



AirPrime SL6087 User Guide

AirPrime SL6087



SIERRA
WIRELESS

WA_DEV_SL6087_PTS_002

001

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Important Notice

Due to the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. Although significant delays or losses of data are rare when wireless devices such as the Sierra Wireless modem are used in a normal manner with a well-constructed network, the Sierra Wireless modem should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. Sierra Wireless accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the Sierra Wireless modem, or for failure of the Sierra Wireless modem to transmit or receive such data.

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Note: Some airlines may permit the use of cellular phones while the aircraft is on the ground and the door is open. Sierra Wireless modems may be used at this time.

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5,515,013	5,629,960	5,845,216	5,847,553	5,878,234	5,890,057	5,929,815	6,169,884
6,191,741	6,199,168	6,339,405	6,359,591	6,400,336	6,516,204	6,561,851	6,643,501
6,653,979	6,697,030	6,785,830	6,845,249	6,847,830	6,876,697	6,879,585	6,886,049
6,968,171	6,985,757	7,023,878	7,053,843	7,106,569	7,145,267	7,200,512	7,295,171
7,287,162	D442,170	D459,303	D599,256	D560,911			

and other patents pending.

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Consult our website for up-to-date product descriptions, documentation, application notes, firmware upgrades, troubleshooting tips, and press releases: www.sierrawireless.com

Document History

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1. Introduction

The AirPrime SL6087 Intelligent Embedded Module is a self-contained GSM850/PCS-GPRS/EGPRS 850/1900 dual-band embedded module.

1.1. Physical Dimensions

- Length: 30.0mm
- Width: 25.0mm
- Thickness: 2.65mm (excluding label thickness)
- Weight: 3.8g

1.2. GSM/GPRS/EGPRS Features

- 2-Watt EGSM – GPRS 850 radio section running under 3.6 volts
- 1-Watt GSM – GPRS 1900 radio section running under 3.6 volts
- 0.5-Watt EGPRS 850 radio section running under 3.6 volts
- 0.4-Watt EGPRS 1900 radio section running under 3.6 volts
- Hardware GSM/GPRS class 10 and EGPRS class 10 capable

1.3. Interfaces

- Digital section running under 2.8V and 1.8V
- 3V/1V8 SIM interface
- Complete Interfacing:
 - Power supply
 - Serial link
 - Analog audio
 - PCM digital audio
 - SIM card
 - USB 2.0 slave
 - Serial LCD (not available with AT commands)

1.4. Operating System

- Real Time Clock (RTC) with calendar
- Battery charger
- Echo cancellation + noise reduction (quadri codec)
- Full GSM or GSM/GPRS/EGPRS Operating System stack

1.5. Connection Interfaces

The SL6087 Embedded Module has a 74-solderable pad LGA form factor that includes:

- One RF connection pad (antenna connection)
- Baseband signals connection

1.6. Environment and Mechanics

1.6.1. RoHS Directive Compliant

The AirPrime SL6087 Embedded Module is compliant with RoHS Directive 2002/95/EC which sets limits for the use of certain restricted hazardous substances. This directive states that “from 1st July 2006, new electrical and electronic equipment put on the market does not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE)”.



1.6.2. Disposing of the Product

This electronic product is subject to the EU Directive 2002/96/EC for Waste Electrical and Electronic Equipment (WEEE). As such, this product must not be disposed off at a municipal waste collection point. Please refer to local regulations for directions on how to dispose of this product in an environmental friendly manner.





2. Functional Specifications

2.1. Functional Architecture

2.1.1. RF Functionalities

The Radio Frequency (RF) functionalities of the AirPrime SL6087 Embedded Module comply with the Phase II GSM 850/PCS 1900 recommendations. The frequency range for the transmit band and receive band are given in the table below.

Table 1: List of RF Frequency Ranges

RF Bandwidth	Transmit Band (Tx)	Receive Band (Rx)
GSM 850	824 to 849 MHz	869 to 894 MHz
PCS 1900	1850 to 1910 MHz	1930 to 1990 MHz

The Radio Frequency (RF) component is based on a specific quad-band chip that includes the following:

- Quad-band LNAs (Low Noise Amplifier)
- Direct Conversion Receiver
- Offset PLL/PL (Phase Locked Loop and Polar Loop) transmitter
- Frequency synthesizer
- Digitally controlled crystal oscillator (DCXO)
- Tx/Rx FEM (Front-End module) for quad-band GSM/GPRS/EGPRS

2.2. Operating System

The AirPrime SL6087 Embedded Module is Sierra Wireless Software Suite compliant. With the Sierra Wireless Software Suite and the AirPrime SL6087 Embedded Module, customers can embed their own applications with the AirPrime SL6087 and turn the AirPrime SL6087 embedded module into a solution for their specific market need.

The operating system allows for the AirPrime SL6087 Embedded Module to be controlled by AT commands. However, some interfaces in the AirPrime SL6087 Embedded Module may still not be available even with AT command control as these interfaces are dependent on the peripheral devices connected to the AirPrime SL6087 Embedded Module.



3. Technical Specifications

3.1. Power Supply

The following table describes the electrical characteristics of the input power supply voltage that will guarantee nominal functioning of the AirPrime SL6087 Embedded Module.

Table 2: Input Power Supply Voltage

	V _{MIN}	V _{NOM}	V _{MAX}	Ripple Max (U _{ripp})	I _{peak} Max
VBATT	3.2V ^{1,2}	3.6V	4.8V	250mVpp (freq < 10kHz) 40mVpp (10kHz < freq < 100kHz) 5mVpp (freq > 100kHz) (TBC)	2.0A

1: This value must be guaranteed during the burst (with 2.0A Peak in GSM, GPRS or EGPRS mode)

2: Maximum operating Voltage Standing Wave Ratio (VSWR) 2:1.

3.2. Mechanical Specifications

The AirPrime SL6087 Embedded Module has a nearly-complete self-contained shield. The mechanical specifications are shown in the figures below, including the area needed for the AirPrime SL6087 Embedded Module to fit in an application.

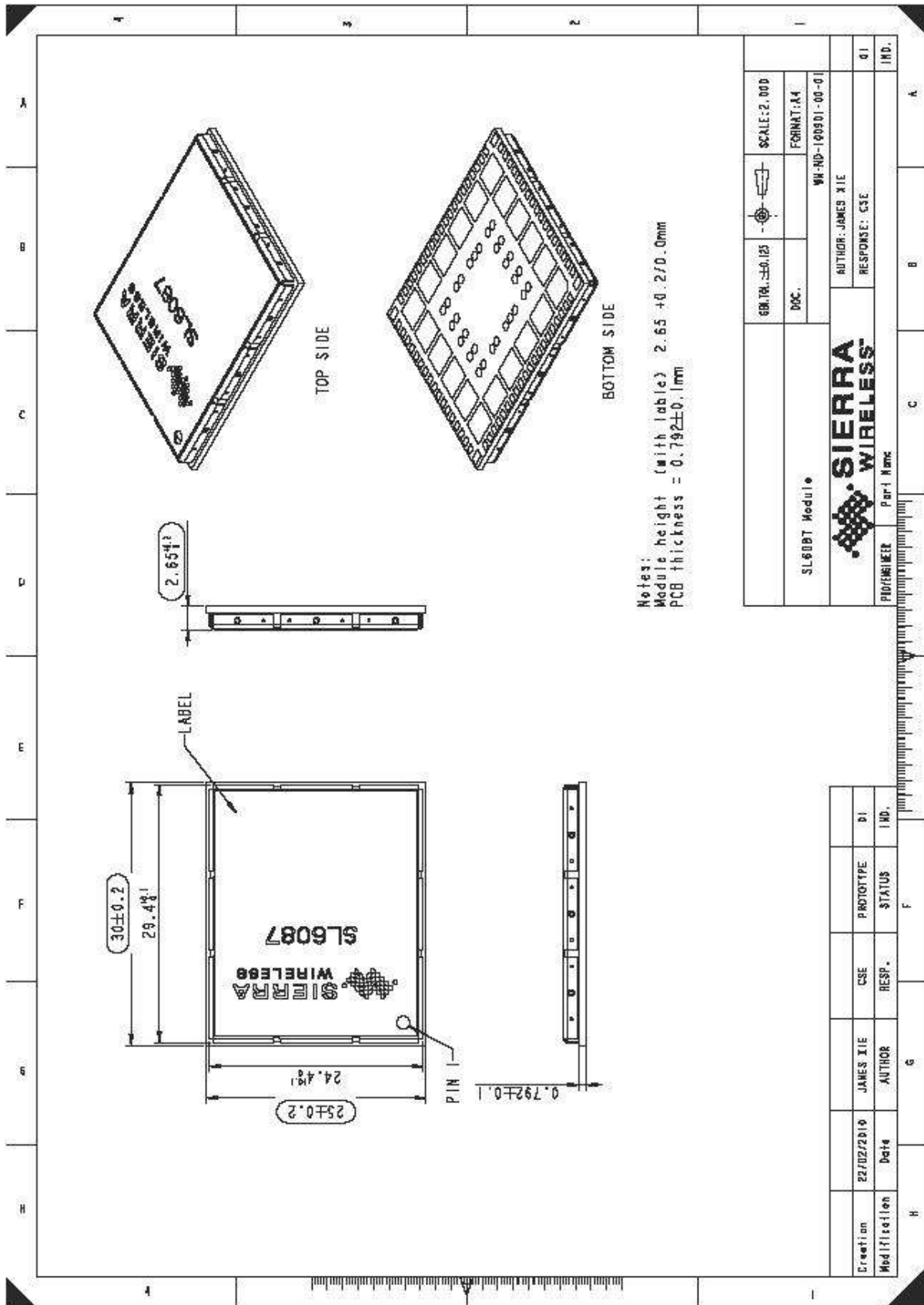


Figure 1. SL6087 Embedded Module Mechanical Drawing

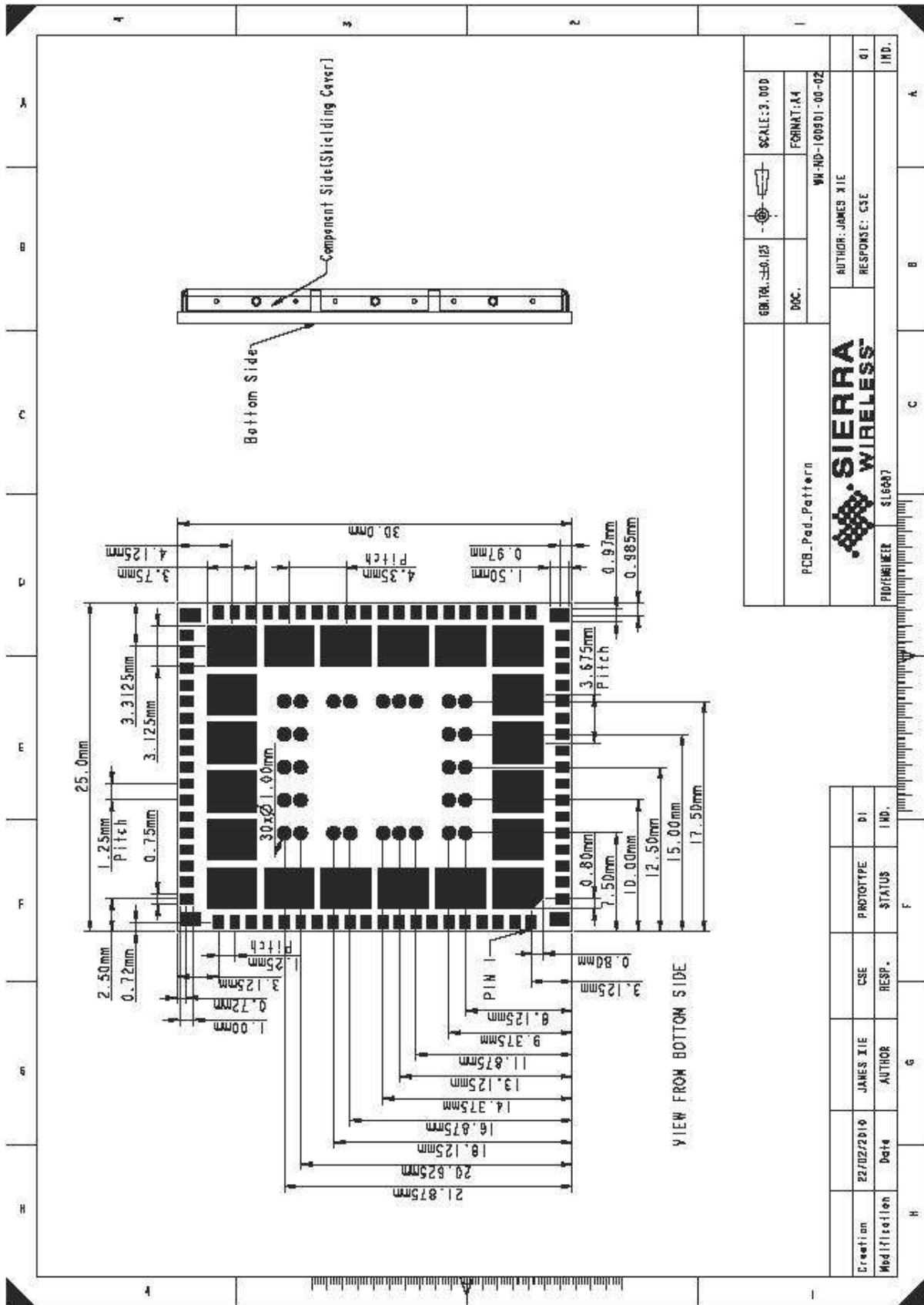


Figure 2. LGA Pin Dimension and Location

4. Interfaces

4.1.1. Pin Description

Refer to the following table for the LGA pads description.

Table 3: LGA Pads Description

Pin #	Signal Name		I/O Type	Voltage	I/O*	Reset State	Description	Dealing with Unused Pins
	Nominal	Mux						
1	CT104-RXD1	GPIO5		VCC_2V8	O	1	Main RS232 Receive	(RXD1) Add a test point for firmware update
2	~CT106-CTS1	GPIO7		VCC_2V8	O	Z	Main RS232 Clear To Send	(CTS1) Add a test point for firmware update
3	BAT-RTC			BAT-RTC	I/O		RTC Battery connection	NC
4	GPIO0	32kHz		VCC_2V8	I/O	32 kHz		NC
5	AUX-ADC			Analog	I		Analog to Digital Input	Pull to GND
6	SIM-VCC			1V8 or 3V	O		SIM Power Supply	
7	~SIM-RST			1V8 or 3V	O	0	SIM reset Output	
8	SIM-IO			1V8 or 3V	I/O	Pull-up (about 10kΩ)	SIM Data	
9	SIM-CLK			1V8 or 3V	O	0	SIM Clock	
10	SIMPRES	GPIO18		VCC_1V8	I	Z	SIM Detection	NC
11	~SPI1-I_CS	GPIO20		VCC_2V8	I/O	Z	SPI1 Chip Select	NC
12	SPI1-CLK	GPIO12		VCC_2V8	O	Z	SPI1 Clock	NC
13	SPI1-IO	GPIO13		VCC_2V8	I/O	Z	SPI1 Data Input / Output	NC
14	SPI1-I	GPIO19		VCC_2V8	I	Z	SPI1 Data Input	NC
15	GPIO21			VCC_2V8	I/O	Undefined		NC

Pin #	Signal Name		I/O Type	Voltage	I/O*	Reset State	Description	Dealing with Unused Pins
	Nominal	Mux						
16	SDA	GPIO2		Open Drain	I/O	Z	I ² C Data	NC
17	SCL	GPIO1		Open Drain	O	Z	I ² C Clock	NC
18	BOOT			VCC_1V8	I		Not Used	Add a test point / a jumper/ a switch to VCC_1V8 (Pin 5) in case Download Specific mode is used (See product specification for details)
19	Reserved_19							
20	Reserved_20							
21	GND							
22	ANT							
23	GND							
24	NC							
25	GND							
26	NC							
27	NC							
28	GND							
29	NC							
30	GND							
31	Reserved_31							
32	Reserved_32							
33	Reserved_33							
34	Reserved_34							
35	Reserved_35							
36	Reserved_36							
37	GPIO24			VCC_2V8	I/O	Z		NC
38	GPIO22			VCC_2V8	I/O	Z		NC

Pin #	Signal Name		I/O Type	Voltage	I/O*	Reset State	Description	Dealing with Unused Pins
	Nominal	Mux						
39	GPIO23			VCC_2V8	I/O	Z		NC
40	ADC1/BAT-TEMP			Analog	I		Analog temperature	Pull to GND
41	CHG-IN			CHG-IN	I		Charger input	NC
42	ADC0/VBATT			VBATT	I		Power Supply	
43	ON/~OFF			VBATT	I		ON / ~OFF Control	
44	ADC0/VBATT			VBATT	I		Power Supply	
45	CT103-TXD2	GPIO14		VCC_1V8	I	Z	Auxiliary RS232 Transmit	(TXD2) Pull-up to VCC_1V8 with 100kΩ and add a test point for debugging
46	CT104-RXD2	GPIO15		VCC_1V8	O	Z	Auxiliary RS232 Receive	Add a test point for debugging
47	~CT106-CTS2	GPIO16		VCC_1V8	O	Z	Auxiliary RS232 Clear To Send	(CTS2) Add a test point for debugging
48	~CT105-RTS2	GPIO17		VCC_1V8	I	Z	Auxiliary RS232 Request To Send	(RTS2) Pull-up to VCC_1V8 with 100kΩ and add a test point for debugging
49	VPAD-USB			VPAD-USB	I		USB Power supply input	NC
50	USB-DP			VPAD-USB	I/O		USB Data	NC
51	USB-DM			VPAD-USB	I/O		USB Data	NC
52	GND							
53	MICP			Analog	I		Microphone Input Positive	NC
54	MICN			Analog	I		Microphone Input Negative	NC
55	Reserved_55							
56	SPKN			Analog	O		Speaker Output Negative	NC
57	SPKP			Analog	O		Speaker Output Positive	NC
58	VCC_2V8			VCC_2V8	O		2.8V Supply Output	NC
59	VCC_1V8			VCC_1V8	O		1.8V Supply Output	NC

Pin #	Signal Name		I/O Type	Voltage	I/O*	Reset State	Description	Dealing with Unused Pins
	Nominal	Mux						
60	LED0			Open Drain	O	1 and Undefined	LED0 Output	NC
61	INT0	GPIO3		VCC_1V8	I	Z	Interruption 0 Input	If INT0 is not used, it should be configured as GPIO
62	INT1	GPIO25		VCC_2V8	I	Z	Interruption 1 Input	If INT1 is not used, it should be configured as GPIO
63	~RESET			VCC_1V8	I/O		RESET Input	NC or add a test point
64	PCM-SYNC			VCC_1V8	O	Pull-down	PCM Frame Synchro	NC
65	PCM-OUT			VCC_1V8	O	Pull-up	PCM Data Output	NC
66	PCM-IN			VCC_1V8	I	Pull-up	PCM Data Input	NC
67	PCM-CLK			VCC_1V8	O	Pull-down	PCM Clock	NC
68	BUZZER0			Open Drain	O	Z	Buzzer Output	NC
69	~CT109-DCD1	GPIO11		VCC_2V8	O	Undefined	Main RS232 Data Carrier Detect	NC
70	~CT108-2-DTR1	GPIO9		VCC_2V8	I	Z	Main RS232 Data Terminal Ready	(DTR1) Pull-up to VCC_2V8 with 100kΩ
71	~CT125-RI	GPIO10		VCC_2V8	O	Undefined	Main RS232 Ring Indicator	NC
72	~CT107-DSR1	GPIO8		VCC_2V8	O	Z	Main RS232 Data Set Ready	NC
73	~CT105-RTS1	GPIO6		VCC_2V8	I	Z	Main RS232 Request To Send	(RTS1) Pull-up to VCC_2V8 with 100kΩ and add a test point for firmware update
74	CT103-TXD1	GPIO4		VCC_2V8	I	Z	Main RS232 Transmit	(TXD1) Pull-up to VCC_2V8 with 100kΩ and add a test point for firmware update
75–98	GND							

* The I/O direction information is only for the nominal signal. When the signal is configured in GPIO, it can always be an Input or an Output.

4.2. RF Interface

The RF (radio frequency) interface of the AirPrime SL6087 Embedded Module allows the transmission of RF signals. This interface has a 50Ω nominal impedance and a 0Ω DC impedance.

4.2.1. RF Connections

The RF input/output of the AirPrime SL6087 Embedded Module is through one of the LGA pins (pin 22, ANT), with grounded LGA pins at both sides.

The ANT pin of the AirPrime SL6087 Embedded Module is ESD protected for both ±4KV contact and ±8KV air discharge.

4.2.2. Antenna Specifications

The antenna must meet the requirements specified in the table below.

The optimum operating frequency depends on the application. A dual-band, tri-band or quad-band antenna should operate in these frequency bands and have the following characteristics.

Table 4: Antenna Specifications

Characteristic		GSM 850	PCS 1900
TX Frequency		824 to 849 MHz	1850 to 1910 MHz
RX Frequency		869 to 894 MHz	1930 to 1990 MHz
Impedance		50Ω	
VSWR	RX max	1.5:1	
	TX max	1.5:1	
Typical Radiated Gain		0dBi in one direction at least	

Note: Sierra Wireless recommends a maximum VSWR of 1.5:1 for both TX and RX bands. Even so, all aspects of this specification will be fulfilled even with a maximum VSWR of 2:1.



5. Certification Compliance and Recommended Standards

5.1. Certification Compliance

The AirPrime SL6087 Embedded Module connected on a development kit board application is compliant with the following requirements.

Table 5: Standards Conformity for the SL6087 Embedded Module

Domain	Applicable Standard
Safety standard	EN 60950-1 (ed.2006)
Health standard (EMF Exposure Evaluation)	EN 62311 (ed. 2008)
Efficient use of the radio frequency spectrum	EN 301 511 (V 9.0.2)
EMC	EN 301 489-1 (v1.8.1) EN 301 489-7 (v1.3.1)
FCC	FCC Part 22, 24
IC	RSS-132 Issue 2 RSS-133 Issue 5

5.2. Applicable Standards Listing

The table hereafter gives the basic list of standards applicable for the AirPrime SL6087 Embedded Module (2G (R99/Rel. 4)).

Note: References to any features can be found from these standards.

Table 6: Applicable Standards and Requirements for the SL6087 Embedded Module

Document	Current Version	Title
NAPRD.03	5.3	Overview of PCS Type certification review board (PTCRB) Mobile Equipment Type Certification and IMEI control
TS 51.010-1	9.1.0	3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Digital cellular telecommunications system (Phase 2+); Mobile Station (MS) conformance specification; Part 1: Conformance specification
TS 51.010-2	9.1.0	3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Mobile Station (MS) conformance specification; Part 2: Protocol Implementation Conformance Statement (PICS) proforma specification
TS 51.010-4	4.14.1	3rd Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; Digital cellular telecommunications system (Phase 2+); Mobile Station (MS) conformance specification; Part 4: SIM Application Toolkit Conformance specification
ETSI 102.230	3.9.0	Smart cards; UICC-Terminal interface; Physical, electrical and logical test specification(Release 99)

The AirPrime SL6087 Intelligent Embedded Module has been granted modular approval for mobile applications. Integrators may use this device in their final products without additional FCC / IC (Industry Canada) certification if the following conditions are met. Otherwise, additional FCC / IC approvals must be obtained.

1. At least 20 cm separation distance between the antenna and the user's body must be maintained at all times.
2. To comply with FCC / IC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile-only exposure condition must not exceed 8.0 dBi in the cellular band and 3.6 dBi in the PCS band.
3. The AirPrime SL6087 Intelligent Embedded Module and its antenna must not be co-located or operating in conjunction with any other transmitter within a host device.
4. A label must be affixed to the outside of the end product into which the AirPrime SL6087 Intelligent Embedded Module is incorporated, with a statement similar to the following:
This device contains FCC ID: N7NSL6087
This equipment contains device certified under IC: 2417C-SL6087
5. A user manual with the end product must clearly indicate the operating requirements and conditions that must be observed to ensure compliance with current FCC / IC RF exposure guidelines.

The end product with an AirPrime SL6087 Intelligent Embedded Module may also need to pass the FCC Part 15 unintentional emission testing requirements and be properly authorized per FCC Part 15.

Note: If this module is intended for use in a portable device, you are responsible for separate approval to satisfy the SAR requirements of FCC Part 2.1093 and IC RSS-102.

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

6. References

6.1. Web Site Support

Check the Sierra Wireless website at <http://sierrawireless.com> for the latest documentation available.

Content	Web Site
General information about AirPrime SL Series Intelligent Embedded Module	http://www.sierrawireless.com/en/productsandservices/AirPrime/Embedded_Modules/SL_Series.aspx
Specific support about the AirPrime SL6087 Embedded Module	http://www.sierrawireless.com/productsandservices/AirPrime/Embedded_Modules/SL_Series/SL_6087.aspx
Carrier/Operator approvals	http://www.sierrawireless.com/en/sitecore/content/Sierra%20Wireless/Support/Downloads/AirPrime/SL_Series/AirPrime_SL6087.aspx
Sierra Wireless Software Suite Introduction	http://www.sierrawireless.com/productsandservices/AirPrime/Sierra_Wireless_Software_Suite/Open_AT_Operating_System.aspx
Developer support for software and hardware	http://forum.sierrawireless.com/

6.2. Reference Documents

For more details, several reference documents can be consulted. The Sierra Wireless documents referenced herein are provided in the Sierra Wireless documentation package; however, the general reference documents which are not Sierra Wireless owned are not provided in the documentation package.

6.2.1. Sierra Wireless Software Documentation

- [1] Getting started with SDK 4.22b
Reference: WM_DEV_OAT_UGD_048
- [2] Tutorial for IDE 1.08 (if using IDE; obsolete if using Developer Studio)
Reference: WM_DEV_OAT_UGD_044
- [3] Tools Manual for IDE 1.08 (if using IDE; obsolete if using Developer Studio)
Reference: WM_DEV_OAT_UGD_045
- [4] Basic Development Guide for SDK 4.22 (if using IDE; obsolete if using Developer Studio)
Reference: WM_DEV_OAT_UGD_050
- [5] ADL User Guide for SDK 4.22 (if using IDE; obsolete if using Developer Studio)
Reference: WM_DEV_OAT_UGD_051
- [6] SDK 4.22 Official Release Note
Reference: WM_DEV_OAT_DVD_338

6.2.2. Firmware Documentation

- [7] Firmware 7.4b AT Commands Manual (Sierra Wireless Software Suite 2.32)
Reference: WM_DEV_OAT_UGD_079 (Version 14)
- [8] AT Commands Interface Guide
Reference: WM_DEV_OAT_UGD_014
- [9] AT Commands Interface Guide (Bluetooth)
Reference: WM_ASW_BLU_UGD_001
- [10] Firmware 7.4 Customer Release Note
Reference: TBC

6.2.3. Hardware Documentation

- [11] AirPrime Q2687 Classic Product Technical Specification
Reference: WM_DEV_Q2687_PTS_001
- [12] AirPrime Q26xx Process Customer Guidelines
Reference: WM_PRJ_Q2686_PTS_004
- [13] AirPrime Q2687 Customer Design Guidelines
Reference: WA_DEV_Q2687_PTS_007
- [14] AirPrime Q2687 Product Technical Specification
Reference: WA_ENG_Q2687_PTS_001
- [15] AirPrime Q Series Development Kit User Guide
Reference: WM_BBD_Q26_UGD_001
- [16] AirPrime Q2687 Refreshed Migration Guide
Reference: WA_DEV_Q26RD_UGD_001
- [17] AirPrime Q2686 Product Technical Specification
Reference: WM_PRJ_Q2686_PTS_001
- [18] AirPrime Q2687 Refreshed Product Technical Specification and Customer Design
Guideline
Reference: WA_DEV_Q26RD_PTS_001
- [19] AirPrime SL Series Development Kit User Guide
Reference: WA_DEV_SL6087_UGD_003
- [20] Customer Process Guideline for AirPrime SL6087
Reference: WM_DEV_SL6087_PTS_001
- [21] AirPrime SL6087 Migration Guide
Reference: WA_DEV_SL6087_UGD_001

6.2.4. Other Sierra Wireless Documentation

- [22] Automotive Environmental Control Plan for SL6087 Embedded Module
Reference: WM_QUA_Q2687_DCP_001
- [23] Bluetooth Interface Application Note
Reference: WM_ASW_OAT_APN_016

6.2.5. Other Related Documentation

- [24] "I²C Bus Specification", Version 2.0, Philips Semiconductor 1998
- [25] ISO 7816-3 Standard

6.2.6. Application Notes

For other application notes, the following reference designs are available upon request to Sierra Wireless support.

Title	Description
Power Supply with automotive constraints	DC-DC converter based on STMicroElectronics L5973AD VIN = 5.5...32V VOUT = 3.8V Especially designed to meet Sierra Wireless Intelligent Embedded Module requirements.
CAN Interface (high speed)	CAN Interface over SPI based on: - MicroChip MCP2515 CAN Controller, - Philips PCA82C250T CAN Transceiver.
CAN Interface (low speed)	CAN Interface (over SPI) based on: - MicroChip MCP2515 CAN Controller, - Philips TJA1054A CAN Transceiver.
Bluetooth Connection	Provides BlueTooth Connectivity (over UART2) based on: Murata LBMA29BAE2 HCI BlueTooth module.
Dual USB Interface	Provides 2 separate serial ports on a USB interface, based on: FTDI FTDI2232C Dual USB UART with FIFO
Power Supply on USB	VIN = 5.0V (from USB supply) VOUT = 3.8V Especially designed to meet Sierra Wireless Intelligent Embedded Module and power supply requirements.
Full GSM-GPRS modem on USB	Based on the two previous designs

6.3. List of Abbreviations

Abbreviation	Definition
AC	Alternative Current
ADC	Analog to Digital Converter
A/D	Analog to Digital conversion
AF	Audio-Frequency
AT	ATtention (prefix for modem commands)
AUX	AUXiliary
CAN	Controller Area Network
CB	Cell Broadcast
CEP	Circular Error Probable
CLK	CLock
CMOS	Complementary Metal Oxide Semiconductor
CS	Coding Scheme
CTS	Clear To Send
DAC	Digital to Analogue Converter
dB	Decibel
DC	Direct Current
DCD	Data Carrier Detect
DCE	Data Communication Equipment
DCS	Digital Cellular System
DR	Dynamic Range
DSR	Data Set Ready
DTE	Data Terminal Equipment
DTR	Data Terminal Ready
EDGE	Enhance Data rates for GSM Evolution
EFR	Enhanced Full Rate
E-GSM	Extended GSM
EGPRS	Enhance GPRS
EMC	ElectroMagnetic Compatibility
EMI	ElectroMagnetic Interference
EMS	Enhanced Message Service
EN	ENable
ESD	ElectroStatic Discharges
FIFO	First In First Out
FR	Full Rate
FTA	Full Type Approval
GND	GrouND
GPI	General Purpose Input
GPC	General Purpose Connector
GPIO	General Purpose Input Output
GPO	General Purpose Output

Abbreviation	Definition
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile communications
HR	Half Rate
I/O	Input / Output
LED	Light Emitting Diode
LGA	Land Grid Array
LNA	Low Noise Amplifier
MAX	MAXimum
MIC	MICrophone
MIN	MINimum
MMS	Multimedia Message Service
MO	Mobile Originated
MT	Mobile Terminated
na	Not Applicable
NF	Noise Factor
NMEA	National Marine Electronics Association
NOM	NOMinal
NTC	Negative Temperature Coefficient
PA	Power Amplifier
Pa	Pascal (for speaker sound pressure measurements)
PBCCH	Packet Broadcast Control CHannel
PC	Personal Computer
PCB	Printed Circuit Board
PDA	Personal Digital Assistant
PFM	Power Frequency Modulation
PSM	Phase Shift Modulation
PWM	Pulse Width Modulation
RAM	Random Access Memory
RF	Radio Frequency
RFI	Radio Frequency Interference
RHCP	Right Hand Circular Polarization
RI	Ring Indicator
RST	ReSeT
RTC	Real Time Clock
RTCM	Radio Technical Commission for Maritime services
RTS	Request To Send
RX	Receive
SCL	Serial CLock
SDA	Serial DAta
SIM	Subscriber Identification Module
SMS	Short Message Service
SPI	Serial Peripheral Interface
SPL	Sound Pressure Level

Abbreviation	Definition
SPK	SPEaKer
SRAM	Static RAM
TBC	To Be Confirmed
TDMA	Time Division Multiple Access
TP	Test Point
TVS	Transient Voltage Suppressor
TX	Transmit
TYP	TYPical
UART	Universal Asynchronous Receiver-Transmitter
USB	Universal Serial Bus
USSD	Unstructured Supplementary Services Data
VSWR	Voltage Standing Wave Ratio



7. Safety Recommendations (For Information Only)

For the efficient and safe operation of your GSM application based on the AirPrime SL6087 Embedded Module, please read the following information carefully.

7.1. RF Safety

7.1.1. General

Your GSM terminal is based on the GSM standard for cellular technology. The GSM standard is spread all over the world. It covers Europe, Asia and some parts of America and Africa. This is the most used telecommunication standard.

Your GSM terminal is actually a low power radio transmitter and receiver. It sends out as well as receives radio frequency energy. When you use your GSM application, the cellular system which handles your calls controls both the radio frequency and the power level of your cellular modem.

7.1.2. Exposure to RF Energy

There has been some public concern about possible health effects of using GSM terminals. Although research on health effects from RF energy has focused on the current RF technology for many years, scientists have begun research regarding newer radio technologies, such as GSM. After existing research had been reviewed, and after compliance to all applicable safety standards had been tested, it has been concluded that the product was fitted for use.

If you are concerned about exposure to RF energy, there are things you can do to minimize exposure. Obviously, limiting the duration of your calls will reduce your exposure to RF energy. In addition, you can reduce RF exposure by operating your cellular terminal efficiently by following the guidelines below.

7.1.3. Efficient Terminal Operation

For your GSM terminal to operate at the lowest power level, consistent with satisfactory call quality:

If your terminal has an extendable antenna, extend it fully. Some models allow you to place a call with the antenna retracted. However your GSM terminal operates more efficiently with the antenna when it is fully extended.

Do not hold the antenna when the terminal is "IN USE". Holding the antenna affects call quality and may cause the modem to operate at a higher power level than needed.

7.1.4. Antenna Care and Replacement

Do not use the GSM terminal with a damaged antenna. If a damaged antenna comes into contact with the skin, a minor burn may result. Replace a damaged antenna immediately. You may repair antenna to yourself by following the instructions provided to you. If so, use only a manufacturer-approved antenna. Otherwise, have your antenna repaired by a qualified technician.

Buy or replace the antenna only from the approved suppliers list. Using unauthorized antennas, modifications or attachments could damage the terminal and may contravene local RF emission regulations or invalidate type approval.

7.2. General Safety

7.2.1. Driving

Check the laws and the regulations regarding the use of cellular devices in the area where you have to drive as you always have to comply with them. When using your GSM terminal while driving, please:

- give full attention to driving,
- pull off the road and park before making or answering a call if driving conditions so require.

7.2.2. Electronic Devices

Most electronic equipment, for example in hospitals and motor vehicles is shielded from RF energy. However, RF energy may affect some improperly shielded electronic equipment.

7.2.3. Vehicle Electronic Equipment

Check with your vehicle manufacturer representative to determine if any on-board electronic equipment is adequately shielded from RF energy.

7.2.4. Medical Electronic Equipment

Consult the manufacturer of any personal medical devices (such as pacemakers, hearing aids, etc...) to determine if they are adequately shielded from external RF energy.

Turn your terminal **OFF** in health care facilities when any regulations posted in the area instruct you to do so. Hospitals or health care facilities may be using RF monitoring equipment.

7.2.5. Aircraft

Turn your terminal OFF before boarding any aircraft.

- Use it on the ground only with crew permission.
- Do not use it in the air.

To prevent possible interference with aircraft systems, Federal Aviation Administration (FAA) regulations require you should have prior permission from a crew member to use your terminal while the aircraft is on the ground. To prevent interference with cellular systems, local RF regulations prohibit using your modem while airborne.

7.2.6. Children

Do not allow children to play with your GSM terminal. It is not a toy. Children could hurt themselves or others (by poking themselves or others in the eye with the antenna, for example). Children could damage the modem, or make calls that increase your modem bills.

7.2.7. Blasting Areas

To avoid interfering with blasting operations, turn your unit OFF when you are in a "blasting area" or in areas posted: "turn off two-way radio". Construction crew often uses remote control RF devices to set off explosives.

7.2.8. Potentially Explosive Atmospheres

Turn your terminal **OFF** when in any area with a potentially explosive atmosphere. Though it is rare, but your modem or its accessories could generate sparks. Sparks in such areas could cause an explosion or fire resulting in bodily injuries or even death.

Areas with a potentially explosive atmosphere are often, but not always, clearly marked. They include fuelling areas such as petrol stations; below decks on boats; fuel or chemical transfer or storage facilities; and areas where the air contains chemicals or particles, such as grain, dust, or metal powders.

Do not transport or store flammable gas, liquid, or explosives, in the compartment of your vehicle which contains your terminal or accessories.

Before using your terminal in a vehicle powered by liquefied petroleum gas (such as propane or butane) ensure that the vehicle complies with the relevant fire and safety regulations of the country in which the vehicle is used.