

### FEATURES

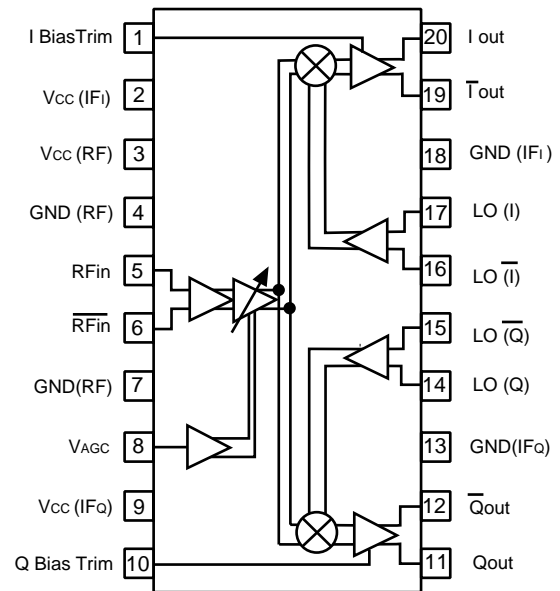
- **BROADBAND OPERATION**  
RF & LO DC to 1 GHz  
IF (IQ) DC to 100 MHz
- **WIDEBAND IQ PHASE AND AMPLITUDE MATCHING**  
Amplitude Matching:  $\pm 0.3$  dB Typical  
Phase Matching:  $\pm 0.3^\circ$  (driven in phase)
- **AGC DYNAMIC RANGE:**  
30 dB Typical
- **LOW DISTORTION:**  
30 dBc Typical
- **SMALL SSOP 20 PACKAGE**
- **TAPE AND REEL PACKAGING AVAILABLE**

### DESCRIPTION

The UPC2766GR Silicon MMIC Wideband IQ Demodulator was manufactured with the NESAT III MMIC process. The NESAT III process produces transistors with  $f_T$  approaching 20 GHz. The device was designed specifically for digital video and data receivers. The IC consists of a wide band RF amplifier, Gain Control amplifier, dual balanced mixers, LO buffers, and I & Q output buffer amplifiers.

NEC's stringent quality assurance and test procedures ensure the highest reliability and performance.

### FUNCTIONAL BLOCK DIAGRAM



### ELECTRICAL CHARACTERISTICS<sup>1</sup> (TA = 25°C, Vcc = 5 V, ZL = 50 Ω)

PART NUMBER PACKAGE OUTLINE			UPC2766GR S20 (SSOP 20)		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
I <sub>CC</sub>	Circuit Current (no signal)	mA		60	78
f <sub>RF</sub>	RF Input Bandwidth <sup>2</sup> f <sub>IF</sub> = 40 MHz, f <sub>RF</sub> > f <sub>LO</sub> , 3 dB down	MHz	DC-750	DC-1000	
f <sub>IF</sub>	IF Output Bandwidth <sup>3</sup> f <sub>RF</sub> = 480 MHz, f <sub>RF</sub> > f <sub>LO</sub> , 3 dB down, V <sub>AGC</sub> = 0 V	MHz		200	
CG	Conversion Gain	dB	15	20	25
NF	Noise Figure	dB		21	
IM3	3rd Order Intermodulation Distortion f <sub>RF1</sub> = 480 MHz, f <sub>RF2</sub> = 490 MHz, f <sub>LO</sub> = 440 MHz, P <sub>IN</sub> = -20 dBm, V <sub>AGC</sub> = 1 V	dBc		30	
ΔΦ	IQ Phase Balance (LO driven in phase)	deg		±0.3	±1.5
ΔG	IQ Amplitude Balance	dB		±0.3	±0.5
G <sub>AGC</sub>	AGC Range, V <sub>AGC</sub> = 0-5 V	dB	40	45	
LO-RF	LO to RF Isolation	dB		55	
LO-IF	LO to IF Isolation	dB		10	
P <sub>SAT</sub>	Saturated Output Level	dBm		+2	
V <sub>O</sub>	Saturated Output Voltage (Z <sub>L</sub> = 250 Ω//2pF)	V <sub>P-P</sub>	1.2	1.5	

Notes:

1. f<sub>RF</sub> = 480 MHz, f<sub>IF</sub> = 40 MHz, P<sub>LO</sub> = -10 dBm, P<sub>RF</sub> = -30 dBm, V<sub>AGC</sub> = 0 V, f<sub>RF</sub> > f<sub>LO</sub> unless otherwise specified.
2. RF Bandwidth defined as 3 dB down from response at f<sub>RF</sub> = 40 MHz.
3. IF Bandwidth defined as 3 dB down from response at f<sub>IF</sub> = 10 MHz.

**ABSOLUTE MAXIMUM RATINGS<sup>1</sup>** (TA = 25°C)

SYMBOLS	PARAMETERS	UNITS	RATINGS
Vcc	Supply Voltage	V	6
Pd	Power Dissipation <sup>2</sup>	mW	430
TOP	Operating Temperature Range	°C	-40 to +85
TSTG	Storage Temperature	°C	-55 to +150

Notes:

1. Operation in excess of any one of these parameters may result in permanent damage.
2. Mounted on a 50x50x1.6 mm epoxy glass PWB (TA = 85°C).

**RECOMMENDED OPERATING CONDITIONS**

SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
Vcc	Supply Voltage	V	4.5	5.0	5.5
TOP	Operating Temperature	°C	-40	+25	+85

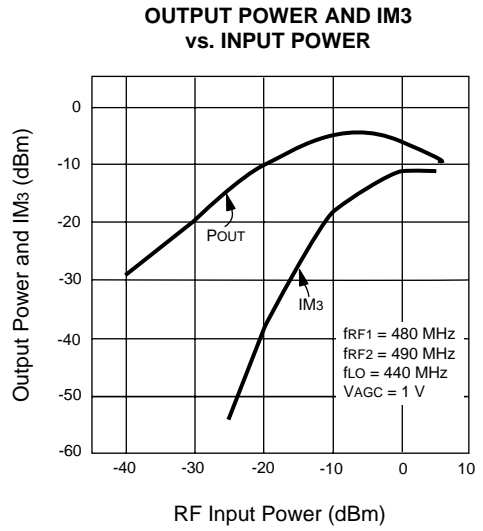
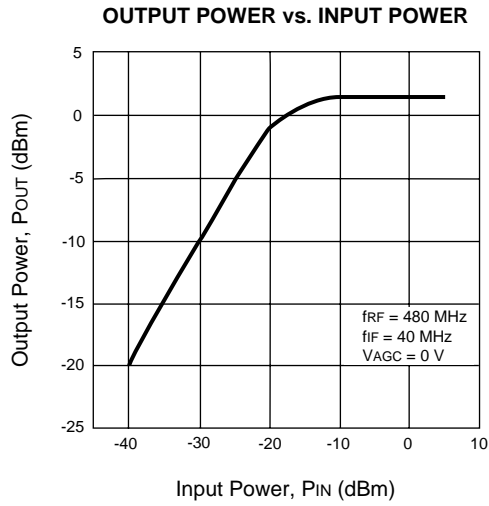
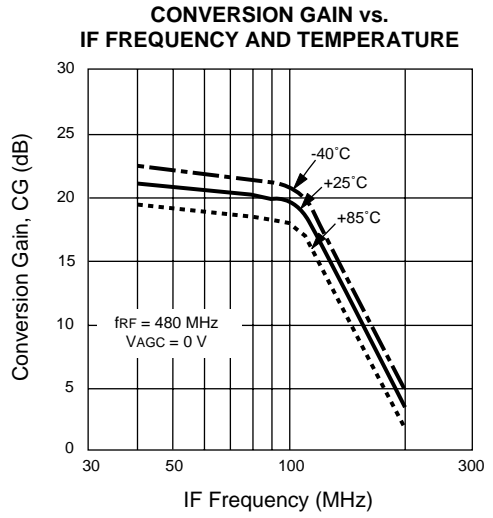
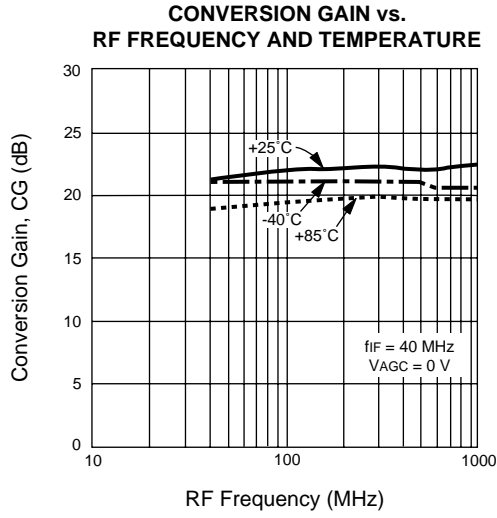
**PIN FUNCTIONS**

Pin No.	Pin Name	Pin Voltage Typ. (V)	Function and Explanation	Equivalent Circuit
1	I Trim	4.2	Limiter control for I-IF output	
2	Vcc (IFi)	5.0	Power supply pin of I-Mixer.	
3	Vcc (RF)	5.0	Power supply pin of RF and AGC block.	
4	GND (RF)	0.0	Ground pin of RF and AGC block.	
5	RFin	2.6	RF input pin. For single-ended applications, Pin 6 should be bypassed to GND via a capacitor.	
6	RFin	2.6		
7	GND (RF)	0.0	Ground pin of RF and AGC block.	
8	VAGC	0-5	Gain control pin. • VAGC = 0 V: Maximum Gain • VAGC = 5 V: Maximum Attenuation	
9	Vcc (IFq)	5.0	Power supply pin of Q-Mixer	
10	Q Trim	4.2	Limiter control for Q-IF output.	

**PIN FUNCTIONS**

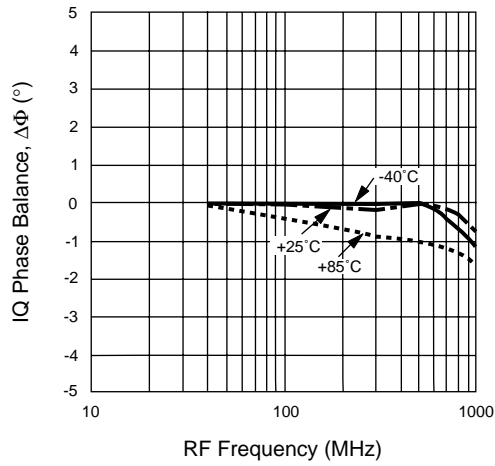
Pin No.	Pin Name	Pin Voltage Typ. (V)	Function and Explanation	Equivalent Circuit
11	Qout	3.3	Q-IF output pin. Output impedance is approximately 55 Ω. Output load should be approximately 250 Ω. Pin 11 and pin 12 are differential outputs. For single-ended applications, terminate unused output with equivalent impedance.	
12	$\overline{\text{Qout}}$	3.3		
13	GND (IF <sub>Q</sub> )	0.0	Ground pin of Q-IF block.	
14	LO (α)	2.2	Oscillator input of Q-Mixer. For single-ended applications, pin 15 should be bypassed to GND via a capacitor.	
15	LO ( $\overline{\alpha}$ )	2.2		
16	LO ( $\overline{i}$ )	2.2	Oscillator input of I-Mixer. For single-ended applications, pin 16 should be bypassed to GND via a capacitor.	
17	LO (i)	2.2		
18	GND (IF <sub>I</sub> )	0.0	Ground pin of I-IF block.	
19	$\overline{\text{lout}}$	3.3	I-IF output pin. Output impedance is approximately 55 Ω. Output load should be approximately 250 Ω. Pin 19 and pin 20 are differential outputs. For single-ended applications, terminate unused output with equivalent impedance.	
20	lout	3.3		

**TYPICAL PERFORMANCE CURVES** (TA = 25°C unless otherwise specified)

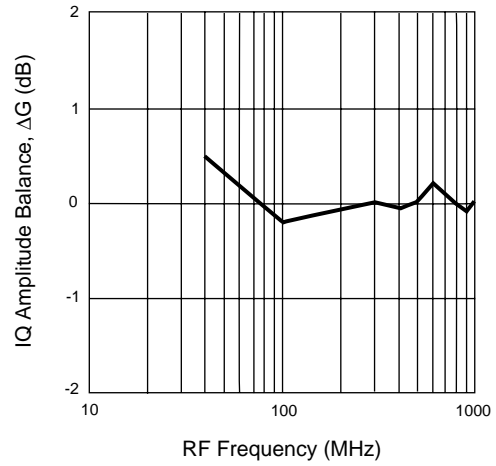


**TYPICAL PERFORMANCE CURVES** (TA = 25°C, fIF = 40 MHz, unless otherwise specified.)

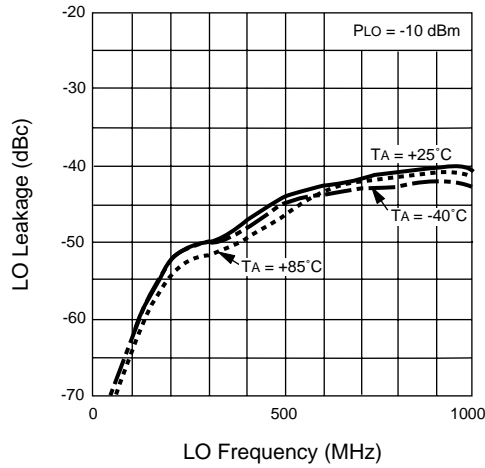
**IQ PHASE BALANCE vs. RF FREQUENCY AND TEMPERATURE**



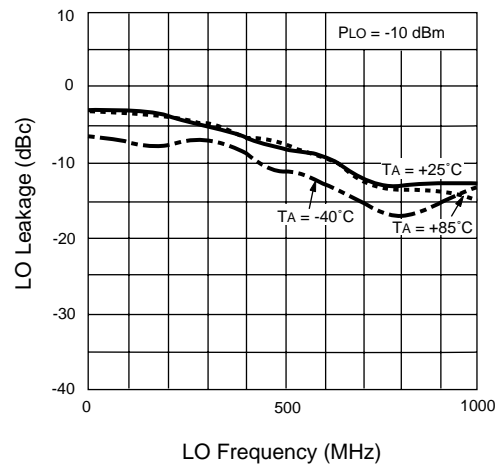
**IQ AMPLITUDE BALANCE vs. RF FREQUENCY**



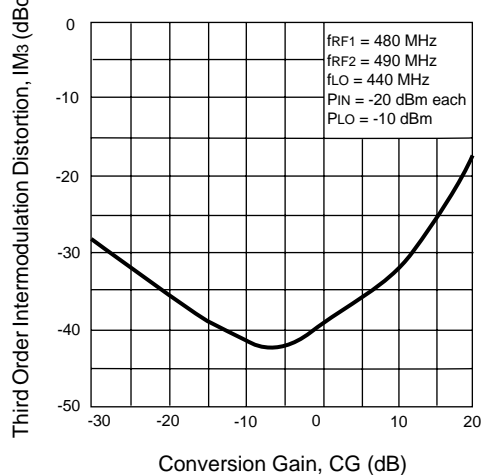
**LO LEAKAGE TO RF PORT vs. LO FREQUENCY AND TEMPERATURE**



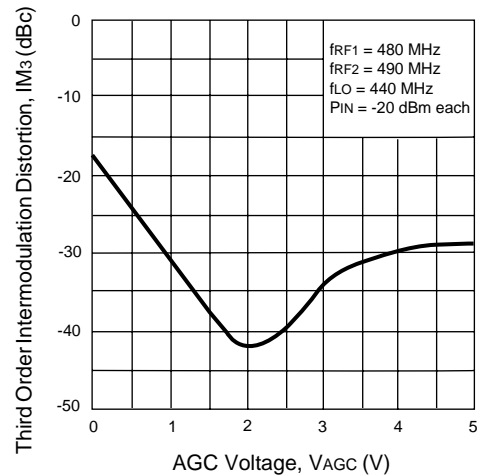
**LO LEAKAGE TO IF PORT vs. LO FREQUENCY AND TEMPERATURE**



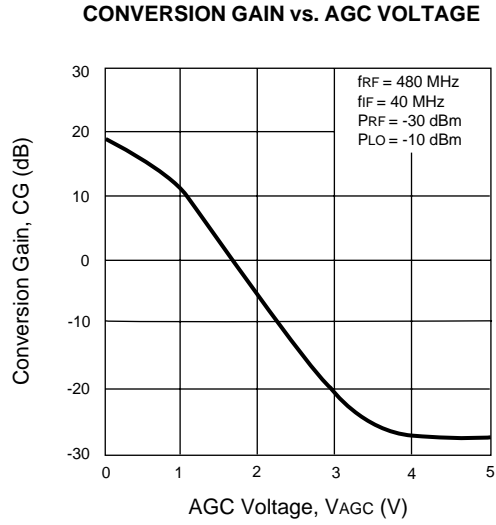
**THIRD ORDER INTERMODULATION vs. CONVERSION GAIN**



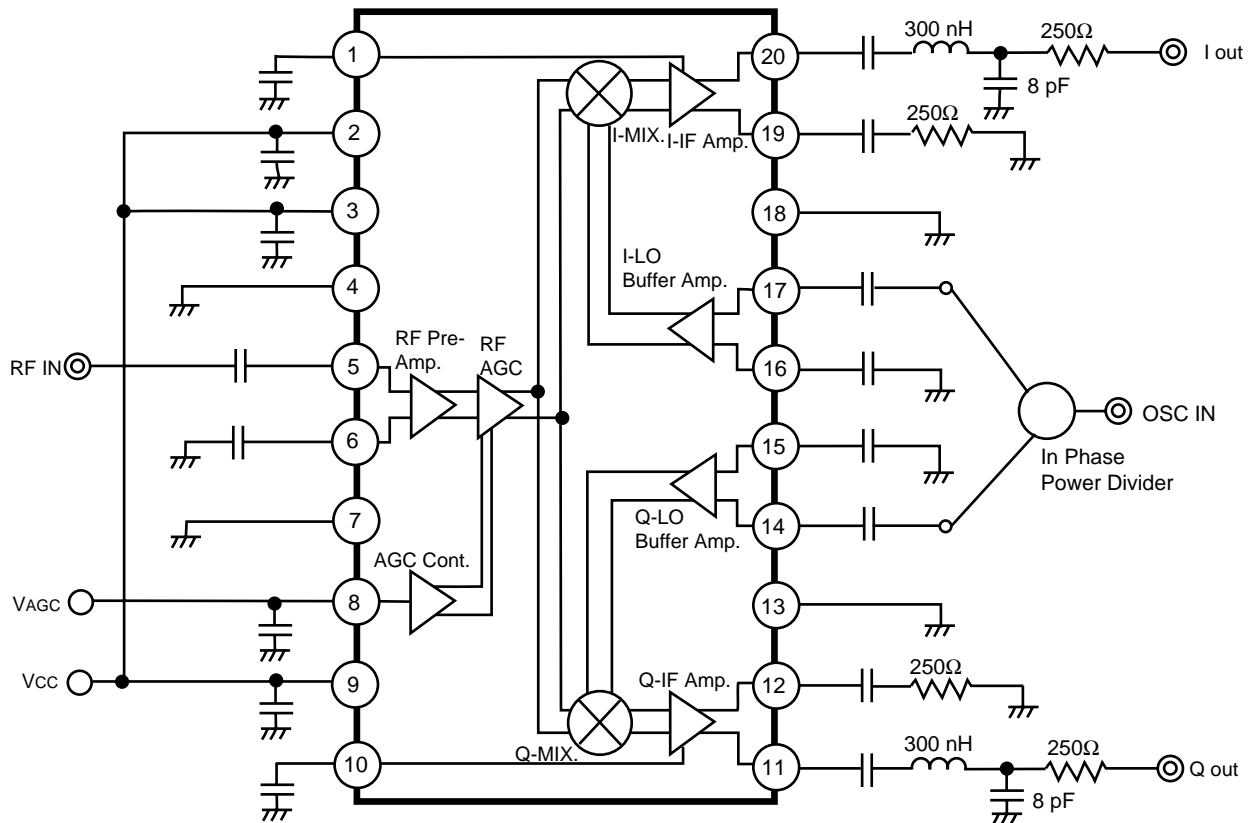
**THIRD ORDER INTERMODULATION vs. AGC VOLTAGE**



TYPICAL PERFORMANCE CURVES (TA = 25°C)



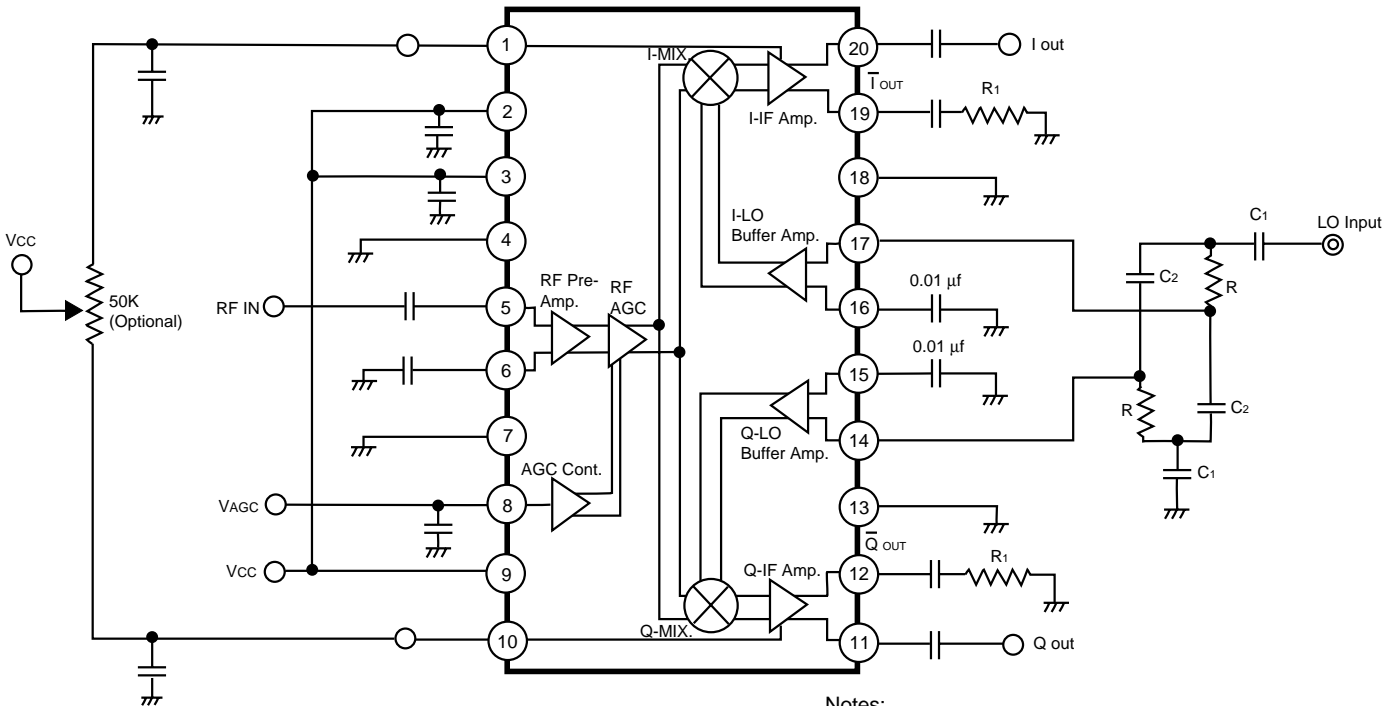
TEST CIRCUIT



Notes:

1. All capacitors are 1000 pF unless otherwise noted.
2. Low Pass Filter on I and QOUT minimizes LO Leakage.

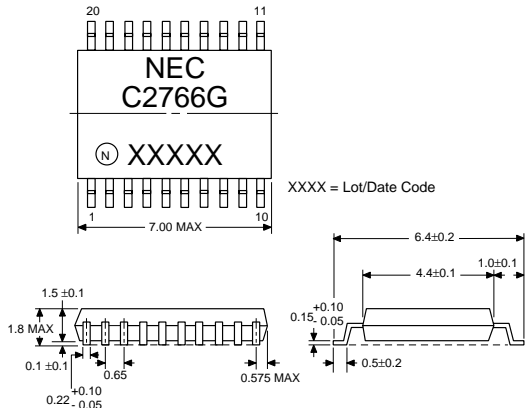
APPLICATION CIRCUIT



- Notes:
1. All capacitors are 1000 pF unless otherwise noted.
  2. Phase shifter element values  
 $X_{C1} \ll R @ f_{LO}$   
 $X_{C2} = R @ f_{LO}$
  3. Set R1 of IOUT and QOUT ports to match the load of IOUT and QOUT ports

OUTLINE DIMENSIONS (Units in mm)

PACKAGE OUTLINE SSOP 20

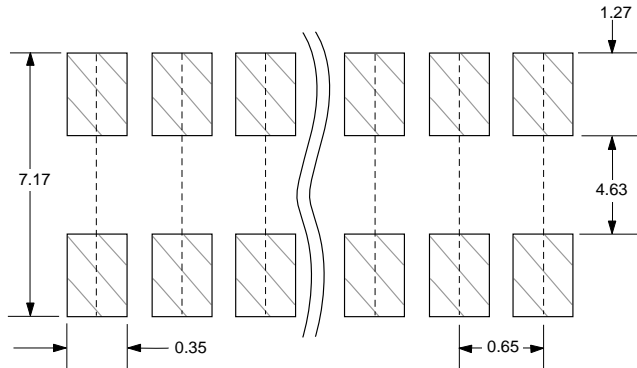


Lead Material: Alloy 42  
 Lead Plating: Lead Tin Alloy

LEAD CONNECTIONS

- |                 |               |
|-----------------|---------------|
| 1. I BIAS TRIM  | 11. Q OUT     |
| 2. Vcc (IFi)    | 12. Q OUT     |
| 3. Vcc (RF)     | 13. GND (IFq) |
| 4. GND (RF)     | 14. LOq       |
| 5. RF IN        | 15. LOq̄      |
| 6. RF IN        | 16. LOi       |
| 7. GND (RF)     | 17. LOi       |
| 8. VAGC         | 18. GND (IFi) |
| 9. Vcc (IFq)    | 19. I OUT     |
| 10. Q BIAS TRIM | 20. I OUT     |

RECOMMENDED PCB LAYOUT (Units in mm)



ORDERING INFORMATION

PART NUMBER	QUANTITY
UPC2766GR-E1	2500/Reel

Note:  
 Embossed Tape, 12 mm wide.