

# BGS12PL6

General purpose RF CMOS power SPDT Switch  
in ultra small package with  $0.77\text{mm}^2$  footprint

## Data Sheet

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## Revision History

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| Page | Subjects (major changes since last revision) |
|------|--|
| 7    | Updated Features                             |
| 9    | Updated Operation Ranges                     |
|      |  |
|      |  |

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Last Trademarks Update 2012-12-13

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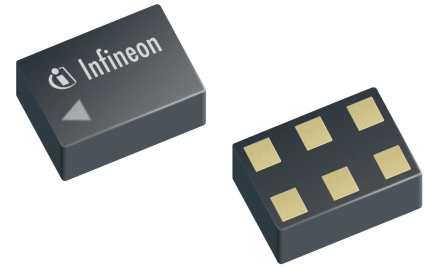
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## BGS12PL6 General purpose RF CMOS power SPDT Switch in ultra small package with 0.77mm<sup>2</sup> footprint

### 1 Features

- 2 high-linearity TRx paths with power handling capability of up to 35 dBm
- All ports fully symmetrical
- Low insertion loss
- Low harmonic generation
- High port-to-port isolation
- 30 MHz to 4 GHz coverage
- High ESD robustness
- On-chip control logic
- Very small leadless and halogen free package TSLP-6-4 (0.7x1.1mm<sup>2</sup>) with super low height of 0.31 mm
- No decoupling capacitors required if no DC applied on RF lines
- RoHS compliant package



### 2 Product Description

The BGS12PL6 general purpose RF MOS power switch is designed to cover a broad range of high power applications from 30 MHz to 4 GHz, mainly in the transmit path of GSM, WCDMA and LTE mobile phones. The symmetric design of its single pole double throw configuration, as shown in Figure 1 offers high design flexibility.

This single supply chip integrates on-chip CMOS logic driven by a simple, single-pin CMOS or TTL compatible control input signal. The 0.1 dB compression point exceeds the switch's maximum input power level of 35 dBm, resulting in linear performance at all signal levels. The RF switch has a very low insertion loss of 0.36 dB in the 1 GHz, 0.46 dB in the 2 GHz and 0.6 dB in the 3 GHz range.

The BGS12PL6 RF switch is manufactured in Infineon's patented MOS technology, offering the performance of GaAs with the economy and integration of conventional CMOS including the inherent higher ESD robustness.

The device has a very small size of only 0.7x 1.1mm<sup>2</sup> and a low height of 0.31mm. No decoupling capacitors are required in typical applications as long as no DC is applied to any RF port.

**Table 1: Ordering Information**

| Type     | Package  | Marking |
|----------|----------|---------|
| BGS12PL6 | TSLP-6-4 | P       |

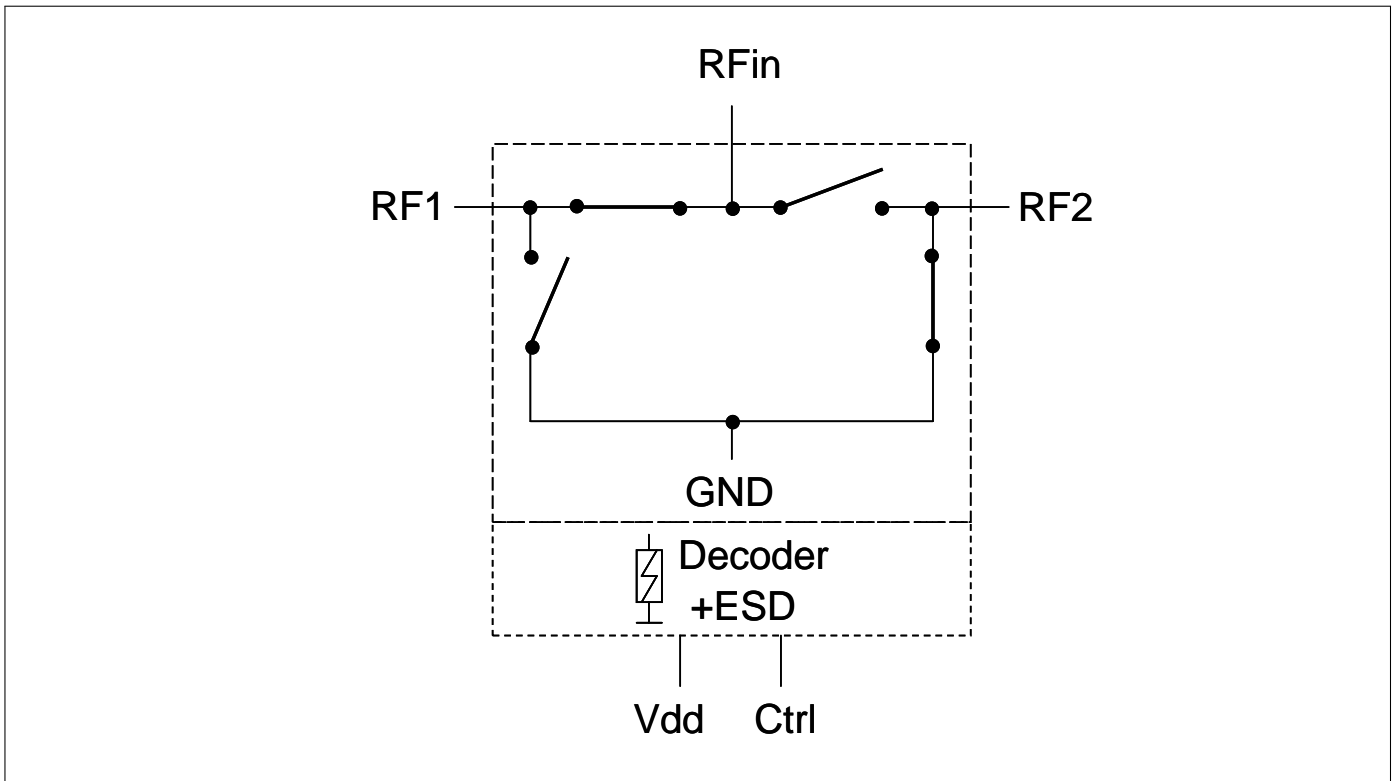


Figure 1: BGS12PL6 Block Diagram

Table 2: Truth Table

| Switched Paths | Ctrl |
|----------------|------|
| RFin - RF1     | 0    |
| RFin - RF2     | 1    |



### 3 Maximum Ratings

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

| Parameter                              | Symbol          | Values |      |      | Unit             | Note / Test Condition                      |
|--|-----------------|--------|------|------|------------------|--|
|  |                 | Min.   | Typ. | Max. |                  |  |
| Supply Voltage                         | $V_{dd}$        | -0.5   | –    | 5.5  | V                | –  |
| Control Voltage                        | $V_{Ctrl}$      | -0.3   | –    | 3.6  | V                | –  |
| Storage Temperature Range              | $T_{STG}$       | -55    | –    | 150  | $^\circ\text{C}$ | –  |
| RF Input Power at all RF Ports         | $P_{RF}$        | –      | –    | 36   | dBm              | CW   |
| Junction Temperature                   | $T_j$           | –      | –    | 125  | $^\circ\text{C}$ | –  |
| <b>ESD Capability</b>                  |                 |        |      |      |                  |  |
| Human Body Model <sup>1)</sup>         | $V_{ESD\_HBM}$  | –1     | –    | +1   | kV               | –  |
| ESD Capability RFin Port <sup>2)</sup> | $V_{ESD\_RFin}$ | –8     | –    | +8   | kV               | RFin versus GND, with 27 nH shunt inductor |

<sup>1)</sup> Human Body Model ANSI/ESDA/JEDEC JS-001-2012 ( $R = 1.5\text{ k}\Omega$ ,  $C = 100\text{ pF}$ ).

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

#### Attention:

Stresses above the max. values listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the integrated circuit.

### 4 Operation Ranges

**Table 4: Operation Ranges**

| Parameter            | Symbol        | Values |      |          | Unit             | Note / Test Condition |
|----------------------|---------------|--------|------|----------|------------------|-----------------------|
|                      |               | Min.   | Typ. | Max.     |                  |                       |
| Ambient Temperature  | $T_A$         | -40    | 25   | 85       | $^\circ\text{C}$ | –                     |
| RF Frequency         | $f$           | 0.03   | –    | 4        | GHz              | –                     |
| Supply Voltage       | $V_{dd}$      | 2.4    | –    | 3.6      | V                | –                     |
| Control Voltage Low  | $V_{Ctrl\_L}$ | -0.3   | –    | 0.3      | V                | –                     |
| Control Voltage High | $V_{Ctrl\_H}$ | 1.4    | –    | $V_{dd}$ | V                | –                     |

**Table 5: RF Input Power**

| Parameter                     | Symbol   | Values |      |      | Unit | Note / Test Condition |
|-------------------------------|----------|--------|------|------|------|-----------------------|
|                               |          | Min.   | Typ. | Max. |      |                       |
| RF Input Power (50 $\Omega$ ) | $P_{In}$ | –      | –    | 35   | dBm  | –                     |

## 5 RF Characteristics

**Table 6: RF Characteristics**

Test Conditions (unless otherwise specified):

- Terminating port impedance:  $Z_0 = 50 \Omega$
- Temperature range:  $T_A = -40 \dots +85 \text{ }^\circ\text{C}$
- Supply voltage:  $V_{dd} = 2.4 \dots 3.6 \text{ V}$
- Input power:  $P_{IN} = 0 \text{ dBm}$

| Parameter                         | Symbol            | Values |      |      | Unit | Note / Test Condition |
|-----------------------------------|-------------------|--------|------|------|------|-----------------------|
|                                   |                   | Min.   | Typ. | Max. |      |                       |
| <b>Insertion Loss</b>             |                   |        |      |      |      |                       |
| All RF Ports                      | $IL$              | 0.27   | 0.36 | 0.55 | dB   | 699-915 MHz           |
|                                   |                   | 0.36   | 0.46 | 0.70 | dB   | 1710-1910 MHz         |
|                                   |                   | 0.46   | 0.56 | 0.85 | dB   | 2170-2690 MHz         |
|                                   |                   | 0.61   | 0.77 | 1.15 | dB   | 3800 MHz              |
| <b>Insertion Loss<sup>1</sup></b> |                   |        |      |      |      |                       |
| All RF Ports                      | $IL$              | 0.33   | 0.36 | 0.40 | dB   | 699-915 MHz           |
|                                   |                   | 0.40   | 0.46 | 0.50 | dB   | 1710-1910 MHz         |
|                                   |                   | 0.52   | 0.56 | 0.65 | dB   | 2170-2690 MHz         |
|                                   |                   | 0.65   | 0.77 | 0.90 | dB   | 3800 MHz              |
| <b>Return Loss</b>                |                   |        |      |      |      |                       |
| All RF Ports                      | $RL$              | 20     | 25   | 35   | dB   | 699-915 MHz           |
|                                   |                   | 16     | 20   | 28   | dB   | 1710-1910 MHz         |
|                                   |                   | 14     | 18   | 27   | dB   | 2170-2690 MHz         |
|                                   |                   | 12     | 15   | 20   | dB   | 3800 MHz              |
| <b>Isolation</b>                  |                   |        |      |      |      |                       |
| RFIn to RF1/RF2 Port              | $ISO_{RFIn-RFx}$  | 34     | 37   | –    | dB   | 699-915 MHz           |
|                                   |                   | 27     | 30   | –    | dB   | 1710-1910 MHz         |
|                                   |                   | 23     | 27   | –    | dB   | 2170-2690 MHz         |
|                                   |                   | 19     | 22   | –    | dB   | 3800 MHz              |
| RF1 to RF2 Port                   | $ISO_{Port-Port}$ | 45     | 50   | –    | dB   | 699-915 MHz           |
|                                   |                   | 34     | 36   | –    | dB   | 1710-1910 MHz         |
|                                   |                   | 28     | 31   | –    | dB   | 2170-2690 MHz         |
|                                   |                   | 24     | 27   | –    | dB   | 3800 MHz              |
| <b>P0.1 dB Compression Point</b>  |                   |        |      |      |      |                       |
| All RF Ports                      | $P_{0.1dB}$       | –      | 38   | –    | dBm  | 699 - 2700 MHz        |

<sup>1</sup>  $T_A = +25 \text{ }^\circ\text{C}$ ,  $V_{dd} = 3 \text{ V}$

| Parameter  | Symbol          | Values |      |      | Unit | Note / Test Condition   |
|--|-----------------|--------|------|------|------|---|
|  |                 | Min.   | Typ. | Max. |      |   |
| <b>Harmonic Generation up to 12.75 GHz<sup>1</sup></b>     |                 |        |      |      |      |   |
| All RF Ports, 2 <sup>nd</sup> Harmonic                     | $P_{Harm}$      | -90    | -80  | -70  | dBc  | $f = 824\text{ MHz}$ , $P_{in} = 27.5\text{ dBm}$ ,<br>50Ω, 50 % duty cycle |
| All RF Ports, 3 <sup>rd</sup> Harmonic                     |                 | -100   | -90  | -80  | dBc  |   |
| <b>Intermodulation Distortion in Rx Band<sup>1,2</sup></b> |                 |        |      |      |      |   |
| IMD2, Low  | $IMD2_{Low}$    | –      | -110 | -100 | dBm  | Tx = 15 dBm,<br>Interferer = -15 dBm, 50Ω                                   |
| IMD3   | $IMD3$          | –      | -110 | -100 | dBm  |   |
| IMD2, High   | $IMD2_{High}$   | –      | -110 | -100 | dBm  |   |
| <b>Switching Time and Current Consumption</b>              |                 |        |      |      |      |   |
| RF Rise Time   | $t_{10\%-90\%}$ | –      | 0.55 | 1.5  | μs   | 10% - 90% of RF Signal  |
| Ctrl to RF Time  | $t_{Ctrl-RF}$   | –      | 1.4  | 3    | μs   | 50% of Ctrl Signal to 90% of RF Signal                                      |
| Supply Current   | $I_{dd}$        | 80     | 200  | 350  | μA   | –   |
| Control Current  | $I_{Ctrl}$      | –      | 1    | 10   | μA   | –   |

Note: All electrical characteristics are measured with all RF ports terminated by 50 Ω loads.

<sup>1</sup>  $T_A = +25\text{ °C}$ ,  $V_{dd} = 3\text{ V}$

<sup>2</sup> With external shunt L

## 6 Pin Description

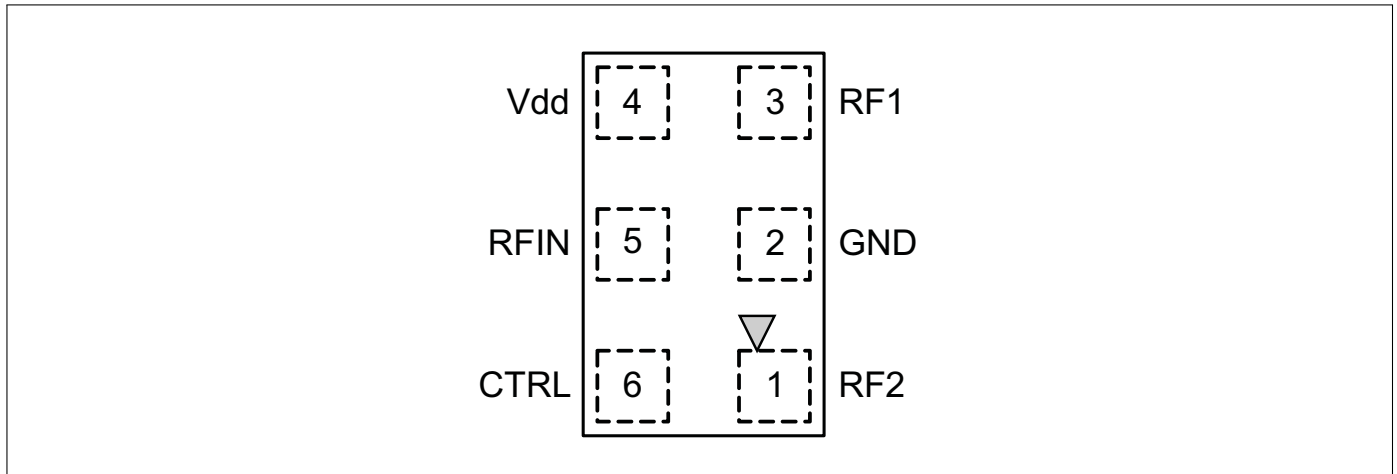


Figure 2: Pin Configuration

Table 7: Pin Description

| Pin No. | Name | Pin Type | Buffer Type | Function       |
|---------|------|----------|-------------|----------------|
| 1       | RF2  | I/O      |             | RF Port 2      |
| 2       | GND  | GND      |             | Ground         |
| 3       | RF1  | I/O      |             | RF Port 1      |
| 4       | Vdd  | PWR      |             | Supply Voltage |
| 5       | RFIN | I/O      |             | RF Port In     |
| 6       | CTRL | I        |             | Control Pin    |

## 7 Package Information

Table 8: Mechanical Data

| Parameter   | Symbol      | Value           | Unit            |
|-------------|-------------|-----------------|-----------------|
| X-Dimension | <i>X</i>    | 0.7 ± 0.05      | mm              |
| Y-Dimension | <i>Y</i>    | 1.1 ± 0.05      | mm              |
| Size        | <i>Size</i> | 0.77            | mm <sup>2</sup> |
| Height      | <i>H</i>    | 0.31+0.01/-0.02 | mm              |

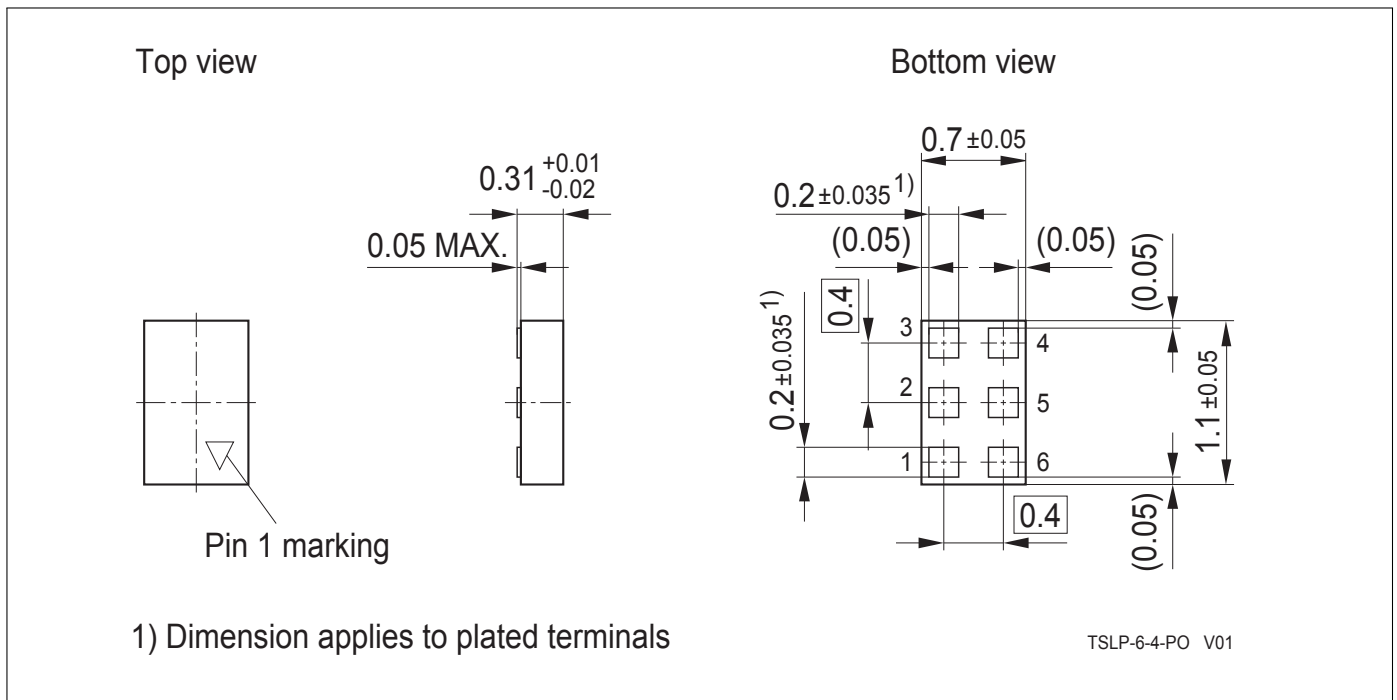


Figure 3: Package Outline

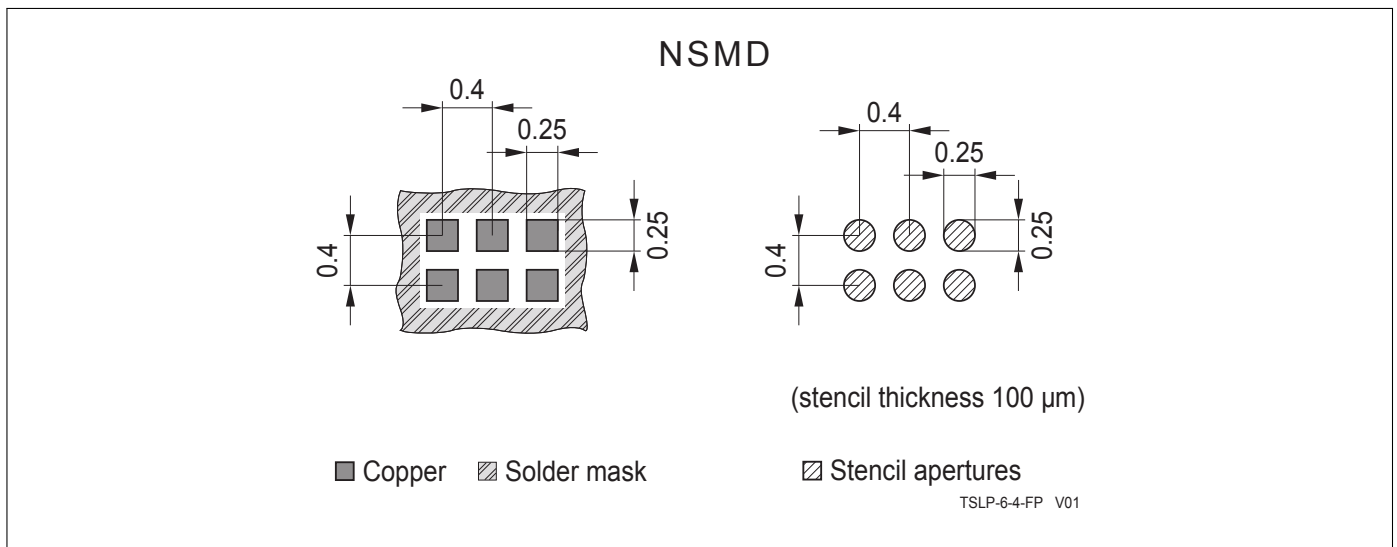


Figure 4: Footprint

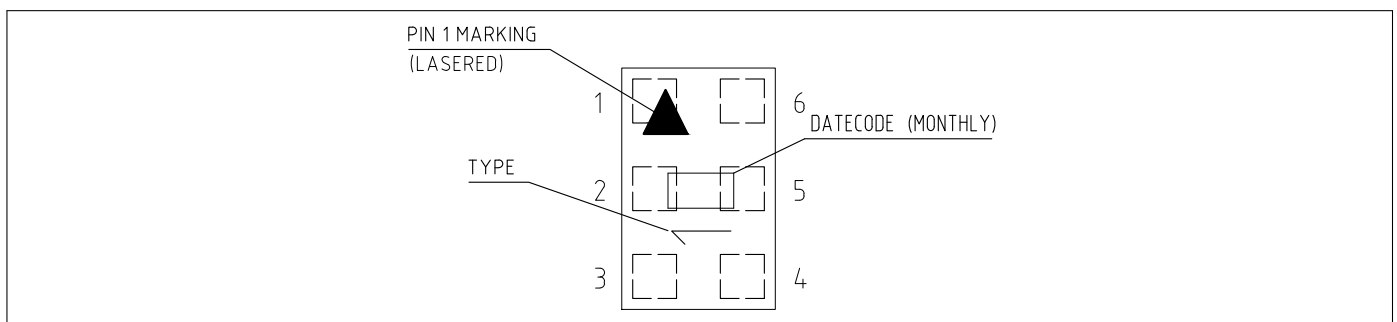


Figure 5: Pin 1 Marking (top view)

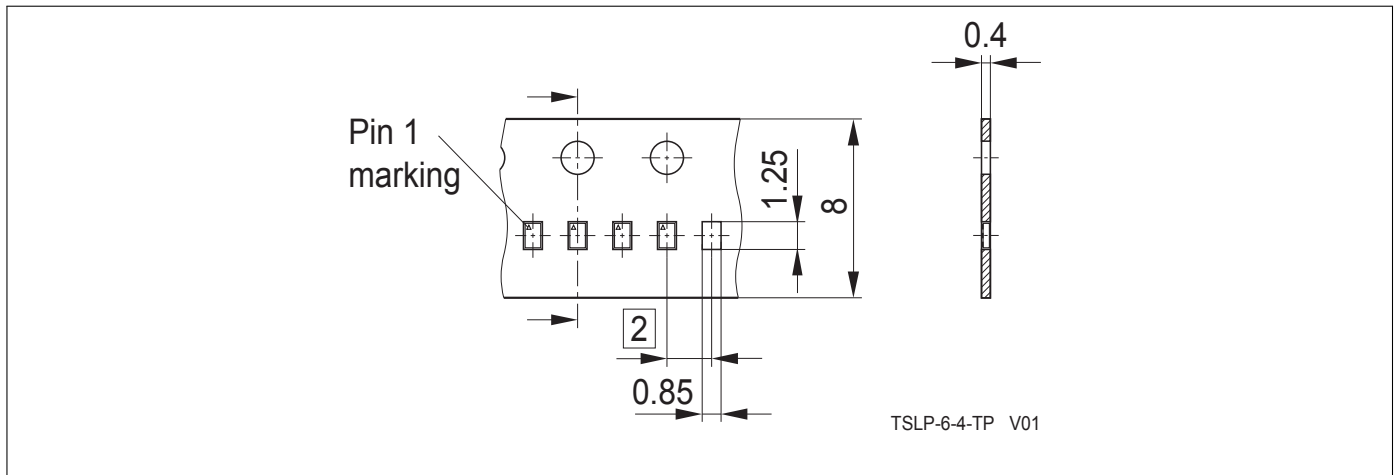


Figure 6: Tape Drawing for TSLP-6-4

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