

FEATURES

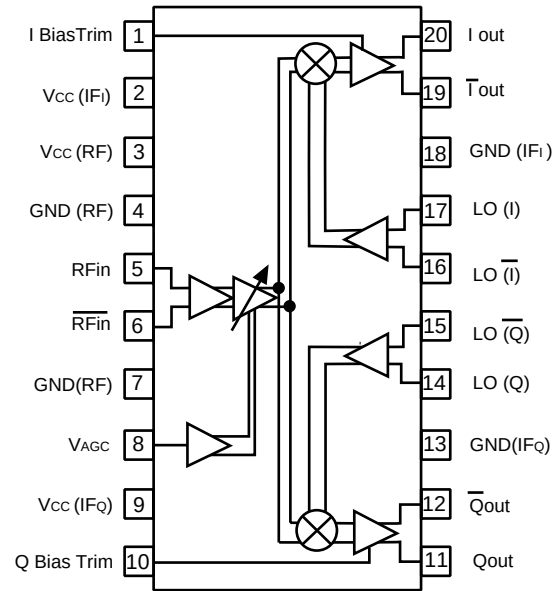
- **BROADBAND OPERATION**
RF & LO DC to 1 GHz
IF (IQ) DC to 100 MHz
- **WIDEBAND IQ PHASE AND AMPLITUDE MATCHING**
Amplitude Matching: ± 0.3 dB Typical
Phase Matching: $\pm 0.3^\circ$ (driven in phase)
- **AGC DYNAMIC RANGE:**
30 dB Typical
- **LOW DISTORTION:**
30 dBc Typical
- **SMALL SSOP 20 PACKAGE**
- **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 CHARACTERISTICS¹ ($T_A = 25^\circ\text{C}$, $V_{CC} = 5\text{ V}$, $Z_L = 50\ \Omega$)

PART NUMBER PACKAGE OUTLINE			UPC2766GR S20 (SSOP 20)		
SYMBOLS	PARAMETERS AND CONDITIONS	UNITS	MIN	TYP	MAX
I_{CC}	Circuit Current (no signal)	mA		60	78
f_{RF}	RF Input Bandwidth ² $f_{IF} = 40\text{ MHz}$, $f_{RF} > f_{LO}$, 3 dB down	MHz	DC-750	DC-1000	
f_{IF}	IF Output Bandwidth ³ $f_{RF} = 480\text{ MHz}$, $f_{RF} > f_{LO}$, 3 dB down, $V_{AGC} = 0\text{ V}$	MHz		200	
CG	Conversion Gain	dB	15	20	25
NF	Noise Figure	dB		21	
IM3	3rd Order Intermodulation Distortion $f_{RF1} = 480\text{ MHz}$, $f_{RF2} = 490\text{ MHz}$, $f_{LO} = 440\text{ MHz}$, $P_{IN} = -20\text{ dBm}$, $V_{AGC} = 1\text{ V}$	dBc		30	
$\Delta\Phi$	IQ Phase Balance (LO driven in phase)	deg		± 0.3	± 1.5
ΔG	IQ Amplitude Balance	dB		± 0.3	± 0.5
GAGC	AGC Range, $V_{AGC} = 0\text{--}5\text{ V}$	dB	40	45	
LO-RF	LO to RF Isolation	dB		55	
LO-IF	LO to IF Isolation	dB		10	
P_{SAT}	Saturated Output Level	dBm		+2	
V_O	Saturated Output Voltage ($Z_L = 250\ \Omega // 2\text{pF}$)	Vp-p	1.2	1.5	

Notes:

- $f_{RF} = 480\text{ MHz}$, $f_{IF} = 40\text{ MHz}$, $P_{LO} = -10\text{ dBm}$, $P_{RF} = -30\text{ dBm}$, $V_{AGC} = 0\text{ V}$, $f_{RF} > f_{LO}$ unless otherwise specified.
- RF Bandwidth defined as 3 dB down from response at $f_{RF} = 40\text{ MHz}$.
- IF Bandwidth defined as 3 dB down from response at $f_{IF} = 10\text{ MHz}$.

ABSOLUTE MAXIMUM RATINGS¹ ($T_A = 25^{\circ}\text{C}$)

SYMBOLS	PARAMETERS	UNITS	RATINGS
V _{CC}	Supply Voltage	V	6
P _D	Power Dissipation ²	mW	430
T _{OP}	Operating Temperature Range	°C	-40 to +85
T _{STG}	Storage Temperature	°C	-55 to +150

Notes:

- Operation in excess of any one of these parameters may result in permanent damage.
- Mounted on a 50x50x1.6 mm epoxy glass PWB ($T_A = 85^{\circ}\text{C}$).

**RECOMMENDED
OPERATING CONDITIONS**

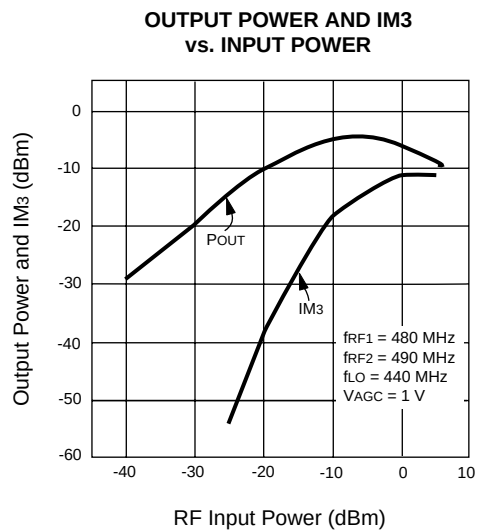
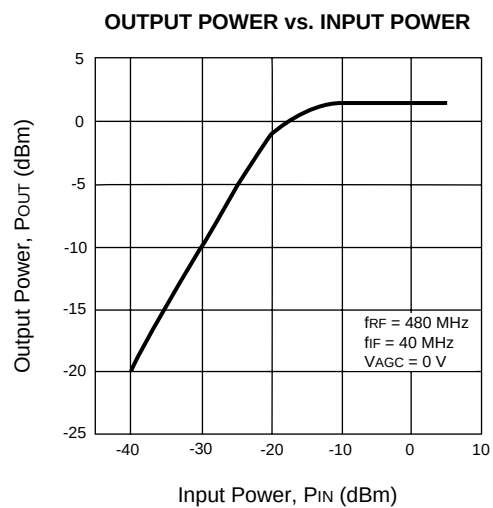
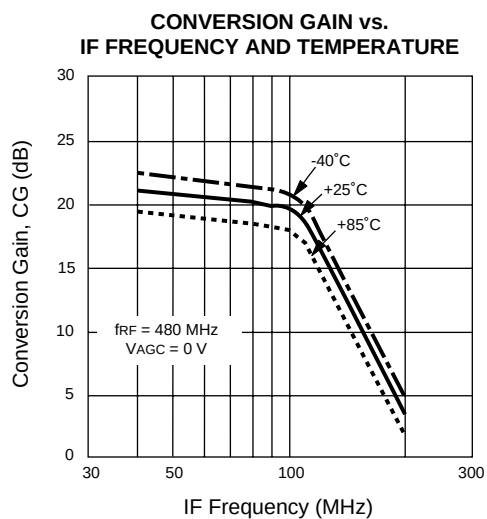
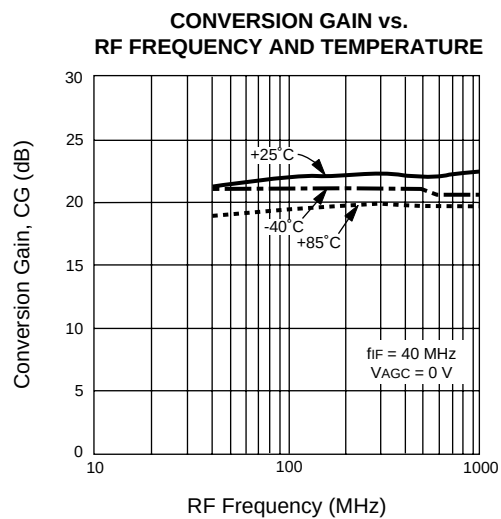
SYMBOLS	PARAMETERS	UNITS	MIN	TYP	MAX
V _{CC}	Supply Voltage	V	4.5	5.0	5.5
T _{OP}	Operating Temperature	°C	-40	+25	+85

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	V _{CC} (IFi)	5.0	Power supply pin of I-Mixer.	
3	V _{CC} (RF)	5.0	Power supply pin of RF and AGC block.	
4	GND (RF)	0.0	Ground pin of RF and AGC block.	
5	RF _{IN}	2.6	RF input pin. For single-ended applications, Pin 6 should be bypassed to GND via a capacitor.	
6	RF _{IN}	2.6		
7	GND (RF)	0.0	Ground pin of RF and AGC block.	
8	V _{AGC}	0~5	Gain control pin. • V _{AGC} = 0 V: Maximum Gain • V _{AGC} = 5 V: Maximum Attenuation	
9	V _{CC} (IF _Q)	5.0	Power supply pin of Q-Mixer	
10	Q Trim	4.2	Limiter control for Q-IF output.	

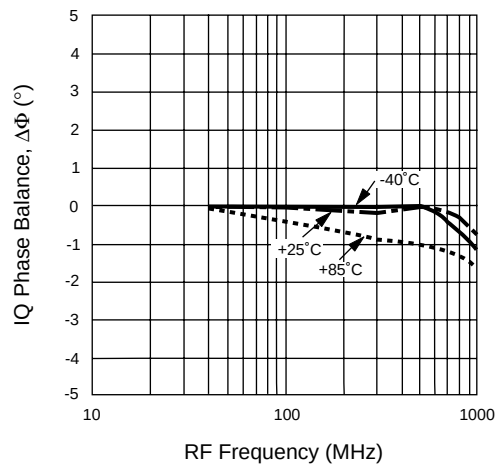
PIN FUNCTIONS

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 (IFQ)	0.0	Ground pin of Q-IF block.	
14	LO (Q)	2.2	Oscillator input of Q-Mixer. For single-ended applications, pin 15 should be bypassed to GND via a capacitor.	
15	LO ($\overline{\text{Q}}$)	2.2		
16	LO ($\overline{\text{I}}$)	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 I)	0.0	Ground pin of I-IF block.	
19	$\overline{\text{Iout}}$	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	Iout	3.3		

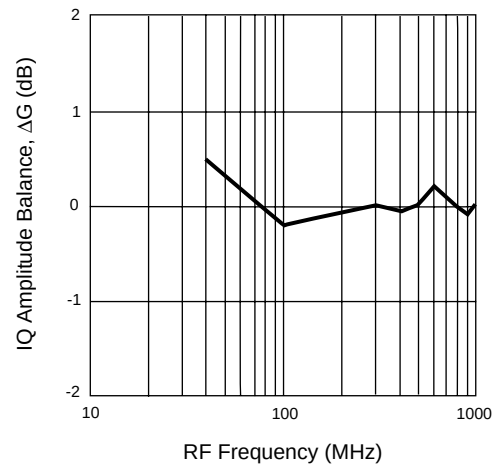
TYPICAL PERFORMANCE CURVES (TA = 25°C unless otherwise specified)

TYPICAL PERFORMANCE CURVES (T_A = 25°C, f_{IF} = 40 MHz, unless otherwise specified.)

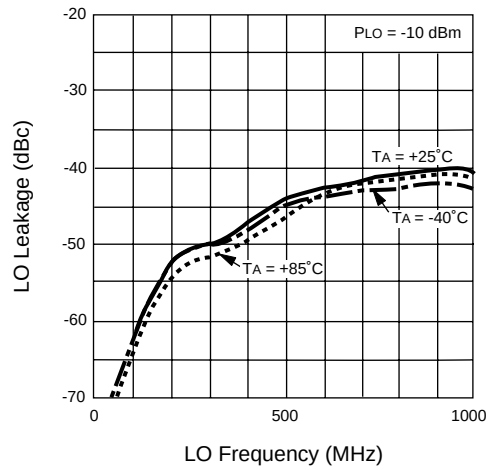
**IQ PHASE BALANCE vs.
RF FREQUENCY AND TEMPERATURE**



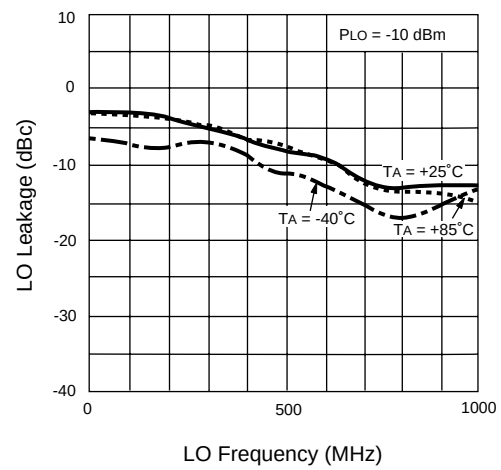
**IQ AMPLITUDE BALANCE
vs. RF FREQUENCY**



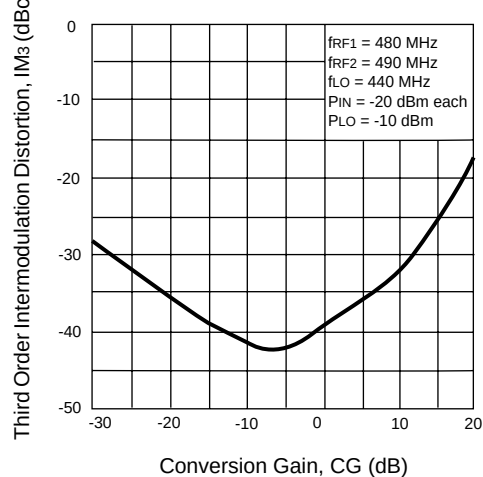
**LO LEAKAGE TO RF PORT vs.
LO FREQUENCY AND TEMPERATURE**



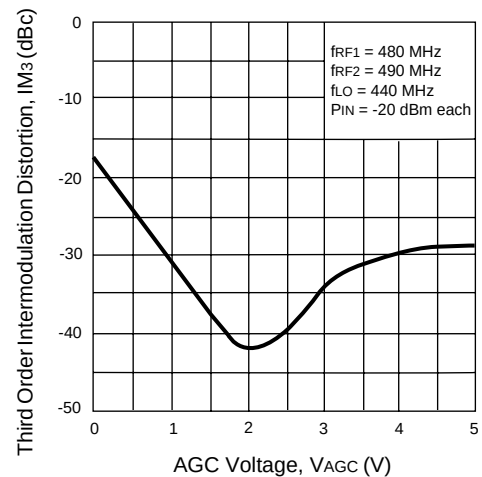
**LO LEAKAGE TO IF PORT vs.
LO FREQUENCY AND TEMPERATURE**



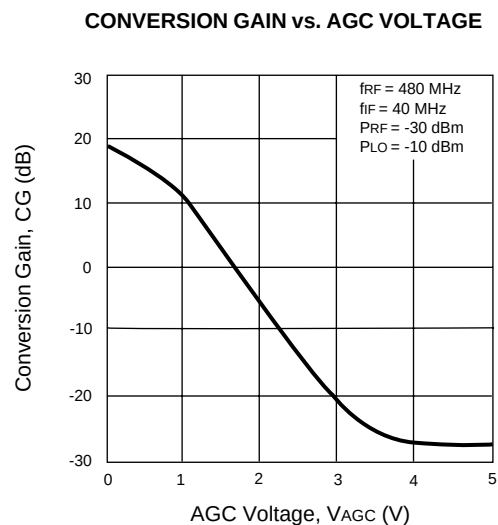
**THIRD ORDER INTERMODULATION
vs. CONVERSION GAIN**



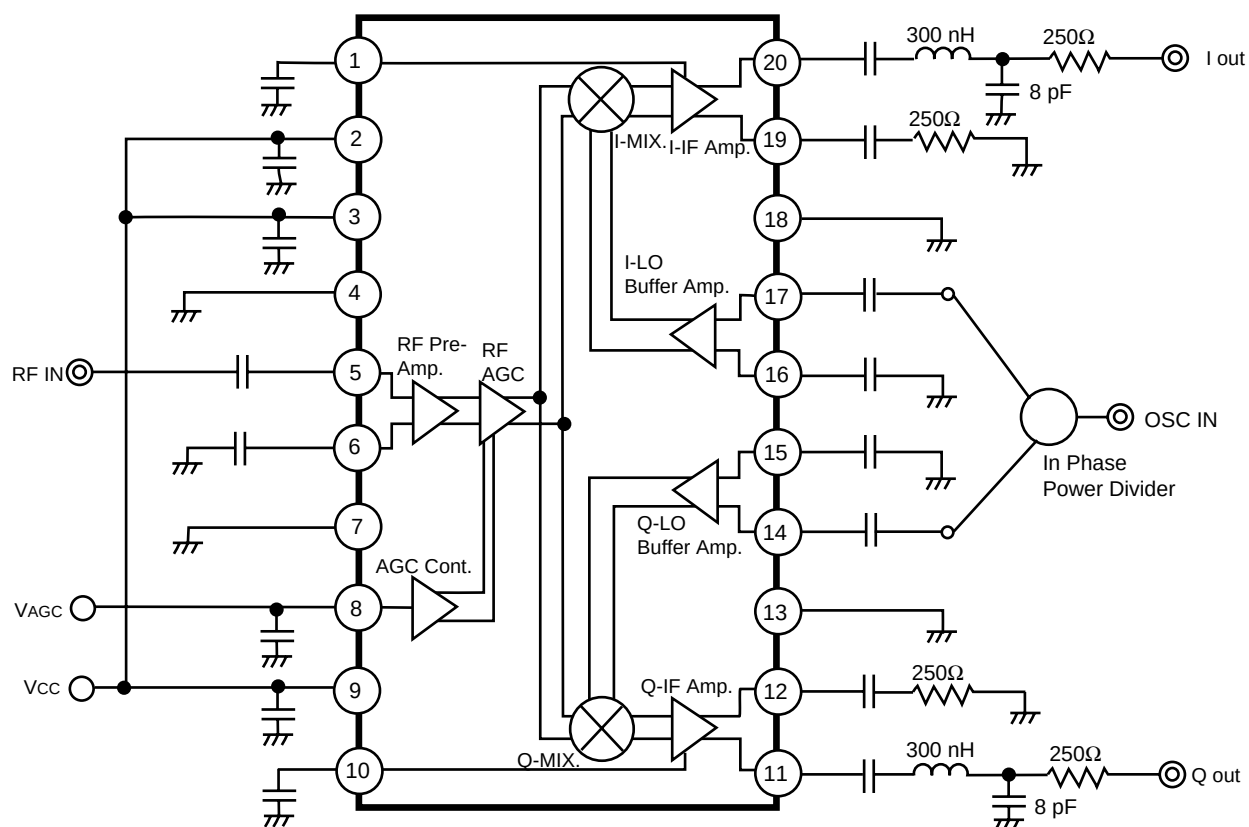
**THIRD ORDER INTERMODULATION
vs. AGC VOLTAGE**



TYPICAL PERFORMANCE CURVES (T_A = 25°C)



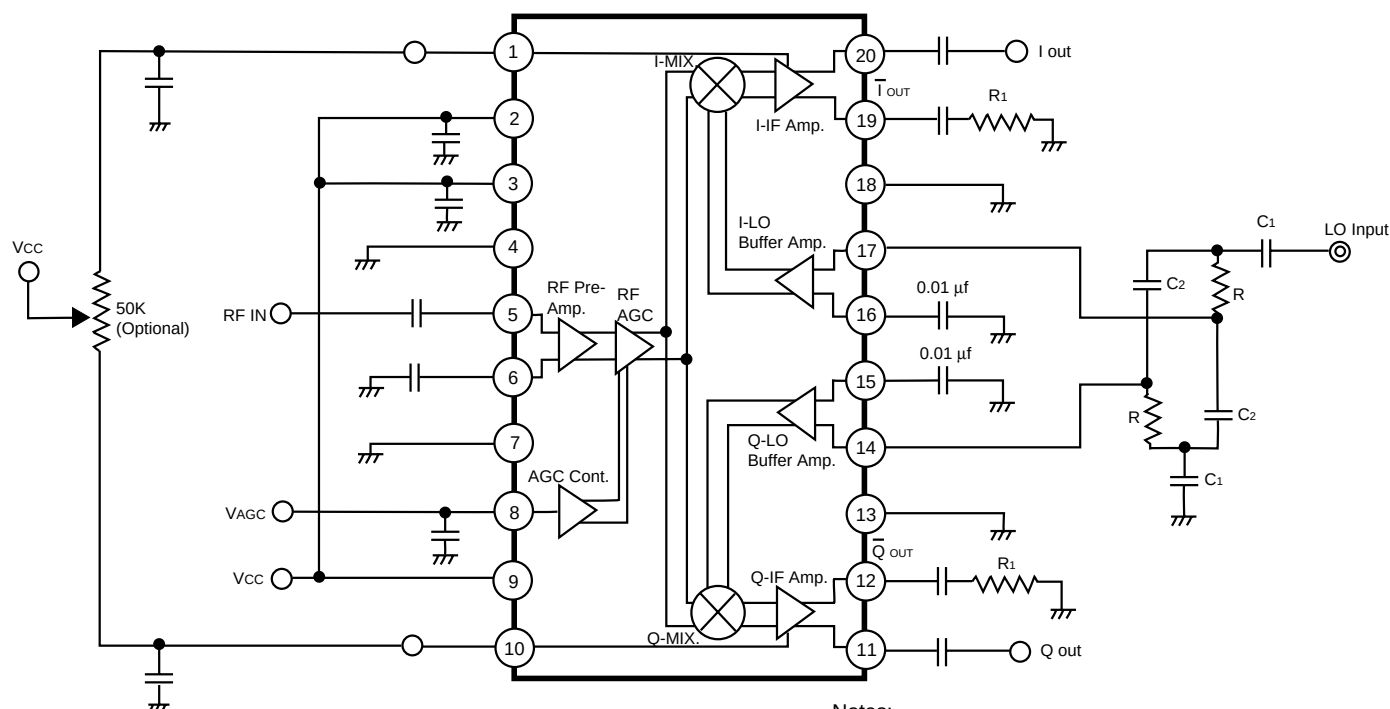
TEST CIRCUIT



Notes:

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

APPLICATION CIRCUIT

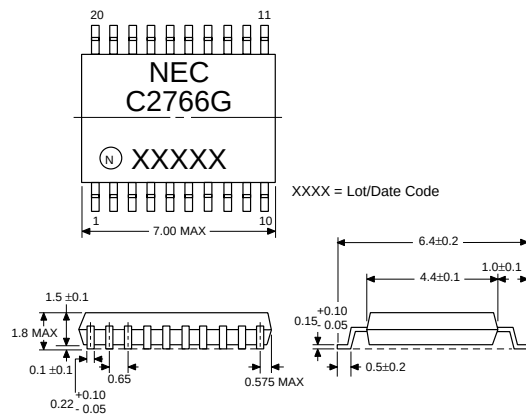


Notes:

1. All capacitors are 1000 pF unless otherwise noted.
2. Phase shifter element values
 $XC1 < R @ f_{LO}$
 $XC2 = R @ f_{LO}$
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



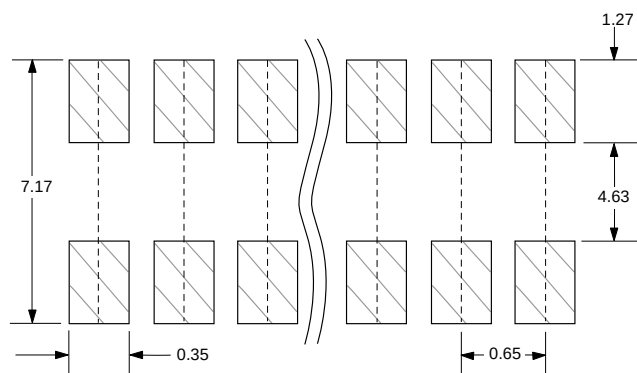
Lead Material: Alloy 42

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. LOQ |
| 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.