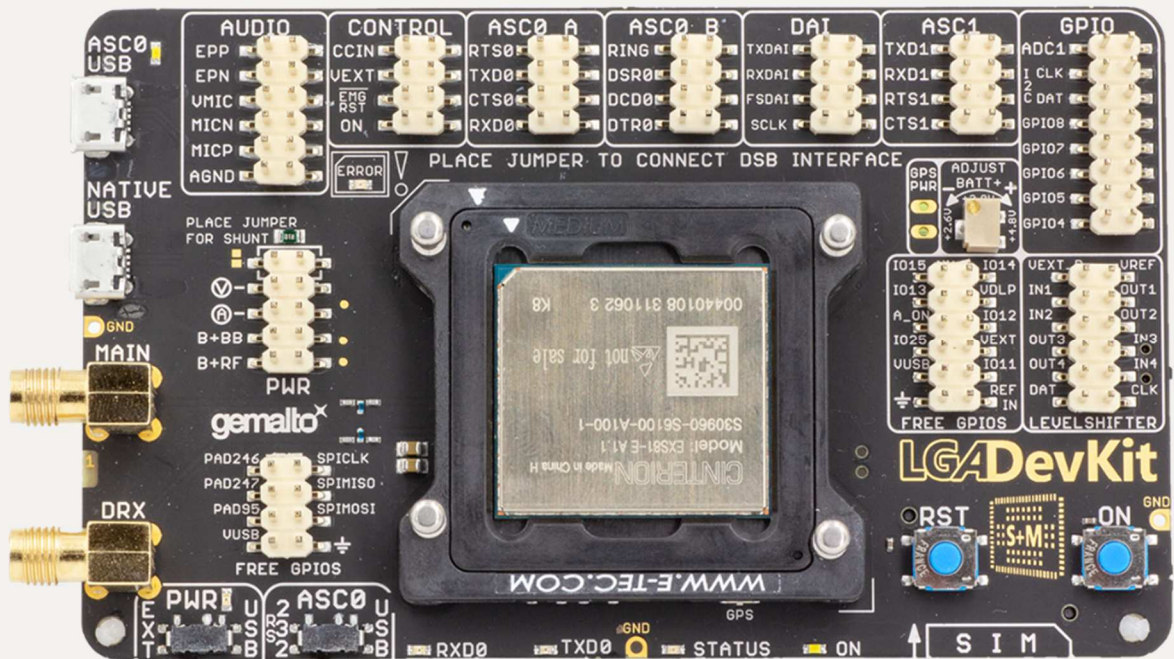


Cinterion® LGA DevKit

User Guide

Version: 00 draft
DocId: UG_LGA DevKit_v01



User Guide:	Cinterion® LGA DevKit
Version:	01
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Document History







New document: "Cinterion® LGA DevKit User Guide" v01

Chapter	What is new
---	Initial document setup.

Safety Precaution Notes

The common safety precautions that apply to mobile phones must also be observed at all times when using this LGA DevKit. Failure to comply with these precautions violates safety standards. Gemalto M2M assumes no liability for customer's failure to comply with these precautions.

The following is a non-extensive list of the mobile phone and LGA DevKit usage restrictions:

	Pacemaker patients are advised to keep their hand-held mobile away from the pacemaker while it is on.
	Mobile phones must be switched off before boarding an aircraft.
	Mobile phones may not be operated in the presence of flammable gases or fumes
	Interference can occur if mobile phones are used close to TV sets, radios, computers or inadequately shielded equipment
	Do not use your mobile while driving a vehicle
	You should never rely solely upon any wireless device for essential communications, for example for emergency calls

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

Regulatory Compliance Information

The Cinterion® LGA DevKit is intended for evaluation and development purposes only, and should therefore only be used in a (laboratory) test environment. The device is not CE approved, and has not been authorized as required by the rules of the FCC. All persons handling the Cinterion® LGA DevKit must be properly trained in electronics and observe good engineering practice standards.

1 Introduction

The Cinterion® LGA DevKit is designed as a generic development adapter for Cinterion LGA modules with the main advantage the user no longer need to handle Cinterion Evaluation modules, instead the user may develop with LGA modules, thus makes the evaluation modules obsolete for most users. The LGA modules can also be investigated on a very deep level as all signals have direct access without any glue between the module and the user interface.

The LGA DevKit may operate stand-alone without the need of additional tools or it can be used as an adapter between the LGA modules and Cinterion® development boards, like DSB75 or DSB.mini as a so called port extender.

The DevKit comes with minor limitations in terms of radio frequency and temperature evaluation as of a slightly increased RF path loss and modules temperature encapsulation inside the LGA socket.

The DevKit is available in two variants, where the version SM supports the complete industrial platform and the version L supports parts of industrial plus modules. It is orderable separated into the DevKit and the Socket, leaving the option to reuse the socket for both DevKit SM and L.

1.1 Package Content

The LGA DevKit packages includes:

- **L30960-N0111-A100** Cinterion® LGA DevKit **SM**
Base PCB for the industrial platform modules
USB and SMA cable
An ultra-wideband high efficiency antenna
A bag of jumpers ~25pcs
A quick start guide
- **L30960-N0112-A100** Cinterion® LGA DevKit **L**
Base PCB for the industrial plus platform modules
USB and SMA cable
An ultra-wideband high efficiency antenna
A bag of jumpers ~25pcs
A quick start guide
- **L30960-N0110-A100** Cinterion® LGA DevKit Socket SML
The needle socket fitting on both PCB versions SM and L
Screws, fixing frames, retention lid

1.2 Features

- Support three different module footprints, LGA106, 114, 120, 156 industrial and plus
- Future proofed, ready for new upcoming modules
- Improves the module inter-compatibility
- Replaces existing evaluation modules
- Stand-alone: Get the LGA module up & running without additional tools
- Supports Cinterion® DSB75 / mini as port extender
- UART via USB VCP and/or native USB communication
- Direct signal module access and complete interruption for deep level investigation
- Real module current consumption measurement, no additional leakage current
- Powering by USB and external DSB
- Adjustable module supply level 2.8...4.5V
- Vext self-adjustment for level shifter reference level
- Further supported: SPS, dual-SIM, ASC1, Audio, GPIO, GPS
- Error detection: Wrong modules, false orientated and shorts by modules preventing damages on DevKit and modules
- Clear & easy concept for usage and signaling
- Cost minimized: Socket reusable on both PCB versions
- 2D barcode scanning leads the user to all needed information

2 DevKit Quickstart

By scanning the underside QR code you will get fully instructed by the DevKit's home.



- Mount the socket on the DevKit PCB
- Insert the module together with the fixing frame and close the retention lid by pressing it down and turn clockwise
- Connect the PCB antenna to the SMA port named „MAIN“
- Check the jumpers are set to default positions
- Connect your host PC to either USB or VCP (depending on module)
If needed, install FT232R drivers in case of VCP connection
- Move both switches (PWR & ASC0) to the right side, the green PWR LED shall light up
- Short pressing the ON button starts the module, the white ON LED lights up

If the red error LED gets active, correct as follow:

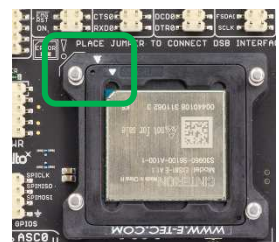
- Blinking: Turn module by 180°
- Blinking twice: Use correct module on DevKit, industrial vs. industrial+
- Permanent: Overcurrent, probably module damaged by short. Exchange module

3 Socket

Before operating, the socket shall be mounted on the LGA DevKit with 4 screws. Scanning the QR on PCB's backside and/or the quick start guide will lead you to the DevKit home and give a quick introduction how to do.

The white printing on the DevKit PCB shows how the socket shall be orientated and mounted. The user can quickly adapt different module shapes on the LGA DevKit by dedicated fixing frames. All contacts have low-resistivity needles which can withstand a permanent DC current up to 2A per needle.

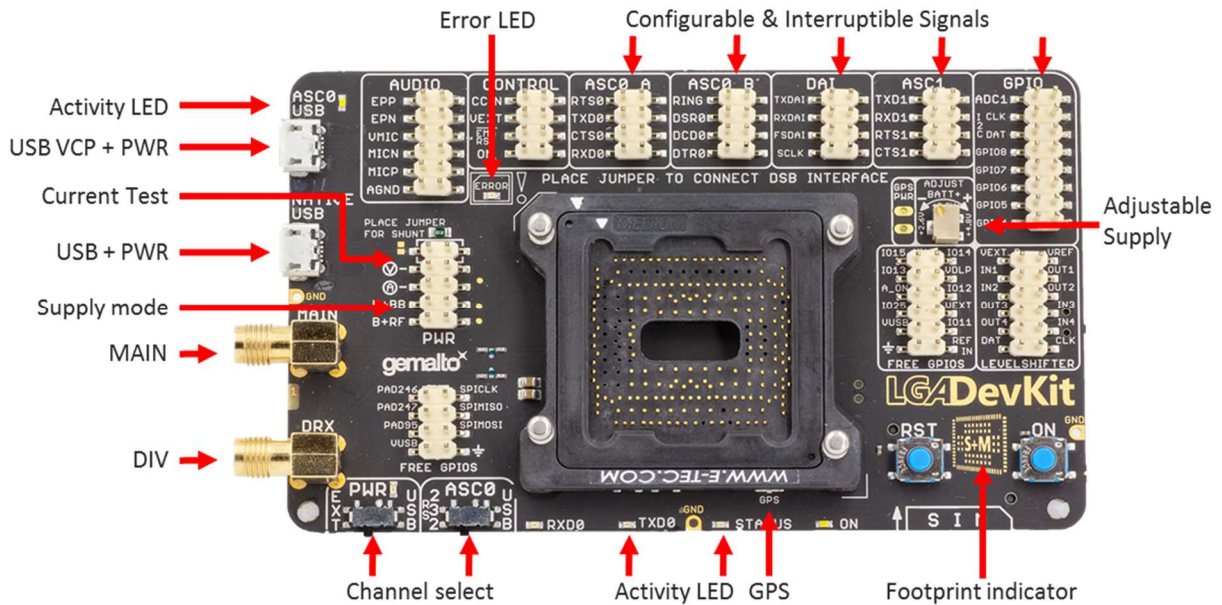
Due to the module thermal encapsulation inside the socket, the module has an increase thermal resistance



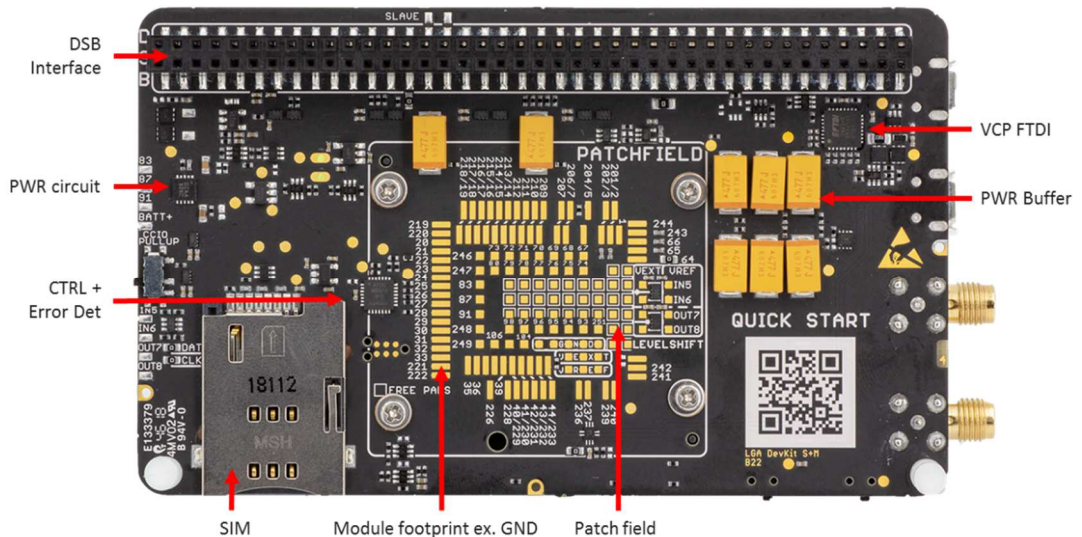
(Rth). As of almost no cooling the modules board temperature may rise quickly until automatic shutdown execution, in special at higher environmental temperatures and high radio output power.

4 LGA DevKit detailed description

4.1 Overview



Picture : Topside overview



Picture: Backside Overview

4.2 Block diagram

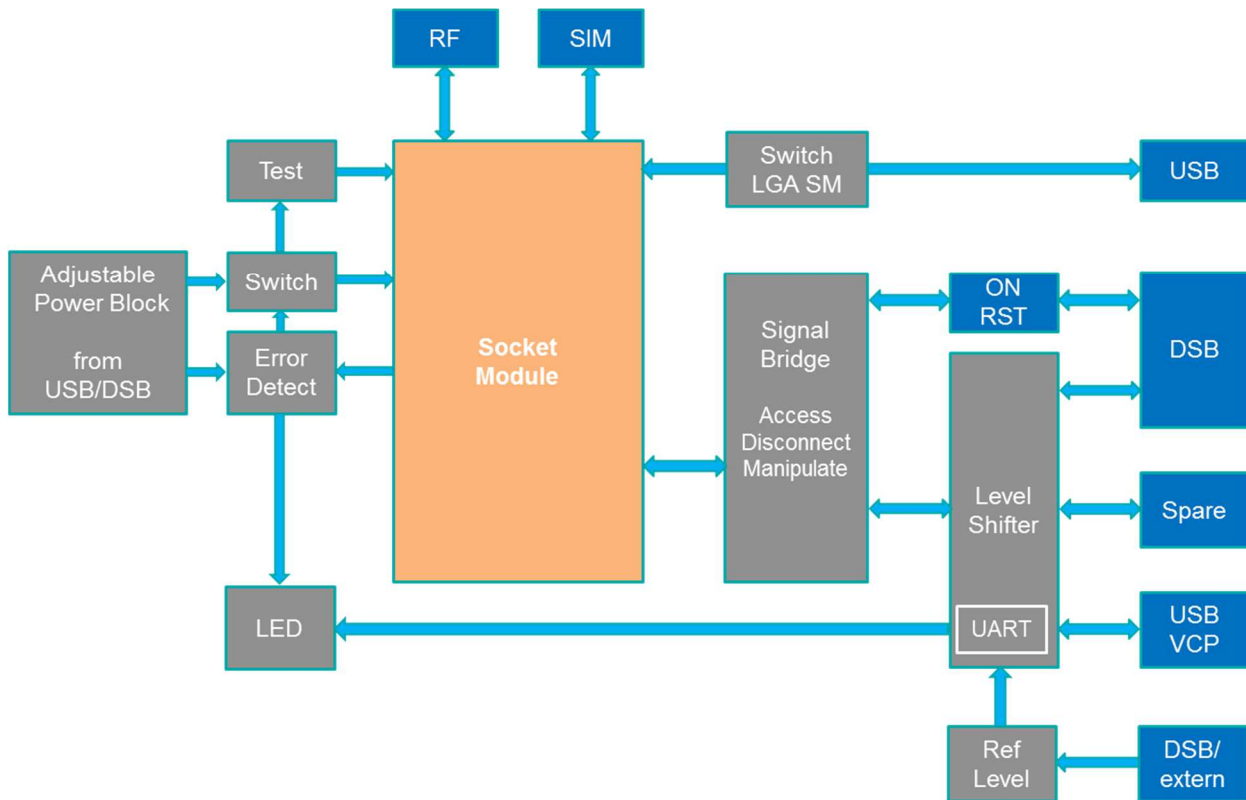


Figure 1: LGA DevKit Block diagram

4.3 Interfaces

4.3.1 USB

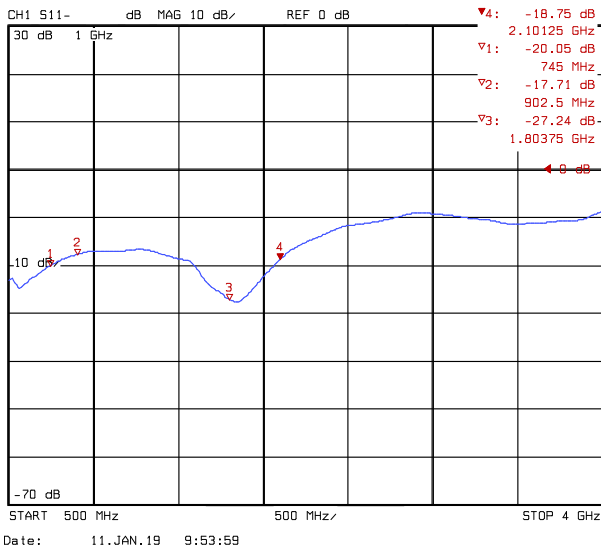
The DevKit comes with two USB interface supporting power supply and serial communication. You may choose to setup communication via modules USB port and/or the modules UART (ASCO) port via FTDI232R VCP.

- Both USB ports can be used in parallel while power is sourced from both ports.
- The native USB power is isolated from the VCP USB power by a diode, meaning the VCP USB power doesn't feedback to native USB power, but not visa verse. This should be noted when supplying the DevKit from different USB power sources, depending on the voltage levels there may happen a power feedback from native USB to VCP USB.
- In case of weak USB power supply both USB ports should be used for improved power capabilities.

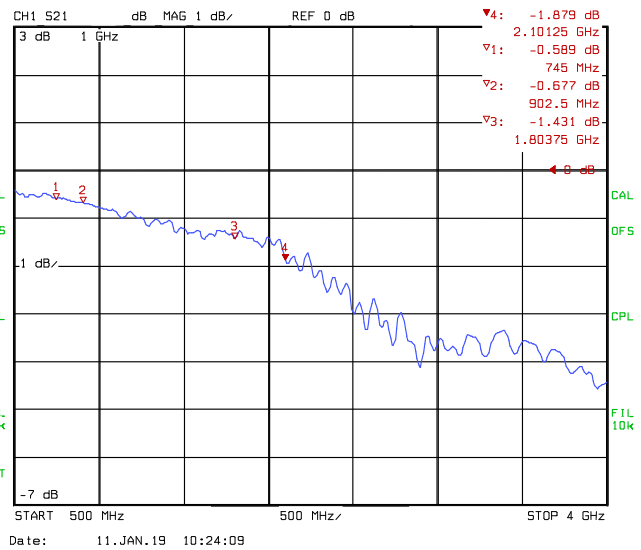
Note: The modem USB driver can be downloaded under www.developer.gemalto.com or follow the QR code.

4.3.2 RF antenna

The DevKit supports three antenna interfaces. Two SMA connectors, named as “MAIN” and “DRX” shall be used for radio transmission. The GPS interface is supported as well by an U.FL connector named “GPS”. All antenna interfaces have additional ESD protection implemented.

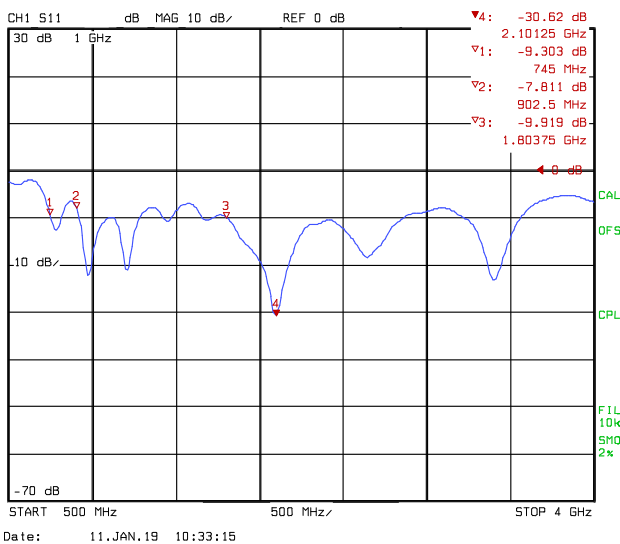


Picture: S11 DevKit MAIN antenna module RF pad



S21 - DevKit MAIN antenna RF path loss

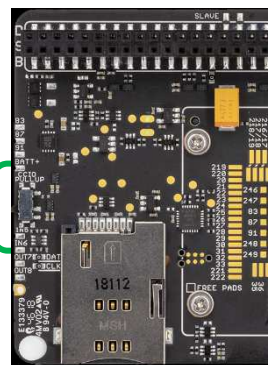
The package includes a broad band high efficiency PCB antenna which can be used with the DevKit for all radio band combinations.



Picture: Antenna S11

4.3.3 SIM

On the DevKit’s underside you will find a SIM card holder, which is connected to the module’s regular SIM interface. However, some Cinterion® modules come with an additional SIM interface, these can be accessed in conjunction with DSB75/mini (as port extender) to support dual SIM feature, the DSB will than serve the second SIM. Some Cinterion® modules requiring additional components on the SIM interface, like pull up resistors, which are managed by the DevKit control logic. Anyhow this can be overridden by manual selection on the DevKit’s backside switch. For modules requiring a CCIO pull up resistor this switch shall be set to “CCIO PULLUP”.



Picture: DevKit backside SIM switch

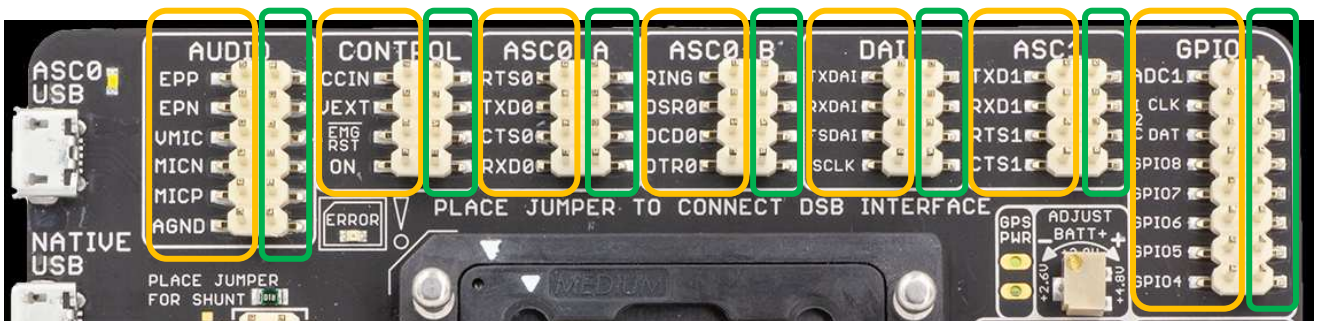
4.3.4 Pin headers

Several pin headers are placed on the top side mainly to setup the connections between the module and the onboard peripherals. Thereby the pin headers which have the signal names on the left side only, named Audio, Control, ASC0_A, ASC0_B, DAI, ASC1, GPIO and PWR, are intended to be shorted by jumper bridges. All those header have the module signal on the left side as named and marked orange, whereas the right side of those headers, marked with green boxes, corresponds the peripheral like level shifter, DSB interface etc.

- Placing a jumper means, this module signal is than connected via a level shifter to the associated pin at the 2x40pin connector underside, see also block diagram.
- Not placing a jumper mean this module signal is left open.

Instead of short jumpers an external periphery can be connected to all accessible module signals.

In such case please pay attention to not violate the maximum module ratings when connecting external periphery to the pin headers.



Picture: Pin header interface

4.3.5 External reference supply

For whom want to drive the DevKit’s interface on certain voltage level, an external reference voltage can be connected with the effect the DevKit’s interface operating on that external reference level. The default case, without the external reference, the interface operates at 3V level to meet DSB75 and DSB.mini requirements, E.g. if the user instead want’s to operate the interface on 5V, an external 5V source shall be connected to “REF IN” and “GND”, see below.



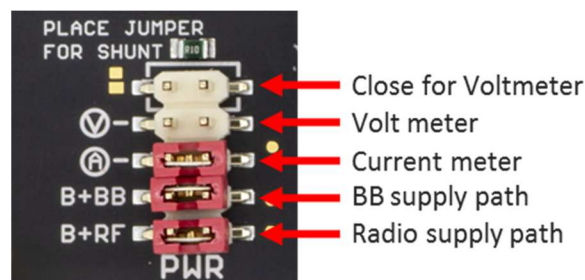
Picture: External reference supply and pin header for free level shifter

4.3.6 Free level shifter

The DevKit supports 8 non-used free level shifter, 4 placed & connected to the underside patch field, another 4 connected to the pin header “LEVELSHIFTER”. Those on the pin header are referenced to module Vext and Vref, which corresponds to 3V per default or “REF IN” if connected.

These level shifter are intended for users need to shift signals which are not conducted on the DSB connector.

4.3.7 LED



RED	Blinking continuously: Module is inserted in wrong direction, not powered, turn by 180° Blinking 2 times: No module inserted Blinking 3 times: A module with not supported footprint is inserted, not powered, change module. Lighting: Over current detected in module power pass, change module, cycle DevKit's power supply
GREEN	Module TXD0 activity, low active
GREEN PWR	Power is powered sufficient but not switched on
Amber	Module RXD0 activity, low active
Blue	Module state GPIO5 / LED
White ON	Module started, V180/300 is at high level
White USB	TX/RX activity on USB VCP

4.3.8 Power supply

The DevKit can be supplied by one or two USB ports, which shall be in range of 5V +-5%, and / or externally by the DSB75/mini. The modules supply level can be adjusted in range of 2.8...4.8V by the top side variable resistor. The DevKit power supply path is short protected with ~2A, in case of over current the power path will be interrupted and the red error LED lights up until the power has been cycled.

As a good engineering practice the DevKit shall be supplied by 5V/1A over one or two USB ports. The onboard bypass capacitors will buffer enough energy to support short 2G peak current up to 2.5A.

4.3.9 Module supply current measurement

The DevKit supports two ways to measure the current consumption of the inserted module.

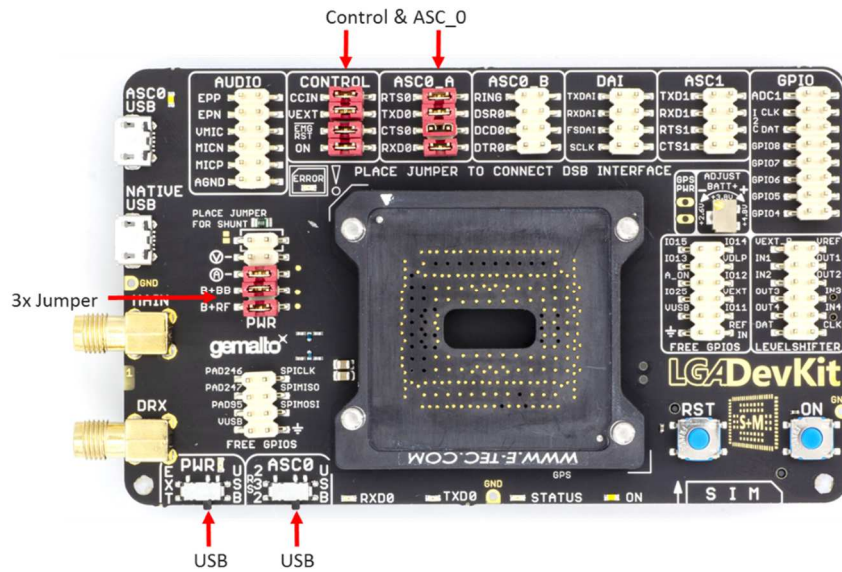
- Measure the voltage cross the on board 100 mΩ shunt resistor.
This option requires the meter to be connected to the 2nd row "Voltmeter", a jumper placed on 1st "close for voltmeter" row and the 3rd row "current meter" to be left open.
- Measure the current by a current meter.
This option requires the meter to be connected to the third row "current meter" with the upper two rows left open.

Both options require a jumper placed on the 4th "BB" and 5th "RF" row for connecting BB and Radio. Those two jumper also allow to measure the current separate for BB and RF path.

Picture: Supply and meter configuration, current metering

4.4 Default configuration

Factory default jumper and switch positioning is according the picture below.

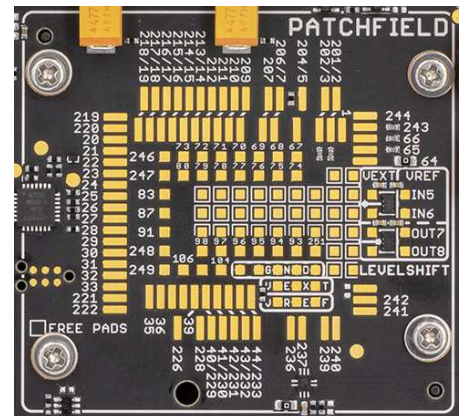


Picture: default configuration

4.5 Patch field

A small patch field is available on the DevKit's underside, where the user can add simple components (LED, Transistor etc) if needed. All module signals, except USB and RF are accessible underside by the labeled pads. 4 level shifters are accessible close to the patch field as well with the reference Vext and Vref.

Attention: Warranty is lost if the patch field was used / soldered.



Picture: Underside patch field

4.5.1 ON Button - Module start & power down

Pushing the ON button short <0.5s the control logic first analysis the module type and orientation. If both are correct the module will be started by different start pulses (). The white LED's indicated the modules Vext state as high.

Picture

Pushing the ON button longer than 2s forces the control logic to deactivate the DevKit power supply, the modules power supply is interrupted regardless the current module state.

4.5.2 RST button - module reset

Pushing the RST button pulls down the Emerge Reset / Off signal and forcing the module into reset or off state (module dependent).

4.5.3 ASC0 switch - module UART channel select

The switch named “ASC0” selects the modules UART communication channel either via “USB” VCP (FTDI232R) or via “RS232” D-Sub interface on DSB75/mini.

Moving this to “RS232” will reset the FTDI VCP bridge in order to release the signal lines, this will lead to a USB VCP disconnect on host PC side.

4.5.4 PWR switch - power source select

The “PWR” switch selects the preferred power source, both sources can be connected at the same time, but doesn't supply the DevKit in parallel.

When “USB” is selected, both DevKit USB ports will contribute the overall current consumption, whereas a connected DSB needs to be powered separately. Selecting “EXT” the power is sourced from the DSB interface.

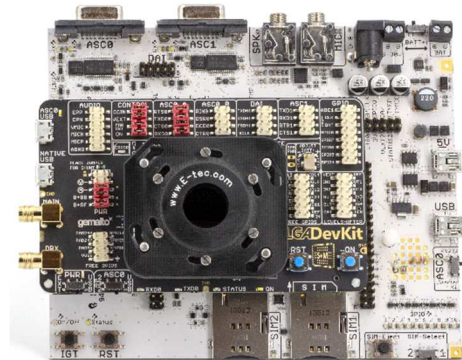
4.6 Operating DevKit on DSB75 and DSB.mini

Underside the LGA DevKit is a 2x40pin connector supported, compatible to DSB75 and DSB.mini. In such case the DSB has the role of a port extender for RS232, second SIM and analog Audio. When operating the DevKit on DSB, the following settings can be adjusted.

- Select the power source by the “PWR” switch, either from “EXT” (DSB) or USB (DevKit). If you select “EXT” the DevKit expects the power on the DSB connector. If you select “USB” the DevKit is powered by its USB ports whereas the DSB expects a separated power source.
- Select the ASC0, the first UART, to be conducted either to DevKit VCP or DSB. If you select the left side “RS232”, modules ASC0 is conducted to DSB and can be accessed on the D-SUB connector. Note the USB VCP bridge will be in reset state while “RS232” is activated with the consequence of de-numerating on host side.

Please refer to chapter 6.3 for a DSB.mini patch needed to operate ASC0 on DSB.mini

Picture: DevKit on DSB



4.6.1 Quick start operating DevKit and DSB

- Stack the DevKit on the DSB75
- Insert module
- Set “PWR” and “ASC0”
- Check if all jumpers are placed at the pin header: CONTROL, ASC0_A and PWR
- Connect the host PC to DSB75 via Sub-D
- Connect power to DSB75 and if needed to DevKit
- Press ON button

5 Characteristics

5.1 Limits

Table 3: Absolute maximum ratings

Parameter	Min	Max	Unit
Voltage on USB ports	-0.3	5.5	V
Voltage on DSB port	-0.3	5.5	V
Voltage on signal pin header, depending on used module	-0.3	2.1	V
Current signal pin header, depending on used module	-10	+10	mA
Voltage on external reference	-0.3	6	V
Socket single contact continues current		2	A

Note: Violation of these limits may cause permanent damages to the LGA DevKit.

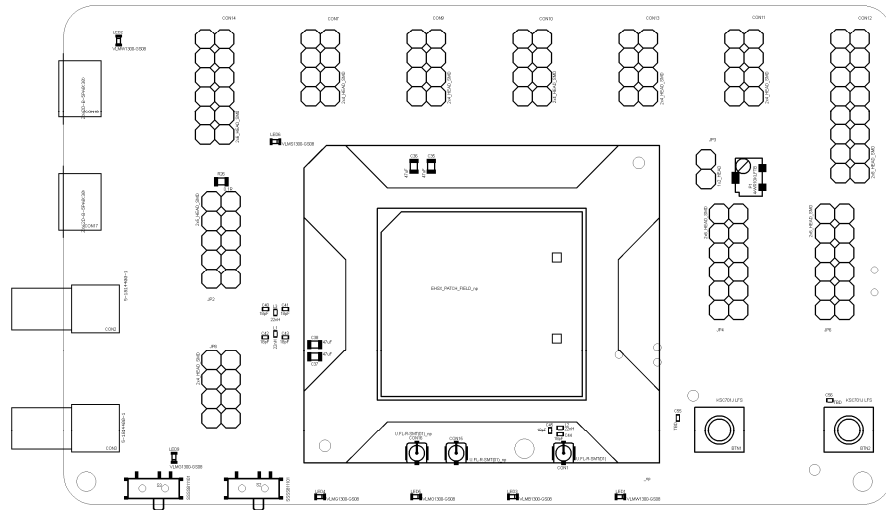
5.2 Electrical characteristics

Table 4: Recommended operating conditions

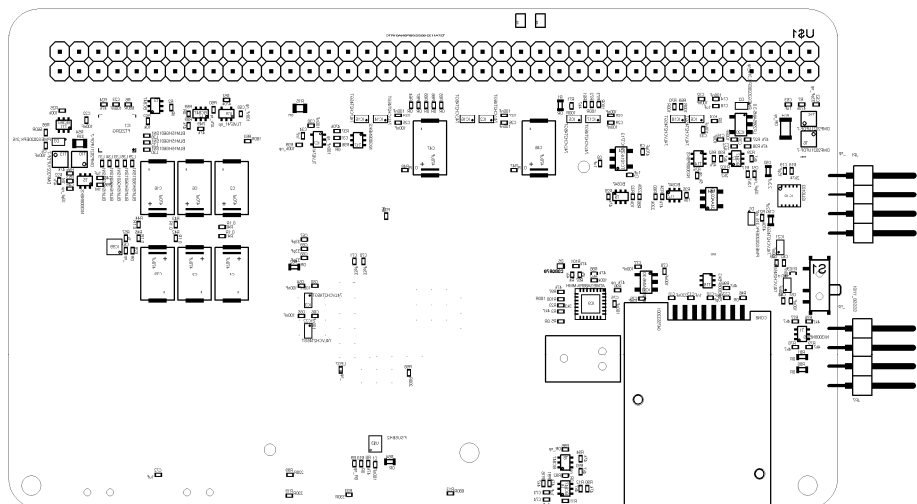
Parameter	Min	Max	Unit
Recommended operating condition			
Supply voltage on USB port	4.75	5.25	V
Supply current capability on USB port	tbd		A
Supply voltage on DSB port	tbd	tbd	
Electrical operating condition			
Socket single contact resistance	80	120	mΩ
Environmental temperature	0	+30	°C

6 Appendix

6.1 Placement

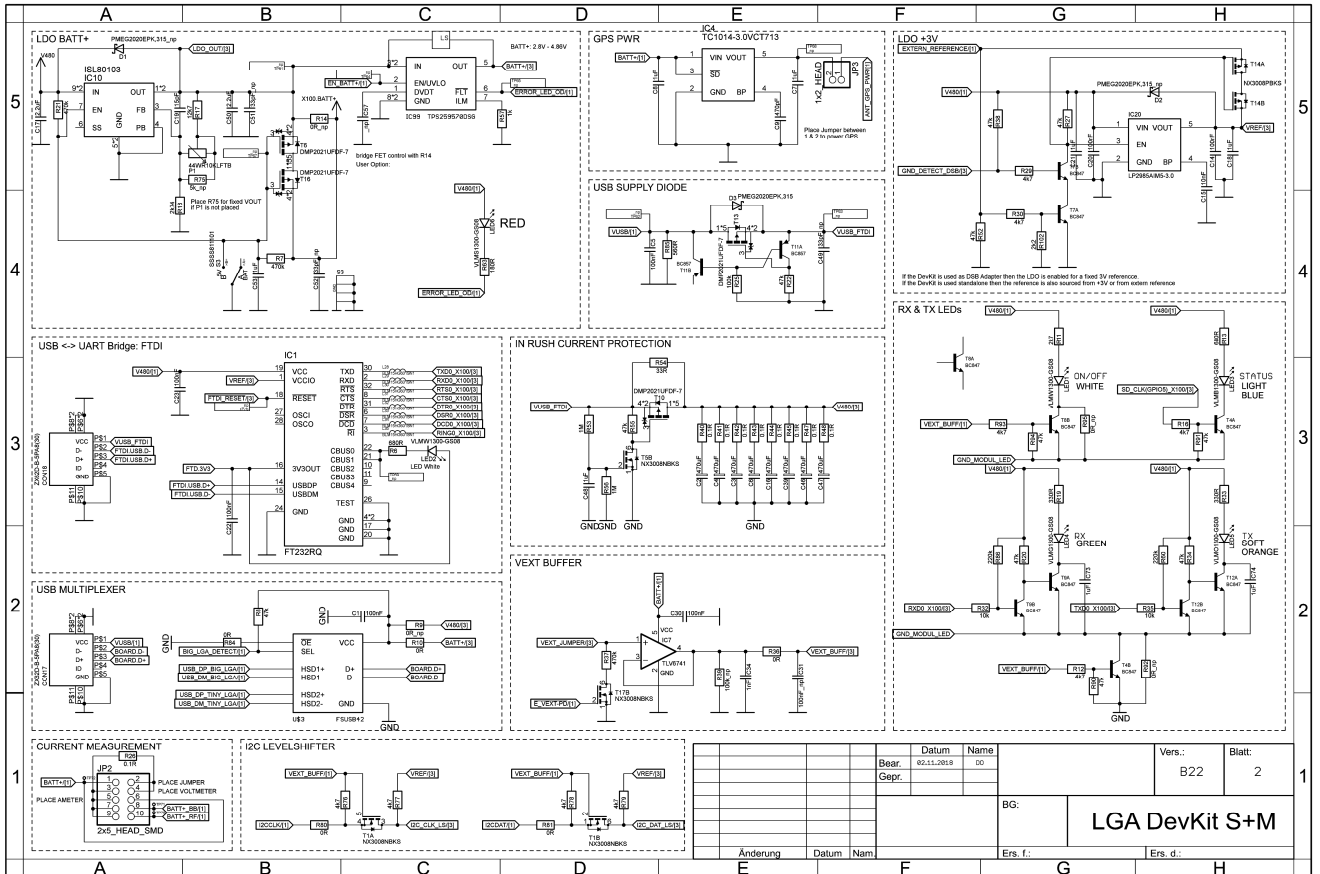
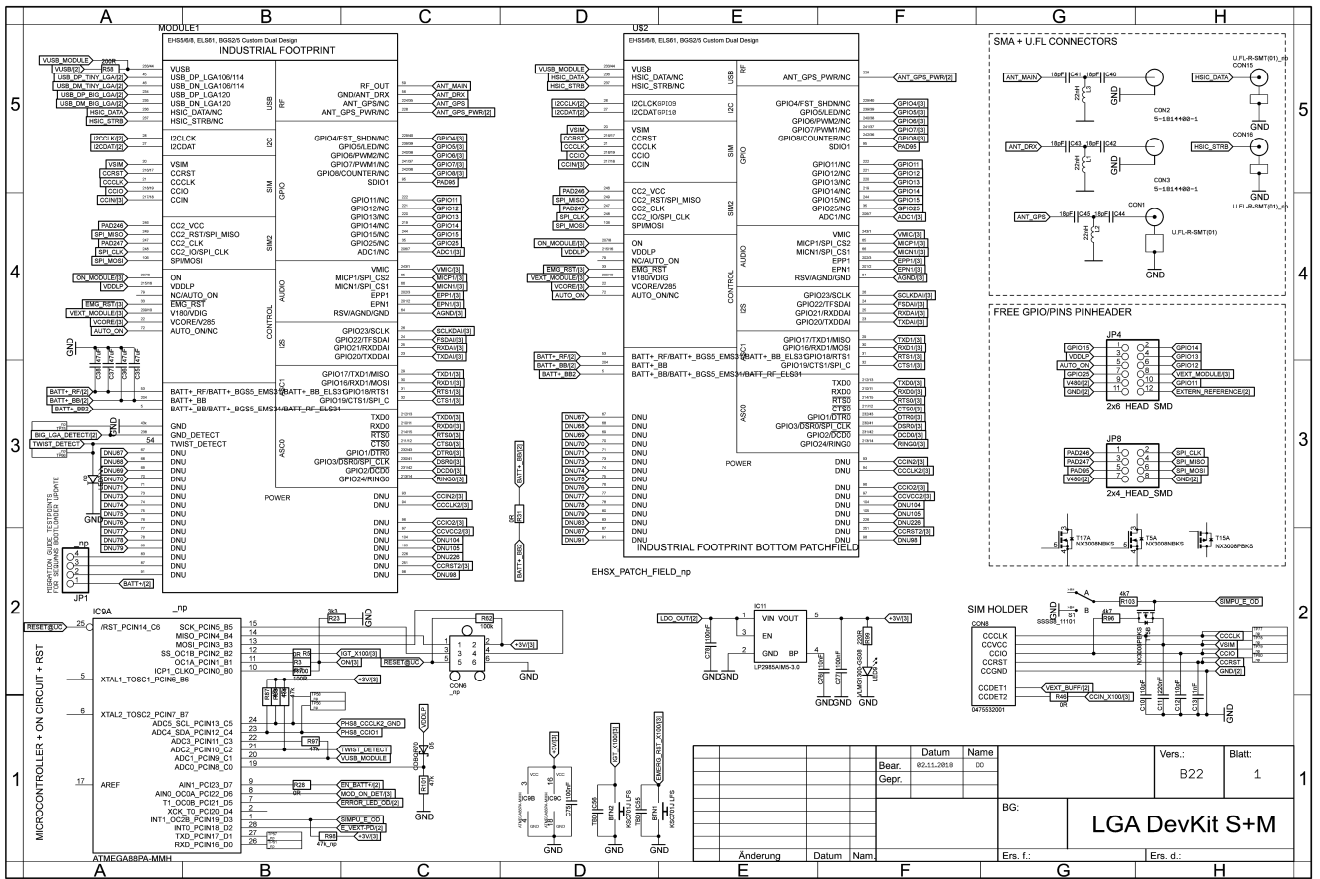


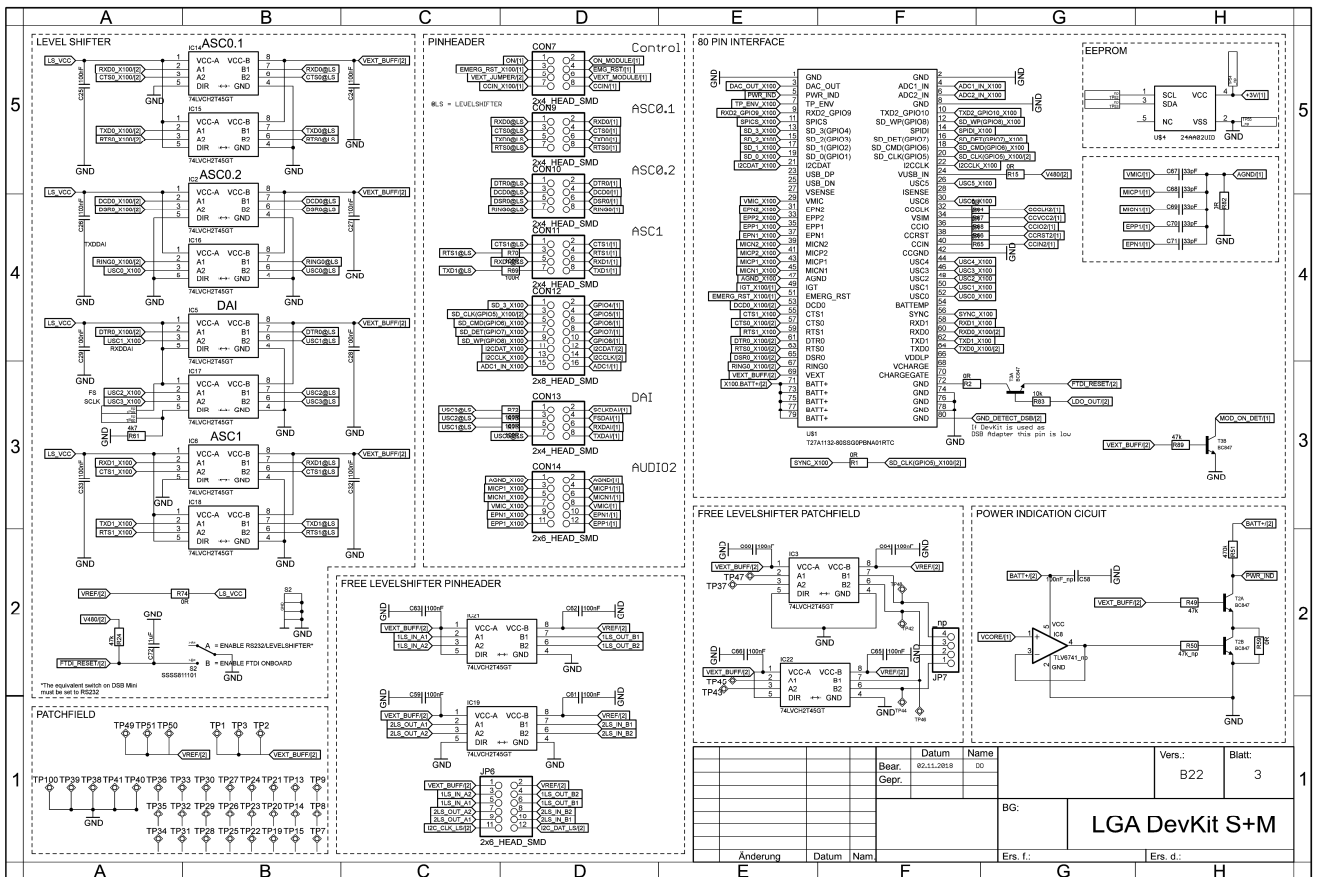
Picture: Top side placement



Picture: Bottom side placement

6.2 Schematics

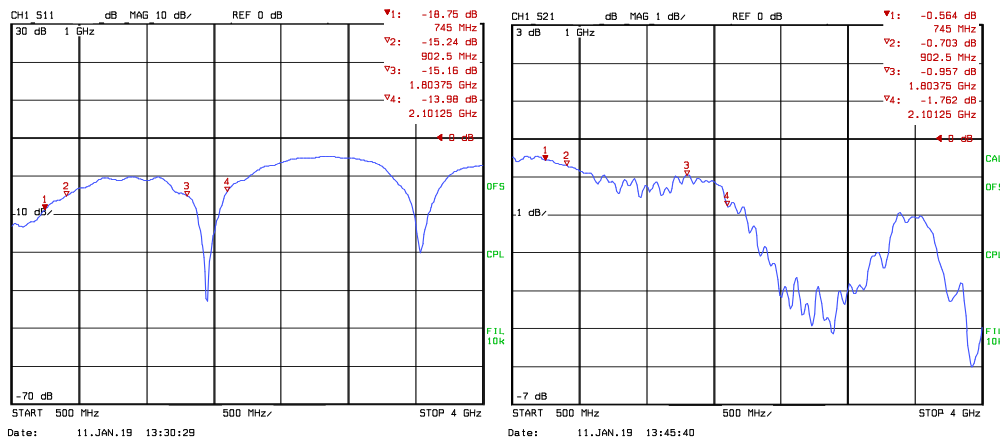




6.4 Errata

6.4.1 PCB B22 antenna matching

The PCB revision B22, built in a smaller quantity, has a decreased RF matching which will be fixed in an upcoming version.



Picture: S11 DevKit MAIN antenna (left) and S21 DevKit MAIN antenna RF path loss (right) of B22 Rev

6.4.2 PCB B22 module rotation detecting limited

The PCB revision B22, built in a smaller quantity, has a limited rotation detecting. In case the DevKit is powered by the native USB and the module is inserted with wrong orientation, the error detecting is limited and allow drawing a limited current (max 20mA) into pad#11/212. The module may get damaged. This failure will be fixed in upcoming version.

6.4.3 PCB B22 footprint detection limited

The PCB revision B22, built in a smaller quantity, has a limited footprint detection. Modules with bold lettering “QUALCOMM” (e.g. EXS81) and wrong positioned RohS symbol (e.g. ELS61/81) on the modules underside, might be detected as a wrong footprint and therefore not powered up by the control logic. This limited behavior will be fixed in upcoming version.

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