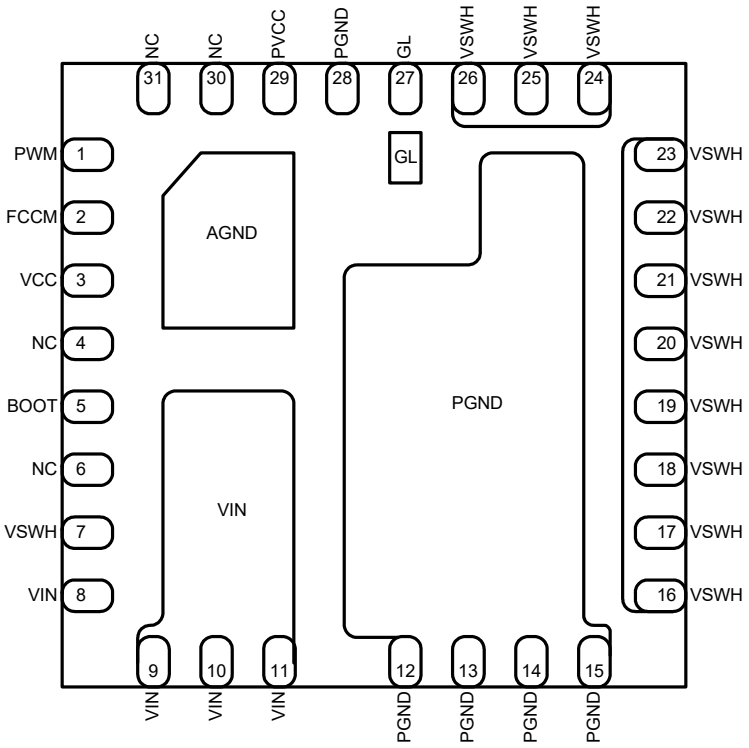
Ordering Information

Part Number	Ambient Temperature Range	Package	Environmental
AOZ5038QI-05	-40°C to +85°C	QFN5X5_31L	RoHS

AOS Green Products use reduced levels of Halogens, and are also RoHS compliant.
Please visit www.aosmd.com/media/AOSGreenPolicy.pdf for additional information.

Pin Configuration

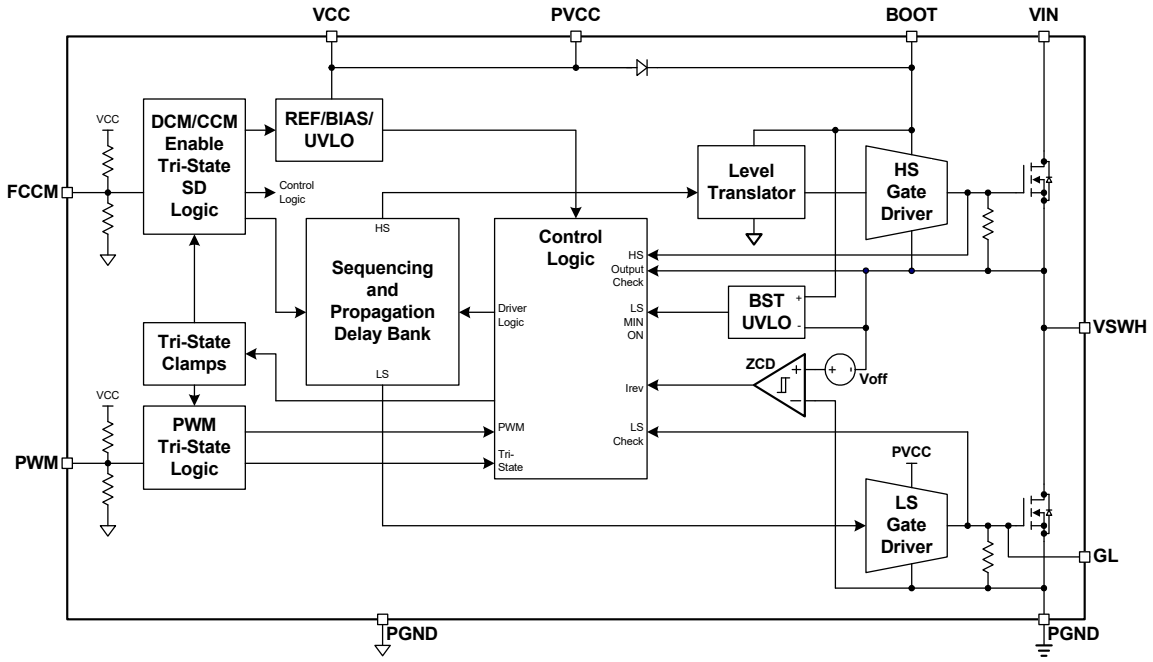


QFN5x5_31L
(Top View)

Pin Description

Pin Number	Pin Name	Pin Function
1	PWM	PWM input signal from the controller IC. This input is compatible with 5V and Tri-State logic level Low Side.
2	FCCM	Continuous conduction mode of operation is allowed when FCCM = High. Discontinuous mode is allowed and diode emulation mode is active when FCCM = Low. High impedance on the input of FCCM will shutdown both high side and low side MOSFETs.
3	VCC	Driver low voltage input pin.
4, 6, 30, 31	NC	No connect.
5	BOOT	High side MOSFET gate driver supply rail. Connect a 100nF ceramic capacitor between BOOT and VSWH (Pin 7).
7	VSWH	Switching node connected to the source of high side MOSFET and the drain of low side MOSFET. This pin is dedicated for bootstrap capacitor connection to BOOT pin.
8, 9, 10, 11	VIN	Power stage high voltage input pin.
12, 13, 14, 15	PGND	Power ground pin for power stage.
16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26	VSWH	Switching node connected to the source of high side MOSFET and the drain of low side MOSFET. These pins are being used for zero cross detect, bootstrap UVLO and Anti-overlap control.
27	GL	Low side MOSFET gate connection. This is for test use only.
28	PGND	Power ground pin for low side MOSFET gate driver.
29	PVCC	Low side MOSFET gate driver supply rail.

Functional Block Diagram



Absolute Maximum Ratings

Exceeding the Absolute Maximum ratings may damage the device.

Parameter	Rating
Low Voltage Supply (VCC, PVCC)	-0.3V to 7V
High Voltage Supply (VIN)	-0.3V to 30V
Control Inputs (PWM, FCCM)	-0.3V to (VCC+0.3V)
Bootstrap Voltage DC (BOOT-PGND)	-0.3V to 33V
Bootstrap Voltage DC (BOOT-VSWH)	-0.3V to 7V
BOOT Voltage Transient(1) (BOOT-VSWH)	-0.3V to 9V
Switch Node Voltage DC (VSWH)	-0.3V to 30V
Switch Node Voltage Transient(1) (VSWH)	-8V to 38V
Low Side Gate Voltage DC (GL)	(PGND-0.3V) to (PVCC+0.3V)
Low Side Gate Voltage Transient(2) (GL)	(PGND-2.5V) to (PVCC+0.3V)
Storage Temperature (T_S)	-65°C to +150°C
Max Junction Temperature (T_J)	150°C
ESD Rating(3)	2kV

Notes:

1. Peak voltages can be applied for 10ns per switching cycle.
2. Peak voltages can be applied for 20ns per switching cycle.
3. Devices are inherently ESD sensitive, handling precautions are required. Human body model rating: 1.5kΩ in series with 100pF.

Recommended Operating Conditions

The device is not guaranteed to operate beyond the Maximum Recommended Operating Conditions.

Parameter	Rating
High Voltage Supply (VIN)	4.5V to 25V
Low Voltage Supply {PVCC, (BOOT-VSWH)}	4.5V to 5.5V
Control Inputs (PWM, FCCM)	0V to (VCC-0.3V)
Operating Frequency	200kHz to 2MHz

Electrical Characteristics[4]

T_A = 25°C, V_{IN} = 12V, P_{VCC} = V_{CC} = 5V unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
V_{IN}	Power Stage Power Supply		4.5		25	V
P_{VCC}	Driver Power Supply	PVCC = VCC = 5V	4.5		5.5	V
$R_{\theta JC}$[5]	Thermal Resistance	PCB Temp = 100°C		2.5		°C / W
$R_{\theta JA}$[5]		AOS Demo Board		10		°C / W
INPUT SUPPLY AND UVLO						
V_{CC}	Under-Voltage Lockout	VCC Rising		3.5	3.9	V
		VCC Falling		3.1		V
V_{CC_HYST}	Under-Voltage Lockout Hysteresis			500		mV
I_{VCC_SD}	Shutdown Bias Supply Current	FCCM = Floating. PWM = Floating		3		µA
I_{PVCC}	Control Circuit Bias Current	FCCM = 5V, PWM = Floating		85		µA
		FCCM = 0V, PWM = Floating		140		µA
PWM INPUT						
V_{PWMH}	PWM Input High Threshold	V_{PWM} Rising, PVCC = 5V	4.1			V
V_{PWML}	PWM Input Low Threshold	V_{PWM} Falling, PVCC = 5V			0.7	V
I_{PWM}	PWM Pin Input Current	Source, PWM = 0V to 5V		+250		µA
		Sink, PWM = 5V to 0V		-250		µA
V_{TRI}	PWM Input Tri-State Threshold Window	PWM = High Impedance	1.65		3.50	V
FCCM INPUT						
V_{FCCMH}	FCCM Enable Threshold	FCCM Rising, PVCC = 5V	3.80			V
V_{FCCML}	FCCM Disable Threshold	FCCM Falling, PVCC = 5V			1.20	V
I_{FCCM}	FCCM Pin Input Current	Source, FCCM = 5V		+50		µA
		Sink, FCCM = 0V		-50		µA
t_{PS4_EXIT}	PS4 Exit Latency	PVCC = 5V			15	µs
GATE DRIVER TIMING						
t_{PDLU}	PWM Falling to GH[6] Turn-Off	PWM 10%, GH 90%		18		ns
t_{PDLL}	PWM Raising to GL Turn-Off	PWM 90%, GL 90%		25		ns
t_{PDHU}	GL Falling to GH Rising Deadtime	GL 10%, GH 10%		20		ns
t_{PDHL}	GH/VSWH Falling to GL Rising Deadtime	GH-VSWH @ 1V, GL 10%		20		ns
t_{TSSHD}	Tri-State Shutdown Delay	Tri-state to GH Falling, Tri-state to GL Falling		135		ns
t_{PTS}	Tri-State Propagation Delay	Tri-state exit		35		ns
t_{LGMIN}	Low-Side Minimum On-Time	FCCM = 0V, DCM mode		600		ns

Notes:

4. All voltages are specified with respect to the corresponding PGND pin.
5. Characterization value. Not tested in production.
6. GH is the internal gate pin of high-side MOSFET.

Timing Diagram

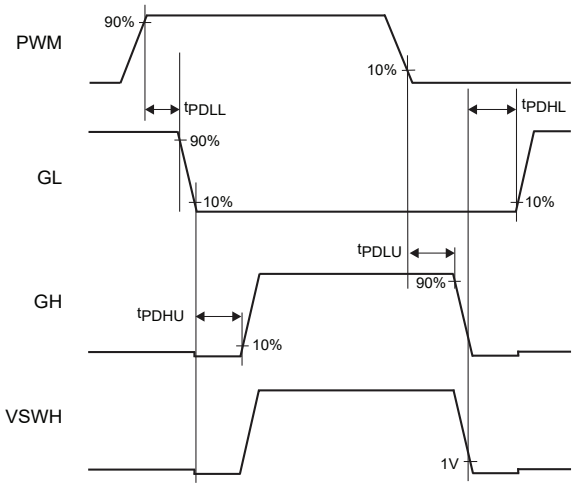


Figure 1. PWM Logic Input Timing Diagram

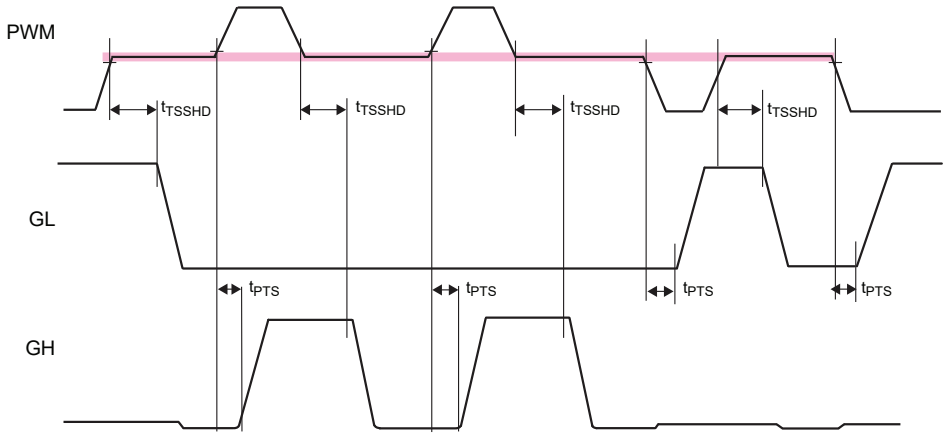


Figure 2. Tri-State Input Logic Timing Diagram

Typical Performance Characteristics

T_A = 25°C, V_{IN} = 19V, PVCC = VCC = 5V, unless otherwise specified.

Figure 3. Efficiency vs. Load Current

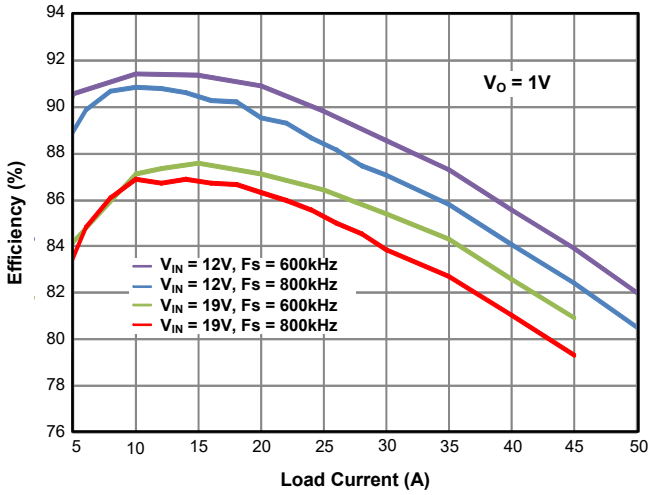


Figure 4. Module Loss vs. Load Current

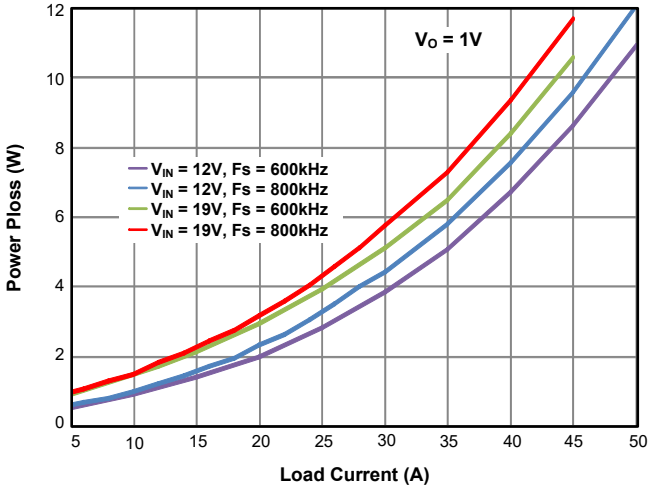


Figure 5. Quiescent Current vs. Temperature

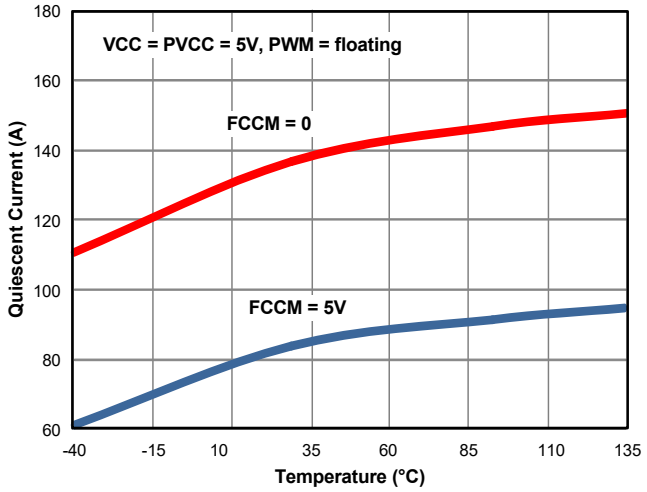


Figure 6. Shutdown Current vs. Temperature

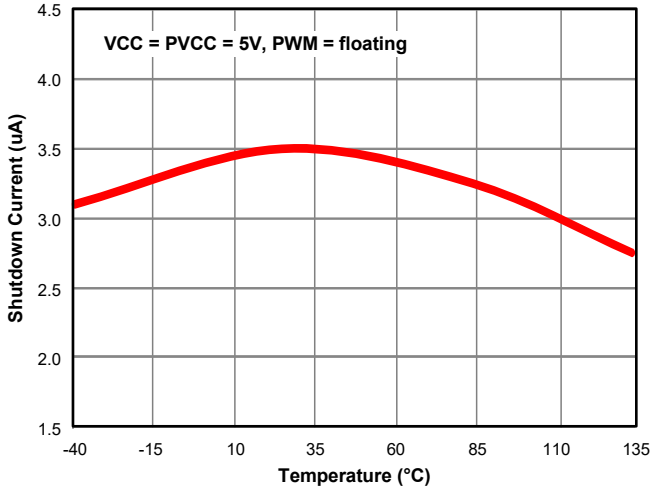


Figure 7. UVLO Threshold vs. Temperature

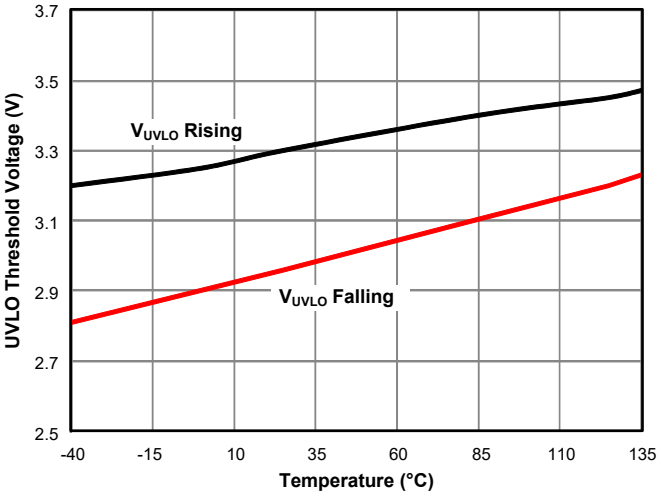
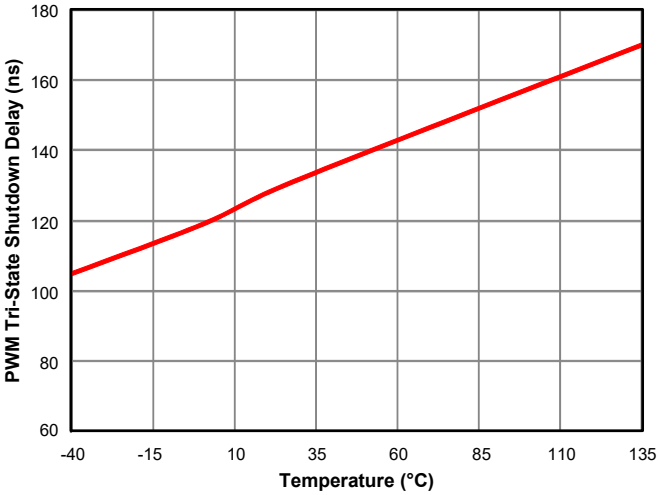


Figure 8. PWM Tri-State Shutdown Delay vs. Temperature



Typical Performance Characteristics (Continued)

Figure 9. PWM Input Threshold vs. Temperature

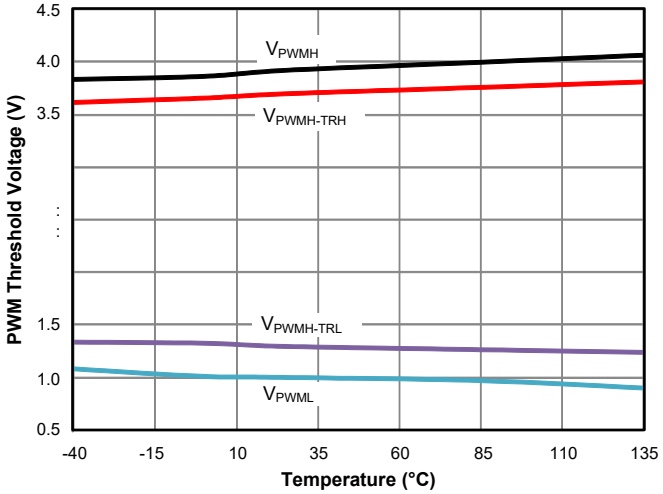


Figure 10. FCCM Input Threshold vs. Temperature

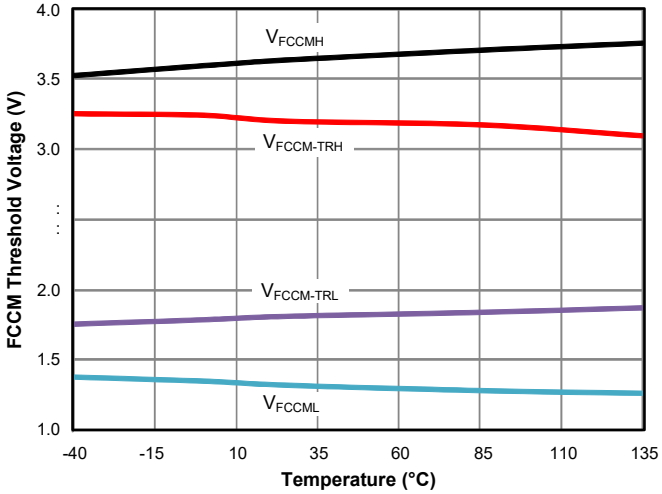


Figure 11. PS4 Exit Latency vs. Temperature

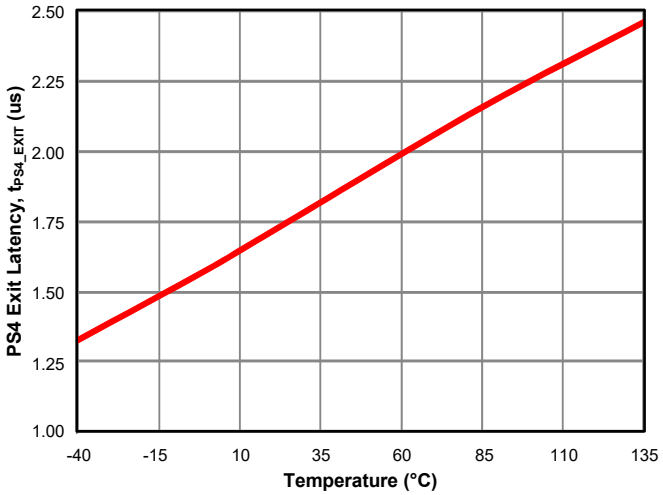


Figure 12. Bootstrap Diode Forward vs. Temperature