

Low voltage 1 Ω single SPDT switch with break-before-make feature

Datasheet – production data

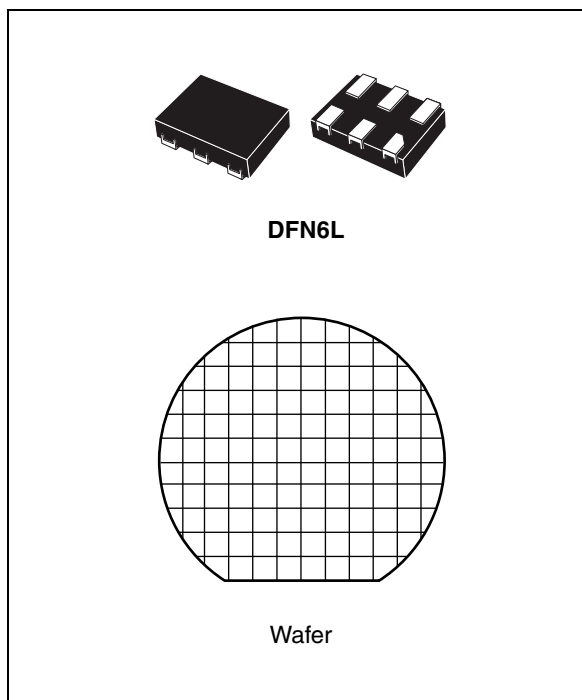
Features

- High speed:
 - $t_{PD} = 130$ ps (typ.) at $V_{CC} = 3.0$ V
 - $t_{PD} = 140$ ps (typ.) at $V_{CC} = 2.3$ V
- Ultra low power dissipation:
 - $I_{CC} = 0.2$ μ A (max.) at $T_A = 85$ °C
- Low ON-resistance:
 - $R_{ON} = 1.0$ Ω (typ.) at $V_{CC} = 4.5$ V
 - $R_{ON} = 1.2$ Ω (typ.) at $V_{CC} = 3.0$ V
 - $R_{ON} = 2.0$ Ω (typ.) at $V_{CC} = 1.8$ V
- Wide operating voltage range:
 - V_{CC} (opr.) = 1.65 to 4.5 V single supply
- 5 V tolerant and 1.8 V compatible threshold ON digital control input at $V_{CC} = 1.65$ to 4.5 V
- Latch-up performance exceeds 200 mA per JESD 78, Class II
- ESD performance tested per JESD 22
 - 2000 V human-body model (A114-B, Class II)
 - 200 V machine model (A115-A)
 - 1000 V charged-device model (C101)

Description

The STG5123 is a high speed CMOS low voltage single analog SPDT (single-pole double-throw) switch or 2:1 multiplexer/demultiplexer switch manufactured using silicon gate C²MOS technology. Designed to operate from a 1.65 to 4.5 V supply, this device is ideal for portable applications.

The device offers very low ON-resistance (1 Ω) at $V_{CC} = 4.5$ V. Switch S1 is ON (connected to common ports Dn) when the SEL input is held high, and OFF (state of high impedance exists between the two ports) when SEL is held low.



Switch S2 is ON (connected to common port D) when the SEL input is held low, and OFF (state of high impedance exists between the two ports) when SEL is held high.

Additional key features are fast switching speed, break-before-make delay time and ultra low power consumption. All inputs and outputs are equipped with protection circuits to protect against static discharge, giving them immunity from ESD and transient excess voltage.

Table 1. Device summary

Order code	Package	Packaging
STG5123DTR	DFN6L (1.2 x 1 mm)	Tape and reel
JSTG5123-CD1		Unsaun wafer

Contents

1	Pin connections and functions	5
2	Electrical ratings	6
3	Electrical characteristics	7
3.1	DC electrical characteristics	7
3.2	AC electrical characteristics	8
3.3	Analog switch characteristics	9
4	Test circuits	10
5	Package information	14
6	Die description	19
7	Revision history	21

List of tables

Table 1.	Device summary	1
Table 2.	Pin descriptions	5
Table 3.	Truth table.	5
Table 4.	Absolute maximum ratings	6
Table 5.	Recommended operating conditions	6
Table 6.	DC specifications	7
Table 7.	AC electrical characteristics ($C_L = 35 \text{ pF}$, $R_L = 50 \Omega$, $t_r = t_f \leq 5 \text{ ns}$)	8
Table 8.	Analog switch characteristics ($C_L = 5 \text{ pF}$, $R_L = 50 \Omega$, $T_A = 25 \text{ }^\circ\text{C}$)	9
Table 9.	DFN6L (1.2 x 1 mm) mechanical data	15
Table 10.	Pad information.	20
Table 11.	Document revision history	21

List of figures

Figure 1.	Pin connections (top through view)	5
Figure 2.	Input equivalent circuit	5
Figure 3.	ON-resistance	10
Figure 4.	Bandwidth	10
Figure 5.	OFF leakage	11
Figure 6.	Channel-to-channel crosstalk	11
Figure 7.	OFF isolation	12
Figure 8.	Test circuit	12
Figure 9.	Break-before-make time delay	13
Figure 10.	Switching time and charge injection ($V_{GEN} = 0\text{ V}$, $R_{GEN} = 0\ \Omega$, $R_L = 1\ \text{M}\Omega$, $C_L = 100\ \text{pF}$)	13
Figure 11.	Turn-on, turn-off delay time	13
Figure 12.	DFN6L (1.2 x 1 mm) package outline	14
Figure 13.	DFN6L (1.2 x 1 mm) footprint recommendation	15
Figure 14.	DFN6L carrier tape information	16
Figure 15.	DFN6L reel information drawing (back view)	17
Figure 16.	DFN6L reel information drawing (front view)	18
Figure 17.	JSTG5123-CD1 die plot	19

1 Pin connections and functions

Figure 1. Pin connections (top through view)

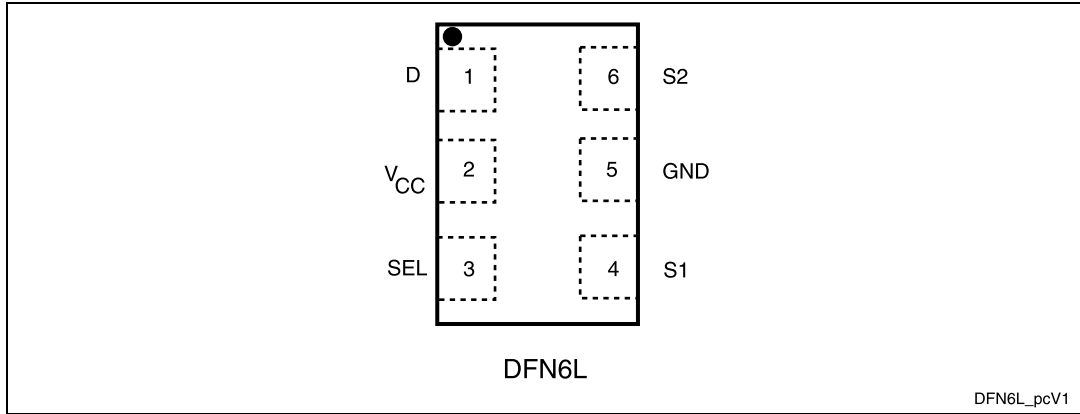


Table 2. Pin descriptions

Pin number	Symbol	Name and function
4	S1	Independent channel
6	S2	Independent channel
1	D	Common channels
3	SEL	Control
2	V _{CC}	Positive supply voltage
5	GND	Ground (0 V)

Figure 2. Input equivalent circuit

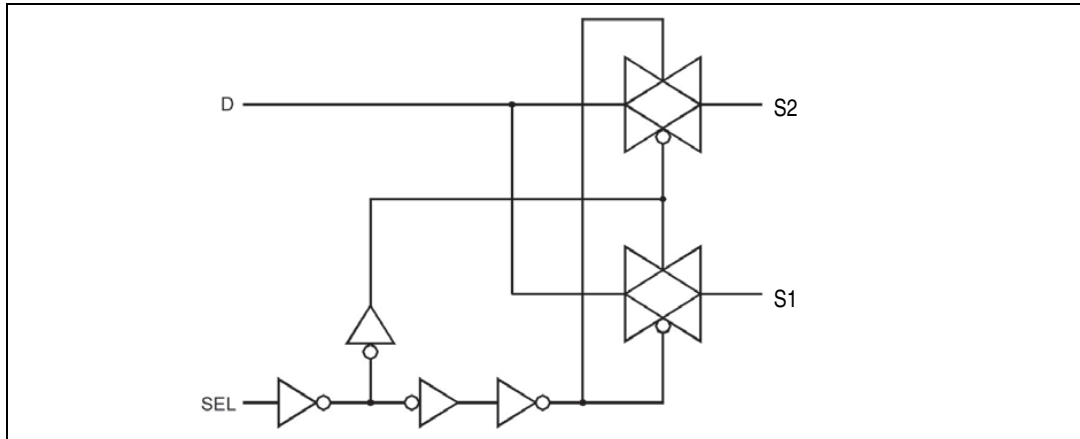


Table 3. Truth table

Sel	Switch S1	Switch S2
H	ON	OFF ⁽¹⁾
L	OFF ⁽¹⁾	ON

1. High impedance.

2 Electrical ratings

Stressing the device above the rating listed in [Table 4: Absolute maximum ratings](#) 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 [Table 5: Recommended operating conditions](#) of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Refer also to the STMicroelectronics™ SURE program and other relevant quality documents.

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 ($V_{SEL} < 0$ 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	±200	mA
I_{OP}	DC output current peak (pulse at 1 ms, 10% duty cycle)	±400	mA
I_{CC} or I_{GND}	DC V_{CC} or ground current	±100	mA
P_D	Power dissipation at $T_A = 70$ °C ⁽¹⁾	1120	mW
T_{STG}	Storage temperature	-65 to 150	°C
T_L	Lead temperature (10 s)	300	°C

1. Derate above 70 °C by 18.5 mW/°C.

Table 5. Recommended operating conditions

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage	1.65 to 4.5	V
V_I	Input voltage	0 to V_{CC}	V
V_{IC}	Control input voltage	0 to 4.5	V
V_O	Output voltage	0 to V_{CC}	V
T_{op}	Operating temperature	-40 to 85	°C
dt/dv	Input rise and fall time control input	$V_{CC} = 1.65$ to 2.7 V	0 to 20
		$V_{CC} = 3.0$ to 4.5 V	0 to 10

3 Electrical characteristics

3.1 DC electrical characteristics

Table 6. DC specifications

Symbol	Parameter	V _{CC} (V)	Test condition	Value					Unit
				T _A = 25 °C			-40 to 85 °C		
				Min.	Typ.	Max.	Min.	Max.	
V _{IH}	High level input voltage	1.65 – 1.95		0.65 V _{CC}			0.65 V _{CC}		V
		2.3 – 2.5		1.2			1.2		
		2.7 – 3.0		1.3			1.3		
		3.3 – 3.6		1.4			1.4		
		4.5		1.6			1.6		
V _{IL}	Low level input voltage	1.65 – 1.95				0.40		0.40	V
		2.3 – 2.5				0.60		0.60	
		2.7 – 3.0				0.60		0.60	
		3.3 – 3.6				0.60		0.60	
		4.5				0.80		0.80	
R _{ON}	Switch ON-resistance	1.8	V _S = 0 V to V _{CC} I _S = 100 mA		2.0	3.0		3.5	Ω
		2.7			1.3	1.6		1.8	
		3.0			1.2	1.5		1.7	
		4.5			1.0	1.2		1.4	
ΔR _{ON}	ON-resistance match between channels ⁽¹⁾	1.8	V _S at R _{ON} max I _S = 100 mA		0.06				Ω
		2.7			0.05				
		3.0			0.05				
		4.5			0.05				
R _{FLAT}	ON-resistance flatness ⁽²⁾	1.8	V _S = 0 V to V _{CC} I _S = 100 mA		1.0	1.5		1.5	Ω
		2.7			0.45	0.60		0.70	
		3.0			0.43	0.50		0.60	
		4.5			0.39	0.50		0.60	
I _{OFF}	OFF state leakage current (Sn), (D)	4.3	V _S = 0.3 or 4 V			±20		±100	nA
I _{IN}	Input leakage current	0 – 4.5	V _{SEL} = 0 to 4.5 V			±0.1		±1.0	μA
I _{CC}	Quiescent supply current	1.65 – 4.5	V _{SEL} = V _{CC} or GND			±0.1		±1.0	μA

Table 6. DC specifications (continued)

Symbol	Parameter	V _{CC} (V)	Test condition	Value					Unit
				T _A = 25 °C			-40 to 85 °C		
				Min.	Typ.	Max.	Min.	Max.	
I _{CCLV}	Quiescent supply current low voltage driving	4.3	V _{SEL} = 1.65 V		±17	±35		±70	µA
		4.3	V _{SEL} = 1.80 V		±15	±30		±60	
		4.3	V _{SEL} = 2.60 V		±5	±10		±20	

1. $\Delta R_{ON} = R_{ON(Max)} - R_{ON(Min)}$
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 pF, R_L = 50 Ω, t_r = t_f ≤ 5 ns)

Symbol	Parameter	V _{CC} (V)	Test conditions	Value					Unit
				T _A = 25 °C			- 40 to 85 °C		
				Min.	Typ.	Max.	Min.	Max.	
t _{PLH} , t _{PHL}	Propagation delay	1.65 – 1.95			0.15				ns
		2.3 – 2.7			0.14				
		3.0 – 3.3			0.13				
		3.6 – 5.0			0.13				
t _{ON}	Turn-ON time	1.65 – 1.95	V _S = 0.8 V		36				ns
		2.3 – 2.7	V _S = 1.5 V		31	40		45	
		3.0 – 3.3			24	31		40	
		3.6 – 5.0			21	28		32	
t _{OFF}	Turn-OFF time	1.65 – 1.95	V _S = 0.8 V		29				ns
		2.3 – 2.7	V _S = 1.5 V		17	27		37	
		3.0 – 3.3			12	23		33	
		3.6 – 5.0			11	21		31	
t _D	Break-before-make time delay	1.65 – 1.95	C _L = 35 pF R _L = 50 Ω V _S = 1.5 V		15				ns
		2.3 – 2.7			10				
		3.0 – 3.3			8				
		3.6 – 5.0			6				
Q	Charge injection	1.65	C _L = 100 pF V _{GEN} = 0 V R _{GEN} = 0 Ω		16				pC
		2.3			22				
		3			26				
		5.0			33				

3.3 Analog switch characteristics

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

Symbol	Parameter	V_{CC} (V)	Test conditions	Value					Unit
				$T_A = 25 \text{ } ^\circ\text{C}$			$-40 \text{ to } 85 \text{ } ^\circ\text{C}$		
				Min.	Typ.	Max.	Min.	Max.	
OIRR	OFF isolation ⁽¹⁾	1.65 – 5.0	$V_S = 1 V_{RMS}$ $f = 100 \text{ kHz}$		- 75				dB
Xtalk	Crosstalk	1.6 – 5.0	$V_S = 1 V_{RMS}$ $f = 100 \text{ kHz}$		- 80				dB
THD	Total harmonic distortion	2.3 – 5.0	$R_L = 600 \text{ } \Omega$ $V_S = 2 V_{PP}$ $f = 20 \text{ Hz to } 20 \text{ kHz}$		0.03				%
BW	-3 dB bandwidth	1.65 – 5.0	$R_L = 50 \text{ } \Omega$		150				MHz
C_{IN}	Control pin input capacitance				6				pF
C_{ON}	Sn port capacitance when switch is enabled	3.3	$f = 1 \text{ MHz}$		52				
C_{OFF}	Sn port capacitance when switch is disabled	3.3	$f = 1 \text{ MHz}$		25				
C_D	D port capacitance when switch is enabled	3.3	$f = 1 \text{ MHz}$		50				

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

4 Test circuits

Figure 3. ON-resistance

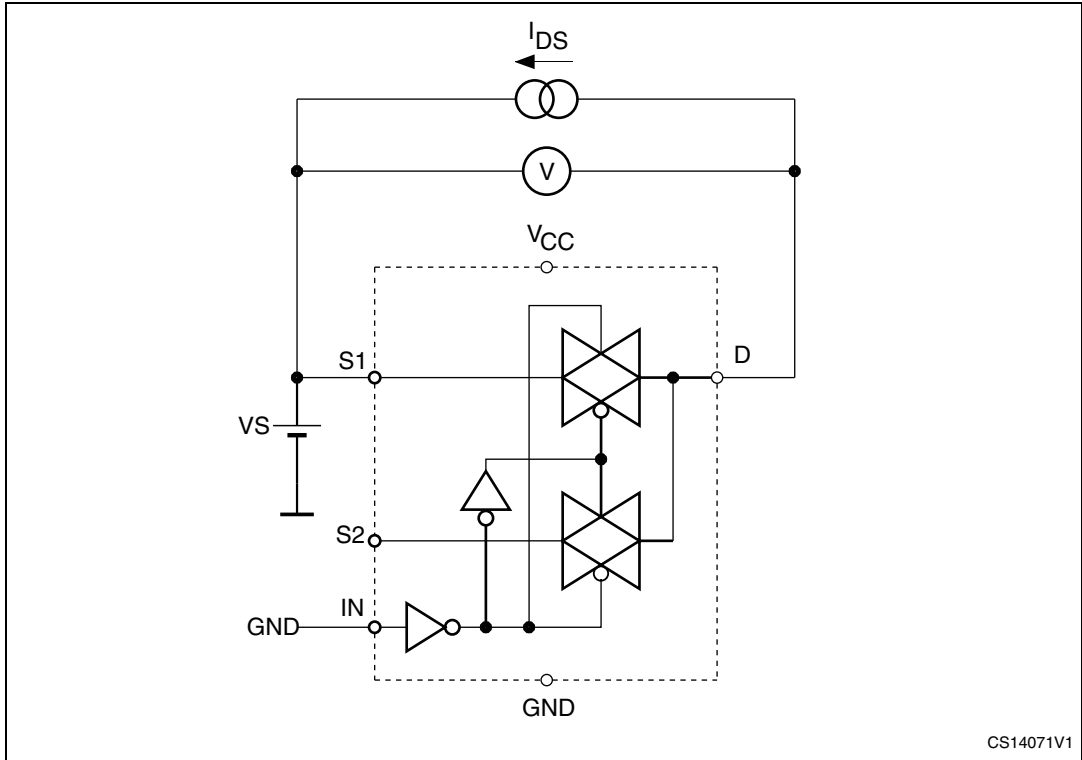


Figure 4. Bandwidth

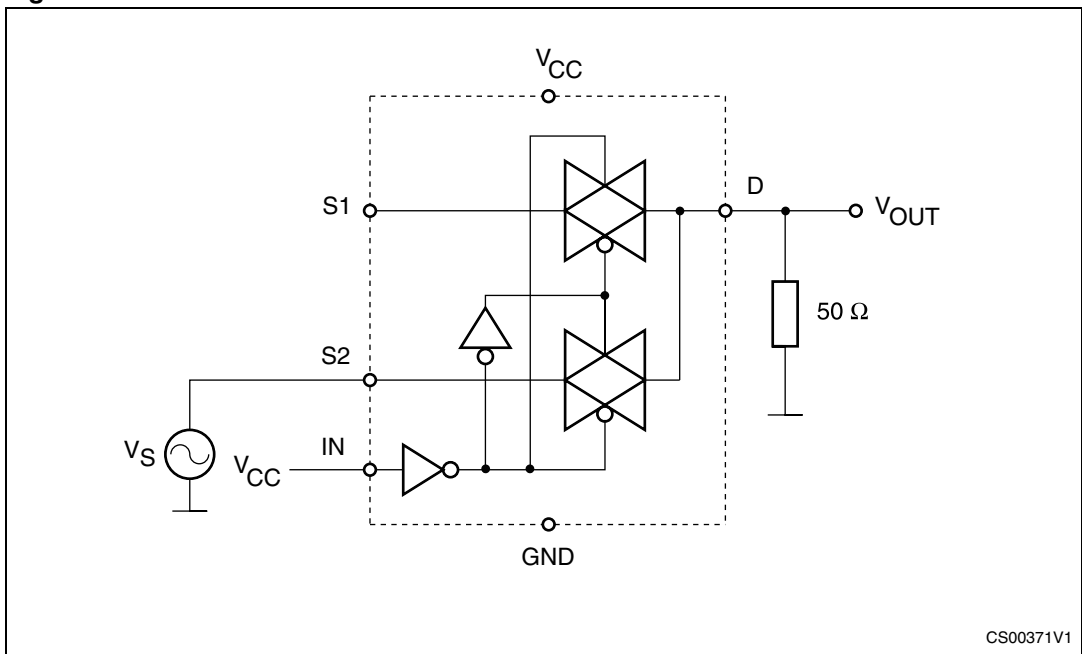


Figure 5. OFF leakage

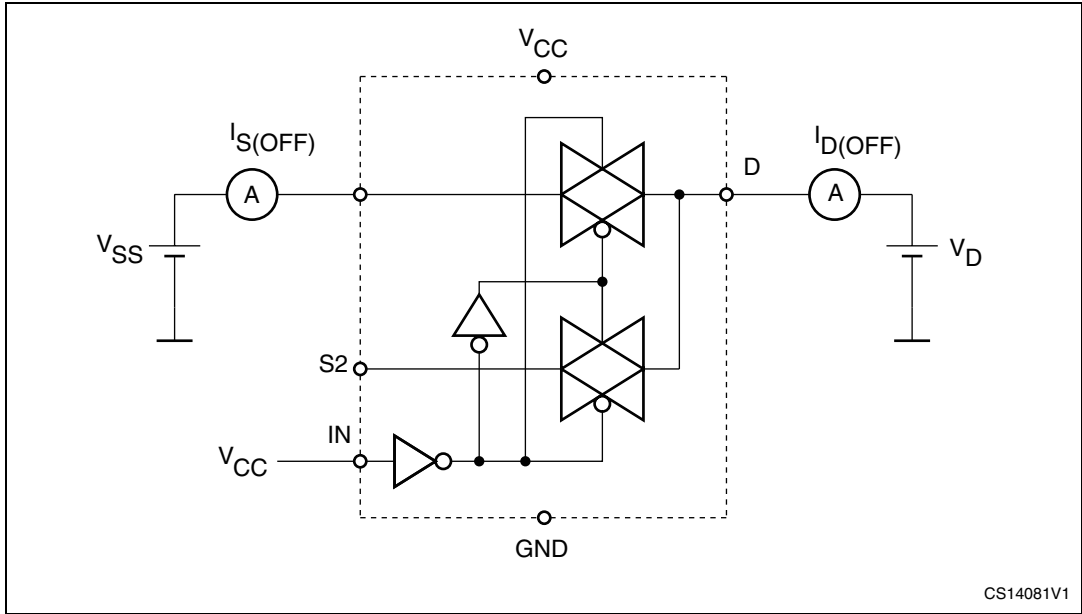


Figure 6. Channel-to-channel crosstalk

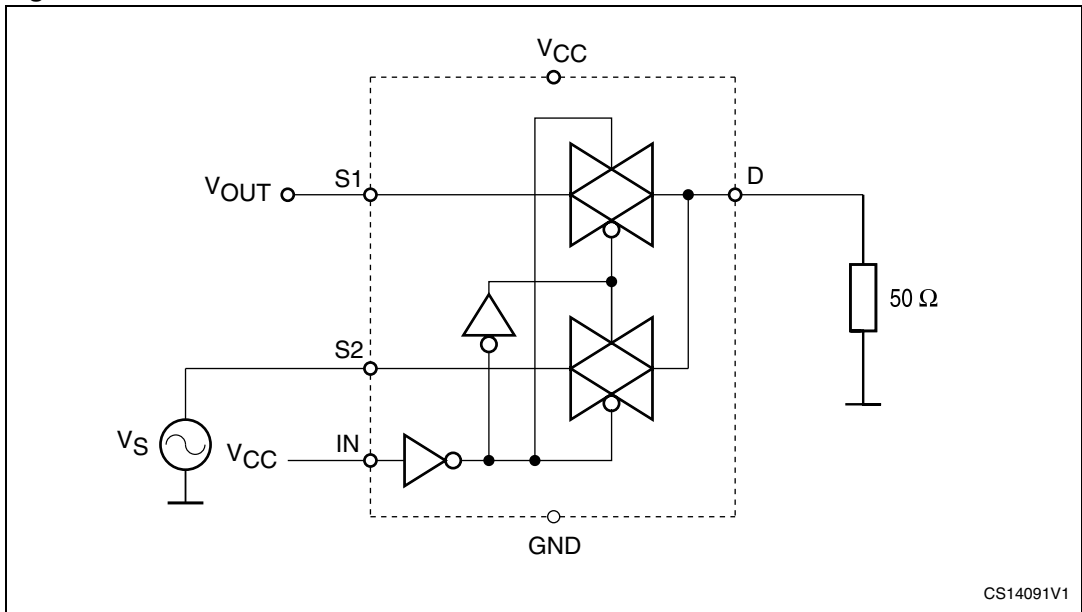


Figure 7. OFF isolation

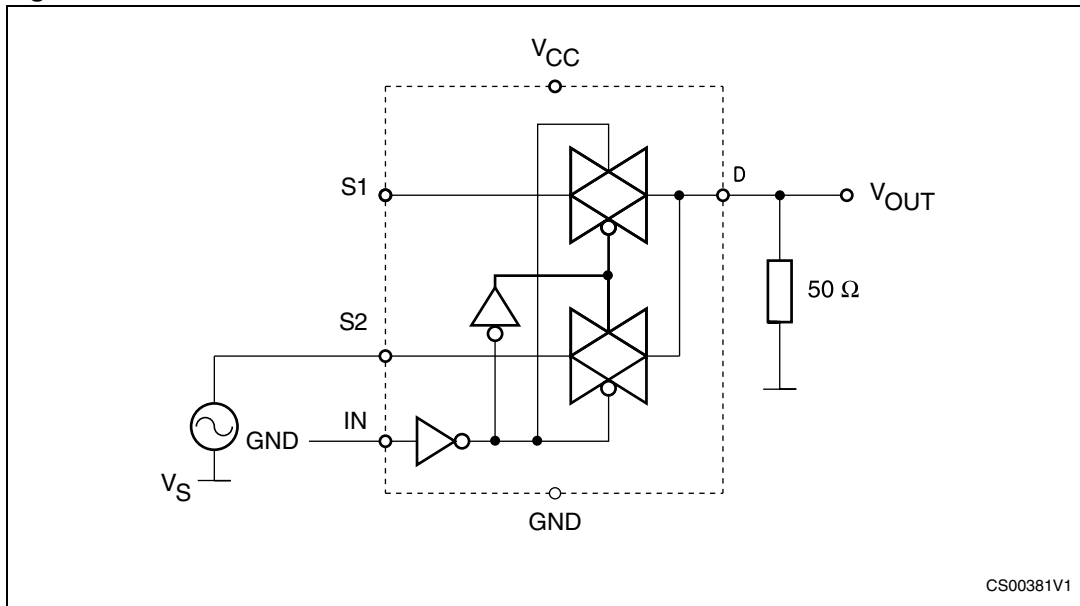
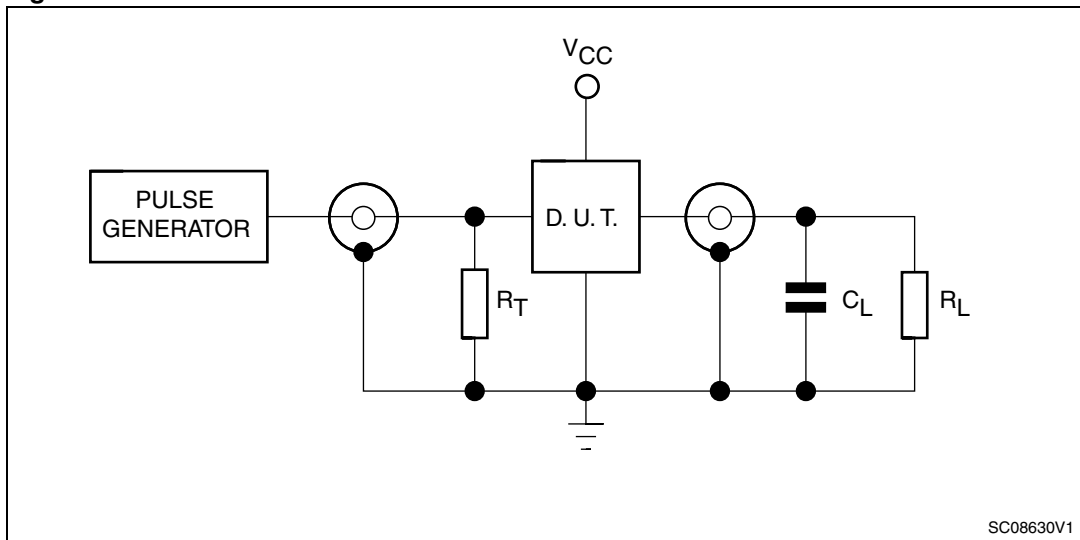


Figure 8. Test circuit



1. $C_L = 5/35$ pF or equivalent: (includes jig capacitance).
2. $R_L = 50 \Omega$ or equivalent.
3. $R_T = Z_{OUT}$ of pulse generator (typically 50Ω).

Figure 9. Break-before-make time delay

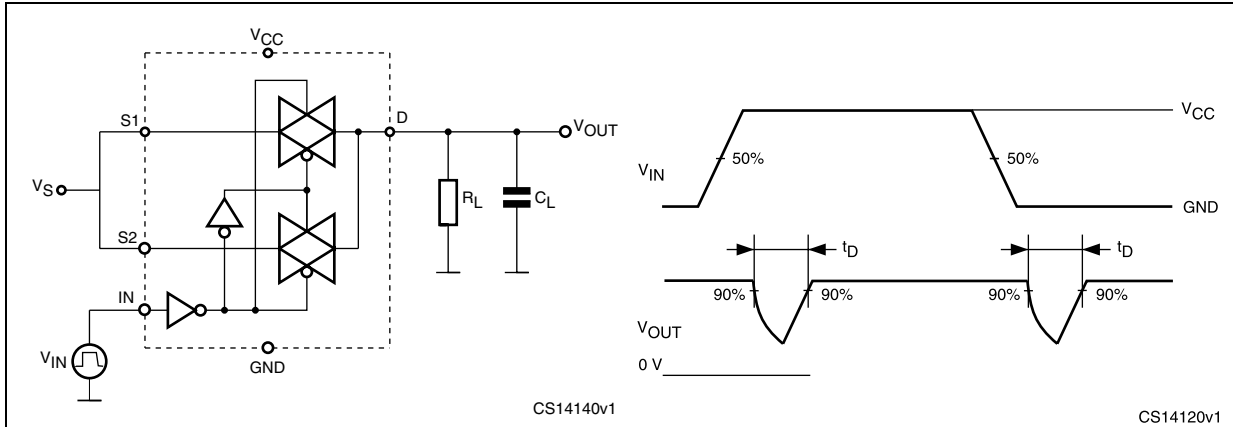


Figure 10. Switching time and charge injection
 ($V_{GEN} = 0\text{ V}$, $R_{GEN} = 0\ \Omega$, $R_L = 1\text{ M}\Omega$, $C_L = 100\text{ pF}$)

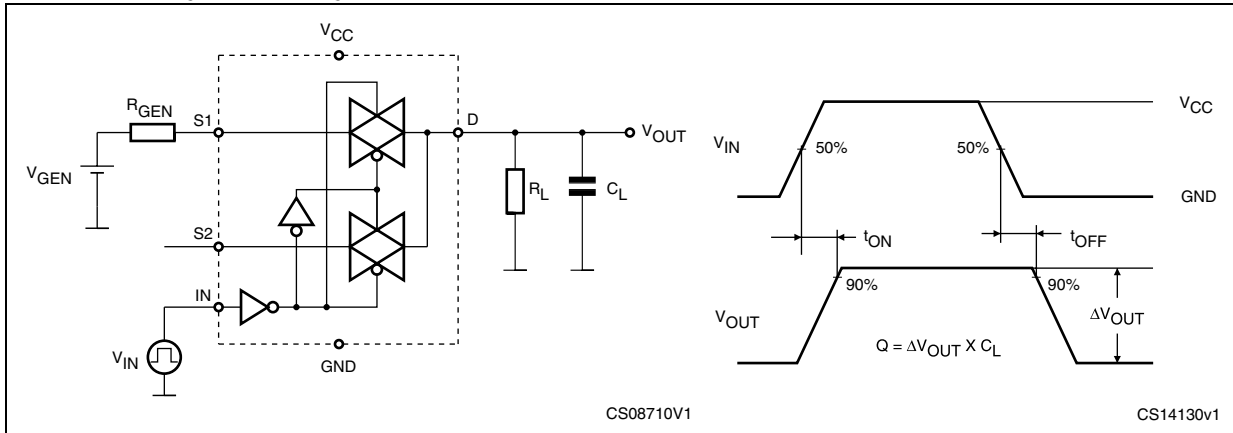
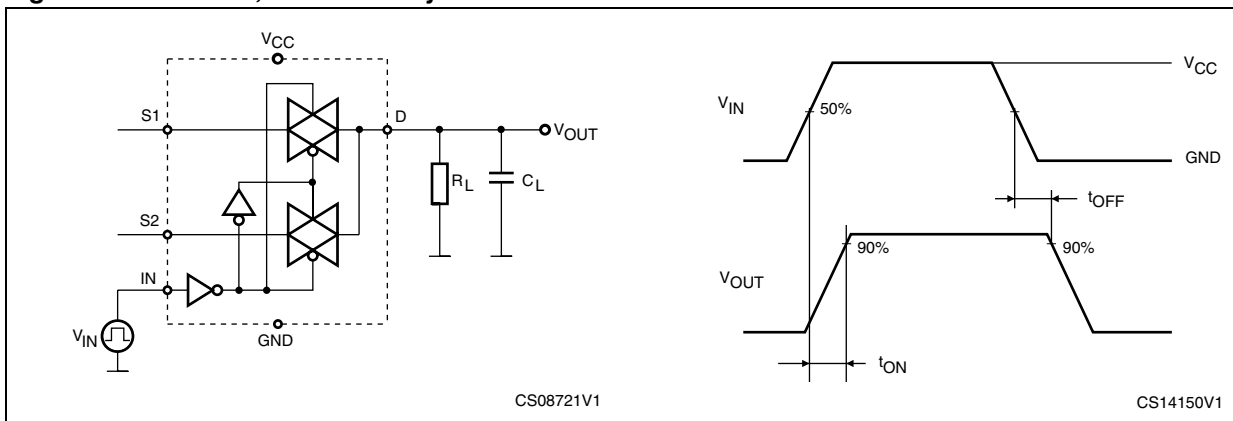


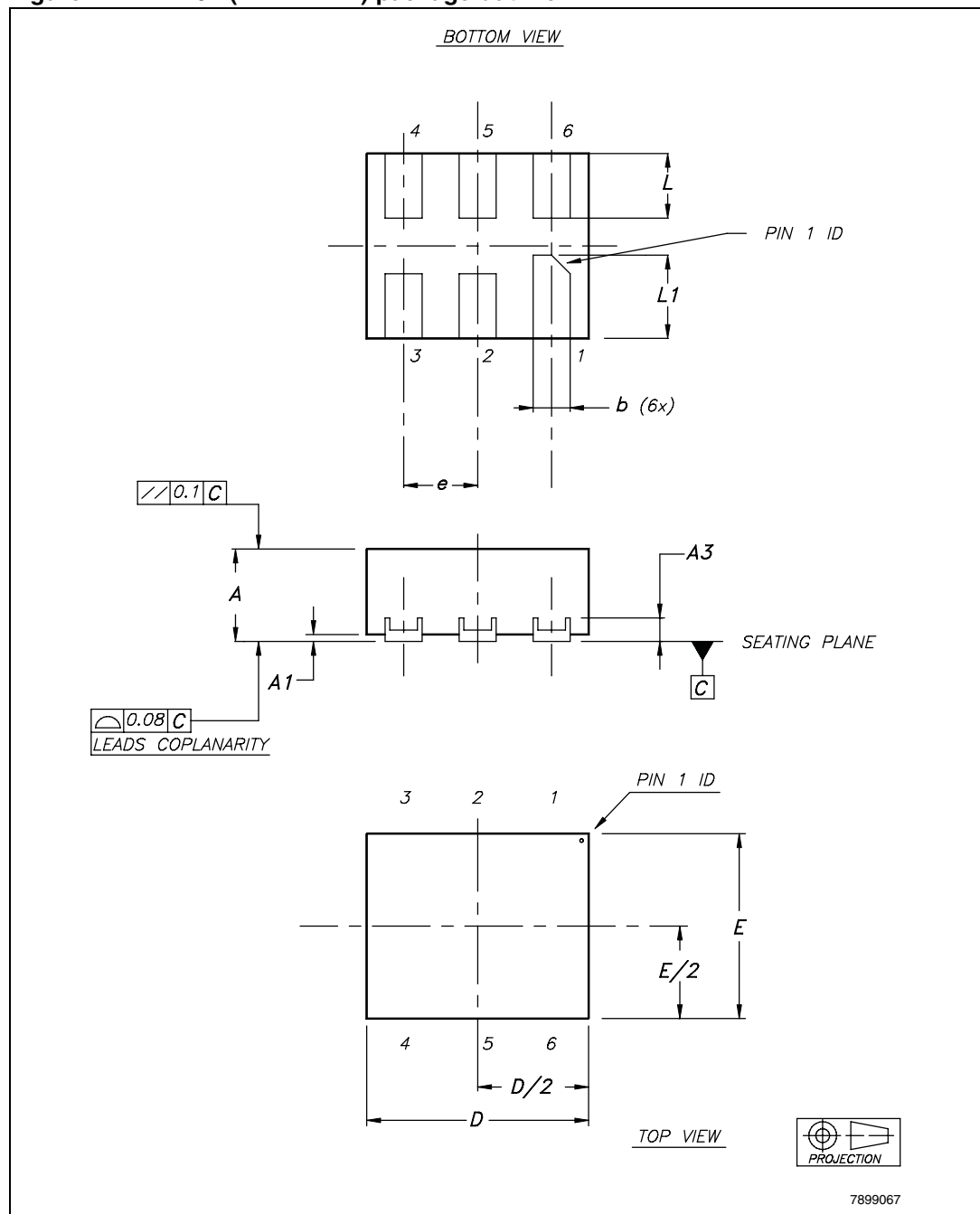
Figure 11. Turn-on, turn-off delay time



5 Package information

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 12. DFN6L (1.2 x 1 mm) package outline



1. Drawing is not to scale.

Table 9. DFN6L (1.2 x 1 mm) mechanical data

Symbol	Dimensions (millimeters)		
	Typ.	Min.	Max.
A	0.50	0.45	0.55
A1	0.02	0	0.05
A3	0.127		
b	0.20	0.15	0.25
D	1.20	1.15	1.25
E	1	0.95	1.05
e	0.40		
L	0.35	0.30	0.40
L1	0.45	0.40	0.50

Figure 13. DFN6L (1.2 x 1 mm) footprint recommendation

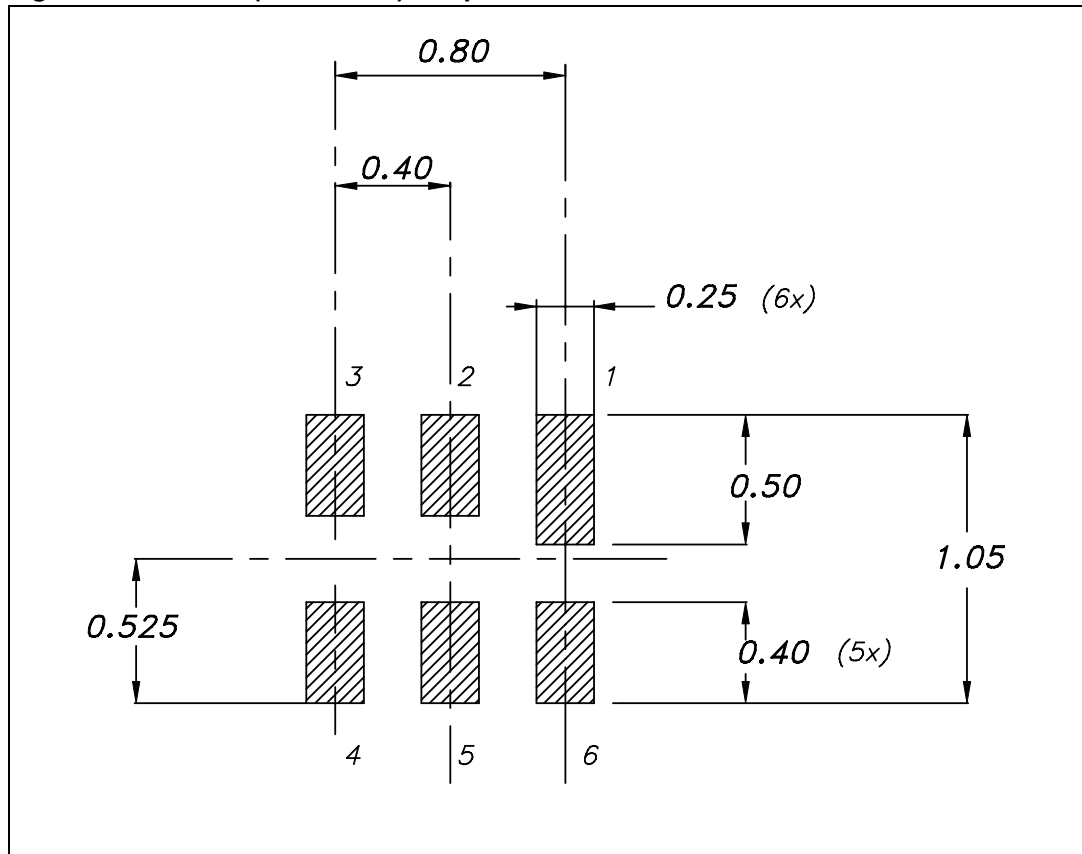
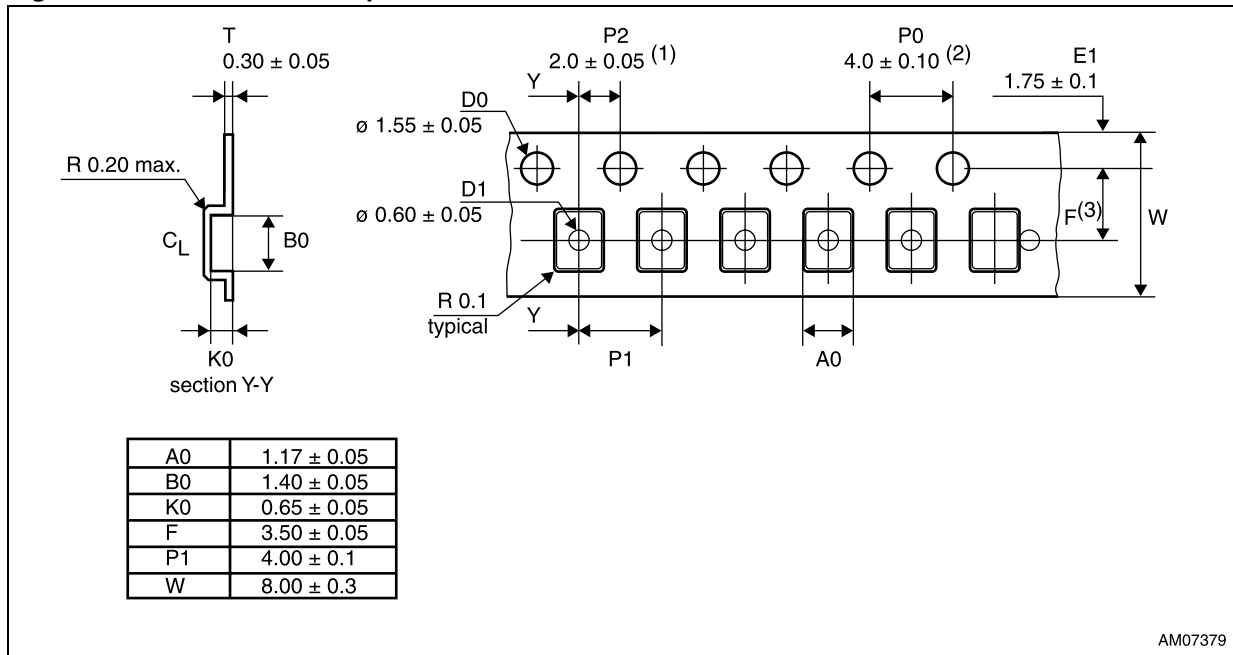


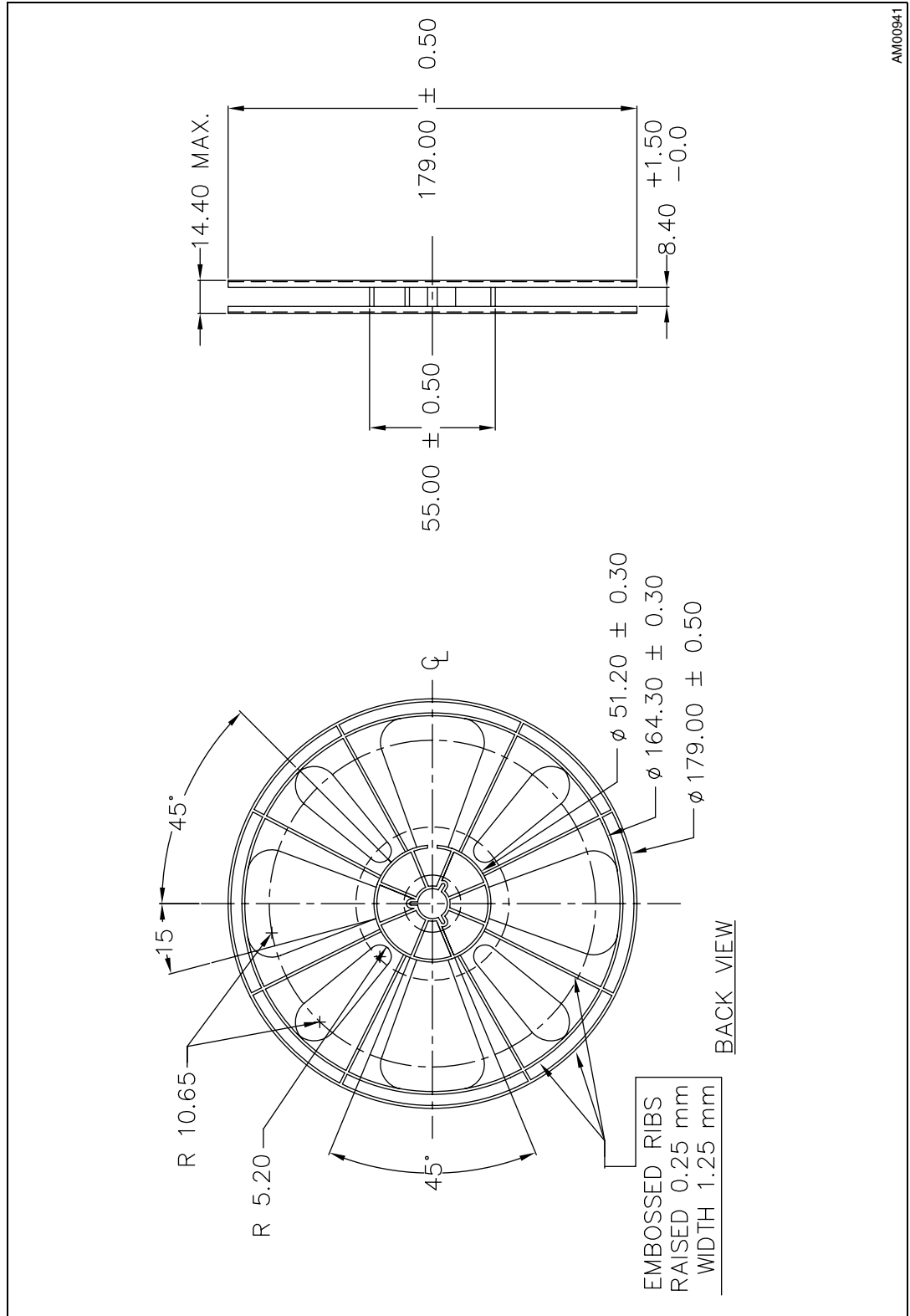
Figure 14. DFN6L carrier tape information



AM07379

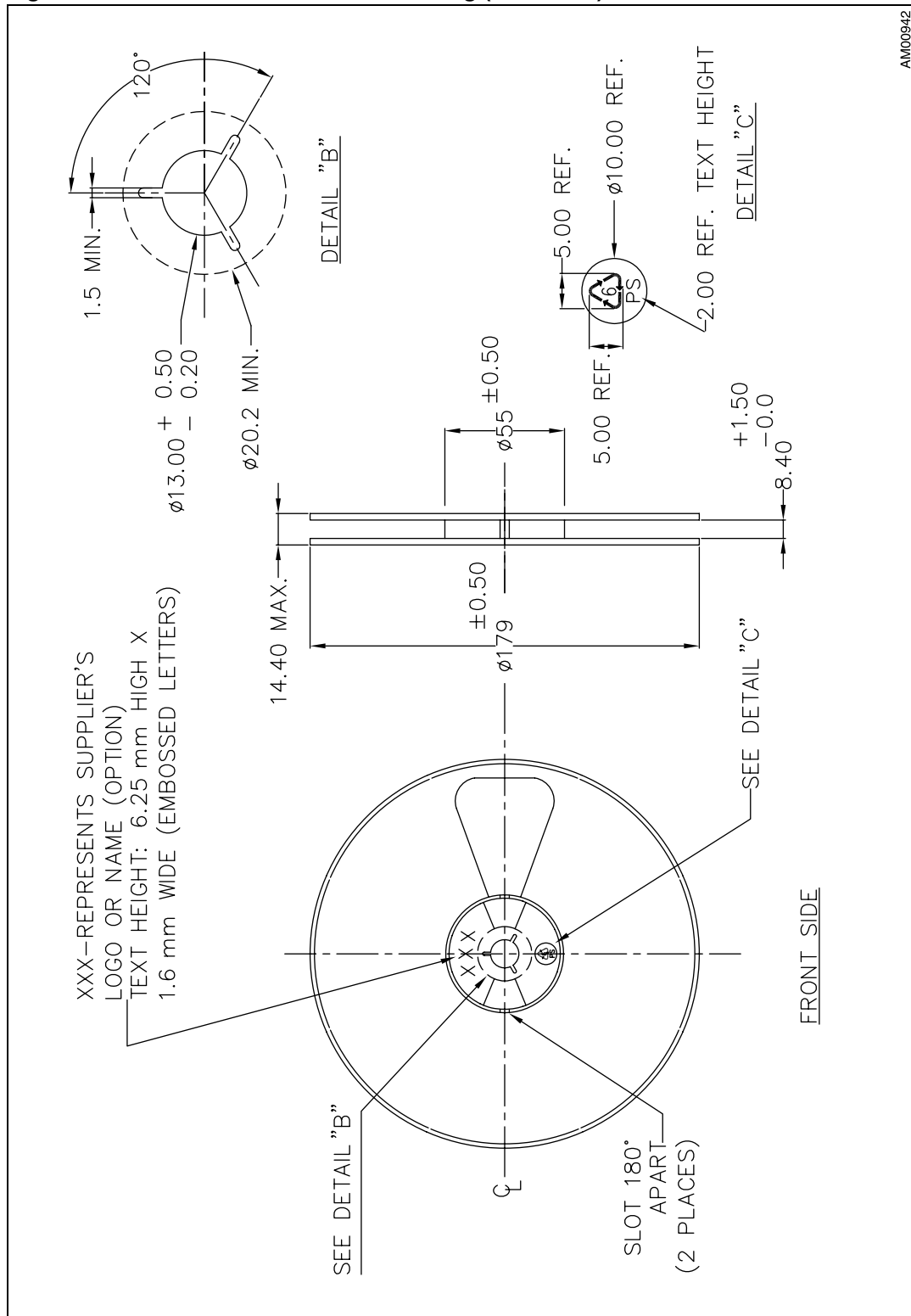
1. Measured from centreline of sprocket hole to centreline of pocket.
2. Cumulative tolerance of 10 sprocket holes is ± 0.20.
3. Measured from centreline of sprocket hole to centreline of pocket.
4. Other material available.
5. Drawing is not to scale.
6. All dimensions are in millimeters unless otherwise stated.

Figure 15. DFN6L reel information drawing (back view)



1. Drawing is not to scale.
2. Dimensions are in millimeters.

Figure 16. DFN6L reel information drawing (front view)



1. Drawing not to scale.
2. Dimensions are in millimeters.

6 Die description

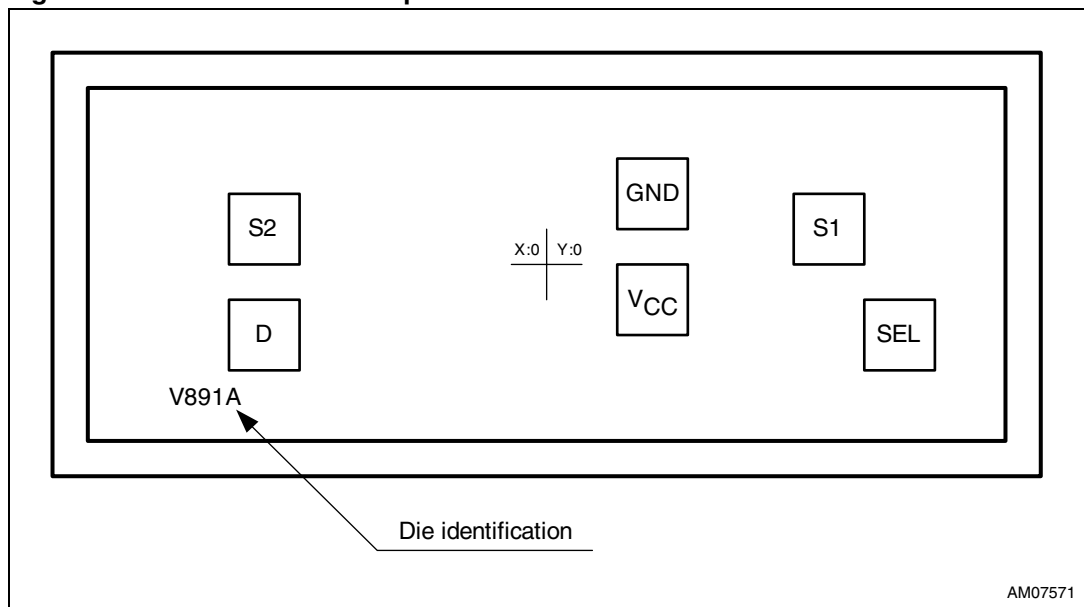
Product JSTG5123-CD1

- Wafer size: 203 mm (8 inches)
- Wafer thickness: 725 μm + 25 μm
- Die identification: V891A.

Die layout

- Design die size (X x Y): 900 x 350 μm
- Scribe line: 100 x 62 μm
- Stepping die size: 1000 x 412 μm
- Pad opening: 76 x 76 μm
- DI: die identification (at the position shown in [Figure 17](#))
- Pads: pad contact (at the position shown in [Figure 17](#) and [Table 10](#)).

Figure 17. JSTG5123-CD1 die plot



Refer to [Table 10](#) for the pad locations.

Table 10. Pad information

Pad function	X (μm)	Y(μm)
S2	-292.25	52
GND	96.75	86
S1	292.25	52
SEL	361	-52
V _{CC}	96.75	-18
D	-292.25	-52

Pad locations are measured relative to the die center (where X and Y are the horizontal and vertical axis, respectively, measured in μm). Refer to [Figure 17](#).

7 Revision history

Table 11. Document revision history

Date	Revision	Changes
30-Oct-2007	1	Initial release.
21-Apr-2010	2	<p><i>Table 6: DC specifications on page 7:</i> Modified values for “Input leakage current” and “Quiescent supply current”.</p> <p>Updated ECOPACK[®] statement in <i>Section 5: Package information</i>.</p> <p>Minor text changes throughout the document.</p>
08-Feb-2011	3	Corrected typo in <i>Table 2, Section 2, Table 6 to Table 9, Figure 12</i> , updated <i>Figure 14</i> .
21-Dec-2011	4	Added wafer, <i>Section 6: Die description</i> , updated <i>Table 1, Section 2: Electrical ratings</i> and Disclaimer, minor text corrections throughout document.
02-Apr-2012	5	Added product maturity information, updated <i>Table 1</i> and <i>Section 6</i> (replaced RPN JTS5123-CD1 by JSTG5123-CD1), minor text corrections throughout document.

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

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[STMicroelectronics:](#)

[STG5123DTR](#)