



4N54 Hermetic Hexadecimal Display With Logic

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T-41-37

DESCRIPTION

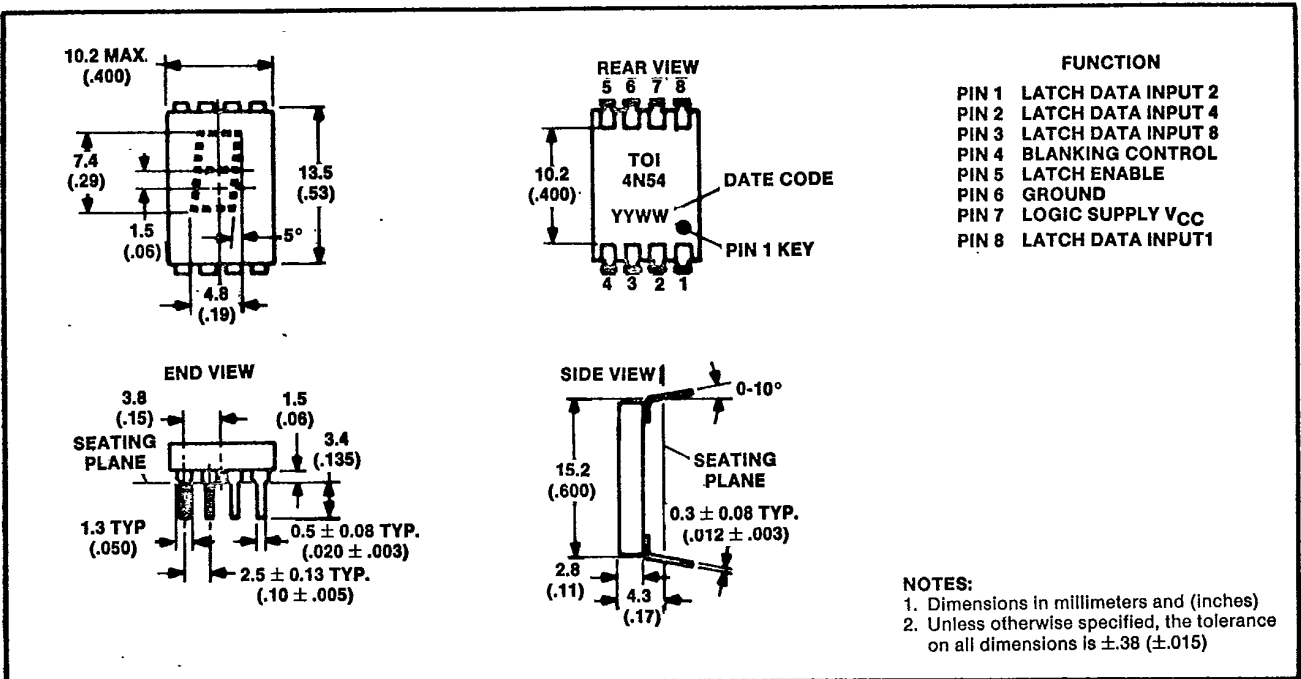
A hermetically sealed solid-state hexadecimal display with on-board memory latch, decoder and driver. The 4N54 decodes positive 8421 BCD logic inputs and displays the appropriate hexadecimal character 0-9 or A-F. A blanking input is provided for blanking the display (all LED's off), without losing the contents of the memory.

FEATURES

- Available with quality conformance inspection in accordance with MIL-D-87157 quality level A
- Specially screened TXV and TXVB versions available
- 7.4 mm (0.29 inch) character height
- Hermetically sealed
- Wide viewing angle
- Gold plated leads
- Categorized for luminous intensity
- Internal TTL MSI chip with latch, decoder and driver
- Withstands severe environment conditions
- 4 x 7 dot matrix character
- Designed for use in military and aerospace applications

MECHANICAL DATA*

The display and TTL MSI chip are mounted on a ceramic header, which is then hermetically sealed to a glass window. Multiple displays may be mounted on 10.45 mm (.410) centers.



*JEDEC Registered Data.

ABSOLUTE MAXIMUM RATINGS*

DESCRIPTION	MIN	MAX	UNIT
Storage Temperature Ambient	-65	+125	°C
Operating Temperature Ambient (2)	-55	+100	°C
Supply Voltage, V _{CC} (1)	-0.5	+7.0	V
Input Voltage (Pins 1, 2, 3, 4, 5, 8)	-0.5	V _{CC}	V
Maximum Solder Temperature @ .062 in Below Seating Plane. t ≤ 5 Seconds		260	°C

Note 1: Voltage values are with respect to common ground pin 6.

RECOMMENDED OPERATING CONDITIONS*

DESCRIPTION	MIN	NOM	MAX	UNIT
Supply Voltage, V _{CC}	4.5	5.0	5.5	V
Operating Temperature, Ambient, T _A (2)	-55		+100	°C
Enable Pulse Width, t _w	100			ns
Data Setup Time Before Latch Strobe Goes High, t _{SETUP}	50			ns
Data Hold Time After Latch Strobe Goes High, t _{HOLD}	50			ns
Enable Pulse Rise Time, t _{TLH}			200	ns

ELECTRICAL/OPTICAL OPERATING CHARACTERISTICS*
(T_A = - 55°C to +100°C, unless otherwise specified)

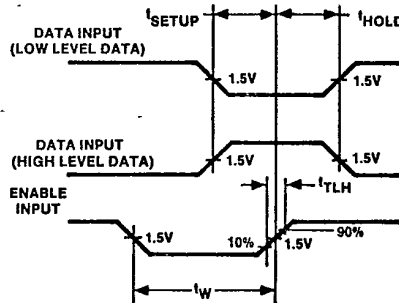
DESCRIPTION	TEST CONDITION	MIN	TYP	MAX	UNIT	
Supply Current, I _{CC}	V _{CC} = 5.5 V, Numeral 5 Lighted		112	170	mA	
Power Dissipation, P _T	V _{CC} = 5.5 V, Numeral 5 Lighted		560	935	mW	
Luminous Intensity Per LED, I _v	V _{CC} = 5.0 V, T _A = 25°C	40	85		μcd	
Logic Low-Level Input Voltage, V _{IL}	V _{CC} = 4.5 V			0.8	V	
Logic High-Level Input Voltage, V _{IH}		2.0			V	
Enable Low-Voltage; Data Being Entered, V _{EL}				0.8	V	
Enable High-Voltage; Data Not Being Entered, V _{EH}		2.0			V	
Blanking Low-Voltage; Display Not Blanked, V _{BL}				0.8	V	
Blanking High-Voltage; Display Blanked, V _{BH}		3.5			V	
Blanking Low-Level Input Current, I _{BL}		V _{CC} = 5.5 V, V _{BL} = 0.8 V			50	μA
Blanking High-Level Input Current, I _{BH}		V _{CC} = 5.5 V, V _{BH} = 4.5 V			1.0	mA
Logic Low-Level Input Current, I _{IL}	V _{CC} = 5.5 V, V _{IL} = 0.4 V			-1.6	mA	
Logic High-Level Input Current, I _{IH}	V _{CC} = 5.5 V, V _{IH} = 2.4 V			+100	μA	
Enable Low-Level Input Current, I _{EL}	V _{CC} = 5.5 V, V _{EL} = 0.4 V			-1.6	mA	
Enable High-Level Input Current, I _{EH}	V _{CC} = 5.5 V, V _{EH} = 2.4 V			+130	μA	
Peak Wavelength, λ _{PEAK}	T _A = 25°C		655		nm	
Dominant Wavelength, λ _d (3)	T _A = 25°C		640		nm	
Weight**			1.0		gm	
Leak Rate				5 x 10 ⁻⁸	ATM CC SEC	

*JEDEC Registered Data. **Non Registered Data

Note 2: θ_{ca} of mounted display should not exceed 35°C/W for operation up to 100°C.

Note 3: λ_d is defined by 1931 CIE Chromaticity diagram by a line drawn from standard Illuminant C thru X, Y chromaticity coordinates.

TIMING DIAGRAM

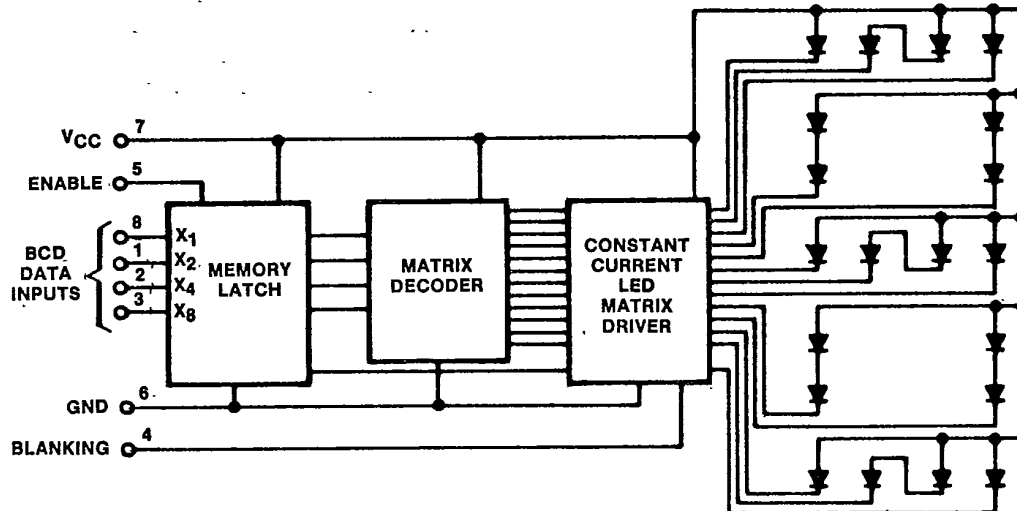




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FUNCTIONAL BLOCK DIAGRAM

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FUNCTION TABLE				
BCD DATA (NOTE 1)				CHARACTER
X8	X4	X2	X1	DISPLAYED
L	L	L	L	0
L	L	L	H	1
L	L	H	L	2
L	L	H	H	3
L	H	L	L	4
L	H	L	H	5
L	H	H	L	6
L	H	H	H	7
H	L	L	L	8
H	L	L	H	9
H	L	H	L	A
H	L	H	H	B
H	H	L	L	C
H	H	L	H	D
H	H	H	L	E
H	H	H	H	F
ENABLE (NOTE 2)		LOAD DATA $V_E = L$ LATCH DATA $V_E = H$		
BLANKING (NOTE 3)		DISPLAY ON $V_B = L$ DISPLAY OFF $V_B = H$		

NOTES:

1. H = Logic High; L = Logic Low.
2. With the enable input at logic high, changes in BCD input logic levels have no effect upon display memory or displayed character.
3. Blanking input has no effect upon display memory.





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HIGH RELIABILITY TESTING

Two standard reliability testing programs are available. The TXVB program is in conformance with Quality Level A of MIL-D-87157 for hermetically sealed displays with 100% screening tests. A TXVB product is tested to Tables I, II, III, and IV. A second program is a TOI modification to the full conformance program and offers the 100% screening portion of Level A, Table I, and Group A, Table II.

PART MARKING SYSTEM

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STANDARD PRODUCT	WITH TABLE I AND II	WITH TABLES I, II, III AND IV
4N54	4N54TXV	4N54TXVB

100% Screening

**TABLE I.
QUALITY LEVEL A OF MIL-D-87157**

TEST SCREEN	MIL-STD-750 METHOD	CONDITIONS
1. Precap Visual	2072	
2. High Temperature Storage	1032	T _A = 125°C, Time = 24 hours
3. Temperature Cycling	1051	Condition B, 10 Cycles, 15 Min. Dwell
4. Constant Acceleration	2006	10,000 G's at Y ₁ Orientation
5. Fine Leak	1071	Condition G or H
6. Gross Leak	1071	Condition C
7. Interim Electrical/Optical Tests ^[2]	—	I _V , I _{CC} , I _{BL} , I _{BH} , I _{EL} , I _{EH} , I _L and I _H and visual function. T _A = 25°C
8. Burn-In ^[1]	1015	Condition B at V _{CC} = 5 V and cycle through logic at 1 character per second. T _A = 100°C, t = 160 hours
9. Final Electrical Test ^[2]	—	Same as Step 7
10. Delta Determinations	—	ΔI _V = -20%, ΔI _{CC} = ± 10 mA, ΔI _H = ±10μA and ΔI _{EH} = ±13μA
11. External Visual ^[1]	2009	

- Notes:**
 1. MIL-STD-883 Test Method applies.
 2. Limits and conditions are per the electrical/optical operating characteristics.

**TABLE II.
GROUP A ELECTRICAL TESTS — MIL-D-87157**

TEST	PARAMETERS	LTPD
Subgroup 1 DC Electrical Tests at 25°C ^[1]	I _V , I _{CC} , I _{BL} , I _{BH} , I _{EL} , I _{EH} , I _L and I _H and visual function T _A = 25°C	5
Subgroup 2 DC Electrical Tests at High Temperature ^[1]	Same as Subgroup 1, except delete I _V and visual function, T _A = +100°C	7
Subgroup 3 DC Electrical Tests at Low Temperature ^[1]	Same as Subgroup 1, except delete I _V and visual function. T _A = -55°C	7
Subgroup 4, 5, and 6 not tested		
Subgroup 7 Optical and Functional Tests at 25°C	Satisfied by Subgroup 1	5
Subgroup 8 External Visual	MIL STD 883 Method 2009	7

- Note:**
 1. Limits and conditions are per the electrical/optical operating characteristics.





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**TABLE III.
GROUP B, CLASS A AND B OF MIL-D-87157
PERFORMED ON EACH LOT**

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TEST	MIL-STD-750 METHOD	CONDITIONS	SAMPLE SIZE
Subgroup 1			
Resistance to Solvents	1022		4 Devices/0 Failures
Decap Internal Visual and Mechanical ^[9]	2075		1 Device/0 Failures
Subgroup 2^[1,2]			
Solderability	2026		LTPD = 15
Subgroup 3			
Thermal Shock (Temp. Cycle)	1051	Condition B1	LTPD = 15
Moisture Resistance	1021		
Fine Leak	1071	Condition G or H, 5×10^{-8} atm cm^3/S Max	
Gross Leak	1071	Condition A, C, E or F	
Electrical/Optical Endpoints ^[4]	—	$I_V, I_{CC}, I_{BL}, I_{BH}, I_{EL}, I_{EH}, I_{IL}, I_{IH}$ and visual function. $T_A = 25^\circ\text{C}$	
Subgroup 4			
Operating Life Test	1027	$T_A = +100^\circ\text{C}$ at $V_{CC} = 5.0$ V and cycling through logic at 1 character per second. $t = 340$ hrs.	LTPD = 10
Electrical/Optical Endpoints ^[4]	—	Same as Subgroup 3.	
Subgroup 5			
Non-operating (Storage) Life Test	1032	$T_A = +125^\circ\text{C}$, $t = 340$ hrs.	LTPD = 10
Electrical/Optical Endpoints ^[4]	—	Same as Subgroup 3	

**TABLE IV.
GROUP C, CLASS A AND B OF MIL-D-87157
PERFORMED EVERY 6 MONTHS**

TEST	MIL-STD-750 METHOD	CONDITIONS	SAMPLE SIZE
Subgroup 1			
Physical Dimensions	2066		2 Devices/0 Failures
Subgroup 2^[2,7]			
Lead Integrity	2004	Condition B2	LTPD = 15
Fine Leak	1071	Condition G or H, 5×10^{-8} atm cm^3/S max	
Gross Leak	1071	Condition A, C, E or F	
Subgroup 3			
Shock	2016	1500G, Time = 0.5 ms, 5 blows in each orientation X_1, Y_1, Y_2	LTPD = 15
Vibration, Variable Frequency	2056		
Constant Acceleration	2006	10,000G at Y_1 orientation	
External Visual ^[7]	1010 or 1011		
Electrical/Optical Endpoints ^[8]	—	$I_V, I_{CC}, I_{BL}, I_{BH}, I_{EL}, I_{EH}, I_{IL}, I_{IH}$ and visual function, $T_A = 25^\circ\text{C}$	
Subgroup 4^[1,3]			
Salt Atmosphere	1041		LTPD = 15
External Visual ^[7]	1010 or 1011		
Subgroup 5			
Bond Strength ^[5]	2037	Condition A	LTPD = 20 (C = 0)
Subgroup 6			
Operating Life Test ^[6]	1026	$T_A = +100^\circ\text{C}$	$\lambda = 10$
Electrical/Optical Endpoints ^[8]	—	Same as Subgroup 3	

Notes:

- Whenever electrical/optical tests are not required as endpoints, electrical rejects may be used.
- The LTPD applies to the number of leads inspected except in no case shall less than three displays be used to provide the number of leads required.
- Solderability samples shall not be used.
- Visual requirements shall be as specified in MIL-STD-883, Methods 1010 or 1011.
- Displays may be selected prior to seal.
- If a given inspection lot undergoing Group B inspection has been selected to satisfy Group C inspection requirements, the 340 hour life tests may be continued on test to 1000 hours in order to satisfy the Group C Life Test requirements. In such cases, either the 340 hour endpoint measurements shall be made a basis for Group B lot acceptance or the 1000 hour endpoint measurement shall be used as the basis for both Group B and Group C acceptance.
- MIL-STD-883 test method applies.
- Limits and conditions are per the electrical/optical operating characteristics.
- Inspection may be performed through the clear glass window.

*JEDEC Registered Data.