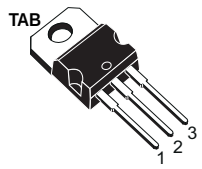
STP160N3LL

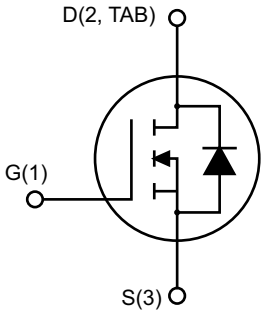
N-channel 30 V, 0.0024 Ω typ., 160 A STripFET™ VI DeepGATE™ Power MOSFET in a TO-220 package

Datasheet - preliminary data



TO-220

Figure 1. Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max	I_D
STP160N3LL	30 V	0.0032 Ω	160 A

- $R_{DS(on)}$ * Q_g industry benchmark
- Extremely low on-resistance $R_{DS(on)}$
- High avalanche ruggedness
- Low gate drive power losses

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using the 6th generation of STripFET™ DeepGATE™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest $R_{DS(on)}$ in all packages.

Table 1. Device summary

Order code	Marking	Package	Packaging
STP160N3LL	160N3LL	TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	30	V
V_{GS}	Gate-source voltage	± 20	V
I_D	Continuous drain current at T_C = 25 °C (silicon limited)	160	A
I_D	Continuous drain current at T_C = 25 °C (package limited)	120	A
I_D	Continuous drain current at T_C = 100 °C	112	A
I_{DM} (1)	Pulsed drain current	480	A
P_{TOT}	Total dissipation at T_C = 25 °C	136	W
	Derating factor	0.9	W/°C
E_{AS} (2)	Single pulse avalanche energy	150	mJ
T_{stg}	Storage temperature	-55 to 175	°C
T_j	Max. operating junction temperature	175	°C

1. Pulse width limited by safe operating area
2. Starting T_j = 25°C, I_{AV} = 40 A

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	1.1	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max	62.5	°C/W

2 Electrical characteristics

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

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown Voltage	I_D = 250 µA, V_{GS}= 0	30			V
I_{DSS}	Zero gate voltage drain current	V_{GS} = 0, V_{DS} = 30 V V_{GS} = 0, V_{DS} = 30 V, T_C = 125 °C			1 10	µA µA
I_{GSS}	Gate body leakage current	V_{DS} = 0, V_{GS} = ± 20 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	1		2.5	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 60 A		0.0024	0.0032	Ω
		V_{GS} = 4.5 V, I_D = 60 A		0.0032	0.0042	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 25 V, f=1 MHz, V_{GS} = 0	-	3100	-	pF
C_{oss}	Output capacitance		-	400	-	pF
C_{rss}	Reverse transfer capacitance		-	380	-	pF
Q_g	Total gate charge	V_{DD} = 15 V, I_D = 120 A V_{GS} = 4.5 V *Figure 3*	-	42	-	nC
Q_{gs}	Gate-source charge		-	9	-	nC
Q_{gd}	Gate-drain charge		-	18	-	nC
R_G	Gate input resistance	f = 1 MHz, gate DC Bias = 0, test signal level = 20 mV, I_D = 0	-	1	-	Ω

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 15 V, I_D = 60 A, R_G = 4.7 Ω, V_{GS} = 5 V *Figure 2*	-	19	-	ns
t_r	Rise time		-	91	-	ns
$t_{d(off)}$	Turn-off delay time		-	24.5	-	ns
t_f	Fall time		-	23.4	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		120	A
I_{SDM}(1)	Source-drain current (pulsed)		-		480	A
V_{SD}(2)	Forward on voltage	I_{SD} = 60 A, V_{GS} = 0	-		1.1	V
t_{rr}	Reverse recovery time	I_{SD} = 120 A, di/dt = 100 A/µs, V_{DD} = 24 V *Figure 4*	-	28.6		ns
Q_{rr}	Reverse recovery charge		-	22.8		nC
I_{RRM}	Reverse recovery current		-	1.6		A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration = 300 µs, duty cycle 1.5%

3 Test circuits

Figure 2. Switching times test circuit for resistive load

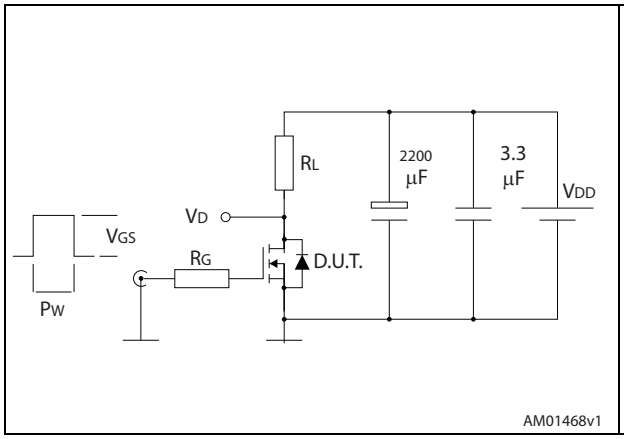


Figure 3. Gate charge test circuit

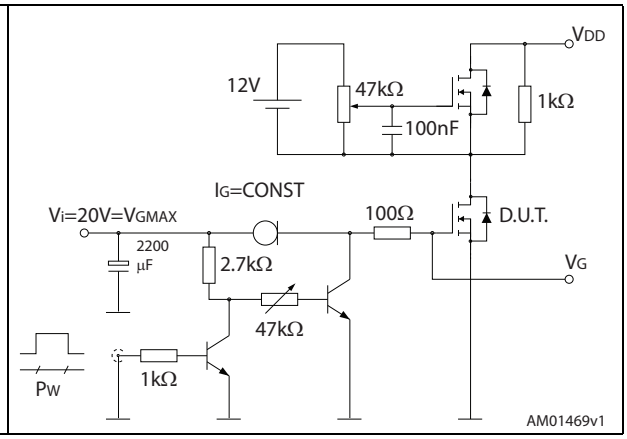


Figure 4. Test circuit for inductive load switching and diode recovery times

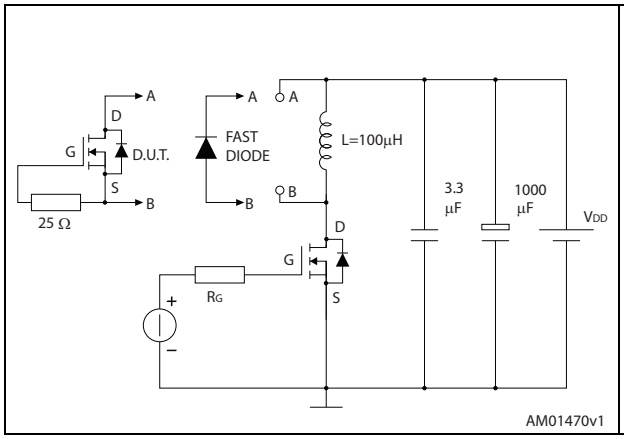


Figure 5. Unclamped inductive load test circuit

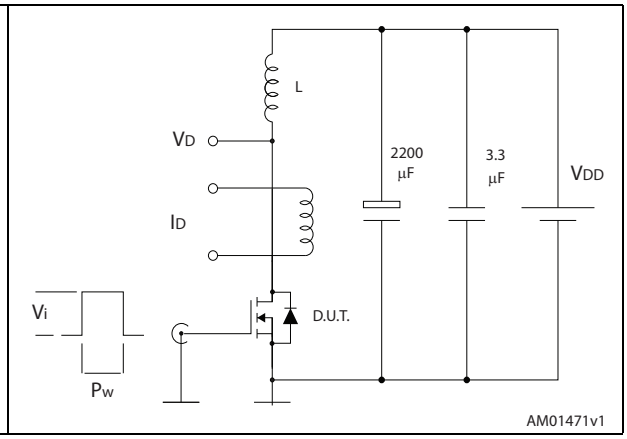


Figure 6. Unclamped inductive waveform

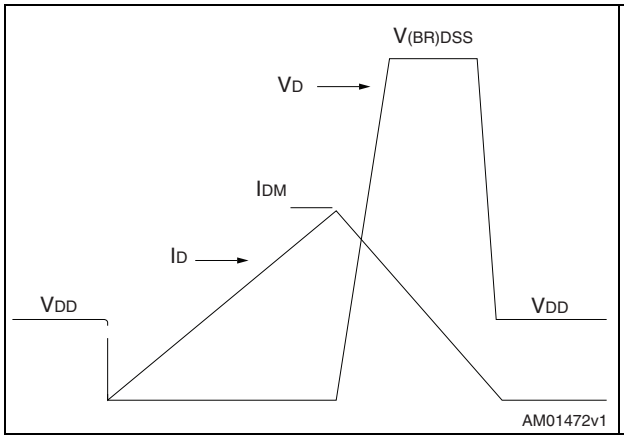
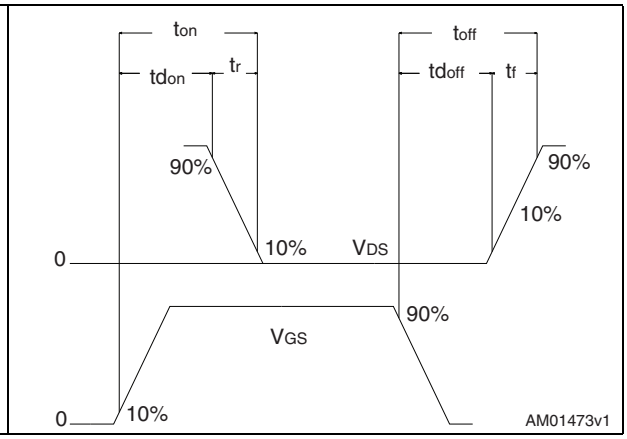


Figure 7. Switching time waveform



4 Package mechanical data

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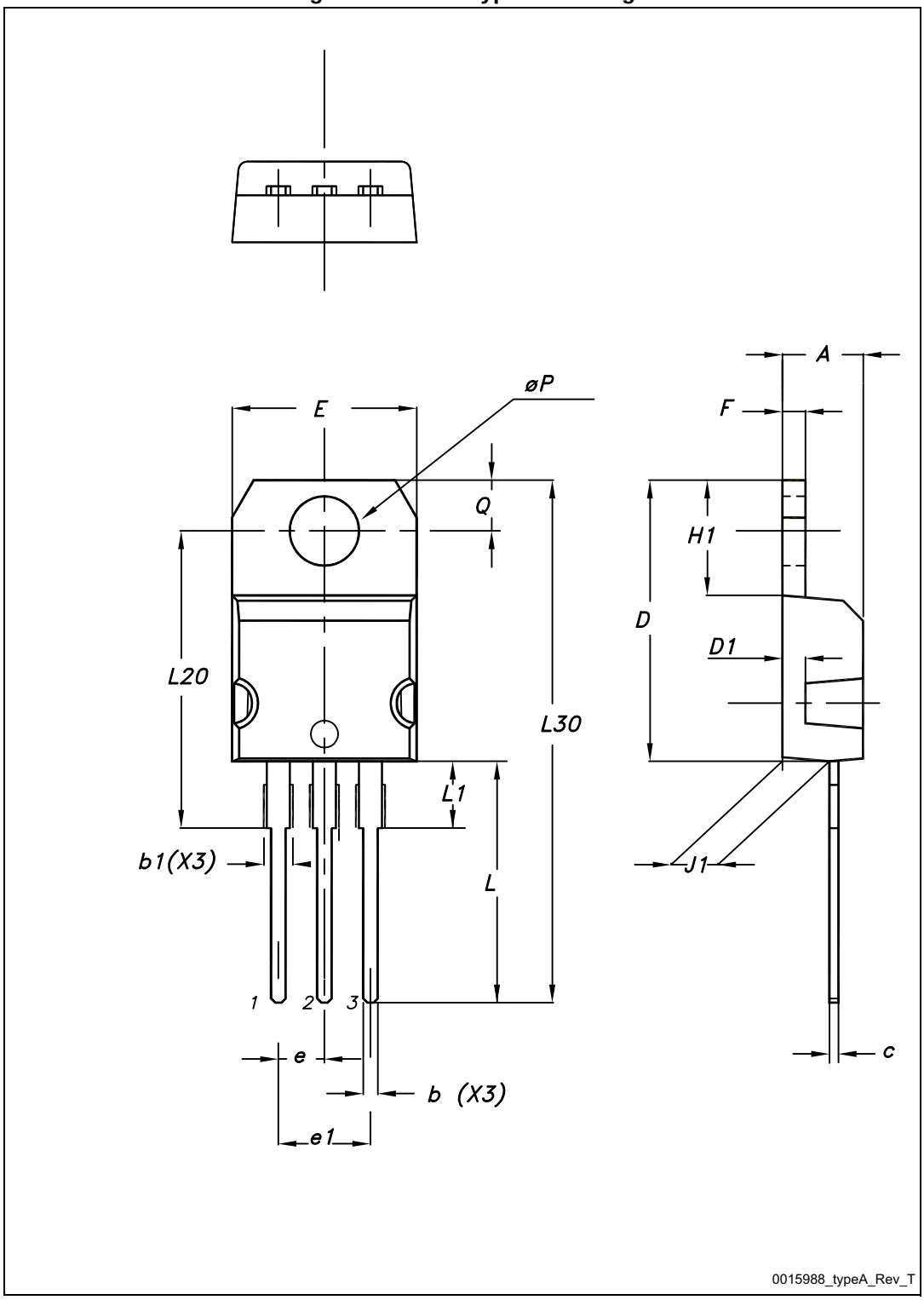
Table 8. TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		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		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
∅P	3.75		3.85
Q	2.65		2.95

Figure 8. TO-220 type A drawing



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
31-Jul-2013	1	First release.

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