



# STB22NM60N, STF22NM60N, STI22NM60N STP22NM60N, STW22NM60N

N-channel 600 V, 0.2 Ω, 16 A MDmesh™ II Power MOSFET  
in D<sup>2</sup>PAK, TO-220FP, I<sup>2</sup>PAK, TO-220 and TO-247

## Features

Order codes	V <sub>DSS</sub> (@T <sub>jmax</sub> )	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STB22NM60N	650 V	< 0.22 Ω	16 A
STF22NM60N	650 V	< 0.22 Ω	16 A
STI22NM60N	650 V	< 0.22 Ω	16 A
STP22NM60N	650 V	< 0.22 Ω	16 A
STW22NM60N	650 V	< 0.22 Ω	16 A

- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

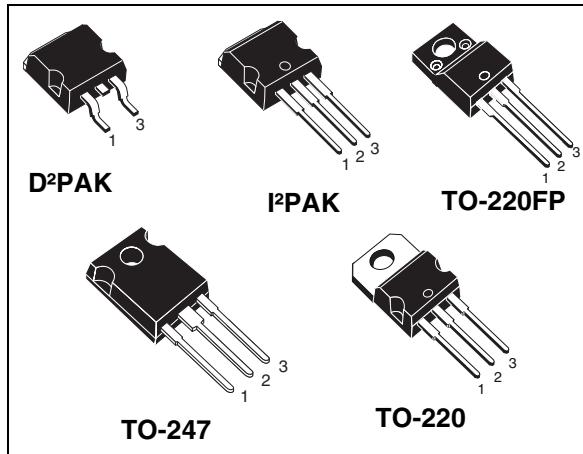
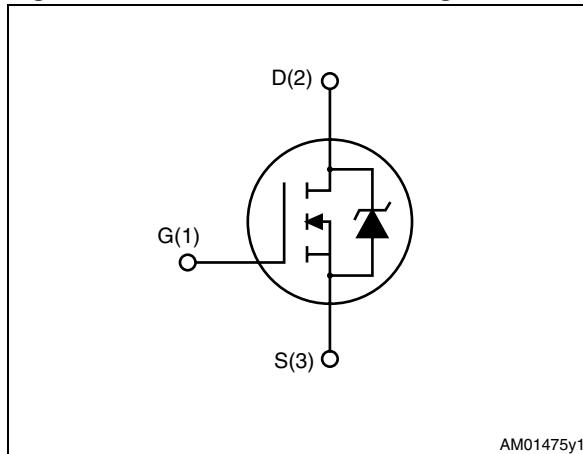


Figure 1. Internal schematic diagram



AM01475y1

Table 1. Device summary

Order codes	Marking	Package	Packaging
STB22NM60N	22NM60N	D <sup>2</sup> PAK	Tape and reel
STF22NM60N		TO-220FP	Tube
STI22NM60N		I <sup>2</sup> PAK	
STP22NM60N		TO-220	
STW22NM60N		TO-247	

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value			Unit
		D <sup>2</sup> PAK I <sup>2</sup> PAK	TO-220 TO-247	TO-220FP	
$V_{GS}$	Gate- source voltage	$\pm 30$			V
$I_D$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	16		16 <sup>(1)</sup>	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	10		10 <sup>(1)</sup>	A
$I_{DM}^{(2)}$	Drain current (pulsed)	64		64 <sup>(1)</sup>	A
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	125		30	W
$dv/dt^{(3)}$	Peak diode recovery voltage slope	15			V/ns
$V_{ISO}$	Insulation withstand voltage (RMS) from all three leads to external heat sink ( $t=1\text{ s}; T_C=25^\circ\text{C}$ )			2500	V
$T_J$ $T_{stg}$	Operating junction temperature Storage temperature	-55 to 150			$^\circ\text{C}$

1. Limited only by maximum temperature allowed
2. Pulse width limited by safe operating area
3.  $I_{SD} \leq 16\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{DSpeak} \leq V_{(BR)DSS}$ ,  $V_{DD} = 80\%$   $V_{(BR)DSS}$

**Table 3. Thermal data**

Symbol	Parameter	Value					Unit
		D <sup>2</sup> PAK	I <sup>2</sup> PAK	TO-220	TO-247	TO-220FP	
$R_{thj-case}$	Thermal resistance junction-case max.	1			4.17		$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max.			62.5	50	62.5	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max.	30					$^\circ\text{C}/\text{W}$
$T_J$	Maximum lead temperature for soldering purpose	300			$^\circ\text{C}/\text{W}$		

1. When mounted on 1inch<sup>2</sup> FR-4 board, 2 oz Cu

**Table 4. Thermal data**

Symbol	Parameter	Value		Unit
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_J$ max)	6		A
$E_{AS}$	Single pulse avalanche energy (starting $T_J = 25^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	300		mJ

## 2 Electrical characteristics

(T<sub>case</sub> = 25 °C unless otherwise specified)

**Table 5. On /off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source breakdown voltage	I <sub>D</sub> = 1 mA, V <sub>GS</sub> = 0	600			V
I <sub>DSS</sub>	Zero gate voltage drain current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max rating V <sub>DS</sub> = Max rating, T <sub>C</sub> =125 °C			1 100	µA µA
I <sub>GSS</sub>	Gate-body leakage current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 25 V			100	nA
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 µA	2	3	4	V
R <sub>DS(on)</sub>	Static drain-source on resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 8 A		0.2	0.22	Ω

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub>	Input capacitance Output capacitance Reverse transfer capacitance	V <sub>DS</sub> = 50 V, f = 1 MHz, V <sub>GS</sub> = 0	-	1330 84 4.6	-	pF pF pF
C <sub>oss eq.</sub> <sup>(1)</sup>	Output equivalent capacitance	V <sub>DS</sub> = 0 to 480 V, V <sub>GS</sub> = 0	-	181	-	pF
R <sub>g</sub>	Gate input resistance	f=1 MHz open drain	-	4.7	-	Ω
Q <sub>g</sub> Q <sub>gs</sub> Q <sub>gd</sub>	Total gate charge Gate-source charge Gate-drain charge	V <sub>DD</sub> = 480 V, I <sub>D</sub> = 16 A, V <sub>GS</sub> = 10 V	-	44 6 25	-	nC nC nC

1. C<sub>oss eq.</sub> is defined as a constant equivalent capacitance giving the same charging time as C<sub>oss</sub> when V<sub>DS</sub> increases from 0 to 80% V<sub>DS</sub>.

**Table 7. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300 \text{ V}$ , $I_D = 8 \text{ A}$ ,		11		ns
$t_{r(v)}$	Voltage rise time	$R_G = 4.7 \Omega$ , $V_{GS} = 10 \text{ V}$	-	18	-	ns
$t_{d(off)}$	Turn-off delay time			74		ns
$t_{f(i)}$	Fall time			38		ns

**Table 8. Source drain diode**

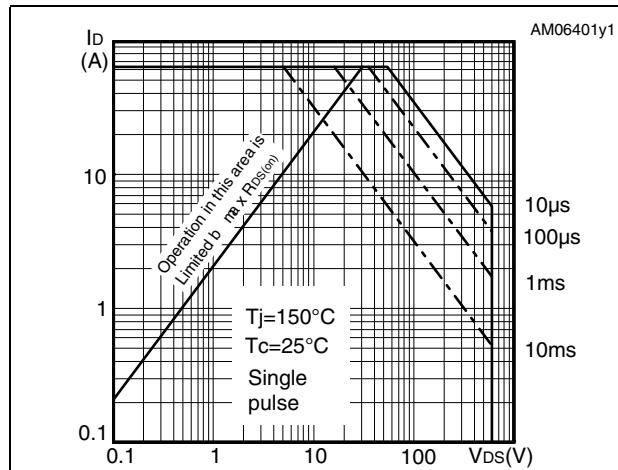
Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$I_{SD}$	Source-drain current		-		16	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				64	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 16 \text{ A}$ , $V_{GS} = 0$	-		1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 16 \text{ A}$ , $dI/dt = 100 \text{ A}/\mu\text{s}$		296		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 60 \text{ V}$	-	4		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current			26.8		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 16 \text{ A}$ , $dI/dt = 100 \text{ A}/\mu\text{s}$		350		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 60 \text{ V}$	-	4.7		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current	$T_J = 150^\circ\text{C}$		27		A

1. Pulse width limited by safe operating area

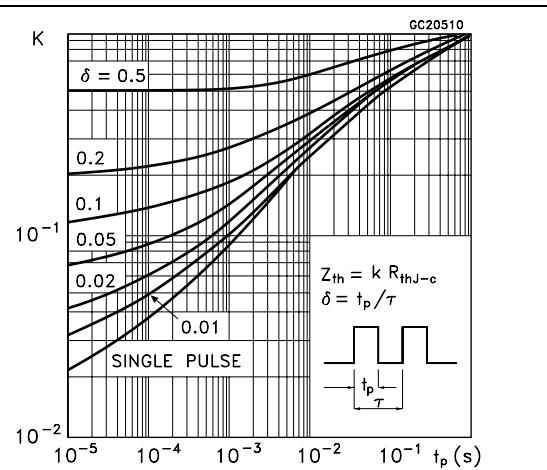
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

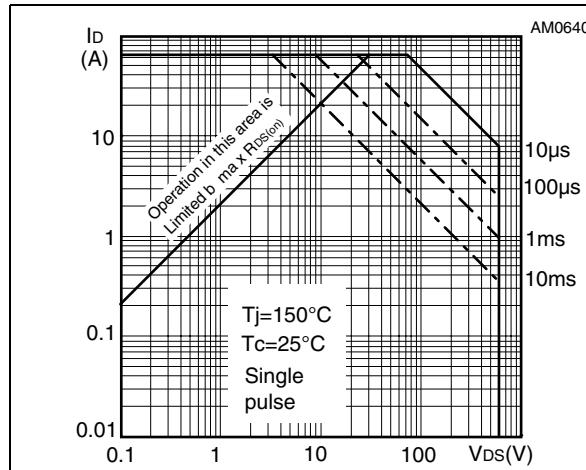
**Figure 2.** Safe operating area for TO-220, D<sup>2</sup>PAK, I<sup>2</sup>PAK



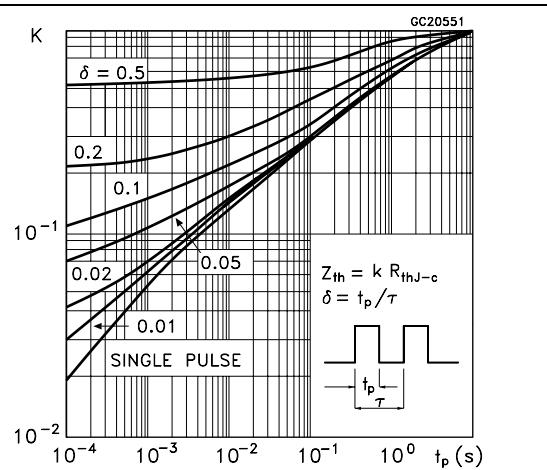
**Figure 3.** Thermal impedance for TO-220, D<sup>2</sup>PAK, I<sup>2</sup>PAK



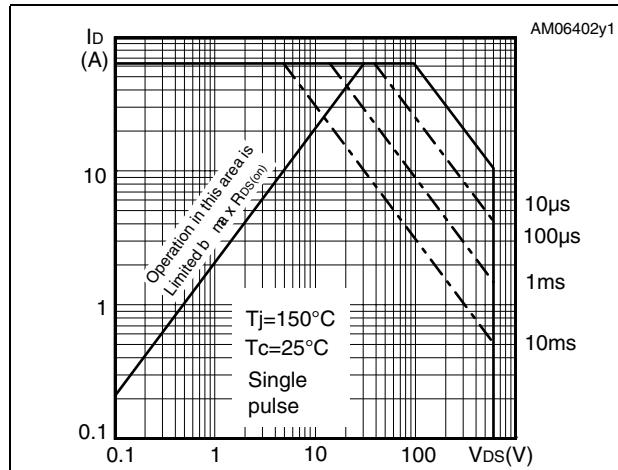
**Figure 4.** Safe operating area for TO-220FP



**Figure 5.** Thermal impedance for TO-220FP



**Figure 6.** Safe operating area for TO-247



**Figure 7.** Thermal impedance for TO-247

