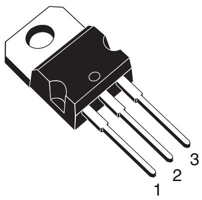
STP52N25M5

N-channel 250 V, 0.055 Ω, 28 A, TO-220 MDmesh^{TM} 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



TO-220

Application

- Switching applications

Description

This devices is an N-channel MDmesh™ V Power MOSFET based on an innovative proprietary vertical process technology, which is combined with STMicroelectronics' well-known PowerMESH™ 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.

Figure 1. Internal schematic diagram

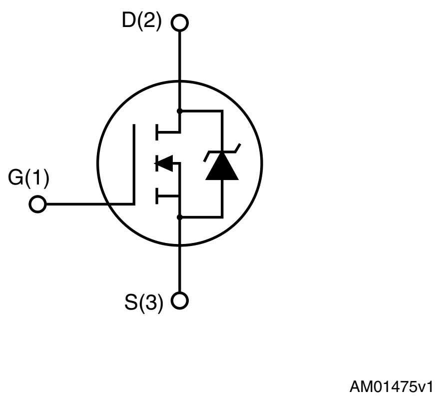


Table 1. Device summary

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

Contents

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 °C	28	A
I_D	Drain current (continuous) at T_C = 100 °C	18	A
I_{DM} (1)	Drain current (pulsed)	112	A
P_{TOT}	Total dissipation at T_C = 25 °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 °C, I_D = I_{AR}, V_{DD} = 50 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 A, di/dt $\leq$ 400 A/µs, V_{Peak} < $V_{(BR)DSS}$.

Table 3. **Thermal data**

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

2 Electrical characteristics

(Tcase =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
$t_{d(V)}$ $t_{r(V)}$ $t_{f(i)}$ $t_{c(off)}$	Voltage delay time Voltage rise time Current fall time Crossing time	V_{DD} = 125 V, I_D = 14 A, R_G = 4.7 Ω, V_{GS} = 10 V *(see Figure 13)*	-	40 18 64 82	-	ns ns ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)		-		28 112	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 28 A, V_{GS} = 0	-		1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 28 A, di/dt = 100 A/µs V_{DD}= 60 V, T_J = 25 °C *(see Figure 15)*	-	168 1.2 14.5		ns µC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 28 A, di/dt = 100 A/µs V_{DD}= 60 V T_J = 150 °C *(see Figure 15)*	-	196 1.7 17		ns µC 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

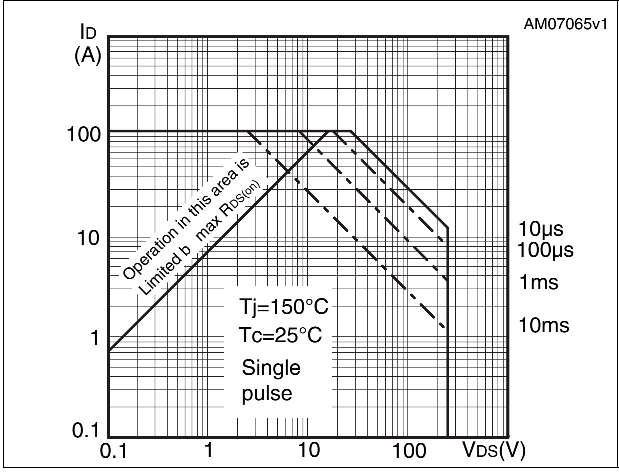


Figure 3. Thermal impedance

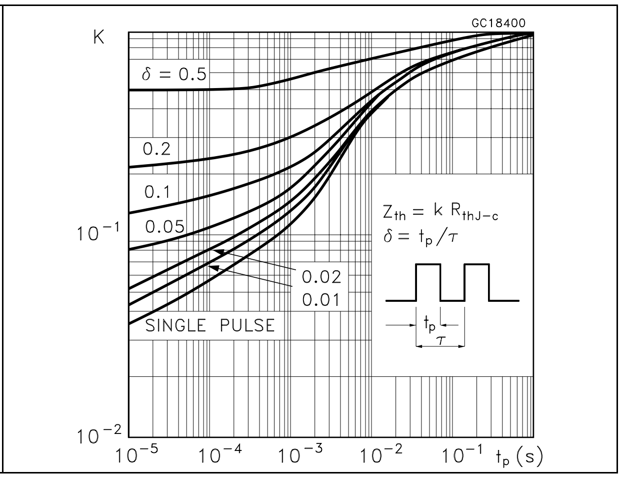


Figure 4. Output characteristics

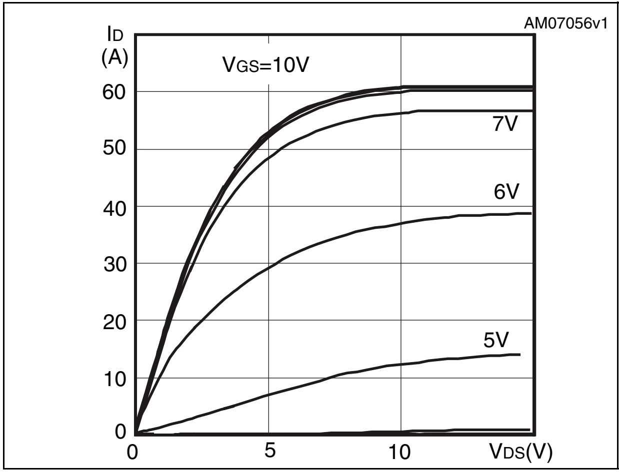


Figure 5. Transfer characteristics

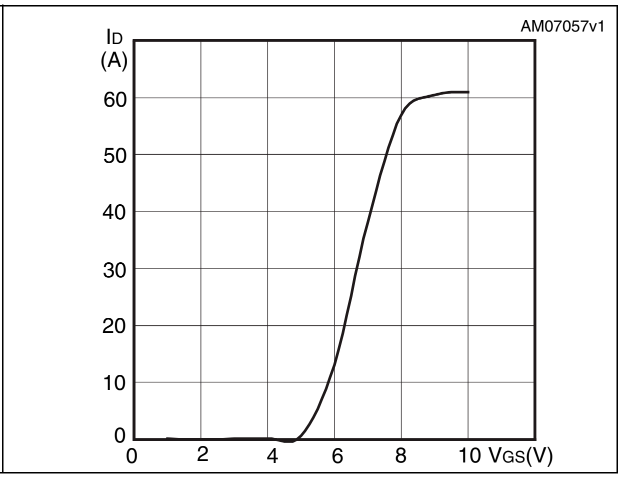


Figure 6. Gate charge vs gate-source voltage

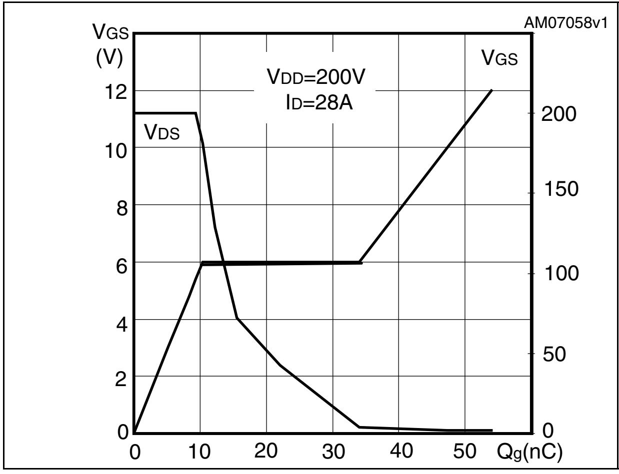


Figure 7. Static drain-source on resistance

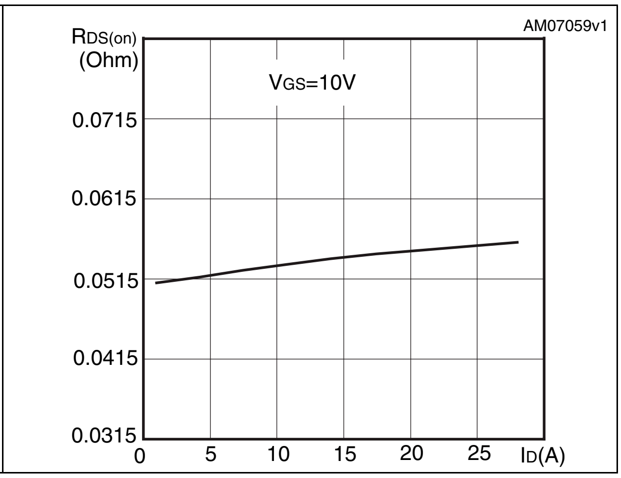


Figure 8. Capacitance variations

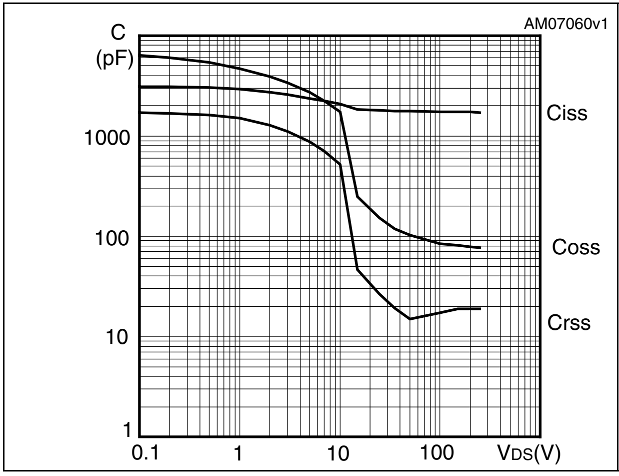


Figure 9. Output capacitance stored energy

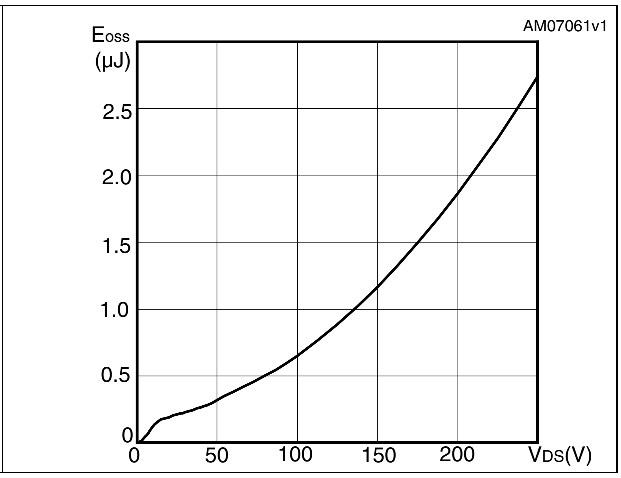


Figure 10. Normalized gate threshold voltage vs temperature

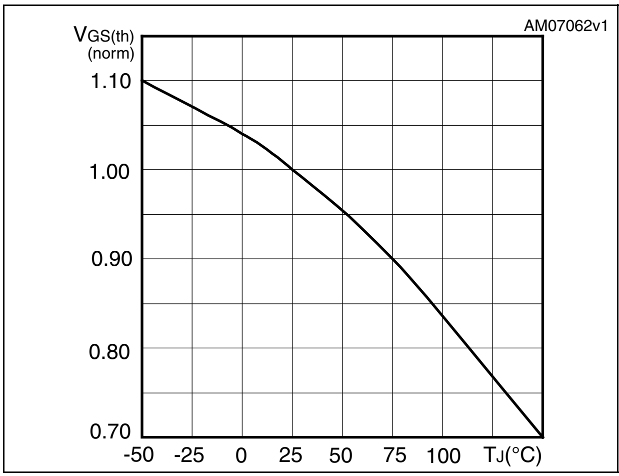


Figure 11. Normalized on resistance vs temperature

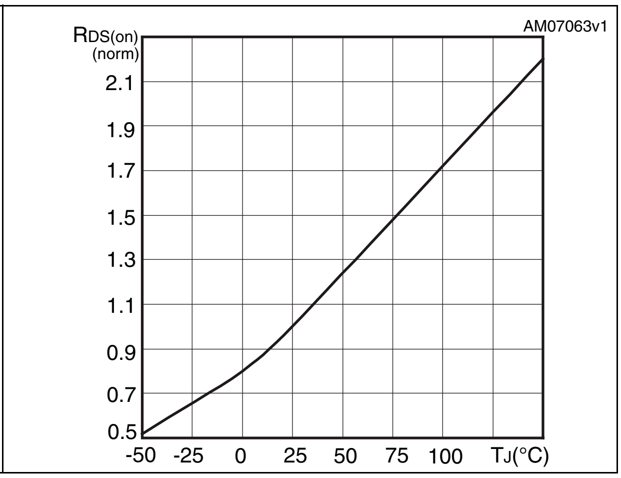
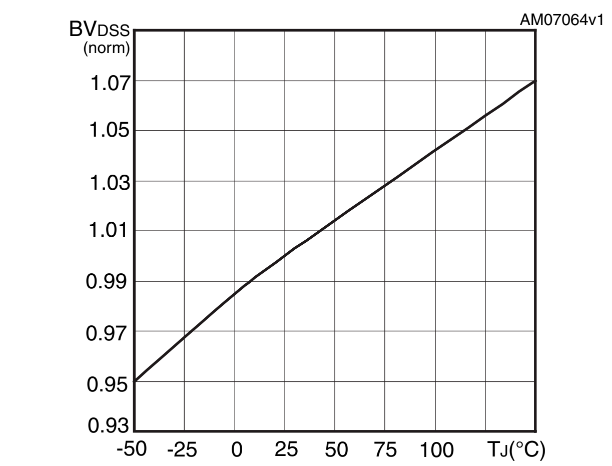


Figure 12. Normalized B_{VDSS} vs temperature



3 Test circuits

Figure 13. Switching times test circuit for resistive load

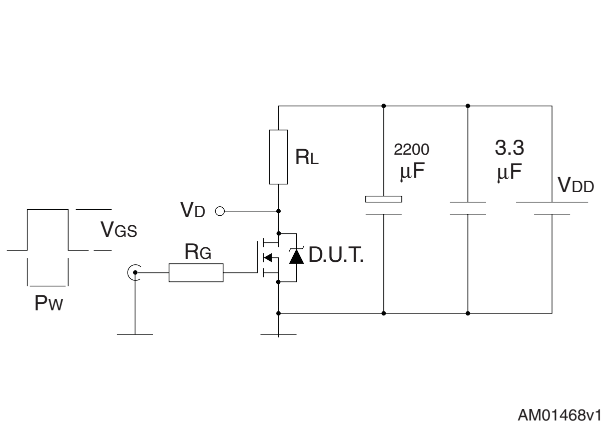


Figure 14. Gate charge test circuit

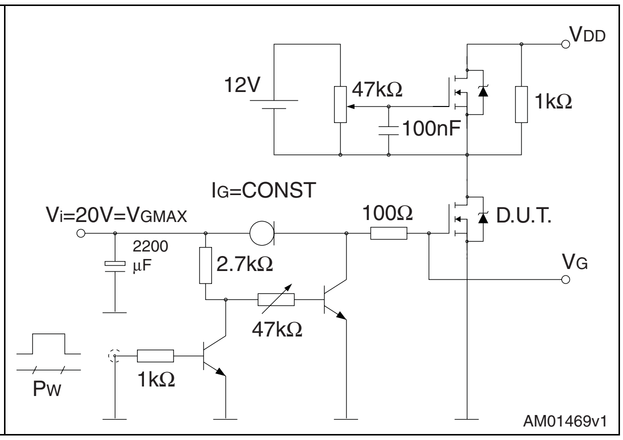


Figure 15. Test circuit for inductive load switching and diode recovery times

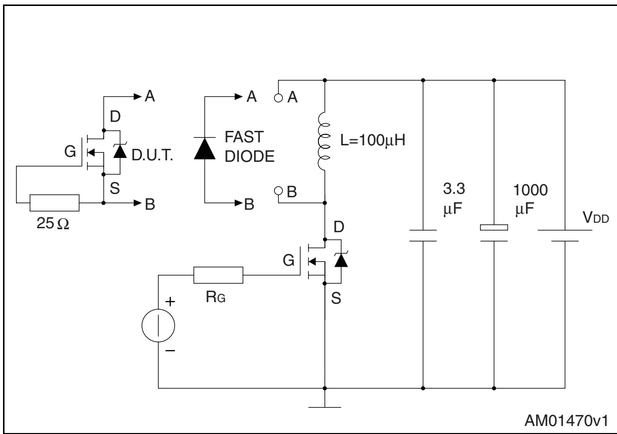


Figure 16. Unclamped inductive load test circuit

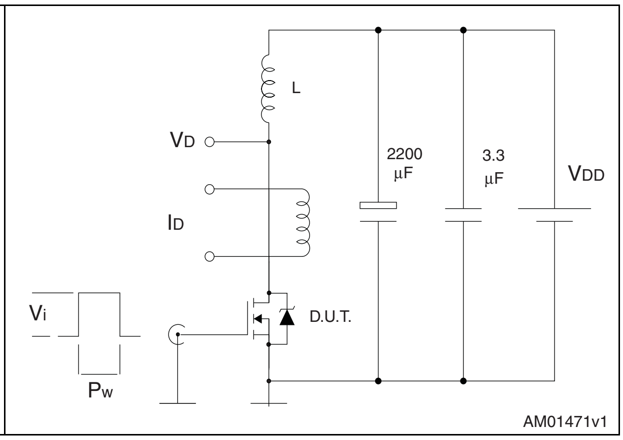


Figure 17. Unclamped inductive waveform

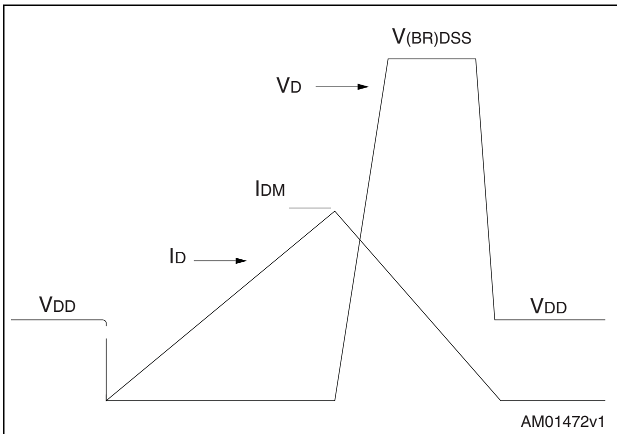
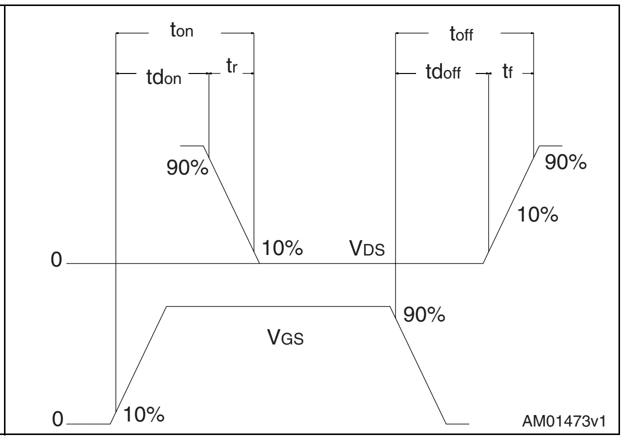


Figure 18. Switching time waveform

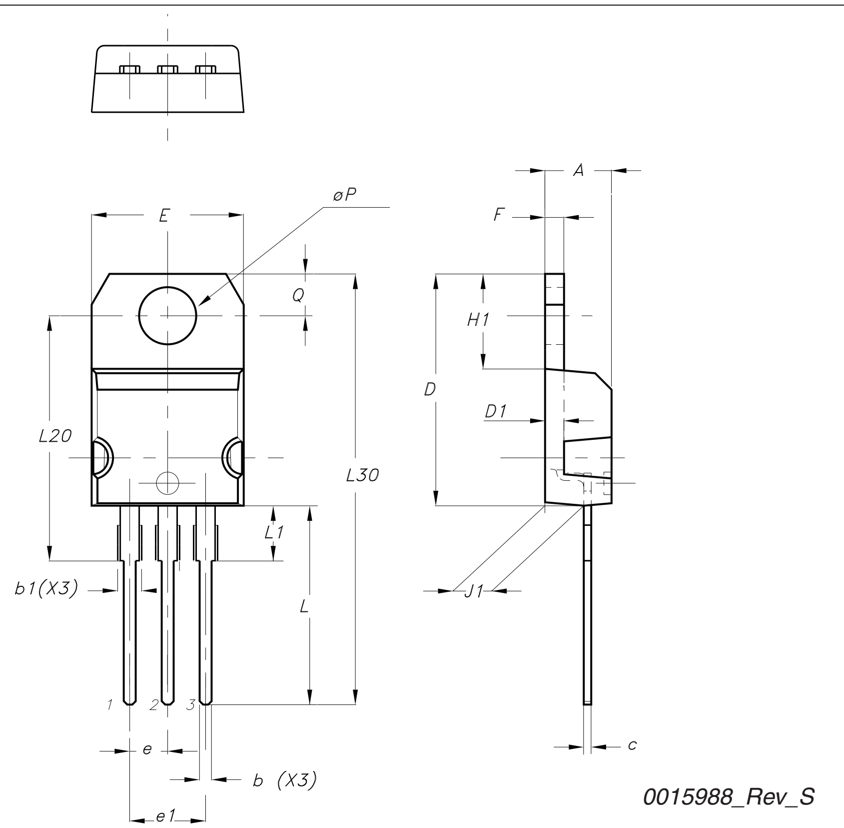


4 Package mechanical data

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	
∅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