

N-channel 250 V, 0.055 Ω 28 A, TO-220
MDmesh™ V Power MOSFET

Features

Type	V_{DSS}	$R_{DS(on)}$ max	I_D
STP52N25M5	250 V	< 0.065 Ω	28 A

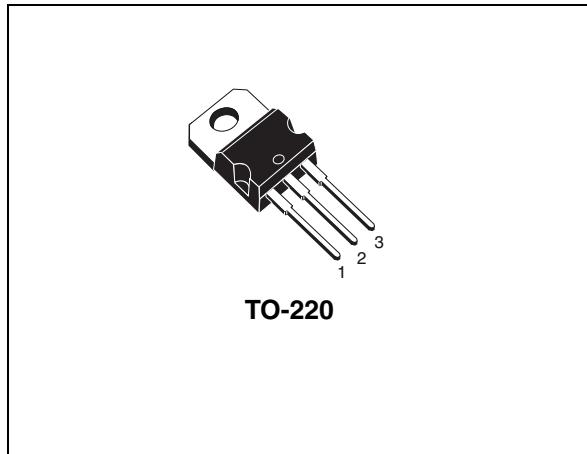
- Amongst the best $R_{DS(on)}$ * area
- High dv/dt capability
- Excellent switching performance
- Easy to drive
- 100% avalanche tested

Application

- Switching applications

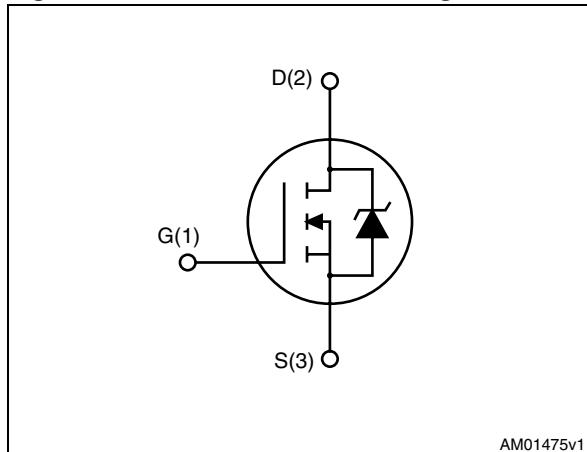
Description

This device is an N-channel MDmesh™ V Power MOSFET based on an innovative proprietary vertical process technology, which is combined with STMicroelectronics' well-known PowerMESHTM horizontal layout structure. The resulting product has extremely low on-resistance, which is unmatched among silicon-based Power MOSFETs, making it especially suitable for applications which require superior power density and outstanding efficiency.



TO-220

Figure 1. Internal schematic diagram



AM01475v1

Table 1. Device summary

Order code	Marking	Package	Packaging
STP52N25M5	52N25M5	TO-220	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate- source voltage	25	V
I_D	Drain current (continuous) at $T_C = 25^\circ\text{C}$	28	A
I_D	Drain current (continuous) at $T_C = 100^\circ\text{C}$	18	A
$I_{DM}^{(1)}$	Drain current (pulsed)	112	A
P_{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	110	W
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_J max)	10	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	230	mJ
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
T_J T_{stg}	Operating junction temperature Storage temperature	-55 to 150	°C

1. Pulse width limited by safe operating area.
2. $I_{SD} \leq 28\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{Peak} < V_{(BR)DSS}$.

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1.14	°C/W
$R_{thj-amb}$	Thermal resistance junction-pcb max	62.5	°C/W
T_J	Maximum lead temperature for soldering purpose	300	°C/W

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 = 1 mA, V _{GS} = 0	250			V
I _{DSS}	Zero gate voltage drain current (V _{GS} = 0)	V _{DS} = Max rating V _{DS} = Max rating, T _C =125 °C			1 100	μA μA
I _{GSS}	Gate-body leakage current (V _{DS} = 0)	V _{GS} = ± 25 V			100	nA
V _{GS(th)}	Gate threshold voltage	V _{DS} = V _{GS} , I _D = 100 μA	3	4	5	V
R _{DS(on)}	Static drain-source on-resistance	V _{GS} = 10 V, I _D = 14 A		0.055	0.065	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C _{iss} C _{oss} C _{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V _{DS} = 50 V, f = 1 MHz, V _{GS} = 0	-	1770 110 17	-	pF pF pF
C _{o(er)} ⁽¹⁾	Equivalent output capacitance energy related	V _{GS} = 0, V _{DS} = 0 to 80% V _{(BR)DSS}	-	93	-	pF
C _{o(tr)} ⁽²⁾	Equivalent output capacitance time related	V _{GS} = 0, V _{DS} = 0 to 80% V _{(BR)DSS}	-	178	-	pF
R _g	Gate input resistance	f=1 MHz open drain	-	2	-	Ω
Q _g Q _{gs} Q _{gd}	Total gate charge Gate-source charge Gate-drain charge	V _{DD} = 200 V, I _D = 28 A, V _{GS} = 10 V (see Figure 14)	-	47 10 24	-	nC nC nC

1. C_{o(er)} is a constant capacitance value that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.
2. C_{o(tr)} is a constant capacitance value that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(V)}$	Voltage delay time	$V_{DD} = 125 \text{ V}$, $I_D = 14 \text{ A}$, $R_G = 4.7 \Omega$, $V_{GS} = 10 \text{ V}$ (see Figure 13)	-	40		ns
$t_{r(V)}$	Voltage rise time			18		ns
$t_{f(i)}$	Current fall time			64		ns
$t_{c(off)}$	Crossing time			82		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
I_{SD}	Source-drain current		-		28	A
	Source-drain current (pulsed)				112	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 28 \text{ A}$, $V_{GS} = 0$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 28 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}$, $T_J = 25 \text{ }^\circ\text{C}$ (see Figure 15)	-	168		ns
	Reverse recovery charge			1.2		μC
	Reverse recovery current			14.5		A
t_{rr}	Reverse recovery time	$I_{SD} = 28 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}$, $T_J = 150 \text{ }^\circ\text{C}$ (see Figure 15)	-	196		ns
	Reverse recovery charge			1.7		μC
	Reverse recovery current			17		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

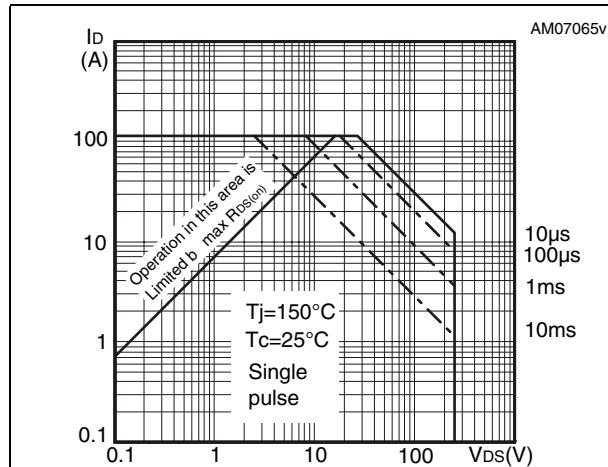


Figure 3. Thermal impedance

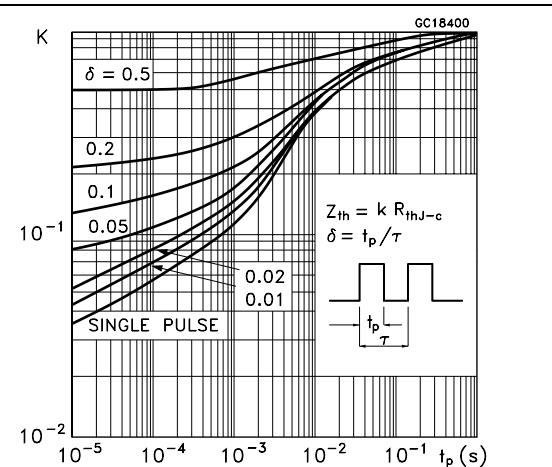


Figure 4. Output characteristics

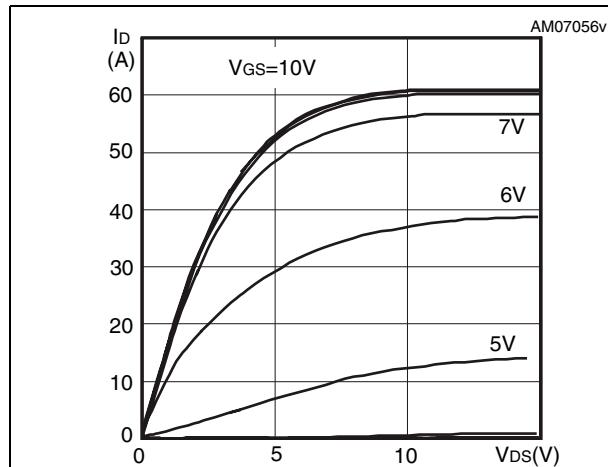


Figure 5. Transfer characteristics

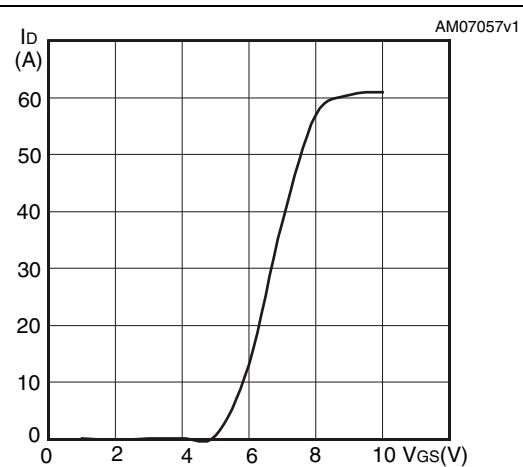


Figure 6. Gate charge vs gate-source voltage

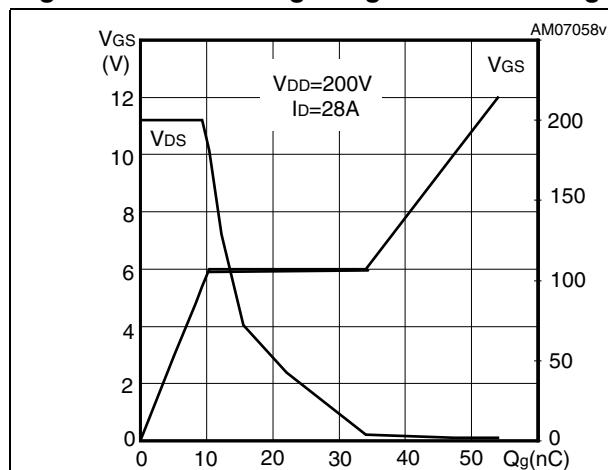


Figure 7. Static drain-source on resistance

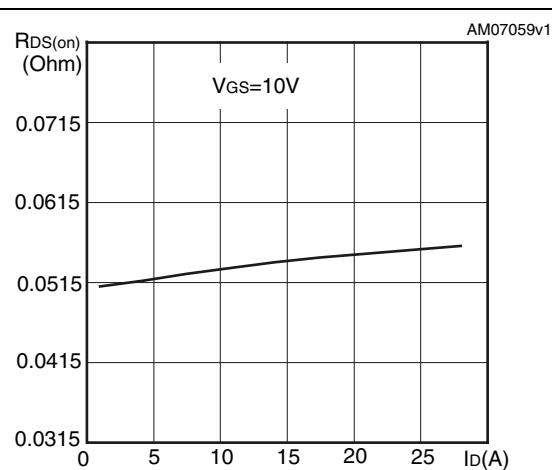


Figure 8. Capacitance variations

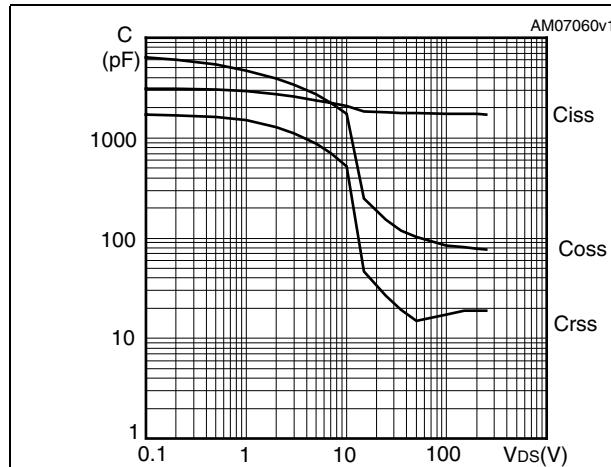


Figure 9. Output capacitance stored energy

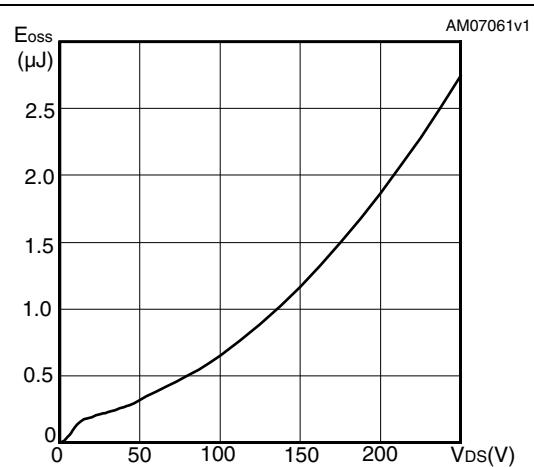


Figure 10. Normalized gate threshold voltage vs temperature

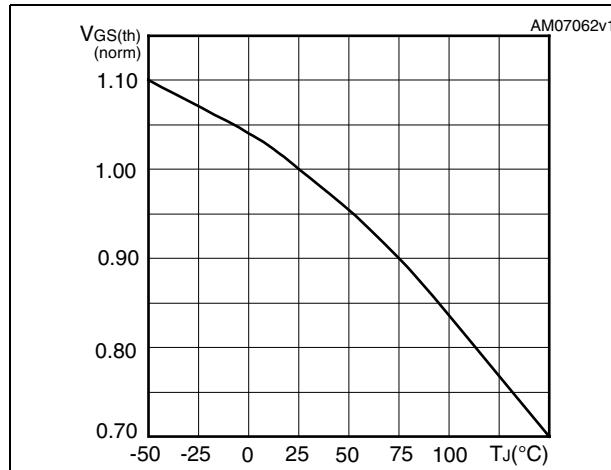
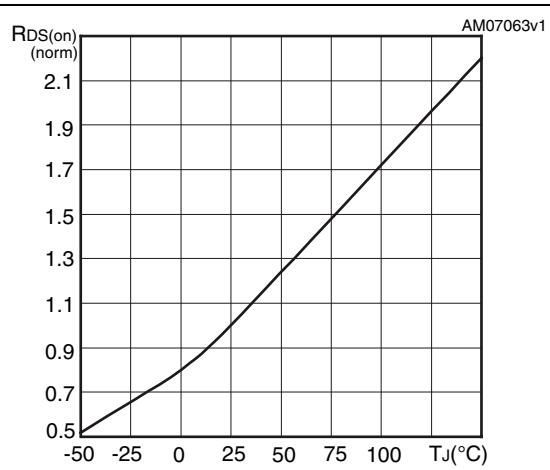
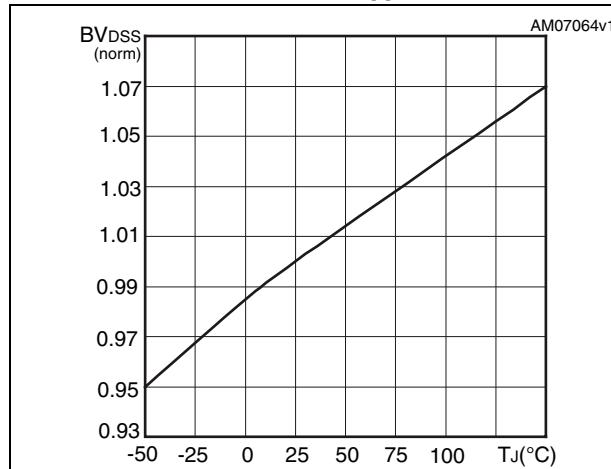


Figure 11. Normalized on resistance vs temperature

Figure 12. Normalized BV_{DSS} vs temperature

3 Test circuits

Figure 13. Switching times test circuit for resistive load

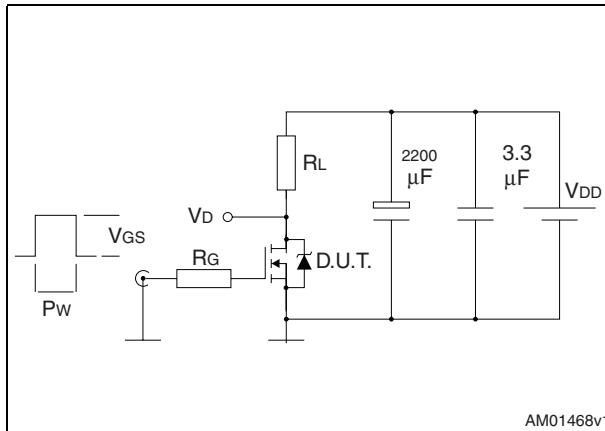


Figure 14. Gate charge test circuit

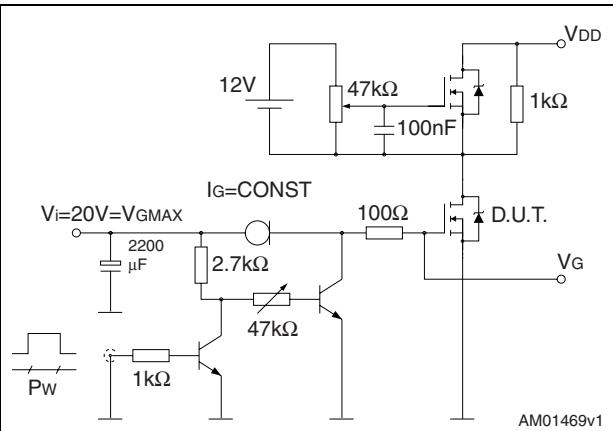


Figure 15. Test circuit for inductive load switching and diode recovery times

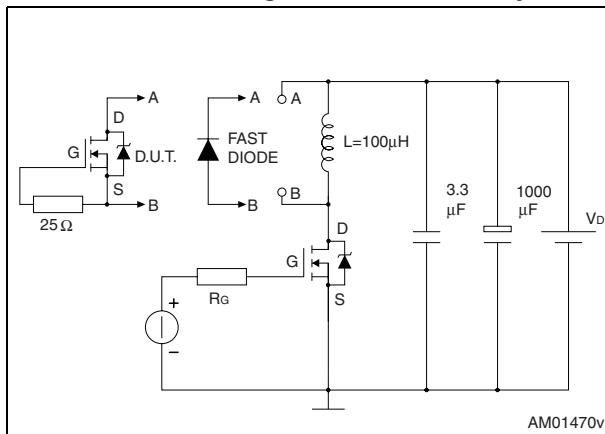


Figure 16. Unclamped inductive load test circuit

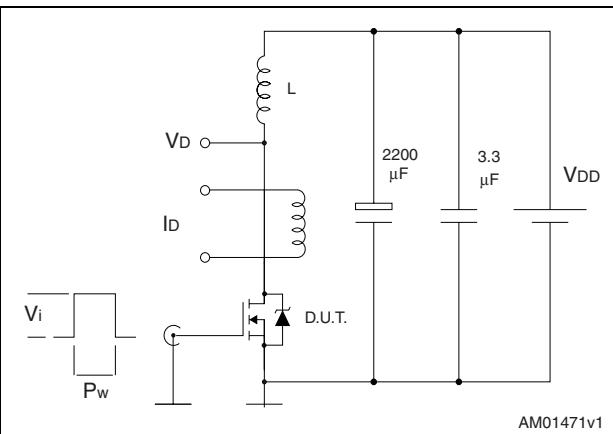


Figure 17. Unclamped inductive waveform

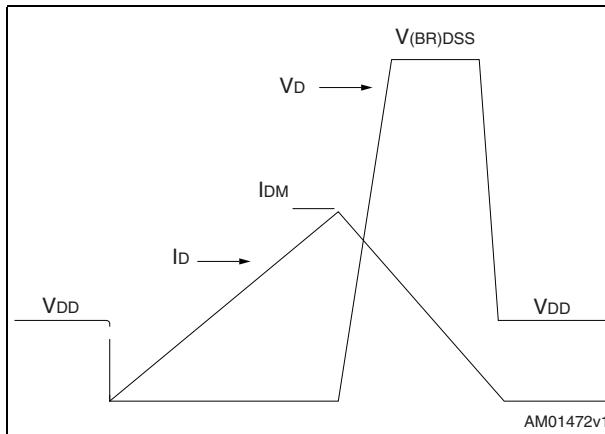
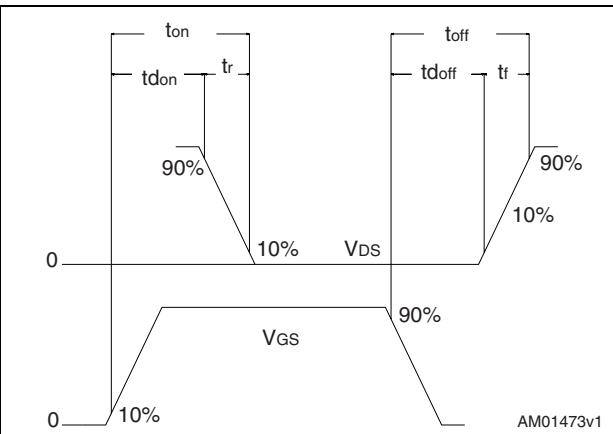


Figure 18. Switching time waveform

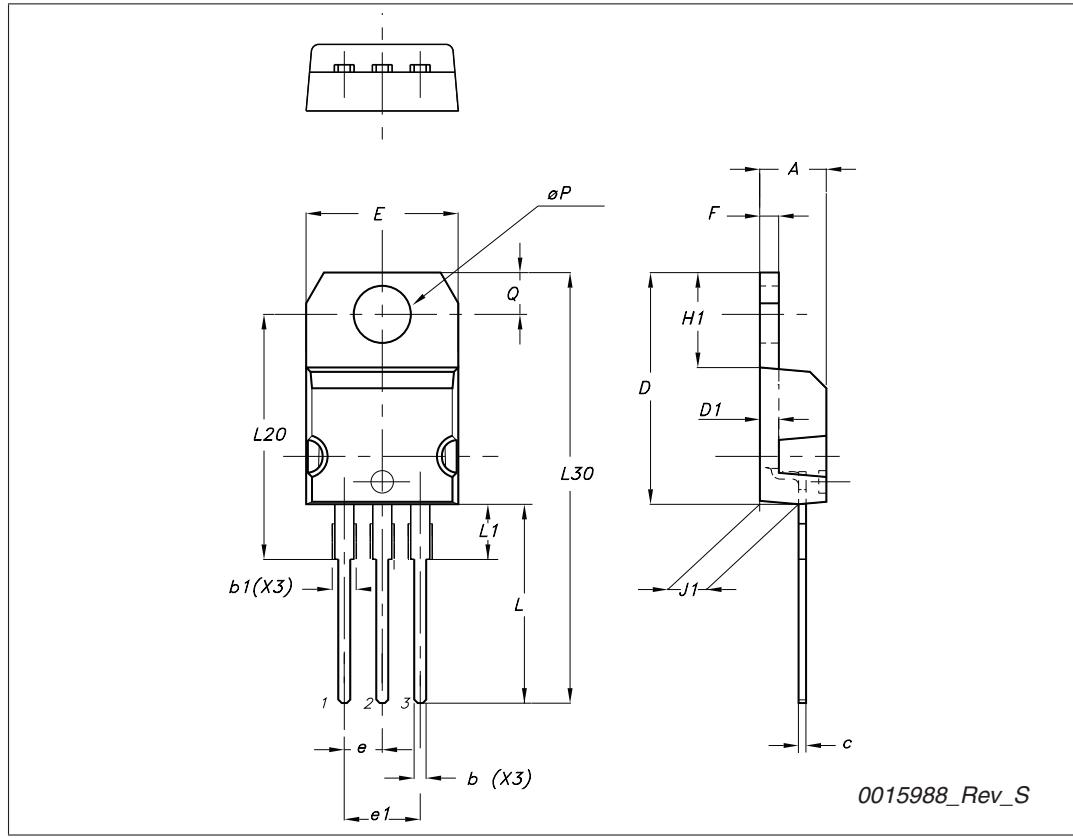


4 Package mechanical data

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.

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	
$\emptyset P$	3.75		3.85
Q	2.65		2.95



5 Revision history

Table 8. Document revision history

Date	Revision	Changes
29-Jul-2010	1	First release

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