

High Frequency Clock Synthesizer

The MC12430 is a general purpose synthesized clock source. Its internal VCO will operate over a range of frequencies from 400 to 800 MHz. The differential PECL output can be configured to be the VCO frequency divided by 1, 2, 4 or 8. With the output configured to divide the VCO frequency by 2, and with a 16.000 MHz external quartz crystal used to provide the reference frequency, the output frequency can be specified in 1 MHz steps. The PLL loop filter is fully integrated so that no external components are required. The synthesizer output frequency is configured using a parallel or serial interface.

- 50 to 800 MHz Differential PECL Outputs
- ± 25 ps Peak-to-Peak Output Jitter
- Fully Integrated Phase-Locked Loop
- Minimal Frequency Over-Shoot
- Synthesized Architecture
- Serial 3-Wire Interface
- Parallel Interface for Power-Up
- Quartz Crystal Interface
- 28-Lead PLCC and 32-Lead LQFP Packages
- Operates from 3.3 V or 5.0V Power Supply

Functional Description

The internal oscillator uses the external quartz crystal as the basis of its frequency reference. The output of the reference oscillator is divided by 16 before being sent to the phase detector. With a 16 MHz crystal, this provides a reference frequency of 1 MHz. Although this data sheet illustrates functionality only for a 16 MHz crystal, any crystal in the 10–20 MHz range can be used.

The VCO within the PLL operates over a range of 400 to 800 MHz. Its output is scaled by a divider that is configured by either the serial or parallel interfaces. The output of this loop divider is applied to the phase detector.

The phase detector and loop filter attempt to force the VCO output frequency to be $M \times 2$ times the reference frequency by adjusting the VCO control voltage. Note that for some values of M (either too high or too low) the PLL will not achieve loop lock.

The output of the VCO is also passed through an output divider before being sent to the PECL output driver. This output divider (N divider) is configured through either the serial or the parallel interfaces and can provide one of four division ratios (1, 2, 4 or 8). This divider extends performance of the part while providing a 50% duty cycle.

The output driver is driven differentially from the output divider and is capable of driving a pair of transmission lines terminated in 50Ω to $V_{CC} - 2.0$ V. The positive reference for the output driver and the internal logic is separated from the power supply for the phase-locked loop to minimize noise induced jitter.

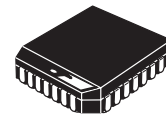
The configuration logic has two sections: serial and parallel. The parallel interface uses the values at the $M[8:0]$ and $N[1:0]$ inputs to configure the internal counters. Normally, on system reset, the $\overline{P_LOAD}$ input is held LOW until sometime after power becomes valid. On the LOW-to-HIGH transition of $\overline{P_LOAD}$, the parallel inputs are captured. The parallel interface has priority over the serial interface. Internal pullup resistors are provided on the $M[8:0]$ and $N[1:0]$ inputs to reduce component count in the application of the chip.

The serial interface centers on a fourteen bit shift register. The shift register shifts once per rising edge of the S_CLOCK input. The serial input S_DATA must meet setup and hold timing as specified in the AC Characteristics section of this document. The configuration latches will capture the value of the shift register on the HIGH-to-LOW edge of the S_LOAD input. See the programming section for more information.

The TEST output reflects various internal node values, and is controlled by the $T[2:0]$ bits in the serial data stream. See the programming section for more information.

MC12430

**HIGH FREQUENCY PLL
CLOCK SYNTHESIZER**



FN SUFFIX
28-LEAD PLCC PACKAGE
CASE 776-02



FA SUFFIX
32-LEAD LQFP PACKAGE
CASE 873A-02

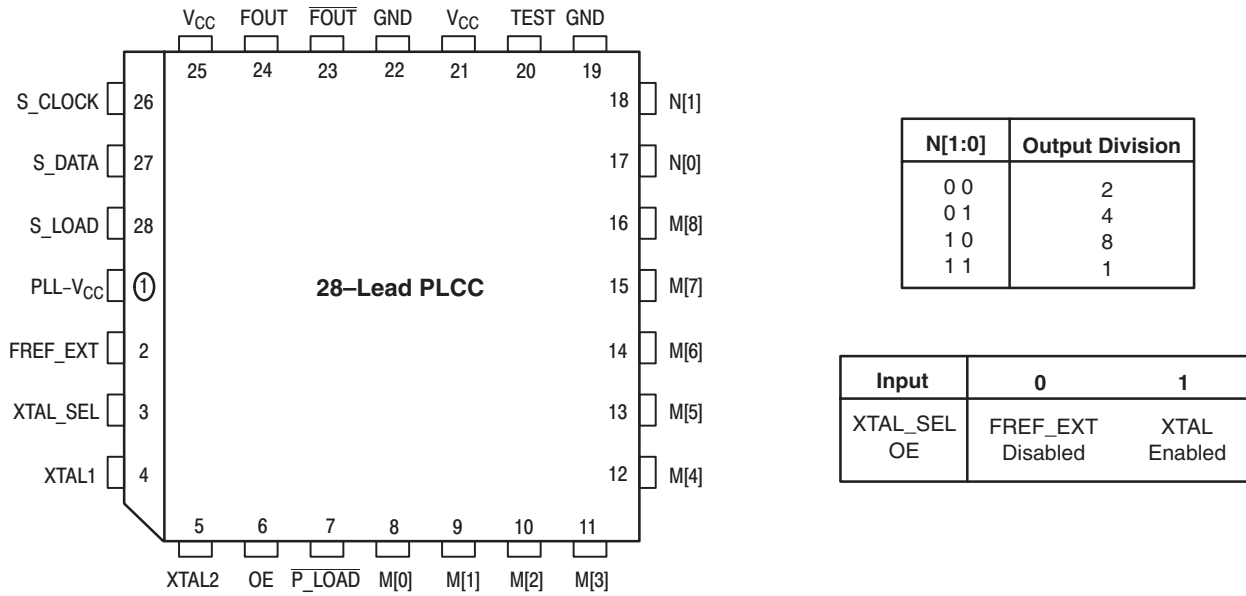


Figure 1. Figure 1. 28-Lead Pinout (Top View)

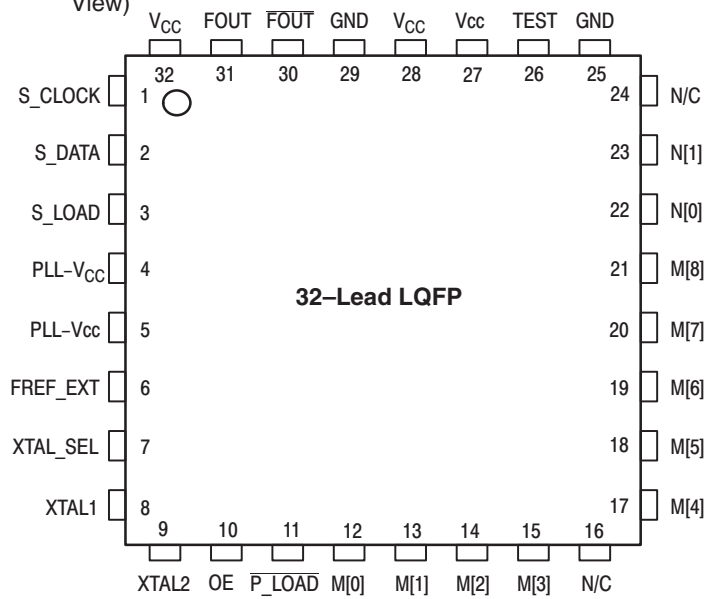


Figure 2. Figure 2. 32-Lead Pinout (Top View)

PIN DESCRIPTIONS

Pin Name	Function
Inputs	
XTAL1, XTAL2	These pins form an oscillator when connected to an external series-resonant crystal.
S_LOAD (Int. Pulldown)	This pin loads the configuration latches with the contents of the shift registers. The latches will be transparent when this signal is HIGH, thus the data must be stable on the HIGH-to-LOW transition of S_LOAD for proper operation.
S_DATA (Int. Pulldown)	This pin acts as the data input to the serial configuration shift registers.
S_CLOCK (Int. Pulldown)	This pin serves to clock the serial configuration shift registers. Data from S_DATA is sampled on the rising edge.
P_LOAD (Int. Pullup)	This pin loads the configuration latches with the contents of the parallel inputs. The latches will be transparent when this signal is LOW, thus the parallel data must be stable on the LOW-to-HIGH transition of P_LOAD for proper operation. P_LOAD is state sensitive.
M[8:0] (Int. Pullup)	These pins are used to configure the PLL loop divider. They are sampled on the LOW-to-HIGH transition of P_LOAD. M[8] is the MSB, M[0] is the LSB.
N[1:0] (Int. Pullup)	These pins are used to configure the output divider modulus. They are sampled on the LOW-to-HIGH transition of P_LOAD.
OE (Int. Pullup)	Active HIGH Output Enable. The Enable is synchronous to eliminate possibility of runt pulse generation on the F_OUT output.
Outputs	
F_OUT, F_OUT	These differential positive-referenced ECL signals (PECL) are the output of the synthesizer.
TEST	The function of this output is determined by the serial configuration bits T[2:0]. The output is single-ended ECL.
Power	
V _{CC}	This is the positive supply for the internal logic and the output buffer of the chip, and is connected to +3.3V or 5.0V (V _{CC} = PLL_V _{CC}). Current drain through V _{CC} ≈ 85 mA.
PLL_V _{CC}	This is the positive supply for the PLL, and should be as noise-free as possible for low-jitter operation. This supply is connected to +3.3V or 5.0V (V _{CC} = PLL_V _{CC}). Current drain through PLL_V _{CC} ≈ 15 mA.
GND	These pins are the negative supply for the chip and are normally all connected to ground.
Other	
FREF_EXT (Int. Pulldown)	LVC MOS/CMOS input which can be used as the PLL reference.
XTAL_SEL (Int. Pullup)	LVC MOS/CMOS input that selects between the crystal and the FREF_EXT source for the PLL reference signal. A HIGH selects the crystal input.

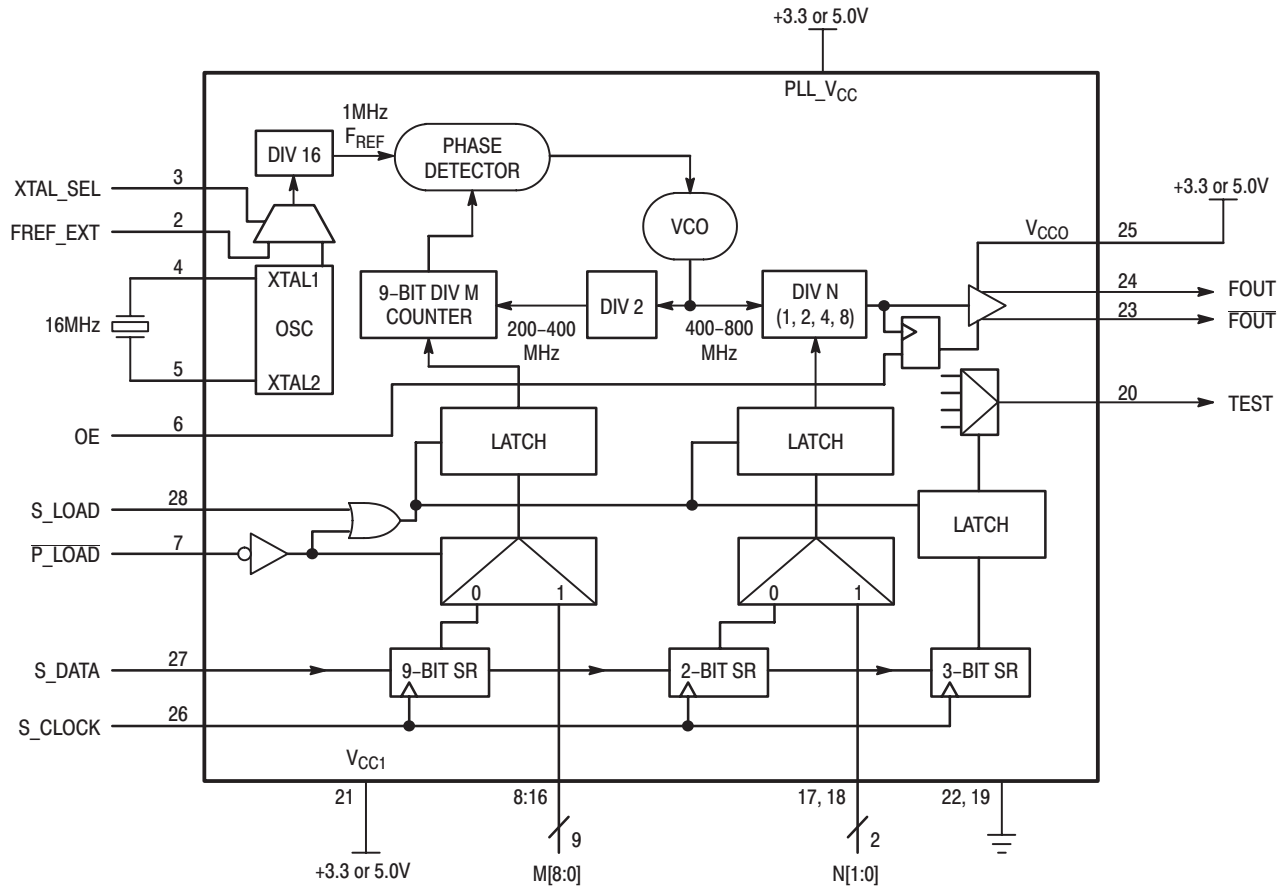


Figure 3. MC12430 Block Diagram (28-Lead PLCC Pinout)

PROGRAMMING INTERFACE

Programming the device amounts to properly configuring the internal dividers to produce the desired frequency at the outputs. The output frequency can be represented by this formula:

$$F_{OUT} = (F_{XTAL} \div 16) \times M \times 2 \div N \quad (1)$$

Where F_{XTAL} is the crystal frequency, M is the loop divider modulus, and N is the output divider modulus. Note that it is possible to select values of M such that the PLL is unable to achieve loop lock. To avoid this, always make sure that M is selected to be $200 \leq M \leq 400$ for any input reference.

Assuming that a 16 MHz reference frequency is used, the above equation reduces to:

$$F_{OUT} = 2 \times M \div N$$

Substituting the four values for N (1, 2, 4, 8) yields:

Output Frequency Range

N	FOUT	OUTPUT FREQUENCY RANGE
1	2 x M	400 – 800 MHZ
2	M	200 – 400 MHZ
4	M ÷ 2	100 – 200 MHZ
8	M ÷ 4	50 – 100 MHZ

From these ranges, the user will establish the value of N required, then the value of M can be calculated based on the appropriate equation above. For example, if an output frequency of 131 MHz was desired, the following steps would be taken to identify the appropriate M and N values. 131MHz falls within the frequency range set by an N value of 4 so $N [1:0] = 01$. For $N = 4$, $F_{OUT} = M \div 2$ and $M = 2 \times F_{OUT}$. Therefore, $M = 131 \times 2 = 262$, so $M[8:0] = 10000110$. Following this same procedure, a user can generate any whole frequency desired between 50 and 800MHz. Note that for $N > 2$ fractional values of FOUT can be realized. The size of the programmable frequency steps (and thus the indicator of the fractional output frequencies achievable) will be equal to $F_{XTAL} \div 8 \div N$.

For input reference frequencies other than 16 MHz, the set of appropriate equations can be deduced from equation 1. For computer applications, another useful frequency base would

be 16.666 MHz. From this reference, one can generate a family of output frequencies at multiples of the 33.333 MHz PCI clock. As an example, to generate a 133.333 MHz clock from a 16.666 MHz reference, the following M and N values would be used:

$$F_{OUT} = 16.666 \div 16 \times M \times 2 \div N = 1.04166 \times M \times 2 \div N$$

$$\text{Let } N = 4, \quad M = 133.3333 \div 1.04166 \times 2 = 256$$

The value for M falls within the constraints set for PLL stability, therefore, N[1:0] = 01 and M[8:0] = 10000000. If the value for M fell outside of the valid range, a different N value would be selected to try to move M in the appropriate direction.

The M and N counters can be loaded either through a parallel or serial interface. The parallel interface is controlled via the $\overline{P_LOAD}$ signal such that a LOW to HIGH transition will latch the information present on the M[8:0] and N[1:0] inputs into the M and N counters. When the $\overline{P_LOAD}$ signal is LOW, the input latches will be transparent and any changes on the M[8:0] and N[1:0] inputs will affect the FOUT output pair. To use the serial port, the S_CLOCK signal samples the information on the S_DATA line and loads it into a 14 bit shift register. Note that the $\overline{P_LOAD}$ signal must be HIGH for the serial load operation to function. The Test register is loaded with the first three bits, the N register with the next two and the M register with the final eight bits of the data stream on the S_DATA input. For each register, the most significant bit is loaded first (T2, N1 and M8). A pulse on the S_LOAD pin after the shift register is fully loaded will transfer the divide values into the counters. The HIGH to LOW transition on the S_LOAD input will latch the new divide values into the counters. Figure 4 illustrates the timing diagram for both a parallel and a serial load of the MC12430 synthesizer.

M[8:0] and N[1:0] are normally specified once at power-up through the parallel interface, and then possibly again through the serial interface. This approach allows the application to come up at one frequency and then change or fine-tune the clock as the ability to control the serial interface becomes available.

The TEST output provides visibility for one of the several internal nodes as determined by the T[2:0] bits in the serial configuration stream. It is not configurable through the parallel interface. The T2, T1 and T0 control bits are preset to '000' when $\overline{P_LOAD}$ is LOW so that the PECL FOUT outputs are as jitter-free as possible. Any active signal on the TEST output pin will have detrimental effects on the jitter of the PECL output pair. In normal operations, jitter specifications are only guaranteed if the TEST output is static. The serial configuration port can be used to select one of the alternate functions for this pin.

Most of the signals available on the TEST output pin are useful only for performance verification of the MC12430 itself. However, the PLL bypass mode may be of interest at the board level for functional debug. When T[2:0] is set to 110 the MC12430 is placed in PLL bypass mode. In this mode the S_CLOCK input is fed directly into the M and N dividers. The N divider drives the FOUT differential pair and the M counter drives the TEST output pin. In this mode the S_CLOCK input could be used for low speed board level functional test or debug. Bypassing the PLL and driving FOUT directly gives the user more control on the test clocks sent through the clock tree. Figure 5 shows the functional setup of the PLL bypass mode. Because the S_CLOCK is a CMOS level, the input frequency is limited to 250 MHz or less. This means the fastest the FOUT pin can be toggled via the S_CLOCK is 250MHz as the minimum divide ratio of the N counter is 1. Note that the M counter output on the TEST output will not be a 50% duty cycle due to the way the divider is implemented.

T2	T1	T0	TEST (Pin 20)
0	0	0	SHIFT REGISTER OUT
0	0	1	HIGH
0	1	0	FREF
0	1	1	M COUNTER OUT/2
1	0	0	FOUT
1	0	1	LOW
1	1	0	M COUNTER/2 in PLL Bypass Mode
1	1	1	FOUT/4

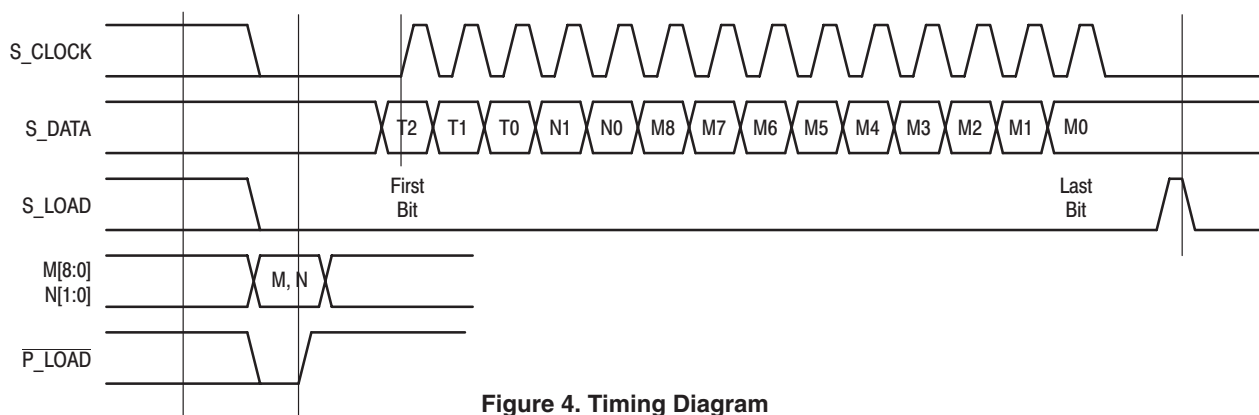
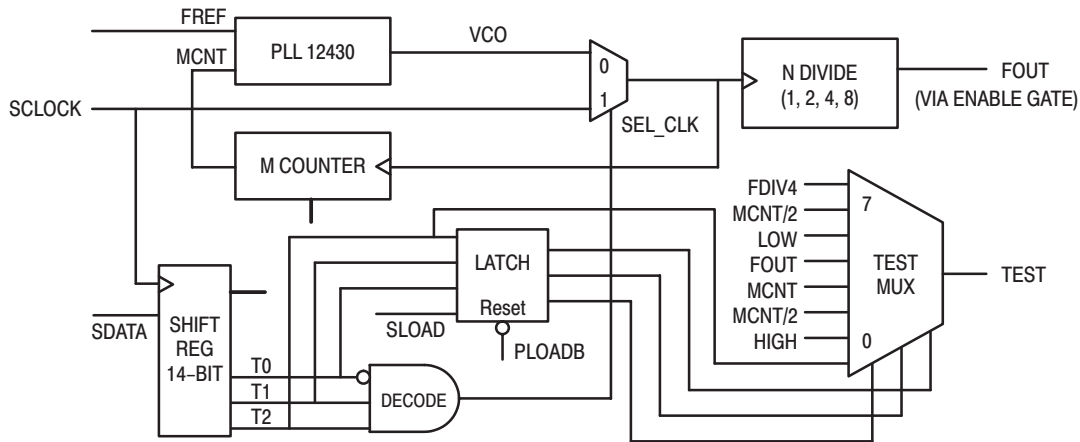


Figure 4. Timing Diagram



- T2=T1=1, T0=0: Test Mode (PLL Bypass)
 - SCLOCK is selected, MCNT/2 is on TEST output, SCLOCK DIVIDE BY N is on FOUT pin
- PLOADB acts as reset for test pin latch. When latch reset T2 data is shifted out TEST pin.

Figure 5. Serial Test Clock Block Diagram

DC CHARACTERISTICS (V_{CC} = 3.3V ±5%)

Symbol	Characteristic	0°C			25°C			70°C			Unit	Condition
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
V _{IH}	Input HIGH Voltage	2.2			2.2			2.2			V	
V _{IL}	Input LOW Voltage			0.8			0.8			0.8	V	
I _{IN}	Input Current			1.0			1.0			1.0	mA	
V _{OH}	Output HIGH Voltage TEST	2.5			2.5			2.5			V	I _{OH} = -0.8mA
V _{OL}	Output LOW Voltage TEST			0.4			0.4			0.4	V	I _{OL} = 0.8mA
V _{OH}	Output HIGH Voltage ¹ . FOUT, \overline{FOUT}	2.28		2.60	2.32		2.49	2.38		2.565	V	V _{CC0} = 3.3V ^{2,3} .
V _{OL}	Output LOW Voltage ¹ . FOUT, \overline{FOUT}	1.35		1.67	1.35		1.67	1.35		1.70	V	V _{CC0} = 3.3V ^{2,3} .
I _{CC}	Power Supply Current V _{CC} PLL_V _{CC}		90 15	110 20		90 15	110 20		90 15	110 20	mA	

1. See applications information section for output level versus frequency information.
2. Output levels will vary 1:1 with V_{CC0} variation.
3. 50 Ω to V_{CC} - 2.0 V termination.

DC CHARACTERISTICS (V_{CC} = 5.0V ±5%)

Symbol	Characteristic	0°C			25°C			70°C			Unit	Condition
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
V _{IH}	Input HIGH Voltage	3.5			3.5			3.5			V	
V _{IL}	Input LOW Voltage			0.8			0.8			0.8	V	
I _{IN}	Input Current			1.0			1.0			1.0	mA	
V _{OH}	Output HIGH Voltage TEST	2.5			2.5			2.5			V	I _{OH} = -0.8 mA
V _{OL}	Output LOW Voltage TEST			0.4			0.4			0.4	V	I _{OL} = 0.8 mA
V _{OH}	Output HIGH Voltage ¹ . FOUT, \overline{FOUT}	3.98		4.30	4.02		4.19	4.08		4.265	V	V _{CC0} = 5.0 V ^{2,3} .
V _{OL}	Output LOW Voltage ¹ . FOUT, \overline{FOUT}	3.05		3.37	3.05		3.37	3.05		3.40	V	V _{CC0} = 5.0 V ^{2,3} .
I _{CC}	Power Supply Current V _{CC} PLL_V _{CC}		90 15	110 20		90 15	110 20		90 15	110 20	mA	

1. See applications information section for output level versus frequency information.
2. Output levels will vary 1:1 with V_{CC0} variation.
3. 50 Ω to V_{CC} - 2.0V termination.

AC CHARACTERISTICS ($T_A = 0^\circ$ to 70°C , $V_{CC} = 3.3\text{V}$ to $5.0\text{V} \pm 5\%$)

Symbol	Characteristic	Min	Max	Unit	Condition
F_{MAXI}	Maximum Input Frequency	S_CLOCK	10	MHz	Note 4.
		Xtal Oscillator	10		
		FREF_EXT	10		
F_{MAXO}	Maximum Output Frequency	VCO (Internal)	400	MHz	Note 7.
		FOUT	50		
t_{LOCK}	Maximum PLL Lock Time		10	ms	
t_{jitter}	Period Deviation (Peak-to-Peak) Note 6.		± 25 ± 65	ps	N = 2, 4, 8; Note 7. N = 1; Note 7.
t_s	Setup Time	S_DATA to S_CLOCK	20	ns	
		S_CLOCK to S_LOAD	20		
		M, N to P_LOAD	20		
t_h	Hold Time	S_DATA to S_CLOCK	20	ns	
		M, N to P_LOAD	20		
tp_{WMIN}	Minimum Pulse Width	S_LOAD	50	ns	
		P_LOAD	50		
t_r, t_f	Output Rise/Fall	FOUT	300	ps	20%–80%; Note 7.

- 10MHz is the maximum frequency to load the feedback divide registers. S_CLOCK can be switched at higher frequencies when used as a test clock in TEST_MODE 6.
- Maximum frequency on FREF_EXT is a function of the internal M counter limitations. The phase detector can handle up to 100MHz on the input, but the M counter must remain in the valid range of $200 \leq M \leq 400$. See the Programming Interface section on page 4 of this data sheet for more details.
- See Applications Information below for additional information.
- 50Ω to $V_{CC} - 2.0\text{V}$ pull-down.

APPLICATIONS INFORMATION**Using the On-Board Crystal Oscillator**

The MC12430 features a fully integrated on-board crystal oscillator to minimize system implementation costs. The oscillator is a series resonant, multivibrator type design as opposed to the more common parallel resonant oscillator design. The series resonant design provides better stability and eliminates the need for large on chip capacitors. The oscillator is totally self contained so that the only external component required is the crystal. As the oscillator is somewhat sensitive to loading on its inputs the user is advised to mount the crystal as close to the MC12430 as possible to avoid any board level parasitics. To facilitate co-location surface mount crystals are recommended, but not required.

The oscillator circuit is a series resonant circuit and thus for optimum performance a series resonant crystal should be used. Unfortunately, most crystals are characterized in a parallel resonant mode. Fortunately, there is no physical difference between a series resonant and a parallel resonant crystal. The difference is purely in the way the devices are characterized. As a result, a parallel resonant crystal can be used with the MC12430 with only a minor error in the desired frequency. A parallel resonant mode crystal used in a series resonant circuit will exhibit a frequency of oscillation a few

hundred ppm lower than specified, a few hundred ppm translates to kHz inaccuracies. In a general computer application, this level of inaccuracy is immaterial. Table 1 below specifies the performance requirements of the crystals to be used with the MC12430.

1. Recommended Crystal Specifications

Parameter	Value
Crystal Cut	Fundamental AT Cut
Resonance	Series Resonance*
Frequency Tolerance	$\pm 75\text{ppm}$ at 25°C
Frequency/Temperature Stability	$\pm 150\text{ppm}$ 0 to 70°C
Operating Range	0 to 70°C
Shunt Capacitance	5–7 pF
Equivalent Series Resistance (ESR)	50 to 80Ω
Correlation Drive Level	100 μW
Aging	5 ppm/Yr (First 3 Years)

* See accompanying text for series versus parallel resonant discussion.

Power Supply Filtering

The MC12430 is a mixed analog/digital product and as such it exhibits some sensitivities that would not necessarily be seen on a fully digital product. Analog circuitry is naturally susceptible to random noise, especially if this noise is seen on the power supply pins. The MC12430 provides separate power supplies for the digital circuitry (V_{CC}) and the internal PLL (PLL_VCC) of the device. The purpose of this design technique is to try and isolate the high switching noise digital outputs from the relatively sensitive internal analog phase-locked loop. In a controlled environment such as an evaluation board, this level of isolation is sufficient. However, in a digital system environment where it is more difficult to minimize noise on the power supplies a second level of isolation may be required. The simplest form of isolation is a power supply filter on the PLL_VCC pin for the MC12430.

Figure 6 illustrates a typical power supply filter scheme. The MC12430 is most susceptible to noise with spectral content in the 1KHz to 1MHz range. Therefore, the filter should be designed to target this range. The key parameter that needs to be met in the final filter design is the DC voltage drop that will be seen between the V_{CC} supply and the PLL_VCC pin of the MC12430. From the data sheet, the I_{PLL_VCC} current (the current sourced through the PLL_VCC pin) is typically 15mA (20mA maximum), assuming that a minimum of 3.0 V must be maintained on the PLL_VCC pin, very little DC voltage drop can be tolerated when a 3.3 V V_{CC} supply is used. The resistor shown in Figure 6 must have a resistance of 10–15 Ω to meet the voltage drop criteria. The RC filter pictured will provide a broadband filter with approximately 100:1 attenuation for noise whose spectral content is above 20KHz. As the noise frequency crosses the series resonant point of an individual capacitor its overall impedance begins to look inductive and thus increases with increasing frequency. The parallel capacitor combination shown ensures that a low impedance path to ground exists for frequencies well above the bandwidth of the PLL.

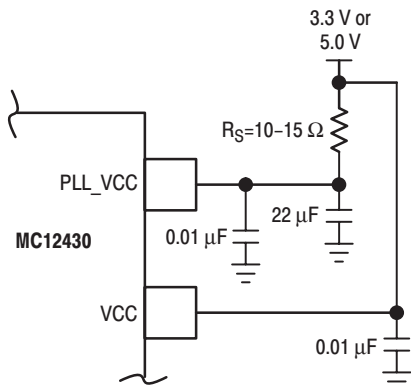


Figure 6. Power Supply Filter

A higher level of attenuation can be achieved by replacing the resistor with an appropriate valued inductor. A 1000 μ H choke will show a significant impedance at 10 KHz frequencies and above. Because of the current draw and the

voltage that must be maintained on the PLL_VCC pin, a low DC resistance inductor is required (less than 15 Ω). Generally, the resistor/capacitor filter will be cheaper, easier to implement and provide an adequate level of supply filtering.

The MC12430 provides sub-nanosecond output edge rates and thus a good power supply bypassing scheme is a must. Figure 7 shows a representative board layout for the MC12430. There exists many different potential board layouts and the one pictured is but one. The important aspect of the layout in Figure 7 is the low impedance connections between V_{CC} and GND for the bypass capacitors. Combining good quality general purpose chip capacitors with good PCB layout techniques will produce effective capacitor resonances at frequencies adequate to supply the instantaneous switching current for the 12430 outputs. It is imperative that low inductance chip capacitors are used; it is equally important that the board layout does not introduce back all of the inductance saved by using the leadless capacitors. Thin interconnect traces between the capacitor and the power plane should be avoided and multiple large vias should be used to tie the capacitors to the buried power planes. Fat interconnect and large vias will help to minimize layout induced inductance and thus maximize the series resonant point of the bypass capacitors.

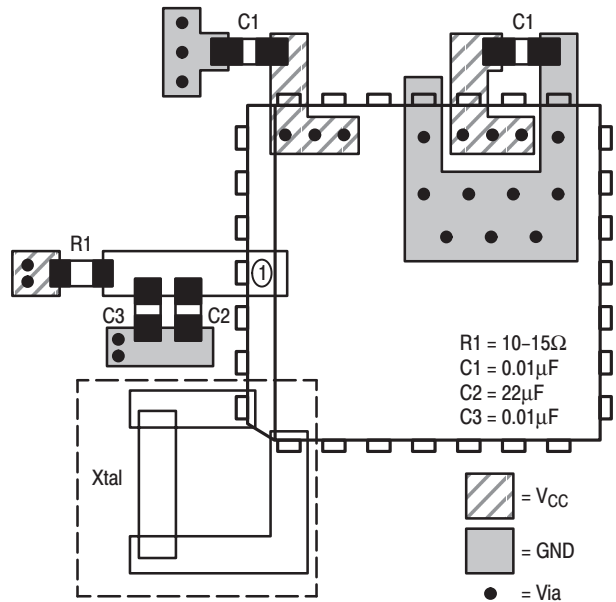


Figure 7. PCB Board Layout for MC12430 (28 PLCC)

Note the dotted lines circling the crystal oscillator connection to the device. The oscillator is a series resonant circuit and the voltage amplitude across the crystal is relatively small. It is imperative that no actively switching signals cross under the crystal as crosstalk energy coupled to these lines could significantly impact the jitter of the device. Special attention should be paid to the layout of the crystal to ensure a stable, jitter free interface between the crystal and the on-board oscillator.

Although the MC12430 has several design features to minimize the susceptibility to power supply noise (isolated

power and grounds and fully differential PLL), there still may be applications in which overall performance is being degraded due to system power supply noise. The power supply filter and bypass schemes discussed in this section should be adequate to eliminate power supply noise related problems in most designs.

Jitter Performance of the MC12430

The MC12430 exhibits long term and cycle-to-cycle jitter which rivals that of SAW based oscillators. This jitter performance comes with the added flexibility one gets with a synthesizer over a fixed frequency oscillator.

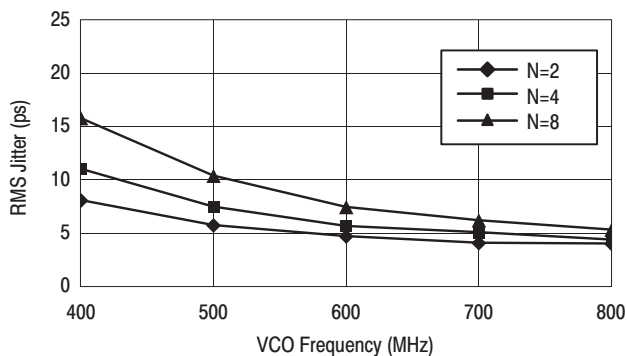


Figure 8. RMS PLL Jitter versus VCO Frequency

Figure 8 illustrates the RMS jitter performance of the MC12430 across its specified VCO frequency range. Note that the jitter is a function of both the output frequency as well as the VCO frequency, however the VCO frequency shows a much stronger dependence. The data presented has not been compensated for trigger jitter, this fact provides a measure of guardband to the reported data.

The typical method of measuring the jitter is to accumulate a large number of cycles, create a histogram of the edge placements and record peak-to-peak as well as standard deviations of the jitter. Care must be taken that the measured edge is the edge immediately following the trigger edge. The oscilloscope cannot collect adjacent pulses, rather it collects pulses from a very large sample of pulses.

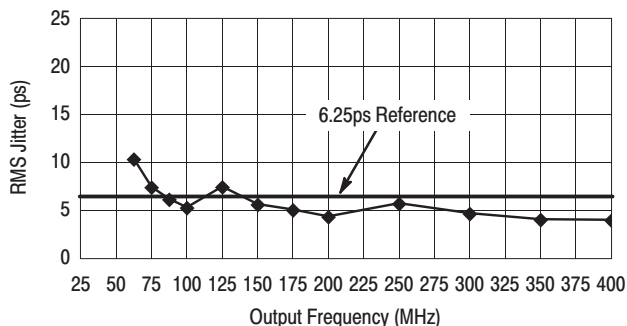


Figure 9. RMS Jitter versus Output Frequency

Figure 9 shows the jitter as a function of the output frequency. For the 12430, this information is probably of more

importance. The flat line represents an RMS jitter value that corresponds to an 8 sigma ± 25 ps peak-to-peak long term period jitter. The graph shows that for output frequencies from 87.5 to 400 MHz the jitter falls within the ± 25 ps peak-to-peak specification. The general trend is that as the output frequency is decreased the output edge jitter will increase.

The jitter data from Figure 8 and Figure 9 do not include the performance of the 12430 when the output is in the divide by 1 mode. In divide by one mode, the MC12430 output jitter distribution is bimodal. Since a bimodal distribution cannot be accurately represented with an rms value, peak-to-peak values of jitter for the divide by one mode are presented.

Figure 10 shows the peak-to-peak jitter of the 12430 output in divide by one mode as a function of output frequency. Notice that as with the other modes the jitter improves with increasing frequency. The ± 65 ps shown in the data sheet table represents a conservative value of jitter, especially for the higher VCO, and thus output frequencies.

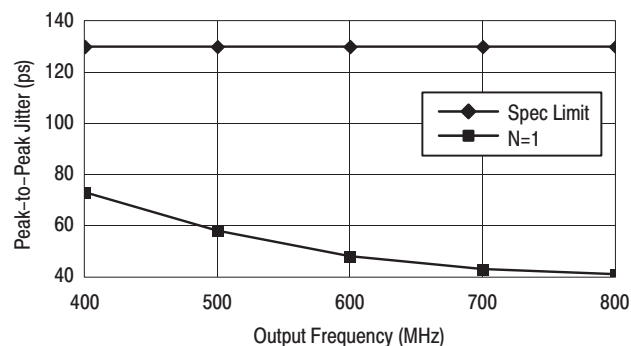


Figure 10. Peak-to-Peak Jitter versus Output Frequency

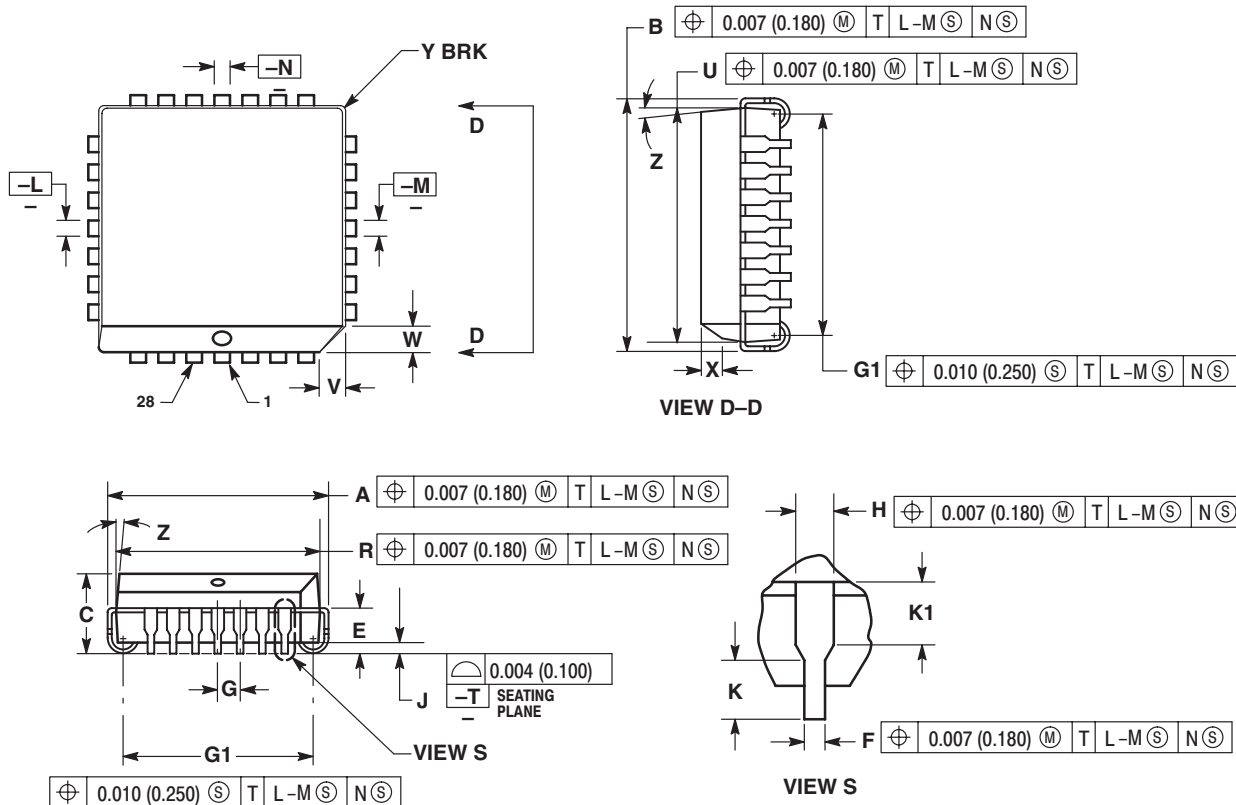
The jitter data presented should provide users with enough information to determine the effect on their overall timing budget. The jitter performance meets the needs of most system designs while adding the flexibility of frequency margining and field upgrades. These features are not available with a fixed frequency SAW oscillator.

Output Voltage Swing vs Frequency

In the divide by one mode, the output rise and fall times will limit the peak to peak output voltage swing. For a 400 MHz output, the peak to peak swing of the 12430 output will be approximately 700 mV. This swing will gradually degrade as the output frequency increases, at 800 MHz the output swing will be reduced to approximately 500 mV. For a worst case analysis, it would be safe to assume that the 12430 output will always generate at least a 500mV output swing. Note that most high speed ECL receivers require only a few hundred millivolt input swings for reliable operation. As a result, the output generated by the 12430 will, under all conditions, be sufficient for clocking standard ECL devices. Note that if a larger swing is required the MC12430 could drive a clock fanout buffer like the MC100EP111.

OUTLINE DIMENSIONS

FN SUFFIX
 PLASTIC PLCC PACKAGE
 CASE 776-02
 ISSUE D



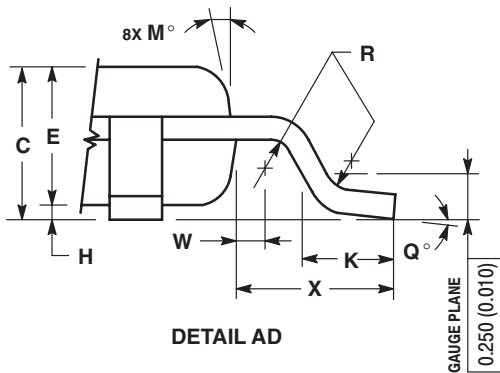
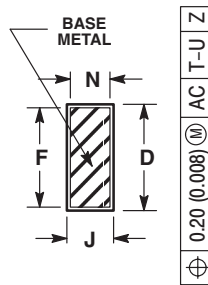
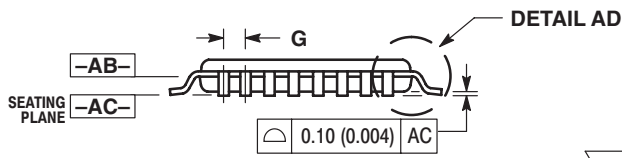
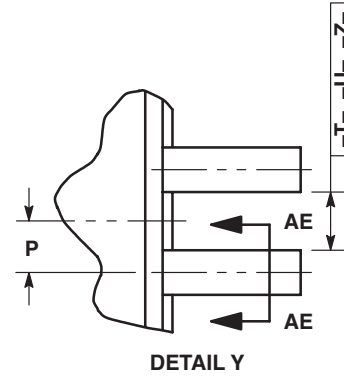
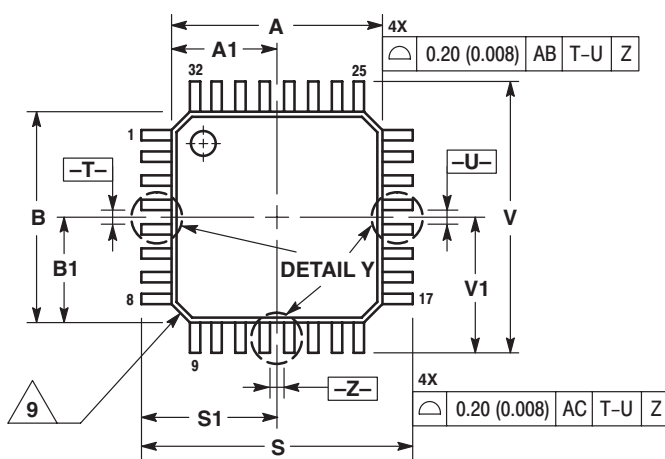
NOTES:

- DATUMS -L-, -M-, AND -N- DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.
- DIM G1, TRUE POSITION TO BE MEASURED AT DATUM -T-, SEATING PLANE.
- DIM R AND U DO NOT INCLUDE MOLD FLASH. ALLOWABLE MOLD FLASH IS 0.010 (0.250) PER SIDE.
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: INCH.
- THE PACKAGE TOP MAY BE SMALLER THAN THE PACKAGE BOTTOM BY UP TO 0.012 (0.300). DIMENSIONS R AND U ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY EXCLUSIVE OF MOLD FLASH, TIE BAR BURRS, GATE BURRS AND INTERLEAD FLASH, BUT INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE PLASTIC BODY.
- DIMENSION H DOES NOT INCLUDE DAMBAR PROTRUSION OR INTRUSION. THE DAMBAR PROTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE GREATER THAN 0.037 (0.940). THE DAMBAR INTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE SMALLER THAN 0.025 (0.635).

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.485	0.495	12.32	12.57
B	0.485	0.495	12.32	12.57
C	0.165	0.180	4.20	4.57
E	0.090	0.110	2.29	2.79
F	0.013	0.019	0.33	0.48
G	0.050 BSC		1.27 BSC	
H	0.026	0.032	0.66	0.81
J	0.020	—	0.51	—
K	0.025	—	0.64	—
R	0.450	0.456	11.43	11.58
U	0.450	0.456	11.43	11.58
V	0.042	0.048	1.07	1.21
W	0.042	0.048	1.07	1.21
X	0.042	0.056	1.07	1.42
Y	—	0.020	—	0.50
Z	2°	10°	2°	10°
G1	0.410	0.430	10.42	10.92
K1	0.040	—	1.02	—

OUTLINE DIMENSIONS


FA SUFFIX
 PLASTIC LQFP PACKAGE
 CASE 873A-02
 ISSUE A



NOTES:

- 1 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- 2 CONTROLLING DIMENSION: MILLIMETER.
- 3 DATUM PLANE -AB- IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE BOTTOM OF THE PARTING LINE.
- 4 DATUMS -T-, -U-, AND -Z- TO BE DETERMINED AT DATUM PLANE -AB-.
- 5 DIMENSIONS S AND V TO BE DETERMINED AT SEATING PLANE -AC-.
- 6 DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.250 (0.010) PER SIDE. DIMENSIONS A AND B DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -AB-.
- 7 DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSION SHALL NOT CAUSE THE D DIMENSION TO EXCEED 0.520 (0.020).
- 8 MINIMUM SOLDER PLATE THICKNESS SHALL BE 0.0076 (0.0003).
- 9 EXACT SHAPE OF EACH CORNER MAY VARY FROM DEPICTION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	7.000	BSC	0.276	BSC
A1	3.500	BSC	0.138	BSC
B	7.000	BSC	0.276	BSC
B1	3.500	BSC	0.138	BSC
C	1.400	1.600	0.055	0.063
D	0.300	0.450	0.012	0.018
E	1.350	1.450	0.053	0.057
F	0.300	0.400	0.012	0.016
G	0.800	BSC	0.031	BSC
H	0.050	0.150	0.002	0.006
J	0.090	0.200	0.004	0.008
K	0.500	0.700	0.020	0.028
M	12°	REF	12°	REF
N	0.090	0.160	0.004	0.006
P	0.400	BSC	0.016	BSC
Q	1°	5°	1°	5°
R	0.150	0.250	0.006	0.010
S	9.000	BSC	0.354	BSC
S1	4.500	BSC	0.177	BSC
V	9.000	BSC	0.354	BSC
V1	4.500	BSC	0.177	BSC
W	0.200	REF	0.008	REF
X	1.000	REF	0.039	REF

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters which may be provided in Motorola data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

MOTOROLA and the Stylized M Logo are registered in the US Patent & Trademark Office. All other product or service names are the property of their respective owners. © Motorola, Inc. 2001.

How to reach us:

USA/EUROPE/Locations Not Listed: Motorola Literature Distribution; P.O. Box 5405, Denver, Colorado 80217. 1-303-675-2140 or 1-800-441-2447

JAPAN: Motorola Japan Ltd.; SPS, Technical Information Center, 3-20-1, Minami-Azabu. Minato-ku, Tokyo 106-8573 Japan. 81-3-3440-3569

ASIA/PACIFIC: Motorola Semiconductors H.K. Ltd.; Silicon Harbour Centre, 2 Dai King Street, Tai Po Industrial Estate, Tai Po, N.T., Hong Kong. 852-26668334

Technical Information Center: 1-800-521-6274

HOME PAGE: <http://www.motorola.com/semiconductors/>

