



Demonstrating DDR-less EtherCAT[®] Slave on AMIC110

User's Guide:

http://processors.wiki.ti.com/index.php/PRU_ICSS_EtherCAT

TI Reference Design:

<http://www.ti.com/tool/TIDEP-0105>

DDR-less EtherCAT® Slave on AMIC110 Reference Design

TI Designs

(ACTIVE) TIDEP-0105

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Key Document

[EtherCAT DDR-less Reference Design](#) (PDF 519 KB)
26 Feb 2018 438 views

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Description

EtherCAT® (Ethernet for Control Automation Technology) continuously grows to establish itself as a dominant, industrial, Ethernet network. The DDR-less EtherCAT reference design serves as a reference design for a completely new and low-cost, DDR-less, EtherCAT slave implementation on the AMIC110, a multiprotocol industrial communications system on a chip (SoC). This reference design showcases the ability to run a full EtherCAT slave stack entirely on the internal memory of the SoC. Significant system bill of materials (BOM) and board savings are achieved with this reference design by eliminating an external ASIC and DDR. Additionally, applications such as connected industrial drives and communications modules can significantly benefit from the faster speeds that are achieved by eliminating external memory transfers for EtherCAT.

Features

- Entire EtherCAT slave stack is hosted on internal memory
- Passes EtherCAT Slave Conformance Testing Tool (CTT) from EtherCAT Technology Group (ETG)
- Eight Fieldbus Memory Management Units (FMMUs) and Sync Managers (SMs) supported by PRU-ICSS firmware
- Enhanced link-loss detection for loop control
- Helps improve system performance with removal of latencies associated with external memory accesses



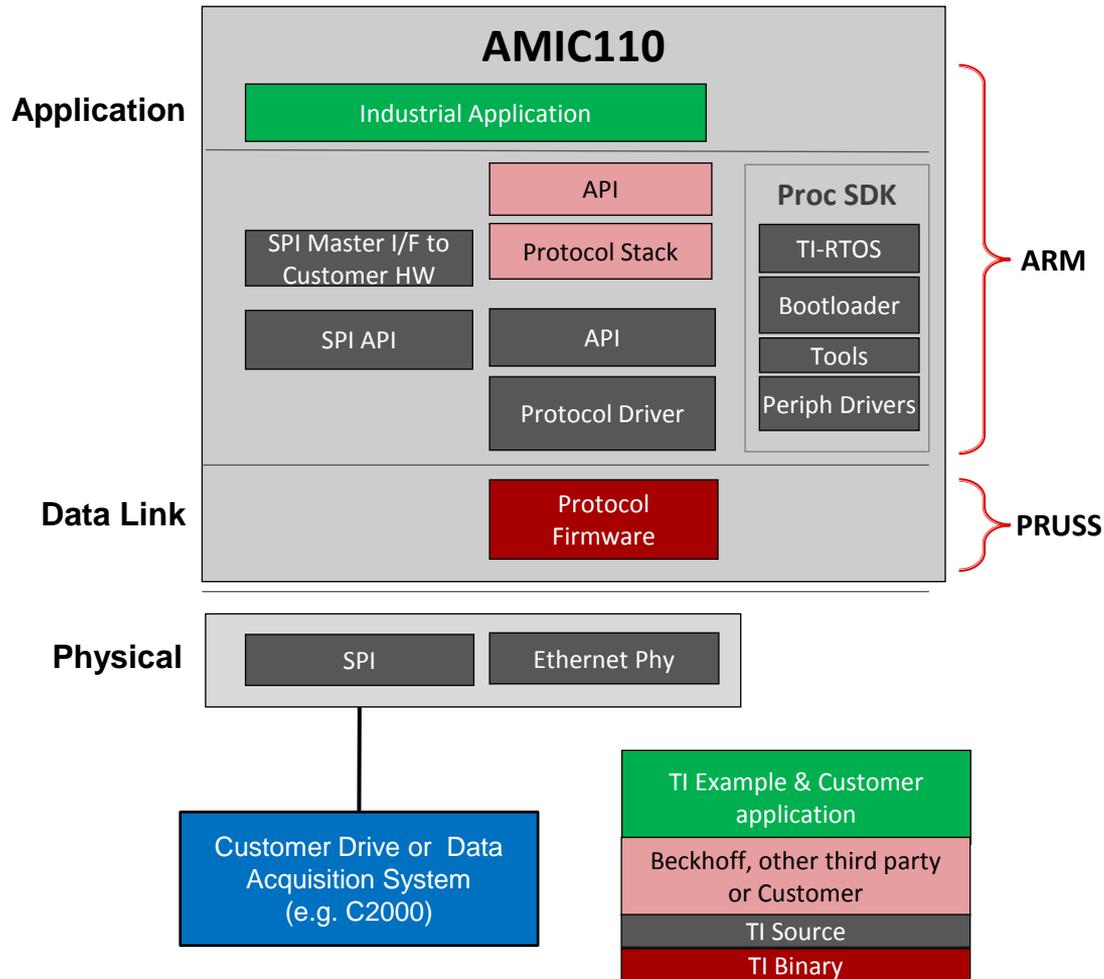
TIDEP-0105 DDR-less EtherCAT® Slave on AMIC110 Reference Design Board
Image

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System overview





Demonstration process overview



http://processors.wiki.ti.com/index.php/pru_icss_ethercat



Set up hardware



5V

XDS200 to PC

Ethernet to PC



TEXAS INSTRUMENTS

AMIC110 ICE EVM

TMDXICE110-BTA
Rev: 1.1
04174P630013

Pulse
HX1188ENL
1504-PP-CHINA

Pulse
HX1188ENL
1504-PP-CHINA

37

36

XDS200
DIGITAL SPECTRUM

CABLE #4
CABLE #4



Software setup

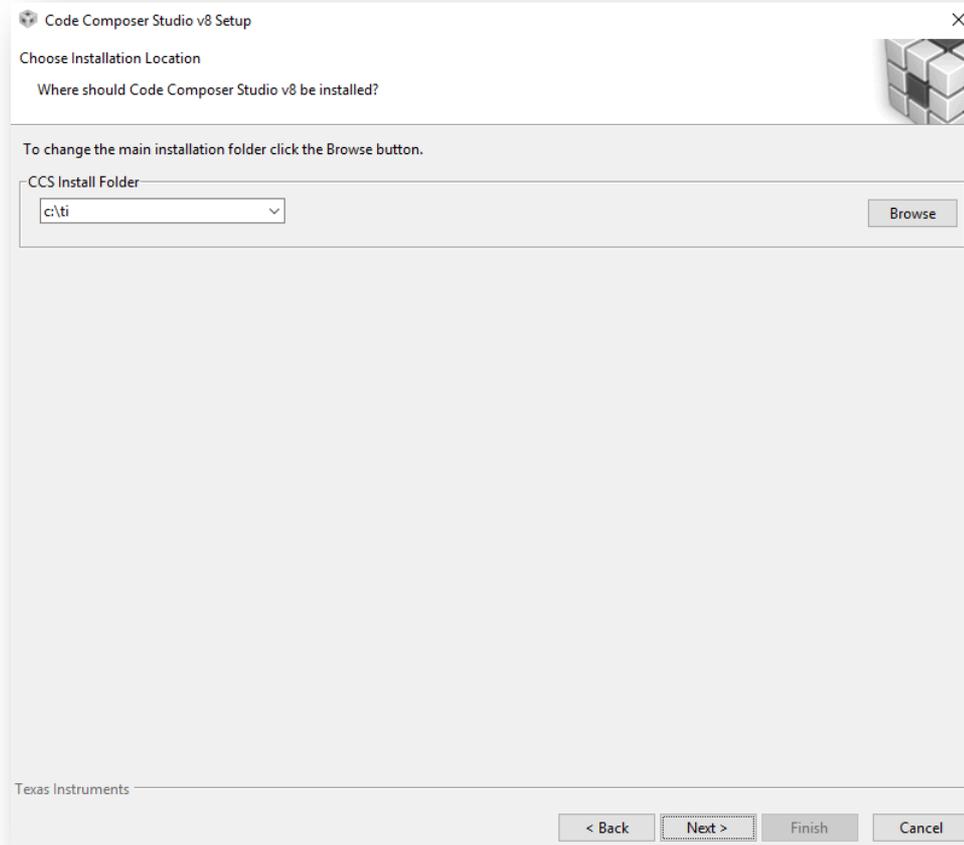
- Code Composer Studio (CCS): http://processors.wiki.ti.com/index.php/Download_CCS
 - Version 8.0.0.00016
- Processor SDK RTOS for AM335x: <http://www.ti.com/tool/PROCESSOR-SDK-AM335X>
 - Version 5.0
- PRU-ICSS EtherCAT Slave software: <http://www.ti.com/tool/PRU-ICSS-INDUSTRIAL-SW>
 - Version 1.00.06
- EtherCAT Slave Stack Code (SSC): <https://www.ethercat.org/>
 - Version 5.12
- TwinCAT 3: <https://www.beckhoff.com/english.asp?download/tc3-downloads.htm>
 - Version 3.1
- Windows Patch Utility: <https://sourceforge.net/projects/gnuwin32/files/patch/2.5.9-7/>
- Text file format converter: <https://sourceforge.net/projects/dos2unix/>



Install software

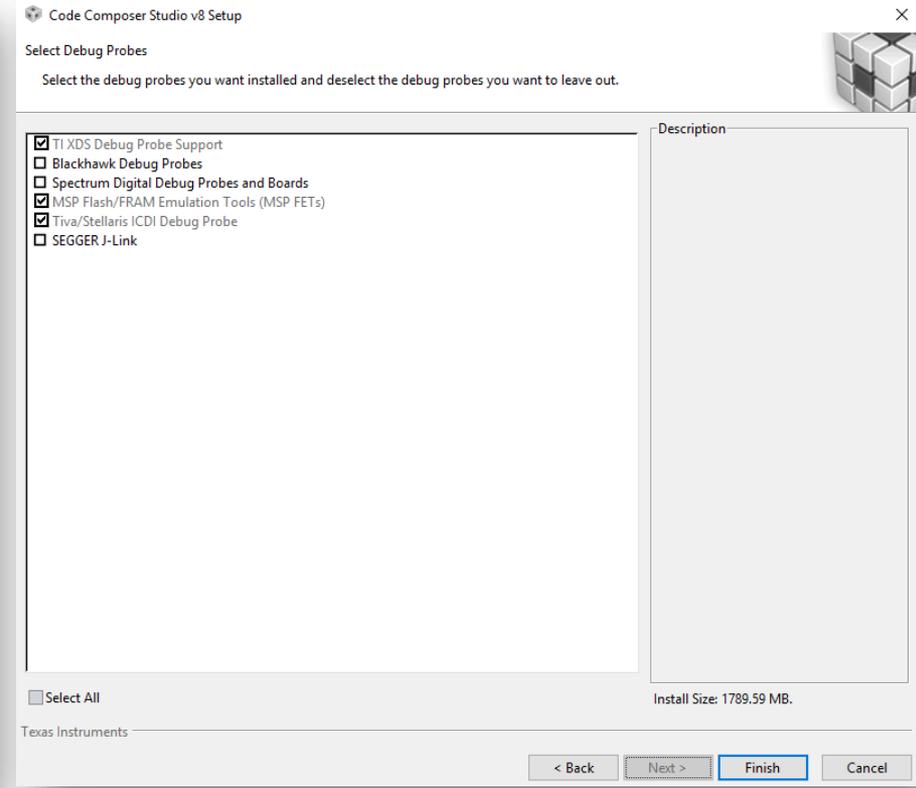
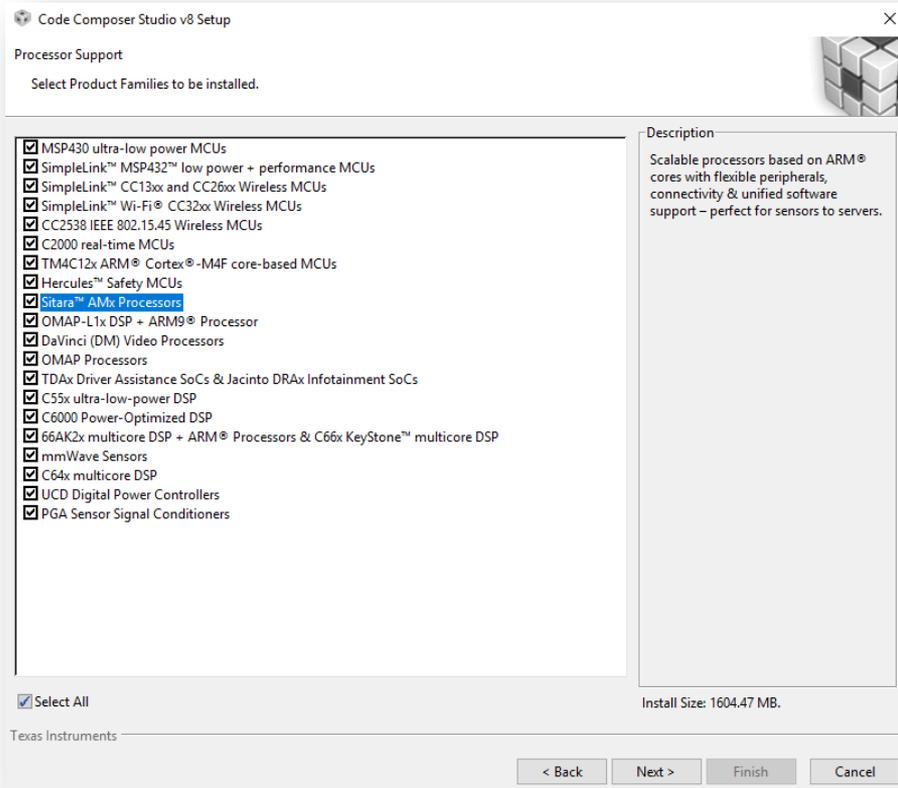


Install CCS



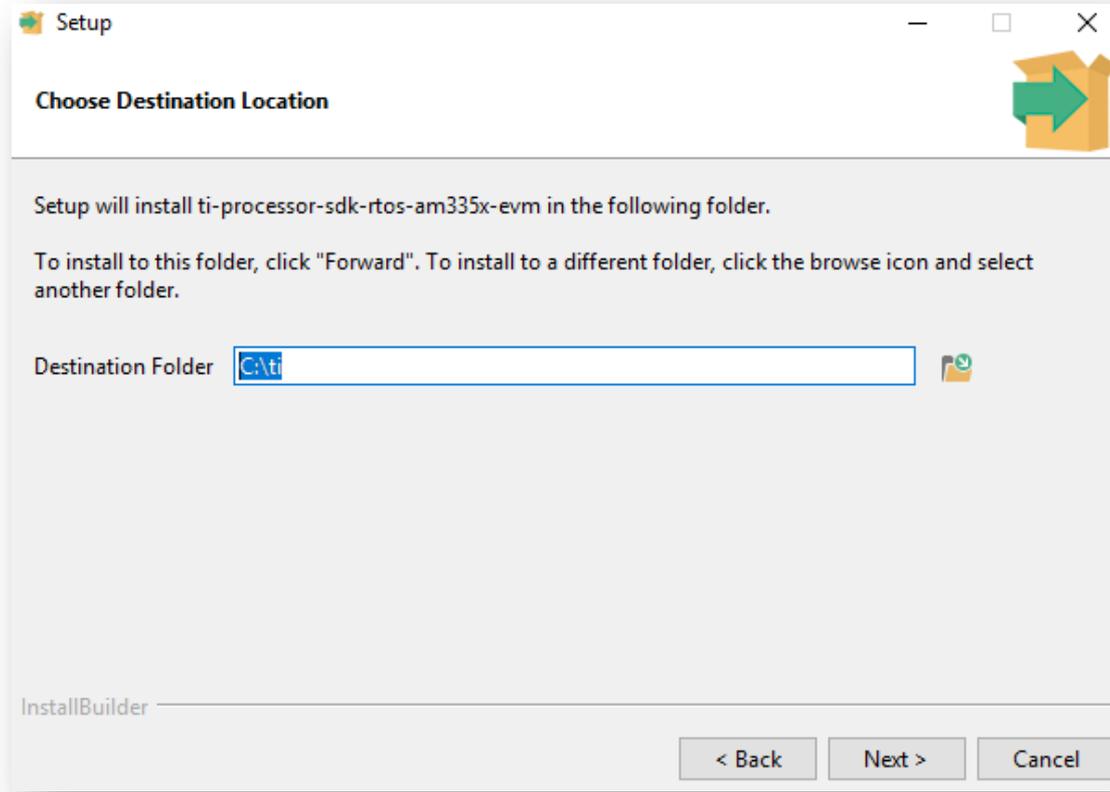
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Install CCS



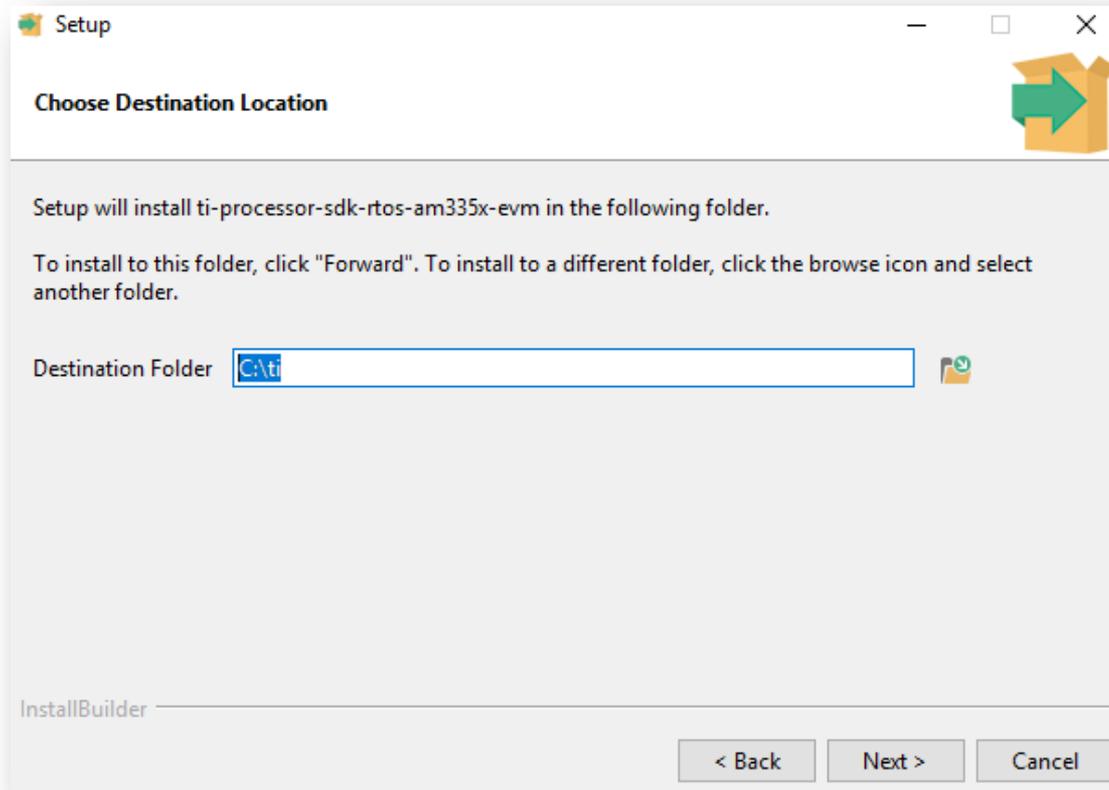
http://processors.wiki.ti.com/index.php/Download_CCS

Install Processor SDK



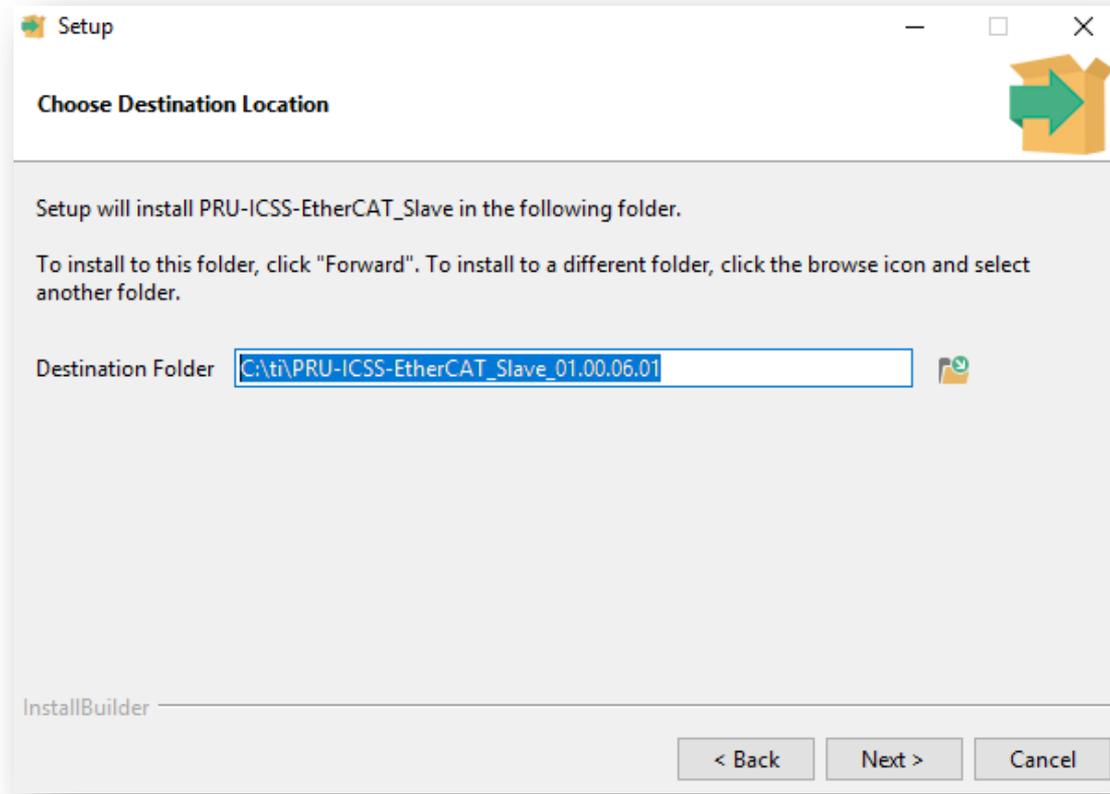
<http://www.ti.com/tool/PROCESSOR-SDK-AM335X>

Install Processor SDK



http://processors.wiki.ti.com/index.php/PRU_ICSS_EtherCAT

Install PRU-ICSS EtherCAT slave



<http://www.ti.com/tool/PRU-ICSS-INDUSTRIAL-SW>

Install EtherCAT slave stack code



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EtherCAT Slave Stack Code (SSC) incl. OD-Tool V1.4.0 Back ↑

The EtherCAT Slave Stack Code (SSC) from Beckhoff Automation is an example source code in ANSI C supporting both the μ C and the SPI interface. The code serves as a development base for implementation of EtherCAT in devices with own processor. The "Object Dictionary Tool" (OD-Tool) has been integrated into the SSC OD configuration tooling, supporting a consistent definition of offline and online object dictionary.

Detailed product info can be found within the official [EtherCAT Product Guide](#).

The Slave Stack Code can be requested for free via the link below.

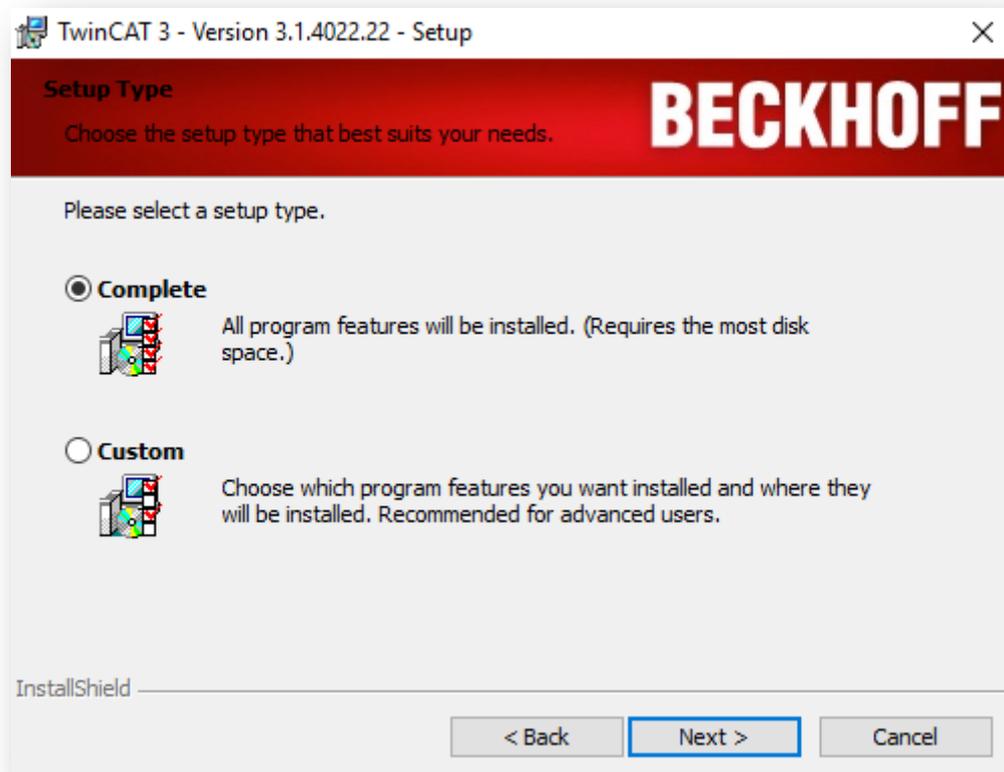
Prerequisites for SSC download:

- ETG Membership
- Valid EtherCAT Vendor ID

	Description	Language	Type	Date	Size	Ver.	Status
	EtherCAT Slave Stack Code (SSC)		ZIP	Dec 01, 2017		5.12	Release

<https://www.ethercat.org/>

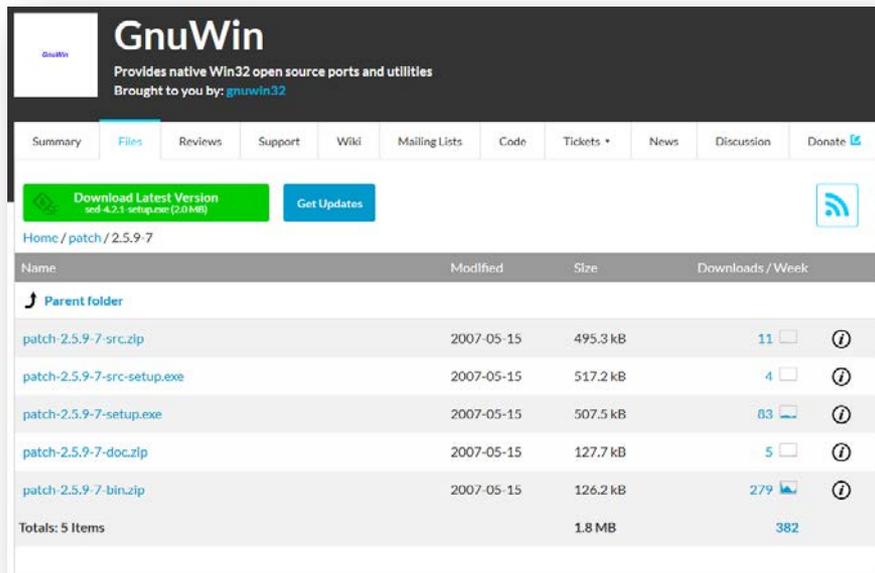
Install Beckhoff TwinCAT 3



<https://www.beckhoff.com/english.asp?download/tc3-downloads.htm>

Install patch utilities: GnuWin and dos2unix

<https://sourceforge.net/projects/gnuwin32/files/patch/2.5.9-7/>



GnuWin
Provides native Win32 open source ports and utilities
Brought to you by: [gnuwin32](#)

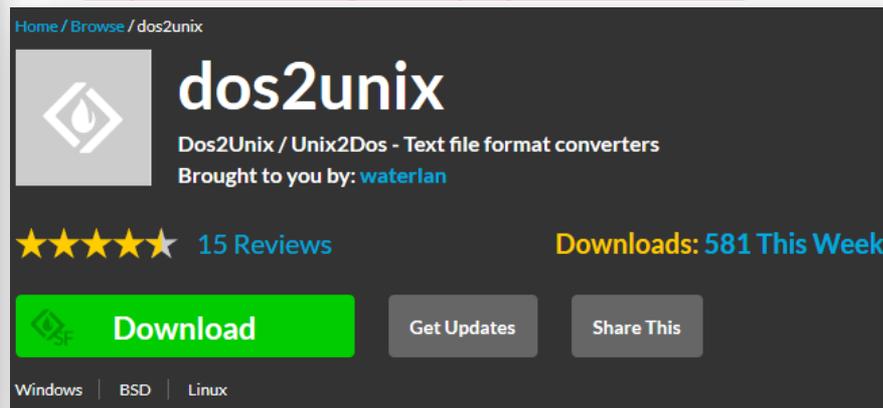
Summary | **Files** | Reviews | Support | Wiki | Mailing Lists | Code | Tickets | News | Discussion | Donate

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Home / patch / 2.5.9-7

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Parent folder			
patch-2.5.9-7-src.zip	2007-05-15	495.3 kB	11
patch-2.5.9-7-src-setup.exe	2007-05-15	517.2 kB	4
patch-2.5.9-7-setup.exe	2007-05-15	507.5 kB	83
patch-2.5.9-7-doc.zip	2007-05-15	127.7 kB	5
patch-2.5.9-7-bin.zip	2007-05-15	126.2 kB	279
Totals: 5 Items		1.8 MB	382

<https://sourceforge.net/projects/dos2unix/>



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dos2unix

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Generate and build application





Generate and build application

Method 1

Generate EtherCAT
source files using a
patch file

Method 2

Generate EtherCAT
source files using the
Beckhoff SSC tool



Generate and build application

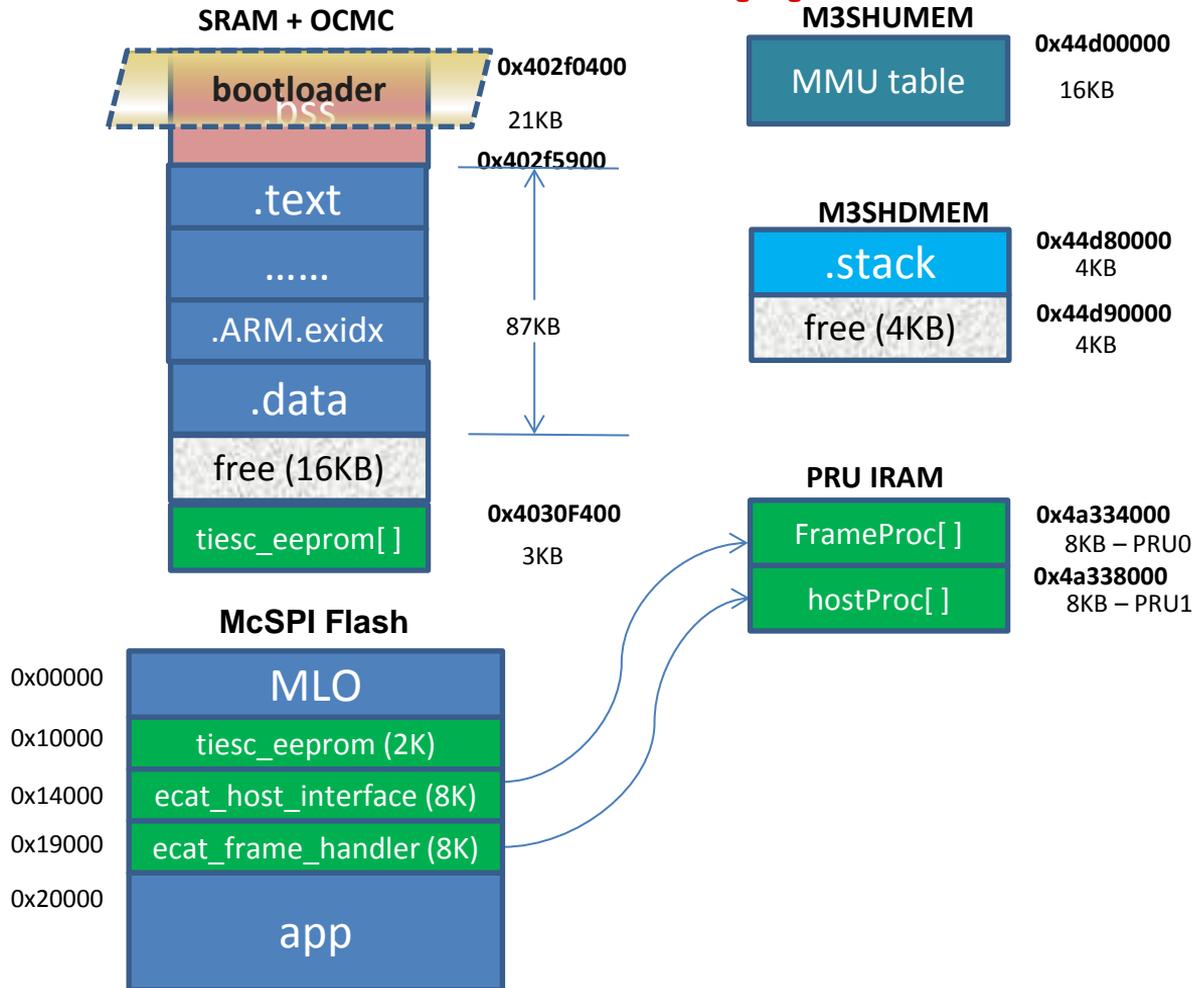
- Video Capture
 1. Generating the EtherCAT source files
 - Option 1: Generating EtherCAT sources using patch file
 - Option 2: Generating EtherCAT sources using Beckoff SSC Tool
 2. Copy source files
 3. CCS Product discovery
 4. Modify projectCreate.bat file
 5. Run projectCreate.bat AM335x arm ethercat_slave_full
 6. Apply thumb mode patch
 7. Rebuild the PDK to generate thumb mode LLD libraries
 8. Open CCS and import the project
 9. Set to release build configuration and build



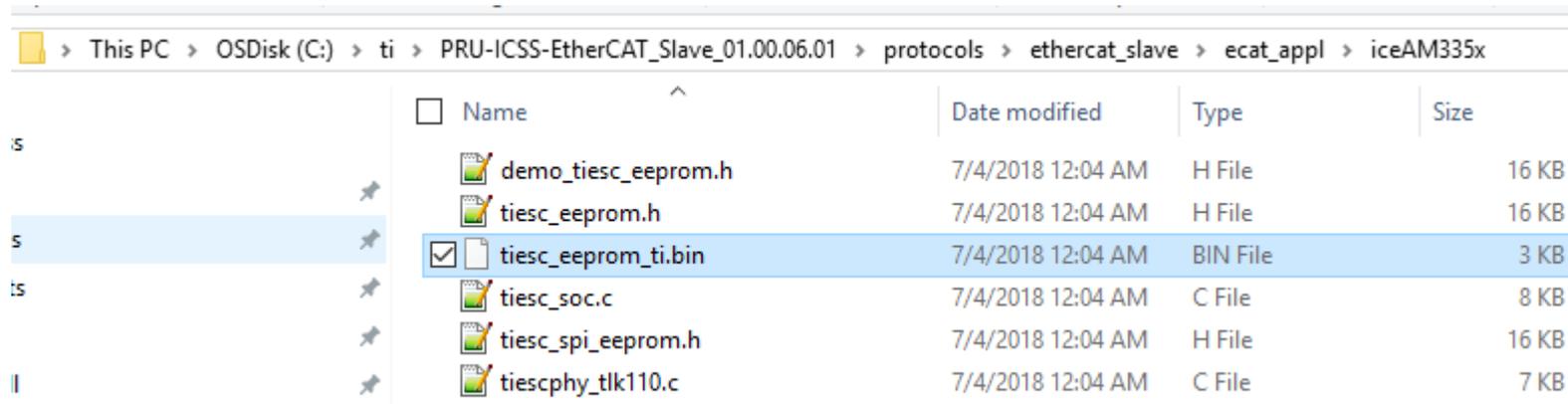
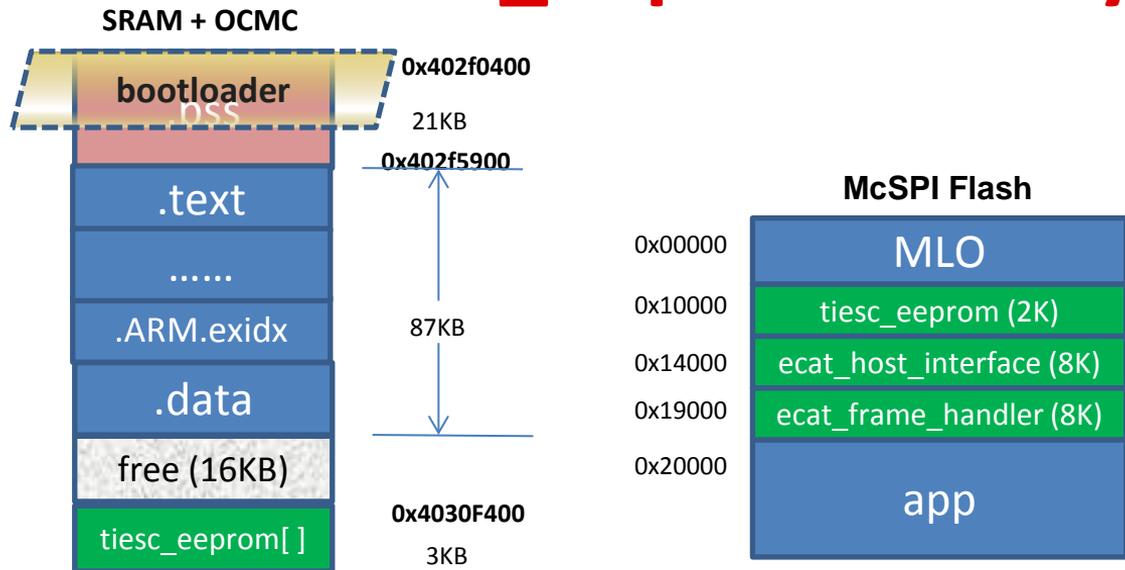
Load and run application



Load and run application



Pre-built tiesc_eeprom binary





Load and run application

- Video
 1. Create the eeprom binary
 2. Create target configuration
 3. Launch target config and connect to A8 core
 4. Load the spi flash writer
 - Go through flashing the 5 binaries

Reset



 **TEXAS
INSTRUMENTS**

AMIC110 ICE EVM

TMDXICE110-BTA
Rev: 1.1
04174P630013

Pulse
HX1188FNL
1504-PP CHINA

Pulse
HX1188FNL
1504-PP CHINA

STM-5
94V-0

6XP7
D9SHC

Assy. PN: 40066

REV: 1.1

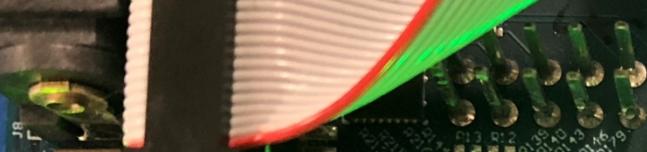
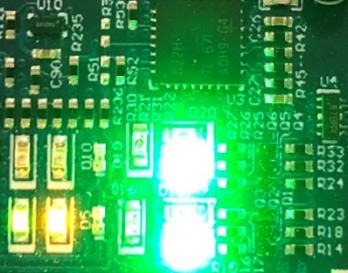
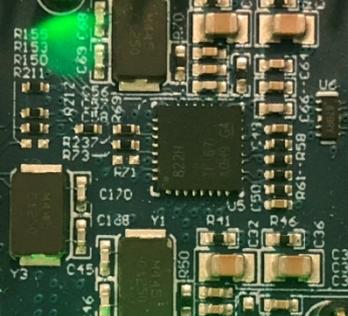


152

2R2

3R3

2R2





Validate application results





Validate application results

Video:

- Copying ESI files to TwinCAT
- Creating a TwinCAT project
- Installing Ethernet Drivers
- Scanning for devices
- Checking device state
- Changing LED status



For more information

- DDR-less EtherCAT Slave on AMIC110 Reference Design:
<http://www.ti.com/tool/TIDEP-0105>
- AMIC11x Device Product Overview:
<http://www.ti.com/processors/sitara/industrial-ethernet/amic11x/overview.html>
- EVM Tool Folder: <http://www.ti.com/tool/tmdxice110>
- Processor SDK RTOS for AM335x: <http://www.ti.com/tool/PROCESSOR-SDK-AM335X>
- PRU-ICSS EtherCAT Slave software: <http://www.ti.com/tool/PRU-ICSS-INDUSTRIAL-SW>
- EtherCAT User Guide: http://processors.wiki.ti.com/index.php/PRU_ICSS_EtherCAT
- For questions about this training, refer to the E2E Community Forums for Sitara at
http://e2e.ti.com/support/arm/sitara_arm/