BP30
BB-SW Interface Specification

Edition 2006

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Table of Contents

1 Document Mission/Scope

1.1 Mission

This document provides general information about how the Hardware for BP30 GLOBE is interfaced by the Software developed. In particular you can find here information of all the Base Band peripherals, intended as general overview and introduction. For more specific information, is also referenced the more detailed Technical Specification to be referred. For Radio Frequency section, please refer to specific documentation.

1.2 Scope

This document offers general overview of the whole base band SW interface, without further details on software implementation. For this reason is intended to be of interest of developers and engineers interested in a basic knowledge of GLOBE peripherals' management, or also to have the right reference to more specific documentation for a particular argument.

2 List of Acronyms

Abbreviation / Term	Explanation / Definition
DSP	Digital Signal Processing
MMI	Man Machine Interface
IIC	Inter Integrated Circuit
LED	Light Emitting Diode
LCD	Liquid Crystal Display
GDD	Graphic Display Driver

3 Introduction

GLOBE platform are powered by BP30 SW releases, which are developed referring to Infineon's chipset for Base band, Power Management, and GSM radio. In particular GLOBE is equipped with EGOLDLite or EGOLDRadio (BB), EPOWERlite (PM) and SmartiSD2 (only EGL) (RF). Furthermore, several external peripherals are provided, such as simple multicolor LED, digital Camera, LCD, etc…Operative System used is OSE for C166 microcontrollers.

4 LED and Backlight

GLOBE is provided with powerful LED control functionality. It is equipped with 3 different LED line, each one with different purpose. Multicolor LED for signaling different status of the MS, when in IDLE or in traffic mode.
Signaling LED (green or red) is used to monitor the status of the network (when connected, when paging is issued) or when battery charge is in progress (and different signaling due to battery charging status). Also a Music LED functionality is implemented. By this, it is possible to syncronise LED flashing with polyphonic ringer meldy rhythm.
Backlight is used to light the LCD, and is capable of different current feed values, and fading.
Both backlight and signaling led are connected to E-POWERlite Power unit, while multicolor are connected to E-GOLDlite through three CAPCOMs.

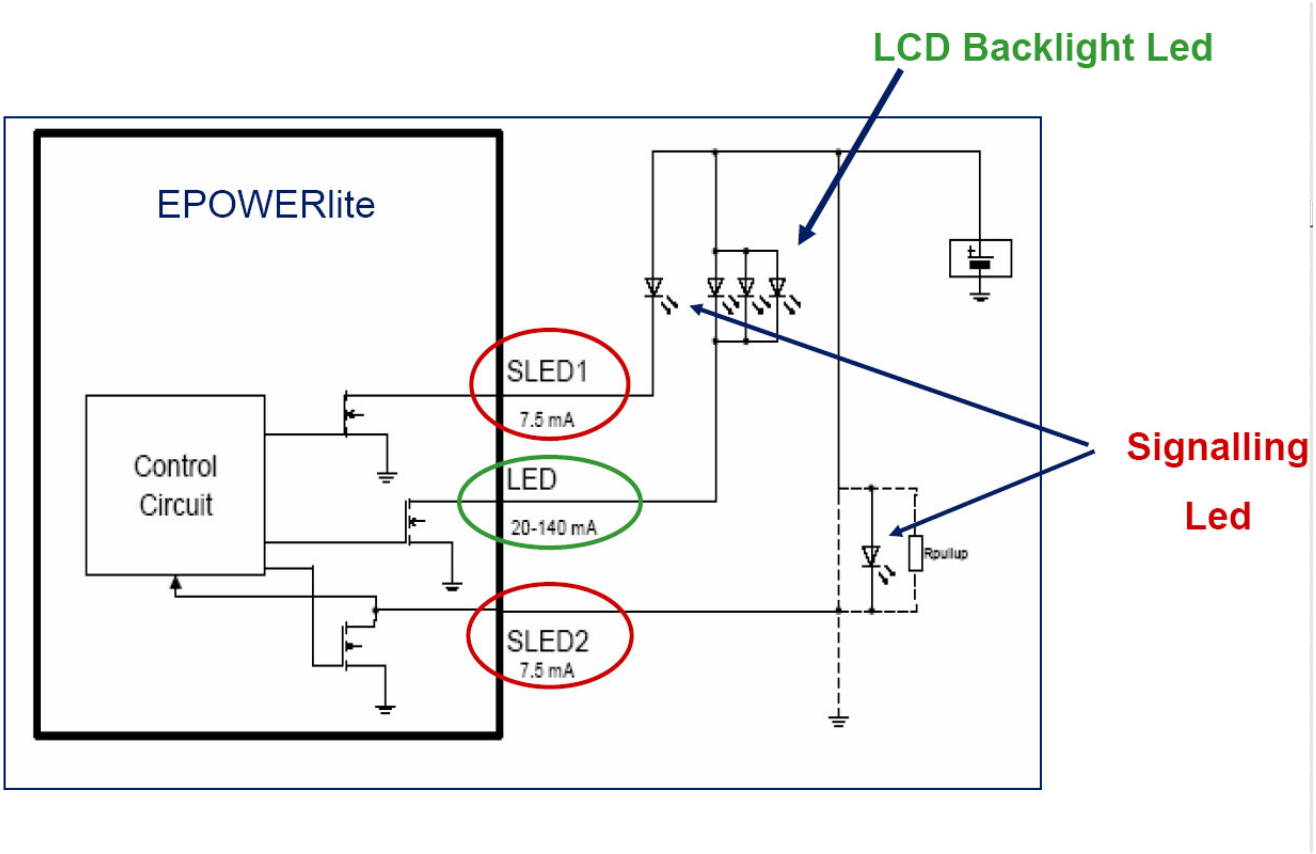

Figure 4-1 EPOWERlite and LED interface

4.1 Multicolor LED

This peripheral is connected to E-GOLDlite through 3 different CAPCOMs (CCy), one for each color; to control intensity an event ON is triggered when a certain threshold level is reached. Then when timer overflows the switch OFF event is accomplished. Refer to figure below.

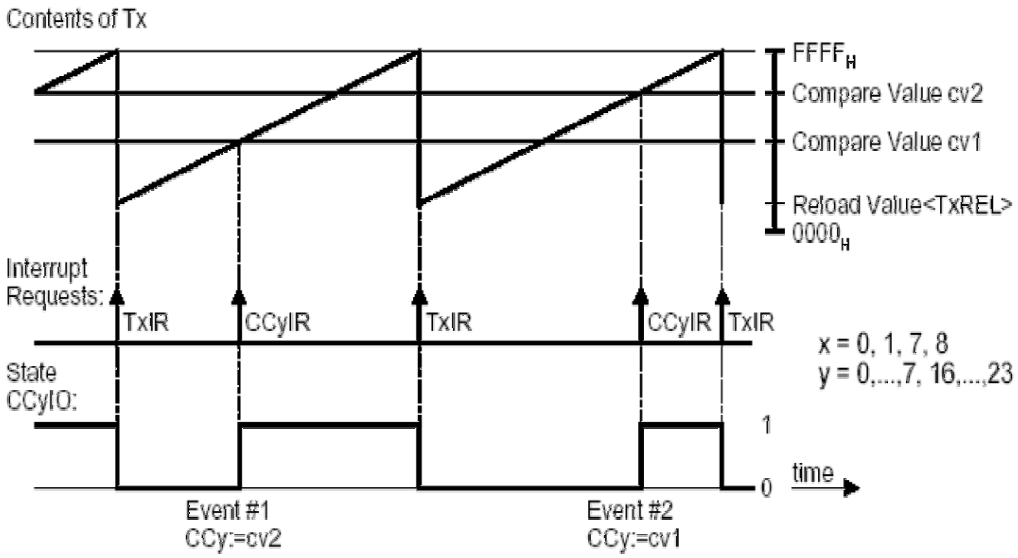

Figure 4-2 - CAPCOM timing for multicolor led

4.2 Signaling LED

Signaling led consist of a red and a green led that are switched on/off by setting the bits SLED1ON and SLED2On in register LEDCTRL2 of EPOWERlite driver as is shown in Figure 4-1.
The main applications of signaling led are:

1) Show charger events:

2) Show MS status:

This two led are controller directly from E-POWERlite power unit, and could be switched by programming bit SLED1 and SLED2 in LEDCTRL2 register.
The SW driver manages them using a SW timer to process event ON OFF or FLASH.

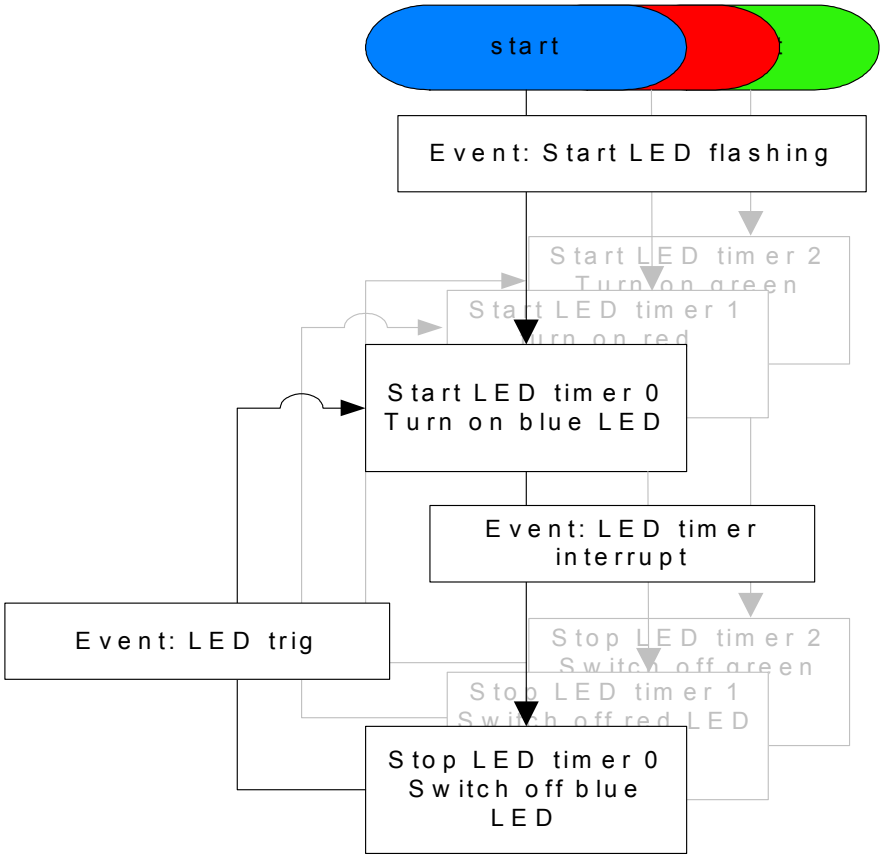

Figure 4-3 - Flashing LED driver

4.3 Backlight

The display backlight line is controlled by power unit. Using LEDCTRL1 and LEDCTRL2 register the Power unit driver can turn on off the line, can feed with different current levels (in step of 20mA), and can modulate the current using a programmable PWM modulation. E-POWERlite can set up to 63 different level of PWM, obtaining duty cycle that varies from 0.5% to 100%.
Sending an appropriate message sequence to power unit, the backlight driver can easily obtain a fading on or off effect, with a pleasant soft smooth effect.
The keyboard backlight is controlled by CAPCOM registers.

5 POWER Management Unit

GLOBE board uses Infineon's E-POWERlite power management unit. It offers a capable way to manage power supply to all peripherals in different MS status. When the MS is switched off, only the RTC is supplied.
When in IDLE only few regulators are active, and when in traffic all regulators are powered on.
E-GOLDlite/E-GOLDRadio can control EPOWERlite regulators, sending commands through IIC bus interface. This is dedicated only to this device.

5.1 IIC bus

There is a SW driver that implements via software all the functionality of IIC bus specification, using two GPIO of EGOLDlite for SDA and SCL line. HW block of BB CPU are not used.
For communication through IIC bus the driver provides an interface that manages all communications, using a lower driver layer which manages all the correct timing commutation for SDA and SDL lines.

5.2 Epower Regulators

E-POWERlite provides a set of Voltage regulators, which are used to supply different section of the GLOBE board. Each supply domain has its own rules for switching on or off during different status of the MS. Each regulator or a group of them is controlled programming a specific register in EPOWERlite. Briefly, a regulator may be switched on or off, or in some cases it can be configured to be OFF when a particular control signal (VCXOEN) is triggered.

5.3 Battery Charger

GLOBE board offers also feature for battery recharge. This is done using EPOWERlite regulators. This functionality is managed programming 2 control register and using a read only status register, for a feedback of the charge in progress.

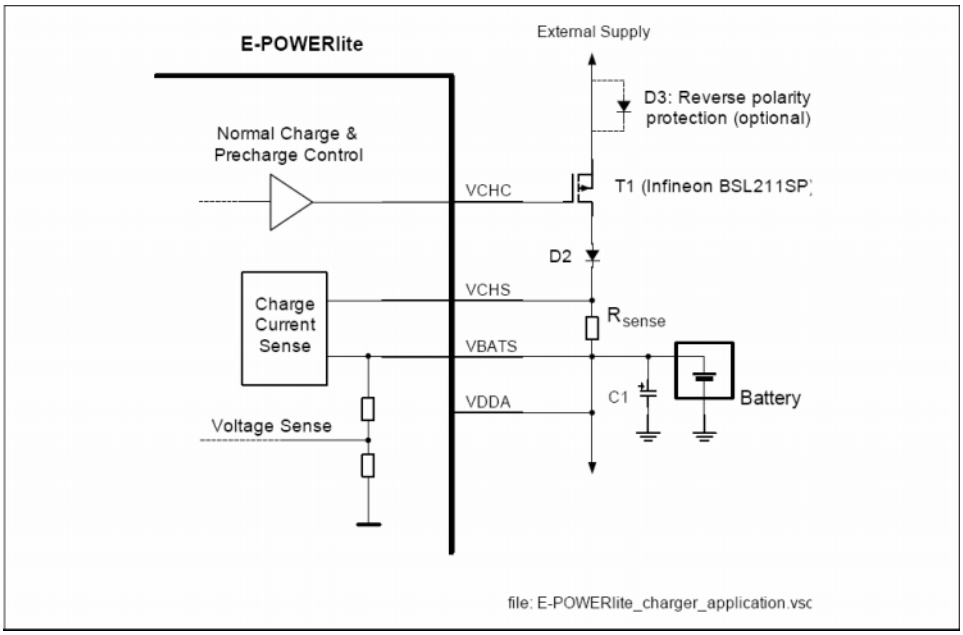

Figure 5-1 - Circuitry for battery recharge

5.3.1 Charger Environment

The charger process is split through different modules, each one communicating with the others and to the MMI, sending messages to it that are used to inform the status of the charge process. In figure below is shown the charger environment architecture.

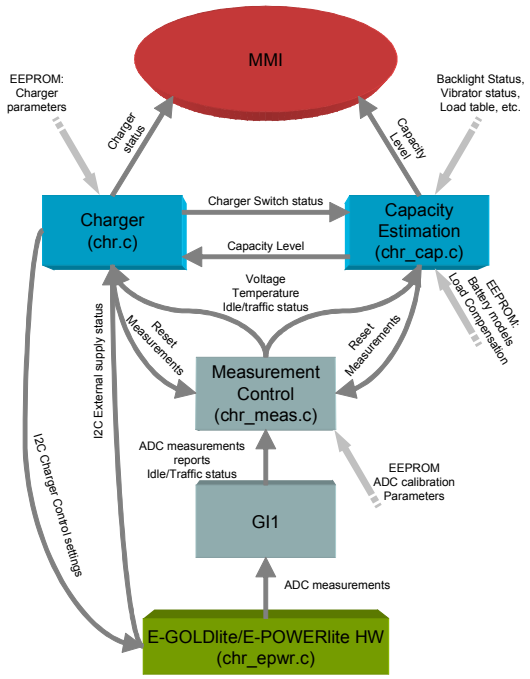

Figure 5-2 - Charger environment architecture

5.3.2 ADC Measurements

To ensure a correct battery recharge, two measurements are needed. EPOWERlite has its own current sensing, but is not available in any register: it is internally monitored and used in reference to certain current thresholds.
EGOLDlite provides an ADC interface which allows measuring the VBAT battery voltage. These measurements are stored in a circular buffer, which is used to calculate various mean values in idle or traffic mode.

5.3.3 Capacity Estimation

Capacity estimation is also involved, to communicate to MMI (under request) the estimated value to display to final user. Only a voltage is not correct to display and is needed a capacity estimation in range 0-100%. This capacity values are based on a complete battery model, and a set of correction factors to consider dependency from temperature of the battery discharging voltage available. The capacity estimation is performed using a state machine.

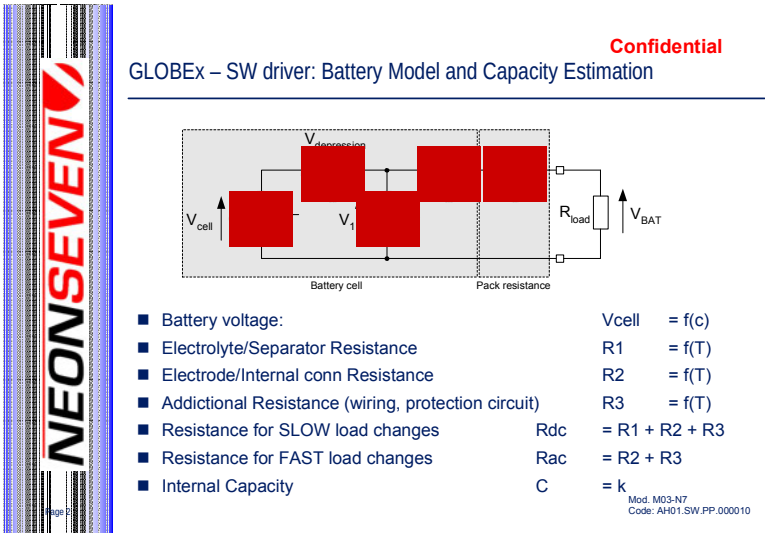

Figure 5-3 - Capacity model parameters

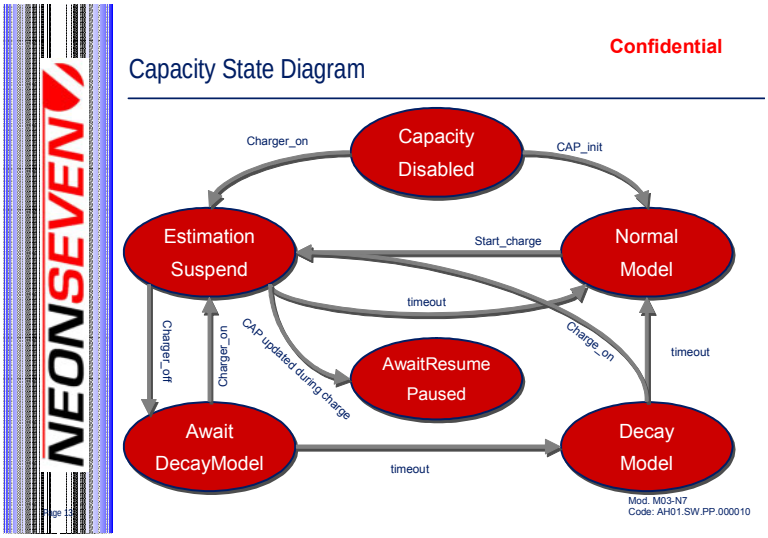

Figure 5-4 - State machine diagram

5.4 VCXOEN

When in IDLE mode, not all peripherals are needed, so E-GOLDlite uses this special pin out to signal to EPOWERlite that it can switch off certain regulators. It is possible to program which regulator will be “linked” to this signal. This signal is managed by SCCU block during Power Saving ON or OFF switching.

6 GDD

This section describes the interface functions of the Graphics Device Driver (GDD). The N7 GDD driver is designed for the E-GOLDlite GSM baseband system chips and abstracts the Comneon APOXI MMI application from various graphics hardware, i.e.

- LCD controller
- Camera module
- Companion chip

The N7 GDD driver is the customized release of the DWD GDD driver for BP2.1 platform. The latter is built on a generic concept, which is prepared for supporting different kinds of HW and is easily extended. Some of the main features of the N7 GDD driver are:

- Agilent series camera support: ADCM1700 in the current version
- Flexible HW interface to LCDs: Serial/Parallel, 8bit/16bit.
- High speed data transmission (PEC).
- Dual LCD configuration.
- LCD only configuration.
- OSE operating system.

6.1 Overall interface specification

The interaction of the GDD module, the Driver Function Interface and the User SW module is shown in the figure below.

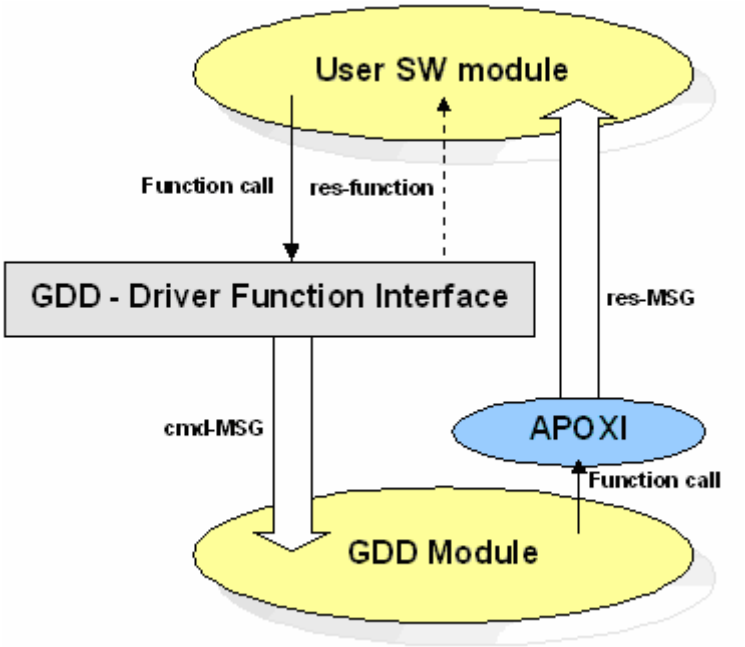

Figure 6-1 - GDD driver interface

6.2 LCD interface

GLOBE board provide up to two LCD displays. Such hw is interfaced as reported below.

- Main LCD: Serial Interface
- Sub LCD: Serial Interface

The GDD driver is also providing a function interface between the application and the graphics hardware for controlling the LCD and the camera. The main features are:

- *Updating the LCD displays*
- *Setting the LCD contrast*

- *Power saving LCD*
- *Providing production test for both LCD*

7 AUDIO

BP30 drivers for audio are derived from DWD audio group's modules. The aim of these modules is to manage also audio HW resource provided by EGOLDlite, which is fully supported by BP30 and mounted in GLOBE board. BP30 offers support for Speech, tone generator, Polyphonic ringer, vibrator, headset amplifier and DSP voice memo. Each resources is allocated by the same sw interface, so the pointer to handler for an audio resource is allocated by calling to the same function for each one.

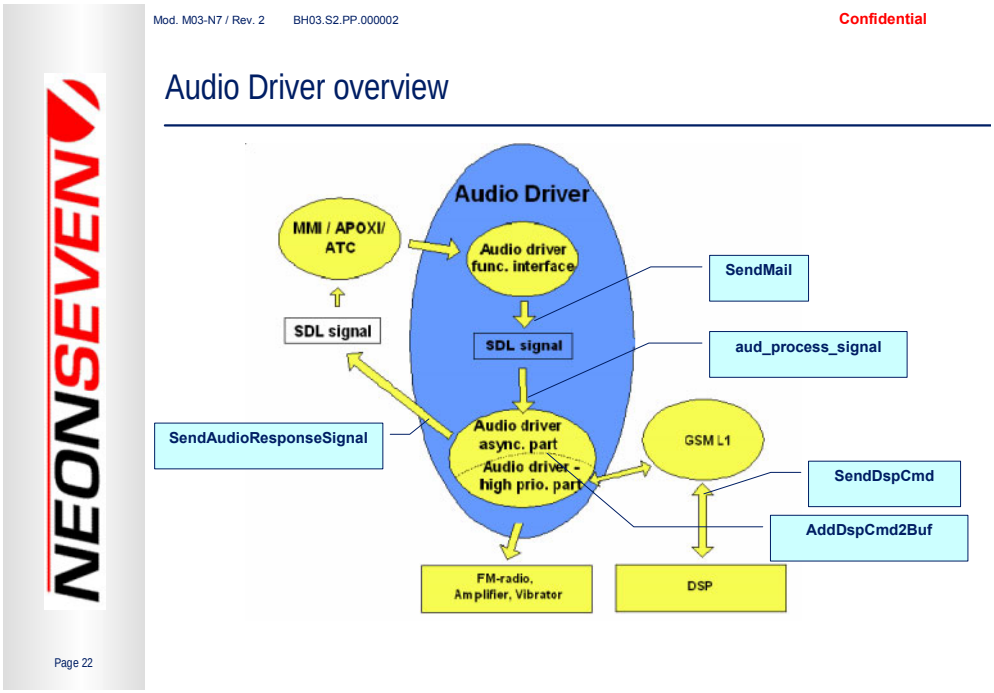

Figure 7-1 Audio driver architecture

7.1 Resources

Each resource is managed by the same interface function. A lower level layer provide to manage the correct structure, according to which HW resource must be used.

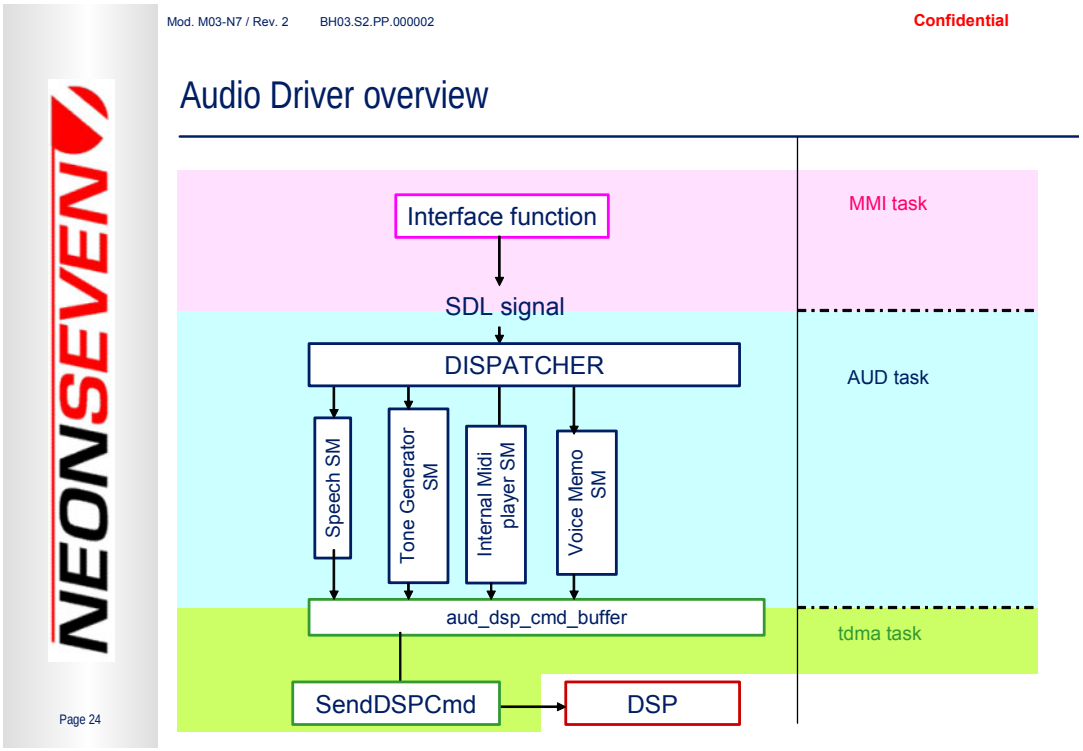

Figure 7-2 Audio driver overview

7.1.1 DSP tones

DSP tones generator is used for supervisory tones and info tones

7.1.2 KEY tones

This resource is handles special. It is not necessary to be allocated, even if DSP is already busy. Only a small delay might occur.

7.1.3 Vibrator

The vibrator is handled calling the driver function provided by epower module.

7.1.4 Internal polyphonic ringer

Used for Midi Player audio driver.

7.1.5 Voice MEMO

This resource is used for recording and playback of voice.

8 FMRadio

The interface for FM radio provided by GLOBE board consists of a state machine with only two states: IDLE ans STARTED. Below is shown the complete state machine diagram.

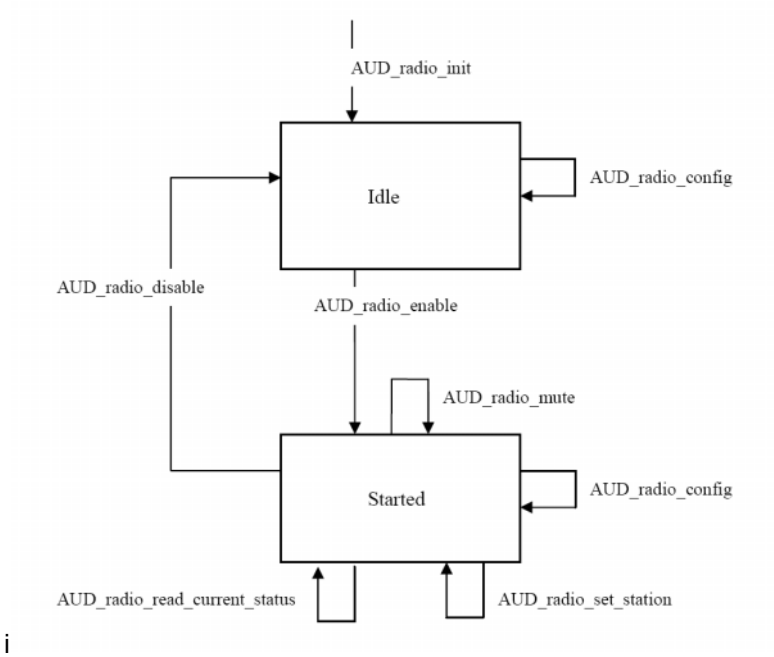

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Figure 8-1 - FM radio state machine

8.1 SDL messages

The function interface uses SDL messages to inform MMI when a station is found.

9 Digital I/O

In GLOBE digital I/O interface provides management of accessory and keyboard.
Accessory interface, provides to detect whenever an external accessory is plugged in or out from the phone. At present only headset detection is provided, but the SW module is open to future extensions.
Keyboard SW interface, provides key press and release detection and to send signal to MMI. Detects hook key press and release, and flip open or close detection.

9.1 Keyboard

The keyboard driver detects each key press or release event and sends the information to MMI through a signal. This includes hook key detection. Furthermore a debounce algorithm is implemented to correct the tipical mechanical switches malfunctions.

9.1.1 E-GOLDlite/E-GOLDRadio interface

Keypad interface from E-GOLDlite/E-GOLDRadio consists of a 10 bit register: 4 input line and 6 output line, which are used to perform keypad scan.

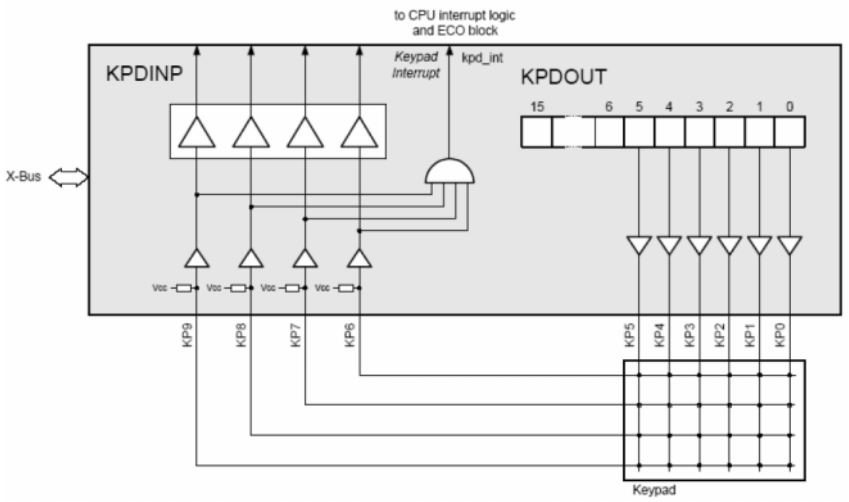

Figure 9-1 - Keypad interface for E-GOLDlite

9.1.2 Key driver architecture

A main state machine detects key press or release, and send an information to MMI

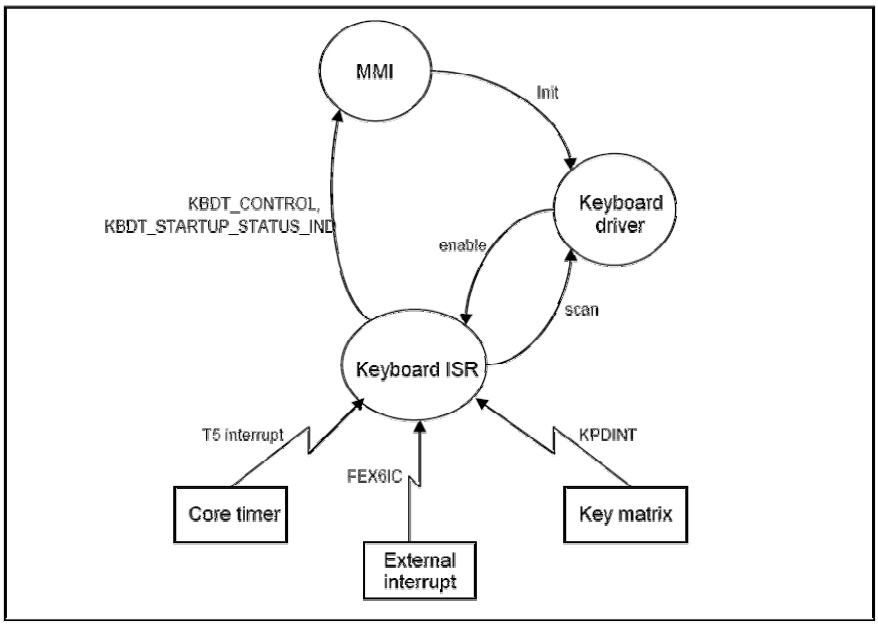

Figure 9-2 - Keyboard driver architecture

9.1.3 Keyboard matrix

The keyboard matrix defines 24 elements. Each one can be associated to a key named PB0..PB23 in the schematics. The element in KEYIN3 are referred to joystick. HeadSet key in GLOBE3 is detected through the ADC.

	KEYIN0	KEYIN1	KEYIN2	KEYIN3
KEYOUT5	PB3	PB4	HOOK	PB9

KEYOUT4	PB15	PB5	PB2	RIGHT
KEYOUT3	PB11	PB1	PB14	UP
KEYOUT2	PB8	PB6	PB7	OK
KEYOUT1	PB17	PB18	PB13	LEFT
KEYOUT0	PB16	PB10	PB12	DOWN

Table 9-1 Keyboard MATRIX

9.1.4 Keyboard HW map

Finally, a keyboard hw map, associates each physical key to a symbol, which defines his logical function.

INDEX	KEY	FUNCTION
0	PB16	*
1	PB17	7
2	PB8	4
3	PB11	1
4	PB15	SND
5	PB3	LSO
6	PB10	0
7	PB18	8
8	PB6	5
9	PB1	2
10	PB5	C
11	PB4	RSO
12	PB12	#
13	PB13	9
14	PB7	6
15	PB14	3
16	PB2	DEL
17		HOOK
18		DOWN
19		LEFT
20		OK
21		UP
22		RIGHT
23	PB9	FREE

Table 9-2 Keyboard MAP

10 RTC

The RTC driver provides an interface easing the implementation of RTC related function in the MMI. The following functionality in headlines are provided:

- Handling of date
- Handling of time
- Handling of different date formats
- Handling of different time formats
- Handling of event
- Signal/mail indication to MMI at every minute elapsed.

- Indication of event timeout to the MMI in MS powered on, MS charge mode and MS powered off
- Indication at power up in case the RTC is invalid i.e. due to drop out of the RTC supply voltage or until the time and date has been set the first time.

The RTC driver works primarily as a utility library for the MMI. However, other modules can use the driver functionality as well (e.g. for use during production test). The only limitation is that the upwards signaling from the RTC driver is dedicated to the MMI.

The RTC driver is special in that way that the driver also needs to be “active” when the phone is powered off in order to handle event time outs (alarms) from powered off mode.

10.1 Architecture

The architectural description of the RTC driver is divided into a functional overview, describing the overall functionality of the driver, and a functional description, describing the functionality of the global functions of the driver.

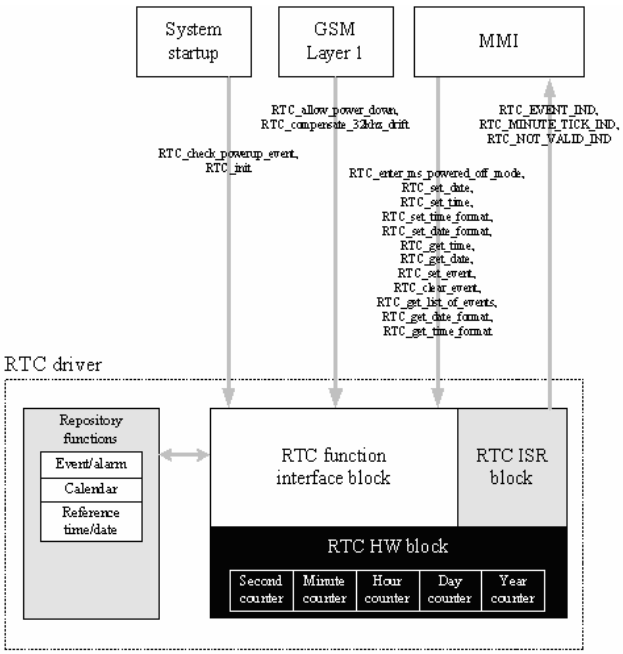

Figure 10-1 RTC driver architecture

11 References

11.1 External

None.

11.2 Internal

Title	Doc ID
Keyboard Diver Secification	AH01.SW.TS.000002
MIDI Driver Specifications	AH01.SW.TS.000022
Audio Driver Specifications	AH01.SW.TS.000021
FM Radio Driver Specifications	AH01.SW.TS.000013
GDD Driver Specifications	AH01.SW.TS.000015
LED Driver Specifications	AH01.SW.TS.000017
RTC Driver Specifications	AH01.SW.TS.000024
Power Management Specifications	AH01.SW.TS.000006
Battery Charge Specifications	AH01.SW.TS.000008
Battery and Capacity Models Specifications	AH01.SW.TS.000009

12 Document change report

	Change Reference		Record of changes made to previous released version	
Rev	**Date**	**CR**	**Section**	**Comment**
1.0	25/02/2005		Document created	
2.0	15/02/2006		Adaption to BP30	

13 Approval

Revision	Approver(s)	Date	Source/signature
1.0	Steno Schiavon		
2.0	Steno Schiavon	15/02/2006	Document stored on server

14 Annex 1

None.