

MSC8156ADS

This document describes the MSC8156ADS and its related hardware kit. The MSC8156ADS getting started procedure explains and verifies the board's basic operation in a step-by-step format.

Settings for switches, jumpers, LEDs, and push buttons are shown, and there are instructions for connecting peripheral devices.

The MSC8156ADS functions with an integrated development environment (IDE), such as Freescale's *CodeWarrior* IDE. Instructions for working with the IDE are beyond the scope of this document.

Note

The MSC8156ADS is provided with an MSC8156 DSP. The basic MSC8156ADS is the environment board for developing applications for the MSC8154, MSC8156, MSC8251, MSC8252, MSC8254, and MSC8256.

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1 Definitions, Acronyms, and Abbreviations

Table 1. Definitions, Acronyms, and Abbreviations

Usage	Description
ADS	Application Development System
AMC	Advanced Mezzanine Card (Form Factor)
BCSR	Board Control and Status Register (implemented in FPGA)
BP	Boot Patch Bit (in RCW)
BPRT	Boot Port Bit (in RCW)
CLK SEL	Clock Select
CLKIN	Clock Input
CLKOUT/CLKO	Clock Output
CS	PCB Component Side
CTLS	Serial RapidIO interface System Mode Bit (in RCW)
DDR	Double Data Rate Memory
DEVID	Device ID Bit (in RCW)
DIP	Dual-in-Line Package (switches)
EEPROM	Electrical Erasable Programmable Memory
EN	Enable
EP	PCI Express End Point
ETH	Ethernet
eUTAP	Embedded UTAP
EWDT	Watchdog Timer Bit (in RCW)
EXP	AMC Expand Card
FPGA	Field-Programmable Gate Array
FSL	Freescale Semiconductor
GE	Gigabit Ethernet Port Bit (in RCW)
GE/TDM	GETH/TDM Port
GETH	Gigabit Ethernet
GPIO	General Purpose IO
HDC	Hardcoded Option (RCW Source)
HRESET/HRST	Hard Reset
I/F	Interface
I ² C	Inter-Integrated Circuit Multi-master Serial Computer Bus
IDE	Integrated Development Environment
IO	Input/Output
J/JP	Jumper
LD/LED	Light-emitting Diode
MAPLE-B	Multi-Accelerator Platform Engine, Baseband
MODCK	Clock Mode
MSC8154	Four Core Broadband Wireless Access DSP with MAPLE-B
MSC8156	Six Core Broadband Wireless Access DSP with MAPLE-B
MSC8251	Single Core DSP without MAPLE-B
MSC8252	Two Core DSP without MAPLE-B

Table 1. Definitions, Acronyms, and Abbreviations (continued)

Usage	Description
MSC8254	Four Core DSP without MAPLE-B
MSC8256	Six Core DSP without MAPLE-B
MUX	Multiplexer
NMI	Non-Maskable Interrupt
OnCE/OCE	On-Chip Emulator, MSC815x Debug Port
PCB	Printed Circuit Board
PCI	Peripheral Components Interconnect Bus
PG	“Power Good”
PLL	Phased Lock Loop
PRDY	PCI Express Ready Bit (in RCW)
PRESET	Power-on-Reset
PRG	FPGA Programming
PS	PCB Print Side
RC	MSC815x Internal Module PCI Express Root Complex
RC[x]	Reset Configuration Bit x
RCW	Reset Configuration Word
RGMII	Reduced General Media Independent Interface
RHE	RIO Host Bit (in RCW)
RJ45 and RJ48	Ethernet or E1/T1 Connectors
RMII	Reduced Media Independent Interface
RMU	Serial RapidIO interface Access Port Bit (in RCW)
S1/2P	SerDes 1/2 Port
SBETH	Simple Boot from Ethernet Bit (in RCW)
SCLK	SerDes Reference Clock Bit (in RCW)
SerDes	<ul style="list-style-type: none"> • Serializer/Deserializer • High Speed Serial Communication Lines: PCI Express, serial RapidIO interface, SGMII, and so forth.
SGMII	Serial Gigabit Media Independent Interface
SIG	Signalling
SMF	MSC815x Special Mode Bit (in RCW)
SMII	Serial Media Independent Interface
SODIMM	SODIMM with ECC Functionality
SODIMM	Mini DIMM Form Factor
SPI	Synchronous Peripheral Interface
SRC	Configuration Source
SRESET/SRST	Soft Reset
SW	Switch
TDM	Time Division Multiplexing
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
UTAP	USB TAP “Wiggler”

2 Bit and Byte Conventions

Table 2. Bit and Byte Terminology

Bit		Byte	
Binary digit with a single binary value, 1 or 0. Commonly used for measuring the amount of data transferred in one second between two telecommunication points.		A unit of data, eight binary units long, that is used as a measure of computer processor storage and real and virtual memory.	
Kbps = Kbit	Kilobit per second (1 Kbps = 1000 bits)	Kbyte = KB = KByte	1 Kilobyte = 1024 bytes
Mbps = Mbit	Megabit per second (1 Mbps = 1,000,000 bits)	Mbyte = MB = MByte	1 Megabyte = ~ 1,000,000 bytes
Gbps = Gbit	Gigabit per second (1 Gbps = "billions of bits")	Gbyte = GB = GByte	1 Gigabyte = ~ 1 billion bytes

3 Related Reading

The below noted documents are available on the Freescale website (www.freescale.com) and from your local sales office or distributor.

Table 3. Related Reading

Document	Description
CodeWarrior Kit Configuration Guide	<ul style="list-style-type: none"> Complete hardware setup explanation. Kit Configuration Guide explains setting up and using each SW component in the development kit.
Data Sheet	Electrical specifications for the MSC8154, MSC8156, MSC8251, MSC8252, MSC8254, and MSC8256 device.
Reference Manual	Detailed functional description for the following DSPs: <ul style="list-style-type: none"> MSC8154 MSC8156 MSC8251 MSC8252 MSC8254 MSC8256.
Note: The ADS supports the MSC8154, MSC8156, MSC8251, MSC8252, MSC8254, and MSC8256 DSPs. For details on these products, refer to the device specific data sheet and reference manual available on the www.freescale.com website or through your local sales office or distributor.	

4 Hardware Kit Contents

1. MSC8156ADS with attached plastic spacers and screws
2. AC/DC 12 V/5.5 A universal power supply kit (1)
3. RS-232 standard serial cable with two 9-pin connectors (1)
4. Ethernet cables (2)
5. USB cable Type A to Type B (1)
6. Allen key (1)

PRINTED MATTER (not shown in Fig. 1)

- MSC8156ADS Hardware Getting Started
- Freescale Warranty Card: 920-75133
- Safety Notice: 926-75254
- Contact Information Sheet: 920-90570-00

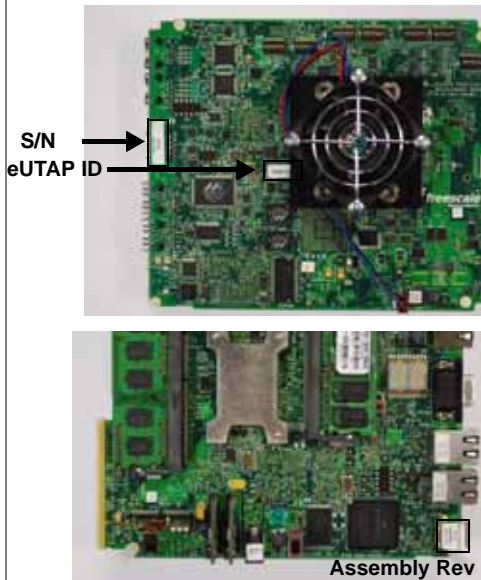


Figure 1. Hardware Kit Inventory

5 Switch Default Settings

The MSC8156ADS has dual-in-line package (DIP) switches; see [Figure 2](#) and [Table 4](#).

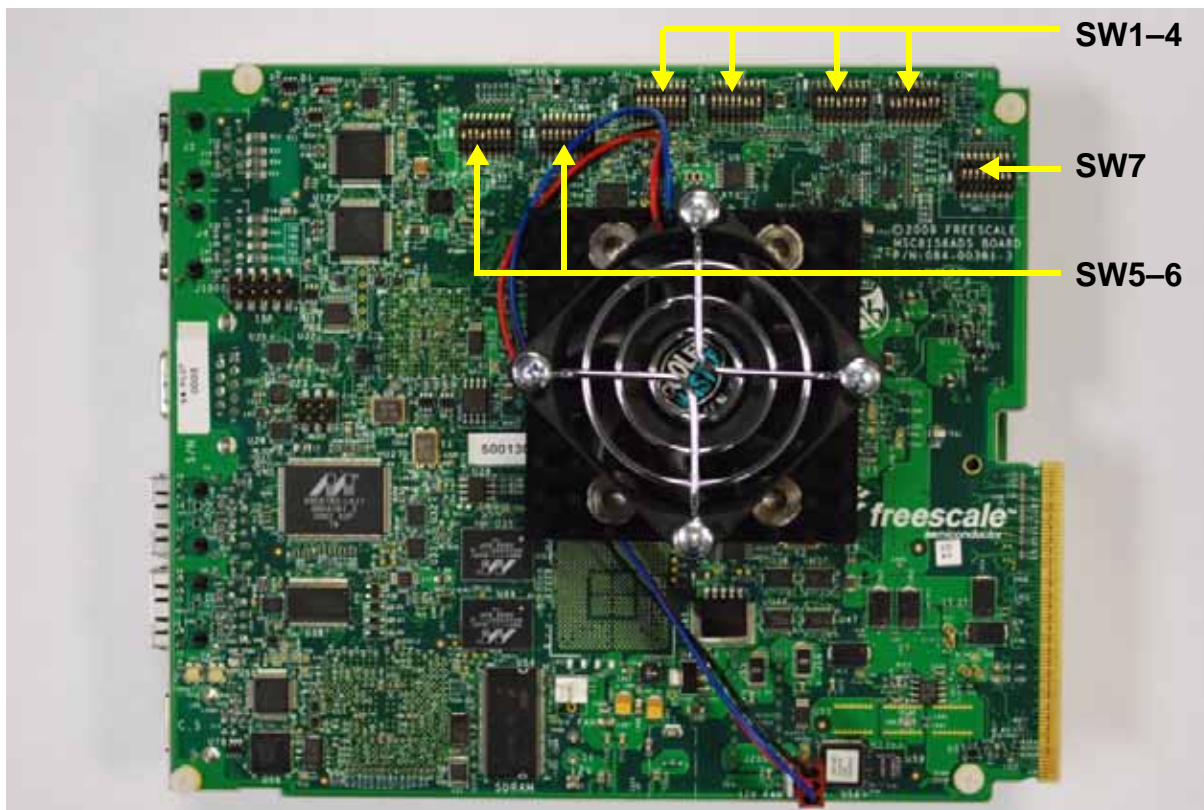


Figure 2. MSC8156ADS DIP-Switch Locations

Table 4. MSC8156ADS DIP-Switch Configurations

SW1 Configuration	
	<p>SW1.1: Boot Patch (BP)</p> <ul style="list-style-type: none"> • Default: ON <p>SW1.2: Simple Boot from ETH (SBETH)</p> <ul style="list-style-type: none"> • Default: ON (disable) <p>SW1.3: RIO Host (RHE)</p> <ul style="list-style-type: none"> • Default: ON (disable) <p>SW1.4: RapidIO Pass-Through Mode 1 (RPT)</p> <ul style="list-style-type: none"> • Default: ON (disable) <p>SW1.5: RapidIO Pass-Through Mode 2 (RIO)</p> <ul style="list-style-type: none"> • Default: ON (disable) <p>SW1.6-8: Boot Port (BPRT) Bits 0 - 2</p> <ul style="list-style-type: none"> • Default: ON (boot from I²C EEPROM)

Table 4. MSC8156ADS DIP-Switch Configurations (continued)

SW2 Configuration	
	<p>SW2.1-3: Device ID (DEVID) Bits 3:5</p> <ul style="list-style-type: none"> • Default: ON (DEVID[5:3] = 0) <p>SW2.4: Serial RapidIO interface Port 2 (R2A)</p> <ul style="list-style-type: none"> • Default: ON (no ID accepted) <p>SW2.5: Serial RapidIO interface Port 1 (R1A)</p> <ul style="list-style-type: none"> • Default: ON (no ID accepted) <p>SW2.6: RGMII Port 2 IO (GE2)</p> <ul style="list-style-type: none"> • Default: OFF (RGMII2 is active) <p>SW2.7: RGMII Port 1 IO (GE1)</p> <ul style="list-style-type: none"> • Default: OFF (RGMII1 is active) <p>SW2.8: SMF</p> <ul style="list-style-type: none"> • Default: ON (mode disable); hidden bit
SW3 Configuration	
	<p>SW3.1: SerDes Port 2 (S2P4)</p> <ul style="list-style-type: none"> • Default: ON (S1P[4:0] = 3) • S2P: Bit 4 <p>SW3.2-3: CLOCK-OUT Control (CLKO0, CLKO1)</p> <ul style="list-style-type: none"> • Default: ON (CLKOUT = 75 MHz) <p>SW3.4: Serial RapidIO interface System Mode (CTLS)</p> <ul style="list-style-type: none"> • Default: OFF • Works in Common Transport Large System mode. <p>SW3.5: Serial RapidIO interface Access Port (RMU)</p> <ul style="list-style-type: none"> • Default: ON • Selects SerDes Port1 RMU local memory access. <p>SW3.6-8: DEVID Bits 0-2</p> <ul style="list-style-type: none"> • Default: ON (DEFID[2:0] = 0)
SW4 Configuration	
	<p>SW4.1-4: SerDes Port 1 (S1P) Configuration Bits 0-3</p> <ul style="list-style-type: none"> • Default: OFF OFF ON ON (S0P = 3) • SerDes Port1 configures as Serial RapidIO interface x4 3.125GHz. <p>SW4.5-8: SerDes Port 2 (S2P) Configuration Bits 0-3</p> <ul style="list-style-type: none"> • Default: OFF OFF ON ON (S1P = 3) • SerDes Port2 configures as Serial RapidIO interface x4 3.125GHz.

Table 4. MSC8156ADS DIP-Switch Configurations (continued)

SW5 Configuration	
	<p>SW5.1: Debug Request</p> <ul style="list-style-type: none"> • Default: OFF (MSC815x enters Debug mode after reset.) <p>SW5.2: SGMII/Serial RapidIO interface Differential Switch Select 1</p> <ul style="list-style-type: none"> • Default: ON (MSC815x works in SerDes Port1 Serial RapidIO interface x4 mode.) <p>SW5.3: SGMII/Serial RapidIO interface Differential Switch Select 2</p> <ul style="list-style-type: none"> • Default: ON (MSC815x works in SerDes Port2 Serial RapidIO interface x4 mode.) <p>SW5.4: SHMOO</p> <ul style="list-style-type: none"> • Default: OFF <p>SW5.5: SGMII or RGMII Select 1</p> <ul style="list-style-type: none"> • Default: ON (RGMII mode for GE port 1.) <p>SW5.6: SGMII or RGMII Select 2</p> <ul style="list-style-type: none"> • Default: ON (RGMII mode for GE port 2.) <p>SW5.7: PLL1EN</p> <ul style="list-style-type: none"> • Default: ON (Enable to PLL.) <p>SW5.8: Spare</p> <ul style="list-style-type: none"> • Default: ON
SW6 Configuration	
	<p>SW6.1: Boot Port (BPRT) Bit 3</p> <ul style="list-style-type: none"> • Default: ON (BPRT[3:0] = 0 for boot from I²C EEPROM) <p>SW6.2: PCI Express Ready (PRDY)</p> <ul style="list-style-type: none"> • Default: ON (Not ready for PCI Express RC mode.) <p>SW6.3: Watchdog (EWDT)</p> <ul style="list-style-type: none"> • Default: ON (Watchdog disabled.) <p>SW6.4: PCI Express Root Complex (RC)</p> <ul style="list-style-type: none"> • Default: ON (PCI Express functions if EP mode-enabled.); hidden bit <p>SW6.5: RCWH30 (EC)</p> <p>SW6.6-8: Configuration Source (SRC) Bits 0 - 2</p> <ul style="list-style-type: none"> • Default: ON ON ON (RCW loaded from DIP-switches.)
SW7 Configuration	
	<p>SW7.1-6: MODCK bit 0 to 5.</p> <ul style="list-style-type: none"> • Default: ON (MODCK[5:0] = 0) <p>SW7.7: SerDes Port 1 Reference Clock (SCLK1)</p> <ul style="list-style-type: none"> • Default: OFF (SerDes Port 1 reference clock is 125MHz.) <p>SW7.8: SerDes Port 2 Reference Clock (SCLK2)</p> <ul style="list-style-type: none"> • Default: OFF (SerDes Port 2 reference clock is 125MHz.)

The default DIP-switch positions establish MSC8156ADS configuration modes; listed in [Table 5](#).

Note

Ensure DIP-switches are set according to default values.

Table 5. MSC8156ADS Default Configuration Modes

Mode	Value
CLKIN	100 MHz
CLKOUT	75 MHz
Cores	1000 MHz
DDR1 and DDR2	800 Mbps
MAPLE	450 MHz
QUICC Engine Subsystem	500 MHz
Serial RapidIO interface	3.125 Gbps

6 Jumper Default Settings

Table 6 lists MSC8156ADS factory default jumper settings. See Figure 3 for jumper locations.

Table 6. MSC8156ADS Jumper Default Settings

#	Name	OPEN Position	CLOSED Position
J2002-3 and J2004-5	2xC	<ul style="list-style-type: none"> MSC8154 mode. This includes MSC8154, MSC8251, MSC8252, and MSC8254. 	<ul style="list-style-type: none"> MSC8156 mode. This includes MSC8156 and MSC8256.
JP1	AMC EXP	<ul style="list-style-type: none"> Default Single board mode 	<ul style="list-style-type: none"> Two MSC8156-ADS boards are linked via an AMC-X-Over expansion card. JTAG bus is chained.
JP2	PRESET	<ul style="list-style-type: none"> Default MSC8156ADS functions normally. 	<ul style="list-style-type: none"> MSC8156-ADS is in continuous PRESET (debug mode).
JP3	CLK SEL	-	<p>1-2 (Default)</p> <ul style="list-style-type: none"> MSC815x clock source is clock oscillator “CLKIN”: <p>2-3</p> <ul style="list-style-type: none"> MSC815x clock source is an external pulse generator connected to P2 “EXT CLK”.
JP1000	PRG	<ul style="list-style-type: none"> Default 	<p>1-2</p> <ul style="list-style-type: none"> Forces FPGA programming over eUTAP. <p>2-3</p> <ul style="list-style-type: none"> Forces FPGA programming over J1000 ISP connector.

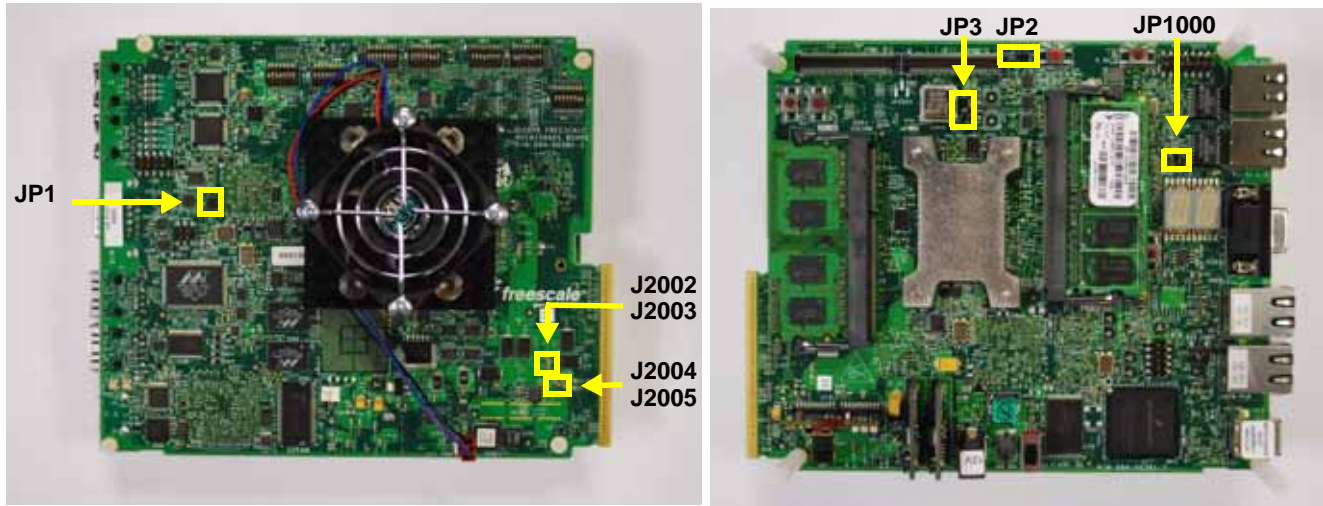


Figure 3. MSC8156ADS Jumper (JP) Locations

7 Connector Default Settings

Table 7 lists MSC8156ADS factory default connector, header, and socket settings. See Figure 4 for connector locations.

Table 7. MSC8156ADS Connector Default Settings

#	Type	Description	Function
J1	Connector (64-pin)	PTMC-3	<ul style="list-style-type: none"> Transmits MSC815x TDM port signals. Used for interconnection and debug purposes.
J2	Connector (64-pin)	PTMC-1	<ul style="list-style-type: none"> Transmits MSC815x GPIO signals. Used for interconnection and debug purposes.
J3	Connector (RJ48)	E1/T1-0,1	<ul style="list-style-type: none"> Transmits MSC815x TDM Analog Port 0 and 1 signals.
J4	Connector (RJ48)	E1/T1-2,3	<ul style="list-style-type: none"> Transmits MSC815x TDM Analog Port 2 and 3 signals.
J5	SODIMM Socket (200-pin)	DDR2-SODIMM	<ul style="list-style-type: none"> DDR2 SODIMM socket
J6	SODIMM Socket (204-pin)	DDR3-SODIMM	<ul style="list-style-type: none"> DDR3 SODIMM socket
J7	Connector (9-pin)	DB9F	<ul style="list-style-type: none"> MSC815x UART interface
J8	Connector (RJ45)	GE1	<ul style="list-style-type: none"> MSC815x GETH port1 1000-BaseT
J9	Header (10-pin)	DPI	<ul style="list-style-type: none"> MPC866 debug port connector
J10	Header (3-pin)	866 UART	<ul style="list-style-type: none"> MPC866 UART interface
J11	Connector (RJ45)	GE2	<ul style="list-style-type: none"> MSC815x GETH port2 1000-BaseT
J12	Header (2-pin)	5V FAN	<ul style="list-style-type: none"> Provides power for on-socket fan.
J13	Socket (Type B)	USB2.0	<ul style="list-style-type: none"> USB2.0 interface
J1000	Header (10-pin)	ISP	<ul style="list-style-type: none"> Lattice FPGA programming
J2000	Header (3-pin)	12V FAN	<ul style="list-style-type: none"> Provides power for on-socket fan.
P1	Header (14-pin)	OnCE	<ul style="list-style-type: none"> OnCE connector for external UTAP
P2	RF Connector	EXT CLK	<ul style="list-style-type: none"> [Optional] External pulse generator for MSC815x CLKIN input.

Table 7. MSC8156ADS Connector Default Settings (continued)

#	Type	Description	Function
P3	RF Connector	CLKOUT	<ul style="list-style-type: none"> [Optional] Measures MSC815x CLKOUT signal.
P4	Edge Connector	AMC Backplane	<ul style="list-style-type: none"> SerDes high-speed connector
P5	Power Connector	12V	<ul style="list-style-type: none"> External power supply

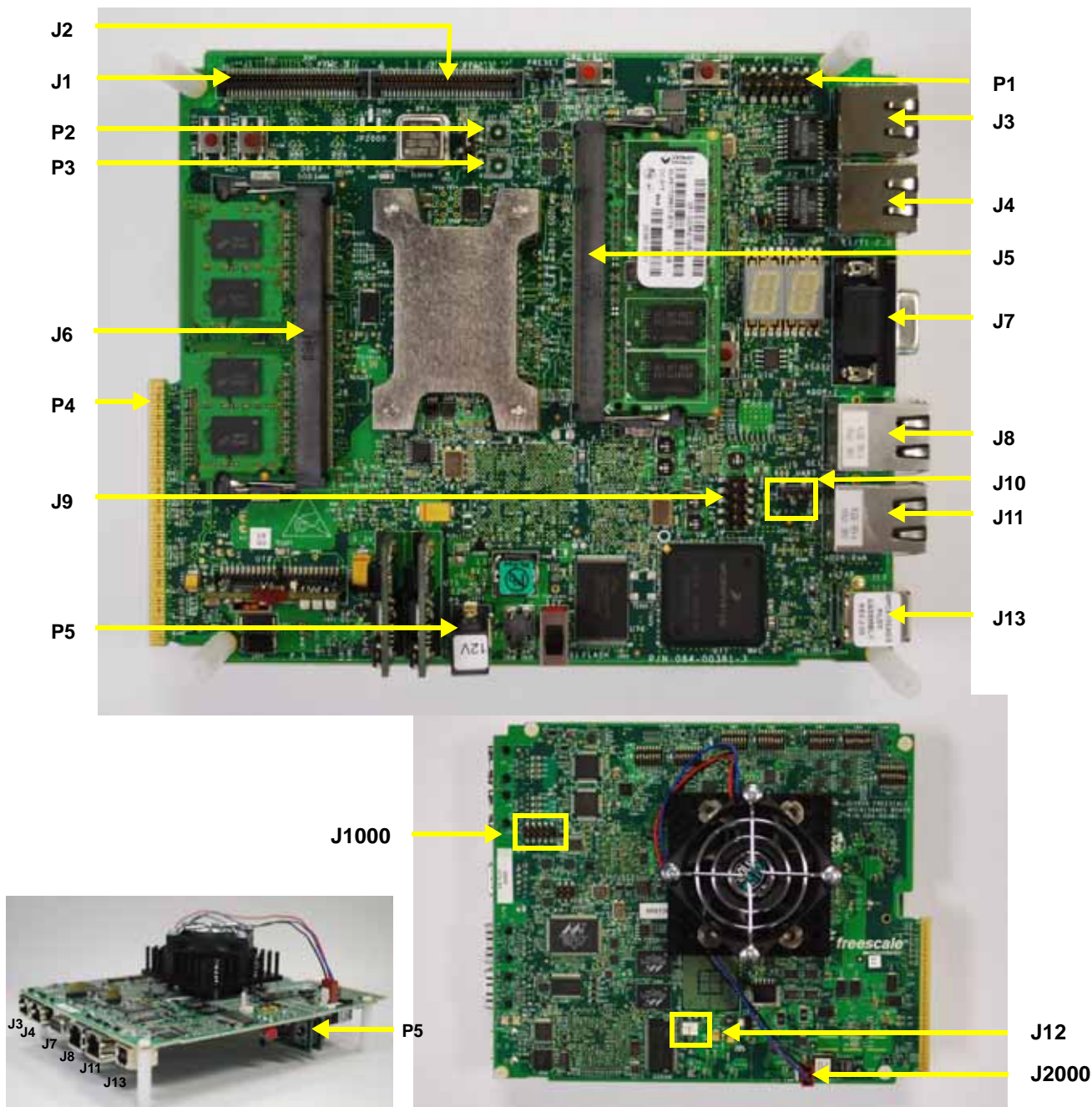


Figure 4. MSC8156ADS Connector Locations

8 LED Indicators

Table 8 lists MSC8156ADS LED indicator functions. See Figure 5 for LED locations.

Table 8. MSC8156ADS LEDs

#	NAME	Color	LED On	Flashing LED	LED Off
LD1	LINK-2	Green	SGMII switch Port 2 link	-	No link.
LD2	LINK-1	Green	SGMII switch Port 1 link	-	No link.
LD3	TARGET	Multicolor	-	Indicates <u>one</u> of the below: <ul style="list-style-type: none"> Red for powered but not configured eUTAP. Green for properly configured eUTAP. Orange when transferring data. 	eUTAP is inactive.
LD4	HOST	Multicolor	Indicates <u>one</u> of the below: <ul style="list-style-type: none"> Unlit until debugger connects to eUTAP. Green when target is running. Red if target pauses. Orange when target is in mixed mode. 	-	eUTAP is inactive.
LD5	BOOT	Green	-	MSC815x boot from: <ul style="list-style-type: none"> I²C EEPROM, or SPI Flash. 	Normal operation.
LD6	SIG2	Green	Indicates BCSR0.6 is low.	-	Indicates BCSR0.6 is high.
LD7	SIG0	Orange	Indicates <u>one</u> of the below: <ul style="list-style-type: none"> BCSR11.0 is low. MSC815x HRESET is asserted. 	-	Indicates that: <ul style="list-style-type: none"> BCSR11.0 is high. MSC815x HRESET is negated.
LD8	DEBUG	Green	MSC815x in debug mode.	-	MSC815x in run mode.
LD9	SIG3	Green	Indicates BCSR11.6 is low.	-	Indicates BCSR11.6 is high.
LD10	SIG1	Orange	Indicates <u>one</u> of the below: <ul style="list-style-type: none"> BCSR11.1 is low. MSC815x SRESET is asserted. 	-	Indicates that: <ul style="list-style-type: none"> BCSR11.1 is high. MSC815x SRESET is negated.
LD11	PRG	Green	FPGA programming is in progress.	-	Normal operation
LD12	-	LED Display	-	-	-
LD13	12V	Green	Indicates external 12V power source. ¹	-	Power off
LD14	PG	Green	“Power Good”	-	No power

¹ Critical indicator.

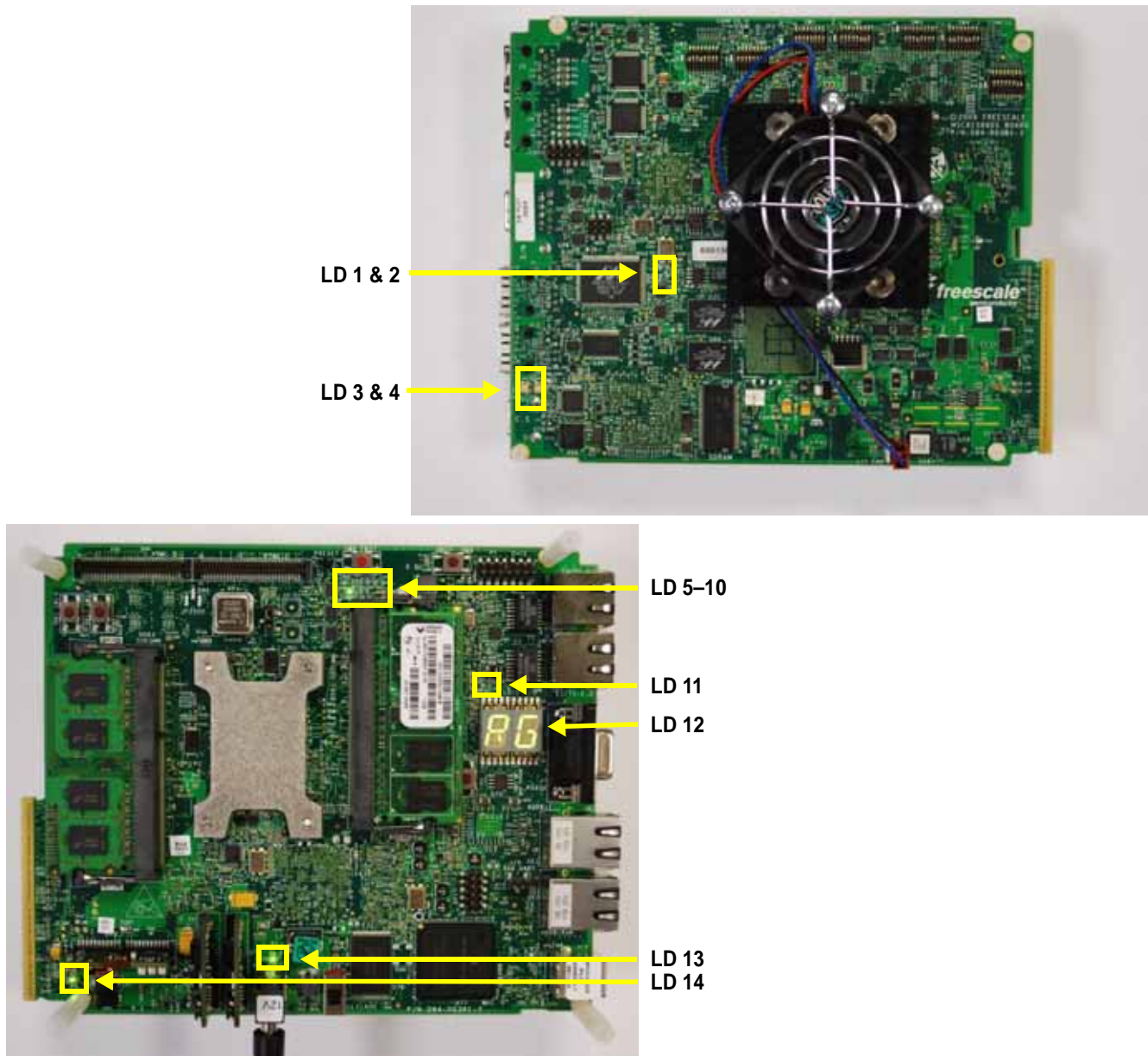


Figure 5. MSC8156ADS LED Locations

9 LED Scroll Display

The MSC8156ADS features a two-digit LED (LD12) display that provides status information. The scroll bar option, available via the SW12 push button, allows users to move through available settings.

1. Apply power to the MSC8156ADS.
2. Initial state of LD12 provides category readings; see [Table 9](#).
3. Push SW12 once for core temperature reading.
4. Push SW12 again to return to category readings.

Note

For easier reading, an asterisk symbol separates display categories and mode values.







Table 9. LED Indicators

Category	Mode Values	Description
RCW	4CYC	<ul style="list-style-type: none"> • Multiplexed external RCW loading. • RCW is driven by external logic on RC[15–0] in four cycles.
	RDUC	<ul style="list-style-type: none"> • RCW from RC[21–0].
	I2CS	<ul style="list-style-type: none"> • RCW is loaded from I²C EEPROM with memory size < 4 KB (referred to as small EEPROM).
	I2CB	<ul style="list-style-type: none"> • RCW is loaded from I²C EEPROM with memory size > 16 KB (referred to as large EEPROM).
	HDC1 or HDC2	<ul style="list-style-type: none"> • RCW source is an internal hardcoded option (1 or 2)
GE/TDM	GE	<ul style="list-style-type: none"> • RGMII Ethernet I/F is active on the MUX port.
	TDM	<ul style="list-style-type: none"> • TDM ports 0 to 3 are selected on the MUX port.
ETH	RGMII1.RGMII2	<ul style="list-style-type: none"> • DIP-switches SW5.5 and 5.6 enable RGMII and SGMII mode combinations for GETH ports.
	RGMII1.SGMII2	
	SGMII1.RGMII2	
	SGMII1.SGMII2	
BOOT	I2C	<ul style="list-style-type: none"> • Boot from I²C EEPROM
	SPI	<ul style="list-style-type: none"> • Boot from SPI Serial Flash
	Serial RapidIO interface	<ul style="list-style-type: none"> • Boot from Serial RapidIO interface port over AMC edge connector
	RGMII1 or RGMII2	<ul style="list-style-type: none"> • Boot from appropriate RGMII port.
	SGMII1 or SGMII2	<ul style="list-style-type: none"> • Boot from appropriate SGMII port.

10 Power Switch and Push Buttons

Table 10 lists the functioning of the MSC8156ADS power switch and push buttons. Figure 6 shows their location.

Table 10. Power Switch and Push Button Functionality

Push Button	Position	Description & Default
S1: ON/OFF		Power switch
SW8: PRESET		Press to PRESET all board components.
SW9: HRST		Press for HRESET.
SW10: NMI (IRQ0)		Press to issue a level 0 interrupt to the board. Note This aborts program execution.
SW11: SRST		Press for SRESET.
SW12: SCROLL		Press to scroll through LED displays.

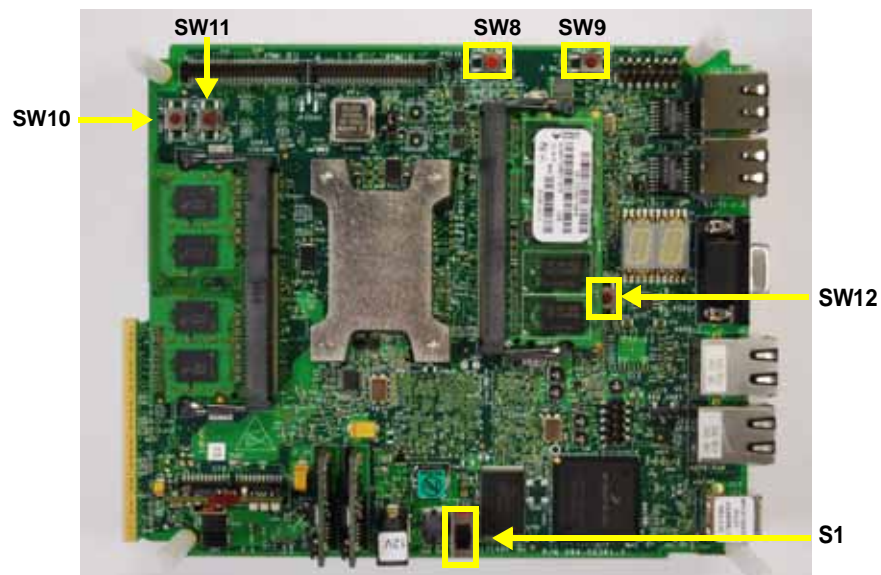


Figure 6. MSC8156ADS Power Switch and Push Button Locations

11 Getting Started Procedure

Use the following steps to set up and initial the ADS:

1. Review the kit contents as listed in [Section 4 Hardware Kit Contents](#) and make sure you have all the components.
2. Review the default switch settings as listed in [Section 5 Switch Default Settings](#) and verify that all switches on the board are set correctly.
3. Review the jumper settings as listed in [Section 6 Jumper Default Settings](#) and verify that all jumpers are set correctly for your desired configuration.
4. Assemble and connect the 12 V power supply (see [Figure 7](#)) using the following steps:
 - a) Make sure that all power is turned off.
 - b) Assemble the AC/DC power supply kit, as follows:
 - Attach the power cable with the country-specific wall output plug for your area.
 - Attach the cable with the plug for the board connection.
 - c) Connect the AC/DC power supply cable to the 12 V (P5) board jack.
 - d) Plug the power cable into the wall outlet.
 - e) Insert one end of the USB cable into J13, the board USB socket. Insert the other cable end into the USB port on a PC.

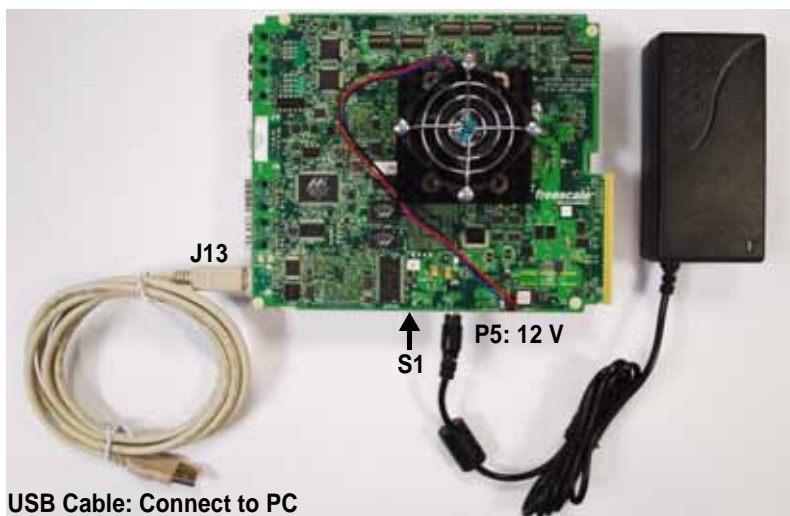


Figure 7. Power Supply Assembly

5. Referring to the information listed in [Section 8 LED Indicators](#), perform the initial power up and check using the following steps:
 - a) Move the power switch (S1) to the ON position, and check for completion of the PRESET sequence; LEDs 13 and 14 display a constant green light.
 - b) Power the system off by moving the power switch (S1) to the OFF position.

Note

Standalone Mode: The board receives power from an external 12 V power supply via the 12 V power jack (P5).

AMC Mode: The board receives power from the AMC-X-Over card.



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