



# Demonstrating DDR-less EtherCAT<sup>®</sup> Slave on AMIC110

User's Guide:

[http://processors.wiki.ti.com/index.php/PRU\\_ICSS\\_EtherCAT](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

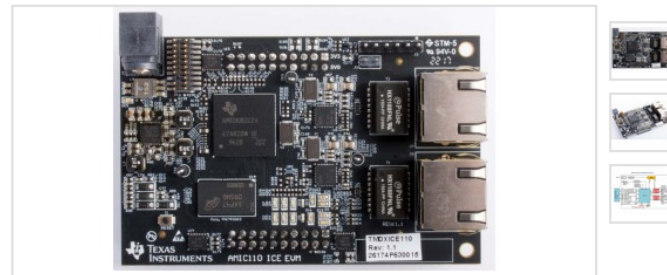
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## Description

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



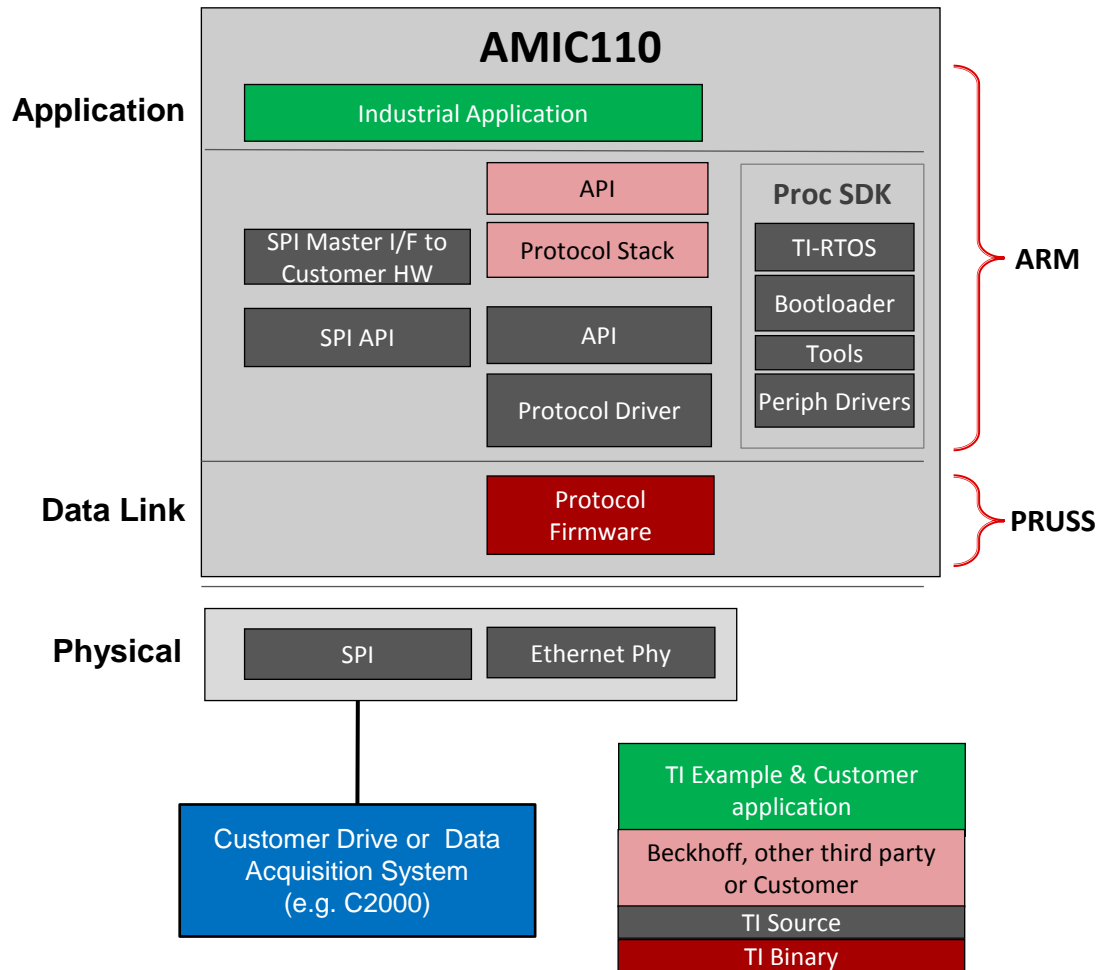
TIDEP-0105 DDR-less EtherCAT® Slave on AMIC110 Reference Design Board  
Image

[View available purchase options](#) for designs kits, evaluation modules and/or the bill of materials.

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# System overview





# Demonstration process overview



[http://processors.wiki.ti.com/index.php/pru\\_icss\\_ethercat](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](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/>

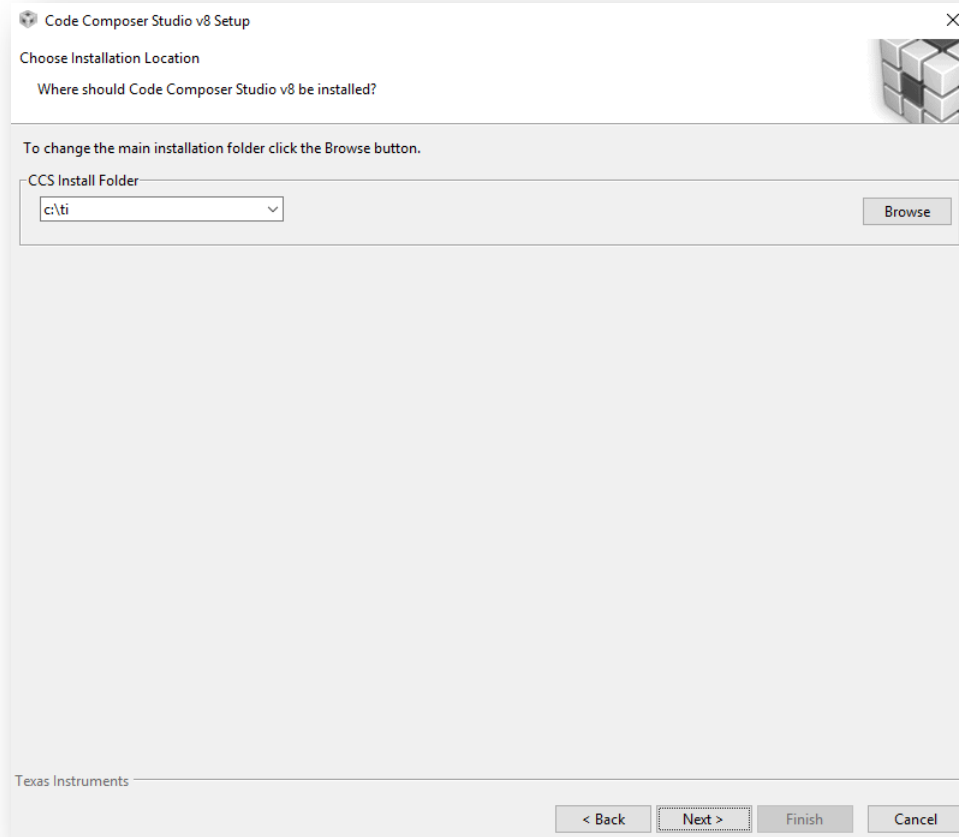


# Install software



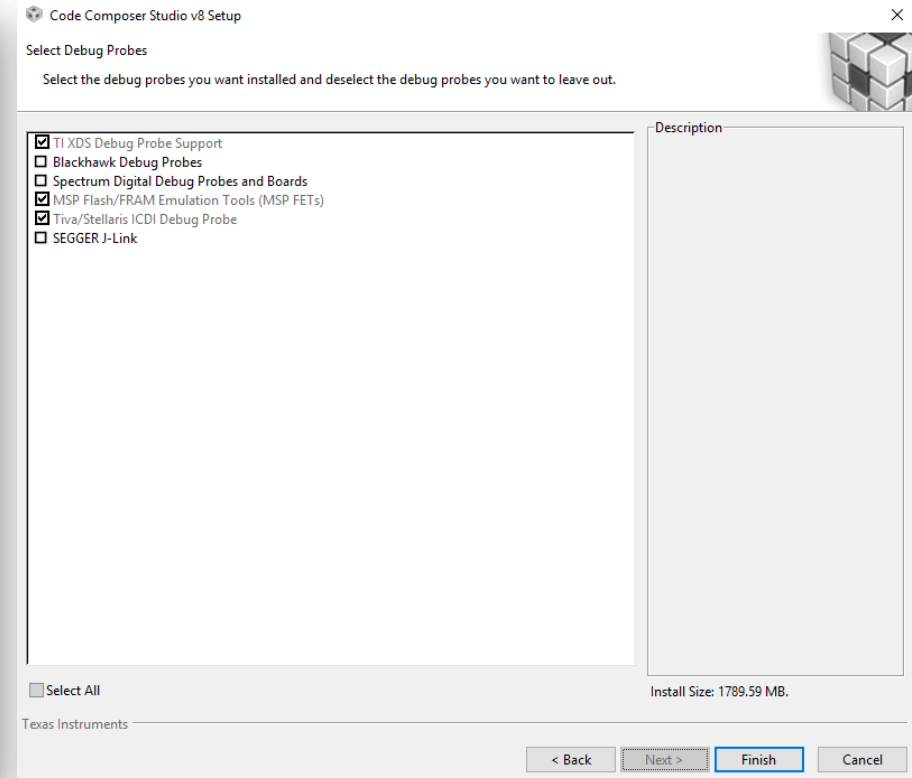
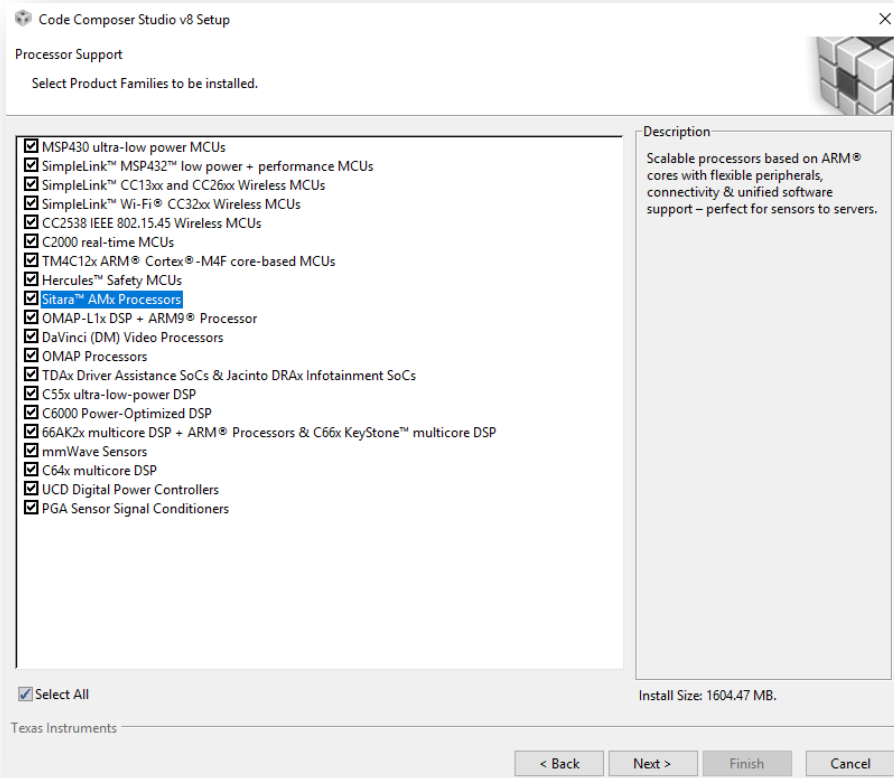


# Install CCS



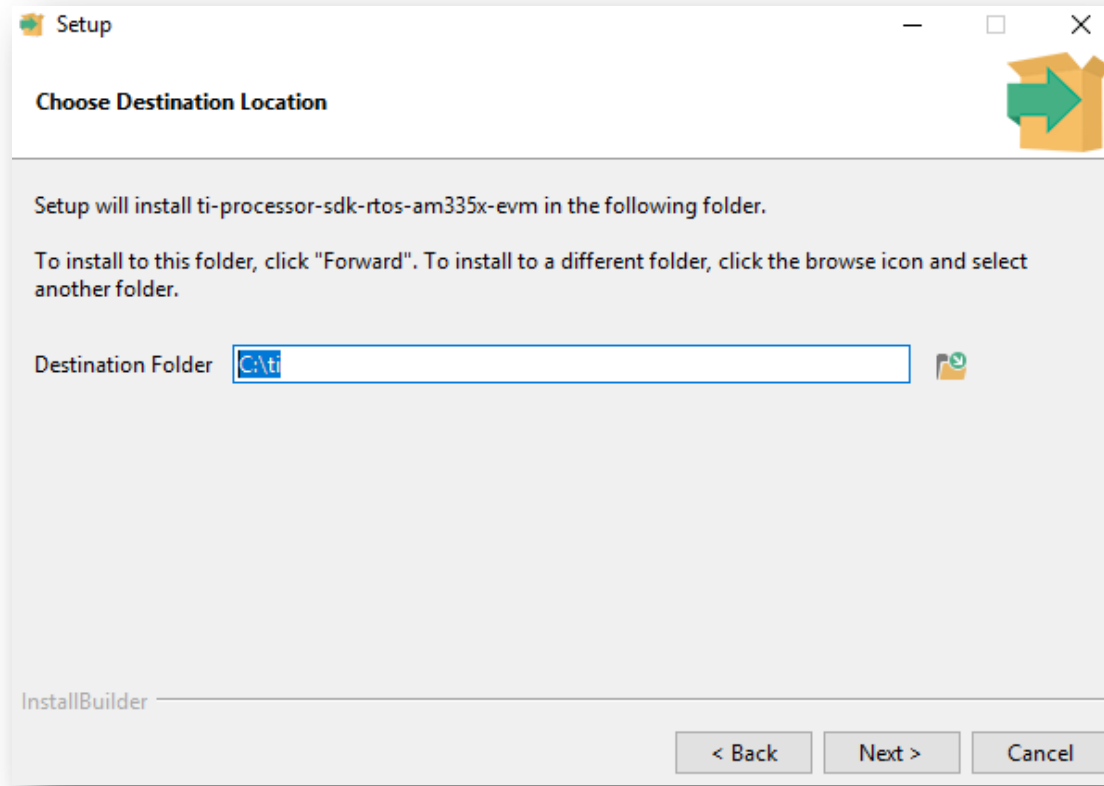
[http://processors.wiki.ti.com/index.php/Download\\_CCS](http://processors.wiki.ti.com/index.php/Download_CCS)

# Install CCS



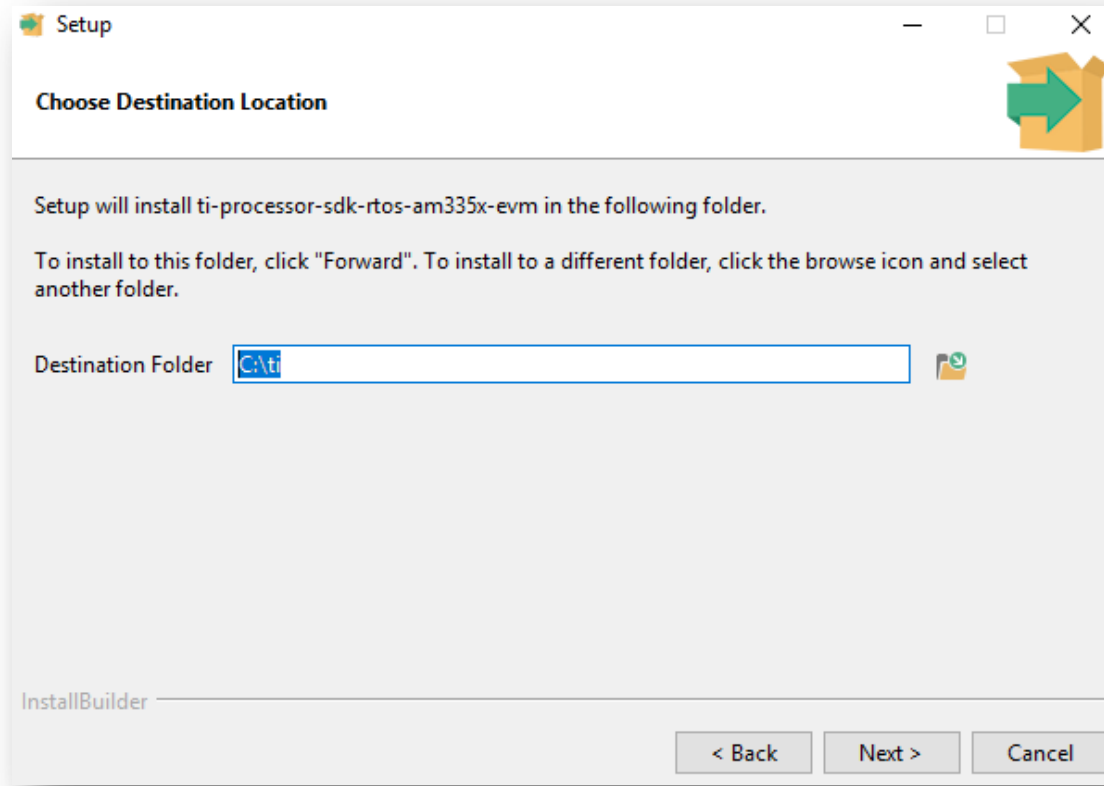
[http://processors.wiki.ti.com/index.php/Download\\_CCS](http://processors.wiki.ti.com/index.php/Download_CCS)

# Install Processor SDK



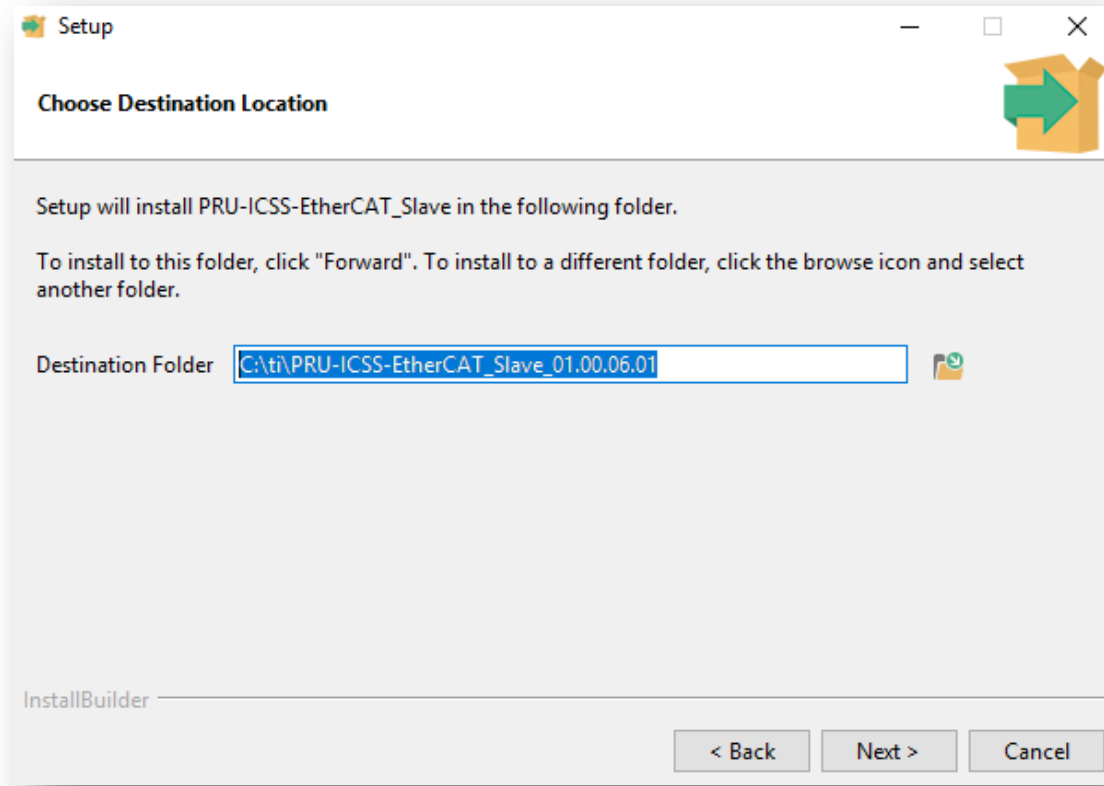
<http://www.ti.com/tool/PROCESSOR-SDK-AM335X>

# Install Processor SDK





[http://processors.wiki.ti.com/index.php/PRU\\_ICSS\\_EtherCAT](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  $\mu$ 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.

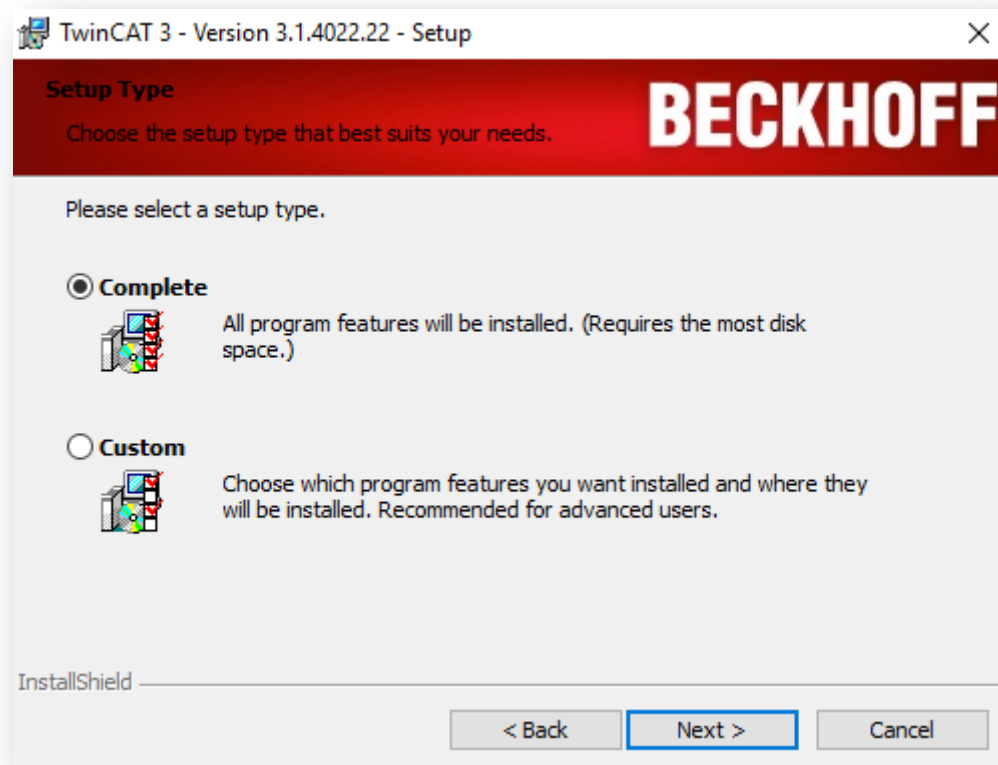
Prerequisites for SSC download:

- 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/>

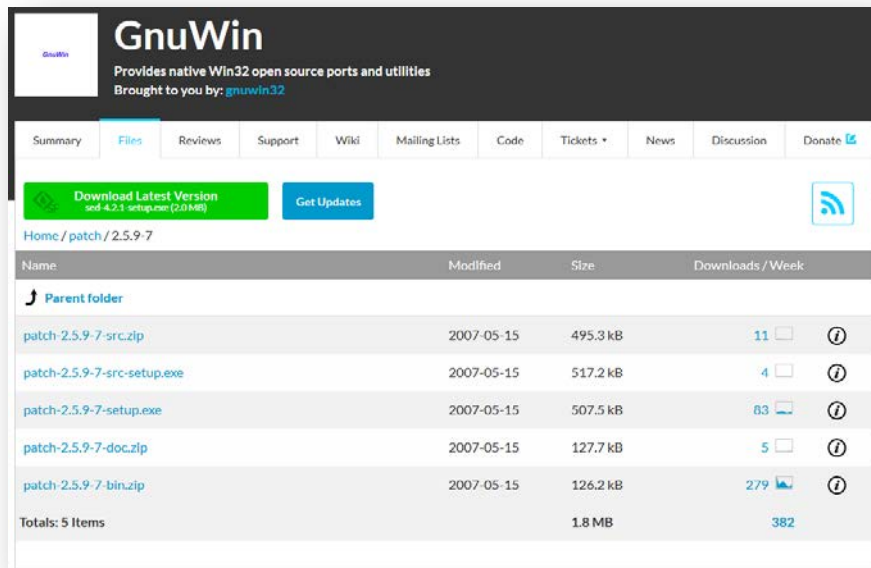
# Install Beckhoff TwinCAT 3



<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](#)

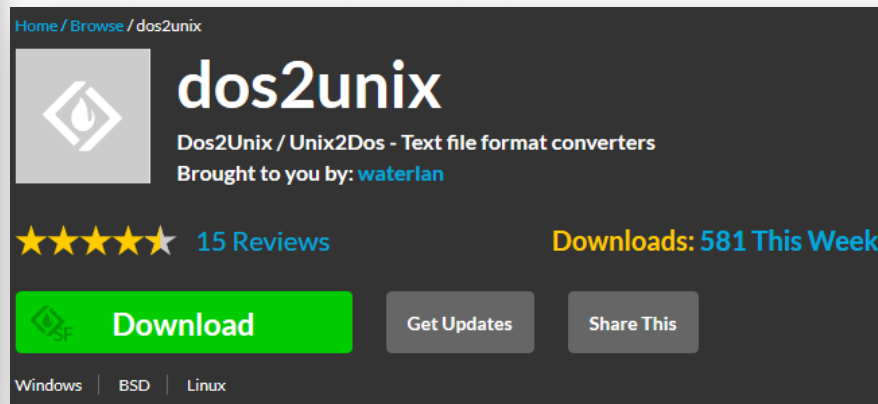
Summary | **Files** | Reviews | Support | Wiki | Mailing Lists | Code | Tickets | News | Discussion | Donate

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Home / patch / 2.5.9-7

Name	Modified	Size	Downloads / Week
Parent folder			
<a href="#">patch-2.5.9-7-src.zip</a>	2007-05-15	495.3 kB	11
<a href="#">patch-2.5.9-7-src-setup.exe</a>	2007-05-15	517.2 kB	4
<a href="#">patch-2.5.9-7-setup.exe</a>	2007-05-15	507.5 kB	83
<a href="#">patch-2.5.9-7-doc.zip</a>	2007-05-15	127.7 kB	5
<a href="#">patch-2.5.9-7-bin.zip</a>	2007-05-15	126.2 kB	279
Totals: 5 Items		1.8 MB	382

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



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## dos2unix

Dos2Unix / Unix2Dos - Text file format converters  
Brought to you by: [waterlan](#)

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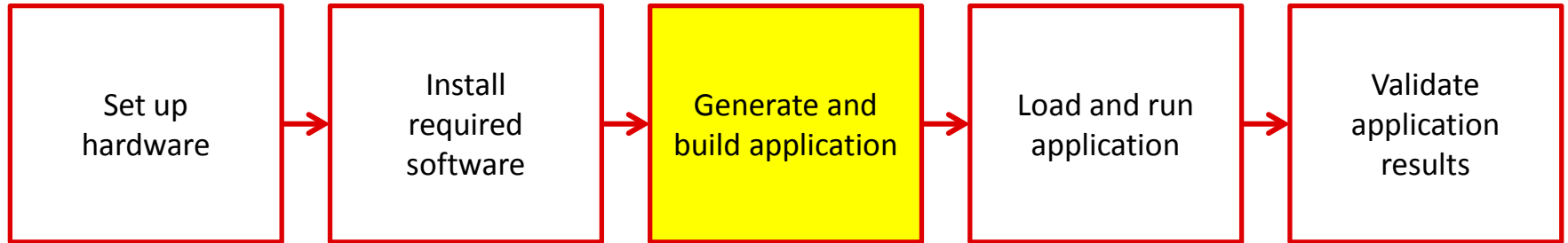
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# Generate and build application





# 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

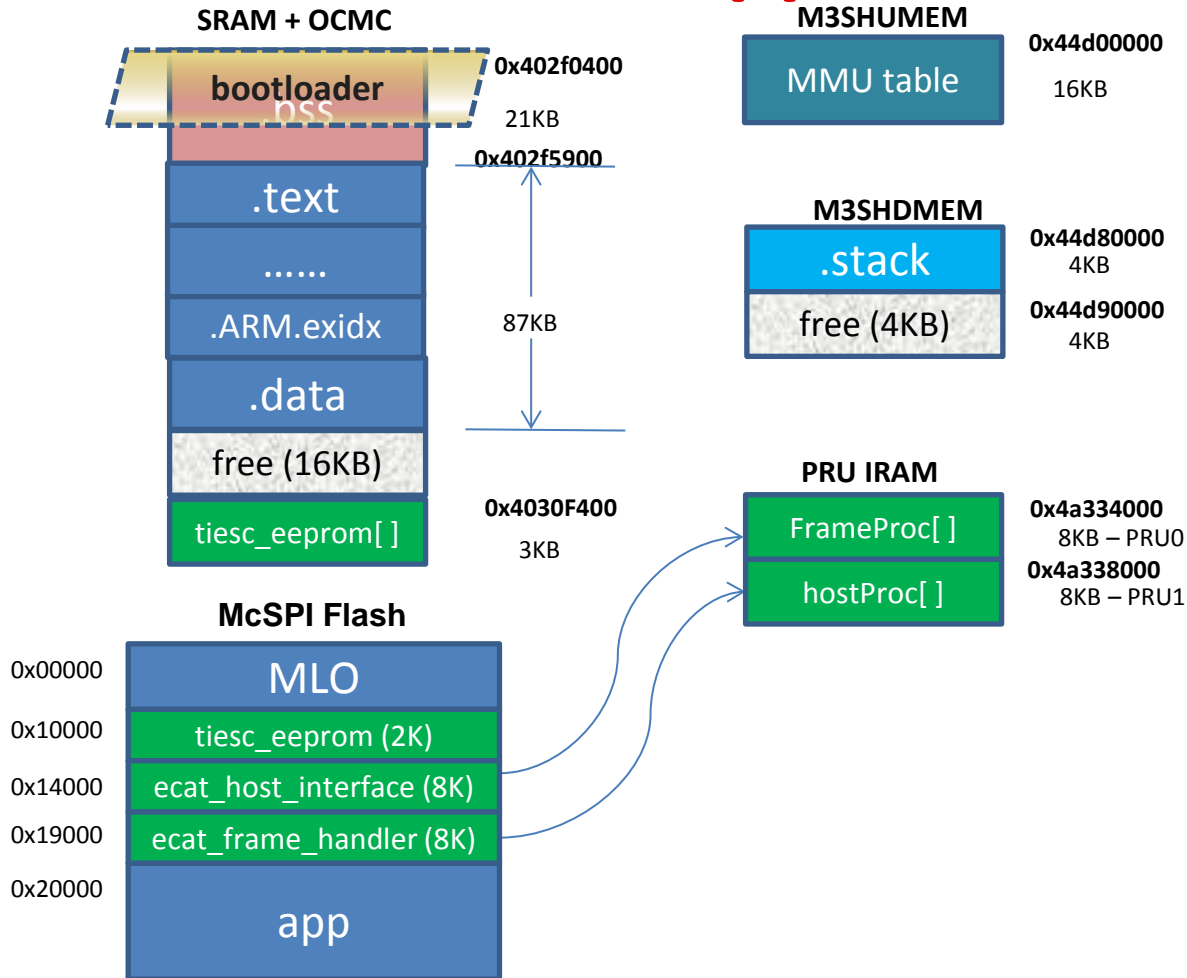
- Video Capture
  1. Generating the EtherCAT source files
    - Option 1: Generating EtherCAT sources using patch file
    - Option 2: Generating EtherCAT sources using Beckoff SSC Tool
  2. Copy source files
  3. CCS Product discovery
  4. Modify projectCreate.bat file
  5. Run projectCreate.bat AM335x 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



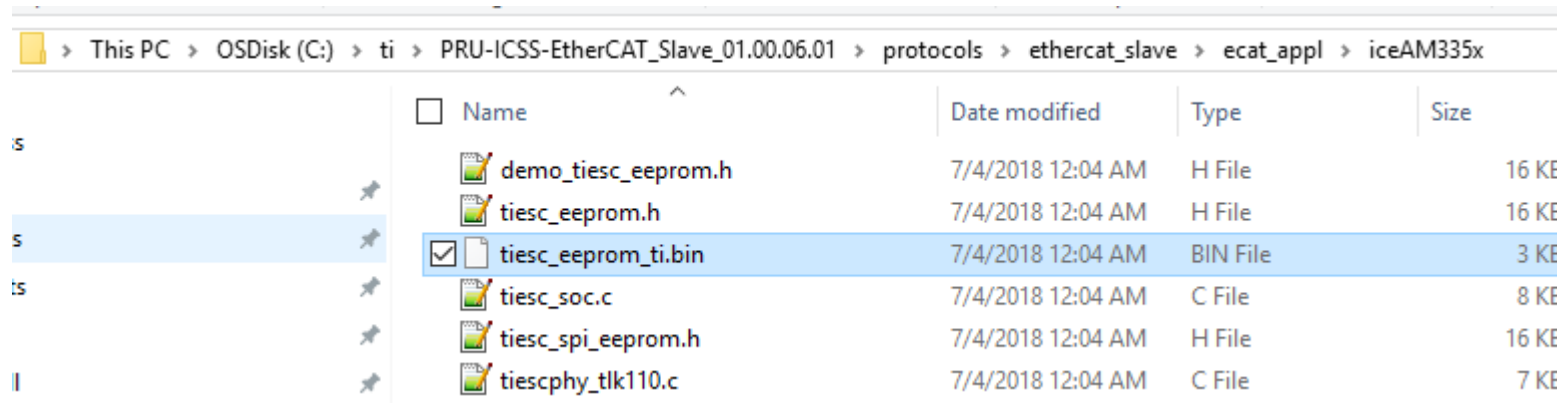
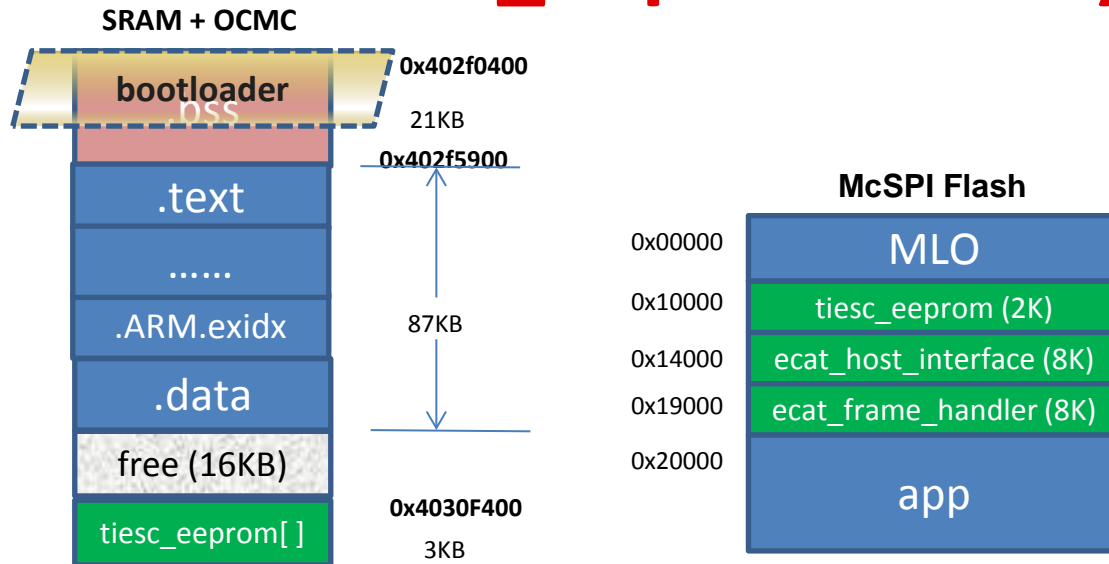
# Load and run application



# 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



STM-5  
94V-0



TMDXICE110-BTA  
Rev: 1.1  
04174P630013



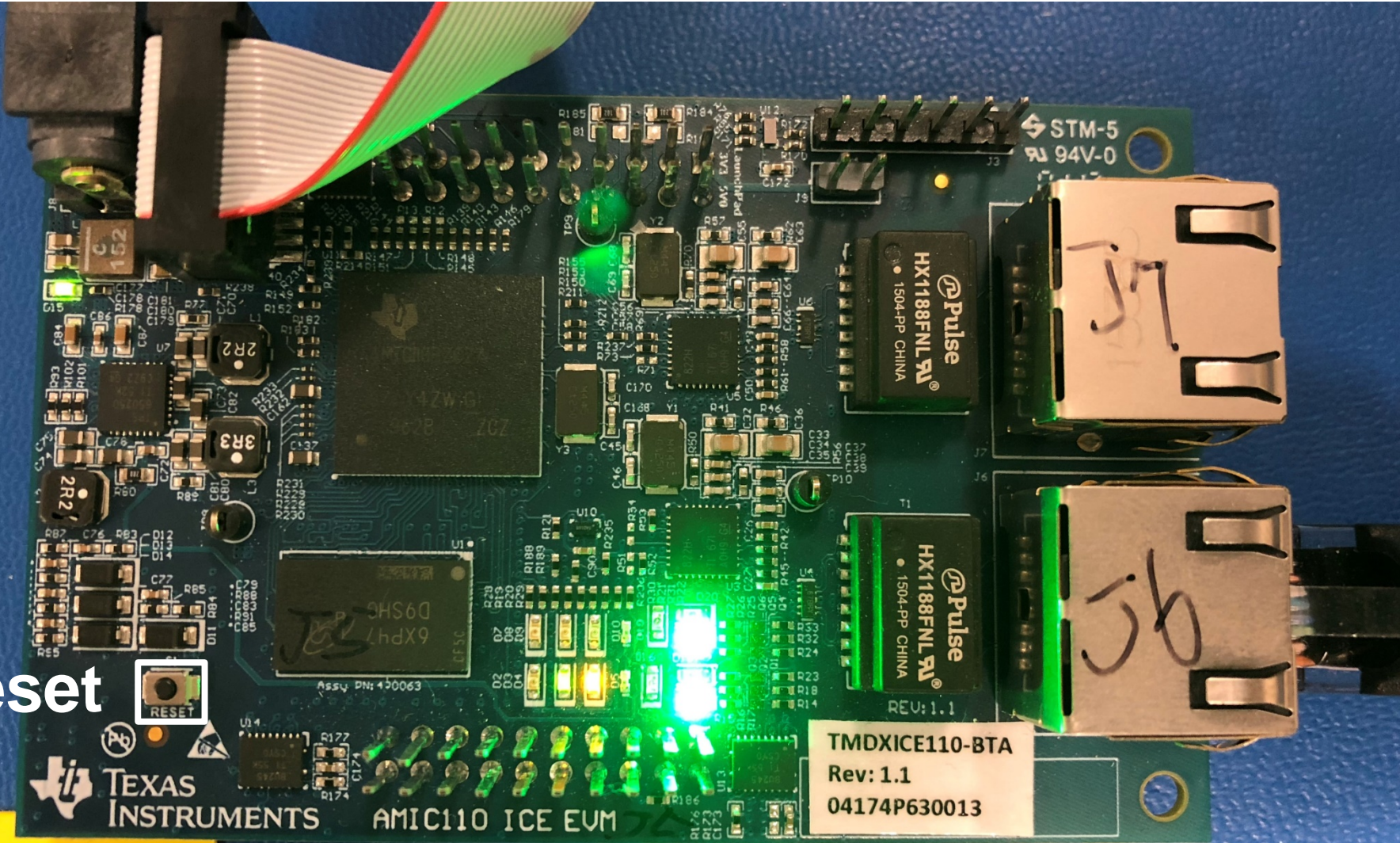
Assy PN: 40066



Reset

TEXAS  
INSTRUMENTS

AMIC110 ICE EVM







# 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](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/](http://e2e.ti.com/support/arm/sitara_arm/)