

LA8633V

SANYO : SSOP24

Low-voltage, Low-current Compander

[LA8633V]

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0.65 0.22

Package Dimensions

(0.33)

unit:mm

3175B-SSOP24

Overview

The LA8633V is a low-voltage, low-current compander IC for battery-powered, cordless telephone applications.

The LA8633V features a good signal-to-noise ratio and a high dynamic range at voice-signal frequencies. The output compression is given by $V_O=0.5\log V_I$, and the expansion, by the inverse operation.

The LA8633V also features an FSK comparator for receiving FSK-modulated digital data, a microphone amplifier, selectable intercom or telephone operation expander outputs, and an output mute control.

The LA8633V operates from a 1.8 to 6.0V supply and is available in 24-pin SSOPs.

Features

- Low-voltage operation and low-power consumption.
- On-chip frequency-shifted keyed (FSK) comparator.
- On-chip microphone amplifier with audio limiter and mute option.
- Expander output analog switch for telephone or intercom operation.
- Low-power, standby mode.
- 1.8 to 6.0V supply.
- 24-pin SSOP

Specifications

Maximum Ratings at $Ta = 25^{\circ}C$

| Parameter | Symbol | Conditions | Ratings | Unit |
|-----------------------------|---------------------|------------|-------------|------|
| Maximum supply voltage | V _{CC} max | | 8 | V |
| Allowable power dissipation | Pd max | | 300 | mW |
| Operating temperature | Topr | | -20 to +75 | °C |
| Storage temperature | Tstg | | -40 to +125 | °C |

Operating Conditions at $Ta = 25^{\circ}C$

| Parameter | Symbol | Conditions | Ratings | Unit |
|--------------------------------|--------------------|------------|------------|------|
| Recommended supply voltage | VCC | | 3 | V |
| Operating supply voltage range | V _{CC} op | | 1.8 to 6.0 | V |

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Electrical Characteristics

| Parameter [Supply current] Ta=25°C, V _{CC} =3V, V _{B1} =1.2V, f=1kH Current drain with no signal Image: Current drain with no signal Standby current Image: Compressor] [Compressor] Vinrefe=10mVrms=0dB, Pre AMP Gain Input impedance COUT rms output voltage Gain error Image: Courrent distortion Total harmonic distortion Image: Courrent distortion COUT rms output noise voltage Image: Courrent distortion COUT rms output noise voltage Image: Courrent distortion COUT rms output noise voltage gain Image: Courrent distortion Data voltage gain Image: Courrent distortion Crosstalk Image: Courrent distortion Expander] Vinrefe=10mVrms=0dB, Filter AMP Gain Expander rms output voltage Image: Courrent distortion Gain error Image: Courrent distortion Gain error Image: Courrent distortion Total harmonic distortion Image: Courrent distortion Expander rms output noise voltage Image: Courrent distortion Total harmonic distortion Image: Courrent distortion Expander rms output noise voltage Image: Courent distortion | ICCO ISTBY in=20dB, Outpu rI VOC Gec1 Gec2 THD VNOC VL VGP max VGD ATTC CTC | $V_{I}=Vinrefe=0dB$ $V_{I}=-20dB$ $V_{I}=-40dB$ $V_{I}=0dB$ $Rg=620\Omega, f=20Hz to 20kHz$ $V_{I}=0dB$ $V_{I}=0dB$ $Expander rms input voltage=100mV$ | min 2.5 300 210 -0.5 -1.0 1.25 1.25 -2 -60 -25 | typ 3.4 500 265 0.0 0.265 1.5 1.40 28 0 -73 | max 5.0 700 335 +0.5 +1.0 1.00 3.0 1.55 | Unit mA μA MVrms dB dB % mVrms Vp-p |
|--|--|--|--|---|---|---|
| Current drain with no signal Standby current [Compressor] Vinrefe=10mVrms=0dB, Pre AMP Gai Input impedance COUT rms output voltage Gain error Total harmonic distortion COUT rms output noise voltage Limiting voltage Maximum preamplifier voltage gain Data voltage gain Mute attenuation Crosstalk [Expander] Vinrefe=10mVrms=0dB, Filter AMP Gain Expander rms output voltage Maximum expander rms output voltage Gain error Total harmonic distortion Expander rms output voltage Maximum expander rms output voltage Maximum expander rms output voltage Maximum expander rms output voltage Gain error Total harmonic distortion Expander rms output noise voltage Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | ICCO ISTBY in=20dB, Output rl VOC Gec1 Gec2 THD VNOC VL VGP max VGD ATTC CTC I=0dB, RL=10kt VOE VOE Gee1 | No signal, data shaper ON (pin 9=H), standby mode (pin 12=L) at: pin 18, RL=10kΩ VI=Vinrefe=0dB VI=-20dB VI=-20dB VI=-40dB VI=0dB VI=0dB VI=0dB VI=0dB Expander rms input voltage=100mV | 300 210 -0.5 -1.0 1.25 -2 -2 -60 | 500 50 265 0.0 0.25 1.5 1.40 28 0 | 700 335 +0.5 +1.0 1.00 3.0 | µA kΩ mVrm dB dB dB % mVrm Vp-p |
| Standby current [Compressor] Vinrefe=10mVrms=0dB, Pre AMP Gai Input impedance COUT rms output voltage Gain error Total harmonic distortion COUT rms output noise voltage Limiting voltage Maximum preamplifier voltage gain Data voltage gain Mute attenuation Crosstalk [Expander] Vinrefe=10mVrms=0dB, Filter AMP Gain Expander rms output voltage Maximum expander rms output voltage Gain error Total harmonic distortion Expander rms output voltage Maximum expander rms output voltage Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | ISTBY in=20dB, Outpu rI V _{OC} Gec1 Gec2 THD V _{NOC} VL V _{GP} max V _{GD} ATTC CTC I=0dB, RL=10kt V _{OE} V _O max Gee1 | No signal, data shaper ON (pin 9=H), standby mode (pin 12=L) at: pin 18, RL=10kΩ VI=Vinrefe=0dB VI=-20dB VI=-20dB VI=-40dB VI=0dB VI=0dB VI=0dB VI=0dB Expander rms input voltage=100mV | 300 210 -0.5 -1.0 1.25 -2 -2 -60 | 500 50 265 0.0 0.25 1.5 1.40 28 0 | 700 335 +0.5 +1.0 1.00 3.0 | µA kΩ mVrm dB dB % mVrm Vp-p |
| [Compressor] Vinrefe=10mVrms=0dB, Pre AMP Gai Input impedance COUT rms output voltage Gain error Total harmonic distortion COUT rms output noise voltage Limiting voltage Maximum preamplifier voltage gain Data voltage gain Mute attenuation Crosstalk [Expander] Vinrefe=10mVrms=0dB, Filter AMP Gain Expander rms output voltage Maximum expander rms output voltage Gain error Total harmonic distortion Expander rms output noise voltage Maximum expander rms output voltage Gain error Total harmonic distortion Expander rms output noise voltage Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | in=20dB, Outpu rI V _{OC} Gec1 Gec2 THD V _{NOC} VL V _{GP} max V _{GD} A _{TTC} CT _C n=0dB, RL=10kx V _{OE} V _O max Gee1 | mode (pin 12=L) ut : pin 18, RL=10kΩ VI=Vinrefe=0dB VI=-20dB VI=-40dB VI=0dB Rg=620Ω, f=20Hz to 20kHz VI=0dB Expander rms input voltage=100mV Ω | 210 -0.5 -1.0 1.25 -2 -60 | 50 265 0.0 0.25 1.5 1.40 28 0 | 335 +0.5 +1.0 1.00 3.0 | kΩ mVrm dB dB % mVrm Vp-p |
| Input impedance COUT rms output voltage Gain error | rl Voc Gec1 Gec2 THD VNOC VL VGP max VGD ATTC CTC =0dB, RL=10kx VOE VOE Gee1 | V _I =Vinrefe=0dB V _I =-20dB V _I =-40dB V _I =0dB Rg=620Ω, f=20Hz to 20kHz V VI=0dB Expander rms input voltage=100mV Ω | -0.5 -1.0 1.25 -2 -60 | 265 0.0 0.25 1.5 1.40 28 0 | +0.5 +1.0 1.00 3.0 | mVrm dB dB % mVrm Vp-p |
| COUT rms output voltage Gain error Total harmonic distortion COUT rms output noise voltage Limiting voltage Maximum preamplifier voltage gain Data voltage gain Mute attenuation Crosstalk [Expander] Vinrefe=10mVrms=0dB, Filter AMP Gain Expander rms output voltage Maximum expander rms output voltage Gain error Total harmonic distortion Expander rms output noise voltage Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | V _{OC} Gec1 Gec2 THD V _{NOC} VL VGP max VGD ATTC CTC I=0dB, RL=10kt VOE VOE Gee1 | VI=-20dB VI=-40dB VI=0dB Rg=620Ω, f=20Hz to 20kHz VI VI Expander rms input voltage=100mV | -0.5 -1.0 1.25 -2 -60 | 265 0.0 0.25 1.5 1.40 28 0 | +0.5 +1.0 1.00 3.0 | mVrm dB dB % mVrm Vp-p |
| Gain error Total harmonic distortion COUT rms output noise voltage Limiting voltage Maximum preamplifier voltage gain Data voltage gain Mute attenuation Crosstalk [Expander] Vinrefe=10mVrms=0dB, Filter AMP Gain Expander rms output voltage Gain error Total harmonic distortion Expander rms output noise voltage Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | Gec1 Gec2 THD VNOC VL VGP max VGD ATTC CTC H=00B, RL=10kt VOE VO max Gee1 | VI=-20dB VI=-40dB VI=0dB Rg=620Ω, f=20Hz to 20kHz VI VI Expander rms input voltage=100mV | -0.5 -1.0 1.25 -2 -60 | 0.0 0.25 1.5 1.40 28 0 | +0.5 +1.0 1.00 3.0 | dB dB % mVrm Vp-p |
| Total harmonic distortion COUT rms output noise voltage Limiting voltage Maximum preamplifier voltage gain Data voltage gain Mute attenuation Crosstalk [Expander] Vinrefe=10mVrms=0dB, Filter AMP Gain Expander rms output voltage Maximum expander rms output voltage Gain error Total harmonic distortion Expander rms output noise voltage Mute attenuation Crosstalk Input/output ratio | Gec2 THD VNOC VL VGP max VGD ATTC CTC a=0dB, RL=10ka VOE VO max Gee1 | VI=-40dB VI=0dB Rg=620Ω, f=20Hz to 20kHz VI VI VI Expander rms input voltage=100mV | -1.0 1.25 -2 -60 | 0.0 0.25 1.5 1.40 28 0 | +1.0 1.00 3.0 | dB % mVrm Vp-p |
| Total harmonic distortion COUT rms output noise voltage Limiting voltage Maximum preamplifier voltage gain Data voltage gain Mute attenuation Crosstalk [Expander] Vinrefe=10mVrms=0dB, Filter AMP Gain Expander rms output voltage Maximum expander rms output voltage Gain error Total harmonic distortion Expander rms output noise voltage Mute attenuation Crosstalk Input/output ratio | THD V _{NOC} V _L V _{GP} max V _{GD} A _{TTC} CT _C a=0dB, R _L =10ka V _{OE} V _O max Gee1 | V _I =0dB Rg=620Ω, f=20Hz to 20kHz VI VI Expander rms input voltage=100mV | 1.25 -2 -60 | 0.25 1.5 1.40 28 0 | 1.00 3.0 | % mVrm Vp-p |
| COUT rms output noise voltage Limiting voltage Maximum preamplifier voltage gain Data voltage gain Mute attenuation Crosstalk [Expander] Vinrefe=10mVrms=0dB, Filter AMP Gain Expander rms output voltage Maximum expander rms output voltage Gain error Total harmonic distortion Expander rms output noise voltage Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | V _{NOC} V _L V _{GP} max V _{GD} A _{TTC} CT _C i=0dB, R _L =10k V _{OE} V _O max Gee1 | Rg=620Ω, f=20Hz to 20kHz VI=0dB Expander rms input voltage=100mV | 2 60 | 1.5 1.40 28 0 | 3.0 | mVrm Vp-p |
| Limiting voltage Maximum preamplifier voltage gain Data voltage gain Mute attenuation Crosstalk [Expander] Vinrefe=10mVrms=0dB, Filter AMP Gain Expander rms output voltage Maximum expander rms output voltage Gain error Total harmonic distortion Expander rms output noise voltage Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | VL V _{GP} max V _{GD} ATTC CT _C m=0dB, RL=10k V _{OE} V _O max Gee1 | V _I =0dB Expander rms input voltage=100mV | 2 60 | 1.40 28 0 | | Vp-p |
| Maximum preamplifier voltage gain Data voltage gain Mute attenuation Crosstalk [Expander] Vinrefe=10mVrms=0dB, Filter AMP Gain Expander rms output voltage Maximum expander rms output voltage Gain error Total harmonic distortion Expander rms output noise voltage Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | V _{GP} max V _{GD} ATTC CT _C ==0dB, RL=10k V _O E V _O max Gee1 | Expander rms input voltage=100mV | 2 60 | 28 0 | 1.55 | |
| Data voltage gain Mute attenuation Crosstalk [Expander] Vinrefe=10mVrms=0dB, Filter AMP Gain Expander rms output voltage Maximum expander rms output voltage Gain error Total harmonic distortion Expander rms output noise voltage Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | V _{GD} ATTC CT _C ==0dB, R _L =10k V _O E V _O max Gee1 | Expander rms input voltage=100mV | -60 | 0 | | · |
| Mute attenuation Crosstalk [Expander] Vinrefe=10mVrms=0dB, Filter AMP Gain Expander rms output voltage Maximum expander rms output voltage Gain error Total harmonic distortion Expander rms output noise voltage Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | A _{TTC} CT _C =0dB, RL=10kt V _{OE} V _O max Gee1 | Expander rms input voltage=100mV | -60 | | | dB |
| Crosstalk [Expander] Vinrefe=10mVrms=0dB, Filter AMP Gain Expander rms output voltage Gain error Total harmonic distortion Expander rms output noise voltage Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | CT _C =0dB, R _L =10k V _O E V _O max Gee1 | Expander rms input voltage=100mV | | . 72 | +2 | dB |
| [Expander] Vinrefe=10mVrms=0dB, Filter AMP Gain Expander rms output voltage Maximum expander rms output voltage Gain error Total harmonic distortion Expander rms output noise voltage Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | CT _C =0dB, R _L =10k V _O E V _O max Gee1 | Ω | -25 | -13 | | dB |
| Expander rms output voltage Maximum expander rms output voltage Gain error Total harmonic distortion Expander rms output noise voltage Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | V _{OE} V _O max Gee1 | | | -34 | | dB |
| Maximum expander rms output voltage Gain error Total harmonic distortion Expander rms output noise voltage Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | V _O max Gee1 | V _I =Vinrefe=0dB | | | | |
| Gain error Total harmonic distortion Expander rms output noise voltage Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | Gee1 | | 100 | 125 | 160 | mVrm |
| Total harmonic distortion | | THD=10%, RL=10kΩ | 600 | 1000 | | mVrm |
| Total harmonic distortion | Gee2 | V _I =5dB | -0.5 | 0 | +0.5 | dB |
| Expander rms output noise voltage Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | | V _I =-20dB | -1.0 | 0 | +1.0 | dB |
| Expander rms output noise voltage Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | Gee3 | V _I =-30dB | -1.5 | 0 | +2.0 | dB |
| Mute attenuation Crosstalk [Compressor lowpass filter] Input/output ratio | THD | V _I =0dB, data shaper ON (pin 9=H) | | 0.40 | 1.00 | % |
| Crosstalk [Compressor lowpass filter] Input/output ratio | V _{NO} e | Rg=620Ω, f=20Hz to 20kHz | | 13 | 80 | μVrm |
| [Compressor lowpass filter] | ATTe | V _I =0dB | -60 | -70 | | dB |
| Input/output ratio | CTe | | -60 | -83 | | dB |
| · · · | | | | | | |
| | | f=3.4kHz | | -3 | | dB |
| Attenuation | ATT | | | -18 | | dB/octav |
| Total harminic distortion | THD | Vin=10mVrms (in : 15pin) | | 0.15 | 1.00 | % |
| Maximum LPF2OUT rms output voltage | V _O max | THD=10%, R _I =10kΩ | 600 | 1000 | | mVrm |
| [Expander lowpass filter] | | | II | | | |
| Input/output ratio | | f=3.4kHz | | -3 | | dB |
| Attenuation | ATT | | | -18 | | dB/octav |
| Total harminic distortion | THD | Vin=10mVrms | | 0.35 | 1.00 | % |
| Maximum LPF1OUT rms output voltage | V _O max | THD=10%, R _I =7.7kΩ | 200 | 340 | | mVrm |
| [Frequency-shifted keyd comparator] | <u> </u> | · E | | | | |
| CCGCTL duty cycle | Duty | V _{IN} =100mVrms | 43 | 48 | 53 | % |
| CHGCTL ON voltage | V _{ON} | Pin 9 | 1 | - | | V |
| CHGCTL OFF voltage | VOFF | Pin 9 | | | 0.4 | V |
| CHGCTL input impedance | RI | Pin 9 | | 200 | 5 | kΩ |
| VHOLD input/output current | IIO | Pin7, pin9=2V | | 80 | | μΑ |
| FSKOUT LOW-level output voltage | VOL | R _I =100kΩ, pin10 | | | 0.3 | V |
| FSKOUT HIGH-level output voltage | VOH | $R_{\rm I} = 100 k\Omega$, pin10 | 2.8 | | 1.5 | V |
| [Standby mode characteristics] | · UI | L, F | | | | |
| STBY voltage | VSTBY | Pin 12 | | | 0.7 | V |
| STBY output current | ISTBY | Pin 12, flowing out current | | | 50 | μA |
| [Digital input characteristics] | .9181 | i z, i o i i i g out out official | | | 50 | P'' \ |
| Input L-level voltage | VIL | Pins16, 17 | | | 0.65 | V |
| Input H-level voltage | VIL VIH | Pins16, 17 | 0.6V _{CC} | | 0.00 | V |
| Input L-level current | | V _I =0.2V, Pins16, 17 | 0.0700 | | 100 | μA |
| Input H-level current | I _{IL} | V ₁ =0.2V, Pins16, 17 V ₁ =2V, Pins16, 17 | | | 5 | μΑ |

Note 1: This IC enters mute mode when the pins 16 and 17 become low.

2 : Pin 6 is used as an output pin when 8 is high (=open), pin 5 is used as an output pin when pin 8 is low.

3 : FSK waveform shaper circuit becomes on when pin 9 is high.

4 : FSK waveform shaping polarity : outputs low in the positive cycle of signal.

Pin Assignment



Block Diagram



Pin Function

| Number | Name | Equivalent circuit | Description |
|--------|---------|--|---|
| 1 | LPF1IN | 1 - St To wave shaper | Lowpass filter 1 buffer amplifier (class A) input. Nominal voltage is 1.2V. |
| 2 | LPF1OUT | 8 ↓ ↓ 15 kΩ | Lowpass filter 1 buffer amplifier (class A) output. Nominal voltage is 1.2V. |
| 3 | EIN | | Expander voltage-to-current converter input. Nominal voltage is 1.5V. |
| 4 | EVREC | VREF VREF 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | Expander full-wave rectifier. |
| 5 | INTOUT | $V_{\text{REF}} \circ \underbrace{15 \text{ k\Omega}}_{15 \text{ k\Omega}} \underbrace{15 \text{ k\Omega}}_{50 \text{ k\Omega}} 15 \text$ | Expander intercom op-amplifier (class AB) output. Nominal voltage is 1.5V. |
| 6 | TELOUT | 50 kΩ Input 0 V _{REF} 0 15 kΩ 50 kΩ 50 kΩ | Expander telephone op-amplifier (class AB) output. Nominal voltage is 1.5V. |
| 7 | VHOLD | From lowpass filter 1 | Voltage hold capacitor connection. Nominal voltage is 1.2V. |
| 9 | CHGCTL | | Charge control input. Nominal voltage is V_{CC} . |
| 10 | FSKOUT | 200 kΩ | Frequency-shifted keyed comparator, open-collector output. |

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| Number | Name | Equivalent circuit | Description |
|--------|-----------------|--|---|
| 8 | INTCTL | | Intercom control input. Nominal voltage is 3V. |
| 11 | GND | | Ground |
| 12 | STBY | 93 kΩ 100 kΩ 777 V _{CC} | Standby control input. Nominal voltage is 1.5V. |
| 14 | VREF | | Reference voltage amplifier (class B) capacitor connection. Nominal voltage is 1.5V. |
| 13 | V _{CC} | | Voltage supply |
| 15 | TXIN | | Transmit data input. Nominal voltage is 1.5V. |
| 20 | COUT | 15 KΩ 15 KΩ | Compander amplifier (class AB) output. Nominal voltage is 1.5V. |
| 16 | EMUTE | | Expandar mute control input. Nominal voltage is 3V. |
| 17 | CMUTE | | Compressor mute control input. Nominal voltage is 3.3V. |
| 18 | LPF2OUT | | Lowpass filter 2 buffer amplifier (class AB) output. Nominal voltage is 1.5V. |
| 19 | LPF2IN | | Lowpass filter 2 buffer amplifier (class AB) input. Nominal voltage is 1.5V. |

Continued on next page.

Continued from preceding page.

| Number | Name | Equivalent circuit | Description |
|--------|-------|--|---|
| 21 | CVREC | | Compressor full-wave rectifier capacitor. |
| 22 | CNF | VREF 0 Input 0 30 kΩ 30 kΩ 22 | Compressor negative feedback capacitor connection. Nominal voltage is 1.5V |
| 23 | PRENF | V _{REF} 0 | Compressor preamplifier negative feedback network connection. Nominal voltage is 1.5V. |
| 24 | PREIN | 23 1.5 kΩ 50 kΩ | Compressor preamplifier input. Nominal voltage is 1.5V. |



Typical Application



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