



## 1. SCOPE

1.1 Scope. This drawing describes the requirements for monolithic silicon, low power Schottky TTL, counter microcircuits. This drawing provides a level of microcircuit quality and reliability assurance for acquisition of microcircuits in accordance with MIL-M-38510.

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

76035	01	E	X
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Drawing number	Device type (1.2.1)	Case outline (1.2.2)	Lead finish (3.3)

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

Device type	Generic number	Circuit
01	54LS190	Synchronous 4 bit BCD counter with mode control

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, 1/4" x 7/8"), dual-in-line package
F	F-5 (16-lead, 1/4" x 3/8"), flat package
2	C-2 (20-terminal .350" x .350"), square chip carrier package

## 1.3 Absolute maximum ratings.

Supply voltage range - - - - -	-0.5 to 7.0 V dc
Input voltage range - - - - -	-1.5 V dc at -18 mA to 5.5 V dc
Storage temperature range - - - - -	-65°C to +150°C
Maximum power dissipation ( $P_D$ ) 1/ - - - - -	190 mW
Lead temperature (soldering, 10 seconds) - - - - -	+300°C
Thermal resistance, junction-to-case ( $\theta_{JC}$ ) - - - - -	See MIL-M-38510, appendix C
Junction temperature ( $T_J$ ) - - - - -	+175°C

## 1.4 Recommended operating conditions.

Supply voltage ( $V_{CC}$ ) - - - - -	4.5 V dc minimum to 5.5 V dc maximum
Minimum high level input voltage ( $V_{IH}$ ) - - - - -	2.0 V dc
Maximum low level input voltage ( $V_{IL}$ ) - - - - -	0.7 V dc
Case operating temperature range ( $T_C$ ) - - - - -	-55°C to +125°C

1/ Must withstand the added  $P_D$  due to short circuit test (e.g.,  $I_{OS}$ ).

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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 Logic diagram. The logic diagram shall be as specified on figure 2.

3.2.3 Truth table. The truth table 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 recommended 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.

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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.

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)  $T_A = +125^{\circ}\text{C}$ , 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, 6, and 8 in table I, method 5005 of MIL-STD-883 shall be omitted.

c. Subgroup 7 tests shall verify the truth table.

##### 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 (method 1005 of MIL-STD-883) conditions:

(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 appendix B of MIL-M-38510 and method 1005 of MIL-STD-883.

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TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions -55°C < T <sub>C</sub> < +125°C unless otherwise specified	Group A subgroups	Limits		Unit
				Min	Max	
High-level output voltage	V <sub>OH</sub>	V <sub>CC</sub> = 4.5 V; I <sub>OH</sub> = -400 μA V <sub>IN</sub> = 0.7 V or 2.0 V	1, 2, 3	2.5		V
Low-level output voltage	V <sub>OL</sub>	V <sub>CC</sub> = 4.5 V; I <sub>OL</sub> = 4 mA V <sub>IN</sub> = 0.7 V or 2.0 V	1, 2, 3		0.4	V
Input clamp voltage	V <sub>IC</sub>	V <sub>CC</sub> = 4.5 V; I <sub>IN</sub> = -18 mA T <sub>C</sub> = +25°C	1		-1.5	V
High level input current at all inputs except enable	I <sub>IH1</sub>	V <sub>CC</sub> = 5.5 V; V <sub>IN</sub> = 2.7 V	1, 2, 3		20	μA
	I <sub>IH2</sub>	V <sub>CC</sub> = 5.5 V; V <sub>IN</sub> = 5.5 V	1, 2, 3		100	μA
High level input current at enable	I <sub>IH3</sub>	V <sub>CC</sub> = 5.5 V; V <sub>IN</sub> = 2.7 V	1, 2, 3		60	μA
	I <sub>IH4</sub>	V <sub>CC</sub> = 5.5 V; V <sub>IN</sub> = 5.5 V	1, 2, 3		300	μA
Low level input current at inputs except enable	I <sub>IL1</sub>	V <sub>CC</sub> = 5.5 V; V <sub>IN</sub> = 0.4 V	1, 2, 3		-0.40	mA
Low level input current at enable	I <sub>IL2</sub>	V <sub>CC</sub> = 5.5 V; V <sub>IN</sub> = 0.4 V	1, 2, 3		-1.2	mA
Short circuit output current	I <sub>OS</sub>	V <sub>CC</sub> = 5.5 V <u>1/</u>	1, 2, 3	-15	-130	mA
Current supply	I <sub>CC</sub>	V <sub>CC</sub> = 5.5 V	1, 2, 3		35	mA
Functional tests		See 4.3.1c	7			
Maximum clock frequency  <u>2/</u>	F <sub>MAX</sub>	V <sub>CC</sub> = 5.0 V R <sub>L</sub> = 2 kΩ ±5%	C <sub>L</sub> = 15 pF ±10%	9	20	MHz
				10, 11	15	MHz
			C <sub>L</sub> = 50 pF ±10%	9	15	MHz
				10, 11	10	MHz

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C < T <sub>C</sub> < +125°C unless otherwise specified	Group A subgroups	Limits		Unit
				Min	Max	
Propagation delay time, high-to-low level output from load to Q outputs  2/	t <sub>PHL1</sub>	V <sub>CC</sub> = 5.0 V R <sub>L</sub> = 2 kΩ ±5% See figure 4	C <sub>L</sub> = 15 pF ±10%	9	50	ns
				10, 11	70	ns
			C <sub>L</sub> = 50 pF ±10%	9	55	ns
				10, 11	77	ns
			C <sub>L</sub> = 15 pF ±10%	9	33	ns
				10, 11	46	ns
Propagation delay time, low-to-high level output from load to Q outputs  2/	t <sub>PLH1</sub>		C <sub>L</sub> = 50 pF ±10%	9	38	ns
				10, 11	53	ns
			C <sub>L</sub> = 15 pF ±10%	9	40	ns
				10, 11	56	ns
			C <sub>L</sub> = 50 pF ±10%	9	45	ns
				10, 11	63	ns
Propagation delay time, high-to-low level output from data to Q outputs  2/	t <sub>PHL2</sub>		C <sub>L</sub> = 15 pF ±10%	9	32	ns
				10, 11	45	ns
			C <sub>L</sub> = 50 pF ±10%	9	37	ns
				10, 11	52	ns
			C <sub>L</sub> = 15 pF ±10%	9	32	ns
				10, 11	45	ns

See footnotes at end of table.

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TABLE 1. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C < T <sub>C</sub> < +125°C unless otherwise specified	Group A subgroups	Limits		Unit
				Min	Max	
Propagation delay time, high-to-low level output from clock to ripple clock  2/	t <sub>PHL3</sub>	V <sub>CC</sub> = 5.0 V R <sub>L</sub> = 2 kΩ ±5% See figure 4	C <sub>L</sub> = 15 pF ±10%	9	24	ns
				10, 11	34	ns
			C <sub>L</sub> = 50 pF ±10%	9	29	ns
				10, 11	41	ns
Propagation delay time, low-to-high level output from clock to ripple clock  2/	t <sub>PLH3</sub>		C <sub>L</sub> = 15 pF ±10%	9	20	ns
				10, 11	28	ns
			C <sub>L</sub> = 50 pF ±10%	9	25	ns
				10, 11	35	ns
Propagation delay time, high-to-low level output from clock to Q outputs  2/	t <sub>PHL4</sub>		C <sub>L</sub> = 15 pF ±10%	9	36	ns
				10, 11	50	ns
			C <sub>L</sub> = 50 pF ±10%	9	41	ns
				10, 11	57	ns
Propagation delay time, low-to-high level output from clock to Q outputs  2/	t <sub>PLH4</sub>		C <sub>L</sub> = 15 pF ±10%	9	24	ns
				10, 11	34	ns
			C <sub>L</sub> = 50 pF ±10%	9	29	ns
				10, 11	41	ns

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C < T <sub>C</sub> < +125°C unless otherwise specified	Group A subgroups	Limits		Unit
				Min	Max	
Propagation delay time, high-to-low level output from clock to MAX/MIN  2/	t <sub>PHL5</sub>	V <sub>CC</sub> = 5.0 V R <sub>L</sub> = 2 kΩ ±5% See figure 4	C <sub>L</sub> = 15 pF ±10%	9	52	ns
				10, 11	73	ns
			C <sub>L</sub> = 50 pF ±10%	9	57	ns
				10, 11	80	ns
Propagation delay time, low-to-high level output from clock to MAX/MIN  2/	t <sub>PLH5</sub>		C <sub>L</sub> = 15 pF ±10%	9	42	ns
				10, 11	59	ns
			C <sub>L</sub> = 50 pF ±10%	9	47	ns
				10, 11	66	ns
Propagation delay time, high-to-low level output from down/up to ripple clock  2/	t <sub>PHL6</sub>		C <sub>L</sub> = 15 pF ±10%	9	45	ns
				10, 11	63	ns
			C <sub>L</sub> = 50 pF ±10%	9	50	ns
				10, 11	70	ns
Propagation delay time, low-to-high level output from down/up to ripple clock  2/	t <sub>PLH6</sub>		C <sub>L</sub> = 15 pF ±10%	9	45	ns
				10, 11	63	ns
			C <sub>L</sub> = 50 pF ±10%	9	50	ns
				10, 11	70	ns

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C < T <sub>C</sub> < +125°C unless otherwise specified	Group A subgroups	Limits		Unit
				Min	Max	
Propagation delay time, high-to-low level output from down/up to MAX/MIN  2/	t <sub>PHL7</sub>	V <sub>CC</sub> = 5.0 V R <sub>L</sub> = 2 kΩ ±5% See figure 4	C <sub>L</sub> = 15 pF ±10%	9	33	ns
				10, 11	46	ns
			C <sub>L</sub> = 50 pF ±10%	9	38	ns
				10, 11	53	ns
Propagation delay time, low-to-high level output from down/up to MAX/MIN  2/	t <sub>PLH7</sub>		C <sub>L</sub> = 15 pF ±10%	9	33	ns
				10, 11	46	ns
			C <sub>L</sub> = 50 pF ±10%	9	38	ns
				10, 11	53	ns
Propagation delay time, high-to-low level output from enable to ripple clock  2/	t <sub>PHL8</sub>		C <sub>L</sub> = 15 pF ±10%	9	33	ns
				10, 11	46	ns
			C <sub>L</sub> = 50 pF ±10%	9	38	ns
				10, 11	53	ns
Propagation delay time, low-to-high level output from enable to ripple clock  2/	t <sub>PLH8</sub>		C <sub>L</sub> = 15 pF ±10%	9	33	ns
				10, 11	46	ns
			C <sub>L</sub> = 50 pF ±10%	9	38	ns
				10, 11	53	ns

- 1/ Not more than one output should be shorted at a time, and the duration of the short circuit condition should not exceed 1 second.
- 2/ Propagation delay time testing and maximum clock frequency testing may be performed using either C<sub>L</sub> = 15 pF or C<sub>L</sub> = 50 pF. However, the manufacturer must certify and guarantee that the microcircuits meet the switching test limits specified for a 50 pF load.

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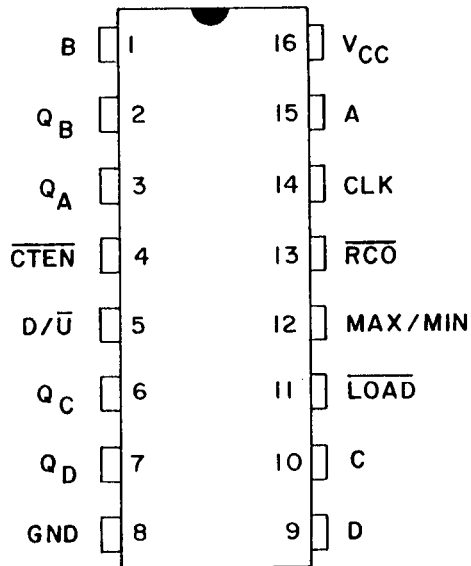
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Cases E and F



Case 2

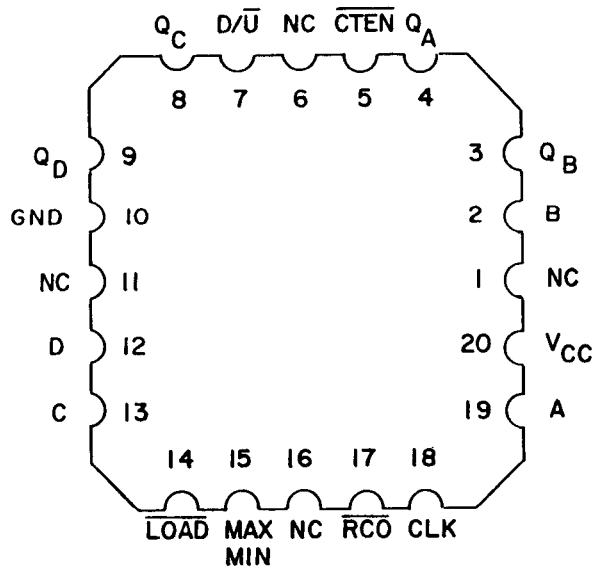


FIGURE 1. Terminal connections.

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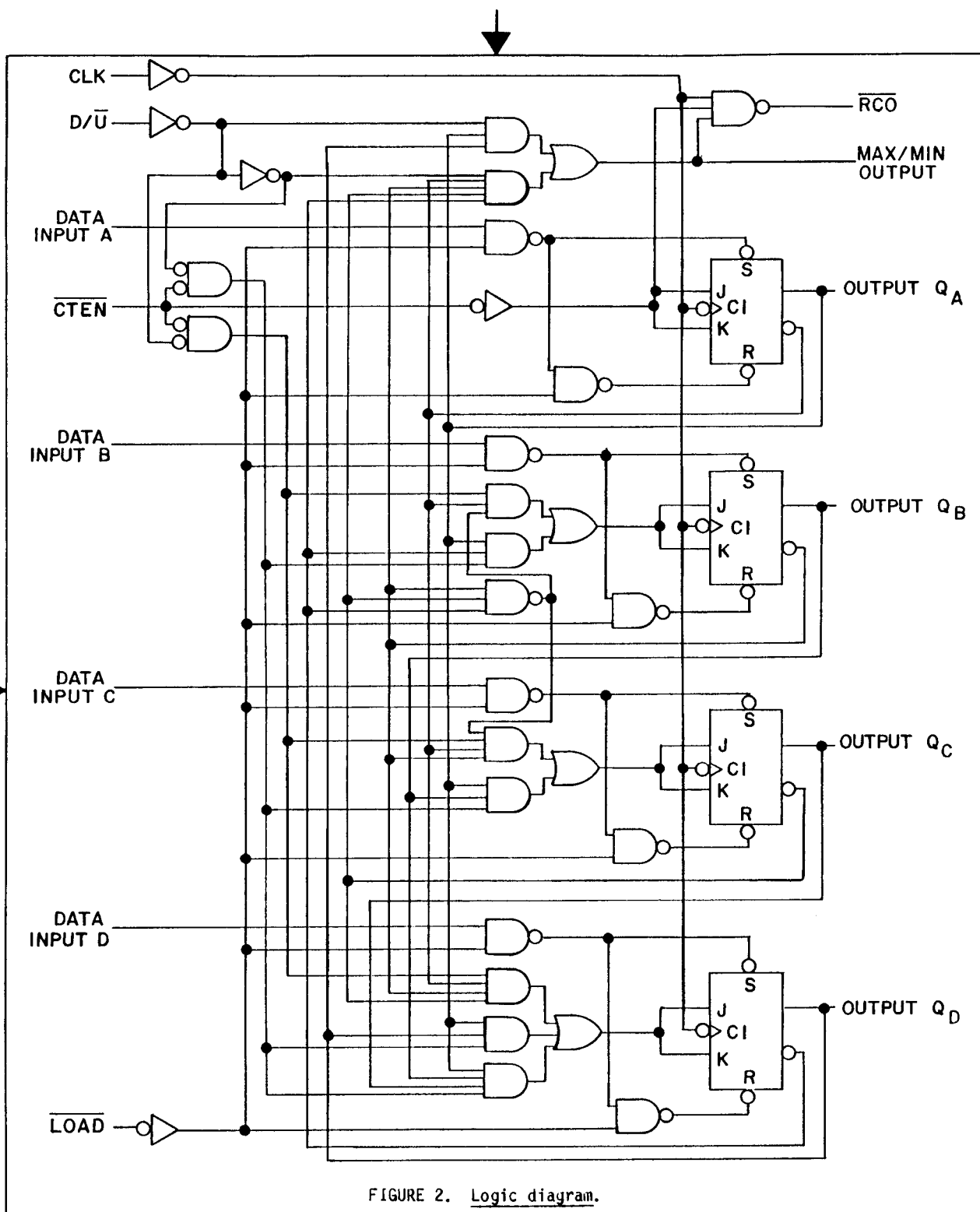


FIGURE 2. Logic diagram.

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Mode select table

Inputs				Mode
Load	Enable G	Down/ $\overline{\text{up}}$	CK	
H	L	L	$\lceil$	Count up
H	L	H	$\lceil$	Count down
L	X	X	X	Preset (asyn)
H	H	X	X	No change (hold)

RC truth table

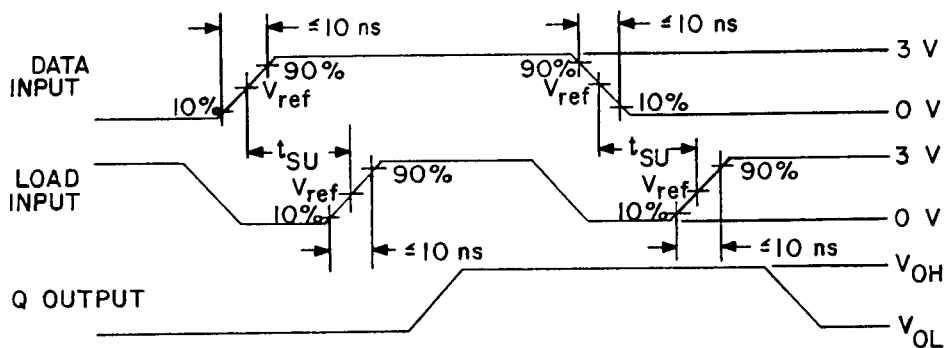
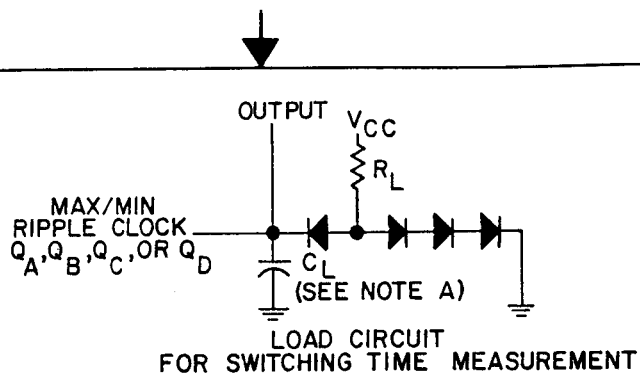
Inputs		Outputs	
Enable G	CK	Max/min	Ripple clock outputs
L	$\lceil$	H	$\lceil$
H	X	X	H
X	X	L	H

Max/min is generated internally.

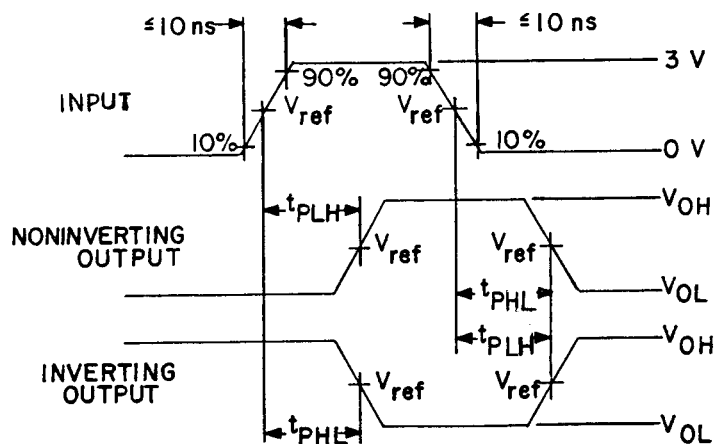
L = LOW voltage level  
 H = HIGH voltage level  
 X = Don't care  
 $\lceil$  = LOW-to-HIGH clock transition  
 $\lceil$  = LOW pulse

FIGURE 3. Truth table.

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DATA SETUP TIME VOLTAGE WAVEFORMS



GENERAL VOLTAGE WAVEFORMS FOR PROPAGATION TIMES

NOTE:  $C_L$  includes probe and jig capacitance.

$V_{REF} = 1.3 \text{ V.}$

FIGURE 4. Waveforms.

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# Typical load, count, and inhibit sequences

Illustrated below is the following sequence:

1. Load (preset) to BCD seven.
2. Count up to eight, nine (maximum), zero, one, and two.
3. Inhibit.
4. Count down to one, zero (minimum), nine, eight, and seven.

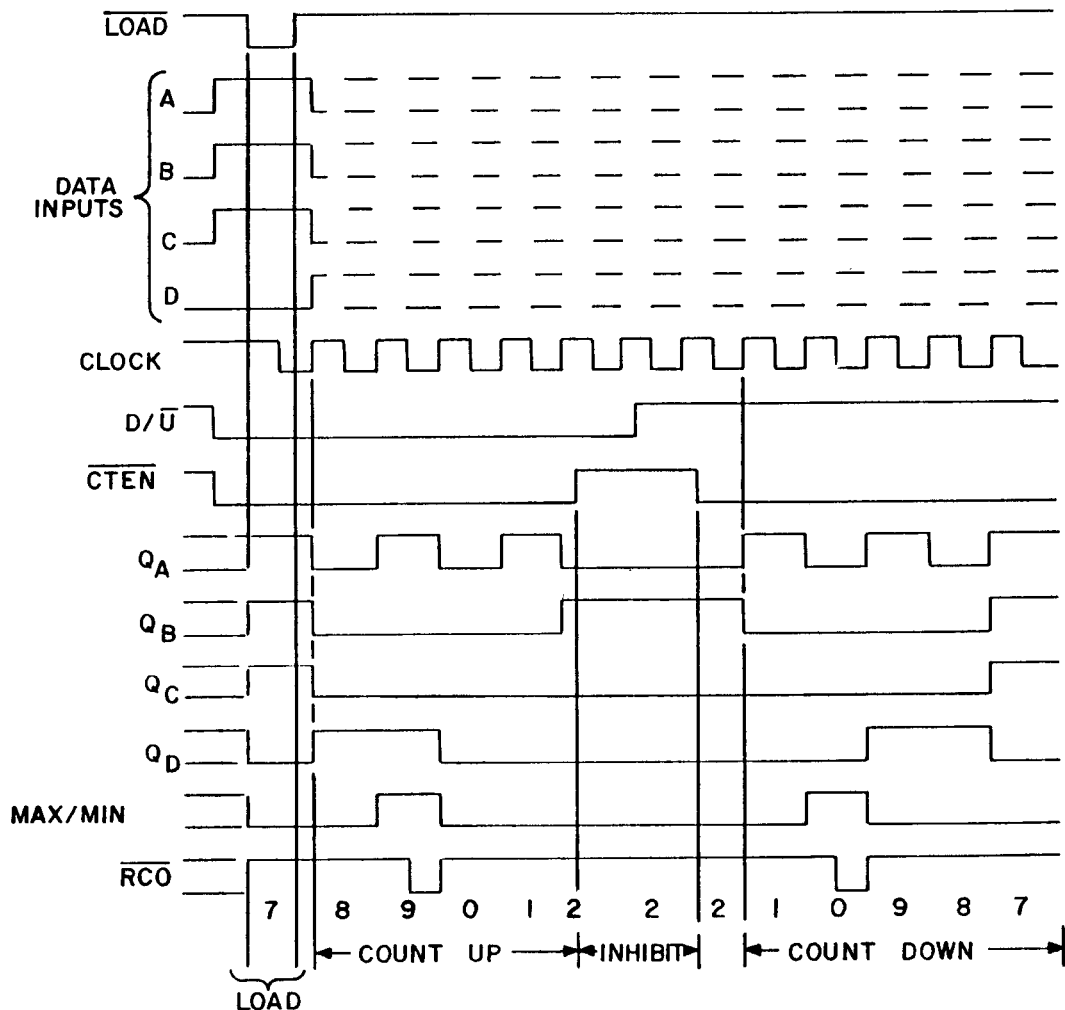


FIGURE 4. Waveforms - Continued.

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

\* PDA applies to subgroup 1.

## 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. Replaceability is determined as follows:

- Microcircuits covered by this drawing will replace the same generic device covered by a contractor-prepared specification or drawing.
- When a QPL source is established, the part numbered device specified in this drawing will be replaced by the microcircuit identified as part number M38510/31513B--.

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 sources of supply. Approved sources of supply are listed herein. Additional sources will be added as they become available. The vendors listed herein have 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>	Replacement military specification part number
7603501EX <u>2/</u>	04713 01295	54LS190/BEAJC SNJ54LS190J	M38510/31513BEX
7603501FX <u>2/</u>	04713 01295	54LS190/BFAJC SNJ54LS190W	M38510/31513BFX
76035012X <u>2/</u>	04713 01295	54LS190M/B2AJC SNJ54LS190FK	M38510/31513B2X

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

2/ Device 01 inactive for new design, use QPL product M38510/31513B--.

Vendor CAGE  
number

01295

04713

Vendor name  
and address

Texas Instruments, Incorporated  
P. O. Box 6448  
Midland, TX 79701

Motorola, Incorporated  
7402 South Price Road  
Tempe, AZ 85283

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