

N-channel 600 V, 0.11 Ω, 25 A FDmesh™ II Power MOSFET
(with fast diode) TO-220, TO-220FP, D²PAK, I²PAK, TO-247

Features

Type	$V_{DSS} @ T_J \text{ max}$	$R_{DS(on)} \text{ max}$	I_D
STB30NM60ND			25 A
STI30NM60ND			25 A
STF30NM60ND	650 V	0.13 Ω	25 A ⁽¹⁾
STP30NM60ND			25 A
STW30NM60ND			25 A

1. Limited only by maximum temperature allowed
- The world's best $R_{DS(on)}$ in TO-220 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.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STB30NM60ND	30NM60ND	D ² PAK	Tape and reel
STI30NM60ND	30NM60ND	I ² PAK	Tube
STF30NM60ND	30NM60ND	TO-220FP	Tube
STP30NM60ND	30NM60ND	TO-220	Tube
STW30NM60ND	30NM60ND	TO-247	Tube

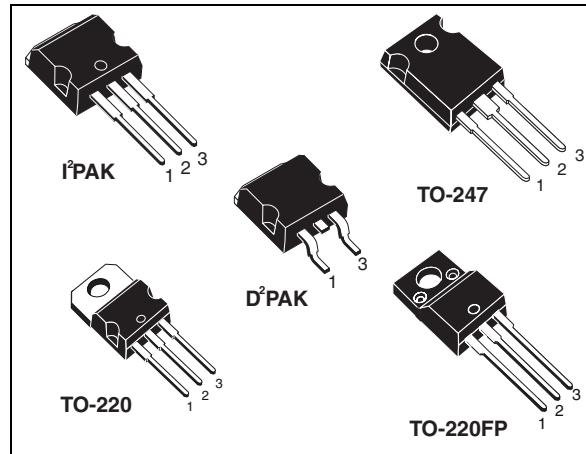
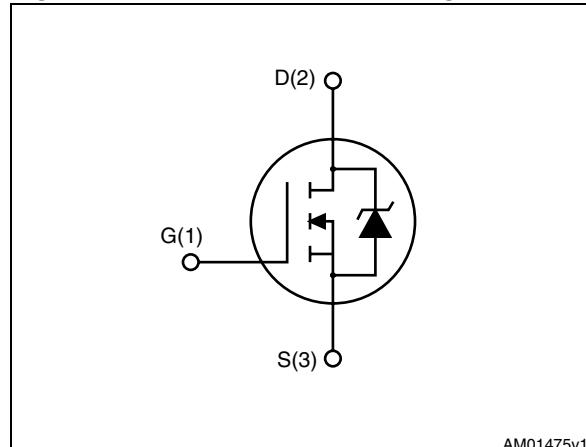


Figure 1. Internal schematic diagram



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It is therefore strongly recommended for bridge topologies, in particular ZVS phase-shift converters.

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220/D ² PAK I ² PAK / TO-247	TO-220FP	
V _{DS}	Drain-source voltage ($V_{GS} = 0$)	600		V
V _{GS}	Gate- source voltage	± 25		V
I _D	Drain current (continuous) at $T_C = 25^\circ\text{C}$	25	25 ⁽¹⁾	A
I _D	Drain current (continuous) at $T_C = 100^\circ\text{C}$	15.8	15.8 ⁽¹⁾	A
I _{DM} ⁽²⁾	Drain current (pulsed)	100	100 ⁽¹⁾	A
P _{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	190	40	W
dv/dt ⁽³⁾	Peak diode recovery voltage slope	40		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 _{stg}	Storage temperature	−55 to 150		°C
T _J	Max. operating junction temperature	150		

1. Limited only by maximum temperature allowed
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 25 \text{ A}$, $dI/dt \leq 600 \text{ A}/\mu\text{s}$, $V_{DD} = 80\% V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	TO-220	I ² PAK	TO-247	D ² PAK	TO-220FP	Unit
R _{thj-case}	Thermal resistance junction-case max	0.66				3.1	°C/W
R _{thj-amb}	Thermal resistance junction-ambient max	62.5		50	--	62.5	°C/W
R _{thj-pcb}	Thermal resistance junction-pcb max	--	--	--	30	--	°C/W
T _I	Maximum lead temperature for soldering purpose	300					°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)	12	A
E _{AS}	Single pulse avalanche energy (starting $T_J = 25^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50 \text{ V}$)	900	mJ

2 Electrical characteristics

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

Table 5. On/off states

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1 \text{ mA}, V_{GS} = 0$	600			V
$dv/dt^{(1)}$	Drain source voltage slope	$V_{DD} = 480 \text{ V}, I_D = 25 \text{ A}, V_{GS} = 10 \text{ V}$	48			V/ns
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating} @ 125^\circ\text{C}$			1 100	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20 \text{ V}$			100	nA
$V_{GS(\text{th})}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	3	4	5	V
$R_{DS(\text{on})}$	Static drain-source on resistance	$V_{GS} = 10 \text{ V}, I_D = 12.5 \text{ A}$		0.11	0.13	Ω

1. Characteristic value at turn off on inductive load

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15 \text{ V}, I_D = 12.5 \text{ A}$		25		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 50 \text{ V}, f = 1 \text{ MHz}, V_{GS} = 0$	2800 200 24			pF pF pF
$C_{oss \text{ eq.}}^{(2)}$	Equivalent output capacitance	$V_{GS} = 0, V_{DS} = 0 \text{ to } 480 \text{ V}$		125		pF
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	$V_{DD} = 300 \text{ V}, I_D = 12.5 \text{ A}$ $R_G = 4.7 \Omega, V_{GS} = 10 \text{ V}$	20 50 110 75			ns ns ns ns
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 480 \text{ V}, I_D = 25 \text{ A}, V_{GS} = 10 \text{ V}$	100 16 54			nC nC nC
R_g	Gate input resistance	f=1MHz Gate DC Bias=0 Test signal level=20 mV Open drain		3.0		Ω

1. Pulsed: pulse duration=300 μs , 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. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current				25	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				100	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 25 \text{ A}, V_{GS} = 0$			1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 25 \text{ A}, V_{DD} = 60 \text{ V}$		170		ns
Q_{rr}	Reverse recovery charge	$di/dt = 100 \text{ A}/\mu\text{s}$		1.2		μC
I_{RRM}	Reverse recovery current			15		A
t_{rr}	Reverse recovery time	$I_{SD} = 25 \text{ A}, V_{DD} = 60 \text{ V}$		250		ns
Q_{rr}	Reverse recovery charge	$di/dt = 100 \text{ A}/\mu\text{s},$		2.5		μC
I_{RRM}	Reverse recovery current	$T_J = 150 \text{ }^\circ\text{C}$		20		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 2. Safe operating area for TO-220 / D²PAK / I²PAK

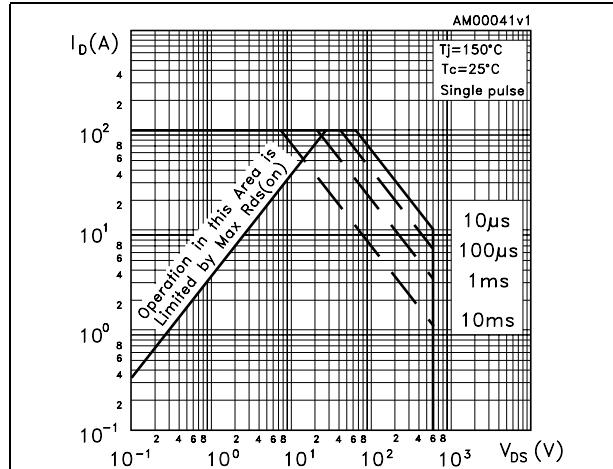


Figure 4. Safe operating area for TO-220FP

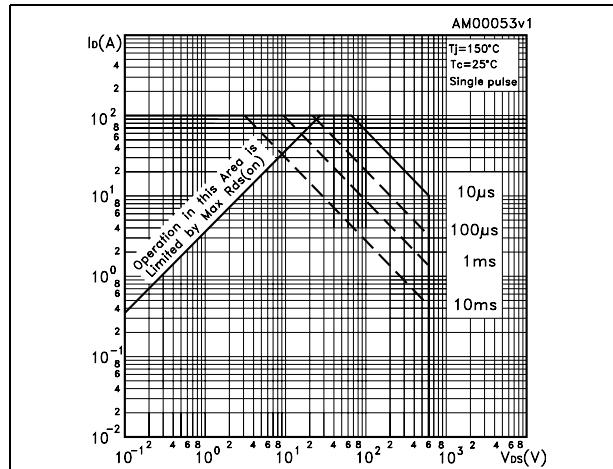


Figure 6. Safe operating area for TO-247

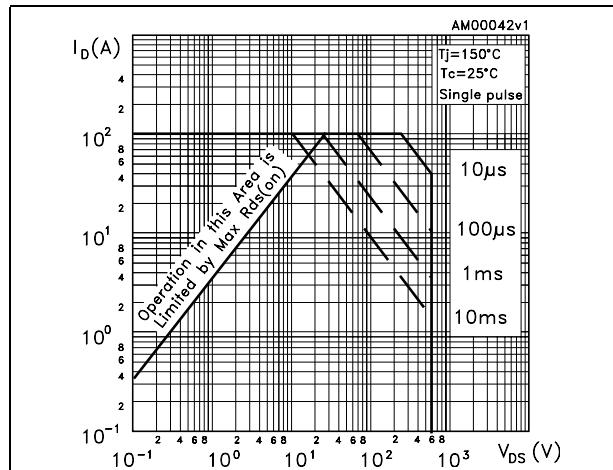


Figure 3. Thermal impedance for TO-220 / D²PAK / I²PAK

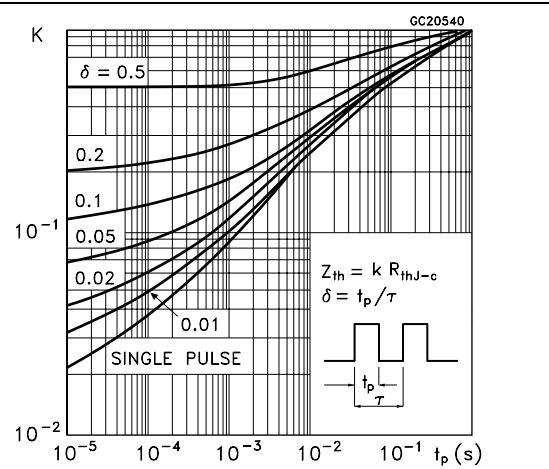


Figure 5. Thermal impedance for TO-220FP

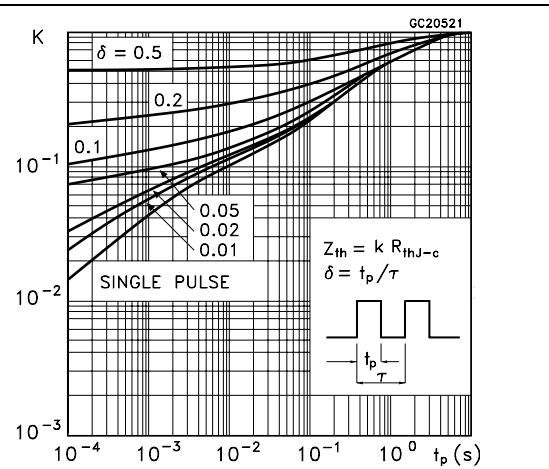


Figure 7. Thermal impedance for TO-247

