STP45NF06

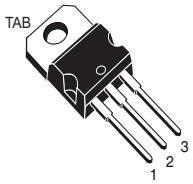
N-channel 60 V, 0.22 Ω typ., 38 A, STripFET™ II Power MOSFET in a TO-220 package

Datasheet – production data

Features

Order code	V_{DS}	$R_{DS(on)}$	I_D
STP45NF06	60 V	0.028 Ω	38 A

- Typical $R_{DS(on)}$ = 0.022 Ω
- Exceptional dv/dt capability
- 100% avalanche tested
- Standard threshold drive



TO-220

Applications

- Switching application

Description

This Power MOSFET has been developed using STMicroelectronics' unique STripFET process, which is specifically designed to minimize input capacitance and gate charge. This renders the device suitable for use as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer applications, and applications with low gate charge driving requirements.

Figure 1. Internal schematic diagram

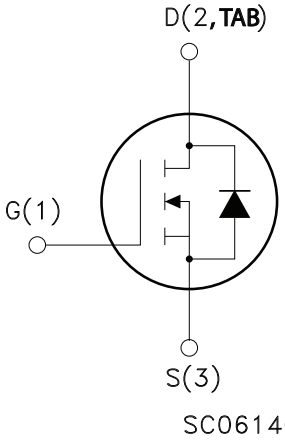


Table 1. Device summary

Order code	Marking	Package	Packaging
STP45NF06	45NF06	TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage	60	V
V_{DGR}	Drain-gate voltage (R_{GS}=20 kΩ)	60	V
V_{GS}	Gate-source voltage	± 20	V
I_D	Drain current (continuous) at T_C = 25 °C	38	A
I_D	Drain current (continuous) at T_C = 100 °C	26	A
I_{DM} (1)	Drain current (pulsed)	152	A
P_{TOT}	Total dissipation at T_C = 25 °C	80	W
	Derating factor	0.53	W/°C
dv/dt (2)	Peak diode recovery voltage slope	7	V/ns
T_{stg}	Storage temperature	- 65 to 175	°C
T_j	Max. operating junction temperature	175	°C

1. Pulse width limited by safe operating area
2. I_{SD} ≤ 38 A, di/dt ≤300 A/µs; $V_{DS(peak)} < V_{(BR)DSS}$, V_{DD}=80 % $V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	1.88	°C/W
$R_{thj\text{-}amb}$ (1)	Thermal resistance junction-ambient max	35	°C/W

1. When mounted on 1 inch² FR-4, 2 Oz copper board.

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetetive or not repetetive (pulse width limited by T_{jmax})	38	A
E_{AS}	Single pulse avalanche energy (starting T_J = 25 °C, I_D= I_{AR}; V_{DD}=50 V)	135	mJ

2 Electrical characteristics

(T_C = 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 mA, V_{GS} = 0	60			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 60 V V_{DS} = 60 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	2	3	4	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D = 19 A		0.022	0.028	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward trasconductance	V_{DS}>$I_{D(on)}$*$R_{DS(on)max}$, I_D=19 A	-	24		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0	-	1730 215 63		pF pF pF
Q_g Q_{gs} Q_{gs}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 48 V, I_D = 38 A, V_{GS} = 10 V	-	43 9 15	58	ns ns ns

1. Pulsed: pulse duration = 300 µs, duty cycle 1.5%

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Voltage rise time	V_{DD} = 30 V, I_D = 19 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 14*)	-	20 100	-	ns ns
$t_{d(off)}$ t_f	Turn-off delay time Fall time		-	50 20	-	ns ns
$t_{d(off)}$ t_f t_c	Off-voltage rise time Fall time Cross-over time	V_{clamp} = 48 V, I_D = 38 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 16*)	-	45 42 60	-	ns ns ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)		-		38 152	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 38 A, V_{GS} = 0	-		1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 38 A, di/dt = 100 A/µs V_{DD} = 100 V, T_j = 150 °C (see *Figure 16*)	-	95 260 5.5		ns µC A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

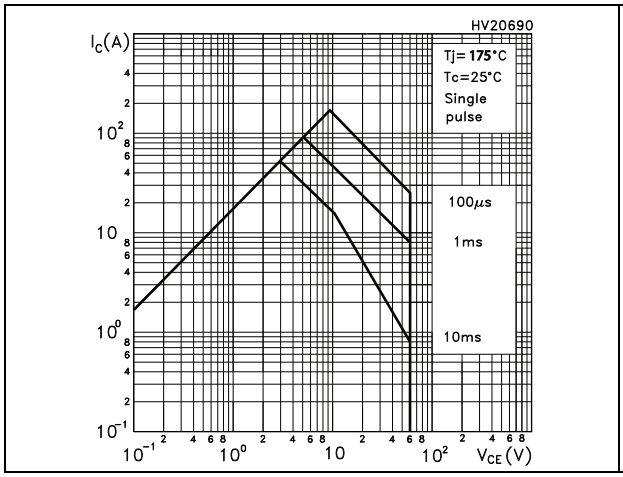


Figure 3. Thermal impedance

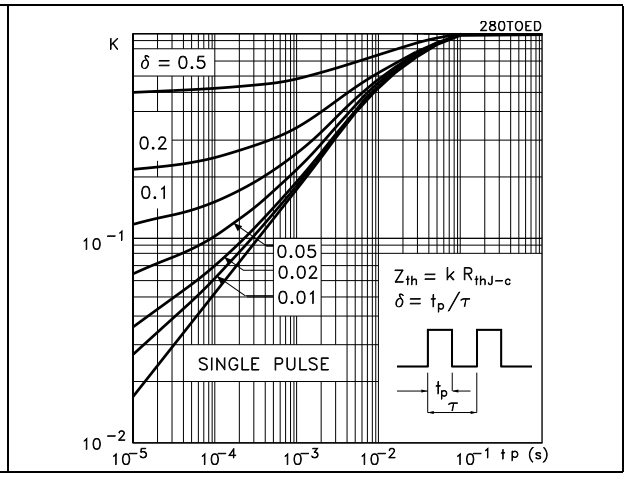


Figure 4. Output characteristics

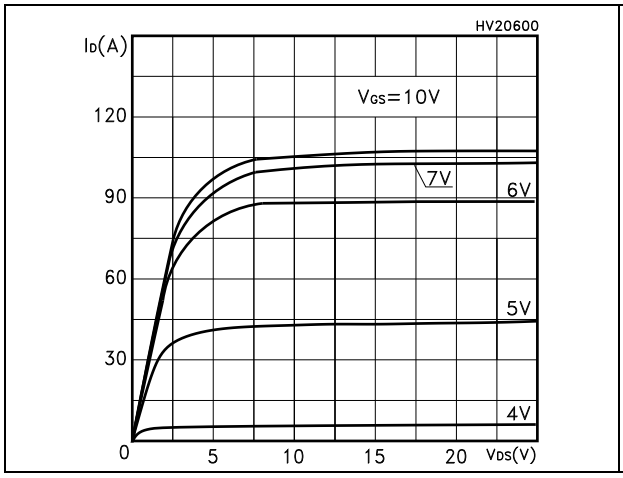


Figure 5. Transfer characteristics

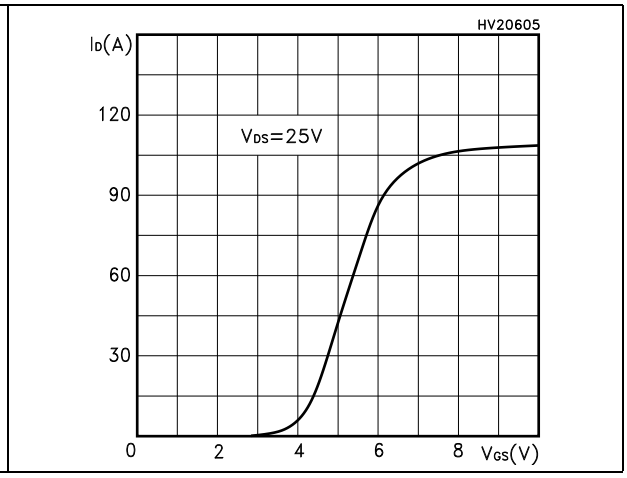


Figure 6. Transconductance

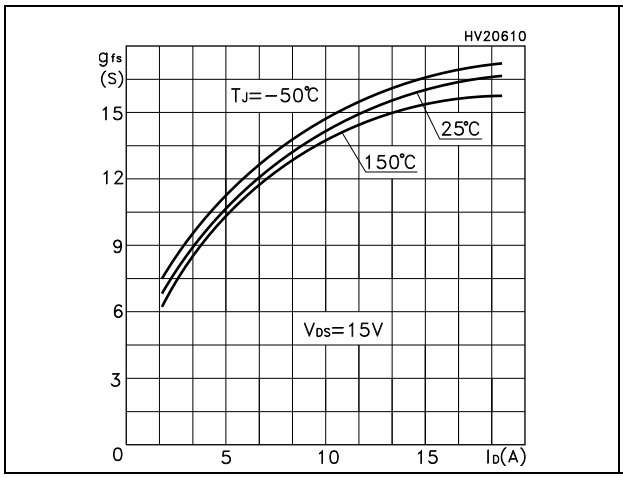


Figure 7. Static drain-source on-resistance

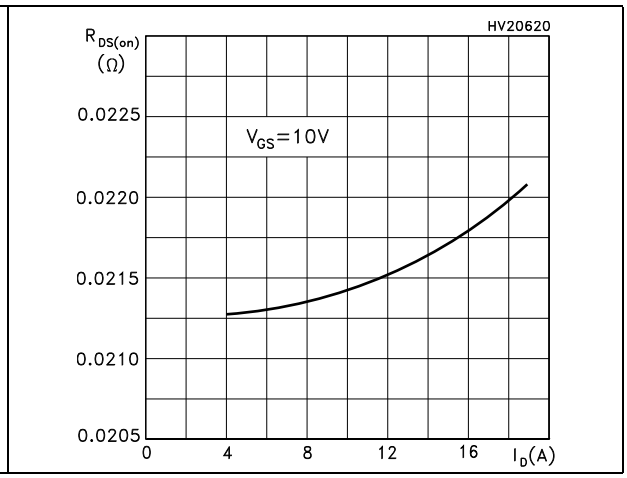


Figure 8. Gate charge vs gate-source voltage

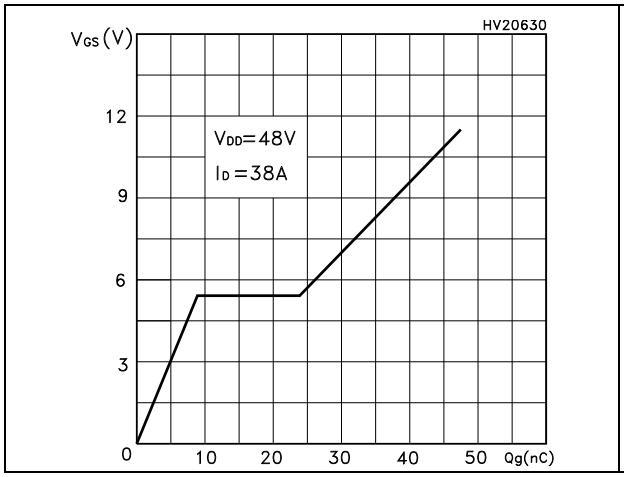


Figure 9. Capacitance variations

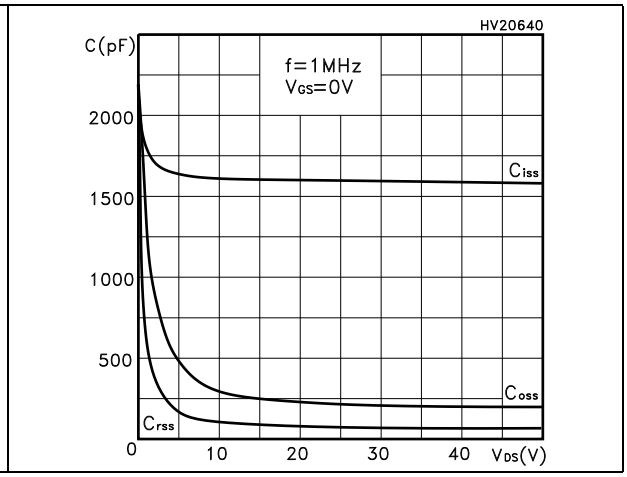


Figure 10. Normalized gate threshold voltage vs temperature

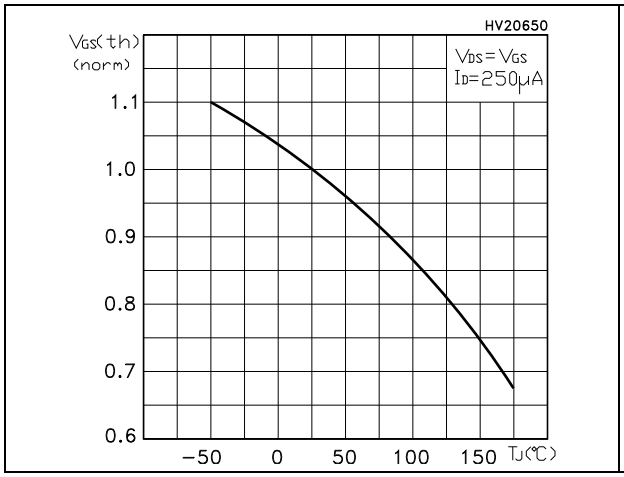


Figure 11. Normalized on-resistance vs temperature

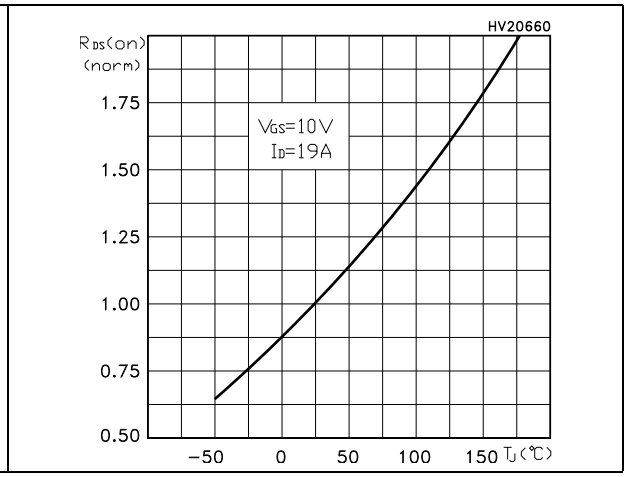


Figure 12. Source-drain diode forward characteristics

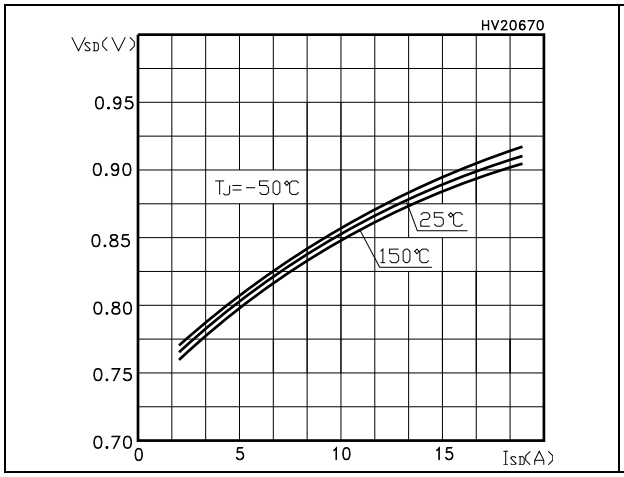
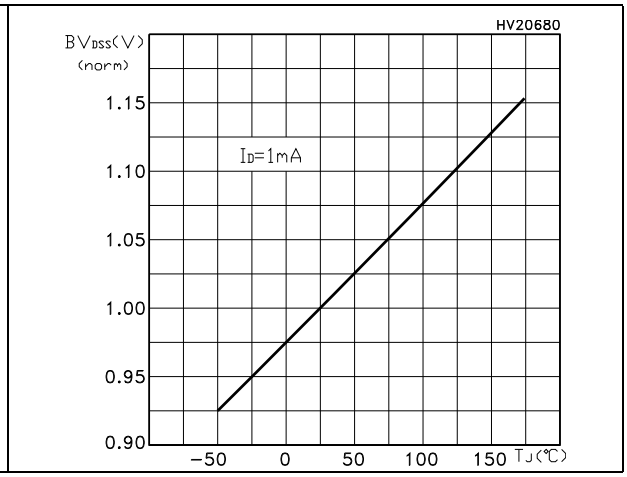


Figure 13. Normalized B_{VDSS} vs temperature



3 Test circuits

Figure 14. Switching times test circuit for resistive load

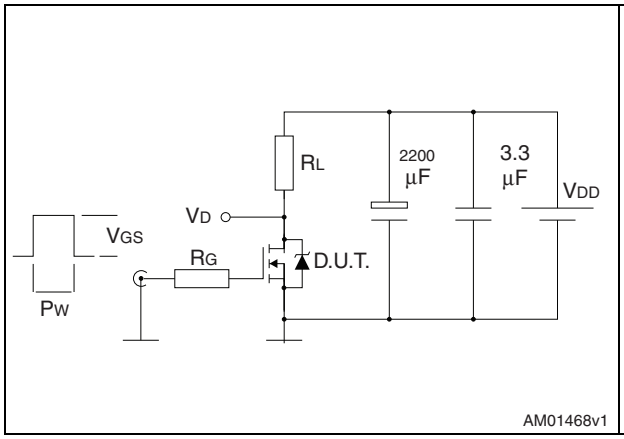


Figure 15. Gate charge test circuit

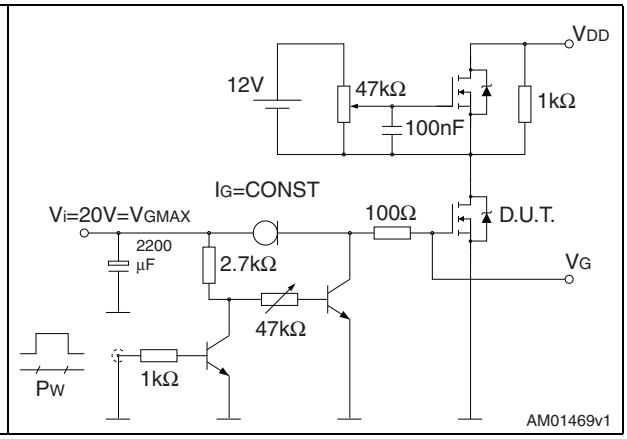


Figure 16. Test circuit for inductive load switching and diode recovery times

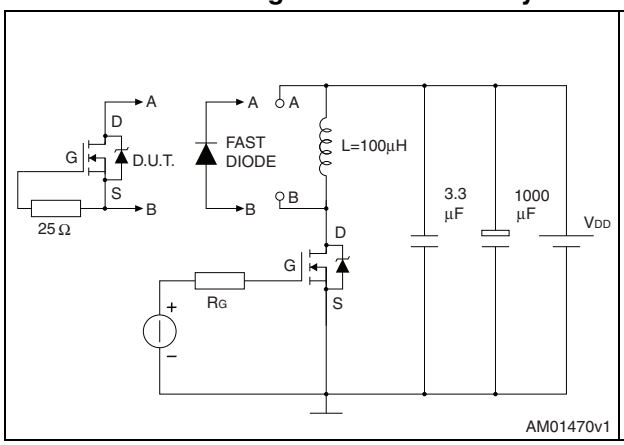


Figure 17. Unclamped inductive load test circuit

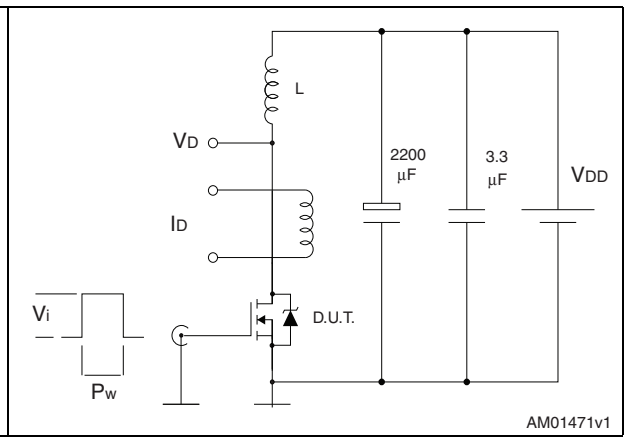


Figure 18. Unclamped inductive waveform

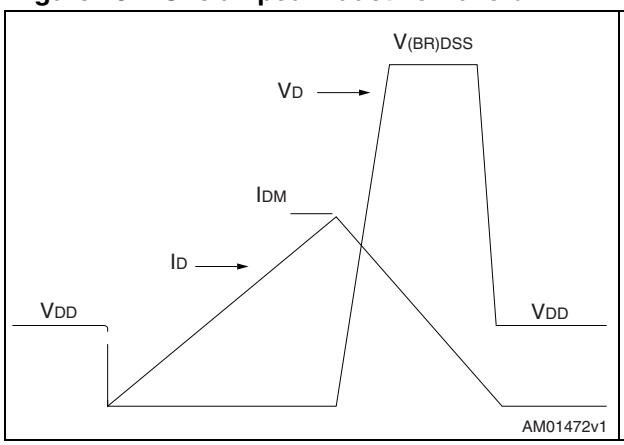
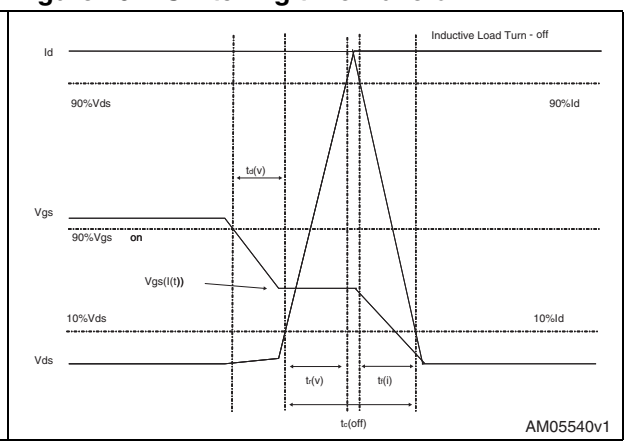


Figure 19. Switching time waveform



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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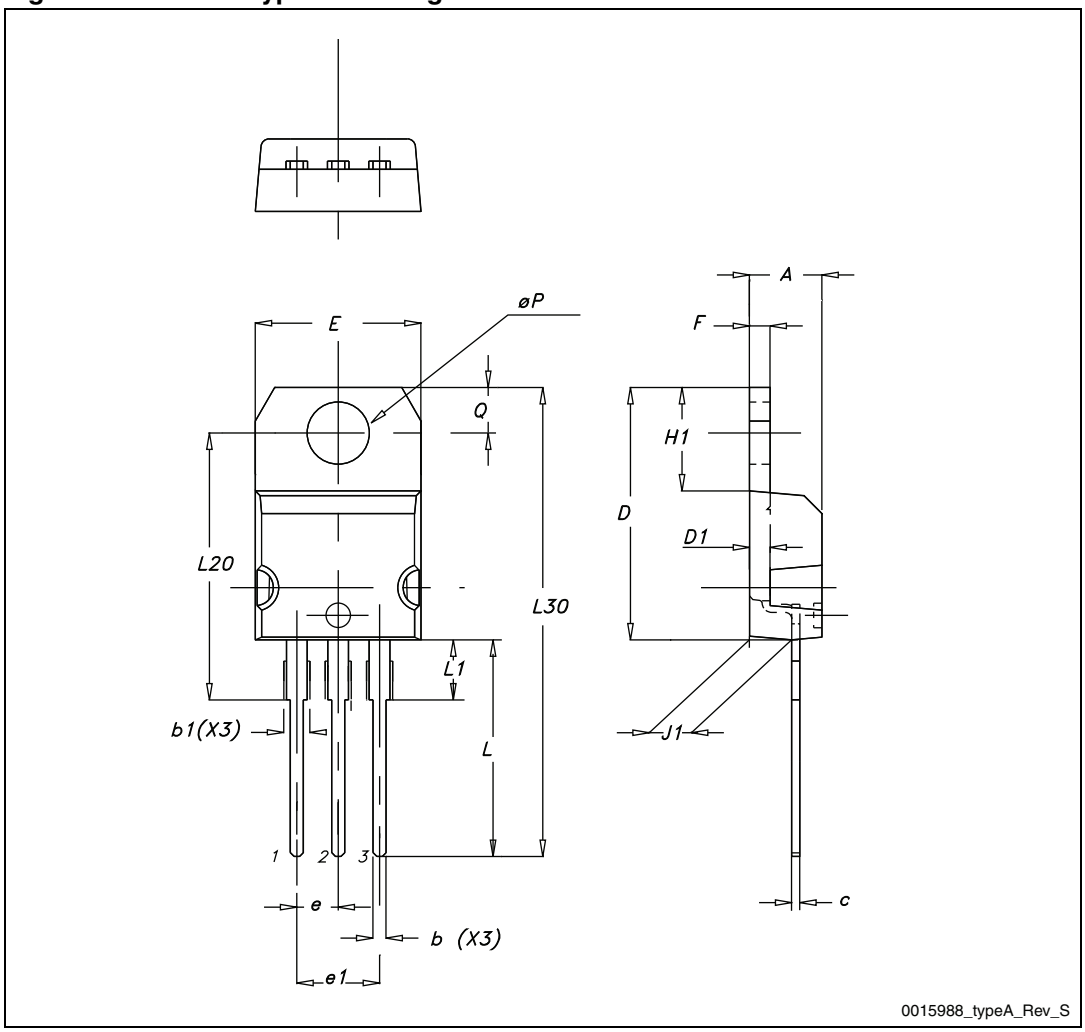
Table 9. TO-220 type A mechanical data

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	
∅P	3.75		3.85
Q	2.65		2.95

Figure 20. TO-220 type A drawing



5 Revision history

Table 10. Revision history

Date	Revision	Changes
09-Sep-2004	1	Preliminary version.
04-Feb-2005	2	Complete version.
17-Aug-2006	3	New template. No content change.
13-Nov-2006	4	Inserted new value.
05-Jul-2010	5	Updated *Section 2.1: Electrical characteristics (curves)*.
19-Dec-2012	6	Updated: *Section 4: Package mechanical data*

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