

N-channel 30 V, 2.7 mΩ typ., 150 A, STripFET™ VI DeepGATE™ Power MOSFET in a TO-220 package

Datasheet – production data

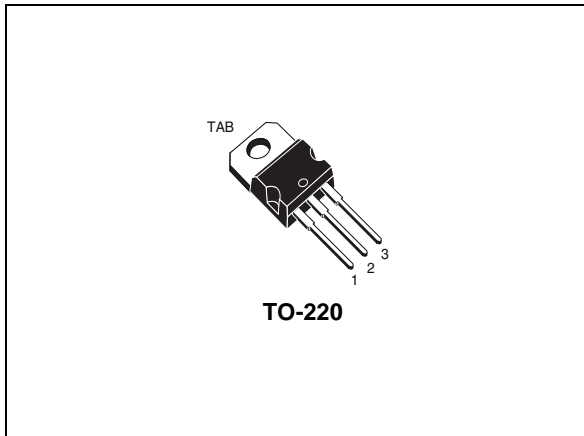
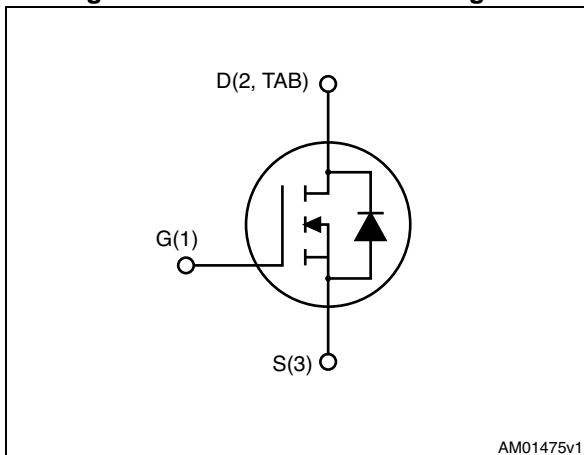


Figure 1. Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max.	I _D
STP105N3LL	30 V	3.5 mΩ	150 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	Packages	Packaging
STP105N3LL	105N3LL	TO-220	Tube

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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 $T_C = 25\text{ }^\circ\text{C}$ (silicon limited)	150	A
I_D	Continuous drain current at $T_C = 100\text{ }^\circ\text{C}$ (silicon limited)	105	A
I_D	Continuous drain current at $T_C = 25\text{ }^\circ\text{C}$ (package limited)	80	A
$I_{DM}^{(1)}$	Pulsed drain current	320	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	140	W
	Derating factor	0.9	W/ $^\circ\text{C}$
$E_{AS}^{(2)}$	Single pulse avalanche energy	150	mJ
T_{stg}	Storage temperature	-55 to 175	$^\circ\text{C}$
T_j	Max. operating junction temperature	175	$^\circ\text{C}$

1. Pulse width limited by safe operating area

2. Starting $T_j = 25\text{ }^\circ\text{C}$, $I_{AV} = 40\text{ A}$

Table 3. Thermal data

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

2 Electrical characteristics

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

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown Voltage	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0$	30			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 30\text{ V}$			1	μA
		$V_{DS} = 30\text{ V}$, $T_C = 125\text{ °C}$			10	μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$	1		2.5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10\text{ V}$, $I_D = 40\text{ A}$		2.7	3.5	m Ω
		$V_{GS} = 4.5\text{ V}$, $I_D = 40\text{ A}$		3.5	4.5	m Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	3500	-	pF
C_{oss}	Output capacitance		-	400	-	pF
C_{riss}	Reverse transfer capacitance		-	380	-	pF
Q_g	Total gate charge	$V_{DD} = 15\text{ V}$, $I_D = 80\text{ A}$	-	42	-	nC
Q_{gs}	Gate-source charge	$V_{GS} = 4.5\text{ V}$	-	9	-	nC
Q_{gd}	Gate-drain charge	<i>Figure 14</i>	-	18	-	nC
R_g	Gate input resistance	$f = 1\text{ MHz}$, 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	$V_{DD} = 15\text{ V}$, $I_D = 40\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 5\text{ V}$ <i>Figure 13</i>	-	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		-		80	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		320	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 40\text{ A}$, $V_{GS} = 0$	-		1.1	V
t_{rr}	Reverse recovery time	$I_{SD} = 80\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 24\text{ V}$ Figure 15	-	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%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

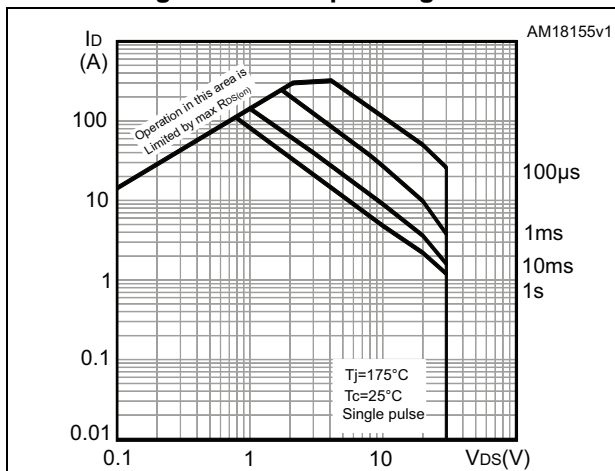


Figure 3. Thermal impedance

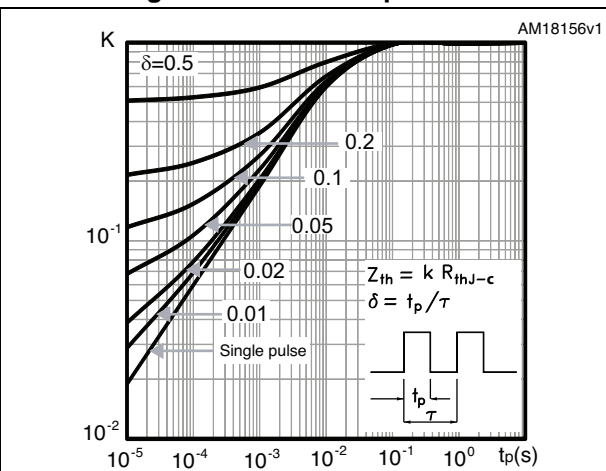


Figure 4. Output characteristics

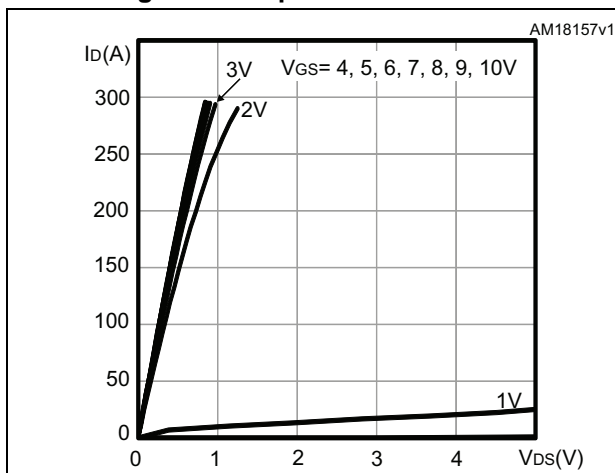


Figure 5. Transfer characteristics

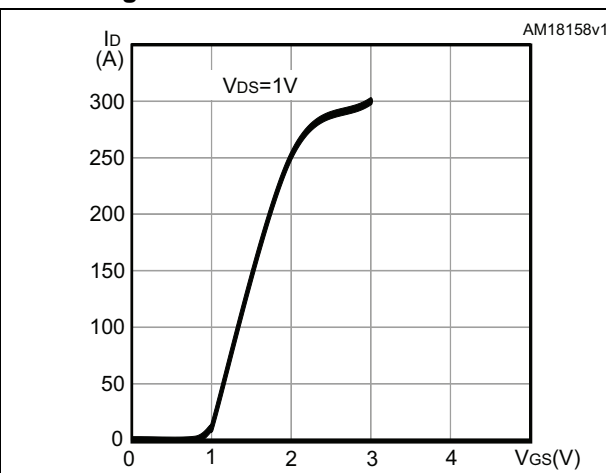


Figure 6. Gate charge vs gate-source voltage

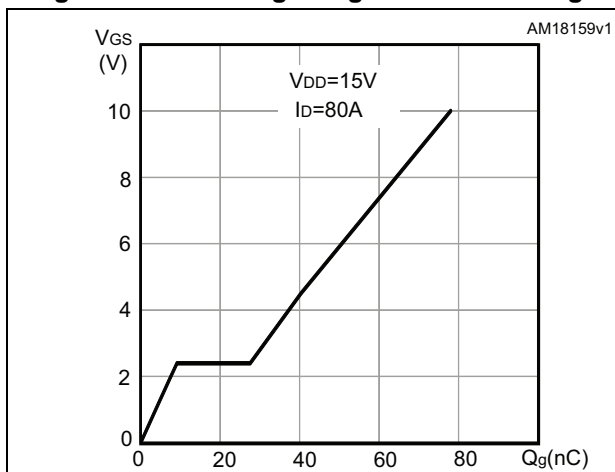


Figure 7. Static drain-source on-resistance

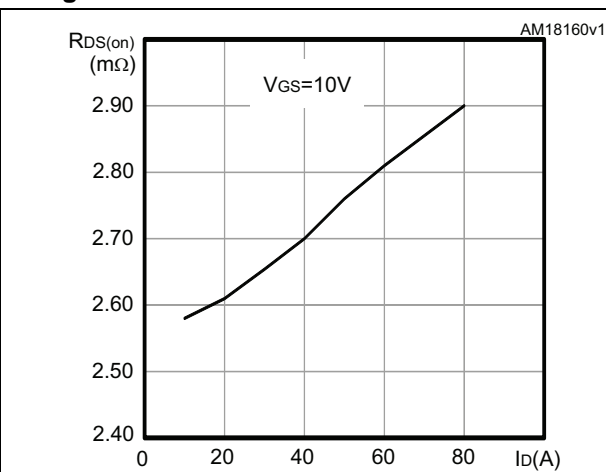


Figure 8. Capacitance variations

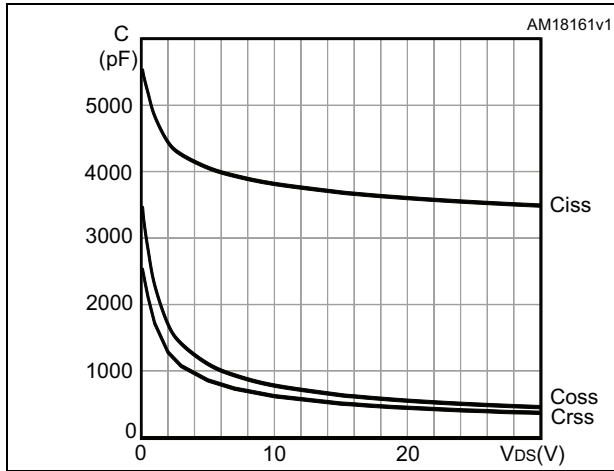


Figure 9. Normalized gate threshold voltage vs temperature

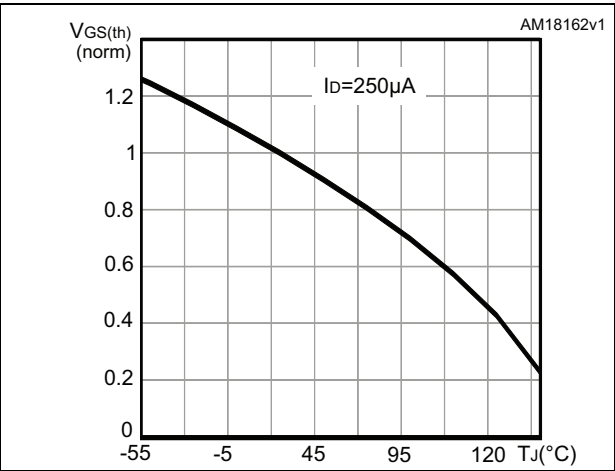


Figure 10. Normalized on-resistance vs temperature

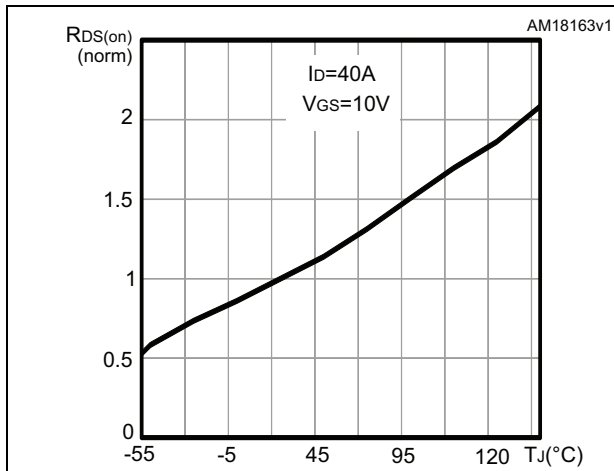


Figure 11. Normalized V(BR)DSS vs temperature

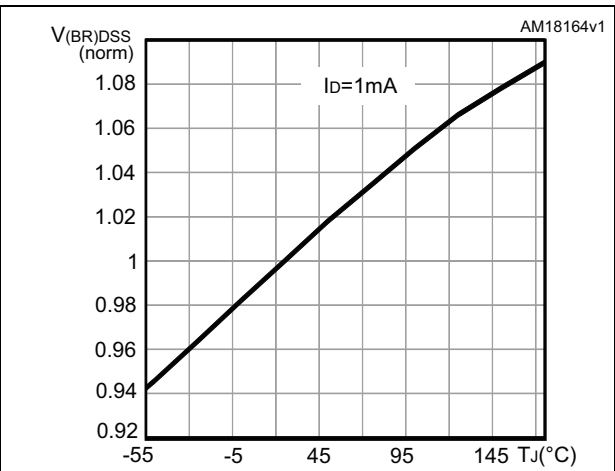
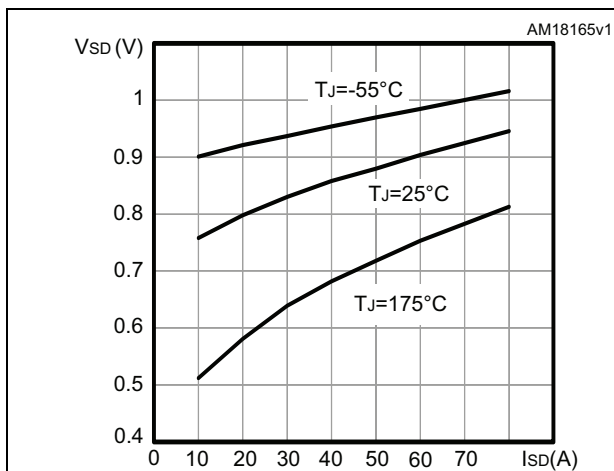


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

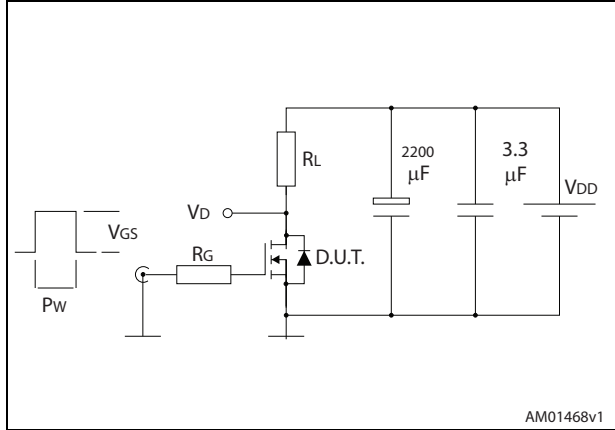


Figure 14. Gate charge test circuit

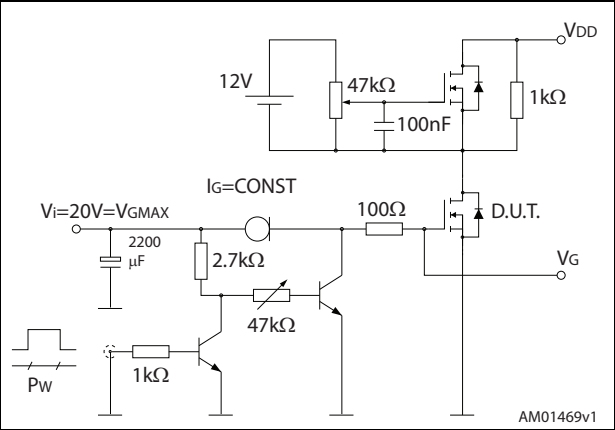


Figure 15. Test circuit for inductive load switching and diode recovery times

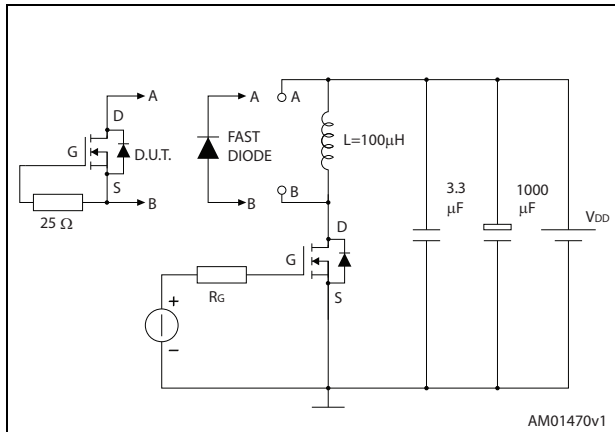


Figure 16. Unclamped inductive load test circuit

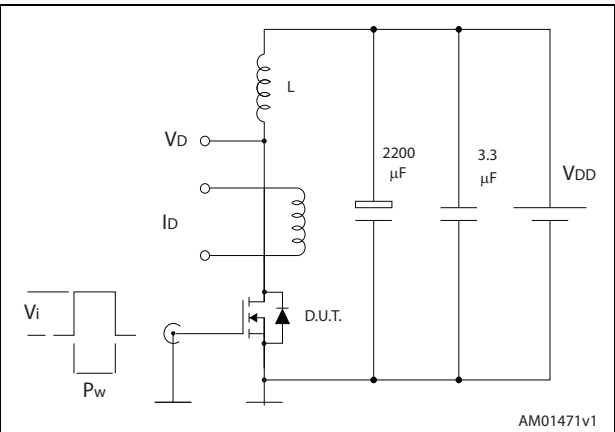


Figure 17. Unclamped inductive waveform

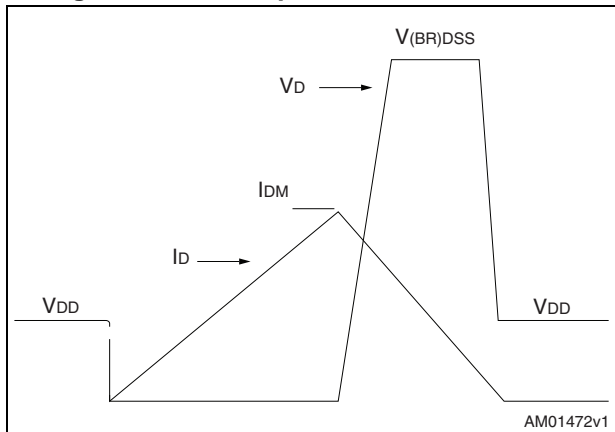
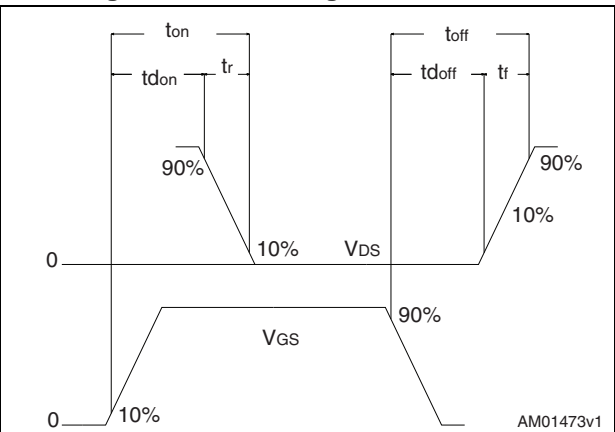


Figure 18. Switching time waveform



4 Package mechanical data

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Figure 19. TO-220 type A drawing

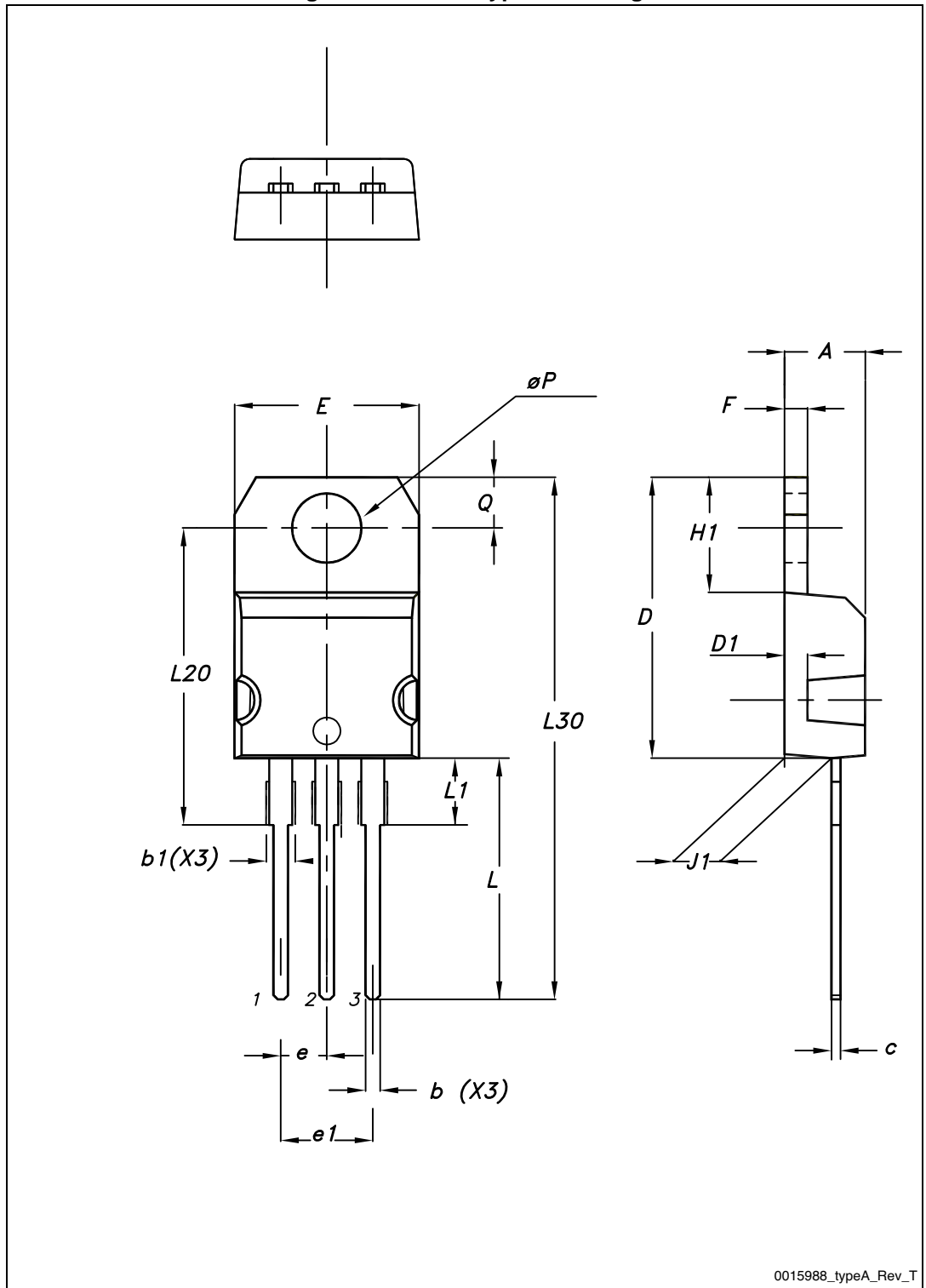


Table 8. TO-220 type A mechanical data

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	
ØP	3.75		3.85
Q	2.65		2.95

5 Revision history

Table 9. Document revision history

Date	Revision	Changes
13-Dec-2012	1	First release.
03-Apr-2014	2	– Added: Section 2.1: Electrical characteristics (curves) – Minor text changes

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