



## **MXD8546**

X-DPDT Switch for 0.4~3.8G Application

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### General Description

The MXD8546 is a CMOS, Silicon-On-Insulator (SOI) double-pole, double-throw (DPDT) switch. The switch provides high linearity performance, low insertion loss and high isolation.

Switching is controlled by one control voltage, V1. Depending on the logic voltage level applied to this pin, the RF1 and RF2 pins connect to one of the two other RF port pins (RF3 or RF4) through a low insertion loss path, while maintaining a high isolation path to the alternate port. No external DC blocking capacitors are required on the RF path as long as no DC voltage is applied externally.

The MXD8546 DPDT switch is provided in a compact Quad Flat No-Lead (QFN) 1.83 x 1.83 mm 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

- Simultaneous voice and LTE systems
- Diversity antenna switching

### Features

- Single control voltage input
- Broadband frequency range: 0.4 to 3.8 GHz
- Low insertion loss: 0.55 dB @ 2.7 GHz
- P0.1dB of 37dBm
- No DC blocking capacitors required
- Positive control voltage range: 1.8 to 3.3 V
- Small, QFN (12-pin, 1.83 x 1.83 mm) package

### Functional Block Diagram and Pin Function

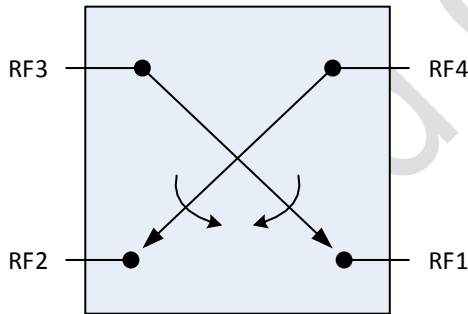


Figure 1. Functional Block Diagram

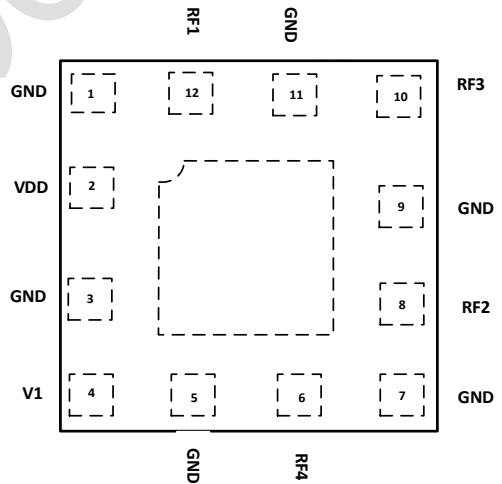
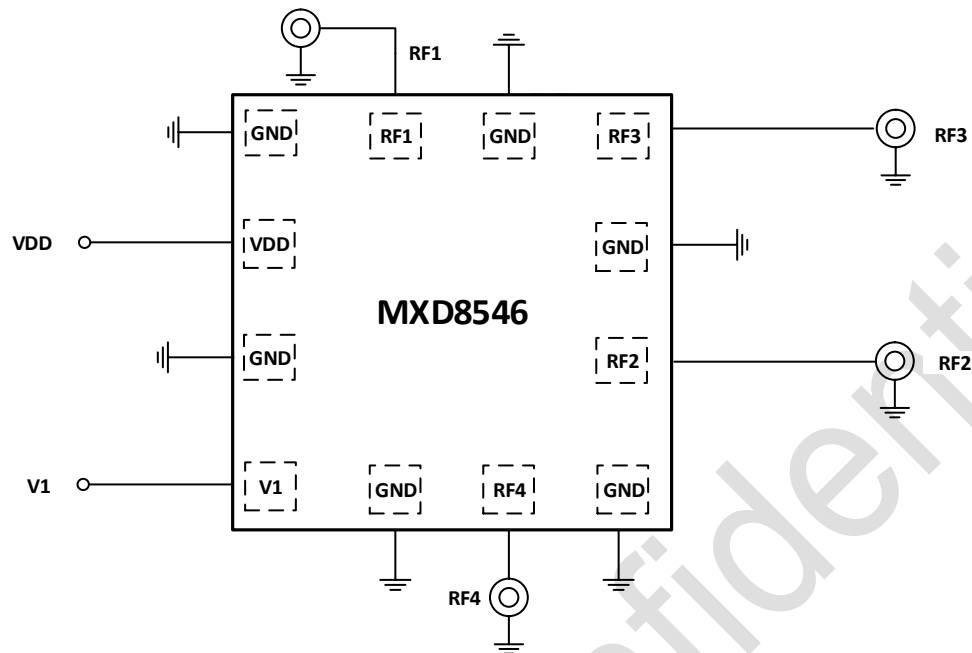


Figure 2. Pin Diagram

**Application Circuit**

**Figure 3. MXD8546 Evaluation Board Schematic**
**Table 1. Pin Description**

| Pin No. | Name | Description           | Pin No. | Name | Description |
|---------|------|-----------------------|---------|------|-------------|
| 1       | GND  | Ground.               | 7       | GND  | Ground.     |
| 2       | VDD  | DC power supply       | 8       | RF2  | RF port 2   |
| 3       | GND  | Ground.               | 9       | GND  | Ground.     |
| 4       | V1   | DC control voltage 1. | 10      | RF3  | RF Port 3   |
| 5       | GND  | Ground.               | 11      | GND  | Ground.     |
| 6       | RF4  | RF port 4             | 12      | RF1  | RF port 1   |

**Note:** Bottom ground paddles must be connected to ground.

**Table 2. Truth Table**

| V1 | State                  |
|----|------------------------|
| 1  | RF3 to RF1, RF4 to RF2 |
| 0  | RF3 to RF2, RF4 to RF1 |

**Note:** "1" = 1.8 to 3.1 V, "0" = -0.20 to +0.45 V;  
Any state other than described in this Table places the switch into an undefined state.

**Recommended Operation Range**
**Table 3.**

| Parameters                  | Symbol             | Min  | Typ | Max | Units |
|-----------------------------|--------------------|------|-----|-----|-------|
| Operation Frequency         | f1                 | 0.4  | -   | 3.8 | GHz   |
| Power supply                | V <sub>DD</sub>    | 1.8  | 2.8 | 3.3 | V     |
| Switch Control Voltage High | V <sub>CTL_H</sub> | 1.5  | 1.8 | 3.3 | V     |
| Switch Control Voltage Low  | V <sub>CTL_L</sub> | -0.2 | 0   | 0.4 | V     |

**Specifications**
**Table 4. Electrical Specifications**

| Parameter  | Symbol       | Specification |         |      | Units         | Test Condition                                 |
|--|--------------|---------------|---------|------|---------------|--|
|  |              | Min.          | Typical | Max. |               |  |
| <b>DC Specifications</b>                               |              |               |         |      |               |  |
| Control voltage:<br>Low                                | $V_{CTL\_L}$ | 0             | 0       | 0.3  | V             |  |
| High   | $V_{CTL\_H}$ | 1.5           | 1.8     | 3.3  | V             |  |
| Supply voltage   | $V_{DD}$     | 1.8           | 2.8     | 3.3  | V             |  |
| Supply current   | $I_{DD}$     |               | 60      | 85   |               | $V_{DD} = 2.8\text{ V}$                        |
| Control current  | $I_{CTL}$    |               | 1       | 5    | $\mu\text{A}$ | $V_{CTL} = 1.8\text{ V}$                       |
| <b>RF Specifications</b>                               |              |               |         |      |               |  |
| Insertion loss (RF1/RF2 to RF3/RF4)                    | IL           |               | 0.45    |      | dB            | 0.7 to 1.0 GHz                                 |
|  |              |               | 0.50    |      | dB            | 1.0 to 2.2 GHz                                 |
|  |              |               | 0.55    |      | dB            | 2.5 to 2.7 GHz                                 |
|  |              |               | 0.70    |      | dB            | 3.4 to 3.8 GHz                                 |
| Isolation (RF1/RF2 to RF3/RF4, RF1 to RF2, RF3 to RF4) | ISO          | 40            | 45      |      | dB            | 0.7 to 1.0 GHz                                 |
|  |              | 36            | 40      |      | dB            | 1.0 to 2.2 GHz                                 |
|  |              | 32            | 35      |      | dB            | 2.5 to 2.7 GHz                                 |
|  |              | 26            | 28      |      | dB            | 3.4 to 3.8 GHz                                 |
| Input return loss (RF1/RF2 to RF3/RF4)                 | RL           | 15            | 20      |      | dB            | 0.7 to 3.8 GHz                                 |
| 0.1 dB Compression Point (RF1/RF2 to RF3/RF4)          | $P_{0.1dB}$  |               | +37     |      | dBm           | 0.7 to 3.8 GHz                                 |
| 2 <sup>nd</sup> Harmonic (RF1/RF2 to RF3/RF4)          | 2fo          |               | -50     |      | dBm           | fo = 824 to 915 MHz, P <sub>IN</sub> = +35 dBm |
| 3 <sup>rd</sup> Harmonic (RF1/RF2 to RF3/RF4)          | 3fo          |               | -50     |      | dBm           |  |
| Switching on time                                      |              |               | 2       | 5    | $\mu\text{s}$ | 50% VCTL to 90% RF                             |
| Switching off time                                     |              |               | 2       | 5    | $\mu\text{s}$ | 50% VCTL to 10% RF                             |
| Startup time   |              |               | 10      |      | $\mu\text{s}$ | Power off state to any RF switch state         |

**Absolute Maximum Ratings**
**Table 5. Maximum ratings**

| Parameters  | Symbol    | Minimum | Maximum | Units |
|---|-----------|---------|---------|-------|
| Supply voltage  | $V_{DD}$  | +1.8    | +3.6    | V     |
| Digital control voltage                                       | $V_{CTL}$ | -0.3    | +3.3    | V     |
| RF input power  | $P_{IN}$  |         | +40     | dBm   |
| Operating temperature   | $T_{OP}$  | -30     | +85     | °C    |
| Storage temperature   | $T_{STG}$ | -55     | +150    | °C    |
| Electrostatic Discharge<br>Human body model (HBM),<br>Class 2 | ESD_HBM   |         | 2000    | V     |
| Machine Model (MM),<br>Class B                                | ESD_MM    |         | 200     |       |
| Charged device model<br>(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

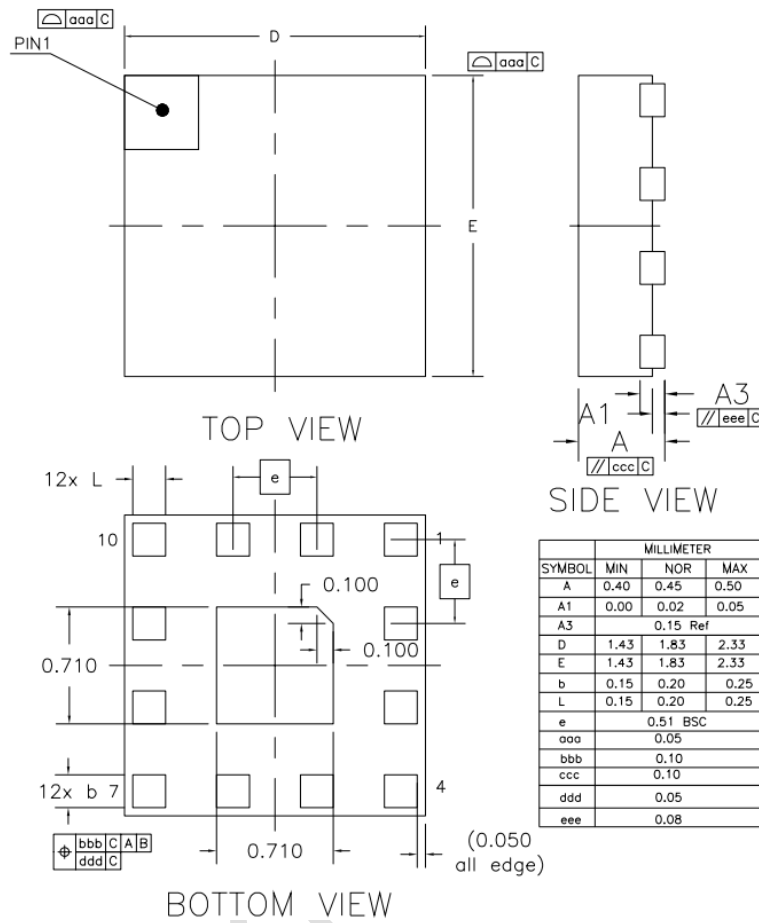


Figure 4. package outline dimension

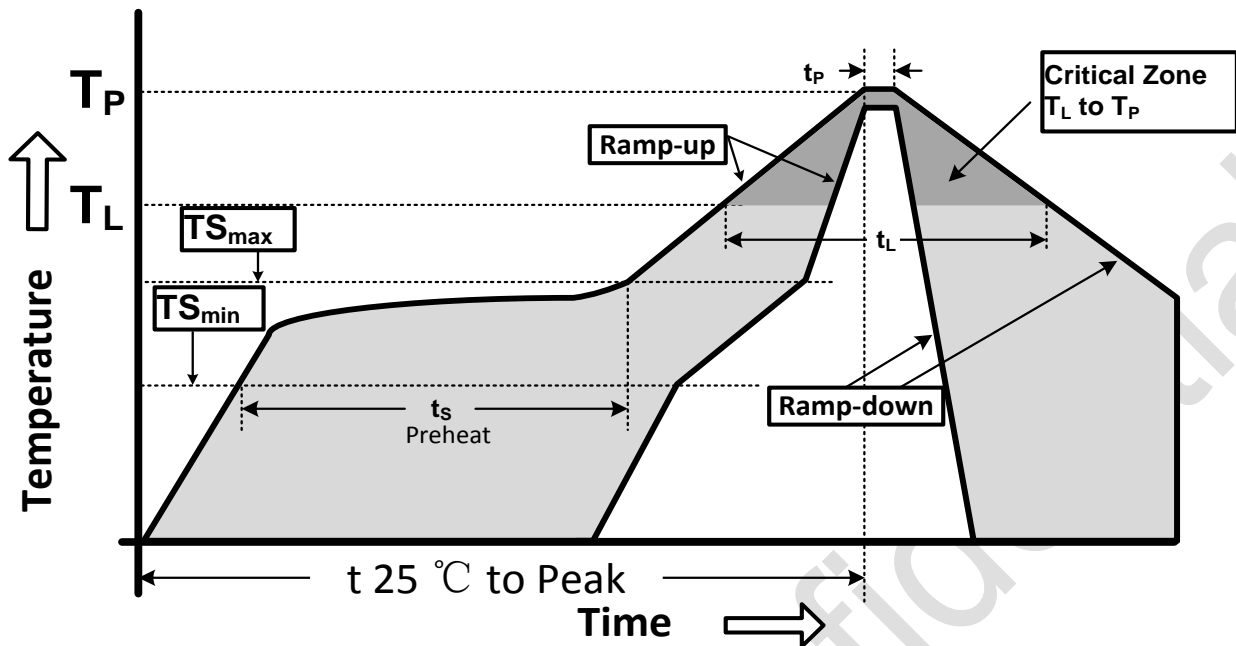
**Reflow Chart**


Figure 5. Recommended Lead-Free Reflow Profile

**Table 6 Reflow condition**

| Profile Parameter                                      | Lead-Free Assembly, Convection, IR/Convection |
|--|---|
| Ramp-up rate ( $T_{S_{max}}$ to $T_P$ )                | 3°C/second max.                               |
| Preheat temperature ( $T_{S_{min}}$ to $T_{S_{max}}$ ) | 150°C to 200°C                                |
| Preheat time ( $t_s$ )                                 | 60 - 180 seconds                              |
| Time above $T_L$ , 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.

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