STP90N6F6

N-channel 60 V, 0.0059 Ω typ., 84 A STripFET™ VI DeepGATE™ Power MOSFET in a TO-220 package

Datasheet - production data

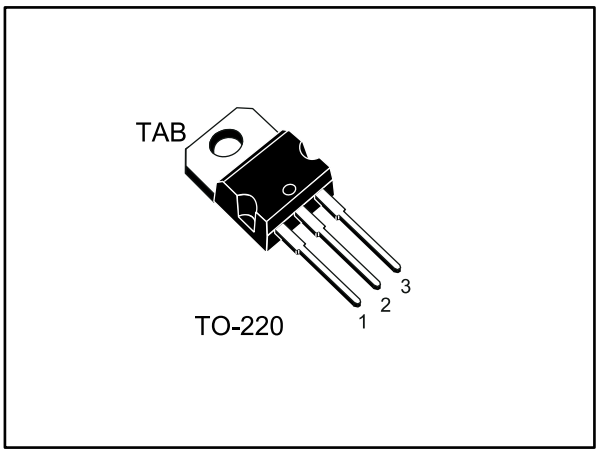
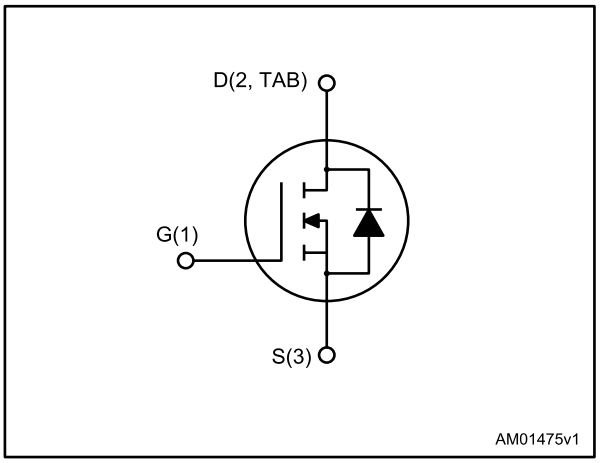


Figure 1: Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$max.	I_D	P_{TOT}
STP90N6F6	60 V	0.0068 Ω	84 A	136 W

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

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
STP90N6F6	90N6F6	TO-220	Tube

Contents

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	60	V
V_{DS}	Drain-source voltage	± 20	V
I_D	Drain current (continuous) at T_c = 25 °C	84	A
I_D	Drain current (continuous) at T_c = 100 °C	55	A
I_{DM} (1)	Drain current (pulsed)	336	A
P_{TOT}	Total dissipation at T_c = 25 °C	136	W
T_J	Operating junction temperature	-55 to 175	°C
T_{stg}	Storage temperature	-55 to 175	°C

Notes:

(1)Pulse width is limited by safe operating area.

Table 3: Thermal data

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

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AV}	Avalanche current, repetitive or not-repetitive (pulse width limited by maximum junction temperature)	38.5	A
E_{AS}	Single pulse avalanche energy (T_J = 25 °C, I_D = I_{AV}, V_{DD} = 43 V)	152	mJ

2 Electrical characteristics

(T_J = 25 °C unless otherwise specified)

Table 5: On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 250 µA, V_{GS} = 0	60			V
I_{DSS}	Zero gate voltage drain current	V_{DS} = 60 V, V_{GS} = 0			10	µA
		V_{DS} = 60 V, V_{GS} = 0, T_J =125 °C			100	µA
I_{GSS}	Gate-body leakage current	V_{GS} = ± 20 V, V_{DS} = 0			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2		4	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 38.5 A		0.0059	0.0068	Ω

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0	-	4295	-	pF
C_{oss}	Output capacitance		-	292	-	pF
C_{rss}	Reverse transfer capacitance		-	190	-	pF
Q_g	Total gate charge	V_{DD} = 30 V, I_D = 84 A, V_{GS} = 10 V	-	74.9	-	nC
Q_{gs}	Gate-source charge		-	19	-	nC
Q_{gd}	Gate-drain charge		-	18.3	-	nC
R_g	Intrinsic gate resistance	f = 1 MHz open drain	-	2.2	-	Ω

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 30 V, I_D = 77 A R_G = 4.7 Ω, V_{GS}= 10 V	-	22	-	ns
t_r	Rise time		-	42	-	ns
$t_{d(off)}$	Turn-off-delay time		-	73	-	ns
t_f	Fall time		-	16	-	ns

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		77	A
I_{SDM} (1)	Source-drain current (pulsed)		-		308	A
V_{SD} (2)	Forward on voltage	I_{SD} = 77 A, V_{GS} = 0	-		1.3	V
t_{rr}	Reverse recovery time	I_{SD} = 77 A, V_{DD} = 48 V di/dt = 100 A/µs, T_j = 25 °C	-	49		ns
Q_{rr}	Reverse recovery charge		-	8.5		nC
I_{RRM}	Reverse recovery current		-	0.3		A

Notes:

(1)Pulse width is limited by safe operating area.

(2)Pulse test: pulse duration = 300 µs, duty cycle 1.5%.

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

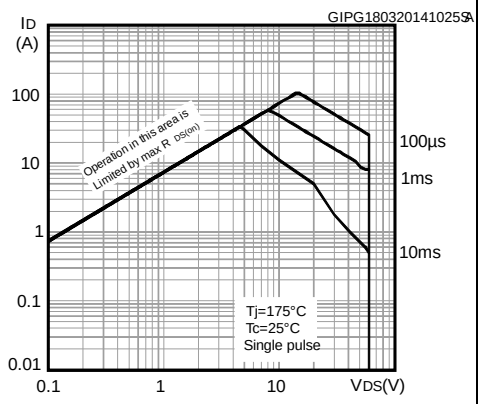


Figure 3: Thermal impedance

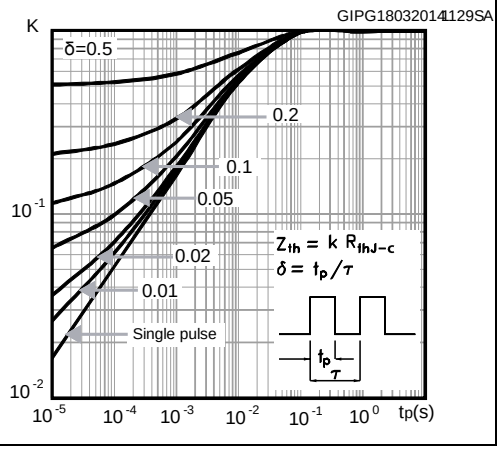


Figure 4: Output characteristics

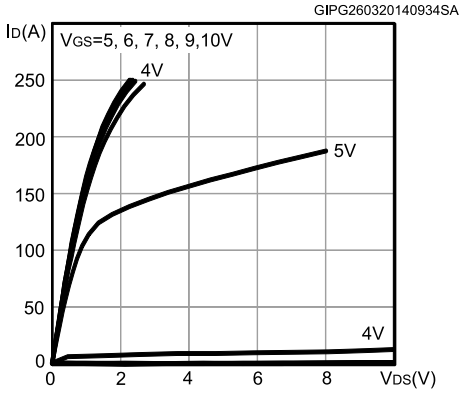


Figure 5: Transfer characteristics

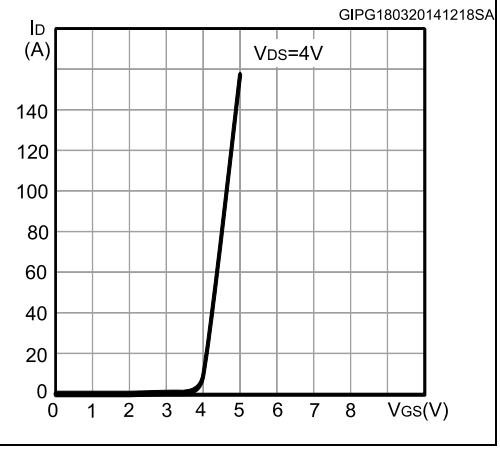


Figure 6: Gate charge vs gate-source voltage

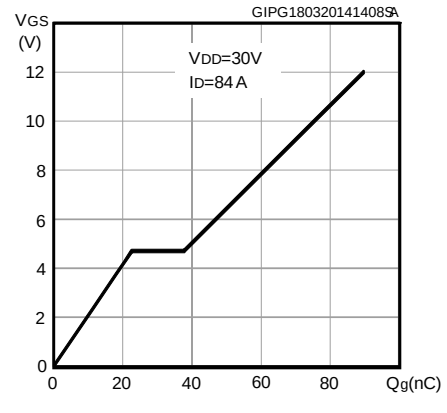


Figure 7: Static drain-source on-resistance

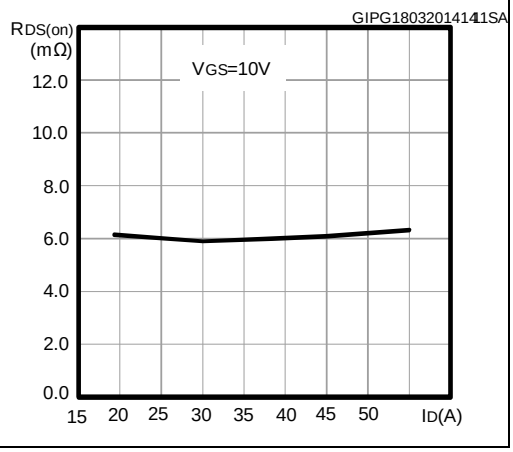


Figure 8: Capacitance variations

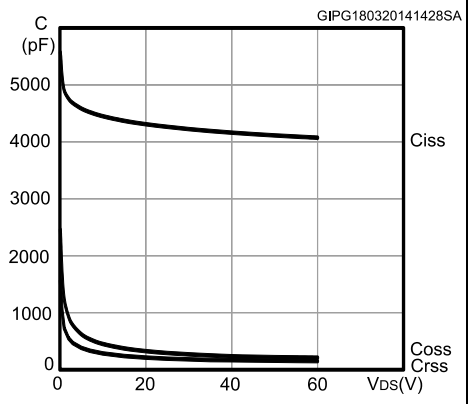


Figure 9: Normalized gate threshold voltage vs temperature

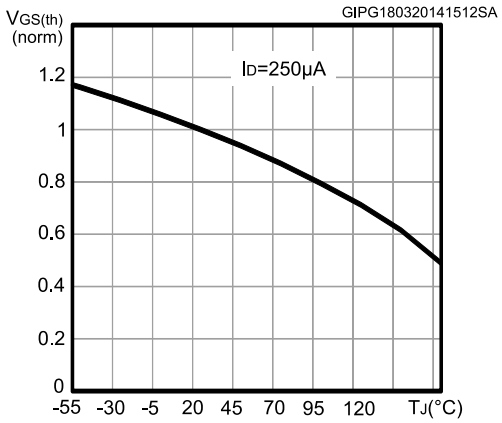


Figure 10: Normalized on-resistance vs temperature

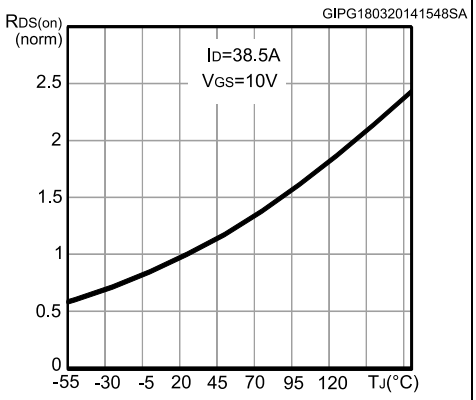


Figure 11: Normalized V(BR)DSS vs temperature

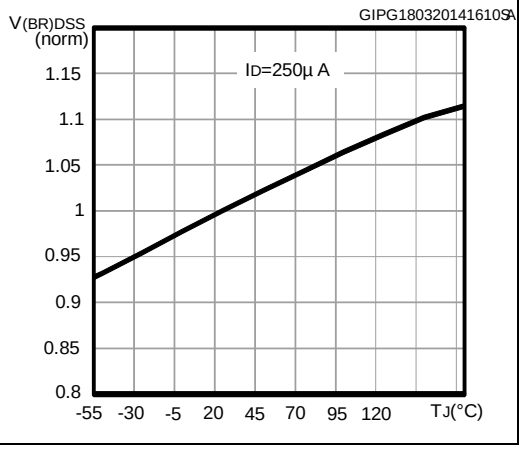
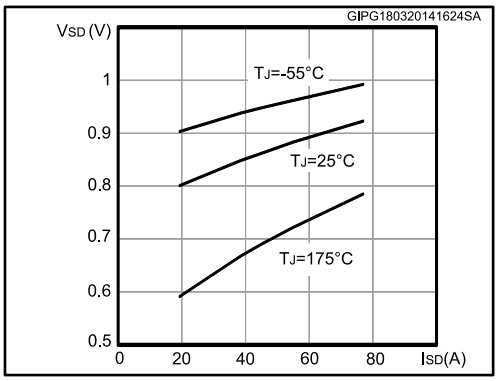


Figure 12: Source-drain diode forward characteristics



3 Test circuits

Figure 13: Switching times test circuit for resistive load

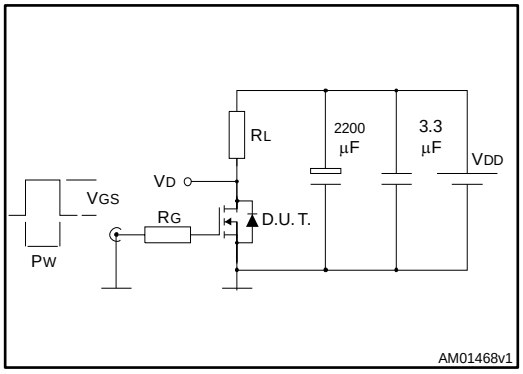


Figure 14: Gate charge test circuit

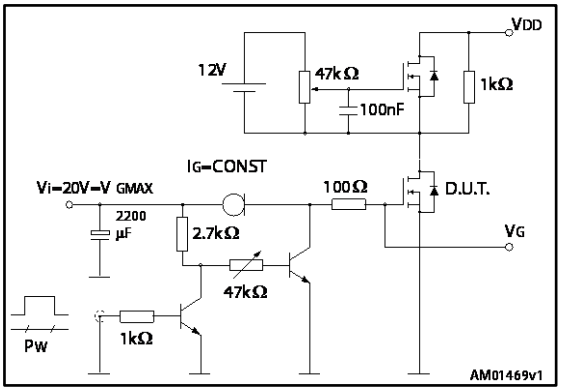


Figure 15: Test circuit for inductive load switching and diode recovery times

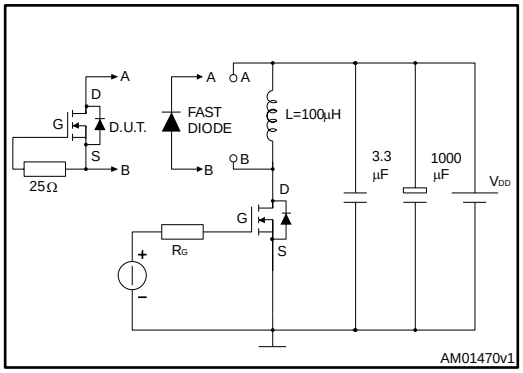


Figure 16: Unclamped inductive load test circuit

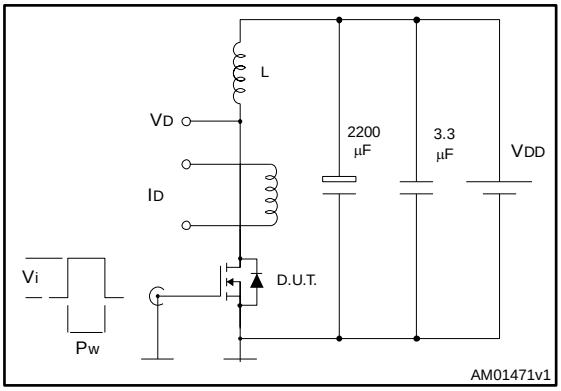


Figure 17: Unclamped inductive waveform

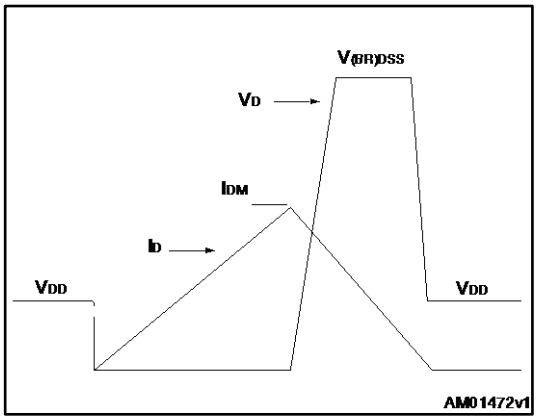
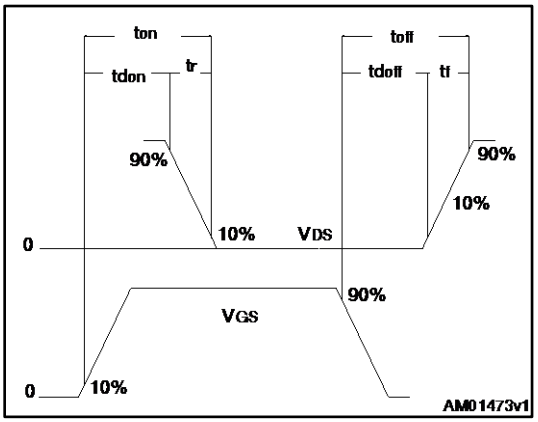


Figure 18: Switching time waveform



4 Package mechanical data

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 mechanical data

Figure 19: TO-220 type A drawings

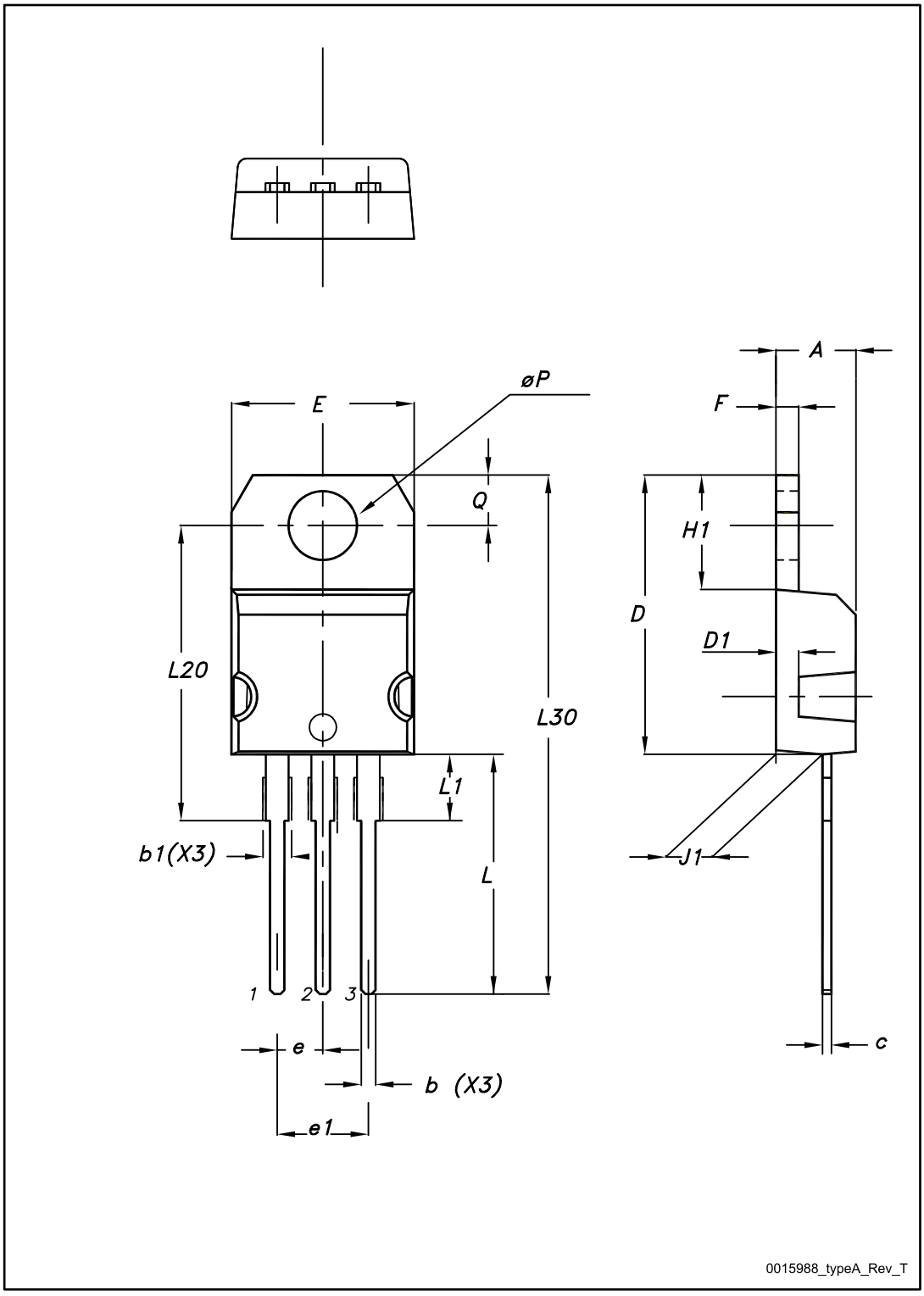


Table 9: TO-220 type A mechanical data

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	
ÆP	3.75		3.85
Q	2.65		2.95

5 Revision history

Table 10: Document revision history

Date	Revision	Changes
03-Sep-2013	1	Initial release.
03-Apr-2014	2	Document status promoted from preliminary to production data. Added new section curves. Minor text changes.

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