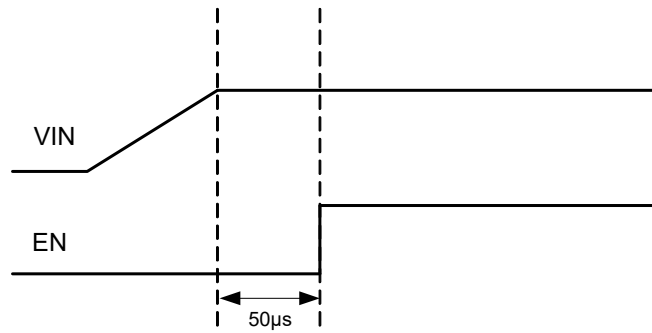


Option Table

Part Number	PFM / Force PWM for Light Load Operation	
	PFM	Force PWM
AOZ2255LQI-30	V	
AOZ2255LQI-31		V

Recommended Start-up Sequence



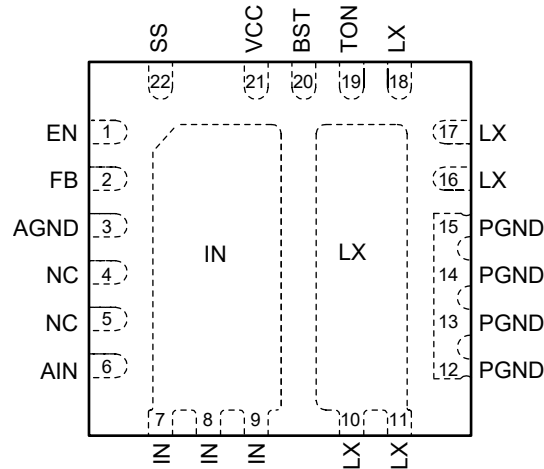
Ordering Information

Part Number	Ambient Temperature Range	Package	Environmental
AOZ2255LQI-31	-40°C to +85°C	22-Pin 4mm x 4mm QFN	Green Product



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



22-Pin 4mm x 4mm QFN
(Top View)

Pin Description

Pin Number	Pin Name	Pin Function
1	EN	Enable Input. The AOZ2255LQI-31 is enabled when EN is pulled high. The device shuts down when EN is pulled low.
2	FB	Feedback Input. Adjust the output voltage with a resistive voltage-divider between the regulator's output and AGND.
3	AGND	Analog Ground.
6	AIN	Supply to internal analog function. AIN pin must be connected to IN pins. For noisy operation, it's better to have a RC filter from IN to AIN for better noise immunity.
7, 8, 9	IN	Supply Input. IN is the regulator input. All IN pins must be connected together.
10, 11, 16, 17, 18	LX	Switching Node.
12, 13, 14, 15	PGND	Power Ground.
19	TON	On-Time Setting Input. Connect a resistor between VIN and TON to set the on time
20	BST	Bootstrap Capacitor Connection. The AOZ2255LQI-31 includes an internal bootstrap diode. Connect an external capacitor between BST and LX as shown in Typical Application diagram.
21	VCC	Supply Input for Analog Functions. Bypass VCC to AGND with a 4.7µF~10µF ceramic capacitor. Place the capacitor close to VCC pin.
22	SS	Soft-Start Time Setting Pin. Connect a capacitor between SS and AGND to set the soft-start time.

Absolute Maximum Ratings

Exceeding the Absolute Maximum Ratings may damage the device.

Parameter	Rating
IN, TON to AGND	-0.3V to 30V
LX to AGND ⁽¹⁾	-0.3V to 30V
BST to AGND	-0.3V to 36V
SS, FB, EN, VCC to AGND	-0.3V to 6V
PGND to AGND	-0.3V to +0.3V
Junction Temperature (T _J)	+150°C
Storage Temperature (T _S)	-65°C to +150°C
ESD Rating ⁽²⁾	2kV

Notes:

- LX to PGND Transient (t<20ns) ----- -7V to V_{IN}+7V.
- Devices are inherently ESD sensitive, handling precautions are required. Human body model rating: 1.5kΩ in series with 100pF.

Maximum Operating Ratings

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

Parameter	Rating
Supply Voltage (V _{IN})	6.5V to 28V
Output Voltage Range	0.6V to 0.85*V _{IN}
Ambient Temperature (T _A)	-40°C to +85°C
Package Thermal Resistance (θ _{JA}) (θ _{JC})	32°C/W 4°C/W

Electrical Characteristics

T_A = 25°C, V_{IN}=12V, EN = 5V, unless otherwise specified. Specifications in **BOLD** indicate a temperature range of -40°C to +85°C.

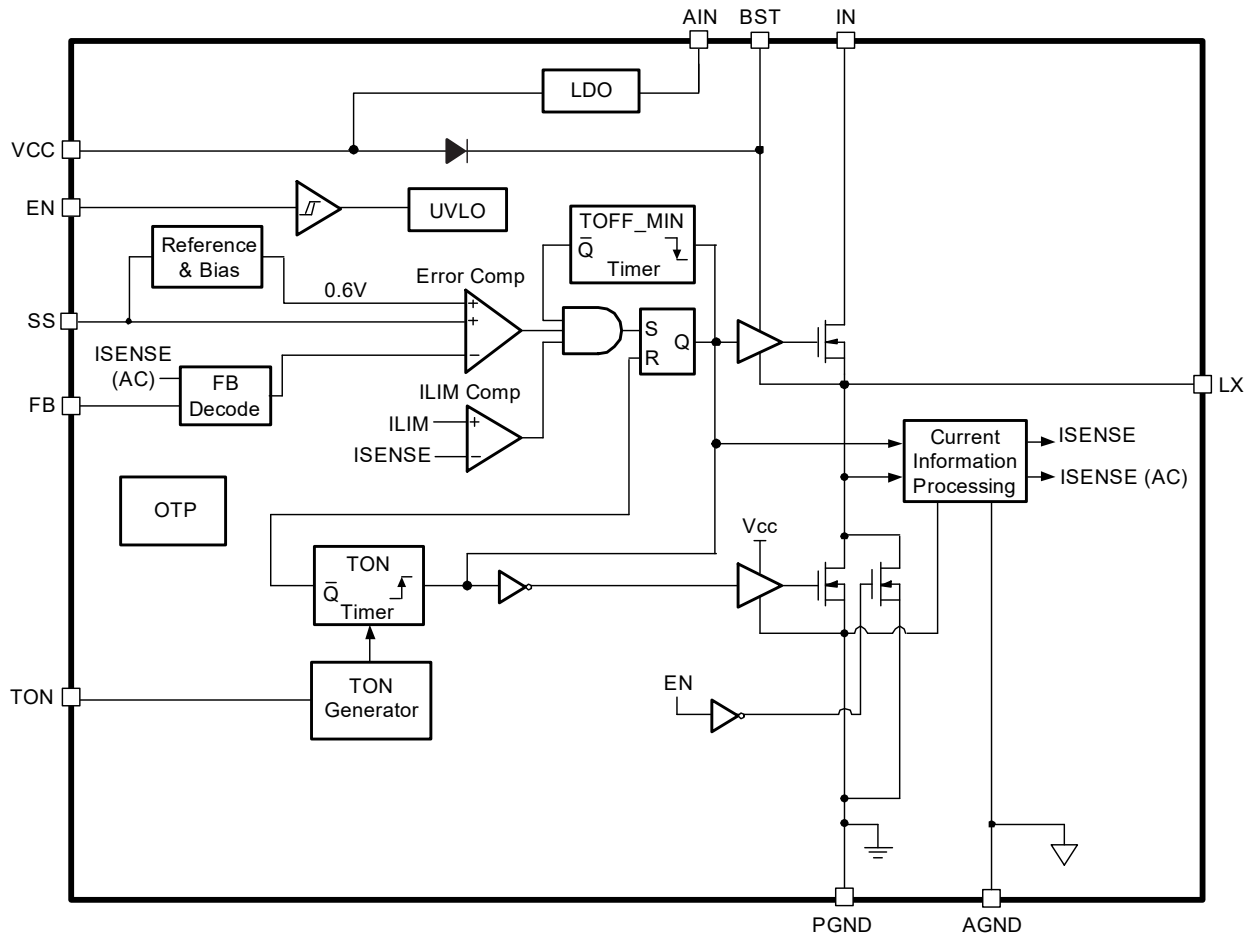
Symbol	Parameter	Conditions	Min.	Typ.	Max	Units
V _{IN}	IN Supply Voltage		6.5		28	V
V _{UVLO}	Under-Voltage Lockout Threshold	V _{CC} rising V _{CC} falling	3.2	4.0 3.7	4.4	V
I _q	Quiescent Supply Current of V _{CC}	I _{OUT} = 0, V _{EN} > 2V		2		mA
I _{OFF}	Shutdown Supply Current	V _{EN} = 0V		15		μA
V _{FB}	Feedback Voltage	T _A = 25°C T _A = 0°C to 85°C	0.594 0.591	0.600 0.600	0.606 0.609	V
	Load Regulation			0.5		%
	Line Regulation			1		%
I _{FB}	FB Input Bias Current				200	nA
Enable						
V _{EN}	EN Input Threshold	Off threshold On threshold	1.6		0.5	V
V _{EN_HYS}	EN Input Hysteresis			300		mV
Modulator						
T _{ON_MIN}	Minimum On Time			60		ns
T _{ON_MAX}	Maximum On Time			2.6		μS
T _{OFF_MIN}	Minimum Off Time			300		ns
Soft-Start						
I _{SS_OUT}	SS Source Current	V _{SS} = 0 C _{SS} = 0.001μF to 0.1μF	7	11	15	μA
Under Voltage and Over Voltage Protection						
V _{PL}	Under Voltage Threshold	FB falling		70		%
T _{PL}	Under Voltage Delay Time			32		μS
V _{PH}	Over Voltage Threshold	FB rising		120		%

Electrical Characteristics

$T_A = 25^\circ\text{C}$, $V_{IN} = 12\text{V}$, $V_{EN} = 5\text{V}$, unless otherwise specified. Specifications in **BOLD** indicate a temperature range of -40°C to $+85^\circ\text{C}$.

Symbol	Parameter	Conditions	Min.	Typ.	Max	Units
Power Stage Output						
$R_{DS(ON)}$	High-Side NFET On-Resistance	$V_{IN} = 12\text{V}$		11		$\text{m}\Omega$
	High-Side NFET Leakage	$V_{EN} = 0\text{V}$, $V_{LX} = 0\text{V}$			10	μA
$R_{DS(ON)}$	Low-Side NFET On-Resistance	$V_{LX} = 12\text{V}$		7		$\text{m}\Omega$
	Low-Side NFET Leakage	$V_{EN} = 0\text{V}$			10	μA
Over-current and Thermal Protection						
I_{LIM}	Current Limit		18			A
	Thermal Shutdown Threshold	T_J rising T_J falling		150 100		$^\circ\text{C}$

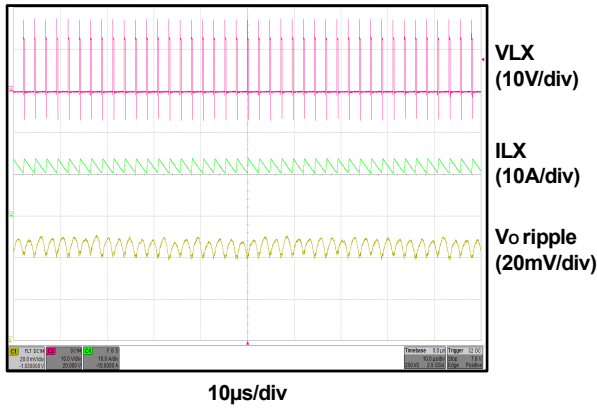
Functional Block Diagram



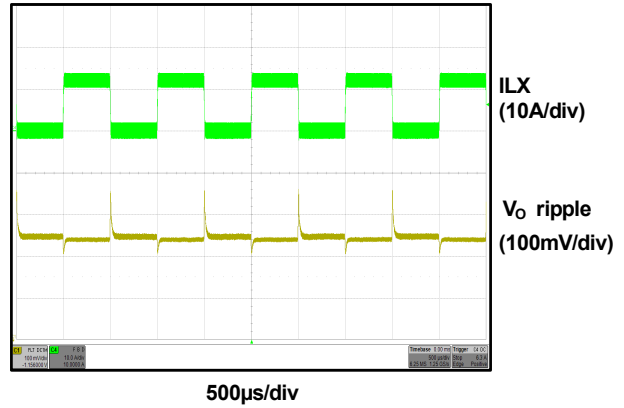
Typical Performance Characteristics

Circuit of Typical Application. $T_A = 25^\circ\text{C}$, $V_{IN} = 12\text{V}$, $V_{OUT} = 1\text{V}$, unless otherwise specified.

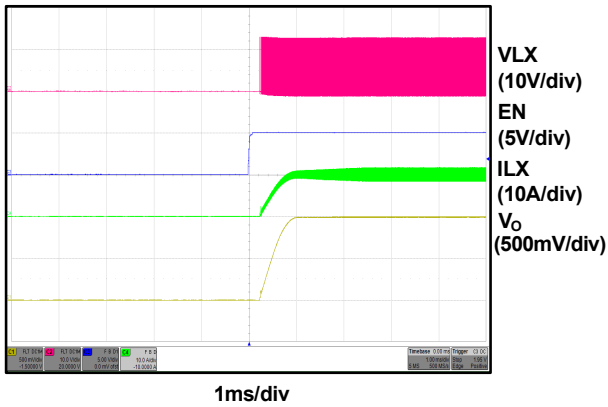
Normal Operation



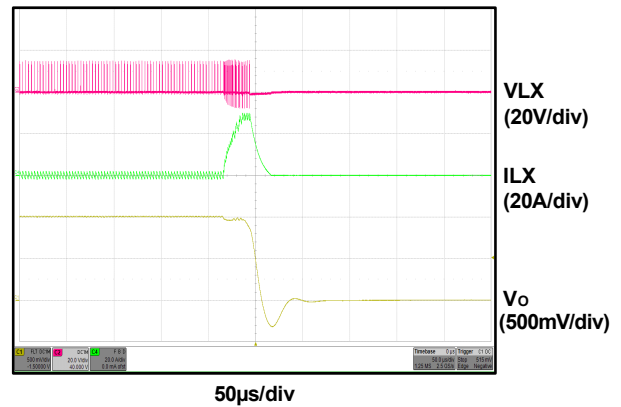
Load Transient 0A to 12A



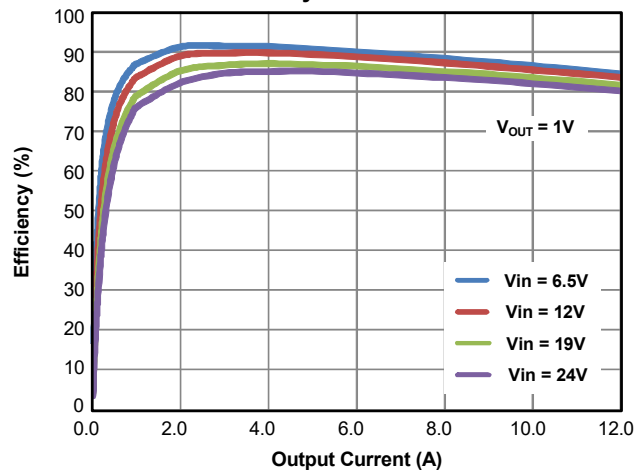
Full Load Start-up



Short Circuit Protection



Efficiency vs. Load Current



Detailed Description

The AOZ2255LQI-31 is a high-efficiency, easy-to-use, synchronous buck regulator optimized for notebook computers. The regulator is capable of supplying 12A of continuous output current with an output voltage adjustable down to 0.6V.

The input voltage of AOZ2255LQI-31 can be as low as 6.5V. The highest input voltage of AOZ2255LQI-31 can be 28V. Constant on-time PWM with input feed-forward control scheme results in ultra-fast transient response while maintaining relatively constant switching frequency over the entire input range. True AC current mode control scheme guarantees the regulator can be stable with ceramics output capacitor. Protection features include V_{CC} under-voltage lockout, cycle-by-cycle current limit, output over voltage and under voltage protection, short-circuit protection, and thermal shutdown.

The AOZ2255LQI-31 is available in 22-pin 4mm×4mm QFN package.

Input Power Architecture

The AOZ2255LQI-31 integrates an internal linear regulator to generate 5.3V ($\pm 5\%$) V_{CC} from input. If input voltage is lower than 5.3V, the linear regulator operates at low drop-output mode; the V_{CC} voltage is equal to input voltage minus the drop-output voltage of internal linear regulator.

Enable and Soft Start

The AOZ2255LQI-31 has external soft start feature to limit in-rush current and ensure the output voltage ramps up smoothly to regulate voltage. A soft start process begins when V_{CC} rises to 4.5V and voltage on EN pin is HIGH. An internal current source charges the external soft-start capacitor; the FB voltage follows the voltage of soft-start pin (V_{SS}) when it is lower than 0.6V. When V_{SS} is higher than 0.6V, the FB voltage is regulated by internal precise band-gap voltage (0.6V). The soft-start time for FB voltage can be calculated by the following formula:

$$T_{SS}(\mu s) = 60 \times C_{SS}(nF)$$

If C_{SS} is 1nF, the soft-start time will be 60 μ seconds; if C_{SS} is 10nF, the soft-start time will be 600 μ seconds.

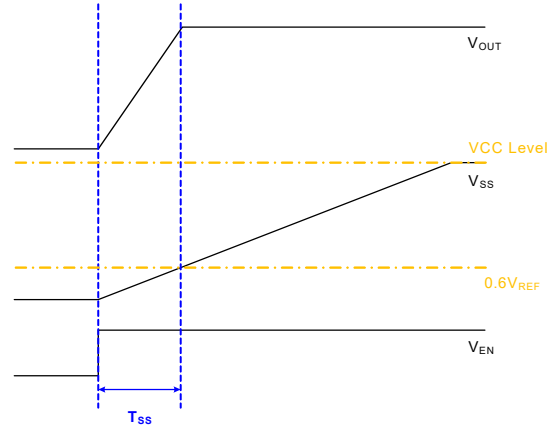


Figure 1. Soft Start Sequence of AOZ2255LQI-31

Constant-On-Time PWM Control with Input Feed-Forward

The control algorithm of AOZ2255LQI-31 is constant-on-time PWM control with input feed-forward. The simplified control schematic is shown in Figure 2. The high-side switch on-time is determined solely by a one-shot whose pulse width is inversely proportional to input voltage (I_N). The one-shot is triggered when the internal 0.6V is higher than the combined information of FB voltage and the AC current information of inductor, which is processed and obtained through the sensed low-side MOSFET current once it turns-on. The added AC current information can help the stability of constant-on time control even with pure ceramic output capacitors, which have very low ESR. The AC current information has no DC offset, which does not cause offset with output load change, which is fundamentally different from other V^2 constant-on time control schemes.

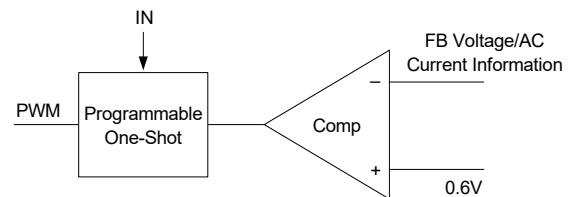


Figure 2. Simplified Control Schematic of AOZ2255LQI-31

The constant-on-time PWM control architecture is a pseudo-fixed frequency with input voltage feed-forward. The internal circuit of AOZ2255LQI-31 sets the on-time of high-side switch inversely proportional to the I_N .

$$T_{on} \propto \frac{R_{ton}(\Omega)}{V_{in}(V)} \quad (1)$$

