MXD8543C

0.4~3.8GHz SP4T Antenna Tuning Switch

Description

The MXD8543C 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 MXD8543C SP4T switch is provided in a compact QFN 1.6mm x 1.6mm x 0.38mm package. A functional block diagram is shown in Figure 1. The pin configuration and package are shown in Figure 1 too. 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: 0.4 to 3.8GHz
- Low insertion: 0.50dB @2.7GHz
- High Peak RF Operating Voltage: 75V
- Ultra-Low On Resistance: 1.75Ω
- Positive low voltage control: V_{CH} = 1.5 to 3.0V
- Small QFN (11-pin, 1.6mm x 1.6mm x 0.38mm) package, MSL1

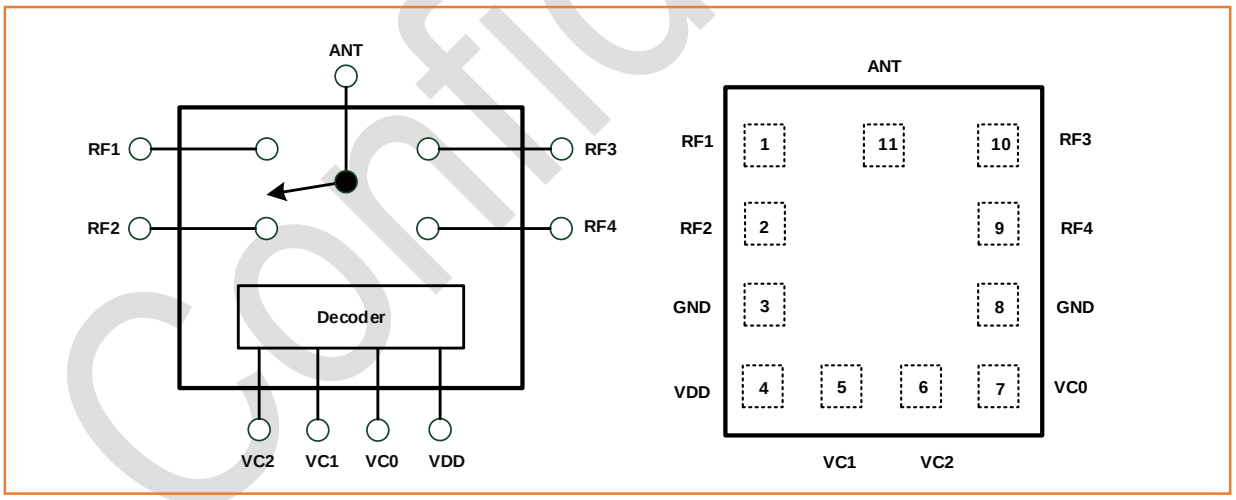

Figure 1 Functional Block and Pin Diagram

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Function Characteristics

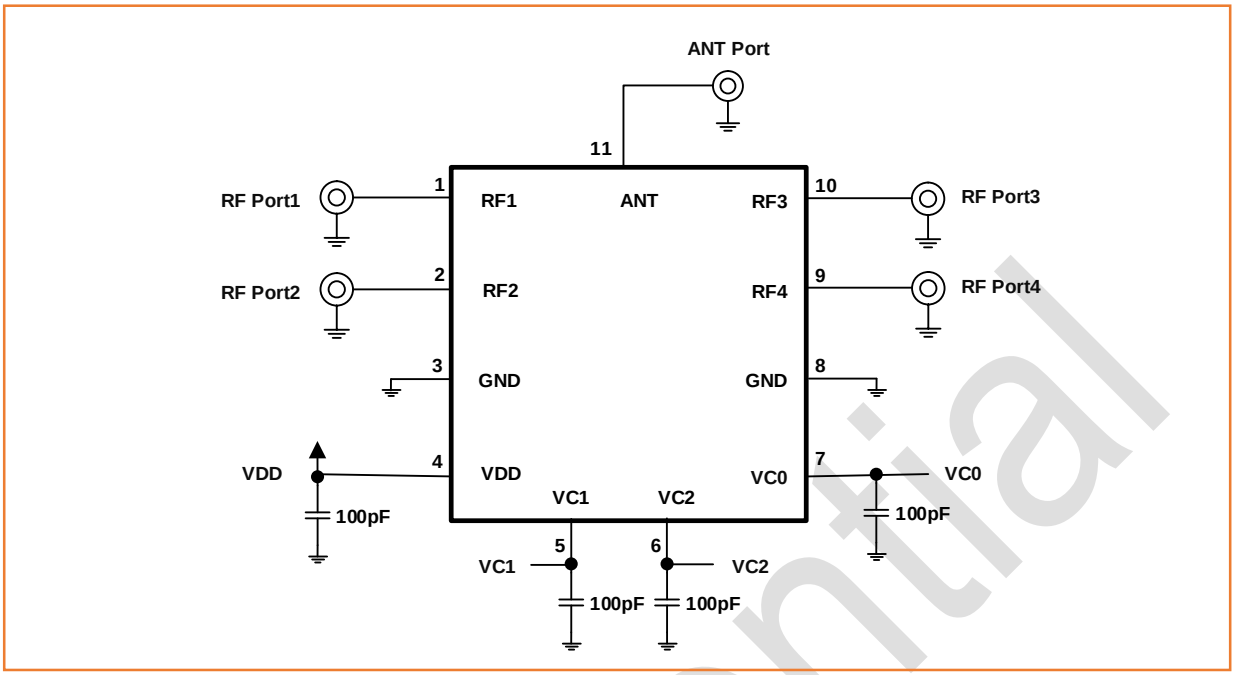

Figure 2 Application Circuit

Table 1 Pin Descriptions

NO.	Name	Description	NO.	Name	Description
1	RF1	RF Port 1	7	VC0	Logic Control Voltage 0
2	RF2	RF Port 2	8	GND	Ground
3	GND	Ground	9	RF4	RF Port 4
4	VDD	DC Power Supply Voltage	10	RF3	RF Port 3
5	VC1	Logic Control Voltage 1	11	ANT	Antenna Port
6	VC2	Logic Control Voltage 2			

Table 2 VC Truth Table for RF Channel Operating Mode

Mode	VC0	VC1	VC2	RF Path Mode
1	Low	Low	Low	All On
2	Low	Low	High	ANT to RF3 and RF4 On
3	Low	High	Low	ANT to RF1 and RF2 On
4	Low	High	High	Isolation
5	High	Low	Low	ANT to RF1 On
6	High	Low	High	ANT to RF2 On
7	High	High	Low	ANT to RF3 On
8	High	High	High	ANT to RF4 On

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Electrical Characteristics

Table 3 Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Condition
DC Supply Voltage	V_{DD}	-0.3	+3.6	V	T_A=25℃
Logic Control Voltage (VC0, VC1,VC2)	V_C	-0.3	+3.6		
Peak RF Input Power	P_{IN}		+48	dBm	20% DC, T_A=25℃
Device Operating Temperature	T_{OP}	-40	+90	℃	
Device Storage Temperature	T_{STG}	-55	+150		
Electrostatic Discharge	$V_{ESD(HBM)}$		1000	V	Human Body Model (HBM), Class 1C
	$V_{ESD(MM)}$		100		Machine Model (MM), Class A
	$V_{ESD(CDM)}$		500		Charged Device Model (CDM), Class III

Notice

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.

Table 4 Recommended Operating Conditions

Parameter	Symbol	MIN	TYP	MAX	Unit
Operating Frequency	F_0	0.4		3.8	GHz
DC Supply Voltage	V_{DD}	1.7	2.8	3.3	V
Logic Control Voltage High(VC0,VC1,VC2)	V_{CH}	1.5	1.8	3.0	V
Logic Control Voltage Low(VC0,VC1,VC2)	V_{CL}	0	0	0.3	V

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Table 5 Nominal Operating Parameters

Parameter	Symbol	Specification			Unit	Condition
		MIN	TYP	MAX		
Normal Condition	V_{DD}=2.8V, V_{CH}=1.8V, V_{CL}=0V, T_A=25℃, P_{IN}=0dBm, Z_O=50Ω, Unless Otherwise Stated					
DC Performances						
DC Supply Current	I_{DD}		140	170	μA	
Current on VC	I_C		1	5	μA	
Timing Performances						
RF Path Switching Time	T_{SW}		9	15	μs	From 50% of final VC to 10%/90% of final RF power
Startup Time	T_{ON}		20	30	μs	From 50% of final VDD to 90% of the RF power
RF Performances						
Insertion Loss (ANT to RF1/2/3/4)	IL		0.25 0.35 0.50 0.75	0.35 0.45 0.70 0.90	dB	F_0=0.4 to 1.0GHz F_0=1.0 to 2.2GHz F_0=2.2 to 3.0GHz F_0=3.4 to 3.8GHz
Isolation (ANT to RF1/2/3/4)	ISO	27 22 19 16	31 26 22 19		dB	F_0=0.4 to 1.0GHz F_0=1.0 to 2.2GHz F_0=2.2 to 3.0GHz F_0=3.4 to 3.8GHz
Input Return Loss	RL	12	15		dB	F_0=0.4 to 3.8GHz
Voltage Standing Wave Ratio(All Ports)	VSWR		1.4:1	2.0:1		F_0=0.4 to 3.8GHz
On Resistance (ANT to RF1/2/3/4)	R_{ON}		1.75	1.90	Ω	RF Path Switch ON @DC
Off Capacitance (ANT to RF1/2/3/4)	C_{OFF}		90	110	fF	RF Path Switch Off @500MHz
Peak RF Operating Voltage (ANT to RF1/2/3/4)	V_{RF}	70	75		V	F_0=950MHz until 3F_0 Nonlinear Isolation Mode
Input 0.1dB Compression Point(ANT to RF1/2/3/4)	$P_{0.1dB}$	+47	+48		dBm	F_0=0.4 to 3.8GHz, 20% DC
LTE TX Harmonic (ANT to RF1/2/3/4)	$2F_0$		-90	-80	dBm	F_0=400 to 3800MHz @+26dBm
	$3F_0$		-90	-80		
GSM LB Harmonic (ANT to RF1/2/3/4)	$2F_0$		-65	-55	dBm	F_0=824 to 915MHz @+35dBm
	$3F_0$		-65	-55		
GSM HB Harmonic (ANT to RF1/2/3/4)	$2F_0$		-65	-55	dBm	F_0=1710 to 1910MHz @+33dBm
	$3F_0$		-65	-55		
2nd Order Intermodulation	IMD2		-115	-105	dBm	Reference to Table 6
3rd Order Intermodulation	IMD3		-115	-105		Reference to Table 7

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Table 6 IMD2 Test Conditions

Band	In-Band Frequency	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 7 IMD3 Test Conditions

Band	In-Band Frequency	CW Carrier		CW Interferer	
	MHz	MHz	dBm	MHz	dBm
1 Low	2140	1950	+20	1760	-15
5 High	881.5	836.5	+20	791.5	-15

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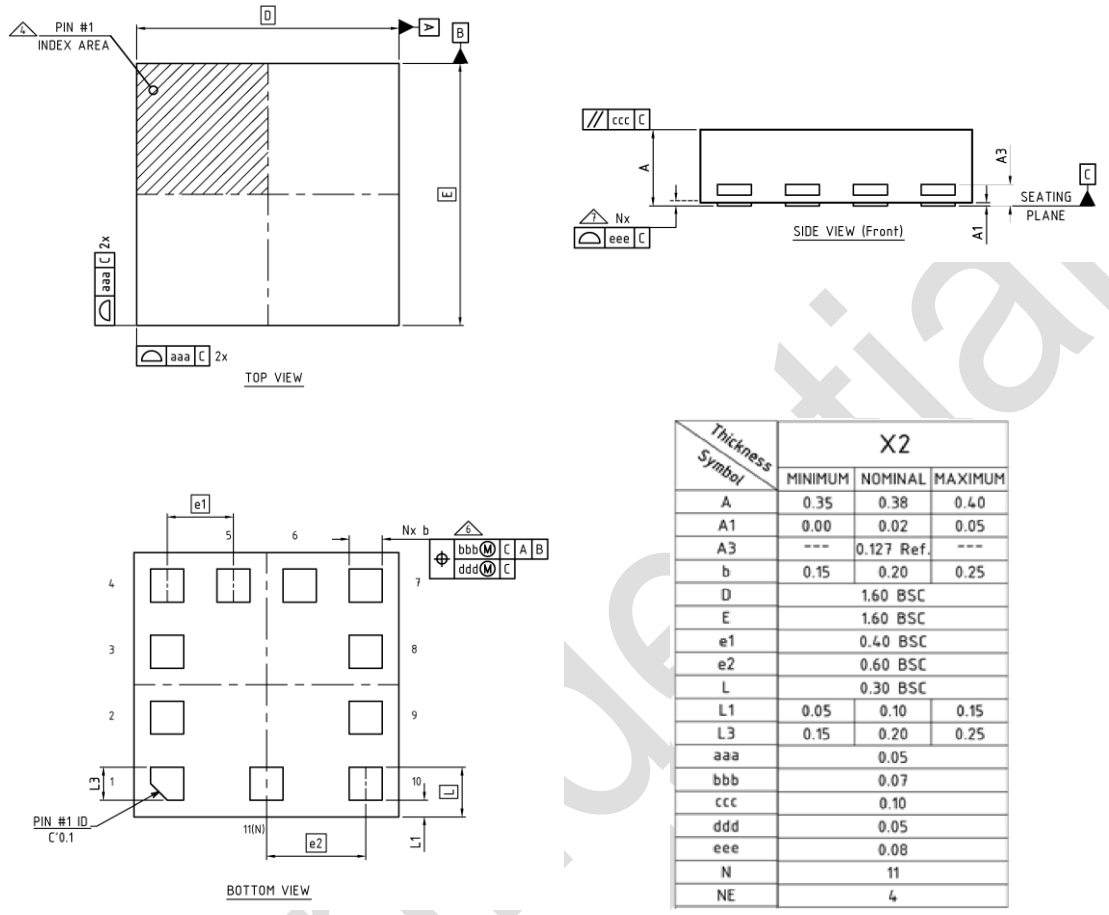
Package Outline Dimensions



Thickness / Symbol	X2		
	MINIMUM	NOMINAL	MAXIMUM
A	0.35	0.38	0.40
A1	0.00	0.02	0.05
A3	---	0.127 Ref.	---
b	0.15	0.20	0.25
D		1.60 BSC	
E		1.60 BSC	
e1		0.40 BSC	
e2		0.60 BSC	
L		0.30 BSC	
L1	0.05	0.10	0.15
L3	0.15	0.20	0.25
aaa		0.05	
bbb		0.07	
ccc		0.10	
ddd		0.05	
eee		0.08	
N		11	
NE		4	

Figure 3 Package Outline Dimensions

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Marking Specification

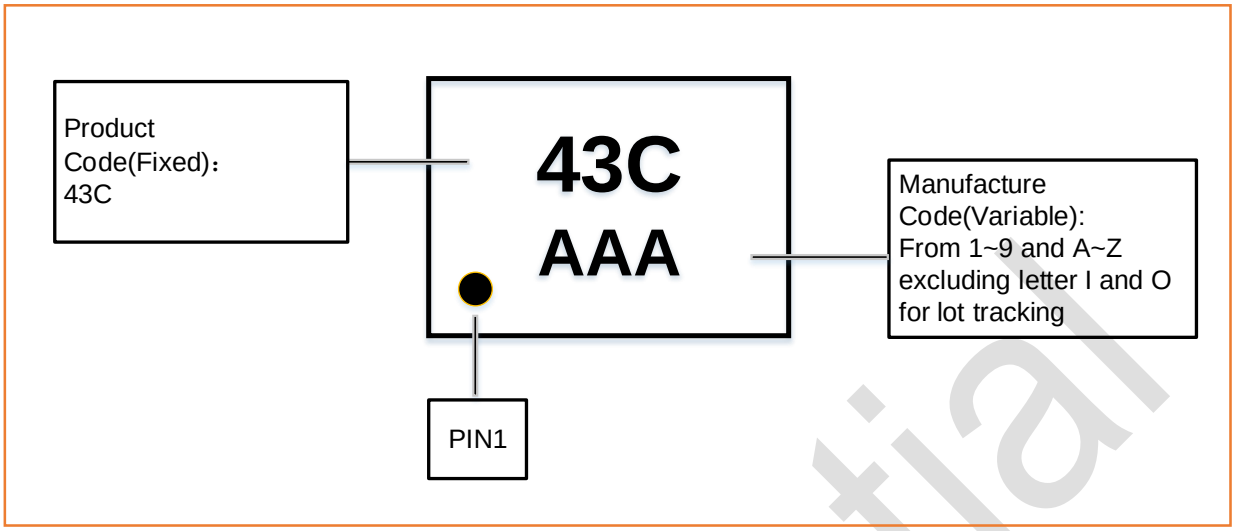

Figure 4 Marking Specification(Top View)

Tape and Reel Dimensions

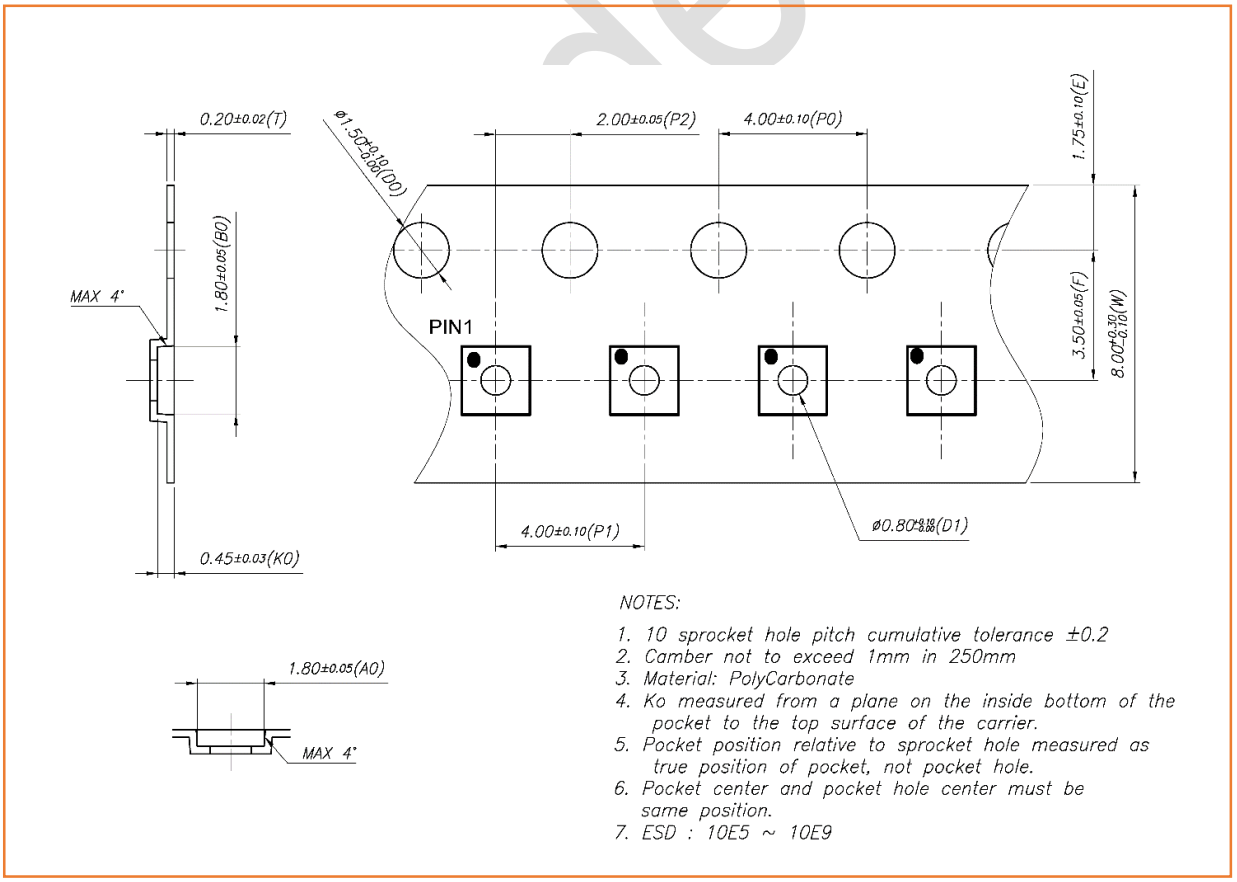

Figure 5 Tape and Reel Dimensions

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Reflow Chart

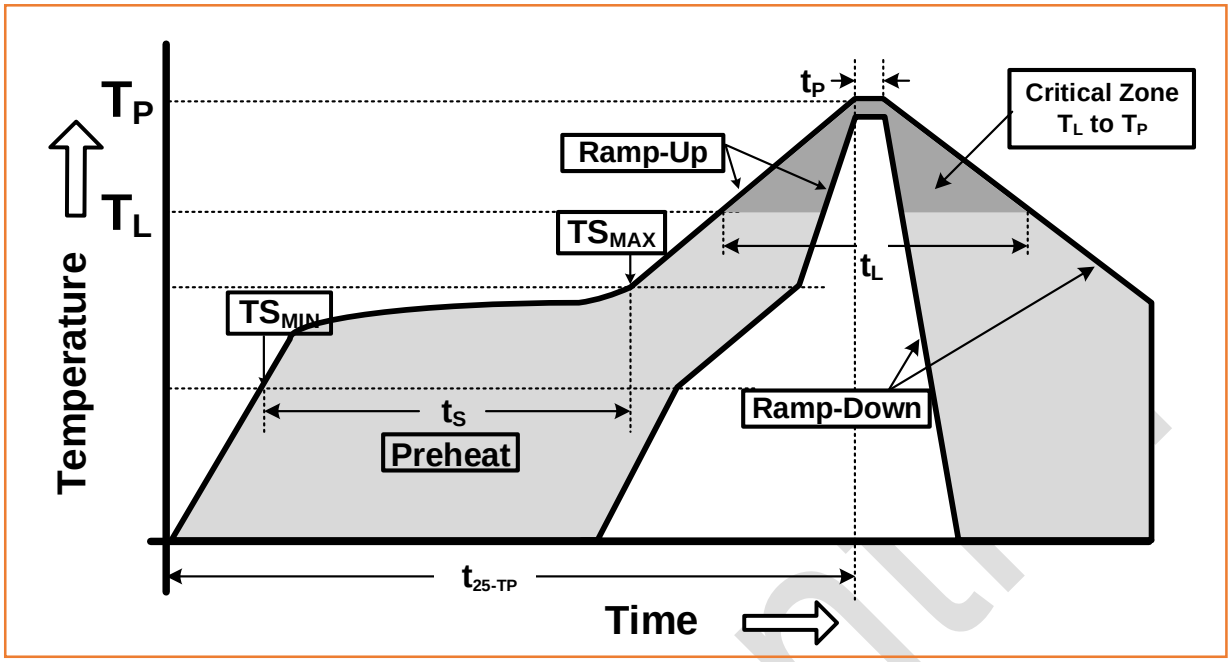

Figure 6 Recommended Lead-Free Reflow Profile

Table 8 Reflow Chart Parameters

Reflow Profile	Parameter
Preheat Temperature(TS_{MIN} to TS_{MAX})	150℃ to 200℃
Preheat Time(t_s)	60 to180 Seconds
Ramp-Up Rate(TS_{MAX} to T_P)	3℃/s MAX
Time Above T_L 217℃(t_L)	60 to 150 Seconds
Peak Temperature (T_P)	260℃
Time within 5℃ of Peak Temperature(t_P)	20 to 40 Seconds
Ramp-Down Rate(TS_{MAX} to T_P)	6℃/s MAX
Time for 25℃ to Peak Temperature($t_{25\text{-}TP}$)	8 Minutes MAX

ESD Sensitivity

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

RoHS Compliant

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

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