NT1192FAAE1S
1.2 GHz band GNSS Low Noise Amplifier

FEATURES

- Frequency range: 1164 MHz to 1300 MHz
- Supply voltage: 1.5 V to 3.7 V (2.8 V typ.)
- Low current: 4.5 mA typ.
- High gain: 20.0 dB typ.@f = 1176 MHz
  20.0 dB typ.@f = 1227 MHz
  19.5 dB typ.@f = 1278 MHz
- Low NF: 0.7 dB typ.@f = 1176 MHz
  0.7 dB typ.@f = 1227 MHz
  0.7 dB typ.@f = 1278 MHz
- P-1dB(IN): -13.5 dBm typ.@f = 1176 MHz
  -13.0 dBm typ.@f = 1227 MHz
  -13.0 dBm typ.@f = 1278 MHz
- Small package size: 0.7 x 1.1 x 0.37 mm typ.
- RoHS compliant and Halogen Free, MSL1

APPLICATIONS

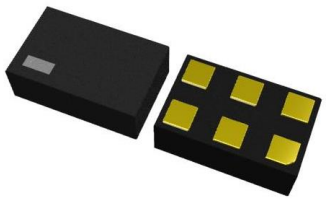
- GNSS L5/L2/L6 band application
- GNSS module, timing module
- Automotive antenna, navigation, dashboard camera
- Tracking device

GENERAL DESCRIPTION

The NT1192 is a low noise amplifier (LNA) GaAs MMIC designed for GNSS 1.2GHz band applications.

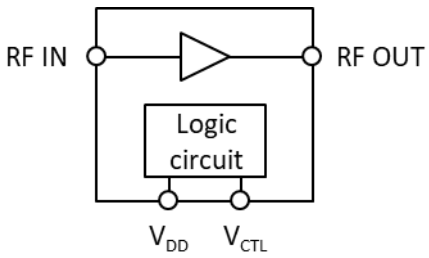
The NT1192 is featured high gain and low noise figure from 1164 MHz to 1300 MHz, which makes it ideal for L5/L2/L6 band GNSS applications and operates from 1.5 V to 3.7 V single voltage. Also, this LNA has the function of stand-by mode.

This LNA achieves compact mounting area by small size package EPFFP6-FA and only two external components.



EPFFP6-FA
0.7 × 1.1 × 0.37 (mm)

BLOCK DIAGRAM



■ PRODUCT NAME INFORMATION

NT1192 FA A E1 S

Description of configuration

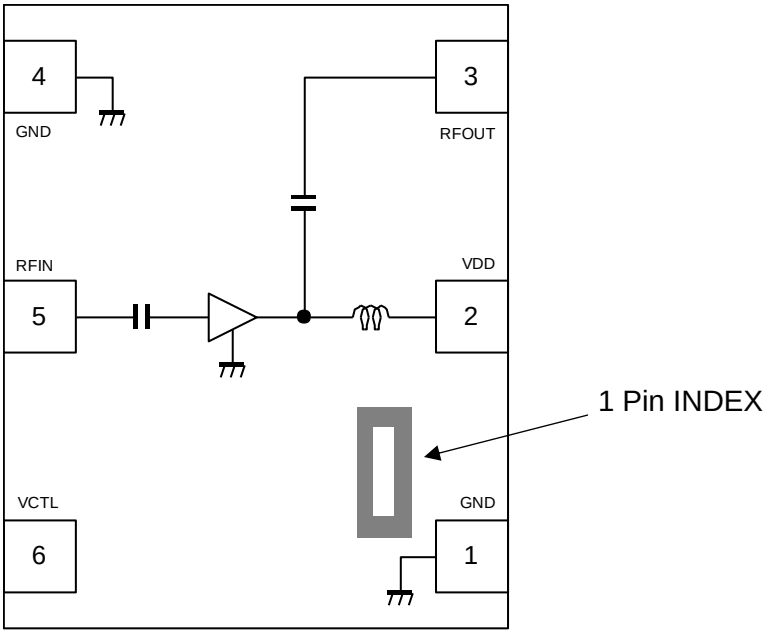
Suffix	Parameter	Description
FA	Package code	Indicates the package. Refer to the order information.
A	Version	Indicates the product version. “A” is initial version.
E1	Packing	Refer to the packing specifications.
S	Grade	Indicates the quality grade. “S” means general-purpose and consumer application. Operating temperature range: −40°C to 105°C, Test temperature: 25°C

■ ORDER INFORMATION

PRODUCT NAME	PACKAGE	RoHS	HALOGEN-FREE	PLATING COMPOSITION	MARKING	WEIGHT (mg)	Quantity per Reel (pcs)
NT1192FAAE1S	EPFFP6-FA	Yes	Yes	Au	7	0.7	3000

■ PIN DESCRIPTIONS

(Top View)



EPFFP6-FA Pin Configuration

Pin No.	Pin Name	Description
1	GND	Ground terminal
2	VDD	Operating voltage supply terminal
3	RFOUT	RF output terminal
4	GND	Ground terminal
5	RFIN	RF input terminal
6	VCTL	Control signal input terminal

Please refer to “APPLICATION CIRCUIT“ for details.

■ TRUTH TABLE

“H”=V_{CTL}(H), “L”=V_{CTL}(L)

V_{CTL}	Mode
H	Active mode
L	Stand-by mode

■ ABSOLUTE MAXIMUM RATINGS

General conditions: T_a = +25°C, Z_S = Z_l = 50Ω

Parameter	Symbol	Ratings	Unit
Supply voltage	V_{DD}	5.0	V
Control voltage	V_{CTL}	5.0	V
Input power	P_{IN} *1	+15	dBm
Power dissipation	P_D *2	430	mW
Operating temperature range	T_{opr}	−40 to +105	°C
Storage temperature range	T_{stg}	−55 to +150	°C

*1 V_{DD} = 2.8 V
*2 4-layer FR4 PCB with through-hole (101.5 x 114.5 mm), T_j = 150°C

ABSOLUTE MAXIMUM RATINGS
Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause permanent damage and may degrade the lifetime and safety for both device and system using the device in the field. The functional operation at or over these absolute maximum ratings is not assured.

■ ELECTROSTATIC DISCHARGE (ESD) PROTECTION VOLTAGE

Symbol	Conditions	Protection Voltage
HBM	C = 100 pF, R = 1.5 kΩ	±2000 V
CDM	Direct CDM	±1000 V

ESD PROTECTION VOLTAGE
The electrostatic discharge test is done based on JEITA ED-4701. In the HBM method, ESD is applied using the GND pin as reference pins.

■ RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value	Unit
Supply voltage	V_{DD}	1.5 to 3.7	V
Control voltage	V_{CTL}	1.5 to 3.7	V
Operating temperature range	T_a	-40 to +105	°C

RECOMMENDED OPERATING CONDITIONS
All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions.

■ ELECTRICAL CHARACTERISTICS 1 (DC)

General conditions: T_a = +25°C, Z_s = Z_l = 50Ω

Parameter	Symbol	Conditions	MIN	TYP	MAX	Unit
Supply voltage	V_{DD}		1.5	2.8	3.7	V
Control voltage (High)	V_{CTL}(H)		1.5	1.8	3.7	V
Control voltage (Low)	V_{CTL}(L)		0	0	0.3	V
Operating current	I_{DD}	RF OFF, V_{DD} = 2.8 V, V_{CTL} = 1.8 V	-	4.5	8.0	mA
		RF OFF, V_{DD} = 1.8 V, V_{CTL} = 1.8 V	-	3.5	7.0	
		RF OFF, V_{DD} = 2.8 V, V_{CTL} = 0 V	-	0.1	3.0	μA
		RF OFF, V_{DD} = 1.8 V, V_{CTL} = 0 V	-	0.1	3.0	
Control current	I_{CTL}	RF OFF, V_{CTL} = 1.8 V	-	5	12	μA

■ ELECTRICAL CHARACTERISTICS 2 (RF)

General conditions: V_{DD} = 2.8 V, V_{CTL} = 1.8 V, f = 1164 MHz to 1300 MHz, T_a = +25°C, Z_s = Z_l = 50Ω, with application circuit

Parameter	Symbol	Conditions	MIN	TYP	MAX	Unit
Small signal gain	Gain	f = 1176 MHz (L5 band), Exclude PCB, connector loss (0.09 dB)	16.0	20.0	24.0	dB
		f = 1227 MHz (L2 band), Exclude PCB, connector loss (0.10 dB)				
		f = 1278 MHz (L6 band), Exclude PCB, connector loss (0.11 dB)	16.0	19.5	24.0	
Noise figure	NF	f = 1176 MHz (L5 band), Exclude PCB, connector loss (0.09 dB)	-	0.70	1.0	dB
		f = 1227 MHz (L2 band), Exclude PCB, connector loss (0.10 dB)				
		f = 1278 MHz (L6 band), Exclude PCB, connector loss (0.11 dB)				
Isolation	ISL	f = 1176 MHz (L5 band)	25	35	-	dB
		f = 1227 MHz (L2 band)				
		f = 1278 MHz (L6 band)				
Input power at 1 dB gain compression point	P-1dB(IN)	f = 1176 MHz (L5 band)	-18.0	-13.5	-	dBm
		f = 1227 MHz (L2 band)	-18.0	-13.0	-	
		f = 1278 MHz (L6 band)				
Input 3rd order intercept point	IIP3	f1 = 1176 MHz, f2 = f1 + 1 MHz, P_{IN} = -30 dBm	-6.5	-2.0	-	dBm
		f1 = 1227 MHz, f2 = f1 + 1 MHz, P_{IN} = -30 dBm				
		f1 = 1278 MHz, f2 = f1 + 1 MHz, P_{IN} = -30 dBm				
RFIN Return loss	RLi	f = 1176 MHz (L5 band)	6.0	12.0	-	dB
		f = 1227 MHz (L2 band)	6.0	15.0	-	
		f = 1278 MHz (L6 band)				
RFOUT Return loss	RLo	f = 1176 MHz (L5 band)	6.0	11.0	-	dB
		f = 1227 MHz (L2 band)				
		f = 1278 MHz (L6 band)	6.0	10.0	-	
k factor	k	f = 50 MHz to 10 GHz	1.0	-	-	-

■ ELECTRICAL CHARACTERISTICS 3 (RF)

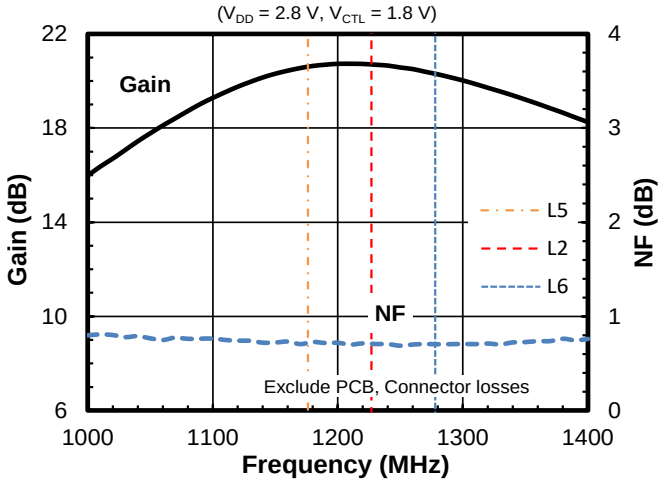
General conditions: V_{DD} = 1.8 V, V_{CTL} = 1.8 V, f = 1164 MHz to 1300 MHz, T_a = +25°C, Z_s = Z_l = 50Ω, with application circuit

Parameter	Symbol	Conditions	MIN	TYP	MAX	Unit
Small signal gain	Gain	f = 1176 MHz (L5 band), Exclude PCB, connector loss (0.09 dB)	15.0	19.5	23.0	dB
		f = 1227 MHz (L2 band), Exclude PCB, connector loss (0.10 dB)				
		f = 1278 MHz (L6 band), Exclude PCB, connector loss (0.11 dB)	15.0	19.0	23.0	
Noise figure	NF	f = 1176 MHz (L5 band), Exclude PCB, connector loss (0.09 dB)	-	0.75	1.0	dB
		f = 1227 MHz (L2 band), Exclude PCB, connector loss (0.10 dB)				
		f = 1278 MHz (L6 band), Exclude PCB, connector loss (0.11 dB)				
Isolation	ISL	f = 1176 MHz (L5 band)	25	35	-	dB
		f = 1227 MHz (L2 band)				
		f = 1278 MHz (L6 band)				
Input power at 1 dB gain compression point	P-1dB(IN)	f = 1176 MHz (L5 band)	-21.0	-17.0	-	dBm
		f = 1227 MHz (L2 band)				
		f = 1278 MHz (L6 band)	-21.0	-16.0	-	
Input 3rd order intercept point	IIP3	f1 = 1176 MHz, f2 = f1 + 1 MHz, P_{IN} = -30 dBm	-9.5	-5.5	-	dBm
		f1 = 1227 MHz, f2 = f1 + 1 MHz, P_{IN} = -30 dBm				
		f1 = 1278 MHz, f2 = f1 + 1 MHz, P_{IN} = -30 dBm	-9.5	-5.0	-	
RFIN Return loss	RLi	f = 1176 MHz (L5 band)	6.0	11.0	-	dB
		f = 1227 MHz (L2 band)	6.0	15.0	-	
		f = 1278 MHz (L6 band)	6.0	14.0	-	
RFOUT Return loss	RLo	f = 1176 MHz (L5 band)	6.0	11.0	-	dB
		f = 1227 MHz (L2 band)				
		f = 1278 MHz (L6 band)	5.0	9.0	-	
k factor	k	f = 50 MHz to 10 GHz	1.0	-	-	-

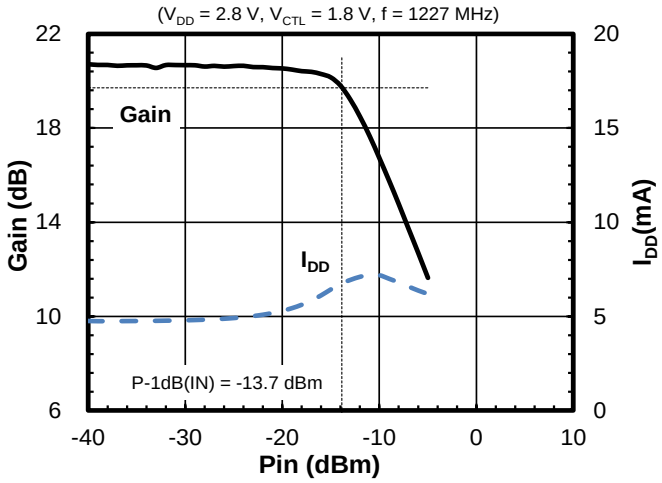
■ TYPICAL CHARACTERISTICS

Conditions: V_{DD} = 2.8 V, V_{CTL} = 1.8 V, T_a = 25°C, Z_s = Z_l = 50 Ω, with application circuit.
(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)

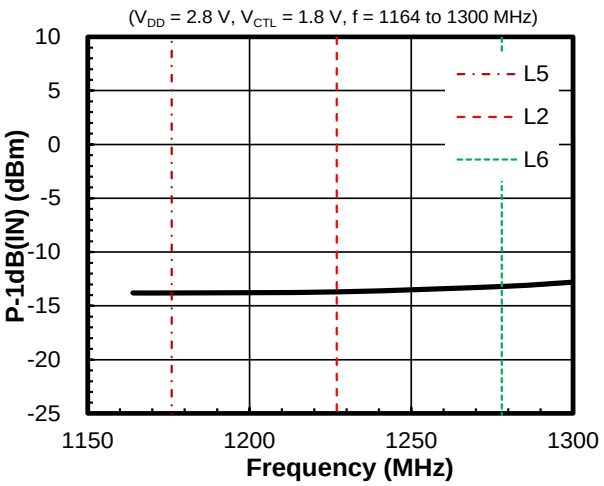
Gain, NF vs. Frequency



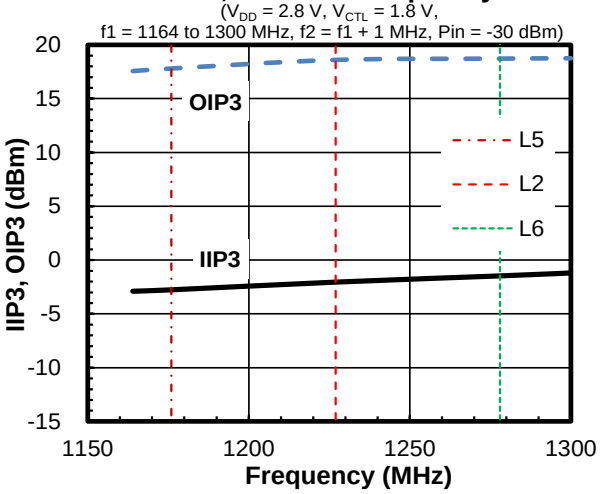
Gain, I_{DD} vs. Pin



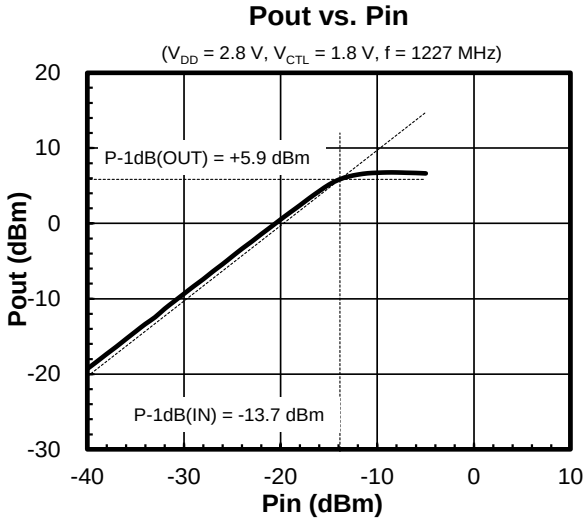
P-1dB(IN) vs. Frequency



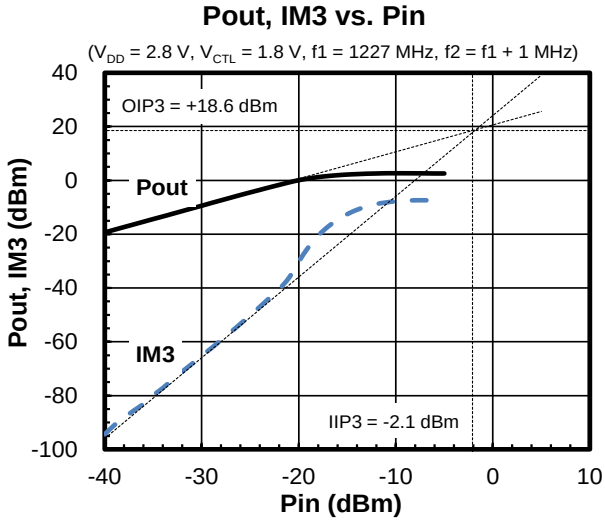
IIP3, OIP3 vs. Frequency



Pout vs. Pin



Pout, IM3 vs. Pin

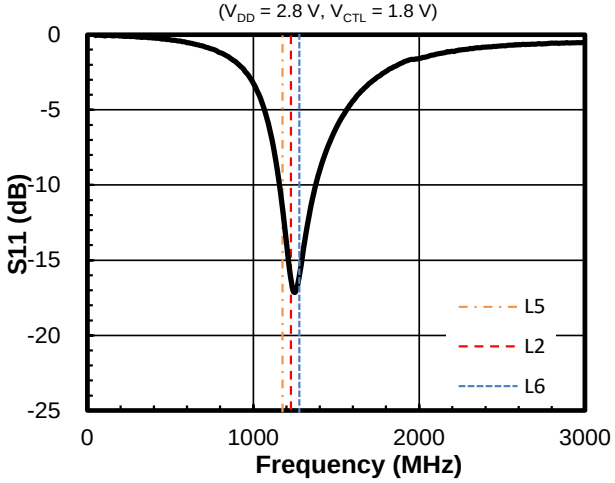


■ TYPICAL CHARACTERISTICS

Conditions: V_{DD} = 2.8 V, V_{CTL} = 1.8 V, T_a = 25°C, Z_S = Z_L = 50 Ω, with application circuit.
(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)

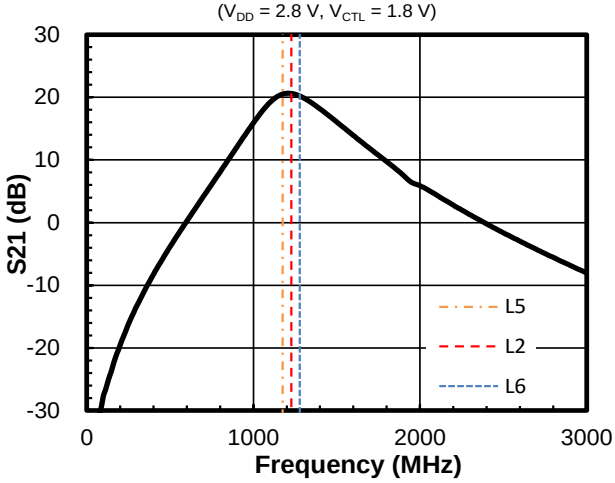
S11 vs. Frequency

(V_{DD} = 2.8 V, V_{CTL} = 1.8 V)



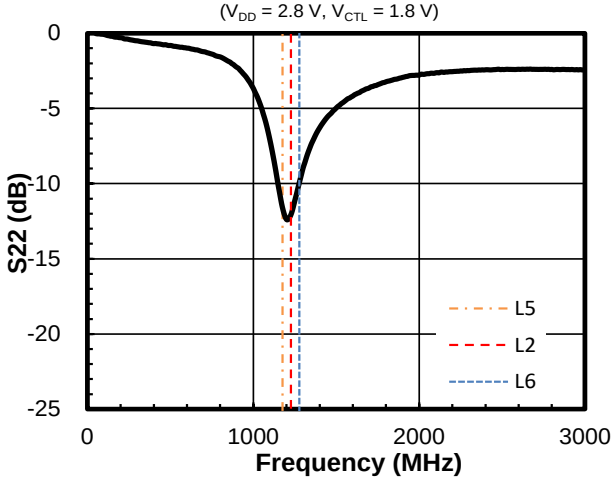
S21 vs. Frequency

(V_{DD} = 2.8 V, V_{CTL} = 1.8 V)



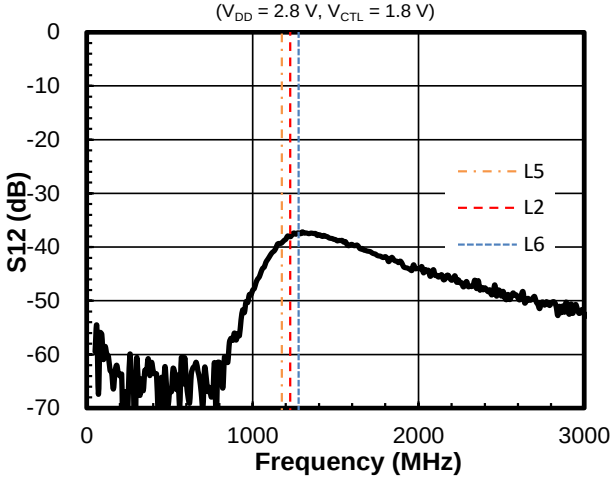
S22 vs. Frequency

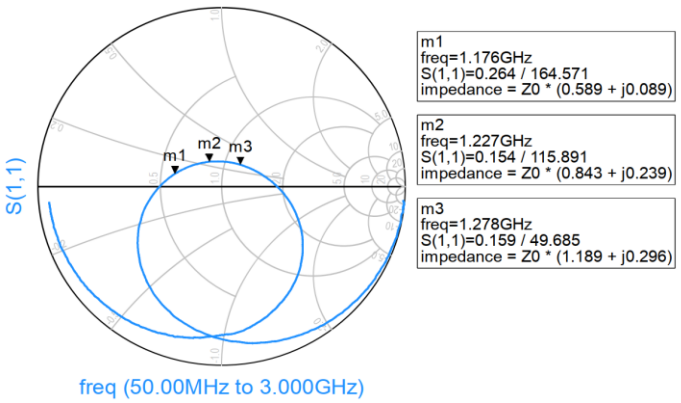
(V_{DD} = 2.8 V, V_{CTL} = 1.8 V)

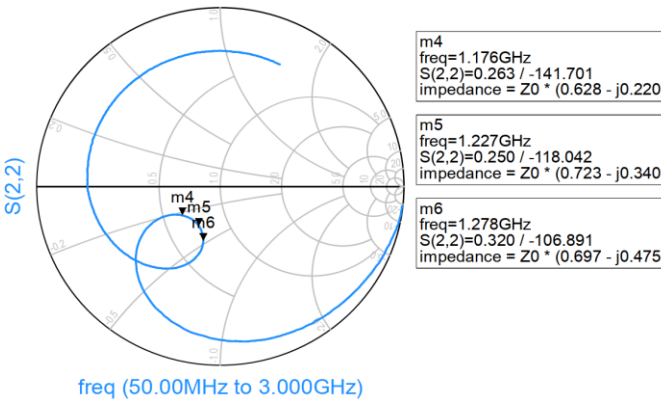


S12 vs. Frequency

(V_{DD} = 2.8 V, V_{CTL} = 1.8 V)





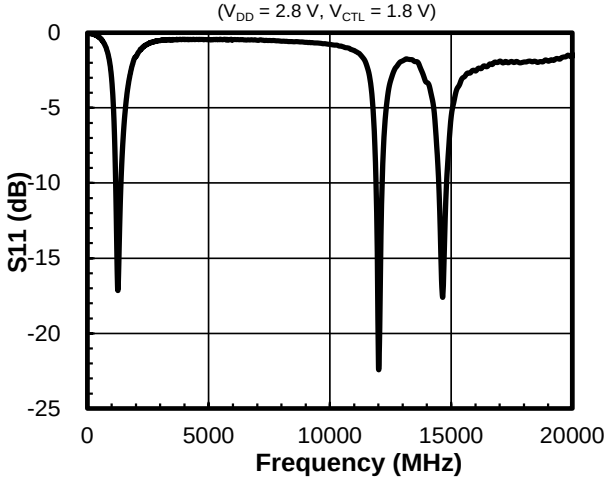


■ TYPICAL CHARACTERISTICS

Conditions: V_{DD} = 2.8 V, V_{CTL} = 1.8 V, T_a = 25°C, Z_s = Z_l = 50 Ω, with application circuit.
(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)

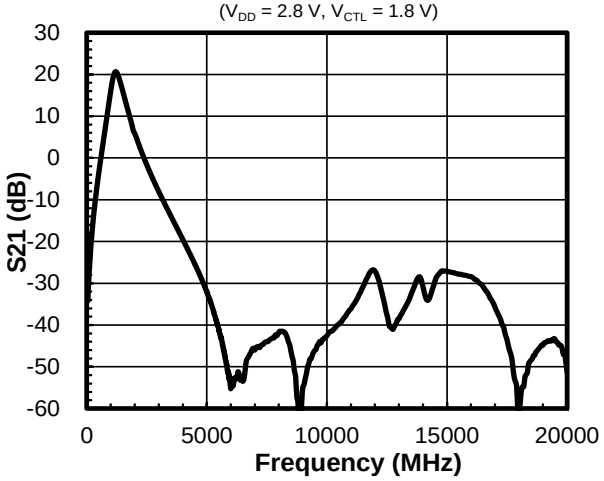
S11 vs. Frequency

(V_{DD} = 2.8 V, V_{CTL} = 1.8 V)



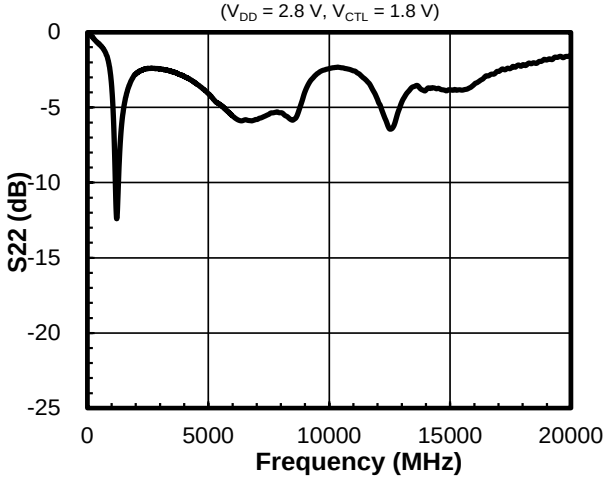
S21 vs. Frequency

(V_{DD} = 2.8 V, V_{CTL} = 1.8 V)



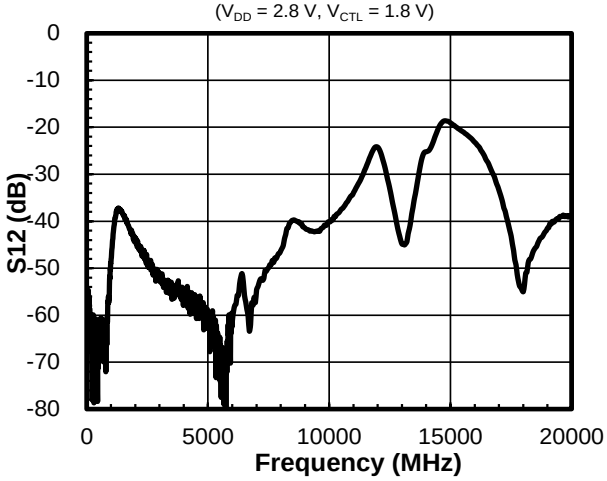
S22 vs. Frequency

(V_{DD} = 2.8 V, V_{CTL} = 1.8 V)



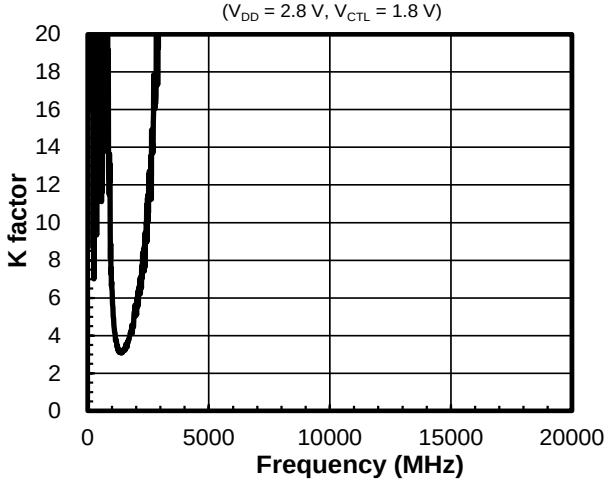
S12 vs. Frequency

(V_{DD} = 2.8 V, V_{CTL} = 1.8 V)



K factor vs. Frequency

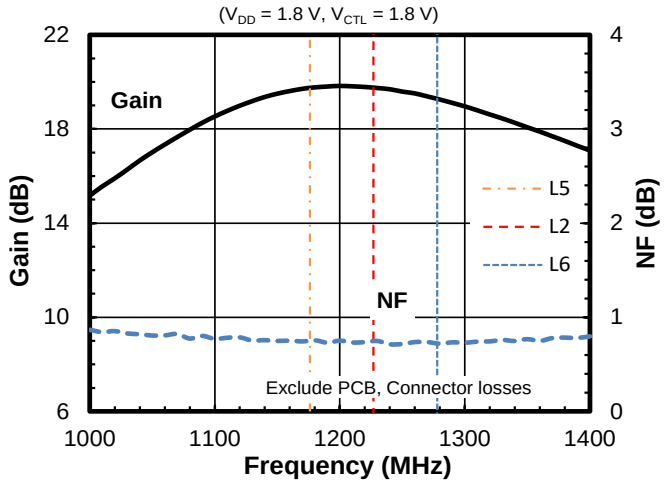
(V_{DD} = 2.8 V, V_{CTL} = 1.8 V)



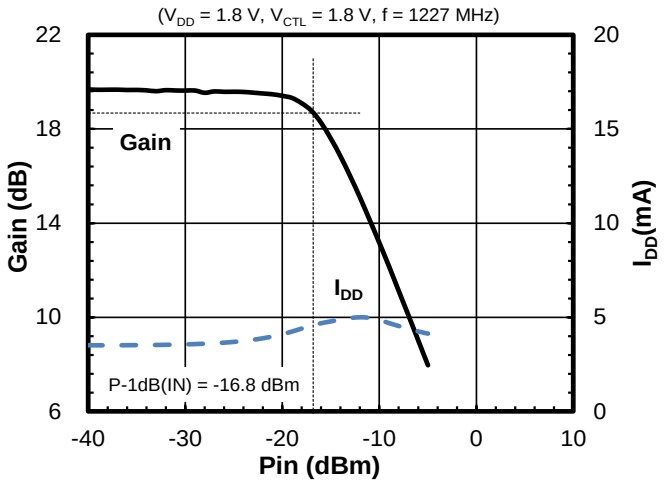
■ TYPICAL CHARACTERISTICS

Conditions: V_{DD} = 1.8 V, V_{CTL} = 1.8 V, T_a = 25°C, Z_S = Z_L = 50 Ω, with application circuit.
(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)

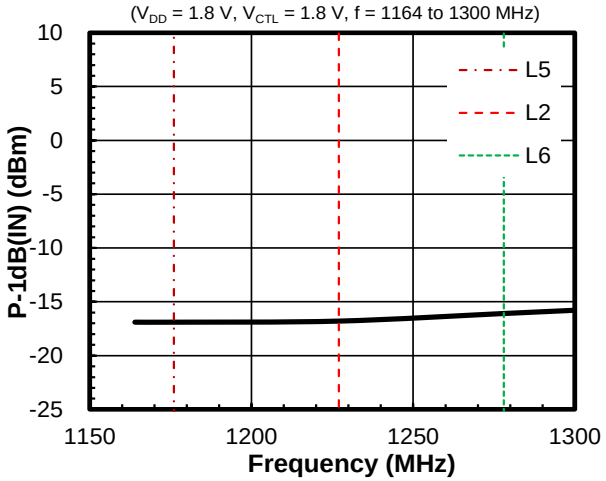
Gain, NF vs. Frequency



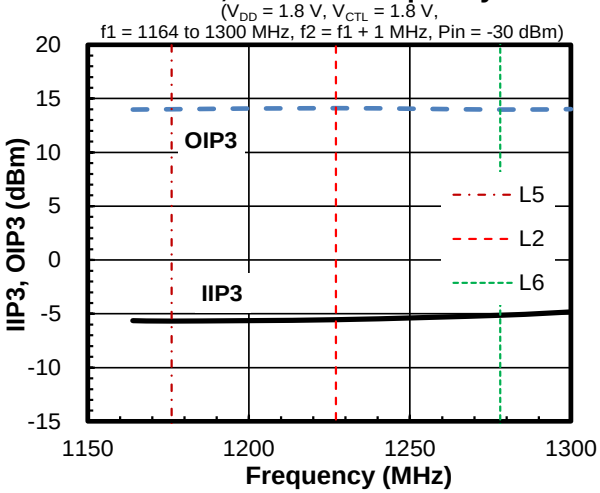
Gain, I_{DD} vs. Pin



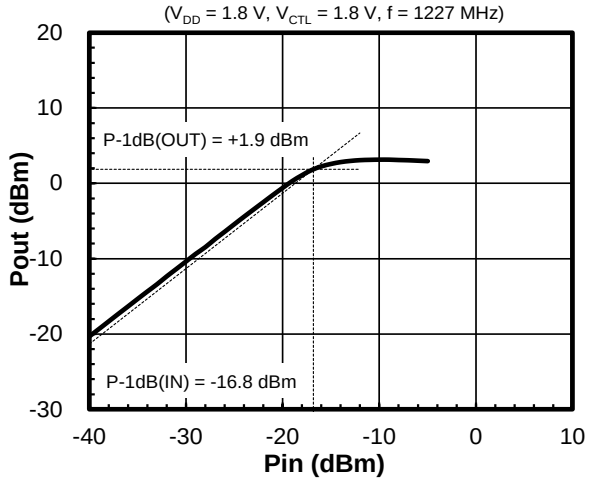
P-1dB(IN) vs. Frequency



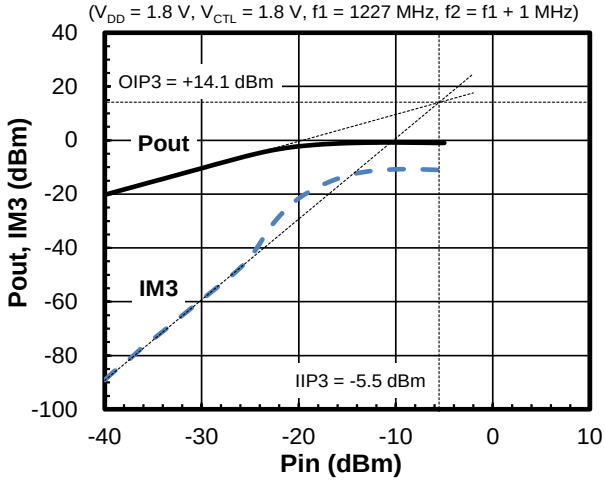
IIP3, OIP3 vs. Frequency



Pout vs. Pin



Pout, IM3 vs. Pin

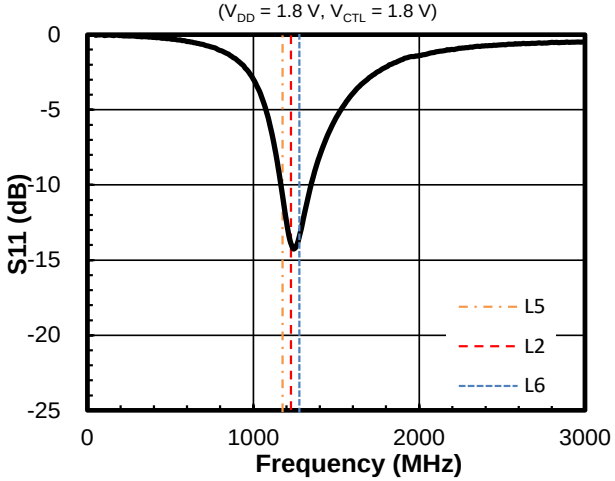


■ TYPICAL CHARACTERISTICS

Conditions: V_{DD} = 1.8 V, V_{CTL} = 1.8 V, T_a = 25°C, Z_S = Z_L = 50 Ω, with application circuit.
(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)

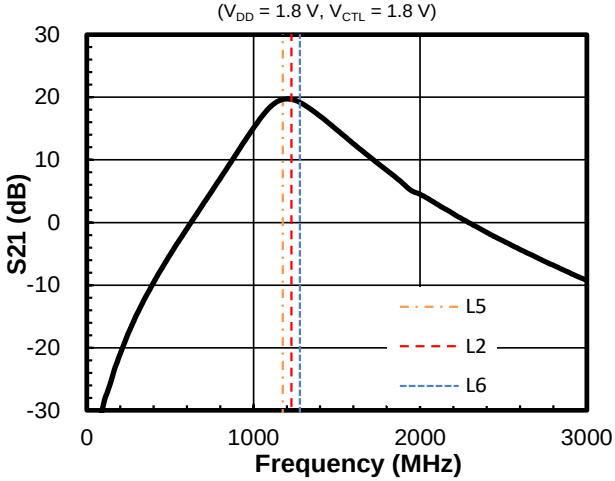
S11 vs. Frequency

(V_{DD} = 1.8 V, V_{CTL} = 1.8 V)



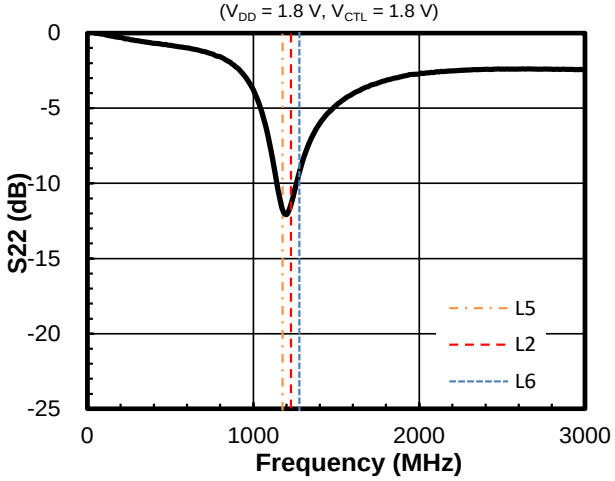
S21 vs. Frequency

(V_{DD} = 1.8 V, V_{CTL} = 1.8 V)



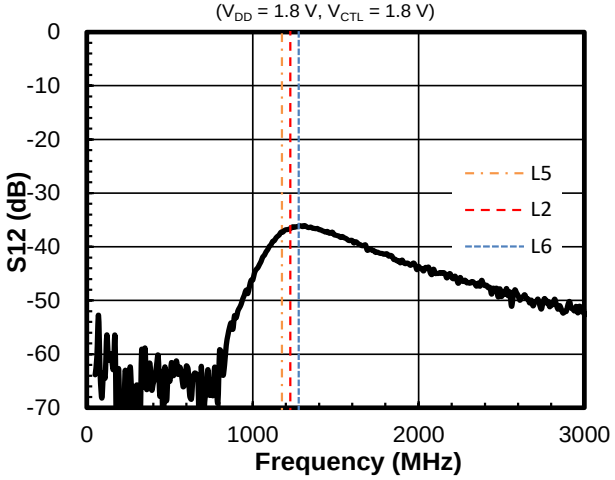
S22 vs. Frequency

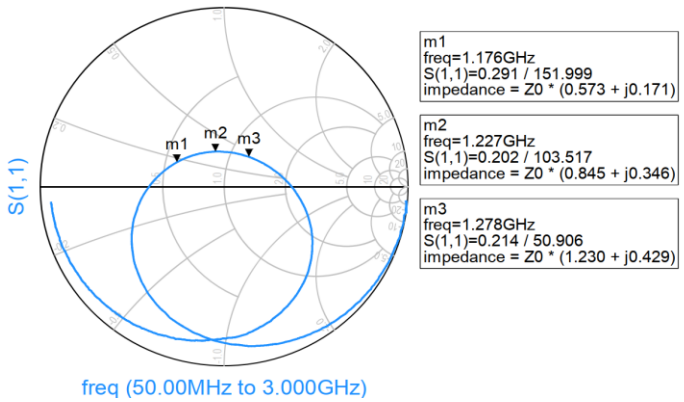
(V_{DD} = 1.8 V, V_{CTL} = 1.8 V)

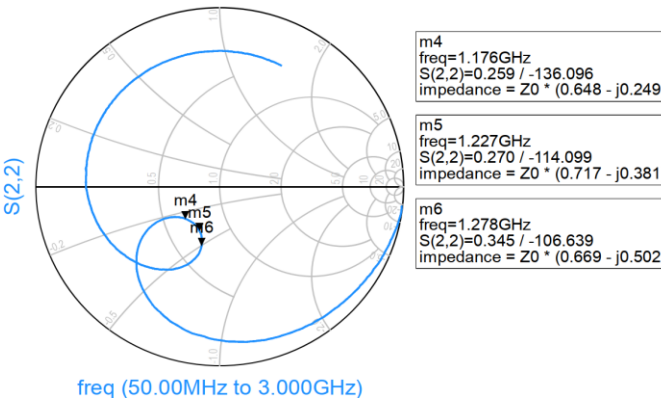


S12 vs. Frequency

(V_{DD} = 1.8 V, V_{CTL} = 1.8 V)





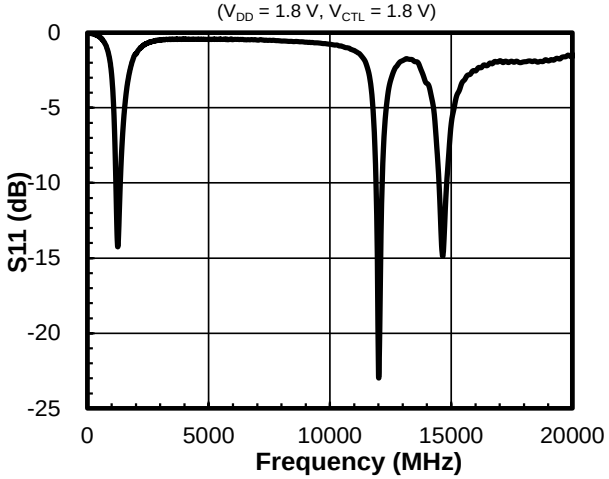


■ TYPICAL CHARACTERISTICS

Conditions: V_{DD} = 1.8 V, V_{CTL} = 1.8 V, T_a = 25°C, Z_s = Z_l = 50 Ω, with application circuit.
(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)

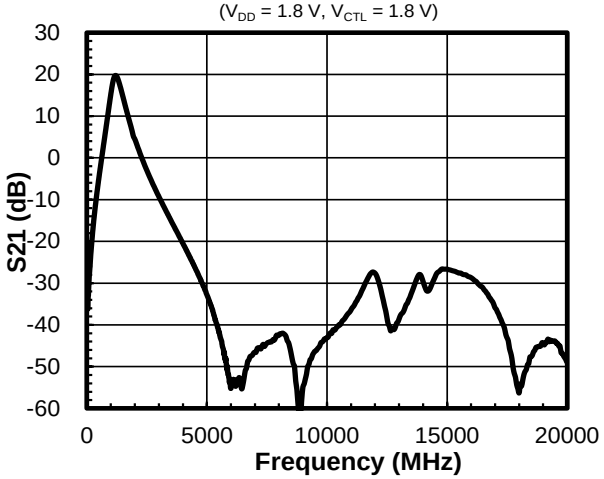
S11 vs. Frequency

(V_{DD} = 1.8 V, V_{CTL} = 1.8 V)



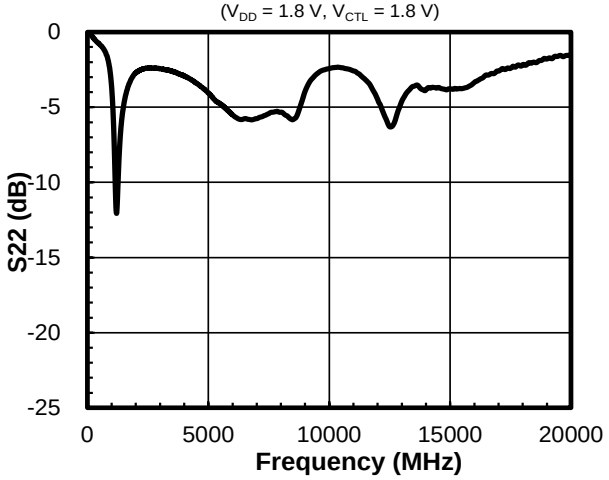
S21 vs. Frequency

(V_{DD} = 1.8 V, V_{CTL} = 1.8 V)



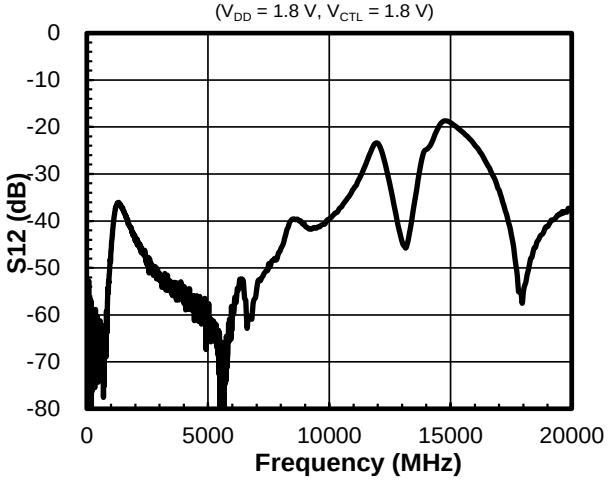
S22 vs. Frequency

(V_{DD} = 1.8 V, V_{CTL} = 1.8 V)



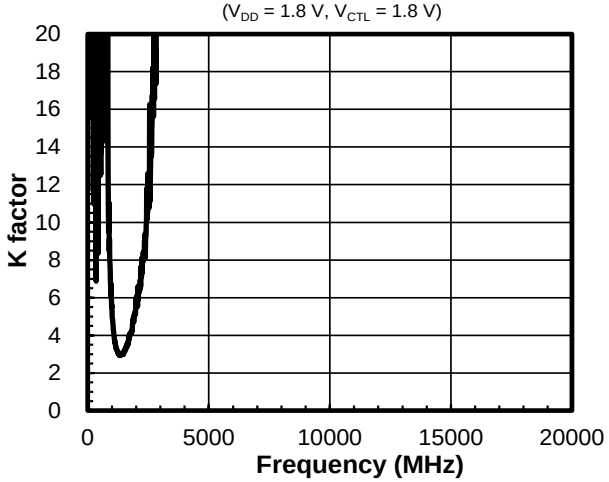
S12 vs. Frequency

(V_{DD} = 1.8 V, V_{CTL} = 1.8 V)



K factor vs. Frequency

(V_{DD} = 1.8 V, V_{CTL} = 1.8 V)

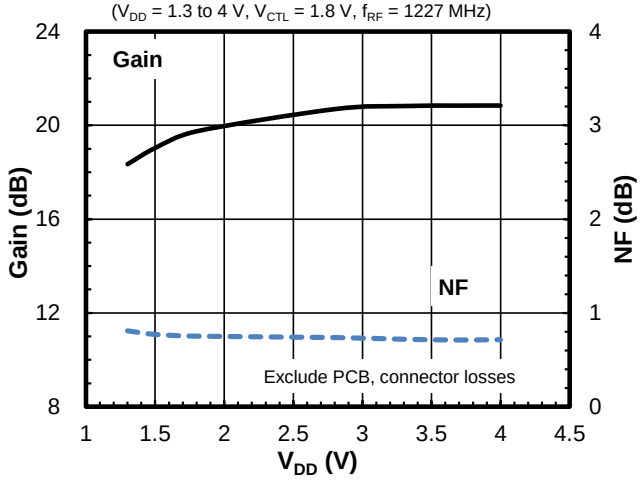


■ TYPICAL CHARACTERISTICS

Conditions: T_a = 25°C, Z_S = Z_L = 50 Ω, with application circuit.
(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)

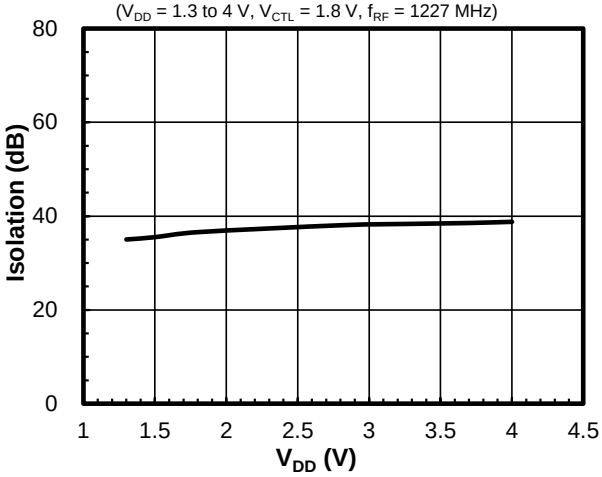
Gain, NF vs. V_{DD}

(V_{DD} = 1.3 to 4 V, V_{CTL} = 1.8 V, f_{RF} = 1227 MHz)



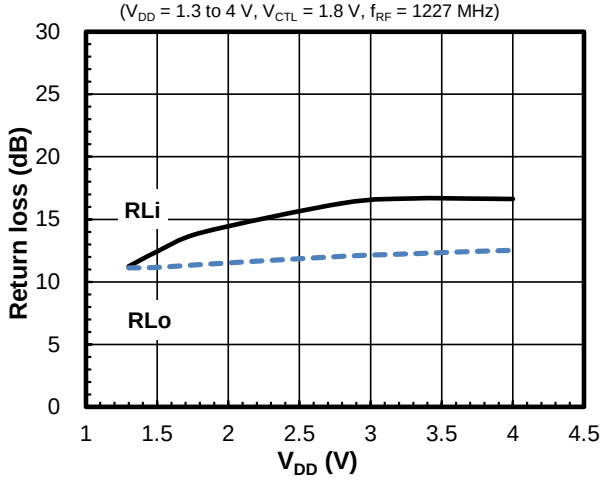
Isolation vs. V_{DD}

(V_{DD} = 1.3 to 4 V, V_{CTL} = 1.8 V, f_{RF} = 1227 MHz)



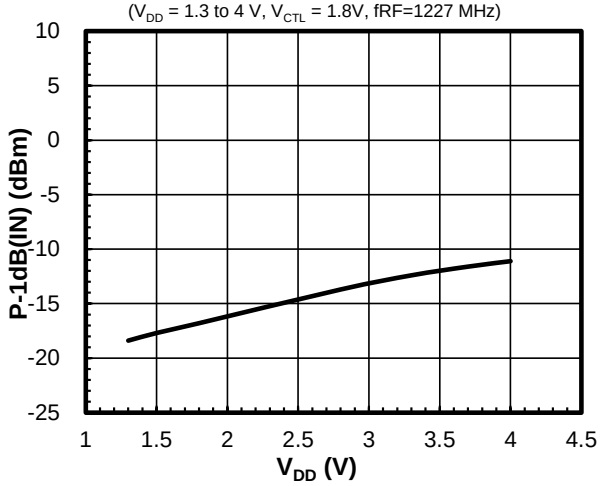
Return loss vs. V_{DD}

(V_{DD} = 1.3 to 4 V, V_{CTL} = 1.8 V, f_{RF} = 1227 MHz)



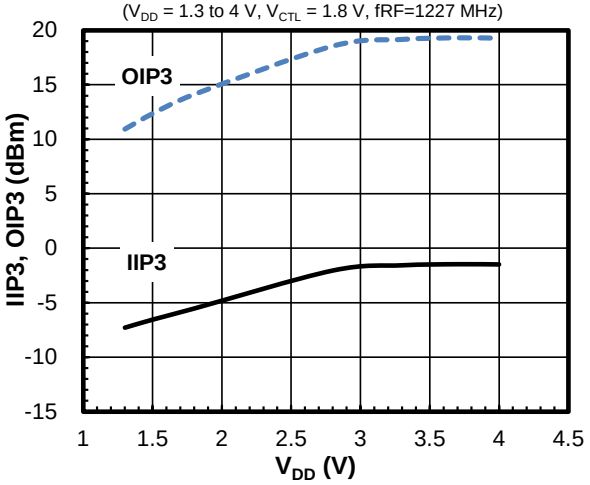
P-1dB(IN) vs. V_{DD}

(V_{DD} = 1.3 to 4 V, V_{CTL} = 1.8V, fRF=1227 MHz)



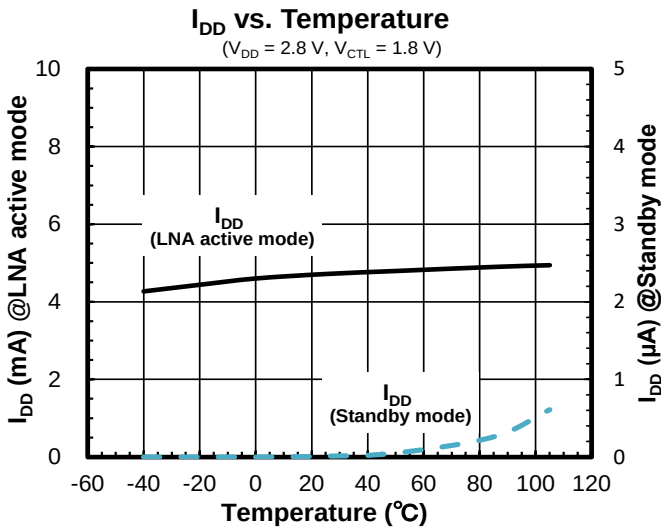
IIP3, OIP3 vs. V_{DD}

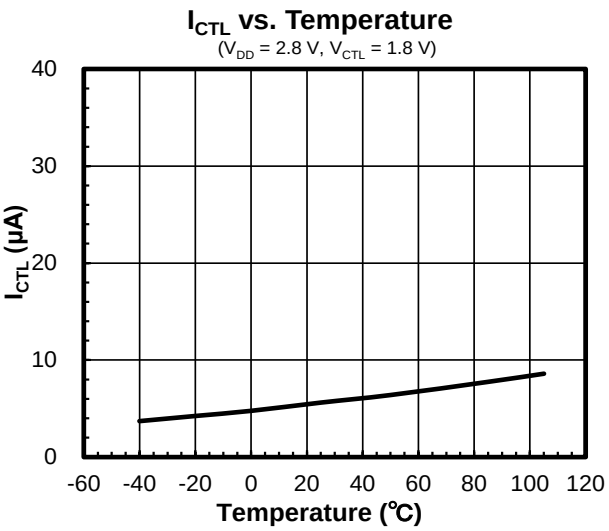
(V_{DD} = 1.3 to 4 V, V_{CTL} = 1.8 V, fRF=1227 MHz)



■ TYPICAL CHARACTERISTICS

Conditions: V_{DD} = 2.8 V, V_{CTL} = 1.8 V, Z_S = Z_I = 50 Ω, with application circuit.
(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)



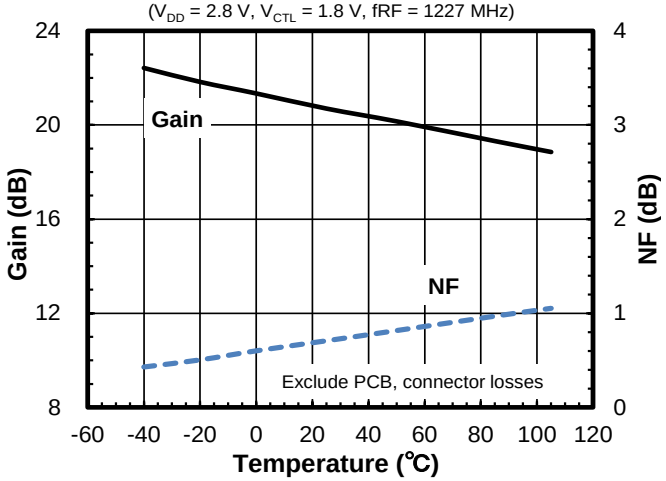


■ TYPICAL CHARACTERISTICS

Conditions: V_{DD} = 2.8 V, V_{CTL} = 1.8 V, Z_S = Z_I = 50 Ω, with application circuit.
(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)

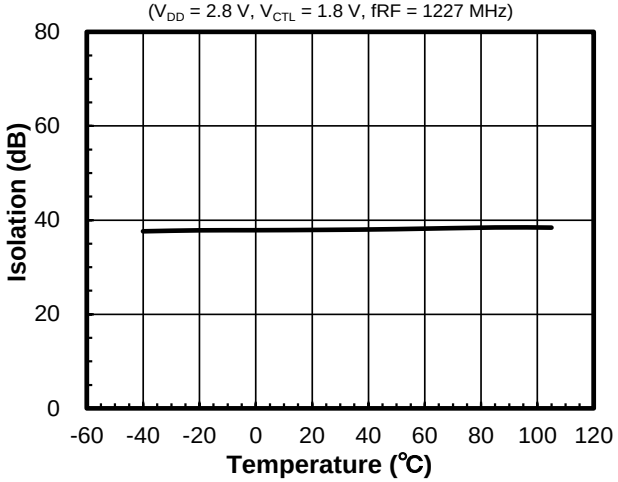
Gain, NF vs. Temperature

(V_{DD} = 2.8 V, V_{CTL} = 1.8 V, fRF = 1227 MHz)



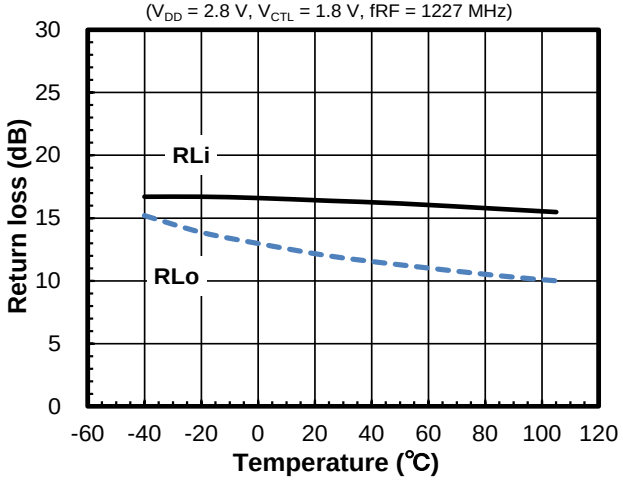
Isolation vs. Temperature

(V_{DD} = 2.8 V, V_{CTL} = 1.8 V, fRF = 1227 MHz)



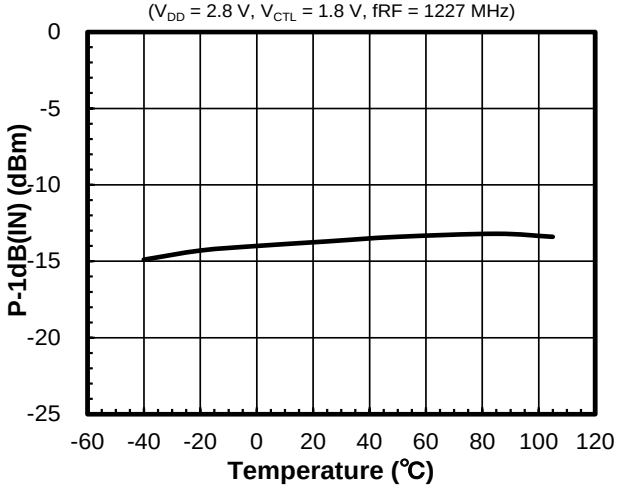
Return loss vs. Temperature

(V_{DD} = 2.8 V, V_{CTL} = 1.8 V, fRF = 1227 MHz)



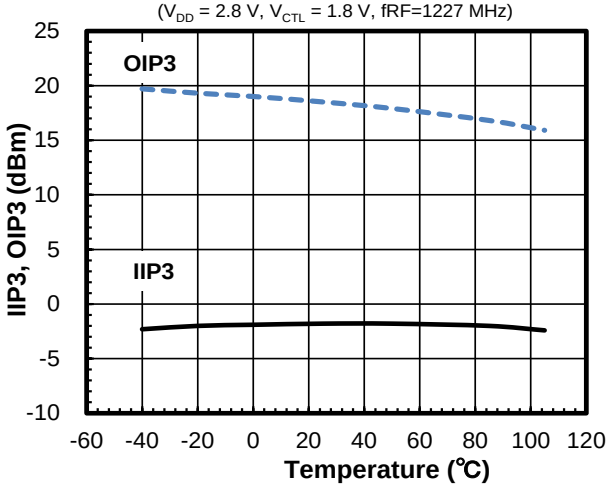
P-1dB(IN) vs. Temperature

(V_{DD} = 2.8 V, V_{CTL} = 1.8 V, fRF = 1227 MHz)



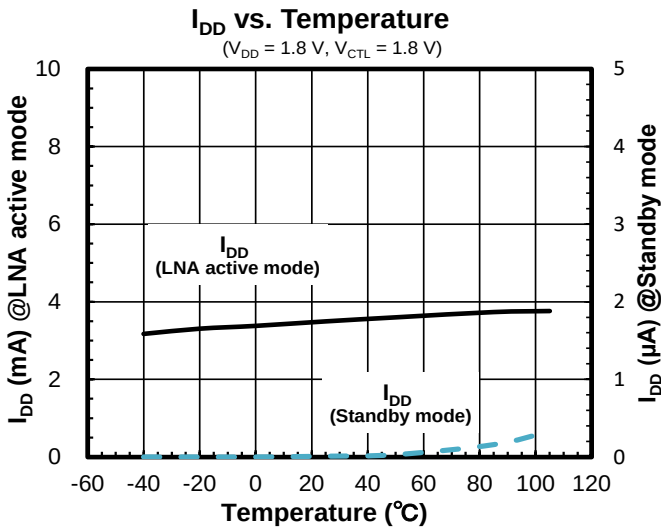
IIP3, OIP3 vs. Temperature

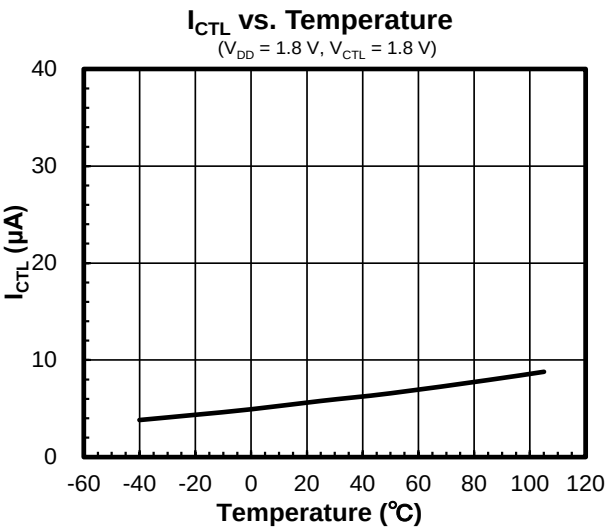
(V_{DD} = 2.8 V, V_{CTL} = 1.8 V, fRF=1227 MHz)



■ **TYPICAL CHARACTERISTICS**

Conditions: V_{DD} = 1.8 V, V_{CTL} = 1.8 V, Z_S = Z_I = 50 Ω, with application circuit.
(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)



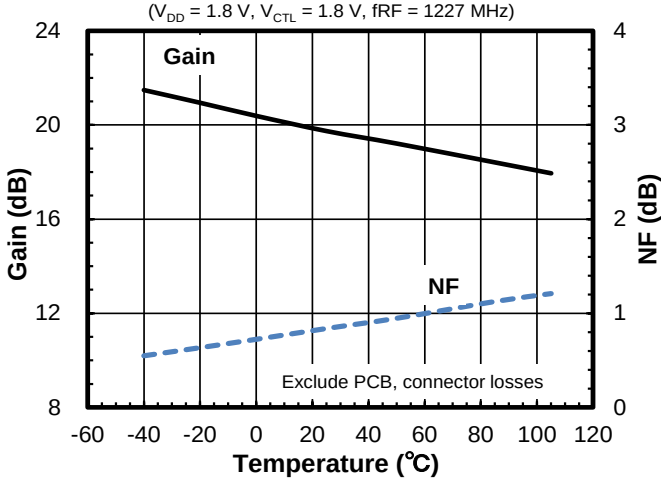


■ TYPICAL CHARACTERISTICS

Conditions: V_{DD} = 1.8 V, V_{CTL} = 1.8 V, Z_S = Z_I = 50 Ω, with application circuit.
(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)

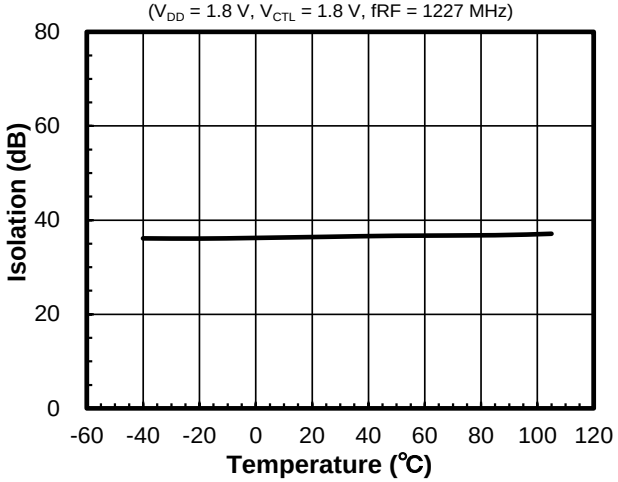
Gain, NF vs. Temperature

(V_{DD} = 1.8 V, V_{CTL} = 1.8 V, fRF = 1227 MHz)



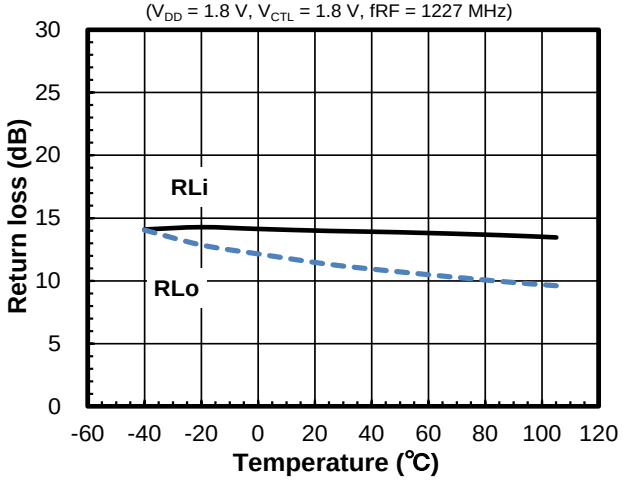
Isolation vs. Temperature

(V_{DD} = 1.8 V, V_{CTL} = 1.8 V, fRF = 1227 MHz)



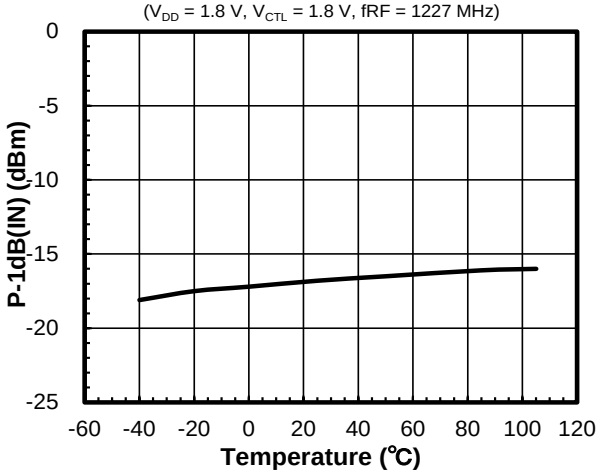
Return loss vs. Temperature

(V_{DD} = 1.8 V, V_{CTL} = 1.8 V, fRF = 1227 MHz)



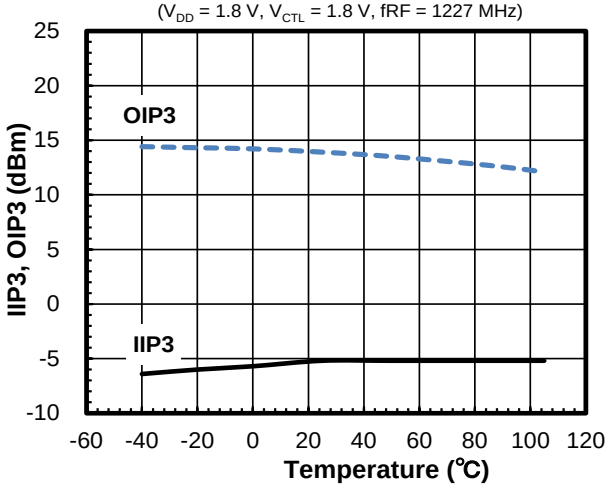
P-1dB(IN) vs. Temperature

(V_{DD} = 1.8 V, V_{CTL} = 1.8 V, fRF = 1227 MHz)

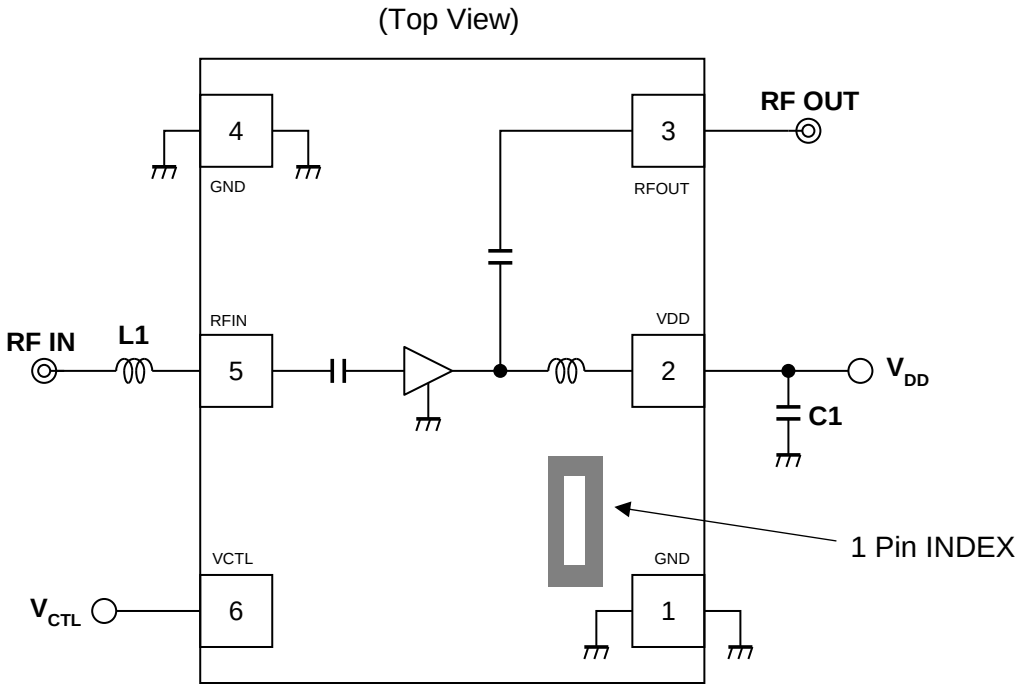


IIP3, OIP3 vs. Temperature

(V_{DD} = 1.8 V, V_{CTL} = 1.8 V, fRF = 1227 MHz)



■ APPLICATION CIRCUIT



NT1192FAAE1S Typical Application Circuit

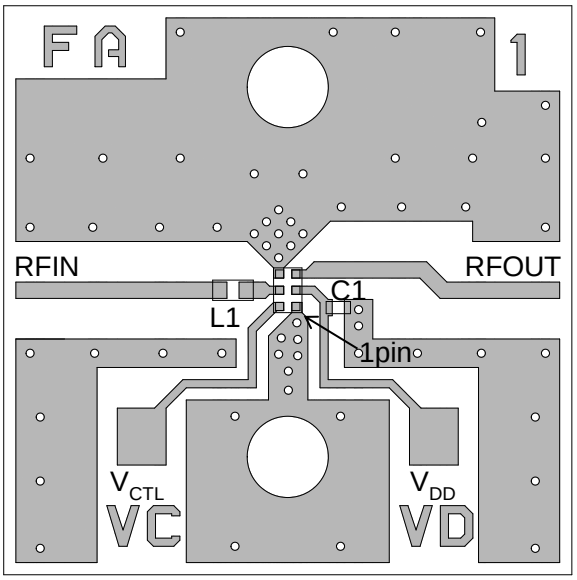
<Parts list>

Part ID	Value	Notes
L1	20 nH	LQW15AN_00 series (MURATA)
C1	1000 pF	GRM03 series (MURATA)

■ APPLICATION NOTES

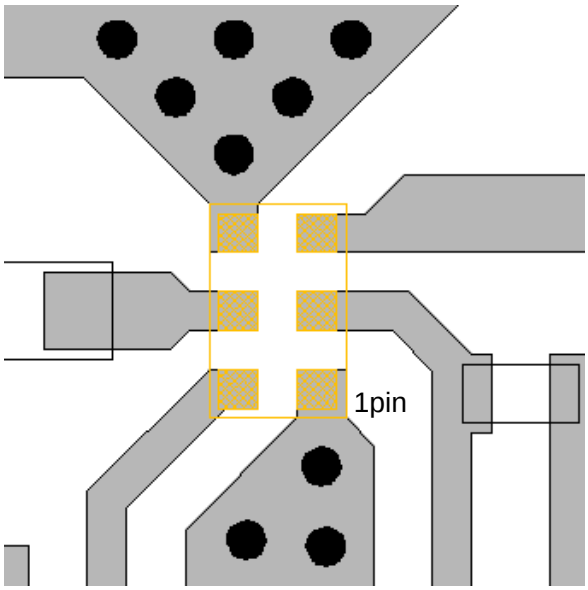
● Evaluation Board / PCB layout

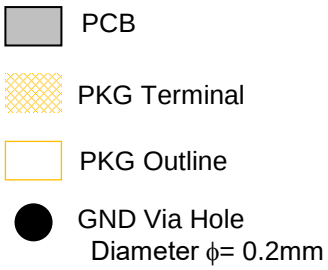
(Top View)



PCB
Substrate: FR-4
Thickness: 0.2 mm
Microstrip line width: 0.4 mm (Z_0=50Ω)
Size: 14.0 x 14.0 mm

● PCB layout guideline





● PRECAUTIONS

- All external parts should be placed as close as possible to the LNA.
- For good RF performance, all GND terminals must be connected to PCB ground plane of substrate, and via-holes for GND should be placed near the LNA.

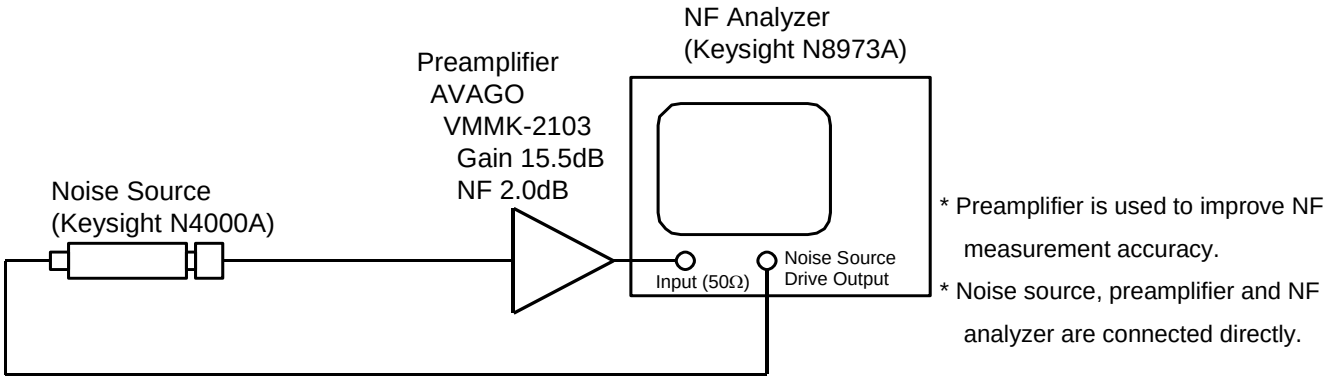
● **NF Measurement Block Diagram**

Measuring instruments

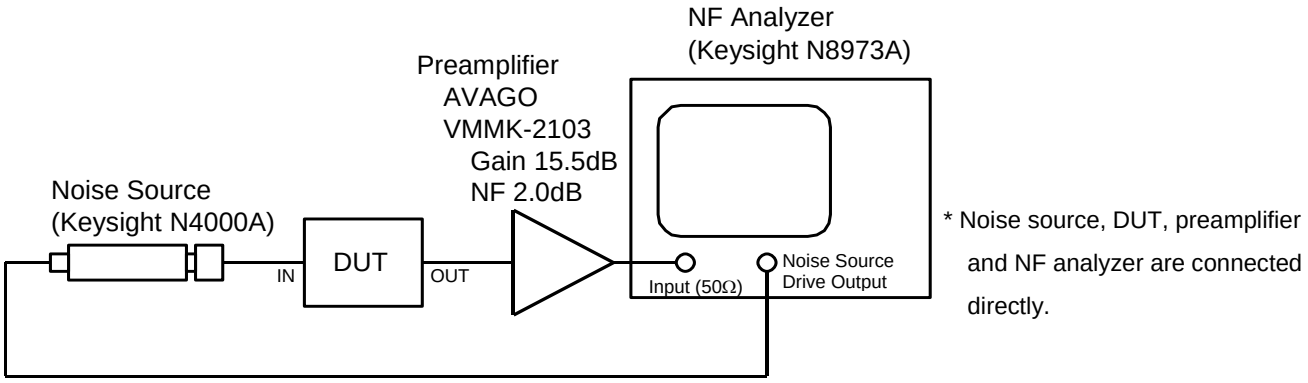
NF Analyzer : Keysight N8973A
Noise Source : Keysight N4000A

Setting the NF analyzer

Measurement mode form
Device under test : Amplifier
System downconverter : off
Mode setup form
Sideband : LSB
Averages : 16
Average mode : Point
Bandwidth : 4 MHz
Loss comp : off
Tcold : setting the temperature of noise source (Auto)



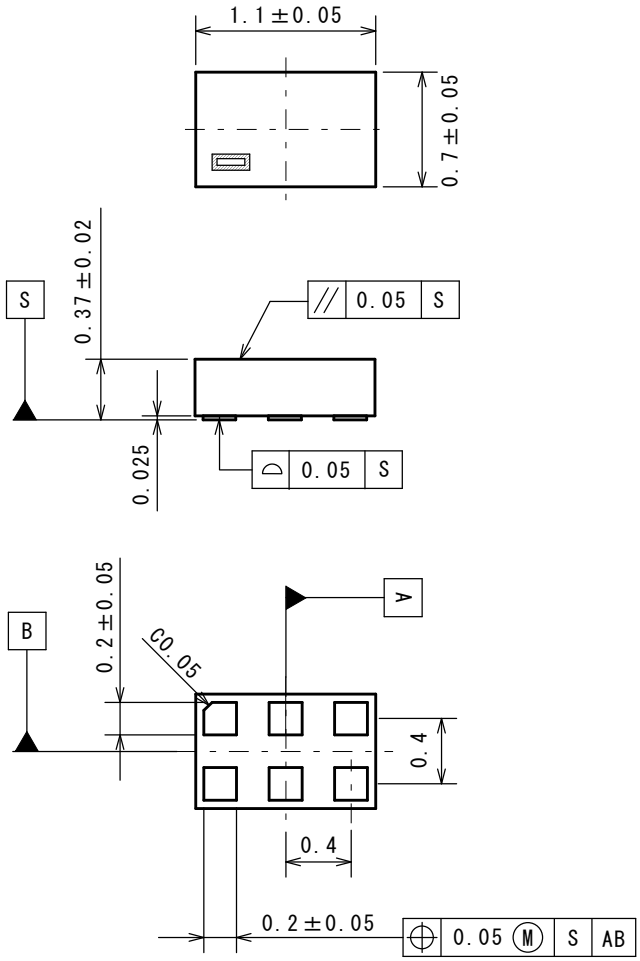
Calibration setup



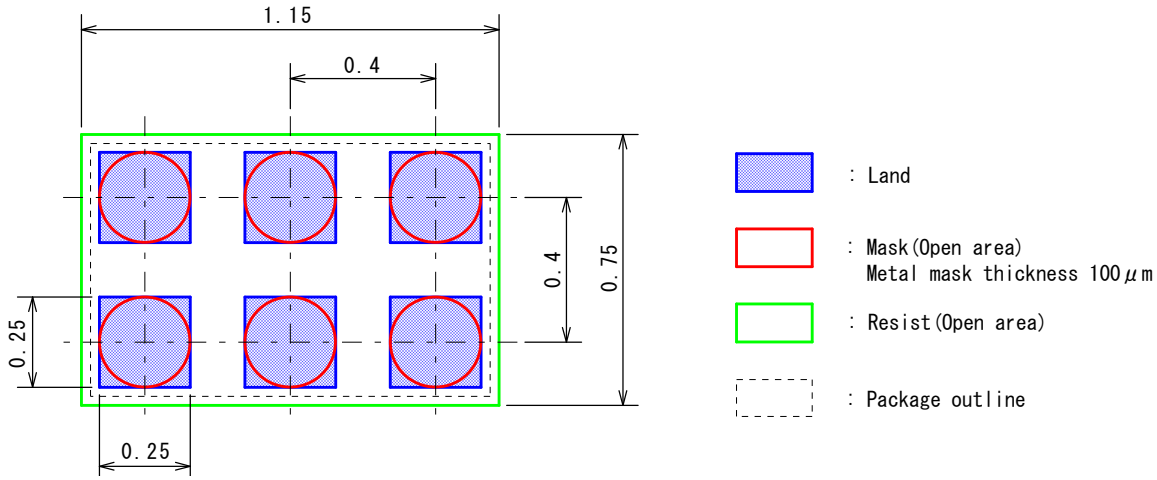
Measurement Setup

■ PACKAGE DIMENSIONS

UNIT: mm



■ EXAMPLE OF SOLDER PADS DIMENSIONS

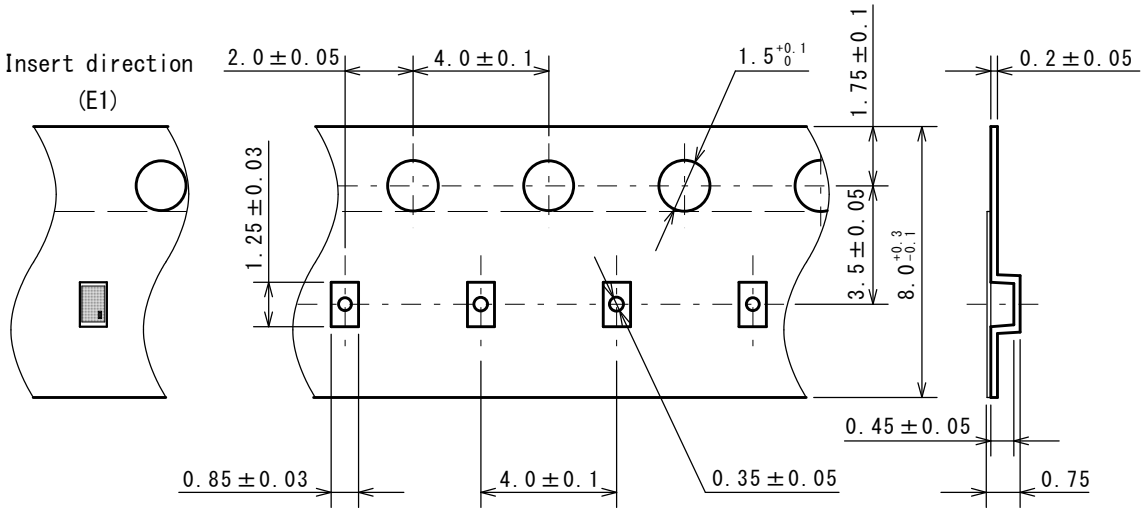


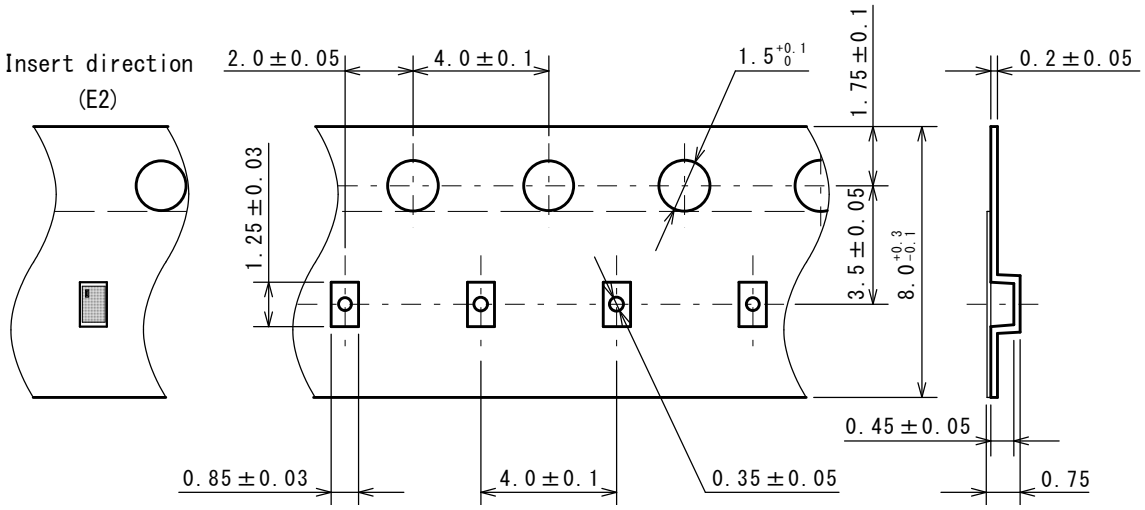
■ PACKING SPEC

UNIT: mm

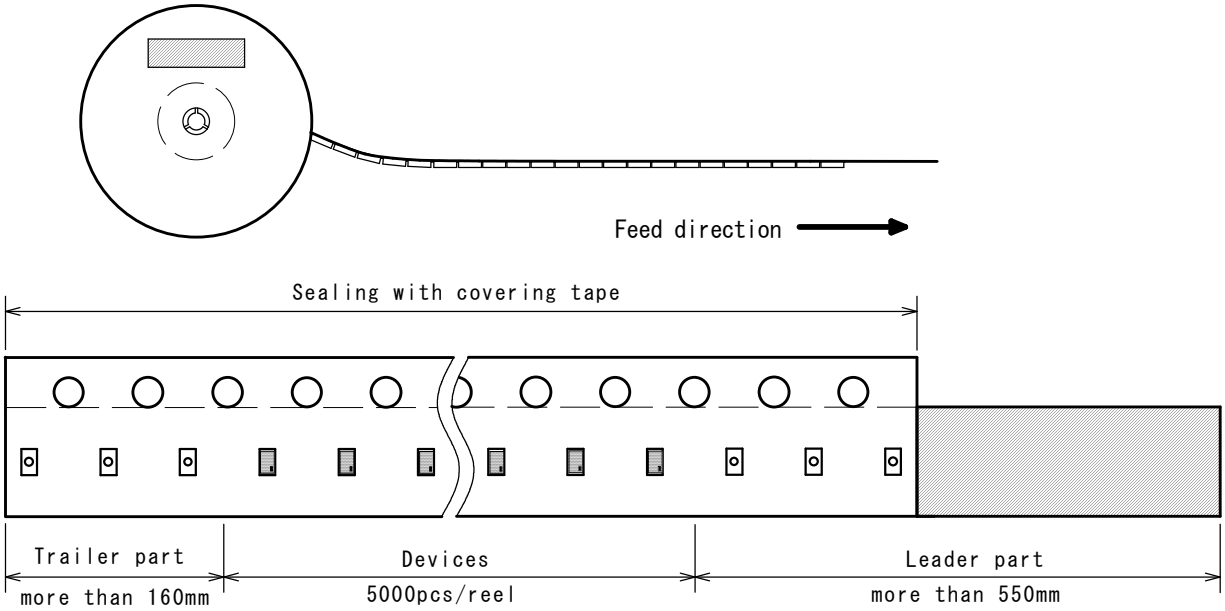
(1) Taping dimensions / Insert direction

Carrier tape material: PS carbon
Cover tape material : PET

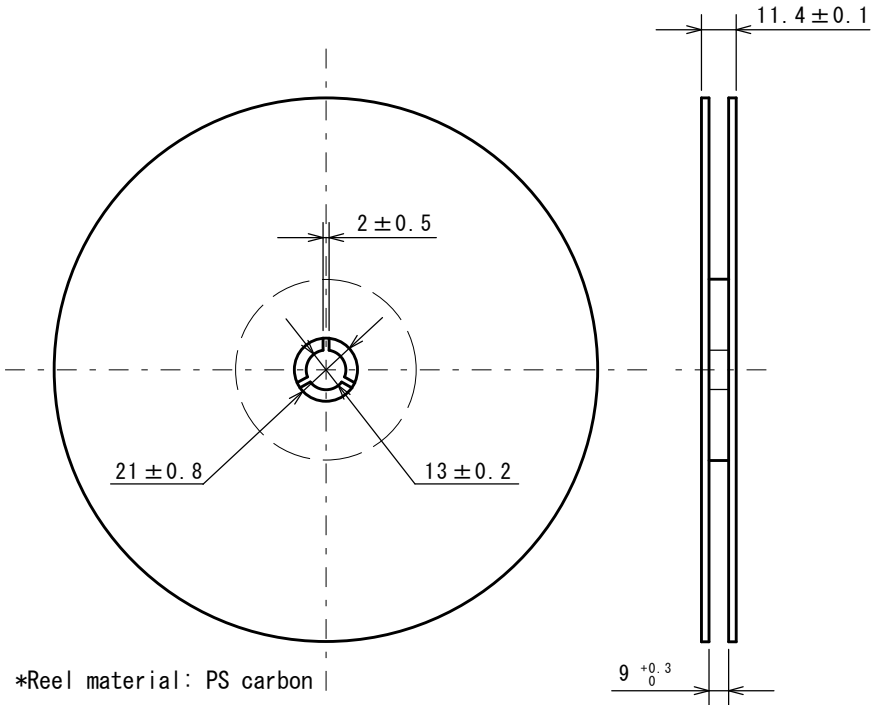




(2) Taping state



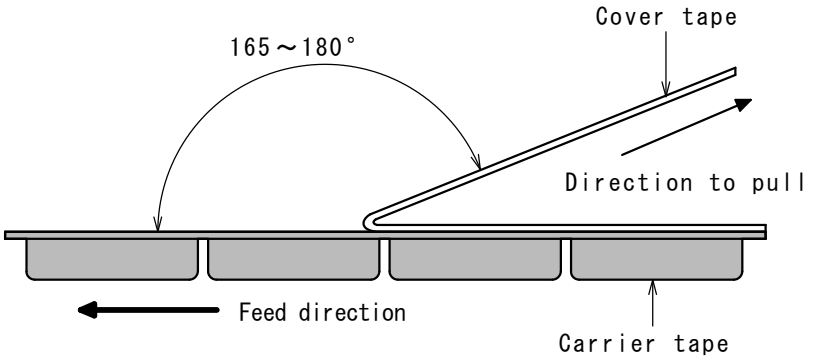
(3) Reel dimensions



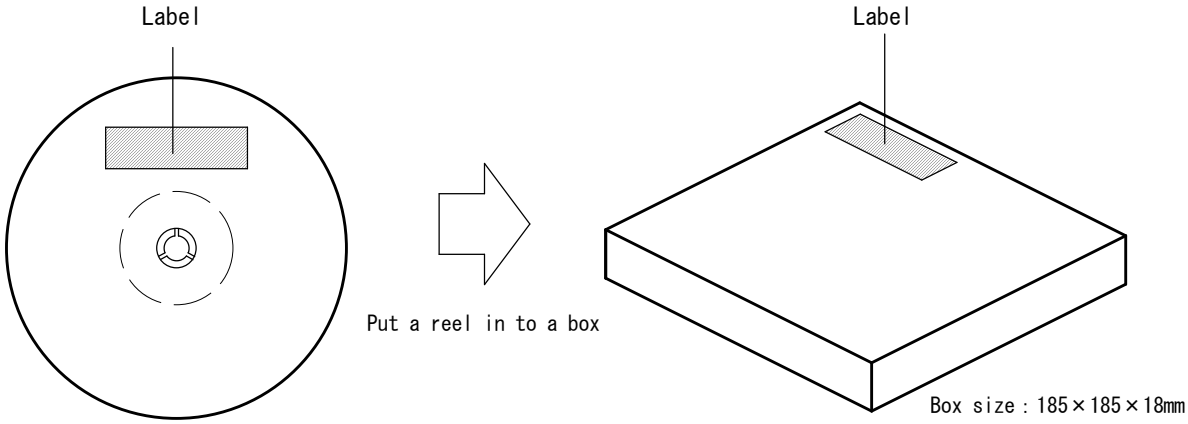
(4) Peeling strength

Peeling strength of cover tape

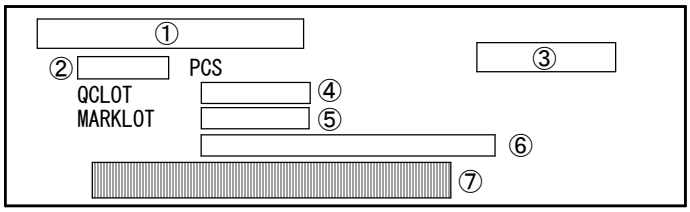
- Peeling angle 165～180° degrees to the taped surface.
- Peeling speed 300mm/min
- Peeling strength 0.1～0.7N



(5) Packing state



(6) Label



①	Product name
②	Quantity
③	Product code
④	QC LOT No.
⑤	MARK LOT No.
⑥	Environmental notation
⑦	Barcode

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    - Equipment Used in the Deep Sea
    - Power Generator Control Equipment (nuclear, steam, hydraulic, etc.)
    - Life Maintenance Medical Equipment
    - Fire Alarms / Intruder Detectors
    - Vehicle Control Equipment (automotive, airplane, railroad, ship, etc.)
    - Various Safety Devices
    - Traffic control system
    - Combustion equipment

    In case your company desires to use this product for any applications other than general electronic equipment mentioned above, make sure to contact our company in advance. Note that the important requirements mentioned in this section are not applicable to cases where operation requirements such as application conditions are confirmed by our company in writing after consultation with your company.
6. We are making our continuous effort to improve the quality and reliability of our products, but semiconductor products are likely to fail with certain probability. In order to prevent any injury to persons or damages to property resulting from such failure, customers should be careful enough to incorporate safety measures in their design, such as redundancy feature, fire containment feature and fail-safe feature. We do not assume any liability or responsibility for any loss or damage arising from misuse or inappropriate use of the products.
7. The products have been designed and tested to function within controlled environmental conditions. Do not use products under conditions that deviate from methods or applications specified in this datasheet. Failure to employ the products in the proper applications can lead to deterioration, destruction or failure of the products. We shall not be responsible for any bodily injury, fires or accident, property damage or any consequential damages resulting from misuse or misapplication of the products.
8. Quality Warranty
    8-1. Quality Warranty Period
    In the case of a product purchased through an authorized distributor or directly from us, the warranty period for this product shall be one (1) year after delivery to your company. For defective products that occurred during this period, we will take the quality warranty measures described in section 8-2. However, if there is an agreement on the warranty period in the basic transaction agreement, quality assurance agreement, delivery specifications, etc., it shall be followed.
    8-2. Quality Warranty Remedies
    When it has been proved defective due to manufacturing factors as a result of defect analysis by us, we will either deliver a substitute for the defective product or refund the purchase price of the defective product.
    Note that such delivery or refund is sole and exclusive remedies to your company for the defective product.
    8-3. Remedies after Quality Warranty Period
    With respect to any defect of this product found after the quality warranty period, the defect will be analyzed by us. On the basis of the defect analysis results, the scope and amounts of damage shall be determined by mutual agreement of both parties. Then we will deal with upper limit in Section 8-2. This provision is not intended to limit any legal rights of your company.
9. Anti-radiation design is not implemented in the products described in this document.
10. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
11. WLCSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.
12. Warning for handling Gallium and Arsenic (GaAs) products (Applying to GaAs MMIC, Photo Reflector). These products use Gallium (Ga) and Arsenic (As) which are specified as poisonous chemicals by law. For the prevention of a hazard, do not burn, destroy, or process chemically to make them as gas or power. When the product is disposed of, please follow the related regulation and do not mix this with general industrial waste or household waste.
13. Please contact our sales representatives should you have any questions or comments concerning the products or the technical information.

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Nisshinbo Micro Devices Inc.

Official website
https://www.nisshinbo-microdevices.co.jp/en/

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