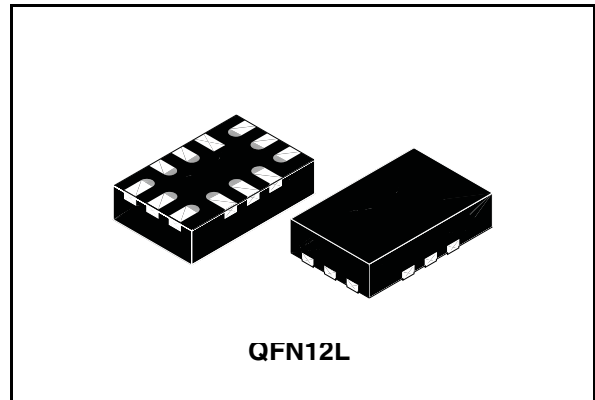


Low voltage 1.0 Ω max dual SP3T switch with break-before-make feature

Features

- High speed:
 - $t_{PD} = 0.3$ ns (typ.) at $V_{CC} = 3.0$ V
 - $t_{PD} = 0.4$ ns (typ.) at $V_{CC} = 2.3$ V
- Ultra low power dissipation:
 - $I_{CC} = 0.2$ μ A (max.) at $T_A = 85^\circ\text{C}$
- Low ON resistance $V_{IN} = 0$ V:
 - $R_{ON} = 1.0$ Ω (max. $T_A = 25^\circ\text{C}$) at $V_{CC} = 4.3$ V
 - $R_{ON} = 1.5$ Ω (max. $T_A = 25^\circ\text{C}$) at $V_{CC} = 3.0$ V
 - $R_{ON} = 1.8$ Ω (max. $T_A = 25^\circ\text{C}$) at $V_{CC} = 2.3$ V
- Wide operating voltage range:
 - V_{CC} (opr) = 1.65 V to 4.3 V single supply
- 4.3 V tolerant and 1.8 V compatible threshold on digital control input at $V_{CC} = 2.3$ to 4.3 V
- Latch-up performance exceeds 300 mA (JESD 17)
- ESD performance (analog channel vs. GND):
HBM > 2 kV (MIL STD 883 method 3015)



Description

The STG3856 is a high-speed CMOS low voltage dual analog SP3T (single pole triple throw) switch or dual 3 : 1 multiplexer /demultiplexer switch fabricated in silicon gate C²MOS technology. It is designed to operate from 1.65 V to 4.3 V, making this device ideal for portable applications.

The device offers very low ON resistance (< 1.0 Ω) at $V_{CC} = 4.3$ V. The disabling and enabling of switches are done by setting the 1IN and 2IN control pins. Additional key features are fast switching speed, and ultra low power consumption. All inputs and outputs are equipped with protection circuits against static discharge, giving them ESD immunity and transient excess voltage.

Table 1. Device summary

Order code	Temperature range	Package	Packaging
STG3856QTR	-40°C to +85°C	QFN12L (2.2 x 1.4 mm)	Tape and reel

1 Summary description

1.1 Pin connections and description

Figure 1. Connection diagram (top through view)

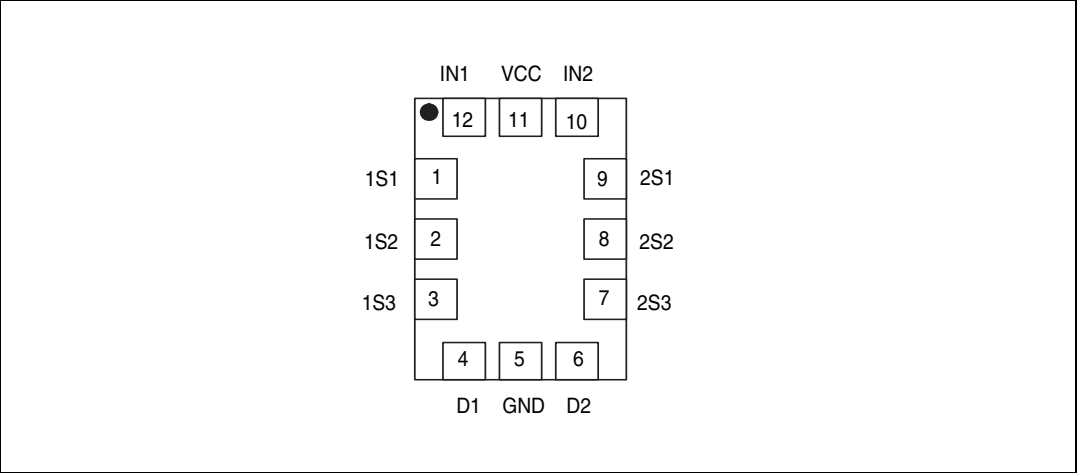


Table 2. Pin description

Pin	Symbol	Name and function
12, 10	1IN, 2IN	Controls
1,2,3, 9,8,7	1S1, 1S2, 1S3, 2S1, 2S2, 2S3	Independent channels
4,6	D1, D2	Common channels
11	V _{CC}	Positive supply voltage
5	GND	Ground (0 V)

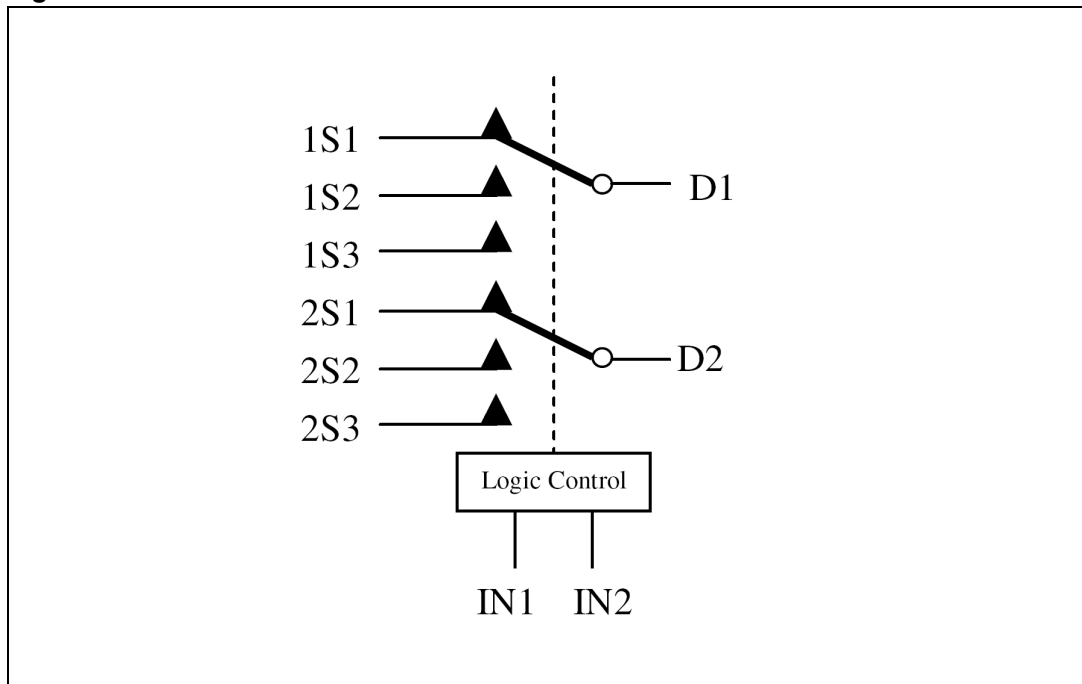
1.2 Truth table

Table 3. Truth table

1IN	2IN	Switch state
L	L	High impedance
L	H	D1-1S1, D2-2S1
H	L	D1-1S2, D2-2S2
H	H	D1-1S3, D2-2S3

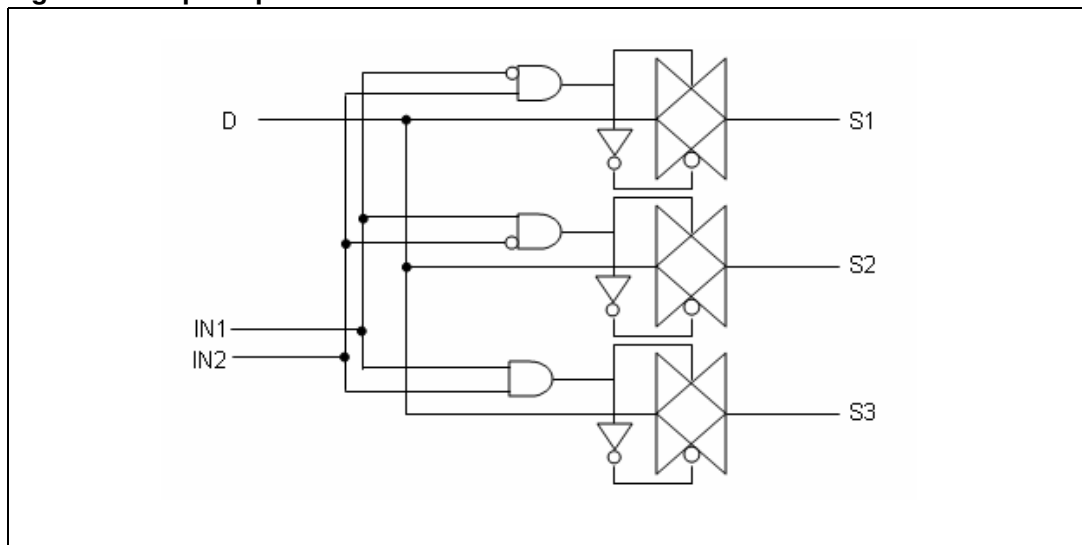
1.3 Internal schematic

Figure 2. Internal schematic



1.4 Input equivalent circuit

Figure 3. Input equivalent circuit



2 Maximum ratings

Stressing the device above the rating listed in the “absolute maximum ratings” table may cause permanent damage to the device. These are stress ratings only and operation of the device at these or any other conditions above those indicated in the operating sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Table 4. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage	-0.5 to 5.5	V
V_I	DC Input voltage	-0.5 to $V_{CC} + 0.5$	V
V_{IC}	DC Control input voltage	-0.5 to 5.5	V
V_O	DC output voltage	-0.5 to $V_{CC} + 0.5$	V
I_{IKC}	DC input diode current on control pin ($V_{IN} < 0$ V)	- 50	mA
I_{IK}	DC input diode current ($V_{IN} < 0$ V)	± 50	mA
I_{OK}	DC output diode current	± 20	mA
I_O	DC output current	± 150	mA
I_{OP}	DC output current peak (pulse at 1 ms, 10% duty cycle)	± 300	mA
I_{CC} or I_{GND}	DC V_{CC} or ground current	± 100	mA
P_D	Power dissipation at $T_A = 70^\circ\text{C}$ ⁽¹⁾		mW
T_{STG}	Storage temperature	-65 to 150	$^\circ\text{C}$
T_L	Lead temperature (10 sec)	300	$^\circ\text{C}$

1. Derate above 70°C by 18.5mW/ $^\circ\text{C}$.

3 Electrical characteristics

Table 5. Recommended operating conditions

Symbol	Parameter		Value	Unit
V_{CC}	Supply voltage ⁽¹⁾		1.4 to 4.3	V
V_I	Input voltage		0 to V_{CC}	V
V_{IC}	Control input voltage		0 to V_{CC}	V
V_O	Output voltage		0 to V_{CC}	V
T_{OP}	Operating temperature		-55 to 125	°C
dt/dv	Input rise and fall time control input	$V_{CC} = 1.65\text{ V to }2.7\text{ V}$	0 to 20	ns/V
		$V_{CC} = 3.0\text{ to }4.3\text{ V}$	0 to 10	

1. Truth table guaranteed: 1.2 V to 4.3 V.

3.1 DC electrical characteristics

Table 6. DC electrical characteristics

Symbol	Parameter	Test condition		Value								Unit
		V _{CC} (V)		T _A = 25°C			-40 to 85°C		-55 to 125°C			
				Min	Typ	Max	Min	Max	Min	Max		
V _{IH}	High level input voltage	1.65 - 1.95		0.65 V _{CC}	—	—	0.65 V _{CC}	—	0.65 V _{CC}	—	V	
		2.3 - 2.5		1.4	—	—	1.4	—	1.4	—		
		2.7 - 3.0		1.4	—	—	1.4	—	1.4	—		
		3.3 - 4.3		1.5	—	—	1.5	—	1.5	—		
V _{IL}	Low level input voltage	1.65 - 1.95		—	—	0.40	—	0.40	—	0.40	V	
		2.3 - 2.5		—	—	0.50	—	0.50	—	0.50		
		2.7 - 3.0		—	—	0.50	—	0.50	—	0.50		
		3.3 - 4.3		—	—	0.50	—	0.50	—	0.50		

Table 6. DC electrical characteristics (continued)

Symbol	Parameter	Test condition		Value							Unit
		V _{CC} (V)		T _A = 25°C			-40 to 85°C		-55 to 125°C		
				Min	Typ	Max	Min	Max	Min	Max	
R _{ON}	Switch ON resistance	4.3	V _S = 0 V to V _{CC} I _S = 100 mA	–	0.6	1.0	–	1.2	–	–	Ω
		3.0		–	1.3	1.5	–	1.8	–	–	
		2.7		–	1.5	1.8	–	2.2	–	–	
		2.3		–	2.0	2.2	–	2.6	–	–	
		1.8		–	2.5	3.0	–	3.6	–	–	
		1.65		–	3.3	4.0	–	4.8	–	–	
ΔR _{ON}	ON resistance match between channels	2.7	V _S at R _{ON} max I _S = 100 mA	–	0.01	–	–	–	–	–	Ω
R _{FLAT}	ON resistance flatness (1)(2)	4.3	V _S = 0 V to V _{CC} I _S = 100 mA	–	–	–	–	–	–	–	Ω
		3.0		–	–	–	–	–	–	–	
		2.7		–	0.22	0.35	–	0.35	–	–	
		2.3		–	–	–	–	–	–	–	
		1.65		–	–	–	–	–	–	–	
I _{OFF}	OFF state leakage current (nSN), (Dn)	4.3	V _S = 0.3 or 4 V	–	–	± 20	–	±10 0	–	–	nA
I _{IN}	Input leakage current	0 - 4.3	V _{IN} = 0 to 4.3 V	–	–	± 0.1	–	± 1	–		μA
I _{CC}	Quiescent supply current	1.65 - 4.3	V _{IN} = V _C or GND	–	–	± 0.05	–	± 0.2	–	± 1	μA
I _{CCLV}	Quiescent supply current low voltage driving	4.3	V _{IN1} , V _{IN2} = 1.65 V	–	± 37	± 50	–	± 10 0	–	–	μA
			V _{IN1} , V _{IN2} = 1.80V	–	± 33	± 40	–	± 50	–	–	
			V _{IN1} , V _{IN2} = 2.60V	–	± 12	± 20	–	± 30	–	–	

1. ΔRon = max |mSN-nSN|, where m = 1 and n = 2, N = 1..3

2. Flatness is defined as the difference between the maximum and minimum value of ON resistance as measured over the specified analog signal ranges.

3.2 AC electrical characteristics

Table 7. AC electrical characteristics ($C_L = 35 \text{ pF}$, $R_L = 50 \text{ } \Omega$, $t_r = t_f \leq 5 \text{ ns}$)

Symbol	Parameter	Test condition		Value							Unit
		V _{CC} (V)		T _A = 25°C			-40 to 85°C		-55 to 125°C		
				Min	Typ	Max	Min	Max	Min	Max	
t _{PLH} , t _{PHL}	Propagation delay	1.65 - 1.95		–	0.45	–	–	–	–	–	ns
		2.3 - 2.7		–	0.40	–	–	–	–	–	
		3.0 - 3.3		–	0.30	–	–	–	–	–	
		3.6 - 4.3		–	0.30	–	–	–	–	–	
t _{ON}	Turn-ON time	1.65 - 1.95	V _S = 0.8 V	–	56	–	–	–	–	–	ns
		2.3 - 2.7	V _S = 1.5 V	–	33	50	–	60	–	–	
		3.0 - 3.3		–	21	40	–	50	–	–	
		3.6 - 4.3		–	19	40	–	50	–	–	
t _{OFF}	Turn-OFF time	1.65 - 1.95	V _S = 0.8	–	24	–	–	–	–	–	ns
		2.3 - 2.7	V _S = 1.5 V	–	17	25	–	40	–	–	
		3.0 - 3.3		–	14	20	–	30	–	–	
		3.6 - 4.3		–	12	20	–	30	–	–	
t _D	Break-before - make time delay	1.65 - 1.95	V _S = 0.8	10	31	–	–	–	–	–	ns
		2.3 - 2.7	V _S = 1.5 V	10	22	40	–	50	–	–	
		3.0 - 3.3		10	18	30	–	40	–	–	
		3.6 - 4.3		10	7	25	–	35	–	–	
Q	Charge injection	1.65 - 1.95	C _L =100pF	–	25	–	–	–	–	–	pC
		2.3 - 2.7	R _L =1MO	–	35	–	–	–	–	–	
		3.0 - 3.3	V _{GEN} =0V	–	40	–	–	–	–	–	
		3.6 - 4.3	R _{GEN} =0Ω	–	55	–	–	–	–	–	

3.3 Analog switch

Table 8. Analog switch characteristics ($C_L = 5\text{ pF}$, $R_L = 50\ \Omega$, $T_A = 25^\circ\text{C}$)

Symbol	Parameter	Test condition		Value								Unit
		V _{CC} (V)		T _A = 25°C			-40 to 85°C		-55 to 125°C			
				Min	Typ	Max	Min	Max	Min	Max		
O _{IRR}	Off Isolation ⁽¹⁾	1.65 - 4.3	V _S = 1V _{RMS} f = 100 kHz	–	-82	–	–	–	–	–	–	dB
X _{talk}	Crosstalk	1.6 - 4.3	V _S = 1 V _{RMS} f = 100 kHz	–	-84	–	–	–	–	–	–	dB
T _{HD}	Total harmonic distortion	2.3 - 4.3	R _L = 600 Ω V _{IN} = 2 V _{PP} f = 20 Hz to 20 kHz	–	0.03	–	–	–	–	–	–	%
BW	-3dB bandwidth	1.65 - 4.3	R _L = 50 Ω	–	100	–	–	–	–	–	–	MHz
C _{IN}	Control pin input capacitance			–	5	–	–	–	–	–	–	pF
C _{Sn(OFF)}	Sn port OFF capacitance	3.3	f = 1 MHz	–	–	–	–	–	–	–	–	
C _{Sn(ON)}	Sn port ON capacitance	3.3	f = 1 MHz	–	–	–	–	–	–	–	–	
C _D	D port capacitance when switch is enabled	3.3	f = 1 MHz	–	–	–	–	–	–	–	–	

1. OFF Isolation = $20 \log_{10} (V_D/V_S)$, V_D = output, V_S = input at off switch

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.

Figure 4. QFN12L (2.2 x 1.4 mm) package outline

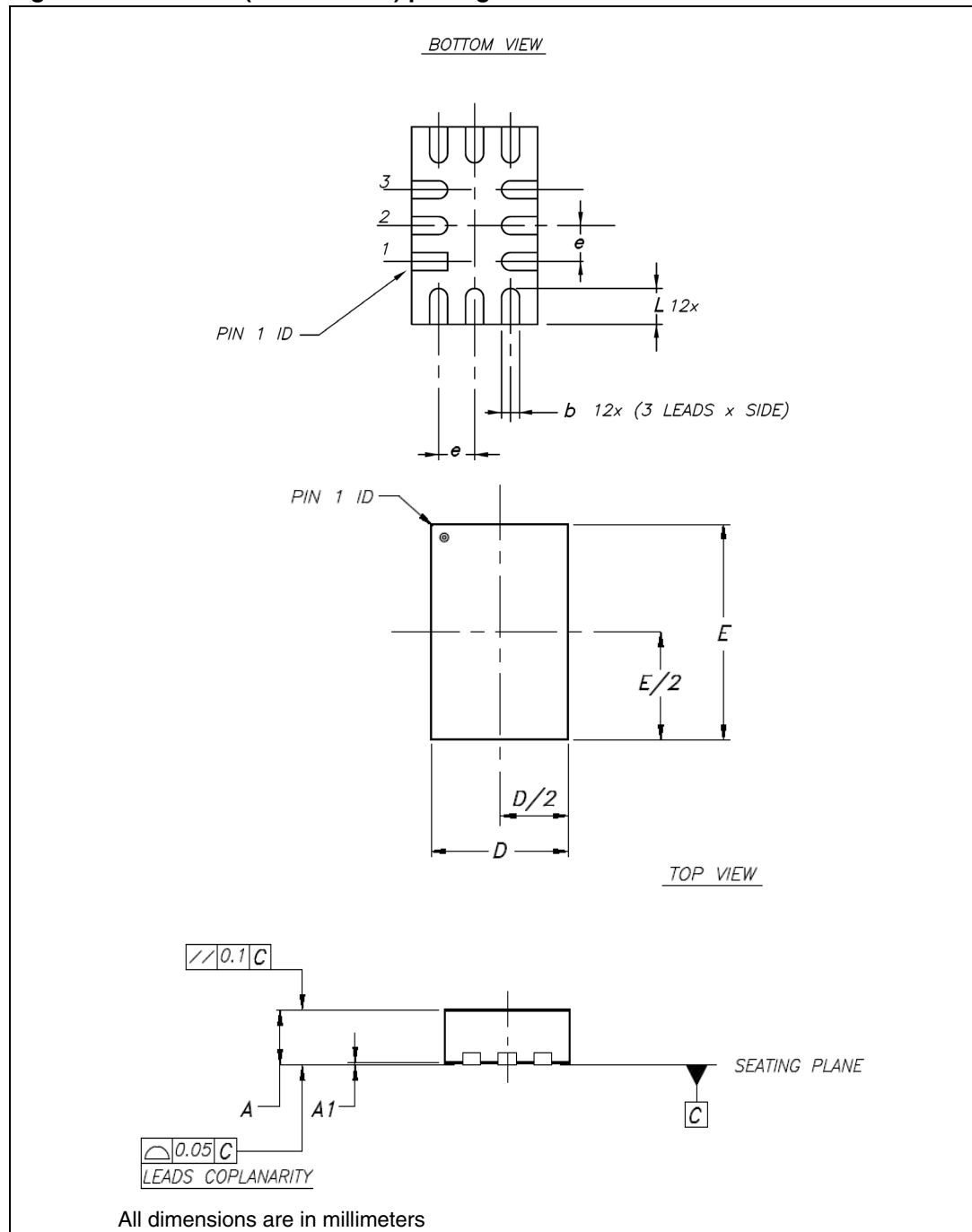


Table 9. FN12L (2.2 x 1.4 mm) mechanical data

Symbol	Millimeters			Inches		
	Min	Typ	Max	Min	Typ	Max
A	0.50	0.55	0.60	0.019	0.021	0.023
A1	0	0.02	0.05	0	0.001	0.002
b	0.15	0.20	0.25	0.006	0.007	0.010
D	1.30	1.40	1.50	0.051	0.055	0.059
E	2.10	2.20	2.30	0.082	0.086	0.090
e		0.40			0.015	
L	0.35	0.40	0.45	0.013	0.015	0.017

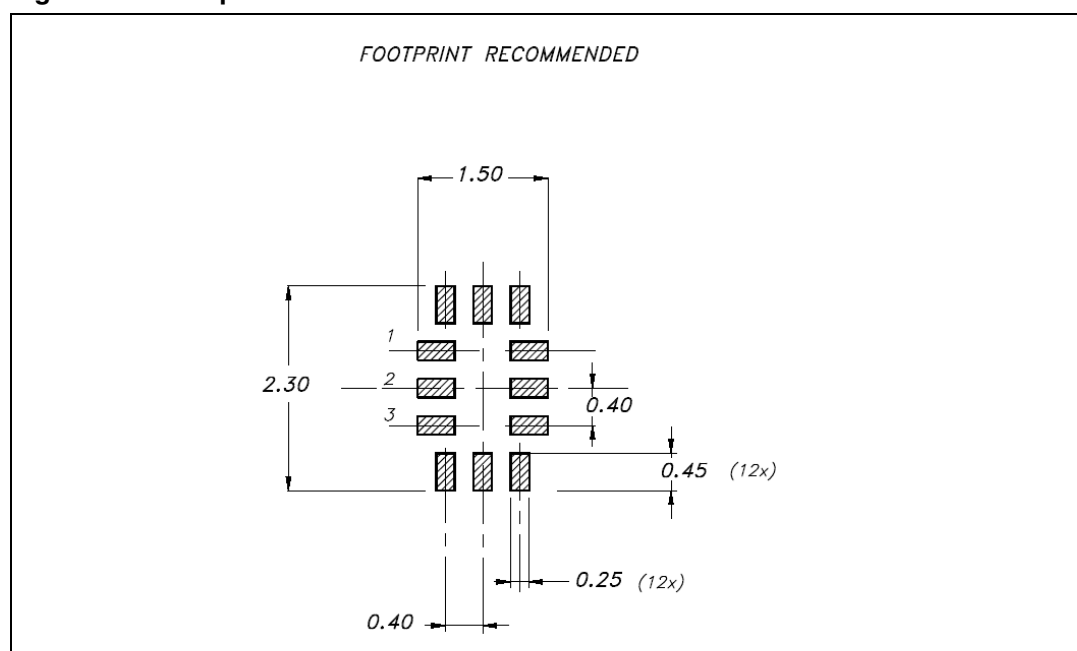
Figure 5. Footprint recommendation

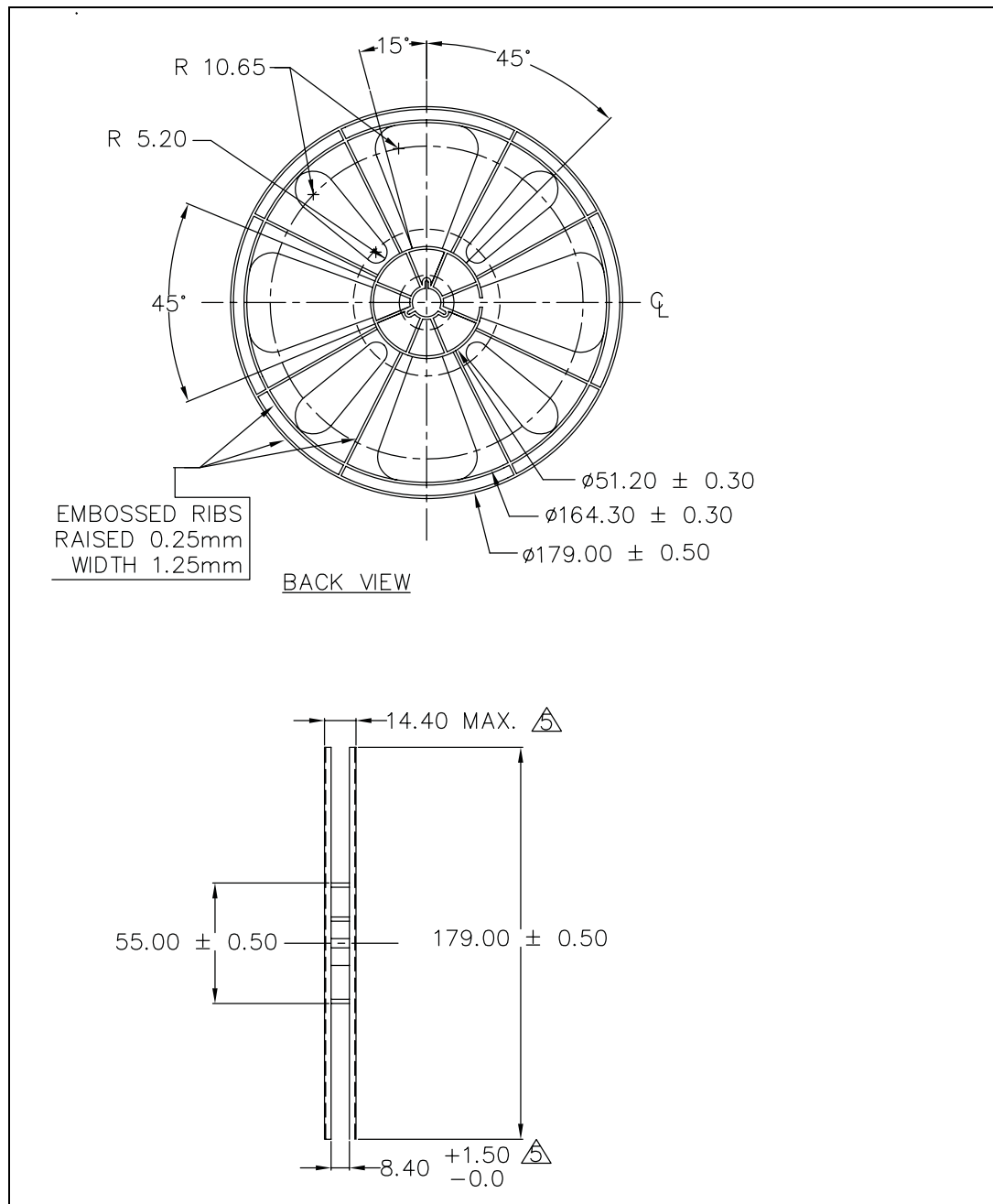
Figure 6. QFN12L (2.2 x 1.4 mm) reel for carrier tape information

Figure 7. QFN12L (2.2 x 1.4 mm) reel for carrier tape information

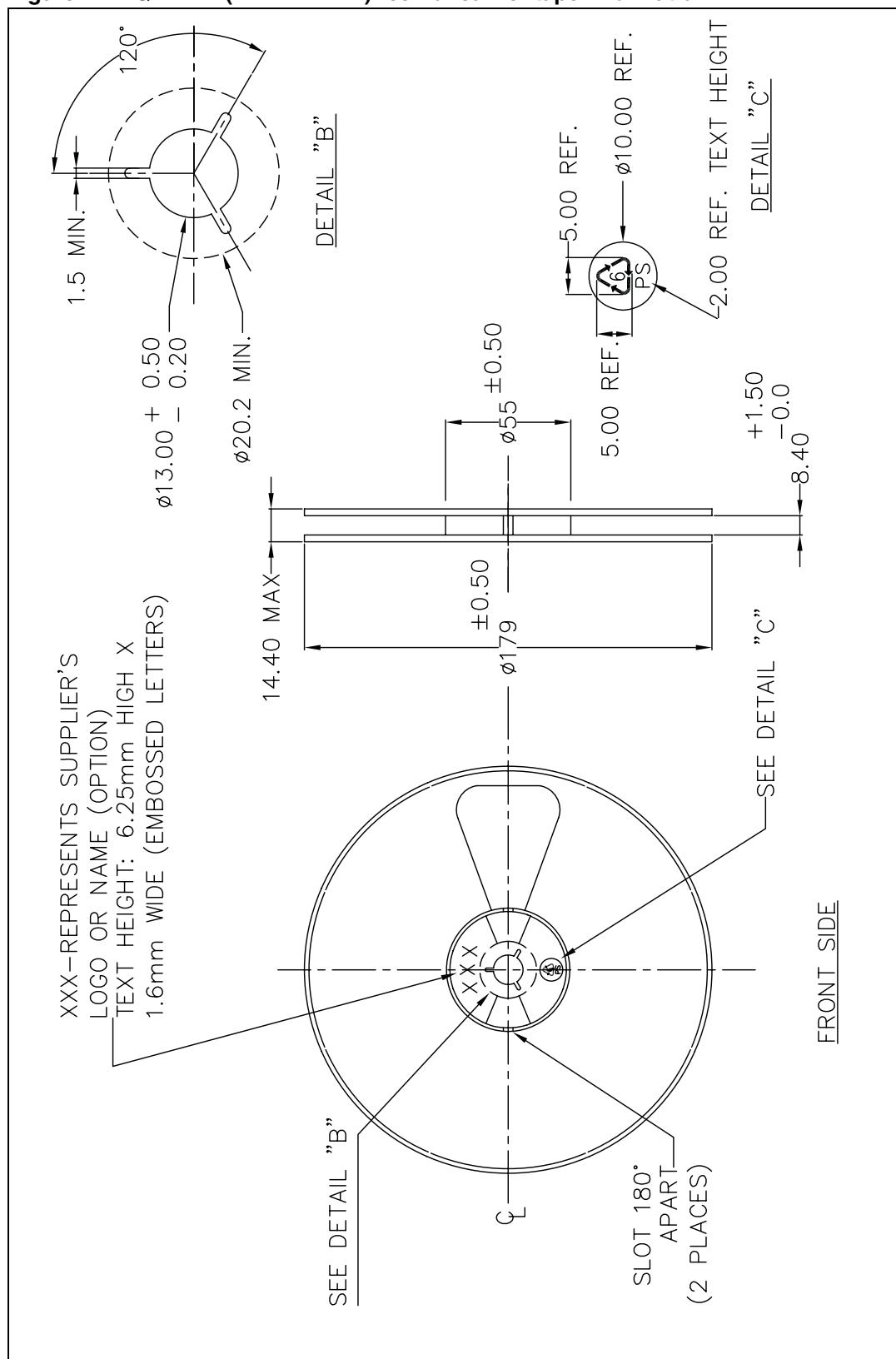
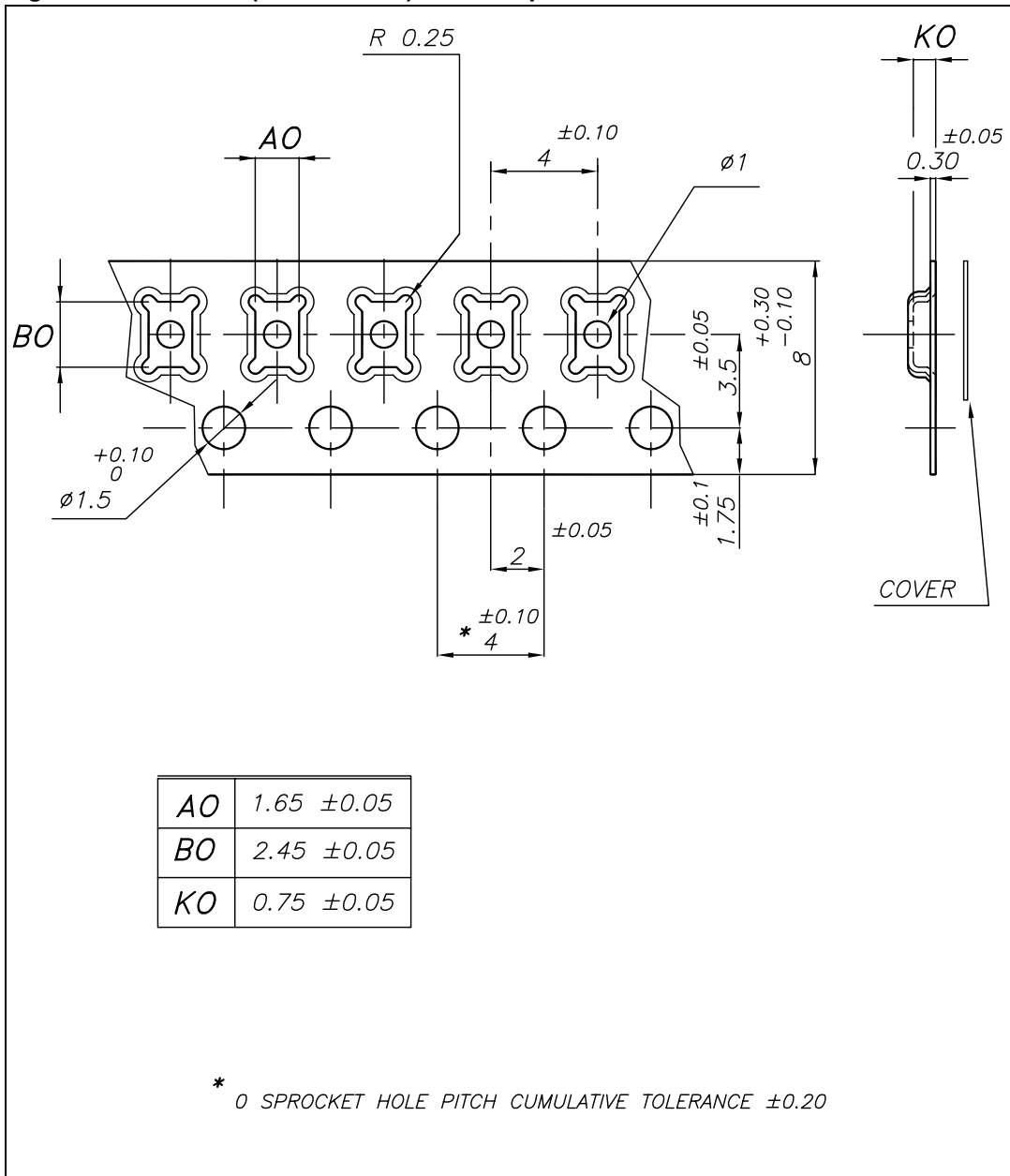


Figure 8. QFN12L (2.2 x 1.4 mm) carrier tape information



5 Revision history

Table 10. Document revision history

Date	Revision	Changes
22-Dec-2005	1	First draft.
23-Dec-2005	2	Few changes.
15-Mar-2010	3	The document has been reformatted, added tape and reel information.

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.

© 2010 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