# MXDLN16GE

# GPS Low Noise Amplifier

## General Description

MXDLN16GE high gain, low noise amplifier(LNA) is dedicated to GPS, GLONASS GalileoandBeidou standards. This product has an extremely low noise figure of 0.6dB, 19dB gain and excellent linearity.

MXDLN16GE works under a 1.1V to 2.85V single power supply while consumes 7.5 mA current, in power down (PD) mode, the power consumption will be reduced to less than 1uA.

MXDLN16GE uses a small 1mm×1.5mm×0.75mm DFN 6-pin package.

## Applications

Automotive Navigation
Personal Navigation Device (PND)
Cell Phone with GPS
MID/PAD with GPS

## Features

- High Gain: 19dB

- Low noise figure 0.6dB @ 1575.42MHz

- Low operation current 6mA & PD current less than 1uA

- 3.5mA current under 1.2V power supply

- Single supply voltage range 1.1V to 2.85V

- Small package 1mm×1.5mm×0.75mm

- Low cost BOM

- Lead-Free and RoHS-Compliant

## Pin Configuration/Application Diagram (Top view)
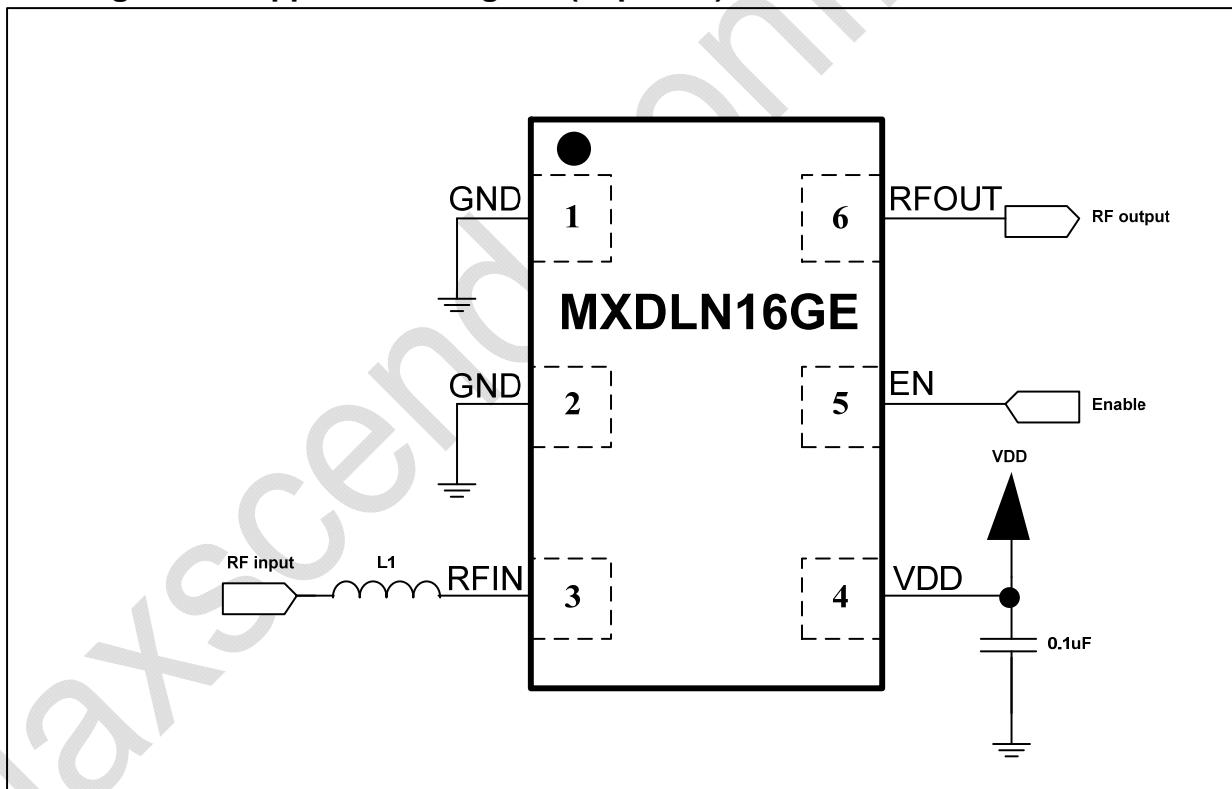


**Figure 1MXDLN16GE application circuit**

**Table 1.**

| Component | Vendor | Type | Part Number& value |
|-----------|--------|------|--------------------|
| L1 | Murata | Wired inductor, high Q | LQW15AN12N, 10nH |
|    | various | Ceramic inductor, low Q | 10nH |

## Absolute Maximum Ratings

**Table 2.**

| Parameters | Range | Units |
|---|---|---|
| Power supply | -0.3 ~ 3 | V |
| Other Pin to GND | -0.3~VDD+0.3 | V |
| Maximum RF Input Power | 10 | dBm |
| Operation Temperature Range | -40~85 | ℃ |
| Junction Temperature | 150 | ℃ |
| Storage temperature Range | -65~160 | ℃ |
| Lead Temperature (soldering) | 260 | ℃ |
| Soldering Temperature (reflow) | 260 | ℃ |
| Human Body Mode ESD | -2000~+2000 | V |
| Machine Mode ESD | -150~+150 | V |
| Charge Device Mode ESD | -500~+500 | V |

## DC Characteristics

$T_A$=-40~+85℃, Typically $T_A$=25℃ VDD=2.8V, unless otherwise noted

**Table 3.**

| Parameters | Condition | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| Supply Voltage | | 1.1 | 2.8 | 2.85 | V |
| Supply Current | EN=High | | 6 | | mA |
| | VDD = 1.2V | | 3.5 | | |
| | EN=Low | | | 1 | uA |
| EN Input High | | 0.8 | | | V |
| EN Input Low | | | | 0.6 | V |

## AC Characteristics

$T_A$=-40~+85℃, typically $T_A$=25℃ VDD=2.8V, all data measured on Maxscend's EVB, unless otherwise noted

**Table 4.**

| Parameters | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| RF Frequency Range | None | | 1575.42 | | MHz |
| Power Gain | | | 19 | | dB |
| | Note7 | | 19 | | |
| Noise Figure | | | 0.6 | | dB |
| | Note7 | | 0.8 | | |
| Input Return Loss | Note1 | | -12 | | dB |
| | Note7 | | -10 | | |
| Output Return Loss | Note1 | | -12 | | dB |
| | Note7 | | -11 | | |
| Reverse Isolation | Note1 | | -28 | | dB |
| | | | | | |
| VSWR | Note1 | | 1.7 | | |
| | | | | | |
| Jammed Noise Figure | Note2 | | 0.85 | | dB |
| | | | | | |
| Stability | Note3 | 1.5 | | | |
| | | | | | |
| Input Power 1-dB Compression Point | 1575MHz | | -9 | | dBm |
| | 1575MHz, 1.2V | | -12 | | |
| | 900MHz | | -10 | | |
| | 2400MHz | | -5 | | |
| Input In-Band IP3 | Note4 | | -1 | | dBm |
| | | | | | |
| Input Out-Band IP3 | Note5 | | +15 | | dBm |
| | | | | | |
| Input IP2 | Note6 | | 43 | | dBm |
| | | | | | |

**Note1:** sweep power -30dBm, 1575.42MHz
**Note2:** jammed signal @ 1.8GHz & 950MHz, -30dBm
**Note3:** frequency range 500MHz-5GHz
**Note4:** f1 = 1574.5 MHz, f2 = 1575.5 MHz, -30dBm
**Note5:** f1 = 2400 MHz, f2 = 2000 MHz, -30dBm  IP3 = pin-(IM3- $Gain_{1575MHz}$)/2
**Note6:** f1 = 2475 MHz, f2 = 900 MHz, -30dBm, IP2 = pin-(IM2-$Gain_{1575MHz}$), IMD2 referred to input port.
**Note7:** Beidou frequency range   B1：1559.052MHz---1591.788MHz

**Gain vs Frequency over Temperature**
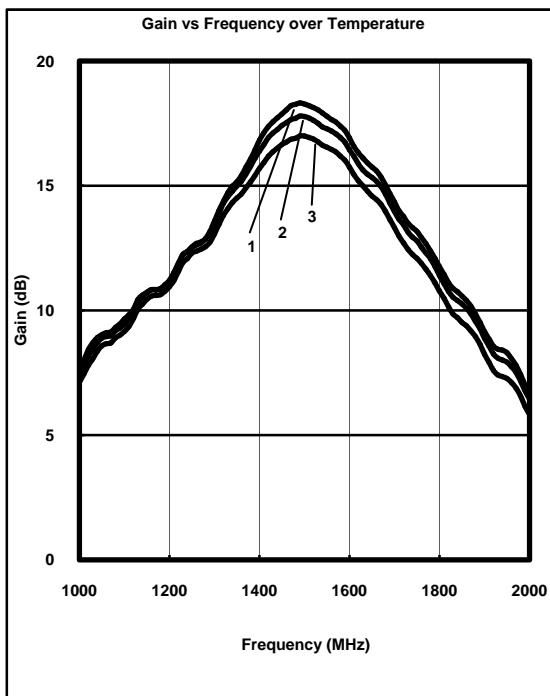


**Figure 2. Gain vs Frequency over Temperature**

VDD = 1.2V
1. - 40℃
2. +25℃
3. +85℃

**Gain vs Frequency over Power Supply**
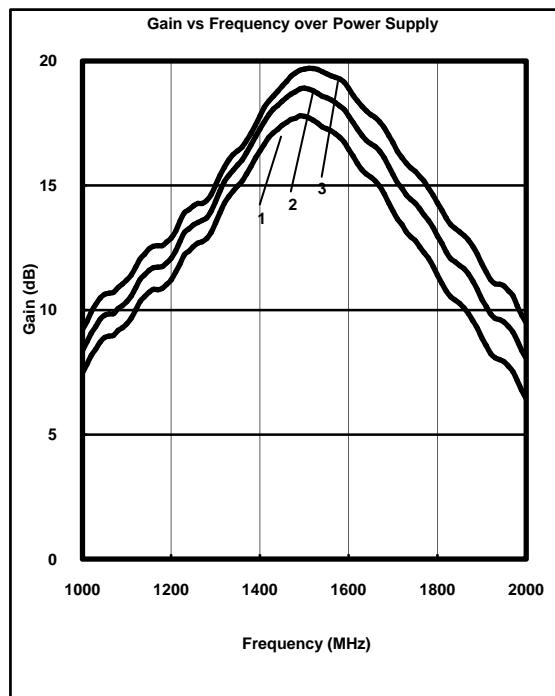


**Figure 3. Gain vs Frequency over Power Supply**

Ta = 25℃
1. 1.2V
2. 1.8V
3. 2.8V

**Gain vs Frequency over Temperature**
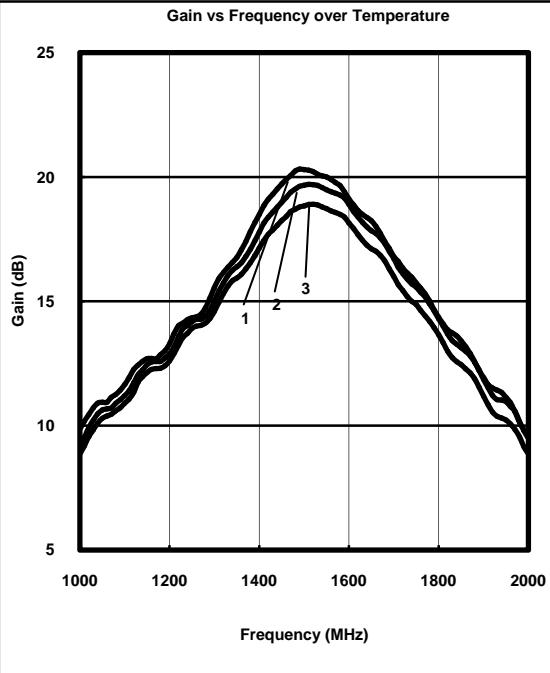


**Figure 4. Gain vs Frequency over Temperature**

VDD = 2.8V
1. - 40℃
2. +25℃
3. +85℃

**Noise Figure vs Power Supply over Temperature**
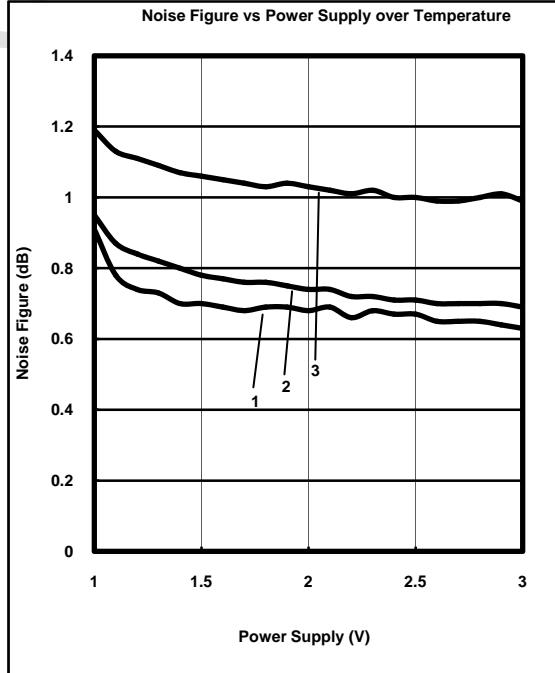


**Figure 5. Noise Figure vs Input Power over Temperature**

VDD = 2.8V
1. - 40℃
2. +25℃
3. +85℃

**Noise Figure vs Frequency over Temperature**
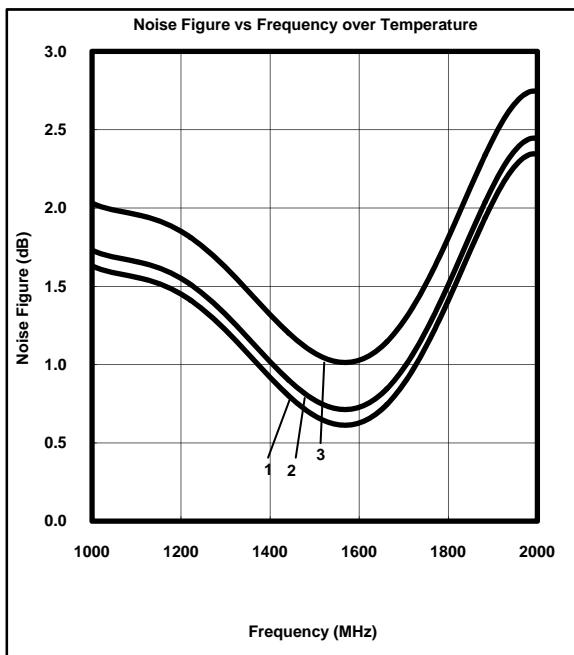


**Figure 6. Noise Figure vs Frequency over Temperature**

VDD = 2.8V
1.   - 40℃
2.   +25℃
3.   +85℃

**Gain vs Input Power over temperature**
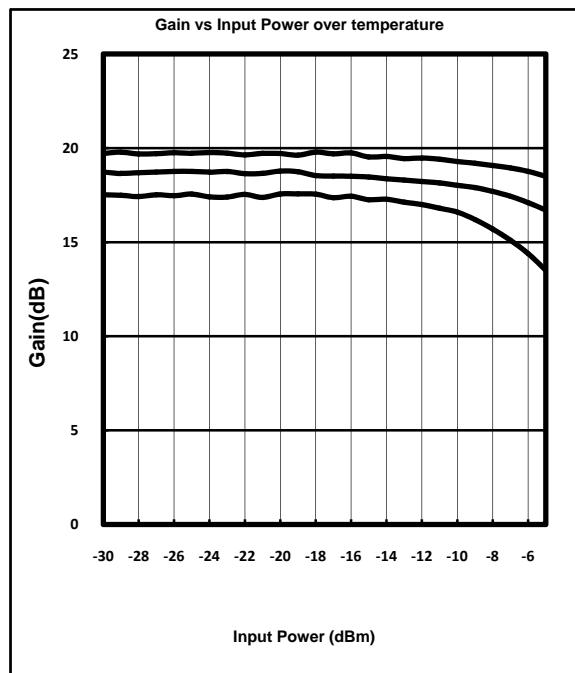


**Figure 7. Gain vs Input Power over Temperature**

VDD = 2.8V
1.   - 40℃
2.   +25℃
3.   +85℃

**Input In-Band IP3 vs Input Power over Temperature**
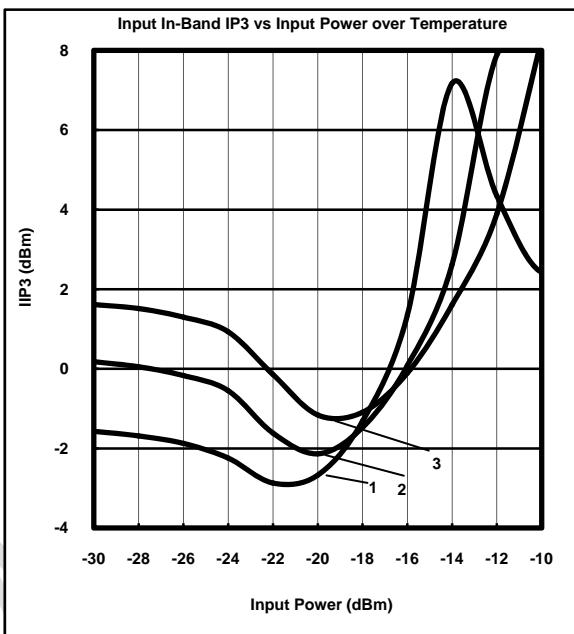


**Figure 8. In-Band IIP3 vs Input Power over Temperature**

f1 = 1574.5 MHz, f2 = 1575.5 MHz
VDD = 2.8V
1.   - 40℃
2.   +25℃
3.   +85℃

**Input In-Band IP3 vs Input Power over Temperature**
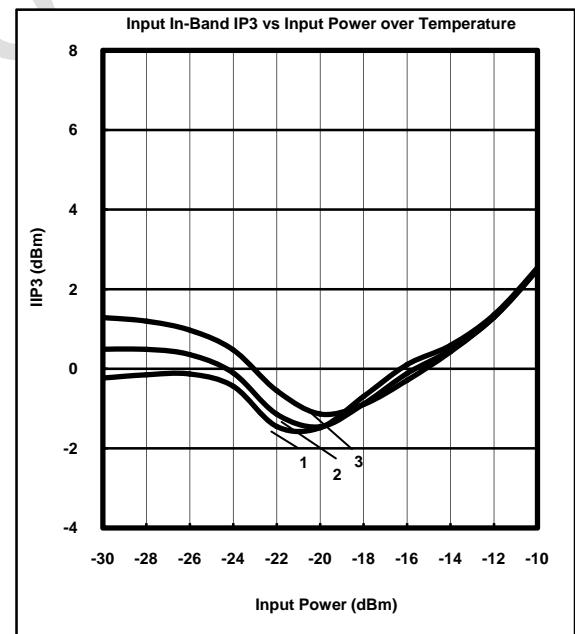


**Figure 9. In-Band IIP3 vs Input Power over Temperature**

f1 = 1574.5 MHz, f2 = 1575.5 MHz
VDD = 1.2V
1.   - 40℃
2.   +25℃
3.   +85℃
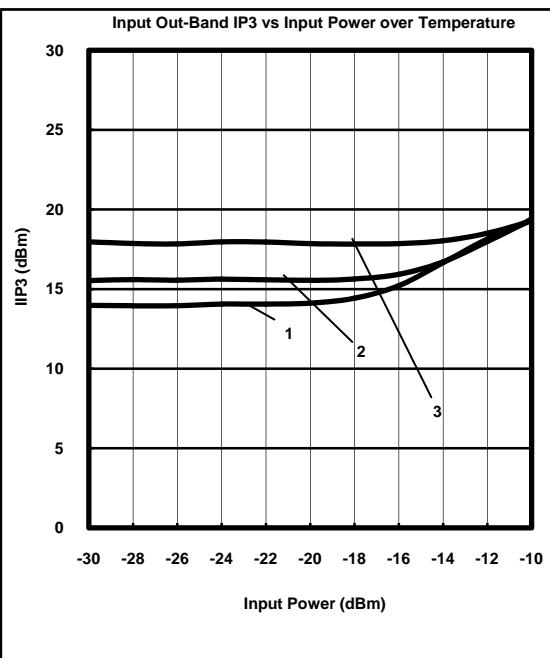
Figure 10. Out-Band IIP3 vs Input Power over Temperature

**f1 = 2175 MHz, f2 = 1875 MHz**
**VDD = 2.8V**
1. **- 40℃**
2. **+25℃**
3. **+85℃**
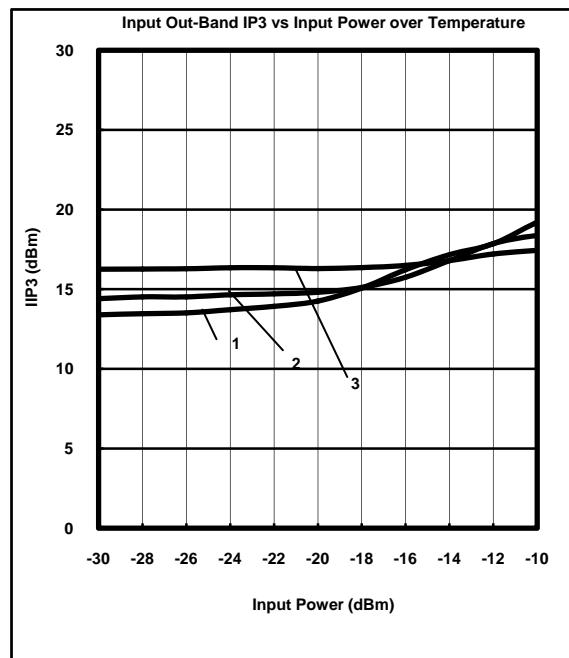


Figure 11. Out-Band IIP3 vs Input Power over Temperature

**f1 = 2175 MHz, f2 = 1875 MHz**
**VDD = 1.2V**
1. **- 40℃**
2. **+25℃**
3. **+85℃**
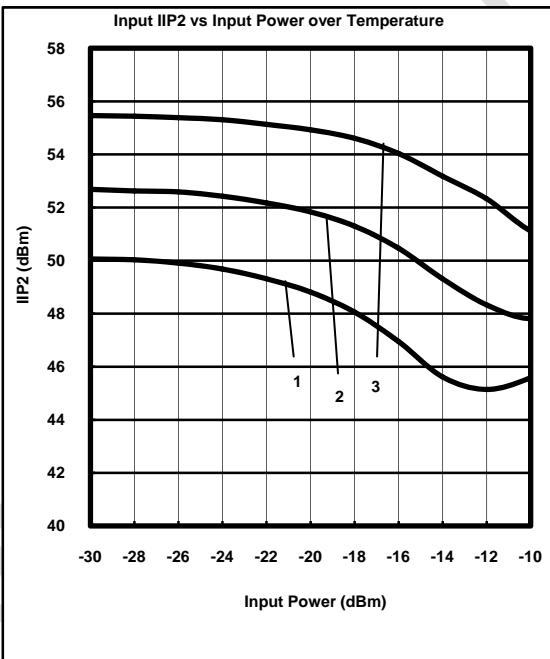


Figure 12. IIP2 vs Input Power over Temperature

**f1 = 2475 MHz, f2 = 900 MHz**
**VDD = 2.8V**
1. **- 40℃**
2. **+25℃**
3. **+85℃**
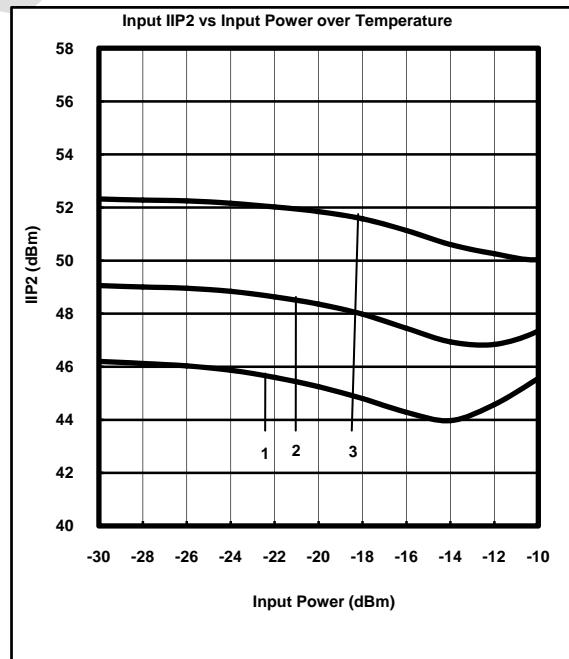


Figure 13. IIP2 vs Input Power over Temperature

**f1 = 2475 MHz, f2 = 900 MHz**
**VDD = 1.2V**
1. **- 40℃**
2. **+25℃**
3. **+85℃**
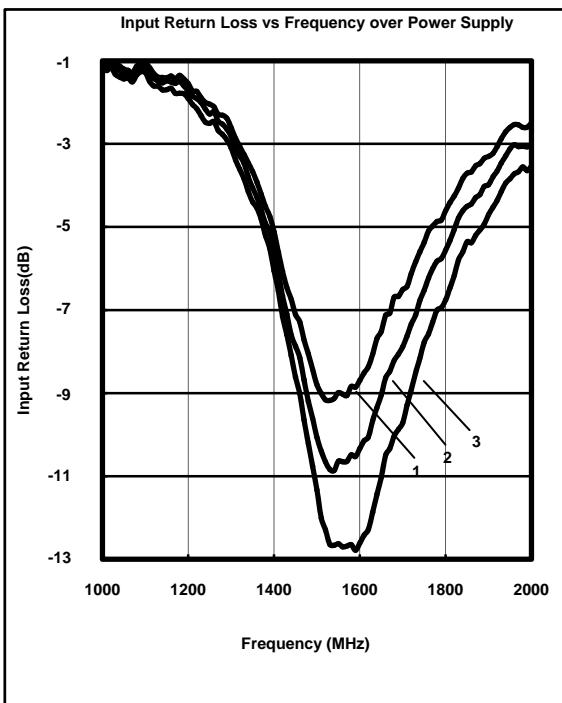
**Figure 14. Input Return Loss vs Frequency over Power Supply**
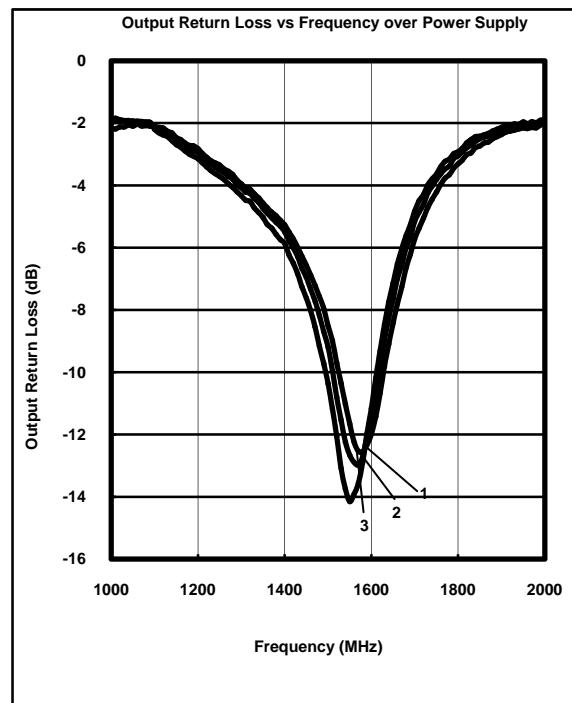
Ta = 25℃
1. 1.2V
2. 1.8V
3. 2.8V



**Figure 15. Output Return Loss vs Frequency over Power Supply**

Ta = 25℃
1. 1.2V
2. 1.8V
3. 2.8V
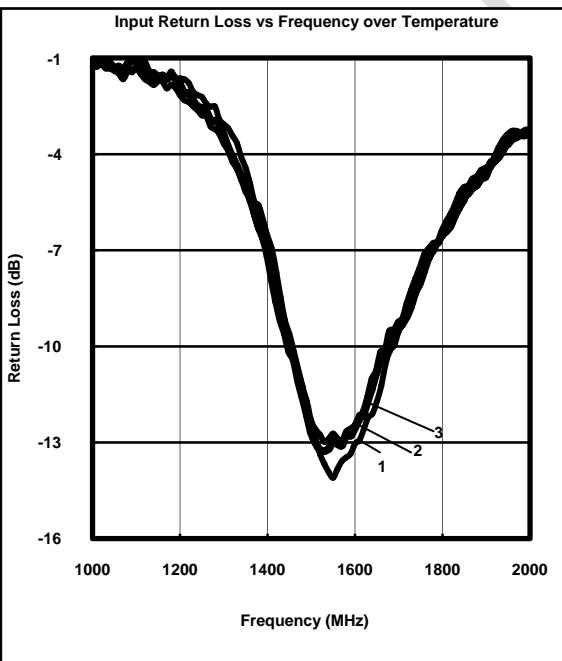


**Figure 16. Input Return Loss vs Frequency over Temperature**
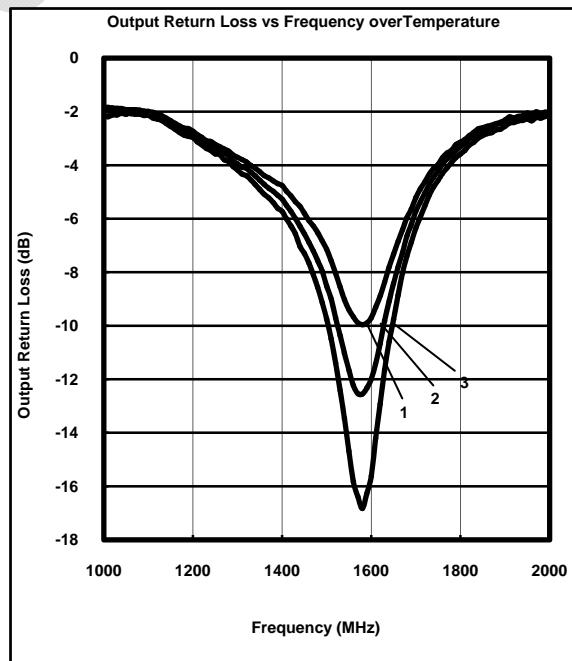
VDD = 2.8V
1. - 40℃
2. +25℃
3. +85℃



**Figure 17. Output Return Loss vs Frequency over Temperature**

VDD = 2.8V
1. - 40℃
2. +25℃
3. +85℃
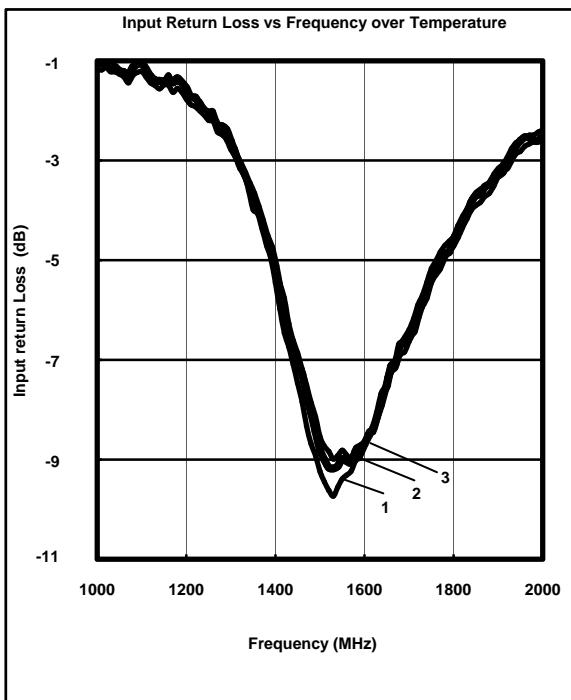
**Figure 18. Input Return Loss vs Frequency over Temperature**
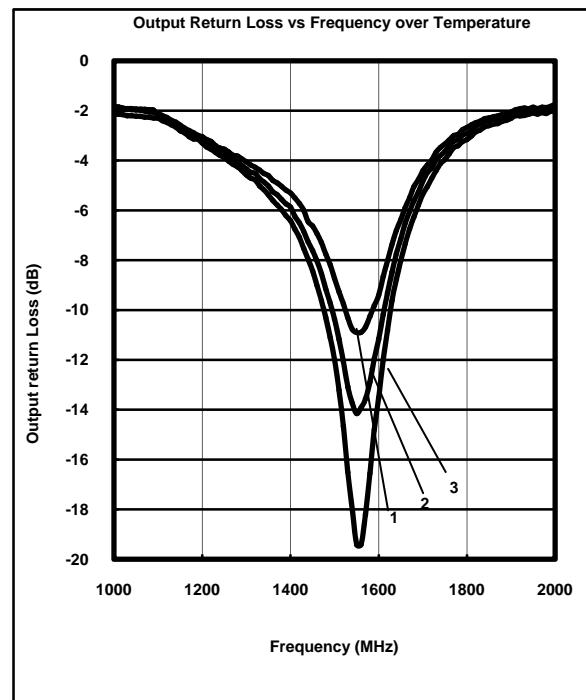
VDD = 1.2V
1. - 40℃
2. +25 ℃
3. +85℃



**Figure 19. Output Return Loss vs Frequency over Temperature**
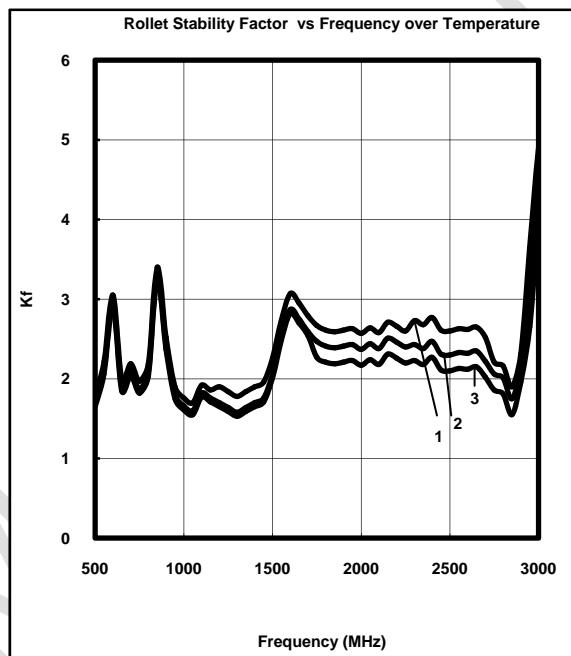
VDD = 1.2V
1. - 40℃
2. +25 ℃
3. +85℃



**Figure 20. Stability Factor vs Frequency over Temperature**

Input power -50dBm
VDD = 2.8V
1. - 40℃
2. +25 ℃
3. +85℃
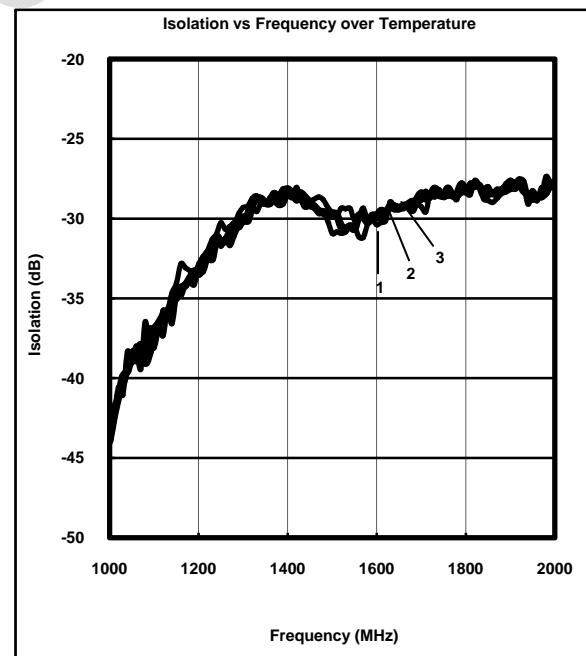


**Figure 21. Isolation vs Frequency over Temperature**

VDD = 1.2V
1. +85℃
2. +25 ℃
3. - 40 ℃

**Isolation vs Frequency over Power Supply**
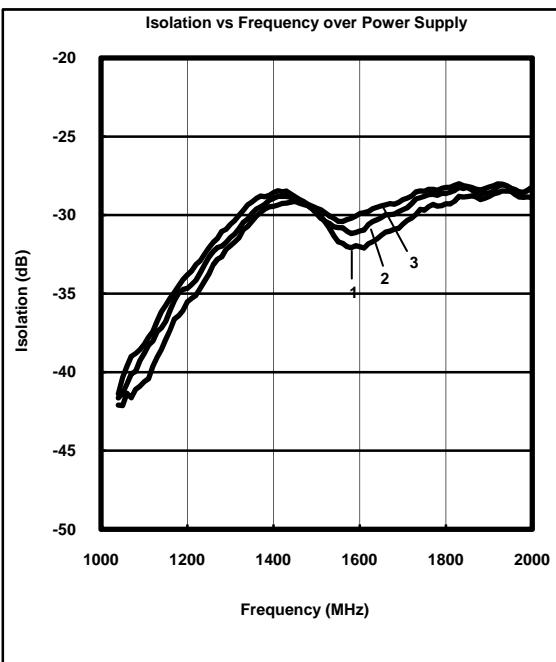


**Figure 22. Isolation vs Frequency over Power Supply**

**Input power -30dBm**

**Ta = 25℃**
1. **1.2V**
2. **1.8V**
3. **2.8V**

**Isolation vs Frequency over Temperature**
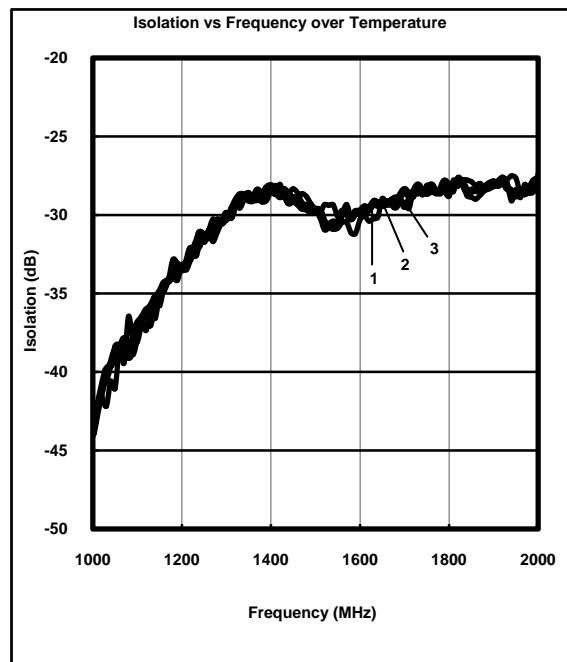


**Figure 23. Isolation vs Frequency over Temperature**

**Input power -30dBm**

**VDD = 2.8V**
1. **- 40℃**
2. **+25℃**
3. **+85℃**

## Pin Descriptions

**Table 5.**

| Pin | Pin Name | I/O | Pin Description |
|---|---|---|---|
| 1 | GND | AG | Analog VSS |
| 2 | GND | AG | Analog VSS |
| 3 | RFIN | AI | LNA input from antenna |
| 4 | VDD | AP | Power supply, 1.1~2.85V |
| 5 | EN | DI | Pull high enable, pull low into power down mode |
| 6 | RFOUT | AO | LNA output |

**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),

## Outline  Dimensions



| * CONTROLLING | DIMENSION | : | MM | | |
|---|---|---|---|---|---|
| SYMBOL | MILLIMETER | | | INCH | |
| | MIN. | NOR. | MAX. | MIN. | NOR. | MAX. |
| A | 0.70 | 0.75 | 0.80 | 0.028 | 0.030 | 0.032 |
| A1 | ——— | ——— | 0.05 | ——— | ——— | 0.002 |
| A2 | 0.50 | 0.55 | 0.60 | 0.020 | 0.022 | 0.024 |
| A3 | 0.20 REF | | | 0.008 REF | | |
| b | 0.17 | 0.20 | 0.23 | 0.007 | 0.008 | 0.009 |
| D | 1.50 bsc | | | 0.060 bsc | | |
| D2 | 0.87 | 0.90 | 0.96 | 0.033 | 0.035 | 0.037 |
| E | 1.00 bsc | | | 0.040 bsc | | |
| E2 | 1.15 | 1.20 | 1.25 | 0.046 | 0.048 | 0.050 |
| L | 0.25 | 0.30 | 0.35 | 0.010 | 0.012 | 0.014 |
| e | 0.50 bsc | | | 0.020 bsc | | |
| TOLERANCES OF FORM AND POSITION | | | | | | |
| ααα | 0.10 | | | 0.004 | | |
| bbb | 0.10 | | | 0.004 | | |
| ccc | 0.05 | | | 0.002 | | |

SIDE VIEW

**Figure 24. MXDLN16GE outline dimension**

## Reflow Chart
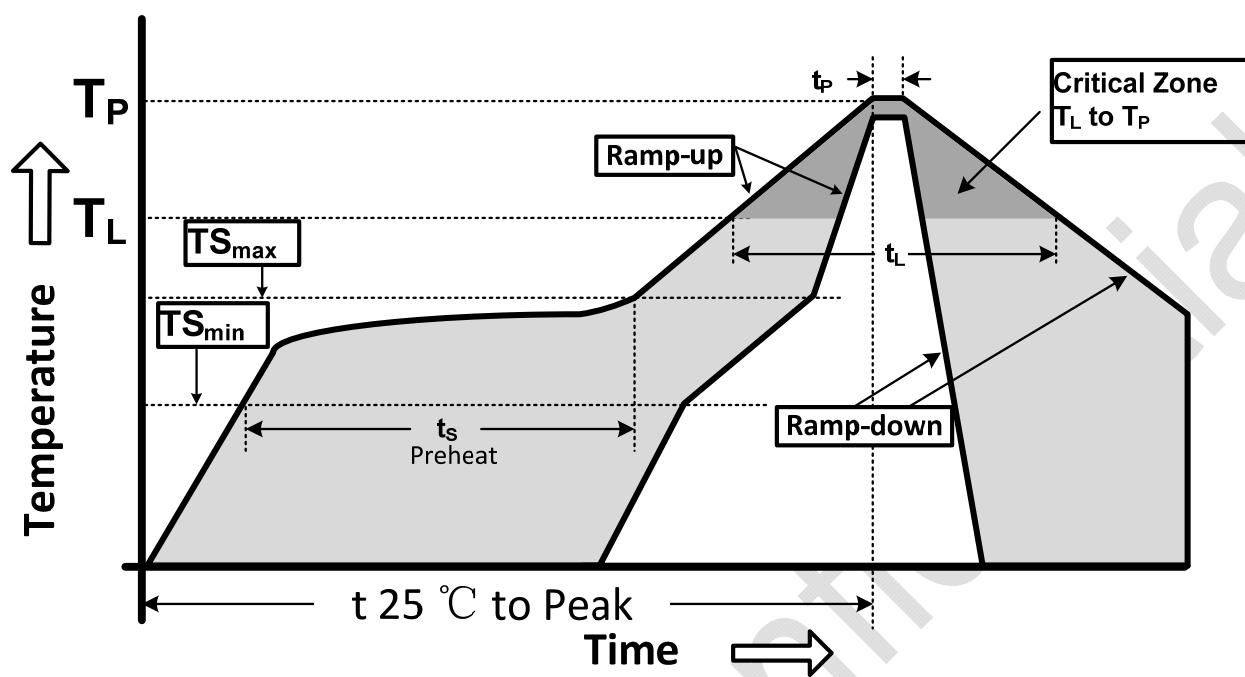


**Figure 25. Recommended Lead-Free Reflow Profile**

**Table 6.**

| 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 polybrominateddiphenyl ethers (PBDE), and are considered RoHS compliant.

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