STx8NM60N

N-channel 600 V, 0.56 Ω,7 A MDmesh™ II Power MOSFET TO-220, TO-220FP, IPAK, DPAK, D²PAK

Features

Type	V_{DSS} (@Tjmax)	$R_{DS(on)}$ max	I_D
STB8NM60N	650 V	< 0.65 Ω	7 A
STD8NM60N	650 V	< 0.65 Ω	7 A
STD8NM60N-1	650 V	< 0.65 Ω	7 A
STF8NM60N	650 V	< 0.65 Ω	7 A(1)
STP8NM60N	650 V	< 0.65 Ω	7 A

1. Limited only by maximum temperature allowed

- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

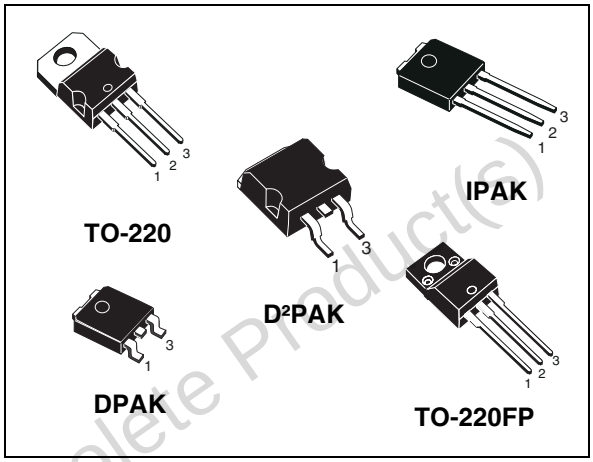
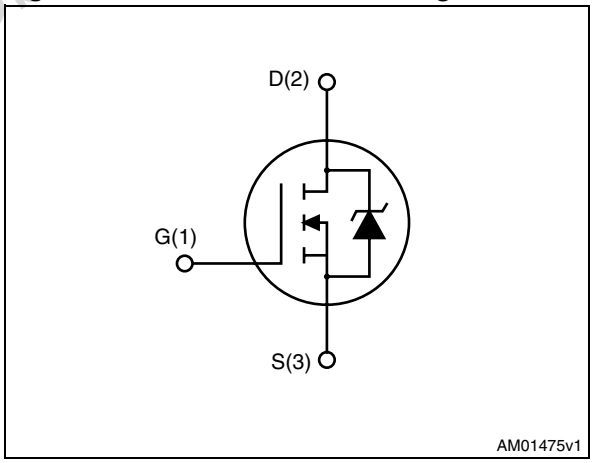


Figure 1. Internal schematic diagram



Application

- Switching applications

Description

This series of devices implements second generation MDmesh™ technology. This revolutionary Power MOSFET associates a new vertical structure to the Company's strip layout to yield one of the world's lowest on-resistance and gate charge. It is therefore suitable for the most demanding high efficiency converters.

Obsolete Product(s) - Obsolete Product(s)

Table 1. Device summary

Order codes	Marking	Package	Packaging
STB8NM60N	B8NM60N	D²PAK	Tape and reel
STD8NM60N	D8NM60N	DPAK	Tape and reel
STD8NM60N-1	D8NM60N	IPAK	Tube
STF8NM60N	F8NM60N	TO-220FP	Tube
STP8NM60N	P8NM60N	TO-220	Tube

Contents

1 Electrical ratings 3

2 Electrical characteristics 4

2.1 Electrical characteristics (curves) 6

3 Test circuit 9

4 Package mechanical data 10

5 Packaging mechanical data 16

6 Revision history 18

Obsolete Product(s) - Obsolete Product(s)

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220, IPAK, DPAK, D²PAK	TO-220FP	
V_{DS}	Drain-source voltage (V_{GS} = 0)	600		V
V_{GS}	Gate-source voltage	± 25		V
I_D	Drain current (continuous) at T_C = 25 °C	7	7 (1)	A
I_D	Drain current (continuous) at T_C = 100 °C	4.3	4.3 (1)	A
I_{DM} (2)	Drain current (pulsed)	28	28 (1)	A
P_{TOT}	Total dissipation at T_C = 25 °C	70	25	W
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s;T_C = 25 °C)	--	2500	V
dv/dt (3)	Peak diode recovery voltage slope	15		V/ns
T_j T_{stg}	Operating junction temperature Storage temperature	-55 to 150		°C

1. Limited only by maximum temperature allowed
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 7$ A, di/dt $\leq$ 400 A/µs, V_{DD} = 80% $V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	Value					Unit
		TO-220	IPAK	DPAK	D²PAK	TO-220FP	
Rthj-case	Thermal resistance junction-case	1.78				5	°C/W
Rthj-amb	Thermal resistance junction-amb	62.5	100	--	62.5		°C/W
T_l	Maximum lead temperature for soldering purpose	300					°C

Table 4. Avalanche characteristics

Symbol	Parameter	Max value	Unit
I_{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by Tj max)	2.5	A
E_{AS}	Single pulse avalanche energy (starting Tj = 25 °C, $I_D = I_{AS}$, V_{DD} = 50 V)	200	mJ

Obsolete Product(s) - Obsolete Product(s)

2 Electrical characteristics

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

Table 5. 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	600			V
dv/dt(1)	Drain-source voltage slope	V_{DD} = 480 V, I_D = 7 A, V_{GS} =10 V		38		V/ns
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max rating, V_{DS} = Max rating,Tc = 125 °C			1 100	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ±20 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10V, I_D = 3.5 A		0.56	0.65	Ω

1. Characteristics value at turn off on inductive load

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs}(1)	Forward transconductance	V_{DS} = 15 V, I_D= 3.5 A		15		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 50 V, f = 1 MHz, V_{GS} = 0		560 37 2		pF pF pF
$C_{oss\ eq.}$(2)	Equivalent output capacitance	V_{GS} = 0, V_{DS} = 0 to 480 V		153		pF
R_G	Gate input resistance	f = 1 MHz Gate DC Bias = 0 Test Signal Level = 20 mV Open Drain		6		Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 480 V, I_D = 7 A V_{GS} = 10 V *(see Figure 19)*		19 3 10		nC nC nC

1. Pulsed: pulse duration = 300µs, duty cycle 1.5%
2. $C_{oss\ eq.}$ is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

Obsolete Product(s) - Obsolete Product(s)

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	V_{DD} = 300 V, I_D = 3.5 A, R_G = 4.7 Ω, V_{GS} = 10 V *(see Figure 18),* *(see Figure 23)*		10 12 40 10		ns ns ns ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)				7 28	A A
V_{SD}(2)	Forward on voltage	I_{SD} = 7 A, V_{GS} = 0			1.3	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 7 A, di/dt = 100 A/µs, V_{DD} = 30 V, Tj = 25 °C *(see Figure 20)*		310 2.40 15		ns µC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 7A, di/dt = 100 A/µs, V_{DD} = 30 V, Tj=150°C *(see Figure 20)*		480 3.50 15		ns µC A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration = 300µs, duty cycle 1.5%

Obsolete Product(s) - Obsolete Product(s)

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220, D²PAK

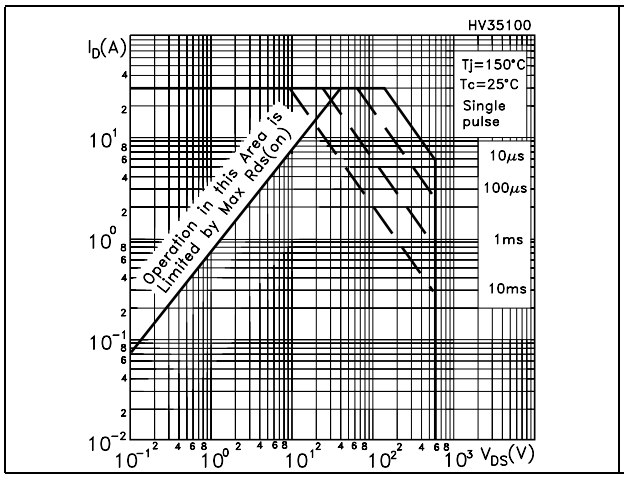


Figure 3. Thermal impedance for TO-220, D²PAK

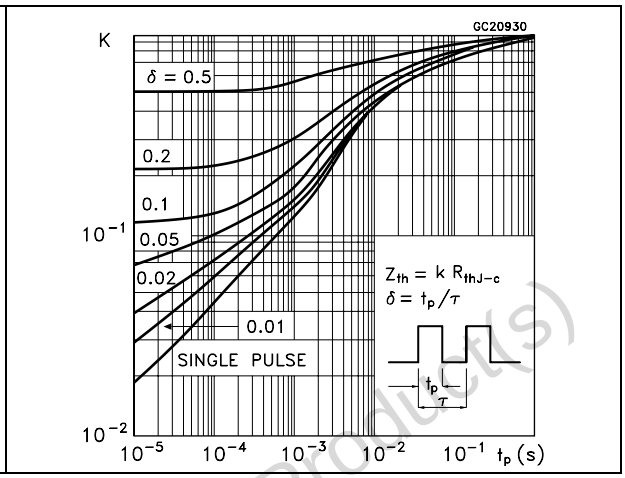


Figure 4. Safe operating area for DPAK, IPAK

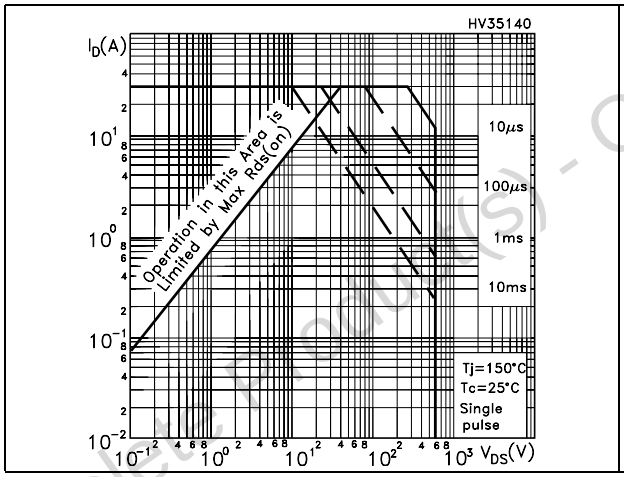


Figure 5. Thermal impedance for DPAK, IPAK

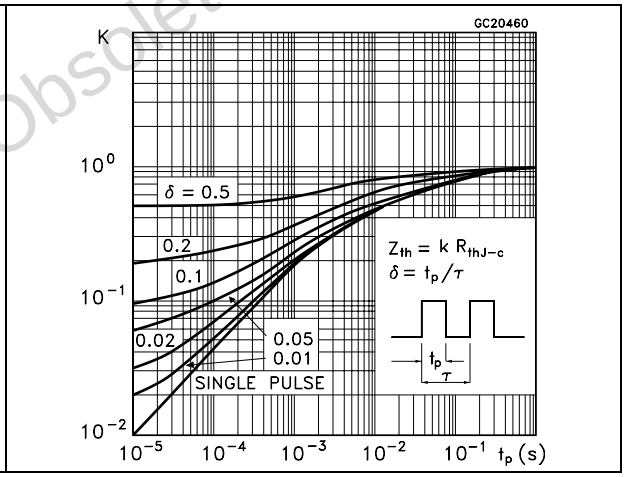


Figure 6. Safe operating area for TO-220FP

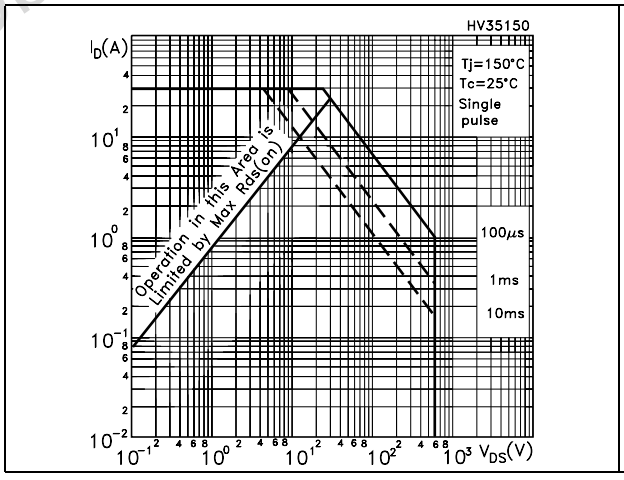
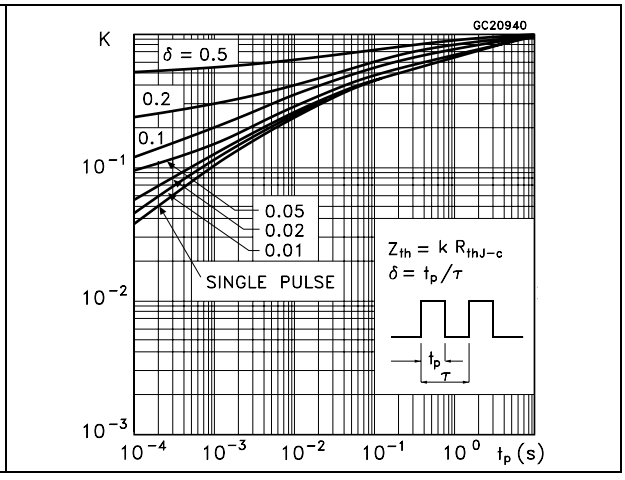


Figure 7. Thermal impedance for TO-220FP



Obsolete Product(s) - Obsolete Product(s)

Figure 8. Output characteristics

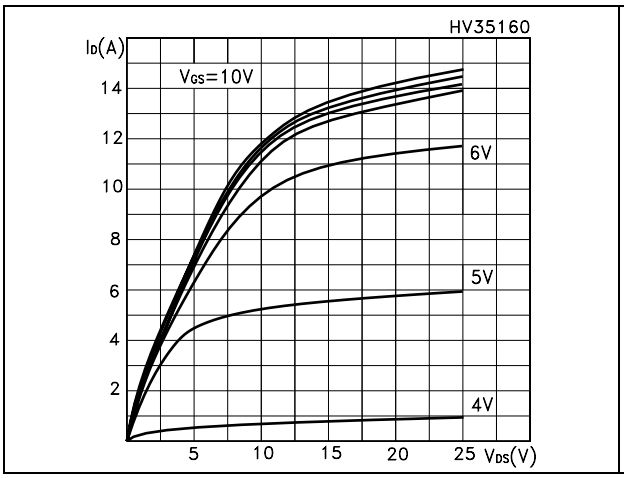


Figure 9. Transfer characteristics

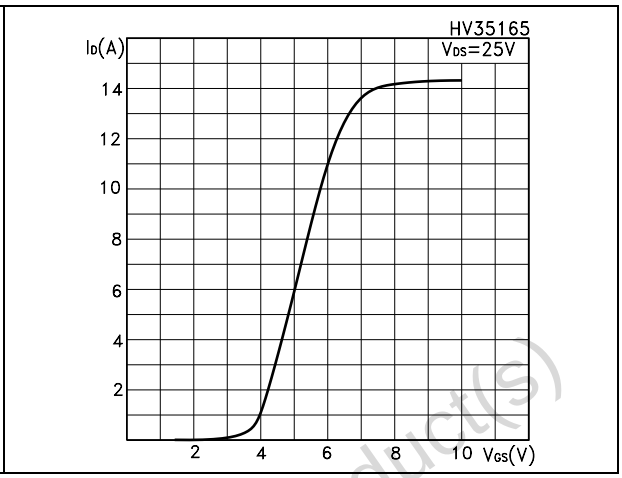


Figure 10. Transconductance

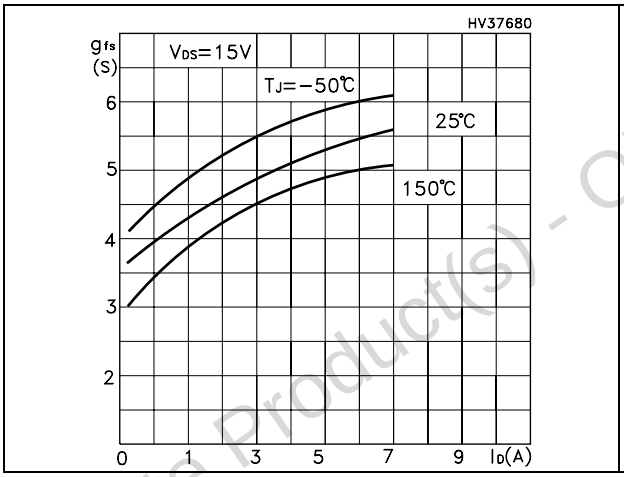


Figure 11. Static-drain source on resistance

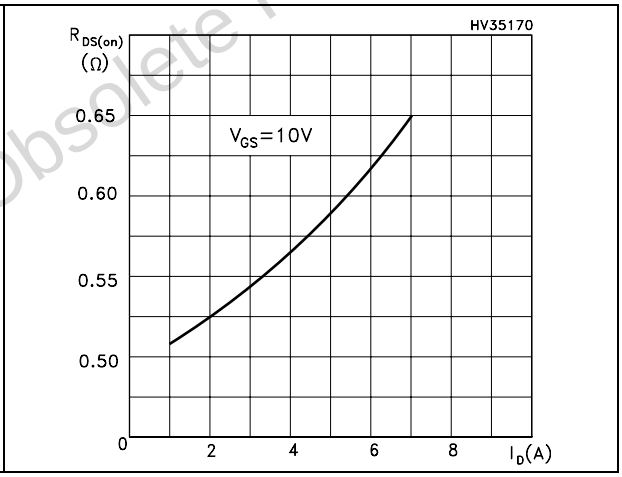


Figure 12. Gate charge vs gate-source voltage

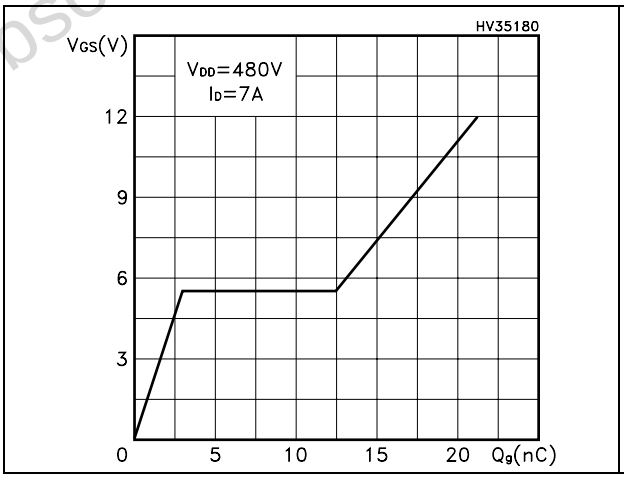
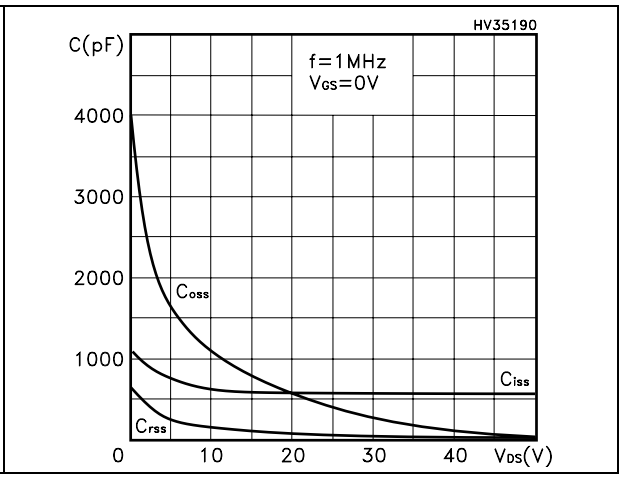


Figure 13. Capacitance variations



Obsolete Product(s) - Obsolete Product(s)

Figure 14. Normalized gate threshold voltage vs temperature

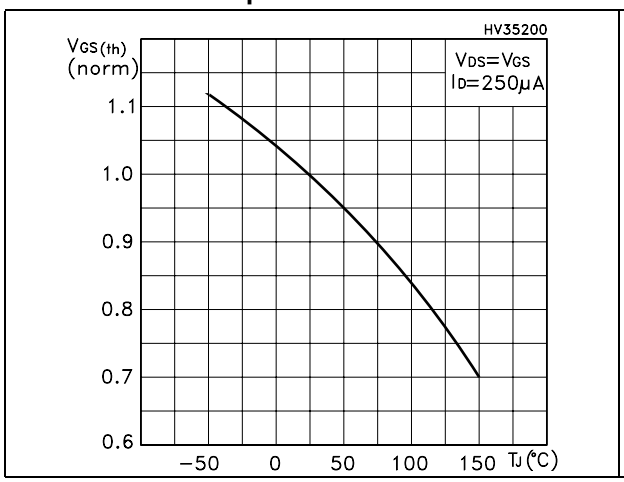


Figure 15. Normalized on resistance vs temperature

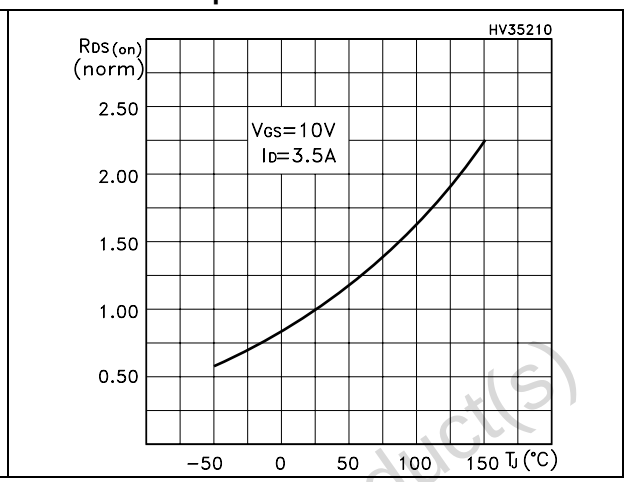


Figure 16. Source-drain diode forward characteristics

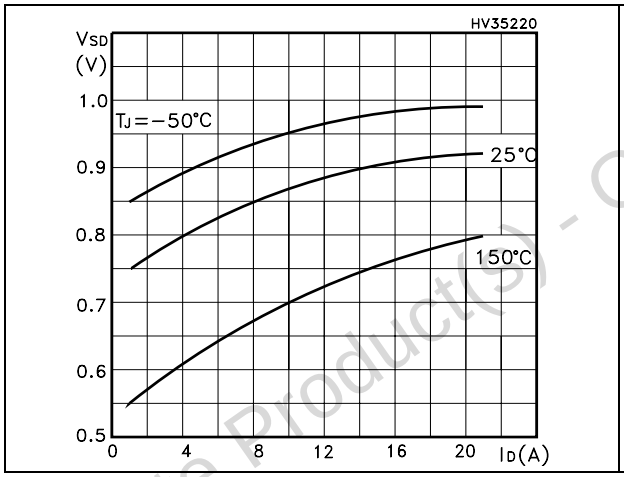
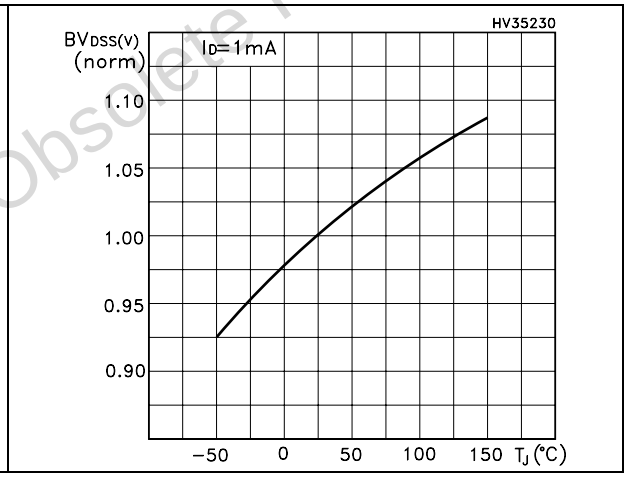


Figure 17. Normalized BV_{DSS} vs temperature



Obsolete Product(s) - Obsolete Product(s)

3 Test circuit

Figure 18. Switching times test circuit for resistive load

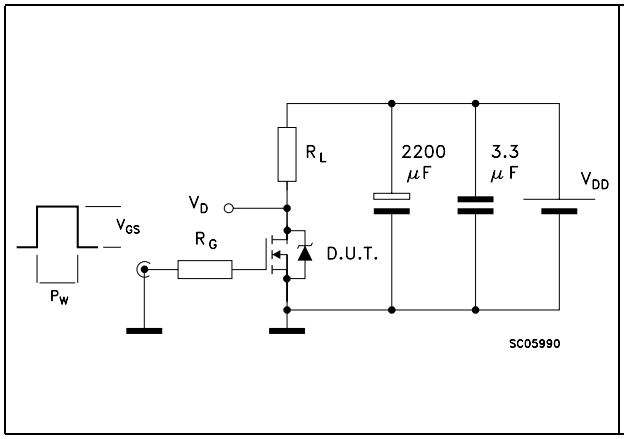


Figure 19. Gate charge test circuit

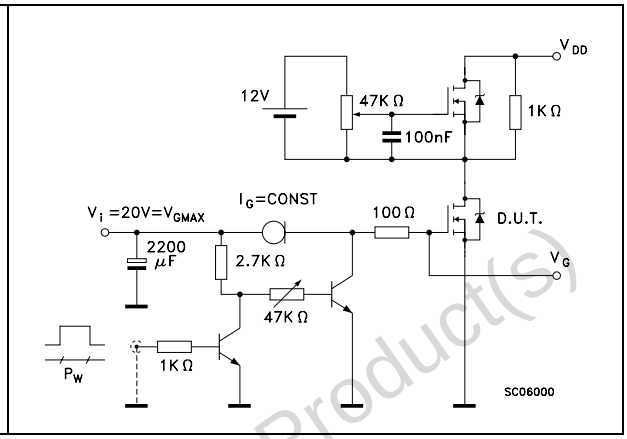


Figure 20. Test circuit for inductive load switching and diode recovery times

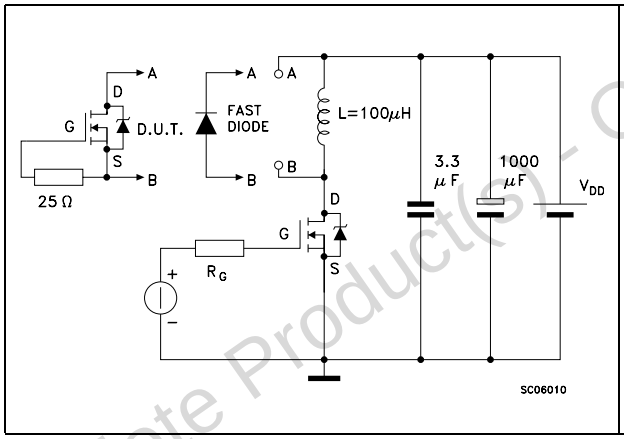


Figure 21. Unclamped inductive load test circuit

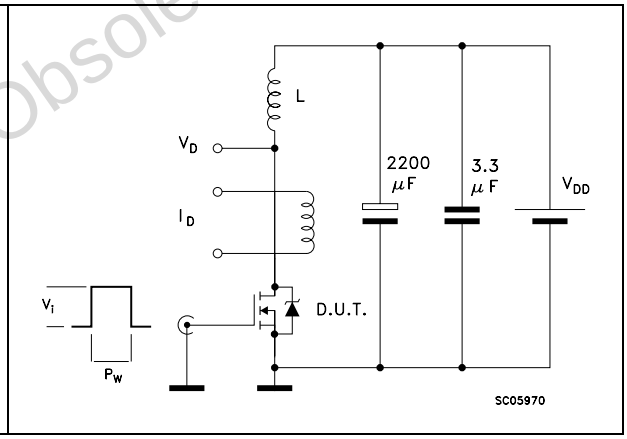


Figure 22. Unclamped inductive waveform

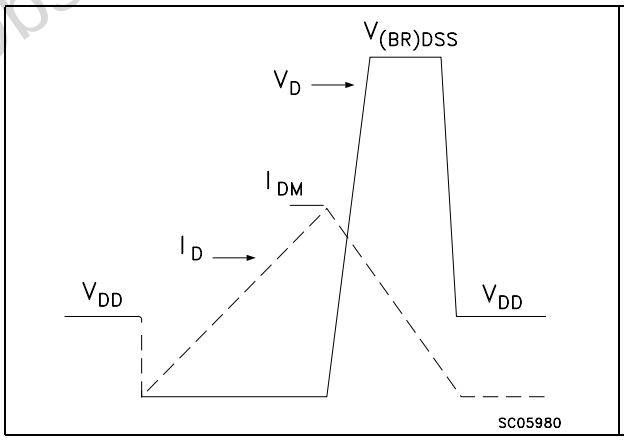
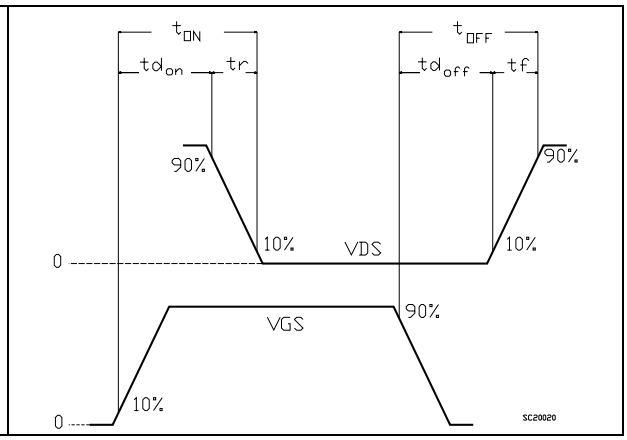


Figure 23. Switching time waveform



Obsolete Product(s) - Obsolete Product(s)

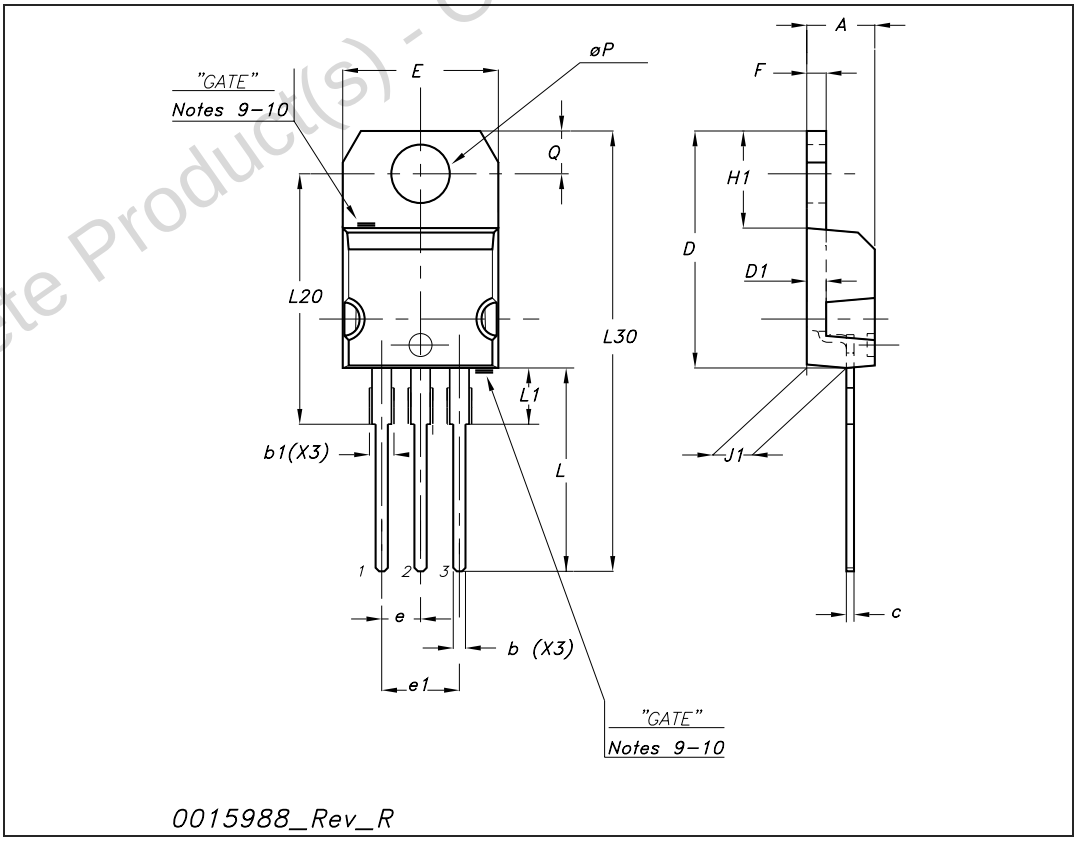
4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: *www.st.com*

Obsolete Product(s) - Obsolete Product(s)

TO-220 mechanical data

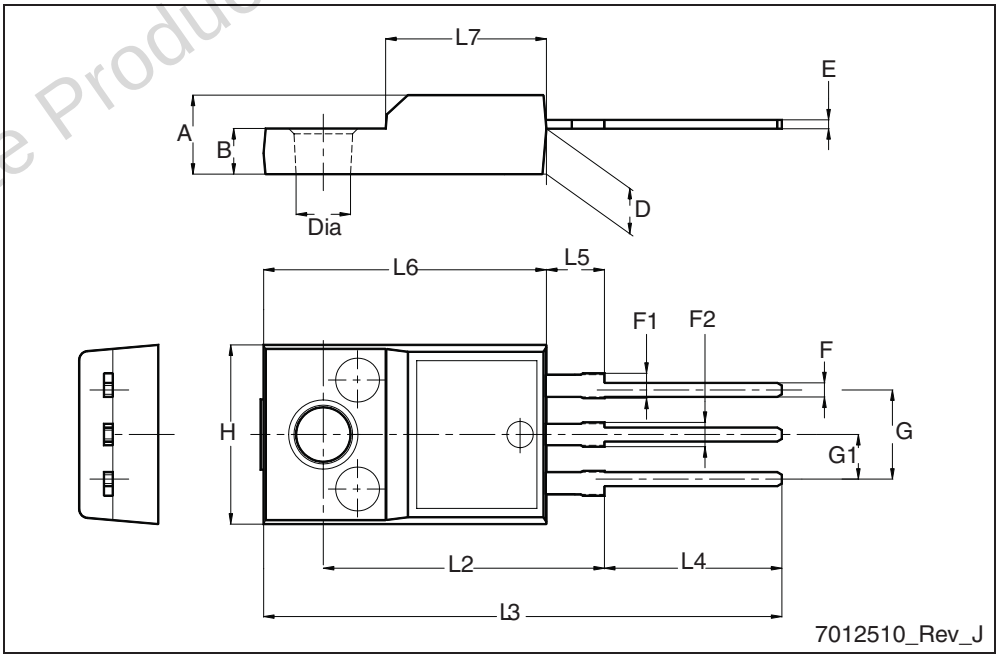
Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.48		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.051
H1	6.20		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



Obsolete Product(s) - Obsolete Product(s)

TO-220FP mechanical data

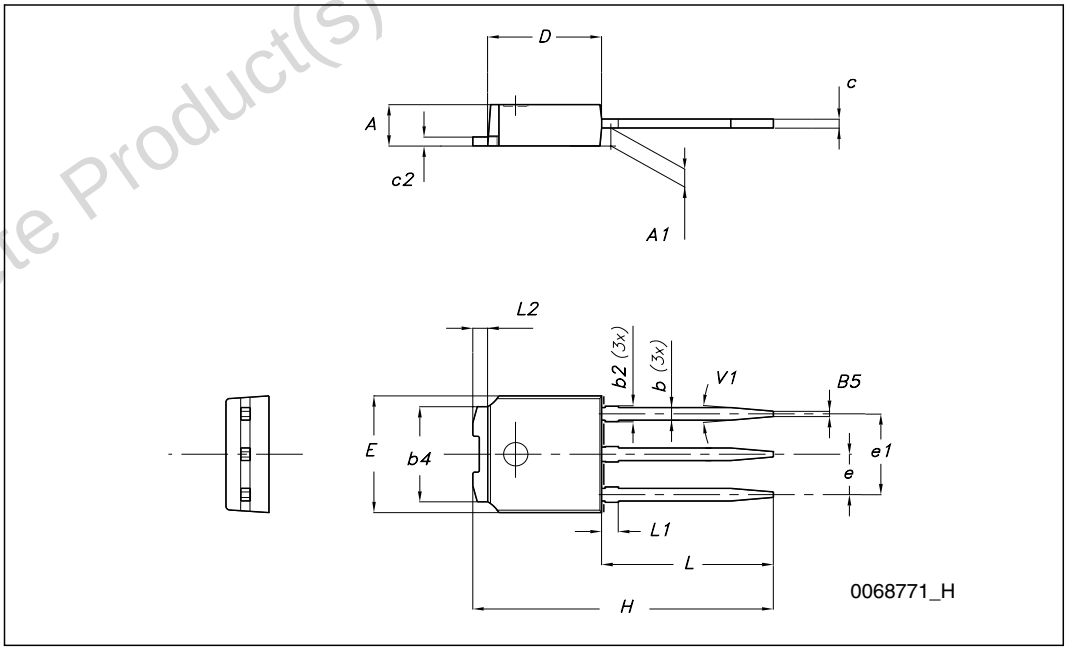
Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.5
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2



Obsolete Product(s) - Obsolete Product(s)

TO-251 (IPAK) mechanical data

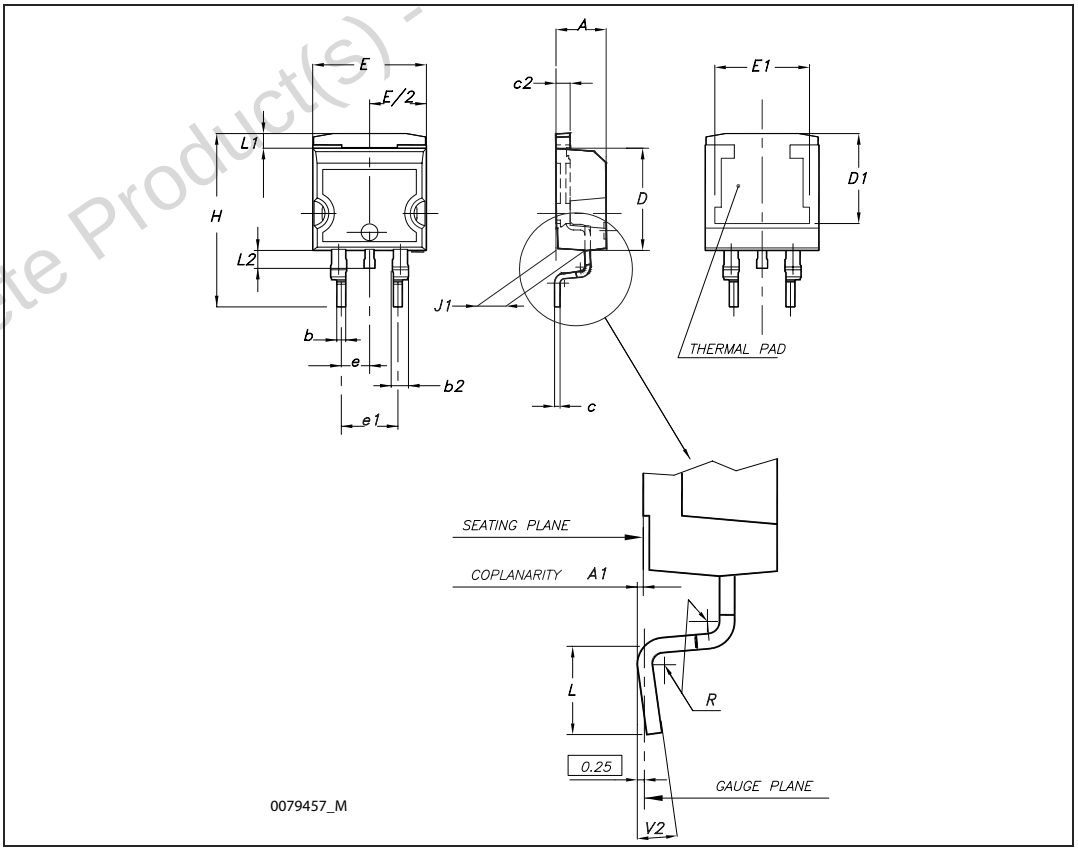
DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
(L1)	0.80		1.20
L2		0.80	
V1		10 °	



Obsolete Product(s) - Obsolete Product(s)

D²PAK (TO-263) mechanical data

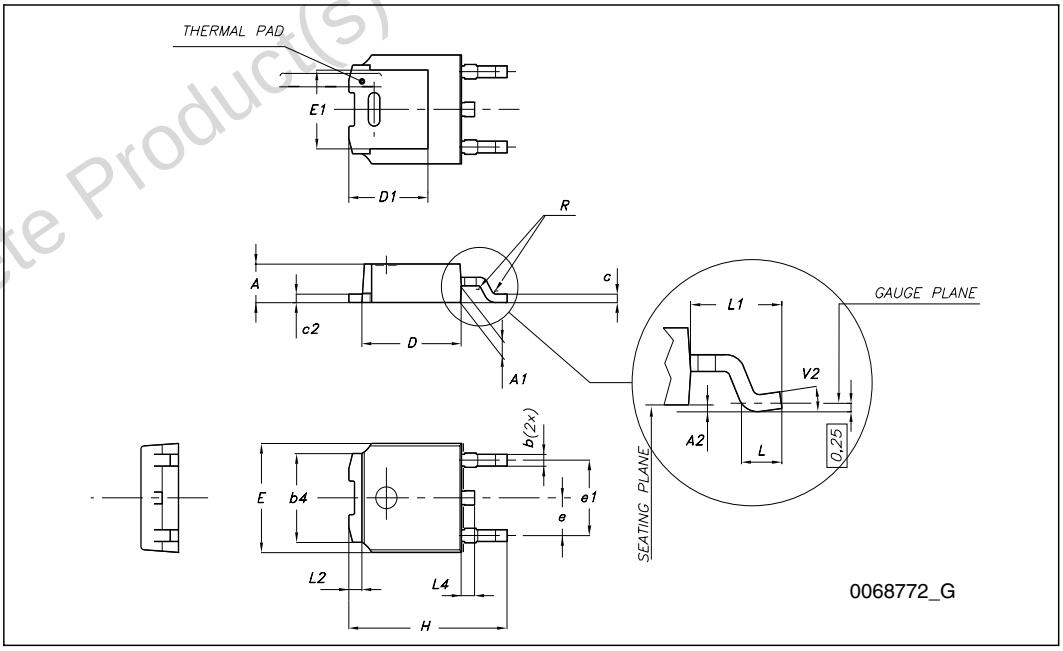
Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
A1	0.03		0.23	0.001		0.009
b	0.70		0.93	0.027		0.037
b2	1.14		1.70	0.045		0.067
c	0.45		0.60	0.017		0.024
c2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1	7.50			0.295		
E	10		10.40	0.394		0.409
E1	8.50			0.334		
e		2.54			0.1	
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°



Obsolete Product(s) - Obsolete Product(s)

TO-252 (DPAK) mechanical data

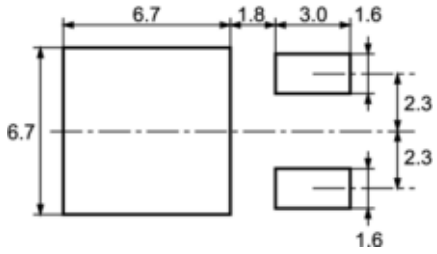
DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0 °		8 °



Obsolete Product(s) - Obsolete Product(s)

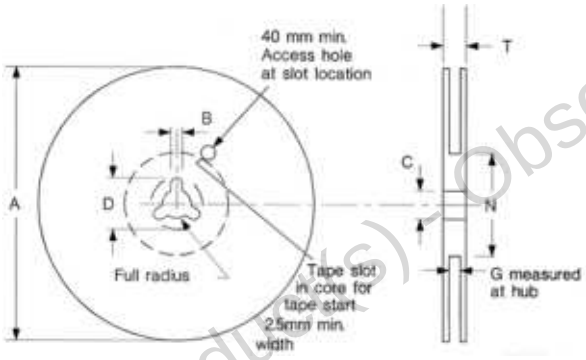
5 Packaging mechanical data

DPAK FOOTPRINT



All dimensions are in millimeters

TAPE AND REEL SHIPMENT



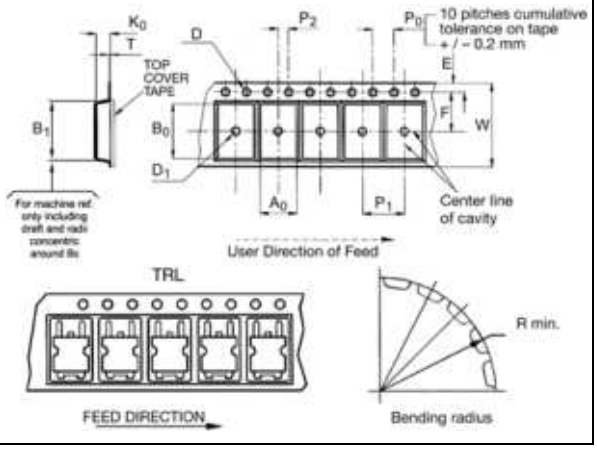
REEL MECHANICAL DATA

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

BASE QTY	BULK QTY
2500	2500

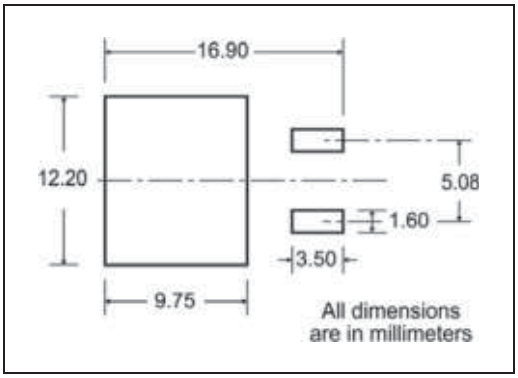
TAPE MECHANICAL DATA

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

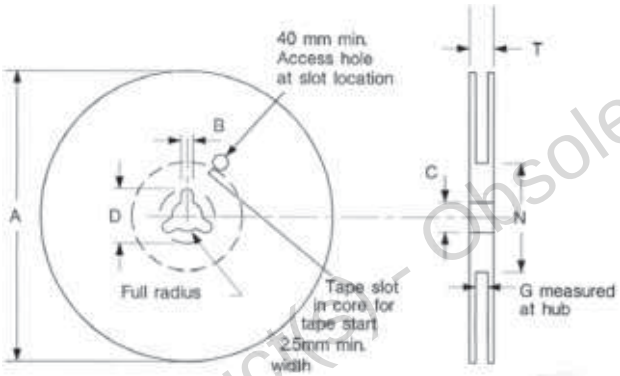


Obsolete Product(s) - Obsolete Product(s)

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



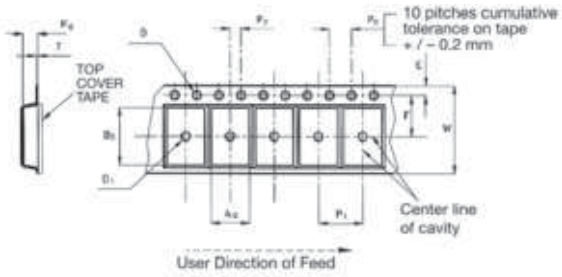
REEL MECHANICAL DATA

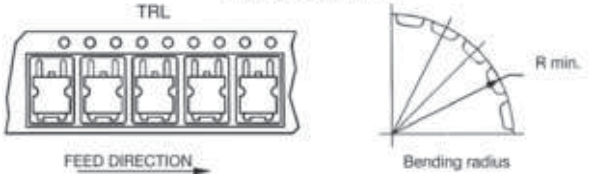
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

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





Obsolete Product(s) - Obsolete Product(s)

6 Revision history

Table 9. Document revision history

Date	Revision	Changes
29-Aug-2007	1	First release
07-Jan-2008	2	I_{DSS} value has been corrected on *Table 5: On/off states*
21-Nov-2008	3	Added new package, mechanical data.

Obsolete Product(s) - Obsolete Product(s)

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.

© 2008 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 - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com

Obsolete Product(s) - Obsolete Product(s)