Connection Diagram: Die

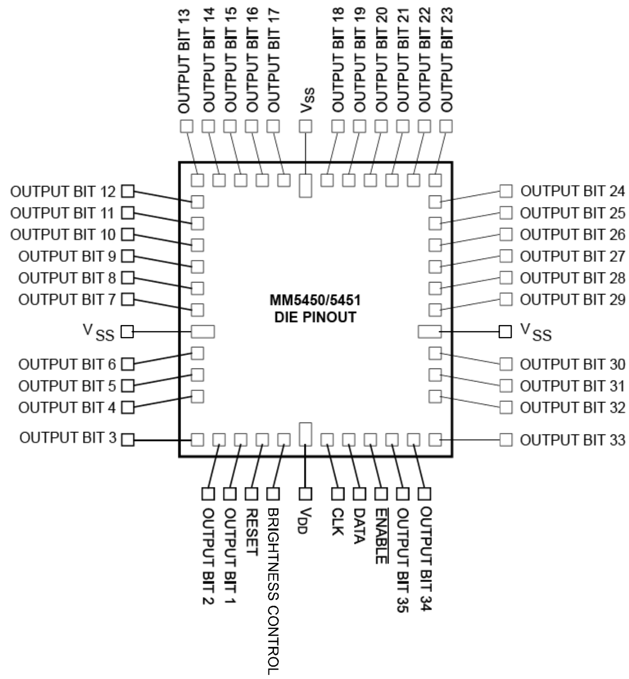


Figure 2.

Connection Diagram: Dual-in-line Package

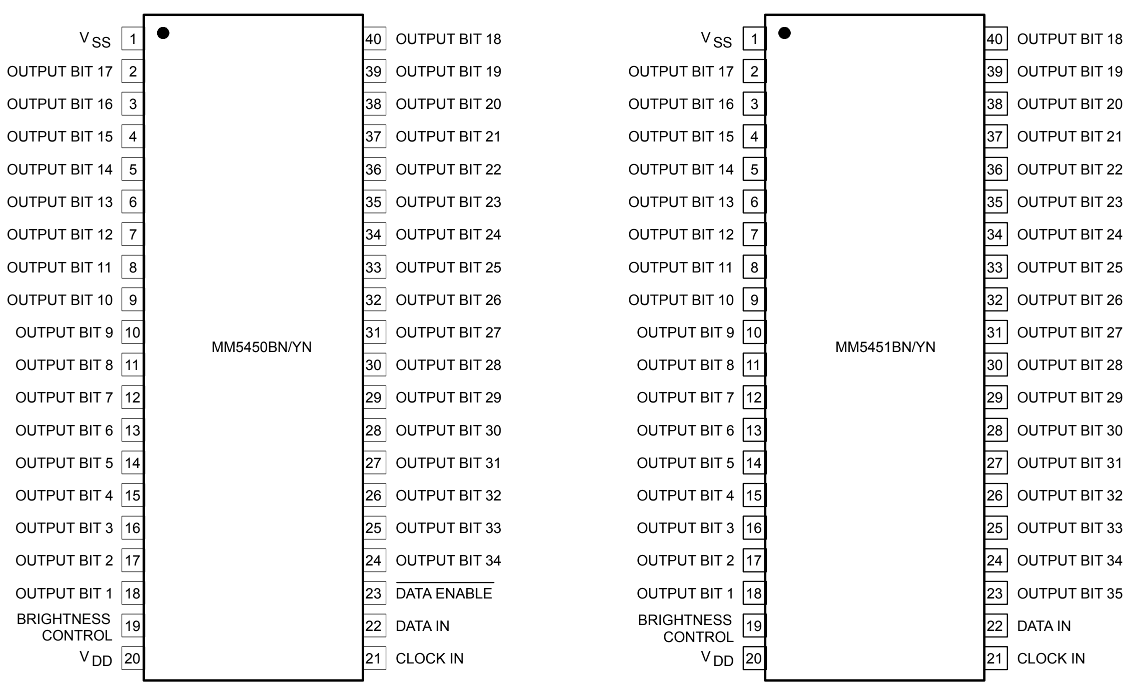
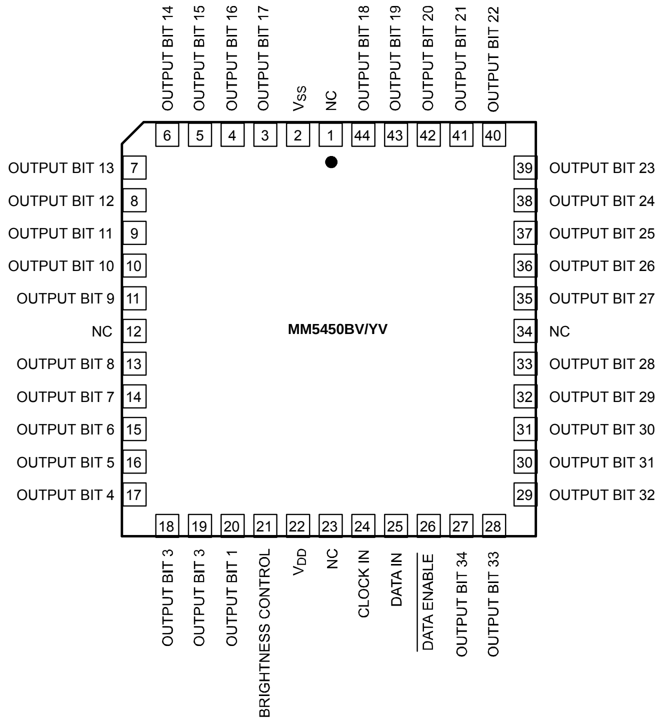


Figure 3a, 3b.

Connection Diagram: Plastic Leaded Chip Carrier



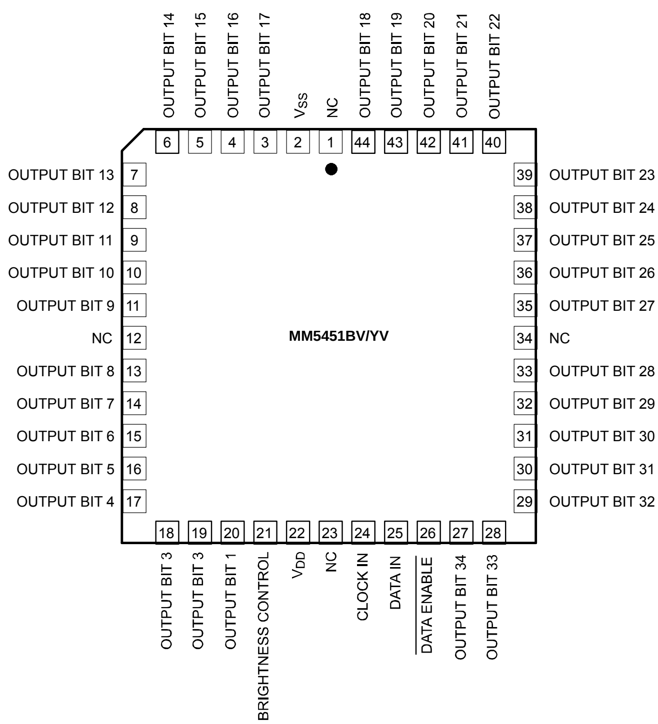


Figure 4a, 4b.

Absolute Maximum Ratings

Voltage (any pin) ....V_{SS} to V_{SS} + 12V
Power Dissipation
+25°C 1W
+85°C 560mW
Junction Temperature (T_J) .... +150°C
Storage Temperature (T_S) ....–65°C to +150°C
Lead Temperature (soldering, 10sec.) .... +300°C

Operating Ratings

Supply voltage (V_{DD} – V_{SS}) .... +4.75V to +11V
Ambient Temperature Range (T_A) ....–40°C to +85°C

Electrical Characteristics

4.5V ≤ V_{DD} ≤ 11V, V_{SS} = 0V; T_A = 25°C, **bold** values indicate –40°C ≤ T_A ≤ +85°C, unless otherwise noted.

Symbol	Parameter	Condition	Min	Typ	Max	Units
	Power Supply Current	–25°C to +85°C, excluding output loads –40°C to +85°C, excluding output loads			**8.5** **10**	mA mA
 V_L V_H	Data Input Voltage	 logic-0 level, ±10 µA input bias logic-1 level, 4.75V ≤ V_{DD} ≤ 5.25V V_{DD} > 5.25V	 **–0.3** **2.2** **V_{DD} –2**		 **0.8** **V_{DD}** **V_{DD}**	 V V V
	Brightness Control Input Current	**Note 2**	**0**		**0.75**	mA
	Output Sink Current	segment off, V_{OUT} = 3.0V			**10**	µA
		segment on, V_{OUT} = 1.8V, **Note 3** brightness input = 0µA brightness input = 100µA brightness input = 750µA	 **0** **2.0** **15**	 2.7 	 **10** **4** **25**	 µA mA mA
	Brightness Control Input Voltage	input current = 750 µA	**3.0**		**4.3**	V
	Output Matching	**Note 1**			**±20**	%
f_C	Clock Input Frequency	**Notes 5, 6**			**500**	kHz
t_H	Clock Input High Time	**Notes 5, 6**	**950**			ns
t_L	Clock Input Low Time	**Notes 5, 6**	**950**			ns
t_{DS}	Data Input Setup Time		**300**			ns
t_{DH}	Data Input Hold Setup Time		**300**			ns
t_{DES}	Data Enable Input Setup Time		**100**			ns
	Reset Pad Current	die	**8**		8	µA

Notes:

1. Output matching is calculated as the percent variation (I_{MAX} + I_{MIN}) / 2.
2. With a fixed resistor on the brightness input pin, some variation in brightness will occur among devices.
3. See Figures 7, 8 and 9 for recommended operating conditions and limits. Absolute maximum for each output should be limited to 40mA.
4. V_{OUT} should be regulated by user. See Figures 8 and 9 for allowable V_{OUT} vs. I_{OUT} operation.
5. AC input waveform specification for test purpose: t_R ≤ 200ns, t_F ≤ 20ns, f = 500kHz, 50% ±10% duty cycle.
6. Clock input rise and fall times must not exceed 300ns.

Functional Description

The MM5450 and MM5451 were designed to drive either 4- or 5-digit alphanumeric LED displays with the added benefit of requiring minimal interface with the display or data source.

Data is transferred serially via 2 signals; clock and serial data. Data transfer without the added inconvenience of an external load signal is accomplished by using a format of a leading "1"followed by the allowed 35 data bits. These 35 data bits are latched after the 36th has been transferred. This scheme provides non multiplexed, direct drive to the LED display. Characters currently displayed (thus, data output) changes only if the serial data bits differ from those previously transferred.

The MIC37252 regulator is fully protected from damage due to fault conditions. Current limiting is provided. This limiting is linear; output current during overload conditions is constant. Thermal shutdown disables the device when the die temperature exceeds the maximum safe operating temperature. Transient protection allows device (and load) survival even when the input voltage spikes above and below nominal. The output structure of these regulators allows voltages in excess of the desired output voltage to be applied without reverse current flow.

Control of the output current for LED displays provides for the display brightness. To prevent oscillations, a 1nF capacitor should be connected to pin 19, brightness control.

The block diagram is shown in Figure 1. For the MIC5450, the /DATA ENABLE is a metal option and is used instead of the 35th output. The output current is typically 20-times greater that the current into pin 19, which is set by an external variable resistor.

There is an external reset connection shown which is available on unpackaged (die) only. Figure 2 illustrates the die pad locations for bonding in "chip on board" applications.

Figure 5 shows the input data format. A leading "1" is followed by 35 bits of data. After the 36th had been transferred, a LOAD signal is generated synchronously with the clock high state. This loads the 35 bits of data into the latches. The low side of the clock is used to generate a RESET signal which clears all shift registers for the next set of data. All shift registers are static master-slave, with no clear for the master portion of the first register, allowing continuous operation.

There must be a complete set of 36 clocks or the shift registers will not clear.

When the chip first powers ON, an internal power ON reset signal is generated which resets all registers and all latches. The START bit and the first clock return the chip to its normal operation.

Figure 3 and 4 show the pinout of the MIC5450 and MIC5451. Bit 1 is the first bit following the start bit and it will appear on pin 18. A logical "1" at the input will turn on the appropriate LED.

Figure 5 shows the timing relationships between data, clock and /DATA ENABLE. A maximum clock frequency of 0.5MHz is assumed.

For applications where a lesser number of outputs are used, it is possible to either increase the current per output, or operate the part at higher than 1V V_{OUT}. The following equation can be used for calculations.

$$T_J = (V_{OUT})\ (I_{LED})\ (\text{No. of segments})\ (124°C/W) + T_A$$

where:

T_J = junction temperature + 150°C max

V_{OUT} = the voltage at the LED driver outputs

I_{LED} = the LED current

124°C/W = thermal resistance of the package

T_A = ambient temperature

The above equation was used to plot Figures 7–9.

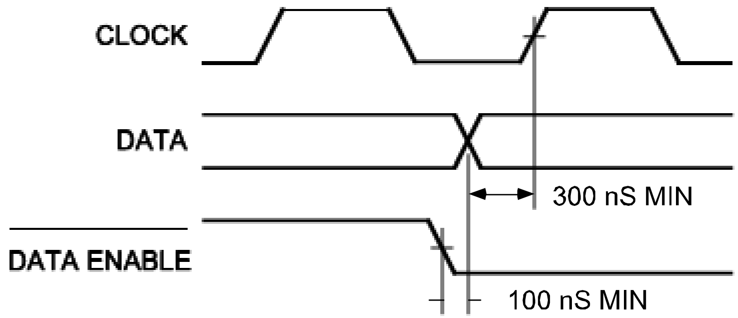


Figure 5.

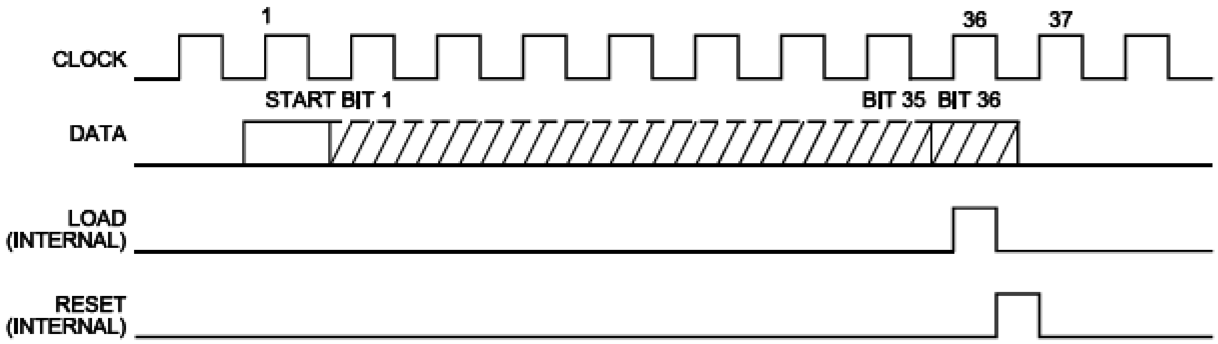


Figure 6. Input Data Format

Typical Performance Characteristics

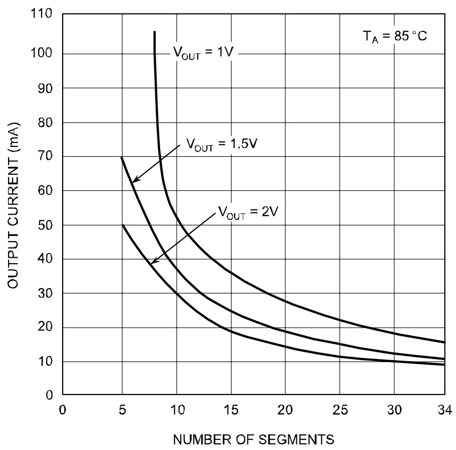


Figure 7.

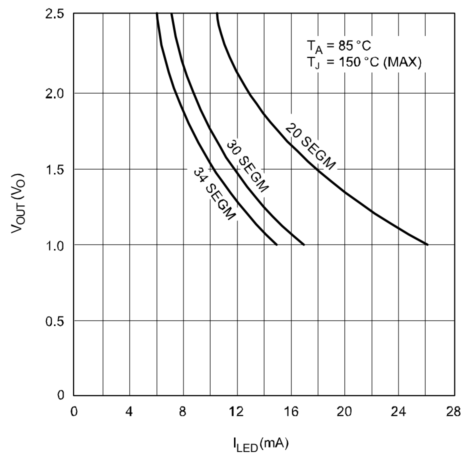


Figure 8.

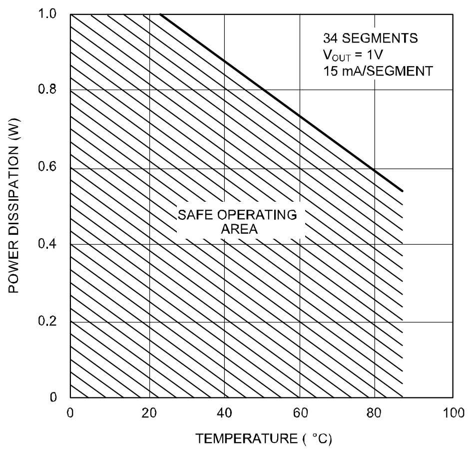


Figure 9.

Typical Applications

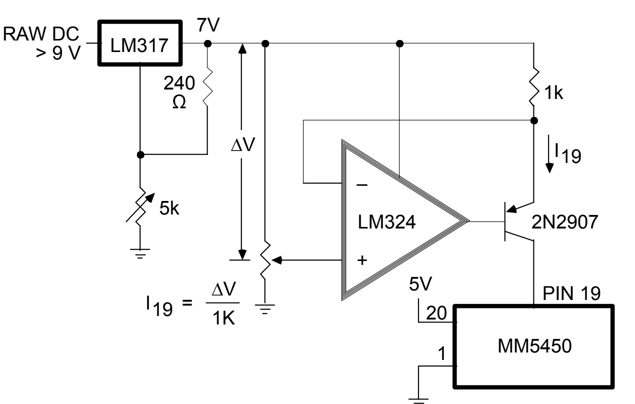


Figure 10. Typical Application of Constant Current Brightness Control

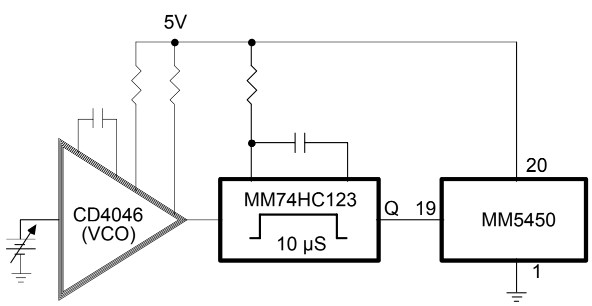


Figure 11. Brightness Control Varying the Duty Cycle

Typical Applications

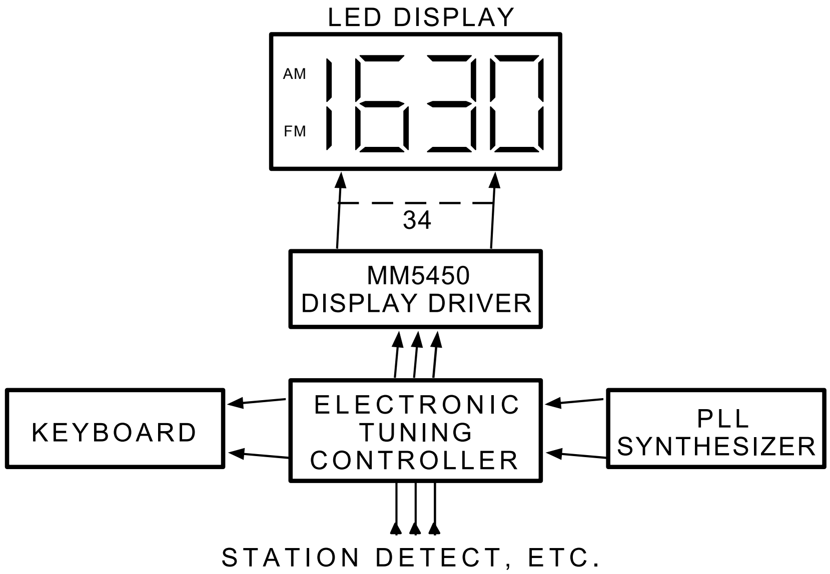


Figure 12. Basic Electronically Tuned Radio System

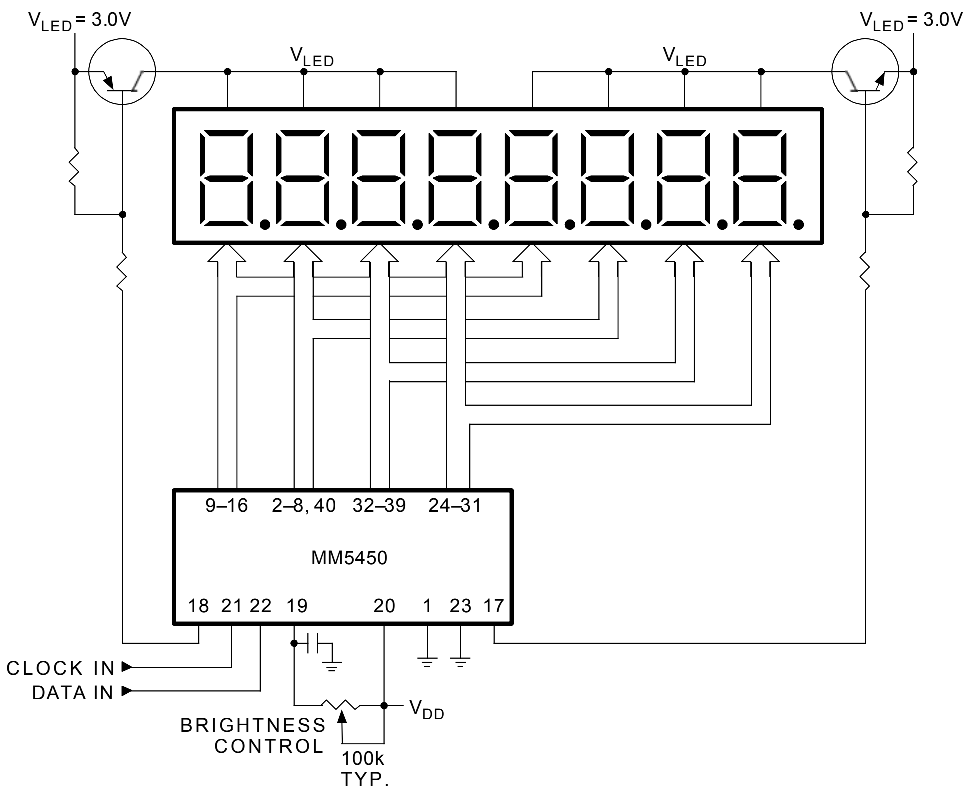
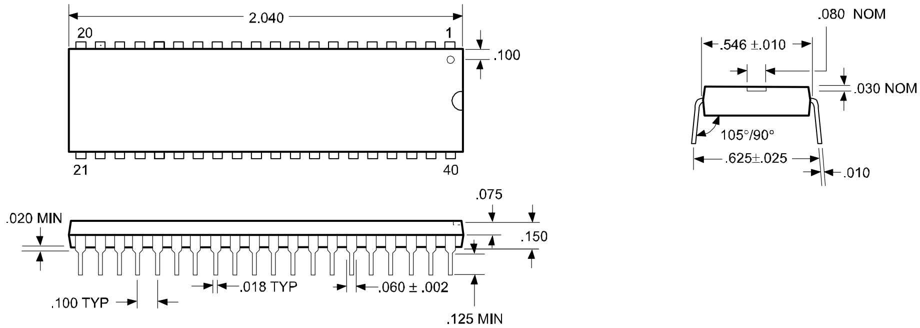
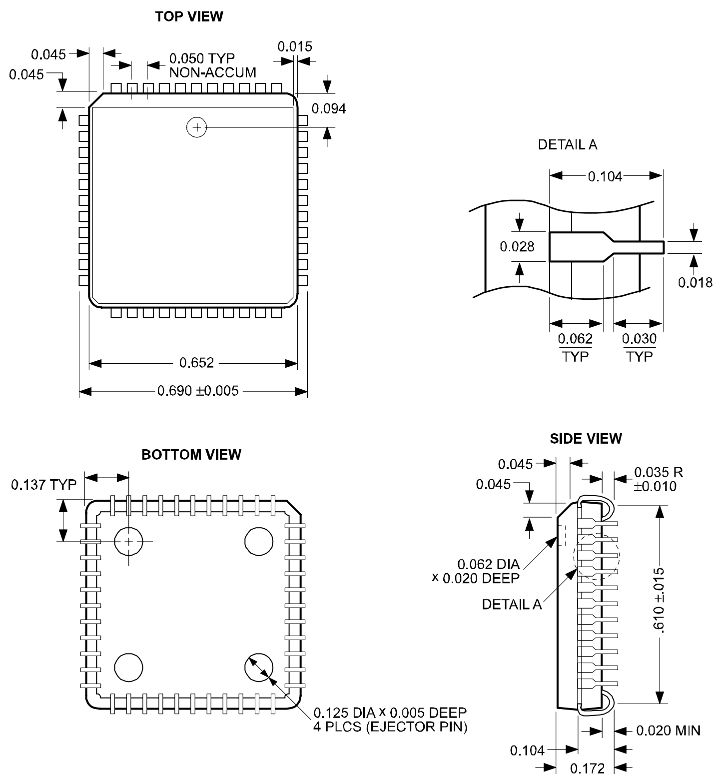


Figure 13. Duplexing 8 Digits with One MM5450

Package Information



40-Pin Plastic DIP (N)



44-Pin PLCC (V)

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