



# Data Sheet

## Electronic displays

Three types of display are available; each has differences as far as the display appearance, operation and electrical characteristics are concerned. Section I describes each device type, section II contains details of suitable decoder/drivers with circuit applications. Separate data sheets are available.

Section III details pin connections and physical dimensions of direct drive 7 segment LCD's.

For the latest range of display products available consult the opto-electronics section of the current **RS** Catalogue.

For information on counter/driver ICs consult the semiconductor section of the current **RS** Catalogue.

### Section I - types of display

#### LED

A range of solid state semiconductor displays having the advantages of mechanical ruggedness, long life and easy interface with semiconductor circuitry.

- Display bezels are available to accommodate the majority of the LED displays:
- Discrete LED displays in a range of character heights 0.3, 0.43, 0.56, 1 and 2.24in. Certain types have segment colours available in red and green, with common anode or common cathode connections and dual format i.e. 7-segment or  $\pm 1$ , thus providing many possible multi-digit display versions. These operate from 2mA drive currents making them ideal for battery powered applications. Displays utilising the industry standard 5 x 7 dot matrix font are available in heights of 1.16 and 2in as either common anode or common cathode row configurations.
- 0.5in multiplexed displays in four digit format in either common anode or common cathode versions. Displays may be edge stacked to give increased number of digits. Multiplexing reduces the number of decoders and drivers and requires less power than dc drive to achieve the same display intensity.
- 0.11in 4 digit multiplexed display housed in a 14 pin dual in-line clear moulded package incorporating magnifier lens. Device may be end stacked for longer displays and is typical of the types used in desktop calculators, hand-held instruments, metering devices and various consumer products, where low power consumption and battery supplies are required.
- 0.27in discrete displays with logic. Two different displays are available with integrated logic chip. One version offers a hexadecimal display with TTL compatible 4-bit latch and decoder/driver, whilst the other offers a 7-segment display with BCD counter, 4-bit latch and decoder/driver.
- 10 segments LED bar arrays. These types, red and green versions, are in a 20 pin DIL package which may be end stacked as desired.

Suitable Bar Array driver is the 3914 device, **RS** stock no. 308-174 (see semiconductor section of the **RS** Catalogue).

#### Liquid crystal

Unlike all other types of displays these do not emit light but reflect incident or transmit back light. Power consumption is extremely low making them ideally suited for battery powered equipment. The types available are field effect devices with either 2, 3 1/2, 4, 4 1/2, 6 or 8 digit, 7-segment format. Operation is from an ac supply, typically 5Vrms. For this reason special forms of decoding are necessary; this is further explained in section II. Panel mounting bezels are available to accommodate LCD displays.

**Note:** The maximum dc component allowed to appear across the device is 25mV.

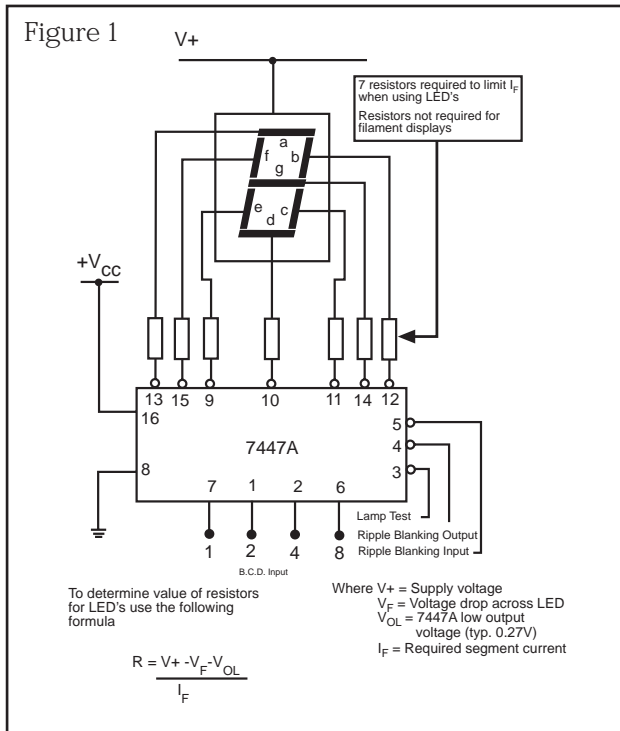
#### LED backlight panels

A range of coloured solid state light guides which have been specially processed to give bright even illumination. Miniature LED light sources are optically connected to the edge of the backlight panel producing a panel of light which is efficient, reliable, has low power consumption and is easy to drive (dc-current limited). These backlight panels can be used to illuminate the Transflective range of direct drive 7 segment LCD's. **RS** stock nos. 215-6464, 185-8535, 215-6458, 185-0159, 185-0171, 185-0200, 185-0187, 185-0193 and 185-0216.

Section II decoders/drivers

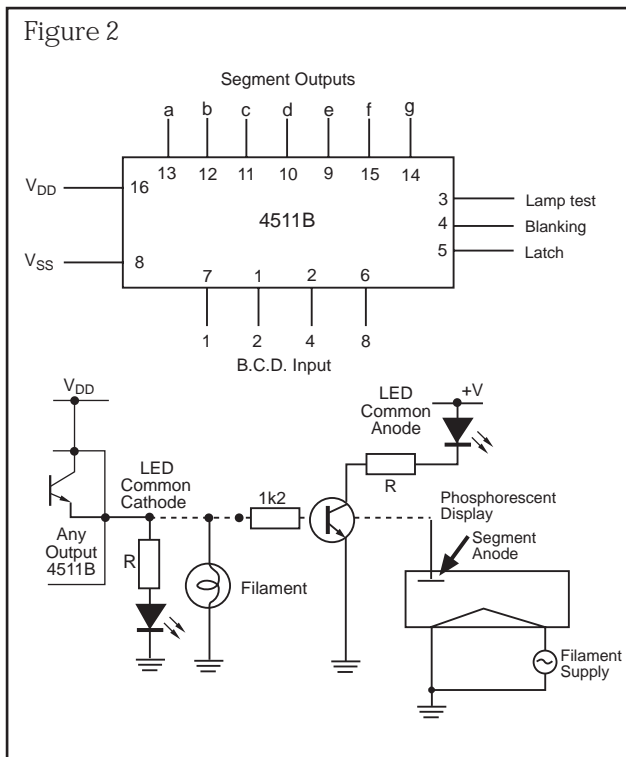
7447A

BCD to 7-segment TTL decoder/driver for use with filament or LED displays. Incorporating open collector output transistors capable of sinking 40mA. Figure 1 gives details of interconnecting filament and common anode LED displays with the 7447A.



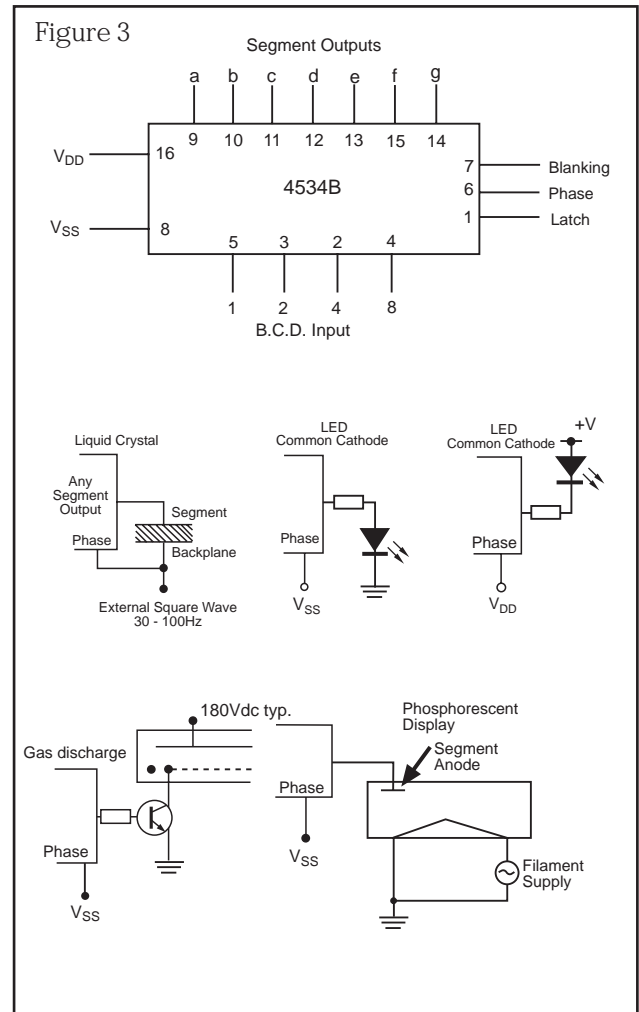
4511B

BCD to 7-segment C-MOS decoder/driver with integral latch. Active pull up output capable of sourcing 25mA. Will drive a filament, common cathode LED or phosphorescent display directly. Figure 2 shows methods of driving various displays.



4543B

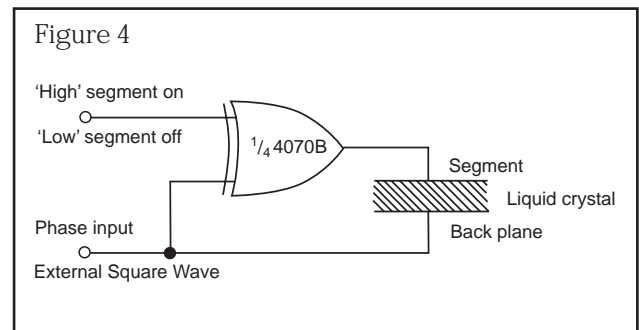
Similar to the 4511B but designed specifically for liquid crystal displays although the phase input may be tied 'high' or 'low' enabling other types of display driving. Source or sink current 10mA maximum. Figure 3 shows various output connections.



4070B

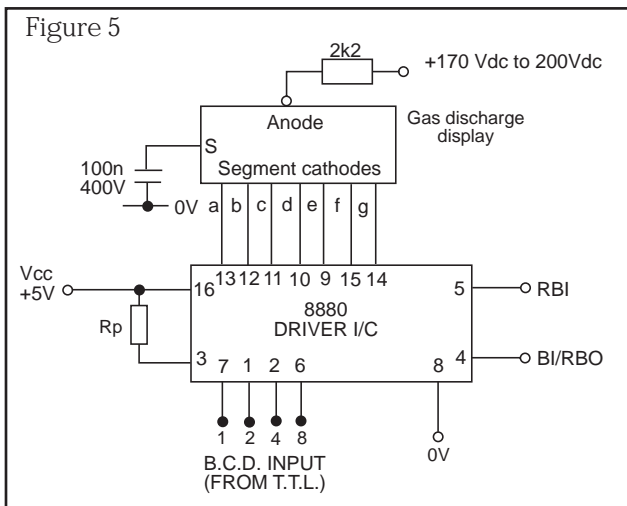
Not strictly a decoder, the 4070B C-MOS quad exclusive OR gates are used for single segment driving of liquid crystal displays. Figure 4 shows the interconnections required.

**Note:** The use of 4543B and 4070B C-MOS drivers with liquid crystal displays produces an artificial ac drive by applying a square wave to the phase input.



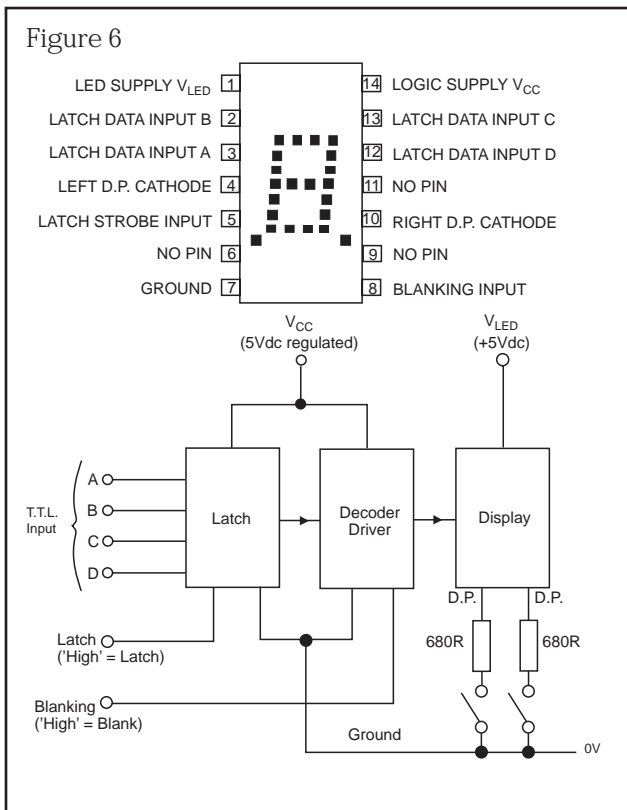
8880

A high voltage 7-segment decoder/driver designed to decode BCD and drive gas filled 7-segment display tubes, (Figure 5).



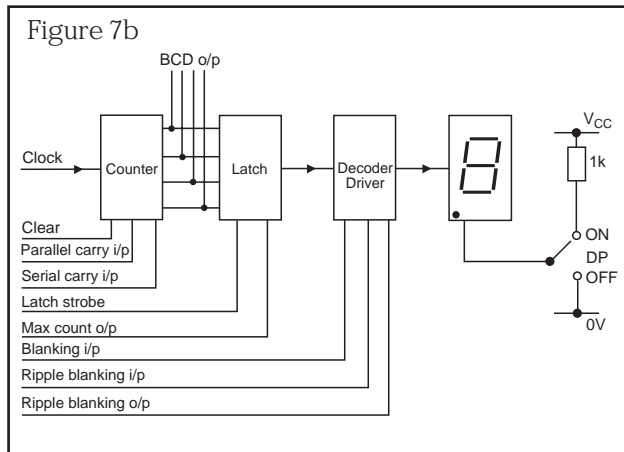
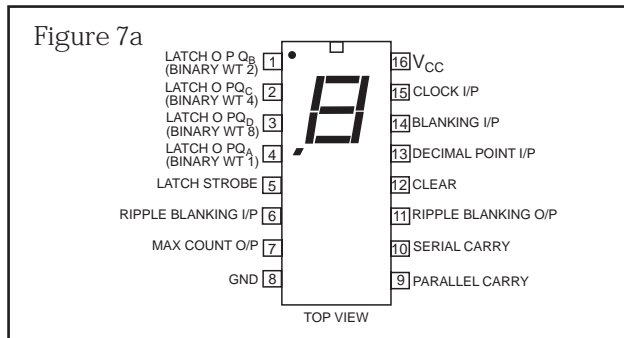
0.27in with logic (hexadecimal TIL 311)

Full hexadecimal decoding with integral latch, blanking and constant current drive to LED display. The two decimal points require external limiting resistors, (Figure 6).



0.27in with logic (7-segment TIL 306)

7-segment decoder/driver with integral BCD counter and four bit latch. Features allow high speed fully synchronous multi-digit counter-systems to be realised without resort to external logic, (Figure 7).



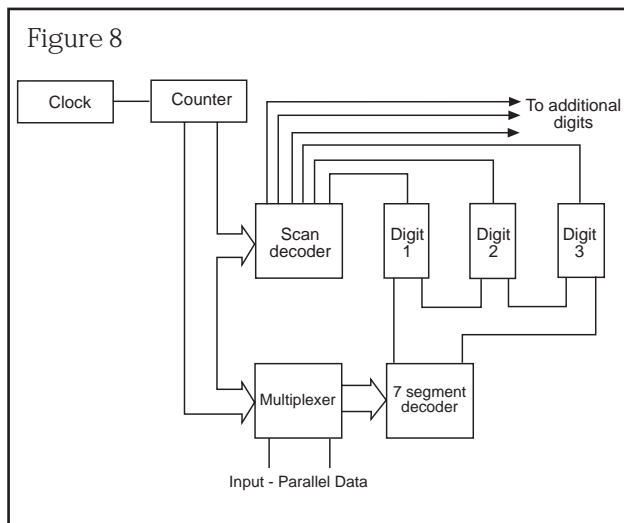
Additional information

Multi-digit displays

The simplest method of direct driving multi-digit displays is to use a decoder/driver for each digit and operate each independently, however, various facilities may be required necessitating interconnections between each decoder. (See multiplexing.)

Multiplexing

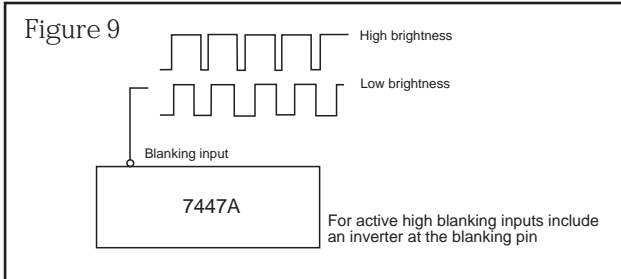
Time division multiplexing can reduce the number of decoders required together with a reduction in the number of interconnections between display and driver circuitry. This form is particularly suited for remote displays. Multiplexing is already incorporated in some multi-digit drivers when the number of output pins is limited, such devices as the ZN1040E and the 7217 have full multiplexing over four digits. The basic operation for this method of driving is shown in Figure 8.



**Intensity control**

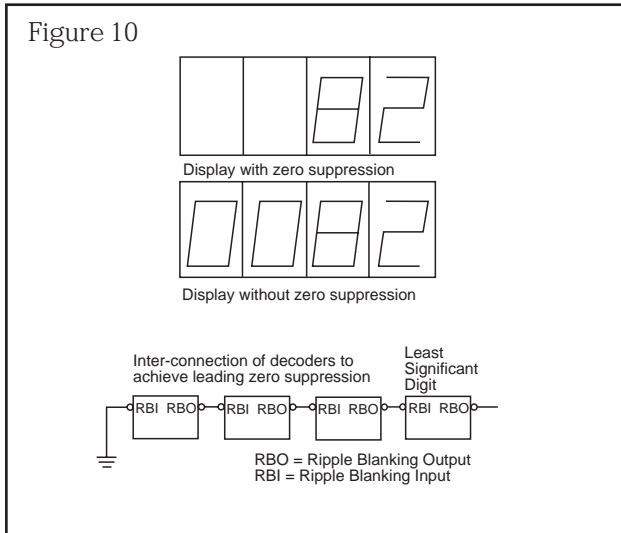
Adjustment of the light output of LED and filament displays may be achieved by pulse width modulating the blanking input of the decoder. Refer to Figure 9. The frequency of this modulation should be high enough to prevent display flicker at short duty cycles.

The 7447A decoder does not have blanking inputs but the ripple blanking output may be used. In this case commoning more than one input may only be done when each RBO pin is individually buffered thereby preventing interaction. Intensity control cannot be incorporated into liquid crystal displays.



**Zero suppression**

Leading or trailing zero suppression, often termed ripple blanking, is a means by which unnecessary zeros in the display are blanked. The connections required are shown in Figure 10.



The 7447A incorporates ripple blanking input and output connections whilst the 4511B and 4543B do not. However, by using external gating the blanking input may be incorporated to achieve this facility.

**Storage**

A storage or latching operation (i.e. where once 'latched' further changes in the BCD input information do not affect the display) may be achieved either by using the internal latches of the 4511B or 4543B, or separate latches such as the 7475 Quad bi-stable latch in conjunction with the 7447A. Multi-digit drivers incorporate latching facilities.

**Lamp test**

A lamp test facility is incorporated in some of these decoders. When operated all segments of the display are illuminated regardless of the input data.

**Display/Decoder selection**

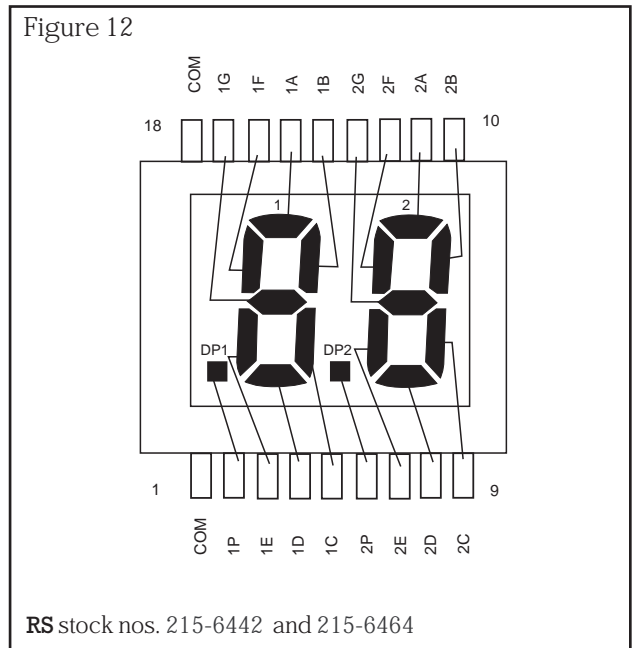
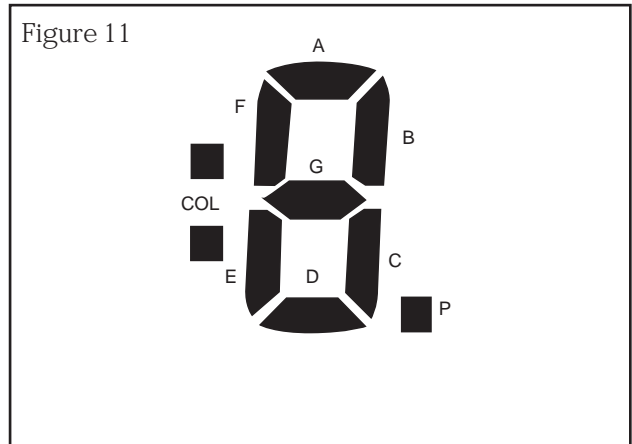
Decoder/Driver	7447A	4511B	4543B	4070B	ZN1040E	7412
Display type:						
Common anode LED	√		√		√*	√
Common cathode LED		√	√		√*	
Multi-digit multiplexed Common anode					√*	√
Liquid crystal			√	√		
Gas discharge			√*			
Phosphorescent		√	√		√*	
0.27 hexadecimal	INTEGRAL LOGIC					
0.27 7-segment	INTEGRAL LOGIC					

\* requires buffer transistors

**Note:** Apart from the display/decoder pairs show above additional forms of display driving may be achieved using external buffer or inverting stages.

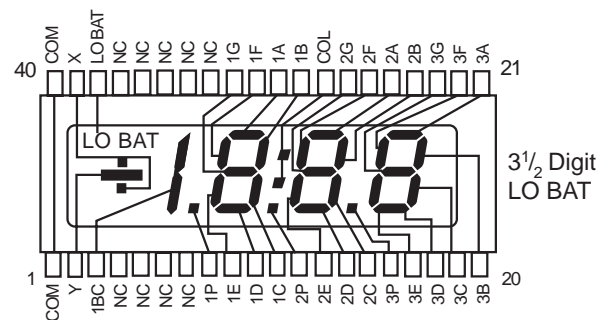
**Section III Liquid Crystal Display**

**Direct Drive 7 segment reflective and transmissive pin connectors.**



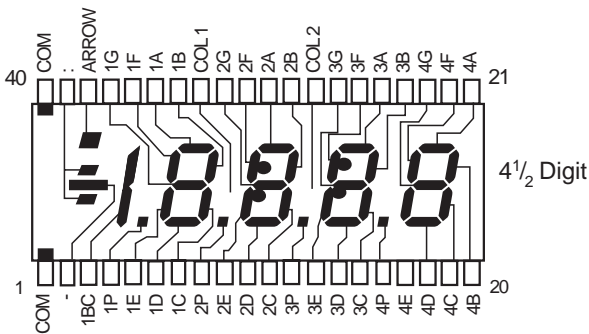
RS stock nos. 215-6442 and 215-6464

Figure 13



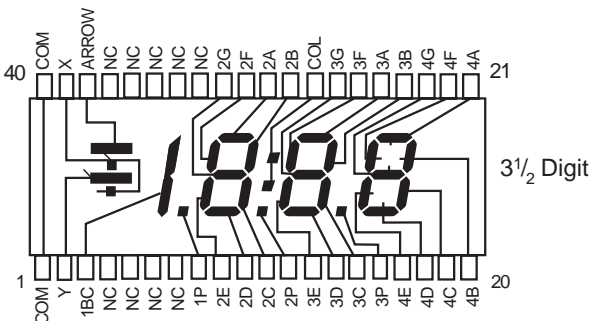
RS stock nos. 185-8529 and 185-8535  
 RS stock nos. 215-6436 and 215-6458

Figure 16



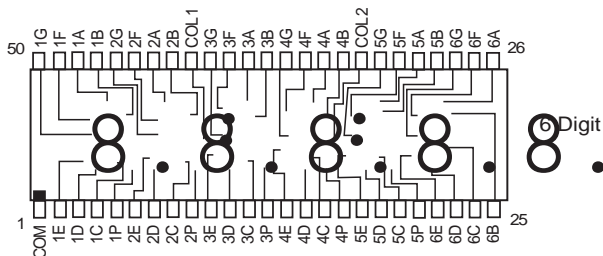
RS stock nos. 184-7721 and 185-0187

Figure 14



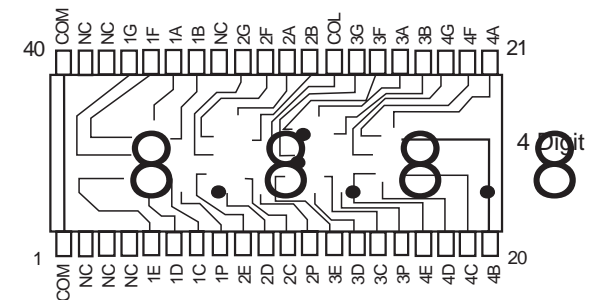
RS stock nos. 184-7709 and 185-0159

Figure 17



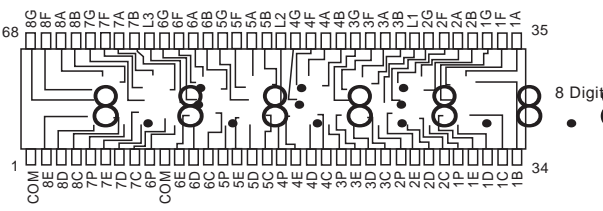
RS stock nos. 184-7737 and 185-0193

Figure 15



RS stock nos. 184-7715 and 185-0171  
 RS stock nos. 184-7743 and 185-0200  
 RS stock nos. 294-8825 and 294-8831

Figure 18



RS stock no. 185-0216

## Dimensions

Display type	RS stock no.	No. of digits	Character Height	L.	H. (ex. pins)	D.	Lead Pitch	Row Spacing
Reflective	215-6442	2	12.7	30.5	28	2.2	2.54	32.7
Transflective	215-6464							
Reflective	185-8529	3 $\frac{1}{2}$	8.9	50.8	22.8	2.2	2.54	25.40
Transflective	185-8535	LOBAT						
Reflective	215-6436	3 $\frac{1}{2}$	12.7	50.8	30.5	2.2	2.54	33.02
Transflective	215-6458	LOBAT						
Reflective	184-7709	3 $\frac{1}{2}$	12.7	50.8	30.5	2.2	2.54	33.02
Transflective	185-0159							
Reflective	184-7715	4	12.7	50.8	30.5	2.2	2.54	33.02
Transflective	185-0171							
Reflective	184-7743	4	17.8	69.9	30.5	2.2	2.54	40.64
Transflective	185-0200							
Reflective	294-8825	4	25.4	93.98	45.72	2.2	2.54	48.26
Transflective	294-8831							
Reflective	184-7721	4 $\frac{1}{2}$	10.2	50.8	38.1	2.2	2.54	33.02
Transflective	185-0187							
Reflective	184-7737	6	12.7	69.9	30.5	2.2	2.54	33.02
Transflective	185-0193							
Transflective	185-0216	8	12.7	93.8	30.5	2.2	2.54	33.02

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