MEDIATEK

MT6333 PMIC Data Sheet

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Document Revision History

Revision	Date	Author	Description
0.1	2013/10/31	ShangYing	Initial Version

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1 Overview

1.1 Features

- Thermal regulation and thermal shut-down
- Boost mode for Flashlight,
  Torch: 300mA(base on LED rating), Flash: 1.0A
- Three bucks for VCORE (1.15V/2A), VMEM (1.225V/1.5A) and VRF (1.825V/450mA)
- Buck_EN & Sleep_B balls communicate with main PMIC (MT6323/MT6322).
- I2C interface
- 2.1259X2.638 WLCSP, 30-balls, 0.4-pitch

1.2 Applications

For power management of smart phones and other portable systems.

1.3 General Descriptions

MT6333 is a sub-power management system chip optimized for 2G/3G handsets and smart phones, especially based on the MediaTek MT6323/MT6322 system solution.

MT6333 highly integrates one boost converter for flashlight driver and 3 buck converters for system power optimization.

The boost mode can be used to supply flashlight from VLED pin.

MT6333 also integrates three buck converters for VCORE/VMEM/VRF which is used for higher current demand.

Buck_En pin is provided for power-on sequence controlled by main PMIC, and Sleep_B pin is for sleep mode control.

MT6333 is available in a WLCSP - 30L package. The operating temperature ranges from -20 to +80°C.

1.4   Ordering Information

Order #	Marking	Temp. range	Package
MT6333P/A		-20~80°C	WLCSP - 30L

1.5   Top Marking Definition

MT6333P/A

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MTK

MT6333P
YYWW-A$$H
  $$$$$$
```

YYWW: Date code
$$$$$$$: Random code

1.6   Pin Assignments and Descriptions

	1	2	3	4	5
A	SCL	DRVCDT	BOOT	VLED	CHRIN
B	SDA	VMEM_FB	VBUS	LX	LX
C	ISET	BATSNS	AGND	CHR_GATE	PGND_CHR
D	VCORE_FB	VRF_FB	GND	CS	CS
E	SLEEP_B	INT	VMEM_LX	VBAT	VBAT
F	BUCK_EN	VRF_LX	PGND_BUCK	PGND_BUCK	VCORE_LX
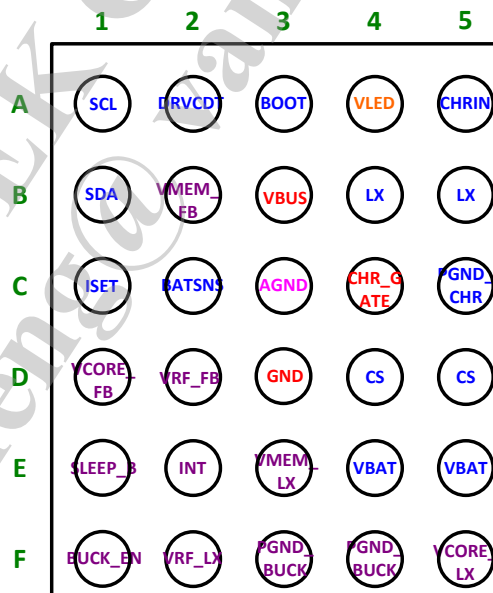
Figure 1-1. MT6333 WLCSP - 30L pin assignment

Table 1-1. MT6333 pin descriptions

Ball	Symbol	I/O	Description
Flashlight Driver			
A2	DRVCDT	O	Internal regulated power. Supplies internal PWM pre-driver and supplies 6323/MT6322's CHR_LDO ball. Connects a 100nF capacitor to GND.
A3	BOOT	I	Connects a 100nF capacitor to LX ball for PWM bootstrapping.
A4	VLED	O	Supplies power to LED.
A5	CHRIN	I	Boost output to flashlight driver, high-current path. Connects a 4.7uF capacitor to GND.
B3	VBUS	I	NC
B4,B5	LX		Switching node. Connects to inductor and connects a 100nF capacitor to BOOT ball.
C1	ISET	I	Used for flashlight driver current calibration, 1Kohm to GND.
C2	BATSNS	I	Battery voltage sense; connects to battery-side.
C4	CHR_GATE	O	NC
C5	PGND_CHR		Internal power GND for flashlight driver. Connect this ball to boost input CAP then to GND plane.
D4,D5	CS	I	Boost internal current sense.
E2	INT	O	Interrupt output; issues abnormal information to main chip; thermal shutdown/OCP, etc.
E4,E5	VBAT	I	Battery input
BUCK			
B2	VMEM_FB	I	VMEM feedback pin
E3	VMEM_LX		Switching node; connects to inductor.
D1	VCORE_FB	I	VCORE feedback pin
F5	VCORE_LX		Switching node; connects to inductor.
D2	VRF_FB	I	VRF feedback pin
F2	VRF_LX		Switching node; connects to inductor.
F3,F4	PGND_BUCK		Internal power GND for BUCK. Connect this ball to BUCK input CAP then to GND plane.
E1	SLEEP_B	I	BUCK sleep mode control input.
F1	BUCK_EN	I	BUCK turn-on/off control input.
I2C			
A1	SCL	I	I2C interface serial clock
B1	SDA	I	I2C interface serial data

2　Electrical Characteristics

2.1　Absolute Maximum Ratings over Operating Free-Air Temperature Range

Stresses beyond those listed under Table 2-1. Absolute maximum ratings may cause permanent damage to the device. These numbers are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect the device reliability.

Table 2-1. Absolute maximum ratings

Parameter	Conditions	Min.	Typical	Max.	Unit
Free-air temperature range		-40		85	°C
Storage temperature range		-65		150	°C
Battery input voltage range				4.5	V
ESD robustness	HBM	2,000			V

2.2　Thermal Characteristic

Parameter	Conditions	Min.	Typical	Max.	Unit
Thermal resistance from junction to ambient	In free air		76[1]		°C/W

Note: The device is mounted on a 4-metal-layer PCB and modeled per JEDEC51-9 condition.

2.3　Pin Voltage Range

Table 2-2. Operation condition

Pin name	Conditions	Min.	Typical	Max.	Unit
BOOT		0		17.2	
CHRIN		0	5	17.2	
DRVCDT		0	4	4.5	
CS		0		4.5	
BATSNS		0		4.5	
BUCK_EN		0	3.8	4.5	
CHR_GATE		0		4.5	
INT		0	1.87	2	
ISET		0		4.5	V

Pin name	Conditions	Min.	Typical	Max.	Unit
LX		-1		7	
SCL		0	1.87	2	
SDA		0	1.87	2	
SLEEP_B		0	1.87	2	
VBAT		0		4.5	
VCORE_FB		0	1.15	1.5	
VCORE_LX		-1		4.5	
VLED		0		5	
VMEM_FB		0	1.2	1.5	
VMEM_LX		-1		4.5	
VRF_FB		0	1.825	2.225	
VRF_LX		-1		4.5	
VBUS		0	5	17.2	

2.4 Recommended Operating Range

Table 2-3. Operation condition

Parameter	Conditions	Min.	Typical	Max.	Unit
Operating temperature range		-25		65	°C

2.5 Electrical Characteristics

VBAT = 3.4 ~ 4.35V, minimum loads applied on all outputs, unless otherwise noted.

Typical values are at T_A = 25°C.

Table 2-4. General electrical specifications

Parameter	Conditions	Min.	Typical	Max.	Unit
Operation ground current					
Standby	Low-power mode		64		µA
Interrupt					
Output high		V_{IO}-0.4			V
Output low				0.2	V
Thermal shut-down					
PMIC shut-down threshold			150		degree

2.6   Regulator Output

Table 2-5. Regulator specifications

Parameter	Conditions	Min.	Typical	Max.	Unit
Buck - VCORE					
Output voltage			1.15		V
Output current			2000		mA
Load transient		-4		4	%
Load regulation		-1		1	%
Buck – VMEM					
Output voltage			1.2		V
Output current			1500		mA
Load transient		-4		4	%
Buck – VRF					
Output voltage			1.825		V
Output current			450		mA
Turn-on overshoot				10	%

2.7   Flash

Table 2-9. Flash specifications

Parameter	Conditions	Min.	Typical	Max.	Unit
Maximum LED current	VLED=4.2V VBAT=3.6V, 3.8V, 4.4V			1.0	A
LED current accuracy	ILED≧ 800mA VBAT=3.6V, 3.8V, 4.4V	-10		10	%
	200≦ ILED ≦800mA VBAT=3.6V, 3.8V, 4.4V	-20		20	%
Over-voltage protection (LED open protection)		4.25	4.4	4.55	V
LED short protection		1.85	2	2.15	V

3   Functional Descriptions

3.1   General Descriptions

MT6333 is an integrated PMIC that contains flashlight driver and BUCKs. Figure 3-1. is the block diagram of the whole picture of MT6333 PMIC.

Figure 3-1. MT6333 block diagram
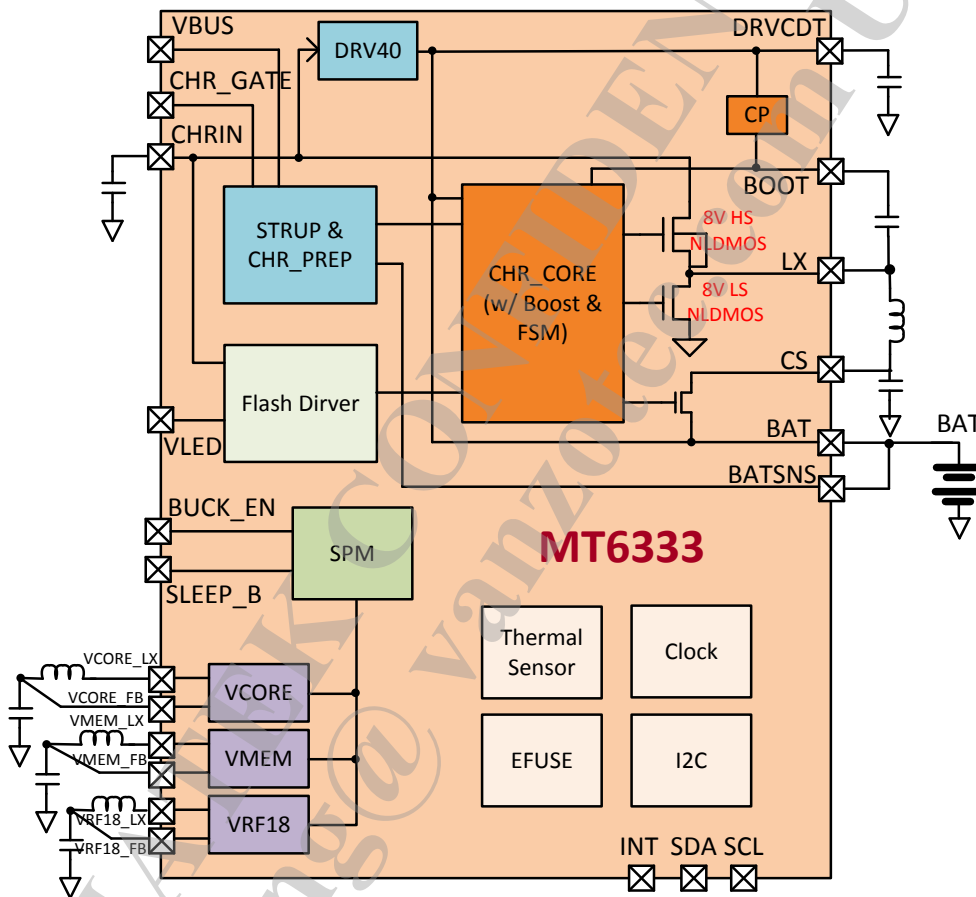
3.2   PMIC Functional Blocks

MT6333 features three BUCKs for baseband, memory and RF and the flashlight driver for flash LED. MT6333 includes the following analog functions for use on smart phone platforms.

- BUCK: Provides regulated lower output voltage level from Li-Ion battery
- Controller: Generates power-on/off sequence for BUCKs in such way to be applicable with MT6323/6322

- Flash driver: Supports LED driver for applications such as flashlight, camara flash or video recording lightening (or torch mode)

More detailed descriptions of each sub-block are explained in the following sections.

3.2.1   Power-On/Off Sequence

Power-On/Off of the BUCKs in MT6333 are controlled by HW pin strapping and SW setting. The On/Off sequence of VCORE and VMEM is controlled by pin "BUCK_EN" as shown in Figure 3-2. VRF18 is controlled by software directly through I^{2}C. Figure 3-2 also depicts the voltage of VCORE wil be reduced in sleep mode.

Power on/off sequence
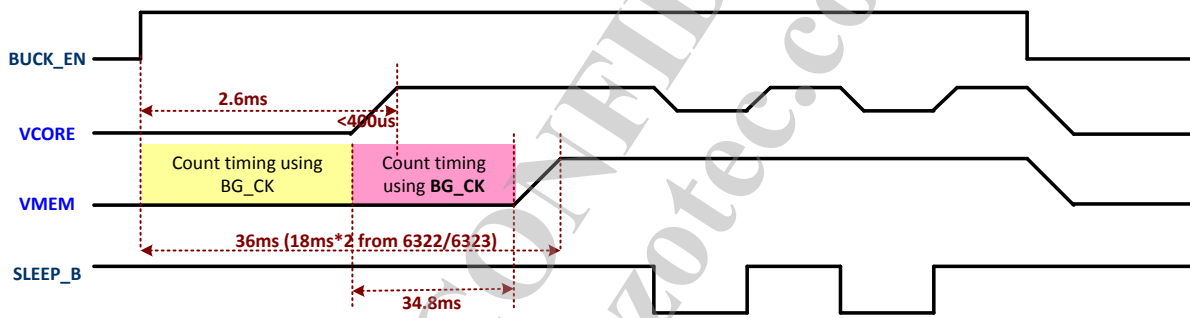
Figure 3-2. Power-on/off control sequence is controlled by MT6322/23: through pin BUCK_EN

Over-temperature protection

If the die temperature of PMIC exceeds 150°C, MT6333 VCORE will be set to sleep mode voltage while VMEM is kept the same. Once the over-temperature state is resolved, every block will return to its normal mode operation. Since VRF18 is controlled by software directly, it will not be affected by this thermal protection.

3.2.2   Buck Converter

There are 3 buck converters in MT6333 to efficiently generate regulated power for digital core, LPDDR3 (and LPDDR2) and RF circuit. Figure 3-3 is the block diagram. The buck converters operate with typically 2MHz (VRF18) and 3MHz (VCORE, VMEM) fixed frequency pulse width modulation (PWM) to heavy load currents. At light load currents, the converter automatically enters pulse frequency modulation (PFM) mode to save power and improve light load efficiency. It also has a force-PWM mode option to allow the converter to remain in the PWM mode regardless of the load current, so that the noise spectrum of the converter can be minimized for certain highly-noise-sensitive handset applications. The buck converters also have an internal over-current protection (OCP) circuit to limit the maximum high-side power FET current in over-load conditions. It has an internal soft start circuit to control the ramp-up rate of the output voltage during start-up.

Table 3-1. Buck converter brief specifications

BUCK name	Vout (Volt)	Imax (mA)	Application
VCORE	0.7 ~ 1.4V (6.25mV/step)	2000	Digital Core
VMEM	1.225V	1500	LPDDR2, LPDDR3
VRF18	1.825V	450	RF chip

1. Digital CORE power, VCORE

   VCORE is a high-current buck converter to provide a highly-efficient power supply for the handset digital core. Powering from a Li-ion battery, VCORE steps down the input voltage from 3.4 ~ 4.4V to the typical output voltage of 1.15V with a maximum load current capability of 2A. The output voltage can be adjusted between 0.7V and 1.4V. In order to optimize the overall system efficiency for digital core, VCORE features a Dynamic Voltage Frequency Scaling (DVFS) function which allows it to dynamically adjust its output voltage between 0.85V and 1.15V under different voltage supply demands from the digital core circuit. For more details, refer to the "Dynamic Voltage Frequency Scaling (DVFS)" section.

2. LPDDR2, LPDDR3 power, VMEM

   VMEM is a high-current buck converter to provide a highly-efficient power supply for the DDR memory. Powering from a Li-ion battery, VMEM steps down the input voltage from 3.4 ~ 4.4V to the typical output voltage of 1.225V with a maximum load current capability of 1.5A.

3. RF power, VRF18

   VRF18 is a buck converter to provide a highly-efficient power supply for the handset RF power. Powering from a Li-ion battery, VRF18 steps down the input voltage from 3.4 ~ 4.4V to the typical output voltage of 1.825V with a maximum load current capability of 0.45A.

3.2.3   Flash Driver

MT6333 has a boost converter with a white LED flash driver which is capable of delivering up to 1.0A and used in camera flash applications. Therefore, there are two modes in flash driver, Flash Mode and Torch (Video) Mode.

Figure 3-9 is the block diagram. The power supply of LED flash driver is CHRIN pin and VLED pin is attached LED. R_{SET}=1kΩ is an external resistor, which sets up the LED current in Flash Mode and Torch Mode.

Flash Mode

In Flash Mode, the LED current source is activated by RG_FLASH_EN. While the Flash on-sequence is done, the LED current will ramp up to the target current. The range of LED current souce is from 50mA to 1,000mA with 13 options. The Flash currents are programmed by register settings.

Torch (Video) Mode

In Torch/Video Mode,the LED current provides 6 options from 50mA to 300mA, and the current level can be adjusted by register settings. The LED current source is activated by RG_TORCH_MODE. The LSB of current level is 50mA.

LED Short Protect

MT6333 Flash driver has an LED short protection. A comparator detects the voltage of VLED pin. When the pin VLED is short to GND, the current source will be turned off immediately.

LED Open Protect

MT6333 Flash driver also has an LED open protection. When the pin VLED voltage rises to the OVP voltage, the LED current source will immediately be shut down. By reboot the LED current source can be resumed to its normal operation.
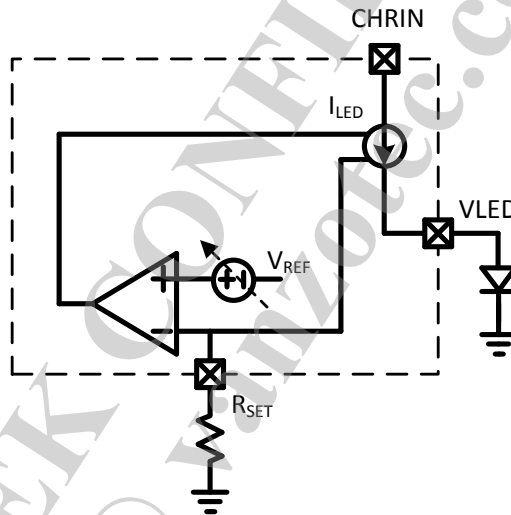
Figure 3-9. Flash driver block diagram

3.3   Register Table and Description

Module name: SWCHR Base address: (+0h)

Address	Name	Width	Register Function
00	CID0	8	Chip ID status 0
25	STA_CON12	8	STA control register 12
31	DIG_CON8	8	DIG control register 8
32	DIG_CON9	8	DIG control register 9
35	DIG_CON12	8	DIG control register 12
37	DIG_CON14	8	DIG control register 14
3C	GPIO_CON0	8	GPIO control register 0
3D	GPIO_CON1	8	GPIO control register 1
3E	GPIO_CON2	8	GPIO control register 2

Address	Name	Width	Register Function
44	**INT_CON0**	8	INT control register 0
45	**INT_CON0_SET**	8	INT control register 0 SET
46	**INT_CON0_CLR**	8	INT control register 0 CLR
47	**INT_CON1**	8	INT control register 1
48	**INT_CON1_SET**	8	INT control register 1 SET
49	**INT_CON1_CLR**	8	INT control register 1 CLR
4A	**INT_CON2**	8	INT control register 2
4B	**INT_CON2_SET**	8	INT control register 2 SET
4C	**INT_CON2_CLR**	8	INT control register 2 CLR
4D	**CHRWDT_CON0**	8	CHRWDT control register 0
4E	**CHRWDT_STATUS0**	8	CHRWDT status register 0
4F	**INT_STATUS0**	8	INT status register 0
50	**INT_STATUS1**	8	INT status register 1
51	**INT_STATUS2**	8	INT status register 2
68	**VCORE_CON17**	8	VCORE control register 17
6B	**VCORE_CON20**	8	VCORE control register 20
6C	**VCORE_CON21**	8	VCORE control register 21
6D	**VCORE_CON22**	8	VCORE control register 22
6E	**VCORE_CON23**	8	VCORE control register 23
80	**VMEM_CON9**	8	VMEM control register 9
81	**VMEM_CON12**	8	VMEM control register 12
82	**VMEM_CON13**	8	VMEM control register 13
83	**VMEM_CON14**	8	VMEM control register 14
84	**VMEM_CON15**	8	VMEM control register 15
9F	**VRF18_CON21**	8	VRF18 control register 21
A0	**VRF18_CON22**	8	VRF18 control register 22
FD	**CID1**	8	Chip ID status 1

00   **CID0**   Chip ID status 0   **93**

Bit	7	6	5	4	3	2	1	0
Mne				CID0				
Type				RO				
Reset	1	0	0	1	0	0	1	1

Bit(s)	Mnemonic	Name	Description
7:0	**CID0**	CID0	CID0

25   **STA_CON12**   STA control register 12   **00**

Bit	7	6	5	4	3	2	1	0
Name		RGS_VLED_OPEN	RGS_VLED_SHORT					

Type		RO	RO					
Reset		0	0					

Bit(s)	Mnemonic	Name	Description
6	**RGS_VLE D_OPEN**	RGS_VLED_OPE N	LED open flag
5	**RGS_VLE D_SHORT**	RGS_VLED_SH ORT	LED short flag

31　　**DIG_CON8**　　　**DIG control register 8**　　　　　　　　**00**

Bit	7	6	5	4	3	2	1	0
Name								RG_FLAS H_EN
Type								RW
Reset								0

Bit(s)	Mnemonic	Name	Description
0	**RG_FLAS H_EN**	RG_FLASH_EN	**Turns on flash current** 0: Disable 1: Enable

32　　**DIG_CON9**　　　**DIG control register 9**　　　　　　　　**00**

Bit	7	6	5	4	3	2	1	0
Name				RG_TORC H_MODE				
Type				RW				
Reset				0				

Bit(s)	Mnemonic	Name	Description
4	**RG_TORC H_MODE**	RG_TORCH_MO DE	**Enables torch mode** 0: Disable 1: Enable

35　　**DIG_CON12**　　　**DIG control register 12**　　　　　　　**00**

Bit	7	6	5	4	3	2	1	0
Name						RG_FLASH_ISET		
Type						RW		
Reset					0	0	0	0

Bit(s)	Mnemonic	Name	Description
3:0	**RG_FLAS H_ISET**	RG_FLASH_ISE T	**ISET current setting** 0000: 50mA (default) 0001: 100mA 0010: 150mA 0011: 200mA 0100: 250mA 0101: 300mA

Bit(s)	Mnemonic	Name	Description
			0110: 400mA
			0111: 500mA
			1000: 600mA
			1001: 700mA
			1010: 800mA
			1011: 900mA
			1100: 1000mA
			1101: 1100mA
			1110: 1200mA
			1111: 1300mA

37   **DIG_CON14**   **DIG control register 14**   **00**

Bit	7	6	5	4	3	2	1	0
Name	RG_FLASH_EN_TIMEOUT_SEL							
Type	RW							
Reset	0	0						

Bit(s)	Mnemonic	Name	Description
7:6	RG_FLASH_EN_TIMEOUT_SEL	RG_FLASH_EN_TIMEOUT_SEL	**Flash current turn-on time-out protection** 00: 200ms 01: 400ms 10: 600ms 11: 800ms

3C   **GPIO_CON0**   **GPIO control register 0**   **02**

Bit	7	6	5	4	3	2	1	0
Name							I2C_DEG_EN	I2C_CONFIG
Type							RW	RW
Reset							1	0

Bit(s)	Mnemonic	Name	Description
1	I2C_DEG_EN	I2C_DEG_EN	**Enables deglitch** 0: Disable 1: Enable
0	I2C_CONFIG	I2C_CONFIG	**Configures I2C SDA IO** 0: Open-drain mode 1: Tri-state mode

3D   **GPIO_CON1**   **GPIO control register 1**   **11**

Bit	7	6	5	4	3	2	1	0
Name	SCL_OUT	SCL_OE	SCL_MODE		SDA_OUT	SDA_OE	SDA_MODE	
Type	RW	RW	RW		RW	RW	RW	
Reset	0	0	0	1	0	0	0	1

Bit(s)	Mnemonic	Name	Description
7	**SCL_OUT**	SCL_OUT	**SDL_OUT GPIO mode**
6	**SCL_OE**	SCL_OE	**SDL_OE GPIO mode**
5:4	**SCL_MODE**	SCL_MODE	00: GPIO_MODE 01: I2C 10: Reserved 11: Reserved
3	**SDA_OUT**	SDA_OUT	**SDA_OUT GPIO mode**
2	**SDA_OE**	SDA_OE	**SDA_OE GPIO mode**
1:0	**SDA_MODE**	SDA_MODE	00: GPIO_MODE 01: I2C 10: Reserved 11: Reserved

3E   **GPIO_CON2**   GPIO control register 2   **09**

Bit	7	6	5	4	3	2	1	0
Name					INT_OUT	INT_OE	INT_MODE	
Type					RW	RW	RW	
Reset					1	0	0	1

Bit(s)	Mnemonic	Name	Description
3	**INT_OUT**	INT_OUT	**INT_OUT GPIO mode**
2	**INT_OE**	INT_OE	**INT_OE GPIO mode**
1:0	**INT_MODE**	INT_MODE	00: GPIO_MODE 01: EINT 10: Debug monitor 11: Reserved

44   **INT_CON0**   INT control register 0   **FF**

Bit	7	6	5	4	3	2	1	0
Name					RG_INT_EN_THERMAL_REG_OUT	RG_INT_EN_THERMAL_REG_IN	RG_INT_EN_THERMAL_SD	
Type					RW	RW	RW	
Reset					1	1	1	

Bit(s)	Mnemonic	Name	Description
3	**RG_INT_EN_THERMAL_REG_OUT**	RG_INT_EN_THERMAL_REG_OUT	**Enables interrupt of THERMAL_REG_OUT** 0: Does not issue interrupt 1: Issue interrupt
2	**RG_INT_EN_THERMAL_REG_IN**	RG_INT_EN_THERMAL_REG_IN	**Enables interrupt of THERMAL_REG_IN** 0: Does not issue interrupt 1: Issue interrupt
1	**RG_INT_EN_THERMAL_SD**	RG_INT_EN_THERMAL_SD	**Enables interrupt of THERMAL_SD** 0: Does not issue interrupt

Bit(s)	Mnemonic	Name	Description
			1: Issue interrupt

45   INT_CON0_SET   INT control register 0 SET   FF

Bit	7	6	5	4	3	2	1	0
Name					RG_INT_EN_THERMAL_REG_OUT_SET	RG_INT_EN_THERMAL_REG_IN_SET	RG_INT_EN_THERMAL_SD_SET	
Type					W1	W1	W1	
Reset					1	1	1	

Bit(s)	Mnemonic	Name	Description
3	RG_INT_EN_THERMAL_REG_OUT_SET	RG_INT_EN_THERMAL_REG_OUT_SET	1'b0: Does not set 1'b1: Set
2	RG_INT_EN_THERMAL_REG_IN_SET	RG_INT_EN_THERMAL_REG_IN_SET	1'b0: Does not set 1'b1: Set
1	RG_INT_EN_THERMAL_SD_SET	RG_INT_EN_THERMAL_SD_SET	1'b0: Does not set 1'b1: Set

46   INT_CON0_CLR   INT control register 0 CLR   FF

Bit	7	6	5	4	3	2	1	0
Name					RG_INT_EN_THERMAL_REG_OUT_CLR	RG_INT_EN_THERMAL_REG_IN_CLR	RG_INT_EN_THERMAL_SD_CLR	
Type					W1	W1	W1	
Reset					1	1	1	

Bit(s)	Mnemonic	Name	Description
3	RG_INT_EN_THERMAL_REG_OUT_CLR	RG_INT_EN_THERMAL_REG_OUT_CLR	1'b0: Does not clear 1'b1: Clear
2	RG_INT_EN_THERMAL_REG_IN_CLR	RG_INT_EN_THERMAL_REG_IN_CLR	1'b0: Does not clear 1'b1: Clear
1	RG_INT_EN_THERMAL_SD_CLR	RG_INT_EN_THERMAL_SD_CLR	1'b0: Does not clear 1'b1: Clear

47 **INT_CON1** **INT control register 1** **FF**

Bit	7	6	5	4	3	2	1	0
Name	RG_INT_EN_FLASH_VLED_OPEN	RG_INT_EN_FLASH_VLED_SHORT	RG_INT_EN_FLASH_EN_TIMEOUT	RG_INT_EN_BUCK_THERMAL	RG_INT_EN_BUCK_VRF18_OC	RG_INT_EN_BUCK_VMEM_OC	RG_INT_EN_BUCK_VCORE_OC	RG_INT_EN_CHRWDT_FLAG
Type	RW	RW	RW	RW	RW	RW	RW	RW
Reset	1	1	1	1	1	1	1	1

Bit(s)	Mnemonic	Name	Description
7	RG_INT_EN_FLASH_VLED_OPEN	RG_INT_EN_FLASH_VLED_OPEN	**Enables interrupt of flash open** 0: Does not issue interrupt 1: Issue interrupt
6	RG_INT_EN_FLASH_VLED_SHORT	RG_INT_EN_FLASH_VLED_SHORT	**Enables interrupt of flash short** 0: Does not issue interrupt 1: Issue interrupt
5	RG_INT_EN_FLASH_EN_TIMEOUT	RG_INT_EN_FLASH_EN_TIMEOUT	**Enables interrupt of flash timeout** 0: Does not issue interrupt 1: Issue interrupt
4	RG_INT_EN_BUCK_THERMAL	RG_INT_EN_BUCK_THERMAL	**Enables interrupt of BUCK_THERMAL** 0: Does not issue interrupt 1: Issue interrupt
3	RG_INT_EN_BUCK_VRF18_OC	RG_INT_EN_BUCK_VRF18_OC	**Enables interrupt of VRF18 OC** 0: Does not issue interrupt 1: Issue interrupt
2	RG_INT_EN_BUCK_VMEM_OC	RG_INT_EN_BUCK_VMEM_OC	**Enables interrupt of VMEM OC** 0: Does not issue interrupt 1: Issue interrupt
1	RG_INT_EN_BUCK_VCORE_OC	RG_INT_EN_BUCK_VCORE_OC	**Enables interrupt of VCORE OC** 0: Does not issue interrupt 1: Issue interrupt
0	RG_INT_EN_CHRWDT_FLAG	RG_INT_EN_CHRWDT_FLAG	**Enables interrupt of CHRWDT_FLAG** 0: Does not issue interrupt 1: Issue interrupt

48 **INT_CON1_SET** **INT control register 1 SET** **FF**

Bit	7	6	5	4	3	2	1	0
Name	RG_INT_EN_FLASH_VLED_OPEN_SET	RG_INT_EN_FLASH_VLED_SHORT_SET	RG_INT_EN_FLASH_EN_TIMEOUT_SET	RG_INT_EN_BUCK_THERMAL_SET	RG_INT_EN_BUCK_VRF18_OC_SET	RG_INT_EN_BUCK_VMEM_OC_SET	RG_INT_EN_BUCK_VCORE_OC_SET	RG_INT_EN_CHRWDT_FLAG_SET
Type	W1	W1	W1	W1	W1	W1	W1	W1
Reset	1	1	1	1	1	1	1	1

Bit(s)	Mnemonic	Name	Description

Bit(s)	Mnemonic	Name	Description
7	RG_INT_EN_FLASH_VLED_OPEN_SET	RG_INT_EN_FLASH_VLED_OPEN_SET	1'b0: Does not set 1'b1: Set
6	RG_INT_EN_FLASH_VLED_SHORT_SET	RG_INT_EN_FLASH_VLED_SHORT_SET	1'b0: Does not set 1'b1: Set
5	RG_INT_EN_FLASH_EN_TIMEOUT_SET	RG_INT_EN_FLASH_EN_TIMEOUT_SET	1'b0: Does not set 1'b1: Set
4	RG_INT_EN_BUCK_THERMAL_SET	RG_INT_EN_BUCK_THERMAL_SET	1'b0: Does not set 1'b1: Set
3	RG_INT_EN_BUCK_VRF18_OC_SET	RG_INT_EN_BUCK_VRF18_OC_SET	1'b0: Does not set 1'b1: Set
2	RG_INT_EN_BUCK_VMEM_OC_SET	RG_INT_EN_BUCK_VMEM_OC_SET	1'b0: Does not set 1'b1: Set
1	RG_INT_EN_BUCK_VCORE_OC_SET	RG_INT_EN_BUCK_VCORE_OC_SET	1'b0: Does not set 1'b1: Set
0	RG_INT_EN_CHRWDT_FLAG_SET	RG_INT_EN_CHRWDT_FLAG_SET	1'b0: Does not set 1'b1: Set

49   INT_CON1_CLR   INT control register 1 CLR   FF

Bit	7	6	5	4	3	2	1	0
Name	RG_INT_EN_FLASH_VLED_OPEN_CLR	RG_INT_EN_FLASH_VLED_SHORT_CLR	RG_INT_EN_FLASH__EN_TIMEOUT_CLR	RG_INT_EN_BUCK_THERMAL_CLR	RG_INT_EN_BUCK_VRF18_OC_CLR	RG_INT_EN_BUCK_VMEM_OC_CLR	RG_INT_EN_BUCK_VCORE_OC_CLR	RG_INT_EN_CHRWDT_FLAG_CLR
Type	W1	W1	W1	W1	W1	W1	W1	W1
Reset	1	1	1	1	1	1	1	1

Bit(s)	Mnemonic	Name	Description
7	RG_INT_EN_FLASH_VLED_OPEN_CLR	RG_INT_EN_FLASH_VLED_OPEN_CLR	1'b0: Does not clear 1'b1: Clear
6	RG_INT_EN_FLASH_VLED_SHORT_CL	RG_INT_EN_FLASH_VLED_SHORT_CLR	1'b0: Does not clear 1'b1: Clear

Bit(s)	Mnemonic	Name	Description
		R	
5	**RG_INT_E N_FLASH _EN_TIME OUT_CLR**	RG_INT_EN_FLA SH_EN_TIMEOU T_CLR	1'b0: Does not clear 1'b1: Clear
4	**RG_INT_E N_BUCK_ THERMAL _CLR**	RG_INT_EN_BU CK_THERMAL_C LR	1'b0: Does not clear 1'b1: Clear
3	**RG_INT_E N_BUCK_ VRF18_O C_CLR**	RG_INT_EN_BU CK_VRF18_OC_ CLR	1'b0: Does not clear 1'b1: Clear
2	**RG_INT_E N_BUCK_ VMEM_O C_CLR**	RG_INT_EN_BU CK_VMEM_OC_ CLR	1'b0: Does not clear 1'b1: Clear
1	**RG_INT_E N_BUCK_ VCORE_O C_CLR**	RG_INT_EN_BU CK_VCORE_OC _CLR	1'b0: Does not clear 1'b1: Clear
0	**RG_INT_E N_CHRW DT_FLAG _CLR**	RG_INT_EN_CH RWDT_FLAG_CL R	1'b0: Does not clear 1'b1: Clear

4A	INT_CON2		INT control register 2					03
Bit	7	6	5	4	3	2	1	0
Name							RG_INT_E N_CHR_P LUG_IN_F LASH	
Type							RW	
Reset							1	

Bit(s)	Mnemonic	Name	Description
1	**RG_INT_E N_CHR_P LUG_IN_F LASH**	RG_INT_EN_CH R_PLUG_IN_FLA SH	0: Does not issue interrupt 1: Issue interrupt

4B	INT_CON2_SET		INT control register 2 SET					03
Bit	7	6	5	4	3	2	1	0
Name							RG_INT_E N_CHR_P LUG_IN_F LASH_SE T	
Type							W1	
Reset							1	

Bit(s)	Mnemonic	Name	Description
1	**RG_INT_E N_CHR_P LUG_IN_F LASH_SE T**	RG_INT_EN_CH R_PLUG_IN_FLA SH_SET	1'b0: Does not set 1'b1: Set

4C **INT_CON2_CLR** INT control register 2 CLR **03**

Bit	7	6	5	4	3	2	1	0
Name							RG_INT_E N_CHR_P LUG_IN_F LASH_CL R	
Type							W1	
Reset							1	

Bit(s)	Mnemonic	Name	Description
1	**RG_INT_E N_CHR_P LUG_IN_F LASH_CL R**	RG_INT_EN_CH R_PLUG_IN_FLA SH_CLR	1'b0: Does not clear 1'b1: Clear

4D **CHRWDT_CON0** CHRWDT control register 0 **0D**

Bit	7	6	5	4	3	2	1	0
Name	RG_CHR WDT_WR				RG_CHRWDT_TD			RG_CHR WDT_EN
Type	RW				RW			RW
Reset	0				1	1	0	1

Bit(s)	Mnemonic	Name	Description
7	**RG_CHR WDT_WR**	RG_CHRWDT_W R	**Clears timer flag**
3:1	**RG_CHR WDT_TD**	RG_CHRWDT_T D	**Time-out interval of watchdog timer** 000: 4 sec 001: 32 sec 010: 60 sec 011: 256 sec 100: 480 sec 101: 1,024 sec 110: 1,800 sec 111: 3,000 sec
0	**RG_CHR WDT_EN**	RG_CHRWDT_E N	**Enables watchdog timer**

4E **CHRWDT_STATUS0** CHRWDT status register 0 **00**

Bit	7	6	5	4	3	2	1	0

Name								RG_CHR WDT_FLA G
Type								RO
Reset								0

Bit(s)	Mnemonic	Name	Description
0	**RG_CHR WDT_FLA G**	RG_CHRWDT_F LAG	Watchdog timer flag

4F   <u>INT_STATUS0</u>   INT status register 0   00

Bit	7	6	5	4	3	2	1	0
Name	RG_INT_S TATUS_O TG_DRVC DT_SHOR T	RG_INT_S TATUS_O TG_CHRI N_SHORT	RG_INT_S TATUS_O TG_THER MAL	RG_INT_S TATUS_O TG_OC	RG_INT_S TATUS_T HERMAL_ REG_OUT	RG_INT_S TATUS_T HERMAL_ REG_IN	RG_INT_S TATUS_T HERMAL_ SD	
Type	RO	RO	RO	RO	RO	RO	RO	
Reset	0	0	0	0	0	0	0	

Bit(s)	Mnemonic	Name	Description
7	**RG_INT_S TATUS_O TG_DRVC DT_SHOR T**	RG_INT_STATUS _OTG_DRVCDT_ SHORT	0: No interrupt issued 1: Interrupt issued
6	**RG_INT_S TATUS_O TG_CHRI N_SHORT**	RG_INT_STATUS _OTG_CHRIN_S HORT	0: No interrupt issued 1: Interrupt issued
5	**RG_INT_S TATUS_O TG_THER MAL**	RG_INT_STATUS _OTG_THERMA L	0: No interrupt issued 1: Interrupt issued
4	**RG_INT_S TATUS_O TG_OC**	RG_INT_STATUS _OTG_OC	0: No interrupt issued 1: Interrupt issued
3	**RG_INT_S TATUS_T HERMAL_ REG_OUT**	RG_INT_STATUS _THERMAL_RE G_OUT	0: No interrupt issued 1: Interrupt issued
2	**RG_INT_S TATUS_T HERMAL_ REG_IN**	RG_INT_STATUS _THERMAL_RE G_IN	0: No interrupt issued 1: Interrupt issued
1	**RG_INT_S TATUS_T HERMAL_ SD**	RG_INT_STATUS _THERMAL_SD	0: No interrupt issued 1: Interrupt issued

50   <u>INT_STATUS1</u>   INT status register 1   **00**

Bit	7	6	5	4	3	2	1	0
Name	RG_INT_STATUS_FLASH_VLED_OPEN	RG_INT_STATUS_FLASH_VLED_SHORT	RG_INT_STATUS_FLASH_EN_TIMEOUT	RG_INT_STATUS_BUCK_THERMAL	RG_INT_STATUS_BUCK_VRF18_OC	RG_INT_STATUS_BUCK_VMEM_OC	RG_INT_STATUS_BUCK_VCORE_OC	RG_INT_STATUS_CHRWDT_FLAG
Type	RO	RO	RO	RO	RO	RO	RO	RO
Reset	0	0	0	0	0	0	0	0

Bit(s)	Mnemonic	Name	Description
7	**RG_INT_STATUS_FLASH_VLED_OPEN**	RG_INT_STATUS_FLASH_VLED_OPEN	0: No interrupt issued 1: Interrupt issued
6	**RG_INT_STATUS_FLASH_VLED_SHORT**	RG_INT_STATUS_FLASH_VLED_SHORT	0: No interrupt issued 1: Interrupt issued
5	**RG_INT_STATUS_FLASH_EN_TIMEOUT**	RG_INT_STATUS_FLASH_EN_TIMEOUT	0: No interrupt issued 1: Interrupt issued
4	**RG_INT_STATUS_BUCK_THERMAL**	RG_INT_STATUS_BUCK_THERMAL	0: No interrupt issued 1: Interrupt issued
3	**RG_INT_STATUS_BUCK_VRF18_OC**	RG_INT_STATUS_BUCK_VRF18_OC	0: No interrupt issued 1: Interrupt issued
2	**RG_INT_STATUS_BUCK_VMEM_OC**	RG_INT_STATUS_BUCK_VMEM_OC	0: No interrupt issued 1: Interrupt issued
1	**RG_INT_STATUS_BUCK_VCORE_OC**	RG_INT_STATUS_BUCK_VCORE_OC	0: No interrupt issued 1: Interrupt issued
0	**RG_INT_STATUS_CHRWDT_FLAG**	RG_INT_STATUS_CHRWDT_FLAG	0: No interrupt issued 1: Interrupt issued

51   <u>INT_STATUS2</u>   INT status register 2   **00**

Bit	7	6	5	4	3	2	1	0
Name							RG_INT_STATUS_CHR_PLUG_IN_FLASH	
Type							RO	
Reset							0	

Bit(s)	Mnemonic	Name	Description
1	**RG_INT_STATUS_CHR_PLUG_IN_FLASH**	RG_INT_STATUS_CHR_PLUG_IN_FLASH	0: No interrupt issued 1: Interrupt issued

68   <u>VCORE_CON17</u>   **VCORE control register 17**   **20**

Bit	7	6	5	4	3	2	1	0
Name				VCORE_EN_CTRL	QI_VCORE_EN	QI_VCORE_STB	VCORE_EN	
Type				RW	RO	RO	RW	
Reset				0	0	0	0	

Bit(s)	Mnemonic	Name	Description
4	**VCORE_EN_CTRL**	VCORE_EN_CTRL	**Enables control** 0: SW control 1: HW control
3	**QI_VCORE_EN**	QI_VCORE_EN	**Enabling signal**
2	**QI_VCORE_STB**	QI_VCORE_STB	**Soft start**
1	**VCORE_EN**	VCORE_EN	0: Enable VCORE 1: Disable VCORE

6B   <u>VCORE_CON20</u>   **VCORE control register 20**   **48**

Bit	7	6	5	4	3	2	1	0
Name		VCORE_VOSEL						
Type		RW						
Reset		1	0	0	1	0	0	0

Bit(s)	Mnemonic	Name	Description
6:0	**VCORE_VOSEL**	VCORE_VOSEL	**Selects VOUT in register mode** 0000000: 0.70000V 0000001: 0.70625V 0000010: 0.71250V 0000011: 0.71875V 0000100: 0.72500V 0000101: 0.73125V 0000110: 0.73750V 0000111: 0.74375V 0001000: 0.75000V 0001001: 0.75625V 0001010: 0.76250V 0001011: 0.76875V 0001100: 0.77500V 0001101: 0.78125V 0001110: 0.78750V 0001111: 0.79375V

Bit(s)	Mnemonic	Name	Description
			0010000: 0.80000V
			0010001: 0.80625V
			0010010: 0.81250V
			0010011: 0.81875V
			0010100: 0.82500V
			0010101: 0.83125V
			0010110: 0.83750V
			0010111: 0.84375V
			0011000: 0.85000V
			0011001: 0.85625V
			0011010: 0.86250V
			0011011: 0.86875V
			0011100: 0.87500V
			0011101: 0.88125V
			0011110: 0.88750V
			0011111: 0.89375V
			0100000: 0.90000V
			0100001: 0.90625V
			0100010: 0.91250V
			0100011: 0.91875V
			0100100: 0.92500V
			0100101: 0.93125V
			0100110: 0.93750V
			0100111: 0.94375V
			0101000: 0.95000V
			0101001: 0.95625V
			0101010: 0.96250V
			0101011: 0.96875V
			0101100: 0.97500V
			0101101: 0.98125V
			0101110: 0.98750V
			0101111: 0.99375V
			0110000: 1.00000V
			0110001: 1.00625V
			0110010: 1.01250V
			0110011: 1.01875V
			0110100: 1.02500V
			0110101: 1.03125V
			0110110: 1.03750V
			0110111: 1.04375V
			0111000: 1.05000V
			0111001: 1.05625V
			0111010: 1.06250V
			0111011: 1.06875V
			0111100: 1.07500V
			0111101: 1.08125V
			0111110: 1.08750V
			0111111: 1.09375V
			1000000: 1.10000V
			1000001: 1.10625V
			1000010: 1.11250V
			1000011: 1.11875V
			1000100: 1.12500V
			1000101: 1.13125V
			1000110: 1.13750V
			1000111: 1.14375V
			1001000: 1.15000V
			1001001: 1.15625V
			1001010: 1.16250V

Bit(s)	Mnemonic	Name	Description
			1001011: 1.16875V
			1001100: 1.17500V
			1001101: 1.18125V
			1001110: 1.18750V
			1001111: 1.19375V
			1010000: 1.20000V
			1010001: 1.20625V
			1010010: 1.21250V
			1010011: 1.21875V
			1010100: 1.22500V
			1010101: 1.23125V
			1010110: 1.23750V
			1010111: 1.24375V
			1011000: 1.25000V
			1011001: 1.25625V
			1011010: 1.26250V
			1011011: 1.26875V
			1011100: 1.27500V
			1011101: 1.28125V
			1011110: 1.28750V
			1011111: 1.29375V
			1100000: 1.30000V
			1100001: 1.30625V
			1100010: 1.31250V
			1100011: 1.31875V
			1100100: 1.32500V
			1100101: 1.33125V
			1100110: 1.33750V
			1100111: 1.34375V
			1101000: 1.35000V
			1101001: 1.35625V
			1101010: 1.36250V
			1101011: 1.36875V
			1101100: 1.37500V
			1101101: 1.38125V
			1101110: 1.38750V
			1101111: 1.39375V
			1110000: 1.40000V
			1110001: 1.40625V
			1110010: 1.41250V
			1110011: 1.41875V
			1110100: 1.42500V
			1110101: 1.43125V
			1110110: 1.43750V
			1110111: 1.44375V
			1111000: 1.45000V
			1111001: 1.45625V
			1111010: 1.46250V
			1111011: 1.46875V
			1111100: 1.47500V
			1111101: 1.48125V
			1111110: 1.48750V
			1111111: 1.49375V

6C	VCORE_CON21	VCORE control register 21					48
Bit	7	6	5	4	3	2	1	0

Name		VCORE_VOSEL_ON						
Type		RW						
Reset		1	0	0	1	0	0	0

Bit(s)	Mnemonic	Name	Description
6:0	**VCORE_V OSEL_ON**	VCORE_VOSEL_ON	**Selects VOUT in normal mode** 0000000: 0.70000V 0000001: 0.70625V 0000010: 0.71250V 0000011: 0.71875V 0000100: 0.72500V 0000101: 0.73125V 0000110: 0.73750V 0000111: 0.74375V 0001000: 0.75000V 0001001: 0.75625V 0001010: 0.76250V 0001011: 0.76875V 0001100: 0.77500V 0001101: 0.78125V 0001110: 0.78750V 0001111: 0.79375V 0010000: 0.80000V 0010001: 0.80625V 0010010: 0.81250V 0010011: 0.81875V 0010100: 0.82500V 0010101: 0.83125V 0010110: 0.83750V 0010111: 0.84375V 0011000: 0.85000V 0011001: 0.85625V 0011010: 0.86250V 0011011: 0.86875V 0011100: 0.87500V 0011101: 0.88125V 0011110: 0.88750V 0011111: 0.89375V 0100000: 0.90000V 0100001: 0.90625V 0100010: 0.91250V 0100011: 0.91875V 0100100: 0.92500V 0100101: 0.93125V 0100110: 0.93750V 0100111: 0.94375V 0101000: 0.95000V 0101001: 0.95625V 0101010: 0.96250V 0101011: 0.96875V 0101100: 0.97500V 0101101: 0.98125V 0101110: 0.98750V 0101111: 0.99375V 0110000: 1.00000V 0110001: 1.00625V 0110010: 1.01250V 0110011: 1.01875V 0110100: 1.02500V 0110101: 1.03125V

Bit(s)	Mnemonic	Name	Description
			0110110: 1.03750V
			0110111: 1.04375V
			0111000: 1.05000V
			0111001: 1.05625V
			0111010: 1.06250V
			0111011: 1.06875V
			0111100: 1.07500V
			0111101: 1.08125V
			0111110: 1.08750V
			0111111: 1.09375V
			1000000: 1.10000V
			1000001: 1.10625V
			1000010: 1.11250V
			1000011: 1.11875V
			1000100: 1.12500V
			1000101: 1.13125V
			1000110: 1.13750V
			1000111: 1.14375V
			1001000: 1.15000V
			1001001: 1.15625V
			1001010: 1.16250V
			1001011: 1.16875V
			1001100: 1.17500V
			1001101: 1.18125V
			1001110: 1.18750V
			1001111: 1.19375V
			1010000: 1.20000V
			1010001: 1.20625V
			1010010: 1.21250V
			1010011: 1.21875V
			1010100: 1.22500V
			1010101: 1.23125V
			1010110: 1.23750V
			1010111: 1.24375V
			1011000: 1.25000V
			1011001: 1.25625V
			1011010: 1.26250V
			1011011: 1.26875V
			1011100: 1.27500V
			1011101: 1.28125V
			1011110: 1.28750V
			1011111: 1.29375V
			1100000: 1.30000V
			1100001: 1.30625V
			1100010: 1.31250V
			1100011: 1.31875V
			1100100: 1.32500V
			1100101: 1.33125V
			1100110: 1.33750V
			1100111: 1.34375V
			1101000: 1.35000V
			1101001: 1.35625V
			1101010: 1.36250V
			1101011: 1.36875V
			1101100: 1.37500V
			1101101: 1.38125V
			1101110: 1.38750V
			1101111: 1.39375V
			1110000: 1.40000V

Bit(s)	Mnemonic	Name	Description
			1110001: 1.40625V
			1110010: 1.41250V
			1110011: 1.41875V
			1110100: 1.42500V
			1110101: 1.43125V
			1110110: 1.43750V
			1110111: 1.44375V
			1111000: 1.45000V
			1111001: 1.45625V
			1111010: 1.46250V
			1111011: 1.46875V
			1111100: 1.47500V
			1111101: 1.48125V
			1111110: 1.48750V
			1111111: 1.49375V

6D **VCORE_CON22** **VCORE control register 22** **18**

Bit	7	6	5	4	3	2	1	0
Name		VCORE_VOSEL_SLEEP						
Type		RW						
Reset		0	0	1	1	0	0	0

Bit(s)	Mnemonic	Name	Description
6:0	VCORE_VOSEL_SLEEP	VCORE_VOSEL_SLEEP	Selects VOUT in sleep mode 0000000: 0.70000V 0000001: 0.70625V 0000010: 0.71250V 0000011: 0.71875V 0000100: 0.72500V 0000101: 0.73125V 0000110: 0.73750V 0000111: 0.74375V 0001000: 0.75000V 0001001: 0.75625V 0001010: 0.76250V 0001011: 0.76875V 0001100: 0.77500V 0001101: 0.78125V 0001110: 0.78750V 0001111: 0.79375V 0010000: 0.80000V 0010001: 0.80625V 0010010: 0.81250V 0010011: 0.81875V 0010100: 0.82500V 0010101: 0.83125V 0010110: 0.83750V 0010111: 0.84375V 0011000: 0.85000V 0011001: 0.85625V 0011010: 0.86250V 0011011: 0.86875V 0011100: 0.87500V 0011101: 0.88125V 0011110: 0.88750V

Bit(s)	Mnemonic	Name	Description
			0011111: 0.89375V
			0100000: 0.90000V
			0100001: 0.90625V
			0100010: 0.91250V
			0100011: 0.91875V
			0100100: 0.92500V
			0100101: 0.93125V
			0100110: 0.93750V
			0100111: 0.94375V
			0101000: 0.95000V
			0101001: 0.95625V
			0101010: 0.96250V
			0101011: 0.96875V
			0101100: 0.97500V
			0101101: 0.98125V
			0101110: 0.98750V
			0101111: 0.99375V
			0110000: 1.00000V
			0110001: 1.00625V
			0110010: 1.01250V
			0110011: 1.01875V
			0110100: 1.02500V
			0110101: 1.03125V
			0110110: 1.03750V
			0110111: 1.04375V
			0111000: 1.05000V
			0111001: 1.05625V
			0111010: 1.06250V
			0111011: 1.06875V
			0111100: 1.07500V
			0111101: 1.08125V
			0111110: 1.08750V
			0111111: 1.09375V
			1000000: 1.10000V
			1000001: 1.10625V
			1000010: 1.11250V
			1000011: 1.11875V
			1000100: 1.12500V
			1000101: 1.13125V
			1000110: 1.13750V
			1000111: 1.14375V
			1001000: 1.15000V
			1001001: 1.15625V
			1001010: 1.16250V
			1001011: 1.16875V
			1001100: 1.17500V
			1001101: 1.18125V
			1001110: 1.18750V
			1001111: 1.19375V
			1010000: 1.20000V
			1010001: 1.20625V
			1010010: 1.21250V
			1010011: 1.21875V
			1010100: 1.22500V
			1010101: 1.23125V
			1010110: 1.23750V
			1010111: 1.24375V
			1011000: 1.25000V
			1011001: 1.25625V

Bit(s)	Mnemonic	Name	Description
			1011010: 1.26250V
			1011011: 1.26875V
			1011100: 1.27500V
			1011101: 1.28125V
			1011110: 1.28750V
			1011111: 1.29375V
			1100000: 1.30000V
			1100001: 1.30625V
			1100010: 1.31250V
			1100011: 1.31875V
			1100100: 1.32500V
			1100101: 1.33125V
			1100110: 1.33750V
			1100111: 1.34375V
			1101000: 1.35000V
			1101001: 1.35625V
			1101010: 1.36250V
			1101011: 1.36875V
			1101100: 1.37500V
			1101101: 1.38125V
			1101110: 1.38750V
			1101111: 1.39375V
			1110000: 1.40000V
			1110001: 1.40625V
			1110010: 1.41250V
			1110011: 1.41875V
			1110100: 1.42500V
			1110101: 1.43125V
			1110110: 1.43750V
			1110111: 1.44375V
			1111000: 1.45000V
			1111001: 1.45625V
			1111010: 1.46250V
			1111011: 1.46875V
			1111100: 1.47500V
			1111101: 1.48125V
			1111110: 1.48750V
			1111111: 1.49375V

6E	VCORE_CON23		VCORE control register 23						48
Bit	7	6	5	4	3	2	1	0	
Name		NI_VCORE_VOSEL							
Type		RO							
Reset		1	0	0	1	0	0	0	

Bit(s)	Mnemonic	Name	Description
6:0	**NI_VCORE_VOSEL**	NI_VCORE_VOSEL	**Selects VOUT** 0000000: 0.70000V 0000001: 0.70625V 0000010: 0.71250V 0000011: 0.71875V 0000100: 0.72500V 0000101: 0.73125V 0000110: 0.73750V 0000111: 0.74375V

Bit(s)	Mnemonic	Name	Description
			0001000: 0.75000V
			0001001: 0.75625V
			0001010: 0.76250V
			0001011: 0.76875V
			0001100: 0.77500V
			0001101: 0.78125V
			0001110: 0.78750V
			0001111: 0.79375V
			0010000: 0.80000V
			0010001: 0.80625V
			0010010: 0.81250V
			0010011: 0.81875V
			0010100: 0.82500V
			0010101: 0.83125V
			0010110: 0.83750V
			0010111: 0.84375V
			0011000: 0.85000V
			0011001: 0.85625V
			0011010: 0.86250V
			0011011: 0.86875V
			0011100: 0.87500V
			0011101: 0.88125V
			0011110: 0.88750V
			0011111: 0.89375V
			0100000: 0.90000V
			0100001: 0.90625V
			0100010: 0.91250V
			0100011: 0.91875V
			0100100: 0.92500V
			0100101: 0.93125V
			0100110: 0.93750V
			0100111: 0.94375V
			0101000: 0.95000V
			0101001: 0.95625V
			0101010: 0.96250V
			0101011: 0.96875V
			0101100: 0.97500V
			0101101: 0.98125V
			0101110: 0.98750V
			0101111: 0.99375V
			0110000: 1.00000V
			0110001: 1.00625V
			0110010: 1.01250V
			0110011: 1.01875V
			0110100: 1.02500V
			0110101: 1.03125V
			0110110: 1.03750V
			0110111: 1.04375V
			0111000: 1.05000V
			0111001: 1.05625V
			0111010: 1.06250V
			0111011: 1.06875V
			0111100: 1.07500V
			0111101: 1.08125V
			0111110: 1.08750V
			0111111: 1.09375V
			1000000: 1.10000V
			1000001: 1.10625V
			1000010: 1.11250V

Bit(s)	Mnemonic	Name	Description
			1000011: 1.11875V
			1000100: 1.12500V
			1000101: 1.13125V
			1000110: 1.13750V
			1000111: 1.14375V
			1001000: 1.15000V
			1001001: 1.15625V
			1001010: 1.16250V
			1001011: 1.16875V
			1001100: 1.17500V
			1001101: 1.18125V
			1001110: 1.18750V
			1001111: 1.19375V
			1010000: 1.20000V
			1010001: 1.20625V
			1010010: 1.21250V
			1010011: 1.21875V
			1010100: 1.22500V
			1010101: 1.23125V
			1010110: 1.23750V
			1010111: 1.24375V
			1011000: 1.25000V
			1011001: 1.25625V
			1011010: 1.26250V
			1011011: 1.26875V
			1011100: 1.27500V
			1011101: 1.28125V
			1011110: 1.28750V
			1011111: 1.29375V
			1100000: 1.30000V
			1100001: 1.30625V
			1100010: 1.31250V
			1100011: 1.31875V
			1100100: 1.32500V
			1100101: 1.33125V
			1100110: 1.33750V
			1100111: 1.34375V
			1101000: 1.35000V
			1101001: 1.35625V
			1101010: 1.36250V
			1101011: 1.36875V
			1101100: 1.37500V
			1101101: 1.38125V
			1101110: 1.38750V
			1101111: 1.39375V
			1110000: 1.40000V
			1110001: 1.40625V
			1110010: 1.41250V
			1110011: 1.41875V
			1110100: 1.42500V
			1110101: 1.43125V
			1110110: 1.43750V
			1110111: 1.44375V
			1111000: 1.45000V
			1111001: 1.45625V
			1111010: 1.46250V
			1111011: 1.46875V
			1111100: 1.47500V
			1111101: 1.48125V

Bit(s)	Mnemonic	Name	Description
			1111110: 1.48750V
			1111111: 1.49375V

| 80 | VMEM_CON9 | | VMEM control register 9 | | | | 00 |

Bit	7	6	5	4	3	2	1	0
Name					QI_VMEM_EN	QI_VMEM_STB	VMEM_EN	
Type					RO	RO	RW	
Reset					0	0	0	

Bit(s)	Mnemonic	Name	Description
3	QI_VMEM_EN	QI_VMEM_EN	**Enabling signal**
2	QI_VMEM_STB	QI_VMEM_STB	**Soft start**
1	VMEM_EN	VMEM_EN	0: Enable VMEM 1: Disable VMEM

| 81 | VMEM_CON12 | | VMEM control register 12 | | | | 50 |

Bit	7	6	5	4	3	2	1	0
Name		VMEM_VOSEL						
Type		RW						
Reset		1	0	1	0	0	0	0

Bit(s)	Mnemonic	Name	Description
6:0	VMEM_VOSEL	VMEM_VOSEL	**Selects VOUT in register mode** 0000000: 0.70000V 0000001: 0.70625V 0000010: 0.71250V 0000011: 0.71875V 0000100: 0.72500V 0000101: 0.73125V 0000110: 0.73750V 0000111: 0.74375V 0001000: 0.75000V 0001001: 0.75625V 0001010: 0.76250V 0001011: 0.76875V 0001100: 0.77500V 0001101: 0.78125V 0001110: 0.78750V 0001111: 0.79375V 0010000: 0.80000V 0010001: 0.80625V 0010010: 0.81250V 0010011: 0.81875V 0010100: 0.82500V 0010101: 0.83125V 0010110: 0.83750V 0010111: 0.84375V

Bit(s)	Mnemonic	Name	Description
			0011000: 0.85000V
			0011001: 0.85625V
			0011010: 0.86250V
			0011011: 0.86875V
			0011100: 0.87500V
			0011101: 0.88125V
			0011110: 0.88750V
			0011111: 0.89375V
			0100000: 0.90000V
			0100001: 0.90625V
			0100010: 0.91250V
			0100011: 0.91875V
			0100100: 0.92500V
			0100101: 0.93125V
			0100110: 0.93750V
			0100111: 0.94375V
			0101000: 0.95000V
			0101001: 0.95625V
			0101010: 0.96250V
			0101011: 0.96875V
			0101100: 0.97500V
			0101101: 0.98125V
			0101110: 0.98750V
			0101111: 0.99375V
			0110000: 1.00000V
			0110001: 1.00625V
			0110010: 1.01250V
			0110011: 1.01875V
			0110100: 1.02500V
			0110101: 1.03125V
			0110110: 1.03750V
			0110111: 1.04375V
			0111000: 1.05000V
			0111001: 1.05625V
			0111010: 1.06250V
			0111011: 1.06875V
			0111100: 1.07500V
			0111101: 1.08125V
			0111110: 1.08750V
			0111111: 1.09375V
			1000000: 1.10000V
			1000001: 1.10625V
			1000010: 1.11250V
			1000011: 1.11875V
			1000100: 1.12500V
			1000101: 1.13125V
			1000110: 1.13750V
			1000111: 1.14375V
			1001000: 1.15000V
			1001001: 1.15625V
			1001010: 1.16250V
			1001011: 1.16875V
			1001100: 1.17500V
			1001101: 1.18125V
			1001110: 1.18750V
			1001111: 1.19375V
			1010000: 1.20000V
			1010001: 1.20625V
			1010010: 1.21250V

Bit(s)	Mnemonic	Name	Description
			1010011: 1.21875V
			1010100: 1.22500V
			1010101: 1.23125V
			1010110: 1.23750V
			1010111: 1.24375V
			1011000: 1.25000V
			1011001: 1.25625V
			1011010: 1.26250V
			1011011: 1.26875V
			1011100: 1.27500V
			1011101: 1.28125V
			1011110: 1.28750V
			1011111: 1.29375V
			1100000: 1.30000V
			1100001: 1.30625V
			1100010: 1.31250V
			1100011: 1.31875V
			1100100: 1.32500V
			1100101: 1.33125V
			1100110: 1.33750V
			1100111: 1.34375V
			1101000: 1.35000V
			1101001: 1.35625V
			1101010: 1.36250V
			1101011: 1.36875V
			1101100: 1.37500V
			1101101: 1.38125V
			1101110: 1.38750V
			1101111: 1.39375V
			1110000: 1.40000V
			1110001: 1.40625V
			1110010: 1.41250V
			1110011: 1.41875V
			1110100: 1.42500V
			1110101: 1.43125V
			1110110: 1.43750V
			1110111: 1.44375V
			1111000: 1.45000V
			1111001: 1.45625V
			1111010: 1.46250V
			1111011: 1.46875V
			1111100: 1.47500V
			1111101: 1.48125V
			1111110: 1.48750V
			1111111: 1.49375V

82 VMEM_CON13 VMEM control register 13 50

Bit	7	6	5	4	3	2	1	0
Name		VMEM_VOSEL_ON						
Type		RW						
Reset		1	0	1	0	0	0	0

Bit(s)	Mnemonic	Name	Description
6:0	VMEM_VOSEL_ON	VMEM_VOSEL_ON	Selects VOUT in normal mode 0000000: 0.70000V

Bit(s)	Mnemonic	Name	Description
			0000001: 0.70625V
			0000010: 0.71250V
			0000011: 0.71875V
			0000100: 0.72500V
			0000101: 0.73125V
			0000110: 0.73750V
			0000111: 0.74375V
			0001000: 0.75000V
			0001001: 0.75625V
			0001010: 0.76250V
			0001011: 0.76875V
			0001100: 0.77500V
			0001101: 0.78125V
			0001110: 0.78750V
			0001111: 0.79375V
			0010000: 0.80000V
			0010001: 0.80625V
			0010010: 0.81250V
			0010011: 0.81875V
			0010100: 0.82500V
			0010101: 0.83125V
			0010110: 0.83750V
			0010111: 0.84375V
			0011000: 0.85000V
			0011001: 0.85625V
			0011010: 0.86250V
			0011011: 0.86875V
			0011100: 0.87500V
			0011101: 0.88125V
			0011110: 0.88750V
			0011111: 0.89375V
			0100000: 0.90000V
			0100001: 0.90625V
			0100010: 0.91250V
			0100011: 0.91875V
			0100100: 0.92500V
			0100101: 0.93125V
			0100110: 0.93750V
			0100111: 0.94375V
			0101000: 0.95000V
			0101001: 0.95625V
			0101010: 0.96250V
			0101011: 0.96875V
			0101100: 0.97500V
			0101101: 0.98125V
			0101110: 0.98750V
			0101111: 0.99375V
			0110000: 1.00000V
			0110001: 1.00625V
			0110010: 1.01250V
			0110011: 1.01875V
			0110100: 1.02500V
			0110101: 1.03125V
			0110110: 1.03750V
			0110111: 1.04375V
			0111000: 1.05000V
			0111001: 1.05625V
			0111010: 1.06250V
			0111011: 1.06875V

Bit(s)	Mnemonic	Name	Description
			0111100: 1.07500V
			0111101: 1.08125V
			0111110: 1.08750V
			0111111: 1.09375V
			1000000: 1.10000V
			1000001: 1.10625V
			1000010: 1.11250V
			1000011: 1.11875V
			1000100: 1.12500V
			1000101: 1.13125V
			1000110: 1.13750V
			1000111: 1.14375V
			1001000: 1.15000V
			1001001: 1.15625V
			1001010: 1.16250V
			1001011: 1.16875V
			1001100: 1.17500V
			1001101: 1.18125V
			1001110: 1.18750V
			1001111: 1.19375V
			1010000: 1.20000V
			1010001: 1.20625V
			1010010: 1.21250V
			1010011: 1.21875V
			1010100: 1.22500V
			1010101: 1.23125V
			1010110: 1.23750V
			1010111: 1.24375V
			1011000: 1.25000V
			1011001: 1.25625V
			1011010: 1.26250V
			1011011: 1.26875V
			1011100: 1.27500V
			1011101: 1.28125V
			1011110: 1.28750V
			1011111: 1.29375V
			1100000: 1.30000V
			1100001: 1.30625V
			1100010: 1.31250V
			1100011: 1.31875V
			1100100: 1.32500V
			1100101: 1.33125V
			1100110: 1.33750V
			1100111: 1.34375V
			1101000: 1.35000V
			1101001: 1.35625V
			1101010: 1.36250V
			1101011: 1.36875V
			1101100: 1.37500V
			1101101: 1.38125V
			1101110: 1.38750V
			1101111: 1.39375V
			1110000: 1.40000V
			1110001: 1.40625V
			1110010: 1.41250V
			1110011: 1.41875V
			1110100: 1.42500V
			1110101: 1.43125V
			1110110: 1.43750V

Bit(s)	Mnemonic	Name	Description
			1110111: 1.44375V
			1111000: 1.45000V
			1111001: 1.45625V
			1111010: 1.46250V
			1111011: 1.46875V
			1111100: 1.47500V
			1111101: 1.48125V
			1111110: 1.48750V
			1111111: 1.49375V

83	VMEM_CON14		VMEM control register 14				50
Bit	7	6	5	4	3	2	1	0
Name		VMEM_VOSEL_SLEEP						
Type		RW						
Reset		1	0	1	0	0	0	0

Bit(s)	Mnemonic	Name	Description
6:0	VMEM_VOSEL_SLEEP	VMEM_VOSEL_SLEEP	Selects VOUT in sleep mode
			0000000: 0.70000V
			0000001: 0.70625V
			0000010: 0.71250V
			0000011: 0.71875V
			0000100: 0.72500V
			0000101: 0.73125V
			0000110: 0.73750V
			0000111: 0.74375V
			0001000: 0.75000V
			0001001: 0.75625V
			0001010: 0.76250V
			0001011: 0.76875V
			0001100: 0.77500V
			0001101: 0.78125V
			0001110: 0.78750V
			0001111: 0.79375V
			0010000: 0.80000V
			0010001: 0.80625V
			0010010: 0.81250V
			0010011: 0.81875V
			0010100: 0.82500V
			0010101: 0.83125V
			0010110: 0.83750V
			0010111: 0.84375V
			0011000: 0.85000V
			0011001: 0.85625V
			0011010: 0.86250V
			0011011: 0.86875V
			0011100: 0.87500V
			0011101: 0.88125V
			0011110: 0.88750V
			0011111: 0.89375V
			0100000: 0.90000V
			0100001: 0.90625V
			0100010: 0.91250V
			0100011: 0.91875V
			0100100: 0.92500V

Bit(s)	Mnemonic	Name	Description
			0100101: 0.93125V
			0100110: 0.93750V
			0100111: 0.94375V
			0101000: 0.95000V
			0101001: 0.95625V
			0101010: 0.96250V
			0101011: 0.96875V
			0101100: 0.97500V
			0101101: 0.98125V
			0101110: 0.98750V
			0101111: 0.99375V
			0110000: 1.00000V
			0110001: 1.00625V
			0110010: 1.01250V
			0110011: 1.01875V
			0110100: 1.02500V
			0110101: 1.03125V
			0110110: 1.03750V
			0110111: 1.04375V
			0111000: 1.05000V
			0111001: 1.05625V
			0111010: 1.06250V
			0111011: 1.06875V
			0111100: 1.07500V
			0111101: 1.08125V
			0111110: 1.08750V
			0111111: 1.09375V
			1000000: 1.10000V
			1000001: 1.10625V
			1000010: 1.11250V
			1000011: 1.11875V
			1000100: 1.12500V
			1000101: 1.13125V
			1000110: 1.13750V
			1000111: 1.14375V
			1001000: 1.15000V
			1001001: 1.15625V
			1001010: 1.16250V
			1001011: 1.16875V
			1001100: 1.17500V
			1001101: 1.18125V
			1001110: 1.18750V
			1001111: 1.19375V
			1010000: 1.20000V
			1010001: 1.20625V
			1010010: 1.21250V
			1010011: 1.21875V
			1010100: 1.22500V
			1010101: 1.23125V
			1010110: 1.23750V
			1010111: 1.24375V
			1011000: 1.25000V
			1011001: 1.25625V
			1011010: 1.26250V
			1011011: 1.26875V
			1011100: 1.27500V
			1011101: 1.28125V
			1011110: 1.28750V
			1011111: 1.29375V

Bit(s)	Mnemonic	Name	Description
			1100000: 1.30000V
			1100001: 1.30625V
			1100010: 1.31250V
			1100011: 1.31875V
			1100100: 1.32500V
			1100101: 1.33125V
			1100110: 1.33750V
			1100111: 1.34375V
			1101000: 1.35000V
			1101001: 1.35625V
			1101010: 1.36250V
			1101011: 1.36875V
			1101100: 1.37500V
			1101101: 1.38125V
			1101110: 1.38750V
			1101111: 1.39375V
			1110000: 1.40000V
			1110001: 1.40625V
			1110010: 1.41250V
			1110011: 1.41875V
			1110100: 1.42500V
			1110101: 1.43125V
			1110110: 1.43750V
			1110111: 1.44375V
			1111000: 1.45000V
			1111001: 1.45625V
			1111010: 1.46250V
			1111011: 1.46875V
			1111100: 1.47500V
			1111101: 1.48125V
			1111110: 1.48750V
			1111111: 1.49375V

84	VMEM_CON15		VMEM control register 15					50
Bit	7	6	5	4	3	2	1	0
Name		NI_VMEM_VOSEL						
Type		RO						
Reset		1	0	1	0	0	0	0

Bit(s)	Mnemonic	Name	Description
6:0	NI_VMEM_VOSEL	NI_VMEM_VOSEL	**Selects VOUT** 0000000: 0.70000V 0000001: 0.70625V 0000010: 0.71250V 0000011: 0.71875V 0000100: 0.72500V 0000101: 0.73125V 0000110: 0.73750V 0000111: 0.74375V 0001000: 0.75000V 0001001: 0.75625V 0001010: 0.76250V 0001011: 0.76875V 0001100: 0.77500V 0001101: 0.78125V

Bit(s)	Mnemonic	Name	Description
			0001110: 0.78750V
			0001111: 0.79375V
			0010000: 0.80000V
			0010001: 0.80625V
			0010010: 0.81250V
			0010011: 0.81875V
			0010100: 0.82500V
			0010101: 0.83125V
			0010110: 0.83750V
			0010111: 0.84375V
			0011000: 0.85000V
			0011001: 0.85625V
			0011010: 0.86250V
			0011011: 0.86875V
			0011100: 0.87500V
			0011101: 0.88125V
			0011110: 0.88750V
			0011111: 0.89375V
			0100000: 0.90000V
			0100001: 0.90625V
			0100010: 0.91250V
			0100011: 0.91875V
			0100100: 0.92500V
			0100101: 0.93125V
			0100110: 0.93750V
			0100111: 0.94375V
			0101000: 0.95000V
			0101001: 0.95625V
			0101010: 0.96250V
			0101011: 0.96875V
			0101100: 0.97500V
			0101101: 0.98125V
			0101110: 0.98750V
			0101111: 0.99375V
			0110000: 1.00000V
			0110001: 1.00625V
			0110010: 1.01250V
			0110011: 1.01875V
			0110100: 1.02500V
			0110101: 1.03125V
			0110110: 1.03750V
			0110111: 1.04375V
			0111000: 1.05000V
			0111001: 1.05625V
			0111010: 1.06250V
			0111011: 1.06875V
			0111100: 1.07500V
			0111101: 1.08125V
			0111110: 1.08750V
			0111111: 1.09375V
			1000000: 1.10000V
			1000001: 1.10625V
			1000010: 1.11250V
			1000011: 1.11875V
			1000100: 1.12500V
			1000101: 1.13125V
			1000110: 1.13750V
			1000111: 1.14375V
			1001000: 1.15000V

Bit(s)	Mnemonic	Name	Description
			1001001: 1.15625V
			1001010: 1.16250V
			1001011: 1.16875V
			1001100: 1.17500V
			1001101: 1.18125V
			1001110: 1.18750V
			1001111: 1.19375V
			1010000: 1.20000V
			1010001: 1.20625V
			1010010: 1.21250V
			1010011: 1.21875V
			1010100: 1.22500V
			1010101: 1.23125V
			1010110: 1.23750V
			1010111: 1.24375V
			1011000: 1.25000V
			1011001: 1.25625V
			1011010: 1.26250V
			1011011: 1.26875V
			1011100: 1.27500V
			1011101: 1.28125V
			1011110: 1.28750V
			1011111: 1.29375V
			1100000: 1.30000V
			1100001: 1.30625V
			1100010: 1.31250V
			1100011: 1.31875V
			1100100: 1.32500V
			1100101: 1.33125V
			1100110: 1.33750V
			1100111: 1.34375V
			1101000: 1.35000V
			1101001: 1.35625V
			1101010: 1.36250V
			1101011: 1.36875V
			1101100: 1.37500V
			1101101: 1.38125V
			1101110: 1.38750V
			1101111: 1.39375V
			1110000: 1.40000V
			1110001: 1.40625V
			1110010: 1.41250V
			1110011: 1.41875V
			1110100: 1.42500V
			1110101: 1.43125V
			1110110: 1.43750V
			1110111: 1.44375V
			1111000: 1.45000V
			1111001: 1.45625V
			1111010: 1.46250V
			1111011: 1.46875V
			1111100: 1.47500V
			1111101: 1.48125V
			1111110: 1.48750V
			1111111: 1.49375V

9F	VRF18_CON21		VRF18 control register 21					08
Bit	7	6	5	4	3	2	1	0
Name		QI_VRF18_EN	QI_VRF18_STB				VRF18_EN	RG_VRF18_MODESET
Type		RO	RO				RW	RW
Reset		0	0				0	0

Bit(s)	Mnemonic	Name	Description
6	**QI_VRF18_EN**	QI_VRF18_EN	**Enabling signal**
5	**QI_VRF18_STB**	QI_VRF18_STB	**Soft start**
1	**VRF18_EN**	VRF18_EN	0: Disable 1: Enable
0	**RG_VRF18_MODESET**	RG_VRF18_MODESET	0: Auto mode 1: Force PWM mode

A0	VRF18_CON22		VRF18 control register 22					00
Bit	7	6	5	4	3	2	1	0
Name								RG_VRF18_MODESET_SPM
Type								RW
Reset								0

Bit(s)	Mnemonic	Name	Description
0	**RG_VRF18_MODESET_SPM**	RG_VRF18_MODESET_SPM	0: Auto mode 1: Force PWM mode

FD	CID1		Chip ID status 1					30
Bit	7	6	5	4	3	2	1	0
Name				CID1				
Type				RO				
Reset	0	0	1	1	0	0	0	0

Bit(s)	Mnemonic	Name	Description
7:0	**CID1**	CID1	CID0

4   Application Notes

4.1   Connection with Main Chip & Main PMIC

The following schematic illustrates the connection with main chip and main PMIC.

- SLEEP_B
  - Sleep mode controlled by SRCLKEN
- INT
  - Interrupt flag report to main chip
- BUCK_EN
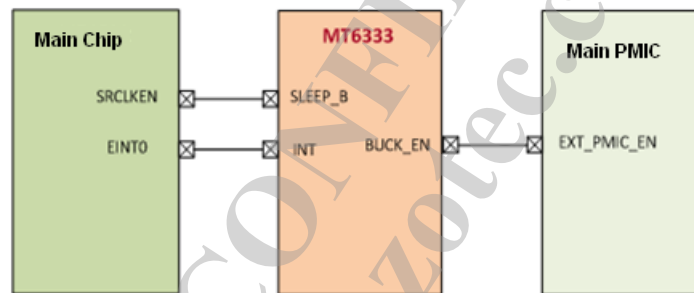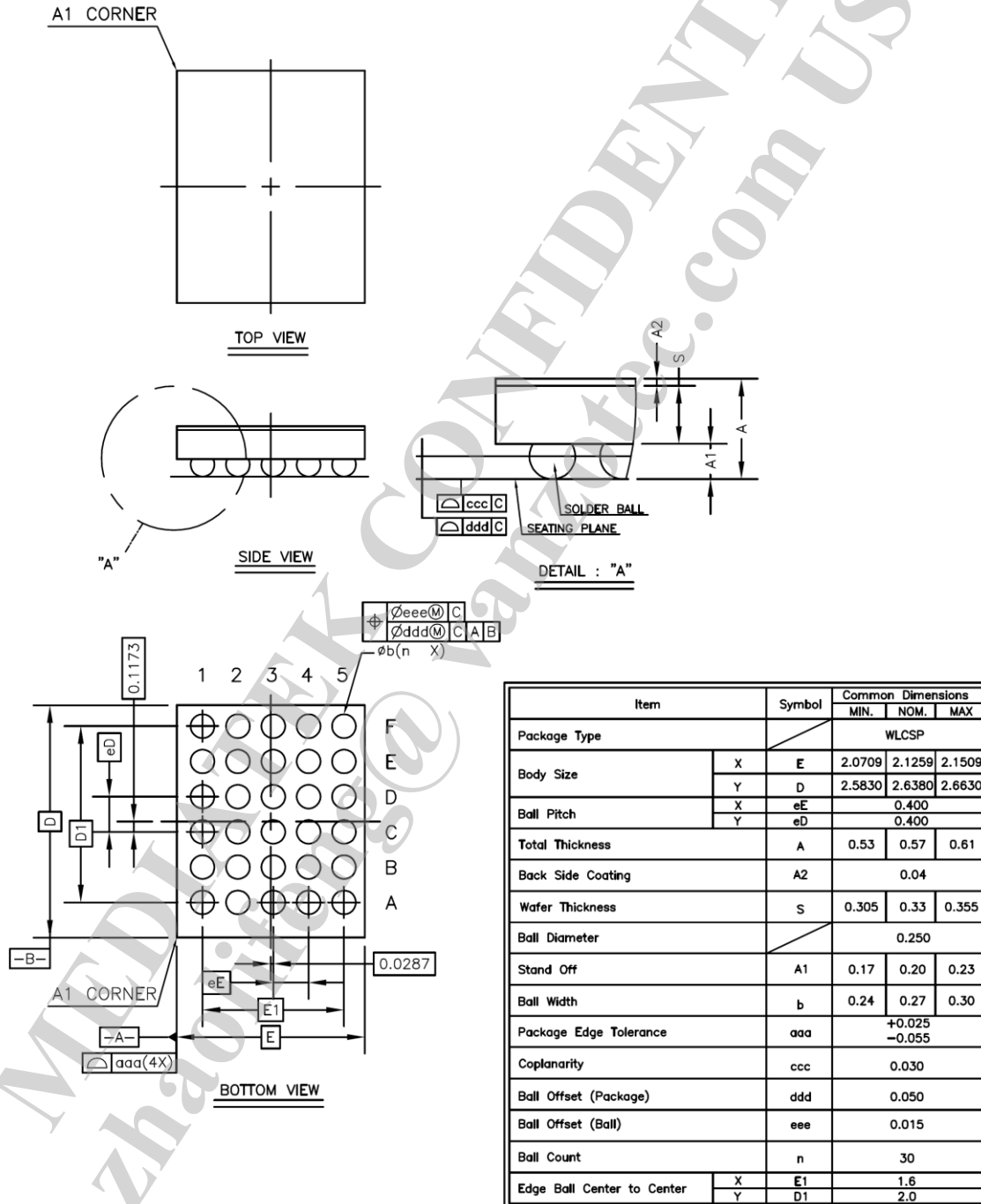 - Turns on/off VCORE & VMEM by main PMIC; 6322/6323

Figure 4-1. MT6333 connection with main chip and main PMIC

5   MT6333 Packaging

5.1   Package Dimensions

Item		Symbol	Common Dimensions		
			MIN.	NOM.	MAX
Package Type			WLCSP		
Body Size	X	E	2.0709	2.1259	2.1509
	Y	D	2.5830	2.6380	2.6630
Ball Pitch	X	eE	0.400		
	Y	eD	0.400		
Total Thickness		A	0.53	0.57	0.61
Back Side Coating		A2	0.04		
Wafer Thickness		S	0.305	0.33	0.355
Ball Diameter			0.250		
Stand Off		A1	0.17	0.20	0.23
Ball Width		b	0.24	0.27	0.30
Package Edge Tolerance		aaa	+0.025 −0.055		
Coplanarity		ccc	0.030		
Ball Offset (Package)		ddd	0.050		
Ball Offset (Ball)		eee	0.015		
Ball Count		n	30		
Edge Ball Center to Center	X	E1	1.6		
	Y	D1	2.0		

Appendix

N/A