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Defense Electronics Supply Center Dayton, Ohio	PREPARED BY Greg A. Pitz	**MILITARY DRAWING** This drawing is available for use by all Departments and Agencies of the Department of Defense
	CHECKED BY Da Di Cenzo	
Original date of drawing: 12 May 1987	APPROVED BY M. A. Frye	TITLE: MICROCIRCUITS, DIGITAL, HIGH-SPEED CMOS, MULTIVABRATOR, DUAL MONOLITHIC SILICON
	SIZE A / CODE IDENT. NO. 14933	DWG NO. 5962-86886
AMSC N/A	REV	PAGE 1 OF 15

5962-E181-4

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

DESC FORM 193
MAY 86

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:

5962-86886	01	E	X
Drawing number	Device type (1.2.1)	Case outline (1.2.2)	Lead finish per MIL-M-38510

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

Device type	Generic number	Circuit function
01	54HC4538	Dual retriggerable precision monostable multivibrator

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 3/4"), dual-in-line package
2	C-2 (20-terminal, .350" x .350"), square chip carrier package

1.3 Absolute maximum ratings. 1/

Supply voltage range	-0.5 V dc to +7.0 V dc
DC input diode current 2/	±20 mA
DC output diode current 3/	±20 mA
DC drain current (per output) 3/	±25 mA
DC V_{CC} or ground current	±50 mA
Maximum power dissipation (P_D)	500 mW 4/
Lead temperature (soldering, 10 seconds)	+260°C
Thermal resistance, junction-to-case (θ_{JC}):	
Case E	See MIL-M-38510, appendix C
Case 2	60°C/W 5/
Junction temperature	+175°C
Storage temperature range	-65°C to +150°C

1/ Unless otherwise specified, all voltages are referenced to ground.
2/ For V_I less than -0.5 V or V_I greater than V_{CC} +0.5 V.
3/ For -0.5 V less than V_O less than V_{CC} +0.5 V.
4/ For T_C = +100°C to +125°C, derate linearly at 12 mW/°C.
5/ When a thermal resistance for this case is specified in MIL-M-38510, appendix C, that value shall supersede the value indicated herein.

1.4 Recommended operating conditions.

Supply voltage	+2.0 V dc to +6.0 V dc
Case operating temperature range (T_C)	-55°C to +125°C
Input rise or fall time:	
V_{CC} = 2.0 V	0 to 1,000 ns
V_{CC} = 4.5 V	0 to 500 ns
V_{CC} = 6.0 V	0 to 400 ns
Minimum input pulse widths A, B (t_{WH}) or R (t_{WL}):	
T_C = +25°C:	
V_{CC} = 2.0 V	80 ns
V_{CC} = 4.5 V	16 ns
V_{CC} = 6.0 V	14 ns
T_C = -55°C, +125°C:	
V_{CC} = 2.0 V	120 ns
V_{CC} = 4.5 V	24 ns
V_{CC} = 6.0 V	20 ns
Minimum reset recovery time (t_{REC}):	
T_C = +25°C:	
V_{CC} = 2.0 V	5 ns
V_{CC} = 4.5 V	5 ns
V_{CC} = 6.0 V	5 ns
T_C = -55°C, +125°C:	
V_{CC} = 2.0 V	5 ns
V_{CC} = 4.5 V	5 ns
V_{CC} = 6.0 V	5 ns

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 Functional diagram. The functional diagram shall be as specified on figure 4.

3.2.5 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.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$ (unless otherwise specified)		Group A subgroups	Limits Min	Limits Max	Unit
High level output voltage	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_O \rvert \le 20\ \mu A$	$V_{CC} = 2.0$ V	1, 2, 3	1.9		V
			$V_{CC} = 4.5$ V		4.4		
			$V_{CC} = 6.0$ V		5.9		
		$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_O \rvert \le 4.0$ mA	$V_{CC} = 4.5$ V		3.7		
		$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_O \rvert \le 5.2$ mA	$V_{CC} = 6.0$ V		5.2		
Low level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_{OL} \rvert \le 20\ \mu A$	$V_{CC} = 2.0$ V			0.1	V
			$V_{CC} = 4.5$ V			0.1	
			$V_{CC} = 6.0$ V			0.1	
		$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_O \rvert \le 4.0$ mA	$V_{CC} = 4.5$ V			0.4	
		$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_O \rvert \le 5.2$ mA	$V_{CC} = 6.0$ V			0.4	

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)		Group A subgroups	Limits Min	Limits Max	Unit
High level input voltage 2/	V_{IH}		V_{CC} = 2.0 V		1.5		V
			V_{CC} = 4.5 V		3.15		
			V_{CC} = 6.0 V		4.2		
Low level input voltage 2/	V_{IL}		V_{CC} = 2.0 V			0.3	V
			V_{CC} = 4.5 V			0.9	
			V_{CC} = 6.0 V			1.2	
Input capacitance	C_{IN}	V_{IN} = 0 V, T_C = +25°C see 4.3.1c		4		10	pF
		V_{IN} = 0 V, T_C = +25°C, R/C_{EXT} (pins 2 and 14), see 4.3.1c				25	
Quiescent current (standby)	I_{CC1}	V_{IN} = V_{CC} or GND, V_{CC} = 6.0 V I_O = 0 µA		1		150	µA
				2, 3		400	
Active supply current (per monostable)	I_{CC2}	V_{IN} = V_{CC} or GND, V_{CC} = 6.0 V R/C_{EXT} = 0.5 V_{CC} or 0.25 V_{CC} I_O = 0 µA, Q outputs high		1		0.6	mA
				2, 3		1.0	
Input leakage current 3/	I_{IN1}	V_{IN} = V_{CC} or GND V_{CC} = 6.0 V		1		±0.1	µA
				2, 3		±1	
	I_{IN2}	R_X, C_X V_{IN} = V_{CC} or GND V_{CC} = 6.0 V Q outputs high		1		±0.5	
				2, 3		±10	
Functional tests		See 4.3.1d		7			

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55°C \le T_C \le +125°C$ (unless otherwise specified) 1/		Group A subgroups	Limits Min	Limits Max	Unit
Propagation delay, time A, $\overline{B}$ to Q or ($\overline{R}$ to $\overline{Q}$) 4/	t_{PLH1},	C_L = 50 pF see figure 5	V_{CC} = 2.0 V	9		275	ns
				10,11		415	
			V_{CC} = 4.5 V	9		55	
				10,11		83	
			V_{CC} = 6.0 V	9		47	
				10,11		71	
Propogation delay time (A, $\overline{B}$ to $\overline{Q}$) 4/	t_{PHL1}	C_L = 50 pF see figure 5	V_{CC} = 2.0 V	9		275	ns
				10,11		415	
			V_{CC} = 4.5 V	9		55	
				10,11		83	
			V_{CC} = 6.0 V	9		47	
				10,11		71	
Propagation delay time ($\overline{R}$ to Q) 4/	t_{PHL2}	C_L = 50 pF see figure 5	V_{CC} = 2.0 V	9		275	ns
				10,11		415	
			V_{CC} = 4.5 V	9		55	
				10,11		83	
			V_{CC} = 6.0 V	9		47	
				10,11		71	
Output transition time 5/	t_{TLH}, t_{THL}	C_L = 50 pF see figure 5	V_{CC} = 2.0 V	9		75	ns
				10,11		110	
			V_{CC} = 4.5 V	9		15	
				10,11		22	
			V_{CC} = 6.0 V	9		13	
				10,11		19	

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$ (unless otherwise specified)		Group A subgroups	Limits Min	Limits Max	Unit
Output pulse width 6/	t_{WQ}	R_X = 10Ω, C_X = 0.1 µF	V_{CC} = 3.0 V	9	0.64	0.78	µs
				10, 11	.605	.819	
			V_{CC} = 5.0 V	9	.63	.77	
				10, 11	.595	.805	

1/ For a power supply of 5.0 V ±10% the worst case output voltage (V_{OH} and V_{OL}) occur for HC at 4.5 V. Thus, the 4.5 V values should be used when designing with this supply. Worst case V_{IN} and V_{IL} occur at V_{CC} = 5.5 V and 4.5 V, respectively. (The V_{IH} value at 5.5 V is 3.85 V.) The worst case leakage current (I_{IN}, I_{CC}, and I_{OZ}) occur for CMOS at the higher voltage so the 6.0 V values should be used. Power dissipation capacitance (C_{PD}), typically 150 pF, determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.
2/ Test not required if applied as a forcing function for V_{OH} or V_{OL}.
3/ Parameter I_{IN2} shall be guaranteed if not tested.
4/ AC testing at V_{CC} = 2.0 V and V_{CC} = 6.0 V shall be guaranteed, if not tested, to the specified parameters.
5/ Transition times (t_{TLH}, t_{THL}) shall be guaranteed, if not tested, to the specified limits.
6/ Output pulse width at V_{CC} = 3.0 V shall be guaranteed, if not tested, to the specified parameters.

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°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 5, 6, and 8 in table I, method 5005 of MIL-STD-883 shall be omitted.

c. Subgroup 4 (C_{IN} measurements) shall be measured only for the initial test and after process or design changes which may affect input capacitance.

d. Subgroup 7 tests sufficient to verify the function 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°C, minimum.

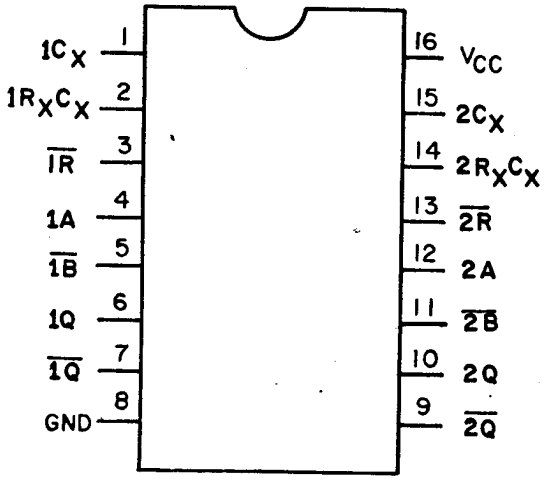
(3) Test duration: 1,000 hours, except as permitted by appendix B of MIL-M-38510 and method 1005 of MIL-STD-883.

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, 9
Group A test requirements (method 5005)	1, 2, 3, 4, 7, 9, 10, 11 **
Groups C and D end-point electrical parameters (method 5005)	1, 2, 3
Additional electrical subgroups for group C periodic inspections	---

* PDA applies to subgroup 1.
** Subgroups 10 and 11, if not tested, shall be guaranteed to the specified limits in table I.

Case E



Case 2

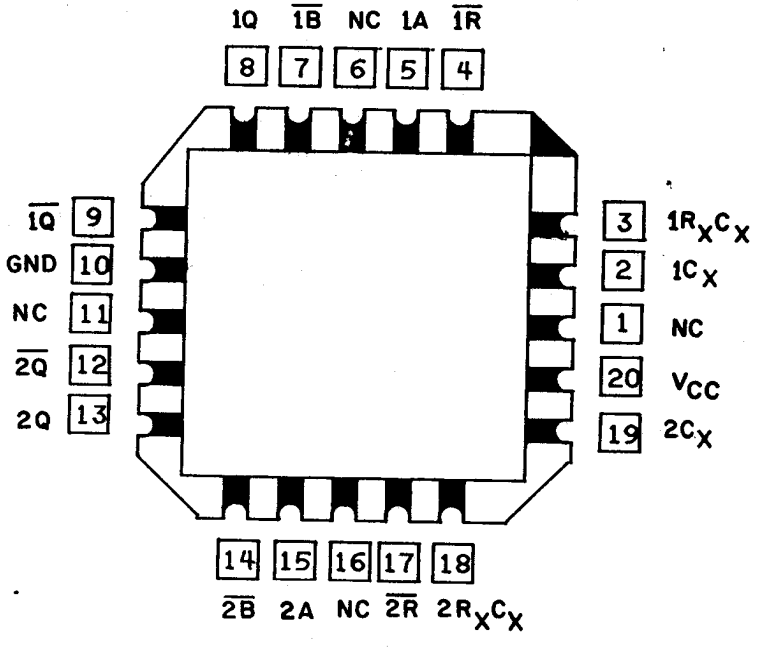


FIGURE 1. Terminal connections (top view).

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Inputs			Outputs	
$\overline{R}$	A	$\overline{B}$	Q	$\overline{Q}$
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	↘	⊓	⊔
H	↗	H	⊓	⊔

H = High level
L = Low level
↗ = Transition from low to high
↘ = Transition from high to low
⊓ = One high level pulse
⊔ = One low level pulse
X = Irrelevant

FIGURE 2. Truth table.

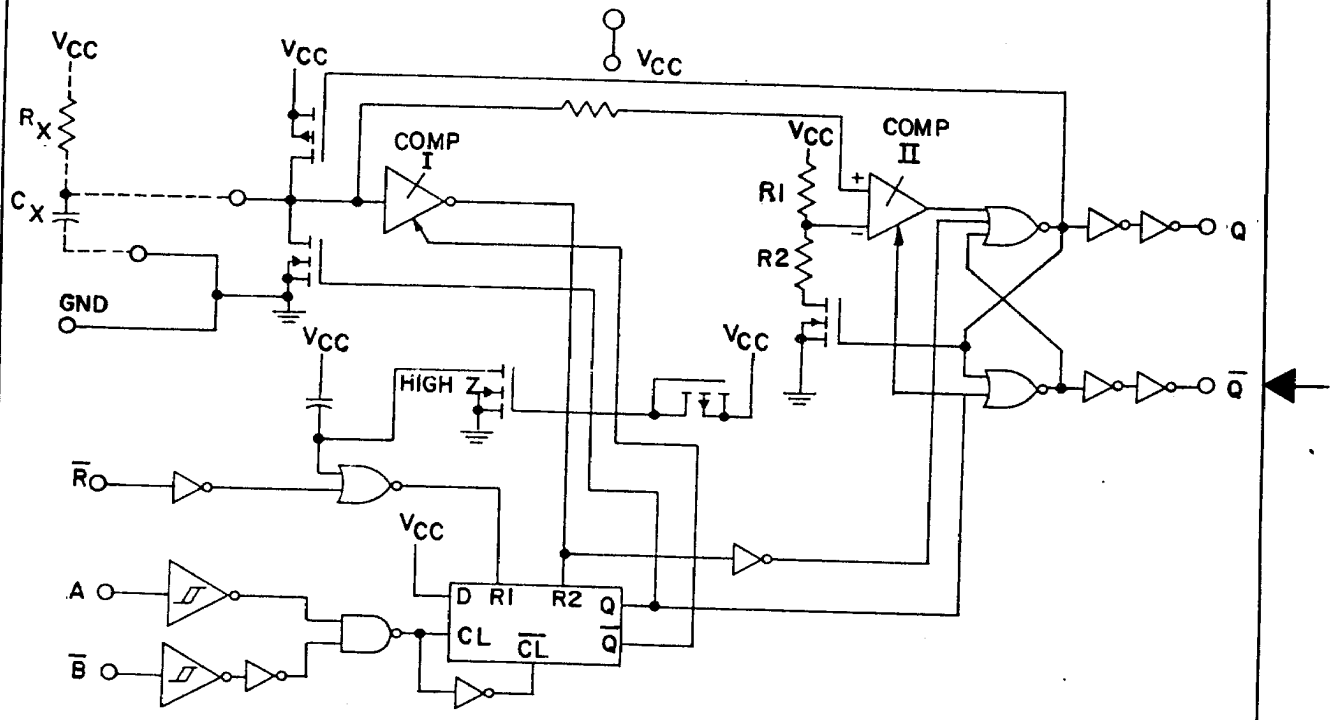

FIGURE 3. Logic diagram.

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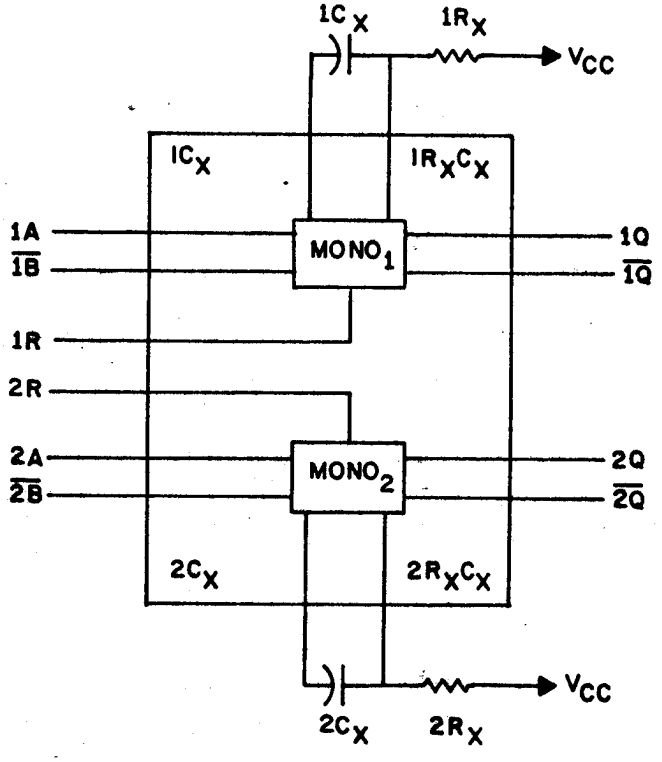

FIGURE 4. Functional diagram and table.

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Functional terminal connections (case E)								
Function	V_{CC} to terminal number		GND to terminal number		Input pulse to terminal number		Other Connections	
	$MONO_1$	$MONO_2$	$MONO_1$	$MONO_2$	$MONO_1$	$MONO_2$	$MONO_1$	$MONO_2$
Leading-edge trigger/ Retriggerable	3, 5	11, 13			4	12		
Leading-edge trigger/ Non-retriggerable	3	13			4	12	5-7	11-9
Trailing-edge trigger/ Retriggerable	3	13	4	12	5	11		
Trailing-edge trigger/ Non-retriggerable	3	13			5	11	4-6	12-10

NOTES:
1. A retriggerable one-shot multivibrator has an output pulse width which is extended one full time period (T) after application of the last trigger pulse.
2. A non-retriggerable one-shot multivibrator has a time period (T) referenced from the application of the first trigger pulse.

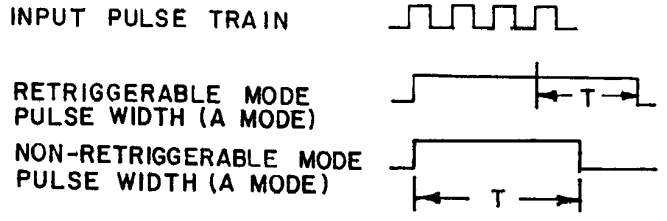

FIGURE 4. Functional diagram and table - Continued.

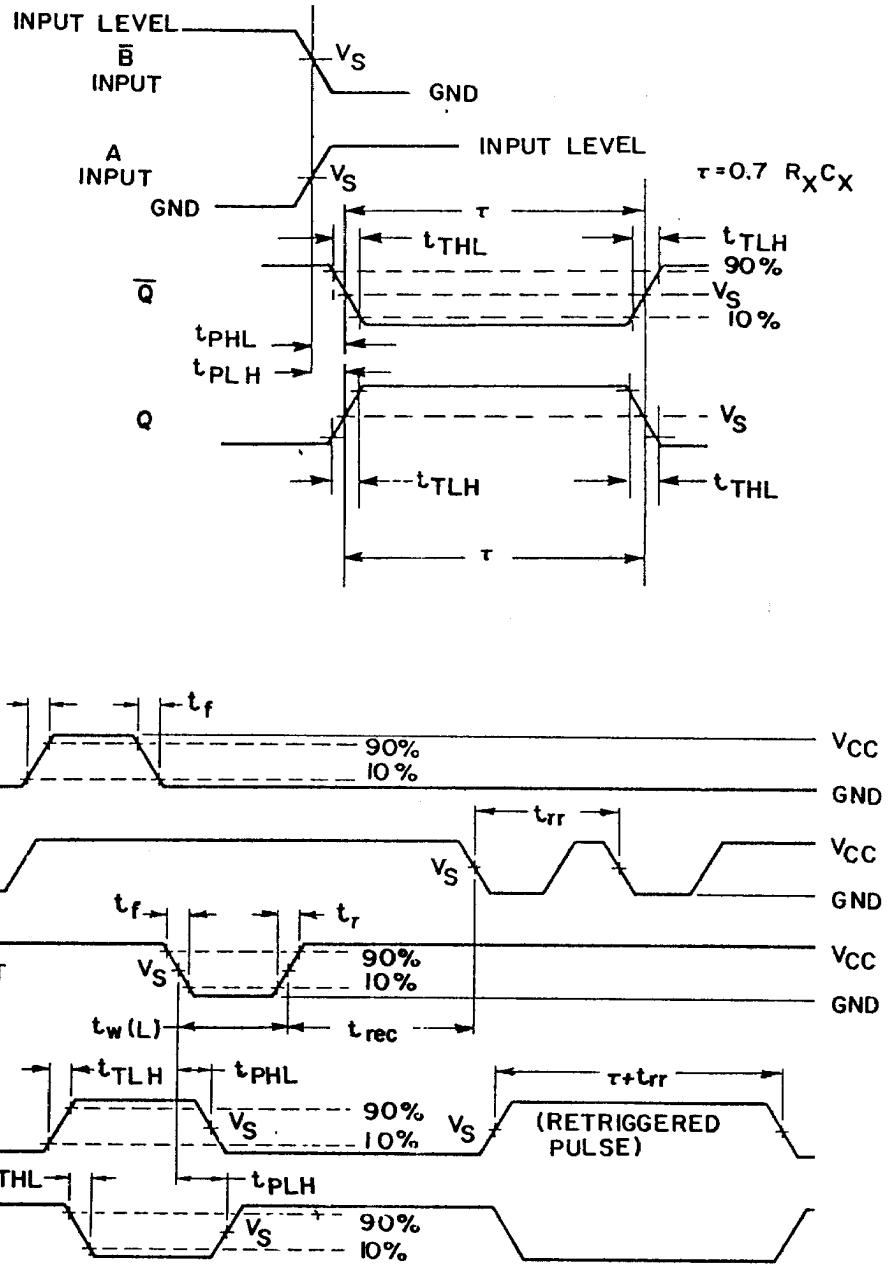

FIGURE 5. Switching waveforms.

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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.

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 1/
5962-8688601EX	04713 18714 27014	54HC4538/BEAJC CD54HC4538F/3A MM54HC4538J/883
5962-86886012X	04713 27014	54HC4538M/B2CJC MM54HC4538E/883

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	Vendor name and address
04713	Motorola, Incorporated 7402 S. Price Road Tempe, AZ 85283
27014	National Semiconductor 2900 Semiconductor Dr. Santa Clara, CA 95052-8090
18714	RCA Corporation Route 202 Somerville, NJ 08876