ALPHA & OMEGA SEMICONDUCTOR

AOZ73004QI

NVIDIA OpenVReg Compliant Controller Multi-Phase (≤ 4 Phase) Controller with PWMVID Interface

General Description

The AOZ73004QI is a high performance multi-phase buck controller designed in compliance with NVIDIA OpenVReg specifications. It provides one output rail and supports PWMVID interface.

AOS offers a novel AOS Advanced Transient Modulator (A^2TM). It combines an advanced variable frequency hysteretic peak current mode control with proprietary phase current sensing scheme for fast transient response and low system cost. The control loop enhances light-load efficiency by seamlessly entering DCM mode of operation. Autonomous Phase Management also assures the optimized efficiency and power loss during light load with single phase DCM mode.

The AOZ73004QI provides complete protection including UVP, OVP, OCP and OTP. AOZ73004QI also offers real time telemetry information via IMON pin for output currents.

The AOZ73004QI features are external reference input and PWMVID dynamic output voltage control, in which the output voltage is regulated and tracks external input reference voltage. The PWMVID duty cycle determines the variable output voltage at REFIN, Vmin is the zero percent duty cycle voltage value. Vmax is the one hundred percent duty cycle voltage value.

AOZ73004QI can be paired and supports multi-sourced industry standard DrMOS and Smart Power Stage (SPS). AOZ73004QI is offered in compact 4mm x 4mm 32-pin QFN package.

Features

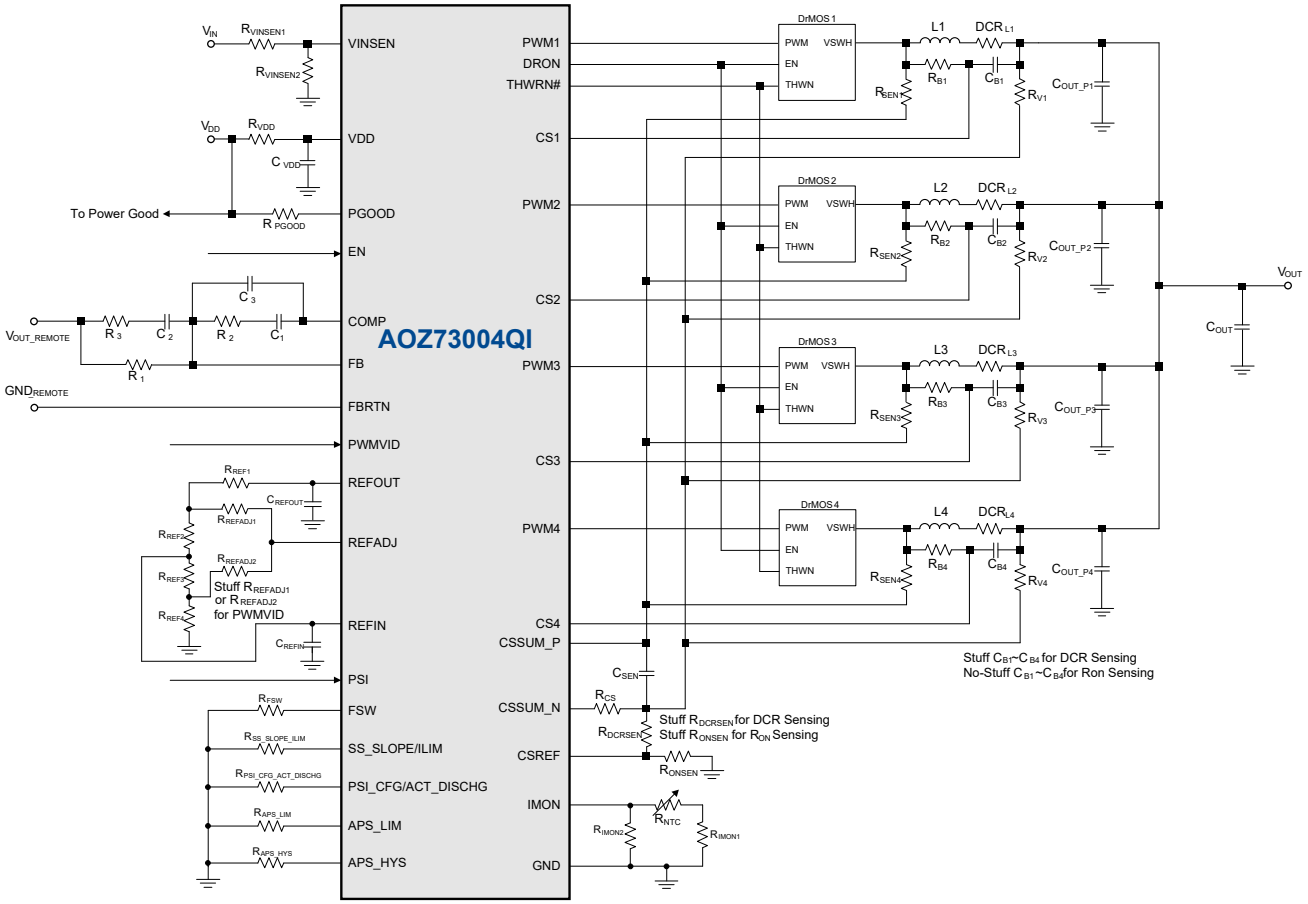
- Compliant with NVIDIA OVR-4-22 Specifications
- Supports up to 4 Phase
- 2.7V to 20V VIN Input Supply Voltage
- 300kHz to 1MHz Programmable Switching Frequency
- High Performance Operational Error Amplifier
- Differential Remote Sensing to Achieve 1% Regulated VOUT Accuracy
- Supports Multi-Sourced Industry Standard DrMOS or SPS Power Stages
- Proprietary, High Performance AOS Advanced Transient Modulator (A^2TM) Control Scheme: - Variable Frequency Hysteretic Peak Current Mode Control Gives Fast Transient Response
  - Dynamic Phase to Phase Current Balancing
  - Excellent Load-Line Control and Phase Current Sensing
  - Seamless CCM to DCM Control to Maximize Efficiency
- Supports DCR or R_{ON_LG} Sensing Current Balance
- Automatic Phase Shedding (APS) With User Settable Thresholds
- Power Saving Interface (PSI)
- Supports Diode Emulation Mode (DEM)
- PWMVID Interface
- Output Under-Voltage Protection (UVP)
- Output Over-Voltage Protection (OVP)
- Over-Current Protection (OCP)
- Over-Temperature Protection (OTP)

Applications

- GPU and CPU power
- Graphic cards
- Desktop and notebook applications

GREEN Product

Typical Application



Ordering Information

Part Number	Ambient Temperature Range	Package	Environmental
AOZ73004QI	-40 °C to +125 °C	QFN4x4-32L	Green

Contact local sales office for full product datasheet.

AOS products are offered in packages with Pb-free plating and compliant to RoHS standards.
Please visit https://aosmd.com/sites/default/files/media/AOSGreenPolicy.pdf for additional information.

Pin Configuration

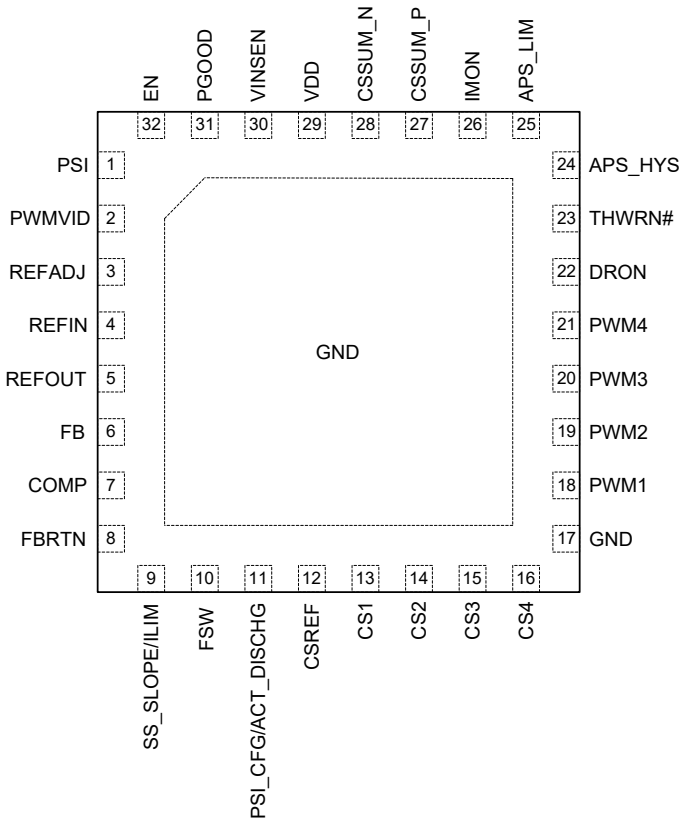
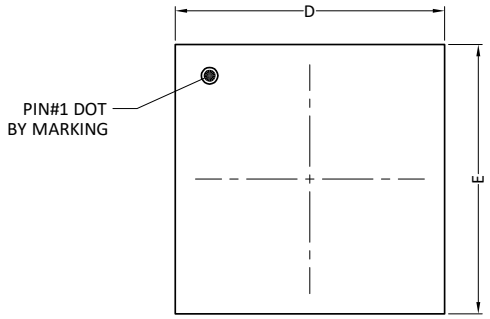


Figure 1. QFN4x4-32L
(Top View)

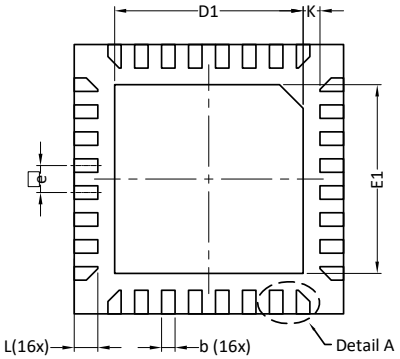
Pin Description

Pin Number	Pin Name	Pin Function
1	PSI	Power Saving Interface control pin. This pin can be set low, high or left floating.
2	PWMVID	PWMVID buffer input.
3	REFADJ	Reference adjustment output. Refer to PWMVID dynamic voltage control.
4	REFIN	Reference voltage input for output voltage regulation.
5	REFOUT	PWMVID reference output. 2V output reference voltage.
6	FB	Error amplifier inverting input of the PWM comparator.
7	COMP	Output of the error amplifier and the inverting input of the PWM comparator.
8	FBRTN	Remote OUTPUT ground sensing for control loop feedback and regulation.
9	SS_SLOPE/ ILIM	Soft start and current limit setting pin. Connected a resistor to ground to program soft start slope and current limit level.
10	FSW	Switching frequency setting pin. Connected a resistor to ground to select the switching frequency.
11	PSI_CFG/ ACT_ DISCHG	This pin is a combined strap to enable active discharge and configure for flexible assignment of active phases to power zones in APS mode. The lowest zone configured by the PSI_CFG portion of this strap is the zone used when the PSI pin is pulled low.
12	CSREF	Current sense reference
13	CS1	Positive node of current balance sense circuit for phase 1.
14	CS2	Positive node of current balance sense circuit for phase 2.
15	CS3	Positive node of current balance sense circuit for phase 3.
16	CS4	Positive node of current balance sense circuit for phase 4.
17	GND	Ground pin.
18	PWM1	PWM signal for Phase 1. Connect to the PWM input of DrMOS or SPS.
19	PWM2	PWM signal for Phase 2. Connect to the PWM input of DrMOS or SPS.
20	PWM3	PWM signal for Phase 3. Connect to the PWM input of DrMOS or SPS.
21	PWM4	PWM signal for Phase 4. Connect to the PWM input of DrMOS or SPS.
22	DRON	Gate driver enable for external drivers.
23	THWRN#	Thermal fault indication from power stage.
24	APS_HYS	A dedicated strap sets the automatic phase shedding (APS) hysteresis. Connected a resistor to ground to program the hysteresis value. The value of APS_LIM minus the hysteresis value is the leaving phase threshold when current falling down.
25	APS_LIM	A dedicated strap sets the automatic phase shedding (APS) threshold limit. Connected a resistor to ground to program the threshold of entering different phase when current rising up.
26	IMON	The IMON pin outputs a current proportional to the sum of the measured inductor current.
27	CSSUM_P	Current Sensing positive terminal.
28	CSSUM_N	Current Sensing negative terminal.
29	VDD	Power for the internal control circuits. A 4.7µF~10µF decoupling capacitor is requires from this pin to ground.
30	VINSEN	Input voltage sense for feedforward.
31	PGOOD	Power good signal output. PGOOD is an open-drain output used to indicate the status of the output voltage. PGOOD is pulled low during soft-start and shut down.
32	EN	Enable input. The AOZ73004QI is enabled when EN is pulled high. The device shuts down when EN is pulled low. Assert EN to high for power-up after VIN and VDD are well supplied.

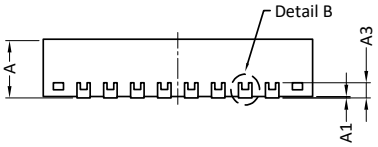
Package Dimensions, QFN4x4-32



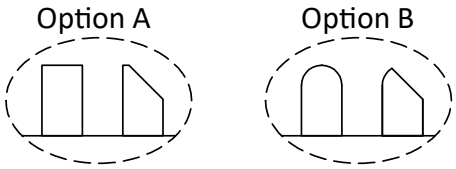
TOP VIEW



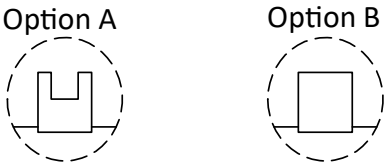
BOTTOM VIEW



SIDE VIEW

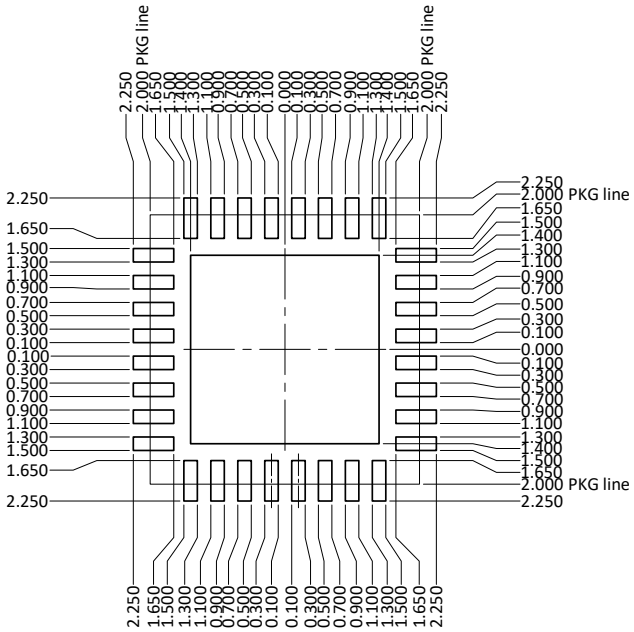


Detail A



Detail B

RECOMMENDED LAND PATTERN

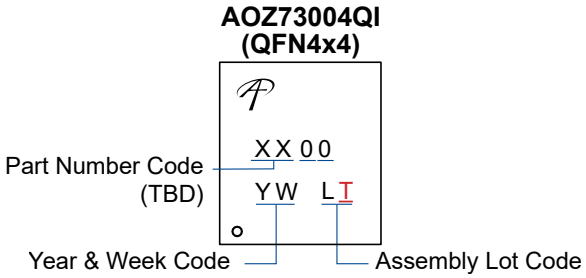


SYMBOLS	DIM. IN MILLMETERS			DIM. IN INCHS		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.800	-	1.000	0.031	-	0.039
A1	0.000	0.020	0.050	0.000	0.001	0.002
A3	0.203 REF.			0.008 REF.		
b	0.150	0.200	0.250	0.006	0.008	0.010
D	3.900	4.000	4.100	0.154	0.157	0.161
D1	2.700	2.800	2.900	0.106	0.110	0.114
E	3.900	4.000	4.100	0.154	0.157	0.161
E1	2.700	2.800	2.900	0.106	0.110	0.114
e	0.400 BSC			0.016 BSC		
L	0.250	0.350	0.450	0.010	0.014	0.018
K	0.250 REF.			0.010 REF.		

UNIT: mm

NOTE:
1. CONTROLLING DIMENSION IS MILLIMETER. CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

Part Marking



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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.