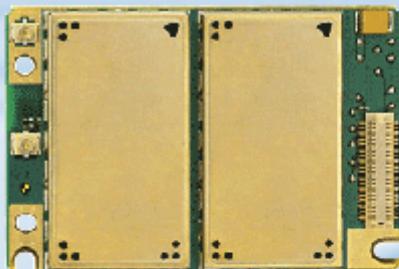


SIEMENS



HC25 Siemens Cellular Engine

Version: 00.220
DocId: HC25_HO_v00.220

Hardware Interface Overview

Document Name:	HC25 Hardware Interface Overview
Version:	00.220
Date:	2007-03-20
DocId:	HC25_HO_v00.220
Status:	Confidential / Preliminary
Supported Products:	HC25

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1 Introduction

This document describes the hardware of the Siemens HC25 module that connects to the cellular device application and the air interface. It helps you quickly retrieve interface specifications, electrical and mechanical details and information on the requirements to be considered for integrating further components.

1.1 Related Documents

- [1] HC25 AT Command Set 00.220
- [2] HC25 Release Notes 00.220

1.2 Terms and Abbreviations

Abbreviation	Description
ANSI	American National Standards Institute
AMR	Adaptive Multirate
ARP	Antenna Reference Point
B2B	Board-to-board connector
BB	Baseband
BEP	Bit Error Probability
BTS	Base Transceiver Station
CB or CBM	Cell Broadcast Message
CE	Conformité Européene (European Conformity)
CS	Coding Scheme
CS	Circuit Switched
CSD	Circuit Switched Data
DAC	Digital-to-Analog Converter
dBm0	Digital level, 3.14dBm0 corresponds to full scale, see ITU G.711, A-law
DCS	Digital Cellular System
DL	Download
DRX	Discontinuous Reception
DSB	Development Support Board
DSP	Digital Signal Processor
DTMF	Dual Tone Multi Frequency
DTX	Discontinuous Transmission
EDGE	Enhanced Data rates for GSM Evolution
EFR	Enhanced Full Rate
EGSM	Enhanced GSM

Abbreviation	Description
EMC	Electromagnetic Compatibility
ERP	Effective Radiated Power
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission (U.S.)
FDD	Frequency Division Duplex
FDMA	Frequency Division Multiple Access
FR	Full Rate
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
HiZ	High Impedance
HSDPA	High Speed Downlink Packed Access
HR	Half Rate
I/O	Input/Output
IF	Intermediate Frequency
IMEI	International Mobile Equipment Identity
ISO	International Standards Organization
ITU	International Telecommunications Union
kbps	kbits per second
LED	Light Emitting Diode
Mbps	Mbits per second
MCS	Modulation and Coding Scheme
MO	Mobile Originated
MS	Mobile Station, also referred to as TE
MT	Mobile Terminated
NTC	Negative Temperature Coefficient
PBCCH	Packet Switched Broadcast Control Channel
PCB	Printed Circuit Board
PCL	Power Control Level
PCM	Pulse Code Modulation
PCS	Personal Communication System, also referred to as GSM 1900
PS	Packet Switched
PDU	Protocol Data Unit
PSK	Phase Shift Keying
R&TTE	Radio and Telecommunication Terminal Equipment

Abbreviation	Description
RACH	Random Access Channel
RF	Radio Frequency
RTC	Real Time Clock
Rx	Receive Direction
SAR	Specific Absorption Rate
SELV	Safety Extra Low Voltage
SIM	Subscriber Identification Module
SLIC	Subscriber Line Interface Circuit
SMS	Short Message Service
SRAM	Static Random Access Memory
SRB	Signalling Radio Bearer
TA	Terminal adapter (e.g. GSM engine)
TDMA	Time Division Multiple Access
TE	Terminal Equipment
TS	Technical Specification
Tx	Transmit Direction
UL	Upload
UMTS	Universal Mobile Telecommunications System
URC	Unsolicited Result Code
USB	Universal Serial Bus
UICC	USIM Integrated Circuit Card
USIM	UMTS Subscriber Identification Module
WCDMA	Wideband Code Division Multiple Access

1.3 Regulatory and Type Approval Information

1.3.1 Directives and Standards

HC25 has been designed to comply with the directives and standards listed below.

Table 1: Directives

99/05/EC	Directive of the European Parliament and of the council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity (in short referred to as R&TTE Directive 1999/5/EC). The product is labeled with the CE conformity mark 
2002/95/EC	Directive of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) 

Table 2: Standards of North American type approval

CFR Title 47	Code of Federal Regulations, Part 22 and Part 24 (Telecommunications, PCS); US Equipment Authorization FCC
UL 60 950	Product Safety Certification (Safety requirements) 
NAPRD.03 V3.9.1	Overview of PCS Type certification review board Mobile Equipment Type Certification and IMEI control PCS Type Certification Review board (PTCRB)
RSS132, RSS133	Canadian Standard

Table 3: Standards of European type approval

3GPP TS 51.010-1	Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification
ETSI EN 301 511 V9.0.2	Candidate Harmonized European Standard (Telecommunications series) Global System for Mobile communications (GSM); Harmonized standard for mobile stations in the GSM 900 and DCS 1800 bands covering essential requirements under article 3.2 of the R&TTE directive (1999/5/EC) (GSM 13.11 version 7.0.1 Release 1998)
GCF-CC V3.23.1	Global Certification Forum - Certification Criteria
ETSI EN 301 489-1 V1.4.1	Candidate Harmonized European Standard (Telecommunications series) Electro Magnetic Compatibility and Radio spectrum Matters (ERM); Electro Magnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common Technical Requirements
ETSI EN 301 489-7 V1.2.1 (2000-09)	Candidate Harmonized European Standard (Telecommunications series) Electro Magnetic Compatibility and Radio spectrum Matters (ERM); Electro Magnetic Compatibility (EMC) standard for radio equipment and services; Part 7: Specific conditions for mobile and portable radio and ancillary equipment of digital cellular radio telecommunications systems (GSM and DCS)
IEC/EN 60950-1 (2001)	Safety of information technology equipment (2000)

Table 3: Standards of European type approval

EN 301 489-24 V1.2.1	Electromagnetic compatibility and Radio Spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 24: Specific conditions for IMT-2000 CDMA Direct Spread (UTRA) for Mobile and portable (UE) radio and ancillary equipment
EN 301 908-01 V2.2.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000 Third Generation cellular networks; Part 1: Harmonized EN for IMT-2000, introduction and common requirements of article 3.2 of the R&TTE Directive
EN 301 908-02 V2.2.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000 Third Generation cellular networks; Part 2: Harmonized EN for IMT-2000, CDMA Direct Spread (UTRA FDD) (UE) covering essential requirements of article 3.2 of the R&TTE Directive
3GPP TS 34.124	Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.
3GPP TS 34.121	Technical Specification Group Radio Access Network; Terminal conformance specification; Radio transmission and reception (FDD)
3GPP TS 34.123-1	User Equipment (UE) conformance specification; Part 1: Protocol conformance specification.
3GPP TS 34.123-3	User Equipment (UE) conformance specification; Part 3: Abstract Test Suites.

Table 4: Requirements of quality

IEC 60068	Environmental testing
DIN EN 60529	IP codes

1.4 SAR requirements specific to portable mobiles

Mobile phones, PDAs or other portable transmitters and receivers incorporating a GSM module must be in accordance with the guidelines for human exposure to radio frequency energy. This requires the Specific Absorption Rate (SAR) of portable HC25 based applications to be evaluated and approved for compliance with national and/or international regulations.

Since the SAR value varies significantly with the individual product design manufacturers are advised to submit their product for approval if designed for portable use. For European and US markets the relevant directives are mentioned below. It is the responsibility of the manufacturer of the final product to verify whether or not further standards, recommendations or directives are in force outside these areas.

Products intended for sale on US markets

ES 59005/ANSI C95.1 Considerations for evaluation of human exposure to Electromagnetic Fields (EMFs) from Mobile Telecommunication Equipment (MTE) in the frequency range 30MHz - 6GHz

Products intended for sale on European markets

EN 50360 Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300MHz - 3GHz)

IMPORTANT:

Manufacturers of portable applications based on HC25 modules are required to have their final product certified and apply for their own FCC Grant and Industry Canada Certificate related to the specific portable mobile. See also [Section 7.2](#).

1.4.1 SELV Requirements

The power supply connected to the HC25 module shall be in compliance with the SELV requirements defined in EN 60950-1.

1.5 Safety Precautions

The following safety precautions must be observed during all phases of the operation, usage, service or repair of any cellular terminal or mobile incorporating HC25. Manufacturers of the cellular terminal are advised to convey the following safety information to users and operating personnel and to incorporate these guidelines into all manuals supplied with the product. Failure to comply with these precautions violates safety standards of design, manufacture and intended use of the product. Siemens AG assumes no liability for customer's failure to comply with these precautions.

	<p>When in a hospital or other health care facility, observe the restrictions on the use of mobiles. Switch the cellular terminal or mobile off, if instructed to do so by the guidelines posted in sensitive areas. Medical equipment may be sensitive to RF energy.</p> <p>The operation of cardiac pacemakers, other implanted medical equipment and hearing aids can be affected by interference from cellular terminals or mobiles placed close to the device. If in doubt about potential danger, contact the physician or the manufacturer of the device to verify that the equipment is properly shielded. Pacemaker patients are advised to keep their hand-held mobile away from the pacemaker, while it is on.</p>
	<p>Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it cannot be switched on inadvertently. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communications systems. Failure to observe these instructions may lead to the suspension or denial of cellular services to the offender, legal action, or both.</p>
	<p>Do not operate the cellular terminal or mobile in the presence of flammable gases or fumes. Switch off the cellular terminal when you are near petrol stations, fuel depots, chemical plants or where blasting operations are in progress. Operation of any electrical equipment in potentially explosive atmospheres can constitute a safety hazard.</p>
	<p>Your cellular terminal or mobile receives and transmits radio frequency energy while switched on. Remember that interference can occur if it is used close to TV sets, radios, computers or inadequately shielded equipment. Follow any special regulations and always switch off the cellular terminal or mobile wherever forbidden, or when you suspect that it may cause interference or danger.</p>
	<p>Road safety comes first! Do not use a hand-held cellular terminal or mobile when driving a vehicle, unless it is securely mounted in a holder for speakerphone operation. Before making a call with a hand-held terminal or mobile, park the vehicle. Speakerphones must be installed by qualified personnel. Faulty installation or operation can constitute a safety hazard.</p>
	<p>IMPORTANT! Cellular terminals or mobiles operate using radio signals and cellular networks. Because of this, connection cannot be guaranteed at all times under all conditions. Therefore, you should never rely solely upon any wireless device for essential communications, for example emergency calls.</p> <p>Remember, in order to make or receive calls, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength.</p> <p>Some networks do not allow for emergency calls if certain network services or phone features are in use (e.g. lock functions, fixed dialing etc.). You may need to deactivate those features before you can make an emergency call. Some networks require that a valid SIM card be properly inserted in the cellular terminal or mobile.</p>

2 Product Concept

2.1 Key Features at a Glance

Feature	Implementation
General	
Frequency bands	UMTS/HSDPA: Triple band, 850//1900/2100MHz GSM/GPRS/EDGE: Quad band, 850/900/1800/1900MHz
GSM class	Small MS
Output power (according to Release 99)	Class 4 (+33dBm ±2dB) for EGSM850 Class 4 (+33dBm ±2dB) for EGSM900 Class 1 (+30dBm ±2dB) for GSM1800 Class 1 (+30dBm ±2dB) for GSM1900 Class E2 (+27dBm ± 3dB) for GSM 850 8-PSK Class E2 (+27dBm ± 3dB) for GSM 900 8-PSK Class E2 (+26dBm +3 /-4dB) for GSM 1800 8-PSK Class E2 (+26dBm +3 /-4dB) for GSM 1900 8-PSK Class 3 (+24dBm +1/-3dB) for UMTS 2100, WCDMA FDD Bdl Class 3 (+24dBm +1/-3dB) for UMTS 1900,WCDMA FDD BdII Class 3 (+24dBm +1/-3dB) for UMTS 850, WCDMA FDD BdV
Power supply	$3.2V \leq V_{BATT+} \leq 4.2V$
Physical	Dimensions: 50mm x 34mm x 4.5mm Weight: approx. 10g
RoHS	All hardware components fully compliant with EU RoHS Directive
HSDPA features	
3GPP Release 5	3.6 Mbps, UL 384 kbps UE CAT. [1-6], 11, 12 supported Compressed mode (CM) supported according to 3GPP TS25.212
UMTS features	
Release 99, June 2004, W-CDMA FDD standard	PS data rate – 384 kbps DL / 384 kbps UL CS data rate – 64 kbps DL / 64 kbps UL

Feature	Implementation
GSM / GPRS / EGPRS features	
Data transfer	<p>GPRS</p> <ul style="list-style-type: none"> • Multislot Class 10 • Full PBCCH support • Mobile Station Class B • Coding Scheme 1 – 4 <p>EGPRS</p> <ul style="list-style-type: none"> • Multislot Class 10 • EDGE E2 power class for 8 PSK • Downlink coding schemes – CS 1-4, MCS 1-9 • Uplink coding schemes – CS 1-4, MCS 1-9 • BEP reporting • SRB loopback and test mode B • 8-bit, 11-bit RACH • PBCCH support • 1 phase/2 phase access procedures • Link adaptation and IR • NACC, extended UL TBF • Mobile Station Class B <p>CSD</p> <ul style="list-style-type: none"> • V.110, RLP, non-transparent • 9.6 kbps
SMS	<p>Point-to-point MT and MO</p> <p>Cell broadcast</p> <p>Text and PDU mode</p>
Fax	Group 3; Class 1
Audio	<p>Audio speech codecs</p> <p>GSM: AMR, EFR, FR, HR</p> <p>3GPP: AMR</p> <p>One ringing melody supported</p> <p>CEPT supervisory tones supported</p> <p>DTMF supported</p> <p>6 audio modes: Approval, Router, Handset, Headset, Speakerphone and Transparent mode</p> <p>TTY support selecting a dedicated audio mode</p> <p>Download of audio parameters</p> <p>Gains and volumes can be controlled by AT commands</p> <p>Several additional ringing melodies</p> <p>CEPT and ANSI supervisory tones supported</p>
Software	
AT commands	<p>AT-Hayes GSM 07.05 and 07.07, Siemens</p> <p>AT commands for RIL compatibility (NDIS/RIL)</p>
Microsoft™ compatibility	RIL / NDIS for Windows Mobile™
SIM Application Toolkit	SAT Class C
Firmware update	Firmware update from host application over USB.

Feature	Implementation
Interfaces	
USB	Supports a USB 2.0 Full Speed (12Mbit/s) device interface.
Wakeup Control	Signal pin to wake up an inactive USB Host into an active state.
Status	Signal pins to indicate network connectivity status.
Audio	1 analog interface
UICC interface	Supported chip cards: SIM / UICC 3V, 1.8V
Antenna	50Ohms. External antenna can be connected via antenna connector or antenna pad (spring contact).
Module interface	50-pin board-to-board connector
Power on/off, Reset	
Power on/off	Switch-on by hardware pin IGT Switch-off by hardware pin IGT Switch-off by AT command
Reset	Orderly shutdown and reset by AT command Emergency off by hardware pin EMERG_OFF and restart with hardware pin IGT
Emergency off	Emergency off by hardware pin EMERG_OFF
Evaluation kit	
DSB	DSB75 Evaluation Board designed to test and type approve Siemens cellular engines and provide a sample configuration for application engineering. A special adapter is required to connect the module to the DSB75.

3 Application Interface

HC25 is equipped with a 50-pin board-to-board connector that connects to the external application and incorporates several sub-interfaces: power supply, USB interface, UICC/SIM interface, analog audio interface, as well as various status and control lines (see also [Chapter 2](#)).

3.1 Operating Modes

The table below briefly summarizes the various operating modes referred to in the following chapters.

Table 5: Overview of operating modes

Mode	Function	
Normal operation	GSM / GPRS / UMTS / HSDPA SLEEP	Power saving mode set automatically when no call is in progress and the USB connection is suspended by host or not present.
	GSM IDLE	Software is active. Once registered to the GSM network, paging with BTS is carried out in order to achieve synchrony with the GSM network. The repetition rate depends on the parameter BSPA_Multiframe. The module is ready to send and receive.
	GSM TALK/ GSM DATA	Connection between two subscribers is in progress. Power consumption depends on the GSM network coverage and several connection settings (e.g. DTX off/on, FR/EFR/HR, hopping sequences and antenna connection). The following applies when power is to be measured in TALK_GSM mode: DTX off, FR and no frequency hopping, otherwise same as for IDLE measurements.
	GPRS IDLE	Module is attached and ready for GPRS data transfer, but no data is currently sent or received.
	GPRS DATA	GPRS data transfer in progress. Power consumption depends on network settings (e.g. power control level), uplink / downlink data rates and GPRS configuration (e.g. used multislot settings).
	EGPRS DATA	EGPRS data transfer in progress. Power consumption depends on network settings (e.g. power control level), uplink / downlink data rates and EGPRS configuration (e.g. used multislot settings).
	UMTS / HSDPA IDLE	Module is attached and ready for UMTS / HSDPA data transfer, but no data is currently sent or received.
	UMTS TALK/ UMTS DATA	UMTS data transfer in progress. Power consumption depends on network settings (e.g. TPC Pattern) and data transfer rate.
	HSDPA DATA	HSDPA data transfer in progress. Power consumption depends on network settings (e.g. TPC Pattern) and data transfer rate.
Power Down	The internal power section is shut down. The SW on the module is not active. The interfaces are not accessible.	

4 Antenna Interface

The RF interface has an impedance of 50Ω. HC25 is capable of sustaining a total mismatch at the antenna connector or pad without any damage, even when transmitting at maximum RF power.

The external antenna must be matched properly to achieve best performance regarding radiated power, DC-power consumption, modulation accuracy and harmonic suppression. Antenna matching networks are not included on the HC25 PCB and should be placed in the host application.

Regarding the return loss HC25 provides the following values in the active band:

Table 6: Return loss in the active band

State of module	Return loss of module	Recommended return loss of application
Receive	≥ 8dB	≥ 12dB
Transmit	not applicable	≥ 12dB
Idle	≤ 5dB	not applicable

The connection of the antenna or other equipment must be decoupled from DC voltage. This is necessary because the antenna connector is DC coupled to ground via an inductor for ESD protection.

Note: The antenna must be isolated for ESD protection (to withstand a voltage resistance up to 8kV air discharge).

4.1 Antenna Installation

To suit the physical design of individual applications HC25 offers two alternative approaches to connecting the antenna:

- Recommended approach: U.FL-R-SMT antenna connector from Hirose assembled on the top side of the PCB. See [Section 4.3](#) for connector details.
- Antenna pad and grounding plane placed on the bottom side. See [Section 4.2](#).

The U.FL-R-SMT connector has been chosen as antenna reference point (ARP) for the Siemens reference equipment submitted to type approve HC25. All RF data specified throughout this manual are related to the ARP.

IMPORTANT: Both solutions can only be applied alternatively. This means, whenever an antenna is plugged to the Hirose connector, the pad must not be used. Vice versa, if the antenna is connected to the pad, then the Hirose connector must be left empty.

No matter which option you choose, ensure that the antenna pad does not come into contact with the holding device or any other components of the host application. It needs to be surrounded by a restricted area filled with air, which must also be reserved 1.4mm in height.

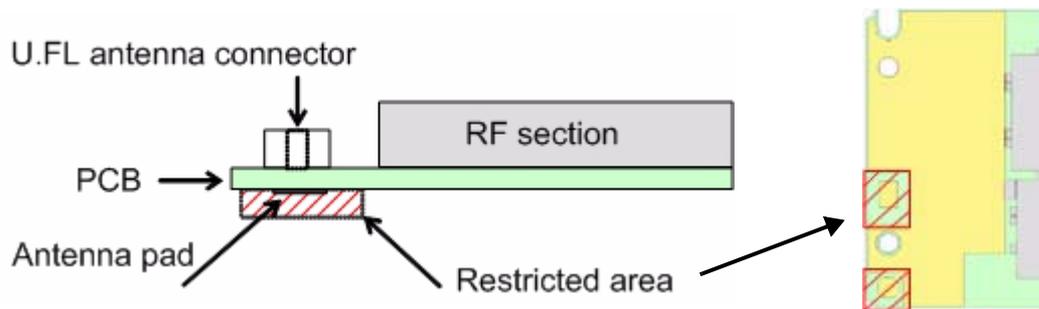


Figure 1: Restricted area around antenna pad (side and bottom view)

4.2 Antenna Pad

The antenna can be attached via contact springs.

If you decide to use the antenna pad take into account that the pad has not been intended as antenna reference point (ARP) for the Siemens HC25 type approval. The antenna pad is provided only as an alternative option which can be used, for example, if the recommended Hirose connection does not fit into your antenna design.

Also, consider that according to the GSM recommendations TS 45.005 and TS 51.010-01 a 50Ω connector is mandatory for type approval measurements. This requires GSM devices with an integral antenna to be temporarily equipped with a suitable connector or a low loss RF cable with adapter.

HC25 material properties:

HC25 PCB: FR4

Antenna pad: Gold plated pad

4.3 Antenna Connector

HC25 uses an ultra-miniature SMT antenna connector supplied from Hirose Ltd. The product name is:

- U.FL-R-SMT

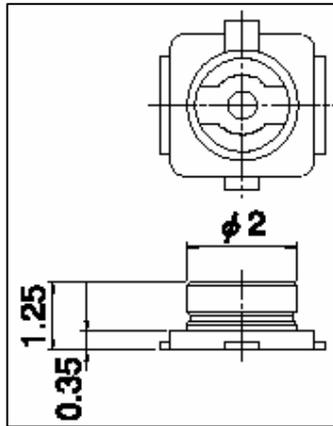


Figure 2: Mechanical dimensions of U.FL-R-SMT connector

Table 7: Product specifications of U.FL-R-SMT connector

Item	Specification	Conditions
Ratings		
Nominal impedance	50Ω	Operating temp:-40°C to + 90°C Operating humidity: max. 90%
Rated frequency	DC to 3GHz	
Mechanical characteristics		
Female contact holding force	0.15N min	Measured with a Ø 0.475 pin gauge
Repetitive operation	Contact resistance: Center 25mΩ Outside 15mΩ	30 cycles of insertion and disengagement
Vibration	No momentary disconnections of 1μs; No damage, cracks and looseness of parts	Frequency of 10 to 100Hz, single amplitude of 1.5mm, acceleration of 59m/s ² , for 5 cycles in the direction of each of the 3 axes
Shock	No momentary disconnections of 1μs. No damage, cracks and looseness of parts.	Acceleration of 735m/s ² , 11 ms duration for 6 cycles in the direction of each of the 3 axes
Environmental characteristics		
Humidity resistance	No damage, cracks and looseness of parts. Insulation resistance: 100MΩ min. at high humidity 500MΩ min. when dry	Exposure to 40°C, humidity of 95% for a total of 96 hours

Table 7: Product specifications of U.FL-R-SMT connector

Item	Specification	Conditions
Temperature cycle	No damage, cracks and looseness of parts. Contact resistance: Center 25mΩ Outside 15mΩ	Temperature: +40°C → 5 to 35°C → +90°C → 5 to 35°C Time: 30min → within 5min → 30min within 5min
Salt spray test	No excessive corrosion	48 hours continuous exposure to 5% salt water

Table 8: Material and finish of U.FL-R-SMT connector and recommended plugs

Part	Material	Finish
Shell	Phosphor bronze	Silver plating
Male center contact	Brass	Gold plating
Female center contact	Phosphor bronze	Gold plating
Insulator	Plug: PBT Receptacle: LCP	Black Beige

Mating plugs and cables can be chosen from the Hirose U.FL Series. Examples are shown below and listed in [Table 9](#). For latest product information please contact your Hirose dealer or visit the Hirose home page, for example <http://www.hirose.com>.

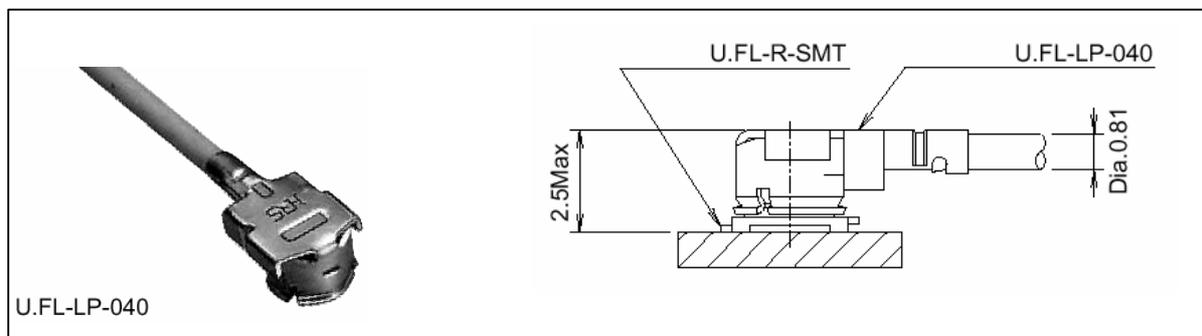


Figure 3: U.FL-R-SMT connector with U.FL-LP-040 plug

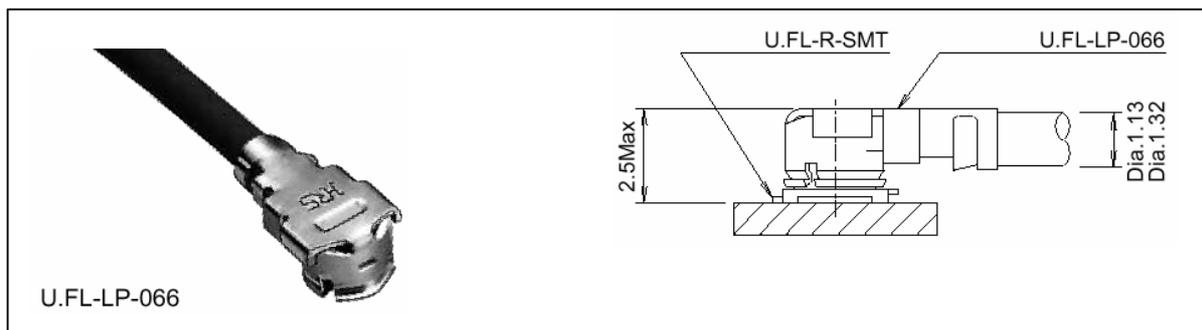


Figure 4: U.FL-R-SMT connector with U.FL-LP-066 plug

In addition to the connectors illustrated above, the U.FL-LP-(V)-040(01) version is offered as an extremely space saving solution. This plug is intended for use with extra fine cable (up to $\varnothing 0.81\text{mm}$) and minimizes the mating height to 2mm. See Figure 5 which shows the Hirose datasheet.

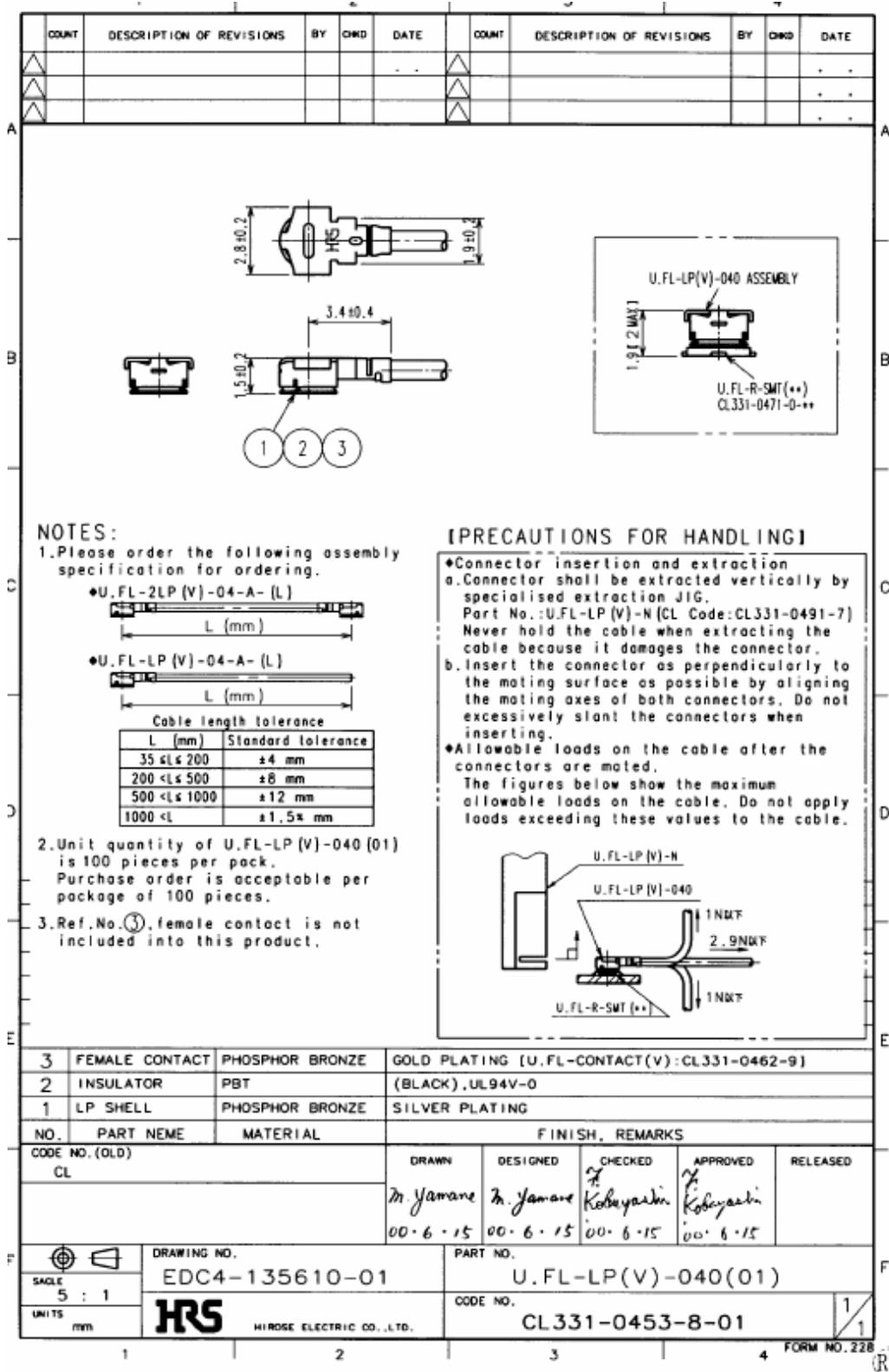


Figure 5: Specifications of U.FL-LP-(V)-040(01) plug

Table 9: Ordering information for Hirose U.FL Series

Item	Part number	HRS number
Connector on HC25	U.FL-R-SMT	CL331-0471-0-10
Right-angle plug shell for Ø 0.81mm cable	U.FL-LP-040	CL331-0451-2
Right-angle plug for Ø 0.81mm cable	U.FL-LP(V)-040 (01)	CL331-053-8-01
Right-angle plug for Ø 1.13mm cable	U.FL-LP-068	CL331-0452-5
Right-angle plug for Ø 1.32mm cable	U.FL-LP-066	CL331-0452-5
Extraction jig	E.FL-LP-N	CL331-04441-9

5 Electrical, Reliability and Radio Characteristics

5.1 Absolute Maximum Ratings

The absolute maximum ratings stated in [Table 10](#) are stress ratings under any conditions. Stresses beyond any of these limits will cause permanent damage to HC25.

Table 10: Absolute maximum ratings

Parameter	Min	Max	Unit
Supply voltage BATT+	-0.3	4.5	V
Voltage at digital pins in POWER DOWN mode	-0.3	0.3	V
Voltage at digital pins in normal operation	-0.3	2.8	V
Voltage at analog pins in POWER DOWN mode	-0.3	0.3	V
Voltage at analog pins in normal operation	-0.3	2.5	V
Voltage at STATUSx pins	-0.5	7.5	V
VUSB	-0.3	7.5	V
USB_DP, USB_DN	-0.3	7.5	V
PWR_IND	-0.3	10	V
VDDL	-0.3	3.25	V

5.2 Operating Temperatures

The values stated below are in compliance with GSM recommendation TS 51.010-01.

Table 11: Board temperature

Parameter	Min	Typ	Max	Unit
Operating temperature range	-20	+25	+85	°C
Automatic shutdown ¹ Temperature measured on HC25 board	< -30	---	>+85	°C

¹. Due to temperature measurement uncertainty, a tolerance on the stated shutdown thresholds may occur. The possible deviation is in the range of $\pm 3^{\circ}\text{C}$ at the overtemperature limit and $\pm 5^{\circ}\text{C}$ at the undertemperature limit.

Table 11 shows the temperatures for automatic shutdown as measured by the on-board measuring element NTC. The maximum allowable ambient temperature that causes the module to shut down depends on various conditions. The following tables Table 12 and Table 13 show sample lab environment conditions. Please be aware that the operating duration and the maximum ambient temperature will vary significantly for your application.

Table 12: Sample operating conditions without forced air circulation (according to IEC 60068-2)

Mode	Ambient Temperature	Voltage	RF Power	Operating Duration
GSM, GPRS/EDGE Class 8	+65°C	$V_{\text{BATT+}} \leq 3.8\text{V}$	Max.	∞
WCDMA	+55°C	$V_{\text{BATT+}} \leq 3.4\text{V}$	$\leq 10\text{dBm}$	∞
WCDMA	+65°C	$V_{\text{BATT+}} \leq 3.4\text{V}$	$\leq 0\text{dBm}$	∞
GRPS/EDGE Class10	+65°C	$V_{\text{BATT+}} \leq 3.8\text{V}$	Max.	$\leq 2\text{min}$
WCDMA	+65°C	$V_{\text{BATT+}} \leq 3.8\text{V}$	Max.	$\leq 2\text{min}$

Table 13: Sample operating conditions with forced air circulation (air speed 0.9m/s)

Mode	Ambient Temperature	Voltage	RF Power	Operating Duration
GSM, GPRS/EDGE Class 8	+75°C	$V_{\text{BATT+}} \leq 3.8\text{V}$	Max.	∞
WCDMA	+60°C	$V_{\text{BATT+}} \leq 3.4\text{V}$	$\leq 10\text{dBm}$	∞
WCDMA	+70°C	$V_{\text{BATT+}} \leq 3.4\text{V}$	$\leq 0\text{dBm}$	∞
GRPS/EDGE Class 10	+65°C	$V_{\text{BATT+}} \leq 3.8\text{V}$	Max.	∞
WCDMA	+60°C	$V_{\text{BATT+}} \leq 3.4\text{V}$	Max.	∞

Note: Generally it is strongly recommended to implement additional measures to lead the heat out of the application, especially at maximum transmission power levels of WCDMA (24dBm), e.g. use of ground area for a heat sink or convection (see Section 6.1 for the ground area that may be used for a heat sink).

5.3 Storage Conditions

The conditions stated below are only valid for modules in their original packed state in weather protected, non-temperature-controlled storage locations. Normal storage time under these conditions is 12 months maximum.

Table 14: Storage conditions

Type	Condition	Unit	Reference
Air temperature: Low High	-40 +85	°C	ETS 300 019-2-1: T1.2, IEC 68-2-1 Ab ETS 300 019-2-1: T1.2, IEC 68-2-2 Bb
Humidity relative: Low High Condens.	10 90 at 30°C 90-100 at 30°C	%	--- ETS 300 019-2-1: T1.2, IEC 68-2-56 Cb ETS 300 019-2-1: T1.2, IEC 68-2-30 Db
Air pressure: Low High	70 106	kPa	IEC TR 60271-3-1: 1K4 IEC TR 60271-3-1: 1K4
Movement of surrounding air	1.0	m/s	IEC TR 60271-3-1: 1K4
Water: rain, dripping, icing and frosting	Not allowed	---	---
Radiation: Solar Heat	1120 600	W/m ²	ETS 300 019-2-1: T1.2, IEC 68-2-2 Bb ETS 300 019-2-1: T1.2, IEC 68-2-2 Bb
Chemically active substances	Not recommended		IEC TR 60271-3-1: 1C1L
Mechanically active substances	Not recommended		IEC TR 60271-3-1: 1S1
Vibration sinusoidal: Displacement Acceleration Frequency range	1.5 5 2-9 9-200	mm m/s ² Hz	IEC TR 60271-3-1: 1M2
Shocks: Shock spectrum Duration Acceleration	semi-sinusoidal 1 50	ms m/s ²	IEC 68-2-27 Ea

5.4 Reliability Characteristics

The test conditions stated below are an extract of the complete test specifications.

Table 15: Summary of reliability test conditions

Type of test	Conditions	Standard
Vibration	Frequency range: 10-20Hz; acceleration: 3.1mm amplitude Frequency range: 20-500Hz; acceleration: 5g Duration: 2h per axis = 10 cycles; 3 axes	DIN IEC 68-2-6
Shock half-sinus	Acceleration: 500g Shock duration: 1msec 1 shock per axis 6 positions ($\pm x$, y and z)	DIN IEC 68-2-27
Dry heat	Temperature: $+70 \pm 2^\circ\text{C}$ Test duration: 16h Humidity in the test chamber: < 50%	EN 60068-2-2 Bb ETS 300 019-2-7
Temperature change (shock)	Low temperature: $-40^\circ\text{C} \pm 2^\circ\text{C}$ High temperature: $+85^\circ\text{C} \pm 2^\circ\text{C}$ Changeover time: < 30s (dual chamber system) Test duration: 1h Number of repetitions: 100	DIN IEC 68-2-14 Na ETS 300 019-2-7
Damp heat cyclic	High temperature: $+55^\circ\text{C} \pm 2^\circ\text{C}$ Low temperature: $+25^\circ\text{C} \pm 2^\circ\text{C}$ Humidity: 93% $\pm 3\%$ Number of repetitions: 6 Test duration: 12h + 12h	DIN IEC 68-2-30 Db ETS 300 019-2-5
Cold (constant exposure)	Temperature: $-40 \pm 2^\circ\text{C}$ Test duration: 16h	DIN IEC 68-2-1

6 Mechanics

6.1 Mechanical Dimensions of HC25

Length: 50.00mm
Width: 34.00mm
Height: 4.5mm

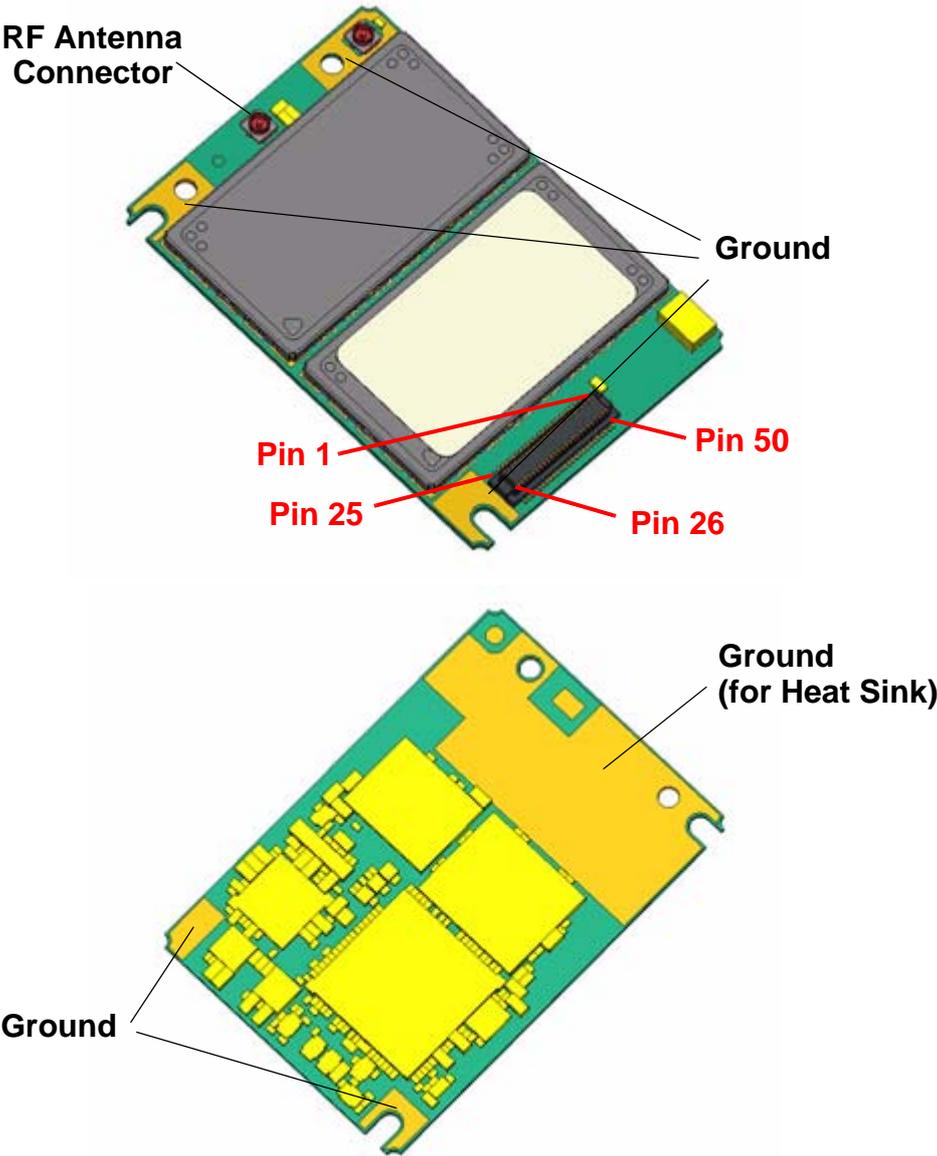


Figure 6: HC25 – Top and bottom view

6.2 Mounting HC25 to the Application Platform

There are many ways to properly install HC25 in the host device. An efficient approach is to mount the HC25 PCB to a frame, plate, rack or chassis.

Fasteners can be M2 screws plus suitable washers, circuit board spacers, or customized screws, clamps, or brackets. In addition, the board-to-board connection can also be utilized to achieve better support. To help you find appropriate spacers a list of selected screws and distance sleeves for 3mm stacking height can be found in [Section 8.2](#).

When using the holes the screws can be inserted from top or bottom.

For proper grounding it is strongly recommended to use the large ground plane on the bottom of board in addition to the five GND pins of the board-to-board connector. The ground plane may also be used to attach cooling elements, e.g. a heat sink or thermally conductive tape. Please take care that attached cooling elements do not touch the antenna pads on the module's bottom side, as this may lead a short-circuit.

To prevent mechanical damage, be careful not to force, bend or twist the module. Be sure it is positioned flat against the host device (see also [Section 8.3](#) with mounting advice sheet).

6.3 Board-to-Board Application Connector

This section provides specifications for the 50-pin board-to-board (B2B) connector used to connect HC25 to the host application.

For the module's external interface the following connector series has been chosen:

Supplier: Hirose (www.hirose.com)
Type: DF12C (3.0)-50DS-0.5V (SlimStack Receptacle)
Height: 3.0 mm

Table 16: Electrical and mechanical characteristics of the board-to-board connector

Parameter	Specification (50-way connector)
Number of Contacts	50
Quantity delivered	2000 Connectors per Tape & Reel
Voltage	50V
Current Rating	0.4A max per contact
Resistance	0.05 Ohm per contact
Dielectric Withstanding Voltage	150V RMS AC for 1min
Operating Temperature	-40°C...+85°C
Contact Material	phosphor bronze finish: solder plating
Insulator Material	PPS, deep brown / Polyamide, beige
FFC/FPC Thickness	0.3mm ±0.05mm (0.012" ±0.002")
Maximum connection cycles	20 (@ 50mOhm max)
Cable	FFC (Flat Flexible Cable), max. length 150mm from SIM interface

A recommended corresponding board-to-board connector series for external applications is:

Supplier: Hirose (www.hirose.com)

Type: DF12x-50DP-0.5V (SlimStack Header)

Height: 3.0 – 5.0 mm

For Hirose sales contacts see [Chapter 8](#).

Note: There is no inverse polarity protection for the board-to-board connector. It is therefore very important that the board-to-board connector is connected correctly to the host application, i.e., pin1 must be connected to pin1, pin2 to pin 2, etc. Pin assignments are listed in [Section 5.5](#), pin locations are shown in [Figure 6](#).

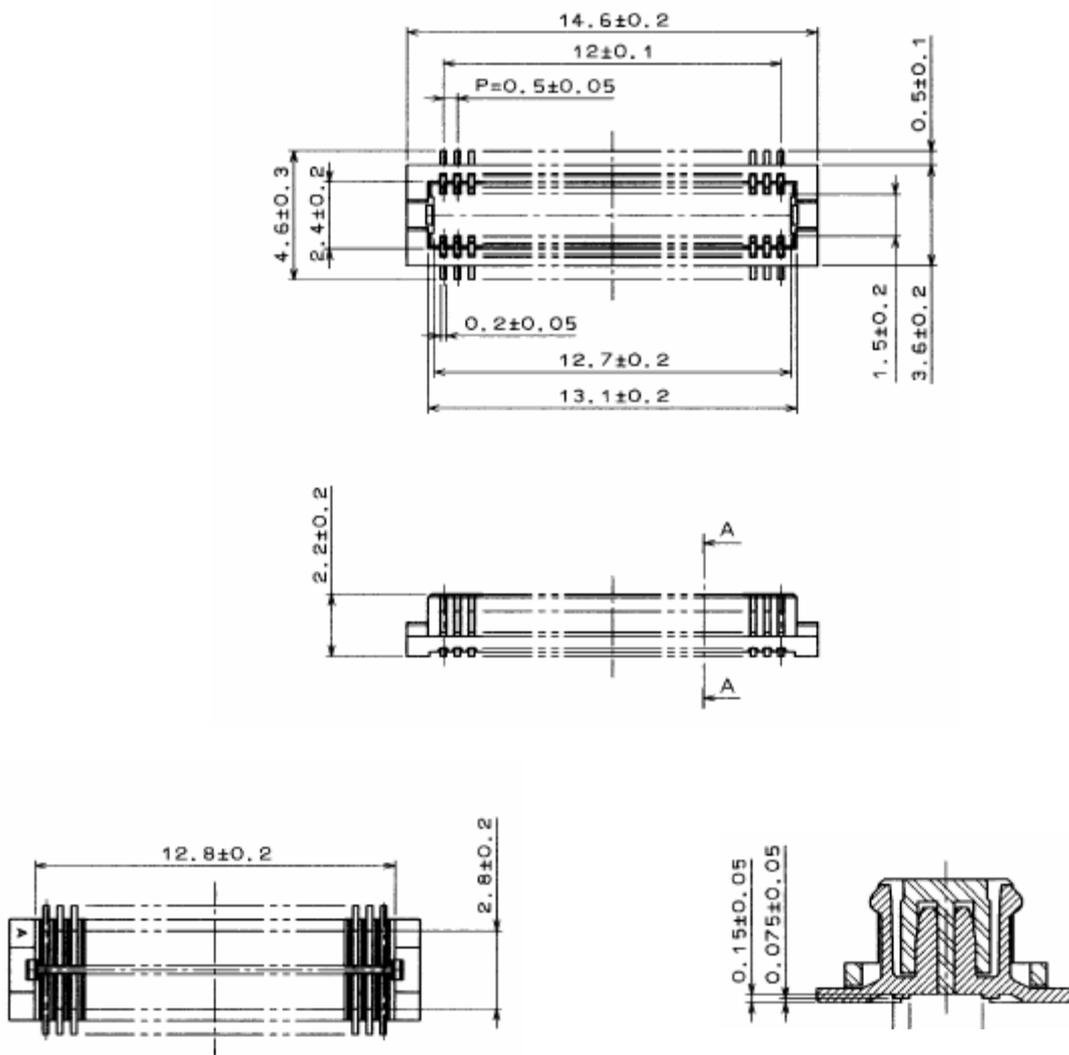


Figure 8: Mechanical dimensions of the board-to-board connector

7 Reference Approval

7.1 Reference Equipment for Type Approval

The Siemens reference setup submitted to type approve HC25 consists of the following components:

- Siemens HC25 cellular engine
- Development Support Box DSB75 and HC15/HC25-DSB75-Adapter for mounting the HC25 module
- SIM card reader integrated on DSB75
- U.FL-LP antenna cable
- Handset type Votronic HH-SI-30.3/V1.1/0
- PC as MMI

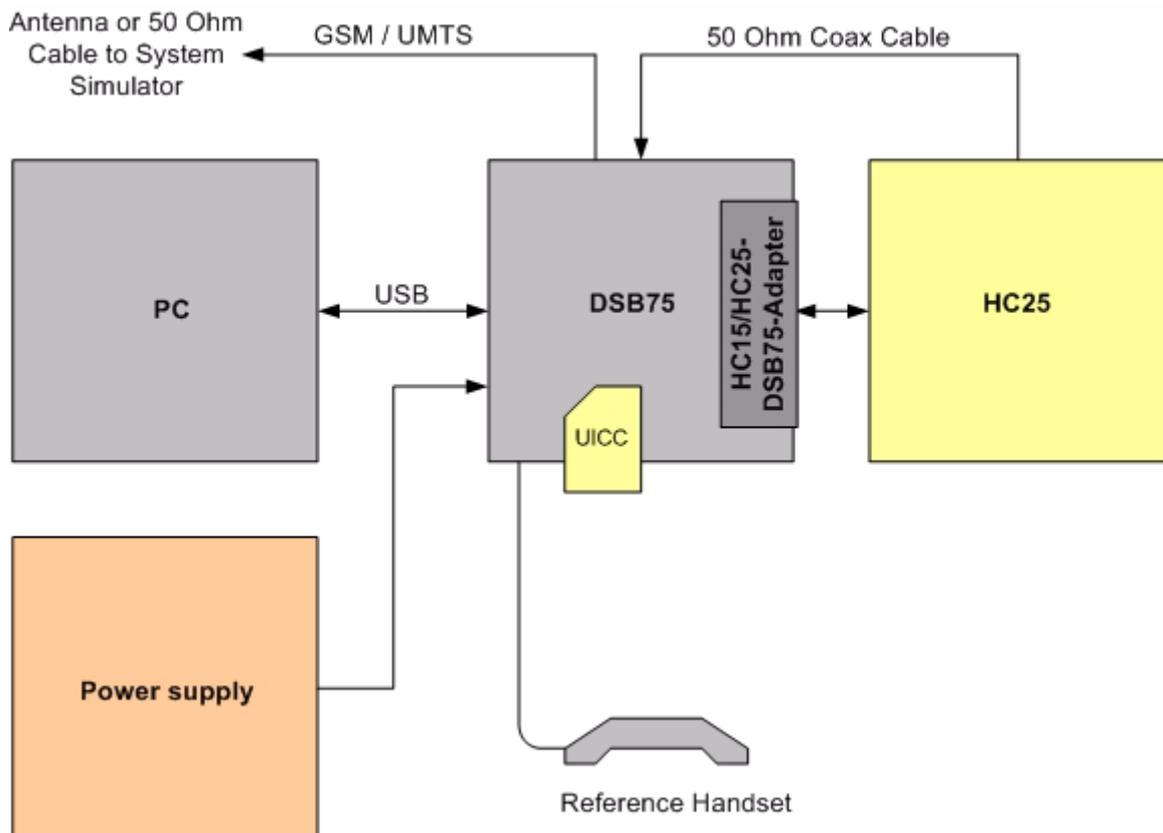


Figure 9: Reference equipment for Type Approval

7.2 Compliance with FCC Rules and Regulations

The Equipment Authorization Certification for the Siemens reference application described in [Section 7.1](#) will be registered under the following identifiers:

FCC Identifier: QIPHC25

Industry Canada Certification Number: 267W-HC25

Granted to Siemens AG

Manufacturers of mobile or fixed devices incorporating HC25 modules are authorized to use the FCC Grants and Industry Canada Certificates of the HC25 modules for their own final products according to the conditions referenced in these documents. In this case, the FCC label of the module shall be visible from the outside, or the host device shall bear a second label stating "Contains FCC ID QIPHC25".

IMPORTANT:

Manufacturers of portable applications incorporating HC25 modules are required to have their final product certified and apply for their own FCC Grant and Industry Canada Certificate related to the specific portable mobile. This is mandatory to meet the SAR requirements for portable mobiles (see [Section 1.4](#) for detail).

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

Note: 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.

8 Appendix

8.1 List of Parts and Accessories

Table 17: List of parts and accessories

Description	Supplier	Ordering information
HC25	Siemens	Standard module (Siemens IMEI) Siemens ordering number: L30960-N1050-A100 Customer IMEI mode: Siemens Ordering number: L30960-N1060-A100
Siemens Car Kit Portable	Siemens	Siemens ordering number: L36880-N3015-A117
DSB75 Support Box	Siemens	Siemens ordering number: L36880-N8811-A100
HC15/HC25-DSB75-Adapter	Siemens	Siemens ordering number: L30960-N1001-A100
Votronic Handset	VOTRONIC	Votronic HH-SI-30.3/V1.1/0 VOTRONIC Entwicklungs- und Produktionsgesellschaft für elektronische Geräte mbH Saarbrücker Str. 8 66386 St. Ingbert Germany Phone: +49-(0)6 89 4 / 92 55-0 Fax: +49-(0)6 89 4 / 92 55-88 e-mail: contact@votronic.com
SIM card holder incl. push button ejector and slide-in tray	Molex	Ordering numbers: 91228 91236 Sales contacts are listed in Table 18 .
Board-to-board connector	Molex	Sales contacts are listed in Table 18 .
Antenna connector	Hirose	Sales contacts are listed in Table 19 .

Table 18: Molex sales contacts (subject to change)

<p>Molex For further information please click: http://www.molex.com</p>	<p>Molex Deutschland GmbH Felix-Wankel-Str. 11 4078 Heilbronn-Biberach Germany Phone: +49-7066-9555 0 Fax: +49-7066-9555 29 Mail: mxgermany@molex.com</p>	<p>American Headquarters Lisle, Illinois 60532 U.S.A. Phone: +1-800-78MOLEX Fax: +1-630-969-1352</p>
<p>Molex China Distributors Beijing, Room 1319, Tower B, COFCO Plaza No. 8, Jian Guo Men Nei Street, 100005 Beijing P.R. China Phone: +86-10-6526-9628 Phone: +86-10-6526-972 Phone: +86-10-6526-9731 Fax: +86-10-6526-9730</p>	<p>Molex Singapore Pte. Ltd. Jurong, Singapore Phone: +65-268-6868 Fax: +65-265-6044</p>	<p>Molex Japan Co. Ltd. Yamato, Kanagawa, Japan Phone: +81-462-65-2324 Fax: +81-462-65-2366</p>

Table 19: Hirose sales contacts (subject to change)

<p>Hirose Ltd. For further information please click: http://www.hirose.com</p>	<p>Hirose Electric (U.S.A.) Inc 2688 Westhills Court Simi Valley, CA 93065 U.S.A. Phone: +1-805-522-7958 Fax: +1-805-522-3217</p>	<p>Hirose Electric GmbH Herzog-Carl-Strasse 4 73760 Ostfildern Germany Phone: +49-711-456002-1 Fax: +49-711-456002-299 Email info@hirose.de</p>
<p>Hirose Electric UK, Ltd Crownhill Business Centre 22 Vincent Avenue, Crownhill Milton Keynes, MK8 OAB Great Britain Phone: +44-1908-305400 Fax: +44-1908-305401</p>	<p>Hirose Electric Co., Ltd. 5-23, Osaki 5 Chome, Shinagawa-Ku Tokyo 141 Japan Phone: +81-03-3491-9741 Fax: +81-03-3493-2933</p>	<p>Hirose Electric Co., Ltd. European Branch First class Building 4F Beechavenue 46 1119PV Schiphol-Rijk Netherlands Phone: +31-20-6557-460 Fax: +31-20-6557-469</p>

8.2 Fasteners and Fixings for Electronic Equipment

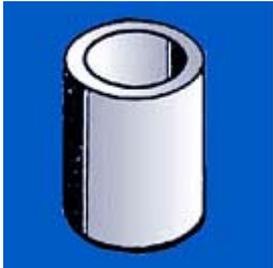
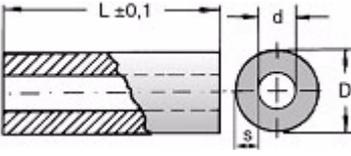
This section provides a list of suppliers and manufacturers offering fasteners and fixings for electronic equipment and PCB mounting. The content of this section is designed to offer basic guidance to various mounting solutions with no warranty on the accuracy and sufficiency of the information supplied. Please note that the list remains preliminary although it is going to be updated in later versions of this document.

8.2.1 Fasteners from German Supplier ETTINGER GmbH

Sales contact:
 ETTINGER GmbH
<http://www.ettinger.de/main.cfm>
 Phone: +49-81-046623-0
 Fax: +49-81-046623-99

The following tables contain only article numbers and basic parameters of the listed components. For further detail and ordering information please contact Ettinger GmbH.

Please note that some of the listed screws, spacers and nuts are delivered with the DSB75 Support Board. See comments below.

Article number: 05.71.038	Spacer - Aluminum / Wall thickness = 0.8mm
Length	3.0mm
Material	AlMgSi-0,5
For internal diameter	M2=2.0-2.3
Internal diameter	d = 2.4mm
External diameter	4.0mm
Vogt AG No.	x40030080.10
	

Article number: 07.51.403	Insulating Spacer for M2 Self-gripping ¹
Length	3.0mm
Material	Polyamide 6.6
Surface	Black
Internal diameter	2.2mm
External diameter	4.0mm
Flammability rating	UL94-HB

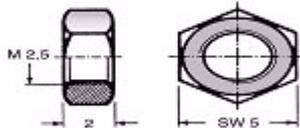
¹: 2 spacers are delivered with DSB75 Support Board

Article number: 05.11.209	Threaded Stud M2.5 - M2 Type E / External thread at both ends
Length	3.0mm
Material	Stainless steel X12CrMoS17
Thread 1 / Length	M2.5 / 6.0mm
Thread 2 / Length	M2 / 8.0mm
Width across flats	5
Recess	yes
Type	External / External

Article number: 01.14.131	Screw M2 ¹ DIN 84 - ISO 1207
Length	8.0mm
Material	Steel 4.8
Surface	Zincd A2K
Thread	M2
Head diameter	D = 3.8mm
Head height	1.30mm
Type	Slotted cheese head screw
	

¹. 2 screws are delivered with DSB75 Support Board

Article number: 01.14.141	Screw M2 DIN 84 - ISO 1207
Length	10.0mm
Material	Steel 4.8
Surface	Zincd A2K
Thread	M2
Head diameter	D = 3.8mm
Head height	1.30mm
Type	Slotted cheese head screw
	

Article number: 02.10.011	Hexagon Nut ¹ DIN 934 - ISO 4032
Material	Steel 4.8
Surface	Zincd A2K
Thread	M2
Wrench size / Ø	4
Thickness / L	1.6mm
Type	Nut DIN/UNC, DIN934
	

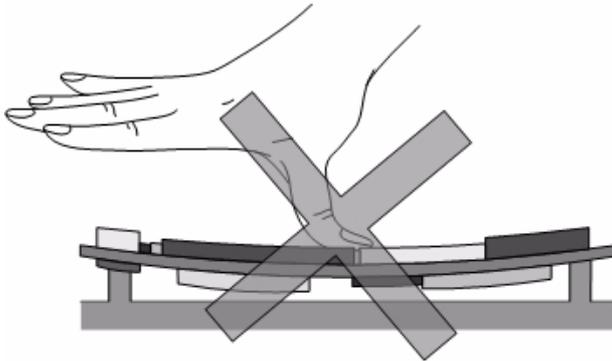
¹. 2 nuts are delivered with DSB75 Support Board

8.3 Mounting Advice Sheet

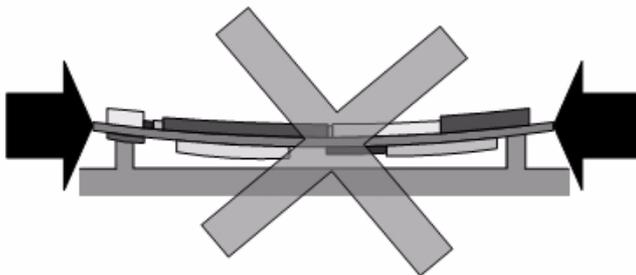
To prevent mechanical damage, be careful not to force, bend or twist the module. Be sure it is positioned flat against the host device. The advice sheet on the next page shows a number of examples for the kind of bending that may lead to mechanical damage of the module.

Mounting Advice

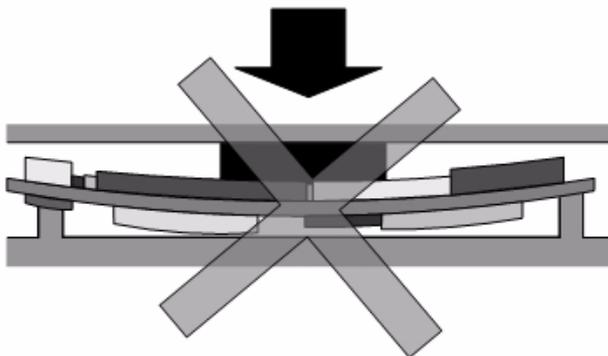
Do NOT BEND the Module



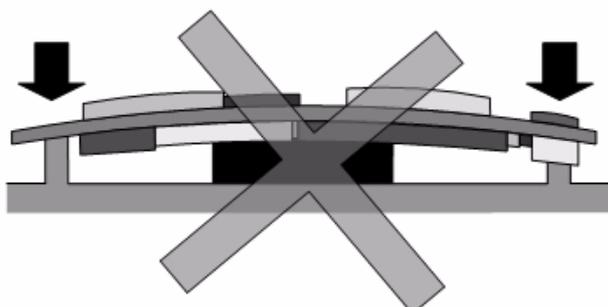
- By pressing from above



- By mounting under pressure



- By putting objects on top



- By putting objects below