19-6534; Rev 0; 12/12
备有评估板

MAX8967

双通道、2A降压型转换器，内置6个LDO，用于基带和应用处理器供电

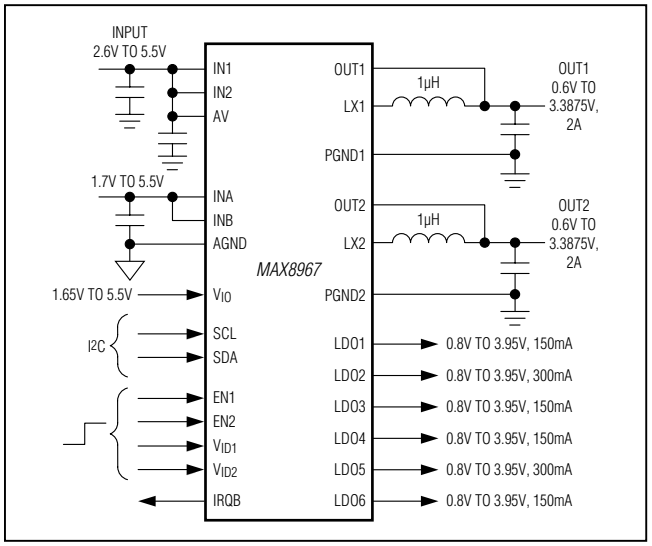
概述

MAX8967是一款集成了两路DC-DC开关型降压转换器和六路可支持远端电容的LDO。降压转换器可分别提供高达2A的负载驱动电流。两路LDO提供最高300mA负载电流，其余四路LDO提供最高150mA负载电流。两路降压转换器均具有远端检测功能，允许负载远离IC。IC工作在2.6V至5.5V输入电源范围。

4.4MHz固定频率PWM工作以及180°相差，允许器件选用小尺寸外部元件。轻载条件下，降压转换器自动切换到跳脉冲模式；该模式下，只在需要时进行开关操作，实现高效工作。将任一降压转换器置于绿色模式时，转换器的静态耗流可降至5µA (典型值)。

IC能够通过I²C接口动态调节输出电压。每个降压转换器带有两个用于输出电压配置的寄存器和一个用于配置电压上升速率。器件提供专有的使能引脚和V_{ID}引脚，在两个输出电压设置之间切换。此外，还提供中断输出，允许IC向主控制器发出报警。

典型工作电路



优势和特性

- 封装紧凑的多路输出PMIC
  - ✧ 双通道、2A降压转换器，带远端输出电压检测
  - ✧ 两个300mA LDO
  - ✧ 四个150mA LDO
  - ✧ 关断电流小于1µA
  - ✧ 2.32mm x 2.44mm封装
- 多用途降压转换器
  - ✧ 可通过I²C总线设置输出电压(0.6V至3.3875V)
  - ✧ 可编程输出电压摆率(12.5mV/µs至50mV/µs)
  - ✧ 通过$V_{ID_}$引脚动态切换两个输出电压配置
- 高效降压型转换器
  - ✧ 内置同步整流器，效率超过95%
  - ✧ 轻载时自动进入跳脉冲模式
  - ✧ 61µA (典型值)低静态电流
  - ✧ 绿色模式、5µA (典型值)/降压转换器
- 可编程LDO
  - ✧ 可编程输出电压(0.8V至3.95V，步长为50mV)
  - ✧ 可编程软启动摆率(5mV/µs至100mV/µs)
- 减小元件尺寸和电路板面积
  - ✧ 4.4MHz降压开关，允许使用1µH电感
  - ✧ 所有LDO需要COUT = 1µF
  - ✧ LDO支持远端电容，减小电路板面积
  - ✧ 内部提供降压转换器和LDO反馈

应用

手机和智能电话

平板电脑

便携设备

定购信息在数据资料的最后给出。

Note: *Some revisions of this device may incorporate deviations from published specifications known as errata. Multiple revisions of any device may be simultaneously available through various sales channels. For information about device errata, go to:* ***china.maximintegrated.com/errata****.*

ABSOLUTE MAXIMUM RATINGS

IN1, IN2, INA, INB, AV, OUT1, OUT2, ,SCL, SDA, SNSP1, SNSN1, SNSP2, SNSN2 to AGND ..... -0.3V to +6.0V
EN1, EN2, $V_{ID\_}$, V_{IO}, IRQB to AGND ..... -0.3V to (V_{AV} + 0.3V)
LDO1, LDO2, LDO3 to AGND ..... -0.3V to (V_{INA} + 0.3V)
LDO4, LDO5, LDO6 to AGND ..... -0.3V to (V_{INB} + 0.3V)
PGND1, PGND2 to AGND ..... -0.3V to +0.3V
LX1, LX2 Current ..... 2.0A_{RMS}

Continuous Power Dissipation (T_A = +70°C)
30-Bump, 2.32mm x 2.44mm WLP
(derate 20.4mW/°C above +70°C) 1632mW
Operating Temperature ..... -40°C to +85°C
Junction Temperature ..... +150°C
Storage Temperature Range ..... -65°C to +150°C
Soldering Temperature (reflow) ..... +260°C

CAUTION! ESD SENSITIVE DEVICE

PACKAGE THERMAL CHARACTERISTICS (Note 1)

WLP
Junction-to-Ambient Thermal Resistance (θ_{JA}) ..... 49°C/W
Junction-to-Case Thermal Resistance (θ_{JC}) ..... 9°C/W

Note 1: Package thermal resistances were obtained using the method described in JEDEC specification JESD51-7, using a four-layer board. For detailed information on package thermal considerations, refer to **china.maximintegrated.com/thermal-tutorial**.

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

ELECTRICAL CHARACTERISTICS

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Operating Input Voltage Range	V_{INPUT}	V_{IN1} = V_{IN2} = V_{AV}		2.6		5.5	V
Overvoltage Lockout	OVP	V_{AV} rising, 100mV hysteresis		5.70	5.85	6.00	V
AV Undervoltage Lockout (UVLO)	UVLO	V_{AV} rising, 55mV hysteresis		2.3	2.4	2.5	V
V_{IO} Operating Range	V_{IO}			1.65		5.5	V
V_{IO} Enable Threshold High				1.4			V
V_{IO} Enable Threshold Low						0.4	V
V_{IO} Enable Hysteresis					100		mV
V_A Shutdown Current		V_{AV} > 2.6V, V_{IO} < 0.4V, EN1 = EN2 = 0	T_A = +25°C	-5	+0.1	+0.5	µA
			T_A = +85°C		0.1		
V_A Standby Current		V_{AV} > 2.6V, V_{IO} > 1.4V, EN1 = EN2 = 0			28		µA
V_{IO} Supply Current		All logic in high or low state			0.1		µA
Quiescent Current (Green Mode)		No switching, $V_{OUT\_}$ = 1.2V, step-down converter in green mode, all LDOs off			5		µA
Quiescent Current (Step-Down Converters On)		No switching, $V_{OUT\_}$ = 1.2V remote sense off			61	85	µA
Quiescent Current (All On Normal Mode)		No switching, $V_{OUT\_}$ = 1.2V, remote sense off, both step-down converters in normal mode, all LDOs on			176		µA
Quiescent Current (Step-Down Converters On, Normal Mode Remote sense ON)		No switching, $V_{OUT\_}$ = 1.2V, remote sense on, both step-down converters on			75	120	µA

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Quiescent Current (All On Green Mode)		No switching, $V_{OUT\_}$= 1.2V, both step-down converters in green mode, all LDOs on			40		µA
FPWM Current		Forced PWM, one step-down converter on only, I_{OUT} = 0A, C_{OUT1} = C_{OUT2} = 22µF, L1 = L2 = 1µH, V_{OUT} = 1.2V			9		mA
Thermal Shutdown		T_A rising, 20°C hysteresis			+160		°C
STEP-DOWN CONVERTER 1							
Output Current		L = 1µH		2			A
Adjustable Output Voltage Range		12.5mV steps		0.6000		3.3875	V
Settling Time		FPWM, I_{OUT1} = 0.2A C_{OUT1} = 22µF, L = 1µH, measure from V_{OUT1} = 1V to V_{OUT1} = 1.2V		20			µs
Output Voltage Accuracy (FPWM)		V_{OUT1} = 1.2V, FPWM, V_{OUT1} < 0.95 x V_{IN}, remote sense disabled (Note 3)		1.176	1.20	1.224	V
Output Voltage Accuracy (Green Mode)		Green mode, $I_{OUT1} \leq$ 5mA (Note 3)		1.152	1.200	1.248	V
Line Regulation		V_{OUT1} = 1.2V, I_{OUT1} = 0.2A, C_{OUT1} = 22µF, L = 1µH			0.04		%/V
Load Regulation		V_{OUT1} = 1.2V, 0 ≤ I_{OUT1} ≤ 2A			+0.125		%/A
Switching Frequency				3.96	4.40	4.84	MHz
Peak Current Limit		FPWM mode		2500	3000	3600	mA
Valley Current Limit		FPWM mode			1800		mA
Negative Current limit		FPWM mode			1		A
Zero-Crossing Current Threshold		Used in skip mode and green mode			20		mA
PMOS On-Resistance		$V_{IN\_}$ = 3.6V, I_{OUT1} = 190mA			60		mΩ
NMOS On-Resistance		$V_{IN\_}$ = 3.6V, I_{OUT1} = 190mA			50		mΩ
LX Leakage		V_{LX1} = V_{IN} , 0V	T_A = +25°C	-1	0.1	+1	µA
			T_A = +85°C		1		
Output Discharge Resistor in Shutdown		Feature must be active, see the *Register Definitions* section			100		Ω

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Step Ramp Rate		Slew_ _[7:6] = 00, see Table 15		12.5		mV/µs
		Slew_ _[7:6] = 01, see Table 15		25		
		Slew_ _[7:6] = 10, see Table 15		50		
Load Transient FPWM		FPWM mode, V_{OUT1} = 1.2V, load steps between 0.2 to 1.2A in 30ns, C_{OUT1} = 22µF, L = 1µH		40		mV
Load Transient (Skip Mode)		Skip mode, V_{OUT} = 1.2V, load steps between 0.2 to 1.2A in 30ns, C_{OUT1} = 22µF, L = 1µH		40		mV
Line Transient		V_{OUT} = 1.2V, I_{OUT1} = 1.2A, C_{OUT1} = 22µF, L = 1µH.		0.25		%/V
Overshoot		Transitions between output voltage states 1.0 and 1.4V, I_{OUT1} = 400mA, C_{OUT1} = 22µF, L = 1µH		40		mV
Chip Enable Time		From chip standby state until first output voltage ramp starts		250		µs
Enable Time		From enabling until voltage ramp starts, the IC is in normal operating state with previous state shut down, $I_{OUT1} \leq$ 100mA, L = 1µH, C_{OUT1} = 22µF		25		µs
Output POK Threshold		V_{OUT1} falling, 1.2V nominal setting	86	90	94	$\%V_{OUT1}$
Output POK Threshold Hysteresis				3		%
Minimum Output Capacitance				12		µF
Minimum Inductance		1µH inductor with 30% duration		1		µH
STEP-DOWN CONVERTER 2						
Output Current		L = 1µH	2			A
Adjustable Output Voltage Range		12.5mV steps	0.6000		3.3875	V
Settling Time		FPWM, I_{OUT2} = 0.2A, C_{OUT2} = 22µF, L = 1µH, measure from V_{OUT2} = 1V to V_{OUT2} = 1.2V		20		µs
Output Voltage Accuracy (FPWM)		V_{OUT2} = 1.2V, FPWM, V_{OUT2} < 0.95 x V_{IN}, remote sense disabled (Note 3)	1.176	1.20	1.224	V
Output Voltage Accuracy (Green Mode)		Green mode, $I_{OUT2} \leq$ 5mA (Note 3)	1.152	1.200	1.248	V
Line Regulation		V_{OUT2} = 1.2V, I_{OUT2} = 0.2A, C_{OUT2} = 22µF, L = 1µH		0.04		%/V

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Load Regulation		V_{OUT2} = 1.2V, 0 ≤ I_{OUT2} ≤ 2A			+0.125		%/A
Switching Frequency				3.96	4.40	4.84	MHz
Peak Current Limit		FPWM mode		2500	3000	3600	mA
Valley Current Limit		FPWM mode			1800		mA
Negative Current Limit		FPWM mode			1		A
Zero-Crossing Current Threshold		Used in skip mode and green mode			20		mA
PMOS On-Resistance		$V_{IN\_}$ = 3.6V, I_{OUT2} = 190mA			60		mΩ
NMOS On-Resistance		$V_{IN\_}$ = 3.6V, I_{OUT2} = 190mA			50		mΩ
LX Leakage		V_{LX2} = V_{IN} ,0V	T_A = +25°C	-1	0.1	+1	µA
			T_A = +85°C		1		
Output Discharge Resistor in Shutdown		Feature must be active, see the *Register Definitions* section			100		Ω
Output Step Ramp Rate		Slew_ _[7:6] = 00, see Table 15			12.5		mV/µs
		Slew_ _[7:6] = 01, see Table 15			25		
		Slew_ _[7:6] = 10, see Table 15			50		
Load Transient FPWM		FPWM mode, V_{OUT2} = 1.2V, load steps between 0.2 to 1.2A in 30ns, C_{OUT2} = 22µF, L = 1µH			40		mV
Load Transient (Skip Mode)		Skip mode, V_{OUT2} = 1.2V, load steps between 0.2 to 1.2A in 30ns, C_{OUT2} = 22µF, L = 1µH			40		mV
Line Transient		V_{OUT2} = 1.2V, I_{OUT2} = 1.2A, C_{OUT2} = 22µF, L = 1µH			0.25		%/V
Overshoot		Transitions between output voltage states 1.0V and 1.4V, I_{OUT21} = 400mA, C_{OUT2} = 22µF, L = 1µH			40		mV
Chip Enable Time		From chip standby state until first output voltage ramp starts			250		µs
Enable Time		From enabling until voltage ramp starts; the IC is in normal operating state with previous state shut down, I_{OUT2} ≤ 100mA, L = 1µH, C_{OUT2} = 22µF			25		µs
Output POK Threshold		V_{OUT2} falling, 1.2V nominal setting		86	90	94	%V_{OUT2}
Output POK Threshold Hysteresis					3		%
Minimum Output Capacitance					12		µF
Minimum Inductance		1µH inductor with 30% duration			1		µH

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
LDO1							
Input Voltage Range	$V_{IN,LDO1}$			1.7		5.5	V
Undervoltage Lockout	$V_{UVLO,LDO1}$	$V_{IN,LDO1}$ rising, 100mV hysteresis			1.6	1.7	V
Output Voltage Range	$V_{OUT,LDO1}$	V_{INLDO1} is the maximum of 3.7V or $V_{OUT,LDO1}$ + 0.3V		0.8		3.95	V
Maximum Output Current	$I_{MAX,LDO1}$	Normal mode		150			mA
		Green mode		5			
Minimum Output Capacitance	$C_{OUT,LDO1}$	(Note 4)	Normal mode		0.7		µF
			Green mode		0.7		
Bias Enable Time	t_{LBIAS1}	Time to enable LDO bias only, central bias is already enabled			90		µs
Bias Enable Currents	I_{QBIAS1}	LDO bias enabled, LDOBIASEN = 1			10		µA
AV Supply Current	$I_{AV,LDO1}$	No load	Shutdown, T_A = +25°C (Note 5)		0		µA
			Normal regulation		3	6	
			Green mode		0.5	3	
INA Input Supply Current	$I_{IN,LDO1}$	No load	Shutdown, T_A = +25°C (Note 6)		0		µA
			Normal regulation		15	30	
			Green mode		1	3	
Output Voltage Accuracy		Normal mode	$V_{IN,LDO1}$ = V_{NOM} + 0.3V to 5.5V with 1.7V minimum, $I_{OUT,LDO1}$ = 0.1mA to $I_{MAX,LDO1}$, $V_{NOM,LDO1}$ set to any voltage	-3		+3	%
		Green mode	$V_{IN,LDO1}$ = $V_{NOM,LDO1}$ + 0.3V to 5.5V with 2.4V minimum, $I_{OUT,LDO1}$ = 0.1mA to 5mA, $V_{NOM,LDO1}$ set to any voltage	-5		+5	

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP	MAX	UNITS
Load Regulation (Note 7)		Normal mode	$I_{OUT,LDO1}$ = 0.1mA to $I_{MAX,LDO1}$, $V_{IN,LDO1}$ = $V_{NOM,LDO1}$ + 0.3V with 1.7V minimum, $V_{NOM,LDO1}$ set to any voltage			0.1		%
		Green mode	$I_{OUT,LDO1}$ = 0.1mA to 5mA, $V_{IN,LDO1}$ = $V_{NOM,LDO1}$ + 0.3V with 2.4V minimum, $V_{NOM,LDO1}$ set to any voltage			0.2		
Line Regulation (Note 7)		Normal mode	$V_{IN,LDO1}$ = $V_{NOM,LDO1}$ + 0.3V to 5.5V with 1.7V minimum, $I_{OUT,LDO1}$ = 0.1mA, $V_{NOM,LDO1}$ set to any voltage			0.03		%/V
		Green mode	$V_{IN,LDO1}$ = $V_{NOM,LDO1}$ + 0.3V to 5.5V with 2.4V minimum, $I_{OUT,LDO1}$ = 0.1mA, $V_{NOM,LDO1}$ set to any voltage			0.1		
Dropout Voltage	$V_{DO,LDO1}$	Normal mode	$I_{OUT,LDO1}$ = $I_{MAX,LDO1}$	$V_{IN,LDO1}$ = 3.7V		60	120	mV
				$V_{IN,LDO1}$ = 1.7V		150	300	
		Green mode	$I_{OUT,LDO1}$ = 5mA, $V_{IN,LDO1}$ = 3.7V			50	100	
Output Current Limit	$I_{LIM,LDO1}$	$V_{OUT,LDO1}$ = 0V			150	225	375	mA
Output Load Transient (LDO1OVCLMP_EN = 1) (Notes 4, 7)		Normal mode, $V_{IN,LDO1}$ = $V_{NOM,LDO1}$ + 0.3V to 5.5V with 1.7V absolute minimum, $I_{OUT,LDO1}$ = 1% to 100% to 1% of $I_{MAX,LDO1}$, $V_{NOM,LDO1}$ set to any voltage, t_{R1} = t_{F1} = 1µs, LDO1COMP[5:4] = 01				66		mV
		Green mode, $V_{IN,LDO1}$ = $V_{NOM,LDO1}$ + 0.3V to 5.5V with 2.4V absolute minimum, $I_{OUT,LDO1}$ = 0.05mA to 5mA to 0.05mA, $V_{NOM,LDO1}$ set to any voltage, t_{R1} = t_{F1} = 1µs				25		

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP	MAX	UNITS
Output Line Transient (Notes 3, 6)		Normal mode, $V_{IN,LDO1}$ = $V_{NOM,LDO1}$ + 0.3V to $V_{NOM,LDO1}$ + 0.8V to $V_{NOM,LDO1}$ + 0.3V with 1.7V absolute minimum, t_{R1} = t_{F1} = 1µs, $I_{OUT,LDO1}$ = $I_{MAX,LDO1}$, $V_{NOM,LDO1}$ set to any voltage				5		mV
		Green mode, $V_{IN,LDO1}$ = $V_{NOM,LDO1}$ + 0.3V to $V_{NOM,LDO1}$ + 0.8V to $V_{NOM,LDO1}$ + 0.3V with 2.4V absolute minimum, t_{R1} = t_{F1} = 1µs, $I_{OUT,LDO1}$ = 5mA, $V_{NOM,LDO1}$ set to any voltage				5		
Power-Supply Rejection	$PSRR_{LDO1}$	Rejection from $V_{IN,LDO1}$ to $V_{OUT,LDO1}$ $I_{OUT,LDO1}$ = 10% of $I_{MAX,LDO1}$	$V_{INLDO1DC}$ = $V_{NOM,LDO1}$ + 0.3V $V_{INLDO1AC}$ = 50mV	f = 1kHz		63		dB
				f = 10kHz		51		
				f = 100kHz		44		
				f = 1000kHz		57		
				f = 4450kHz		33		
		Green mode, $I_{OUT,LDO1}$ = 1mA, f = 1kHz, rejection from $V_{IN,LDO1}$ to $V_{OUT,LDO1}$				50		
Output Noise		f = 10Hz to 100kHz, $I_{OUT,LDO1}$ = 10% of $I_{MAX,LDO1}$		$V_{OUT,LDO1}$ = 0.8V		45		$µV_{RMS}$
				$V_{OUT,LDO1}$ = 1.8V		45		
				$V_{OUT,LDO1}$ = 3.7V		60		
Startup Ramp Rate	$t_{SS,LDO1}$	After enabling		LDO1SS = 0		100		mV/µs
				LD01SS = 1		5		
Active-Discharge Resistance		$V_{OUT,LDO1}$ = 1V, output disabled		Active discharge enabled, LDO1ADE = 1		0.16	0.3	kΩ
				Active discharge disabled, LDO1ADE = 0	1000			

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Clamp Active Regulation Voltage		Clamp active (LDO1OVCLMP_EN = 1), LDO output sinking 0.1mA			$V_{NOM,LDO1}$		V
Clamp Disabled Overvoltage Sink Current		$V_{OUT,LDO1}$ = $V_{NOM,LDO1}$ x 110%			2.2		µA
Enable Delay (Note 4)	$t_{LON,LDO1}$	Time from LDO enable command received to the output starting to slew	Ramp rate = 100mV/µs		10		µs
			Ramp rate = 5mV/µs		60		
Disable Delay (Note 4)		After LDO is disabled; the LDO output voltage discharges based on load and C_{OUT}; to ensure fast discharge times, enable the active discharge resistor			0.1		µs
Transition Time from Green Mode to Normal Mode					10		µs
Thermal Shutdown		Output disabled or enabled	T_J rising		165		°C
			T_J falling		150		
Power-OK Threshold	$V_{POKTHL1}$	$V_{OUT,LDO1}$ when V_{POK} switches	$V_{OUT,LDO1}$ rising		92	95	%
			$V_{OUT,LDO1}$ falling	84	87		
Power-OK Noise Pulse Immunity	V_{POKNF1}	$V_{OUT,LDO1}$ pulsed from 100% to 80% of regulation			25		µs
LDO2							
Input Voltage Range	$V_{IN,LDO2}$			1.7		5.5	V
Undervoltage Lockout	$V_{UVLO,LDO2}$	$V_{IN,LDO2}$ rising, 100mV hysteresis			1.6	1.7	V
Output Voltage Range	$V_{OUT,LDO2}$	$V_{IN,LDO2}$ is the maximum of 3.7V or $V_{OUT,LDO2}$ + 0.3V		0.8		3.95	V
Maximum Output Current	$I_{MAX,LDO2}$	Normal mode		300			mA
		Green mode		5			
Minimum Output Capacitance	$C_{OUT,LDO2}$	(Note 3)	Normal mode		0.7		µF
			Green mode		0.7		
Bias Enable Time	t_{LBIAS2}	Time to enable LDO bias only, central bias is already enabled			90		µs
Bias Enable Current	I_{LBIAS2}	LDO bias enabled			10		µA

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
AV Supply Current	$I_{AV,LDO2}$	No load	Shutdown, T_A = +25°C (Note 5)		0		µA
			Normal regulation		3	6	
			Green mode		0.5	3	
INA Supply Current	$I_{IN,LDO2}$	No load	Shutdown, T_A = +25°C (Note 5)		0		µA
			Normal regulation		17	30	
			Green mode		1	3	
Output Voltage Accuracy		Normal mode	$V_{IN,LDO2}$ = $V_{NOM,LDO2}$ + 0.3V to 5.5V with 1.7V minimum, $I_{OUT,LDO2}$ = 0.1mA to $I_{MAX,LDO2}$, $V_{NOM,LDO2}$ set to any voltage	-3		+3	%
		Green mode	$V_{IN,LDO2}$ = $V_{NOM,LDO2}$ + 0.3V to 5.5V with 2.4V minimum, $I_{OUT,LDO2}$ = 0.1mA to 5mA, $V_{NOM,LDO2}$ set to any voltage	-5		+5	
Load Regulation (Note 6)		Normal mode	$I_{OUT,LDO2}$ = 0.1mA to $I_{MAX,LDO2}$, $V_{IN,LDO2}$ = $V_{NOM,LDO2}$ + 0.3V with 1.7V minimum, $V_{NOM,LDO2}$ set to any voltage		0.1		%
		Green mode	$I_{OUT,LDO2}$ = 0.1mA to 5mA, $V_{IN,LDO2}$ = $V_{NOM,LDO2}$ + 0.3V with 2.4V minimum, $V_{NOM,LDO2}$ set to any voltage		0.2		
Line Regulation (Note 6)		Normal mode	$V_{IN,LDO2}$ = $V_{NOM,LDO2}$ + 0.3V to 5.5V with 1.7V minimum; $I_{OUT,LDO2}$ = 0.1mA, $V_{NOM,LDO2}$ set to any voltage		0.03		%/V
		Green mode	$V_{IN,LDO2}$ = $V_{NOM,LDO2}$ + 0.3V to 5.5V with 2.4V minimum; $I_{OUT,LDO2}$ = 0.1mA, $V_{NOM,LDO2}$ set to any voltage		0.1		

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP	MAX	UNITS
Dropout Voltage	$V_{DO,LDO2}$	Normal mode	$I_{OUT,LDO2}$ = $I_{MAX,LDO2}$	$V_{IN,LDO2}$ = 3.7V		50	100	mV
				$V_{IN,LDO2}$ = 1.7V		150	450	
		Green mode	$I_{OUT,LDO2}$ = 5mA, $V_{IN,LDO2}$ = 3.7V			150	300	
Output Current Limit	$I_{LIM,LDO2}$	$V_{OUT,LDO2}$ = 0V			300	450	750	mA
Output Load Transient (LDO2OVCLMP_EN = 1) (Notes 3, 6)		Normal mode, $V_{IN,LDO2}$ = $V_{NOM,LDO2}$ + 0.3V to 5.5V with 1.7V absolute minimum; $I_{OUT,LDO2}$ = 1% to 100% to 1% of $I_{MAX,LDO2}$, $V_{NOM,LDO2}$ set to any voltage, t_{R2} = t_{F2} = 1µs, LDO2COMP[5:4] = 01				66		mV
		Green mode, $V_{IN,LDO2}$ = $V_{NOM,LDO2}$ + 0.3V to 5.5V with 2.4V absolute minimum; $I_{OUT,LDO2}$ = 0.05mA to 5mA to 0.05mA, $V_{NOM,LDO2}$ set to any voltage, t_{R2} = t_{F2} = 1µs				25		
Output Line Transient (Notes 3, 6)		Normal mode, $V_{IN,LDO2}$ = $V_{NOM,LDO2}$ + 0.3V to $V_{NOM,LDO2}$ + 0.8V to $V_{NOM,LDO2}$ + 0.3V with 1.7V absolute minimum; t_{R2} = t_{F2} = 1µs, $I_{OUT,LDO2}$ = $I_{MAX,LDO2}$, $V_{NOM,LDO2}$ set to any voltage				5		mV
		Green mode, $V_{IN,LDO2}$ = $V_{NOM,LDO2}$ + 0.3V to $V_{NOM,LDO2}$ + 0.8V to $V_{NOM,LDO2}$ + 0.3V with 2.4V absolute minimum; t_{R2} = t_{F2} = 1µs, $I_{OUT,LDO2}$ = 5mA, $V_{NOM,LDO2}$ set to any voltage				5		

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP	MAX	UNITS
Power-Supply Rejection	$PSRR_{LDO2}$	Rejection from $V_{IN,LDO2}$ to $V_{OUT,LDO2}$ $I_{OUT,LDO2}$ = 10% of $I_{MAX,LDO2}$	$V_{INLDO2DC}$ = $V_{NOM,LDO2}$ +0.3V $V_{INLDO2AC}$ = 50mV	f = 1kHz		63		dB
				f = 10kHz		51		
				f = 100kHz		44		
				f = 1000kHz		57		
				f = 4450kHz		33		
		Green mode, $I_{OUT,LDO2}$ = 1mA, f = 1kHz, rejection from $V_{IN,LDO2}$ to $V_{OUT,LDO2}$				50		
Output Noise		f = 10Hz to 100kHz, $I_{OUT,LDO2}$ = 10% of $I_{MAX,LDO2}$	$V_{OUT,LDO2}$ = 0.8V			45		μV_{RMS}
			$V_{OUT,LDO2}$ = 1.8V			45		
			$V_{OUT,LDO2}$ = 3.7V			60		
Startup Ramp Rate	t_{SS22}	After enabling	LDO2SS = 0			100		mV/µs
			LDO2SS = 1			5		
Active-Discharge Resistance		$V_{OUT,LDO2}$ = 1V, output disabled	Active discharge enabled, LDO2ADE = 1			0.16	0.3	kΩ
			Active discharge disabled, LDO2ADE = 0		1000			
Clamp Active Regulation Voltage		Clamp active (LDO2OVCLMP_EN = 1), LDO output sinking 0.1mA				$V_{NOM, LDO2}$		V
Clamp Disabled Overvoltage Sink Current		$V_{OUT,LDO2}$ = $V_{NOM,LDO2}$ x 110%				2.2		µA
Enable Delay (Note 3)	t_{LON2}	Time from LDO enable command received to the output starting to slew	Ramp rate = 100mV/µs			10		µs
			Ramp rate = 5mV/µs			60		
Disable Delay (Note 3)		After LDO is disabled; the LDO output voltage discharges based on load and C_{OUT}; to ensure fast discharge times, enable the active discharge resistor				0.1		µs

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Transition Time from Green Mode to Normal Mode					10		µs
Thermal Shutdown		Output disabled or enabled	T_J rising		165		°C
			T_J falling		150		
Power-OK Threshold	$V_{POKTHL2}$	$V_{OUT,LDO2}$ when V_{POK} switches	$V_{OUT,LDO2}$ rising		92	95	%
			$V_{OUT,LDO2}$ falling	84	87		
Power-OK Noise Pulse Immunity	V_{POKNF2}	$V_{OUT,LDO2}$ pulsed from 100% to 80% of regulation			25		µs
LDO3							
Input Voltage Range	$V_{IN,LDO3}$			1.7		5.5	V
Undervoltage Lockout	$V_{UVLO,LDO3}$	$V_{IN,LDO3}$ rising, 100mV hysteresis			1.6	1.7	V
Output Voltage Range	$V_{OUT,LDO3}$	$V_{IN,LDO3}$ is the maximum of 3.7V or $V_{OUT,LDO3}$ + 0.3V		0.8		3.95	V
Maximum Output Current	$I_{MAX,LDO3}$	Normal mode		150			mA
		Green mode		5			
Minimum Output Capacitance	$C_{OUT,LDO3}$	(Note 3)	Normal mode		0.7		µF
			Green mode		0.7		
Bias Enable Time	t_{LBIAS3}	Time to enable LDO bias only, central bias is already enabled			90		µs
Bias Enable Currents	I_{QBIAS3}	LDO bias enabled			10		µA
AV Supply Current	$I_{AV,LDO3}$	No load	Shutdown, T_A = +25°C (Note 4)		0		µA
			Normal regulation		3	6	
			Green mode		0.5	3	
INA Supply Current	$I_{IN,LDO3}$	No load	Shutdown, T_A = +25°C (Note 5)		0		µA
			Normal regulation		15	30	
			Green mode		1	3	

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP	MAX	UNITS
Output Voltage Accuracy		Normal mode	$V_{IN,LDO3}$ = $V_{NOM,LDO3}$ + 0.3V to 5.5V with 1.7V minimum, $I_{OUT,LDO3}$ = 0.1mA to $I_{MAX,LDO3}$, $V_{NOM,LDO3}$ set to any voltage		-3		+3	%
		Green mode	$V_{IN,LDO3}$ = $V_{NOM,LDO3}$ + 0.3V to 5.5V with 2.4V minimum, $I_{OUT,LDO3}$ = 0.1mA to 5mA, $V_{NOM,LDO3}$ set to any voltage		-5		+5	
Load Regulation (Note 6)		Normal mode	$I_{OUT,LDO3}$ = 0.1mA to $I_{MAX,LDO3}$, $V_{IN,LDO3}$ = $V_{NOM,LDO3}$ + 0.3V with 1.7V minimum, $V_{NOM,LDO3}$ set to any voltage			0.1		%
		Green mode	$I_{OUT,LDO3}$ = 0.1mA to 5mA, $V_{IN,LDO3}$ = $V_{NOM,LDO3}$ + 0.3V with 2.4V minimum, $V_{NOM,LDO3}$ set to any voltage			0.2		
Line Regulation (Note 6)		Normal mode	$V_{IN,LDO3}$ = $V_{NOM,LDO3}$ + 0.3V to 5.5V with 1.7V minimum, $I_{OUT,LDO3}$ = 0.1mA, $V_{NOM,LDO3}$ set to any voltage			0.03		%/V
		Green mode	$V_{IN,LDO3}$ = $V_{NOM,LDO3}$ + 0.3V to 5.5V with 2.4V minimum, $I_{OUT,LDO3}$ = 0.1mA, $V_{NOM,LDO3}$ set to any voltage			0.1		
Dropout Voltage	$V_{DO,LDO3}$	Normal Mode	$I_{OUT,LDO3}$ = $I_{MAX,LDO3}$	$V_{IN,LDO3}$ = 3.7V		60	120	mV
				$V_{IN,LDO3}$ = 1.7V		150	300	
		Green Mode	$I_{OUT,LDO3}$ = 5mA, $V_{IN,LDO3}$ = 3.7V			50	100	
Output Current Limit	$I_{LIM,LDO3}$	V_{OUT} = 0V			150	225	375	mA

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP	MAX	UNITS
Output Load Transient (LDO3OVCLMP_EN = 1) (Notes 3, 6)		Normal mode, $V_{IN,LDO3}$ = $V_{NOM,LDO3}$ + 0.3V to 5.5V with 1.7V absolute minimum, $I_{OUT,LDO3}$ = 1% to 100% to 1% of $I_{MAX,LDO3}$, $V_{NOM,LDO3}$ set to any voltage, t_{R3} = t_{F3} = 1µs, LDO3COMP[5:4] = 01				66		mV
		Green mode, $V_{IN,LDO3}$ = $V_{NOM,LDO3}$ + 0.3V to 5.5V with 2.4V absolute minimum, $I_{OUT,LDO3}$ = 0.05mA to 5mA to 0.05mA, $V_{NOM,LDO3}$ set to any voltage, t_{R3} = t_{F3} = 1µs				25		
Output Line Transient (Notes 3, 6)		Normal mode, $V_{IN,LDO3}$ = $V_{NOM,LOD3}$ + 0.3V to $V_{NOM,LDO3}$ + 0.8V to $V_{NOM,LDO3}$ + 0.3V with 1.7V absolute minimum, t_{R3} = t_{F3} = 1µs, $I_{OUT,LOD3}$ = $I_{MAX,LDO3}$, $V_{NOM,LOD3}$ set to any voltage				5		mV
		Green mode, $V_{IN,LDO3}$ = $V_{NOM,LOD3}$ + 0.3V to $V_{NOM,LDO3}$ + 0.8V to $V_{NOM,LDO3}$ + 0.3V with 2.4V absolute minimum, t_{R3} = t_{F3} =1µs, $I_{OUT,LOD3}$ = 5mA, $V_{NOM,LOD3}$ set to any voltage				5		
Power-Supply Rejection	$PSRR_{LDO3}$	Rejection from $V_{IN,LDO3}$ to $V_{OUT,IDO3}$ $I_{OUT,LDO3}$ = 10% of $I_{MAX,LDO3}$	$V_{INLDO3DC}$ = $V_{NOM,LDO3}$ + 0.3V $V_{INLDO3AC}$ = 50mV	f = 1kHz		63		dB
				f = 10kHz		51		
				f = 100kHz		44		
				f = 1000kHz		57		
				f = 4450kHz		33		
		Green mode, $I_{OUT,LDO3}$ = 1mA, f = 1kHz, rejection from $V_{IN,LDO3}$ to $V_{OUT,LDO3}$				50		

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Output Noise		f = 10Hz to 100kHz, I_{OUT} = 10% of $I_{MAX,LDO3}$	$V_{OUT,LDO3}$ = 0.8V		45		μV_{RMS}
			$V_{OUT,LDO3}$ = 1.8V		45		
			$V_{OUT,LDO3}$ = 3.7V		60		
Startup Ramp Rate	t_{SS3}	After enabling	LDO3SS = 0		100		mV/µs
			LDO3SS = 1		5		
Active-Discharge Resistance		$V_{OUT,LDO3}$ = 1V, output disabled	Active discharge enabled, LDO3ADE = 1		0.16	0.3	kΩ
			Active discharge disabled, LDO3ADE = 0	1000			
Clamp Active Regulation Voltage		Clamp active (LDO3OVCLMP_EN = 1), LDO output sinking 0.1mA			$V_{NOM,LDO3}$		V
Clamp Disabled Overvoltage Sink Current		$V_{OUT,LDO3}$ = $V_{NOM,LDO3}$ x110%			2.2		µA
Enable Delay (Note 3)	t_{LON3}	Time from LDO enable command received to the output starting to slew	Ramp rate = 100mV/µs		10		µs
			Ramp rate = 5mV/µs		60		
Disable Delay (Note 3)		After LDO is disabled; the LDO output voltage discharges based on Load and $C_{OUT,LDO3}$; to ensure fast discharge times enable the active discharge resistor			0.1		µs
Transition Time from Green Mode to Normal Mode					10		µs
Thermal Shutdown		Output disabled or enabled	T_J rising		165		°C
			T_J falling		150		
Power-OK Threshold	$V_{POKTHL3}$	$V_{OUT,LDO3}$ when V_{POK} switches	$V_{OUT,LDO3}$ rising		92	95	%
			$V_{OUT,LDO3}$ falling	84	87		
Power-OK Noise Pulse Immunity	V_{POKNF3}	$V_{OUT,LDO3}$ pulsed from 100% to 80% of regulation			25		µs
LDO4							
Input Voltage Range	$V_{IN,LDO4}$			1.7		5.5	V
Undervoltage Lockout	$V_{UVLO,LDO4}$	$V_{IN,LDO4}$ rising, 100mV hysteresis			1.6	1.7	V
Output Voltage Range	$V_{OUT,LDO4}$	$V_{IN,LDO4}$ is the maximum of 3.7V or $V_{OUT,LDO4}$ + 0.3V		0.8		3.95	V
Maximum Output Current	$I_{MAX,LDO4}$	Normal mode		150			mA
		Green mode		5			
Minimum Output Capacitance	$C_{OUT,LDO4}$	(Note 3)	Normal mode		0.7		µF
			Green mode		0.7		

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Bias Enable Time	t_{LBIAS4}	Time to enable LDO bias only, central bias is already enabled			90		µs
Bias Enable Currents	I_{QBIAS4}	LDO bias enabled			10		µA
AV Supply Current	$I_{AV,LDO4}$	No load	Shutdown, T_A = +25°C (Note 4)		0		µA
			Normal regulation		3	6	
			Green mode		0.5	3	
INB Supply Current	$I_{IN,LDO4}$	No load	Shutdown, T_A = +25°C (Note 5)		0		µA
			Normal regulation		15	30	
			Green mode		1	3	
Output Voltage Accuracy		Normal mode	$V_{IN,LDO4}$ = $V_{NOM,LDO4}$ + 0.3V to 5.5V with 1.7V minimum, $I_{OUT,LDO4}$ = 0.1mA to $I_{MAX,LD04}$, $V_{NOM,LDO4}$ set to any voltage	-3		+3	%
		Green mode	$V_{IN,LDO4}$ = $V_{NOM,LDO4}$ + 0.3V to 5.5V with 2.4V minimum, $I_{OUT,LDO4}$ = 0.1mA to 5mA, $V_{NOM,LDO4}$ set to any voltage	-5		+5	
Load Regulation (Note 6)		Normal mode	$I_{OUT,LDO4}$ = 0.1mA to $I_{MAX,LD04}$, V_{IN} = $V_{NOM,LDO4}$ + 0.3V with 1.7V minimum, $V_{NOM,LDO4}$ set to any voltage		0.1		%
		Green mode	$I_{OUT,LDO4}$ = 0.1mA to 5mA, V_{IN} = $V_{NOM,LDO4}$ + 0.3V with 2.4V minimum, $V_{NOM,LDO4}$ set to any voltage		0.2		

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP	MAX	UNITS
Line Regulation (Note 6)		Normal mode	$V_{IN,LDO4}$ = $V_{NOM,LDO4}$ + 0.3V to 5.5V with 1.7V minimum, $I_{OUT,LDO4}$ = 0.1mA, $V_{NOM,LDO4}$ set to any voltage			0.03		%/V
		Green mode	$V_{IN,LDO4}$ = $V_{NOM,LDO4}$ + 0.3V to 5.5V with 2.4V minimum, $I_{OUT,LDO4}$ = 0.1mA, $V_{NOM,LDO4}$ set to any voltage			0.1		
Dropout Voltage	$V_{DO,LDO4}$	Normal mode	$I_{OUT,LDO4}$ = $I_{MAX,LD04}$	$V_{IN,LDO4}$ = 3.7V		60	120	mV
				$V_{IN,LDO4}$ = 1.7V		150	300	
		Green mode	$I_{OUT,LDO4}$ = 5mA, $V_{IN,LDO4}$ = 3.7V			50	100	
Output Current Limit	$I_{LIM,LDO4}$	$V_{OUT,LDO4}$ = 0V			150	225	375	mA
Output Load Transient (LDO4OVCLMP_EN = 1) (Notes 3, 6)		Normal mode, $V_{IN,LDO4}$ = $V_{NOM,LDO4}$ + 0.3V to 5.5V with 1.7V absolute minimum. $I_{OUT,LDO4}$ = 1% to 100% to 1% of $I_{MAX,LDO4}$, $V_{NOM,LD04}$ set to any voltage, t_{R4} = t_{F4} = 1µs, LDO4COMP[5:4] = 01				66		mV
		Green mode, $V_{IN,LDO4}$ = $V_{NOM,LDO4}$ + 0.3V to 5.5V with 2.4V absolute minimum, $I_{OUT,LDO4}$ = 0.05mA to 5mA to 0.05mA, $V_{NOM,LDO4}$ set to any voltage, t_{R4} = t_{F4} = 1µs				25		
Output Line Transient (Notes 3, 6)		Normal mode, $V_{IN,LDO4}$ = $V_{NOM,LDO4}$ + 0.3V to $V_{NOM,LDO4}$ + 0.8V to $V_{NOM,LDO4}$ + 0.3V with 1.7V absolute minimum, t_{R4} = t_{F4} = 1µs, $I_{OUT,LDO4}$ = $I_{MAX,LDO4}$, $V_{NOM,LDO4}$ set to any voltage				5		mV
		Green mode, $V_{IN,LDO4}$ = $V_{NOM,LDO4}$ + 0.3V to $V_{NOM,LDO4}$ + 0.8V to $V_{NOM,LDO4}$ + 0.3V with 2.4V absolute minimum, t_{R4} = t_{F4} = 1µs, $I_{OUT,LDO4}$ = 5mA, $V_{NOM,LDO4}$ set to any voltage				5		

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP	MAX	UNITS
Power-Supply Rejection	$PSRR_{LDO4}$	Rejection from $V_{IN,LDo4}$ to $V_{OUT,LDO4}$ $I_{OUT,LDO4}$ = 10% of $I_{MAX,LDO4}$	$V_{INLDO4DC}$ = $V_{NOM,LDO4}$ + 0.3V, $V_{INLDO4AC}$ = 50mV	f = 1kHz		63		dB
				f = 10kHz		51		
				f = 100kHz		44		
				f = 1000kHz		57		
				f = 4450kHz		33		
		Green mode, $I_{OUT,LDO4}$ = 1mA, f = 1kHz, rejection from $V_{IN,LDO4}$ to $V_{OUT,LDO4}$				50		
Output Noise		f = 10Hz to 100kHz, I_{OUT} = 10% of I_{MAX}	V_{OUT} = 0.8V			45		μV_{RMS}
			V_{OUT} = 1.8V			45		
			V_{OUT} = 3.7V			60		
Startup Ramp Rate	t_{SS4}	After enabling	LDO4SS = 0			100		mV/µs
			LDO4SS = 1			5		
Active-Discharge Resistance		$V_{OUT,LDO4}$ = 1V, output disabled	Active discharge enabled, LDO4ADE = 1			0.16	0.3	kΩ
			Active discharge disabled, LDO4ADE = 0		1000			
Clamp Active Regulation Voltage		Clamp active (LDO4OVCLMP_EN = 1), LDO output sinking 0.1mA				$V_{NOM,LDO4}$		V
Clamp Disabled Overvoltage Sink Current		$V_{OUT,LDO4}$ = $V_{NOM,LDO4}$ x 110%				2.2		µA
Enable Delay (Note 3)	t_{LON4}	Time from LDO enable command received to the output starting to slew	Ramp rate = 100mv/µs			10		µs
			Ramp rate = 5mv/µs			60		
Disable Delay (Note 3)		After LDO is disabled; the LDO output voltage discharges based on load and $C_{OUT,LDO4}$; to ensure fast discharge times enable the active discharge resistor				0.1		µs
Transition time from Green Mode to Normal Mode						10		µs
Thermal Shutdown		Output disabled or enabled	T_J rising			165		°C
			T_J falling			150		

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Power-OK Threshold	$V_{POKTHL4}$	$V_{OUT,LDO4}$ when V_{POK} switches	$V_{OUT,LDO4}$ rising		92	95	%
			$V_{OUT,LDO4}$ falling	84	87		
Power-OK Noise Pulse Immunity	V_{POKNF4}	$V_{OUT,LDO4}$ pulsed from 100% to 80% of regulation			25		µs
LDO5							
Input Voltage Range	$V_{IN,LDO5}$			1.7		5.5	V
Undervoltage Lockout	$V_{UVLO,LDO5}$	$V_{IN,LDO5}$ rising, 100mV hysteresis			1.6	1.7	V
Output Voltage Range	$V_{OUT,LDO5}$	$V_{IN,LDO5}$ is the maximum of 3.7V or $V_{OUT,LDO5}$ + 0.3V		0.8		3.95	V
Maximum Output Current	$I_{MAX,LDO5}$	Normal mode		300			mA
		Green mode		5			
Minimum Output Capacitance	$C_{OUT,LDO5}$	(Note 3)	Normal mode		0.7		µF
			Green mode		0.7		
Bias Enable Time	t_{LBIAS5}	Time to enable LDO bias only, central bias is already enabled			90		µs
Bias Enable Currents	I_{QBIAS5}	LDO bias enabled			10		µA
AV Supply Current	$I_{AV,LDO5}$	No load	Shutdown, T_A = +25°C (Note 4)		0		µA
			Normal regulation		3	6	
			Green mode		0.5	3	
INB Supply Current	$I_{IN,LDO5}$	No load	Shutdown, T_A = +25°C (Note 5)		0		µA
			Normal regulation		17	30	
			Green mode		1	3	
Output Voltage Accuracy		Normal mode	$V_{IN,LDO5}$ = $V_{NOM,LDO5}$ + 0.3V to 5.5V with 1.7V minimum, $I_{OUT,LDO5}$ = 0.1mA to $I_{MAX,LDO5}$, $V_{NOM,LDO5}$ set to any voltage	-3		+3	%
		Green mode	$V_{IN,LDO5}$ = $V_{NOM,LDO5}$ + 0.3V to 5.5V with 2.4V minimum, $I_{OUT,LDO5}$ = 0.1mA to 5mA, $V_{NOM,LDO5}$ set to any voltage	-5		+5	

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP	MAX	UNITS
Load Regulation (Note 6)		Normal mode	$I_{OUT,LDO5}$ = 0.1mA to $I_{MAX,LDO5}$, $V_{IN,LDO5}$ = $V_{NOM,LDO5}$ + 0.3V with 1.7V minimum, $V_{NOM,LDO5}$ set to any voltage			0.1		%
		Green mode	$I_{OUT,LDO5}$ = 0.1mA to 5mA, $V_{IN,LDO5}$ = $V_{NOM,LDO5}$ + 0.3V with 2.4V minimum, $V_{NOM,LDO5}$ set to any voltage			0.2		
Line Regulation (Note 6)		Normal mode	$V_{IN,LDO5}$ = $V_{NOM,LDO5}$ + 0.3V to 5.5V with 1.7V minimum. $I_{OUT,LDO5}$ = 0.1mA, $V_{NOM,LDO5}$ set to any voltage			0.03		%/V
		Green mode	$V_{IN,LDO5}$ = $V_{NOM,LDO5}$ + 0.3V to 5.5V with 2.4V minimum. $I_{OUT,LDO5}$ = 0.1mA, $V_{NOM,LDO5}$ set to any voltage			0.1		
Dropout Voltage	$V_{DO,LDO5}$	Normal mode	$I_{OUT,LDO5}$ = $I_{MAX,LDO5}$	$V_{IN,LDO5}$ = 3.7V		50	100	mV
				$V_{IN,LDO5}$ = 1.7V		150	450	
		Green mode	$I_{OUT,LDO5}$ = 5mA, $V_{IN,LDO5}$ = 3.7V			150	300	
Output Current Limit	$I_{LIM,LDO5}$	$V_{OUT,LDO5}$ = 0V			300	450	750	mA
Output Load Transient (LDO5OVCLMP_EN = 1) (Notes 3, 6)		Normal mode, $V_{IN,LDO5}$ = $V_{NOM,LDO5}$ + 0.3V to 5.5V with 1.7V absolute minimum, $I_{OUT,LDO5}$ = 1% to 100% to 1% of $I_{MAX,LDO5}$, $V_{NOM,LDO5}$ set to any voltage, t_{R5} = t_{F5} = 1µs, LDO5COMP[5:4] = 01				66		mV
		Green mode, $V_{IN,LDO5}$ = $V_{NOM,LDO5}$ + 0.3V to 5.5V with 2.4V absolute minimum, $I_{OUT,LDO5}$ = 0.05mA to 5mA to 0.05mA, $V_{NOM,LDO5}$ set to any voltage, t_{R5} = t_{F5} = 1µs				25		

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP	MAX	UNITS
Output Line Transient (Notes 3, 6)		Normal mode, $V_{IN,LOD5}$ = $V_{NOM,LDO5}$ + 0.3V to $V_{NOM,LDO5}$ + 0.8V to $V_{NOM,LDO5}$ + 0.3V with 1.7V absolute minimum, t_{R5} = t_{F5} = 1µs, $I_{OUT,LDO5}$ = $I_{MAX,LDO5}$, $V_{NOM,LDO5}$ set to any voltage				5		mV
		Green mode, $V_{IN,LDO5}$ = $V_{NOM,LDO5}$ + 0.3V to $V_{NOM,LDO5}$ + 0.8V to $V_{NOM,LDO5}$ + 0.3V with 2.4V absolute minimum, t_{R5} = t_{F5} = 1µs, $I_{OUT,LDO5}$ = 5mA, $V_{NOM,LDO5}$ set to any voltage				5		
Power-Supply Rejection	$PSRR_{LDO5}$	Rejection from $V_{IN,LDO5}$ to $V_{OUT,LDO5}$ $I_{OUT,LDO5}$ = 10% of $I_{MAX,LDO5}$	$V_{INLDO5DC}$ = $V_{NOM,LDO5}$ + 0.3V $V_{INLDO5AC}$ = 50mV	f = 1kHz		63		dB
				f = 10kHz		51		
				f = 100kHz		44		
				f = 1000kHz		57		
				f = 4450kHz		33		
		Green mode, I_{OUT} = 1mA, f = 1kHz, rejection from $V_{IN,LDO5}$ to $V_{OUT,LDO5}$				50		
Output Noise		f = 10Hz to 100kHz, I_{OUT} = 10% of $I_{MAX,LDO5}$	$V_{OUT,LDO5}$ = 0.8V			45		$µV_{RMS}$
			$V_{OUT,LDO5}$ = 1.8V			45		
			$V_{OUT,LDO5}$ = 3.7V			60		
Startup Ramp Rate	t_{SS5}	After enabling	LDO5SS = 0			100		mV/µs
			LDO5SS = 1			5		
Active-Discharge Resistance		$V_{OUT,LDO5}$ = 1V, output disabled	Active discharge enabled, LDO5ADE = 1			0.16	0.3	kΩ
			Active discharge disabled, LDO5ADE = 0		1000			
Clamp Active Regulation Voltage		Clamp active (LDO5OVCLMP_EN = 1), LDO output sinking 0.1mA				$V_{NOM,LD05}$		V

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Clamp Disabled Overvoltage Sink Current		$V_{OUT,LDO5}$ = $V_{NOM,LDO5}$ x 110%			2.2		µA
Enable Delay (Note 3)	t_{LON5}	Time from LDO enable command received to the output starting to slew	Ramp rate =100mV/µs		10		µs
			Ramp rate = 5mV/µs		60		
Disable Delay (Note 3)		After LDO is disabled; the LDO output voltage discharges based on load and C_{OUT}; to ensure fast discharge times, enable the active discharge resistor			0.1		µs
Transition Time from Green Mode to Normal Mode					10		µs
Thermal Shutdown		Output disabled or enabled	T_J rising		165		°C
			T_J falling		150		
Power-Ok Threshold	V_{POKTHL}	$V_{OUT,LDO5}$ when V_{POK} switches	$V_{OUT,LDO5}$ rising		92	95	%
			$V_{OUT,LDO5}$ falling	84	87		
Power-Ok Noise Pulse Immunity	V_{POKNF}	$V_{OUT,LDO5}$ pulsed from 100% to 80% of regulation			25		µs
LDO6							
Input Voltage Range	$V_{IN,LDO6}$			1.7		5.5	V
Undervoltage Lockout	$V_{UVLO,LDO6}$	Rising, 100mV hysteresis			1.6	1.7	V
Output Voltage Range	$V_{OUT,LDO6}$	$V_{IN,LDO6}$ is the maximum of 3.7V or $V_{OUT,LDO6}$ + 0.3V		0.8		3.95	V
Maximum Output Current	$I_{MAX,LDO6}$	Normal mode		150			mA
		Green mode		5			
Minimum Output Capacitance	$C_{OUT,LDO6}$	(Note 3)	Normal mode		0.7		µF
			Green mode		0.7		
Bias Enable Time	t_{LBIAS6}	Time to enable LDO bias only, central bias is already enabled			90		µs
Bias Enable Currents	I_{QBIAS6}	LDO bias enabled			10		µA
AV Supply Current	$I_{AV,LDO6}$	No load	Shutdown, T_A = +25°C (Note 4)		0		µA
			Normal regulation		3	6	
			Green mode		0.5	3	
INB Supply Current	$I_{IN,LDO6}$	No load	Shutdown, T_A = +25°C (Note 5)		0		µA
			Normal regulation		15	30	
			Green mode		1	3	

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP	MAX	UNITS
Output Voltage Accuracy		Normal mode	$V_{IN,LDO6}$ = $V_{NOM,LDO6}$ + 0.3V to 5.5V with 1.7V minimum, $I_{OUT,LDO6}$ = 0.1mA to $I_{MAX,LDO6}$, $V_{NOM,LDO6}$ set to any voltage		-3		+3	%
		Green mode	$V_{IN,LDO6}$ = $V_{NOM,LDO6}$ + 0.3V to 5.5V with 2.4V minimum, $I_{OUT,LDO6}$ = 0.1mA to 5mA, $V_{NOM,LDO6}$ set to any voltage		-5		+5	
Load Regulation (Note 6)		Normal mode	$I_{OUT,LDO6}$ = 0.1mA to $I_{MAX,LDO6}$, $V_{IN,LDO6}$ = $V_{NOM,LDO6}$ + 0.3V with 1.7V minimum, $V_{NOM,LDO6}$ set to any voltage			0.1		%
		Green mode	$I_{OUT,LDO6}$ = 0.1mA to 5mA, $V_{IN,LDO6}$ = $V_{NOM,LDO6}$ + 0.3V with 2.4V minimum, $V_{NOM,LDO6}$ set to any voltage			0.2		
Line Regulation (Note 6)		Normal mode	$V_{IN,LDO6}$ = $V_{NOM,LDO6}$ + 0.3V to 5.5V with 1.7V minimum, $I_{OUT,LDO6}$ = 0.1mA, $V_{NOM,LDO6}$ set to any voltage			0.03		%/V
		Green mode	$V_{IN,LDO6}$ = $V_{NOM,LDO6}$ + 0.3V to 5.5V with 2.4V minimum, $I_{OUT,LDO6}$ = 0.1mA, $V_{NOM,LDO6}$ set to any voltage			0.1		
Dropout Voltage	$V_{DO,LDO6}$	Normal mode	$I_{OUT,LDO6}$ = $I_{MAX,LDO6}$	$V_{IN,LDO6}$ = 3.7V		60	120	mV
				$V_{IN,LDO6}$ = 1.7V		150	300	
		Green mode	$I_{OUT,LDO6}$ = 5mA, $V_{IN,LDO6}$ = 3.7V			50	100	
Output Current Limit	$I_{LIM,LDO6}$	$V_{OUT,LDO6}$ = 0V			150	225	375	mA

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS			MIN	TYP	MAX	UNITS
Output Load Transient (LDO6OVCLMP_EN = 1) (Notes 3, 6)		Normal mode, $V_{IN,LDO6}$ = $V_{NOM,LDO6}$ + 0.3V to 5.5V with 1.7V absolute minimum, $I_{OUT,LDO6}$ = 1% to 100% to 1% of $I_{MAX,LDO6}$, $V_{NOM,LDO6}$ set to any voltage, t_{R6} = t_{F6} = 1µs, LDO6COMP[5:4] = 01				66		mV
		Green mode, $V_{IN,LDO6}$ = $V_{NOM,LDO6}$ +0.3V to 5.5V with 2.4V absolute minimum, $I_{OUT,LDO6}$ = 0.05mA to 5mA to 0.05mA, $V_{NOM,LDO6}$ set to any voltage, t_{R6} = t_{F6} = 1µs				25		
Output Line Transient (Notes 3, 6)		Normal mode, $V_{IN,LDO6}$ = $V_{NOM,LDO6}$ + 0.3V to $V_{NOM,DLo6}$ + 0.8V to $V_{NOM,LDO6}$ + 0.3V with 1.7V absolute minimum, t_{R6} = t_{F6} = 1µs, $I_{OUT,LDO6}$ = $I_{MAX,LDO6}$, $V_{NOM,LDO6}$ set to any voltage				5		mV
		Normal mode, $V_{IN,LDO6}$ = $V_{NOM,LDO6}$ + 0.3V to $V_{NOM,DLo6}$ + 0.8V to $V_{NOM,LDO6}$ + 0.3V with 2.4V absolute minimum, t_{R6} = t_{F6} = 1µs, $I_{OUT,LDO6}$ = 5mA, $V_{NOM,LDO6}$ set to any voltage				5		
Power-Supply Rejection	$PSRR_{LDO6}$	Rejection from $V_{IN,LDO6}$ to $V_{OUT,LDO06}$ $I_{OUT,LDO6}$ = 10% of $I_{MAX,LDO6}$	$V_{INLOD6DC}$ = $V_{NOM,LDO6}$ + 0.3V, $V_{INLDO6AC}$ = 50mV	f = 1kHz		63		dB
				f = 10kHz		51		
				f = 100kHz		44		
				f = 1000kHz		57		
				f = 4450kHz		33		
		Green mode, $I_{OUT,LDO6}$ = 1mA, f = 1kHz, rejection from $V_{IN,LDO6}$ to $V_{OUT,LDO6}$				50		

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Output Noise		f = 10Hz to 100kHz, $I_{OUT,LDO6}$ = 10% of $I_{MAX,LDO6}$	$V_{OUT,LDO6}$ = 0.8V		45		μV_{RMS}
			$V_{OUT,LDO6}$ = 1.8V		45		
			$V_{OUT,LDO6}$ = 3.7V		60		
Startup Ramp Rate	$t_{SS,LDO6}$	After enabling	LDO6SS = 0		100		mV/µs
			LDO6SS = 1		5		
Active-Discharge Resistance		$V_{OUT,LDO6}$ = 1V, output disabled	Active discharge enabled, LDO6ADE = 1		0.16	0.3	kΩ
			Active discharge disabled, LDO6ADE = 0	1000			
Clamp Active Regulation Voltage		Clamp active (LDO6OVCLMP_EN = 1), LDO output sinking 0.1mA			$V_{NOM,LDO6}$		V
Clamp Disabled Overvoltage Sink Current		$V_{OUT,LDO6}$ = $V_{NOM,LDO6}$ x 110%			2.2		µA
Enable Delay (Note 3)	t_{LON6}	Time from LDO enable command received to the output starting to slew	Ramp rate = 100mV/µs		10		µs
			Ramp rate = 5mV/µs		60		
Disable Delay (Note 3)		After LDO is disabled, the LDO output voltage discharges based on load and $C_{OUT,LDO6}$; to ensure fast discharge times, enable the active discharge resistor			0.1		µs
Transition Time from Green mode to Normal Mode					10		µs
Thermal Shutdown		Output disabled or enabled	T_J rising		165		°C
			T_J falling		150		
Power-OK Threshold	$V_{POKTHL6}$	$V_{OUT,LDO6}$ when V_{POK} switches	$V_{OUT,}$LDO6 rising		92	95	%
			$V_{OUT,LDO6}$ falling	84	87		
Power-OK Noise Pulse Immunity	V_{POKNF6}	$V_{OUT,LDO6}$ pulsed from 100% to 80% of regulation			25		µs
DIGITAL I/O							
Logic Input High Voltage Threshold	V_{IH}	$V_{ID\_}$, EN_, SDA, SCL, V_{IN1} = V_{IN2} = V_{AV} = 2.6V to 5.5V V_{IO} = 1.65V to 3.6V		1.4			V
Logic Input Low Voltage Threshold	V_{IL}	$V_{ID\_}$, EN_, SDA, SCL, V_{IN1} = V_{IN2} = V_{AV} = 2.6V to 5.5V V_{IO} = 1.65V to 3.6V				0.4	V

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Logic Input Current (SDA, SCL)		V_{IL} = 0V or V_{IH} = 3.6V, EN_ = AGND	T_A = +25°C	-1		+1	µA
			T_A = +85°C		0.1		
Logic Input Current ($V_{ID\_}$, EN_)		V_{IL} = 0V, EN_ = AGND	T_A = +25°C	-1		+1	µA
			T_A = +85°C		0.1		
$V_{ID\_}$, EN_ Logic Input Pulldown Resistor				400			kΩ
I²C INTERFACE							
SDA Output Low Voltage		I_{SDA} = 3mA				0.1	V
I²C Clock Frequency						400	kHz
Bus-Free Time Between START and STOP	t_{BUF}	See Figure 7 in the *Digital I/O* section		1.3			µs
Hold Time Repeated START Condition	t_{HD_STA}	See Figure 7 in the *Digital I/O* section		0.6	0.1		µs
SCL Low Period	t_{LOW}	See Figure 7 in the *Digital I/O* section		1.3	0.2		µs
SCL High Period	t_{HIGH}	See Figure 7 in the *Digital I/O* section		0.6	0.1		µs
Setup Time Repeated START Condition	t_{SU_STA}	See Figure 7 in the *Digital I/O* section		0.6	0.1		µs
SDA Hold Time	t_{HD_DAT}	See Figure 7 in the *Digital I/O* section		0	-0.01		µs
SDA Setup Time	t_{SU_DAT}	See Figure 7 in the *Digital I/O* section		0.1	0.05		µs
Glitch Filter		Maximum pulse width of spikes that must be suppressed by the input filter of both the DATA and CLK pins			50		ns
Setup Time for STOP Condition	t_{SU_STO}	See Figure 7 in the *Digital I/O* section		0.6	0.1		µs

Note 2: Specifications are 100% production tested at T_A = +25°C. Limits over the operating temperature range are guaranteed by design and characterization. LDO_COMP = 01 (default).

Note 3: V_{OUT} is limited to approximately: V_{IN} - (inductor DCR + output trace resistance + 100mΩ) x I_{OUT}.

Note 4: Values are based on simulations and bench testing; they are not production tested.

Note 5: System shutdown current is guaranteed by testing the combined current part in shutdown in the main bias section.

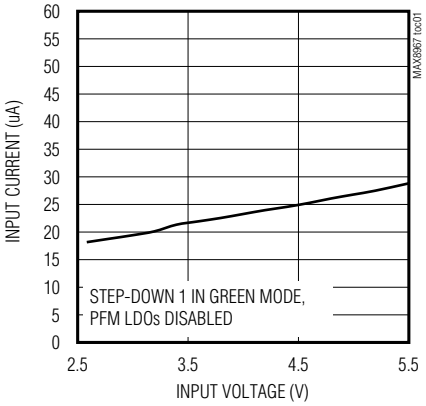
Note 6: IN shutdown current is guaranteed by testing the combined current of all IN_ and LDO_ pins in shutdown to a 5µA (max).

Note 7: Does not include ESR of the capacitance or trace resistance of the module/PCB.

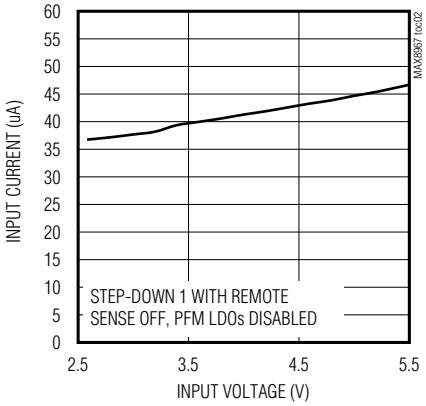
典型工作特性

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, *Typical Application Circuit*, T_A = +25°C, unless otherwise noted.)

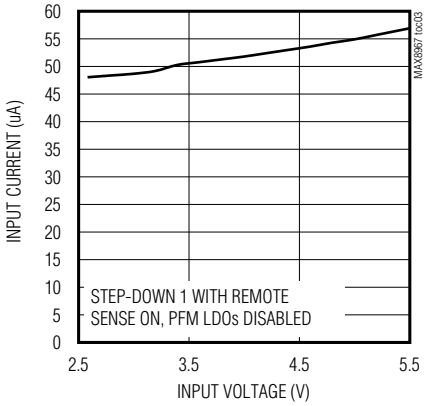
INPUT SUPPLY CURRENT vs. INPUT VOLTAGE



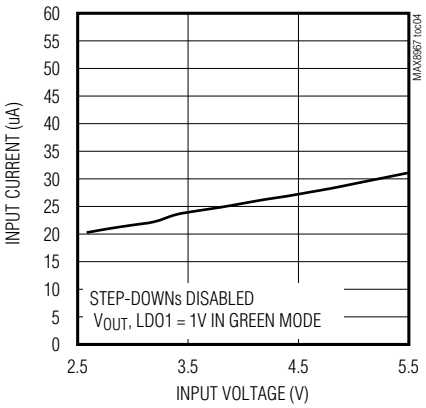
INPUT SUPPLY CURRENT vs. INPUT VOLTAGE



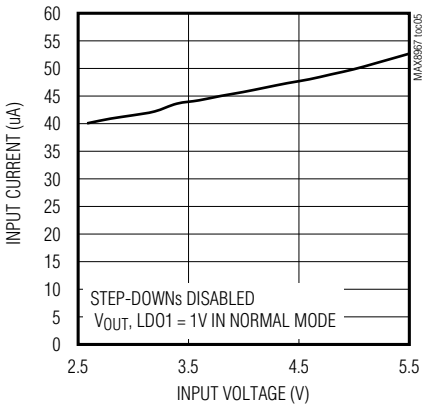
INPUT SUPPLY CURRENT vs. INPUT VOLTAGE



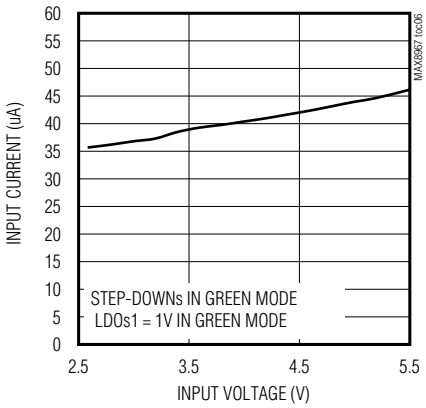
INPUT SUPPLY CURRENT vs. INPUT VOLTAGE



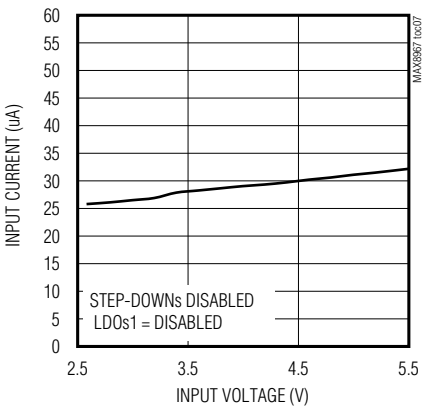
INPUT SUPPLY CURRENT vs. INPUT VOLTAGE



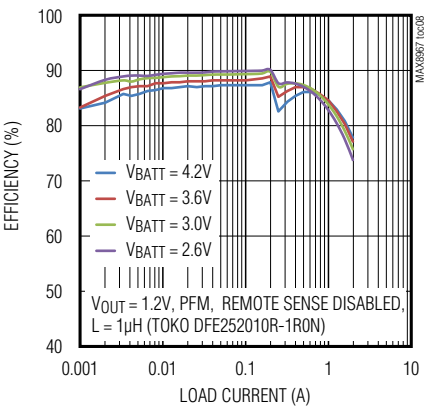
INPUT SUPPLY CURRENT vs. INPUT VOLTAGE



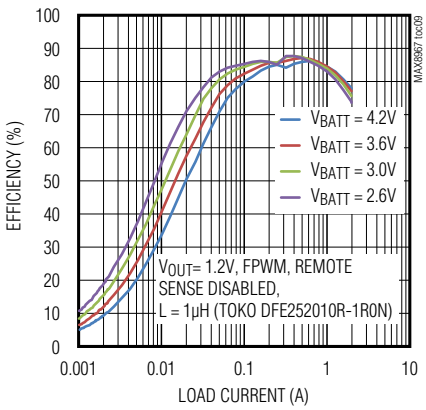
STANDBY CURRENT vs. INPUT VOLTAGE



STEP-DOWN EFFICIENCY vs. LOAD CURRENT



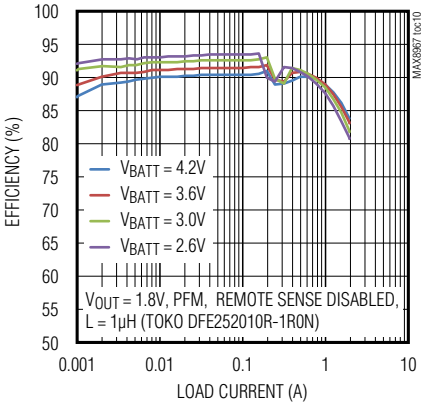
STEP-DOWN EFFICIENCY vs. LOAD CURRENT



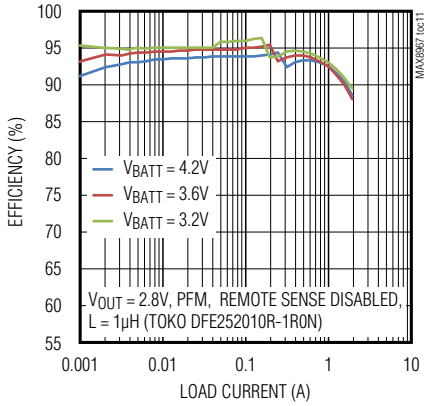
典型工作特性(续)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, *Typical Application Circuit*, T_A = +25°C, unless otherwise noted.)

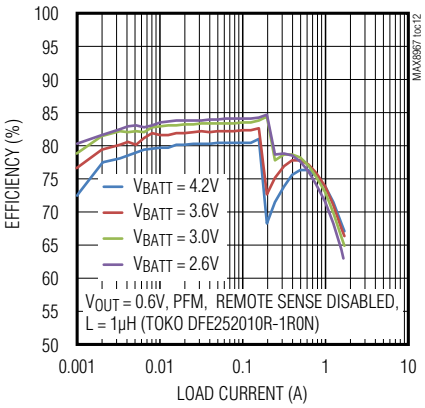
STEP-DOWN EFFICIENCY vs. LOAD CURRENT



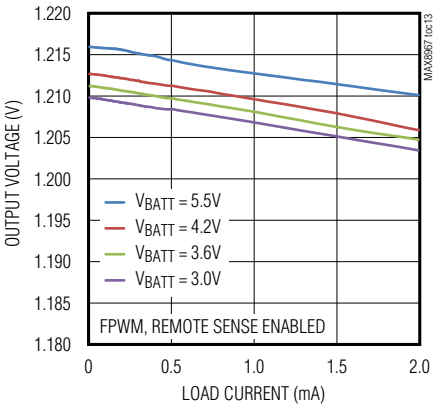
STEP-DOWN EFFICIENCY vs. LOAD CURRENT



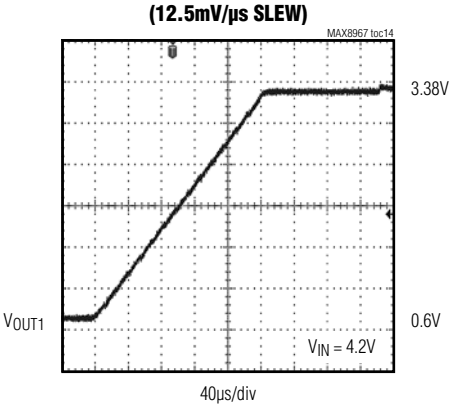
STEP-DOWN EFFICIENCY vs. LOAD CURRENT



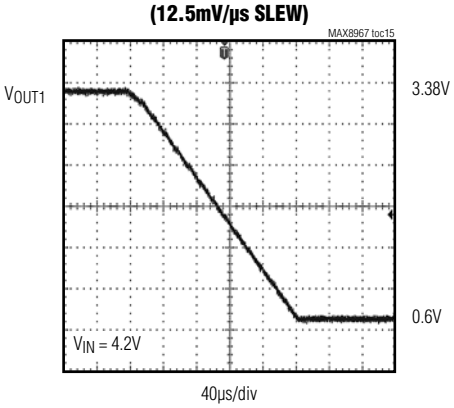
STEP-DOWN LOAD REGULATION



V_{ID} TRANSTION (12.5mV/µs SLEW)



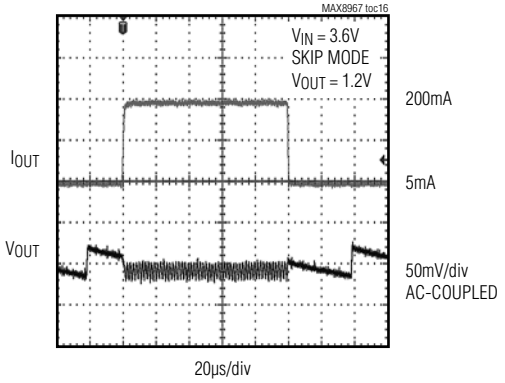
V_{ID} TRANSTION (12.5mV/µs SLEW)



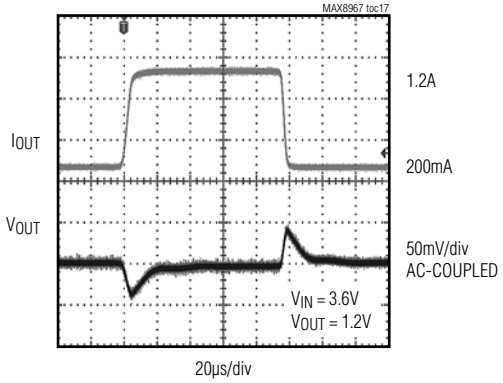
典型工作特性(续)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, *Typical Application Circuit*, T_A = +25°C, unless otherwise noted.)

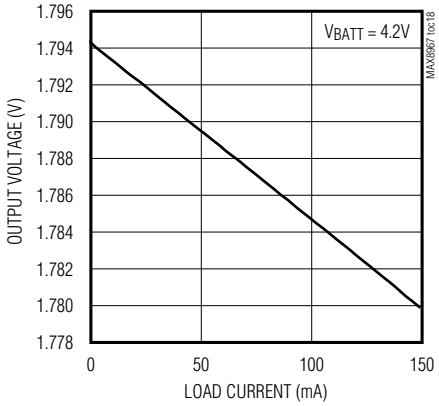
STEP-DOWN LOAD TRANSIENT



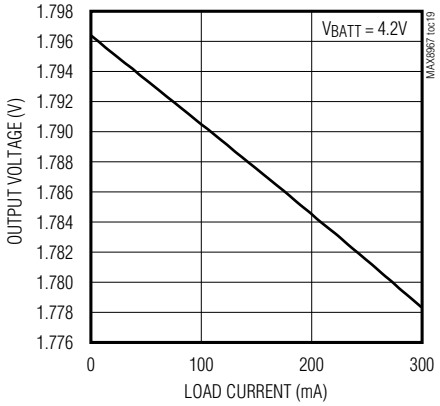
STEP-DOWN LOAD TRANSIENT



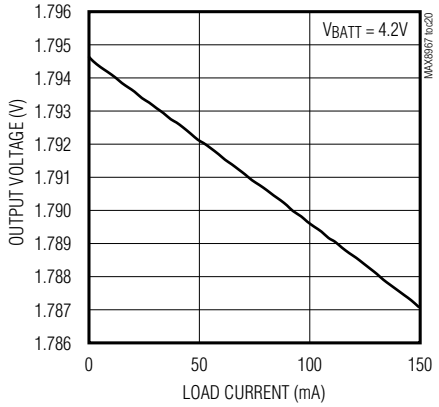
LDO1 OUTPUT VOLTAGE vs. LOAD CURERNT



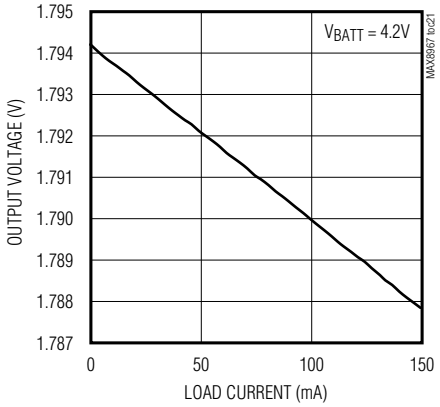
LDO2 OUTPUT VOLTAGE vs. LOAD CURERNT



LDO3 OUTPUT VOLTAGE vs. LOAD CURERNT



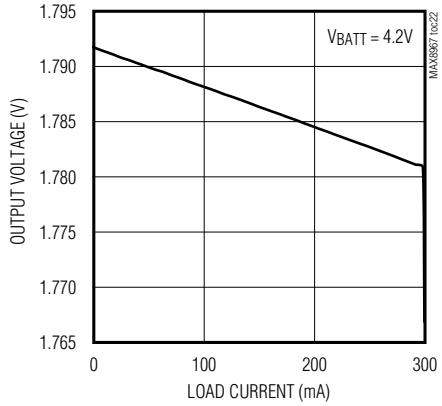
LDO4 OUTPUT VOLTAGE vs. LOAD CURERNT



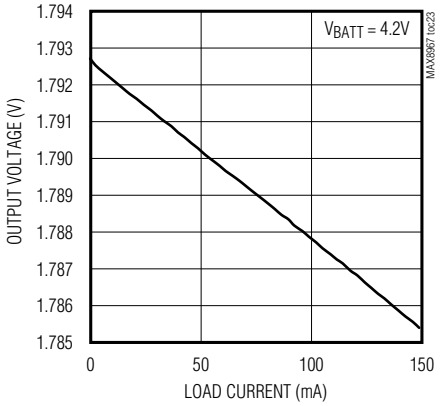
典型工作特性(续)

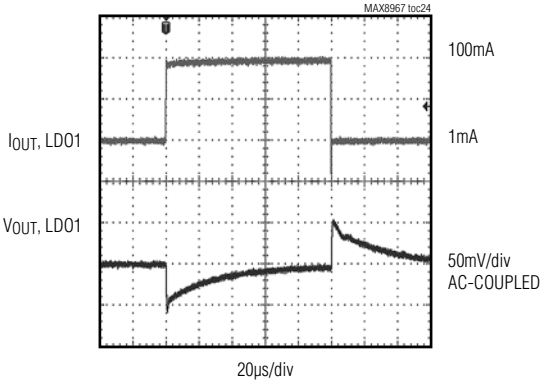
($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, *Typical Application Circuit*, T_A = +25°C, unless otherwise noted.)

LDO5 OUTPUT VOLTAGE vs. LOAD CURERNT

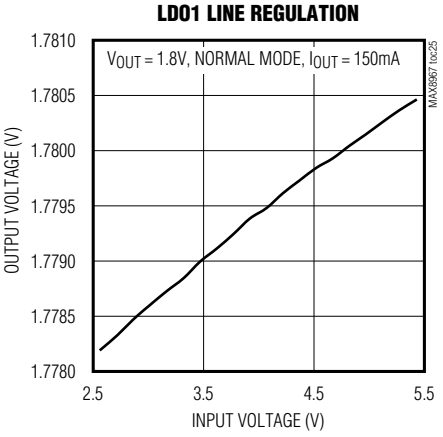


LDO6 OUTPUT VOLTAGE vs. LOAD CURERNT

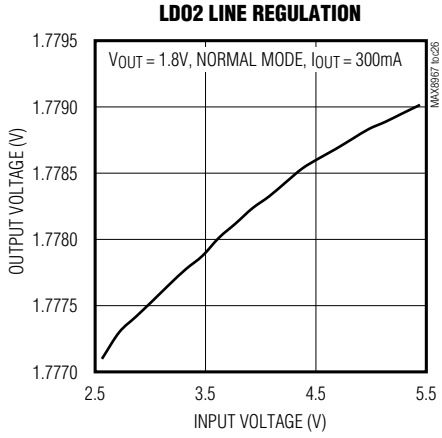




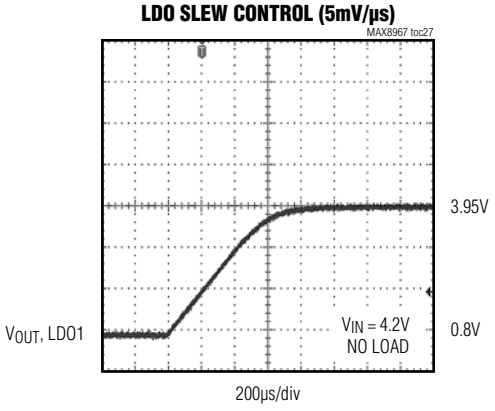
LDO1 LINE REGULATION



LDO2 LINE REGULATION



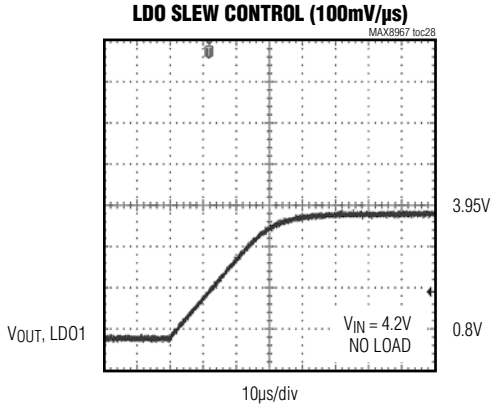
LDO SLEW CONTROL (5mV/µs)



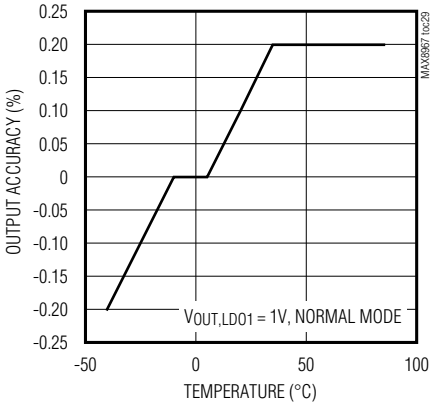
典型工作特性(续)

($V_{IN\_}$ = V_{AV} = 3.6V, V_{IO} = 1.8V, *Typical Application Circuit*, T_A = +25°C, unless otherwise noted.)

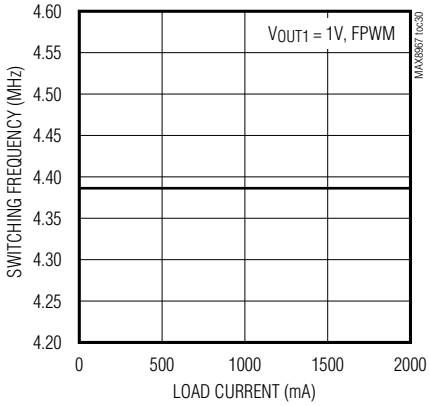
LDO SLEW CONTROL (100mV/µs)



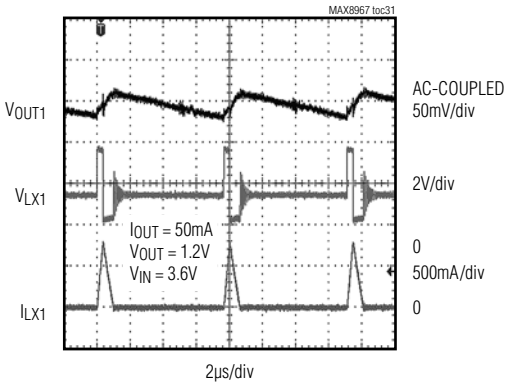
LDO OUTPUT VOLTAGE ACCURACY vs. TEMPERATURE



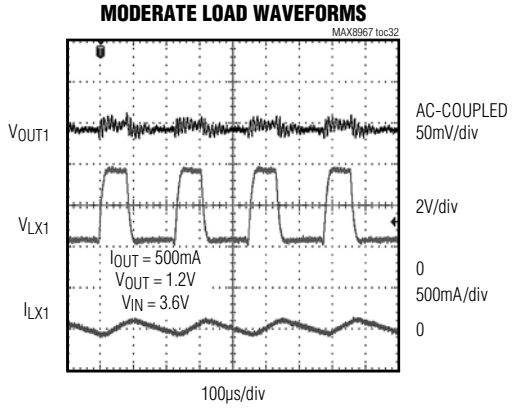
STEP-DOWN SWITCHING FREQUENCY vs. LOAD CURRENT



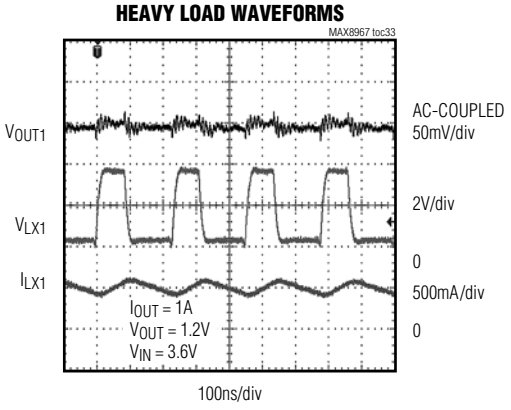
LIGHT LOAD WAVEFORMS



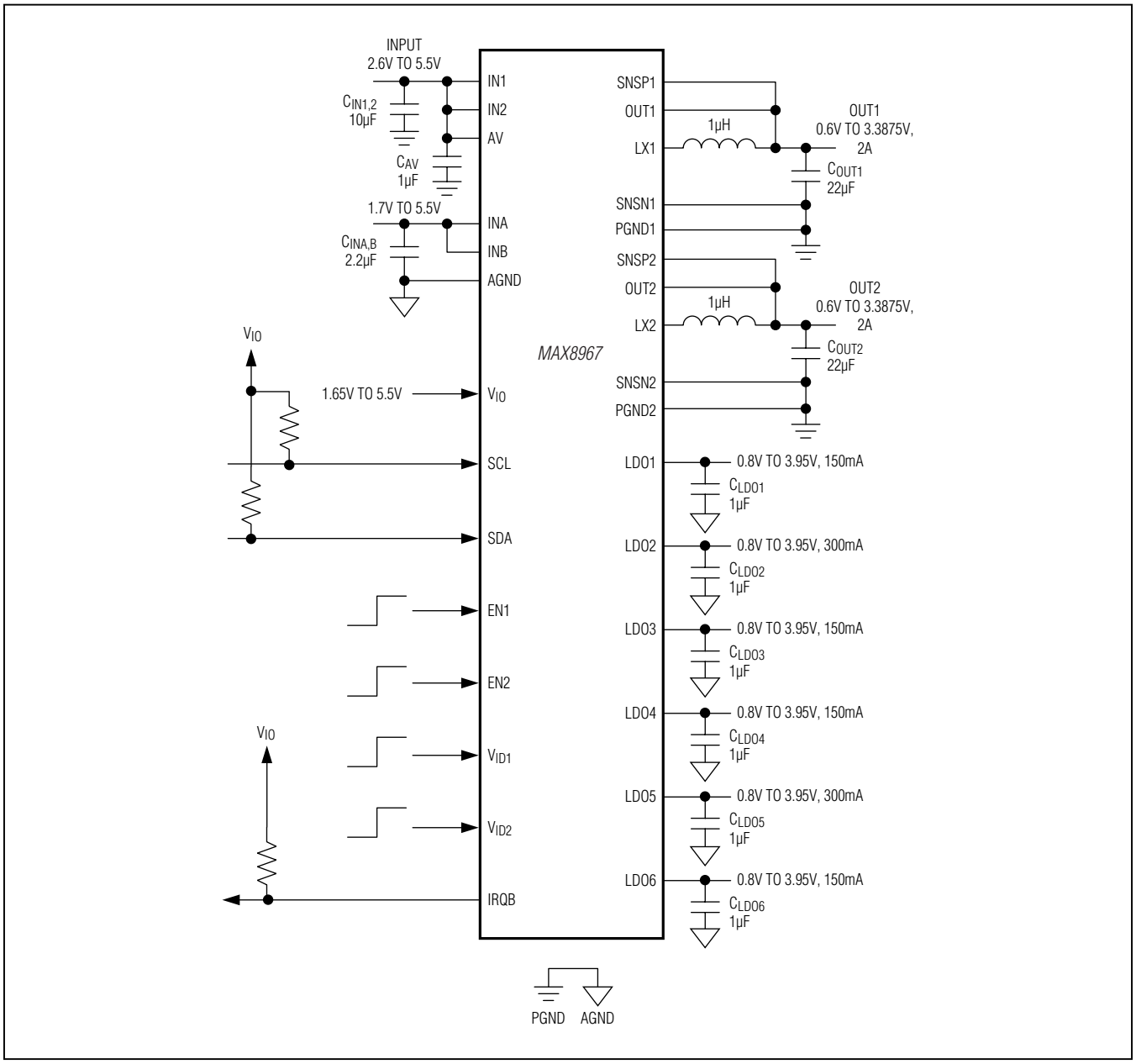
MODERATE LOAD WAVEFORMS



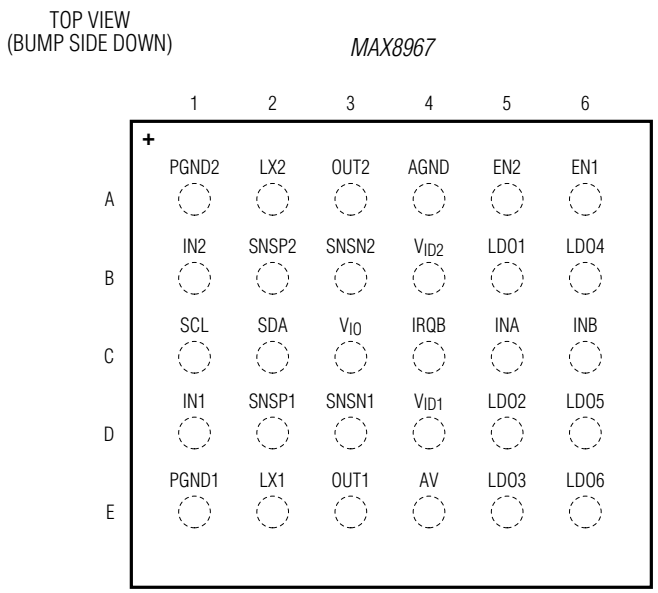
HEAVY LOAD WAVEFORMS



典型应用电路


INPUT
2.6V TO 5.5V
IN1
IN2
AV
CIN1,2
10µF
CAV
1µF
1.7V TO 5.5V
INA
INB
AGND
CINA,B
2.2µF
VIO
1.65V TO 5.5V
VIO
SCL
SDA
EN1
EN2
VIO
VID1
VID2
IRQB
MAX8967
SNSP1
OUT1
LX1
1µH
OUT1
0.6V TO 3.3875V,
2A
COUT1
22µF
SNSN1
PGND1
SNSP2
OUT2
LX2
1µH
OUT2
0.6V TO 3.3875V,
2A
COUT2
22µF
SNSN2
PGND2
LDO1
0.8V TO 3.95V, 150mA
CLDO1
1µF
LDO2
0.8V TO 3.95V, 300mA
CLDO2
1µF
LDO3
0.8V TO 3.95V, 150mA
CLDO3
1µF
LDO4
0.8V TO 3.95V, 150mA
CLDO4
1µF
LDO5
0.8V TO 3.95V, 300mA
CLDO5
1µF
LDO6
0.8V TO 3.95V, 150mA
CLDO6
1µF
PGND
AGND

引脚配置



WLP

引脚说明

引脚	名称	功能
A1	PGND2	降压转换器2的功率地。利用10µF陶瓷电容将IN2旁路至PGND2，电容尽量靠近器件放置。
A2	LX2	降压转换器2的电感开关节点，在LX2和OUT2之间连接1µH电感。LX2在禁止时为高阻态。
A3	OUT2	降压转换器2的输出检测和放电连接端。利用22µF陶瓷电容将OUT2旁路至PGND2；禁止OUT2时，也可利用I²C命令控制其通过内部100Ω电阻接地。
A4	AGND	模拟地，将AGND接PGND_。
A5	EN2	降压转换器2的使能逻辑输入，也可通过I²C接口使能降压转换器2。EN2具有800kΩ内部下拉电阻。
A6	EN1	降压转换器1的使能逻辑输入，也可通过I²C接口使能降压转换器2。EN1具有800kΩ内部下拉电阻。
B1	IN2	降压转换器2的输入电源，利用10µF陶瓷电容将IN2旁路至PGND2，电容尽量靠近器件放置。将IN2连接至IN1和AV。
B2	SNSP2	降压转换器2的远端电压检测正端，将SNSP2连接至OUT2旁路电容的正端。

引脚说明(续)

引脚	名称	功能
B3	SNSN2	降压转换器2的远端电压检测负端。将SNSN2连接至OUT2旁路电容的负端。
B4	V_{ID2}	电压标识数字2。将V_{ID2}置于逻辑高电平或逻辑低电平，切换降压转换器2的两个输出电压。V_{ID2}具有800kΩ下拉电阻。
B5	LDO1	LDO1输出，利用1µF陶瓷电容将LDO1旁路至AGND。
B6	LDO4	LDO4输出，利用1µF陶瓷电容将LDO4旁路至AGND。
C1	SCL	I^2C时钟信号，通过2.2kΩ上拉电阻将SCL连接至V_{IO}。
C2	SDA	I^2C数据信号，通过2.2kΩ上拉电阻将SCA连接至V_{IO}。
C3	V_{IO}	I/O输入电源，将V_{IO}连接至I^2C总线主机电源。
C4	IRQB	低电平有效漏极开路中断输出。发生故障时，触发IRQB中断。通过100kΩ上拉电阻将IRQB连接至V_{IO}。
C5	INA	LDO 1、2和3的输入电源，通过2.2µF陶瓷电容将INA旁路至AGND，电容尽量靠近IC放置。
C6	INB	LDO 4、5和6的输入电源，通过2.2µF陶瓷电容将INB旁路至AGND，电容尽量靠近IC放置。
D1	IN1	降压转换器1的电源输入，将IN1旁路至PGND1，电容尽量靠近IC放置；IN1连接至IN2和AV。
D2	SNSP1	降压转换器1的远端电压检测正端，将SNSP1连接至OUT1旁路电容的正端。
D3	SNSN1	降压转换器1的远端电压检测负端，将SNSN1连接至OUT1旁路电容的负端。
D4	V_{ID1}	电压标识数字1，将V_{ID1}置于逻辑高电平或逻辑低电平，切换降压转换器1的两个输出电压。V_{ID1}具有800kΩ下拉电阻。
D5	LDO2	LDO2输出，利用1µF陶瓷电容将LDO2旁路至AGND。
D6	LDO5	LDO5输出，利用1µF陶瓷电容将LDO5连接至AGND。
E1	PGND1	降压转换器1的电源地，利用10µF陶瓷电容将IN1旁路至PGND1，电容尽量靠近器件放置。
E2	LX1	降压转换器1的电感连接，LX在禁止时为高阻态。
E3	OUT1	降压转换器1的输出检测和放电连接端，利用22µF陶瓷电容将OUT1旁路至PGND1； 禁止OUT1时，可通过I^2C命令将该输出端通过内部100Ω电阻接地。
E4	AV	模拟输入电源，将AV连接至IN1和IN2。利用1µF陶瓷电容将AV旁路至AGND，电容尽量靠近IC放置。
E5	LDO3	LDO3输出，利用1µF陶瓷电容将LDO3旁路至AGND。
E6	LDO6	LDO6输出，利用1µF陶瓷电容将LDO6旁路至AGND。

MAX8967

双通道、2A降压型转换器，内置6个LDO，用于基带和应用处理器供电

概述

MAX8967的两路超低IQ降压转换器理想用于调制解调器、应用处理器核、存储器、系统I/O及便携设备供电。常规工作模式下，降压转换器的静态电流只有16µA (典型值)；绿色模式下，静态电流降至5µA (典型值)，同时也降低了负载驱动能力。通过写控制寄存器位，可将每个降压转换器分别置于绿色模式。

降压转换器

每个降压转换器均提供内部反馈，使外部元件数量降至最少。两个降压转换器的输出电压均可通过IC串口设置。4.4MHz开关频率将外部元件尺寸降至最小。提供动态电压调节，以降低功耗。两路降压转换器均可从跳脉冲模式自动转换到FPWM工作模式。通过写控制寄存器位，使能强制PWM工作模式。

交错开关

降压转换器的高边开关在振荡器的正时钟沿导通，有助于将输入电流纹波降至最小，从而减小抑制输入电压纹波所需的输入电容。

跳脉冲/FPWM工作

常规工作状态下，当负载电流增大时，两个降压转换器自动从跳脉冲模式转换到固定频率工作模式。对于要求尽可降低输出纹波的情况，通过写对应FPWM_寄存器位使能强制PWM开关工作，参见表3和表15。

用V_{ID}控制电压

两路降压转换器带有V_{ID}控制，用于驱动调制解调器、应用处理器核等负载时，可大幅降低功耗。每个V_{ID}控制允许转换器在由I^2C预设的两种状态之间切换，无需占用I^2C通信控制相关的开销，即可实现两种电压状态的转换。V_{ID}控制允许在处理器时钟变慢时降低核电压。器件退出休眠模式(通过更改V_{ID}的状态)时，将恢复常规的核电源电压，以此优化工作条件，获得最佳的系统性能。

远端检测输出电压

每个降压转换器的输出具有远端电压检测功能，提高输出电压精度。远端检测支持远距离负载驱动，提供高达200mV的输出电压修正。SNSP_和SNSN_输入直接跨接在负载两端，SNSN_连接到靠近负载的低噪模拟地，SNSP_直接连接到输出旁路电容。

远端检测功能要求AV和OUT_之间具有1V或更大压差，以获得最佳性能。可通过寄存器禁止远端检测功能，以降低静态耗流。此外，绿色工作模式下禁止该功能。

输出电压摆率

增大或降低输出电压时，可以调节两个降压转换器的摆率。标称摆率为12.5mV/µs，另外提供两种摆率(25mV/µs和50mV/µs)供用户设置，因此，可以选择较快或较慢的摆率。器件还提供了一个可实现最快摆率的选项，允许转换器工作在限流状态，获得最快摆率。

调低输出电压时，由单个寄存器位提供两种设置。将该控制位置位时，转换器工作在强制PWM (FPWM)模式，具有负的电感电流，使得输出电压按照所选摆率，以有限步长降低；该控制位复位时，转换器工作在跳脉冲模式，输出电压的实际摆率取决于外部负载，输出电压的下降不必遵循摆率设置。

输出纹波

对于常规工作(没有处于绿色模式)，输出电流小于50mA时，输出纹波应小于20mV_{P-P}。增大输出电容，使其高于最小值，可进一步减小纹波，实现稳定工作。从跳脉冲模式转换为PWM模式应在电流小于50mA的条件下。绿色模式下，$V_{OUT\_}$ = 0.7V时，输出纹波可能增大到40mV_{P-P} (最大值)；可通过增加额外的输出电容，降低纹波。

绿色工作模式

绿色模式下，每个降压转换器的静态电流从16µA (典型值)降至5µA (典型值)。如果在绿色模式下调节输出电压，摆率极低。此外，输出电流限值在5mA以内。通过将相应转换器控制寄存器的PWR_[5:4]位置为10，进入绿色模式，参见表3。可分别选择任一转换器进入绿色模式。

放电电阻

IC为每个被关断的降压转换器提供一个内部100Ω放电电阻。可通过nADEN_寄存器位使能、禁用放电电阻的连接，提供设计灵活性，参见表3。

LDO详细说明

IC集成了六个LDO，输出可调，如表1所示。

关断、待机和复位

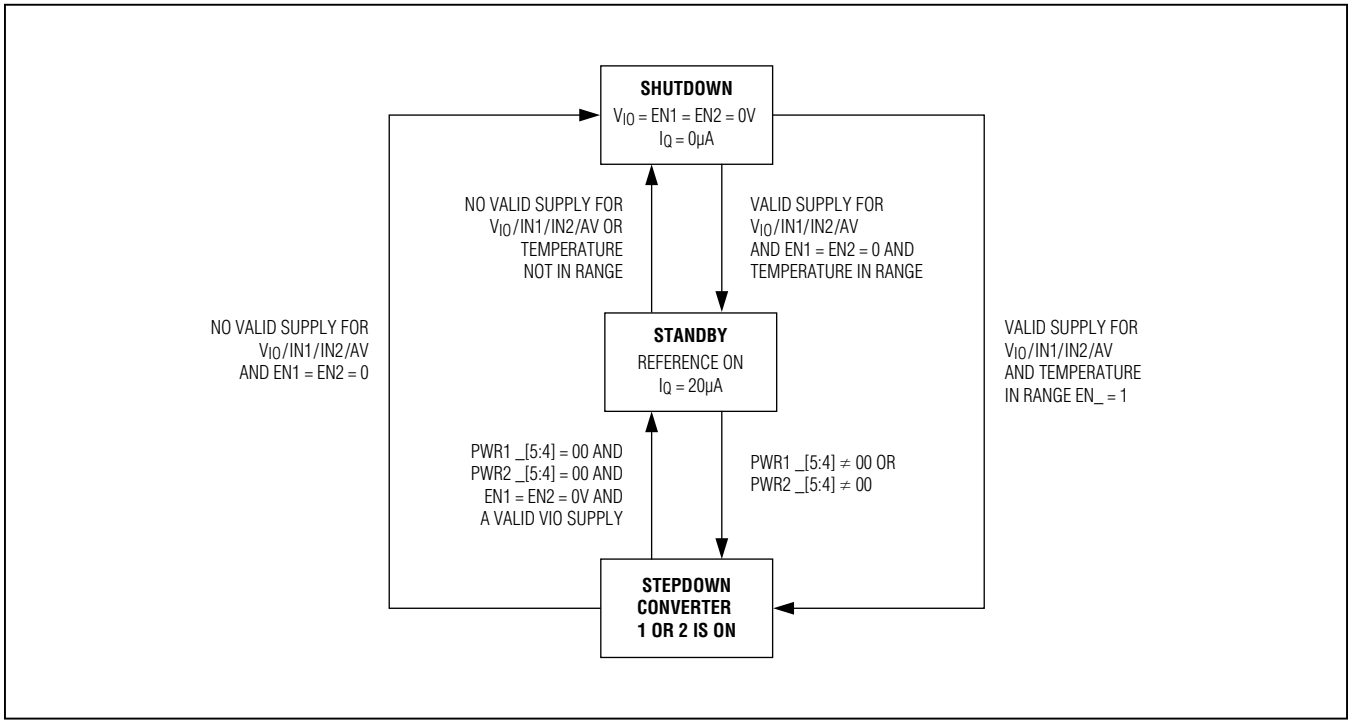


图1. 电源模式状态图

表1. LDO说明

LDO	$V_{IN\_}$ RANGE (V)	INPUT SUPPLY	V_{OUT} RANGE (V)	MAXIMUM OUTPUT CURRENT (mA)	C_{OUT} (µF)
LDO1	1.7 to 5.5	INA	0.8 to 3.95	150	1
LDO2	1.7 to 5.5	INA	0.8 to 3.95	300	1
LDO3	1.7 to 5.5	INA	0.8 to 3.95	150	1
LDO4	1.7 to 5.5	INB	0.8 to 3.95	150	1
LDO5	1.7 to 5.5	INB	0.8 to 3.95	300	1
LDO6	1.7 to 5.5	INB	0.8 to 3.95	150	1

LDO电源模式

所有LDO稳压器可通过其LDO_PWR[7:6]位独立使能和关闭。此外，每个LDO具有特殊的绿色模式，使静态电流降至1.5µA (典型值)以内。绿色模式下，每个稳压器支持高达10mA的负载电流。负载调整率随负载电流的减小成比例下降。

绿色模式提供几个工作选项。为强制稳压器进入绿色模式，设置LDO_PWR[7:6] = 10。

软启动和动态电压调节

LDO稳压器的软启动上升速率可以设置。使能LDO时，输出电压以5mV/µs或100mV/µs摆率上升到相应的最终稳压值，具体取决于LDO_SS位的状态，参见表3和表20。

对于300mA稳压器，采用1µF输出电压、空载条件下，5mV/µs摆率使输入浪涌电流限制在大约5mA；1µF输出电容、空载条件下，采用100mV/µs摆率时，浪涌电流可达100mA，但在50µs内达到稳压值。如果没有禁止在两种输出电压之间动态切换，则软启动摆率也是输出电压的变化速率。

LDO软启动电路支持启动时进入预偏置输出。

电源就绪比较器

每个稳压器包括一个电源就绪(POK)比较器。POK比较器输出(LDO_POK)指示每路输出是否超出稳压范围(即输出电压低于V_{POKTHL})。POK输出具有25µs噪声抑制滤波器($V_{POKNF\_}$)。绿色模式下禁止POK比较器工作，以降低功耗。当任意一路POK信号(LDO_POK)变为低电平时，产生中断。

注意，LDO采用专有的POK技术，即使LDO处于软启动阶段也允许POK比较器正常工作。如果LDO在其软启动阶段发生过载，POK为低电平；如果在软启动阶段未发生过载，则POK输出高电平。

有源放电

每个线性稳压器均配备了有源放电电阻，可利用LDO_ADE位控制使能/禁止，参见表3和表20。使能有源放电功能有助于确保全部系统外设完全、及时地关断。有源放电电阻默认状态为使能，每当VUVLO，LDO_低于其门限UVLO时，将禁止所有稳压器，相应的有源放电电阻导通；当VUVLO，LDO_低于1.0V时，控制有源放电电阻的NMOS晶体管没有栅极驱动，为开路状态。

如果禁止有源放电通道，当关闭稳压器时，内部有源放电电阻与输出不连接，输出电压下降的速率由输出电容和外部负载决定。

使能稳压器时，内部有源放电电阻不连接输出。如果使能有源放电，当关闭稳压器时，内部有源放电电阻将连接到输出端，对输出电容储存的电能进行放电。

可调节补偿

所有六个LDO均具有可调节补偿，以支持远端电容。该功能依据远端电容的电阻和电感对LDO进行补偿，使得每个LDO按照远端电容位置的不同来优化负载瞬态性能，详细信息请参考表20。应在关断LDO时切换到LDO补偿。如果在使能LDO时切换到补偿，由于将接入未充电的电容作为补偿变化，从而产生不可预测的输出尖峰脉冲。

过压箝位

每个LDO均具有过压箝位，当输出电压高于目标电压时，允许吸入电流。该过压箝位默认为使能，但可利用LDO_OVCLMP_EN禁止，参见表3和表15。以下列出了过压箝位的三种典型应用。

- **LDO负载向LDO输出漏电流：**有些LDO负载在特定工作模式下会向LDO输出漏电，这种情况通常发生在负载是微处理器的情况。例如，电源电压为3.3V、2.5V、1.8V和1.0V的微处理器工作在待机模式。该模式下，较高的电源电压会向较低电压的电源漏入几个mA的电流。如果LDO提供1.0V电压，LDO输出电压随漏电流的大小升高。如果使能LDO过压箝位，当输出电压升高到目标稳压值以上时，过压箝位从输出电容吸入电流，使输出电压恢复到稳压范围内。
- **0A引起的负向负载瞬变：**当LDO负载电流快速变化到0A (即300mA跳变到0A的负载瞬变，跳变时间为1µs)，输出电压会产生过冲(即骤升)。由于LDO不能立即关断调整管，LDO输出电压将发生过冲。这种情况下，当输出电压升高到目标稳压值以上时，过压箝位从输出电容吸收电流，使输出电压恢复到稳压范围内。
- **负向动态电压跳变：**如果系统负载较轻，当LDO输出目标电压降低时(即1.2V变为0.8V)，输出电容中的能量会趋向于保持输出电压。当输出电压高于其目标稳压值时，过压箝位从输出电容吸收电流，使输出电压恢复到稳压范围内。

LDO中断

电源就绪比较器输出驱动一组中断。正常工作期间，一旦输出超出稳压范围，稳压器将产生中断；绿色模式下，禁止POK比较器，稳压器不产生中断。

散热考虑

大多数应用中，由于IC高效工作，发热并不大。但是，如果应用环境温度较高、负载较重，较大功耗可能造成温度超出器件允许的最高结温。如果结温达到+165°C左右，则触发热过载保护。

IC的最大功率耗散取决于IC封装和电路板热阻。器件的功率耗散为：

$$PD = P_{OUT1} \times (1/\eta 1 - 1) + P_{OUT2} \times (1/\eta 2 - 1)$$

式中，η1和η2为每个转换器的效率，P_{OUT1}和P_{OUT2}为每个转换器的输出功率。

最大允许功率耗散为：

$$P_{MAX} = (T_{JMAX} - T_A)/\theta_{JA}$$

$T_{JMAX} - T_A$为IC的最高额定结温与周围空气之间的温差，θ_{JA}为PCB、铜线及其它材料与周围空气接触的热阻。

数字接口

IC具有四种数字接口：

- 两个使能控制引脚(EN_)，每个降压转换器一个使能控制。
- 两个V_{ID}引脚($V_{ID\_}$)，每个降压转换器一个控制端。
- 中断引脚，IRQB。
- 2线I^2C接口。

I^2C接口用于设置IC状态，两个使能引脚和两个V_{ID}引脚(每个降压转换器一个控制端)用于快速控制或切换之前通过I^2C接口定义的两种电压和工作模式。

使能(EN_)

两个使能逻辑输入端可快速控制每路降压转换器的通、断。使能引脚与I^2C降压转换器的PWR MD (模式)位配合工作，控制每路降压转换器的通/断、常规模式或绿色模式，以及使能和禁止。每个转换器均可通过专用使能引脚或I^2C逻辑“或”功能使能。

电压标识数字($V_{ID\_}$)

器件的两个$V_{ID_}$引脚用于快速切换每个降压转换器预先定义的状态。也可通过多个寄存器设置每个转换器的输出电压和工作模式。

IRQB

IRQB为低电平有效开漏输出，任一或多个降压转换器发生故障时产生中断报警。独立监测每个转换器和LDO的POK状态，并监测整个MAX8967的热关断状态。

表2. 降压转换器工作模式

EN_	I²C MD BITS		MODE
0	0	0	Off
0	0	1	On, green
0	1	0	On, normal, remote sense on
0	1	1	On, normal, remote sense off
1	0	0	On, normal, remote sense on
1	0	1	On, green
1	1	0	On, normal, remote sense on
1	1	1	On, normal, remote sense off

I²C接口

I²C兼容的2线串行接口控制降压转换器输出电压、摆率、工作模式和同步。串行总线由一条双向串行数据线(SDA)和一条串行时钟输入(SCL)组成。主控制器在总线上发起数据传输并产生SCL信号，启动数据传输。

I²C为低电平有效开漏总线。SDA和SCL需要上拉电阻(500Ω或更大)，可在SDA和SCL线上连接串联电阻(24Ω)，保护器件输入不受总线上高压尖峰的损害。串联电阻还将总线上的串扰和下冲降至最小。

位传输

每个SCL时钟周期传输一位数据。在SCL时钟脉冲为高电平期间，SDA数据必须保持稳定，参见图2。SCL为高电平时，SDA上的变化将产生控制信号，信息信息请参考*START和STOP条件*部分。

每次传输都以START (S)条件和STOP (P)条件打包成帧，每个数据包为9位长，8位数据之后是应答位。IC支持SCL频率高达400kHz的数据传输。

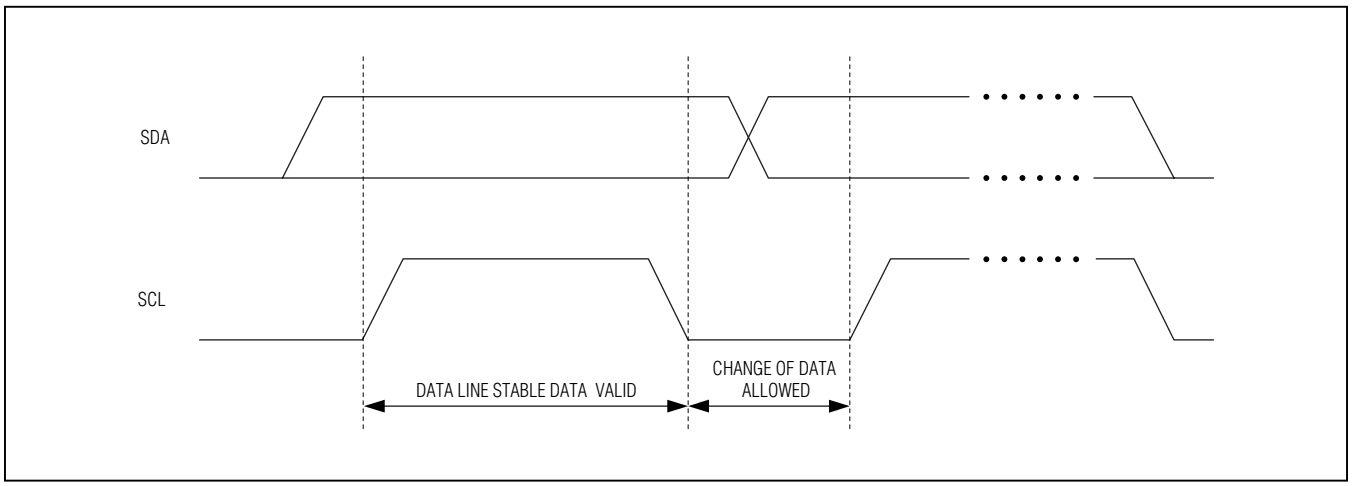


图2. I²C位传输

START和STOP条件

串行总线无效时，SDA和SCL为空闲高电平。主机通过发送START条件启动通信，START条件是SCL为高电平时，SDA由高到低的跳变。STOP条件是SCL为高电平时，SDA由低到高跳变，参见图3。

来自主机的START条件通知IC开始传输。主机通过发送非应答(nACK)和随后的STOP条件结束传输，详细信息请参考应答部分。STOP条件释放总线。为了向从机连续发送命令，主机可发送REPEATED START (Sr)命令，而非STOP命令，保持总线控制。一般情况下，REPEATED START命令的作用等效于定时START命令。

检测到STOP条件或不正确地址时，IC在内部断开SCL与串行总线的连接，直到下一个START条件，将数字噪声和馈通降至最小。

系统配置

I²C总线发出消息的器件称为发送器，接收消息的器件称为接收器。控制消息的器件为主机，受主机控制的器件称为从机。

应答

START和STOP条件之间，发送器和接收器的数据字节数量不受限。每8位字节后边跟一个应答位，应答期间，发送器在主机产生的一个额外应答脉冲期间释放SDA。被寻址的从器件必须在收到每个字节后产生一次应答；主机也必须在接收到从器件发出的每个字节后产生一次应答。

应答器件必须在应答时钟脉冲内拉低SDA，使SDA在应答脉冲的高电平周期内稳定在低电平(还需满足建立和保持时间)。主机接收器必须在从机发出最后一个字节后产生非应答信号，以终止数据传输。这种情况下，发送器必须释放SDA，使得主机能够产生STOP条件。

更新输出工作模式

如果更新输出电压或IC当前所处模式的工作模式寄存器，则在IC发送I²C数据字节应答的同时更新输出电压/工作模式。

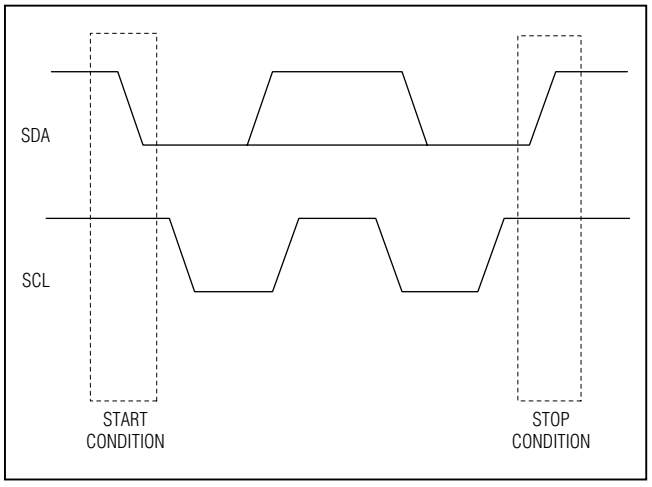


图3. I²C START和STOP条件

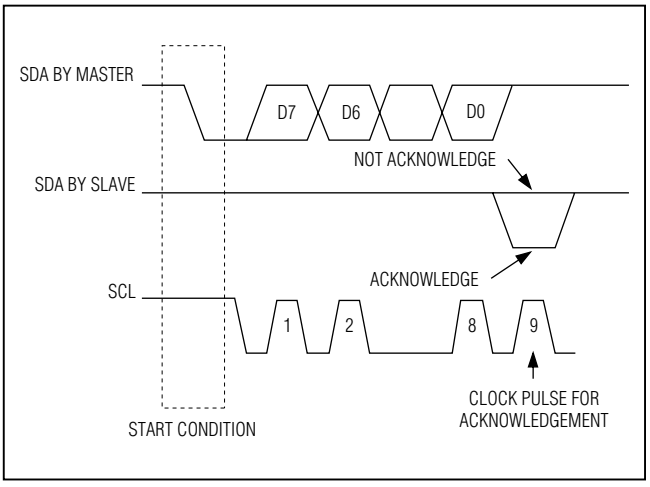


图4. I²C应答

从地址

总线主机通过发送START条件和随后的从机地址启动一次通信。从地址字节包括7个地址位(1100011x)和一个读/写位(R/$\overline{W}$)。接收到相应的地址后，IC通过在第9个时钟周期内将SDA拉低进行应答。

IC的默认I²C从地址为C6h，可为器件分配其它两个从地址(C8h和CAh)。详细情况请联系工厂，*参见选型指南*。

写操作

IC按照SMBus规范的定义识别写字节协议。写字节协议允许I²C主器件向从器件发送1个字节的数据。写字节协议需要一个寄存器指针用于随后的写操作。即使器件中只存在这些寄存器的一个子集，IC也会应答所有寄存器指针。写字节协议如下：

1) 主机发送START命令。
2) 主机发送7位从机地址和后续的写控制位。
3) 被寻址的从机通过拉低SDA进行应答。
4) 主机发送一个8位寄存器指针。
5) 从机应答寄存器指针。
6) 主机发送一个数据字节。
7) 从机应答数据字节。
8) 从机用新数据更新
9) 主机发送STOP条件。

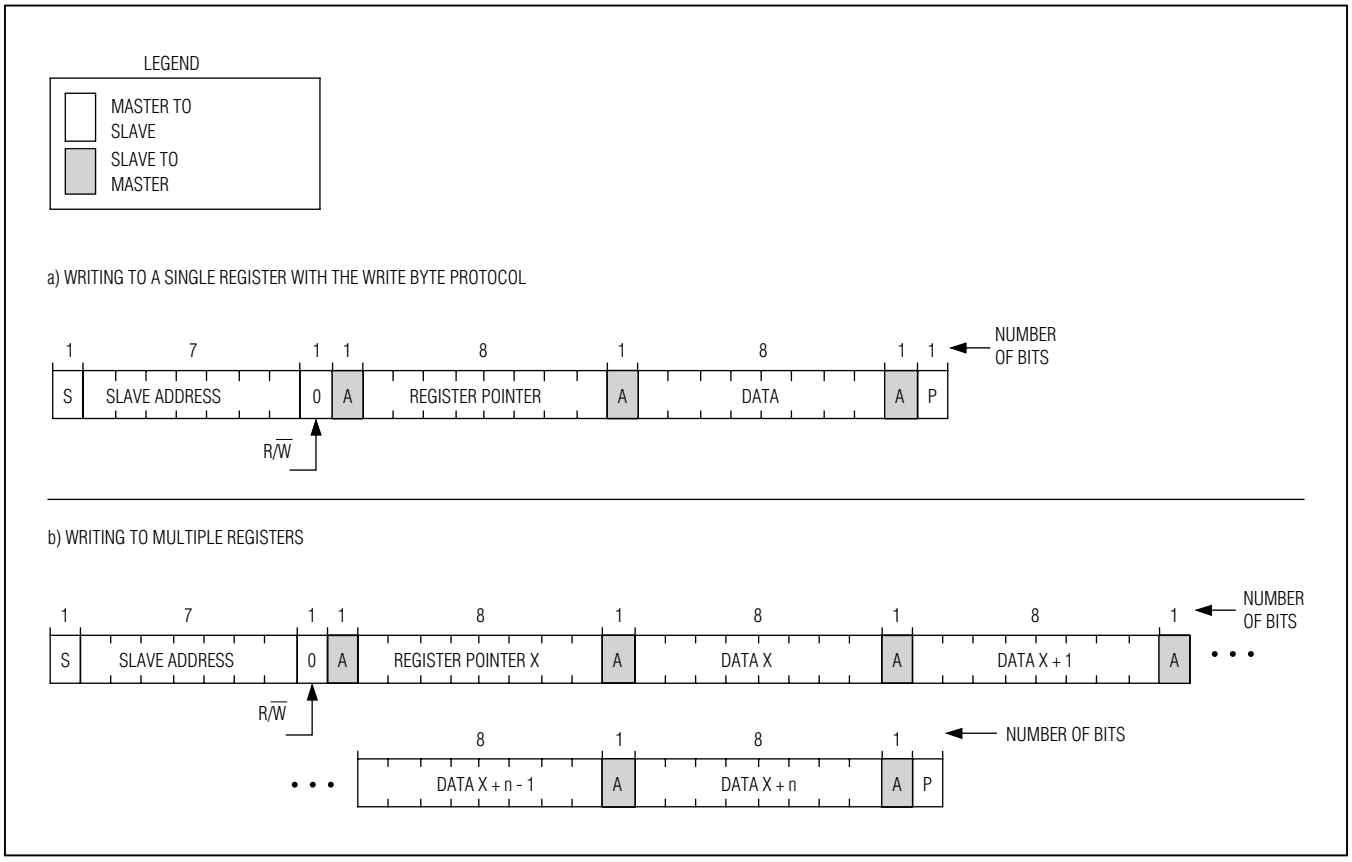


图5. I²C写操作

除写字节协议外，IC还可以连续写入多个寄存器，如图5所示。该协议允许I²C主机寻址一次即可将所有数据发送到指定以寄存器指针为起始地址的连续寄存器区域。

采用以下步骤进行连续的写寄存器操作：

1) 主机发送START命令。
2) 主机发送7位从机地址和随后的写控制位。
3) 被寻址的从器件通过拉低SDA进行应答。
4) 主机发送第一个写寄存器的8位寄存器地址指针。
5) 从机应答寄存器指针。
6) 主机发送一个数据字节。
7) 从机应答数据字节。
8) 从机更新到新数据
9) 对数据块内的寄存器重复步骤6至8，寄存器指针每次自动递增。
10) 主机发送STOP条件。

读操作

读单个寄存器(字节)的方法如下图所示。读单个寄存器：

1) 主机发送START命令。
2) 主机发送7位从机地址和随后的写控制位。
3) 被寻址的从机通过拉低SDA进行应答。
4) 主机发送一个8位寄存器指针。
5) 从机应答寄存器指针。
6) 主机发送重复START条件。
7) 主机发送7位从机地址和随后的读操作位。
8) 从机通过拉低SDA进行应答。
9) 从机发送8位数据(寄存器内容)。
10) 主机通过保持SDA为高电平发送非应答。
11) 主机发送STOP条件。

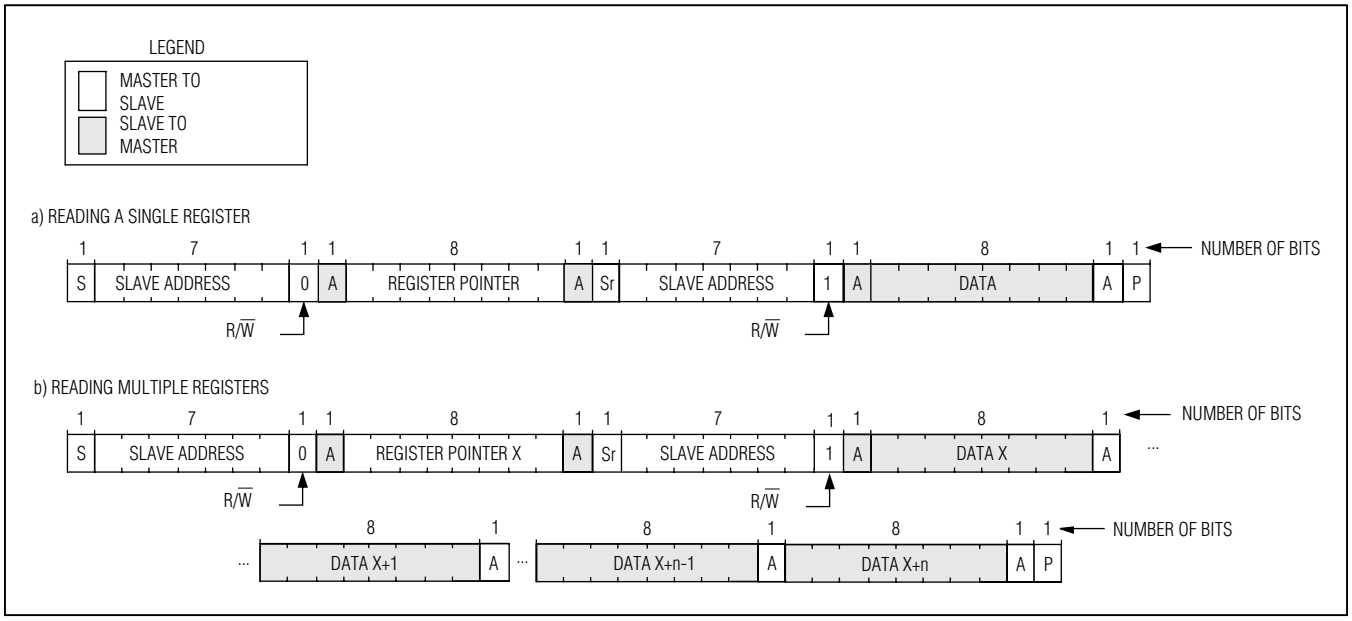


图6. I²C读操作

此外，IC也可读取多个连续寄存器组成的块，如图6所示。采用以下步骤读连续的寄存器块：

1) 主机发送START命令。
2) 主机发送一个7位从机地址和随后的写操作位。
3) 被寻址的从机通过拉低SDA进行应答。
4) 主机发送数据块中第一个寄存器的8位寄存器指针。
5) 从机应答寄存器指针。
6) 主机发送重复START条件。
7) 主机发送7位从机地址和随后的读操作位。
8) 从机通过拉低SDA进行应答。
9) 从机发送8位数据(寄存器内容)。
10) 有更多数据需要读取时，主机通过拉低SDA发送应答；或在读取所有数据后，通过保持SDA为高电平发送非应答。
11) 对数据块内的寄存器重复步骤9和10，寄存器指针每次自动递增。
12) 主机发送STOP条件。

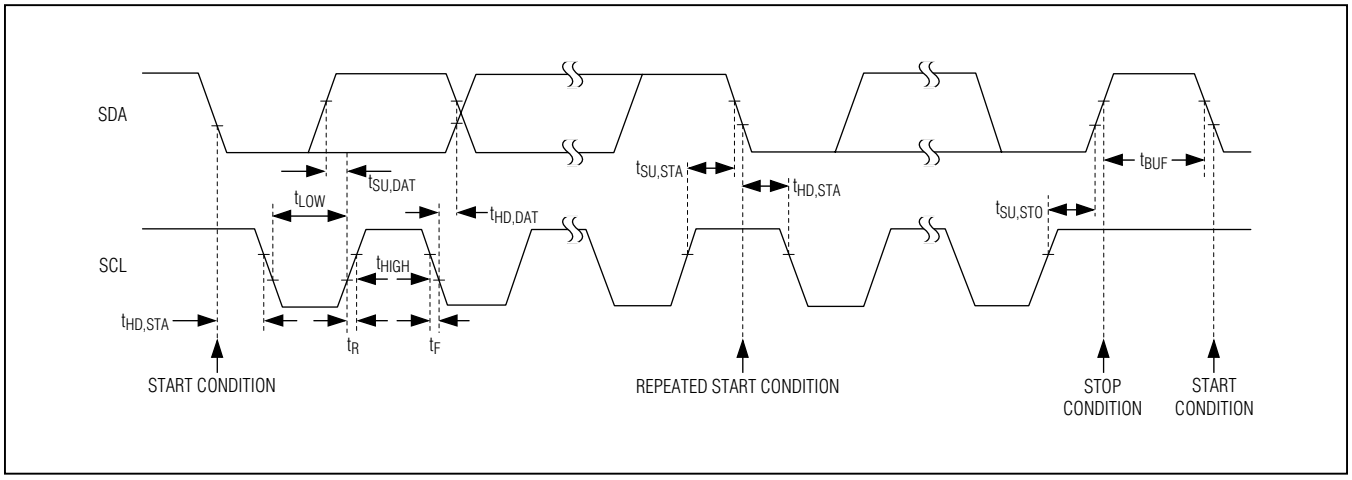


图7. I²C时序图

I²C命令

寄存器复位

加至V_{IO}的电压下降到门限0.4V以下时，与IC I²C接口相关的所有寄存器内容将复位到其默认值，参见*Electrical Characteristics*表。IC的从地址为0xC6。

I²C高级寄存器映射

表3. I²C高级寄存器映射

REGISTER	DESCRIPTION	BIT							
		7 MSB	6	5	4	3	2	1	0 LSB
0x00	ID	ID[7:0]							
0x01	Chip Configuration	FREQ[2:0]			RSVD	RSVD	RSVD	RSVD	RSVD
0x02	Step-Down 1 Voltage V_{ID} High	VOUT_B1_VIDH[7:0]							
0x03	Step-Down 1 Voltage V_{ID} Low	VOUT_B1_VIDL[7:0]							
0x04	Step-Down 1 Configuration V_{ID} High	SLEW1H[7:6]		PWR1H[5:4]		nADEN1H	FPWM1H	RSVD	FALL SLEW1H
0x05	Step-Down 1 Configuration V_{ID} Low	SLEW1L[7:6]		PWR1L[5:4]		nADEN1L	FPWM1L	RSVD	FALL SLEW1L
0x06	Step-Down 2 Voltage V_{ID} High	VOUT_B2_VIDH[7:0]							
0x07	Step-Down 2 Voltage V_{ID} Low	VOUT_B2_VIDL[7:0]							
0x08	Step-Down 2 Configuration V_{ID} High	SLEW2H[7:6]		PWR2H[5:4]		nADEN2H	FPWM2H	RSVD	FALL SLEW2H
0x09	Step-Down 2 Configuration V_{ID} Low	SLEW2L[7:6]		PWR2L[5:4]		nADEN2L	FPWM2L	RSVD	FALL SLEW2L
0x0B	Status	PNOK1	PNOK2	TH	LDO_ PNOK	RSVD	RSVD	RSVD	RSVD
0x0C	Interrupt	PNOK1_ INT	PNOK2_ INT	TH_INT	LDO_ PNOK_ INT	RSVD	RSVD	RSVD	RSVD
0x0D	Interrupt Mask	PNOK1M	PNOK2M	THM	LDO_ PNOKM	RSVD	RSVD	RSVD	RSVD
0x0E	LDO 1 Configuration 1	LDO1PWR[7:6]		LDO1TV[5:0]					
0x0F	LDO 1 Configuration 2	LDO1OV CLMP_EN	RSVD	LDO1COMP[5:4]		LDO1POK	RSVD	LDO1 ADE	LDO1SS
0x10	LDO 2 Configuration 1	LDO2PWR[7:6]		LDO2TV[5:0]					
0x11	LDO 2 Configuration 2	LDO2OV CLMP_EN	RSVD	LDO2COMP[5:4]		LDO2POK	RSVD	LDO2 ADE	LDO2SS
0x12	LDO 3 Configuration 1	LDO3PWR[7:6]		LDO3TV[5:0]					
0x13	LDO 3 Configuration 2	LDO3OV CLMP_EN	RSVD	LDO3COMP[5:4]		LDO3POK	RSVD	LDO3 ADE	LDO3SS

表3. I²C高级寄存器映射(续)

REGISTER	DESCRIPTION	BIT							
		7 MSB	6	5	4	3	2	1	0 LSB
0x14	LDO 4 Configuration 1	LDO4PWR[7:6]		LDO4TV[5:0]					
0x15	LDO 4 Configuration 2	LDO4OV CLMP_EN	RSVD	LDO4COMP[5:4]		LDO4POK	RSVD	LDO4 ADE	LDO4SS
0x16	LDO 5 Configuration 1	LDO5PWR[7:6]		LDO5TV[5:0]					
0x17	LDO 5 Configuration 2	LDO5OV CLMP_EN	RSVD	LDO5COMP[5:4]		LDO5POK	RSVD	LDO5 ADE	LDO5SS
0x18	LDO 6 Configuration 1	LDO6PWR[7:6]		LDO6TV[5:0]					
0x19	LDO 6 Configuration 2	LDO6OV CLMP_EN	RSVD	LDO6COMP[5:4]		LDO6POK	RSVD	LDO6 ADE	LDO6SS
0x1B	LDO INT	RSVD		L06_INT	L05_INT	L04_INT	L03_INT	L02_INT	L01_INT
0x1C	LDO INTM	RSVD		L06_INTM	L05_INTM	L04_INTM	L03_INTM	L02_INTM	L01_INTM

表4. ID寄存器

COMMAND NAME	ID
I²C address	MAX8967 I²C address
Command code	**0x00**
Access type	Read only
Reset condition	Hard wired, not reset

位	名称	说明	默认值
7–0	ID[7:0]	编码为唯一的芯片版本标识。	0x66

表5. 芯片配置寄存器

COMMAND NAME	CHIP CONFIGURATION
I²C address	MAX8967 I²C address
Command code	**0x01**
Access type	Read/write
Reset condition	Power-up/chip reset

位	名称	说明	默认值
7, 6, 5	FREQ[2:0]	开关频率选择位。 000 = 4.4MHz　100 = 4.2MHz 001 = 4.8MHz　101 = RSVD 010 = 4.0MHz　110 = 4.6MHz 011 = RSVD　111 = RSVD	0b000
4–0	保留	—	0b0

表6. 降压转换器1输出电压(VID为高)

COMMAND NAME	STEP-DOWN CONVERTER 1 VOLTAGE VID HIGH
I²C address	MAX8967 I²C address
Command code	**0x02**
Access type	Read/write
Reset condition	Power-up/chip reset

位	名称	说明	默认值
7:0	VOUT_ B1_VIDH [7:0]	见表14	0x00

表7. 降压转换器1输出电压(VID为低)

COMMAND NAME	STEP-DOWN CONVERTER 1 VOLTAGE VID LOW
I²C address	MAX8967 I²C address
Command code	**0x03**
Access type	Read/write
Reset condition	Power-up/chip reset

位	名称	说明	默认值
7–0	VOUT_B1_VIDL [7:0]	见表14	0x30

表8. 降压转换器1配置寄存器(VID为高)

COMMAND NAME	STEP-DOWN CONVERTER 1 CONFIGURATION VID HIGH
I²C address	MAX8967 I²C address
Command code	**0x04**
Access type	Read/write
Reset condition	Power-up/chip reset

位	名称	说明	默认值
7–0	见表15	见表15	0x00

表9. 降压转换器1配置寄存器(VID为低)

COMMAND NAME	STEP-DOWN CONVERTER 1 CONFIGURATION VID LOW
I²C address	MAX8967 I²C address
Command code	**0x05**
Access type	Read/write
Reset condition	Power-up/chip reset

位	名称	说明	默认值
7–0	见表15	见表15	0x00

表10. 降压转换器2配置寄存器(VID为高)

COMMAND NAME	STEP-DOWN 2 VOLTAGE VID HIGH
I²C address	MAX8967 I²C address
Command code	**0x06**
Access type	Read/write
Reset condition	Power-up/chip reset

位	名称	说明	默认值
7–0	VOUT_B2_VIDH[7:0]	见表14	0x00

表11. 降压转换器2输出电压(VID为低)

COMMAND NAME	STEP-DOWN 2 VOLTAGE VID LOW
I²C address	MAX8967 I²C address
Command code	**0x07**
Access type	Read/write
Reset condition	Power-up/chip reset

位	名称	说明	默认值
7–0	VOUT_B2_VIDL[7:0]	见表14	0x30

表12. 降压转换器2配置寄存器(VID为高)

COMMAND NAME	STEP-DOWN 2 CONFIGURATION VID HIGH
I²C address	MAX8967 I²C address
Command code	**0x08**
Access type	Read/write
Reset condition	Power-up/chip reset

位	名称	说明	默认值
7–0	见表15	见表15	0x00

表13. 降压转换器2配置寄存器(VID为低)

COMMAND NAME	STEP-DOWN 2 CONFIGURATION VID LOW
I²C address	MAX8967 I²C address
Command code	**0x09**
Access type	Read/write
Reset condition	Power-up/chip reset

位	名称	说明	默认值
7–0	见表15	见表15	0x00

表14. 降压转换器输出电压表

BIT	DESCRIPTION							DEFAULT
VOUT_B_VID_[7:0]	0x00 = 0.6000V	0x20 = 1.0000V	0x40 = 1.4000V	0x60 = 1.8000V	0x80 = 2.2000V	0xA0 = 2.6000V	0xC0 = 3.0000V	See the *Electrical Characteristics* table.
	0x01 = 0.6125V	0x21 = 1.0125V	0x41 = 1.4125V	0x61 = 1.8125V	0x81 = 2.2125V	0xA1 = 2.6125V	0xC1 = 3.0125V	
	0x02 = 0.6250V	0x22 = 1.0250V	0x42 = 1.4250V	0x62 = 1.8250V	0x82 = 2.2250V	0xA2 = 2.6250V	0xC2 = 3.0250V	
	0x03 = 0.6375V	0x23 = 1.0375V	0x43 = 1.4375V	0x63 = 1.8375V	0x83 = 2.2375V	0xA3 = 2.6375V	0xC3 = 3.0375V	
	0x04 = 0.6500V	0x24 = 1.0500V	0x44 = 1.4500V	0x64 = 1.8500V	0x84 = 2.2500V	0xA4 = 2.6500V	0xC4 = 3.0500V	
	0x05 = 0.6625V	0x25 = 1.0625V	0x45 = 1.4625V	0x65 = 1.8625V	0x85 = 2.2625V	0xA5 = 2.6625V	0xC5 = 3.0625V	
	0x06 = 0.6750V	0x26 = 1.0750V	0x46 = 1.4750V	0x66 = 1.8750V	0x86 = 2.2750V	0xA6 = 2.6750V	0xC6 = 3.0750V	
	0x07 = 0.6875V	0x27 = 1.0875V	0x47 = 1.4875V	0x67 = 1.8875V	0x87 = 2.2875V	0xA7 = 2.6875V	0xC7 = 3.0875V	
	0x08 = 0.7000V	0x28 = 1.1000V	0x48 = 1.5000V	0x68 = 1.9000V	0x88 = 2.3000V	0xA8 = 2.7000V	0xC8 = 3.1000V	
	0x09 = 0.7125V	0x29 = 1.1125V	0x49 = 1.5125V	0x69 = 1.9125V	0x89 = 2.3125V	0xA9 = 2.7125V	0xC9 = 3.1125V	
	0x0A = 0.7250V	0x2A = 1.1250V	0x4A = 1.5250V	0x6A = 1.9250V	0x8A = 2.3250V	0xAA = 2.7250V	0xCA = 3.1250V	
	0x0B = 0.7375V	0x2B = 1.1375V	0x4B = 1.5375V	0x6B = 1.9375V	0x8B = 2.3375V	0xAB = 2.7375V	0xCB = 3.1375V	
	0x0C = 0.7500V	0x2C = 1.1500V	0x4C = 1.5500V	0x6C = 1.9500V	0x8C = 2.3500V	0xAC = 2.7500V	0xCC = 3.1500V	
	0x0D = 0.7625V	0x2D = 1.1625V	0x4D = 1.5625V	0x6D = 1.9625V	0x8D = 2.3625V	0xAD = 2.7625V	0xCD = 3.1625V	
	0x0E = 0.7750V	0x2E = 1.1750V	0x4E = 1.5750V	0x6E = 1.9750V	0x8E = 2.3750V	0xAE = 2.7750V	0xCE = 3.1750V	
	0x0F = 0.7875V	0x2F = 1.1875V	0x4F = 1.5875V	0x6F = 1.9875V	0x8F = 2.3875V	0xAF = 2.7875V	0xCF = 3.1875V	
	0x10 = 0.8000V	0x30 = 1.2000V	0x50 = 1.6000V	0x70 = 2.0000V	0x90 = 2.4000V	0xB0 = 2.8000V	0xD0 = 3.2000V	
	0x11 = 0.8125V	0x31 = 1.2125V	0x51 = 1.6125V	0x71 = 2.0125V	0x91 = 2.4125V	0xB1 = 2.8125V	0xD1 = 3.2125V	
	0x12 = 0.8250V	0x32 = 1.2250V	0x52 = 1.6250V	0x72 = 2.0250V	0x92 = 2.4250V	0xB2 = 2.8250V	0xD2 = 3.2250V	
	0x13 = 0.8375V	0x33 = 1.2375V	0x53 = 1.6375V	0x73 = 2.0375V	0x93 = 2.4375V	0xB3 = 2.8375V	0xD3 = 3.2375V	

表14. 降压转换器输出电压表(续)

BIT	DESCRIPTION							DEFAULT
VOUT_ B_ VID_[7:0]	0x14 = 0.8500V	0x34 = 1.2500V	0x54 = 1.6500V	0x74 = 2.0500V	0x94 = 2.4500V	0xB4 = 2.8500V	0xD4 = 3.2500V	See the *Electrical Characteristics* table.
	0x15 = 0.8625V	0x35 = 1.2625V	0x55 = 1.6625V	0x75 = 2.0625V	0x95 = 2.4625V	0xB5 = 2.8625V	0xD5 = 3.2625V	
	0x16 = 0.8750V	0x36 = 1.2750V	0x56 = 1.6750V	0x76 = 2.0750V	0x96 = 2.4750V	0xB6 = 2.8750V	0xD6 = 3.2750V	
	0x17 = 0.8875V	0x37 = 1.2875V	0x57 = 1.6875V	0x77= 2.0875V	0x97 = 2.4875V	0xB7 = 2.8875V	0xD7 = 3.2875V	
	0x18 = 0.9000V	0x38 = 1.3000V	0x58 = 1.7000V	0x78 = 2.1000V	0x98 = 2.5000V	0xB8 = 2.9000V	0xD8 = 3.3000V	
	0x19 = 0.9125V	0x39 = 1.3125V	0x59 = 1.7125V	0x79 = 2.1125V	0x99 = 2.5125V	0xB9 = 2.9125V	0xD9 = 3.3125V	
	0x1A = 0.9250V	0x3A = 1.3250V	0x5A = 1.7250V	0x7A = 2.1250V	0x9A = 2.5250V	0xBA = 2.9250V	0xDA = 3.3250V	
	0x1B = 0.9375V	0x3B = 1.3375V	0x5B = 1.7375V	0x7B = 2.1375V	0x9B = 2.5375V	0xBB = 2.9375V	0xDB = 3.3375V	
	0x1C = 0.9500V	0x3C = 1.3500V	0x5C = 1.7500V	0x7C = 2.1500V	0x9C = 2.5500V	0xBC = 2.9500V	0xDC = 3.3500V	
	0x1D = 0.9625V	0x3D = 1.3625V	0x5D = 1.7625V	0x7D = 2.1625V	0x9D = 2.5625V	0xBD = 2.9625V	0xDD = 3.3625V	
	0x1E = 0.9750V	0x3E = 1.3750V	0x5E = 1.7750V	0x7E = 2.1750V	0x9E = 2.5750V	0xBE = 2.9750V	0xDE = 3.3750V	
	0x1F = 0.9875V	0x3F = 1.3875V	0x5F = 1.7875V	0x7F = 2.1875V	0x9F = 2.5875V	0xBF = 2.9875V	0xDF = 3.3875V	

表15. 降压转换器配置表

BIT	NAME	DESCRIPTION	DEFAULT
0	FALLSLEW_	**Active-Low Step-Down Converter Falling Slew Rate Enable** 0 = The slew rate control circuit is active when the output voltage is decreased. The desired regulation voltage is decreased in 12.5mV steps, and forced PWM mode is enabled so that negative inductor current can be used to pull energy out of the output capacitor. 1 = The slew rate control circuit is disabled when the output voltage is decreased. The desired regulation voltage is decreased in 12.5mV steps, but it is up to the external load to drain energy from the output capacitor in order to pull down on the output voltage.	0b0
1	RSVD	Reserved	0b0
2	FPWM_	**Step-Down Forced PWM Mode Enable** 0 = Step-Down Converter automatically skips pulses under light load conditions, and transfers to fixed frequency operation as the load current increases. 1 = Step-Down Converter operates with fixed frequency under all load conditions.	0b0
3	nADEN_	**Active-Low Buck Converter Active Discharge Enable** 0 = The active discharge function is enabled. When the buck converter is disabled, an internal 100Ω discharge resistor is connected to the output to discharge the energy stored in the output capacitor. When the buck converter is enabled, the discharge resistor is disconnected from the output. 1 = The active discharge function is disabled. When the buck converter is disabled, the internal 100Ω discharge resistor is not connected to the output, and the discharge rate is dependent on the output capacitance and the load present. When the buck converter is enabled, the discharge resistor is disconnected from the output.	0b0
5:4	PWR_[5:4]	**Step-Down Power Mode Configuration.** These bits determine the mode of operation for this converter. 00 = Disabled 01 = Normal operation mode with remote sense disabled 10 = Green mode 11 = Normal operation mode with remote sense enabled	0b00
7:6	SLEW_[7:6]	**Step-Down Rising Slew Rate** 00 = 12.5mV/µs ramp rate 01 = 25mV/µs ramp rate 10 = 50mV/µs ramp rate 11 = No slew rate control. Output voltage increases as fast as the current limit allows.	0b00

表16. 状态

COMMAND NAME	STATUS
I²C address	MAX8967 I²C address
Command code	**0x0B**
Access type	Read only. Status is masked by the interrupt mask register and is cleared by reading related interrupt register bits.
Reset condition	Power-up/chip reset/0b1 written to bit

位	名称	说明	默认值
7	PNOK1	0 = 降压转换器1开启。 1 = 降压转换器1关闭或为默认值。	0b1
6	PNOK2	0 = 降压转换器2打开。 1 = 降压转换器2关闭或为默认值。	0b1
5	TH	0 = 温度低于热关断门限。 1 = 温度超过热关断门限。	0b0
4	LDO_PNOK	0 = 一个或多个LDO关闭或高于POK门限。 1 = 一个或多个LDO打开且低于POK门限。	0b0
3	RSVD	保留	0b1
2	RSVD	保留	0b1
1	RSVD	保留	0b1
0	RSVD	保留	0b1

表 17. 中断

COMMAND NAME	INTERRUPT
I²C address	MAX8967 I²C address
Command code	**0x0C**
Access type	Read—clear on read
Reset condition	Power-up/chip reset/0b1 written to bit

位	名称	说明	默认值
7	PNOK1_INT	**降压转换器1中断位** 0 = 输出正常。 1 = 输出下降到电源就绪门限以下。	0b0
6	PNOK2_INT	**降压转换器2中断位** 0 = 输出正常。 1 = 输出下降到电源就绪门限以下。	0b0
5	TH_INT	**热中断位** 0 = 管芯温度正常。 1 = 管芯温度超过热关断门限。	0b0
4	LDO_PNOK_INT	一个或多个LDO未达到电源就绪电压。	0b0
3	RSVD	保留	0b0
2	RSVD	保留	0b0
1	RSVD	保留	0b0
0	RSVD	保留	0b0

表18. 中断屏蔽

COMMAND NAME	**INTERRUPT MASK**
I²C address	MAX8967 I²C address
Command code	**0x0D**
Access type	Read–clear on read
Reset condition	Power-up/chip reset/0b1 written to bit

位	名称	说明	默认值
7	PNOK1M	**降压转换器1中断屏蔽位** 0 = 中断未屏蔽。 1 = 中断已屏蔽。	0b1
6	PNOK2M	**降压转换器2中断屏蔽位** 0 = 中断未屏蔽。 1 = 中断已屏蔽。	0b1
5	THM	**热中断屏蔽位** 0 = 中断未屏蔽。 1 = 中断已屏蔽。	0b1
4	LDO_PNOKM	**LDO中断屏蔽位** 0 = 中断未屏蔽。 1 = 中断已屏蔽。	0b1
3	RSVD	保留	0b1
2	RSVD	保留	0b0
1	RSVD	保留	0b0
0	RSVD	保留	0b0

表19. LDO_配置1寄存器

REGISTER NAME	**LDO_ CONFIGURATION 1**
Register address	See Table 3
Access type	Read/write
Reset condition	Power-up/chip reset

位	名称	说明	默认值
7, 6	LDO_PWR [7:6]	**LDO电源模式配置** 00 = 禁止输出 01 = 禁止输出 10 = 绿色模式 11 = 常规模式	0b00
5–0	LDO_TV[5:0]	**设置LDO的目标电压** 以0.05V步长设置。 0x00 = 0.80V　0x0A = 1.30V　0x14 = 1.80V　0x1E = 2.30V　0x28 = 2.80V　0x32 = 3.30V　0x3C = 3.80V 0x01 = 0.85V　0x0B = 1.35V　0x15 = 1.85V　0x1F = 2.35V　0x29 = 2.85V　0x33 = 3.35V　0x3D = 3.85V 0x02 = 0.90V　0x0C = 1.40V　0x16 = 1.90V　0x20 = 2.40V　0x2A = 2.90V　0x34 = 3.40V　0x3E = 3.90V 0x03 = 0.95V　0x0D = 1.45V　0x17 = 1.95V　0x21 = 2.45V　0x2B = 2.95V　0x35 = 3.45V　0x3F = 3.95V 0x04 = 1.00V　0x0E = 1.50V　0x18 = 2.00V　0x22 = 2.50V　0x2C = 3.00V　0x36 = 3.50V 0x05 = 1.05V　0x0F = 1.55V　0x19 = 2.05V　0x23 = 2.55V　0x2D = 3.05V　0x37 = 3.55V 0x06 = 1.10V　0x10 = 1.60V　0x1A = 2.10V　0x24 = 2.60V　0x2E = 3.10V　0x38 = 3.60V 0x07 = 1.15V　0x11 = 1.65V　0x1B = 2.15V　0x25 = 2.65V　0x2F = 3.15V　0x39 = 3.65V 0x08 = 1.20V　0x12 = 1.70V　0x1C = 2.20V　0x26 = 2.70V　0x30 = 3.20V　0x3A = 3.70V 0x09 = 1.25V　0x13 = 1.75V　0x1D = 2.25V　0x27 = 2.75V　0x31 = 3.25V　0x3B = 3.75V	0b00

表20. LDO_配置2寄存器

REGISTER NAME	**LDO_ CONFIGURATION 2**
Register address	See Table 3.
Access type	Read only for bit 3, and read/write for the rest
Reset condition	Power-up/chip reset

位	名称	说明	默认值
7	LDO_OVCLMP_EN	**过压箝位使能** 0 = 禁止过压箝位。 1 = 使能过压箝位。	0b1
6	RSVD	保留	0b0
5, 4	LDO_COMP	**LDO步长** 00 = 假设至远端电容的走线阻抗为50mΩ/5nH。 01 = 假设至远端电容的走线阻抗为100mΩ/10nH。 10 = 假设至远端电容的走线阻抗为50mΩ至200mΩ/5nH至20nH。 11 = 假设至远端电容的走线阻抗为100mΩ至400mΩ/10nH至40nH。 **注：**只有在禁止LDO时才可更改LDO_COMP位。如果在使能LDO时更改补偿位，补偿变化会造成输出电压产生尖峰脉冲。	0b01
3	LDO_POK	**电压就绪状态位** 0 = 电压低于POK门限，器件处于常规模式。 1 = 电压高于POK门限或LDO工作在绿色模式，或者LDO被禁止。	0b0
2	RSVD	保留	—
1	LDO_ADE	**有源放电使能** 0 = 禁止有源放电功能。 1 = 使能有源放电功能。	0b1
0	LDO_SS	**设置LDO软启动摆率** (适用于启动和输出电压设置变化) 0 = 快速启动和动态电压变化——100mV/µs。 1 = 慢速启动和动态电压变化——5mV/µs。	0b1

表21. LDO_INT寄存器

REGISTER NAME	LDO_INT
Register address	**0x1B**
Access type	Read—clear on read
Reset condition	Power-up/chip reset

位	名称	说明	默认值
7, 6	RSVD	保留	
5	L06_INT	**LDO6中断位** 0 = LDO输出正常。 1 = LDO输出下降至电源就绪门限以下。	0b0
4	L05_INT	**LDO5中断位** 0 = LDO输出正常。 1 = LDO输出下降至电源就绪门限以下。	0b0
3	L04_INT	**LDO4中断位** 0 = LDO输出正常。 1 = LDO输出下降至电源就绪门限以下。	0b0
2	L03_INT	**LDO3中断位** 0 = LDO输出正常。 1 = LDO输出下降至电源就绪门限以下。	0b0
1	L02_INT	**LDO2中断位** 0 = LDO输出正常。 1 = LDO输出下降至电源就绪门限以下。	0b0
0	L01_INT	**LDO1中断位** 0 = LDO输出正常。 1 = LDO输出下降至电源就绪门限以下。	0b0

表22. LDO_INTM寄存器

REGISTER NAME	LDO_INTM
Register address	0x1C
Access type	Read—clear on read
Reset condition	Power-up/chip reset

位	名称	说明	默认值
7, 6	RSVD	保留	0b11
5	L06_INTM	**LDO6中断屏蔽位** 0 = 中断未屏蔽。 1 = 中断已屏蔽。	0b1
4	L05_INTM	**LDO5中断屏蔽位** 0 = 中断未屏蔽。 1 = 中断已屏蔽。	0b1
3	L04_INTM	**LDO4中断屏蔽位** 0 = 中断未屏蔽。 1 = 中断已屏蔽。	0b1
2	L03_INTM	**LDO4中断屏蔽位** 0 = 中断未屏蔽。 1 = 中断已屏蔽。	0b1
1	L02_INTM	**LDO2中断屏蔽位** 0 = 中断未屏蔽。 1 = 中断已屏蔽。	0b1
0	L01_INTM	**LDO1中断屏蔽位** 0 = 中断未屏蔽。 1 = 中断已屏蔽。	0b1

应用信息

电感选择

每个降压转换器的工作电感标称值为1µH，建议使用DCR小于50mΩ的电感，以降低I^2R损耗。

输出电容选择

IC设计使用至少22µF陶瓷电容(X5R等级)，电容连接至每个降压转换器输出。注意，每路输出电容可安装在负载端，作为旁路。

每个LDO输出需要1µF (X5R等级)陶瓷电容。电容可置于IC远端，通过I^2C命令选择相应的补偿，参见表20。

输入电容选择

由于采用了消纹波技术，最糟糕的情况下，当一路电源工作在接近2A的最大负载电流时，另一路电源则提供非常小的负载电流。由于IC通常连接到较大的电容节点，本地只需使用4.7µF电容。建议使用X5R的10µF陶瓷电容。

PCB布局

IC产生的噪声几乎全部集中在IN1、IN2和PGND_引脚，这些引脚的旁路电容应靠近IC放置。应在PGND_引脚连接到对应降压转换器输入电容之后，再连接PGND_和AGND。两个降压转换器均具有远端检测，能够提供高达200mV的远端输出电压修正，详细信息请参考MAX8967评估板。

定购信息

器件	引脚-封装	温度范围	降压转换器输出1 (V)	降压转换器输出2 (V)
MAX8967EWV+T	30 WLP	-40°C至+85°C	1.20	1.20
MAX8967AEWV+T	30 WLP	-40°C至+85°C	1.20	1.80
MAX8967BEWV+T	30 WLP	-40°C至+85°C	1.20	2.80
MAX8967CEWV+T	30 WLP	-40°C至+85°C	1.20	3.20

+表示无铅(Pb)/符合RoHS标准的封装。

芯片信息

PROCESS: BiCMOS

封装信息

如需最近的封装外形信息和焊盘布局(占位面积)，请查询china.maximintegrated.com/packages。请注意，封装编码中的“+”、“#”或“–”仅表示RoHS状态。封装图中可能包含不同的尾缀字符，但封装图只与封装有关，与RoHS状态无关。

封装类型	封装编码	外型编号	焊盘布局编号
30 WLP	W302B2+2	21-0548	参考应用笔记1891

修订历史

修订号	修订日期	说明	修改页
0	12/12	最初版本。	—

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