

UP CONVERTOR FOR CABLE MODEM

DESCRIPTION

The μPC2799GR is Silicon monolithic IC designed for use-as up-converter for cable modem. This IC consists of local oscillator, AGC amplifier, mixer and so on. μPC1686GV and μPC2798GR are also available as for kit-use with this IC.

So, these devices contribute to make RF block small.

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

FEATURES

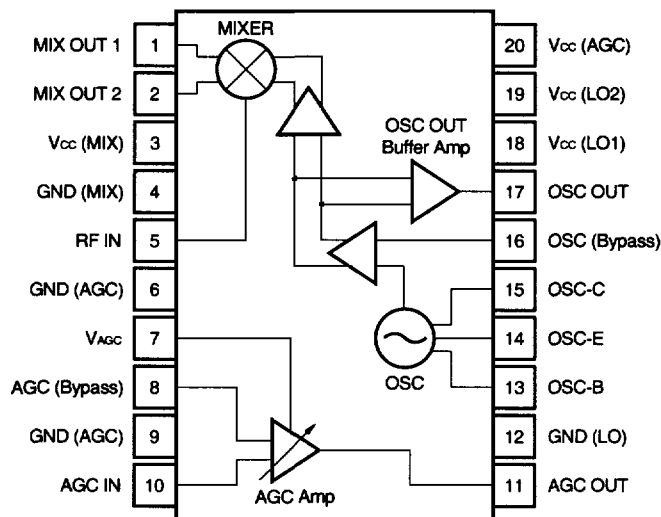
- On-chip low distortion AGC amplifier, mixer
- Low phase noise OSC transistor
- Packaged in 20-pin SSOP suitable for high-density surface mounting

ORDERING INFORMATION

| PART NUMBER | PACKAGE | PACKAGE STYLE |
|--------------|-------------------------------|--|
| μPC2799GR-E1 | 20-pin plastic SSOP (225 mil) | Embossed tape 12 mm wide. 2.5 k/REEL Pin 1 indicates pull-out direction of tape |

For evaluation sample order, please contact your local NEC office. (Part number for sample order: μPC2799GR)

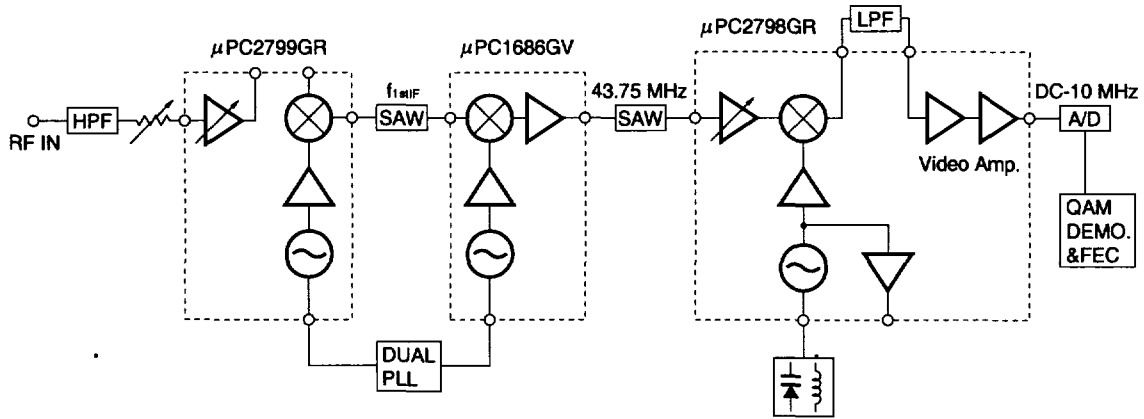
INTERNAL BLOCK DIAGRAM AND PIN CONFIGURATION (Top View)



Caution: electro-static sensitive device

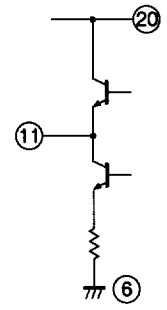
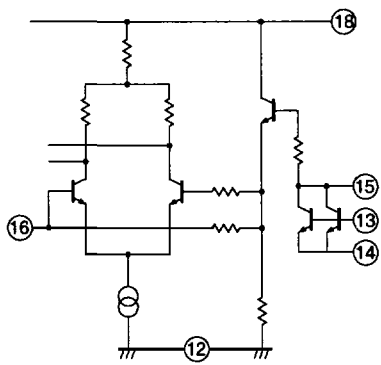
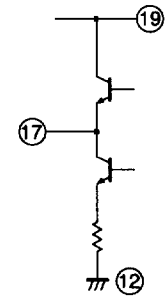
The information in this document is subject to change without notice.

EXAMPLE FOR SYSTEM APPLICATION (CABLE MODEM)



PIN EXPLANATIONS

| Pin No. | Symbol | Pin Voltage (V, TYP.) | Explanation | Equivalent Circuit |
|---------|-----------------------|-----------------------|--|--------------------|
| 1 | MIX OUT | - | Output pin of mixer. This pin is assigned for the open collector output with high impedance dependent on external inductance. | |
| 2 | MIX OUT | - | | |
| 3 | V _{CC} (MIX) | 5 | Power supply pin of mixer block. Must be connected bypass capacitor to minimize ground impedance. | |
| 4 | GND (MIX) | 0 | Ground pin of mixer block. Must be connected to the system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible. | |
| 5 | RF IN | 1.89 | Input pin of RF signal. | |
| 6 | GND (AGC) | 0 | Ground pin of AGC block. Must be connected to the system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible. | |
| 7 | V _{AGC} | 0 to 5 | Automatic gain control pin. This pin's bias govern the AGC output level. Minimum gain at V _{AGC} = 0 V Maximum gain at V _{AGC} = 5 V Recommend to use by deviding AGC voltage with externally resistor (ex. 100 kΩ). | |
| 8 | AGC (bypass) | 2.58 | Bypass pin for AGC amplifier. Grounded through 2200 pF capacitor. | |
| 9 | GND (AGC) | 0 | Ground pin of AGC block. Must be connected to the system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible. | |
| 10 | AGC IN | 1.10 | Signal input pin of AGC amplifier. | |

| Pin No. | Symbol | Pin Voltage (V, TYP.) | Explanation | Equivalent Circuit |
|---------|---------------|-----------------------|--|---|
| 11 | AGC OUT | 2.5 | Output pin of AGC amplifier. This pin features low-impedance because of its emitter-follower output port. |  |
| 12 | GND (LO) | 0 | Ground pin of AGC block. Must be connected to the system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible. |  |
| 13 | OSC base | - | | |
| 14 | OSC emitter | - | | |
| 15 | OSC collector | - | | |
| 16 | OSC (bypass) | 3.18 | Bypass pin of OSC amplifier. Grounded through 100 pF capacitor. | |
| 17 | OSC OUT | 3.2 | Output pin of Oscillator frequency. Connected to PLL synthesizer IC's input pin. |  |
| 18 | Vcc (LO1) | 5 | Power supply pin of local block. Must be connected bypass capacitor to minimize ground impedance. | |
| 19 | Vcc (LO2) | 5 | | |
| 20 | Vcc (AGC) | 5 | Power supply pin of AGC block. Must be connected bypass capacitor to minimize ground impedance. | |

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 ¹ | 433 | mW |
| Operating Ambient Temperature | T _A | | -40 to +85 | °C |
| Storage Temperature Range | T _{stg} | | -55 to +150 | °C |
| OSC Collector Current | I _{OSC} | | 48 | mA |
| OSC Collector to Base Voltage | V _{CBO} | | 6.0 | V |
| OSC Collector to Emitter Voltage | V _{CEO} | | 4.0 | V |
| OSC Emitter to Base Voltage | V _{EBO} | | 2.5 | V |

*1. Mounted on 50 × 50 × 1.6 mm double epoxy glass board.

RECOMMENDED OPERATING RANGE

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|-------------------------------|------------------|------|------|-----------------|------|
| Supply Voltage | V _{CC} | 4.5 | 5.0 | 5.5 | V |
| Operating Ambient Temperature | T _A | -40 | +25 | +85 | °C |
| RF Input Frequency Range | f _{RF} | 250 | - | 850 | MHz |
| AGC Voltage | V _{AGC} | 0 | - | V _{CC} | V |

ELECTRICAL CHARACTERISTICS (TA = 25 °C, VCC = 5 V, VAGC = 5 V, fRF = 500 MHz, PRF = -20 dBm, P_{MIXIN} = -15 dBm, fOSC = 1415 MHz, P_{OSC} = -10 dBm, fIF = 915 MHz, unless otherwise specified)

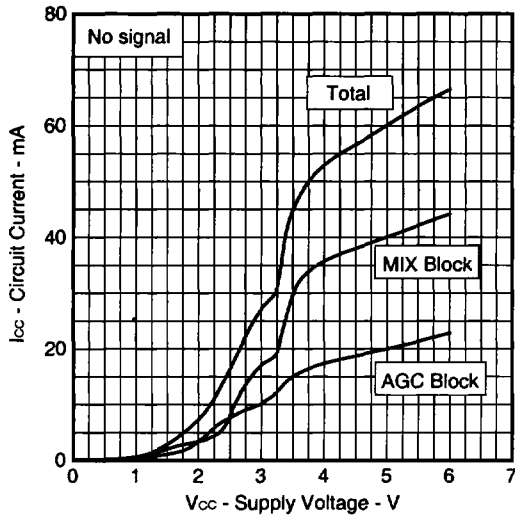
| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT | TEST CONDITIONS |
|------------------------|------------------------|------|------|------|------|---|
| TOTAL | | | | | | |
| Circuit Current | I _{CC} | - | 60 | 78 | mA | no input signal |
| AGC AMPLIFIER BLOCK | | | | | | |
| AGC Maximum Gain | G _{AGC MAX} | 12.5 | 15.0 | 17.5 | dB | |
| AGC Minimum Gain | G _{AGC MIN} | - | 0.5 | - | dB | V _{AGC} = 0 V |
| Gain Control Range | GCR | 10 | 14.5 | - | dB | V _{AGC} = 0 to 5 V |
| Maximum Output Power 1 | P _{O (sat) 1} | 3.0 | 6.0 | - | dBm | P _{RF} = 0 dBm |
| Maximum Output Power 2 | P _{O (sat) 2} | - | -9.0 | - | dBm | V _{AGC} = 0 V, P _{RF} = 0 dBm |
| MIXER BLOCK | | | | | | |
| Conversion Gain | CG | 1.5 | 4.5 | 7.5 | dB | |
| Maximum Output Power 3 | P _{O (sat) 3} | -1.5 | 1.5 | - | dBm | P _{MIXIN} = 0 dBm |

STANDARD CHARACTERISTICS (FOR REFERENCE) (TA = 25 °C, VCC = 5 V, VAGC = 5 V, fRF = 500 MHz, fOSC = 1415 MHz, P_{OSC} = -10 dBm, fIF = 915 MHz, unless otherwise specified)

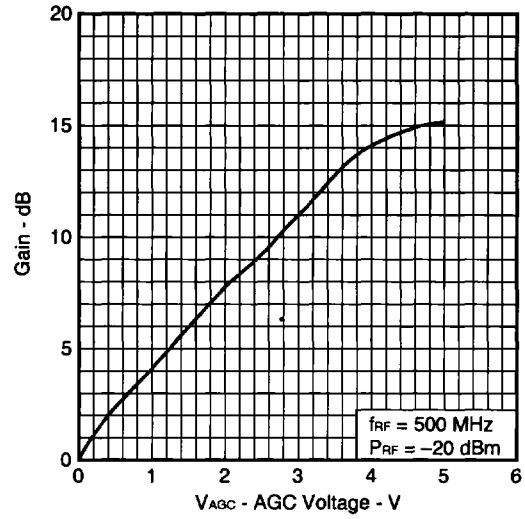
| PARAMETER | SYMBOL | REFERENCE VALUES | UNIT | TEST CONDITIONS |
|-------------------------|-------------------|------------------|------|--|
| AGC AMPLIFIER BLOCK | | | | |
| Noise Figure 1 | NF1 | 8.5 | dB | |
| Input Intercept Point 1 | IIP ₃₁ | +0.5 | dBm | f _{RF1} = 499 MHz, f _{RF2} = 501 MHz |
| Input Intercept Point 2 | IIP ₃₂ | -2 | dBm | f _{RF1} = 499 MHz, f _{RF2} = 501 MHz, V _{AGC} = 0 V |
| MIXER BLOCK | | | | |
| Noise Figure 2 | NF2 | 17 | dB | DSB, P _{OSC} = -10 dBm |
| Noise Figure 3 | NF3 | 13 | dB | DSB, P _{OSC} = 0 dBm |
| Input Intercept Point 3 | IIP ₃₃ | +5 | dBm | f _{RF1} = 499 MHz, f _{RF2} = 501 MHz |

TYPICAL CHARACTERISTICS (AGC block, $T_A = 25^\circ\text{C}$, $V_{CC} = 5\text{ V}$, unless otherwise specified)

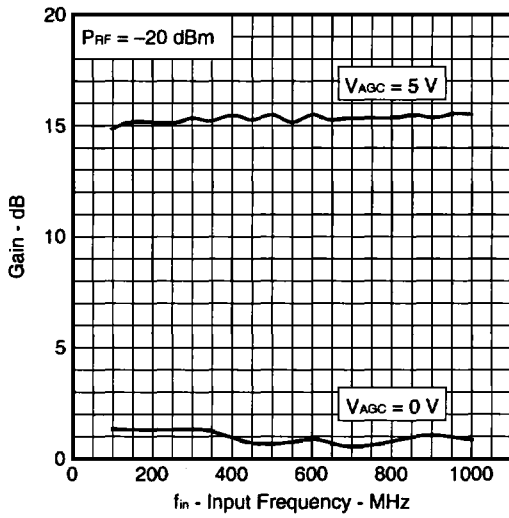
CIRCUIT CURRENT VS. SUPPLY VOLTAGE



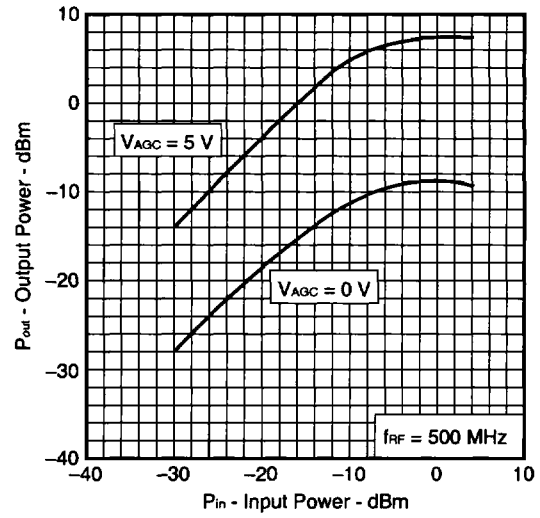
GAIN VS. AGC VOLTAGE



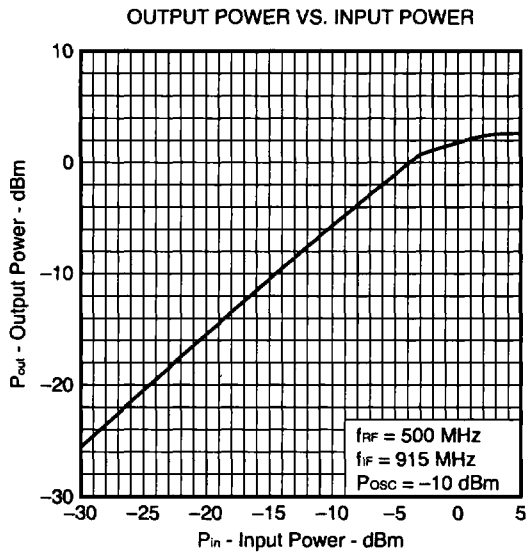
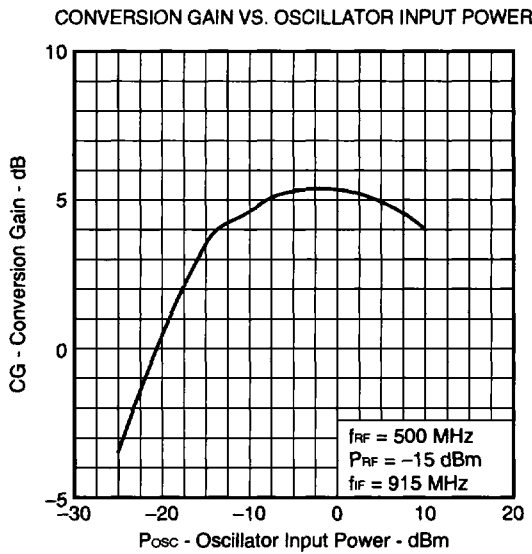
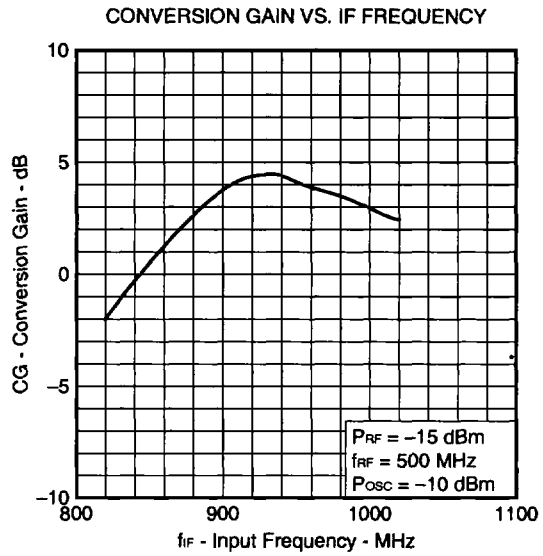
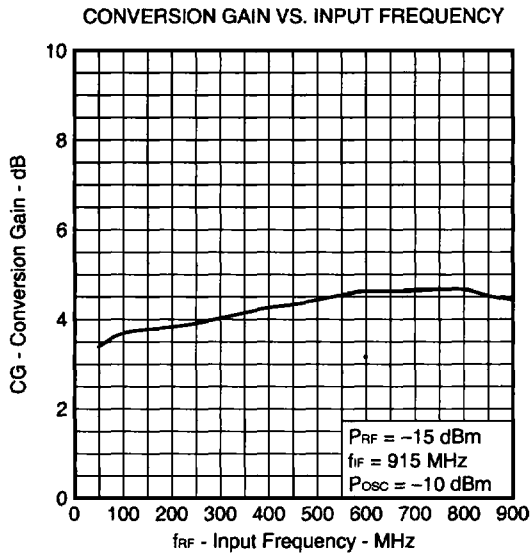
GAIN VS. INPUT FREQUENCY



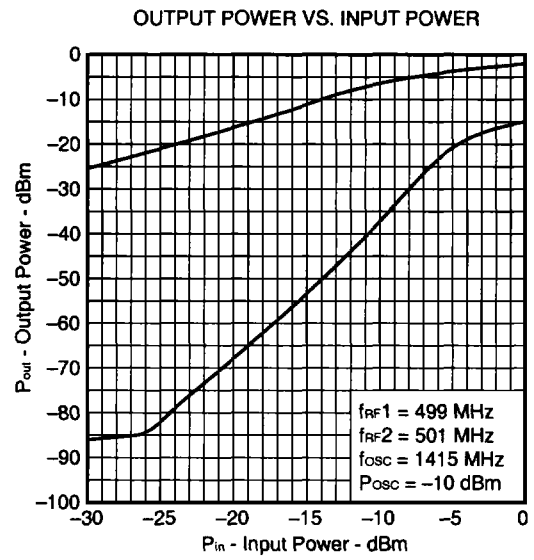
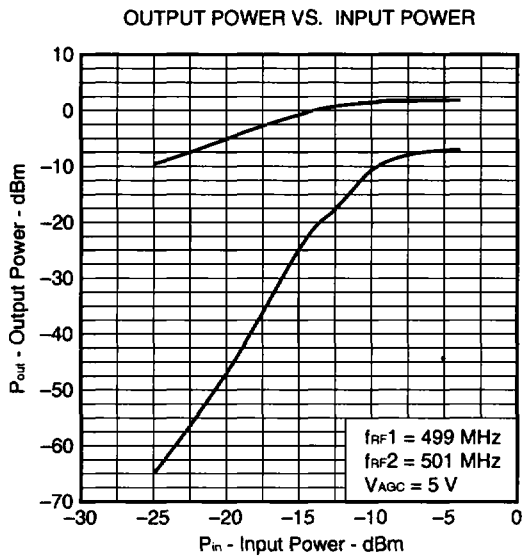
OUTPUT POWER VS. INPUT POWER



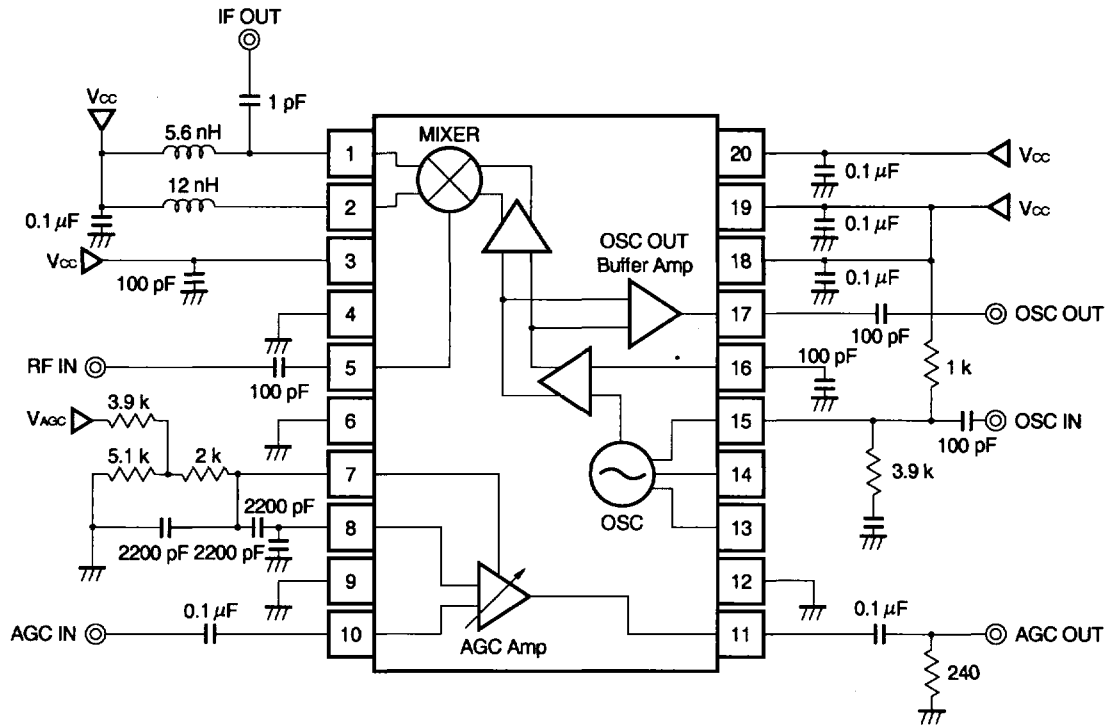
TYPICAL CHARACTERISTICS (MIX block, $T_A = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$, unless otherwise specified)



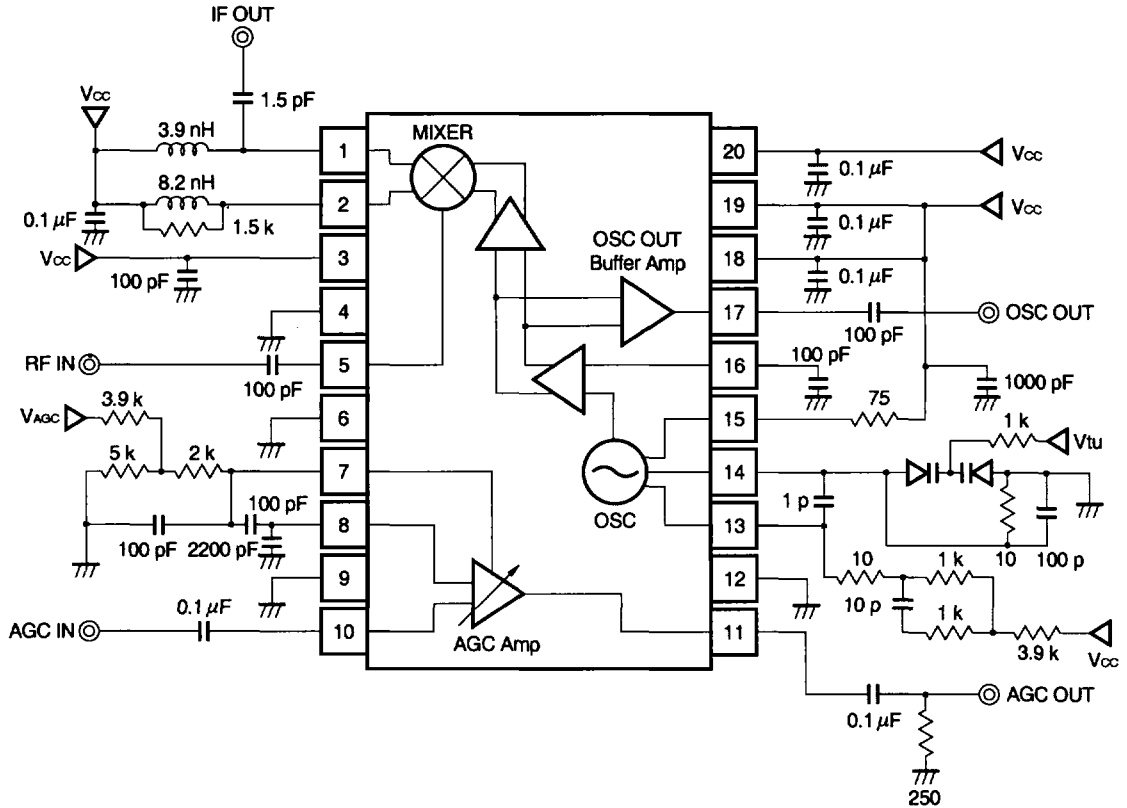
STANDARD CHARACTERISTICS ($T_A = 25^\circ\text{C}$, $V_{CC} = 5\text{ V}$, unless otherwise specified)



MEASUREMENT CIRCUIT



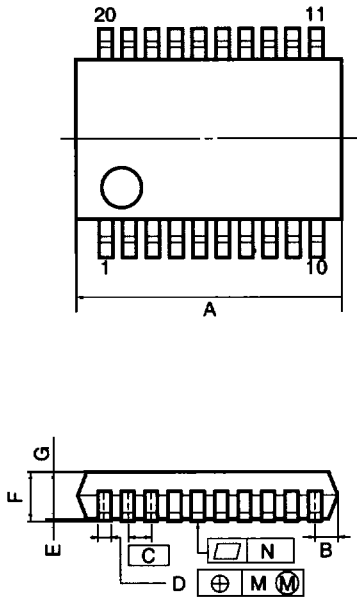
APPLICATION CIRCUIT EXAMPLE



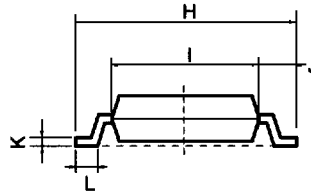
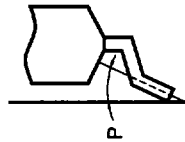
The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

PACKAGE DIMENSIONS

20PINS PLASTIC SSOP (225 mil)
(UNIT: mm)



detail of lead end



NOTE

Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

| ITEM | MILLIMETERS | INCHES |
|------|--|---|
| A | 7.00 MAX. | 0.276 MAX. |
| B | 0.575 MAX. | 0.023 MAX. |
| C | 0.65 (T.P.) | 0.026 (T.P.) |
| D | 0.22 ^{+0.10} / _{-0.05} | 0.009 ^{+0.004} / _{-0.002} |
| E | 0.1 ±0.1 | 0.004 ±0.004 |
| F | 1.8 MAX. | 0.071 MAX. |
| G | 1.5 ±0.1 | 0.058 ±0.004 |
| H | 6.4 ±0.2 | 0.253 ±0.008 |
| I | 4.4 ±0.1 | 0.174 ±0.004 |
| J | 1.0 | 0.040 |
| K | 0.15 ^{+0.10} / _{-0.05} | 0.060 ^{+0.004} / _{-0.002} |
| L | 0.5 ±0.2 | 0.020 ^{+0.008} / _{-0.004} |
| M | 0.10 | 0.004 |
| N | 0.15 | 0.006 |
| P | 3° ^{+7°} / _{-3°} | 3° ^{+7°} / _{-3°} |

RECOMMENDED SOLDERING CONDITIONS

The following conditions (see table below) must be met when soldering this product.

Please consult with our sales officers in case other soldering process is used or in case soldering is done under different conditions.

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

μPC2799GR

| Soldering process | Soldering conditions | Symbol |
|------------------------|--|-----------|
| Infrared ray reflow | Peak package's surface temperature: 235 °C or below, Reflow time: 30 seconds or below (210 °C or higher), Number of reflow process: 3, Exposure limit ^{Note} : None | IR35-00-3 |
| VPS | Peak package's surface temperature: 215 °C or below, Reflow time: 40 seconds or below (200 °C or higher), Number of reflow process: 3, Exposure limit ^{Note} : None | VP15-00-3 |
| Partial heating method | Terminal temperature: 300 °C or below, Flow time: 3 seconds or below, Exposure limit ^{Note} : None | |

Note Exposure limit before soldering after dry-pack package is opened.
Storage conditions: 25 °C and relative humidity at 65% or less.

Caution Do not apply more than single process at once, except for "Partial heating method".

[MEMO]

[MEMO]

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Anti-radioactive design is not implemented in this product.