

MSI PC/104 Embedded PC Series

MSI-P412 ANALOG INPUT CARD

FEATURES

- ◆ Up to 32 analog input channels, low cost, high performance.
- ◆ 12-bit resolution, $\pm 1/2$ LSB linearity.
- ◆ Software selectable input ranges of 0-5V, 0-10V, $\pm 5V$, $\pm 10V$, 0-20 mA (with MSI-P910) requiring no jumper selections.
- ◆ Single +5V power supply operation, -40° to 85° C.
- ◆ Fault protected input multiplexer ($\pm 16.5V$).
- ◆ 12 μs total conversion time for a 83 ksps rate for each 8 channels (332 ksps for 32 channels).
- ◆ Two programmable power down modes .
- ◆ 8-bit stackthrough PC/104 with I/O mapped 16-bit addressing.
- ◆ Jumper selectable address and interrupt options.
- ◆ Complete hardware documentation with schematics.
- ◆ Two-year warranty from date of shipment.

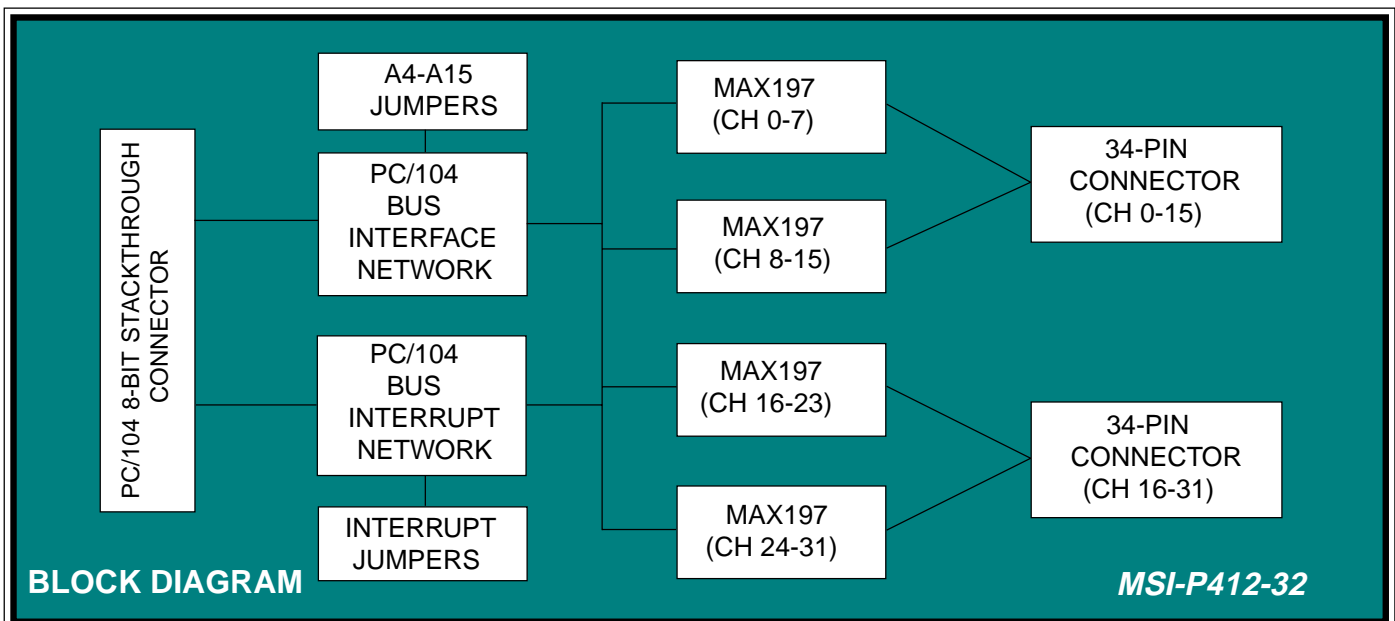
DESCRIPTION

The MSI-P412 is a low cost, high performance 12-bit analog input card designed for use with all PC/104 embedded systems. Four models provide input capacities of 8, 16, 24 or 32 channels which operate from a single +5V supply. Software programmable input ranges are 0-5V,



0-10V, $\pm 5V$ and $\pm 10V$ with a linearity of $1/2$ LSB. In addition, the inputs are overvoltage tolerant to $\pm 16.5V$ and a fault condition on any channel will not effect the conversion result on the selected channel.

A/D Converters - The card employs up to four MAX197 eight-channel A/D converters that incorporate a precision 2.5V reference source with buffer amp, an internal 1.56 MHz clock, and successive approximation and internal input track/hold circuitry to convert the analog signal



of each channel into a 12-bit digital signal. Low span and offset errors result in no adjustments being required for these functions. Typical total conversion times of 12 us gives a sample rate of 83 ksps for each group of eight channels yielding rates up to 332 ksps for 32 input channels.

Card Addressing - The card is I/O mapped using 16-bit addressing to select the input channels and device status. Option jumpers are provided for specifying the card **base** address (A4 - A15). The address of the control word/ input data (C/I) and status for each channel is

Channels	C/I Address	Status Address
0-7	base + 0 (lo) base + 1 (hi)	base + 8 (bit 0)
8-15	base + 2 (lo) base + 3 (hi)	base + 8 (bit 1)
16-23	base + 4 (lo) base + 5 (hi)	base + 8 (bit 2)
24-31	base + 6 (lo) base + 7 (hi)	base + 8 (bit 3)

Interrupts - Interrupt processing is provided for IRQ4 thru IRQ7 and IRQ9 using options jumpers.

Programming - Performing conversions is very simple. A control byte is written to the desired channel group lo byte specifying the channel within the group (bits 0-2), input range (bit 3), polarity (bit 4), mode (bit 5), and the clock and power down selection (bits 6-7). The status bit of the channel group indicates when the conversion is complete. The data is then read, D0-D7 at the lo address of the channel group and D8-D11 at the hi address of the channel group, bits 0-3. The read operation can be performed under software polling or by using interrupt processing.

Models - The MSI-P412 comes in four models as shown.

MSI-P412-8	8 input channels
MSI-P412-16	16 input channels
MSI-P412-24	24 input channels
MSI-P412-32	32 input channels

SPECIFICATIONS

PC/104	8-bit, stackthrough
Analog Inputs	
Channels	8 to 32 in groups of 8
Converter	MAXIM MAX197
Input Ranges	0-5V, 0-10V, $\pm 5V$, $\pm 10V$ 0-20 mA with MSI-P910
Resolution	12 bits
Conversion Rate	82 ksps per 8 channels
Non-linearity	$\pm 1/2$ LSB
Offset Error	< 0.5% of Span
Gain Error	< 0.5% of Span
Signal-to-Noise	70 dB min
Small Signal BW	5 MHz ($\pm 10V$ range) 2.5 MHz ($\pm 5V$ range) 2.5 MHz (0-10V range) 1.25 MHz (0-5V range)
Input Resistance	21 kOhms (Unipolar) 16 kOhms (Bipolar)
Card Addressing	
16-Bit I/O Mapped	Base address set by option jumpers for A4 thru A15.
Internal Reference	
Ref Out Voltage	4.096 V $\pm 1.5\%$ max.
Temp. Coeff.	40 ppm/ $^{\circ}C$
Connectors	
MSI-P412-8	One (1) AMP 103311-1 or eq. (16-pin)
MSI-P412-16	One (1) AMP 103311-1 or eq. (34-pin)
MSI-P412-24	Two (2) AMP 103311-1 or eq. (34-pin)
MSI-P412-32	Two (2) AMP 103311-1 or eq. (34-pin)
Interrupts	
Channels	One, sharing with tri-state buffer for IRQ4-7, 9
Option Jumpers	.025" square posts, 0.1" grid
Electrical & Environmental	
+5V @ 40 mA typical	
-40 $^{\circ}$ to 85 $^{\circ}$ C	
MTBF - 20 years (based on onboard PLD data retention life)	



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