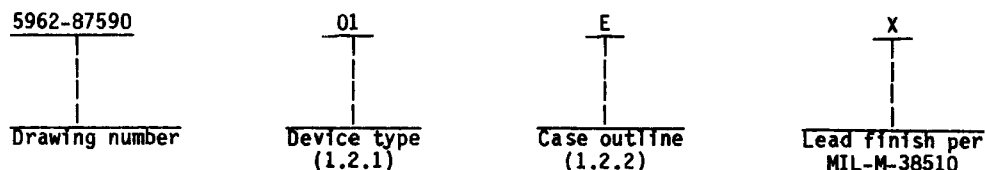




## 1. SCOPE

1.1 Scope. This drawing describes device requirements for Class B microcircuits in accordance with 1.2.1 of MIL-STD-883, "Provisions for the use of MIL-STD-883 in conjunction with compliant non-JAN devices".

1.2 Part number. The complete part number shall be as shown in the following example:



1.2.1 Device type. The device type shall identify the circuit function as follows:

Device type	Generic number	Circuit function
01	10H416	4-bit binary counter

1.2.2 Case outlines. The case outlines shall be as designated in appendix C of MIL-M-38510, and as follows:

Outline letter	Case outline
E	D-2 (16-lead, .840" x .310" x .200"), dual-in-line package
F	F-5 (16-lead, .440" x .285" x .085"), flat package
2	C-2 (20-terminal, .358" x .358" x .100"), square chip carrier package

## 1.3 Absolute maximum ratings.

Supply voltage range ( $V_{EE}$ )	-8.0 V dc to 0.0 V dc
Input voltage range	-5.2 V dc to 0.0 V dc
Storage temperature range	-65°C to +165°C
Lead temperature (soldering, 10 seconds)	+300°C
Junction temperature ( $T_J$ )	+165°C
Maximum power dissipation ( $P_D$ )	718 mW
Thermal resistance, junction-to-case ( $\theta_{JC}$ )	See MIL-M-38510, appendix C

## 1.4 Recommended operating conditions.

Supply voltage range ( $V_{EE}$ )	-5.46 V dc minimum to -4.94 V dc maximum
Supply voltage range ( $V_{CC}$ )	-0.02 V dc to +0.02 V dc or +1.98 V dc to +2.02 V dc
Ambient operating temperature range ( $T_A$ )	-55°C to +125°C
Minimum high level input voltage ( $V_{IH}$ ):	
$T_A = +25^\circ\text{C}$	-0.780 V dc
$T_A = +125^\circ\text{C}$	-0.650 V dc
$T_A = -55^\circ\text{C}$	-0.840 V dc
Maximum low level input voltage ( $V_{IL}$ )	-1.950 V dc

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## 2. APPLICABLE DOCUMENTS

2.1 Government specification and standard. Unless otherwise specified, the following specification and standard, of the issue listed in that issue of the Department of Defense Index of Specifications and Standards specified in the solicitation, form a part of this drawing to the extent specified herein.

### SPECIFICATION

#### MILITARY

MIL-M-38510 - Microcircuits, General Specification for.

### STANDARD

#### MILITARY

MIL-STD-883 - Test Methods and Procedures for Microelectronics.

(Copies of the specification and standard required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

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 shall take precedence.

## 3. REQUIREMENTS

3.1 Item requirements. The individual item requirements shall be in accordance with 1.2.1 of MIL-STD-883, "Provisions for the use of MIL-STD-883 in conjunction with compliant non-JAN devices" and as specified herein.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-M-38510 and herein.

3.2.1 Terminal connections. The terminal connections shall be as specified on figure 1.

3.2.2 Truth tables. The truth tables shall be as specified on figure 2.

3.2.3 Test circuit and switching waveforms. The test circuit and switching waveforms shall be as specified on figure 3.

3.2.4 Case outlines. The case outlines shall be in accordance with 1.2.2 herein.

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

3.4 Marking. Marking shall be in accordance with MIL-STD-883 (see 3.1 herein). The part shall be marked with the part number listed in 1.2 herein. In addition, the manufacturer's part number may also be marked as listed in 6.4 herein.

3.5 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 6.4. The certificate of compliance submitted to DESC-ECS prior to listing as an approved source of supply shall state that the manufacturer's product meets the requirements of MIL-STD-883 (see 3.1 herein) and the requirements herein.

3.6 Certificate of conformance. A certificate of conformance as required in MIL-STD-883 (see 3.1 herein) shall be provided with each lot of microcircuits delivered to this drawing.

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TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions -55°C < T <sub>A</sub> < +125°C Unless otherwise specified	Group A subgroups	Limits		Unit		
				Min	Max			
Cases E, F, and 2								
Quiescent tests 1/								
High level output voltage	V <sub>OH</sub>	Outputs terminated through 100Ω to -2 V V <sub>CC</sub> = 0.0 V V <sub>EE</sub> = -5.2 V 27	V <sub>IH</sub>	V <sub>IL</sub>				
			-0.780	-1.950	1	-1.010	-0.780	V
			-0.650	-1.950	2	-0.860	-0.650	
Low level output voltage	V <sub>OL</sub>		-0.840	-1.950	3	-1.060	-0.840	
			-0.780	-1.950	1	-1.950	-1.580	V
			-0.650	-1.950	2	-1.950	-1.565	
High level threshold output voltage	V <sub>OHA</sub>		-0.840	-1.950	3	-1.950	-1.610	
			-1.110	-1.480	1	-1.010	-0.780	V
			-0.960	-1.465	2	-0.860	-0.650	
Low level threshold output voltage	V <sub>OLA</sub>		-1.160	-1.510	3	-1.060	-0.840	
		-1.110	-1.480	1	-1.950	-1.580	V	
		-0.960	-1.465	2	-1.950	-1.565		
Power supply drain current 3/	I <sub>EE</sub>	V <sub>EE</sub> = -5.46 V V <sub>CC</sub> = 0.0 V V <sub>IH</sub> = -0.780 V at +25°C -0.650 V at +125°C -0.840 V at -55°C			1 2,3	-115 -126		mA
High level input current	I <sub>IH1</sub>		Master reset	1,2 3		700 1190	μA	
	I <sub>IH2</sub>		All other inputs	1,2 3		265 450		
Low level input current	I <sub>IL</sub>		V <sub>EE</sub> = -4.94 V V <sub>CC</sub> = 0.0 V V <sub>IL</sub> = -1.950 V	3/	1,3 2	0.5 0.3	μA	
Functional tests			See 4.3.1c		7,8			
See footnotes at end of table.								
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				REVISION LEVEL A	SHEET 4			

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C ≤ T <sub>A</sub> ≤ +125°C Unless otherwise specified	Group A subgroups	Limits		Unit		
				Min	Max			
Cases E and F DC rapid tests 4/								
High level output voltage	V <sub>OH</sub>	Outputs terminated through 100Ω to -2 V V <sub>CC</sub> = 0.0 V V <sub>EE</sub> = -5.2 V 2/	V <sub>IH</sub>	V <sub>IL</sub>				
			-0.810	-1.950	1	-1.037	-0.810	V
			-0.682	-1.950	2	-0.890	-0.682	
Low level output voltage	V <sub>OL</sub>		-0.872	-1.950	3	-1.090	-0.872	
			-0.810	-1.950	1	-1.950	-1.589	V
			-0.682	-1.950	2	-1.950	-1.575	
High level threshold output voltage	V <sub>OHA</sub>	-0.872	-1.950	3	-1.950	-1.620		
		-1.137	-1.489	1	-1.037	-0.810	V	
		-0.990	-1.475	2	-0.890	-0.682		
Low level threshold output voltage	V <sub>OLA</sub>	-1.190	-1.520	3	-1.090	-0.872		
		-1.137	-1.489	1	-1.950	-1.589	V	
		-0.990	-1.475	2	-1.950	-1.575		
Power supply drain current 3/	I <sub>EE</sub>	V <sub>EE</sub> = -5.46 V V <sub>CC</sub> = 0.0 V V <sub>IH</sub> = -0.810 V at +25°C -0.682 V at +125°C -0.872 V at -55°C			1	-114		
					2,3	-125		
High level input current	I <sub>IH1</sub>			Master reset		1,2 3	685 1175	μA
	I <sub>IH2</sub>			All other inputs		1,2 3	250 435	
Low level input current	I <sub>IL</sub>		V <sub>EE</sub> = -4.94 V V <sub>CC</sub> = 0.0 V V <sub>IL</sub> = -1.950 V 3/			1,3 2	0.5 0.3	
Functional tests		See 4.3.1c			7,8			

See footnotes at end of table.

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\* U. S. GOVERNMENT PRINTING OFFICE: 1968-549-904

TABLE 1. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C < T <sub>A</sub> < +125°C Unless otherwise specified	Group A subgroups	Limits		Unit		
				Min	Max			
Case 2 DC rapid tests 4/								
High level output voltage	V <sub>OH</sub>	Outputs terminated through 100Ω to -2 V V <sub>CC</sub> = 0.0 V V <sub>EE</sub> = -5.2 V 2/	V <sub>IH</sub>	V <sub>IL</sub>				
			-0.809	-1.950	1	-1.037	-0.809	V
			-0.682	-1.950	2	-0.889	-0.682	
			-0.872	-1.950	3	-1.089	-0.872	
Low level output voltage	V <sub>OL</sub>		-0.809	-1.950	1	-1.950	-1.589	V
			-0.682	-1.950	2	-1.950	-1.575	
			-0.872	-1.950	3	-1.950	-1.620	
High level threshold output voltage	V <sub>OHA</sub>		-1.137	-1.489	1	-1.037	-0.809	V
			-0.989	-1.475	2	-0.889	-0.682	
			-1.189	-1.520	3	-1.089	-0.872	
Low level threshold output voltage	V <sub>OLA</sub>		-1.137	-1.489	1	-1.950	-1.589	V
			-0.989	-1.475	2	-1.950	-1.575	
			-1.189	-1.520	3	-1.950	-1.620	
Power supply drain current 3/	I <sub>EE</sub>		V <sub>EE</sub> = -5.46 V V <sub>CC</sub> = 0.0 V V <sub>IH</sub> = -0.809 V at +25°C -0.682 V at +125°C -0.872 V at -55°C			1 2,3	-114 -125	mA
High level input current	I <sub>IH1</sub>			Master reset	1,2 3		685 1175	μA
	I <sub>IH2</sub>			All other inputs	1,2 3		250 435	
Low level input current	I <sub>IL</sub>	V <sub>EE</sub> = -4.94 V V <sub>CC</sub> = 0.0 V V <sub>IL</sub> = -1.950 V	3/	1,3 2	0.5 0.3		μA	
Functional tests		See 4.3.1c		7,8				
See footnotes at end of table.								

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MILITARY DRAWING**

DEFENSE ELECTRONICS SUPPLY CENTER  
DAYTON, OHIO 45444

SIZE  
**A**

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REVISION LEVEL

A

SHEET

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C < T <sub>A</sub> < +125°C Unless otherwise specified	Group A subgroups	Limits		Unit
				Min	Max	
Cases E, F, and 2 AC tests						
Transition time	t <sub>TLH</sub> , t <sub>THL</sub>	V <sub>EE</sub> = -2.94 V V <sub>CC</sub> = +2.0 V C <sub>L</sub> ≤ 5 pF R <sub>L</sub> = 100Ω See figure 3	9	0.5	2.1	ns
			10	0.5	2.2	
			11	0.5	2.0	
Propagation delay time, CP to Q, CP to TC, and MR to Q	t <sub>PLH</sub>		9	0.7	2.6	ns
			10	0.7	2.9	
			11	0.7	2.5	
	t <sub>PHL</sub>		9	0.7	2.6	ns
			10	0.7	2.9	
			11	0.7	2.5	
Maximum clock frequency	f <sub>MAX</sub>	9	200		MHz	
		10	200			
		11	200			

- 1/ The quiescent limits are determined after a device has reached thermal equilibrium. This is defined as the reading taken with the device in a socket with  $> 500\text{ LFPM}$  of  $+25^{\circ}\text{C}$ ,  $+125^{\circ}\text{C}$ , or  $-55^{\circ}\text{C}$  (as applicable) air blowing on the unit in a transverse direction with power applied for at least 4 minutes before the reading is taken. This method was used for theoretical limit establishment only. All devices shall be tested to the delta V (rapid test) conditions specified herein. The rapid test method is an equivalent method of testing quiescent conditions.
- 2/ The high and low level output current varies with temperature, and shall be calculated using the following formula:  $I_{OH} = (V_{OH} - 2\text{ V})/100\Omega$ ,  $I_{OL} = (V_{OL} - 2\text{ V})/100\Omega$ .
- 3/ The  $I_{EE}$  and  $I_{IL}$  limits, although specified in the minimum column, shall not be exceeded, in magnitude, as a maximum value.
- 4/ The dc rapid test forcing functions and limits are used for all dc testing. These limits are determined for each device type based on the power dissipation and package type. The rapid test (delta V) limits and forcing functions are skewed allowing rapid testing to be performed at standard temperatures without the addition of delta T's.

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3.7 Notification of change. Notification of change to DESC-ECS shall be required in accordance with MIL-STD-883 (see 3.1 herein).

3.8 Verification and review. DESC, DESC'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 section 4 of MIL-M-38510 to the extent specified in MIL-STD-883 (see 3.1 herein).

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 or E using the circuit submitted with the certificate of compliance (see 3.5 herein).

(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.

##### 4.3.1 Group A inspection.

a. Tests shall be as specified in table II herein.

b. Subgroups 4, 5, and 6 in table I, method 5005 of MIL-STD-883 shall be omitted.

c. Subgroups 7 and 8 tests shall verify the truth table specified on figure 2 herein.

##### 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 or E using the circuit submitted with the certificate of compliance (see 3.5 herein).

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

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

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Case outlines	E	F	2
Terminal number	Terminal symbol		
1	VCC1	CP	NC
2	Q1	Q3	VCC1
3	Q0	Q2	Q1
4	TC	VCC2	Q0
5	PE	VCC1	TC
6	CE	Q1	NC
7	P0	Q0	PE
8	VEE	TC	CE
9	P1	PE	P0
10	P2	CE	VEE
11	P3	P0	NC
12	MR	VEE	P1
13	CP	P1	P2
14	Q3	P2	P3
15	Q2	P3	MR
16	VCC2	MR	NC
17	---	---	CP
18	---	---	Q3
19	---	---	Q2
20	---	---	VCC2

NC = No connection

FIGURE 1. Terminal connections.

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Synchronous counting sequence PE = H, CE = L				
Q0	Q1	Q2	Q3	TC
L	L	L	L	H
H	L	L	L	H
L	H	L	L	H
H	H	L	L	H
L	L	H	L	H
H	L	H	L	H
L	H	H	L	H
H	H	H	L	H
L	L	L	H	H
H	L	L	H	H
L	H	L	H	H
H	H	L	H	H
L	L	H	H	H
H	L	H	H	H
L	H	H	H	H
H	H	H	H	L

PE = L Parallel input P0, P1, P2, P3	Output at Qt + 1 Q0, Q1, Q2, Q3
L	L
H	H

PE	CE	Mode of operation
L	L	Parallel
L	H	Load
H	L	Count
H	H	Hold Count

MR	Output Q
L	See tables above
L	L

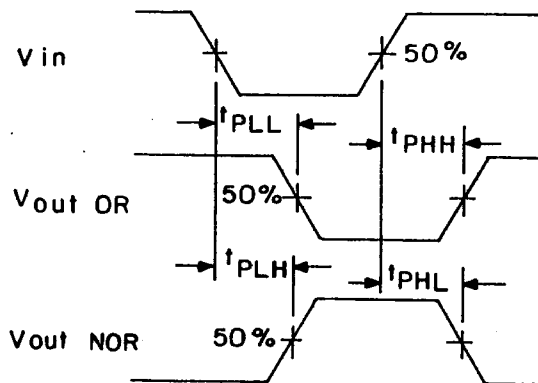
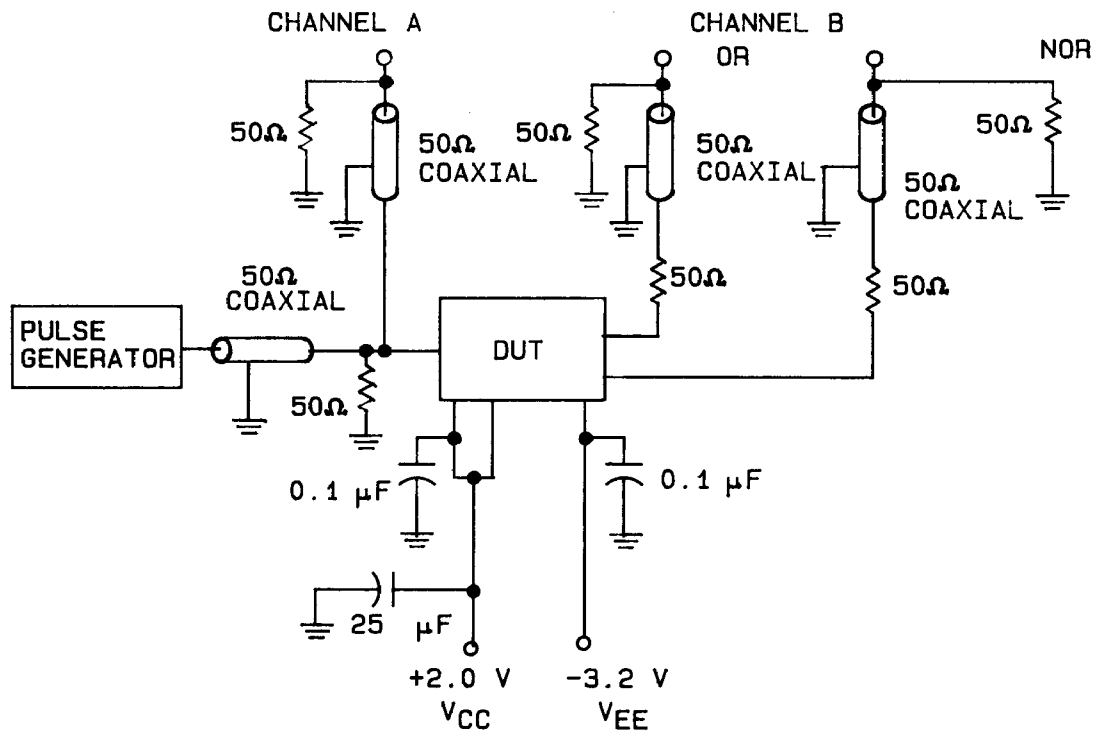
H = High voltage level  
L = Low voltage level

FIGURE 2. Truth tables.

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NOTE: Pulse generator characteristics:  
 PRR = 1 MHz,  $t_{THL} = t_{TLH} = 2.0 \pm 0.2$  ns (20 to 80 percent), duty cycle = 50 percent.

FIGURE 3. Test circuit and switching waveforms.

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TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (per method 5005, table I)
Interim electrical parameters (method 5004)	1
Final electrical test parameters (method 5004)	1*, 2, 3, 7*, 8, 9
Group A test requirements (method 5005)	1, 2, 3, 7, 8, 9, 10, 11
Groups C and D end-point electrical parameters (method 5005)	1, 2, 3

\* PDA applies to subgroups 1 and 7.

#### 5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-M-38510.

#### 6. NOTES

6.1 Intended use. Microcircuits conforming to this drawing are intended for use when military specifications do not exist and qualified military devices that will perform the required function are not available for OEM application. When a military specification exists and the product covered by this drawing has been qualified for listing on QPL-38510, the device specified herein will be inactivated and will not be used for new design. The QPL-38510 product shall be the preferred item for all applications.

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

6.3 Comments. Comments on this drawing should be directed to DESC-ECS, Dayton, Ohio 45444, or telephone 513-296-5375.

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6.4 Approved source of supply. An approved source of supply is listed herein. Additional sources will be added as they become available. The vendor listed herein has agreed to this drawing and a certificate of compliance (see 3.5 herein) has been submitted to DESC-ECS.

Military drawing part number	Vendor CAGE number	Vendor similar part number <u>1/</u>
5962-8759001EX	04713	10H416/BEAJC
5962-8759001FX	04713	10H416/BFAJC
5962-87590012X	04713	10H416M/B2AJC

1/ Caution. Do not use this numoer for item acquisition. Items acquired to this number may not satisfy the performance requirements of this drawing.

Vendor CAGE  
number

04713

Vendor name  
and address

Motorola, Incorporated  
7402 South Price Road  
Tempe, AZ 85283

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