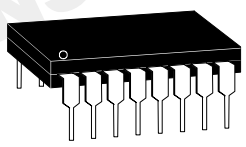
MX•COM, INC. **MX118**

FULL-DUPLEX SCRAMBLER FOR CORDLESS TELEPHONES

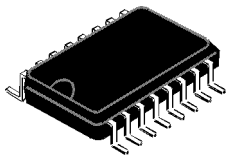
NOT RECOMMENDED FOR NEW DESIGNS

Features

- **Full-Duplex Audio Processing**
- **On-Chip "Brick-wall" Filters (300-3000 Hz)**
- **Low Voltage CMOS**
- **High Baseband and Carrier Rejection**
- **Excellent Audio Quality**
- **ECPA* Qualified Voice Protection**



MX118P
(16 pin PDIP)



MX118DW
(SOIC-16)

Applications

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

Description

The MX118 is a full-duplex frequency inversion scrambler that secures cordless telephone conversations. The two audio paths, C1 and C2, are identical and independent. Each consists of the following:

1) A 10th order lowpass filter cut off at 3.1 kHz.
2) A balanced modulator with high baseband and carrier rejection.
3) A 3.3 kHz inversion carrier (injection tone).
4) A 14th order bandpass filter (300-3000 Hz).
5) Input op-amps with externally adjustable gain.

The MX118 uses CMOS switched-capacitor filter technology and operates from a single supply in the range of 3.0 V to 5.5 V. The inversion carrier's frequency and filter switching clock are generated on-chip using an external 4.433619 MHz crystal or clock input.

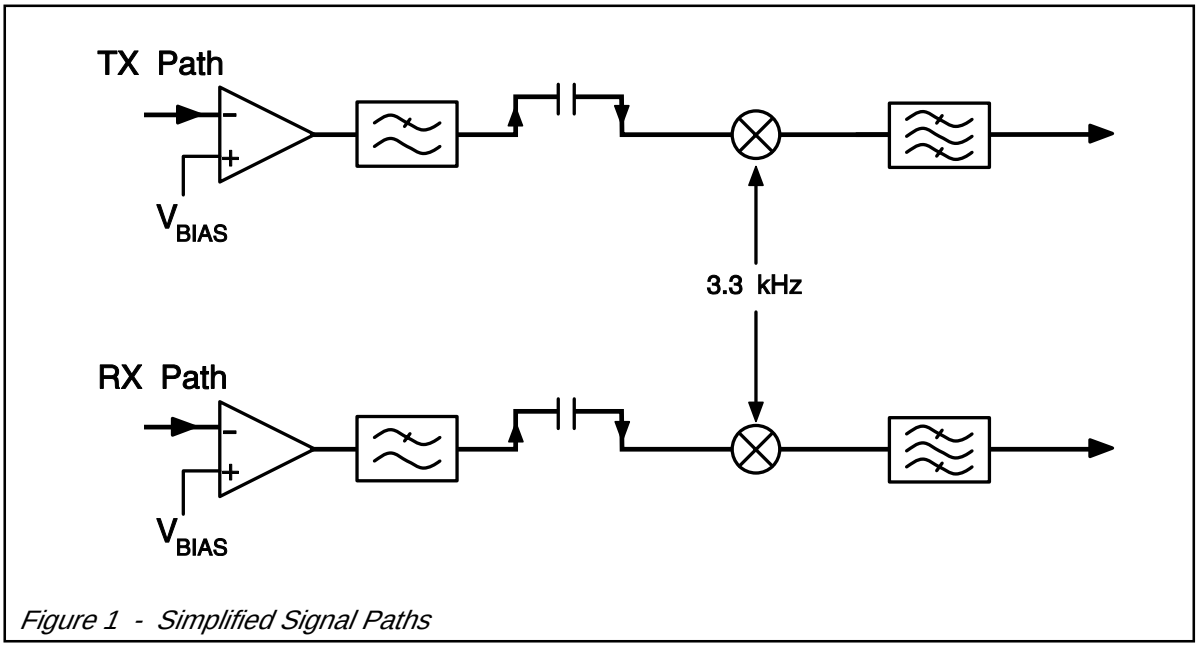


Figure 1 - Simplified Signal Paths

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

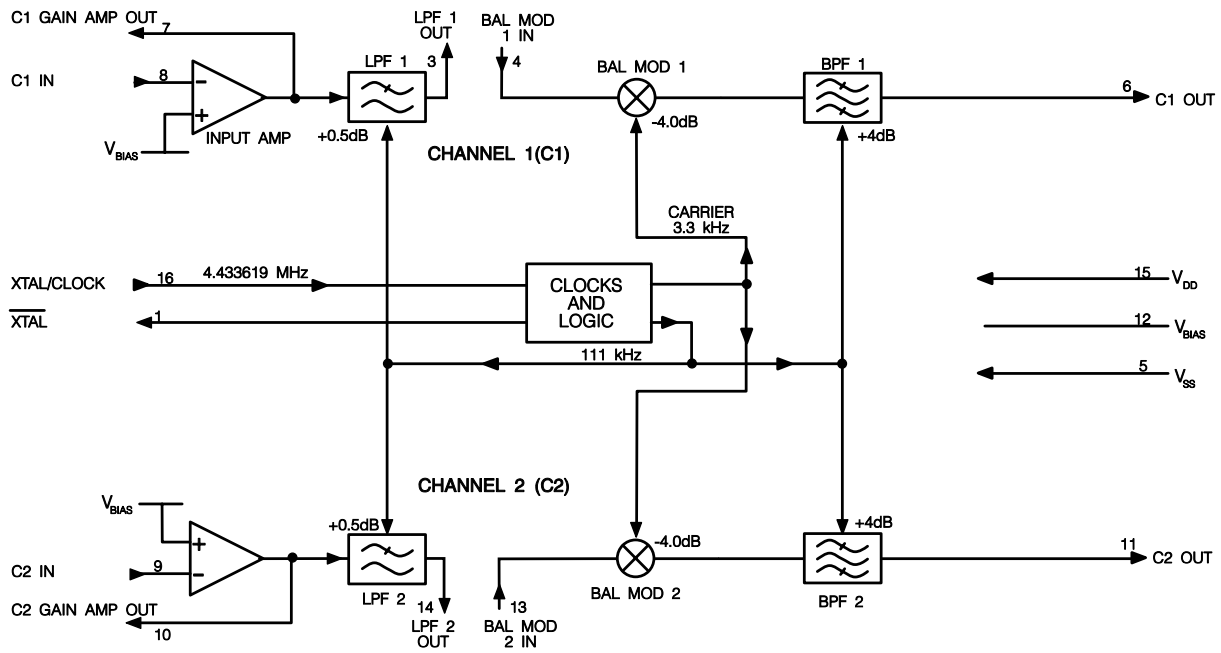
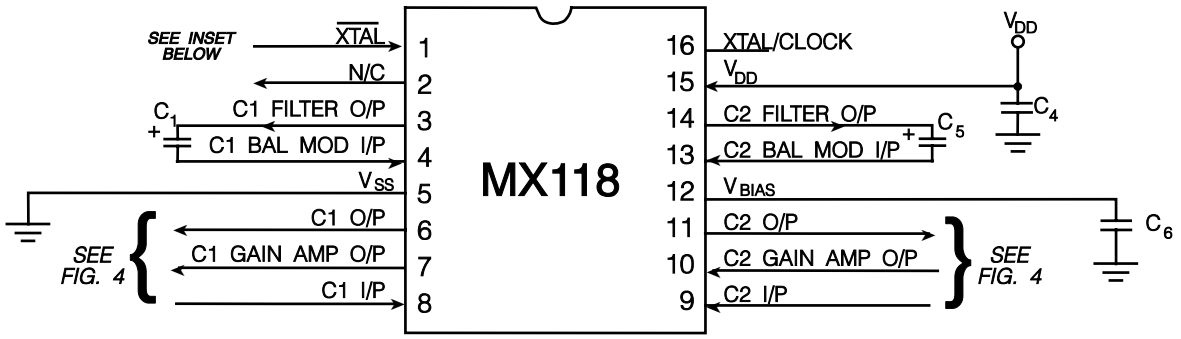
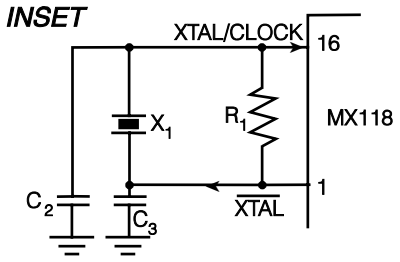


Figure 2 - Block Diagram





Component	Value
R1	1.0MΩ
C1	1.0µF
C2	33.0pF
C3	47.0pF
C4	0.47µF
C5	1.0µF
C6	1.0µF
X1	4.433619 MHz

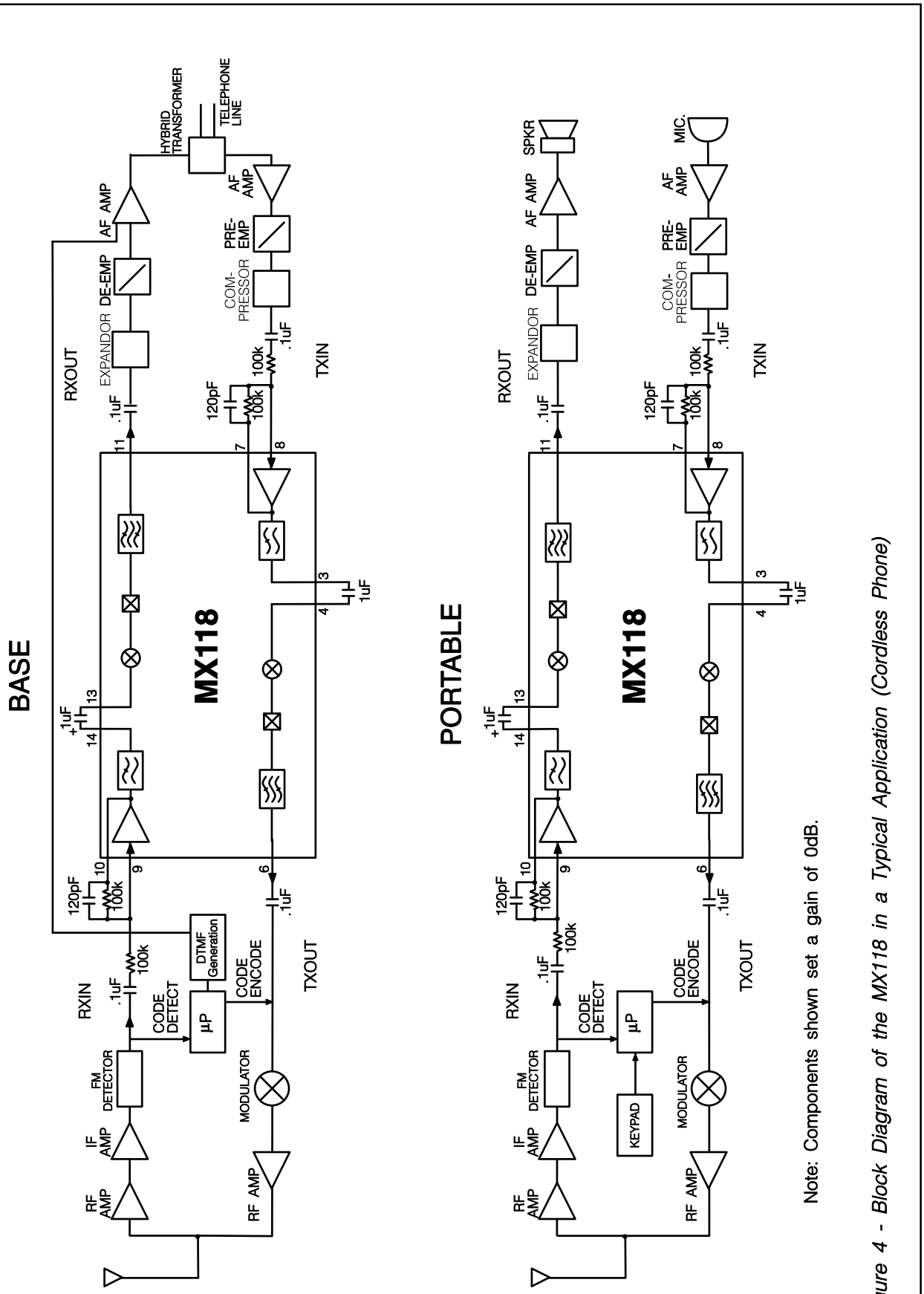
Tolerances: R = ±10%, C = ±20%

Notes: *1. Xtal circuitry shown is in accordance with MX-COM's Application Note on Crystal Oscillators (see Appendix).*

Figure 3 - Recommended External Components

Pin Function Chart

Pin	Function
1	**$\overline{\text{Xtal}}$:** This is the output of the clock oscillator inverter.
2	No Connection.
3	**C1 Filter Output:** This is the output of the channel 1 input filter. It should be coupled to pin 4 (C1 Balanced Modulator Input) by a 1.0 μF cap. See Figure 3.
4	**C1 Balanced Modulator Input:** This is the input to the channel 1 balanced modulator. Internally biased at $V_{DD}/2$, it should be coupled to pin 3 (C1 Filter Output) by capacitor C_2.
5	**V_{SS}:** Negative supply (GND).
6	**C1 Output:** This is the analog output of channel 1. It is internally biased at $V_{DD}/2$.
7	**C1 Gain Amp Output:** This is the output pin of the channel 1 gain adjusting op-amp. See Figure 4 for test gain setting components.
8	**C1 Input:** This is the analog signal input to channel 1. This input is to a gain adjusting op-amp whose gain is set by internal components. See Figure 4.
9	**C2 Input:** This is the analog signal input to channel 2. This input is to a gain adjusting op-amp whose gain is set by internal components. See Figure 4.
10	**C2 Gain Amp Output:** This is the output pin of the channel 2 gain adjusting op-amp. See Figure 4 for test gain setting components.
11	**C2 Output:** This is the analog output of channel 2. It is internally biased at $V_{DD}/2$.
12	**V_{BIAS}:** This is the analog bias line at $V_{DD}/2$. It should be coupled to V_{SS} by a 1.0 μF or greater capacitor. See Figure 3.
13	**C2 Balanced Modulator Input:** This is the input to the channel 2 balanced modulator. Internally biased at $V_{DD}/2$, it should be coupled to pin 14 (C2 Filter Output) by capacitor C_7.
14	**C2 Filter Output:** This is the output of the channel 1 input filter. It should be coupled to pin 13 (C2 Balanced Modulator Input) by a 1.0 μF capacitor. See Figure 3.
15	**V_{DD}:** Positive supply of 3.0 V to 5.5 V.
16	**Xtal/Clock:** 4.433619 MHz or an externally derived clock is injected at this pin. (See Figure 3.)



Note: Components shown set a gain of 0dB.

Figure 4 - Block Diagram of the MX118 in a Typical Application (Cordless Phone)

Application Information

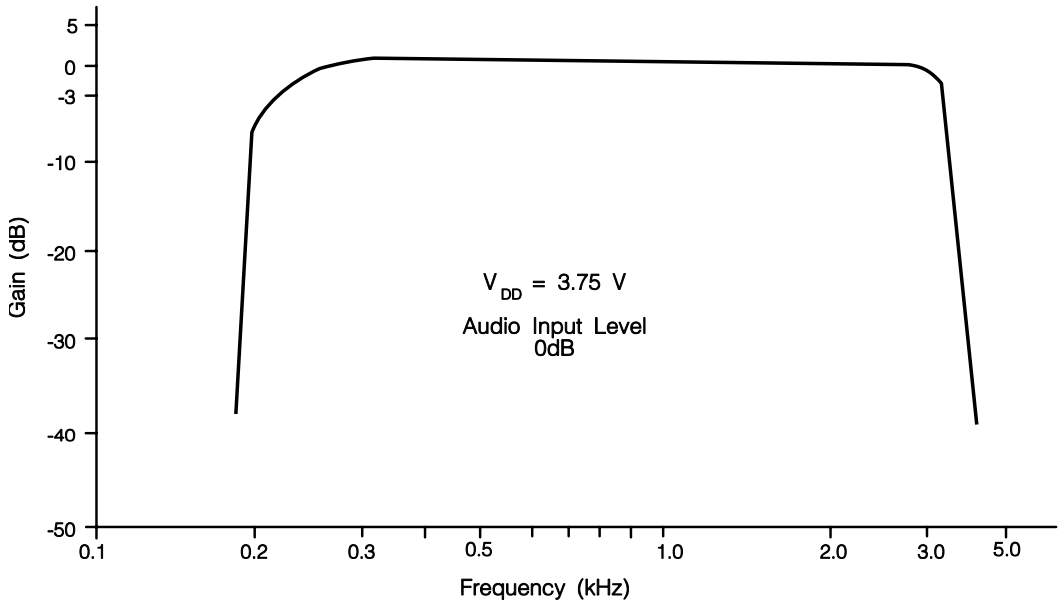


Figure 5 - Typical Audio Frequency Response of a Single Scrambled or De-scrambled Channel

System Gains

When calculating the external components for the operation of the MX118 the following should be considered:

a) The input Lowpass Filter has a typical gain of 0.5 dB.

b) The Balanced Modulator has a typical attenuation of 4.0 dB.

c) The Output Bandpass Filter has a typical gain of 4.5 dB.

How the Inverter Works

Carrier Frequency *minus* Input Voice Frequency *equals* Scrambled Voice Frequency.

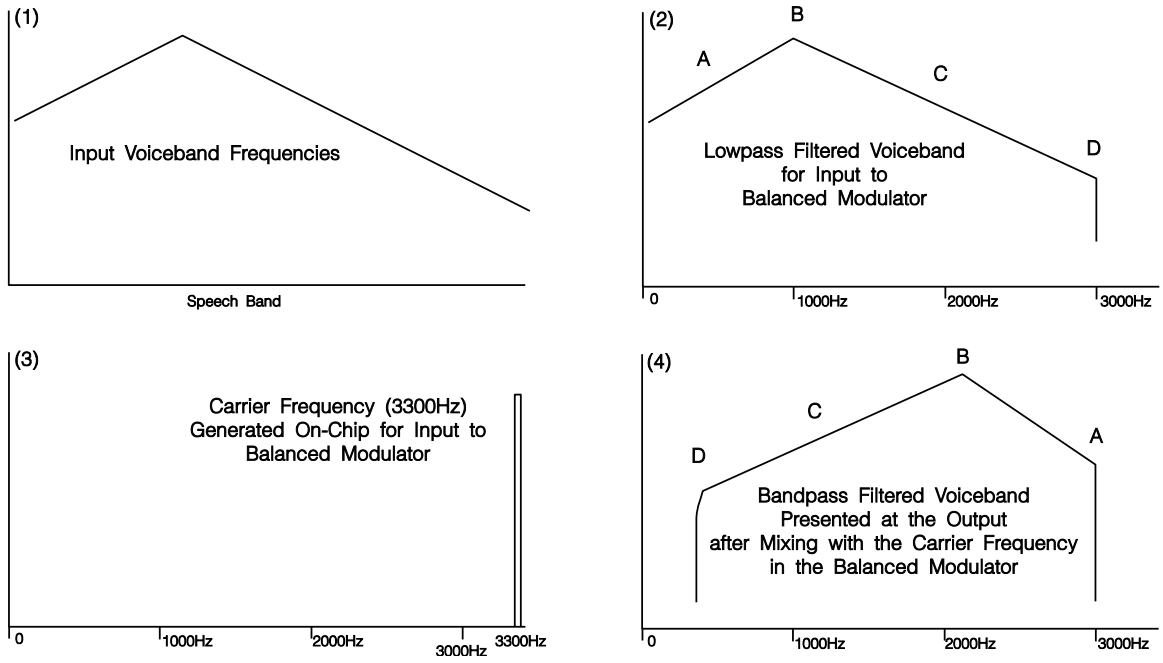


Figure 6 - An Explanation of the MX118 Scramble Operation

Specifications

Absolute Maximum Ratings

Exceeding the maximum rating can result in device damage. Operation of the device outside the operating limits is not suggested.

Supply Voltage	-0.3 to 7.0 V
Input Voltage at any pin (Ref. V_{SS} = 0V)	-0.3V to (V_{DD} + 0.3V)
Output sink/source current	
supply pins	±30mA
other pins	±20mA
Total Device Dissipation @ 25°C	800mW max.
Derating	10mW/°C
Operating Temperature	-10°C to +70°C
Storage Temperature	-40°C to +85°C

Operating Limits

All devices were measured under the following conditions unless otherwise noted.

V_{DD} = 3.75 V

T_{AMB} = 25°C

Clock = 4.433619 MHz

Audio Level 0dB Ref. = 387 mVrms @ 1 kHz

Noise Bandwidth = 30kHz

Characteristics	See Note	Min.	Typ.	Max.	Unit
Static Values					
Supply Voltage		3.0	3.75	5.5	V
Supply Current		-	4.0	6.0	mA
Input Impedance, Amplifiers		1.0	10.0	-	MΩ
Output Impedance					
C1, C2		-	200	-	Ω
Amplifiers		-	10.0	-	kΩ
Logic 1 Voltage		70% V_{DD}	-	-	
Logic 0 Voltage		-	-	30% V_{DD}	
On-Chip Xtal Oscillator					
R_{IN}		10.0	-	-	MΩ
R_{OUT}		-	10.0	-	kΩ
Inverter Gain		-	10.0	-	V/V
Gain/Bandwidth Product		-	10.0	-	MHz
Dynamic Values (Single Channel)					
Analog Signal Input Levels		-16.0	-	+3	dB
Carrier Breakthrough	1,2	-	-64.0	-	dB
Baseband Breakthrough	1,2	-	-50.0	-	dB
Carrier Frequency	5	-	3299	-	Hz
Analog Output Noise	3	-	-47.0	-42.0	dB
Upper Cut-off Frequency (-3dB)		3100	-	-	Hz
Passband Ripple (300 to 2950 Hz)		-1.5	-	+1.5	dB
Attenuation at 3.3 kHz		30.0	34.0	-	dB
Passband Gain		-2	0.5	+3	dB
Overall Modulated or De-Modulated Channel Response (Scrambler-Descrambler End-to-End)					
Passband Frequencies		300	-	2950	Hz
Passband Ripple		-3	-	+2	dB
Passband Gain @ 1 kHz	4	0	1.0	3.0	dB
Distortion	1	-	-	3.0	%
Low Frequency Attenuation @ 150 Hz		26	34	-	dB

NOTES

1. Measured with Input Level -3 dB.
2. Single Modulated Channel.
3. Short circuit input, any analog output, in 30 kHz bandwidth.
4. Op Amp gain 0 dB.
5. Accuracy dependent on Xtal/clock.

CML Microcircuits

COMMUNICATION SEMICONDUCTORS

CML Product Data

In the process of creating a more global image, the three standard product semiconductor companies of CML Microsystems Plc *(Consumer Microcircuits Limited (UK), MX-COM, Inc (USA) and CML Microcircuits (Singapore) Pte Ltd)* have undergone name changes and, whilst maintaining their separate new names *(CML Microcircuits (UK) Ltd, CML Microcircuits (USA) Inc and CML Microcircuits (Singapore) Pte Ltd*), now operate under the single title **CML Microcircuits**.
These companies are all 100% owned operating companies of the CML Microsystems Plc Group and these changes are purely changes of name and do not change any underlying legal entities and hence will have no effect on any agreements or contacts currently in force.

CML Microcircuits Product Prefix Codes

Until the latter part of 1996, the differentiator between products manufactured and sold from MXCOM, Inc. and Consumer Microcircuits Limited were denoted by the prefixes MX and FX respectively. These products use the same silicon etc. and today still carry the same prefixes. In the latter part of 1996, both companies adopted the common prefix: CMX.

This notification is relevant product information to which it is attached.

CML Microcircuits (USA) [formerly MX-COM, Inc.] Product Textual Marking

On CML Microcircuits (USA) products, the **'MX-COM'** textual logo is being replaced by a **'CML'** textual logo.

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