

BGS16GA14

SP6T Diversity Antenna Switch with GPIO Interface

Data Sheet

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| 12 | Carrier tape drawing updated |
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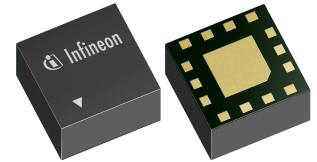
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BGS16GA14

1 Features

- 6 high-linearity, interchangeable RX ports
- Low insertion loss
- Low harmonic generation
- High port-to-port-isolation
- Suitable for Edge / C2K / LTE / WCDMA Applications
- 0.1 to 3.8 GHz coverage
- No decoupling capacitors required if no DC applied on RF lines
- On chip control logic including ESD protection
- General Purpose Input-Output (GPIO) Interface
- Small form factor 2.0 mm x 2.0 mm
- No power supply blocking required
- High EMI robustness
- RoHS and WEEE compliant package



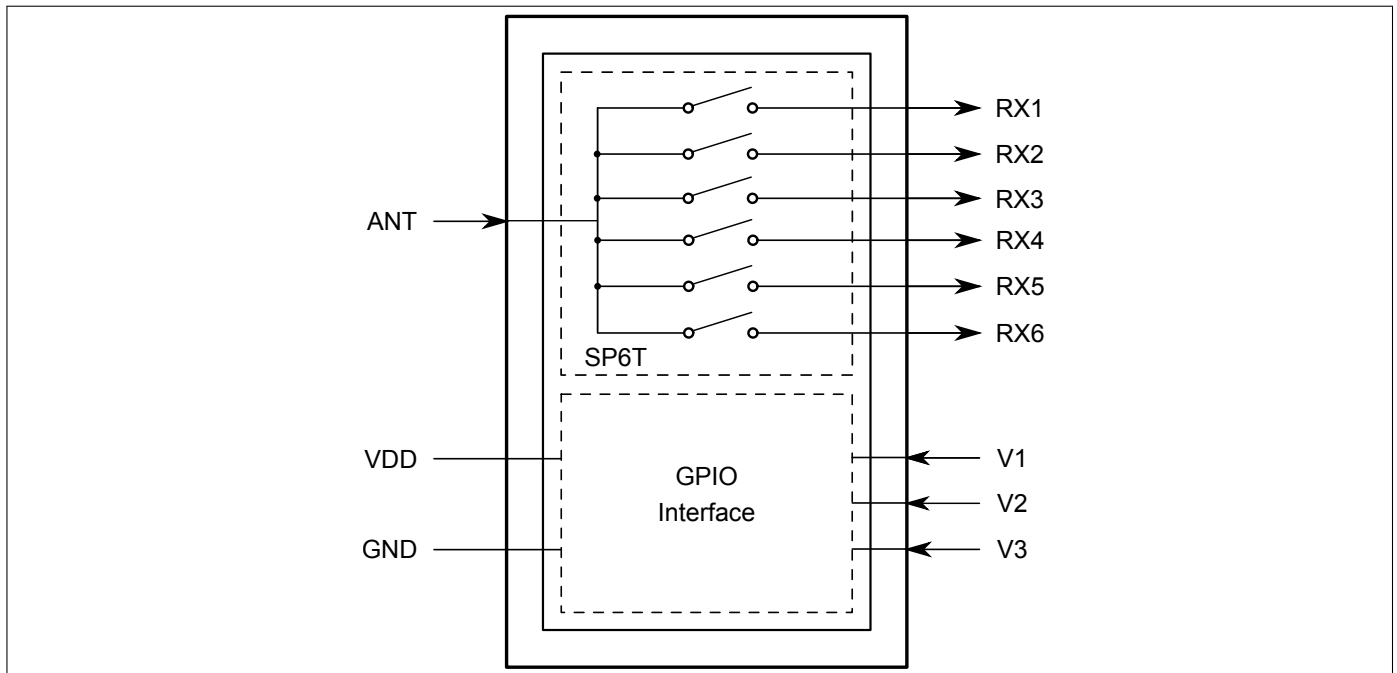
2 Product Description

The BGS16GA14 is a Single Pole Eight Throw (SP8T) Diversity Switch Module optimized for wireless applications up to 3.8 GHz. As part of a pin- and functional-compatible SP3T-SP8T product family it has been designed to meet the requirements of chipset reference designs. The module comes in a miniature ATSLP package and comprises of a high power CMOS SP8T switch with integrated GPIO interface. This RF switch is a perfect solution for multimode handsets based on LTE and WCDMA. The switch device configuration is shown in Fig. 1.

The switch is controlled via a GPIO interface. It features DC-free RF ports and unlike GaAs technology, external DC blocking capacitors at the RF ports are only required if DC voltage is applied externally.

Table 1: Ordering Information

| Type | Package | Marking |
|-----------|----------|---------|
| BGS16GA14 | ATSLP-14 | G6 |


Figure 1: BGS16GA14 block diagram

3 Maximum Ratings

Table 2: Maximum Ratings, Table I at $T_A = 25\text{ }^\circ\text{C}$, unless otherwise specified

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--|--------------|--------|------|------|------------------|--|
| | | Min. | Typ. | Max. | | |
| Frequency Range | f | 0.1 | – | – | GHz | ¹⁾ |
| Supply voltage | V_{dd} | -0.5 | – | 3.6 | V | – |
| Storage temperature range | T_{STG} | -55 | – | 150 | $^\circ\text{C}$ | – |
| Junction temperature | T_j | – | – | 125 | $^\circ\text{C}$ | – |
| RF input power at all Rx ports | P_{RF_Rx} | – | – | 32 | dBm | CW |
| ESD capability, CDM ²⁾ | V_{ESDCDM} | -500 | – | +500 | V | All pins |
| ESD capability, HBM ³⁾ | V_{ESDHBM} | -1 | – | +1 | kV | Digital, digital versus RF |
| | | -1 | – | +1 | V | RF |
| ESD capability, system level ⁴⁾ | V_{ESDANT} | -8 | – | +8 | kV | ANT versus system GND, with 27 nH shunt inductor |

¹⁾ There is also a DC connection between switched paths. The DC voltage at RF ports V_{RFDC} has to be 0V.

²⁾ Field-Induced Charged-Device Model JESD22-C101. Simulates charging/discharging events that occur in production equipment and processes. Potential for CDM ESD events occurs whenever there is metal-to-metal contact in manufacturing.

³⁾ Human Body Model ANSI/ESDA/JEDEC JS-001-2012 ($R = 1.5\text{ k}\Omega$, $C = 100\text{ pF}$).

⁴⁾ IEC 61000-4-2 ($R = 330\text{ }\Omega$, $C = 150\text{ pF}$), contact discharge.

Table 3: Maximum Ratings, Table II at $T_A = 25\text{ }^\circ\text{C}$, unless otherwise specified

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|---|-------------|--------|------|--------------|------|------------------------------------|
| | | Min. | Typ. | Max. | | |
| Thermal resistance junction - soldering point | R_{thJS} | – | 60 | – | K/W | – |
| Maximum DC-voltage on RF-Ports and RF-Ground | V_{RFDC} | 0 | – | 0 | V | No DC voltages allowed on RF-Ports |
| GPIO control voltage levels | V_{Ctrlx} | -0.7 | – | $V_{dd}+0.7$ | V | – |

4 Operation Ranges

Table 4: Operation Ranges

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--------------------------------|---------------|--------|------|----------|------------------|-----------------------|
| | | Min. | Typ. | Max. | | |
| Supply voltage | V_{dd} | 2.4 | 3.0 | 3.4 | V | – |
| Supply current | I_{dd} | – | 75 | 175 | μA | – |
| GPIO control voltage high | V_{Ctrl_H} | 1.35 | – | V_{dd} | V | – |
| GPIO control voltage low | V_{Ctrl_L} | 0 | – | 0.45 | V | – |
| GPIO control input capacitance | C_{Ctrl} | – | – | 2 | pF | – |
| Ambient temperature | T_A | -30 | 25 | 85 | $^\circ\text{C}$ | – |

Table 5: RF Input Power

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|-------------------------|--------------|--------|------|------|------|-----------------------|
| | | Min. | Typ. | Max. | | |
| Rx ports (50 Ω) | P_{RF_Rx} | – | – | 28 | dBm | – |

5 RF Characteristics

Table 6: RF Characteristics at $T_A = -30\text{ }^{\circ}\text{C} \dots 85\text{ }^{\circ}\text{C}$, $P_{IN} = 0\text{ dBm}$, Supply Voltage $V_{dd} = 2.4\text{ V} \dots 3.4\text{ V}$, unless otherwise specified

| Parameter | Symbol | Values | | | Unit | Note / Test Condition |
|--|-----------|--------|------|------|---------------|------------------------------------|
| | | Min. | Typ. | Max. | | |
| Insertion Loss¹⁾ | | | | | | |
| All Rx Ports | IL | – | 0.23 | 0.36 | dB | 698–960 MHz |
| | | – | 0.36 | 0.56 | dB | 1428–1990 MHz |
| | | – | 0.43 | 0.58 | dB | 1920–2170 MHz |
| | | – | 0.47 | 0.62 | dB | 2170–2690 MHz |
| | | – | 0.50 | 0.71 | dB | 3400–3600 MHz |
| | | – | 0.50 | 0.74 | dB | 3600–3800 MHz |
| Return Loss¹⁾ | | | | | | |
| All Rx Ports | RL | 20 | 26 | – | dB | 698–960 MHz |
| | | 14 | 19 | – | dB | 1428–1990 MHz |
| | | 13 | 17 | – | dB | 1920–2170 MHz |
| | | 12 | 15 | – | dB | 2170–2690 MHz |
| | | 11 | 14 | – | dB | 3400–3600 MHz |
| | | 11 | 14 | – | dB | 3600–3800 MHz |
| Isolation¹⁾ | | | | | | |
| All Rx Ports | ISO | 32 | 50 | – | dB | 698–960 MHz |
| | | 26 | 41 | – | dB | 1428–1990 MHz |
| | | 24 | 39 | – | dB | 1920–2170 MHz |
| | | 22 | 37 | – | dB | 2170–2690 MHz |
| | | 19 | 33 | – | dB | 3400–3600 MHz |
| | | 19 | 32 | – | dB | 3600–3800 MHz |
| Harmonic Generation (UMTS Band 1, Band 5)¹⁾ | | | | | | |
| 2 nd harmonic generation | P_{H2} | 92 | 105 | – | dBc | 25 dBm, 50 Ω , CW mode |
| 3 rd harmonic generation | P_{H3} | 88 | 96 | – | dBc | 25 dBm, 50 Ω , CW mode |
| Intermodulation Distortion (UMTS Band 1, Band 5)¹⁾ | | | | | | |
| 2 nd order intermodulation | IMD2 low | – | -105 | -100 | dBm | IMT, US Cell (see Tab. 7) |
| 3 rd order intermodulation | IMD3 | – | -110 | -105 | dBm | IMT, US Cell (see Tab. 8) |
| 2 nd order intermodulation | IMD2 high | – | -115 | -110 | dBm | IMT, US Cell (see Tab. 7) |
| Switching Time | | | | | | |
| RF Rise Time | t_{RT} | – | – | 2 | μs | 10 % to 90 % RF signal |
| Switching Time | t_{ST} | – | 2 | 4 | μs | 50 % Ctrl signal to 90 % RF signal |
| Power Up Settling Time | t_{PUp} | – | 10 | 25 | μs | After power down mode |

¹⁾On application board without any matching components.

Table 7: IMD2 Testcases

| Band | CW tone 1 (MHz) | CW tone 1 (dBm) | CW tone 2 (MHz) | CW tone 2 (dBm) |
|---------|-----------------|-----------------|------------------|-----------------|
| IMT | 1950 | 20 | 190 (IMD2 low) | -15 |
| | | | 4090 (IMD2 high) | |
| US Cell | 835 | 20 | 45 (IMD2 low) | -15 |
| | | | 1715 (IMD2 high) | |

Table 8: IMD3 Testcases

| Band | CW tone 1 (MHz) | CW tone 1 (dBm) | CW tone 2 (MHz) | CW tone 2 (dBm) |
|---------|-----------------|-----------------|-----------------|-----------------|
| IMT | 1950 | 20 | 1760 | -15 |
| US Cell | 835 | 20 | 790 | -15 |

6 GPIO Specification

Table 9: Modes of Operation (Truth Table)

| State | Mode | Control Inputs | | |
|-------|-------------|----------------|----|----|
| | | V1 | V2 | V3 |
| 1 | RX1-ANT | 0 | 0 | 0 |
| 2 | RX2-ANT | 0 | 0 | 1 |
| 3 | RX3-ANT | 0 | 1 | 0 |
| 4 | RX4-ANT | 0 | 1 | 1 |
| 5 | RX5-ANT | 1 | 0 | 0 |
| 6 | RX6-ANT | 1 | 0 | 1 |
| 7 | RX3/RX5-ANT | 1 | 1 | 0 |
| 8 | Shutdown | 1 | 1 | 1 |

7 Package related information

The switch has a package size of 2000 μm in x-dimension and 2000 μm in y-dimension with a maximum deviation of $\pm 50 \mu\text{m}$ in each dimension. Fig. 2 shows the footprint from top view. The definition of each pin can be found in Tab. 11. In addition a recommendation for the land pattern is displayed in Fig. 4 followed by information regarding laser marking (see Fig. 5).

Table 10: Mechanical Data

| Parameter | Symbol | Value | Unit |
|---------------------|--------|---------------|---------------|
| Package X-Dimension | X | 2000 \pm 50 | μm |
| Package Y-Dimension | Y | 2000 \pm 50 | μm |
| Package Height | H | 0.65 max | μm |

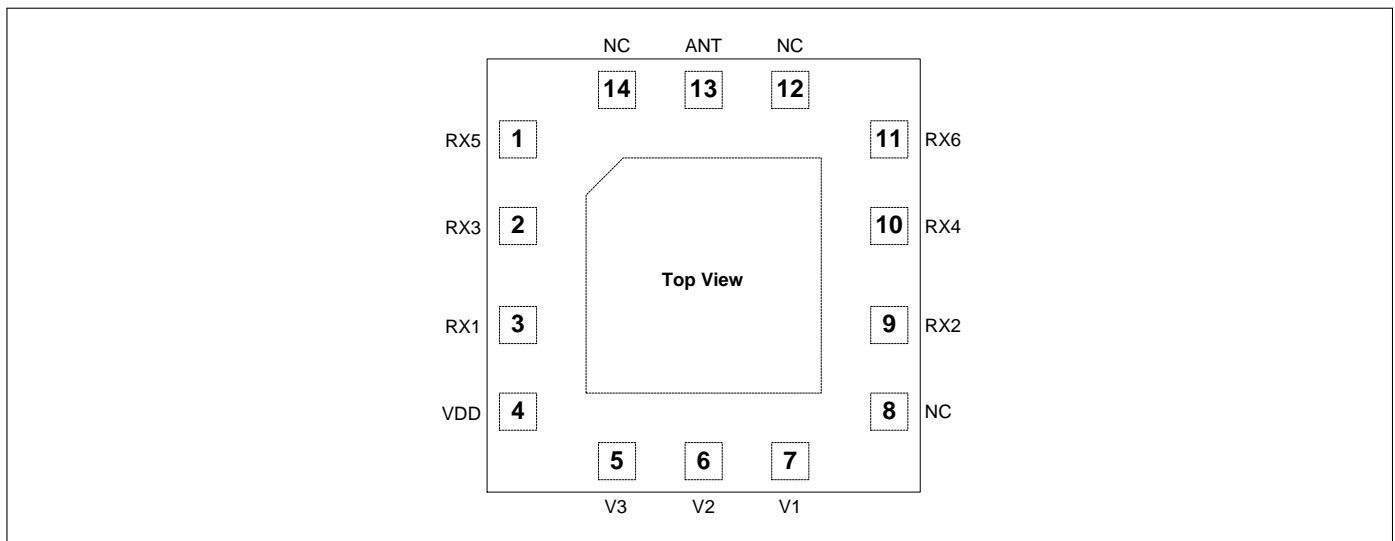

Figure 2: Footprint, top view

Table 11: Pin Definition

| No. | Name | Pin Type | Function |
|-----|------|----------|--------------------|
| 0 | GND | GND | RF ground; die pad |
| 1 | RX5 | I/O | RX port 5 |
| 2 | RX3 | I/O | RX port 3 |
| 3 | RX1 | I/O | RX port 1 |
| 4 | VDD | PWR | V_{DD} supply |
| 5 | V3 | I | GPIO control pin |
| 6 | V2 | I | GPIO control pin |
| 7 | V1 | I | GPIO control pin |
| 8 | NC | | Not connected |
| 9 | RX2 | I/O | RX port 2 |
| 10 | RX4 | I/O | RX port 4 |
| 11 | RX6 | I/O | RX port 6 |
| 12 | NC | | Not connected |
| 13 | ANT | I/O | Antenna port |
| 14 | NC | | Not connected |

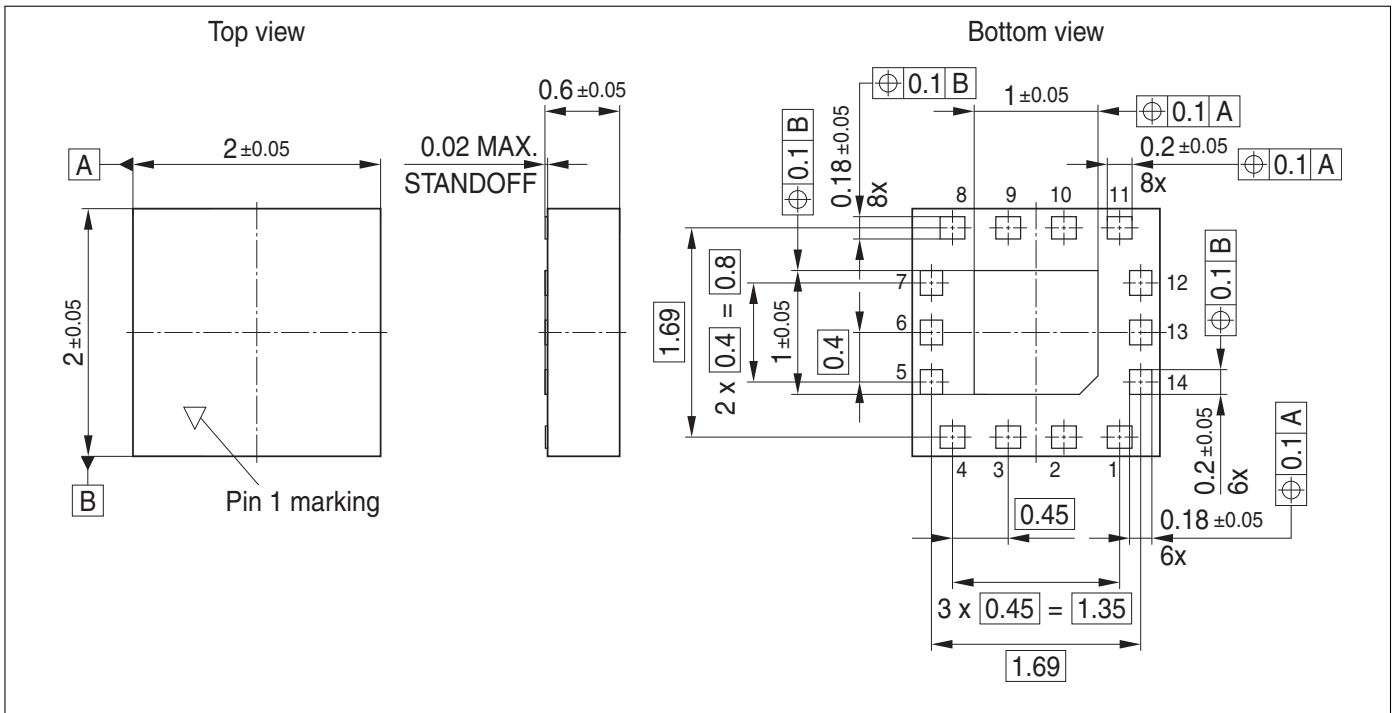


Figure 3: Package Outline Drawing

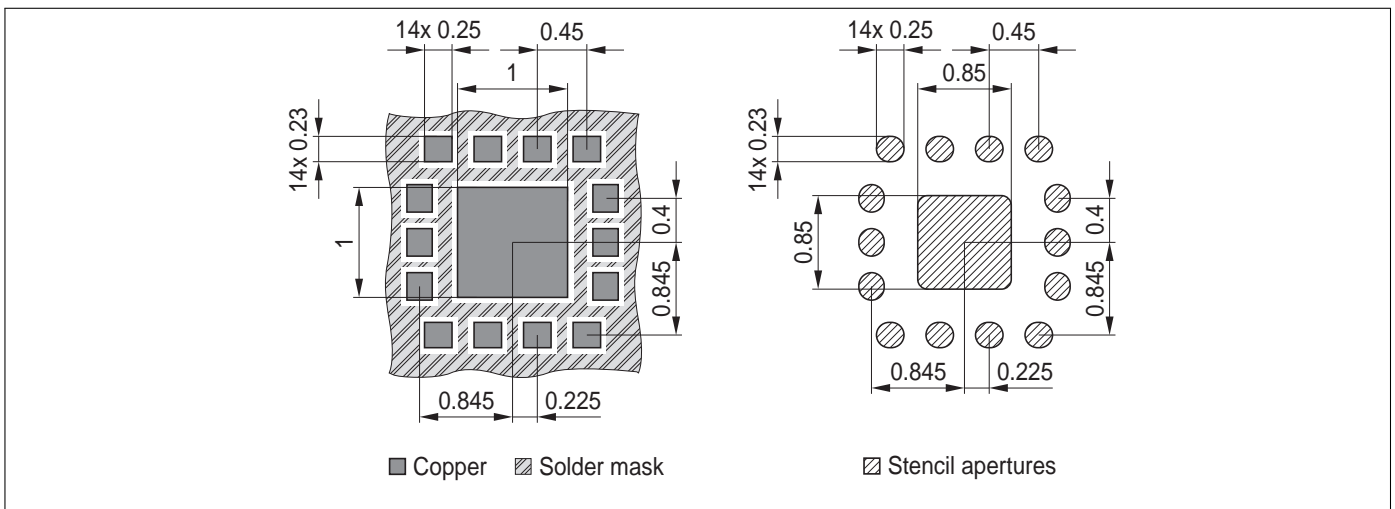


Figure 4: Land Pattern Drawing

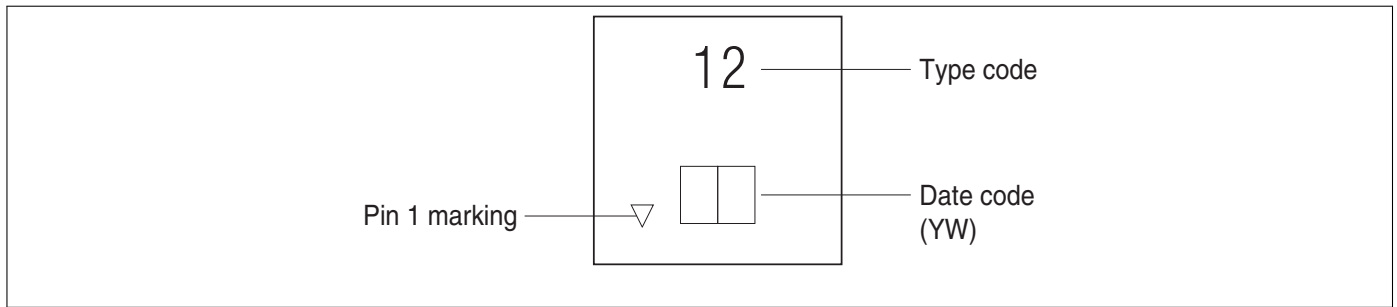


Figure 5: Laser marking

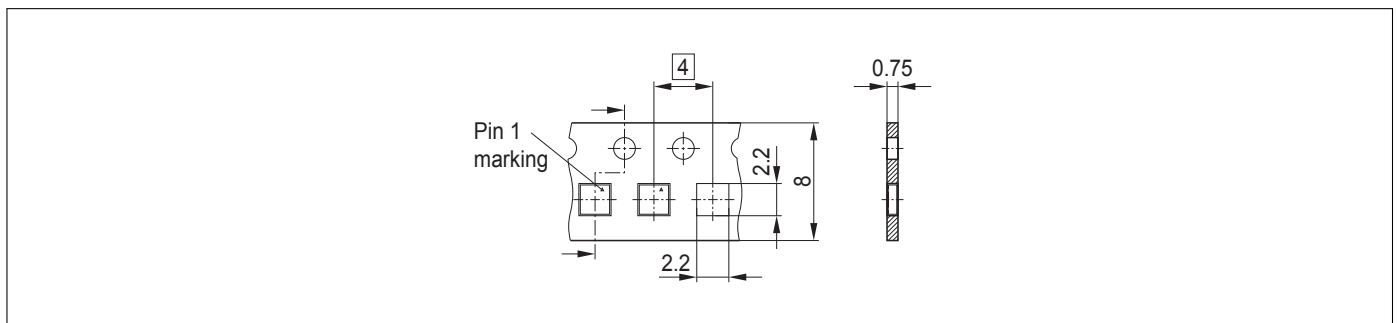


Figure 6: Carrier Tape

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