DLX3G

Hardware Interface Description

Version: 0.1

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Charpt 1. Regulatory Information

1.1. 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 DLX3G 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 US and European 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 DLX3G modules are required to have their final product certified and apply for their own FCC Grant and Industry Canada Certificate relat-ed to the specific portable mobile.

Charpt 2. Product Concept

2.1. Key Features at a Glance

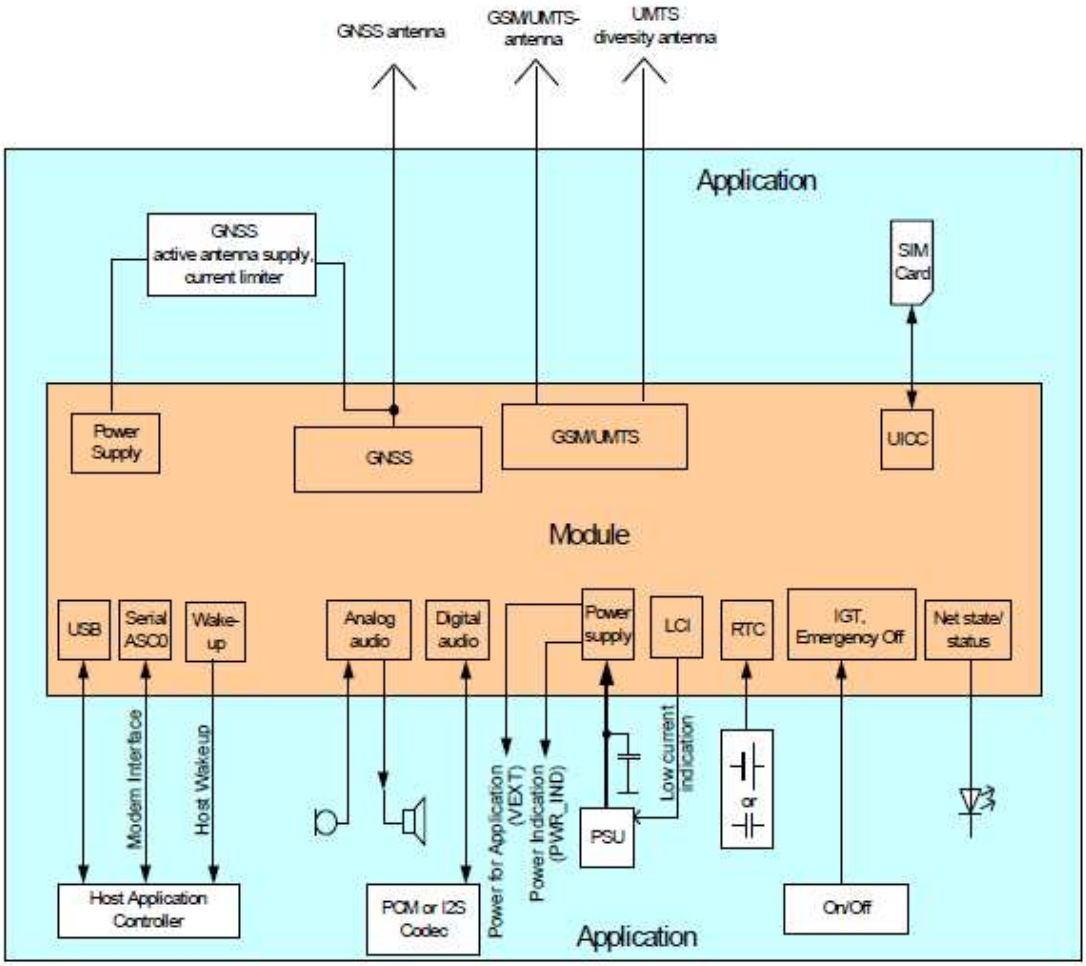
Feature	Implementation
General	
Frequency bands	GSM/GPRS/EDGE: Quad band, 850/900/1800/1900MHz UMTS/HSPA+: Five band, 800/850/900/1900/2100MHz
GSM class	Small MS
Output power (according to Release 99)	Class 4 (+33dBm ±2dB) for EGSM850 Class 4 (+33dBm ±2dB) for EGSM900 Class 1 (+30dBm ±2dB) for GSM1800 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 BdI Class 3 (+24dBm +1/-3dB) for UMTS 1900,WCDMA FDD BdII Class 3 (+24dBm +1/-3dB) for UMTS 900, WCDMA FDD BdVIII Class 3 (+24dBm +1/-3dB) for UMTS 850, WCDMA FDD BdV Class 3 (+24dBm +1/-3dB) for UMTS 800, WCDMA FDD BdVI
Power supply	3.3V < V BATT+ < 4.2V
Operating temperature (board temperature)	Normal operation: -30℃ to +85℃ Extended operation: -40℃ to +95℃
Physical	Dimensions: 33mm x 29mm x 2mm Weight: approx. 5g
RoHS	All hardware components fully compliant with EU RoHS Directive
HSPA features	
3GPP Release 6, 7	DL 14.4Mbps, UL 5.7Mbps UE CAT. 1-12 supported Compressed mode (CM) supported according to 3GPP TS25.212
UMTS features	
3GPP Release 4	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	GPRS: • Multislot Class 12 •Full PBCCH support •Mobile Station Class B •Coding Scheme 1 – 4 EGPRS: •Multislot Class 12 •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 •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 CSD: •V.110, RLP, non-transparent •14.4kbps •USSD
SMS	Point-to-point MT and MO Cell broadcast Text and PDU mode
GNSS Features	
Protocol	NMEA
Modes	Standalone GNSS Assisted GNSS - Control plane - E911 - User plane - gpsOneXTRA™
General	Power saving modes
Software	
AT commands	Hayes, 3GPP TS 27.007 and 27.005, and proprietary Gemalto M2M commands
SIM Application Toolkit	SAT Release 99
Audio	Audio speech codecs GSM： AMR, EFR, FR, HR 3GPP： AMR Speakerphone operation, echo cancellation, noise suppression, 9 ringing tones, TTY support
Firmware update	Generic update from host application over ASC0 or USB

Feature	Implementation
Interfaces	
Module interface	Surface mount device with solderable connection pads (SMT application interface). Land grid array (LGA) technology ensures high solder joint reliability and provides the possibility to use an optional module mounting socket. For more information on how to integrate SMT modules see also [7] This application note comprises chapters on module mounting and application layout issues as well as on additional SMT application development equipment.
Antenna	50Ω Main GSM/UMTS antenna, UMTS diversity antenna, GNSS antenna (active/passive)
USB	USB 2.0 High Speed (480Mbps) device interface, Full Speed (12Mbps) compliant
Serial interface	ASC0: •8-wire modem interface with status and control lines, unbalanced, asynchronous •Adjustable baud rates from 9,600bps up to 921,600bps •Supports RTS0/CTS0 hardware flow control •Multiplex ability according to GSM 07.10 Multiplexer Protocol
UICC interface	Supported chip cards: UICC/SIM/USIM 3V, 1.8V
Status	Signal line to indicate network connectivity state
Audio	1 analog interface with microphone feeding 1 digital interface: PCM or I^2S USB audio
Power on/off, Reset	
Power on/off	Switch-on by hardware signal IGT Switch-off by AT command (AT^SMSO) Automatic switch-off in case of critical temperature or voltage conditions
Reset	Orderly shutdown and reset by AT command
Emergency-off	Emergency-off by hardware signal EMERG_OFF if IGT is not active
Special Features	
Phonebook	SIM and phone
TTY/CTM support	Integrated CTM modem
Emergency Call Handling	EU eCall 3GPP Release 10 compliant ERA GLONASS compliant
RLS Monitoring	Jamming Detection
Antenna	SAIC (Single Antenna Interference Cancellation) / DARP (Downlink Advanced Receiver Performance) Rx diversity (receiver type 3i - 16-QAM)

Feature	Implementation
Evaluation kit	
Evaluation module	DLX3G module soldered onto a dedicated PCB that can be connected to an adapter in order to be mounted onto the DSB75.
DSB75	DSB75 Development Support Board designed to test and type approve Gemalto M2M modules and provide a sample configuration for application engineering. A special adapter is required to connect the DLX3G evaluation module to the DSB75.

2.2. DLX3G System Overview



Charpt 3. Application Interface

3.1. Operating Modes

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

Table: Overview of operating modes

Mode	Function	
Normal operation	GSM / GPRS / UMTS / HSPA SLEEP	Power saving set automatically when no call is in progress and the USB connection is suspended by host or not present and no active communication via ASC0.
	GSM / GPRS / UMTS / HSPA IDLE	Power saving disabled or an USB connection not suspended, but no call in progress.
	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.
	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 TALK/ UMTS DATA	UMTS data transfer in progress. Power consumption depends on network settings (e.g. TPC Pattern) and data transfer rate.
	HSPA DATA	HSPA data transfer in progress. Power consumption depends on network settings (e.g. TPC Pattern) and data transfer rate.
Power Down	Normal shutdown after sending the AT^SMSO command. Only a voltage regulator is active for powering the RTC. Software is not active. Interfaces are not accessible. Operating voltage (connected to BATT+) remains applied.	
Airplane mode	Airplane mode shuts down the radio part of the module, causes the module to log off from the GSM/GPRS network and disables all AT commands whose execution requires a radio connection. Airplane mode can be controlled by AT command.	

Charpt 4. GNSS Receiver

DLX3G integrates a GNSS receiver that offers the full performance of GPS/GLONASS technology. The GNSS receiver is able to continuously track all GPS/GLONASS satellites in view, thus providing accurate satellite position data.

The integrated GNSS receiver supports the NMEA protocol via USB or ASC0 interface. NMEA is a combined electrical and data specification for communication between various (marine) electronic devices including GNSS receivers. It has been defined and controlled by the US-based National Marine Electronics Association.

Depending on the receiver's knowledge of last position, current time and ephemeris data, the receiver's startup time (i.e., TTFF = Time-To-First-Fix) may vary: If the receiver has no knowledge of its last position or time, a startup takes considerably longer than if the receiver has still knowledge of its last position, time and almanac or has still access to valid ephemeris data and the precise time.

By default, the GNSS receiver is switched off. It has to be switched on and configured using AT commands.

Charpt 5. Antenna Interfaces

5.1. GSM/UMTS Antenna Interface

The DLX3G GSM/UMTS antenna interface comprises a main GSM/UMTS antenna as well as an optional UMTS Rx diversity antenna to improve signal reliability and quality[1], The interface has an impedance of 50Ω. DLX3G is capable of sustaining a total mismatch at the antenna without any damage, even when transmitting at maximum RF power.

The external antenna must be matched properly to achieve best performance regarding radiated power, modulation accuracy and harmonic suppression. Matching networks are not included on the DLX3G PCB and should be placed in the host application, if the antenna does not have an impedance of 50Ω.

Regarding the return loss DLX3G provides the following values in the active band:

Table: 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

[1] By delivery default the optional UMTS Rx diversity antenna is configured as available for the module. To avoid negative side effects and performance degradation it is recommended to disable the diversity antenna path if
- the host application does not support a diversity antenna
- the host application includes a diversity antenna - but a 3G network simulator is used for development and performance tests.

5.2. Antenna Installation

The antenna is connected by soldering the antenna pads (ANT_WGSM; ANT_DRX) and their neighboring ground pads directly to the application's PCB.

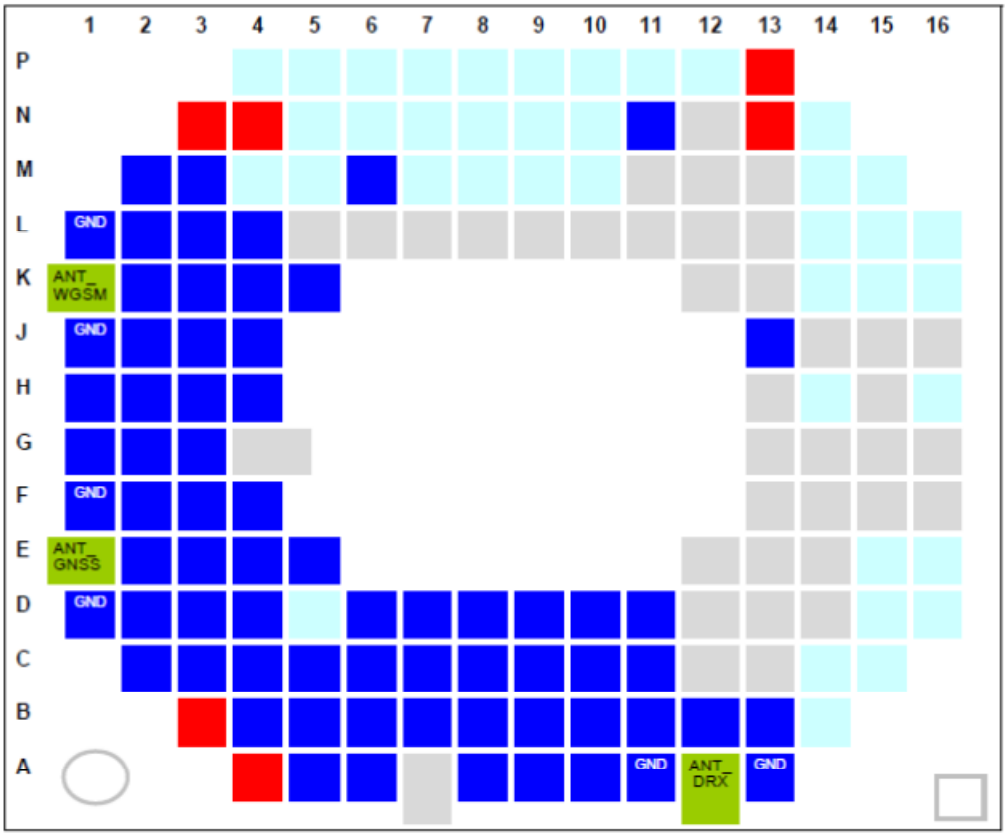


Figure : **Antenna pads (bottom view)**

The distance between the antenna pads and their neighboring GND pads has been optimized for best possible impedance. To prevent mismatch, special attention should be paid to these pads on the application' PCB.

The wiring of the antenna connection, starting from the antenna pad to the application's antenna should result in a 50 Ω line impedance. Line width and distance to the GND plane need to be optimized with regard to the PCB's layer stack.

To prevent receiver desensitization due to interferences generated by fast transients like high speed clocks on the external application PCB, it is recommended to realize the antenna connection line using embedded Stripline rather than Micro Stripline technology.

For type approval purposes, the use of a 50Ω coaxial antenna connector (U.FL-R-SMT) might be necessary. In this case the U.FL-R-SMT connector should be placed as close

as possible to DLX3G‘s antenna pad.

Charpt 6. Electrical and Radio Characteristics

6.1. Operating Temperatures

Table : Board temperature

Parameter	Min	Typ	Max	Unit
Operating temperature range[1] Normal temperature range Extreme temperature range	 +15 -30	 +25	 +55 +85	 °C °C
Extended temperature range[2]	-40		+95	°C
Automatic shutdown[3] Temperature measured on DLX3G board	 <-40	 ---	 >+95	 °C

1. Operating temperature range according to 3GPP type approval specification
2. Extended operation allows normal mode data transmissions for limited time until automatic thermal shutdown takes effect.
   Within the extended temperature range (outside the operating temperature range) there should not be any unrecoverable malfunctioning. General performance parameters like Pout or RX sensitivity however may be reduced in their values. The module's life time may also be affected, if deviating from a general temperature allocation model .
3. Due to temperature measurement uncertainty, a tolerance on the stated shutdown thresholds may occur. The possible deviation is in the range of ± 2°C at the over temperature and under temperature limit.

Note that within the specified operating temperature ranges the board temperature may vary to a great extent depending on operating mode, used frequency band, radio output power and current supply voltage. Note also the differences and dependencies that usually exist between board (PCB) temperature and ambient temperature. The possible ambient temperature range depends on the mechanical application design including the module and the PCB with its size and layout. A thermal solution will have to take these differences into account and should therefore be an integral part of application design.

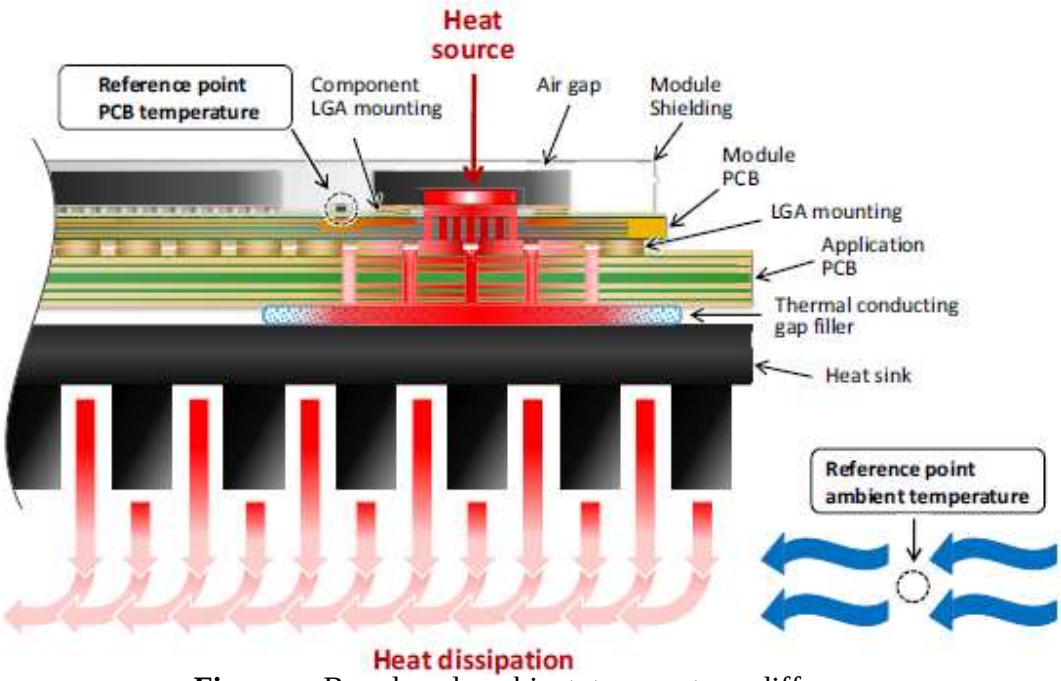


Figure: Board and ambient temperature differences

6.1.1. Temperature Allocation Model

The temperature allocation model shown in Table 21 assumes shares of a module's average lifetime of 10 years (given in %) during which the module is operated at certain temperatures.

Table: Temperature allocation model

Module lifetime share (in %)[1]	1	1	5	53	35	3	1	1
Module Temperature (in °C)	-40	-30	-10	20	40	70	85	95

1.Based on an assumed average module lifetime of 10 years (=100%).

Any deviations from the above temperature allocation model may reduce the module's life span, for example if the module is operated close to the maximum automatic shutdown temperature not only for 1% but for 20% of its product life.

6.2. Pad Assignment and Signal Description

The SMT application interface on the DLX3G provides connecting pads to integrate the module into external applications.

Please note that a number of connecting pads are marked as reserved for future use (rfu) or ground (GND) and further qualified as either (dnu), (GND) or (nc):

- Pads marked "rfu" and qualified as "dnu" (do not use) may be soldered but should not be connected to an external application.
- Pads marked "rfu" and qualified as "GND" (ground) are assigned to ground with DLX3Gmodules, but may have different assignments with future Gemalto M2M products using thesame pad layout.
- Pads marked "GND" and qualified as "nc" (not connected) are internally not connected withDLX3G modules but may be soldered and arbitrarily be connected to external ground.

Strongly recommends to solder all connecting pads for mechanical stability and heat dissipation.

Table : Overview: Pad assignments

Pad No.	Signal Name	Pad No.	Signal Name	Pad No.	Signal Name
A4	BATT+_WCDMA	E2	GND	L2	GND
A5	GND	E3	GND	L3	GND
A6	GND	E4	GND	L4	GND
A7	rfu (dnu)	E5	GND	L5	rfu (dnu)
A8	GND	E12	rfu (GND)	L6	rfu (dnu)
A9	GND	E13	rfu (GND)	L7	rfu (dnu)
A10	GND	E14	rfu (GND)	L8	rfu (dnu)
A11	GND	E15	EPP	L9	rfu (dnu)
A12	ANT_DRX	E16	EPN	L10	rfu (dnu)
A13	GND	F1	GND	L11	rfu (dnu)
B3	BATT+_WCDMA	F2	GND	L12	rfu (dnu)
B4	GND	F3	GND	L13	rfu (dnu)
B5	GND	F4	GND	L14	CCRST
B6	GND	F13	rfu (GND)	L15	CCCLK
B7	GND	F14	rfu (dnu)	L16	IGT
B8	GND	F15	rfu (dnu)	M2	GND
B9	GND	F16	rfu (dnu)	M3	GND
B10	GND	G1	GND	M4	PWR_IND
B11	GND	G2	GND	M5	VEXT
B12	GND	G3	GND	M6	GND
B13	GND	G4	rfu (dnu)	M7	PCM_IN/I2S_DIN
B14	STATUS	G13	rfu (GND)	M8	PCM_CLK/I2S_SCLKIN
C2	GND	G14	rfu (dnu)	M9	PCM_FSC/I2S_WSIN
C3	GND	G15	rfu (dnu)	M10	PCM_OUT
C4	GND	G16	rfu (dnu)	M11	rfu (dnu)
C5	GND	H1	GND	M12	rfu (dnu)
C6	GND	H2	GND	M13	rfu (dnu)
C7	GND	H3	GND	M14	CCIN
C8	GND	H4	GND	M15	VDDLP
C9	GND	H13	rfu (GND)	N3	BATT+_GSM
C10	GND	H14	WAKEUP	N4	BATT+_GSM
C11	GND	H15	rfu (dnu)	N5	VUSB_IN
C12	rfu (GND)	H16	LC_IND	N6	I2S_SCLKOUT
C13	rfu (GND)	J1	GND	N7	I2S_WSOUT
C14	VMIC	J2	GND	N8	CTS0
C15	AGND	J3	GND	N9	DCD0
D1	GND	J4	GND	N10	RTS0
D2	GND	J13	GND (nc)	N11	GND
D3	GND	J14	rfu (dnu)	N12	rfu (dnu)
D4	GND	J15	rfu (dnu)	N13	BATT+
D5	ANT_GNSS_DC	J16	rfu (dnu)	N14	EMERG_OFF
D6	GND	K1	ANT_WGSM	P4	USB_DP
D7	GND	K2	GND	P5	USB_DN
D8	GND	K3	GND	P6	I2S_MCLKOUT
D9	GND	K4	GND	P7	I2S_DOUT
D10	GND	K5	GND	P8	DTR0
D11	GND	K12	rfu (dnu)	P9	DSR0
D12	rfu (GND)	K13	rfu (dnu)	P10	RING0
D13	rfu (GND)	K14	CCIO	P11	RXD0
D14	rfu (GND)	K15	CCVCC	P12	TXD0
D15	MICP	K16	VGNSS	P13	BATT+
D16	MICN	L1	GND		
E1	ANT_GNSS				

Figure : DLX3G bottom view: Pad assignments

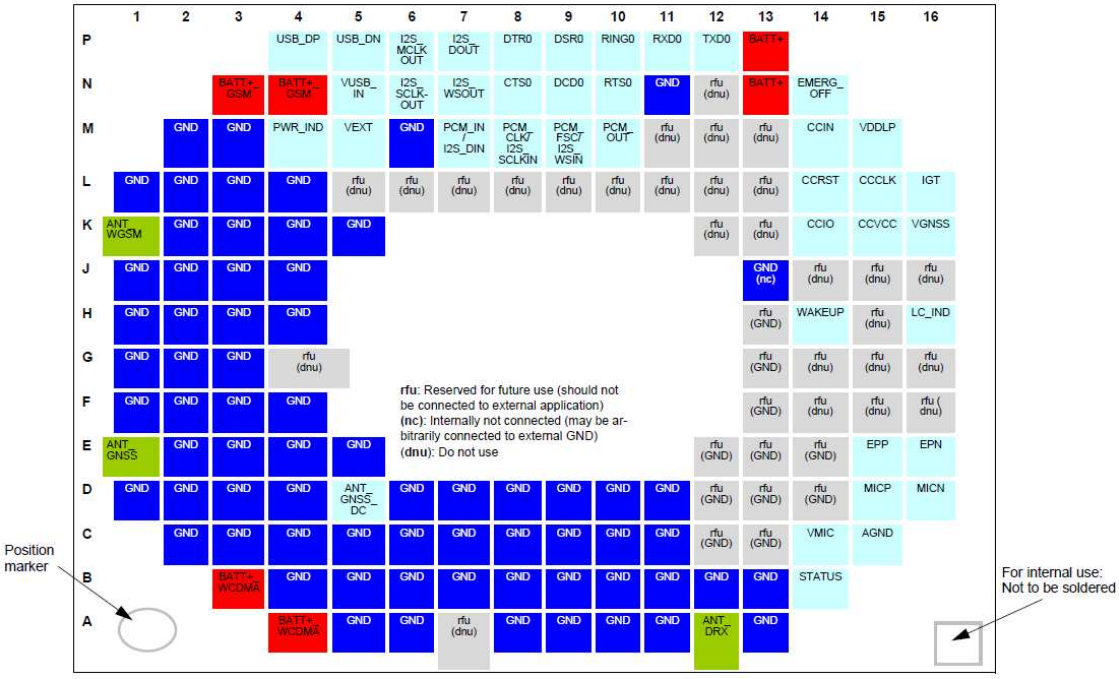
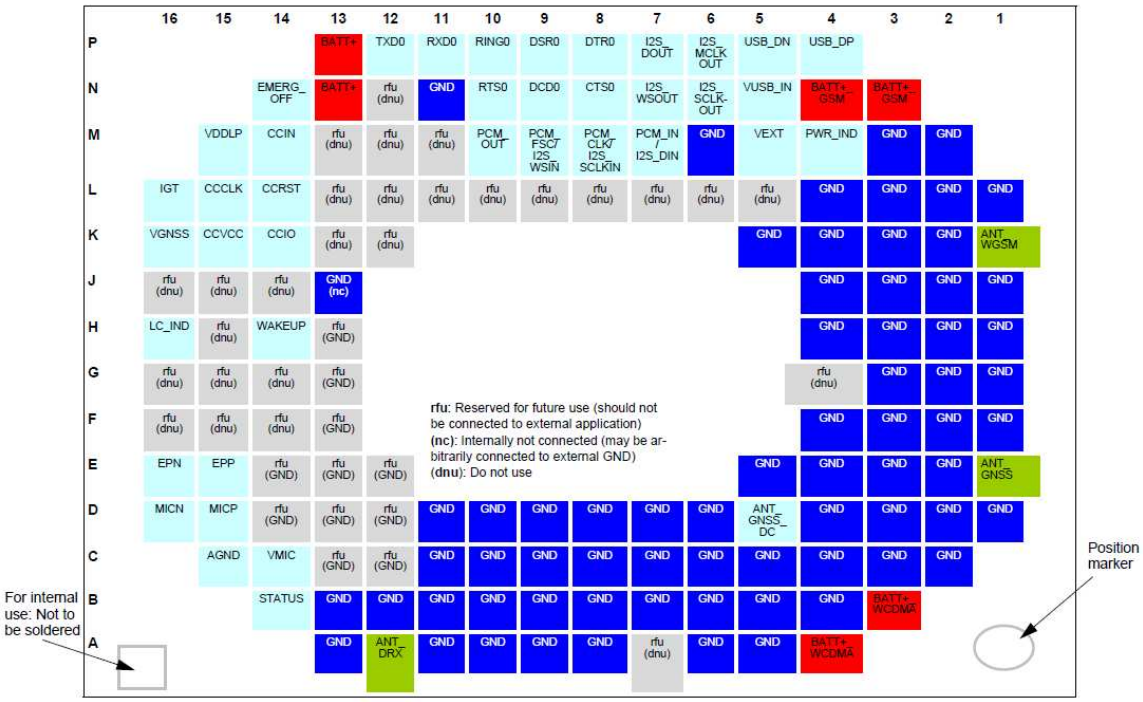


Figure : DLX3G top view: Pad assignments



6.3. RF Antenna Interface Characteristics

Table: RF Antenna interface GSM / UMTS

Parameter		Conditions	Min.	Typical	Max.	Unit
UMTS/HSPA connectivity[1]		Band I, II, V, VI, VIII				
Receiver Input Sensitivity @ ARP[1]		UMTS 800/850 Band VI/V	-104.7/ -106.7	-110		dBm
		UMTS 900 Band VIII	-103.7	-110		dBm
		UMTS 1900 Band II	-104.7	-109		dBm
		UMTS 2100 Band I	-106.7	-110		dBm
RF Power @ ARP with 50Ω Load		UMTS 800/850 Band VI/V	+21	+24	+25	dBm
		UMTS 900 Band VIII	+21	+24	+25	dBm
		UMTS 1900 Band II	+21	+24	+25	dBm
		UMTS 2100 Band I	+21	+24	+25	dBm
Tx noise @ ARP with max. RF power for UMTS: Band 1 channel 9777 Band 2 channel 9477		GNSS band		-170		dBm/Hz
GPRS coding schemes		Class 12, CS1 to CS4				
EGPRS		Class 12, MCS1 to MCS9				
GSM Class		Small MS				
Static Receiver input Sensitivity @ ARP		GSM 850 / E-GSM 900	-102	-109		dBm
		GSM 1800 / GSM 1900	-102	-108		dBm
RF Power @ ARP with 50Ω Load	GSM	GSM 850 / E-GSM 900		33		dBm
		GSM 1800 / GSM 1900		30		dBm

Table: RF Antenna interface GSM / UMTS

Parameter		Conditions	Min.	Typical	Max.	Unit
RF Power @ ARP with 50Ω Load, (**ROPR = 4**, i.e. no reduction)	GPRS, TX	GSM 850 / E-GSM 900		33		dBm
		GSM 1800 / GSM 1900		30		dBm
	EDGE, 1 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		26		dBm
	GPRS, TX	GSM 850 / E-GSM 900		33		dBm
		GSM 1800 / GSM 1900		30		dBm
	EDGE,	GSM 850 / E-GSM 900		27		dBm

	2 TX	GSM 1800 / GSM 1900		26		dBm
	GPRS, TX	GSM 850 / E-GSM 900		33		dBm
		GSM 1800 / GSM 1900		30		dBm
	EDGE, 3 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		26		dBm
	GPRS, TX	GSM 850 / E-GSM 900		33		dBm
		GSM 1800 / GSM 1900		30		dBm
	EDGE, 4 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		26		dBm
RF Power @ ARP with 50Ω Load, (**ROPR = 5**)	GPRS, TX	GSM 850 / E-GSM 900		33		dBm
		GSM 1800 / GSM 1900		30		dBm
	EDGE, 1 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		26		dBm
	GPRS, TX	GSM 850 / E-GSM 900		33		dBm
		GSM 1800 / GSM 1900		30		dBm
	EDGE, 2 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		26		dBm
	GPRS, TX	GSM 850 / E-GSM 900		32,2		dBm
		GSM 1800 / GSM 1900		29,2		dBm
	EDGE, 3 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		26		dBm
	GPRS, TX	GSM 850 / E-GSM 900		31		dBm
		GSM 1800 / GSM 1900		28		dBm
	EDGE, 4 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		26		dBm

Parameter		Conditions	Min.	Typical	Max.	Unit
RF Power @ ARP with 50Ω Load, (**ROPR = 6**)	GPRS, 1 TX	GSM 850 / E-GSM 900		33		dBm
		GSM 1800 / GSM 1900		30		dBm
	EDGE, 1 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		26		dBm
	GPRS, 2 TX	GSM 850 / E-GSM 900		31		dBm
		GSM 1800 / GSM 1900		28		dBm

	EDGE, 2 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		26		dBm
	GPRS, 3 TX	GSM 850 / E-GSM 900		30,2		dBm
		GSM 1800 / GSM 1900		27,2		dBm
	EDGE, 3 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		26		dBm
	GPRS, 4 TX	GSM 850 / E-GSM 900		29		dBm
		GSM 1800 / GSM 1900		26		dBm
	EDGE, 4 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		26		dBm
RF Power @ ARP with 50Ω Load, (**ROPR = 7**)	GPRS, 1 TX	GSM 850 / E-GSM 900		33		dBm
		GSM 1800 / GSM 1900		30		dBm
	EDGE, 1 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		26		dBm
	GPRS, 2 TX	GSM 850 / E-GSM 900		30		dBm
		GSM 1800 / GSM 1900		27		dBm
	EDGE, 2 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		26		dBm
	GPRS, 3 TX	GSM 850 / E-GSM 900		28,2		dBm
		GSM 1800 / GSM 1900		25,2		dBm
	EDGE, 3 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		26		dBm
	GPRS, 4 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		24		dBm
	EDGE, 4 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		26		dBm

Parameter		**Conditions**	**Min.**	**Typical**	**Max.**	**Unit**
RF Power @ ARP with 50Ω Load, (**ROPR = 8**, i.e. maximum reduction)	GPRS, 1 TX	GSM 850 / E-GSM 900		33		dBm
		GSM 1800 / GSM 1900		30		dBm
	EDGE, 1 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		26		dBm

	GPRS, 2 TX	GSM 850 / E-GSM 900		30		dBm
		GSM 1800 / GSM 1900		27		dBm
	EDGE, 2 TX	GSM 850 / E-GSM 900		24		dBm
		GSM 1800 / GSM 1900		23		dBm
	GPRS, 3 TX	GSM 850 / E-GSM 900		28,2		dBm
		GSM 1800 / GSM 1900		25,2		dBm
	EDGE, 3 TX	GSM 850 / E-GSM 900		22,2		dBm
		GSM 1800 / GSM 1900		21,2		dBm
	GPRS, 4 TX	GSM 850 / E-GSM 900		27		dBm
		GSM 1800 / GSM 1900		24		dBm
	EDGE, 4 TX	GSM 850 / E-GSM 900		21		dBm
		GSM 1800 / GSM 1900		20		dBm

1.Applies also to UMTS Rx diversity antenna .

6.4. GNSS Interface Characteristics

The following tables list general characteristics of the GNSS interface.

Table 33: GNSS properties

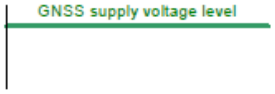
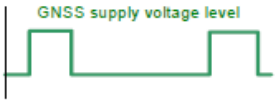
Parameter	Conditions	Min.	Typical	Max.	Unit
Frequency	GPS GLONASS	1597.551	1575.42	1605.886	MHz
Tracking Sensitivity	Open sky Active antenna or LNA Passive antenna		 -159 -156		dBm
Acquisition Sensitivity	Open sky Active antenna or LNA Passive antenna		 -149 -145		dBm
Cold Start sensitivity[1]			-145		dBm
Time-to-First-Fix (TTFF)[2]	Cold[3]		25	32	s
	Warm[4]		10	29	s

1. Test condition: Assumes 300 seconds timeout, QoS=1000m, and 50% yield.
2. Test condition: TTFF is defined for an open sky environment, i.e., with a clear view to the sky and a min-imum signal level of -130dBm at the antenna for at least 3…4 satellites. This signal level represents C/No=42dB in an NMEA $GPGSV message.
3. For test purposes a cold start may be triggered by AT command: AT^SBNW="agps",-1.
4. To optimize GPS start-up behavior, it is recommended to backup the module's internal real time clock via VDDLP line as described.

Through the external GNSS antenna DC feeding the module is able to supply an active

GNSS antenna. The supply voltage level at the GNSS antenna interface depends on the GNSS con-figuration done with AT^SGPSC as shown in follow Table .

Table: Power supply for active GNSS antenna

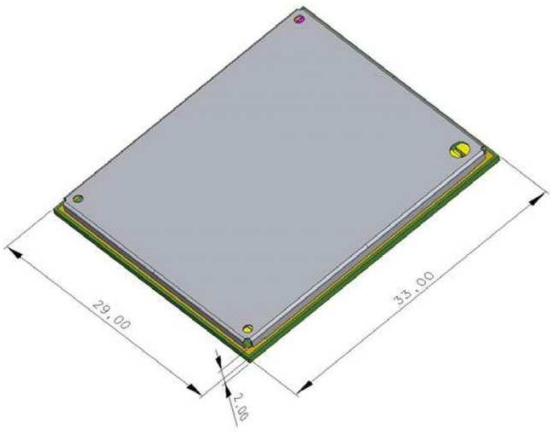
Function	Setting samples	IO	Signal form and level
GNSS active antenna supply	Supply voltage with: GNSS receiver off Active antenna off	O	
	Supply voltage with[1]: GNSS receiver on Active antenna on SLEEP mode	O	
	Supply voltage with[2]: GNSS receiver on Active antenna auto	O	

1. Same behavior if GNSS active antenna set to auto and AT^SGPSC="NMEA/Freq",x with x < 4
2. Frequency of a position request (fix) should be set with AT^SGPSC="NMEA/Freq",x with x > 4

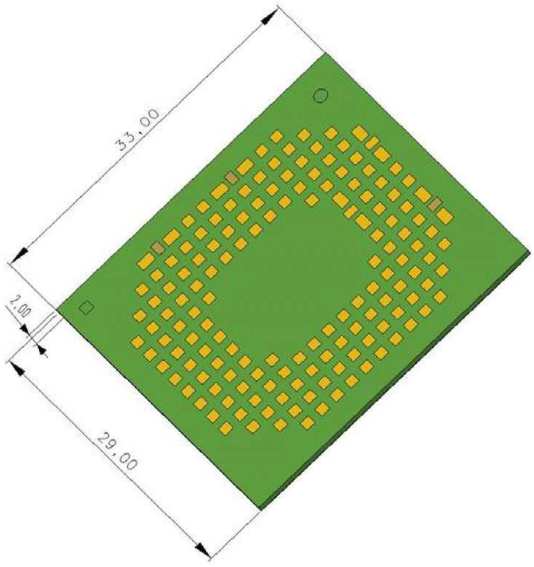
Charpt 7. Mechanics

Follow figure shows a 3D view1 of DLX3G and provides an overview of the board's mechanical dimensions.

Length: 33mm
Width: 29mm
Height: 2mm



Top view



Bottom view

Figure: DLX3G – top and bottom view

Charpt 8. Reference Approval

8.1. Compliance with FCC and IC Rules and Regulations

•DLX3G:
FCC Identifier: U4GDLX3G
Industry Canada Certification Number: 3862E-DLX3G

Manufacturers of mobile or fixed devices incorporating DLX3G modules are authorized to use the FCC Grants and Industry Canada Certificates of the DLX3G 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: U4GDLX3G", and accordingly “Contains IC: 3862E-DLX3G“. The integration is limited to fixed or mobile categorized host devices, where a separation distance between the antenna and any person of min. 20cm can be assured during normal operating conditions. For mobile and fixed operation configurations the antenna gain, including cable loss, must not exceed the limits 3.92dBi (850MHz) and 2.51dBi (1900MHz).

IMPORTANT：
Manufacturers of portable applications incorporating DLX3G 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.

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.

Industry Canada (IC) Statements:

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

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

RF Radiation Exposure Statement:

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

Déclaration d'exposition aux radiations:

Cet appareil est conforme aux limites d'exposition aux rayonnements définies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé à une distance minimale de 20 centimètres entre le radiateur et votre corps.

Required end product labeling:

Any device incorporating this module must include an external, visible, permanent marking or label which states: “Contains IC: 3862E-DLX3G”