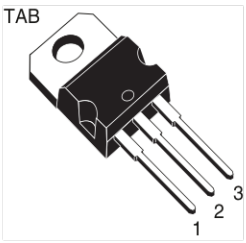
STP160N4LF6

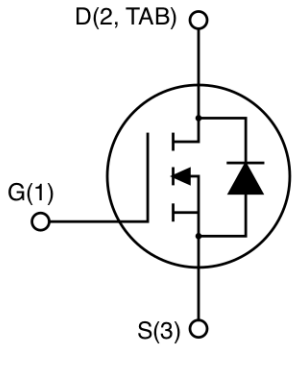
N-channel 40 V, 0.0021 mΩ typ., 120 A, STripFET™ VI DeepGATE™ Power MOSFET in a TO-220 package

Datasheet - production data



TO-220

Figure 1. Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max	I_D	P_{TOT}
STP160N4LF6	40 V	0.0029 Ω	120 A	150 W

- $R_{DS(on)}$ * Q_g industry benchmark
- Extremely low on-resistance $R_{DS(on)}$
- Logic level drive
- High avalanche ruggedness
- 100% avalanche tested

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
STP160N4LF6	160N4LF6	TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	40	V
V_{GS}	Gate-source voltage	± 20	V
I_D	Drain current (continuous) at T_C = 25 °C	120	A
I_D	Drain current (continuous) at T_C = 100 °C	100	A
I_{DM}(1)	Drain current (pulsed)	480	A
P_{TOT}	Total dissipation at T_C = 25 °C	150	W
	Derating factor	1	W/°C
I_{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_{jmax})	60	A
E_{AS}	Single pulse avalanche energy	323	mJ
T_{stg}	Storage temperature	-55 to 175	°C
T_j	Operating junction temperature		

1. Pulse width is limited by safe operating area

Table 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	1.0	°C/W
$R_{thj\text{-}a}$	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 (V_{GS}= 0)	I_D = 250 µA	40			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 20 V V_{DS} = 20 V, Tc = 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			V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 60 A		0.0022	0.0029	Ω
		V_{GS} = 5 V, I_D = 60 A		0.0024	0.0031	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 20 V, f=1 MHz, V_{GS} = 0 V	-	8130	-	pF
C_{oss}	Output capacitance		-	770	-	pF
C_{rss}	Reverse transfer capacitance		-	670	-	pF
Q_g	Total gate charge	V_{DD} = 20 V, I_D = 60 A V_{GS} = 10 V *(see Figure 14)*	-	181	-	nC
Q_{gs}	Gate-source charge		-	22	-	nC
Q_{gd}	Gate-drain charge		-	46	-	nC

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 20 V, I_D = 60 A, R_G = 4.7 Ω, V_{GS} = 10 V *(see Figure 15)*	-	20	-	ns
t_r	Rise time		-	131	-	ns
$t_{d(off)}$	Turn-off delay time		-	205	-	ns
t_f	Fall time		-	116		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} = 120 A, V_{GS} = 0	-		0.97	V
t_{rr}	Reverse recovery time	I_{SD} = 120 A, di/dt = 100 A/µs, V_{DD} = 32 V *(see Figure 17)*	-	57		ns
Q_{rr}	Reverse recovery charge		-	53		nC
I_{RRM}	Reverse recovery current		-	1.86		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

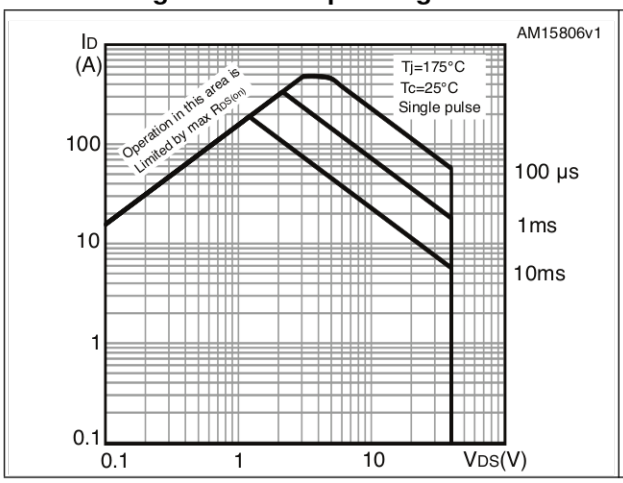


Figure 3. Thermal impedance

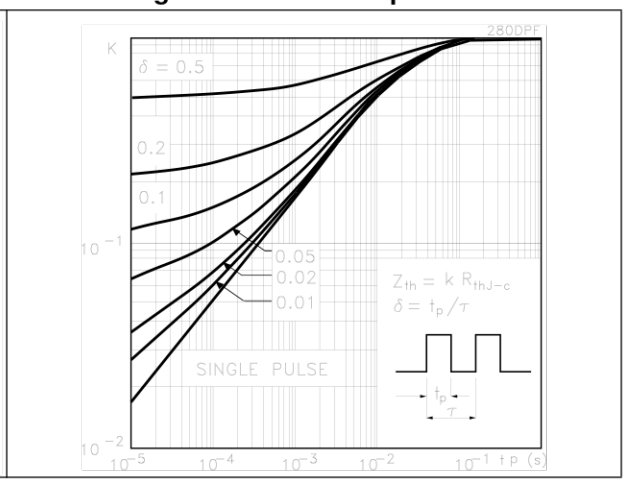


Figure 4. Output characteristics

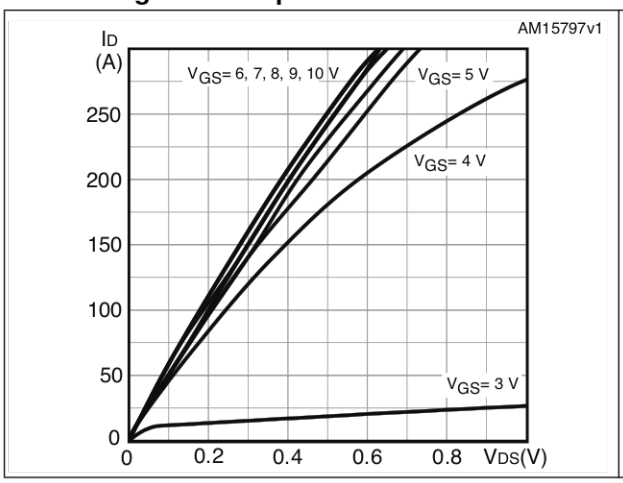


Figure 5. Transfer characteristics

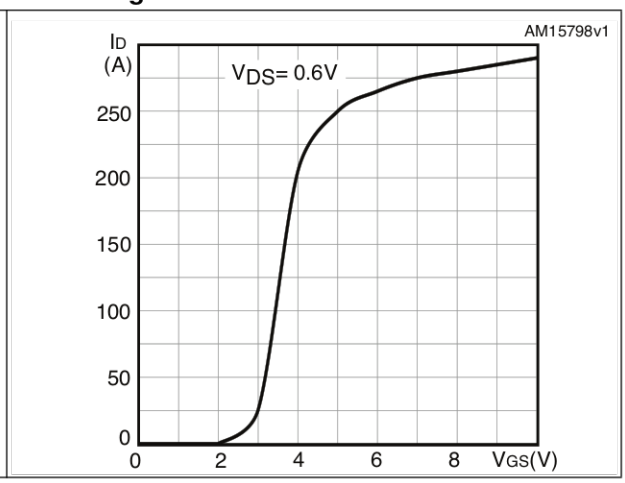


Figure 6. Gate charge vs gate-source voltage

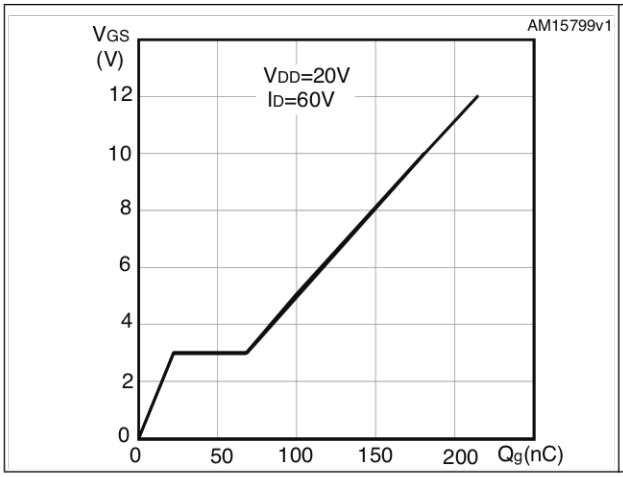


Figure 7. Static drain-source on-resistance

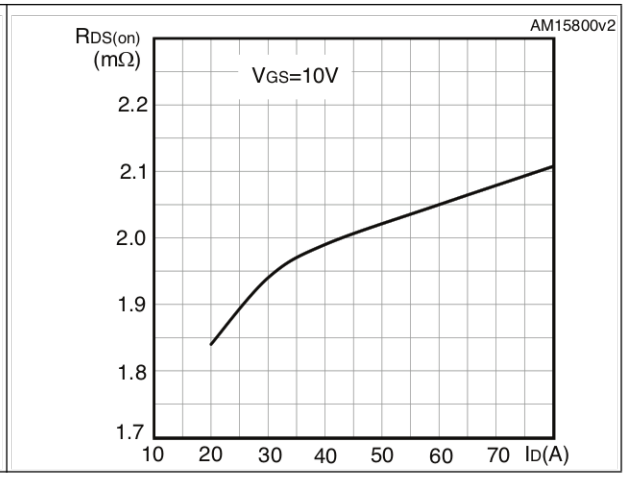


Figure 8. Capacitance variations

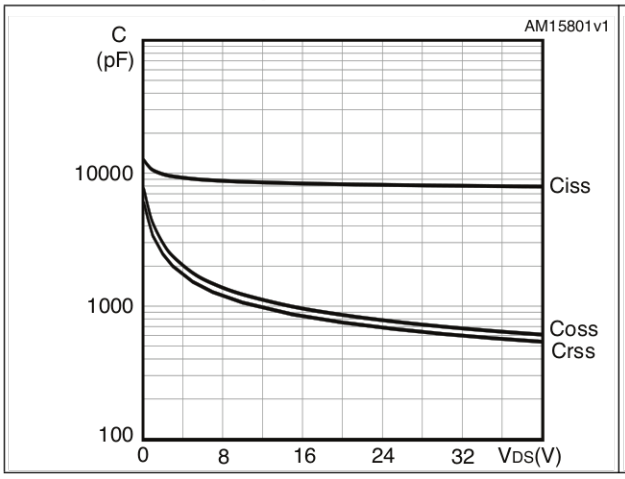


Figure 9. Normalized $V_{(BR)DSS}$ vs temperature

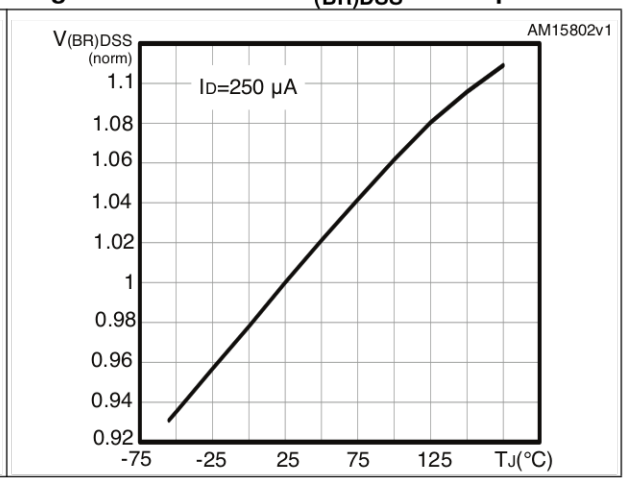


Figure 10. Normalized gate threshold voltage vs temperature

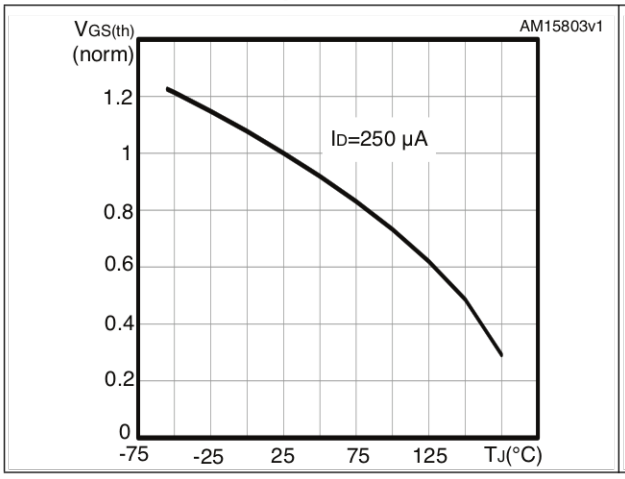


Figure 11. Normalized on-resistance vs temperature

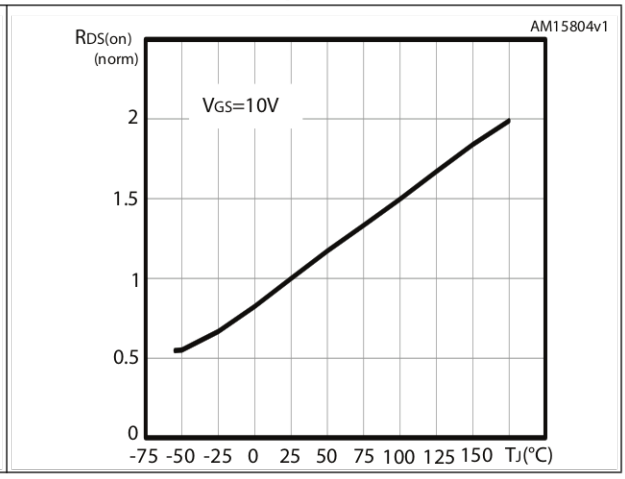
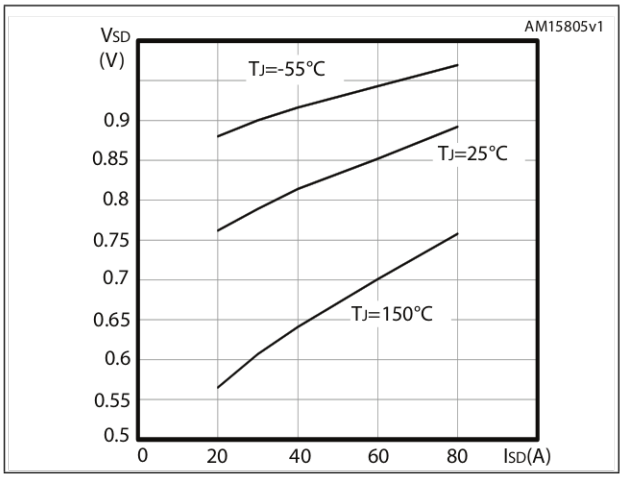


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

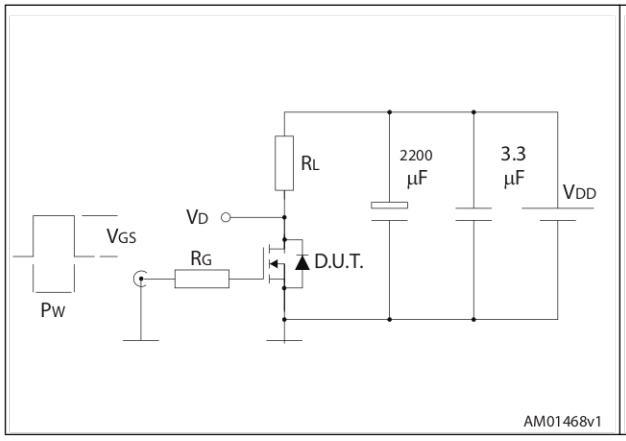


Figure 14. Gate charge test circuit

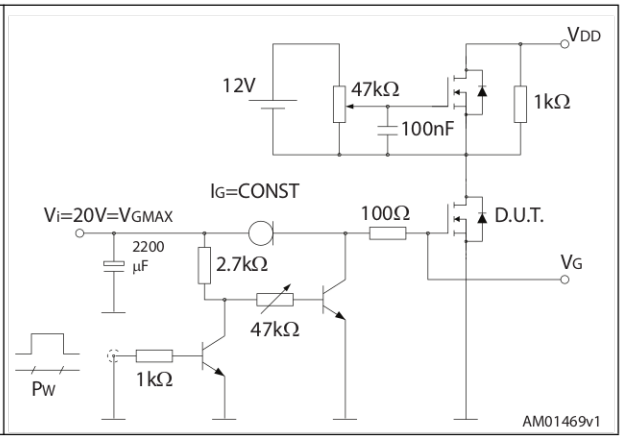


Figure 15. Test circuit for inductive load switching and diode recovery times

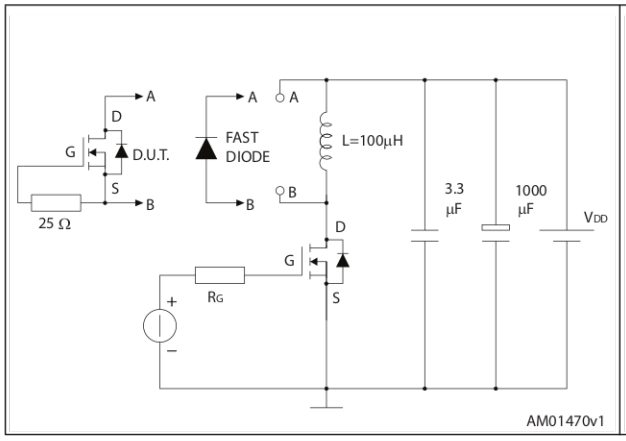


Figure 16. Unclamped inductive load test circuit

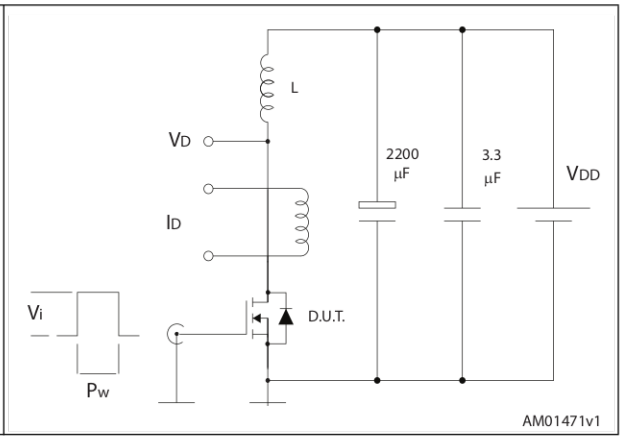


Figure 17. Unclamped inductive waveform

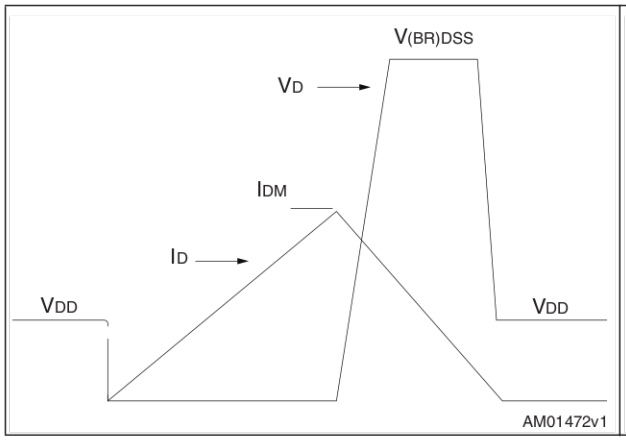


Figure 18. Switching time waveform

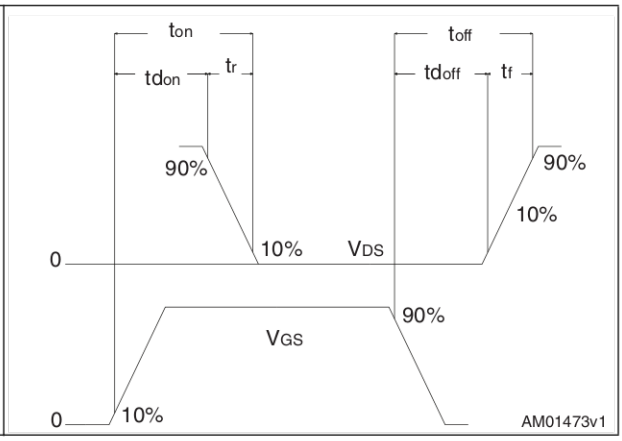
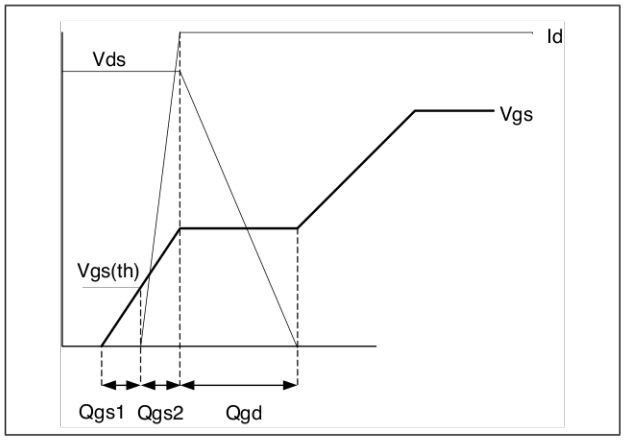


Figure 19. Gate charge waveform



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*. ECOPACK® is an ST trademark.

Figure 20. TO-220 type A drawing

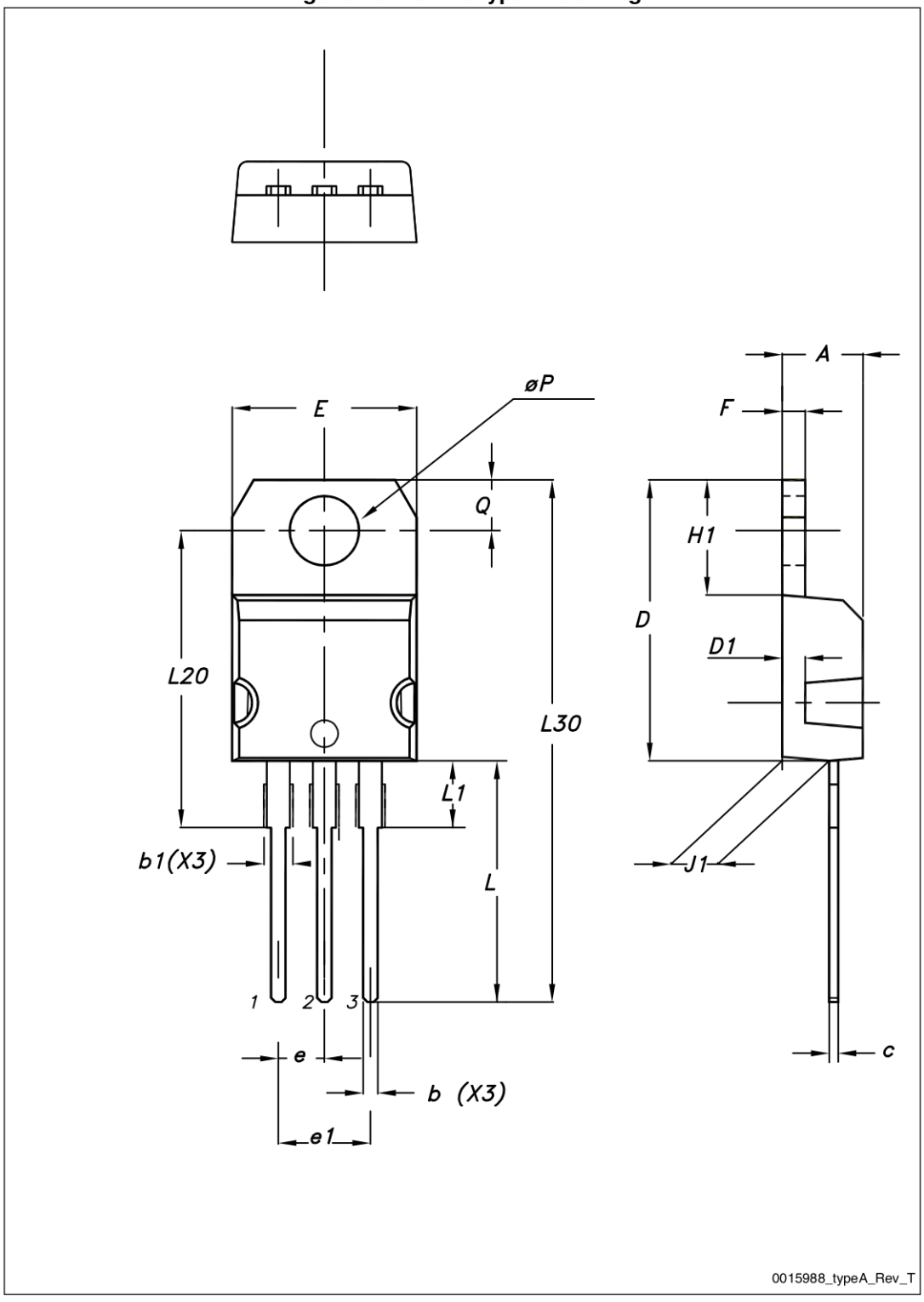


Table 8. TO-220 type A mechanical data

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	
∅P	3.75		3.85
Q	2.65		2.95

5 Revision history

Table 9. Document revision history

Date	Revision	Changes
24-Apr-2014	1	First release.

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