Broadband Low Noise Amplifier GaAs MMIC

■ FEATURES

- Wide frequency range 950 to 3224 MHz
- Supply Voltage 3.0 to 5.5V
- Operating current 40 mA typ. @V_{DD} = 3.3 V
- High gain 16.0 dB typ. @ f = 950 to 3224 MHz, V_{DD}= 3.3 V
- Low noise figurer 2.5 dB typ. @ f = 950 to 3224 MHz, V_{DD} = 3.3 V
- High P-1dB (IN) +1.0 dBm typ.
- High Input IIP3 +15.0 dBm typ.
- Small package size 1.6 mm x 1.6 mm x 0.397 mm typ.
- RoHS compliant and Halogen Free, MSL1

■ GENERAL DESCRIPTION

The NJG1188KG1 is a wide band low noise amplifier MMIC mainly intended BS/CS TV and others broadcasting system.

This LNA features low distortion, +15 dBm high linearity and 16 dB of high flat gain for wide bandwidth from 950 MHz to 3224 MHz, Integrated ESD protection device on each port achieves excellent ESD robustness.

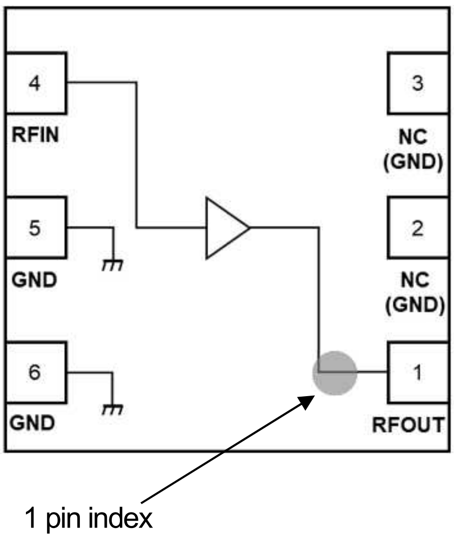
The small and thin ESON6-G1 package is adopted.

■ APPLICATION

- BS/CS TV, TV Tuner Module, STB and others Broadcasting applications.
- Wide Band applications from 950MHz to 3224MHz

■ BLOCK DIAGRAM (ESON6-G1)

(Top view)



■ PIN CONFIGURATION

PIN NO.	SYMBOL	DESCRIPTION
1	RFOUT	RF output and voltage supply terminal
2	NC(GND)	No connected terminal (Ground terminal)
3	NC(GND)	No connected terminal (Ground terminal)
4	RFIN	RF input terminal
5	GND	Ground terminal
6	GND	Ground terminal
Exposed pad	-	Ground terminal

■ PRODUCT NAME INFORMATION

NJG1188 KG1 (TE3)

Part number / Package / Taping form

■ ORDERING INFORMATION

PART NUMBER	PACKAGE OUTLINE	RoHS	HALOGEN-FREE	TERMINAL FINISH	MARKING	WEIGHT (mg)	MOQ (pcs.)
NJG1188KG1	ESON6-G1	Yes	Yes	Sn-Bi	1188	3.5	3,000

■ ABSOLUTE MAXIMUM RATINGS

T_a = +25°C, Z_s = Z_l = 50 Ω

PARAMETER	SYMBOL	RATINGS	UNIT
Supply voltage	V_{DD}	6.0	V
Input power	P_{IN} (1)	+10	dBm
Power dissipation	P_D (2)	1200	mW
Operating temperature	T_{opr}	-40 to +105	°C
Storage temperature	T_{stg}	-40 to +150	°C

(1): V_{DD} = 3.3 V

(2): 4-layer FR4 PCB with through-hole (101.5 x 114.5 mm), T_j = 150°C

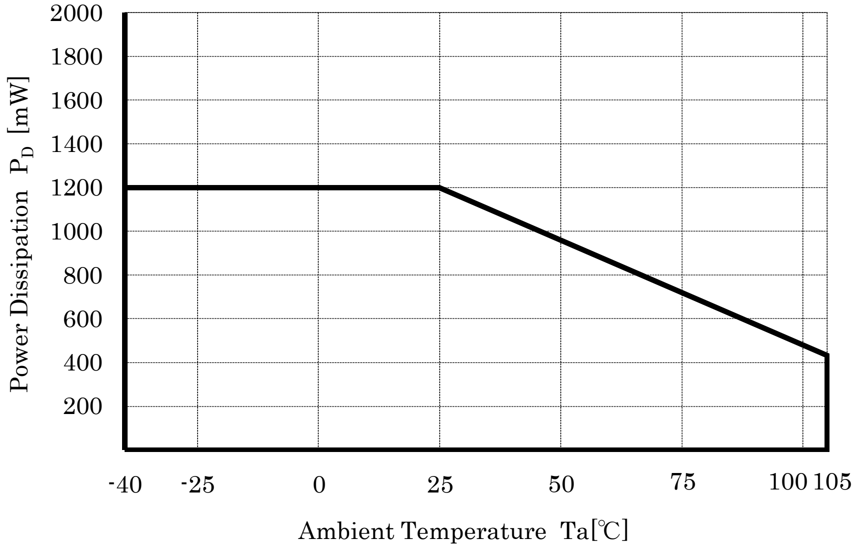
■ POWER DISSIPATION VS. AMBIENT TEMPERATURE

Please, refer to the following Power Dissipation and Ambient Temperature.

(Please note the surface mount package has a small maximum rating of Power Dissipation [P_D], a special attention should be paid in designing of thermal radiation.)

Power Dissipation－Ambient Temperature Characteristic

Mounted on PCB



■ ELECTRICAL CHARACTERISTICS 1 (DC)

General conditions: T_a = +25°C, with application circuit

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply voltage	V_{DD}		3.0	3.3	5.5	V
Operating current	I_{DD}	RF OFF, V_{DD} = 3.3 V	-	40.0	60.0	mA

■ ELECTRICAL CHARACTERISTICS 2 (RF 1)

General conditions: V_{DD} = 3.3 V, f_{RF} = 950 to 3224 MHz, T_a = +25°C, Z_s = Z_l = 50 Ω, with application circuit

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Small signal gain_ 1	Gain_1	Exclude PCB, Connector Losses*	13.0	16.0	19.0	dB
Noise figure	NF	Exclude PCB, Connector Losses*	-	2.5	3.0	dB
Input power at 1 dB gain compression point	P-1dB(In)		-5.0	+1.0		dBm
Input 2rd order intercept point_1	IIP2_1	f1 = 950 to 3224MHz, f2 = f1 + 1MHz Pin = -20 dBm	+15.0	+22.0	-	dBm
Input 2rd order intercept point_2	IIP2_2	f1 = 1394.72MHz, f2 =1433.08 MHz Pin = -15 dBm	+15.0	+22.0	-	dBm
Input 3rd order intercept point_1	IIP3_1	f1 = 950 to 3224MHz, f2 = f1 + 1MHz Pin = -20 dBm	+6.5	+15.0	-	dBm
Input 3rd order intercept point_2	IIP3_2	f1 = 1394.72MHz, f2 =1433.08 MHz Pin = -15 dBm	+8.0	+15.0	-	dBm
RF IN return loss_1	RLi_1		7.0	10.0	-	dB
RF OUT return loss_1	RLo_1		7.0	10.0	-	dB
k factor	K	f = 0.05GHz to 10 GHz	1.0	-	-	-

* Input & output PCB and connector losses : 0.05 dB (950MHz)、0.10 dB (1800MHz)、0.23 dB (3224MHz)

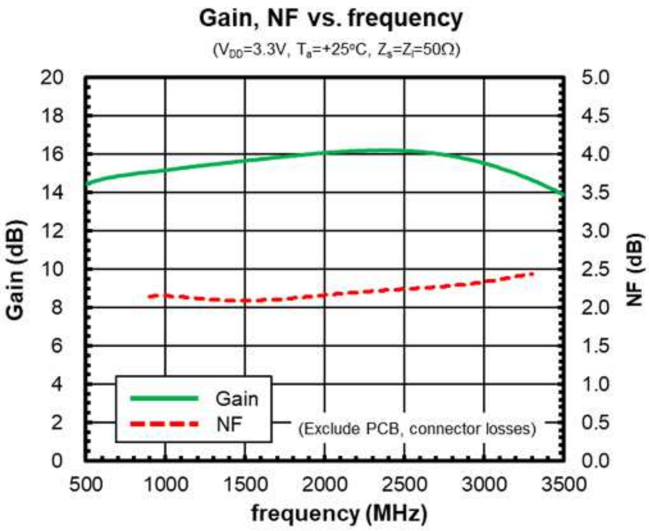
■ ELECTRICAL CHARACTERISTICS 2 (RF 2)

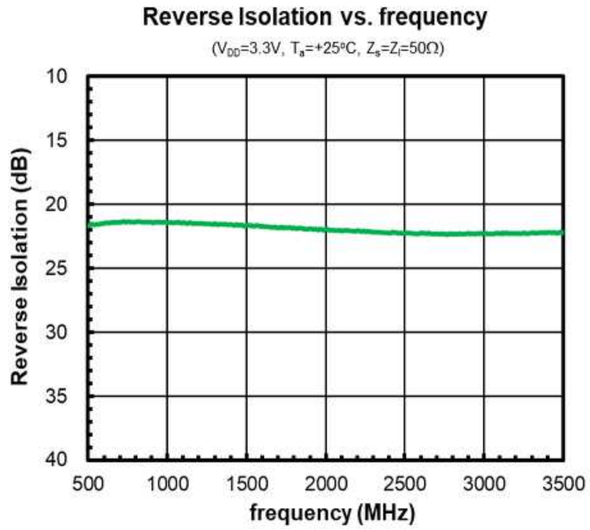
General conditions: V_{DD} = 3.3 V, f_{RF} = 950 to 3224 MHz, T_a = +25°C, Z_s = Z_l = 75 Ω, with application circuit

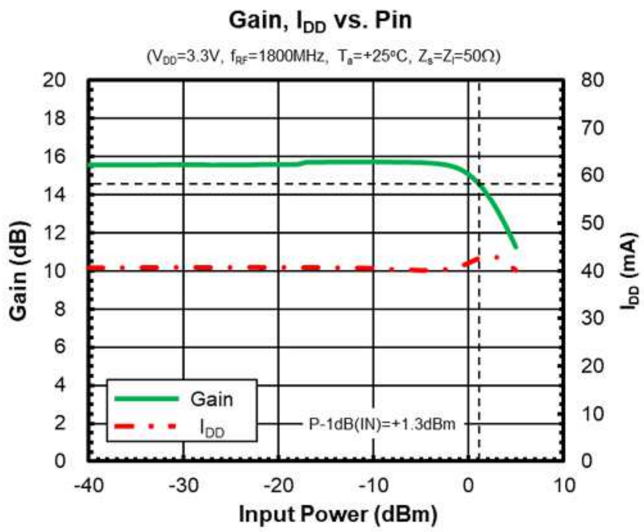
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Small signal gain_2	Gain_2	Exclude PCB, Connector Losses	-	16.0	-	dB
RF IN return loss_2	RLi_2		-	10.0	-	dB
RF OUT return loss_2	RLo_2		-	10.0	-	dB

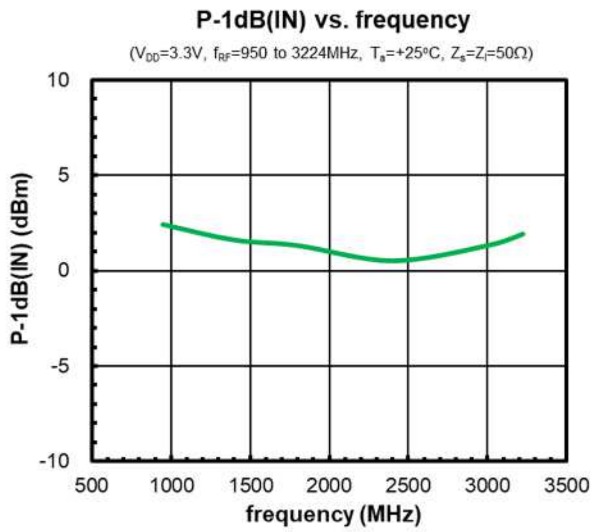
■ **ELECTRICAL CHARACTERISTICS**

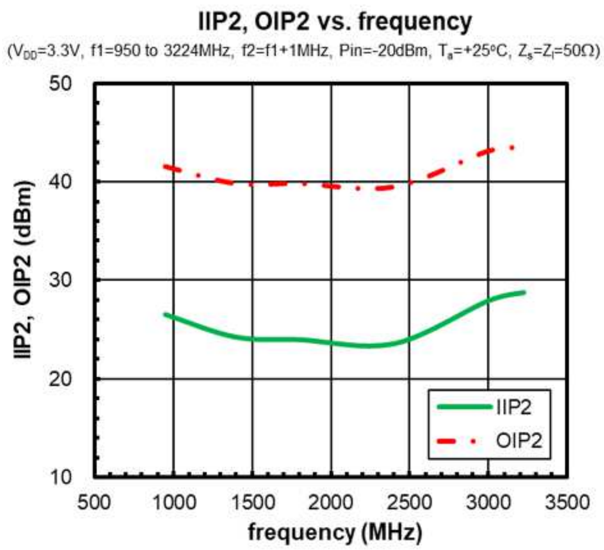
Conditions: V_{DD} = 3.3 V, T_a = +25°C, Z_s = Z_l = 50 Ω, with application circuit

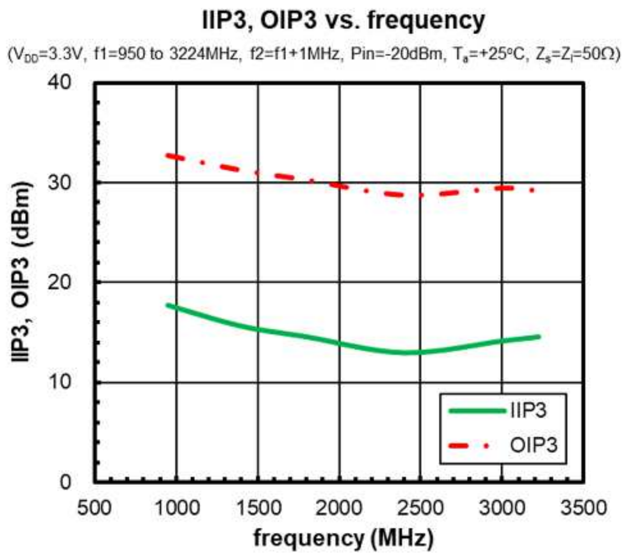






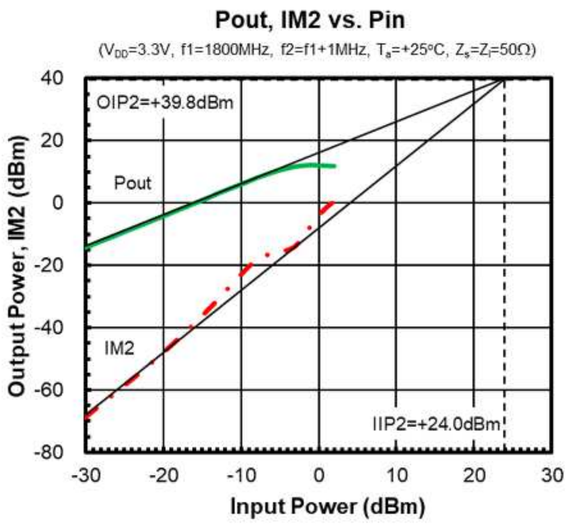


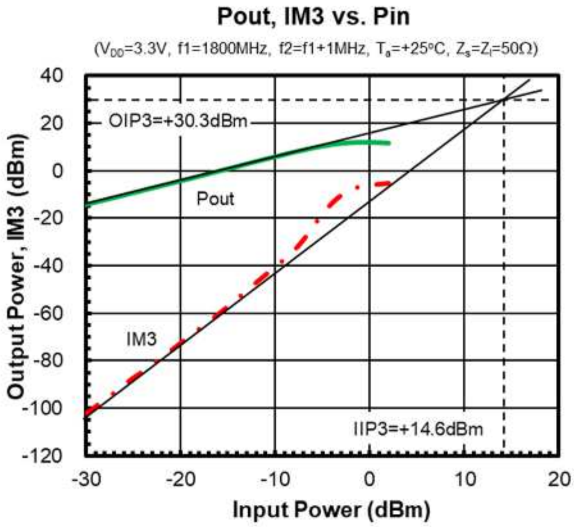


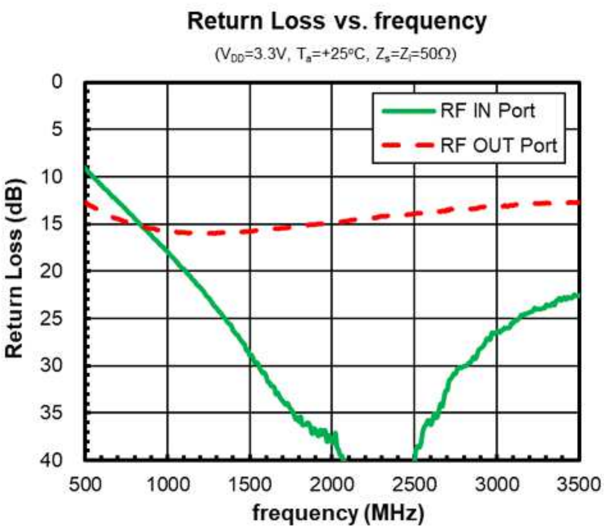


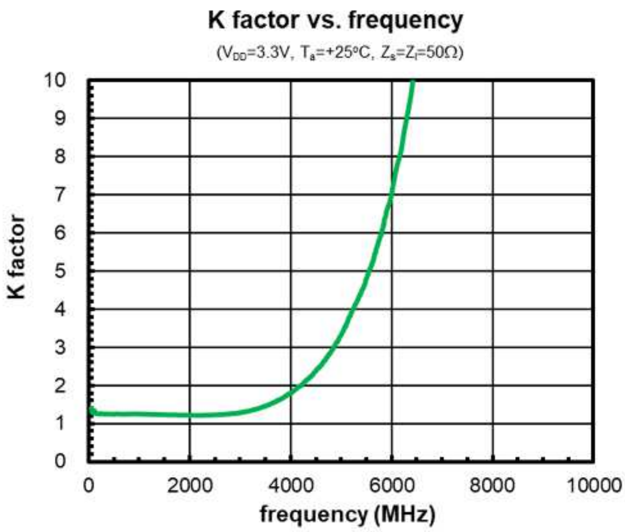
■ ELECTRICAL CHARACTERISTICS

Conditions: V_{DD} = 3.3 V, T_a = +25°C, Z_s = Z_l = 50 Ω, with application circuit



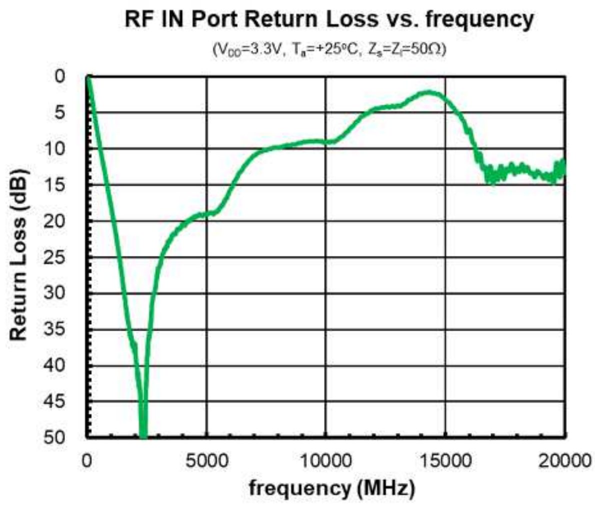


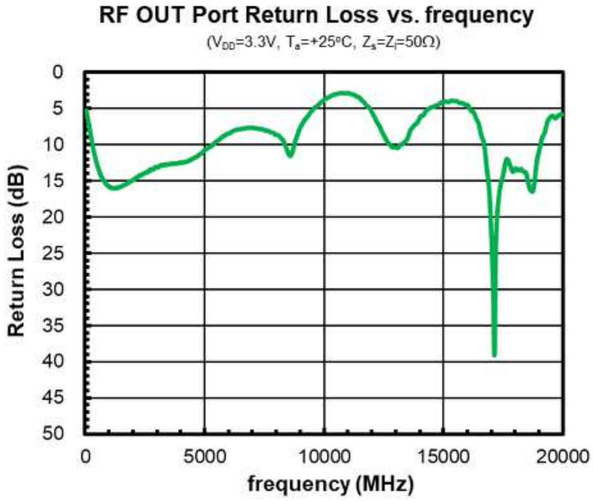


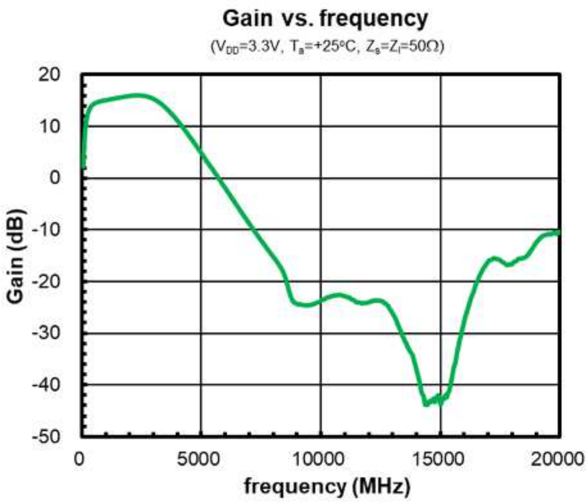


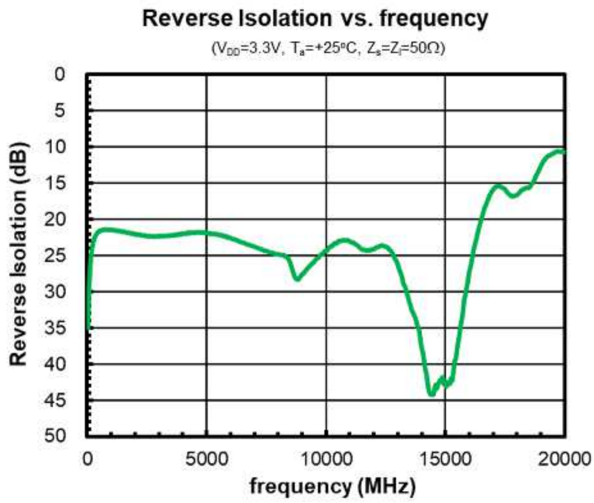
■ ELECTRICAL CHARACTERISTICS

Conditions: V_{DD} = 3.3 V, f_{RF} = 50MHz ~ 20GHz, T_a = +25°C, Z_s = Z_l = 50 Ω, with application circuit



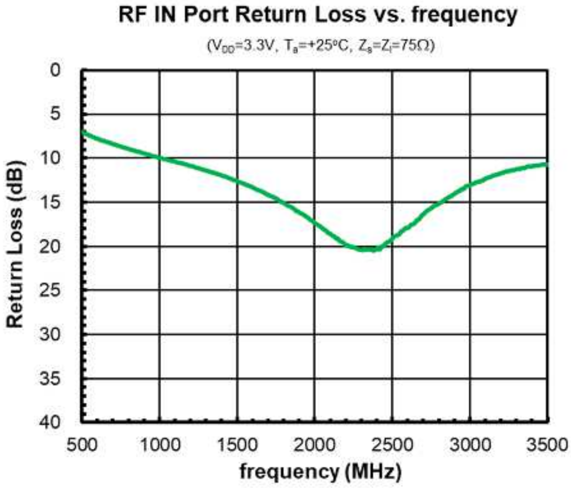


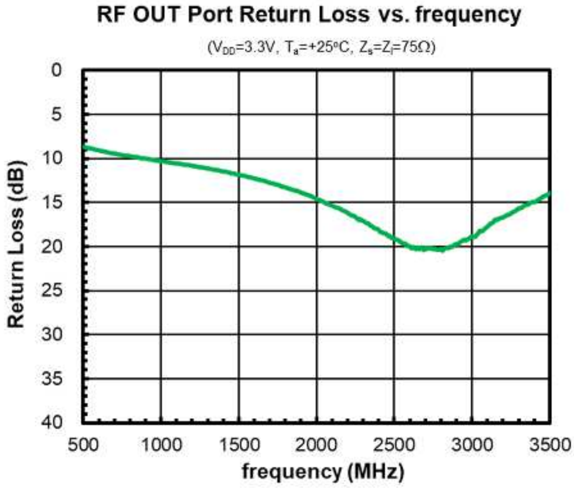


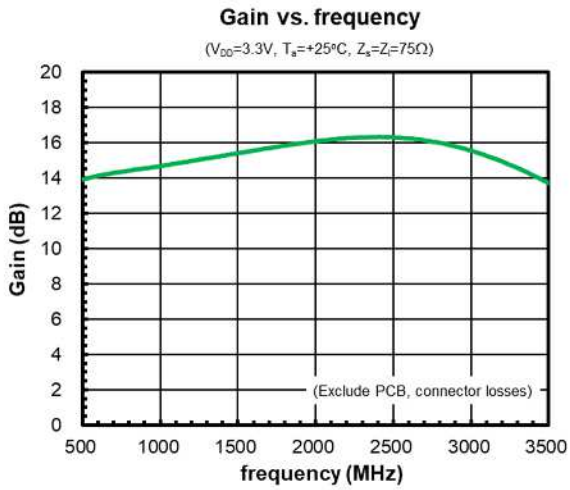


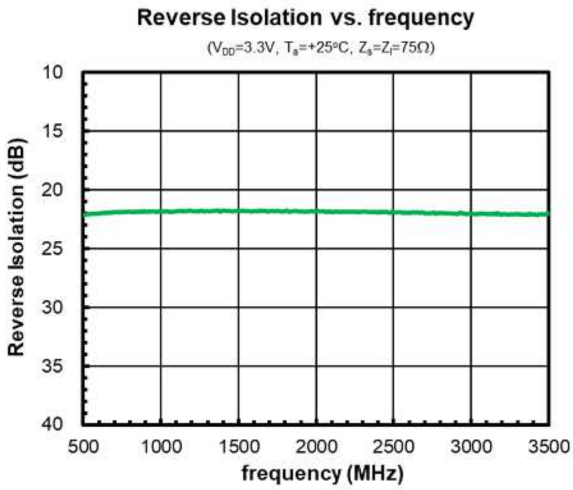
■ **ELECTRICAL CHARACTERISTICS**

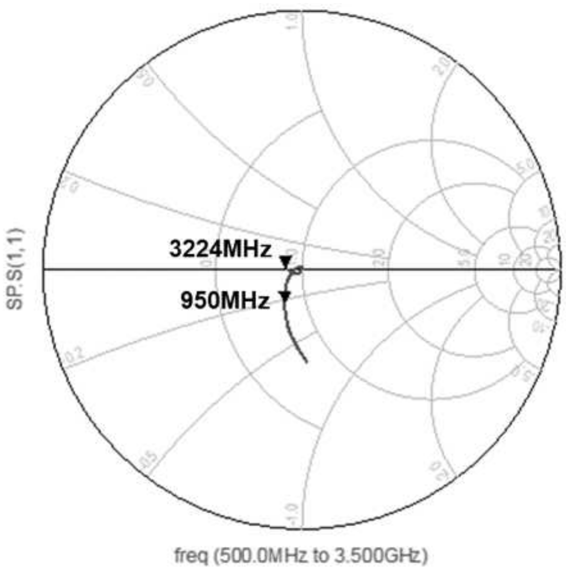
Conditions: V_{DD} = 3.3 V, f_{RF} = 500 to 3500 MHz, T_a = +25°C, Z_s = Z_l = 75 Ω, with application circuit

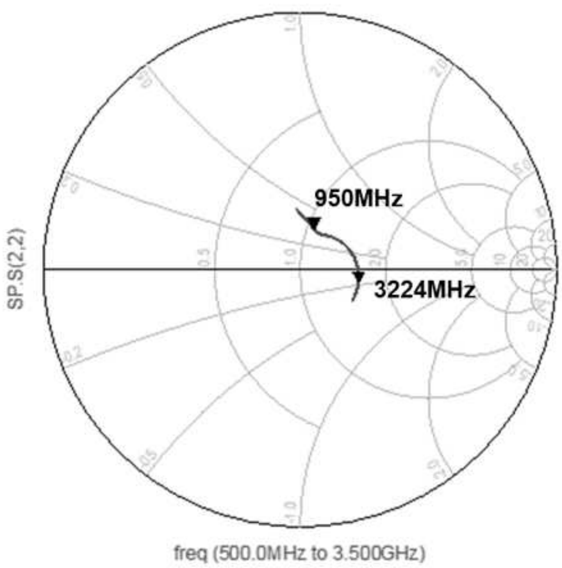






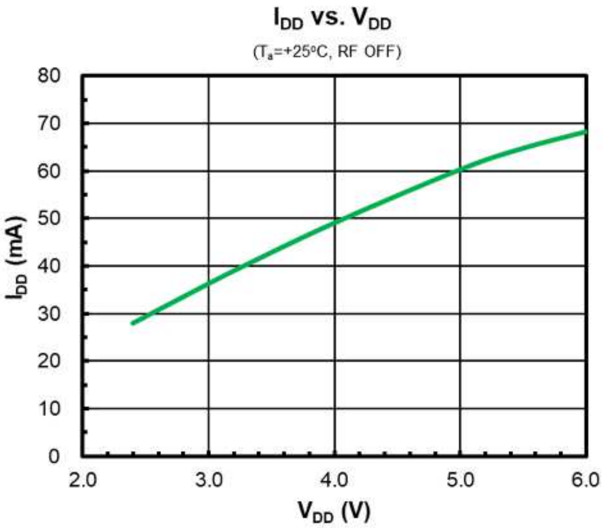


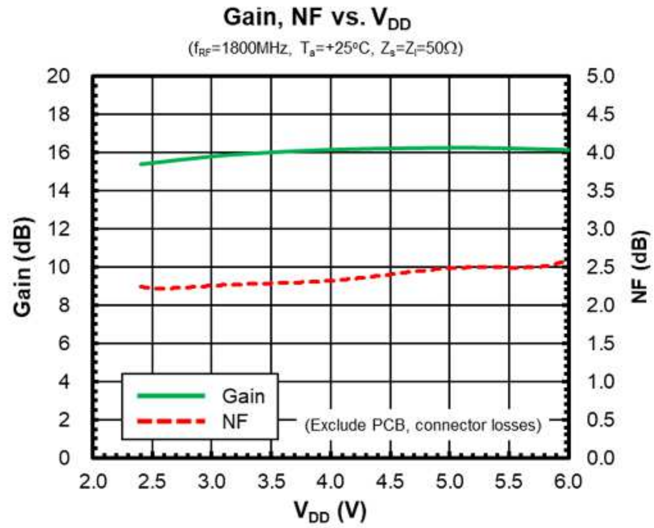


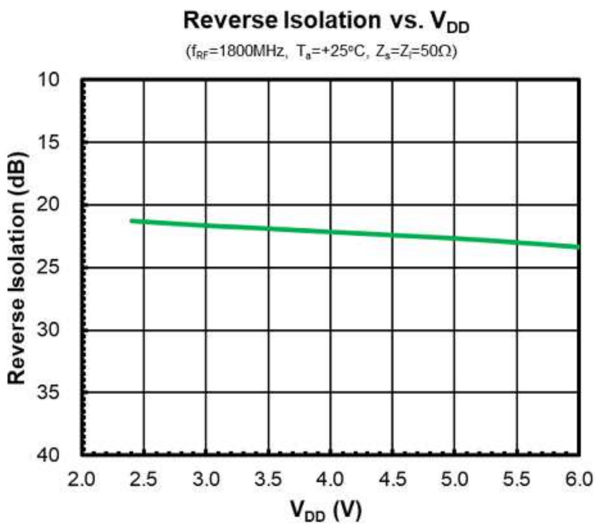


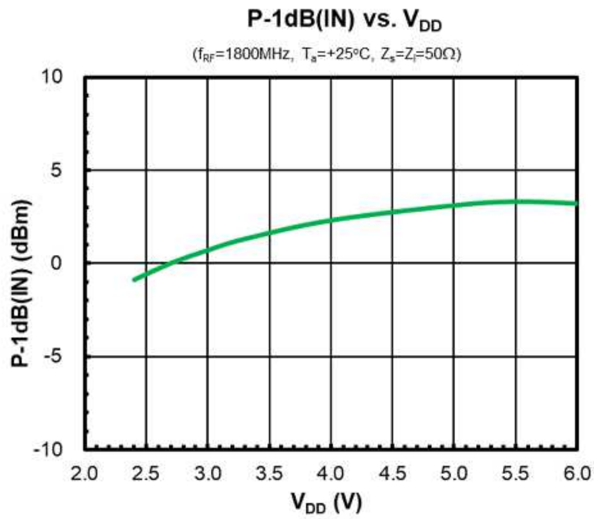
■ **ELECTRICAL CHARACTERISTICS**

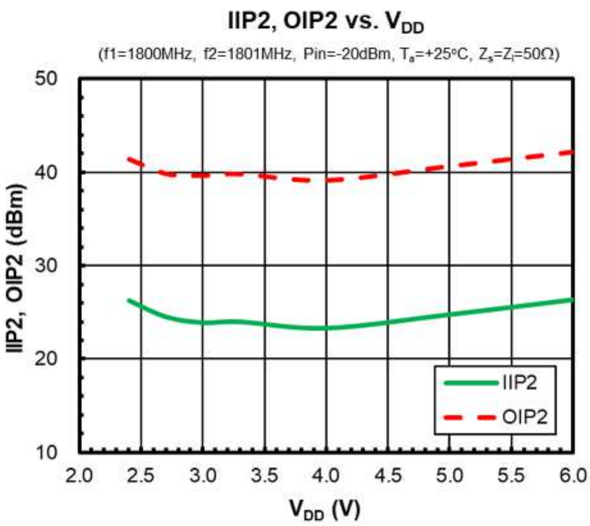
Conditions: T_a = +25°C, Z_s = Z_l = 50 Ω, with application circuit

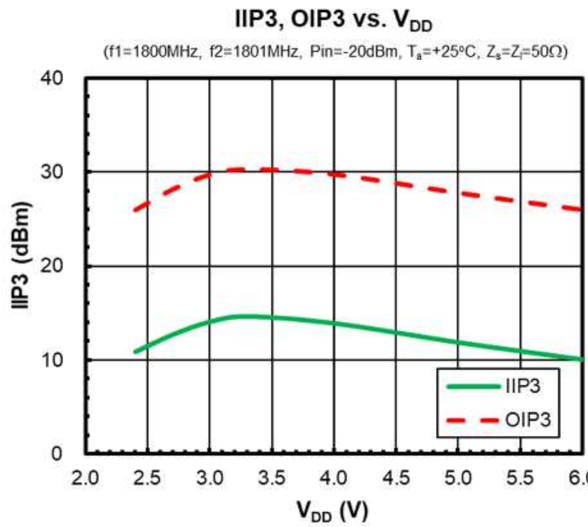






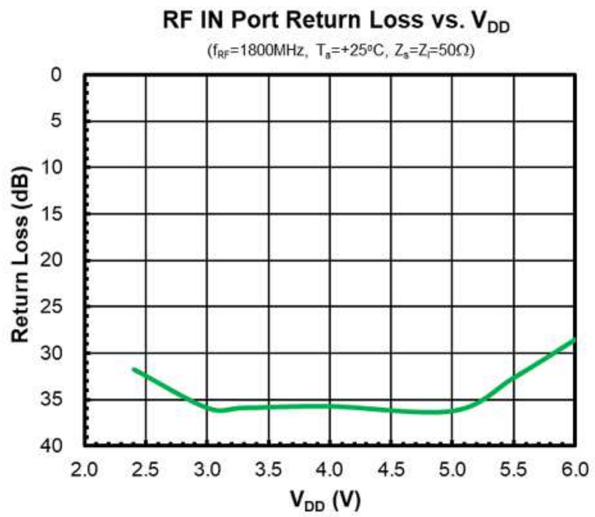


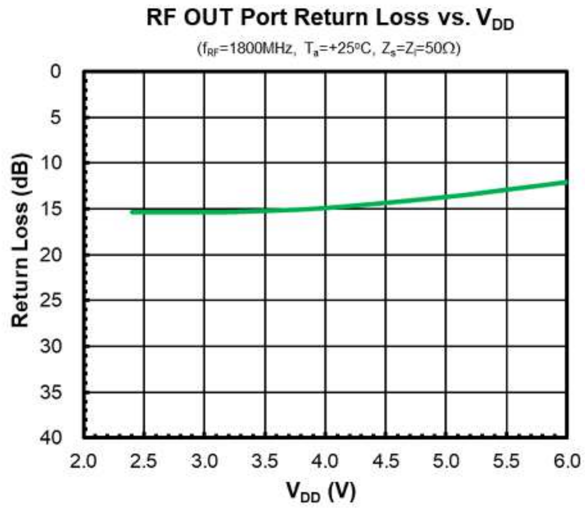


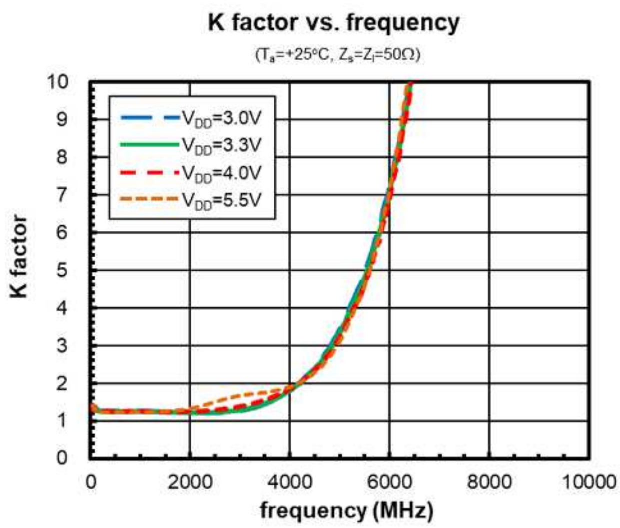


■ **ELECTRICAL CHARACTERISTICS**

Conditions: T_a = +25°C, Z_s = Z_l = 50 Ω, with application circuit

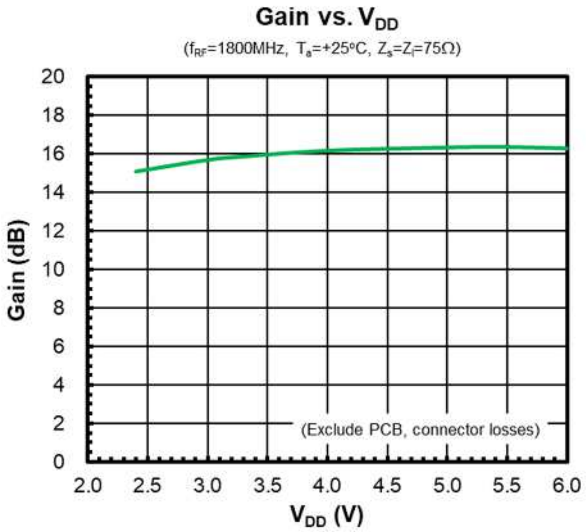


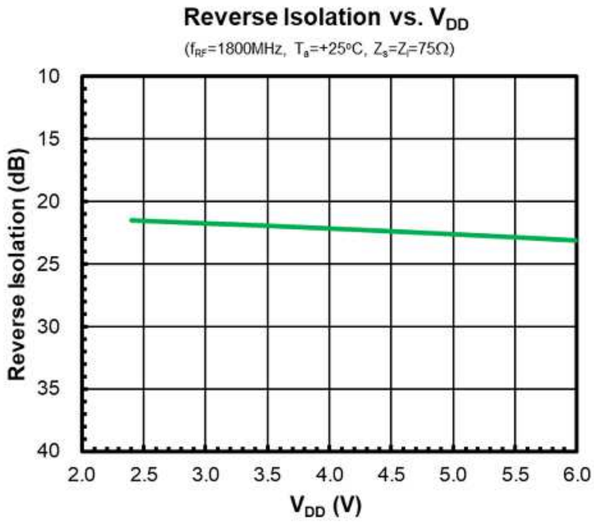


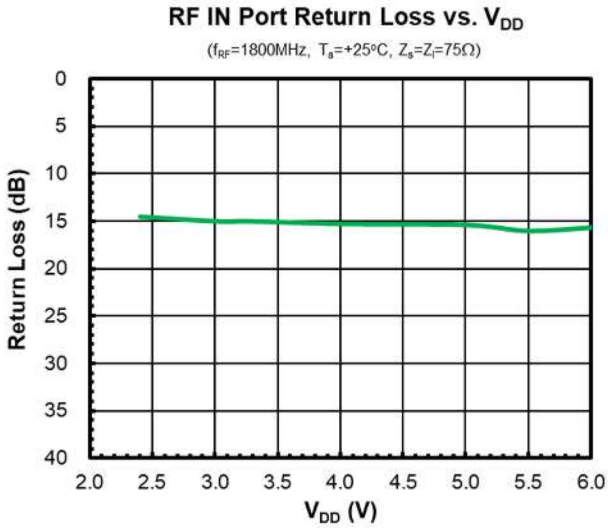


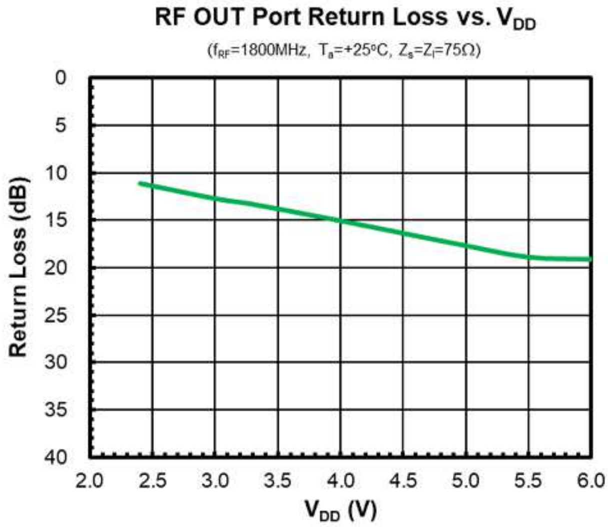
■ ELECTRICAL CHARACTERISTICS

Conditions: T_a = +25°C, Z_s = Z_l = 75 Ω, with application circuit



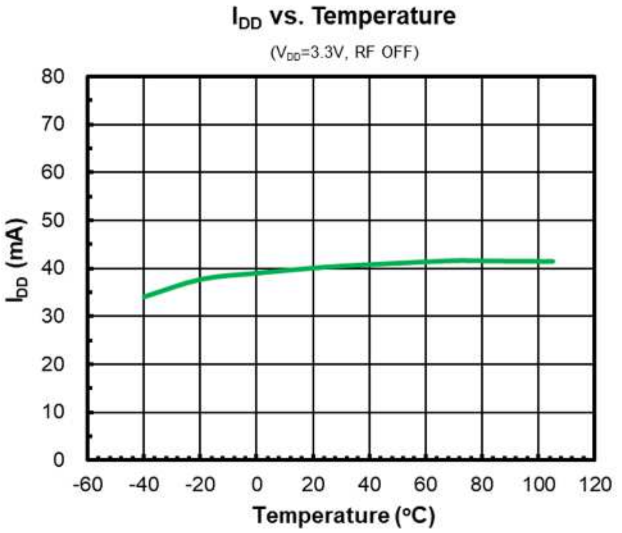


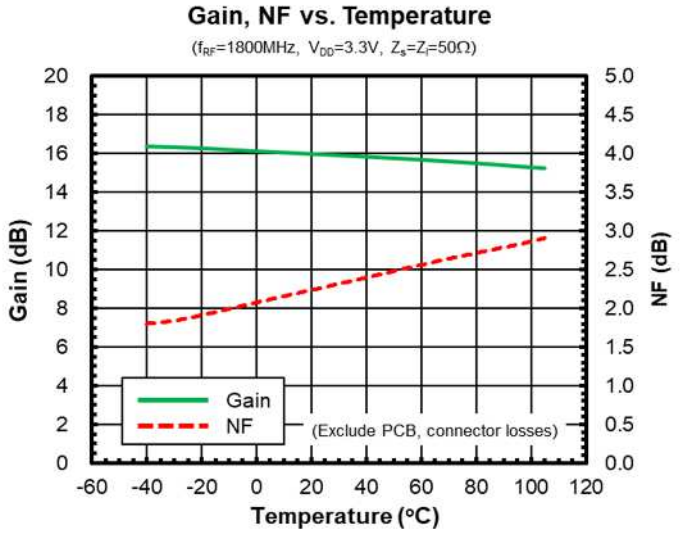


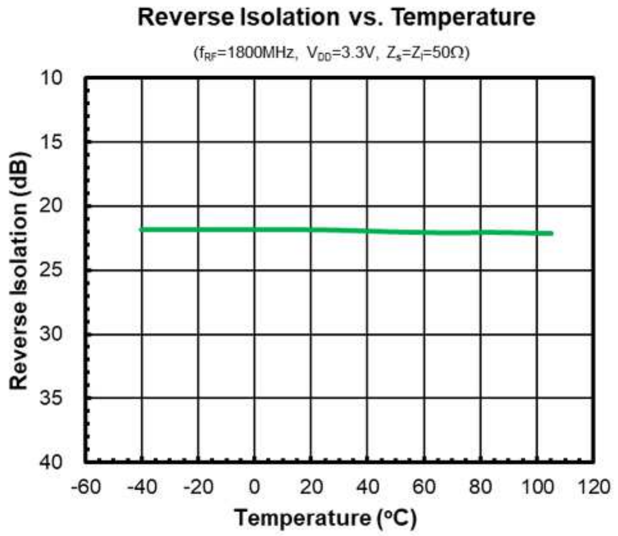


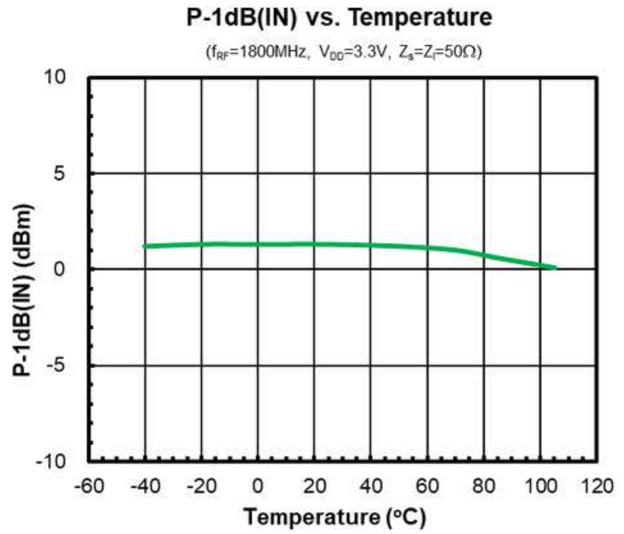
■ ELECTRICAL CHARACTERISTICS

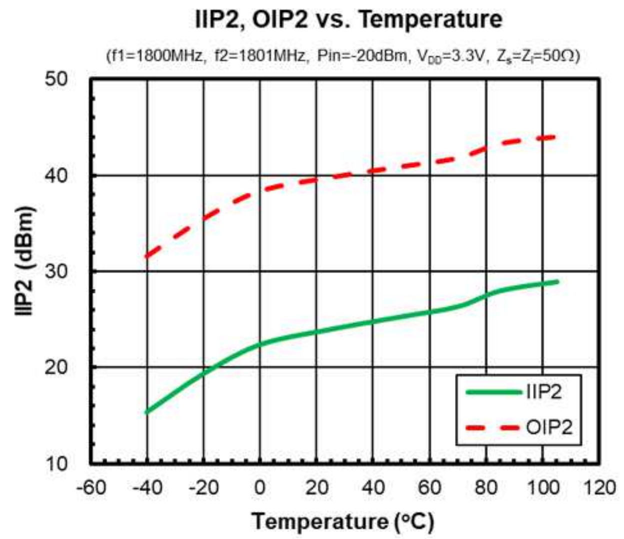
Conditions: V_{DD} = 3.3 V, Z_s = Z_l = 50 Ω, with application circuit

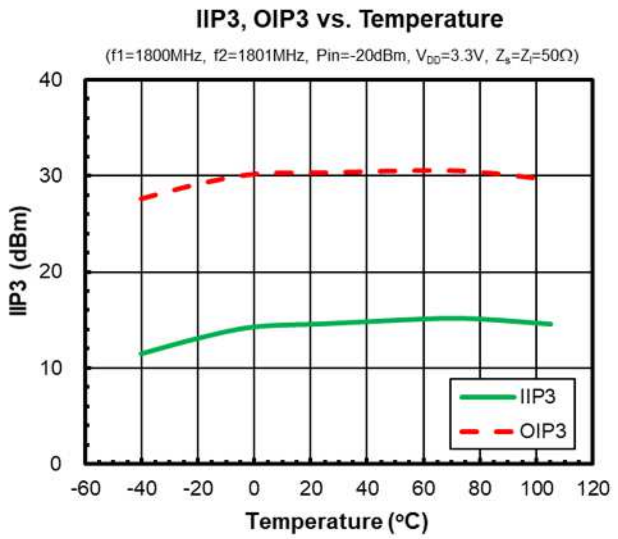






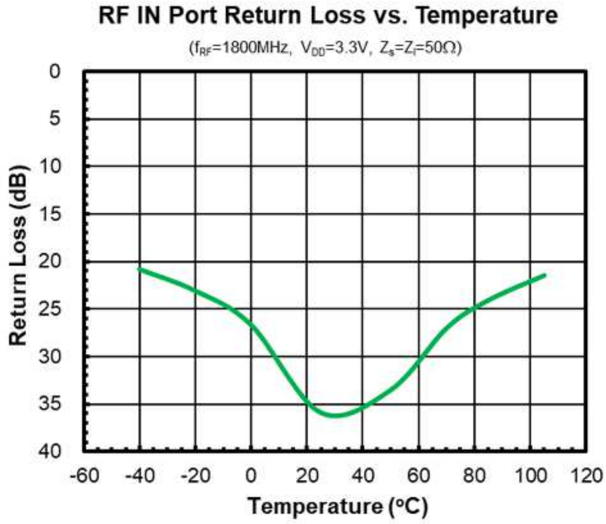


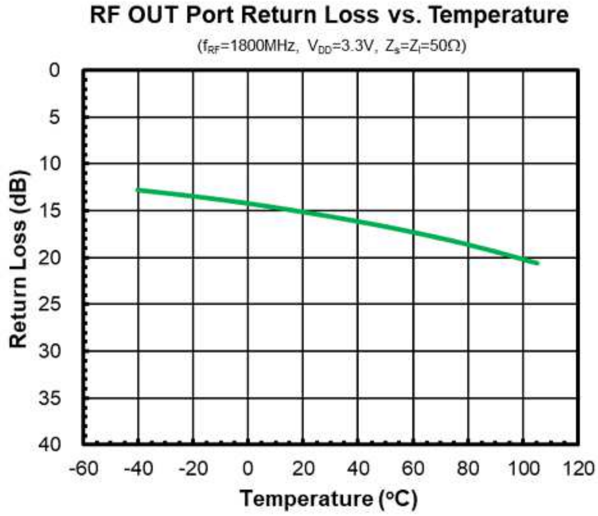


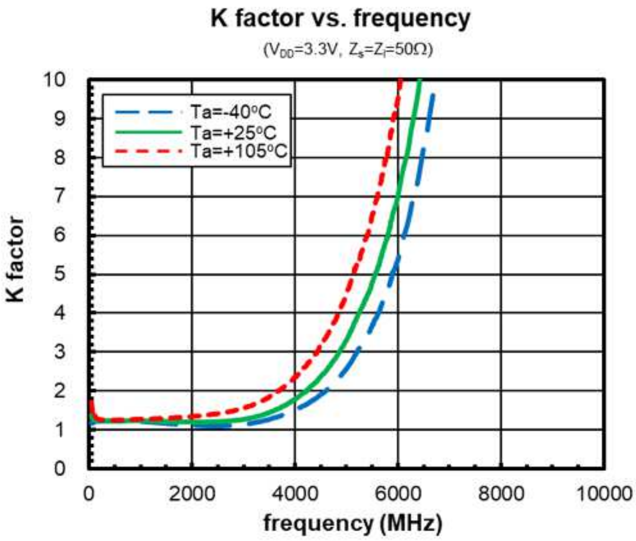


■ **ELECTRICAL CHARACTERISTICS**

Conditions: V_{DD} = 3.3 V, Z_s = Z_l = 50 Ω, with application circuit

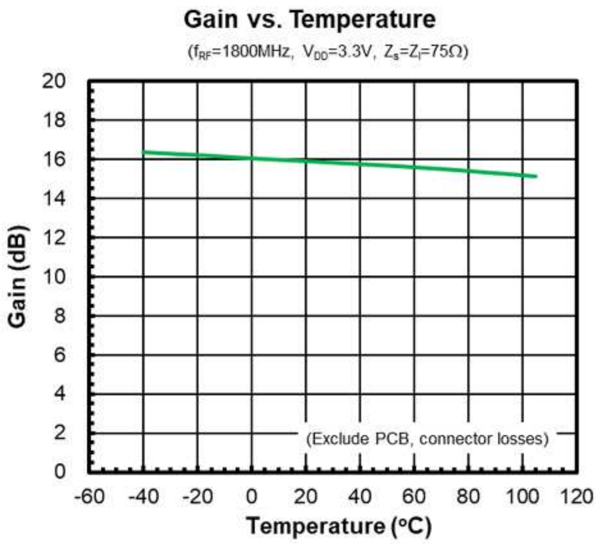


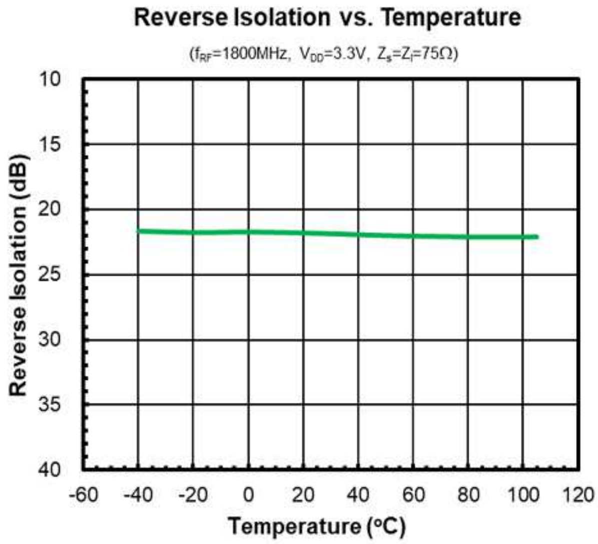


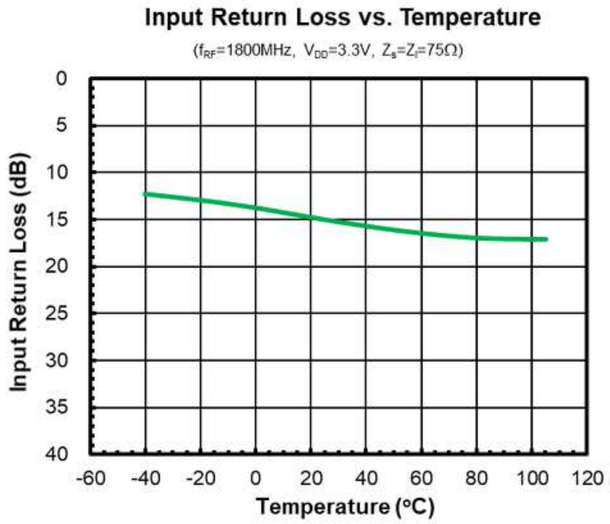


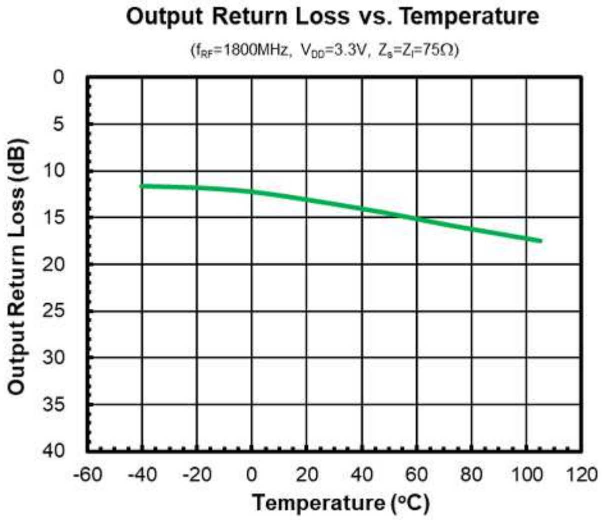
■ **ELECTRICAL CHARACTERISTICS**

Conditions: V_{DD} = 3.3 V, Z_s = Z_l = 75 Ω, with application circuit

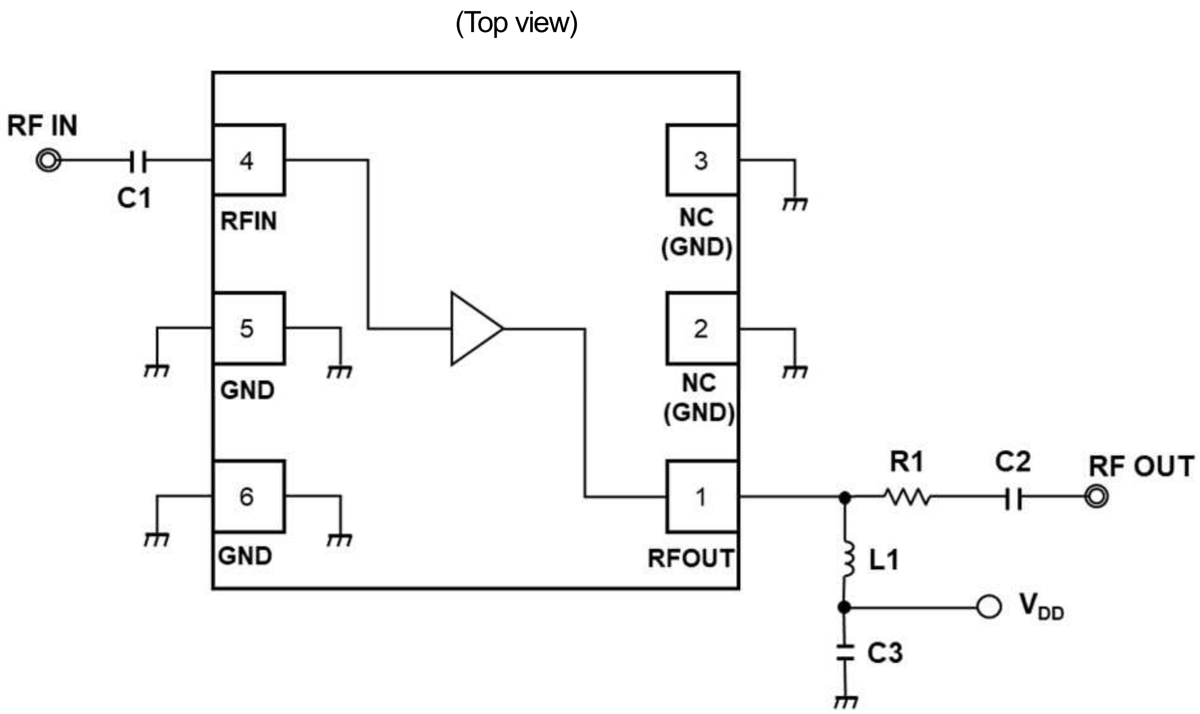








■ **APPLICATION CIRCUIT**

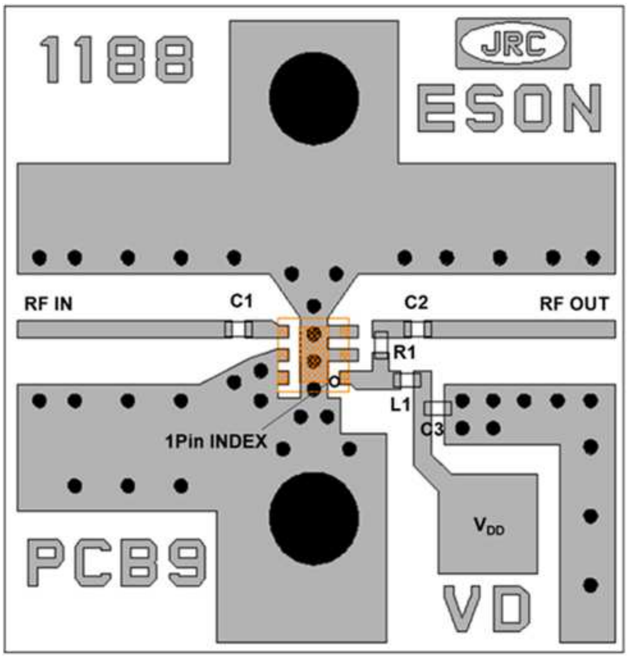


<PARTS LIST>

Part ID	Value	Notes
L1	47 nH	LQP03TN_02 Series (Murata)
C1	1000 pF	GRM03 Series (Murata)
C2		
C3		
R1	10 Ω	0603 size

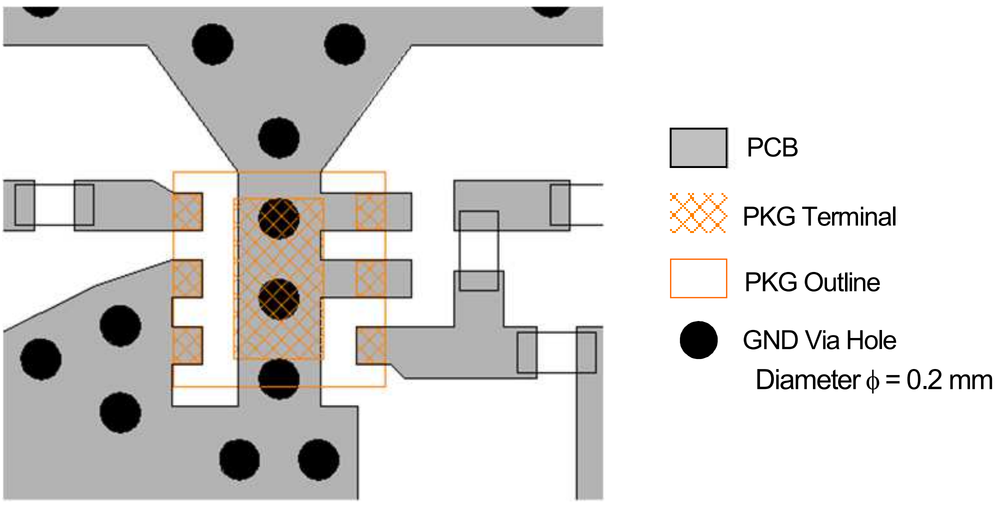
■ EVALUATION BOARD

(Top view)



PCB
Substrate: FR-4
Thickness: 0.2 mm
Microstrip line width: 0.38 mm (Z_0 = 50 Ω)
Size: 14.0 mm x 14.0 mm

<PCB LAYOUT GUIDELINE>



PRECAUTIONS

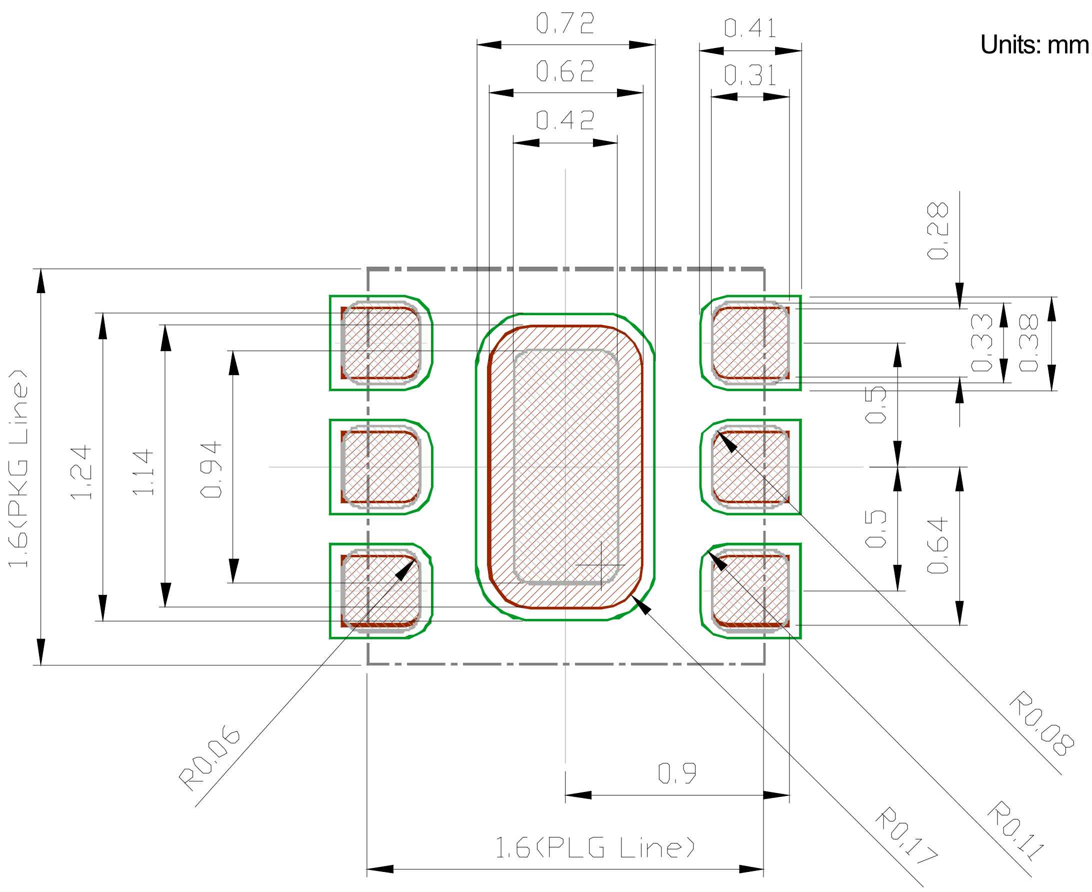
• All external parts should be placed as close as possible to the IC.

• 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 IC.

■ **RECOMMENDED FOOTPRINT PATTERN** (ESON6-G1)

PKG: 1.6 mm x 1.6 mm
Pin pitch: 0.5 mm

: Land
: Mask (Open area) *Metal mask thickness : 100μm
: Resist (Open area)



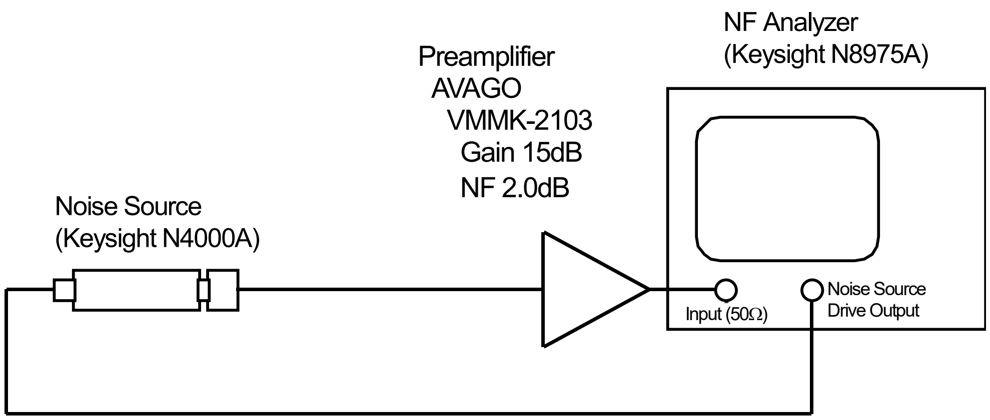
■ **NOISE FIGURE MEASUREMENT BLOCK DIAGRAM**

Measuring instruments

NF Analyzer	: Keysight N8975A
Noise Source	: Keysight N4000A

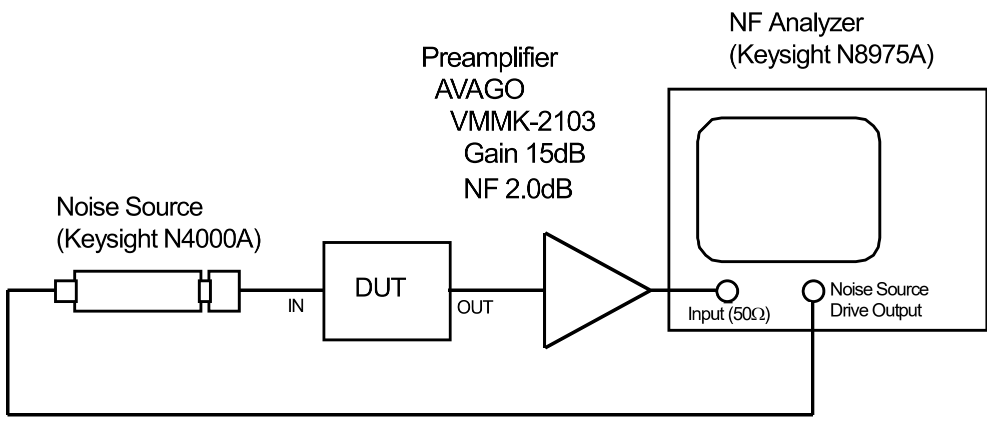
Setting the NF analyzer

Measurement mode form	
Device under test	: Amplifier
System downconverter	: off
Mode setup form	
Sideband	: LSB
Averages	: 8
Average mode	: Point
Bandwidth	: 4 MHz
Loss comp	: off
Tcold	: Auto



* Preamplifier is used to improve NF measurement accuracy.
* Noise source, preamplifier and NF analyzer are connected directly.

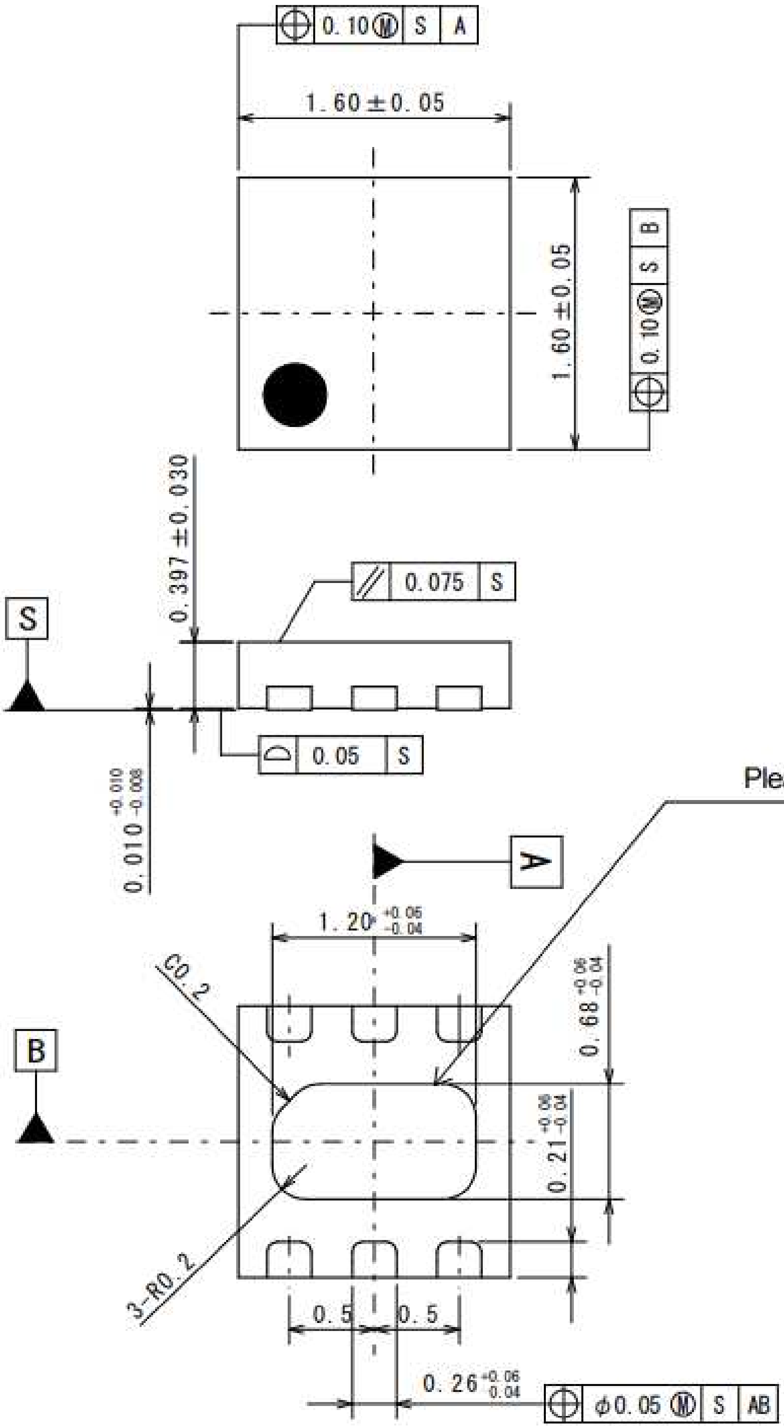
Calibration setup



* Noise source, DUT, preamplifier and NF analyzer are connected directly.

Measurement Setup

■ PACKAGE OUTLINE (ESON6-G1)

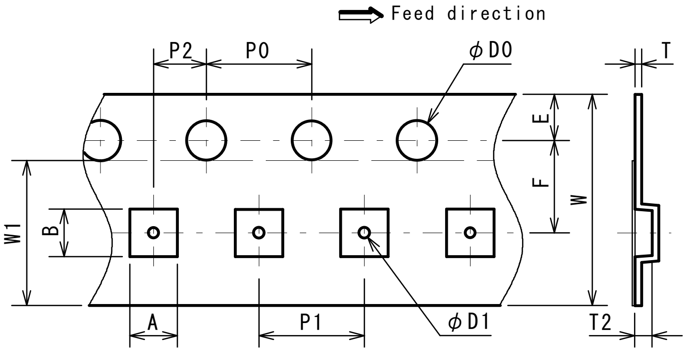


Unit	: mm
Substrate	: Cu
Terminal Treat	: SnBi
Molding Material	: Epoxy Resin
Weight	: 0.0035 (g)

■PACKING SPEC

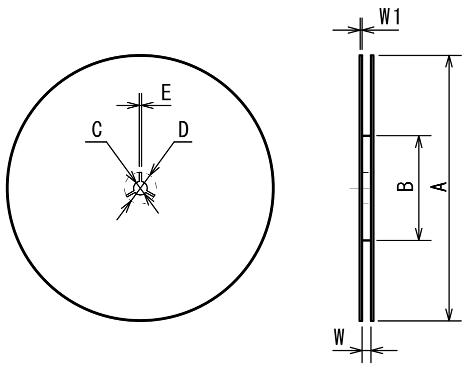
Unit: mm

TAPING DIMENSIONS



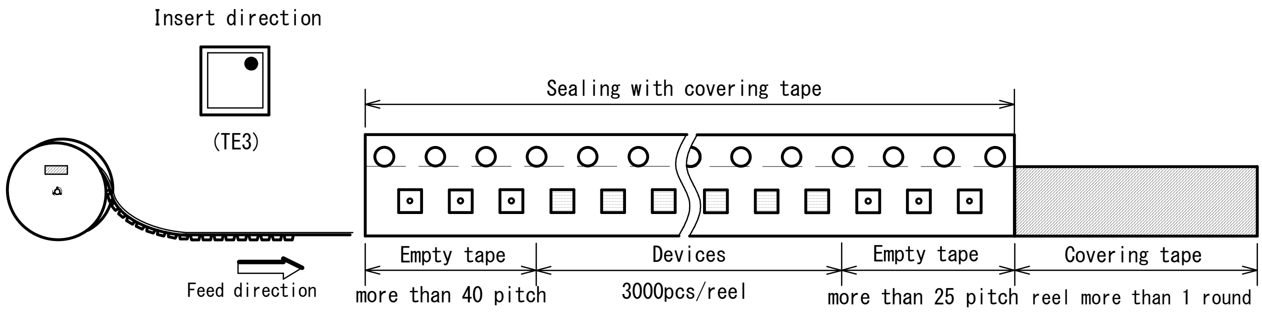
SYMBOL	DIMENSION	REMARKS
A	1.85±0.05	BOTTOM DIMENSION
B	1.85±0.05	BOTTOM DIMENSION
D0	$1.5^{+0.1}_{0}$	
D1	0.5±0.1	
E	1.75±0.1	
F	3.5±0.05	
P0	4.0±0.1	
P1	4.0±0.1	
P2	2.0±0.05	
T	0.25±0.05	
T2	0.65±0.05	
W	8.0±0.2	
W1	5.5	THICKNESS 0.1max

REEL DIMENSIONS

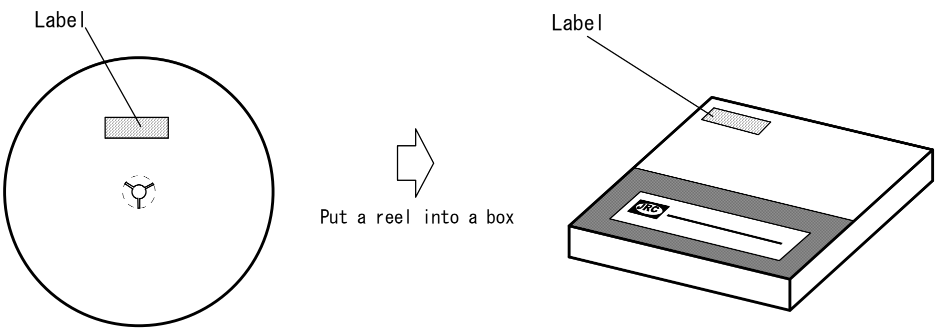


SYMBOL	DIMENSION
A	$\phi 180^{\ 0}_{-1.5}$
B	$\phi\ 60^{+1}_{\ 0}$
C	ϕ 13±0.2
D	ϕ 21±0.8
E	2±0.5
W	$9^{+0.3}_{\ 0}$
W1	1.2

TAPING STATE



PACKING STATE



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    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.
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    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.
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