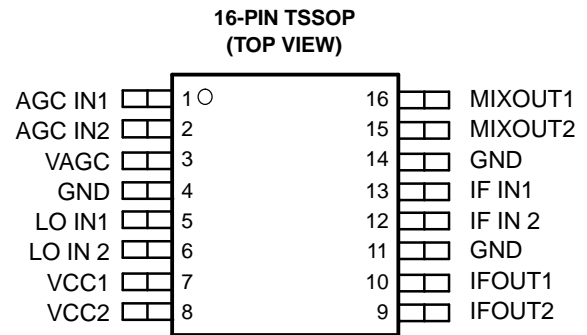


**FEATURES**

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

**APPLICATION**

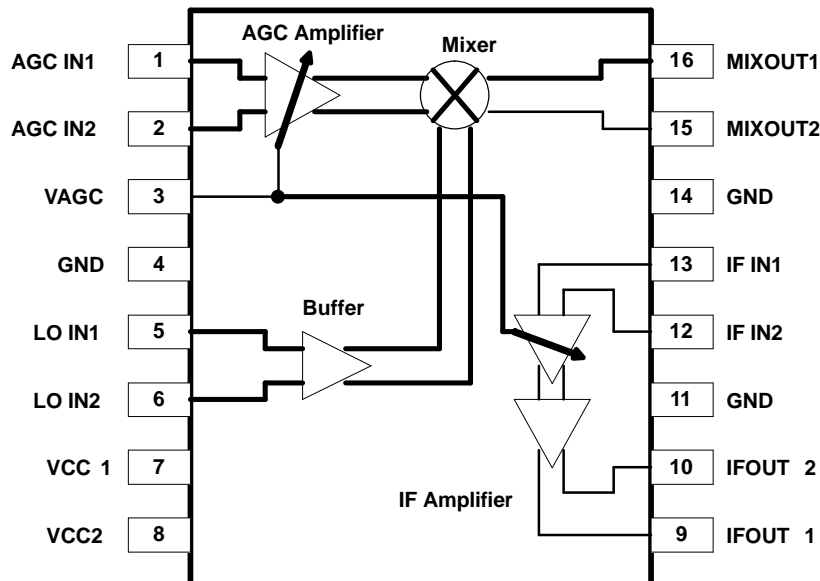
- CATV



**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.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

**TERMINAL FUNCTIONS**

TERMINAL NAME		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		

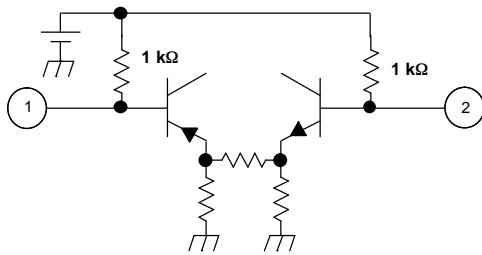


Figure 1.

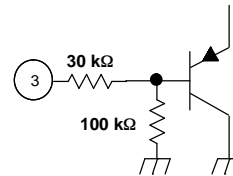


Figure 2.

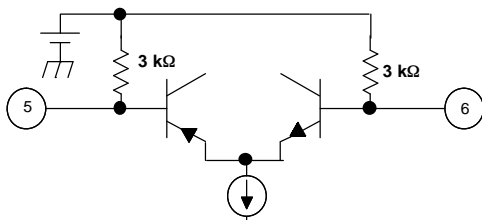


Figure 3.

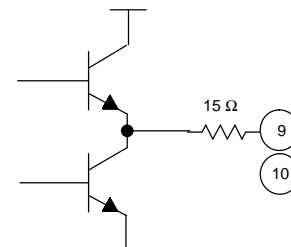


Figure 4.

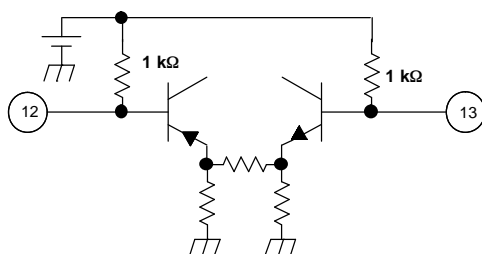


Figure 5.

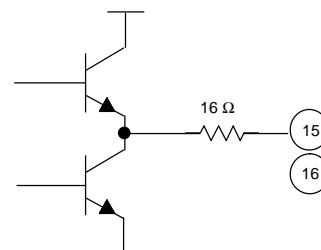


Figure 6.

## ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted) <sup>(1)</sup>

Supply voltage, $V_{CC}$ <sup>(2)</sup>	VCC1,2 (Pin 7, 8)	-0.4 V to 6.5 V
Input voltage <sup>(2)</sup>	$V_{IN}$ (Pins 1, 2, 3, 5, 6, 12, 13)	-0.4 V to VCC
Continuous total dissipation, $P_D$ <sup>(3)</sup>	$T_A \leq 25^\circ\text{C}$	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  $T_A \geq 25^\circ\text{C}$ .

## 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

$V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ , unless otherwise noted

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$I_{CC}$ Supply current	No signal, $V_{AGC} = 0\text{ V}$		67		mA
$I_{AGC}$ Input current ( $V_{AGC}$ )	$V_{AGC} = 3\text{ V}$		22	33	$\mu\text{A}$
$V_{AGC\text{MAX}}$ AGC voltage high at maximum gain		3		$V_{CC}$	V
$V_{AGC\text{MIN}}$ AGC voltage low at minimum gain		0		0.5	V

## AC ELECTRICAL CHARACTERISTICS

$V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ , unless otherwise noted

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

- (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

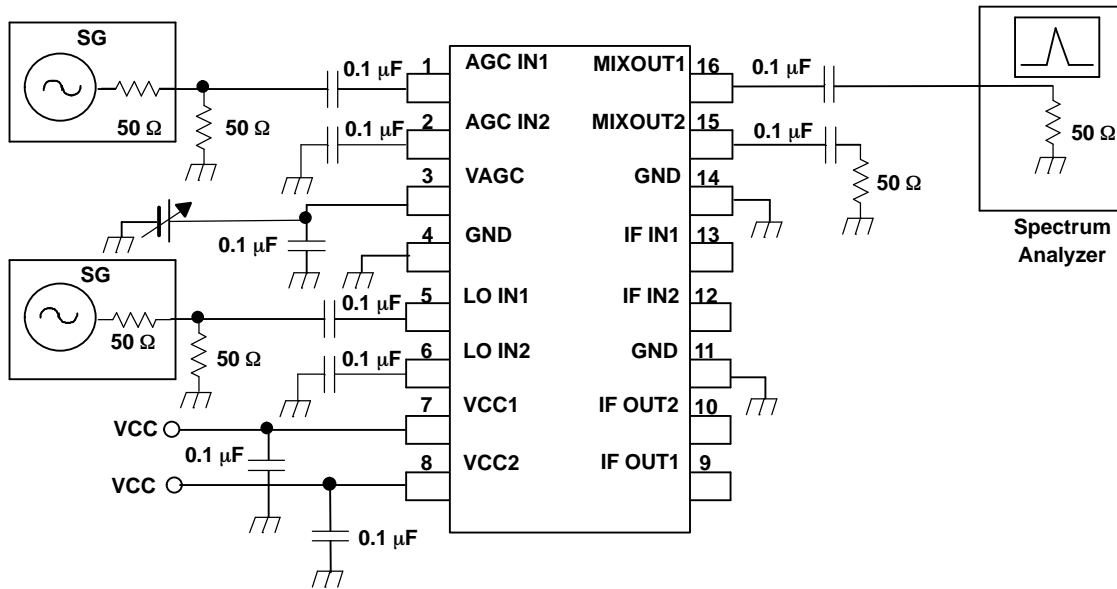


Figure 7. Measurement Circuit 1

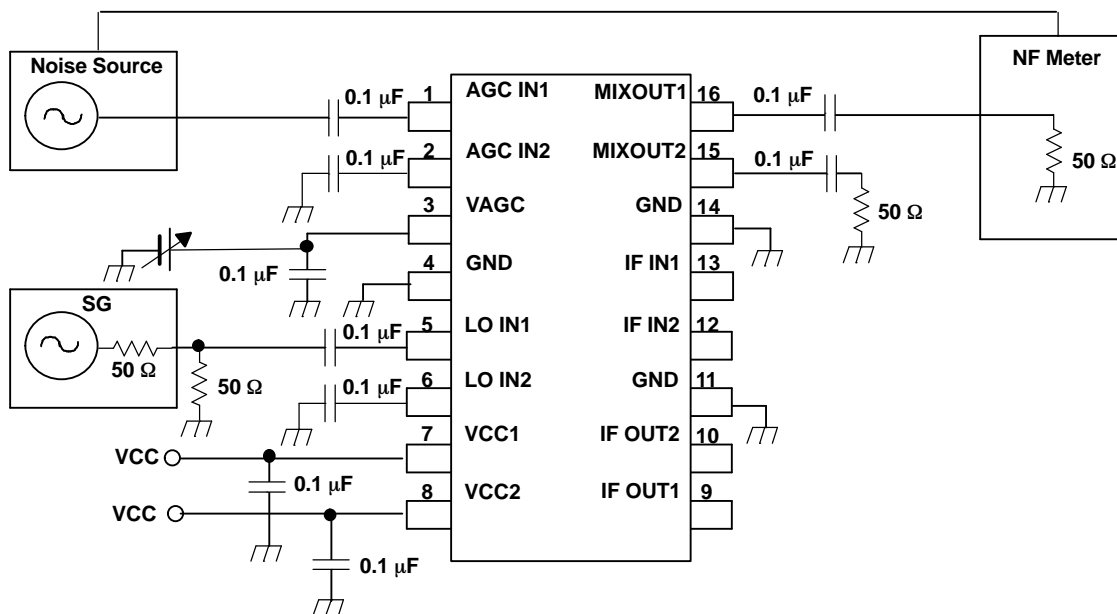
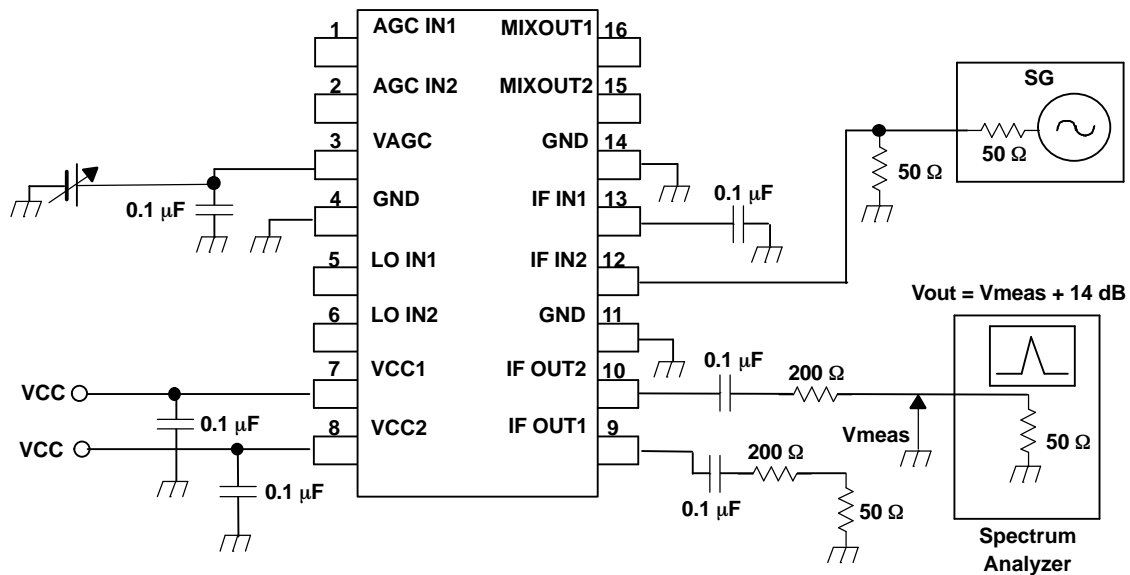


Figure 8. Measurement Circuit 2

**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

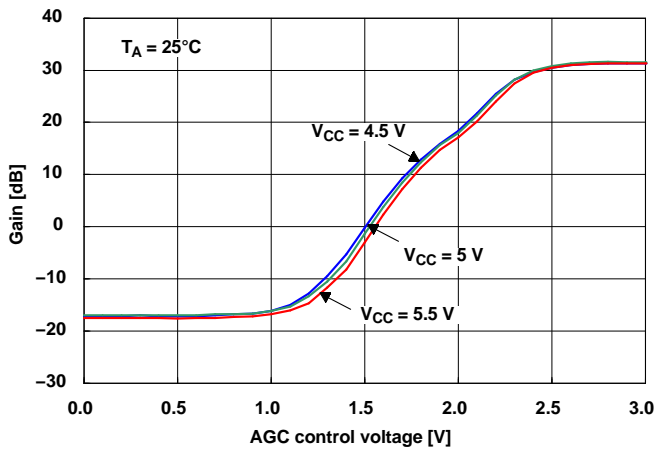


Figure 10.

Mixer Conversion Gain  
vs  
AGC Control Voltage

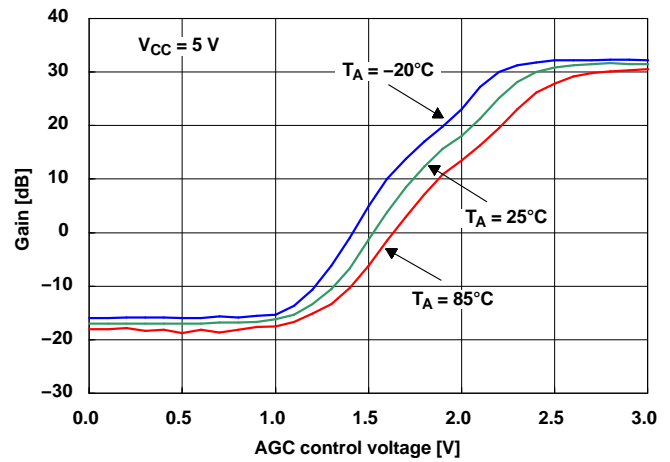


Figure 11.

Mixer Output Level  
vs  
AGC IN Input Level

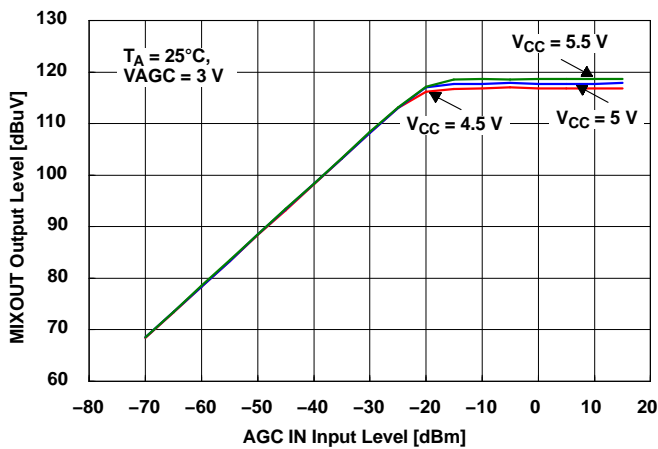


Figure 12.

Mixer Output Level  
vs  
LO IN Input Level

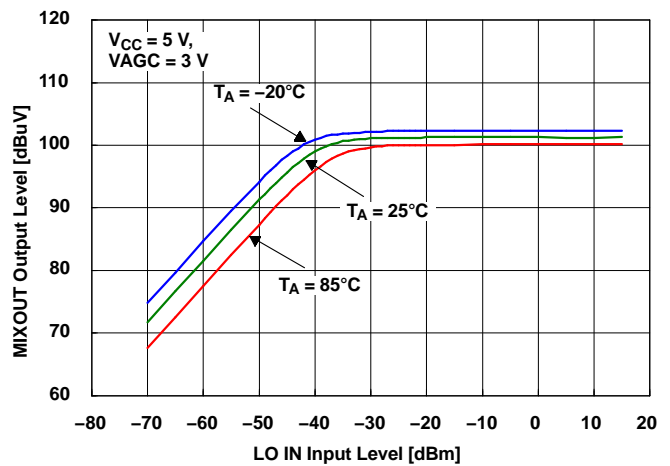


Figure 13.

TYPICAL CHARACTERISTICS (continued)

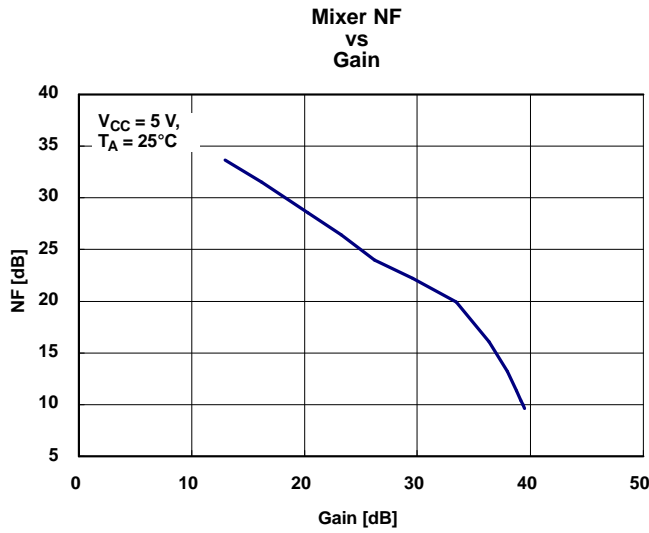


Figure 14.

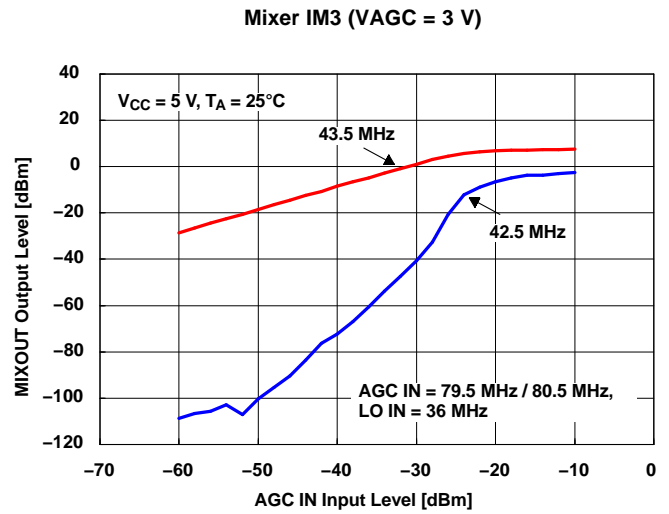


Figure 15.

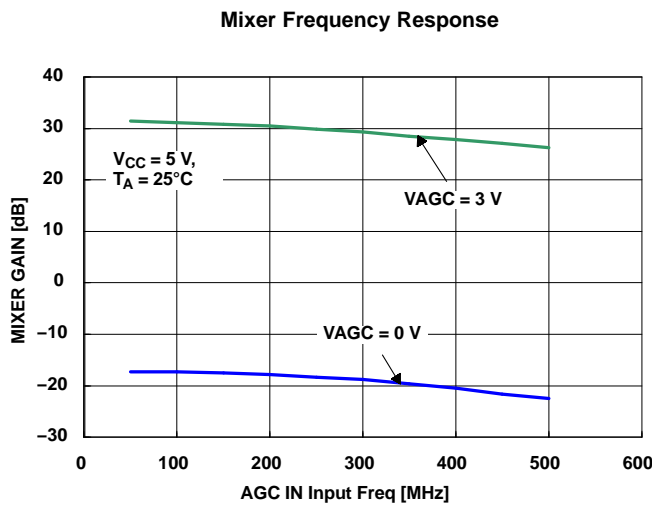


Figure 16.

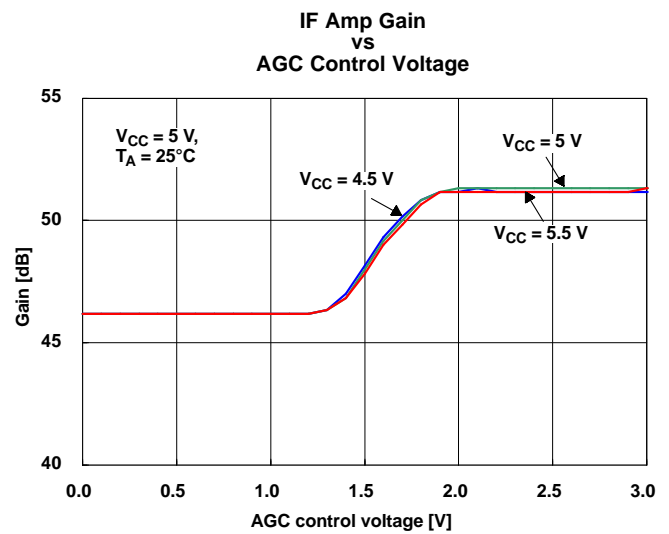
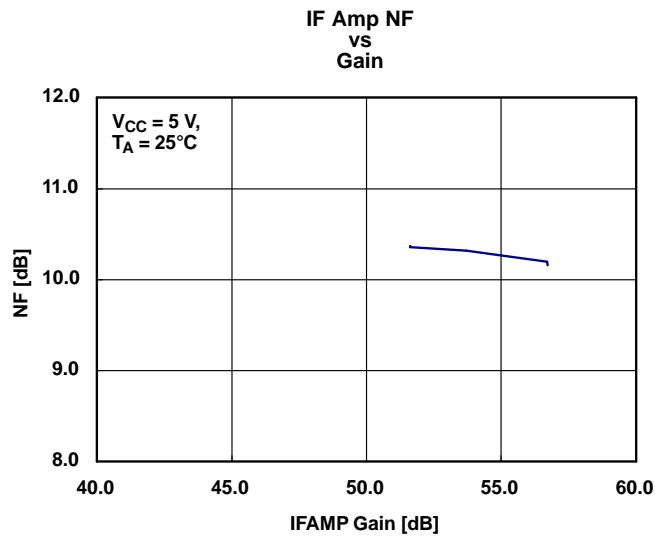
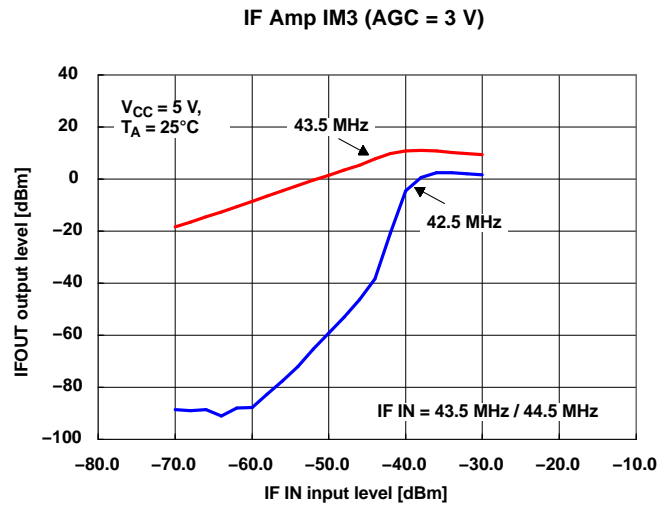
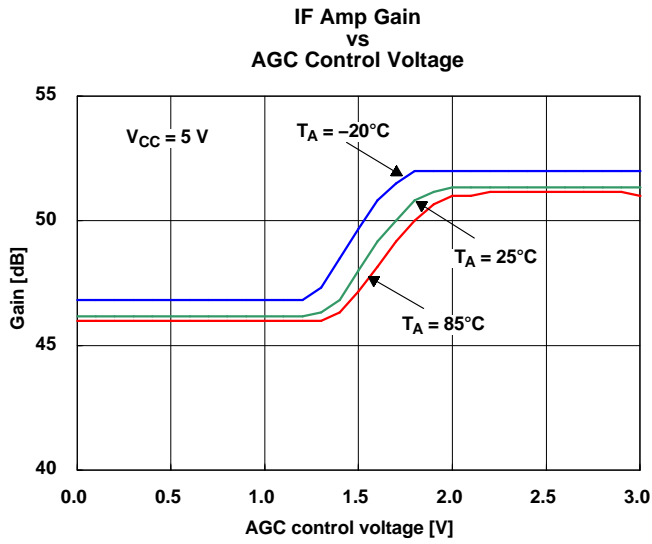


Figure 17.

TYPICAL CHARACTERISTICS (continued)





TYPICAL CHARACTERISTICS (continued)

S-PARAMETER

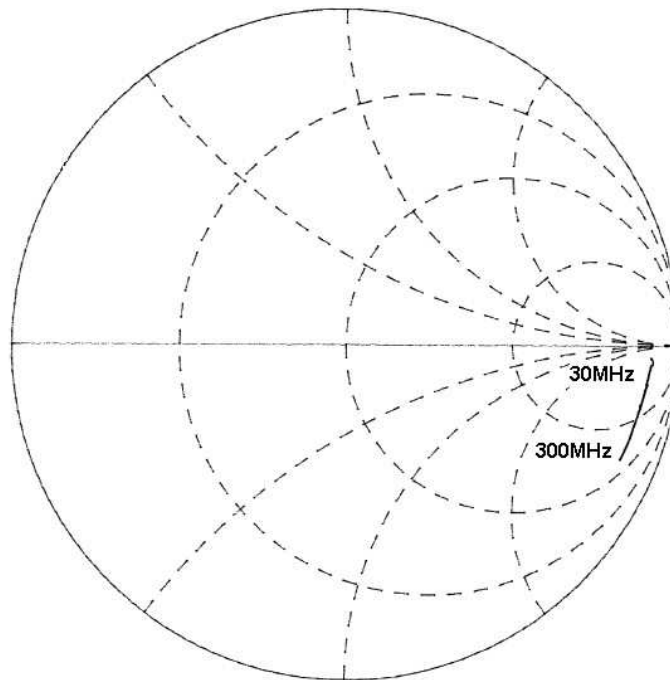


Figure 21. AGC IN

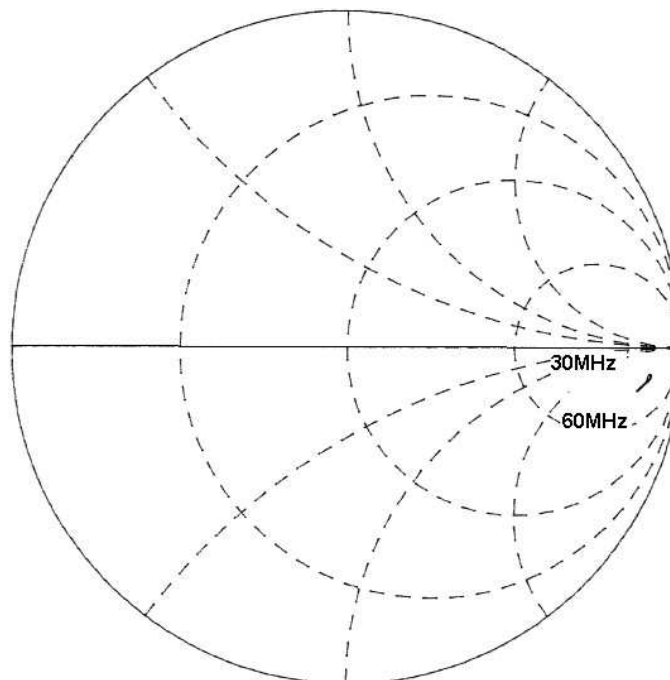


Figure 22. IF IN

TYPICAL CHARACTERISTICS (continued)

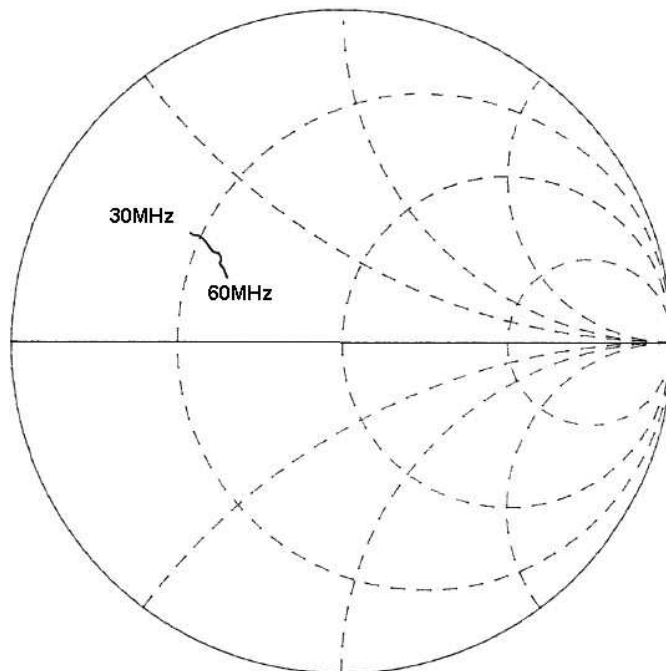


Figure 23. IF OUT

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
SN761688PW	OBSOLETE	TSSOP	PW	16		TBD	Call TI	Call TI	-20 to 85		
SN761688PWR	OBSOLETE	TSSOP	PW	16		Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-20 to 85	B1688	
SN761688PWRG4	OBSOLETE	TSSOP	PW	16		Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-20 to 85	B1688	

(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.

(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

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## TAPE AND REEL INFORMATION



### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN761688PWR	TSSOP	PW	16	0	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN761688PWR	TSSOP	PW	16	0	367.0	367.0	35.0

PW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4040064-4/G 02/11

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  -  C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
  -  D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
  - E. Falls within JEDEC MO-153

PW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
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