



# STB15NM60ND - STF/15NM60ND STP15NM60ND - STW15NM60ND

N-channel 600 V - 0.27  $\Omega$  - 14 A - FDmesh™ II Power MOSFET  
D<sup>2</sup>PAK, I<sup>2</sup>PAK, TO-220, TO-220FP, TO-247

## Features

Type	V <sub>DSS</sub> (@T <sub>jmax</sub> )	R <sub>DS(on)</sub> max	I <sub>D</sub>
STB15NM60ND	650 V	0.299 $\Omega$	14 A
STF15NM60ND			14 A
STI15NM60ND			14 A <sup>(1)</sup>
STP15NM60ND			14 A
STW15NM60ND			14 A

1. Limited only by maximum temperature allowed

- The worldwide best R<sub>DS(on)</sub>\* area amongst the fast recovery diode devices
- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance
- Extremely high dv/dt and avalanche capabilities

## Application

- Switching applications

## Description

The FDmesh™ II series belongs to the second generation of MDmesh™ technology. This revolutionary Power MOSFET associates a new vertical structure to the company's strip layout and associates all advantages of reduced on-resistance and fast switching with an intrinsic fast-recovery body diode. Strongly recommended for bridge topologies, in ZVS phase-shift converters.

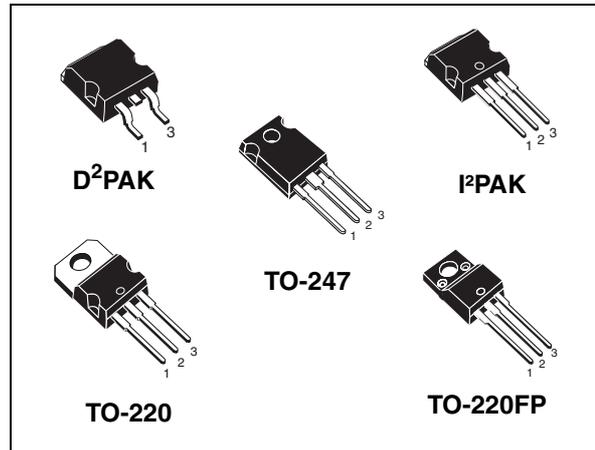


Figure 1. Internal schematic diagram

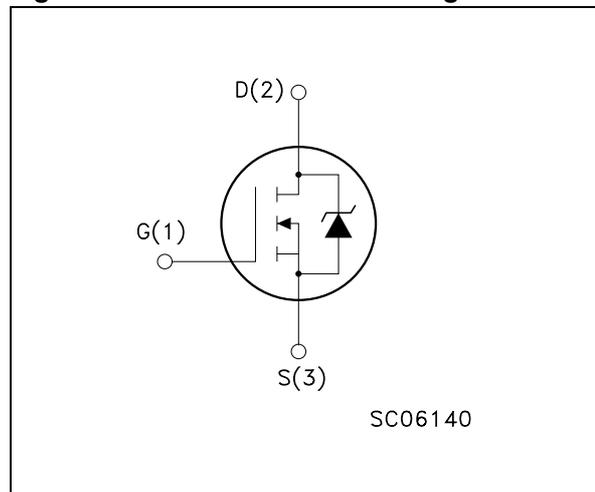


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB15NM60ND	15NM60ND	D <sup>2</sup> PAK	Tape and reel
STF15NM60ND	15NM60ND	TO-220FP	Tube
STI15NM60ND	15NM60ND	I <sup>2</sup> PAK	Tube
STP15NM60ND	15NM60ND	TO-220	Tube
STW15NM60ND	15NM60ND	TO-247	Tube

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		DPAK/I <sup>2</sup> PAK TO-220/IPAK	TO-220FP	
V <sub>DS</sub>	Drain-source voltage (V <sub>GS</sub> =0)	600		V
V <sub>GS</sub>	Gate-source voltage	± 25		V
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 25 °C	14	14 <sup>(1)</sup>	A
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 100 °C	9	9 <sup>(1)</sup>	A
I <sub>DM</sub> <sup>(2)</sup>	Drain current (pulsed)	56	56 <sup>(1)</sup>	A
P <sub>TOT</sub>	Total dissipation at T <sub>C</sub> = 25 °C	125	30	W
dv/dt <sup>(3)</sup>	Peak diode recovery voltage slope	40		V/ns
V <sub>ISO</sub>	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1 s; T <sub>C</sub> =25 °C)	--	2500	V
T <sub>stg</sub>	Storage temperature	-55 to 150		°C
T <sub>j</sub>	Operating junction temperature	150		°C

1. Limited only by maximum temperature allowed
2. Pulse width limited by safe operating area
3. I<sub>SD</sub> ≤ 14 A, di/dt ≤ 400 A/μs, V<sub>DD</sub> = 80% V<sub>(BR)DSS</sub>

**Table 3. Thermal data**

Symbol	Parameter	TO-220	I <sup>2</sup> PAK	TO-247	D <sup>2</sup> PAK	TO-220FP	Unit
R <sub>thj-case</sub>	Thermal resistance junction-case max	1				4.2	°C/W
R <sub>thj-amb</sub>	Thermal resistance junction-amb max	62.5		50	--	62.5	°C/W
R <sub>thj-pcb</sub>	Thermal resistance junction-pcb max	--	--	--	30	--	°C/W
T <sub>l</sub>	Maximum lead temperature for soldering purposes	300					°C

**Table 4. Avalanche characteristics**

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

## 2 Electrical characteristics

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

**Table 5. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1 \text{ mA}, V_{GS} = 0$	600			V
$dv/dt^{(1)}$	Drain-source voltage slope	$V_{DD} = 480 \text{ V}, I_D = 14 \text{ A}, V_{GS} = 10 \text{ V}$	30			V/ns
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating}, V_{DS} = \text{Max rating}, @ 125^{\circ}C$			1 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20 \text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10 \text{ V}, I_D = 7 \text{ A}$		0.27	0.299	$\Omega$

1. Value measured at turn off under inductive load

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15 \text{ V}, I_D = 7 \text{ A}$		10		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 50 \text{ V}, f = 1 \text{ MHz}, V_{GS} = 0$		1250 65 5		pF pF pF
$C_{oss \text{ eq.}}^{(2)}$	Equivalent output capacitance	$V_{GS} = 0, V_{DS} = 0 \text{ V to } 480 \text{ V}$		180		pF
$R_g$	Gate input resistance	$f = 1 \text{ MHz}$ Gate DC Bias=0 Test signal level=20 mV open drain		4		$\Omega$
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 480 \text{ V}, I_D = 14 \text{ A}$ $V_{GS} = 10 \text{ V}$		40 8 22		nC nC nC

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

2.  $C_{oss \text{ eq.}}$  is defined as a constant equivalent capacitance giving the same charging time as  $C_{oss}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DSS}$

**Table 7.      Switching times**

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$ , $I_D = 7\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$		17		ns
$t_r$	Rise time			20		ns
$t_{d(off)}$	Turn-off delay time			47		ns
$t_f$	Fall time			28		ns

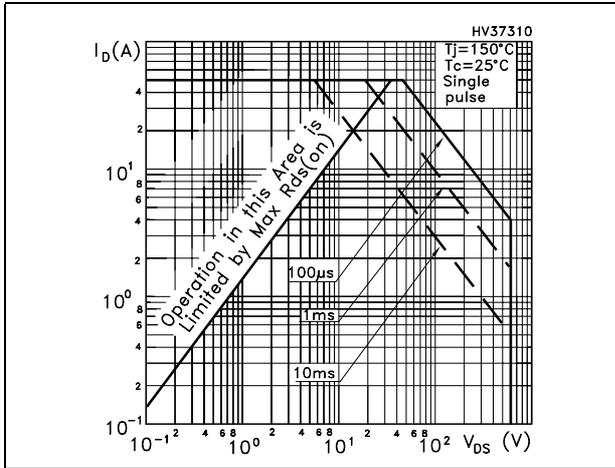
**Table 8.      Source drain diode**

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$I_{SD}$	Source-drain current				14	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				56	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 14\text{ A}$ , $V_{GS}=0$			1.3	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 14\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 100\text{ V}$		148		ns
$Q_{rr}$	Reverse recovery charge			910		nC
$I_{RRM}$	Reverse recovery current			12		A
$t_{rr}$	Reverse recovery time	$V_{DD} = 100\text{ V}$ $di/dt = 100\text{ A}/\mu\text{s}$ , $I_{SD} = 14\text{ A}$ $T_j = 150\text{ }^\circ\text{C}$		190		ns
$Q_{rr}$	Reverse recovery charge			1280		nC
$I_{RRM}$	Reverse recovery current			13		A

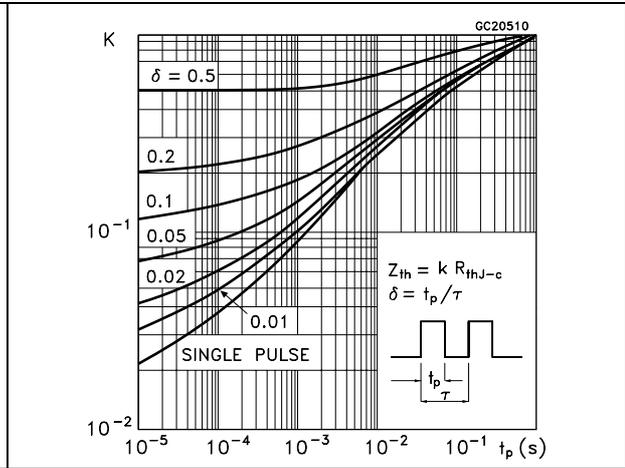
1. Pulse width limited by safe operating area
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

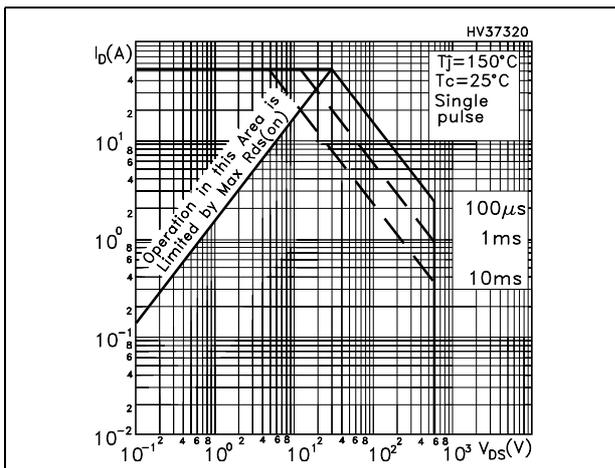
**Figure 2. Safe operating area for TO-220 / D<sup>2</sup>PAK / I<sup>2</sup>PAK**



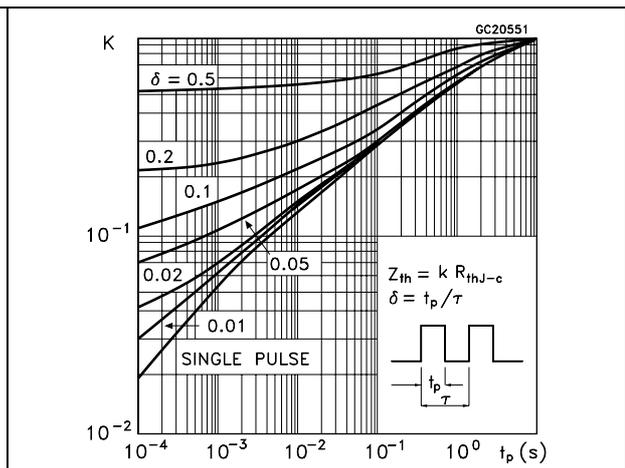
**Figure 3. Thermal impedance for TO-220 / D<sup>2</sup>PAK / I<sup>2</sup>PAK**



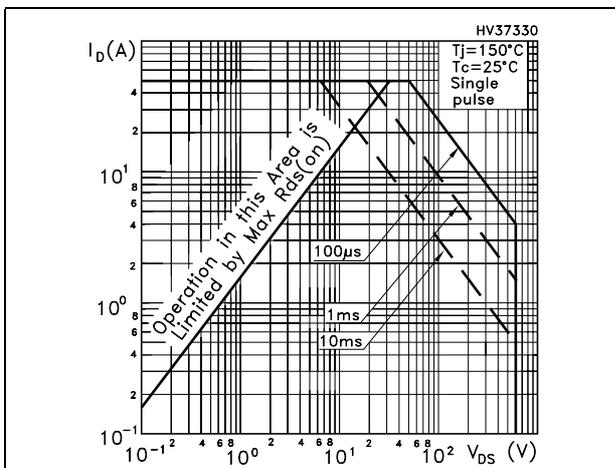
**Figure 4. Safe operating area for TO-220FP**



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



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



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

