MXD8545A

0.1-3.0GHz SP4T Antenna Tuning Switch

General Description

The MXD8545A 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 MXD8545A 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 43.3dBm
- Positive low voltage control: VC = 1.0 to 3.0 V, VDD = 2.5 to 3.3 V, Small QFN (10-pin, 1.1mm x 1.5mm x 0.38mm) package，MSL1
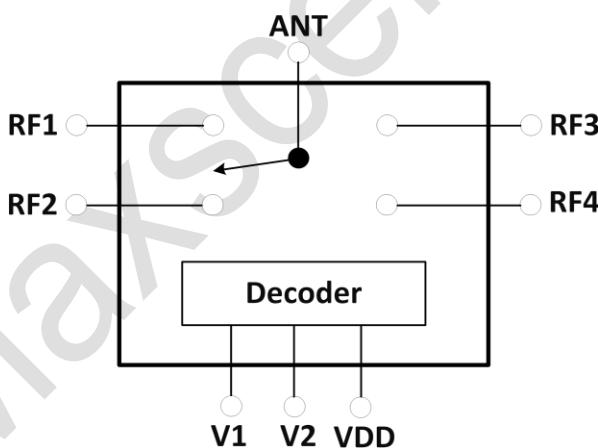
Functional Block Diagram and Pin Function
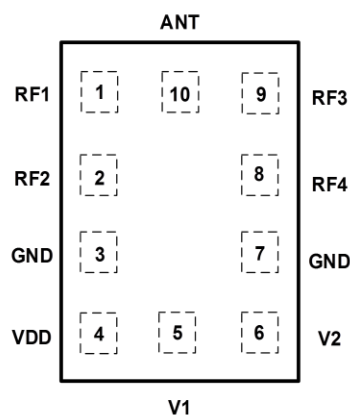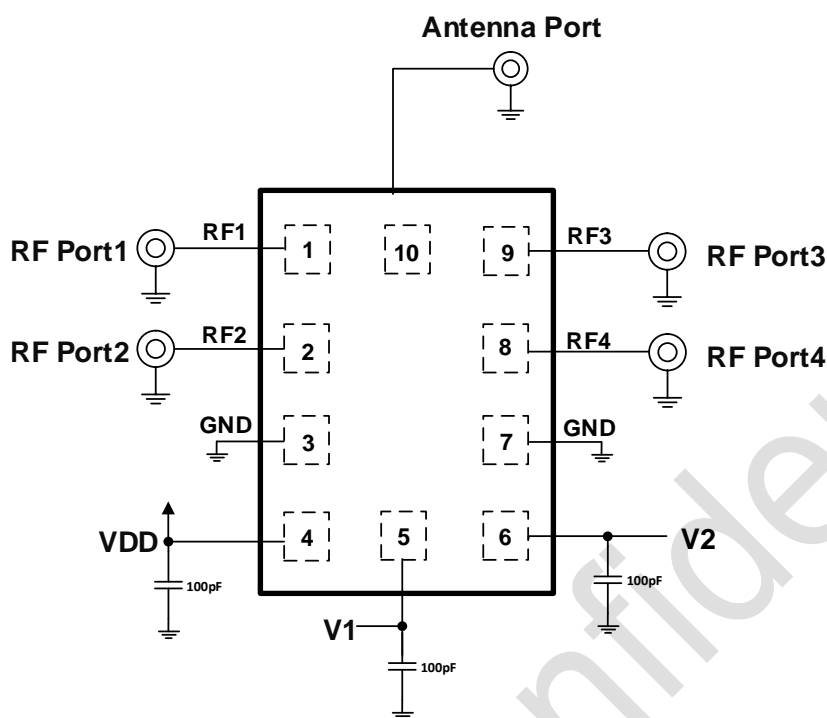

Figure 1.Functional Block Diagram

Figure 2.Pin-out (Top View)

Application Circuit

Figure 3. MXD8545A 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	3.3	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

Specifications

Table 4.Electrical Specifications

Parameter	Symbol	Specification			Units	Test Condition
		Min.	Typical	Max.		
DC Specifications						
Control voltage: Low High	V_{CTL_L} V_{CTL_H}	0 1.0	0 1.8	0.3 3.0	V 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 0.50	0.45 0.55 0.70	dB dB dB	0.8 to 1.0 GHz 1.0 to 2.2 GHz 2.2 to 3.0 GHz
Isolation	ISO	26 22 19	28 24 22		dB dB dB	0.8 to 1.0 GHz 1.0 to 2.2 GHz 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)	Ron		1.05	1.15	Ω	Switch on Path
OFF Capacitance (RF1/2/3/4 to ANT)	Coff		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	f0 = 700 to 2700 MHz, 25% duty cycle
LTE TX harmonic (RF1/2/3/4 to ANT)	2f0		-80	-70	dBm	f0 = 700 to 2700 MHz, PIN = +26 dBm
	3f0		-90	-80	dBm	
GSM LB harmonic (RF1/2/3/4 to ANT)	2f0		-60	-50	dBm	f0 = 824 to 915 MHz, PIN = +35 dBm
	3f0		-60	-50	dBm	
GSM HB harmonic (RF1/2/3/4 to ANT)	2f0		-60	-50	dBm	f0 = 1710 to 2690 MHz, PIN = +33 dBm
	3f0		-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
input power (RF port, 25% DC)	P_{IN}		+43.8	dBm
input power (RF port, VSWR =10:1, CW)	P_{IN}		+38	dBm
input power (RF port, LTE 10M Full RB, VSWR =10:1,CW)	P_{IN}		+32	dBm
input power (GSM LB, CW and 50% DC)	P_{IN}		+40	dBm
input power (GSM HB, CW and 50% DC)	P_{IN}		+38	dBm
Operating temperature	T_{OP}	−35	+90	℃
Storage temperature	T_{STG}	−55	+150	℃
Electrostatic Discharge Human body model (HBM), Class 2	ESD_HBM		1500	V
Machine Model (MM), Class B	ESD_MM		150	
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.
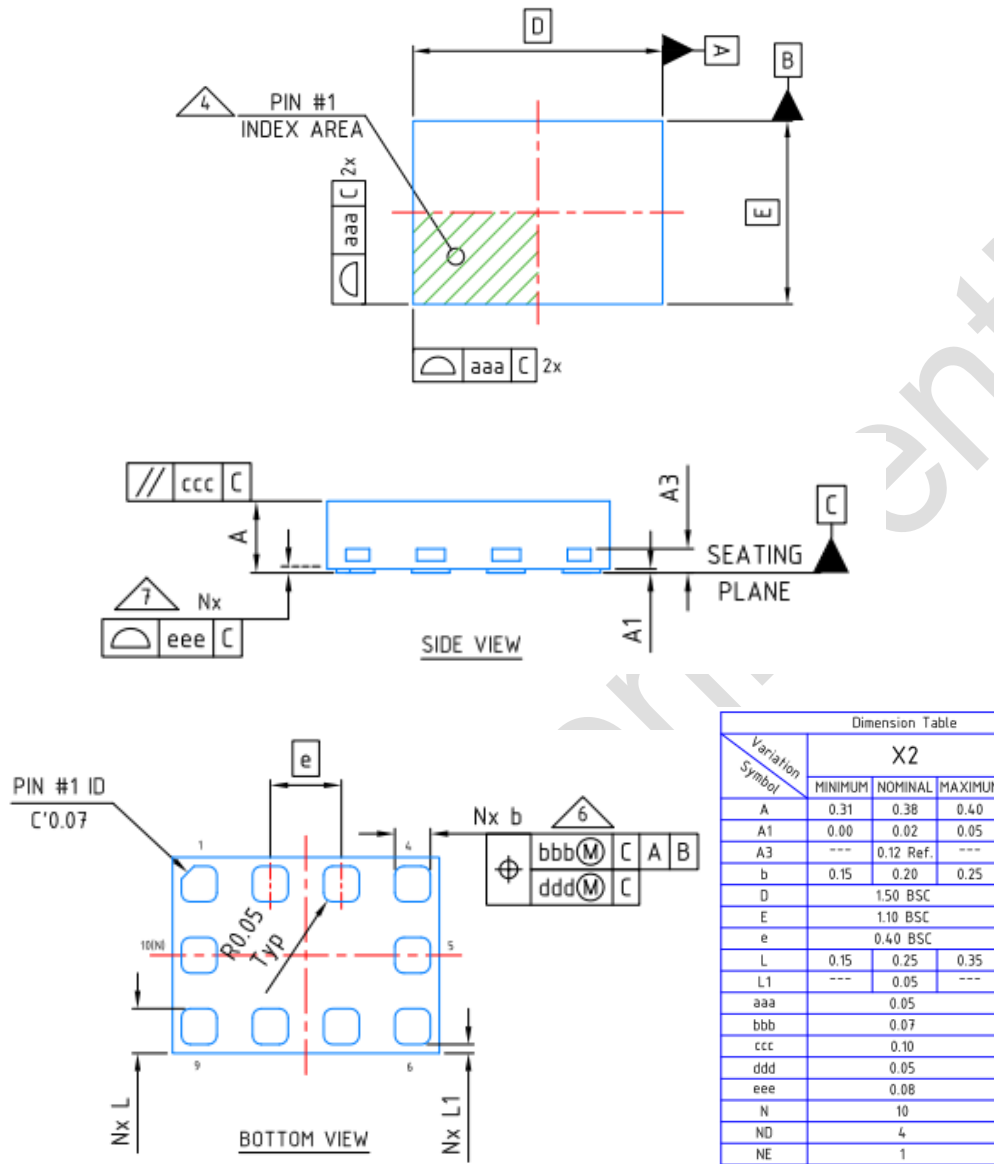
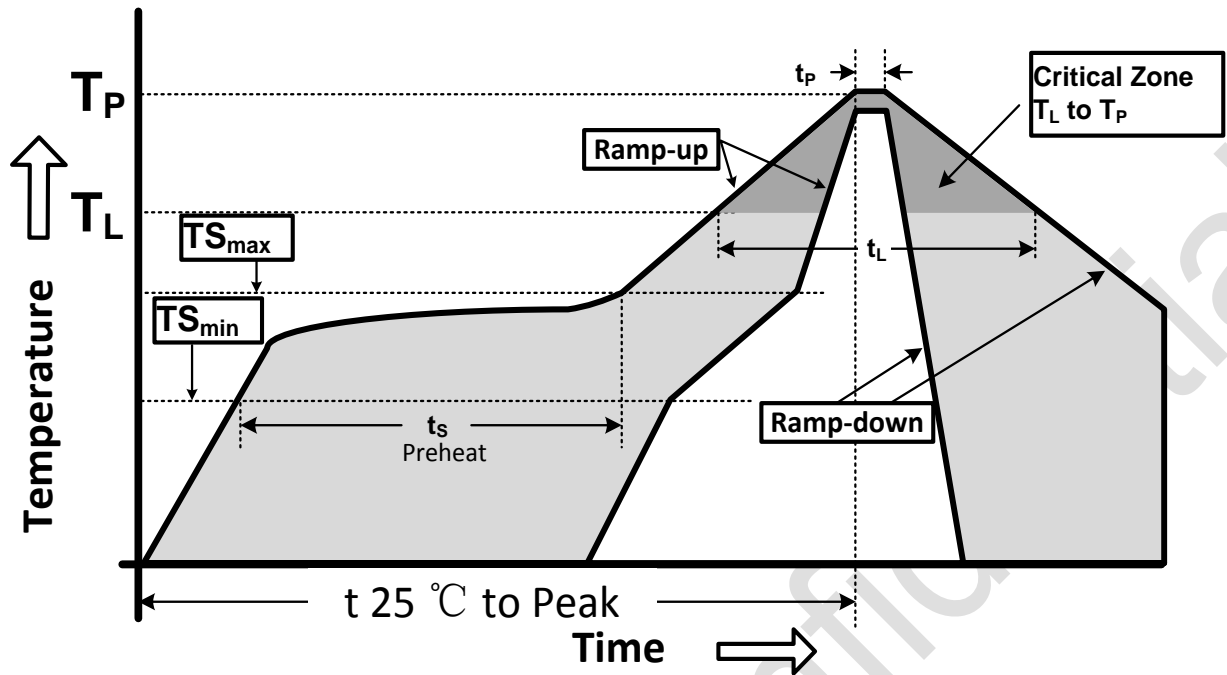## Package Outline Dimension

Figure 4. Package outline dimension

Dimension Table			
Variation Symbol	X2		
	MINIMUM	NOMINAL	MAXIMUM
A	0.31	0.38	0.40
A1	0.00	0.02	0.05
A3	---	0.12 Ref.	---
b	0.15	0.20	0.25
D	1.50 BSC		
E	1.10 BSC		
e	0.40 BSC		
L	0.15	0.25	0.35
L1	---	0.05	---
aaa	0.05		
bbb	0.07		
ccc	0.10		
ddd	0.05		
eee	0.08		
N	10		
ND	4		
NE	1		

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℃/second max.
Preheat temperature（TS_{min} to TS_{max}）	150℃ to 200℃
Preheat time（t_s）	60 - 180 seconds
Time above TL , 217℃（t_L）	60 - 150 seconds
Peak temperature（T_p）	260℃
Time within 5℃ of peak temperature(t_p)	20 - 40 seconds
Ramp-down rate	6℃/second max.
Time 25℃ 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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