



MXD8545B

0.1-3.0GHz SP4T Antenna Tuning Switch

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General Description

The MXD8545B is a CMOS silicon-on-insulator (SOI), single-pole, four-throw (SP4T) switch. The high linearity and ruggedness performance and extremely low insertion loss makes the device an ideal choice for GSM/WCDMA/LTE handset antenna tuning application.

The MXD8545B SP4T switch is provided in a compact QFN 1.1mm x 1.5mm x 0.38mm package. A functional block diagram is shown in Figure 1. The pin configuration and package are shown in Figure 2. Signal pin assignments and functional pin descriptions are provided in Table 1.

Applications

- GSM/WCDMA/LTE band and mode switching
- Antenna tuning switch

Features

- Broadband frequency range: 0.1 to 3.0 GHz
- Low insertion 0.50dB @ 2.7 GHz
- High P0.1dB of 45dBm
- Positive low voltage control: VC = 1.0 to 3.0 V, VDD = 2.5 to 3.0 V, Small QFN (10-pin, 1.1mm x 1.5mm x 0.38mm) package

Functional Block Diagram and Pin Function

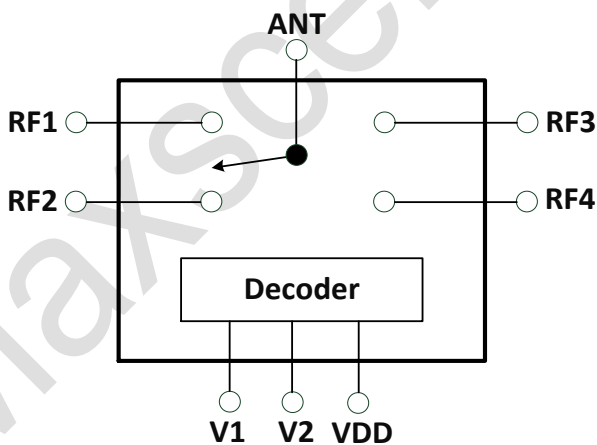


Figure 1. Functional Block Diagram

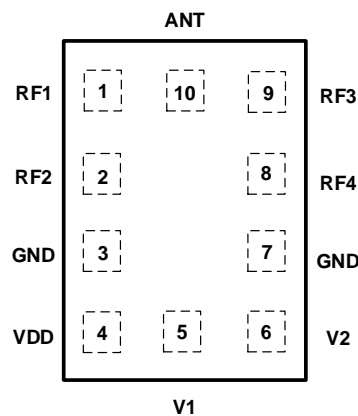
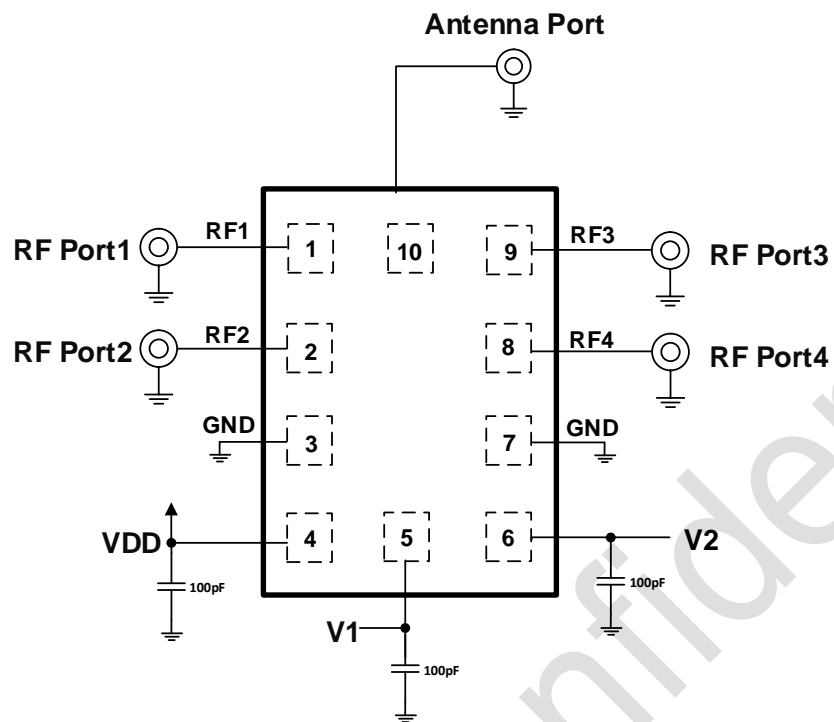


Figure 2. Pin-out (Top View)

Application Circuit

Figure 3. MXD8545B Application Circuit
Table 1. Pin Description

| Pin No. | Name | Description | Pin No. | Name | Description |
|---------|------|------------------|---------|------|------------------|
| 1 | RF1 | RF port 1 | 6 | V2 | Control Logic #2 |
| 2 | RF2 | RF port 2 | 7 | GND | Ground |
| 3 | GND | Ground | 8 | RF4 | RF port 4 |
| 4 | VDD | DC power supply | 9 | RF3 | RF port 3 |
| 5 | V1 | Control Logic #1 | 10 | ANT | Antenna port |

Truth Table
Table 2.

| State | V1 | V2 | RF Path |
|-------|----|----|------------|
| RF1 | 0 | 0 | ANT to RF1 |
| RF2 | 0 | 1 | ANT to RF2 |
| RF3 | 1 | 0 | ANT to RF3 |
| RF4 | 1 | 1 | ANT to RF4 |

Note: "1" = 1.0 V to 3.00 V. "0" = 0 V to +0.3 V.

Recommended Operation Range
Table 3.

| Parameters | Symbol | Min | Typ | Max | Units |
|-----------------------------|--------------------|-----|-----|-----|-------|
| Operation Frequency | f1 | 0.1 | - | 3.0 | GHz |
| Power supply | V _{DD} | 2.5 | 2.8 | 3.0 | V |
| Switch Control Voltage High | V _{CTL_H} | 1.0 | 1.8 | 3.0 | V |
| Switch Control Voltage Low | V _{CTL_L} | 0 | 0 | 0.3 | V |

Specifications
Table 4. Electrical Specifications

| Parameter | Symbol | Specification | | | Units | Test Condition |
|------------------------------------|-----------------|---------------|---------|------|----------|--|
| | | Min. | Typical | Max. | | |
| DC Specifications | | | | | | |
| Control voltage: Low | V_{CTL_L} | 0 | 0 | 0.3 | V | |
| High | V_{CTL_H} | 1.0 | 1.8 | 3.0 | V | |
| Supply voltage | V_{DD} | 2.5 | 2.8 | 3.0 | V | |
| Supply current | I_{DD} | | 90 | 120 | μA | $V_{DD} = 2.8 V$ |
| Control current | I_{CTL} | | 1 | 5 | μA | $V_{CTL} = 1.8 V$ |
| RF Specifications | | | | | | |
| Insertion loss | IL | | 0.35 | 0.45 | dB | 0.8 to 1.0 GHz |
| | | | 0.45 | 0.55 | dB | 1.0 to 2.2 GHz |
| | | | 0.50 | 0.70 | dB | 2.2 to 3.0 GHz |
| Isolation | ISO | 27 | 30 | | dB | 0.8 to 1.0 GHz |
| | | 25 | 27 | | dB | 1.0 to 2.2 GHz |
| | | 20 | 22 | | dB | 2.2 to 3.0 GHz |
| Return loss | $ S_{11} $ | | 20 | | dB | 0.8 to 3.0 GHz |
| Voltage Standing Wave Ratio | VSWR | | 1.20 | | | 0.8 to 3.0 GHz |
| On Resistance (RF1/2/3/4 to ANT) | R_{on} | | 1.45 | 1.55 | Ω | Switch on Path |
| OFF Capacitance (RF1/2/3/4 to ANT) | C_{off} | | 110 | 135 | fF | Switch off Path |
| Input 0.1 dB compression point | $P_{0.1dB}$ | +44 | +45 | | dBm | 0.8 to 3.0 GHz, ANT to RF1/2/3/4 |
| Peak RF operating voltage | V_{peak} | 55 | 60 | | V | $f_0 = 700$ to 2700 MHz, 25% duty cycle |
| LTE TX harmonic (RF1/2/3/4 to ANT) | 2f ₀ | -70 | -85 | | dBm | $f_0 = 700$ to 2700 MHz, PIN = +26 dBm |
| | 3f ₀ | -70 | -85 | | dBm | |
| GSM LB harmonic (RF1/2/3/4 to ANT) | 2f ₀ | -55 | -65 | | dBm | $f_0 = 824$ to 915 MHz, PIN = +35 dBm |
| | 3f ₀ | -55 | -65 | | dBm | |
| GSM HB harmonic (RF1/2/3/4 to ANT) | 2f ₀ | -55 | -65 | | dBm | $f_0 = 1710$ to 2690 MHz, PIN = +33 dBm |
| | 3f ₀ | -55 | -65 | | dBm | |
| Second order intermodulation | IMD2 | -105 | -115 | | dBm | CW Carrier on RF Port, +20 dBm CW Interferer on ANT port, -15 dBm |
| Third order intermodulation | IMD3 | -105 | -115 | | dBm | CW Carrier on RF Port, +20 dBm CW Interferer on ANT port, -15 dBm |
| Switching on time | | | 3.0 | 5.0 | μs | 50% VCTL to 90% RF |
| Switching off time | | | 3.0 | 5.0 | μs | 50% VCTL to 10% RF |
| Startup time | | | 10 | | μs | Power off state to any RF switch state |

Table 5. IMD2 Test Conditions

| Band | In-band freq | CW Carrier | | CW Interferer | |
|--------|--------------|------------|-----|---------------|-----|
| | MHz | MHz | dBm | MHz | dBm |
| 1 Low | 2140 | 1950 | +20 | 190 | -15 |
| 1 High | 2140 | 1950 | +20 | 4090 | -15 |
| 5 Low | 881.5 | 836.5 | +20 | 45 | -15 |
| 5 High | 881.5 | 836.5 | +20 | 1718 | -15 |

Table 6. IMD3 Test Conditions

| Band | In-band freq | CW Carrier | | CW Interferer | |
|------|--------------|------------|-----|---------------|-----|
| | MHz | MHz | dBm | MHz | dBm |
| 1 | 2140 | 1950 | +20 | 1760 | -15 |
| 5 | 881.5 | 836.5 | +20 | 791.5 | -15 |

Absolute Maximum Ratings

Table 7. Maximum ratings

| Parameters | Symbol | Minimum | Maximum | Units |
|---|------------------|---------|---------|-------|
| Supply voltage | V _{DD} | +2.5 | +3.6 | V |
| Digital control voltage | V _{CTL} | 0 | +3.6 | V |
| RF input power | P _{IN} | | +45.5 | dBm |
| Operating temperature | T _{OP} | -30 | +85 | °C |
| Storage temperature | T _{STG} | -55 | +150 | °C |
| Electrostatic Discharge Human body model (HBM), Class 2 | ESD_HBM | | 2000 | V |
| Machine Model (MM), Class B | ESD_MM | | 200 | |
| Charged device model (CDM), Class III | ESD_CDM | | 500 | |

Note: Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

Package Outline Dimension

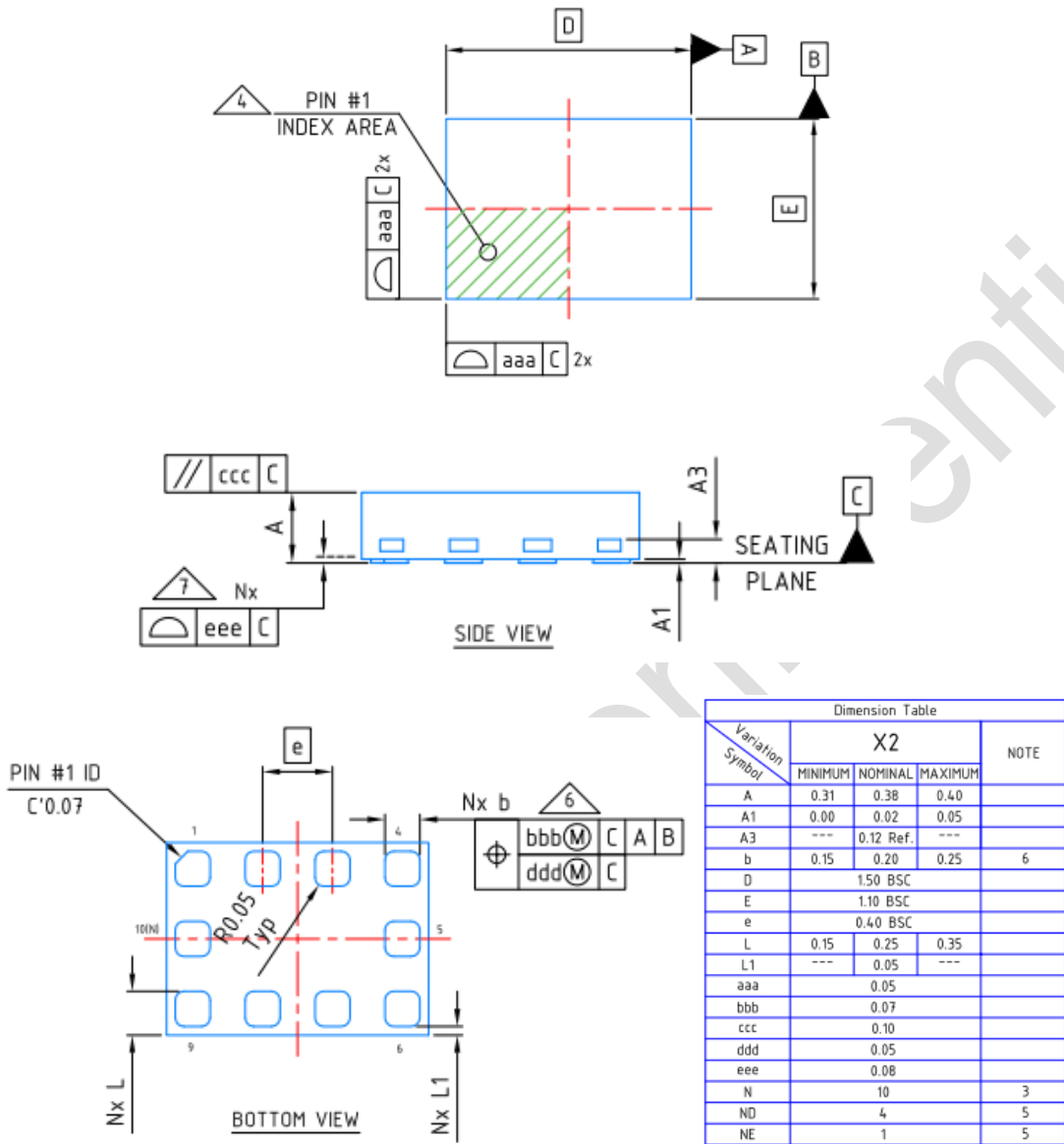


Figure 4. Package outline dimension

NOTE:

1. Dimensioning and tolerancing conform to ASME Y14.5-2009.
2. All dimensions are in millimeters.
3. N is the total number of terminals.
4. The location of the marked terminal #1 identifier is within the hatched area.
5. ND and NE refers to the maximum number of terminals on each D and E side respectively.
6. Dimension b applies to the metallized terminal and is measured between 0.15mm and 0.30mm from the terminal tip. If the terminal has a radius on the other end of it, dimension b should not be measured in that radius area.
7. Coplanarity applies to the terminals and all other bottom surface metallization.

Reflow Chart

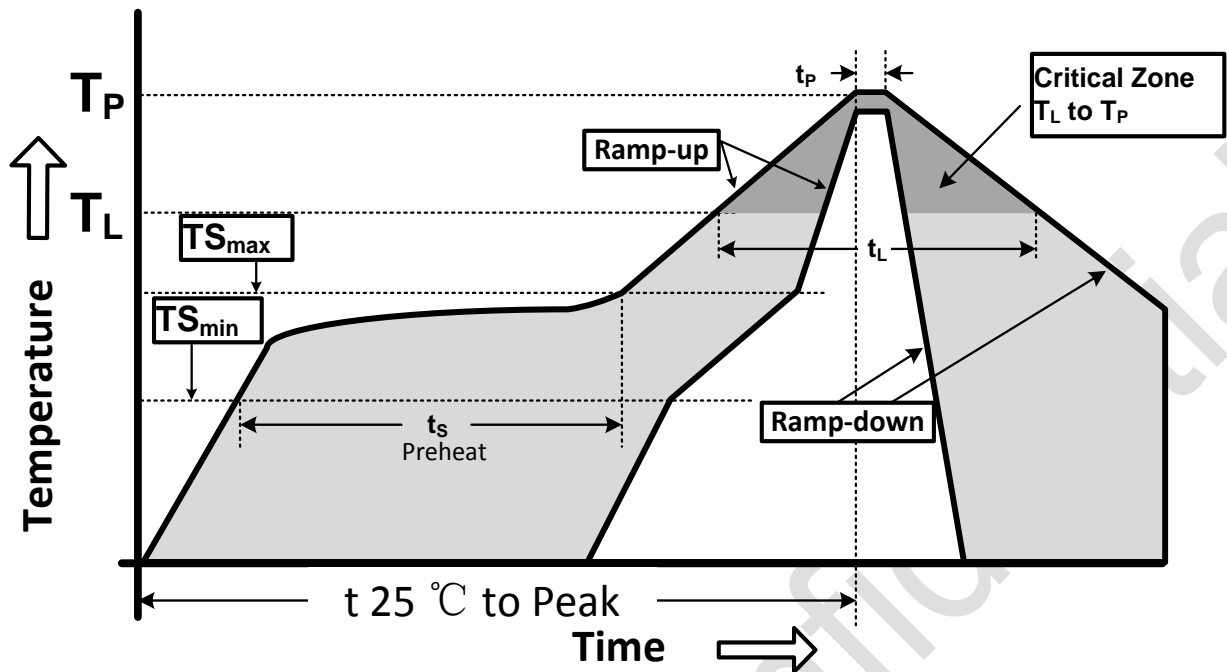


Figure 5. Recommended Lead-Free Reflow Profile

Table 8.

| Profile Parameter | Lead-Free Assembly, Convection, IR/Convection |
|---|---|
| Ramp-up rate (TS _{max} to T _p) | 3°C/second max. |
| Preheat temperature (TS _{min} to TS _{max}) | 150°C to 200°C |
| Preheat time (t _s) | 60 - 180 seconds |
| Time above TL, 217°C (t _L) | 60 - 150 seconds |
| Peak temperature (T _p) | 260°C |
| Time within 5°C of peak temperature(t _p) | 20 - 40 seconds |
| Ramp-down rate | 6°C/second max. |
| Time 25°C to peak temperature | 8 minutes max. |

ESD Sensitivity

Integrated circuits are ESD sensitive and can be damaged by static electric charge. Proper ESD protection techniques should be used when handling these devices.

RoHS Compliant

This product does not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE), and are considered RoHS compliant.

1.1.1

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