



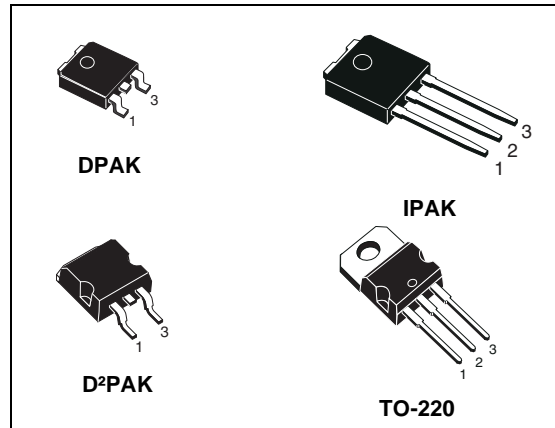
STB95N3LLH6, STD95N3LLH6 STP95N3LLH6, STU95N3LLH6

N-channel 30 V, 0.0037 Ω , 80 A, D²PAK, DPAK, IPAK, TO-220
STripFET™ VI DeepGATE™ Power MOSFET

Features

Type	V _{DSS}	R _{DS(on) max}	I _D
STB95N3LLH6	30 V	0.0042 Ω	80 A
STD95N3LLH6	30 V	0.0042 Ω	80 A
STP95N3LLH6	30 V	0.0042 Ω	80 A
STU95N3LLH6	30 V	0.0047 Ω	80 A

- R_{DS(on)} * Q_g industry benchmark
- Extremely low on-resistance R_{DS(on)}
- High avalanche ruggedness
- Low gate drive power losses



Application

- Switching applications

Description

This product utilizes the 6th generation of design rules of ST's proprietary STripFET™ technology, with a new gate structure. The resulting Power MOSFET exhibits the lowest R_{DS(on)} in all packages.

Figure 1. Internal schematic diagram

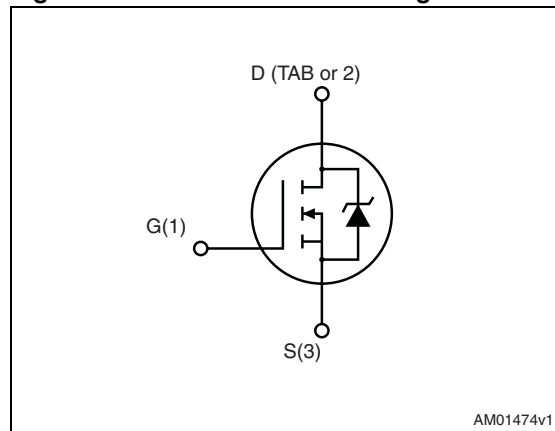


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB95N3LLH6	95N3LLH6	D ² PAK	Tape and reel
STD95N3LLH6	95N3LLH6	DPAK	Tape and reel
STP95N3LLH6	95N3LLH6	TO-220	Tube
STU95N3LLH6	95N3LLH6	IPAK	Tube

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
	2.1 Electrical characteristics (curves)	6
3	Test circuits	8
4	Package mechanical data	10
5	Packaging mechanical data	16
6	Revision history	18

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	30	V
V_{GS}	Gate-source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	80	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	61	A
$I_{DM}^{(2)}$	Drain current (pulsed)	320	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	70	W
	Derating factor	0.47	W/ $^\circ\text{C}$
$E_{AS}^{(3)}$	Single pulse avalanche energy	150	mJ
T_{stg}	Storage temperature	-55 to 175	$^\circ\text{C}$
T_j	Max. operating junction temperature	175	$^\circ\text{C}$

1. Limited by wire bonding
2. Pulse width limited by safe operating area
3. Starting $T_j = 25\text{ }^\circ\text{C}$, $I_{AV} = 55\text{ A}$, $L = 0.1\text{ mH}$

Table 3. Thermal data

Symbol	Parameter	Value				Unit
		D ² PAK	DPAK	IPAK	TO-220	
$R_{thj-case}$	Thermal resistance junction-case max	2.14				$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max		100		62.5	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max	35	35			$^\circ\text{C}/\text{W}$
T_l	Maximum lead temperature for soldering purpose	275			300	$^\circ\text{C}$

1. When mounted on FR-4 board of 1 inch², 2 oz Cu.

2 Electrical characteristics

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

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown Voltage	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0$	30			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 30\text{ V}$ $V_{DS} = 30\text{ V}$, $T_c = 125\text{ °C}$			1 10	μA μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$	1		2.5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 40\text{ A}$ SMD version		0.0037	0.0042	Ω
		$V_{GS} = 10\text{ V}$, $I_D = 40\text{ A}$		0.0042	0.0047	Ω
		$V_{GS} = 4.5\text{ V}$, $I_D = 40\text{ A}$ SMD version		0.0055	0.007	Ω
		$V_{GS} = 4.5\text{ V}$, $I_D = 40\text{ A}$		0.006	0.0075	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	2200	-	pF
C_{oss}	Output capacitance			400		pF
C_{rss}	Reverse transfer capacitance			280		pF
Q_g	Total gate charge	$V_{DD} = 15\text{ V}$, $I_D = 80\text{ A}$	-	20	-	nC
Q_{gs}	Gate-source charge	$V_{GS} = 4.5\text{ V}$		8.2		nC
Q_{gd}	Gate-drain charge	Figure 13		7.5		nC
Q_{gs1}	Pre V_{th} gate-to-source charge	$V_{DD} = 15\text{ V}$, $I_D = 80\text{ A}$ Figure 18	-	3.4	-	nC
Q_{gs2}	Post V_{th} gate-to-source charge			6.2		nC
R_G	Gate input resistance	$f = 1\text{ MHz}$ gate bias Bias = 0 test signal level = 20 mV open drain	-	1	-	Ω

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	$V_{DD} = 15\text{ V}$, $I_D = 40\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 5\text{ V}$ Figure 12	-	19 91	-	ns ns
$t_{d(off)}$ t_f	Turn-off delay time Fall time	$V_{DD} = 15\text{ V}$, $I_D = 40\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 5\text{ V}$ Figure 12	-	24.5 23.4	-	ns 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	$I_{SD} = 40\text{ A}$, $V_{GS} = 0$	-		1.1	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 80\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 24\text{ V}$ Figure 14	-	28.6 22.8 1.6		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

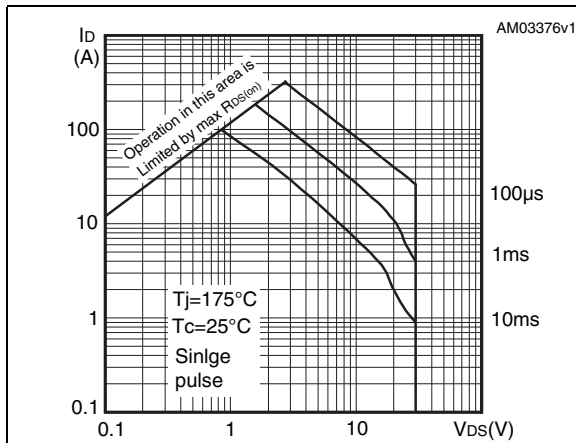


Figure 3. Thermal impedance

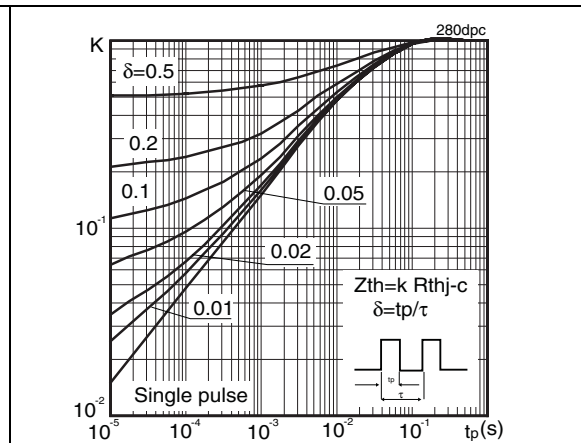


Figure 4. Output characteristics

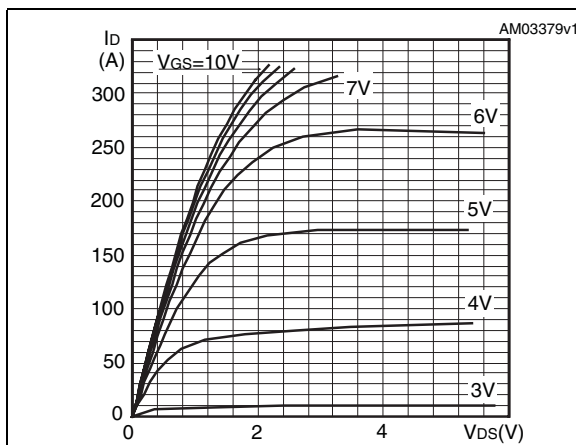


Figure 5. Transfer characteristics

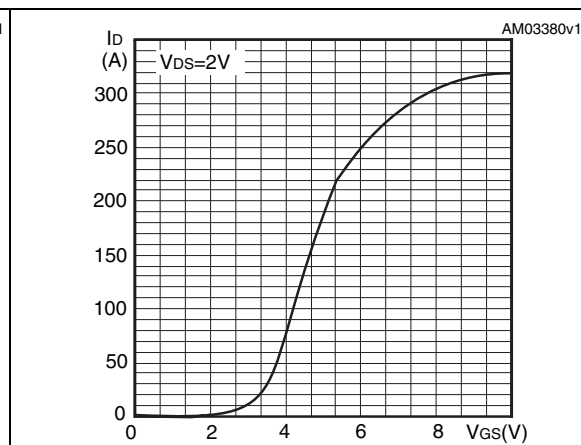


Figure 6. Normalized BV_{DSS} vs temperature

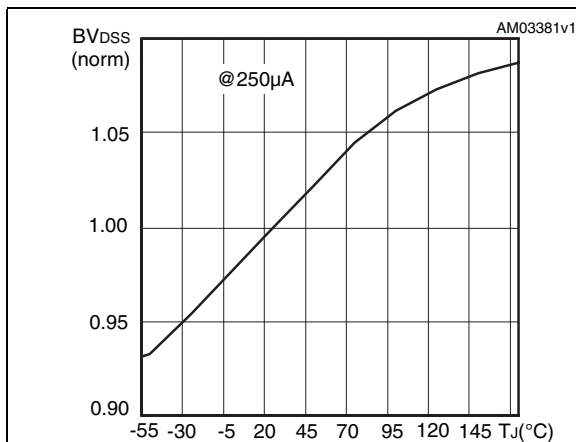


Figure 7. Static drain source on resistance

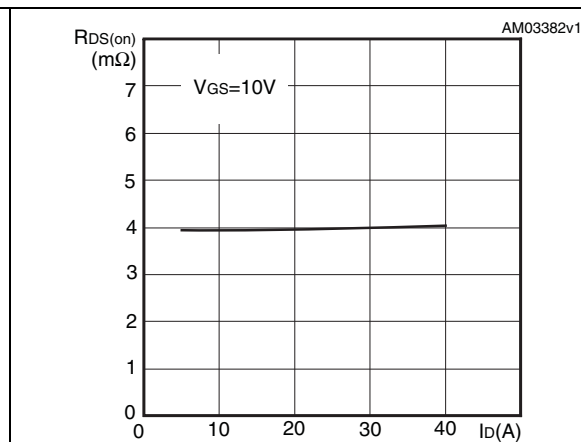


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

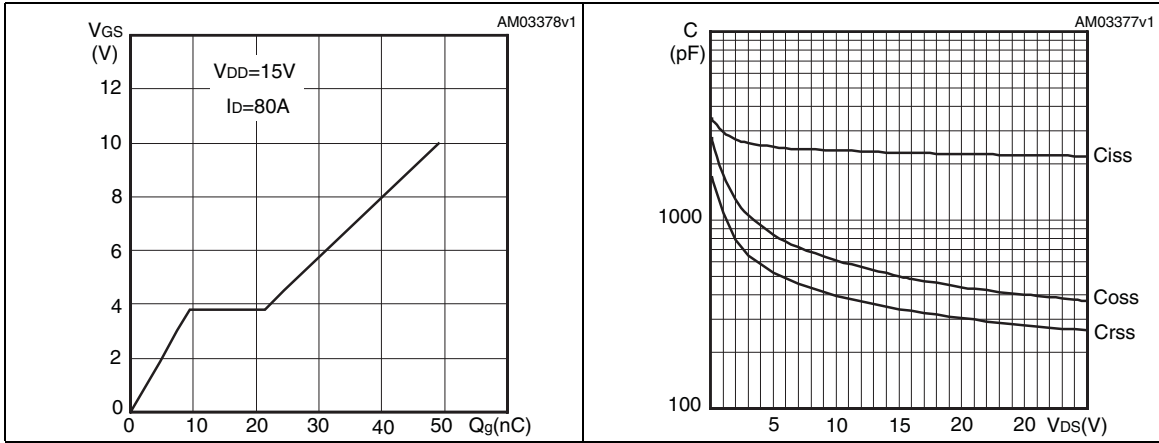
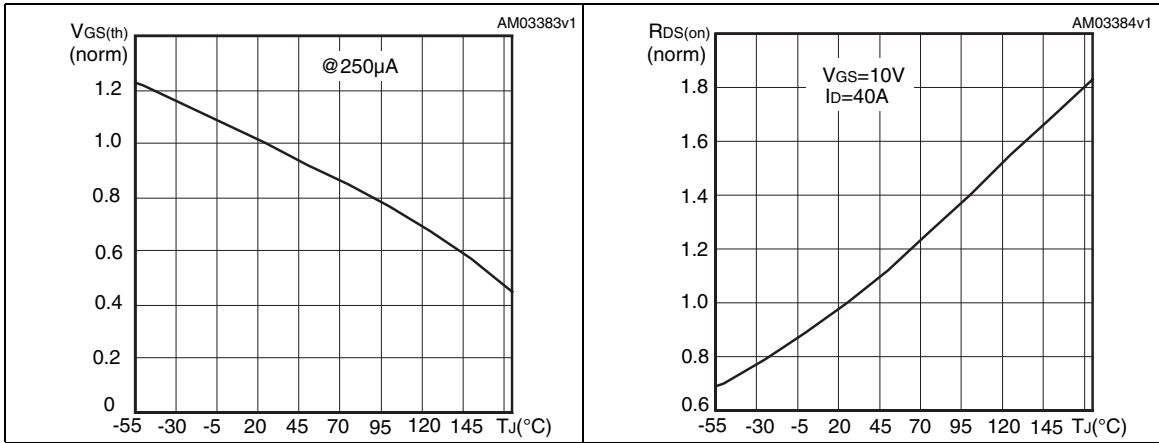


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature



3 Test circuits

Figure 12. Switching times test circuit for resistive load

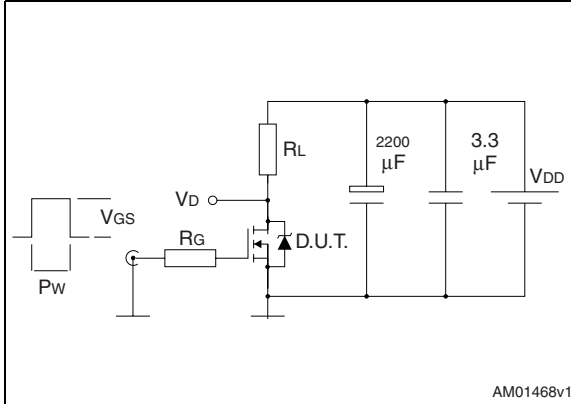


Figure 13. Gate charge test circuit

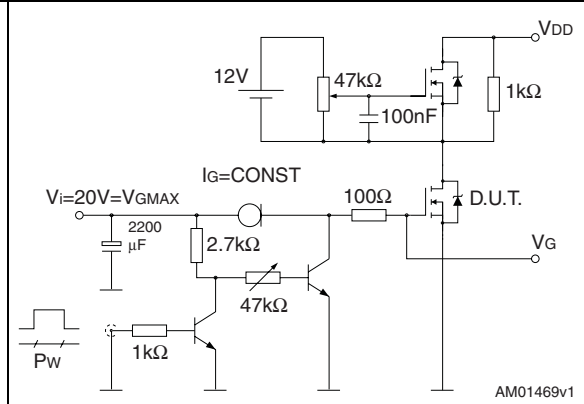


Figure 14. Test circuit for inductive load switching and diode recovery times

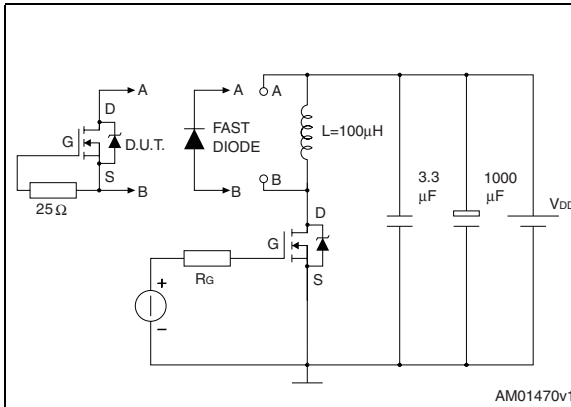


Figure 15. Unclamped inductive load test circuit

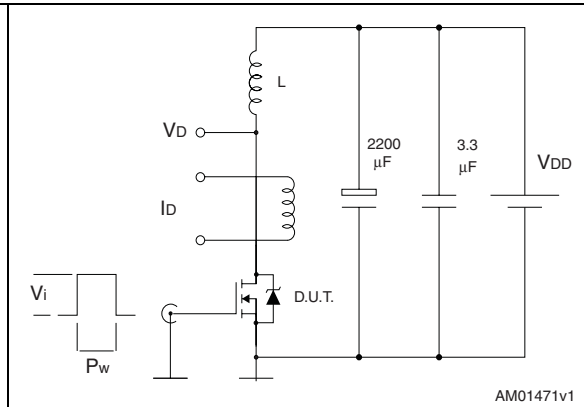


Figure 16. Unclamped inductive waveform

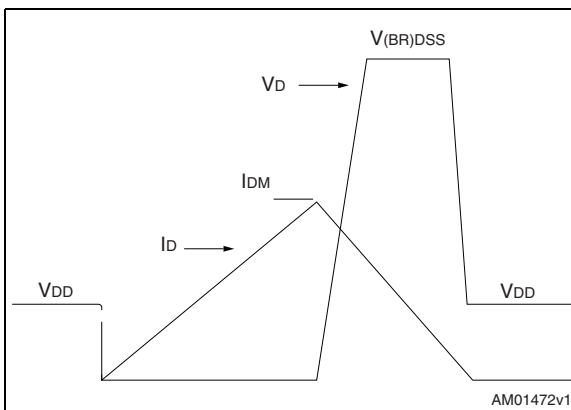


Figure 17. Switching time waveform

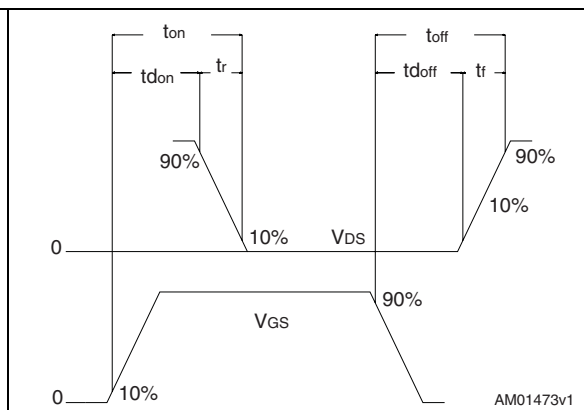
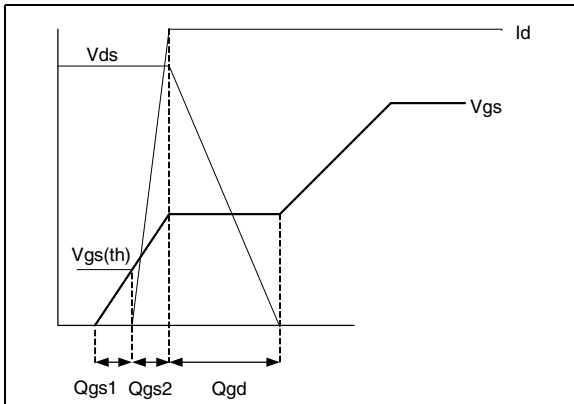


Figure 18. Gate charge waveform

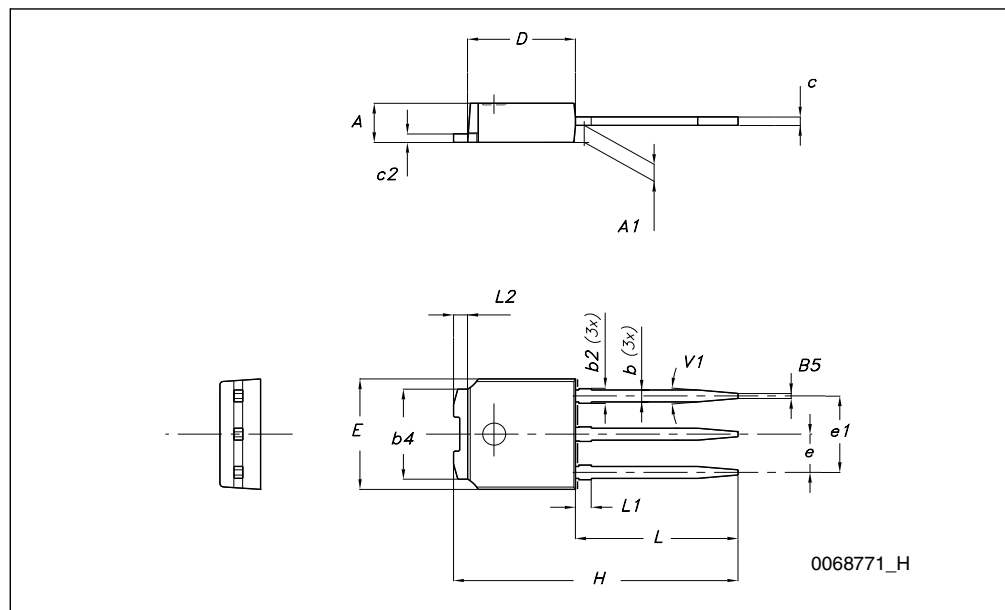


4 Package mechanical data

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.

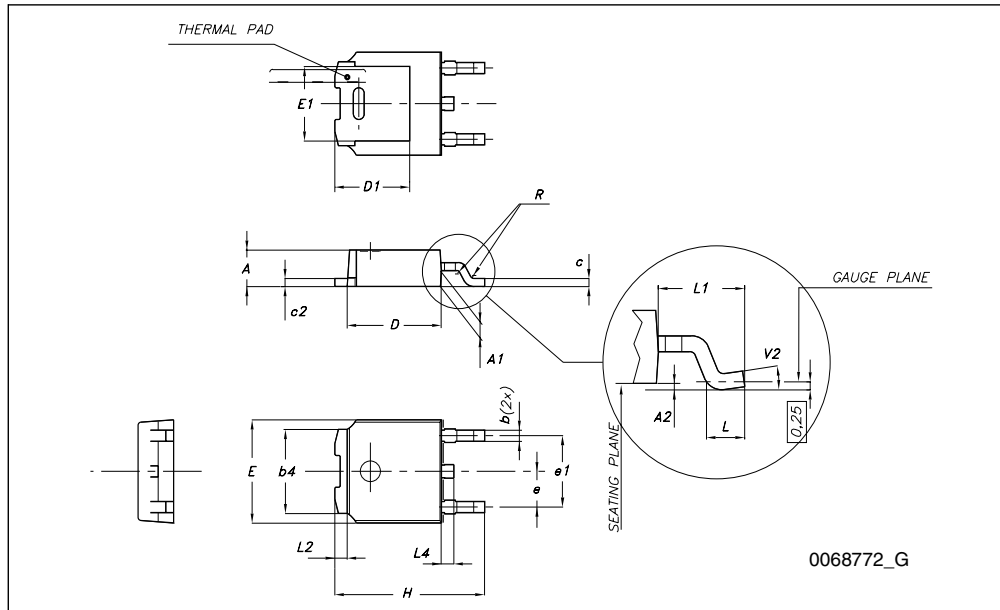
TO-251 (IPAK) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
(L1)	0.80		1.20
L2		0.80	
V1		10°	



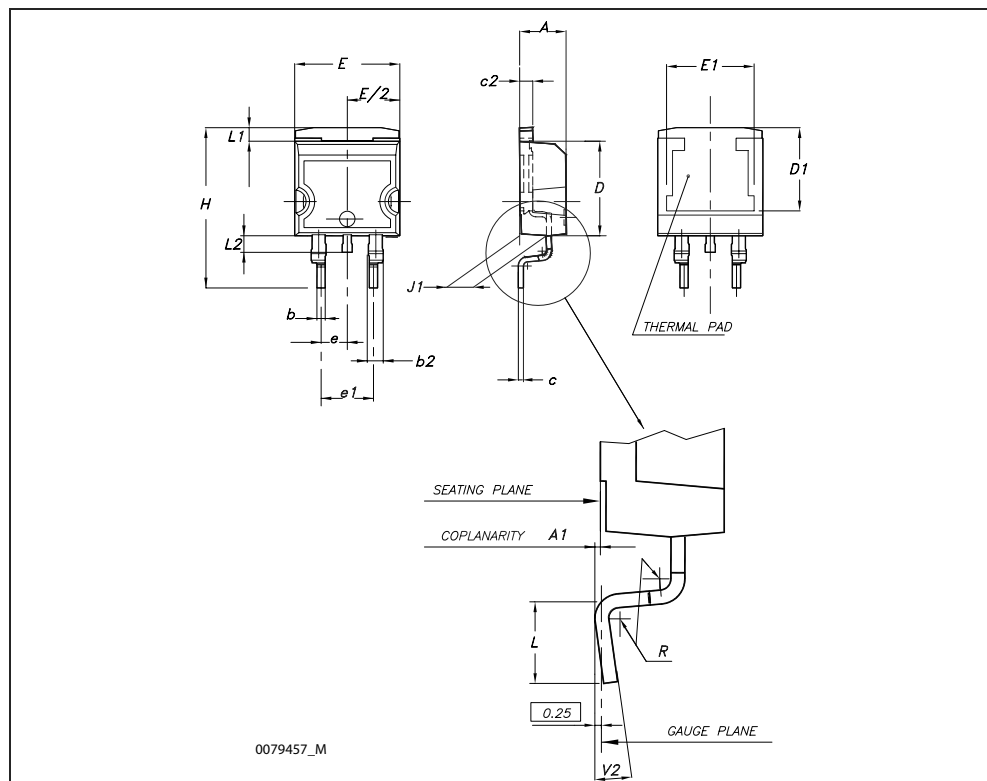
TO-252 (DPAK) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0°		8°



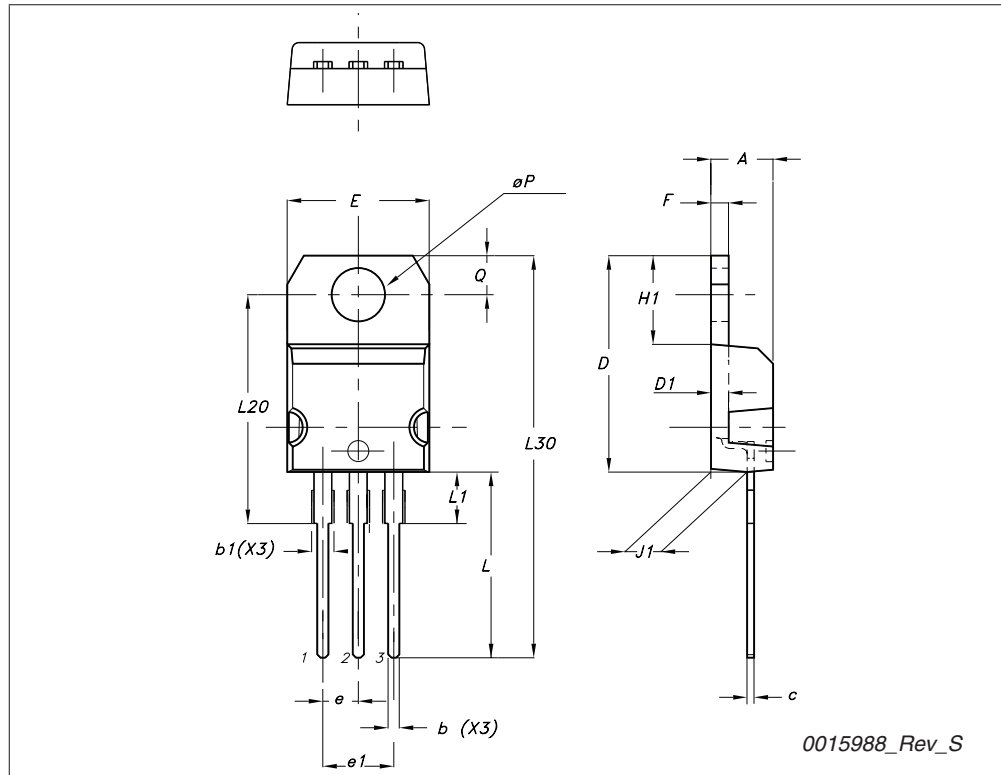
D²PAK (TO-263) mechanical data

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°



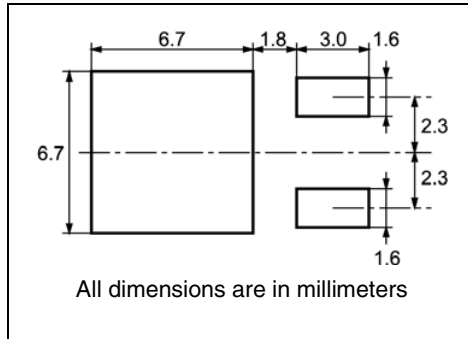
TO-220 type A mechanical data

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 Packaging mechanical data

DPAK FOOTPRINT



TAPE AND REEL SHIPMENT

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

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	16.4	18.4	0.645	0.724
N	50		1.968	
T		22.4		0.881

TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	6.8	7	0.267	0.275
B0	10.4	10.6	0.409	0.417
B1		12.1		0.476
D	1.5	1.6	0.059	0.063
D1	1.5		0.059	
E	1.65	1.85	0.065	0.073
F	7.4	7.6	0.291	0.299
K0	2.55	2.75	0.100	0.108
P0	3.9	4.1	0.153	0.161
P1	7.9	8.1	0.311	0.319
P2	1.9	2.1	0.075	0.082
R	40		1.574	
W	15.7	16.3	0.618	0.641

BASE QTY

2500

BULK QTY

2500

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

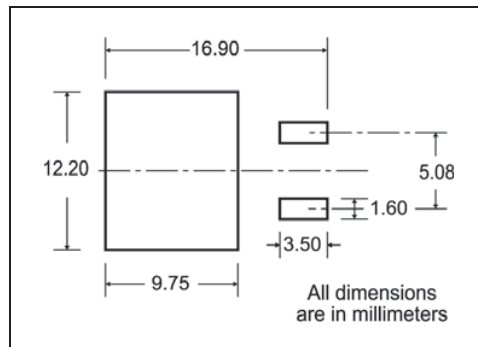
For machine ref. only including draft and radii concentric around B0

TRL

FEED DIRECTION

Bending radius R min.

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

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 1000 **BULK QTY** 1000

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

User Direction of Feed

TRL

FEED DIRECTION

Bending radius R min.

6 Revision history

Table 8. Document revision history

Date	Revision	Changes
01-Dec-2008	1	First release
20-May-2009	2	– Document status promoted from preliminary data to datasheet. – Added new package, mechanical data: D ² PAK
10-Nov-2009	3	Added new device in TO-220

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2009 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com