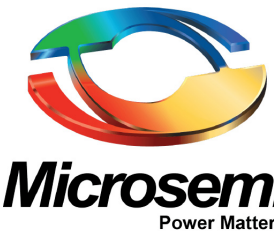
Le87614
PLC Dual Channel Class AB Line Driver
Line Driver BD870 Series

Preliminary Datasheet

Microsemi
Power Matters.™



Microsemi Corporate Headquarters
One Enterprise, Aliso Viejo,
CA 92656 USA
Within the USA: +1 (800) 713-4113
Outside the USA: +1 (949) 380-6100
Sales: +1 (949) 380-6136
Fax: +1 (949) 215-4996
E-mail: sales.support@microsemi.com
www.microsemi.com

About Microsemi

Microsemi Corporation (Nasdaq: MSCC) offers a comprehensive portfolio of semiconductor and system solutions for communications, defense & security, aerospace and industrial markets. Products include high-performance and radiation-hardened analog mixed-signal integrated circuits, FPGAs, SoCs and ASICs; power management products; timing and synchronization devices and precise time solutions, setting the world's standard for time; voice processing devices; RF solutions; discrete components; enterprise storage and communication solutions, security technologies and scalable anti-tamper products; Ethernet solutions; Power-over-Ethernet ICs and midspans; as well as custom design capabilities and services. Microsemi is headquartered in Aliso Viejo, Calif., and has approximately 4,800 employees globally. Learn more at **www.microsemi.com**.

Contents

Figures

Tables

1 Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

1.1 Revision 1.0

Revision 1.0 was the first publication of this document.

2 Overview

The Le87614 is a dual channel differential amplifier designed to work in Home Plug Alliance HPAV2 systems with very low power dissipation.

The Le87614 contains two pairs of wide-band amplifiers designed with Microsemi's HV15 Bipolar SOI process for low power consumption.

The line driver gain is fixed internally. The amplifiers are powered from a single supply.

The device can be programmed to one of three preset bias levels or to a disable state. Each channel can be controlled independently. The control pins respond to input levels that can be generated with a standard tri-state GPIO. Two pairs of switches allow receiver loads to be disconnected during transmit mode, saving driver power.

The Le87614 is available in a 28-pin, 4 mm x 5 mm QFN package with an exposed pad for enhanced thermal conductivity.

2.1 Features

- 28-pin, 4 mm x 5 mm QFN package
- Very low power dissipation
  - Class AB operation
- 4 programmable states
- No external gain resistors required
- RoHS compliant

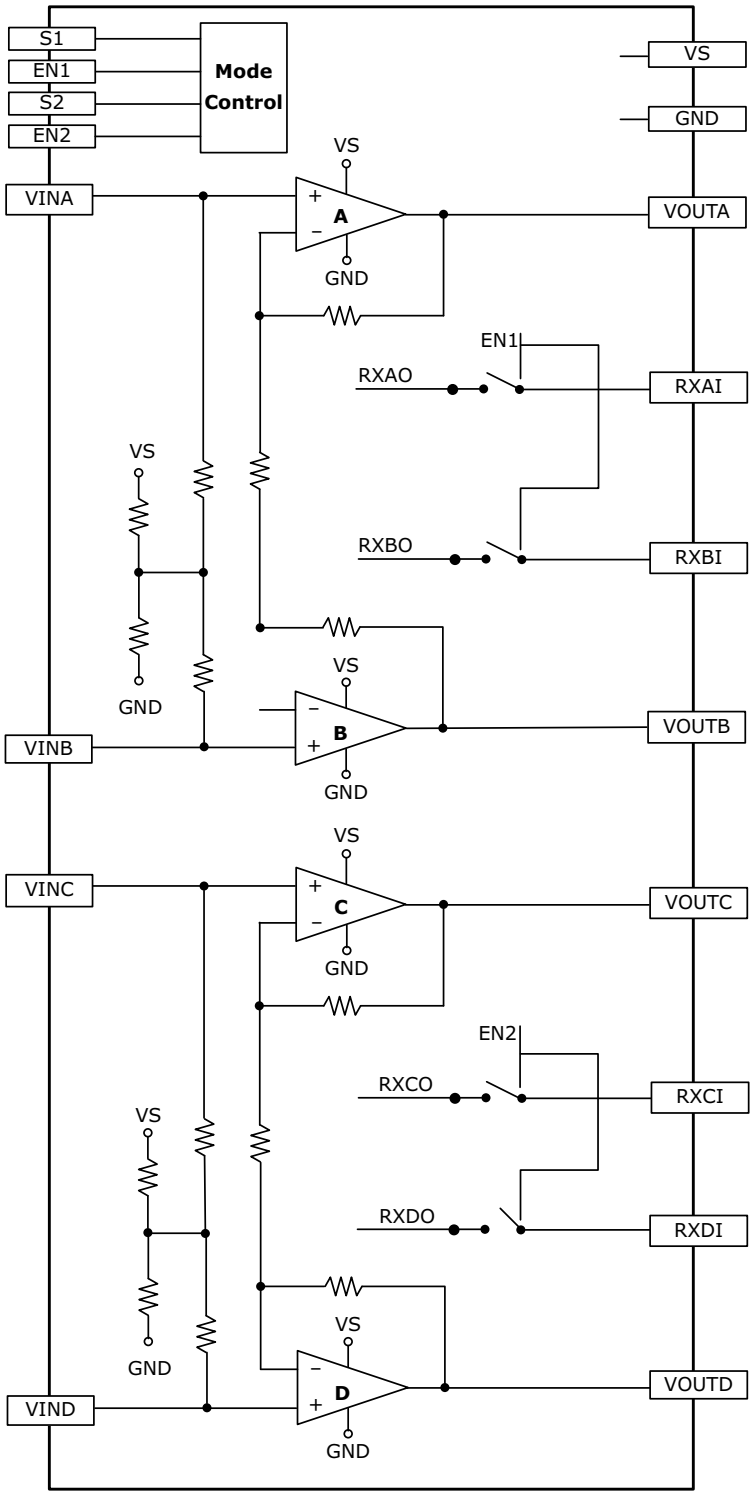
2.2 Target Applications

- Power Line Communications
- Home Networking
- HPNA
- G.HN

2.3 Block Diagram

The following figure shows the Le87614 block diagram.

Figure 1 • **Block Diagram**



3 Functional Descriptions

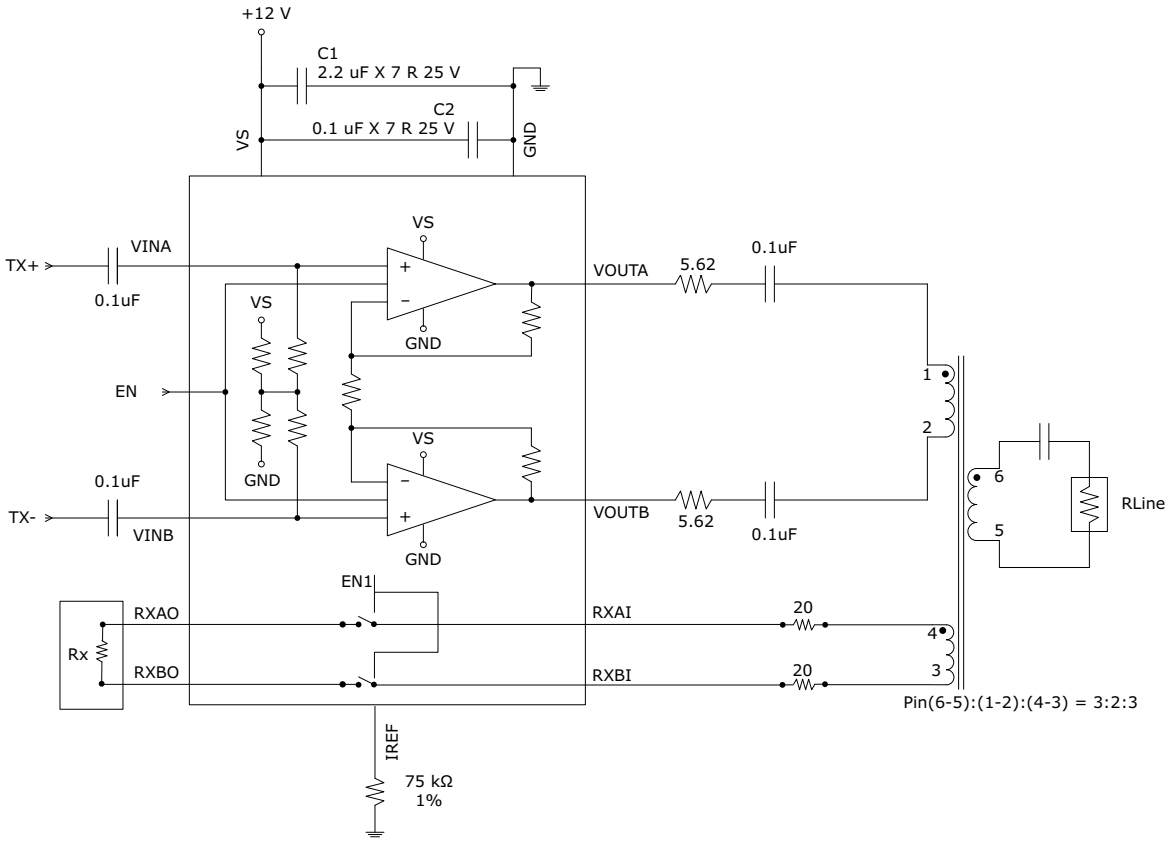
3.1 Applications

The Le87614 integrates two sets of high-power line driver amplifiers designed for low distortion of signals up to 106 MHz.

3.1.1 Block Diagram

The following figure shows an application circuit of channel 1 with amplifiers A and B in transmission.

Figure 2 • **Application Circuit Diagram**



3.1.1.1 Input Considerations

The driving source impedance should be less than 100 nH to avoid any ringing or oscillation.

3.1.1.2 Output Driving Considerations

The internal metalization is designed to carry up to about 100 mA of steady DC current and there is no current limit mechanism. The device does feature integrated thermal shutdown protection with hysteresis. It is recommended that series resistors are used to drive lines.

3.1.1.3 Power Supplies and Component Placement

The power supplies should be well bypassed close to the Le87614 device. A 2.2 µF tantalum capacitor and a 0.1 µF ceramic capacitor are recommended for the VS supply.

4 Electrical Specifications

This section provides the DC characteristics, AC characteristics, recommended operating conditions, and stress ratings for the Le87614 device.

Typical Conditions: VS = +12 V, R_{REF} = 75 kΩ, and TA = 25 °C. For more information, see Figure 3, page 6.

Min/Max Parameters: TA = 0 to +85 °C

The following tables show the electrical specifications.

Table 1 • **Supply Current Characteristics**

Symbol	Parameter Description	Condition	Min	Typ	Max	Unit
I_{VS}	Supply current (per channel)	Full power state	17	23	29	mA
		Medium power state	11	19	23	mA
		Low power state	5	10.5	15	mA
		Disable state		1	1.5	mA

Table 2 • **Control Input (S1, S2, EN1, EN2) Specifications**

Symbol	Parameter Description	Condition	Min	Typ	Max	Unit
V_{IH}	Input high voltage		2.0	3.3	3.6	V
V_{IM}	Input middle voltage (S1, S2)			1.5		V
V_{IL}	Input low voltage		–0.3	0	0.8	V
	Enable time			500		ns

Table 3 • **Amplifier Characteristics**

Symbol	Parameter Description	Condition	Min	Typ	Max	Unit
	Differential gain	Full power state, V_{OUT}/V_{IN}	8.2	8.7	9.0	V/V
	Bandwidth, -3 dB	Full power state		200		MHz
		Medium power state		200		MHz
		Low power state		115		MHz
V_O	Output voltage			10		V
I_O[1]	Output current		150			mA
Z_I	Input impedance	Differential	13	15	18	kΩ

1. Not tested in production. Guaranteed by characterization and design.

Table 4 • **Amplifier Dynamic Characteristics**

Symbol	Parameter Description	Condition	Min	Typ	Max	Unit
Noise[1]	Input referred noise	2 – to 106 MHz		9	15	nV/$\sqrt{Hz}$
TSD	Thermal shutdown temperature			170		°C

1. Not tested in production. Guaranteed by characterization and design.

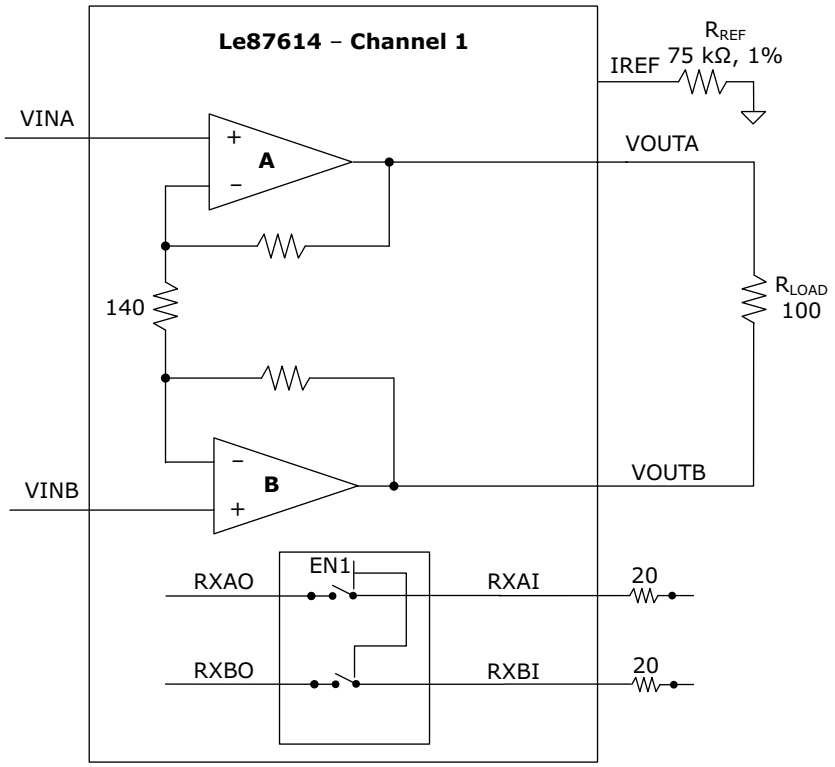
Table 5 • **Switch Characteristics**

Symbol	Parameter Description	Condition	Min	Typ	Max	Unit
R_{ON}	On resistance	EN = 0		2		Ω
R_{OFF}	Off resistance	EN = 1	15			kΩ
V_{IM}	Common mode voltage[1]			4.1		V

1. Not tested in production. Guaranteed by design and characterization.

The following figure shows the basic test circuit:

Figure 3 • **Basic Test Circuit**



4.1 State Control

S1, EN1 and S2, EN2 pins are used as combinatorial logic inputs to control the line driver operating states. For more information, see Table 6 and Table 7 .

S1 and S2 are tri-state inputs that accept three operating levels. These pins have internal resistors tied to +1.5 V, which forces a middle logic input level when the control to these pins is tri-stated.

The following tables show channel 1 and channel 2 matrix.

Table 6 • **Channel 1 Control Matrix**

S1	EN1	Transmit State	Receive State
X	0	Disable	Switch on
0	1	Enable low bias	Switch off
Open	1	Enable medium bias	Switch off
1	1	Enable full bias	Switch off

Table 7 • **Channel 2 Control Matrix**

S2	EN2	Transmit State	Receive State
X	0	Disable	Switch on
0	1	Enable low bias	Switch off
Open	1	Enable medium bias	Switch off
1	1	Enable full bias	Switch off

4.1.1 Disable State

Amplifier bias current is removed. This is the lowest power state. Amplifier output is high impedance. Gain-setting feedback resistors are still connected across amplifier output pins, creating 1300 Ω differential impedance at pins.

4.1.2 Bias State

Line driver is active for transmission. States are different only in the amount of bias current to the amplifiers, and therefore power consumption. There is a trade-off between bias current and bandwidth.

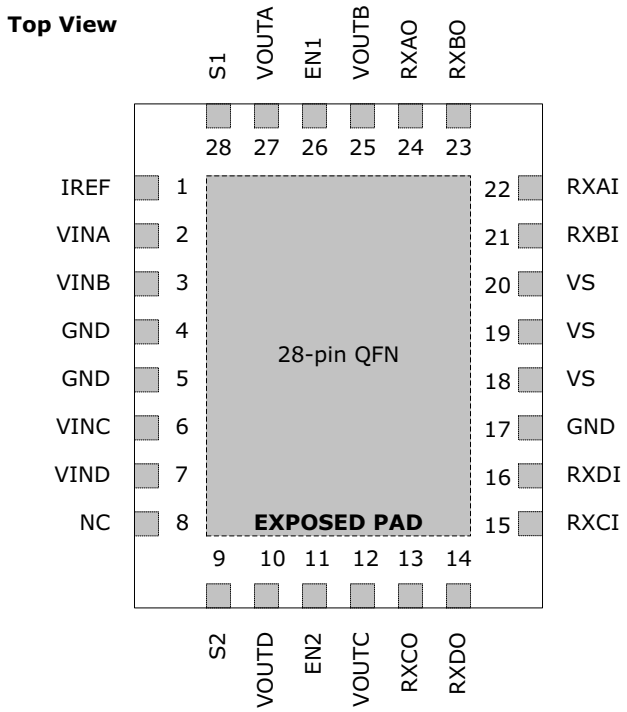
5 Pin Descriptions

The Le87614 device has 28 pins, which are described in this section.

5.1 Connection Diagram

The following illustration represents the pin diagram for the Le87614 device, as seen looking through the package from the top of it.

Figure 4 • **Connection Diagram**



Note:

The Le87614 device incorporates an exposed die pad on the underside of its package. The pad acts as a heat sink and must be connected to a copper plane through thermal via, for proper heat dissipation. It must be connected to GND.

5.1.1 Pin Description

The following table shows the functional pin descriptions for the Le87614 device.

Table 8 • **Pin Descriptions**

Pin	Pin Name	Type	Description
1	IREF	Input	Device internal reference current. Connect a resistor (R_{REF}) to GND
2	VINA	Input	Non-inverting input of amplifier A
3	VINB	Input	Non-inverting input of amplifier B
4	GND	Ground	Reference ground
5	GND	Ground	Reference ground
6	VINC	Input	Non-inverting input of amplifier C
7	VIND	Input	Non-inverting input of amplifier D
8	NC		No internal connection
9	S2	Input	Channel 2 state control
10	VOUTD	Output	Amplifier D output
11	EN2	Input	Enable channel 2 transmission
12	VOUTC	Output	Amplifier C output
13	RXCO	Output	Receive switch C output
14	RXDO	Output	Receive switch D output
15	RXCI	Input	Receive switch C input
16	RXDI	Input	Receive switch D input
17	GND	Ground	Reference ground
18	VS	Power	Power supply, +12 V
19	VS	Power	Power supply, +12 V
20	VS	Power	Power supply, +12 V
21	RXBI	Input	Receive switch B input
22	RXAI	Input	Receive switch A input
23	RXBO	Output	Receive switch B output
24	RXAO	Output	Receive switch A output
25	VOUTB	Output	Amplifier B output
26	EN1	Input	Enable channel 1 transmission
27	VOUTA	Output	Amplifier A output
28	S1	Input	Channel 1 state control
	Exposed pad		Thermal conduction pad, must be grounded

6 Package Information

6.1 Absolute Maximum Ratings

If the stress is above the values listed in Table 9, it can cause permanent device failure. Functionality at or above these limits is not implied. Exposure to absolute maximum ratings for extended periods can affect device reliability.

The following table shows the absolute maximum ratings.

Table 9 • **Absolute Maximum Ratings**

Names	Range
Storage temperature	–65 ≤ TA ≤ +150 °C
Operating junction temperature (1)	–40 ≤ T_j ≤ +150 °C
VS with respect to GND	–0.3 V to +16 V
Control inputs with respect to GND	–0.3 V to 4 V
Continuous driver output current	100 mA
Maximum device power dissipation, continuous (2)- T_A = 85 °C, P_D	1.0 W
Junction to ambient thermal resistance (2,3), θ_{JA}	36.0 °C/W
Junction to board thermal resistance (2), θ_{JB}	18.3 °C/W
Junction to case bottom (exposed pad) thermal resistance, $\theta_{JC\ (BOTTOM)}$	8.9 °C/W
Junction-to-top characterization parameter (2), ψ_{JT}	1.2 °C/W
ESD immunity (Human Body Model)	JESD22 class 2 compliant
ESD immunity (Charge Device Model)	JESD22 class IV compliant

1. Continuous operation above 145 °C junction temperature may degrade device reliability.
2. *For more information, see Thermal Resistance, page 10*
3. No air flow

6.1.1 Thermal Resistance

The thermal performance of a thermally enhanced package is assured through optimized printed circuit board layout. Specified performance requires that the exposed thermal pad be soldered to an equally sized exposed copper surface, which, in turn, conducts heat through multiple via to larger internal copper planes.

6.1.2 Package Assembly

The green package devices are assembled with enhanced, environmental compatible lead-free, halogen-free, and antimony-free materials. The leads possess a matte-tin plating, which is compatible with conventional board assembly processes or newer lead-free board assembly processes.

Refer to IPC/JEDEC J-Std-020 Table 9 for recommended peak soldering temperature and Table 10 for the recommended solder re-flow temperature profile.

6.1.3 Operating Ranges

Microsemi guarantees the performance of the Le87614 device over the 0°C to 85°C temperature range by conducting electrical characterization over each range and by conducting a production test with single insertion coupled with periodic sampling. These characterization and test procedures comply with the Telcordia GR-357-CORE generic requirements for assuring the reliability of components used in telecommunications equipment.

The following table shows the operating ranges.

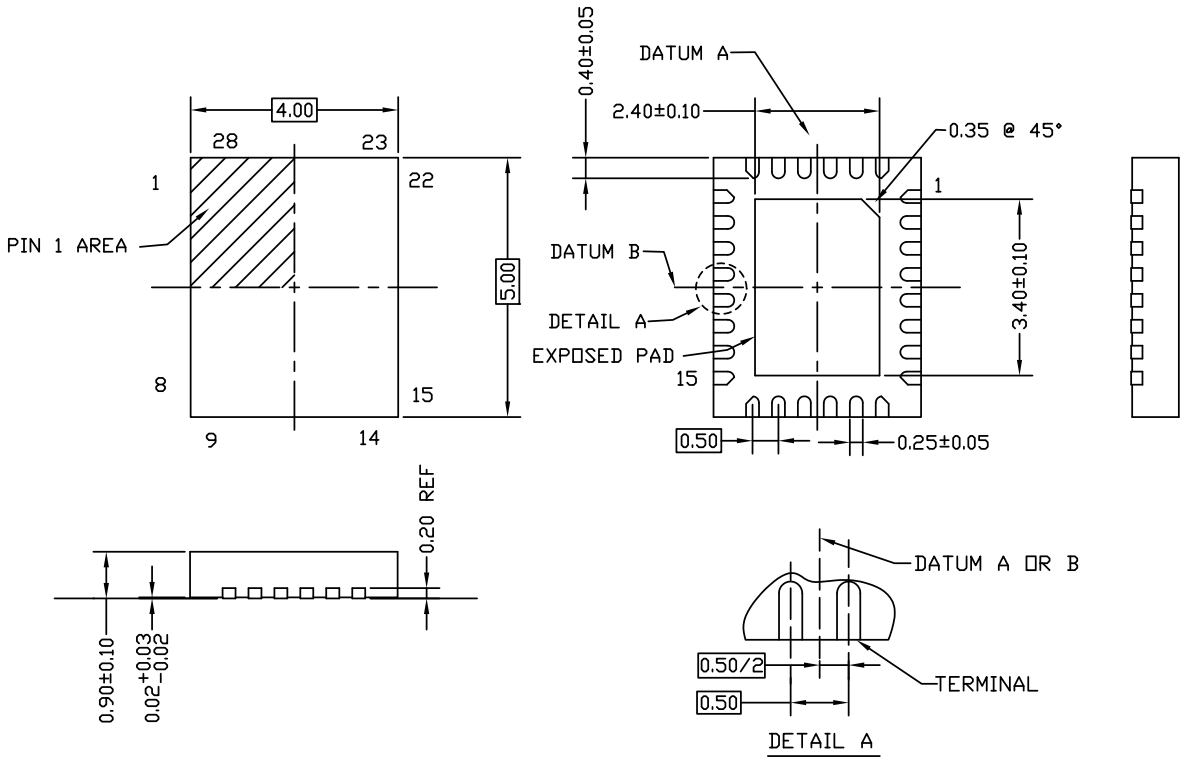
Table 10 • **Operating Ranges**

Name	Unit	Range
Ambient temperature	T_A	0 °C to 85 °C
Power supply	VS with respect to GND	12 V ± 5%

6.2 Physical Dimension - 28-Pin Diagram

The following illustration shows the package drawing for the Le87614 device. The drawing contains the top view, bottom view, side view, dimensions, and tolerances.

Figure 5 • **Package Drawing**



7 Ordering Information

The following table lists the ordering information for the Le87614 device.

Table 11 • **Ordering Information**

Part Order Number	Description	
Le87614MQC	28-pin,4 mm x 5 mm QFN green package with an exposed pad	Tray
Le87614MQCT	28-pin, 4 mm x 5 mm QFN green package with an exposed pad	Tape and reel

Note: The green package meets RoHS 2 Directive 2011/65/EU of the European Council to minimize the environmental impact of electrical equipment.

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for Buffers & Line Drivers ***category:***

Click to view products by Microchip ***manufacturer:***

Other Similar products are found below :

LXV200-024SW 74AUP2G34FW3-7 HEF4043BP PI74FCT3244L MC74HCT365ADTR2G Le87401NQC Le87402MQC 028192B 042140C 051117G 070519XB NL17SZ07P5T5G NLU1GT126AMUTCG 74AUP1G17FW5-7 74LVC2G17FW4-7 CD4502BE 5962-8982101PA 5962-9052201PA 74LVC1G125FW4-7 NL17SH17P5T5G NL17SH125P5T5G NLV37WZ07USG RHRXH162244K1 74AUP1G34FW5-7 74AUP1G07FW5-7 74LVC2G126RA3-7 NLX2G17CMUTCG 74LVCE1G125FZ4-7 Le87501NQC 74AUP1G126FW5-7 TC74HC4050AP(F) 74LVCE1G07FZ4-7 NLX3G16DMUTCG NLX2G06AMUTCG NLVVHC1G50DFT2G LE87100NQC LE87290YQC LE87290YQCT LE87511NQC LE87511NQCT LE87557NQC LE87557NQCT LE87614MQC LE87614MQCT 74AUP1G125FW5-7 NLU2G16CMUTCG MC74LCX244MN2TWG NL17SG126DFT2G NLVHCT245ADTR2G NLV37WZ16USG