C2000 Real-Time Microcontrollers Peripherals

Reference Guide

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Table of Contents

List of Tables

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Read This First

About This Manual

This reference guide describes all the peripherals available for TMS320x28x and F29x devices. Chapter 2 shows the peripherals used by each device. Chapter 3 provides descriptions of the peripherals. You can download a document by clicking on the literature number, which is linked to the portable document format (pdf) file.

Note

Texas Instruments is transitioning to use more inclusive terminology. Some language may be different than what you would expect to see for certain technology areas.

Related Documentation from Texas Instruments

For a complete listing of related documentation and development-support tools for these devices, visit the Texas Instruments website at www.ti.com.

The *TMS320C28x DSP CPU and Instruction Set Reference Guide* and the *TMS320C28x Floating Point Unit and Instruction Set Reference Guide* must be used in conjunction with this reference guide.

The *F29x CPU Reference Guide* must be used in conjunction with this reference guide.

Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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Chapter 1

Abbreviations

Throughout this document and other peripheral guides, the following abbreviations are used for a series of C28x and C29x microcontrollers:

- **TMS320x28xx** refers to TMS320x281x and TMS320x280x devices.
- **TMS320x28xxx** refers to TMS320x2801x, TMS320x2802x, TMS320x2803x, TMS320x2804x, TMS320x2805x, TMS320x2806x, TMS320x2807x, TMS320x2823x, TMS320x2833x, TMS320x2834x, TMS320x2837xD, and TMS320x2837xS devices.
- **TMS320F28002x** refers to F28002x devices.
- **TMS320F28003x** refers to F28003x devices.
- **TMS320F28004x** refers to F28004x devices.
- **TMS320F280013x** refers to F280013x devices.
- **TMS320F280015x** refers to F280015x devices.
- **TMS320F2838x** refers to F2838x devices.
- **TMS320x28M3xx** refers to F28M35x and F28M36x devices.
- **TMS320F28P55x** refers to F28P55x devices.
- **TMS320F28P65x** refers to F28P65x devices.
- **F28E12x** refers to F28E12 devices.
- **F29H85x** refers to F29H85x devices.
- **F29P58x** refers to F29P58x devices.

Specific device abbreviations are listed in the following sections.

1.1 Gen 1 Device Abbreviations

Specific device abbreviations for the generation 1 devices are listed in Table 1-1.

Table 1-1. Device Abbreviation Matrix (Gen 1 Devices)

Family	Device[1]	Device Abbreviation Used	Group Abbreviation
TMS320x280x	TMS320F2801, TMS320C2801	2801	280x
	TMS320F2802, TMS320C2802	2802	
	TMS320F2806	2806	
	TMS320F2808	2808	
	TMS320F2809	2809	
TMS320x2801x	TMS320F28015	28015	2801x
	TMS320F28016	28016	
TMS320x281x	TMS320F2810	2810	281x
	TMS320F2811	2811	
	TMS320F2812	2812	
TMS320F2823x	TMS320F28232	28232	2823x
	TMS320F28234	28234	
	TMS320F28235	28235	
TMS320F2833x	TMS320F28332	28332	2833x
	TMS320F28333	28333	
	TMS320F28334	28334	
	TMS320F28335	28335	
TMS320x2834x	TMS320C28341	28341	2834x
	TMS320C28342	28342	
	TMS320C28343	28343	
	TMS320C28344	28344	
	TMS320C28345	28345	
	TMS320C28346	28346	

(1) Where F precedes the device abbreviation, F stands for Flash memory; C stands for RAM.

1.2 Gen 2 Device Abbreviations

Specific device abbreviations for the generation 2 devices are listed in Table 1-2.

Table 1-2. Device Abbreviation Matrix (Gen 2 Devices)

Family	Device[1]	Device Abbreviation Used	Group Abbreviation
TMS320F2802x	TMS320F28020	28020	2802x
	TMS320F280200	280200	
	TMS320F28021	28021	
	TMS320F28022	28022	
	TMS320F28023	28023	
	TMS320F28026	28026	
	TMS320F28026F	28026F	
	TMS320F28027	28027	
	TMS320F28027F	28027F	

Table 1-2. Device Abbreviation Matrix (Gen 2 Devices) (continued)

Family	Device[1]	Device Abbreviation Used	Group Abbreviation
TMS320F2803x	TMS320F28030	28030	2803x
	TMS320F28031	28031	
	TMS320F28032	28032	
	TMS320F28033	28033	
	TMS320F28034	28034	
	TMS320F28035	28035	
TMS320x2804x	TMS320F28044	28044	2804x
TMS320F2805x	TMS320F28050	28050	2805x
	TMS320F28051	28051	
	TMS320F28052	28052	
	TMS320F28052F	28052F	
	TMS320F28052M	28052M	
	TMS320F28053	28053	
	TMS320F28054	28054	
	TMS320F28054F	28054F	
	TMS320F28054M	28054M	
	TMS320F28055	28055	
TMS320F2806x	TMS320F28062	28062	2806x
	TMS320F28062F	28062F	
	TMS32028062U	28062U	
	TMS320F28063	28063	
	TMS32028063U	28063U	
	TMS320F28064	28064	
	TMS32028064U	28064U	
	TMS320F28065	28065	
	TMS32028065U	28065U	
	TMS320F28066	28066	
	TMS32028066U	28066U	
	TMS320F28067	28067	
	TMS32028067U	28067U	
	TMS320F28068F	28068F	
	TMS320F28068M	28068M	
	TMS32028068U	28068U	
	TMS320F28069	28069	
	TMS320F28069F	28069F	
	TMS320F28069M	28069M	
	TMS32028069U	28069U	
TMS320F28M35x	F28M35E20B	35E20B	M35x
	F28M35H22C	35H22C	
	F28M35M22C	35M22C	
	F28M35H52C	35H52C	
	F28M35M52C	35M52C	

Table 1-2. Device Abbreviation Matrix (Gen 2 Devices) (continued)

Family	Device[1]	Device Abbreviation Used	Group Abbreviation
TMS320F28M36x	F28M36H33B	M36H33B	M36x
	F28M36H53B	M36H53B	
	F28M36P53C	M36P53C	
	F28M36P63C	M36P63C	

(1) Where F precedes the device abbreviation, F stands for Flash memory; C stands for RAM.

1.3 Gen 3 Device Abbreviations

Specific device abbreviations for the generation 3 devices are listed in Table 1-3.

Table 1-3. Device Abbreviation Matrix (Gen 3 Devices)

Family	Device[1]	Device Abbreviation Used	Group Abbreviation
F28E12x	F28E120SB	F28E120SB	28E12x
	F28E120SC	F28E120SC	
TMS320F2807x	TMS320F28075	28075	2807x
	TMS320F28076	28076	
TMS320F28002x	TMS320F280021	280021	28002x
	TMS320F280023	280023	
	TMS320F280023C	280023C	
	TMS320F280025	280025	
	TMS320F280025C	280025C	
TMS320F28003x	TMS320F280033	280033	28003x
	TMS320F280034	280034	
	TMS320F280036	280036	
	TMS320F280036C	280036C	
	TMS320F280037	280037	
	TMS320F280037C	280037C	
	TMS320F280038	280038	
	TMS320F280038C	280038C	
	TMS320F280039	280039	
	TMS320F280039C	280039C	
TMS320F28004x	TMS320F280040	280040	28004x
	TMS320F280040C	280040C	
	TMS320F280041	280041	
	TMS320F280041C	280041C	
	TMS320F280045	280045	
	TMS320F280048	280048	
	TMS320F280048C	280048C	
	TMS320F280049	280049	
	TMS320F280049C	280049C	
TMS320F280013x	TMS320F2800132	2800132	280013x
	TMS320F2800133	2800133	
	TMS320F2800135	2800135	
	TMS320F2800137	2800137	

Table 1-3. Device Abbreviation Matrix (Gen 3 Devices) (continued)

Family	Device[1]	Device Abbreviation Used	Group Abbreviation
TMS320F280015x	TMS320F2800152	2800152	280015x
	TMS320F2800153	2800153	
	TMS320F2800154	2800154	
	TMS320F2800156	2800156	
	TMS320F2800157	2800157	
TMS320F2837xD	TMS320F28374D	28374D	2837xD
	TMS320F28375D	28375D	
	TMS320F28376D	28376D	
	TMS320F28377D	28377D	
	TMS320F28378D	28378D	
	TMS320F28379D	28379D	
TMS320F2837xS	TMS320F28374S	28374S	2837xS
	TMS320F28375S	28375S	
	TMS320F28376S	28376S	
	TMS320F28377S	28377S	
	TMS320F28378S	28378S	
	TMS320F28379S	28379S	
TMS320F2838x	TMS320F28384D	28384D	2838x
	TMS320F28384S	28384S	
	TMS320F28386D	28386D	
	TMS320F28386S	28386S	
	TMS320F28388D	28388D	
	TMS320F28388S	28388S	
TMS320F28P55x	TMS320F28P550SC	28P550SC	28P55x
	TMS320F28P550SD	28P550SD	
	TMS320F28P550SG	28P550SG	
	TMS320F28P550SJ	28P550SJ	
	TMS320F28P559SG	28P559SG	
	TMS320F28P559SJ	28P559SJ	
TMS320F28P65x	TMS320F28P650	28P650	28P65x
	TMS320F28P659	28P659	

(1) Where F precedes the device abbreviation, F stands for Flash memory; C stands for RAM.

1.4 Gen 4 Device Abbreviations

Specific device abbreviations for the generation 4 devices are listed in Table 1-4.

Table 1-4. Device Abbreviation Matrix (Gen 4 Devices)

Family	Device[1]	Device Abbreviation Used	Group Abbreviation
F29H85x	F29H850DM	F29H850DM	29H85x
	F29H850DU	F29H850DU	
	F29H850TU	F29H850TU	
	F29H859DM	F29H859DM	
	F29H859DU	F29H859DU	
	F29H859TM	F29H859TM	
	F29H859TU	F29H859TU	
F29P58x	F29P580DM	F29P580DM	29P58x
	F29P589DM	F29P589DM	
	F29P589DU	F29P589DU	

(1) Where F precedes the device abbreviation, F stands for Flash memory; C stands for RAM.

Chapter 2

Peripherals Available Per Device

This section lists the peripherals available for each of the C28x and C29x devices. The literature number is a link to the document that can be downloaded.

2.1 Gen 1 Device Peripherals

This section lists the peripherals available for each of the generation 1 devices. The literature number is a link to the document that can be downloaded.

2.1.1 TMS320x280x, TMS320x2801x Peripherals

Table 2-1 lists the peripherals available on the TMS320x280x and TMS320x2801x devices.

Table 2-1. TMS320x280x, TMS320x2801x Peripheral Selection Guide

Peripheral	Lit. No.	Type(1)	2809, 2808, 2806, 2802, 2801	28016	28015
System Control and Interrupts	SPRU712	–	X	X	X
Boot ROM	SPRU722	–	X	X	X
Analog-to-Digital Converter (ADC)	SPRU716	1	X	X	X
Analog-to-Digital Converter Wrapper	SPRU716	0	X	X	X
Serial Communications Interface (SCI)	SPRUFK7	0	X	X	X
Serial Peripheral Interface (SPI)	SPRUG72	0	X	X	X
Enhanced Controller Area Network (eCAN)	SPRUEU0	0	X	X	–
Enhanced Quadrature Encoder Pulse (eQEP)	SPRU790	0	X	–	–
Enhanced Pulse Width Modulator Module (ePWM)	SPRU791	0	X	X	X
Enhanced Capture (eCAP) Module	SPRU807	0	X	X	X
Inter-Integrated Circuit (I2C)	SPRU721	0	X	X	X

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the peripheral reference guides.

2.1.2 TMS320x281x Peripherals

Table 2-2 lists the peripherals available on the TMS320x281x device.

Table 2-2. TMS320x281x Peripheral Selection Guide

Peripheral	Lit. No.	Type(1)	2812	2811, 2810
System Control and Interrupts	SPRU078	–	X	X
Boot ROM	SPRU095	–	X	X
Analog-to-Digital Converter (ADC)	SPRU060	0	X	X
Analog-to-Digital Converter Wrapper	SPRU060	0	X	X
External Interface (XINTF)	SPRU067	0	X	–
Enhanced Controller Area Network (eCAN)	SPRU074	0	X	X
Event Manager (EV)	SPRU065	0	X	X
Multichannel Buffered Serial Port (McBSP)	SPRU061	0	X	X
Serial Communications Interface (SCI)	SPRU051	0	X	X
Serial Peripheral Interface (SPI)	SPRU059	0	X	X

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the peripheral reference guides.

2.1.3 TMS320F2823x Peripherals

Table 2-3 lists the peripherals available on the TMS320F2823x device.

Table 2-3. TMS320F2823x Peripheral Selection Guide

Peripheral	Lit. No.	Type(1)	28235, 28234, 28232
System Control and Interrupts	SPRUI07	–	X
Boot ROM		–	X
Analog-to-Digital Converter (ADC)		2	X
Analog-to-Digital Converter Wrapper		0	X
Multichannel Buffered Serial Port (McBSP)		1	X
Serial Communications Interface (SCI)		0	X
Serial Peripheral Interface (SPI)		0	X
Enhanced Controller Area Network (eCAN)		0	X
Enhanced Quadrature Encoder Pulse (eQEP)		0	X
Enhanced Pulse Width Modulator Module (ePWM)		0	X
Enhanced Capture Module (eCAP)		0	X
Inter-Integrated Circuit (I2C)		0	X
Direct Memory Access (DMA)		0	X
External Interface (XINTF)		1	X

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.

2.1.4 TMS320F2833x Peripherals

Table 2-4 lists the peripherals available on the TMS320F2833x device.

Table 2-4. TMS320F2833x Peripheral Selection Guide

Peripheral	Lit. No.	Type(1)	28335, 28334, 28333, 28332
System Control and Interrupts	SPRUI07	–	X
Boot ROM		–	X
Analog-to-Digital Converter (ADC)		2	X
Analog-to-Digital Converter Wrapper		0	X
Multichannel Buffered Serial Port (McBSP)		1	X
Serial Communications Interface (SCI)		0	X
Serial Peripheral Interface (SPI)		0	X
Enhanced Controller Area Network (eCAN)		0	X
Enhanced Quadrature Encoder Pulse (eQEP)		0	X
Enhanced Pulse Width Modulator Module (ePWM)		0	X
Enhanced Capture Module (eCAP)		0	X
Inter-Integrated Circuit (I2C)		0	X
Direct Memory Access (DMA)		0	X
External Interface (XINTF)		1	X
Floating-Point Unit (FPU)	SPRUHS1	–	X

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.

2.1.5 TMS320x2834x Peripherals

Table 2-5 lists the peripherals available on the TMS320x2834x device.

Table 2-5. TMS320x2834x Peripheral Selection Guide

Peripheral	Lit. No.	Type(1)	28346, 28345, 28344, 28343, 28342, 28341
System Control and Interrupts	SPRUFN1	–	X
Boot ROM	SPRUFN5	–	X
Multichannel Buffered Serial Port (McBSP)	SPRUG80	1	X
Serial Communications Interface (SCI)	SPRUG75	0	X
Serial Peripheral Interface (SPI)	SPRUG73	0	X
Enhanced Controller Area Network (eCAN)	SPRUEU4	0	X
Enhanced Quadrature Encoder Pulse (eQEP)	SPRUG74	0	X
Enhanced Pulse Width Modulator Module (ePWM)	SPRUFZ6	0	X
Enhanced Capture Module (eCAP)	SPRUG79	0	X
Inter-Integrated Circuit (I2C)	SPRUG76	0	X
Direct Memory Access (DMA)	SPRUG78	0	X
External Interface (XINTF)	SPRUFN4	1	X
Floating-Point Unit (FPU)	SPRUHS1	–	X

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the peripheral reference guide.

2.2 Gen 2 Device Peripherals

This section lists the peripherals available for each of the generation 2 devices. The literature number is a link to the document that can be downloaded.

2.2.1 TMS320F2802x Peripherals

Table 2-6 lists the peripherals available on the TMS320F2802x device.

Table 2-6. TMS320F2802x Peripheral Selection Guide

Peripheral	Lit. No.	Type(1)	28027, 28026, 28023, 28022	28021, 28020, 280200
System Control and Interrupts	SPRUI09	–	X	X
Boot ROM		–	X	X
Analog-to-Digital Converter (ADC)(2)		3	X	X
Analog-to-Digital Converter Wrapper		1	X	X
Comparator Module (COMP)		0	X	X
Serial Communications Interface (SCI)		0	X	X
Serial Peripheral Interface (SPI)		1	X	X
Enhanced Pulse Width Modulator Module (ePWM)		1	X	X
Enhanced Capture Module (eCAP)		0	X	X
Inter-Integrated Circuit (I2C)		0	X	X
InstaSPIN-FOC	SPRUHP4	–	X(3)	X(3)

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.
(2) The ADC module is Type 3 and the Comparator module is Type 0.
(3) InstaSPIN-FOC™ is available only on TMS320F2802xF devices.

2.2.2 TMS320F2803x Peripherals

Table 2-7 lists the peripherals available on the TMS320F2803x device.

Table 2-7. TMS320F2803x Peripheral Selection Guide

Peripheral	Lit. No.	Type(1)	28035, 28033	28034, 28032	28031, 28030
System Control and Interrupts	SPRUI10	–	X	X	X
Boot ROM		–	X	X	X
Analog-to-Digital Converter (ADC)(2)		3	X	X	X
Analog-to-Digital Converter Wrapper		1	X	X	X
Comparator Module (COMP)		0	X	X	X
Serial Communications Interface (SCI)		0	X	X	X
Serial Peripheral Interface (SPI)		1	X	X	X
Enhanced Controller Area Network (eCAN)		0	X	X	X
Enhanced Quadrature Encoder Pulse (eQEP)		0	X	X	X
Enhanced Pulse Width Modulator (ePWM)		1	X	X	X
Enhanced Capture Module (eCAP)		0	X	X	X
Inter-Integrated Circuit (I2C)		0	X	X	X
Local Interconnect Network (LIN)		0	X	X	X
High-Resolution Capture (HRCAP)		0	X	X	–
Control Law Accelerator (CLA)		0	X	–	–

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.
(2) The ADC module is Type 3 and the Comparator module is Type 0.

2.2.3 TMS320x2804x Peripherals

Table 2-8 lists the peripherals available on the TMS320x2804x device.

Table 2-8. TMS320x2804x Peripheral Selection Guide

Peripheral	Lit. No.	Type(1)	28044
System Control and Interrupts	SPRU712	–	X
Boot ROM	SPRU722	–	X
Analog-to-Digital Converter (ADC)	SPRU716	1	X
Analog-to-Digital Converter Wrapper	SPRU716	0	X
Serial Communications Interface (SCI)	SPRUFK7	0	X
Serial Peripheral Interface (SPI)	SPRUG72	0	X
Enhanced Pulse Width Modulator Module (ePWM)	SPRU791	0	X
Inter-Integrated Circuit (I2C)	SPRU721	0	X

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the peripheral reference guides.

2.2.4 TMS320F2805x Peripherals

Table 2-9 lists the peripherals available on the TMS320F2805x device.

Table 2-9. TMS320F2805x Peripheral Selection Guide

Peripheral	Lit. No.	Type(1)	28055, 28054, 28053	28052, 28051, 28050
System Control and Interrupts	SPRUHE5	–	X	X
Boot ROM		–	X	X
Analog-to-Digital Converter (ADC)(2)		3	X	X
Analog-to-Digital Converter Wrapper		1	X	X
Comparator Module (COMP)		1	X	X
Buffered Digital-to-Analog Converter (DAC)		0	X	X
Programmable Gain Amplifiers (PGA)		0	X	X
Serial Communications Interface (SCI)		0	X	X
Serial Peripheral Interface (SPI)		1	X	X
Enhanced Controller Area Network (eCAN)		0	X	X
Enhanced Quadrature Encoder Pulse (eQEP)		0	X	X
Enhanced Pulse Width Modulator (ePWM)		1	X	X
Enhanced Capture Module (eCAP)		0	X	X
Inter-Integrated Circuit (I2C)		0	X	X
Control Law Accelerator (CLA)		0	X	–
InstaSPIN–FOC	SPRUHW0	–	X(3)	X(3)
InstaSPIN-MOTION	SPRUHW1	–	X(4)	X(4)

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.
(2) The ADC module is Type 3 and the Comparator module is Type 1.
(3) InstaSPIN-FOC™ is available only on TMS320F2805xF and TMS320F2805xM devices.
(4) InstaSPIN-MOTION™ is available only on TMS320F2805xM devices.

2.2.5 TMS320F2806x Peripherals

Table 2-10 lists the peripherals available on the TMS320F2806x device.

Table 2-10. TMS320F2806x Peripheral Selection Guide

Peripheral	Lit. No.	Type(1)	28069, 28065	28068, 28064	28067, 28066, 28063, 28062
System Control and Interrupts	SPRUH18	–	X	X	X
Boot ROM		–	X	X	X
Analog-to-Digital Converter (ADC)(2)		3	X	X	X
Analog-to-Digital Converter Wrapper		1	X	X	X
Comparator Module (COMP)		0	X	X	X
Serial Communications Interface (SCI)		0	X	X	X
Serial Peripheral Interface (SPI)		1	X	X	X
Enhanced Controller Area Network (eCAN)		0	X	X	X
Enhanced Quadrature Encoder Pulse (eQEP)		0	X	X	X
Enhanced Pulse Width Modulator (ePWM)		1	X	X	X
Enhanced Capture Module (eCAP)		0	X	X	X
Inter-Integrated Circuit (I2C)		0	X	X	X
High-Resolution Capture (HRCAP)		0	X	X	X
Control Law Accelerator (CLA)		0	X	–	–
Direct Memory Access (DMA)		0	X	X	X
Multichannel Buffered Serial Port (McBSP)		1	X	X	X
Universal Serial Bus (USB)		0	X(3)	X(3)	X(3)
InstaSPIN–FOC	SPRUHI9	–	X(4)	X(4)	X(4)
InstaSPIN-MOTION	SPRUHJ0	–	X(5)	X(5)	X(5)
Floating-Point Unit (FPU)	SPRUHS1	–	X	X	X
Viterbi, Complex Math and CRC Unit (VCU)		1	X	X	–

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.
(2) The ADC module is Type 3 and the Comparator module is Type 0.
(3) USB is available only on TMS320F2806xU, TMS320F2806xF, and TMS320F2806xM devices.
(4) InstaSPIN-FOC™ is available only on TMS320F2806xF and TMS320F2806xM devices.
(5) InstaSPIN-MOTION™ is available only on TMS320F2806xM devices.

2.2.6 TMS320F28M35x Peripherals

Table 2-11 lists the peripherals available on the TMS320F28M35x device.

Table 2-11. TMS320F28M35x Peripheral Selection Guide

Peripheral	Lit. No.	Type[1]	M35xx2C	M35xx0B
System Control and Interrupts	SPRUH22	–	X	X
Boot ROM		–	X	X
Analog-to-Digital Converter (ADC)[2]		3	X	X
Analog-to-Digital Converter Wrapper		2	X	X
Comparator Module (COMP)		0	X	X
External Peripheral Interface (EPI)		0	X	X
Hardware Built-in Self-Test Module (HWBIST)		0	X	X
Arm® Cortex®-M3 Peripherals				
Ethernet Media Access Controller (EMAC)		0	X	–
Synchronous Serial Interface (SSI)		0	X	X
Controller Area Network (DCAN)		0	X	X
Universal Serial Bus (USB)		0	X	-
M3 Inter-Integrated Circuit (I2C)		0	X	X
Universal Asynchronous Receiver/Transmitter (UART)		0	X	X
Micro Cyclic Redundancy Check Module (µCRC)		0	X	X
Direct Memory Access (µDMA)		0	X	X
Control Subsystem - C28x Peripherals				
Serial Communications Interface (SCI)		0	X	X
Enhanced Quadrature Encoder Pulse (eQEP)		0	X	X
Enhanced Pulse-Width Modulator (ePWM)		2	X	X
Enhanced Capture Module (eCAP)		0	X	X
Inter-Integrated Circuit (I2C)		0	X	X
Direct Memory Access Module (DMA)		0	X	X
Multichannel Buffered Serial Port (McBSP)		1	X	X
Serial Peripheral Interface (SPI)		0	X	X
Viterbi, Complex Math and CRC Unit (VCU)	SPRUHS1	0	X	X
Floating-Point Unit (FPU)		–	X	X

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.
(2) The ADC module is Type 3 and the Comparator module is Type 0.

2.2.7 TMS320F28M36x Peripherals

Table 2-12 lists the peripherals available on the TMS320F28M36x device.

Table 2-12. TMS320F28M36x Peripheral Selection Guide

Peripheral	Lit. No.	Type(1)*	M36xxxC	M36xxxB
System Control and Interrupts	SPRUHE8	–	X	X
Boot ROM		–	X	X
Analog-to-Digital Converter (ADC)(2)		3	X	X
Analog-to-Digital Converter Wrapper		2	X	X
Comparator Module (COMP)		0	X	X
External Peripheral Interface (EPI)(3)		0	X	X
Hardware Built-in Self-Test Module (HWBIST)		0	X	X
Arm® Cortex®-M3 Peripherals				
Ethernet Media Access Controller (EMAC)		0	X	–
Synchronous Serial Interface (SSI)		0	X	X
Controller Area Network (DCAN)		0	X	X
Universal Serial Bus (USB)		0	X	–
M3 Inter-Integrated Circuit (I2C)		0	X	X
Universal Asynchronous Receiver/Transmitter (UART)		0	X	X
Micro Cyclic Redundancy Check Module (µCRC)		0	X	X
Direct Memory Access (µDMA)		0	X	X
Control Subsystem - C28x Peripherals				
Serial Communications Interface (SCI)		0	X	X
Enhanced Quadrature Encoder Pulse (eQEP)		0	X	X
Enhanced Pulse Width Modulator (ePWM)		2	X	X
Enhanced Capture Module (eCAP)		0	X	X
Inter-Integrated Circuit (I2C)		0	X	X
Direct Memory Access (DMA)		0	X	X
Multichannel Buffered Serial Port (McBSP)		1	X	X
Serial Peripheral Interface (SPI)		0	X	X
Viterbi, Complex Math and CRC Unit (VCU)	SPRUHS1	0	X	X
Floating-Point Unit (FPU)		–	X	X

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.
(2) The ADC module is Type 3 and the Comparator module is Type 0.
(3) The EPI module is controlled by either CPU. Refer to the relevant section of SPRUHE8 for more information.

2.3 Gen 3 Device Peripherals

This section lists the peripherals available for each of the generation 3 devices. The literature number is a link to the document that can be downloaded.

2.3.1 TMS320F2807x Peripherals

Table 2-13 lists the peripherals available on the TMS320F2807x device.

Table 2-13. TMS320F2807x Peripheral Selection Guide

Peripheral	Lit. No.	Type(1)	28076	28075
System Control and Interrupts	SPRUHM9	–	X	X
ROM Code and Peripheral Booting		–	X	X
Analog-to-Digital Converter (ADC)		4	X	X
Analog-to-Digital Converter Wrapper		3	X	X
Direct Memory Access (DMA)		0	X	X
Control Law Accelerator (CLA)		1	X	X
General-Purpose Input /Output (GPIO)		–	X	X
Comparator Subsystem (CMPSS)		0	X	X
Configurable Logic Block (CLB)		1	X	–
Buffered Digital to Analog Converter (DAC)		1	X	X
Sigma Delta Filter Module (SDFM)		0	X	X
Hardware Built-in Self-Test Module (HWBIST)		0	X	X
Enhanced Capture Module (eCAP)		0	X	X
Enhanced Pulse Width Modulator (ePWM)		4	X	X
Enhanced Quadrature Encoder Pulse (eQEP)		0	X	X
Serial Peripheral Interface (SPI)		2	X	X
Serial Communications Interface (SCI)		0	X	X
Inter-Integrated Circuit (I2C)		0	X	X
Multichannel Buffered Serial Port (McBSP)		1	X	X
Controller Area Network (DCAN)		0	X	X
Universal Serial Bus (USB)		0	X	X
External Memory Interface (EMIF)		0	X	X
Crossbar (X-BAR)		0	X	X
Trigonometric Math Unit (TMU)	SPRUHS1	0	X	X
Floating-Point Unit (FPU)		–	X	X

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.

2.3.2 TMS320F28002x Peripherals

Table 2-14 lists the peripherals available on the TMS320F28002x device.

Table 2-14. TMS320F28002x Peripheral Selection Guide

Peripheral	Lit. No.	Type(1)	280025C, 280024C, 280023C	280025, 280024, 280023, 280022, 280021
System Control and Interrupts	SPRUIN7	–	X	X
ROM Code and Peripheral Booting		–	X	X
Dual-Clock Comparator (DCC)		2	X	X
Analog-to-Digital Converter (ADC)		5	X	X
Analog-to-Digital Converter Wrapper		3	X	X
Direct Memory Access (DMA)		0	X	X
General-Purpose Input/Output (GPIO)		–	X	X
Temperature Sensor		–	X	X
Comparator Subsystem (CMPSS)		1	X	X
Configurable Logic Block (CLB)		3	X	-
Enhanced Pulse Width Modulator (ePWM)		4	X	X
Enhanced Capture Module (eCAP)		2	X	X
Enhanced Quadrature Encoder Pulse (eQEP)		2	X	X
High-Resolution Capture Module (HRCAP)		2	X	X
Serial Peripheral Interface (SPI)		2	X	X
Serial Communications Interface (SCI)		0	X	X
Inter-Integrated Circuit (I2C)		1	X	X
Local Interconnect Network (LIN)		1	X	X
Fast Serial Interface (FSI)		1	X	X
Power Management Bust Module (PMBus)		0	X	X
Host Interface Controller (HIC)		1	X	X
Background CRC-32 (BGCRC)		0	X	X
Controller Area Network (DCAN)		0	X	X
Hardware Built-in Self-Test Module (HWBIST)		0	X	X
Memory Power On Self-Test (MPOST)		0	X	X
Embedded Real-time Analysis and Diagnostic (ERAD)		1	X	X
Crossbar (X-BAR)		0	X	X
Trigonometric Math Unit (TMU)	SPRUHS1	1	X	X
Cyclic Redundancy Check (VCRC)		–	X	X
Floating-Point Unit (FPU)		–	X	X
Motor Control Libraries in ROM	SPRUJ26	–	X(2)	–

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.
(2) Motor Control Libraries in ROM is available only on TMS320F28002xC devices.

2.3.3 TMS320F28003x Peripherals

Table 2-15 lists the peripherals available on the TMS320F28003x device.

Table 2-15. TMS320F28003x Peripheral Selection Guide

Peripheral	Lit. No.	Type[1]	280039C, 280038C, 280037C, 280036C	280039, 280038, 280037, 280036, 280034	280033
System Control and Interrupts	SPRUIW9	–	X	X	X
ROM Code and Peripheral Booting		–	X	X	X
Dual-Clock Comparator (DCC)		2	X	X	X
Analog-to-Digital Converter (ADC)		5	X	X	X
Analog-to-Digital Converter Wrapper		3	X	X	X
Advance Encryption Standard (AES) Accelerator		–	X	X	X
Direct Memory Access (DMA)		0	X	X	X
General-Purpose Input/Output (GPIO)		–	X	X	X
Temperature Sensor		–	X	X	X
Comparator Subsystem (CMPSS)		2	X	X	X
Configurable Logic Block (CLB)		3	X	–	–
Dual-Clock Comparator (DCC)		–	X	X	X
Enhanced Pulse Width Modulator (ePWM)		4	X	X	X
Enhanced Capture Module (eCAP)		2	X	X	X
Enhanced Quadrature Encoder Pulse (eQEP)		2	X	X	X
High-Resolution Capture Module (HRCAP)		2	X	X	X
Serial Peripheral Interface (SPI)		2	X	X	X
Serial Communications Interface (SCI)		0	X	X	X
Inter-Integrated Circuit (I2C)		1	X	X	X
Local Interconnect Network (LIN)		1	X	X	X
Fast Serial Interface (FSI)		2	X	X	X
Power Management Bust Module (PMBus)		0	X	X	X
Host Interface Controller (HIC)		1	X	X	X
Background CRC-32 (BGCRC)		0	X	X	X
Controller Area Network (DCAN)		0	X	X	X
Embedded Real-time Analysis and Diagnostic (ERAD)		1	X	X	X
Control Law Accelerator (CLA)		2	X	X	–
Hardware Built-in Self-Test Module (HWBIST)		0	X	X	X
Memory Power On Self-Test (MPOST)		0	X	X	X
Buffered Digital-to-Analog Converter (DAC)		2	X	X	X
Sigma Delta Filter Module (SDFM)		2	X	X	X
Modular Controller Area Network (MCAN)		1	X	X	X
Embedded Pattern Generator (EPG)		0	X	X	X
Crossbar (X-BAR)		0	X	X	X

Table 2-15. TMS320F28003x Peripheral Selection Guide (continued)

Peripheral	Lit. No.	Type[1]	280039C, 280038C, 280037C, 280036C	280039, 280038, 280037, 280036, 280034	280033
Trigonometric Math Unit (TMU)	SPRUHS1	1	X	X	X
Cyclic Redundancy Check (VCRC)		–	X	X	X
Floating-Point Unit (FPU)		–	X	X	X
Motor Control Libraries in ROM	SPRUJ26	–	X[2]	–	–

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.
(2) Motor Control Libraries in ROM is available only on TMS320F28003xC devices.

2.3.4 TMS320F28004x Peripherals

Table 2-16 lists the peripherals available on the TMS320F28004x device.

Table 2-16. TMS320F28004x Peripheral Selection Guide

Peripheral	Lit. No.	Type[1]	280049C, 280049, 280048C, 280048, 280045, 280041C, 280041, 280040C, 280040
System Control and Interrupts	SPRUI33	–	X
ROM Code and Peripheral Booting		–	X
Dual-Clock Comparator (DCC)		1	X
Analog-to-Digital Converter (ADC)		5	X
Analog-to-Digital Converter Wrapper		3	X
Direct Memory Access (DMA)		0	X
Control Law Accelerator (CLA)		2	X
Configurable Logic Block (CLB)		2	X[2]
General-Purpose Input/Output (GPIO)		–	X
Temperature Sensor		–	X
Comparator Subsystem (CMPSS)		1	X
Buffered Digital to Analog Converter (DAC)		2	X
Programmable Gain Amplifier (PGA)		1	X
Sigma Delta Filter Module (SDFM)		1	X
Enhanced Pulse Width Modulator (ePWM)		4	X
Enhanced Capture Module (eCAP)		1	X
Enhanced Quadrature Encoder Pulse (eQEP)		1	X
High-Resolution Capture Module (HRCAP)		1	X
Serial Peripheral Interface (SPI)		2	X
Serial Communications Interface (SCI)		0	X
Inter-Integrated Circuit (I2C)		1	X
Local Interconnect Network (LIN)		1	X
Fast Serial Interface (FSI)		0	X
Power Management Bust Module (PMBus)		0	X
CLA Program ROM CRC (CLAPROMCRC)		0	X
Controller Area Network (DCAN)		0	X
Memory Power On Self-Test (MPOST)		0	X
Embedded Real-time Analysis and Diagnostic (ERAD)		0	X
Crossbar (X-BAR)		0	X
Trigonometric Math Unit (TMU)	SPRUHS1	0	X
Viterbi, Complex Math, and CRC Unit (VCU-I)		1	X
Floating-Point Unit (FPU)		–	X
InstaSPIN-FOC	SPRUHJ1	–	X[3]

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.
(2) Configurable Logic Block (CLB) is available only on TMS320F28004xC devices.
(3) InstaSPIN-FOC™ is available only on TMS320F28004xC devices.

2.3.5 TMS320F280013x Peripherals

Table 2-17 lists the peripherals available on the TMS320F280013x device.

Table 2-17. TMS320F280013x Peripheral Selection Guide

Peripheral	Lit. No.	Type(1)	2800137, 2800135, 2800133	2800132
System Control and Interrupts	SPRUIX1	–	X	X
ROM Code and Peripheral Booting		–	X	X
Dual-Clock Comparator (DCC)		2	X	X
Analog-to-Digital Converter (ADC)		5	X	X
Analog-to-Digital Converter Wrapper		3	X	X
General-Purpose Input/Output (GPIO)		–	X	X
Temperature Sensor		–	X	X
Comparator Subsystem (CMPSS)		2	X	X
Comparator Subsystem LITE (CMPSS_LITE)		0	X	X
Embedded Pattern Generator (EPG)		0	X	X
Enhanced Pulse Width Modulator (ePWM)		4	X	X
Enhanced Capture Module (eCAP)		2	X	X
Enhanced Quadrature Encoder Pulse (eQEP)		2	X	X
Serial Peripheral Interface (SPI)		2	X	X
Serial Communications Interface (SCI)		0	X	X
Inter-Integrated Circuit (I2C)		1	X	X
Controller Area Network (CAN)		0	X	–
Memory Power On Self-Test (MPOST)		0	X	X
Crossbar (X-BAR)		0	X	X
Trigonometric Math Unit (TMU)	SPRUHS1	0	X	X
Floating-Point Unit (FPU)		–	X	X
InstaSPIN-FOC	SPRUHJ1	–	X(2)	–

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.

(2) InstaSPIN-FOC™ is available only on these devices.

2.3.6 TMS320F280015x Peripherals

Table 2-18 lists the peripherals available on the TMS320F280015x device.

Table 2-18. TMS320F280015x Peripheral Selection Guide

Peripheral	Lit. No.	Type[1]	2800157, 2800155, 2800153
System Control and Interrupts	SPRUIY4	–	X
ROM Code and Peripheral Booting		–	X
Dual-Clock Comparator (DCC)		2	X
Analog-to-Digital Converter (ADC)		5	X
Analog-to-Digital Converter Wrapper		3	X
General-Purpose Input/Output (GPIO)		–	X
Temperature Sensor		–	X
Comparator Subsystem (CMPSS)		2	X
Comparator Subsystem LITE (CMPSS_LITE)		0	X
Embedded Pattern Generator (EPG)		0	X
Enhanced Pulse Width Modulator (ePWM)		4	X
Enhanced Capture Module (eCAP)		2	X
Enhanced Quadrature Encoder Pulse (eQEP)		2	X
Serial Peripheral Interface (SPI)		2	X
Serial Communications Interface (SCI)		0	X
Inter-Integrated Circuit (I2C)		1	X
Local Interconnect Network (LIN)		1	X
Power Management Bust Module (PMBus)		0	X
Lockstep Compare Module (LCM)		0	X
Controller Area Network (DCAN)		0	X
Modular Controller Area Network (MCAN)		2	X
Memory Power On Self-Test (MPOST)		0	X
Crossbar (X-BAR)		0	X
Trigonometric Math Unit (TMU)	SPRUHS1	0	X
Cyclic Redundancy Check (VCRC)		–	X
Floating-Point Unit (FPU)		–	X
InstaSPIN-FOC	SPRUHJ1	–	X

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.

2.3.7 TMS320F2837xD Peripherals

Table 2-19 lists the peripherals available on theTMS320F2837xD device.

Table 2-19. TMS320F2837xD Peripheral Selection Guide

Peripheral	Lit. No.	Type(1)	28379D, 28377D, 28376D, 28375D, 28374D
System Control and Interrupts	SPRUHM8	–	X
ROM Code and Peripheral Booting		–	X
Analog-to-Digital Converter (ADC)		4	X
Analog-to-Digital Converter Wrapper		3	X
Temperature Sensor		–	X
Direct Memory Access (DMA)		0	X
Control Law Accelerator (CLA)		1	X
Configurable Logic Block (CLB)		1	X
Inter-processor Communication (IPC)		–	X
General-Purpose Input/Output (GPIO)		–	X
Comparator Subsystem (CMPSS)		0	X
Buffered Digital to Analog Converter (DAC)		1	X
Sigma Delta Filter Module (SDFM)		0	X
Hardware Built-in Self-Test Module (HWBIST)		0	X
Enhanced Pulse Width Modulator (ePWM)		4	X
Enhanced Capture Module (eCAP)		0	X
Enhanced Quadrature Encoder Pulse (eQEP)		0	X
Serial Peripheral Interface (SPI)		2	X
Serial Communications Interface (SCI)		0	X
Inter-Integrated Circuit (I2C)		0	X
Multichannel Buffered Serial Port (McBSP)		1	X
Controller Area Network (DCAN)		0	X
Universal Serial Bus (USB)		0	X
Universal Parallel Port (uPP)		0	X
External Memory Interface (EMIF)		0	X
Crossbar (X-BAR)		0	X
Trigonometric Math Unit (TMU)	SPRUHS1	0	X
Viterbi, Complex Math, and CRC Unit (VCU-II)		2	X
Floating-Point Unit (FPU)		–	X

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.

2.3.8 TMS320F2837xS Peripherals

Table 2-20 lists the peripherals available on theTMS320F2837xS device.

Table 2-20. TMS320F2837xS Peripheral Selection Guide

Peripheral	Lit. No.	Type[1]	28379S, 28377S, 28376S, 28375S, 28374S
System Control and Interrupts	SPRUHX5	–	X
ROM Code and Peripheral Booting		–	X
Analog-to-Digital Converter (ADC)		4	X
Analog-to-Digital Converter Wrapper		3	X
Temperature Sensor		–	X
Direct Memory Access (DMA)		0	X
Control Law Accelerator (CLA)		1	X
Configurable Logic Block (CLB)		1	X
General-Purpose Input/Output (GPIO)		–	X
Comparator Subsystem (CMPSS)		0	X
Buffered Digital to Analog Converter (DAC)		1	X
Sigma Delta Filter Module (SDFM)		0	X
Hardware Built-in Self-Test Module (HWBIST)		0	X
Enhanced Pulse Width Modulator (ePWM)		4	X
Enhanced Capture Module (eCAP)		0	X
Enhanced Quadrature Encoder Pulse (eQEP)		0	X
Serial Peripheral Interface (SPI)		2	X
Serial Communications Interface (SCI)		0	X
Inter-Integrated Circuit (I2C)		0	X
Multichannel Buffered Serial Port (McBSP)		1	X
Controller Area Network (DCAN)		0	X
Universal Serial Bus (USB)		0	X
Universal Parallel Port (uPP)		0	X
External Memory Interface (EMIF)		0	X
Crossbar (X-BAR)		0	X
Trigonometric Math Unit (TMU)	SPRUHS1	0	X
Viterbi, Complex Math, and CRC Unit (VCU-II)		2	X
Floating-Point Unit (FPU)		–	X

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.

2.3.9 TMS320F2838x Peripherals

Table 2-21 lists the peripherals available on theTMS320F2838x device.

Table 2-21. TMS320F2838x Peripheral Selection Guide

Peripheral	Lit. No.	Type[1]	28388D, 28388S	28386D, 28386S	28384D, 28384S
System Control and Interrupts	SPRUII0	–	X	X	X
ROM Code and Peripheral Booting		–	X	X	X
Dual-Clock Comparator (DCC)		2	X	X	X
Analog-to-Digital Converter (ADC)		4	X	X	X
Analog-to-Digital Converter Wrapper		3	X	X	X
Temperature Sensor		–	X	X	X
Direct Memory Access (DMA)		0	X	X	X
Control Law Accelerator (CLA)		2	X	X	X
Configurable Logic Block (CLB)		3	X	X	–
Inter-processor Communication (IPC)		–	X	X	X
General-Purpose Input/Output (GPIO)		–	X	X	X
Comparator Subsystem (CMPSS)		1	X	X	X
Embedded Real-time Analysis and Diagnostic (ERAD)		1	X	X	X
Connectivity Manager - Arm® Cortex®-M4 Peripherals					
EtherCAT® SubordinateDevice Controller (ESC)		0	X	–	–
Ethernet Media Access Controller (EMAC)		0	X	X	X
Modular Controller Area Network (MCAN)		0	X	X	X
CM Inter-Integrated Circuit (I2C)		–	X	X	X
Synchronous Serial Interface (SSI)		0	X	X	X
Universal Asynchronous Receiver/Transmitter (UART)		0	X	X	X
C28x Peripherals					
Buffered Digital to Analog Converter (DAC)		1	X	X	X
Sigma Delta Filter Module (SDFM)		2	X	X	X
Enhanced Pulse Width Modulator (ePWM)		4	X	X	X
Hardware Built-in Self-Test Module (HWBIST)		0	X	X	X
Enhanced Capture Module (eCAP)		2	X	X	X
High-Resolution Capture Module (HRCAP)		2	X	X	X
Enhanced Quadrature Encoder Pulse (eQEP)		2	X	X	X
Serial Peripheral Interface (SPI)		2	X	X	X
Serial Communications Interface (SCI)		0	X	X	X
Inter-Integrated Circuit (I2C)		1	X	X	X
Multichannel Buffered Serial Port (McBSP)		1	X	X	X
Controller Area Network (CAN)		0	X	X	X
Memory Power On Self-Test (MPOST)		0	X	X	X
Universal Serial Bus (USB)		0	X	X	X
Background CRC-32 (BGCRC)		0	X	X	X
Generic Cyclic Redundancy Check (GCRC)		–	X	X	X
External Memory Interface (EMIF)		0	X	X	X
Fast Serial Interface (FSI)		1	X	X	X
Power Management Bus (PMBus)		0	X	X	X
Crossbar (X-BAR)		0	X	X	X

Table 2-21. TMS320F2838x Peripheral Selection Guide (continued)

Peripheral	Lit. No.	Type[1]	28388D, 28388S	28386D, 28386S	28384D, 28384S
Trigonometric Math Unit (TMU)	SPRUHS1	0	X	X	X
Cyclic Redundancy Check (VCRC)		–	X	X	X
Floating-Point Unit (FPU32 and FPU64)		–	X	X	X

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.

2.3.10 TMS320F28P55x Peripherals

Table 2-22 lists the peripherals available on theTMS320F28P55x device.

Table 2-22. TMS320F28P55x Peripheral Selection Guide

Peripheral	Lit. No.	Type(1)	28P559S	28P550S
System Control and Interrupts	SPRUJ53	–	X	X
ROM Code and Peripheral Booting		–	X	X
Dual-Clock Comparator (DCC)		2	X	X
Analog-to-Digital Converter (ADC)		6	X	X
Analog-to-Digital Converter Wrapper		5	X	X
Advance Encryption Standard (AES) Accelerator		0	X	X
Temperature Sensor		–	X	X
Direct Memory Access (DMA)		0	X	X
Control Law Accelerator (CLA)		2	X	X
Configurable Logic Block (CLB)		3	X	X
Inter-processor Communication (IPC)		–	X	X
General-Purpose Input/Output (GPIO)		–	X	X
Comparator Subsystem (CMPSS)		6	X	X
Embedded Pattern Generator (EPG)		0	X	X
Embedded Real-time Analysis and Diagnostic (ERAD)		2	X	X
Modular Controller Area Network (MCAN)		2	X	X
Buffered Digital to Analog Converter (DAC)		2	X	X
Programmable Gain Amplifier (PGA)		2	X	X
Enhanced Pulse Width Modulator (ePWM)		4	X	X
Enhanced Capture Module (eCAP)		2	X	X
Enhanced Quadrature Encoder Pulse (eQEP)		2	X	X
Serial Peripheral Interface (SPI)		2	X	X
Serial Communications Interface (SCI)		0	X	X
Inter-Integrated Circuit (I2C)		2	X	X
Local Interconnect Network (LIN)		1	X	X
Universal Serial Bus (USB)		0	X	X
Fast Serial Interface (FSI)		2	X	X
Power Management Bus (PMBus)		1	X	X
Memory Power On Self-Test (MPOST)		0	X	X
Neural-Network Processing Unit (NPU)		0	X	X
Crossbar (X-BAR)		0	X	X
Trigonometric Math Unit (TMU)	SPRUHS1	1	X	X
Cyclic Redundancy Check (VCRC)		–	X	X
Floating-Point Unit (FPU32)		–	X	X

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.

2.3.11 TMS320F28P65x Peripherals

Table 2-23 lists the peripherals available on theTMS320F28P65x device.

Table 2-23. TMS320F28P65x Peripheral Selection Guide

Peripheral	Lit. No.	Type[1]	28P659DH, 28P659DK	28P659SH	28P650DH	28P650DK	28P650SH, 28P650SK
System Control and Interrupts	SPRUIZ1	–	X	X	X	X	X
ROM Code and Peripheral Booting		–	X	X	X	X	X
Dual-Clock Comparator (DCC)		2	X	X	X	X	X
Analog-to-Digital Converter (ADC)		4	X	X	X	X	X
Analog-to-Digital Converter Wrapper		3	X	X	X	X	X
Advance Encryption Standard (AES) Accelerator		–	X	X	X	X	X
Temperature Sensor		–	X	X	X	X	X
Direct Memory Access (DMA)		0	X	X	X	X	X
Control Law Accelerator (CLA)		2	X	X	X	X	X
Configurable Logic Block (CLB)		3	X	X	X	X	X
Inter-processor Communication (IPC)		–	X	X	X	X	X
General-Purpose Input/Output (GPIO)		–	X	X	X	X	X
Comparator Subsystem (CMPSS)		6	X	X	X	X	X
Embedded Pattern Generator (EPG)		0	X	X	X	X	X
Embedded Real-time Analysis and Diagnostic (ERAD)		2	X	X	X	X	X
EtherCAT SubordinateDevice Controller (ESC)		0	–	–	–	X	X
Modular Controller Area Network (MCAN)		2	X	X	X	X	X
Universal Asynchronous Receiver/Transmitter (UART)		0	X	X	X	X	X
Buffered Digital to Analog Converter (DAC)		1	X	X	X	X	X
Sigma Delta Filter Module (SDFM)		2	X	X	X	X	X
Enhanced Pulse Width Modulator (ePWM)		5	X	X	X	X	X
Hardware Built-in Self-Test Module (HWBIST)		0	X	X	X	X	X
Enhanced Capture Module (eCAP)		3	X	X	X	X	X
High-Resolution Capture Module (HRCAP)		2	X	X	X	X	X
Enhanced Quadrature Encoder Pulse (eQEP)		2	X	X	X	X	X
Serial Peripheral Interface (SPI)		2	X	X	X	X	X
Serial Communications Interface (SCI)		0	X	X	X	X	X
Inter-Integrated Circuit (I2C)		1	X	X	X	X	X
Local Interconnect Network (LIN)		1	X	X	X	X	X
Controller Area Network (CAN)		0	X	X	X	X	X
Memory Power On Self-Test (MPOST)		0	X	X	X	X	X
Universal Serial Bus (USB)		0	X	X	X	X	X
Background CRC-32 (BGCRC)		2	X	X	X	X	X
External Memory Interface (EMIF)		0	–	X	X	X	–
Fast Serial Interface (FSI)		2	X	X	X	X	X
Power Management Bus (PMBus)		0	X	X	X	X	X
Lockstep Compare Module (LCM)		0	X	–	–	X	–
Crossbar (X-BAR)		0	X	X	X	X	X

Table 2-23. TMS320F28P65x Peripheral Selection Guide (continued)

Peripheral	Lit. No.	Type[1]	28P659DH, 28P659DK	28P659SH	28P650DH	28P650DK	28P650SH, 28P650SK
Trigonometric Math Unit (TMU)	SPRUHS1	1	X	X	X	X	X
Cyclic Redundancy Check (VCRC)		–	X	X	X	X	X
Floating-Point Unit (FPU32 and FPU64)		–	X	X	X	X	X

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.

2.3.12 F28E12x Peripherals

Table 2-24 lists the peripherals available on the F28E12x device.

Table 2-24. F28E12x Peripheral Selection Guide

Peripheral	Lit. No.	Type[1]	F28E120SC, F28E120SB
System Control and Interrupts	SPRUJD3	–	X
ROM Code and Peripheral Booting		–	X
Dual-Clock Comparator (DCC)		1	X
Analog-to-Digital Converter (ADC)		7	X
Analog-to-Digital Converter Wrapper		6	X
General-Purpose Input/Output (GPIO)		–	X
Temperature Sensor		–	X
Direct Memory Access (DMA)		0	X
Comparator Subsystem LITE (CMPSS_LITE)		0	X
Programmable Gain Amplifier (PGA)		3	X
Multi-Channel Pulse Width Modulator (MCPWM)		0	X
Enhanced Capture Module (eCAP)		2	X
Enhanced Quadrature Encoder Pulse (eQEP)		2	X
Serial Peripheral Interface (SPI)		2	X
Serial Communications Interface (SCI)		0	X
Inter-Integrated Circuit (I2C)		2	X
Universal Asynchronous Receiver/Transmitter (UART)		0	X
Crossbar (X-BAR)		0	X
Floating-Point Unit (FPU)	SPRUHS1	–	X

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.

2.4 Gen 4 Device Peripherals

This section lists the peripherals available for each of the generation 4 devices. The literature number is a link to the document that can be downloaded.

2.4.1 F29H85x and F29P58x Peripherals

Table 2-25 lists the peripherals available on the F29H85x and F29P58x devices.

Table 2-25. F29H85x and F29P58x Peripheral Selection Guide

Peripheral	Lit. No.	Type[1]	29H85x	29P58x
System Control and Interrupts	SPRUJ79	–	X	X
Peripheral Interrupt and Priority Expansion (PIPE)		0	X	X
ROM Code and Peripheral Booting		–	X	X
Data Logger and Trace (DLT)		0	X	X
Dual-Clock Comparator (DCC)		2	X	X
Analog-to-Digital Converter (ADC) - 12-bit		5	X	X
Analog-to-Digital Converter (ADC) - 16-bit		4	X	X
Analog-to-Digital Converter Wrapper		5	X	X
Real-Time Direct Memory Access (RTDMA)		0	X	X
Configurable Logic Block (CLB)		3	X	X
Inter-processor Communication (IPC)		1	X	X
General-Purpose Input/Output (GPIO)		–	X	X
Comparator Subsystem (CMPSS)		6	X	X
Embedded Pattern Generator (EPG)		0	X	X
Embedded Real-time Analysis and Diagnostic (ERAD)		5	X	X
Error Aggregator		0	X	X
Error Signaling Module (ESM)		0	X	X
EtherCAT SubordinateDevice Controller (ESC)		0	X	–
Modular Controller Area Network (MCAN)		2	X	X
Universal Asynchronous Receiver/Transmitter (UART)		0	X	X
Buffered Digital to Analog Converter (DAC)		2	X	X
Sigma Delta Filter Module (SDFM)		2	X	X
Enhanced Pulse Width Modulator (ePWM)		5	X	X
High-Resolution Pulse-Width Modulator (HRPWM)		5	X	X
Memory Power On Self-Test (MPOST)		0	X	X
Logic Power On Self-Test (LPOST)		0	X	X
Enhanced Capture Module (eCAP)		3	X	X
High-Resolution Capture Module (HRCAP)		3	X	–
Enhanced Quadrature Encoder Pulse (eQEP)		2	X	X
Single Edge Nibble Transmission (SENT)		1	X	X
Serial Peripheral Interface (SPI)		2	X	X
Inter-Integrated Circuit (I2C)		2	X	X
Local Interconnect Network (LIN)		1	X	X
External Memory Interface (EMIF)		0	X	–
Fast Serial Interface RX/FX (FSI)		2	X	X
Power Management Bus (PMBus)		1	X	X
Lockstep Compare Module (LCM)		1	X	X
Temperature Sensor		–	X	X
Safety and Security (SSU)		0	X	X

Table 2-25. F29H85x and F29P58x Peripheral Selection Guide (continued)

Peripheral	Lit. No.	Type[1]	29H85x	29P58x
Waveform Analyzer Diagnostic (WADI)		0	X	X
Crossbar (X-BAR)		1	X	X
Hardware Security Module (HSM)		–	X	X
Cryptographic Accelerators		–	X	X
Trigonometric Math Unit (TMU)		1	X	X
Floating-Point Unit (FPU32 and FPU64)		–	X	X

(1) A type change represents a major functional feature difference in a peripheral module. Within a peripheral type, there can be minor differences between devices that do not affect the basic functionality of the module. These device-specific differences are listed in Chapter 3 and in the TRM.

Chapter 3

Peripheral Descriptions

Brief descriptions of the peripherals are included in the following sections.

3.1 Coprocessor and CPU Extended Instruction Sets

3.1.1 Control Law Accelerator (CLA) Module

The Control Law Accelerator (CLA) module is an independent, fully-programmable, 32-bit floating-point math processor that brings concurrent control-loop execution to the device family. The low interrupt-latency of the CLA allows the CLA to read ADC samples "just-in-time." This significantly reduces the ADC sample to output delay to enable faster system response and higher MHz control loops. By using the CLA to service time-critical control loops, the main CPU is free to perform other system tasks such as communications and diagnostics.

Refer to the device-specific technical reference manual for more information.

Table 3-1 lists the CLA types, including device-specific differences within each type.

Table 3-1. Control Law Accelerator (CLA) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original CLA Module Type	2803x	Only supports data RAM0 and 1 and does not allow CPU access when CLA data RAM is enabled.
		2805x, 2806x	Adds supports for data RAM2 and adds option to enable CPU access to data RAMs.
1	Increased Program address reachability to 16-bits; added instructions to support the new address reach; added two new offset addressing modes; CLA program memory is now user selectable and can reside anywhere in the lower 64k address space (excluding the M0 and M1 space). The job of giving control to the CLA and assigning triggers to a task is now done at the system level; a task can now fire an interrupt to main CPU mid execution.	2807x, 2837xD, 2837xS	–
2	Added Background-code mode, that can run task like communications and clean-up routines in Background; Background tasks runs continuously until disable or device/soft reset; Background task can be triggered by a peripheral or software; other foreground tasks can interrupt background task in the priority order defined; added provision for making sections of background code uninterruptible; added debug enhancements that has true software breakpoint support, where CLA re-fetches from the same address where halted during debug stop.	28003x, 28004x, 2838x, 28P55x, 28P65x	–

3.1.2 Floating-Point Unit (FPU)

The CPU plus floating-point (C28x+FPU) processor extends the capabilities of the fixed-point CPU by adding registers and instructions to support IEEE single-precision floating point operations. Devices with the C28x+FPU include the standard register set plus an additional set of floating-point unit registers. The additional floating-point unit registers are the following:

- Eight floating-point result registers, RnH (where n = 0–7)
- Floating-point Status Register (STF)
- Repeat Block Register (RB)

All of the floating-point registers, except the repeat block register, are shadowed. This shadowing can be used in high-priority interrupts for fast context save and restore of the floating-point registers.

In C29x, the FPU is available on the CPU subsystem itself as in-built instructions.

For more information on C28x instructions, see the *TMS320C28x Extended Instruction Sets Technical Reference Manual*.

Table 3-2 lists the FPU types, including device-specific differences within each type.

Table 3-2. Floating-Point Unit (FPU) Type Description

Type	Description	Devices Covered	Device-Specific Options
–	Original FPU Instruction Set	2806x, 2807x, 28004x, 280013x, 280015x, 2833x, 2834x, 2837xD, 2837xS, 28E12x, 28P55x, M35x, M36x	–
		28002x, 28003x	New instructions for Fast Integer Division.
		2838x, 28P65x	Additional double-precision float instruction set (FPU64). New instructions for Fast Integer Division.
		29H85x, 29P58x	FPU is built into the CPU. FPU64 is only present in CPU3. Refer to device variant.

3.1.3 Viterbi, Complex Math, and CRC Unit (VCU)

The C28x Viterbi, Complex Math and CRC Unit (VCU) is a fully-programmable block that accelerates the performance of communications-based algorithms by up to a factor of 8× over the C28x CPU alone. In addition to eliminating the need for a second processor to manage the communications link, the performance gains of the VCU provides headroom for future system growth and higher bit rates or, conversely, enables devices to operate at a lower MHz to reduce system cost and power consumption.

For more information, see the *TMS320C28x Extended Instruction Sets Technical Reference Manual*.

Table 3-3 lists the VCU types, including device-specific differences within each type.

Table 3-3. Viterbi, Complex Math, and CRC Unit (VCU) Type Description

Type	Description	Devices Covered	Device-Specific Options
0/1	Original VCU Module Type (both types are equivalent)	2806x, 28004x, M35x, M36x	–
2	Added instructions to improve performance in Viterbi decoding, complex arithmetic instructions, complex FFT, AES encryption and decryption. Added instructions for direct register access between VCU and C28x. Added Interrupt to PIE.	2837xD, 2837xS	–

3.1.4 Cyclic Redundancy Check (VCRC) Module

The CPU with VCRC (C28x+VCRC) processor extends the capabilities of the CPU by adding registers and instructions to support CRC. CRC algorithms provide a straightforward method for verifying data integrity over large data blocks, communication packets, or code sections. The C28x+VCRC can perform 8-, 16-, 24-, and 32-bit CRCs.

For more information on C28x instructions, see the *TMS320C28x Extended Instruction Sets Technical Reference Manual*.

Table 3-4 lists the VCRC types, including device-specific differences within each type.

Table 3-4. Cyclic Redundancy Check (VCRC) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original VCRC Module Type	28002x, 28003x, 280015x, 2838x, 28P55x, 28P65x	–

3.1.5 Trigonometric Math Unit (TMU)

The Trigonometric Math Unit (TMU) is an accelerator that extends the capabilities of the C28x+FPU, specifically designed to speed up the execution of common trigonometric and arithmetic operations.

In C29x, the TMU is available on the CPU subsystem itself as in-built instructions.

For more information on C28x instructions, see the *TMS320C28x Extended Instruction Sets Technical Reference Manual*.

Table 3-5 lists the TMU types, including device-specific differences within each type.

Table 3-5. Trigonometric Math Unit (TMU) Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original TMU Module Type	2807x, 28004x, 280013x, 280015x, 2837xD, 2837xS, 2838x	–
1	Added new instructions supporting NLPID	28002x, 28003x, 28P55x, 28P65x	–
		29H85x, 29P58x	TMU is built into the CPU. TMU64 is only present in CPU3. Refer to device variant.

3.2 System Peripherals

The following sections describe the system peripherals.

3.2.1 Advance Encryption Standard (AES) Accelerator Module

The Advance Encryption Standard (AES) Accelerator module provides hardware-accelerated data encryption and decryption operations based on a binary key. The AES is a symmetric cipher module that supports a 128-, 192-, or 256-bit key in hardware for encryption and decryption. The AES module is based on a symmetric algorithm, which means that the encryption and decryption keys are identical. To encrypt data means to convert the data from plain text to an unintelligible form called cipher text. Decrypting cipher text converts previously encrypted data to the original plain text form.

The standalone AES module is found within the application CPU subsystem or Hardware Security Module (HSM) depending on the device.

Refer to the device-specific technical reference manual for more information.

Table 3-6 lists the AES accelerator module types, including device-specific differences within each type.

Table 3-6. Advance Encryption Standard (AES) Accelerator Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original AES Accelerator Module Type	28003x, 2838x, 28P55x, 28P65x	–
1	Supports Secure and Public contexts	29H85x, 29P58x	Cryptographic accelerators available through HSM.

3.2.2 Background CRC-32 (BGCRC) Module

The Background CRC (BGCRC) module computes a CRC-32 on a configurable block of memory. The BGCRC accomplishes this by fetching the specified block of memory during idle cycles (when the CPU, CLA, or DMA is not accessing the memory block). The calculated CRC-32 value is compared against a golden CRC-32 value to indicate a pass or fail. In essence, the BGCRC helps identify memory faults and corruption.

Refer to the device-specific technical reference manual for more information.

Table 3-7 lists the BGCRC types, including device-specific differences within each type.

Table 3-7. Background CRC-32 (BGCRC) Module Type Description

Type	Description	Devices Covered	Device- Specific Options
0	Original BGCRC Module Type	28002x, 28003x, 28004x, 2838x, 28P65x	–

3.2.3 Boot ROM

The boot ROM is factory-programmable with bootloading software. Boot-mode signals (general-purpose I/Os) are used to indicate to the bootloader software which mode to use. The Boot ROM also contains standard math tables such as SIN/COS for use in IQ math related algorithms.

The device-specific Boot ROM guides are:

- *TMS320x281x Boot ROM Reference Guide*
- *TMS320x280x, 2801x, 2804x DSP Boot ROM Reference Guide*
- *TMS320x2834x Boot ROM Reference Guide*

For devices not listed above, refer to the device-specific technical reference manual.

3.2.4 Crossbar (X-BAR) Module

The Crossbar (X-BAR) module expands connectivity between modules and external I/Os through arrays of muxes. The crossbar module is made up of various submodules which are responsible for different types of connectivity. For example the Input XBAR module consists of identical muxes where the inputs to each mux are the GPIOs and AIOs on the device. The outputs of these muxes are accessible by various modules within the device, allowing for flexible I/O connections and simpler design. In contrast, the CLB X-BAR submodule takes in inputs from internal device signals and routes them to the input muxes of the CLB module. A similar pattern is repeated for other submodules such as EPWM-XBAR, Output X-BAR, etc.

Refer to your device-specific technical reference manual for more information.

Table 3-8 lists the X-BAR module types, including device-specific differences within each type.

Table 3-8. Crossbar (X-BAR) Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original C28 X-BAR Module Type	2807x, 2837xD, 2837xS, 28004x	CLB X-BAR, EPWM X-BAR, Input X-BAR, Output X-BAR
		2838x, 28002x, 28003x, 28P55x,	Addition of CLB Input X-BAR, CLB Output X-BAR
		28E12x, 280013x, 280015x	CLB related X-BAR submodules not applicable / removed
		28P65x	Addition of MINDB X-BAR, ICL X-BAR
1	Original C29 X-BAR Module Type	29H85x, 29P58x	Structure of X-BAR submodules changed, removal of CLB Input X-BAR, CLB Output X-BAR, expanded Input X-BAR to 64 muxes. Additional features for Output X-BAR.

3.2.5 Data Logger and Trace (DLT) Module

For critical CPU run-time content, the Data Logger and Trace (DLT) module has the ability to control what data gets logged, when to start data-logging, and the size of the data to capture. Critical run-time content can include any information that needs to be monitored as the content is computed. When data-logging the DLT is non-intrusive meaning there is no impact to run-time or CPU core behavior. The ability to view intermediate values of computation in a critical task, such as a control loop, can help users fine-tune the loop. The DLT module can generate interrupts to the interrupt controller, issue RTDMA transfer requests, and interact with ERAD event triggers.

The DLT can collect, time-stamp, prefilter, export, and do real-time and post analysis of data.

Refer to the device-specific technical reference manual for more information.

Table 3-9 lists the DLT types, including device-specific differences within each type.

Table 3-9. Data Logger and Trace (DLT) Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original DLT Module Type	29H85x, 29P58x	–

3.2.6 Direct Memory Access (DMA) Module

The Direct Memory Access (DMA) module provides a hardware method of transferring data between peripherals and memory without intervention from the CPU, thereby freeing up bandwidth for other system functions. Additionally, the DMA has the capability to orthogonally rearrange the data, as the data is transferred as well as “ping-pong” data between buffers. These features are useful for structuring data into blocks for CPU processing.

The device-specific DMA guide is:

- *TMS320x2834x Direct Memory Access (DMA) Module Reference Guide*

For devices not listed above, refer to the device-specific technical reference manual.

Table 3-10 lists the DMA types, including device-specific differences within each type.

Table 3-10. Direct Memory Access (DMA) Module Type Description

Type	Description	Devices Covered	Device-Specific Options	
0	Original DMA Module Type	2834x	DMA does not interface to ePWM.	6-Channel module.
		2823x, 2833x, M35x, M36x	Added interface to ADC and ePWM.	
		2806x	Added interface to USB.	
		2807x, 28002x, 28003x, 28004x, 2837xD, 2837xS, 2838x, 28P55x, 28P65x	Added interface to SPI and SDFM (for devices with SDFM). Modified Peripheral Interrupt Event Trigger configuration registers.	
		28E12x		2-Channel module.

3.2.7 Dual-Clock Comparator (DCC) Module

The Dual-Clock Comparator (DCC) module is used for evaluating and monitoring the clock input based on a second clock, which can be a more accurate and reliable version. This instrumentation is used to detect faults in clock source or clock structures; thereby, enhancing the system safety metrics.

Refer to the device-specific technical reference manual for more information.

Table 3-11 lists the DCC types, including device specific differences within each type.

Table 3-11. Dual-Clock Comparator (DCC) Type Description

Type	Description	Devices Covered	Device-Specific Options
1	Original DCC Module Type	28004x, 28E12x	–
2	Added 4-bit key to enable writes to DCC Clock Source0, FIFO support, and continue-on-error mode.	28002x, 28003x, 280013x, 280015x, 2838x, 28P55x, 28P65x, 29H85x, 29P58x	Clock sources available for Counter0 and Counter1 differs between devices.

3.2.8 Embedded Pattern Generator (EPG) Module

The Embedded Pattern Generator (EPG) module is a customizable pattern and clock generator that serves many test and application scenarios that require a simple pattern generator or a periodic clock generator. The EPG module can also be used to capture an incoming serial stream of data.

Refer to the device-specific technical reference manual for more information.

Table 3-12 lists the EPG types, including device-specific differences within each type.

Table 3-12. Embedded Pattern Generator (EPG) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original EPG Module Type	28003x	Only one clock generator is available.
		280013x, 280015x, 28P55x, 28P65x, 29H85x, 29P58x	Two clock generators are available.

3.2.9 Embedded Real-time Analysis and Diagnostic (ERAD) Module

The Embedded Real-time Analysis and Diagnostic (ERAD) module enhances the debug and system-analysis capabilities of the device. The debug and system-analysis enhancements provided by the ERAD module is done outside of the CPU. The ERAD module is accessible by the debugger and by the application software, which significantly increases the debug capabilities of many real-time systems, especially in situations where debuggers are not connected.

Refer to the device-specific technical reference manual for more information.

Table 3-13 lists the ERAD types, including device-specific differences within each type.

Table 3-13. Embedded Real-time Analysis and Diagnostic (ERAD) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original ERAD Module Type	28004x	–
1	Addition of CRC block. Addition of EVENT masking and exporting feature.	28002x, 28003x, 2838x	–
2	Added Program Counter Trace feature.	28P55x, 28P65x	–
5	ERAD Module Type	29H85x, 29P58x	–

3.2.10 Error Aggregator Module

Error Aggregator is an interface module between peripherals that generate various errors like C29x, RTDMA, Memory controllers, Peripheral bridges, Read Interfaces and ESM (Error Signaling Module). Main purpose of Error Aggregator is to accumulate various errors from various sources and provide aggregated error output to ESM module. The module also logs the error status, error address and error type information while segregating high priority errors and low priority errors for ESM to generate appropriate action to alert CPU.

Refer to the device-specific technical reference manual for more information.

Table 3-14 lists the Error Aggregator types, including device-specific differences within each type.

Table 3-14. Error Aggregator Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original Error Aggregator Module Type	29H85x, 29P58x	–

3.2.11 Error Signaling Module (ESM)

The Error Signaling Module (ESM) provides systematic consolidation of responses to error events throughout the device into one location. The ESM can signal programmable priority interrupts to the processor to deal with an event and/or manipulate an I/O error pin to signal an external hardware that an error has occurred. Therefore, an external controller is able to reset the device or keep the system in a safe, known state.

Refer to the device-specific technical reference manual for more information.

Table 3-15 lists the ESM types, including device-specific differences within each type.

Table 3-15. Error Signaling Module (ESM) Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original ESM Module Type	29H85x, 29P58x	–

3.2.12 External Memory Interface (EMIF)

The External Memory Interface (EMIF) is a data port that provides ease and flexibility when connecting to a variety of external devices including SDR SDRAM and asynchronous devices. EMIF is compliant with JESD21-C memories utilizing 8-bit, 16-bit, or 32-bit data buses.

Refer to the device-specific technical reference manual for more information.

Table 3-16 lists the EMIF types, including device specific differences within each type.

Table 3-16. External Memory Interface (EMIF) Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original EMIF Module Type	2807x, 2837xD, 2837xS	–
		2838x, 28P65x, 29H85x, 29P58x	With optional re-mapping of SDRAM in lower 22 bits address range of memory.

3.2.13 External Peripheral Interface (EPI)

The External Peripheral Interface (EPI) is a high-speed parallel interface to external peripherals or memories. The EPI supports µDMA access, clocking control, 8/16/32-bit dedicated parallel bus, blocking and non-blocking reads, and three functional modes: Synchronous Dynamic Random Access Memory (SDRAM), Host-bus, and General Purpose.

Refer to the device-specific technical reference manual for more information.

Table 3-17 lists the EPI types, including device-specific differences within each type.

Table 3-17. External Peripheral Interface (EPI) Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original EPI Module Type	M35x, M36x	–

3.2.14 Event Manager (EV) Module

The Event Manager (EV) module includes general-purpose timers, full-compare/pulse-width modulation (PWM) units, capture inputs (CAP) and quadrature-encoder pulse (QEP) circuits. Two such event managers are provided, which enable two three-phase motors to be driven or four two-phase motors. The event managers on the F281x are compatible to the event managers on the 240x devices (with some minor enhancements).

The device-specific EV guide is:

- *TMS320x281x DSP Event Manager (EV) Reference Guide*

For devices not listed above, refer to the device-specific technical reference manual.

Table 3-18 lists the EV types, including device-specific differences within each type.

Table 3-18. Event Manager (EV) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original EV Module Type	281x	–

3.2.15 External Interface (XINTF) Module

The External Interface (XINTF) module is an asynchronous bus that is used to interface to external devices and memory.

The device-specific XINTF guides are:

- *TMS320x281x External Interface (XINTF) Reference Guide*
- *TMS320x2834x External Interface (XINTF) Reference Guide*

For devices not listed above, refer to the device-specific technical reference manual.

Table 3-19 lists the XINTF types, including device-specific differences within each type.

Table 3-19. External Interface (XINTF) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	External Interface with x16 Data Bus	281x	–
1	External Interface with x16 or x32 Data Bus	2823x, 2833x, 2834x	–

3.2.16 Hardware Built-in Self-Test (HWBIST) Module

The Hardware Built-in Self-Test (HWBIST) module is capable of testing the CPU, VCU, FPU, and TMU for defective circuitry. The library routine can be executed whenever convenient in an application to detect if the circuitry is defective or damaged, and allow the system code to manage the fault condition in a controlled manner. This module produces coverage up to 99%. The execution of this routine can be adjusted to meet performance and latency requirements within the system.

Refer to the device-specific technical reference manual for more information.

Table 3-20 lists the HWBIST types, including device-specific differences within each type.

Table 3-20. Hardware Built-in Self-Test (HWBIST) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original HWBIST Module Type	M35x, M36x, 2837xD, 2837xS	–
		28002x, 28003x	Coverage up to 90%
		2807x, 2838xD	Coverage up to 99%
		28P65x	

3.2.17 Host Interface Controller (HIC) Module

The Host Interface Controller (HIC) module allows an external host controller to directly access resources of the device (peripheral) by emulating the ASRAM protocol. The HIC has two modes of operation: direct access and mailbox access. In direct access mode, device resources are directly written to and read from the external host. In mailbox access mode, the external host and device write to and read from a buffer and notify each other when the buffer write or read is complete.

Refer to the device-specific technical reference manual for more information.

Table 3-21 lists the HIC types, including device-specific differences within each type.

Table 3-21. Host Interface Controller (HIC) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original HIC Module Type	28002x	–
1	Added commit scheme for the lock bits to avoid potential security holes	28003x	–

3.2.18 Interprocessor Communication (IPC) Module

The Interprocessor Communications (IPC) module allows communication between the two CPU subsystems. The IPC features that each CPU can use to request and share information are:

- IPC flags and interrupts
- IPC command registers
- Free-running counter
- Message RAMs (F2837xD, F2838x, and F28P65x devices)
- Flash pump semaphore (F2837xD, F2838x, and F28P65x devices)
- Clock configuration semaphore (F2837xD, F2838x, and F28P65x devices)

All IPC features are independent of each other, and most do not require any specific data format.

Refer to the device-specific technical reference manual for more information.

Table 3-22 lists the IPC types, including device-specific differences within each type.

Table 3-22. Interprocessor Communication (IPC) Type Description

Type	Description	Devices Covered	Device-Specific Options
–	Original IPC Module Type	2837xD, 2838x, 28P55x, 28P65x	–
1	Registers are 4x the original size, Increased number of interrupt flags, All interrupts are tied to IPCFLAG0	29H85x, 29P58x	(1) IPC instance per CPU

3.2.19 Lockstep Comparator Module (LCM)

Hardware module integrity during run-time is a critical functional safety requirement. Hardware Redundancy implemented by lockstep CPU architecture (two CPUs executing the same function and the output of the CPUs are continuously compared) is a proven method for achieving high diagnostic coverage for both permanent and transient faults. The Lockstep Comparator Module (LCM) is implemented to compare output from the C28x CPU to detect permanent and transient faults.

Refer to the device-specific technical reference manual for more information.

Table 3-23 lists the LCM types, including device-specific differences within each type.

Table 3-23. Lockstep Comparator Module (LCM) Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original LCM Module Type	280015x, 28P65x	–
1	In split-lock, modules such as the CPU subsystem and RTDMA instances are capable of operating independently.	29H85x, 29P58x	-

3.2.20 Logic Power On Self-Test (LPOST) Module

The Logic Power On Self-Test (LPOST) module is capable of performing testing on the SRAM and ROM memories in parallel when the chip is being powered. The test is executed automatically by on-chip hardware during boot-up if enabled in the one-time programmable (OTP) configurations. LPOST is a hardware diagnostic for covering permanent faults in the digital logic of the device. This logic can programmed and executed to run self-tests of the entire digital logic on the device to help achieve functional safety levels of ASIL D/SIL 3.

Table 3-24 lists the LPOST types, including device-specific differences within each type.

Table 3-24. Logic Power On Self-Test (LPOST) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original LPOST Module Type	29H85x, 29P58x	–

3.2.21 Memory Power On Self-Test (MPOST) Module

The Memory Power On Self-Test (MPOST) module is capable of performing testing on the SRAM and ROM memories in parallel when the chip is being powered. The test is executed automatically by on-chip hardware during boot-up if enabled in the one-time programmable (OTP) configurations. For more information, see *C2000™ Memory Power-On Self-Test (M-POST)*.

Table 3-25 lists the MPOST types, including device-specific differences within each type.

Table 3-25. Memory Power On Self-Test (MPOST) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original MPOST Module Type	28002x, 28003x, 28004x, 280013x, 280015x, 2838x, 28P55x, 28P65x, 29H85x, 29P58x	–

3.2.22 Micro Cyclic Redundancy Check (µCRC) Module

The Micro Cyclic Redundancy Check (µCRC) module can be used to compute CRC on data and program data in specified memory locations. The µCRC supports the CRC8, CRC16-1, CRC16-2, and CRC32 polynomials.

Refer to the device-specific technical reference manual for more information.

Table 3-26 lists the µCRC types, including device-specific differences within each type.

Table 3-26. Micro Cyclic Redundancy Check (µCRC) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original µCRC Module Type	M35x, M36x	–

3.2.23 Neural-Network Processing Unit (NPU)

Refer to the device-specific technical reference manual for more information.

Table 3-27 lists the NPU types, including device specific differences within each type.

Table 3-27. Neural-Network Processing Unit (NPU) Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original NPU Type	28P55x	–

3.2.24 Peripheral Interrupt Priority and Expansion (PIPE) Module

Each Peripheral Interrupt Priority and Expansion (PIPE) module instance arbitrates peripheral interrupts for the respective CPU. All asserted interrupts are arbitrated each clock cycle, with the highest priority interrupt asserted to the appropriate CPU interrupt line (NMI, RTINT, or INT). The PIPE module is responsible for providing vector addresses to the CPU for NMI, RTINT, INT and RESET. The PIPE is capable of custom ordering of interrupts, prioritization, and nesting.

Refer to the device-specific technical reference manual for more information.

Table 3-28 lists the PIPE types, including device-specific differences within each type.

Table 3-28. Peripheral Interrupt Priority and Expansion (PIPE) Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original PIPE Module Type	29H85x, 29P58x	–

3.2.25 Real Time Direct Memory Access (RTDMA) Module

The Real Time Direct Memory Access (RTDMA) module is an event-based machine, meaning the RTDMA module requires a peripheral, channel, or software trigger to start a RTDMA transfer to start memory transfers periodically. Each software configurable channel in an RTDMA instance contains an independent Interrupt Controller interrupt to let the CPU know when a RTDMA transfer has either started or completed.

Refer to the device-specific technical reference manual for more information.

Table 3-29 lists the RTDMA types, including device-specific differences within each type.

Table 3-29. Real Time Direct Memory Access (RTDMA) Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original RTDMA Module Type	29H85x, 29P58x	–

3.2.26 Safety and Security Unit (SSU)

The Safety and Security Unit (SSU) is the central element of the C29x security architecture. The SSU provides run-time safety and security for the application CPU subsystems, and governs debug access to various resources on the chip. The SSU also provides hardware infrastructure for managing Flash firmware update operations, using the Firmware-Over-The-Air (FOTA) or Live Firmware Update (LFU) processes.

Refer to the device-specific technical reference manual for more information.

Table 3-30 lists the SSU types, including device-specific differences within each type.

Table 3-30. Safety and Security Unit (SSU) Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original SSU Type	29H85x, 29P58x	–

3.2.27 Watchdog Module

The watchdog module can optionally trigger a reset, if the watchdog module is not serviced by the CPU within a user-specified amount of time.

Refer to the device-specific technical reference manual for more information

Table 3-31 lists the watchdog types, including device-specific differences within each type.

Table 3-31. Watchdog Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original watchdog module	281x, 280x, 2802x, 2803x, 2805x, 2806x, 2823x, 2833x, 2834x, M35x, M36x	–
1	Windowed watchdog	2807x, 2837xD, 2837xS	–
2	Added prescaler	28002x, 28003x, 28004x, 280013x, 280015x, 2838xD, 28E12x, 28P55x, 28P65x, 29H85x, 29P58x	–

3.2.28 NMI Watchdog (NMIWD) Module

The NMI Watchdog (NMIWD) module is used to handle system-level errors. If the CPU does not respond to the latched error condition, then the NMI watchdog triggers a reset after a programmable time interval.

Refer to the device-specific technical reference manual for more information

Table 3-32 lists the NMI watchdog types, including device-specific differences within each type.

Table 3-32. NMI Watchdog (NMIWD) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original NMI watchdog module	2802x, 2803x, 2805x, 2806x, 2807x, 28002x, 28003x, 28004x, 280013x, 280015x, 2837xD, 2837xS, 2838xD, 28P65x, M35x, M36x	–
		29H85x, 29P58x	NMIWD is routed through the ESM.

3.2.29 Waveform Analyzer Diagnostic (WADI)

The Waveform Analyzer and Diagnostic (WADI) peripheral consists of many useful built in signal analysis support and provides a safety mechanism for the signals. WADI is primarily useful for safety applications where driving switches or capturing signals require an action or a linking of actions to occur if the signal analysis reports any misbehavior.

Refer to the device-specific technical reference manual for more information.

Table 3-33 lists the WADI types, including device-specific differences within each type.

Table 3-33. Waveform Analyzer Diagnostic (WADI) Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original WADI Type	29H85x, 29P58x	–

3.2.30 System Control and Interrupts

The device-specific System Control and Interrupts guides are:

- *TMS320x281x System Control and Interrupts Reference Guide*
- *TMS320x280x, 2801x, and 2804x System Control and Interrupts Reference Guide*
- *TMS320x2834x System Control and Interrupts Reference Guide*

For devices not listed above, refer to the device-specific technical reference manual.

These guides include information on the following modules depending on the specific device:

- Memory, including Flash and OTP memory configuration
- Code security module (CSM)
- Safety and Security
  - Dual Code Security Module (DCSM)
  - Hardware Security Manager (HSM)
  - Safety and Security Unit (SSU)
- Clocking and low-power modes
- 32-bit CPU-Timers
- Watchdog Timer
- General-purpose inputs/outputs (GPIO)
- Peripheral frames
- Interrupt Controller(s)
  - Peripheral interrupt expansion (PIE)
  - Peripheral interrupt and priority expansion (PIPE)
- Low-power modes
- External Interrupts

3.3 Control Peripherals

The following sections describe the Control peripherals.

3.3.1 Analog-to-Digital Converter (ADC) Modules

The device-specific ADC guides are:

- *TMS320x281x Analog-to-Digital Converter (ADC) Reference Guide*
- *TMS320x280x 2801x, 2804x Analog-to-Digital Converter (ADC) Module Reference Guide*

For devices not listed above, refer to the device-specific technical reference manual.

3.3.1.1 Analog-to-Digital Converter (ADC) Module

The Analog-to-Digital Converter (ADC) module samples an analog signal and converts the analog signal to a digital value for use in an application.

Refer to the device-specific technical reference manual for more information.

Table 3-34 lists the ADC types, including device-specific differences within each type.

Table 3-34. Analog-to-Digital Converter (ADC) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original ADC Module Type. Fixed reference range of 0V to 3.0V. 12-bit pipelined architecture.	281x	–
1	Added Offset Trim and Reference Select registers.	280x, 2801x, 2804x	–
2	Added Internal/External Trim registers (OTP trim).	2823x, 2833x	–
3	Fixed internal reference range from 0V to 3.3V or ratiometric external reference. 12-bit hybrid pipeline/SAR architecture.	2802x, 2803x, 2805x, 2806x, M35x, M36x	–
4	12-bit or 16-bit SAR architecture. Ratiometric external reference. Single-ended or differential inputs. Trimmed for gain, offset, and linearity.	2807x, 2837xD, 2837xS, 2838x, 28P65x, 29H85x, 29P58x	–
5	12-bit and single-ended mode ONLY. 16-bit and differential mode not applicable.	28002x, 28003x, 28004x, 280013x, 280015x, 29H85x, 29P58x	–
6	12-bit and single-ended mode ONLY. External reference full and half-mode support.	28P55x	–
7	12-bit and single-ended mode ONLY. External reference full and half-mode support.	28E12x	–

3.3.1.2 Analog-to-Digital Converter (ADC) Wrapper Module

The Analog-to-Digital Converter (ADC) Wrapper module provides control and sequencing of the ADC.

Refer to the device-specific technical reference manual for more information.

Table 3-35 lists the ADC wrapper types, including device-specific differences within each type.

Table 3-35. Analog-to-Digital Converter (ADC) Wrapper Module Type Descriptions

Type	Description	Devices Covered	Device-Specific Options
0	Original ADC wrapper type. Dual 8-channel sequencer architecture.	280x, 281x, 2801x, 2804x, 2823x, 2833x	–
1	Start-of conversion (SOC) x16 architecture.	2802x, 2803x, 2805x, 2806x	–
2	Modified Type 1 accessed through ACIB.	M35x, M36x	–
3	Modified Type 1. Added burst mode, integrated post-processing blocks.	2807x, 28002x, 28003x, 28004x, 280013x, 280015x, 2837xD, 2837xS, 2838x	–
4	Modified Type 3. Added repeater block to PPB.	28P65x	–
5	Modified Type 4. Added SOC capacitor reset and PPB delta calculation.	28P55x, 29H85x, 29P58x	–
6	Modified Type 5. One Trigger Repeater Block with oversampling of up to 8 samples, undersampling removed, and phase delay removed. Three PPBs with absolute value error calculation removed, result delta calculation removed, in-limit flags added for all PPB instances, digital trip filter removed, sample delay capture removed, and oversampling available only on PPB1; with min and max functionality removed. Added ADCSOCC and ADCSOCD PWM triggers. Added sample capacitor reset mode option to select VREFHI/2 as reset value. Modified sample and hold window to use configurable base and offset values. Burst mode removed. Added DMA flag, force, and clear fields for ADC DMA triggers.	28E12x	–

3.3.2 Configurable Logic Block (CLB) Module

The Configurable Logic Block (CLB) module is a collection of blocks that can be interconnected using software to implement custom digital logic functions or enhance existing on-chip peripherals. The CLB is able to enhance existing peripherals through a set of crossbar interconnections, which provide a high level of connectivity to existing control peripherals such as enhanced pulse width modulators (ePWM), enhanced capture modules (eCAP), and enhanced quadrature encoder pulse modules (eQEP).

Refer to the device-specific technical reference manual for more information.

Table 3-36 lists the CLB types, including device-specific differences within each type.

Table 3-36. Configurable Logic Block (CLB) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
1	Original CLB Module Type.	2807x, 2837xD, 2837xS	–
2	- The CLB Counter module includes a prescalar, shift register/serializer mode. - The CLB module includes an Output Conditioning Block that can gate CLB output signals through combinational logic. - The CLB HLC module can generate events based on both the rising and falling edge of the EVENT signals. - The CLB Tiles have up to 24 outputs instead of 16 outputs. - The CLB modules can generate NMIs.	28004x	–
3	- The CLB Counter module contains a PIPELINE mode. This allows the add/sub/shift operations, which are triggered by an event, to use the value of the counter in the previous cycle. - The CLB HLC module has access to CLB Tile outputs delayed by one cycle.	28002x, 28003x, 2838x, 28P55x, 28P65x, 29H85x, 29P58x	–

3.3.3 Comparator (COMP) Module

The Comparator (COMP) module is built around an analog voltage comparator with a digital output that can signal the on-chip ePWM modules when a trip condition is detected. The positive input of the comparator is sourced directly from a device pin. The negative input of the comparator is sourced by a programmable, full-scale internal reference DAC.

Refer to the device-specific technical reference manual for more information.

Table 3-37 lists the COMP types, including device-specific differences within each type.

Table 3-37. Comparator (COMP) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original Comparator module. Internal reference DAC has 10-bit resolution. Qualification stage for glitch filtering. Ramp generator logic.	2802x, 2803x, 2806x, M35x, M36x	–
1	Internal reference DAC has 6-bit resolution. Digital filter stage for glitch filtering. No ramp generator logic.	2805x	–

3.3.4 Comparator Subsystem (CMPSS) Module

The Comparator Subsystem (CMPSS) module consists of analog comparators and supporting components that are combined into a topology that is useful for power applications such as peak current mode control, switched-mode power, power factor correction and voltage trip monitoring. Each CMPSS module includes two analog comparators, two programmable 12-bit DACs, one ramp generator, and two digital filters. CMPSS has the ability to synchronize with PWMSYNC signals.

Refer to the device-specific technical reference manual for more information.

Table 3-38 lists the CMPSS types, including device-specific differences within each type.

Table 3-38. Comparator Subsystem (CMPSS) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original CMPSS Module Type	2807x, 2837xD, 2837xS	–
1	Blanking capability added that helps clear and reset the existing/imminent trip conditions near ePWM boundaries. Fixed Trip versus Clear-and-reset arbitration when the RAMP generator is used.	28002x, 28004x, 2838x	–
2	CMPSS Type 1 updated with digital filter enhancement (increase in filter prescale)	28003x	–
3	Buffered DACL support	280013x	–
4	Not released	–	–
5	Incrementing Ramp support. Added External FILTIN support PWMSYNCPER selection per High and Low comparator.	280015x	–
6	RAMPCLKDIV added to scale the ramp generator clock.	28P55x	28P55x does not support diode emulation
		28P65x, 29H85x, 29P58x	Diode Emulation Support added (Type 5 ePWM required)

3.3.5 Comparator Subsystem LITE (CMPSS_LITE) Module

The Comparator Subsystem LITE (CMPSS_LITE) module shares a common architecture with the Comparator Subsystem (CMPSS) module. However some features and performance levels are only supported by the full CMPSS variant. The device data sheet indicates electrical characteristics for the two variants separately.

The CMPSS_LITE module consists of analog comparators and supporting components that are combined into a topology that is useful for power applications such as peak current mode control, switched-mode power, power factor correction and voltage trip monitoring. Each CMPSS module includes two analog comparators, two programmable reference DACs, and two digital filters. CMPSS_LITE has the ability to synchronize with PWMSYNC signals.

Refer to the device-specific technical reference manual for more information.

Table 3-39 lists the CMPSS types, including device-specific differences within each type.

Table 3-39. Comparator Subsystem LITE (CMPSS_LITE) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original CMPSS_LITE Module Type, shared architecture with CMPSS Type 2.	280013x	–
		280015x	Digital filter with increased value for prescaler
		28E12x	DAC output added for select instances; consult the device data sheet.

3.3.6 Digital-to-Analog Converter (DAC) Module

The Buffered Digital-to-Analog Converter (DAC) module is able to output arbitrary DC voltages to the device pins.

Refer to the device-specific technical reference manual for more information.

Table 3-40 lists the DAC types, including device-specific differences within each type.

Table 3-40. Digital-to-Analog Converter (DAC) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original DAC module. 6-bit programmable range.	2805x	–
1	12-bit programmable range.	2807x, 2837xD, 2837xS, 2838x	–
2	Pull-down register on the output removed: $1^{\times}$ and $2^{\times}$ gain options added; increased load support.	28003x, 28004x, 28P65x, 29H85x, 29P58x	–
		28P55x	28P55x does not support VDAC reference.

3.3.7 Enhanced Capture (eCAP) Module

The Enhanced Capture (eCAP) module is essential in systems where accurate timing of external events is important. Uses for eCAP include:

- Speed measurements of rotating machinery (for example, toothed sprockets sensed using Hall sensors)
- Elapsed time measurements between position sensor triggers
- Period and duty cycle measurements of pulse train signals
- Decoding current or voltage amplitude derived from duty cycle encoded current/voltage sensors

The eCAP guides are:

- *TMS320x280x, 2801x, 2804x Enhanced Capture (eCAP) Module Reference Guide*
- *TMS320x2834x Enhanced Capture (eCAP) Module Reference Guide*

For devices not listed above, refer to the device-specific technical reference manual.

Table 3-41 lists the eCAP types, including device-specific differences within each type.

Table 3-41. Enhanced Capture (eCAP) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original eCAP Module Type	280x, 2801x	eCAP 1 SYNCIN is applied from the ePWM module. Then all other eCAP modules have the SYNCINs applied from the eCAP module numerically preceding them.
		2802x, 2803x, 2805x, 2806x, 2807x, 2823x, 2833x, 2834x, 2837xD, 2837xS, M35x, M36x	eCAP 1 SYNCIN and eCAP4 SYNCIN are applied from the ePWM module. Then eCAP 2, 3, 5, and 6 SYNCINs are applied from the eCAP modules numerically preceding them.
1	Clears event filter, modulo counter, and any pending interrupt flags. Provides a separate DMA trigger on every capture event. Critical registers are EALLOW protected. High-Resolution capture (HRCAP) capability now an extension of eCAP.	28004x	eCAP-1 to eCAP-5 are normal eCAP. eCAP-6 and eCAP-7 have HRCAP functionality enabled.
2	Sync related enhancements	28002x, 28003x	eCAP-1 to eCAP-3 are normal eCAP. eCAP-3 has HRCAP functionality enabled.
		2838x	eCAP-1 to eCAP-5 are normal eCAP. eCAP-6 and eCAP-7 have HRCAP functionality enabled.
		280013x, 280015x, 28E12x, 28P55x	All eCAP instances are normal eCAP.
3	Enhanced signal monitoring for edge, pulse width, and period. DMA and SOC event generation, glitch filtering on input signals, and an increased number of multiplexed capture inputs.	28P65x, 29H85x, 29P58x	eCAP-1 to eCAP-5 are normal eCAP. eCAP-6 and eCAP-7 have HRCAP functionality enabled.

3.3.8 Enhanced Pulse Width Modulator (ePWM) Module

The Enhanced Pulse Width Modulator (ePWM) module controls many of the power-related systems found in both commercial and industrial equipments. The main systems include digital motor control, switch mode power supply control, uninterruptible power supplies (UPS), and other forms of power conversion. The PWM peripheral performs a DAC function, where the duty cycle is equivalent to a DAC analog value; sometimes referred to as a Power DAC.

The ePWM guides are:

- *TMS320x280x, 2801x, 2804x Enhanced Pulse Width Modulator (ePWM) Module Reference Guide*
- *TMS320x2834x Enhanced Pulse Width Modulator (ePWM) Module Reference Guide*

The High-Resolution Pulse Width Modulator (HRPWM) module extends the time resolution capabilities of the conventionally derived digital pulse width modulator (PWM). HRPWM is typically used when PWM resolution falls below approximately 9-10 bits.

The HRPWM guides are:

- *TMS320x280x, 2801x, 2804x High-Resolution Pulse Width Modulator (HRPWM) Module Reference Guide*
- *TMS320x2834x High Resolution Pulse Width Modulator (HRPWM) Reference Guide*

For devices not listed above, refer to the device-specific technical reference manual.

Table 3-42 lists the ePWM types, including device-specific differences within each type.

Table 3-42. Enhanced Pulse Width Modulator (ePWM) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original ePWM Module Type and HRPWM Module Type	280x(1), 2801x	Time-base synchronization scheme 1: ePWM1 SYNC out is applied to eCAP1 and ePWM2. All other ePWM modules have the SYNCIN signals applied from the ePWM module numerically preceding them.
		2804x, 2809	Time-base synchronization scheme 2: Two ePWM pinouts are possible: A-channel only or 280x compatible. If the ePWM pinout is configured for A-channel only mode, ePWM1 SYNC out is applied to eCAP1, ePWM2, ePWM5, ePWM9, and ePWM13. All other ePWM modules have the SYNCIN signals applied from the ePWM module numerically preceding them. If the ePWM pinout is configured for 280x-compatible mode, synchronization scheme 1 is used.
		2823x, 2833x, 28234	Time-base synchronization scheme 3: ePWM1 SYNC out is applied to eCAP1, ePWM2, and ePWM4. All other ePWM modules have the SYNCINs applied from the ePWM module numerically preceding them.
1	Doubled deadband resolution, interrupts, and ADC SOC can be generated on both CTR = 0 or CTR = PRD. Added digital compare submodule and added hooks for high-resolution period.	2805x	No HRPWM support.
		2802x, 2803x, 2806x	Added high-resolution period support, added option to select high-resolution B output, added automatic micro-step conversion.

Table 3-42. Enhanced Pulse Width Modulator (ePWM) Module Type Description (continued)

Type	Description	Devices Covered	Device-Specific Options
2	Expanded Register set, added High-Resolution to Dead-band RED and FED, added Dead-band generator module enhancements. Added HRPWM capability to ePWMxB channels. Added enhancements to Counter Compare Module, Event Trigger Module, and Digital Compare Module. Supports Simultaneous writes to TBPRD and CMPx Registers. Added Shadow to Active Load on SYNC of TBPRD and CMP registers. Added independent high-resolution control on B-channel output, added dead band control for falling and rising edge delay, added additional delay lines per ePWM module, added SYNC pulse timings.	M35x, M36x	–
3	This type is not used.	–	–
4	Remapped address space for ease of use. Added Delayed Trip functionality. Dead-band Generator Module enhancements. One shot and Global reload of Registers, Trip Zone Module Enhancements, and PWM SYNC related enhancements. Remapped address space. Added global shadow-to-active reload. Added one-shot shadow-to-active reload.	2807x, 28004x, 2837xD, 2837xS	–
	Enhancements to enable independent PWM action configuration on a CBC and an OST trip event. Changes to enable the PWM to work at the maximum SYSCLK frequency. Changes to enable a simplified SYNC scheme. Addition of DCA/BEVTs as SYNCOUT sources. One-shot syncout synchronized to one-shot global load of shadow registers. Individual HRPWM module clocked from the respective EPWMxCLK. Separate clock to HRCAL. Clocks to individual HRPWM modules can be hooked up to the respective ePWMs.	28002x, 28003x, 280013x, 280015x, 2838x, 28P55x	–
5	Added diode emulation, minimum deadband, illegal combination logic.	28P65x, 29H85x, 29P58x	–

(1) The time-base synchronization scheme 1 is not available in the TMS320F2809 part.

3.3.9 Enhanced Quadrature Encoder Pulse (eQEP) Module

The Enhanced Quadrature Encoder Pulse (eQEP) module is used for direct interface with a linear or rotary incremental encoder to get position, direction, and speed information from a rotating machine for use in a high-performance motion and position-control system.

The eQEP module guides are:

- *TMS320x280x, 2801x, 2804x Enhanced Quadrature Encoder Pule (eQEP) Module Reference Guide*
- *TMS320x2834x Enhanced Quadrature Encoder Pulse (eQEP) Module Reference Guide*

For devices not listed above, refer to the device-specific technical reference manual.

Table 3-43 lists the eQEP types, including device-specific differences within each type.

Table 3-43. Enhanced Quadrature Encoder Pulse (eQEP) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original eQEP Module Type	280x, 2803x, 2805x, 2806x, 2807x, 2823x, 2833x, 2834x, 2837xD, 2837xS, M35x, M36x	–
1	Addition of QMA (QEP Mode Adapter) Block : - Error detection logic to detect illegal transitions on eQEPA and eQEPB input signals. - xCLKMOD block that looks at transitions on input signals to generate clock signal going into eQEP module. - xDIRMOD block that looks at transitions on input signals to generate direction signal going into eQEP module.	28004x	–
2	Latching Position count on ADCSOC from PWM module. Support for SinCos transducers.	28002x, 28003x, 280013x, 280015x, 2838x, 28E12x, 28P55x, 28P65x, 29H85x, 29P58x	–

3.3.10 High-Resolution Capture (HRCAP) Module

The High-Resolution Capture (HRCAP) module captures the width of pulses with a typical resolution of hundreds of picoseconds and performs both conventional and high-resolution delta time measurements.

Uses for the HRCAP include:

- Capacitive touch applications
- High-resolution period and duty cycle measurements of pulse train cycles
- Instantaneous speed measurements
- Instantaneous frequency measurements
- Voltage measurements across an isolation boundary
- Distance/sonar measurement and scanning

Refer to the device-specific technical reference manual for more information.

Table 3-44 lists the HRCAP types, including device-specific differences within each type.

Table 3-44. High-Resolution Capture (HRCAP) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original HRCAP Module Type	2803x, 2806x	–
1	Simplified calibration scheme: HRCAP is always functional, never offline, always running calibration on the background that drastically reduces software overhead to calibrate. Fractional and integer are packed into 32 bits. All eCAP hardware is accessible while using HRCAP.	28004x	eCAP-1 to eCAP-5 are normal eCAP. eCAP-6 and eCAP-7 have HRCAP functionality enabled.
2	Sync related enhancements	28002x, 28003x	eCAP-3 has HRCAP functionality enabled.
		2838x, 28P65x	eCAP-6 and eCAP-7 have HRCAP functionality enabled.
3	HRCAP Module Type	29H85x, 29P58x	

3.3.11 InstaSPIN™ Solutions

InstaSPIN™ three-phase motor solutions make designing motor control applications easier whether you have a simple application or a complex design.

3.3.11.1 InstaSPIN-FOC™

InstaSPIN-FOC™ is a three-phase motor field-oriented torque control that can identify, tune the torque controller, and efficiently control your motor in minutes, without the use of any mechanical rotor sensors. InstaSPIN-FOC includes the Flux Angle Speed Torque (FAST™) estimator and additional motor control functions needed for cascaded speed and torque loops for efficient three-phase field-oriented motor control. InstaSPIN-FOC is made available in ROM with user callable APIs. The user also has the option of executing all FOC functions in user memory (Flash or RAM), which then makes calls to the proprietary FAST estimator firmware in ROM.

The device-specific InstaSPIN-FOC documents are:

- *TMS320F28026F, TMS320F28027F InstaSPIN™-FOC Software Technical Reference Manual*
- *TMS320F28069F, TMS320F28068F, TMS320F28062F InstaSPIN™-FOC Software Technical Reference Manual*
- *TMS320F28054F, TMS320F28052F InstaSPIN-FOC™ Software Technical Reference Manual*
- *InstaSPIN-FOC™ and InstaSPIN-MOTION™ User's Guide*

3.3.11.2 InstaSPIN-MOTION™

Note

InstaSPIN-MOTION™ is no longer recommended for new designs and does not have application support. For motion control issues, see the latest examples released in the MotorControl software development kit (SDK) for C2000™ MCUs.

InstaSPIN-MOTION is the first offering from Texas Instruments to combine TI 32-bit C2000 microcontrollers with comprehensive motor-, motion-, speed-, and position-control software. InstaSPIN-MOTION delivers robust velocity and position control at the highest efficiency for motor applications that operate in various motion state transitions. InstaSPIN-MOTION is a sensorless or sensored field-oriented motor control (FOC) that can identify, tune, and control your motor in minutes. InstaSPIN-MOTION features the Flux Angle Speed Torque (FAST) premium software sensor and the SpinTAC™ Motion controller.

The device-specific InstaSPIN-MOTION documents are:

- *TMS320F28069M, TMS320F28068M InstaSPIN™-MOTION Software User's Guide*
- *TMS320F28054M, TMS320F28052M InstaSPIN-MOTION™ Software User's Guide*
- *InstaSPIN-FOC™ and InstaSPIN-MOTION™ User's Guide*

Table 3-45 lists the InstaSPIN modules, including device-specific differences within each module.

Table 3-45. InstaSPIN™ Module Type Description

Module	Description	Devices	Device-Specific Options
InstaSPIN-FOC	InstaSPIN-FOC ROM	28062F, 28068F, 28069F, 280040C, 280041C, 280048C, 280049C	1 or 2 motors
		28026F, 28027F, 28052F, 28054F	1 motor
InstaSPIN-MOTION	InstaSPIN-MOTION ROM	28052M, 28054M, 28068M, 28069M	–

3.3.12 Multi-Channel Pulse Width Modulator (MCPWM) Module

The Multi-Channel Pulse Width Modulator (MCPWM) module is a key element in controlling many of the power electronic systems found in both commercial and industrial equipment. The MCPWM module is able to generate complex pulse width waveforms with minimal CPU overhead by building the peripheral up from smaller modules with separate resources that can operate together to form a system. Some of the highlights of the MCPWM module include complex waveform generation, dead-band generation, a flexible synchronization scheme, advanced trip-zone functionality, and global register reload capabilities.

The MCPWM module is similar to the ePWM module. The *EPWM to MCPWM Migration Guide* details the differences between the two modules and how to migrate software between the two modules.

Refer to the device-specific technical reference manual for more information.

Table 3-46 lists the MCPWM types, including device-specific differences with each type.

Table 3-46. Multi-Channel Pulse Width Modulator (MCPWM) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original MCPWM Module Type	28E12x	-

3.3.13 Programmable Gain Amplifier (PGA) Module

The Programmable Gain Amplifier (PGA) module is designed to buffer and amplify small input signals into an output range that is an excellent choice for the on-chip ADC and Comparator modules.

Refer to the device-specific technical reference manual for more information.

Table 3-47 lists the PGA types, including device-specific differences within each type.

Table 3-47. Programmable Gain Amplifier (PGA) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original PGA Module Type	2805x	Programmable gain modes: x3, x6, x11
1	Added gain mode of 24×. Supports Low-Pass Filtering. Features Hardware-based trims to reduce offset and gain errors.	28004x	Programmable gain modes: x2, x6, x12, x24
2	Added supports for buffer (Unity Gain), standalone op-amp, and subtractor operation modes. Rail to rail on both input pins. Internal negative input sharing across PGAs. Hardware assisted chopping for offset and 1/f noise reduction.	28P55x	Programmable gain modes: x2, x4, x8, x16, x32, x64 (non-inverting mode) x(-1), x(-3), x(-7), x(-15), x(-31), x(-63) (inverting mode)
3	Added 3-to-1 mux to input pins.	28E12x	

3.3.14 Sigma Delta Filter Module (SDFM)

The Sigma Delta Filter Module (SDFM) is a four-channel digital filter designed specifically for current measurement and resolver position decoding in motor control applications. Each input channel can receive an independent sigma-delta (ΣΔ) modulated bit stream. The bit streams are processed by four individually programmable digital decimation filters. The filter set includes a fast comparator (secondary filter) for immediate digital threshold comparisons for over-current and under-current monitoring, and zeros-crossing detection.

Refer to the device-specific technical reference manual for more information.

Table 3-48 lists the SDFM types, including device-specific differences within each type.

Table 3-48. Sigma Delta Filter (SDFM) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original SDFM Module Type	2807x, 2837xD, 2837xS	–
1	Data filter changes: - Added 16-deep x 32-bit FIFO - Wait for Sync feature - FIFO freeze feature - Type 0 saturation bug resolved - Any PWMx.SOCA/SOCB event can trigger SDSYNC event - Each filter module data acknowledge event can trigger CPU interrupt Comparator filter changes: - Added zeros threshold comparator - All comparator events MUXed to ECAPxIN signal	28004x	–
2	- SDFM Input Qualification - SDFM Clock Control Comparator filter changes: - Added additional lower threshold and higher threshold comparators - Digital filter to comparator events	28003x, 2838x, 28P65x, 29H85x, 29P58x	Supports only Mode 0

3.4 Communication Peripherals

The following sections describe the communications peripherals.

3.4.1 Controller Area Network (DCAN) Module

Note

The DCAN is not software compatible with the C28x eCAN module.

The Controller Area Network (CAN) is a serial communications protocol that efficiently supports distributed real-time control with a high level of reliability. The DCAN module is compliant with the ISO11898-1 (CAN 2.0B) protocol specification. The DCAN supports bit rates up to 1M bits/s, programmable FIFO, parity checking, individual identifier masks, and interrupts. This module is similar to the Arm® Cortex®-M3 DCAN module.

Refer to the device-specific technical reference manual for more information.

Table 3-49 lists the DCAN types, including device-specific differences within each type.

Table 3-49. Controller Area Network (DCAN) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original DCAN Design. Not Software compatible with eCAN	2807x, 28002x, 28003x, 28004x, 280013x, 280015x, 2837xD, 2837xS, 2838x, 28P65, M35x, M36x	–

3.4.2 Enhanced Controller Area Network (eCAN) Module

Note

The eCAN module is not software compatible with the DCAN module.

The Enhanced Controller Area Network (eCAN) module supports 32 mailboxes, time stamping of messages, and is ISO11898-1 (CAN 2.0B) compliant.

The eCAN guides are:

- *TMS320x281x DSP Enhanced Controller Area Network (eCAN) Reference Guide*
- *TMS320x280x, 2801x DSP Enhanced Controller Area Network (eCAN) Reference Guide*
- *TMS320x2834x Enhanced Controller Area Network (eCAN) Reference Guide*

For devices not listed above, refer to the device-specific technical reference manual.

Table 3-50 lists the eCAN types, including device-specific differences within each type.

Table 3-50. Enhanced Controller Area Network (eCAN) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original eCAN Module Type	280x, 2801x, 281x, 28016	CAN module clock = SYSCLK
		2803x, 2805x, 2806x, 2823x, 2833x	CAN module clock = SYSCLK/2
		2834x	CAN module clock = SYSCLK/4

3.4.3 EtherCAT® SubordinateDevice Controller (ESC)

Note

Texas Instruments is transitioning to use more inclusive terminology. Some language may be different than what you would expect to see for certain technology areas.

Ethernet for Control Automation Technology (EtherCAT®) is an Ethernet-based field bus system, invented by Beckhoff Automation and is standardized in IEC 61158. All the SubordinateDevice nodes connected to the bus interpret, process, and modify the data addressed to the nodes in progress, without having to buffer the frame inside the node.

The frames are directly forwarded with minimum additional delay. This real-time behavior, frame processing and forwarding requirements are implemented by the EtherCAT SubordinateDevice controller hardware. The EtherCAT does not require software interaction for data transmission inside the SubordinateDevice nodes. The EtherCAT only defines the MAC layer while the higher layer protocols and stack are implemented in software on the microcontrollers connected to the ESC.

Refer to the device-specific technical reference manual for more information.

Table 3-51 lists the ESC types, including device-specific differences within each type.

Table 3-51. EtherCAT® SubordinateDevice Controller (ESC) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original ESC Module Type	2838x, 28P65x, 29H85x, 29P58x	–

3.4.4 Ethernet Media Access Controller (EMAC) Module

The Ethernet Media Access Controller (EMAC) module conforms to the IEEE 802.3-2002 specifications and fully supports 10BASE-T and 100BASE-TX standards. The EMAC module supports data rates of 10/100Mbps, CRC error-rejection control, user-configurable interrupts, and efficient transfers using the Micro Direct Memory Access Controller.

Refer to the device-specific technical reference manual for more information.

Table 3-52 lists the EMAC types, including device-specific differences within each type.

Table 3-52. Ethernet Media Access Controller (EMAC) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original EMAC Module Type	2838x, M35x, M36x	–

3.4.5 Fast Serial Interface (FSI) Module

The Fast Serial Interface (FSI) module is a serial communication peripheral capable of reliable, high-speed communication across isolation devices. Galvanic isolation devices are used in situations where two different electronic circuits, which do not have common power and ground connections, must exchange information. Though isolation devices facilitate these signal communications, isolation devices can also introduce a large delay on the signal lines and add skew between the signals. The FSI is designed specifically without using added components to make sure that high-speed communication for system scenarios that involve communication across isolation barriers are reliable.

Refer to the device-specific technical reference manual for more information.

Table 3-53 lists the FSI types, including device-specific differences with each type.

Table 3-53. Fast Serial Interface (FSI) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original FSI Module Type	28004x	–
1	Enhanced to feed TDM_IN port on to TX port controlled by a CLB output. Added tag match notification scheme.	28002x, 2838x	–
2	Added support for connected drive architecture (hardware-based RX to TX loopback)	28003x, 28P55x, 28P65x, 29H85x, 29P58x	–

3.4.6 Inter-Integrated Circuit (I2C) Module

The Inter-Integrated Circuit (I2C) module provides an interface between one of these DSPs and devices compliant with Philips Semiconductors Inter-IC bus (I2C-bus) specification version 2.1 and connected by way of an I2C-bus. External components attached to this 2-wire serial bus can transmit/receive 1- to 8-bit data to/from the DSP through the I2C module. This guide assumes the reader is familiar with the I2C-bus specification.

The C28x I2C guides are:

- *TMS320x280x, 2801x, 2804x Inter-Integrated Circuit (I2C) Module Reference Guide*
- *TMS320x2834x Inter-Integrated Circuit (I2C) Module Reference Guide*

For devices not listed above, refer to the device-specific technical reference manual.

Table 3-54 lists the I2C types, including device-specific differences within each type.

Table 3-54. Inter-Integrated Circuit (I2C) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original C28x I2C Module Type. Not software compatible with M3 I2C.	280x, 2801x, 2804x, 2807x, 2823x, 2833x, 2834x, 2837xD, 2837xS, M35x, M36x	16-level FIFO
		2802x, 2803x, 2805x, 2806x	4-level FIFO
1	Fixed the bug from Type-0 related to timing of XRDY transmit interrupt.	28002x, 28003x, 28004x, 280013x, 280015x, 2838x, 28P65x	16-level FIFO
2	Added Extended clock stretching and Manual clock stretching.	28E12x, 28P55x, 29H85x, 29P58x	16-level FIFO

3.4.7 M3 Inter-Intergrated Circuit (I2C) Module

The M3 Inter-Integrated Circuit (I2C) module provides an interface between one of these DSPs and devices compliant with Philips Semiconductors Inter-IC bus (I2C-bus) specification version 2.1 and connected by way of an I2C-bus. External components attached to this 2-wire serial bus can transmit/receive 1- to 8-bit data to/from the DSP through the I2C module. This guide assumes the reader is familiar with the I2C-bus specification.

Refer to the device-specific technical reference manual for more information.

Table 3-55 lists the M3 I2C types, including device specific differences within each type.

Table 3-55. M3 Inter-Integrated Circuit (I2C) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original M3 I2C Module Type. Not software compatible with C28x I2C.	M35x, M36x	–

3.4.8 Local Interconnect Network (LIN) Module

The Local Interconnect Network (LIN) module provides a serial communications structure at a hardware and software level. The LIN provides a low-cost answer where the bandwidth and fault tolerance of a Controller Area Network (CAN) are not required. The Type 0 LIN module is compliant to the LIN1.3 and 2.0 protocols. The Type 1 LIN module is compliant to the 2.1 protocol. The LIN module is based on a C28x Type 0 SCI module with the addition of an error detector, a mask filter, a synchronizer, and a multibuffered receiver and transmitter.

Refer to the device-specific technical reference manual for more information.

Table 3-56 lists the LIN types, including device-specific differences within each type.

Table 3-56. Local Interconnect Network (LIN) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original LIN Module Type	2803x	–
1	Compliant to the LIN 2.1 protocol specifications.	28002x, 28003x, 28004x, 280015x	–
		28P55x, 28P65x, 29H85x, 29P58x	SYSCLK divider (for VCLK) for lower baud rates in auto-baud mode.

3.4.9 Modular Controller Area Network (MCAN) Module

The Modular Controller Area Network (MCAN) module supports both classic CAN and CAN FD (CAN with flexible data-rate) protocols. The CAN FD feature allows higher throughput and increased payload per data frame. Classic CAN and CAN FD devices can coexist on the same network without any conflict provided that partial networking transceivers, which can detect and ignore CAN FD without generating bus errors, are used by the classic CAN devices. The MCAN module is compliant to ISO 11898-1:2015.

Refer to the device-specific technical reference manual for more information.

Table 3-57 lists the MCAN types, including device-specific differences within each type.

Table 3-57. Modular Controller Area Network (MCAN) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original MCAN Module Type with 17KB MCAN RAM	2838x	–
1	8KB MCAN RAM	28003x	–
2	4KB MCAN RAM	280015x, 28P55x, 28P65x, 29H85x, 29P58x	–

3.4.10 Multichannel Buffered Serial Port (McBSP) Module

The Multichannel Buffered Serial Port (McBSP) module is used to connect to E1/T1 lines, phone-quality codecs for modem applications or high-quality stereo-quality Audio DAC devices. The McBSP receive and transmit registers are supported by a 16-level FIFO. This significantly reduces the overhead for servicing this peripheral.

The McBSP guides are:

- *TMS320x281x Multichannel Buffered Serial Port (McBSP) Reference Guide*
- *TMS320x2834x Multichannel Buffered Serial Port (McBSP) Reference Guide*

For devices not listed above, refer to the device-specific technical reference manual.

Table 3-58 lists the McBSP types, including device-specific differences within each type.

Table 3-58. Multichannel Buffered Serial Port (McBSP) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original McBSP Module Type	281x	–
1	Removed FIFO to allow interconnect with DMA module. Removed FIFO-related registers (MFFTX, MFFRX, MFFCT, MFFST).	2806x, 2807x, 2823x, 2833x, 2834x, 2837xD, 2837xS, 2838x, M35x, M36x	–

3.4.11 Power Management Bus (PMBus) Module

The Power Management Bus (PMBus) module provides an interface between the microcontroller and devices compliant with the SMI Forum PMBus Specification Part I version 1.0 and Part II version 1.1 PMBus is based on SMBus, which uses a similar physical layer to I2C.

Refer to the device-specific technical reference manual for more information.

Table 3-59 lists the PMBus types, including device-specific differences with each type.

Table 3-59. Power Management Bus (PMBus) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original PMBus Module Type	28002x, 28003x, 28004x, 280015x, 2838x, 28P65x	–
1	Added support for 1MHz speed and 0ns hold time.	28P55x, 29H85x, 29P58x	–

3.4.12 Serial Communications Interface (SCI) Module

The Serial Communications Interface (SCI) module is a two-wire asynchronous serial port, commonly known as UART. The SCI supports a receive and transmit FIFO for reducing servicing overhead.

The SCI guides are:

- *TMS320x281x Serial Communications Interface (SCI) Reference Guide*
- *TMS320x280x, 2801x, 28044 Serial Communications Interface (SCI) Reference Guide*
- *TMS320x2834x Serial Communications Interface (SCI) Reference Guide*

For devices not listed above, refer to the device-specific technical reference manual.

Table 3-60 lists the SCI types, including device-specific differences within each type.

Table 3-60. Serial Communications Interface (SCI) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original SCI Module Type	280x, 281x, 2801x, 2804x, 2807x, 28002x, 28003x, 28004x, 280013x, 280015x, 2823x, 2833x, 2834x, 2837xD, 2837xS, 2838x, 28E12x, 28P55x, 28P65x, M35x, M36x	16-level FIFO
		2802x, 2803x, 2805x, 2806x	4-level FIFO

3.4.13 Serial Peripheral Interface (SPI) Module

The Serial Peripheral Interface (SPI) module is a high-speed, synchronous serial I/O port that allows a serial bit stream of programmed length (1 to 16 bits) to be shifted into and out of the device at a programmable bit-transfer rate. Normally, the SPI is used for communications between the DSP controller and external peripherals or another processor. Typical applications include external I/O or peripheral expansion through devices such as shift registers, display drivers, and ADCs. Multi-device communications are supported by the controller and peripheral operation of the SPI. The port supports a receive and transmit FIFO for reducing servicing overhead.

The SPI guides are:

- *TMS320x281x Serial Peripheral Interface (SPI) Reference Guide*
- *TMS320x280, 2801x, 2804x Serial Peripheral Interface (SPI) Reference Guide*
- *TMS320x2834x Serial Peripheral Interface (SPI) Reference Guide*

For devices not listed above, refer to the device-specific technical reference manual.

Table 3-61 lists the SPI types, including device-specific differences within each type.

Table 3-61. Serial Peripheral Interface (SPI) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original SPI Module Type	280x, 281x, 2801x, 2804x, 2823x, 2833x, 2834x, M35x, M36x	–
1	Added support for 3-wire bidirectional mode and reduced to 4-level FIFO.	2802x	No STEINV bit
		2803x, 2805x, 2806x	Added STEINV bit (inverts SPISTE signal to support digital audio receive mode with 2 SPIs).
2	Type 1 with STEINV. Added high-speed mode. Added DMA support (for devices with DMA); increased to 16-level FIFO.	2807x, 28004x, 280013x, 280015x, 2837xD, 2837xS, 28E12x	–
	Support for custom CLB interface to update RXBUF.	28002x, 28003x, 2838x, 28P55x, 28P65x, 29H85x, 29P58x	–

3.4.14 Single Edge Nibble Transmission (SENT) Module

The Single Edge Nibble Transmission (SENT) module is based on the open standard SAE J2716 with additional enhancements such as additional sensor format support.

Refer to the device-specific technical reference manual for more information.

Table 3-62 lists the SENT types, including device-specific differences within each type.

Table 3-62. Single Edge Nibble Transmission (SENT) Type Description

Type	Description	Devices Covered	Device-Specific Options
1	Original SENT Module Type	29H85x, 29P58x	–

3.4.15 Synchronous Serial Interface (SSI) Module

The Synchronous Serial Interface (SSI) module is a synchronous serial I/O port that supports communication with peripheral devices that have Texas Instruments Synchronous Serial Interfaces, SPI, or Freescale serial formats. This module supports controller or peripheral operation, programmable clock bit rates, 16-bit and 8-deep transmit and receive FIFOs, interrupts, and µDMA access.

Refer to the device-specific technical reference manual for more information.

Table 3-63 lists the SSI types, including device-specific differences within each type.

Table 3-63. Synchronous Serial Interface (SSI) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original SSI Module Type	2838x, M35x, M36x	–

3.4.16 Universal Asynchronous Receiver/Transmitter (UART) Module

The Universal Asynchronous Receiver/Transmitter (UART) module is a serial communication port that supports programmable baud-rate generation, 16/8 TX and RX FIFOS, serial-to-parallel and parallel-to-serial conversions, DMA access, and interrupts.

Refer to the device-specific technical reference manual for more information.

Table 3-64 lists the UART types, including device-specific differences within each type.

Table 3-64. Universal Asynchronous Receiver/Transmitter (UART) Module Type Description

Type	Description	Devices Covered	Device-Specific Options	
0	Original UART Module Type	M35x, M36x	Accessible by the M3 CPU and the µDMA.	FIFO trigger levels of 1/8, 1/4, 1/2, 3/4, and 7/8 available.
		2838x	Accessible by the CM CPU and the µDMA.	
		28P65x	Accessible by the C28x CPU and the DMA.	
		29H85x, 29P58x	Accessible by the C29x CPU and the RTDMA.	
		28E12x	Accessible by the C28x CPU and the DMA.	Single-byte FIFO granularity added. FIFO trigger levels of 1/16, 2/16, 3/16, … ,15/16 available.

3.4.17 Universal Parallel Port (uPP) Module

The Universal Parallel Port (uPP) module is a high-speed parallel interface with dedicated data lines and minimal control signals. The uPP is designed to interface with high-speed ADCs, DACs, FPGAs, or other uPP devices. The supports single channel 8-bit input or output as well as 50MHz SDR and 25MHz DDR interface clock frequencies.

Refer to the device-specific technical reference manual for more information.

Table 3-65 lists the uPP types, including device specific differences within each type.

Table 3-65. Universal Parallel Port (uPP) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original uPP Module Type	2837xD, 2837xS	–

3.4.18 Universal Serial Bus (USB) Module

The Universal Serial Port (USB) module is a USB 2.0 compliant USB Controller and PHY. The USB supports full speed operation as a device and both low- and full-speed in host operating modes. TI provides drivers for the USB controller as well as a protocol stack free of charge in our controlSUITE™ software package.

Refer to the device-specific technical reference manual for more information.

Table 3-66 lists the USB types, including device specific differences within each type.

Table 3-66. Universal Serial Bus (USB) Module Type Description

Type	Description	Devices Covered	Device-Specific Options
0	Original USB Module Type	2806x(1), 2807x, 2837xD, 2837xS	No USB-OTG support
		M35x, M36x	USB-OTG supported
	Global interrupt enable, flag and clear registers added.	2838x, 28P55x, 28P65x	No USB-OTG support

(1) Original USB module type is only available on devices with TMS320F2806xU, TMS320F2806xF, and TMS320F2806xM part numbers.

Revision History

Changes from November 7, 2024 to July 31, 2025 (from Revision T (November 2024) to Revision U (July 2025)) **Page**

- Added F28E12x to Abstract in Chapter 1 8
- Added F28E12x in Table 1-3 11
- Added Section 2.3.12, F28E12x Peripherals 37
- Added 28E12x in Table 3-2 42
- Added 28E12x to Type 0 in Table 3-8 45
- Added 28E12x and changed Device-Specific Options in Table 3-10 46
- Added 28E12x to Type 1 in Table 3-11 47
- Added 28E12x to Type 2 in Table 3-31 54
- Changed Type 6 Description in Table 3-34 56
- Added Type 7 and 28E12x to Type 7 in Table 3-34 56
- Added Type 6 and 28E12x to Type 6 in Table 3-35 57
- Added 28E12x and changed Device-Specific Options in Table 3-39 60
- Added 28E12x to Type 2 in Table 3-41 61
- Added 28E12x to Type 2 in Table 3-43 64
- Added Section 3.3.12, Multi-Channel Pulse Width Modulator (MCPWM) Module 67
- Changed Device-Specific Options in Table 3-47 67
- Added Type 3 and 28E12x to Type 3 in Table 3-47 67
- Added 28E12x to Type 2 in Table 3-54 71
- Added 28E12x in Table 3-60 74
- Added 28E12x to Type 2 in Table 3-61 75
- Added 28E12x and changed Device-Specific Options in Table 3-64 76

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