
MXD8544A

0.1-3.0GHz SP4T Antenna Tuning Switch



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General Description

The MXD8544A 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 MXD8544A SP4T switch is provided in a compact LGA 1.1mm x 1.5mm x 0.36mm 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 43.3dBm
- Positive low voltage control: VC = 1.0 to 3.0 V, VDD = 2.5 to 3.3 V, Small LGA (10-pin, 1.1mm x 1.5mm x 0.36mm) package

Functional Block Diagram and Pin Function

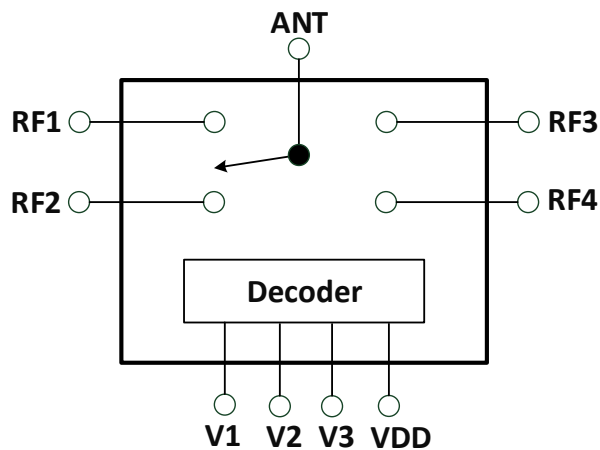


Figure 1. Functional Block Diagram

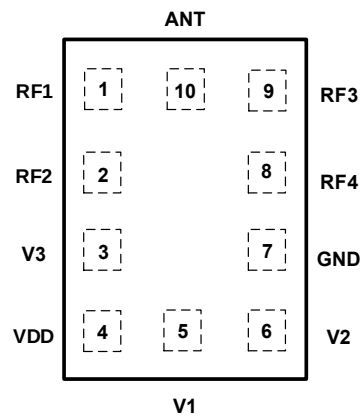


Figure 2. Pin-out (Top View)

Application Circuit

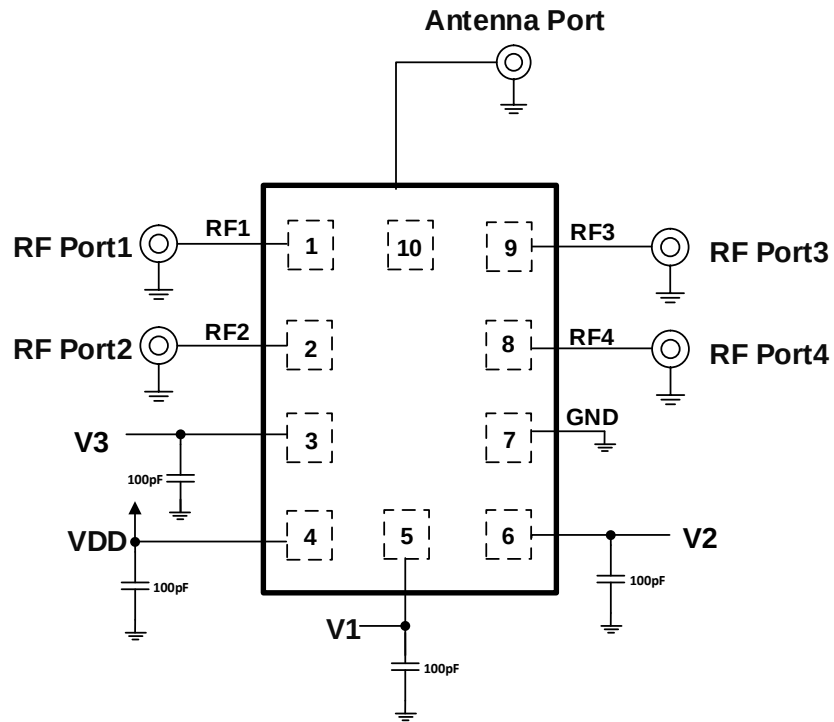


Figure 3. MXD8544A Application Circuit

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	V3	Control Logic #3	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	V3	RF Path
1	0	0	1	All Ron
2	0	1	1	ANT to RF1 and RF2
3	1	0	1	ANT to RF3 and RF4
4	0	0	0	ANT to RF1
5	0	1	0	ANT to RF2
6	1	0	0	ANT to RF3
7	1	1	0	ANT to RF4
8	1	1	1	All isolation

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	3.3	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

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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	3.3	V	
Supply current	I _{DD}		75	110	uA	V _{DD} = 2.8 V
Control current	I _{CTL}		1	5	uA	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	26	28		dB	0.8 to 1.0 GHz
		22	24		dB	1.0 to 2.2 GHz
		19	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}		1.05	1.15	Ω	Switch on Path
OFF Capacitance (RF1/2/3/4 to ANT)	C _{off}		130	150	fF	Switch off Path
Input 0.1 dB compression point	P _{0.1dB}	+43	+43.3		dBm	0.8 to 3.0 GHz, ANT to RF1/2/3/4
Peak RF operating voltage	V _{peak}		45		V	f ₀ = 700 to 2700 MHz, 25% duty cycle
LTE TX harmonic (RF1/2/3/4 to ANT)	2f ₀		-90	-80	dBm	f ₀ = 700 to 2700 MHz, PIN = +26 dBm
	3f ₀		-80	-70	dBm	
GSM LB harmonic (RF1/2/3/4 to ANT)	2f ₀		-60	-50	dBm	f ₀ = 824 to 915 MHz, PIN = +35 dBm
	3f ₀		-60	-50	dBm	
GSM HB harmonic (RF1/2/3/4 to ANT)	2f ₀		-60	-50	dBm	f ₀ = 1710 to 2690 MHz, PIN = +33 dBm
	3f ₀		-60	-50	dBm	
Second order intermodulation	IMD2		-112	-105	dBm	CW Carrier on RF Port, +20 dBm CW Interferer on ANT port, -15 dBm
Third order intermodulation	IMD3		-112	-105	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	20	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}		+43.8	dBm
Operating temperature	T _{OP}	−30	+85	°C
Storage temperature	T _{STG}	−55	+150	°C
Electrostatic Discharge Human body model (HBM), Class 2 Machine Model (MM), Class B Charged device model (CDM), Class III	ESD_HBM ESD_MM ESD_CDM		2000 200 500	V

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

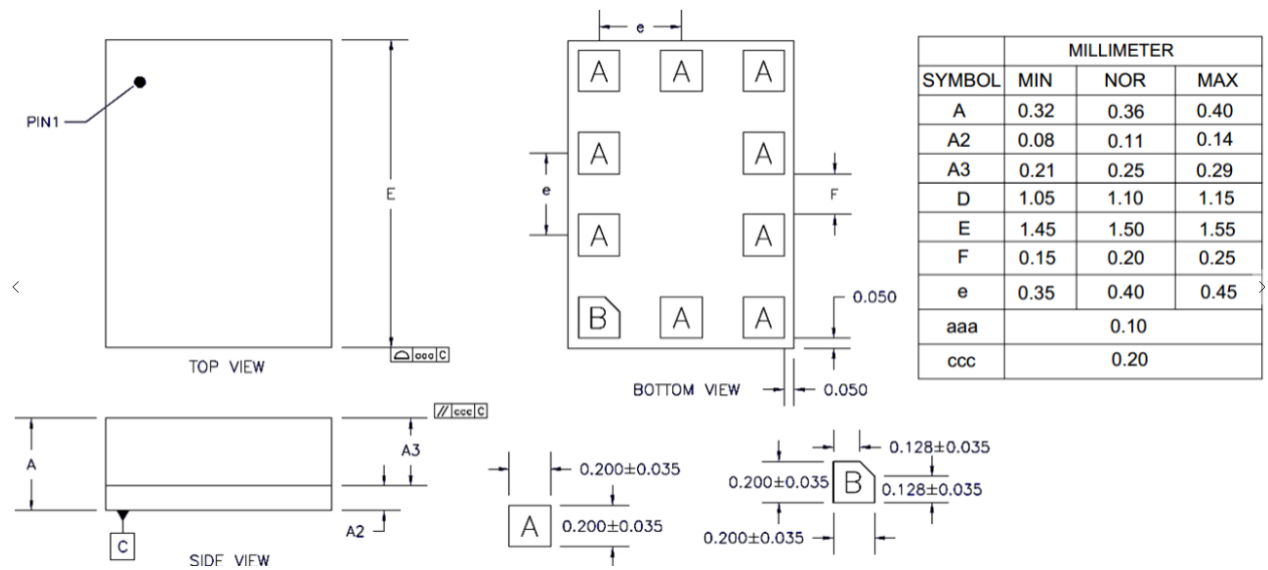


Figure 4. Package outline dimension

Reflow Chart

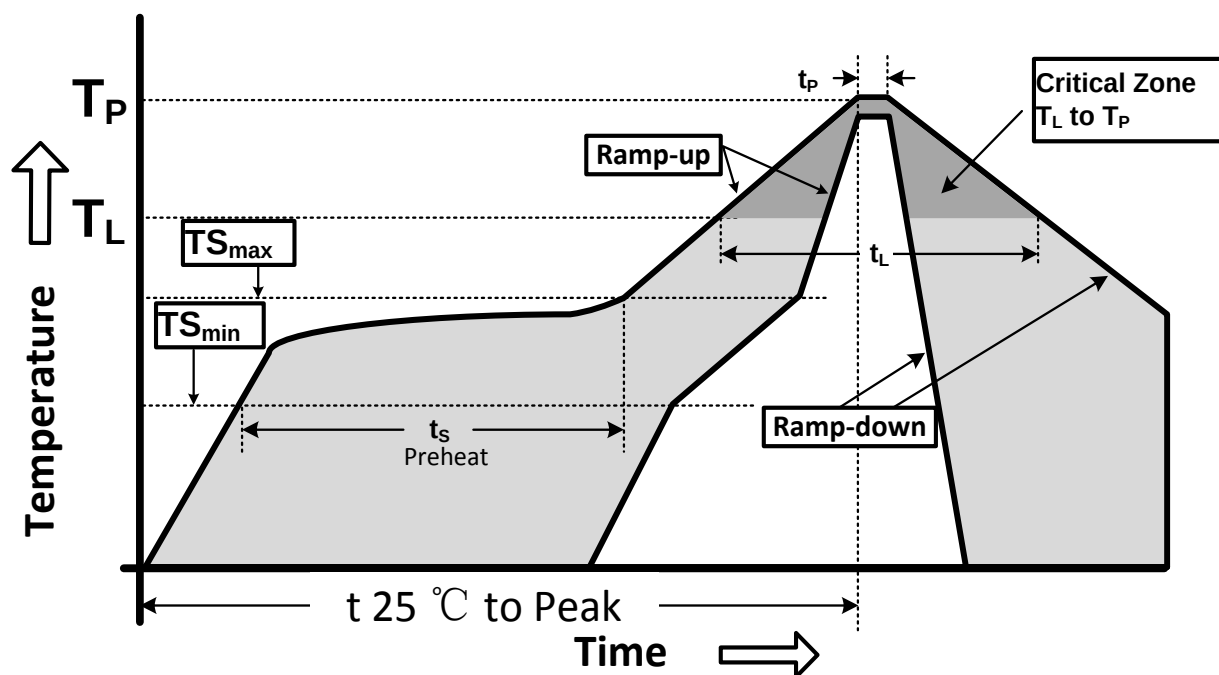


Figure 5. Recommended Lead-Free Reflow Profile

Table 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 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.