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
G	Update boilerplate to current MIL-PRF-38535 requirements. - CFS	07-06-26	Thomas M. Hess
H	Update boilerplate to current MIL-PRF-38535 requirements. - PHN	12-04-16	Thomas M. Hess

REV	H	H	H	H	H	H	H													
SHEET	35	36	37	38	39	40	41													
REV	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
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	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14		

PMIC N/A

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DRAWING APPROVAL DATE
89-02-16

REVISION LEVEL
H

DLA LAND AND MARITIME
COLUMBUS, OHIO 43218-3990
http://www.landandmaritime.dla.mil

STANDARD MICROCIRCUIT DRAWING

THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE

AMSC N/A

MICROCIRCUIT, DIGITAL, CMOS, 16-BIT MICROPROCESSOR, MONOLITHIC SILICON

SIZE	CAGE CODE	
A	**67268**	**5962-88501**

SHEET 1 OF 41

1. SCOPE

1.1 Scope. This drawing documents two product assurance class levels consisting of high reliability (device classes Q and M) and space application (device class V). A choice of case outlines and lead finishes are available and are reflected in the Part or Identifying Number (PIN). When available, a choice of Radiation Hardness Assurance (RHA) levels is reflected in the PIN.

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

5962-88501	01	Y	X
Drawing number	Device type (see 1.2.2)	Case outline (see 1.2.4)	Lead finish (see 1.2.5)

1.2.1 RHA designator. Device classes Q and V RHA marked devices meet the MIL-PRF-38535 specified RHA levels and are marked with the appropriate RHA designator. Device class M RHA marked devices meet the MIL-PRF-38535, appendix A specified RHA levels and are marked with the appropriate RHA designator. A dash (-) indicates a non-RHA device.

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

Device type	Generic number	Frequency	Circuit function
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

1.2.3 Device class designator. The device class designator is a single letter identifying the product assurance level as follows:

Device class	Device requirements documentation
M	Vendor self-certification to the requirements for MIL-STD-883 compliant, non-JAN class level B microcircuits in accordance with MIL-PRF-38535, appendix A
Q or V	Certification and qualification to MIL-PRF-38535

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

Outline letter	Descriptive designator	Terminals	Package style
Y	See figure 1	68	Ceramic quad flatpack
Z	CMGA3-P68	68	Pin grid array

1.2.5 Lead finish. The lead finish is as specified in MIL-PRF-38535 for device classes Q and V or MIL-PRF-38535, appendix A for device class M.

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_D)	1 W
Storage temperature range	-65°C to +150°C
Thermal resistance, junction-to-case (θ_{JC}):	
Case Y	13°C/W
Case Z	See MIL-STD-1835
Junction temperature (T_J)	+150°C
Lead temperature (soldering, 5 seconds)	+260°C

1.4 Recommended operating conditions.

Supply voltage range (V_{CC}):	
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_C)	-55°C to +125°C

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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATION

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

DEPARTMENT OF DEFENSE STANDARDS

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

DEPARTMENT OF DEFENSE HANDBOOKS

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

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or http://assist.daps.dla.mil or 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 for device classes Q and V shall be in accordance with MIL-PRF-38535 as specified herein, or as modified in the device manufacturer's Quality Management (QM) plan. The modification in the QM plan shall not affect the form, fit, or function as described herein. The individual item requirements for device class M shall be in accordance with MIL-PRF-38535, appendix A for non-JAN class level B devices and as specified herein.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-PRF-38535 and herein for device classes Q and V or MIL-PRF-38535, appendix A and herein for device class M.

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.

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. The part shall be marked with the PIN listed in 1.2 herein. In addition, the manufacturer's PIN may also be marked. 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. For RHA product using this option, the RHA designator shall still be marked. Marking for device classes Q and V shall be in accordance with MIL-PRF-38535. Marking for device class M shall be in accordance with MIL-PRF-38535, appendix A.

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 DLA Land and Maritime -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 DLA Land and Maritime -VA shall be required for any change that affects this drawing.

3.9 Verification and review. DLA Land and Maritime, DLA Land and Maritime '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.

TABLE I. Electrical performance characteristics.

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

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

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

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$ unless otherwise specified	Device type	Group A subgroups	Limits		Unit
					Min	Max	
INT_X, NMI, $\overline{TEST}$, TMRIN set-up time 6/	t_{INVCH}	See figure 4	01, 02	9, 10, 11	20		ns
			03		10		
			04-06		15		
DRQ0, DRQ1 set-up time 6/	t_{INVCL}		01, 02	9, 10, 11	20		ns
			03		10		
			04-06		15		
Address valid delay	t_{CLAV}		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_{CLAX}		01, 02	9, 10, 11	0		ns
			03-06		0 2/		
Address float delay	t_{CLAZ}		01	9, 10, 11	t_{CLAX}	30	ns
			02		t_{CLAX}	25	
			03-04		t_{CLAX}	20	
			05		t_{CLAX}	25	
			06		t_{CLAX}	30	
Command lines float delay	t_{CHCZ}		01	9, 10, 11		40	ns
			02			33	
			03			25	
			04			28	
			05			33	
			06			40	
Command lines valid delay (after float)	t_{CHCV}		01	9, 10, 11		45	ns
			02			37	
			03			26	
			04			32	
			05			36	
			06			44	

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

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

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$ unless otherwise specified	Device type	Group A subgroups	Limits		Unit
					Min	Max	
$\overline{WR}$ inactive to $\overline{DEN}$ inactive	t_{WHDEX}	See figure 4	01, 02	9, 10, 11	t_{CLCH}-10		ns
		Equal loading See figure 4	03-06		t_{CLCH}-10		
$\overline{WR}$ inactive to ALE high	t_{WHLH}	See figure 4	01, 02	9, 10, 11	t_{CLCH}-14		ns
		Equal loading See figure 4	03-06		t_{CLCH}-14		
Control active delay 1	t_{CVCTV}	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_{CHCTV}		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_{CVCTX}		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_{CVDEX}		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.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$ unless otherwise specified	Device type	Group A subgroups	Limits		Unit
					Min	Max	
Address float to $\overline{RD}$ active 2/	t_{AZRL}	See figure 4	All	9, 10, 11	0		ns
$\overline{RD}$ active delay	t_{CLRL}		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_{CLRH}		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_{RHLH}	See figure 4	01, 02	9, 10, 11	t_{CLCH}-14		ns
		Equal loading See figure 4	03-06		t_{CLCH}-14		
$\overline{RD}$ inactive to address active (min)	t_{RHAV}	See figure 4	01	9, 10, 11	t_{CLCL}-40		ns
			02		t_{CLCL}-20		
		Equal loading See figure 4	03-06		t_{CLCL}-15		
HLDA valid delay	t_{CLHAV}	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_{RLRH}		01	9, 10, 11	$2t_{CLCL}$-46		ns
			02		$2t_{CLCL}$-40		
			03		$2t_{CLCL}$-20		
			04-05		$2t_{CLCL}$-25		
			06		$2t_{CLCL}$-30		

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$ unless otherwise specified	Device type	Group A subgroups	Limits		Unit
					Min	Max	
$\overline{WR}$ pulse width (min)	t_{WLWH}	See figure 4	01	9, 10, 11	$2t_{CLCL}$-34		ns
			02		$2t_{CLCL}$-30		
			03		$2t_{CLCL}$-20		
			04-05		$2t_{CLCL}$-25		
			06		$2t_{CLCL}$-30		
Address valid to ALE low (min)	t_{AVLL}	See figure 4	01	9, 10, 11	t_{CLCH}-19		ns
			02		t_{CLCH}-15		
		Equal loading See figure 4	03		t_{CLCH}-10		
			04-05		t_{CLCH}-15		
			06		t_{CLCH}-18		
Status active delay	t_{CHSV}	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_{CLSH}		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_{CLTMV}	C_L = 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.

TABLE I. Electrical performance characteristics - Continued.

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

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$ unless otherwise specified	Device type	Group A subgroups	Limits		Unit
					Min	Max	
Chip-select hold from command inactive	t_{CXCSX}	See figure 4	01, 02	9, 10, 11	t_{CLCH}-10		ns
		Equal loading See figure 4	03-06		t_{CLCH}-10		
Chip-select inactive delay	t_{CHCSX}	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_{CKIN}		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_{RVCH}		01, 02	9, 10, 11	25		ns
Chip select valid to ALE low	t_{CSVLL}		01, 02	9, 10, 11	t_{CLCH}-14		ns
CLKIN fall time 2/	t_{CKHL}	3.5 V to 1.0 V See figure 4 7/	All	9, 10, 11		5	ns
CLKIN rise time 2/	t_{CKLH}	1.0 V to 3.5 V See figure 4 7/	All	9, 10, 11		5	ns
CLKIN low time	t_{CLCK}	At 1.5 V See figure 4 7/ 8/	01	9, 10, 11	23		ns
			02		18		
			03		10	∞	
			04		13	∞	
			05		16	∞	
			06		20	∞	

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

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

See footnotes on next sheet.

TABLE I. Electrical performance characteristics - Continued.

1/ V_{CC} = 5.0 V ±5% for device types 01 and 02 and V_{CC} = 5.0 V ±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 pF (10 MHz). For device type 02, C_L = 50 - 100 pF (12.5 MHz). For device types 03 through 06, all outputs test conditions are with C_L = 50 pF unless noted. For ac tests, input V_{IL} = 0.45 V and V_{IH} = 2.4 V except at X1 where $V_{IH} = V_{CC} – 0.5$ 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 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.

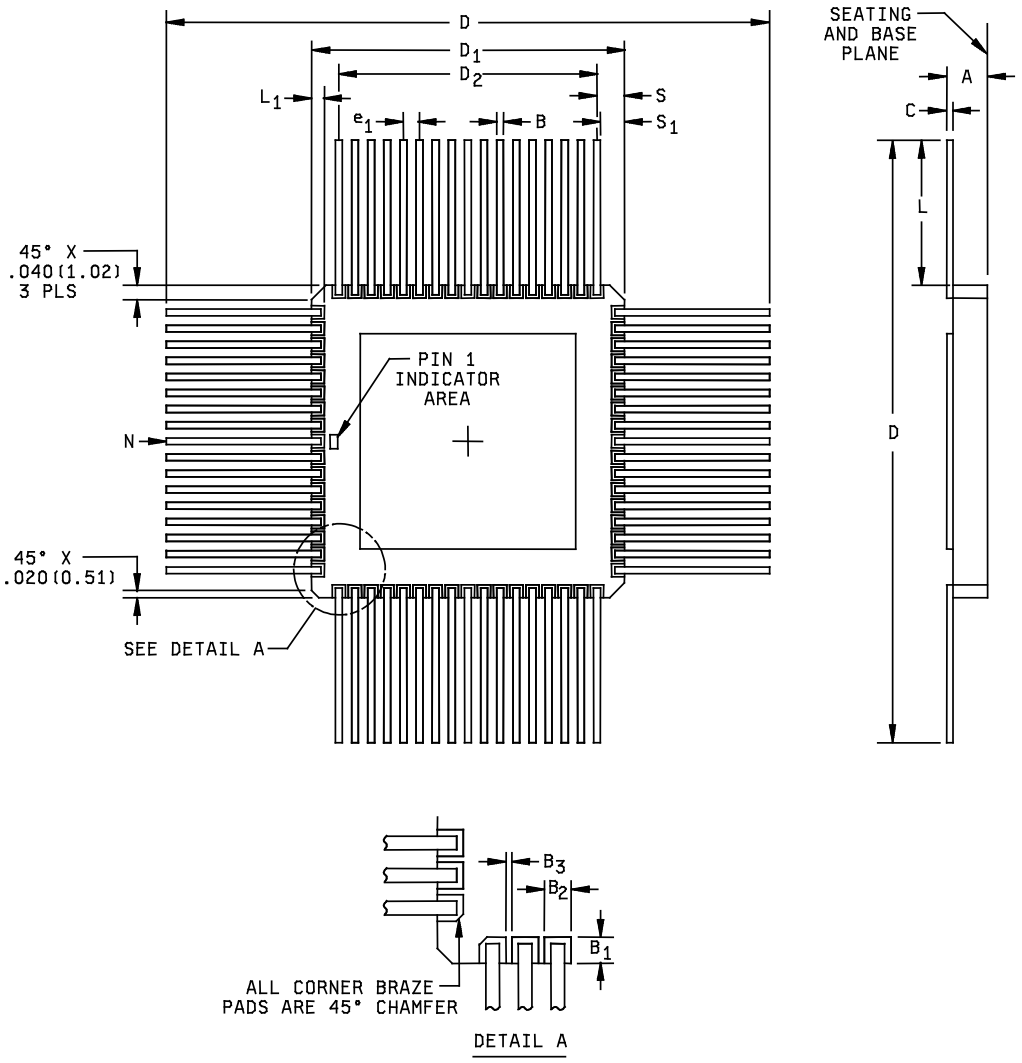
5/ Pins being floated during HOLD or by invoking the ONCE mode.

6/ To guarantee recognition at next CLK.

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

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

Case Y



Dimensions									
Symbol	Inches		Millimeters		Symbol	Inches		Millimeters	
	Min	Max	Min	Max		Min	Max	Min	Max
A	.080	.106	2.03	2.69	D_2	.800 BSC		20.32 BSC	
B	.016	.020	0.41	0.51	e_1	.050 BSC		1.27 BSC	
B_1	.040	.060	1.02	1.52	L	.375	.450	9.53	11.43
B_2	.030	.040	0.76	1.02	L_1	.040	.060	1.02	1.52
B_3	.005	.020	0.13	0.51	N	68		68	
C	.008	.012	0.20	0.31	S	.066	.087	1.68	2.21
D	1.640	1.870	41.66	47.50	S_1	.050		1.27	
D_1	.935	.970	23.75	24.64					

FIGURE 1. Case outlines.

Device type	All				
Case outline	Y				
Terminal number	Terminal symbol	Terminal number	Terminal symbol	Terminal number	Terminal symbol
1	V_{CC}	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_{SS}
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_{CC}	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	$\overline{RD}$ / $\overline{QSMD}$	39	$\overline{DEN}$	62	AD8
17	ALE/QS0	40	$\overline{MCS0}$	63	AD1
18	V_{SS}	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.

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_{SS}	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_{CC}	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_{CC}	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_{SS}
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.

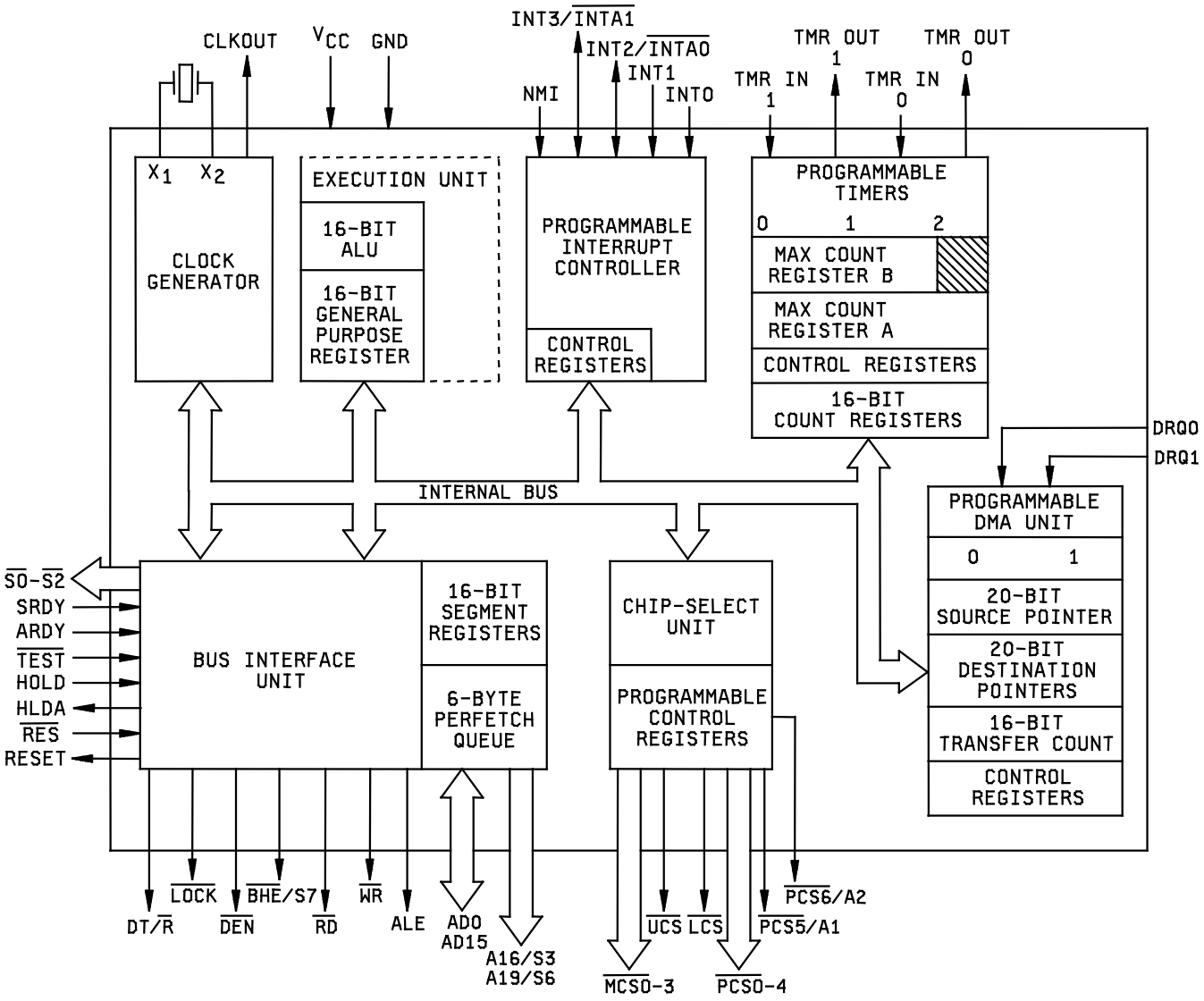


FIGURE 3. Functional block diagram.

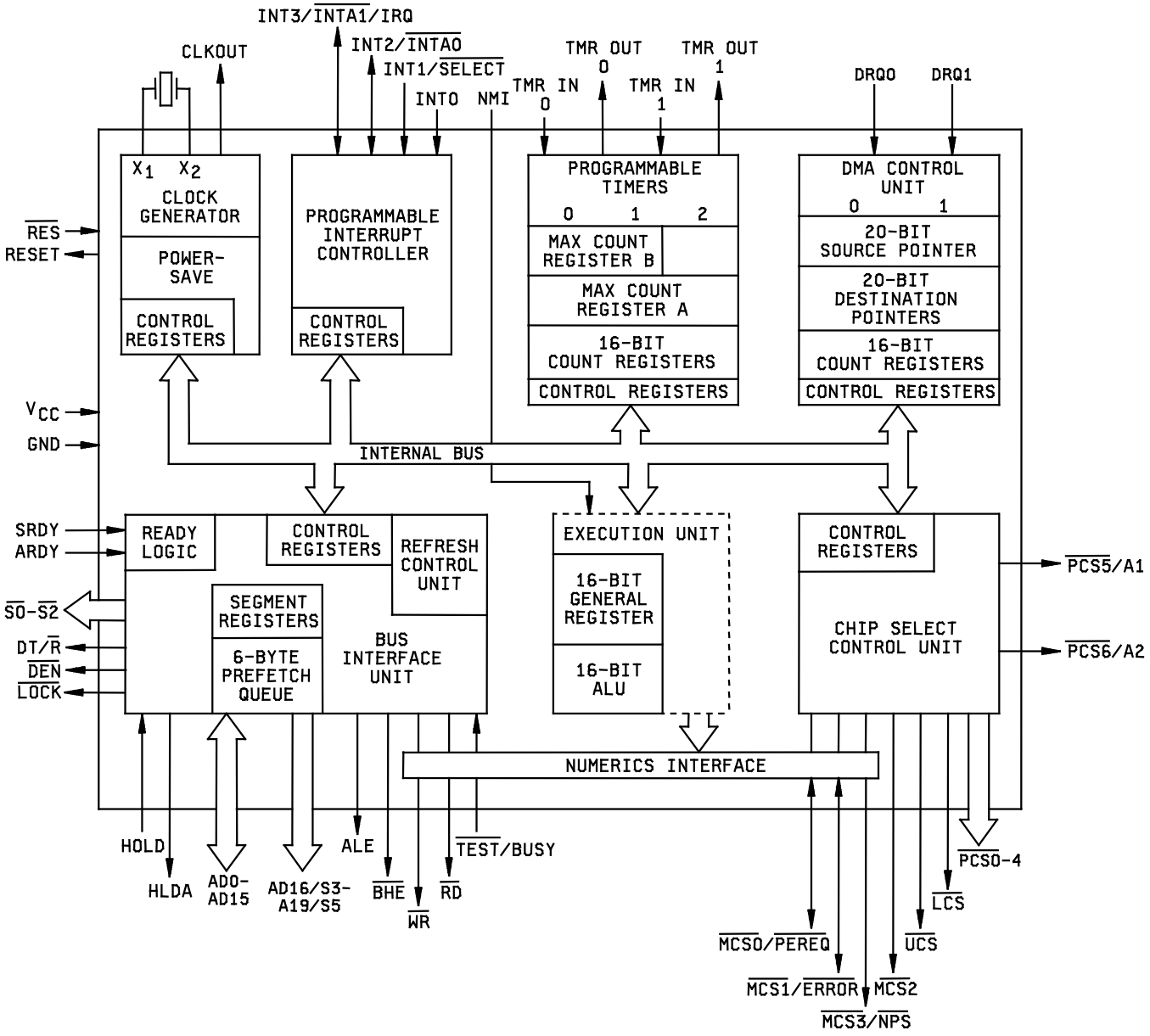


FIGURE 3. Functional block diagram - Continued.

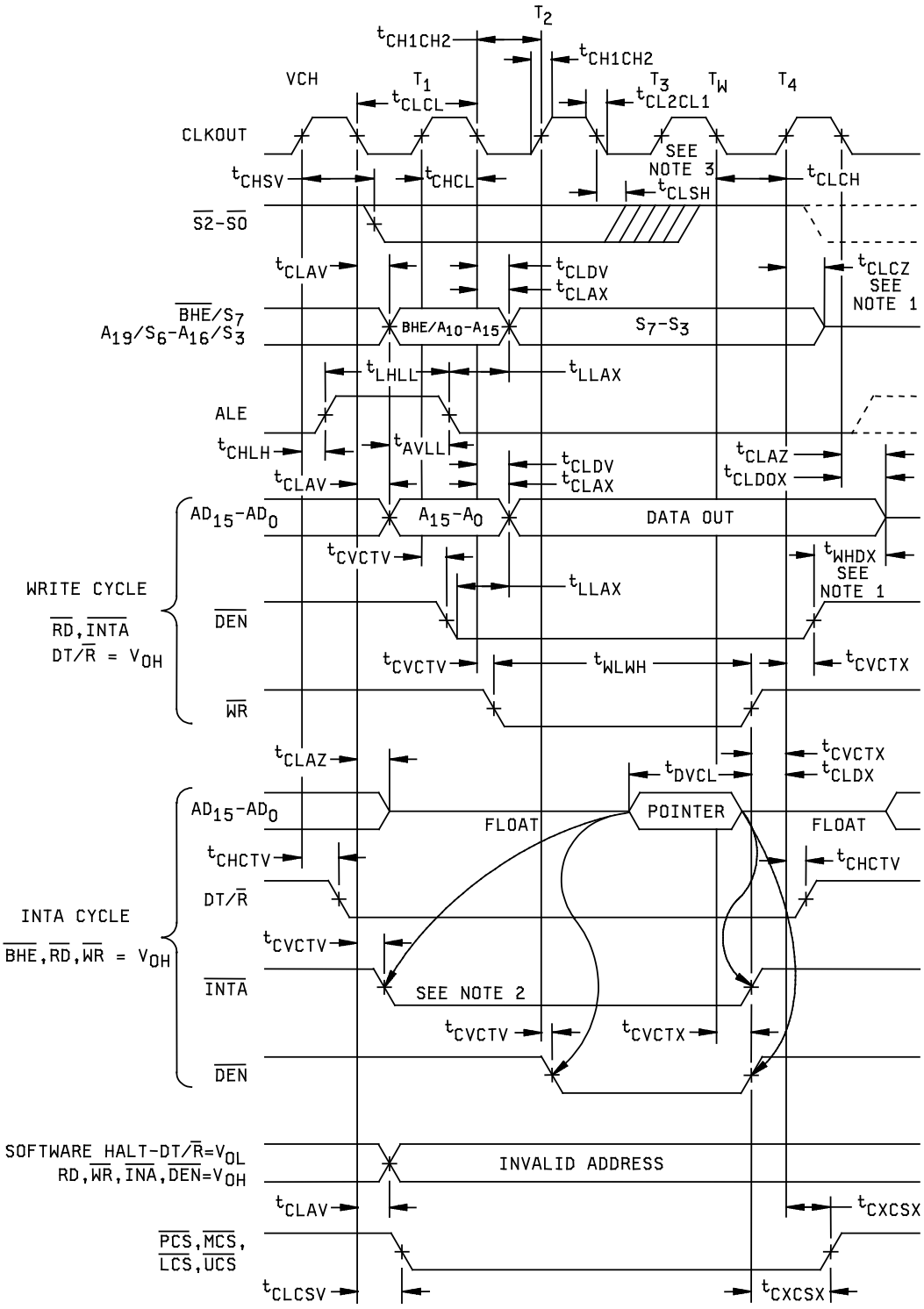
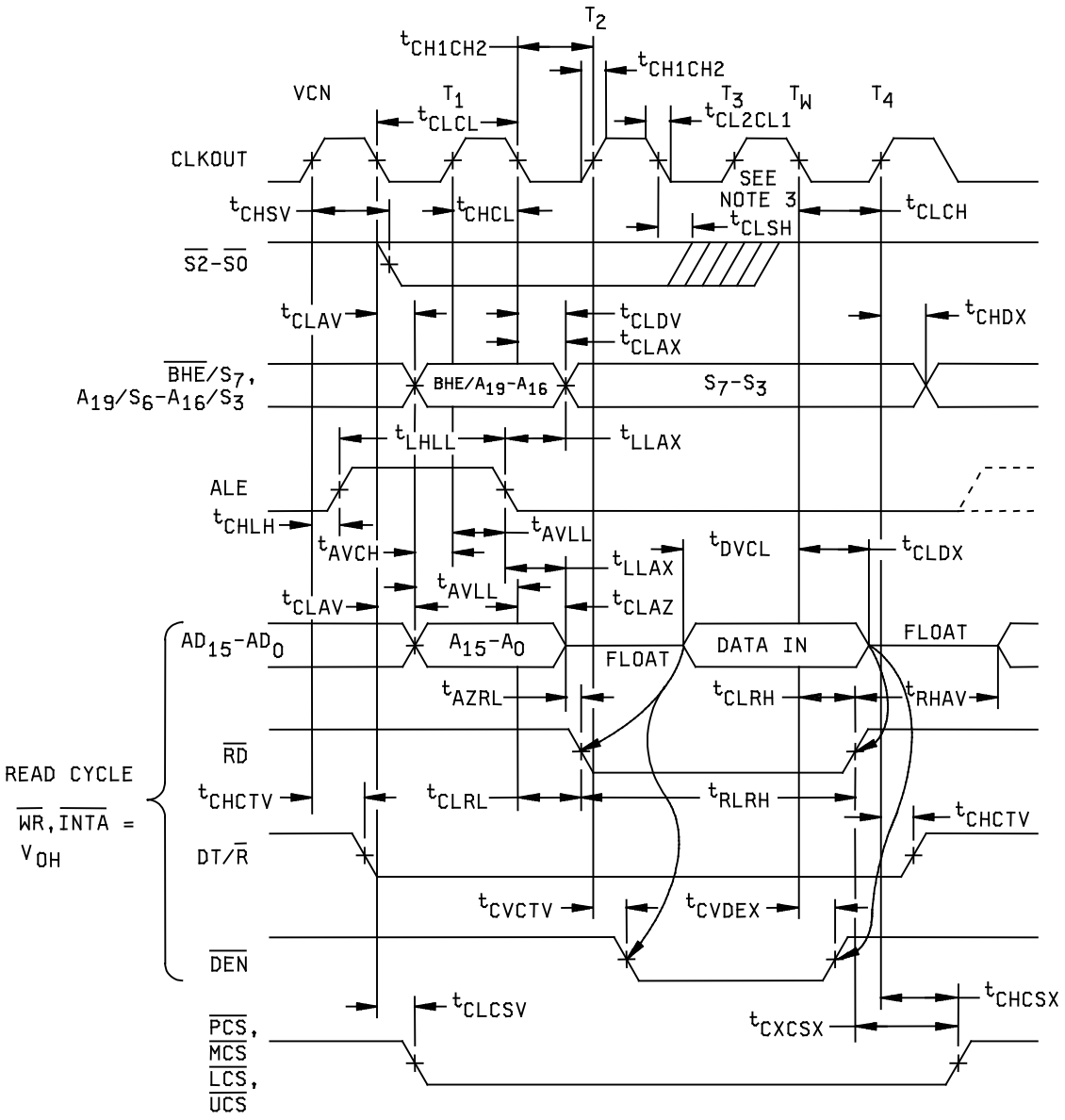


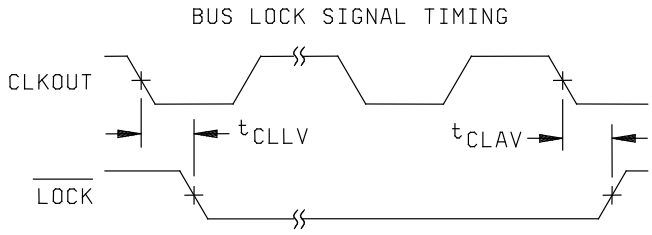
FIGURE 4. Timing waveforms.

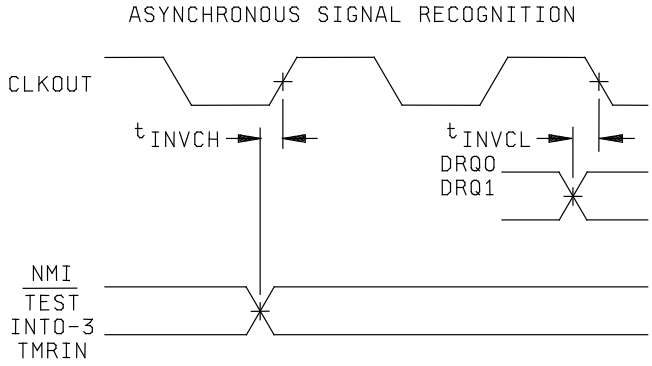


NOTES:

1. Following a write cycle, the local bus is floated by the devices only when the devices enter a “hold acknowledge” state.
2. $\overline{\text{INTA}}$ 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 $\overline{\text{PCS5}}$ and $\overline{\text{PCS6}}$.
5. For write cycle followed by read.

FIGURE 4. Timing waveforms – Continued.





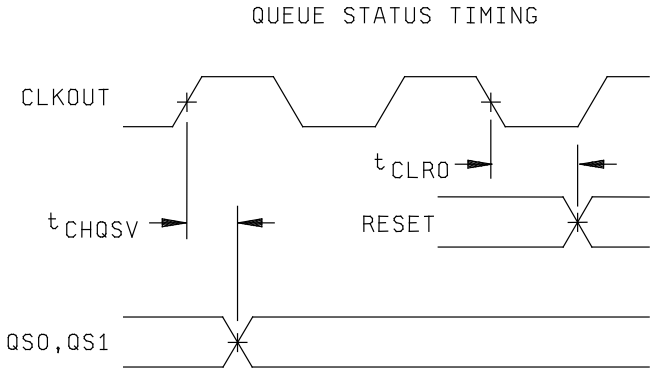


FIGURE 4. Timing waveforms – Continued.

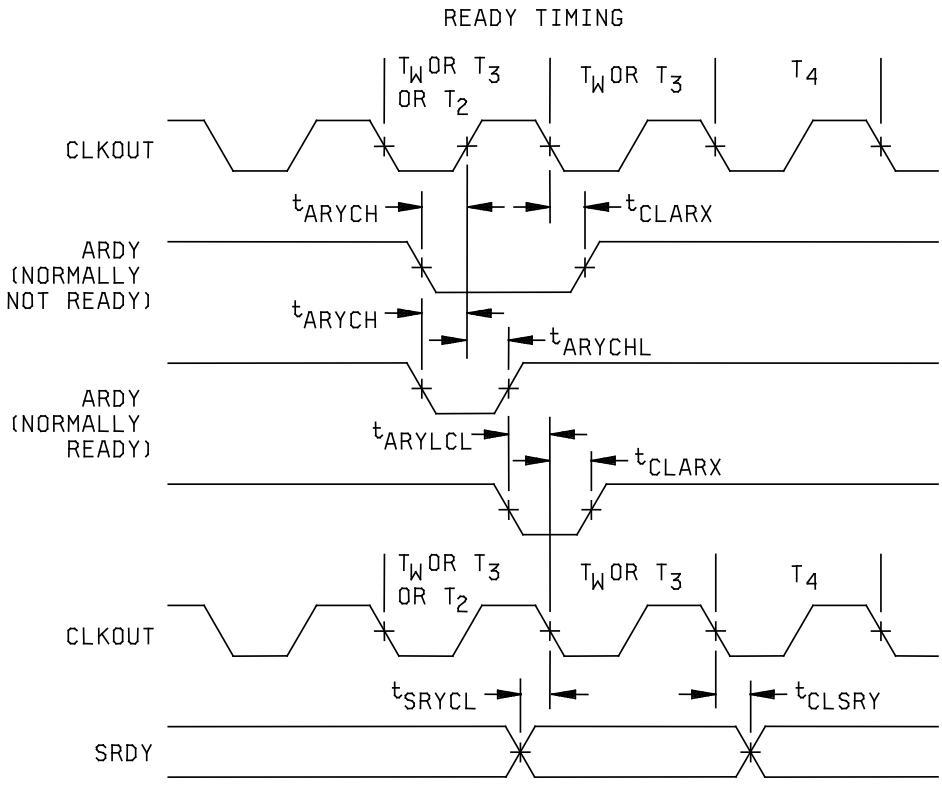
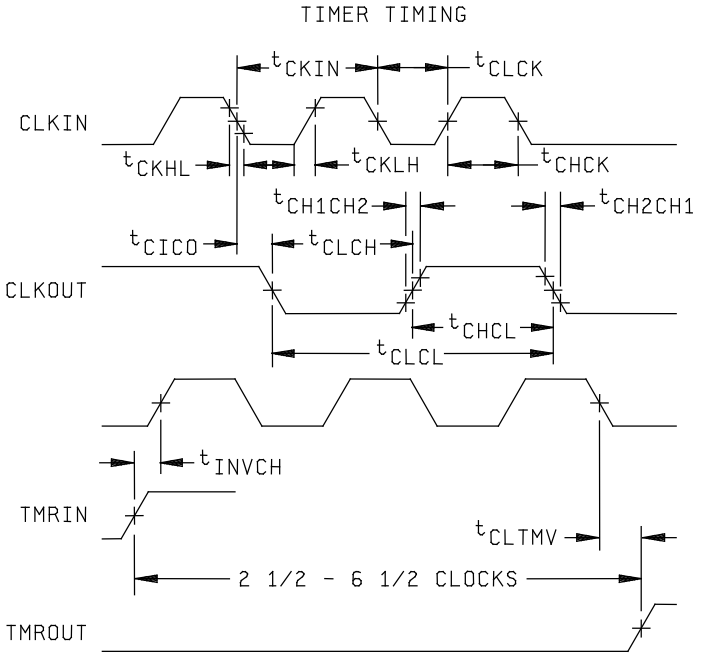


FIGURE 4. Timing waveforms – Continued.



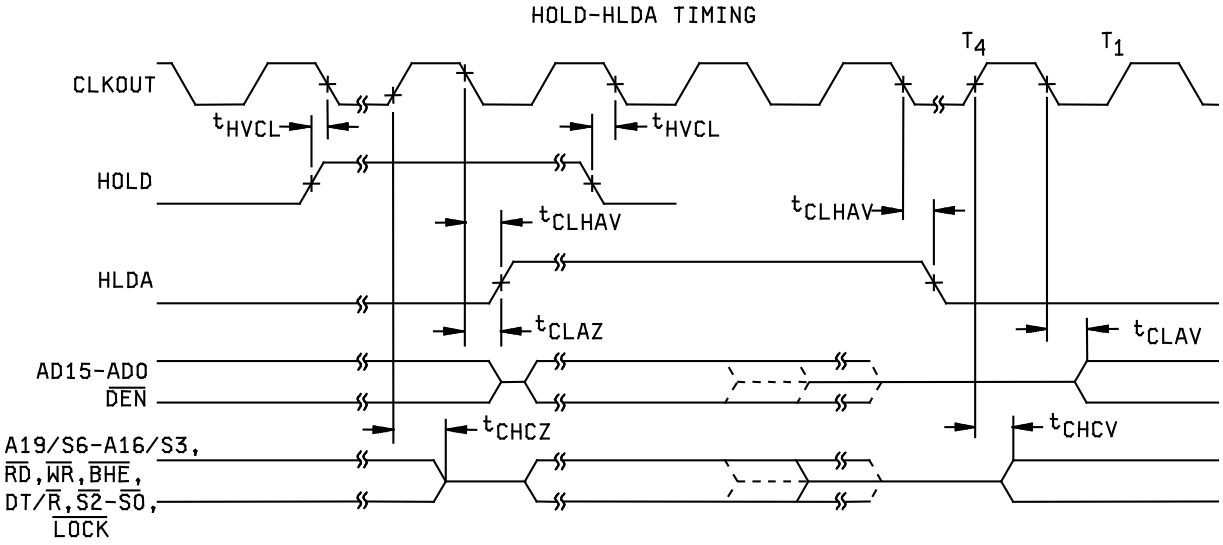


FIGURE 4. Timing waveforms – Continued.

4. VERIFICATION

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 method 1015 of MIL-STD-883.

(2) T_A = +125°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.

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)	---
Final electrical test parameters (method 5004)	1*, 2, 3, 7, 8, 9, 10, 11
Group A test requirements (method 5005)	1, 2, 3, 4, 7, 8, 9, 10, 11
Groups C and D end-point electrical parameters (method 5005)	1, 2, 3 or 2, 8A, 10

* 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 method 1005 of MIL-STD-883.

(2) T_A = +125°C, minimum.

(3) Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

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.

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

6.2 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.

6.3 Record of users. Military and industrial users should inform DLA Land and Maritime when a system application requires configuration control and which SMD's are applicable to that system. DLA Land and Maritime 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 microelectronic devices (FSC 5962) should contact DLA Land and Maritime -VA, telephone (614) 692-0547.

6.4 Comments. Comments on this drawing should be directed to DLA Land and Maritime -VA, Columbus, Ohio 43218-3990, or telephone (614) 692-0540.

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

6.6 Approved sources of supply for device class M. Approved sources of supply for class M 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 DLA Land and Maritime -VA.

TABLE III. Instruction set summary.

Function	Format				Clock cycles	Comments
DATA TRANSFER						
MOV = Move:						
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	
PUSH = Push:						
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	
PUSHA = Push All	0 1 1 0 0 0 0 0				36	
POP = Pop:						
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 $\neq$ 0)			8	
POPA = Pop All	0 1 1 0 0 0 0 0				51	
XCHG = Exchange:						
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	
IN = Input from:						
Fixed port	1 1 1 0 0 1 0 w	port			10	
Variable port	1 1 1 0 1 1 0 w				8	
OUT = Output to:						
Fixed port	1 1 1 0 0 1 1 w	port			9	
Variable port	1 1 1 0 1 1 1 w				7	

TABLE III. Instruction set summary - Continued.

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

TABLE III. Instruction set summary - Continued.

Function	Format				Clock cycles	Comments
ARITHMETIC – Continued						
SUB = Subtract:						
Reg/memory and register to either	0 0 1 0 1 0 d w	mod reg r/m			3/10	
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	8/16-bit
SBB = Subtract with borrow:						
Reg/memory and register to either	0 0 0 1 1 0 d w	mod reg r/m			3/10	
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	8/16-bit
DEC = Decrement:						
Register/memory	1 1 1 1 1 1 1 w	mod 0 0 1 r/m			3/15	
Register	0 1 0 0 1 reg				3	
CMP = Compare:						
Register/memory with register	0 0 1 1 1 0 1 w	mod reg r/m			3/10	
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	8/16-bit
NEG = Change sign register/memory	1 1 1 1 0 1 1 w	mod 0 1 1 r/m			3/10	
AAA = ASCII adjust for add	0 0 1 1 0 1 1 1				8	
DAA = Decimal adjust for add	0 0 1 0 0 1 1 1				4	
AAS = ASCII adjust for subtract	0 0 1 1 1 1 1 1				7	
DAS = Decimal adjust for subtract	0 0 1 0 1 1 1 1				4	
MUL = Multiply (unsigned):	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	

TABLE III. Instruction set summary - Continued.

Function	Format				Clock cycles	Comments
ARITHMETIC – Continued						
IMUL = Integer multiply (signed):	1 1 1 1 0 1 1 w	mod 1 0 1 r/m				
Register-Byte					25-28	
Register-Word					34-37	
Memory-Byte					31-34	
Memory-Word					40-43	
IMUL = 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	
DIV = Divide (unsigned):	1 1 1 1 0 1 1 w	mod 1 1 0 r/m				
Register-Byte					29	
Register-Word					38	
Memory-Byte					35	
Memory-Word					44	
IDIV = Integer divide (signed):	1 1 1 1 0 1 1 w	mod 1 1 1 r/m				
Register-Byte					44-52	
Register-Word					53-61	
Memory-Byte					50-58	
Memory-Word					59-67	
AAM = ASCII adjust for multiply	1 1 0 1 0 1 0 0	0 0 0 0 1 0 1 0			19	
AAD = ASCII adjust for divide	1 1 0 1 0 1 0 1	0 0 0 0 1 0 1 0			15	
CBW = Convert byte to word	1 0 0 1 1 0 0 0				2	
CWD = Convert word to double word	1 0 0 1 1 0 0 1				4	
LOGIC						
Shift/Rotate instructions:						
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					

TABLE III. Instruction set summary - Continued.

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

TABLE III. Instruction set summary - Continued.

Function	Format			Clock cycles	Comments
STRING MANIPULATION – Continued					
Repeated by count in CX					
MOVS = Move string	1 1 1 1 0 0 1 0	1 0 1 0 0 1 0 w		8+8n	
CMPS = Compare string	1 1 1 1 0 0 1 z	1 0 1 0 0 1 1 w		5+22n	
SCAS = Scan string	1 1 1 1 0 0 1 z	1 0 1 0 1 1 1 w		5+15n	
LODS = Load string	1 1 1 1 0 0 1 0	1 0 1 0 1 1 0 w		6+11n	
STOS = Store string	1 1 1 1 0 0 1 0	1 0 1 0 1 0 1 w		6+9n	
INS = Input string	1 1 1 1 0 0 1 0	0 1 1 0 1 1 0 w		8+8n	
OUTS = Output string	1 1 1 1 0 0 1 0	0 1 1 0 1 1 1 w		8+8n	
CONTROL TRANSFER					
CALL = Call:					
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		23	
		segment selector			
Indirect intersegment	1 1 1 1 1 1 1 1	mod 0 1 1 r/m	(mod ≠ 11)	38	
JMP = Unconditional jump:					
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		14	
		segment selector			
Indirect intersegment	1 1 1 1 1 1 1 1	mod 1 0 1 r/m	(mod ≠ 11)	26	
RET = Return from call:					
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	

TABLE III. Instruction set summary - Continued.

Function	Format				Clock cycles	Comments
CONTROL TRANSFER – Continued						
JE/JZ = Jump on equal/zero	0 1 1 1 0 1 0 0	disp			4/13	JMP not taken/JMP taken
JL/JNGE = Jump on less/not greater or equal	0 1 1 1 1 1 0 0	disp			4/13	
JLE/JNG = Jump on less or equal/not greater	0 1 1 1 1 1 1 0	disp			4/13	
JB/JNAE = Jump on below/not above or equal	0 1 1 1 0 0 1 0	disp			4/13	
JBE/JNA = Jump on below or equal/not above	0 1 1 1 0 1 1 0	disp			4/13	
JP/JPE = Jump on parity/parity even	0 1 1 1 1 0 1 0	disp			4/13	
JO = Jump on overflow	0 1 1 1 0 0 0 0	disp			4/13	
JS = Jump on sign	0 1 1 1 1 0 0 0	disp			4/13	
JNE/JNZ = Jump on not equal/ not zero	0 1 1 1 0 1 0 1	disp			4/13	
JNL/JGE = Jump on not less/greater or equal	0 1 1 1 1 1 0 1	disp			4/13	
JNLE/JG = Jump on not less or equal/greater	0 1 1 1 1 1 1 1	disp			4/13	
JNB/JAE = Jump on not below/above or equal	0 1 1 1 0 0 1 1	disp			4/13	
JNBE/JA = Jump on not below or equal/above	0 1 1 1 0 1 1 1	disp			4/13	
JNP/JPO = Jump on not par/par odd	0 1 1 1 1 0 1 1	disp			4/13	
JNO = Jump on not overflow	0 1 1 1 0 0 0 1	disp			4/13	
JNS = Jump on not sign	0 1 1 1 1 0 0 1	disp			4/13	
JCXZ = Jump on CX zero	1 1 1 0 0 0 1 1	disp			5/15	
LOOP = Loop CX times	1 1 1 0 0 0 1 0	disp			6/16	LOOP not taken/LOOP taken
LOOPZ/LOOPE = Loop while zero/equal	1 1 1 0 0 0 0 1	disp			6/16	
LOOPNZ/LOOPNE = Loop while not zero/equal	1 1 1 0 0 0 0 0	disp			6/16	
ENTER = 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)	
LEAVE = Leave procedure	1 1 0 0 1 0 0 1				8	
INT = Interrupt:						
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
INTO = Interrupt on overflow	1 1 0 0 1 1 1 0				48/4	

TABLE III. Instruction set summary - Continued.

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

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

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 2nd 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 folowing:

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.

TABLE IV. Pin description.

Symbol	Name and Function
V_{CC}	System power: +5 volt power supply.
V_{SS}	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_{CC} 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	The $\overline{TEST}$ pin is sampled during and after reset to determine whether the device is to enter compatible or enhanced mode. Enhanced mode requires $\overline{TEST}$ to be high on the rising edge of $\overline{RES}$ 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. $\overline{TEST}$, in compatible mode, this pin is configured to operate as $\overline{TEST}$. This pin is examined by the WAIT instruction. If the $\overline{TEST}$ input is high when WAIT execution begins, instruction execution will suspend. $\overline{TEST}$ 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 $\overline{TEST}$, interrupts will be serviced. 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.
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.

TABLE IV. Pin description - Continued.

<table>
<tr><th>Symbol</th><th>Name and Function</th></tr>
<tr><td>NMI</td><td>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.</td></tr>
<tr><td>INT0, INT1, INT2/$\overline{\text{INTA0}}$, INT3/$\overline{\text{INTA1}}$</td><td>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.</td></tr>
<tr><td>A19/S6,
A18/S5,
A17/S4,
A16/S3</td><td>Address bus outputs (16-19) and bus cycle status (3-6) reflect the four most significant address bits during T_1. These signals are active high. During T_2, T_3, T_w, and T_4, status information is available on these lines as encoded below:

<table><tr><td></td><td>Low</td><td>High</td></tr><tr><td>S6</td><td>Processor cycle</td><td>DMA cycle</td></tr></table>
S3, S4, and S5 are defined as LOW during T_2-T_4.</td></tr>
<tr><td>AD_{15} – AD_0</td><td>Address/data bus (0-15) signals constitute the time multiplexed memory or I/O address (T_1) and data (T_2. T_3, T_w, and T_4) bus. The bus is active high A_0 is analogous to $\overline{\text{BHE}}$ for the lower byte of the data bus, pins D_7 through D_0. It is low during T_1 when a byte is to be transferred onto the lower portion of the bus in memory of I/O operations.</td></tr>
<tr><td>$\overline{\text{BHE}}$ /S7</td><td>The $\overline{\text{BHE}}$ (bus high enable) signal is analogous to A0 in that it is used to enable data on to the most significant half of the data bus, pins D15-D8. $\overline{\text{BHE}}$ will be low during T_1 when the upper byte is transferred and will remain low through T_3 and T_w. $\overline{\text{BHE}}$ 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 A0 being high.

<table><tr><th colspan="3">$\overline{\text{BHE}}$ and A0 encodings</th></tr><tr><th>$\overline{\text{BHE}}$ value</th><th>A0 value</th><th>Function</th></tr><tr><td>0</td><td>0</td><td>Word tranfer</td></tr><tr><td>0</td><td>1</td><td>Byte transfer on upper half of data bus (D15-D8)</td></tr><tr><td>1</td><td>0</td><td>Byte transfer on lower half of data bus (D7-D0)</td></tr><tr><td>1</td><td>1</td><td>Refresh</td></tr></table></td></tr>
<tr><td>ALE/QS0</td><td>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_1 of the associated bus cycle. The trailing edge is generated off the CLKOUT rising edge in T_1. Note that ALE is never floated.</td></tr>
</table>

TABLE IV. Pin description - Continued.

<table>
<tr><th>Symbol</th><th>Name and Function</th></tr>
<tr><td>$\overline{WR}$ /QS1</td><td>Write strobe/queue status 1 indicates that the data on the bus is to be written into a memory or an I/O device. $\overline{WR}$ is active for T_2, T_3, and T_w 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 $\overline{WR}$ /QS1 pins provide information about processor instruction queue interaction.
<table>
<tr><th>QS1</th><th>QS0</th><th>Queue operation</th></tr>
<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>
</table></td></tr>
<tr><td>$\overline{RD}$ / $\overline{QSMD}$</td><td>Read strobe indicates that the device is performing a memory or I/O read cycle. $\overline{RD}$ is active low for T_2, T_3. and T_w of any read cycle. It is guaranteed not to go low in T_2 until after the address bus is floated. $\overline{RD}$ is active low, and floats during “HOLD”. $\overline{RD}$ is driven high for one clock during reset, and then the output driver is floated. A weak internal pull-up mechanism on the $\overline{RD}$ line holds it high when the line is not driven. During RESET the pin is sampled to determine whether the device should provide ALE, $\overline{WR}$, and $\overline{RD}$, or if the queue-status should be provided. $\overline{RD}$ should be connected to GND to provide queue-status data.</td></tr>
<tr><td>ARDY</td><td>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 V_{CC}, 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.</td></tr>
<tr><td>SRDY</td><td>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 V_{CC}, 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.</td></tr>
<tr><td>$\overline{LOCK}$</td><td>$\overline{LOCK}$ output indicates that other system bus masters are not to gain control of the system bus while $\overline{LOCK}$ is active low. The $\overline{LOCK}$ signal is requested by the $\overline{LOCK}$ prefix instruction and is activated at the beginning of the first data cycle associated with the instruction following the $\overline{LOCK}$ prefix. It remains active until the completion of the instruction following the $\overline{LOCK}$ prefix. No prefetches will occur while $\overline{LOCK}$ is asserted. $\overline{LOCK}$ is active low and is driven high for one clock during RESET. $\overline{LOCK}$ on devices 03-06 stay high during reset, while it is floated on the 01 and 02 devices.</td></tr>
</table>

TABLE IV. Pin description - Continued.

<table>
<tr><th>Symbol</th><th>Name and Function</th></tr>
<tr><td>$\overline{S0}$, $\overline{S1}$, $\overline{S2}$</td><td>Bus cycle status $\overline{S0}$ - $\overline{S2}$ are encoded to provide bus-transaction information.
<table>
<tr><th>$\overline{S2}$</th><th>$\overline{S1}$</th><th>$\overline{S0}$</th><th>Queue operation</th></tr>
<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>
</table>
The status pins float during “HOLD/HLDA”.
$\overline{S2}$ may be used as a logical M/I$\overline{O}$ indicator, and $\overline{S1}$ as a DT/$\overline{R}$ indicator.

The status lines are driven high for one clock during reset, and then floated until a bus cycle begins.</td></tr>
<tr><td>HOLD (input)
HLDA (output)</td><td>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 T_4 or T_1. 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.

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.</td></tr>
<tr><td>$\overline{UCS}$</td><td>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 $\overline{UCS}$ is software programmable.

$\overline{UCS}$ and $\overline{LCS}$ are sampled upon the rising edge of $\overline{RES}$. 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. $\overline{UCS}$ has weak internal pullup for normal operation.</td></tr>
<tr><td>$\overline{LCS}$</td><td>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 $\overline{LCS}$ is software programmable.

$\overline{UCS}$ and $\overline{LCS}$ are sampled upon the rising edge of $\overline{RES}$. 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. $\overline{UCS}$ has weak internal pullup for normal operation.</td></tr>
</table>

TABLE IV. Pin description - Continued.

Symbol	Name and Function
$\overline{MCS0}$/PEREQ $\overline{MCS1}$/$\overline{ERROR}$ $\overline{MCS2}$ $\overline{MCS3}$/$\overline{NPS}$	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 $\overline{MCS0}$-3 are software programmable. In enhanced mode, $\overline{MCS0}$ 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. $\overline{MCS3}$ becomes $\overline{NPS}$ (numeric processor select) which may only be activated by communication to the numeric processor extension. $\overline{MCS1}$ becomes $\overline{ERROR}$ in enhanced mode and is used to signal numeric coprocessor errors.
$\overline{PCS0}$ $\overline{PCS1}$-4	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 $\overline{PCS0}$-4 are software programmable.
$\overline{PCS5}$/A1	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 $\overline{PCS5}$ is software programmable. When programmed to provide latched A1, rather than $\overline{PCS5}$, this pin will retain the previously latched value of A1 during a bus HOLD. A1 is active high.
$\overline{PCS6}$/A2	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 $\overline{PCS6}$ is software progranmiable. When programmed to provide latched A2, rather than $\overline{PCS6}$, this pin will retain the previously latched value of A2 during a bus HOLD. A2 is active HIGH.
DT/$\overline{R}$	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.
$\overline{DEN}$	Data enable is provided as a data bus transceiver output enable. $\overline{DEN}$ is active low during each memory and I/O access. $\overline{DEN}$ is high whenever DT/$\overline{R}$ changes state.

STANDARD MICROCIRCUIT DRAWING BULLETIN

DATE: 12-04-16

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 DLA Land and Maritime -VA. This information bulletin is superseded by the next dated revision of MIL-HDBK-103 and QML-38535. DLA Land and Maritime maintains an online database of all current sources of supply at http://www.landandmaritime.dla.mil/Programs/Smcr/.

Standard microcircuit drawing PIN 1/	Vendor CAGE number	Vendor similar PIN 2/
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	3/	MG80C186XL-20/B
5962-8850104ZA	3/	MG80C186XL-16/B
5962-8850105ZA	3/	MG80C186XL-12/B
5962-8850106ZA	3/	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/ Not available from an approved source of supply.

Vendor CAGE number	Vendor name and address
3V146	Rochester Electronics Inc. 16 Malcolm Hoyt Drive Newburyport, MA 01950