NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC3205GR

IQ DEMODULATOR FOR DIGITAL VIDEO/DATA RECEIVER

DESCRIPTION

The μPC3205GR is Silicon monolithic IC designed for use as IQ demodulator in digital communication systems. This IC consists of AGC amplifier, dual balanced mixers (DBM), oscillator, quadrature phase shifter and I & Q output buffer amplifiers.

The package is 20-pin SSOP (shrink small outline package) suitable for high-density surface mount.

FEATURES

- On chip quadrature (90°) phase shifter
- IQ phase and amplitude balance — Amplitude Balance : ±0.5 dB; Phase Balance : ±2.0 degree
- Low distortion — IM_3 : 56 dBc (@0.708 V_{P-P}/tone)
- Supply Voltage — V_{CC} : 5 V
- Packaged in 20-pin SSOP suitable for high-density surface mount

ORDERING INFORMATION

Part Number	Package	Supplying Form
μPC3205GR-E1	20-pin plastic SSOP (225 mil)	Embossed tape 12 mm wide. Pin 1 indicates pull-out direction of tape. Q'ty 2.5 k/reel

For evaluation sample order, please contact your local NEC office. (Part number for sample order: μPC3205GR)

Caution electro-static sensitive device

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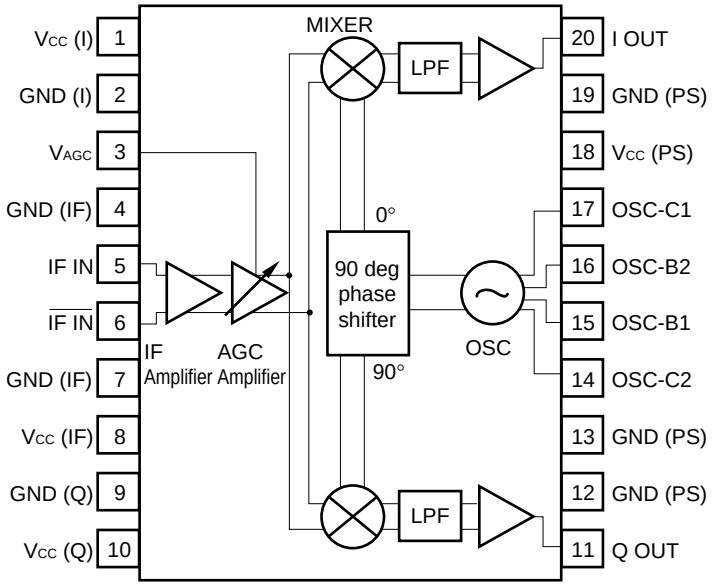
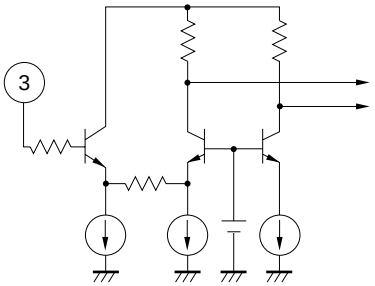
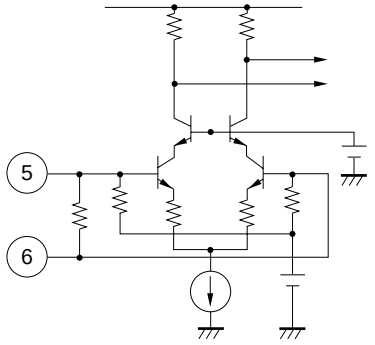
Printed in Japan

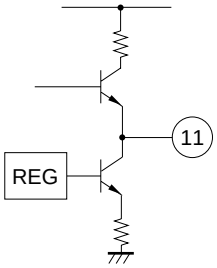
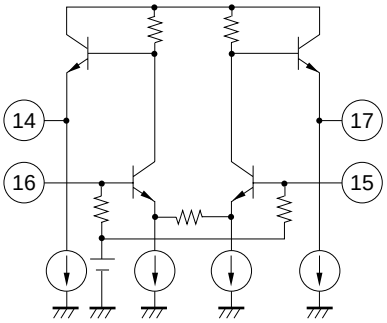
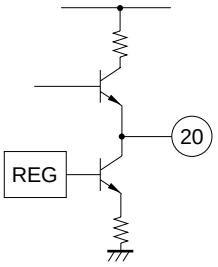
The mark ★ shows major revised points.

INTERNAL BLOCK DIAGRAM AND PIN CONFIGURATION (Top View)



PIN FUNCTIONS

Pin No.	Pin Name	Pin Voltage TYP. (V)	Function and Explanation	Equivalent Circuit
1	V_{CC}(I)	5.0	Supply voltage pin.	
2	GND(I)	0.0	Ground pin.	
3	V_{AGC}	0 to 5	Gain control pin. V_{AGC} = 0 V: Full gain V_{AGC} = 5 V: Full reduction	
4	GND(IF)	0.0	Ground pin.	
5	IF IN	2.7	IF input pins. In case of single input, 5 pin or 6 pin should be grounded through capacitor.	
6	$\overline{\text{IF IN}}$	2.7		
7	GND(IF)	0.0	Ground pin.	
8	V_{CC}(IF)	5.0	Supply voltage pin.	
9	GND (Q)	0.0	Ground pin.	
10	V_{CC} (Q)	5.0	Supply voltage pin.	

Pin No.	Pin Name	Pin Voltage TYP. (V)	Function and Explanation	Equivalent Circuit
11	Q OUT	2.6	Q-signal output pin.	
12	GND(PS)	0.0	Ground pin.	
13	GND(PS)	0.0	Ground pin.	
14	OSC-C2	3.4	Connected capacitor between 14 pin and 15 pin to oscillate with active feedback loop.	
15	OSC-B1	3.0	Connected SAW resonator through capacitor.	
16	OSC-B2	3.0	Connected SAW resonator through capacitor.	
17	OSC-C1	3.4	Connected capacitor between 16 pin and 17 pin to oscillate with active feedback loop.	
18	V_{CC}(PS)	5.0	Supply voltage pin.	
19	GND(PS)	0.0	Ground pin.	
20	I OUT	2.6	I-signal output pin.	

ABSOLUTE MAXIMUM RATINGS (T_A = +25°C unless otherwise specified)

Parameter	Symbol	Test Condition	Rating	Unit
Supply Voltage	V_{CC}		6.0	V
Power Dissipation	P_D	T_A = +85°C[Note]	433	mW
Operating Ambient Temperature	T_A		–40 to +85	°C
Storage Temperature	T_{stg}		–55 to +150	°C

Note Mounted on 50 mm × 50 mm × 1.6 mm double epoxy glass board.

RECOMMENDED OPERATING RANGE

Parameter	Symbol	Test Condition	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{CC}		4.5	5.0	5.5	V
Operating Ambient Temperature	T_A		–25	+25	+85	°C
IF Input Level Range	P_{IF}	V_{out} = 1 V_{P-P}	–45	–	–25	dBm
Gain Control Voltage Range	V_{AGC}		0.0	–	V_{CC}	V

ELECTRICAL CHARACTERISTICS (T_A = +25°C, V_{CC} = 5 V, Z_{in} = 50 Ω, Z_{out} = 1 kΩ)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	I_{CC}	No input signal	48	65	78	mA
IF Input Frequency	f_{IF}	$f_{IF} > f_{OSC}$ **Note**	440	–	520	MHz
IQ Output Frequency	f_{IQ}	Gcv (@f_{IQ} = 10 MHz) ± 1 dB, Vout = 1 V_{P-P} P_{IF} = –45 to –25 dBm **Note**	0.3	–	30	MHz
Conversion Gain 1	Gcv1	f_{IF} = 490 MHz, f_{OSC} = 479.5 MHz V_{AGC} = 0 to 0.5 V **Note**	49	53	–	dB
Conversion Gain 2	Gcv2	f_{IF} = 490 MHz, f_{OSC} = 479.5 MHz, V_{AGC} = 2 V **Note**	–	44	–	dB
Conversion Gain 3	Gcv3	f_{IF} = 490 MHz, f_{OSC} = 479.5 MHz V_{AGC} = 4.5 V to V_{CC} **Note**	–	–	10	dB
AGC Gain Control Range	GCR	f_{IF} = 490 MHz, f_{OSC} = 479.5 MHz V_{AGC} = 0.5 to 4.5 V **Note**	39	–	–	dB
IQ Phase Balance	$\Delta\phi$	f_{IF} = 490 MHz, f_{OSC} = 479.5 MHz, V_{out} = 1 V_{P-P} P_{IF} = –45 to –25 dBm **Note**	–2	0	+2	deg
IQ Amplitude Balance	ΔV	f_{IF} = 490 MHz, f_{OSC} = 479.5 MHz, V_{out} = 1 V_{P-P} P_{IF} = –45 to –25 dBm **Note**	–0.5	0	+0.5	dB
Output Voltage	V_{out}	f_{IQ} = 0.3 to 30 MHz, P_{IF} = –45 to –25 dBm **Note**	–	1.0	–	V_{P-P}
Maximum Output Voltage	Voclip	V_{AGC} = 0 to 0.5 V, P_{IF} = –45 to –25 dBm **Note**	1.8	–	–	V_{P-P}

Note By measurement circuit 1

STANDARD CHARACTERISTICS (T_A = +25 °C, V_{CC} = 5 V, Z_{in} = 50 Ω, Z_{out} = 1 kΩ)

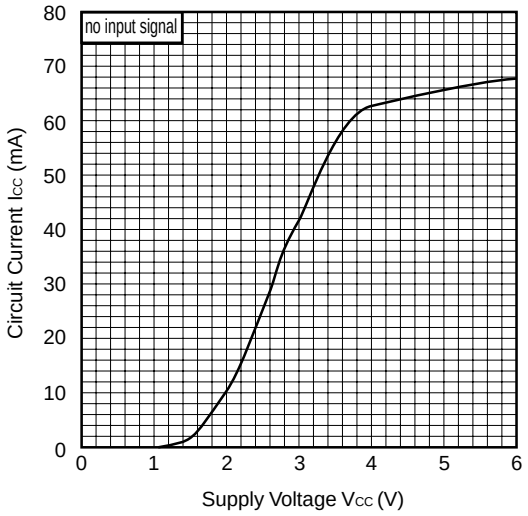
Parameter	Symbol	Test Conditions	Reference Value	Unit
Noise Figure (DSB)	NF	f_{OSC} = 479.5 MHz, f_{IQ} = 10 MHz, V_{AGC} = 0.5 V **Note 1**	12.5	dB
Third Order Intermodulation Distortion	IM_3	$f_{IF}1$ = 489 MHz, $f_{IF}2$ = 490 MHz, f_{OSC} = 479.5 MHz V_{out} = 0.708 V_{P-P}/tone **Note 2**	56	dBc
LO to IF Isolation	Iso(LO-IF)	f = 480 MHz, 15 pin or 16 pin to 5 pin **Note 2**	50	dB
LO to IQ Isolation	Iso(LO-IQ)	f = 480 MHz 15 pin or 16 pin to 11 pin or 20 pin **Note 2**	30	dB
I to Q Isolation	Iso(I-Q)	f = 10 MHz, 11 pin to 20 pin **Note 2**	30	dB
IF Input Impedance	Z_{in}(IF)	f_{IF} = 480 MHz	138-j45	Ω
IF Input Return Loss	RL(IF)	f_{IF} = 480 MHz	6	dB
IQ Output Impedance	Z_O(IQ)	f_{IQ} = 0.3 to 30 MHz	25	Ω

Notes 1. By measurement circuit 2

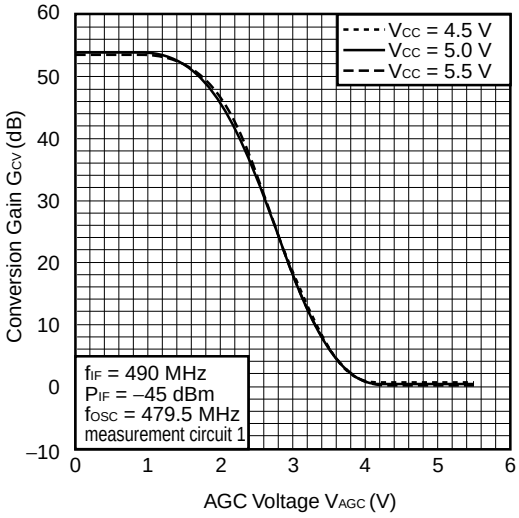
2. By measurement circuit 1

TYPICAL CHARACTERISTICS (T_A = +25°C)

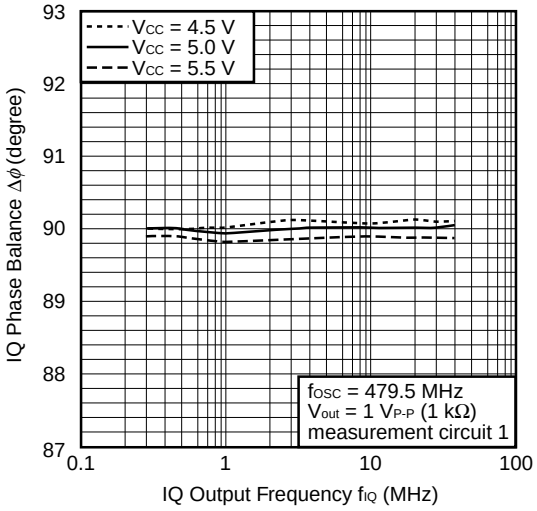
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



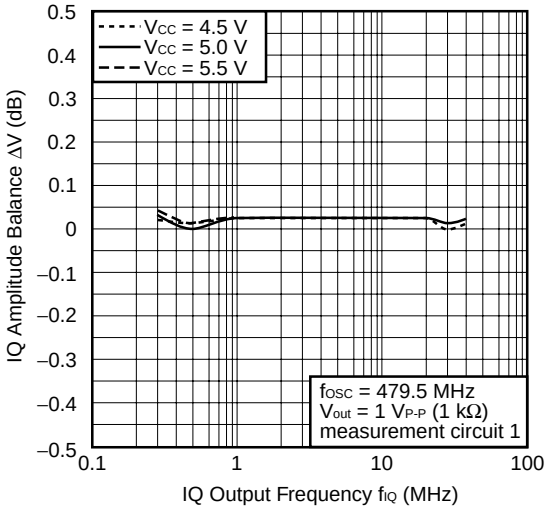
CONVERSION GAIN vs. AGC VOLTAGE



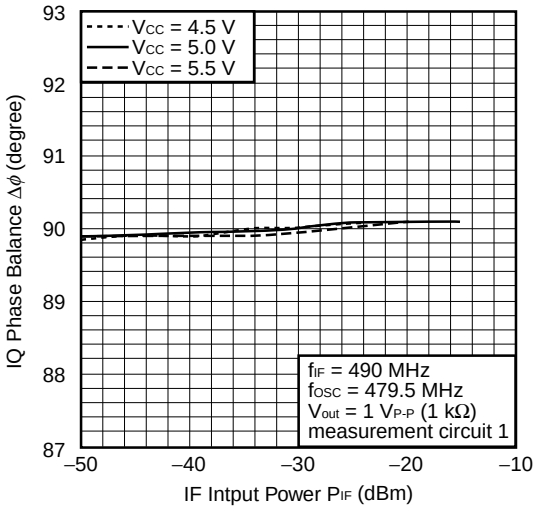
IQ PHASE BALANCE vs. IQ OUTPUT FREQUENCY



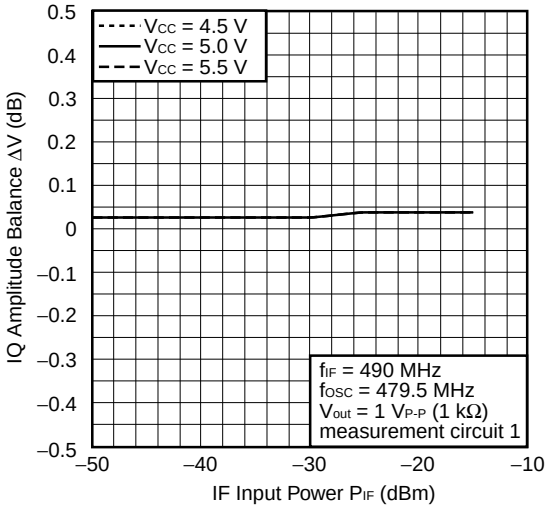
IQ AMPLITUDE BALANCE vs. IQ OUTPUT FREQUENCY



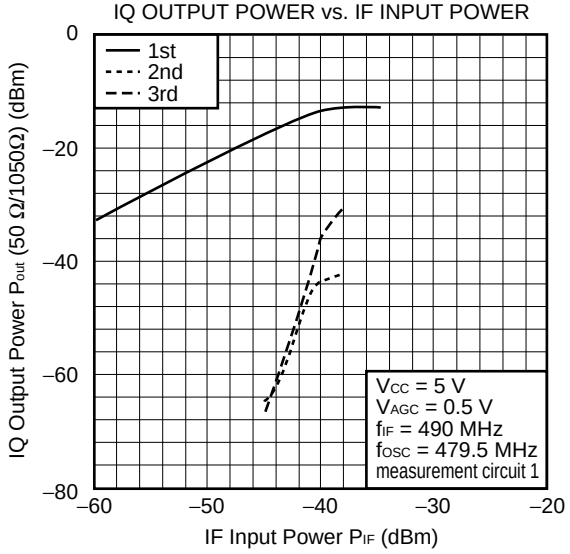
IQ PHASE BALANCE vs. IF INPUT POWER



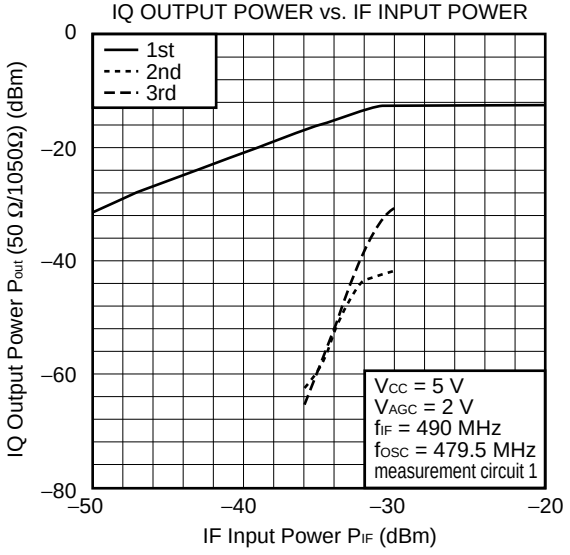
IQ AMPLITUDE BALANCE vs. IF INPUT POWER



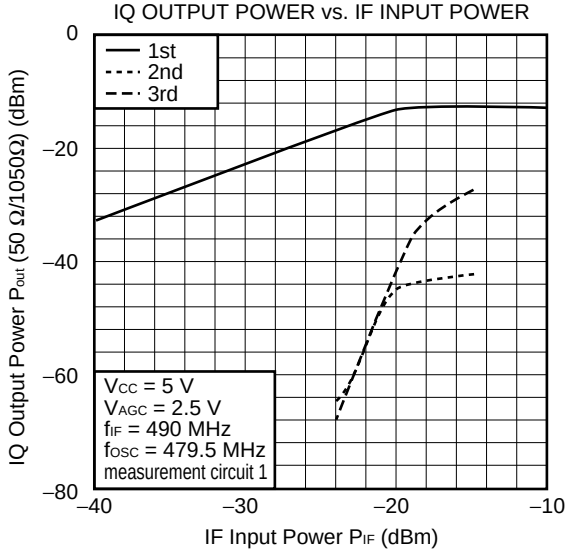
IQ OUTPUT POWER vs. IF INPUT POWER



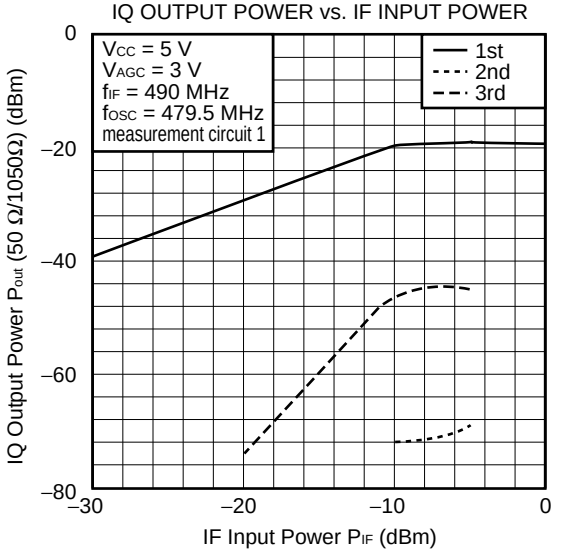
IQ OUTPUT POWER vs. IF INPUT POWER



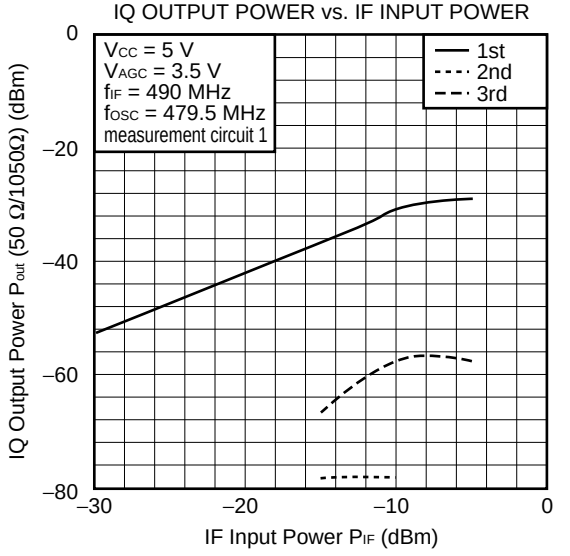
IQ OUTPUT POWER vs. IF INPUT POWER



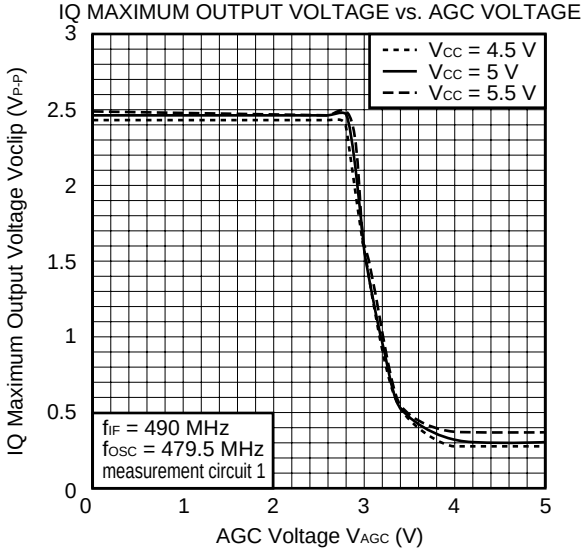
IQ OUTPUT POWER vs. IF INPUT POWER



IQ OUTPUT POWER vs. IF INPUT POWER

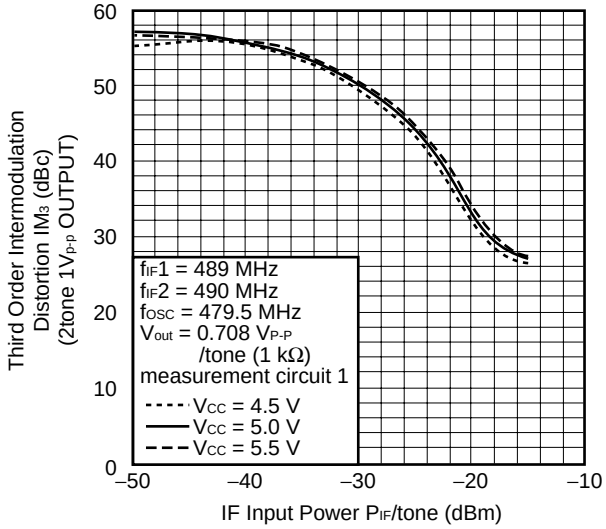


IQ MAXIMUM OUTPUT VOLTAGE vs. AGC VOLTAGE

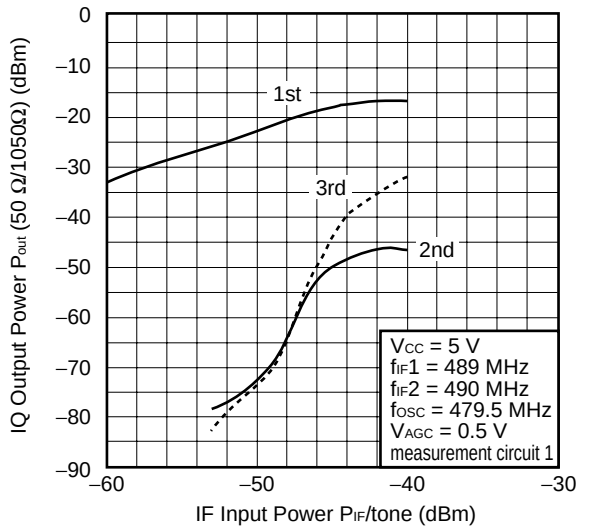


STANDARD CHARACTERISTICS (T_A = +25°C)

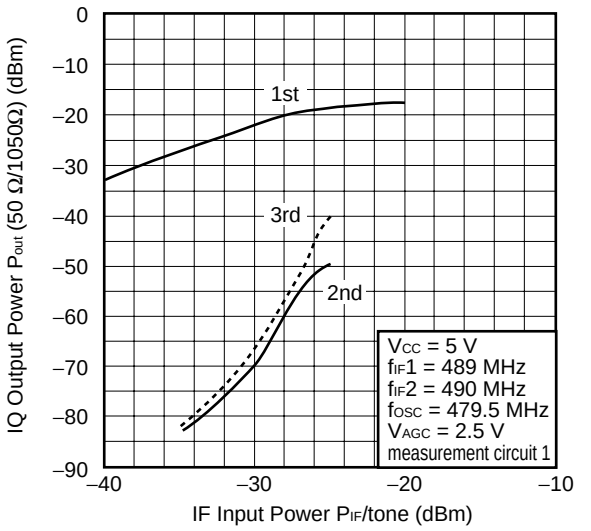
THIRD ORDER INTERMODULATION DISTORTION



2nd/3rd ORDER INTERMODULATION DISTORTION

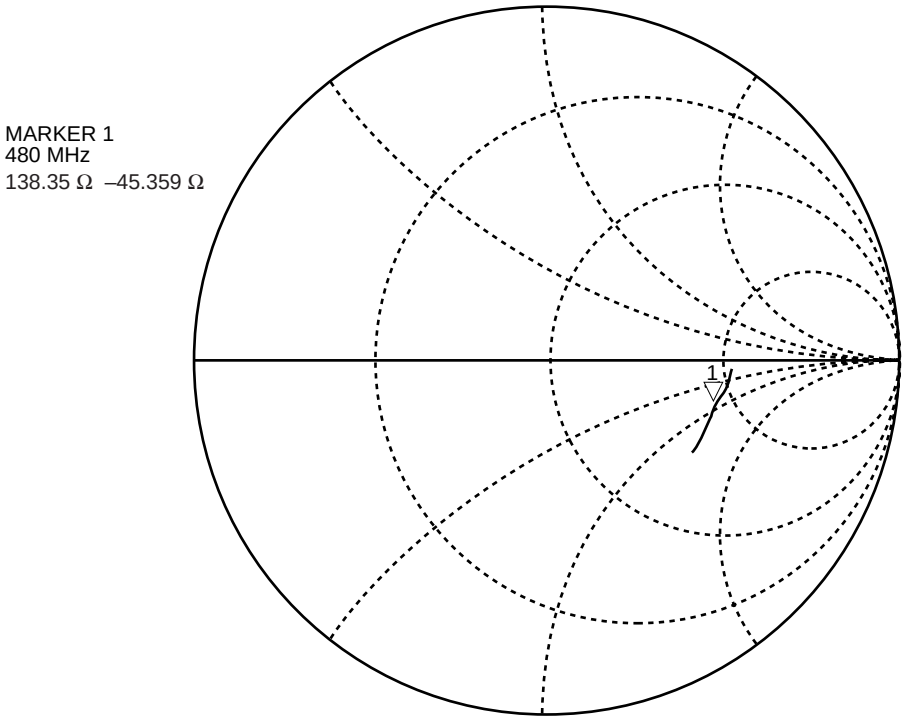


2nd/3rd ORDER INTERMODULATION DISTORTION

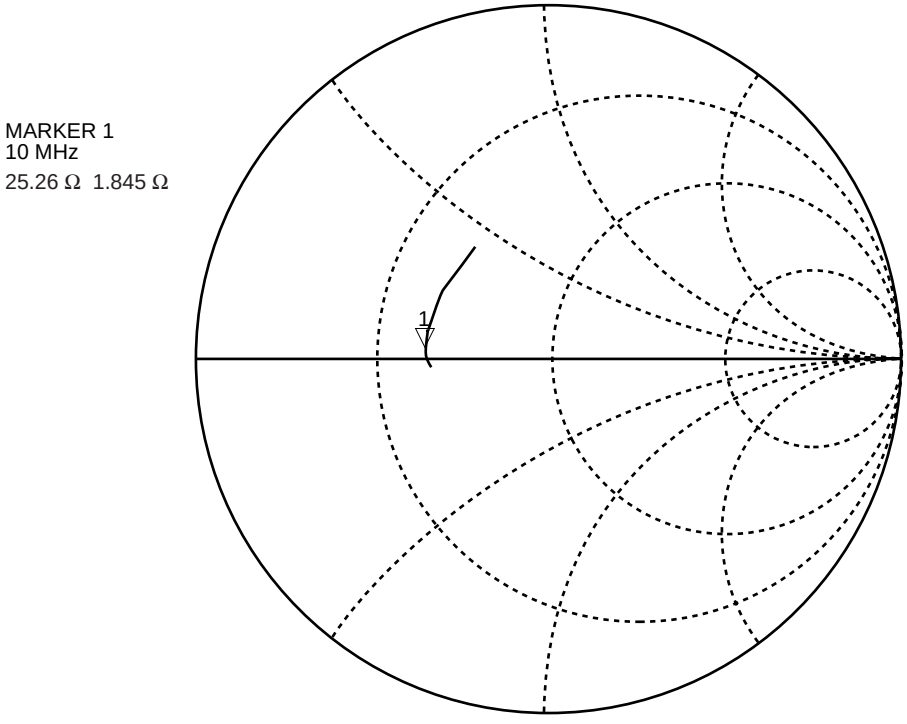


STANDARD CHARACTERISTICS

IF INPUT IMPEDANCE

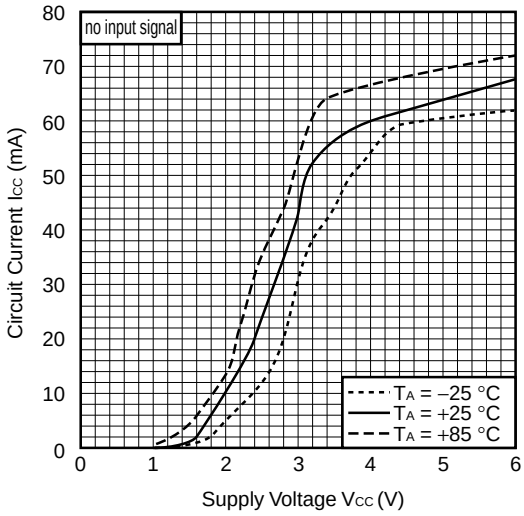


IQ OUTPUT IMPEDANCE

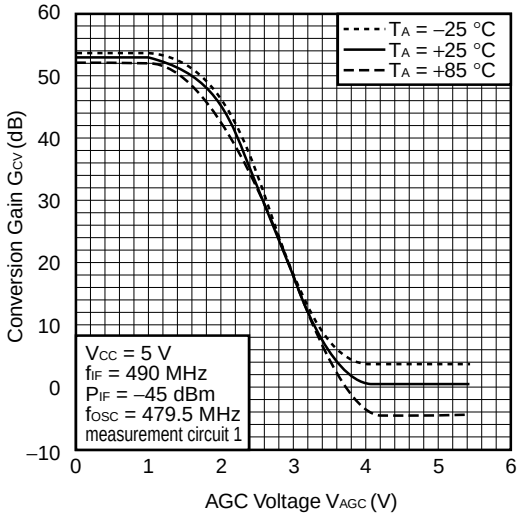


THERMAL CHARACTERISTICS (FOR REFERENCE)

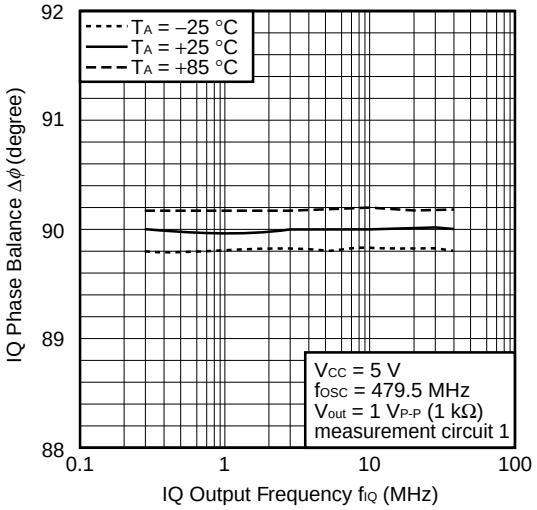
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



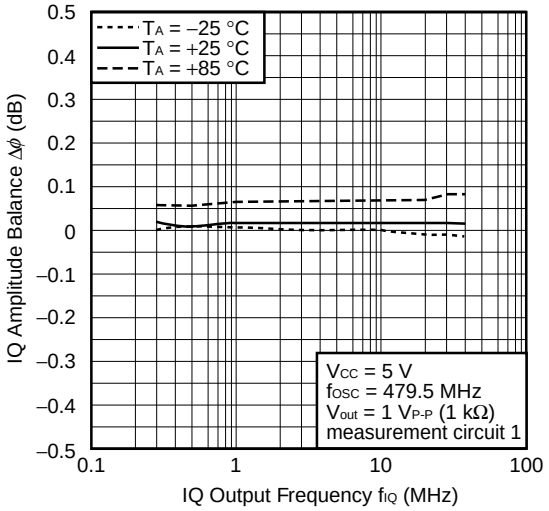
CONVERSION GAIN vs. AGC VOLTAGE



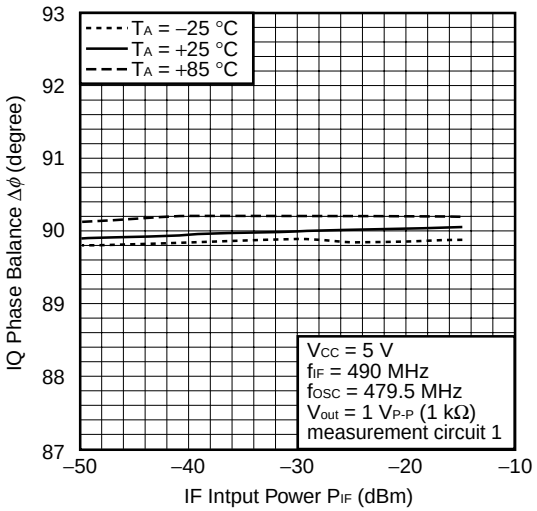
IQ PHASE BALANCE vs. IQ OUTPUT FREQUENCY



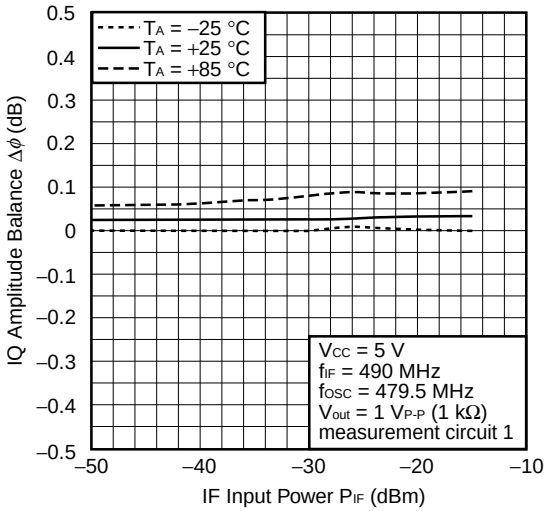
IQ AMPLITUDE BALANCE vs. IQ OUTPUT FREQUENCY



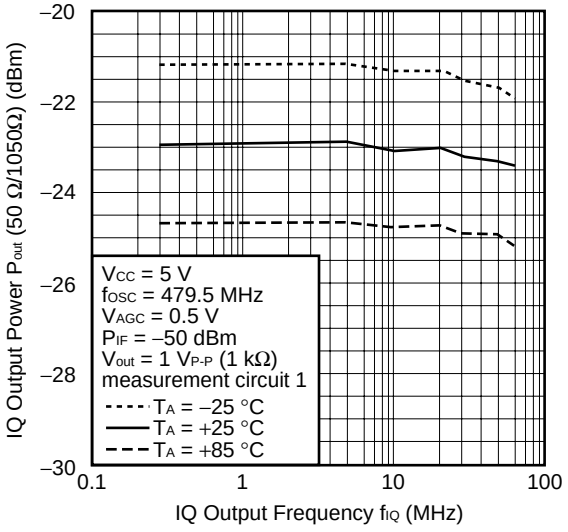
IQ PHASE BALANCE vs. IF INPUT POWER



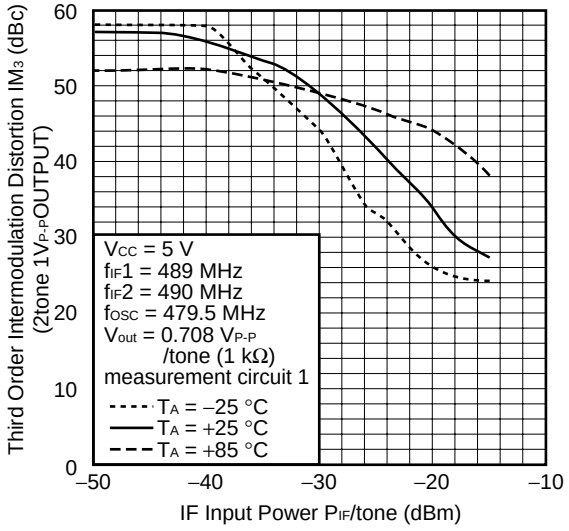
IQ AMPLITUDE BALANCE vs. IF INPUT POWER



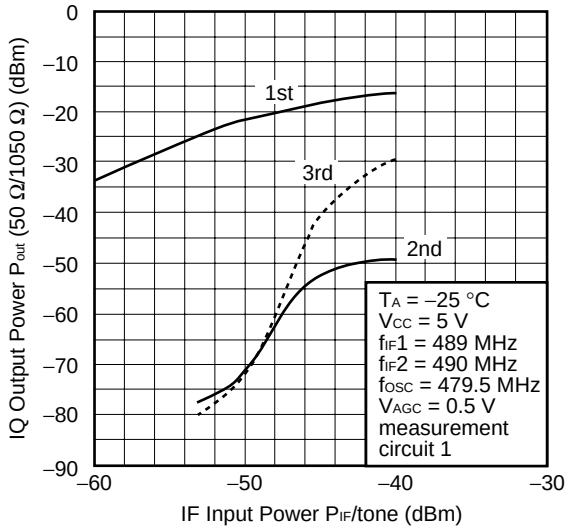
IQ OUTPUT POWER vs. IQ OUTPUT FREQUENCY



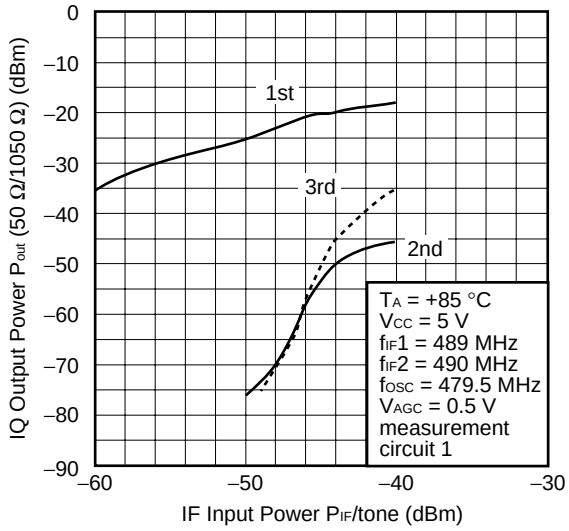
3rd ORDER INTERMODULATION DISTORTION



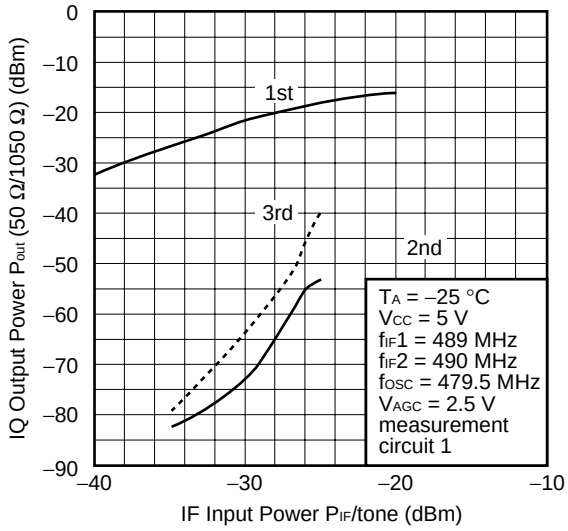
2nd/3rd ORDER INTERMODULATION DISTORTION



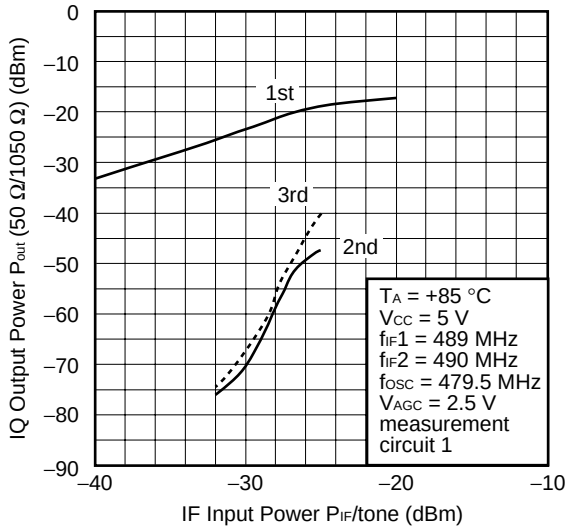
2nd/3rd ORDER INTERMODULATION DISTORTION



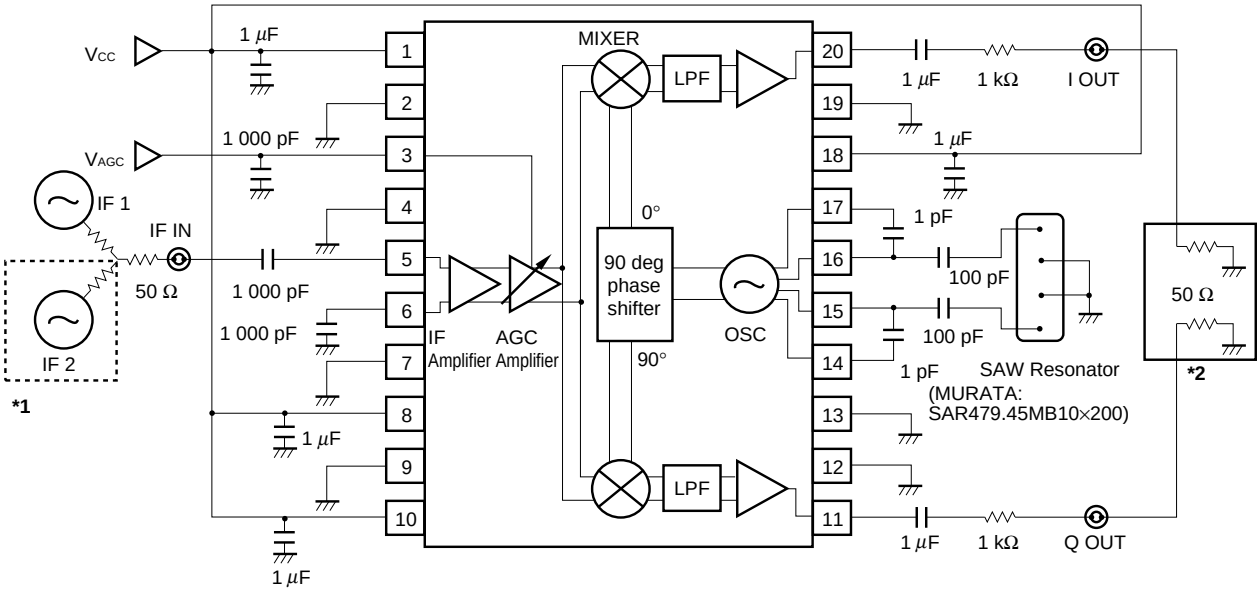
2nd/3rd ORDER INTERMODULATION DISTORTION



2nd/3rd ORDER INTERMODULATION DISTORTION



MEASUREMENT CIRCUIT 1

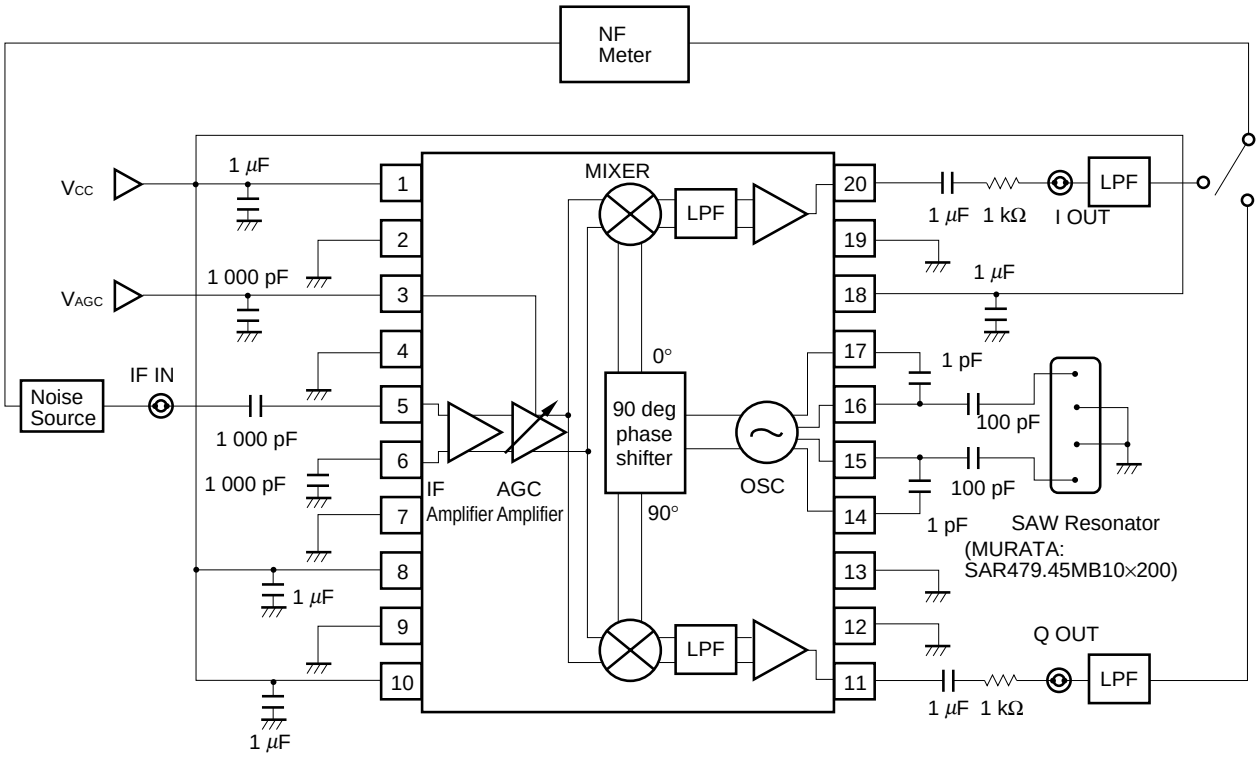


***1** In the case of measurement of IM_3.

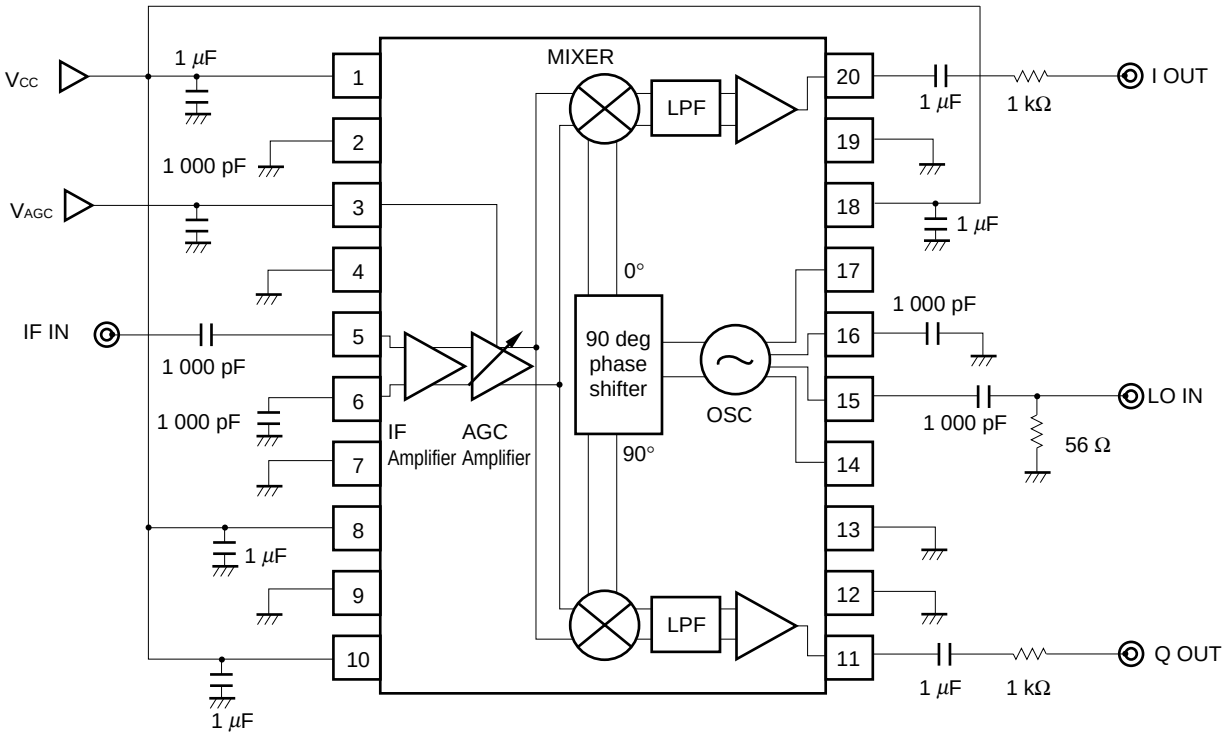
***2** • Vector Signal Analyzer or Vector Voltage Meter @measurement of IQ phase balance and IQ amplitude balance.

• Spectrum Analyzer @measurement of bandwidth and IM_3.

MEASUREMENT CIRCUIT 2



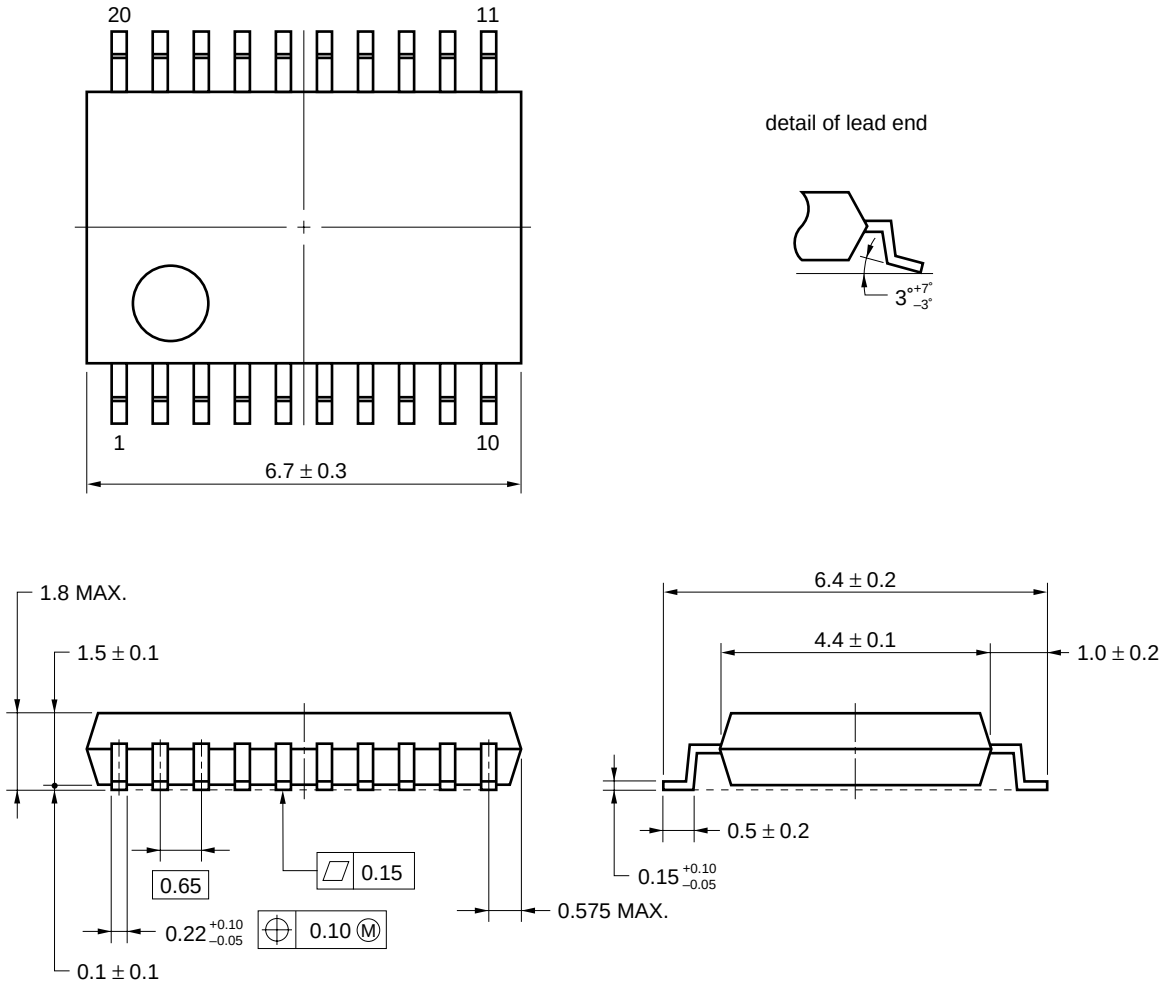
APPLICATION CIRCUIT EXAMPLE (In the case of LO single input)



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

PACKAGE DIMENSIONS

★ **20 PIN PLASTIC SSOP (225 mil) (UNIT: mm)**



NOTE Each lead centerline is located within 0.10 mm of its true position (T.P.) at maximum material condition.

NOTE ON CORRECT USE

(1) Observe precautions for handling because of electro-static sensitive devices.
(2) Form a ground pattern as widely as possible to minimize ground impedance (to prevent undesires oscillation).
(3) Keep the track length of the ground pins as short as possible.
(4) A low pass filter must be attached to V_{CC} line.

RECOMMENDED SOLDERING CONDITIONS

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

Soldering Method	Soldering Conditions	Recommended Condition Symbol
Infrared Reflow	Package peak temperature: 235 °C or below Time: 30 seconds or less (at 210 °C) Count: 3, Exposure limit[Note]: None	IR35-00-3
VPS	Package peak temperature: 215 °C or below Time: 40 seconds or less (at 200 °C) Count: 3, Exposure limit[Note]: None	VP15-00-3
Wave soldering	Soldering bath temperature: 260 °C or below Time: 10 seconds or less Count: 1, Exposure limit[Note]: None	WS60-00-1
Partial Heating	Pin temperature: 300 °C Time: 3 seconds or less (per side of device) Exposure limit[Note]: None	–

Note After opening the dry pack, keep it in a place below 25 °C and 65% RH for the allowable storage period.

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

For details of recommended soldering conditions for surface mounting, refer to information document **SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL (C10535E).**

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