BULLETIN NO. 1145 September 15, 1968

NIXIE® NUMERICAL INDICATOR TUBE

(FOR DC AND TIME SHARING APPLICATIONS)

TYPES
B-5859
B-5859S

PRELIMINARY INFORMATION

The B-5859 NIXIE tube is an ultra-long life, high quality, cold-cathode indicator tube having a common anode. It can display the numerals 0-9 and has two decimal points inside the tube (right and left of the numerals) which are independently operable. The numeral aspect ratio (height to width) has been designed to provide the optimum in readability and viewing distance. The small diameter of the tube (0.510" max) permits 0.520" center-to-center mounting and its short seated height (1.350" max including standoff) allows for minimal instrument panel dimensions.

A moveable pin-straightener-standoff, which is used to align the tube pins for ease of PC layout and insertion, is part of the tube assembly. The standoff also allows solder gas to escape during soldering. These tubes have been specifically designed to operate both in normal DC applications and strobed/time sharing applications (See Note 8).

The B-5859S is identical to the B-5859 except its leads are cut to 0.175" ± .015 for use with the SK-207 socket, Bulletin 1138.

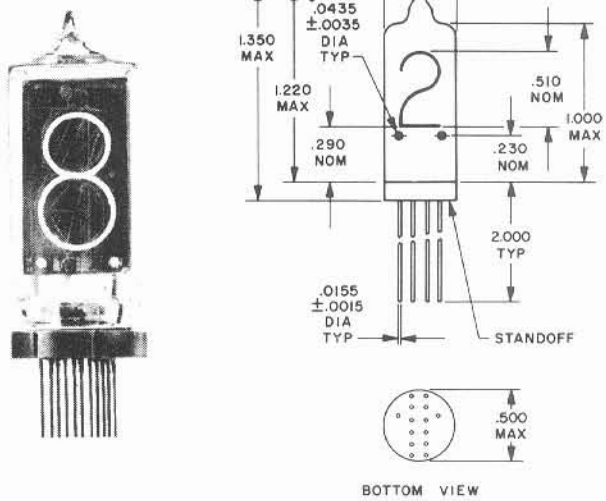


Figure 1. OUTLINE DRAWING

ELECTRICAL SPECIFICATIONS

Absolute Ratings

Ionization Voltage (Note 1, Fig. 4)	+170 Vdc max
Supply Voltage	+170 Vdc min
Anode Current (Note 5)	5.0 ma max
Peak Anode Current (Notes 8 & 9)	20 ma max
Decimal Point Cathode Current (Note 6)	0.1 ma to 0.5 ma
Cathode Pre-bias	+60 Vdc to +110 Vdc

Typical Operating Conditions (Notes 1, 2 & 7, Figures 4, 5 & 6)

Supply Voltage	+170 Vdc
Series Resistor (Table 2)	10 kΩ
Anode Current (Figure 4)	3.4 ma typ
Decimal Point Current (Table 2)	0.35 ma typ
Cathode Pre-bias Voltage	+60 Vdc

Test Conditions (Figures 4, 5 and 6)

Test Limits (Figures 4, 5 and 6)

MECHANICAL SPECIFICATIONS

Outline Drawing	Figure 1
Pin Connection	Table 1
Pin Layout	Figure 2
Basing Diagram	Figure 3
Weight	0.4 oz. max
Lead Finish B-5859	Hot tin dip from 0.600 in. from tube base
Max. Viewing Distance	24 feet
Mounting	Note 3
Color	Neon red 3650, 4358, 5654 & 5852 angstroms
Brightness	200 ft. lamberts
Soldering Heat B-5859	260 ± 5°C for 10 ± 1 sec. 0.250" from tube base

ENVIRONMENTAL DATA

Shock	250 g's, 1.0 msec., 20 total shocks X1, X2, Y1 and Y2 planes
Thermal Shock	15 sec., 90°C water - immediate transfer to 30°C water, 15 seconds
Life Expectancy (dynamic)	(200,000 hours) (Note 10)
Ambient temperature	−20 to +55°C −40 to 70°C (reduced life)
Altitude	70,000 ft.
Vibration	10-50-10 cps., 08" total excursion 50-2000 cps 10 g's 15 minutes X1, X2, Y1 planes

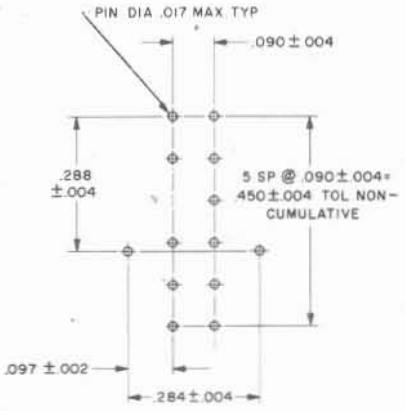
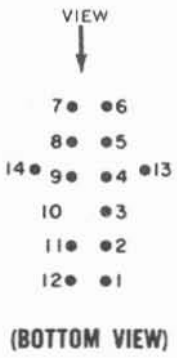


Figure 2. PIN LAYOUT (TOP VIEW)

PIN	CONNECTIONS
1	NUMERAL 1
2	NUMERAL 2
3	NUMERAL 3
4	NUMERAL 4
5	NUMERAL 5
6	NUMERAL 6
7	ANODE
8	NUMERAL 7
9	NUMERAL 8
10	NO PIN
11	NUMERAL 9
12	NUMERAL 0
13	RT DEC PT
14	LFT DEC PT

Table 1. PIN CONNECTIONS



(BOTTOM VIEW)

Figure 3. BASING DIAGRAM

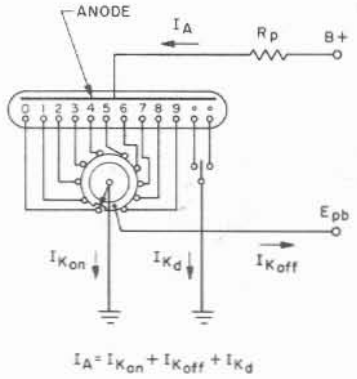


Figure 4. TEST CIRCUIT

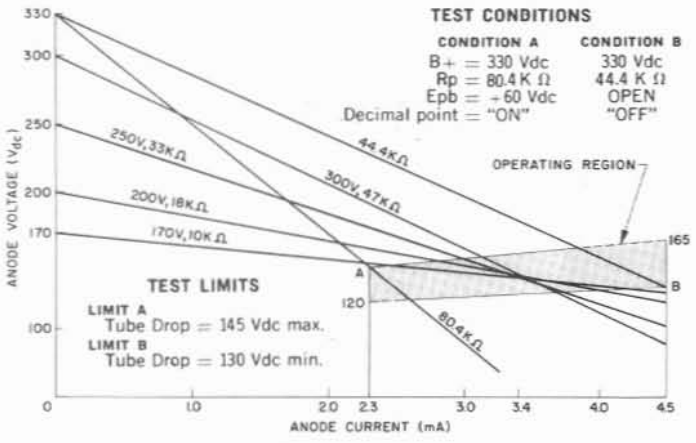


Figure 5. TUBE CHARACTERISTICS DC (NOTE 7)

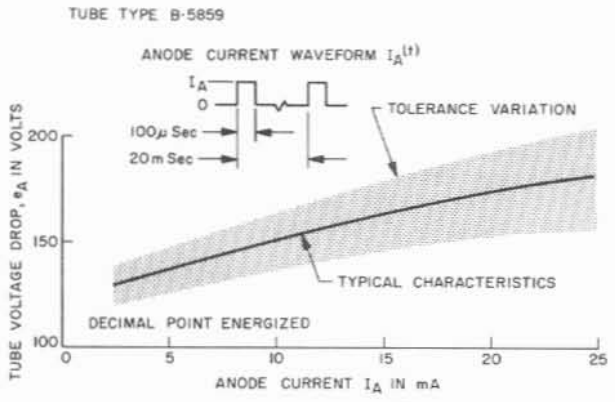


Figure 6. TUBE CHARACTERISTICS (TIME SHARING) (NOTES 7 AND 8)

NOTES

1. The minimum supply voltage should be +170 Vdc, however, the use of the highest voltage available with an appropriate series resistor is recommended to provide: 1) greater tolerance of B+ & Rp; 2) more uniform brightness; 3) more constant current operation; 4) improved operation with temperature and 5) improved life. (See Table 2 and Note 7)
2. This NIXIE tube can be used in 4 modes of operation (Figure 4)
   a) When a numeral is always "on" and a decimal point will never be "on."
   b) When a numeral is always "on" and a decimal point may or may not be "on."
   c) When a numeral is always "on" and a decimal point is always "on."
   d) When a numeral or a decimal point will be "on" but not at the same time (numeral or decimal point are lighted alone) — use the anode resistor plus a decimal point resistor.

   In cases a, b and c, only the limiting anode resistor is necessary. (See Table 2)

   NOTE: In cases a, b and c, a numeral **must** be "on" when the decimal point is "on" to prevent the decimal point from receiving excessive current.

Supply Voltage (Vdc)	170	200	250	300
Anode Resistor (Rp) (kΩ)	10	18	33	47
Decimal point resistor (Rkd) (kΩ)	100	180	330	470

Table 2

3. For proper viewing the tube should be oriented so that pins 7 and 6 are closest to the viewer (Figure 3.)
4. Lead length on B-5859S is 0.175" ± .015 (for use with SK-207 socket).
5. Value when decimal point is "off."
6. Value when only the decimal point is "on."
7. For proper NIXIE tube operation, a load line must pass through the operating region (shaded area) above point "A" and below point "B" in Figure 5. Operation at an anode current below point "A" can result in partial or incomplete numeral glow. Operation at an anode current above point "B" can result in shorter life. Typical load lines for 170 Vdc-10 kΩ, 200 Vdc-18 kΩ, 250 Vdc-33 kΩ, and 300 Vdc-47 kΩ are shown. The limits of the operating region were determined at the 330 V-80.4 kΩ, 330 V-44.4 kΩ. At these limits the tubes will exhibit an anode current within the limits of 2.3 ma min. and 4.5 ma max. These limits can be used to determine if a tube meets the specification.
8. In a typical strobed/time sharing application, (Figure 6) "same-numeral" cathodes (i.e., all 1's, all 2's, etc.) of all tubes are connected in parallel and the anodes are strobed sequentially. The rapid strobing is above the flicker rate and visual indication is normal. However, since the "on" duty cycle is not 100%, a higher than normal current is used to compensate for loss of brightness. The B-5859 NIXIE tubes are constructed and specified for these peak current conditions and no extraneous glow is exhibited during this operation.
9. The maximum pulse duration is 5.0 milliseconds with a 10% max duty cycle.
10. Under normal DC operating conditions.

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