



STP52N25M5

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 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.

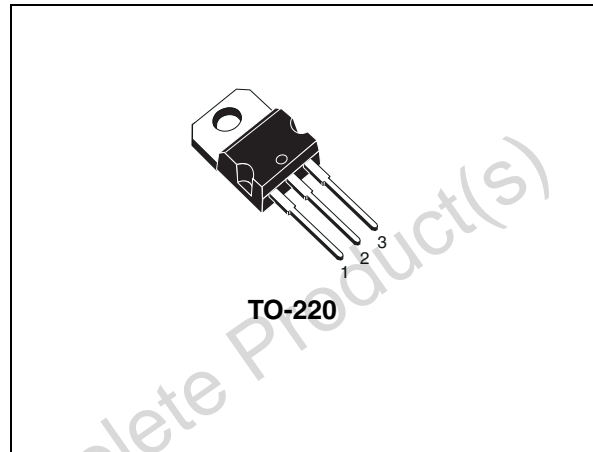


Figure 1. Internal schematic diagram

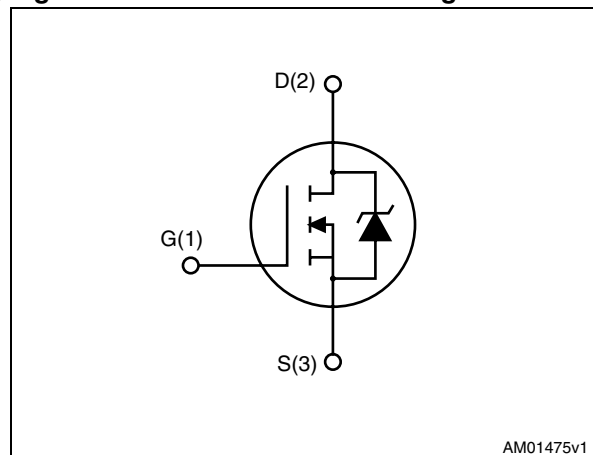


Table 1. Device summary

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

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Obsolete Product(s) - Obsolete Product(s)

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 $T_C = 25\text{ °C}$	28	A
I_D	Drain current (continuous) at $T_C = 100\text{ °C}$	18	A
$I_{DM}^{(1)}$	Drain current (pulsed)	112	A
P_{TOT}	Total dissipation at $T_C = 25\text{ °C}$	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 $T_J = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	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}	Input capacitance	V _{DS} = 50 V, f = 1 MHz, V _{GS} = 0	-	1770	-	pF
C _{oss}	Output capacitance			110		pF
C _{rss}	Reverse transfer capacitance			17		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	Total gate charge	V _{DD} = 200 V, I _D = 28 A,	-	47	-	nC
Q _{gs}	Gate-source charge	V _{GS} = 10 V		10		nC
Q _{gd}	Gate-drain charge	(see Figure 14)		24		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
$I_{SDM}^{(1)}$	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
Q_{rr}	Reverse recovery charge		-	1.2		μC
I_{RRM}	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
Q_{rr}	Reverse recovery charge		-	1.7		μC
I_{RRM}	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

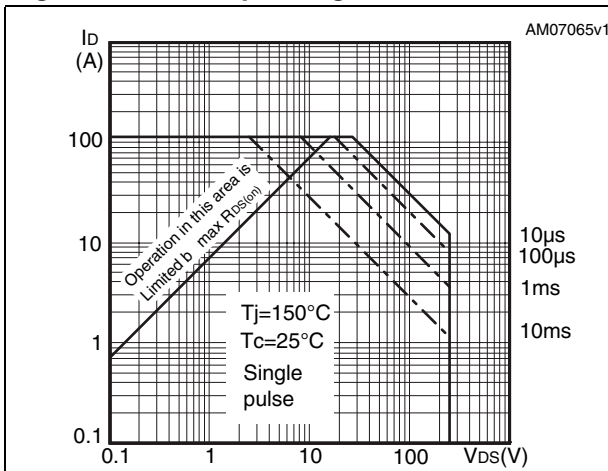


Figure 3. Thermal impedance

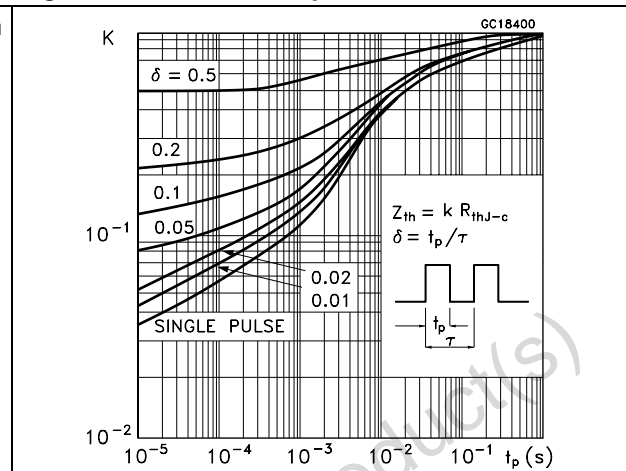


Figure 4. Output characteristics

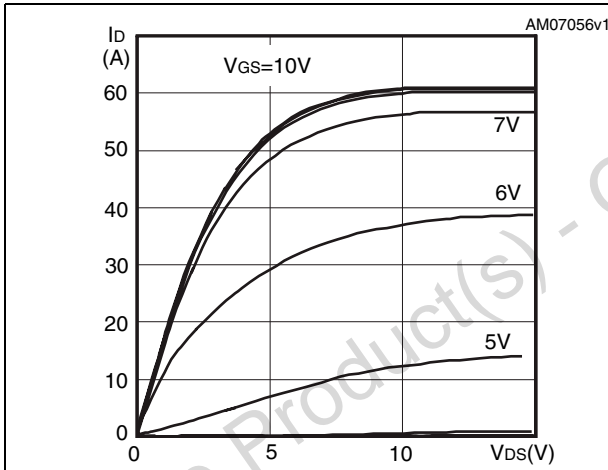


Figure 5. Transfer characteristics

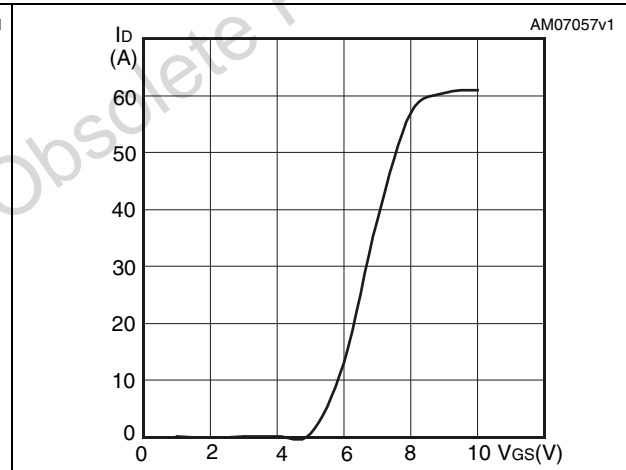


Figure 6. Gate charge vs gate-source voltage

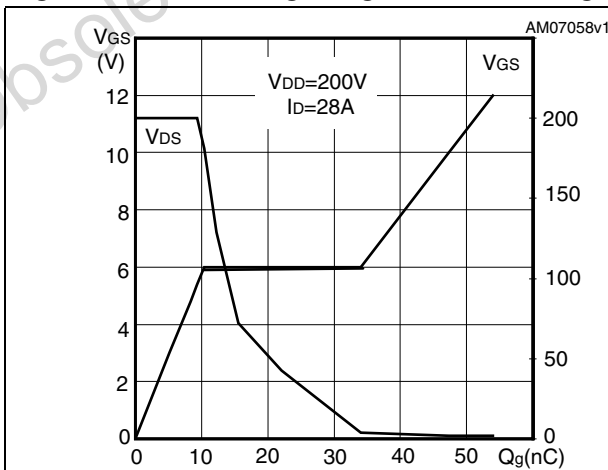


Figure 7. Static drain-source on resistance

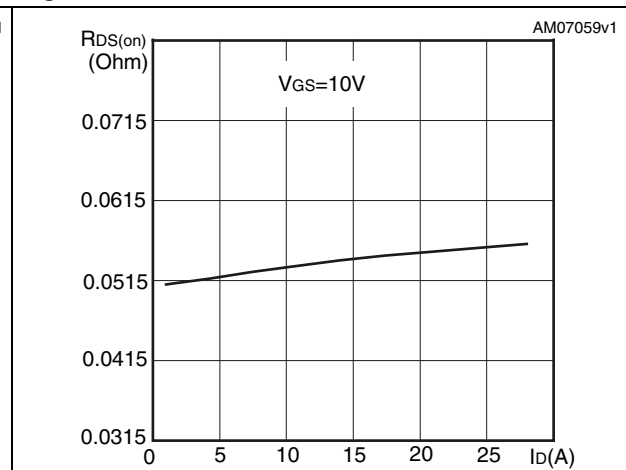


Figure 8. Capacitance variations

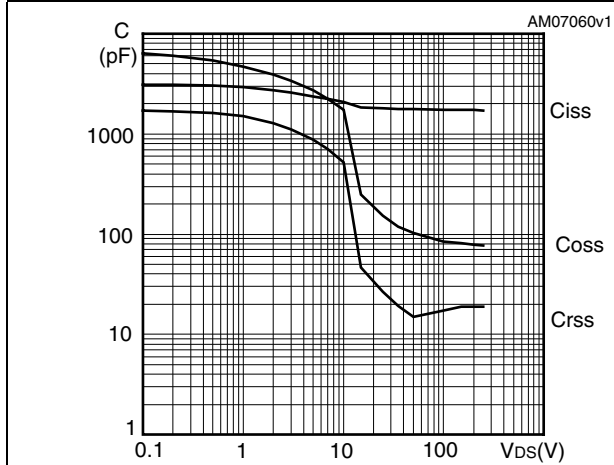


Figure 9. Output capacitance stored energy

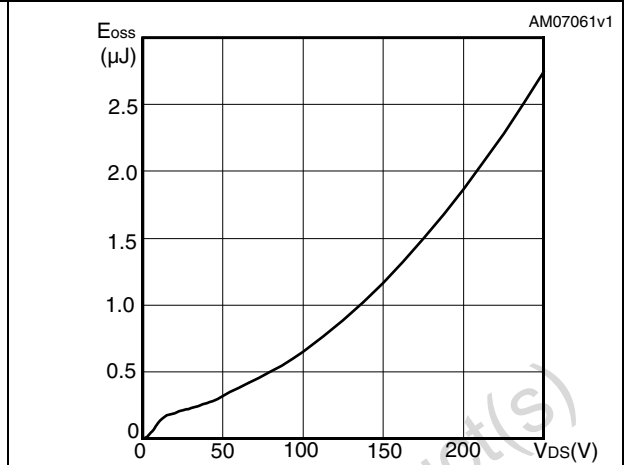


Figure 10. Normalized gate threshold voltage vs temperature

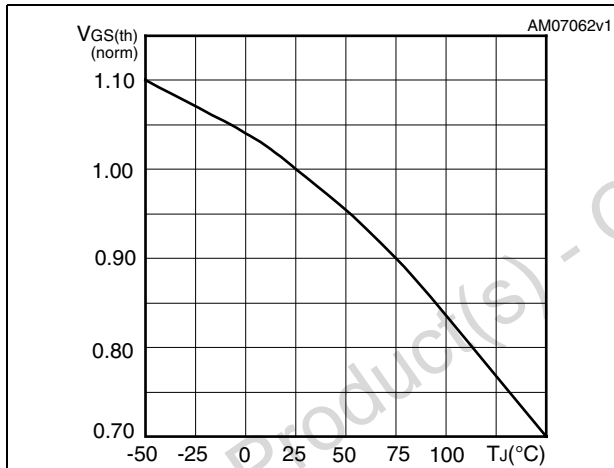


Figure 11. Normalized on resistance vs temperature

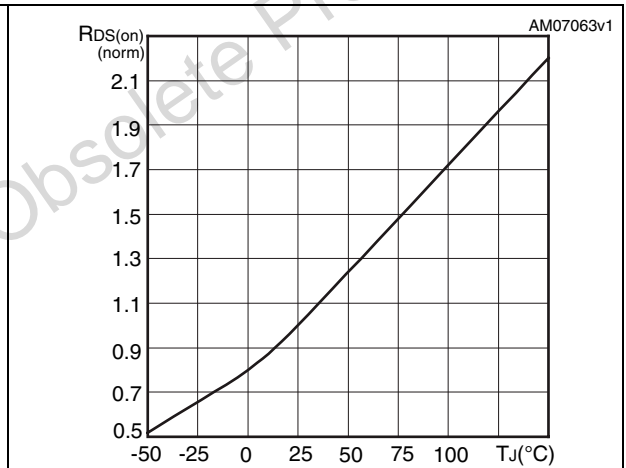
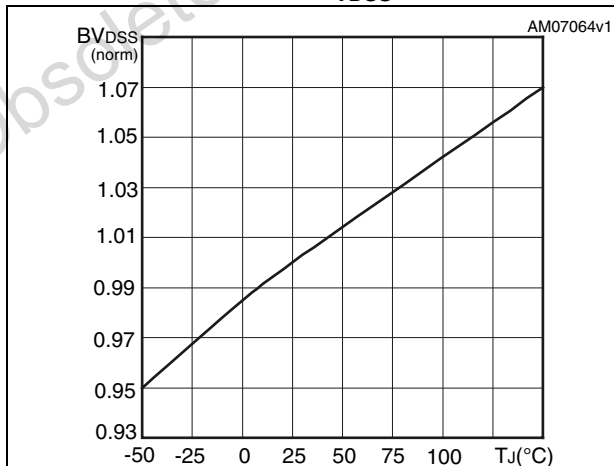


Figure 12. Normalized BV_{DSS} vs temperature



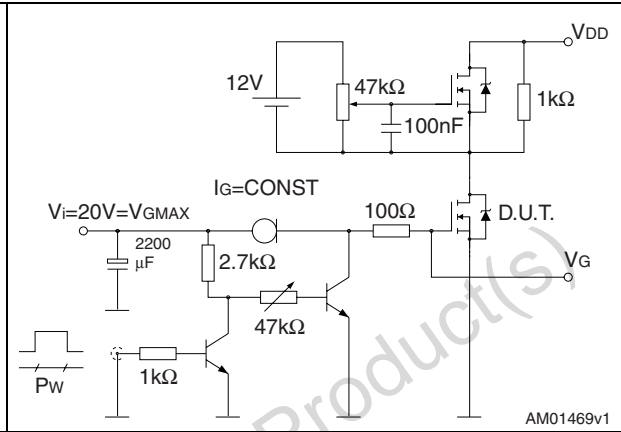
3 Test circuits

Figure 13. Switching times test circuit for resistive load



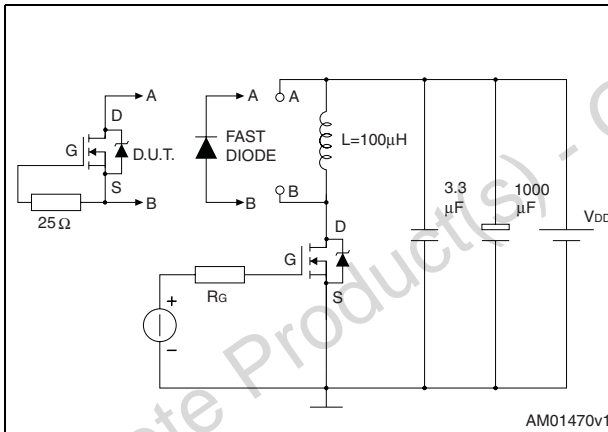
AM01468v1

Figure 14. Gate charge test circuit



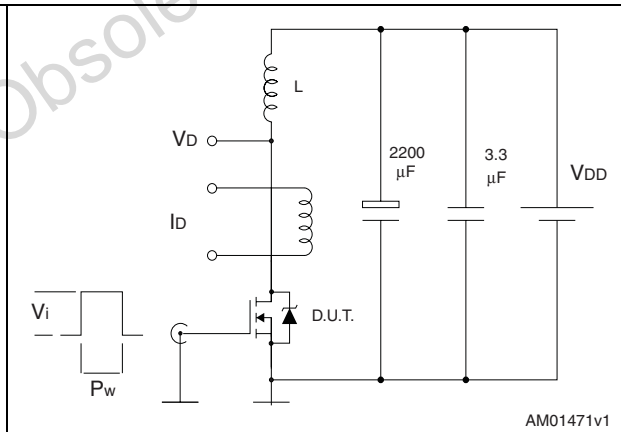
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Figure 15. Test circuit for inductive load switching and diode recovery times



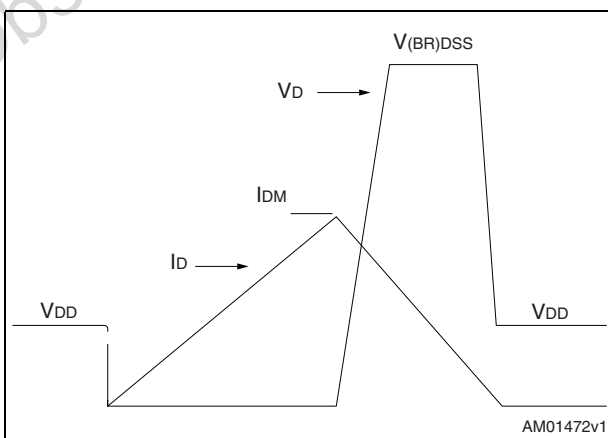
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Figure 16. Unclamped inductive load test circuit



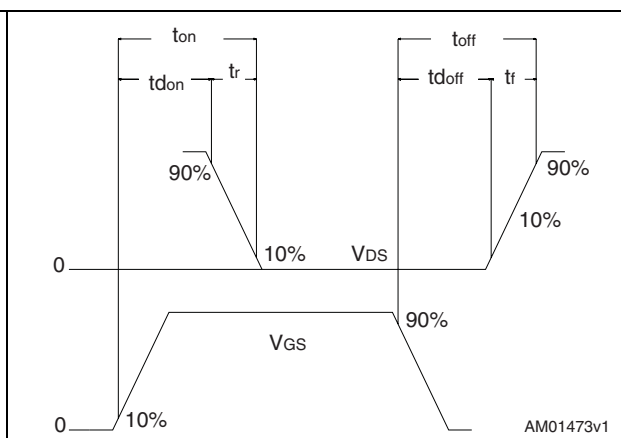
AM01471v1

Figure 17. Unclamped inductive waveform



AM01472v1

Figure 18. Switching time waveform



AM01473v1

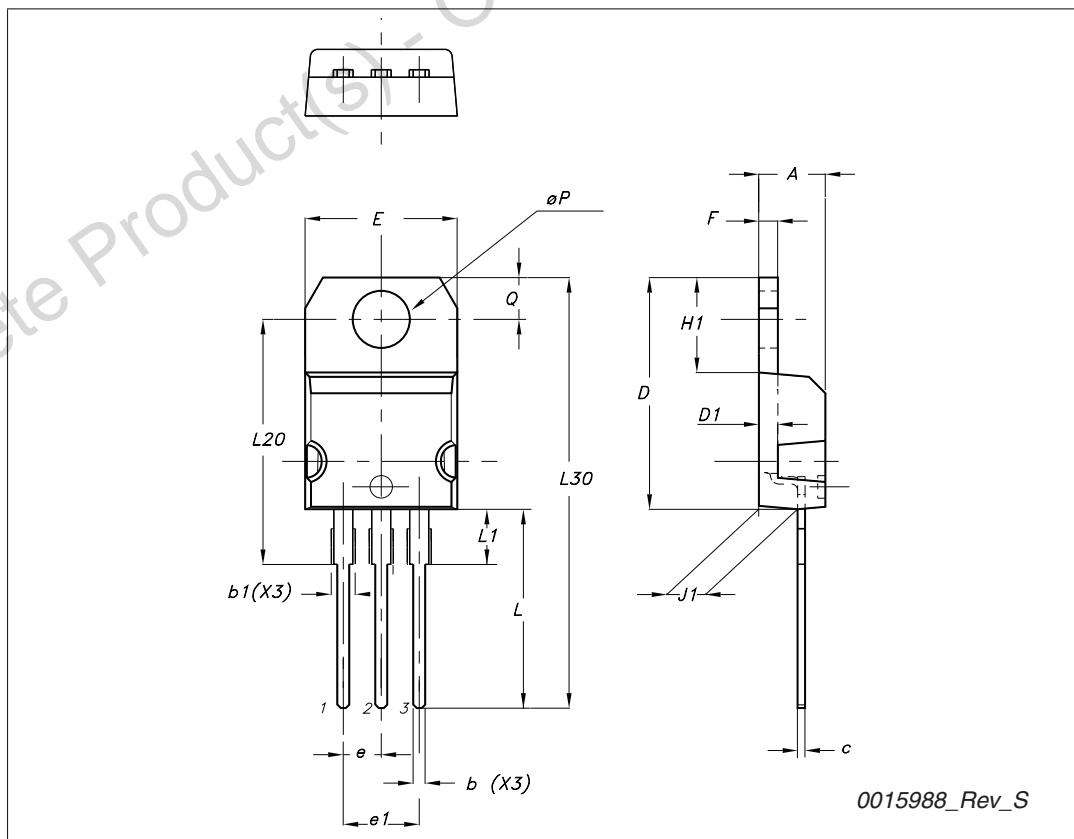
4 Package mechanical data

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.

Obsolete Product(s) - Obsolete Product(s)

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

Obsolete Product(s) - Obsolete Product(s)

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