HSC SELECTIVE CALLING DECODER

FEATURES:

- **Low Power Consumption**
- **Single-in-Line Hybrid Construction**
- **Metropage, CCIR, EEA, and ZVEI Tonesets**
- **Dual Address Capability**
- **5-Tone Sequential Reliability and Speed**
- **Multiple Beep Alert Patterns**

APPLICATIONS:

- **Group/All Call Tone Decoding**
- **Pagers**
- **Mobile Radio**

DESCRIPTION:

The MX1103 (*) HSC Selective Calling Decoder processes the sequential tones of a coded address to output audible beep alerts and control an associated radio's speaker or "call waiting" lamp.

The MX1103 decodes sequential 5-tone selective calling signals and compares the incoming information with an address stored in an external diode ROM or matrix. Three distinct audio outputs are generated: an interrupted audio alert triggered by successful decode of the pager's primary address, a continuous audio alert which sounds when the primary address is followed by an additional instruction tone (tone C), and a special "group call" alert triggered by a "group" or "all call".

The MX1103 utilizes special instruction tones to cancel previous calls left in storage or to mute all open speakers in a system.

The MX1103 can operate from a three-cell battery and consumes a minimum of power. It combines the MX003, MX103, and external components onto a thick film hybrid substrate.

(*) please specify toneset: QA (Metropage), QC (CCIR), QE (EEA), or QZ (ZVEI).

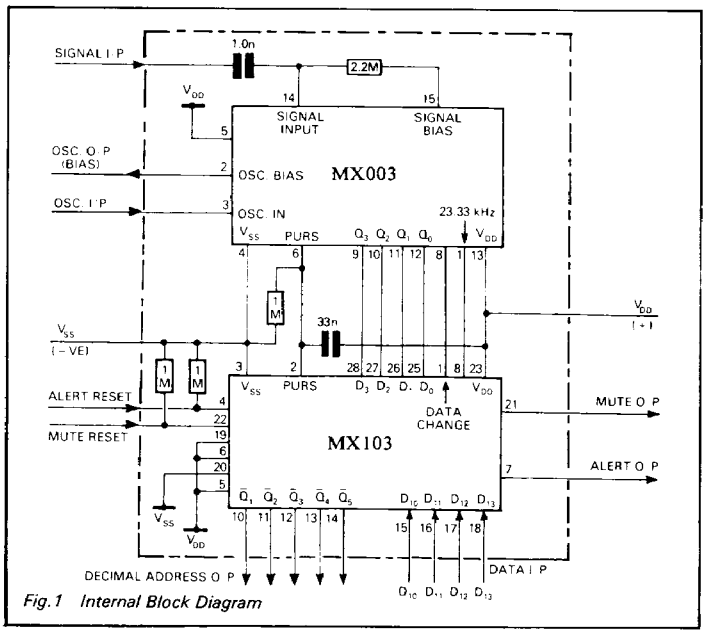


Fig. 1 Internal Block Diagram

OPERATION:

Codes are programmed as written into the code plug, without restrictions for successively repeated digits. For address codes of less than five digits, the hexadecimal "E" is programmed immediately after the last address digit, e.g. "123E" will be decoded as "123".

The MX1103 operates in accordance with the signalling protocols outlined in the HSC Systems Overview. The hexadecimal "E" is transmitted as a repeat character. The hexadecimal "A" tone denotes all digits values 0-9 for All and Group Call applications. A "C" tone added to the end of an address code flags the alternate continuous alert. A "D" suffix mutes open speakers and a "DC" suffix mutes speakers and clears any call in memory. An "F" code represents the "NOTONE" state. Every transmission must begin and end with an "F" condition presents -- however, no "F's" are allowed between digits.

The MX1103 is a state-sequential, time-independent decoder. Tone duration is not a factor, as long as the specified minimum detect period is met. This permits manually encoded data to be transmitted at indefinite human key entry rates or for address data to be buffered and sent at the minimum specified rate.

A Beep-Alert sounds on first power-up as an indication that the decoder is operational. Upon decoding a discrete unit address, i.e. "12345", the MX1103 outputs a 50% duty cycle interrupted tone of 2.1 KHz. On decoding an address with a "C" suffix appended, e.g. "12345C". a continuous alert is sounded. Any Group or All-Call Code such as "1234A" or "AEAEA" causes an interrupted tone alert of a morse code "V" pattern to be generated. Unless reset manually, all alerts sound for 10 seconds. The exception is the power-up alert, which sounds for 5 seconds.

A call bearing a "D" suffix, i.e. "12345D" inhibits all beeping and resets the call output latch, or optionally quiets an unmuted speaker. Suffix instructions have precedence over the Group/All call alert pattern, thus a transmission of "1234AC" results in a continuous (alternate alert) pattern for, in this exmple, ten decoders.

APPLICATION:

HSC Selective Calling Decoders may be applied in any voice-grade communications system if the encoded tones are within the decoder's specified bandwidth. Unconditioned phone lines and conventional 2-way radio channels are examples of acceptable systems. SSB radios with voice clarifiers pose special problems due to probable frequency translation errors.

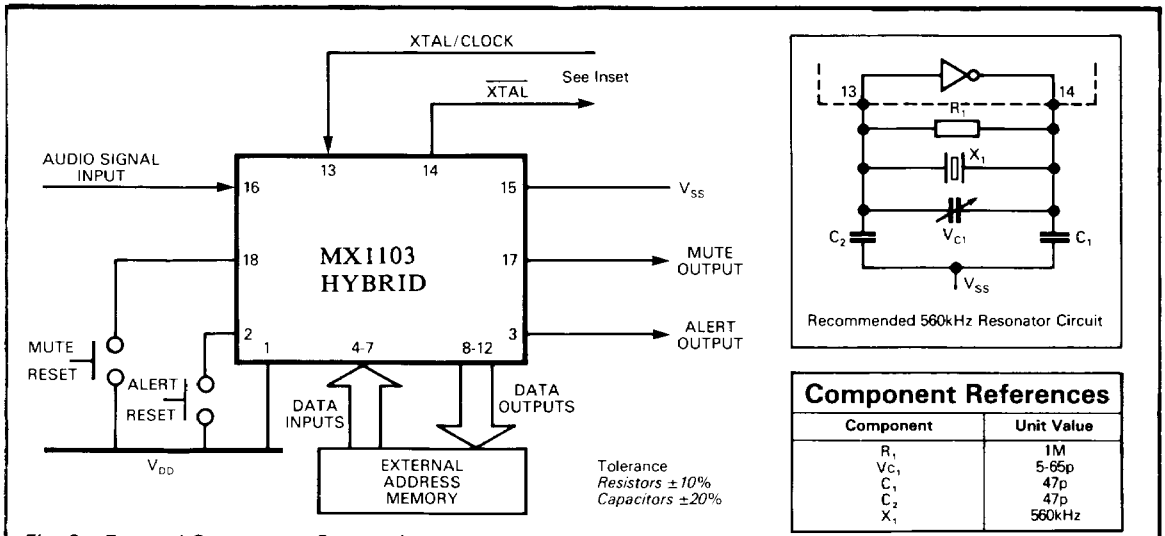
MX1103 PIN FUNCTION TABLE

PIN	FUNCTION	DESCRIPTION
1	V_{DD}	Positive Supply (+ VE).
2	**Alert Reset I/P**	The Audio 'Alert' output can be manually reset by the 'Alert Reset' input. If the audio is not reset within 10 seconds, the hybrid will clear the 'Alert' output and the audio pattern type is then loaded into a memory. Pressing the audio reset button will cause the memory contents to be reloaded into the alert pattern generator. This 'absent page memory' feature stores the last audio alert output which was not manually reset. The audio output can be reset in the normal manner.
3	**Alert O/P**	
4	D_{13}	D_{10} (LSB) to D_{13} (MSB) data inputs are connected to the anodes of the diode matrix for the External Address Memory.
5	D_{12}	
6	D_{11}	
7	D_{10}	
8	$\overline{Q_5}$	$\overline{Q_1}$ to $\overline{Q_5}$ Decimal Address Digits Select outputs are taken to the cathodes of the diode matrix for the External Address Memory.
9	$\overline{Q_4}$	
10	$\overline{Q_3}$	
11	$\overline{Q_2}$	
12	$\overline{Q_1}$	
13	**OSC I/P**	A 560kHz clock or resonator input. *See Figure 2 and Operating Note 4 (Resonator).*
14	**OSC O/P**	Oscillator output (bias).

15	V_{SS}	– VE Supply (GND)
16	**Signal I/P**	Biasing and a.c. coupling are provided internally.
17 18	**Mute O/P** **Mute Reset I/P**	The 'Mute' output is switched high when the device decodes an incoming selective call. This can be used to enable the audio amplifier of pagers equipped for 'tone and voice' operation. It remains 'on' until reset by the 'Mute Reset' input. The 'Mute' output can be considered as a call signal in 'tone only' applications. In this case the 'Mute Reset' and 'Alert Reset' inputs can be connected together. *See Operating Note 2. (Transmitted Instruction Codes).*

Operating Notes:

1. **PURS:** The Power Up Reset components are included in the hybrid. This prevents malfunction when power is applied. A one-second burst of rapid pips is generated at the 'Alert' output as a power on test. The maximum power supply rise time (to 90%) for correct operation is 2ms.
2. **Transmitted Instruction Codes:** The MX1103 can decode selectively addressed reset instructions using extra tones decoded in addition to those specified by Metropage, CCIR, EEA and ZVEI. Address suffix tones can be added after a selcall to reset the 'Mute' output and also erase the memory. The Mute is reset when tone D follows a call. Only when this is followed by tone C, will the device erase the memory; any other state (or no transmission) will inhibit the erasure. These transmitted instructions are also valid under group calling instructions.
   A voice paging system organized with transmitted reset instructions offers the possibility of hands-free operation at the receiver.
3. **Group Call:** The hybrid will decode group calls where any one or more digits of the address have been replaced by a group frequency (tone A). Groups ranging from ten units to all the pagers on a network can be simultaneously called. The hybrid will output a distinctive audio alert pattern when a group call is decoded. The additional second address instruction tone is also valid for group calls and causes the circuit to generate a continuous alert.
4. **Resonator:** The MX1103 requires a 560.0kHz clock which can be derived from a ceramic resonator as shown in figure 2. It may be tuned to the precise frequency by a variable (or select-on-test) capacitor. Wiring should be kept short. The frequency may be monitored at pin 14 by a high impedance counter with low capacitive loading. This single adjustment tunes all the decoder's frequencies.
5. **External Address Memory:** The selective calling address must be stored in a separate external memory. The memory input and output lines of the MX1103 have been designed to interface directly to fusable link diode matrices. Selcall numbers are programmed into the matrices directly without repeat codes (code E). The circuit automatically recognizes where successive address digits are identical and searches for the repeat tone. The code E is used in the memory as a terminator where less than 5 address digits are used. It is programmed into the external memory after rhe last digit and instructs the MX1103 to search for the address suffix tone codes or the no transmission state.



Component References

Component	Unit Value
R_1	1M
Vc_1	5-65p
C_1	47p
C_2	47p
X_1	560kHz

Fig. 2 External Component Connections

MX1103 ELECTRICAL SPECIFICATION

Absolute Maximum Ratings

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

Supply voltage	−0.3V to 7.0V
Input voltage at any pin (ref. V_{ss} = 0V)	−0.3V to (V_{DD} + 0.3V)
Output Sink/source current (total)	20mA
Maximum device dissipation	100mW
Operating temperature range:	−20°C to + 60°C
Storage temperature range:	−40°C to + 85°

Operating Limits

All characteristics are measured using a standard MX-COM standard test circuit with the following test parameters.

V_{DD} = 5.0V, T_{amb} = 25°C, fo = 560kHz, △fo = 0Hz.
Composite test signal: 0dB ref = 775mVrms.
Input signal; Tone @ −15dB with −21dB band limited 6kHz gaussian white noise.

Characteristics	See Note	Min	Typ	Max	Unit
Static Values					
Supply Voltage		3.3	5.0	5.5	V
Supply Current (decoding)		—	600	—	μA
Analog Input Impedance		—	2	—	MΩ
Alert Output Impedance		—	5	—	kΩ
Input logic '1'		3.5	—	—	V
Input logic '0'		—	—	1.5	V
Output logic '1'		4.5	—	—	V
Output logic '0'		—	—	0.5	V
Dynamic Values					
Signal Input Level		35	—	V_{DD}	mVrms
Input Tone Period (each tone)					
CCIR		20	100	—	ms
EEA		20	40	—	ms
ZVEI		20	70	—	ms
Metropage		25	33	—	ms
Decoder Bandwidth					
CCIR	1	±1	—	—	%
EEA	1	±1	—	—	%
ZVEI	1	±2	—	—	%
Metropage	1	±20	—	—	Hz
Signal to Noise Ratio Performance	1	0	—	—	dB
Not-decode Bandwidth					
CCIR	2		—	±3	%
EEA	2		—	±3	%
ZVEI	2		—	±4.5	%
Metropage	2		—	±60	Hz
False Decode Probability from Noise					
(5 tone address) CCIR	3, 4	—	2.5×10^{-31}	—	per hour
EEA	3, 4	—	2.5×10^{-31}	—	per hour
ZVEI	3, 4	—	4.8×10^{-31}	—	per hour
Metropage	3, 4	—	1×10^{-17}	—	per hour

MX1103 ELECTRICAL SPECIFICATIONS (cont.)

Characteristics	See Note	Min	Typ	Max	Unit
Alert Output Frequency		—	2.121	—	kHz
Alert Output Duration		—	—	10	s

Notes: *1. Decode probability > 0.975 (tone sequence).*
2. Decode probability < 0.025 (5 tone Sequence).
3. Including group and second address calls.
4. Measured with 100mVrms, 6kHz white noise.

MX1103 EXAMPLE TONE SEQUENCES

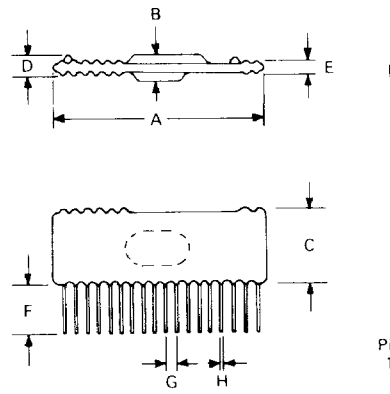
12345	Interrupted alert output — Mute high
12345C	Continuous alert output — Mute high
12A45	Group Pattern alert output — Mute high
AEAEA	All call — Group pattern alert output on all units — Mute high
12345D	No alert output — Reset Mute (i.e. low)
12345DC	No alert output — Reset Mute (i.e. Low) clear memory
AEAEAD	Mute all units — No output
NOTE:	Where A is the Group Frequency, E is the Repeat Frequency, and C and D are additional signalling tones.

(Example Address 12345)

ORDERING INFORMATION

MX1103 QA: METROPAGE toneset
Mx1103 QC: CCIR toneset
MX1103 QE: EEA toneset
MX1103 QZ: ZVEI toneset

MX1103 MECHANICAL DIMENSIONS



NOTE: All dimensions in mm.

Dimension	Min.	Typ.	Max.
A	—	47.0	—
B	—	4.1	—
C	—	13.5	—
D	—	3.9	—
E	—	3.3	—
F	—	7.6	—
G	2.49	2.54	2.59
H	0.48	0.5	0.52
I	—	0.25	—