



## Preliminary Data Sheet

BIPOLAR ANALOG INTEGRATED CIRCUIT

# $\mu$ PC3231GV

### 5 V AGC AMPLIFIER + VIDEO AMPLIFIER

#### DESCRIPTION

The  $\mu$ PC3231GV is silicon monolithic IC designed for use as AGC amplifier for digital CATV, cable modem and digital terrestrial systems. This IC consists of gain control amplifier and video amplifier.

The package is 8-pin SSOP (shrink small outline package) suitable for surface mount.

This IC is manufactured using our 30 GHz  $f_{max}$  UHS0 (Ultra High Speed Process) silicon bipolar process. This process uses silicon nitride passivation film. This material can protect chip surface from external pollution and prevent corrosion/migration. Thus, this IC has excellent performance, uniformly and reliability.

#### FEATURES

- Low distortion :  $IM_3 = 53.5$  dBc TYP. @ single-ended output,  $V_{out} = 105$ dB $\mu$ V (0.5  $V_{P-P}$ )/tone
- Low noise figure : NF = 5.0 dB TYP. @ Maximum Gain
- Wide AGC dynamic range : GCR = 61 dB TYP. @ input prescribe
- On-chip video amplifier :  $V_{out} = 1.0$   $V_{P-P}$  TYP. @ single-ended output
- Supply Voltage :  $V_{CC} = 5.0$  V TYP.
- Packaged in 8-pin SSOP suitable for surface mounting.

#### APPLICATIONS

- Digital terrestrial TV
- Digital CATV
- Cable modem receivers

#### ORDERING INFORMATION (PLAN)

Part Number	Package	Supplying Form
$\mu$ PC3231GV-E1	8-pin plastic SSOP (4.45mm(175))	Embossed tape 8mm wide. Pin 1 indicates pull-out direction of tape. Qty 1kpcs/reel.

**Remark** To order evaluation samples, please contact your local NEC sales office.

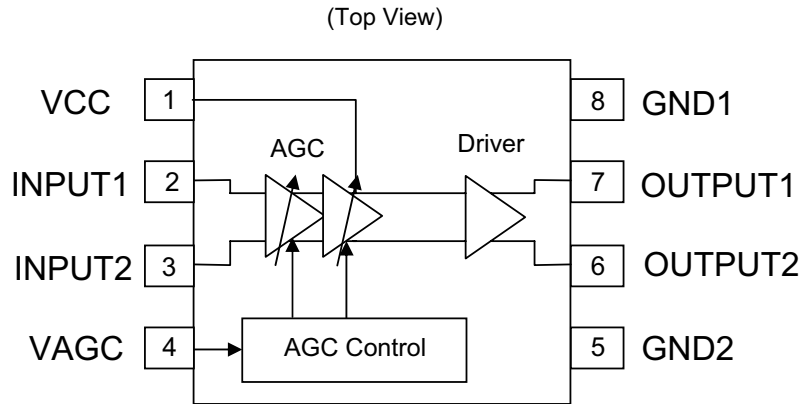
Part number for sample order:  $\mu$ PC3231GV

**Caution** Observe precautions when handling because these devices are sensitive to electrostatic discharge.

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

Not all devices/types available in every country. Please check with local NEC Electronics sales representative for availability and additional information.

INTERNAL BLOCK DIAGRAM AND PIN CONFIGURATION



PRODUCT LINE-UP OF 5V AGC AMPLIFIER

Part Number	I <sub>cc</sub> (mA)	G <sub>MAX</sub> (dB)	G <sub>MIN</sub> (dB)	G <sub>CR</sub> (dB)	NF (dB)	IM <sub>3</sub> (dBc)	Package
μPC3217GV	23	53	0	53	6.5	50 <sup>NOTE1</sup>	8-pin SSOP ( 4.45mm(175))
μPC3218GV	23	63	10	53	3.5	50 <sup>NOTE1</sup>	
μPC3219GV	36.5	42.5	0	42.5	9.0	58 <sup>NOTE1</sup>	
μPC3221GV	33	60	10	50	4.2	56 <sup>NOTE1</sup>	
μPC3231GV	36	65	4	61	5.0	53.5 <sup>NOTE2</sup>	

**NOTE1** f<sub>1</sub>=44MHz, f<sub>2</sub>=45MHz, V<sub>out</sub>=0.7Vp-p/tone, single-ended output

**NOTE2** f<sub>1</sub>=44MHz, f<sub>2</sub>=45MHz, V<sub>out</sub>=0.5Vp-p/tone, single-ended output

**PIN EXPLANATIONS**

Pin No.	Pin Name	Applied Voltage (V)	Pin Voltage (V) <small>Note</small>	Function and application	Internal Equivalent Circuit
1	V <sub>CC</sub>	4.5 to 5.5	-	Power supply pin. This pin should be externally equipped with bypass capacitor to minimize ground impedance,	
2	INPUT1	-	1.32	Signal input pins to AGC amplifier. This pin should be coupled with capacitor for DC cut.	
3	INPUT2	-	1.32		
4	V <sub>AGC</sub>	0 to V <sub>CC</sub>	-	Gain control pin. This pin's bias govern the AGC output level. Minimum Gain at V <sub>AGC</sub> :0 to 0.1V Maximum Gain at V <sub>AGC</sub> :2.7 to 3.3V Recommended to use AGC voltage with externally resistor (example:1kΩ)	
5	GND2	0	-	Ground pin. This pin should be connected to system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible.	
6	OUTUT2	-	1.91	Signal output pins of video amplifier. This pin should be coupled with capacitor for DC cut.	
7	OUTUT1	-	1.91		
8	GND1	0	-	Ground pin. This pin should be connected to system ground with minimum inductance. Ground pattern on the board should be formed as with as possible. All ground pins must be connected together with wide ground pattern to decrease impedance difference.	

**Note** Pin voltage is measured at V<sub>CC</sub>=5.0V

**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Test Conditions	Rating	Unit
Supply Voltage	$V_{CC}$	$T_A=+25^\circ\text{C}$	6.0	V
Gain Control Voltage Range	$V_{AGC}$	$T_A=+25^\circ\text{C}$	0 to $V_{CC}$	V
Power Dissipation	$P_D$	$T_A=+85^\circ\text{C}$ Note	250	mW
Storage Temperature	$T_{stg}$		-55 to +150	$^\circ\text{C}$

**Note** Mounted on double-sided copper-clad 50 × 50 × 1.6 mm epoxy glass PWB

**RECOMMENDED OPERATING RANGE**

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Supply Voltage	$V_{CC}$		4.5	5.0	5.5	V
Operating Ambient Temperature	$T_A$	$V_{CC} = 4.5$ to $5.5$ V	-40	+25	+85	$^\circ\text{C}$
Gain Control Voltage Range	$V_{AGC}$		0	–	3.3	V
Operating Frequency Range	$f_{(BW)}$		30	–	90	MHz

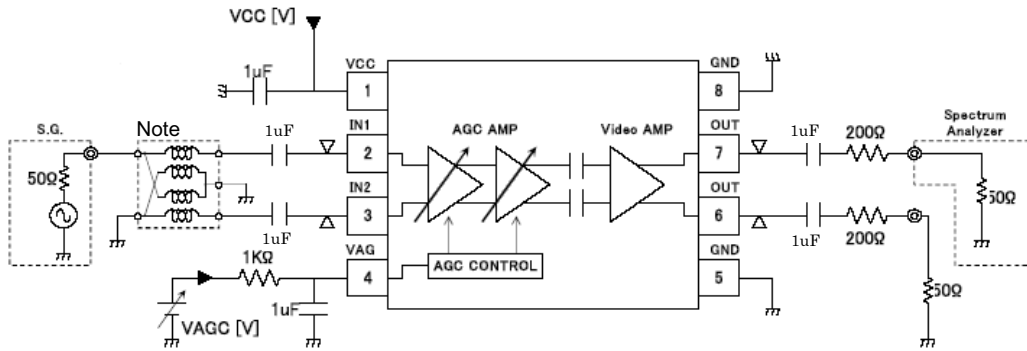
## ELECTRICAL CHARACTERISTICS

(T<sub>A</sub>=+25°C, V<sub>CC</sub> = 5V, f = 45MHz, Z<sub>s</sub> = 50Ω, Z<sub>L</sub> = 250Ω, single-ended output)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
DC Characteristics						
Circuit Current	I <sub>CC</sub>	V <sub>CC</sub> =5V, No input signal Note 1	28	36	44	mA
AGC Voltage High Level	V <sub>AGC(H)</sub>	@ Maximum gain Note 1	2.7	-	3.3	V
AGC Voltage Low Level	V <sub>AGC(L)</sub>	@ Minimum gain Note 1	0	-	0.1	V
RF Characteristics						
IF Input Frequency Range	f <sub>in</sub>	f <sub>c</sub> = -3dB @45MHz Note 1	30	-	90	MHz
Maximum Voltage Gain	G <sub>MAX</sub>	V <sub>AGC</sub> =2.7V, P <sub>in</sub> = -60dBm Note 1	62.5	65	67.5	dB
Minimum Voltage Gain	G <sub>MIN</sub>	V <sub>AGC</sub> =0.1V, P <sub>in</sub> = -30dBm Note 1	0	4	7	dB
Gain Control Range (input prescribe)	GCR <sub>in</sub>	V <sub>AGC</sub> =0.1 to 2.7 V Note 1	55.5	61	-	dB
Gain Control Range (output prescribe)	GCR <sub>out</sub>	V <sub>out</sub> = 1.0 V <sub>P-P</sub> Note 1	45	55	-	dB
Output Voltage	V <sub>out</sub>	P <sub>in</sub> = -61~-6dBm Note 1	-	1.0	-	V <sub>P-P</sub>
Maximum Output Voltage	V <sub>oclip</sub>	V <sub>AGC</sub> = 3.0 V Note 1	2.0	3.3	-	V <sub>P-P</sub>
Noise Figure	NF	V <sub>AGC</sub> = 3.0 V Note 2	-	5.0	6.5	dB
3rd Order Inter-modulation Distortion	IM <sub>3</sub>	f <sub>1</sub> = 44 MHz, f <sub>2</sub> = 45 MHz, P <sub>in</sub> = -20 dBm/tone, V <sub>out</sub> =105dBμV (0.5V <sub>P-P</sub> )/tone Note 1	50	53.5	-	dBc
Input impedance	Z <sub>in</sub>	V <sub>AGC</sub> =0 V Note 3	-	1.35//6	-	KΩ//pF

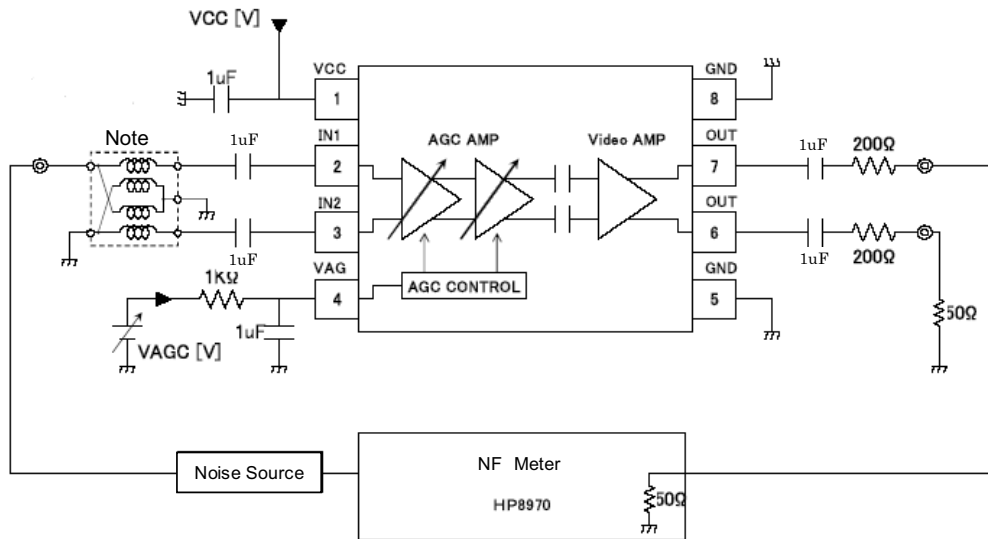
- Note**
1. By measurement circuit 1
  2. By measurement circuit 2
  3. By measurement circuit 3

MEASUREMENT CIRCUIT 1



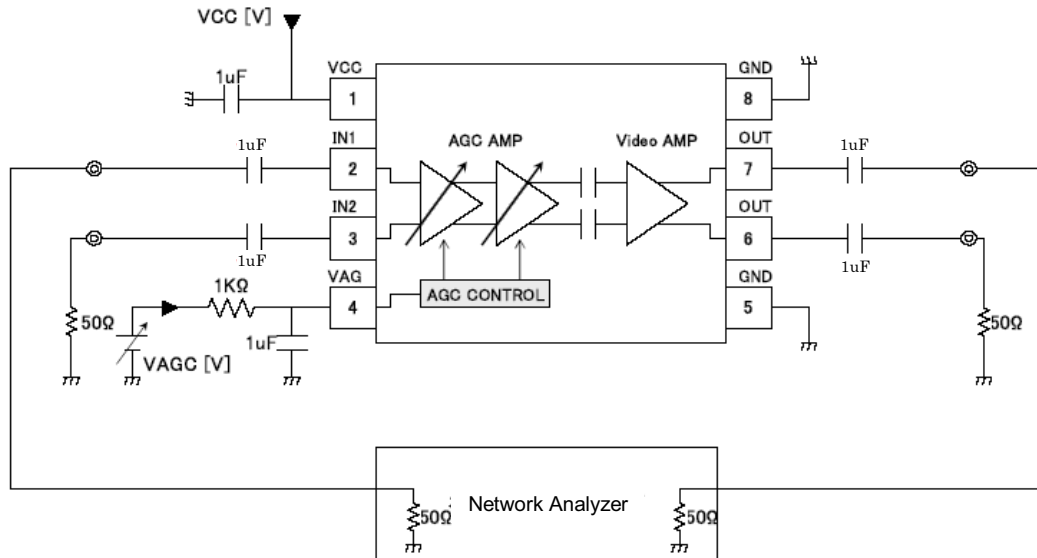
Note Balun Transformer : TOKO 617DB-1674 B4F (Double balanced type)

MEASUREMENT CIRCUIT 2



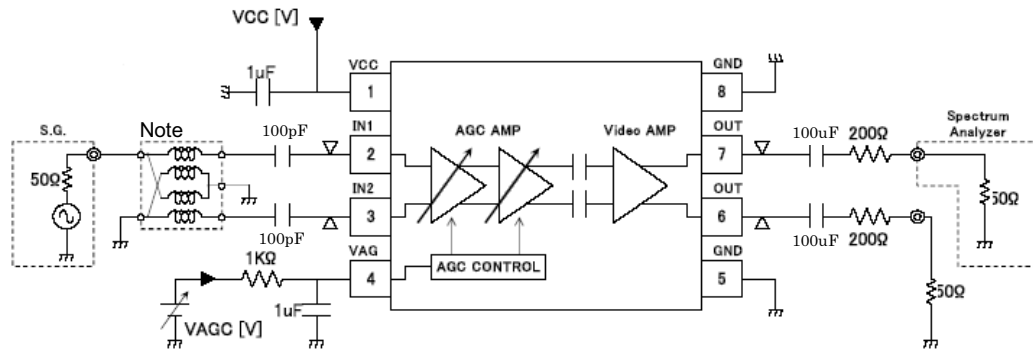
Note Balun Transformer : TOKO 617DB-1674 B4F (Double balanced type)

MEASUREMENT CIRCUIT 3



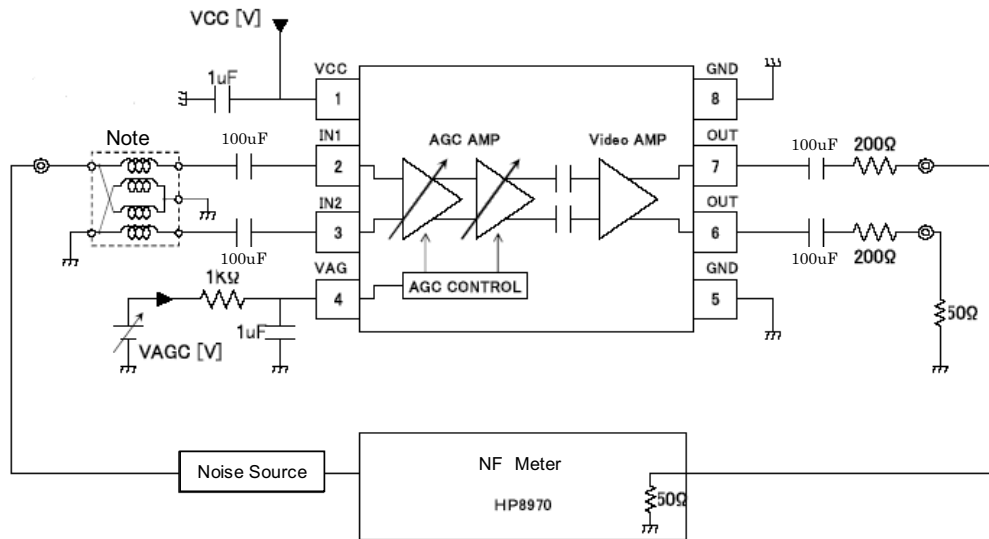
The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

**MEASUREMENT CIRCUIT 4 [ PRESSURE IMPROVEMENT RECOMMENDATION CIRCUIT ]**



**Note** Balun Transformer : TOKO 617DB-1674 B4F (Double balanced type)

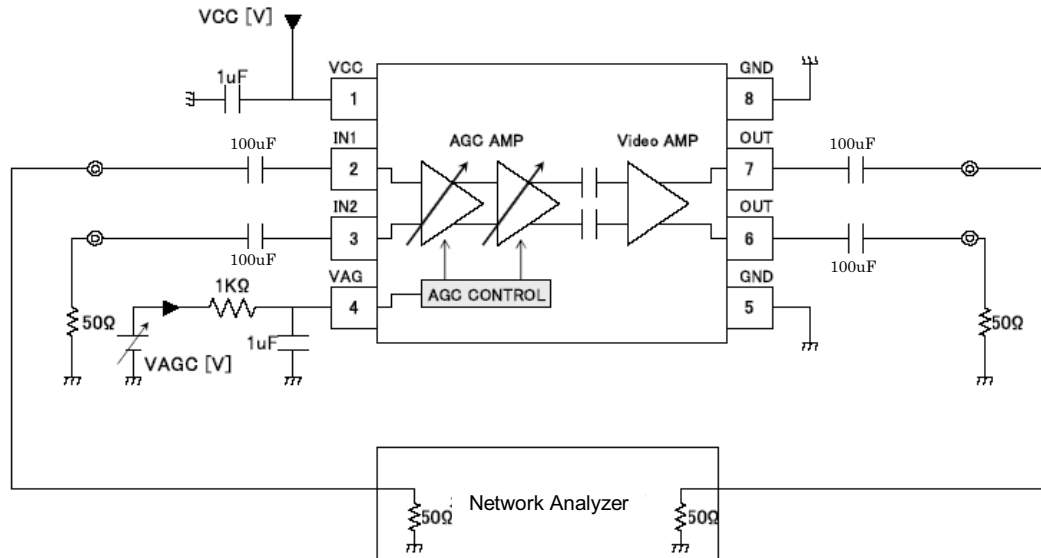
**MEASUREMENT CIRCUIT 5 [ PRESSURE IMPROVEMENT RECOMMENDATION CIRCUIT ]**



**Note** Balun Transformer : TOKO 617DB-1674 B4F (Double balanced type)

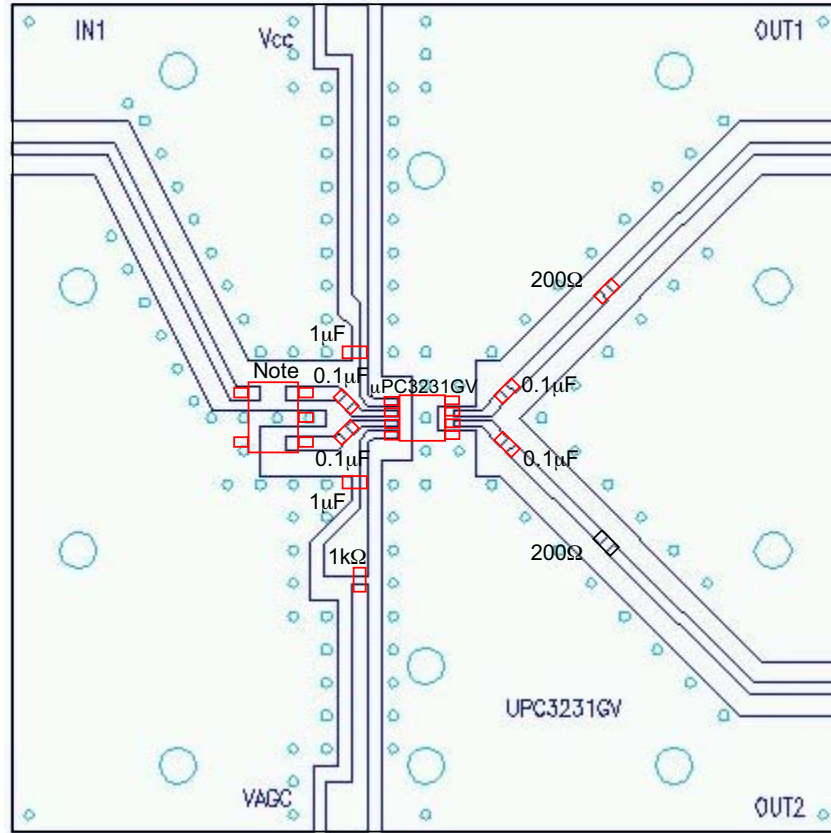


MEASUREMENT CIRCUIT 6 [ PRESSURE IMPROVEMENT RECOMMENDATION CIRCUIT ]



The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD  
(MEASUREMENT CIRCUIT 1)



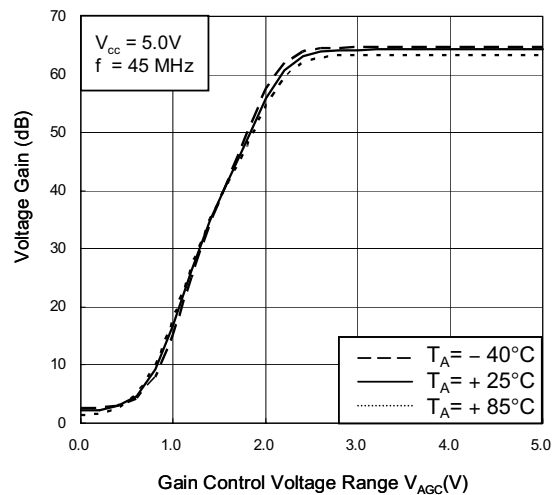
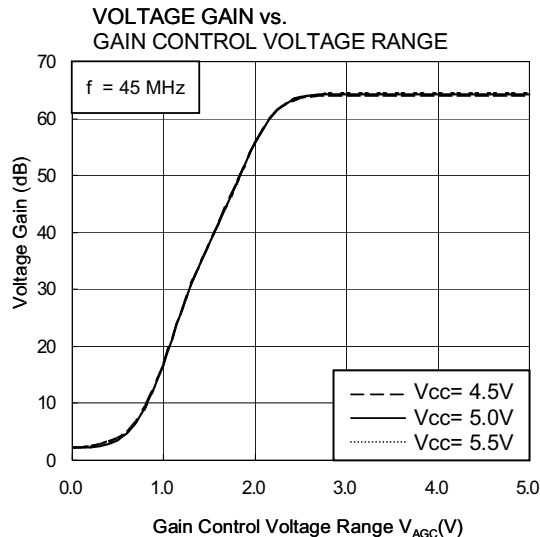
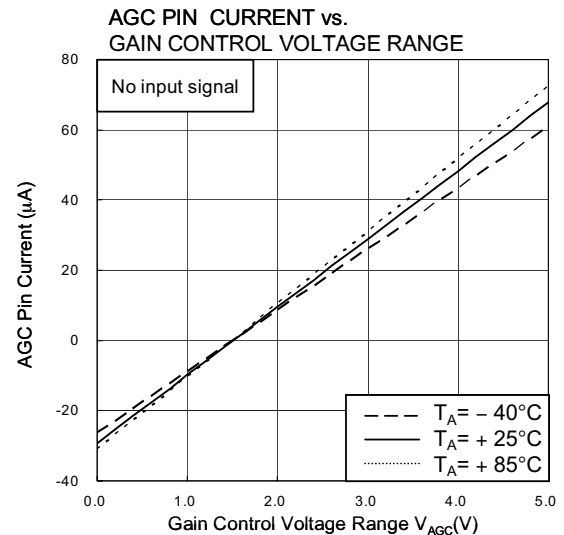
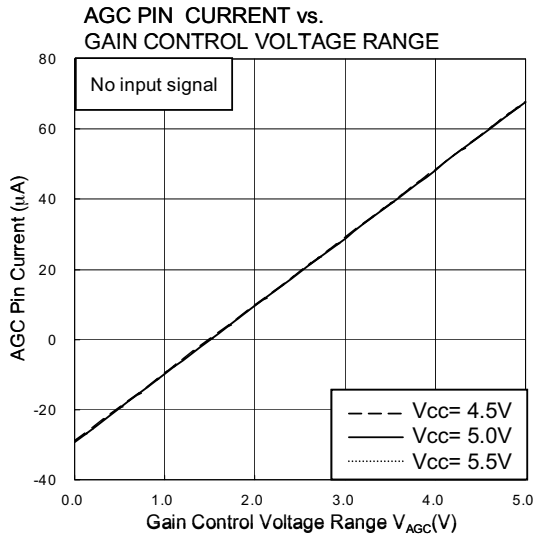
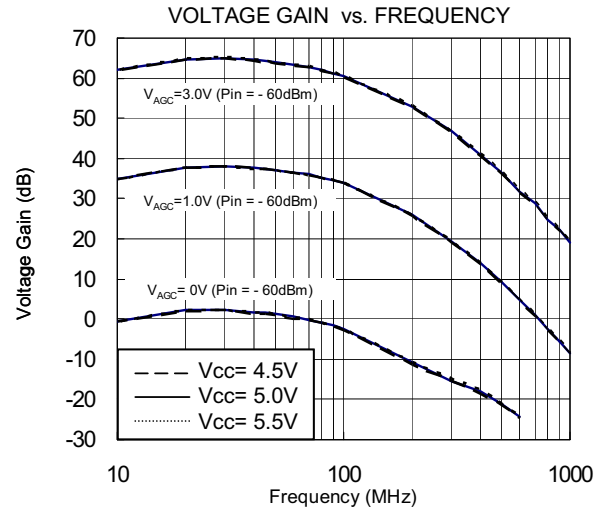
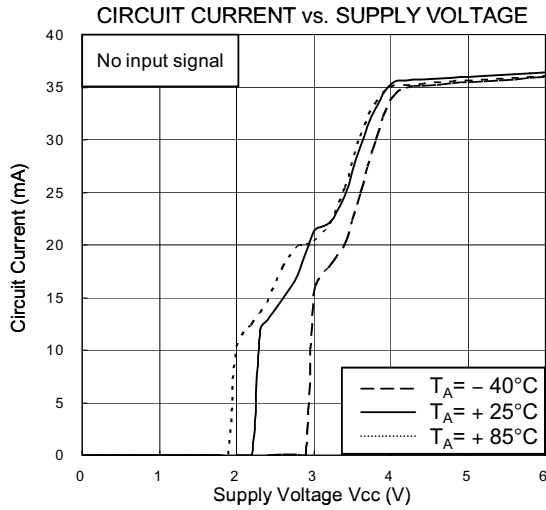
**Note** Balun Transformer

**Remarks**

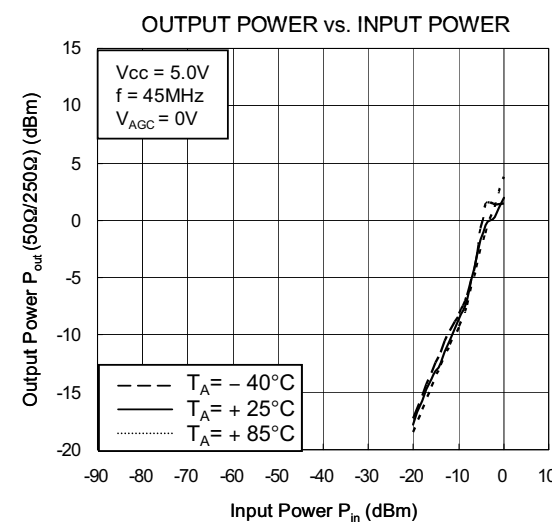
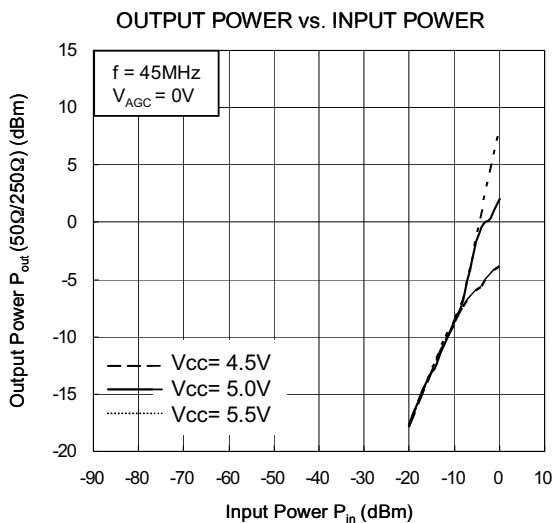
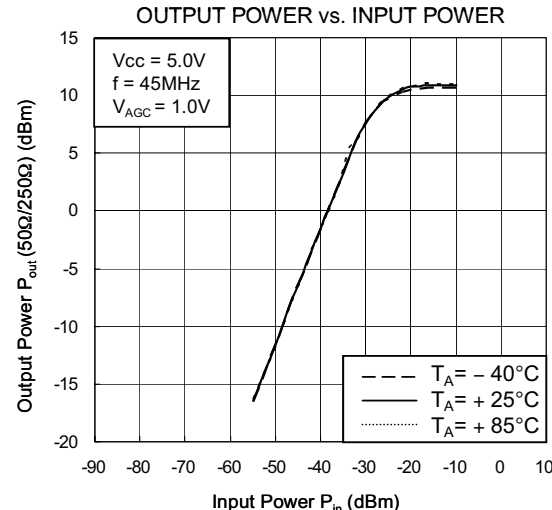
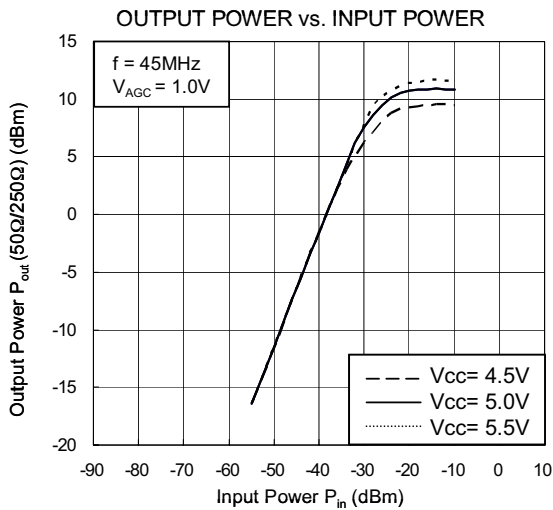
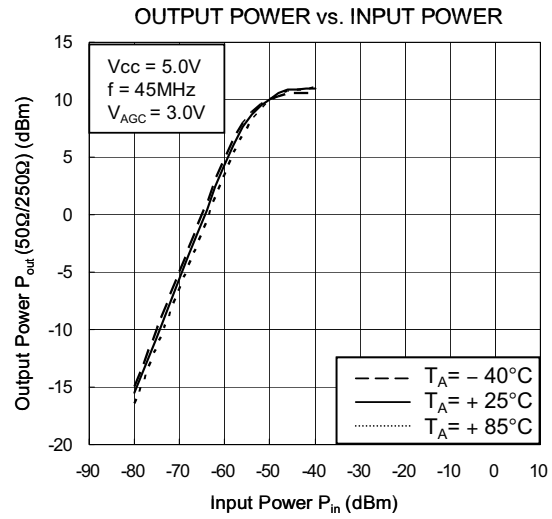
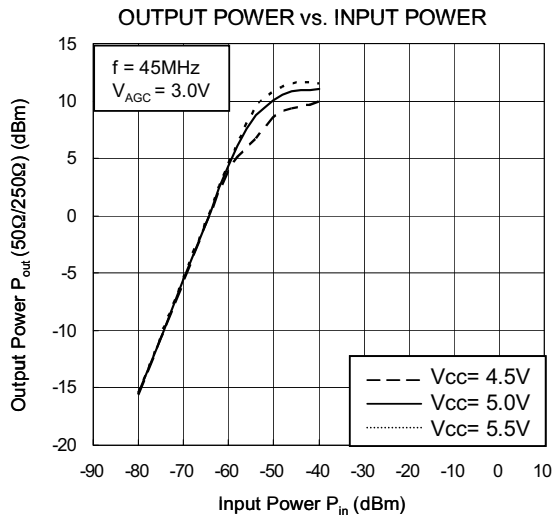
1. Back side: GND pattern
2. Au plated on pattern
3. ○: Through hole

TYPICAL CHARACTERISTICS

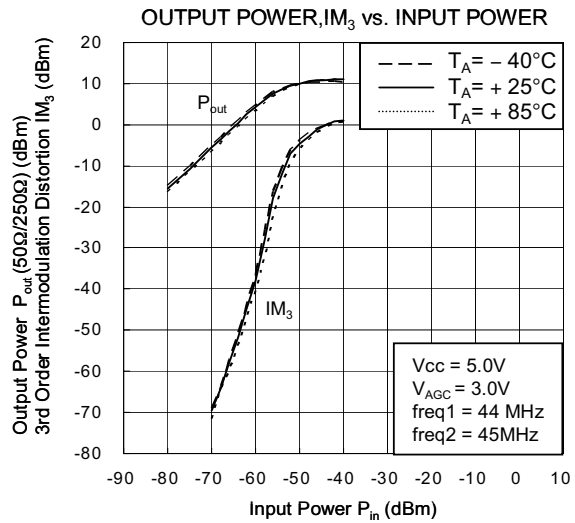
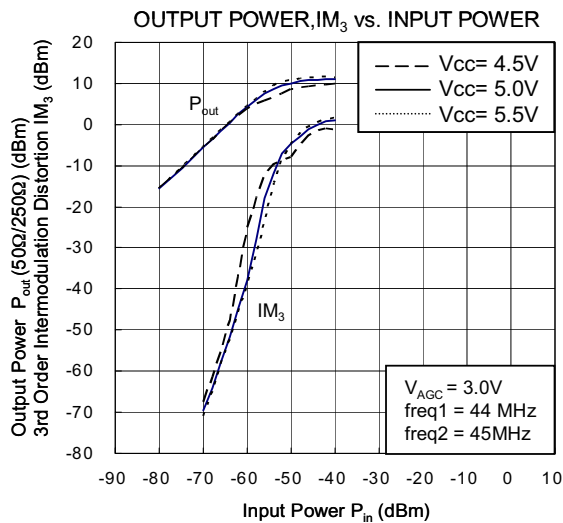
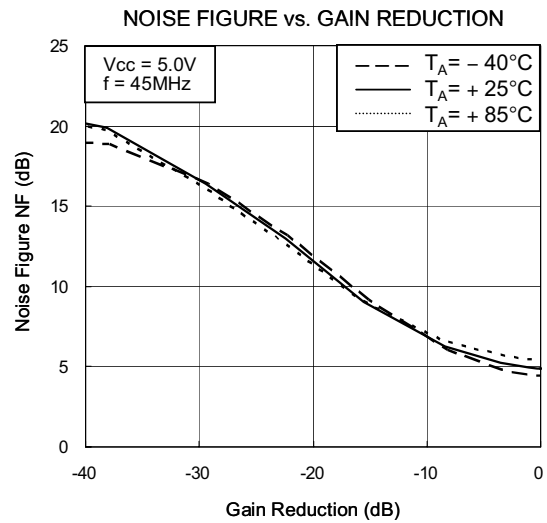
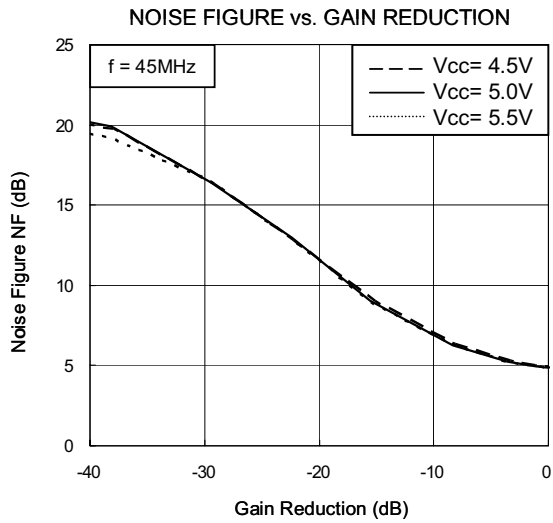
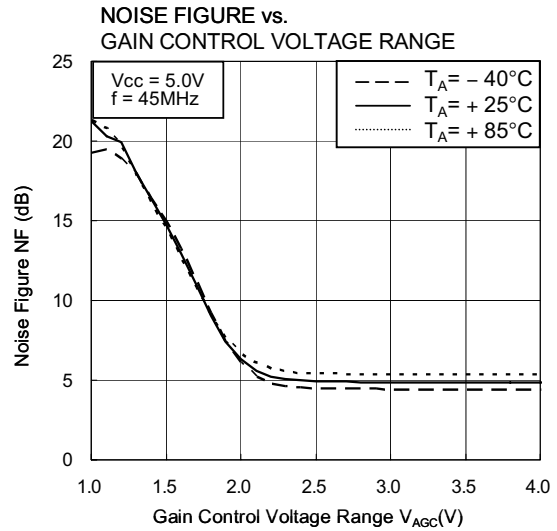
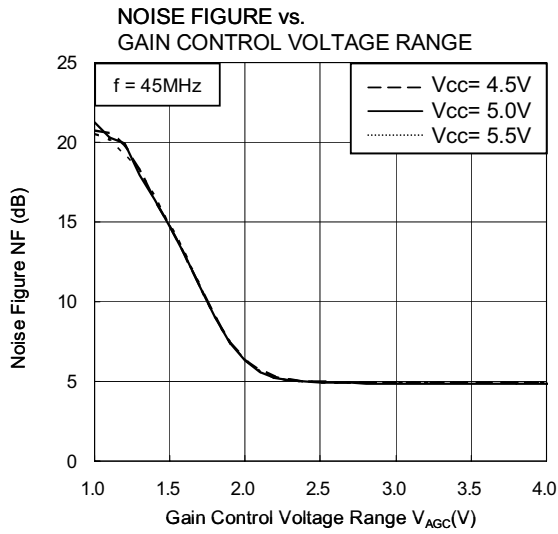
( $T_A = +25^\circ\text{C}$ , unless otherwise specified)



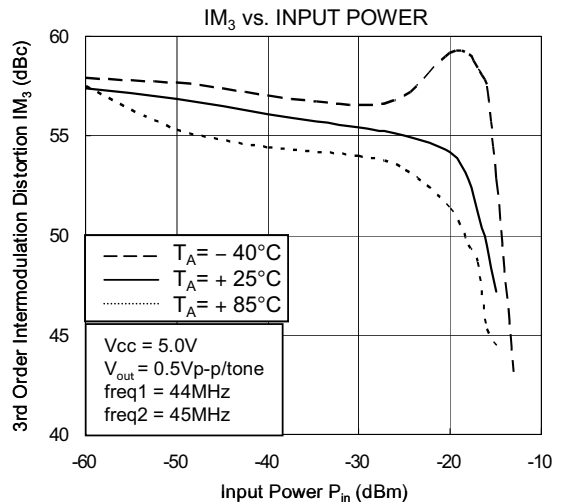
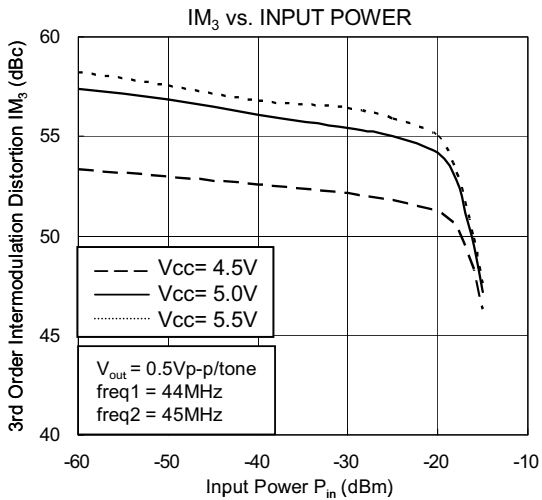
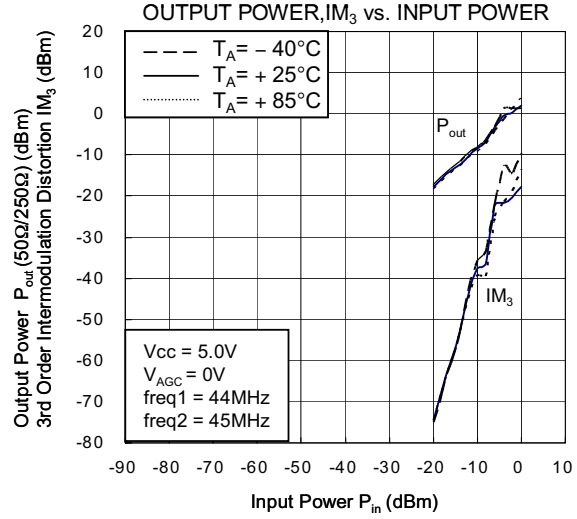
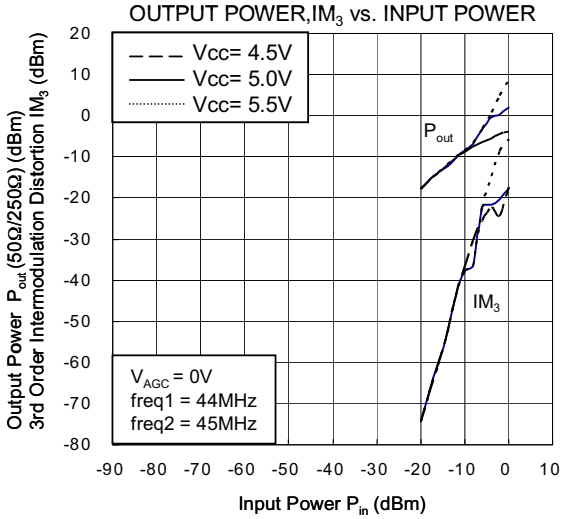
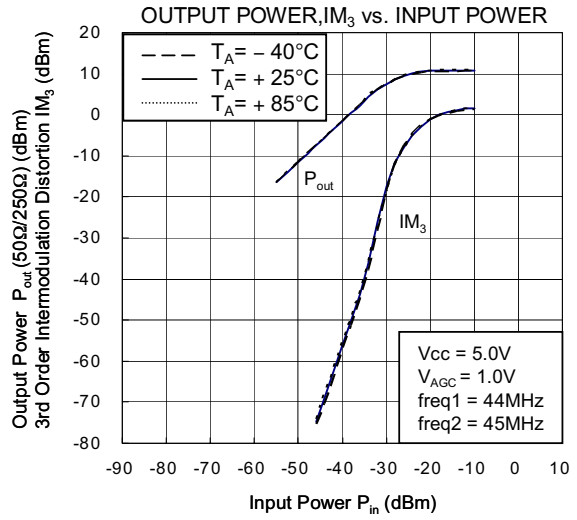
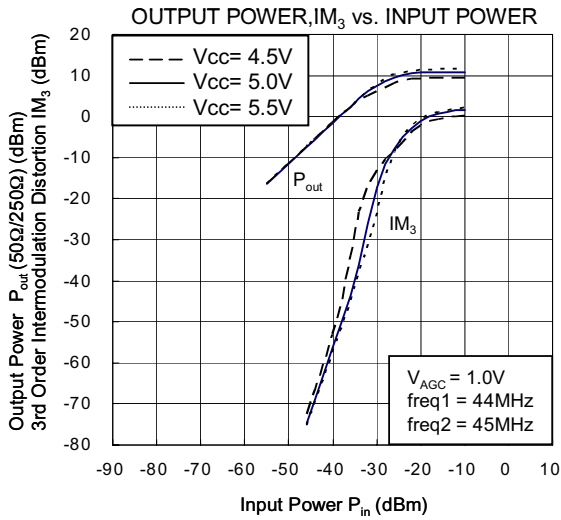
Remark The graphs is indicate nominal characteristics.



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Remark 0The graphs is indicate nominal characteristics.

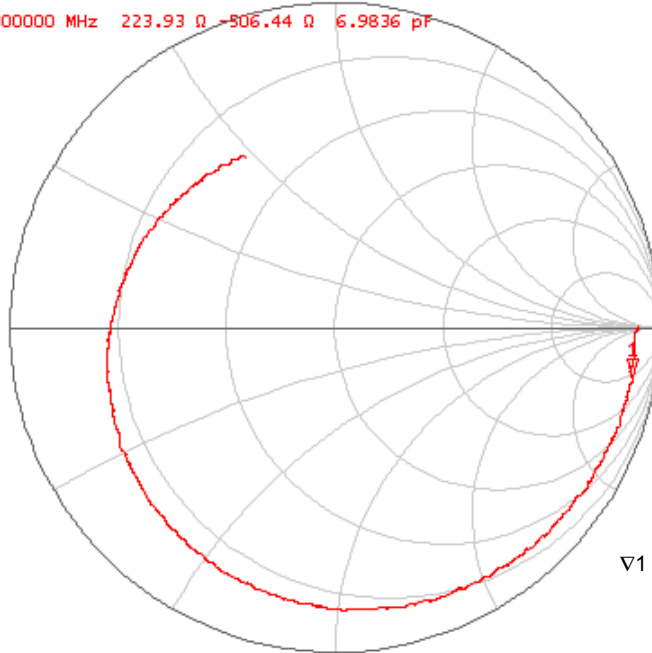


**Remark** The graphs indicate nominal characteristics.

S-PARAMETERS (T<sub>A</sub> = + 25°C, V<sub>cc</sub> = 5V, V<sub>AGC</sub>=0V)

S11 – FREQUENCY

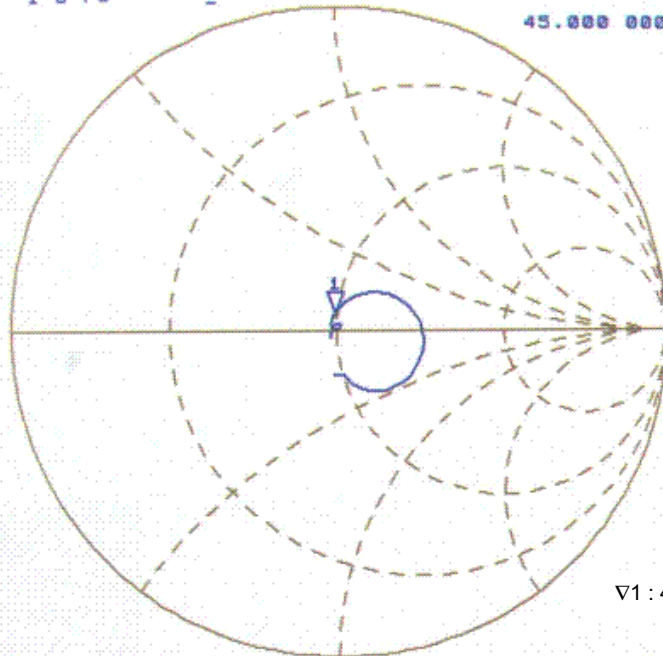
>1 45.00000000 MHz 223.93 Ω -506.44 Ω 6.9836 pF



∇1 : 45MHz 223.93Ω -506.44Ω 6.98pF

S22 – FREQUENCY

1 0 FS 1: 49.68 Ω 5.3887 Ω 19.859 nH  
45.000 000 MHz

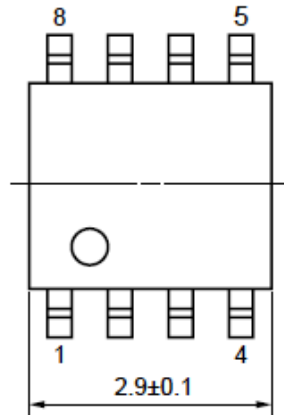


∇1 : 45MHz 49.68Ω 5.39Ω 19.86nH

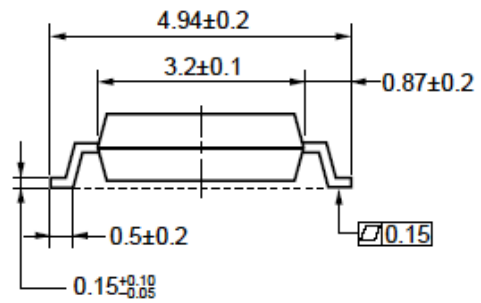
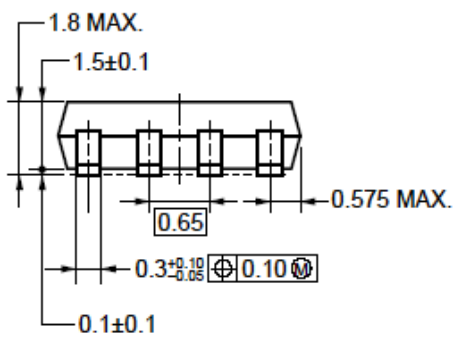
START 1.000 000 MHz STOP 1 000.000 000 MHz

**μPC3231GV\* PACKAGE DIMENSIONS**

8 PIN PLASTIC SSOP (4.45mm(175)) (Unit : mm)



detail of lead end





**RECOMMENDED SOLDERING CONDITIONS**

This product should be soldered and mounted under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your nearby sales office.

Soldering Method	Soldering Conditions	Condition Symbol
Infrared Reflow	Peak temperature (package surface temperature) : 260°C or below Time at peak temperature : 10 seconds or less Time at temperature of 220°C or higher : 60 seconds or less Preheating time at 120 to 180°C : 120±30 seconds Maximum number of reflow processes : 3 times Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	IR260
Wave Soldering	Peak temperature (molten solder temperature) : 260°C or below Time at peak temperature : 10 seconds or less Preheating temperature (package surface temperature) : 120°C or below Maximum number of flow processes : 1 time Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	WS260
Partial Heating	Peak temperature (terminal temperature) : 350°C or below Soldering time (per side of device) : 3 seconds or less Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	HS350

**Caution** Do not use different soldering methods together (except for partial heating).

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M8E 02. 11-1

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This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

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