RCA Solid State Division

Digital Integrated Circuits

CD2500E
CD2501E
CD2502E
CD2503E

BCD to 7-Segment Decoder-Drivers

Monolithic Silicon

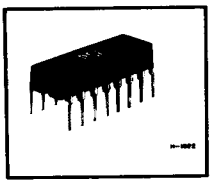
RCA CD2500E series 7-Segment Decoder-Drivers are monolithic MSI integrated circuits which decode BCD (8-4-2-1 code) inputs to 7-line outputs representing a decimal number from 0 to 9 on 7-segment incandescent display devices.

RCA CD2500E and CD2501E are 30 mA per-output-line devices designed for use with incandescent display devices such as the RCA DR2000 and DR2010. The CD2500E, in addition to the outputs for the 7-segment display device, has a decimal point output; the CD2501E also has a special-feature, a terminal to provide for ripple blanking output and intensity control input. The ripple blanking output blanks out all non-significant zeroes in the numerical display. The ripple blanking output terminal is also available for use as an intensity control input from an external variable pulse-width control source, as shown in Fig. 7.

RCA CD2502E and CD2503E are 80 mA-per-line versions of the CD2500E and CD2501E, respectively, and are designed for use with high-current lamps and relays.

RCA CD2500E series devices are supplied in 16-lead dual in-line plastic packages which can be used over the operating temperature range of 0° C to + 75° C.

30mA and 80mA/Segment DECODER-DRIVERS For Use With Low-Voltage Digital Display Devices, Lamps, and Relays



DP_0 = Decimal Point Output
DP_I = Decimal Point Input

DP_I must be supplied from an external source

CD2500E and CD2502E perform the inverter-driver function necessary to energize the decimal point filament in the display device.

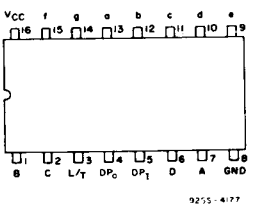


Fig. 1 - CD2500E and CD2502E (with decimal point)

FEATURES:

- High current sinking capability for direct display driving
- Intensity control provision
- BCD inputs are compatible with commercially available DTL & TTL devices
- Lamp test provision
- 5 V power supply
- Clamp diodes on all inputs
- Lamp supply up to +8 volts
- Ripple blanking capability
- Decimal point output
- Over-range detection (automatic blanking of display device when BCD input > 9)

RB_0 = Ripple-Blanking Output & Intensity Control Input
RB_I = Ripple-Blanking Input

Fig. 2 - CD2501E and CD2503E (with ripple blanking and intensity control provision)

ABSOLUTE MAXIMUM RATINGS at 25° C unless otherwise specified:

Power Supply Voltage:
- Continuous (0° C to + 75° C) . . . . . − 0.5 to + 5.5 V
- Pulsed (duration 1 second) . . . . . − 0.5 to + 8 V

Input Voltage . . . . . − 0.5 to + 5.5 V

Output Voltage (open collector transistor) . . − 0.5 to + 8 V

Operating Temperature Range . . . . . 0° C to + 75° C

Storage Temperature Range . . . . . − 65 °C to + 150° C

Lead Temperature (During Soldering):
At distance 1/16 ± 1/32 inch (1.59 ± 0.79mm) from case for 10 seconds max. . . . . +265° C

ELECTRICAL CHARACTERISTICS at Ambient Temperature (T_A) Indicated

CHARACTERISTICS	SYMBOLS	MEASUREMENT TERMINALS	TEST CONDITIONS		0° C		+ 25° C			+ 75° C		UNITS
					MIN.	MAX.	MIN.	TYP.	MAX.	MIN.	MAX.	
Input High Voltage (Logic 1)	V_{IH}	1, 2, 5, 6, & 7	Input high threshold voltage		2.0	–	2.0	–	–	2.0	–	V
		3	V_{CC} = 4.75 V, I_{IH} = 0 Ground all other inputs		2.4	–	2.4	–	–	2.4	–	V
Input Low Voltage (Logic 0)	V_{IL}	1, 2, 5, 6, & 7	Input low threshold voltage		–	0.85	–	–	0.85	–	0.85	V
		3			–	0.45	–	–	0.45	–	0.45	
Input Forward Current	I_{IL}	1, 2, 5, 6, & 7	V_F = 0.45 V	V_{CC} = 5.25 V	–	− 1.6	–	− 1.0	− 1.6	–	− 1.6	mA
		3 CD2501E, CD2503E			–	− 10.0	–	–	− 10.0	–	− 10.0	
		3 CD2500E, CD2502E			–	− 10.4	–	–	− 10.4	–	− 10.4	
		1, 2, 5, 6, & 7	V_F = 0 Terminal 3 only	V_{CC} = 4.75 V	–	− 1.41	–	–	− 1.41	–	− 1.41	mA
		3 CD2501E, CD2503E			–	− 9.0	–	–	− 9.0	–	− 9.0	
		3 CD2500E, CD2502E			–	− 9.4	–	–	− 9.4	–	− 9.4	
Input Reverse Current	I_{IH}	1, 2, 5, 6, & 7	V_{CC} = 5.25 V Terminal 3 grounded	V_R = 4.5 V	–	40	–	–	40	–	60	μA
				V_R = 2.4 V	–	40	–	–	40	–	40	
Output Low Voltage	V_{OL}	9 thru 15 CD2500E, CD2501E and 4 of CD2500E	V_{CC} = 4.75 V, I_{OL} = 30 mA		–	0.40	–	0.30	0.40	–	0.40	V
		4 CD2501E, CD2503E	V_{CC} = 5.25, I_{OL} = 3.2 mA		–	0.45	–	0.30	0.45	–	0.45	
			V_{CC} = 4.75, I_{OL} = 2.82 mA		–	0.45	–	0.30	0.45	–	0.45	
		9 thru 15 CD2502E, CD2503E and 4 of CD2502E	V_{CC} = 4.75 V, I_{OL} = 80 mA		–	1.0	–	0.60	1.0	–	1.0	
Output High Voltage	V_{OH}	9 thru 15 – All types and 4 of CD2500E, CD2502E	V_{CC} = 5 V, I_{OH} = 200 μA		8.0	–	8.0	–	–	8.0	–	V
		4 – CD2501E, CD2503E	V_{CC} = 4.75 V, I_{OH} = − 240 μA		2.4	–	2.4	–	–	2.4	–	
Input Capacitance	C_{IN}	1, 2, 5, 6, & 7	V_{CC} = 5.0 V		–	–	–	3	5	–	–	pF
Power Supply Current Drain (Terminal 16)	I_{CC_L}	CD2501E, CD2503E	V_{CC} = 5.0 V (Segment Output Currents = 0)		–	–	–	48	–	–	–	mA
		CD2500E, CD2502E	Terminal 3 Grounded		–	–	–	50	–	–	–	

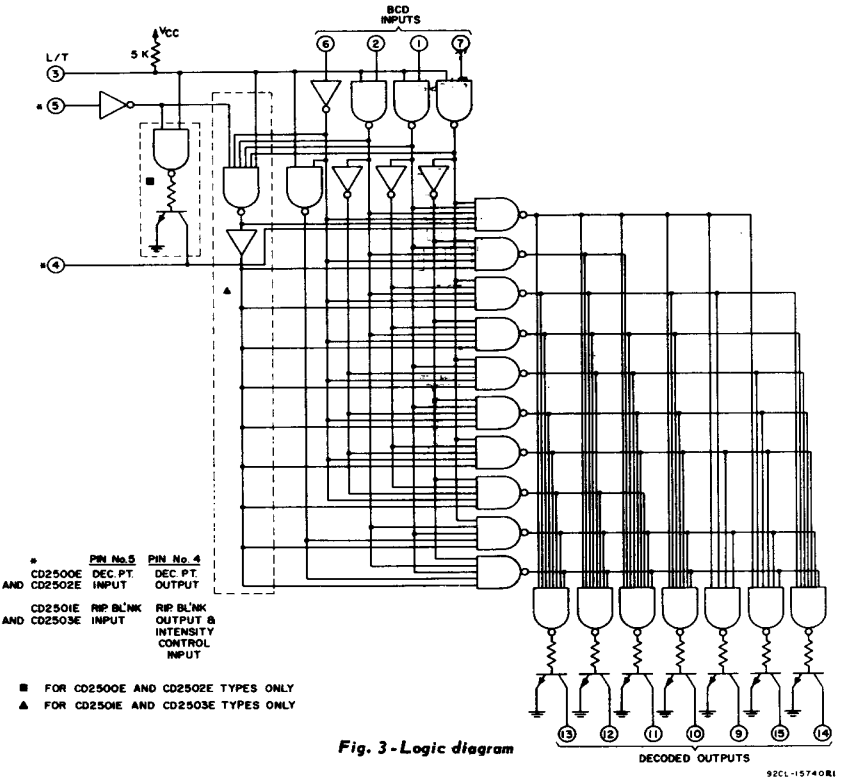
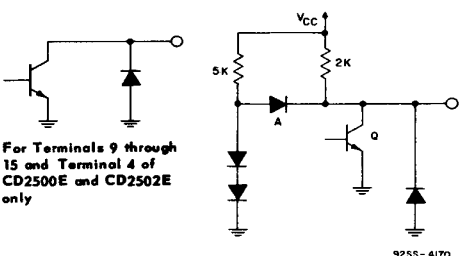


Fig. 3 - Logic diagram



For Terminals 9 through 15 and Terminal 4 of CD2500E and CD2502E only

For Terminal 4 of CD2501E and CD2503E.

Transistor Q is "turned on" when BCD code equals 0 and Terminal 5 is at "0 Level" (Grounded). When BCD code is between 0 and 9, transistor Q is "open". Diode A and transistor are "open" when BCD code is > 9.

Fig. 4 - Equivalent output circuits

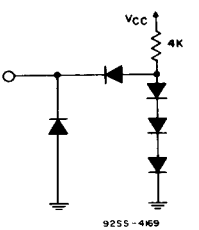


Fig. 5 - Equivalent input circuit for terminals 1, 2, 5, 6 & 7

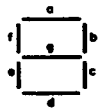
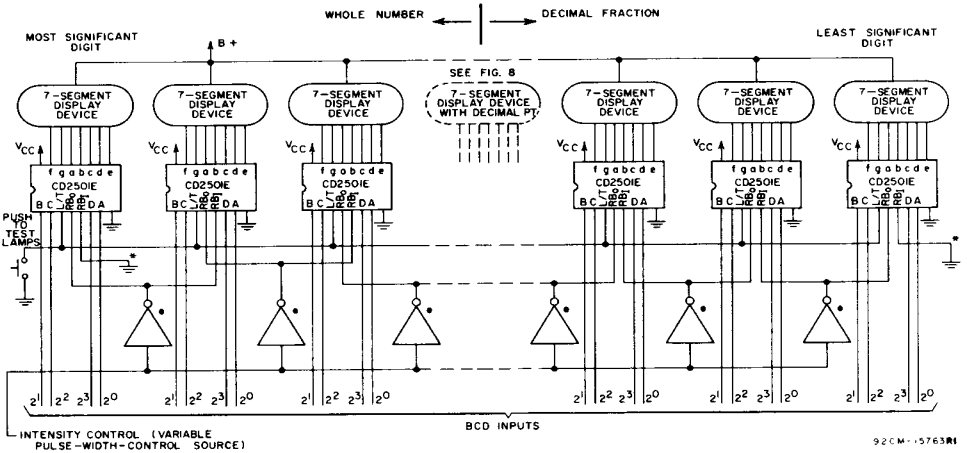


Fig. 6-Digital display device segment designation

TRUTH TABLE

INPUT 0 = Low Level 1 = High Level							OUTPUT 0 = Filament Lit 1 = Filament OUT									TUBE DISPLAY
D	C	B	A	L/T	DP_I	RB_I	a	b	c	d	e	f	g	DP_O	RB_O	
X	X	X	X	0	–	X	0	0	0	0	0	0	0	–	1	8
0	0	0	0	1	–	0	1	1	1	1	1	1	1	–	0	
0	0	0	0	1	–	1	0	0	0	0	0	0	1	–	1	0
0	0	0	1	1	–	X	1	0	0	1	1	1	1	–	1	1
0	0	1	0	1	–	X	0	0	1	0	0	1	0	–	1	2
0	0	1	1	1	–	X	0	0	0	0	1	1	0	–	1	3
0	1	0	0	1	–	X	1	0	0	1	1	0	0	–	1	4
0	1	0	1	1	–	X	0	1	0	0	1	0	0	–	1	5
0	1	1	0	1	–	X	0	1	0	0	0	0	0	–	1	6
0	1	1	1	1	–	X	0	0	0	1	1	1	1	–	1	7
1	0	0	0	1	–	X	0	0	0	0	0	0	0	–	1	8
1	0	0	1	1	–	X	0	0	0	0	1	0	0	–	1	9
1	0	1	0	1	–	X	1	1	1	1	1	1	1	–	1	
1	0	1	1	1	–	X	1	1	1	1	1	1	1	–	1	
1	1	0	0	1	–	X	1	1	1	1	1	1	1	–	1	
1	1	0	1	1	–	X	1	1	1	1	1	1	1	–	1	
1	1	1	0	1	–	X	1	1	1	1	1	1	1	–	1	
1	1	1	1	1	–	X	1	1	1	1	1	1	1	–	1	
–	–	–	–	1	1	–	–	–	–	–	–	–	–	0	–	.
–	–	–	–	1	0	–	–	–	–	–	–	–	–	1	–	
–	–	–	–	0	X	–	–	–	–	–	–	–	–	0	–	.

X = Don't care (0 or 1 entry has no effect)
L/T = Lamp test
RB_I = Ripple Blanking Input
RB_O = Ripple Blanking Output
DP_I = Decimal Point Input
DP_O = Decimal Point Output



• Resistor pull-up output T^2L, DTL, or RTL inverter.

* Suppression of the non-significant zeroes (at both extremes of the display) is accomplished by grounding the RB_1 terminal of the devices associated with the most significant digit of the whole part of the number displayed and the least significant digit of the fractional portion of that number.

Fig. 7 - Typical ripple blanking and intensity control application diagram using RCA CD2501E and display devices DR2000 or equivalents (See Table A)

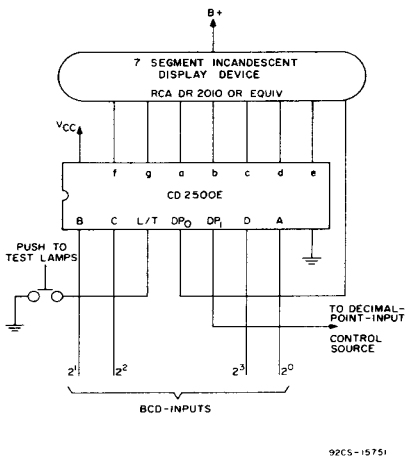


Fig. 8 - Typical decimal point feature application diagram using RCA CD2500E and RCA display device DR2010 (or equivalent)

TABLE A

DISPLAY DEVICE TYPE	TYPE OF DISPLAY	CHARACTERISTICS
DR2000		Required Driving Current = 24 ± 2 mA per segment
DR2010	x	0.6" Letter height