

1.6GHz ON/OFF Function LNA

■ GENERAL DESCRIPTION

The XC2407A816UR-G is an ultra-low-noise amplifier (LNA) with low operating voltage, low noise figure (NF), low power consumption using CMOS process, The XC2407 is designed for GPS band frequency (1.6GHz).

The IC's internal circuit can be placed in stand-by mode via the CE function, In the stand-by mode, consumption current is greatly reduced and there is no need to add external ON/OFF control function like LDO.

External R_{BIAS} can adjust power supply to any voltage of 1.71V~3.63V as self bias function. Standard power supply voltages are 3.45V, 3.00V, 2.85V and 1.80V.

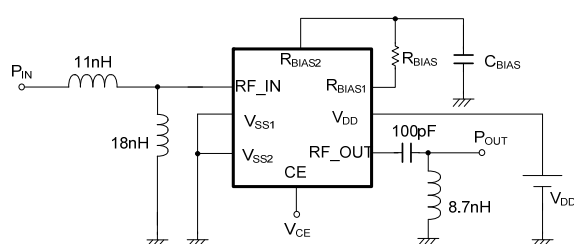
■ APPLICATIONS

- GPS band RF signal amplified

■ FEATURES

- Noise Figure : NF=0.96dB (TYP.) (@1.575GHz)
- Low Power Consumption : 7.02mW (TYP.) ($V_{DD}=1.80V$, $R_{BIAS}=430\Omega$)
- High Gain : S21=15dB (TYP.) (@1.575GHz)
- CE Function : CE "H" 1.1V~ V_{DD} ($1.71V \leq V_{DD} \leq 3.15V$)
CE "L" 0V~0.4V
- Operation Voltage Range : 1.71V~3.63V
- Output : CMOS Output
50 Ω Driver Built-in
- Operating Temperature Range : -40°C~+85°C
- Package : USP-8A01
- Environmentally Friendly : EU RoHS Compliant, Pb Free

■ TYPICAL APPLICATION CIRCUIT



TOP VIEW

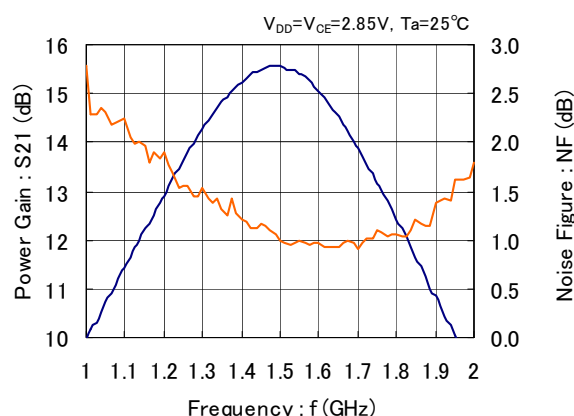
V_{DD} [V] (TYP.)	R_{BIAS} [Ω]
3.45	620
3.00	470
2.85	430
1.80	150

* R_{BIAS} should be used in $\pm 1\%$ tolerance and $\pm 200\text{ppm}/^\circ\text{C}$ temperature stability.

■ TYPICAL PERFORMANCE CHARACTERISTICS

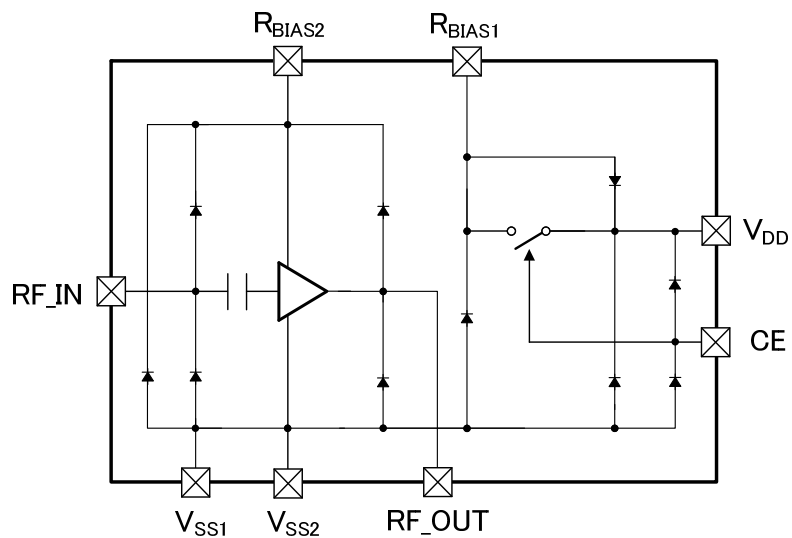
Power Gain / Noise Figure vs. Frequency

XC2407A816



XC2407A816UR-G

BLOCK DIAGRAM



* Diodes inside the circuit are an ESD protection diode.

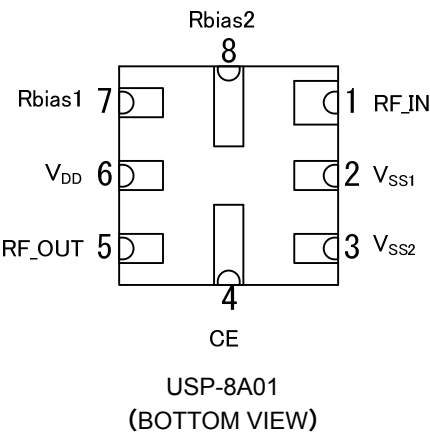
PRODUCT CLASSIFICATION

Ordering Information

PRODUCT NAME	PACKAGE	ORDER UNIT
XC2407A816UR-G ^(*)	USP-8A01	3,000 / Reel

^(*) The “-G” suffix denotes Halogen and Antimony free as well as being fully RoHS compliant.

PIN CONFIGURATION



PIN ASSIGNMENT

PIN NUMBER	PIN NAME	FUNCTION
1	RF_IN	RF Signal Input
2	V _{SS1}	Ground
3	V _{SS2}	Ground
4	CE	ON/OFF Control Pin
5	RF_OUT	RF Signal Output
6	V _{DD}	Power Supply
7	R _{BIAS1}	R _{BIAS} Connect Pin
8	R _{BIAS2}	R _{BIAS} Connect Pin

FUNCTION CHART

PIN NAME	SIGNAL	STATUS
CE	CE High	Active
	CE Low	Stand-by
	CE OPEN	Undefined State

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■ ABSOLUTE MAXIMUM RATINGS

Ta=25°C

PARAMETER	SYMBOL	RATINGS	UNITS
Power Supply Voltage	V _{DD}	-0.3~4.0	V
CE Input Voltage	V _{CE}	-0.3~V _{DD} +0.3 or 4.0 ^{(*)1}	V
Current Circuit	I _{DD}	42	mA
R _{BIAS1} Input Voltage	R _{BIAS1}	-0.3~V _{DD} +0.3 or 4.0 ^{(*)1}	V
R _{BIAS2} Input Voltage	R _{BIAS2}	-0.3~+1.6	V
RF Input Power	P _{IN}	10	dBm
RF_IN Input Voltage	V _{RF_IN}	-0.3~R _{BIAS2} +0.3 or +1.6 ^{(*)2}	V
RF_OUT Input Voltage	V _{RF_OUT}	0~R _{BIAS2} or +1.6 ^{(*)3}	V
Power Dissipation	P _d	120	mW
Operating Ambient Temperature	T _{opr}	-40~+85	°C
Storage Temperature	T _{stg}	-55~+125	°C

* All voltages are described based on the V_{SS1} and V_{SS2} pin.

V_{SS1} pin and V_{SS2} pin should be connected each other outside.

^{(*)1} The maximum value should be either V_{DD}+0.3V or +4.00V in the lowest.

^{(*)2} The maximum value should be either R_{BIAS2}+0.3V or +1.60V in the lowest.

^{(*)3} The maximum value should be either R_{BIAS2} or +1.60V in the lowest.

ELECTRICAL CHARACTERISTICS

●DC Characteristics

Ta=25°C

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Power Supply Voltage	V _{DD}	R _{BIAS} =620Ω ^{(*)2}	3.278	3.450	3.630	V	①
		R _{BIAS} =470Ω ^{(*)2}	2.850	3.000	3.150	V	①
		R _{BIAS} =430Ω ^{(*)2}	2.708	2.850	2.992	V	①
		R _{BIAS} =150Ω ^{(*)2}	1.710	1.800	1.890	V	①
Current Circuit	I _{DD}	1.71V ≤ V _{DD} ≤ 3.63V ^{(*)1} V _{CE} =V _{DD}	-	3.9	7.5	mA	①
Stand-by Current	I _{STBY}	1.71V ≤ V _{DD} ≤ 3.63V ^{(*)1} V _{CE} =0V	-	-	0.1	μA	①
CE "H" Level Voltage	V _{CEH}	1.71V ≤ V _{DD} ≤ 3.15V	1.1	-	V _{DD}	V	①
		3.15V < V _{DD} ≤ 3.63V	1.3	-	V _{DD}	V	①
CE "L" Level Voltage	V _{CEL}	-	0	-	0.4	V	①

^{(*)1} For the relation of V_{DD} and R_{BIAS}, Please refer to the "Power Supply Voltage vs. R_{BIAS} Table" below.

^{(*)2} R_{BIAS} should be used in ±1% tolerance and ±200ppm/°C temperature stability.

●AC Characteristics

V_{DD}=V_{CE}=2.85V, R_{BIAS}=430Ω, Ta=25°C

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Power Gain	S21	f=1.575GHz	13.5	15.0	-	dB	②
Input Return Loss	S11	f=1.575GHz	-	9.5	-	dB	②
Output Return Loss	S22	f=1.575GHz	-	9.5	-	dB	②
Isolation	S12	f=1.575GHz	-	-20	-	dB	②
Noise Figure ^{(*)1}	NF	f=1.575GHz	-	0.96	-	dB	③
Input Power IP3	I _{IP3}	f=1.575GHz, 1.576GHz	-	-5.1	-	dBm	④
Input Power IP2	I _{IP2}	f=0.8GHz, 2.375GHz	-	10.3	-	dBm	④
Input Power @ 1dB Gain Compression	P1dB	f=1.575GHz	-	-19	-	dBm	②

^{(*)1} NF is the value excluding the substrate loss.

Power Supply Voltage vs. R_{BIAS}

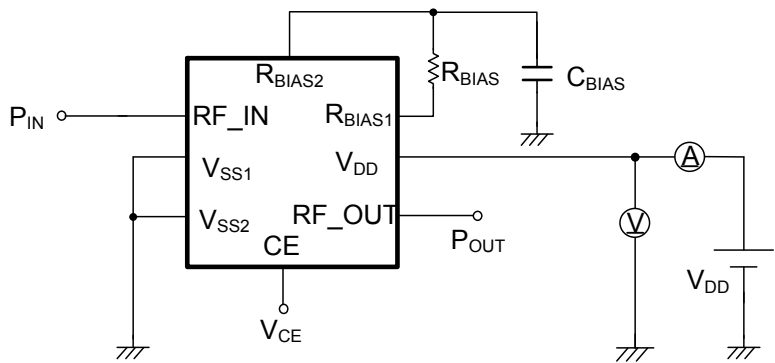
V _{DD} [V]	R _{BIAS} [Ω]
3.278~3.630	620
2.850~3.150	470
2.708~2.992	430
1.710~1.890	150

NOTE ON USE

1. For temporary, transitional voltage drop or voltage rising phenomenon, the IC is liable to malfunction should the ratings be exceeded.
2. Please eliminate static electricity from the operational table, people, and soldering iron.
3. Please use noiseless power supply for stable operation.
4. Please connect C_{BIAS} to R_{BIAS2} pin as close as possible.
5. V_{SS1} pin and V_{SS2} pin should be connected each other outside.
6. Please ensure to use an external component which does not depend on bias or temperature too much.
7. Torex places an importance on improving our products and their reliability.
We request that users incorporate fail-safe designs and post-aging protection treatment when using Torex products in their systems.

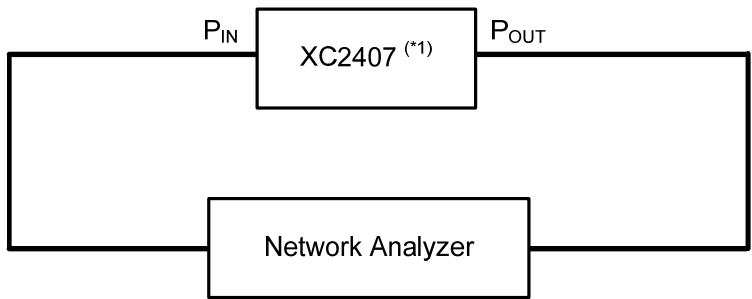
■ TEST CIRCUITS

● Circuit ① (DC Characteristics: Power Supply Pin Voltage, Circuit Current, Stand-by Current)



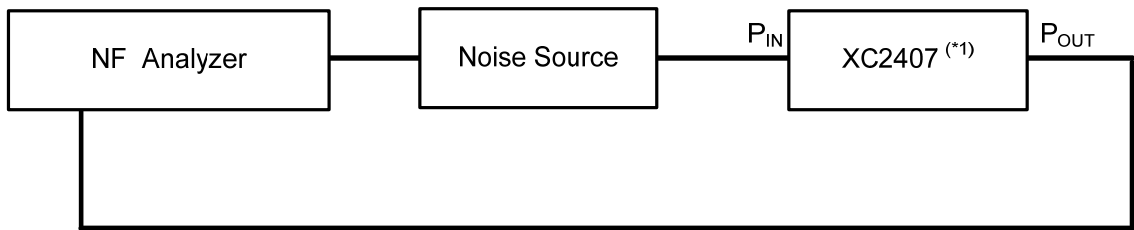
* P_IN / P_OUT is 50 Ω

● Circuit ② (Power Gain, Input Return Loss, Output Return Loss, Isolation, Input Power @ 1dB Gain Compression)



(*1) Refer to the circuit ⑤ for the block detail.

● Circuit ③ (Noise Figure)

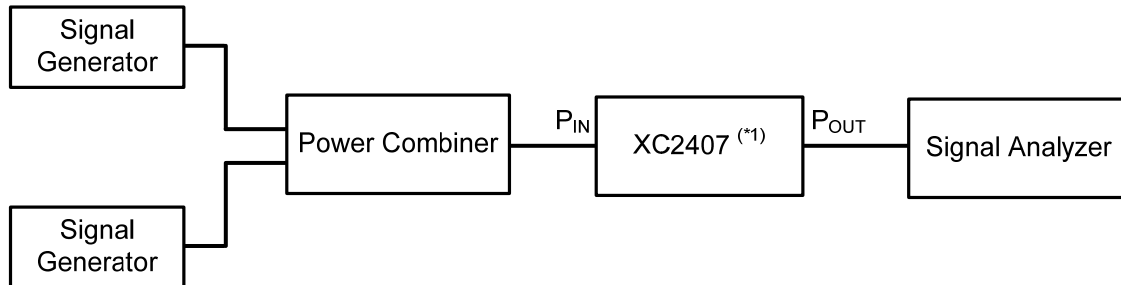


(*1) Refer to the circuit ⑤ for the block detail.

XC2407A816UR-G

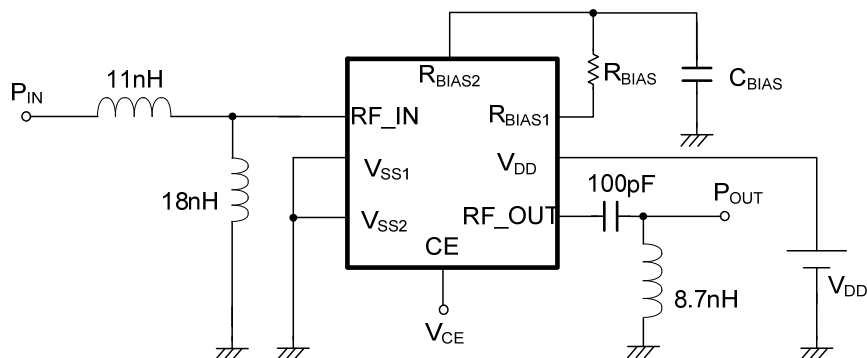
TEST CIRCUITS (Continued)

● Circuit ④ (Input Power IP3, Input Power IP2)



(*) Refer to the circuit ⑤ for the block detail.

● Circuit ⑤ (XC2407 series, the circuit of the block)

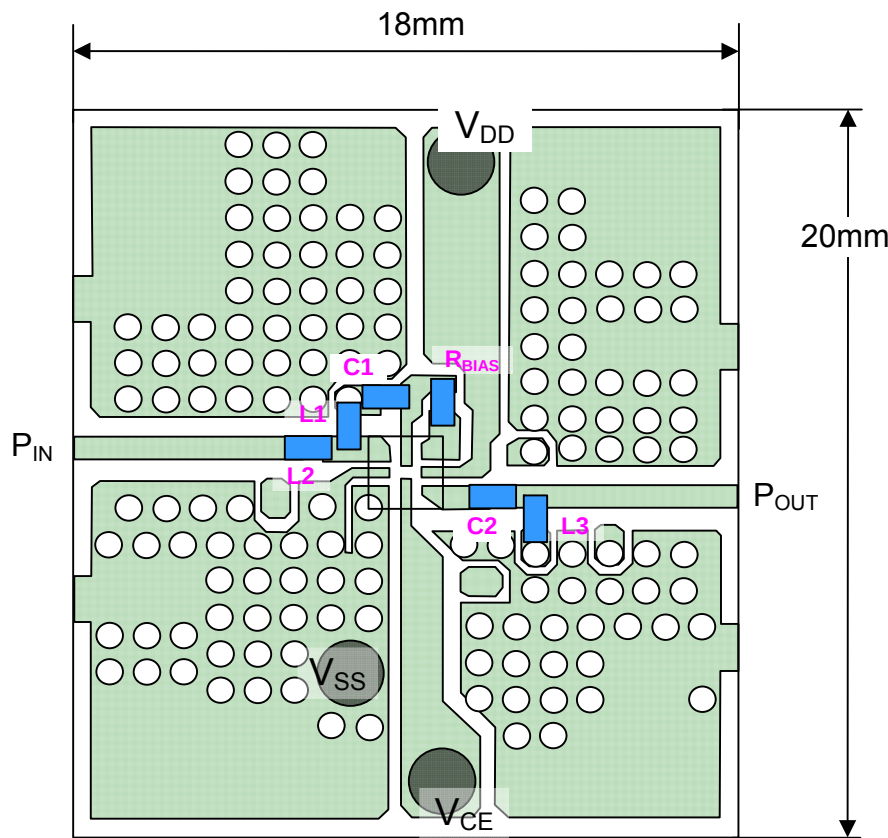


V_{DD} (V) (TYP.)	R_{BIAS} (Ω)
3.45	620
3.00	470
2.85	430
1.80	150

* R_{BIAS} should be used in $\pm 1\%$ tolerance and $\pm 200\text{ppm}/^\circ\text{C}$ temperature stability.

■ TEST CIRCUITS (Continued)

Evaluation Board



PCB (FR-4)
MICROSTRIPLINE WIDTH=0.6mm
t=0.18mm
PCB size=18mm × 20mm

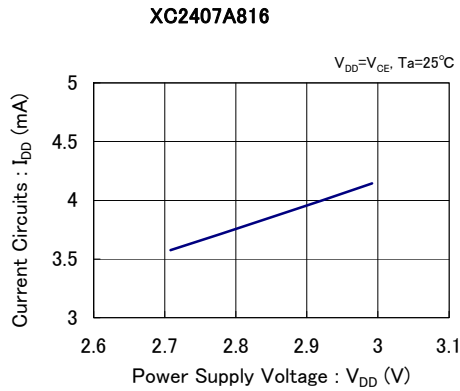
* Please use an external component which does not depend on bias or temperature too much.

External Components

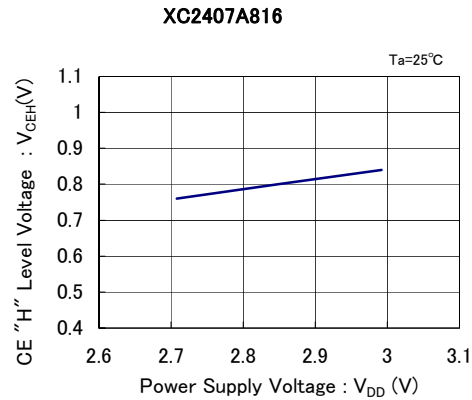
SYMBOL	SPEC	COMMENT
C1	10nF	-
C2	100pF	-
L1	18nH	MURATA (LQW15A18NG00D)
2	11nH	MURATA (LQW15A11NG00D)
L3	8.7nH	MURATA (LQW15A8N7G00D)
R _{BIAS}	-	Less than ±1% tolerance, Less than ±200ppm/°C temperature stability

TYPICAL PERFORMANCE CHARACTERISTICS

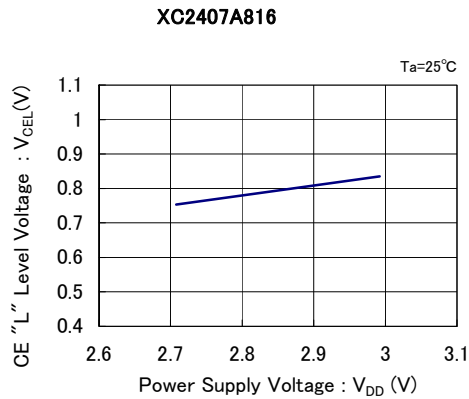
(1) Current Circuits vs. Supply Voltage



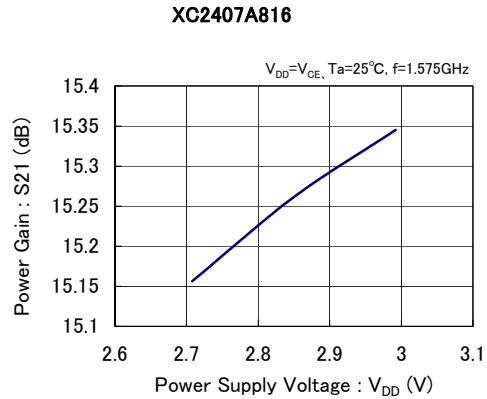
(2) CE "H" Level Voltage vs. Supply Voltage



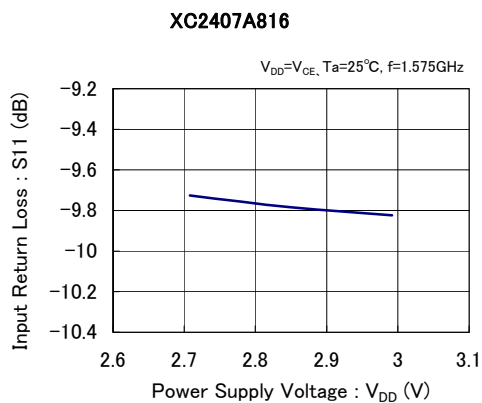
(3) CE "L" Level Voltage vs. Power Supply Voltage



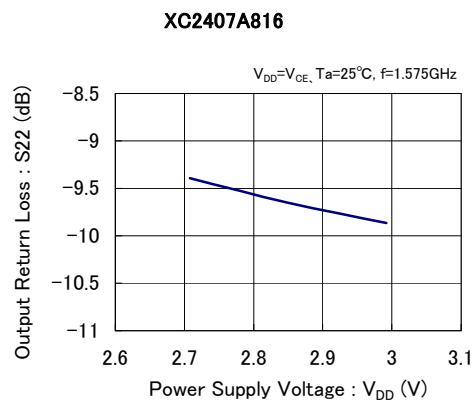
(4) Power Gain vs. Power Supply Voltage



(5) Input Return Loss vs. Power Supply Voltage

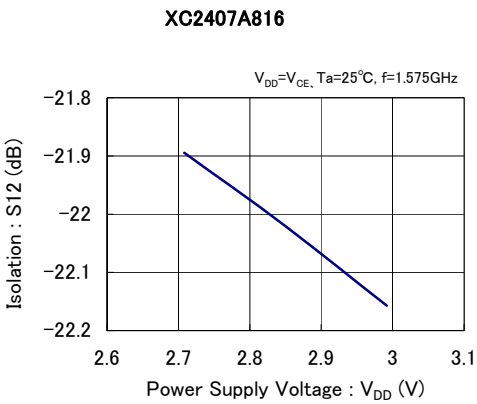


(6) Output Return Loss vs. Supply Voltage

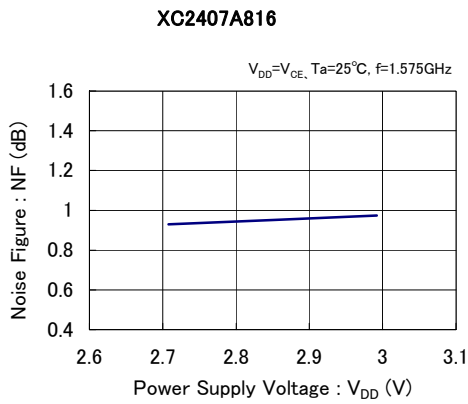


■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

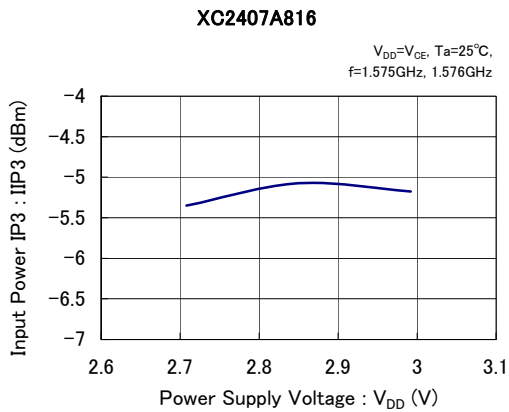
(7) Isolation vs. Power Supply Voltage



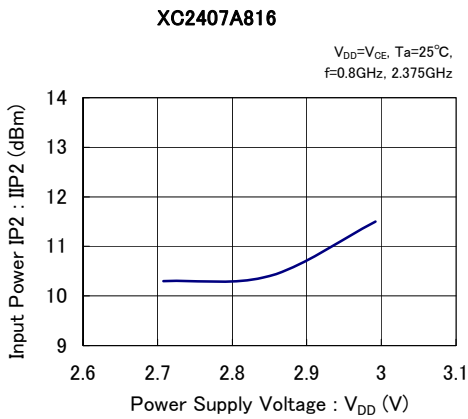
(8) Noise Figure vs. Power Supply Voltage



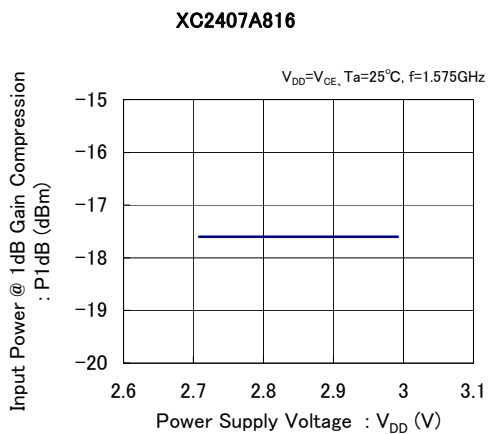
(9) Input Power IP3 vs. Power Supply Voltage



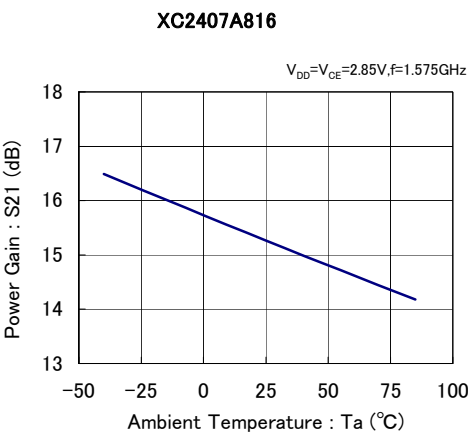
(10) Input Power IP2 vs. Power Supply Voltage



(11) Input Power @ 1dB Gain Compression vs. Power Supply Voltage

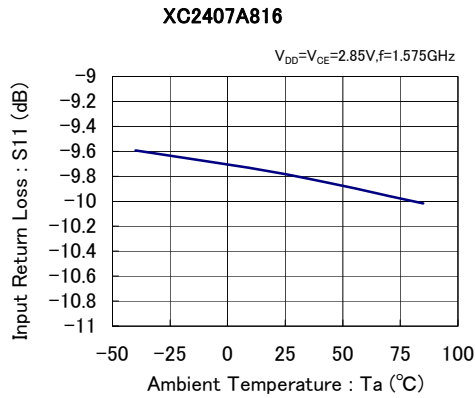


(12) Power Gain vs. Ambient Temperature

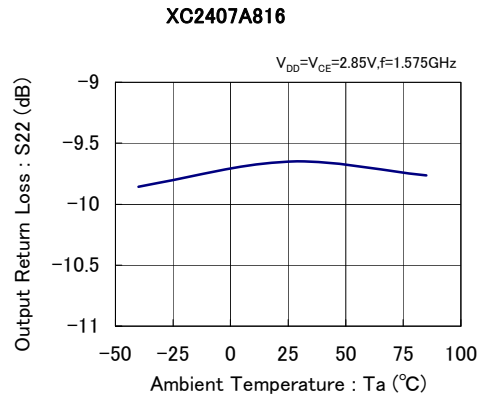


TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

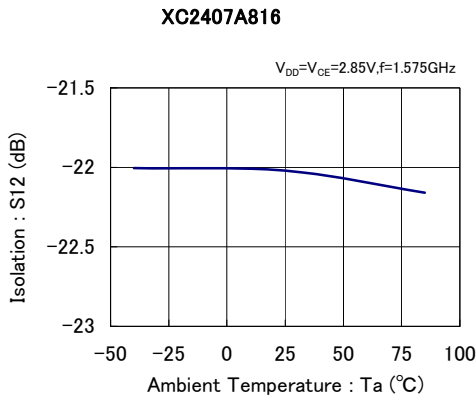
(13) Input Return Loss vs. Ambient Temperature



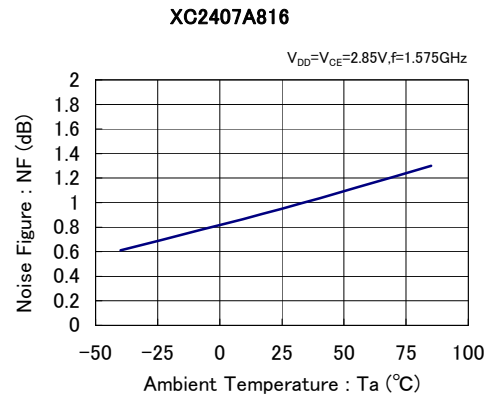
(14) Output Return Loss vs. Ambient Temperature



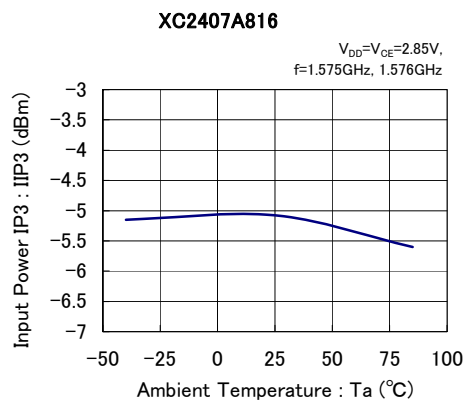
(15) Isolation vs. Ambient Temperature



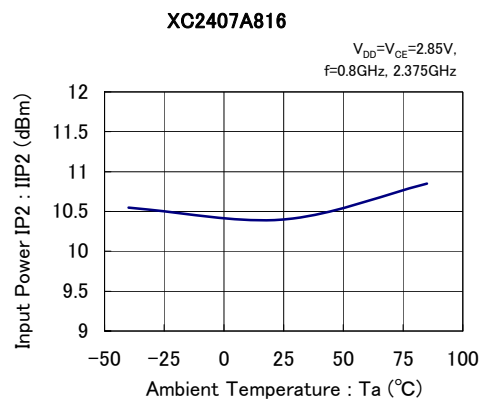
(16) Noise Figure vs. Ambient Temperature



(17) Input Power IP3 vs. Ambient Temperature

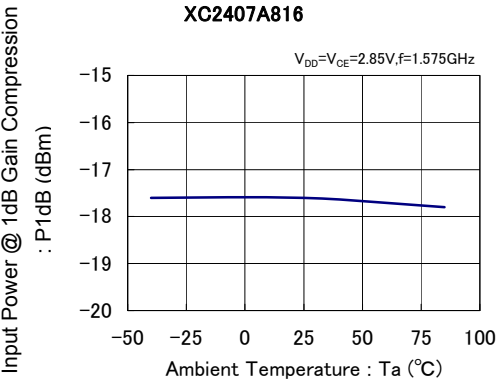


(18) Input Power IP2 vs. Ambient Temperature

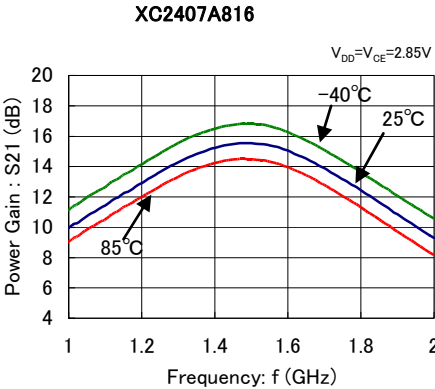


TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

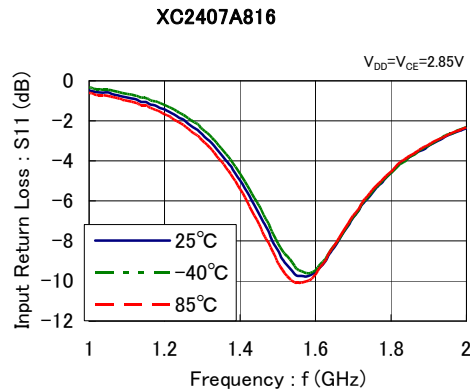
(19) Input Power @ 1dB Gain Compression vs. Ambient Temperature



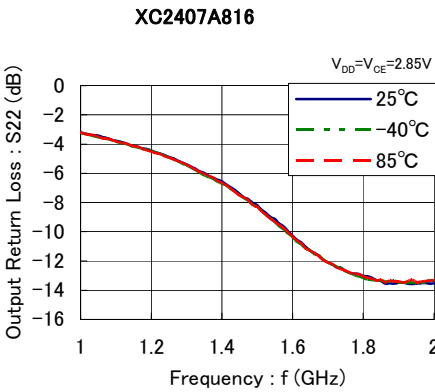
(20) Power Gain vs. Frequency



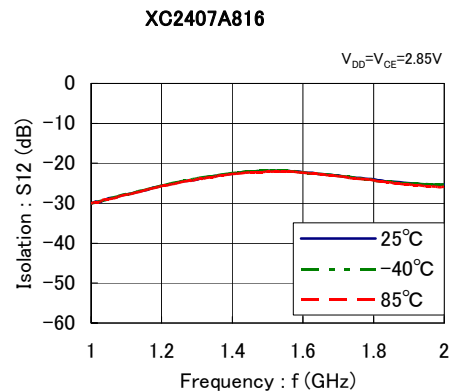
(21) Input Return Loss vs. Frequency



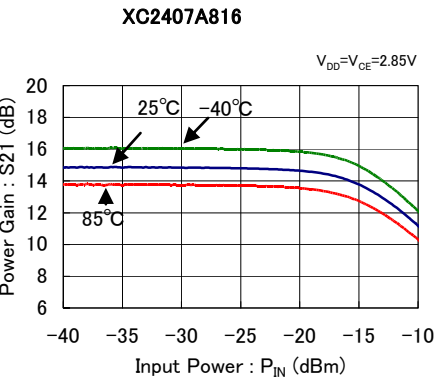
(22) Output Return Loss vs. Frequency



(23) Isolation vs. Frequency



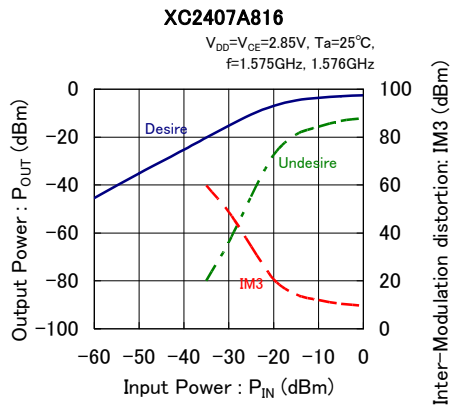
(24) Power Gain vs. Input Power



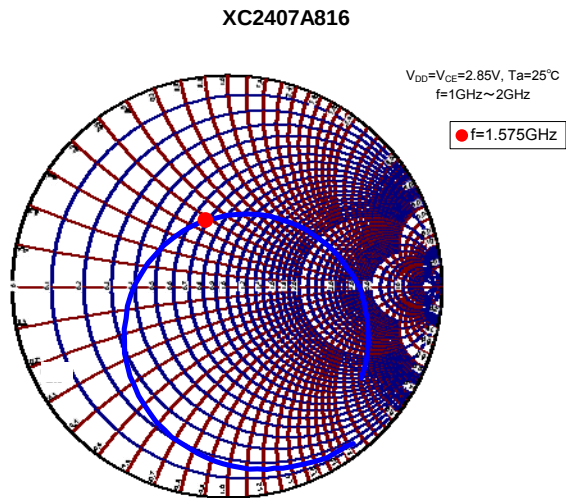
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TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

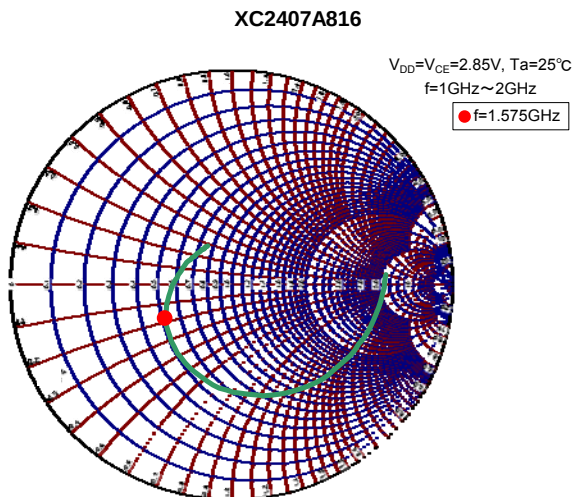
(25) Output Power / IM3 vs. Input Power



(26) Input Return Loss vs. Frequency (Smith Chart)

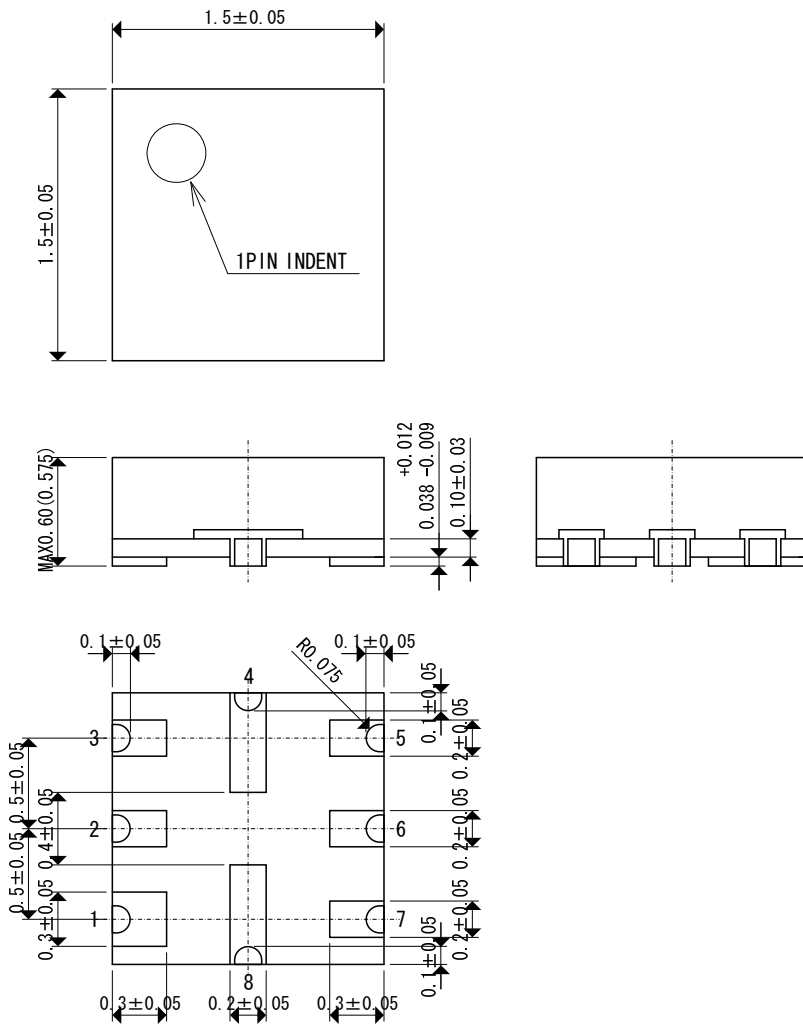


(27) Output Return Loss vs. Frequency (Smith Chart)



■ PACKAGING INFORMATION

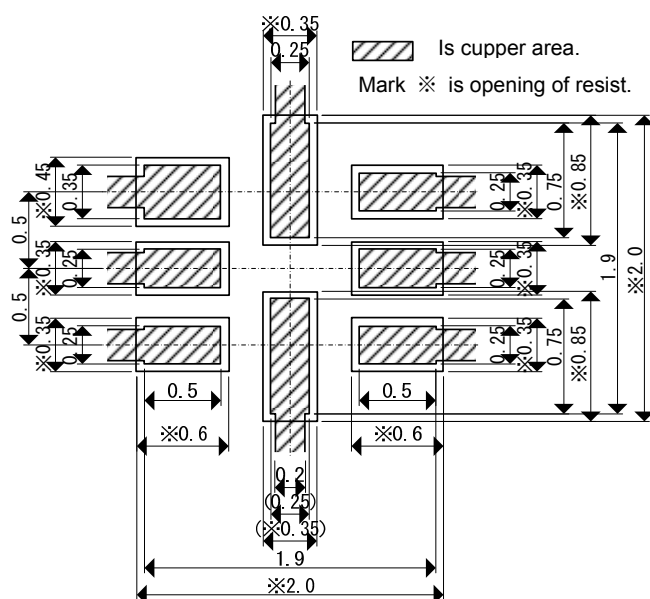
●USP-8A01 (unit:mm)



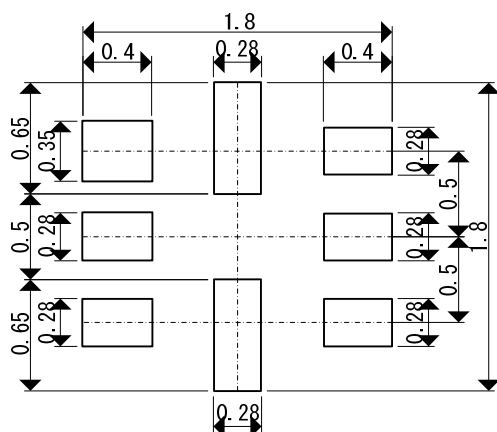
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■ PACKAGING INFORMATION (Continued)

● USP-8A01 Reference Pattern Layout (unit:mm)

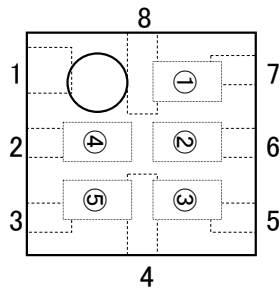


●USP-8A01 Reference Metal Mask Design (unit:mm)



MARKING RULE

USP-8A01



① represents product series.

MARK	PRODUCT SERIES
7	XC2407*****-G

② represents product.

MARK	PRODUCT SERIES
②	
A	XC2407A****-G

③ represents product.

MARK	PRODUCT SERIES
③	
8	XC2407*8****-G

④,⑤ represents production lot number.

01 to 09, 0A to 0Z, 11 to 9Z, A1 to A9, AA to AZ and B1 to ZZ in order.

(G, I, J, O, Q, W excepted)

*No character inversion used.

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