

## SEMICONDUCTOR

### TECHNICAL DATA

**MC68HC05P1**  
**MC68HCL05P1**  
**MC68HSC05P1**

*Addendum to*  
**MC68HC05P1**  
**HCMOS Microcontroller Unit**  
**Technical Data**

This addendum supplements *MC68HC05P1 Technical Data* (Motorola document number MC68HC05P1/D REV. 1) with the following additional information:

- Corrections to *MC68HC05P1 Technical Data* REV. 1
- New Ordering Information — **SECTION 10 ORDERING INFORMATION** in this addendum replaces **SECTION 10 ORDERING INFORMATION** in *MC68HC05P1 Technical Data* REV. 1
- MC68HCL05P1 data — APPENDIX A contains data for the MC68HCL05P1, a low-power version of the MC68HC05P1
- MC68HSC05P1 data — APPENDIX B contains data for the MC68HSC05P1, a high-speed version of the MC68HC05P1





MOTOROLA  
2

MC68HC05P1AD/D  
REV. 1

**CORRECTIONS TO MC68HC05P1 Technical Data REV. 1**

Corrections to MC68HC05P1 Technical Data REV. 1 are as follows:

1. Page 3-25, **3.5.2 WAIT Mode** — Delete the following sentence from the first paragraph:  
If the A/D converter is enabled, it is also active in WAIT mode.
2. Page 3-25, **3.5.2 WAIT Mode** — Delete the second paragraph.
3. Page 6-9, **6.7 Timer during WAIT Mode** — The first sentence should read as follows:  
The internal clock halts during WAIT mode, but the capture/compare timer remains active.
4. Page 6-9, **6.8 Timer during STOP Mode** — The second sentence should read as follows:  
If  $\overline{\text{IRQ}}$  is used to exit STOP mode, the timer resumes counting from the count value that was present when STOP mode was entered.
5. Page 8-4, **Table 8-4. DC Electrical Characteristics ( $V_{\text{DD}} = 3.3 \text{ Vdc}$ )** — NOTE 2 at the bottom of Table 8-4 should read as follows:
  2. Run (operating)  $I_{\text{DD}}$  and WAIT  $I_{\text{DD}}$  measured using external square wave clock source ( $f_{\text{OSC}} = 2.1 \text{ MHz}$ ). All inputs 0.2 V from rail. No dc loads. Less than 50 pF on all outputs.  $C_{\text{L}} = 20 \text{ pF}$  on OSC2.
6. Page 8-6, **Figure 8-5. Maximum Supply Current vs Clock Frequency** — Internal clock frequency scale at bottom of  $V_{\text{DD}} = 3.3 \text{ V}$  10% graph should read as follows:
 

0	250 kHz	500 kHz	750 kHz	1 MHz
---	---------	---------	---------	-------



MOTOROLA  
4

MC68HC05P1AD/D  
REV. 1

## SECTION 10 ORDERING INFORMATION

This section contains information for ordering custom-masked ROM MCUs.

### 10.1 MCU Ordering Forms

To initiate an order for a ROM-based MCU, first obtain the current ordering form for the MCU from a Motorola representative. Submit the following items when ordering MCUs:

- A current MCU ordering form that is **completely filled out** (Contact your Motorola sales office for assistance.)
- A copy of the customer specification if the customer specification deviates from the Motorola specification for the MCU
- Customer's application program on one of the media listed in **10.2 Application Program Media**. The current MCU ordering form is also available through the Motorola Freeware Bulletin Board Service (BBS). The telephone number is (512) 891-FREE. After making the connection, type `bbs` in lowercase letters and press the return key to start the BBS software.

### 10.2 Application Program Media

Please deliver the application program to Motorola in one of the following media:

- Macintosh<sup>®1</sup> 3-1/2-inch diskette (double-sided 800K or double-sided high-density 1.4M)
- MS-DOS<sup>®2</sup> or PC-DOS<sup>®3</sup> 3-1/2-inch diskette (double-sided 720K or double-sided high-density 1.44M)
- MS-DOS<sup>®</sup> or PC-DOS<sup>®</sup> 5-1/4-inch diskette (double-sided double-density 360K or double-sided high-density 1.2M)
- EPROM(s) 2716, 2732, 2764, 27128, 27256, or 27512 (depending on the size of the memory map of the MCU)

Use positive logic for data and addresses.

---

1. Macintosh is a registered trademark of Apple Computer, Inc.  
 2. MS-DOS is a registered trademark of Microsoft, Inc.  
 3. PC-DOS is a registered trademark of International Business Machines Corporation.

## 10.2.1 Diskettes

If submitting the application program on a diskette, clearly label the diskette with the following information:

- Customer name
- Customer part number
- Project or product name
- File name of object code
- Date
- Name of operating system that formatted diskette
- Formatted capacity of diskette

On diskettes, the application program must be in Motorola's S-record format (S1 and S9 records), a character-based object file format generated by M6805 cross assemblers and linkers.

### NOTE

Begin the application program at the first user ROM location. Program addresses must correspond exactly to the available on-chip user ROM addresses as shown in the memory map. **Write \$00 in all non-user ROM locations, or leave all non-user ROM locations blank.** See the current MCU ordering form for additional requirements.

If the memory map has two user ROM areas with the same addresses, write the two areas in separate files on the diskette. Label the diskette with both file names.

In addition to the object code, a file containing the source code can be included. Motorola keeps this code confidential and uses it only to expedite ROM pattern generation in case of any difficulty with the object code. Label the diskette with the file name of the source code.

## 10.2.2 EPROMs

If submitting the application program in an EPROM, clearly label the EPROM with the following information:

- Customer name
- Customer part number
- Checksum
- Project or product name
- Date

### NOTE

Begin the application program at the first user ROM location. Program addresses must correspond exactly to the available on-chip user ROM addresses as shown in the memory map. **Write \$00 in all non-user ROM locations.** See the current MCU ordering form for additional requirements.

Submit the application program in one EPROM large enough to contain the entire memory map. If the memory map has two user ROM areas with the same addresses, write the two areas on separate EPROMs. Label the EPROMs with the addresses they contain.

Pack EPROMs securely in a conductive IC carrier for shipment. Do not use Styrofoam.

### 10.3 ROM Program Verification

The primary use for the on-chip ROM is to hold the customer's application program. The customer develops and debugs the application program, and then submits the MCU order along with the application program.

Motorola inputs the customer's application program code into a computer program that generates a listing verify file. The listing verify file represents the memory map of the MCU. The listing verify file contains the user ROM code and may also contain non-user ROM code, such as self-check code. Motorola sends the customer a computer printout of the listing verify file along with a listing verify form.

To aid the customer in checking the listing verify file, Motorola will program the listing verify file into customer-supplied blank EPROMs or preformatted Macintosh or DOS disks. All original pattern media is filed for contractual purposes and is not returned.

Check the listing verify file thoroughly, then complete and sign the listing verify form and return the listing verify form to Motorola. The signed listing verify form constitutes the contractual agreement for the creation of the custom mask.

### 10.4 ROM Verification Units

After receiving the signed listing verify form, Motorola manufactures a custom photographic mask. The mask contains the customer's application program and is used to process silicon wafers. The application program cannot be changed after the manufacture of the mask begins. Motorola then produces ten MCUs, called ROM verification units (RVUs), and sends the RVUs to the customer. RVUs are usually packaged in unmarked ceramic and tested to 5 Vdc at room temperature. RVUs are not tested to environmental extremes because their sole purpose is to demonstrate that the customer's user ROM pattern was properly implemented.

The ten RVUs are free of charge with the minimum order quantity but are not production parts. RVUs are not guaranteed by Motorola Quality Assurance.



**10.5 MC Order Numbers**

Table 10-1 provides ordering information for available package types.

**Table 10-1. MC Order Numbers**

<b>Package Type</b>	<b>Temperature</b>	<b>MC Order Number</b>
28-Pin Plastic Dual In-Line Package (DIP)	0 C to +70 C -40 C to +85 C	MC68HC05P1P MC68HC05P1CP
28-Pin Small Outline Integrated Circuit (SOIC)	0 C to +70 C -40 C to +85 C	MC68HC05P1DW MC68HC05P1CDW



**APPENDIX A  
MC68HCL05P1**

This appendix introduces the MC68HCL05P1, a low-power version of the MC68HC05P1. All of the information in *MC68HC05P1 Technical Data* applies to the MC68HCL05P1 with the exceptions given in this appendix.

**A.1 DC ELECTRICAL CHARACTERISTICS**

The data in Table 8-3 and Table 8-4 of *MC68HC05P1 Technical Data* applies to the MC68HCL05P1 with the exceptions given in **Table A-1**, **Table A-2**, and **Table A-3**.

**Table A-1. Low-Power Output Voltage ( $V_{DD} = 1.8\text{--}2.4\text{ Vdc}$ )**

Characteristic	Symbol	Min	Typ	Max	Unit
Output High Voltage ( $I_{LOAD} = -0.1\text{ mA}$ ) PA7–PA0, PB7–PB5, PC5–PC0, PD5, TCMP	$V_{OH}$	$V_{DD} - 0.3$	—	—	V
Output Low Voltage ( $I_{LOAD} = 0.2\text{ mA}$ ) PA3–PA0, PB7–PB5, PC5–PC0, PD5, TCMP	$V_{OL}$	—	—	0.3	V

**Table A-2. Low-Power Output Voltage ( $V_{DD} = 2.5\text{--}3.6\text{ Vdc}$ )**

Characteristic	Symbol	Min	Typ	Max	Unit
Output High Voltage ( $I_{LOAD} = -0.2\text{ mA}$ ) PA7–PA0, PB7–PB5, PC5–PC0, PD5, TCMP	$V_{OH}$	$V_{DD} - 0.3$	—	—	V
Output Low Voltage ( $I_{LOAD} = 0.4\text{ mA}$ ) PA7–PA0, PB7–PB5, PC5–PC0, PD5, TCMP	$V_{OL}$	—	—	0.3	V

**Table A-3. Low-Power Supply Current**

Characteristic	Symbol	Min	Typ <sup>(1)</sup>	Max	Unit
Supply Current ( $V_{DD} = 4.5\text{--}5.5$ Vdc, $f_{OP} = 2.1$ MHz)	$I_{DD}$	—	3.0	4.25	mA
Run <sup>(2)</sup>		—	1.6	2.25	mA
WAIT <sup>(3)</sup>		—	0.5	15	$\mu$ A
STOP <sup>(4)</sup>		—	2.0	25	$\mu$ A
25 C 0 C to 70 C (Standard)					
Supply Current ( $V_{DD} = 2.5\text{--}3.6$ Vdc, $f_{OP} = 1.0$ MHz)	$I_{DD}$	—	1.0	1.6	mA
Run <sup>(2)</sup>		—	0.7	1.0	mA
WAIT <sup>(3)</sup>		—	0.2	5.0	$\mu$ A
STOP <sup>(4)</sup>		—	2.0	10.0	$\mu$ A
25 C 0 C to 70 C (Standard)					
Supply Current ( $V_{DD} = 2.5\text{--}3.6$ Vdc, $f_{OP} = 500$ kHz)	$I_{DD}$	—	600	800	$\mu$ A
Run <sup>(2)</sup>		—	350	500	$\mu$ A
WAIT <sup>(3)</sup>		—	0.2	5.0	$\mu$ A
STOP <sup>(4)</sup>		—	2.0	10.0	$\mu$ A
25 C 0 C to 70 C (Standard)					
Supply Current ( $V_{DD} = 1.8\text{--}2.4$ Vdc, $f_{OP} = 500$ kHz)	$I_{DD}$	—	300	600	$\mu$ A
Run <sup>(2)</sup>		—	200	400	$\mu$ A
WAIT <sup>(3)</sup>		—	0.1	2	$\mu$ A
STOP <sup>(4)</sup>		—	2.0	5	$\mu$ A
25 C 0 C to 70 C (Standard)					

1. Typical values reflect average measurements at midpoint of voltage range at 25 C.
2. Run (operating)  $I_{DD}$  measured using external square wave clock source with all inputs 0.2 V from rail. No dc loads. Less than 50 pF on all outputs.  $C_L = 20$  pF on OSC2.
3. WAIT  $I_{DD}$  measured using external square wave clock source with all inputs 0.2 V from rail. No dc loads. Less than 50 pF on all outputs.  $C_L = 20$  pF on OSC2. All ports configured as inputs.  $V_{IL} = 0.2$  V,  $V_{IH} = V_{DD} - 0.2$  V. OSC2 capacitance linearly affects WAIT  $I_{DD}$ .
4. STOP  $I_{DD}$  measured with OSC1 =  $V_{DD}$ . All ports configured as inputs.  $V_{IL} = 0.2$  V,  $V_{IH} = V_{DD} - 0.2$  V.

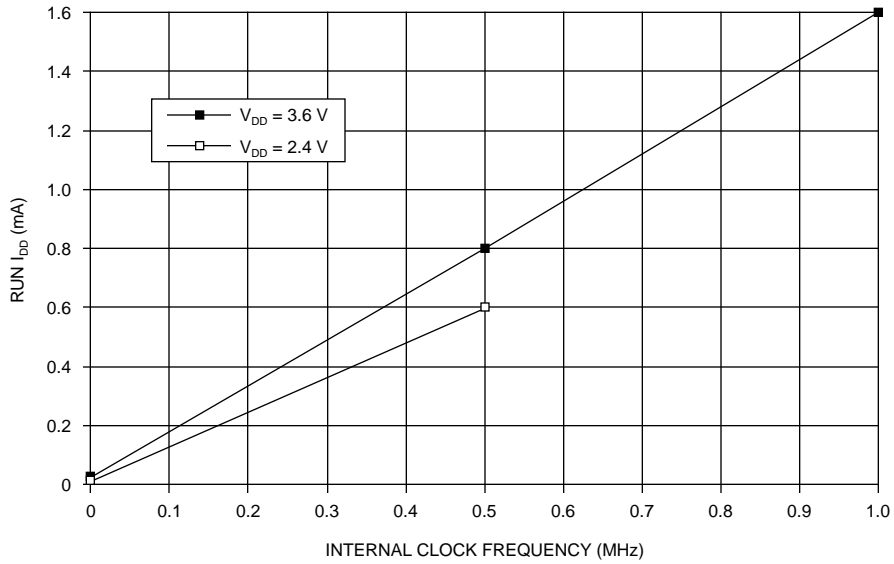


Figure A-1. Maximum Run Mode I<sub>DD</sub> vs Frequency

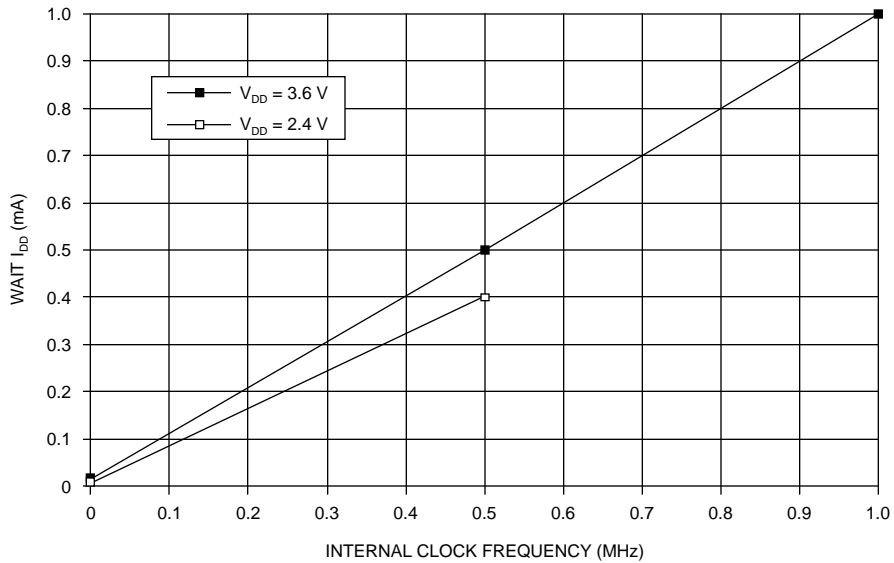


Figure A-2. Maximum WAIT Mode I<sub>DD</sub> vs Frequency



**A.2 MC ORDERING INFORMATION**

Table A-4 provides ordering information for available package types.

**Table A-4. MC Order Numbers**

<b>Package Type</b>	<b>Temperature</b>	<b>MC Order Number</b>
28-Pin Plastic Dual In-Line Package (DIP)	0 C to +70 C	MC68HCL05P1P
28-Pin Small Outline Integrated Circuit (SOIC)	0 C to +70 C	MC68HCL05P1DW

**APPENDIX B  
MC68HSC05P1 MCU**

This appendix introduces the MC68HSC05P1, a high-speed version of the MC68HC05P1. All of the information in *MC68HC05P1 Technical Data* applies to the MC68HSC05P1 with the exceptions given in this appendix.

**B.1 DC ELECTRICAL CHARACTERISTICS**

The data in Table 8-3 and Table 8-4 of *MC68HC05P1 Technical Data* applies to the MC68HSC05P1 with the exceptions given in **Table B-1**.

**Table B-1. High-Speed Supply Current<sup>(1)</sup>**

Characteristic	Symbol	Min	Typ <sup>(2)</sup>	Max	Unit
Supply Current ( $V_{DD} = 4.5\text{--}5.5$ Vdc, $f_{OP} = 4.0$ MHz)					
Run <sup>(3)</sup>	$I_{DD}$	—	6.7	8.0	mA
WAIT <sup>(4)</sup>		—	3.5	4.0	mA
STOP <sup>(5)</sup>			2.0	25	$\mu$ A
Supply Current ( $V_{DD} = 3.0\text{--}3.6$ Vdc, $f_{OP} = 2.1$ MHz)					
Run <sup>(3)</sup>	$I_{DD}$	—	2.5	4.0	mA
WAIT <sup>(4)</sup>		—	1.3	3.0	mA
STOP <sup>(5)</sup>			2.0	10	$\mu$ A

- $T_A = 0$  C to 70 C
- Typical values at midpoint of voltage range, 25 C only.
- Run (operating)  $I_{DD}$  measured using external square wave clock source. All inputs 0.2 V from rail. No dc loads. Less than 50 pF on all outputs.  $C_L = 20$  pF on OSC2.
- WAIT  $I_{DD}$  measured using external square wave clock source. All inputs 0.2 V from rail. No dc loads. Less than 50 pF on all outputs.  $C_L = 20$  pF on OSC2. All ports configured as inputs.  $V_{IL} = 0.2$  V.  $V_{IH} = V_{DD} - 0.2$  V. OSC2 capacitance linearly affects WAIT  $I_{DD}$ .
- STOP  $I_{DD}$  measured with OSC1 =  $V_{SS}$ . All ports configured as inputs.  $V_{IL} = 0.2$  V.  $V_{IH} = V_{DD} - 0.2$  V.

**B.2 CONTROL TIMING**

The data in Table 8-6 and Table 8-7 of *MC68HC05P1 Technical Data* applies to the MC68HSC05P1 with the exceptions given in **Table B-2** and **Table B-3**.

**Table B-2. High-Speed Control Timing ( $V_{DD} = 5.0$  Vdc 10%)**

Characteristic	Symbol	Min	Max	Unit
Oscillator Frequency	$f_{OSC}$	—	8.0	MHz
Crystal Oscillator		dc	8.0	MHz
External Clock				
Internal Operating Frequency ( $f_{OSC} \ddot{O}2$ )	$f_{OP}$	—	4.0	MHz
Crystal Oscillator		dc	4.0	MHz
External Clock				
Internal Clock Cycle Time	$t_{CYC}$	250	—	ns
Input Capture Pulse Width	$t_{TH}, t_{TL}$	63	—	ns
Interrupt Pulse Width Low (Edge-Triggered)	$t_{LILH}$	63	—	ns
OSC1 Pulse Width	$t_{OH}, t_{OL}$	45	—	ns

**Table B-3. High-Speed Control Timing ( $V_{DD} = 3.3$  Vdc 10%)**

Characteristic	Symbol	Min	Max	Unit
Oscillator Frequency	$f_{OSC}$	—	4.2	MHz
Crystal Oscillator		dc	4.2	MHz
External Clock				
Internal Operating Frequency ( $f_{OSC} \ddot{O}2$ )	$f_{OP}$	—	2.1	MHz
Crystal Oscillator		dc	2.1	MHz
External Clock				
Internal Clock Cycle Time	$t_{CYC}$	480	—	ns
Input Capture Pulse Width	$t_{TH}, t_{TL}$	125	—	ns
Interrupt Pulse Width Low (Edge-Triggered)	$t_{LILH}$	125	—	ns
OSC1 Pulse Width	$t_{OH}, t_{OL}$	90	—	ns

**B.3 MC ORDERING INFORMATION**

Table B-4 provides ordering information for available package types.

**Table B-4. MC Order Numbers**

<b>Package Type</b>	<b>Temperature</b>	<b>MC Order Number</b>
28-Pin Plastic Dual In-Line Package (DIP)	0 C to +70 C	MC68HSC05P1P
28-Pin Small Outline Integrated Circuit (SOIC)	0 C to +70 C	MC68HSC05P1DW



# Freescale Semiconductor, Inc.

**Home Page:**

[www.freescale.com](http://www.freescale.com)

**email:**

[support@freescale.com](mailto:support@freescale.com)

**USA/Europe or Locations Not Listed:**

Freescale Semiconductor  
Technical Information Center, CH370  
1300 N. Alma School Road  
Chandler, Arizona 85224  
(800) 521-6274  
480-768-2130

[support@freescale.com](mailto:support@freescale.com)

**Europe, Middle East, and Africa:**

Freescale Halbleiter Deutschland GmbH  
Technical Information Center  
Schatzbogen 7  
81829 Muenchen, Germany  
+44 1296 380 456 (English)  
+46 8 52200080 (English)  
+49 89 92103 559 (German)  
+33 1 69 35 48 48 (French)  
[support@freescale.com](mailto:support@freescale.com)

**Japan:**

Freescale Semiconductor Japan Ltd.  
Headquarters  
ARCO Tower 15F  
1-8-1, Shimo-Meguro, Meguro-ku  
Tokyo 153-0064, Japan  
0120 191014  
+81 2666 8080  
[support.japan@freescale.com](mailto:support.japan@freescale.com)

**Asia/Pacific:**

Freescale Semiconductor Hong Kong Ltd.  
Technical Information Center  
2 Dai King Street  
Tai Po Industrial Estate,  
Tai Po, N.T., Hong Kong  
+800 2666 8080  
[support.asia@freescale.com](mailto:support.asia@freescale.com)

**For Literature Requests Only:**

Freescale Semiconductor  
Literature Distribution Center  
P.O. Box 5405  
Denver, Colorado 80217  
(800) 441-2447  
303-675-2140  
Fax: 303-675-2150  
[LDCForFreescaleSemiconductor@hibbertgroup.com](mailto:LDCForFreescaleSemiconductor@hibbertgroup.com)

RoHS-compliant and/or Pb- free versions of Freescale products have the functionality and electrical characteristics of their non-RoHS-compliant and/or non-Pb- free counterparts. For further information, see <http://www.freescale.com> or contact your Freescale sales representative.

For information on Freescale's Environmental Products program, go to <http://www.freescale.com/epp>.

Information in this document is provided solely to enable system and software implementers to use Freescale Semiconductor products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits or integrated circuits based on the information in this document. Freescale Semiconductor reserves the right to make changes without further notice to any products herein. Freescale Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Freescale Semiconductor 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 Freescale Semiconductor 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. Freescale Semiconductor does not convey any license under its patent rights nor the rights of others. Freescale Semiconductor 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 Freescale Semiconductor product could create a situation where personal injury or death may occur. Should Buyer purchase or use Freescale Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold Freescale Semiconductor 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 Freescale Semiconductor was negligent regarding the design or manufacture of the part.



MC68HC05P1AD/D



**For More Information On This Product,  
Go to: [www.freescale.com](http://www.freescale.com)**