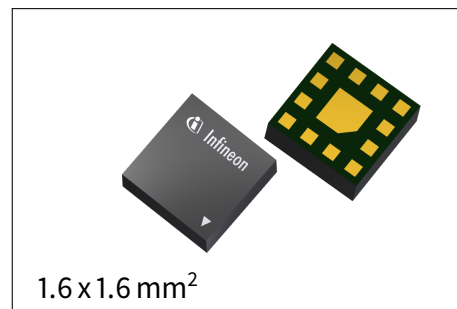


# BGSX44MA12

## 4P4T Rx Switch with MIPI RFFE Interface

### Features

- 4P4T Receive switch
- Low Insertion Loss and high port to port Isolation up to 3.8GHz
- Low current consumption
- MIPI RFFE 2.0 compliant control interface
- External USID select pin
- Ultra low profile leadless plastic package
- RoHS and WEEE compliant package



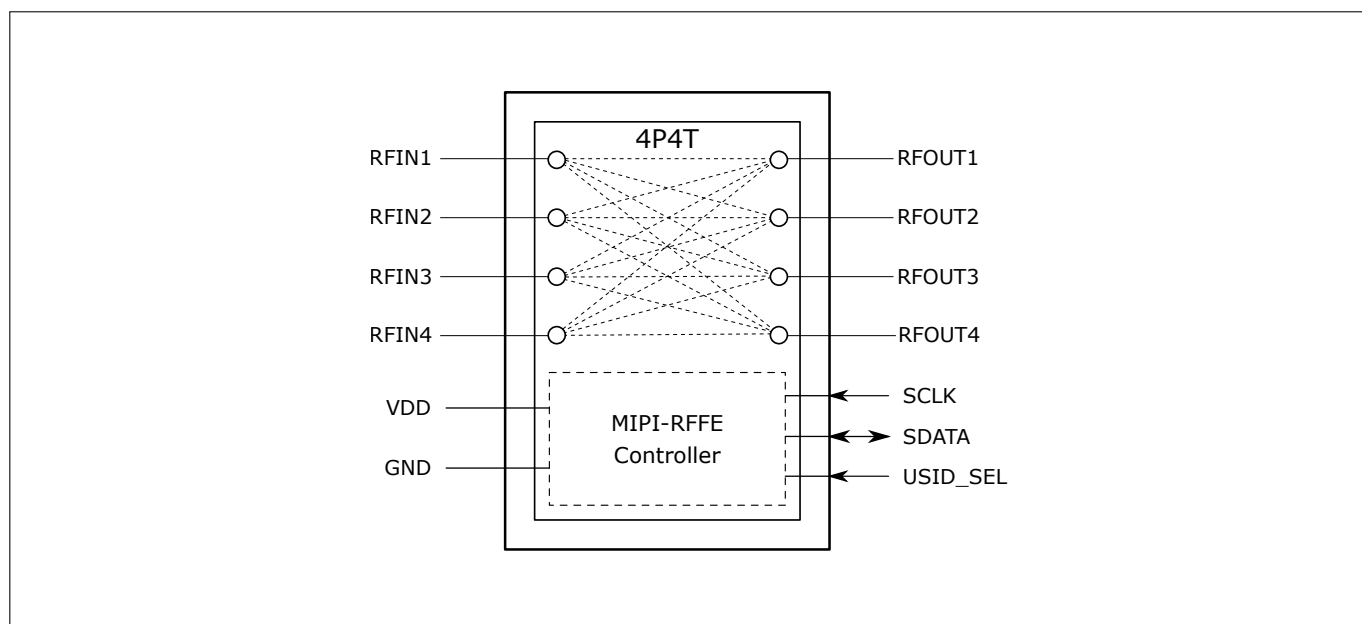
### Application

Quadruple Receive Switch for Cellular Mobile devices. GSM/WCDMA/LTE Multimode Support including LTE Carrier Aggregation.

### Product validation

Qualified for industrial applications according to the relevant tests of JEDEC47/20/22.

### Block diagram



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# BGSX44MA12

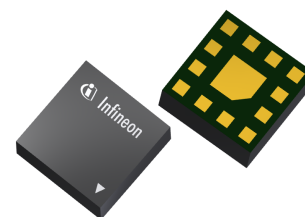
## 4P4T Rx Switch with MIPI RFFE Interface



### Product Description

## 1 Features

- RF CMOS 4P4T Receive switch with high linearity
- Suitable for multi-mode LTE and WCDMA applications
- Ultra-low insertion loss and harmonics generation
- 0.1 to 3.8 GHz coverage
- High port-to-port-isolation
- Common VDD and MIPI supply for small package
- Integrated MIPI RFFE interface operating in 1.65 to 1.95 V voltage range
- External USID select pin
- Leadless and halogen free package ATSLP-12-12 with lateral size of 1.6 mm x 1.6 mm and thickness of 0.6 mm
- High EMI robustness
- RoHS and WEEE compliant package



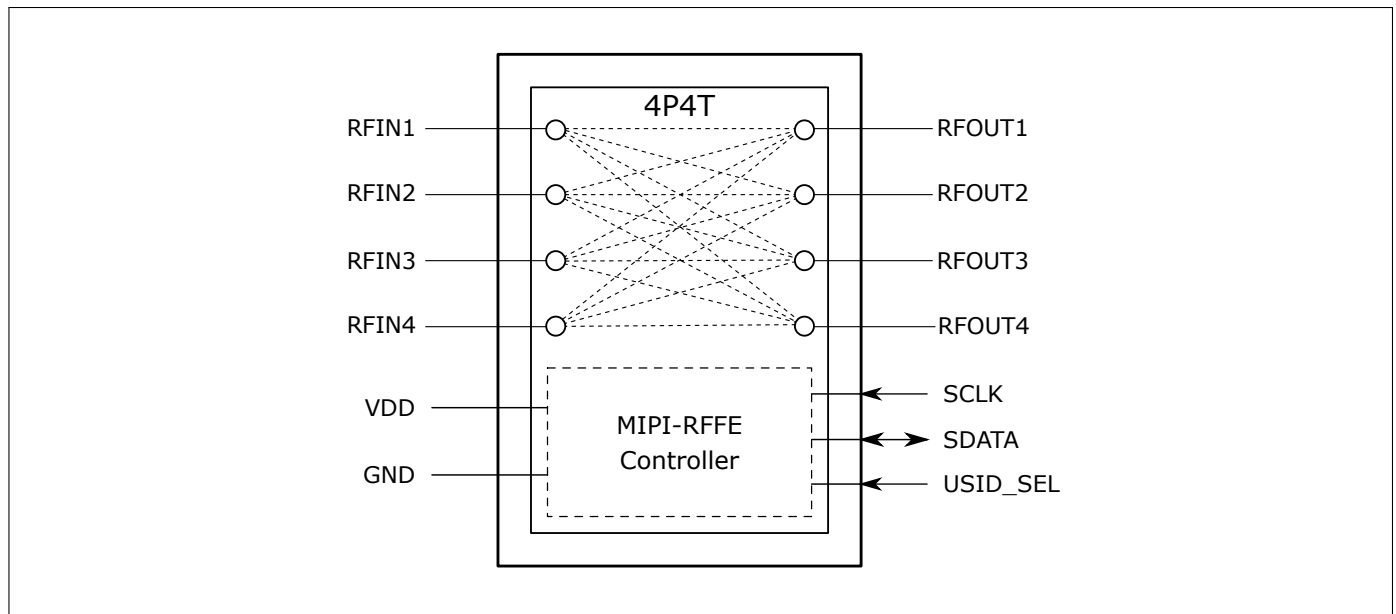
## 2 Product Description

The BGSX44MA12 RF CMOS switch is specifically designed for LTE and WCDMA Receive path applications. This 4P4T offers low insertion loss and low harmonic generation.

The switch is controlled via a MIPI RFFE controller. The on-chip controller allows power-supply voltages from 1.65 to 1.95 V. The BGSX44MA12 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 1.6 x 1.6 mm<sup>2</sup> and a maximum thickness of 0.6 mm.

| Product Name | Marking | Package     |
|--------------|---------|-------------|
| BGSX44MA12   | X4      | ATSLP-12-12 |

**Maximum Ratings**



**Figure 1:** BGSX44MA12 Block Diagram

### 3 Maximum Ratings

**Table 1: Maximum Ratings, Table I** at  $T_A = 25^\circ\text{C}$ , unless otherwise specified

| Parameter                                  | Symbol         | Values |      |          | Unit             | Note / Test Condition                           |
|--------------------------------------------|----------------|--------|------|----------|------------------|-------------------------------------------------|
|                                            |                | Min.   | Typ. | Max.     |                  |                                                 |
| Frequency Range                            | f              | 0.1    | –    | 3.8      | GHz              | <sup>1)</sup>                                   |
| Chip & RFFE Supply voltage                 | $V_{DD}$       | -0.5   | –    | 2.2      | V                | –                                               |
| Storage temperature range                  | $T_{STG}$      | -55    | –    | 150      | $^\circ\text{C}$ | –                                               |
| Junction temperature                       | $T_j$          | –      | –    | 125      | $^\circ\text{C}$ | –                                               |
| RF input power at all RF ports             | $P_{RF}$       | –      | –    | 28       | dBm              | CW                                              |
| ESD capability, CDM <sup>2)</sup>          | $V_{ESD\_CDM}$ | –      | –    | Class C3 |                  | All pins                                        |
| ESD capability, HBM <sup>3)</sup>          | $V_{ESD\_HBM}$ | –      | –    | Class 2  |                  | All pins                                        |
| ESD capability, system level <sup>4)</sup> | $V_{ESD\_RF}$  | -8     | –    | +8       | kV               | RF versus system GND, with 27 nH shunt inductor |
|                                            |                | -6     | –    | +6       | kV               | RF versus system GND, with 56 nH shunt inductor |

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

<sup>2)</sup> Field-Induced Charged-Device Model ANSI/ESDA/JEDEC JS-002. 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.

<sup>3)</sup> ANSI/ESDA/JEDEC JS-001 (R=1.5 k $\Omega$ , C=100 pF).

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

## Operation Ranges

**Table 2: 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.                              |      |                                    |
| Maximum DC-voltage on RF-Ports and RF-Ground | $V_{\text{RFDC}}$                         | 0      | –    | 0                                 | V    | No DC voltages allowed on RF-Ports |
| RFFE Control Voltage Levels                  | $V_{\text{SCLK}}$ ,<br>$V_{\text{SDATA}}$ | -0.7   | –    | $V_{\text{DD}}+0.7$<br>(max. 2.2) | V    | –                                  |

**Warning: Stresses above the max. values listed here may cause permanent damage to the device. Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the integrated circuit. Exposure to conditions at or below absolute maximum rating but above the specified maximum operation conditions may affect device reliability and life time. Functionality of the device might not be given under these conditions.**

## 4 Operation Ranges

**Table 3: Operation Ranges**

| Parameter                                    | Symbol            | Values                    |      |                           | Unit               | Note / Test Condition     |
|----------------------------------------------|-------------------|---------------------------|------|---------------------------|--------------------|---------------------------|
|                                              |                   | Min.                      | Typ. | Max.                      |                    |                           |
| Chip & RFFE Supply voltage <sup>1)</sup>     | $V_{\text{DD}}$   | 1.65                      | 1.8  | 1.95                      | V                  | –                         |
| Chip & RFFE supply current <sup>2)</sup>     | $I_{\text{DD}}$   | –                         | 80   | 210                       | $\mu\text{A}$      | –                         |
| Supply current in standby mode <sup>2)</sup> | $I_{\text{DD}}$   | –                         | 3.5  | 10                        | $\mu\text{A}$      | Default or low-power mode |
| RFFE input high voltage <sup>3)</sup>        | $V_{\text{IH}}$   | $0.7 \cdot V_{\text{DD}}$ | –    | $V_{\text{DD}}$           | V                  | –                         |
| RFFE input low voltage <sup>3)</sup>         | $V_{\text{IL}}$   | 0                         | –    | $0.3 \cdot V_{\text{DD}}$ | V                  | –                         |
| RFFE output high voltage <sup>3)</sup>       | $V_{\text{OH}}$   | $0.8 \cdot V_{\text{DD}}$ | –    | $V_{\text{DD}}$           | V                  | –                         |
| RFFE output low voltage <sup>3)</sup>        | $V_{\text{OL}}$   | 0                         | –    | $0.2 \cdot V_{\text{DD}}$ | V                  | –                         |
| RFFE control input capacitance               | $C_{\text{Ctrl}}$ | –                         | –    | 2                         | pF                 | –                         |
| Ambient temperature                          | $T_A$             | -40                       | 25   | 85                        | $^{\circ}\text{C}$ | –                         |

<sup>1)</sup> Bypass capacitor 1nF - 10nF

<sup>2)</sup>  $T_A = -40\text{ }^{\circ}\text{C} \dots 85\text{ }^{\circ}\text{C}$ ,  $V_{\text{DD}} = 1.65 \dots 1.95\text{ V}$

<sup>3)</sup> SCLK and SDATA

**Table 4: RF Input Power**

| Parameter                    | Symbol          | Values |      |      | Unit | Note / Test Condition |
|------------------------------|-----------------|--------|------|------|------|-----------------------|
|                              |                 | Min.   | Typ. | Max. |      |                       |
| RF input power(50 $\Omega$ ) | $P_{\text{RF}}$ | –      | –    | 25   | dBm  | –                     |

## RF Characteristics

## 5 RF Characteristics

**Table 5: RF Characteristics<sup>1)</sup>** at  $T_A = -40\text{ }^{\circ}\text{C} \dots 85\text{ }^{\circ}\text{C}$ ,  $P_{IN} = 0\text{ dBm}$ , Supply Voltage  $V_{DD} = 1.65\text{V} \dots 1.95\text{V}$ , unless otherwise specified

| Parameter                                                          | Symbol | Values |      |      | Unit | Note / Test Condition |
|--------------------------------------------------------------------|--------|--------|------|------|------|-----------------------|
|                                                                    |        | Min.   | Typ. | Max. |      |                       |
| Insertion Loss at T <sub>A</sub> = 25 °C, V <sub>DD</sub> = 1.8V   |        |        |      |      |      |                       |
| All RFIN/RFOUT ports<br>except<br>RFIN1,2/RFOUT2<br>RFIN3,4/RFOUT4 | IL     | –      | 0.45 | 0.55 | dB   | 699 to 960MHz         |
|                                                                    |        | –      | 0.60 | 0.70 | dB   | 1710 to 2200MHz       |
|                                                                    |        | –      | 0.70 | 0.80 | dB   | 2300 to 2700MHz       |
|                                                                    |        | –      | 0.80 | 1.00 | dB   | 3400 to 3800MHz       |
| RFIN1,2/RFOUT2<br>RFIN3,4/RFOUT4                                   | IL     | –      | 0.45 | 0.55 | dB   | 699 to 960MHz         |
|                                                                    |        | –      | 0.60 | 0.80 | dB   | 1710 to 2200MHz       |
|                                                                    |        | –      | 0.75 | 0.90 | dB   | 2300 to 2700MHz       |
|                                                                    |        | –      | 0.90 | 1.20 | dB   | 3400 to 3800MHz       |
| Insertion Loss                                                     |        |        |      |      |      |                       |
| All RFIN/RFOUT ports<br>except<br>RFIN1,2/RFOUT2<br>RFIN3,4/RFOUT4 | IL     | –      | 0.45 | 0.60 | dB   | 699 to 960MHz         |
|                                                                    |        | –      | 0.60 | 0.80 | dB   | 1710 to 2200MHz       |
|                                                                    |        | –      | 0.70 | 0.90 | dB   | 2300 to 2700MHz       |
|                                                                    |        | –      | 0.90 | 1.10 | dB   | 3400 to 3800MHz       |
| RFIN1,2/RFOUT2<br>RFIN3,4/RFOUT4                                   | IL     | –      | 0.45 | 0.60 | dB   | 699 to 960MHz         |
|                                                                    |        | –      | 0.60 | 0.85 | dB   | 1710 to 2200MHz       |
|                                                                    |        | –      | 0.75 | 1.00 | dB   | 2300 to 2700MHz       |
|                                                                    |        | –      | 1.00 | 1.30 | dB   | 3400 to 3800MHz       |
| Return Loss                                                        |        |        |      |      |      |                       |
| All RFIN/RFOUT ports                                               | RL     | 19     | 23   | –    | dB   | 699 to 960MHz         |
|                                                                    |        | 12     | 17   | –    | dB   | 1710 to 2200MHz       |
|                                                                    |        | 11     | 15   | –    | dB   | 2300 to 2700MHz       |
|                                                                    |        | 7.5    | 11   | –    | dB   | 3400 to 3800MHz       |
| Isolation                                                          |        |        |      |      |      |                       |
| All RFIN/RFOUT ports                                               | ISO    | 36     | 46   | –    | dB   | 699 to 960MHz         |
|                                                                    |        | 31     | 40   | –    | dB   | 1710 to 2200MHz       |
|                                                                    |        | 29     | 38   | –    | dB   | 2300 to 2700MHz       |
|                                                                    |        | 25     | 36   | –    | dB   | 3400 to 3800MHz       |

<sup>1)</sup> Measured on application board without any external matching components

# BGSX44MA12

## 4P4T Rx Switch with MIPI RFFE Interface



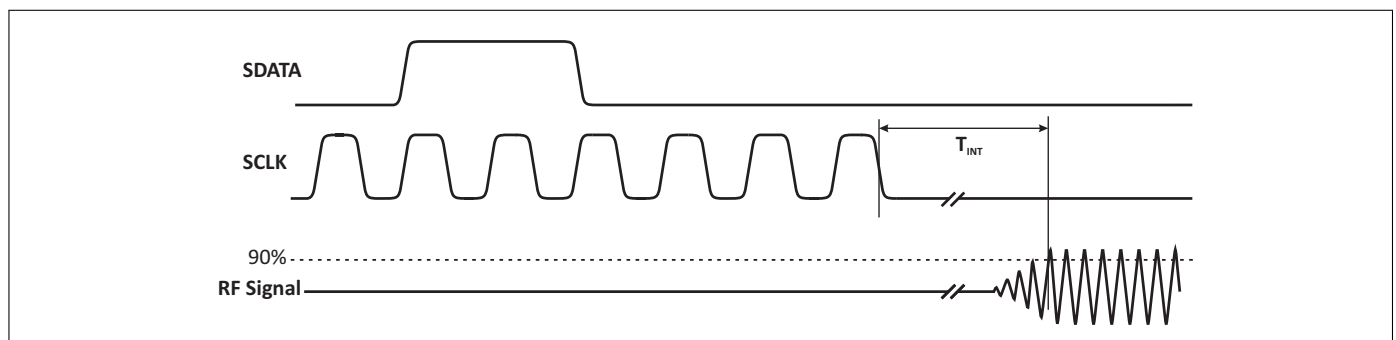
### RF Characteristics

**Table 6: RF Characteristics**<sup>1)</sup> at  $T_A = -40\text{ }^{\circ}\text{C} \dots 85\text{ }^{\circ}\text{C}$ ,  $P_{IN} = 0\text{ dBm}$ , Supply Voltage  $V_{DD} = 1.65\text{V} \dots 1.95\text{V}$ , unless otherwise specified

| Parameter                                           | Symbol            | Values |      |      | Unit | Note / Test Condition                              |
|-----------------------------------------------------|-------------------|--------|------|------|------|----------------------------------------------------|
|                                                     |                   | Min.   | Typ. | Max. |      |                                                    |
| Harmonic Generation up to 12.75 GHz                 |                   |        |      |      |      |                                                    |
| All RFIN/RFOUT ports, H2                            | P <sub>Harm</sub> | –      | -105 | -95  | dBc  | 15 dBm, 50 Ω, CW Mode                              |
| All RFIN/RFOUT ports, H3                            | P <sub>Harm</sub> | –      | -95  | -90  | dBc  | 15 dBm, 50 Ω, CW Mode                              |
| Intermodulation Distortion in Rx Band               |                   |        |      |      |      |                                                    |
| 2nd order input refered intercept point (all Ports) | IIP2              | 100    | 115  | –    | dBm  | Tx = 20 dBm,<br>Interferer = 0 dBm, 50Ω            |
| 3rd order input refered intercept point (all Ports) | IIP3              | 55     | 61   | –    | dBm  |                                                    |
| Switching Time <sup>2)</sup>                        |                   |        |      |      |      |                                                    |
| MIPI to RF time                                     | t <sub>INT</sub>  | –      | 2.5  | 4    | μs   | 50 % last SCLK falling edge to 90 % ON, see Fig. 2 |
| Power up settling time                              | t <sub>PUP</sub>  | –      | 10   | 25   | μs   | After power down mode                              |

<sup>1)</sup> Measured on application board without any external matching components

<sup>2)</sup> Do not change switch state during first 10  $\mu\text{s}$  of power-up



**Figure 2: MIPI to RF Time**

## 6 MIPI RFFE Specification

All sequences are implemented according to the 'MIPI Alliance Specification for RF Front-End Control Interface' document version 2.0 - 25. September 2014.

**Table 7: MIPI Features**

| Feature                                                  | Supported | Comment                                                                                                      |
|----------------------------------------------------------|-----------|--------------------------------------------------------------------------------------------------------------|
| MIPI RFFE 2.0 standard                                   | Yes       |                                                                                                              |
| Register read and write command sequence                 | Yes       |                                                                                                              |
| Extended register read and write command sequence        | Yes       |                                                                                                              |
| Support for standard frequency range operations for SCLK | Yes       | Up to 26 MHz for read and write                                                                              |
| Support for extended frequency range operations for SCLK | Yes       | Up to 52 MHz for write                                                                                       |
| Half speed read                                          | Yes       |                                                                                                              |
| Full speed read                                          | Yes       |                                                                                                              |
| Full speed write                                         | Yes       |                                                                                                              |
| Programmable Group SID                                   | Yes       |                                                                                                              |
| Programmable USID                                        | Yes       | Support for three registers write and extended write sequences & extended register write with EXT_PRODUCT_ID |
| Trigger functionality                                    | Yes       |                                                                                                              |
| Broadcast / GSID write to PM TRIG register               | Yes       |                                                                                                              |
| Reset                                                    | Yes       | Via VDD, PM TRIG or software register                                                                        |
| Status / error sum register                              | Yes       |                                                                                                              |
| Extended product ID register                             | Yes       |                                                                                                              |
| Revision ID register                                     | Yes       |                                                                                                              |
| Group SID register                                       | Yes       |                                                                                                              |
| USID select pin                                          | Yes       | External pin for changing USID:<br>USID_SEL=0 → 1010<br>USID_SEL=1 → 1011                                    |
| USID selection via SDATA / SCLK swap feature             | No        |                                                                                                              |

**Table 8: Startup Behavior**

| Feature          | State     | Comment                                                            |
|------------------|-----------|--------------------------------------------------------------------|
| Power status     | Low power | Lower power mode after start-up                                    |
| Trigger function | Enabled   | Enabled after start-up. Programmable via behavior control register |



# BGSX44MA12

## 4P4T Rx Switch with MIPI RFFE Interface



### MIPI RFFE Specification

**Table 9: Register Mapping, Table I**

| Register Address | Register Name | Data Bits | Function                      | Description                                                                                                                                                                                         | Default    | Broadcast_ID Support | Trigger Support | R/W |
|------------------|---------------|-----------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------|-----------------|-----|
| 0x01             | REGISTER_1    | 7:0       | MODE_CTRL                     | RFIN 1 & 2 control                                                                                                                                                                                  | 00000000   | No                   | Trigger1        | R/W |
| 0x02             | REGISTER_2    | 7:0       | MODE_CTRL                     | RFIN 3 & 4 control                                                                                                                                                                                  | 00000000   | No                   | Trigger1        | R/W |
| 0x1C             | PM_TRIG       | 7         | PWR_MODE(1), Operation Mode   | 0: Normal operation (ACTIVE)                                                                                                                                                                        | 1          | Yes                  | No              | R/W |
|                  |               |           |                               | 1: Low Power Mode (LOW POWER)                                                                                                                                                                       |            |                      |                 |     |
|                  |               | 6         | PWR_MODE(0), State Bit Vector | 0: No action (ACTIVE)                                                                                                                                                                               | 0          |                      |                 |     |
|                  |               |           |                               | 1: Powered Reset (STARTUP to ACTIVE to LOW POWER)                                                                                                                                                   |            |                      |                 |     |
|                  |               | 5         | TRIGGER_MASK_2                | 0: Data masked (held in shadow REG)                                                                                                                                                                 | 0          | No                   |                 |     |
|                  |               |           |                               | 1: Data not masked (ready for transfer to active REG)                                                                                                                                               |            |                      |                 |     |
|                  |               | 4         | TRIGGER_MASK_1                | 0: Data masked (held in shadow REG)                                                                                                                                                                 | 0          |                      |                 |     |
|                  |               |           |                               | 1: Data not masked (ready for transfer to active REG)                                                                                                                                               |            |                      |                 |     |
|                  |               | 3         | TRIGGER_MASK_0                | 0: Data masked (held in shadow REG)                                                                                                                                                                 | 0          |                      |                 |     |
|                  |               |           |                               | 1: Data not masked (ready for transfer to active REG)                                                                                                                                               |            |                      |                 |     |
|                  |               | 2         | TRIGGER_2                     | 0: No action (data held in shadow REG)                                                                                                                                                              | 0          | Yes                  |                 |     |
|                  |               |           |                               | 1: Data transferred to active REG                                                                                                                                                                   |            |                      |                 |     |
|                  |               | 1         | TRIGGER_1                     | 0: No action (data held in shadow REG)                                                                                                                                                              | 0          |                      |                 |     |
|                  |               |           |                               | 1: Data transferred to active REG                                                                                                                                                                   |            |                      |                 |     |
|                  |               | 0         | TRIGGER_0                     | 0: No action (data held in shadow REG)                                                                                                                                                              | 0          |                      |                 |     |
|                  |               |           |                               | 1: Data transferred to active REG                                                                                                                                                                   |            |                      |                 |     |
| 0x1D             | PRODUCT_ID    | 7:0       | PRODUCT_ID                    | This is a read-only register. However, during the programming of the USID a write command sequence is performed on this register, even though the write does not change its value.                  | 11100110   | No                   | No              | R   |
| 0x1E             | MAN_ID        | 7:0       | MANUFACTURER_ID [7:0]         | This is a read-only register. However, during the programming of the USID, a write command sequence is performed on this register, even though the write does not change its value.                 | 00011010   | No                   | No              | R   |
| 0x1F             | MAN_USID      | 7:6       | RESERVED                      | Reserved for future use                                                                                                                                                                             | 00         | No                   | No              | R   |
|                  |               | 5:4       | MANUFACTURER_ID [9:8]         | These bits are read-only. However, during the programming of the USID, a write command sequence is performed on this register even though the write does not change its value.                      | 01         |                      |                 |     |
|                  |               | 3:0       | USID[3:0]                     | Programmable USID. Performing a write to this register using the described programming sequences will program the USID in devices supporting this feature. These bits store the USID of the device. | See Tab. 7 | No                   | No              | R/W |

# BGSX44MA12

## 4P4T Rx Switch with MIPI RFFE Interface



### MIPI RFFE Specification

**Table 10: Register Mapping, Table II**

| Register Address | Register Name  | Data Bits | Function                 | Description                                                                                                       | Default  | Broadcast_ID Support | Trigger Support | R/W |
|------------------|----------------|-----------|--------------------------|-------------------------------------------------------------------------------------------------------------------|----------|----------------------|-----------------|-----|
| 0x20             | EXT_PRODUCT_ID | 7:0       | RESERVED                 | Extension to PRODUCT_ID register 0x1D                                                                             | 00000000 | No                   | No              | R   |
| 0x21             | REV_ID         | 7:4       | MAIN_REVISION            | Packaged switch revision ID                                                                                       | 0000     | No                   | No              | R   |
|                  |                | 3:0       | SUB_REVISION             | Packaged switch sub-revision ID                                                                                   | 0001     |                      |                 |     |
| 0x22             | GSID           | 7:4       | GSID0[3:0]               | Primary Group Slave ID.                                                                                           | 0000     | No                   | No              | R/W |
|                  |                | 3:0       | RESERVED                 | Reserved for secondary Group Slave ID.                                                                            | 0000     |                      |                 |     |
| 0x23             | UDR_RST        | 7         | UDR_RST                  | Reset all configurable non-RFFE Reserved registers to default values.<br>0: Normal operation<br>1: Software reset | 0        | Yes                  | No              | R/W |
|                  |                | 6:0       | RESERVED                 | Reserved for future use                                                                                           | 00000000 |                      |                 |     |
| 0x24             | ERR_SUM        | 7         | RESERVED                 | Reserved for future use                                                                                           | 0        | No                   | No              | R   |
|                  |                | 6         | COMMAND_FRAME_PARITY_ERR | Command Sequence received with parity error — discard command.                                                    | 0        |                      |                 |     |
|                  |                | 5         | COMMAND_LENGTH_ERR       | Command length error.                                                                                             | 0        |                      |                 |     |
|                  |                | 4         | ADDRESS_FRAME_PARITY_ERR | Address frame with parity error.                                                                                  | 0        |                      |                 |     |
|                  |                | 3         | DATA_FRAME_PARITY_ERR    | Data frame with parity error.                                                                                     | 0        |                      |                 |     |
|                  |                | 2         | READ_UNUSED_REG          | Read command to an invalid address.                                                                               | 0        |                      |                 |     |
|                  |                | 1         | WRITE_UNUSED_REG         | Write command to an invalid address.                                                                              | 0        |                      |                 |     |
|                  |                | 0         | BID_GID_ERR              | Read command with a BROADCAST_ID or GROUP_ID.                                                                     | 0        |                      |                 |     |

# BGSX44MA12

## 4P4T Rx Switch with MIPI RFFE Interface



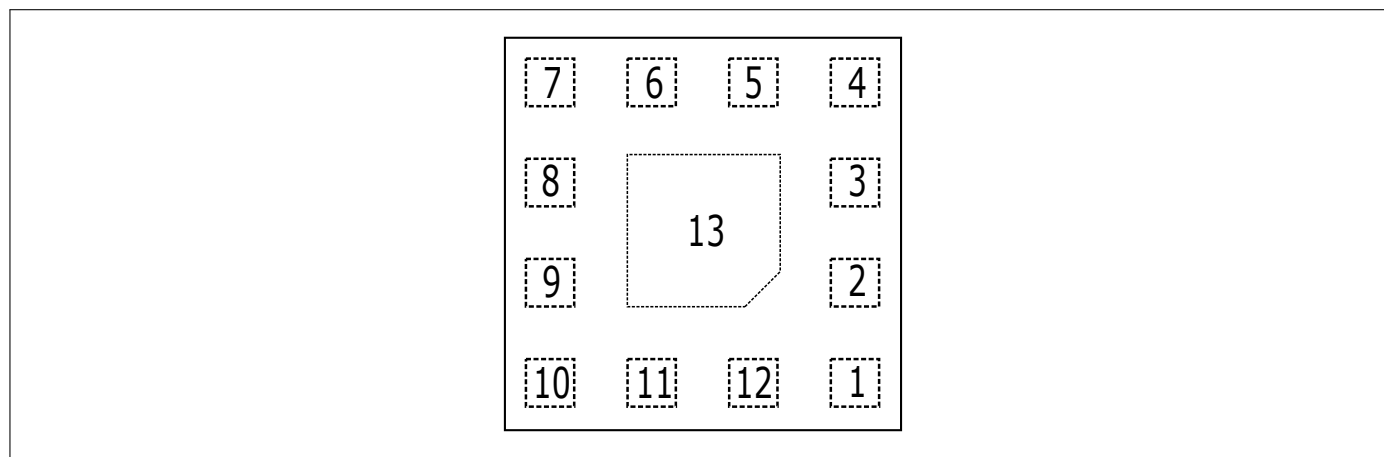
### MIPI RFFE Specification

**Table 11: Modes of Operation (Truth Table)**

|       |                  | REGISTER_1 Bits |    |    |    |    |    |    |    |
|-------|------------------|-----------------|----|----|----|----|----|----|----|
| State | Mode             | D7              | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| 1     | RFIN1-RFOUT1 ISO | x               | x  | x  | x  | x  | x  | x  | 0  |
| 2     | RFIN1-RFOUT1     | x               | x  | x  | x  | x  | x  | x  | 1  |
| 3     | RFIN1-RFOUT2 ISO | x               | x  | x  | x  | x  | x  | 0  | x  |
| 4     | RFIN1-RFOUT2     | x               | x  | x  | x  | x  | x  | 1  | x  |
| 5     | RFIN1-RFOUT3 ISO | x               | x  | x  | x  | x  | 0  | x  | x  |
| 6     | RFIN1-RFOUT3     | x               | x  | x  | x  | x  | 1  | x  | x  |
| 7     | RFIN1-RFOUT4 ISO | x               | x  | x  | x  | 0  | x  | x  | x  |
| 8     | RFIN1-RFOUT4     | x               | x  | x  | x  | 1  | x  | x  | x  |
| 9     | RFIN2-RFOUT1 ISO | x               | x  | x  | 0  | x  | x  | x  | x  |
| 10    | RFIN2-RFOUT1     | x               | x  | x  | 1  | x  | x  | x  | x  |
| 11    | RFIN2-RFOUT2 ISO | x               | x  | 0  | x  | x  | x  | x  | x  |
| 12    | RFIN2-RFOUT2     | x               | x  | 1  | x  | x  | x  | x  | x  |
| 13    | RFIN2-RFOUT3 ISO | x               | 0  | x  | x  | x  | x  | x  | x  |
| 14    | RFIN2-RFOUT3     | x               | 1  | x  | x  | x  | x  | x  | x  |
| 15    | RFIN2-RFOUT4 ISO | 0               | x  | x  | x  | x  | x  | x  | x  |
| 16    | RFIN2-RFOUT4     | 1               | x  | x  | x  | x  | x  | x  | x  |
|       |                  | REGISTER_2 Bits |    |    |    |    |    |    |    |
| State | Mode             | D7              | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| 1     | RFIN3-RFOUT1 ISO | x               | x  | x  | x  | x  | x  | x  | 0  |
| 2     | RFIN3-RFOUT1     | x               | x  | x  | x  | x  | x  | x  | 1  |
| 3     | RFIN3-RFOUT2 ISO | x               | x  | x  | x  | x  | x  | 0  | x  |
| 4     | RFIN3-RFOUT2     | x               | x  | x  | x  | x  | x  | 1  | x  |
| 5     | RFIN3-RFOUT3 ISO | x               | x  | x  | x  | x  | 0  | x  | x  |
| 6     | RFIN3-RFOUT3     | x               | x  | x  | x  | x  | 1  | x  | x  |
| 7     | RFIN3-RFOUT4 ISO | x               | x  | x  | x  | 0  | x  | x  | x  |
| 8     | RFIN3-RFOUT4     | x               | x  | x  | x  | 1  | x  | x  | x  |
| 9     | RFIN4-RFOUT1 ISO | x               | x  | x  | 0  | x  | x  | x  | x  |
| 10    | RFIN4-RFOUT1     | x               | x  | x  | 1  | x  | x  | x  | x  |
| 11    | RFIN4-RFOUT2 ISO | x               | x  | 0  | x  | x  | x  | x  | x  |
| 12    | RFIN4-RFOUT2     | x               | x  | 1  | x  | x  | x  | x  | x  |
| 13    | RFIN4-RFOUT3 ISO | x               | 0  | x  | x  | x  | x  | x  | x  |
| 14    | RFIN4-RFOUT3     | x               | 1  | x  | x  | x  | x  | x  | x  |
| 15    | RFIN4-RFOUT4 ISO | 0               | x  | x  | x  | x  | x  | x  | x  |
| 16    | RFIN4-RFOUT4     | 1               | x  | x  | x  | x  | x  | x  | x  |

## 7 Application Information

### Pin Configuration and Function



**Figure 3:** BGSX44MA12 Pin Configuration (top view)

**Table 12: Pin Definition and Function**

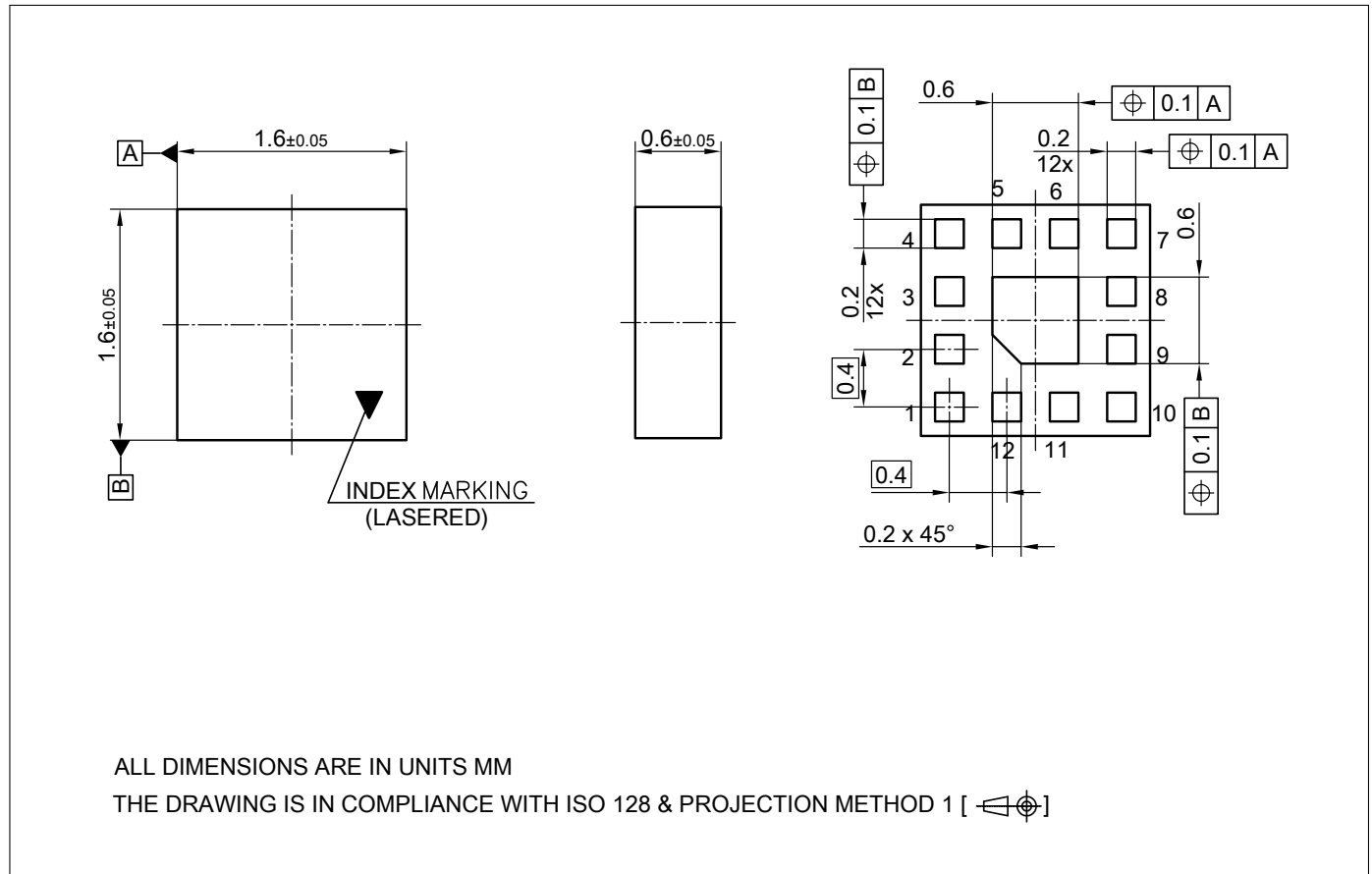
| Pin No. | Name     | Function                                             |
|---------|----------|------------------------------------------------------|
| 1       | USID_SEL | MIPI USID select pin (to be connected to VDD or GND) |
| 2       | RFOUT3   | RFout port 3                                         |
| 3       | RFOUT4   | RFout port 4                                         |
| 4       | RFIN4    | RFin port 4                                          |
| 5       | RFIN3    | RFin port 3                                          |
| 6       | RFIN2    | RFin port 2                                          |
| 7       | RFIN1    | RFin port 1                                          |
| 8       | RFOUT2   | RFout port 2                                         |
| 9       | RFOUT1   | RFout port 1                                         |
| 10      | VDD      | Common VDD & MIPI supply                             |
| 11      | SCLK     | MIPI RFFE clock                                      |
| 12      | SDATA    | MIPI RFFE data                                       |
| 13      | GND      | Common ground                                        |

# BGSX44MA12

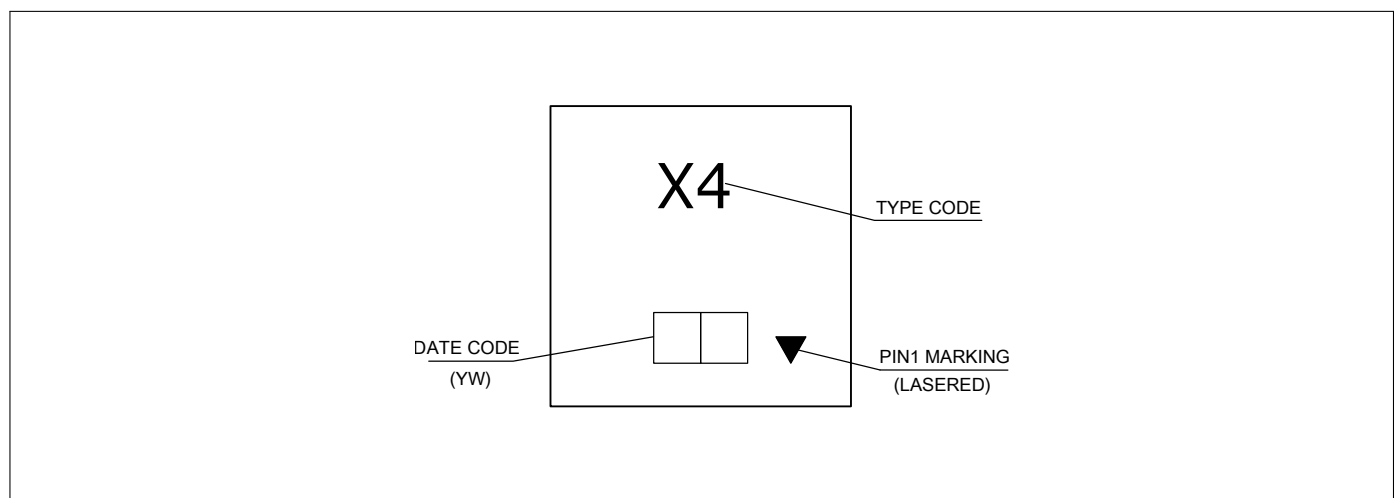
## 4P4T Rx Switch with MIPI RFFE Interface

### Package Information

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**Figure 4:** ATSLP-12-12 Package Outline (top, side and bottom views)



**Figure 5:** Marking Specification (top view)

**Table 13: Year date code marking - digit "Y"**

| Year | "Y" | Year | "Y" | Year | "Y" |
|------|-----|------|-----|------|-----|
| 2010 | 0   | 2020 | 0   | 2030 | 0   |
| 2011 | 1   | 2021 | 1   | 2031 | 1   |
| 2012 | 2   | 2022 | 2   | 2032 | 2   |
| 2013 | 3   | 2023 | 3   | 2033 | 3   |
| 2014 | 4   | 2024 | 4   | 2034 | 4   |
| 2015 | 5   | 2025 | 5   | 2035 | 5   |
| 2016 | 6   | 2026 | 6   | 2036 | 6   |
| 2017 | 7   | 2027 | 7   | 2037 | 7   |
| 2018 | 8   | 2028 | 8   | 2038 | 8   |
| 2019 | 9   | 2029 | 9   | 2039 | 9   |

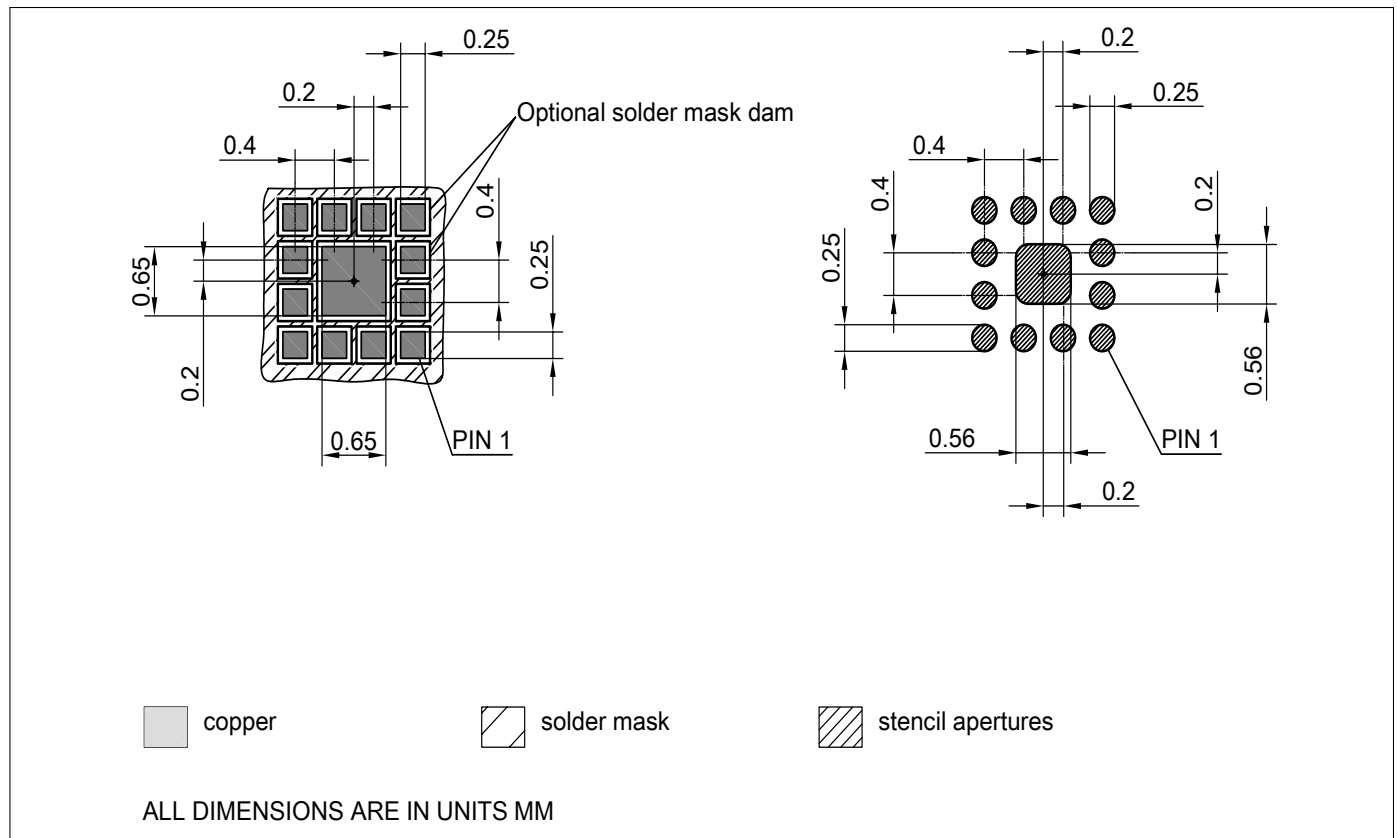
**Table 14: Week date code marking - digit "W"**

| Week | "W" | Week | "W" | Week | "W" | Week | "W" | Week | "W" |
|------|-----|------|-----|------|-----|------|-----|------|-----|
| 1    | A   | 12   | N   | 23   | 4   | 34   | h   | 45   | v   |
| 2    | B   | 13   | P   | 24   | 5   | 35   | j   | 46   | x   |
| 3    | C   | 14   | Q   | 25   | 6   | 36   | k   | 47   | y   |
| 4    | D   | 15   | R   | 26   | 7   | 37   | l   | 48   | z   |
| 5    | E   | 16   | S   | 27   | a   | 38   | n   | 49   | 8   |
| 6    | F   | 17   | T   | 28   | b   | 39   | p   | 50   | 9   |
| 7    | G   | 18   | U   | 29   | c   | 40   | q   | 51   | 2   |
| 8    | H   | 19   | V   | 30   | d   | 41   | r   | 52   | 3   |
| 9    | J   | 20   | W   | 31   | e   | 42   | s   |      |     |
| 10   | K   | 21   | Y   | 32   | f   | 43   | t   |      |     |
| 11   | L   | 22   | Z   | 33   | g   | 44   | u   |      |     |

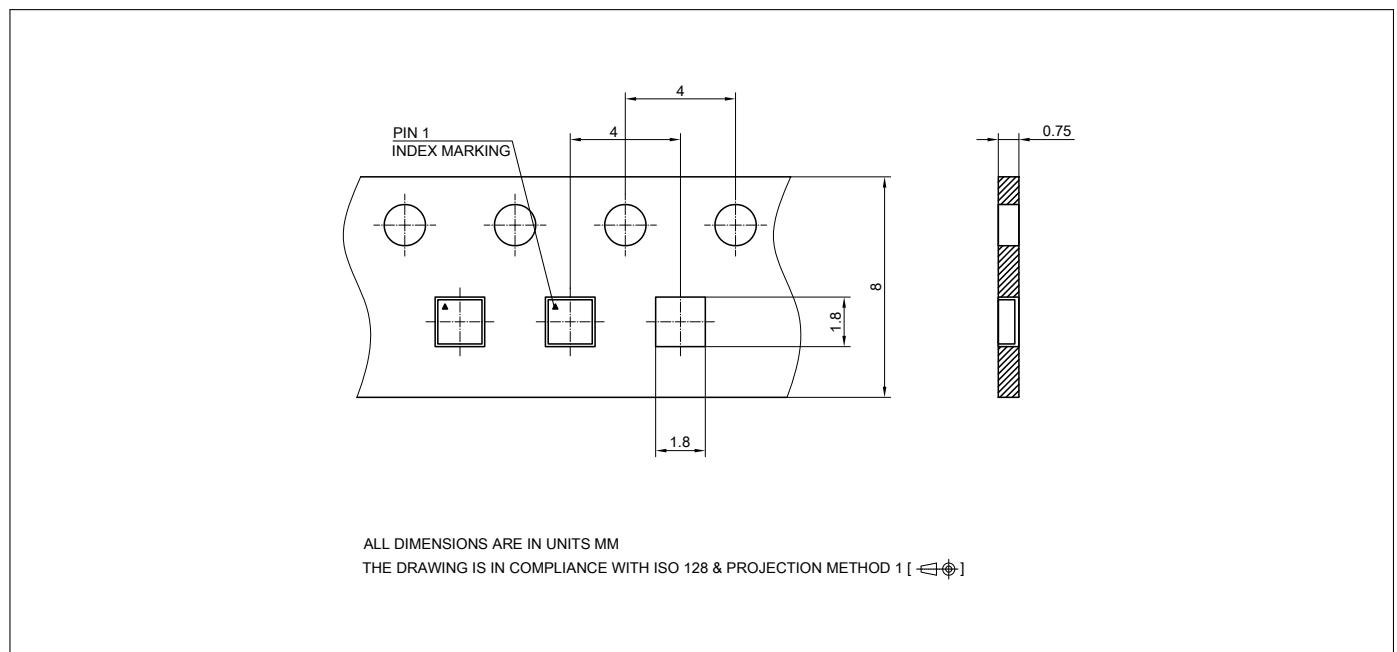
# BGSX44MA12

## 4P4T Rx Switch with MIPI RFFE Interface

### Package Information



**Figure 6:** Footprint Recommendation



**Figure 7:** ATSLP-12-12 Carrier Tape

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**Revision History**

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**Revision v2.1 - 2018-04-26**

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| <b>Page or Item</b> | <b>Subjects (major changes since previous revision)</b> |
|---------------------|---------------------------------------------------------|
|---------------------|---------------------------------------------------------|

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**Revision 2.2, 2018-05-28**

|   |                                    |
|---|------------------------------------|
| 3 | Maximum Ratings updated in Table 1 |
|---|------------------------------------|

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**Edition 2018-05-28**  
**Published by**  
**Infineon Technologies AG**  
**81726 Munich, Germany**

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