

WirelessUSB™ P_{RoC}™ Flash Programmable MCU + Radio

Features

- Microcontroller with Programmable System-on-Chip (PSoC®)
 - Cypress M8C CPU
 - CPU clock up to 12 MHz
 - Internal oscillator – no crystal required
 - 8-KB flash program memory with EEPROM emulation
 - 512 bytes SRAM data storage
 - Four analog blocks provide:
 - Two comparators with DAC Refs
 - Two ADCs with 10-bit resolution
 - Four digital blocks provide:
 - 8- to 32-bit timers, counters, and pulse-width modulators (PWMs)
 - Cyclical redundancy check (CRC) and pseudo random sequence (PRS) modules
 - Full-duplex UART, SPI master or slave
 - Connectable to all GPIO pins
 - 18 GPIO lines which are individually configurable. P0 [1:0], P1[7:0], P2[7:0]
- 2.4-GHz direct-sequence spread spectrum (DSSS) radio transceiver
 - Operates in the unlicensed Industrial, Scientific and Medical band (ISM) band (2.4 GHz to 2.483 GHz)
 - -95 dBm receive sensitivity
 - Up to 0 dBm output power
 - Range of up to 50 meters or more
 - Data throughput of up to 62.5 kbits/sec
 - Highly integrated low-cost, minimal number of external components required
 - DSSS baseband controller
 - 13-MHz crystal clock
 - Integrated 30-bit manufacturing ID
- Operating voltage from 2.7 V to 3.6 V
- Operating temperature from 0 °C to 70 °C
- Offered in a small footprint 48-pin QFN

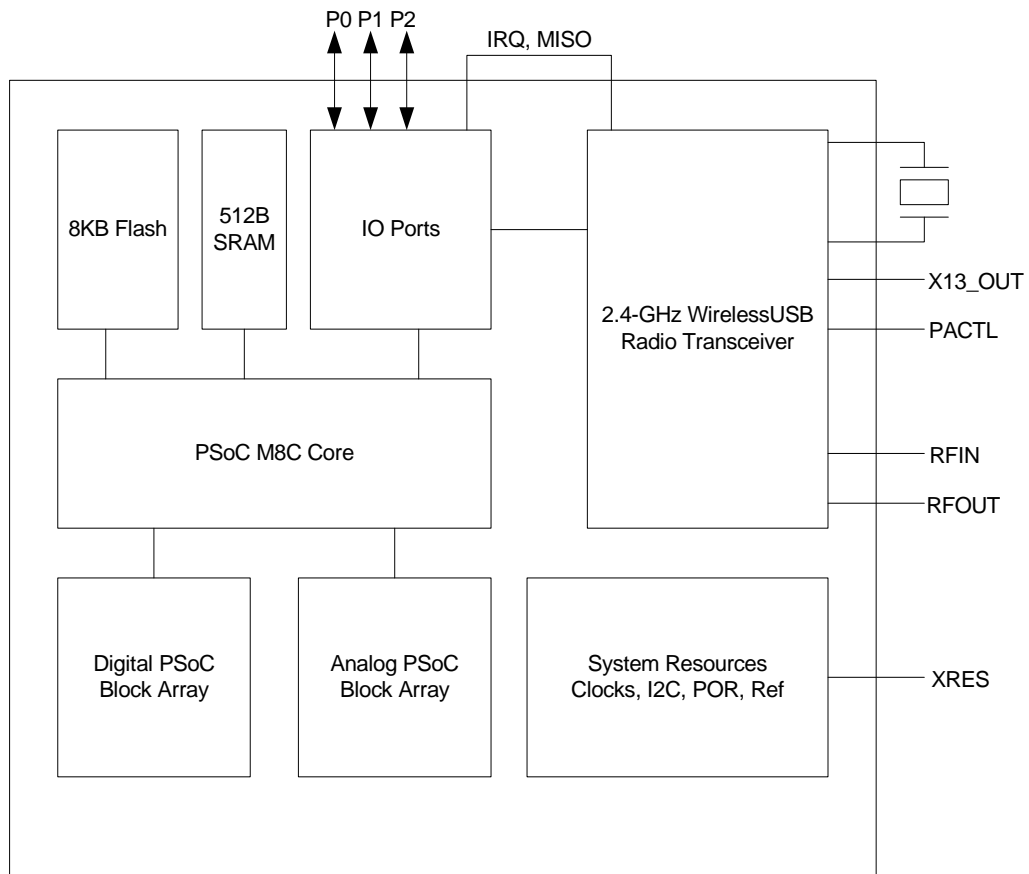
Applications

- Consumer and PC
 - Locator alarms
 - Presenter tools
 - Remote controls
 - Toys
 - White goods
- Building and home automation
 - Climate control
 - Lighting control
 - Smart appliances
 - On-site paging systems
 - Alarm and security
- Industrial control
 - Inventory management
 - Factory automation
 - Data acquisition
 - Automatic meter reading (AMR)
- Transportation
 - Diagnostics
 - Remote keyless entry
- Medical

Functional Description

The CYWUSB6953 WirelessUSB™ Programmable Radio System-on-Chip (P_{RoC}™) device is the world's first low cost flash programmable microcontroller with an integrated 2.4-GHz radio transceiver.

PRoC Block Diagram



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Functional Overview

The CYWUSB6953 is a complete radio system-on-chip device, enabling many simple RF systems to be implemented with a single device and a handful of discrete components. The CYWUSB6953 is designed to implement low cost wireless systems operating in the worldwide 2.4 GHz ISM frequency band (2.400 GHz to 2.4835 GHz).

The radio meets the following world-wide regulatory requirements:

- Europe
 - ETSI EN 301 489-1 V1.4.1
 - ETSI EN 300 328-1 V1.3.1
- North America
 - FCC CFR 47 Part 15
- Japan
 - ARIB STD-T66

The microcontroller is a powerful programmable system-on-chip. It has highly reconfigurable and flexible digital and analog blocks. The microcontroller core is the M8C 8-bit engine that supports a rich instruction set. It contains 512 bytes of data SRAM and 8 Kbytes code flash memory. Full data on the microcontroller can be found in the [CY8C21534 datasheet](#) and the [PSoC® Technical Reference Manual](#).

The radio is a high-performance 2.4 GHz transceiver with a fully integrated DSSS baseband. The radio and baseband are both code and frequency agile. Protocols supporting frequency agile direct-spread interference avoidance algorithms such as WirelessUSB are fully compatible with this radio. Full data on the radio can be found in the [CYWUSB6935 datasheet](#).

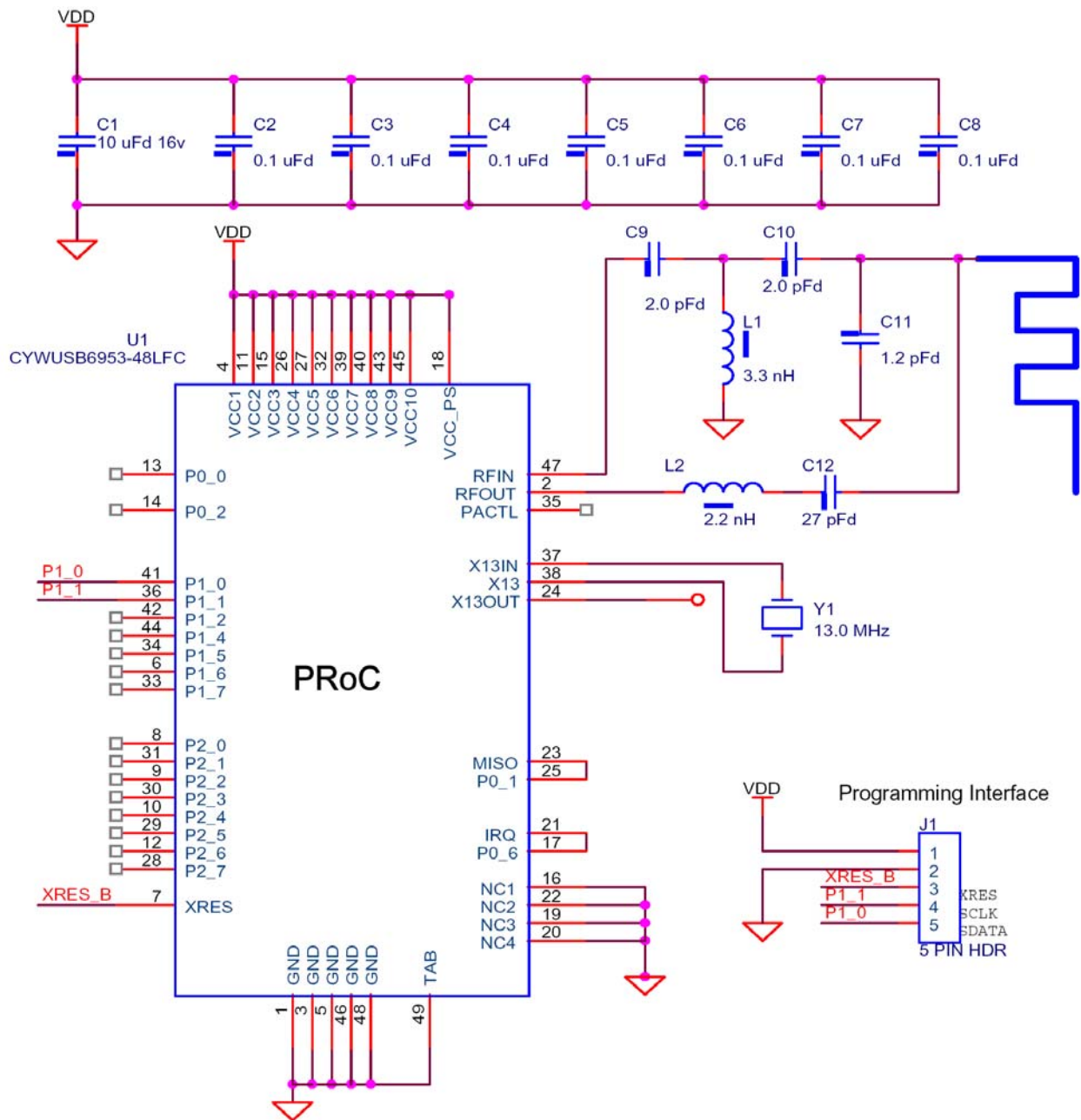
Radio Data Rate Considerations

The PSoC Designer tool provides a software based SPI User Module for control of the radio portion of the PProC. Therefore, there is a direct relationship between CPU clock speed and supportable radio data rate. For operation of CPU clock rates less than 12 MHz, radio data rate must be set to 16 Kbps. Also note that for operation at $V_{CC} < 3.0$ V, the CPU clock rate must be set to 3 MHz per the [CY8C21534 datasheet](#). Therefore, at operation below 3 V, the radio data rate must be set to 16 Kbps.

Pin Descriptions

Pin QFN	Name	Type	Die	Description
Analog RF				
47	RFIN		Radio	Modulated RF signal received
2	RFOUT		Radio	Modulated RF signal to be transmitted
Crystal and PA Control				
38	X13	I	Radio	Crystal input
37	X13IN	I	Radio	Crystal input
24	X13OUT	O	Radio	Reference clock output
35	PACTL	IO	Radio	External power amplifier control. Pull-down or make output
Reserved				
23, 25	MISO	IO	Radio, MCU	Radio SPI Master In, Slave Out. Connect pins 23 and 25 on the application board
17, 21	IRQ	IO	Radio, MCU	Radio interrupt. Connect pins 17 and 21 on the application board
Microcontroller Digital and Analog				
13	P0[0]	IO/M	MCU	Analog Column Mux Input
14	P0[2]	IO/M	MCU	Analog Column Mux Input
41	P1[0]	IO/M	MCU	I ² C serial data (SDA)
36	P1[1]	IO/M	MCU	I ² C serial clock (SCL)
42	P1[2]	IO/M	MCU	
44	P1[4]	IO/M	MCU	Optional external clock input (EXT-CLK)
34	P1[5]	IO/M	MCU	I ² C SDA
6	P1[6]	IO/M	MCU	
33	P1[7]	IO/M	MCU	I ² C SCL
8	P2[0]	IO/M	MCU	Direct Switched Capacitor Block Input
31	P2[1]	IO/M	MCU	Direct Switched Capacitor Block Input
9	P2[2]	IO/M	MCU	Direct Switched Capacitor Block Input
30	P2[3]	IO/M	MCU	Direct Switched Capacitor Block Input
10	P2[4]	IO/M	MCU	
29	P2[5]	IO/M	MCU	
12	P2[6]	IO/M	MCU	
28	P2[7]	IO/M	MCU	
7	XRES	I	MCU	Active HIGH external reset with internal pull-down
Power and Ground				
4, 11, 15, 18, 26, 27, 32, 39, 40, 43, 45	V _{CC}			Supply voltage
1, 3, 5, 46, 48	GND			Ground connection
PADDLE	GND			Ground connection
19, 20	RSVD			Connect to ground
16, 22,	NC			No connect

Application Example



PRoC Absolute Maximum Ratings

Parameter	Description	Min	Typ	Max	Unit
T _{STG}	Storage temperature	-55	–	100	°C
T _A	Ambient temperature with power applied	0	–	70	°C
V _{dd}	Supply voltage on V _{CC} Relative to GND	-0.3	–	3.9	V
V _{IO}	DC voltage to logic inputs	-0.3	–	V _{CC} + 0.3	V
V _{IOZ}	DC voltage applied to outputs in High-Z State	-0.3	–	V _{CC} + 0.3	V
I _{MIO}	Maximum current into any port pin	-25	–	50	mA
ESD	Electrostatic discharge voltage (Other)	–	–	1600	V
I _{LU}	Latch up current	–	–	200	mA

PRoC Operating Conditions

Parameter	Description	Min	Typ	Max	Unit
V _{CC}	Supply voltage	2.7	3	3.6	V
T _A	Ambient temperature	0	25	70	°C

PRoC DC Electrical Characteristics

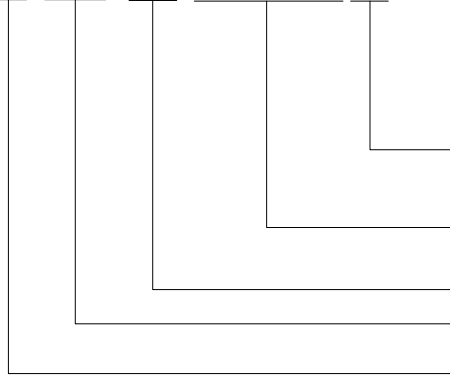
Parameter	Description	Min	Typ	Max	Unit
V _{CC}	Supply voltage	2.7	3	3.6	V
I _{CC}	Supply current (Radio in power-down)	–	1.7	2	mA
RX I _{CC}	Supply current radio receive	–	61.3	–	mA
TX I _{CC}	Supply current radio transmit	–	74.7	–	mA
SYNTH SETTLE I _{CC}	Current consumption with synthesizer on, no transmit or receive	–	33.0	–	mA
IDLE I _{CC}	Supply current radio idle	–	5	–	mA
I _{SLEEP}	Sleep mode supply current	–	3	20	μA

Ordering Information

Part Number	Radio	Package Name	Package Type	Operating Range
CYWUSB6953-48LFXC	Transceiver	48-pin QFN	Pb-free 48 QFN package (Punch Type)	Commercial
CYWUSB6953-48LTXC	Transceiver	48-pin QFN	Pb-free 48 QFN package (Sawn Type)	Commercial

Ordering Code Definition

CY WUSB 6953 48-LFX/LTX C



Temperature range: Commercial

Pb-free 48 QFN package (Punch Type)

Pb-free 48 QFN package (Sawn Type)

X = Pb-free

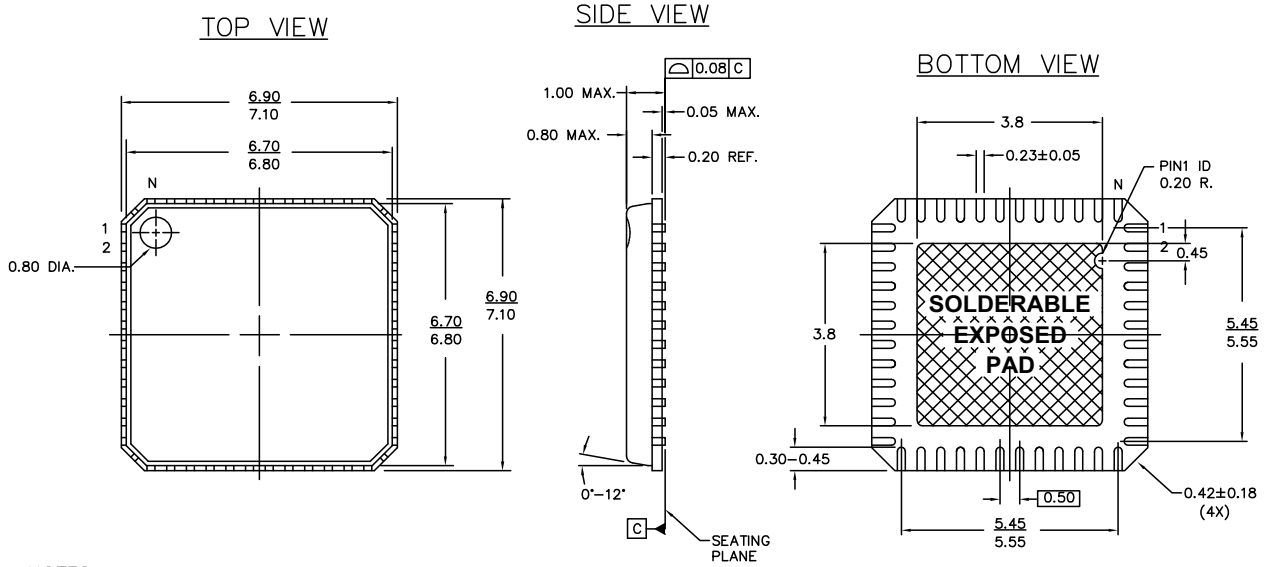
Part Number

Marketing Code: Wireless USB family


Company ID: CY = Cypress

Package Diagrams

Figure 1. 48-Pin QFN 7x7 mm LF48A (Punch)



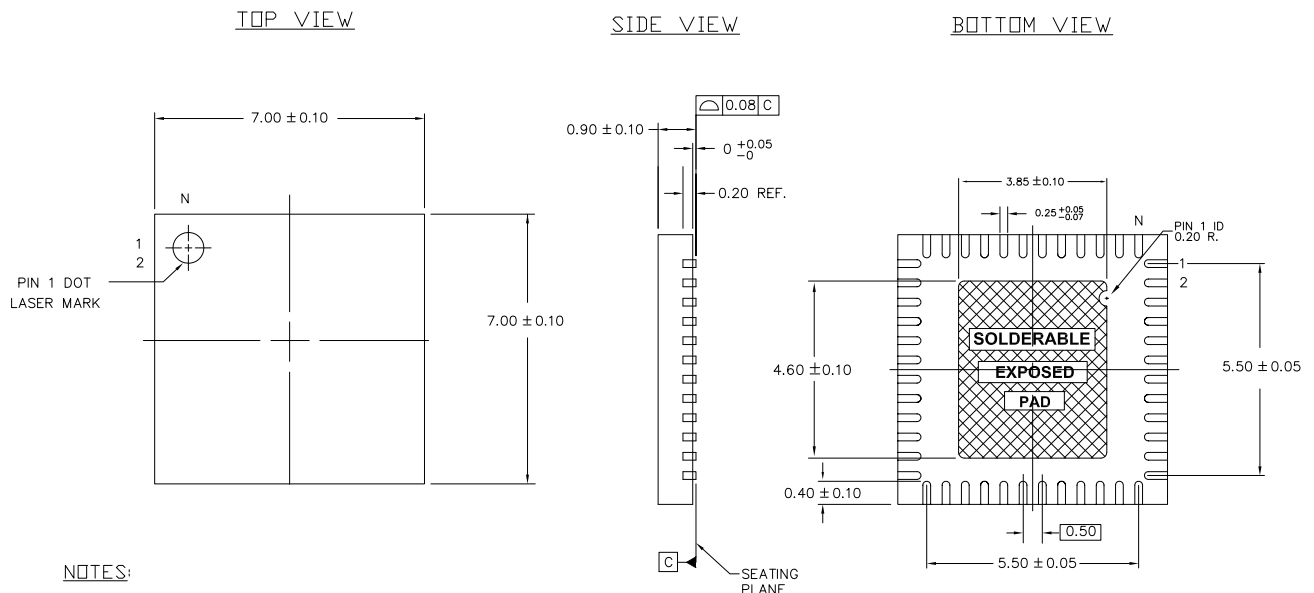
NOTES:

1.  HATCH AREA IS SOLDERABLE EXPOSED METAL.
2. REFERENCE JEDEC#: MO-220
3. PACKAGE WEIGHT: 0.13g
4. ALL DIMENSIONS ARE IN MM [MIN/MAX]
5. PACKAGE CODE


PART #	DESCRIPTION
LF48	STANDARD
LY48	LEAD FREE

51-85152 *E

Figure 2. 48-pin QFN 7x7 mm LT48E (Sawn)



NOTES:

1.  HATCH AREA IS SOLDERABLE EXPOSED METAL.
2. REFERENCE JEDEC#: MO-220
3. PACKAGE WEIGHT: 0.14g
4. ALL DIMENSIONS ARE IN MM [MIN/MAX]

001-57024 *A

Acronyms

Table 1. Acronyms Used in this Document

Acronym	Description
ADC	analog-to-digital converter
AMR	Automatic meter reading
CRC	cyclic redundancy check
DAC	digital-to-analog converter
DSSS	direct-sequence spread spectrum
EEPROM	electrically erasable programmable read-only memory
GPIO	general purpose I/O
ISM	industrial, scientific, and medical band
PRoC™	Programmable Radio System-on-Chip
PRS	pseudo random sequence
PSoC®	Programmable System-on-Chip
PWM	pulse-width modulator
QFN	quad flat no leads
SPI	serial peripheral interface
SRAM	static random-access memory
UART	universal asynchronous receiver/transmitter
USB	universal serial bus

Document Conventions

Units of Measure

Table 2. Units of Measure

Symbol	Unit of Measure
°C	degrees Celsius
dB	decibels
GHz	gigahertz
Kbps	kilobits per second
μA	microamperes
mA	milliamperes
MHz	megahertz
V	volts

Document History Page

Document Title: CYWUSB6953 WirelessUSB™ PRoC™ Flash Programmable MCU + Radio Document Number: 38-16017				
Rev.	ECN No.	Orig. of Change	Submission Date	Description of Change
**	329973	BON	See ECN	New data sheet
*A	337935	BON	See ECN	In the Feature Section, changed "90 dBm receive sensitivity" to "- 90 dBm receive sensitivity", and "13 MHz crystal clock" to "13 MHz crystal clock" In the Functional Overview, changed "CYWUSB6934" to "CYWUSB6935" In the Application Example, changed "ISSP" to "Programming Interface"
*B	380254	BON	See ECN	Updated the PRoC DC Electrical Characteristics. Changed "- 90 dBm receive sensitivity" to "- 95 dBm receive sensitivity" in the Feature section. Removed lead-free part offering. Changed supported CPU clock from 24 MHz to 12 MHz
*C	392781	BON	See ECN	Added the Radio Data Rate Considerations section
*D	495870	OYR	See ECN	Took off the photograph of the chip from the first page Added Pb-free part numbers Took off parts with lead Quad flat package to QFN Named Variables in Table
*E	2620679	CMCC/ PYRS	12/12/08	Added Package Handling information
*F	3048368	HEMP	10/05/2010	Sunset review; no technical updates. Format updates per template. Updated package diagram.
*G	3322999	ODC	08/05/2011	Updated Package Diagrams, Ordering Information, and Ordering Code Definition. Added Acronyms and Document Conventions. Added Table of Contents.

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