



# STB85NF55L STP85NF55L

N-channel 55 V, 0.0060  $\Omega$ , 80 A, TO-220, D<sup>2</sup>PAK  
STripFET™ II Power MOSFET

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on) max</sub>	I <sub>D</sub>
STB85NF55L	55 V	< 0.008 $\Omega$	80 A
STP85NF55L	55 V	< 0.008 $\Omega$	80 A

- Low threshold drive

## Application

- Switching applications

## Description

This 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 therefore a remarkable manufacturing reproducibility.

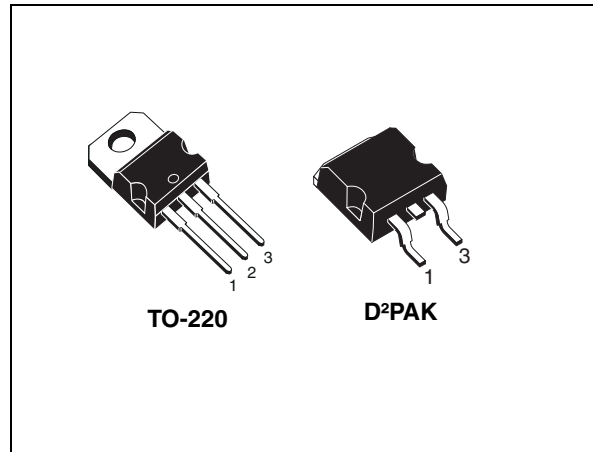


Figure 1. Internal schematic diagram

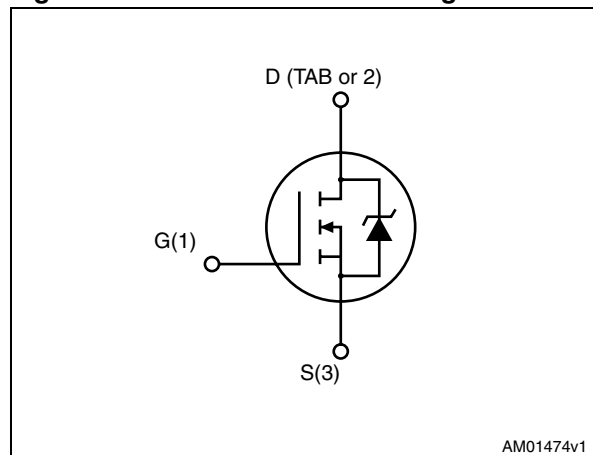


Table 1. Device summary

Order code	Marking	Package	Packaging
STB85NF55LT4	B85NF55L	D <sup>2</sup> PAK	Tape and reel
STP85NF55L	P85NF55L	TO-220	Tube

# Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>3</b>
<b>2</b>	<b>Electrical characteristics</b> .....	<b>4</b>
2.1	Electrical characteristics (curves) .....	6
<b>3</b>	<b>Test circuit</b> .....	<b>8</b>
<b>4</b>	<b>Package mechanical data</b> .....	<b>9</b>
<b>5</b>	<b>Packaging mechanical data</b> .....	<b>12</b>
<b>6</b>	<b>Revision history</b> .....	<b>13</b>

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	55		V
$V_{GS}$	Gate-source voltage	$\pm 15$		V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	80		A
$I_D^{(1)}$	Drain current (continuous) at $T_C=100\text{ }^\circ\text{C}$	80		A
$I_{DM}^{(2)}$	Drain current (pulsed)	320		A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	300		W
	Derating factor	2.0		W/ $^\circ\text{C}$
$dv/dt^{(3)}$	Peak diode recovery voltage slope	10		V/ns
$E_{AS}^{(4)}$	Single pulse avalanche energy	980		mJ
$T_J$	Operating junction temperature	-55 to 175		$^\circ\text{C}$
$T_{stg}$	Storage temperature			

1. Current limited by package
2. Pulse width limited by safe operating area
3.  $I_{SD} \leq 80\text{ A}$ ,  $di/dt \leq 300\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq T_{JMAX}$
4. Starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $I_D = 40\text{ A}$ ,  $V_{DD} = 40\text{ V}$

**Table 3. Thermal data**

Symbol	Parameter	Value		Unit
		D <sup>2</sup> PAK	TO-220	
$R_{thj-case}$	Thermal resistance junction-case max.	0.5		$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max.	62.5		$^\circ\text{C}/\text{W}$
$R_{thj-pcb}$	Thermal resistance junction-pcb max. <sup>(1)</sup>	35		$^\circ\text{C}/\text{W}$
$T_l$	Maximum lead temperature for soldering purpose	300		$^\circ\text{C}$

1. When mounted on 1inch<sup>2</sup> FR-4 2Oz Cu board

## 2 Electrical characteristics

(T<sub>CASE</sub>= 25 °C unless otherwise specified)

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source breakdown voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0	55			V
I <sub>DSS</sub>	Zero gate voltage drain current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = max rating, V <sub>DS</sub> = max rating @ 125 °C			1 10	μA μA
I <sub>GSS</sub>	Gate body leakage current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ±15 V			±100	nA
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1	1.6	2.5	V
R <sub>DS(on)</sub>	Static drain-source on resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 40 A		0.0060	0.008	Ω
		V <sub>GS</sub> = 5 V, I <sub>D</sub> = 40 A		0.008	0.01	

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub> <sup>(1)</sup>	Forward transconductance	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 40 A	-	130		S
C <sub>iss</sub>	Input capacitance	V <sub>DS</sub> = 25 V, f = 1 MHz, V <sub>GS</sub> = 0	-	4050		pF
C <sub>oss</sub>	Output capacitance			860		pF
C <sub>rss</sub>	Reverse transfer capacitance			300		pF
Q <sub>g</sub>	Total gate charge	V <sub>DD</sub> = 27.5 V, I <sub>D</sub> = 80 A V <sub>GS</sub> = 5 V	-	80	110	nC
Q <sub>gs</sub>	Gate-source charge			20		nC
Q <sub>gd</sub>	Gate-drain charge			45		nC

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

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t <sub>d(on)</sub>	Turn-on delay time	V <sub>DD</sub> = 27.5 V, I <sub>D</sub> = 40 A, R <sub>G</sub> = 4.7 Ω, V <sub>GS</sub> = 5 V <i>Figure 14 on page 8</i>	-	35		ns
t <sub>r</sub>	Rise time			165		ns
t <sub>d(off)</sub>	Turn-off delay time			70		ns
t <sub>f</sub>	Fall time			55		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	$I_{SD} = 80 \text{ A}$ , $V_{GS} = 0$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 80 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ , $V_{DD} = 20 \text{ V}$ , $T_J = 150 \text{ }^\circ\text{C}$ <a href="#">Figure 16 on page 8</a>	-	80		ns
$Q_{rr}$	Reverse recovery charge			240		nC
$I_{RRM}$	Reverse recovery current			6		A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration=300 $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

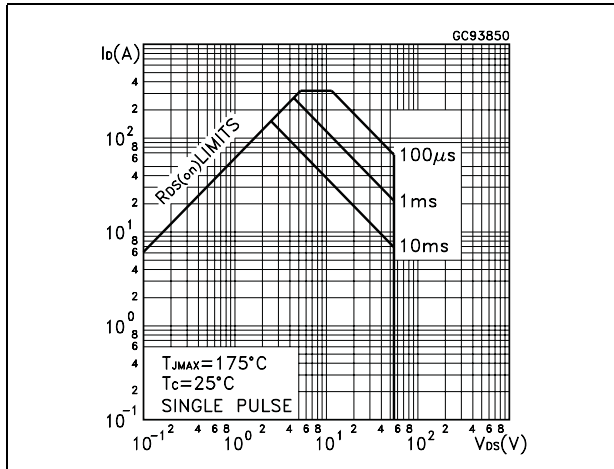


Figure 3. Thermal impedance

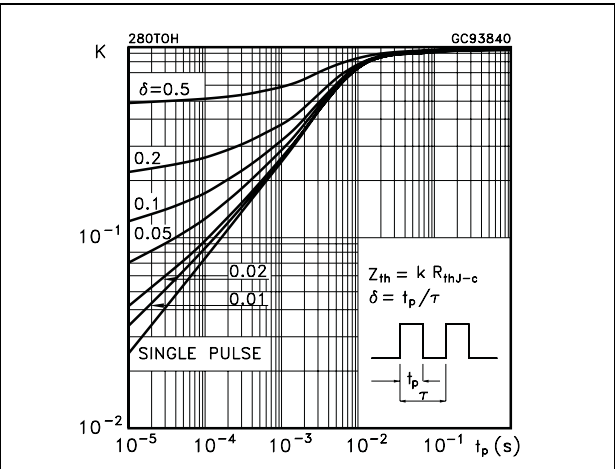


Figure 4. Output characteristics

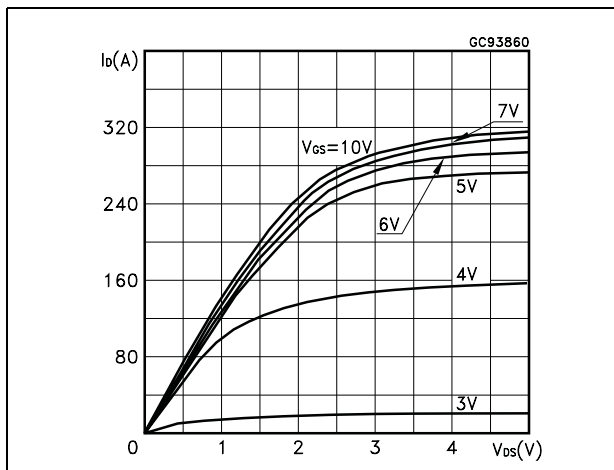


Figure 5. Transfer characteristics

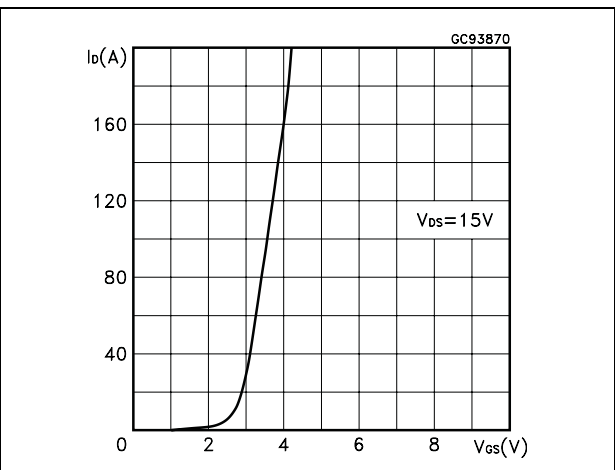


Figure 6. Transconductance

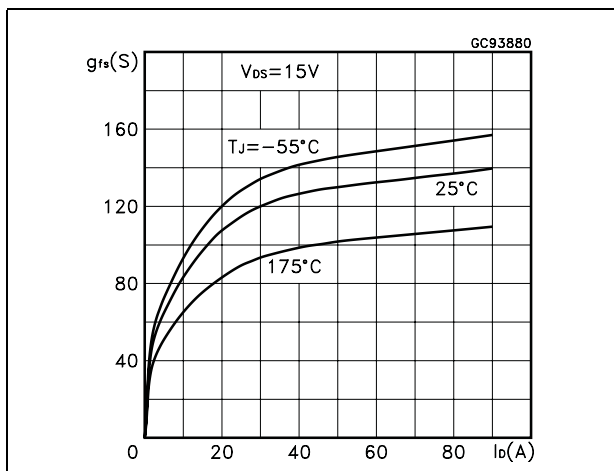


Figure 7. Static drain-source on resistance

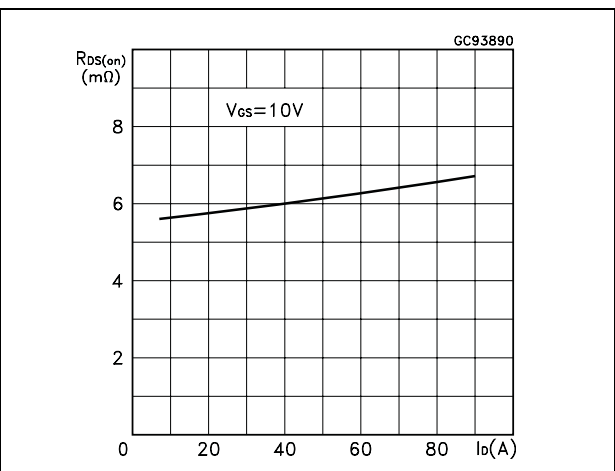


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

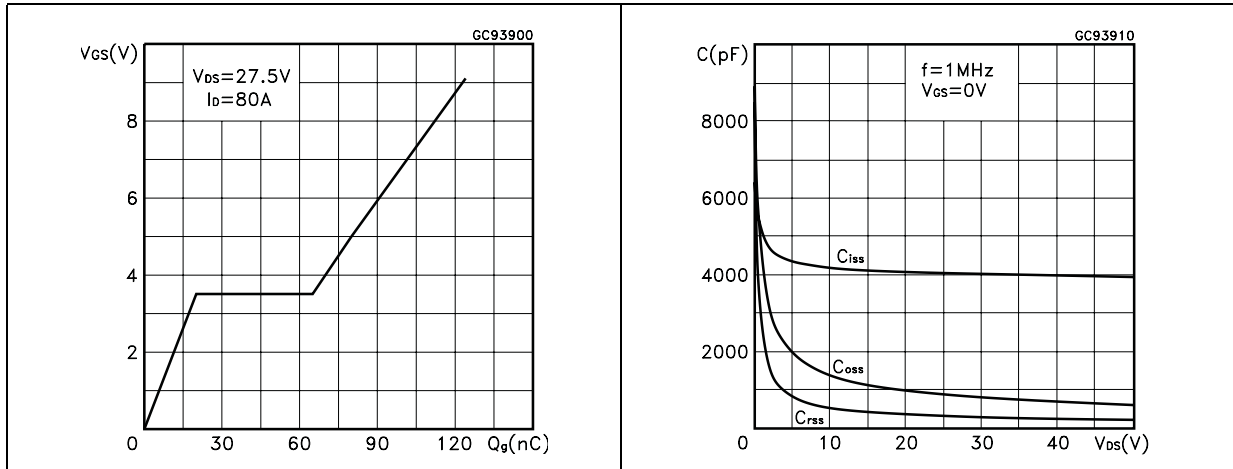


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

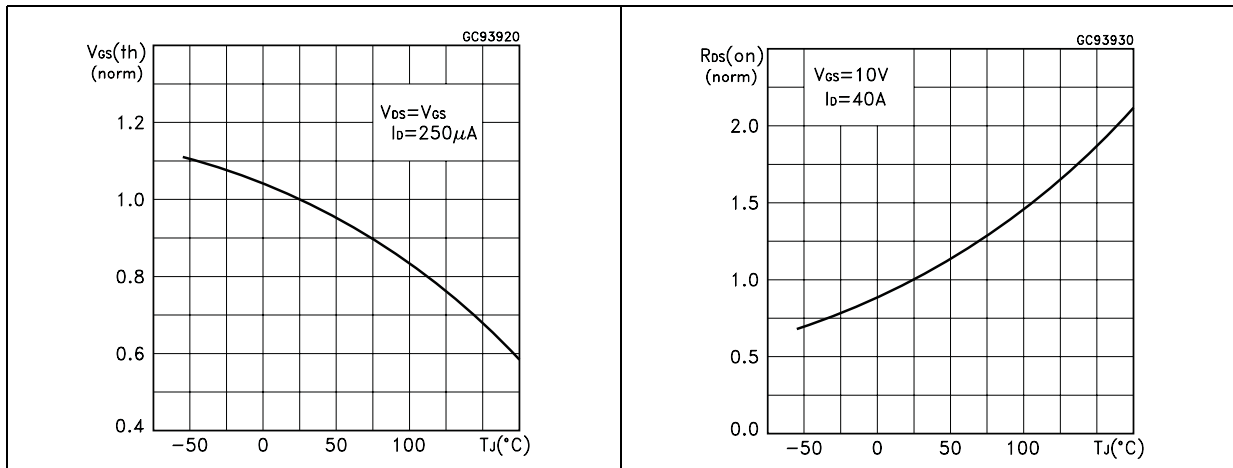
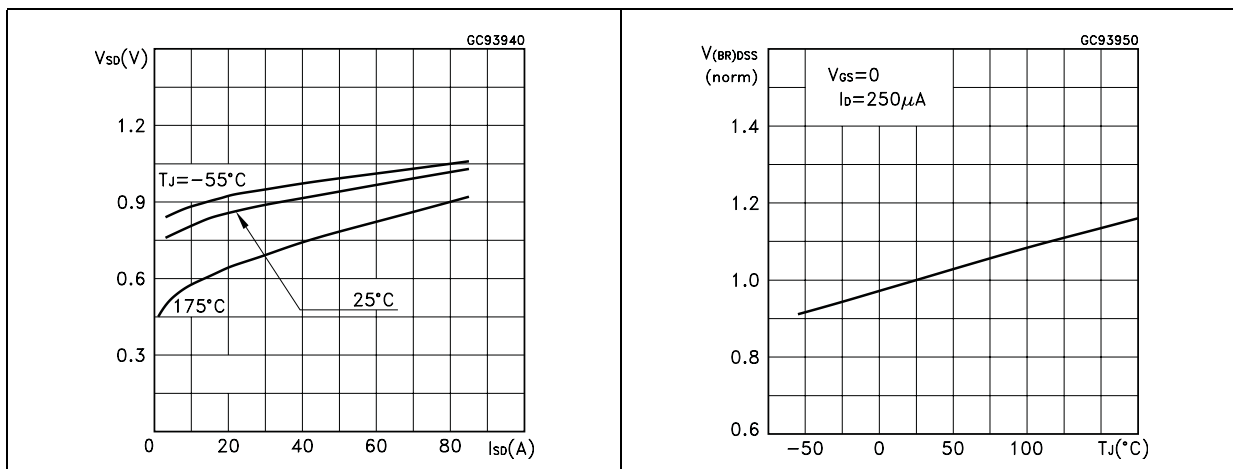


Figure 12. Source-drain diode forward characteristics Figure 13. Normalized  $B_{VDSS}$  vs temperature

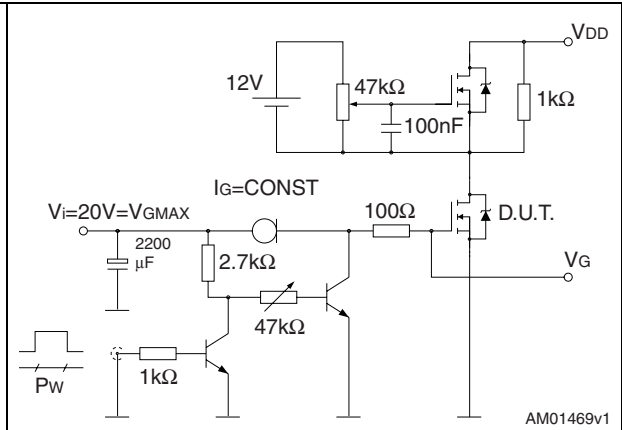


### 3 Test circuits

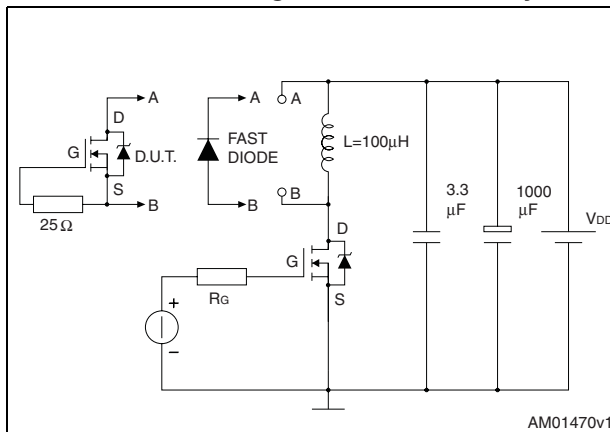
**Figure 14. Switching times test circuit for resistive load**



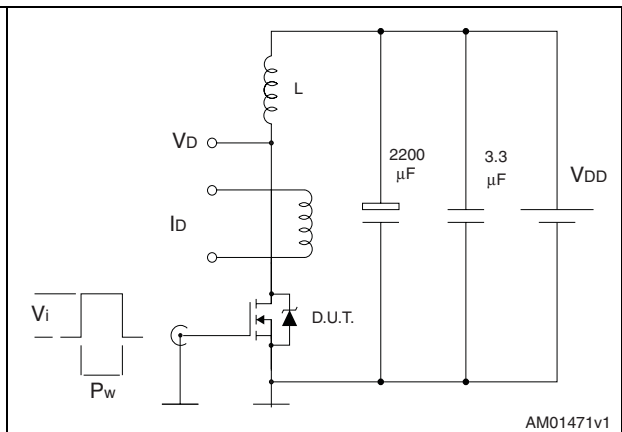
**Figure 15. Gate charge test circuit**



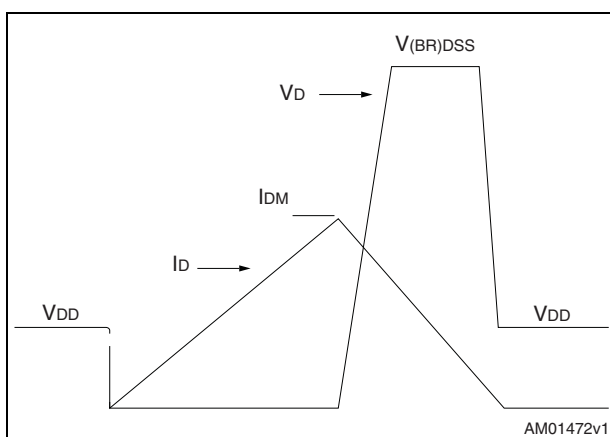
**Figure 16. Test circuit for inductive load switching and diode recovery times**



**Figure 17. Unclamped inductive load test circuit**



**Figure 18. Unclamped inductive waveform**



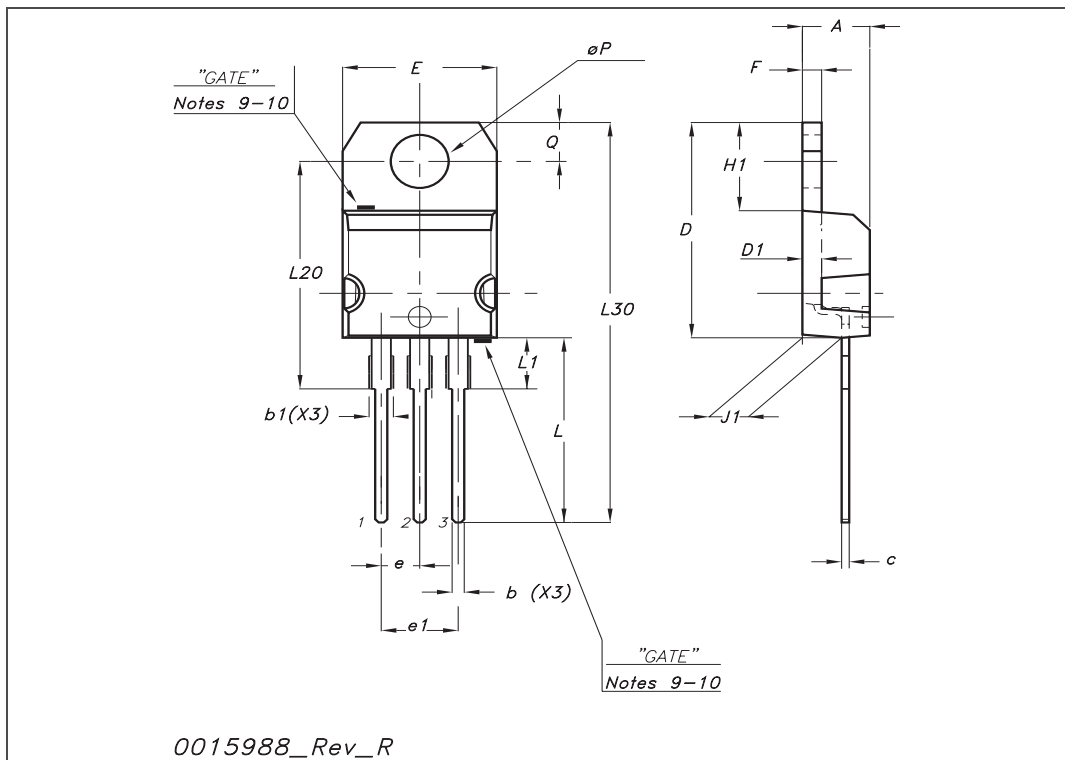


## 4 Package mechanical data

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](http://www.st.com). ECOPACK is an ST trademark.

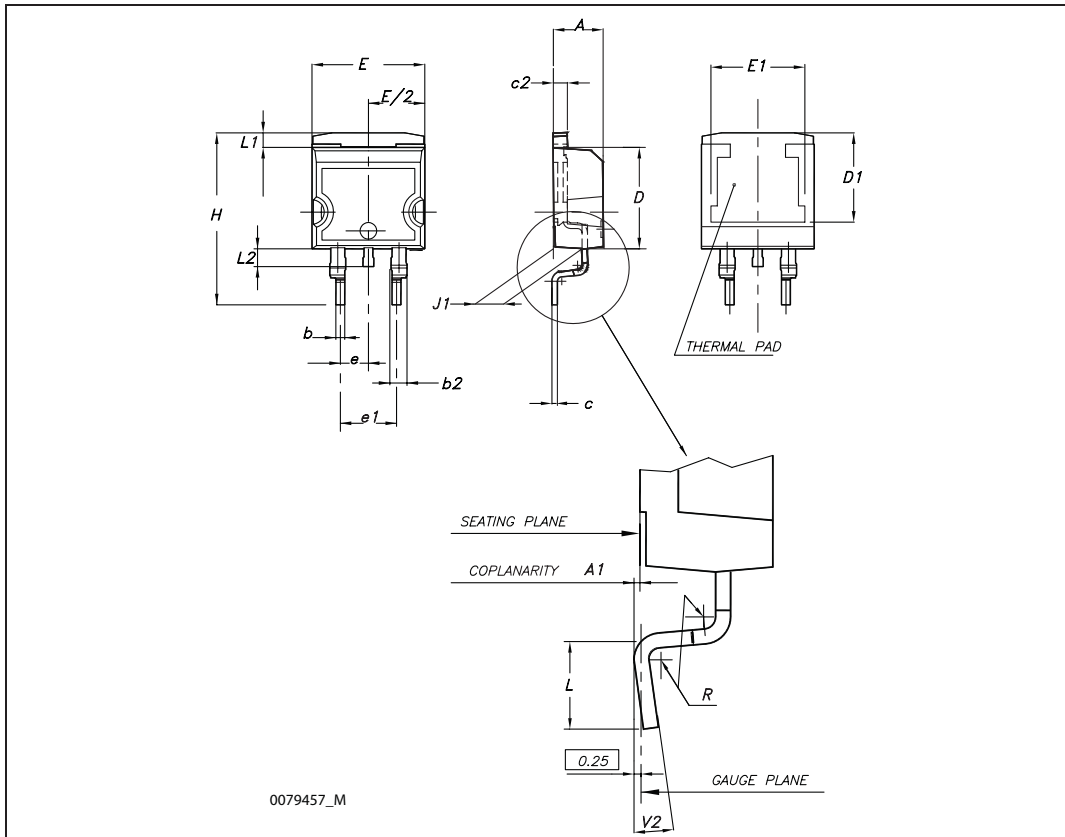
TO-220 mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.48		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.051
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
∅P	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



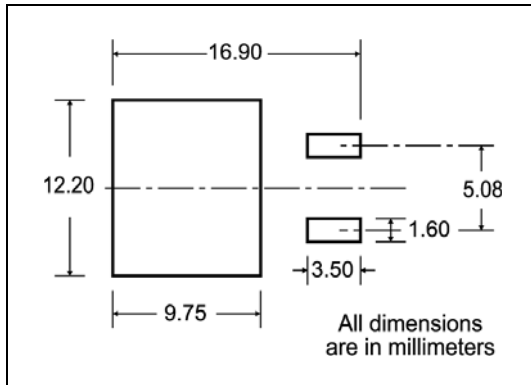
D<sup>2</sup>PAK (TO-263) mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
A1	0.03		0.23	0.001		0.009
b	0.70		0.93	0.027		0.037
b2	1.14		1.70	0.045		0.067
c	0.45		0.60	0.017		0.024
c2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1	7.50			0.295		
E	10		10.40	0.394		0.409
E1	8.50			0.334		
e		2.54			0.1	
e1	4.88		5.28	0.192		0.208
H	15		15.85	0.590		0.624
J1	2.49		2.69	0.099		0.106
L	2.29		2.79	0.090		0.110
L1	1.27		1.40	0.05		0.055
L2	1.30		1.75	0.051		0.069
R		0.4			0.016	
V2	0°		8°	0°		8°



# 5 Packaging mechanical data

## D<sup>2</sup>PAK FOOTPRINT



## TAPE AND REEL SHIPMENT

**TAPE MECHANICAL DATA**

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	10.5	10.7	0.413	0.421
B0	15.7	15.9	0.618	0.626
D	1.5	1.6	0.059	0.063
D1	1.59	1.61	0.062	0.063
E	1.65	1.85	0.065	0.073
F	11.4	11.6	0.449	0.456
K0	4.8	5.0	0.189	0.197
P0	3.9	4.1	0.153	0.161
P1	11.9	12.1	0.468	0.476
P2	1.9	2.1	0.075	0.082
R	50		1.574	
T	0.25	0.35	0.0098	0.0137
W	23.7	24.3	0.933	0.956

**REEL MECHANICAL DATA**

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

10 pitches cumulative tolerance on tape +/- 0.2 mm

## 6 Revision history

**Table 8. Document revision history**

Date	Revision	Changes
19-May-2009	7	New ECOPACK <sup>®</sup> statement in <i>Section 4: Package mechanical data</i> Content reworked to improve readability, no technical changes
06-Aug-2009	8	<i>Table 3: Thermal data</i> has been updated

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