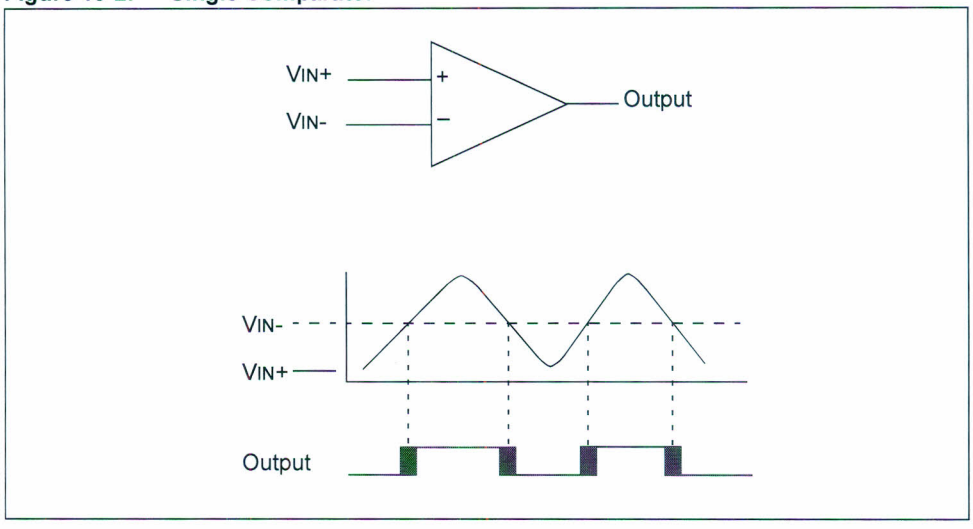
19.3 COMPARATOR OPERATION

A single comparator is shown in Figure 19-2, along with the relationship between the analog input levels and the digital output. When the analog input at VIN+ is less than the analog input VIN-, the output of the comparator is a digital low level. When the analog input at VIN+ is greater than the analog input, VIN-, the output of the comparator is a digital high level. The shaded areas of the output of the comparator in Figure 19-2 represent the uncertainty due to input offsets and response time.

Figure 19-2: Single Comparator



19.4 COMPARATOR REFERENCE

Depending on the comparator operating mode, either an external or internal voltage reference may be used. The analog signal present at VIN- is compared to the signal at VIN+ and the digital output of the comparator is adjusted accordingly (Figure 19-2).

19.4.1 External Reference Signal

When external voltage references are used, the comparator module can be configured to have the comparators operate from the same, or different, reference sources. However, threshold detector applications may require the same reference.

19.4.2 Internal Reference Signal

The comparator module also allows the selection of an internally generated voltage reference from the comparator voltage reference module. This module is described in more detail in **Section 20. "Comparator Voltage Reference Module"**.

The internal reference is available when C1POS = 0, C2POS = 0 and the CVRSS bit (CVRCON<4>) = 0. In this mode, the internal voltage reference is applied to the VIN+ pin of both comparators.

19.5 COMPARATOR RESPONSE TIME

Response time is the maximum time, after selecting a new reference voltage or input source, before the comparator output has a valid level. If the internal reference is changed, the maximum delay of the internal voltage reference must be considered when using the comparator outputs. Otherwise, the maximum delay of the comparators should be used.

23.0 COMPARATOR MODULE

Note: This data sheet summarizes the features of this group of PIC24F devices. It is not intended to be a comprehensive reference source. For more information on the Comparator module, refer to the *"PIC24F Family Reference Manual"*, **Section 46. "Scalable Comparator Module"** (DS39734).

The comparator module provides three dual input comparators. The inputs to the comparator can be configured to use any one of four external analog inputs, as well as a voltage reference input from either the internal band gap reference, divided by 2 (VBG/2), or the comparator voltage reference generator.

The comparator outputs may be directly connected to the CxOUT pins. When the respective COE equals '1', the I/O pad logic makes the unsynchronized output of the comparator available on the pin.

A simplified block diagram of the module is shown in Figure 23-1. Diagrams of the possible individual comparator configurations are shown in Figure 23-2.

Each comparator has its own control register, CMxCON (Register 23-1), for enabling and configuring its operation. The output and event status of all three comparators is provided in the CMSTAT register (Register 23-2).

COE COMPARATOR ENABLE BIT

COE OUTPUT ENABLE BIT

FIGURE 23-1: COMPARATOR MODULE BLOCK DIAGRAM

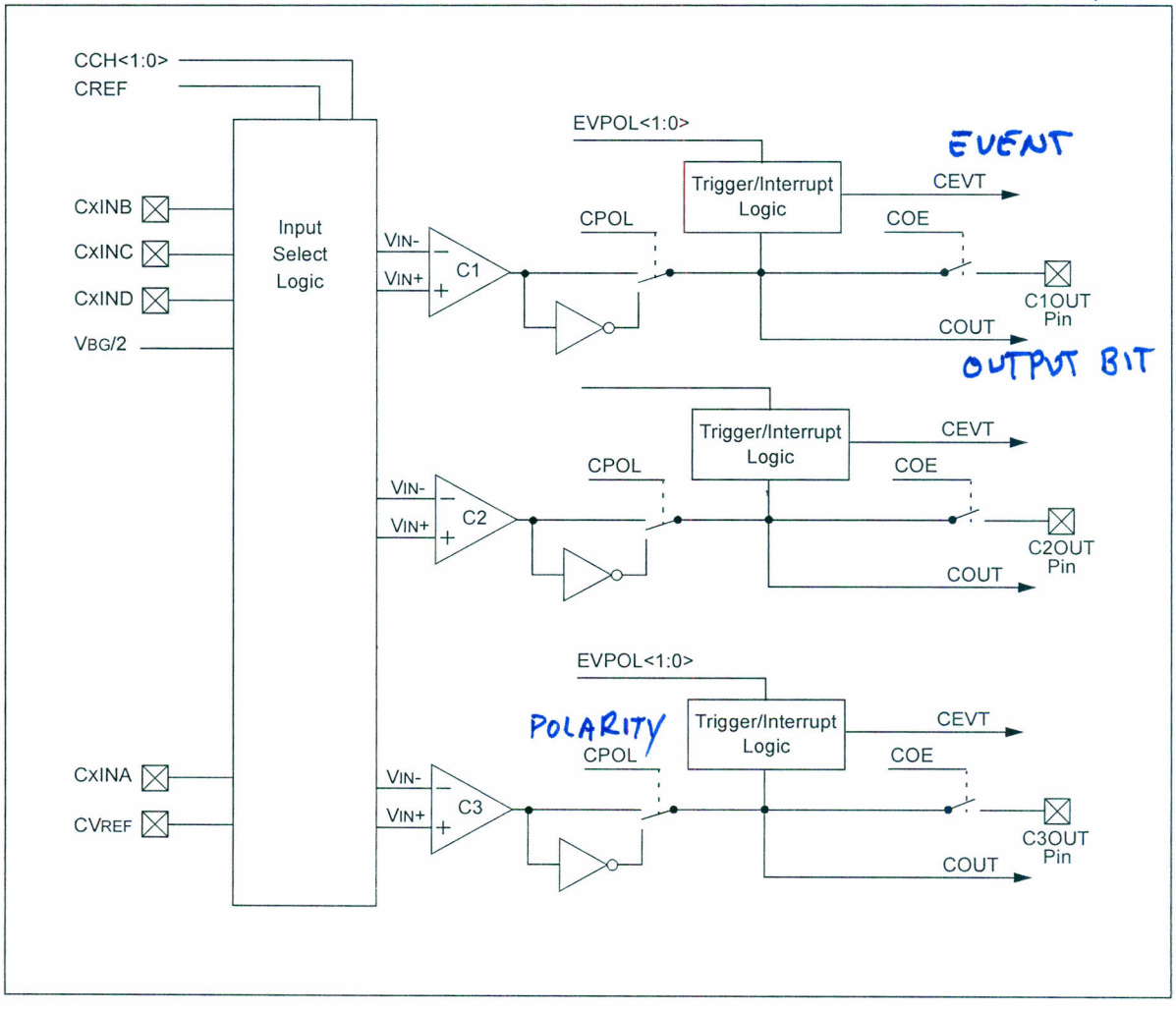
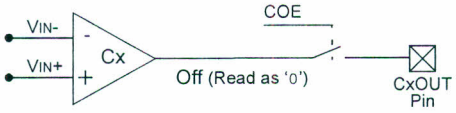
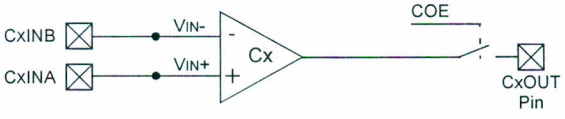


FIGURE 23-2: INDIVIDUAL COMPARATOR CONFIGURATIONS

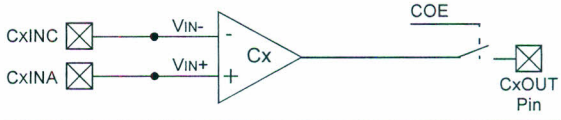
Comparator Off
CON = 0, CREF = x, CCH<1:0> = xx



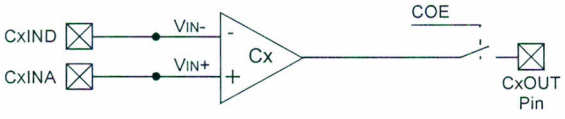
Comparator CxINB > CxINA Compare
CON = 1, CREF = 0, CCH<1:0> = 00



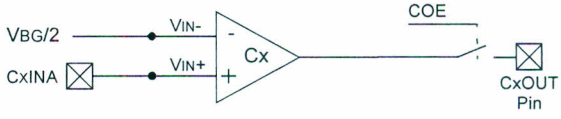
Comparator CxINC > CxINA Compare
CON = 1, CREF = 0, CCH<1:0> = 01



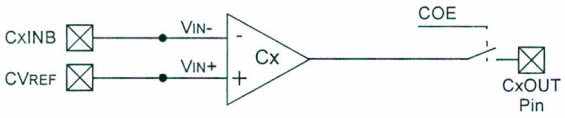
Comparator CxIND > CxINA Compare
CON = 1, CREF = 0, CCH<1:0> = 10



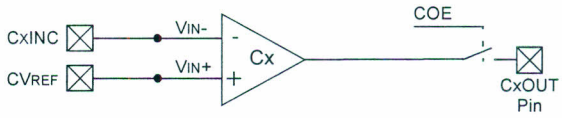
Comparator VBG > CxINA Compare
CON = 1, CREF = 0, CCH<1:0> = 11



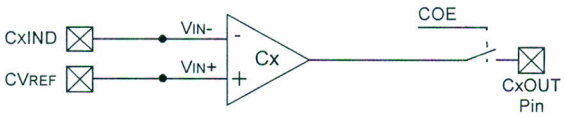
Comparator CxINB > CVREF Compare
CON = 1, CREF = 1, CCH<1:0> = 00



Comparator CxINC > CVREF Compare
CON = 1, CREF = 1, CCH<1:0> = 01



Comparator CxIND > CVREF Compare
CON = 1, CREF = 1, CCH<1:0> = 10



Comparator VBG > CVREF Compare
CON = 1, CREF = 1, CCH<1:0> = 11