

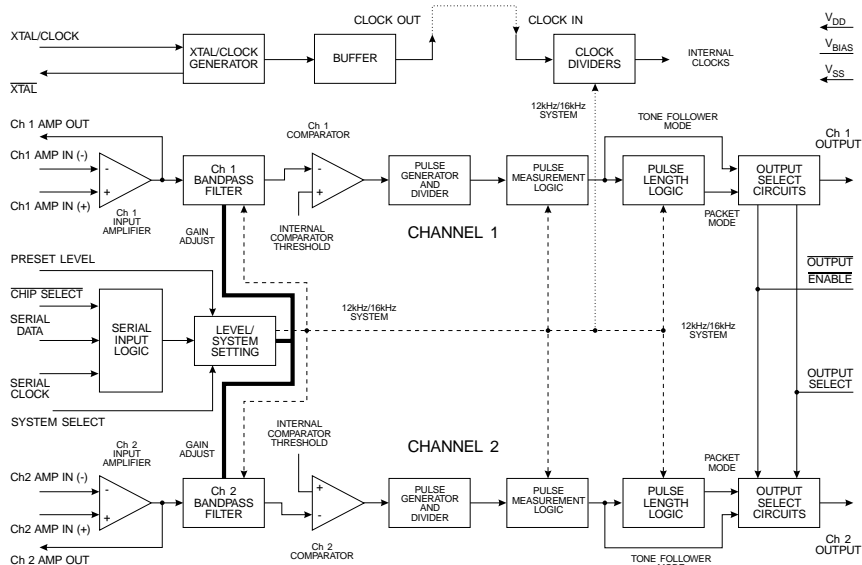
### PRELIMINARY INFORMATION

### Features

- Two (12kHz / 16kHz) SPM Detectors on a Single Chip
- Detects 12 or 16kHz SPM Frequencies
- 'Controlled' ( $\mu$ C) & 'Fixed' Signal Sensitivity Modes
- Selectable Tone Follower or Packet Mode Outputs
- High Speech-Band Rejection Properties
- 'Output Enable' Multiplexing Facility

### Applications

- Call Charge Applications on PABX Line Cards
- Remote Telephone Applications



The MX641 is a low-power, system-selectable Dual Subscriber Pulse Metering (SPM) Detector designed to indicate the presence, on a telephone line, of either 12kHz or 16kHz telephone call-charge frequencies. It is designed for PBX and PABX line-card and remote telephone installations. Under  $\mu$ Processor control via a common serial interface, each channel of the MX641 will detect call-charge pulses from a telephone line and provide a digital output for recording, billing or security purposes. A common set of external components and a stable 3.579545MHz Xtal/clock input ensures that the MX641 adheres accurately to most national "Must and Must-Not" decode band-edges and threshold levels. For non- $\mu$ Processor systems a preset sensitivity/system input allows external channel level and system setting

The digital output is pin-selectable to one of three modes:

- (1) Tone Follower mode: logic level for the period of a correct decode.
- (2) Packet mode: respond/de-respond after a cumulative period of tone or notone in a fixed (intrinsic hardwired period that is not user controlled) period.
- (3) High-impedance output: for device multiplexing.

The MX641 requires a 5V supply and is available in the following packages: 24-pin SOIC (MX641DW) and 24-pin PDIP (MX641P)

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# 1. Block Diagram

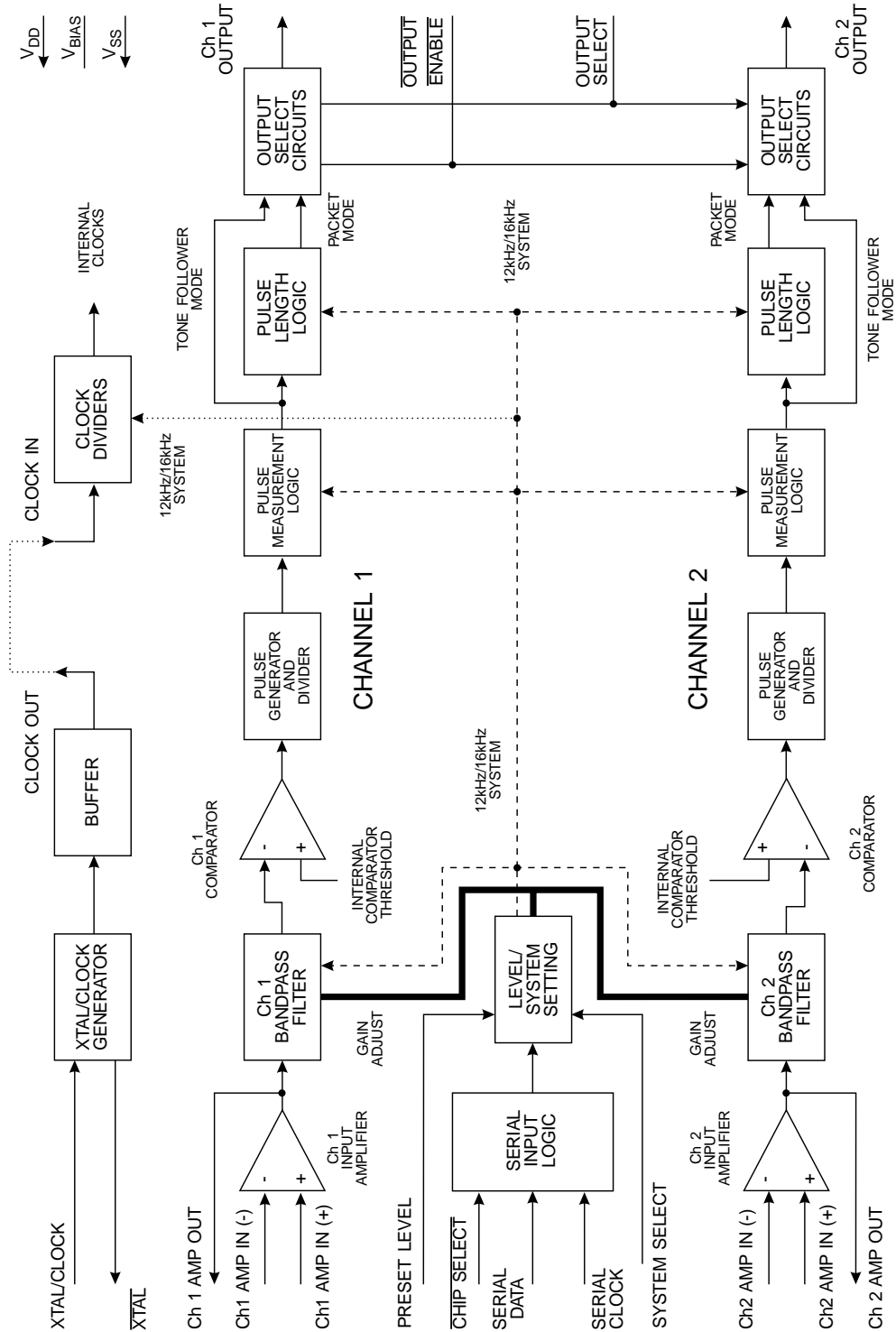


Figure 1: Block Diagram

## 2. Signal List

Pin No.	Name	Type	Description
1	Xtal/Clock	input	The input to the on-chip clock oscillator; for use with a 3.579545MHz Xtal in conjunction with the Xtal output; circuit components are on-chip. When using a Xtal input, the Clock Out pin should be connected directly to the Clock In pin. If a clock pulse input is used at the Clock In pin, this (Xtal/Clock) pin must be connected directly to $V_{DD}$ (see Figure 2). See Figure 3 for details of clock frequency distribution.
2	$\overline{XTAL}$	output	The output of the on-chip clock oscillator inverter.
3	Clock Out	output	The buffered output of the on-chip-clock oscillator inverter. If a Xtal input is used, this output should be connected directly to the Clock In pin. This output can support up to 3 additional MX641 ICs. See Figure 3 for details of clock frequency distribution.
4	Clock In	input	The 3.579545 clock pulse input to the internal clock dividers. If an externally generated clock pulse input is used, the Xtal/Clock input pin should be connected to $V_{DD}$ .
5	$\overline{\text{Output Enable}}$	input	For multi-chip output multiplexing; controls the state of both Ch1 and Ch2 outputs. When this input is placed high (logic '1') both outputs are set to a high impedance. When placed low (logic '0') both outputs are enabled.
6	Ch 2 Output	output	The digital output of the Channel 2 SPM detector when enabled. The format of the signal at this pin, in common with Ch 1, is selectable to either 'Tone Follower' or 'Packet' mode via the Output Select input.
7	Ch 1 Output	output	The digital output of the Channel 1 SPM detector when enabled. The format of the signal at this pin, in common with Ch 2, is selectable to either 'Tone Follower' or 'Packet' mode via the Output Select input.
8	$V_{BIAS}$	power	The output of the on-chip analog bias circuitry. Held internally at $V_{DD}/2$ , this pin should be decoupled to $V_{SS}$ (see Figure 2).
9	Ch 1 Amp Out	output	The output of the Channel 1 Input Amplifier. See Figure 2 and Figure 8.
10	Ch 1 Amp In (-):	input	The negative input to the Channel 1 Input Amplifier. See Figure 2 and Figure 8.
11	Ch 1 Amp In (+):	input	The positive input to the Channel 1 Input Amplifier. See Figure 2 and Figure 8.
12	$V_{SS}$	power	Negative supply (GND).
13	N/C		No internal connection; leave open circuit.
14	Ch 2 Amp In (+):	input	The positive input to the Channel 2 Input Amplifier. See Figure 2 and Figure 8.
15	Ch 2 Amp In (-):	input	The negative input to the Channel 2 Input Amplifier. See Figure 2 and Figure 8.
16	Ch 2 Amp Out	output	The output of the Channel 2 Input Amplifier. See Figure 2 and Figure 8.
17	Output Select	input	A logic input to set the Channel 1 and Channel 2 output modes. When high (logic '1'), the outputs are in the Tone Follower mode; when low (logic '0'), the outputs are in the Packet mode.
18	Preset Level	input	A logic input to set the sensitivity mode of the MX641. When high (logic '1'), both channels are in the Fixed Sensitivity mode. The external components govern the input sensitivity; the System Select input selects 12kHz or 16kHz operation. When low (logic '0'), both channels are in the Controlled Sensitivity mode. Device sensitivities and system selection are via the Chip Select/Serial Data/Serial Clock inputs. This input has an internal pull-up resistor on chip (Fixed Sensitivity Mode).

Pin No.	Name	Type	Description
19	$\overline{\text{Chip Select}}$	input	The Chip Select input for use in data loading when using the MX641 in the Controlled Sensitivity mode (see Figure 9). The device is selected when this input is set low (logic '0'). When the MX641 is in the Fixed Sensitivity mode this input should be connected to either $V_{SS}$ or $V_{DD}$ .
20	Serial Clock	input	The Serial Clock input for use in data loading when using the MX641 in the Controlled Sensitivity mode (see Figure 9). Data is loaded to the MX641 on this clock's rising edge. When the MX641 is in the Fixed Sensitivity mode this input should be connected to either $V_{SS}$ or $V_{DD}$ .
21	Serial Data	input	The Serial Data input for use in data loading when using the MX641 in the Controlled Sensitivity mode (see Figure 9 and Table 4). When the device is in the Fixed Sensitivity mode this input should be connected to either $V_{SS}$ or $V_{DD}$ .
22	System Select	input	In the Fixed Sensitivity mode this pin selects the system frequency. High (logic '1') = 12kHz; Low (logic '0') = 16kHz. In the Controlled Sensitivity mode this pin should be tied to $V_{DD}$ or left unconnected. This pin has an internal pull-up resistor on chip.
23	N/C		No internal connection; leave open circuit.
24	$V_{DD}$	power	Positive supply rail; a single, stable power supply is required. Critical levels and voltages within the MX641 are dependent upon this supply. This pin should be decoupled to $V_{SS}$ by a capacitor mounted close to the pin

**Table 1: Signal List**

### 3. External Components

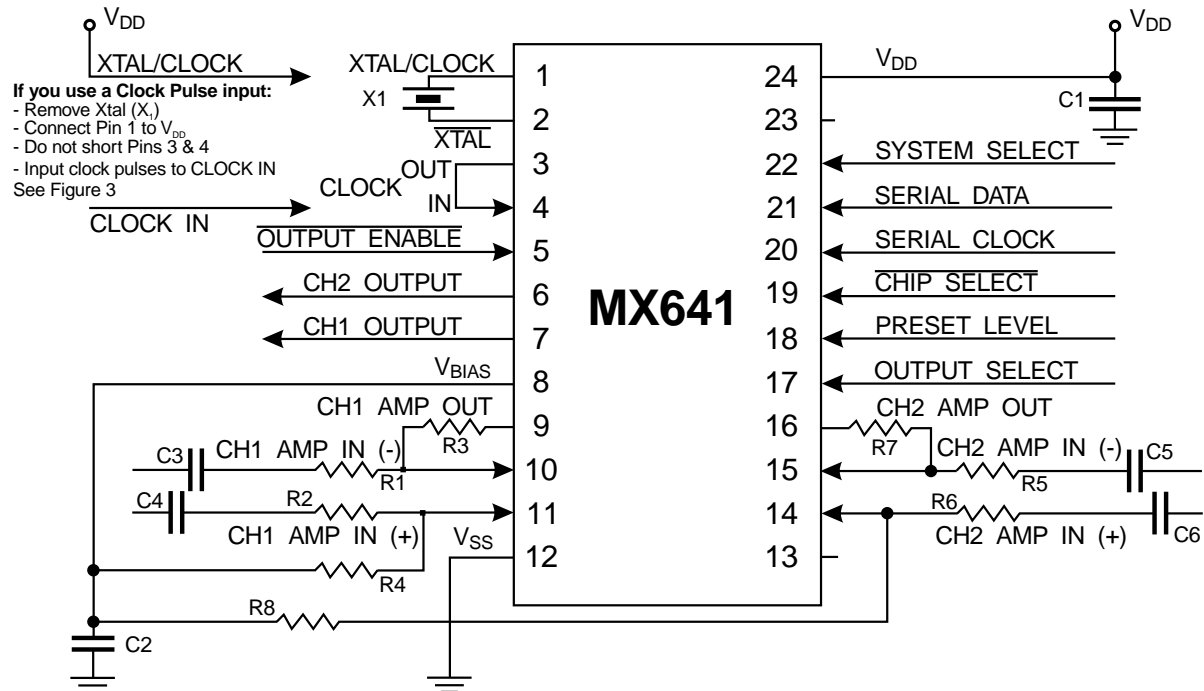


Figure 2: Recommended External Components

R1		68k $\Omega$	$\pm 1\%$	C1		1.0 $\mu$ F	$\pm 20\%$
R2		68k $\Omega$	$\pm 1\%$	C2		1.0 $\mu$ F	$\pm 20\%$
R3	Note 1	750k $\Omega$	$\pm 1\%$	C3		270pF	$\pm 5\%$
R4	Note 1	750k $\Omega$	$\pm 1\%$	C4		270pF	$\pm 5\%$
R5		68k $\Omega$	$\pm 1\%$	C5		270pF	$\pm 5\%$
R6		68k $\Omega$	$\pm 1\%$	C6		270pF	$\pm 5\%$
R7	Note 1	750k $\Omega$	$\pm 1\%$				
R8	Note 1	750k $\Omega$	$\pm 1\%$	X1	Note 2, 3	3.579545MHz	

Table 2: Recommended External Components

**Note:**

1. Fixed Sensitivity Setting: when calculating/selecting gain components, R3, R4, R7 and R8 should always be greater than or equal to 100k $\Omega$ .
2. For best results, a crystal oscillator design should drive the clock inverter input with signal levels of at least 40% of  $V_{DD}$ , peak to peak. Tuning fork crystals generally cannot meet this requirement. To obtain crystal oscillator design assistance, consult your crystal manufacturer.
3. The on-chip crystal circuitry includes a feedback resistor (nominally 2M $\Omega$ ) between pins 1 & 2 and load capacitors on pins 1 & 2 (nominally 10pF each, excluding package and board parasitics).

## 4. General Description

### 4.1 Xtal/Clock Distribution

The MX641 requires a 3.579545MHz Xtal or clock pulse input. With the exception of the Xtal, all oscillator components are incorporated on chip. If a Xtal input is employed the Clock Out pin should be directly linked to the Clock In pin.

To reduce component and layout complexity, the clock requirements of up to 3 additional MX641 microcircuits may be supplied from a Xtal-driven MX641 acting as the system master clock. With reference to Figure 3, the clock should be distributed as illustrated and the Xtal/Clock pins of the driven microcircuits should be connected directly to  $V_{DD}$ .

Note (see section 6.1.3) that the maximum load on the master Clock Out pin should not be exceeded.

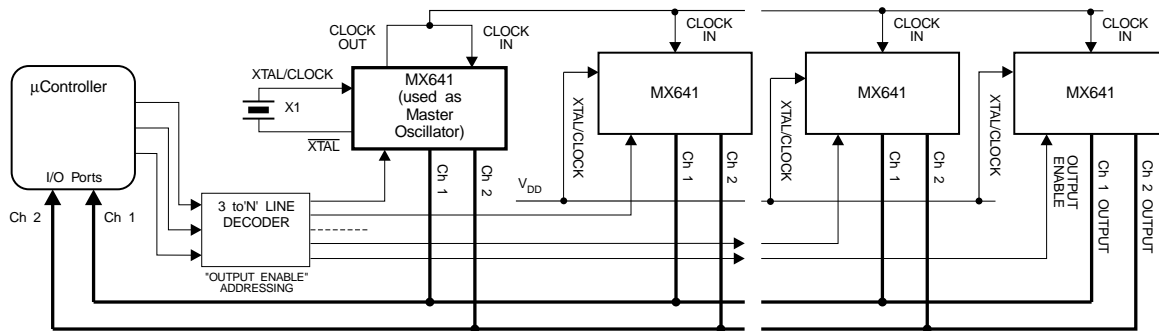


Figure 3: Xtal/Clock Distribution and Output Multiplexing

### 4.2 Channel Outputs

Channel 1 and Channel 2 outputs operate together under the control of the Output Enable and Output Select inputs.

Table 3 describes the operations.

The digital output is pin-selectable to one of three modes:

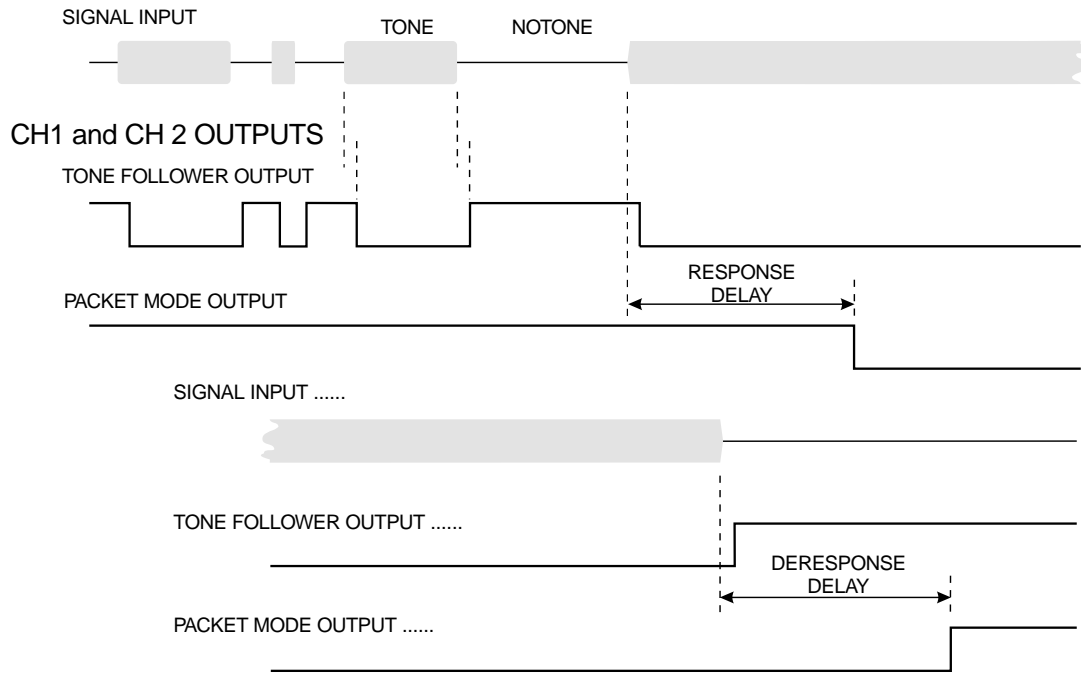
- (1) Tone Follower mode: a logic level for the period of a correct decode.
- (2) Packet mode: respond/de-respond after a cumulative period of tone or notone in a fixed (intrinsic hardwired period that is not user controlled) period.
- (3) High-impedance output: for device multiplexing.

System Select	Preset Level	Output Select	Output Enable	Operating Mode		
				Mode	Sensitivity	Frequency
X	0	0	0	Packet Mode Output;	Serial Data Control (see note)	
X	0	1	0	Tone Follower Output;	Serial Data Control (see note)	
0	1	0	0	Packet Mode Output;	Fixed Sensitivity	16kHz
1	1	0	0	Packet Mode Output;	Fixed Sensitivity	12kHz
0	1	1	0	Tone Follower Output;	Fixed Sensitivity	16kHz
1	1	1	0	Tone Follower Output;	Fixed Sensitivity	12kHz
X	X	X	1	Tristate Output (High Z)		

X = don't care

Note: Device sensitivity and system frequency must be serially loaded

Table 3: Operating Mode Configuration



**Figure 4: Tone Follower and Packet Mode Outputs**

### 4.3 Sensitivity Setting

To enable the MX641 to operate correctly to most national 12kHz and 16kHz SPM specifications, the input sensitivity can be accurately adjusted and set.

There are two different pin-selectable modes of sensitivity setting available to the MX641: Controlled Sensitivity Mode and Fixed Sensitivity Mode

The Controlled Sensitivity mode allows the sensitivity setting from a  $\mu$ Controller via a 6-bit serial data input. This same serial input also sets operation (bit 0) to either 12kHz or 16kHz systems. Both channels are set identically.

The Fixed Sensitivity mode allows the sensitivity of each channel to be set to a fixed "gain" by external components at the input amplifiers. Operation to either 12kHz or 16kHz is by the System Select input.

#### 4.3.1 Controlled Sensitivity Setting

With the external gain (sensitivity) components used as shown in Figure 2, the gain of the input stages is 19.8dB (12kHz) or 20.5dB (16kHz). For controlled sensitivity setting the gain of each bandpass filter, and therefore the device sensitivity, is adjusted by the applied serial bits D1 to D5.

In the Controlled Sensitivity mode the system frequency is selected by bit D0 ('1' = 12kHz; '0' = 16kHz). Data is loaded Bit 5 (D5) first. Table 4 details the serial data inputs for the required sensitivity. Minimum, Nominal and Maximum Sensitivity figures are provided to make complete allowance for internal circuit offsets and component tolerances.

0dB(ref.) = 775mV<sub>RMS</sub> at  $V_{DD} = 5.0$  volts; varies directly with  $V_{DD}$ .

**Note: Device sensitivity is directly proportional to  $V_{DD}$**



### 4.3.1.1 Controlled Sensitivity Setting Information

The sensitivity figures in Table 4 are based on the following:

1. The recommended amplifier components (see Figure 2) are used, providing an amplifier gain at 16kHz of 19.8dB  $\pm$ 0.3dB or at 12kHz of 19.1dB  $\pm$ 0.3dB.
2. A comparator sensitivity of 1.6dB(ref.)  $\pm$ 1dB (the variation is due to filter gain error, filter output offset, comparator input offset or a combination of all 3).
3. The applied  $V_{DD}$  is 5.0 volts; 0dB (ref.) = 775mV<sub>RMS</sub>.

Serial Data Bits	Bandpass Filter Gain	12kHz System Bit D0 = '1'			16kHz System Bit D0 = '0'		
		Minimum Sensitivity	Nominal Sensitivity	Maximum Sensitivity	Minimum Sensitivity	Nominal Sensitivity	Maximum Sensitivity
D5 - D1	(dB)	dB(ref.)	dB(ref.)	dB(ref.)	dB(ref.)	dB(ref.)	dB(ref.)
00000	0	-16.2	-17.5	-18.8	-16.9	-18.2	-19.5
00001	1.0	-17.2	-18.5	-19.8	-17.9	-19.2	-20.5
00010	2.0	-18.2	-19.5	-20.8	-18.9	-20.2	-21.5
00011	3.0	-19.2	-20.5	-21.8	-19.9	-21.2	-22.5
00100	4.0	-20.2	-21.5	-22.8	-20.9	-22.2	-23.5
00101	5.0	-21.2	-22.5	-23.8	-21.9	-23.2	-24.5
00110	6.0	-22.2	-23.5	-24.8	-22.9	-24.2	-25.5
00111	7.0	-23.2	-24.5	-25.8	-23.9	-25.2	-26.5
01000	8.0	-24.2	-25.5	-26.8	-24.9	-26.2	-27.5
01001	9.0	-25.2	-26.5	-27.8	-25.9	-27.2	-28.5
01010	10.0	-26.2	-27.5	-28.8	-26.9	-28.2	-29.5
01011	11.0	-27.2	-28.5	-29.8	-27.9	-29.2	-30.5
01100	12.0	-28.2	-29.5	-30.8	-28.9	-30.2	-31.5
01101	13.0	-29.2	-30.5	-31.8	-29.9	-31.2	-32.5
01110	14.0	-30.2	-31.5	-32.8	-30.9	-32.2	-33.5
01111	15.0	-31.2	-32.5	-33.8	-31.9	-33.2	-34.5
10000	16.0	-32.2	-33.5	-34.8	-32.9	-34.2	-35.5
10001	17.0	-33.2	-34.5	-35.8	-33.9	-35.2	-36.5
10010	18.0	-34.2	-35.5	-36.8	-34.9	-36.2	-37.5
10011	19.0	-35.2	-36.5	-37.8	-35.9	-37.2	-38.5
10100	20.0	-36.2	-37.5	-38.8	-36.9	-38.2	-39.5
10101	21.0	-37.2	-38.5	-39.8	-37.9	-39.2	-40.5
10110	22.0	-38.2	-39.5	-40.8	-38.9	-40.2	-41.5
10111	23.0	-39.2	-40.5	-41.8	-39.9	-41.2	-42.5
11000	24.0	-40.2	-41.5	-42.8	-40.9	-42.2	-43.5
11001	25.0	-41.2	-42.5	-43.8	-41.9	-43.2	-44.5
11010	26.0	-42.2	-43.5	-44.8	-42.9	-44.2	-45.5
11011	27.0	-43.2	-44.5	-45.8	-43.9	-45.2	-46.5
11100 11101 11110 11111	These states should never be used. If sensitivities of this order are required (e.g. the Swedish Rural SPM specification), it is recommended that the Controlled Sensitivity setting be set to 20dB (10100) and external components selected to set the Input Amp gain to a higher figure. This action will prevent falsing by sub-harmonic frequencies.						

**Table 4: Controlled Sensitivity Setting Information**

### 4.3.1.2 German FTZ Specification (16kHz)

The FTZ system has a Must Decode level of -21dB (ref.) and a Must-Not Decode level of -27dB (ref.). Reference to

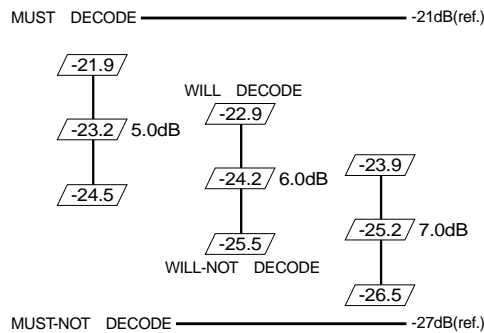
Table 4 shows that Bandpass Filter Gain settings of 5dB, 6dB or 7dB will enable an MX641 channel to meet this level specification. Figure 5 illustrates the range of these various settings.

To meet the German FTZ specification, the input data (D5 to D0) must be:

	0 0 1 0 1	0	5.0dB
or	0 0 1 1 0	0	6.0dB
or	0 0 1 1 1	0	7.0dB

**Note:**

1. By selecting the middle setting, the greatest noise immunity is achieved.



**Figure 5: German Specification - Possible Settings**

### 4.3.1.3 French Specification (12kHz)

This system has a Must Decode level of -17.36dB (ref.) and a Must-Not Decode level of -23.8dB (ref.). Reference to

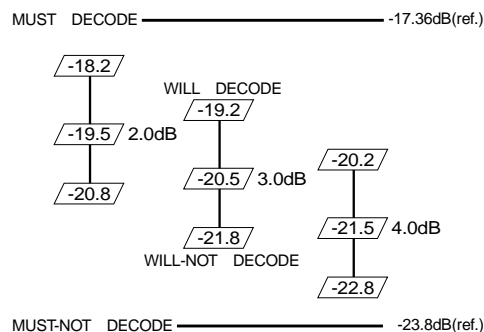
Table 4 shows that Bandpass Filter Gain settings of 2dB, 3dB or 4dB will enable an MX641 channel to meet this level specification. Figure 6 illustrates the range of these various settings.

To meet the French SPM specification, the input data (D5 to D0) must be:

	0 0 0 1 0	1	2.0dB
or	0 0 0 1 1	1	3.0dB
or	0 0 1 0 0	1	4.0dB

**Note:**

1. By selecting the middle setting, the greatest noise immunity is achieved.



**Figure 6: French Specifications - Possible Settings**

### 4.3.2 Fixed Sensitivity Setting

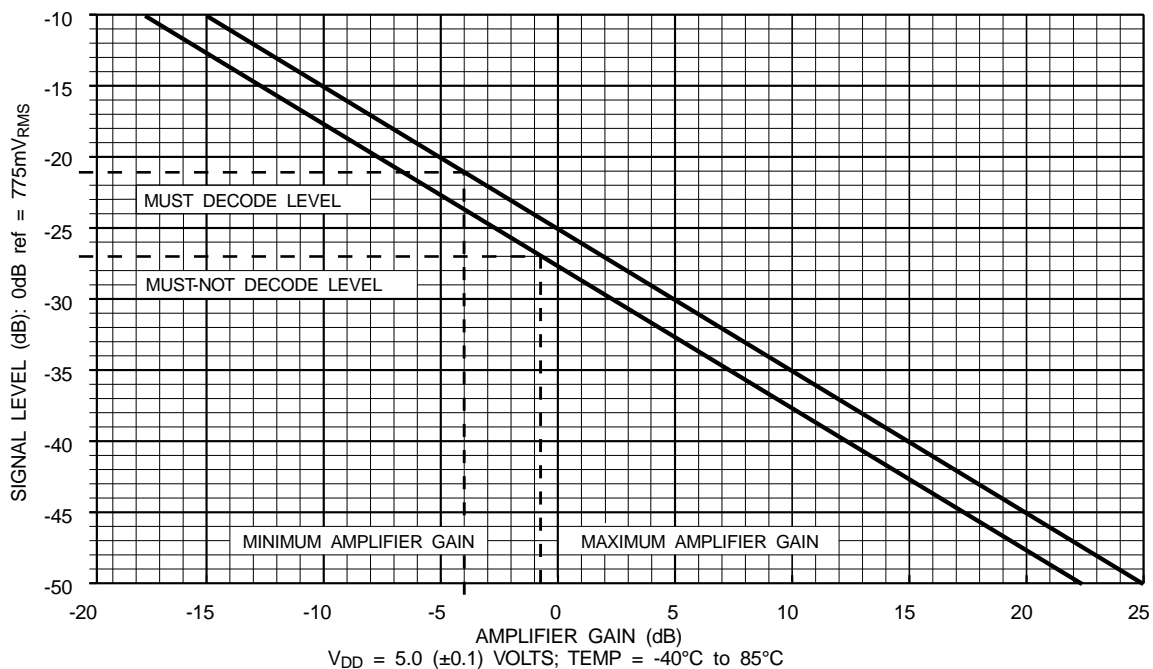
In this mode the sensitivity of each channel is set by the correct selection of the components around the Channel Input Amplifier. Note that the device sensitivity is directly proportional to the applied power supply ( $V_{DD}$ ) and that the gain bandwidth product of the input opamp can attenuate the SPM signal gain at some input gain configurations.

#### 4.3.2.1 Input Gain Calculation

The input amplifier, with external circuitry, is used to set the sensitivity of the MX641 to conform to the user's national level specification with regard to 'Must' and 'Must-Not' decode signal levels.

With reference to the graph in Figure 7, the following steps will assist in the determination of the required gain/attenuation.

- Step 1 Draw two horizontal lines from the Y-axis (Signal Level) in Figure 7. The upper line represents the required 'Must' decode level. The lower line represents the required 'Must-Not' decode level
- Step 2 Mark the intersection of the upper horizontal line and the upper sloping line; drop a vertical line from this point to the X-axis (Amplifier Gain (dB)). The point where the vertical line meets the X-axis indicates the minimum Input Amp gain required for reliable decoding of valid signals
- Step 3 Mark the intersection of the lower horizontal line and the lower sloping line; drop a vertical line from this point to the X-axis. The point where the vertical line meets the X-axis will indicate the maximum allowable Input Amp gain. Input signals at or below the 'Must-Not' decode level will not be detected as long as the amplifier gain is no higher than this level.



**Figure 7: Input Gain Calculation Graph for use in the Fixed Sensitivity Mode**

#### 4.3.2.2 Input Gain Components

Refer to the gain components shown in Figure 2. The user should calculate and select external components (R1/R3/C3, R2/R4/C4 and R5/R7/C5, R6/R8/C6) to provide amplifier gains within the limits obtained in Steps 2 and 3.

Component tolerances should not move the gain-figure outside these limits. The graph in Figure 7 is for the calculation of input gain components for an MX641 using a  $V_{DD}$  of 5.0 ( $\pm 0.1$ ) volts.

It is recommended that the designed gain is near the center of the calculated range.

## 5. Applications

### 5.1.1 Input Configurations

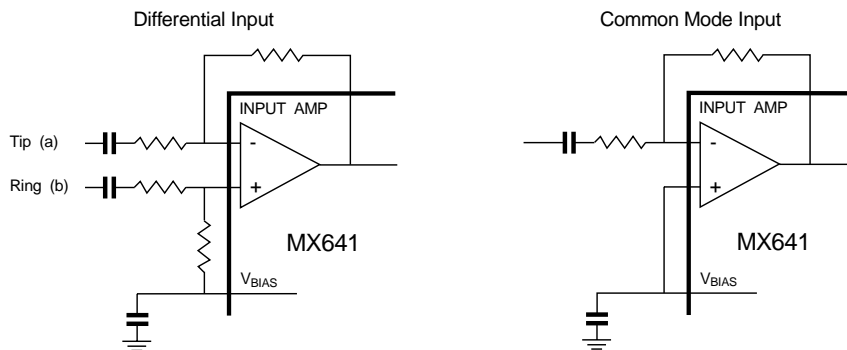


Figure 8: Input Configurations

### 5.1.2 Protection Against High Voltages

Telephone systems may have high d.c. and a.c. voltages present on the line. If the MX641 is part of a host equipment that has its own signal input protection circuitry, there will be no need for further protection as long as the voltage on any pin is limited to within  $V_{DD} + 0.3V$  and  $V_{SS} - 0.3V$ .

If the host system does not have input protection, or there are signals present outside the device's specified limits, the MX641 will require protection diodes at its signal inputs (+ and -). The breakdown voltage of capacitors and the peak inverse voltage of the diodes must be sufficient to withstand the sum of the d.c. voltages plus all expected signal peaks.

### 5.1.3 Aliasing

Due to the sampling nature of switched-capacitor filters used in the MX641, high frequency noise or unwanted signals can alias into the passband, disrupting detection. External components must be chosen carefully to avoid alias effects.

Possible Alias Frequencies:

$$12\text{kHz Mode} = 52\text{kHz}$$

$$16\text{kHz Mode} = 69\text{kHz}$$

If other filtering in the system has not attenuated these alias frequencies, capacitors should be employed across resistors R3, R4, R7 and R8 to provide anti-alias filtering.

The low-pass cutoff frequency should be chosen to be approximately 20kHz to 25kHz for a 12kHz system, or 25kHz to 30kHz for a 16kHz system.

$$\text{i.e. } C = \frac{1}{2 \times \pi \times f_O \times R3}$$

When anti-alias capacitors are used, an allowance must be made for reduced gain at the SPM frequency (12kHz or 16kHz).

## 6. Performance Specification

### 6.1 Electrical Specifications

#### 6.1.1 Absolute Maximum Ratings

Exceeding the maximum rating can result in device damage.

Parameter	Min.	Typ.	Max.	Unit
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
<b>DW / P Packages</b>				
Total allowable device dissipation at $T_{AMB} 25^{\circ}C$			800	mW
Derating above $T_{AMB} 25^{\circ}C$			10	mW/ $^{\circ}C$ above $T_{AMB} 25^{\circ}C$
Operating Temperature	-40		85	$^{\circ}C$
Storage Temperature	-40		85	$^{\circ}C$

#### 6.1.2 Operating Limits

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

Parameter	Min.	Typ.	Max.	Unit
Supply Voltage ( $V_{DD}$ )	4.5	5.0	5.5	V
Operating Temperature	-40		85	
Xtal/Clock Frequency	3.558918		3.589368	MHz

#### 6.1.3 Operating Characteristics

All device characteristics are measured under the following conditions unless otherwise specified:

$V_{DD} = 5.0V$  @  $T_{AMB} = 25^{\circ}C$

Audio Level 0dB (ref.) = 775mV<sub>RMS</sub>, Noise Bandwidth = 50kHz

Xtal/Clock Frequency = 3.579545MHz, System Setting = 12kHz or 16kHz

	Notes	Min.	Typ.	Max.	Units
Supply Current			2.0	5.0	mA
<b>Input/Output Parameters</b>					
Clock Out Load	17			15.0	pF
<b>Logic Inputs</b>					
Input Logic '1' (High)		3.5			V
Input Logic '0' (Low)				1.5	V
Input Leakage Current ( $V_{IN} = 0$ to $V_{DD}$ )	13	-5.0		5.0	$\mu A$
Input Current ( $V_{IN} = 0$ )	14	-15.0			$\mu A$

	Notes	Min.	Typ.	Max.	Units
<b>Channel Outputs</b>					
Output Logic '1'	$I_{OH} = 120\text{mA}$ (Enabled)	1	4.6		V
Output Logic '0'	$I_{OL} = 360\text{mA}$ (Enabled)	1		0.4	V
Output Leakage Current	High-Z Output	2	-5.0	5.0	$\mu\text{A}$
<b>Input Amplifier</b>					
D. C. Gain			60.0		dB
Bandwidth (-3dB)			100		Hz
Input Impedance			1.0		$\text{M}\Omega$
<b>Overall Performance</b>					
12kHz Detect Bandwidth		3	11.82	12.18	kHz
12kHz Not-detect Frequencies	(Below 12kHz)	3		11.52	kHz
12kHz Not-detect Frequencies	(Above 12kHz)	3	12.48		kHz
16kHz Detect Bandwidth		3	15.76	16.24	
16kHz Upper Decode Band Edge	(Below 16kHz)	3		15.36	kHz
16kHz Lower Decode Band Edge	(Above 16kHz)	3	16.64		kHz
Level Sensitivity					
Controlled Sensitivity Mode	3,4,12,15	2.6	1.6	0.6	dB(ref.)
Preset Sensitivity Mode	3,4,5,16	-25.4	-26.4	-27.4	dB(ref.)
<b>Signal Quality Requirements</b>					
Signal-to-Noise	(Amp Input)	4,8,9,10	22.0	20.0	dB
Signal-to-Voice	(Amp Input)	4,8,9,11	-36.0	-40.0	dB
Signal-to-Voice	(Amp Output)	4,8,10,11	-1.0		-27.0 dB
Channel Outputs	(Ch1 and Ch2) Figure 4				
Mode Change Time		6		500	ns
Tone Follower Mode (Table 3)					
Response and De-Response Time		3, 4, 7		10.0	ms
Packet Mode (Table 3)					
Response and De-Response Time		3, 4, 7	40.0	48.0	ms

**Note:**

1. Tone Follower or Packet mode enabled; see Table 3
2. Tristate selected; see Table 3.
3. With adherence to Signal-to-Voice and Signal-to Noise specifications.
4. 12kHz and/or 16kHz system.
5. With Input Amp gain setting = 0dB.
6. Time taken to change between any two of the operational modes: Tone Follower, Packet or Tristate, and with a maximum capacitive load of 30pF on an output.
7. The time delay, after a valid serial data load (or after device powerup), before the condition of the outputs can be guaranteed correct.
8. Immunity to false responses and/or de-responses.
9. Common Mode SPM and balanced voice input signal.
10. With SPM and voice signal amplitudes balanced; to avoid false de-responses due to saturation, the peak-to-peak voice + noise level at the output of the Input Amp should be no greater than the dynamic

range of the device. For this reason, the signal-to-voice figure at the AMP Output will vary with the sensitivity setting. The lowest signal-to-voice figure occurs at the highest sensitivity setting. (Table 4 27dB)

11. Maximum voice frequencies = 3.4kHz.
12. With the Input Amplifier gain at 0dB and the Bandpass Filter gain set at 0dB (Table 4); subtract 1.0dB from this specification for each extra single dB of Bandpass Filter gain programmed. Alternatively, with the input components as recommended in Figure 2, the sensitivity is as defined in Table 4.
13. Logic inputs with no internal pull-up; Chip Select, Serial Data, Serial Clock, Output Enable, Output Select and Clock In pins.
14. Logic inputs with an internal pull-up; Preset Level and System Select pins.
15. Preset Level = '0', System Select = don't care; Chip Select, Serial Clock and Serial Data inputs active; see Table 3.
16. Preset Level = '1', System Select = input active; Chip Select, Serial Clock and Serial Data inputs inactive; see Table 3
17. Maximum Clock Output Fan out = 4 (including master)

## 6.2 Timing

Parameter		Min.	Typ.	Max.	Unit
$t_{PWH}$	Serial Clock 'High' Pulse Width	250			ns
$t_{PWL}$	Serial Clock 'Low' Pulse Width	250			ns
$t_{CYC}$	Serial Clock Period	600			ns
$t_{CSE}$	Chip Select 'Low' to Clock 'High' Edge	450			ns
$t_{DH}$	Data Hold Time	50.0			ns
$t_{DS}$	Data Setup Time	250			ns

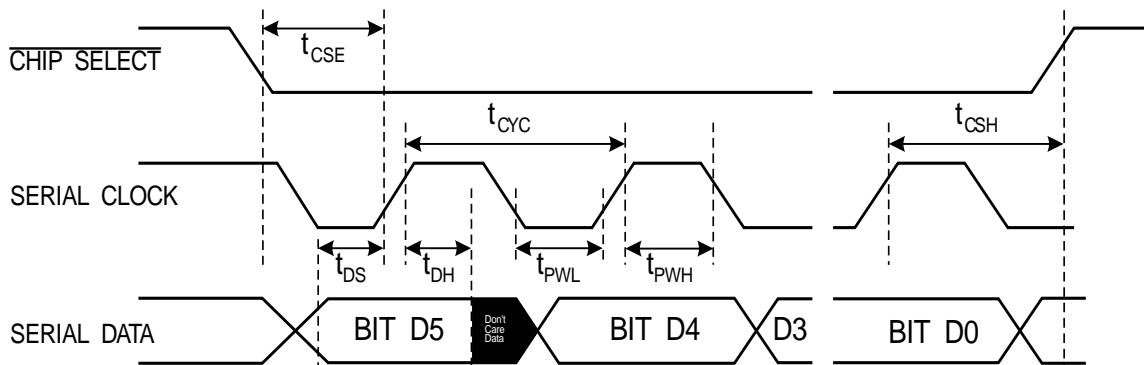


Figure 9: Data Load Timing for the Controlled Sensitivity Mode

6.3 Packages

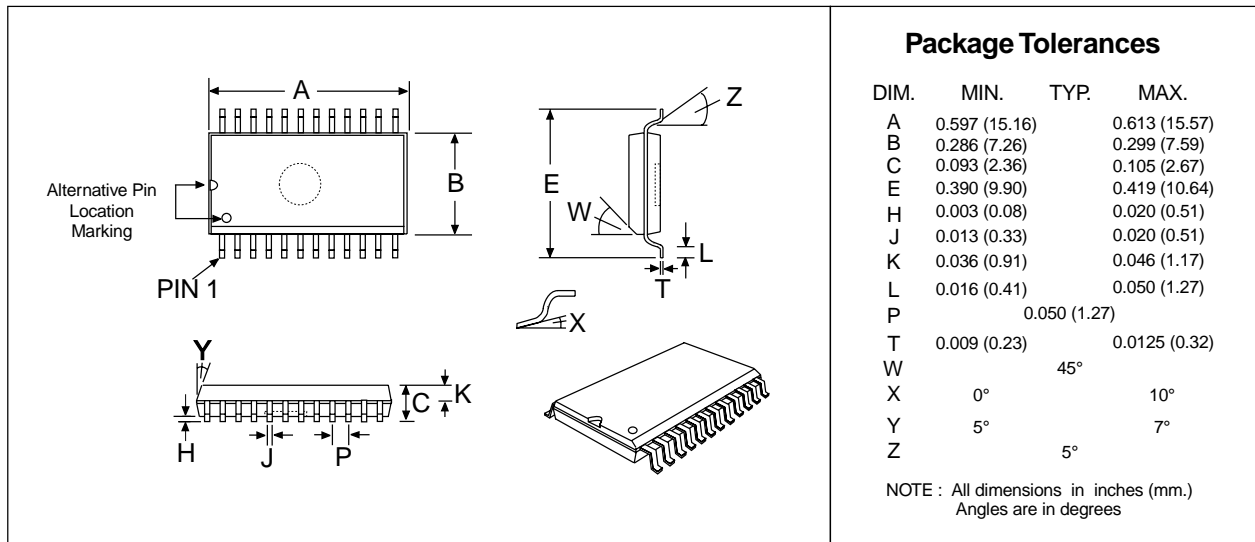


Figure 10: 24-pin SOIC Mechanical Outline: order as part no. MX641DW

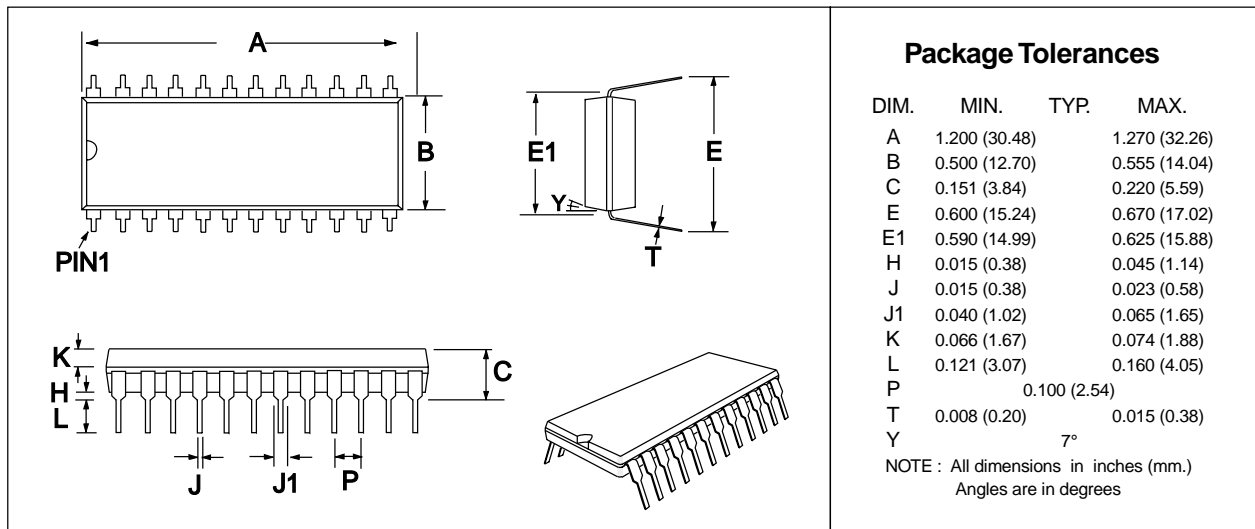


Figure 11: 24-pin PDIP Mechanical Outline: order as part no. MX641P





**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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