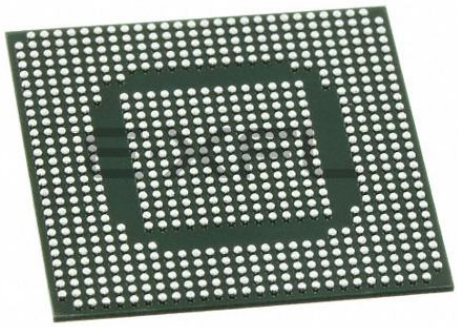

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Embedded - System On Chip (SoC): The Heart of Modern Embedded Systems

Embedded - System On Chip (SoC) refers to an integrated circuit that consolidates all the essential components of a computer system into a single chip. This includes a microprocessor, memory, and other peripherals, all packed into one compact and efficient package. SoCs are designed to provide a complete computing solution, optimizing both space and power consumption, making them ideal for a wide range of embedded applications.

What are Embedded - System On Chip (SoC)?

System On Chip (SoC) integrates multiple functions of a computer or electronic system onto a single chip. Unlike traditional multi-chip solutions, SoCs combine a central

Details	
Product Status	Active
Architecture	MCU, FPGA
Core Processor	Dual ARM® Cortex®-A9 MPCore™ with CoreSight™
Flash Size	-
RAM Size	64KB
Peripherals	DMA, POR, WDT
Connectivity	CANbus, EBI/EMI, Ethernet, I²C, MMC/SD/SDIO, SPI, UART/USART, USB OTG
Speed	700MHz
Primary Attributes	FPGA - 25K Logic Elements
Operating Temperature	-40°C ~ 125°C (TJ)
Package / Case	672-FBGA
Supplier Device Package	672-UBGA (23x23)
Purchase URL	https://www.e-xfl.com/product-detail/intel/5csema2u23a7n

Contents

1. Overview

1.1. Intel Automotive-Grade Devices

Intel automotive-grade devices are certified to AEC-Q100 (Grade 2 level) and are available in CPLD, FPGA, system on a chip (SoC), and Intel® Enpirion® PowerSoCs. You can use these devices in high-temperature environments, such as in automotive sectors.

1.2. Intel Automotive Qualifications

The automotive grade devices are designed and developed per a quality management system (QMS) that is registered to ISO 9001:2015. The scope of the ISO 9001:2015 registration includes design, development, and provision of semiconductor components, intellectual properties, and software tools. All the foundry, assembly, and test sites that manufacture the automotive devices are operating a QMS that is registered to IATF 16949 in addition to ISO 9001:2015.

Selected Intel devices are complied to the following Functional Safety (FuSa) standards:

- ISO-26262
- IEC-61508

Intel provides certified Automotive Functional Safety Data Package (AFSDP) for devices that are complied to ISO-26262. AFSDP delivers the framework, methodology, tools, and IP to assist you in building a safe system with cost and time savings. AFSDP typically saves you 12-18 man-months in certifying your safety critical applications at system level.

AFSDP includes:

- Intel FPGA (automotive-grade Cyclone® V, Cyclone V SoC)
- Software development tools, including the Intel Quartus® Prime software version 14.1
- FMEDA tool
- Diagnostic and standard intellectual property (IP)
- Safety manual
- Certificate

Related Information

- Accelerate Automotive with Intel FPGAS, Intel page
  Provides more information about Intel automotive solutions.
- AN 704: FPGA-based Safety Separation Design Flow for Rapid Functional Safety Certification

- A Safety Methodology for ADAS Designs in FPGAs white paper
  Provides more information on Advanced Driver Assisted Systems (ADAS) applications.
- Next-Generation Transportation, Intel page
- Automotive Applications, Intel page
  Provides more information on functional safety for automotive applications.
- Industrial Automation, Intel page
  Provides more information on functional safety for industrial automation.
- Intel Programmable Solutions Group ISO 9001:2015 Certification

1.3. Supported Device Families

Table 1. Intel Automotive-Grade Device Families

Category	Product Family	Quartus Software Support (1)	Description
IC, FPGA	Intel Cyclone 10 LP	Version 17.1 and later	Low-cost, low-power, feature-rich FPGAs
IC, FPGA	Intel MAX® 10	Version 14.0.2 and later	Low-cost, instant-on, small form factor programmable logic device, integrated analog module
IC, SoC	Cyclone V SoC	Version 12.1 and later	Low-cost, low-power, user-customizable ARM-based SoC devices
IC, FPGA	Cyclone V	Version 11.1 and later	Low-cost, low-power, feature-rich 28 nm FPGAs
IC, FPGA	Cyclone IV	Version 9.1 SP2 and later	Low-cost, low-power, feature-rich 60 nm FPGAs (1.2 V)
IC, CPLD	MAX V	Version 11.0 and later	High-density, low-power glue logic CPLDs (1.8 V)
IC, CPLD	MAX II	Version 7.2 SP1 and later	High-density, low-power glue logic CPLDs (3.3 V, 2.5 V)
IC, power	Intel Enpirion	—	Integrated inductor, combination of small footprint, low noise performance, and high efficiency

Volume Production Support for Legacy Device Families			
Category	**Product Family**	**Quartus Software Support (2)**	**Description**
IC, FPGA	Cyclone III	Version 8.0 to 13.1	Low-cost, feature-rich 65 nm FPGAs
IC, FPGA	Cyclone II	Version 7.2 SP1 to 13.0	Low-cost, feature-rich 90 nm FPGAs
IC, FPGA	Cyclone	Version 7.2 SP1 to 13.0	Low-cost, glue logic 130 nm FPGAs
IC, CPLD	MAX 7000AE	Version 7.2 SP1 to 13.0	High-performance, glue logic CPLDs (5-V I/O compatible)

(1) Starting from version 15.1, the Quartus II software is known as the Intel Quartus Prime Standard Edition software.

(2) The legacy devices are only supported in the Quartus II software.

2. Supported Automotive-Grade Devices

2.1. Intel Cyclone 10 LP Devices

2.1.1. Supported Automotive-Grade Devices

Table 2. Automotive-Grade in Intel Cyclone 10 LP Devices

Other automotive-grade product line/package combinations or ordering codes might be available upon request. Consult your Intel sales representative to submit your request.

Device Ordering Code	Device	Package	Junction Temperature Range	Speed Grade
10CL006YE144A7G	10CL006	144-pin EQFP	–40°C to 125°C	–7
10CL006YU256A7G	10CL006	256-pin UBGA	–40°C to 125°C	–7
10CL010YE144A7G	10CL010	144-pin EQFP	–40°C to 125°C	–7
10CL010YM164A7G	10CL010	164-pin MBGA	–40°C to 125°C	–7
10CL010YU256A7G	10CL010	256-pin UBGA	–40°C to 125°C	–7
10CL016YE144A7G	10CL016	144-pin EQFP	–40°C to 125°C	–7
10CL016YM164A7G	10CL016	164-pin MBGA	–40°C to 125°C	–7
10CL016YU256A7G	10CL016	256-pin UBGA	–40°C to 125°C	–7
10CL025YE144A7G	10CL025	144-pin EQFP	–40°C to 125°C	–7
10CL025YU256A7G	10CL025	256-pin UBGA	–40°C to 125°C	–7
10CL025YU484A7G	10CL025	484-pin UBGA	–40°C to 125°C	–7
10CL040YU484A7G	10CL040	484-pin UBGA	–40°C to 125°C	–7
10CL055YU484A7G	10CL055	484-pin UBGA	–40°C to 125°C	–7
10CL080YU484A7G	10CL080	484-pin UBGA	–40°C to 125°C	–7

Device Ordering Code	Device	Package	Junction Temperature Range	Speed Grade
10M25DAF256A7G	10M25DA	256-pin FBGA	–40°C to 125°C	–7
10M40SCE144A7G	10M40SC	144-pin EQFP	–40°C to 125°C	–7
10M40DCF256A7G	10M40DC	256-pin FBGA	–40°C to 125°C	–7
10M50SCE144A7G	10M50SC	144-pin EQFP	–40°C to 125°C	–7
10M50DCF256A7G	10M50DC	256-pin FBGA	–40°C to 125°C	–7

2.3.2. Package Options and Maximum User I/Os

Table 6. Package Options and Maximum User I/Os in Intel MAX 10 Single Power Supply Devices

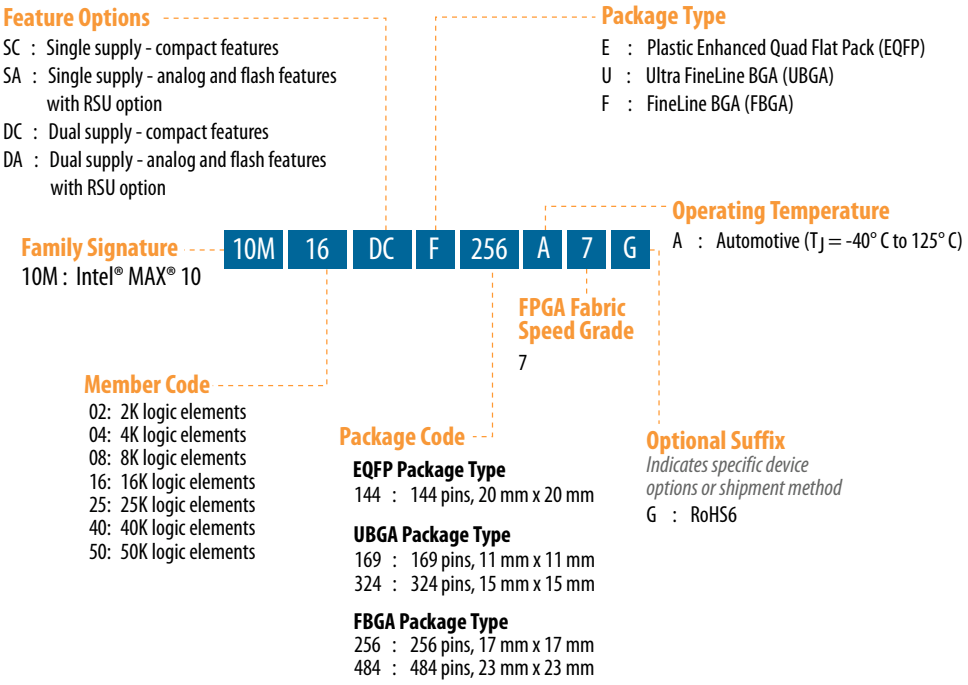
Device	Package		
	Type	U169 169-pin UBGA	E144 144-pin EQFP
	Size	11 mm × 11 mm	22 mm × 22 mm
	Pitch	0.8 mm	0.5 mm
10M02S		130	101
10M04S		130	101
10M08S		130	101
10M16S		130	101
10M25S		—	101
10M40S		—	101
10M50S		—	101

Table 7. Package Options and Maximum User I/Os in Intel MAX 10 Dual Power Supply Devices

Device	Package			
	Type	U324 324-pin UBGA	F256 256-pin FBGA	F484 484-pin FBGA
	Size	15 mm × 15 mm	17 mm × 17 mm	23 mm × 23 mm
	Ball Pitch	0.8 mm	1.0 mm	1.0 mm
10M02D		160	—	—
10M04D		246	178	—
10M08D		246	178	250
10M16D		246	178	320
10M25D		—	178	360
10M40D		—	178	360
10M50D		—	178	360

2.3.3. Device Ordering Codes

Figure 2. Automotive-Grade Ordering Information for Intel MAX 10 Devices



2.4. Cyclone V SoC Devices

2.4.1. Supported Automotive-Grade Devices

Table 8. Automotive-Grade in Cyclone V SoC Devices

Other automotive-grade product line/package combinations or ordering codes might be available upon request. Consult your Intel sales representative to submit your request.

Device Ordering Code	Device	Package	Junction Temperature Range	Speed Grade
5CSEBA2U19A7N	5CSEBA2	484-pin UBGA	–40°C to 125°C	–7
5CSEBA2U23A7N	5CSEBA2	672-pin UBGA	–40°C to 125°C	–7
5CSEMA2U23A7N	5CSEMA2	672-pin UBGA	–40°C to 125°C	–7
5CSEBA4U19A7N	5CSEBA4	484-pin UBGA	–40°C to 125°C	–7
5CSEBA4U23A7N	5CSEBA4	672-pin UBGA	–40°C to 125°C	–7
5CSEMA4U23A7N	5CSEMA4	672-pin UBGA	–40°C to 125°C	–7
5CSEBA5U19A7N	5CSEBA5	484-pin UBGA	–40°C to 125°C	–7
5CSEBA5U23A7N	5CSEBA5	672-pin UBGA	–40°C to 125°C	–7
5CSEMA5U23A7N	5CSEMA5	672-pin UBGA	–40°C to 125°C	–7
5CSEMA5F31A7N	5CSEMA5	896-pin FBGA	–40°C to 125°C	–7

continued...

Device Ordering Code	Device	Package	Junction Temperature Range	Speed Grade
5CSEBA6U19A7N	5CSEBA6	484-pin UBGA	–40°C to 125°C	–7
5CSEBA6U23A7N	5CSEBA6	672-pin UBGA	–40°C to 125°C	–7
5CSEMA6U23A7N	5CSEMA6	672-pin UBGA	–40°C to 125°C	–7
5CSEMA6F31A7N	5CSEMA6	896-pin FBGA	–40°C to 125°C	–7
5CSXFC2C6U23A7N	5CSXFC2	672-pin UBGA	–40°C to 125°C	–7
5CSXFC4C6U23A7N	5CSXFC4	672-pin UBGA	–40°C to 125°C	–7
5CSXFC5C6U23A7N	5CSXFC5	672-pin UBGA	–40°C to 125°C	–7
5CSXFC6C6U23A7N	5CSXFC6	672-pin UBGA	–40°C to 125°C	–7
5CSXFC6D6F31A7N	5CSXFC6	896-pin FBGA	–40°C to 125°C	–7

2.4.2. Package Options and Maximum User I/Os

Table 9. Package Options and Maximum User I/Os in Cyclone V SE Devices

Package Type/ Pin Count	Ball Spacing (mm)	Dimensions (mm)	Product Line			
			5CSEA2	5CSEA4	5CSEA5	5CSEA6
			(25K LEs)	(40K LEs)	(85K LEs)	(110K LEs)
			FPGA I/Os / HPS I/Os			
UBGA-484	0.8	19 x 19	66 / 151	66 / 151	66 / 151	66 / 151
UBGA-672	0.8	23 x 23	145 / 181	145 / 181	145 / 181	145 / 181
FBGA-896	1	31 x 31	—	—	288 / 181	288 / 181

Table 10. Package Options and Maximum User I/Os in Cyclone V SX Devices

Package Type/ Pin Count	Ball Spacing (mm)	Dimensions (mm)	Product Line			
			5CSXC2	5CSXC4	5CSXC5	5CSXC6
			(25K LEs)	(40K LEs)	(85K LEs)	(110K LEs)
			FPGA I/Os / HPS I/Os / XCVRs			
UBGA-672	0.8	23 x 23	145 / 181 / 6	145 / 181 / 6	145 / 181 / 6	145 / 181 / 6
FBGA-896	1	31 x 31	—	—	—	288 / 181 / 9

2.5. Cyclone V Devices

2.5.1. Supported Automotive-Grade Devices

Table 11. Automotive-Grade in Cyclone V Devices

Other automotive-grade product line/package combinations or ordering codes might be available upon request. Consult your Intel sales representative to submit your request.

Device Ordering Code	Device	Package	Junction Temperature Range	Speed Grade
5CEBA2F17A7N	5CEBA2	256-pin FBGA	–40°C to 125°C	–7
5CEFA2U19A7N	5CEFA2	484-pin UBGA	–40°C to 125°C	–7
5CEBA4F17A7N	5CEBA4	256-pin FBGA	–40°C to 125°C	–7
5CEFA4U19A7N	5CEFA4	484-pin UBGA	–40°C to 125°C	–7
5CEFA5U19A7N	5CEFA5	484-pin UBGA	–40°C to 125°C	–7
5CEFA7U19A7N	5CEFA7	484-pin UBGA	–40°C to 125°C	–7
5CEFA9U19A7N	5CEFA9	484-pin UBGA	–40°C to 125°C	–7
5CGXFC3B6U15A7N	5CGXFC3	324-pin UBGA	–40°C to 125°C	–7
5CGXFC3B6U19A7N	5CGXFC3	484-pin UBGA	–40°C to 125°C	–7
5CGXFC4C6U19A7N	5CGXFC4	484-pin UBGA	–40°C to 125°C	–7
5CGXFC5C6U19A7N	5CGXFC5	484-pin UBGA	–40°C to 125°C	–7
5CGXFC5C6F23A7N	5CGXFC5	484-pin FBGA	–40°C to 125°C	–7
5CGXFC7C6U19A7N	5CGXFC7	484-pin UBGA	–40°C to 125°C	–7
5CGXFC7D6F31A7N	5CGXFC7	896-pin FBGA	–40°C to 125°C	–7
5CGXFC9A6U19A7N	5CGXFC9	484-pin UBGA	–40°C to 125°C	–7

2.5.2. Package Options and Maximum User I/Os

Table 12. Package Options and Maximum User I/Os in Cyclone V E Devices

Package Type/ Pin Count	Ball Spacing (mm)	Dimensions (mm)	Product Line				
			5CEA2	5CEA4	5CEA5	5CEA7	5CEA9
			(25K LEs)	(49K LEs)	(77K LEs)	(149.5K LEs)	(301K LEs)
			I/Os				
FBGA-256	1	17 x 17	128	128	—	—	—
UBGA-484	0.8	19 x 19	224	224	224	240	240

Table 13. Package Options and Maximum User I/Os in Cyclone V GX Devices

Package Type/ Pin Count	Ball Spacing (mm)	Dimensions (mm)	Product Line				
			5CGXC3 (36K LEs)	5CGXC4 (50K LEs)	5CGXC5 (77K LEs)	5CGXC7 (149.5K LEs)	5CGXC9 (301K LEs)
			I/Os / XCVRs				
UBGA-324	0.8	15 x 15	144 / 3	—	—	—	—
UBGA-484	0.8	19 x 19	208 / 3	224 / 6	224 / 6	240 / 6	240 / 5
FBGA-484	1	23 x 23	—	—	240 / 6	—	—
FBGA-896	1	31 x 31	—	—	—	480 / 9	—

2.5.3. Device Ordering Codes

Figure 5. Automotive-Grade Ordering Information for Cyclone V E Devices

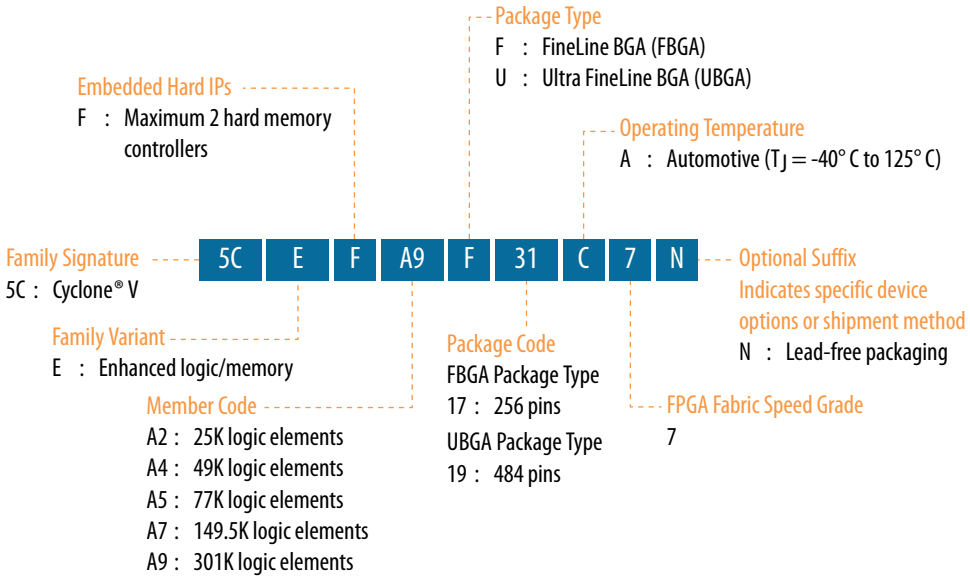
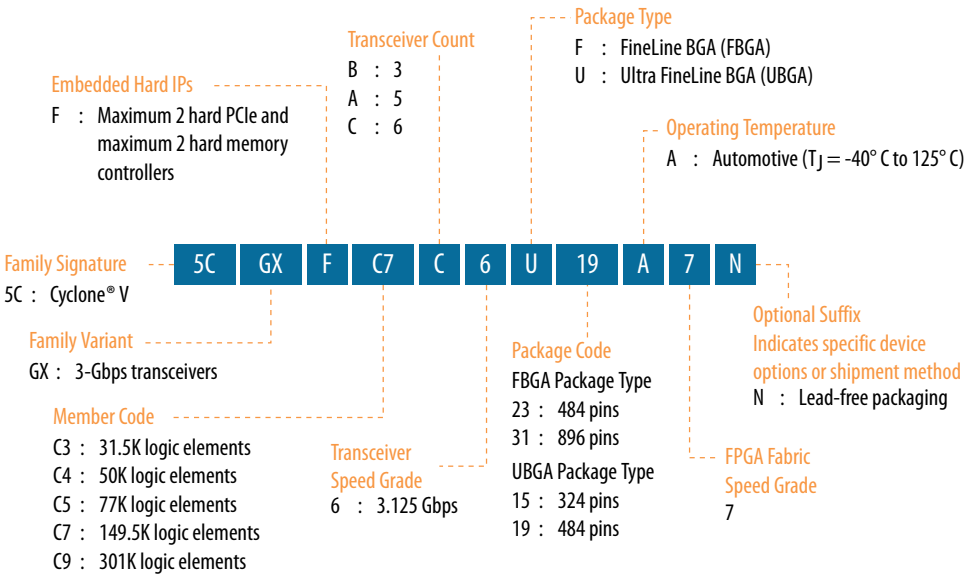


Figure 6. Automotive-Grade Ordering Information for Cyclone V GX Devices



2.6. Cyclone IV Devices

2.6.1. Supported Automotive-Grade Devices

Table 14. Automotive-Grade in Cyclone IV Devices

Other automotive-grade product line/package combinations or ordering codes might be available upon request. Consult your Intel sales representative to submit your request.

Device Ordering Code	Device	Package	Junction Temperature Range	Speed Grade
EP4CE6F17A7N	EP4CE6	256-pin FBGA	–40°C to 125°C	–7
EP4CE6E22A7N	EP4CE6	144-pin EQFP	–40°C to 125°C	–7
EP4CE10F17A7N	EP4CE10	256-pin FBGA	–40°C to 125°C	–7
EP4CE10E22A7N	EP4CE10	144-pin EQFP	–40°C to 125°C	–7
EP4CE15F17A7N	EP4CE15	256-pin FBGA	–40°C to 125°C	–7
EP4CE15F23A7N	EP4CE15	484-pin FBGA	–40°C to 125°C	–7
EP4CE15U14A7N	EP4CE15	256-pin UBGA	–40°C to 125°C	–7
EP4CE22F17A7N	EP4CE22	256-pin FBGA	–40°C to 125°C	–7
EP4CE22E22A7N	EP4CE22	144-pin EQFP	–40°C to 125°C	–7
EP4CE22U14A7N	EP4CE22	256-pin UBGA	–40°C to 125°C	–7
EP4CE30F19A7N	EP4CE30	324-pin FBGA	–40°C to 125°C	–7
EP4CE30F23A7N	EP4CE30	484-pin FBGA	–40°C to 125°C	–7
EP4CE40F19A7N	EP4CE40	324-pin FBGA	–40°C to 125°C	–7
EP4CE40F23A7N	EP4CE40	484-pin FBGA	–40°C to 125°C	–7

continued...

Device Ordering Code	Device	Package	Junction Temperature Range	Speed Grade
EP4CE40U19A7N	EP4CE40	484-pin UBGA	–40°C to 125°C	–7
EP4CE55F23A7N	EP4CE55	484-pin FBGA	–40°C to 125°C	–7
EP4CGX15BF14A7N	EP4CGX15	169-pin FBGA	–40°C to 125°C	–7

2.6.2. Package Options and Maximum User I/Os

Table 15. Package Options and Maximum User I/Os in Cyclone IV E Devices

Package Type/ Pin Count	Ball Spacing (mm)	Dimensions (mm)	Product Line						
			EP4CE6 (6.3K LEs)	EP4CE10 (10.3K LEs)	EP4CE15 (15.4K LEs)	EP4CE22 (22.3K LEs)	EP4CE30 (28.8K LEs)	EP4CE40 (39.6K LEs)	EP4CE55 (55.9K LEs)
			I/Os						
EQFP-144	0.5	22 x 22	91	91	—	79	—	—	—
UBGA-256	0.8	14 x 14	—	—	165	153	—	—	—
FBGA-256	1	17 x 17	179	179	165	153	—	—	—
UBGA-484	0.8	19 x 19	—	—	—	—	—	328	—
FBGA-324	1	19 x 19	—	—	—	—	193	193	—
FBGA-484	1	23 x 23	—	—	343	—	328	328	324

Table 16. Package Options and Maximum User I/Os in Cyclone IV GX Devices

Package Type/ Pin Count	Ball Spacing (mm)	Dimensions (mm)	Product Line
			EP4CGX15 (14.4K LEs)
			I/Os
FBGA-169	1	14 x 14	72 / 2

2.6.3. Device Ordering Codes

Figure 7. Automotive-Grade Ordering Information for Cyclone IV E Devices

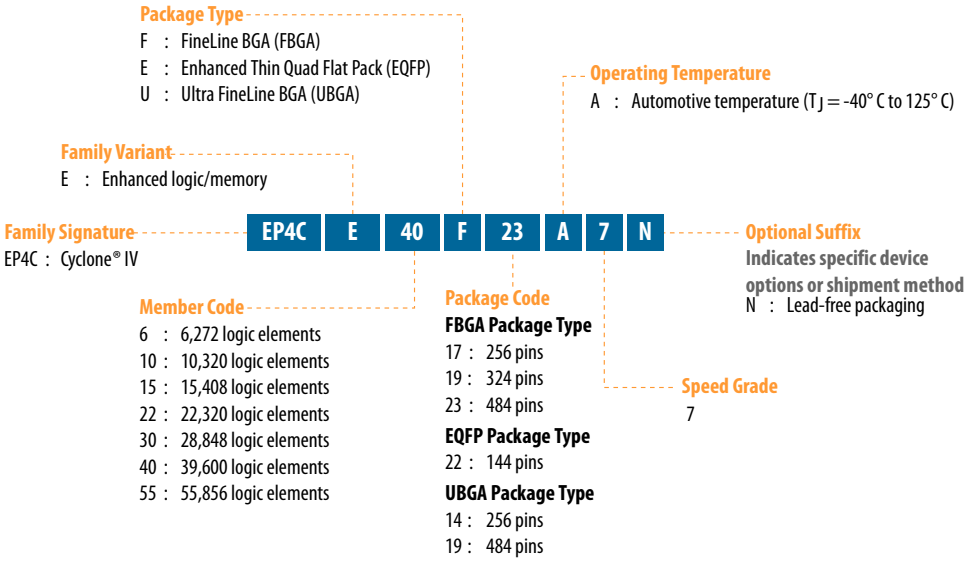
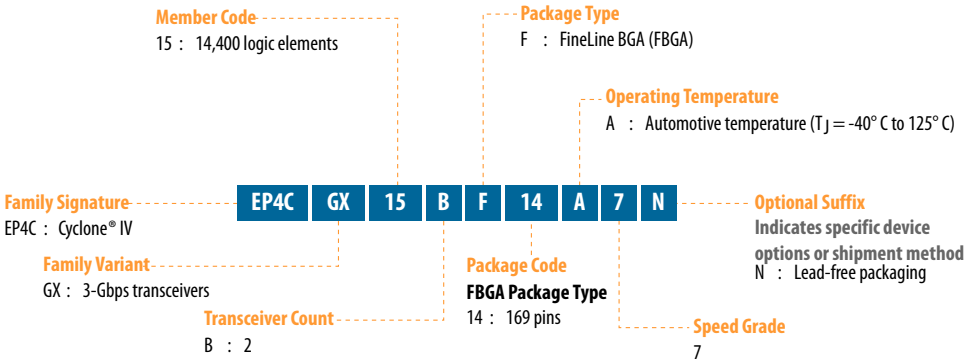


Figure 8. Automotive-Grade Ordering Information for Cyclone IV GX Devices



2.7. MAX V Devices

2.7.1. Supported Automotive-Grade Devices

Table 17. Automotive-Grade in MAX V Devices

Other automotive-grade product line/package combinations or ordering codes might be available upon request. Consult your Intel sales representative to submit your request.

Device Ordering Code	Device	Package	Junction Temperature Range	Speed Grade
5M40ZE64A5N	5M40Z	64-pin EQFP	–40°C to 125°C	–5
5M80ZE64A5N	5M80Z	64-pin EQFP	–40°C to 125°C	–5
5M80ZT100A5N	5M80Z	100-pin TQFP	–40°C to 125°C	–5

continued...

Device Ordering Code	Device	Package	Junction Temperature Range	Speed Grade
5M160ZE64A5N	5M160Z	64-pin EQFP	–40°C to 125°C	–5
5M160ZT100A5N	5M160Z	100-pin TQFP	–40°C to 125°C	–5
5M240ZT100A5N	5M240Z	100-pin TQFP	–40°C to 125°C	–5
5M570ZT100A5N	5M570Z	100-pin TQFP	–40°C to 125°C	–5
5M1270ZF256A5N	5M1270Z	256-pin FBGA	–40°C to 125°C	–5
5M1270ZT144A5N	5M1270Z	144-pin TQFP	–40°C to 125°C	–5

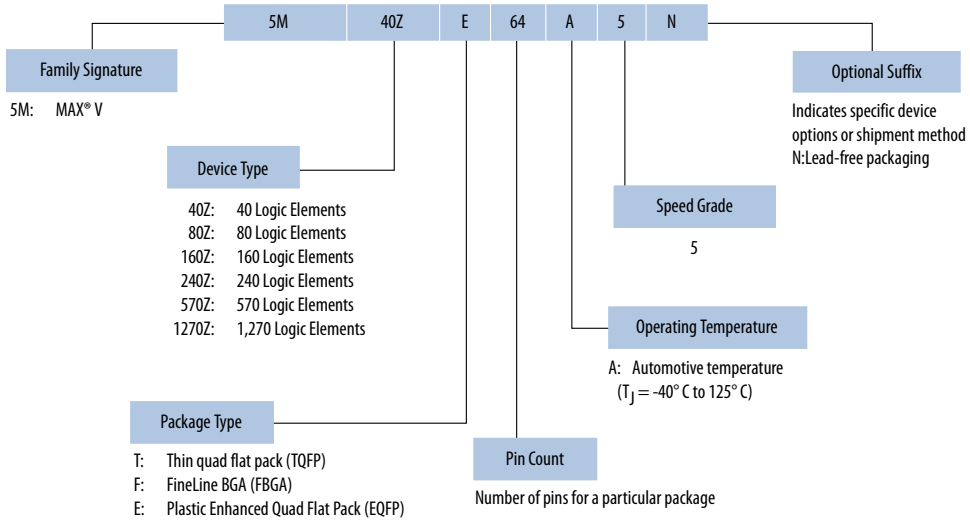
2.7.2. Package Options and Maximum User I/Os

Table 18. Package Options and Maximum User I/Os in MAX V Devices

Package Type/ Pin Count	Ball Spacing (mm)	Dimensions (mm)	Product Line					
			5M40Z (40K LEs)	5M80Z (80K LEs)	5M160Z (160K LEs)	5M240Z (240K LEs)	5M570Z (570K LEs)	5M1270Z (1270K LEs)
			I/Os					
EQFP-64	0.5	7 x 7	54	54	54	—	—	—
TQFP-100	0.5	14 x 14	—	79	79	79	74	—
TQFP-144	0.5	20 x 20	—	—	—	—	—	114
FBGA-256	1	17 x 17	—	—	—	—	—	211

2.7.3. Device Ordering Codes

Figure 9. Automotive-Grade Ordering Information for MAX V Devices



2.10. Cyclone II Devices (Legacy Support)

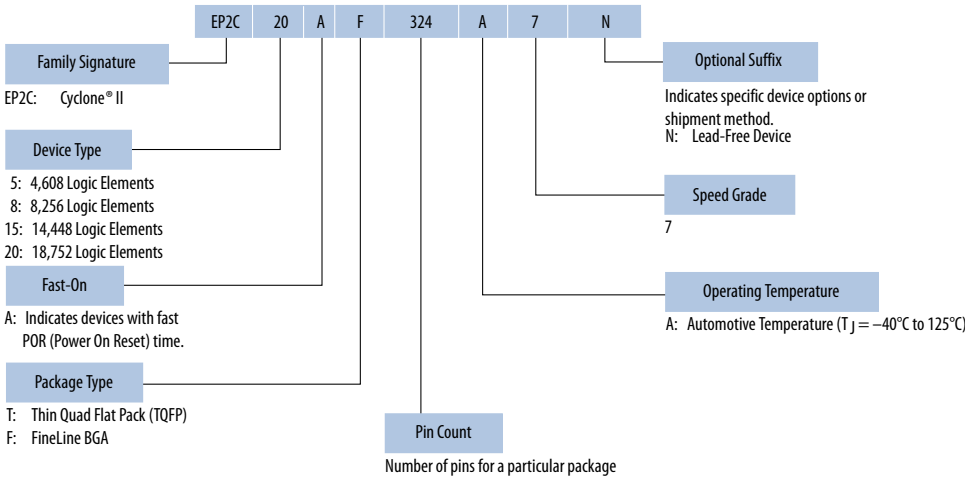
2.10.1. Supported Automotive-Grade Devices

Table 21. Automotive-Grade in Cyclone II Devices

Device Ordering Code	Device	Package	Junction Temperature Range	Speed Grade
EP2C5AT144A7N	EP2C5	144-pin TQFP	–40°C to 125°C	–7
EP2C5AF256A7N	EP2C5	256-pin FBGA	–40°C to 125°C	–7
EP2C8AF256A7N	EP2C8	256-pin FBGA	–40°C to 125°C	–7
EP2C15AF256A7N	EP2C15	256-pin FBGA	–40°C to 125°C	–7
EP2C15AF484A7N	EP2C15	484-pin FBGA	–40°C to 125°C	–7
EP2C20AF256A7N	EP2C20	256-pin FBGA	–40°C to 125°C	–7
EP2C20AF484A7N	EP2C20	484-pin FBGA	–40°C to 125°C	–7

2.10.2. Device Ordering Codes

Figure 12. Automotive-Grade Ordering Information for Cyclone II Devices



2.11. Cyclone Devices (Legacy Support)

2.11.1. Supported Automotive-Grade Devices

Table 22. Automotive-Grade in Cyclone Devices

Device Ordering Code	Device	Package	Junction Temperature Range	Speed Grade
EP1C3T100A8N	EP1C3	100-pin TQFP	–40°C to 125°C	–8
EP1C3T144A8N	EP1C3	144-pin TQFP	–40°C to 125°C	–8

3. Intel Quartus Prime Software Support

The Intel Quartus Prime design software supports the automotive-grade devices in the automotive temperature range. The Intel Quartus Prime software provides a comprehensive environment for SoC design. It also includes HDL and schematic design entry, compilation and logic synthesis, full simulation and advanced timing analysis, Signal Tap II logic analyzer, and device configuration.

To target an automotive-grade device in your design in the Intel Quartus Prime software, follow these steps:

1. Click **Assignments ➤ Device**. The **Settings** dialog box appears.
2. In the **Family** drop-down list, select your device.
3. Under **Target device**, select **Specific device selected in 'Available devices' list**.
4. In the **Available devices** list, select the appropriate ordering code.

   Note: The Intel Quartus Prime software does not show the "N" suffix, which indicates a lead-free device. For example, the 5CGXFC3B6U15A7N device is shown only as 5CGXFC3B6U15A7.
5. Click **OK**.

The following automotive-grade devices are from the legacy device families and are not recommended for new automotive designs.

- Cyclone III
- Cyclone II
- Cyclone
- MAX 7000AE

The input data consists of the signal activities data (toggle rates and static probabilities) of the compiled design. Signal activity data can be derived from simulation results, user assignment in the Assignment Editor, user-defined default toggle rate, and vectorless estimation.

The operating conditions include device power characteristic, ambient and junction temperature, cooling solution, and board thermal model, all of which can be set in the Intel Quartus Prime software.

The Power Analyzer tool calculates the dynamic, static and I/O thermal power consumption, current consumed from voltage source, a summary of the signal activities used for analysis, and a confidence metric that reflects the overall quality of the data sources for the signal activities.

Related Information

Power Analysis chapter, Intel Quartus Prime Standard Edition Handbook Volume 3: Verification

A. Document Revision History for the Automotive-Grade Device Handbook

Document Version	Changes
2018.10.01	• Updated the *Intel Automotive-Grade Devices* and *Intel Automotive Qualifications* sections. • Updated Intel Cyclone 10 devices to Intel Cyclone 10 LP devices. • Changed Enpirion to Intel Enpirion. • Removed Intel Arria® 10 devices. — Removed Intel Arria 10 devices from the *Intel Automotive-Grade Device Families* table. — Removed Intel Arria 10 devices from the *Supported Automotive-Grade Devices* section. • Updated the description for Intel MAX 10 in the *Intel Automotive-Grade Device Families* table. • Removed ES optional suffix from the *Automotive-Grade Ordering Information for Intel Cyclone 10 LP Devices* diagram. • Updated the *Automotive-Grade in Intel Enpirion Devices*. — Replaced Device column with Maximum Output Current column. — Renamed the column Ambient Temperature Range as Ambient Operating Temperature Range. — Added the Junction Temperature Range column. • Removed the following devices from the *Automotive-Grade in Intel MAX 10 Devices* table. — 10M02SCM153A7G — 10M02DCV36A7G — 10M04SCM153A7G — 10M04DAU324A7G — 10M08DCV81A7G — 10M08DFV81A7G — 10M08SCM153A7G — 10M08DAU324A7G — 10M08DCF484A7G — 10M08DAF484A7G — 10M16DAU324A7G — 10M16DAF484A7G — 10M25DCF484A7G — 10M25DAF484A7G — 10M25DCF672A7G — 10M25DAF672A7G — 10M40DAF256A7G — 10M40DCF484A7G — 10M40DAF484A7G — 10M40DCF672A7G — 10M40DAF672A7G — 10M50DAF256A7G — 10M50DCF484A7G — 10M50DAF484A7G — 10M50DCF672A7G — 10M50DAF672A7G • Removed M153 package in the *Package Options and Maximum User I/Os in Intel MAX 10 Single Power Supply Devices* table. • Removed V36, V81, and F672 packages in the *Package Options and Maximum User I/Os in Intel MAX 10 Dual Power Supply Devices* table.

Date	Version	Changes
		• Removed the following devices from Automotive-Grade in MAX 10 Devices table. — 10M04SFE144A7G — 10M04SFU169A7G — 10M04DFF256A7G — 10M04DFU324A7G — 10M08SFE144A7G — 10M08SFU169A7G — 10M08DFF256A7G — 10M08DFU324A7G — 10M08DFF484A7G — 10M16SFE144A7G — 10M16SFU169A7G — 10M16DFF256A7G — 10M16DFU324A7G — 10M16DFF484A7G — 10M25SFE144A7G — 10M25DFF256A7G — 10M25DFF484A7G — 10M25DFF672A7G — 10M40SFE144A7G — 10M40DFF256A7G — 10M40DFF484A7G — 10M40DFF672A7G — 10M50SFE144A7G — 10M50DFF256A7G — 10M50DFF484A7G — 10M50DFF672A7G • Updated the Package Options and Maximum User I/Os in Cyclone V GX Devices table. — Updated the LE count for 5CGXC3 from 31.5K LEs to 36K LEs. — Added I/Os / XCVRs count for UBGA-484 package in 5CGXC9 device. • Updated the Package Options and Maximum User I/Os in Cyclone V GT Devices table. — Added I/Os / XCVRs count for UBGA-484 package in 5CGTD9 device. • Updated the following device ordering codes diagrams: — Automotive-Grade Ordering Information for MAX 10 Devices — Automotive-Grade Ordering Information for Cyclone IV E Devices — Automotive-Grade Ordering Information for Cyclone V SE Devices — Automotive-Grade Ordering Information for Cyclone V SX Devices • Changed instances of *Quartus II* to *Quartus Prime*.
September 2014	2014.09.22	• Added MAX 10 devices. • Removed HardCopy® II devices. • Updated the Quartus II software support versions for the legacy device families. — Cyclone III—Version 8.0 to 13.1 — Cyclone II—Version 7.2 SP1 to 13.0 — Cyclone—Version 7.2 SP1 to 13.0 — MAX 7000AE—Version 7.2 SP1 to 13.0

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Date	Version	Changes
		• Added new automotive-grade devices for the following device families: — Cyclone V—5CGXFC5C6F23A7N — Cyclone IV—EP4CE40U19A7N and EP4CGX15BF14A7N — MAX V—5M40ZE64A5N, 5M80ZT100A5N, and 5M160ZT100A5N • Added Cyclone IV GX ordering information diagram. • Updated HPS I/O count for Cyclone V SE and SX devices.
September 2013	3.4	• Updated Table 3–2, Table 3–3, and Table 3–4. • Updated Figure 3–1, Figure 3–2, and Figure 3–3.
June 2013	3.3	Updated Table 3–1 and Table 3–5.
May 2013	3.2	• Updated Figure 3–2, Figure 3–3, Figure 4–1, and Figure 5–1. • Updated Table 3–1, Table 3–5, Table 4–2, Table 5–1, and Table 5–3.
February 2013	3.1	Updated Table 2-2, Table 2-3, Table 3–2, Table 3–3, Table 3–4, Table 4–2, Table 4–3, and Table 5–2.
January 2013	3.0	• Added Cyclone V and Cyclone V SoC devices. • Added Table 4–2, Table 4–3, and Table 5–2. • Updated Table 4–1, Table 4–4, Table 6–1, and Table 6–2. • Updated Figure 4–1. • Listed the following devices under legacy support: — Cyclone III — Cyclone II — Cyclone — MAX 7000A
May 2011	2.0	• Added MAX V devices. • Updated part number for Cyclone III, Cyclone IV, and HardCopy II devices. • Template conversion. • Minor text edits.
March 2010	1.2	• Added Cyclone IV devices. • Removed Referenced Documents section.
October 2008	1.1	• Updated DC and Timing Specifications section. • Converted to new template.
February 2008	1.0	Initial release.