	Drain current (continuous) at $T_C = 25^\circ\text{C}$	12	A
I_D	Drain current (continuous) at $T_C = 100^\circ\text{C}$	7.6	A
$I_{DM}^{(1)}$	Drain current (pulsed)	48	A
P_{tot}	Total dissipation at $T_C = 25^\circ\text{C}$	230	W
	Derating Factor	1.85	W/ $^\circ\text{C}$
$E_{AS}^{(2)}$	Single pulse avalanche energy	4.5	mJ
T_{stg}	Storage temperature	-55 to 150	$^\circ\text{C}$
T_j	Max. operating junction temperature		

1. Pulse width limited by safe operating area.
 2. $I_{SD} \leq 2\text{A}$, $dI/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(\text{BR})DSS}$, $T_j \leq T_{JMAX}$.

Table 2. Thermal data

Rthj-case	Thermal resistance junction-case max	0.54	$^\circ\text{C/W}$
Rthj-amb	Thermal resistance junction-ambient max	50	$^\circ\text{C/W}$
T_J	Maximum lead temperature for soldering purpose	300	$^\circ\text{C}$

Table 3. Avalanche characteristics

Symbol	Parameter	Max value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	12	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	450	mJ

Table 4. Gate-source zener diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
BV_{GSO}	Gate-source breakdown voltage	$I_{GS} = \pm 1\text{mA}$ (open drain)	30			V

2 Electrical characteristics

($T_{CASE}=25^\circ\text{C}$ unless otherwise specified)

Table 5. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{mA}$, $V_{GS} = 0$	800			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{max rating}$ $V_{DS} = \text{max rating}$, $T_C = 125^\circ\text{C}$			1 50	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{V}$			± 10	μA
$V_{GS(\text{th})}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 100\mu\text{A}$	3	3.75	4.5	V
$R_{DS(\text{on})}$	Static drain-source on resistance	$V_{GS} = 10\text{V}$, $I_D = 6\text{A}$		0.53	0.65	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15\text{V}$, $I_D = 6\text{A}$		11		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25\text{V}$, $f = 1\text{MHz}$, $V_{GS} = 0$		3480 312 67		pF pF pF
$C_{oss\ eq}^{(2)}$	Equivalent output capacitance	$V_{GS} = 0\text{V}$, V_{DS} from 0 to 720V		150		pF
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	$V_{DD} = 400\text{V}$, $I_D = 6\text{A}$ $R_G = 4.7\Omega$, $V_{GS} = 10\text{V}$		33 22 95 55		ns ns ns ns
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 640\text{V}$, $I_D = 12\text{A}$, $V_{GS} = 10\text{V}$, $R_G = 4.7\Omega$		115 31 51	155	nC nC nC

1. Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %.

2. $C_{oss\ eq}$ 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. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM}^{(1)}$	Source-drain current Source-drain current (pulsed)				12 48	A A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 12A, V_{GS} = 0$			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 12A, dI/dt = 100A/\mu s,$ $V_{DD} = 100V, T_j = 25^\circ C$		632 7.2 26		ns μC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 12A, dI/dt = 100A/\mu s,$ $V_{DD} = 100V, T_j = 150^\circ C$		805 10 25		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 1. Safe operating area

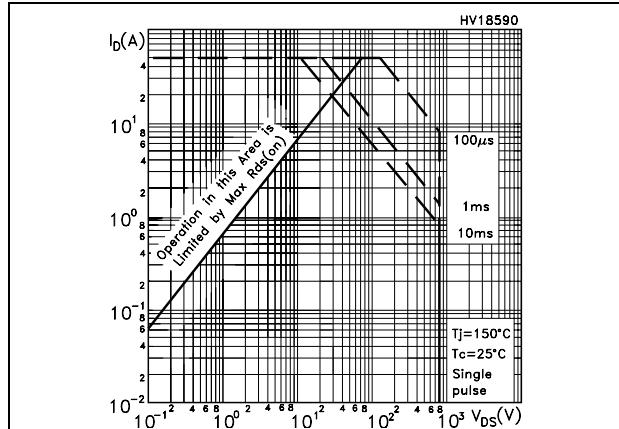


Figure 2. Thermal impedance

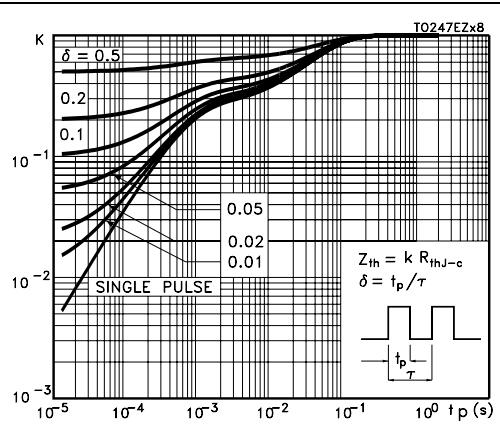


Figure 3. Output characteristics

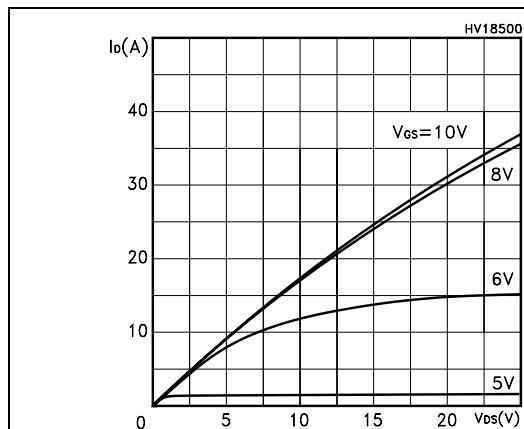


Figure 4. Transfer characteristics

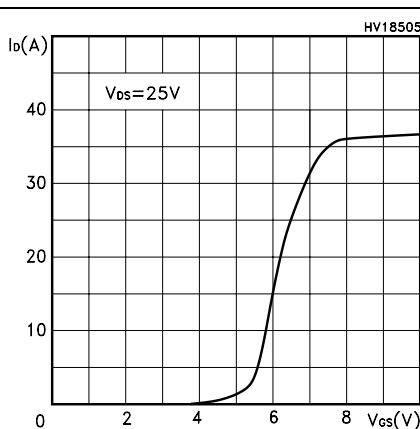


Figure 5. Transconductance

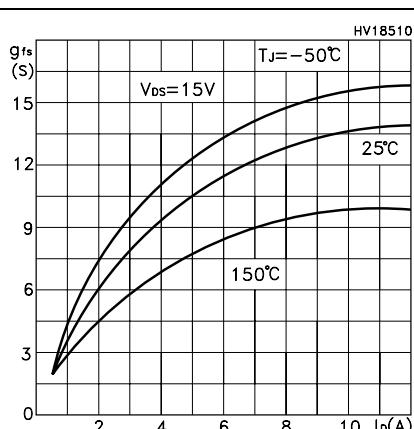


Figure 6. Static drain-source on resistance

