

**REVISIONS**

LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Technical changes were made in table I, Editorial changes throughout.	90-08-15	William K. Heckman
B	Changes in accordance with NOR 5962-R023-92.	91-10-30	Monica L.Poelking
C	Changes in accordance with NOR 5962-R189-93.	93-07-07	Joe Dupay
D	Add devices 03, 04, 05, and 06. Editorial changes throughout.	94-11-26	Monica L.Poelking
E	Changes in accordance with NOR 5962-R001-01. - LTG	00-12-21	Thomas M. Hess
F	Update boilerplate to the requirements of MIL-PRF-38535. Editorial changes throughout. - TVN	01-12-03	Thomas M. Hess

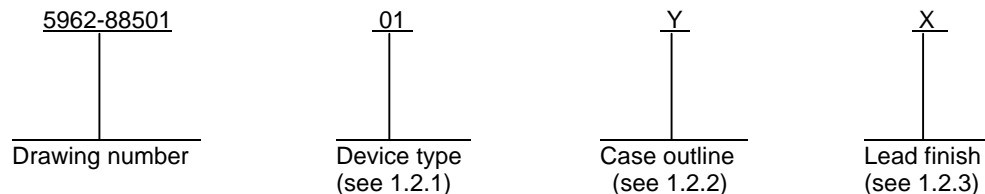
THE ORIGINAL FIRST SHEET OF THIS DRAWING HAS BEEN REPLACED.

REV	35	36	37	38	39	40	41	42												
SHEET	F	F	F	F	F	F	F	F												
REV	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
SHEET	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
REV STATUS OF SHEETS				REV		F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
				SHEET		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
PMIC N/A				PREPARED BY Tim Noh					<b>DEFENSE SUPPLY CENTER COLUMBUS</b> <b>COLUMBUS, OHIO 43216</b> <a href="http://www.dscc.dla.mil">http://www.dscc.dla.mil</a>											
<b>STANDARD MICROCIRCUIT DRAWING</b>  THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE  AMSC N/A				CHECKED BY Tim Noh																
				APPROVED BY William K.Heckman					MICROCIRCUIT, DIGITAL, CMOS, 16-BIT MICROPROCESSOR, MONOLITHIC SILICON											
				DRAWING APPROVAL DATE 89-02-16																
				REVISION LEVEL <b>F</b>					SIZE <b>A</b>	CAGE CODE <b>67268</b>	<b>5962-88501</b>									
					SHEET	1	OF	42												

1. SCOPE

1.1 Scope. This drawing describes device requirements for MIL-STD-883 compliant, non-JAN class level B microcircuits in accordance with MIL-PRF-38535, appendix A.

1.2 Part or Identifying Number (PIN). The complete PIN is as shown in the following example:



1.2.1 Device type(s). The device type(s) identify the circuit function as follows:

<u>Device type</u>	<u>Generic number</u>	<u>Frequency</u>	<u>Circuit function</u>
01	M80C186	10 MHz	16-bit CHMOS microprocessor
02	M80C186	12.5 MHz	16-bit CHMOS microprocessor
03	M80C186XL	20 MHz	16-bit CHMOS microprocessor
04	M80C186XL	16 MHz	16-bit CHMOS microprocessor
05	M80C186XL	12.5 MHz	16-bit CHMOS microprocessor
06	M80C186XL	10 MHz	16-bit CHMOS microprocessor

1.2.2 Case outline(s). The case outline(s) are as designated in MIL-STD-1835 and as follows:

<u>Outline letter</u>	<u>Descriptive designator</u>	<u>Terminals</u>	<u>Package style</u>
Y	See figure 1	68	Ceramic quad package
Z	CMGA3-P68	68	Pin grid array package

1.2.3 Lead finish. The lead finish is as specified in MIL-PRF-38535, appendix A.

1.3 Absolute maximum ratings.

Voltage on any pin (referenced to GND).....	-1.0 V dc to +7.0 V dc
Maximum power dissipation (P <sub>D</sub> ) .....	1 W
Storage temperature range .....	-65°C to +150°C
Thermal resistance, junction-to-case (Θ <sub>JC</sub> ):	
Case Y .....	13°C/W
Case Z .....	See MIL-STD-1835
Junction temperature (T <sub>J</sub> ).....	+150°C
Lead temperature (soldering, 5 seconds) .....	+260°C

1.4 Recommended operating conditions.

Supply voltage range (V <sub>CC</sub> ):	
Device types 01, 02 .....	4.75 V dc to 5.25 V dc
Device types 03 - 06.....	4.5 V dc to 5.5 V dc
Frequency of operation:	
Device type 01 .....	10 MHz
Device type 02 .....	12.5 MHz
Device type 03 .....	20 MHz
Device type 04 .....	16 MHz
Device type 05 .....	12.5 MHz
Device type 06 .....	10 MHz
Case operating temperature range (T <sub>C</sub> ).....	-55°C to +125°C

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>2</b>

2. APPLICABLE DOCUMENTS

2.1 Government specification, standards, and handbooks. The following specification, standards, and handbooks form a part of this drawing to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATION

DEPARTMENT OF DEFENSE

MIL-PRF-38535 - Integrated Circuits, Manufacturing, General Specification for.

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-883 - Test Method Standard Microcircuits.  
MIL-STD-1835 - Interface Standard Electronic Component Case Outlines.

HANDBOOKS

DEPARTMENT OF DEFENSE

MIL-HDBK-103 - List of Standard Microcircuit Drawings.  
MIL-HDBK-780 - Standard Microcircuit Drawings.

(Unless otherwise indicated, copies of the specification, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2 Order of precedence. In the event of a conflict between the text of this drawing and the references cited herein, the text of this drawing takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Item requirements. The individual item requirements shall be in accordance with MIL-PRF-38535, appendix A for non-JAN class level B devices and as specified herein. Product built to this drawing that is produced by a Qualified Manufacturer Listing (QML) certified and qualified manufacturer or a manufacturer who has been granted transitional certification to MIL-PRF-38535 may be processed as QML product in accordance with the manufacturers approved program plan and qualifying activity approval in accordance with MIL-PRF-38535. This QML flow as documented in the Quality Management (QM) plan may make modifications to the requirements herein. These modifications shall not affect form, fit, or function of the device. These modifications shall not affect the PIN as described herein. A "Q" or "QML" certification mark in accordance with MIL-PRF-38535 is required to identify when the QML flow option is used. This drawing has been modified to allow the manufacturer to use the alternate die/fabrication requirements of paragraph A.3.2.2 of MIL-PRF-38535 or other alternative approved by the Qualifying Activity.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-PRF-38535, appendix A and herein.

3.2.1 Case outlines. The case outlines shall be in accordance with 1.2.2 and figure 1 herein.

3.2.2 Terminal connections. The terminal connections shall be as specified on figure 2.

3.2.3 Functional block diagram. The functional block diagram shall be as specified on figure 3.

3.2.4 Timing waveforms. The timing waveforms shall be as specified on figure 4.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>3</b>

3.3 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in table I and shall apply over the full case operating temperature range.

3.4 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table II. The electrical tests for each subgroup are described in table I.

3.5 Marking. Marking shall be in accordance with MIL-PRF-38535, appendix A. The part shall be marked with the PIN listed in 1.2 herein. In addition, the manufacturer's PIN may also be marked as listed in MIL-HDBK-103 (see 6.7 herein). For packages where marking of the entire SMD PIN number is not feasible due to space limitations, the manufacturer has the option of not marking the "5962-" on the device.

3.5.1 Certification/compliance mark. A compliance indicator "C" shall be marked on all non-JAN devices built in compliance to MIL-PRF-38535, appendix A. The compliance indicator "C" shall be replaced with a "Q" or "QML" certification mark in accordance with MIL-PRF-38535 to identify when the QML flow option is used. For product built in accordance with A.3.2.2 of MIL-PRF-38535, or as modified in the manufacturer's QM plan, the "QD" certification mark shall be used in place of the "Q" or "QML" certification mark.

3.6 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to be listed as an approved source of supply in MIL-HDBK-103 (see 6.7 herein). The certificate of compliance submitted to DSCC-VA prior to listing as an approved source of supply shall affirm that the manufacturer's product meets the requirements of MIL-PRF-38535, appendix A and the requirements herein.

3.7 Certificate of conformance. A certificate of conformance as required in MIL-PRF-38535, appendix A shall be provided with each lot of microcircuits delivered to this drawing.

3.8 Notification of change. Notification of change to DSCC-VA shall be required in accordance with MIL-PRF-38535, appendix A.

3.9 Verification and review. DSCC, DSCC's agent, and the acquiring activity retain the option to review the manufacturer's facility and applicable required documentation. Offshore documentation shall be made available onshore at the option of the reviewer.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with MIL-PRF-38535, appendix A.

4.2 Screening. Screening shall be in accordance with method 5004 of MIL-STD-883, and shall be conducted on all devices prior to quality conformance inspection. The following additional criteria shall apply:

a. Burn-in test, method 1015 of MIL-STD-883.

(1) Test condition D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1015 of MIL-STD-883.

(2)  $T_A = +125^\circ\text{C}$ , minimum.

b. Interim and final electrical test parameters shall be as specified in table II herein, except interim electrical parameter tests prior to burn-in are optional at the discretion of the manufacturer.

4.3 Quality conformance inspection. Quality conformance inspection shall be in accordance with method 5005 of MIL-STD-883 including groups A, B, C, and D inspections. The following additional criteria shall apply.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>4</b>

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions <sup>1/</sup> -55°C ≤ T <sub>C</sub> ≤ +125°C unless otherwise specified	Device type	Group A subgroups	Limits		Unit
					Min	Max	
Low level input voltage, except X1	V <sub>IL</sub>		All	1, 2, 3	-0.5	0.2V <sub>CC</sub> -0.3	V
High level input voltage, all except X1, $\overline{\text{RES}}$	V <sub>IH1</sub>		01, 02	1, 2, 3	0.2V <sub>CC</sub> +1.1	V <sub>CC</sub> +0.5	V
			03-06		0.2V <sub>CC</sub> +0.9	V <sub>CC</sub> +0.5	
High level input voltage, at $\overline{\text{RES}}$	V <sub>IH2</sub>		All	1, 2, 3	3.0	V <sub>CC</sub> +0.5	V
High level input voltage, at ARDY/SRDY	V <sub>IH3</sub>		01, 02	1, 2, 3	0.2V <sub>CC</sub> +1.3	V <sub>CC</sub> +0.5	V
Low level output voltage	V <sub>OL</sub>	I <sub>OL</sub> = 2.5 mA for $\overline{\text{S0}} - \overline{\text{S2}}$ I <sub>OL</sub> = 2.0 mA for all other outputs	All	1, 2, 3		0.45	V
High level output voltage	V <sub>OH</sub>	I <sub>OH</sub> = -200 μA at 0.8V <sub>CC</sub>	01, 02	1, 2, 3	0.8V <sub>CC</sub>	V <sub>CC</sub> <u>2/</u>	V
		I <sub>OH</sub> = -200 μA at V <sub>CC</sub> - 0.5 V	03-06		V <sub>CC</sub> -0.5	V <sub>CC</sub> <u>2/</u>	
		I <sub>OH</sub> = -2.4 mA at 2.4 V	All		2.4	V <sub>CC</sub> <u>2/</u>	
Power supply current <sup>3/</sup>	I <sub>CC</sub>	V <sub>CC</sub> = Max <sup>4/</sup>	01	1, 2, 3		140	mA
			02			160	
			03			100	
			04			90	
			05			80	
			06			70	
Input leakage current	I <sub>IL</sub>	0.45 V < V <sub>IN</sub> < V <sub>CC</sub>	All	1, 2, 3		±10	μA
Output leakage current	I <sub>OL</sub>	0.45 V < V <sub>OUT</sub> < V <sub>CC</sub> <sup>5/</sup> At 0.5 MHz	All	1, 2, 3		±10	μA
Low level clock output voltage	V <sub>CLO</sub>	I <sub>CLO</sub> = 4.0 mA	01, 02	1, 2, 3		0.5	V
			03-06			0.45	
High level clock output voltage	V <sub>CHO</sub>	I <sub>CHO</sub> = -500 μA	01, 02	1, 2, 3	0.8V <sub>CC</sub>		V
			03-06		V <sub>CC</sub> -0.5		
Low level clock input voltage (X1)	V <sub>CLI</sub>		All	1, 2, 3	-0.5	+0.6	V
High level clock input voltage (X1)	V <sub>CHI</sub>		All	1, 2, 3	3.9	V <sub>CC</sub> +0.5	V

See footnotes at end of table.

**STANDARD  
MICROCIRCUIT DRAWING**  
DEFENSE SUPPLY CENTER COLUMBUS  
COLUMBUS, OHIO 43216-5000

SIZE  
**A**

**5962-88501**

REVISION LEVEL  
**F**

SHEET  
**5**

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions <sup>1/</sup> -55°C ≤ T <sub>C</sub> ≤ +125°C unless otherwise specified	Device type	Group A subgroups	Limits		Unit
					Min	Max	
Input capacitance	C <sub>IN</sub>	See 4.3.1c f = 1 MHz	All	4		10	pF
I/O capacitance	C <sub>IO</sub>					20	
Functional test		See 4.3.1d	All	7, 8			
Data in set-up (A/D)	t <sub>DVCL</sub>	See figure 4	01, 02	9, 10, 11	20		ns
			03		10		
			04-06		15		
Data in hold (A/D)	t <sub>CLDX</sub>		01, 02	9, 10, 11	5		ns
			03-06		3		
ARDY resolution transition set-up time <sup>6/</sup>	t <sub>ARYCH</sub>		01, 02	9, 10, 11	20		ns
			03		10		
			04-06		15		
Asynchronous ready (ARDY) set-up time	t <sub>ARYLCL</sub>		01, 02	9, 10, 11	30		ns
			03		15		
			04-06		25		
ARDY active hold time	t <sub>CLARX</sub>		01, 02	9, 10, 11	15		ns
			03		10		
			04-06		15		
ARDY inactive hold time	t <sub>ARYCHL</sub>		01, 02	9, 10, 11	15		ns
			03		10		
			04-06		15		
Synchronous ready (SRDY) transition set-up time	t <sub>SRYCL</sub>		01, 02	9, 10, 11	20		ns
			03		10		
			04-06		15		
SRDY transition hold time	t <sub>CLSRY</sub>		01, 02	9, 10, 11	20		ns
			03		10		
			04-06		15		
Hold set-up <sup>6/</sup>	t <sub>HVCL</sub>		01, 02	9, 10, 11	20		ns
			03		10		
			04-06		15		

See footnotes at end of table.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>6</b>

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions <sup>1/</sup> -55°C ≤ T <sub>C</sub> ≤ +125°C unless otherwise specified	Device type	Group A subgroups	Limits		Unit
					Min	Max	
INT <sub>x</sub> , NMI, $\overline{\text{TEST}}$ , TMRIN set-up time $\underline{6/}$	t <sub>INVCH</sub>	See figure 4	01, 02	9, 10, 11	20		ns
			03		10		
			04-06		15		
DRQ0, DRQ1 set-up time $\underline{6/}$	t <sub>INVCL</sub>		01, 02	9, 10, 11	20		ns
			03		10		
			04-06		15		
Address valid delay	t <sub>CLAV</sub>		01	9, 10, 11	5	50	ns
			02		5	37	
			03		1	27	
			04		1	33	
			05		3	36	
			06		3	44	
Address hold	t <sub>CLAX</sub>		01, 02	9, 10, 11	0		ns
			03-06		0 $\underline{2/}$		
Address float delay	t <sub>CLAZ</sub>		01	9, 10, 11	t <sub>CLAX</sub>	30	ns
			02		t <sub>CLAX</sub>	25	
			03-04		t <sub>CLAX</sub>	20	
			05		t <sub>CLAX</sub>	25	
			06		t <sub>CLAX</sub>	30	
Command lines float delay	t <sub>CHCZ</sub>		01	9, 10, 11		40	ns
			02			33	
			03			25	
			04			28	
			05			33	
			06			40	
Command lines valid delay (after float)	t <sub>CHCV</sub>		01	9, 10, 11		45	ns
			02			37	
			03			26	
			04			32	
			05			36	
			06			44	

See footnotes at end of table.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>7</b>

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ -55°C ≤ T <sub>C</sub> ≤ +125°C unless otherwise specified	Device type	Group A subgroups	Limits		Unit
					Min	Max	
ALE width	t <sub>LHLL</sub>	See figure 4	01, 02	9, 10, 11	t <sub>CLCL</sub> -30		ns
			03-06		t <sub>CLCL</sub> -15		
ALE active delay	t <sub>CHLH</sub>		01	9, 10, 11		30	ns
			02			25	
			03-04			20	
			05			25	
			06			30	
ALE inactive delay	t <sub>CHLL</sub>		01	9, 10, 11		30	ns
			02			25	
			03-04			20	
		05			25		
		06			30		
Address hold to ALE inactive	t <sub>LLAX</sub>	See figure 4	01	9, 10, 11	t <sub>CHCL</sub> -20		ns
			02		t <sub>CHCL</sub> -15		
		Equal loading See figure 4	03		t <sub>CHCL</sub> -10		
			04-06		t <sub>CHCL</sub> -15		
Data valid delay	t <sub>CLDV</sub>	See figure 4	01	9, 10, 11	5	40	ns
			02		5	36	
			03		1	27	
			04		1	33	
			05		3	36	
			06		3	40	
Data hold time	t <sub>CLDOX</sub>		01, 02	9, 10, 11	3		ns
			03, 04		1		
			05, 06		3		
Data hold after $\overline{WR}$ (min)	t <sub>WHDX</sub>		See figure 4	01	9, 10, 11	t <sub>CLCL</sub> -34	
		02		t <sub>CLCL</sub> -20			
		Equal loading See figure 4	03	t <sub>CLCL</sub> -15			
			04-05	t <sub>CLCL</sub> -20			
			06	t <sub>CLCL</sub> -34			

See footnotes at end of table.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>8</b>

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ -55°C ≤ T <sub>C</sub> ≤ +125°C unless otherwise specified	Device type	Group A subgroups	Limits		Unit
					Min	Max	
$\overline{WR}$ inactive to $\overline{DEN}$ inactive	t <sub>WHDEX</sub>	See figure 4	01, 02	9, 10, 11	t <sub>CLCH</sub> -10		ns
		Equal loading See figure 4	03-06		t <sub>CLCH</sub> -10		
$\overline{WR}$ inactive to ALE high	t <sub>WHLH</sub>	See figure 4	01, 02	9, 10, 11	t <sub>CLCH</sub> -14		ns
		Equal loading See figure 4	03-06		t <sub>CLCH</sub> -14		
Control active delay 1	t <sub>CVCTV</sub>	See figure 4	01	9, 10, 11	3	56	ns
			02		3	47	
			03		1	22	
			04		1	31	
			05		3	37	
			06		3	44	
Control active delay 2	t <sub>CHCTV</sub>	See figure 4	01	9, 10, 11	5	44	ns
			02		5	37	
			03		1	22	
			04		1	31	
			05		3	37	
			06		3	44	
Control inactive delay	t <sub>CVCTX</sub>	See figure 4	01	9, 10, 11	3	44	ns
			02		3	37	
			03		1	25	
			04		1	31	
			05		3	37	
			06		3	44	
$\overline{DEN}$ inactive delay (nonwrite cycle)	t <sub>CVDEX</sub>	See figure 4	01	9, 10, 11	5	56	ns
			02		5	47	
			03		1	22	
			04		1	31	
			05		3	37	
			06		3	44	

See footnotes at end of table.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>9</b>

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions <sup>1/</sup> -55°C ≤ T <sub>C</sub> ≤ +125°C unless otherwise specified	Device type	Group A subgroups	Limits		Unit
					Min	Max	
Address float to $\overline{RD}$ active <sup>2/</sup>	t <sub>AZRL</sub>	See figure 4	All	9, 10, 11	0		ns
$\overline{RD}$ active delay	t <sub>CLRL</sub>		01	9, 10, 11	5	44	ns
			02		5	37	
			03		1	27	
			04		1	31	
			05		3	37	
			06		3	44	
$\overline{RD}$ inactive delay	t <sub>CLR<sub>H</sub></sub>		01	9, 10, 11	5	44	ns
			02		5	37	
			03		1	27	
			04		1	31	
			05		3	37	
			06		3	44	
$\overline{RD}$ inactive to ALE high	t <sub>RHLH</sub>	See figure 4	01, 02	9, 10, 11	t <sub>CLCH</sub> -14		ns
		Equal loading See figure 4	03-06		t <sub>CLCH</sub> -14		
$\overline{RD}$ inactive to address active (min)	t <sub>RHAV</sub>	See figure 4	01	9, 10, 11	t <sub>CLCL</sub> -40		ns
			02		t <sub>CLCL</sub> -20		
		Equal loading See figure 4	03-06		t <sub>CLCL</sub> -15		
HLDA valid delay	t <sub>CLHAV</sub>	See figure 4	01	9, 10, 11	3	40	ns
			02		3	33	
			03		1	22	
			04		1	25	
			05		3	33	
			06		3	40	
$\overline{RD}$ pulse width (min)	t <sub>RLRH</sub>		01	9, 10, 11	2t <sub>CLCL</sub> -46		ns
			02		2t <sub>CLCL</sub> -40		
			03		2t <sub>CLCL</sub> -20		
			04-05		2t <sub>CLCL</sub> -25		
			06		2t <sub>CLCL</sub> -30		

See footnotes at end of table.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET 10

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ -55°C ≤ T <sub>C</sub> ≤ +125°C unless otherwise specified	Device type	Group A subgroups	Limits		Unit
					Min	Max	
WR pulse width (min)	t <sub>WLWH</sub>	See figure 4	01	9, 10, 11	2t <sub>CLCL</sub> -34		ns
			02		2t <sub>CLCL</sub> -30		
			03		2t <sub>CLCL</sub> -20		
			04-05		2t <sub>CLCL</sub> -25		
			06		2t <sub>CLCL</sub> -30		
Address valid to ALE low (min)	t <sub>AVLL</sub>	See figure 4	01	9, 10, 11	t <sub>CLCH</sub> -19		ns
			02		t <sub>CLCH</sub> -15		
		Equal loading See figure 4	03		t <sub>CLCH</sub> -10		
			04-05		t <sub>CLCH</sub> -15		
			06		t <sub>CLCH</sub> -18		
Status active delay	t <sub>CHSV</sub>	See figure 4	01	9, 10, 11	5	45	ns
			02		5	35	
			03		1	25	
			04		1	31	
			05		3	35	
			06		3	45	
Status inactive delay	t <sub>CLSH</sub>	See figure 4	01	9, 10, 11	5	50	ns
			02		5	35	
			03		1	25	
			04		1	30	
			05		3	35	
			06		3	46	
Timer output delay	t <sub>CLTMV</sub>	C <sub>L</sub> = 100 pF maximum at 10 MHz See figure 4	01	9, 10, 11		48	ns
		See figure 4	02			40	
			03			22	
			04			27	
			05			33	
			06			40	

See footnotes at end of table.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>11</b>

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ -55°C ≤ T <sub>C</sub> ≤ +125°C unless otherwise specified	Device type	Group A subgroups	Limits		Unit
					Min	Max	
Reset delay	t <sub>CLR0</sub>	See figure 4	01	9, 10, 11		48	ns
			02			40	
			03			22	
			04			27	
			05			33	
			06			40	
Queue status delay	t <sub>CHQSV</sub>		01-02	9, 10, 11		28	ns
			03			27	
			04			30	
			05			32	
			06			37	
$\overline{\text{RES}}$ set-up	t <sub>RESIN</sub>		03-06	9, 10, 11	15		ns
Status hold time	t <sub>CHDX</sub>		01-02	9, 10, 11	5		ns
Address valid to clock high	t <sub>AVCH</sub>		All	9, 10, 11	0		ns
$\overline{\text{LOCK}}$ valid/invalid delay	t <sub>CLLV</sub>		01	9, 10, 11	3	45	ns
			02		3	40	
			03		1	22	
			04		1	35	
			05		3	37	
			06		3	40	
$\overline{\text{DEN}}$ inactive to DT/ $\overline{\text{R}}$ low	t <sub>DXDL</sub>	See figure 4	01, 02	9, 10, 11	0		ns
		Equal loading See figure 4	03-06		0		
Chip-select active delay	t <sub>CLCSV</sub>	See figure 4	01	9, 10, 11		45	ns
			02			33	
			03		1	25	
			04		1	30	
			05		3	33	
			06		3	42	

See footnotes at end of table.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET 12

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions <u>1/</u> -55°C ≤ T <sub>C</sub> ≤ +125°C unless otherwise specified	Device type	Group A subgroups	Limits		Unit
					Min	Max	
Chip-select hold from command inactive	t <sub>CXCSX</sub>	See figure 4	01, 02	9, 10, 11	t <sub>CLCH</sub> -10		ns
		Equal loading See figure 4	03-06		t <sub>CLCH</sub> -10		
Chip-select inactive delay	t <sub>CHCSX</sub>	See figure 4	01	9, 10, 11	5	40	ns
			02		5	36	
			03		1	20	
			04		1	35	
			05		3	30	
			06		3	35	
CLKIN period	t <sub>CKIN</sub>		01	9, 10, 11	50	1000	ns
			02		40	1000	
			03		25	∞	
			04		31.25	∞	
			05		40	∞	
			06		50	∞	
$\overline{RD}$ valid to clock high	t <sub>RVCH</sub>		01, 02	9, 10, 11	25		ns
Chip select valid to ALE low	t <sub>CSVLL</sub>		01, 02	9, 10, 11	t <sub>CLCH</sub> -14		ns
CLKIN fall time <u>2/</u>	t <sub>CKHL</sub>	3.5 V to 1.0 V See figure 4 <u>7/</u>	All	9, 10, 11		5	ns
CLKIN rise time <u>2/</u>	t <sub>CKLH</sub>	1.0 V to 3.5 V See figure 4 <u>7/</u>	All	9, 10, 11		5	ns
CLKIN low time	t <sub>CLK</sub>	At 1.5 V See figure 4 <u>7/</u> <u>8/</u>	01	9, 10, 11	23		ns
			02		18		
			03		10	∞	
			04		13	∞	
			05		16	∞	
			06		20	∞	

See footnotes at end of table.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>13</b>

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions <sup>1/</sup> -55°C ≤ T <sub>C</sub> ≤ +125°C unless otherwise specified	Device type	Group A subgroups	Limits		Unit
					Min	Max	
CLKIN high time	t <sub>CHCK</sub>	At 1.5 V See figure 4 <sup>7/</sup> <sup>8/</sup>	01	9, 10, 11	23		ns
			02		18		
			03		10	∞	
			04		13	∞	
			05		16	∞	
			06		20	∞	
CLKIN to CLKOUT skew	t <sub>CICO</sub>	See figure 4	01	9, 10, 11		25	ns
			02			21	
			03-04			17	
			05			21	
			06			25	
			CLKOUT period		t <sub>CLCL</sub>		
02	80	2000					
03	50	∞					
04	62.5	∞					
05	80	∞					
06	100	∞					
CLKOUT low time	t <sub>CLCH</sub>	At 1.5 V C <sub>L</sub> = 100 pF See figure 4 <sup>7/</sup>	01	9, 10, 11	0.5t <sub>CLCL</sub> -8		ns
			02		0.5t <sub>CLCL</sub> -7		
			03-05		0.5t <sub>CLCL</sub> -5		
			06		0.5t <sub>CLCL</sub> -6		
CLKOUT high time	t <sub>CHCL</sub>		01	9, 10, 11	0.5t <sub>CLCL</sub> -8		ns
			02		0.5t <sub>CLCL</sub> -7		
			03-05		0.5t <sub>CLCL</sub> -5		
			06		0.5t <sub>CLCL</sub> -6		
CLKOUT rise time	t <sub>CH1CH2</sub>	1.0 V to 3.5 V See figure 4 <sup>7/</sup>	01, 02	9, 10, 11		10	ns
			03			8	
			04-06			10	
CLKOUT fall time	t <sub>CL2CL1</sub>	3.5 V to 1.0 V See figure 4 <sup>7/</sup>	01, 02	9, 10, 11		10	ns
			03			8	
			04-06			10	

See footnotes on next sheet.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET 14

TABLE I. Electrical performance characteristics - Continued.

1/  $V_{CC} = 5.0\text{ V} \pm 5\%$  for device types 01 and 02 and  $V_{CC} = 5.0\text{ V} \pm 10\%$  for device types 03 through 06.

All timings are measured at 1.5 V and 100 pF loading on CLKOUT unless specified. For device type 01, the outputs are measured with  $C_L = 50 - 200\text{ pF}$  (10 MHz). For device type 02,  $C_L = 50 - 100\text{ pF}$  (12.5 MHz). For device types 03 through 06, all outputs test conditions are with  $C_L = 50\text{ pF}$  unless noted. For ac tests, input  $V_{IL} = 0.45\text{ V}$  and  $V_{IH} = 2.4\text{ V}$  except at X1 where  $V_{IH} = V_{CC} - 0.5\text{ V}$ . See figure 4.

2/ Guaranteed if not tested to the limits specified.

3/ Power save current ( $I_{PS}$ ) at +25°C with  $V_{CC} = 5.0\text{ V}$  is typically 10 mA per MHz + 20 mA.

4/ Current is measured with the device in RESET with X1 and X2 driven and all other nonpower pins open.

5/ Pins being floated during HOLD or by invoking the ONCE mode.

6/ To guarantee recognition at next CLK.

7/ Voltages indicated refer to voltage measurements on waveforms on figure 4.

8/  $t_{CLK}$  and  $t_{CHK}$  (CLKIN low and high times) should not have a duration less than 45 percent of  $t_{CKIN}$ .

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET 15

Case Y

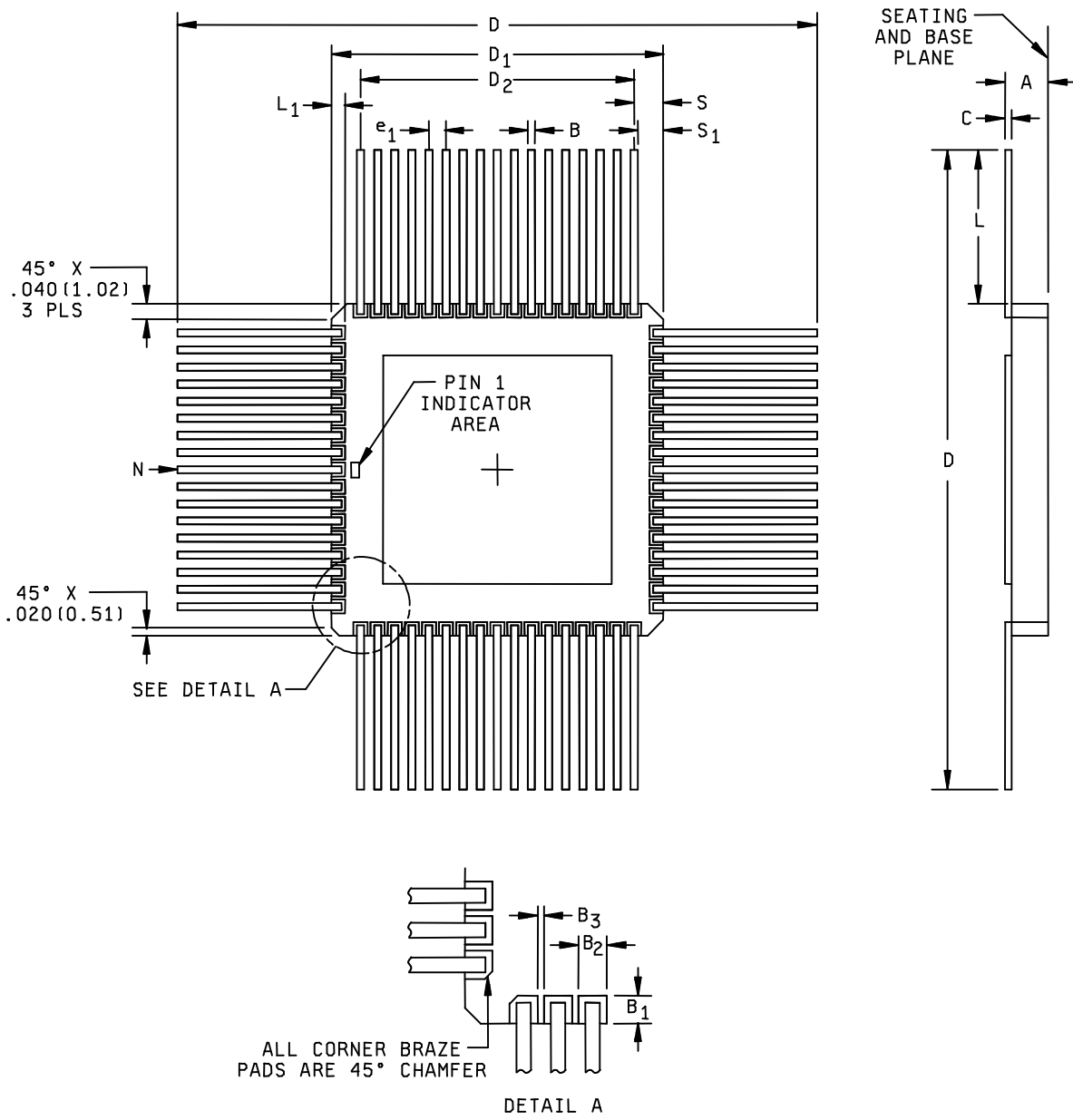


FIGURE 1. Case outline.

<p><b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000</p>	<p>SIZE <b>A</b></p>		<p><b>5962-88501</b></p>
		<p>REVISION LEVEL <b>F</b></p>	<p>SHEET <b>16</b></p>

Case Y				
Symbol	Inches		Millimeters	
	Min	Max	Min	Max
A	.080	.106	2.03	2.69
B	.016	.020	0.41	0.51
B <sub>1</sub>	.040	.060	1.02	1.52
B <sub>2</sub>	.030	.040	0.76	1.02
B <sub>3</sub>	.005	.020	0.13	0.51
C	.008	.012	0.20	0.31
D	1.640	1.870	41.66	47.50
D <sub>1</sub>	.935	.970	23.75	24.64
D <sub>2</sub>	.800 BSC		20.32 BSC	
e <sub>1</sub>	.050 BSC		1.27 BSC	
L	.375	.450	9.53	11.43
L <sub>1</sub>	.040	.060	1.02	1.52
N	68		68	
S	.066	.087	1.68	2.21
S <sub>1</sub>	.050		1.27	

FIGURE 1. Case outline - Continued.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>17</b>

Device type	All				
Case outline	Y				
Terminal number	Terminal symbol	Terminal number	Terminal symbol	Terminal number	Terminal symbol
1	V <sub>CC</sub>	24	$\overline{S2}$	47	$\overline{PCS5/A1}$
2	AD4	25	$\overline{S1}$	48	$\overline{PCS4}$
3	AD12	26	$\overline{S0}$	49	$\overline{PCS3}$
4	AD5	27	HLDA	50	$\overline{PCS2}$
5	AD13	28	HOLD	51	$\overline{PCS1}$
6	AD6	29	SRDY	52	V <sub>SS</sub>
7	AD14	30	$\overline{LOCK}$	53	$\overline{PCS0}$
8	AD7	31	$\overline{TEST}$	54	$\overline{RES}$
9	AD15	32	NMI	55	TMR OUT 1
10	A16/S3	33	INT0	56	TMR OUT 0
11	A17/S4	34	INT1	57	TMR IN 1
12	A18/S5	35	V <sub>CC</sub>	58	TMR IN 0
13	A19/S6	36	INT2/ $\overline{INTA0}$	59	DRQ1
14	$\overline{BHE/S7}$	37	INT3/ $\overline{INTA1}$	60	DRQ0
15	$\overline{WR/QS1}$	38	DT/ $\overline{R}$	61	AD0
16	$\overline{RD/QSMD}$	39	$\overline{DEN}$	62	AD8
17	ALE/QS0	40	$\overline{MCS0}$	63	AD1
18	V <sub>SS</sub>	41	$\overline{MCS1}$	64	AD9
19	X1	42	$\overline{MCS2}$	65	AD2
20	X2	43	$\overline{MCS3}$	66	AD10
21	RESET	44	$\overline{UCS}$	67	AD3
22	CLKOUT	45	$\overline{LCS}$	68	AD11
23	ARDY	46	$\overline{PCS6/A2}$		

FIGURE 2. Terminal connections.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>18</b>

Device type	All				
Case outline	Z				
Terminal number	Terminal symbol	Terminal number	Terminal symbol	Terminal number	Terminal symbol
A2	A16/S3	C11	SRDY	J10	$\overline{\text{MCS0}}$
A3	A18/S5	D1	AD13	J11	$\overline{\text{MCS1}}$
A4	$\overline{\text{BHE}}/S7$	D2	AD5	K1	AD0
A5	$\overline{\text{RD}}/\overline{\text{QSMD}}$	D10	$\overline{\text{LOCK}}$	K2	DRQ1
A6	V <sub>ss</sub>	D11	$\overline{\text{TEST}}$	K3	TMR IN 1
A7	X2	E1	AD12	K4	TMR OUT 1
A8	CLKOUT	E2	AD4	K5	$\overline{\text{PCS0}}$
A9	$\overline{\text{S2}}$	E10	NMI	K6	$\overline{\text{PCS1}}$
A10	$\overline{\text{S0}}$	E11	INT0	K7	$\overline{\text{PCS3}}$
B1	AD15	F1	V <sub>cc</sub>	K8	$\overline{\text{PCS5/A1}}$
B2	AD7	F2	AD11	K9	$\overline{\text{LCS}}$
B3	A17/S4	F10	INT1	K10	$\overline{\text{MCS2}}$
B4	A19/S6	F11	V <sub>cc</sub>	K11	$\overline{\text{MCS3}}$
B5	$\overline{\text{WR}}/QS1$	G1	AD3	L2	DRQ0
B6	ALE/QS0	G2	AD10	L3	TMR IN 0
B7	X1	G10	INT2/ $\overline{\text{INTA0}}$	L4	TMR OUT 0
B8	RESET	G11	INT3/ $\overline{\text{INTA1}}$	L5	$\overline{\text{RES}}$
B9	ARDY	H1	AD2	L6	V <sub>ss</sub>
B10	$\overline{\text{S1}}$	H2	AD9	L7	$\overline{\text{PCS2}}$
B11	HLDA	H10	DT/ $\overline{\text{R}}$	L8	$\overline{\text{PCS4}}$
C1	AD14	H11	$\overline{\text{DEN}}$	L9	$\overline{\text{PCS6/A2}}$
C2	AD6	J1	AD1	L10	$\overline{\text{UCS}}$
C10	HOLD	J2	AD8		

FIGURE 2. Terminal connections - Continued.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>19</b>

Device types 01 and 02

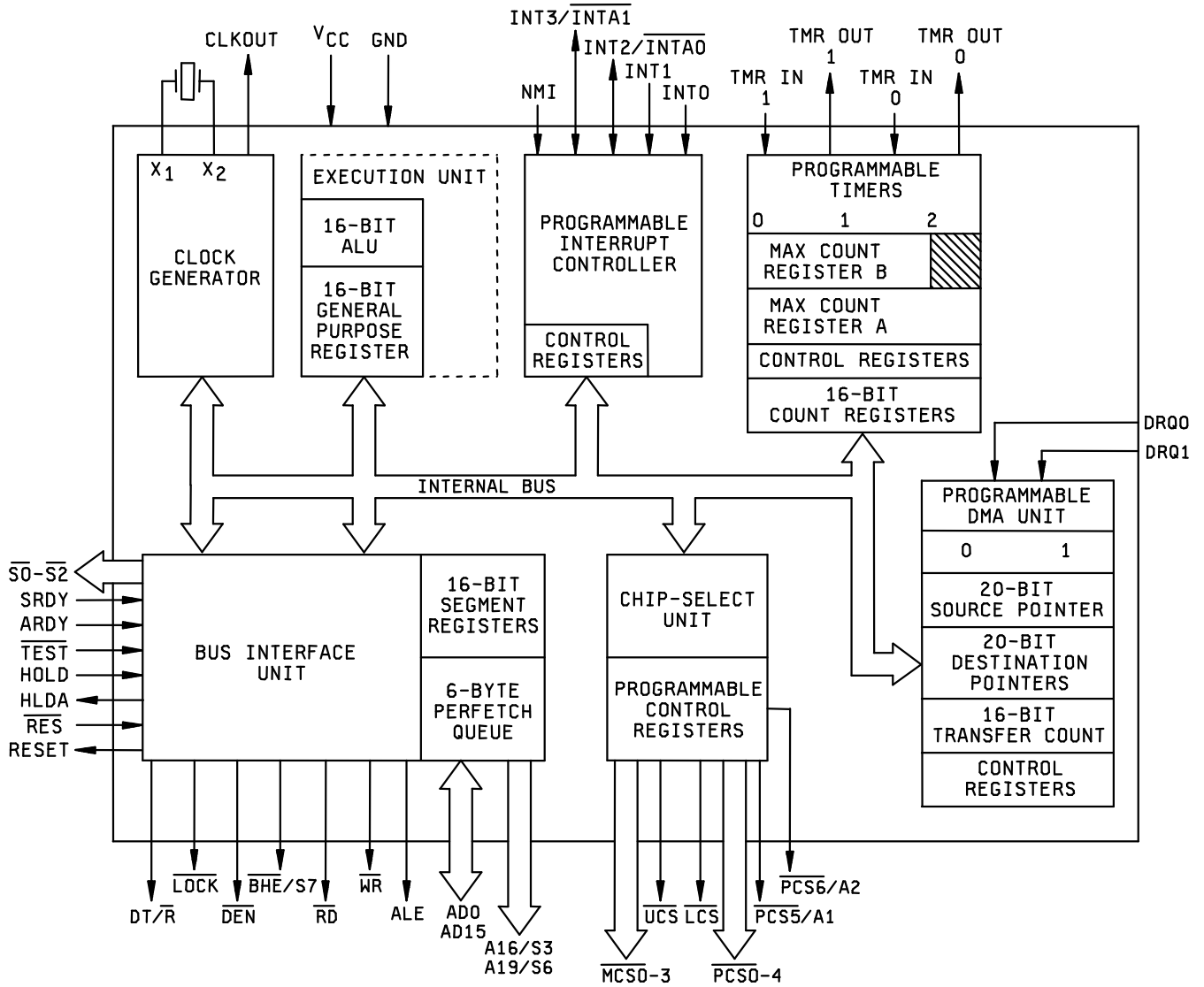


FIGURE 3. Functional block diagram.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET 20

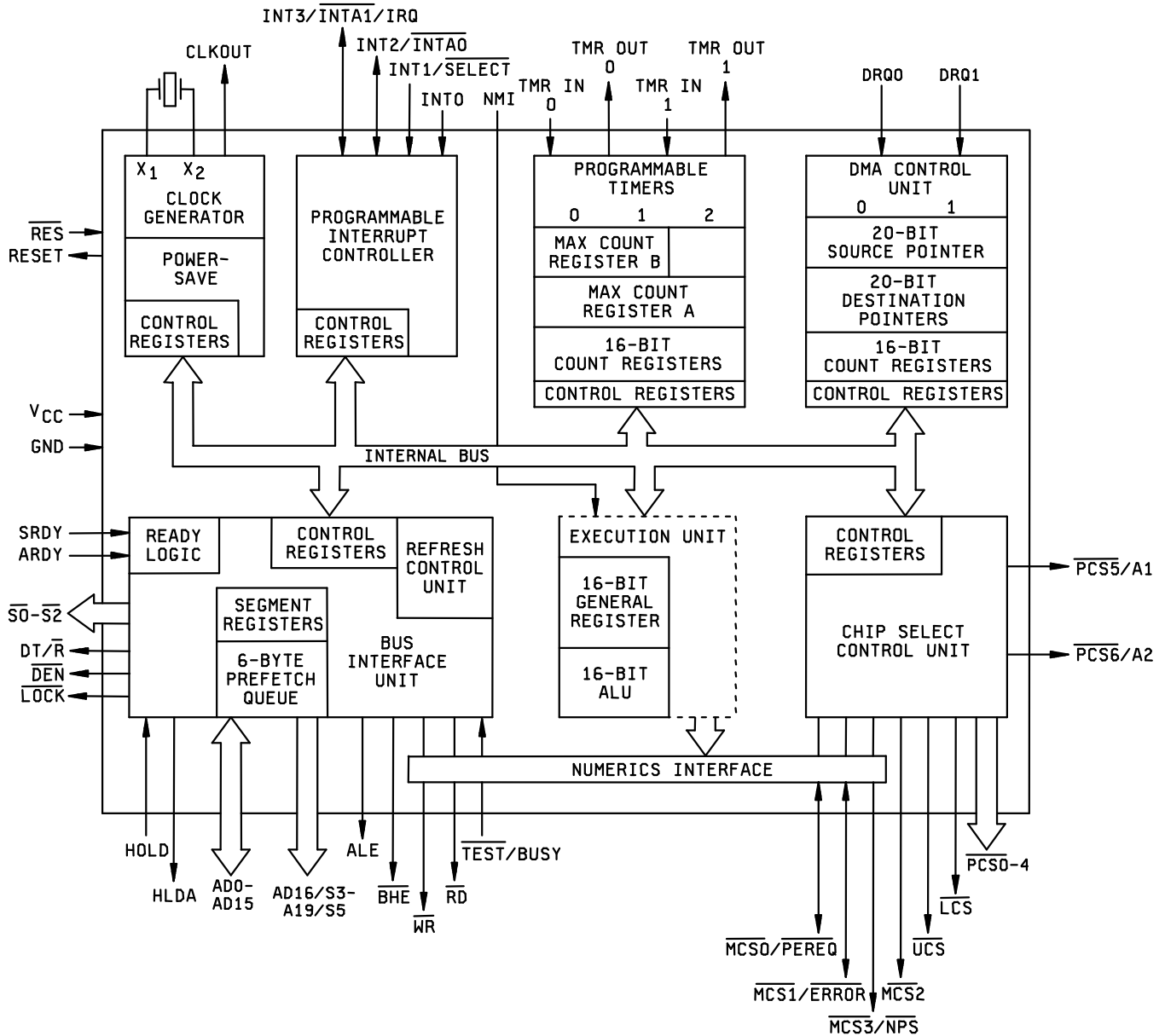
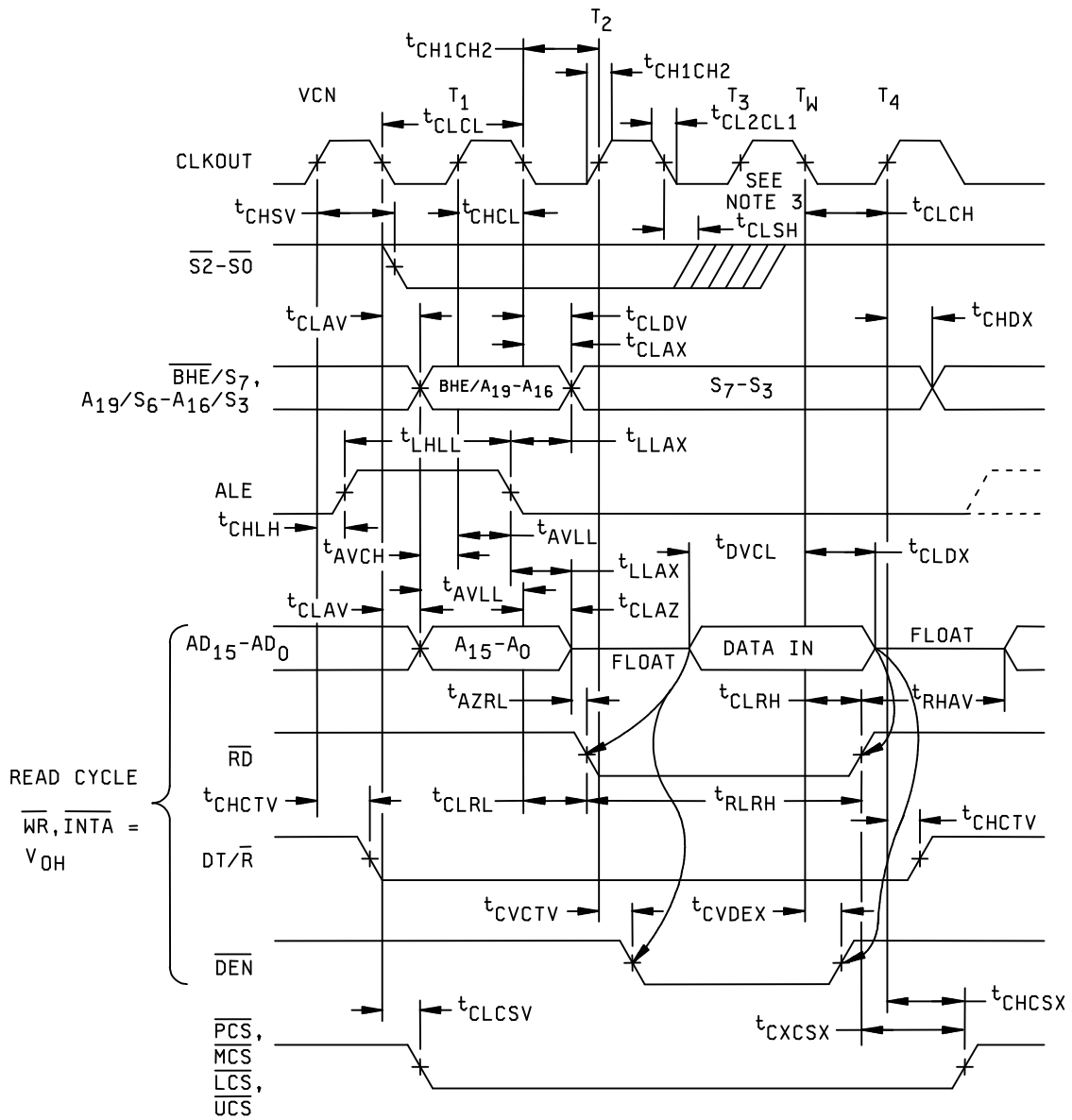


FIGURE 3. Functional block diagram - Continued.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET 21





NOTES:

1. Following a write cycle, the local bus is floated by the devices only when the devices enter a "hold acknowledge" state.
2.  $\overline{INTA}$  occurs one clock later in slave mode.
3. Status inactive just prior to  $T_4$ .
4. Latched A1 and A2 have the same timings as  $\overline{PCS5}$  and  $\overline{PCS6}$ .
5. For write cycle followed by read.

FIGURE 4. Timing waveforms – Continued.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>23</b>

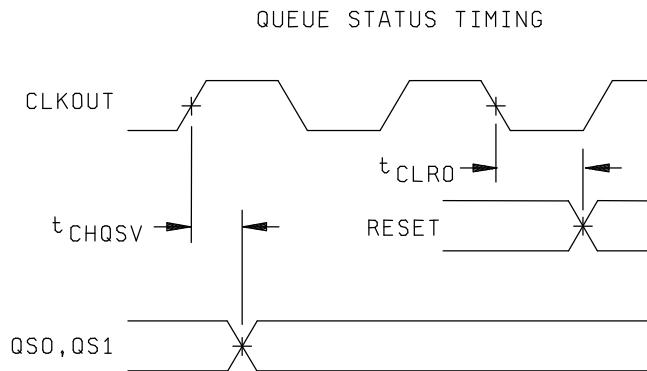
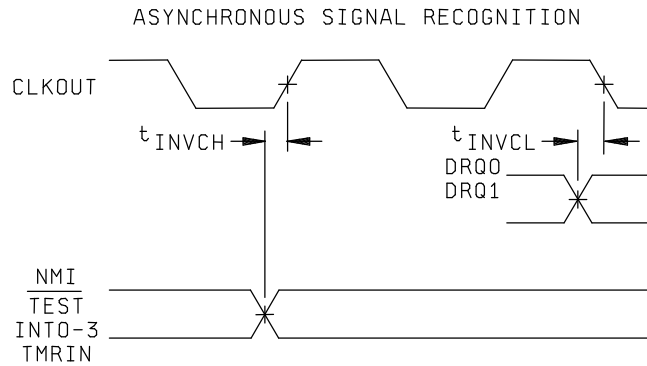
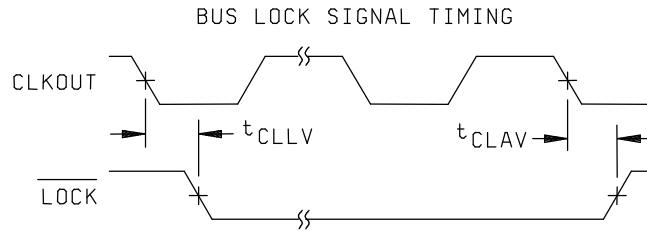


FIGURE 4. Timing waveforms – Continued.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET 24

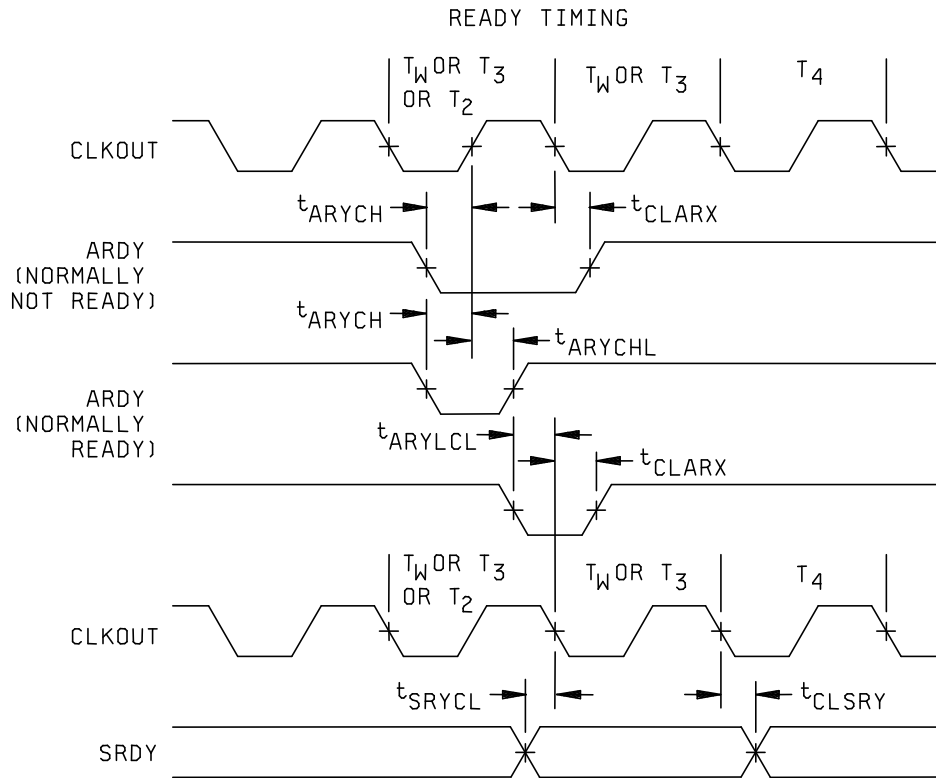


FIGURE 4. Timing waveforms – Continued.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET 25

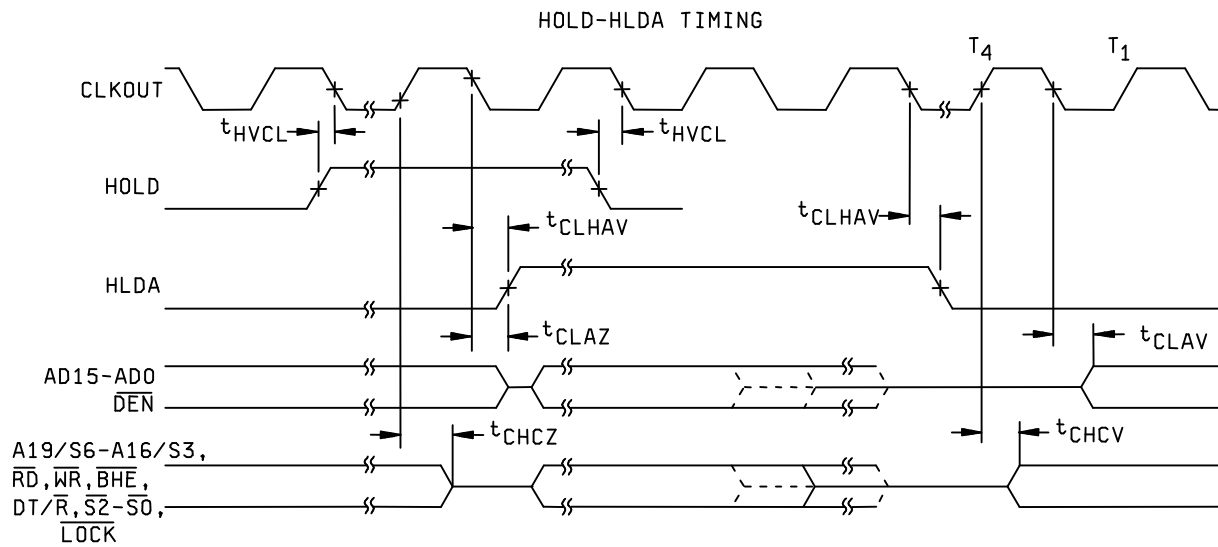
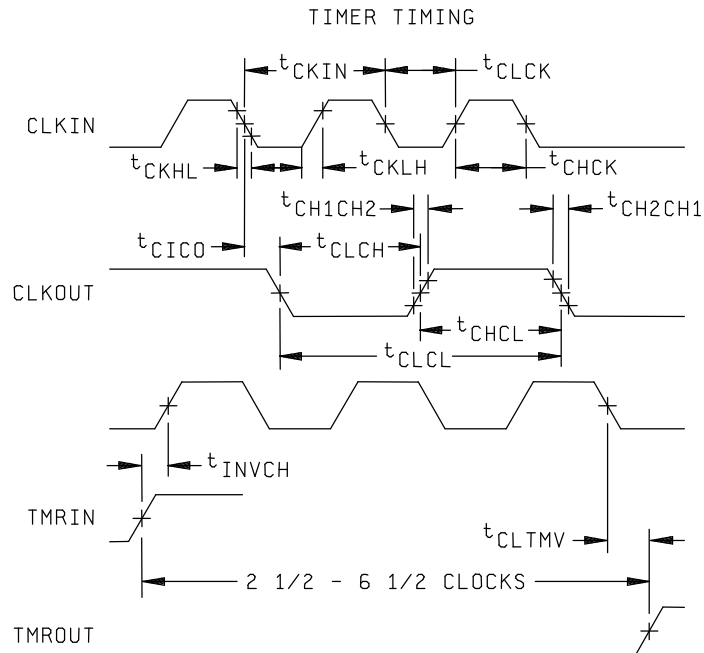


FIGURE 4. Timing waveforms – Continued.

**STANDARD  
MICROCIRCUIT DRAWING**  
DEFENSE SUPPLY CENTER COLUMBUS  
COLUMBUS, OHIO 43216-5000

SIZE  
**A**

**5962-88501**

REVISION LEVEL  
**F**

SHEET  
**26**

TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (in accordance with MIL-STD-883, method 5005, table I)
Interim electrical parameters (method 5004 or 5010)	---
Final electrical test parameters (method 5004 or 5010)	1*, 2, 3, 7, 8, 9, 10, 11
Group A test requirements (method 5005 or 5010)	1, 2, 3, 4, 7, 8, 9, 10, 11
Groups C and D end-point electrical parameters (method 5005 or 5010)	1, 2, 3 or 2, 8A, 10
Additional electrical subgroups for group C periodic inspections	---

\* PDA applies to subgroup 1.

4.3.1 Group A inspection.

- a. Tests shall be as specified in table II herein.
- b. Subgroups 5 and 6 in table I, method 5005 of MIL-STD-883 shall be omitted.
- c. Subgroup 4 ( $C_{IN}$  and  $C_{OUT}$  measurements) shall be measured only for the initial test and after process or design changes which may affect capacitance. A minimum sample size of 5 devices with zero rejects shall be required.
- d. Subgroups 7 and 8 shall include verification of the instruction set (see table III).

4.3.2 Groups C and D inspections.

- a. End-point electrical parameters shall be as specified in table II herein.
- b. Steady-state life test conditions, method 1005 of MIL-STD-883.
  - (1) Test condition D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1005 of MIL-STD-883.
  - (2)  $T_A = +125^{\circ}\text{C}$ , minimum.
  - (3) Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>27</b>

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-PRF-38535, appendix A.

6. NOTES

6.1 Intended use. Microcircuits conforming to this drawing are intended for use for Government microcircuit applications (original equipment), design applications, and logistics purposes.

6.2 Replaceability. Microcircuits covered by this drawing will replace the same generic device covered by a contractor-prepared specification or drawing.

6.3 Configuration control of SMD's. All proposed changes to existing SMD's will be coordinated with the users of record for the individual documents. This coordination will be accomplished using DD Form 1692, Engineering Change Proposal.

6.4 Record of users. Military and industrial users shall inform Defense Supply Center Columbus when a system application requires configuration control and the applicable SMD. DSCC will maintain a record of users and this list will be used for coordination and distribution of changes to the drawings. Users of drawings covering microelectronics devices (FSC 5962) should contact DSCC-VA, telephone (614) 692-0544.

6.5 Comments. Comments on this drawing should be directed to DSCC-VA, Columbus, Ohio 43216-5000, or telephone (614) 692-0547.

6.6 Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein are defined in MIL-PRF-38535, MIL-HDBK-1331, and table IV herein.

6.7 Approved sources of supply. Approved sources of supply are listed in MIL-HDBK-103. The vendors listed in MIL-HDBK-103 have agreed to this drawing and a certificate of compliance (see 3.6 herein) has been submitted to and accepted by DSCC-VA.

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>28</b>

TABLE III. Instruction set summary.

Function	Format			Clock cycles	Comments	
<b>DATA TRANSFER</b>						
<b>MOV = Move:</b>						
Register to register/memory	1 0 0 0 1 0 0 w	mod reg r/m		2/12		
Register/memory to register	1 0 0 0 1 0 1 w	mod reg r/m		2/9		
Immediate to register/memory	1 0 0 0 1 1 1 w	mod 0 0 0 r/m	data	data if w = 1	12-13	8/16-bit
Immediate to register	1 0 1 1 w reg	data	data if w = 1		3-4	8/16-bit
Memory to accumulator	1 0 1 0 0 0 0 w	addr-low	addr-high		8	
Accumulator to memory	1 0 1 0 0 0 1 w	addr-low	addr-high		9	
Register/memory to segment register	1 0 0 0 1 1 1 0	mod 0 reg r/m		2/9		
Segment register to register/memory	1 0 0 0 1 1 1 0	mod 0 reg r/m		2/11		
<b>PUSH = Push:</b>						
Memory	1 1 1 1 1 1 1 1	mode 1 1 0 r/m		16		
Register	0 1 0 1 0 reg			10		
Segment register	0 0 0 reg 1 0 1			9		
Immediate	0 1 1 0 1 0 s 0	data	data if s = 0		10	
<b>PUSHA = Push All</b>	0 1 1 0 0 0 0 0			36		
<b>POP = Pop:</b>						
Memory	1 0 0 0 1 1 1 1	mode 1 1 0 r/m		20		
Register	0 1 0 1 1 reg			10		
Segment register	0 0 0 reg 1 1 1	(reg ≠ 0)		8		
POPA = Pop All	0 1 1 0 0 0 0 0			51		
<b>XCHG = Exchange:</b>						
Register/memory with register	1 0 0 0 0 1 1 w	mode reg r/m		4/17		
Register with accumulator	1 0 0 1 0 reg			3		
<b>IN = Input from:</b>						
Fixed port	1 1 1 0 0 1 0 w	port		10		
Variable port	1 1 1 0 1 1 0 w			8		
<b>OUT = Output to:</b>						
Fixed port	1 1 1 0 0 1 1 w	port		9		
Variable port	1 1 1 0 1 1 1 w			7		

**STANDARD  
MICROCIRCUIT DRAWING**  
DEFENSE SUPPLY CENTER COLUMBUS  
COLUMBUS, OHIO 43216-5000

SIZE  
**A**

REVISION LEVEL  
**F**

**5962-88501**

SHEET  
**29**

TABLE III. Instruction set summary - Continued.

Function	Format	Clock cycles	Comments
<b>DATA TRANSFER – Continued</b>			
<b>XLAT</b> = Translate byte to AL	1 1 0 1 0 1 1 1	11	
<b>LEA</b> = Load EA to register	1 0 0 0 1 1 0 1    mod reg r/m	6	
<b>LDS</b> = Load pointer to DS	1 1 0 0 0 1 0 1    mod reg r/m	18	(mod ≠ 11)
<b>LES</b> = Load pointer to ES	1 1 0 0 0 1 0 0    mod reg r/m	18	(mod ≠ 11)
<b>LAHF</b> = Load AH with flags	1 0 0 1 1 1 1 1	2	
<b>SAHF</b> = Store AH into flags	1 0 0 1 1 1 1 0	3	
<b>PUSHF</b> = Push flags	1 0 0 1 1 1 0 0	9	
<b>POPF</b> = Pop flags	1 0 0 1 1 1 0 1	8	
<b>SEGMENT = Segment override:</b>			
<b>CS</b>	0 0 1 0 1 1 1 0	2	
<b>SS</b>	0 0 1 1 0 1 1 0	2	
<b>DS</b>	0 0 1 1 1 1 1 0	2	
<b>ES</b>	0 0 1 0 0 1 1 0	2	
<b>ARITHMETIC</b>			
<b>ADD = Add:</b>			
Reg/memory with register to either	0 0 0 0 0 d w    mod reg r/m	3/10	
Immediate to register/memory	1 0 0 0 0 s w    mod 0 0 0 r/m    data    data if sw = 01	4/16	
Immediate to accumulator	0 0 0 0 0 1 0 w    data    data if w = 1	3/4	8/16-bit
<b>ADC = Add with carry:</b>			
Reg/memory with register to either	0 0 0 1 0 0 d w    mod reg r/m	3/10	
Immediate to register/memory	1 0 0 0 0 s w    mod 0 1 0 r/m    data    data if sw = 01	4/16	
Immediate to accumulator	0 0 0 1 0 1 0 w    data    data if w = 1	3/4	8/16-bit
<b>INC = Increment:</b>			
Register/memory	1 1 1 1 1 1 1 w    mod 0 0 0 r/m	3/15	
Register	0 1 0 0 0 reg	3	

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET 30

TABLE III. Instruction set summary - Continued.

Function	Format	Clock cycles	Comments
<b>ARITHMETIC – Continued</b>			
<b>SUB = Subtract:</b>			
Reg/memory and register to either	0 0 1 0 1 0 d w    mod reg r/m	3/10	8/16-bit
Immediate from register/memory	1 0 0 0 0 0 s w    mod 1 0 1 r/m    data    data if sw = 01	4/16	
Immediate from accumulator	0 0 1 0 1 1 0 w    data    data if w = 1	3/4	
<b>SBB = Subtract with borrow:</b>			
Reg/memory and register to either	0 0 0 1 1 0 d w    mod reg r/m	3/10	8/16-bit
Immediate from register/memory	1 0 0 0 0 0 s w    mod 0 1 1 r/m    data    data if sw = 01	4/16	
Immediate from accumulator	0 0 0 1 1 1 0 w    data    data if w = 1	3/4	
<b>DEC = Decrement:</b>			
Register/memory	1 1 1 1 1 1 1 w    mod 0 0 1 r/m	3/15	3
Register	0 1 0 0 1 reg		
<b>CMP = Compare:</b>			
Register/memory with register	0 0 1 1 1 0 1 w    mod reg r/m	3/10	8/16-bit
Register with register/memory	0 0 1 1 1 0 0 w    mod reg r/m	3/10	
Immediate with register/memory	1 0 0 0 0 0 s w    mod 1 1 1 r/m    data    data if sw = 01	3/10	
Immediate with accumulator	0 0 1 1 1 1 0 w    data    data if w = 1	3/4	
<b>NEG = Change sign</b> register/memory	1 1 1 1 0 1 1 w    mod 0 1 1 r/m	3/10	
<b>AAA = ASCII adjust for add</b>	0 0 1 1 0 1 1 1	8	
<b>DAA = Decimal adjust for add</b>	0 0 1 0 0 1 1 1	4	
<b>AAS = ASCII adjust for subtract</b>	0 0 1 1 1 1 1 1	7	
<b>DAS = Decimal adjust for subtract</b>	0 0 1 0 1 1 1 1	4	
<b>MUL = Multiply (unsigned):</b>	1 1 1 1 0 1 1 w    mod 1 0 0 r/m		
Register-Byte		26-28	
Register-Word		35-37	
Memory-Byte		32-34	
Memory-Word		41-43	

**STANDARD  
MICROCIRCUIT DRAWING**  
DEFENSE SUPPLY CENTER COLUMBUS  
COLUMBUS, OHIO 43216-5000

SIZE  
**A**

REVISION LEVEL  
**F**

**5962-88501**

SHEET  
**31**

TABLE III. Instruction set summary - Continued.

Function	Format				Clock cycles	Comments
<b>ARITHMETIC – Continued</b>						
<b>IMUL</b> = Integer multiply (signed): Register-Byte Register-Word Memory-Byte Memory-Word	1 1 1 1 0 1 1 w		mod 1 0 1 r/m		25-28 34-37 31-34 40-43	
<b>IMUL</b> = Integer immediate multiply (signed):	0 1 1 0 1 0 s 1	mod reg r/m	data	data if s = 0	22-25/ 29-32	
<b>DIV</b> = Divide (unsigned): Register-Byte Register-Word Memory-Byte Memory-Word	1 1 1 1 0 1 1 w		mod 1 1 0 r/m		29 38 35 44	
<b>IDIV</b> = Integer divide (signed): Register-Byte Register-Word Memory-Byte Memory-Word	1 1 1 1 0 1 1 w		mod 1 1 1 r/m		44-52 53-61 50-58 59-67	
<b>AAM</b> = ASCII adjust for multiply	1 1 0 1 0 1 0 0	0 0 0 0 1 0 1 0		19		
<b>AAD</b> = ASCII adjust for divide	1 1 0 1 0 1 0 1	0 0 0 0 1 0 1 0		15		
<b>CBW</b> = Convert byte to word	1 0 0 1 1 0 0 0				2	
<b>CWD</b> = Convert word to double word	1 0 0 1 1 0 0 1				4	
<b>LOGIC</b>						
<b>Shift/Rotate instructions:</b>						
Register/memory by 1	1 1 0 1 0 0 0 w	mod TTT r/m			2/15	
Register/memory by CL	1 1 0 1 0 0 1 w	mod TTT r/m			5+n/17+n	
Register/memory by count	1 1 0 0 0 0 0 w	mod TTT r/m		count	5+n/17+n	
TTT instruction 0 0 0 ROL 0 0 1 ROR 0 1 0 RCL 0 1 1 RCR 1 0 0 SHL/SAL 1 0 1 SHR 1 1 1 SAR						

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET 32

TABLE III. Instruction set summary - Continued.

Function	Format	Clock cycles	Comments
<b>LOGIC – Continued</b>			
<b>AND = And:</b>			
Reg/memory and register to either	0 0 1 0 0 0 d w    mod reg r/m	3/10	8/16-bit
Immediate to register/memory	1 0 0 0 0 0 0 w    mod 1 0 0 r/m    data    data if w = 1	4/16	
Immediate to accumulator	0 0 1 0 0 1 0 w    data    data if w = 1	3/4	
<b>TEST = And function to flags, no result:</b>			
Register/memory and register	1 0 0 0 0 1 0 w    mod reg r/m	3/10	8/16-bit
Immediate data and register/memory	1 1 1 1 0 1 1 w    mod 0 0 0 r/m    data    data if w = 1	4/10	
Immediate data and accumulator	1 0 1 0 1 0 0 w    data    data if w = 1	3/4	
<b>OR = Or:</b>			
Reg/memory and register to either	0 0 0 0 1 0 d w    mod reg r/m	3/10	8/16-bit
Immediate to register/memory	1 0 0 0 0 0 0 w    mod 0 0 1 r/m    data    data if w = 1	4/16	
Immediate to accumulator	0 0 0 0 1 1 0 w    data    data if w = 1	3/4	
<b>XOR = Exclusive or:</b>			
Reg/memory and register to either	0 0 1 1 0 0 d w    mod reg r/m	3/10	8/16-bit
Immediate to register/memory	1 0 0 0 0 0 0 w    mod 1 1 0 r/m    data    data if w = 1	4/16	
Immediate to accumulator	0 0 1 1 0 1 0 w    data    data if w = 1	3/4	
<b>NOT = Invert register/memory</b>	1 1 1 1 0 1 1 w    mod 0 1 0 r/m	3/10	
<b>STRING MANIPULATION</b>			
<b>MOVS = Move byte/word</b>	1 0 1 0 0 1 0 w	14	
<b>CMPS = Compare byte/word</b>	1 0 1 0 0 1 1 w	22	
<b>SCAS = Scan byte/word</b>	1 0 1 0 1 1 1 w	15	
<b>LODS = Load byte/wd to ALAX</b>	1 0 1 0 1 1 0 w	12	
<b>STOS = Store byte/wd from ALA</b>	1 0 1 0 1 0 1 w	10	
<b>INS = Input byte/wd from DX port</b>	0 1 1 0 1 1 0 w	14	
<b>OUTS = Output byte/wd to DX port</b>	0 1 1 0 1 1 1 w	14	

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>33</b>

TABLE III. Instruction set summary - Continued.

Function	Format	Clock cycles	Comments
<b>STRING MANIPULATION –</b> Continued			
Repeated by count in CX			
<b>MOVS</b> = Move string	1 1 1 1 0 0 1 0   1 0 1 0 0 1 0 w	8+8n	
<b>CMPS</b> = Compare string	1 1 1 1 0 0 1 z   1 0 1 0 0 1 1 w	5+22n	
<b>SCAS</b> = Scan string	1 1 1 1 0 0 1 z   1 0 1 0 1 1 1 w	5+15n	
<b>LODS</b> = Load string	1 1 1 1 0 0 1 0   1 0 1 0 1 1 0 w	6+11n	
<b>STOS</b> = Store string	1 1 1 1 0 0 1 0   1 0 1 0 1 0 1 w	6+9n	
<b>INS</b> = Input string	1 1 1 1 0 0 1 0   0 1 1 0 1 1 0 w	8+8n	
<b>OUTS</b> = Output string	1 1 1 1 0 0 1 0   0 1 1 0 1 1 1 w	8+8n	
<b>CONTROL TRANSFER</b>			
<b>CALL = Call:</b>			
Direct within segment	1 1 1 0 1 0 0 0   disp-low   disp-high	15	
Register/memory indirect within segment	1 1 1 1 1 1 1 1   mod 0 1 0 r/m	13/19	
Direct intersegment	1 0 0 1 1 0 1 0   segment offset   segment selector	23	
Indirect intersegment	1 1 1 1 1 1 1 1   mod 0 1 1 r/m   (mod ≠ 11)	38	
<b>JMP = Unconditional jump:</b>			
Short/long	1 1 1 0 1 0 1 1   disp-low	14	
Direct within segment	1 1 1 0 1 0 0 1   disp-low   disp-high	14	
Register/memory indirect within segment	1 1 1 1 1 1 1 1   mod 1 0 0 r/m	11/17	
Direct intersegment	1 1 1 0 1 0 1 0   segment offset   segment selector	14	
Indirect intersegment	1 1 1 1 1 1 1 1   mod 1 0 1 r/m   (mod ≠ 11)	26	
<b>RET = Return from call:</b>			
Within segment	1 1 0 0 0 0 1 1	16	
Within seg adding immed to SP	1 1 0 0 0 0 1 0   data-low   data-high	18	
Intersegment	1 1 0 0 1 0 1 1	22	
Intersegment adding immediate to SP	1 1 0 0 1 0 1 0   data-low   data-high	25	

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET 34

TABLE III. Instruction set summary - Continued.

Function	Format			Clock cycles	Comments	
<b>CONTROL TRANSFER – Continued</b>						
<b>JE/JZ</b> = Jump on equal/zero	0 1 1 1 0 1 0 0	disp		4/13	JMP not taken/JMP taken	
<b>JL/JNGE</b> = Jump on less/not greater or equal	0 1 1 1 1 1 0 0	disp		4/13		
<b>JLE/JNG</b> = Jump on less or equal/not greater	0 1 1 1 1 1 1 0	disp		4/13		
<b>JB/JNAE</b> = Jump on below/not above or equal	0 1 1 1 0 0 1 0	disp		4/13		
<b>JBE/JNA</b> = Jump on below or equal/not above	0 1 1 1 0 1 1 0	disp		4/13		
<b>JP/JPE</b> = Jump on parity/parity even	0 1 1 1 1 0 1 0	disp		4/13		
<b>JO</b> = Jump on overflow	0 1 1 1 0 0 0 0	disp		4/13		
<b>JS</b> = Jump on sign	0 1 1 1 1 0 0 0	disp		4/13		
<b>JNE/JNZ</b> = Jump on not equal/ not zero	0 1 1 1 0 1 0 1	disp		4/13		
<b>JNL/JGE</b> = Jump on not less/greater or equal	0 1 1 1 1 1 0 1	disp		4/13		
<b>JNLE/JG</b> = Jump on not less or equal/greater	0 1 1 1 1 1 1 1	disp		4/13		
<b>JNB/JAE</b> = Jump on not below/above or equal	0 1 1 1 0 0 1 1	disp		4/13		
<b>JNBE/JA</b> = Jump on not below or equal/above	0 1 1 1 0 1 1 1	disp		4/13		
<b>JNP/JPO</b> = Jump on not par/par odd	0 1 1 1 1 0 1 1	disp		4/13		
<b>JNO</b> = Jump on not overflow	0 1 1 1 0 0 0 1	disp		4/13		
<b>JNS</b> = Jump on not sign	0 1 1 1 1 0 0 1	disp		4/13		
<b>JCXZ</b> = Jump on CX zero	1 1 1 0 0 0 1 1	disp		5/15		
<b>LOOP</b> = Loop CX times	1 1 1 0 0 0 1 0	disp		6/16		LOOP not taken/LOOP taken
<b>LOOPZ/LOOPE</b> = Loop while zero/equal	1 1 1 0 0 0 0 1	disp		6/16		
<b>LOOPNZ/LOOPNE</b> = Loop while not zero/equal	1 1 1 0 0 0 0 0	disp		6/16		
<b>ENTER</b> = Enter procedure	1 1 0 0 1 0 0 0	data-low	data-high	L		
L = 0				15		
L = 1				25		
L > 1				22+16(n-1)		
<b>LEAVE</b> = Leave procedure	1 1 0 0 1 0 0 1			8		
<b>INT = Interrupt:</b>						
Type specified	1 1 0 0 1 1 0 1	type			47	
Type 3	1 1 0 0 1 1 0 0			45	if INT. taken/if INT. not taken	
<b>INTO</b> = Interrupt on overflow	1 1 0 0 1 1 1 0			48/4		

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>35</b>

TABLE III. Instruction set summary - Continued.

Function	Format	Clock cycles	Comments
<b>CONTROL TRANSFER – Continued</b>			
<b>IRET</b> = Interrupt return	1 1 0 0 1 1 1 1	28	
<b>BOUND</b> = Detect value out of range	0 1 1 0 0 0 1 0 mod reg r/m	33-35	
<b>PROCESSOR CONTROL</b>			
<b>CLC</b> = Clear carry	1 1 1 1 1 0 0 0	2	
<b>CMC</b> = Complement carry	1 1 1 1 0 1 0 1	2	
<b>STC</b> = Set carry	1 1 1 1 1 0 0 1	2	
<b>CLD</b> = Clear direction	1 1 1 1 1 1 0 0	2	
<b>STD</b> = Set direction	1 1 1 1 1 1 0 1	2	
<b>CLI</b> = Clear interrupt	1 1 1 1 1 0 1 0	2	
<b>SLI</b> = Set interrupt	1 1 1 1 1 0 1 1	2	
<b>HLT</b> = Halt	1 1 1 1 0 1 0 0	2	
<b>WAIT</b> = Wait	1 0 0 1 1 0 1 1	6	if $\overline{\text{test}} = 0$
<b>LOCK</b> = Bus lock prefix	1 1 1 1 0 0 0 0	2	
<b>ESC</b> = Processor extension escape	1 1 0 1 1 T T T mod LLL r/m	6	
(TTT LLL are opcode to processor extension)			

NOTES:

The effective address (EA) of the memory operand is computed according to the mod and r/m fields:

if mod = 11 then r/m is treated as a REG field

if mod = 00 then DISP = 0\*, disp-low and disp-high are absent

if mod = 01 then DISP = disp-low sign-extended to 16-bits, disp-high is absent

if mod = 10 then DISP = disp-high: disp-low

if r/m = 000 then EA = (BX) + (SI) + DISP

if r/m = 001 then EA = (BX) + (DI) + DISP

if r/m = 010 then EA = (BP) + (SI) + DISP

if r/m = 011 then EA = (BP) + (DI) + DISP

if r/m = 100 then EA = (SI) + DISP

<b>STANDARD MICROCIRCUIT DRAWING</b> DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000	SIZE <b>A</b>		<b>5962-88501</b>
		REVISION LEVEL <b>F</b>	SHEET <b>36</b>

TABLE III. Instruction set summary - Continued.

if  $r/m = 101$  then  $EA = (DI) + DISP$

if  $r/m = 110$  then  $EA = (BP) + DISP^*$

if  $r/m = 111$  then  $EA = (BX) + DISP$

DISP follows 2<sup>nd</sup> byte of instruction (before data if required)

\* Except if  $mod = 00$  and  $r/m = 110$  then  $EA = disp-high: disp-low$ .

EA calculation time is 4 clock cycles for all modes, and is included in the execution times given whenever appropriate.

**Segment override prefix**

0	0	1	reg	1	1	0
---	---	---	-----	---	---	---

reg is assigned according to the following:

reg	Segment Register
00	ES
01	CS
10	SS
11	DS

REG is assigned according to the following table:

16-Bit (w = 1)	8-Bit (w = 0)
000 AX	000 AL
001 CX	001 CL
010 DX	010 DL
011 BX	011 BL
100 SP	100 AH
101 BP	101 CH
110 SI	110 DH
111 DI	111 BH

The physical addresses of all operands addressed by the BP register are computed using the SS segment register. The physical addresses of the destination operands of the string primitive operations (those addressed by the DI register) are computed using the ES segment, which may not be overridden.

<p align="center"><b>STANDARD MICROCIRCUIT DRAWING</b></p> <p>DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216-5000</p>	<p align="center">SIZE <b>A</b></p>		<p align="center"><b>5962-88501</b></p>
		<p align="center">REVISION LEVEL <b>F</b></p>	<p align="center">SHEET <b>37</b></p>

TABLE IV. Pin description.

Symbol	Name and Function
V <sub>CC</sub>	System power: +5 volt power supply.
V <sub>SS</sub>	System ground.
RESET	Reset output indicates that the device CPU is being reset, and can be used as a system reset. It is active HIGH, synchronized with the processor clock, and lasts an integer number of clock periods corresponding to the length of the $\overline{RES}$ signal. Reset goes inactive 2 clockout periods after $\overline{RES}$ goes inactive. When tied to the $\overline{TEST}$ /BUSY pin, Reset forces the devices into enhanced mode.
X1, X2	Crystal inputs, X1 and X2, provide an external connections for a fundamental mode or third overtone parallel resonant crystal for the internal oscillator. X1 can interface to an external clock instead of a crystal. In this case, minimize the capacitance on X2 or drive X2 with complemented X1. The input or oscillator frequency is internally divided by two to generate the clock signal (CLKOUT).
CLKOUT	Clock output provides the system with a 50 percent duty cycle waveform. All device pin timings are specified relative to CLKOUT. CLKOUT has sufficient MOS drive capabilities for the numeric processor extension.
$\overline{RES}$	System reset causes the device to immediately terminate its present activity, clear the internal logic, and enter a dormant state. This signal may be asynchronous to the device clock. The device begins fetching instructions approximately 61/2 clock cycles after $\overline{RES}$ is returned HIGH. For proper initialization, V <sub>CC</sub> must be within specifications and the clock signal must be stable for more than 4 clocks with $\overline{RES}$ held low. $\overline{RES}$ is internally synchronized. This input is provided with a Schmitt-trigger to facilitate power-on $\overline{RES}$ generation via an RC network. When $\overline{RES}$ occurs, the device will drive the status lines to an inactive level for one clock, and then float them.
$\overline{TEST}$ /BUSY	<p>The <math>\overline{TEST}</math> pin is sampled during and after reset to determine whether the device is to enter compatible or enhanced mode. Enhanced mode requires <math>\overline{TEST}</math> to be high on the rising edge of <math>\overline{RES}</math> and low four clocks later. Any other combination will place the device in compatible mode. A weak internal pullup insures a high state when the pin is not driven.</p> <p><math>\overline{TEST}</math>, in compatible mode, this pin is configured to operate as <math>\overline{TEST}</math>. This pin is examined by the WAIT instruction. If the <math>\overline{TEST}</math> input is high when WAIT execution begins, instruction execution will suspend. <math>\overline{TEST}</math> will be resampled every five clocks until it goes low, at which time execution will resume. If interrupts are enabled while the device is waiting for <math>\overline{TEST}</math>, interrupts will be serviced.</p> <p>BUSY, in enhanced mode, this pin is configured to operate as BUSY. The BUSY input is used to notify the device of numerics processor extension activity. Floating point instructions executing in the device sample the BUSY pin to determine when the numeric processor is ready to accept a new coninand. BUSY is active high.</p>
TMR IN 0, TMR IN 1	Timer inputs are used either as clock or control signals, depending upon the programmed timer mode. These inputs are active high (or low-to-high transitions are counted) and internally synchronized.
TMR OUT 0, TMR OUT 1	Timer outputs are used to provide single pulse or continuous waveform generation, depending upon the timer mode selected.
DRQ0, DRQ1	DMA request is driven high by an external device when it desires that a DMA (channel 0 or 1) perform a transfer. These signals are active high, level-triggered, and internally synchronized.

**STANDARD  
MICROCIRCUIT DRAWING**  
DEFENSE SUPPLY CENTER COLUMBUS  
COLUMBUS, OHIO 43216-5000

SIZE  
A

**5962-88501**

REVISION LEVEL  
F

SHEET  
38

TABLE IV. Pin description - Continued.

Symbol	Name and Function																		
NMI	Nonmaskable interrupt is an edge-triggered input which causes a type 2 interrupt. NMI is not maskable internally. A transition from a low to high initiates the interrupt at the next instruction boundary. NMI is latched internally. An NMI duration of one clock or more will guarantee service. This input is internally synchronized.																		
INT0, INT1, INT2/INTA0, INT3/INTA1	Maskable interrupt requests can be requested by activating one of these pins. When configured as inputs, these pins are active high. Interrupt requests are synchronized internally. INT2 and INT3 may be configured via software to provide active-low interrupt-acknowledge output signals. All interrupt inputs may be configured via software to be either edge- or level-triggered. To ensure recognition, all interrupt requests must remain active until the interrupt is acknowledged. When slave mode is selected, the function of these pins changes.																		
A19/S6, A18/S5, A17/S4, A16/S3	Address bus outputs (16-19) and bus cycle status (3-6) reflect the four most significant address bits during T <sub>1</sub> . These signals are active high. During T <sub>2</sub> , T <sub>3</sub> , T <sub>w</sub> , and T <sub>4</sub> , status information is available on these lines as encoded below: <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>Low</td> <td>High</td> </tr> <tr> <td>S6</td> <td>Processor cycle</td> <td>DMA cycle</td> </tr> </table> <p>S3, S4, and S5 are defined as LOW during T<sub>2</sub>-T<sub>4</sub>.</p>		Low	High	S6	Processor cycle	DMA cycle												
	Low	High																	
S6	Processor cycle	DMA cycle																	
AD <sub>15</sub> – AD <sub>0</sub>	Address/data bus (0-15) signals constitute the time multiplexed memory or I/O address (T <sub>1</sub> ) and data (T <sub>2</sub> , T <sub>3</sub> , T <sub>w</sub> , and T <sub>4</sub> ) bus. The bus is active high A <sub>0</sub> is analogous to $\overline{\text{BHE}}$ for the lower byte of the data bus, pins D <sub>7</sub> through D <sub>0</sub> . It is low during T <sub>1</sub> when a byte is to be transferred onto the lower portion of the bus in memory of I/O operations.																		
$\overline{\text{BHE}}$ /S7	The $\overline{\text{BHE}}$ (bus high enable) signal is analogous to A <sub>0</sub> in that it is used to enable data on to the most significant half of the data bus, pins D <sub>15</sub> -D <sub>8</sub> . $\overline{\text{BHE}}$ will be low during T <sub>1</sub> when the upper byte is transferred and will remain low through T <sub>3</sub> and T <sub>w</sub> . $\overline{\text{BHE}}$ does not need to be latched. $\overline{\text{BHE}}$ will float during hold or reset. In enhanced mode, $\overline{\text{BHE}}$ will also be used to signify DRAM refresh cycles. A refresh cycle is indicated by $\overline{\text{BHE}}$ and A <sub>0</sub> being high. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="3"><math>\overline{\text{BHE}}</math> and A<sub>0</sub> encodings</th> </tr> <tr> <th><math>\overline{\text{BHE}}</math> value</th> <th>A<sub>0</sub> value</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Word transfer</td> </tr> <tr> <td>0</td> <td>1</td> <td>Byte transfer on upper half of data bus (D<sub>15</sub>-D<sub>8</sub>)</td> </tr> <tr> <td>1</td> <td>0</td> <td>Byte transfer on lower half of data bus (D<sub>7</sub>-D<sub>0</sub>)</td> </tr> <tr> <td>1</td> <td>1</td> <td>Refresh</td> </tr> </tbody> </table>	$\overline{\text{BHE}}$ and A <sub>0</sub> encodings			$\overline{\text{BHE}}$ value	A <sub>0</sub> value	Function	0	0	Word transfer	0	1	Byte transfer on upper half of data bus (D <sub>15</sub> -D <sub>8</sub> )	1	0	Byte transfer on lower half of data bus (D <sub>7</sub> -D <sub>0</sub> )	1	1	Refresh
$\overline{\text{BHE}}$ and A <sub>0</sub> encodings																			
$\overline{\text{BHE}}$ value	A <sub>0</sub> value	Function																	
0	0	Word transfer																	
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1	0	Byte transfer on lower half of data bus (D <sub>7</sub> -D <sub>0</sub> )																	
1	1	Refresh																	
ALE/QS0	Address latch enable/queue status 0 is provided by the device to latch the address. ALE is active high. Addresses are guaranteed to be valid on the trailing edge of ALE. The ALE rising edge is generated off the rising edge of the CLKOUT immediately preceding T <sub>1</sub> of the associated bus cycle. The trailing edge is generated off the CLKOUT rising edge in T <sub>1</sub> . Note that ALE is never floated.																		

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**A**

**5962-88501**

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**F**

SHEET  
**39**

TABLE IV. Pin description - Continued.

Symbol	Name and Function															
$\overline{WR}/QS1$	<p>Write strobe/queue status 1 indicates that the data on the bus is to be written into a memory or an I/O device. <math>\overline{WR}</math> is active for <math>T_2</math>, <math>T_3</math>, and <math>T_w</math> of any write cycle. It is active low, and floats during "HOLD" or "Reset". It is driven high for one clock during reset, and then floated. When the device is in queue status mode, the ALE/QS0 and <math>\overline{WR}/QS1</math> pins provide information about processor instruction queue interaction.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>QS1</th> <th>QS0</th> <th>Queue operation</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>No queue operation</td> </tr> <tr> <td>0</td> <td>1</td> <td>First opcode byte fetched from the queue</td> </tr> <tr> <td>1</td> <td>1</td> <td>Subsequent byte fetched from the queue</td> </tr> <tr> <td>1</td> <td>0</td> <td>Empty the queue</td> </tr> </tbody> </table>	QS1	QS0	Queue operation	0	0	No queue operation	0	1	First opcode byte fetched from the queue	1	1	Subsequent byte fetched from the queue	1	0	Empty the queue
QS1	QS0	Queue operation														
0	0	No queue operation														
0	1	First opcode byte fetched from the queue														
1	1	Subsequent byte fetched from the queue														
1	0	Empty the queue														
$\overline{RD}/QSMD$	<p>Read strobe indicates that the device is performing a memory or I/O read cycle. <math>\overline{RD}</math> is active low for <math>T_2</math>, <math>T_3</math>, and <math>T_w</math> of any read cycle. It is guaranteed not to go low in <math>T_2</math> until after the address bus is floated. <math>\overline{RD}</math> is active low, and floats during "HOLD". <math>\overline{RD}</math> is driven high for one clock during reset, and then the output driver is floated. A weak internal pull-up mechanism on the <math>\overline{RD}</math> line holds it high when the line is not driven. During RESET the pin is sampled to determine whether the device should provide ALE, <math>\overline{WR}</math>, and <math>\overline{RD}</math>, or if the queue-status should be provided. <math>\overline{RD}</math> should be connected to GND to provide queue-status data.</p>															
ARDY	<p>Asynchronous ready informs the device that the addressed memory space or I/O device will complete a data transfer. The ARDY input pin will accept an asynchronous input, and is active high. Only the rising edge is internally synchronized by the device. This means that the falling edge of ARDY must be synchronized to the device clock. If connected to <math>V_{CC}</math>, no WAIT states are inserted. Asynchronous ready (ARDY) or synchronous ready (SRDY) must be active to terminate a bus cycle. If unused, this line should be tied LOW to yield control to the SRDY pin.</p>															
SRDY	<p>Synchronous ready must be synchronized externally to the device. The use of SRDY provides a relaxed system-timing specification on the ready input. This is accomplished by eliminating the one-half clock cycle which is required for internally resolving the signal level when using the ARDY input. This line is active high. If this line is connected to <math>V_{CC}</math>, no WAIT states are inserted. Asynchronous ready (ARDY) or synchronous ready (SRDY) must be active before a bus cycle is terminated. If unused, this line should be tied LOW to yield control to the ARDY pin.</p>															
$\overline{LOCK}$	<p><math>\overline{LOCK}</math> output indicates that other system bus masters are not to gain control of the system bus while <math>\overline{LOCK}</math> is active low. The <math>\overline{LOCK}</math> signal is requested by the <math>\overline{LOCK}</math> prefix instruction and is activated at the beginning of the first data cycle associated with the instruction following the <math>\overline{LOCK}</math> prefix. It remains active until the completion of the instruction following the <math>\overline{LOCK}</math> prefix. No prefetches will occur while <math>\overline{LOCK}</math> is asserted. <math>\overline{LOCK}</math> is active low and is driven high for one clock during RESET. <math>\overline{LOCK}</math> on devices 03-06 stay high during reset, while it is floated on the 01 and 02 devices.</p>															

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COLUMBUS, OHIO 43216-5000

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**A**

**5962-88501**

REVISION LEVEL  
**F**

SHEET  
**40**

TABLE IV. Pin description - Continued.

Symbol	Name and Function																																				
$\overline{S0}$ , $\overline{S1}$ , $\overline{S2}$	<p>Bus cycle status <math>\overline{S0}</math> - <math>\overline{S2}</math> are encoded to provide bus-transaction information.</p> <table border="1" data-bbox="418 283 1399 667"> <thead> <tr> <th><math>\overline{S2}</math></th> <th><math>\overline{S1}</math></th> <th><math>\overline{S0}</math></th> <th>Queue operation</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>Interrupt acknowledge</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>Read I/O</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>Write I/O</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>Halt</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>Instruction fetch</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>Read data from memory</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>Write data to memory</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>Passive (no bus cycle)</td></tr> </tbody> </table> <p>The status pins float during "HOLD/HLDA".  <math>\overline{S2}</math> may be used as a logical M/I <math>\overline{O}</math> indicator, and <math>\overline{S1}</math> as a DT/<math>\overline{R}</math> indicator.</p> <p>The status lines are driven high for one clock during reset, and then floated until a bus cycle begins.</p>	$\overline{S2}$	$\overline{S1}$	$\overline{S0}$	Queue operation	0	0	0	Interrupt acknowledge	0	0	1	Read I/O	0	1	0	Write I/O	0	1	1	Halt	1	0	0	Instruction fetch	1	0	1	Read data from memory	1	1	0	Write data to memory	1	1	1	Passive (no bus cycle)
$\overline{S2}$	$\overline{S1}$	$\overline{S0}$	Queue operation																																		
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1	0	1	Read data from memory																																		
1	1	0	Write data to memory																																		
1	1	1	Passive (no bus cycle)																																		
HOLD (input) HLDA (output)	<p>HOLD indicates that another bus master is requesting the local bus. The HOLD input is active high. HOLD may be asynchronous with respect to the device clock. The device will issue a HLDA (high) in response to a HOLD request at the end of <math>T_4</math> or <math>T_1</math>. Simultaneous with the issuance of HLDA the device will float the local bus and control lines. After HOLD is detected as being LOW, the device will lower HLDA. When the device needs to run another bus cycle, it will again drive the local bus and control lines.</p> <p>In enhanced mode, HLDA will go low when a DRAM refresh cycle is pending in the device and an external bus master has control of the bus. It will be up to the external master to relinquish the bus by lowering HOLD so that the device may execute the refresh cycle. Lowering HOLD for four clocks and returning high will insure only one refresh cycle to the external master. HLDA will immediately go active after the refresh cycle has taken place.</p>																																				
$\overline{UCS}$	<p>Upper memory chip select is an active LOW output whenever a memory reference is made to the defined upper portion (1K-256K block) of memory. This line is not floated during bus HOLD. The address range activating <math>\overline{UCS}</math> is software programmable.</p> <p><math>\overline{UCS}</math> and <math>\overline{LCS}</math> are sampled upon the rising edge of <math>\overline{RES}</math>. If both pins are held low, the device will enter ONCE mode. In ONCE mode all pins assume a high impedance state and remain so until a subsequent RESET. <math>\overline{UCS}</math> has weak internal pullup for normal operation.</p>																																				
$\overline{LCS}$	<p>Lower memory chip select is an active LOW whenever a memory reference is made to the defined lower portion (1K-256K block) of memory. This line is not floated during bus HOLD. The address range activating <math>\overline{LCS}</math> is software programmable.</p> <p><math>\overline{UCS}</math> and <math>\overline{LCS}</math> are sampled upon the rising edge of <math>\overline{RES}</math>. If both pins are held low, the device will enter ONCE mode. In ONCE mode all pins assume a high impedance state and remain so until a subsequent RESET. <math>\overline{UCS}</math> has weak internal pullup for normal operation.</p>																																				

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SIZE  
**A**

**5962-88501**

REVISION LEVEL  
**F**

SHEET  
**41**

TABLE IV. Pin description - Continued.

Symbol	Name and Function
$\overline{\text{MCS0}}/\overline{\text{PEREQ}}$ $\overline{\text{MCS1}}/\overline{\text{ERROR}}$ $\overline{\text{MCS2}}$ $\overline{\text{MCS3}}/\overline{\text{NPS}}$	<p>Mid-range memory chip select signals are active low when a memory reference is made to the defined mid-range portion of memory (8K-512K). These lines are not floated during bus HOLD. The address ranges activating <math>\overline{\text{MCS0}}</math>-3 are software programmable.</p> <p>In enhanced mode, <math>\overline{\text{MCS0}}</math> becomes a PEREQ input (processor extension request). When connected to the numerics processor extension, this input is used to signal the device when to make numeric data transfers to and from the NPX. <math>\overline{\text{MCS3}}</math> becomes NPS (numeric processor select) which may only be activated by communication to the numeric processor extension. <math>\overline{\text{MCS1}}</math> becomes <math>\overline{\text{ERROR}}</math> in enhanced mode and is used to signal numeric coprocessor errors.</p>
$\overline{\text{PCS0}}$ $\overline{\text{PCS1}}$ -4	<p>Peripheral chip select signals 0-4 are active low when a reference is made to the defined peripheral area (64K byte I/O space). These lines are not floated during bus HOLD. The address ranges activating <math>\overline{\text{PCS0}}</math>-4 are software programmable.</p>
$\overline{\text{PCS5}}/\text{A1}$	<p>Peripheral chip select 5 or latched A1 may be programmed to provide a sixth peripheral chip select, or to provide an internally latched A1 signal. The address range activating <math>\overline{\text{PCS5}}</math> is software programmable. When programmed to provide latched A1, rather than <math>\overline{\text{PCS5}}</math>, this pin will retain the previously latched value of A1 during a bus HOLD. A1 is active high.</p>
$\overline{\text{PCS6}}/\text{A2}$	<p>Peripheral chip select 6 or latched A2 may be programmed to provide a seventh peripheral chip select, or to provide an internally latched A2 signal. The address range activating <math>\overline{\text{PCS6}}</math> is software programmable. When programmed to provide latched A2, rather than <math>\overline{\text{PCS6}}</math>, this pin will retain the previously latched value of A2 during a bus HOLD. A2 is active HIGH.</p>
$\text{DT}/\overline{\text{R}}$	<p>Data transmit/receive controls the direction of data flow through the external data bus transceiver. When low, data is transferred to the device. When high, the device places write data on the data bus.</p>
$\overline{\text{DEN}}$	<p>Data enable is provided as a data bus transceiver output enable. <math>\overline{\text{DEN}}</math> is active low during each memory and I/O access. <math>\overline{\text{DEN}}</math> is high whenever <math>\text{DT}/\overline{\text{R}}</math> changes state.</p>

**STANDARD  
MICROCIRCUIT DRAWING**  
 DEFENSE SUPPLY CENTER COLUMBUS  
 COLUMBUS, OHIO 43216-5000

SIZE  
A

**5962-88501**

REVISION LEVEL  
F

SHEET  
42

STANDARD MICROCIRCUIT DRAWING BULLETIN

DATE: 01-12-03

Approved sources of supply for SMD 5962-88501 are listed below for immediate acquisition information only and shall be added to MIL-HDBK-103 and QML-38535 during the next revision. MIL-HDBK-103 and QML-38535 will be revised to include the addition or deletion of sources. The vendors listed below have agreed to this drawing and a certificate of compliance has been submitted to and accepted by DSCC-VA. This bulletin is superseded by the next dated revision of MIL-HDBK-103 and QML-38535.

Standard microcircuit drawing PIN <u>1</u> /	Vendor CAGE number	Vendor similar PIN <u>2</u> /
5962-8850101ZA	3V146	MG80C186-10/BZA
5962-8850101ZC	3V146	MG80C186-10/BZC
5962-8850101YA	3V146	MQ80C186-10/BYA
5962-8850101YC	3V146	MQ80C186-10/BYC
5962-8850102ZA	3V146	MG80C186-12/BZA
5962-8850102ZC	3V146	MG80C186-12/BZC
5962-8850102YA	3V146	MQ80C186-12/BYA
5962-8850102YC	3V146	MQ80C186-12/BYC
5962-8850103ZA	<u>3</u> /	MG80C186XL-20/B
5962-8850104ZA	<u>3</u> /	MG80C186XL-16/B
5962-8850105ZA	<u>3</u> /	MG80C186XL-12/B
5962-8850106ZA	<u>3</u> /	MG80C186XL-10/B

- 1/ The lead finish shown for each PIN representing a hermetic package is the most readily available from the manufacturer listed for that part. If the desired lead finish is not listed contact the vendor to determine its availability.
- 2/ Caution. Do not use this number for item acquisition. Items acquired to this number may not satisfy the performance requirements of this drawing.
- 3/ No longer available from an approved source of supply.

Vendor CAGE  
number

63V146

Vendor name  
and address

Rochester Electronics Inc.  
10 Malcolm Hoyt Drive  
Newburyport, MA 01950

The information contained herein is disseminated for convenience only and the Government assumes no liability whatsoever for any inaccuracies in the information bulletin.