



MediaTek Inc.

MT6189 Data Sheet

21 December 2005

V0.9

MT6189 Data Sheet



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1 Introduction

1.1 Features

- 1 Fully integrated single-chip for FM radio
- 2 Cover EURO/US/Japan FM bands
- 3 Low power consumption 9mA
- 4 Power supply 2.5V~3.6V
- 5 I²C/3-wire serial interface
- 6 Internal RF AGC control circuit
- 7 Power down mode
- 8 Fully integrated FM demodulator
- 9 Fully integrated channel filter and limiter
- 10 Signal dependent stereo blend and soft mute
- 11 High cut control
- 12 Adjust-free stereo decoder
- 13 Stereo audio outputs for audio amplifiers
- 14 Fewer external components
- 15 No manually tunable parts required
- 16 10-bit IF counter
- 17 4-bit RSSI register
- 18 High SNR
- 19 High sensitivity
- 20 Low distortion
- 21 Integrated VCO circuit with only one external inductor
- 22 Operates with a standard 32.768kHz crystal or externally applied 32.768k/13/26MHz clock
- 23 Small 6x6 mm² 40-pin QFN Package

1.2 Applications

Flash MP3, Cell Phone, Portable Radio.

1.3 General Descriptions

MT6189 is a highly integrated FM radio IC for low power portable devices. The radio can tune the EURO/US/Japan FM bands. The MT6189 includes LNA and mixer with AGC, integrated channel filter, limiter amplifier, 4bit RSSI indicator, IF counter, FM demodulator, stereo decoder, and an integrated VCO with only one off-chip inductor. The MT6129 includes control circuits to implement different operating modes. The device is housed in a small size 40-pin QFN SMD package.

A functional block diagram of the MT6189 and its pin assignment is shown in Figure 1.



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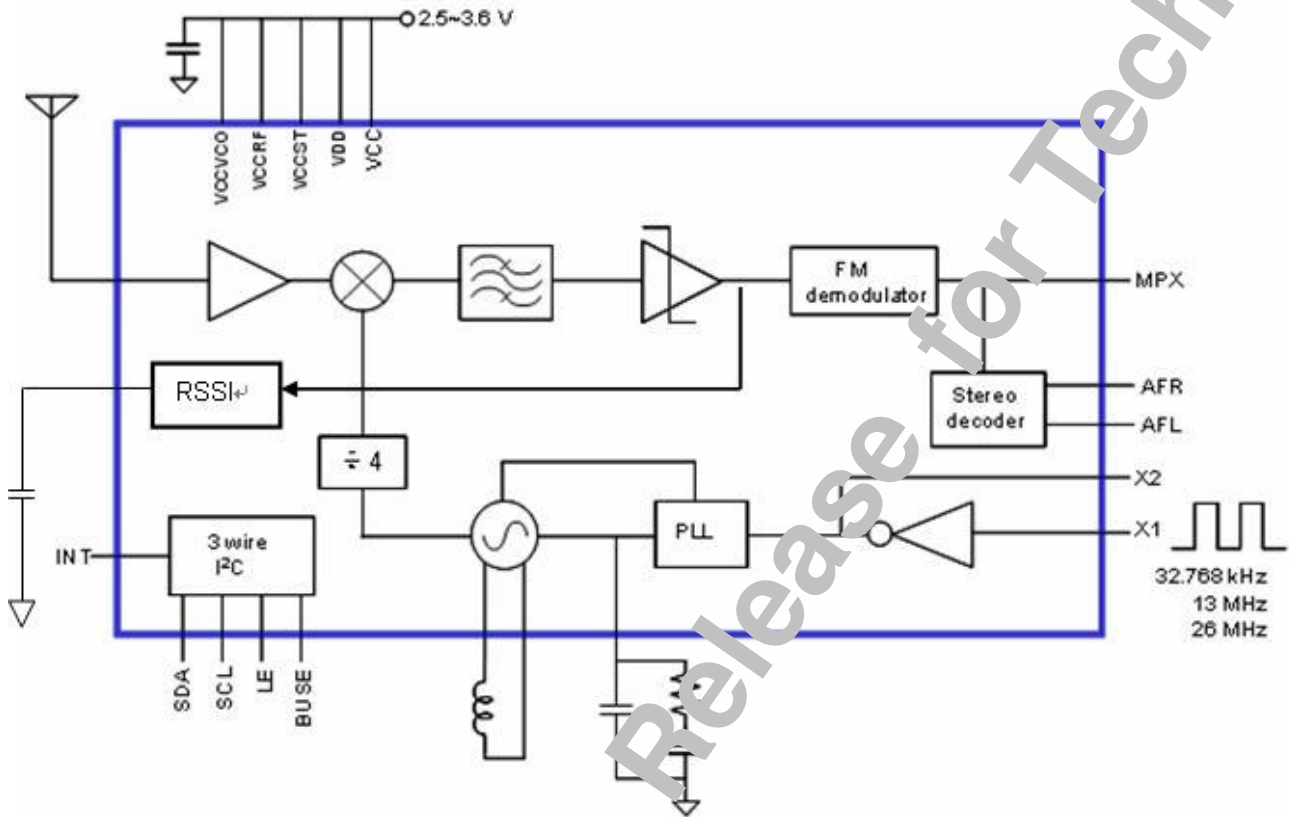


Figure 1 MT6189 Function Block Diagram



1.4 Pin Assignments and Descriptions

Pin No.	Pin Name	I/O	Description
1	AFR	output	Right audio output
2	VCC	power	Audio power supply input
3	NC	NC	Leave this pin no connect
4	NC	NC	Leave this pin no connect
5	NC	NC	Leave this pin no connect
6	GND	ground	Audio ground
7	VCCRF	power	RF power supply input
8	RFINN	input	RF signal input negative
9	RFINP	input	RF signal input positive
10	GNDRF	ground	RF ground
11	NC	NC	Leave this pin no connect
12	NC	NC	Leave this pin no connect
13	VCCVCO	power	VCO power supply input
14	GNDVCO	ground	VCO ground
15	INDP	input	VCO inductor positive
16	INDN	input	VCO inductor negative
17	CP	Input/output	PLL loop filter
18	NC	NC	Leave this pin no connect
19	NC	NC	Leave this pin no connect
20	X1/XIN	input	32.768kHz Crystal positive input or external 32.768k/13/26MHz clock input
21	X2	Input/output	32.768kHz Crystal negative input or reference clock output
22	NC	NC	Leave this pin no connect
23	NC	NC	Leave this pin no connect
24	NC	NC	Leave this pin no connect
25	NC	NC	Leave this pin no connect
26	MPX	output	FM demodulated output
27	NC	NC	Leave this pin no connect
28	VCCST	power	Stereo decoder power supply input
29	GNDST	ground	stereo decoder ground
30	INT	output	Hardware interrupt
31	NC	NC	Leave this pin no connect
32	NC	NC	Leave this pin no connect
33	LE	input	3wire Latch
34	SDA	input	I ² C/3wire serial data
35	SCL	input	I ² C/3wire serial clock input
36	NC	NC	Leave this pin no connect
37	BUSE	input	Selection of I ² C or 3wire mode
38	VDD	power	Digital power supply input
39	GNDD	ground	Digital ground
40	AFL	output	Left audio output

Table 1 MT6189 Pin Descriptions



2 Electrical Characteristics

2.1 Absolute Maximum Ratings

Prolonged exposure to absolute maximum ratings may reduce device reliability. Functional operation at these maximum ratings is not implied.

Item	Symbol	Min.	Max.	Unit
Power supply voltage	VCC	-0.3	5.5	V
Pin voltage	V _T	-0.3	VCC+0.3	V
Operating ambient temperature	T _{opr}	-40	85	°C
Storage temperature	T _{stg}	-55	125	°C
ESD human body mode	HBM		2500	V
ESD machine mode	MM		150	V

Table 2 Absolute Maximum Ratings

2.2 Recommended Operating Range

Item	Symbol	Min.	Typ.	Max	Unit
Power supply voltage	VCCRF, VCCVCO, VCCST	2.5	2.8	3.6	V
Power supply voltage	VDD	2.5	2.8	3.6	V
Operating ambient temperature	T _{opr}	-20	25	75	°C

Table 3 Recommended Operating Range

2.3 DC Characteristics

VCCRF=VCCVCO=VCCST= VDD= 2.8 V, Ta = 25 °C unless otherwise specified.

Item	Min.	Typ.	Max.	Unit	Test condition
Power supply voltage (VCCST, VCCVCO, VCCST)	2.5	2.8	3.6	V	
Power supply voltage (VDD)	2.5	2.8	3.6	V	
Power supply current		9		mA	VCCRF=VCCVCO=VCCST=VDD = 3V
Power down mode supply current		1.0		uA	
Serial data VH (SCL, SDA, LE, BUSE)	2.5			V	VDD = 2.8 V
Serial data VL (SCL, SDA, LE, BUSE)			0.3	V	VDD = 2.8 V

Table 4 DC Characteristics



2.4 AC Characteristics

VCCRF=VCCVCO=VCCST= VDD= 2.8 V, Ta = 25 °C unless otherwise specified.

Item	Min.	Typ.	Max.	Unit	Test condition
Tuned frequency range	88.1		107.9	MHz	United States band
	87.5		108	MHz	European band
	76		90	MHz	Japanese band
RFAGC starts level		70		dBuVemf	RF gain compress 1dB
Sensitivity		7		dBuVemf	$\Delta f = 22.5\text{kHz}$, mono, (S+N)/N=30dB
IIP3		92.5		dBuVemf	
LNA input S11			-10	dB	With off-chip matching network
Maximum input level			118	dBuVemf	
IF filter center frequency		140		kHz	
RSSI detectable range	4		59	dBuVemf	
MPX output					
MPX output AC load		4.7K		ohm	
MPX output swing		60		mVrms	$\Delta f = 22.5\text{kHz}$, mono
MPX output S+N/N		46		dB	$\Delta f = 22.5\text{kHz}$, mono, de-emp=75us, BW=200Hz~15kHz
MPX output THD		0.2		%	RF=1mVrms, $\Delta f = 75\text{kHz}$, de-emp=75us
Stereo Audio Outputs					
AFR/AFL outputs AC load		10K		ohm	
AFR/AFL outputs swing, VAF		75		mVrms	$\Delta f = 22.5\text{kHz}$, mono
AFR/AFL outputs (S+N)/N		46		dB	$\Delta f = 22.5\text{kHz}$, mono, de-emp=75us, BW=200Hz~15kHz
AFR/AFL outputs THD		0.2		%	RF=1mVrms, $\Delta f = 75\text{kHz}$, de-emp=75us
Right/Left difference	-1		+1	dB	
Stereo separation		30		dB	
Pilot tone at AFR/AFL outputs		-45		dB	
Soft Mute start level		8		dBuVemf	VAF -3dB point
Soft Mute attenuation		30		dB	
Stereo blend start level		50		dBuVemf	Separation -3dB point
Crystal oscillator					
Xtal frequency drift -20~85 °C	-122		0	ppm	Xtal Temperature Characteristic is 0.034 ppm/degree^2.
Xtal frequency tolerance	-20		+20	ppm	
Frequency step		8.192		kHz	Xtal frequency is 32.768kHz
		8.464		kHz	Xtal frequency is 13MHz or 26MHz

Table 5 AC Characteristics



3 Package Dimensions

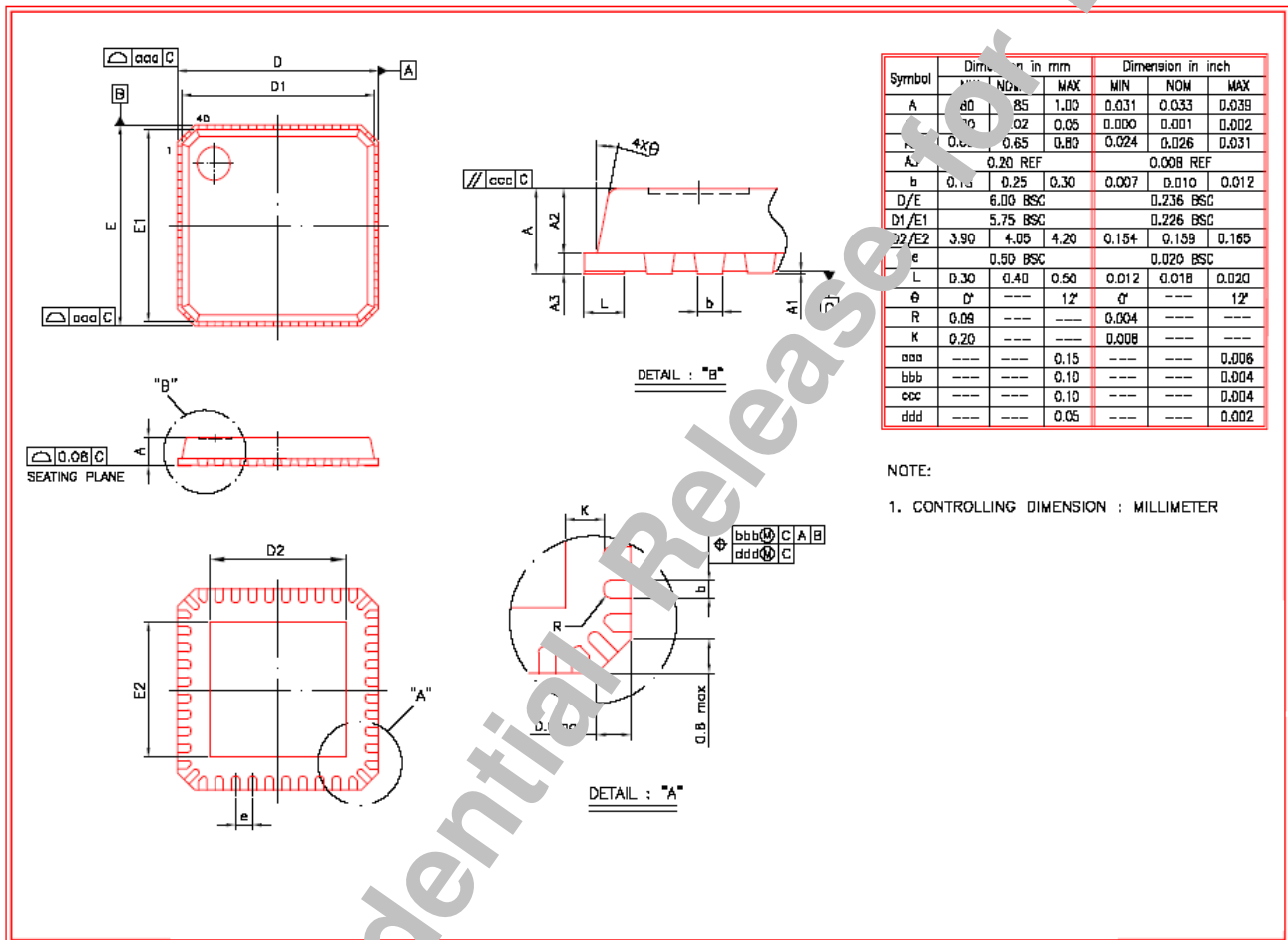


Figure 2 Package dimension



4 Footprint Dimension

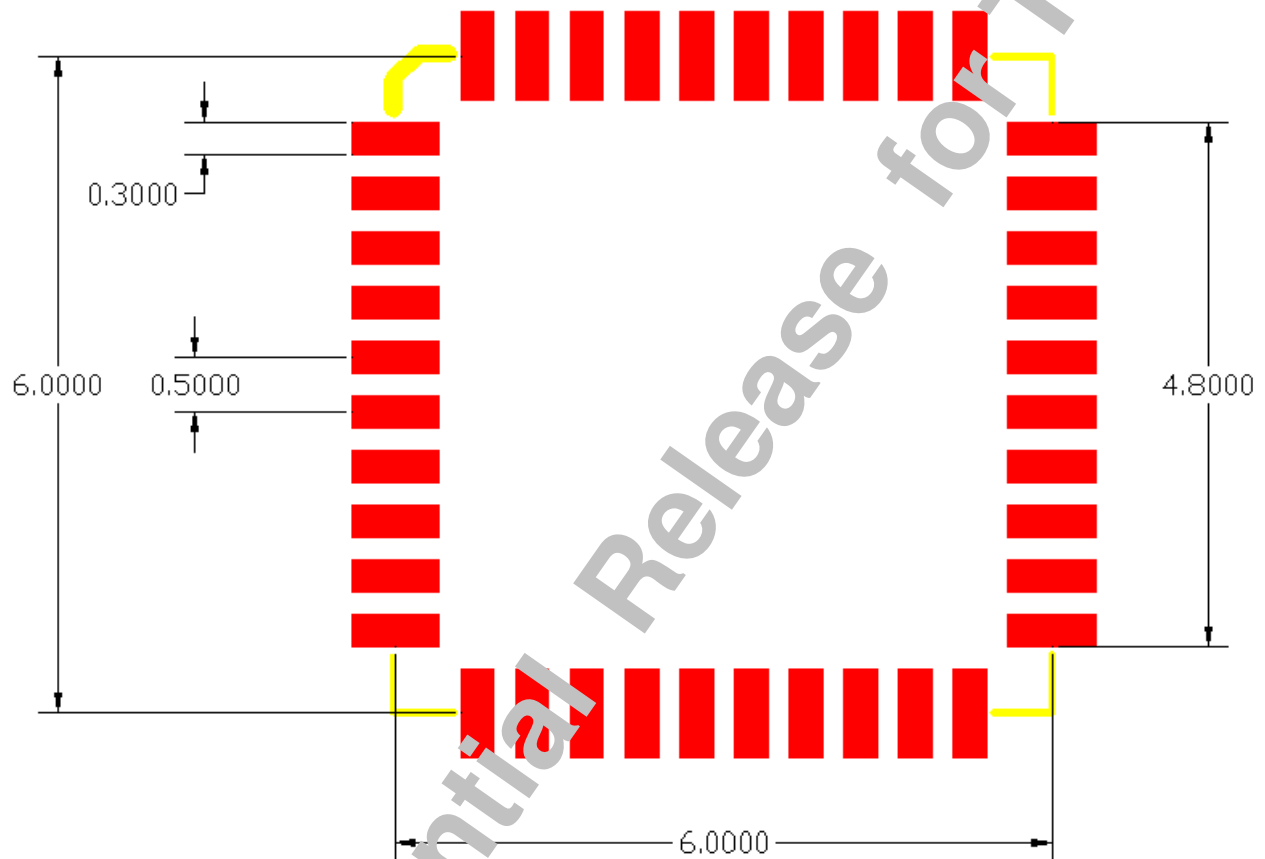


Figure 3 QFN-40 Footprint Dimensions



Reference Application Circuit

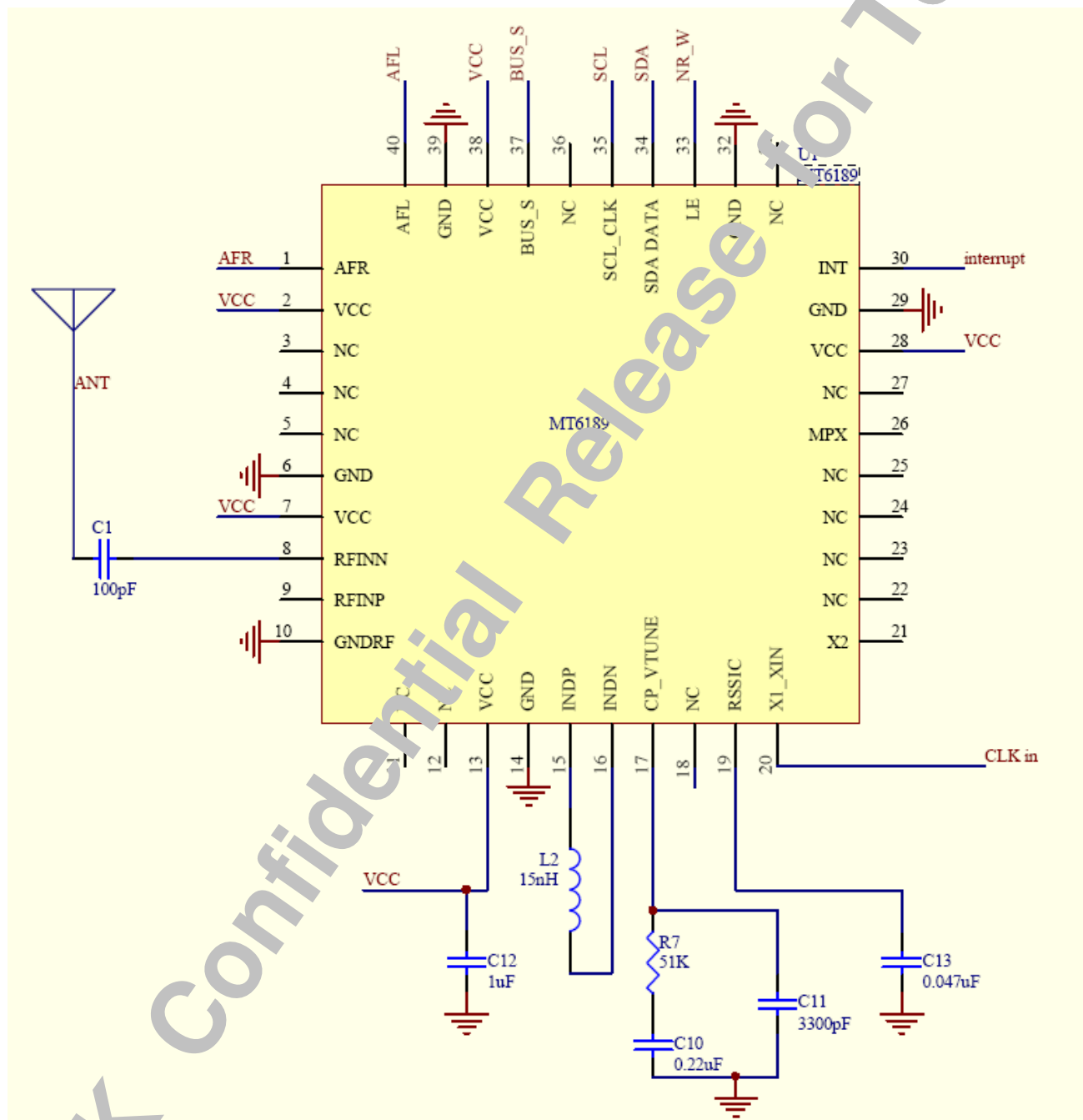


Figure 4 MT6189 with external clock & without antenna matching circuit

*note that circuits without antenna matching may cause sensitivity degradation.



Reference Application Circuit

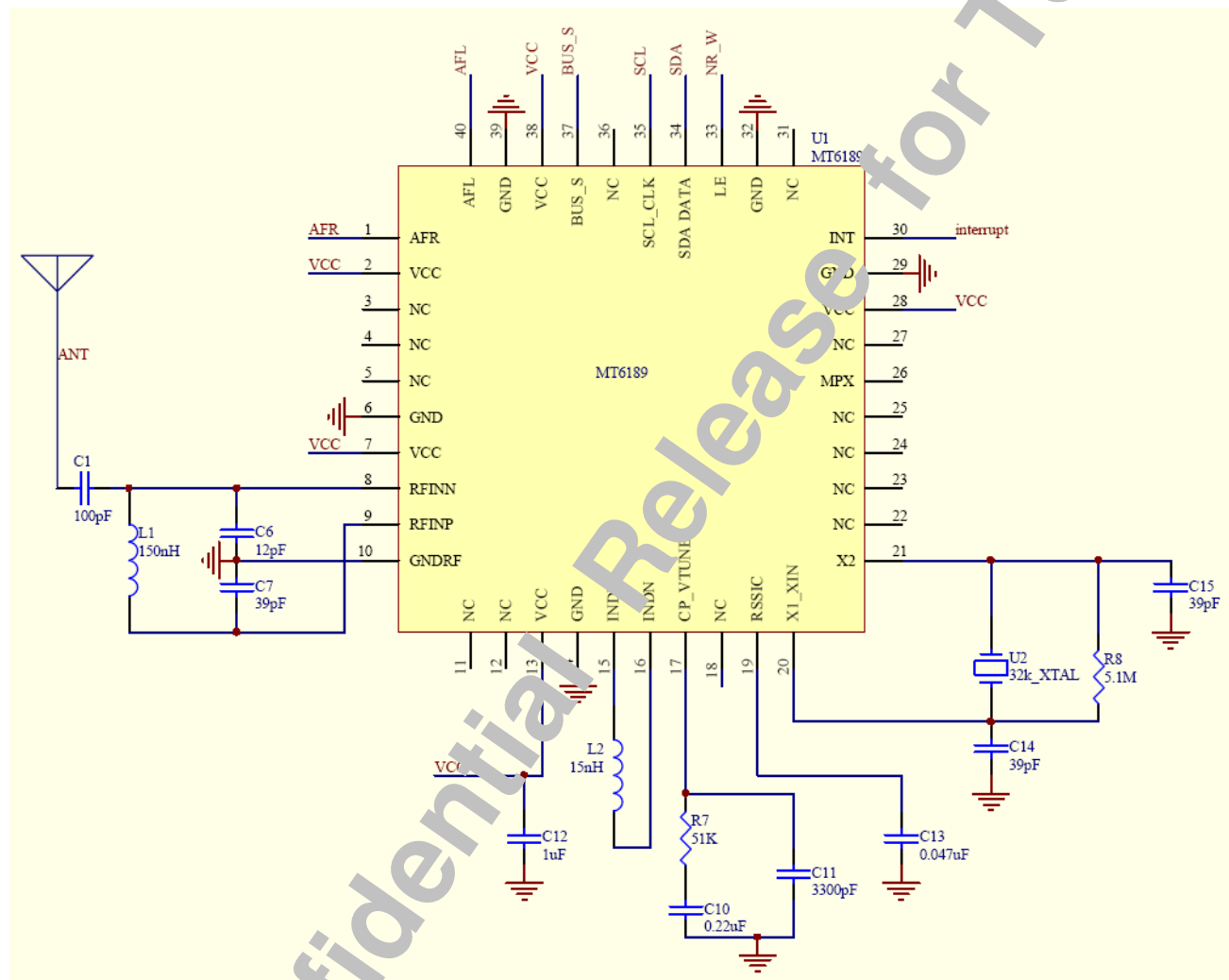


Figure 5 MT6189 with crystal oscillator & antenna matching circuit



Bill of Materials

components	Value	Description	Annotations
U1		MT6189 FM Tuner	necessary
C12	1uF	0402; supply bypass	necessary
C13	0.047uF	0402; RSSI cap.	necessary
C11	3300pF	0402; loop filter	necessary
R7	51K		
C10	0.22uF		
L2	15nH	0402; inductor	necessary; $Q \geq 25$ is required.
L1	150nH	0402; RF input matching	could be removed with little degradation on sensitivity
C6	12pF		
C7	39pF		



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