RC2798

Integrated QAM IF Downconverter

Features

- RF input frequency range 30 to 250MHz
- On chip VCO with LO frequency range 30 to 250MHz
- IF amplifier with AGC setting
- High dynamic range -9dBm IIP3
- On chip Video Amplifier
- Built in ESD protection
- Supply voltage range 5 to 10 V
- Space saving 20-Lead TSSOP package

Applications

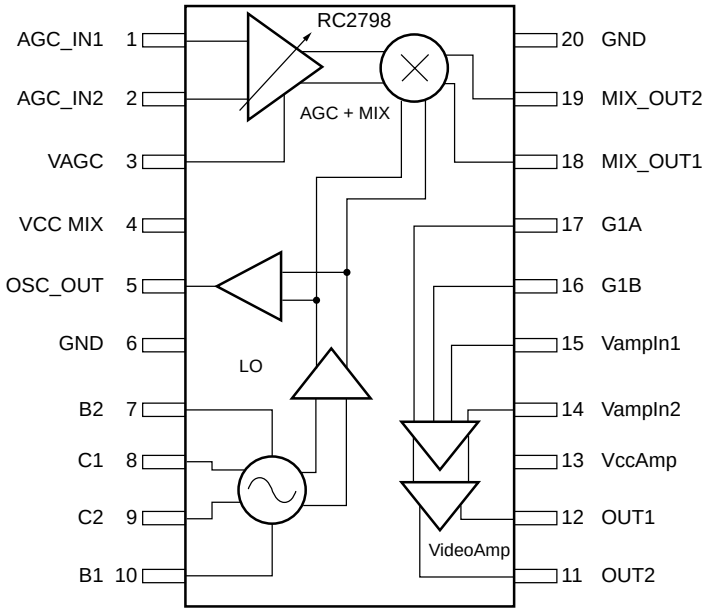
- Digital Set-top receivers
- Cable modems
- Internet surfboards
- Network Interface Modules
- Multimedia PCs

Description

The RC2798 is an integrated solution for the down-conversion of QAM IF signals in the front-end design of cable modem and set-top receivers. It is intended for use in 64QAM and 256QAM IF downconversion applications. The RC2798 integrates IF amplifier with AGC , mixer, VCO, and a video amplifier on a single chip. It accepts the QAM IF signals via SAW filter and downconverts it to 5MHz baseband signal.

The baseband signal can be digitized using Fairchild Semiconductor's 8 bit A/D (TMC1175 series) or 10bit A/D (TMC1185 series) and decoded further with a QAM demodulator. The IF, Oscillator and Mixer section work at 5V. The video amplifier works at 5V to 10V. The RC2798 is available in a 20 Lead TSSOP package.

Block Diagram



Absolute Maximum Ratings (T_A = 25°C unless otherwise specified)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
Video Amplifier 5V Operation						
Vcc_Mix	Supply voltage 1 (for AGC amplifier, oscillator, and mixer)	AGC amplifier, oscillator, and mixer block			6	V
VccVamp	Supply voltage 2 (for video amplifier)	Video amplifier block			6	V
P_D	Power dissipation	T_A = 85°C[1]			430	mW
T_A	Operation temperature range		-40		+85	°C
Tstg	Storage temperature range		-55		+150	°C
Video Amplifier 9V Operation						
Vcc_Mix	Supply voltage 1 (for AGC amplifier, oscillator, and mixer)	AGC amplifier, oscillator, and mixer block			6	V
VccVamp	Supply voltage 2 (for video amplifier)	Video amplifier block			11	V
P_D	Power dissipation	T_A = 75°C[1]			500	mW
T_A	Operation temperature range		-40		+75	°C
Tstg	Storage temperature range		-55		+150	°C

Notes:

1. Mounted on 50 X 50 X 1.6mm double epoxy glasss board.

Recommended Operating Range

Parameter		Min.	Typ.	Max.	Unit
Vcc_Mix	Supply voltage 1 (for AGC amplifier, oscillator, and mixer)	4.5	5.0	5.5	V
VccVamp	Supply voltage 2 (for video amplifier)	4.5	5.0	10.0	V
Ta1	Operation temperature range 1[1]	-40	+25	+85	°C
Ta2	Operation temperature range 2[2]	-40	+25	+75	°C

Notes:

1. @ Vcc_Mix = VccVamp = 4.5 to 5.5V
2. @ Vcc_Mix = 4.5 to 5.5V, VccVamp = 4.5 to 10.0V

Electrical Characteristics (T_A = 25°C)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
AGC Amplifier, Oscillator, and Mixer Blocks (Vcc = 5V)						
Icc1	Supply current 1	no input signal	17.0	23.0	31.0	mA
f_{RF}	RF input frequency range		30		250	MHz
f_{OSC}	OSC frequency range		30		250	MHz
f_{IF}	IF output frequency range		DC		150	MHz
CG_{MAX}	Maximum conversion gain	V_{AGC} = 4.0V		25		dB
CG_{MIN}	Minimum conversion gain	V_{AGC} = 1.0V		-7		dB
GCR	AGC dynamic range	V_{AGC} = 1.0 to 4.0V	24	32	40	dB
NF	Noise figure	SSB, V_{AGC} = 4.0V At maximum gain		9		dB
V_{AGC} H	AGC voltage high level	At maximum gain	4.0			V
V_{AGC} L	AGC voltage low level	At minimum gain			1.0	V
Video Amplifier Block (Vcc = 5V)						
Icc2	Supply current 2	No input signal	7.0	12.5	17.0	mA
V_{OUT}	Output voltage	RL = 1KΩ, differential		3.0		Vp-p
G1	Differential gain 1	G1A-G1B pins: short, V_{OUT} = 3Vp-p	150	200	250	V/V
G2	Differential gain 2	G1A-G1B pins: open, V_{OUT} = 3Vp-p	22.0	26.0	30.0	V/V
Video Amplifier Block (Vcc = 9V)						
Icc2	Supply current 2	no input signal	18.0	24.0	32.0	mA
V_{OUT}	Output voltage	RL = 1KΩ, differential		3.0		Vp-p
G1	Differential gain 1	G1A-G1B pins: short, RL = 2KΩ	300	385	470	V/V
G2	Differential gain 2	G1A-G1B pins: open, RL = 2KΩ	25.0	28.5	32.0	V/V
Video Amplifier Block (Vcc = 5V or 9V)						
BW_{G1}	Bandwidth 1	G1		50		MHz
BW_{G2}	Bandwidth 2	G2		50		MHz
Rin1	Input resistance 1	G1		3.5		KΩ
Rin2	Input resistance 2	G2		7.5		KΩ
Cin	Input capacitance			1.6		pF

Standard Characteristics (V_{CC} = 5V, T_A = 25°C)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
AGC Amplifier Block (Vcc = 5V)						
AGC IIP3	AGC input intercept point	At minimum gain (AGC amplifier + mixer)		-9		dBm
Video Amplifier Block (Vcc = 5V or 9V)						
CMRR	Common mode rejection ratio			80		dB
PSRR	Power supply rejection ratio			70		dB
τ_r	Rise time			2.6		nS
τ_{PD}	Propagation delay time			4.4		nS

Typical Characteristics

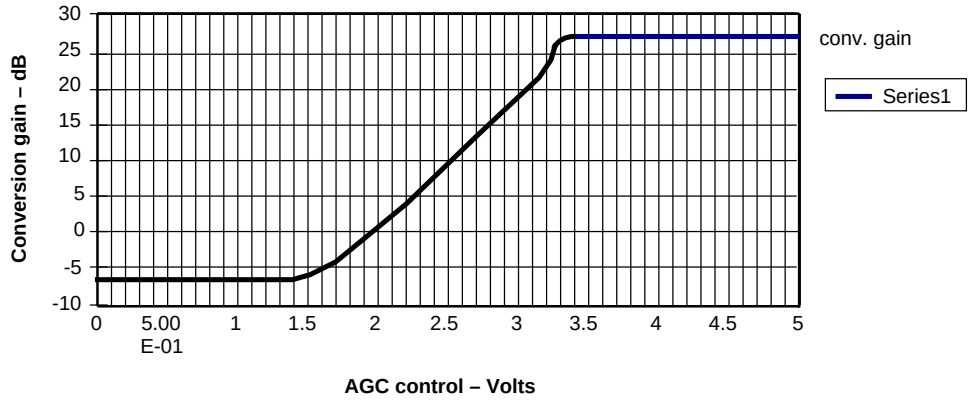


Figure 1. AGC Control Characteristics

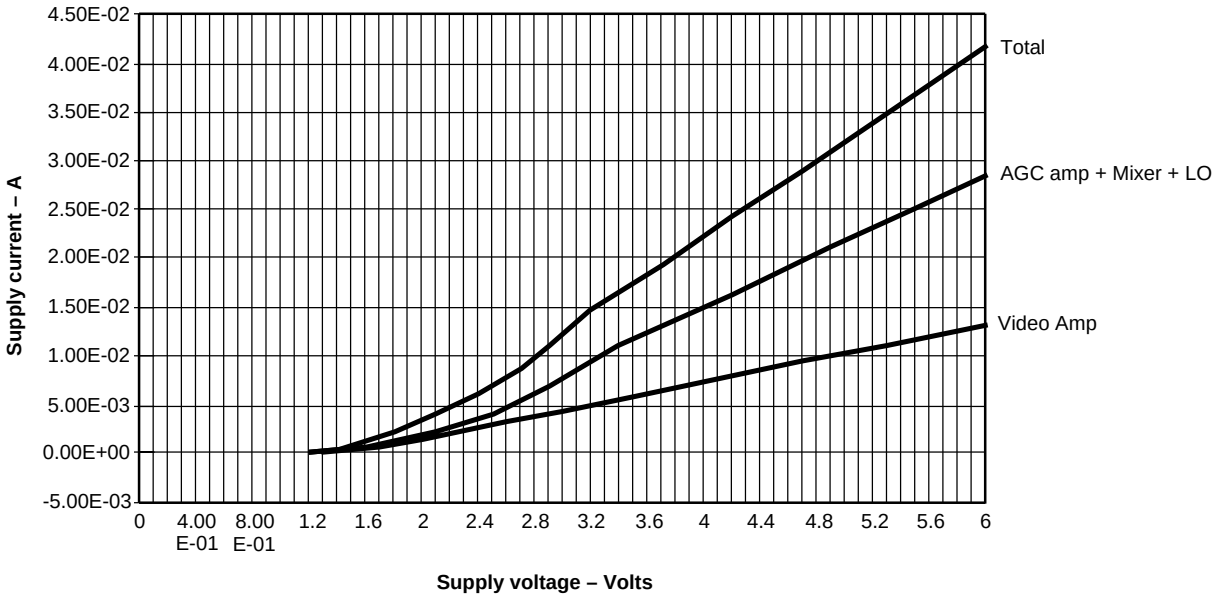


Figure 2. Supply Current vs. Supply Voltage

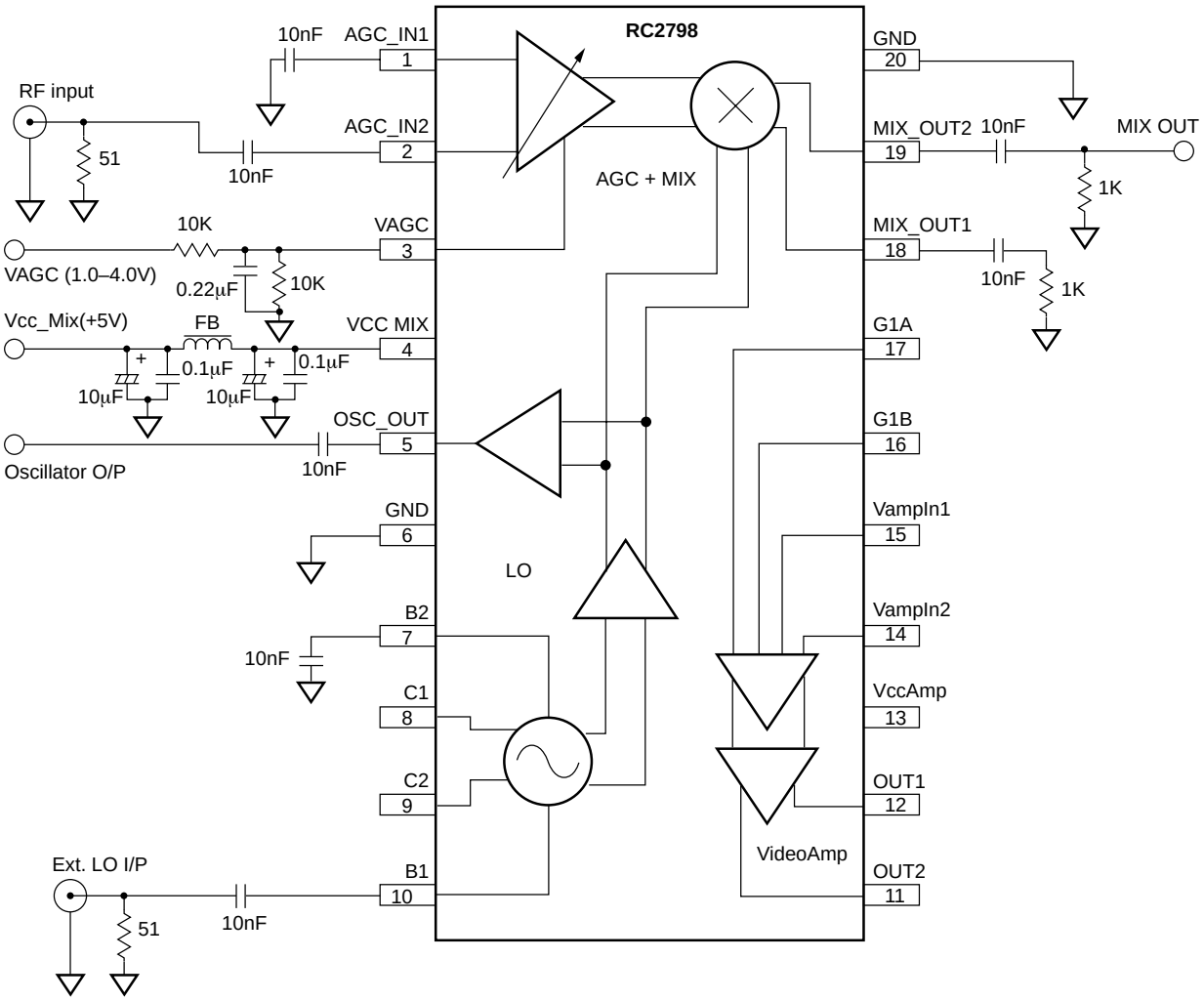


Figure 3. Measurement Circuit 1—AGC + MIX Block

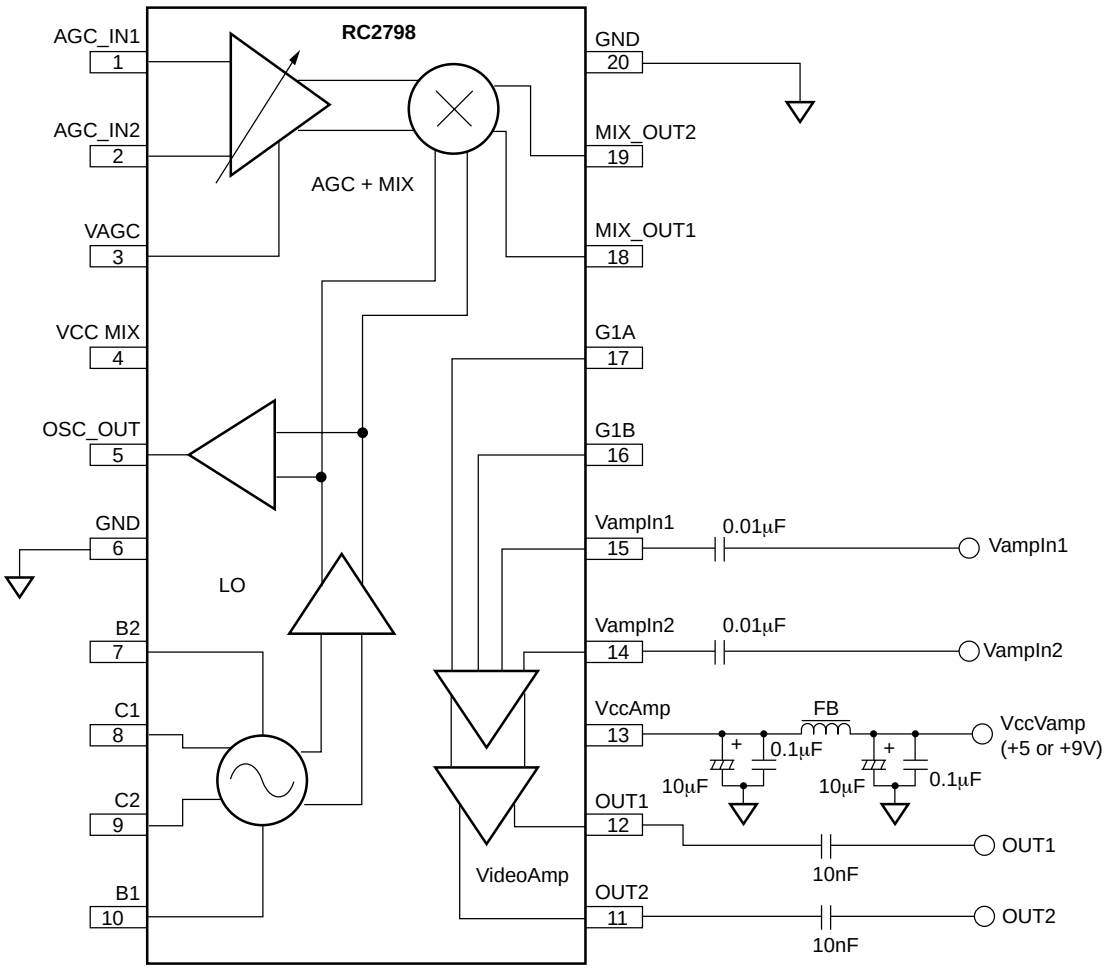
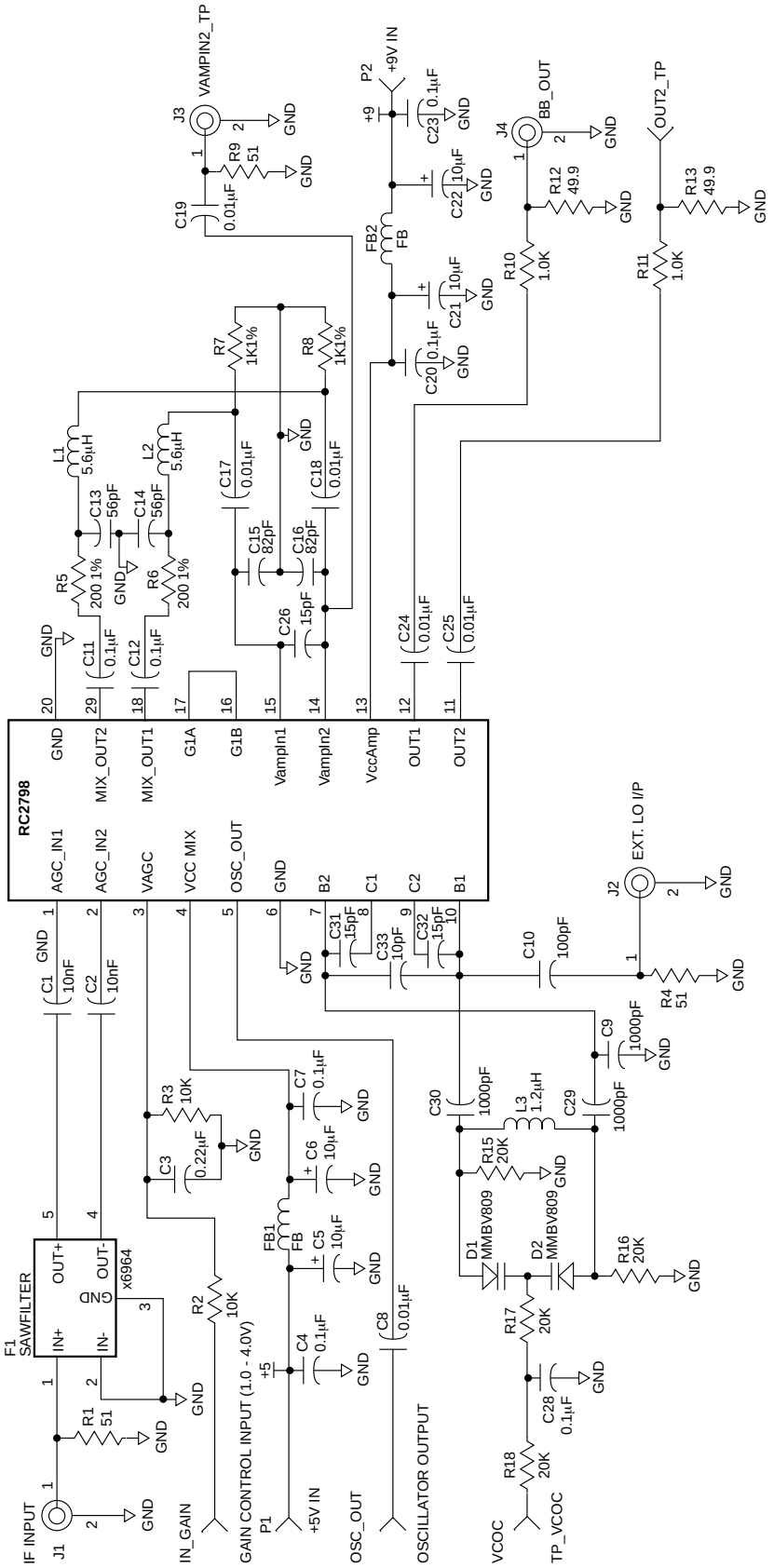


Figure 4. Measurement Circuit 2—Video Amplifier Block

Applications Discussion



Notes:
1. For self oscillation, do not load C9, and C10.
2. Fro external injection (VCO), do not load C28, C29, C30, C31, C32, C33, L3, D1, D2, R15, R16, R17, and R18.
3. For down convesion with video amplifier, do not load C19.
4. For using video amplifier only, do not load C17, C18, C16, C26, and change C15 to 0.1µF.

Figure 5. Application Circuit

Crystal Oscillator Implementation

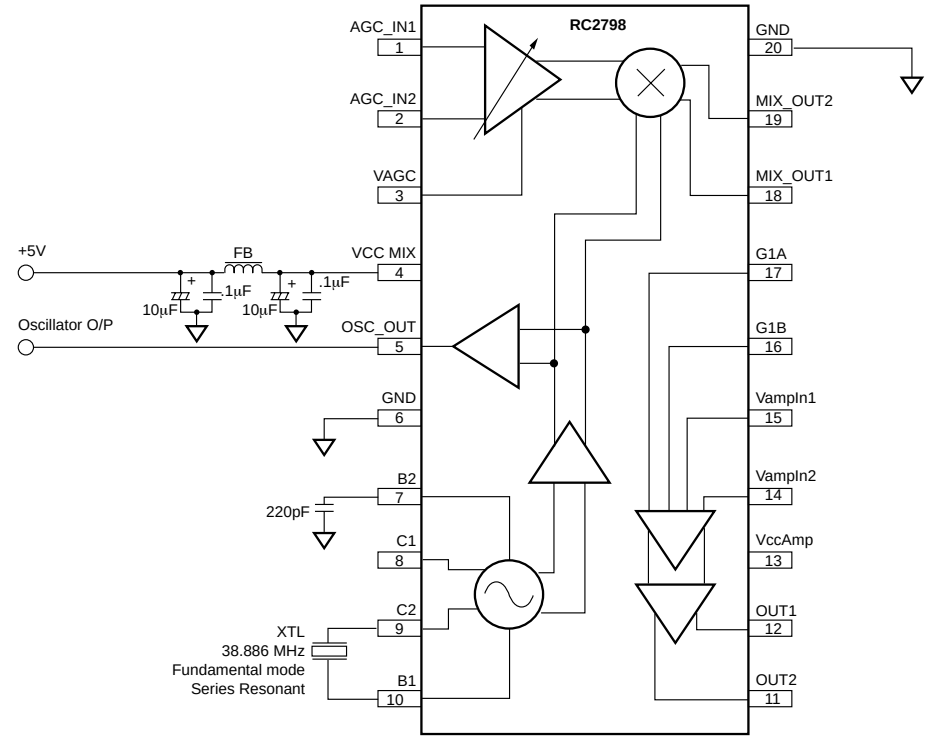


Figure 6. Fundamental Mode—Series Resonant XTL

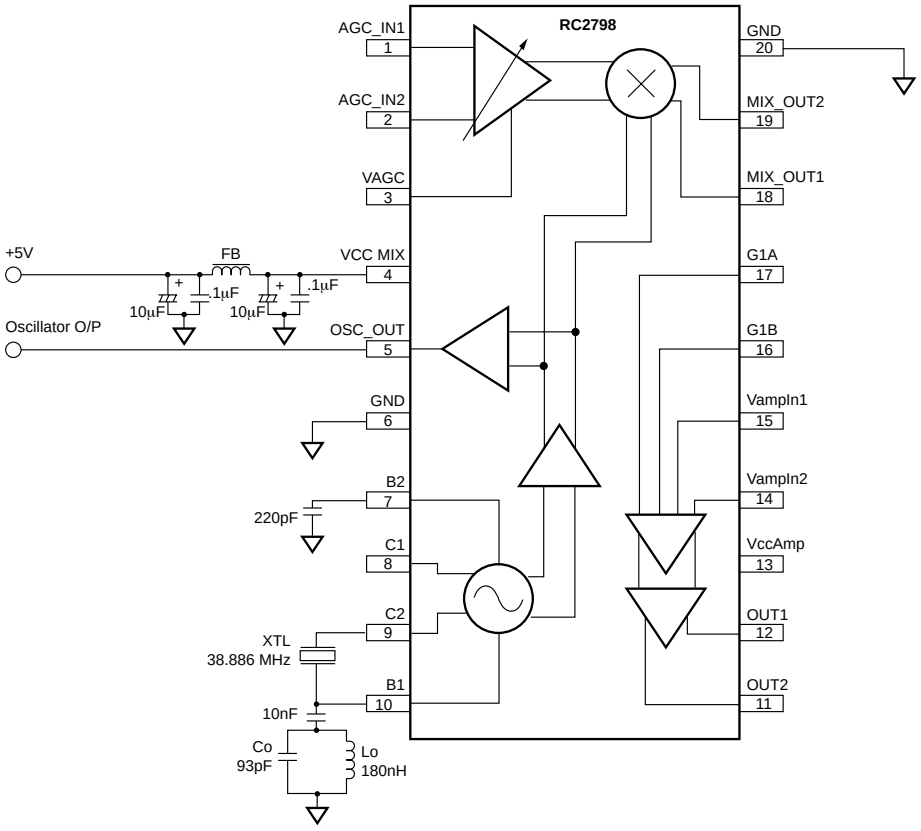


Figure 7. Overtone Mode—Series Resonant XTL

Overtone Mode—Series Resonant XTL

If it is desired to operate a XTL at non-fundamental or overtone frequency, an AC coupled parallel resonant network should be connected to feedback input pin, B1. The typical impedance looking into B1 with B2 AC grounded is approximately Rin =1KΩ @ 38MHz. It is recommended to design the value of Qo at approximately 15 to 25. The Lo and Co values can be calculated from the following equations:

$$Qo = \omega_o \, Co \, Rin$$

$$\omega_o = 2\pi \; fo = (1/LoCo)^{1/2}$$

The XTL is a series resonant type and it is operated at third overtone frequency.

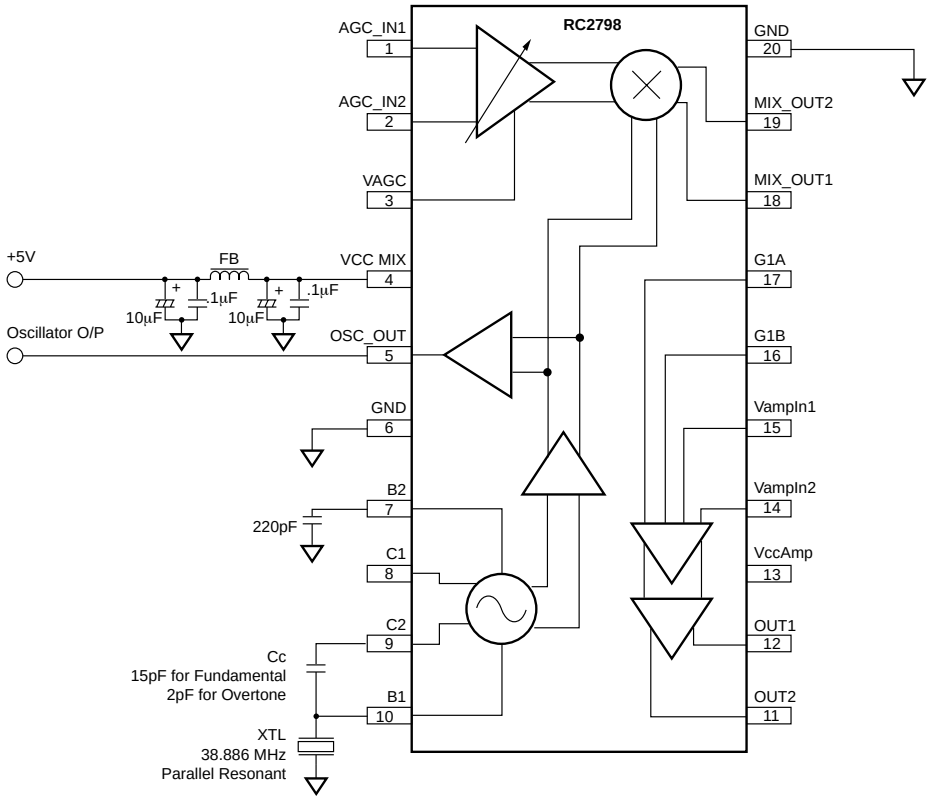


Figure 8. Fundamental or Overtone Mode—Parallel Resonant XTL

Fundamental or Overtone Mode– Parallel Resonant XTL

Figure 8 shows the implemenation of parallel resonant XTL at fundamental or overtone frequency. The XTL is a parallel resonant type and can be operated at either fundamental or third overtone frequency depending upon the feedback capacitor, Cc. When used with Cal Crystal Lab's XTL, P/N#CCL-6-38.8860G153, for Cc = 15pF it operates at fundamental mode and for Cc = 2pF, it operates at third overtone mode (38.886MHz).

For symmetrical reasons, the following design is recommended for better duty cycle (50 to 50%) output from VCO (see Figure 9).

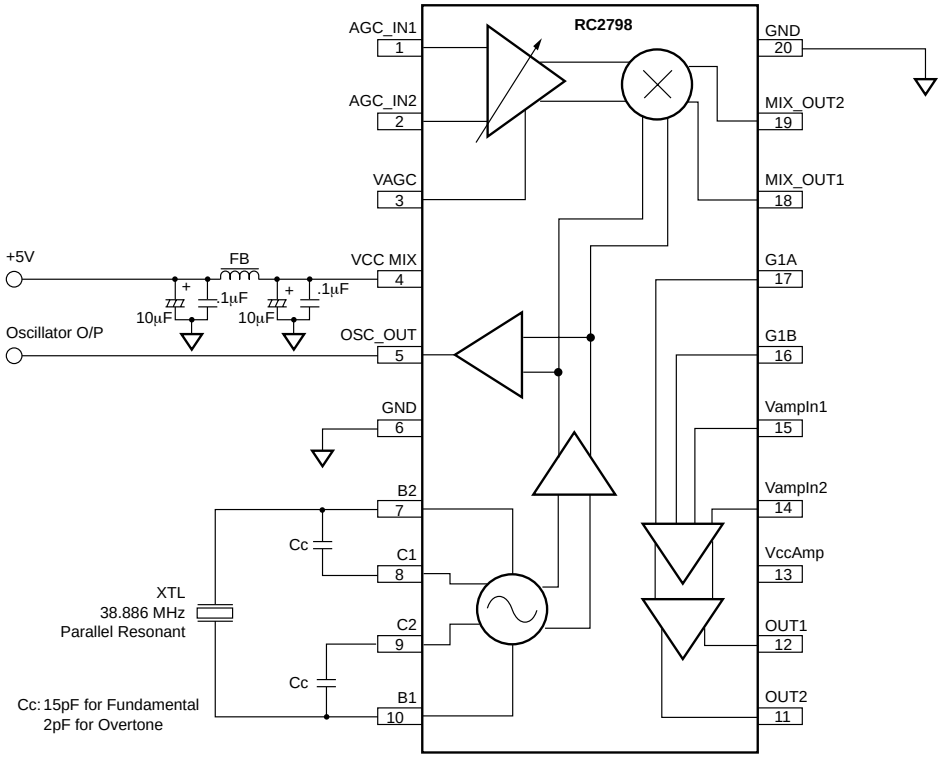


Figure 9. Fundamental or Overtone Mode with Improved Duty Cycle—Parallel Resonant XTL

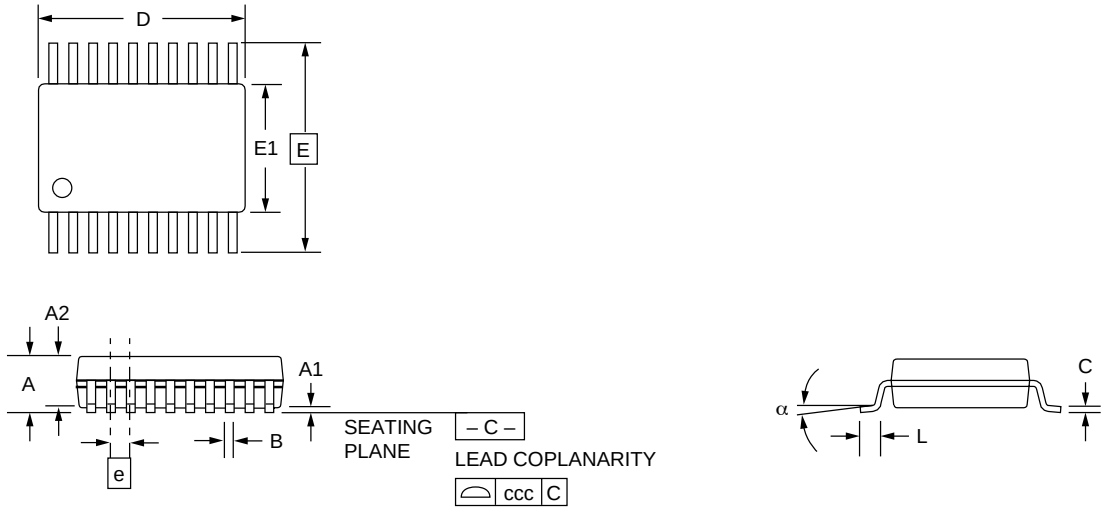
Package Dimensions

20-pin TSSOP package

Symbol	Inches		Millimeters		Notes
	Min.	Max.	Min.	Max.	
A	—	.047	—	1.20	
A1	.002	.006	0.05	0.15	
A2	.031	.041	0.80	1.05	
B	.007	.012	0.19	0.30	5
C	.004	.008	0.09	0.20	5
D	.250	.257	6.40	6.60	2, 4
E	.240	.264	6.10	6.70	
E1	.168	.176	4.30	4.50	
e	.026 BSC		0.65 BSC		
L	.018	.029	0.45	0.75	3
N	20		20		6
α	0°	10°	0°	10°	
ccc	—	.004	—	0.10	

Notes:

1. Dimensioning and tolerancing per ANSI Y14.5M-1982.
2. "D" and "E1" do not include mold flash. Mold flash or protrusions shall not exceed .010 inch (0.25mm).
3. "L" is the length of terminal for soldering to a substrate.
4. Terminal numbers are shown for reference only.
5. "B" & "C" dimensions include solder finish thickness.
6. Symbol "N" is the maximum number of terminals.



Ordering Information

Product Number	Package
RC2798G	20 pin TSSOP

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Contents

Datasheet
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This pagePrint version

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How to order products
Product Change Notices (PCNs)
Support
Distributor and field sales representatives
Quality and reliability
Design tools

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back to top

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back to top

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back to top

Product status/pricing/packaging

Product	Product status	Pricing*	Inventory check & ordering	Package marking	Packing method
RC2798G	Lifetime Buy	$1.43	Purchase	$Y&Z&2&T RC2798G	RAIL
RC2798GT	Lifetime Buy	$1.43	Purchase	$Y&Z&2&T RC2798G	TAPE REEL

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back to top