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	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

PMIC N/A	PREPARED BY <i>Monica L. Pelling</i>	DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444		
STANDARDIZED MILITARY DRAWING THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE AMSC N/A	CHECKED BY <i>Ray Monnin</i>	MICROCIRCUIT, DIGITAL, ADVANCED CMOS, BINARY COUNTER, MONOLITHIC SILICON		
	APPROVED BY <i>Michael A. J.</i>			
	DRAWING APPROVAL DATE 5 JUNE 1989	SIZE A	CAGE CODE 67268	5962-89582
	REVISION LEVEL	SHEET 1 OF 17		

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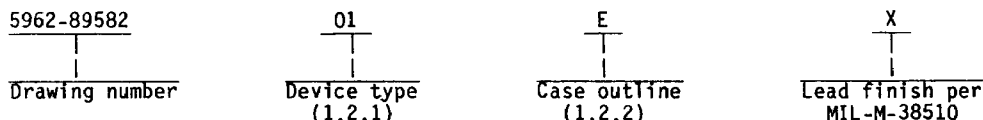
• U.S. GOVERNMENT PRINTING OFFICE: 1987 - 748-129/60911
5962-E1300

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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	54AC163	Synchronous presettable 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 1/	- - - - -	-0.5 V dc to +6.0 V dc
DC input voltage 1/	- - - - -	-0.5 V dc to $V_{CC} + 0.5$ V dc
DC output voltage 1/	- - - - -	-0.5 V dc to $V_{CC} + 0.5$ V dc
Clamp diode current	- - - - -	± 20 mA
DC output current (per pin)	- - - - -	± 50 mA
DC V_{CC} or GND current (per pin)	- - - - -	± 100 mA
Storage temperature range	- - - - -	-65°C to 150°C
Maximum power dissipation (P_D)	- - - - -	+500 mW
Lead temperature (soldering, 10 seconds)	- - - - -	+300°C
Thermal resistance, junction-to-case (θ_{JC})	- - - - -	See MIL-M-38510, appendix C
Junction temperature (T_J) 2/	- - - - -	+175°C

1.4 Recommended operating conditions.

Supply voltage (V_{CC}) 3/	- - - - -	+3.0 V dc to +5.5 V dc
Input voltage	- - - - -	0.0 V dc to V_{CC}
Output voltage	- - - - -	0.0 V dc to V_{CC}
Case operating temperature range (T_C)	- - - - -	-55°C to +125°C
Input rise or fall times:		
$V_{CC} = 3.6$ V	- - - - -	0 to 10 ns
$V_{CC} = 5.5$ V	- - - - -	0 to 8 ns

- 1/ Unless otherwise specified, all voltages are referenced to GND.
 2/ Maximum junction temperature shall not be exceeded except for allowable short duration burn-in screening conditions in accordance with method 5004 of MIL-STD-883.
 3/ Operation from 2.0 V dc to 3.0 V dc is provided for compatibility with data retention and battery backup systems. Data retention implies no input transitions and no stored data loss with the following conditions: $V_{IH} \geq 70$ percent V_{CC} , $V_{IL} < 30$ percent V_{CC} , $V_{OH} \geq 70$ percent V_{CC} at -20 μ A, $V_{OL} < 30$ percent V_{CC} at 20 μ A.

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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 table. The truth table shall be as specified on figure 2.

3.2.3 Logic diagram. The logic diagram 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 case 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 _C < +125°C unless otherwise specified		Group A subgroups	Limits		Unit				
					Min	Max					
High level output voltage <u>1/</u>	V _{OH}	V _{IN} = V _{IH} minimum or V _{IL} maximum I _{OH} = -50 μA	V _{CC} = 3.0 V	1, 2, 3	2.9		V				
			V _{CC} = 4.5 V		4.4						
			V _{CC} = 5.5 V		5.4						
		V _{IN} = V _{IH} minimum or V _{IL} maximum I _{OH} = -4.0 mA	V _{CC} = 3.0 V		2.4						
			V _{CC} = 4.5 V		3.7						
					V _{CC} = 5.5 V	4.7					
		V _{IN} = V _{IH} minimum or V _{IL} maximum I _{OH} = -50 mA	V _{CC} = 5.5 V		3.85						
		Low level output voltage <u>1/</u>	V _{OL}		V _{IN} = V _{IH} minimum or V _{IL} maximum I _{OL} = 50 μA	V _{CC} = 3.0 V		1, 2, 3		0.1	V
						V _{CC} = 4.5 V				0.1	
V _{CC} = 5.5 V				0.1							
V _{IN} = V _{IH} minimum or V _{IL} maximum I _{OL} = 12 mA	V _{CC} = 3.0 V				0.5						
	V _{CC} = 4.5 V				0.5						
				V _{CC} = 5.5 V		0.5					
V _{IN} = V _{IH} minimum or V _{IL} maximum I _{OL} = 50 mA	V _{CC} = 5.5 V				1.65						

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C < T _C < +125°C unless otherwise specified	Group A subgroups	Limits		Unit
				Min	Max	
High level input voltage	V _{IH}	2/ V _{CC} = 3.0 V	1, 2, 3	2.1		V
				3.15		
				3.85		
Low level input voltage	V _{IL}	2/ V _{CC} = 3.0 V	1, 2, 3		0.9	V
					1.35	
					1.65	
Input leakage current	I _{IL}	V _{IN} = 0.0 V	1, 2, 3		-1.0	μA
	I _{IH}	V _{IN} = 5.5 V			1.0	
Quiescent supply current	I _{CCH}	V _{IN} = V _{CC} or GND V _{CC} = 5.5 V I _{OUT} = 0.0 μA	1, 2, 3		160	μA
	I _{CCL}				160	
Input capacitance	C _{IN}	See 4.3.1c	4		8.0	pF
Power dissipation capacitance	C _{PD}	See 4.3.1c 3/	4		60	pF
Functional tests		Tested at V _{CC} = 3.0 V and repeated at V _{CC} = 5.5 V see 4.3.1d	7, 8			

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C ≤ T _C ≤ +125°C unless otherwise specified	Group A subgroups	Limits		Unit	
				Min	Max		
Propagation delay time, CP to Q (count mode)	t _{PHL1}	C _L = 50 pF R _L = 500Ω See figures 4 and 5 4/	V _{CC} = 3.0 V	9 10,11	1.0 1.0	10.5 12.5	ns
			V _{CC} = 4.5 V	9 10,11	1.0 1.0	8.0 9.5	
	t _{PLH1}		V _{CC} = 3.0 V	9 10,11	1.0 1.0	11.0 13.5	ns
			V _{CC} = 4.5 V	9 10,11	1.0 1.0	8.0 9.5	
Propagation delay time, CP to Q (load mode)	t _{PHL2}	C _L = 50 pF R _L = 500Ω See figures 4 and 5 4/	V _{CC} = 3.0 V	9 10,11	1.0 1.0	9.5 12.0	ns
			V _{CC} = 4.5 V	9 10,11	1.0 1.0	7.0 8.5	
	t _{PLH2}		V _{CC} = 3.0 V	9 10,11	1.0 1.0	10.5 12.5	ns
			V _{CC} = 4.5 V	9 10,11	1.0 1.0	7.5 9.0	
Propagation delay time, CP to TC	t _{PHL3}	C _L = 50 pF R _L = 500Ω See figures 4 and 5 4/	V _{CC} = 3.0 V	9 10,11	1.0 1.0	12.5 15.0	ns
			V _{CC} = 4.5 V	9 10,11	1.0 1.0	10.0 11.0	
	t _{PLH3}		V _{CC} = 3.0 V	9 10,11	1.0 1.0	13.5 16.5	ns
			V _{CC} = 4.5 V	9 10,11	1.0 1.0	9.5 11.0	

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C < T _C < +125°C unless otherwise specified	Group A subgroups	Limits		Unit	
				Min	Max		
Propagation delay time, CET to TC	t _{PHL4}	C _L = 50 pF R _L = 500Ω See figures 4 and 5 4/	V _{CC} = 3.0 V	9 10,11	1.0 1.0	10.5 12.0	ns
			V _{CC} = 4.5 V	9 10,11	1.0 1.0	7.5 9.0	
	t _{PLH4}		V _{CC} = 3.0 V	9 10,11	1.0 1.0	9.0 11.0	ns
			V _{CC} = 4.5 V	9 10,11	1.0 1.0	6.0 7.5	
Input setup and hold conditions, SR to CP (high or low)	t _{s1}	See figures 4 and 5 4/	V _{CC} = 3.0 V	9 10,11	14.0 17.0		ns
			V _{CC} = 4.5 V	9 10,11	9.5 12.0		
	t _{h1}		V _{CC} = 3.0 V	9 10,11	-1.0 -0.5		ns
			V _{CC} = 4.5 V	9 10,11	0.0 0.0		
Input setup and hold conditions, Pn to CP (high or low)	t _{s2}	See figures 4 and 5 4/	V _{CC} = 3.0 V	9 10,11	13.5 17.0		ns
			V _{CC} = 4.5 V	9 10,11	8.5 11.0		
	t _{h2}		V _{CC} = 3.0 V	9 10,11	-1.0 -0.5		ns
			V _{CC} = 4.5 V	9 10,11	0.0 0.0		

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C < T _C < +125°C unless otherwise specified	Group A subgroups	Limits		Unit
				Min	Max	
Input setup and hold conditions, PE to CP (high or low)	t _{s3}	See figures 4 and 5 <u>4/</u>	V _{CC} = 3.0 V	9 10,11	12.5 16.0	ns
			V _{CC} = 4.5 V	9 10,11	8.0 9.5	
	t _{h3}		V _{CC} = 3.0 V	9 10,11	-1.5 -0.5	ns
			V _{CC} = 4.5 V	9 10,11	-0.5 0.0	
Input setup and hold conditions, CET, CEP to CP (high or low)	t _{s4}	See figures 4 and 5 <u>4/</u>	V _{CC} = 3.0 V	9 10,11	6.5 8.0	ns
			V _{CC} = 4.5 V	9 10,11	4.5 5.5	
	t _{h4}		V _{CC} = 3.0 V	9 10,11	0.0 0.0	ns
			V _{CC} = 4.5 V	9 10,11	0.0 0.5	
Pulse width CP (count mode)	t _{w1}	See figures 4 and 5 <u>4/</u>	V _{CC} = 3.0 V	9 10,11	5.0 5.0	ns
			V _{CC} = 4.5 V	9 10,11	5.0 5.0	
Pulse width CP (load mode)	t _{w2}	See figures 4 and 5 <u>4/</u>	V _{CC} = 3.0 V	9 10,11	5.0 5.0	ns
			V _{CC} = 4.5 V	9 10,11	5.0 5.0	

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C ≤ T _C ≤ +125°C unless otherwise specified	Group A subgroups	Limits		Unit
				Min	Max	
Maximum clock frequency, CP	f _{max}	See figures 4 and 5 4/	V _{CC} = 3.0 V	9 10,11	70 55	MHz
			V _{CC} = 4.5 V	9 10,11	95 90	

- 1/ V_{OH} and V_{OL} tests will be tested at V_{CC} = 3.0 V and V_{CC} = 4.5 V. V_{OH} and V_{OL} tests are guaranteed, if not tested, for V_{CC} = 5.5 V. Limits shown apply to operation at V_{CC} = 3.3 V ± 0.3 V and V_{CC} = 5.0 V ± 0.5 V. Transmission driving tests are performed at V_{CC} = 5.5 V with a 2 ms duration maximum.
- 2/ V_{IH} and V_{IL} tests are not required, and shall be used as forcing functions for the V_{OH} and V_{OL} tests.
- 3/ Power dissipation capacitance (C_{PD}), determines the dynamic power consumption, P_D = (C_{PD} + C_L) V_{CC}² f, and the dynamic current consumption (I_S) is, I_S = (C_{PD} + C_L) V_{CC} f.
- 4/ AC limits at V_{CC} = 5.5 V are equal to limits at V_{CC} = 4.5 V and guaranteed by testing at V_{CC} = 4.5 V. Minimum ac limits are guaranteed for V_{CC} = 5.5 V by guardbanding V_{CC} = 4.5 V limits to 1.5 ns (minimum).

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 A, B, C, or D using the circuit submitted with the certificate of compliance (see 3.5 herein).
 - (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.

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Case outlines	E and F	2
Terminal number	Terminal symbol	
1	SR	NC
2	CP	SR
3	PO	CP
4	P1	PO
5	P2	P1
6	P3	NC
7	CEP	P2
8	GND	P3
9	PE	CEP
10	CET	GND
11	Q3	NC
12	Q2	PE
13	Q1	CET
14	Q0	Q3
15	TC	Q2
16	V _{CC}	NC
17	---	Q1
18	---	Q0
19	---	TC
20	---	V _{CC}

NC = No connection

FIGURE 1. Terminal connections.

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Inputs				Action on the rising clock edge
SR	PE	CET	CEP	
L	X	X	X	Reset (clear)
H	L	X	X	Load (Pn to Qn)
H	H	H	H	Count (increment)
H	H	L	X	No change (hold)
H	H	X	L	No change (hold)

H = High voltage level
L = Low voltage level
X = Immaterial

FIGURE 2. Truth table.

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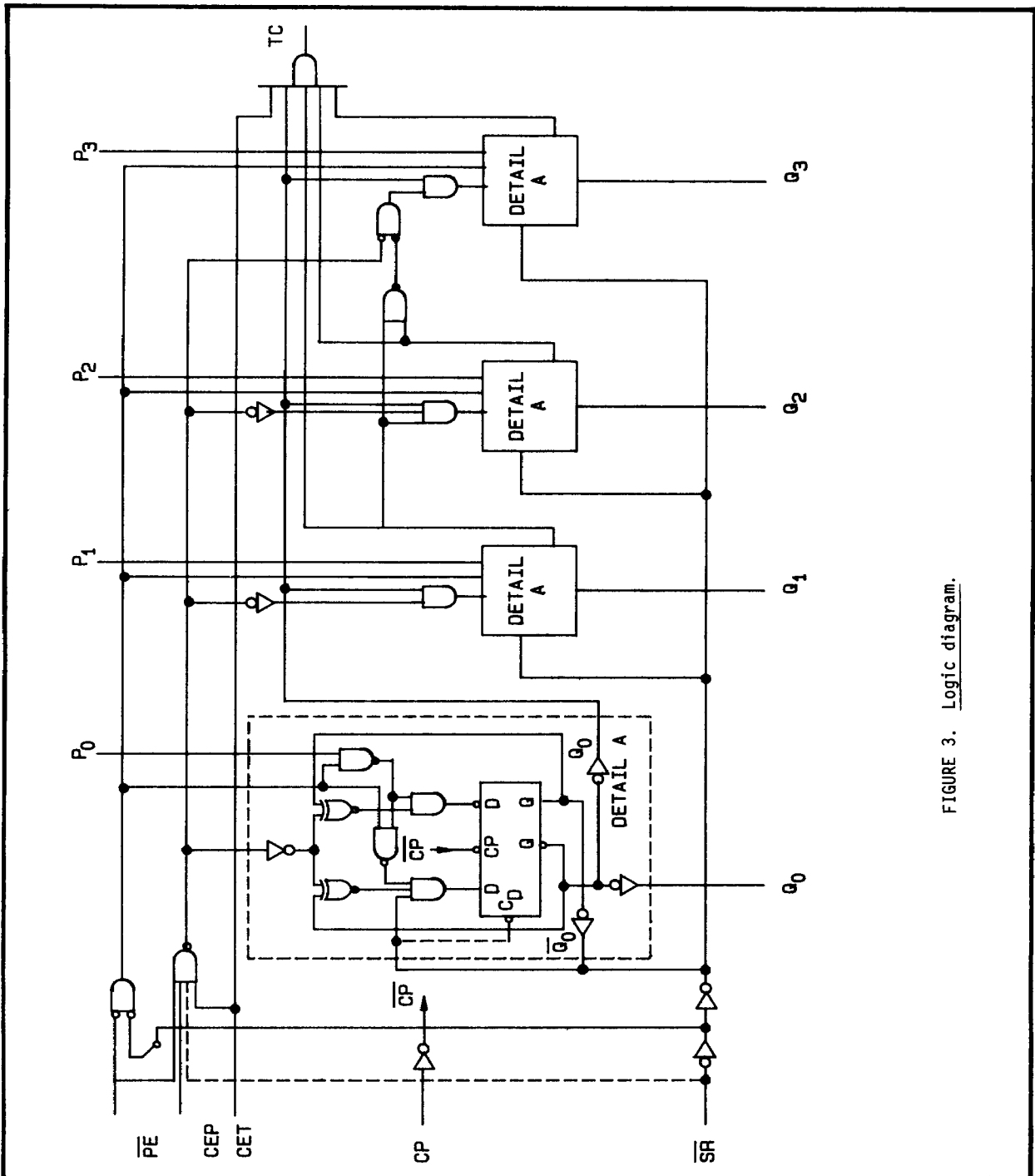


FIGURE 3. Logic diagram.

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Sequence illustrated in waveforms:

1. Reset outputs to zero.
2. Preset to binary twelve.
3. Count to thirteen, fourteen, fifteen, zero, one, and two.
4. Inhibit.

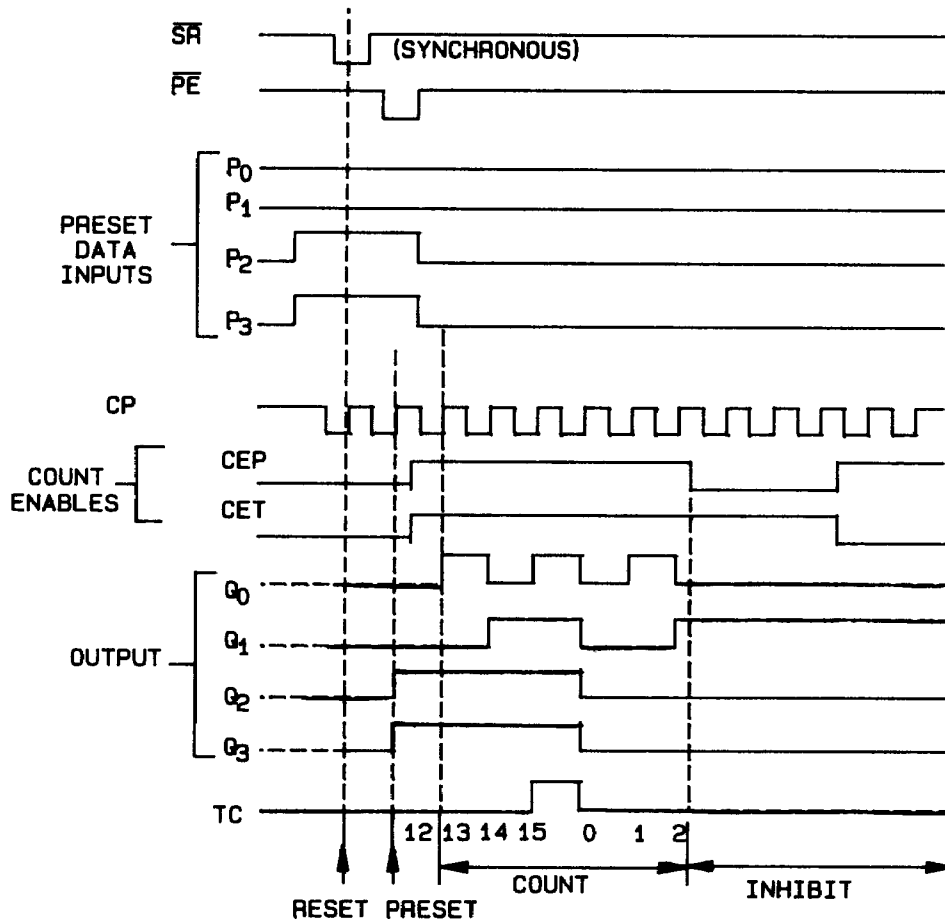
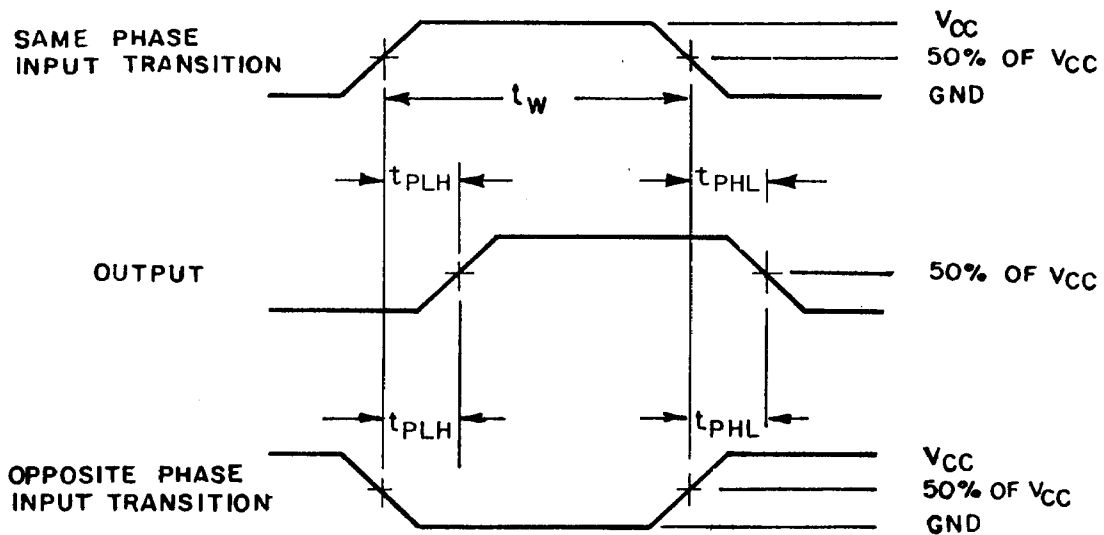
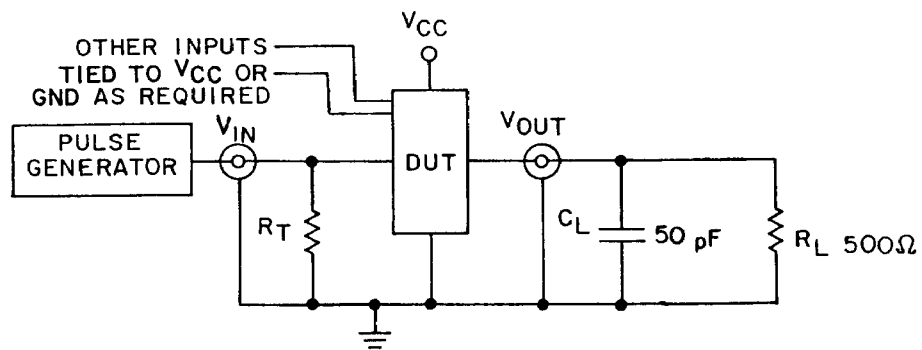


FIGURE 4. Counting sequence.

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- NOTES:
1. C_L includes probe and jig capacitance.
 2. R_T should be equal to Z_{OUT} of the pulse generator.
 3. Input characteristics: $t_r = t_f = 3.0$ ns (10% to 90%) unless otherwise specified. Duty cycle = 50%, PRR = 1 MHz.

FIGURE 5. Test circuit and switching waveforms.

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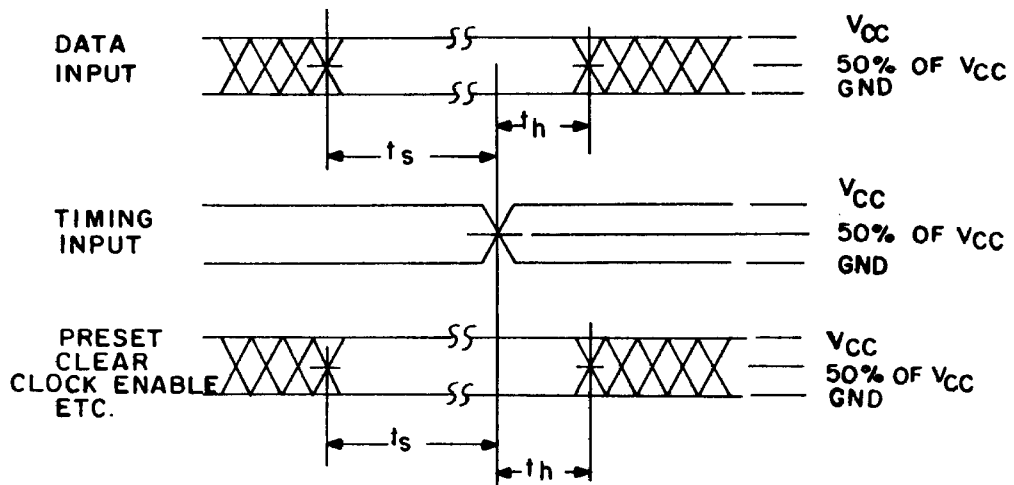


FIGURE 5. Test circuit and switching waveforms - Continued.

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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)	---
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

*PDA applies to subgroup 1.

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 5 and 6 in table I, method 5005 of MIL-STD-883 shall be omitted.
- c. Subgroup 4 (C_{IN} and C_{PD} measurements) shall be measured only for the initial test and after process or design changes which may affect capacitance. Test all applicable pins on five devices with zero failures.
- d. Subgroup 7 and 8 tests shall verify the truth table as specified on figure 2.

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 A, B, C, or D 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.

5. PACKAGING

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

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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.

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>
5962-8958201EX	27014	54AC163DMQB
5962-8958201FX	27014	54AC163FMQB
5962-89582012X	27014	54AC163LMQB

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

Vendor CAGE number

27014

Vendor name and address

National Semiconductor
333 Western Avenue
South Portland, ME 04106

STANDARDIZED MILITARY DRAWING DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE A		5962-89582
		REVISION LEVEL	SHEET 17

DESC FORM 193A
SEP 87

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