

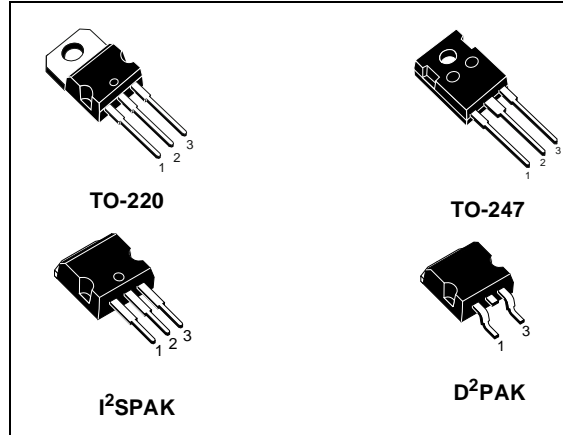


STP20NK50Z - STW20NK50Z STB20NK50Z - STB20NK50Z-S

N-CHANNEL 500V -0.23Ω- 17A TO-220/D²PAK/I²SPAK/TO-247
Zener-Protected SuperMESH™ MOSFET

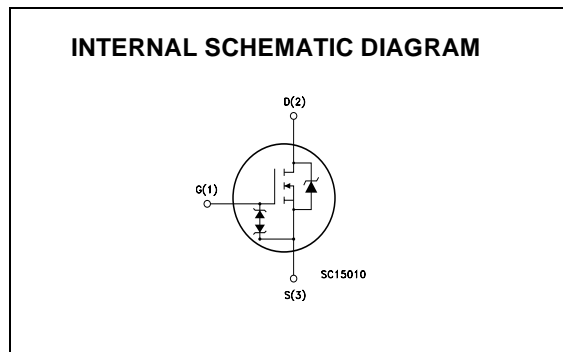
TYPE	V _{DSS}	R _{DS(on)}	I _D	P _w
STB20NK50Z	500 V	< 0.27 Ω	17 A	190 W
STB20NK50Z-S	500 V	< 0.27 Ω	17 A	190 W
STP20NK50Z	500 V	< 0.27 Ω	17 A	190 W
STW20NK50Z	500 V	< 0.27 Ω	17 A	190 W

- TYPICAL R_{DS(on)} = 0.23 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED GATE CHARGE MINIMIZED
- VERY LOW INTRINSIC CAPACITANCES
- VERY GOOD MANUFACTURING REPEATIBILITY



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

- HIGH CURRENT, HIGH SPEED SWITCHING
- IDEAL FOR OFF-LINE POWER SUPPLIES, ADAPTORS AND PFC

ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STB20NK50ZT4	B20NK50Z	D ² PAK	TAPE & REEL
STB20NK50Z-S	B20NK50Z	I ² SPAK	TUBE
STP20NK50Z	P20NK50Z	TO-220	TUBE
STW20NK50Z	W20NK50Z	TO-247	TUBE

STP20NK50Z - STB20NK50Z - STW20NK50Z - STB20NK50Z-S

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source Voltage ($V_{GS} = 0$)	500	V
V_{DGR}	Drain-gate Voltage ($R_{GS} = 20 \text{ k}\Omega$)	500	V
V_{GS}	Gate- source Voltage	± 30	V
I_D	Drain Current (continuous) at $T_C = 25^\circ\text{C}$	17	A
I_D	Drain Current (continuous) at $T_C = 100^\circ\text{C}$	10.71	A
$I_{DM}(\bullet)$	Drain Current (pulsed)	68	A
P_{TOT}	Total Dissipation at $T_C = 25^\circ\text{C}$	190	W
	Derating Factor	1.51	W/ $^\circ\text{C}$
$V_{ESD(G-S)}$	Gate source ESD(HBM-C=100 pF, R=1.5 K Ω)	6000	V
dv/dt (1)	Peak Diode Recovery voltage slope	4.5	V/ns
T_j T_{stg}	Operating Junction Temperature Storage Temperature	-55 to 150	$^\circ\text{C}$

(\bullet) Pulse width limited by safe operating area

(1) $I_{SD} \leq 17\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_j \leq T_{JMAX}$.

(*) Limited only by maximum temperature allowed

THERMAL DATA

		TO-220/D2PAK	TO-247	
Rthj-case	Thermal Resistance Junction-case Max	0.66		$^\circ\text{C}/\text{W}$
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	50	$^\circ\text{C}/\text{W}$
T_j	Maximum Lead Temperature For Soldering Purpose	300		$^\circ\text{C}$

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max)	17	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50 \text{ V}$)	850	mJ

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

PROTECTION FEATURES OF GATE-TO-SOURCE ZENER DIODES

The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.

STP20NK50Z - STB20NK50Z - STW20NK50Z - STB20NK50Z-S

ELECTRICAL CHARACTERISTICS ($T_{CASE} = 25^{\circ}C$ UNLESS OTHERWISE SPECIFIED)
ON/OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1 \text{ mA}, V_{GS} = 0$	500			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}, T_C = 125^{\circ}C$			1 50	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20 \text{ V}$			± 10	μA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 100 \mu A$	3	3.75	4.5	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V, I_D = 8.5 \text{ A}$		0.23	0.27	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (1)$	Forward Transconductance	$V_{DS} = 15 \text{ V}, I_D = 8.5 \text{ A}$		13		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25V, f = 1 \text{ MHz}, V_{GS} = 0$		2600 328 72		pF pF pF
$C_{oss \text{ eq.}} (3)$	Equivalent Output Capacitance	$V_{GS} = 0V, V_{DS} = 0V \text{ to } 640V$		187		pF

SWITCHING ON/OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on Delay Time Rise Time Turn-off Delay Time Fall Time	$V_{DD} = 250 \text{ V}, I_D = 8.5 \text{ A}$ $R_G = 4.7\Omega, V_{GS} = 10 \text{ V}$ (Resistive Load see, Figure 3)		28 20 70 15		ns ns ns ns
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400 \text{ V}, I_D = 17 \text{ A},$ $V_{GS} = 10 \text{ V}$		85 15.5 42	119	nC nC nC

SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} $I_{SDM} (2)$	Source-drain Current Source-drain Current (pulsed)				17 68	A A
$V_{SD} (1)$	Forward On Voltage	$I_{SD} = 17 \text{ A}, V_{GS} = 0$			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 17 \text{ A}, di/dt = 100 \text{ A}/\mu s$ $V_R = 100 \text{ V}, T_j = 25^{\circ}C$ (see test circuit, Figure 5)		355 3.90 22		ns μC A
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 17 \text{ A}, di/dt = 100 \text{ A}/\mu s$ $V_R = 100 \text{ V}, T_j = 150^{\circ}C$ (see test circuit, Figure 5)		440 5.72 26		ns μC A

- Note: 1. Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %.
2. Pulse width limited by safe operating area.
3. $C_{oss \text{ eq.}}$ 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} .

TO-247 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.85		5.15	0.19		0.20
D	2.20		2.60	0.08		0.10
E	0.40		0.80	0.015		0.03
F	1		1.40	0.04		0.05
F1		3			0.11	
F2		2			0.07	
F3	2		2.40	0.07		0.09
F4	3		3.40	0.11		0.13
G		10.90			0.43	
H	15.45		15.75	0.60		0.62
L	19.85		20.15	0.78		0.79
L1	3.70		4.30	0.14		0.17
L2		18.50			0.72	
L3	14.20		14.80	0.56		0.58
L4		34.60			1.36	
L5		5.50			0.21	
M	2		3	0.07		0.11
V		5°			5°	
V2		60°			60°	
Dia	3.55		3.65	0.14		0.143

