STP40NF10

N-channel 100 V, 0.025 Ω, 50 A TO-220
low gate charge STripFET™ II Power MOSFET

Features

Order code	V$_{DSS}$	R$_{DS(on)}$ max.	I$_D$
STP40NF10	100 V	< 0.028 Ω	50 A

■ Exceptional dv/dt capability

■ Low gate charge

■ 100% avalanche tested

Application

Switching applications

Description

This N-channel 100 V Power MOSFET is the latest development of STMicroelectronics unique "single feature size" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps allowing remarkable manufacturing reproducibility.
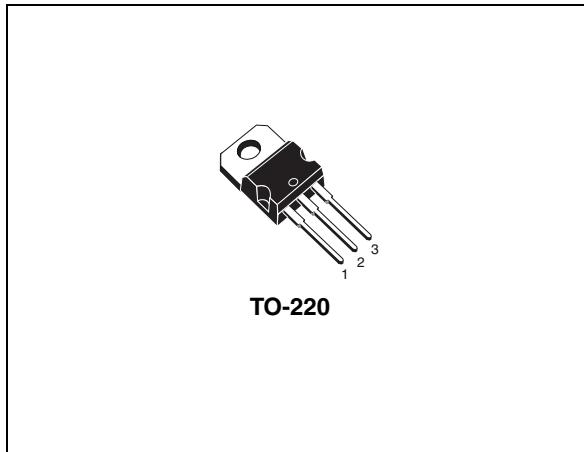

TO-220

Figure 1.   Internal schematic diagram

SC06140
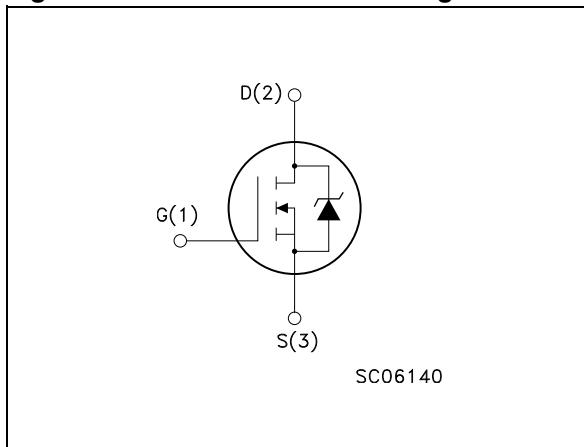
Table 1.   Device summary

Order code	Marking	Package	Packaging
STP40NF10	P40NF10@	TO-220	Tube

Contents

1   Electrical ratings

Table 2.   Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (V_{GS} = 0)	100	V
V_{GS}	Gate- source voltage	±20	V
I_D[1]	Drain current (continuous) at T_C = 25 °C	50	A
I_D	Drain current (continuous) at T_C = 100 °C	35	A
I_{DM} [2]	Drain current (pulsed)	200	A
P_{TOT}	Total dissipation at T_C = 25 °C	150	W
	Derating factor	1	W/°C
dv/dt[3]	Peak diode recovery voltage slope	27	V/ns
E_{AS} [4]	Single pulse avalanche energy	385	mJ
T_{stg}	Storage temperature	- 55 to 175	°C
T_j	Max. operating junction temperature		°C

1. Limited by wire bonding
2. Pulse width limited by safe operating area
3. I_{SD} ≤50 A, di/dt ≤600 A/µs, V_{DD} ≤$V_{(BR)DSS}$, T_j ≤$T_{JMAX.}$
4. Starting T_j= 25 °C, I_D= 50 A, V_{DD}=25 V

Table 3.   Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1	°C/W
R_{thj-a}	Thermal resistance junction-ambient max	62.5	°C/W
T_l	Maximum lead temperature for soldering purpose	300	°C

2 Electrical characteristics

(T_{CASE} = 25 °C unless otherwise specified)

Table 4. 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	100			V
I_{DSS}	Zero gate voltage Drain current (V_{GS} = 0)	V_{DS} = Max rating			1	µA
		V_{DS}=Max rating,T_C=125°C			10	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 = 25 A		0.025	0.028	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} [1]	Forward transconductance	V_{DS} = 15 V, I_D=28 A	-	22		S
C_{iss}	Input capacitance			2180		pF
C_{oss}	Output capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0	-	298		pF
C_{rss}	Reverse transfer capacitance			83.7		pF
Q_g	Total gate charge	V_{DD} = 50 V, I_D = 40 A, V_{GS} = 10V *(see Figure 15)*		46.5	62	nC
Q_{gs}	Gate-source charge		-	13.3		nC
Q_{gd}	Gate-drain charge			17.5	22.5	nC

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

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 50V, I_D = 25A R_G = 4.7Ω V_{GS} = 10V *(see Figure 14)*	-	21	-	ns
t_r	Rise time			46		ns
$t_{d(off)}$	Turn-off-delay time		-	54	-	ns
t_f	Fall time			13		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	$I_{SD} = 50A$, $V_{GS} = 0$	-		1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 50A$, $V_{DD} = 25V$ di/dt = 100A/µs, $T_j = 150°C$ *(see Figure 16)*	-	80 250 6.4		ns nC 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 for TO-220
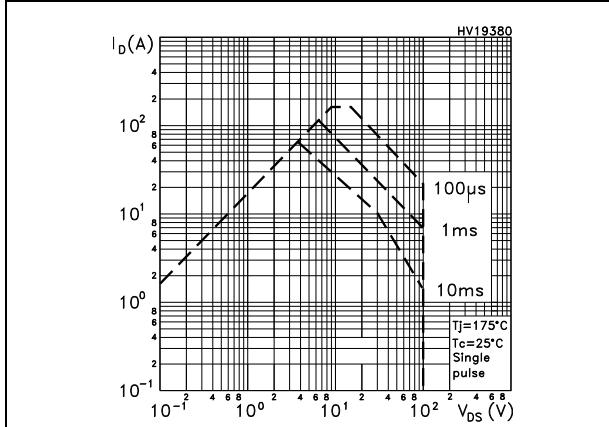
Figure 3. Thermal impedance for TO-220
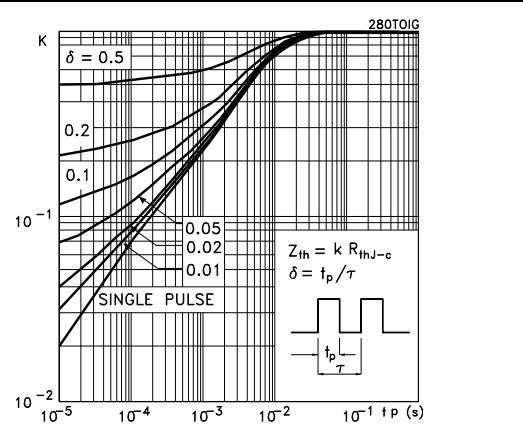

Figure 4. Output characteristics
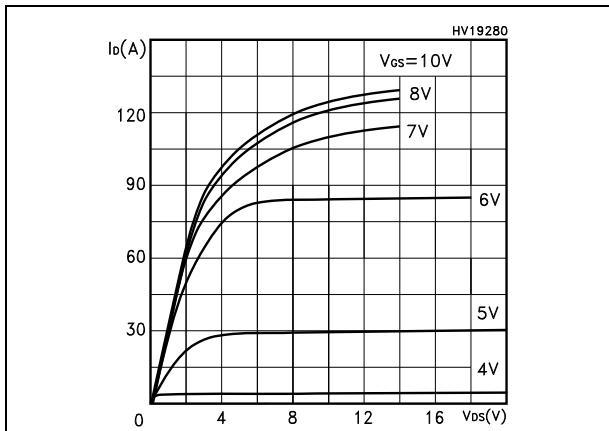
**Figure 5. Transfer characteristics**
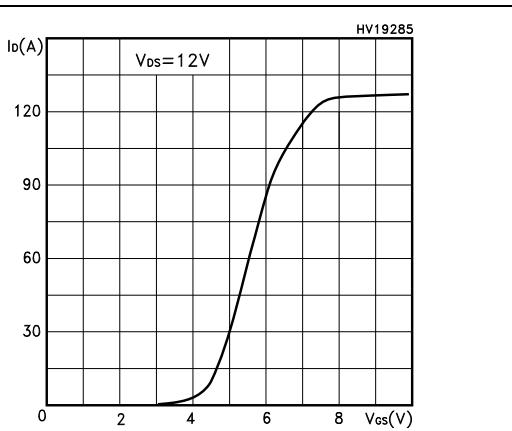
**Figure 6. Transconductance**
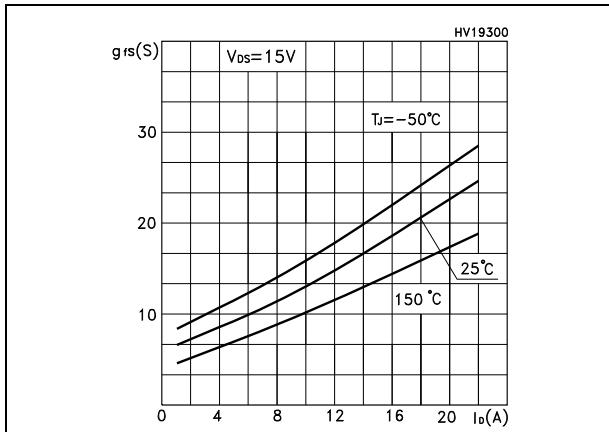


Figure 7. Static drain-source on resistance
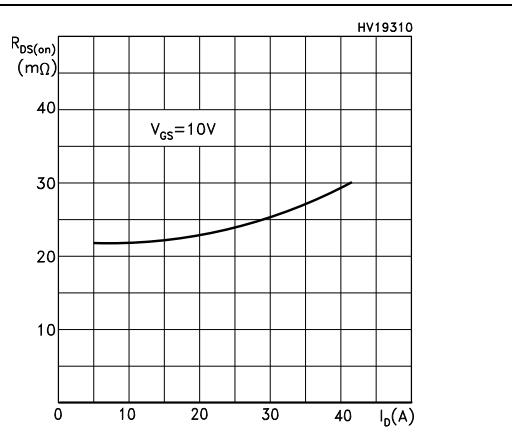
Figure 8. Gate charge vs. gate-source voltage


Figure 9. Capacitance variations
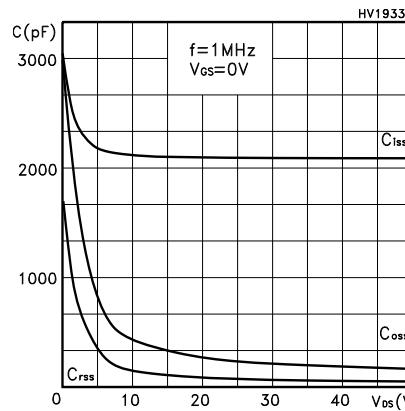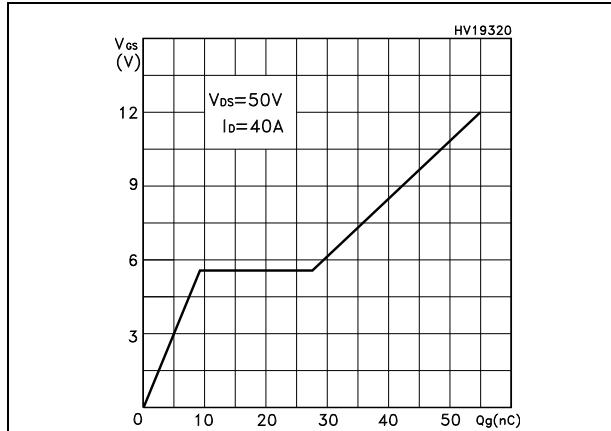
Figure 10. Normalized gate threshold voltage vs. temperature
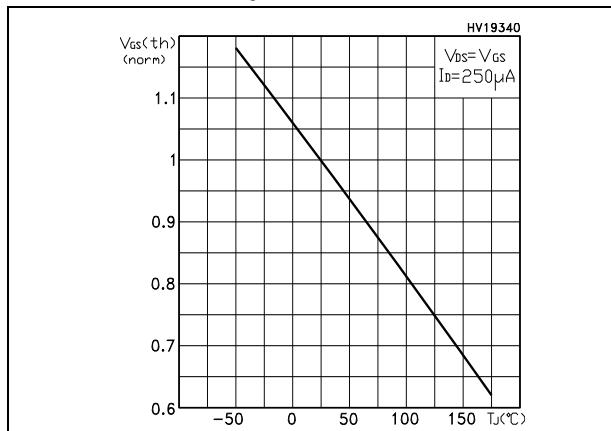
Figure 11. Normalized on resistance vs. temperature
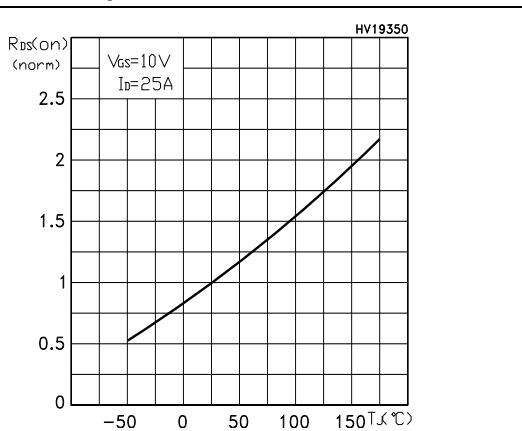

Figure 12. Source-drain diode forward characteristics
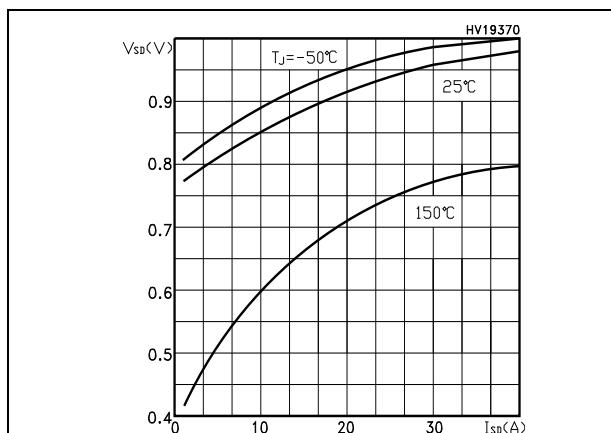
**Figure 13. Normalized breakdown voltage vs. Tj**
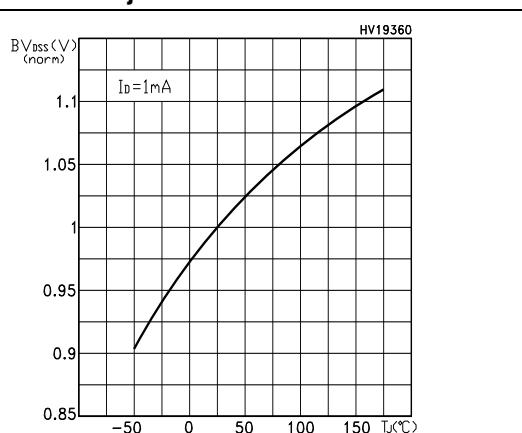
3 Test circuit

Figure 14. Switching times test circuit for resistive load


AM01468v1
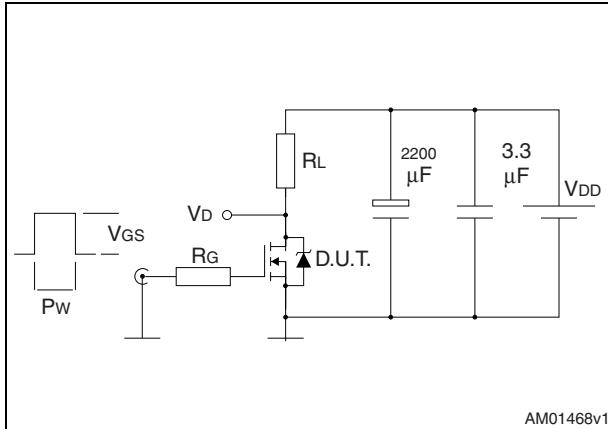
Figure 15. Gate charge test circuit

AM01469v1
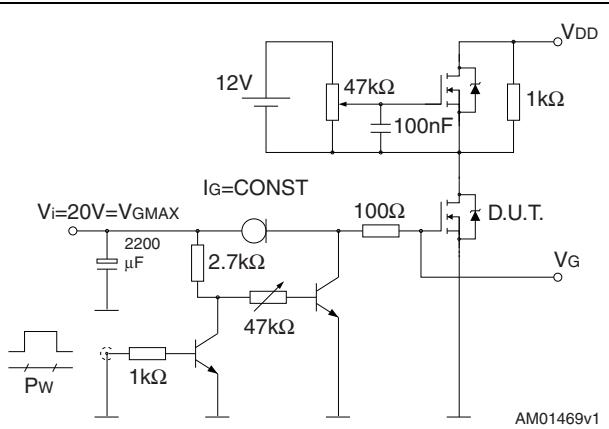
Figure 16. Test circuit for inductive load switching and diode recovery times

AM01470v1
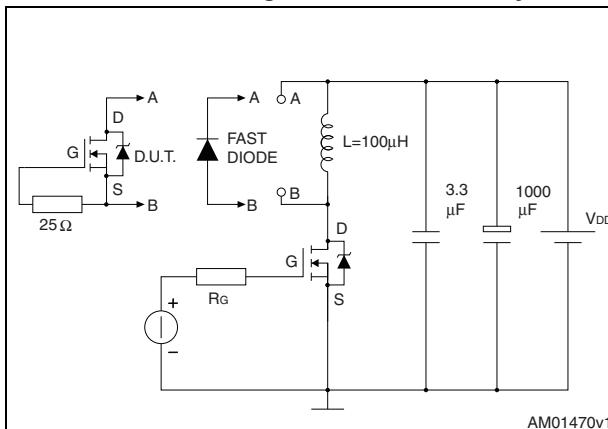
Figure 17. Unclamped Inductive load test circuit

AM01471v1
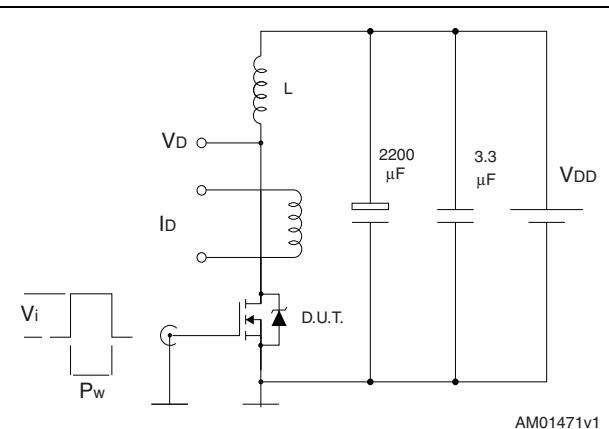
Figure 18. Unclamped inductive waveform

AM01472v1
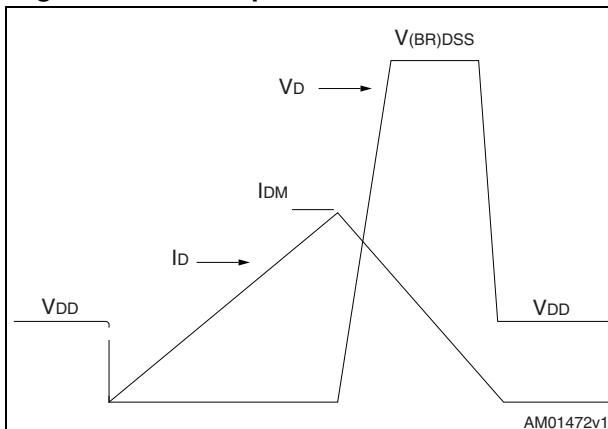
Figure 19. Switching time waveform

AM01473v1
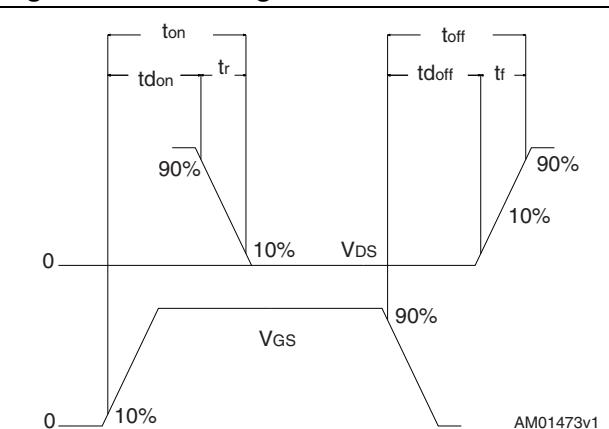
4 Package mechanical data

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.

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

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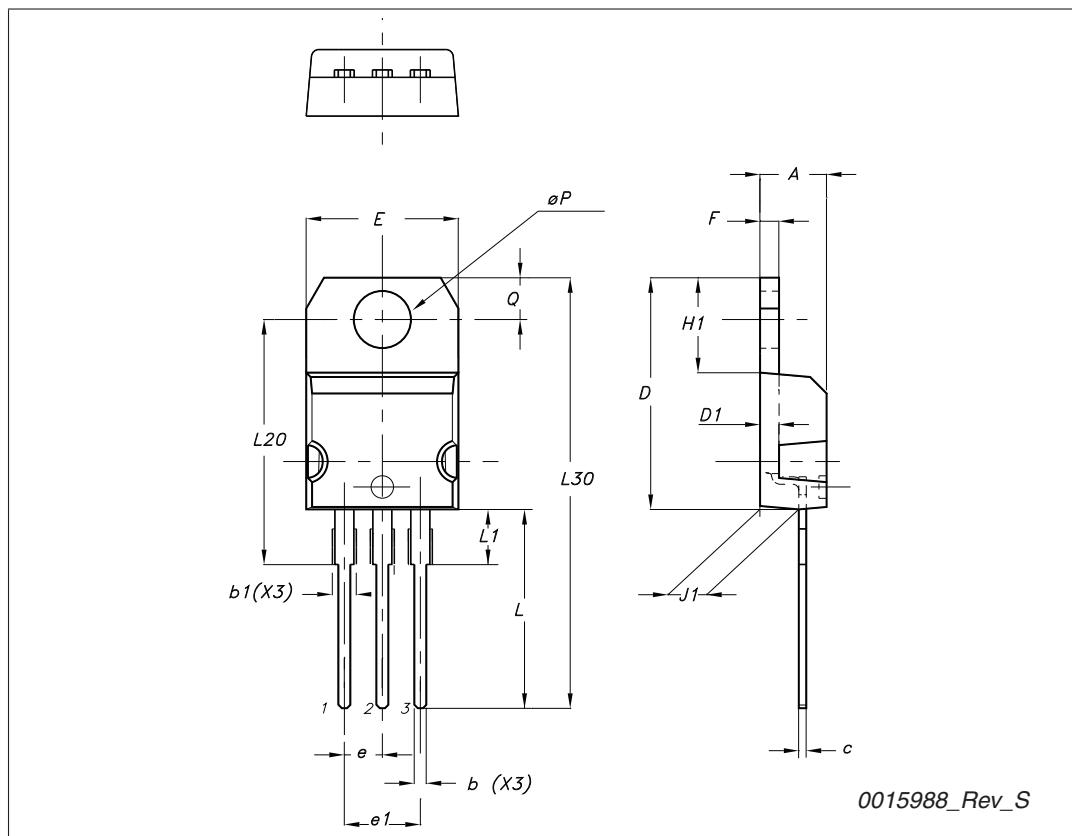
5   Revision history

Table 8.   Document revision history

Date	Revision	Changes
16-Dec-2004	1	First version.
17-Aug-2006	2	The document has been reformatted.
31-Jan-2007	3	Typo mistake on *Table 2*.
19-Sep-2007	4	Added DPAK.
10-Nov-2010	5	Removed DPAK.

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