CML Semiconductor Products

PRODUCT INFORMATION

FX013 HSC Tone Decoder for 'Pagers

Obsolete Product
- For Information Only -

Features

- 'N'-Tone HSC Decoding
- EIA and CCIR Tonesets
- 4-Bit Parallel (HEX) Data Output
- µProcessor Interface
- Auxiliary 23.33kHz Clock Output
- Low-Power (2.5V @ 500µA$_{MIN}$) Requirement
- Radiopaging, PMR Selcall and Remote Signalling Applications
- Selectable 560kHz or 4.48MHz Xtal/Clock Operation
- Automatic Power-Up Reset Facility
- 24-Pin/Lead Package Versions

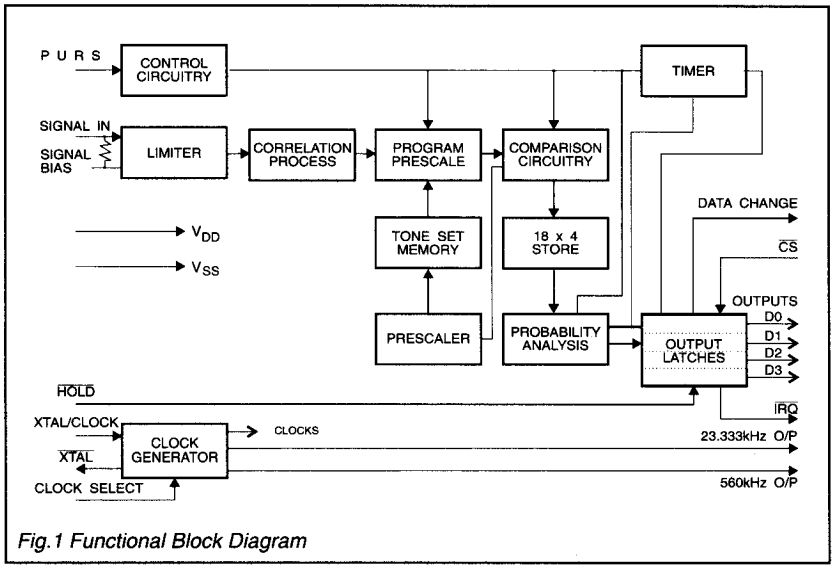


Fig.1 Functional Block Diagram

FX013

Brief Description

The FX013 is a very low-voltage continuous "N"-Tone EIA and CCIR HSC tone decoder which is ideal for tone-paging applications.

From an analogue signal input the FX013 will produce a representative 4-bit (HEX) parallel output word for either toneset. Hold, Data Change and Interrupt features combined with the 4-bit data output enable µProcessor interface and control. Alternatively, the FX013 may be used in a simple passive system using the Data Change and Data Outputs

This device can be used with a customer specified µProcessor or with a pre-programmed address decoder/display driver.

The FX013 has on-chip automatic Power-Up Reset circuitry, which with selected time-constant components ensures the correct start-up settings for most supply conditions, making this device ideal for installation within radiopaging units.

Operating at 2.5 volts with a minimum current requirement of 500µA, the FX013 is available in two toneset versions to decode either EIA (A) or CCIR (C) tones.

To cater for variations in design requirements the FX013 is produced in both 24-pin cerdip DIL and plastic quad packages.

Pin Number	Function
FX013J/LG	
3	**Signal In:** HSC input tones are a.c. coupled to this pin; dc bias of the internal high gain limiter is set up by an internal 3MΩ bias resistor connected between this pin and the Signal Bias pin. Neither pin should be loaded with any other circuitry.
5	**Signal Bias:** See Signal In.
7	**23.33kHz** Clock **Out:** A 23.333kHz buffered squarewave logic output directly derived from the oscillator frequency (nominally 560.0kHz). This pin may be used for auxiliary functions, e.g. external timing of received tone periods and for other '03 series devices.
8	**$\overline{\text{Xtal}}$:** Output from on-chip inverter.
9	**Xtal/Clock:** Input to on-chip inverter. May be used in conjunction with the $\overline{\text{Xtal}}$ O/P and a 560kHz ceramic resonator/trimming capacitor, or a 4.48MHz Xtal Circuit. May also be used with a buffered input from an externally derived 560kHz or 4.48MHz clock.
10	**560kHz** Buffered **O/P:** A buffered 560kHz signal is output from this pin.
11	**Clock** Frequency **Select:** Normally at logic "1" if a 560kHz resonator is being used. If held at logic "0," a divide by 8 function is switched in after the oscillator circuit to divide down the 4.48MHz frequency to 560kHz. This pin has an internal 1MΩ pullup resistor.
12	**V_{SS}:** Negative Supply (GND).
13	**$\overline{\text{Hold}}$ I/P:** If taken to V_{SS} and a tone is input, the resulting Data Change output latches to logic "1" and the Data lines output the code for the detected tone regardless of subsequent changes to the input tone, until Hold is returned to V_{DD}. This facilitates interrupt/handshake routines for µProcessors when used in conjunction with the Data Change O/P. This pin has an internal 1MΩ pullup resistor.
14	**Power-Up Reset (P U R S):** To reset internal circuitry on power-up, a logic "1" is required at this pin for a duration of at least 1.0ms after clock is applied. For slow-rising supplies the time constant recommended by the components in Figure 2 should be increased accordingly.
15	**$\overline{\text{IRQ}}$:** Interrupt Request. This output, is latched to logic "0" when a tone is detected and the CS pin is at V_{DD}, i.e. chip disabled. This pin is reset to logic "1," enabling its for use in wire-ORing with similar outputs from other peripherals. This pin has internal 1kΩ pulldown and 100kΩ pullup resistors on-chip.
16	**$\overline{\text{CS}}$**: Chip Select. When this pin is at V_{DD}, the chip is disabled and the data outputs D0 - D3 and Data Change output go open circuit. When at V_{SS} the chip is enabled and the IRQ output is reset to logic "1."
17	**Data Change:** A 1.0 ms pulse is generated at this pin upon detection of a valid tone and new data is presented to the D0 - D3 outputs. The signal from this pin can be latched at a logic "1" after detection of a tone (see Hold input). This output is tri-state.
19 20 22 23	**D3 Data Outputs:** A 4-bit word, that represents the HEX value of the decoded tone **D2** frequency, is output from these pins after a successful decode. **D1** These outputs are tri-state. See Table 1. **D0**
24	**V_{DD}:** Positive Supply
1, 2, 4, 6, 18, 21	Not connected. Leave open-circuit.

Application Information

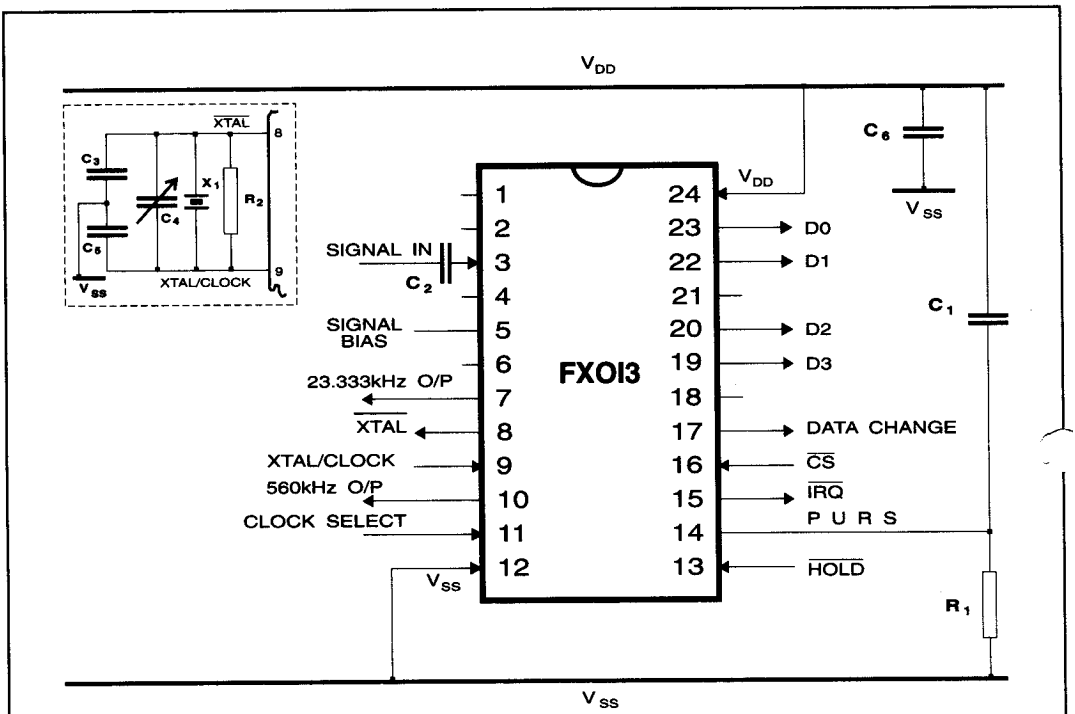


Fig. 2 Recommended External Components

Component	Value		
R_1	1MΩ	C_3	47.0pF
R_2	1MΩ	C_4	5 - 65pF
C_1	0.01μF	C_5	47.0pF
C_2	0.001μF	C_6	1.0μF
		X_1	560kHz

Tolerance: R = ±10% C = ±20%

Input Tone Frequencies (Hz) FX013 A (EIA)	FX013 C (CCIR)	Binary Coded Output D3	D2	D1	D0	Quadradecimal Data Character
600	1981	0	0	0	0	0
741	1124	0	0	0	1	1
882	1197	0	0	1	0	2
1023	1275	0	0	1	1	3
1164	1358	0	1	0	0	4
1305	1446	0	1	0	1	5
1446	1540	0	1	1	0	6
1587	1640	0	1	1	1	7
1728	1747	1	0	0	0	8
1869	1860	1	0	0	1	9
2151	2400	1	0	1	0	A
2433	930	1	0	1	1	B
2010	2247	1	1	0	0	C
2292	991	1	1	0	1	D
459	2110	1	1	1	0	E
NoTone	NoTone	1	1	1	1	F

Table 1 Decode Frequency Tonesets

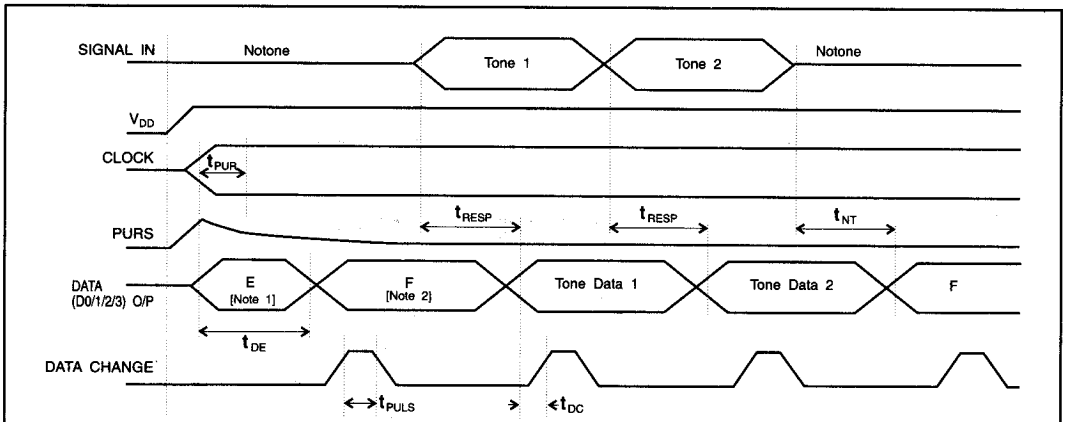


Fig.3 Normal Timing Operation [not to scale]

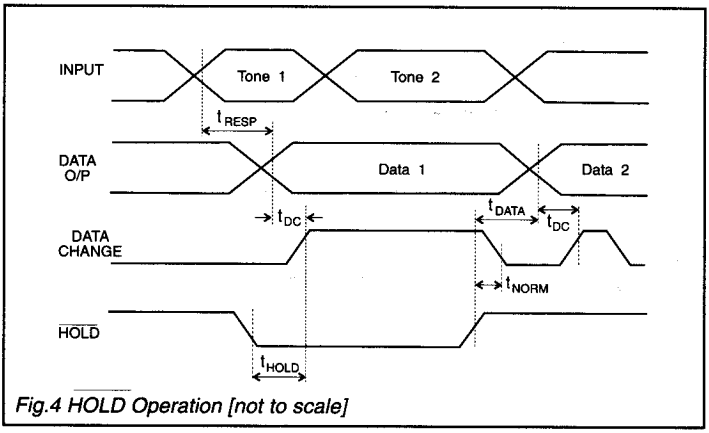


Fig.4 $\overline{HOLD}$ Operation [not to scale]

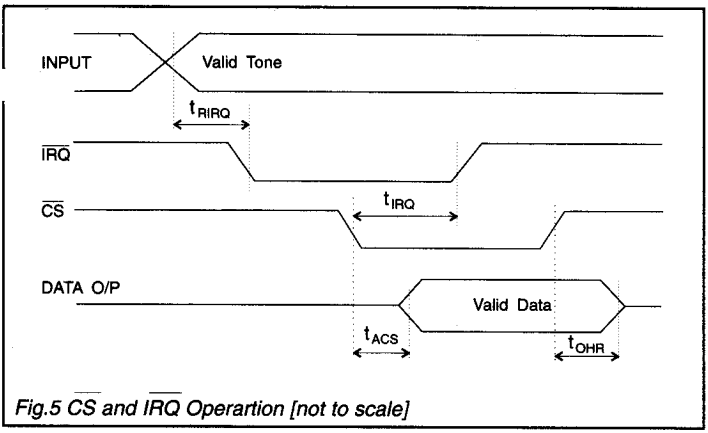


Fig.5 $\overline{CS}$ and $\overline{IRQ}$ Operartion [not to scale]

Timing Specification

	Min.	Typ.	Max.	Unit
t_{PUR}	2.0	-	-	ms
t_{DE}	-	33.0	-	ms
t_{PULS}	-	1.0	-	ms
t_{DC}	0.5	-	1.0	ms
t_{RESP}	20.0	-	33.0	ms
t_{NT}	33.0	-	53.0	ms
t_{DATA}	-	-	2.0	ms
t_{NORM}	-	-	120	µs
t_{HOLD}	50.0	-	-	µs
t_{IRQ}	-	-	250	ns
t_{RIRQ}	20.5	-	34.0	ms
t_{ACS}	-	-	250	ns
t_{OHR}	-	-	100	ns

Notes:

1. 'E' is the start-up (power-up reset) condition.
2. The state of D0/1/2/3 will represent the input frequency present during and after Power-Up Reset (F [NOTONE] in the Figure 3 example).

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		-0.3 to 7.0V
Input voltage at any pin (ref V_{SS} = 0V)		-0.3 to (V_{DD} + 0.3V)
Sink/source current (supply pins)		+/- 30mA
(other pins)		+/- 20mA
Total device dissipation @ T_{AMB} 25°C		800mW Max.
Derating		10mW/°C
Operating Temperature (T_{OP}):	**FX013J/LG**	-40°C to +85°C
Storage temperature range (T_{ST}):	**FX013J/LG**	-55°C to +125°C

Functional Limits	**Min.**	**Max.**	**Unit**	
Supply Voltage (V_{DD})	2.5	5.5	V	at 25°C

All device characteristics are measured under the following conditions unless otherwise specified:
V_{DD} = 5.0V T_{OP} = -40 to +85 °C. Xtal/Clock or 'Clock In' Frequency = 560kHz.

Characteristics	**See Note**	**Min.**	**Typ.**	**Max.**	**Unit**
Static Values					
Supply Voltage (V_{SS}=0V)		2.5	-	5.5	V
Supply Current		-	500	-	µA
Logic "1" Output (Source = 1 mA)	1	4.5	-	-	V
Logic "0" Output (Sink = 1 mA)	1	-	-	0.5	V
Logic "1" Input Level	2	3.5	-	-	V
Logic "0" Input Level	2	-	-	1.5	V
Oscillator Output Level					
Input Impedances					
Signal In		-	1.0	-	MΩ
Clock Select		-	1.0	-	MΩ
Hold I/P		-	1.0	-	MΩ
Chip Select		-	10.0	-	MΩ
Output Impedances					
D0 - D3		-	1.0	-	kΩ
Data Change		-	1.0	-	kΩ
Oscillator Outputs		-	10.0	-	kΩ
Dynamic Values					
Signal Input Range	3	35.0	-	V_{DD}/2	mVrms
Decode Bandwidth when P>0.995					
QA	4	±20.0	-	-	Hz
QC	4	±1.0	-	-	%
Not-Decode Bandwidth when P<0.03					
QA	5	-	-	±60.0	Hz
QC	5	-	-	±3.0	%
Noise Response Rate (hours per F - F - F single character response with no input tone).					
QA	6	-	0.15	-	/hour
QC	6	-	40.0	-	/hour
Decode Response Time:					
NOTONE to Tone (F - F)	7	20.0	25.0	33.0	ms
Tone to NOTONE, Tf (F - F)	7	33.0	-	53.0	ms
Minimum inter-tone gap for "F"	8	15.0	-	28.0	ms

Notes:

1. Pins 7, 8, 17 and 19, 20, 22 and 23.
2. Pins 13,14 and 16.
3. An ac coupled sine/squarewave.
4. With minimum tone period (Tp) specified for toneset. P = Decode Probability. (QA) SNR = 3dB. (QC) SNR = 0dB.
5. All conditions of input SNR and amplitude with maximum Tp specified for the toneset.
6. Gaussian input noise, bandwidth 6.0kHz, maximum input level corresponds to 1-digit code falsing rate. F = random single character.
7. Delay from change of input (tone applied/removed) to change at Q0-Q3 outputs.
8. Included in t_{NT}. Minimum tone gap requirement for "NOTONE" recognition. Outputs = F after delay.

Package Outlines

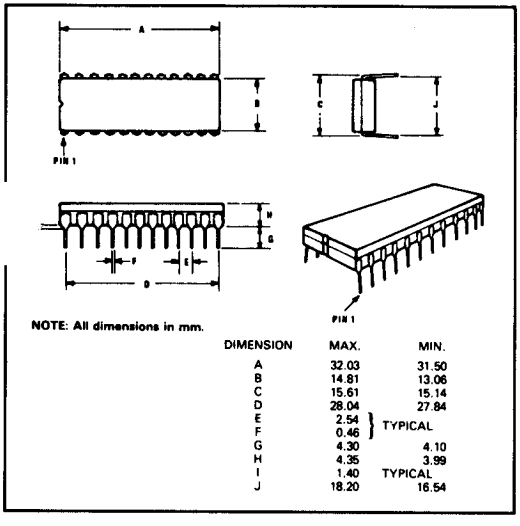
The FX013J, the cerdip package is shown in Figure 6 and the 'LG' quad plastic version in Figure 7.

Pin 1 identification marking is shown on the relevant diagram and pins on both package styles number anti-clockwise when viewed from the top (marked side).

Handling Precautions

The FX013 is a CMOS LSI circuit which includes input protection. However precautions should be taken to prevent static discharges which may cause damage.

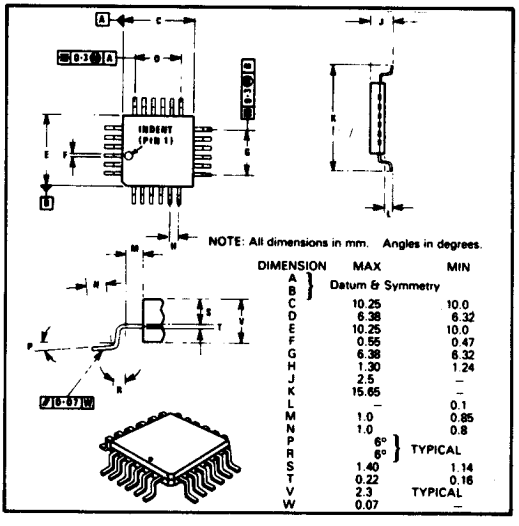
Fig.6 ***FX013J 24-pin cerdip Package***



NOTE: All dimensions in mm.

DIMENSION	MAX.	MIN.
A	32.03	31.50
B	14.81	13.06
C	15.61	15.14
D	28.04	27.84
E	2.54	TYPICAL
F	0.46	
G	4.30	4.10
H	4.35	3.99
I	1.40	TYPICAL
J	18.20	16.54

Fig.7 ***FX013LG quad plastic Package***



NOTE: All dimensions in mm. Angles in degrees.

DIMENSION	MAX	MIN
A, B	Datum & Symmetry	
C	10.25	10.0
D	6.38	6.32
E	10.25	10.0
F	0.55	0.47
G	6.38	6.32
H	1.30	1.24
J	2.5	–
K	15.65	–
L	–	0.1
M	1.0	0.85
N	1.0	0.8
P	6°	TYPICAL
R	6°	
S	1.40	1.14
T	0.22	0.16
V	2.3	TYPICAL
W	0.07	–

Ordering Information

The FX013 is available in two tonesets and two package styles: 'A' = EIA Tones
'C' = CCIR Tones
Please order the correct toneset in the correct package.

FX013J 'A' / 'C'

24-pin cerdip DIL

FX013LG 'A' / 'C'

24-pin plastic encapsulated bent and cropped

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