

## N-channel 40 V, 3.8 mΩ typ., 80 A STripFET™ F6 Power MOSFET in a TO-220 package

Datasheet - production data

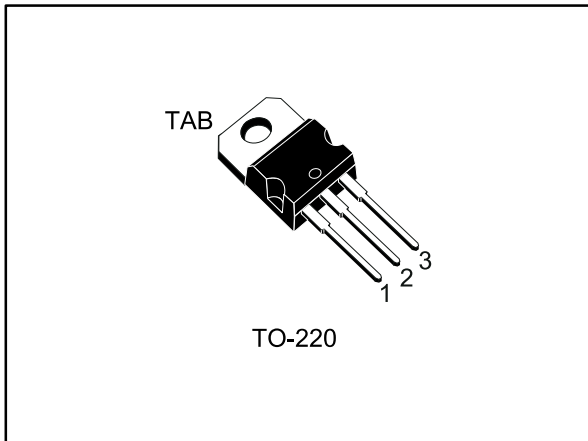
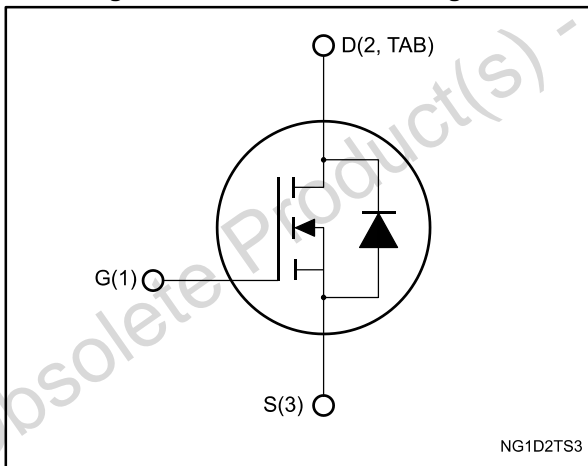


Figure 1: Internal schematic diagram



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>	P <sub>TOT</sub>
STP140N4F6	40 V	4.3 mΩ	80 A	168 W

- Very low on-resistance
- Very low gate charge
- High avalanche ruggedness
- Low gate drive power loss

### Applications

- Switching applications
- Power tools

### Description

This device is an N-channel Power MOSFET developed using the STripFET™ F6 technology with a new trench gate structure. The resulting Power MOSFET exhibits very low R<sub>DS(on)</sub> in all packages.

Table 1: Device summary

Order code	Marking	Package	Packing
STP140N4F6	140N4F6	TO-220	Tube

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# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage	40	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_{case} = 25\text{ }^\circ\text{C}$	80	A
	Drain current (continuous) at $T_{case} = 100\text{ }^\circ\text{C}$	80	
$I_{DM}^{(1)}$	Drain current (pulsed)	320	A
$P_{TOT}$	Total dissipation at $T_{case} = 25\text{ }^\circ\text{C}$	168	W
$T_{stg}$	Storage temperature	-55 to 175	$^\circ\text{C}$
$T_j$	Operating junction temperature		

**Notes:**

(1) Limited by package

**Table 3: Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.89	$^\circ\text{C/W}$
$R_{thj-amb}$	Thermal resistance junction-amb	62.5	

**Table 4: Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}^{(1)}$	Avalanche current, repetitive or not repetitive	40	A
$E_{AS}^{(2)}$	Single pulse avalanche energy	240	mJ

**Notes:**

(1) Pulse width limited by  $T_{jmax}$ .

(2) starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = I_{AR}$ ,  $V_{DD} = 25\text{ V}$ .

## 2 Electrical characteristics

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

**Table 5: Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(\text{BR})\text{DSS}}$	Drain-source breakdown voltage	$V_{\text{GS}} = 0\text{ V}$ , $I_{\text{D}} = 250\text{ }\mu\text{A}$	40			V
$I_{\text{DSS}}$	Zero gate voltage drain current	$V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 20\text{ V}$			1	$\mu\text{A}$
		$V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 20\text{ V}$ , $T_{\text{case}} = 125\text{ °C}$			10	
$I_{\text{GSS}}$	Gate-body leakage current	$V_{\text{DS}} = 0\text{ V}$ , $V_{\text{GS}} = \pm 20\text{ V}$			$\pm 100$	nA
$V_{\text{GS(th)}}$	Gate threshold voltage	$V_{\text{DS}} = V_{\text{GS}}$ , $I_{\text{D}} = 250\text{ }\mu\text{A}$	2		4	V
$R_{\text{DS(on)}}$	Static drain-source on-resistance	$V_{\text{GS}} = 10\text{ V}$ , $I_{\text{D}} = 40\text{ A}$		3.8	4.3	m $\Omega$

**Table 6: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{\text{ISS}}$	Input capacitance	$V_{\text{DS}} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{\text{GS}} = 0\text{ V}$	-	4260	-	$\mu\text{F}$
$C_{\text{OSS}}$	Output capacitance		-	635	-	
$C_{\text{RSS}}$	Reverse transfer capacitance		-	310	-	
$Q_{\text{g}}$	Total gate charge	$V_{\text{DD}} = 20\text{ V}$ , $I_{\text{D}} = 80\text{ A}$ , $V_{\text{GS}} = 10\text{ V}$ (see <a href="#">Figure 15: "Gate charge test circuit"</a> )	-	70	-	nC
$Q_{\text{gs}}$	Gate-source charge		-	20	-	
$Q_{\text{gd}}$	Gate-drain charge		-	18	-	
$R_{\text{G}}$	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	1.3	-	$\Omega$

**Table 7: Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{\text{d(on)}}$	Turn-on delay time	$V_{\text{DD}} = 20\text{ V}$ , $I_{\text{D}} = 40\text{ A}$ $R_{\text{G}} = 4.7\text{ }\Omega$ , $V_{\text{GS}} = 10\text{ V}$ (see <a href="#">Figure 14: "Switching times test circuit for resistive load"</a> and <a href="#">Figure 19: "Switching time waveform"</a> )	-	20	-	ns
$t_{\text{r}}$	Rise time		-	63	-	
$t_{\text{d(off)}}$	Turn-off delay time		-	58	-	
$t_{\text{f}}$	Fall time		-	20	-	

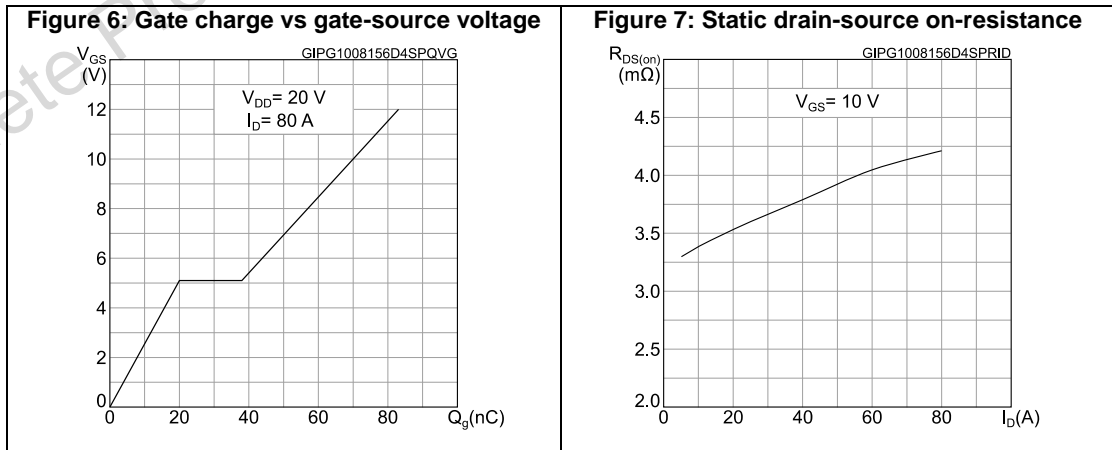
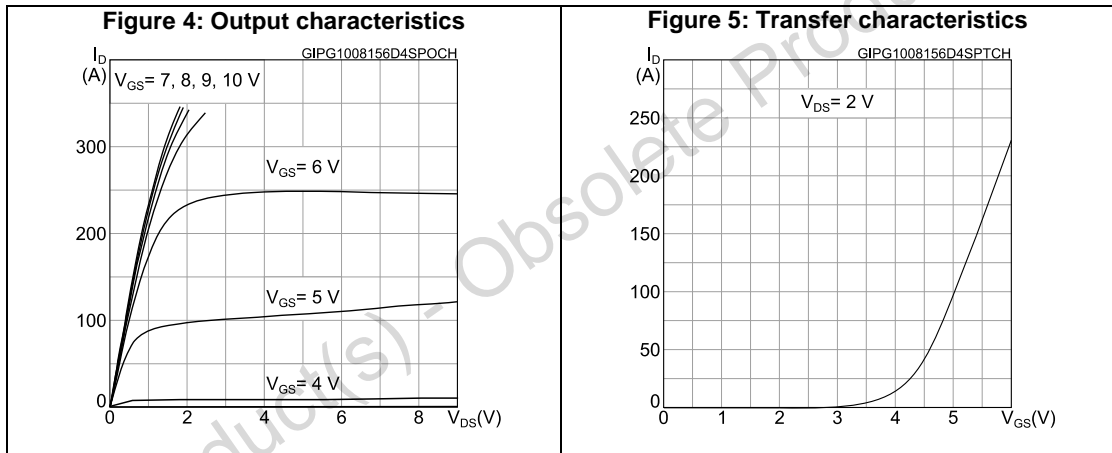
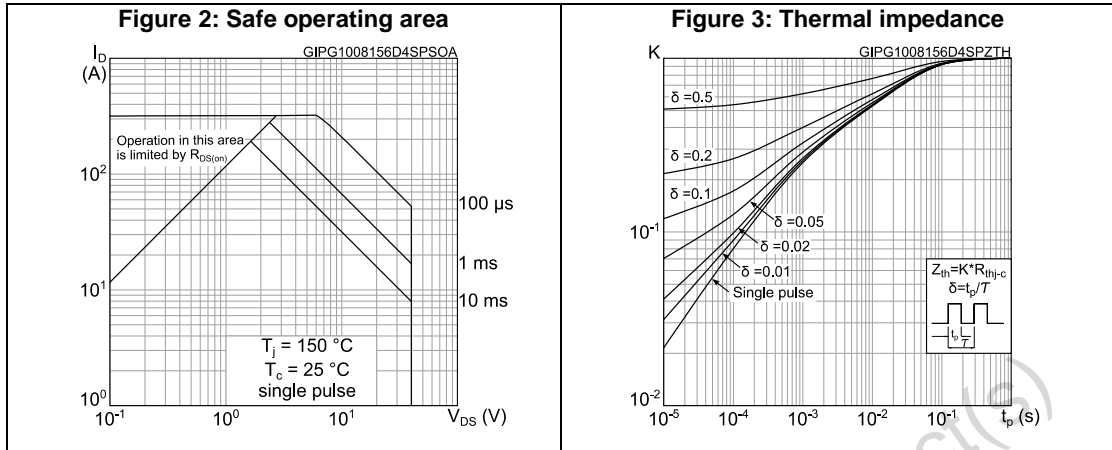
Table 8: Source-drain diode

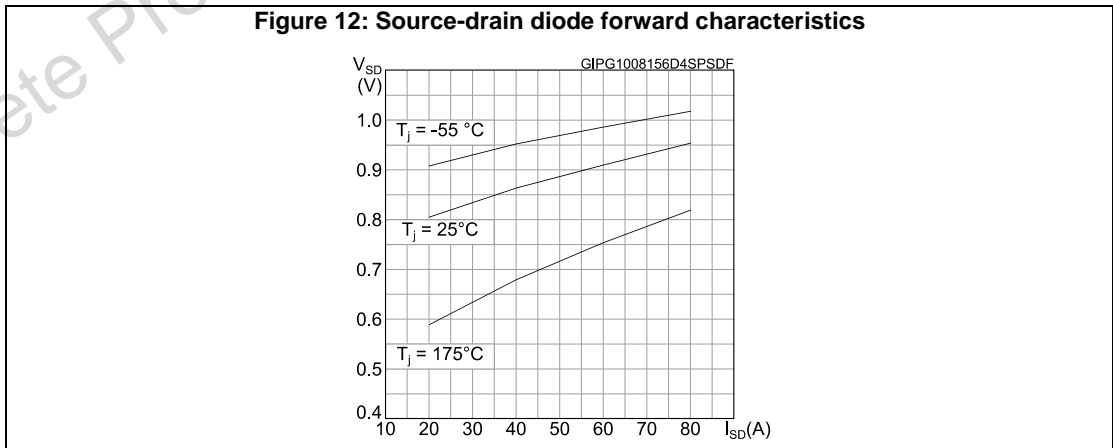
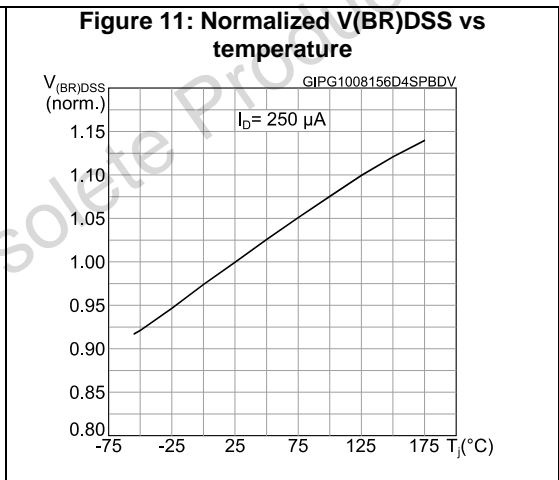
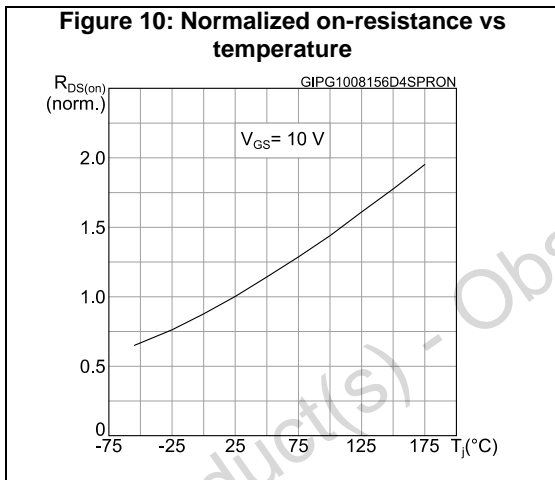
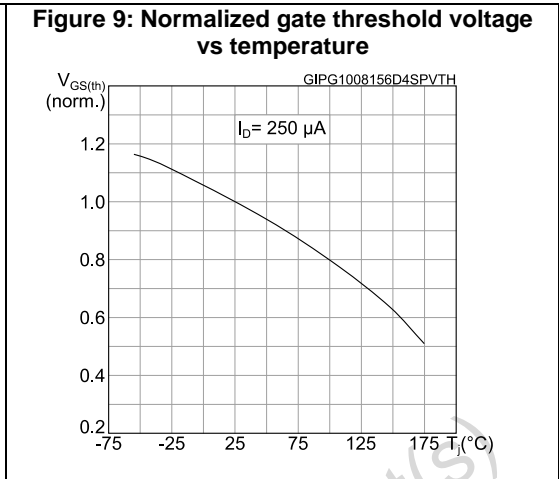
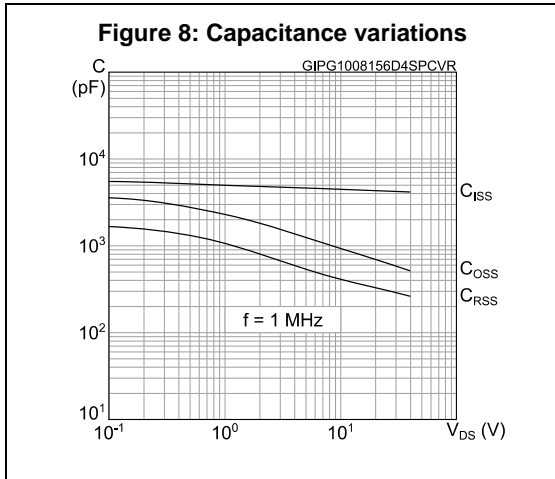
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		80	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		320	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0 \text{ V}$ , $I_{SD} = 40 \text{ A}$	-		1.3	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 80 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ , $V_{DD} = 30 \text{ V}$ (see <a href="#">Figure 16: "Test circuit for inductive load switching and diode recovery times"</a> )	-	41		ns
$Q_{rr}$	Reverse recovery charge		-	58		nC
$I_{RRM}$	Reverse recovery current		-	2.8		A

**Notes:**

- (1) Pulse width is limited by safe operating area.  
(2) Pulse test: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

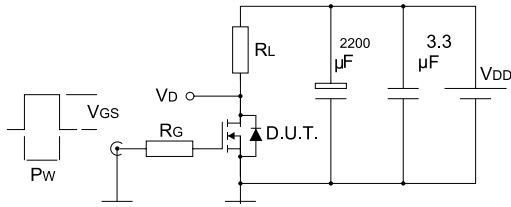
## 2.1 Electrical characteristics (curves)





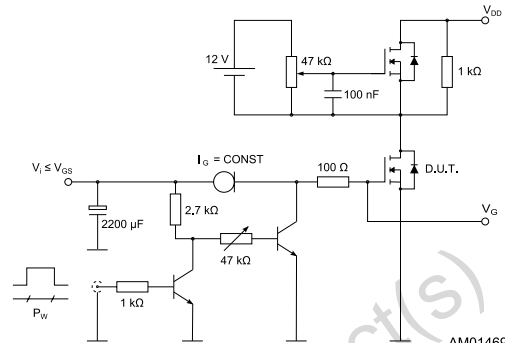
### 3 Test circuits

**Figure 13: Switching times test circuit for resistive load**



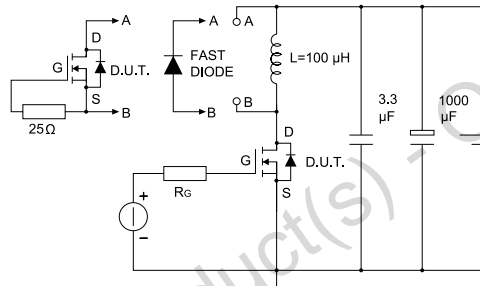
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**Figure 14: Gate charge test circuit**



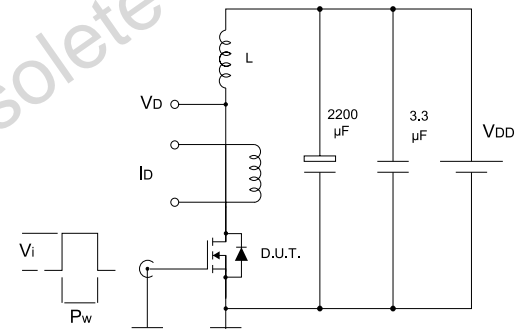
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**Figure 15: Test circuit for inductive load switching and diode recovery times**



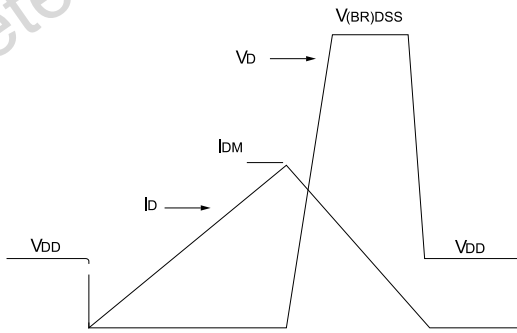
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**Figure 16: Unclamped inductive load test circuit**



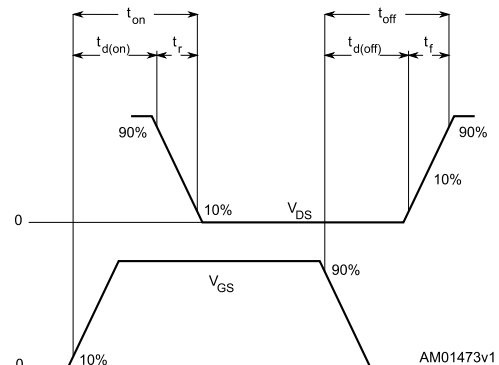
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**Figure 17: Unclamped inductive waveform**



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**Figure 18: Switching time waveform**



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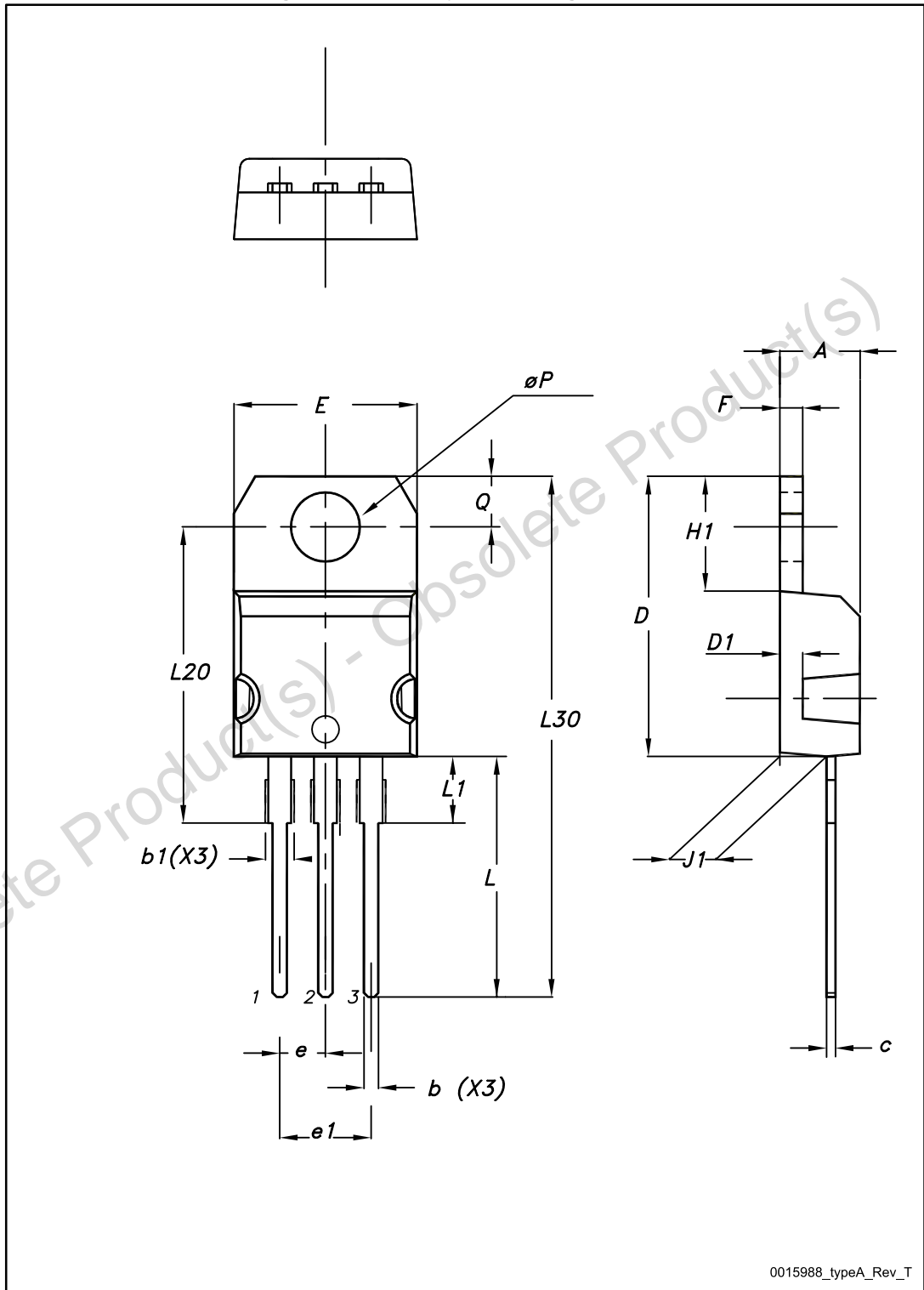
## 4 Package information

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](http://www.st.com). ECOPACK® is an ST trademark.

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### 4.1 TO-220 type A package information

Figure 19: TO-220 type A package outline



0015988\_typeA\_Rev\_T

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	
øP	3.75		3.85
Q	2.65		2.95

## 5 Revision history

Table 10: Document revision history

Date	Revision	Changes
18-Aug-2015	1	Initial version

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