

## High Current, Highly Configurable System PMIC

### General Description

DA9083 is a six-channel, advanced, system power management IC (PMIC) that integrates four buck converters, one LDO, and one load switch. This high current, integrated PMIC is ideal for Client and Enterprise SSD Modules, Hybrid Drives, and other memory management applications. Due to its highly configurable and flexible design, it supports a wide variety of other applications with integrated microcontrollers, DSPs, and FPGAs in embedded applications and a host of other Internet of Things (IoT) and consumer applications.

DA9083 includes many robust protection features, a dedicated I<sup>2</sup>C interface, and programmable output voltages. Dynamic voltage control (DVC) enables supply voltage controllability based on the application requirements. This PMIC is capable of achieving high efficiencies and fast transient responses to line and load changes while keeping the overall board space to a minimum. All of these features and functionality is offered in a compact 36-lead CSP package.

### Key Features

- Power supply voltage ( $V_{IN}$ ) 2.9 V to 5.5 V
- 4 buck converters
- Selectable output voltage range for all bucks:
  - 1.5 V to 2.7 V, 20 mV step
  - 0.55 V to 1.9 V, 10 mV step
- Maximum output current:
  - CH1, CH2, CH3 Bucks: 2.5 A
  - CH4 Buck: 5.0 A
- Interleaving of switching phases of bucks
- LDO:
  - $V_{OUT}$ : 1.4 V to 1.9 V, 20 mV step
  - $I_{OUT}$ : 0.1 A (max)
- Load switch (LSW)
  - $R_{DS\_ON}$ : 20 m $\Omega$  (typ)
  - Current limit at soft start: 100 mA
  - Current limit: 4 A
- Protection functions:
  - Over-current protection
  - Over/Under-voltage protection
  - Thermal shutdown protection
- I<sup>2</sup>C control interface:
  - Standard mode (100 kbit/s)
  - Fast mode (400 kbit/s)
  - Fast mode+ (1 Mbit/s)
  - High-speed mode (3.4 Mbit/s)

### Applications

- SSD (solid state drive) module
- Portable devices
- Home entertainment equipment

### System Diagram

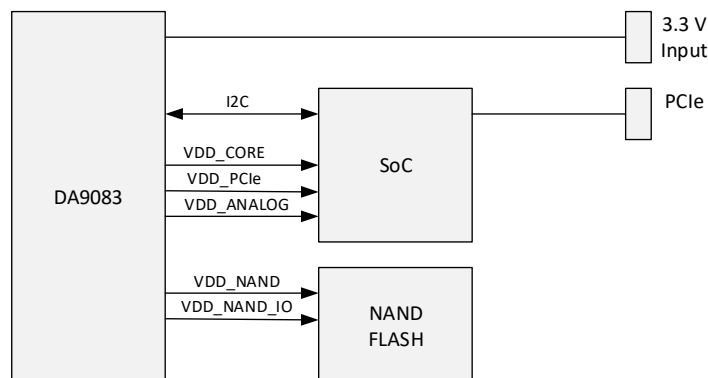


Figure 1: System Diagram

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## High Current, Highly Configurable System PMIC

### 1 Terms and Definitions

CDM	Charged-Device Model
CH	Channel
DVC	Dynamic voltage control
ESD	Electrostatic discharge
HBM	Human Body Model
HPM	High Power mode
LPM	Low Power mode
OTP	One-time programmable
OVP	Over-voltage protection
POR	Power-on reset
PMIC	Power management integrated circuit
PWM	Pulse width modulation
PFM	Pulse frequency modulation
TSD	Thermal shut down
UVLO	Under-voltage lock out
UVP	Under-voltage protection

### 2 References

- [1] I<sup>2</sup>C-Bus Specification Rev 06 UM1010204, issued on 4 April 2014

### 3 Block Diagram

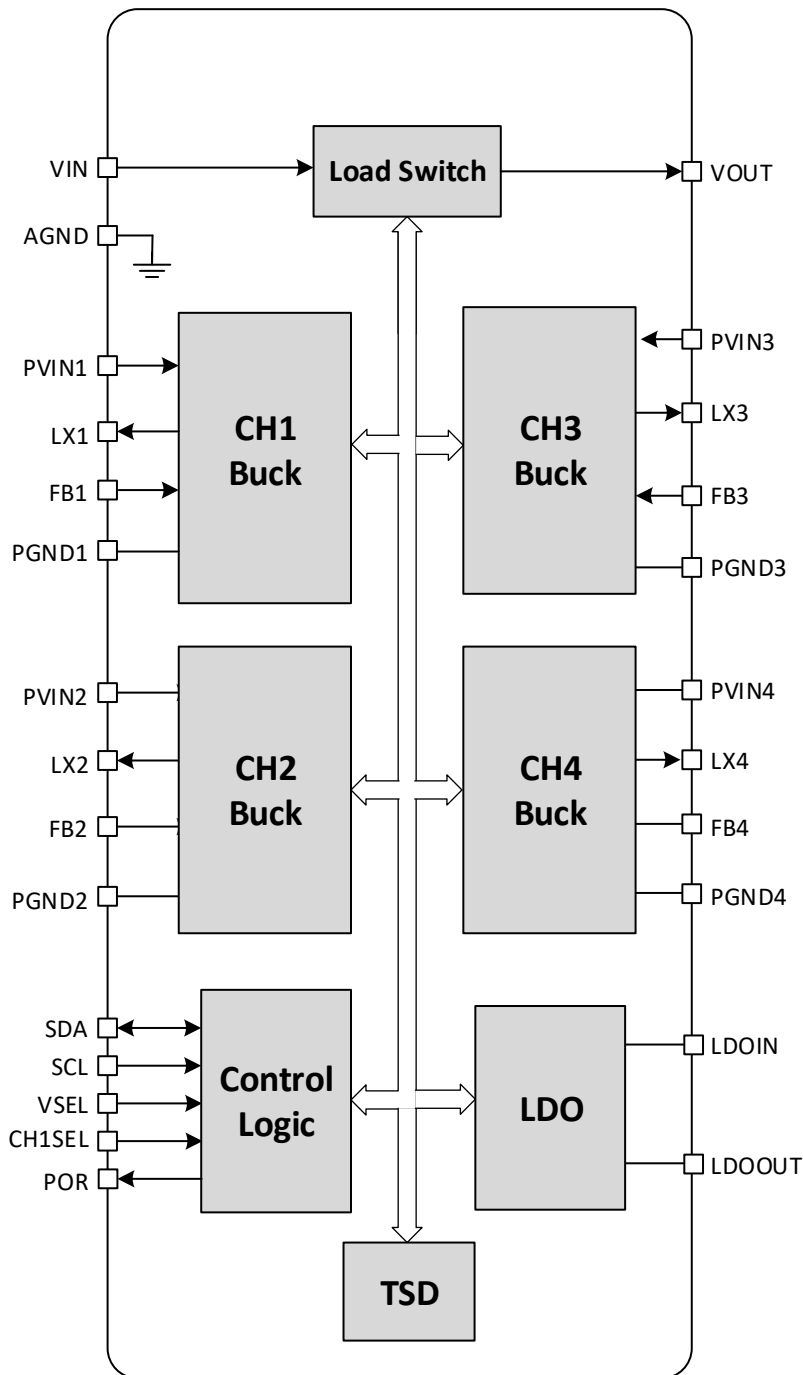


Figure 2: Block Diagram

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### 4 Pinout

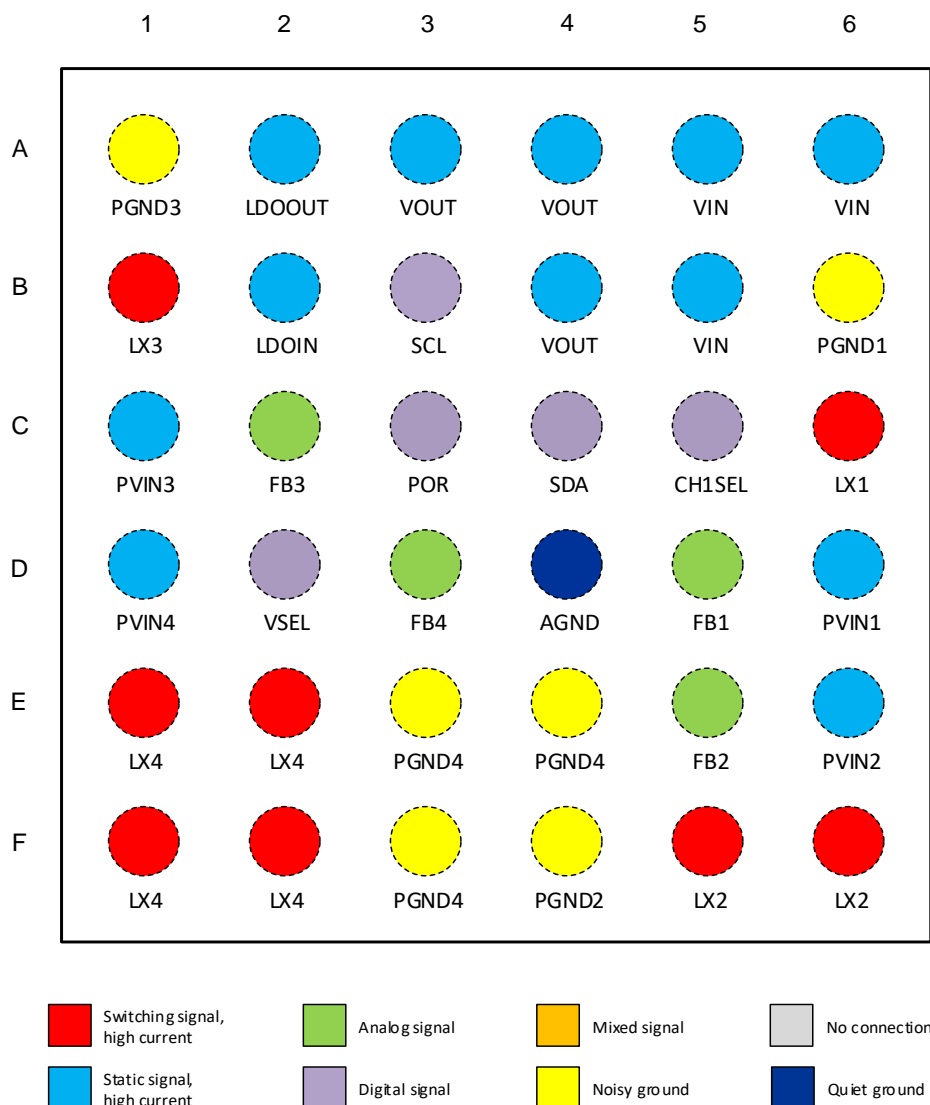


Figure 3: WLCSP Pinout Diagram (Top View)

Table 1: Pin Description

Pin #	Pin Name	Type (Table 2)	Description
A1	PGND3	GND	CH3 DCDC buck converter ground
A2	LDOOUT	AO	LDO output, bypass to ground with ceramic capacitor
A3	VOUT	AO	Load Switch output
A4	VOUT	AO	Load Switch output
A5	VIN	PWR	Load Switch input
A6	VIN	PWR	Load Switch input
B1	LX3	AIO	CH3 DCDC buck converter switching node
B2	LDOIN	PWR	LDO input, bypass to ground with a ceramic capacitor

## High Current, Highly Configurable System PMIC

Pin #	Pin Name	Type (Table 2)	Description
B3	SCL	DI	I <sup>2</sup> C interface data, connect SCL to the logic rail through a pull-up resistor
B4	VOUT	AO	Load Switch output
B5	VIN	PWR	Load Switch input
B6	PGND1	GND	CH1 Buck converter power ground
C1	PVIN3	PWR	CH3 Buck converter input
C2	FB3	AI	CH3 Buck output voltage feedback connection
C3	POR	DOD	Power-on-Reset release output signal (Power Good), output open-drain
C4	SDA	DIOD	I <sup>2</sup> C interface data. Connect SDA to the logic rail through a pull-up resistor
C5	CH1SEL	DI	Reserved. Needs to be tied to ground
C6	LX1	AIO	CH1 Buck converter switching node
D1	PVIN4	PWR	CH4 Buck converter power
D2	VSEL	DI	Reserved. Needs to be tied to ground
D3	FB4	AI	CH4 Buck output voltage feedback connection
D4	AGND	GND	Quiet ground connection, Connect to a quiet ground area
D5	FB1	AI	CH1 Buck output voltage feedback connection
D6	PVIN1	PWR	CH1 Buck converter input
E1	LX4	AIO	CH4 Buck converter switching node
E2	LX4	AIO	CH4 Buck converter switching node
E3	PGND4	GND	CH4 Buck converter power ground
E4	PGND4	GND	CH4 Buck converter power ground
E5	FB2	AI	CH2 Buck output voltage feedback connection
E6	PVIN2	PWR	CH2 Buck converter input
F1	LX4	AIO	CH4 Buck converter switching node
F2	LX4	AIO	CH4 Buck converter switching node
F3	PGND4	GND	Power ground for the CH4 Buck converter
F4	PGND2	GND	Power ground for the CH2 Buck converter
F5	LX2	AIO	CH2 Buck converter switching node
F6	LX2	AIO	CH2 Buck converter switching node

**Table 2: Pin Type Definition**

Pin Type	Description	Pin Type	Description
DI	Digital input	AI	Analog input
DO	Digital output	AO	Analog output
DIOD	Digital input/output open drain	AIO	Analog input/output
DOD	Digital output open drain	GND	Ground
PWR	Power		



## High Current, Highly Configurable System PMIC

### 5 Characteristics

#### 5.1 Absolute Maximum Ratings

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, so functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification are not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

**Table 3: Absolute Maximum Ratings**

Parameter	Description	Conditions	Min	Max	Unit
T <sub>STG</sub>	Storage temperature		-60	150	°C
V <sub>SYS</sub>	System supply voltage	Referenced to AGND	-0.3	6	V
V <sub>PIN</sub>	All other terminals	Referenced to AGND	-0.3	6	V

#### 5.2 Electrostatic Discharge Ratings

**Table 4: Electrostatic Discharge Ratings**

Parameter	Description	Conditions	Value	Unit
ESD <sub>HBM</sub>	Maximum ESD protection	Human body model (HBM) All exposed pins	2	kV
ESD <sub>CDM</sub>	Maximum ESD protection	Charged device model (CDM)	0.5	kV

#### 5.3 Recommended Operating Conditions

**Table 5: Recommended Operating Conditions**

Parameter	Description	Conditions	Min	Typ	Max	Unit
T <sub>A</sub>	Operating ambient temperature		-40		85	°C
T <sub>J</sub>	Operating junction temperature		-40		125	°C
V <sub>IN</sub>	Input Supply voltage		2.9		5.5	V
V <sub>PIN</sub>	Voltage on pins		-0.3		V <sub>IN</sub> +0.3	V

#### 5.4 Thermal Characteristics

**Table 6: Package Ratings**

Parameter	Description	Conditions	Min	Typ	Max	Unit
R <sub>θJA</sub>	Package thermal resistance <a href="#">Note 1</a>			28.6		°C/W
P <sub>D</sub>	Power dissipation	Derating factor above T <sub>A</sub> = 70°C, 35 mW/°C (1/R <sub>θJA</sub> )		2450		mW

**Note 1** Obtained from package thermal simulation, 4-layer board (JEDEC). Influenced by PCB technology and layout.

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### 5.5 CH1 Buck Converter Characteristics

Table 7: CH1 Buck Converter Electrical Characteristics

Parameter	Description	Conditions	Min	Typ	Max	Unit
<b>External Electrical Conditions</b>						
$V_{IN}$	Input voltage of power stage		2.7	3.3	5.5	V
$C_{OUT}$	Output capacitance, including voltage and temperature coefficient	Only local capacitor without decoupling capacitor at load side.	11	22	29	$\mu$ F
$ESR_{COUT}$	Output capacitor series resistance	$f > 100$ kHz		3		m $\Omega$
L	Inductor value, including current and temperature dependence		0.23	0.47	0.61	$\mu$ H
$DCR_L$	Inductor DC resistance			20	50	m $\Omega$
<b>Electrical Performance</b>						
$I_{Q\_LPM}$	Quiescent current in Low Power mode (no switching)	$V_{IN} = 3.3$ V $T_A = 27$ °C		18		$\mu$ A
$I_{Q\_AUTO}$	Quiescent current in Auto mode (no switching)	$V_{IN} = 3.3$ V $T_A = 27$ °C		42		$\mu$ A
$f_{SW}$	Switching frequency		1.9	2	2.1	MHz
$V_{DROPOUT}$	Voltage drop from $PV_{IN}$ to $V_{OUT}$			1		V
$V_{OUT\_DIV}$	Range of output voltage with divider (OTP option), programmable in 20 mV steps.	$PV_{IN1} = 2.7$ V to 5.5 V	1.5		2.7	V
$V_{OUT\_NO\_DIV}$	Range of output voltage without divider (OTP option), programmable in 10 mV steps.	$PV_{IN1} = 2.7$ V to 5.5 V	0.5		1.9	V
$SR_{SS}$	Soft start slew rate			2.5		mV/ $\mu$ s
$V_{OUT\_ACC}$	Output voltage accuracy, including static line and load regulation	$V_{OUT} \geq 1$ V $T_A = 27$ °C	-1		1	%
$V_{OUT\_ACC}$	Output voltage accuracy, including static line and load regulation	$V_{OUT} < 1$ V	-10		10	mV
$R_{ON\_PMOS}$	On resistance of switching PMOS	$V_{IN} = 3.3$ V $T_A = 27$ °C		62		m $\Omega$
$R_{ON\_NMOS}$	On resistance of switching NMOS	$V_{IN} = 3.3$ V $T_A = 27$ °C		28		m $\Omega$

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Parameter	Description	Conditions	Min	Typ	Max	Unit
I <sub>POSLIM</sub>	Positive current limit threshold	With default setting V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C	3	4		A
V <sub>THR_OVP_RISE</sub>	Over-voltage protection threshold		+200	+300	+400	mV
V <sub>THR_UVP_FALL</sub>	Under-voltage protection threshold		-400	-300	-200	mV
R <sub>DCHG</sub>	Discharge resistance for LX node	V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C		10		Ω
t <sub>ON_MIN</sub>	Buck minimum On-time	V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C		20		ns

### 5.6 CH2 Buck Converter Characteristics

Table 8: CH2 Buck Converter Electrical Characteristics

Parameter	Description	Conditions	Min	Typ	Max	Unit
<b>External Electrical Conditions</b>						
V <sub>IN</sub>	Input voltage of power stage		2.7	3.3	5.5	V
C <sub>OUT</sub>	Output capacitance, including voltage and temperature coefficient	Only local capacitor without decoupling capacitor at load side.	11	22	29	μF
ESR <sub>COUT</sub>	Output capacitor series resistance	f > 100 kHz		3		mΩ
L	Inductor value, including current and temperature dependence		0.23	0.47	0.61	μH
DCR <sub>L</sub>	Inductor DC resistance			20	50	mΩ
<b>Electrical Performance</b>						
I <sub>Q_LPM</sub>	Quiescent current in Low Power mode (no switching)	V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C		17		μA
I <sub>Q_AUTO</sub>	Quiescent current in Auto mode (no switching)	V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C		42		μA
f <sub>SW</sub>	Switching frequency		1.9	2	2.1	MHz
V <sub>DROPOUT</sub>	Voltage drop from P <sub>VIN</sub> to V <sub>OUT</sub>			1		V
V <sub>OUT_DIV</sub>	Range of output voltage with divider (OTP option), programmable in 20 mV steps.	P <sub>VIN2</sub> = 2.7 V to 5.5 V	1.5		2.7	V

## High Current, Highly Configurable System PMIC

Parameter	Description	Conditions	Min	Typ	Max	Unit
$V_{OUT\_NO\_DIV}$	Range of output voltage with no divider (OTP option), programmable in 10 mV steps.	$PV_{IN2} = 2.7\text{ V to }5.5\text{ V}$	0.5		1.9	V
$SR_{SS}$	Soft start slew rate			2.5		mV/ $\mu$ s
$V_{OUT\_ACC}$	Output voltage accuracy, including static line and load regulation	$V_{OUT} \geq 1\text{ V}$ $T_A = 27\text{ }^\circ\text{C}$	-1		1	%
$V_{OUT\_ACC}$	Output voltage accuracy, including static line and load regulation	$V_{OUT} < 1\text{ V}$	-10		10	mV
$R_{ON\_PMOS}$	On resistance of switching PMOS	$V_{IN} = 3.3\text{ V}$ $T_A = 27\text{ }^\circ\text{C}$		62		m $\Omega$
$R_{ON\_NMOS}$	On resistance of switching NMOS	$V_{IN} = 3.3\text{ V}$ $T_A = 27\text{ }^\circ\text{C}$		28		m $\Omega$
$I_{POSLIM}$	Positive current limit threshold	With default setting $V_{IN} = 3.3\text{ V}$ $T_A = 27\text{ }^\circ\text{C}$	3	4		A
$V_{THR\_OVP\_RISE}$	Over-voltage protection threshold		+200	+300	+400	mV
$V_{THR\_UVP\_FALL}$	Under-voltage protection threshold		-400	-300	-200	mV
$R_{DCHG}$	Discharge resistance for LX node	$V_{IN} = 3.3\text{ V}$ $T_A = 27\text{ }^\circ\text{C}$		20		$\Omega$
$t_{ON\_MIN}$	Buck minimum On-time	$V_{IN} = 3.3\text{ V}$ $T_A = 27\text{ }^\circ\text{C}$		20		ns

### 5.7 CH3 Buck Converter Characteristics

Table 9: CH3 Buck Converter Electrical Characteristics

Parameter	Description	Conditions	Min	Typ	Max	Unit
<b>External Electrical Conditions</b>						
$V_{IN}$	Input voltage of power stage		2.7	3.3	5.5	V
$C_{OUT}$	Output capacitance, including voltage and temperature coefficient	Only local capacitor without decoupling capacitor at load side.	11	22	29	$\mu$ F
$ESR_{COUT}$	Output capacitor series resistance	$f > 100\text{ kHz}$		5		m $\Omega$
L	Inductor value, including current and temperature dependence		0.23	0.47	0.61	$\mu$ H

## High Current, Highly Configurable System PMIC

Parameter	Description	Conditions	Min	Typ	Max	Unit
DCR <sub>L</sub>	Inductor DC resistance			20	50	mΩ
<b>Electrical Performance</b>						
I <sub>Q_LPM</sub>	Quiescent current in Low Power mode (no switching)	V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C		17		μA
I <sub>Q_AUTO</sub>	Quiescent current in Auto mode (no switching)	V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C		42		μA
f <sub>sw</sub>	Switching frequency		1.9	2	2.1	MHz
V <sub>DROPOUT</sub>	Voltage drop from P <sub>VIN</sub> to V <sub>OUT</sub>			1		V
V <sub>OUT_DIV</sub>	Range of output voltage with divider (OTP option), programmable in 20 mV steps.	P <sub>VIN3</sub> = 2.7 V to 5.5 V	1.5		2.7	V
V <sub>OUT_NO_DIV</sub>	Range of output voltage with no divider (OTP option), programmable in 10 mV steps.	P <sub>VIN3</sub> = 2.7 V to 5.5 V	0.5		1.9	V
SR <sub>SS</sub>	Soft start slew rate			2.5		mV/μs
V <sub>OUT_ACC</sub>	Output voltage accuracy, including static line and load regulation	V <sub>OUT</sub> ≥ 1 V T <sub>A</sub> = 27 °C	-1		1	%
V <sub>OUT_ACC</sub>	Output voltage accuracy, including static line and load regulation	V <sub>OUT</sub> < 1 V	-10		10	mV
R <sub>ON_P MOS</sub>	On resistance of switching PMOS	V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C		62		mΩ
R <sub>ON_N MOS</sub>	On resistance of switching NMOS	V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C		28		mΩ
I <sub>POSLIM</sub>	Positive current limit threshold	With default setting V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C	3	4		A
V <sub>THR_OVP_RISE</sub>	Over-voltage protection threshold		+200	+300	+400	mV
V <sub>THR_UVP_FALL</sub>	Under-voltage protection threshold		-400	-300	-200	mV
R <sub>DCHG</sub>	Discharge resistance for LX node	V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C		30		Ω
t <sub>ON_MIN</sub>	Buck minimum On-time	V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C		20		ns

## High Current, Highly Configurable System PMIC

### 5.8 CH4 Buck Converter Characteristics

Table 10: CH4 Buck Converter Electrical Characteristics

Parameter	Description	Conditions	Min	Typ	Max	Unit
<b>External Electrical Conditions</b>						
$V_{IN}$	Input voltage of power stage		2.7	3.3	5.5	V
$C_{OUT}$	Output capacitance, including voltage and temperature coefficient	Only local capacitor without decoupling capacitor at load side.	11	22	29	$\mu$ F
$ESR_{COUT}$	Output capacitor series resistance	$f > 100$ kHz		3		m $\Omega$
L	Inductor value, including current and temperature dependence		0.23	0.47	0.61	$\mu$ H
$DCR_L$	Inductor DC resistance			20	50	m $\Omega$
<b>Electrical Performance</b>						
$I_{Q\_LPM}$	Quiescent current in Low Power mode (no switching)	$V_{IN} = 3.3$ V $T_A = 27$ °C		17		$\mu$ A
$I_{Q\_AUTO}$	Quiescent current in Auto mode (no switching)	$V_{IN} = 3.3$ V $T_A = 27$ °C		42		$\mu$ A
$f_{SW}$	Switching frequency		1.9	2	2.1	MHz
$V_{DROPOUT}$	Voltage drop from $PV_{IN}$ to $V_{OUT}$			1		V
$V_{OUT\_DIV}$	Range of output voltage with divider (OTP option), programmable in 20 mV steps.	$PV_{IN4} = 2.7$ V to 5.5 V	1.5		2.7	V
$V_{OUT\_NO\_DIV}$	Range of output voltage with no divider (OTP option), programmable in 10 mV steps.	$PV_{IN4} = 2.7$ V to 5.5 V	0.5		1.9	V
$SR_{SS}$	Soft start slew rate			2.5		mV/ $\mu$ s
$V_{OUT\_ACC}$	Output voltage accuracy, including static line and load regulation	$V_{OUT} \geq 1$ V $T_A = 27$ °C	-1		1	%
$V_{OUT\_ACC}$	Output voltage accuracy, including static line and load regulation	$V_{OUT} < 1$ V	-10		10	mV
$R_{ON\_PMOS}$	On resistance of switching PMOS	$V_{IN} = 3.3$ V $T_A = 27$ °C		52		m $\Omega$
$R_{ON\_NMOS}$	On resistance of switching NMOS	$V_{IN} = 3.3$ V $T_A = 27$ °C		20		m $\Omega$

## High Current, Highly Configurable System PMIC

Parameter	Description	Conditions	Min	Typ	Max	Unit
I <sub>POSLIM</sub>	Positive current limit threshold	With default setting V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C	7	8.5		A
V <sub>THR_OVP_RISE</sub>	Over-voltage protection threshold		+200	+300	+400	mV
V <sub>THR_UVP_FALL</sub>	Under-voltage protection threshold		-400	-300	-200	mV
R <sub>DCHG</sub>	Discharge resistance for LX node	V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C		25		Ω
t <sub>ON_MIN</sub>	Buck minimum On-time	V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C		20		ns

### 5.9 Load Switch Characteristics

Table 11: Load Switch Electrical Characteristics

Parameter	Description	Conditions	Min	Typ	Max	Unit
<b>External Electrical Conditions</b>						
V <sub>IN</sub>	Input voltage		2.2	3.3	5.5	V
<b>Electrical Performance</b>						
I <sub>Q</sub>	Quiescent current	V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C		14.5		μA
R <sub>ON</sub>	On resistance	V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C I <sub>OUT</sub> = 200 mA		20		mΩ
I <sub>LIM_SOFTSTART</sub>	Current limit at soft start	V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C	50	100	150	mA
I <sub>LIM</sub>	Current limit	V <sub>IN</sub> = 3.3 V T <sub>A</sub> = 27 °C	4			A
t <sub>SOFTSTART</sub>	Soft start time	No load condition V <sub>IN</sub> = 3.3 V C <sub>OUT</sub> = 50 μF		1.5		ms

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### 5.10 LDO Electrical Characteristics

Table 12: LDO Electrical Characteristics

Parameter	Description	Conditions	Min	Typ	Max	Unit
<b>External Electrical Conditions</b>						
$V_{IN}$	Input voltage of power stage		2.7	3.3	5.5	V
$C_{OUT}$	Output capacitance, including voltage and temperature coefficient		2.3	4.7	6.1	$\mu$ F
<b>Electrical Performance</b>						
$I_Q$	Quiescent current	$V_{IN} = 3.3$ V $T_A = 27$ °C		3.5		$\mu$ A
$V_{OUT}$	Output voltage range		1.4		1.9	V
$V_{OUT\_STEP}$	Output voltage programable step			20		mV
$V_{OUT\_ACC}$	Output voltage accuracy, including static line and load regulation	$V_{IN} = 3.3$ V $V_{LDOOUT} = 1.8$ V $I_{OUT} = 10$ mA $T_A = 27$ °C,	1.782	1.8	1.818	V
$t_{SOFTSTART}$	Soft start time	No load condition $V_{IN} = 3.3$ V $V_{LDOOUT} = 1.8$ V $T_A = 27$ °C $C_{OUT} = 4.7$ $\mu$ F		0.5	0.8	ms
$I_{INRUSH}$	Inrush current	$V_{IN} = 3.3$ V $T_A = 27$ °C $C_{OUT} = 4.7$ $\mu$ F			200	mA
$I_{LIM}$	Current limit threshold	$V_{IN} = 3.3$ V $V_{LDOOUT} = 1.8$ V $T_A = 27$ °C $C_{OUT} = 4.7$ $\mu$ F	200			mA
$V_{DROPOUT}$	Voltage drop from LDOIN to LDOOUT	$V_{IN} = 3.3$ V $V_{LDOOUT} = 1.8$ V $I_{OUT} = 200$ mA $T_A = 27$ °C $C_{OUT} = 4.7$ $\mu$ F		250	530	mV
$V_{THR\_OVP\_RISE}$	Over-voltage protection threshold		2.2	2.25	2.3	V
$V_{THR\_UVP\_FALL}$	Under-voltage protection threshold		0.95	1	1.05	V
$R_{DCHG}$	Discharge resistance			47		$\Omega$



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### 5.11 Supervision Characteristics

**Table 13: Supervision Electrical Characteristics**

Parameter	Description	Conditions	Min	Typ	Max	Unit
<b>External Electrical Conditions</b>						
$V_{IN}$	Input voltage		2.9		5.5	V
<b>Electrical Performance</b>						
$I_Q$	Quiescent current			11.5		$\mu A$
$V_{THR\_OVP\_RISE}$	$V_{IN}$ over-voltage protection threshold for $V_{IN}$ rising		5.6	5.7	5.85	V
$V_{THR\_OVP\_HYS}$	$V_{IN}$ over-voltage protection hysteresis			0.3		V
$V_{THR\_UVLO\_FALL}$	$V_{IN}$ UVLO threshold for $V_{IN}$ falling		2.1		2.3	V
$V_{THR\_UVLO\_HYS}$	$V_{IN}$ UVLO hysteresis			0.1		V
$V_{THR\_POR\_FALL}$	$V_{OUT}$ POR threshold for $V_{OUT}$ falling		2.6	2.7	2.8	V
$V_{THR\_POR\_HYS}$	$V_{OUT}$ POR hysteresis		0.05	0.1	0.15	V
$t_{D\_POR}$	POR delay time until POR pin is asserted.			6		ms
$T_{THR\_SHDN}$	Thermal shutdown threshold		130	140	150	$^{\circ}C$
$T_{THR\_SHDN\_HYS}$	Thermal shutdown hysteresis			15		$^{\circ}C$

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### 5.12 I<sup>2</sup>C Characteristics

Table 14: I2C Electrical Characteristics

Parameter	Description	Conditions	Min	Typ	Max	Unit
<b>Electrical Performance</b>						
<b>Standard/Fast/Fast+ Mode</b>						
t <sub>BUS</sub>	Bus free time between a STOP and START condition		0.5			μs
C <sub>BUS</sub>	Bus line capacitive load				150	pF
f <sub>SCL</sub>	SCL clock frequency				1000	kHz
t <sub>LO_SCL</sub>	SCL low time		0.5			μs
t <sub>HI_SCL</sub>	SCL high time		0.26			μs
t <sub>RISE</sub>	SCL and SDA rise time. Requirement for input.				1000	ns
t <sub>FALL</sub>	SCL and SDA fall time. Requirement for input.				300	ns
t <sub>SETUP_START</sub>	Start condition setup time		0.26			μs
t <sub>HOLD_START</sub>	Start condition hold time		0.26			μs
t <sub>SETUP_STOP</sub>	Stop condition setup time		0.26			μs
t <sub>DATA</sub>	Data valid time				0.45	μs
t <sub>DATA_ACK</sub>	Data valid acknowledge time				0.45	μs
t <sub>SETUP_DATA</sub>	Data setup time		50			ns
t <sub>HOLD_DATA</sub>	Data hold time		0			ns
t <sub>SPIKE</sub>	Spike suppression pulse width		0		50	ns
<b>HS Mode</b>						
C <sub>BUS</sub>	Bus line capacitive load				100	pF
f <sub>SCL</sub>	SCL clock frequency				3400	kHz
t <sub>LO_SCL</sub>	SCL low time		160			ns
t <sub>HI_SCL</sub>	SCL high time		60			ns
t <sub>RISE</sub>	SCL and SDA rise time. Requirement for input.				160	ns
t <sub>FALL</sub>	SCL and SDA fall time. Requirement for input.				160	ns
t <sub>SETUP_START</sub>	Start condition setup time		160			ns
t <sub>HOLD_START</sub>	Start condition hold time		160			ns

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Parameter	Description	Conditions	Min	Typ	Max	Unit
t <sub>SETUP_STOP</sub>	Stop condition setup time		160			ns
t <sub>SETUP_DATA</sub>	Data setup time		10			ns
t <sub>HOLD_DATA</sub>	Data hold time		0			ns
t <sub>SPIKE</sub>	Spike suppression pulse width		0		10	ns

### 5.13 Digital I/O Characteristics

Table 15: Digital I/O Electrical Characteristics

Parameter	Description	Conditions	Min	Typ	Max	Unit
<b>Electrical Performance</b>						
V <sub>IH_SCL_SDA</sub>	Input high voltage, SCL, SDA		1.2			V
V <sub>IL_SCL_SDA</sub>	Input low voltage, SCL, SDA				0.4	V
V <sub>OL_POR</sub>	Output low voltage, POR	I <sub>OUT</sub> = 3 mA			0.4	V
V <sub>OL_SDA</sub>	Output low voltage, SDA	I <sub>OUT</sub> = 3 mA			0.4	V
V <sub>IH_VSEL</sub>	Input high voltage, VSEL		1.2			V
V <sub>IL_VSEL</sub>	Input low voltage, VSEL				0.4	V
V <sub>IH_CH1SEL</sub>	Input high voltage, CH1SEL		1.2			V
V <sub>IL_CH1SEL</sub>	Input low voltage, CH1SEL				0.4	V
R <sub>PD_VSEL</sub>	Pull-down resistor, VSEL		1	10	100	kΩ
R <sub>PU_VSEL</sub>	Pull-up resistor, VSEL		1	10	100	kΩ
I <sub>LKG_POR</sub>	V <sub>POR</sub> = 3.3 V				1	μA

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## 6 Functional Description

### 6.1 Function State

The function state flow is described in Figure 4 and Table 16. Normal sequences such as start-up and shut-down are controlled by this flow. Fault protection also follows this flow.

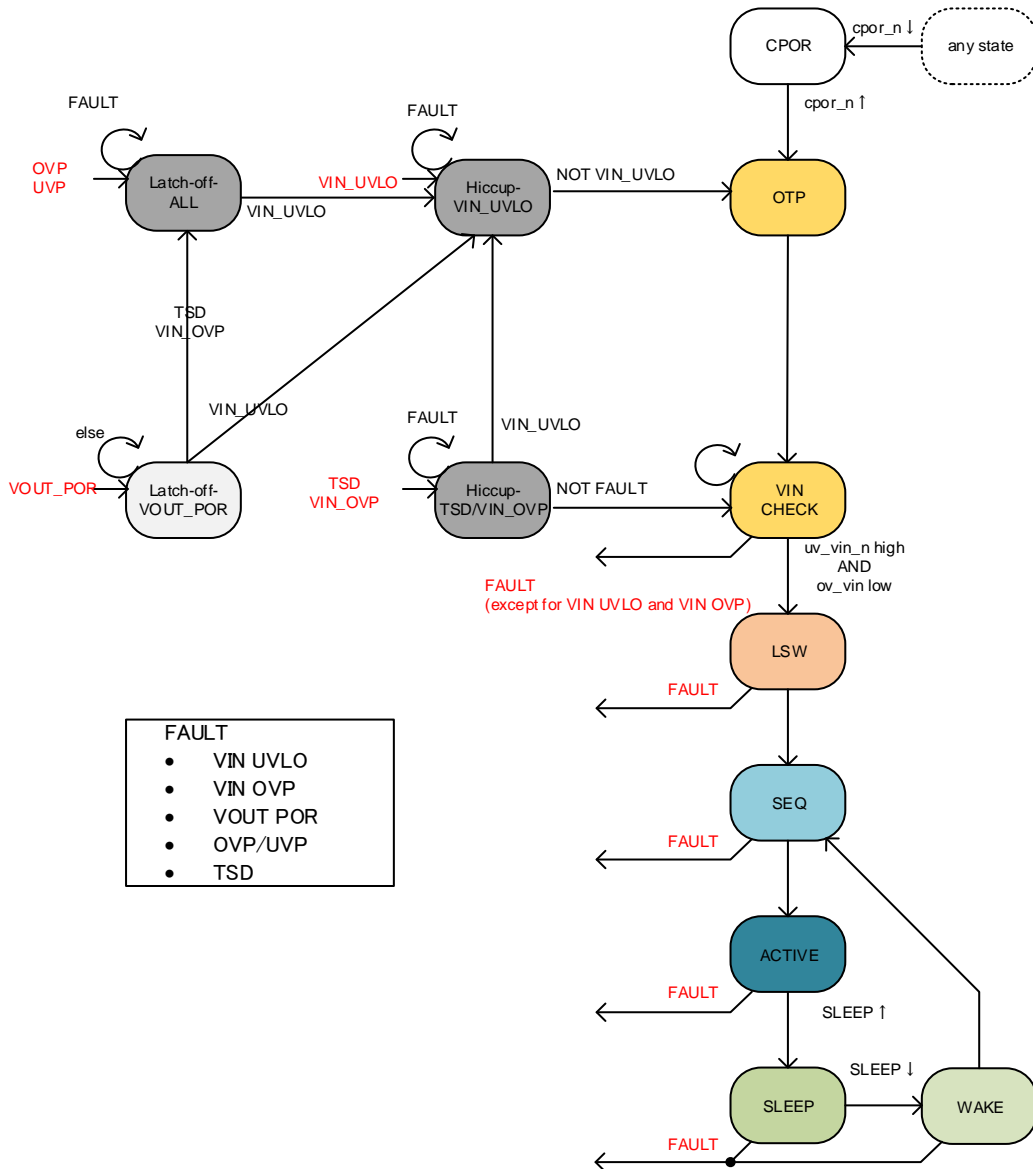


Figure 4: Function State Control Flow

Table 16: Function State

State Name	Function
CPOR	Enter this state when VIN < CPOR (2.0 V). All registers are cleared. (Digital hardware reset)
OTP	Initialize registers by loading OTP contents. Clear all the fault event bits (VOUT POR, OVPs, UVPs and TSD) for transition from Hiccup-VIN_UVLO.
VIN CHECK	Check VIN level and wait until it is within the appropriate range.

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State Name	Function
LSW	Activate LSW
SEQ	Activate Buck CH<x> and LDO. Then assert POR pin.
ACTIVE	All rails active, wait for SLEEP command.
SLEEP	Shutdown rails by SLEEP command.
WAKE	Activate rails by WAKE command.
Latch-Off-ALL	Latch-off all rails (CH<x>, LDO, LSW, and POR = L).
Latch-Off-VOUT_POR	Latch-off rails except for LSW (CH<x>, LDO, and POR = L).
Hiccup-VIN_UVLO	Hiccup all rails (CH<x>, LDO, LSW, and POR = L) and go to RESET (OTP) state.
Hiccup-TSD/VIN_OVP	Hiccup all rails (CH<x>, LDO, LSW, and POR = L) and go to Non Reset (VIN CHECK).

## 6.2 Normal Sequence

### 6.2.1 Power On and Power Off Sequence

Power on and power off sequence can be configured by OTP. Wake-up timings of all buck converters and the LDO during power-on sequence are selectable from 15 time slots by PMC\_CH<x>CH<y>\_WAKEUP\_TIME and PMC\_LDO\_WAKEUP\_TIME registers. Each time slot is approximately 0.5 ms.

POR delay timing is programmed from 3 ms to 6 ms with 1 ms step.

For an example power on and power off sequence, see [Figure 5](#). This sequence only works at start-up by power on.

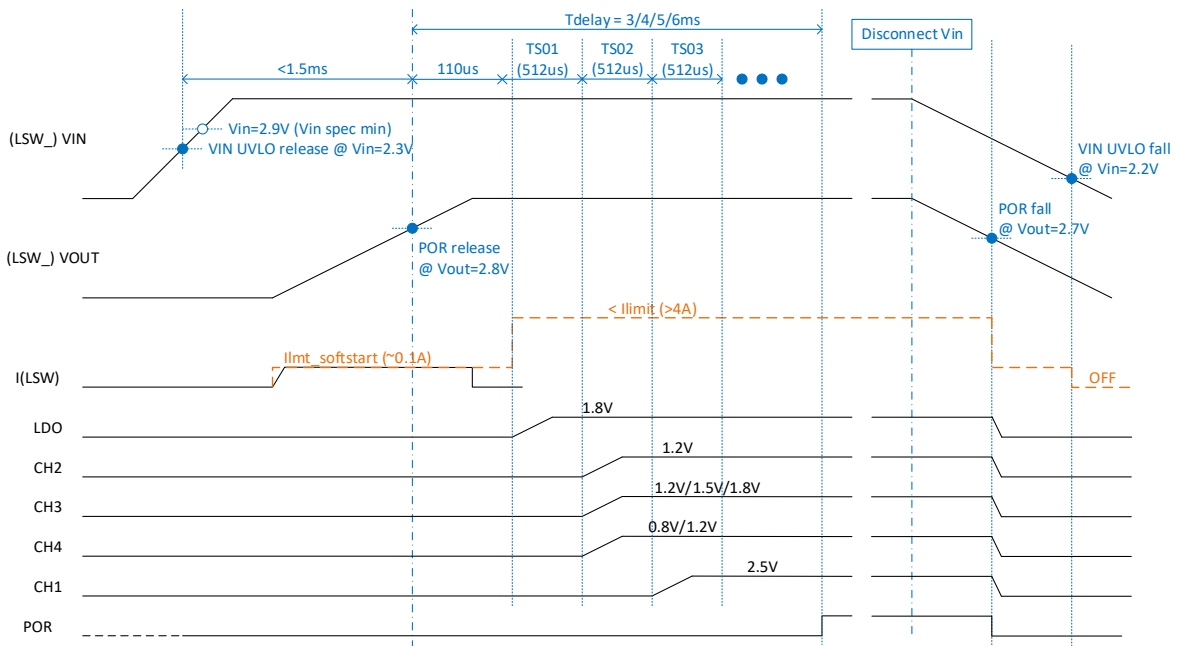


Figure 5: Power On and Off Sequence

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### 6.2.2 Sleep Mode Enter and Exit Sequence

DA9083 enters Sleep mode immediately when SLEEP bit of PMC\_SLEEP\_REG0 register is asserted. All the buck converters and the LDO move to their SLEEP state according to CH<x>\_ALIVE and LDO\_ALIVE bits of PMC\_SLEEP\_REG0. Some of them are disabled and the others are in Low Power mode (LPM).

DA9083 exits Sleep mode when SLEEP bit of PMC\_SLEEP\_REG0 register is negated. Wake-up delays of disabled buck converters and LDO are the same as power-on sequence.

For an example sleep enter and exit sequence, see Figure 6. CH2 wakes up in TS02 and CH1 wakes up in TS03.

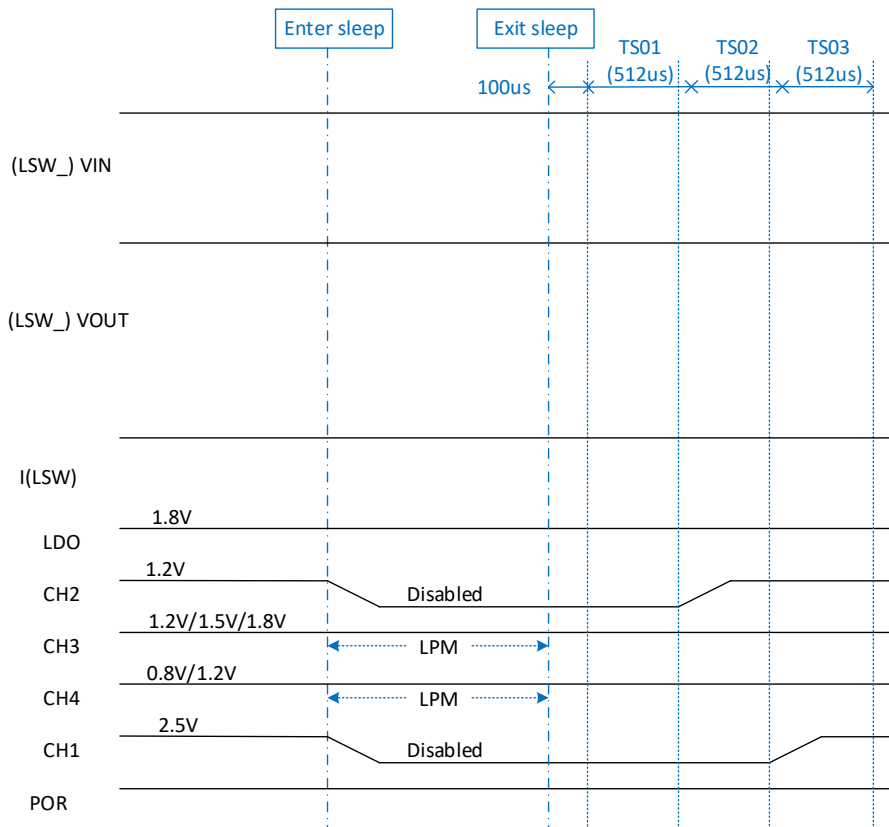


Figure 6: Sleep Enter and Exit Sequence

### 6.3 Fault and Protection

Protection functions are triggered by fault events. The behavior depends on type of fault event, see Table 17.

Table 17: Fault Events and Protection Functions

Fault Events	Shut-Down Blocks	Recovery from Shut-Down	Register
OCP	None	N/A	N/A
POR (LSW VOUT)	CH1-4 Buck, LDO	Latch-off	Keep
OVP (Buck)	CH1 Buck to CH4 Buck, LDO, LSW	Latch-off	Keep
UVP (Buck and LDO)	CH1 Buck to CH4 Buck, LDO, LSW	Latch-off	Keep

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Fault Events	Shut-Down Blocks	Recovery from Shut-Down	Register
VIN OVP	CH1 Buck to CH4 Buck, LDO, LSW	Hiccup	Keep
VIN UVLO	CH1 Block to CH4 Block, LDO, LSW	Hiccup	Reset
TSD	CH1 Block to CH4 Block, LDO, LSW	Hiccup	Keep

As an OTP option, POR pin can be assigned as IRQ output. In this case, fault events such as over-current, over-voltage, under-voltage, and/or over-temperature can be set to trigger IRQ.

### 6.4 Buck Converters

DA9083 has four channels of switching buck converters, CH1 Buck to CH4 Buck. Each of the bucks has an I<sup>2</sup>C programable voltage register, PMC\_CH<x>\_SEL\_REG, which defines the output voltage.

When a buck is enabled, its output voltage gradually goes up with soft-start. When the buck output reaches the target voltage, Power Good condition is shown via the CH<x>\_NT\_UV\_OV status bit in PMC\_RAIL\_STATUS\_REG1 register.

When the buck output drops below  $V_{THR\_UVP\_FALL}$ , the device sets the CH<x>\_UV bit in the PMC\_RAIL\_STATUS\_REG2 register to 0x1. When the buck output increases above  $V_{THR\_OVP\_RISE}$  the device sets the CH<x>\_OV bit in the PMC\_RAIL\_STATUS\_REG3 register to 0x1. The status of the Power Good indicator, for both a UVP event and an OVP event and for each of the buck converters, can be read back via I<sup>2</sup>C from the CH<x>\_NT\_UV\_OV, CH<x>\_UV, and CH<x>\_OV bits.

The Power Good status on each of buck converter is masked during the buck start-up period.

The buck converters support DVC, with the following features:

- When the value of the target voltage (PMC\_CH<x>\_SEL\_REG) changes, the output voltage updates to the new target value.
- The DVC controller operates in pulse width modulation (PWM) mode with synchronous rectification. During DVC operation the PMC\_RAIL\_STATUS\_REG1 register remains at 0xFC to indicate a Power Good condition.
- The slew rate of the DVC transition for each channel is programmed in bits CH<x>\_TSTEP<1:0> in registers PMC\_CH<x>\_CFG\_REG.

Each of the bucks has current limit and its threshold is programable with CH<x>\_ILMAX<1:0> and OTP option.

A pull-down resistor for each channel is enabled when the channel is disabled. This feature can be disabled by setting register bits CH<x>\_DIS to 0x0 (register PMC\_DISCHARGE\_REG0).

#### 6.4.1 Buck Operation Mode

Buck operation modes are selected, via I<sup>2</sup>C, by bits CH<X>\_ALIVE, LDO\_ALIVE and SLEEP in the PMC\_SLEEP\_REG0 register. Operation mode of CH<X> during High Power mode is selected by CH<X>\_PWM. See [Table 18](#).

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**Table 18: Buck Operation Mode**

Operation Mode	Buck Mode	
Normal mode	High Power mode (HPM)	Auto mode
		Force PWM mode
	Low Power mode (LPM)	
	Disable	
Sleep mode	Low Power mode (LPM)	
	Disable	

### 6.5 LDO

DA9083 has one LDO. It has an I<sup>2</sup>C programmable voltage register (PMC\_LDO\_SEL\_REG) which defines the output voltage. It has soft-start function and its output voltage gradually increases when the LDO is enabled.

When the output voltage reaches the target, a Power Good condition is shown via the LDO\_NT\_UV\_OV status bit in the PMC\_RAIL\_STATUS\_REG1 register. It indicates that the output voltage is higher than the under-voltage protection level ( $V_{THR\_UVP\_FALL}$ ) and lower than the over-voltage protection threshold level ( $V_{THR\_OVP\_RISE}$ ).

When the output drops below  $V_{THR\_UVP\_FALL}$ , the device sets the LDO\_UV bit in the PMC\_RAIL\_STATUS\_REG2 register to 0x1. When the output exceeds  $V_{THR\_OVP\_RISE}$ , the device sets the LDO\_OV bit in the PMC\_RAIL\_STATUS\_REG3 register to 0x1.

The status of the Power Good indicator, UVP event, and OVP event of the LDO can be read via I<sup>2</sup>C from the LDO\_NT\_UV\_OV, LDO\_UV, and LDO\_OV bits respectively.

The Power Good status on LDO is masked during the buck start-up period.

### 6.6 I<sup>2</sup>C Communication

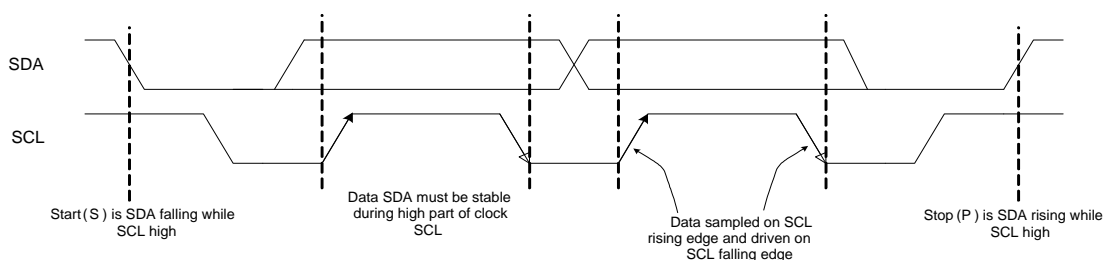
DA9083 includes an I<sup>2</sup>C-compatible 2-wire serial interface to access the internal registers. Through the I<sup>2</sup>C interface, the host processor controls each channel and reads back system status. The DA9083 only operates as a slave device. For detailed information about each register, refer to Section 7 and Section 8.

The host processor provides the serial clock at the SCL pin. DA9083 supports I<sup>2</sup>C Standard-mode at 100 kHz and Fast-mode at 400 kHz, see [1].

DA9083 SLAVE address is 0x1B.

The I<sup>2</sup>C data pin, SDA, is open drain which allows multiple devices to share a communication line.

All transmissions begin with a START condition issued from the Master while the bus is in an IDLE state (the bus is free). The START condition is initiated by a high to low transition on SDA while SCL is high. Alternately, a STOP condition is indicated by a low to high transition on SDA while SCL is high, see Figure 7.



**Figure 7: I<sup>2</sup>C Start (S) and Stop (P)**

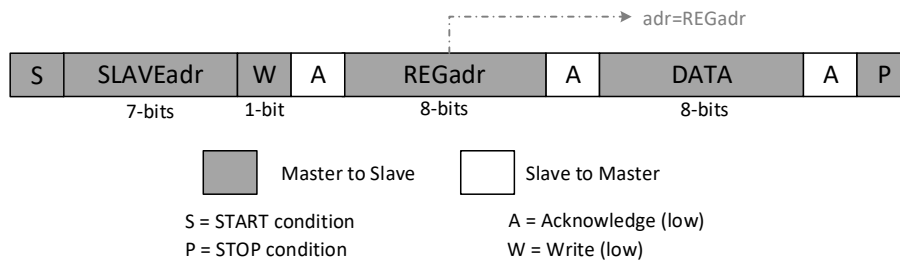


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The I<sup>2</sup>C interface uses a two-byte serial protocol containing one byte for address and one byte for data. The data and address are transferred with MSB transmitted first for both read and write operations.

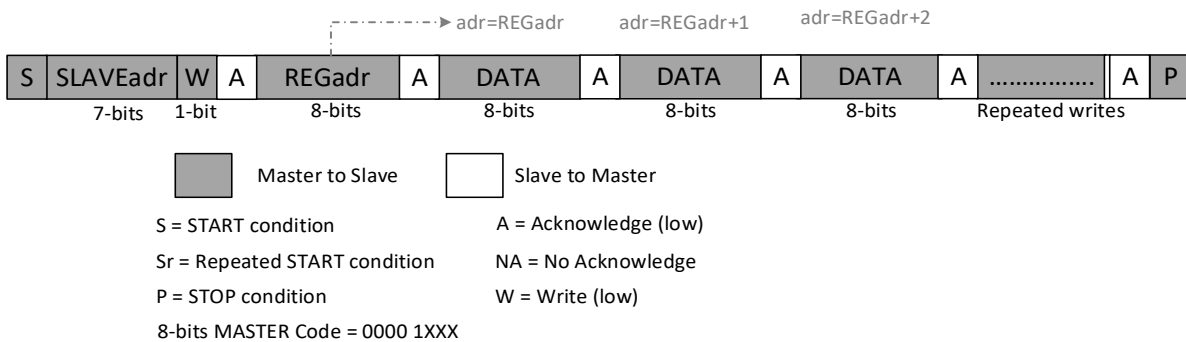
DA9083 monitors the serial bus for a valid SLAVE address when the interface is enabled. When it receives its own slave address, DA9083 immediately gives an Acknowledge signal to the host by pulling SDA low during the following clock cycle. A Not Acknowledge signal is given by a logic 1, not pulling down the SDA line.

A single-byte write is shown in Figure 8. Here the slave address is followed by a write bit (low), the register address, and the write data. Finally, the transaction is terminated with a STOP.



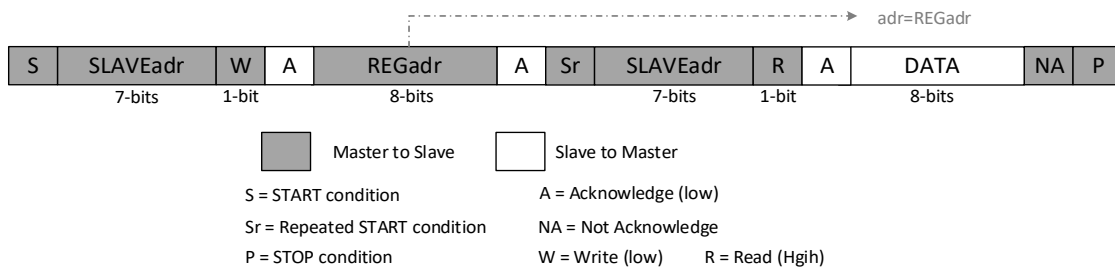
**Figure 8: Single Write Command**

DA9083 also supports multiple byte writes, shown in Figure 9. By not sending the STOP command, data is written to consecutive addresses.



**Figure 9: Consecutive Write Command**

The data read protocol differs from the write protocol. A read does not have a register address immediately preceding it. To read from a specific address, the register address is given by using a write command followed by a Repeated START. A single-byte read is shown in Figure 10. A Repeated START is followed by the slave address and a read bit. After the read data is returned to the host, the host then responds with a Not Acknowledge and a STOP.



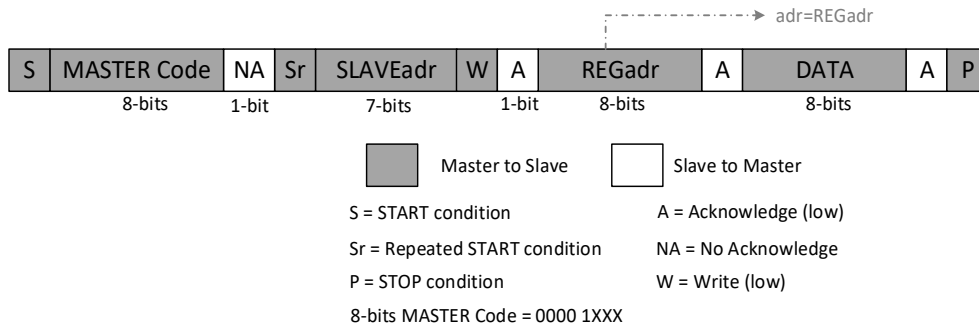
**Figure 10: Single Read Command**

The DA9083 also supports a multiple byte read protocol. If the host responds to the returned data with an Acknowledge rather than Not Acknowledge and STOP, data will be read from sequential addresses until a Not Acknowledge and STOP command is given, as shown in Figure 11. If a read



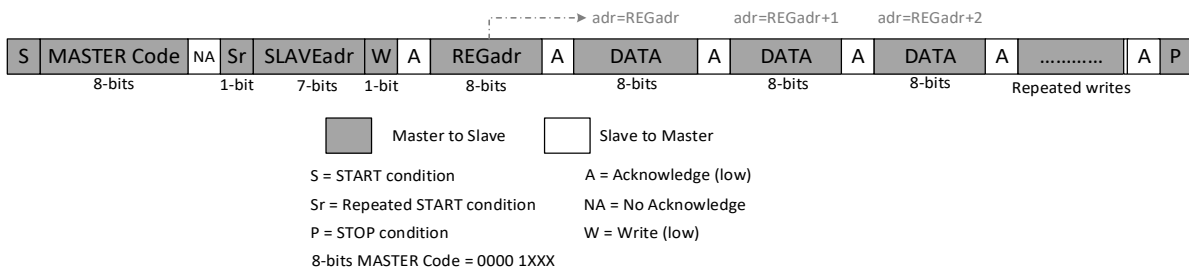
## High Current, Highly Configurable System PMIC

A single-byte write with High-Speed mode is shown in Figure 12. Here the slave address is followed by a write bit (low), the register address, and the write data. Finally, the transaction is terminated with a STOP.



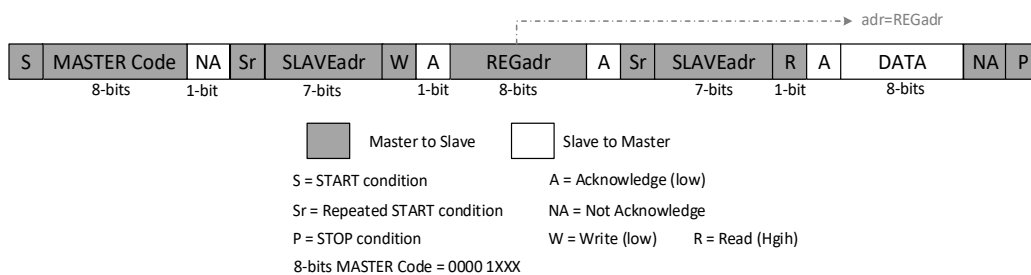
**Figure 12: High-Speed-Mode Single Write Command**

DA9083 also supports multiple byte writes in High-Speed mode, see Figure 13. By not sending the STOP command, data is written to consecutive addresses.



**Figure 13: HS-Mode Consecutive Write Command**

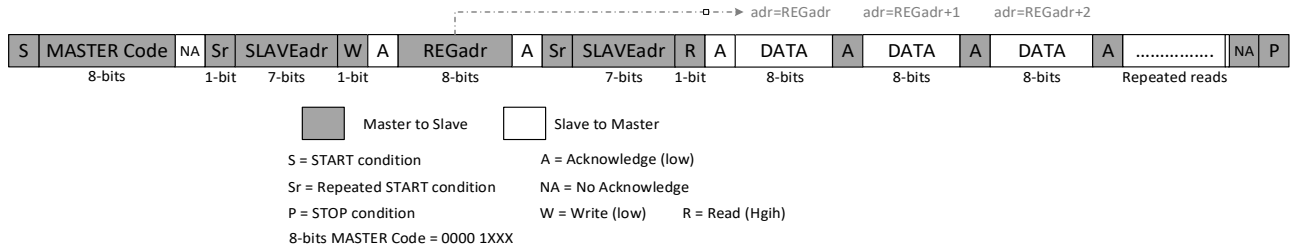
The data read protocol in High-Speed mode differs in that a read does not have a register address, immediately preceding it. To read from a specific address, the register address is given by using a write command followed by a Repeated START. A single byte read is shown in Figure 14. A Repeated START is followed by the slave address and a read bit. After the read data is returned to the host, the host then responds with a Not Acknowledge and a STOP.



**Figure 14: HS-Mode Single Read Command**

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The DA9083 also supports a multiple byte read protocol in High-Speed mode. If the host responds to the returned data with an Acknowledge rather than Not Acknowledge and STOP, data will be read from sequential addresses until a Not Acknowledge and STOP command is given, see Figure 15. If a read address is given with a write and Repeated START, consecutive addresses are read from the write address.



**Figure 15: High-Speed Mode Consecutive Read Command**

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### 7 Register Definitions

#### 7.1 Register Map

Addr	Register	7	6	5	4	3	2	1	0	Reset
<b>Functional Registers</b>										
<b>PMIC Function Registers</b>										
0x0000	PMC_RAIL_STATUS_REG1	CH1_NT_UV_OV	CH2_NT_UV_OV	CH3_NT_UV_OV	CH4_NT_UV_OV	LDO_NT_UV_OV	POR	Reserved	Reserved	0x00
0x0001	PMC_RAIL_STATUS_REG2	CH1_UV	CH2_UV	CH3_UV	CH4_UV	LDO_UV	Reserved	Reserved	Reserved	0x00
0x0002	PMC_RAIL_STATUS_REG3	CH1_OV	CH2_OV	CH3_OV	CH4_OV	LDO_OV	VIN_OV	PMIC_OT	Reserved	0x00
0x0003	PMC_CH1_CFG_REG	CH1_ILMAX<1:0>		CH1_TSTEP<1:0>		CH1_FREQ<2:0>			Reserved	0x6A
0x0005	PMC_CH2_CFG_REG	CH2_ILMAX<1:0>		CH2_TSTEP<1:0>		CH2_FREQ<2:0>			Reserved	0x6A
0x0007	PMC_CH3_CFG_REG	CH3_ILMAX<1:0>		CH3_TSTEP<1:0>		CH3_FREQ<2:0>			Reserved	0x6A
0x0009	PMC_CH4_CFG_REG	CH4_ILMAX<1:0>		CH4_TSTEP<1:0>		CH4_FREQ<2:0>			Reserved	0x6A
0x000B	PMC_LDO_SEL_REG	LDO_SEL<4:0>					Reserved	Reserved	Reserved	0xA0
0x000F	PMC_DCDCCTRL0_REG0	LSW_EN	CH1_EN	Reserved	CH2_EN	CH3_EN	CH4_EN	LDO_EN	Reserved	0x00
0x0010	PMC_SLEEP_REG0	CH1_ALIVE	Reserved	CH2_ALIVE	CH3_ALIVE	CH4_ALIVE	LDO_ALIVE	Reserved	SLEEP	0x1C
0x0011	PMC_DCDCCTRL1_REG	CH1_PWM	CH2_PWM	CH3_PWM	CH4_PWM	Reserved	Reserved	Reserved	Reserved	0x00
0x0012	PMC_DISCHARGE_REG0	CH1_DIS	CH2_DIS	CH3_DIS	CH4_DIS	LDO_DIS	LSW_DIS	Reserved	Reserved	0xF8
0x0013	PMC_DCDCCTRL2_REG	CH1_LPM	Reserved	CH2_LPM	CH3_LPM	CH4_LPM	LDO_LPM	Reserved	Reserved	0x00
0x0014	PMC_CH1CH2_WAKEUP_TIME	CH1_WAKEUP_TIME<3:0>				CH2_WAKEUP_TIME<3:0>				0x32
0x0015	PMC_CH3CH4_WAKEUP_TIME	CH3_WAKEUP_TIME<3:0>				CH4_WAKEUP_TIME<3:0>				0x22
0x0016	PMC_LDO_WAKEUP_TIME	LDO_WAKEUP_TIME<3:0>				Reserved	Reserved	Reserved	Reserved	0x10
0x001E	PMC_VOUT_CH1	CH1_VOUT<7:0>								
0x001F	PMC_VOUT_CH2	CH2_VOUT<7:0>								
0x0020	PMC_VOUT_CH3	CH3_VOUT<7:0>								
0x0021	PMC_VOUT_CH4	CH4_VOUT<7:0>								

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### 8 Register Descriptions

#### 8.1.1 PMIC Function Registers

**Table 19: PMC\_RAIL\_STATUS\_REG1 (0x0000)**

Bit	Type	Field Name	Description	Reset
[7]	R	CH1_NT_UV_OV	Status bit. Indicates UV/OV not triggered on CH1 <b>Value</b> <b>Description</b> 0x0        CH1 OV or UV triggered. 0x1        CH1 OV and UV not triggered.	0x0
[6]	R	CH2_NT_UV_OV	Status bit. Indicates UV/OV not triggered on CH2 <b>Value</b> <b>Description</b> 0x0        CH2 OV or UV triggered. 0x1        CH2 OV and UV not triggered.	0x0
[5]	R	CH3_NT_UV_OV	Status bit. Indicates UV/OV not triggered on CH3 <b>Value</b> <b>Description</b> 0x0        CH3 OV or UV triggered. 0x1        CH3 OV and UV not triggered.	0x0
[4]	R	CH4_NT_UV_OV	Status bit. Indicates UV/OV not triggered on CH4 <b>Value</b> <b>Description</b> 0x0        CH4 OV or UV triggered. 0x1        CH4 OV and UV not triggered.	0x0
[3]	R	LDO_NT_UV_OV	Status bit. Indicates UV/OV not triggered on LDO <b>Value</b> <b>Description</b> 0x0        LDO OV or UV triggered. 0x1        LDO OV and UV not triggered.	0x0
[2]	R	POR	Status bit. Indicates POR pin output. <b>Value</b> <b>Description</b> 0x0        POR pin low 0x1        POR pin high	0x0

**Table 20: PMC\_RAIL\_STATUS\_REG2 (0x0001)**

Bit	Type	Field Name	Description	Reset
[7]	RW1C	CH1_UV	Status bit. Indicates UV on CH1 <b>Value</b> <b>Description</b> 0x0        CH1 UV not breached 0x1        CH1 UV breached	0x0

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Bit	Type	Field Name	Description	Reset
[6]	RW1C	CH2_UV	Status bit. Indicates UV on CH2 <b>Value</b> <b>Description</b> 0x0        CH2 UV not breached 0x1        CH2 UV breached	0x0
[5]	RW1C	CH3_UV	Status bit. Indicates UV on CH3 <b>Value</b> <b>Description</b> 0x0        CH3 UV not breached 0x1        CH3 UV breached	0x0
[4]	RW1C	CH4_UV	Status bit. Indicates UV on CH4 <b>Value</b> <b>Description</b> 0x0        CH4 UV not breached 0x1        CH4 UV breached	0x0
[3]	RW1C	LDO_UV	Status bit. Indicates UV on LDO <b>Value</b> <b>Description</b> 0x0        LDO UV not breached 0x1        LDO UV breached	0x0

**Table 21: PMC\_RAIL\_STATUS\_REG3 (0x0002)**

Bit	Type	Field Name	Description	Reset
[7]	RW1C	CH1_OV	Status bit. Indicates OV on CH1 <b>Value</b> <b>Description</b> 0x0        CH1 OV not breached 0x1        CH1 OV breached	0x0
[6]	RW1C	CH2_OV	Status bit. Indicates OV on CH2 <b>Value</b> <b>Description</b> 0x0        CH2 OV not breached 0x1        CH2 OV breached	0x0
[5]	RW1C	CH3_OV	Status bit. Indicates OV on CH3 <b>Value</b> <b>Description</b> 0x0        CH3 OV not breached 0x1        CH3 OV breached	0x0
[4]	RW1C	CH4_OV	Status bit. Indicates OV on CH4 <b>Value</b> <b>Description</b> 0x0        CH4 OV not breached 0x1        CH4 OV breached	0x0

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Bit	Type	Field Name	Description	Reset
[3]	RW1C	LDO_OV	Status bit. Indicates OV on LDO <b>Value</b> <b>Description</b> 0x0        LDO OV not breached 0x1        LDO OV breached	0x0
[2]	RW1C	VIN_OV	Status bit. Indicates OV on VIN <b>Value</b> <b>Description</b> 0x0        VIN OV not breached 0x1        VIN OV breached	0x0
[1]	RW1C	PMIC_OT	Status bit. Indicates OT on PMIC <b>Value</b> <b>Description</b> 0x0        PMIC OT not breached 0x1        PMIC OT breached	0x0

**Table 22: PMC\_CH1\_CFG\_REG (0x0003)**

Bit	Type	Field Name	Description	Reset
[7:6]	RW	CH1_ILMAX	CH1 ILMAX setting (A) <b>Value</b> <b>Description</b> 0x0        3.0 0x1        4.0 0x2        5.0 0x3        6.0	0x1
[5:4]	RW	CH1_TSTEP	CH1 TSTEP setting <b>Value</b> <b>Description</b> 0x0        up: 20 mV/μs, down: 5m V/μs 0x1        up: 15 mV/μs, down: 5mV/μs 0x2        up: 10mV/μs, down: 5mV/μs 0x3        up: 5mV/μs, down: 5mV/μs	0x2
[3:1]	RW	CH1_FREQ	CH1 FREQ is fixed to 2 MHz	0x5

**Table 23: PMC\_CH2\_CFG\_REG (0x0005)**

Bit	Type	Field Name	Description	Reset
[7:6]	RW	CH2_ILMAX	CH2 ILMAX setting (A) <b>Value</b> <b>Description</b> 0x0        3.0 0x1        4.0 0x2        5.0 0x3        6.0	0x1



## High Current, Highly Configurable System PMIC

Bit	Type	Field Name	Description	Reset
[5:4]	RW	CH2_TSTEP	CH2 TSTEP setting <b>Value</b> <b>Description</b> 0x0        up: 20 mV/μs, down: 5 mV/μs 0x1        up: 15mV/μs, down: 5mV/μs 0x2        up: 10mV/μs, down: 5mV/μs 0x3        up: 5mV/μs, down: 5mV/μs	0x2
[3:1]	RW	CH2_FREQ	CH2 FREQ is fixed to 2 MHz	0x5

**Table 24: PMC\_CH3\_CFG\_REG (0x0007)**

Bit	Type	Field Name	Description	Reset
[7:6]	RW	CH3_ILMAX	CH3 ILMAX setting (A) <b>Value</b> <b>Description</b> 0x0        3.0 0x1        4.0 0x2        5.0 0x3        6.0	0x1
[5:4]	RW	CH3_TSTEP	CH3 TSTEP setting <b>Value</b> <b>Description</b> 0x0        up: 20 mV/μs, down: 5 mV/μs 0x1        up: 15 mV/μs, down: 5 mV/μs 0x2        up: 10 mV/μs, down: 5 mV/μs 0x3        up: 5 mV/μs, down:5 mV/μs	0x2
[3:1]	RW	CH3_FREQ	CH3 FREQ is fixed to 2 MHz	0x5

**Table 25: PMC\_CH4\_CFG\_REG (0x0009)**

Bit	Type	Field Name	Description	Reset
[7:6]	RW	CH4_ILMAX	CH4 ILMAX setting (A) <b>Value</b> <b>Description</b> 0x0        5.5 0x1        7.0 0x2        8.5 0x3        10.0	0x1
[5:4]	RW	CH4_TSTEP	CH4 TSTEP setting <b>Value</b> <b>Description</b> 0x0        up: 20 mV/μs, down: 5 mV/μs 0x1        up: 15 mV/μs, down: 5 mV/μs 0x2        up: 10 mV/μs, down: 5 mV/μs 0x3        up: 5 mV/μs, down: 5 mV/μs	0x2

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Bit	Type	Field Name	Description	Reset
[3:1]	RW	CH4_FREQ	CH4 FREQ is fixed to 2 MHz	0x5

**Table 26: PMC\_LDO\_SEL\_REG (0x000B)**

Bit	Type	Field Name	Description	Reset
			LDO output voltage (V).	
			<b>Value</b> <b>Description</b>	
			0x00    1.40	
			0x01    1.42	
			0x02    1.44	
			0x03    1.46	
			0x04    1.48	
			0x05    1.50	
			0x06    1.52	
			0x07    1.54	
			0x08    1.56	
			0x09    1.58	
			0x0A    1.60	
			0x0B    1.62	
[7:3]	RW	LDO_SEL	0x0C    1.64	0x14
			0x0D    1.66	
			0x0E    1.68	
			0x0F    1.70	
			0x10    1.72	
			0x11    1.74	
			0x12    1.76	
			0x13    1.78	
			0x14    1.80	
			0x15    1.82	
			0x16    1.84	
			0x17    1.86	
			0x18    1.88	
			0x19    1.90	
			0x1A    1.90	
			0x1F    1.90	

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**Table 27: PMC\_DCDCCTRL0\_REG0 (0x000F)**

Bit	Type	Field Name	Description	Reset
[7]	RW	LSW_EN	LSW enable <b>Value</b> <b>Description</b> 0x0        Disable 0x1        Enable	0x0
[6]	RW	CH1_EN	CH1 Buck enable <b>Value</b> <b>Description</b> 0x0        Disable 0x1        Enable	0x0
[4]	RW	CH2_EN	CH2 Buck enable <b>Value</b> <b>Description</b> 0x0        Disable 0x1        Enable	0x0
[3]	RW	CH3_EN	CH3 Buck enable <b>Value</b> <b>Description</b> 0x0        Disable 0x1        Enable	0x0
[2]	RW	CH4_EN	CH4 Buck enable <b>Value</b> <b>Description</b> 0x0        Disable 0x1        Enable	0x0
[1]	RW	LDO_EN	LDO enable <b>Value</b> <b>Description</b> 0x0        Disable 0x1        Enable	0x0

**Table 28: PMC\_SLEEP\_REG0 (0x0010)**

Bit	Type	Field Name	Description	Reset
[7]	RW	CH1_ALIVE	Set CH1 Buck operation during sleep. <b>Value</b> <b>Description</b> 0x0        When Sleep, CH1 turn off 0x1        When Sleep, CH1 alive and enter LPM	0x0
[5]	RW	CH2_ALIVE	Set CH2 Buck operation during sleep. <b>Value</b> <b>Description</b> 0x0        When Sleep, CH2 turn off 0x1        When Sleep, CH2 alive and enter LPM	0x0

## High Current, Highly Configurable System PMIC

Bit	Type	Field Name	Description	Reset
[4]	RW	CH3_ALIVE	Set CH3 Buck operation during sleep. <b>Value</b> <b>Description</b> 0x0        When Sleep, CH3 turn off 0x1        When Sleep, CH3 alive and enter LPM	0x1
[3]	RW	CH4_ALIVE	Set CH4 Buck operation during sleep. <b>Value</b> <b>Description</b> 0x0        When Sleep, CH4 turn off 0x1        When Sleep, CH4 alive and enter LPM	0x1
[2]	RW	LDO_ALIVE	Set LDO operation during sleep. <b>Value</b> <b>Description</b> 0x0        When Sleep, LDO turn off 0x1        When Sleep, LDO alive and enter LPM	0x1
[0]	RW	SLEEP	Sleep mode setting <b>Value</b> <b>Description</b> 0x0        Exit Sleep mode 0x1        Enter Sleep mode	0x0

**Table 29: PMC\_DCDCCTRL1\_REG (0x0011)**

Bit	Type	Field Name	Description	Reset
[7]	RW	CH1_PWM	CH1 operation mode while not in LPM <b>Value</b> <b>Description</b> 0x0        Auto mode 0x1        Forced PWM mode	0x0
[6]	RW	CH2_PWM	CH2 operation mode while not in LPM <b>Value</b> <b>Description</b> 0x0        Auto mode 0x1        Forced PWM mode	0x0
[5]	RW	CH3_PWM	CH3 operation mode while not in LPM <b>Value</b> <b>Description</b> 0x0        Auto mode 0x1        Forced PWM mode	0x0
[4]	RW	CH4_PWM	CH4 operation mode while not in LPM <b>Value</b> <b>Description</b> 0x0        Auto mode 0x1        Forced PWM mode	0x0

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**Table 30: PMC\_DISCHARGE\_REG0 (0x0012)**

Bit	Type	Field Name	Description	Reset
[7]	RW	CH1_DIS	Enable discharge of CH1 output while channel is disabled <b>Value</b> <b>Description</b> 0x0        Discharge disabled 0x1        Discharge enabled	0x1
[6]	RW	CH2_DIS	Enable discharge of CH2 output while channel is disabled <b>Value</b> <b>Description</b> 0x0        Discharge disabled 0x1        Discharge enabled	0x1
[5]	RW	CH3_DIS	Enable discharge of CH3 output while channel is disabled <b>Value</b> <b>Description</b> 0x0        Discharge disabled 0x1        Discharge enabled	0x1
[4]	RW	CH4_DIS	Enable discharge of CH4 output while channel is disabled <b>Value</b> <b>Description</b> 0x0        Discharge disabled 0x1        Discharge enabled	0x1
[3]	RW	LDO_DIS	Enable discharge of LDO output while channel is disabled <b>Value</b> <b>Description</b> 0x0        Discharge disabled 0x1        Discharge enabled	0x1
[2]	RW	LSW_DIS	Enable discharge of LSW output while channel is disabled <b>Value</b> <b>Description</b> 0x0        Discharge disabled 0x1        Discharge enabled	0x0

**Table 31: PMC\_DCDCTRL2\_REG (0x0013)**

Bit	Type	Field Name	Description	Reset
[7]	RW	CH1_LPM	CH1 Buck LPM mode <b>Value</b> <b>Description</b> 0x0        High Power mode 0x1        Low Power mode	0x0

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Bit	Type	Field Name	Description	Reset
[5]	RW	CH2_LPM	CH2 Buck LPM mode <b>Value</b> <b>Description</b> 0x0        High Power mode 0x1        Low Power mode	0x0
[4]	RW	CH3_LPM	CH3 Buck LPM mode <b>Value</b> <b>Description</b> 0x0        High Power mode 0x1        Low Power mode	0x0
[3]	RW	CH4_LPM	CH4 Buck LPM mode <b>Value</b> <b>Description</b> 0x0        High Power mode 0x1        Low Power mode	0x0
[2]	RW	LDO_LPM	LDO Buck LPM mode <b>Value</b> <b>Description</b> 0x0        High Power mode 0x1        Low Power mode	0x0

**Table 32: PMC\_CH1CH2\_WAKEUP\_TIME (0x0014)**

Bit	Type	Field Name	Description	Reset
[7:4]	RW	CH1_WAKEUP_TIME	The duration between wake-up signal and a rail rising edge, $t_{WAKE\_UP\_DELAY} = 150 \mu s + (N-1) * 512 \mu s$ <b>Value</b> <b>Description</b> 0x0        Disable wake-up 0x1        Time slot 1 0x2        Time slot 2 0x3        Time slot 3 0x4        Time slot 4 0x5        Time slot 5 0x6        Time slot 6 0x7        Time slot 7 0x8        Time slot 8 0x9        Time slot 9 0xA        Time slot 10 0xB        Time slot 11 0xC        Time slot 12 0xD        Time slot 13 0xE        Time slot 14 0xF        Time slot 15	0x3

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Bit	Type	Field Name	Description	Reset																																		
[3:0]	RW	CH2_WAKEUP_TIME	<p>The duration between wake-up signal and a rail rising edge, <math>t_{WAKE\_UP\_DELAY} = 150\mu s + (N-1) * 512 \mu s</math></p> <table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr><td>0x0</td><td>Disable wake-up</td></tr> <tr><td>0x1</td><td>Time slot 1</td></tr> <tr><td>0x2</td><td>Time slot 2</td></tr> <tr><td>0x3</td><td>Time slot 3</td></tr> <tr><td>0x4</td><td>Time slot 4</td></tr> <tr><td>0x5</td><td>Time slot 5</td></tr> <tr><td>0x6</td><td>Time slot 6</td></tr> <tr><td>0x7</td><td>Time slot 7</td></tr> <tr><td>0x8</td><td>Time slot 8</td></tr> <tr><td>0x9</td><td>Time slot 9</td></tr> <tr><td>0xA</td><td>Time slot 10</td></tr> <tr><td>0xB</td><td>Time slot 11</td></tr> <tr><td>0xC</td><td>Time slot 12</td></tr> <tr><td>0xD</td><td>Time slot 13</td></tr> <tr><td>0xE</td><td>Time slot 14</td></tr> <tr><td>0xF</td><td>Time slot 15</td></tr> </tbody> </table>	Value	Description	0x0	Disable wake-up	0x1	Time slot 1	0x2	Time slot 2	0x3	Time slot 3	0x4	Time slot 4	0x5	Time slot 5	0x6	Time slot 6	0x7	Time slot 7	0x8	Time slot 8	0x9	Time slot 9	0xA	Time slot 10	0xB	Time slot 11	0xC	Time slot 12	0xD	Time slot 13	0xE	Time slot 14	0xF	Time slot 15	0x2
Value	Description																																					
0x0	Disable wake-up																																					
0x1	Time slot 1																																					
0x2	Time slot 2																																					
0x3	Time slot 3																																					
0x4	Time slot 4																																					
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0x6	Time slot 6																																					
0x7	Time slot 7																																					
0x8	Time slot 8																																					
0x9	Time slot 9																																					
0xA	Time slot 10																																					
0xB	Time slot 11																																					
0xC	Time slot 12																																					
0xD	Time slot 13																																					
0xE	Time slot 14																																					
0xF	Time slot 15																																					

**Table 33: PMC\_CH3CH4\_WAKEUP\_TIME (0x0015)**

Bit	Type	Field Name	Description	Reset																										
[7:4]	RW	CH3_WAKEUP_TIME	<p>The duration between wake-up signal and a rail rising edge, <math>t_{WAKE\_UP\_DELAY} = 150 \mu s + (N-1) * 512 \mu s</math></p> <table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr><td>0x0</td><td>Disable wake-up</td></tr> <tr><td>0x1</td><td>Time slot 1</td></tr> <tr><td>0x2</td><td>Time slot 2</td></tr> <tr><td>0x3</td><td>Time slot 3</td></tr> <tr><td>0x4</td><td>Time slot 4</td></tr> <tr><td>0x5</td><td>Time slot 5</td></tr> <tr><td>0x6</td><td>Time slot 6</td></tr> <tr><td>0x7</td><td>Time slot 7</td></tr> <tr><td>0x8</td><td>Time slot 8</td></tr> <tr><td>0x9</td><td>Time slot 9</td></tr> <tr><td>0xA</td><td>Time slot 10</td></tr> <tr><td>0xB</td><td>Time slot 11</td></tr> </tbody> </table>	Value	Description	0x0	Disable wake-up	0x1	Time slot 1	0x2	Time slot 2	0x3	Time slot 3	0x4	Time slot 4	0x5	Time slot 5	0x6	Time slot 6	0x7	Time slot 7	0x8	Time slot 8	0x9	Time slot 9	0xA	Time slot 10	0xB	Time slot 11	0x2
Value	Description																													
0x0	Disable wake-up																													
0x1	Time slot 1																													
0x2	Time slot 2																													
0x3	Time slot 3																													
0x4	Time slot 4																													
0x5	Time slot 5																													
0x6	Time slot 6																													
0x7	Time slot 7																													
0x8	Time slot 8																													
0x9	Time slot 9																													
0xA	Time slot 10																													
0xB	Time slot 11																													

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Bit	Type	Field Name	Description	Reset
			0xC Time slot 12 0xD Time slot 13 0xE Time slot 14 0xF Time slot 15	
[3:0]	RW	CH4_WAKEUP_TIME	The duration between wake-up signal and a rail rising edge, $t_{WAKE\_UP\_DELAY} = 150 \mu s + (N-1) * 512 \mu s$ <b>Value</b> <b>Description</b> 0x0    Disable wake-up 0x1    Time slot 1 0x2    Time slot 2 0x3    Time slot 3 0x4    Time slot 4 0x5    Time slot 5 0x6    Time slot 6 0x7    Time slot 7 0x8    Time slot 8 0x9    Time slot 9 0xA    Time slot 10 0xB    Time slot 11 0xC    Time slot 12 0xD    Time slot 13 0xE    Time slot 14 0xF    Time slot 15	0x2



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**Table 34: PMC\_LDO\_WAKEUP\_TIME (0x0016)**

Bit	Type	Field Name	Description	Reset
[7:4]	RW	LDO_WAKEUP_TIME	The duration between wake-up signal and a rail rising edge, $t_{WAKE\_UP\_DELAY} = 150 \mu s + (N-1) * 512 \mu s$	0x1
			<b>Value</b> <b>Description</b>	
			0x0    Disable wake-up	
			0x1    Time slot 1	
			0x2    Time slot 2	
			0x3    Time slot 3	
			0x4    Time slot 4	
			0x5    Time slot 5	
			0x6    Time slot 6	
			0x7    Time slot 7	
			0x8    Time slot 8	
			0x9    Time slot 9	
			0xA    Time slot 10	
			0xB    Time slot 11	
			0xC    Time slot 12	
			0xD    Time slot 13	
0xE    Time slot 14				
0xF    Time slot 15				

**Table 35: PMC\_VOUT\_CH1 (0x001E)**

Bit	Type	Field Name	Description	Reset
[7:0]	RW	CH1_VOUT	CH1 output voltage (V). Format is (without divider)/(with divider). Default selectable by VSEL.	0x55
			<b>Value</b> <b>Description</b>	
			0x00    Reserved	
			0x32    0.50/Reserved	
			0x33    0.51/Reserved	
			0x34    0.52/Reserved	
			0x35    0.53/Reserved	
			0x36    0.54/Reserved	
			0x37    0.55/Reserved	
			0x38    0.56/Reserved	
			0x39    0.57/Reserved	
			0x3A    0.58/Reserved	
			0x3B    0.59/Reserved	

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Bit	Type	Field Name	Description	Reset
			0x3C 0.60/Reserved	
			0x3D 0.61/Reserved	
			0x3E 0.62/Reserved	
			0x3F 0.63/Reserved	
			0x40 0.64/Reserved	
			0x41 0.65/Reserved	
			0x42 0.66/Reserved	
			0x43 0.67/Reserved	
			0x44 0.68/Reserved	
			0x45 0.69/Reserved	
			0x46 0.70/Reserved	
			0x47 0.71/Reserved	
			0x48 0.72/Reserved	
			0x49 0.73/Reserved	
			0x4A 0.74/Reserved	
			0x4B 0.75/1.50	
			0x4C 0.76/1.52	
			0x4D 0.77/1.54	
			0x4E 0.78/1.56	
			0x4F 0.79/1.58	
			0x50 0.80/1.60	
			0x51 0.81/1.62	
			0x52 0.82/1.64	
			0x53 0.83/1.66	
			0x54 0.84/1.68	
			0x55 0.85/1.70	
			0x56 0.86/1.72	
			0x57 0.87/1.74	
			0x58 0.88/1.76	
			0x59 0.89/1.78	
			0x5A 0.90/1.80	
			0x5B 0.91/1.82	
			0x5C 0.92/1.84	
			0x5D 0.93/1.86	
			0x5E 0.94/1.88	
			0x5F 0.95/1.90	
			0x60 0.96/1.92	

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Bit	Type	Field Name	Description	Reset
			0x61 0.97/1.94	
			0x62 0.98/1.96	
			0x63 0.99/1.98	
			0x64 1.00/2.00	
			0x65 1.01/2.02	
			0x66 1.02/2.04	
			0x67 1.03/2.06	
			0x68 1.04/2.08	
			0x69 1.05/2.10	
			0x6A 1.06/2.12	
			0x6B 1.07/2.14	
			0x6C 1.08/2.16	
			0x6D 1.09/2.18	
			0x6E 1.10/2.20	
			0x6F 1.11/2.22	
			0x70 1.12/2.24	
			0x71 1.13/2.26	
			0x72 1.14/2.28	
			0x73 1.15/2.30	
			0x74 1.16/2.32	
			0x75 1.17/2.34	
			0x76 1.18/2.36	
			0x77 1.19/2.38	
			0x78 1.20/2.40	
			0x79 1.21/2.42	
			0x7A 1.22/2.44	
			0x7B 1.23/2.46	
			0x7C 1.24/2.48	
			0x7D 1.25/2.50	
			0x7E 1.26/2.52	
			0x7F 1.27/2.54	
			0x80 1.28/2.56	
			0x81 1.29/2.58	
			0x82 1.30/2.60	
			0x83 1.31/2.62	
			0x84 1.32/2.64	
			0x85 1.33/2.66	

## High Current, Highly Configurable System PMIC

Bit	Type	Field Name	Description	Reset
			0x86 1.34/2.68	
			0x87 1.35/2.70	
			0x88 1.36/Reserved	
			0x89 1.37/Reserved	
			0x8A 1.38/Reserved	
			0x8B 1.39/Reserved	
			0x8C 1.40/Reserved	
			0x8D 1.41/Reserved	
			0x8E 1.42/Reserved	
			0x8F 1.43/Reserved	
			0x90 1.44/Reserved	
			0x91 1.45/Reserved	
			0x92 1.46/Reserved	
			0x93 1.47/Reserved	
			0x94 1.48/Reserved	
			0x95 1.49/Reserved	
			0x96 1.50/Reserved	
			0x97 1.51/Reserved	
			0x98 1.52/Reserved	
			0x99 1.53/Reserved	
			0x9A 1.54/Reserved	
			0x9B 1.55/Reserved	
			0x9C 1.56/Reserved	
			0x9D 1.57/Reserved	
			0x9E 1.58/Reserved	
			0x9F 1.59/Reserved	
			0xA0 1.60/Reserved	
			0xA1 1.61/Reserved	
			0xA2 1.62/Reserved	
			0xA3 1.63/Reserved	
			0xA4 1.64/Reserved	
			0xA5 1.65/Reserved	
			0xA6 1.66/Reserved	
			0xA7 1.67/Reserved	
			0xA8 1.68/Reserved	
			0xA9 1.69/Reserved	
			0xAA 1.70/Reserved	

## High Current, Highly Configurable System PMIC

Bit	Type	Field Name	Description	Reset
			0xAB 1.71/Reserved	
			0xAC 1.72/Reserved	
			0xAD 1.73/Reserved	
			0xAE 1.74/Reserved	
			0xAF 1.75/Reserved	
			0xB0 1.76/Reserved	
			0xB1 1.77/Reserved	
			0xB2 1.78/Reserved	
			0xB3 1.79/Reserved	
			0xB4 1.80/Reserved	
			0xB5 1.81/Reserved	
			0xB6 1.82/Reserved	
			0xB7 1.83/Reserved	
			0xB8 1.84/Reserved	
			0xB9 1.85/Reserved	
			0xBA 1.86/Reserved	
			0xBB 1.87/Reserved	
			0xBC 1.88/Reserved	
			0xBD 1.89/Reserved	
			0xBE 1.90/Reserved	
			0xBF Reserved	
			0xFF Reserved	

**Table 36: PMC\_VOUT\_CH2 (0x001F)**

Bit	Type	Field Name	Description	Reset																				
[7:0]	RW	CH2_VOUT	<p>CH2 output voltage (V). Format is (without divider)/(with divider). Default selectable by VSEL.</p> <table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr><td>0x00</td><td>Reserved</td></tr> <tr><td>0x36</td><td>Reserved</td></tr> <tr><td>0x37</td><td>0.55/Reserved</td></tr> <tr><td>0x38</td><td>0.56/Reserved</td></tr> <tr><td>0x39</td><td>0.57/Reserved</td></tr> <tr><td>0x3A</td><td>0.58/Reserved</td></tr> <tr><td>0x3B</td><td>0.59/Reserved</td></tr> <tr><td>0x3C</td><td>0.60/Reserved</td></tr> <tr><td>0x3D</td><td>0.61/Reserved</td></tr> </tbody> </table>	Value	Description	0x00	Reserved	0x36	Reserved	0x37	0.55/Reserved	0x38	0.56/Reserved	0x39	0.57/Reserved	0x3A	0.58/Reserved	0x3B	0.59/Reserved	0x3C	0.60/Reserved	0x3D	0.61/Reserved	0x6E
Value	Description																							
0x00	Reserved																							
0x36	Reserved																							
0x37	0.55/Reserved																							
0x38	0.56/Reserved																							
0x39	0.57/Reserved																							
0x3A	0.58/Reserved																							
0x3B	0.59/Reserved																							
0x3C	0.60/Reserved																							
0x3D	0.61/Reserved																							

## High Current, Highly Configurable System PMIC

Bit	Type	Field Name	Description	Reset
			0x3E 0.62/Reserved	
			0x3F 0.63/Reserved	
			0x40 0.64/Reserved	
			0x41 0.65/Reserved	
			0x42 0.66/Reserved	
			0x43 0.67/Reserved	
			0x44 0.68/Reserved	
			0x45 0.69/Reserved	
			0x46 0.70/Reserved	
			0x47 0.71/Reserved	
			0x48 0.72/Reserved	
			0x49 0.73/Reserved	
			0x4A 0.74/Reserved	
			0x4B 0.75/1.50	
			0x4C 0.76/1.52	
			0x4D 0.77/1.54	
			0x4E 0.78/1.56	
			0x4F 0.79/1.58	
			0x50 0.80/1.60	
			0x51 0.81/1.62	
			0x52 0.82/1.64	
			0x53 0.83/1.66	
			0x54 0.84/1.68	
			0x55 0.85/1.70	
			0x56 0.86/1.72	
			0x57 0.87/1.74	
			0x58 0.88/1.76	
			0x59 0.89/1.78	
			0x5A 0.90/1.80	
			0x5B 0.91/1.82	
			0x5C 0.92/1.84	
			0x5D 0.93/1.86	
			0x5E 0.94/1.88	
			0x5F 0.95/1.90	
			0x60 0.96/1.92	
			0x61 0.97/1.94	
			0x62 0.98/1.96	

## High Current, Highly Configurable System PMIC

Bit	Type	Field Name	Description	Reset
			0x63 0.99/1.98	
			0x64 1.00/2.00	
			0x65 1.01/2.02	
			0x66 1.02/2.04	
			0x67 1.03/2.06	
			0x68 1.04/2.08	
			0x69 1.05/2.10	
			0x6A 1.06/2.12	
			0x6B 1.07/2.14	
			0x6C 1.08/2.16	
			0x6D 1.09/2.18	
			0x6E 1.10/2.20	
			0x6F 1.11/2.22	
			0x70 1.12/2.24	
			0x71 1.13/2.26	
			0x72 1.14/2.28	
			0x73 1.15/2.30	
			0x74 1.16/2.32	
			0x75 1.17/2.34	
			0x76 1.18/2.36	
			0x77 1.19/2.38	
			0x78 1.20/2.40	
			0x79 1.21/2.42	
			0x7A 1.22/2.44	
			0x7B 1.23/2.46	
			0x7C 1.24/2.48	
			0x7D 1.25/2.50	
			0x7E 1.26/2.52	
			0x7F 1.27/2.54	
			0x80 1.28/2.56	
			0x81 1.29/2.58	
			0x82 1.30/2.60	
			0x83 1.31/2.62	
			0x84 1.32/2.64	
			0x85 1.33/2.66	
			0x86 1.34/2.68	
			0x87 1.35/2.70	

## High Current, Highly Configurable System PMIC

Bit	Type	Field Name	Description	Reset
			0x88 1.36/Reserved	
			0x89 1.37/Reserved	
			0x8A 1.38/Reserved	
			0x8B 1.39/Reserved	
			0x8C 1.40/Reserved	
			0x8D 1.41/Reserved	
			0x8E 1.42/Reserved	
			0x8F 1.43/Reserved	
			0x90 1.44/Reserved	
			0x91 1.45/Reserved	
			0x92 1.46/Reserved	
			0x93 1.47/Reserved	
			0x94 1.48/Reserved	
			0x95 1.49/Reserved	
			0x96 1.50/Reserved	
			0x97 1.51/Reserved	
			0x98 1.52/Reserved	
			0x99 1.53/Reserved	
			0x9A 1.54/Reserved	
			0x9B 1.55/Reserved	
			0x9C 1.56/Reserved	
			0x9D 1.57/Reserved	
			0x9E 1.58/Reserved	
			0x9F 1.59/Reserved	
			0xA0 1.60/Reserved	
			0xA1 1.61/Reserved	
			0xA2 1.62/Reserved	
			0xA3 1.63/Reserved	
			0xA4 1.64/Reserved	
			0xA5 1.65/Reserved	
			0xA6 1.66/Reserved	
			0xA7 1.67/Reserved	
			0xA8 1.68/Reserved	
			0xA9 1.69/Reserved	
			0xAA 1.70/Reserved	
			0xAB 1.71/Reserved	
			0xAC 1.72/Reserved	



## High Current, Highly Configurable System PMIC

Bit	Type	Field Name	Description	Reset
			0xAD 1.73/Reserved	
			0xAE 1.74/Reserved	
			0xAF 1.75/Reserved	
			0xB0 1.76/Reserved	
			0xB1 1.77/Reserved	
			0xB2 1.78/Reserved	
			0xB3 1.79/Reserved	
			0xB4 1.80/Reserved	
			0xB5 1.81/Reserved	
			0xB6 1.82/Reserved	
			0xB7 1.83/Reserved	
			0xB8 1.84/Reserved	
			0xB9 1.85/Reserved	
			0xBA 1.86/Reserved	
			0xBB 1.87/Reserved	
			0xBC 1.88/Reserved	
			0xBD 1.89/Reserved	
			0xBE 1.90/Reserved	
			0xBF Reserved	
			0xFF Reserved	

**Table 37: PMC\_VOUT\_CH3 (0x0020)**

Bit	Type	Field Name	Description	Reset																								
[7:0]	RW	CH3_VOUT	<p>CH3 output voltage (V). Format is (without divider)/(with divider). Default selectable by VSEL.</p> <table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0x00</td> <td>Reserved</td> </tr> <tr> <td>0x36</td> <td>Reserved</td> </tr> <tr> <td>0x37</td> <td>0.55/Reserved</td> </tr> <tr> <td>0x38</td> <td>0.56/Reserved</td> </tr> <tr> <td>0x39</td> <td>0.57/Reserved</td> </tr> <tr> <td>0x3A</td> <td>0.58/Reserved</td> </tr> <tr> <td>0x3B</td> <td>0.59/Reserved</td> </tr> <tr> <td>0x3C</td> <td>0.60/Reserved</td> </tr> <tr> <td>0x3D</td> <td>0.61/Reserved</td> </tr> <tr> <td>0x3E</td> <td>0.62/Reserved</td> </tr> <tr> <td>0x3F</td> <td>0.63/Reserved</td> </tr> </tbody> </table>	Value	Description	0x00	Reserved	0x36	Reserved	0x37	0.55/Reserved	0x38	0.56/Reserved	0x39	0.57/Reserved	0x3A	0.58/Reserved	0x3B	0.59/Reserved	0x3C	0.60/Reserved	0x3D	0.61/Reserved	0x3E	0.62/Reserved	0x3F	0.63/Reserved	0x6E
Value	Description																											
0x00	Reserved																											
0x36	Reserved																											
0x37	0.55/Reserved																											
0x38	0.56/Reserved																											
0x39	0.57/Reserved																											
0x3A	0.58/Reserved																											
0x3B	0.59/Reserved																											
0x3C	0.60/Reserved																											
0x3D	0.61/Reserved																											
0x3E	0.62/Reserved																											
0x3F	0.63/Reserved																											

## High Current, Highly Configurable System PMIC

Bit	Type	Field Name	Description	Reset
			0x40 0.64/Reserved	
			0x41 0.65/Reserved	
			0x42 0.66/Reserved	
			0x43 0.67/Reserved	
			0x44 0.68/Reserved	
			0x45 0.69/Reserved	
			0x46 0.70/Reserved	
			0x47 0.71/Reserved	
			0x48 0.72/Reserved	
			0x49 0.73/Reserved	
			0x4A 0.74/Reserved	
			0x4B 0.75/1.50	
			0x4C 0.76/1.52	
			0x4D 0.77/1.54	
			0x4E 0.78/1.56	
			0x4F 0.79/1.58	
			0x50 0.80/1.60	
			0x51 0.81/1.62	
			0x52 0.82/1.64	
			0x53 0.83/1.66	
			0x54 0.84/1.68	
			0x55 0.85/1.70	
			0x56 0.86/1.72	
			0x57 0.87/1.74	
			0x58 0.88/1.76	
			0x59 0.89/1.78	
			0x5A 0.90/1.80	
			0x5B 0.91/1.82	
			0x5C 0.92/1.84	
			0x5D 0.93/1.86	
			0x5E 0.94/1.88	
			0x5F 0.95/1.90	
			0x60 0.96/1.92	
			0x61 0.97/1.94	
			0x62 0.98/1.96	
			0x63 0.99/1.98	
			0x64 1.00/2.00	

## High Current, Highly Configurable System PMIC

Bit	Type	Field Name	Description	Reset
			0x65 1.01/2.02	
			0x66 1.02/2.04	
			0x67 1.03/2.06	
			0x68 1.04/2.08	
			0x69 1.05/2.10	
			0x6A 1.06/2.12	
			0x6B 1.07/2.14	
			0x6C 1.08/2.16	
			0x6D 1.09/2.18	
			0x6E 1.10/2.20	
			0x6F 1.11/2.22	
			0x70 1.12/2.24	
			0x71 1.13/2.26	
			0x72 1.14/2.28	
			0x73 1.15/2.30	
			0x74 1.16/2.32	
			0x75 1.17/2.34	
			0x76 1.18/2.36	
			0x77 1.19/2.38	
			0x78 1.20/2.40	
			0x79 1.21/2.42	
			0x7A 1.22/2.44	
			0x7B 1.23/2.46	
			0x7C 1.24/2.48	
			0x7D 1.25/2.50	
			0x7E 1.26/2.52	
			0x7F 1.27/2.54	
			0x80 1.28/2.56	
			0x81 1.29/2.58	
			0x82 1.30/2.60	
			0x83 1.31/2.62	
			0x84 1.32/2.64	
			0x85 1.33/2.66	
			0x86 1.34/2.68	
			0x87 1.35/2.70	
			0x88 1.36/Reserved	
			0x89 1.37/Reserved	

## High Current, Highly Configurable System PMIC

Bit	Type	Field Name	Description	Reset
			0x8A 1.38/Reserved	
			0x8B 1.39/Reserved	
			0x8C 1.40/Reserved	
			0x8D 1.41/Reserved	
			0x8E 1.42/Reserved	
			0x8F 1.43/Reserved	
			0x90 1.44/Reserved	
			0x91 1.45/Reserved	
			0x92 1.46/Reserved	
			0x93 1.47/Reserved	
			0x94 1.48/Reserved	
			0x95 1.49/Reserved	
			0x96 1.50/Reserved	
			0x97 1.51/Reserved	
			0x98 1.52/Reserved	
			0x99 1.53/Reserved	
			0x9A 1.54/Reserved	
			0x9B 1.55/Reserved	
			0x9C 1.56/Reserved	
			0x9D 1.57/Reserved	
			0x9E 1.58/Reserved	
			0x9F 1.59/Reserved	
			0xA0 1.60/Reserved	
			0xA1 1.61/Reserved	
			0xA2 1.62/Reserved	
			0xA3 1.63/Reserved	
			0xA4 1.64/Reserved	
			0xA5 1.65/Reserved	
			0xA6 1.66/Reserved	
			0xA7 1.67/Reserved	
			0xA8 1.68/Reserved	
			0xA9 1.69/Reserved	
			0xAA 1.70/Reserved	
			0xAB 1.71/Reserved	
			0xAC 1.72/Reserved	
			0xAD 1.73/Reserved	
			0xAE 1.74/Reserved	

## High Current, Highly Configurable System PMIC

Bit	Type	Field Name	Description	Reset
			0xAF 1.75/Reserved	
			0xB0 1.76/Reserved	
			0xB1 1.77/Reserved	
			0xB2 1.78/Reserved	
			0xB3 1.79/Reserved	
			0xB4 1.80/Reserved	
			0xB5 1.81/Reserved	
			0xB6 1.82/Reserved	
			0xB7 1.83/Reserved	
			0xB8 1.84/Reserved	
			0xB9 1.85/Reserved	
			0xBA 1.86/Reserved	
			0xBB 1.87/Reserved	
			0xBC 1.88/Reserved	
			0xBD 1.89/Reserved	
			0xBE 1.90/Reserved	
			0xBF Reserved	
			0xFF Reserved	

**Table 38: PMC\_VOUT\_CH4 (0x0021)**

Bit	Type	Field Name	Description	Reset																												
[7:0]	RW	CH4_VOUT	<p>CH4 output voltage (V). Format is (without divider)/(with divider). Default selectable by VSEL.</p> <table border="1"> <thead> <tr> <th>Value</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0x00</td> <td>Reserved</td> </tr> <tr> <td>0x36</td> <td>Reserved</td> </tr> <tr> <td>0x37</td> <td>0.55/Reserved</td> </tr> <tr> <td>0x38</td> <td>0.56/Reserved</td> </tr> <tr> <td>0x39</td> <td>0.57/Reserved</td> </tr> <tr> <td>0x3A</td> <td>0.58/Reserved</td> </tr> <tr> <td>0x3B</td> <td>0.59/Reserved</td> </tr> <tr> <td>0x3C</td> <td>0.60/Reserved</td> </tr> <tr> <td>0x3D</td> <td>0.61/Reserved</td> </tr> <tr> <td>0x3E</td> <td>0.62/Reserved</td> </tr> <tr> <td>0x3F</td> <td>0.63/Reserved</td> </tr> <tr> <td>0x40</td> <td>0.64/Reserved</td> </tr> <tr> <td>0x41</td> <td>0.65/Reserved</td> </tr> </tbody> </table>	Value	Description	0x00	Reserved	0x36	Reserved	0x37	0.55/Reserved	0x38	0.56/Reserved	0x39	0.57/Reserved	0x3A	0.58/Reserved	0x3B	0.59/Reserved	0x3C	0.60/Reserved	0x3D	0.61/Reserved	0x3E	0.62/Reserved	0x3F	0.63/Reserved	0x40	0.64/Reserved	0x41	0.65/Reserved	0x46
Value	Description																															
0x00	Reserved																															
0x36	Reserved																															
0x37	0.55/Reserved																															
0x38	0.56/Reserved																															
0x39	0.57/Reserved																															
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0x3B	0.59/Reserved																															
0x3C	0.60/Reserved																															
0x3D	0.61/Reserved																															
0x3E	0.62/Reserved																															
0x3F	0.63/Reserved																															
0x40	0.64/Reserved																															
0x41	0.65/Reserved																															

## High Current, Highly Configurable System PMIC

Bit	Type	Field Name	Description	Reset
			0x42 0.66/Reserved	
			0x43 0.67/Reserved	
			0x44 0.68/Reserved	
			0x45 0.69/Reserved	
			0x46 0.70/Reserved	
			0x47 0.71/Reserved	
			0x48 0.72/Reserved	
			0x49 0.73/Reserved	
			0x4A 0.74/Reserved	
			0x4B 0.75/1.50	
			0x4C 0.76/1.52	
			0x4D 0.77/1.54	
			0x4E 0.78/1.56	
			0x4F 0.79/1.58	
			0x50 0.80/1.60	
			0x51 0.81/1.62	
			0x52 0.82/1.64	
			0x53 0.83/1.66	
			0x54 0.84/1.68	
			0x55 0.85/1.70	
			0x56 0.86/1.72	
			0x57 0.87/1.74	
			0x58 0.88/1.76	
			0x59 0.89/1.78	
			0x5A 0.90/1.80	
			0x5B 0.91/1.82	
			0x5C 0.92/1.84	
			0x5D 0.93/1.86	
			0x5E 0.94/1.88	
			0x5F 0.95/1.90	
			0x60 0.96/1.92	
			0x61 0.97/1.94	
			0x62 0.98/1.96	
			0x63 0.99/1.98	
			0x64 1.00/2.00	
			0x65 1.01/2.02	
			0x66 1.02/2.04	

## High Current, Highly Configurable System PMIC

Bit	Type	Field Name	Description	Reset
			0x67 1.03/2.06	
			0x68 1.04/2.08	
			0x69 1.05/2.10	
			0x6A 1.06/2.12	
			0x6B 1.07/2.14	
			0x6C 1.08/2.16	
			0x6D 1.09/2.18	
			0x6E 1.10/2.20	
			0x6F 1.11/2.22	
			0x70 1.12/2.24	
			0x71 1.13/2.26	
			0x72 1.14/2.28	
			0x73 1.15/2.30	
			0x74 1.16/2.32	
			0x75 1.17/2.34	
			0x76 1.18/2.36	
			0x77 1.19/2.38	
			0x78 1.20/2.40	
			0x79 1.21/2.42	
			0x7A 1.22/2.44	
			0x7B 1.23/2.46	
			0x7C 1.24/2.48	
			0x7D 1.25/2.50	
			0x7E 1.26/2.52	
			0x7F 1.27/2.54	
			0x80 1.28/2.56	
			0x81 1.29/2.58	
			0x82 1.30/2.60	
			0x83 1.31/2.62	
			0x84 1.32/2.64	
			0x85 1.33/2.66	
			0x86 1.34/2.68	
			0x87 1.35/2.70	
			0x88 1.36/Reserved	
			0x89 1.37/Reserved	
			0x8A 1.38/Reserved	
			0x8B 1.39/Reserved	

## High Current, Highly Configurable System PMIC

Bit	Type	Field Name	Description	Reset
			0x8C 1.40/Reserved	
			0x8D 1.41/Reserved	
			0x8E 1.42/Reserved	
			0x8F 1.43/Reserved	
			0x90 1.44/Reserved	
			0x91 1.45/Reserved	
			0x92 1.46/Reserved	
			0x93 1.47/Reserved	
			0x94 1.48/Reserved	
			0x95 1.49/Reserved	
			0x96 1.50/Reserved	
			0x97 1.51/Reserved	
			0x98 1.52/Reserved	
			0x99 1.53/Reserved	
			0x9A 1.54/Reserved	
			0x9B 1.55/Reserved	
			0x9C 1.56/Reserved	
			0x9D 1.57/Reserved	
			0x9E 1.58/Reserved	
			0x9F 1.59/Reserved	
			0xA0 1.60/Reserved	
			0xA1 1.61/Reserved	
			0xA2 1.62/Reserved	
			0xA3 1.63/Reserved	
			0xA4 1.64/Reserved	
			0xA5 1.65/Reserved	
			0xA6 1.66/Reserved	
			0xA7 1.67/Reserved	
			0xA8 1.68/Reserved	
			0xA9 1.69/Reserved	
			0xAA 1.70/Reserved	
			0xAB 1.71/Reserved	
			0xAC 1.72/Reserved	
			0xAD 1.73/Reserved	
			0xAE 1.74/Reserved	
			0xAF 1.75/Reserved	
			0xB0 1.76/Reserved	



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**High Current, Highly Configurable System PMIC**

Bit	Type	Field Name	Description	Reset
			0xB1 1.77/Reserved	
			0xB2 1.78/Reserved	
			0xB3 1.79/Reserved	
			0xB4 1.80/Reserved	
			0xB5 1.81/Reserved	
			0xB6 1.82/Reserved	
			0xB7 1.83/Reserved	
			0xB8 1.84/Reserved	
			0xB9 1.85/Reserved	
			0xBA 1.86/Reserved	
			0xBB 1.87/Reserved	
			0xBC 1.88/Reserved	
			0xBD 1.89/Reserved	
			0xBE 1.90/Reserved	
			0xBF Reserved	
			0xFF Reserved	

High Current, Highly Configurable System PMIC

9 Package Information

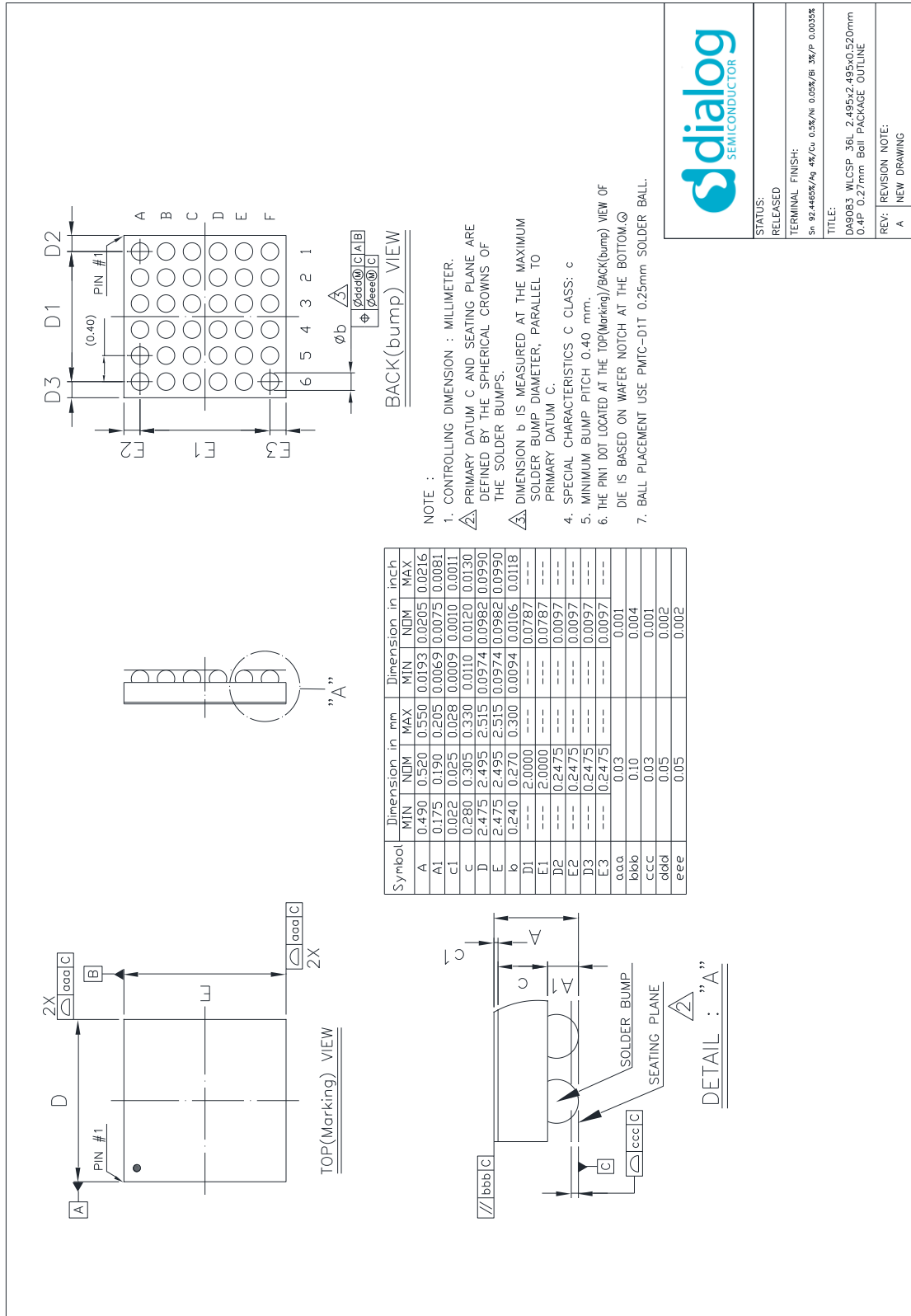


Figure 16: Package Outline Diagram

## High Current, Highly Configurable System PMIC

### 9.1 Moisture Sensitivity Level

The Moisture Sensitivity Level (MSL) is an indicator for the maximum allowable time period (floor lifetime) in which a moisture sensitive plastic device, once removed from the dry bag, can be exposed to an environment with a specified maximum temperature and a maximum relative humidity before the solder reflow process. The MSL classification is defined in [Table 39](#).

For detailed information on MSL levels refer to the IPC/JEDEC standard J-STD-020, which can be downloaded from <http://www.jedec.org>.

The package is qualified for MSL 1.

**Table 39: MSL Classification**

MSL Level	Floor Lifetime	Conditions
MSL 4	72 hours	30 °C / 60 % RH
MSL 3	168 hours	30 °C / 60 % RH
MSL 2A	4 weeks	30 °C / 60 % RH
MSL 2	1 year	30 °C / 60 % RH
MSL 1	Unlimited	30 °C / 85 % RH

### 9.2 WLCSP Handling

Manual handling of WLCSP packages should be reduced to the absolute minimum. In cases where it is still necessary, a vacuum pick-up tool should be used. In extreme cases plastic tweezers could be used, but metal tweezers are not acceptable, since contact may easily damage the silicon chip.

Removal of a WLCSP package will cause damage to the solder balls. Therefore a removed sample cannot be reused.

WLCSP packages are sensitive to visible and infrared light. Precautions should be taken to properly shield the chip in the final product.

### 9.3 Soldering Information

Refer to the IPC/JEDEC standard J-STD-020 for relevant soldering information. This document can be downloaded from <http://www.jedec.org>.

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## High Current, Highly Configurable System PMIC

### 10 Ordering Information

The ordering number consists of the part number followed by a suffix indicating the packing method. For details and availability, please consult Dialog Semiconductor's [customer support portal](#) or your local sales representative.

**Table 40: Ordering Information**

Part Number (Note 1)	Package	Size (mm)	Shipment Form	Pack Quantity
DA9083-xxUUA2	36 WLCSP	2.5 x 2.5	T&R	6000
DA9083-xxUUA6	36 WLCSP	2.5 x 2.5	Waffle Tray	500

**Note 1** xx represents the OTP variant.

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11 Application Information

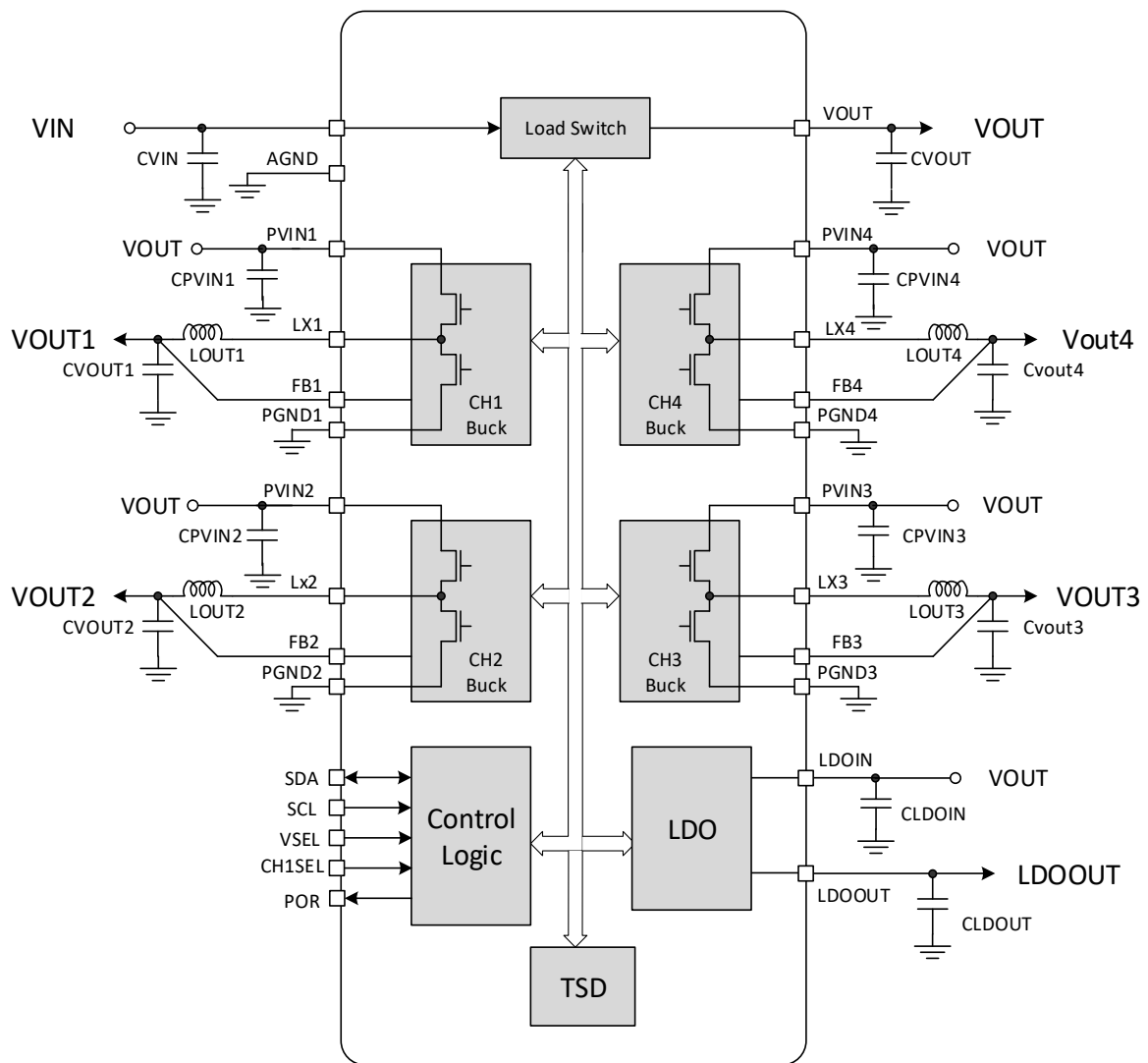


Figure 17: Applications Diagram

## High Current, Highly Configurable System PMIC

### Status Definitions

Revision	Datasheet Status	Product Status	Definition
1.<n>	Target	Development	This datasheet contains the design specifications for product development. Specifications may be changed in any manner without notice.
2.<n>	Preliminary	Qualification	This datasheet contains the specifications and preliminary characterization data for products in pre-production. Specifications may be changed at any time without notice in order to improve the design.
3.<n>	Final	Production	This datasheet contains the final specifications for products in volume production. The specifications may be changed at any time in order to improve the design, manufacturing and supply. Major specification changes are communicated via Customer Product Notifications. Datasheet changes are communicated via <a href="http://www.dialog-semiconductor.com">www.dialog-semiconductor.com</a> .
4.<n>	Obsolete	Archived	This datasheet contains the specifications for discontinued products. The information is provided for reference only.

### RoHS Compliance

Dialog Semiconductor's suppliers certify that its products are in compliance with the requirements of Directive 2011/65/EU of the European Parliament on the restriction of the use of certain hazardous substances in electrical and electronic equipment. RoHS certificates from our suppliers are available on request.

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## High Current, Highly Configurable System PMIC

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