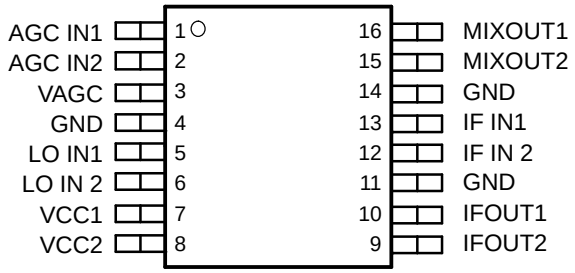
## FEATURES

- **RF AGC Amplifier, Mixer, and IF Amplifier Circuits**
- **Low Distortion**
- **5-V Power Supply**
- **16-Pin TSSOP Package**

## APPLICATION

- **CATV**

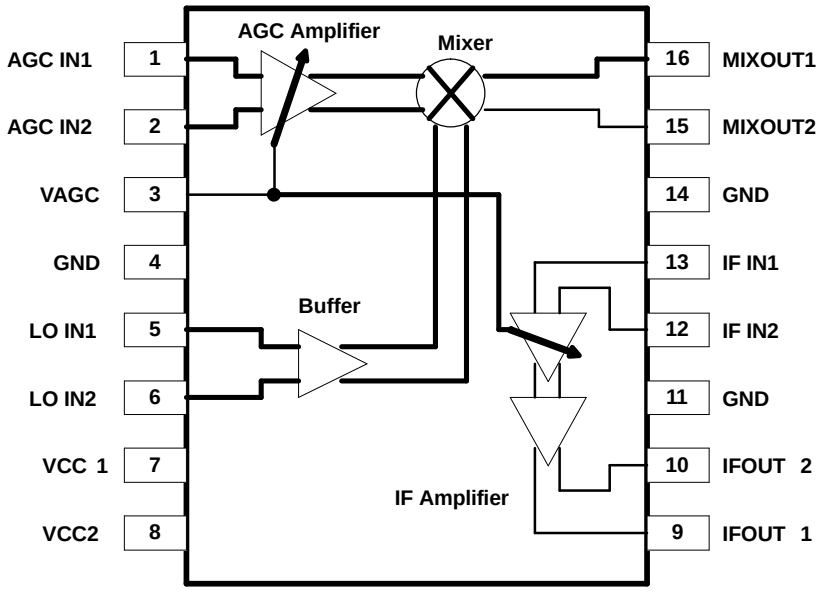
**16-PIN TSSOP**
**(TOP VIEW)**




## DESCRIPTION

The SN761688 is a monolithic IC designed as an out-of-band tuner for CATV. The circuit consists of an RF AGC amplifier, mixer, and IF amplifier, and is available in a small-outline package.

## FUNCTIONAL BLOCK DIAGRAM




This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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## TERMINAL FUNCTIONS

| TERMINAL NAME | TERMINAL NO. | DESCRIPTION | SCHEMATIC |
|---|---|---|---|
| AGC IN1 | 1 | Input of AGC amplifier | Figure 1 |
| AGC IN2 | 2 | | |
| VAGC | 3 | Input of gain control voltage | Figure 2 |
| GND | 4, 11, 14 | Ground | |
| LO IN1 | 5 | Input of local OSC | Figure 3 |
| LO IN2 | 6 | | |
| VCC1 | 7 | 5 V power supply; AGC/Mixer/Buffer | |
| VCC2 | 8 | 5 V power supply; IF amplifier | |
| IF OUT1 | 9 | Output of IF amplifier | Figure 4 |
| IF OUT2 | 10 | | |
| IF IN2 | 12 | Input of IF amplifier | Figure 5 |
| IF IN1 | 13 | | |
| MIXOUT2 | 15 | Output of Mixer | Figure 6 |
| MIXOUT1 | 16 | | |

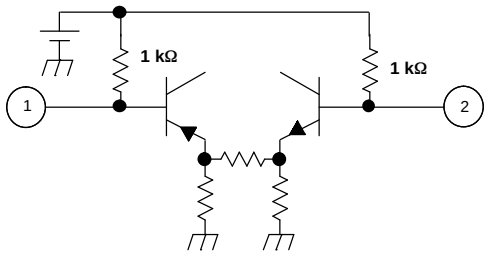


**Figure 1.**

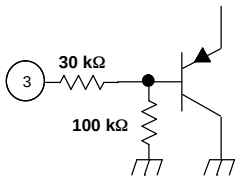


**Figure 2.**

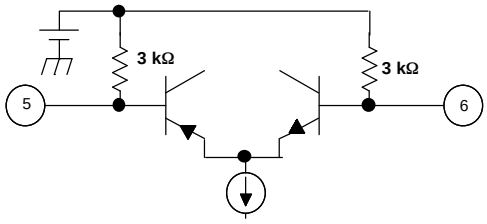


**Figure 3.**

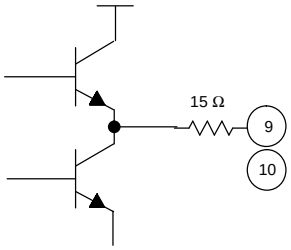


**Figure 4.**

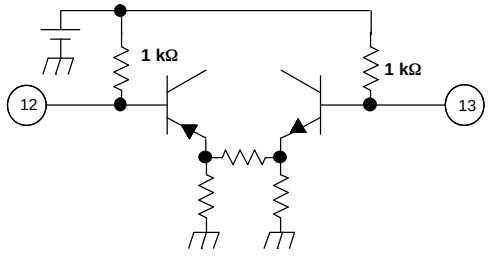


**Figure 5.**

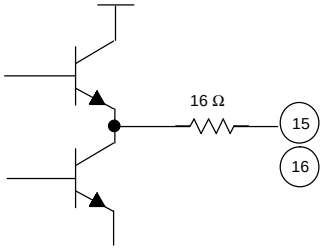


**Figure 6.**

## ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted) (1)

| | | |
|---|---|---|
| Supply voltage, $V_{CC}$ (2) | VCC1,2 (Pin 7, 8) | –0.4 V to 6.5 V |
| Input voltage (2) | $V_{IN}$ (Pins 1, 2, 3, 5, 6, 12, 13) | –0.4 V to VCC |
| Continuous total dissipation, $P_D$ (3) | $T_A \leq 25°C$ | 775 mW |
| Maximum junction temperature, $T_J$ | | 150°C |

(1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) Voltage values are with respect to the GND of the circuit.
(3) Derating factor is 6.2 mW/°C for $T_A \geq 25°C$.

## RECOMMENDED OPERATING CONDITIONS

over operating free-air temperature range (unless otherwise noted)

| | | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|---|
| Supply voltage, $V_{CC}$ | | 4.5 | 5 | 5.5 | V |
| Operating free-air temperature, $T_A$ | | –20 | | 85 | °C |

## DC ELECTRICAL CHARACTERISTICS

$V_{CC}$ = 5 V, $T_A$ = 25°C, unless otherwise noted

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| $I_{CC}$ | Supply current | No signal, $V_{AGC}$ = 0 V | | 67 | | mA |
| $I_{IAGC}$ | Input current (VAGC) | $V_{AGC}$ = 3 V | | 22 | 33 | µA |
| $V_{AGCMAX}$ | AGC voltage high at maximum gain | | 3 | | $V_{CC}$ | V |
| $V_{AGCMIN}$ | AGC voltage low at minimum gain | | 0 | | 0.5 | V |

## AC ELECTRICAL CHARACTERISTICS

$V_{CC}$ = 5 V, $T_A$ = 25°C, unless otherwise noted

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| | AGC amplifier and mixer (1) | | | | | |
| $GC_{MAX}$ | Maximum conversion gain | $V_{AGC}$ = 3 V | 27 | 30 | 33 | dB |
| $GC_{MIN}$ | Minimum conversion gain | $V_{AGC}$ = 0 V | -21 | -18 | -15 | dB |
| $GCR_{MIX}$ | Gain control range | $V_{AGC}$ = 0 V to 3 V | | 48 | | dB |
| $V_{MIXOUT}$ | Mixer output voltage | $V_{AGC}$ = 3 V, Single-ended output | | 117 | | dBµV |
| NF | Noise figure (2) | $V_{AGC}$ = 3 V | | 10 | | dB |
| $IM3_{GMX}$ | Third order intermodulation distortion | $f_{IN1}$ = 79.5 MHz, $f_{IN2}$ = 80.5 MHz, $V_{OUT}$ = -10 dBm, $V_{AGC}$ = 3 V | | -60 | | dBc |
| $OIP3_{GMX}$ | Output intercept point | $f_{IN1}$ = 79.5 MHz, $f_{IN2}$ = 80.5 MHz, $V_{AGC}$ = 3 V | | 20 | | dBm |
| | IF amplifier (3) | | | | | |
| $GV_{IFMAX}$ | Maximum voltage gain | $V_{AGC}$ = 3 V | | 51 | | dB |
| $GV_{IFMIN}$ | Minimum voltage gain | $V_{AGC}$ = 0 V | | 46 | | dB |
| $GVR_{IF}$ | Gain control range | $V_{AGC}$ = 0 V to 3 V | | 5 | | dB |
| $IM3_{IF}$ | Third order intermodulation distortion | $f_{IN1}$ = 43.5 MHz, $f_{IN2}$ = 445 MHz, $V_{IFOUT}$ = 1 dBm, $V_{AGC}$ = 3 V | | -60 | | dBc |
| $V_{IFOUT}$ | IF amplifier output voltage | $V_{AGC}$ = 3 V, Single-ended output | | 122 | | dBµV |

(1) Measurement Circuit 1 except for Noise Figure measurement. AGC IN = 80 MHz/-37 dBm, LO IN = 36 MHz / -20 dBm, IF = 44 MHz, unless otherwise noted.
(2) Measurement Circuit 2.
(3) Measurement Circuit 3. IF IN = 44 MHz / -50 dBm, unless otherwise noted.

## APPLICATION INFORMATION

### MEASUREMENT CIRCUITS

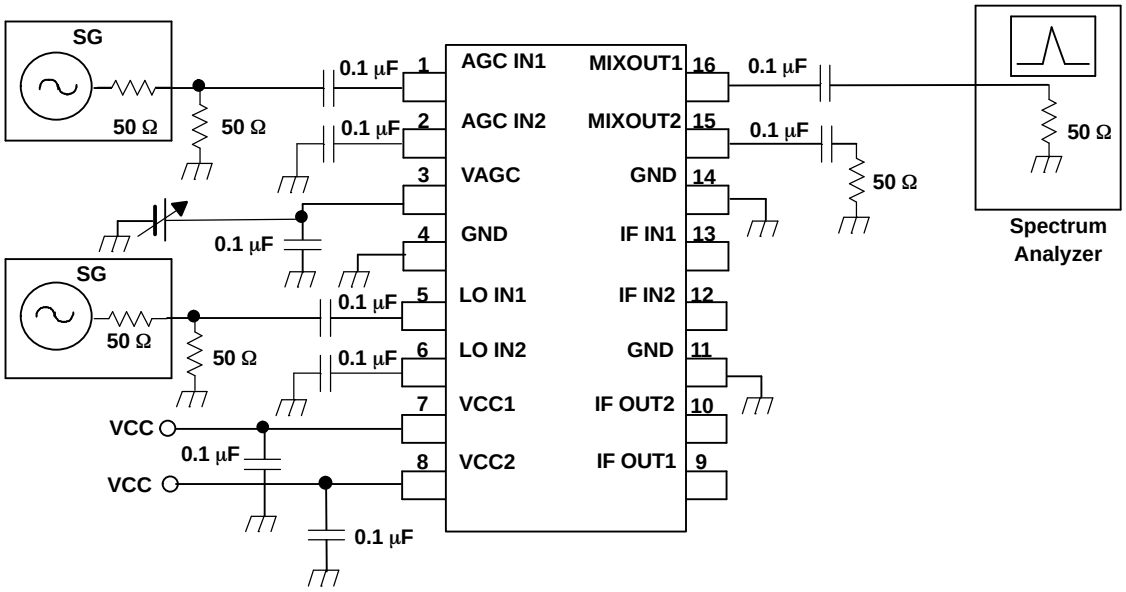


**Figure 7. Measurement Circuit 1**

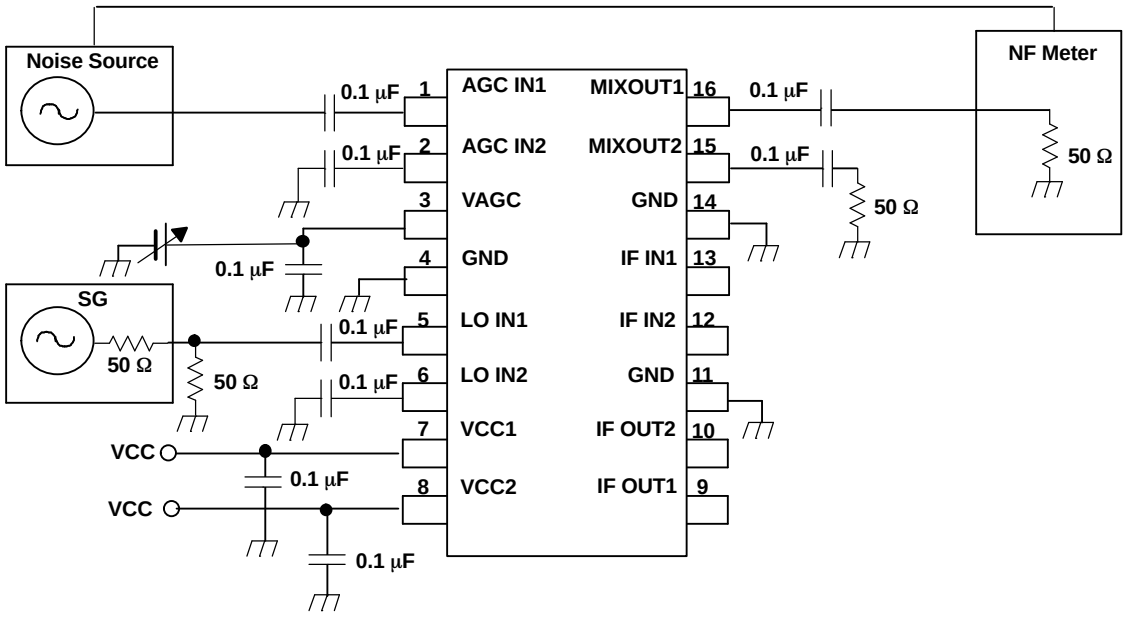


**Figure 8. Measurement Circuit 2**

## APPLICATION INFORMATION (continued)

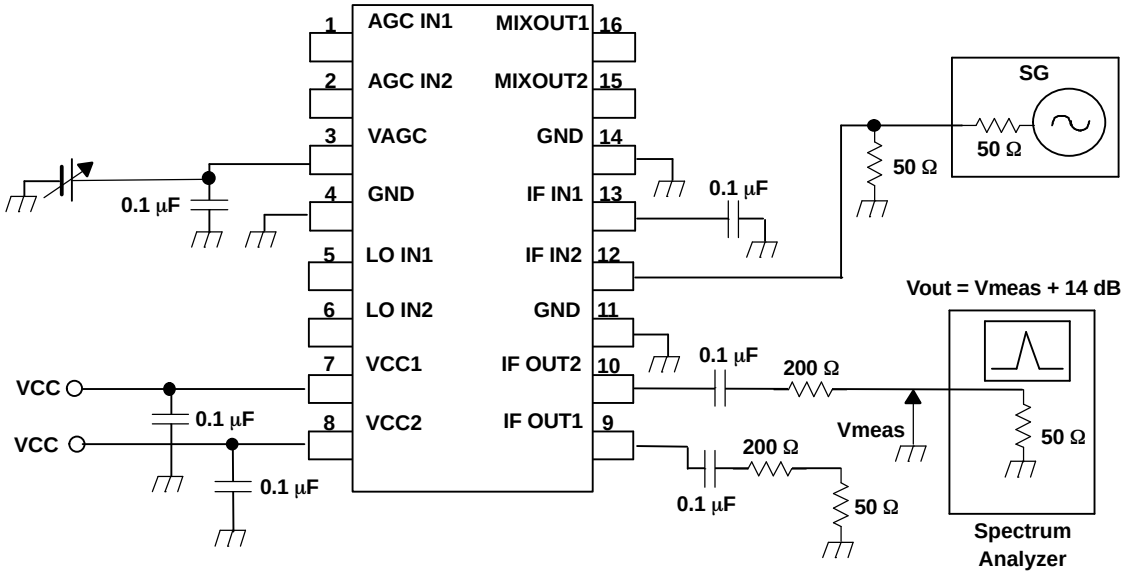


**Figure 9. Measurement Circuit 3**

**NOTE:**

This application information is advisory and a performance check is required at the actual application circuits.

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## TYPICAL CHARACTERISTICS

Mixer Conversion Gain
vs
AGC Control Voltage

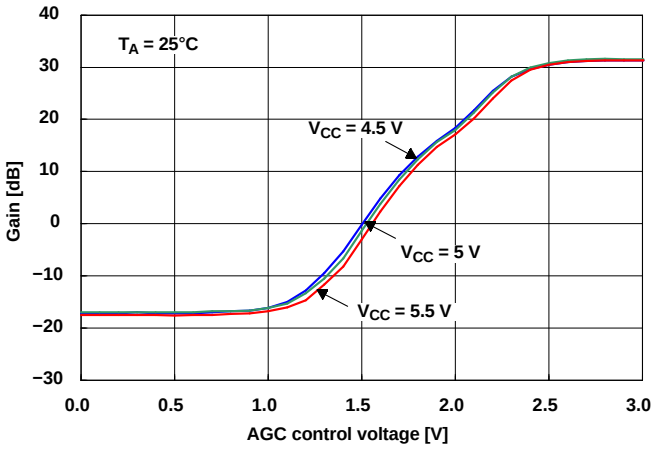


Figure 10.

Mixer Conversion Gain
vs
AGC Control Voltage

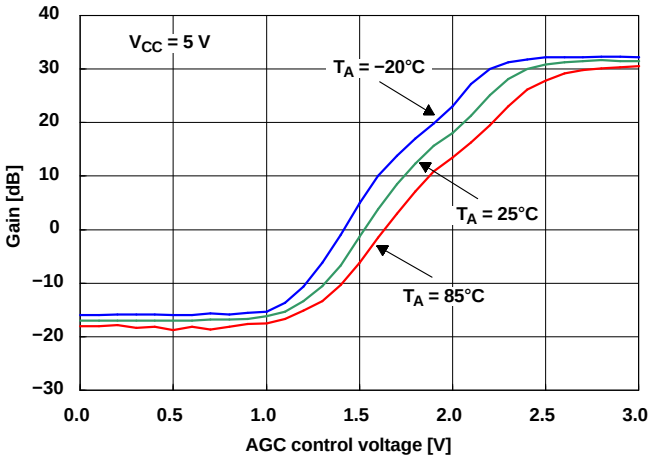


Figure 11.

Mixer Output Level
vs
AGC IN Input Level

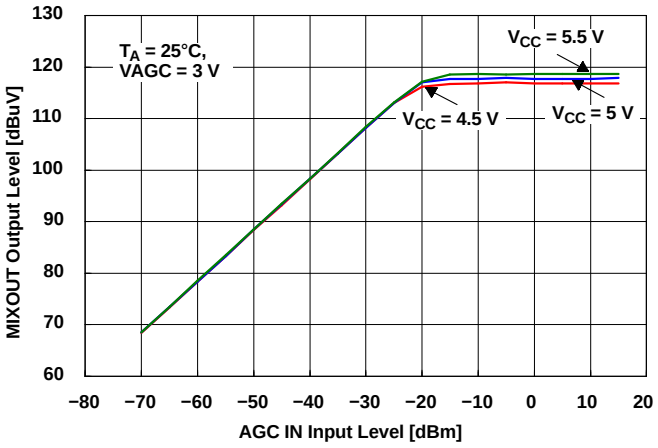


Figure 12.

Mixer Output Level
vs
LO IN Input Level

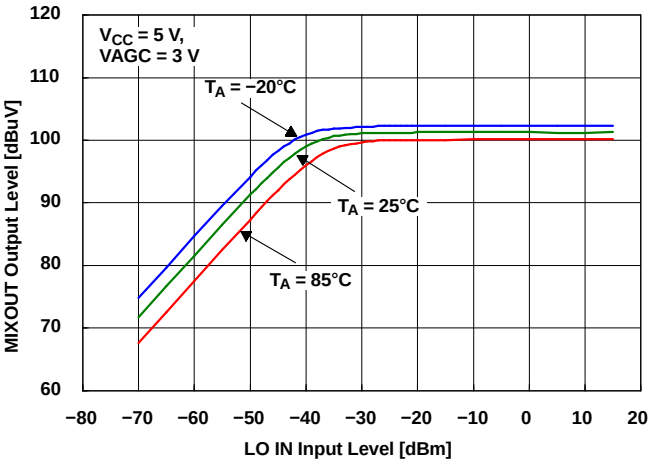


Figure 13.

## TYPICAL CHARACTERISTICS (continued)

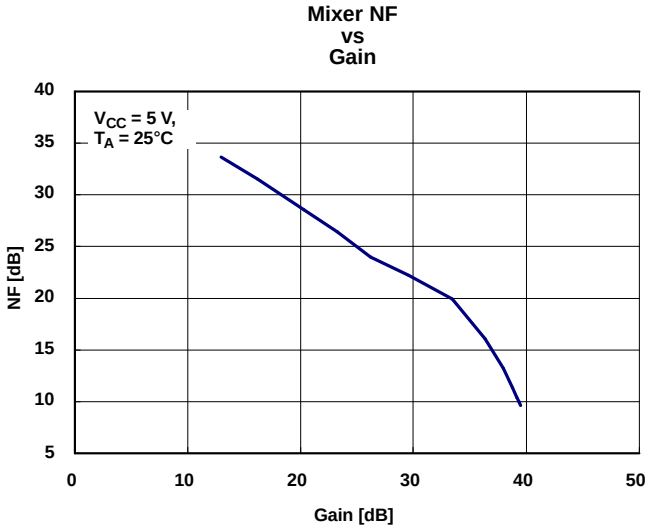


Figure 14.

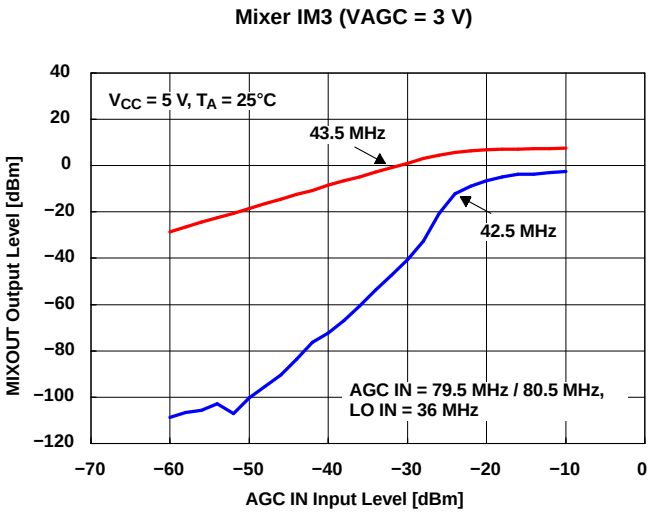


Figure 15.

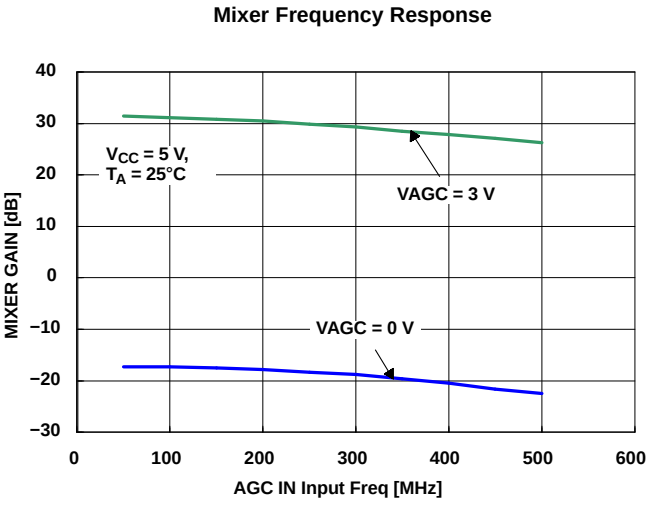


Figure 16.

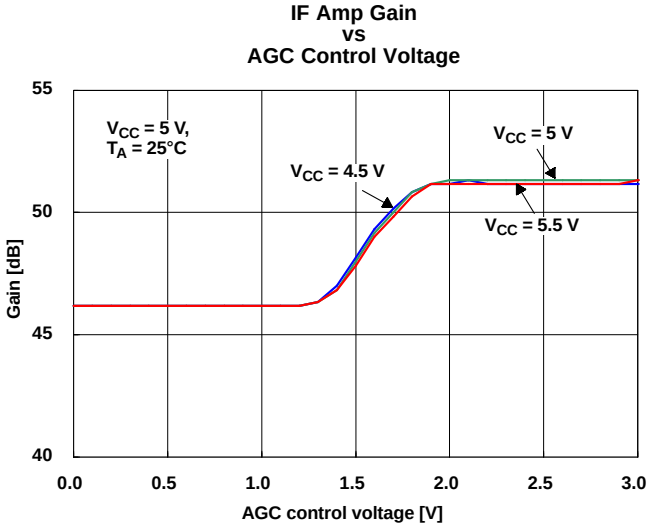


Figure 17.

## TYPICAL CHARACTERISTICS (continued)

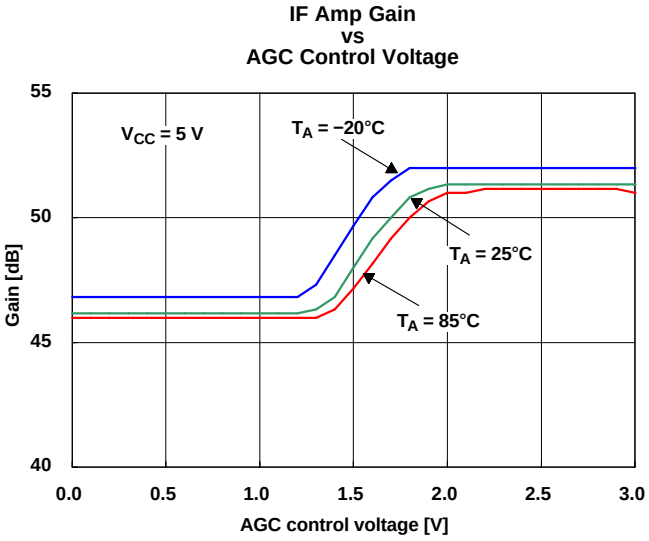


Figure 18.

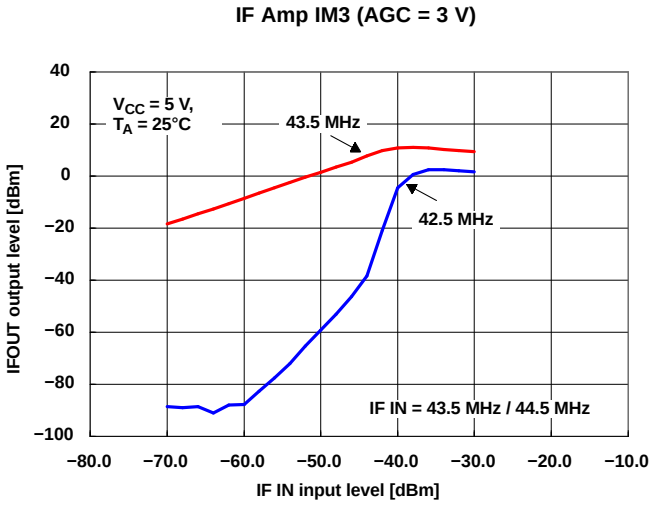


Figure 19.

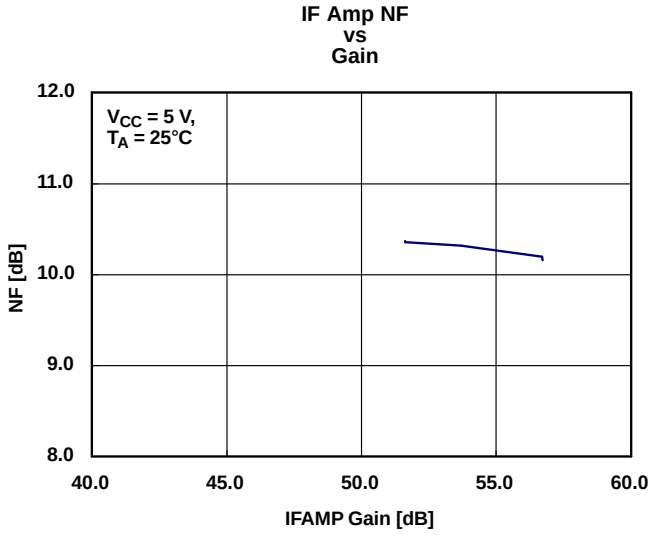


Figure 20.

## TYPICAL CHARACTERISTICS (continued)

### S-PARAMETER

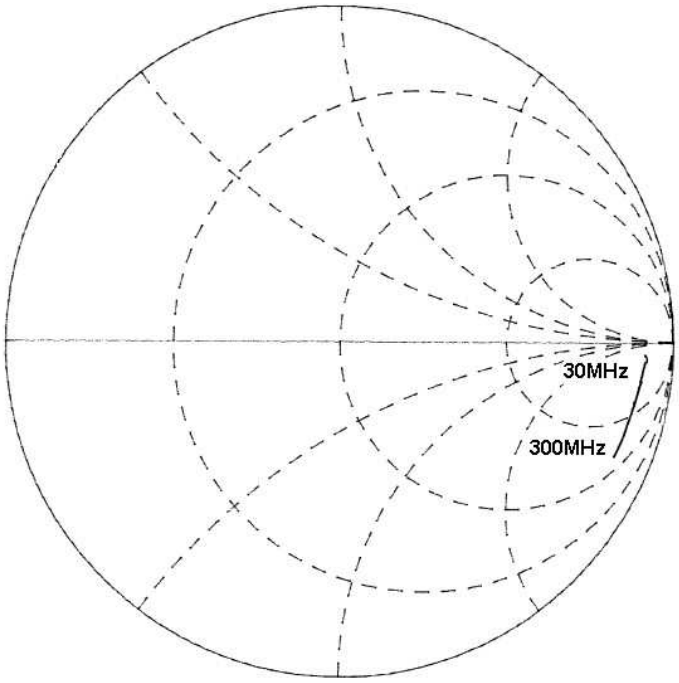


**Figure 21. AGC IN**

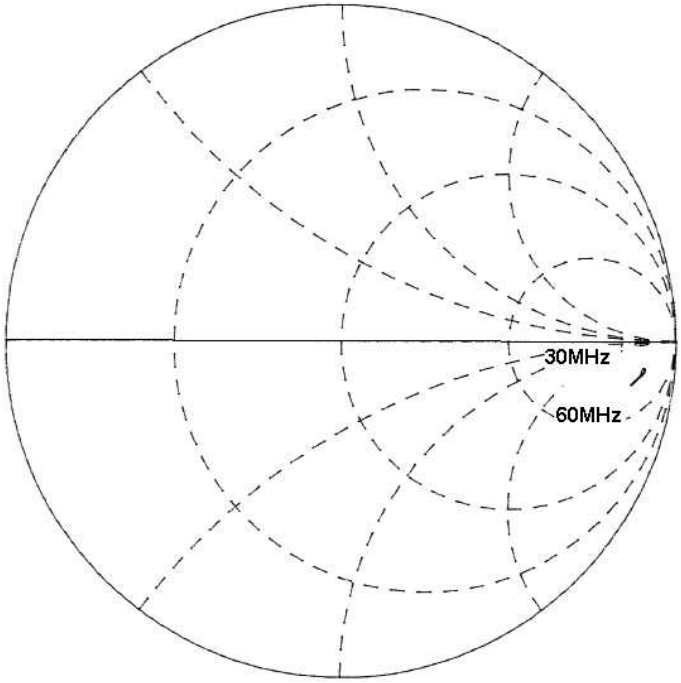


**Figure 22. IF IN**

## TYPICAL CHARACTERISTICS (continued)

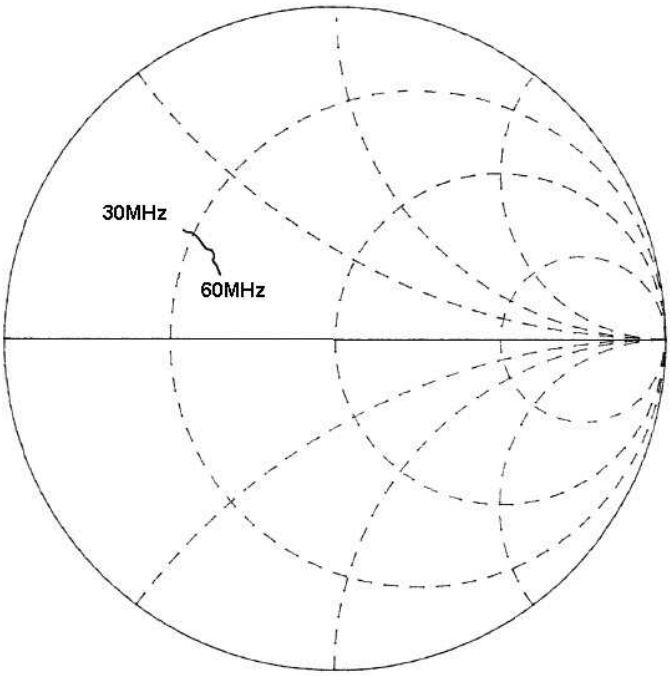


**Figure 23. IF OUT**

## PACKAGING INFORMATION

| Orderable Device | Status [1] | Package Type | Package Drawing | Pins | Package Qty | Eco Plan [2] | Lead/Ball Finish | MSL Peak Temp [3] |
|---|---|---|---|---|---|---|---|---|
| SN761688PW | ACTIVE | TSSOP | PW | 16 | 90 | TBD | Call TI | Call TI |
| SN761688PWR | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN761688PWRG4 | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |

[1] The marketing status values are defined as follows:
**ACTIVE:** Product device recommended for new designs.
**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.
**OBSOLETE:** TI has discontinued the production of the device.

[2] Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
**TBD:** The Pb-Free/Green conversion plan has not been defined.
**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

[3] MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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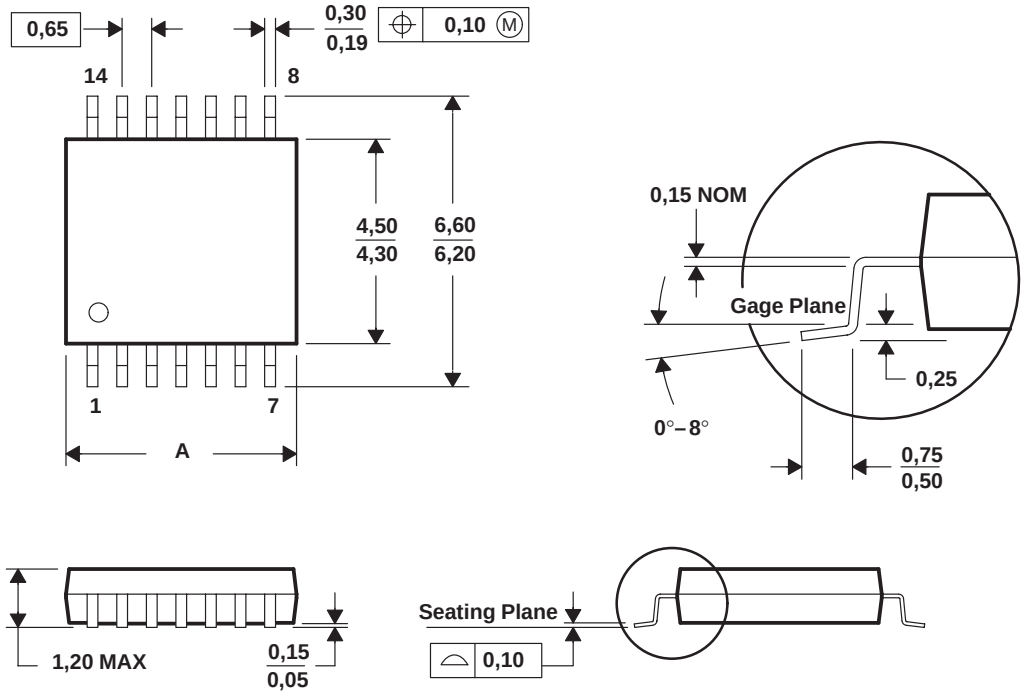
**PW (R-PDSO-G**)** **PLASTIC SMALL-OUTLINE PACKAGE**

**14 PINS SHOWN**




| DIM \ PINS ** | 8 | 14 | 16 | 20 | 24 | 28 |
|---|---|---|---|---|---|---|
| A MAX | 3,10 | 5,10 | 5,10 | 6,60 | 7,90 | 9,80 |
| A MIN | 2,90 | 4,90 | 4,90 | 6,40 | 7,70 | 9,60 |

**4040064/F 01/97**

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
D. Falls within JEDEC MO-153

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