



Direct Broadcast by Satellite



Meeting the challenges of DBS

The Direct Broadcast by Satellite (DBS) market presents system developers with a number of quite specific challenges. High levels of analog device integration can help support the efforts to produce cost-effective, high performance and power efficient products. However, it is also vital to remain adaptable in the face of new architectures and system approaches.

Working closely with DBS product developers, Zetex Semiconductors has applied its systems design and process expertise in the analog and RF domains. This has helped to develop highly integrated parts, which combine to create complete DBS system solutions. Its range of versatile and reliable ICs provide complete Intermediate Frequency (IF) integration with all the supporting functions of GaAs FET and mixer bias, control, micro-processor interface and power management functions demanded by the sector.

Supported by reference designs, technical support and PCB layouts, the comprehensive Zetex DBS product range provides highly integrated solutions for applications including Low Noise Blocks (LNBs), satellite switch boxes and distribution systems, return path and VSAT, DiSEQC™ systems, and base stations.

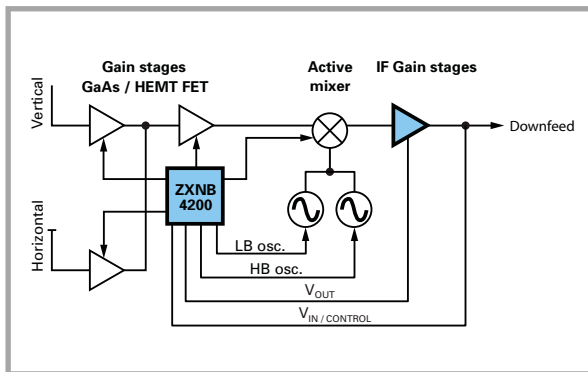
For more information visit www.zetex.com/satproducts



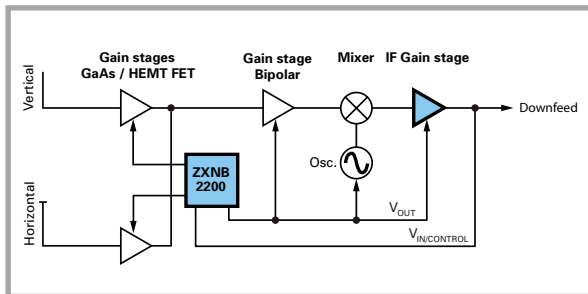
Single output LNBS

From single universal, C-band or mono block LNBS, developers need reliable performance and design flexibility at low cost. Zetex achieves this by integrating the bias, control and power management functions supporting the RF and IF signal path.

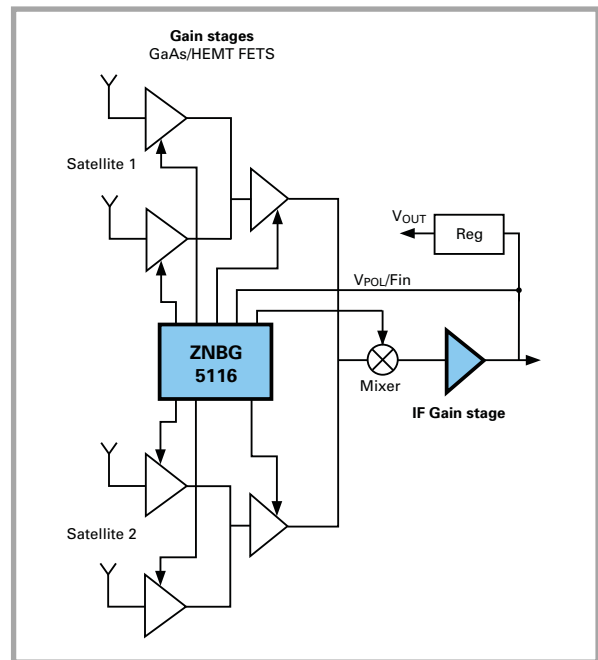
To enhance performance, all of Zetex' products are temperature compensated and its DBS power management products feature full electrical protection to withstand a harsh outdoor environment.



Typical single universal LNB



Typical C-band LNB



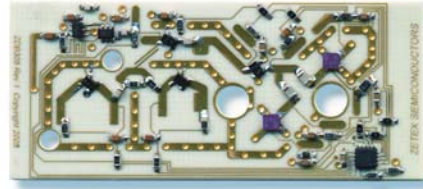
Typical Japanese mono block LNB

Single output LNBS: bias, control and power management

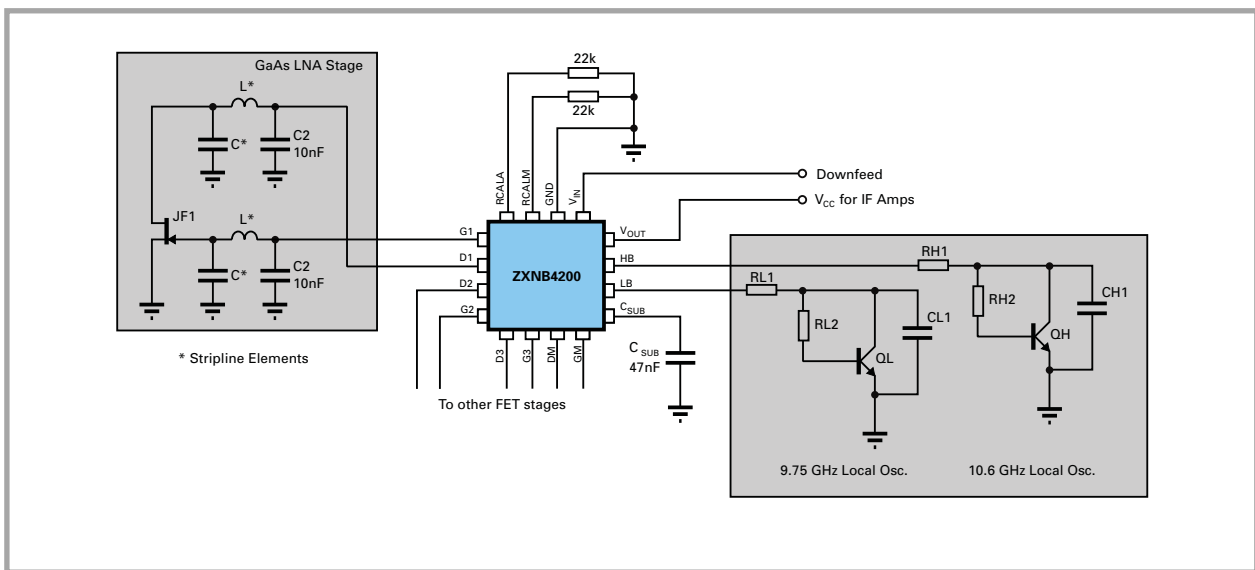
At the heart of single output LNBS, the ZXNB series of ICs provide a single chip solution that provides bias, control and power management functionality. Being highly integrated devices, they help reduce component count by 10 and PCB size by at least 20%.

Incorporating an internal regulator, these high performance ZXNB parts are 'self-powering' and provide a temperature compensated high current output voltage to power all other parts of the LNB circuit, such as the IF gain stage.

Integral bias circuits drive both GaAs LNAs and a mixer; to optimize system performance the drain current of each is user selectable via a single external reference resistor. A reliable voltage detector allows the ZXNB part to enable the required polarization channel by controlling the appropriate FET. A tone detector with an integrated filter and unwanted signal rejection provides band switching between the high and low band oscillators.



Zetex' single universal reference design



Single universal applications circuit for all bias control and power management

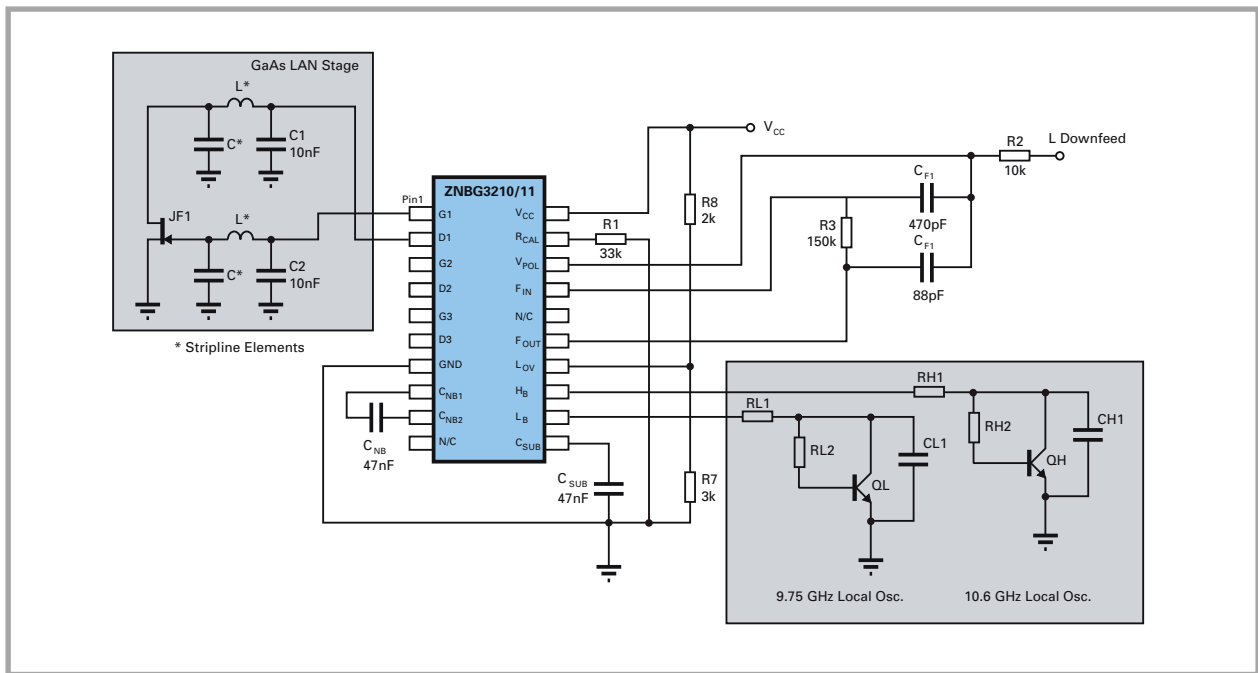
Single chip switch bias, control and power management ICs

| Part number | Number of bias stages | | V _{out} V | Max. total load mA | V _{POL} V | F Tone kHz | V _{drain} V | V _{G(off)} V | I _{drain LNA} mA | I _{drain mixer} mA | Package |
|--------------|-----------------------|-------|-----------------------|-----------------------|-----------------------|---------------|-------------------------|--------------------------|------------------------------|--------------------------------|---------|
| | LNA | Mixer | | | | | | | | | |
| ZXNB2200JA16 | 2 | 0 | 5 | 80 | 14.0 to 15.5 | na | 2.0 | 0.0 | 0 to 15 | na | QFN1633 |
| ZXNB4100JA16 | 3 | 1 | 5 | 80 | 14.0 to 15.5 | 22 | 2.0 | -2.5 | 0 to 15 | 0 to 10 | QFN1633 |
| ZXNB4200JA16 | 3 | 1 | 5 | 80 | 14.0 to 15.5 | 22 | 2.0 | 0 | 0 to 15 | 0 to 10 | QFN1633 |
| ZXNB4200JB16 | 3 | 1 | 5 | 115 | 14.0 to 15.5 | 22 | 2.0 | 0 | 0 to 15 | 0 to 10 | QFN1644 |

Single output LNBS: bias and control

Where a single output LNB design requires a greater number of bias stages and a more complex control strategy, the ZNBG chips listed below provide the 'building block' flexibility that is needed.

With the exception of the high levels of integration and additional power management functions, these chips provide all of the functionality of the ZXNB series previously introduced and offer the similar reliable voltage and tone detection for polarization and band switching.



Single universal applications circuit for traditional bias and control

Switch bias and control ICs

| Part number | Number of bias stages | | V _{drain} V | V _{G(off)} V | V _{POL} V | F _{Tone} kHz | I _q mA | V _{neg} V | Package |
|-----------------------------|-----------------------|-------|-------------------------|--------------------------|-----------------------|--------------------------|----------------------|-----------------------|---------|
| | LNA | Mixer | | | | | | | |
| ZNBG3010Q16 | 3 | 0 | 2.2 | -3 | 14.0 to 15.5 | na | 5 | -3 | QSOP16 |
| ZNBG3020Q16 | 3 | 0 | 2.2 | 0 | 14.0 to 15.0 | na | 5 | -3 | QSOP16 |
| ZNBG3021Q16 ⁽¹⁾ | 3 | 0 | 2.0 | 0 | 14.0 to 15.5 | na | 5 | -3 | QSOP16 |
| ZNBG3021JA16 ⁽¹⁾ | 3 | 0 | 2.0 | 0 | 14.0 to 15.5 | na | 5 | -3 | QFN1633 |
| ZNBG3113Q20 | 3 | 0 | 2.2 | -2.5 | 14.0 to 15.5 | 22 ^(d) | 7 | -3 | QSOP20 |
| ZNBG3115Q16 | 3 | 0 | 2.2 | -2.5 | 14.0 to 15.5 | 22 ^(d) | 7 | -3 | QSOP16 |
| ZNBG3115Q20 | 3 | 0 | 2.2 | -2.5 | 14.0 to 15.5 | 22 ^(d) | 7 | -3 | QSOP20 |
| ZNBG3210Q20 | 3 | 0 | 2.2 | 0 | 14.0 to 15.5 | 22 | 7 | -3 | QSOP20 |
| ZNBG3211Q20 | 3 | 0 | 2.0 | 0 | 14.0 to 15.5 | 22 | 7 | -3 | QSOP20 |
| ZNBG4211Q24 | 3 | 1 | 2.0 | 0 | 14.0 to 15.5 | 22 | 8 | -3 | QSOP24 |
| ZNBG5116Q24 | 6 | 1 | 2.0 | -2.1 | 12.0 to 13.5 | 32-53 | 8 | -2.4 | QSOP24 |

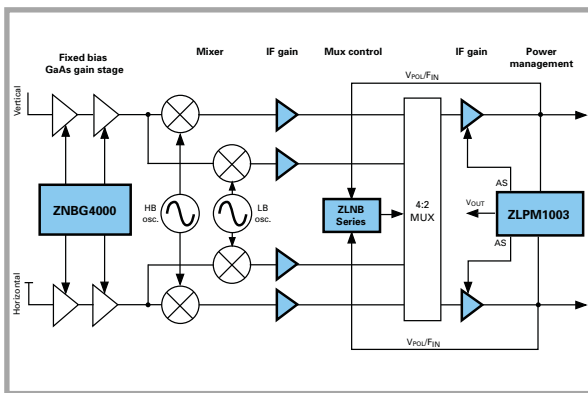
^(d) Tone delay ^(e) Tone rejection ⁽¹⁾ Refer to Zetex for availability

Multiple output LNBS and satellite switch boxes

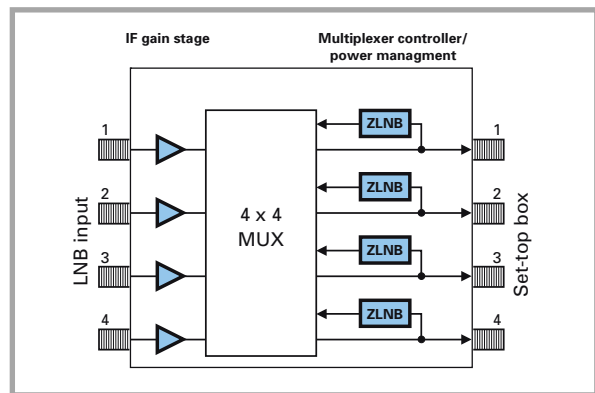
Zetex provides integrated solutions to support low power, highly integrated and cost effective multi-feed LNB designs that minimize the effort that is needed to conform with global regulatory and systems requirements.

The product range offers integrated IF solutions and all the bias, control, interfacing and power management functions to address the needs of multi-feed LNBS, satellite switch-boxes and distribution systems.

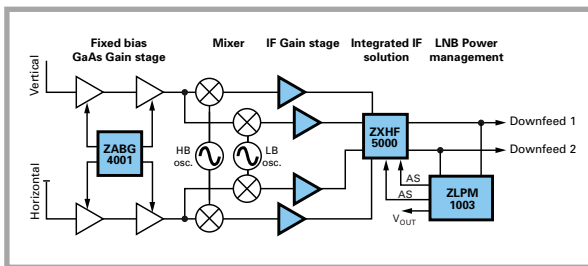
A typical configuration for a new low power, highly integrated twin LNB is shown below along with a low power, more traditional twin LNB design. The new LNB architecture shown needs a much smaller housing and PCB than standard LNBS and operates with less than half the power, producing one of most efficient and smallest multiple output LNBS or switch boxes on the market.



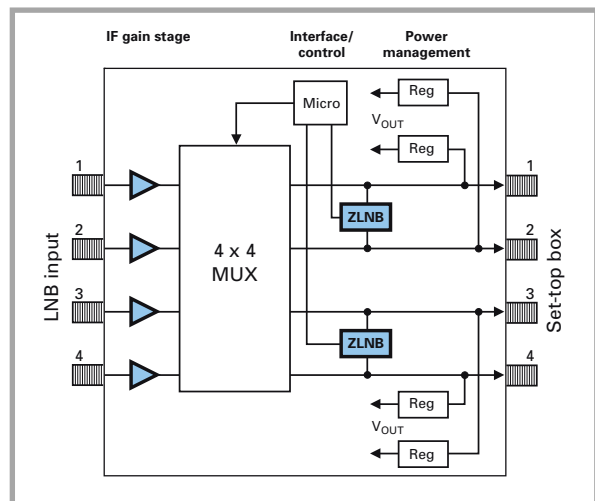
Existing low power twin LNB design



Typical 4x4 switch box with integrated power management



New integrated and low power twin LNB design



Typical 4x4 DiSEqC™ switch box

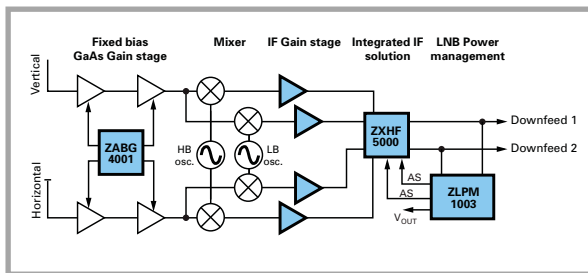
Fixed bias LNAs

In Low Noise Amplifier (LNA) and active-mixer applications, the ZABG and ZNBG series of fixed bias generators offer designers considerable flexibility and provide opportunities to optimize system design.

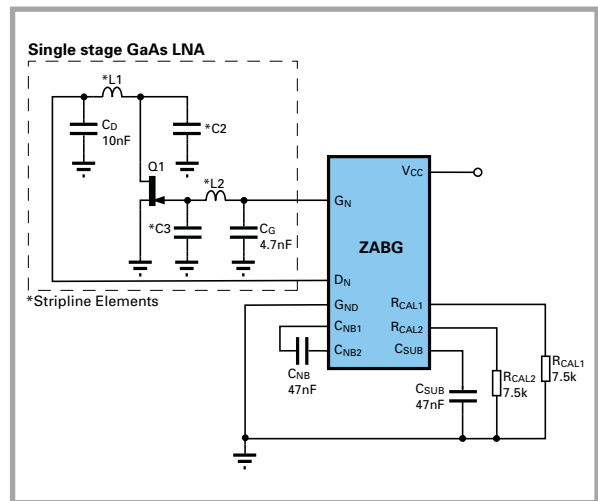
The devices generate an internal negative voltage from a single supply, which is used to bias the gates of the GaAs and HEMT FETs. With the ZABG and ZNBG series, the drain current of groups of FETs can be set individually using an external resistor.

The ZABG series has been designed specifically to allow a micro-controller or a logic signal to shut down the groups of FETs; this combined with the lower operating current provides a highly power efficient solution. The ZABG are pin compatible with the ZNBG series.

Since the device makes the negative rail accessible, it can also be used for other functions such as biasing additional FET stages or mixers. The fixed bias series also provides protection for the FETs during any operating condition, including start-up.



New integrated and low power twin LNB design



Applications circuit for a fixed bias generator

Fixed bias generators

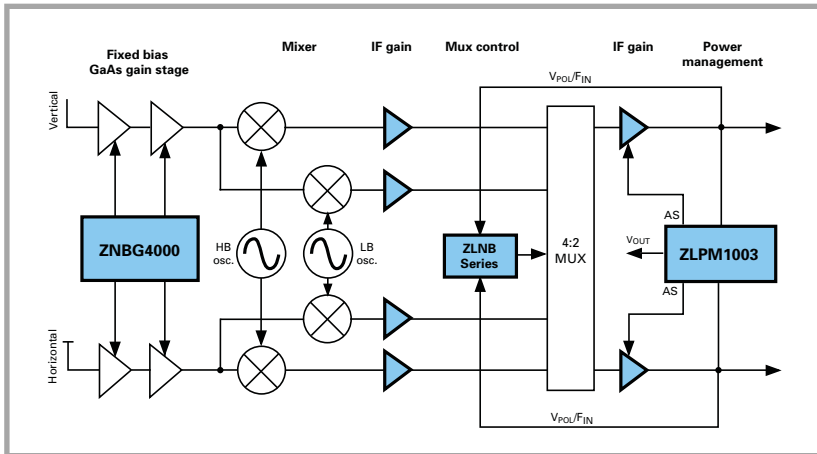
| Part number | Number of bias stages | | V _{drain} V | I _{drain} mA | I _q mA | V _{CC} V | V _{neg} V | Package |
|-----------------------------|-----------------------|-------|-------------------------|--------------------------|----------------------|----------------------|-----------------------|---------|
| | LNA | Mixer | | | | | | |
| ZNBG2000X10 | 2 | 0 | 2.2 | 0 to 15 | 5 | 5.0 to 12.0 | -3.0 | MSOP10 |
| ZNBG2001X10 | 2 | 0 | 2.0 | 0 to 15 | 5 | 5.0 to 12.0 | -3.0 | MSOP10 |
| ZNBG3000Q16 | 3 | 0 | 2.2 | 0 to 15 | 5 | 5.0 to 12.0 | -3.0 | QSOP16 |
| ZNBG3001Q16 | 3 | 0 | 2.0 | 0 to 15 | 5 | 5.0 to 12.0 | -3.0 | QSOP16 |
| ZNBG4000Q16 | 4 | 0 | 2.2 | 0 to 15 | 5 | 5.0 to 12.0 | -3.0 | QSOP16 |
| ZNBG4001Q16 | 4 | 0 | 2.0 | 0 to 15 | 5 | 5.0 to 12.0 | -3.0 | QSOP16 |
| ZNBG6000Q20 | 6 | 0 | 2.2 | 0 to 15 | 6 | 5.0 to 12.0 | -3.0 | QSOP20 |
| ZNBG6001Q20 | 6 | 0 | 2.0 | 0 to 15 | 6 | 5.0 to 12.0 | -3.0 | QSOP20 |
| ZNBG6005Q20 | 4 | 2 | 2.2 | 0 to 15 | 5 | 5.0 to 12.0 | -3.0 | QSOP20 |
| ZABG4001JA16 ⁽¹⁾ | 4 | 0 | 2.0 | 0 to 15 | 2 | 3.3 to 8.0 | -2.8 | QFN1633 |
| ZABG6001JB20 ⁽¹⁾ | 6 | 0 | 2.0 | 0 to 15 | 2 | 3.3 to 8.0 | -2.8 | QFN2044 |
| ZABG4001Q16 ⁽¹⁾ | 4 | 0 | 2.0 | 0 to 15 | 2 | 3.3 to 8.0 | -2.8 | QSOP16 |
| ZABG6001Q20 | 6 | 0 | 2.0 | 0 to 15 | 2 | 3.3 to 8.0 | -2.8 | QSOP20 |

⁽¹⁾ Refer to Zetex for availability

Multiplexer control and micro-controller interfacing

The ZLNB series provides a simple and reliable solution addressing most IF multiplexer control and micro-processor interfacing requirements. It supports a variety of combinations of voltage switches, tone switches and DiSEqC™ interfaces with a choice of logical outputs and internal power management.

For a safe and reliable solution the majority of the ZLNB parts have been designed to reject unwanted signals, including transients and unwanted tone signals. These products have been developed to meet the demanding needs of multiple output LNBS, satellite switch box and distribution systems, and DiSEqC™ applications.



Existing low power twin LNB design

Multiplexer control ICs

| Part number | Controller type | MUX type | Control | | Output ports | | | V _{CC} V | Package |
|-------------|---------------------------------------|----------------|-----------------------|--------------------------|--------------|-----------|-----------------|----------------------|---------|
| | | | V _{POL} V | F _{Tone} kHz | Decoded | Type | No rec detector | | |
| ZLNB100N8 | Dual port | IC, diode, amp | 14.0 to 15.5 | na | no | std | no | 5.0 to 12.0 | SO8 |
| ZLNB101N8 | Dual port | IC, diode, amp | 14.0 to 15.0 | na | no | std | no | 5.0 to 12.0 | SO8 |
| ZLNB102N8 | Dual port | IC, diode, amp | 14.0 to 14.5 | na | no | std | no | 5.0 to 12.0 | SO8 |
| ZLNB1001N8 | Single port with integrated regulator | IC, diode, amp | 14.0 to 15.0 | 22 ^(r) | yes | std | no | 9.0 to 21.0 | SO8 |
| ZLNB2003Q16 | Dual port | IC | 14.0 to 15.5 | 22 ^(d) | no | std | yes | 5.0 to 10.0 | QSOP16 |
| ZLNB2004Q16 | Dual port | IC | 14.0 to 15.5 | 22 ^(d) | no | inv | yes | 5.0 to 10.0 | QSOP16 |
| ZLNB2006Q20 | Dual port | Diode | 14.0 to 15.5 | 22 ^(d) | yes | std | no | 5.0 to 10.0 | QSOP20 |
| ZLNB2009Q20 | Dual port | Diode | 14.0 to 15.5 | 22 ^(d) | yes | std | yes | 5.0 to 10.0 | QSOP20 |
| ZLNB2010Q16 | Dual port | Diode | 14.0 to 15.5 | 22 ^(r) | yes | std | yes | 5.0 to 10.0 | QSOP16 |
| ZLNB2012Q16 | Dual port | IC | 14.0 to 14.5 | 22 ^(r) | no | std & inv | yes | 5.0 to 10.0 | QSOP16 |
| ZLNB2013Q16 | Dual port | IC | 14.0 to 15.5 | 22 ^(r) | no | std & inv | yes | 5.0 to 10.0 | QSOP16 |
| ZLNB2310Q16 | Dual port | Diode | 14.0 to 15.5 | 22 ^(r) | yes | std | yes | 3.3 to 6.0 | QSOP16 |
| ZLNB2312Q16 | Dual port | IC | 14.0 to 14.5 | 22 ^(r) | yes | std & inv | yes | 3.3 to 8.0 | QSOP16 |

Micro-processor interfacing ICs

| Part number | Decoder | | | | Control | | Output ports | | | V _{CC} V | Package |
|----------------------------|---------|------|-----|-----|-----------------------|--------------------------|--------------|-----------------|-----------------|----------------------|---------|
| | DiSEqC™ | Tone | H/V | ETC | V _{POL} V | F _{Tone} kHz | Type | No rec detector | Over V detector | | |
| ZLNB153X8 | 1 | 1 | 1 | 1 | 14.0 to 15.5 | 22 ^(r) | combined | yes | no | 5.0 to 8.0 | MSOP8 |
| ZLNB253N8 | 2 | 2 | 0 | 0 | na | 22 ^(r) | std | no | no | 5.0 to 8.0 | SO8 |
| ZLNB254M622 ⁽¹⁾ | 2 | 2 | 0 | 0 | na | na | std | no | no | 3.3 to 8.0 | MLP622 |
| ZLNB255JA16 ⁽¹⁾ | 2 | 2 | 2 | 2 | 14.0 to 15.0 | 22 ^(r) | std | yes | yes | 3.3 to 8.0 | QFN1633 |

^(d) Tone delay ^(r) Tone rejection ⁽¹⁾ Refer to Zetex for availability

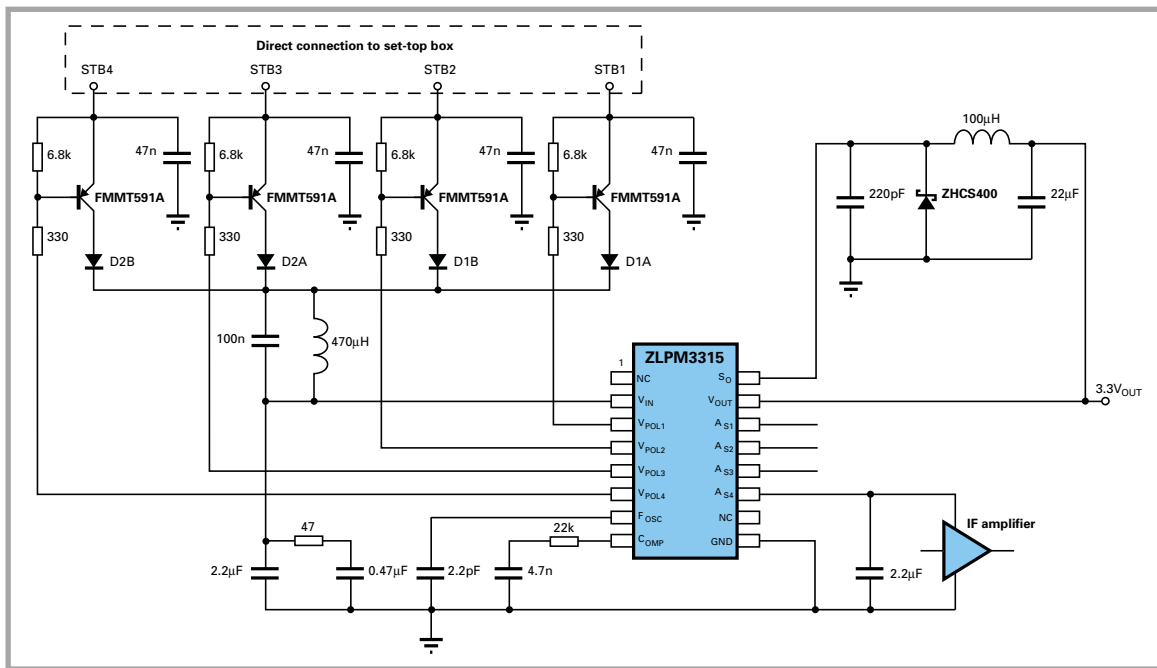
Power management

Power efficiency is becoming increasingly important in the DBS market. Concern for the environment is becoming a major factor here since satellite dishes are never (or rarely) turned off. With millions of these dishes deployed around the world, any effort made to minimize or cleverly manage power consumption is of great benefit.

DBS systems are however becoming more complex to cope with the increasingly sophisticated capabilities demanded by the end-user, which places additional pressure on the power budget. In some markets the existing infrastructure of legacy systems is unable to cope with the power requirements of new LNBS.

The ZLPM series provides a highly integrated solution to power management in LNBS. At the core of each device is a DC-DC converter operating at efficiencies in excess of 80%. Due to the 13V/18V polarization switching in LNBS, the ZLPM series can operate over the wide 9V to 21V supply voltage range while still supplying an output voltage of 5V or 3.3V. In addition, the series incorporates overvoltage protection to guard against transients and incorrect LNB installations.

The range includes devices that incorporate switchable power supplies to the cable drive amplifiers. If there is no STB present, the amplifier will automatically shutdown to save power. Where there are multiple sources powering the LNB, the ZLPM series provides port-to-port isolation to prevent control signal bleed.



Power management applications circuit for a low power quad LNB

Power management ICs

| Part number | Features DC-DC regulator + | No. of AS _{out} | V _{out} V | I _{out} mA | AS _{out} V | Efficiency % | Package |
|----------------------------|-------------------------------|--------------------------|-----------------------|------------------------|------------------------|-----------------|---------|
| ZLPM100X8 ⁽¹⁾ | - | 0 | 3.3/5.0 | 300 | na | 80 | MSOP8 |
| ZLPM1003X10 | 2x IF amp switch | 2 | 5.0 | 300 | 4.8 | 80 | MSOP10 |
| ZLPM1005Q16 | 4x IF amp switch | 4 | 5.4 | 300 | 5.0 | 80 | QSOP16 |
| ZLPM3315Q16 | 4x IF amp switch + i/p select | 4 | 3.3 | 300 | 3.0 | 80 | QSOP16 |
| ZLPM5015Q16 ⁽¹⁾ | 4x IF amp switch + i/p select | 4 | 5.4 | 300 | 5.0 | 80 | QSOP16 |

⁽¹⁾ Refer to Zetex for availability

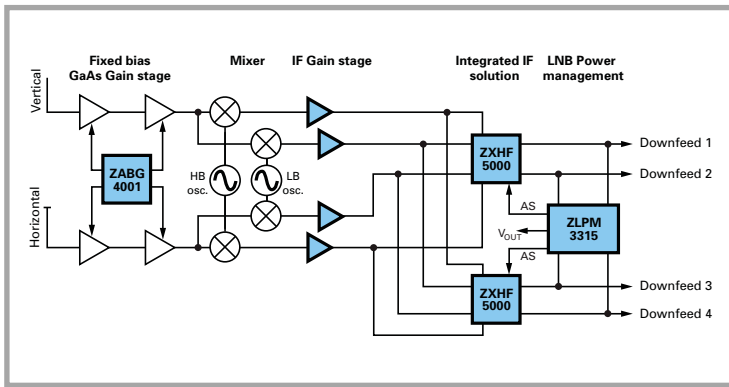
IF integration

The ZXHF5000 series is the next generation of DBS IF and control, providing a complete integrated IF solution for multiple output LNBS and switch box applications. Based on a 4x2 multiplexer these devices offer 19dB of positive wideband gain which extends from 200MHz to 2500MHz.

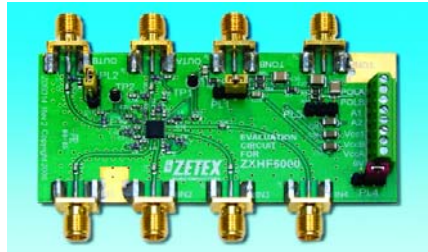
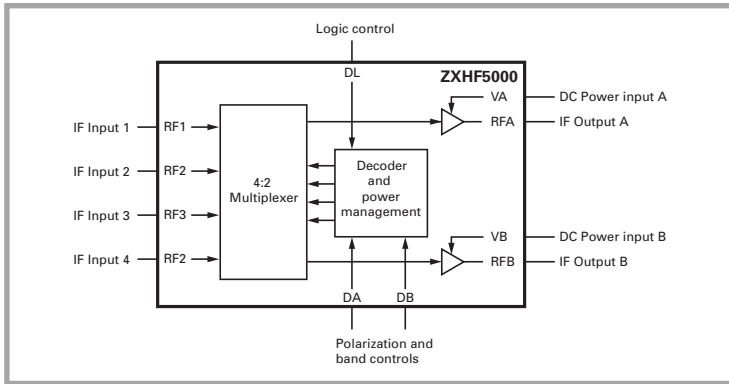
The ZXHF5000 also has an outstanding isolation performance of over 30dB across the band and includes all the control and decoders required for tone and voltage based DBS designs.

The ZXHF5001 is targeted to achieve isolation figures of 38dB. The high level of integration and unique features of these parts provide the scope to drastically reduce the size of the LNB or switch box.

With their intelligent power management functions and operating voltage of 3.3V the ZXHF5000 series provides a low power solution which fits perfectly with the ZABG fixed bias controllers and 3.3V ZLPM power management IC to create a complete 3.3V system.



New integrated and low power quad LNB design



ZXHF5000 evaluation board

Functional diagram of the ZXHF5000

IF integration ICs

| Part number | MUX type | Bandwidth MHz | Gain dB | Isolation dB | OIP3 dBm | Return loss | | Control | | V _{CC} V | Package |
|-----------------------------|----------|------------------|------------|-----------------|-------------|-------------|--------------|------------------|-------------|----------------------|---------|
| | | | | | | Input dB | Output dB | V threshold V | Tone kHz | | |
| ZXHF5000JB24 | 4x2 | 200-2500 | 19 | 30 | 16 | 12 | 12 | 14.0 to 15.5 | 22 | 3.3 | QFN2444 |
| ZXHF5001JB24 ⁽¹⁾ | 4x2 | 200-2500 | 19 | 38 | 16 | 13 | 14 | 14.0 to 14.5 | 22 | 3.3 | QFN2444 |

All measurements at 2GHz unless otherwise specified

⁽¹⁾ Refer to Zetex for availability



About Zetex

Zetex Semiconductors designs and manufactures high performance semiconductor solutions for analog signal processing and the management of power in automotive, communications, consumer and industrial electronics.

Meeting the demand for greater power economy, precision and speed in analog circuit design, the broad Zetex product range comprises application specific linear ICs and discrete semiconductor devices in multiple package configurations.

As a specialist in analog technology, Zetex offers a diverse series of ICs for motor control, lighting and DC-DC conversion as well as audio, DBS, video and linear applications. Its discrete component range features trench MOSFETs, IntelliFET™ smart MOSFETs and bipolar transistors.

Headquartered near Manchester in the UK, Zetex Semiconductors has manufacturing and sales operations in Asia, Europe and the USA and is supported by distributors in more than 45 countries.

For more information about Zetex, please visit
www.zetex.com
www.zetex.cn



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