



STGB20V60DF STGP20V60DF

600 V, 20 A very high speed trench gate field-stop IGBT

Datasheet – preliminary data

Features

- Maximum junction temperature : $T_J = 175\text{ }^\circ\text{C}$
- Very high speed switching
- Negligible tail current
- Low saturation voltage: $V_{CE(sat)} = 1.8\text{ V (typ.)}$
@ $I_C = 20\text{ A}$
- Tight parameters distribution
- Safe paralleling
- Low thermal resistance
- Very fast soft recovery antiparallel diode
- Lead free package

Applications

- Photovoltaic inverters
- Uninterruptible power supply
- Welding
- Power factor correction
- Very high frequency converters

Description

This device is an IGBT developed using an advanced proprietary trench gate and field stop structure. This new IGBT "V" series offers the optimum compromise between conduction and switching losses, maximizing the efficiency of very high frequency converters. Furthermore, a positive $V_{CE(sat)}$ temperature coefficient and very tight parameter distribution result in easier paralleling operation.

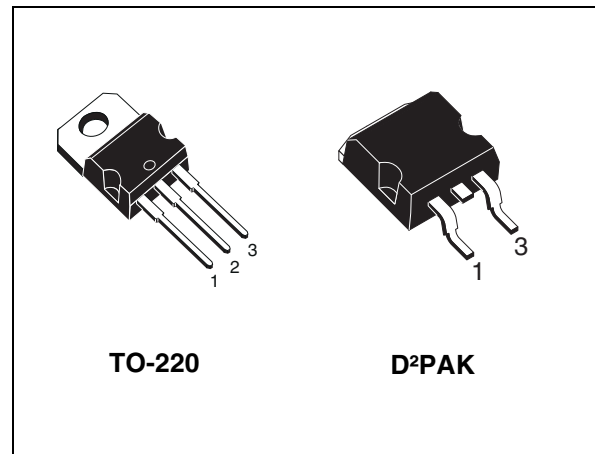


Figure 1. Internal schematic diagram

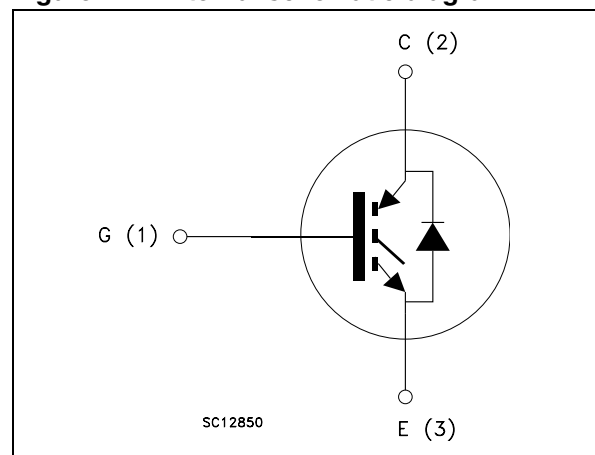


Table 1. Device summary

Order code	Marking	Package	Packaging
STGB20V60DF	GB20V60DF	D ² PAK	Tape & reel
STGP20V60DF	GP20V60DF	TO-220	Tube

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage ($V_{GE} = 0$)	600	V
I_C	Continuous collector current at $T_C = 25\text{ °C}$	40	A
I_C	Continuous collector current at $T_C = 100\text{ °C}$	20	A
$I_{CP}^{(1)}$	Pulsed collector current	80	A
V_{GE}	Gate-emitter voltage	± 20	V
I_F	Continuous forward current at $T_C = 25\text{ °C}$	TBD	A
	Continuous forward current at $T_C = 100\text{ °C}$	TBD	
I_{FP}	Pulsed forward current	80	A
P_{TOT}	Total dissipation at $T_C = 25\text{ °C}$	TBD	W
T_{STG}	Storage temperature range	- 55 to 175	°C
T_J	Operating junction temperature		

1. Pulse width limited by maximum junction temperature and turn-off within RBSOA

Table 3. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case IGBT	1.25	°C/W
R_{thJC}	Thermal resistance junction-case diode	2.5	°C/W
R_{thJA}	Thermal resistance junction-ambient	62.5	°C/W

2 Electrical characteristics

$T_J = 25\text{ °C}$ unless otherwise specified.

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage ($V_{GE} = 0$)	$I_C = 2\text{ mA}$	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}, I_C = 20\text{ A}$		1.8		V
		$V_{GE} = 15\text{ V}, I_C = 20\text{ A}$ $T_J = 125\text{ °C}$		2.1		
		$V_{GE} = 15\text{ V}, I_C = 20\text{ A}$ $T_J = 175\text{ °C}$		2.25		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}, I_C = 1\text{ mA}$		6.0		V
I_{CES}	Collector cut-off current ($V_{GE} = 0$)	$V_{CE} = 600\text{ V}$			25	μA
I_{GES}	Gate-emitter leakage current ($V_{CE} = 0$)	$V_{GE} = \pm 20\text{ V}$			250	nA

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{ V}, f = 1\text{ MHz},$ $V_{GE} = 0$	-	TBD	-	pF
C_{oes}	Output capacitance			TBD		
C_{res}	Reverse transfer capacitance			TBD		
Q_g	Total gate charge	$V_{CC} = 480\text{ V}, I_C = 20\text{ A},$ $V_{GE} = 15\text{ V}$	-	TBD	-	nC
Q_{ge}	Gate-emitter charge			TBD		
Q_{gc}	Gate-collector charge			TBD		

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on delay time Current rise time Turn-on current slope	$V_{CE} = 400\text{ V}$, $I_C = 20\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	TBD TBD TBD	-	ns ns A/ μ s
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on delay time Current rise time Turn-on current slope	$V_{CE} = 400\text{ V}$, $I_C = 20\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ $T_J = 175\text{ }^\circ\text{C}$	-	TBD TBD TBD	-	ns ns A/ μ s
$t_r(V_{off})$ $t_{d(off)}$ t_f	Off voltage rise time Turn-off delay time Current fall time	$V_{CE} = 400\text{ V}$, $I_C = 20\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	TBD TBD TBD	-	ns ns ns
$t_r(V_{off})$ $t_{d(off)}$ t_f	Off voltage rise time Turn-off delay time Current fall time	$V_{CE} = 400\text{ V}$, $I_C = 20\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ $T_J = 175\text{ }^\circ\text{C}$	-	TBD TBD TBD	-	ns ns ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}^{(1)}$ $E_{off}^{(2)}$ E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	$V_{CE} = 400\text{ V}$, $I_C = 20\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$	-	TBD 0.22 TBD	-	mJ mJ mJ
$E_{on}^{(1)}$ $E_{off}^{(2)}$ E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	$V_{CE} = 400\text{ V}$, $I_C = 20\text{ A}$, $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$ $T_J = 175\text{ }^\circ\text{C}$	-	TBD 0.3 TBD	-	mJ mJ mJ

1. Energy losses include reverse recovery of the diode.

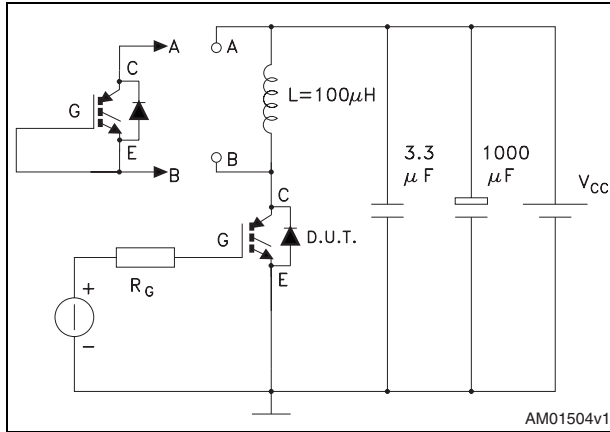
2. Turn-off losses include also the tail of the collector current.

Table 8. Collector-emitter diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_F	Forward on-voltage	$I_F = 16\text{ A}$ $I_F = 16\text{ A}$, $T_J = 175\text{ }^\circ\text{C}$	-	TBD 1.3	2.2	V V
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_F = 16\text{ A}$, $V_R = 400\text{ V}$, $R_G = 10\ \Omega$	-	TBD TBD TBD	-	ns nC A
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_F = 16\text{ A}$, $V_R = 400\text{ V}$, $R_G = 10\ \Omega$, $T_J = 175\text{ }^\circ\text{C}$	-	150 330 5	-	ns nC A

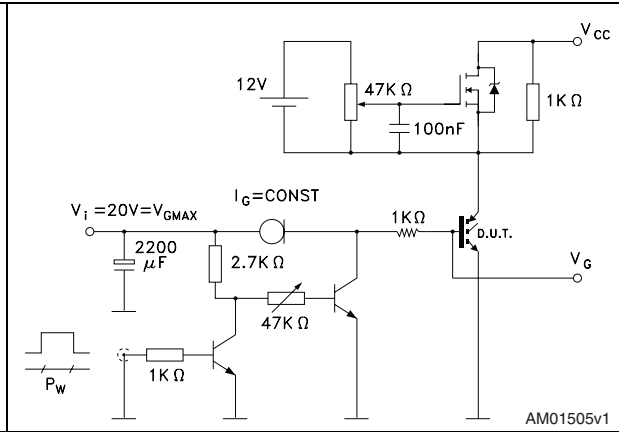
3 Test circuits

Figure 2. Test circuit for inductive load switching



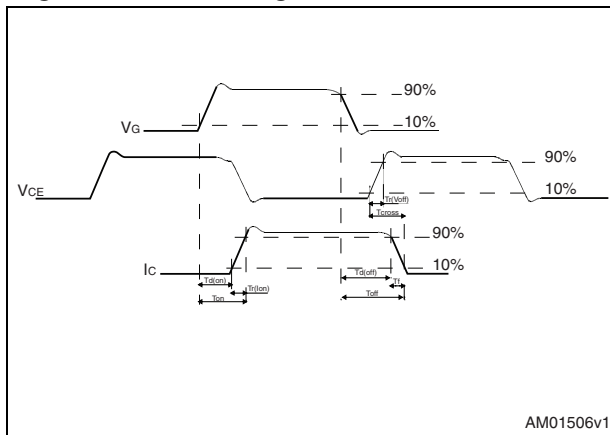
AM01504v1

Figure 3. Gate charge test circuit



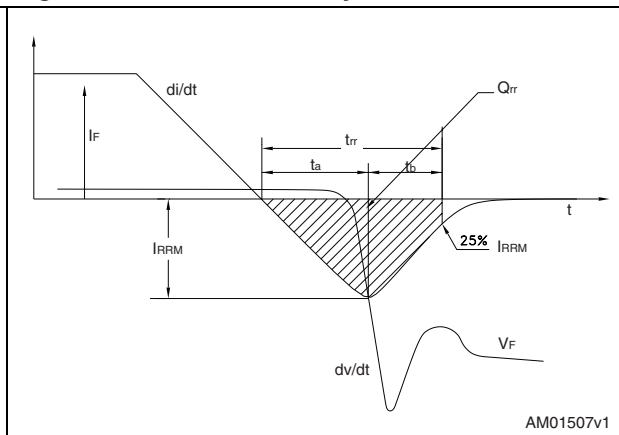
AM01505v1

Figure 4. Switching waveform



AM01506v1

Figure 5. Diode recovery time waveform



AM01507v1

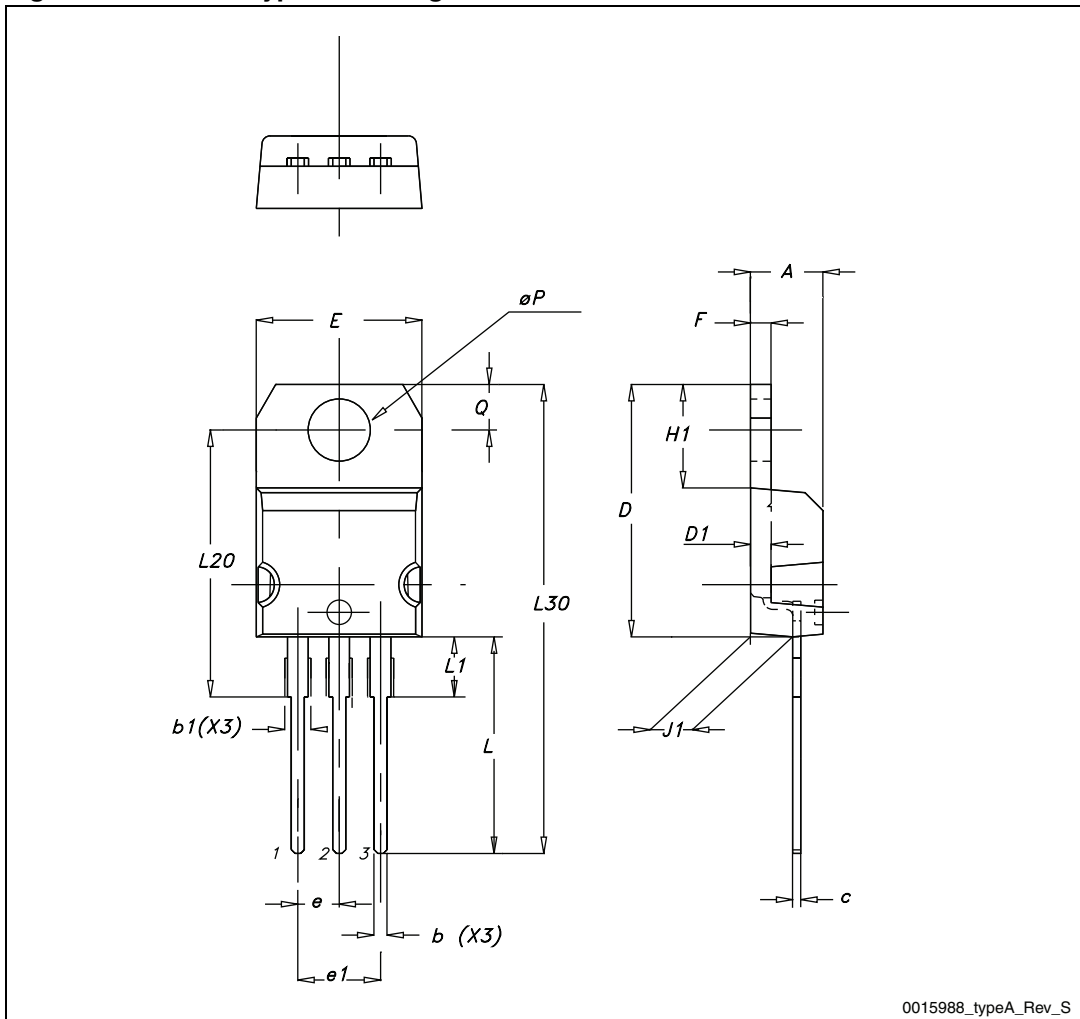
4 Package mechanical data

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.

Table 9. 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	
ØP	3.75		3.85
Q	2.65		2.95

Figure 6. TO-220 type A drawing



0015988_typeA_Rev_S

Table 10. D²PAK mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
A1	0.03		0.23
b	0.70		0.93
b2	1.14		1.70
c	0.45		0.60
c2	1.23		1.36
D	8.95		9.35
D1	7.50		
E	10		10.40
E1	8.50		

Table 10. D²PAK mechanical data

Dim.	mm		
	Min.	Typ.	Max.
e		2.54	
e1	4.88		5.28
H	15		15.85
J1	2.49		2.69
L	2.29		2.79
L1	1.27		1.40
L2	1.30		1.75
R		0.4	
V2	0°		8°

Figure 7. D²PAK drawing

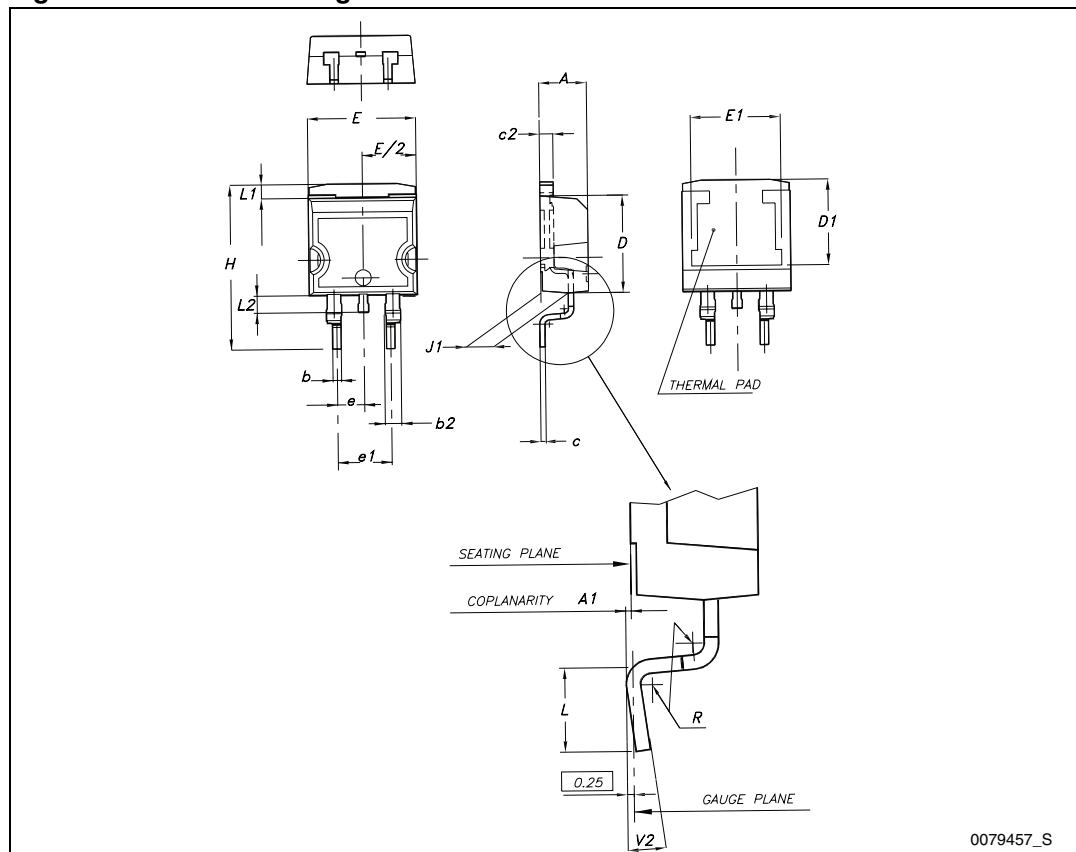
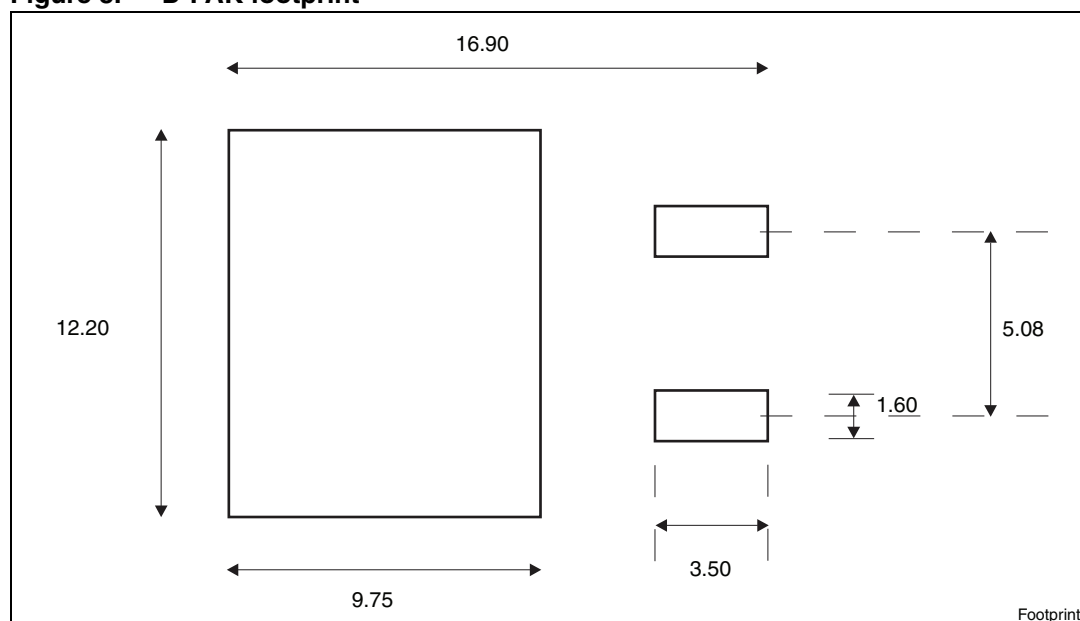


Table 11. D²PAK tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	10.5	10.7	A		330
B0	15.7	15.9	B	1.5	
D	1.5	1.6	C	12.8	13.2
D1	1.59	1.61	D	20.2	
E	1.65	1.85	G	24.4	26.4
F	11.4	11.6	N	100	
K0	4.8	5.0	T		30.4
P0	3.9	4.1			
P1	11.9	12.1	Base qty		1000
P2	1.9	2.1	Bulk qty		1000
R	50				
T	0.25	0.35			
W	23.7	24.3			

Figure 8. D²PAK footprint^(a)

a. All dimension are in millimeters

Figure 9. Tape

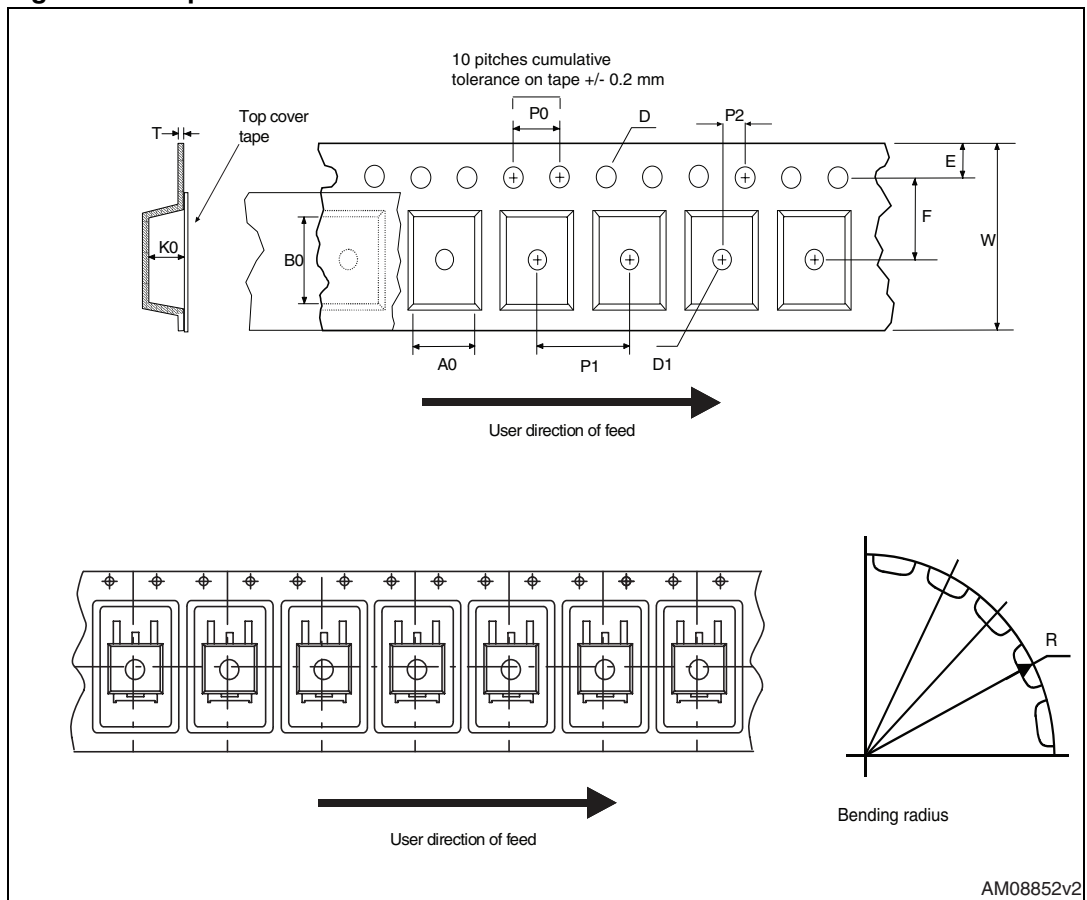
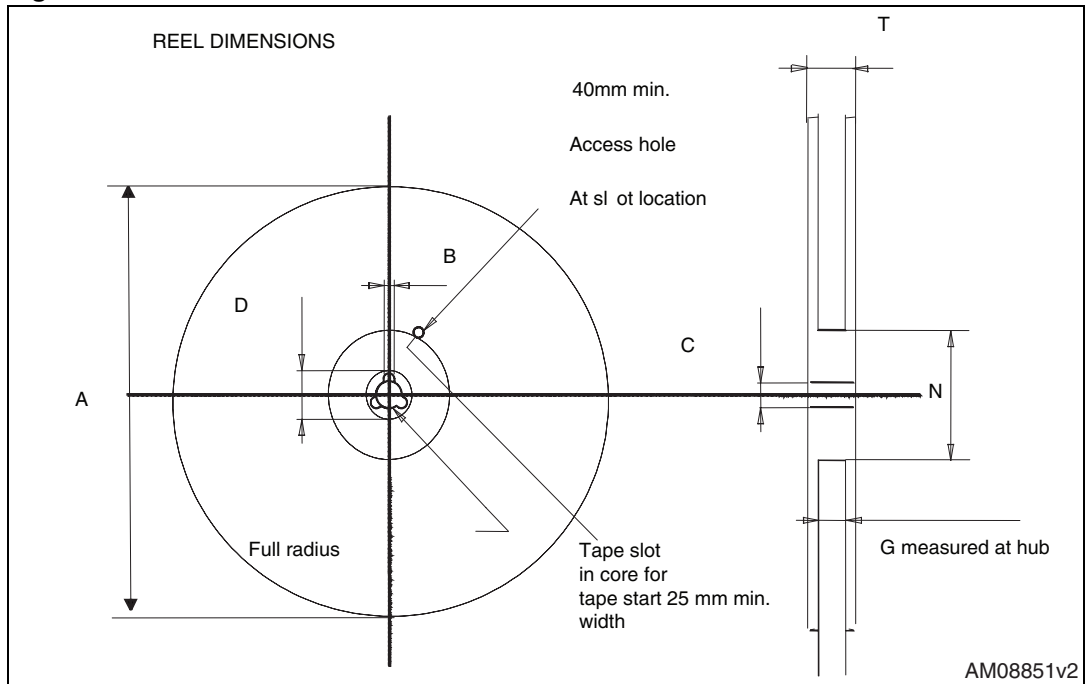


Figure 10. Reel



5 Revision history

Table 12. Document revision history

Date	Revision	Changes
20-Sep-2012	1	Initial release.

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 TWO AUTHORIZED ST REPRESENTATIVES, 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.

© 2012 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