

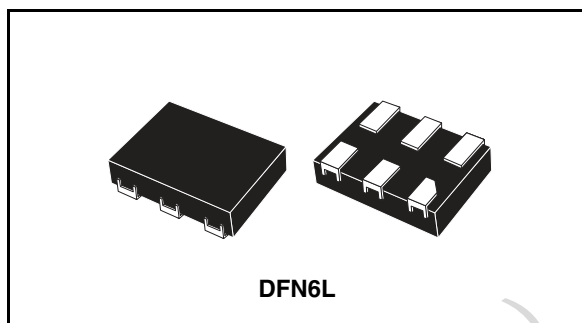


STG3155

Low voltage 0.5Ω Max single SPDT switch with break-before-make feature

Features

- High speed:
 - $t_{PD} = 1.5\text{ns}$ (Typ.) at $V_{CC} = 3.0\text{V}$
 - $t_{PD} = 1.5\text{ns}$ (Typ.) at $V_{CC} = 2.3\text{V}$
- Ultra low power dissipation:
 - $I_{CC} = 0.2\mu\text{A}$ (Max.) at $T_A = 85^\circ\text{C}$
- Low "ON" resistance:
 - $R_{ON} = 0.5\Omega$ ($T_A = 25^\circ\text{C}$) at $V_{CC} = 4.3\text{V}$
 - $R_{ON} = 0.6\Omega$ ($T_A = 25^\circ\text{C}$) at $V_{CC} = 3.0\text{V}$
 - $R_{ON} = 1.0\Omega$ ($T_A = 25^\circ\text{C}$) at $V_{CC} = 1.8\text{V}$
- Wide operating voltage range:
 - V_{CC} (OPR) = 1.65V to 4.3V single supply
- 4.3V Tolerant and 1.8V compatible threshold on digital control input at $V_{CC} = 2.3\text{V}$ to 3.0V
- Latch-up performance exceeds 300mA (JESD 17)
- ESD Performance (Analog Chan. Vs. GND):
HMB >2kV (MIL STD 883 method 3015)



Description

The STG3155 is a high-speed CMOS low voltage single analog S.P.D.T. (Single Pole Dual Throw) switch or 2:1 Multiplexer/Demultiplexer switch fabricated in silicon gate C²MOS technology. It is designed to operate from 1.65V to 4.3V, making this device ideal for portable applications.

The device offers very low ON-Resistance (<0.5Ω) at $V_{CC} = 4.3\text{V}$. The SEL inputs are provided to control the switch. The switch S1 is ON (they are connected to common Ports Dn) when the SEL input is held high and OFF (high impedance state exists between the two ports) when SEL is held low; the switch S2 is ON (it is connected to common Port D) when the SEL input is held low and OFF (high impedance state 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 against static discharge, giving them ESD immunity and transient excess voltage.

Table 1. Device summary

| Part number | Package | Packaging |
|-------------|----------------------|---------------|
| STG3155DTR | DFN6L (1.45mm x 1mm) | Tape and Reel |

Contents

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1 Pin connections and functions

Figure 1. Pin connections (top through view)

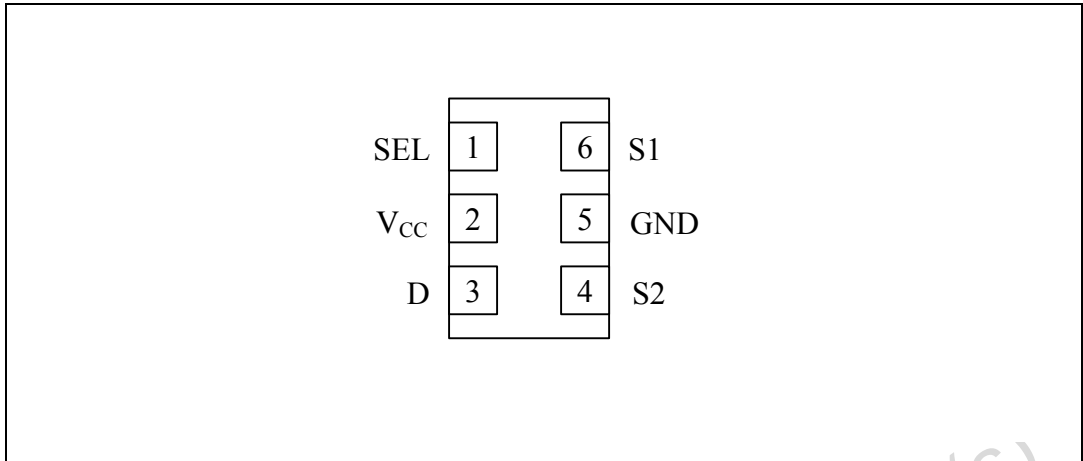
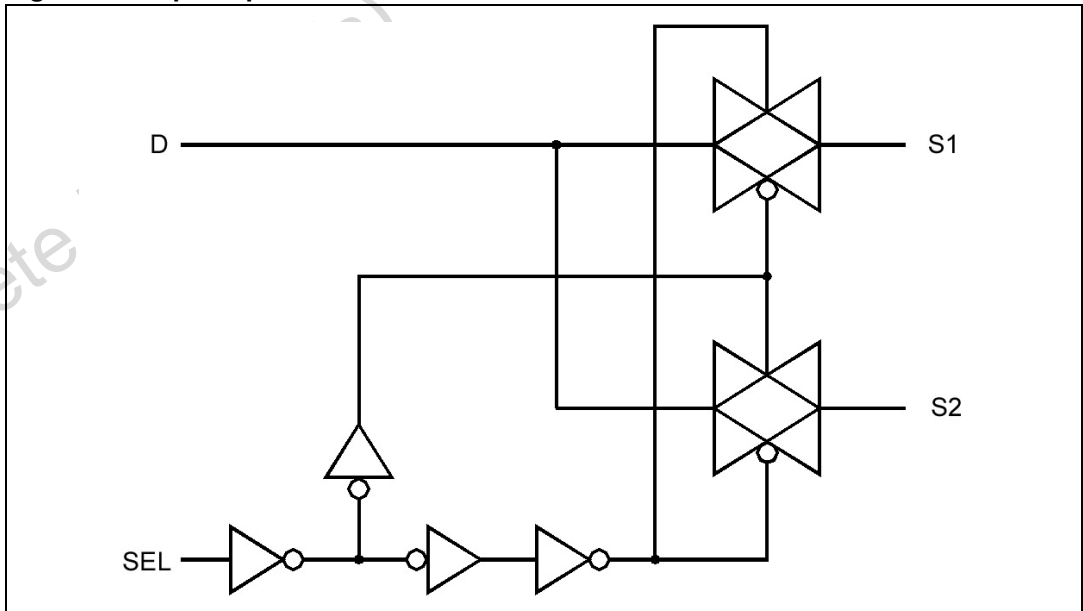


Table 2. Pin descriptions

| Pin N° | Symbol | Name and function |
|--------|-----------------|-------------------------|
| 6, 4 | S1, S2 | Independent Channels |
| 3 | D | Common Channels |
| 1 | SEL | Control |
| 2 | V _{CC} | Positive Supply Voltage |
| 5 | GND | Ground (0V) |

Figure 2. Input equivalent circuit



2 Electrical 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. Refer also to the STMicroelectronics SURE Program and other relevant quality documents.

Table 3. 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 ($V_{SEL} < 0V$) | -50 | mA |
| I_{IK} | DC Input diode current ($V_{SEL} < 0V$) | ± 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 1ms, 10% duty cycle) | ± 500 | mA |
| I_{CC} or I_{GND} | DC V_{CC} or ground current | ± 100 | mA |
| P_D | Power dissipation at $T_A = 70^\circ C$ ⁽¹⁾ | 1120 | mW |
| T_{stg} | Storage temperature | -65 to 150 | $^\circ C$ |
| T_L | Lead temperature (10 sec) | 300 | $^\circ C$ |

1. Derate above 70°C by 18.5mW/C

Table 4. Recommended operating conditions

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

1. Truth table guaranteed: 1.2V to 4.3V

3 Electrical characteristics

3.1 DC Electrical characteristics

Table 5. DC Specifications

| Symbol | Parameter | Test conditions | | 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 | | 0.65V _{CC} | | | 0.65V _{CC} | | 0.65V _{CC} | | V |
| | | 2.3-2.5 | | 1.2 | | | 1.2 | | 1.2 | | |
| | | 2.7-3.0 | | 1.3 | | | 1.3 | | 1.3 | | |
| | | 3.3-3.6 | | 1.4 | | | 1.4 | | 1.4 | | |
| | | 4.3 | | 1.6 | | | 1.6 | | 1.6 | | |
| V _{IL} | Low Level Input Voltage | 1.65-1.95 | | | | 0.25 | | 0.25 | | 0.25 | V |
| | | 2.3-2.5 | | | | 0.25 | | 0.25 | | 0.25 | |
| | | 2.7-3.0 | | | | 0.25 | | 0.25 | | 0.25 | |
| | | 3.3-3.6 | | | | 0.30 | | 0.30 | | 0.30 | |
| | | 4.3 | | | | 0.40 | | 0.40 | | 0.40 | |
| R _{PEAK} | Switch ON Peak Resistance | 1.8 | V _S = 0V to V _{CC} I _S = 100mA | | 1.1 | 1.5 | | 1.5 | | | Ω |
| | | 2.7 | | | 0.7 | 0.8 | | 0.9 | | | |
| | | 3.0 | | | 0.7 | 0.8 | | 0.9 | | | |
| | | 4.3 | | | 0.6 | 0.7 | | 0.8 | | | |
| R _{ON} | Switch On Resistance | 1.8 | V _S = 0.9V I _S = 100mA | | 1.0 | 1.2 | | 1.4 | | | Ω |
| | | 2.7 | V _S = 1.3V I _S = 100mA | | 0.6 | 0.7 | | 0.8 | | | |
| | | 3.0 | V _S = 1.5V I _S = 100mA | | 0.6 | 0.7 | | 0.8 | | | |
| | | 4.3 | V _S = 2.5V I _S = 100mA | | 0.5 | 0.6 | | 0.7 | | | |
| ΔR _{ON} | ON Resistance Match between channels ⁽¹⁾ | 1.8 | V _S @ R _{ON} Max I _S = 100mA | | 12 | | | | | | mΩ |
| | | 2.7 | | | 17 | | | | | | |
| | | 3.0 | | | 18 | | | | | | |
| | | 4.3 | | | 21 | | | | | | |
| R _{FLAT} | ON Resistance FLATNESS ⁽²⁾ | 1.8 | V _S = 0V to V _{CC} I _S = 100mA | | 0.45 | 0.50 | | 0.50 | | | Ω |
| | | 2.7 | | | 0.28 | 0.32 | | 0.32 | | | |
| | | 3.0 | | | 0.27 | 0.32 | | 0.32 | | | |
| | | 4.3 | | | 0.25 | 0.30 | | 0.30 | | | |

Table 5. DC Specifications (continued)

| Symbol | Parameter | Test conditions | | Value | | | | | | Unit | |
|-------------------|--|-----------------|---|-----------------------|------|-------|-------------|------|--------------|------|------|
| | | Vcc (V) | | T _A = 25°C | | | -40 to 85°C | | -55 to 125°C | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| I _{OFF} | OFF State Leakage Current (SN), (D) | 4.3 | V _S = 0.3 or 4V | | | ±20 | | ±100 | | | nA |
| I _{IN} | Input Leakage Current | 0 – 4.3 | V _{SEL} = 0 to 4.3V | | | ±0.1 | | ±1 | | | µA |
| I _{CC} | Quiescent Supply Current | 1.65 – 4.3 | V _{SEL} = V _{CC} or GND | | | ±0.05 | | ±0.2 | | ±1 | µA |
| I _{CCLV} | Quiescent Supply Current Low Voltage Driving | 4.3 | V _{SEL} = 1.65V | | ±23 | ±50 | | ±100 | | | µA |
| | | | V _{SEL} = 1.80V | | ±18 | ±40 | | ±50 | | | |
| | | | V _{SEL} = 2.60V | | ±7 | ±20 | | ±30 | | | |

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

$C_L = 35\text{pF}$, $R_L = 50\Omega$, $t_r = t_f \leq 5\text{ns}$

Table 6. AC Electrical characteristics

| Symbol | Parameter | Test conditions | | Value | | | | | | Unit | |
|--|------------------------------|-----------------|--|-----------------------|------|------|-------------|------|--------------|------|------|
| | | Vcc (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 | V _S = OPEN | | 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 = 0.8V | | 120 | | | | | | ns |
| | | 2.3-2.7 | V _S = 1.5V | | 45 | 55 | | 65 | | | |
| | | 3.0-3.3 | | | 52 | 55 | | 65 | | | |
| | | 3.6-4.3 | | | 40 | 55 | | 65 | | | |
| t _{OFF} | TURN-OFF time | 1.65-1.95 | V _S = 0.8 | | 22 | | | | | | ns |
| | | 2.3-2.7 | V _S = 1.5V | | 18 | 30 | | 40 | | | |
| | | 3.0-3.3 | | | 16 | 30 | | 40 | | | |
| | | 3.6-4.3 | | | 15 | 30 | | 40 | | | |
| t _D | Break Before Make Time Delay | 1.65-1.95 | C _L = 35pF R _L = 50Ω V _S = 1.5V | | 28 | | | | | | ns |
| | | 2.3-2.7 | | | 10 | | | | | | |
| | | 3.0-3.3 | | | 7 | | | | | | |
| | | 3.6-4.3 | | | 4 | | | | | | |
| Q | Charge Injection | 1.65 | C _L = 100pF V _{GEN} = 0V R _{GEN} = 0Ω | | 25 | | | | | | pC |
| | | 2.3 | | | 34 | | | | | | |
| | | 3 | | | 42 | | | | | | |
| | | 4.3 | | | 53 | | | | | | |

3.3 Analog switch characteristics

$C_L = 5\text{pF}$, $R_L = 50\Omega$, $T_A = 25^\circ\text{C}$

Table 7. Analog switch characteristics

| Symbol | Parameter | Test conditions | | Value | | | | | | Unit | | |
|-----------------|---|-----------------|--|-----------------------|------|------|-------------|------|--------------|------|------|-----|
| | | Vcc (V) | | T _A = 25°C | | | -40 to 85°C | | -55 to 125°C | | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. | |
| OIRR | Off Isolation (1) | 1.65-4.3 | V _S = 1V _{RMS} f = 100kHz | | -74 | | | | | | | dB |
| Xtalk | Crosstalk | 1.6-4.3 | V _S = 1V _{RMS} f = 100kHz | | -72 | | | | | | | dB |
| THD | Total Harmonic Distortion | 2.3-4.3 | R _L = 600Ω V _S = 2V _{PP} f = 20Hz to 20 kHz | | 0.03 | | | | | | | % |
| BW | -3dB Bandwidth | 1.65-4.3 | R _L = 50Ω | | 70 | | | | | | | MHz |
| C _{IN} | Control Pin Input Capacitance | | | | 6.6 | | | | | | | pF |
| C _{Sn} | Sn Port Capacitance | 3.3 | f = 1MHz | | 42 | | | | | | | |
| C _D | D Port Capacitance when Switch is Enabled | 3.3 | f = 1MHz | | 103 | | | | | | | |

1. OFF Isolation = $20\text{Log}_{10}(V_D/V_S)$, V_D = output. V_S = input to OFF switch.

3.4 Truth table

Table 8. Truth table

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

1. High impedance

4 Typical application circuit

Figure 3. ON-Resistance

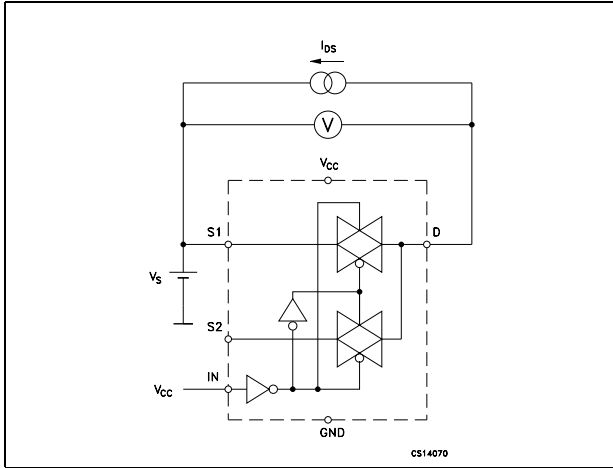


Figure 4. Bandwidth

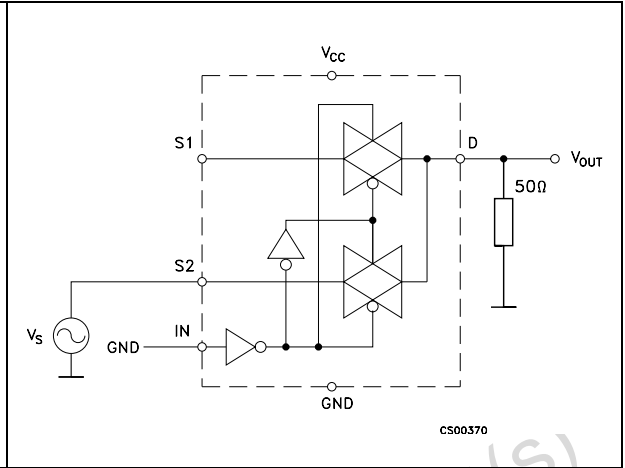


Figure 5. OFF Leakage

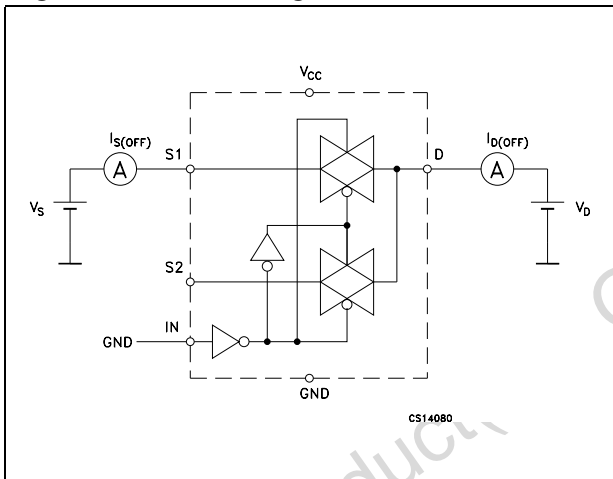


Figure 6. Channel to channel crosstalk

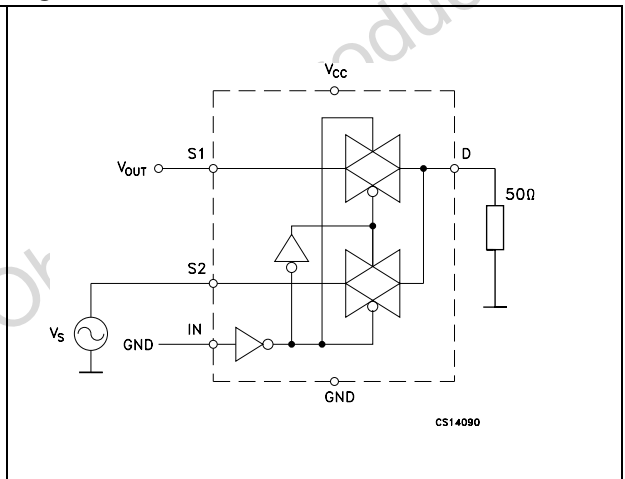
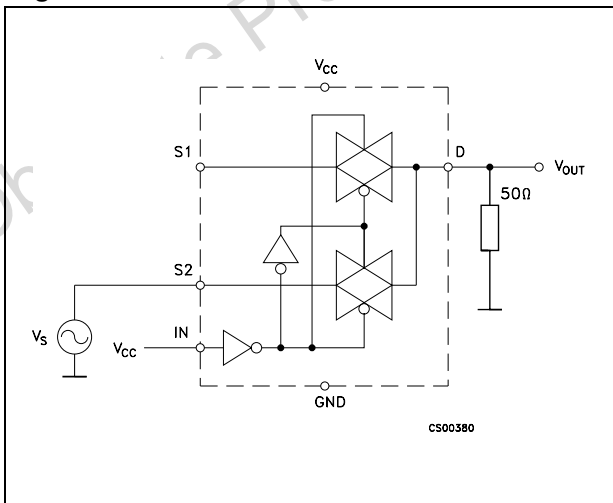
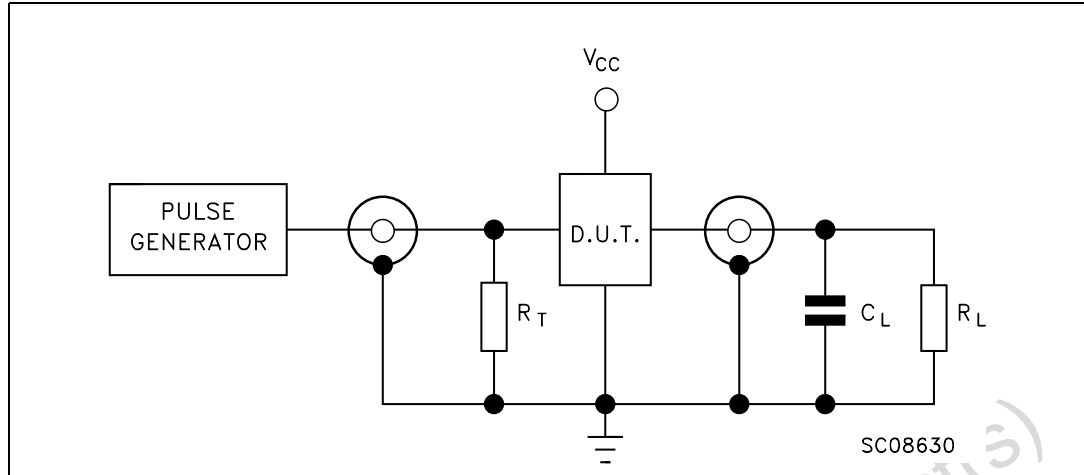


Figure 7. OFF Isolation



5 Test circuit

Figure 8. Test circuit



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

Figure 9. Break-before-make time delay

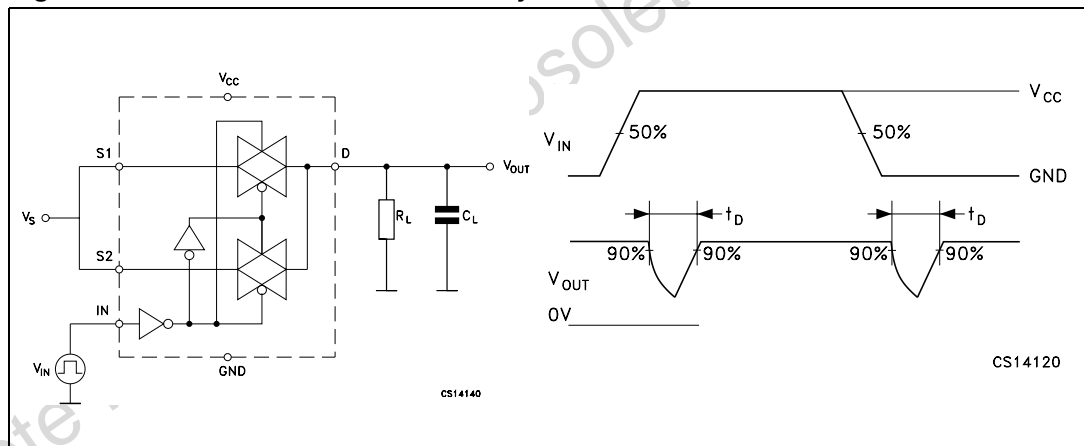


Figure 10. Switching time and charge injection
 ($V_{GEN} = 0V$, $R_{GEN} = 0\Omega$, $R_L = 1M\Omega$, $C_L = 100pF$)

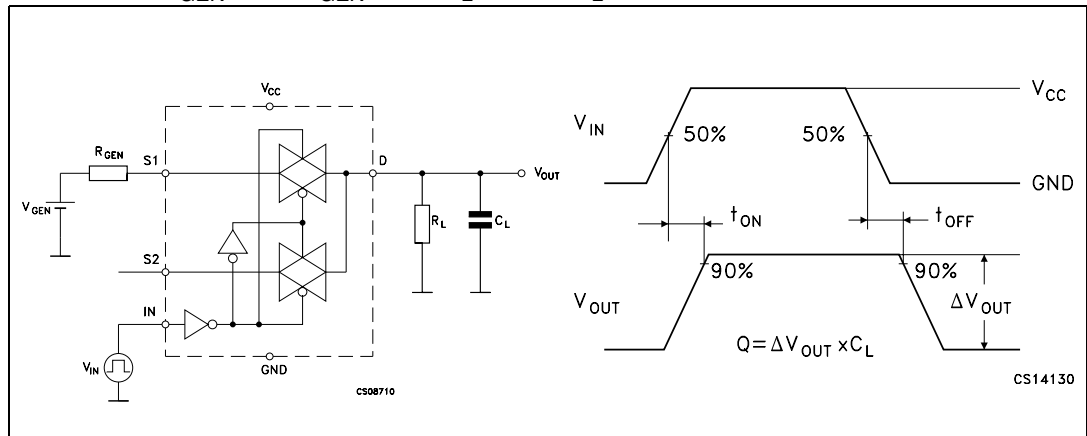
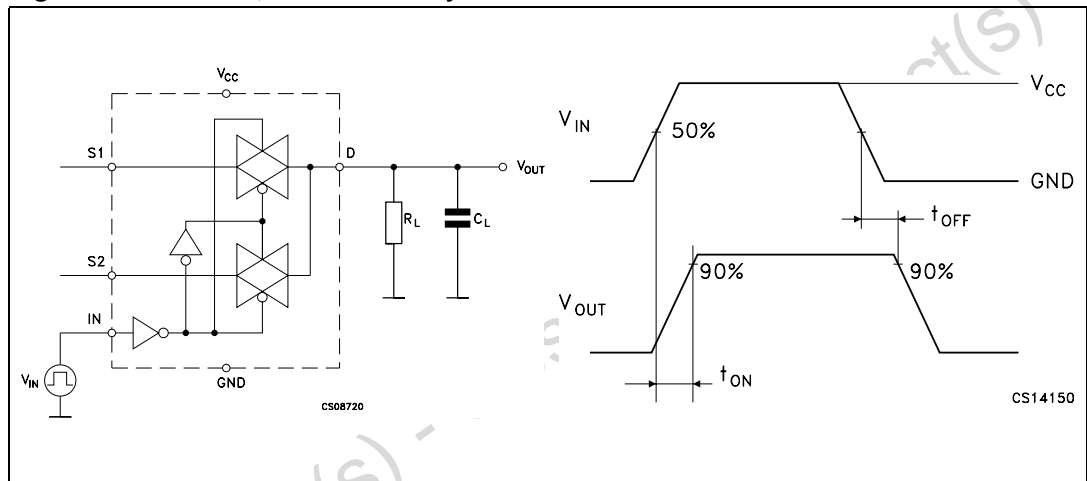


Figure 11. Turn ON, turn OFF delay time



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6 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)

Table 9. DFN6L (1.45mm x 1mm) Mechanical data

| Dim. | mm. | | | inch | | |
|------|------|-------|------|-------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 0.45 | 0.50 | 0.55 | 0.017 | 0.019 | 0.021 |
| A1 | 0 | 0.02 | 0.05 | 0 | 0.001 | 0.002 |
| A3 | | 0.127 | | | 0.005 | |
| b | 0.20 | 0.25 | 0.30 | 0.007 | 0.010 | 0.011 |
| D | 1.35 | 1.45 | 1.55 | 0.053 | 0.057 | 0.061 |
| E | 0.90 | 1 | 1.10 | 0.035 | 0.040 | 0.043 |
| e | | 0.50 | | | 0.020 | |
| L | 0.25 | 0.35 | 0.45 | 0.010 | 0.013 | 0.017 |

Figure 12. Package dimensions

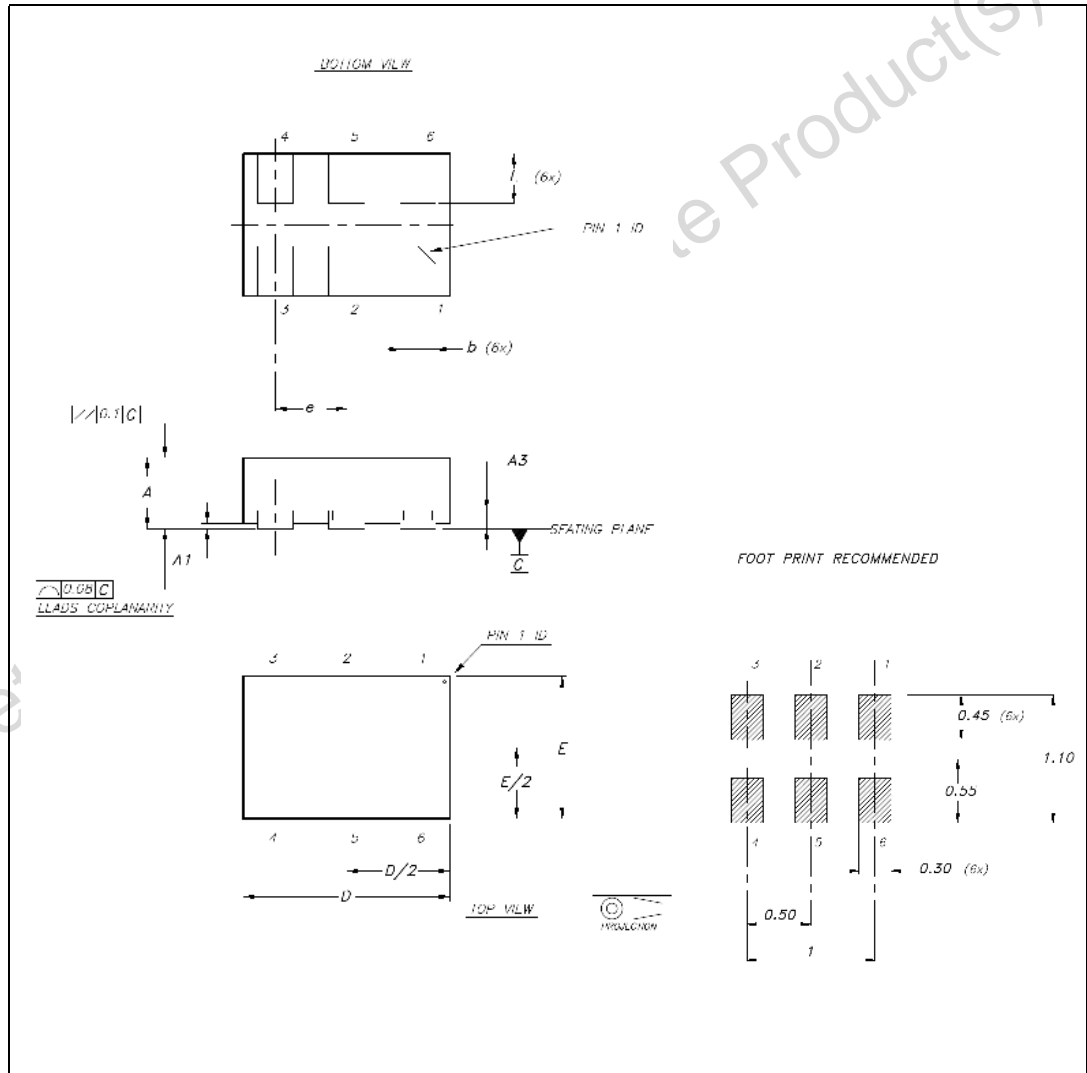
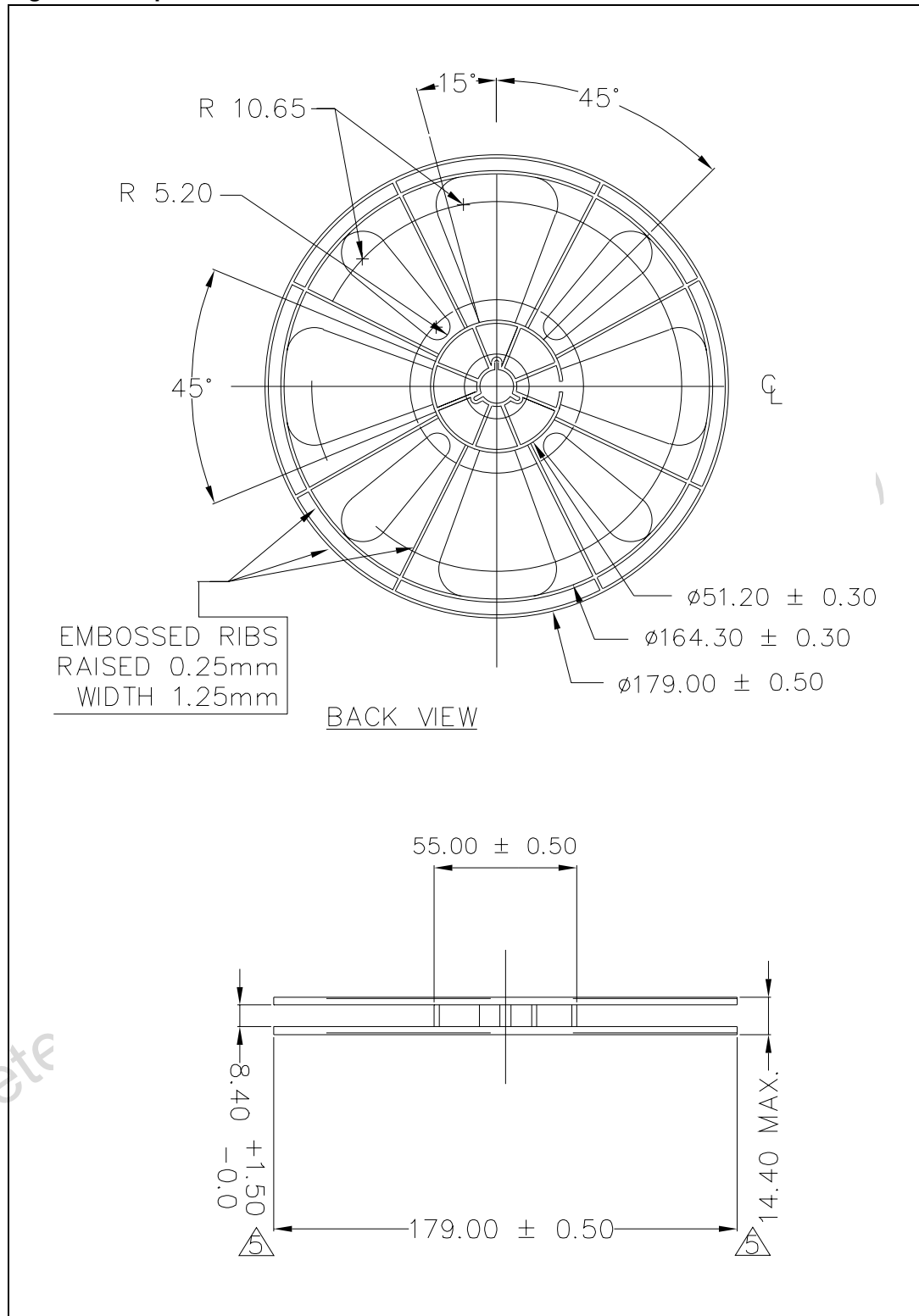
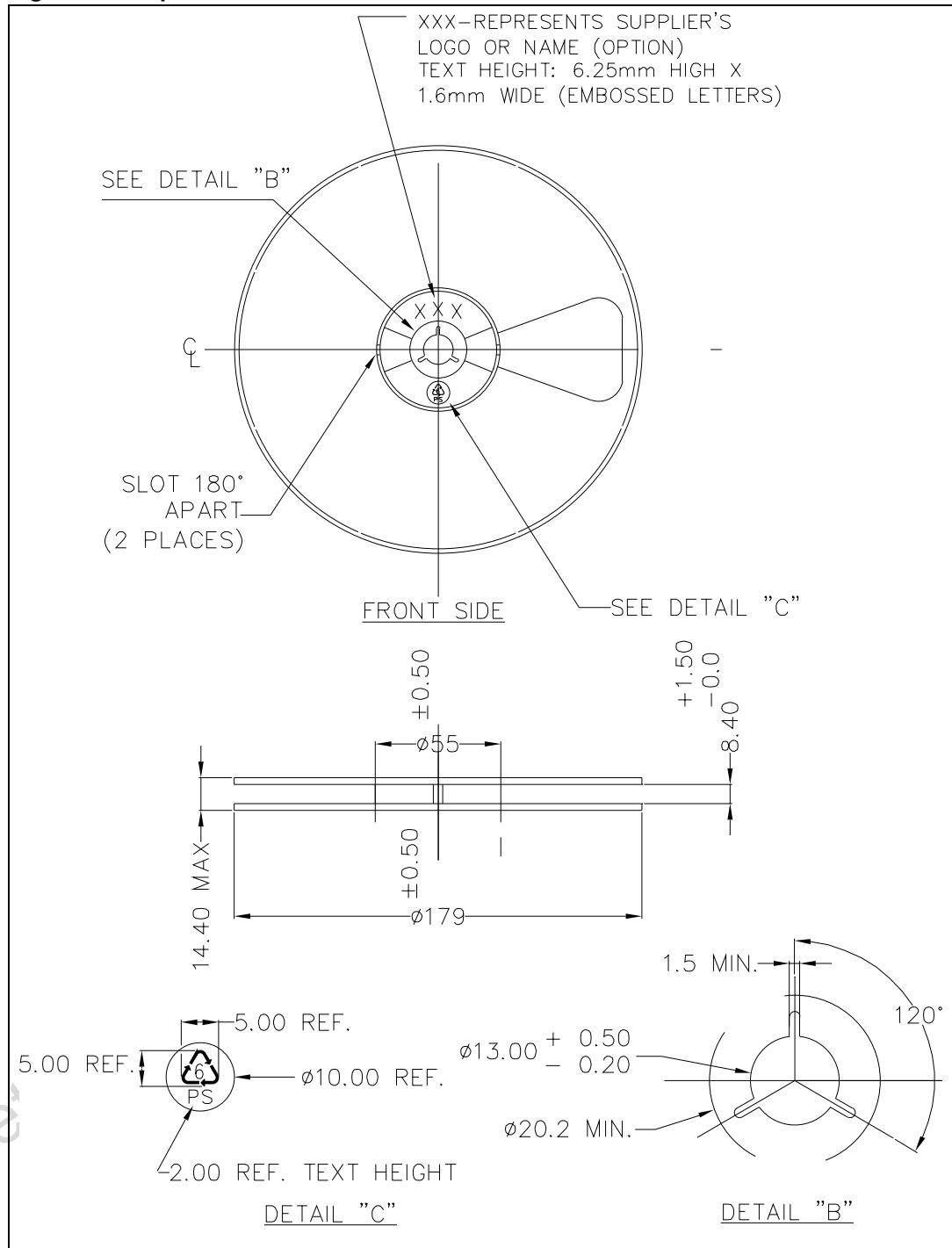


Figure 13. Tape and Reel Information



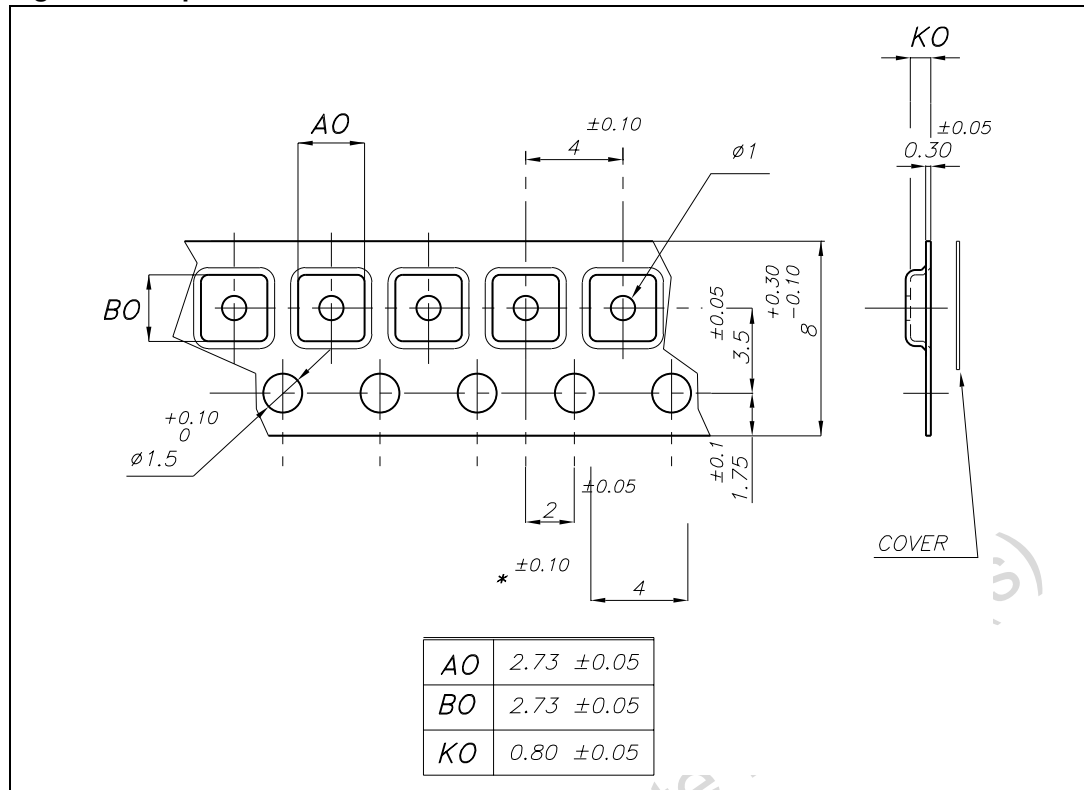
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Figure 14. Tape and Reel Information



Obsolete

Figure 15. Tape and Reel Information



Obsolete Product(s) - Obsolete

7 Revision history

Table 10. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 22-Feb-2006 | 1 | First release |
| 25-May-2007 | 2 | Updated R _{ON} values on Chapter Table 5.: DC Specifications |

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