Comparator Datasheet CMP V 1.00

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UM Configurations	PSoC® Resources			API Memory (Bytes)		Pins (per External I/O)
	CMP	LPF (Optional)	Analog Interrupt	Flash	ROM	
CY8C24x93						
Without LPF and ISR	1	0	0	106	0	0 to 3*
With LPF only**	1	1	0	124	0	0 to 3*
With ISR only	1	0	1	125	0	0 to 3*
With LPF and ISR**	1	1	1	143	0	0 to 3*

* Depends on UM parameters.
** These configurations are available only for CY8C24193 and CY8C24493 devices

For one or more fully configured, functional code examples that use this user module go to www.cypress.com/psocexampleprojects.

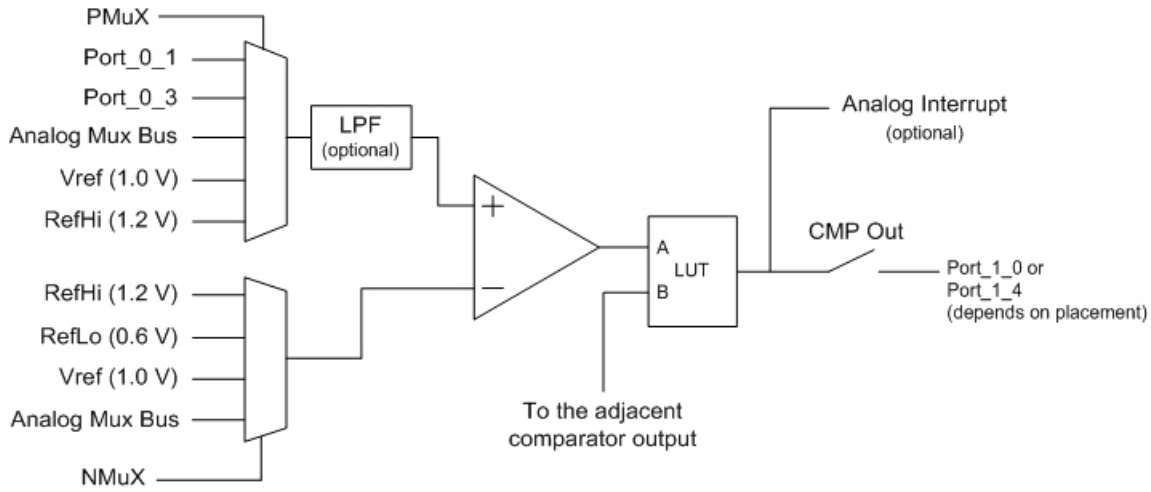
Features and Overview

- Provides two comparators separately
- LPF is accessible to only one instance through the user module placement; however, you can modify the code and use it for both instances
- Supports AMUX connection in both the inputs
- Supports routing CMP output to an external pin

Functional Description

The CMP User Module offers a simple comparator. You can route a pin to the positive input of the comparator and compare it against a reference on the negative input or another pin via AMUX. You can also optionally use an LPF on the positive input. The output of the comparator can be read in firmware for processing or can be routed out via a pin to the external world.

Figure 1. CMP Block Diagram

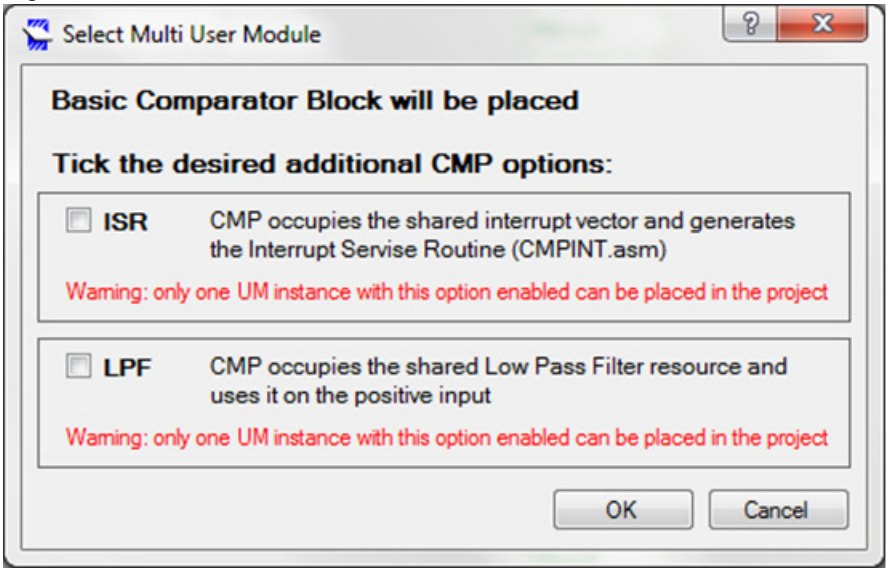


Multi User Module Wizard

The MUM has four combinations for the CY8C24193, CY8C24493, and CY8C24593 devices:

- User module with neither low pass filter (LPF) or interrupt service routine (ISR)
- User module with only LPF
- User module with only ISR
- User module with LPF and ISR

Figure 2. MUM GUI for the CY8C24193, CY8C24493, and CY8C2459 devices

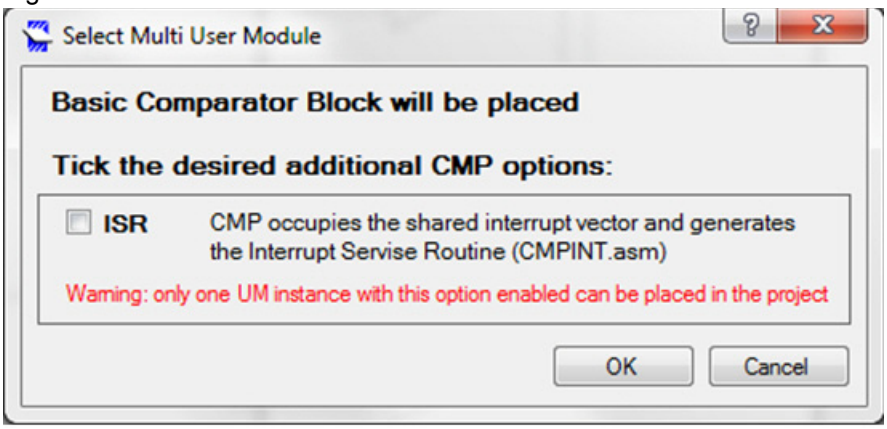


The MUM has two combinations for the CY8C24093, CY8C24293, CY8C24393, and CY8C24693 devices:

- User module without ISR

- User module with ISR

Figure 3. MUM GUI for CY8C20xx7-based Devices



Parameters and Resources

PMuX

This parameter selects the input to a comparator positive input. The affected registers are CMP_MUX and CS_CR3.

Type	ENUM
Range	Port_0_1 Port_0_3 AMuX Vref (1.0 V) RefHi (1.2 V)
Default	Port_0_1

Note If the Vref (1.0 V) or RefHi (1.2 V) is selected – the shared CS_CR3 register is used; therefore, it may override the setting of the user module, which is placed on the adjacent comparator block.

NMuX

This parameter selects the input to a comparator negative input. The affected registers are CMP_MUX and CMP_CR0.

Type	ENUM
Range	RefHi (1.2 V) RefLo (0.6 V) Vref (1.0 V) AMuX
Default	Vref (1.0 V)

Note If the RefHi or AMuX is selected – the shared CMP_CR0 register is used; therefore, it may override the setting of the user module, which is placed on the adjacent comparator block.

LPF Time Constant

This parameter sets the LPF time constant. The dependency is displayed only for devices based out of CY8C20x66A and only if the comparator with the LPF option is selected in MUM. The affected register is CS_CR3.

Type	ENUM
Range	1 µs 2 µs 5 µs 10 µs
Default	1 µs

CMP Out

This parameter connects the comparator output pin. The affected registers are PRTxDR, PRTxDMx, OUT_P1, ADC_TEST2.

Type	ENUM
Range	Port_1_0 (for CMP0) or Port_1_4 (for CMP1)None
Default	None

Application Programming Interface

The Application Programming Interface (API) routines are given as part of the user module to help you deal with the module at a higher level. This section specifies the interface to each function together with related constants given by the “include” files.

Note

In this, as in all user module APIs, the values of the A and X register may be altered by calling an API function. It is the responsibility of the calling function to preserve the values of A and X before the call if those values are required after the call. This “registers are volatile” policy was selected for efficiency reasons. The C compiler automatically takes care of this requirement. Assembly language programmers must ensure their code observes the policy, too. Though some user module API function may leave A and X unchanged, there is no guarantee they may do so in the future.

For Large Memory Model devices, it is also the caller's responsibility to preserve any value in the CUR_PP, IDX_PP, MVR_PP, and MVW_PP registers. Even though some of these registers may not be modified now, there is no guarantee that will remain the case in future releases.

CMP_Start

Description:

Starts the Comparator by setting the power bit and enables comparator output connection to pin if selected.

C Prototype:

```
void  CMP_Start(void);
```

Assembler:

```
lcall  CMP_Start
```

Parameters:

None

Return Value:

None

CMP_Stop

Description:

Stops the Comparator by clearing the power bit.

C Prototype:

```
void  CMP_Stop(void);
```

Assembler:

```
lcall  CMP_Stop
```

Parameters:

None

Return Value:

None

CMP_ChangeMuxes

Description:

Selects the PMuX and NMuX connection for the comparator.

C Prototype:

```
void CMP_ChangeMuxes (BYTE bPMuX, BYTE bNMuX);
```

Assembly:

```
mov A, CMP_PMUX_PORT_0_1 ; bPMuX
mov X, CMP_NMUX_VREF     ; bNMuX
lcall CMP_ChangeMuxes
```

Parameters:

BYTE bPMuX:

Value Name	Value depends on Placement		Description
	CMP0	CMP1	
CMP_PMUX_AMUXBUS	00h	00h	AMUX

Value Name	Value depends on Placement		Description
	CMP0	CMP1	
CMP_PMUX_PORT_0_1	08h	80h	P0[1]
CMP_PMUX_PORT_0_3	0Ch	C0h	P0[1]
CMP_PMUX_VREF	24h	60h	VREF (1.0 V)
CMP_PMUX_REF_HI	04h	40h	RefHi (1.2 V)

BYTE bNMuX:

Value Name	Value depends on Placement		Description
	CMP0	CMP1	
CMP_NMUX_AMUXBUS	42h	60h	AMUX
CMP_NMUX_REF_HI	02h	20h	RefHi (1.2 V)
CMP_NMUX_REF_LO	01h	10h	RefLo (0.6 V)
CMP_NMUX_VREF	00h	00h	VREF (1.0 V)

Return Value:

None

CMP_SetLPF

Description:

Selects the LPF constant for the LPF. Available only if the LPF option is selected in MUM.

C Prototype:

```
void CMP_SetLPF (BYTE bLPFVal);
```

Assembler:

```
Mov A, CMP_LPF_1_US ; bLPFVal
lcall CMP_SetLPF
```

Parameters:

BYTE bLPFVal:

Value Name	Value	Description
CMP_LPF_1_US	0h	1 microsecond
CMP_LPF_2_US	4h	2 microseconds
CMP_LPF_5_US	8h	5 microseconds
CMP_LPF_10_US	Ch	10 microseconds

Return Value:

None

CMP_SetLUT

Description:

Selects the LUT output, which is used for the Comparator output and, therefore, for comparator ISR (if enabled).

C Prototype:

```
void CMP_SetLUT (BYTE bLUTSel);
```

Assembly:

```
Mov A, CMP_LUT_A ; bLUTSel
lcall CMP_ SetLUT
```

Parameters:

BYTE bLUTSel:

Value Name	Value	Description
CMP_LUT_FA	0h	FALSE (zero)
CMP_LUT_A_AND_B	1h	A and B
CMP_LUT_A_AND_NB	2h	A and ~B
CMP_LUT_A	3h	A
CMP_LUT_NA_AND_B	4h	~A and B
CMP_LUT_B	5h	B
CMP_LUT_A_XOR_B	6h	A XOR B
CMP_LUT_A_OR_B	7h	A OR B
CMP_LUT_A_NOR_B	8h	~ (A or B)
CMP_LUT_A_NXOR_B	9h	~ (A XOR B)
CMP_LUT_NB	Ah	~B
CMP_LUT_A_OR_NB	Bh	A or ~B
CMP_LUT_NA	Ch	~A
CMP_LUT_NA_OR_B	Dh	~A or B
CMP_LUT_A_NAND_B	Eh	~ (A and B)
CMP_LUT_TRUE	Fh	TRUE (one)

A > UM’s own Comparator output

B > Adjacent (opposite) Comparator output

Return Value:

None

CMP_EnableInt

Description:

Enables the comparator ISR; this API is not available when the interrupt option is disabled in the MUM selection.

C Prototype:

```
void CMP_EnableInt (void);
```

Assembly:

```
lcall CMP_EnableInt
```

Parameters:

None

Return Value:

None

CMP_DisableInt

Description:

Disables the comparator ISR; this API is not available when the interrupt option is disabled in the MUM selection.

C Prototype:

```
void CMP_DisableInt (void);
```

Assembly:

```
lcall CMP_DisableInt
```

Parameters:

None

Return Value:

None

CMP_ClearInt

Description:

Clears the comparator ISR if set; this API is not available when the interrupt option is disabled in the MUM selection.

C Prototype:

```
void CMP_ClearInt (void);
```

Assembly:

```
lcall CMP_ClearInt
```

Parameters:

None

Return Value:

None

CMP_bStatus

Description:

Returns the comparator output state.

C Prototype:

```
void CMP_bStatus (void);
```

Assembly:

```
lcall CMP_bStatus
jz    .Zero ;if cmp out is low
;else cmp out is high
```

Parameters:

None

Return Value:

Non-zero if the Comparator output is high; otherwise, it is zero.

Sample Firmware Source Code

C Sample Code:

```
//-------------------------------------------------------------------------
// CMP sample code
//
// UM should be named "CMP"
//-------------------------------------------------------------------------

#include <m8c.h>        // part specific constants and macros
#include "PSoCAPI.h"    // PSoC API definitions for all User Modules

void main(void)
{
    CMP_ChangeMuxes(CMP_PMUX_PORT_0_1, CMP_NMUX_VREF);
    CMP_Start();
    M8C_EnableGInt;
    while(1);
}
```

ASM Sample Code:

```
;-------------------------------------------------------------
; CMP sample code
;
; UM should be named "CMP"
;-------------------------------------------------------------

include "m8c.inc"       ; part specific constants and macros
```

```
include "memory.inc"    ; Constants & macros for SMM/LMM and Compiler
include "PSoCAPI.inc"   ; PSoC API definitions for all User Modules

export _main

area text (rel,con,rom,code)

_main:
    mov   A, CMP_PMUX_PORT_0_1 ; bPMuX
    mov   X, CMP_NMUX_VREF     ; bNMuX
    lcall CMP_ChangeMuxes
    lcall CMP_Start
    M8C_EnableGInt

.mainloop:
    jmp   .mainloop
```

Version History

Version	Originator	Description
1.00	HPHA	Initial version

Note PSoC Designer 5.1 introduces a Version History in all user module datasheets. This section documents high level descriptions of the differences between the current and previous user module versions.

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