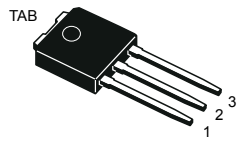
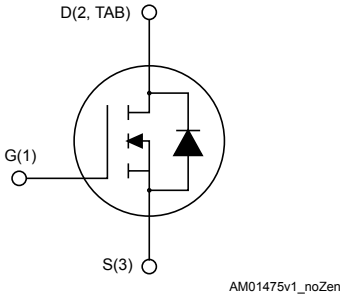
STU7LNM60N

Datasheet

N-channel 600 V, 0.89 Ω typ., 4.5 A, MDmesh II Power MOSFET in an IPAK package



IPAK



Features

Type	V_{DS}	$R_{DS(on)}$ max.	I_D
STU7LNM60N	600 V	0.99 Ω	4.5 A

- 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
STU7LNM60N

Product summary	
Order code	STU7LNM60N
Marking	7LNM60N
Package	IPAK
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	4.5	A
	Drain current (continuous) at T_C = 100 °C	2.9	
I_{DM}(1)	Drain current pulsed	18	A
P_{TOT}	Total power 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} ≤ 4.5 A, di/dt ≤ 400 A/µs, V_{DS} peak ≤ $V_{(BR)DSS}$, 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	100	°C/W

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_J max)	2	A
E_{AS}	Single-pulse avalanche energy (starting T_J = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	119	mJ

2 Electrical characteristics

(T_C = 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	V_{GS} = 0 V, I_D = 1 mA	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} = ±25 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		0.89	0.99	Ω

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

Table 5. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 50 V, V_{GS} = 0 V, f = 1 MHz	-	363	-	pF
C_{oss}	Output capacitance		-	24.6	-	pF
C_{rss}	Reverse transfer capacitance		-	1.1	-	pF
$C_{oss\ eq.}$(1)	Equivalent output capacitance	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 13. Test circuit for gate charge behavior)	-	14	-	nC
Q_{gs}	Gate-source charge		-	2.7	-	nC
Q_{gd}	Gate-drain charge		-	7.7	-	nC

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 12. Test circuit for resistive load switching times and Figure 17. Switching time waveform)	-	7.2	-	ns
t_r	Rise time		-	10.3	-	ns
$t_{d(off)}$	Turn-off delay time		-	26.4	-	ns
t_f	Fall time		-	12.6	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		4.5	A
I_{SDM}(1)	Source-drain current (pulsed)		-		18	A
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, V_{DD} = 60 V, di/dt = 100 A/µs (see Figure 14. Test circuit for inductive load switching and diode recovery times)	-	213		ns
Q_{rr}	Reverse recovery charge		-	1.5		µA
I_{RRM}	Reverse recovery current		-	14		A
t_{rr}	Reverse recovery time	I_{SD} = 5 A, V_{DD} = 60 V, di/dt = 100 A/µs, T_J = 150 °C (see Figure 14. Test circuit for inductive load switching and diode recovery times)	-	265		ns
Q_{rr}	Reverse recovery charge		-	1.8		µA
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

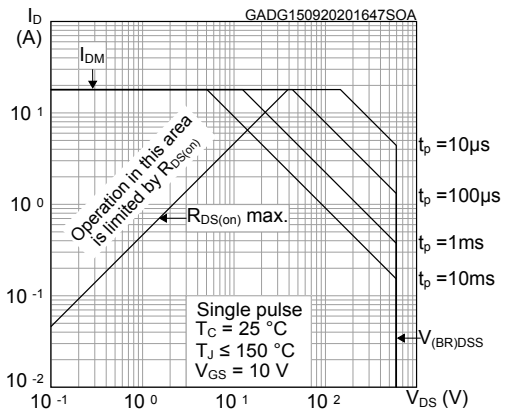


Figure 2. Thermal impedance

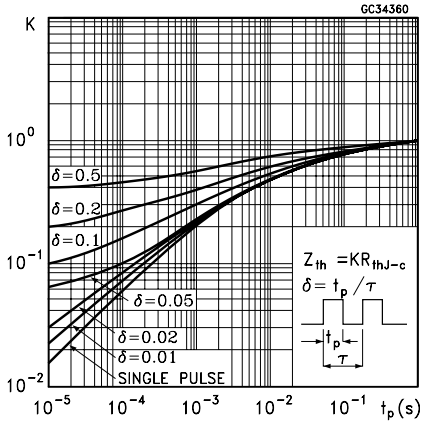


Figure 3. Output characteristics

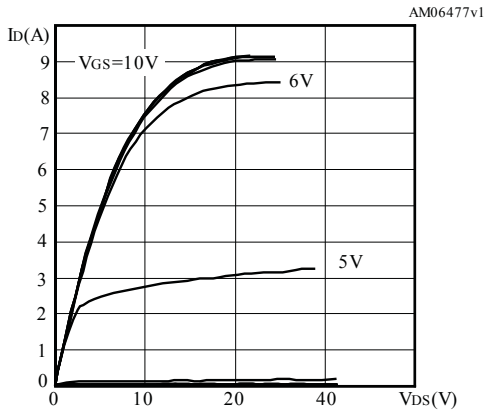


Figure 4. Transfer characteristics

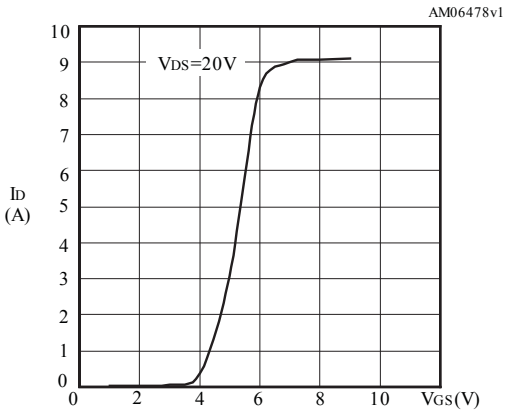


Figure 5. Gate charge vs gate-source voltage

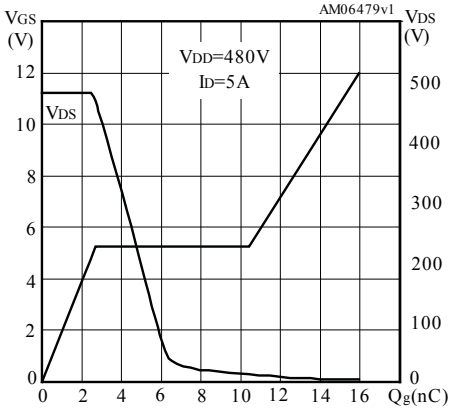


Figure 6. Static drain-source on-resistance

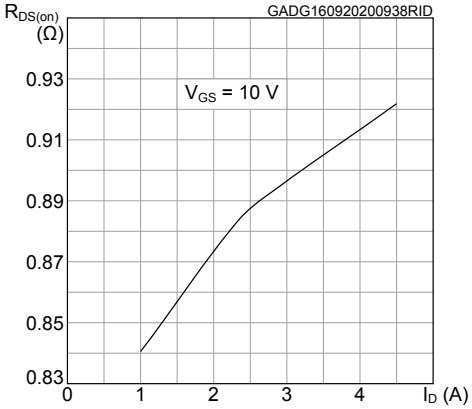


Figure 7. Capacitance variations

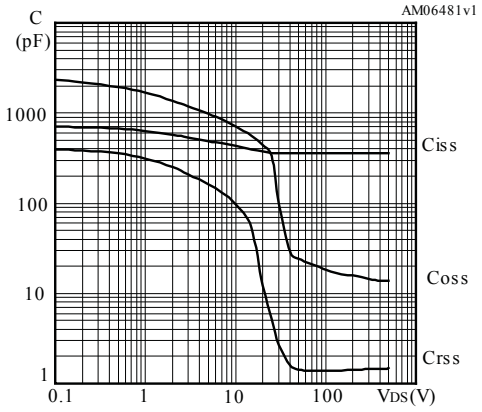


Figure 8. Output capacitance stored energy

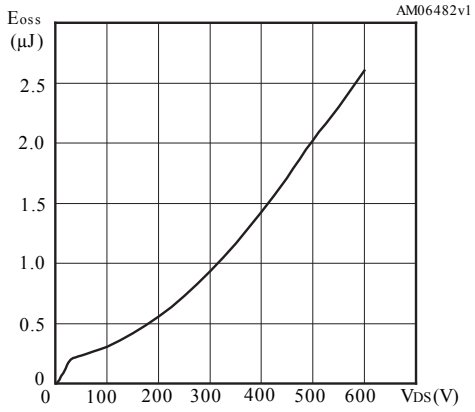


Figure 9. Normalized gate threshold voltage vs temperature

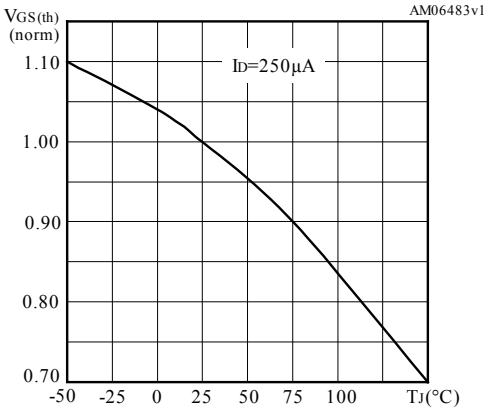


Figure 10. Normalized on-resistance vs temperature

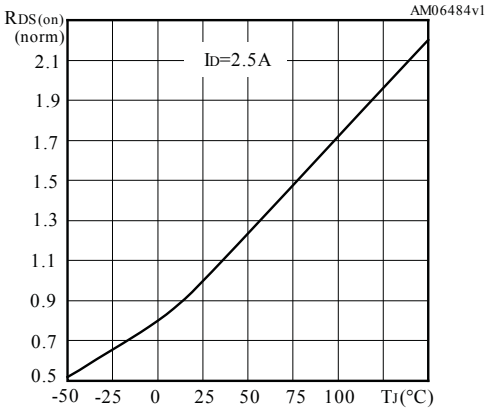
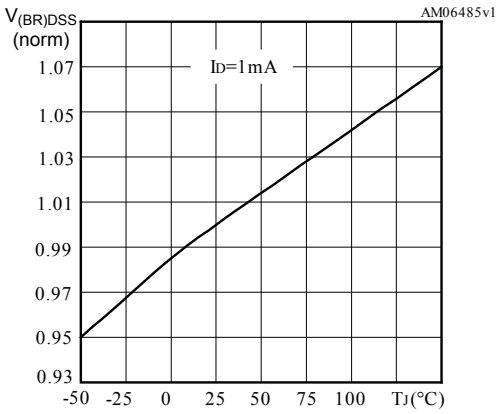


Figure 11. Normalized $V_{(BR)DSS}$ vs temperature



3 Test circuits

Figure 12. Test circuit for resistive load switching times

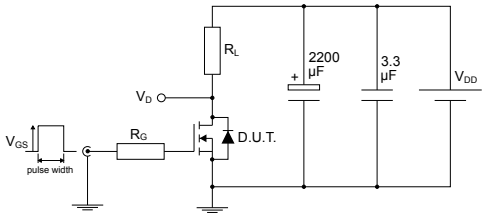


Figure 13. Test circuit for gate charge behavior

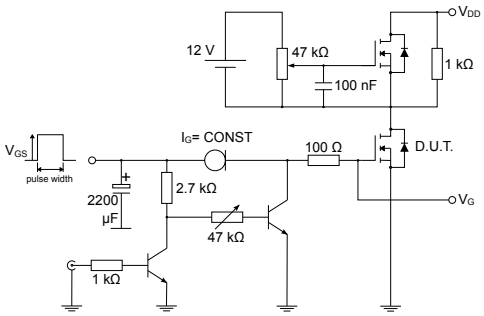


Figure 14. Test circuit for inductive load switching and diode recovery times

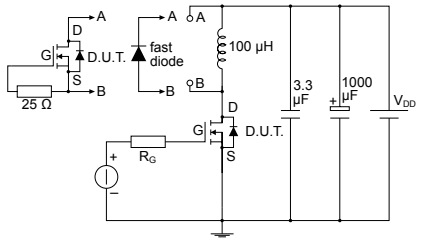


Figure 15. Unclamped inductive load test circuit

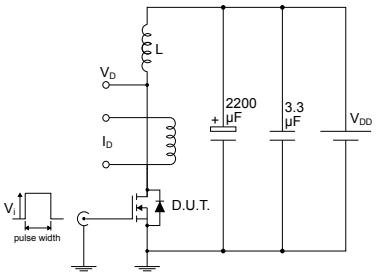


Figure 16. Unclamped inductive waveform

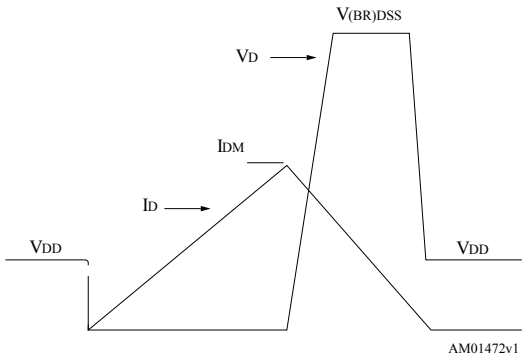
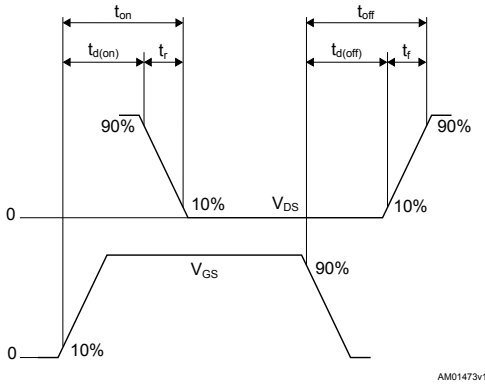


Figure 17. Switching time waveform



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 IPAK (TO-251) type A package information

Figure 18. IPAK (TO-251) type A package outline

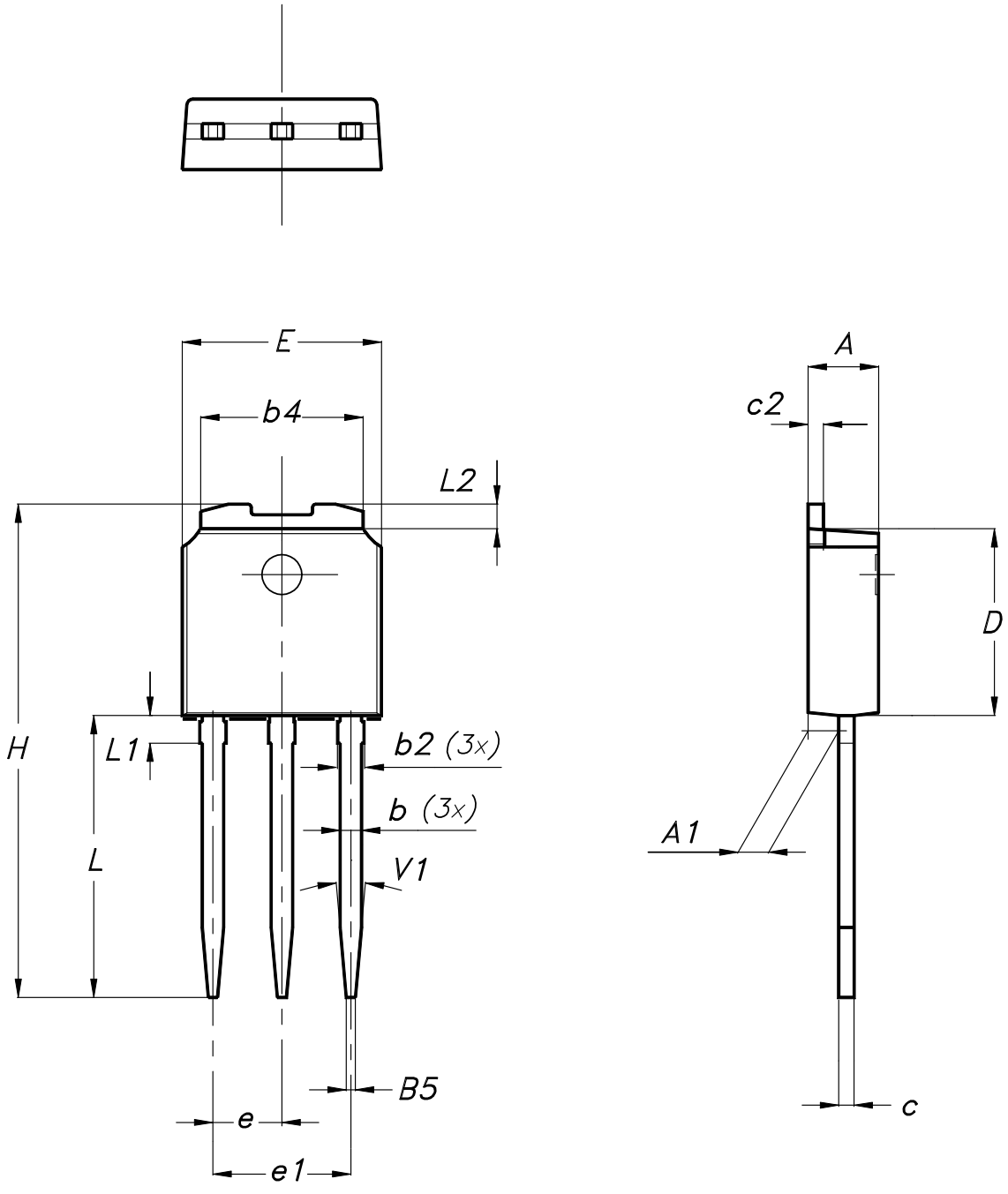


Table 8. **IPAK (TO-251) type A package mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.35
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
B5		0.30	
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.15
E	6.40		6.55
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
L1	0.80		1.20
L2		0.80	1.00
V1		10°	

Revision history

Table 9. **Document revision history**

Date	Version	Changes
18-Sep-2020	1	First release.

Contents