SGM3843A
Power Management IC for AMOLED Display

GENERAL DESCRIPTION

The SGM3843A is a PMIC (Power Management IC) designed for powering AMOLED (Active Matrix Organic LED) displays which require V_{ELVDD}, V_{ELVSS}, V_{AVDD}, V_{DVDD} and V_{VGL}.

The device integrates two Boost converters VO1 for V_{ELVDD} and VO3 for V_{AVDD}, one dual-phase inverting Buck-Boost converter VO2 for V_{ELVSS}, one single-phase inverting Buck-Boost converter VO5 for V_{VGL}, and one Buck converter VO4 for V_{DVDD}. It also integrates one negative low dropout linear regulator (LDO) VO5_LDO for V_{VGL_LDO}.

The DVDD, VGL and VGL_LDO are used for powering the DDIC (Display-Driver IC).

All output voltages of these converters can be programmed in digital steps through the SWIRE interfaces.

The SGM3843A is available in a Green WLCSP-3.3×3.3-64B package.

FEATURES

- **2.9V to 5.0V Input Supply Voltage Range**
- **Synchronous Boost Converter VO1 (ELVDD)**
  - **4.6V to 5.0V Output Voltage with 100mV Steps**
  - **4.6V Default Output Voltage**
  - **0.65% Accuracy at 4.6V**
  - **1200mA Output Current Capability**
- **Synchronous Inverting Buck-Boost Converter VO2 (ELVSS)**
  - **-7.0V to -1.05V Output Voltage with 50mV Steps**
  - **-4.0V Default Output Voltage**
  - **1% Accuracy at -4.0V**
  - **1200mA Output Current Capability**
- **Synchronous Boost Converter VO3 (AVDD)**
  - **5.7V to 8.0V Output Voltage with 50mV Steps**
  - **7.6V Default Output Voltage**
  - **0.66% Accuracy at 7.6V**
  - **200mA Output Current Capability**
- **Synchronous Buck Converter VO4 (DVDD)**
  - **0.7V to 2.075V Output Voltage with 25mV Steps**
  - **1.05V Default Output Voltage**
  - **0.6% Initial Accuracy at 1.05V**
  - **400mA Output Current Capability**
- **Synchronous Inverting Buck-Boost Converter VO5 (VGL)**
  - **-4.0V to -12.5V Output Voltage with 100mV Steps**
  - **-7V Default Output Voltage**
  - **0.8% Accuracy at -7V**
  - **30mA Output Current Capability**
- **Low Dropout Linear Regulator VO5_LDO (VGL_LDO)**
  - **Fixed 300mV Dropout Voltage**
  - **30mA Output Current Capability**
- **Excellent Line Transient Regulation**
- **High Performance Load Regulation**
- **V_{IN} and V_{OUT} Bi-Directional Isolation**
- **SWIRE Interface**
- **Under-Voltage Lockout (UVLO)**
- **All Channels Soft-Start**
- **All Channels Fast Discharge Function (FD)**
- **All Channels Short Circuit Protection (SCP)**
- **All Channels Over-Current Protection (OCP)**
- **Over-Temperature Protection (OTP)**
- **Overload Protection (OLP)**
- **Start-Up Short Detection (SSD)**
- **V_{ELVSS} Start-Up Delay: 6ms**
- **Short Circuit and OLP Detection Time: 1ms**
- **Available in a Green WLCSP-3.3×3.3-64B Package**

APPLICATIONS

Smartphones & Tablets

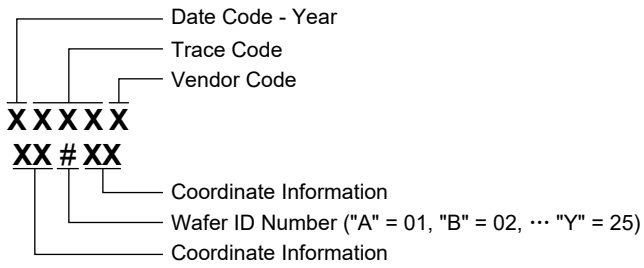
Active Matrix OLED Displays

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM3843A	WLCSP-3.3×3.3-64B	-40℃ to +85℃	SGM3843AYG/TR	SGM 3843AYG XXXXX XX#XX	Tape and Reel, 5000

MARKING INFORMATION

NOTE: XXXXX = Date Code, Trace Code and Vendor Code. XX#XX = Coordinate Information and Wafer ID Number.



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

Voltage Range (with Respect to Ground Pin)
PVIN1, PVIN2A, PVIN2B, PVIN4, PVIN5, AVIN, VO1, VO1_FB, VO4_FB ..... -0.3V to 6V
VO4_EN, VO5_EN, SWIRE1, SWIRE2, RESETB, VIO, PGOOD ..... -0.3V to 6V
VO2A, VO2B, VO2_FB ..... -9V to GND + 0.3V
VO5, IN_LDO, VO5_LDO ..... -15V to GND + 0.3V
SW1, SW4 ..... -0.3V to 6V
SW1, SW4 (Transient: 10ns) ..... -1V to 8V
SW3, VO3 ..... -0.3V to 10V
SW3 (Transient: 10ns) ..... -1V to 12V
SW2A, SW2B ..... -9V to 6V
SW2A, SW2B (Transient: 10ns) ..... -11V to 8V
SW5 ..... -15V to 6V
SW5 (Transient: 10ns) ..... -17V to 8V
Package Thermal Resistance
WLCSP-3.3×3.3-64B, θ_{JA} ..... 27℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 2000V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Operating Junction Temperature Range ..... -40℃ to +125℃
Operating Ambient Temperature Range ..... -40℃ to +85℃

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

ESD SENSITIVITY CAUTION

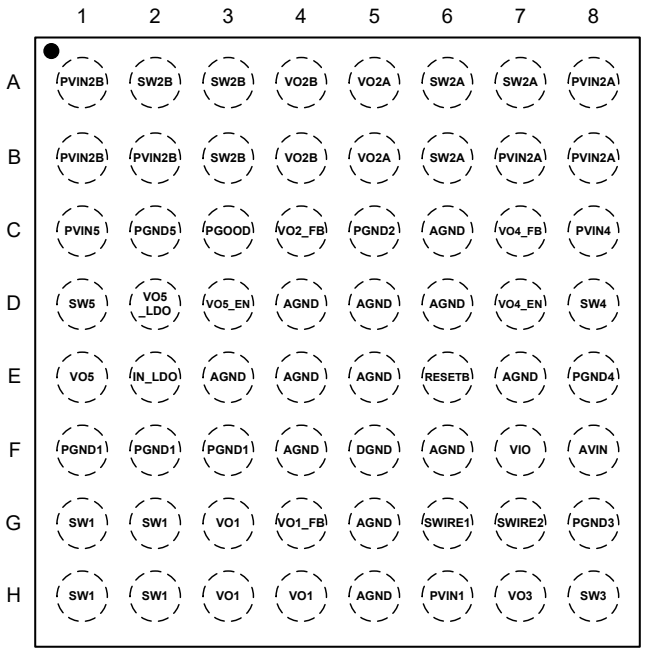
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATION

(TOP VIEW)



WLCSP-3.3×3.3-64B

PIN DESCRIPTION

PIN	NAME	TYPE	DESCRIPTION
A1, B1, B2	PVIN2B	I	VO2 Inverting Buck-Boost Converter B Power Supply Input Pin.
A2, A3, B3	SW2B	I/O	VO2 Inverting Buck-Boost Converter B Switching Node.
A4, B4	VO2B	O	VO2 Inverting Buck-Boost Converter B Output Pin.
A5, B5	VO2A	O	VO2 Inverting Buck-Boost Converter A Output Pin.
A6, A7, B6	SW2A	I/O	VO2 Inverting Buck-Boost Converter A Switching Node.
A8, B7, B8	PVIN2A	I	VO2 Inverting Buck-Boost Converter A Power Supply Input Pin.
C1	PVIN5	I	VO5 Inverting Buck-Boost Converter Power Supply Input Pin.
C2	PGND5	G	VO5 Power Ground.
C3	PGOOD	O	Power Good Open-Drain Output.
C4	VO2_FB	I	VO2 Inverting Buck-Boost Converter Output Sense Input.
C5	PGND2	G	VO2 Inverting Buck-Boost Converter Power Ground.
C6, D4, D5, D6, E3, E4, E5, E7, F4, F6, G5, H5	AGND	G	Analog Ground Pin.

PIN DESCRIPTION (continued)

PIN	NAME	TYPE	DESCRIPTION
C7	VO4_FB	O	VO4 Buck Converter Output Sense Input.
C8	PVIN4	I	VO4 Buck Converter Power Supply Input Pin.
D1	SW5	I/O	VO5 Inverting Buck-Boost Converter Switching Node.
D2	VO5_LDO	O	VO5 Negative Low Dropout Regulator Output.
D3	VO5_EN	I	VO5 Inverting Buck-Boost Converter Enable Pin.
D7	VO4_EN	I	VO4 Buck Converter Enable Pin.
D8	SW4	I/O	VO4 Buck Converter Switching Node.
E1	VO5	O	VO5 Inverting Buck-Boost Converter Output.
E2	IN_LDO	I	VO5 Inverting Buck-Boost Converter and LDO Power Supply Input Pin.
E6	RESETB	I	Reset Control Input Pin.
E8	PGND4	G	VO4 Buck Converter Power Ground.
F1, F2, F3	PGND1	G	VO1 Boost Converter Power Ground.
F5	DGND	G	Digital Ground Pin.
F7	VIO	I	Input Voltage Supply for I/O Circuits. Bypass this pin to AGND with at least 1μF high quality ceramic capacitor (X5R or better).
F8	AVIN	I	Analog Input Supply Pin.
G1, G2, H1, H2	SW1	I/O	VO1 Boost Converter Switching Node.
G3, H3, H4	VO1	O	VO1 Boost Converter Output.
G4	VO1_FB	I	VO1 Boost Converter Output Sense Input.
G6	SWIRE1	I	VO1/VO2 Converter Enable and Programming Pin.
G7	SWIRE2	I	VO3 Converter Enable and VO3/VO4/VO5 Programming Pin.
G8	PGND3	G	VO3 Boost Converter Power Ground.
H6	PVIN1	I	VO1 Boost Converter Power Supply Input Pin.
H7	VO3	O	VO3 Boost Converter Output.
H8	SW3	I/O	VO3 Boost Converter Switching Node.

NOTE: I: input, O: output, I/O: input or output, G: ground.

TYPICAL APPLICATION

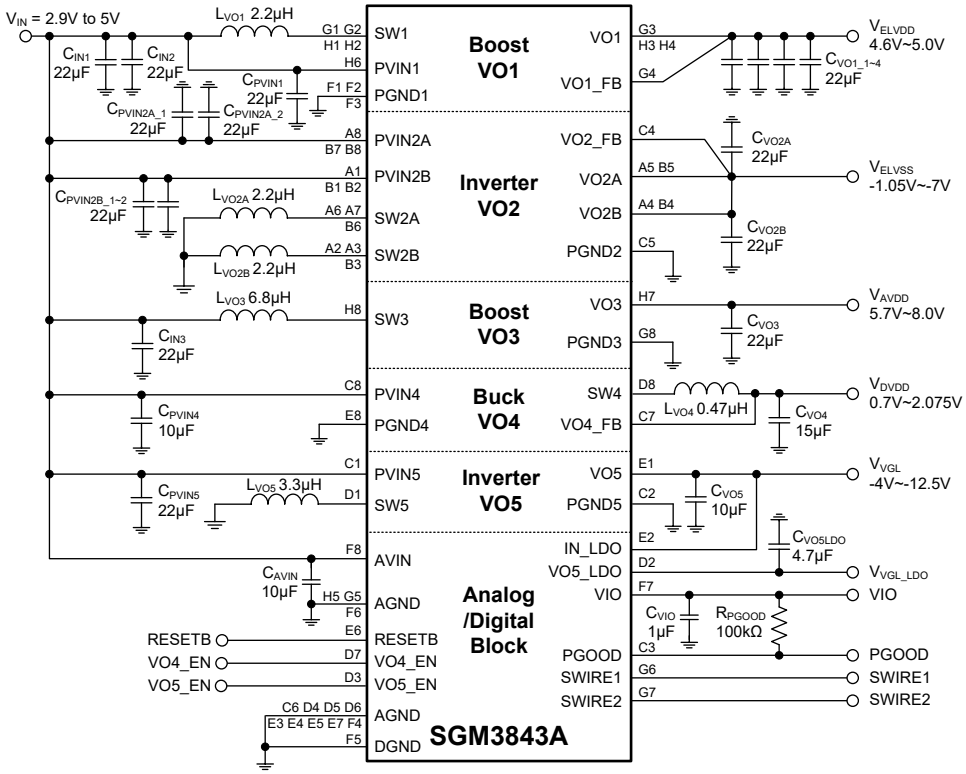


Figure 1. Typical Application Circuit

RECOMMENDED COMPONENT SELECTION

Table 1. Recommended Component Selection

Component	Value	Number	Electrical Spec	Part Number	Manufacturer
C_{IN1}, C_{IN2}, C_{IN3}, C_{PVIN1}, C_{PVIN2A_1}, C_{PVIN2A_2}, C_{PVIN2B_1}, C_{PVIN2B_2}, C_{PVIN5}, C_{VO1_1}, C_{VO1_2}, C_{VO1_3}, C_{VO1_4}, C_{VO2A} (1), C_{VO2B} (1), C_{VO3}	22μF	16	X5R, 16V, 0805	GRM219R61C226ME15L	Murata
C_{PVIN4}, C_{AVIN}	10μF	2	X5R, 16V, 0603	GRM188R61C106MA73	Murata
C_{VO4} (2)	15μF	1	X5R, 10V, 0603	C1608X5R1A156M080AC	TDK
C_{VO5}	10μF	1	X5R, 25V, 0603	GRM188R61E106MA73	Murata
C_{VIO}	1μF	1	X5R, 16V, 0603	GRM155R61C105KA12	Murata
C_{VO5LDO}	4.7μF	1	X5R, 25V, 0603	GRM188R61E475ME11	Murata
L_{VO1}, L_{VO2A}, L_{VO2B}	2.2μH	3	4A, 70mΩ, 322512	HMLQ32251B-2R2MS	Cyntec
L_{VO3}	6.8μH	1	1.1A, 275mΩ, 252012	VLS252012CX-6R8M-1	TDK
L_{VO4} (2)	0.47μH	1	2.9A, 54mΩ, 160808	TFM160808ALC-R47MTAA	TDK
L_{VO5}	3.3μH	1	1.5A, 228mΩ, 252010	1269AS-H-3R3M=P2	Murata
R_{PGOOD}	100kΩ	1			

NOTES:

1. C_{VO2A} = C_{VO2B} = 2×22μF are recommended for I_{VO2} > 1A.
2. L_{VO4} = 2.2μH & C_{VO4} = 2.2μF are recommended for V_{DVDD} ≤ 1.5V application due to better efficiency.
   L_{VO4} = 0.47μH & C_{VO4} = 15μF can be used for 0.7V ≤ V_{DVDD} ≤ 2.075V application.

ELECTRICAL CHARACTERISTICS

(V_{IN} = 3.7V, V_{VO1} = 4.6V, V_{VO2} = -4.0V, V_{VO3} = 7.6V, V_{VO4} = 1.05V, V_{VO5} = -7V, T_J = -40℃ to +85℃, typical values are at T_J = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
General							
AVIN, PVIN Input Voltage Range	V_{S_VIN}			2.9		5	V
Shutdown Current into PVINx, AVIN	I_{SD}	All channels off			1.0	2.0	μA
Quiescent Current into PVINx, AVIN	I_{QON}	All channels on, no load, pulse 130			4.3		mA
Quiescent Current into PVINx, AVIN	I_{QON}	All channels on, no load, pulse 129			1.6		mA
AVIN Start Threshold Voltage	V_{START}	V_{IN} rising		2.2	2.36	2.5	V
AVIN Stop Threshold Voltage	V_{STOP}	V_{IN} falling		2.1	2.25	2.4	V
Thermal Shutdown Temperature	T_{SD}	Temperature rising			150		℃
Thermal Shutdown Hysteresis	ΔT_{SD}	TSD release threshold temperature = T_{SD} - ΔT_{SD}			15		℃
ELVDD Boost Converter (V_{VO1} = V_{ELVDD})							
Output Default Voltage	V_{VO1}	4.6V to 5.0V with 100mV/step, default 4.6V		4.6	4.6	5.0	V
Output Voltage Total Accuracy		V_{VO1} = 4.6V, no load	T_J = +25℃	-0.5		0.5	%
			T_J = -40℃ to +85℃	-0.65		0.65	
SW1 MOSFET On-Resistance	$R_{DS(ON)11}$	I_{DS} = 200mA			60		mΩ
SW1 MOSFET Rectifier On-Resistance	$R_{DS(ON)12}$	I_{DS} = 200mA			110		mΩ
SW1 Current Limit	I_{SW1_LIM}	Inductor valley current, T_J = +25℃		2.5	2.9	3.3	A
SW1 Switching Frequency	f_{SW1}	I_{VO1} = 100mA		1.25	1.45	1.65	MHz
Maximum Output Current	I_{VO1_MAX}	V_{IN} = 2.9V to 5.0V, T_J = +25℃		1200			mA
VO1 and FB1 Leakage	I_{LEAK_VO1}	No discharge, EL_EN = 0			0.5	1.2	μA
Short Circuit Protection Threshold in Operation	V_{VO1_FBCP}	V_{VO1} falling, percentage of nominal V_{VO1}, T_J = +25℃		78	87	94	%
Discharging Resistance	R_{DCHG_VO1}	I_{VO1} = 20mA			75		Ω
Discharge Time	t_{DVO1}				8		ms
Line Transient	$VO1_{LINETRA}$	ΔV_{IN} = 0.5V, t_R = t_F = 10μs, I_{VO1} = 0mA to 300mA	Overshoot		8		mV
			Undershoot		8		
		ΔV_{IN} = 0.5V, t_R = t_F = 10μs, I_{VO1} = 300mA to 1200mA	Overshoot		18		mV
			Undershoot		18		
Line Regulation	$VO1_{LINEREG}$	I_{VO1} = 100mA, V_{IN} = 2.9V to 5.0V			±0.014		%/V
		No load, V_{IN} = 2.9V to 5.0V			±0.014		
Output Voltage Ripple	$VO1_{RIPPLE}$	I_{VO1_VO2} = 0mA to 700mA			14		mV_{PP}
		I_{VO1_VO2} = 700mA to 1200mA			20		mV_{PP}
Load Transient	$VO1_{LOADTRA}$	ΔI_{VO1} = 10mA to 1200mA, t_R = t_F = 5ms	Overshoot		6		mV
			Undershoot		6		
Load Regulation	$VO1_{LOADREG}$	0mA ≤ I_{VO1} ≤ 1200mA, V_{IN} = 2.9V to 5.0V			3		mV

ELECTRICAL CHARACTERISTICS (continued)

(V_{IN} = 3.7V, V_{VO1} = 4.6V, V_{VO2} = -4.0V, V_{VO3} = 7.6V, V_{VO4} = 1.05V, V_{VO5} = -7V, T_J = -40℃ to +85℃, typical values are at T_J = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
ELVSS Buck-Boost Converter (V_{VO2} = V_{ELVSS})							
Output Voltage Range	V_{VO2}	-7.0V to -1.05V with 50mV/step, default -4.0V		-7	-4	-1.05	V
Output Voltage Total Accuracy		V_{VO2} = -4.0V, no load	T_J = +25℃	-25		25	mV
			T_J = -40℃ to +85℃	-40		40	
SW2A MOSFET On-Resistance	$R_{DS(ON)A1}$	I_{DS} = 200mA			90		mΩ
SW2A MOSFET Rectifier On-Resistance	$R_{DS(ON)A2}$	I_{DS} = 200mA			65		mΩ
SW2B MOSFET On-Resistance	$R_{DS(ON)B1}$	I_{DS} = 200mA			90		mΩ
SW2B MOSFET Rectifier On-Resistance	$R_{DS(ON)B2}$	I_{DS} = 200mA			65		mΩ
SW2A Current Limit	I_{SW2A_LIM}	Inductor peak current, T_J = +25℃		2.85	3.6	4.45	A
SW2B Current Limit	I_{SW2B_LIM}	Inductor peak current, T_J = +25℃		2.85	3.6	4.45	A
Average Load Current Threshold with Dual-Phase	$I_{RMSA\&B}$	Load current rising			200		A
Average Load Current Threshold with Phase A Only	I_{RMSA}	Load current falling			130		A
SW2 Switching Frequency	f_{SW2}	I_{VO2} = 100mA		1.05	1.25	1.45	MHz
Maximum Output Current	I_{VO2_MAX}	V_{IN} = 3.0V to 5.0V, T_J = +25℃		1200			mA
Short Circuit Protection Threshold in Operation	V_{VO2_SCP}	V_{VO2} rising, percentage of nominal V_{VO2}, T_J = +25℃		75	83	89	%
Discharging Resistance	R_{DCHG_VO2}	I_{VO2} = 20mA			65		Ω
Discharge Time	t_{DVO2}				3.5		ms
VO2 Leakage, No Discharge	I_{LEAK_VO2}				1.3	2.7	μA
Output Voltage Ripple	$VO2_{RIPPLE}$	I_{VO1_VO2} = 0mA to 650mA, V_{VO2} = -1.0V to -7.0V			20		mV_{PP}
		I_{VO1_VO2} = 0mA to 1200mA, V_{VO2} = -1.0V to -5.0V			31		mV_{PP}
Line Transient	$VO2_{LINETRA}$	ΔV_{IN} = 0.5V, t_R = t_F = 10μs, I_{VO2} = 0mA to 650mA, V_{VO2} = -1.0V to -7.0V	Overshoot		19		mV
			Undershoot		18		
		ΔV_{IN} = 0.5V, t_R = t_F = 10μs, I_{VO2} = 650mA to 1200mA, V_{VO2} = -1.0V to -5.0V	Overshoot		22		mV
			Undershoot		20		
Line Regulation	$VO2_{LINEREG}$	I_{VO2} = 100mA, V_{IN} = 2.9V to 5.0V			±0.013		%/V
Load Transient	$VO2_{LOADTRA}$	ΔI_{VO2} = 10mA to 1200mA, V_{VO2} = -4V, t_R = t_F = 5ms	Overshoot		25		mV
			Undershoot		35		
Load Regulation	$VO2_{LOADREG}$	0mA ≤ I_{VO2} ≤ 1200mA			±0.011		%/A

ELECTRICAL CHARACTERISTICS (continued)

(V_{IN} = 3.7V, V_{VO1} = 4.6V, V_{VO2} = -4.0V, V_{VO3} = 7.6V, V_{VO4} = 1.05V, V_{VO5} = -7V, T_J = -40℃ to +85℃, typical values are at T_J = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
AVDD Boost Converter (V_{VO3} = V_{AVDD})							
Output Voltage Range	V_{VO3}	5.7V to 8.0V with 50mV/step, default 7.6V		5.7	7.6	8.0	V
Output Voltage Total Accuracy		V_{VO3} = 7.6V, no load	T_J = +25℃	-35		35	mV
			T_J = -40℃ to +85℃	-50		50	
SW3 MOSFET On-Resistance	$R_{DS(ON)31}$	I_{DS} = 200mA			430		mΩ
SW3 MOSFET Rectifier On-Resistance	$R_{DS(ON)32}$	I_{DS} = 200mA			550		mΩ
SW3 Current Limit	I_{SW3_LIM}	Inductor peak current, T_J = +25℃		0.85	1.23	1.65	A
SW3 Switching Frequency	f_{SW3}	I_{VO3} = 30mA		1.25	1.45	1.65	MHz
Maximum Output Current	I_{VO3_MAX}	V_{IN} = 3.0V to 5.0V, T_J = +25℃		200			mA
Short Circuit Protection Threshold in Operation	V_{VO3_SCP}	V_{VO3} falling, percentage of nominal V_{VO3}, T_J = +25℃		79	86	92	%
VO3 Leakage, No Discharge	I_{LEAK_VO3}				2.5	3.5	μA
Discharging Resistance	R_{DCHG_VO3}	I_{VO3} = 20mA			52		Ω
Discharge Time	t_{DVO3}				1.5		ms
Output Voltage Ripple	$VO3_{RIPPLE}$	I_{VO3} = 0mA to 200mA			32		mV_{PP}
Line Transient	$VO3_{LINETRA}$	ΔV_{IN} = 0.5V, t_R = t_F = 10μs, I_{VO3} = 30mA	Overshoot		16		mV
			Undershoot		16		
Line Regulation	$VO3_{LINEREG}$	I_{VO3} = 100mA, V_{IN} = 2.9V to 5.0V			±0.011		%/V
Load Transient	$VO3_{LOADTRA}$	ΔI_{VO3} = 50mA to 100mA, t_R = t_F = 10μs, V_{IN} = 3.8V	Overshoot		43		mV
			Undershoot		43		
Load Regulation	$VO3_{LOADREG}$	0mA ≤ I_{VO3} ≤ 200mA			±0.036		%/A
DVDD Buck Converter (V_{VO4} = V_{DVDD})							
Output Voltage Range	V_{VO4}	0.7V to 2.075V with 25mV/step, default 1.05V		0.7	1.05	2.075	V
Output Voltage Total Accuracy (Initialization)		V_{VO4} = 1.05V, T_J = +25℃		-6		6	mV
Output Voltage Total Accuracy		V_{VO4} = 1.05V	T_J = +25℃	-10		10	mV
			T_J = -40℃ to +85℃	-18		18	
SW4 Current Limit	I_{SW4_LIM}	Inductor peak current, T_J = +25℃		0.8	1.2	1.6	A
SW4 MOSFET On-Resistance	$R_{DS(ON)41}$	I_{DS} = 200mA			370		mΩ
SW4 MOSFET Rectifier On-Resistance	$R_{DS(ON)42}$	I_{DS} = 200mA			220		mΩ
SW4 Switching Frequency	f_{SW4}	I_{VO4} = 400mA			2.7		MHz
Maximum Output Current	I_{DVDD_MAX}	V_{IN} = 2.9V to 5.0V, T_J = +25℃		400			mA
Discharging Resistance	R_{DCHG_VO4}	I_{VO4} = 20mA			75		Ω
VO4 Discharge Time	t_{DVO4}				2.5		ms
Output Voltage Ripple	$VO4_{RIPPLE}$				22		mV_{PP}
Line Transient	$VO4_{LINETRA}$	ΔV_{IN} = 0.5V, t_R = t_F = 10μs, I_{VO4} = 200mA	Overshoot		13		mV
			Undershoot		13		
Line Regulation	$VO4_{LINEREG}$	I_{VO4} = 60mA to 100mA, V_{IN} = 2.9V to 5V			±0.021		%/V
Load Transient	$VO4_{LOADTRA}$	ΔI_{VO4} = 100mA, t_R = t_F = 10μs, V_{IN} = 2.9V to 5V	Overshoot		8		mV
			Undershoot		28		
Load Regulation	$VO4_{LOADREG}$	0mA ≤ I_{VO4} ≤ 400mA			5		mV

ELECTRICAL CHARACTERISTICS (continued)

(V_{IN} = 3.7V, V_{VO1} = 4.6V, V_{VO2} = -4.0V, V_{VO3} = 7.6V, V_{VO4} = 1.05V, V_{VO5} = -7V, T_J = -40℃ to +85℃, typical values are at T_J = +25℃, unless otherwise noted.)

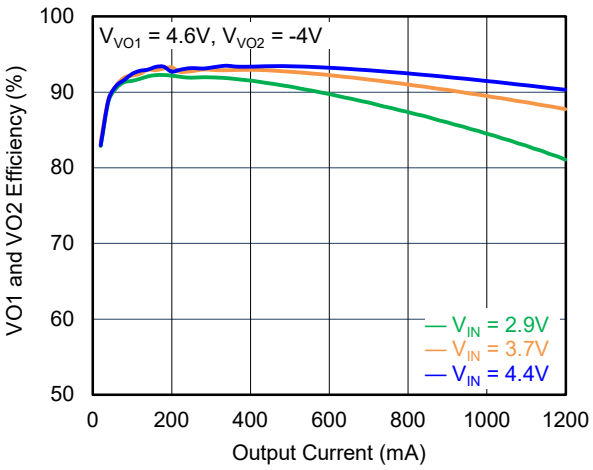
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
VGL Buck-Boost Converter (V_{VO5} = V_{VGL})							
Output Voltage Range	V_{VO5}	-4.0V to -12.5V with 100mV/step, default -7V		-12.5	-7	-4	V
Output Voltage Total Accuracy		V_{VO5} = -7V, no load	T_J = +25℃	-0.6		0.6	%
			T_J = -40℃ to +85℃	-0.8		0.8	
SW5 Current Limit	I_{SW5_LIM}	Inductor peak current, T_J = +25℃		0.70	1.05	1.45	A
SW5 MOSFET On-Resistance	$R_{DS(ON)51}$	I_{DS} = 200mA			720		mΩ
SW5 MOSFET Rectifier On-Resistance	$R_{DS(ON)52}$	I_{DS} = 200mA			360		mΩ
SW5 Switching Frequency	f_{SW5}	I_{VO5} = 30mA		1.05	1.25	1.45	MHz
Maximum Output Current	I_{VO5_MAX}	V_{IN} = 2.9V to 5.0V, T_J = +25℃		30			mA
VO5 Short Circuit Protection	V_{VO5_SCP}	V_{VO5} rising, percentage of nominal V_{VO5}, T_J = +25℃		60	76	85	%
Discharging Resistance	R_{DCHG_VO5}	I_{VO5} = 20mA			120		Ω
VO5 Discharge Time	t_{DVO5}				2.5		ms
VO5 Leakage, No Discharge	I_{LEAK_VO5}				2.6	4	μA
Output Voltage Ripple	$VO5_{RIPPLE}$	I_{VO5} = 0mA to 30mA			34		mV_{PP}
Line Transient	$VO5_{LINETRA}$	ΔV_{IN} = 0.5V, t_R = t_F = 10μs, I_{VO5} = 0mA to 30mA	Overshoot		35		mV
			Undershoot		35		
Line Regulation	$VO5_{LINEREG}$	I_{VO5} = 5mA, V_{IN} = 2.9V to 5V			±0.011		%/V
Load Transient	$VO5_{LOADTRA}$	ΔI_{VO5} = 0mA to 10mA, V_{VO5} = -7V, t_R = t_F = 10μs	Overshoot		8		mV
			Undershoot		18		
Load Regulation	$VO5_{LOADREG}$	0mA ≤ I_{VO5} ≤ 30mA			±0.31		%/A
Negative LDO (VO5_LDO)							
Output Default Voltage	V_{VO5_LDO}				V_{VO5} + 0.3		V
Output Voltage Accuracy		V_{VO5} = -7.1V, no load	T_J = +25℃	-1.1		1.1	%
			T_J = -40℃ to +85℃	-1.2		1.2	
Load Regulation	dL_{LDO}	0mA ≤ I_{VO5_LDO} ≤ 30mA			±0.37		%/A
Line Regulation	dV_{LDO}	I_{VO5_LDO} = 5mA, V_{IN} = 2.9V to 5V			±0.013		%/V
Logic I/O Pin Characteristics (VO4_EN, VO5_EN, RESETB, SWIRE1, SWIRE2)							
Input High Threshold Voltage	V_{IH_S}	Input rising		1.0			V
Input Low Threshold Voltage	V_{IL_S}	Input falling				0.4	V
Logic I/O Pin Characteristics (PGOOD) – Open-Drain							
Output Logic Low Voltage	V_{OL}	At 5mA sink current				0.4	V

TIMING REQUIREMENTS

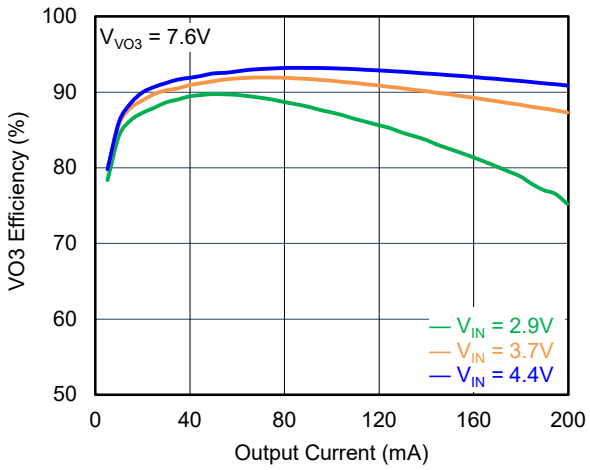
PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Short Circuit Timer					
VO1 Short Circuit Detection Time in Start-Up	$t_{VO1(SCP)}$	2	2.50	3	ms
VO1 Short Circuit Detection Time in Operation		0.8	1.0	1.3	
VO2 Short Circuit Detection Time in Start-Up	$t_{VO2(SCP)}$	5.5	6.7	7.9	
VO2 Short Circuit Detection Time in Operation		0.8	1.0	1.3	
VO3 Short Circuit Detection Time in Start-Up	$t_{VO3(SCP)}$		3.4		
VO3 Short Circuit Detection Time in Operation		0.8	1.0	1.3	
VO5 Short Circuit Detection Time in Start-Up	$t_{VO5(SCP)}$		3.4		
VO5 Short Circuit Detection Time in Operation		0.8	1.0	1.3	
SWIRE1&SWIRE2 Interface					
Initialization Time	t_{INIT}		350	450	µs
Shutdown Time Period	t_{OFF}	35	55	80	
Pulse High Level Time Period	t_{HIGH}	2	10	20	
Pulse Low Level Time Period	t_{LOW}	2	10	20	
Data Storage/Accept Time Period	t_{STORE}	35	55	80	
Power Sequence					
VO1 Start-Up Time	t_{SS1}		3.0		ms
VO2 Start-Up Time	t_{SS2}		2.0		
VO2 Start-Up Time Delay after VO1	t_{DELAY}		2.7		
VO3 Start-Up Time	t_{SS3}		1.9		
VO4 Start-Up Time	t_{SS4}		1.0		
VO5 Start-Up Time (after VO5_EN = High)	t_{SS5}		1.0		
VO5_LDO Start-Up Time (after VO5_EN = High)	t_{SS5_L}		3.5		

TYPICAL PERFORMANCE CHARACTERISTICS

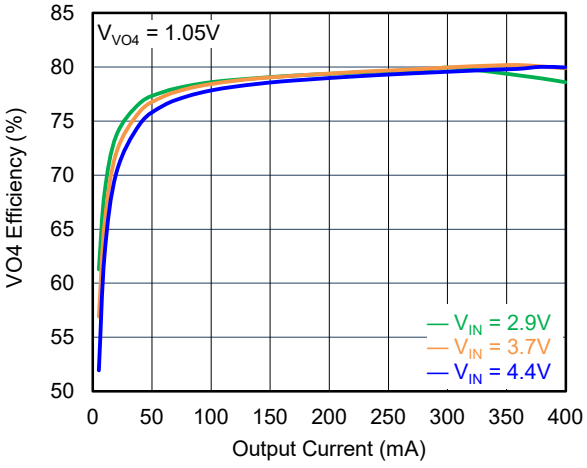
VO1 and VO2 Combined Efficiency vs. Output Current



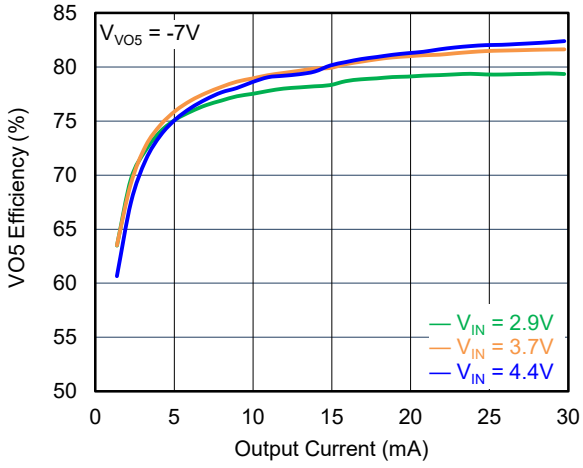
VO3 Efficiency vs. Output Current



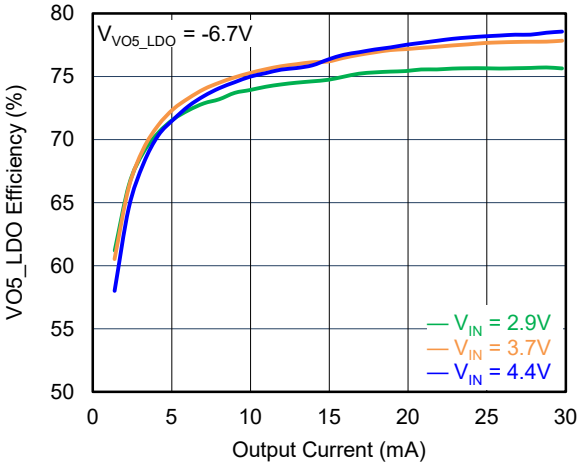
VO4 Efficiency vs. Output Current



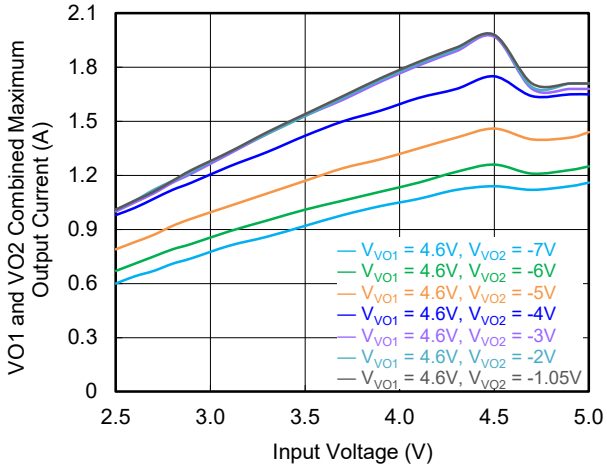
VO5 Efficiency vs. Output Current



VO5_LDO Efficiency vs. Output Current

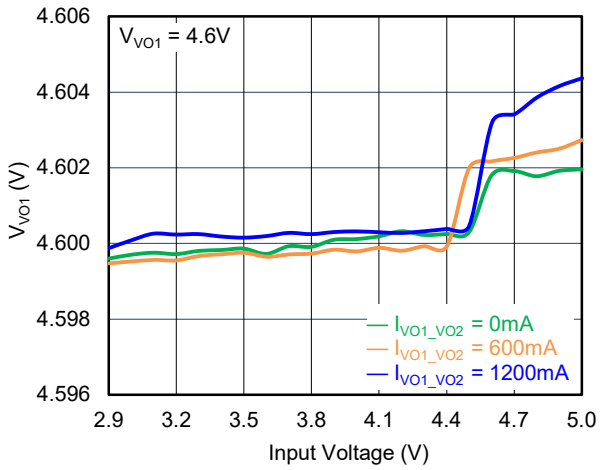


VO1 and VO2 Combined Maximum Output Current vs. Input Voltage

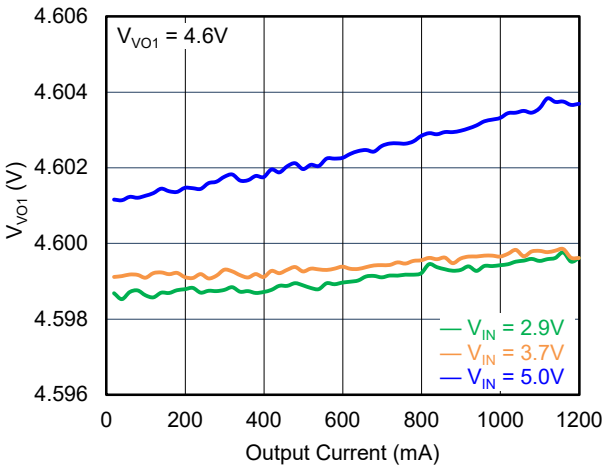


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

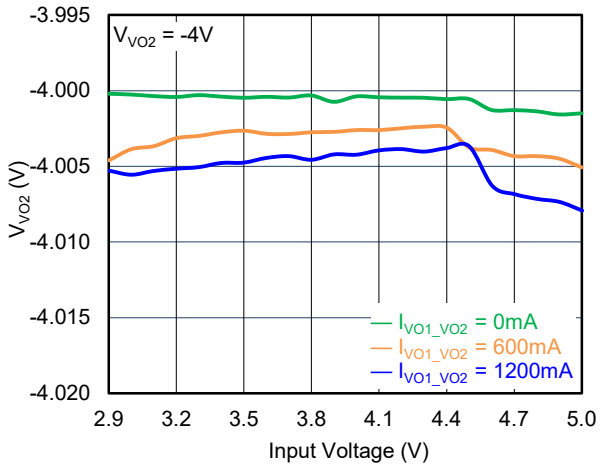
VO1 Line Regulation



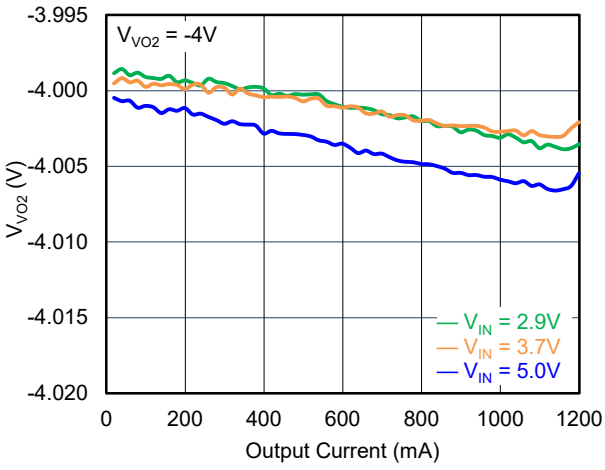
VO1 Load Regulation



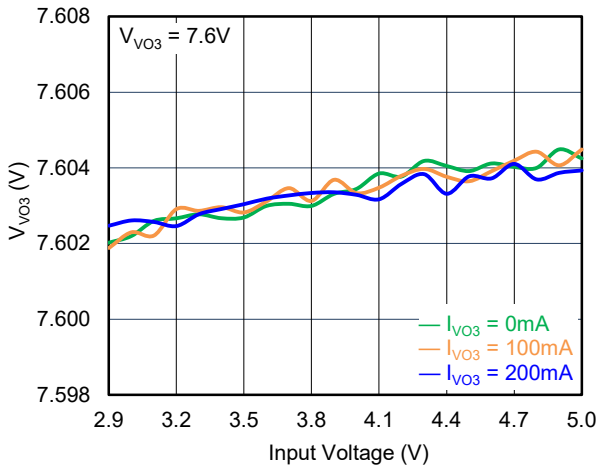
VO2 Line Regulation



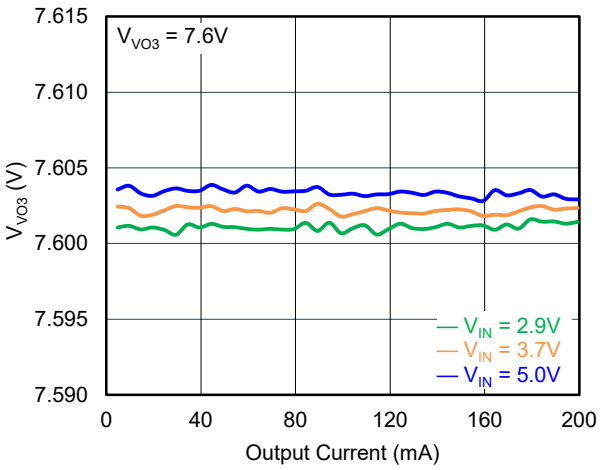
VO2 Load Regulation



VO3 Line Regulation

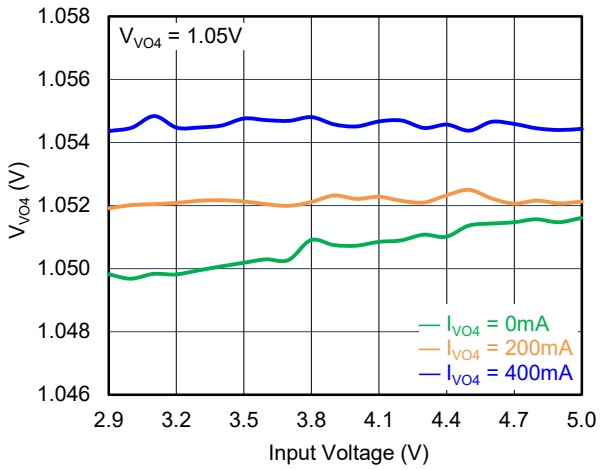


VO3 Load Regulation

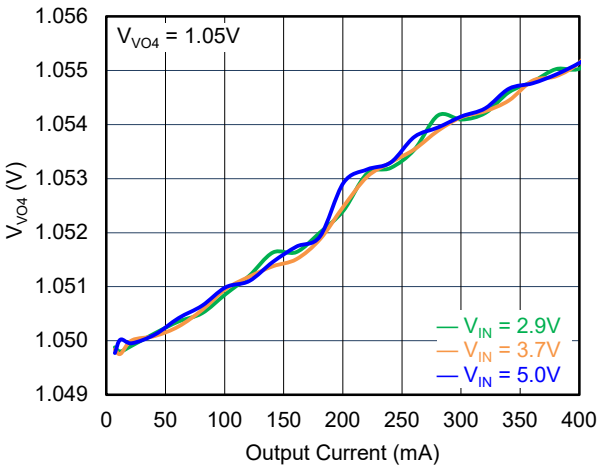


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

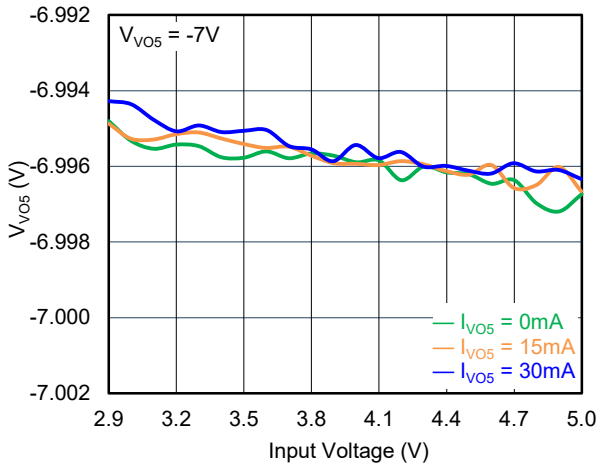
VO4 Line Regulation



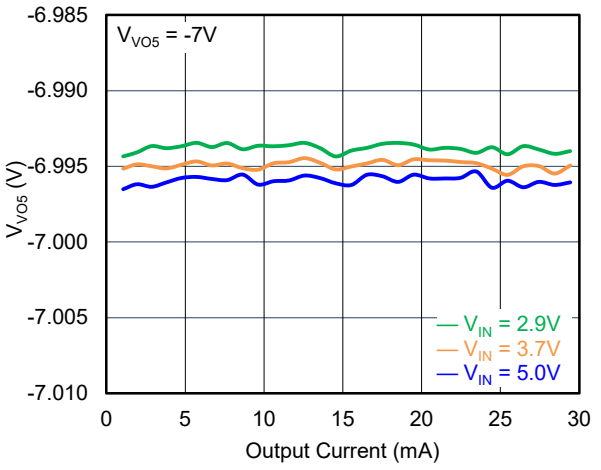
VO4 Load Regulation



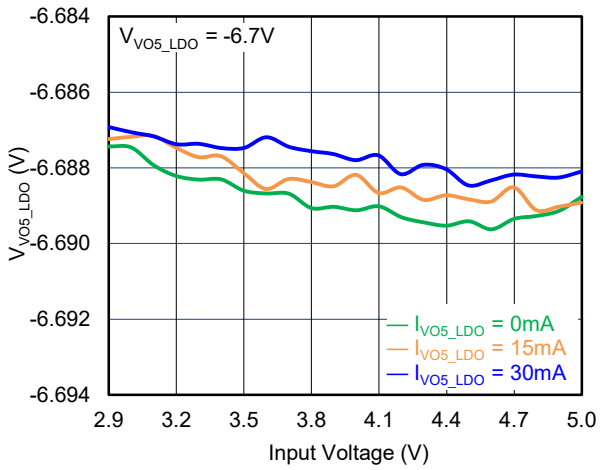
VO5 Line Regulation



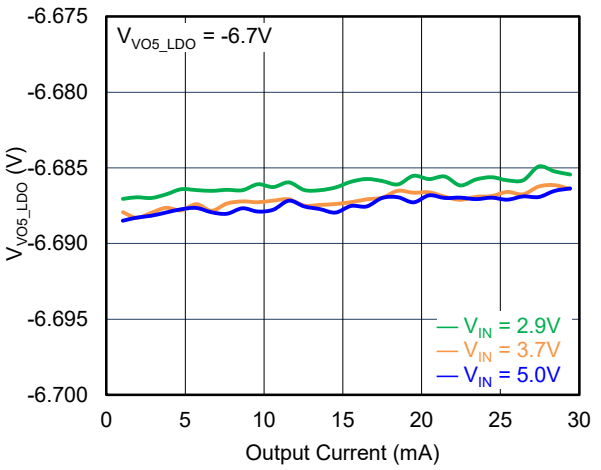
VO5 Load Regulation



VO5_LDO Line Regulation

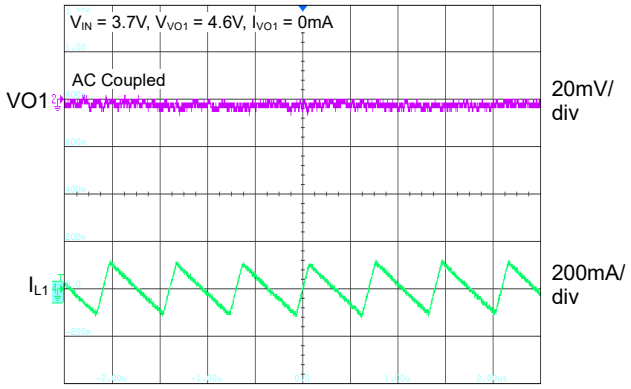


VO5_LDO Load Regulation

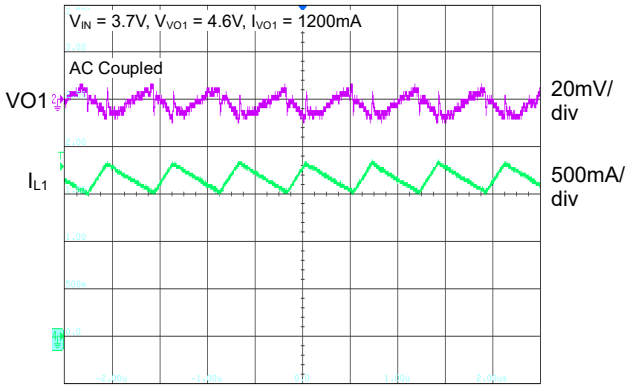


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

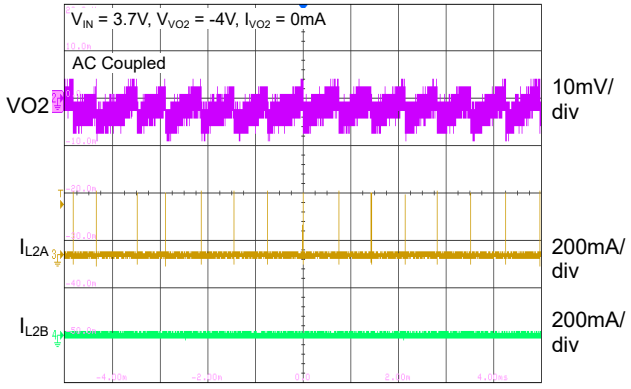
VO1 Output Voltage Ripple at No Load



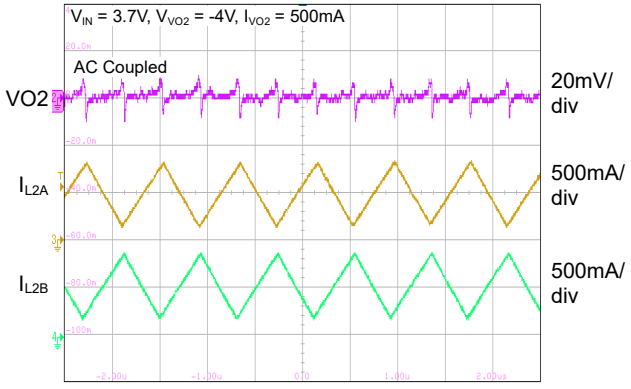
VO1 Output Voltage Ripple at Heavy Load



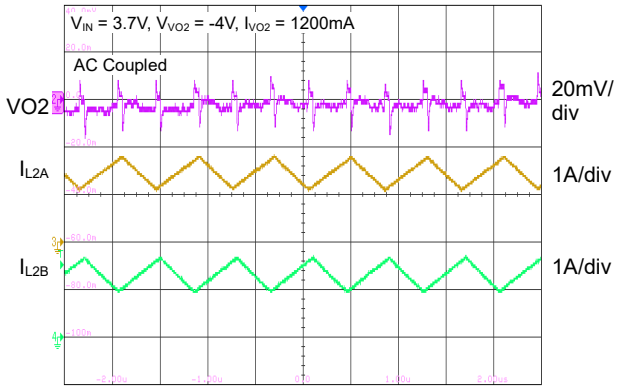
VO2 Output Voltage Ripple at No Load



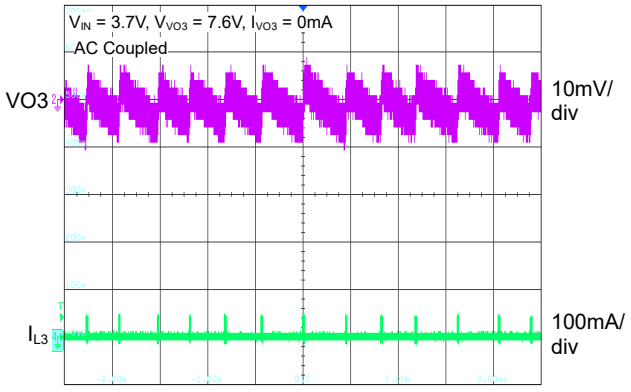
VO2 Output Voltage Ripple at Moderate Load



VO2 Output Voltage Ripple at Heavy Load

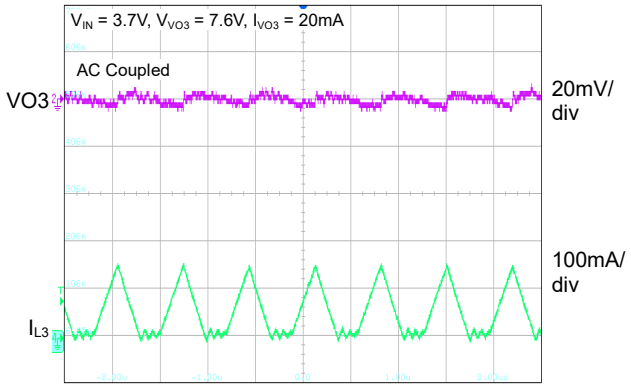


VO3 Output Voltage Ripple at No Load

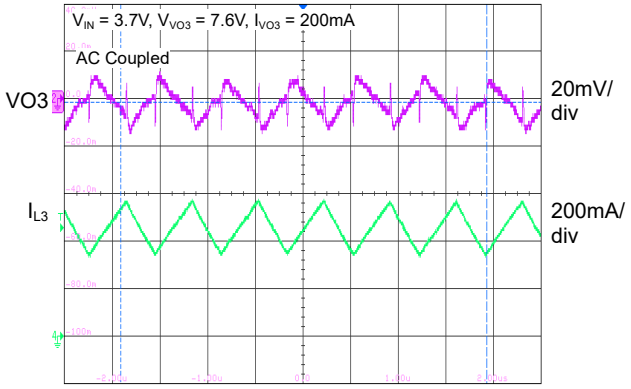


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

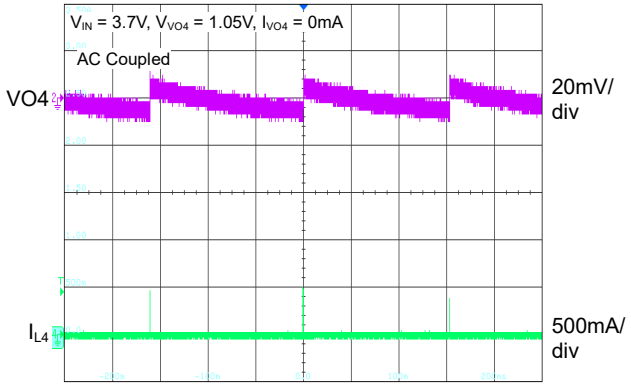
VO3 Output Voltage Ripple at Light Load



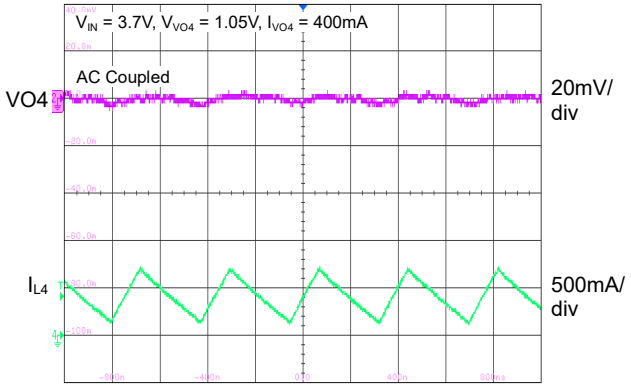
VO3 Output Voltage Ripple at Heavy Load



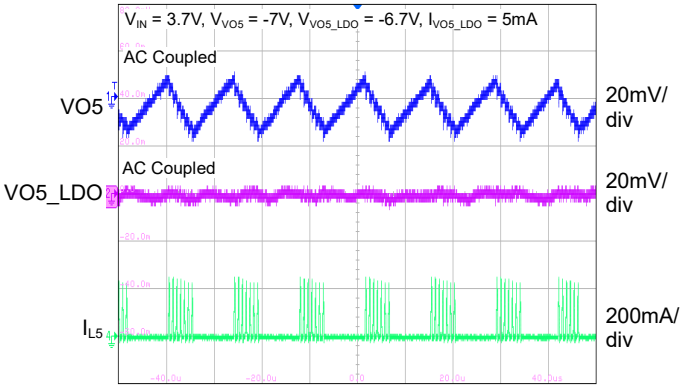
VO4 Output Voltage Ripple at No Load



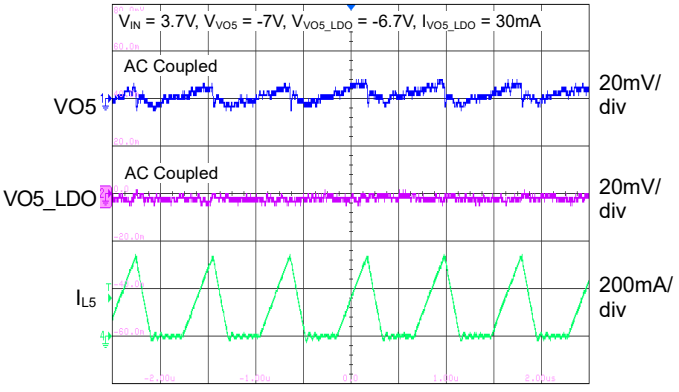
VO4 Output Voltage Ripple at Heavy Load



VO5 and VO5_LDO Output Voltage Ripple at Light Load

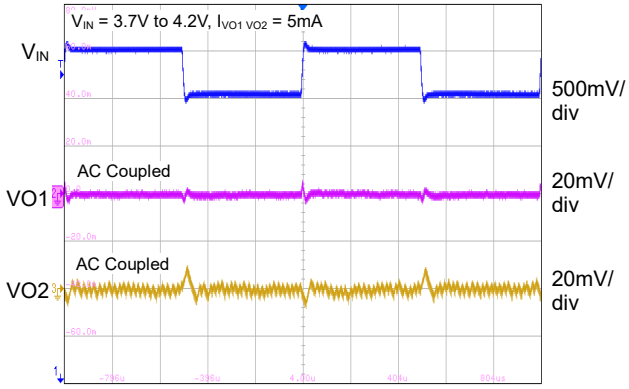


VO5 and VO5_LDO Output Voltage Ripple at Heavy Load



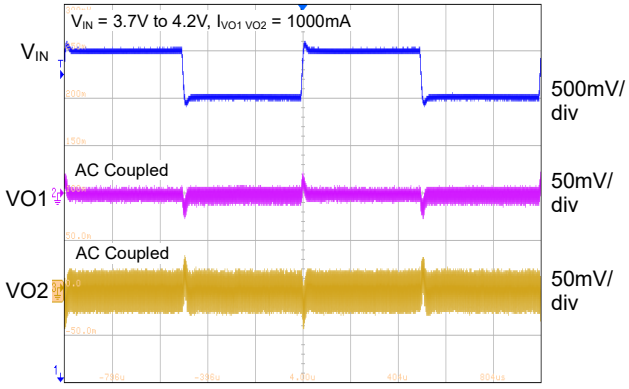
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

VO1 and VO2 Line Transient at Light Load



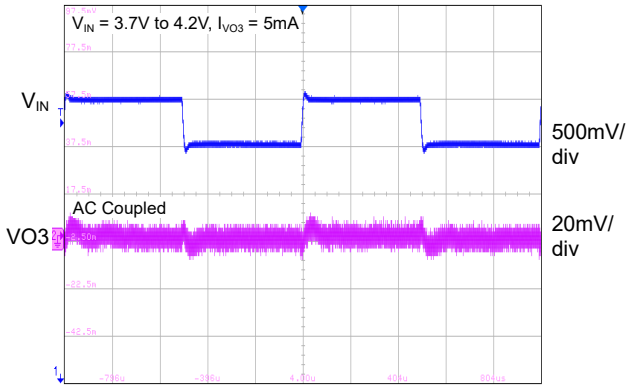
Time (200μs/div)

VO1 and VO2 Line Transient at Heavy Load



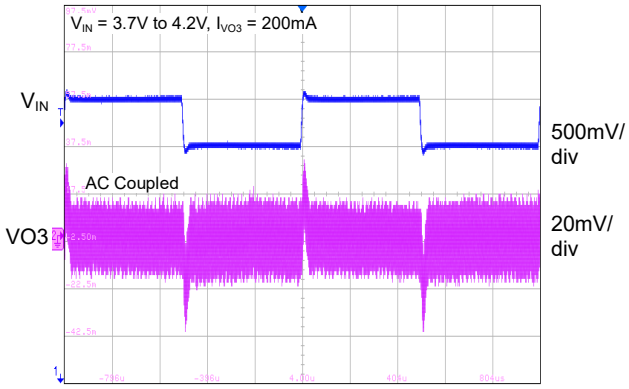
Time (200μs/div)

VO3 Line Transient at Light Load



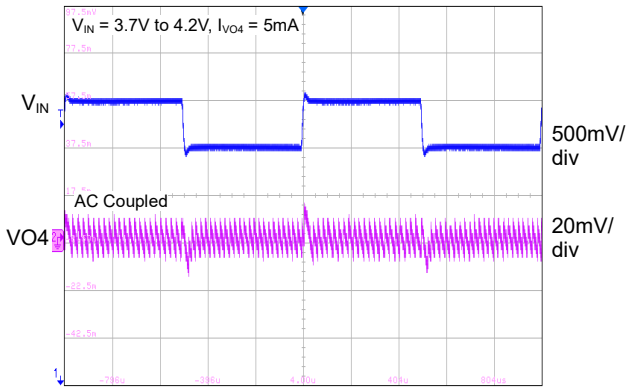
Time (200μs/div)

VO3 Line Transient at Heavy Load



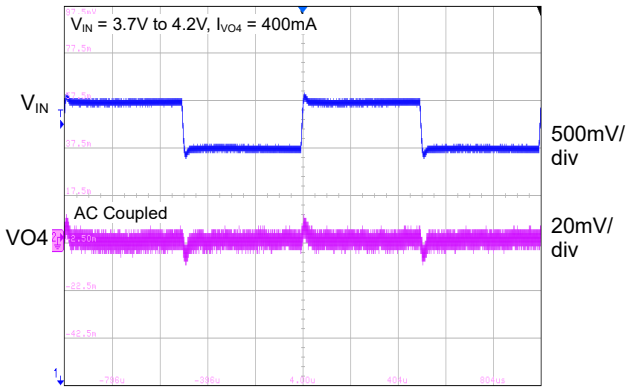
Time (200μs/div)

VO4 Line Transient at Light Load



Time (200μs/div)

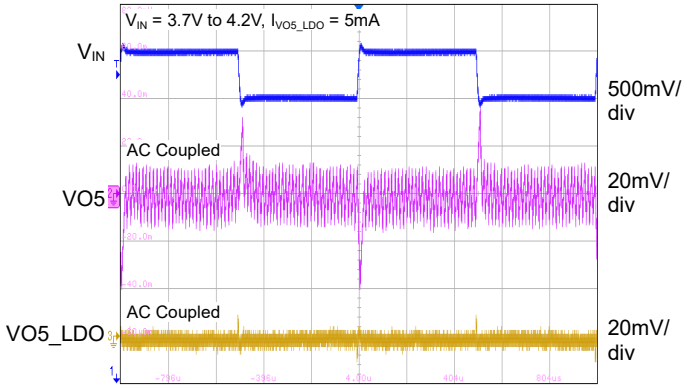
VO4 Line Transient at Heavy Load



Time (200μs/div)

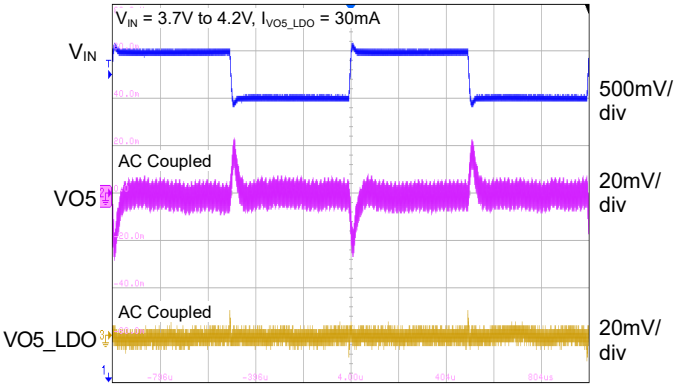
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

VO5 and VO5_LDO Line Transient at Light Load



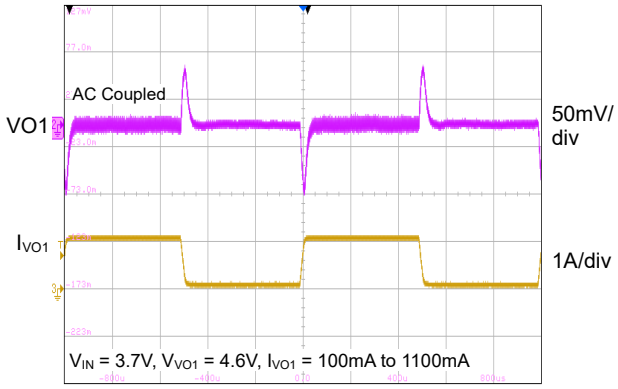
Time (200μs/div)

VO5 and VO5_LDO Line Transient at Heavy Load



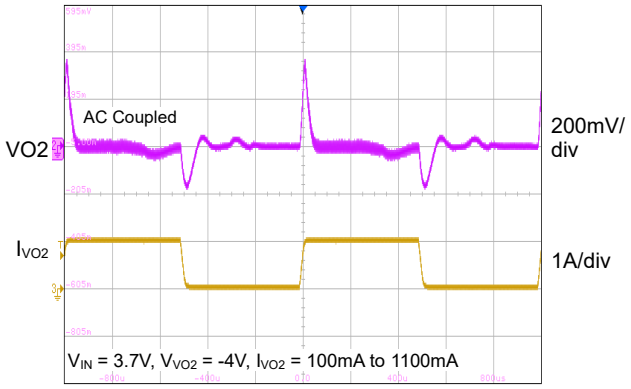
Time (200μs/div)

VO1 Load Transient



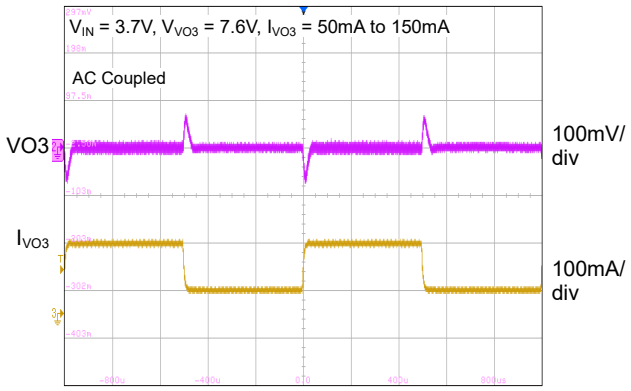
Time (200μs/div)

VO2 Load Transient



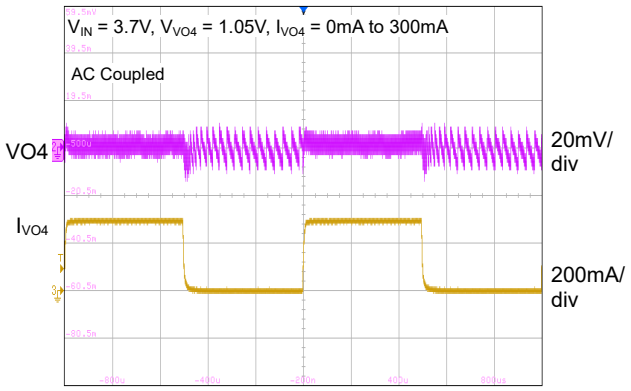
Time (200μs/div)

VO3 Load Transient



Time (200μs/div)

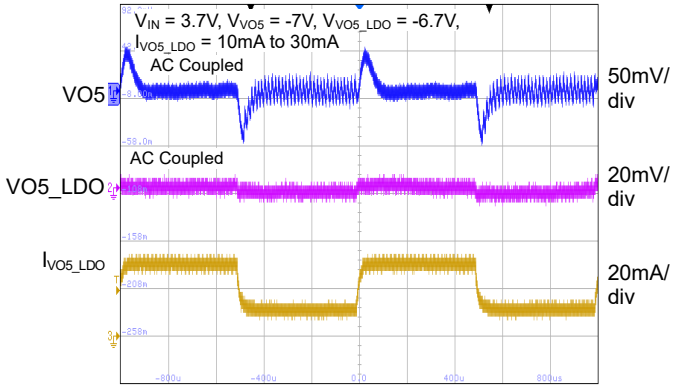
VO4 Load Transient



Time (200μs/div)

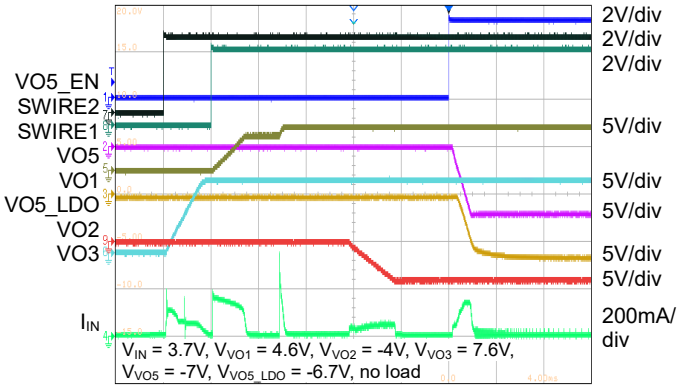
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

VO5 and VO5_LDO Load Transient



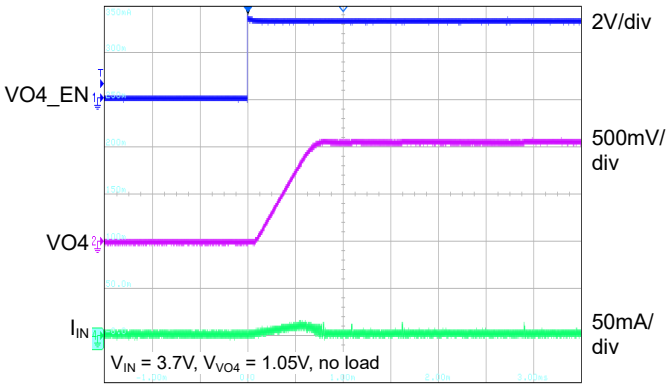
Time (200μs/div)

Start-Up Sequence



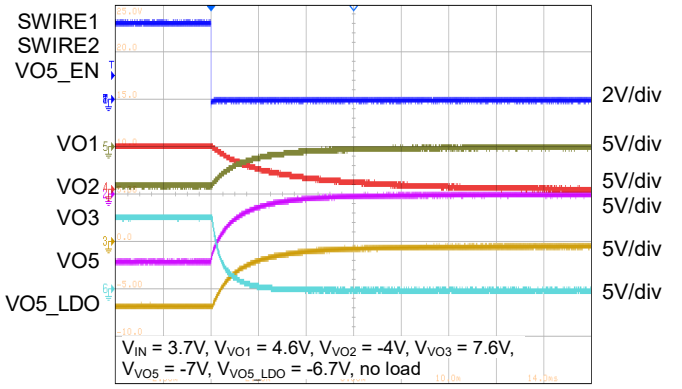
Time (2ms/div)

Start-Up Sequence



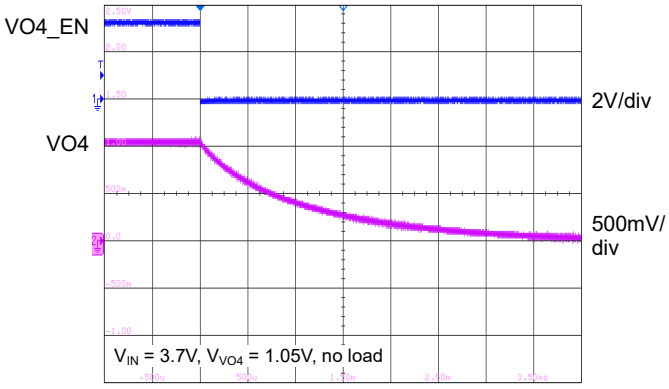
Time (500μs/div)

Shutdown Sequence Discharge = ON



Time (2ms/div)

Shutdown Sequence Discharge = ON



Time (500μs/div)

FUNCTIONAL BLOCK DIAGRAM

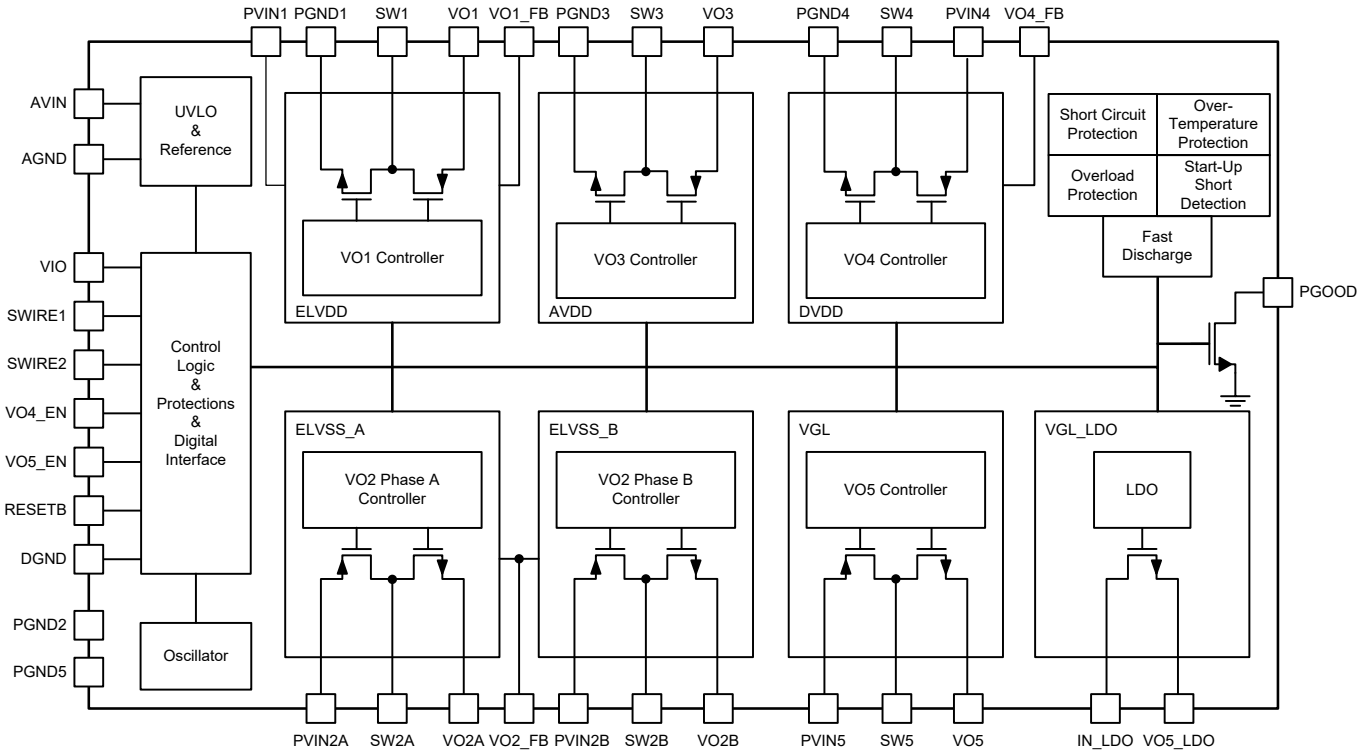


Figure 2. Functional Block Diagram

TIMING DIAGRAMS

Start-Up Sequence

Figure 3 shows the start-up sequence of SGM3843A.

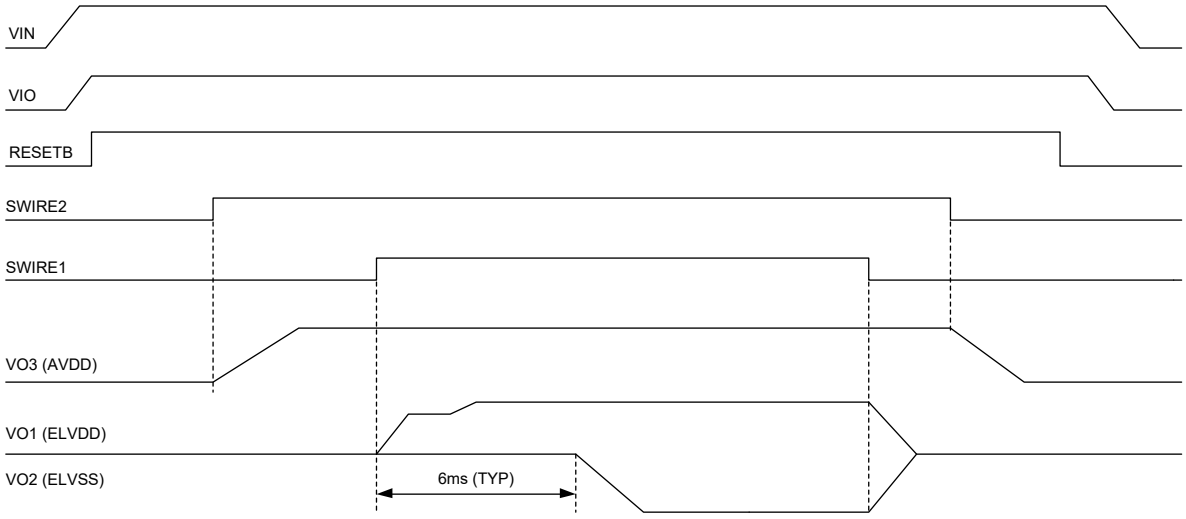


Figure 3. Start-Up Sequence

TIMING DIAGRAMS (continued)

Timing Sequence

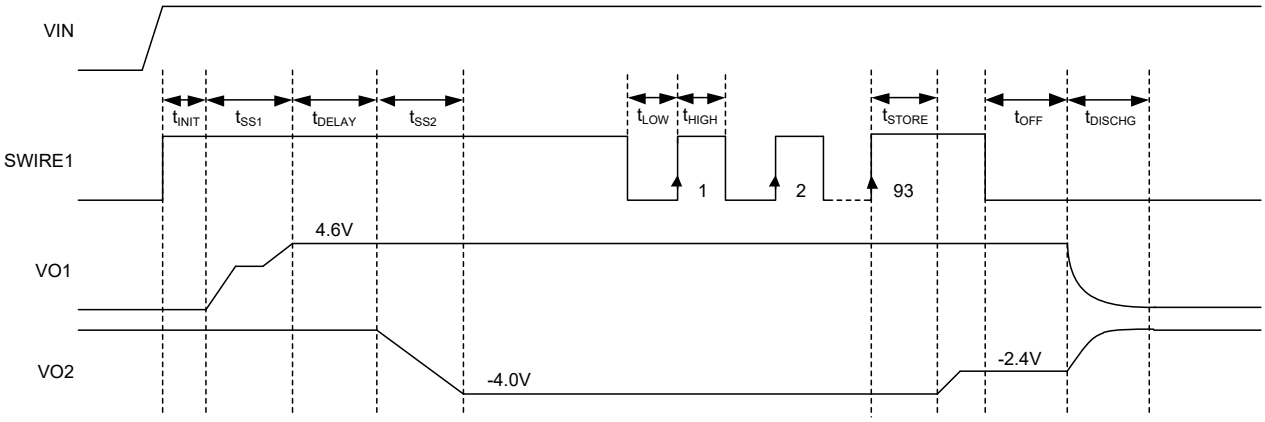


Figure 4. VO1, VO2 Timing Sequence

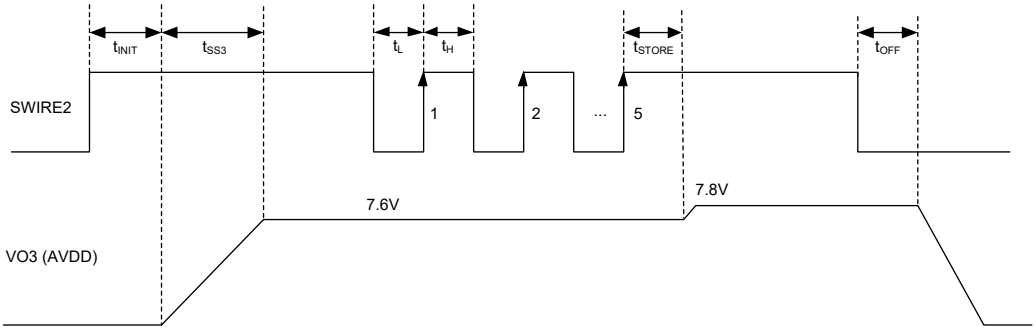


Figure 5. AVDD Timing Sequence

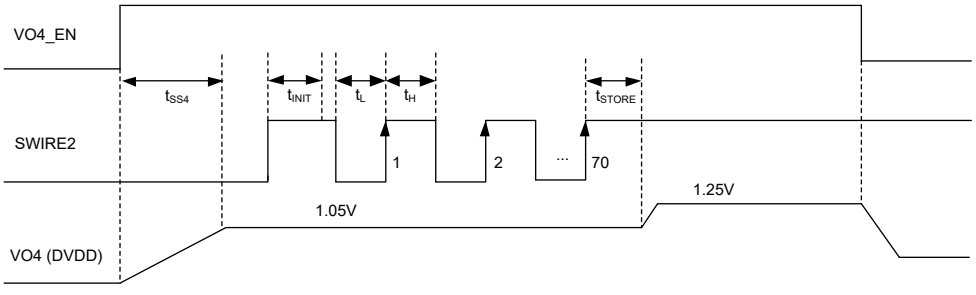


Figure 6. DVDD Timing Sequence 1

TIMING DIAGRAMS (continued)

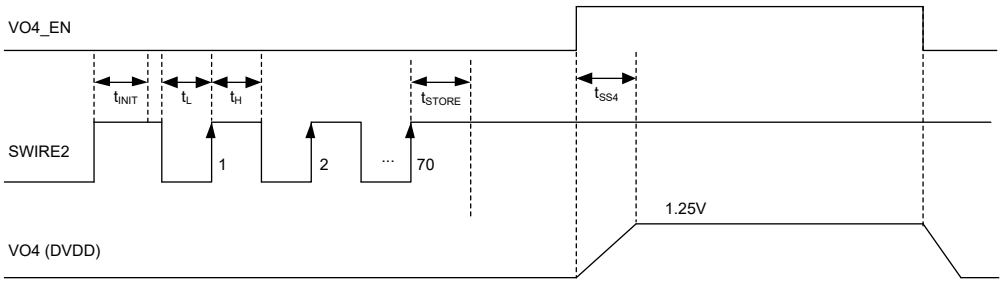


Figure 7. DVDD Timing Sequence 2

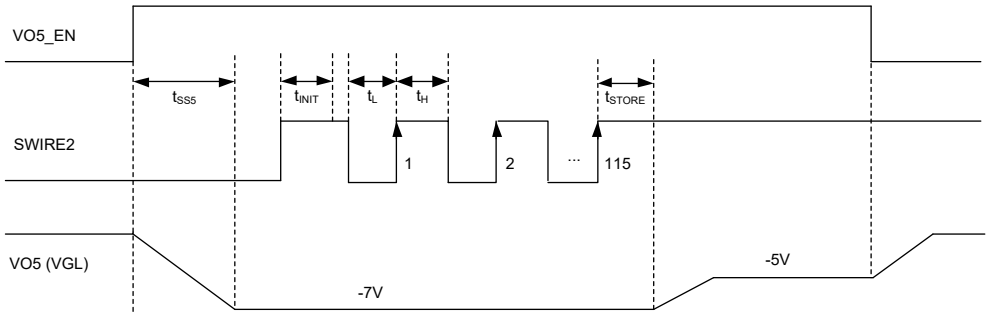


Figure 8. VGL Timing Sequence 1

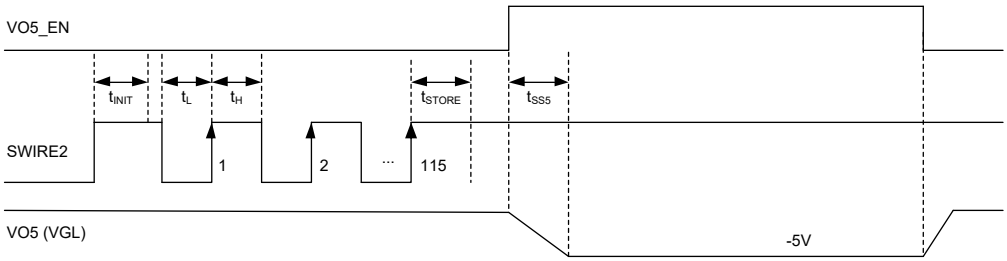


Figure 9. VGL Timing Sequence 2

DETAILED DESCRIPTION

Under-Voltage Lockout (UVLO)

The built-in under-voltage lockout function (UVLO) monitors the input voltage and disables the device when the input voltage is too low to operate.

Thermal Shutdown (TSD)

The device has a function of thermal shutdown, which prevents the device from damage due to overheating and excessive power dissipation. The device stops switching and shuts down all the outputs when the junction temperature exceeds +150℃ (TYP), and restarts with the same programmed voltages and sequences when the temperature decreases to +135℃ (TYP).

Boost Converter VO1 (ELVDD)

The Boost converter VO1 operates with a valley-current-mode topology and fixed 1.45MHz frequency. The VO1 output voltage can be programmed between 4.6V and 5.0V (default 4.6V) with 100mV steps (see Table 2).

The output sense pin (VO1_FB) is always connected to the positive pin of output capacitor for the highest output voltage accuracy.

The output of VO1 is fully isolated in shutdown mode.

Inverting Buck-Boost Converter VO2 (ELVSS)

The inverting Buck-Boost converter VO2 operates with a peak-current-mode topology and dual-phase fixed 1.25MHz (TYP) frequency. The VO2 output voltage can be programmed between -1.05V and -7V (default -4V) with 50mV steps (see Table 2).

When the load current exceeds 200mA, both phase A and phase B of the inverting Buck-Boost converter work. And only phase A works when the load current decreases to 130mA for reducing the switching loss.

The output of VO2 is fully isolated in shutdown mode.

Boost Converter VO3 (AVDD)

The Boost converter VO3 operates with a peak-current-mode topology and fixed 1.45MHz (TYP) frequency. The VO3 output voltage can be programmed between 5.7V and 8.0V (default 7.6V) with 50mV steps (see Table 3).

The output of VO3 is fully isolated in shutdown mode.

Buck Converter VO4 (DVDD)

The Buck converter VO4 operates with an adaptive COT (constant-on-time) mode topology. The VO4 output voltage can be programmed between 0.7V and 2.075V (default 1.05V) with 25mV steps (see Table 3).

The output of VO4 is fully isolated in shutdown mode.

Inverting Buck-Boost Converter VO5 (VGL)

The inverting Buck-Boost converter VO5 operates with a peak-current-mode topology and fixed 1.25MHz (TYP) frequency. The VO5 output voltage can be programmed between -4V and -12.5V (default -7V) with 100mV steps (see Table 4).

The output of VO5 is fully isolated in shutdown mode.

VO5_LDO (VGL_LDO)

The device contains a negative voltage LDO. The absolute output voltage is always 300mV lower than the input voltage.

The output of VO5_LDO is fully isolated in shutdown mode.

Output Current Capacity

The device operates with an input voltage range of 2.9V to 5.0V. However, due to different input voltage and different output voltage, the output current capacity is quite different. A lower input voltage (above UVLO) or a higher output voltage leads to a lower output current capacity.

Input Power Supply

The input power supply voltage is recommended between 2.9V and 5.0V. To achieve full performance, a stable and noise-free input source is needed. Once the distance between input source and SGM3843A is a bit long, additional capacitors are suggested to place as close to the device as possible. Please refer to the typical application circuit for the suggested input capacitance.

DETAILED DESCRIPTION (continued)

Soft-Start, Start-Up, Discharge and Shutdown

The built-in soft-start function is adopted to limit the inrush current.

Toggling SWIRE1 high enables the VO1 Boost converter. VO1 starts with a 0.4A soft-start current limit until it rises to the programmed voltage. Then the full current limit is active (2.9A, TYP).

6ms after toggling SWIRE1 high, the VO2 converter starts switching phase A (VO2A) with a 0.8A current limit until the VO2 rises to the default voltage (-4V). Then the full current limit is active (3.6A per phase, TYP).

Toggling SWIRE2 high enables the VO3 Boost converter. Before VO3 rises to the default value (7.6V), it rises linearly for 1.9ms with a 0.35A current limit. Then the full current limit is active (1.23A, TYP).

Toggling VO4_EN high starts the VO4 Buck converter. Before VO4 rises to the default value (1.05V), it rises linearly for 1ms with a 0.65A current limit. Then the full current limit is active (1.2A, TYP).

Toggling VO5_EN high starts the VO5 Buck-Boost inverting converter and the VO5_LDO. Before VO5 rises to the default value (-7V), it rises linearly for 1ms with a 0.65A current limit. Then the full current limit is active (1.05A, TYP).

The output discharge function can be controlled by the fast discharge control pulses of SWIRE1 and SWIRE2.

Short Circuit and Overload Protection

The device is protected from damage of all the converters shorting to ground. The device is also protected when V_{ELVDD} and V_{ELVSS} are shorted together.

A short at anyone of V_{ELVDD}, V_{ELVSS}, V_{AVDD} and V_{VGL} can shut down all the four converters, then the shutdown state is latched, and the input is fully disconnected with these outputs.

The device detects a short or an overload when one of the below conditions is fulfilled:

- V_{ELVDD} is not in regulation 2.5ms after V_{ELVDD} is enabled then V_{ELVDD}, V_{ELVSS}, V_{AVDD} and V_{VGL} converters shut down.
- V_{ELVSS} is not in regulation 6.7ms after V_{ELVSS} is enabled then V_{ELVDD}, V_{ELVSS}, V_{AVDD} and V_{VGL} converters shut down.
- V_{AVDD} protection is enabled when the soft-start is completed.
- V_{VGL} protection is enabled when the soft-start is completed.
- V_{ELVDD} falls below 87% of the programmed output voltage longer than 1ms then all converters shut down.
- V_{ELVSS} rises above 83% of the programmed output voltage longer than 1ms then all converters shut down.
- V_{AVDD} falls below 86% of the programmed output voltage longer than 1ms then all converters shut down.
- V_{VGL} rises above 76% of the programmed output voltage longer than 1ms then all converters shut down.

Device Reset

In order to reset the whole device, V_{IN} has to cycle below UVLO.

- Pulling RESETB low or a power cycle resets all settings to default values.
- Short circuit at one of the V_{ELVDD}, V_{ELVSS}, V_{AVDD} and V_{VGL} resets all the four converters' voltage settings.
- Pulling SWIRE1 low for t_{OFF} resets the output voltage setting of ELVDD and ELVSS.
- Pulling SWIRE2 low for t_{OFF} resets the output voltage setting of AVDD.
- Pulling SWIRE2 and VO4_EN low for t_{OFF} resets the output voltage setting of DVDD.
- Pulling SWIRE2 and VO5_EN low for t_{OFF} resets the output voltage setting of VGL and VGL_LDO.
- Pulling SWIRE1 high from shutdown resets the fast discharge of ELVDD and ELVSS.
- Pulling SWIRE2 high from shutdown resets the fast discharge of AVDD, DVDD and VGL.

DETAILED DESCRIPTION (continued)

Digital Interface (SWIRE1 & SWIRE2)

The positive output voltages V_{ELVDD}, V_{AVDD}, V_{DVDD} and the negative output voltage V_{ELVSS}, V_{VGL} can be programmed through the SWIRE digital interfaces.

Each of the SWIRE1 and SWIRE2 pins can be used as a standard enable pin if programming is not required. The device starts with default values (green marked values in Table 2, Table 3 and Table 4) if enabled. The SWIRE1 and SWIRE2 interfaces count the rising edges to set the corresponding values as shown in the tables. The device utilizes a volatile memory to store the settings.

Pulse 121 of SWIRE1 and pulse 104 of SWIRE2 are special pulses. The DDIC can send out all pulses in the programming tables directly if it can support 8-bit pulses (0 to 255). However, if the DDIC can only support 7-bit pulses (0 to 127) and target pulse greater than 127 is used, the DDIC can send out the special pulse first to make the SWIRE interface to wait for next pulse (the difference number between the target pulse and the special pulse), then the target pulse is active. Sending the special pulse twice successively can clean itself. Example for 7-bit DDIC:

130 pulse of SWIRE1: 121 + 9;

180 pulse of SWIRE2: 104 + 76.

Table 2. SWIRE1 Programming Table

SWIRE1 Rising Edges	VO2 (V_{ELVSS})	SWIRE1 Rising Edges	VO2 (V_{ELVSS})	SWIRE1 Rising Edges	VO2 (V_{ELVSS})	SWIRE1 Rising Edges	VO2 (V_{ELVSS})	SWIRE1 Rising Edges	VO2 (V_{ELVSS})	SWIRE1 Rising Edges	VO1 & Functions
0/no pulse	-4.00V FD On	25	-5.80V	50	-4.55V	75	-3.30V	100	-2.05V	0/no pulse	4.6V FD On
1	-7.00V	26	-5.75V	51	-4.50V	76	-3.25V	101	-2.00V	122	5.0V
2	-6.95V	27	-5.70V	52	-4.45V	77	-3.20V	102	-1.95V	123	4.9V
3	-6.90V	28	-5.65V	53	-4.40V	78	-3.15V	103	-1.90V	124	4.8V
4	-6.85V	29	-5.60V	54	-4.35V	79	-3.10V	104	-1.85V	125	4.7V
5	-6.80V	30	-5.55V	55	-4.30V	80	-3.05V	105	-1.80V	126	4.6V
6	-6.75V	31	-5.50V	56	-4.25V	81	-3.00V	106	-1.75V	127	VO1/2 FD On
7	-6.70V	32	-5.45V	57	-4.20V	82	-2.95V	107	-1.70V	128	VO1/2 FD Off
8	-6.65V	33	-5.40V	58	-4.15V	83	-2.90V	108	-1.65V	129	LPD_En
9	-6.60V	34	-5.35V	59	-4.10V	84	-2.85V	109	-1.60V	130	LPD_Dis
10	-6.55V	35	-5.30V	60	-4.05V	85	-2.80V	110	-1.55V	131	HLPM_EN
11	-6.50V	36	-5.25V	61	-4.00V	86	-2.75V	111	-1.50V	132	HLPM_Dis
12	-6.45V	37	-5.20V	62	-3.95V	87	-2.70V	112	-1.45V	133	1-Phase
13	-6.40V	38	-5.15V	63	-3.90V	88	-2.65V	113	-1.40V	134	2-Phase
14	-6.35V	39	-5.10V	64	-3.85V	89	-2.60V	114	-1.35V		
15	-6.30V	40	-5.05V	65	-3.80V	90	-2.55V	115	-1.30V		
16	-6.25V	41	-5.00V	66	-3.75V	91	-2.50V	116	-1.25V		
17	-6.20V	42	-4.95V	67	-3.70V	92	-2.45V	117	-1.20V		
18	-6.15V	43	-4.90V	68	-3.65V	93	-2.40V	118	-1.15V		
19	-6.10V	44	-4.85V	69	-3.60V	94	-2.35V	119	-1.10V		
20	-6.05V	45	-4.80V	70	-3.55V	95	-2.30V	120	-1.05V		
21	-6.00V	46	-4.75V	71	-3.50V	96	-2.25V	121	Active >127 Pulse		
22	-5.95V	47	-4.70V	72	-3.45V	97	-2.20V				
23	-5.90V	48	-4.65V	73	-3.40V	98	-2.15V				
24	-5.85V	49	-4.60V	74	-3.35V	99	-2.10V				

DETAILED DESCRIPTION (continued)

Table 3. SWIRE2 Programming Table 1

SWIRE2 Rising Edges	VO3 (V_{AVDD})	SWIRE2 Rising Edges	VO3 (V_{AVDD})	SWIRE2 Rising Edges	VO4 (V_{DVDD})	SWIRE2 Rising Edges	VO4 (V_{DVDD})	SWIRE2 Rising Edges	VO4 (V_{DVDD})
0/no pulse	7.6V FD On	24	6.85	0/no pulse	1.050V FD On	71	1.275V	95	1.875V
1	8.00	25	6.80	48	0.700V	72	1.300V	96	1.900V
2	7.95	26	6.75	49	0.725V	73	1.325V	97	1.925V
3	7.90	27	6.70	50	0.750V	74	1.350V	98	1.950V
4	7.85	28	6.65	51	0.775V	75	1.375V	99	1.975V
5	7.80	29	6.60	52	0.800V	76	1.400V	100	2.00V
6	7.75	30	6.55	53	0.825V	77	1.425V	101	2.025V
7	7.70	31	6.50	54	0.850V	78	1.450V	102	2.050V
8	7.65	32	6.45	55	0.875V	79	1.475V	103	2.075V
9	7.60	33	6.40	56	0.900V	80	1.500V	104	Active >127 Pulse
10	7.55	34	6.35	57	0.925V	81	1.525V		
11	7.50	35	6.30	58	0.950V	82	1.550V		
12	7.45	36	6.25	59	0.975V	83	1.575V		
13	7.40	37	6.20	60	1.000V	84	1.600V		
14	7.35	38	6.15	61	1.025V	85	1.625V		
15	7.30	39	6.10	62	1.050V	86	1.650V		
16	7.25	40	6.05	63	1.075V	87	1.675V		
17	7.20	41	6.00	64	1.100V	88	1.700V		
18	7.15	42	5.95	65	1.125V	89	1.725V		
19	7.10	43	5.90	66	1.150V	90	1.750V		
20	7.05	44	5.85	67	1.175V	91	1.775V		
21	7.00	45	5.80	68	1.200V	92	1.800V		
22	6.95	46	5.75	69	1.225V	93	1.825V		
23	6.90	47	5.70	70	1.250V	94	1.850V		

DETAILED DESCRIPTION (continued)

Table 4. SWIRE2 Programming Table 2

SWIRE2 Rising Edges	VO5 (V_{VGL})	SWIRE2 Rising Edges	VO5 (V_{VGL})	SWIRE2 Rising Edges	VO5 (V_{VGL})	SWIRE2 Rising Edges	VO5 (V_{VGL})	SWIRE2 Rising Edges	Functions
0/no pulse	-7.0V FD On	126	-6.1V	148	-8.3V	170	-10.5V	191	VO3 FD On
105	-4.0V	127	-6.2V	149	-8.4V	171	-10.6V	192	VO3 FD Off
106	-4.1V	128	-6.3V	150	-8.5V	172	-10.7V	193	VO4 FD On
107	-4.2V	129	-6.4V	151	-8.6V	173	-10.8V	194	VO4 FD Off
108	-4.3V	130	-6.5V	152	-8.7V	174	-10.9V	195	VO5 FD On
109	-4.4V	131	-6.6V	153	-8.8V	175	-11.0V	196	VO5 FD Off
110	-4.5V	132	-6.7V	154	-8.9V	176	-11.1V		
111	-4.6V	133	-6.8V	155	-9.0V	177	-11.2V		
112	-4.7V	134	-6.9V	156	-9.1V	178	-11.3V		
113	-4.8V	135	-7.0V	157	-9.2V	179	-11.4V		
114	-4.9V	136	-7.1V	158	-9.3V	180	-11.5V		
115	-5.0V	137	-7.2V	159	-9.4V	181	-11.6V		
116	-5.1V	138	-7.3V	160	-9.5V	182	-11.7V		
117	-5.2V	139	-7.4V	161	-9.6V	183	-11.8V		
118	-5.3V	140	-7.5V	162	-9.7V	184	-11.9V		
119	-5.4V	141	-7.6V	163	-9.8V	185	-12.0V		
120	-5.5V	142	-7.7V	164	-9.9V	186	-12.1V		
121	-5.6V	143	-7.8V	165	-10.0V	187	-12.2V		
122	-5.7V	144	-7.9V	166	-10.1V	188	-12.3V		
123	-5.8V	145	-8.0V	167	-10.2V	189	-12.4V		
124	-5.9V	146	-8.1V	168	-10.3V	190	-12.5V		
125	-6.0V	147	-8.2V	169	-10.4V				

APPLICATION INFORMATION

Layout Considerations

The PCB layout is quite important in the power supply design. An incorrect layout could cause many problems such as instability, load and line transient regulation problems, output voltage noise, and EMI issues. Good grounding becomes important, especially in the case of heavy load current.

The following PCB layout guide should be applied:

• In order to avoid any inductive or capacitive coupling of the switching power supply noise to the sensitive analog control circuits, there are 7 separated grounds (AGND, DGND, PGND1, PGND2, PGND3, PGND4 and PGND5) in the SGM3843A. The signal ground (AGND/DGND) and noisy power ground (PGND1, PGND2, PGND3, PGND4, PGND5) should be well separated on the PCB, and connected only at one point.

• Traces of switching nodes (SW1, SW2A, SW2B, SW3, SW4 and SW5) should be short and wide.

• Place input capacitors on PVIN (PVIN1, PVIN2A, PVIN2B, PVIN4 and PVIN5) as close as possible to the device.

• Place output capacitors on VO1, VO2A, VO2B, VO3 and VO5 as close as possible to the device.

• Use short and wide traces to connect the input capacitors on PVIN and the output capacitors.

• Place input capacitors on VIO as close as possible to the device.

REVISION HISTORY

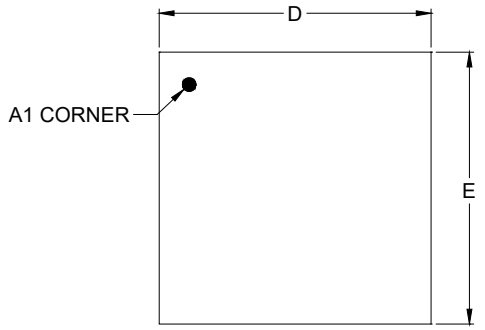
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

NOVEMBER 2023 – REV.A to REV.A.1	Page
Added Timing Requirements section	10
Updated Typical Performance Characteristics section	11

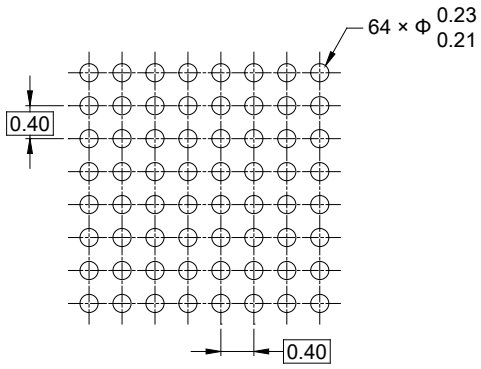
Changes from Original (OCTOBER 2023) to REV.A	Page
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

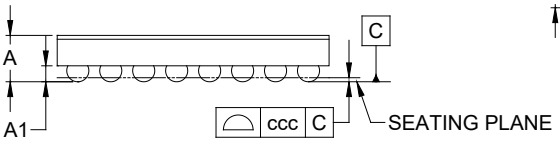
WLCSP-3.3×3.3-64B



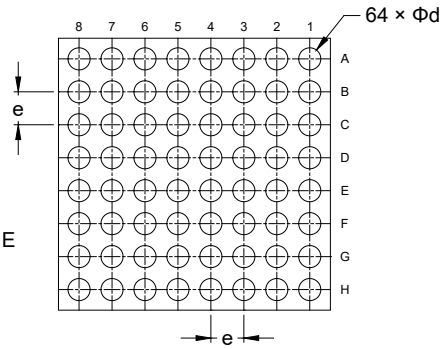
TOP VIEW



RECOMMENDED LAND PATTERN (Unit: mm)



SIDE VIEW



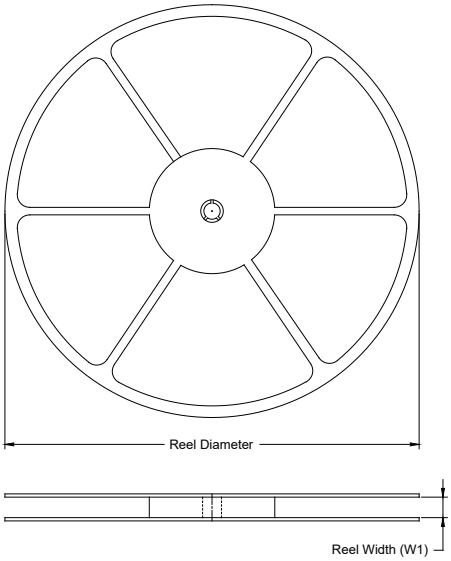
BOTTOM VIEW

Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	-	-	0.601
A1	0.174	-	0.214
D	3.270	-	3.330
E	3.270	-	3.330
d	0.238	-	0.298
e	0.400 BSC		
ccc	0.050		

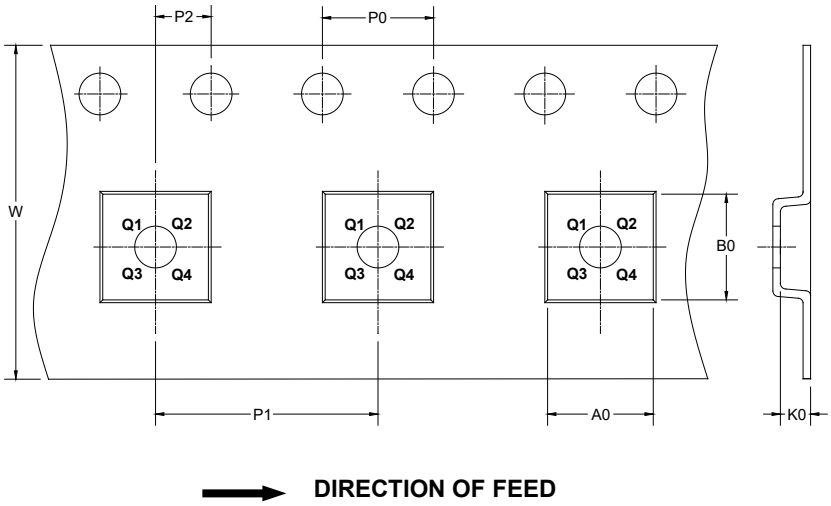
NOTE: This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



DIRECTION OF FEED

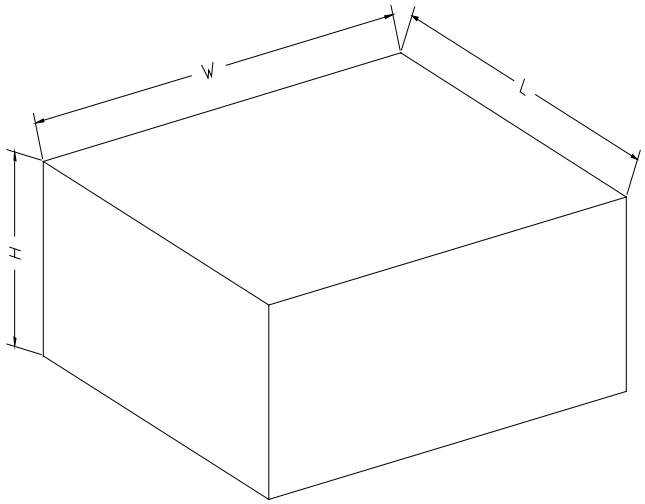
NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
WLCSP-3.3×3.3-64B	13"	12.4	3.52	3.52	0.81	4.0	8.0	2.0	12.0	Q1

DD0001

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
13″	386	280	370	5

DD0002