# MXD8921H

## SiGe Low Noise Amplifier

## with Bypass Mode for LTE Mid-High Band

## Rev1.3

## General Description

MXD8921H high gain, low noise amplifier (LNA) is dedicated to LTE middle band and high band receive using advanced SiGe process. This product has two operation modes, low noise mode and bypass mode.

MXD8921H works under a 1.6V to 3.6V single power supply while consumes 4.2 mA current in low noise mode, in bypass mode, the power consumption will be reduced to less than 1uA.

MXD8921H uses a small 1.1mm × 0.7mm × 0.45mm LGA 6-pin package.

## Applications

- LTE high-mid band receiving

## Features

- Broadband frequency range: 1.7G to 2.7 GHz
- High Gain
  - 14.6dB gain at 1.7GHz to 1.8GHz
  - 14.5dB gain at 1.8GHz to 2.2GHz
  - 13.5dB gain at 2.3GHz to 2.7GHz
- Ultra low noise figure
  - 0.60dB noise figure at 1.7GHz to 1.8GHz
  - 0.65dB noise figure at 1.8GHz to 2.2GHz
  - 0.8dB noise figure at 2.3GHz to 2.7GHz
- Operation current 4.2mA
- Single supply voltage range 1.6V to 3.6V
- Small, LGA (6-pin, 1.1mm x 0.7mm x 0.45mm) package ，MSL1



## Pin Configuration/Application Diagram (Top view)

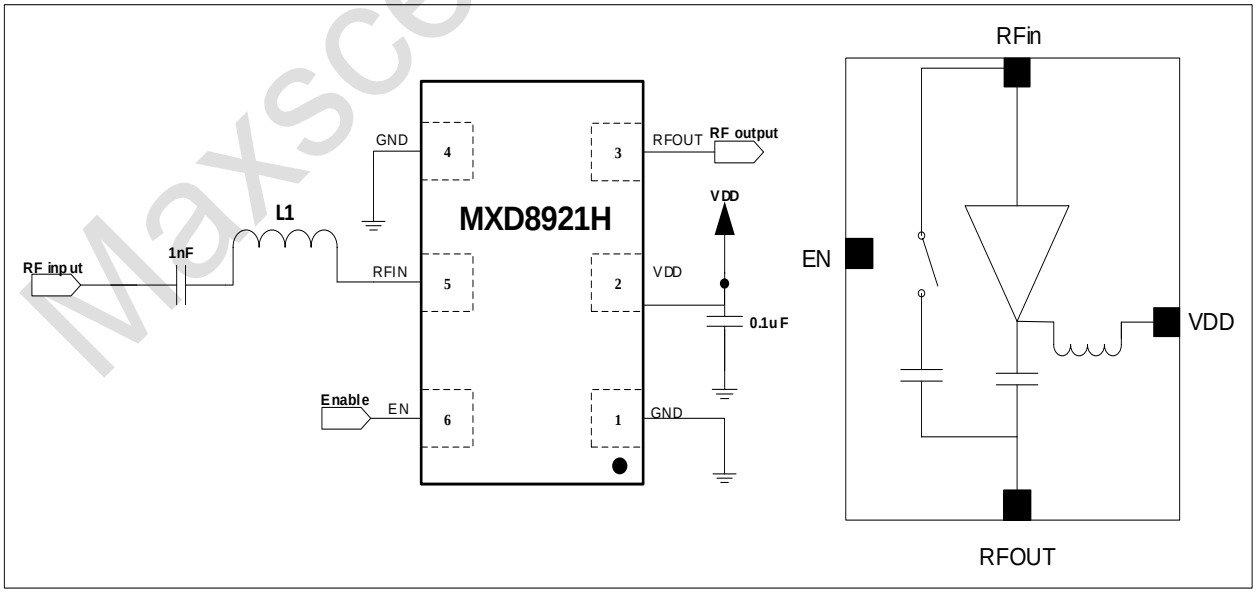



**Figure 1 MXD8921H application circuit**

## Pin Descriptions & Input matching inductance

**Table 1**

| Pin | Pin Name | I/O | Pin Description |
|---|---|---|---|
| 1 | GND | AG | Analog VSS |
| 2 | VDD | AP | Power supply |
| 3 | RFOUT | AO | LNA output |
| 4 | GND | AG | Analog VSS |
| 5 | RFIN | AI | LNA input from antenna |
| 6 | EN | DI | Pull high into low noise mode, pull low into bypass mode |

**Note:** *DI* (digital input), *DO* (digital output), *DIO* (digital bidirectional), *AI* (analog input), *AO* (analog output), *AIO* (analog bidirectional), *AP* (analog power), *AG* (analog ground),

**Table 2 Input matching inductance**

| Component | Matching Band | Vendor | Type | Part Number & value |
|---|---|---|---|---|
| L1 | 1700MHz – 1800MHz | Murata | Wired inductor, high Q | LQW15AN, 5.1nH |
| | | various | Ceramic inductor, low Q | 4.7nH |
| | 1800MHz – 2200MHz | Murata | Wired inductor, high Q | LQW15AN, 4.6nH |
| | | various | Ceramic inductor, low Q | 4nH |
| | 2300MHz – 2700MHz | Murata | Wired inductor, high Q | LQW15AN, 3.9nH |
| | | various | Ceramic inductor, low Q | 3.3nH |

## Recommended Operation Range

**Table 3**

| Parameters | Symbol | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| Operation Frequency | f1 | 1700 | - | 2700 | MHz |
| Power supply | $V_{DD}$ | 1.6 | 2.8 | 3.6 | V |
| Control Voltage High | $V_{CTL\_H}$ | 1.0 | 1.8 | VDD | V |
| Control Voltage Low | $V_{CTL\_L}$ | 0 | 0 | 0.3 | V |

## Absolute Maximum Ratings

**Table 4 Maximum ratings**

| Parameters | Symbol | Minimum | Maximum | Units |
|---|---|---|---|---|
| Supply voltage | $V_{DD}$ | -0.3 | +4.0 | V |
| Digital control voltage | $V_{CTL}$ | -0.3 | VDD+0.3 | V |
| RF input power | $P_{IN}$ | - | +25 | dBm |
| Operating temperature | $T_{OP}$ | –40 | +90 | ℃ |
| Storage temperature | $T_{STG}$ | –65 | +160 | ℃ |
| Electrostatic Discharge<br>Human body model (HBM), Class 1B[Note1]<br>Charged device model (CDM), Class III[Note2] | <br>ESD_HBM<br>ESD_CDM | - | <br>2000<br>1000 | 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.
**Note1**: According to ESDA/JEDECJS-001-2014
**Note2**: According to ESDA/JEDECJS-002-2014

## Specifications

Typically $T_A$=25℃ VDD=2.8V, All data measured on Maxscend's EVB, unless otherwise noted

**Table 5 High Gain mode Electrical Specifications**

| Parameter | Symbol | Specification | | | Units | Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typical | Max. | | |
| **DC Specifications** | | | | | | |
| Supply voltage | $V_{DD}$ | 1.6 | 2.8 | 3.6 | V | |
| Supply current | $I_{DD}$ | 3 | 4.2 | 5.8 | mA | $V_{DD}$ = 2.8V, $V_{EN}$=1.8V |
| **RF Specifications** | | | | | | |
| Power gain | G | 12.6<br>12.5<br>11.5 | 14.6<br>14.5<br>13.5 | 16.6<br>16.5<br>15.5 | dB<br>dB<br>dB | 1700-1800MHz<br>1800-2200MHz<br>2300-2700MHz |
| Noise figure | NF | -<br>-<br>- | 0.6<br>0.65<br>0.8 | 0.95<br>1.0<br>1.15 | dB<br>dB<br>dB | 1700-1800MHz<br>1800-2200MHz<br>2300-2700MHz |
| Input Return loss | \|S11\| | -<br>-<br>- | -8<br>-10<br>-12 | -4<br>-5<br>-6 | dB<br>dB<br>dB | 1700-1800MHz<br>1800-2200MHz<br>2300-2700MHz |
| Output Return loss | \|S22\| | -<br>-<br>- | -8<br>-12<br>-14 | -4<br>-6<br>-8 | dB<br>dB<br>dB | 1700-1800MHz<br>1800-2200MHz<br>2300-2700MHz |
| Isolation | ISL | - | -23 | -18 | dB | 1700 to 2700MHz |
| Stability factor | Kf | 1.0 | - | - | | |
| Input 1 dB compression point | P1dB | -8.3<br>-6 | -4.8<br>-2.5 | -<br>- | dBm<br>dBm | at 2GHz<br>at 2.5GHz |
| Input IP3 | IIP3 | 0<br>2 | 5<br>7 | -<br>- | dBm<br>dBm | Note1<br>Note2 |
| Switch time | turn-on-time | - | - | 4 | μs | Bypass state to High gain state, to 90% of the Gain |
| | turn-off-time | - | - | 1 | μs | High Gain state to Bypass state, to 10% of the Gain |

**Note1: Pin=Pin2=-20dBm, F1=2000MHz, F2=2001MHz**
**Note2: Pin=Pin2=-20dBm, F1=2500MHz, F2=2501MHz**

**Table 6 Bypass mode Electrical Specifications**

| Parameter | Symbol | Specification | | | Units | Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typical | Max. | | |
| **DC Specifications** | | | | | | |
| Supply voltage | $V_{DD}$ | 1.6 | 2.8 | 3.6 | V | |
| Supply current | $I_{DD}$ | 0 | 0.1 | 1 | uA | $V_{DD}$ = 2.8 V, $V_{EN}$=low |
| **RF Specifications** | | | | | | |
| Insertion loss | IL | -8<br>-7 | -5<br>-4 | -<br>- | dB<br>dB | 1700-1800MHz<br>1800-2700MHz |
| Input Return loss | \|S11\| | - | -10 | -5 | dB | 1700 to 2700MHz |
| Output Return loss | \|S22\| | - | -10 | -5 | dB | 1700 to 2700MHz |
| Input 1 dB compression point | P1dB | 5 | 10 | - | dBm | 1700 to 2700MHz |

## Specifications

Typically $T_A$=25℃ VDD=1.8V, All data measured on Maxscend's EVB, unless otherwise noted

**Table 7 High Gain mode Electrical Specifications**

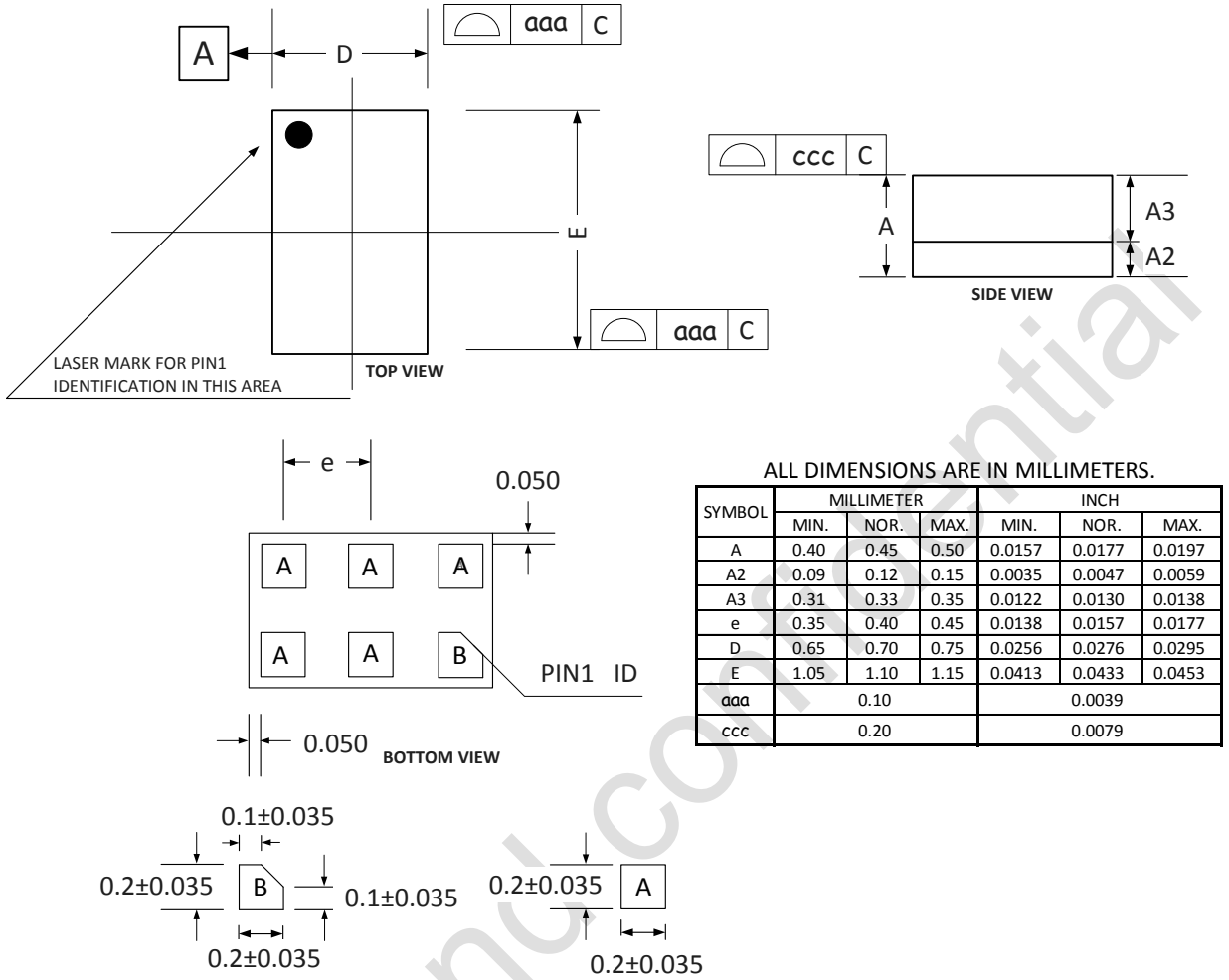
| Parameter | Symbol | Specification | | | Units | Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typical | Max. | | |
| **DC Specifications** | | | | | | |
| Supply voltage | $V_{DD}$ | 1.6 | 1.8 | 3.6 | V | |
| Supply current | $I_{DD}$ | 2.8 | 4.0 | 5.6 | mA | $V_{DD}$ = 1.8V, $V_{EN}$=1.8V |
| **RF Specifications** | | | | | | |
| Power gain | G | 12.3<br>12.2<br>11.2 | 14.3<br>14.2<br>13.2 | 16.3<br>16.2<br>15.2 | dB<br>dB<br>dB | 1700-1800MHz<br>1800-2200MHz<br>2300-2700MHz |
| Noise figure | NF | -<br>-<br>- | 0.6<br>0.65<br>0.8 | 0.95<br>1.0<br>1.15 | dB<br>dB<br>dB | 1700-1800MHz<br>1800-2200MHz<br>2300-2700MHz |
| Input Return loss | \|S11\| | -<br>-<br>- | -8<br>-10<br>-12 | -4<br>-5<br>-6 | dB<br>dB<br>dB | 1700-1800MHz<br>1800-2200MHz<br>2300-2700MHz |
| Output Return loss | \|S22\| | -<br>-<br>- | -8<br>-12<br>-14 | -4<br>-6<br>-8 | dB<br>dB<br>dB | 1700-1800MHz<br>1800-2200MHz<br>2300-2700MHz |
| Isolation | ISL | - | -23 | -18 | dB | 1700 to 2700MHz |
| Stability factor | Kf | 1.0 | - | - | | |
| Input 1 dB compression point | P1dB | -10.5<br>-8.5 | -7<br>-5 | -<br>- | dBm<br>dBm | at 2GHz<br>at 2.5GHz |
| Input IP3 | IIP3 | -1<br>0 | 3<br>5 | - | dBm<br>dBm | Note1<br>Note2 |
| Switch time | turn-on-time | - | - | 4 | μs | Bypass state to High gain state, to 90% of the Gain |
| | turn-off-time | - | - | 1 | μs | High Gain state to Bypass state, to 10% of the Gain |

**Note1: Pin=Pin2=-20dBm, F1=2000MHz, F2=2001MHz**
**Note2: Pin=Pin2=-20dBm, F1=2500MHz, F2=2501MHz**

**Table 8 Bypass mode Electrical Specifications**

| Parameter | Symbol | Specification | | | Units | Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typical | Max. | | |
| **DC Specifications** | | | | | | |
| Supply voltage | $V_{DD}$ | 1.6 | 1.8 | 3.6 | V | |
| Supply current | $I_{DD}$ | 0 | 0.1 | 1 | uA | $V_{DD}$ = 1.8 V, $V_{EN}$=low |
| **RF Specifications** | | | | | | |
| Insertion loss | IL | -8.4<br>-7.4 | -5.4<br>-4.4 | -<br>- | dB<br>dB | 1700-1800MHz<br>1800-2700MHz |
| Input Return loss | \|S11\| | - | -10 | -5 | dB | 1700 to 2700MHz |
| Output Return loss | \|S22\| | - | -10 | -5 | dB | 1700 to 2700MHz |
| Input 1 dB compression point | P1dB | 5 | 10 | - | dBm | 1700 to 2700MHz |

## Package Outline Dimensions




ALL DIMENSIONS ARE IN MILLIMETERS.

| SYMBOL | MILLIMETER | | | INCH | | |
|---|---|---|---|---|---|---|
| | MIN. | NOR. | MAX. | MIN. | NOR. | MAX. |
| A | 0.40 | 0.45 | 0.50 | 0.0157 | 0.0177 | 0.0197 |
| A2 | 0.09 | 0.12 | 0.15 | 0.0035 | 0.0047 | 0.0059 |
| A3 | 0.31 | 0.33 | 0.35 | 0.0122 | 0.0130 | 0.0138 |
| e | 0.35 | 0.40 | 0.45 | 0.0138 | 0.0157 | 0.0177 |
| D | 0.65 | 0.70 | 0.75 | 0.0256 | 0.0276 | 0.0295 |
| E | 1.05 | 1.10 | 1.15 | 0.0413 | 0.0433 | 0.0453 |
| aaa | 0.10 | | | 0.0039 | | |
| ccc | 0.20 | | | 0.0079 | | |

**Figure 2 MXD8921H outline dimension**

## Marking Specification

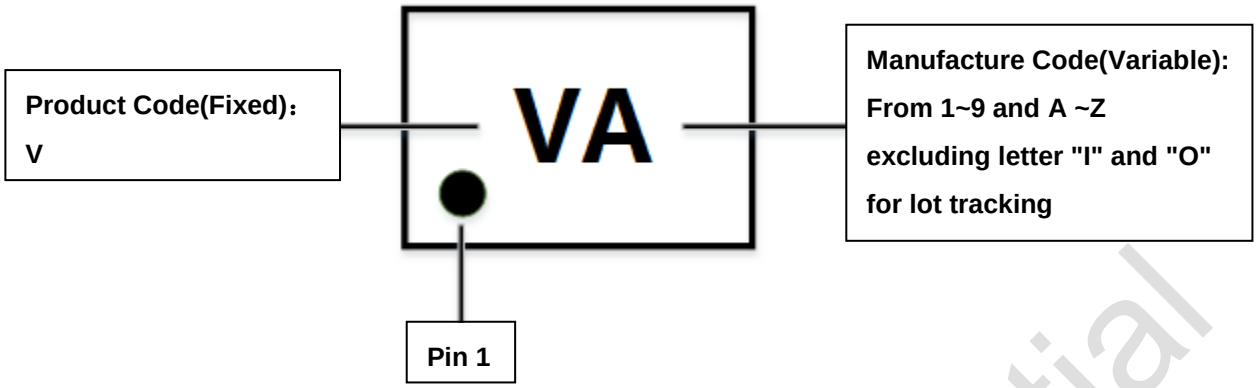
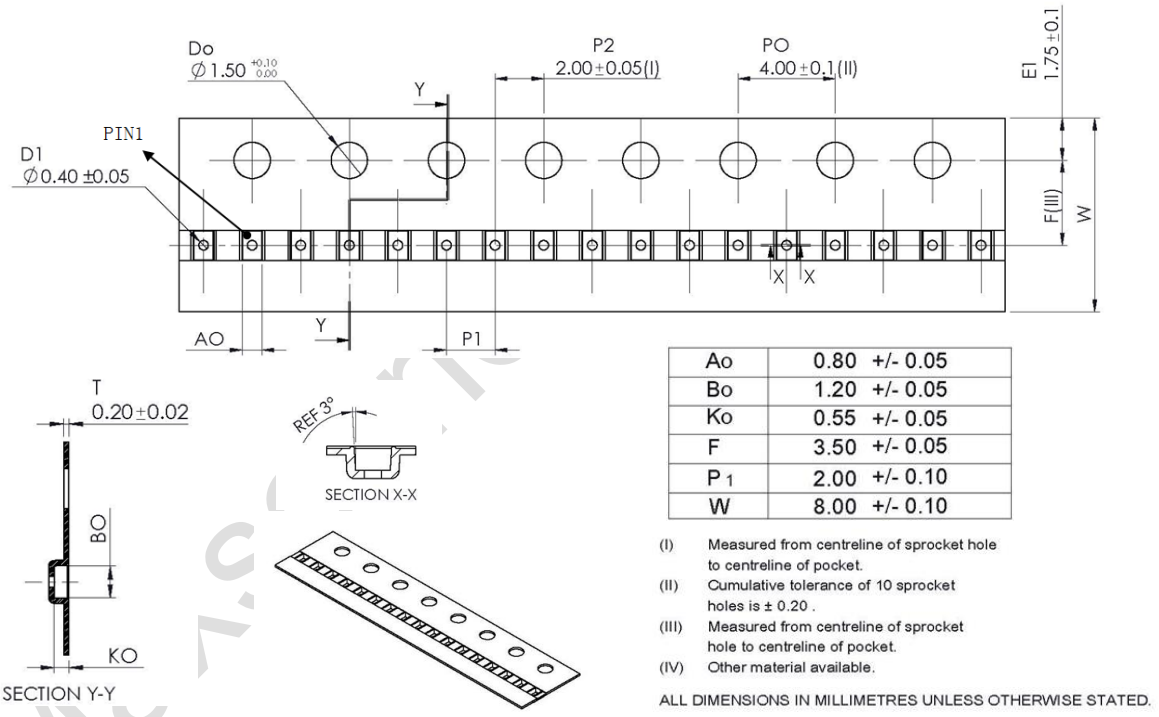



**Figure 3 Marking specification (Top View)**

## Tape and Reel Dimensions




| | |
|---|---|
| Ao | 0.80 +/- 0.05 |
| Bo | 1.20 +/- 0.05 |
| Ko | 0.55 +/- 0.05 |
| F | 3.50 +/- 0.05 |
| P 1 | 2.00 +/- 0.10 |
| W | 8.00 +/- 0.10 |

(I) Measured from centreline of sprocket hole to centreline of pocket.
(II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
(III) Measured from centreline of sprocket hole to centreline of pocket.
(IV) Other material available.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

**Figure 4 Tape and reel dimensions**

## Reflow Chart

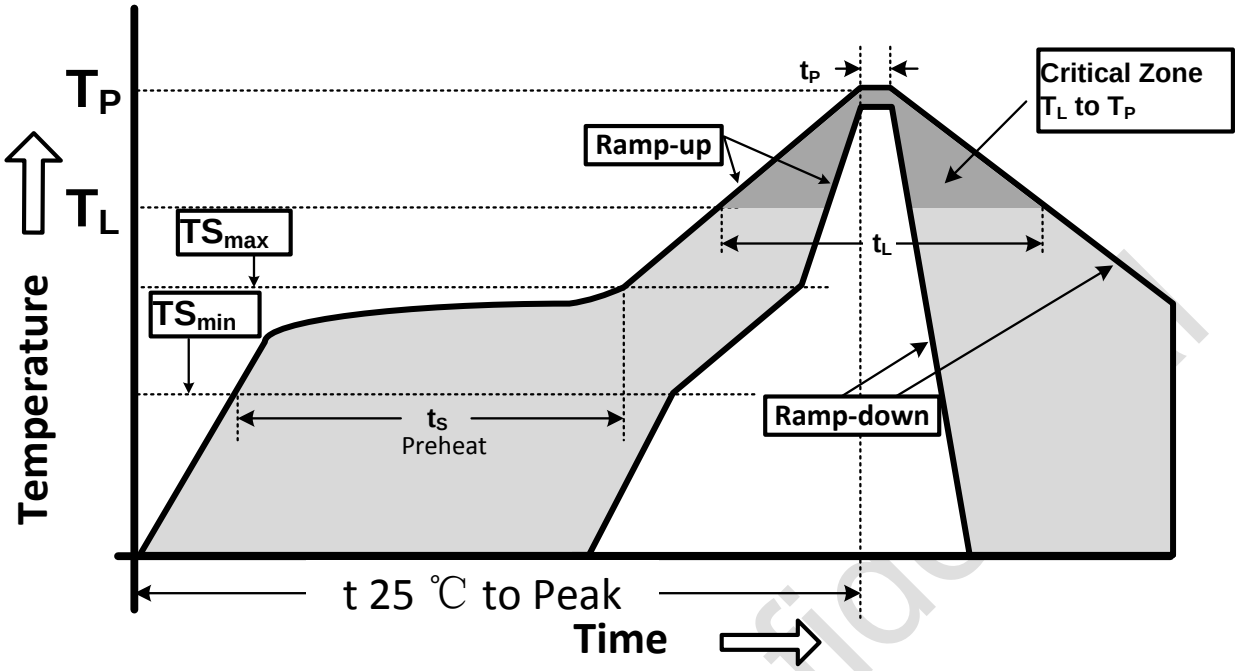



**Figure 5 Recommended Lead-Free Reflow Profile**

**Table 9 Reflow condition**

| 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.

1.3.1

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