MXDLN16G GPS Low Noise Amplifier

Version	Date Start	Date Complete	By	Description of Change
0.0	2012/10/05		Dayu Gao	Initial draft.
0.1	2012/11/15		Shubin Xiao / Dayu Gao	Voltage range, Current over temp Stab over temp Reflow profile Application circuit
1.0	2012/12/20		Dayu Gao	Update P1dB, IP2, IP3
1.1	2013/02/14		Dayu Gao	Update HR2, VSWR, IM3, GLONASS L1/L2 NF
1.2	2013/02/20		Dayu Gao	
1.3	2013/04/15		Dayu Gao	Update POD
1.4	2013/08/26		Xiaoshubin	Update EN Voltage
1.5	2014/03/15		Dayu Gao	Update AC characteristics
1.6	2014/03/19		Dayu Gao	Update POD & reflow chart

Table 1 Revision History

General Description

MXDLN16G high gain, low noise amplifier (LNA) is dedicated to GPS, GLONASS Galileo and Compass standards. This product has an extremely low noise figure of 0.6dB, 19dB gain and excellent linearity.

MXDLN16G works under a 1.1V to 2.85V single power supply while consumes 6mA current, in power down (PD) mode, the power consumption will be reduced to less than 1uA.

MXDLN16G 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)

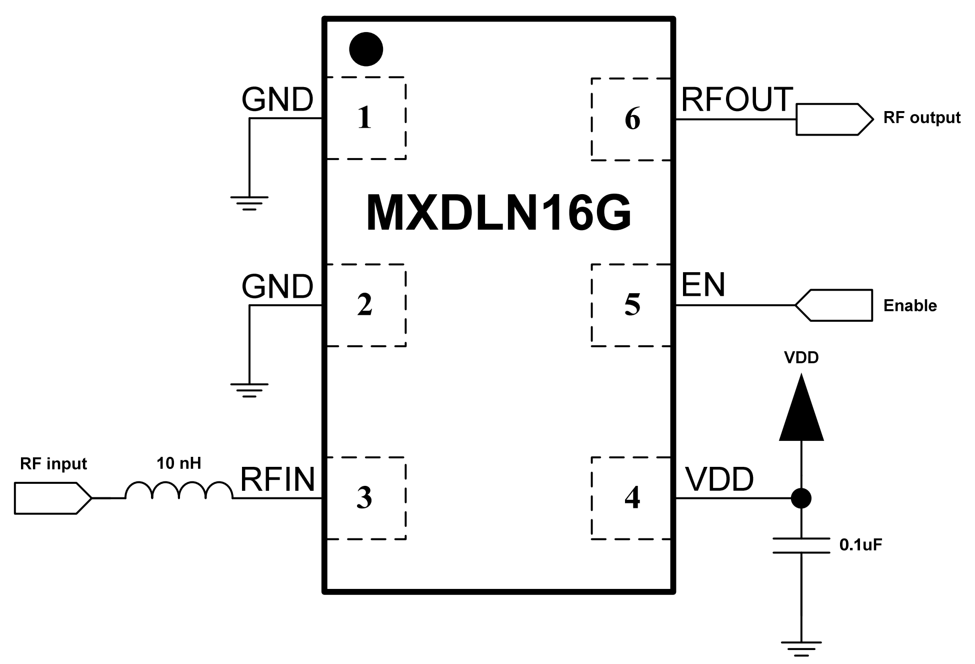


Figure 1. MXDLN16G application circuit

Absolute Maximum Ratings

Table 1.

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	-100~+100	V
Charge Device Mode ESD	-500~+500	V

Specifications

DC Characteristics

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

Table 2.

<table>
<tr><th>Parameters</th><th>Condition</th><th>Min</th><th>Typ</th><th>Max</th><th>Units</th></tr>
<tr><td>Supply Voltage</td><td></td><td>1.1</td><td>2.8</td><td>2.85</td><td>V</td></tr>
<tr><td rowspan="3">Supply Current</td><td>EN=High</td><td></td><td>6</td><td></td><td rowspan="2">mA</td></tr>
<tr><td>VDD = 1.2V</td><td></td><td>3.5</td><td></td></tr>
<tr><td>EN=Low</td><td></td><td></td><td>1</td><td>uA</td></tr>
<tr><td>EN Input High</td><td></td><td>0.8</td><td></td><td></td><td>V</td></tr>
<tr><td>EN Input Low</td><td></td><td></td><td></td><td>0.6</td><td>V</td></tr>
</table>

AC Characteristics

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

Table 3.

Parameters	Conditions	Min	Typ	Max	Units
RF Frequency Range	None		1575.42		MHz
Power Gain			19		dB
Noise Figure			0.6		dB
Input Return Loss	Note1		-12		dB
Output Return Loss	Note1		-12		dB
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		-16		dBm
	1575MHz, 1.2V		-18		
	900MHz		-13		
	2400MHz		-5		
Input In-Band IP3	Note4		-2		dBm
Input Out-Band IP3	Note5		+15		dBm
Input IP2	Note6		42.8		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.

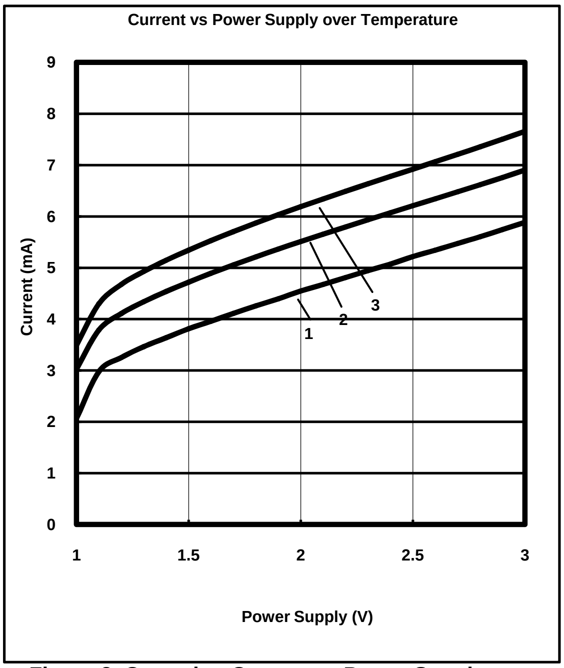


Figure 2. Operation Current vs Power Supply over Temperature

1. - 40℃
2. +25℃
3. +85℃

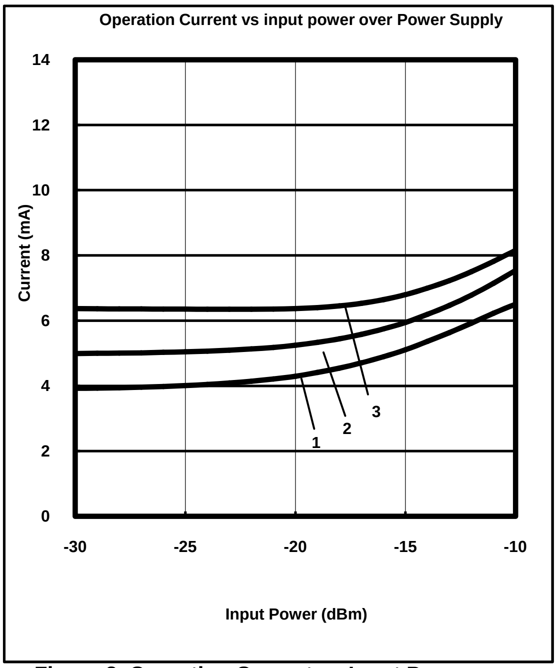


Figure 3. Operation Current vs Input Power over Temperature

Ta = 25℃
1. 1.2V
2. 1.8V
3. 2.8V

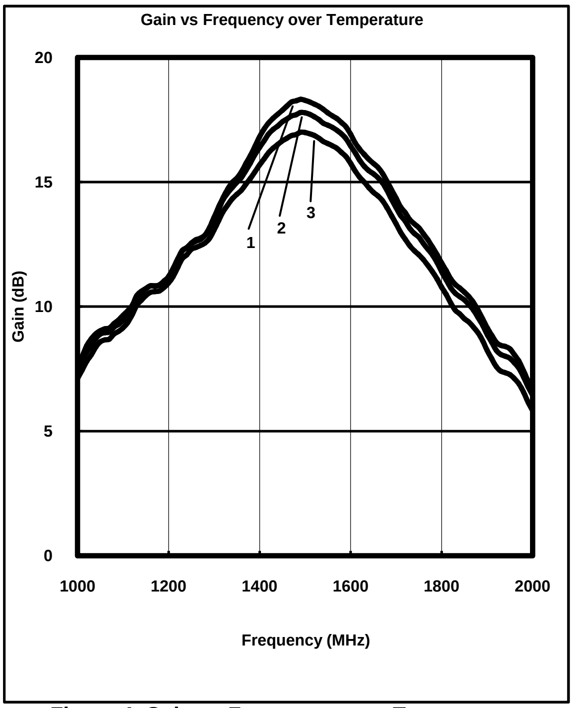


Figure 4. Gain vs Frequency over Temperature

VDD = 1.2V
1. - 40℃
2. +25℃
3. +85℃

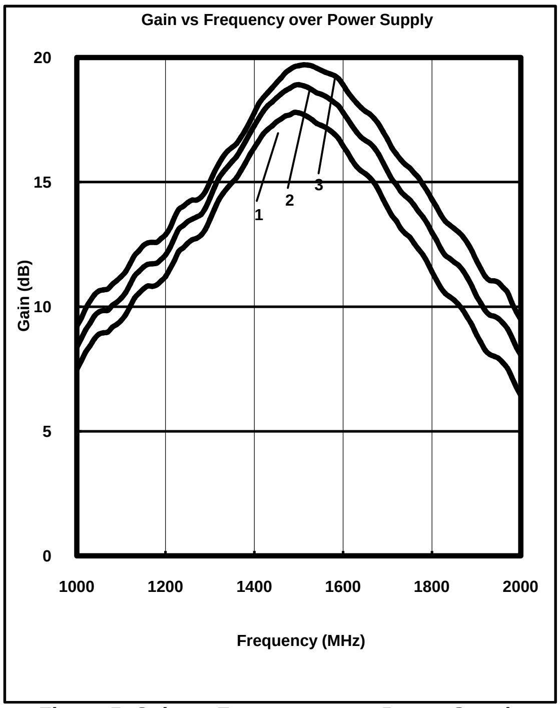


Figure 5. Gain vs Frequency over Power Supply

Ta = 25℃
1. 1.2V
2. 1.8V
3. 2.8V

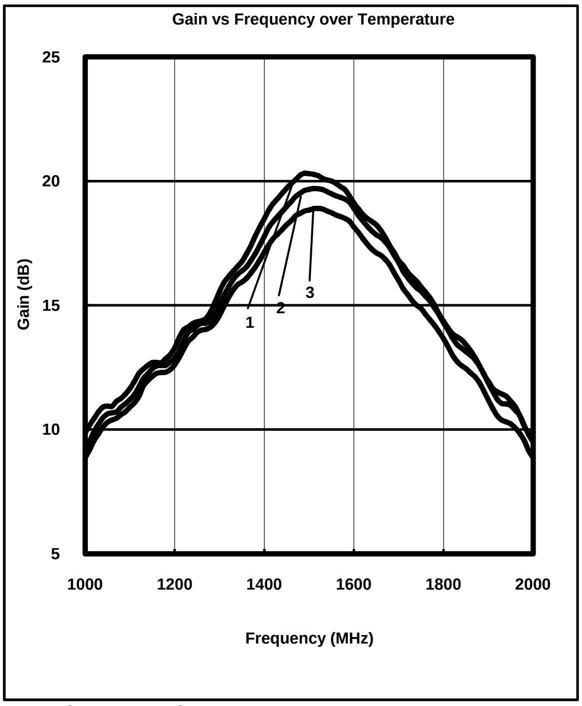


Figure 6. Gain vs Frequency over Temperature

VDD = 2.8V
1. - 40℃
2. +25℃
3. +85℃

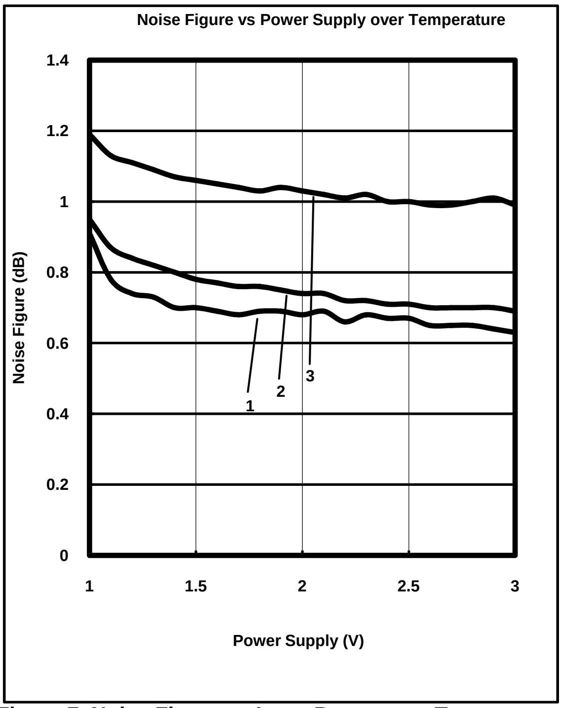


Figure 7. Noise Figure vs Input Power over Temperature

VDD = 2.8V
1. - 40℃
2. +25℃
3. +85℃

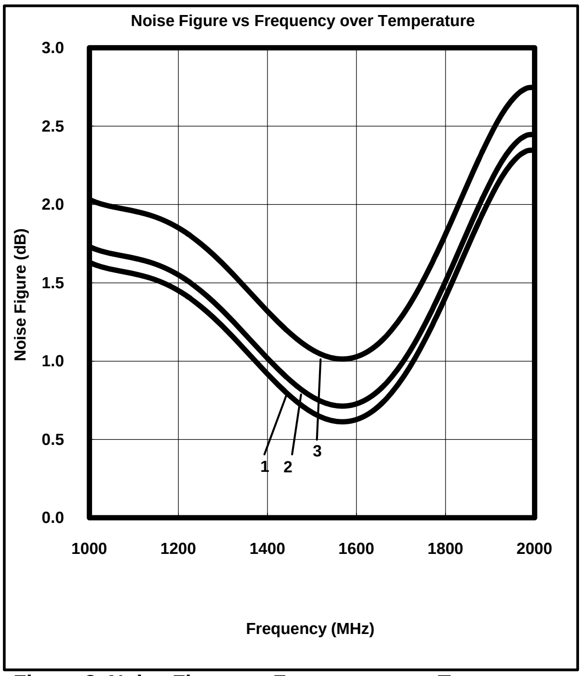


Figure 8. Noise Figure vs Frequency over Temperature

VDD = 2.8V
1. - 40℃
2. +25℃
3. +85℃

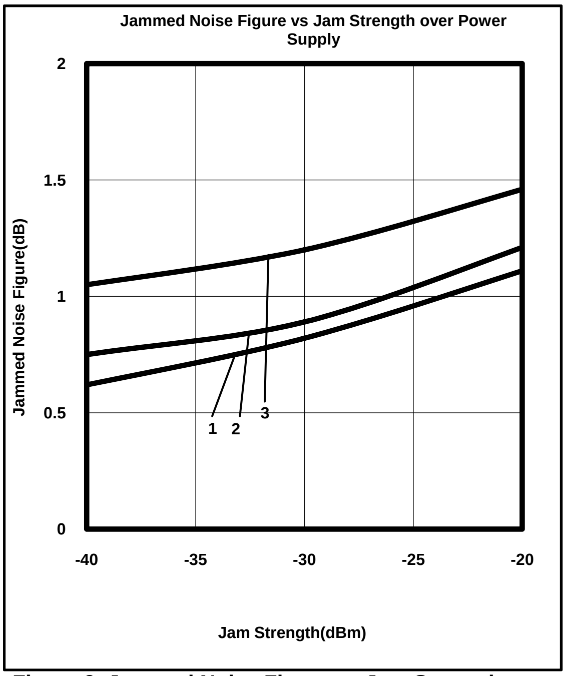


Figure 9. Jammed Noise Figure vs Jam Strength over Temperature

VDD = 2.8V
1. - 40℃
2. +25℃
3. +85℃

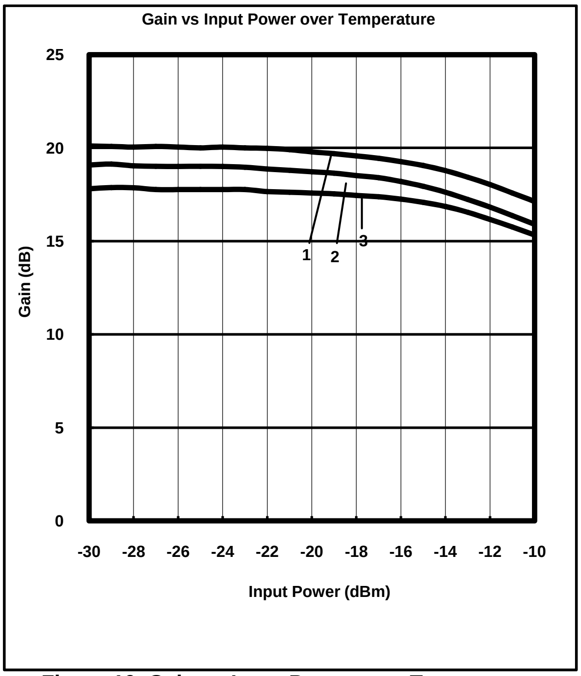


Figure 10. Gain vs Input Power over Temperature

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

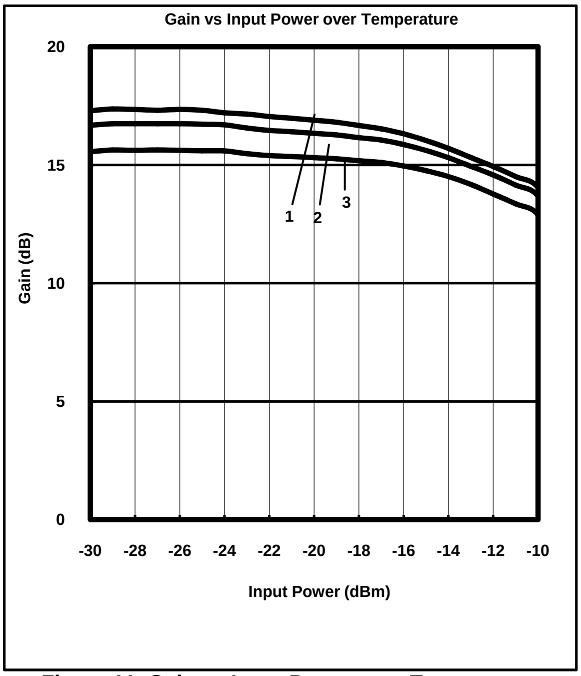


Figure 11. Gain vs Input Power over Temperature

VDD = 1.2V
1. **- 40℃**
2. **+25℃**
3. **+85℃**

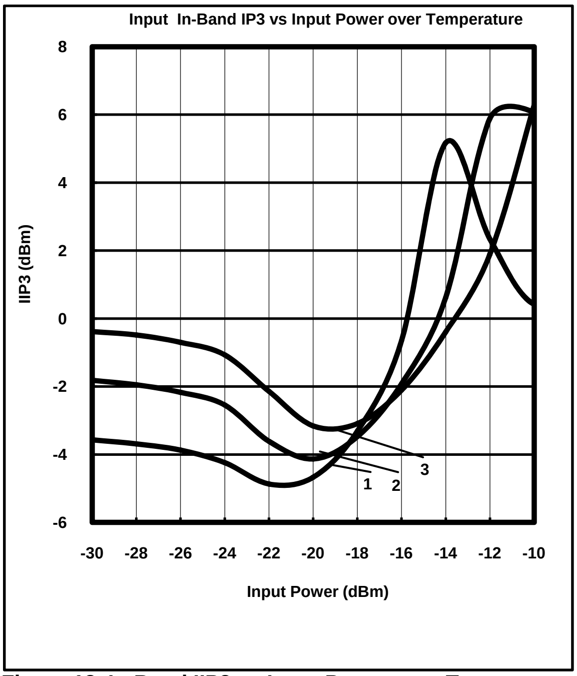


Figure 12. In-Band IIP3 vs Input Power over Temperature

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

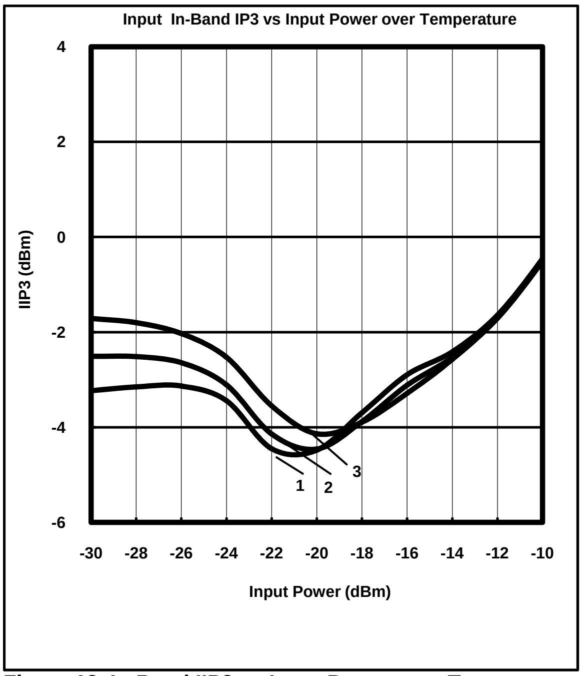


Figure 13. In-Band IIP3 vs Input Power over Temperature

f1 = 1574.5 MHz, f2 = 1575.5 MHz
VDD = 1.2V
1. **- 40℃**
2. **+25℃**
3. **+85℃**

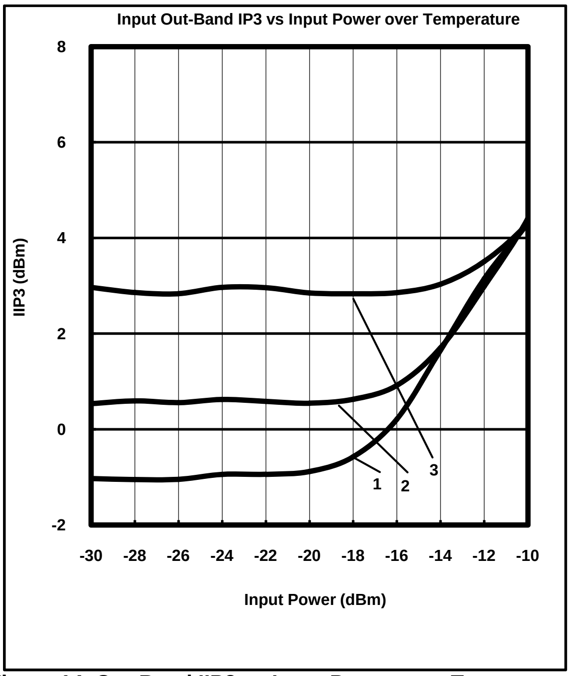


Figure 14. Out-Band IIP3 vs Input Power over Temperature

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

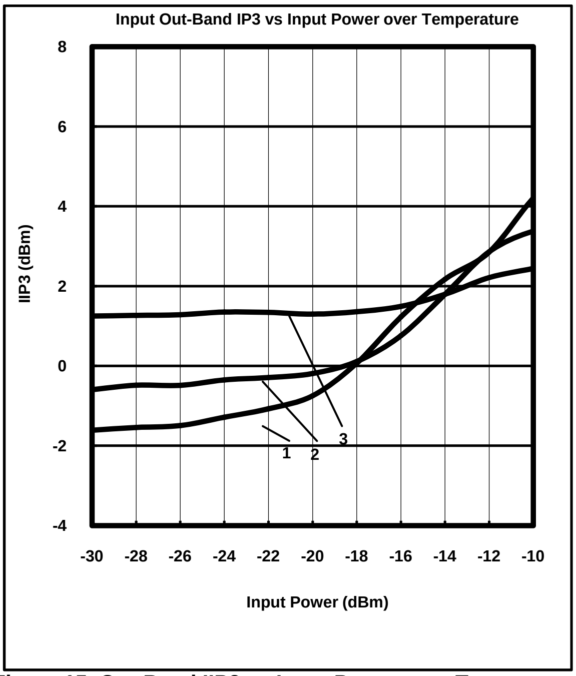


Figure 15. Out-Band IIP3 vs Input Power over Temperature

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

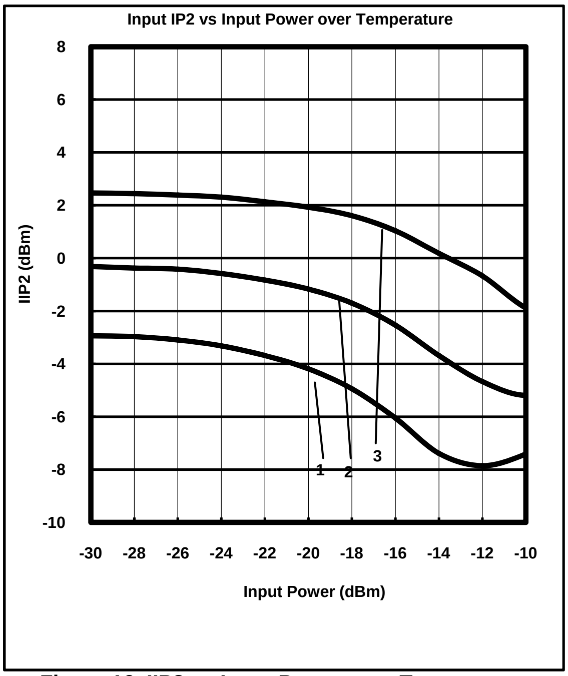


Figure 16. IIP2 vs Input Power over Temperature

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

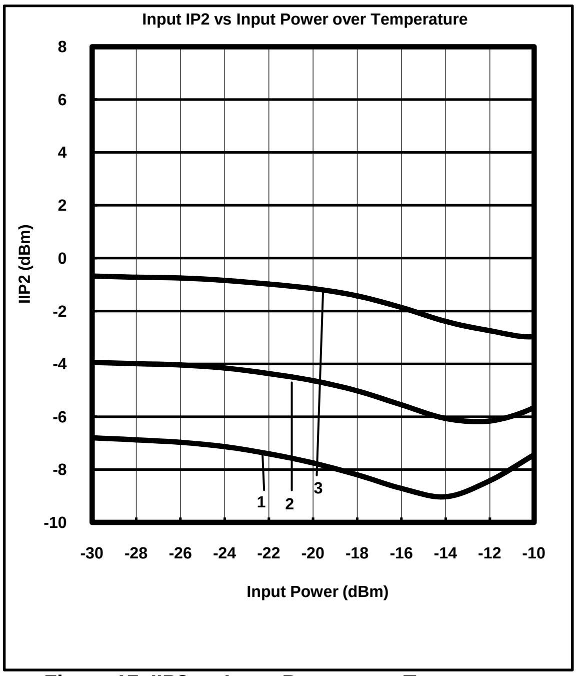


Figure 17. IIP2 vs Input Power over Temperature

f1 = 2475 MHz, f2 = 900 MHz
VDD = 1.2V
1. - 40℃
2. +25℃
3. +85℃

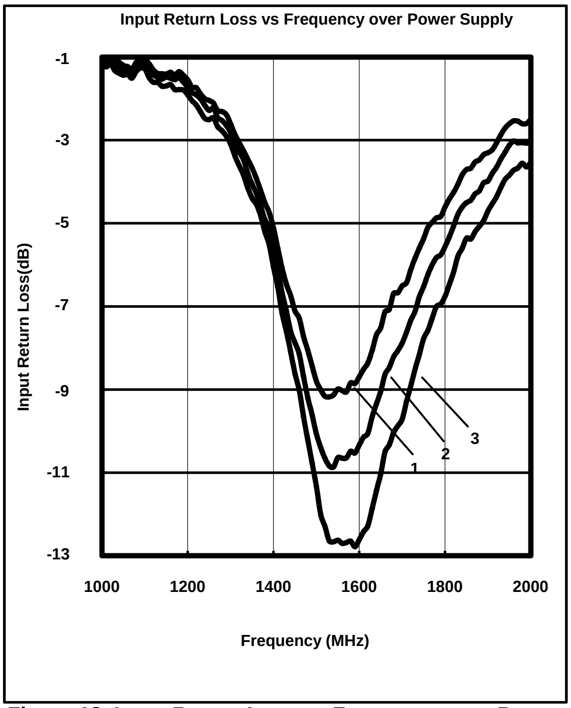


Figure 18. Input Return Loss vs Frequency over Power Supply

Ta = 25℃
1. 1.2V
2. 1.8V
3. 2.8V

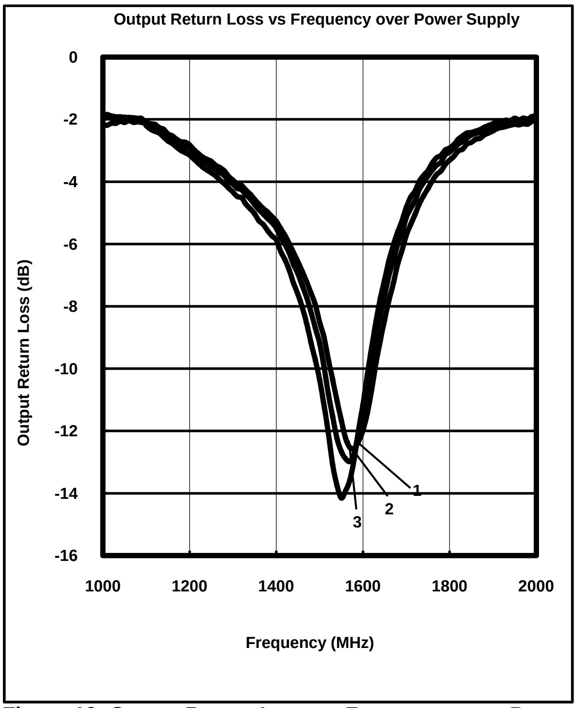


Figure 19. Output Return Loss vs Frequency over Power Supply

Ta = 25℃
1. 1.2V
2. 1.8V
3. 2.8V

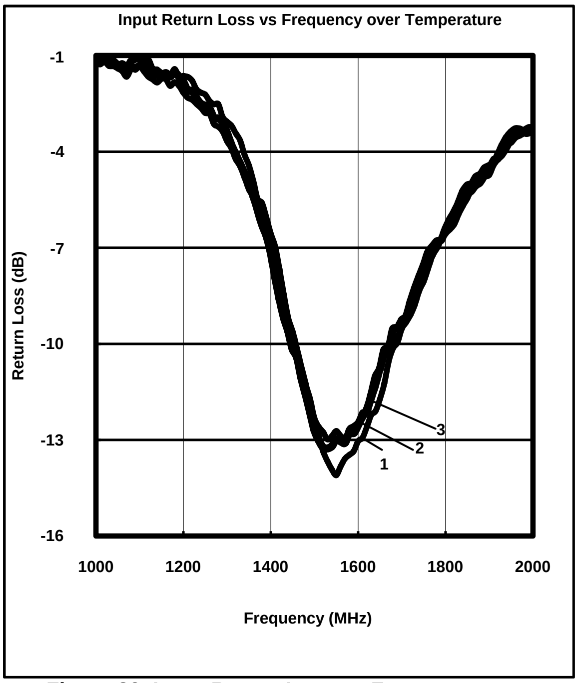


Figure 20. Input Return Loss vs Frequency over Temperature

VDD = 2.8V
1. - 40℃
2. +25℃
3. +85℃

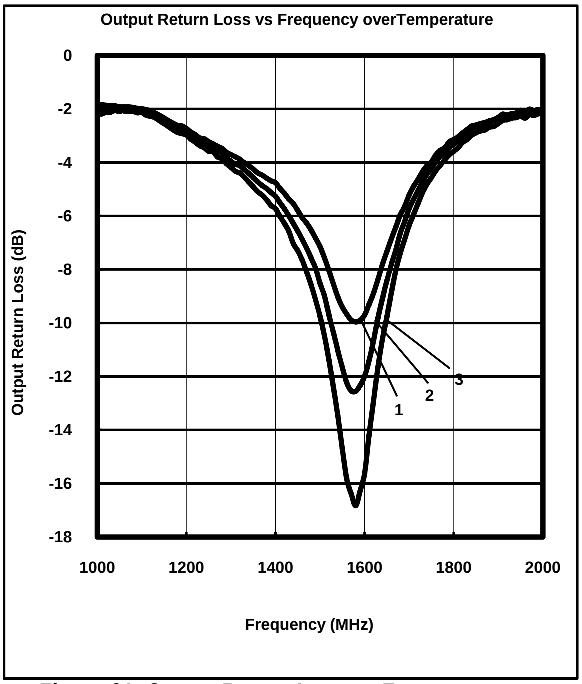


Figure 21. Output Return Loss vs Frequency over Temperature

VDD = 2.8V
1. - 40℃
2. +25℃
3. +85℃

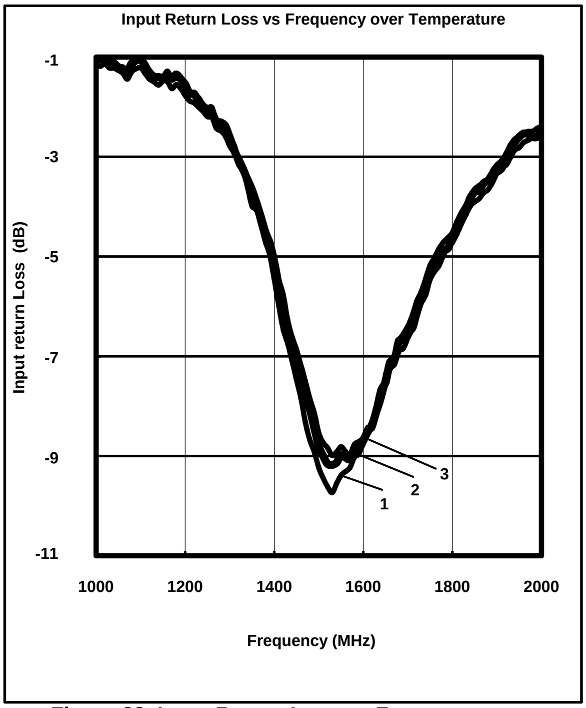


Figure 22. Input Return Loss vs Frequency over Temperature

VDD = 1.2V
1. - 40 ℃
2. +25 ℃
3. +85 ℃

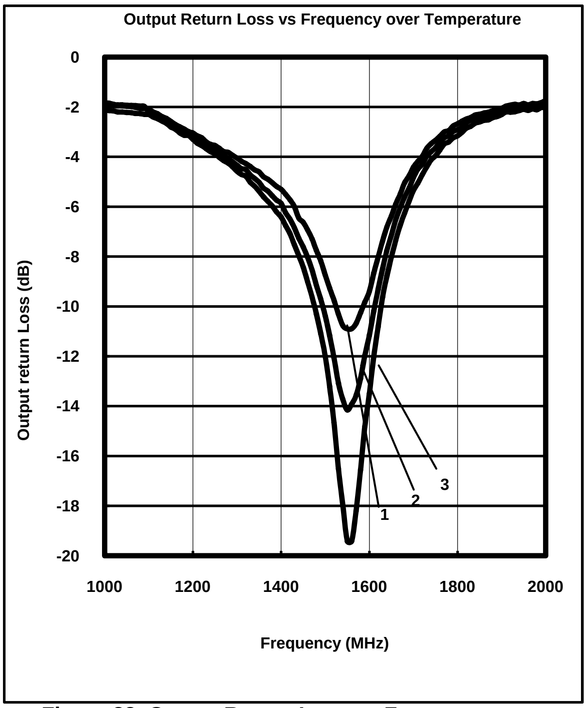


Figure 23. Output Return Loss vs Frequency over Temperature

VDD = 1.2V
1. - 40 ℃
2. +25 ℃
3. +85 ℃

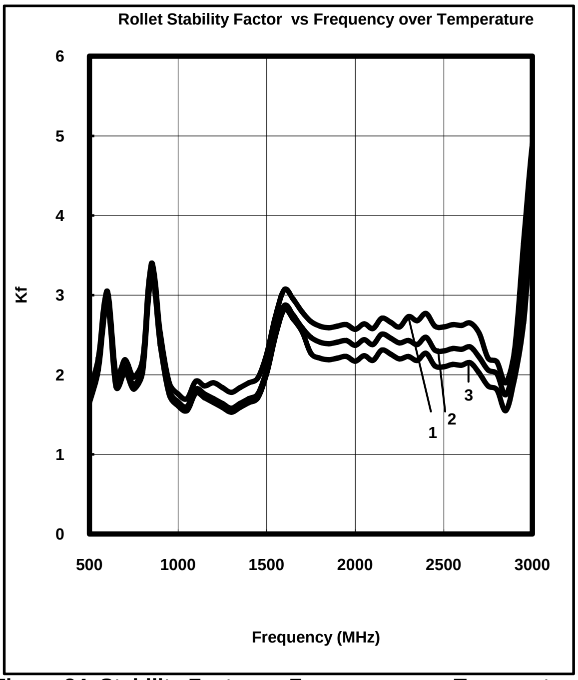


Figure 24. Stability Factor vs Frequency over Temperature

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

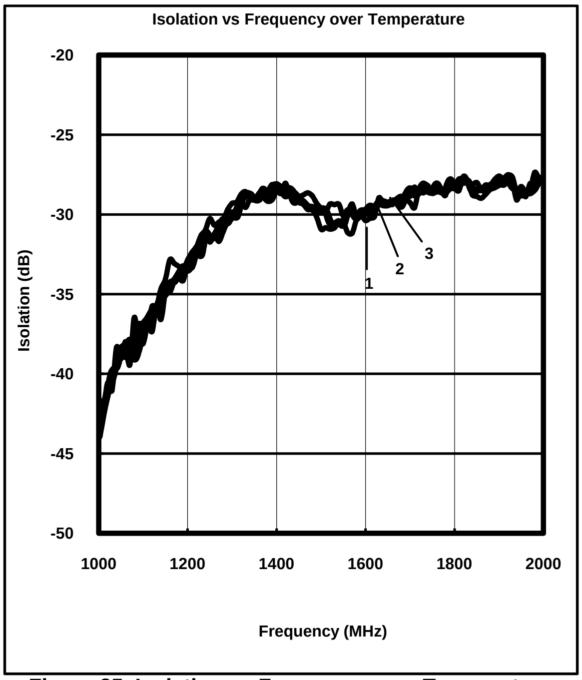


Figure 25. Isolation vs Frequency over Temperature

VDD = 1.2V
1. +85 ℃
2. +25 ℃
3. - 40 ℃

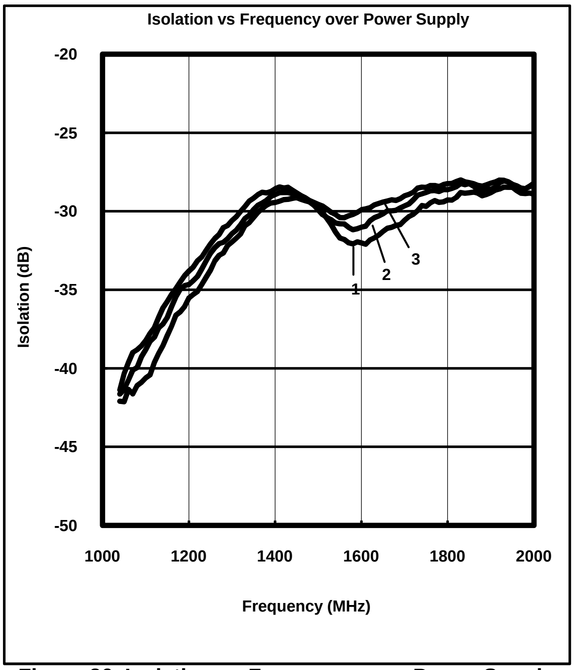


Figure 26. Isolation vs Frequency over Power Supply

Input power -30dBm

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

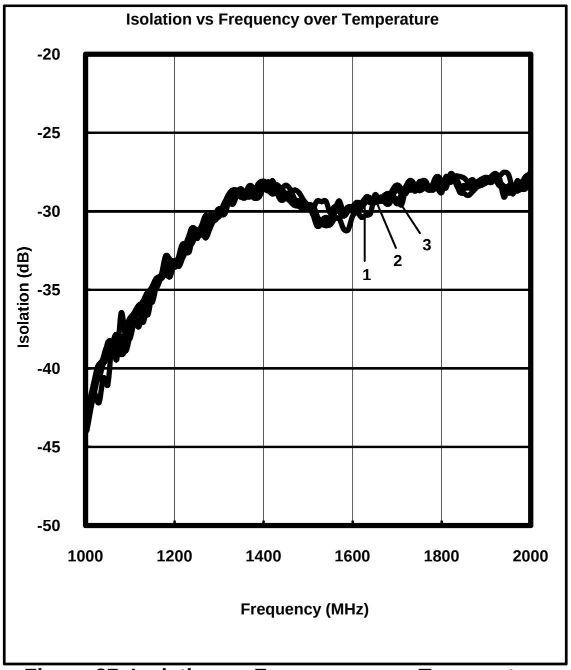


Figure 27. Isolation vs Frequency over Temperature

Input power -30dBm

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

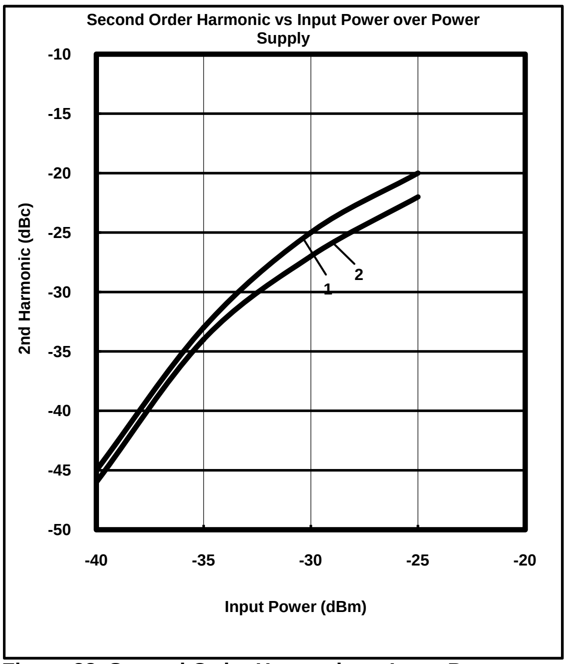


Figure 28. Second Order Harmonic vs Input Power over Power Supply

Ta = 25 ℃
f1 = 787.76MHz, measured at 1575.52MHz

1. **2.8V**
2. **1.2V**

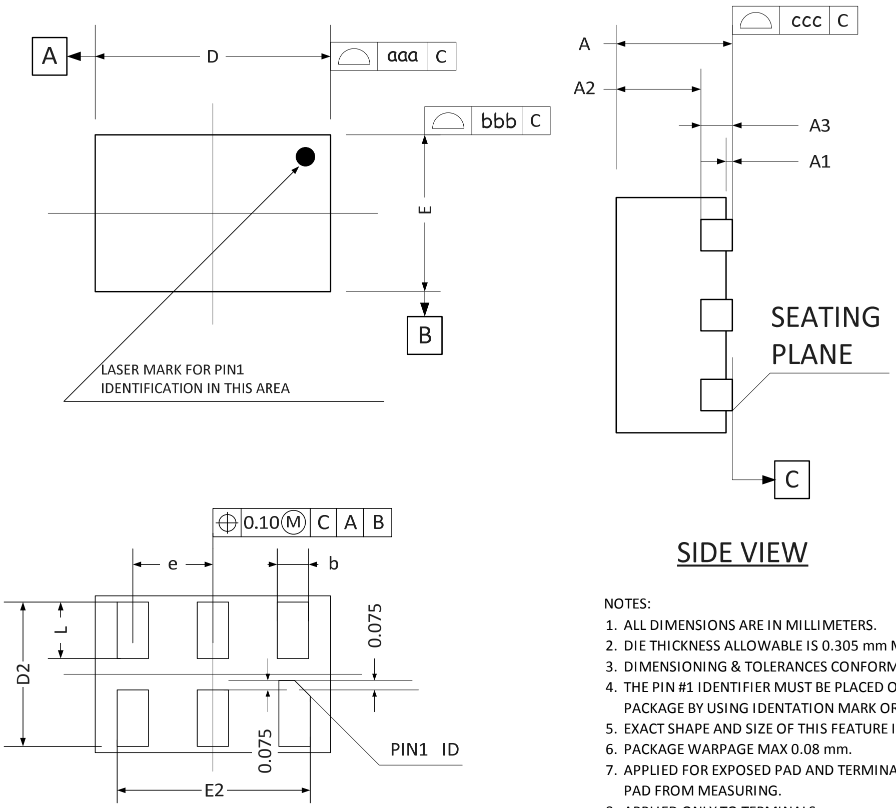
Pin Descriptions

Table 4.

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	0.92	0.96	0.035	0.037	0.039
E	1.00 bsc			0.040 bsc		
E2	1.15	1.20	1.25	0.046	0.048	0.050
L	0.30	0.35	0.40	0.012	0.014	0.016
e	0.50 bsc			0.020 bsc		
TOLERANCES OF FORM AND POSITION						
aaa	0.10			0.004		
bbb	0.10			0.004		
ccc	0.05			0.002		

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIE THICKNESS ALLOWABLE IS 0.305 mm MAXIMUM(.012 INCHES MAXIMUM)
3. DIMENSIONING & TOLERANCES CONFORM TO ASME Y14.5M, -1994.
4. THE PIN #1 IDENTIFIER MUST BE PLACED ON THE TOP SURFACE OF THE PACKAGE BY USING IDENTATION MARK OR OTHER FEATURE OF PACKAGE BODY.
5. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
6. PACKAGE WARPAGE MAX 0.08 mm.
7. APPLIED FOR EXPOSED PAD AND TERMINALS EXCLUDE EMBEDDING PART OF EXPOSED PAD FROM MEASURING.
8. APPLIED ONLY TO TERMINALS.

Figure 29. MXDLN16G outline dimension

Reflow Chart

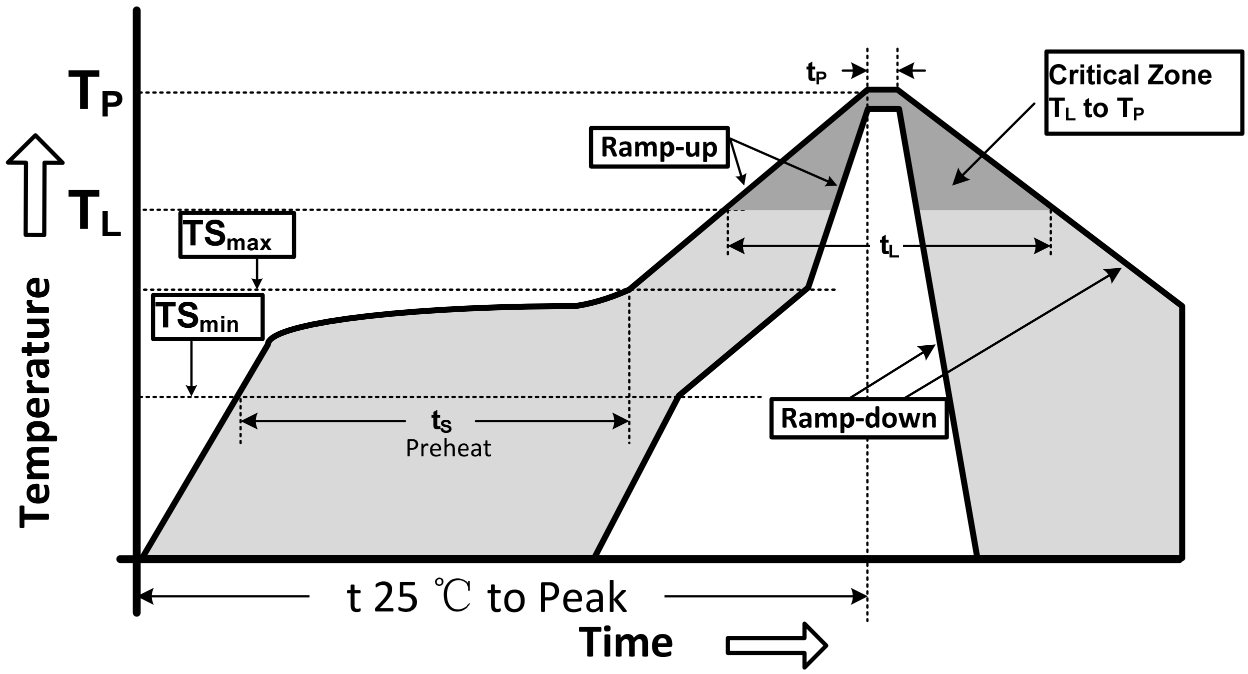


Figure 30. Recommended Lead-Free Reflow Profile

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.