



STN3N45K3 STQ3N45K3-AP, STU3N45K3

N-channel 450 V, 3.2 Ω , 1.8 A, TO-92, SOT-223, IPAK
SuperMESH3™ Power MOSFET

Preliminary data

Features

Type	V _{DSS}	R _{DS(on) max}	I _D	P _w
STN3N45K3	450 V	< 3.8 Ω	0.6 A	2 W
STQ3N45K3-AP	450 V	< 3.8 Ω	0.6 A	2.5 W
STU3N45K3	450 V	< 3.8 Ω	1.8 A	27 W

- 100% avalanche tested
- Extremely high dv/dt capability
- Gate charge minimized
- Very low intrinsic capacitance
- Improved diode reverse recovery characteristics
- Zener-protected

Application

- Switching applications

Description

The new SuperMESH3™ series is obtained through the combination of a further fine tuning of ST's well established strip-based PowerMESH™ layout with a new optimization of the vertical structure. In addition to reducing on-resistance significantly versus previous generation, special attention has been taken to ensure a very good dv/dt capability and higher margin in breakdown voltage for the most demanding application.

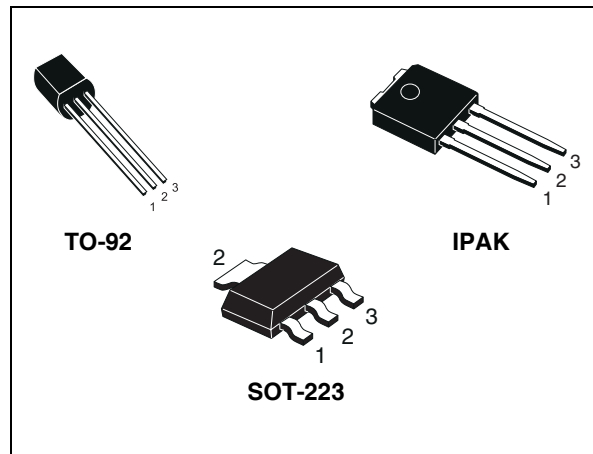


Figure 1. Internal schematic diagram

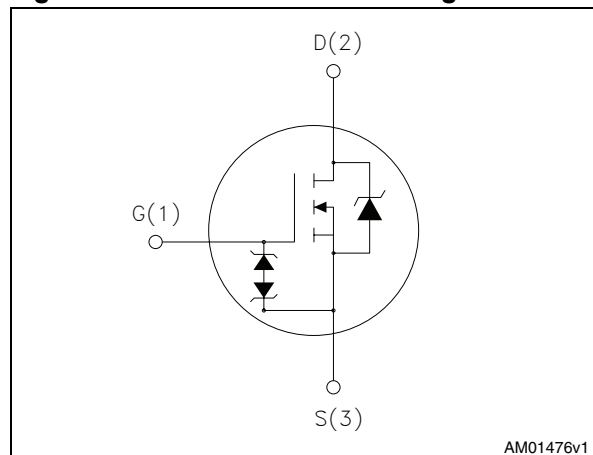


Table 1. Device summary

Order codes	Marking	Package	Packaging
STN3N45K3	3N45K3	SOT-223	Tube
STQ3N45K3-AP	3N45K3	TO-92	Ammopak
STU3N45K3	3N45K3	IPAK	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value			Unit
		SOT-223	TO-92	IPAK	
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	450			V
V_{GS}	Gate- source voltage	± 30			V
I_D	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	0.6		1.8	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	0.38		1	A
$I_{DM}^{(1)}$	Drain current (pulsed)	2.4		7.2	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	2	2.5	27	W
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.

Table 3. Thermal data

Symbol	Parameter	SOT-223	TO-92	IPAK	Unit
$R_{thj-case}$	Thermal resistance junction-case max	62.50	50	4.63	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max			100	$^\circ\text{C}/\text{W}$
T_l	Maximum lead temperature for soldering purpose	300			$^\circ\text{C}$

Table 4. Avalanche characteristics

Symbol	Parameter	Max value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	0.5	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{V}$)	TBD	mJ

2 Electrical characteristics

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

Table 5. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0$	450			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating}$, $T_C = 125\text{ °C}$			1 50	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 10	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 50\text{ }\mu\text{A}$	3	3.75	4.5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 0.5\text{ A}$		3.2	3.8	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	150	-	pF
C_{oss}	Output capacitance			30		pF
C_{rss}	Reverse transfer capacitance			6		pF
R_G	Intrinsic gate resistance			$f = 1\text{ MHz}$ open drain		-
Q_g	Total gate charge	$V_{DD} = 360\text{ V}$, $I_D = 1.8\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 3)	-	6	-	nC
Q_{gs}	Gate-source charge			TBD		nC
Q_{gd}	Gate-drain charge			TBD		nC

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 225\text{ V}$, $I_D = 0.5\text{ A}$, $R_G = 4.7\text{ }\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 2)	-	TBD	-	ns
t_r	Rise time			TBD		ns
$t_{d(off)}$	Turn-off-delay time			TBD		ns
t_f	Fall time			TBD		ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		1.8	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		7.2	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 1.8 \text{ A}, V_{GS} = 0$	-		TBD	V
t_{rr}	Reverse recovery time	$I_{SD} = 1.8 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 100 \text{ V}$ (see Figure 7)	-	TBD		ns
Q_{rr}	Reverse recovery charge			TBD		nC
I_{RRM}	Reverse recovery current			TBD		A
t_{rr}	Reverse recovery time	$I_{SD} = 1.8 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 100 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$ (see Figure 7)	-	TBD		ns
Q_{rr}	Reverse recovery charge			TBD		nC
I_{RRM}	Reverse recovery current			TBD		A

1. Pulse width limited by safe operating area.

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

Table 9. 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

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.

3 Test circuits

Figure 2. Switching times test circuit for resistive load

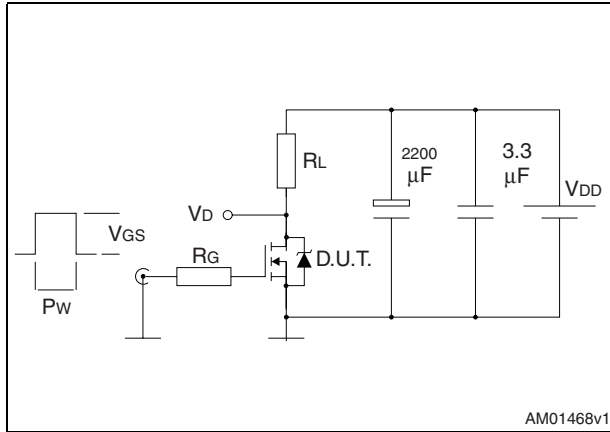


Figure 3. Gate charge test circuit

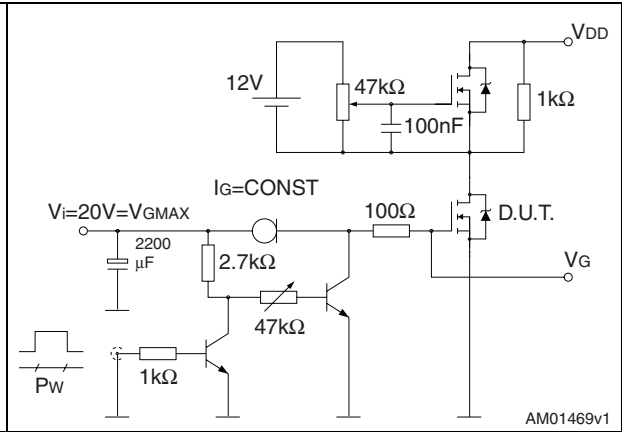


Figure 4. Test circuit for inductive load switching and diode recovery times

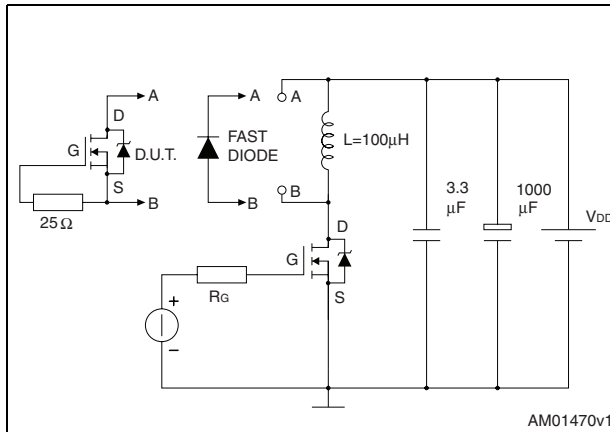


Figure 5. Unclamped Inductive load test circuit

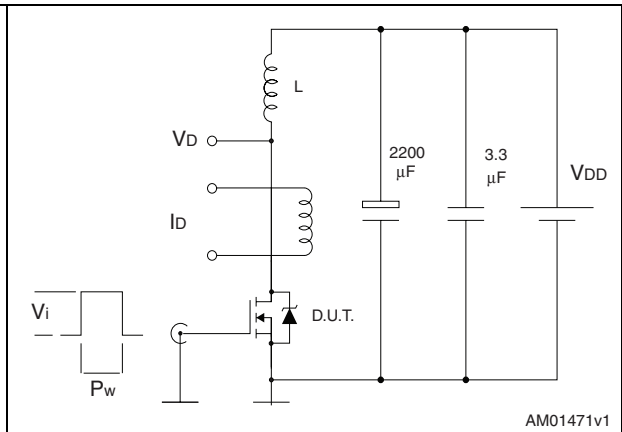


Figure 6. Unclamped inductive waveform

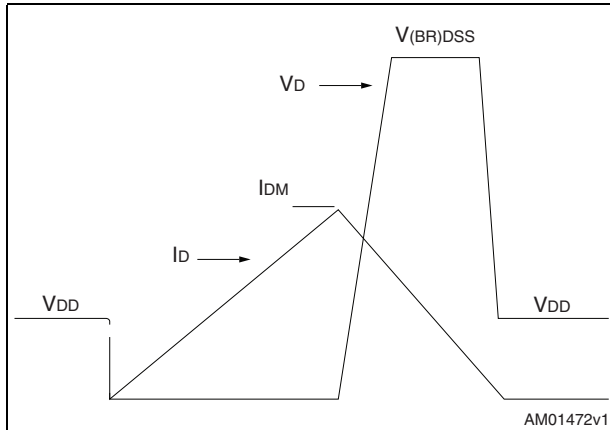
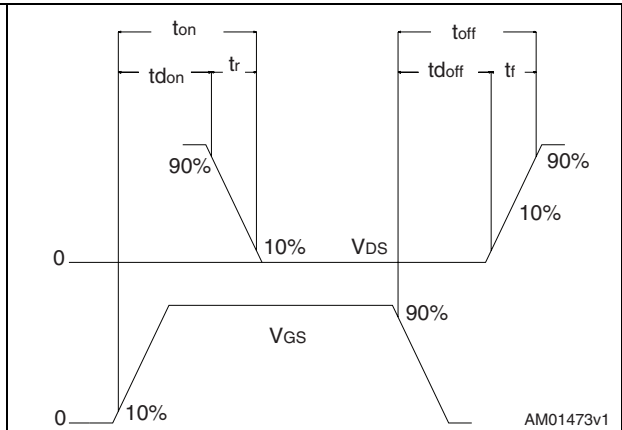


Figure 7. Switching time waveform



4 Package mechanical data

In order 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.

SOT-223 mechanical data

DIM.	mm.		
	min.	typ	max.
A			1.80
A1	0.02		0.1
B	0.60	0.70	0.85
B1	2.90	3.00	3.15
c	0.24	0.26	0.35
D	6.30	6.50	6.70
e		2.30	
e1		4.60	
E	3.30	3.50	3.70
H	6.70	7.00	7.30
V			10 °

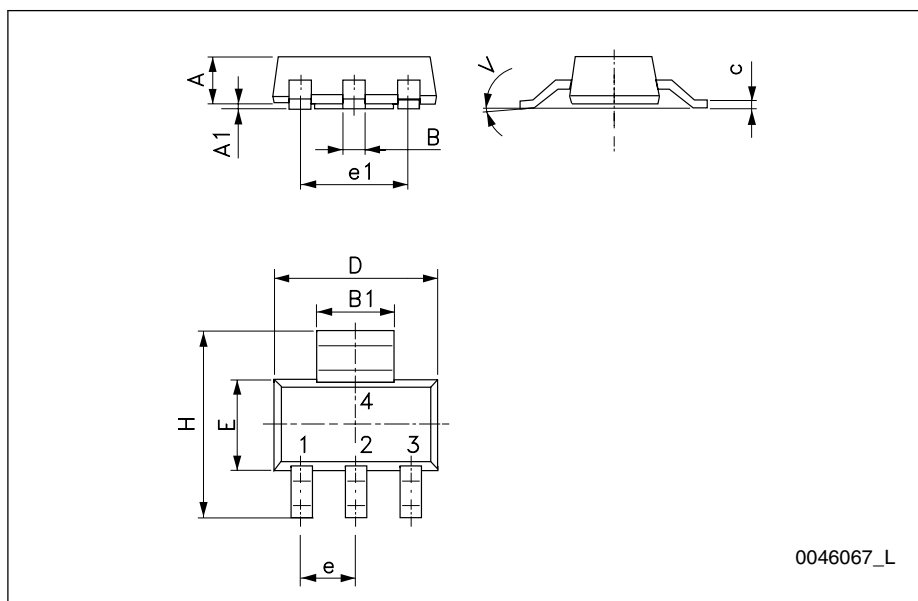
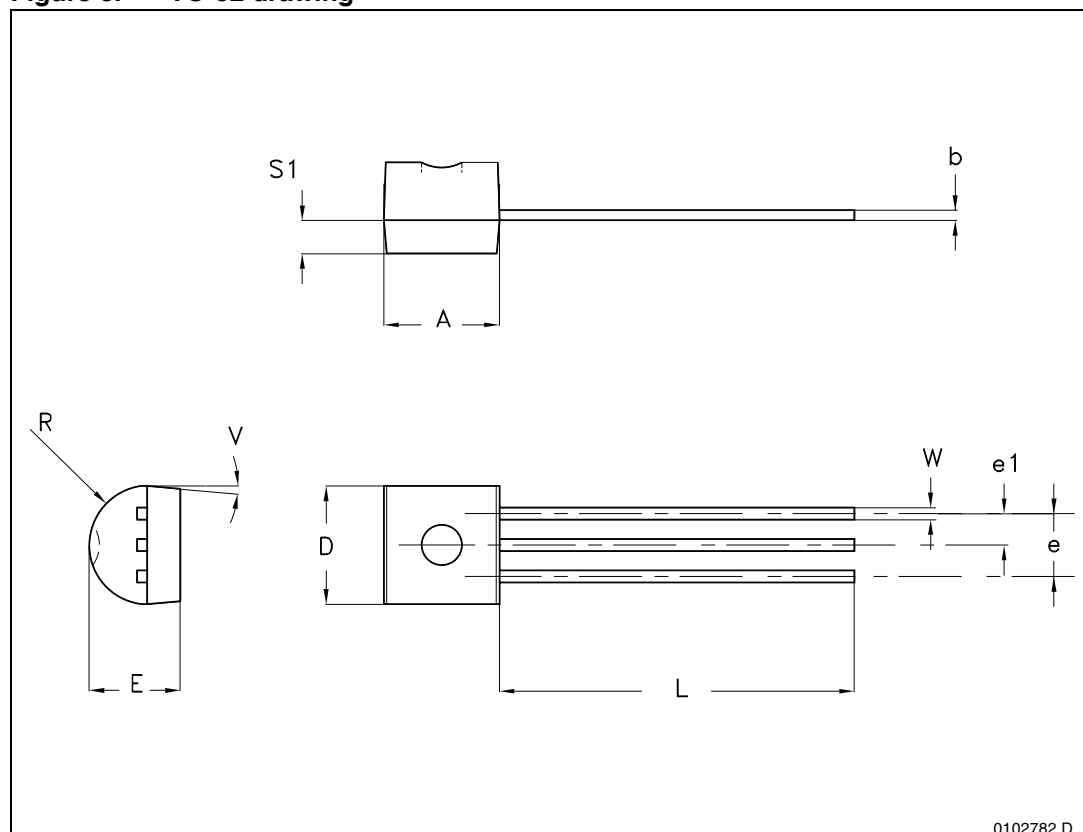


Table 10. TO-92 mechanical data

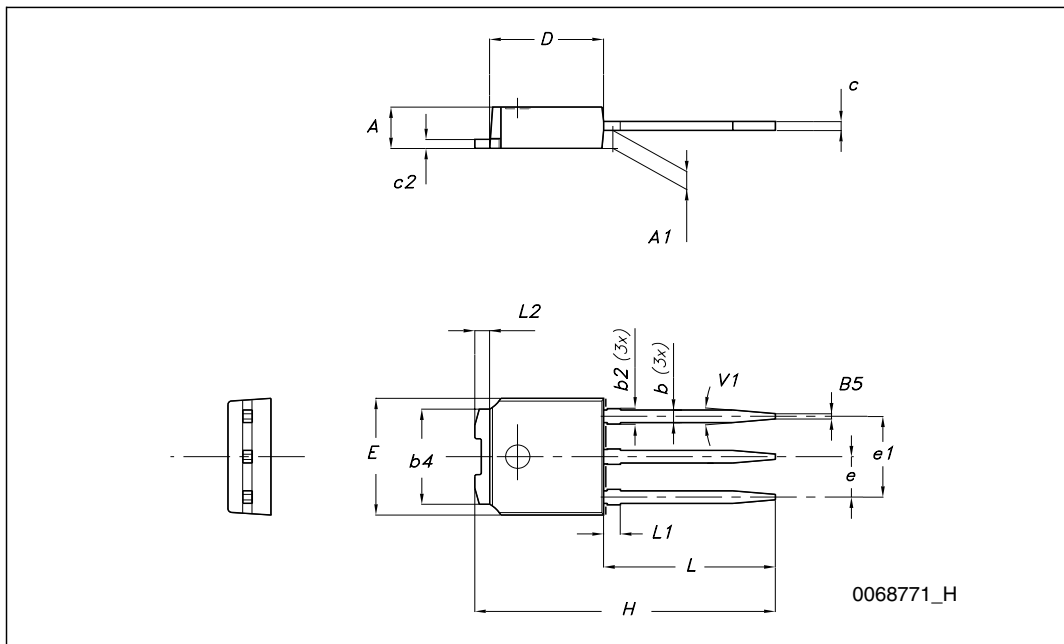
Dim.	mm		
	Min.	Typ.	Max.
A	4.32		4.95
b	0.36		0.51
D	4.45		4.95
E	3.30		3.94
e	2.41		2.67
e1	1.14		1.40
L	12.70		15.49
R	2.16		2.41
S1	0.92		1.52
W	0.41		0.56
V		5°	

Figure 8. TO-92 drawing



TO-251 (IPAK) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
(L1)	0.80		1.20
L2		0.80	
V1		10 °	



5 Revision history

Table 11. Document revision history

Date	Revision	Changes
02-Mar-2010	1	First release
23-Apr-2010	2	Changed root part number

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