

BIPOLAR ANALOG INTEGRATED CIRCUIT

μ PC2753GR

IF DOWN-CONVERTER IC FOR 3 V GPS RECEIVER

The μ PC2753GR is a monolithic IC designed as IF down-converter for GPS receivers. This IF down-converter IC features high gain and the GC (gain control) function, and operates on 3 volts typ. Therefore, this IC is suitable for enhancing the performance and reducing the power consumption of user's application sets.

This IC is packaged in a 20-pin shrink SOP that enables high-density surface mounting.

The μ PC27 \times \times series is manufactured using NEC original silicon bipolar process technology called "NESAT™ III" ($f_T = 20$ GHz). This process technology includes direct silicon nitride film and gold electrode structure. Semiconductor chips produced with this technology have excellent moisture resistivity, anticorrosion, current characteristics, and high-frequency performance. As a result, this IC features excellent reliability and electrical characteristics.

FEATURES

- Low power operation: power supply $V_{CC} = 3.0$ V typ.
- Low power consumption: $I_{CCTOTAL} = 6.5$ mA typ.
- High gain of 79 dB in total: 38 dB typ. in down-converter block ($V_{GC} \leq 12$ V), and 41 dB typ. in 2nd IF amplifier block
- GC function: GC dynamic range (D_{GC}) = 19 dB typ.
- Available in 20-pin shrink SOP : enabling high-density surface mount

ORDERING INFORMATION

| Part Number | Package | Packing Style |
|-------------------|--|--|
| μ PC2753GR-E1 | 20-pin plastic Shrink SOP (225 mil) | Embossed tape 12-mm wide. No. 1 pin is in pull-out direction. 2500 pieces/reel |
| μ PC2753GR-E2 | 20-pin plastic Shrink SOP (225 mil) | embossed tape 12-mm wide. No. 1 pin is in roll-in direction. 2500 pieces/reel |

Remark To order evaluation samples, please contact local NEC sales representative, mentioning " μ PC2753GR."

Caution electro-static sensitive device

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 representative for availability and additional information.

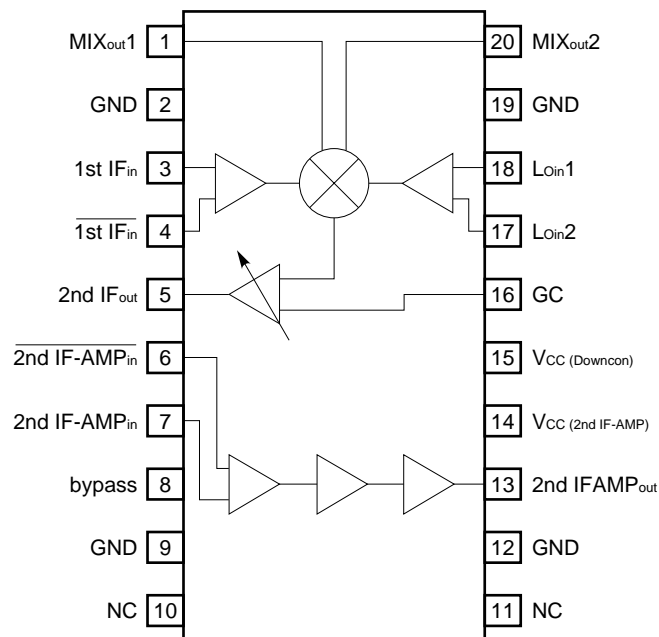
PRODUCT LINE-UP (T_A =+ 25 °C, V_{CC} = 3.0 V)

| Type | Part Number | I _{CC} (mA) | Gain (dB) | SSB NF (dB) | f _{in} (GHz) |
|-------------------|-------------|----------------------|--------------------------|-------------|-----------------------|
| RF Down-converter | μPC2756T | 6 | 14 | 12 | 0.1 - 2.0 |
| IF Down-converter | μPC2753GR | 6.5 | 60 to 79 ^{Note} | 12 | DC - 0.4 |

Remark Typical values of major parameters. For test conditions, refer to Electrical Characteristics Tables.

Note V_{GC} = 0 to 2.4 V

PIN CONFIGURATION AND BLOCK DIAGRAM (Top View)



PIN FUNCTION

| Pin No. | Symbol | Pin Voltage (V) | Description | Equivalent Circuit |
|---------|--------------------------|-----------------|--|--------------------|
| 3 | 1st IF _{in} | 2.5 | No. 3 pin is the input pin of the 1st IF amplifier. No. 4 pin should be connected to GND via a bypass capacitor. | |
| 4 | 1st IF _{in} | 2.5 | | |
| 5 | 2nd IF _{out} | 1.1 | No. 5 pin is the output pin of the 2nd IF. The output signal comes from the mixer unit via the GC amplifier. This output pin features low impedance because of its emitter-follower output port. | |
| 6 | 2ndIF-AMP _{in} | 2.1 | No. 6 and 7 pins are the input pins of the 2nd IF amplifier. These two inputs are internally connected to each base of the pair transistors of the differential amplifier. No.6 pin should be connected to GND via a bypass capacitor. | |
| 7 | 2ndIF-AMP _{in} | | | |
| 8 | bypass | 2.1 | No. 8 pin is connected to the feedback loop of the 2nd IF amplifier. This pin should be connected to GND via a bypass capacitor to stabilize the DC bias. | |
| 13 | 2ndIF-AMP _{out} | 1.4 | No. 13 pin is the output pin of the 2nd IF amplifier. This output pin features low impedance because of its emitter-follower output port. | |

PIN FUNCTION

| Pin No. | Symbol | Pin Voltage (V) | Description | Equivalent Circuit |
|--------------------|---------------------|------------------------------|---|--------------------|
| 16 | GC | 0 to 2.4 (Supply voltage) | No. 16 pin is the gain control pin for the GC amplifier. The gain of the GC amplifier is controlled by the applied voltage of this pin. This GC amplifier functions as a reverse GC. | |
| 17 | Lo2 | 2.5 | No. 17 and 18 pins are the local input pins of the mixer. The Lo2 pin should be connected to GND via a bypass capacitor. | |
| 18 | Lo1 | 2.5 | | |
| 15 | Vcc (Downcon) | – | No. 15 pin is the Vcc supply pin for the IF down-converter block. This pin is independent of the Vcc pin for the IF amplifier. Apply 3 V to the No. 15 pin. | – |
| 14 | Vcc (2nd IF-AMP) | – | No. 14 pin is the Vcc supply pin for the 2nd IF amplifier. This pin is independent of the Vcc pin for the IF down-converter unit. Apply 3 V to the No. 16 pin. | – |
| 2 9 12 19 | GND | – | This pin is the ground pin for the entire chip. Therefore the ground of the IF down-converter and 2nd IF amplifier blocks are not separated. The ground pattern to be connected to this pin should be formed as wide as possible to minimize its impedance. | – |
| 10 11 | NC | – | No. 10 and 11 pins are not connected to the internal circuits. Connecting these pins to GND is recommended, though these pins may be left unconnected. | – |
| 1 | MIX _{out1} | – | No. 1 and 20 pins are the output pins of the mixer block. These pins are used to monitor the signal output from the 2nd IF amplifier and to be input to the GC amplifier. When this IC is actually used, these pins should be left opened. | – |
| 20 | MIX _{out2} | | | |

ELECTRICAL SPECIFICATIONS

Absolute Maximum Ratings

| Parameter | Symbol | Conditions | Rating | Unit |
|-------------------------------|------------------|---|-------------|------|
| Supply Voltage | V _{CC} | T _A = +25 °C | 4.0 | V |
| Gain control Voltage | V _{GC} | T _A = +25 °C | 4.0 | V |
| Power Dissipation | P _D | When mounted on double-sided copper clad epoxy glass board of 50 x 50 x 1.6 mm, T _a = +85 °C | 34 | mW |
| Operating Ambient Temperature | T _{opt} | | -40 to +85 | °C |
| Storage Temperature | T _{stg} | | -55 to +150 | °C |

Recommended Operating Conditions

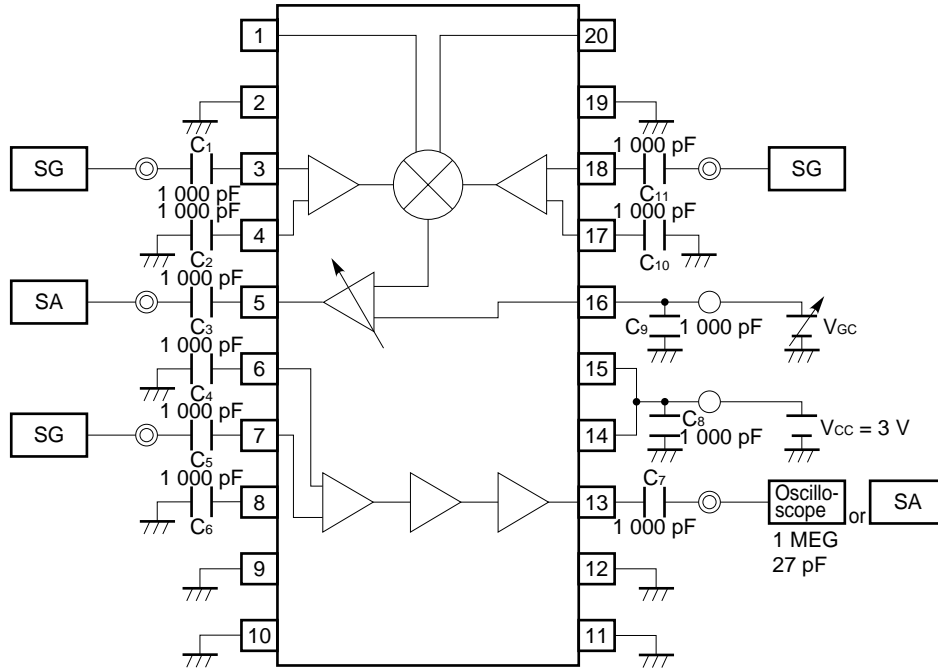
| Parameter | Symbol | MIN. | TYP. | MAX. | Unit |
|-------------------------------|-------------------|------|------|------|------|
| Supply Voltage | V _{CC} | 2.7 | 3.0 | 3.3 | V |
| Operating Ambient Temperature | T _{opt} | -40 | +25 | +85 | °C |
| Lo Input Level | P _{LoIn} | -20 | - | 0 | dBm |

Electrical Characteristics (Unless otherwise specified, T_A = +25 °C, V_{CC} = 3.0 V, Z_s = Z_o = 50 Ω)

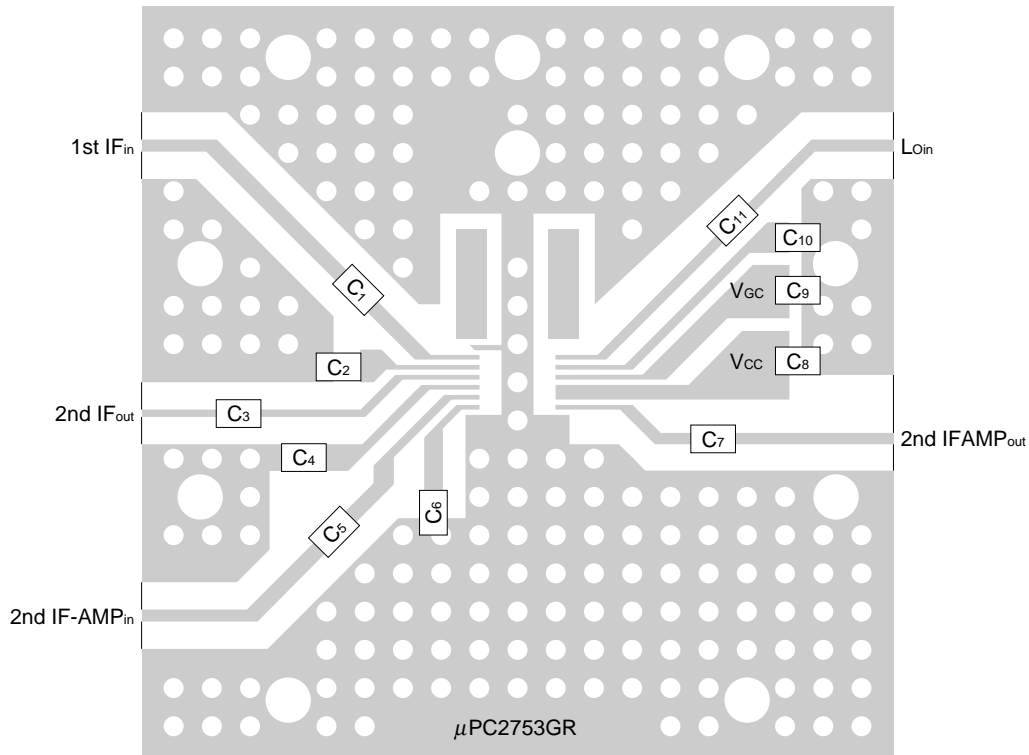
| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|--------------------------------|------------------------|---|------|---------|------|-------------------|
| Circuit Current | I _{CC TOTAL} | No signal, V _{GC} = GND | 4.7 | 6.9 | 8.5 | mA |
| (1) IF Down-converter Block | | | | | | |
| 1st IF Input Frequency | f _{1st IFIn} | Within -3 dB from CG at f _{1st IFIn} = 50 MHz f _{1st IFOut} = 4 MHz, V _{GC} = GND | DC | | 400 | MHz |
| 2nd IF Output Frequency | f _{2nd IFOut} | Within -3 dB from CG at f _{1st IFIn} = 200 MHz f _{1st IFIn} = 200 MHz, V _{GC} = GND | DC | | 20 | MHz |
| Conversion Gain | C.G | f _{1st IFIn} = 200 MHz, f _{2nd IFOut} = 4 MHz V _{GC} = GND | 35 | 38 | 42 | dB |
| Noise Figure | SSB NF | f _{1st IFIn} = 200 MHz, f _{2nd IFOut} = 20 MHz V _{GC} = GND | - | 12 | 15 | dB |
| * Input VSWR | VSWR1 | f _{1stIF} ≤ 400 MHz | | 1.5 : 1 | | |
| * Lo Leak to 2nd IF output pin | LO 2nd IFOut | f _{LO} = 1 to 400 MHz | | -62 | | dBm |
| * Lo Leak to 1st IF input pin | LO 1st IFIn | f _{LO} = 1 to 500 MHz | | -25 | | dBm |
| Gain control Voltage | V _{GC} | Voltage at CG = max. | | | 1.2 | V |
| Gain control Dynamic Range | D _{GC} | f _{1st IFIn} = 200 MHz, f _{2nd IFOut} = 4 MHz V _{GC} = 1.2 V to 2.4 V | 15 | 19 | | dB |
| (2) 2nd IF Amplifier Block | | | | | | |
| Input Frequency | f _{AMPIn} | Within -3 dB from the gain at f = 4 MHz | DC | | 20 | MHz |
| Output Voltage | V _{AMPout} | f = 4 MHz, Z _o = 1 MΩ/27 pF | 350 | 450 | 550 | mV _{P-P} |
| Gain | S ₂₁ | f = 4 MHz | 38 | 41 | 45 | dB |

* For reference only

Test Circuit



Footprint of Test Circuit



Legends

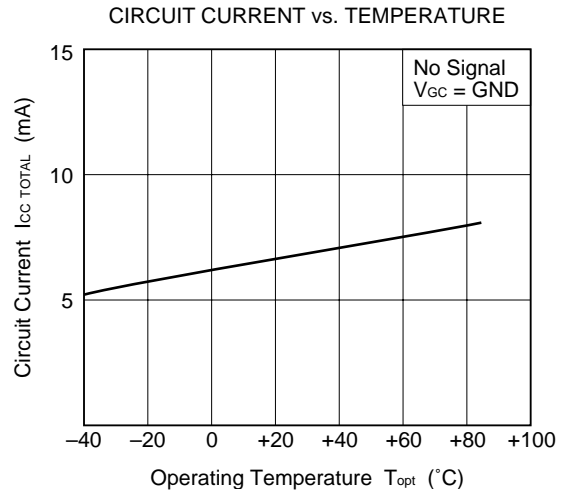
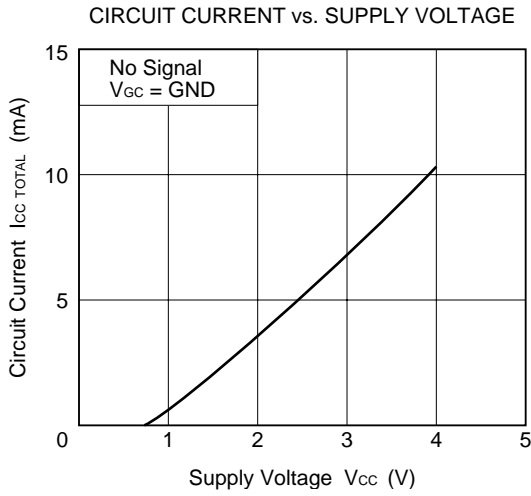
- (*1) Double-sided patterning with 35-μm-thick copper on polyimide board sizing 50 × 50 × 0.4 mm
- (*2) GND pattern on backside
- (*3) Solder coating over patterns
- (*4) ○○ indicate through-holes

Parts

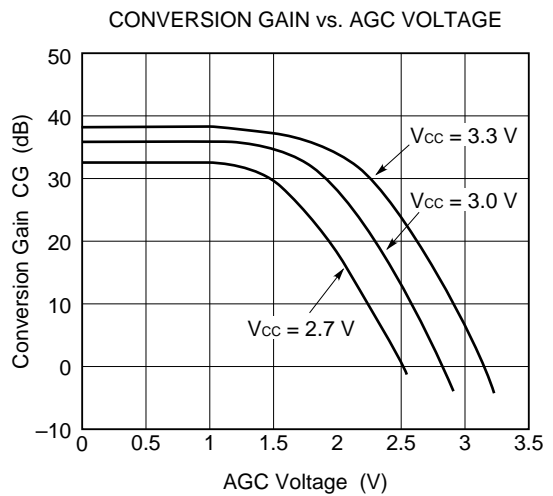
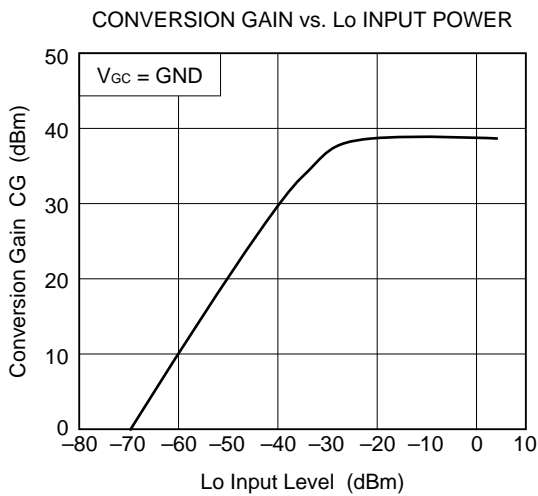
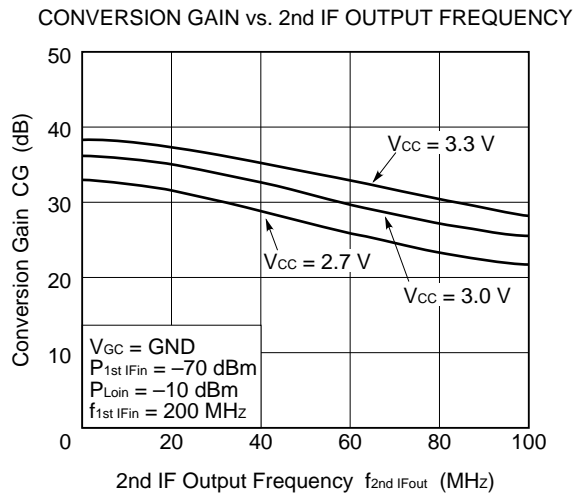
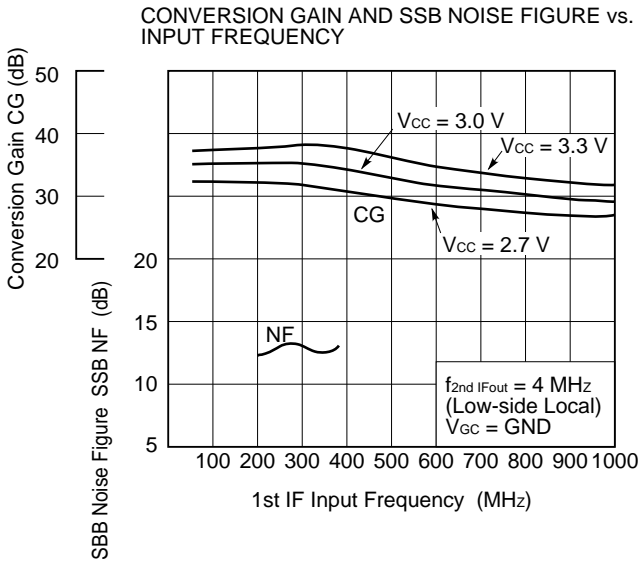
| Number | Value |
|-----------------------------------|----------|
| C ₁ to C ₁₁ | 1 000 pF |

Characteristic Curves (Unless otherwise specified, $T_A = +25\text{ }^\circ\text{C}$, $V_{CC} = 3\text{ V}$)

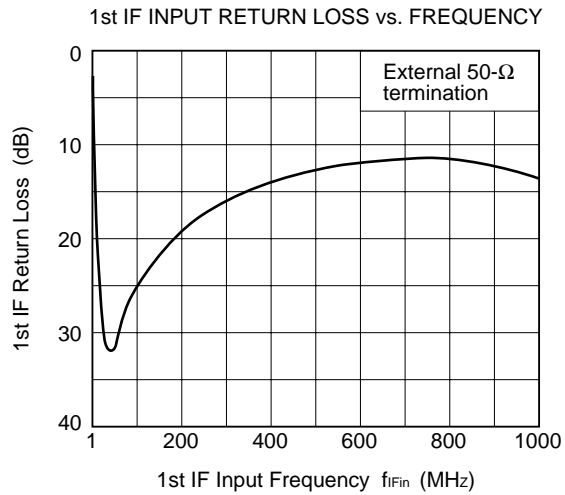
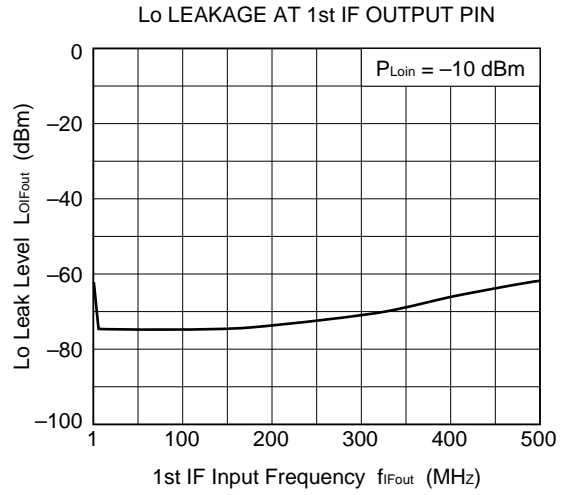
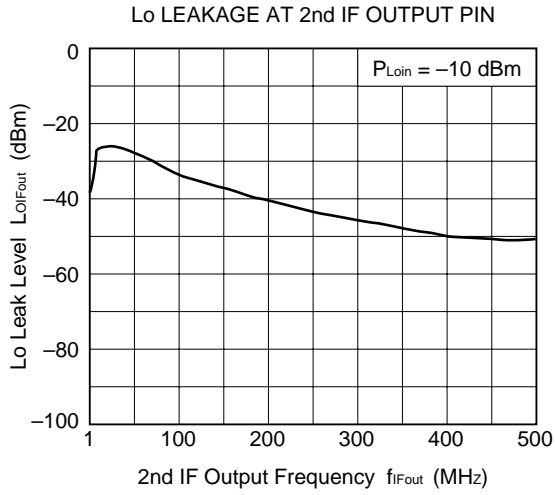
– Entire IC –



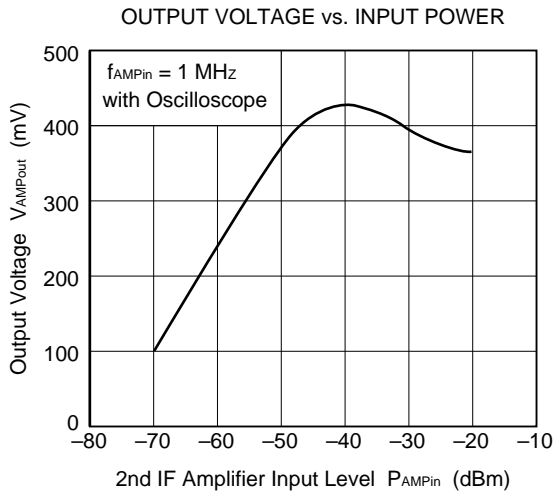
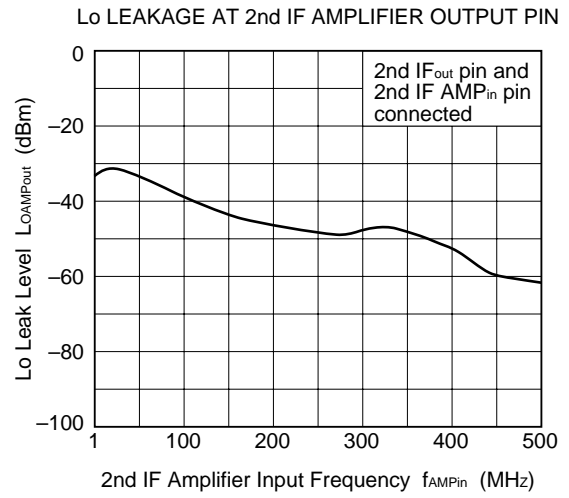
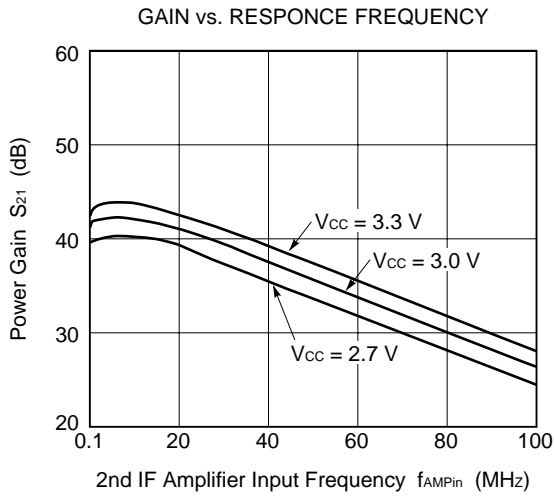
– IF Down-Converter Block –



– IF Down-Converter Block –

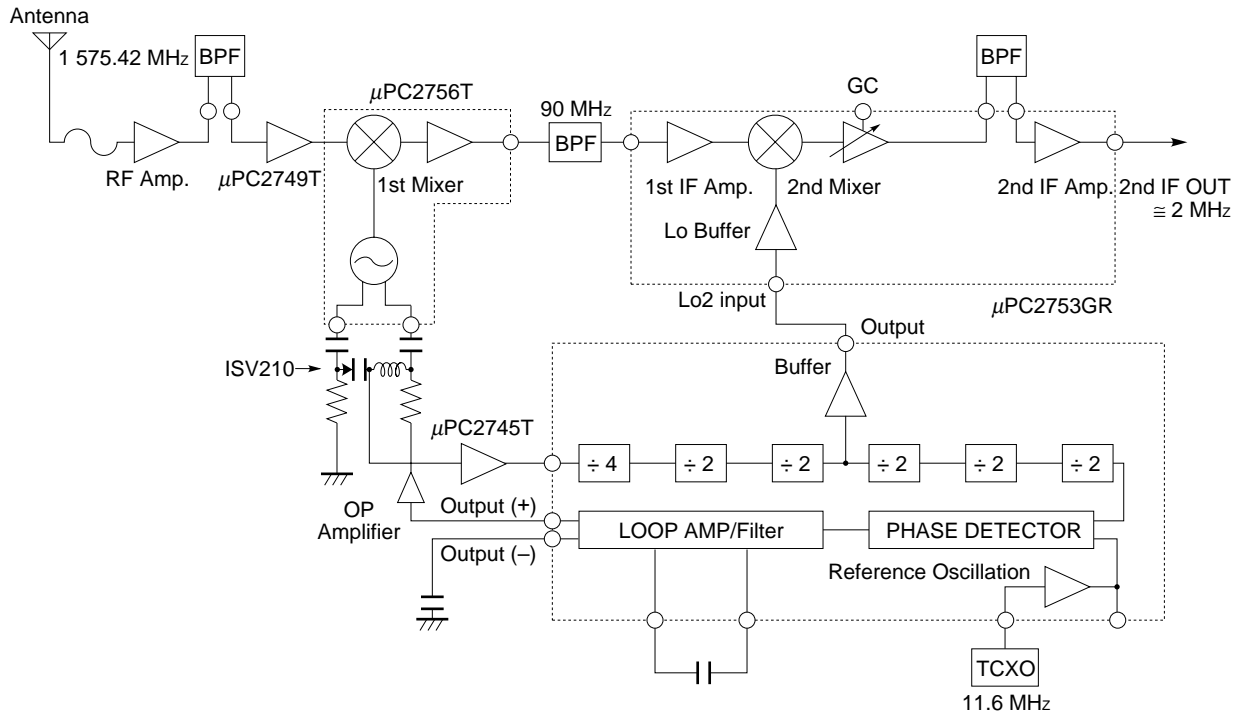


– 2nd IF Amplifier Block –



SYSTEM APPLICATION EXAMPLES: GPS Receiver Schematic

GPS RECEIVER CHIP SET

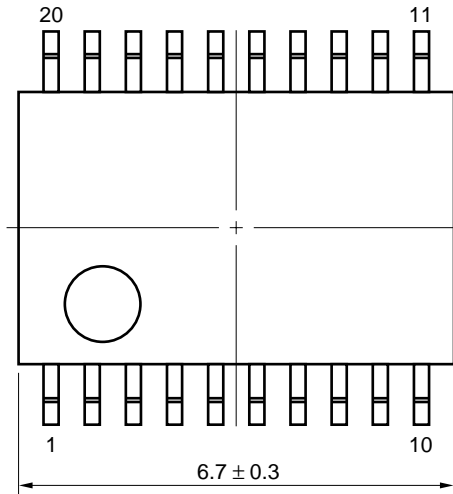


Caution This block diagram schematically represents the chip set product line-up only, and does not imply a detailed application circuit.

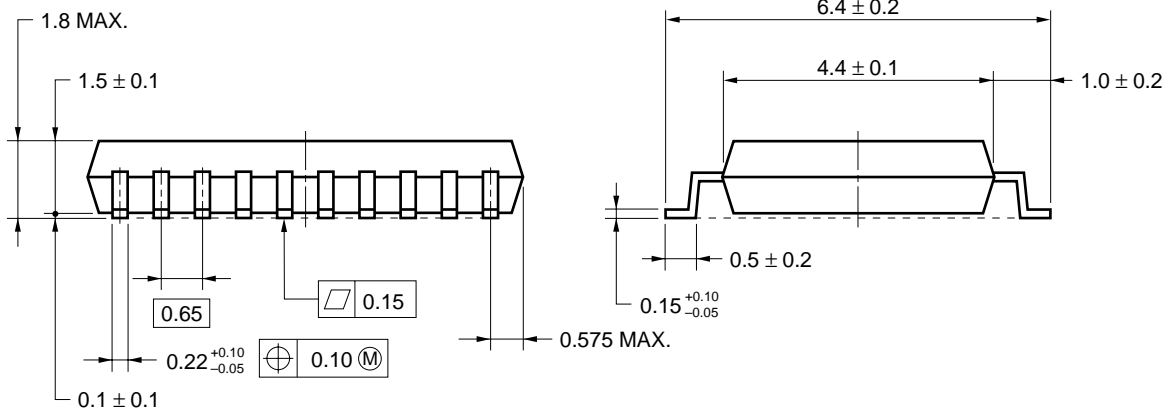
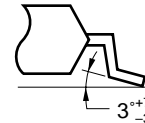
For details on the related devices, refer to the latest data sheet of each device.

PACKAGE DIMENSIONS

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



detail of lead end



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

ATTENTION ON USING THIS IC

- (1) Observe precautions for handling because of electrostatic sensitive devices.
- (2) The ground pattern should be designed as wide as possible to minimize its ground impedance. Otherwise, undesired oscillation may occur.
- (3) The track length of the ground pins should be as short as possible.
- (4) A bypass capacitor should be inserted between the V_{cc} pin and the V_{cc} line.

RECOMMENDED SOLDERING CONDITIONS

The following conditions must be met when soldering this product.
 Please consult with our sales offices in case other soldering process is used, or in case soldering is done under different conditions.

μPC2753GR

| Soldering Process | Soldering Conditions | Symbols |
|------------------------|---|-----------|
| Infrared Ray Reflow | Peak temperature of package surface : 235 °C, Reflow time : 30 seconds or less (210 °C or higher), Number of reflow processes : 2, Exposure limit : none ^{Note} | IR35-00-2 |
| VPS | Peak temperature of package surface : 215 °C, Reflow time : 40 seconds or less (200 °C or higher), Number of reflow processes : 2, Exposure limit : none ^{Note} | VP15-00-2 |
| Wave Soldering | Solder temperature : 260 °C or lower, Flow time : 10 seconds or less, Number of reflow processes : 1, Exposure limit : none ^{Note} | WS60-00-1 |
| Partial Heating Method | Pin temperature : 300 °C or lower, Time : 10 seconds or less for each pin, Exposure limit : none ^{Note} | |

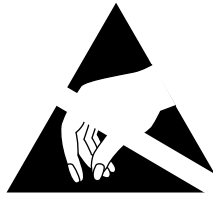
Note Exposure limit before soldering after dry-pack package is opened.
 Storage conditions : 25 °C and relative humidity of 65 % or less.

Caution Do not apply more than one soldering method at any one time, except for the partial heating method.

[MEMO]

[MEMO]

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ATTENTION

OBSERVE PRECAUTIONS
FOR HANDLING
ELECTROSTATIC
SENSITIVE
DEVICES

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 - Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)
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