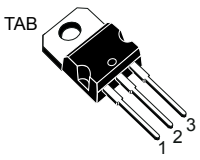
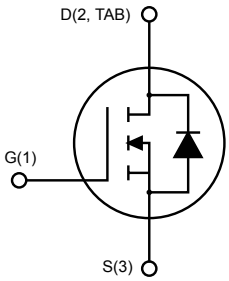
Datasheet

N-channel 600 V, 0.8 Ω typ., 5 A MDmesh™ II Power MOSFET in a TO-220 package



TO-220



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Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D	Package
STP7NM60N	600 V	0.9 Ω	5 A	TO-220

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

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using the second generation of MDmesh™ technology. This revolutionary Power MOSFET associates a vertical structure to the company's strip layout to yield one of the world's lowest on-resistance and gate charge. It is therefore suitable for the most demanding high efficiency converters.

Product status
STP7NM60N

Device summary	
Order code	STP7NM60N
Marking	7NM60N
Package	TO-220
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	600	V
V_{GS}	Gate-source voltage	±25	V
I_D	Drain current (continuous) at T_C = 25 °C	5	A
I_D	Drain current (continuous) at T_C = 100 °C	3	A
I_{DM} (1)	Drain current (pulsed)	20	A
P_{TOT}	Total dissipation at T_C = 25 °C	45	W
dv/dt (2)	Peak diode recovery voltage slope	15	V/ns
T_j	Operating junction temperature range	-55 to 150	°C
T_{stg}	Storage temperature range		

1. *Pulse width limited by safe operating area.*
2. *I_{SD} ≤ 5 A, di/dt ≤ 100 A/µs, V_{DSpeak} ≤ $V_{(BR)DSS}$, V_{DD} = 80% $V_{(BR)DSS}$.*

Table 2. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	2.78	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	62.5	°C/W

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AS} (1)	Avalanche current, repetitive or not-repetitive	2	A
E_{AS} (2)	Single pulse avalanche energy	119	mJ

1. *Pulse width limited by T_j max.*
2. *Starting T_j = 25 °C, I_D = I_{AS}, V_{DD} = 50 V.*

2 Electrical characteristics

(T_{CASE} = 25 °C unless otherwise specified)

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 1 mA, V_{GS} = 0 V	600			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0 V, V_{DS} = 600 V			1	µA
		V_{GS} = 0 V, V_{DS} = 600 V, T_C = 125 °C (1)			100	µA
I_{GSS}	Gate body leakage current	V_{DS} = 0 V, V_{GS} = ±20 V			100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 2.5 A		0.8	0.9	Ω

1. *Defined by design, not subject to production test.*

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 50 V, f = 1 MHz, V_{GS} = 0 V	-	363	-	pF
C_{oss}	Output capacitance			24.6		
C_{rss}	Reverse transfer capacitance			1.1		
$C_{oss\ eq.}$ (1)	Equivalent capacitance time related	V_{DS} = 0 to 480 V, V_{GS} = 0 V	-	130	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz open drain	-	5.4	-	Ω
Q_g	Total gate charge	V_{DD} = 480 V, I_D = 5 A, V_{GS} = 0 to 10 V (see Figure 12. Test circuit for gate charge behavior)	-	14	-	nC
Q_{gs}	Gate-source charge			2.7		
Q_{gd}	Gate-drain charge			7.7		

1. *$C_{oss\ eq.}$ 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 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 300 V, I_D = 2.5 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 11. Test circuit for resistive load switching times and Figure 16. Switching time waveform)	-	7	-	ns
t_r	Rise time			10		
$t_{d(off)}$	Turn-off delay time			26		
t_f	Fall time			12		

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		5	A
I_{SDM} (1)	Source-drain current (pulsed)				20	
V_{SD} (2)	Forward on voltage	I_{SD} = 5 A, V_{GS} = 0 V	-		1.3	V
t_{rr}	Reverse recovery time	I_{SD} = 5 A, di/dt = 100 A/µs	-	213		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 60 V (see Figure 13. Test circuit for inductive load switching and diode recovery times)		1.5		µC
I_{RRM}	Reverse recovery current			14		A
t_{rr}	Reverse recovery time	I_{SD} = 5 A, di/dt = 100 A/µs	-	265		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 60 V, T_j = 150 °C(see Figure 13. Test circuit for inductive load switching and diode recovery times)		1.8		µC
I_{RRM}	Reverse recovery current			14		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 1. Safe operating area

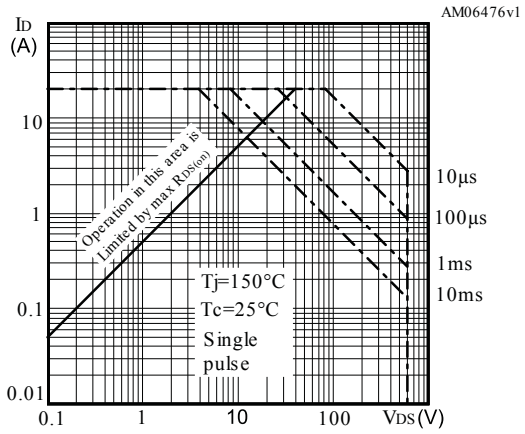


Figure 2. Thermal impedance

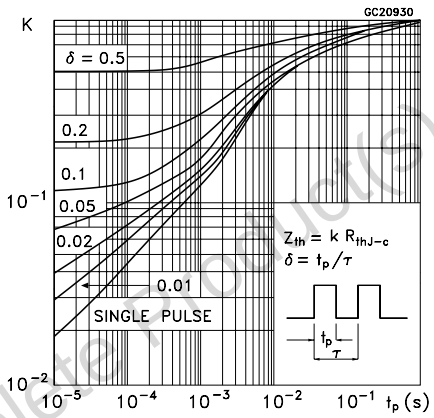


Figure 3. Output characterisics

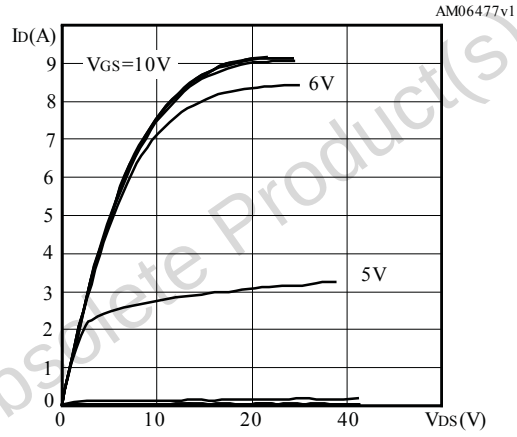


Figure 4. Transfer characteristics

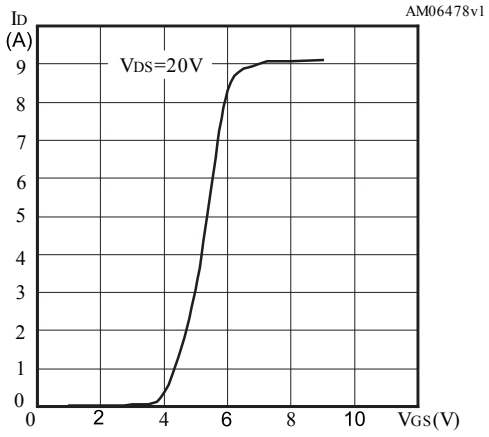


Figure 5. Gate charge vs gate-source voltage

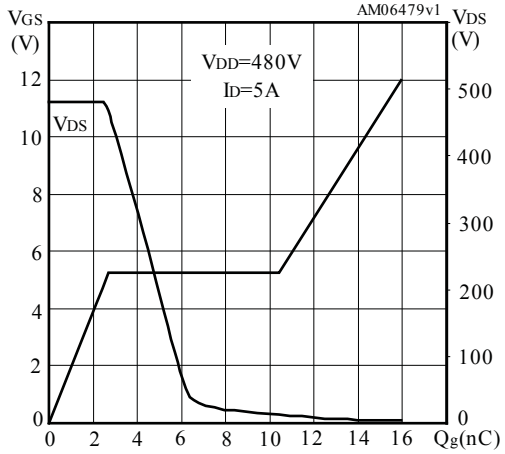


Figure 6. Static drain-source on-resistance

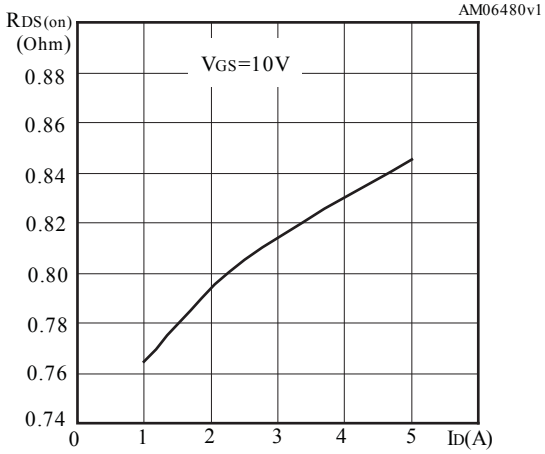


Figure 7. Capacitance variations

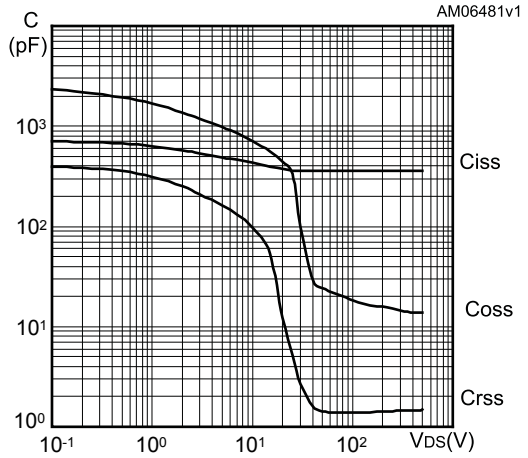


Figure 8. Normalized gate threshold voltage vs temperature

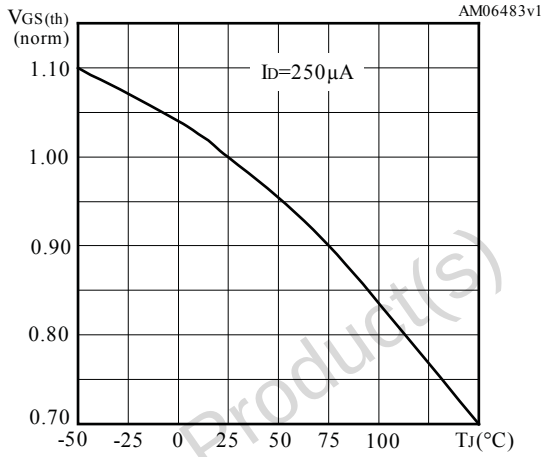


Figure 9. Normalized on-resistance vs temperature

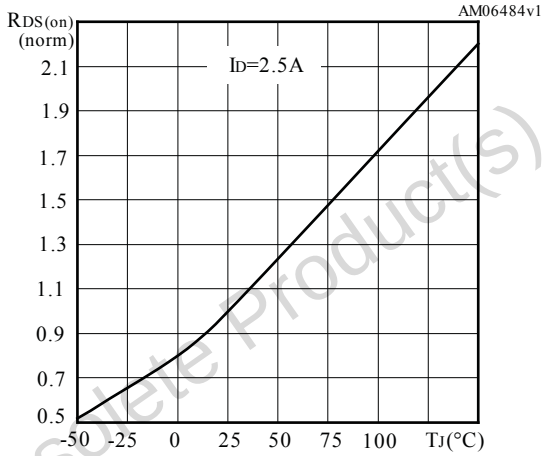
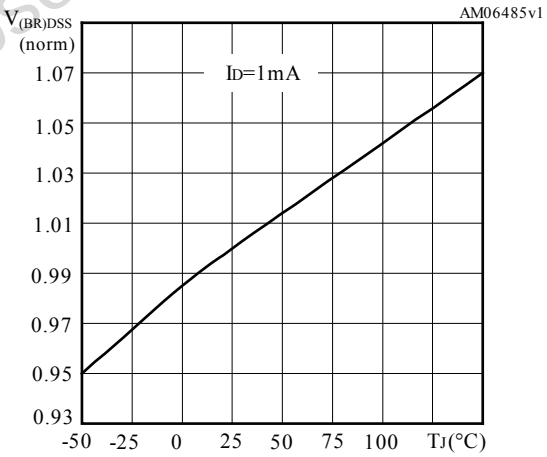


Figure 10. Normalized $V_{(BR)DSS}$ vs temperature



3 Test circuits

Figure 11. Test circuit for resistive load switching times

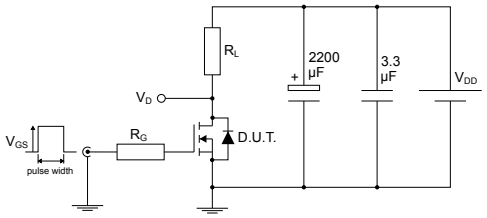


Figure 12. Test circuit for gate charge behavior

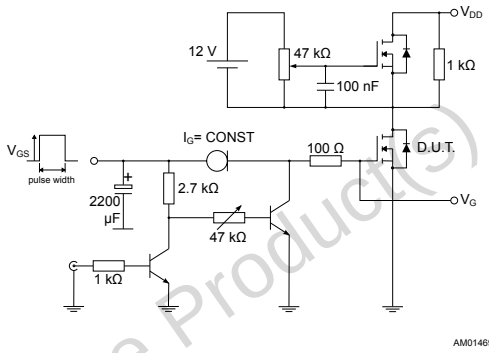


Figure 13. Test circuit for inductive load switching and diode recovery times

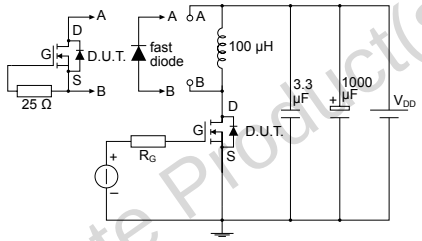


Figure 14. Unclamped inductive load test circuit

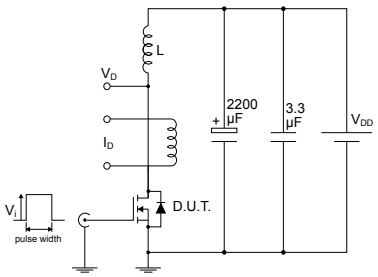


Figure 15. Unclamped inductive waveform

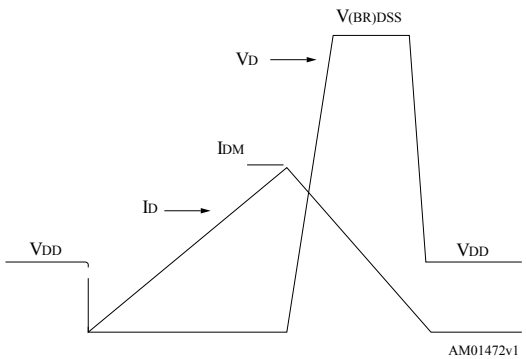
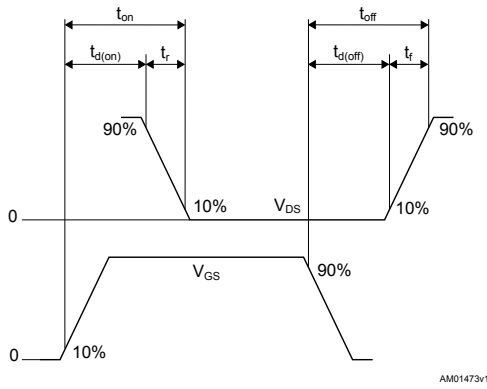


Figure 16. Switching time waveform



4 Package information

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.

4.1 TO-220 type A package information

Figure 17. **TO-220 type A package outline**

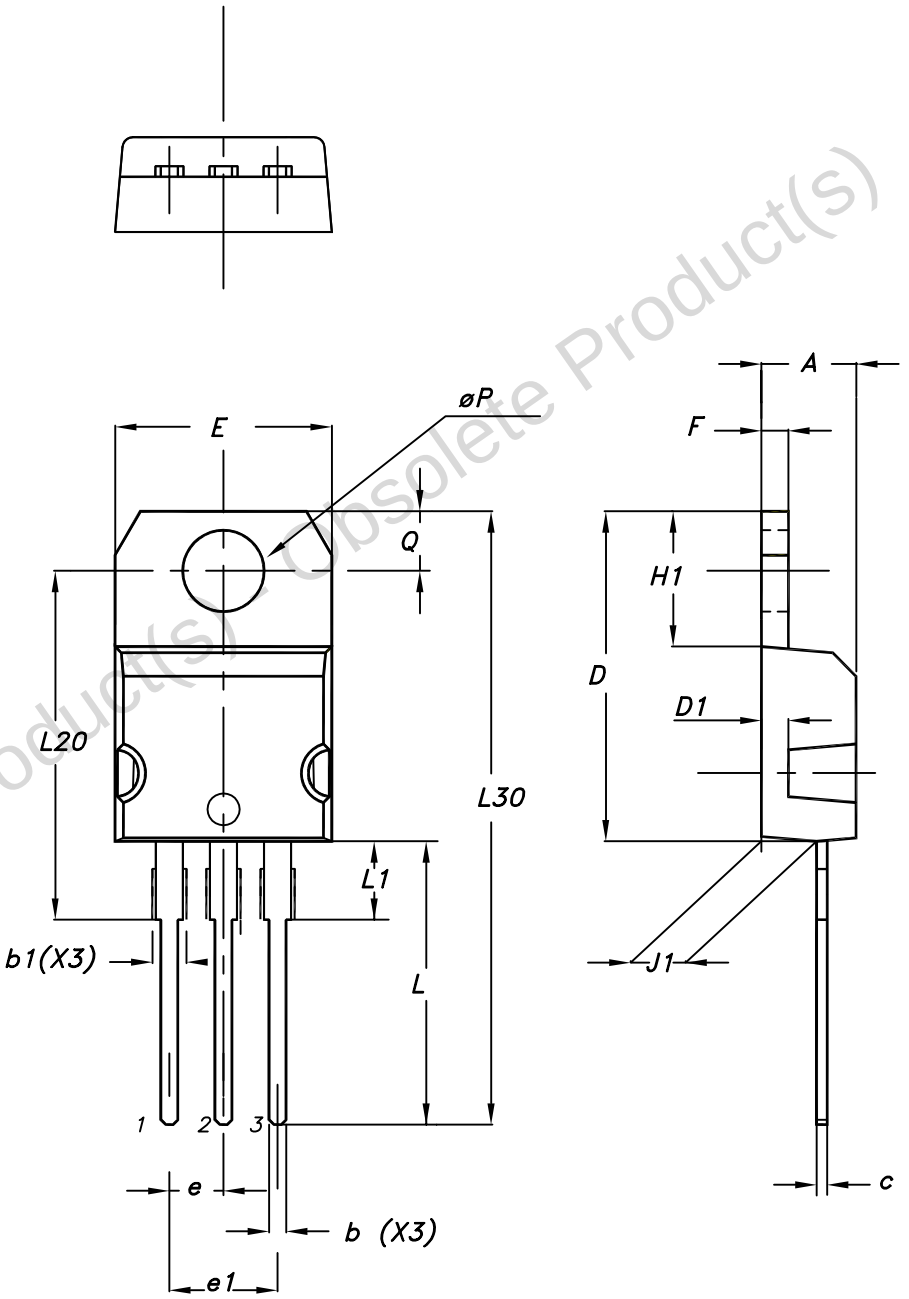


Table 8. **TO-220 type A package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.55
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10.00		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13.00		14.00
L1	3.50		3.93
L20		16.40	
L30		28.90	
øP	3.75		3.85
Q	2.65		2.95

Contents

Revision history

Table 9. **Document revision history**

Date	Version	Changes
13-Sep-2018	1	First release. Part number previously included in datasheet DocID16472.

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