68HC16MOD-16WIDE

Component List

DESIGNATION	QTY	DESCRIPTION
C1	1	10µF, 25V electrolytic capacitor
C2, C8–C12, C14	7	0.1µF ceramic capacitors
C3	1	1µF ceramic capacitor
C4, C5	2	22µF, 25V electrolytic capacitors
C6, C7	2	22pF ceramic capacitors
C13	1	100µF, 25V electrolytic capacitor
D1	1	1N4001 diode
D2	1	1N4742A 12V, 1W zener diode
J2	1	2-circuit terminal block
J3	1	Right-angle printed circuit board mount, DB9 female socket
LED1	1	Light-emitting diode
P1, P2	2	40-pin right-angle male connectors
R1	1	10MΩ, 5% resistor
R2	1	330kΩ, 5% resistor
R3, R4	2	10kΩ, 5% resistors
R5	1	470Ω, 5% resistor
R6	1	10kΩ, SIP resistor
R7	1	100Ω, 5% resistor

DESIGNATION	QTY	DESCRIPTION
SW1	1	Slide switch
SW2	1	Momentary pushbutton switch
U1	1	68HC16 microcontroller MC68HC16Z1CFC16 (132-pin plastic quad flat pack)
U2	1	Maxim MAX233CPP
U3	1	27C256 EPROM containing monitor program
U3	1	28-pin socket
U4	1	7805 regulator, TO-220 size
U4	1	Heatsink, thermalloy # 6078
U5, U8	2	62256 (32K x 8) static RAMs
U6, U9	2	74HCT245 bidirectional buffers
U6, U9	2	20-pin sockets
U7	1	Maxim MAX707CPA
U10	1	Maxim ICL7662CPA
Y1	1	32.768kHz watch crystal
None	4	Rubber feet
None	1	5" x 5" printed circuit board

General Description

The 68HC16MOD-16WIDE module is an assembled and tested printed-circuit board intended for use with Maxim's high-speed evaluation kits (EV kits). The module uses a full 16-bit implementation of Motorola's MC68HC16Z1 microcontroller (µC). It requires an IBM-compatible personal computer and an external DC power supply, typically 12V or as specified in the EV kit manual.

Maxim's 68HC16MOD-16WIDE module allows customers to evaluate selected Maxim products. It is not intended to be used as a microprocessor development platform, and such use is not supported by Maxim.

Detailed Description

Power Input Connector J2

The 68HC16MOD-16WIDE module draws its power from a user-supplied power source connected to terminal block J2. Be sure to note the positive and negative markings on the board. A three-terminal 5V regulator allows input voltages between 8V and an absolute maximum of 20V. The 68HC16MOD-16WIDE module typically requires 200mA of input current.

68HC16 Microcontroller

U1 is Motorola's 68HC16Z1 µC. Contact Motorola for µC information, development, and support. Maxim EV kits may use the 16-bit wide bus or use the high-speed queued serial peripheral interface (QSPI™) and the internal chip-select generation.

A MAX707 on the module (U7) monitors the 5V logic supply, generates the power-on reset, and produces a reset pulse whenever the reset button is pressed.

QSPI is a trademark of Motorola Corp.

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The 68HC16MOD-16WIDE module uses a phase-locked loop (PLL) to set its bus speed. Crystal Y1 is a 32.768kHz frequency reference. The internal oscillator runs 256 times faster than the external crystal. When the 68HC16MOD-16WIDE module is reset, it waits for the PLL to lock before it executes any software. After the PLL locks onto the reference frequency, the software doubles the clock speed by writing to the clock synthesizer control register, selecting a bus speed of 16.78MHz.

U5 and U8, the user RAM area, are 32kbyte CMOS static RAMs.

The 74HCT245 octal buffers let the 68HC16MOD-16WIDE module access a 16-bit port on the interface connectors. This memory-mapped port consists of separate read and write strobes, four chip selects, four address LSBs, and sixteen data bits.

Serial Communications

J3 is an RS-232 serial port, designed to be compatible with the IBM PC 9-pin serial port. Use a straight-through DB9 male-to-female cable to connect J3 to this port. If the only available serial port has a 25-pin connector, you may use a standard 25-pin to 9-pin adapter. Table 1 shows the pinout of J3.

The MAX233 is an RS-232 interface voltage level-shifter with two transmitters and two receivers. It includes a built-in charge pump with internal capacitors that generates the output voltages necessary to drive RS-232 lines.

40-Pin Connectors P1 and P2

The 20 x 2 pin headers (P1 and P2) connect the 68HC16MOD-16WIDE module to a Maxim EV kit. Table 2 lists the function of each pin.

Address Ranges

The 68HC16 µC generates various enable signals for different address ranges. The ROM and RAM enable signals are fed directly to the respective chips. Several additional signals (P1–33 to P1–36) are available on the data connector to be used by Maxim EV kits. Table 3 outlines the address ranges for each of the elements found on the 68HC16MOD-16WIDE module, and Table 4 is a truth table that describes the logic for each of the module's chip-select outputs. Because the addresses are not completely decoded, the boot ROM and has a shadow at address 08000 hex.

Table 1. Serial Communications Port J3

PIN	NAME	FUNCTION
1	DCD	Handshake; hard-wired to DTR and DSR
2	RXD	RS-232-compatible data output from 68HC16MOD-16WIDE module
3	TXD	RS-232-compatible data input to 68HC16MOD-16WIDE module
4	DTR	Handshake; hard-wired to DCD and DSR
5	GND	Signal ground connection
6	DSR	Handshake; hard-wired to DCD and DTR
7	RTS	Handshake; hard-wired to CTS
8	CTS	Handshake; hard-wired to RTS
9	None	Unused

Boot ROM

The boot ROM, U3, is configured as an 8-bit memory device. Resistor R4 pulls data bit 0 low during system reset, forcing the µC to fetch instructions using only the upper eight data bits. The boot ROM checks the system and waits for commands from the host. Refer to the EV kit manual for specific start-up procedures.

Software

All software is supplied on a disk with the EV kit. Instructions for operating the software are included in the EV kit manual. Refer to the EV kit manual for more information.

Use the 68HC16MOD-16WIDE module only with those EV kits that are designed to support it, and only download code that is targeted for the 68HC16MOD-16WIDE module. Downloading incorrect object code into the 68HC16MOD-16WIDE module will have unpredictable results.

Self Check

The 68HC16MOD-16WIDE module includes a self-diagnostic routine, which checks the power supply, microprocessor, RAM, and ROM, independent of the EV kit or computer. Note that it does not exercise the RS-232 port or the EV kit 80-pin interface. Connect the power supply to the power terminals (J2) and slide the power switch SW1 to the “ON” position. The LED will light up, and will flash within 5 seconds.

If the LED flashes with a 50% duty cycle, then the module passed its self check.

If the LED flashes with a 10%-on/90%-off duty cycle, then the module failed its self check. Most likely, one of the RAM chips (U5 or U8) is bad.

If the LED remains on and does not flash, then the problem is either U3 (the EPROM), U1 (the microprocessor), U4 (the regulator), the MAX707 reset generator, or the power supply. Use a voltmeter to verify that the power supplies are good; check the power-supply input and the +5V output from the regulator. Use an oscilloscope to see if the 32.768kHz reference oscillator is running.

Table 2. P1 and P2 Data-Connector Signals

HEADER	PIN	NAME	68HC16-16WIDE MODULE FUNCTION
P1	1, 4	GND	Ground return
	5, 6	VPREREG	+12V from wall cube
	7, 8	+5V	+5V from 78M05
	9, 10	-12V	-12V from ICL7662 (typically -8V at 15mA load)
	11	PCS2	QSPI peripheral chip select 2
	12	PCS3	QSPI peripheral chip select 3
	13	PCS0/SS	QSPI peripheral chip select 0
	14	PCS1	QSPI peripheral chip select 1
	15	MOSI	QSPI Master Output, Slave Input
	16	SCK	QSPI Serial Clock
	17	—	Not used
	18	MISO	QSPI Master Input, Slave Output
	19	IC2	General purpose I/O; Input Capture 2; can be used as an IRQ
	20	IC1	General purpose I/O; Input Capture 1; can be used as an IRQ
	21	OC1	General purpose I/O; Output Compare 1
	22	IC3	General purpose I/O; Input Capture 3; can be used as an IRQ
	23	—	Not used
	24	OC2	General purpose I/O; Output Compare 2
	25	OC4	General purpose I/O; Output Compare 4
	26	OC3	General purpose I/O; Output Compare 3
	27	PAI	Pulse Accumulator Input
	28	IC4	General purpose I/O; Input Capture 4; can be used as an IRQ
	29	PWMB	Pulse-Width Modulator B output (drives the status LED)
	30	PWMA	Pulse-Width Modulator A output

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Table 2. P1 and P2 Data-Connector Signals (continued)

HEADER	PIN	NAME	68HC16-16WIDE MODULE FUNCTION
P1	31	—	Not used
	32	PCLK	Pulse Accumulator Clock Input
	33	CS10/7F800	Chip select strobe for I/O area $7F800
	34	CS9/7F000	Chip select strobe for I/O area $7F000
	35	CS7/7E000	Chip select strobe for I/O area $7E000
	36	CS8/7E800	Chip select strobe for I/O area $7E800
	37	CS5/WRIO	Active low write strobe for I/O area
	38	CS1/RDIO	Active low read strobe for I/O area
	39, 40	—	Not used
P2	1	EXTD0	External I/O data bus LSB
	2–15	EXTD1–14	External I/O data bus
	16	EXTD15	External I/O data bus MSB
	17, 18	—	Not used
	19	A01	Word address LSB
	20	A02	Word address
	21	A03	Word address
	22	A04	Word address
	23–40	—	Not used

Table 3. Memory Map (all address values are in 20-bit hex)

PIN	FUNCTION
00000–07FFF	Boot ROM (U3, strobed by CSBOOT)
08000–0FFFF	Shadow of boot ROM
10000–1FFFF	User RAM (U5 and U8, strobed by CS0 and CS2)
20000–203FF	Internal standby RAM; 1kbyte
20400–7DFFF	Unused
7E000–7E7FF	External chip select (P1 pin 35) (CS7)
7E800–7EFFF	External chip select (P1 pin 36) (CS8)
7F000–7F7FF	External chip select (P1 pin 34) (CS9)
7F800–7FFFF	External chip select (P1 pin 33) (CS10)
80000–F7FFF	Not accessed by the 68HC16

PIN	FUNCTION
F8000–FF6FF	Unused
FF700–FF73F	68HC16's built-in ADC (not used)
FF740–FF8FF	Unused
FF900–FF93F	General-purpose timer module (GPT)
FF940–FF9FF	Unused
FFA00–FFA7F	System integration module (SIM)
FFA80–FFAFF	Unused
FFB00–FFB07	Internal standby RAM (SRAM) control registers
FFB08–FFBFF	Unused
FFC00–FFDFF	Queued serial module (QSM)
FFE00–FFFFF	Unused

Table 4. Chip-Select Outputs Truth Table

ADDRESS RANGE	CSBOOT	CS0	CS1	CS2	CS5	CS6	CS7	CS8	CS9	CS10
0xxxx read	L	H	H	H	H	H	H	H	H	H
1xxxx read	H	H	H	L	H	H	H	H	H	H
1xxxx write	H	L	H	H	H	H	H	H	H	H
7E0xx read	H	H	L	H	H	L	L	H	H	H
7E0xx write	H	H	H	H	L	L	L	H	H	H
7E8xx read	H	H	L	H	H	L	H	L	H	H
7E8xx write	H	H	H	H	L	L	H	L	H	H
7F0xx read	H	H	L	H	H	L	H	H	L	H
7F0xx write	H	H	H	H	L	L	H	H	L	H
7F8xx read	H	H	L	H	H	L	H	H	H	L
7F8xx write	H	H	H	H	L	L	H	H	H	L

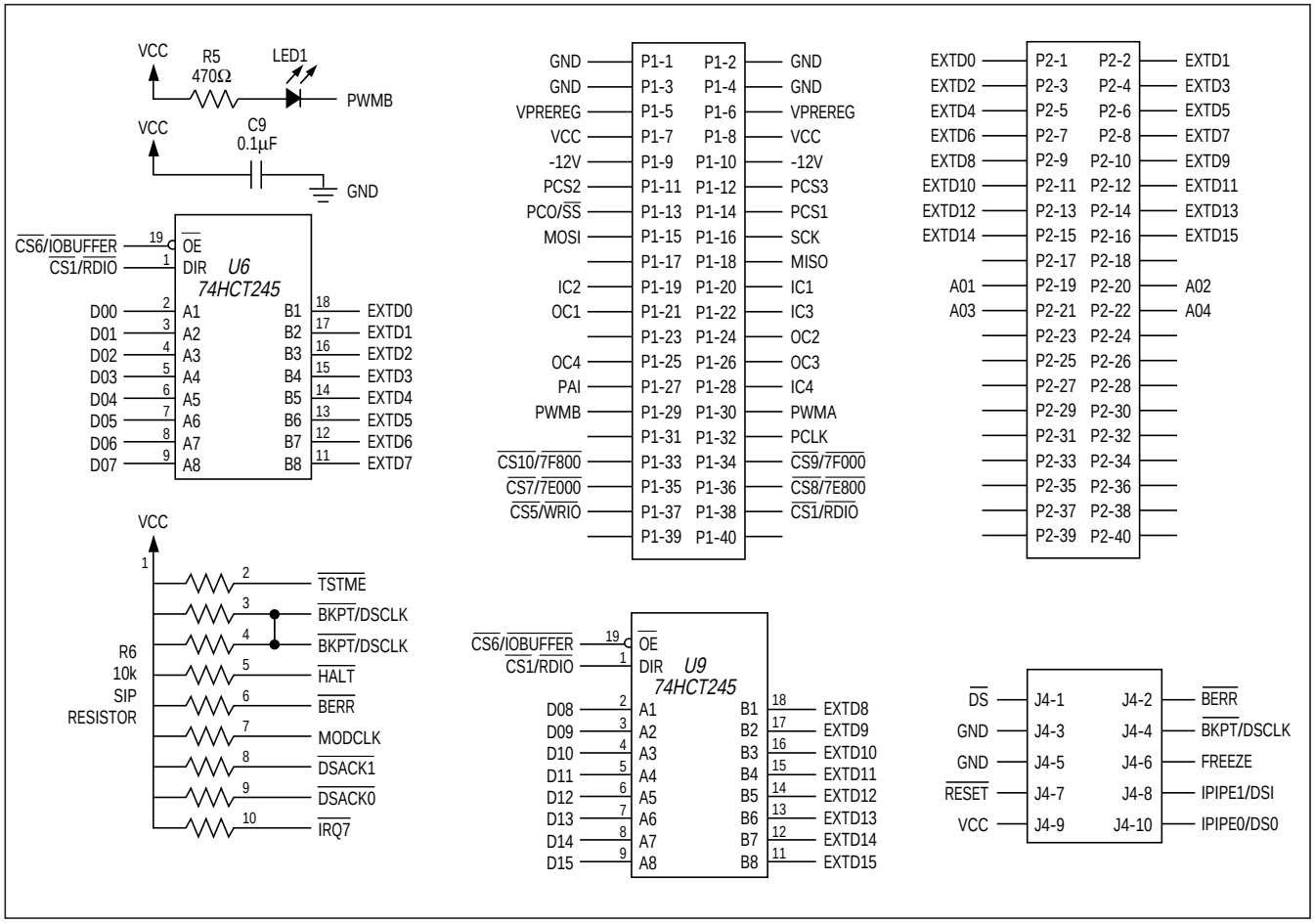

Figure 1. 68HC16MOD-16WIDE Module Schematic

68HC16MOD-16WIDE

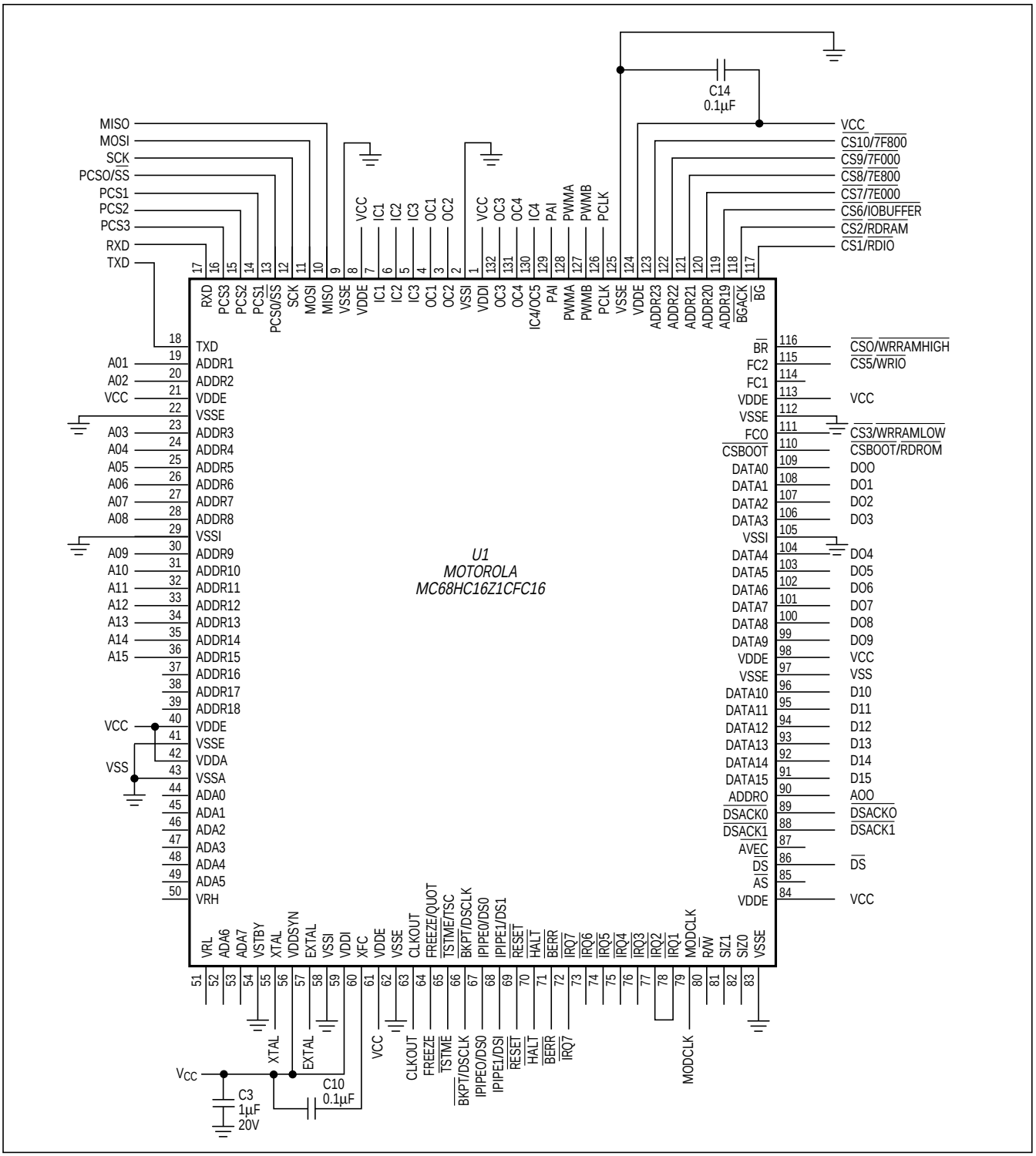

Figure 1. 68HC16MOD-16WIDE Module Schematic (continued)

68HC16MOD-16WIDE

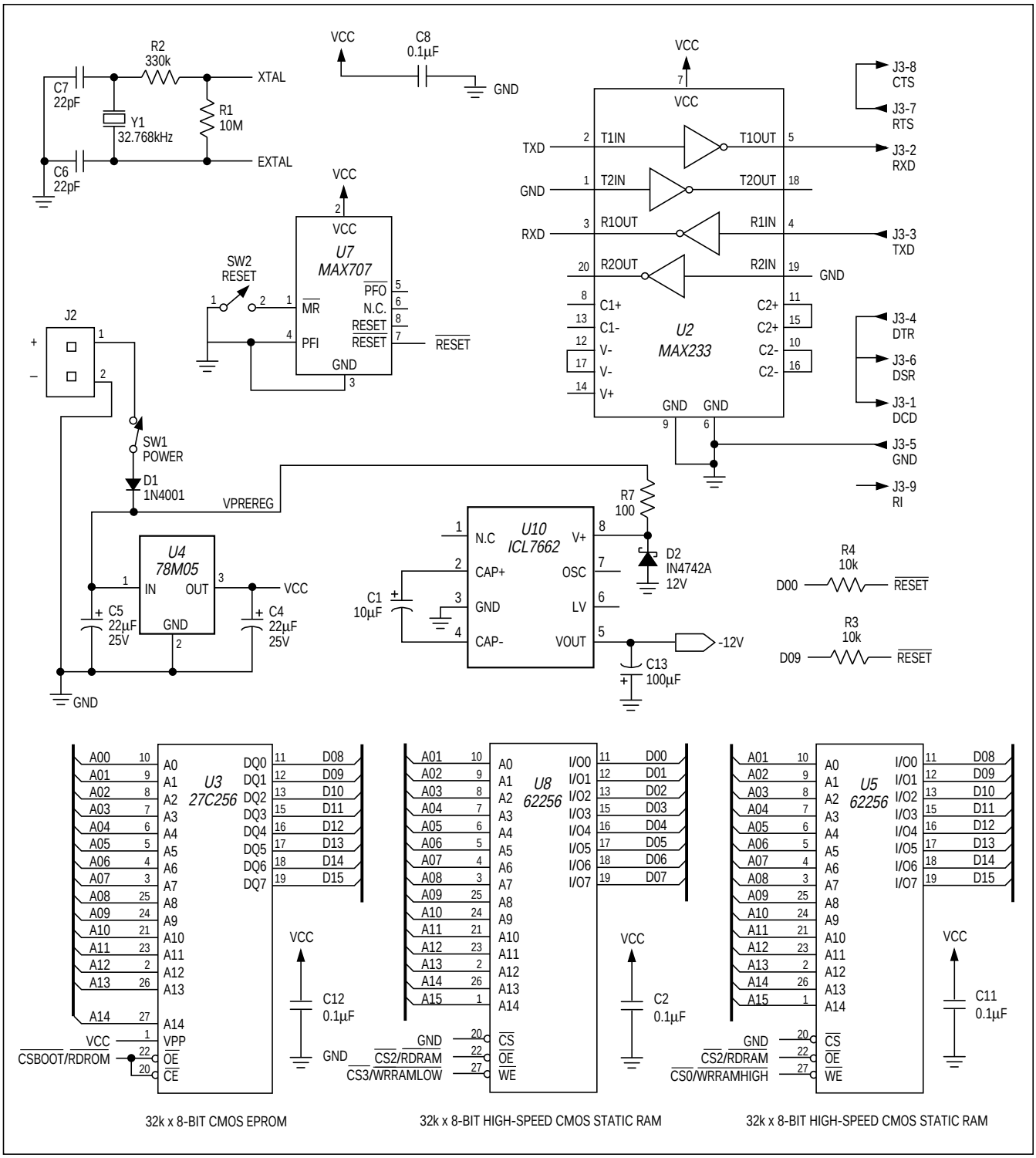

Figure 1. 68HC16MOD-16WIDE Module Schematic (continued)

68HC16MOD-16WIDE

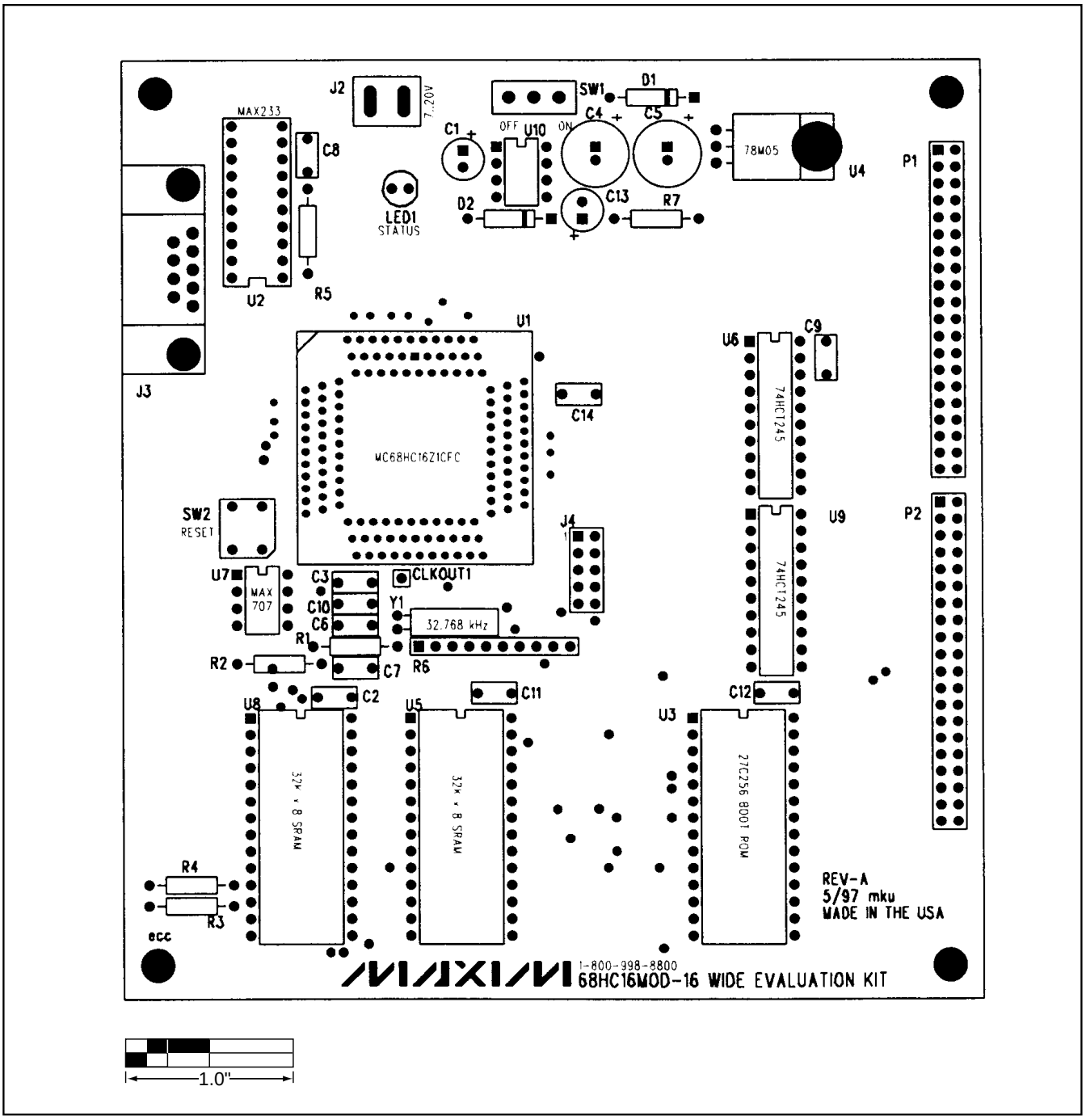

Figure 2. 68HC16MOD-16WIDE Module Component Placement Guide

68HC16MOD-16WIDE

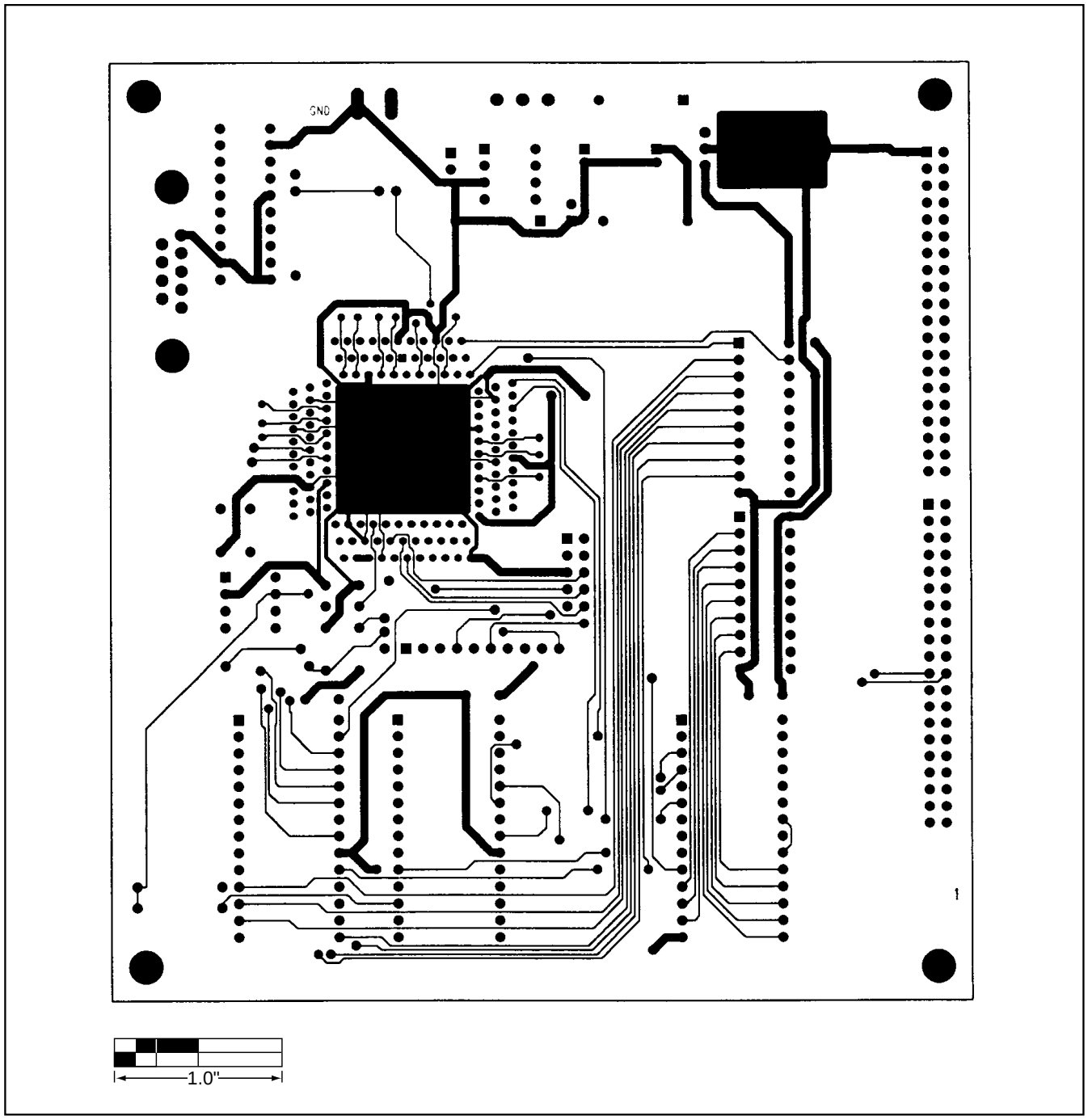

Figure 3. 68HC16MOD-16WIDE Module PC Board Layout—Component Side

68HC16MOD-16WIDE

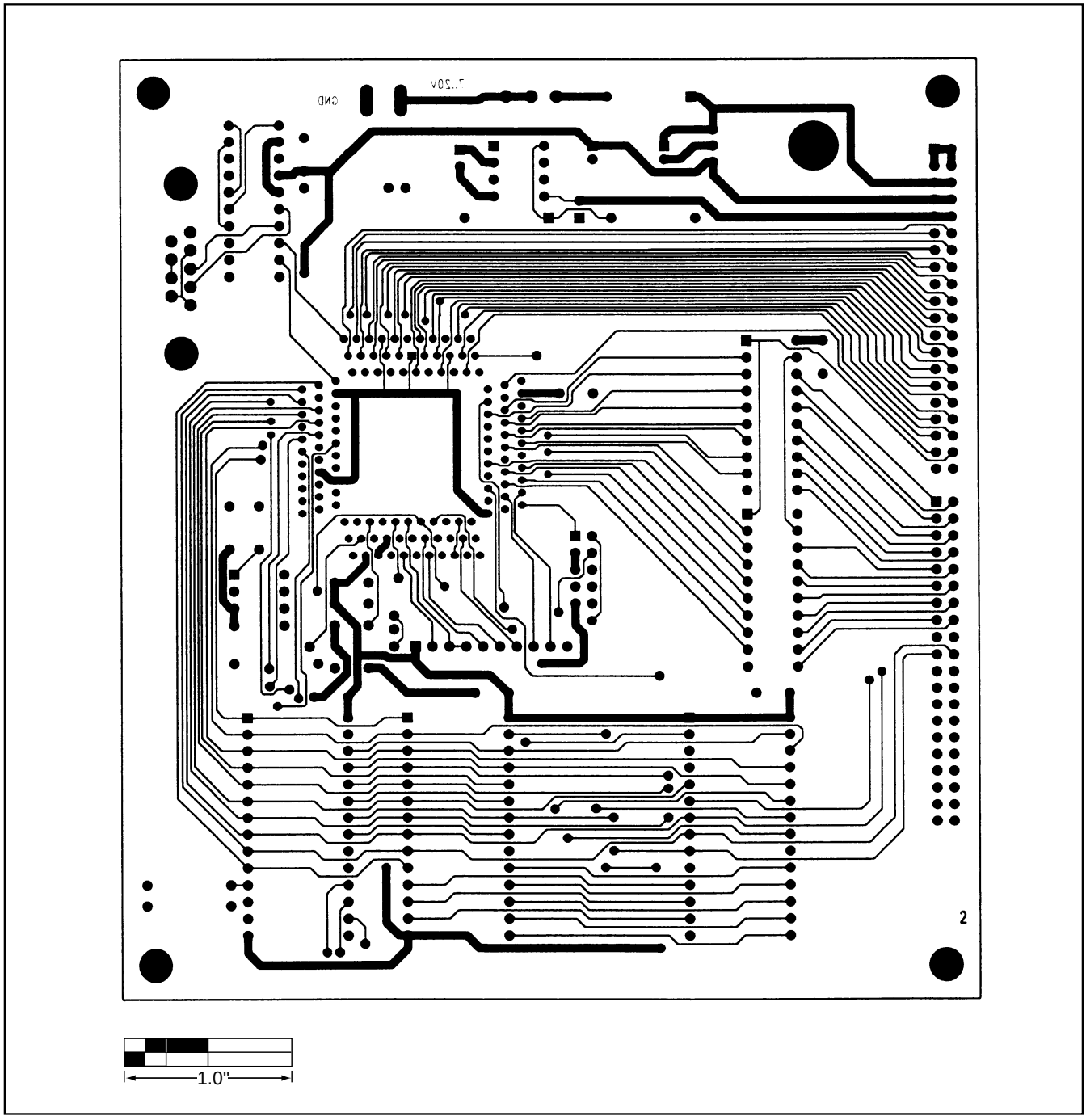

Figure 4. 68HC16MOD-16WIDE Module PC Board Layout—Solder Side

NOTES

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NOTES

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