11/19/03

Features:

- Conforms to MIL-PRF-87157
- Three character options
  Numeric, Hexadecimal or Over range
- 4 X 7 dot matrix character
- Memory latch/decoder/driver is TTL compatible
- Categorized for luminous intensity

Applications:

- High reliability systems
- Instrumentation panels
- Communication equipment
- Medical equipment
- Harsh environments

DESCRIPTION

The **4N51, 4N52, 4N53 and 4N54** series are solid state numeric and hexadecimal displays for use in high reliability applications. The displays feature an on-board decoder/driver and memory (except 4N53). These displays are hermetically sealed and conform to MIL-PRF-87157, the general specification for light emitting diode displays. The character height is 0.290" (7.37mm).

The 4N51 is a numeric display which decodes positive BCD logic into the numbers "0-9", a "-" sign, a right-hand decimal point, and a test pattern (all LED's on).
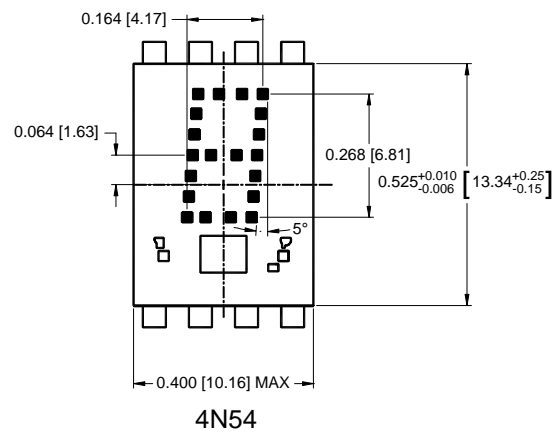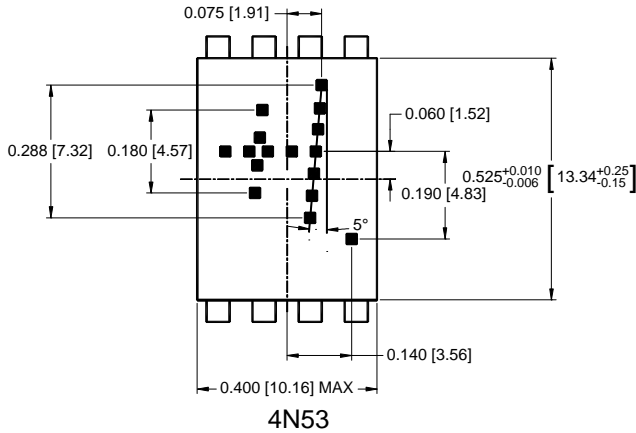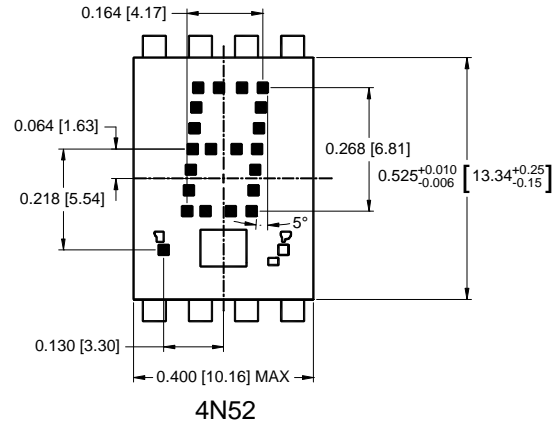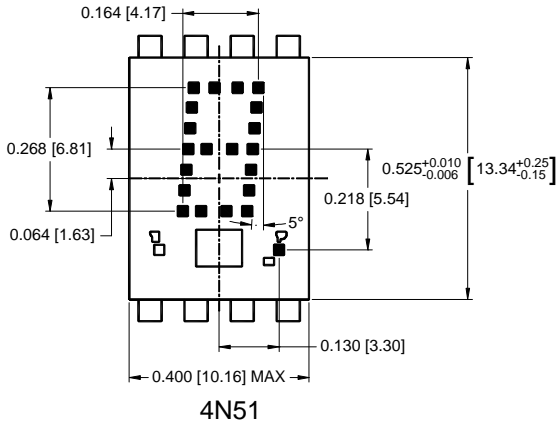
The 4N52 is the same as the 4N51, but the decimal point is located on the left side of the device.

The 4N53 is an over range device which displays "$\pm$1" and a right-hand decimal point. This display is typically driven using external switching transistors.
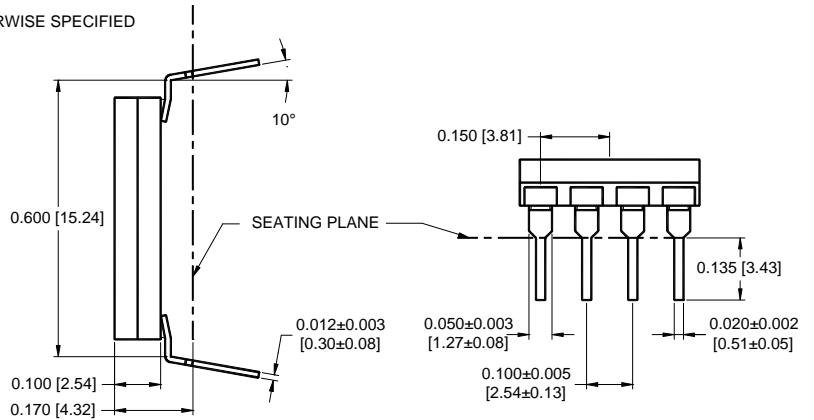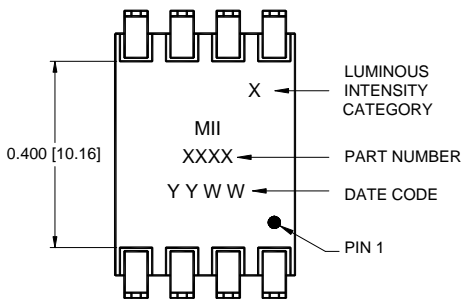
The 4N54 is a hexadecimal display which decodes positive BCD logic into 16 characters "0-9, A-F". Input is provided to blank the display (all LED's off) without losing the contents of the memory.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (4N51, 4N52, 4N54) .... -0.5 V to 7 V
Voltage Applied to Input Logic, DP and Enable Pins .... -0.5 V to 7 V
Voltage Applied to Blanking Input (4N54 only) .... -0.5 V to 7 V
Forward Current, Each LED (4N53 only) .... 10 mA
Reverse Voltage, Each LED (4N53 only) .... 4 V
Storage Temperature .... -65°C to +125°C
Operating Free-Air Temperature Range .... -55°C to +100°C
Lead Solder Temperature (10seconds, 1/16" below seating plane) .... 260°C

0.164 [4.17]

0.268 [6.81]

0.064 [1.63]

5°

$0.525^{+0.010}_{-0.006}$ $[13.34^{+0.25}_{-0.15}]$

0.218 [5.54]

0.130 [3.30]

0.400 [10.16] MAX

4N51

0.164 [4.17]

0.064 [1.63]

0.268 [6.81]

0.218 [5.54]

5°

$0.525^{+0.010}_{-0.006}$ $[13.34^{+0.25}_{-0.15}]$

0.130 [3.30]

0.400 [10.16] MAX

4N52

0.075 [1.91]

0.288 [7.32] 0.180 [4.57]

0.060 [1.52]

0.190 [4.83]

5°

$0.525^{+0.010}_{-0.006}$ $[13.34^{+0.25}_{-0.15}]$

0.140 [3.56]

0.400 [10.16] MAX

4N53

0.164 [4.17]

0.064 [1.63]

0.268 [6.81]

5°

$0.525^{+0.010}_{-0.006}$ $[13.34^{+0.25}_{-0.15}]$

0.400 [10.16] MAX

4N54

ALL TOLERANCES ARE ± 0.008 [0.20] UNLESS OTHERWISE SPECIFIED

X LUMINOUS INTENSITY CATEGORY

MII

XXXX PART NUMBER

Y Y W W DATE CODE

PIN 1

0.400 [10.16]

10°

0.600 [15.24]

SEATING PLANE

0.012±0.003 [0.30±0.08]

0.100 [2.54]

0.170 [4.32]

0.150 [3.81]

0.135 [3.43]

0.050±0.003 [1.27±0.08]

0.020±0.002 [0.51±0.05]

0.100±0.005 [2.54±0.13]

ALL TOLERANCES ARE ± 0.015 UNLESS OTHERWISE SPECIFIED

ALL DIMENSIONS ARE IN INCHES [MILLIMETERS].

*JEDEC Registered Data

*ELECTRICAL OPTICAL CHARACTERISTICS

T_A = -55°C to +100°C unless otherwise specified.

PARAMETER		SYMBOL	MIN	TYP	MAX	UNITS	TEST CONDITIONS	NOTE
Supply Current	4N51	I_{CC}		112	170	mA	V_{CC} = 5.5V	1
	4N52			112	170		Numeral 5 and DP lighted	
	4N54			112	170			
Power Dissipation	4N51	P_T		560	935	mW	V_{CC} = 5.5V	1, 3
	4N52			560	935			
	4N53			280	320		Numeral 5 and DP lighted	
	4N54			560	935			
Luminous Intensity per LED	4N51	I_V	40	85		μcd	V_{CC} = 5V, T_A = 25°C	2
	4N52		40	85			V_{CC} = 5V, T_A = 25°C	
	4N53		45	85			I_F = 10mA, T_A = 25°C	
	4N54		40	85			V_{CC} = 5V, T_A = 25°C	
Forward Voltage per LED	4N53	V_F		1.6	2.0	V	I_F = 10mA	
Logic Low-Level Input Voltage	4N51	V_{IL}			0.8	V	V_{CC} = 4.5V	
	4N52				0.8			
	4N54				0.8			
Logic High-Level Input Voltage	4N51	V_{IH}	2			V	V_{CC} = 4.5V	
	4N52		2					
	4N54		2					
Enable Low-Voltage; Data Being Entered	4N51	V_{EL}			0.8	V	V_{CC} = 4.5V	
	4N52				0.8			
	4N54				0.8			
Enable High-Voltage; data not being entered	4N51	V_{EH}	2			V	V_{CC} = 4.5V	
	4N52		2					
	4N54		2					
Blanking Low-Voltage display not blanked	4N54	V_{BL}			0.8	V	V_{CC} = 4.5V	
Blanking High-Voltage display not blanked	4N54	V_{BH}	3.5			V	V_{CC} = 4.5V	
Leak Rate	ALL				5×10^{-8}		cc/sec	
Blanking Low-Level Input Current	4N54	I_{BL}			50	mA	V_{CC} = 5.5V, V_{BL} = 0.8V	
Blanking High-Level Input Current	4N54	I_{BH}			1.0	mA	V_{CC} = 5.5V, V_{BH} = 4.5V	
Logic Low-Level Input Current	4N51	I_{IL}			-1.6	mA	V_{CC} = 5.5V, V_{IL} = 0.4V	
	4N52							
	4N54							
Logic High-Level Input Current	4N51	I_{IH}			+100	μA	V_{CC} = 5.5V, V_{IH} = 2.4V	
	4N52							
	4N54							
Enable Low-Level Input Current	4N51	I_{EL}			-1.6	mA	V_{CC} = 5.5V, V_{EL} = 0.4V	
	4N52							
	4N54							
Enable High-Level Input Current	4N51	I_{EH}			+130	μA	V_{CC} = 5.5V, V_{EH} = 2.4V	
	4N52							
	4N54							
Wavelength at Peak Emission	ALL	λ_P		655		nm	T_A = 25°C	
Dominant Wavelength	ALL	d		640			T_A = 25°C	2
Forward Voltage per LED	4N53	V_F		1.6	2.0	V	I_F = 10mA	
Weight	ALL			1		gm		

NOTES:

1. All typical values at V_{CC} = 5.0 volts, t_A = 25°C.
2. The dominant wavelength, λ_d is a single wavelength that defines the saturated color of monochromatic light, as derived from the CIE chromaticity diagram.
3. For 4N53 test conditions, I_F = 10mA, all diodes lit.
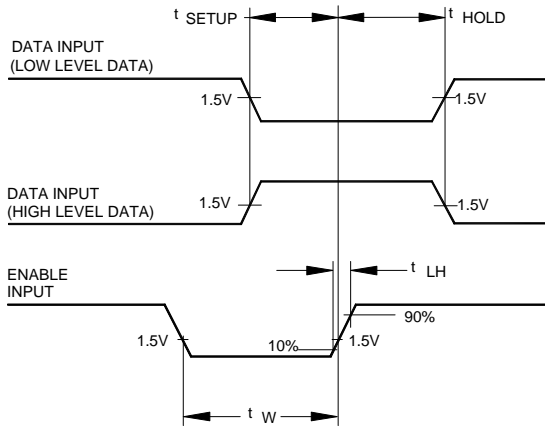
*JEDEC Registered Data

4N51, 4N52, 4N54 Logic

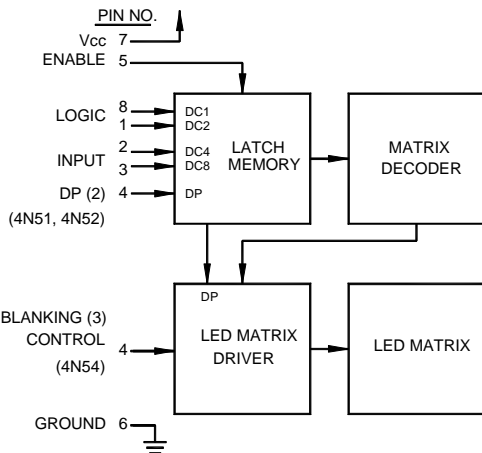FIGURE 1. Timing Diagram of 4N51, 4N52 and 4N54 Series Logic

FIGURE 2. Block Diagram of 4N51, 4N52 and 4N54 Series Logic

TRUTH TABLE

BCD DATA [1]				4N51/4N52	4N54
X_8	X_4	X_2	X_1		
L	L	L	L	0	0
L	L	L	H	1	1
L	L	H	L	2	2
L	L	H	H	3	3
L	H	L	L	4	4
L	H	L	H	5	5
L	H	H	L	6	6
L	H	H	H	7	7
H	L	L	L	8	8
H	L	L	H	9	9
H	L	H	L	▯	A
H	L	H	H	(BLANK)	B
H	H	L	L	(BLANK)	C
H	H	L	H	.....	D
H	H	H	L	(BLANK)	E
H	H	H	H	(BLANK)	F

DECIMAL PT. [2]	ON	$V_{DP} = L$
	OFF	$V_{DP} = H$
ENABLE [1]	LOAD DATA	$V_E = L$
	LATCH DATA	$V_E = H$
BLANKING [3]	DISPLAY ON	$V_B = L$
	DISPLAY OFF	$V_B = H$

NOTES:
1. H = Logic High: L = Logic Low. With the enable input at logic high changes in BCD input levels or D.P. input have no effect upon display memory, displayed character, or D.P.
2. The decmal point, DP, pertains only to the 4N51 and 4N52 displays.
3. The blanking control, B, pertains only to the 4N54 hexadecimal display. Blanking input has no effect upon memory.

4N53 Over Range Character

PIN	FUNCTION
1	Plus
2	Numeral One
3	Numeral One
4	DP
5	Open
6	Open
7	Vcc
8	Minus/Plus

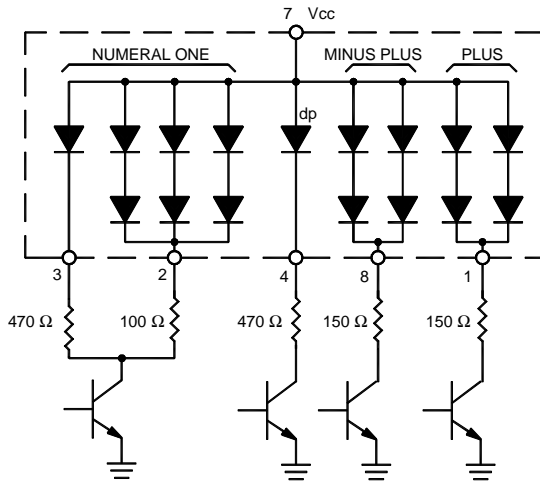FIGURE 3. Typical Driving Circuit

TRUTH TABLE FOR TYPICAL DRIVING CIRCUIT

CHARACTER	PIN			
	1	2,3	4	8
+	H	X	X	H
-	L	X	X	H
1	X	H	X	X
DECIMAL POINT	X	X	H	X
BLANK	L	L	L	L

NOTES:
L: Line switching transistor in figure 3 cutoff.
H: Line transistor in figure 3 saturated.
X: Don't Care.

*RECOMMENDED OPERATING CONDITIONS:

PARAMETER		SYMBOL	MIN	MAX	UNITS
Supply Voltage	4N51		4.5	5.5	V
	4N52	V_{CC}	4.5	5.5	V
	4N53		NA	NA	NA
	4N54		4.5	5.5	V
Operating Temperature	ALL	T_A	-55	100	°C
Enable Pulse Width	4N51				
	4N52	t_W	100		Ns
	4N54				
Time data must be held before positive	4N51				
transition of enable line	4N52	t_{SETUP}	50		ns
	4N54				
Time data must be held after positive	4N51				
transition of enable line	4N52	t_{HOLD}	50		ns
	4N54				
Enable pulse rise time	4N51				
	4N52	t_{TLH}		200	ns
	4N54				
Forward Current	4N53	I_F	5	10	mA

SELECTION GUIDE

67023-001	4N51 Commercial
67023-011	4N51 Military Temp. Range
67023-101	4N51 Screened, TXV level
67023-101C	4N51 DSCC P/N JM87157/00101AXX
67023-002	4N52 Commercial
67023-012	4N52 Military Temp. Range
67023-102	4N52 Screened, TXV level
67023-102C	4N52 DSCC P/N JM87157/00102AXX
67023-003	4N53 Commercial
67023-013	4N53 Military Temp. Range
67023-103	4N53 Screened, TXV level
67023-103C	4N53 DSCC P/N JM87157/00103AXX
67023-004	4N54 Commercial
67023-014	4N54 Military Temp. Range
67023-104	4N54 Screened, TXV level
67023-104C	4N54 DSCC P/N JM87157/00104AXX

NOTES:

1. When ordering DSCC part numbers, you may order by the MII part number or the DSCC part number.
2. The first X at the end of M87157/0010XA[X]X designates lead finish. In place of the X use A for hot solder dip or C for gold finish.
3. Second X at the end of the M87157/0010XAX[X] designates luminous intensity code. In place of the X use C thru K to indicate desired intensity level.

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