ZLPM3316
Low current power management solution for DBS

Summary

The ZLPM3316 is an efficient switch mode regulator designed specifically for the Direct Broadcast by Satellite (DBS) market. At the heart of a low power satellite Low Noise Block (LNB) and multi-switches it provides a complete power supply management solution for up to four ports per IC. Eliminating system compatibility problems whilst maximising efficiency the ZLPM3316 combined with other parts in the Zetex low power product range allows the whole system to operate reliably, efficiently and from 3.3V.

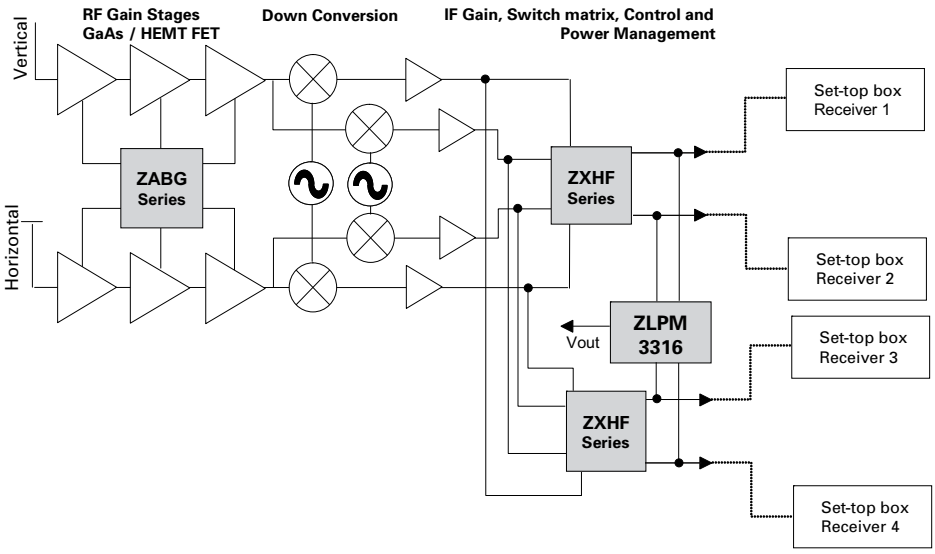
Features

- High efficiency switching converter to reduce LNB power consumption
- Intelligent power supply selection
- Eliminates all linear regulators
- High current 3.3V output voltage
- Four independent intelligent power supplies for the cable drive amplifiers.
- Integrated power switch
- 22kHz tone filter
- Helps eliminate system compatibility issues
- Direct connection to ZXHF and ZABG series

Applications

- Quad Universal LNB's
- Multi Output LNB's
- Satellite Multi-Switches

Typical Low Power Quad Universal LNB System



Description

The ZLPM3316 is a switching regulator specifically designed to meet the requirements of multiple output satellite LNB's and multi switches. Using an efficient non isolating buck converter, the ZLPM3316 will provide a 3.3V supply voltage which can supply a maximum output current of 300mA from any input supply in the range of 9V to 21V.

In addition to the main 3.3V LNB power supply the ZLPM3316 includes four independently controlled down-feed driver amplifier supply switches, providing a regulated 3.0V to each of the line driving IF amplifiers. The internal controller detects the presence or absence of a Set-top box or a power supply on any of the four down-feeds (V_{pol1} - V_{pol4}) and if a non-valid power supply is detected it switches off the corresponding down-feed amplifier (A_{s1} - A_{s4}) to avoid unwanted signal reflections and power loss. The detectors can also be used as part of a smart energy efficient LNB and the output can be used to drive standard logic or other control circuits that can switch off further parts of the LNB or multi switch.

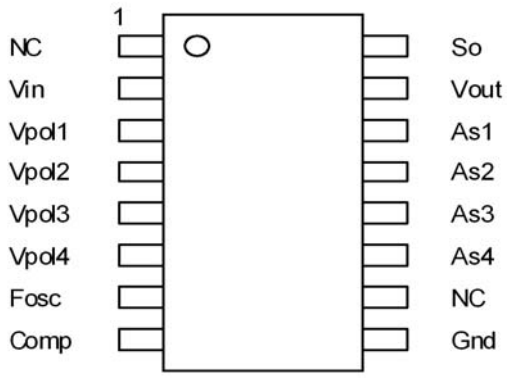
The ZLPM3316 also includes intelligent input power supply selection logic that assists in maintaining LNB compatibility with STB's not designed to drive low current LNBs. This is done with the minimal voltage drop from the supply, maximising efficiency.

As the ZLPM3316 has been designed specifically for DBS applications it can operate over the wide input supply of 10V to 21V. .

To help minimise PCB size ZLPM3316 is supplied in the miniature QSOP16 surface mount package.

Pinout Diagram

ZLPM3316 pinout for QSOP16
Package Designator - Q16



Maximum Ratings

Supply Voltage	-0.6V to +26V
Supply Current	400mA
Vpol1/2/3/4 Input Voltage	26V Continuous
Power Dissipation	350mW
Operating Temperature Range	-40°C to +85°C
Storage Temperature Range	-50°C to +150°C

Electrical Characteristics

Measured at Tamb = 25°C, Vin = 18V, Rpol1,2,3,4 = 330 ohm unless otherwise specified.

Parameter	Conditions	Limits			Units
		Min	Typ	Max	
Supply Voltage Operating Range		9		21	V
Supply Current	All outputs unloaded, Vfosc = 0		3	6	mA

Vpol1/2/3/4 Inputs					
Input Current Uns.	Vpoln = 21V, Vpoln+x = 21V, Vpoln-x = 0V(2)	15	35	100	µA
Input Current Sel.	Vpoln = 21V, Vpoln+1 = 0V, Vpoln-x = 21V(2)	3.75	5.0	6.25	mA
Input Cur. Sel. Thres.	Vpoln+x = 0V, Vpoln-x = 21V(2)	6.0	7.5	9.0	V
Vpol As Threshold	Vin = 9V to 21V	6.0	7.5	9.0	V
Switching Speed				100	µs

As1/2/3/4 Outputs					
Voltage High	Vpol = 9V, Iload = -25mA, Vout = 3.3V	2.7	3.0	3.3	V
Leakage Current	Vpol = 0, Vas = 0, Vout = 3.3V			10	µA
Current range		0		30	mA

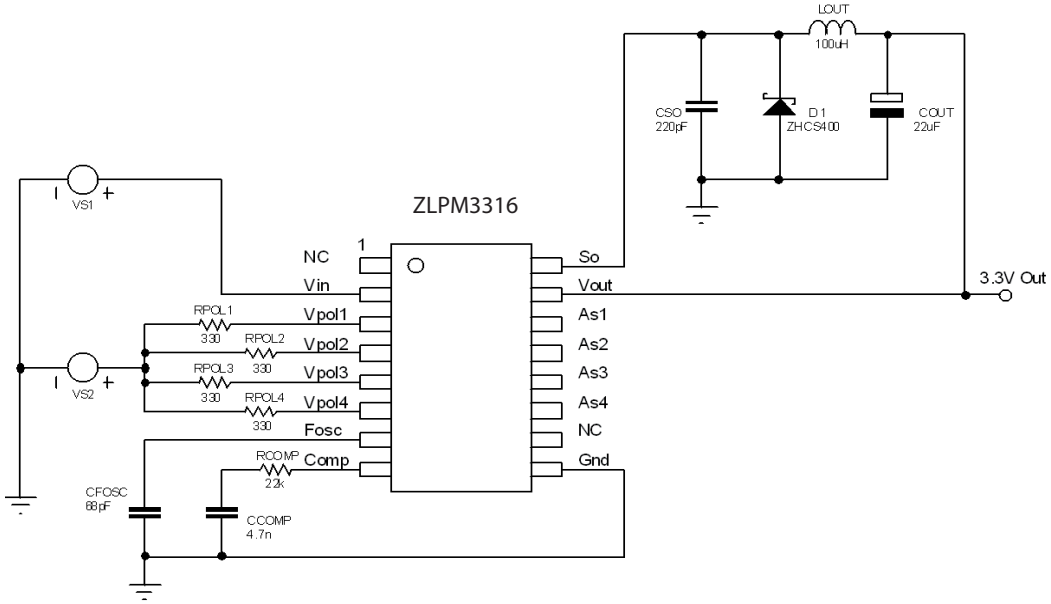
Switching Frequency					
Range		0		500	kHz
Frequency(3)	Cfosc = 68pF		120		kHz

Parameter	Conditions	Limits			Units
		Min	Typ	Max	
Power Switch					
Saturation Volt.	Iso = 300mA, Vout = 3.1V, Vfosc = 0V, Vin = 9V	1.0		2.5	V
Current	Vout = 3.1, Vfosc = 0V, Vso = Vin-3.0, Vin = 9V	400			mA
Leakage(Off)	Vso = 0, Vout = 3.5V, Vfosc = 2V, Vin = 21V			10	μA
Leakage(O.V.)	Vso = 0, Vout = 3.1V, Vin = 26V			1	mA

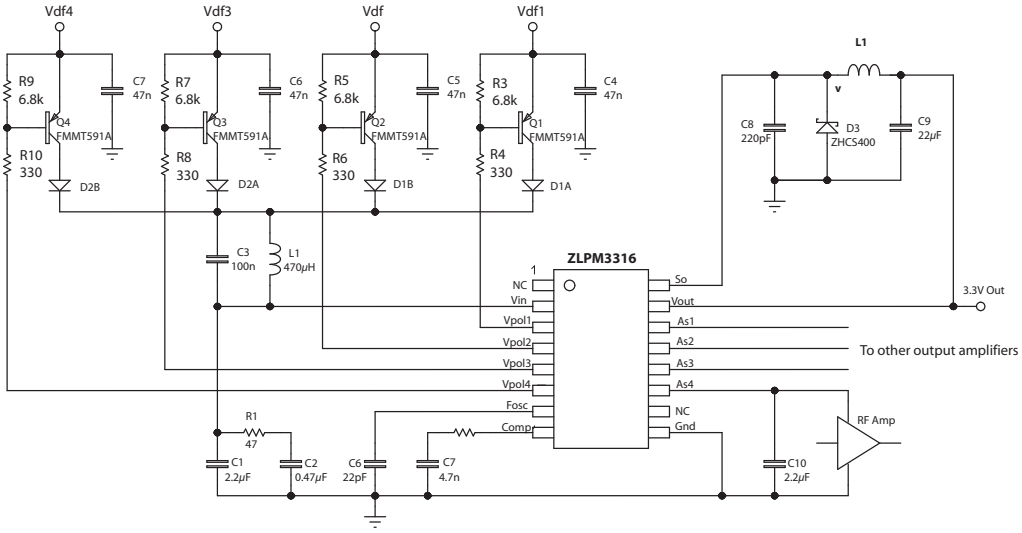
Regulator					
Output Voltage	Test Circuit 1, Il = 200mA	3.1	3.3	3.5	V
Total Output Current	Test Circuit 1, Iout+AS1+AS2+AS3+AS4	0		300	mA
Output Ripple	Test Circuit 1, Il = 200mA		5		mV
dVout / dVin	Test Circuit 1, Il = 200mA		0.5		mV/V
dVout / dIl	Test Circuit 1, Il = 100 to 200mA		-45		mV/A
dVout / dT			50		ppm

NOTES:
(1) Vpol stimulus applied via a 330 ohm resistor. All levels measured on the input to this resistor.
(2) Vpoln means the input under test, Vpoln+x means all Vpol inputs of higher number and Vpoln-x means all Vpol inputs of lower number.
(3) Switching frequency (fosc) is inversely proportional to Vin.

Test Circuit



Applications information



The above is a typical partial application circuit for the ZLPM3316.

The operating frequency of the switching converter is user controlled over the range 0 to 500kHz. The frequency is set by an external capacitor wired between Fosc and ground.

The pins Vpol1, Vpol2, Vpol3 and Vpol4 are dual function inputs and outputs. The first input function is to control the state of the amplifier power switch outputs As1, As2, As3 and As4 respectively. The Vpol1-4 pins are designed to be wired to the power inputs of an LNB via ESD protection resistors (330 ohms nominal). Should the voltage on any input fall below 6V, the associated amplifier power switch output will be disabled by switching to 0V. Enabled, the amplifier power switch outputs will source up to 30mA loads from the output of the switching converter (Vout). These power switches allow any output amplifier connected to an inactive set-top-box to be disabled, avoiding signal reflections from miss-matched lines and unnecessary power loss. When enabled, the output voltage of each power switch is set to be 3.0V nominal. Since the switches have an inherent voltage drop of around 0.3V, the output voltage of the buck converter is set at 3.3V nominal.

The second function of pins Vpol1, Vpol2, Vpol3 and Vpol4 is to select which active STBs are used to power the LNB. Some STB designs do not support low supply current LNBs and can cause system problems. Since the objective of the ZLMP3315 is to reduce STB loading, these set-top box designs may malfunction if their output loading is made too low by the use of the IC. The ZLPM3316 caters for such STBs by including internal logic which selects one STB only to supply all LNB loading. Because of the use of an efficient switching converter, the resulting loading is still less than standard linear designs that share loading between STBs. When more than one powered STB is connected to the ZLMP3315, the device acts to select one of these as the sole power source to the LNB. Selection is achieved by varying the input (sink) current of the Vpol pins. A Vpol pin connected to an active but not selected STB sinks approximately 50µA. The Vpol pin connected to the selected STB sinks approximately 4mA. This difference in current is used with up to four external low cost PNP transistors to direct power only from the selected STB to the switching converter. The four Vpol pins operate with a strictly defined hierarchy. The highest

number pin powered will be selected (e.g. Vpol4 will be selected over Vpol3 etc.). Should the selected STB be switched off or disconnected, then the next highest number powered input pin will take control. Selection is not dependent on input voltage for valid inputs in the range 10V-21V.

The ZLPM3316 requires an RC compensation network to maintain loop stability. This series connected network is wired from the Comp pin to ground. The component values required are dependent on the inductor and load capacitor used in the switching converter. Application circuits following these notes show typical values.

It is expected that the ZLPM3316 will be connected to the power input of its LNB via forward biased diodes, present either to 'OR' together multiple power inputs or perhaps simply to give reverse supply protection. To guarantee correct operation with LNB power inputs down to 10V, the ZLPM3316 has been design to operate from 9V or greater, hence allowing for the voltage drop of any input diodes. .

Vpol Input Current Truth Table

As described above, the input current taken by the Vpol1-4 pins is switched high (>3mA) or low (<100μA) by the ZLPM3316 to select which STB is to supply the power input to the switching converter. The following truth table shows the controlling logic.

The terms used in the table are as follows:-

Ivpol(H) means input current on this pin only is greater than 3.0mA (all others <100μA)

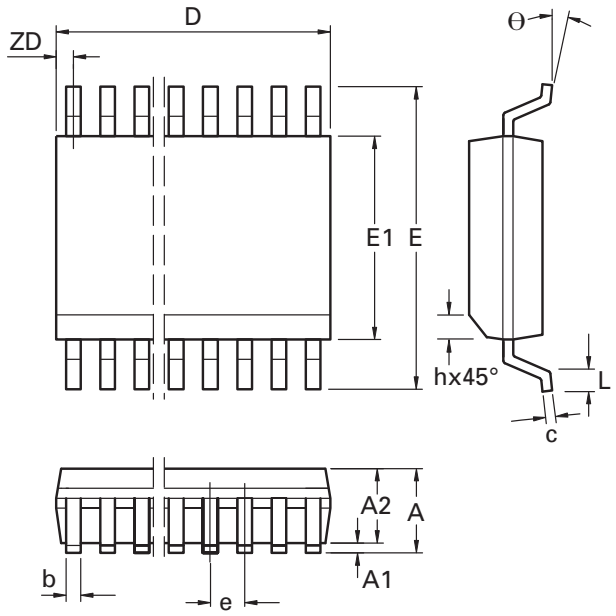
Vvpol1-4 Enabled means input voltage applied to this pin is greater than 9.0V

Vvpol1-4 Disabled means input voltage applied to this pin is less than 6V

Vvpol1-4 D/C means input voltage applied to this pin has no effect on Ivpol1-4

Ivpol(H)	**Vvpol**			
	Vpol4	**Vpol3**	**Vpol2**	**Vpol1**
Vpol4	Enabled	D/C	D/C	D/C
Vpol3	Disabled	Enabled	D/C	D/C
Vpol2	Disabled	Disabled	Enabled	D/C
Vpol1	Disabled	Disabled	Disabled	Enabled

Package outline - QSOP16 (Q16)



Common dimensions

DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.053	0.069	1.35	1.75	e	0.025 BSC		0.64 BSC	
A1	0.004	0.010	0.10	0.25	b	0.008	0.012	0.20	0.30
E	0.228	0.244	5.79	6.20	c	0.007	0.010	0.18	0.25
E1	0.150	0.157	3.81	3.99	θ	0°	8°	0°	8°
L	0.016	0.050	0.41	1.27	h	0.010	0.020	0.25	0.50

Note: Controlling dimensions are in inches. Approximate dimensions are provided in millimeters

Ordering Information

Device	Package	Reel size (inches)	Tape width (mm)	Quantity per reel
ZLPM3316Q16TC	QSOP16	13	12	2500

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