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General Description

The TH7108 antenna board is designed to optimally match the differential power amplifier output to a loop antenna. The TH7108 can be populated either for FSK, ASK or FM transmission. The default population is for FSK or ASK transmission. Adding a varactor diode can

easily be done in order to modify the circuit for analog FM. The evaluation board contains a differential-drive loop antenna printed on the PCB (Printed Circuit Board). The size of the loop antenna is matched to the resonant frequency.

Board layout data in Gerber format is available on request.

Features

- Fully integrated, PLL-stabilized VCO
- Flexible frequency range from 850 MHz to 930 MHz
- FSK through crystal pulling allows modulation from DC to 20 kbit/s
- High deviation possible for wideband data transmission
- ASK achieved by on/off keying of internal power amplifier
- FM possible with external varactor
- Wide power supply range from 2.2 V to 5.5 V
- High over-all frequency accuracy
- Very low standby current
- Adjustable equivalent radiated power (ERP) range from -20 dBm to -6 dBm
- Adjustable current consumption from 6.2 mA to 12.5 mA
- Frequency deviation and center frequency independently adjustable
- Differential output well-suited for loop antenna
- External clock available for μ C drive, down to 1.9 V supply
- "Clock only" mode
- Conforms to EN 300 220 standard

Ordering Information

Part No.

EVB7108-868-FSK
EVB7108-868-ASK

EVB7108-915-FSK
EVB7108-915-ASK

Applications

- Keyless car and central locking
- Low-power telemetry
- Alarm and security systems
- General digital data transmission
- General analog audio signal transmission

Theory of Operation

General

As depicted in Fig.1, the TH7108 transmitter consists of a fully integrated voltage-controlled oscillator (VCO), a divide-by-32 divider (div32), a phase-frequency detector (PFD) and a charge pump. An external loop filter at pin LF determines the dynamic behaviour of the PLL and suppresses reference spurious signals.

The VCO's output signal feeds the power amplifier (PA). RF signal power P_o can be adjusted in six steps from $P_o = -15$ dBm to +1 dBm either by changing the value of resistor R_{PS} or by varying the voltage V_{PS} at pin PS. The open-collector differential output (OUT1, OUT2) can be used to either directly drive a loop antenna or to be converted to a single-ended impedance by means of a balanced-to-unbalanced (balun) transformer. For maximum available output power, the differential output should be matched to a load of approx. 1 k Ω . Bandgap biasing ensures stable operation of the IC at a power supply range of 2.2 V to 5.5 V.

FSK Modulation

A Colpitts crystal oscillator (XOSC) is used as the reference oscillator of a phase-locked loop (PLL) synthesizer. FSK modulation is achieved by pulling the crystal (XTAL) through the data. So a CMOS-compatible data stream applied at input DATA digitally modulates the XOSC. Two external pulling capacitors C_{X1} and C_{X2} allow the FSK deviation and center frequency to be adjusted independently. At DATA = LOW C_{X2} is connected in parallel to C_{X1} leading to the low-frequency component of the FSK spectrum (f_{min}); while at DATA = HIGH C_{X2} is deactivated and the XOSC is set to its high frequency, leading to f_{max} .

An external reference signal can be directly AC-coupled to pin RO1. Then the TH7108 is used without an XTAL. The reference signal has to contain the FSK (or FM) and sets the carrier frequency.

Frequency Modulation (FM)

For FM operation an external varactor is required. It simply acts as a pulling capacitor connected in series to the crystal. Then the analog modulation signal, applied through a series resistor, directly modulates the XOSC.

ASK Modulation

The TH7108 can be ASK-modulated by applying data directly at pin PS. This turns the PA on and off and therefore leads to an ASK signal at the output.

Mode Control Logic

The mode control logic allows four different modes of operation as listed in the following table. The mode control pins ENCK and ENTX are pulled-down internally. This guarantees that the whole circuit is shut down if these pins are left floating. The clock output CKOUT can be used to drive a μ C. This output can be activated by the ENCK pin as required for any specific application. Clock frequency is 1/8 of the reference crystal frequency. The clock output is slew-rate limited in order to keep spurious signal emission as low as possible. The voltage swing at CKOUT depends on the capacitive loading at this pin. It is approx. $2 V_{pp}$ at $C_{load} = 5$ pF.

ENCK	ENTX	Mode	Description
0	0	all OFF	whole circuit in standby
0	1	TX only	TX functionality only, no clock available
1	0	clock only	TX in standby and clock available
1	1	all ON	TX functional and clock available

Table 1: Modes of operation

For more detailed information, please refer to the latest TH7108 data sheet revision.

Block Diagram

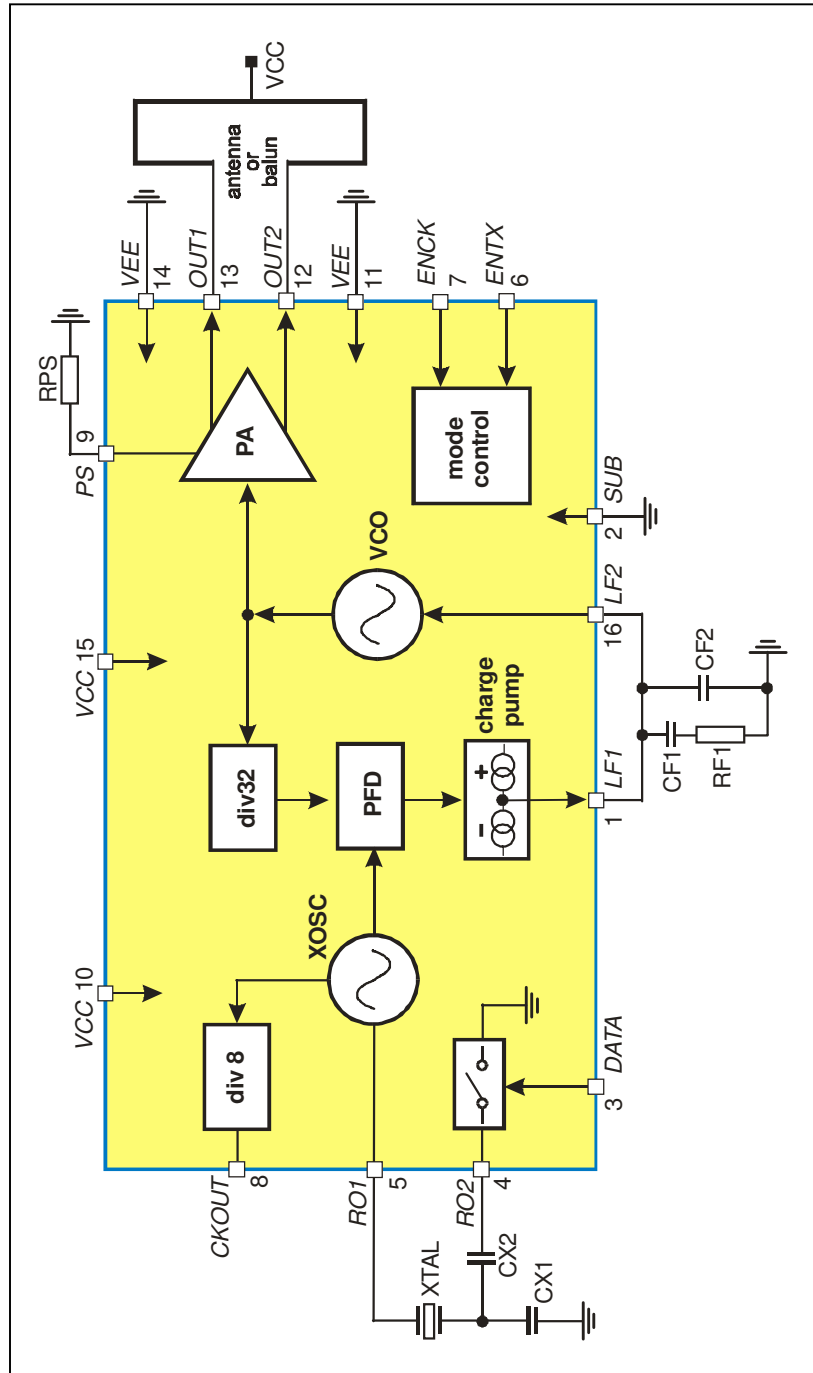
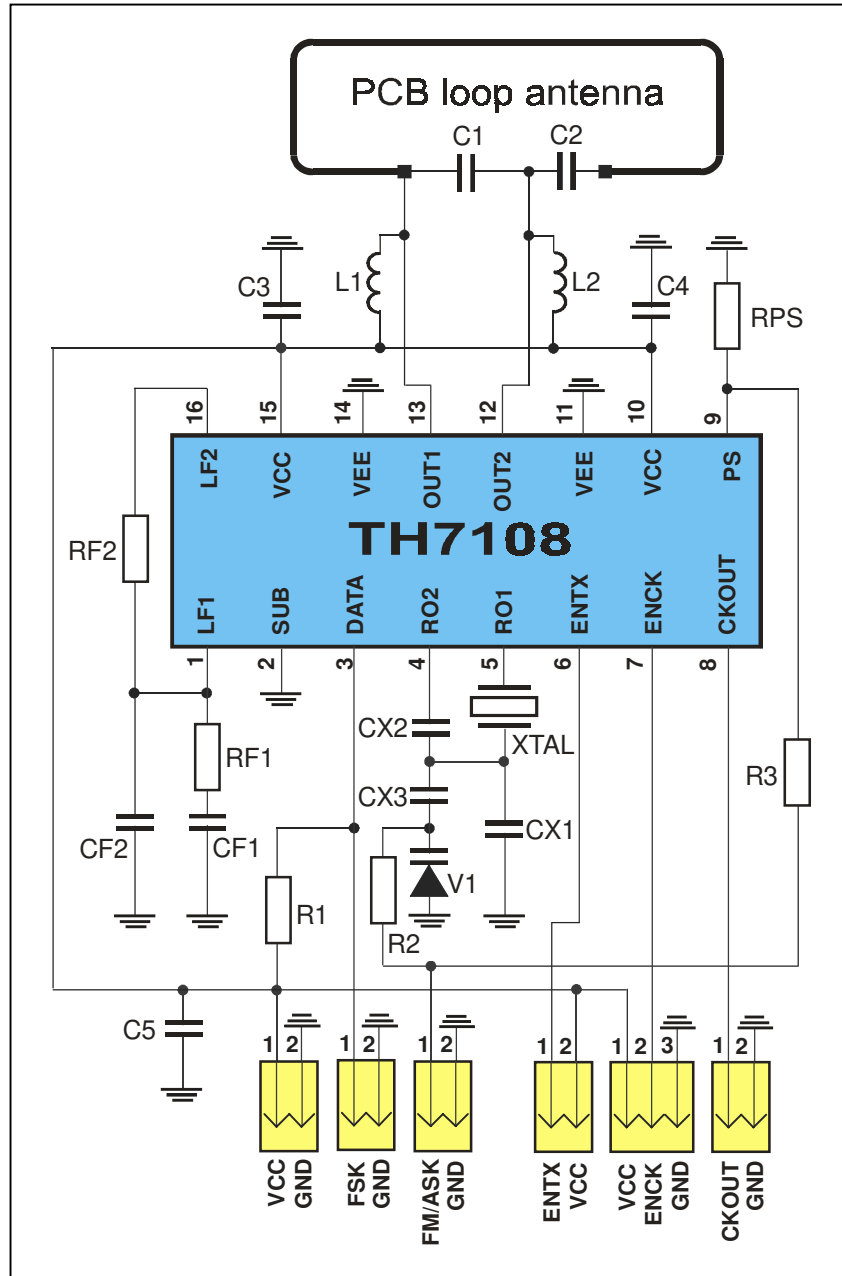
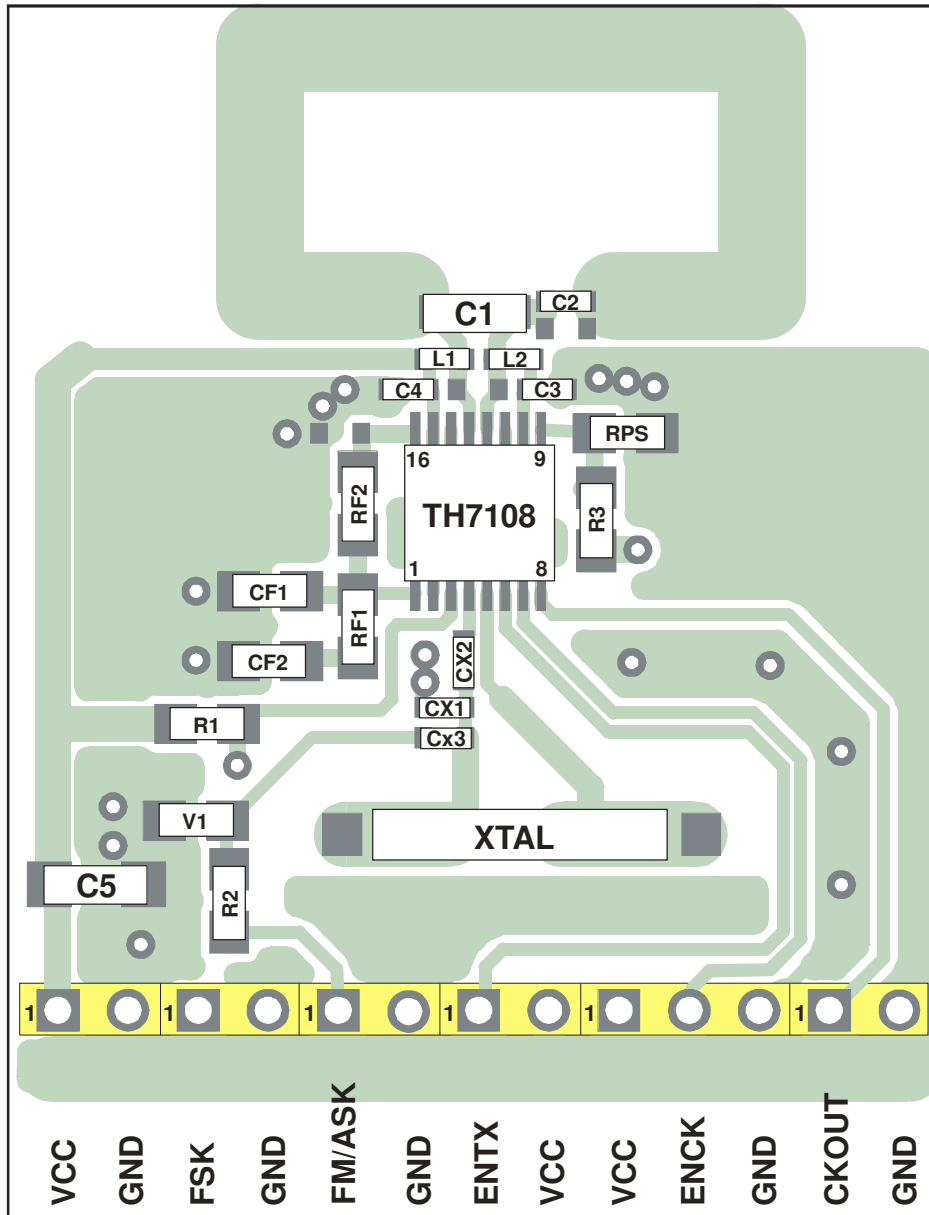


Fig. 1: TH7108 block diagram with external components

Circuit Diagram



PCB Top View



Board size is 34mm x 44mm

Board Connection

VCC	Power supply (2.2 V to 5.5 V)	ENCK	Mode control pin (see table 1)
FSK	Input for FSK data (CMOS)	ENTX	Mode control pin (see table 1)
FM/ASK	Input for FM signal (analog) or ASK data (CMOS)	GND	Several ground pins
CKOUT	Clock output (3.4 MHz)		

Board Component Values

Part	Size	Value 868.3 MHz	Value 915 MHz	Tolerance	Description
CF1	0805	5.6 nF	4.7 nF	±10%	loop filter capacitor
CF2	0805	27 pF	27 pF	±10%	loop filter capacitor
CX1_FSK	0603	56 pF	56 pF	±5%	XOSC capacitor for FSK ($\Delta f = \pm 30$ kHz)
CX1_ASK	0603	18 pF	18 pF	±5%	XOSC capacitor for ASK, trimmed to f_c
CX2	0603	1 nF	1 nF	±5%	XOSC capacitor, only needed for FSK
CX3	0603	1 nF	1 nF	±10%	XOSC capacitor, only needed for FM
C1	1206	2.2 pF	2.2 pF	±2%	antenna resonance capacitor
C2	0805	1.2 pF	1 pF	±2%	antenna resonance capacitor
C3	0603	330 pF	330 pF	±10%	blocking capacitor
C4	0603	330 pF	330 pF	±10%	blocking capacitor
C5	1206	220 nF	220 nF	±20%	blocking capacitor
L1	0603	150 nH	150 nH	±10%	biasing inductor
L2	0603	150 nH	150 nH	±10%	biasing inductor
RF1	0805	1.6 k Ω	1.6 k Ω	±10%	loop filter resistor
RF2	0805	2.0 k Ω	2.0 k Ω	±10%	loop filter resistor
RPS	0805	47 k Ω	47 k Ω	±10%	power-select resistor
R1	0805	470 k Ω	470 k Ω	±10%	optional pull-up resistor, typically not needed
R2	0805	30 k Ω	30 k Ω	±10%	varactor bias resistor, only needed for FM
R3	0805	0 Ω	0 Ω	±10%	ASK jumper, only needed for ASK
V1	SOD323	BB535			varactor diode, only needed for FM
XTAL	HC49/S	27.1344 MHz fundamental wave	28.5938 MHz fundamental wave	±30ppm calibration ±30ppm temp.	crystal, $C_{load} = 12$ pF to 15 pF, $C_0, max = 7$ pF, $R_m, max = 40$ Ω
PCB loop antenna	long side length	18 mm	18 mm		on FR4 PCB material side length including length of C1 and C2
PCB loop antenna	small side length	9 mm	9 mm		on FR4 PCB material
PCB loop antenna	Line width	2 mm	2 mm		on FR4 PCB material

The listed component values are default values. All values might be changed to fit to any specific application. As for example FSK deviation can be set by varying CX1 and CX2, output power at FSK/FM transmission can be changed through RPS or through RPS and R3 at ASK transmission, respectively.

Pads for C1 are for population of a fixed-value capacitor with size 1206 or a to use trimming capacitor either.

Package Information

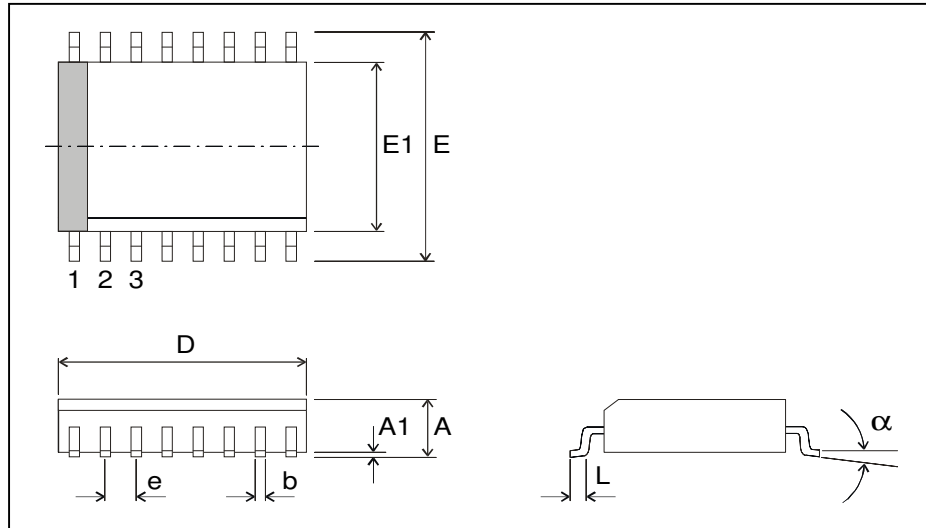


Fig. 2: QSOP16

all Dimension in mm, coplanarity < 0.1mm									
	D	E1	E	A	A1	e	b	L	α
min	4.80	3.81	5.79	1.35	0.10	0.635	0.20	0.40	0°
max	4.98	3.99	6.20	1.75	0.25		0.30	1.27	8°
all Dimension in inch, coplanarity < 0.004"									
min	0.189	0.150	0.228	0.0532	0.0040	0.025	0.008	0.016	0°
max	0.196	0.157	0.244	0.0688	0.0098		0.012	0.050	8°

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