

Triton-Lite TWL3031

**Texas Instruments Shanghai
Wireless Customer Integration & Design
Center**

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REAL WORLD SIGNAL PROCESSING™

 **TEXAS INSTRUMENTS**

- Overview
- System management.
- Power management control
- Power-supply
- Audio resources.
- Battery charger & control
- Transceiver & drivers.
- RTC (Real Time Clock)
- Hot-Die function and Thermal Shutdown
- Housekeeping

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TWL3031 device provides the following resources :

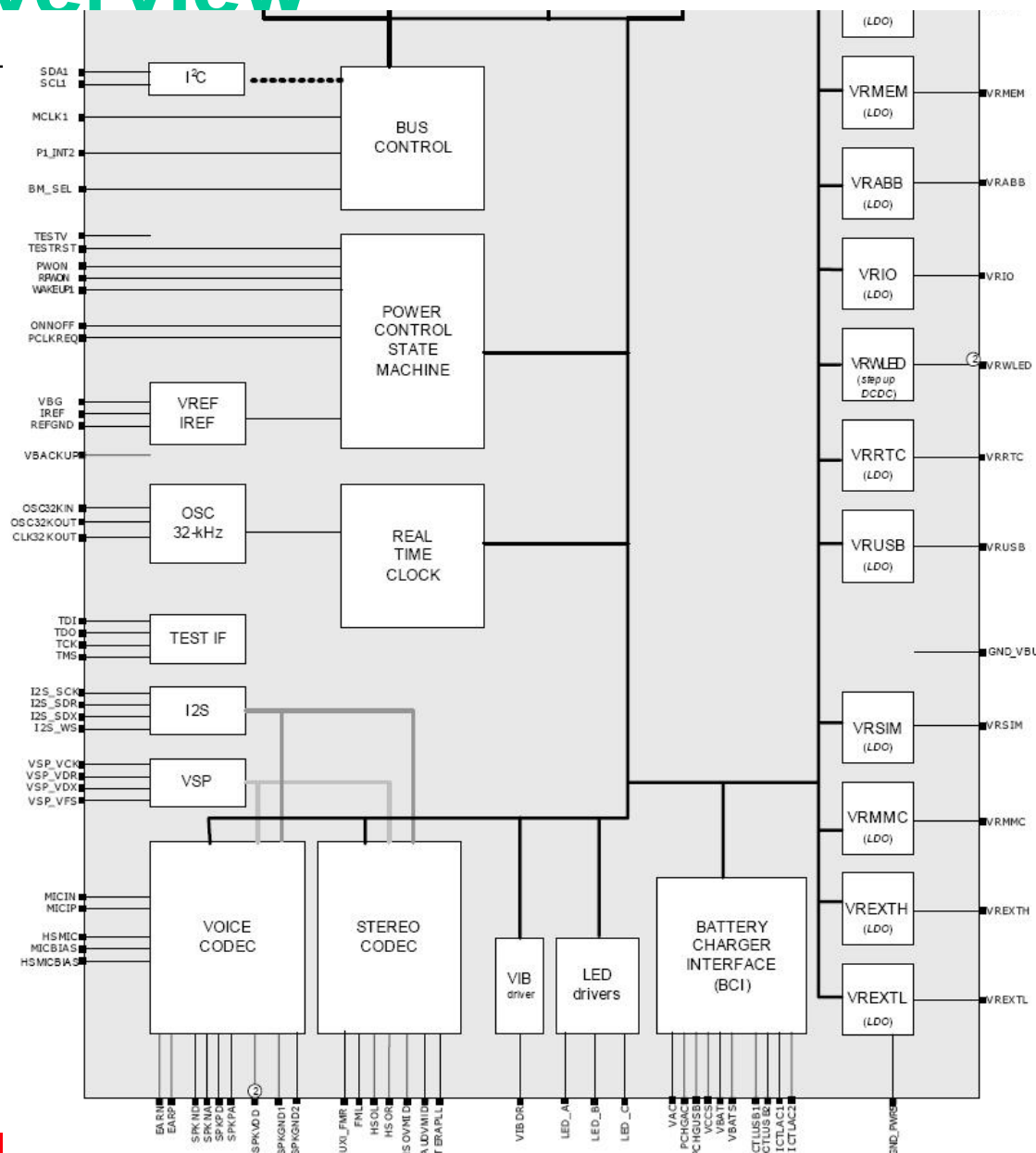
- System management
- Power Management resources
- Power supply resources
- Voice & Audio resources
- Battery charger & control resources
- Real Time clock resources
- Analog transceivers / drivers resources
- Housekeeping

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Overview

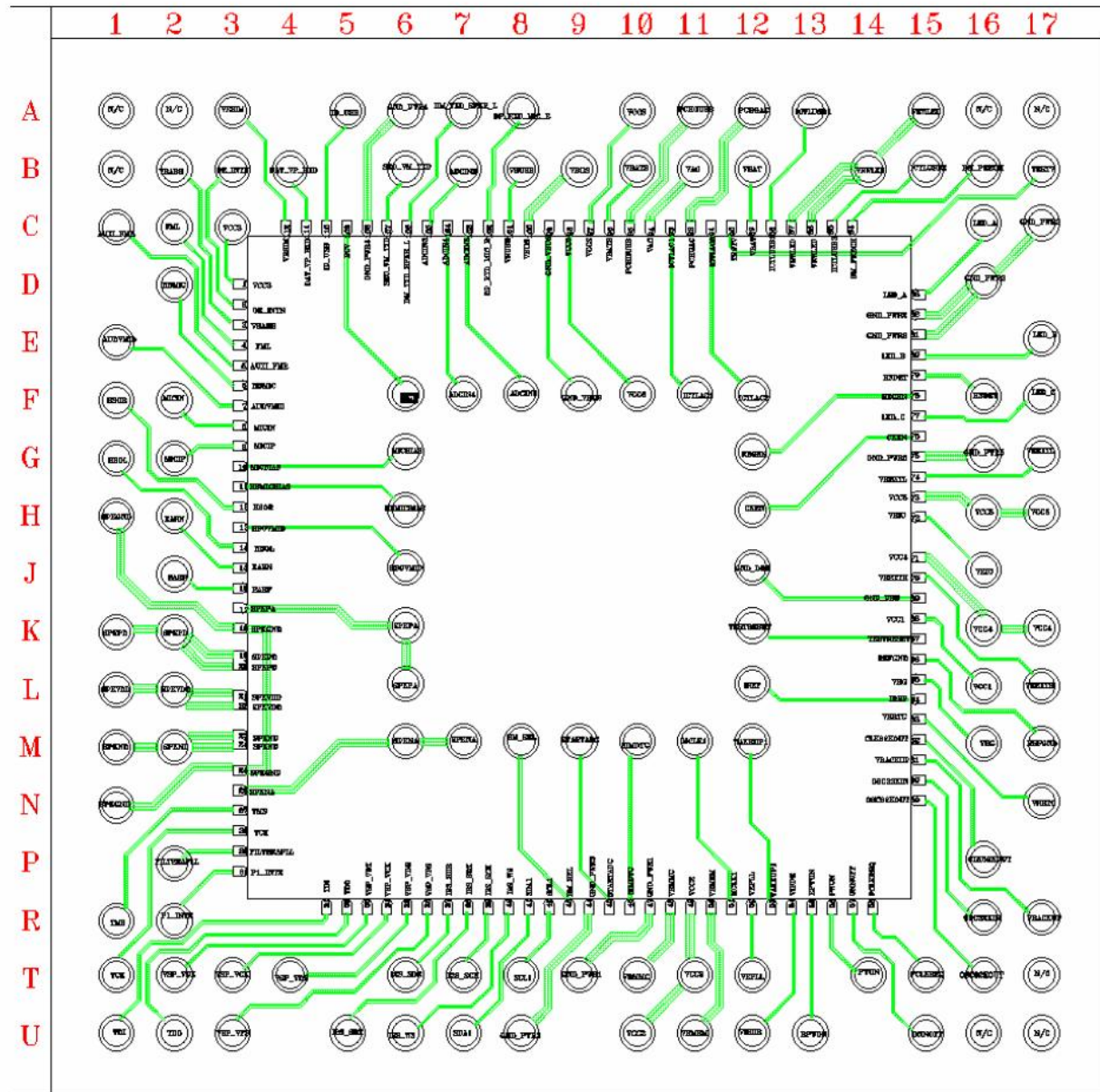
TWL3031 Functional Block Diagram

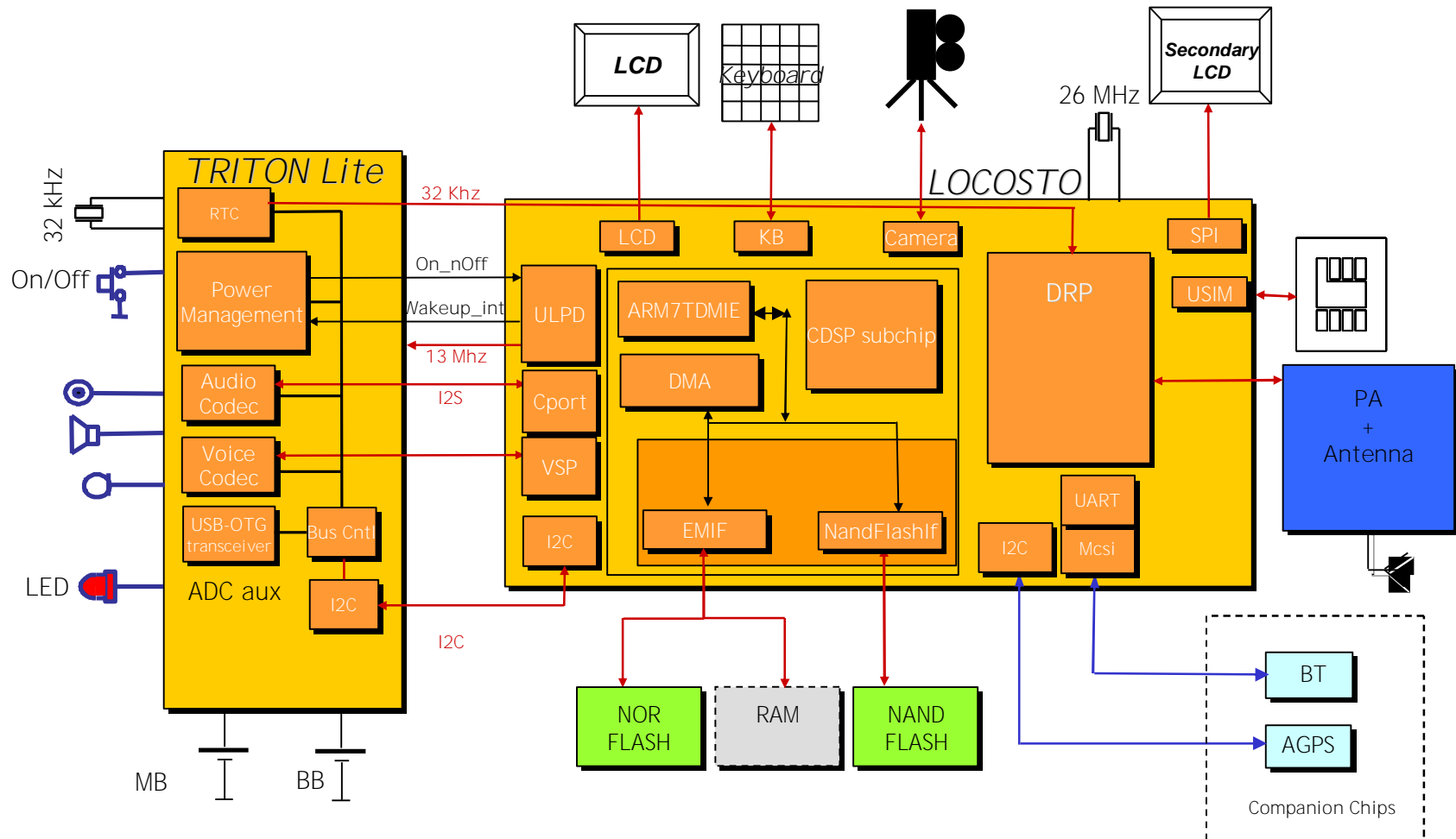


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TWL3031 terminal assignments





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System clock

System management provides read / write access to configure registers of the embedded resources and manages the interrupt handling.

System clock:

The system clock frequency of TWL3031 is 13-MHz.
MCLK1 System clock input (from host processor)

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Control port

One unmarked serial interface provides the mean of communication between TWL3031 and two host processors (modem and application processor).

After the reset signal, the serial interface has read/write access to all internal registers of TWL3031 device.

SDA1 I2C Bi-directional data signal

SCL1 I2C Bi-directional clock signal

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Interrupt handling

P1_INT2 interrupt signal can be asserted by any TWL3031 resource and sent to the suitable host processor.

INT2 sources	P #1	Section	Block	Description
1	X	AUX	BCI	Charge-stop event
2	X	AUX	BCI	VBUS pre-charge detection
3	X	AUX	BCI	Watchdog overflow
4	X	AUX	M-ADC	Monitoring ADC end of conversion (SW #1)
5		AUX	M-ADC	Monitoring ADC end of conversion (SW #2)
6	X	AUX	USB	USB/Carkit ID VBUS D+/D- detection
7	X	AUX	SIM-card	SIM-card plug / un-plug detection
8	X	PM	PM control	Falling-edge on PWON
9	X	PM	PM control	Event on RPWON
10	X	PM	PM control	Battery charger detection
11	X	PM	PM control	RTC event
12	X	PM	PM control	Low-battery detection
13	X	PM	PM control	USB ID / V _{BUS} detection
14	X	PM	Thermistor	Hot-Die condition detection
15		AUDIO	Audio/Voice	Audio Send / End detection (Hook-detect)
16	X	AUDIO	Audio/Voice	Headset plug / un-plug detection

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Power management resources include:

- **Power-On Reset**, in order to generate a system reset at battery plug-in.
- **Power Control State Machine**, which controls the power on sequence of the system initiated by external events (Button, Accessory plug / un-plug, ...) or internal event (Interrupt, Wake-up event).

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Power-On Reset

The Power Control State Machine controls the transition sequences among the different operating states of the system

Other function of the Power Control State Machine is to monitor power supply elements and detect power failures or over-temperature conditions.

PWON	External switch-on event (ON Button) with 32-kHz de-bouncing
RPWON	External switch-on event (Remote) with 32-kHz de-bouncing
WAKEUP1	System switch-on event (processor #1)
PCLKREQ	Peripheral clock request
TESTRESET	Test pin
TESTV	LDOs sense
TOTAL PINS	6

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System operating state

Five system operating states are defined:

NO SUPPLY: No battery is present.

BACKUP: Only backup battery is present.

OFF: Main battery is present, backup battery present or not.

Default configuration is all power supplies are in off-state except VRTC.

ACTIVE: Main battery is present, backup battery present or not. Power supplies are on.

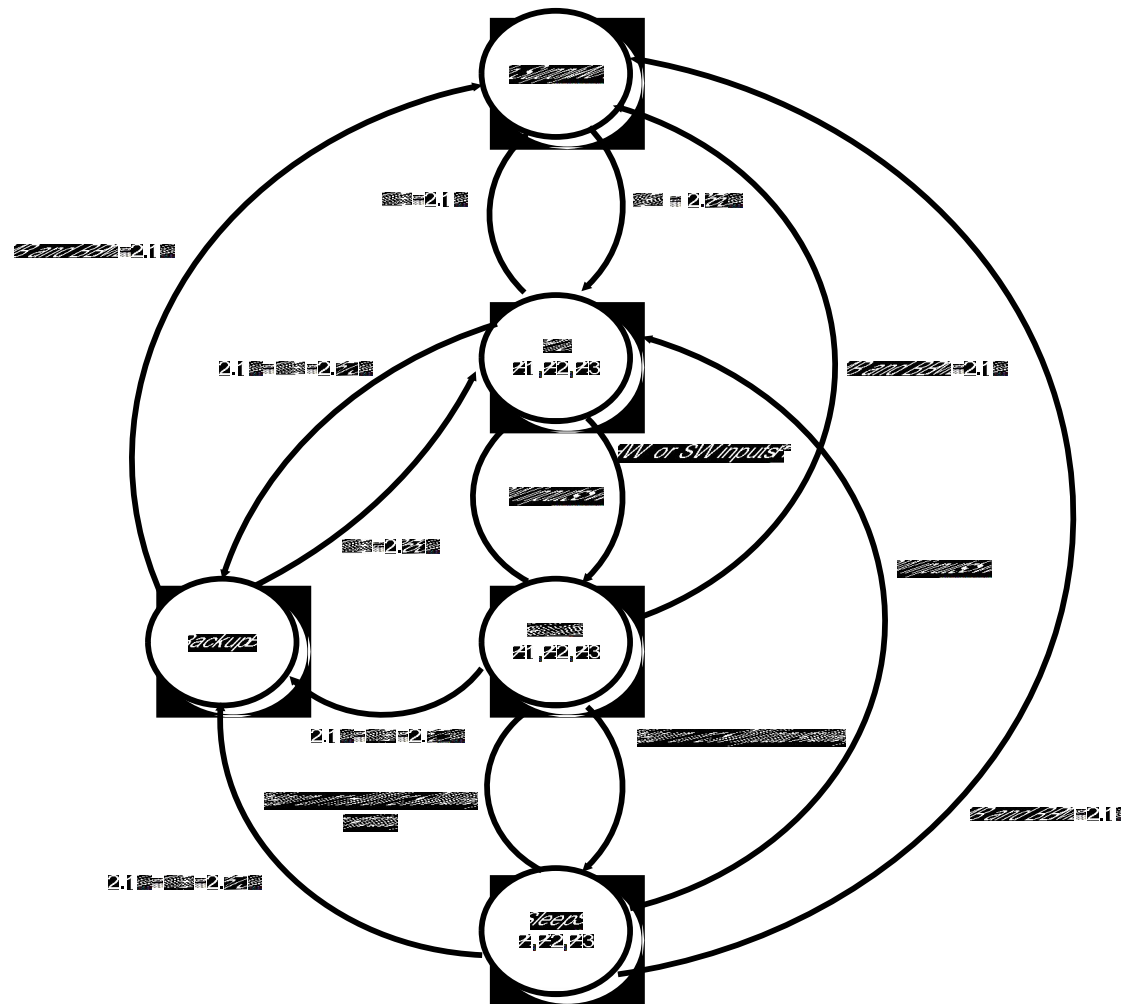
SLEEP: Main battery is present, backup battery present or not. Power supplies are in low-power mode.

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System operating state

Transition		Conditions
1	No Supply to Off	$V_{main} > V_{backup}$ and $V_{main} > 2.6V$ & $V_{main} < V_{backup}$ and $V_{main} > 2.8V$
2	Backup to No Supply	V_{main} and $V_{backup} < 2.1V$
3	Backup to Off	$V_{main} > 2.8V$
4	Off to No Supply	V_{main} and $V_{backup} < 2.1V$
5	Off to Backup	$V_{main} < 2.8V$
6	Off to Active	Pwon or Rpwon1 or RpWon1 or Wakeup or Battery plug. & $V_{main} > 3.2V$
7	Active to No Supply	V_{main} and $V_{backup} < 2.1V$
8	Active to Backup	$V_{main} < 2.8V$ and $V_{backup} > 2.1V$
9	Active to Off	Software Device Off
		or $V_{main} < 2.8V$
10	Active to Sleep	Software Device Sleep
11	Sleep to no Supply	V_{main} and $V_{backup} < 2.1V$
12	Sleep to Backup	$V_{main} < 2.8V$ and $V_{backup} > 2.1V$
13	Sleep to Active	Pwon or Rpwon1 or RpWon1 or Wakeup or Battery plug. & $V_{main} > 3.2V$
14	Sleep to Off	Software controlled transition in a two- processors system application

System operating state



System operating state

Reference voltage and reference current:

VBG	Band Gap voltage. External decoupling capacitor
IREF	Current reference generation. External resistor.
REFGND	System reference ground
VBACKUP	Backup battery
TOTAL PINS	4

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Three modes are defined for the power supply modules:

OFF: No voltage, no current.

ON: Nominal voltage, nominal output rating current.

LOW POWER: Nominal voltage, low output rating current.

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Power-supply

Modem DBB:

Name	Voltage	Current	Type	Off	On	Sleep
VRPLL	1.3V/1.4V/1.05V	10mA	LDO	X	X	X
VRMEM	1.8V	200mA	LDO	X	X	X
VRIO	1.8V	200mA	LDO	X	X	X

Peripherals:

Name	Voltage	Current	Type	Off	On	Sleep
VREXTH	2.8V/1.8V	200mA @ 1.8V 100mA @ 2.8V	LDO	X	X	X
VREXTL ¹	1.3V/1.05V 1.8V/2.8V	200mA @ 1.3V 100mA @ 1.8-2.8V	LDO	X	X	X

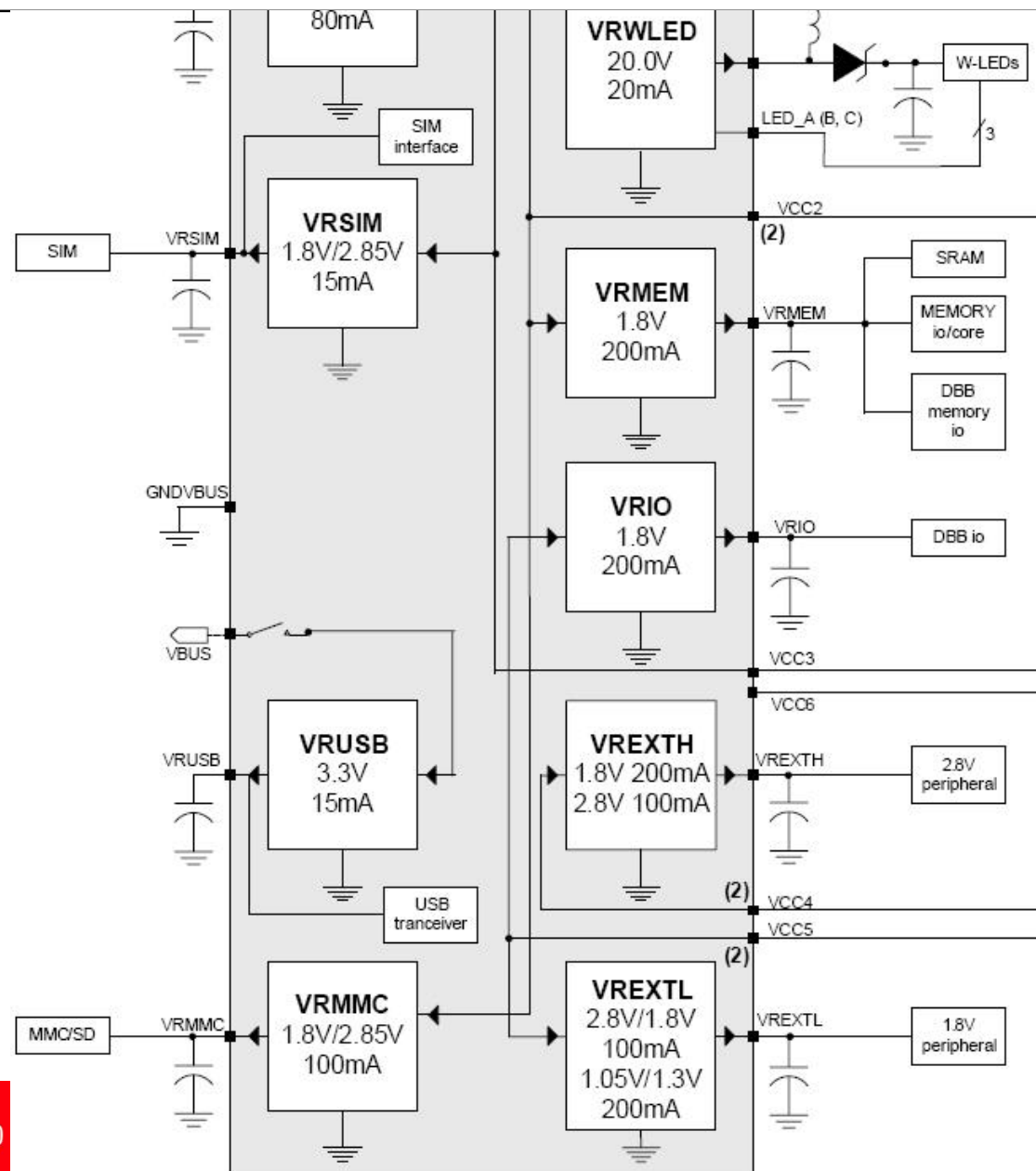
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TWL3031:

Name	Voltage	Current	Type	Off	On	Sleep
VRABB	2.8V	80mA	LDO	X	X	X
VRRTC	1.8V	20mA	LDO		X	X
VRUSB	3.3V	15mA	LDO	X	X	
VRWLED	20.0V	20mA	CP	X	X	X
VRSIM	1.8V/2.85V	15mA	LDO	X	X	X
VRMMC	1.8V/2.85V	100mA	LDO	X	X	X

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Power supplies diagram



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TWL3031 provides voice and audio resources:

- Telephone voice codec
- Audio stereo path.
- Clock frequency: same as master clock frequency.
- One SPI (VSP) interface for voice and one I2S serial interface (master) for audio.

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Voice Codec characteristics:

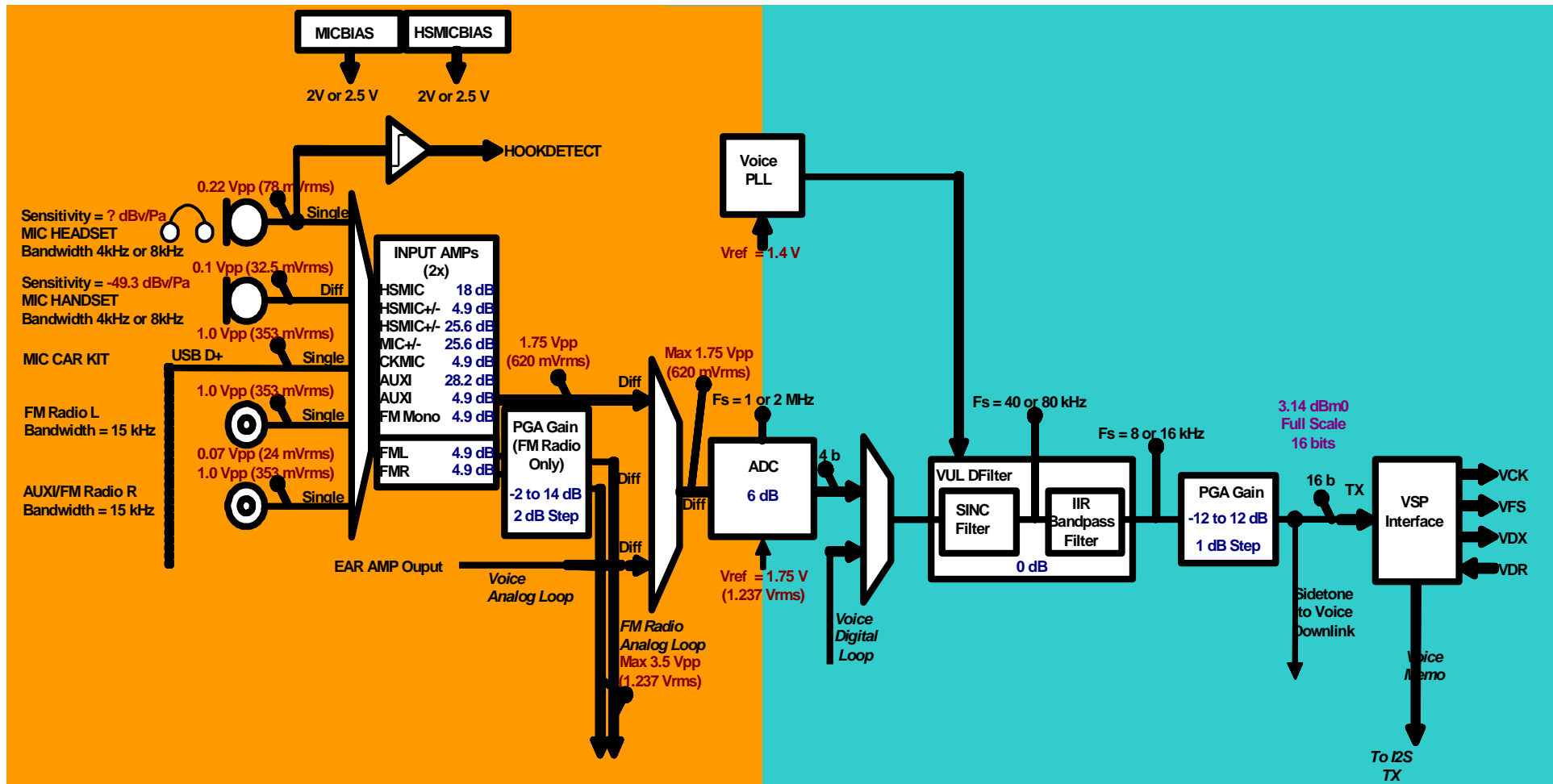
- 8-kHz & 16-kHz sample rate.
- 13-bit ADC / 15-bit DAC and digital filtering.
- Uplink & Downlink PGA, Side tone and volume control.
- Microphone and headset microphone bias generation.
- Send / End detection (Hook detect1).
- Voice memo function through transmission path.

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Voice Uplink



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Audio Stereo path characteristics:

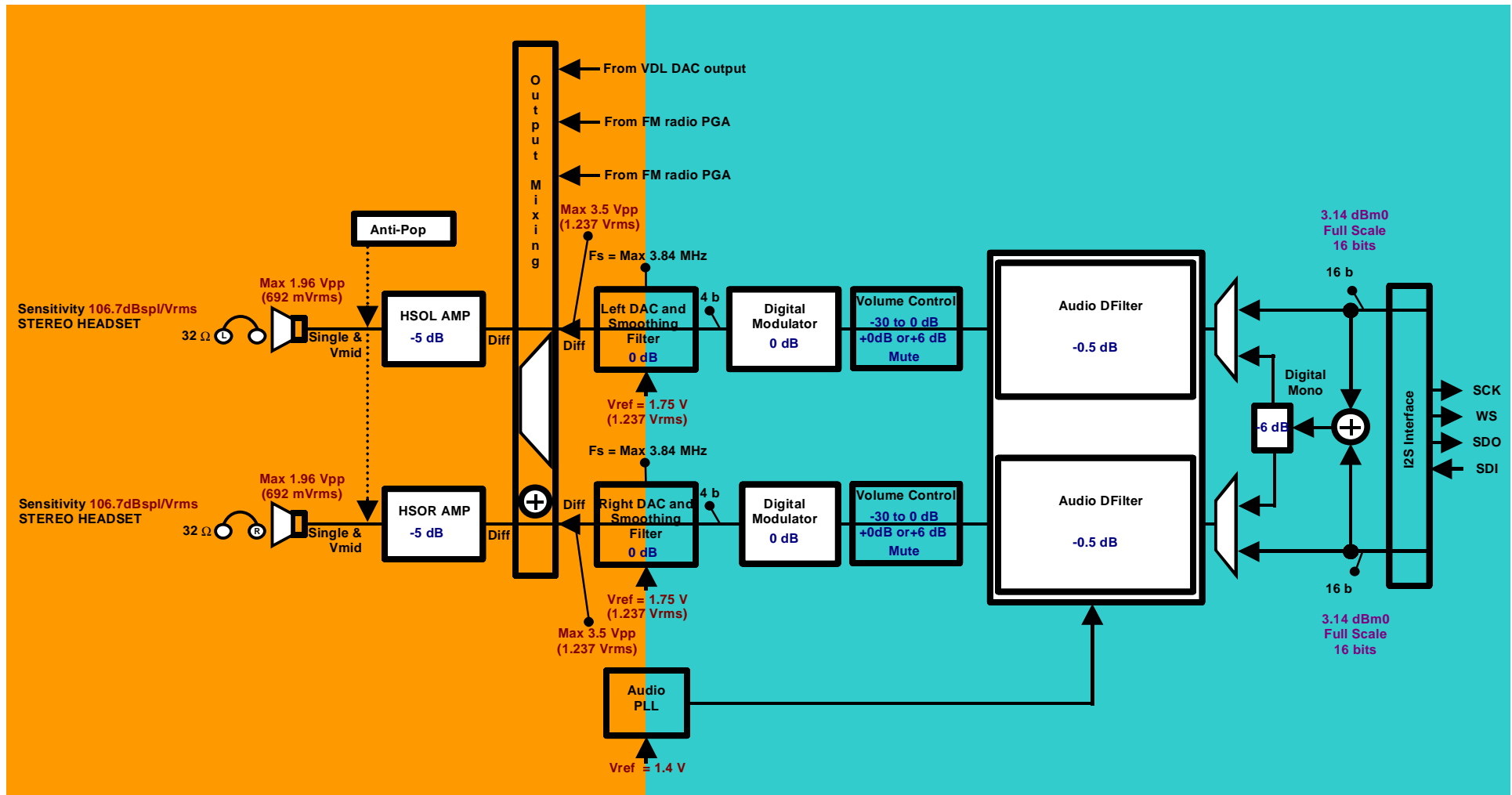
- Digital interface Sampling rate
- 8-kHz, 11.025-kHz, 12-kHz, 16-kHz, 22.05-kHz, 24-kHz, 32-kHz, 44.1-kHz, 48-kHz.
- 15-bits linear stereo DAC, digital filtering.
- Independent right and left volume control.

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Audio Stereo



Audio analog inputs:

- Differential microphone input (20-Hz to 8-kHz bandwidth).
- Single ended headset microphone input (20-Hz to 8-kHz bandwidth).
- Left & Right analog inputs with volume control for FM radio (20-Hz to 8-kHz bandwidth): FM stereo
- (through FML and AUXI_FMR pins) and FM mono (through AUXI_FMR pin).

Audio analog outputs:

- Microphone and headset microphone bias outputs.
- Differential Earphone output.
- Single ended headset output.
- 8-Ohm Hands Free output.
- Left & Right Auxiliary outputs.
- Left & Right single ended headset outputs.
- Pseudo-ground output to avoid AC coupling.

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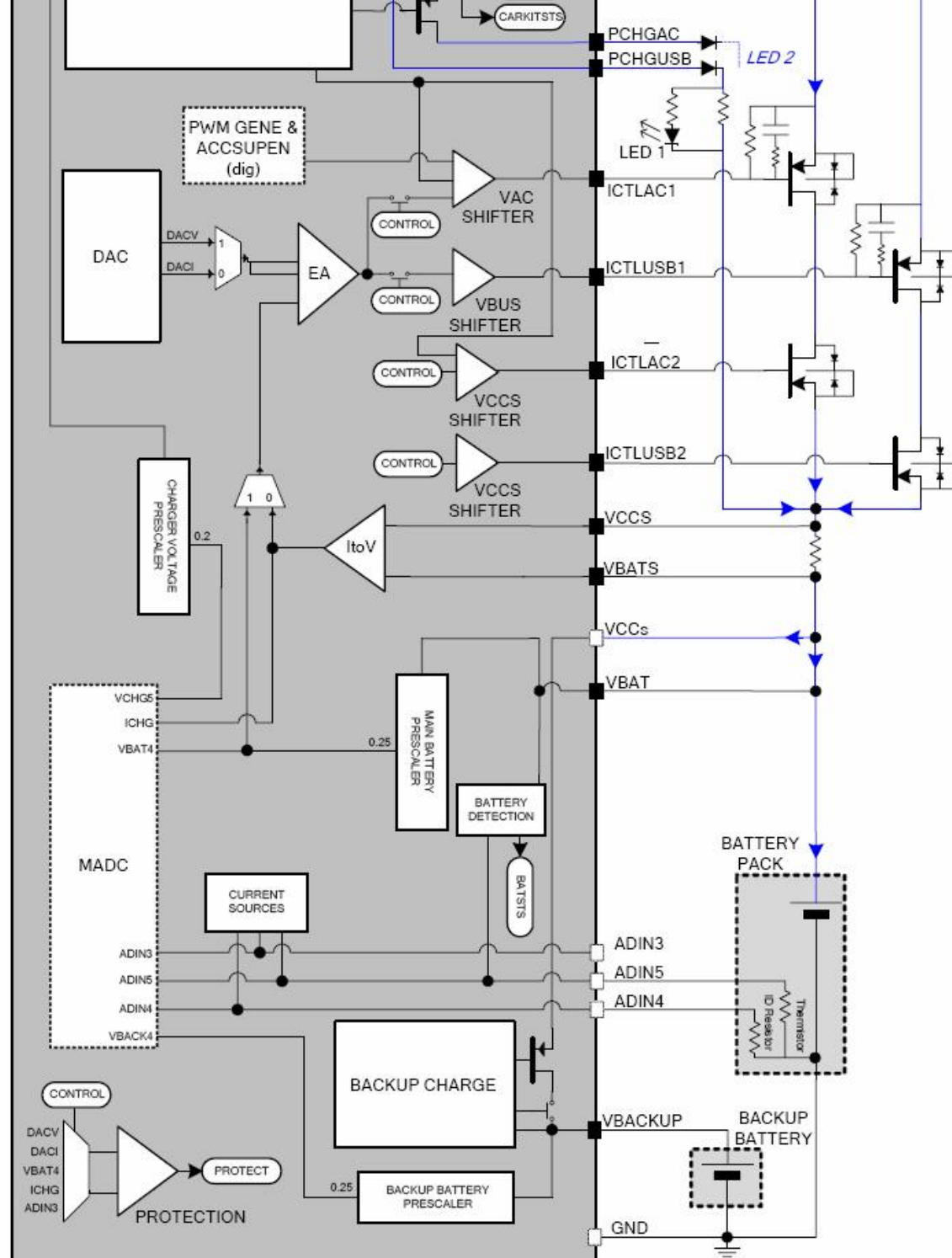
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High voltage (20V) Main battery charger interface:

- Allows use of low cost 20V unregulated charger
- Capability of charging from USB (Li-Ion, Li-polymer)
- Li-Ion, Li-polymer and Ni-Mh battery
- Linear charge through constant current / constant voltage modes
- Pulsed charge through PWM signal
- AC and car-kit pre-charge. Automatic starts and stop depending on main battery voltage
- Battery monitoring (Voltage, Temperature, Type, Charge current) done via the general purpose 10bit ADC

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TWL3031 provides the following transceivers and drivers:

- SIM-card interface (insertion / extraction detection function);
- USB 2.0 FS transceiver (slave only);
- Vibrator driver;
- White-LED's drivers.

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SIM-Card interface:

- Purpose of the SIM-card interface is to allow use of 1.8V/2.85V SIM-card types.
- TWL3031 provides only the insertion / extraction detection function.
- All the other signals from / to the SIM-card module (SIO, SCK, SRST) are managed directly by the digital IC companion.

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USB Transceiver:

OTG transceiver specification (compliance only)

TWL3031 includes a single USB 2.0 Full-Speed (FS) transceiver compatible with the “Universal Serial Bus Specification Revision 2.0”

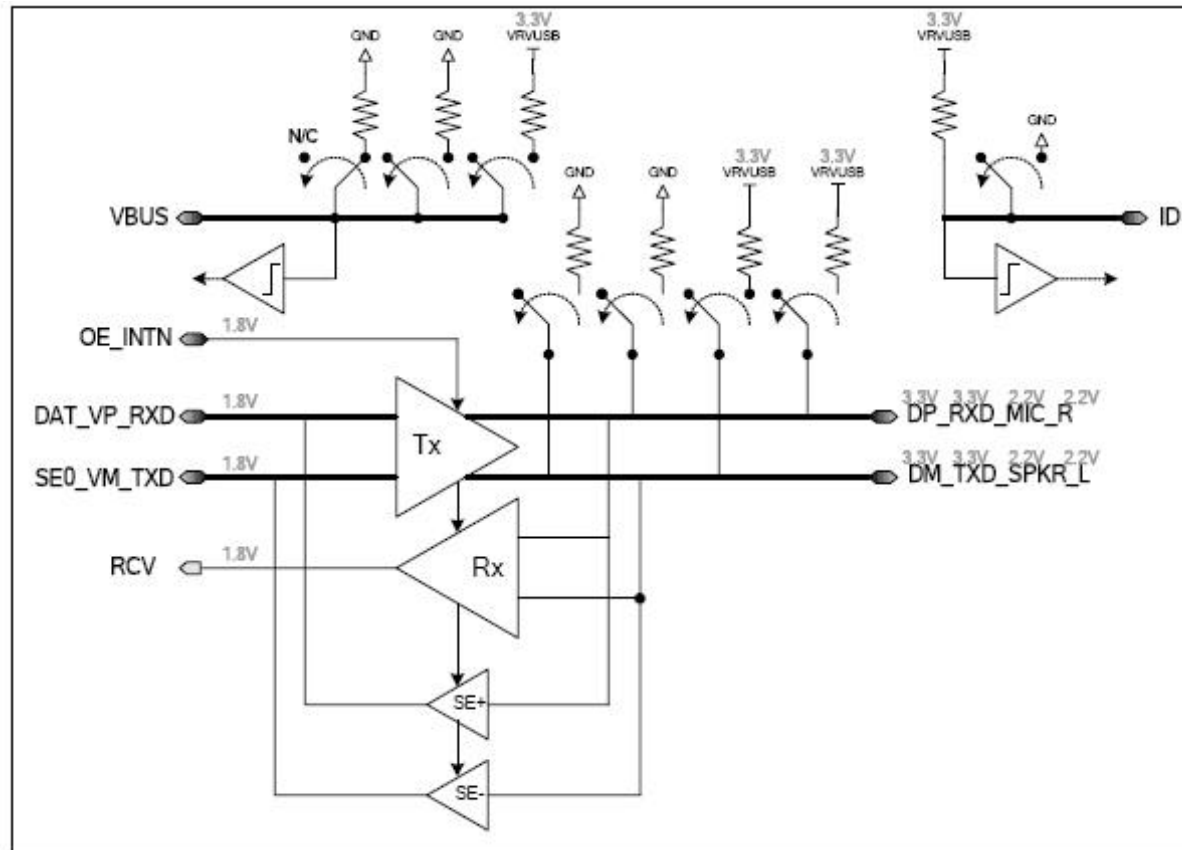
Mini-USB Analog Car Kit Interface

For compliance with CEA-936-A standard, TWL3031 USB interface supports the following functionalities:

- USB digital data.
- 4 Wire Analog Car-kit.
- UART (RS232) digital data.
- Charge phone.

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USB transceiver diagram



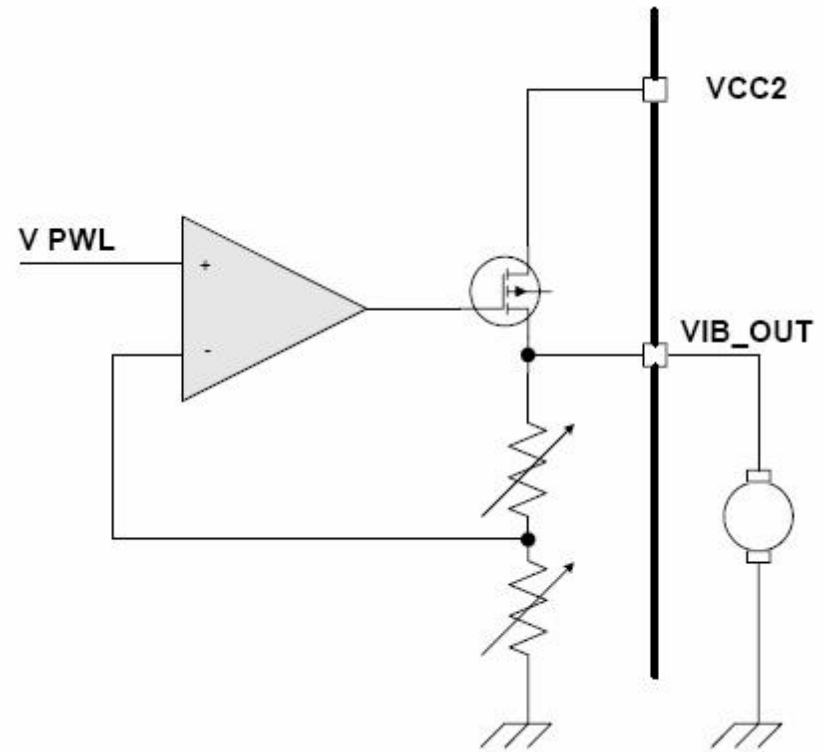
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Vibrator driver:

TWL3031 includes a vibrator driver.

The main features of the vibrator driver are:

- programmable output voltage (a) linear or (b) pulse density modulation (from 1.2V up to 2.7V, 75mA maximum output current) with soft turn-on/turn-off and,
- very low frequency (4-Hz) and variable duty cycle (25 / 50 / 75 / 100%).



Vibrator driver block scheme

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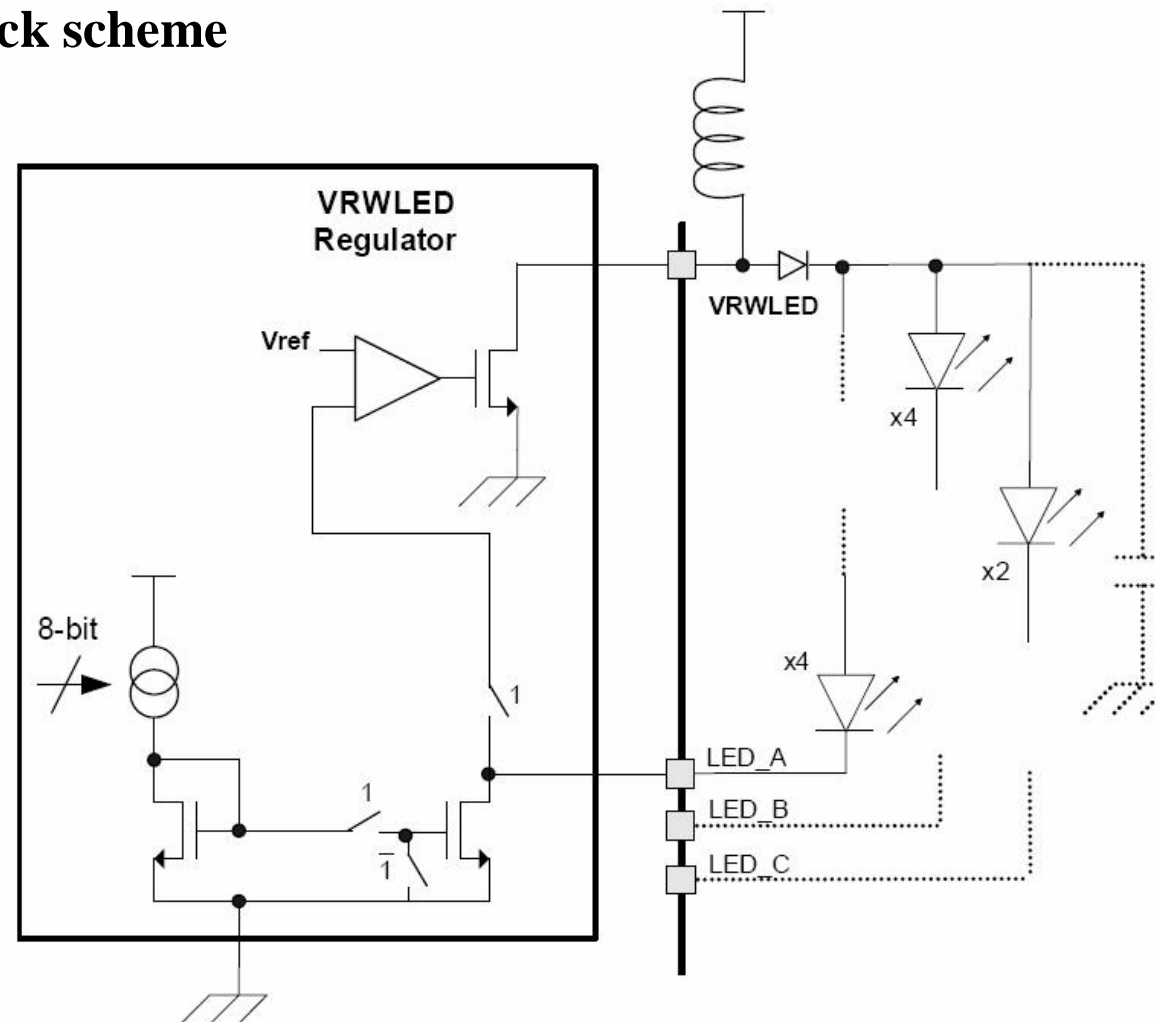
White-LED's drivers:

TWL3031 includes three white-LED's drivers for

- (1) the main screen,
- (2) the keypad and
- (3) the auxiliary screen

LED_A	LED_A driver output (main screen)
LED_B	LED_B driver output (keypad)
LED_C	LED_C driver output (auxiliary screen)
TOTAL PINS	3

W-LED's driver block scheme



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The RTC block is an embedded Real Time Clock (RTC) module, directly accessible from the control port interface, which consists of (1) a 32-kHz oscillator (two-pins architecture) and (2) a RTC module.

The principal features/characteristics of the RTC block are:

- Time information
- Calendar Information
- Interrupt generation
- Time correction

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Hot-Die function

TWL3031 contains a programmable temperature monitoring system (Hot-Die function), which is capable to generate an interrupt when a critical junction temperature is reached within the device itself.

This interrupt (#14) is a request to the software to close non-critical applications to reduce the amount of power drawn from TWL3031, thus reducing the internal dissipation.

The temperature monitoring system is also capable to generate a thermal shutdown signal whenever the temperature further increases. This signal generates an immediate, unconditional reset to the TWL3031 device.

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Housekeeping

A general purpose 10-bit ADC provides the means to monitor internal or external parameters. It includes a 11 channel multiplexed inputs arranged as follows:

Internal monitoring (6 channels) for:

- Main Battery voltage
- Main Battery charging current
- Backup battery voltage
- Charger voltage
- USB VBUS voltage
- Internal IC temperature

External monitoring (3 channels):

- One simple input (ADCIN3)
- Two inputs with current sources (ADCIN4 and ADCIN5) for battery type and battery temperature respectively

Thank you!

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