TMS570LS31x Hercules Development Kit (HDK)

User's Guide

![Texas Instruments logo]

Contents

List of Figures

List of Tables

Read This First

About This Manual

This document describes the board level operations of the TMS570LS31 Hercules™ Development Kit (HDK). The HDK is based on the Texas Instruments TMS570LS3137 Microcontroller. The TMS570LS31 HDK is a table top card that allows engineers and software developers to evaluate certain characteristics of the TMS570LS3137 microcontroller to determine if the microcontroller meets the designer's application requirements as well as begin early application development. Evaluators can create software to execute on board or expand the system in a variety of ways.

Notational Conventions

This document uses the following conventions.

The TMS570LS31 HDK will sometimes be referred to as the HDK.

Program listings, program examples, and interactive displays are shown in a special italic typeface. Here is a sample program listing:

- equations
- !rd = !strobe&rw

Information About Cautions

This book may contain cautions.

This is an example of a caution statement.

A caution statement describes a situation that could potentially damage your software, or hardware, or other equipment. The information in a caution is provided for your protection. Please read each caution carefully.

Related Documentation From Texas Instruments

Information regarding this device can be found at the following Texas Instruments website: http://www.ti.com/tms570

Hercules, Code Composer Studio are trademarks of Texas Instruments.
ARM is a registered trademark of ARM Limited.
All other trademarks are the property of their respective owners.

Introduction

This development kit provides a product-ready hardware and software platform for evaluating the functionality of the Texas Instruments TMS570LS31 microcontroller family. Schematics, list of materials, and PCB layout are available to ease hardware development and reduce time to market.

1.1 Scope of Document

This user's guide lists the contents of the development kit, points out the features of the major components, and provides the instructions necessary to verify your development kit is in working order. Any additional usage instructions or details fall outside the scope of this document. Additional resources will be listed at the end of this user's guide.

1.2 TMS570LS31 HERCULES Development Kit (HDK) Features

The HDK comes with a full complement of on board devices that suit a wide variety of application environments. Key features include:

- A Hercules TMS570LS3137 337-pin BGA microcontroller
- Integrated USB JTAG Emulator (XDS100v2)
- External JTAG Headers (ARM® 20 pin and TI Compact 20-pin CTI)
- 10/100 Mbps Ethernet interface
- Two CAN transceivers (SN65HVDA541Q1) and screw terminal blocks
- One ambient light sensor
- One ambient temperature sensor
- Microcontroller's serial communication interface (SCI) universal asynchronous receiver/transmitter (UART) accessible through a USB virtual COM port
- One 8MB SDRAM
- Eight user programmable white LEDs around the MCU silicon
- One user programmable pushbutton
- Three expansion connectors for hardware prototyping
- Reset pushbuttons (nPORRST and nRST)
- One SD card slot (SPI mode)
- Embedded trace macrocell (ETM) debug interface via MIPI connector
- Configurable pin mux options
- 5 V and 3.3 V analog-to-digital converter (ADC) option jumper
- Current measurement capability for 3.3 V IO, 1.2 V core, 1.2 V core, 1.2 V PLL, 3.3 V or 5 V ADC, and 3.3 V V_{CCP}
- Accepts an external power supply between +5V and +12V

1.3 HDK Board Block Diagram

Figure 1-1 illustrates the HDK block diagram.
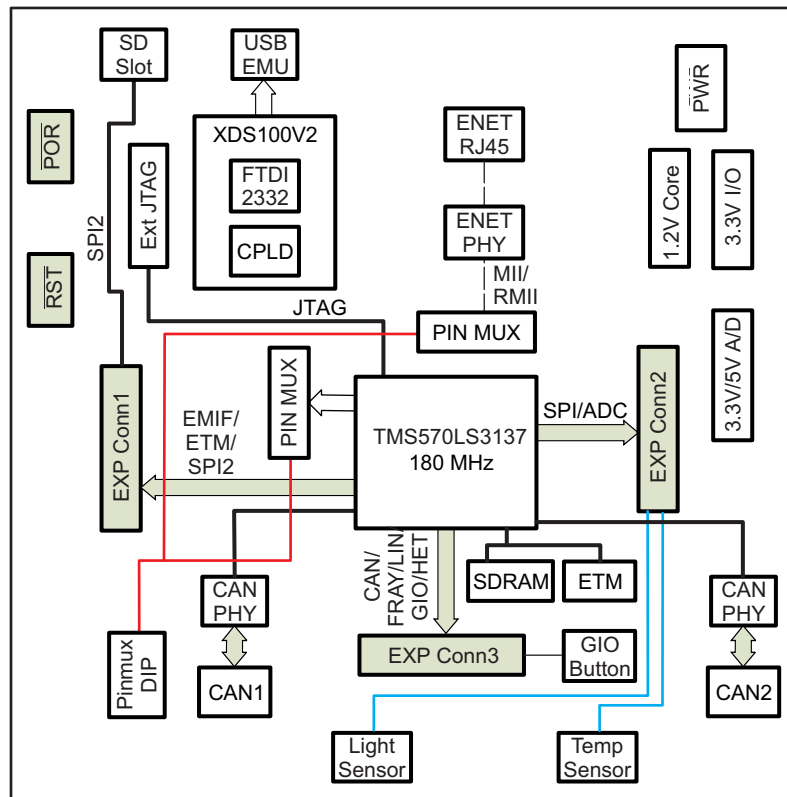
Figure 1-1. TMS570LS31 HDK Board Block Diagram

1.4 TMS570LS31 HDK Contents

The kit contains everything needed to develop and run applications for TMS570LS3137 microcontrollers including:

- Board:
  - TMS570LS31 Card
- Cables and Accessories
  - 12 V power supply with power adapters for US, or Europe
  - Type A to mini B USB cable for using on board XDS100V2 JTAG emulator
  - Ethernet cable
  - Flashlight for light sensor demo
- CCS DVD Containing:
  - Texas Instruments' Code Composer Studio™ Integrated Development Environments (IDE)
- Hercules DVD Containing:
  - Hercules Safety Demos
  - Hardware Abstraction Layer Code Generator (HALCoGen)
  - Training Videos
  - Device Documentation

1.5 HDK Specifications

- Board supply voltage: 5 V–12 V Vdc
- Board supply current: 130 mA typ (fully active, CPU at 180 MHz)
- Dimensions: 4.90" x 4.30" x 0.85" (LxWxH)

1.6 Basic Operation

The HDK is designed to work with TI's Code Composer Studio and other third party ARM IDEs. The IDE communicates with the board through the embedded emulator or an external JTAG emulator. To start, follow the instructions in the Quick Start Guide to install Hercules-specific software. This process will install all of the necessary development tools, documentation and drivers.

1.7 Memory Map

The TMS570LS31 family of MCUs have a large byte addressable address space. Table 1-1 shows the address space of a TMS570LS3137 microcontroller on the left with specific details of how each region is used by the HDK on the right. By default, the internal memory sits at the beginning of the address space.

The SDRAM is mapped into CS0 space on the EMIF. CS[4:2] are used for synchronous memory for example SRAM, NOR Flash, NAND Flash, and so forth.

To use EMIF, the MPU has to be enabled, and the CS regions have to be configured as "device mode" or "strongly ordered mode" through MPU.

Table 1-1. TMS570LS31 Memory Map

Start Address	End Address	HDK
0x0000 0000	0x002F FFFF	Flash
0x0800 0000	0x0803 FFFF	RAM
0x0840 0000	0x0843 FFFF	RAM-ECC
0x6000 0000	0x63FF FFFF	CS2 Async RAM
0x6400 0000	0x67FF FFFF	CS3 Async RAM
0x6800 0000	0x7BFF FFFF	CS4 Async RAM
0x8000 0000	0x87FF FFFF	CS0 Sync SDRAM

1.8 Power Supply

The HDK board operates from a single +12 V external power supply connected to the main power input (P1), a 2.5 mm, barrel-type plug. Internally, the +12 V input is converted into +1.2 V, +3.3 V and +5.0 V using Texas Instruments swift voltage regulators and PTH power module. The +1.2 V supply is used for the MCU core while the +3.3 V supply is used for the MCU's I/O buffers and other module on the board. The +5.0 V supply is used for ADC power (second option) and USB VBUS.

There are multiple power test points on the HDK board. The three main test point pairs provide a convenient mechanism to check the HDK's current for each supply. Table 1-2 shows the voltages for each test point and what the supply is used for.

Table 1-2. Power Test Points

Test Point Pair	Voltage	Voltage Use
TP14 and TP15	1.2 V	MCU core
TP16 and TP17	3.3 V	MCU IO and logic
TP18 and TP19	1.2 V	MCU PLL
TP20 and TP21	3.3 V	MCU Flash pump
TP22 and TP23	3.3 V or 5.0 V (J8 to enable 5 V)	MCU MibADC, and ADREFHI

Physical Description

This section describes the physical layout of the TMS570LS31 HDK board and its interfaces.

2.1 Board Layout

The TMS570LS31 HDK board is a 4.9 x 4.3 inch (125 x 109 mm) eight layer printed circuit board that is powered by an external +5 V to approximately +12 V only power supply. Figure 2-1 shows the layout of the TMS570LS31 HDK board.

Figure 2-1. TMS570LS31 HDK Board, Interfaces Top Side

2.2 Connectors

The HDK board has 13 interfaces to various peripherals. These interfaces are described in the following sections.
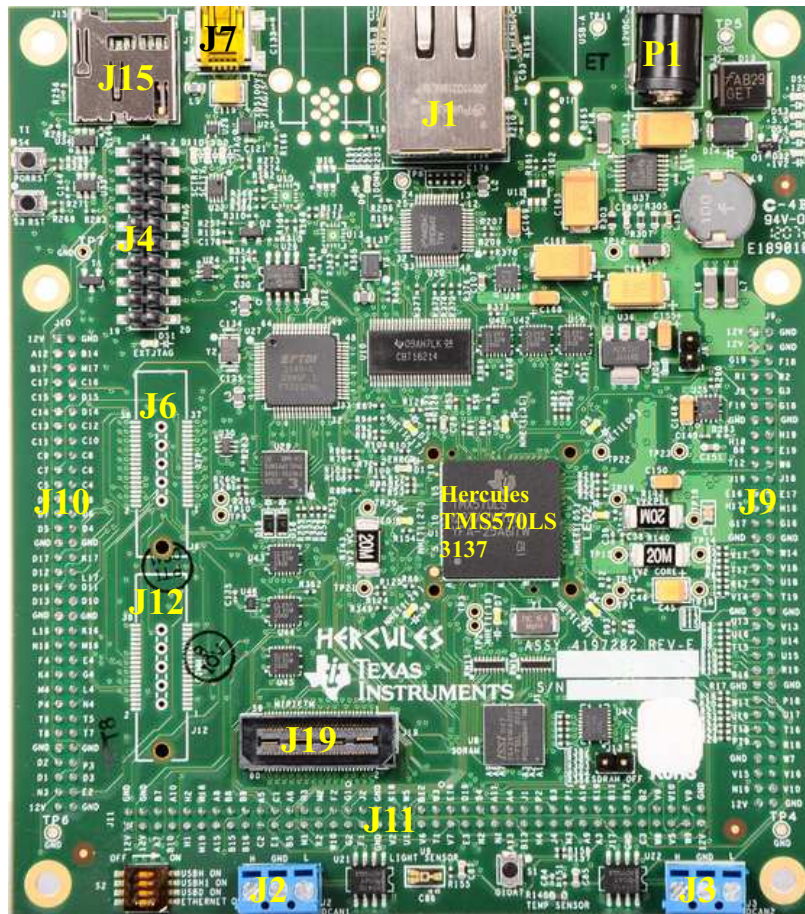

Figure 2-2. Connectors on TMS570LS31 HDK

Table 2-1. Connectors on HDK Board

Connector	Size	Function
J1	RJ45	Ethernet
J2	3 terminal, 2.54mm	DCAN1
J3	3 terminal, 2.54mm	DCAN2
J4	10x2, 2.54mm	ARM 20pin JTAG header
J6	19x2, mictor	RTP
J7	4pin, Mini-B USB	XDS100V2 USB
J9	33x2, 2mm	Exp P1, SPI1, SPI5, ADC
J10	33x2, 2mm	EXP P2, SPI2, EMIF, ECLK
J11	40x2, 2mm	EXP P3, SPI3, GIO, NHET, DCAN, LIN
J12	19x2, mictor	DMM
J15		SD card
J19	30x2, MIPI	ETM MIPI Header
P1	2.5mm	+12 V In

2.2.1 20-Pin ARM JTAG Header

In addition to on board XDS100V2 JTAG, one 20-pin ARM JTAG header is added for using external emulator. This is the standard interface used by JTAG emulators to interface to ARM microcontrollers. The pinout for the connector is shown in Table 2-2.

Table 2-2. 20-Pin ARM JTAG Header

Signal Name	Pin Number	Pin Number	Signal Name
Vref	1	2	V_{CC}
nTRST	3	4	GND
TDI	5	6	GND
TMS	7	8	GND
TCK	9	10	GND
RTCK	11	12	GND
TDO	13	14	GND
nRST	15	16	GND
NC	17	18	GND
NC	19	20	GND

2.2.2 Ethernet Interface

The TMS570LS3137 integrates an MII/RMII Ethernet MAC on chip. This interface is routed to the on board PHY via CBT switches. The board uses a DP83640 PHY. The interface is isolated and brought out to a RJ-45 connector with integrated magnetics, J1. The pinmux control DIP S2 is used to control the CBT FET switch for RMII, MII or other functions.

The J1 connector is used to provide a 10/100 Mbps Ethernet interface. This is a standard RJ-45 connector. The cable end pinout for the J1 connector is shown in Table 2-3.

Table 2-3. J1, Ethernet Interface

Pin Number	Signal	Pin Number	Signal
1	D0+	2	D0-
3	D1-	4	D2+
5	D2-	6	D1-
7	D3+	8	D3-

Two LEDs are embedded into the connector to report link status (green LED) and transmit and receive status of the PHY (yellow LED).

2.2.3 CAN Interface

The TMS570LS3137 has up to three DCAN interfaces that provide a high-speed serial interface. Two 3-pin screw terminal blocks, J2, J3, are used to interface to the DCAN bus. The pinouts for this connector are shown in Figure 2-4. H means CAN High (CAN H), and L means CAN Low (CAN L).
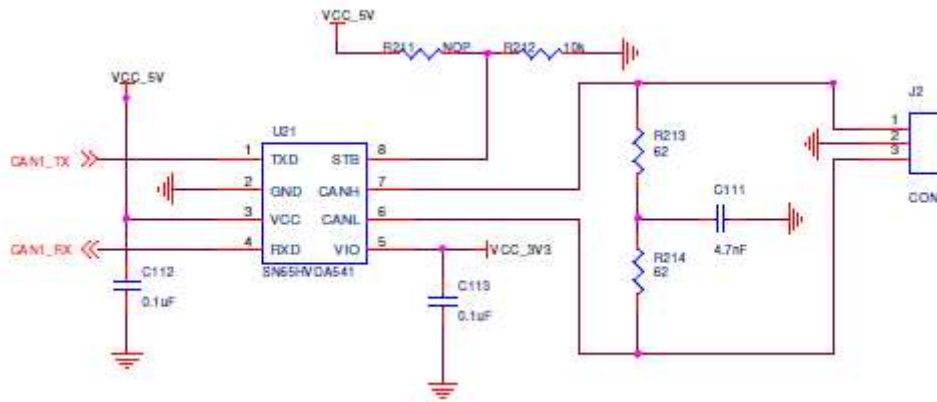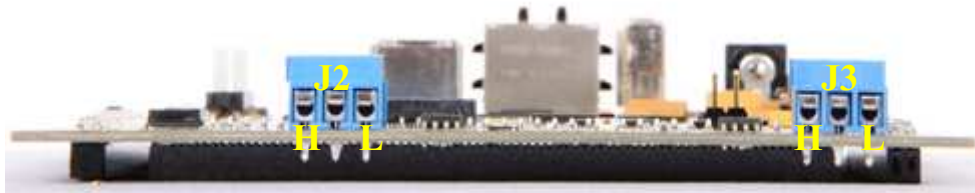
Figure 2-3. CAN Bus Termination

Figure 2-4. J2, J3 CAN Bus Interface (Screw Terminal)

2.2.4   J19, MIPI ETM Connector
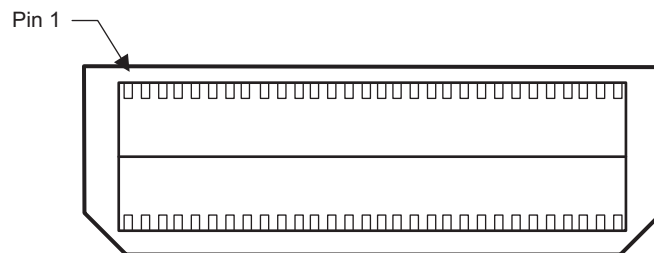
Figure 2-5 and Table 2-4 show the 60 pin MIPI header.

Figure 2-5. J19, 60 Pin MIPI ETM Header

Table 2-4. J19, MIPI Connector Signal Mapping

MCU Signals	Pin Number		Pin Number	MCU Signals
3.3V	1		2	TMS
TCK	3		4	TDO
TDI	5		6	System reset
RTCK	7		8	nTRST
NC	9		10	NC
NC	11		12	3.3 V
ETMTACECLKOUT	13		14	NC
To GND thru 0 W	15		16	GND
EMTTRACECTL	17		18	ETMDATA[19]
ETMDATA[0]	19		20	ETMDATA[20]
ETMDATA[1]	21		22	ETMDATA[21]
ETMDATA[2]	23		24	ETMDATA[22]
ETMDATA[3]	25		26	ETMDATA[23]
ETMDATA[4]	27		28	ETMDATA[24]
ETMDATA[5]	29		30	ETMDATA[25]
ETMDATA[6]	31		32	ETMDATA[26]
ETMDATA[7]	33		34	ETMDATA[27]
ETMDATA[8]	35		36	ETMDATA[28]
ETMDATA[9]	37		38	ETMDATA[29]
ETMDATA[10]	39		40	ETMDATA[30]
ETMDATA[11]	41		42	ETMDATA[31]
ETMDATA[12]	43		44	NC
ETMDATA[13]	45		46	NC
ETMDATA[14]	47		48	NC
ETMDATA[15]	49		50	NC
ETMDATA[16]	51		52	NC
ETMDATA[17]	53		54	NC
ETMDATA[18]	55		56	NC
GND	57		58	GND
NC	59		60	NC

2.2.5 J7, XDS100V2 USB JTAG Interface

The USB connector J7 is used to connect to the host development system that is running the software development IDE, Code Composer Studio. The signals on this connector are shown in Table 2-5.

Table 2-5. J7, XDS100V2 USB JTAG Interface

Pin Number	Signal Name
1	USBVDD
2	D-
3	D+
4	NC
5	USBVSS

Before the board is shipped, the XDS100V2 port1 is configured as JTAG, and port2 is configured as SCI. The CPLD on the board is also programmed to route the JTAG signals to the MCU.

There is a circuitry to detect the external JTAG emulator. If a device is plugged onto the header J4 and J19, the DS1 LED will be turned on, and XDS100V2 JTAG is disabled.

2.2.6 P1, +5 V to +12 V Input

Connector P1 is the input power connector. This connector brings in +5 V to +12 V to the HDK board. This is a 2.5 mm jack. Figure 2-6 shows this connector as viewed from the card edge.
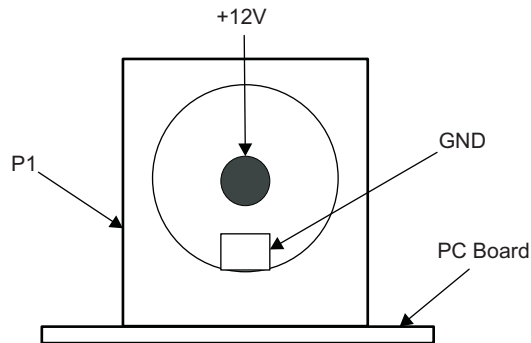

Figure 2-6. +12 V Input Jack

2.2.7 SCI Interface

The internal SCI on the TMS570LS3137 device is connected to the second port of the XDS100V2. The XDS100V2 USB driver makes the FT2232H second channel appear as a virtual COM port (VCP). This allows the user to communicate with the USB interface via a standard PC serial emulation port.

2.2.8 Daughter Card Interface

The HDK provides expansion connectors that can be used to accept plug-in daughter cards. The daughter card allows users to build on their EVM platform to extend its capabilities and provide customer and application specific I/O. The expansion connectors are for all major interfaces including asynchronous memory, peripherals, and A/D expansion.

There are three daughter card interfaces: J9, J10, J11. These connectors are described in Table 2-6.
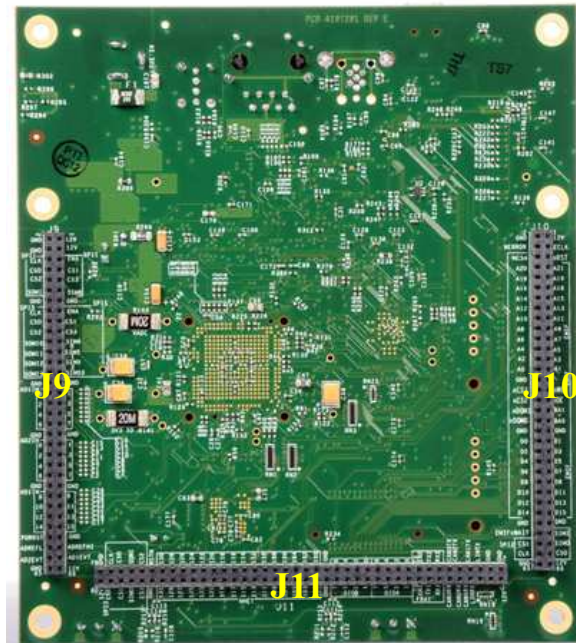
Figure 2-7. J9, J10, and J11 on HDK

Table 2-6. Expansion Connector P1 (J9, Left, BottomView)

Signal Name	Pin Number	Number		Pin Number	Signal Name
EXP_12V		1	2		GND
EXP_12V		3	4		GND
MibSPI1ENA	G19	5	6	F18	MibSPI1CLK
MibSPI1CS[1]	F3	7	8	R2	MibSPI1CS[0]
MibSPI1CS[3]	J3	9	10	G3	MibSPI1CS[2]
MibSPI1SIMO	F19	11	12	G18	MibSPI1SOMI
GND		13	14		GND
MibSPI5ENA	H18	15	16	H19	MibSPI5CLK
MibSPI5CS[1]	B6	17	18	E19	MibSPI5CS[0]
MibSPI5CS[3]	T12	19	20	W6	MibSPI5CS[2]
MibSPI5SIMO[0]	J19	21	22		MibSPI5SOMI[0]
MibSPI5SIMO[1]	E16	23	24	E17	MibSPI5SOMI[1]
MibSPI5SIMO[2]	H17	25	26	H16	MibSPI5SOMI[2]
MibSPI5SIMO[3]	G17	27	28	G16	MibSPI5SOMI[3]
GND		29	30		GND
AD1IN[1]	V17	31	32	W14	AD1IN[0]
AD1IN[3]	T17	33	34	V18	AD1IN[2]
AD1IN[5]	R17	35	36	U18	AD1IN[4]
AD1IN[7]	V14	37	38	T19	AD1IN[6]
GND		39	40		GND
AD2IN[1]	U13	41	42	V13	AD2IN[0]
AD2IN[3]	U16	43	44	U14	AD2IN[2]
AD2IN[5]	T15	45	46	U15	AD2IN[4]
AD2IN[7]	R16	47	48	R19	AD2IN[6]
AGND		49	50		GND
AD1IN[9]	W17	51	52	P18	AD1IN[8]

Table 2-6. Expansion Connector P1 (J9, Left, BottomView) (continued)

Signal Name	Pin Number	Number		Pin Number	Signal Name
AD1IN[11]	U19	53	54	U17	AD1IN[10]
AD1IN[13]	T18	55	56	T16	AD1IN[12]
AD1IN[15]	P19	57	58	R18	AD1IN[14]
GND		59	60		POR_RSTn
ADREFHI	V15	61	62	V16	ADREFLO
AD1EVT	N19	63	64	V10	AD2EVT
EXP_12V		65	66		GND

Table 2-7. Expansion Connector P2 (J10, Right, BottomView)

Signal Name	Pin Number	Number		Pin Number	Signal Name
EXP_12V		1	2		GND
ECLK	A12	3	4	B14	ERRORn
RST		5	6	M17	EMIF_CS[4]
NC	C17	7	8	C16	NC
NC	C15	9	10	D15	NC
NC	C14	11	12	D14	NC
NC	C13	13	14	C12	NC
NC	C11	15	16	C10	EMIF_ADDR[12]
EMIF_ADDR[11]	C9	17	18	C8	EMIF_ADDR[10]
EMIF_ADDR[9]	C7	19	20	C6	EMIF_ADDR[8]
EMIF_ADDR[7]	C5	21	22	C4	EMIF_ADDR[6]
EMIF_ADDR[5]	D9	23	24	D8	EMIF_ADDR[4]
EMIF_ADDR[3]	D7	25	26	D6	EMIF_ADDR[2]
EMIF_ADDR[1]	D5	27	28	D4	EMIF_ADDR[0]
GND		29	30		GND
EMIF_Wen	D17	31	32	K17	EMIF_CS[3]
EMIF_Oen	D12	33	34	L17	EMIF_CS[2]
EMIF_BA[1]	D16	35	36	D11	EMIF_DQMn[1]
EMIF_BA[0]	D13	37	38	D10	EMIF_DQMn[0]
GND		39	40		GND
EMIFDATA[1]	L16	41	42	K16	EMIFDATA[0]
EMIFDATA[3]	N16	43	44	M16	EMIFDATA[2]
EMIFDATA[5]	F4	45	46	E4	EMIFDATA[4]
EMIFDATA[7]	K4	47	48	G4	EMIFDATA[6]
EMIFDATA[9]	M4	49	50	L4	EMIFDATA[8]
EMIFDATA[11]	P4	51	52	N4	EMIFDATA[10]
EMIFDATA[13]	T6	53	54	T5	EMIFDATA[12]
EMIFDATA[15]	T8	55	56	T7	EMIFDATA[14]
GND		57	58		GND
SPI2_SOMI	D2	59	60	P3	EMIF_nWAIT
SPI2_SIMO	D1	61	62	D3	SPI2_CS1
SPI2_CS0	N3	63	64	E2	SPI2_CLK
EXP_12V		65	66		GND

Table 2-8. Expansion Connector P3 (J11, Bottom One, TopView)

Signal Name	Pin Number	Number		Pin Number	Signal Name
EXP_12V		1	2		GND
EXP_12V		3	4		GND
LINRX	A7	5	6	B7	LINTX
CAN1RX	B10	7	8	A10	CAN1TX
CAN2RX	H1	9	10	H2	CAN2TX
CAN3RX	M19	11	12	M18	CAN3TX
FRAYRX1	A15	13	14	A8	FRAYRX2
FRAYTX1	B15	15	16	B8	FRAYTX2
FRAYTXEN1	B16	17	18	B9	FRAYTXEN2
GIOA[1]	C2	19	20	A5	GIOA[0]
GIOA[3]	E1	21	22	C1	GIOA[2]
GIOA[5]	B5	23	24	A6	GIOA[4]
GIOA[7]	M1	25	26	H3	GIOA[6]
GIOB[1]	K2	27	28	M2	GIOB[0]
GIOB[3]	W10	29	30	F2	GIOB[2]
GIOB[5]	G2	31	32	G1	GIOB[4]
GIOB[7]	F1	33	34	J2	GIOB[6]
GND		35	36		GND
NHET1[1]	V2	37	38	K18	NHET1[0]
NHET1[3]	U1	39	40	W5	NHET1[2]
NHET1[5]	V6	41	42	B12	NHET1[4]
NHET1[7]	T1	43	44	W3	NHET1[6]
NHET1[9]	V7	45	46	E18	NHET1[8]
NHET1[11]	E3	47	48	D19	NHET1[10]
NHET1[13]	N2	49	50	B4	NHET1[12]
NHET1[15]	N1	51	52	A11	NHET1[14]
NHET1[17]	A13	53	54	A4	NHET1[16]
NHET1[19]	B13	55	56	J1	NHET1[18]
NHET1[21]	H4	57	58	P2	NHET1[20]
NHET1[23]	J4	59	60	B3	NHET1[22]
NHET1[25]	M3	61	62	P1	NHET1[24]
NHET1[27]	A9	63	64	A14	NHET1[26]
NHET1[29]	A3	65	66	K19	NHET1[28]
NHET1[31]	J17	67	68	B11	NHET1[30]
GND		69	70		GND
MibSPI3CS[3]	C3	71	72	B2	MibSPI3CS[2]
MibSPI3SIMO	W8	73	74	V8	MibSPI3SOMI
MibSPI3CS[1]	V5	75	76	V10	MibSPI3CS[0]
MibSPI3ENA	W9	77	78	V9	MibSPI3CLK
EXP_12V		79	80		GND

2.3 LEDs

The TMS570LS31 HDK board has 19 LEDs. Eight of these LEDs (shown in Table 2-9) are under user control. Those LEDs are controlled and programmed by NHET signals.

LEDs DS2, DS3, DS4, and DS5 indicate the presence of the power (+1.2 V, +5 V, 3.3 V, and 12 V) s on the board. The LED functions are summarized in Table 2-9 and Table 2-10.

Table 2-9. Demo LEDs

LED Number	Location	Signals	Color
D3	Left Top	NHET1[17]	White
D4	Top	NHET1[31]	White
D5	Right Top	NHET1[0]	White
D6	Right Bottom	NHET1[25]	White
D7	Bottom	NHET1[18]	White
D8	Left bottom	NHET1[29]	White
LED1	Left	NHET1[27]	White
LED2	Right	NHET1[05]	White

Table 2-10. Other LEDs as Indicator

Number	LED	Color
D1	nERROR	Red
D10	XDS100V2 SCI RX	Blue
D11	XDS100V2 SCI TX	Blue
D12	XDS100V2 PWRENn	Blue
D2	JTAG TDI	Blue
D9	Ethernet Speed	Blue
DS1	ARM JTAG Plugin	Blue
DS2	VCC_1V2	Blue
DS3	VCC_5V	Blue
DS4	VCC_3V3	Blue
DS5	VCC_12V	Blue

2.4 S2 DIP Switch

There is one 4-position DIP switches located on the left-bottom corner at reference designator S2. By default, all of the switches are set to the "OFF" position and should remain in that position when completing the steps in this user's guide.
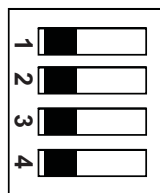
Figure 2-8. DIP Switch Settings

The S2 DIP switch is reserved for user application general purpose. Table 2-11 describes the function of each channel on S2.

Table 2-11. S2 DIP Switch Functions

Switch	OFF Position	ON Position
S2:1 [1]	USB Host0 Disabled	USB Host0 Enabled
S2:2 [2]	USB Host1 Disabled	USB Host1 Enabled
S2:3 [2]	USB Device Disabled	USB Device Enabled
S2:4 [3]	Ethernet Disabled	Ethernet Enabled

[1] S2:1 indicates slide 1 on the S2 DIP switch, S2:2 indicates slide 2 on the S2 DIP switch, and so on.
[2] S2:2 and S2:3 cannot be enabled at the same time since those two ports have pinmux.
[3] To use Ethernet, S2:4 should be enabled and all other have to be disabled.

2.5 Jumpers

The HDK board has two jumpers that are used to enable and disable the on-board SDRAM and select 5 V or 3.3 V ADC.

Table 2-12. Jumpers

Jumper Number	OFF	ON
J8	5 V ADC	3.3 V ADC
J13	SDRAM on	SDRAM Off

2.6 S4, Power On Reset Switch

TMS570LS31 MCU has two resets: warm reset (nRST) and power-on reset (nPORRST). Switch S4 is a momentary switch that asserts power on reset to the TMS570LS3137 device. The nPORRST condition is intended to reset all logic on the device including the test and emulation circuitry.

2.7 S3, System Reset Switch

Switch S3 is used to assert a warm reset the TMS570LS3137 device. Warm reset does not reset any test or emulation logic. The reset signal from window watchdog will also assert a warm reset to the MCU. The warm reset can be invoked by pushing nRST button, or by RESET signals from XDS100 CPLD, ARM JTAG SREST.

Operation Notices

The user assumes all responsibility and liability for proper and safe handling of the boards. It is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

- For additional information regarding the embedded emulation, see the XDS100 USB wiki on the TI web site at the following URL: http://tiexpressdsp.com/index.php?title=XDS100

- Code Composer Studio support is available via a forum at: http://community.ti.com/forums/138.aspx

- Hercules MCU support is available via a forum at: http://www.ti.com/hercules-support

EVALUATION BOARD/KIT/MODULE (EVM) ADDITIONAL TERMS

Texas Instruments (TI) provides the enclosed Evaluation Board/Kit/Module (EVM) under the following conditions:

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please visit www.ti.com/esh or contact TI.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used. TI currently deals with a variety of customers for products, and therefore our arrangement with the user is not exclusive. TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.

REGULATORY COMPLIANCE INFORMATION

As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant

Caution

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concerning EVMs including detachable antennas

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

Concernant les EVMs avec appareils radio

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

【Important Notice for Users of EVMs for RF Products in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,

2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or

3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

Texas Instruments Japan Limited
(address) 24-1, Nishi-Shinjuku 6 chome, Shinjuku-ku, Tokyo, Japan

http://www.tij.co.jp

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】

本開発キットは技術基準適合証明を受けておりません。

本製品のご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。
1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

　　　上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。

日本テキサス・インスツルメンツ株式会社
東京都新宿区西新宿６丁目２４番１号
西新宿三井ビル
http://www.tij.co.jp

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have *not* been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products		Applications	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		