MX•COM, INC. MiXed Signal ICs

DATA BULLETIN

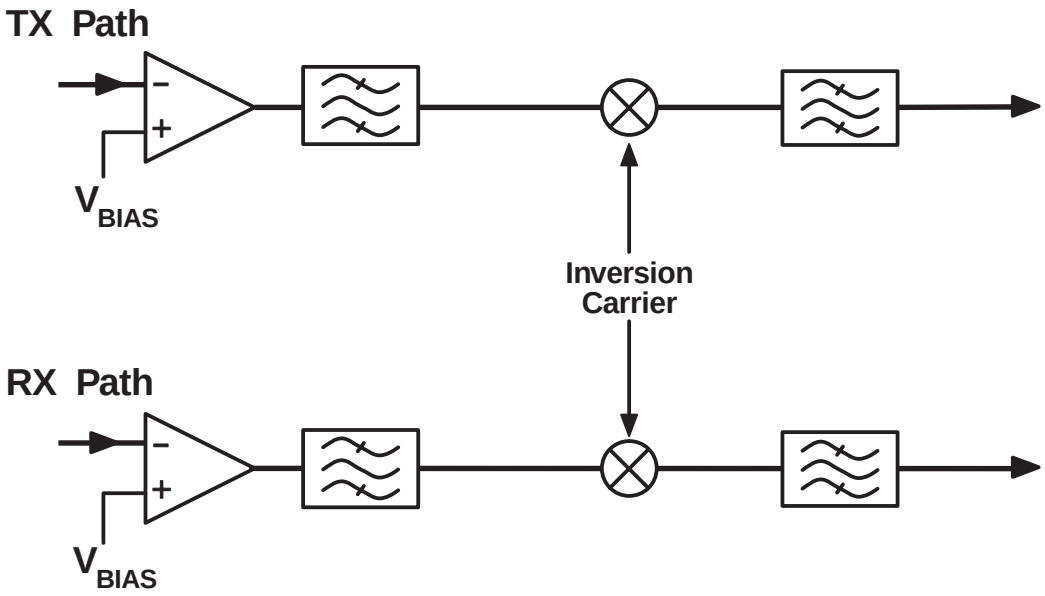
MX128 Cordless Telephone Scrambler

Features

- **Full-Duplex Audio Processing**
- **On-Chip Filters**
- **Carrier Rejection >55dB**
- **Uses IF (10.24 MHz) Clock**
- **Requires No Extra Crystal**
- **Excellent Audio Quality**
- **Low Voltage 3.3V/5.0V Operation**
- **ECPA* Qualified Voice Protection**

Applications

- **Battery Powered Portability**
- **Cordless Telephones**
- **Wireless PBXs**



The MX128 is a full-duplex frequency inversion scrambler designed to provide secure conversations for 46/49 MHz cordless telephone users. The RX and TX audio paths consist of the following:

1. A switched-capacitor balanced modulator with high baseband and carrier rejection.
2. A 3.3 kHz inversion carrier (injection tone).
3. A 3100 Hz lowpass filter.
4. Input op-amps with externally adjustable gain.

The MX128 uses mixed signal CMOS switched-capacitor filter technology and operates from a single supply in the range of 3.0V to 5.5V. The inversion carrier's frequency and filter switching clock are generated on-chip using an external 10.24 MHz or 3.58/3.6864 MHz crystal or clock input (selectable).

The MX128 is available in the following package styles: 16-pin SOIC (MX128DW) and 16-pin PDIP (MX128P).

***Electronics Communications Privacy Act (Title 18, US Code 2510 et seq.)**

www.mxcom.com Tel: 800 638-5577 336 744-5050 Fax: 336 744-5054
4800 Bethania Station Road, Winston-Salem, NC 27105-1201 USA

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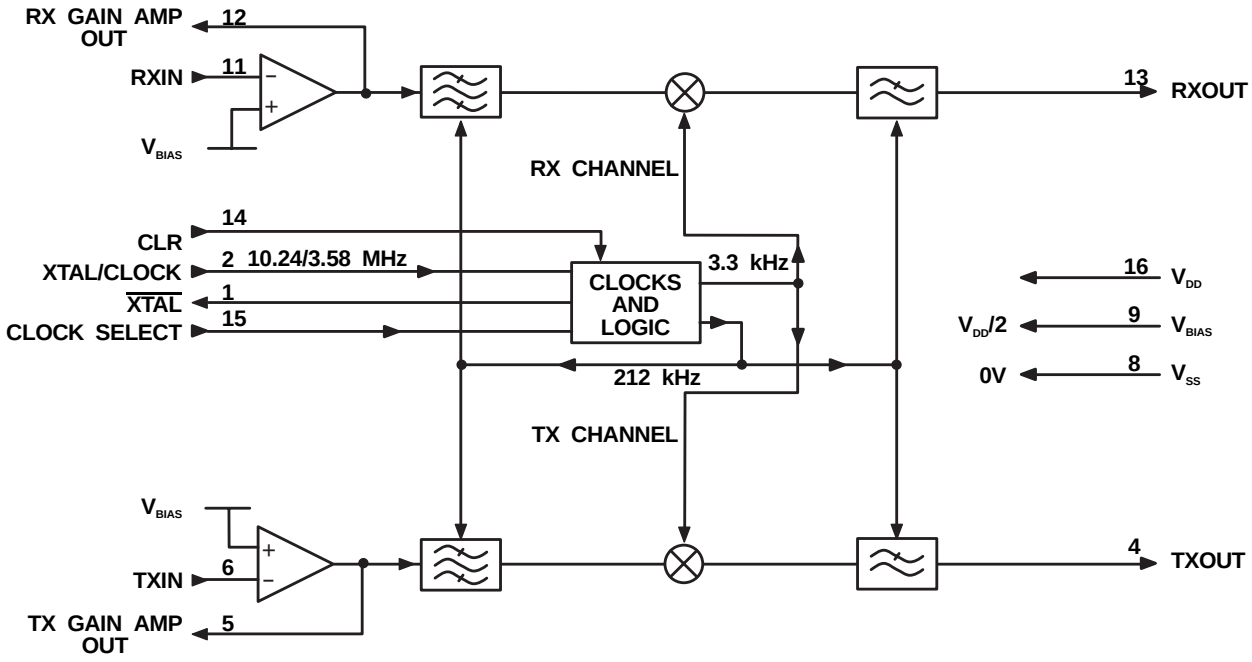
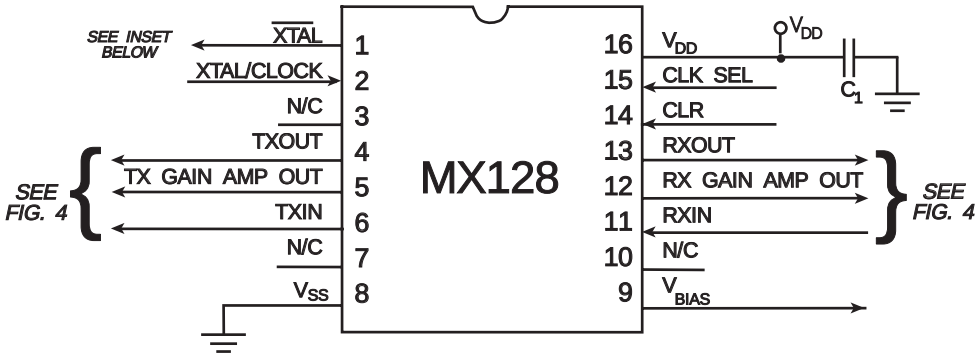


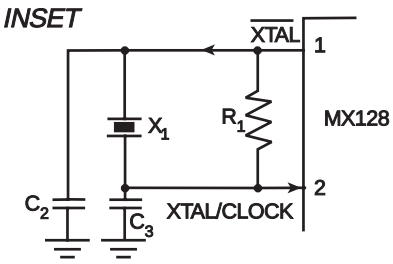
Figure 1: Device Block Diagram

2. Signal List

Pin No.	Signal	Type	Description
1	$\overline{\text{Xtal}}$	output	This is the output of the clock oscillator inverter
2	Xtal/Clock	input	A 10.24 MHz, 3.58/3.6864 MHz, or an externally derived clock signal is injected at this pin. See Figure 3
4	TXOUT	output	This is the analog output of the transmit channel. It is internally biased at $V_{DD}/2$
5	TX Gain Ampout	output	This is the output pin of the transmit channel gain adjusting op-amp. See Figure 4 for gain setting components
6	TXIN	input	This is the analog signal input to the transmit channel. This input is to a gain adjusting op-amp whose gain is set by internal components. See Figure 4.
8	V_{SS}	power	Negative supply (GND)
9	V_{BIAS}	output	This is an internally generated bias voltage output ($V_{DD}/2$)
11	RXIN	input	This is the analog signal input to the receive channel. This input is to a gain adjusting op-amp whose gain is set by internal components. See Figure 4.
12	RX Gain Ampout	output	This is the output pin of the receive channel gain adjusting op-amp. See Figure 4 for gain setting components
13	RXOUT	output	This is the analog output of the receive channel. It is internally biased at $V_{DD}/2$
14	CLR		A logic 1 on this input selects the invert mode. A logic 0 selects the clear (not inverted) mode
15	Clock Select		Selects either 10.24 or 3.58/3.6864 MHz clock frequency. A logic “1” selects 10.24 MHz, and a logic “0” selects 3.58/3.6864 MHz. This input is internally pulled high
16	V_{DD}	power	Positive supply of 3.0V to 5.5 V
3, 7, 10	N/C		No internal connections

3. External Components





10.24 MHz			
R1		1.0MΩ	±10%
C1		0.47µF	±20%
C2		22.0pF	±20%
C3		22.0pF	±20%
X1		10.24 MHz	

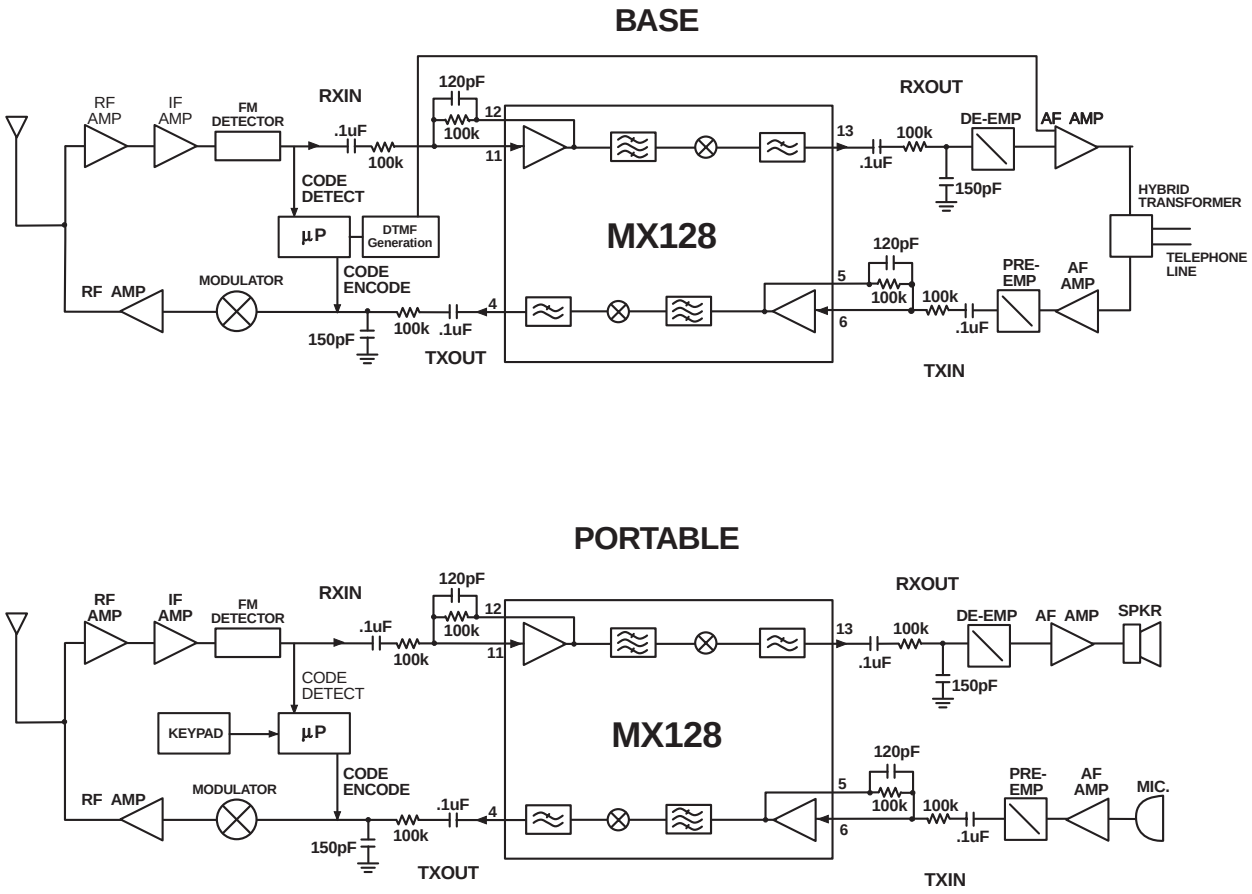
3.58/3.6864 MHz			
R1		1.0MΩ	±10%
C1		0.47µF	±20%
C2		33.0pF	±20%
C3		47.0pF	±20%
X1	Note 1	3.58/3.6864 MHz	

Figure 2: Recommended External Components

External Components Note:

1. For best results, a crystal oscillator should drive the clock inverter input with signal levels of at least 40% of V_{DD} peak - peak. Tuning fork crystals generally cannot meet this requirement. To obtain crystal oscillator design assistance, consult your crystal manufacturer.

4. Application



Note: Components shown set a gain of 0dB.

Figure 3: Block Diagram of a Typical Application of the MX128 (Cordless Phone)

4.1 Application Notes

Formulas for calculating the carrier frequency, upper cutoff frequency and lower cutoff frequency with clock select pin high are as follows:

Carrier Frequency	=	(3.2995kHz / 10.24MHz) * XTAL frequency
Upper Cutoff Frequency	=	(2.800kHz / 10.24MHz) * XTAL frequency
Lower Cutoff Frequency	=	(400Hz / 10.24MHz) * XTAL frequency

Formulas for calculating the carrier frequency, upper cutoff frequency and lower cutoff frequency with clock select pin low are as follows:

Carrier Frequency	=	(3.2995kHz / 3.415MHz) * XTAL frequency
Upper Cutoff Frequency	=	(2.800kHz / 3.415MHz) * XTAL frequency
Lower Cutoff Frequency	=	(400Hz / 3.415MHz) * XTAL frequency

5. Performance Specification

5.1 Electrical Performance

Absolute Maximum Ratings

Exceeding these maximum ratings can result in damage to the device.

General	Min.	Max.	Units
Supply Voltage (V_{DD} - V_{SS})	-0.3	7.0	V
Voltage on any pin to V_{SS}	-0.3	V_{DD} + 0.3	V
Current			
V_{DD}	-30	30	mA
V_{SS}	-30	30	mA
Any other pin	-20	20	mA
P/DW Packages			
Total Allowable Power Dissipation at T_{AMB} = 25°C		800	mW max.
Derating above 25°C		10	mW/°C above 25°C
Operating Temperature	-40	85	°C
Storage Temperature	-55	125	°C

Operating Limits

Correct operation of the device outside these limits is not implied.

	Notes	Min.	Max.	Units
Supply (V_{DD} - V_{SS})		3.0	5.5	V
Operating Temperature		-40	85	°C
Clock Frequency			10.24	MHz

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Operating Characteristics

For the following conditions unless otherwise specified:

V_{DD} = 3.3V at T_{AMB} = 25°C
Clock Frequency = 10.24MHz
Audio Level 0dB ref. @ 1kHz = (V_{DD}-1) x 150mV_{RMS} e.g. V_{DD} = 3.3V 0dB = 345m$V_{RMS.}$

	Notes	Min.	Typ.	Max	Units
Static Values					
Supply Current			2.0	3.0	mA
Input Impedance					
Digital	2	100			kΩ
Amplifiers	2	1.0	10.0		MΩ
Output Impedance (RXOUT, TXOUT)			1.0		kΩ
Input Logic 1 Voltage	1	70%			V_{DD}
Input Logic 0 Voltage	1			30%	V_{DD}
Dynamic Values					
Analog Signal Input Levels		-16.0		3	dB
Analog Output Noise	4		2.5	5.0	mV_{RMS}
Clear Mode					
Passband -3dB Cutoff Frequencies					
Low				300	Hz
High		3000			Hz
Passband Ripple (300-3000Hz)					
RX Channel		0		3.6	dB
TX Channel		0		2.9	dB
Passband Ripple (500-2750Hz)					
RX Channel		0		2.2	dB
TX Channel		0		2.0	dB
Filter Attenuation at 3.3 kHz					
RX Channel			30		dB
TX Channel			30		dB
Filter Attenuation at 3.6 kHz					
RX Channel			45		dB
TX Channel			45		dB
Passband Gain (@1kHz ref.)					
RX Channel		-1.5		0.5	dB
TX Channel		-1.5		0.5	dB
Switched-Capacitor Filter Sampling			211.066		kHz
Carrier Frequency			3298		Hz
Invert Mode Combined TX and RX Response					
Passband -3dB Cutoff Frequencies					
Low				400	Hz
High		2800			Hz
Passband Gain		-3		0.5	dB
Distortion (@1kHz)	3		1.75	2.75	%
Passband Gain (@1kHz ref.)	5	-2.5	-1.5	0	dB
Low Frequency Roll-off (<200 Hz)		12			dB/octave

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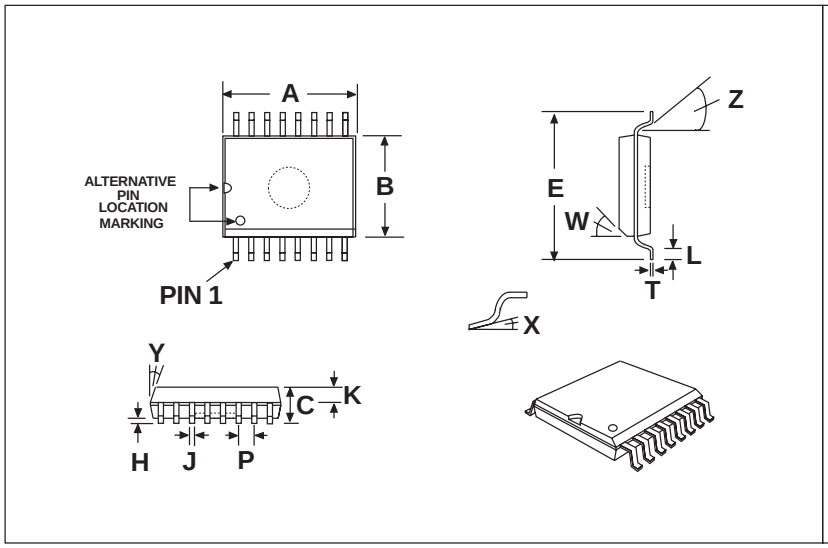
	Notes	Min.	Typ.	Max	Units
Invert Mode Single Channel Response					
Unwanted Modulation Products	3				
RX Channel			-40		dB
TX Channel			-40		dB
Carrier Breakthrough	3				
RX Channel			-55		dB
TX Channel			-55		dB
Baseband Breakthrough	3				
RX Channel			-40		dB
TX Channel			-40		dB

Operating Characteristics Notes:

1. Batch sampled only
2. By characterization only
3. Measured with Input Level 0dB
4. Short circuit RX or TX input, measure noise at corresponding analog output, in 30KHz bandwidth
5. Op Amp gain 0dB
6. Clear mode only

5.2 Packaging

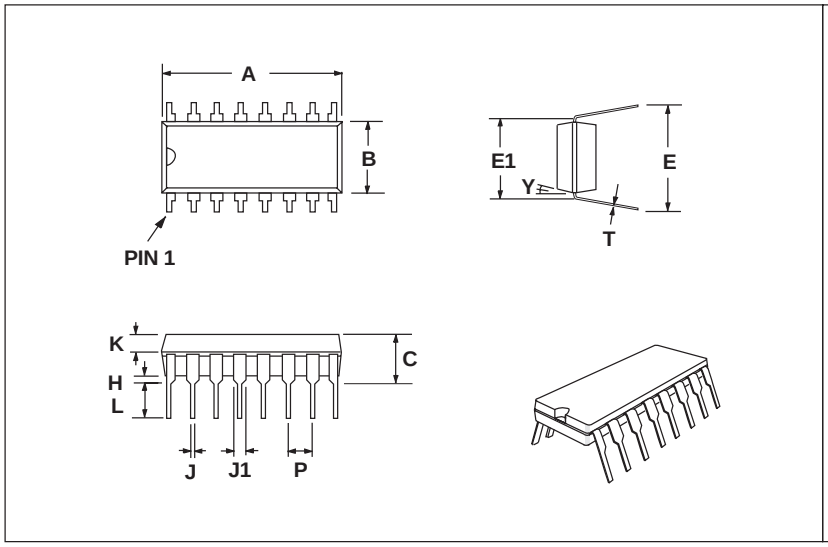


Package Tolerances

DIM.	MIN.	TYP.	MAX.
A	0.395 (10.03)		0.413 (10.49)
B	0.286 (7.26)		0.299 (7.59)
C	0.093 (2.36)		0.105 (2.67)
E	0.390 (9.90)		0.419 (10.64)
H	0.003 (0.08)		0.020 (0.51)
J	0.013 (0.33)		0.020 (0.51)
K		0.041 (1.04)	
L	0.016 (0.41)		0.050 (1.27)
P		0.050 (1.27)	
T	0.009 (0.23)		0.0125 (0.32)
W		45°	
X	0°		10°
Y	5°		7°
Z		5°	

NOTE : All dimensions in inches (mm.)
Angles are in degrees

Figure 4: 16-pin SOIC Mechanical Outline: Order as part no. MX128DW



Package Tolerances

DIM.	MIN.	TYP.	MAX.
A	0.740 (18.80)		0.810 (20.57)
B	0.240 (6.10)		0.262 (6.63)
C	0.135 (3.43)		0.200 (5.06)
E	0.300 (7.62)		0.390 (9.91).
E1	0.290 (7.37)		0.325 (8.26)
H	0.015 (0.38)		0.070 (1.77)
J	0.014 (0.35)		0.023 (0.58)
J1	0.040 (1.02)		0.065 (1.65)
K	0.056 (1.42)		0.064 (1.63)
L	0.121 (3.07)		0.150 (3.81)
P		0.100 (2.54)	
T	0.008 (0.20)		0.015 (0.38)
Y		7°	

NOTE : All dimensions in inches (mm.)
Angles are in degrees

Figure 5: 16-pin PDIP Mechanical Outline: Order as part no. MX128P

