



No. 4078

LA8633V

**Low-voltage, Low-current Compander**

**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.

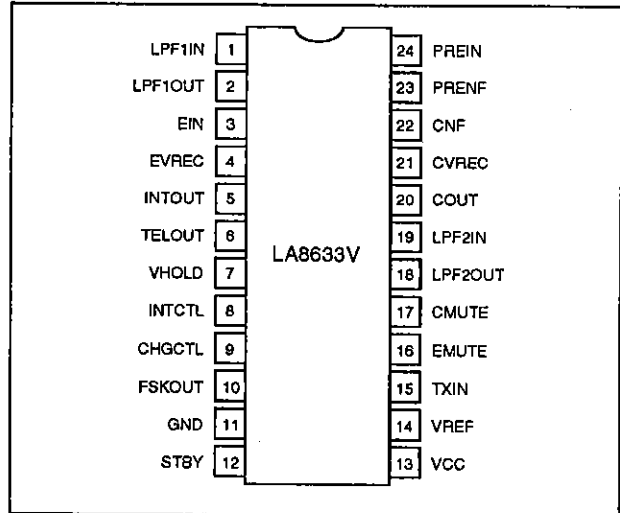
The LA8633V also features an FSK comparator for receiving FSK-modulated digital data, a microphone amplifier, selectable intercom or telephone operation expander outputs, and an output mute control.

The LA8633V operates from a 1.8 to 6.0 V 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 6.0 V supply
- 24-pin SSOP

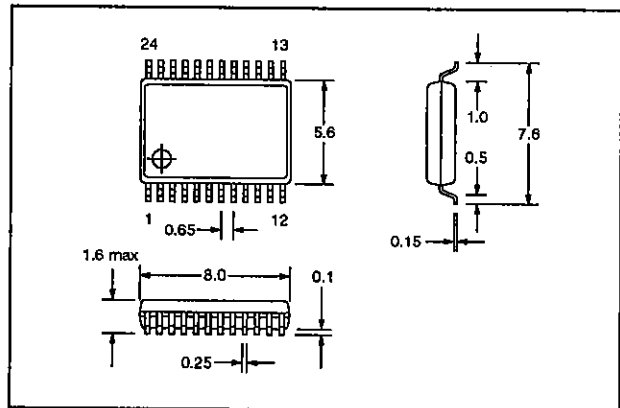
**PINOUT**



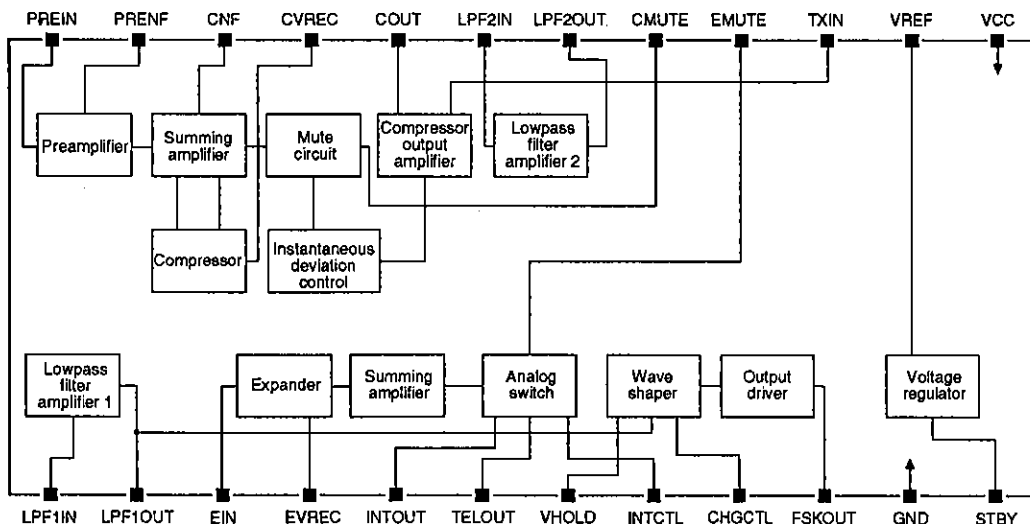
**PACKAGE DIMENSIONS**

Unit: mm

3175-SSOP24



**BLOCK DIAGRAM**



**PIN DESCRIPTION**

Number	Name	Equivalent circuit	Description
1	LPF1IN		Lowpass filter 1 buffer amplifier (class A) input. Nominal voltage is 1.2 V.
2	LPF1OUT		Lowpass filter 1 buffer amplifier (class A) output. Nominal voltage is 1.2 V.
3	EIN		Expander voltage-to-current converter input. Nominal voltage is 1.5 V.
4	EVREC		Expander full-wave rectifier
5	INTOUT		Expander intercom op-amp (class AB) output. Nominal voltage is 1.5 V.

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Number	Name	Equivalent circuit	Description
6	TELOUT		Expander telephone op-amp (class AB) output. Nominal voltage is 1.5 V.
7	VHOLD		Voltage hold capacitor connection. Nominal voltage is 1.2 V.
9	CHGCTL		Charge control input. Nominal voltage is $V_{CC}$ .
10	FSKOUT		Frequency-shifted keyed comparator, open-collector output
8	INTCTL		Intercom control input. Nominal voltage is 3 V.
11	GND		Ground
12	STBY		Standby control input. Nominal voltage is 1.5 V.
14	VREF		Reference voltage amplifier (class B) capacitor connection. Nominal voltage is 1.5 V.
13	VCC		Voltage supply
15	TXIN		Transmit data input. Nominal voltage is 1.5 V.
20	COUT		Companion amplifier (class AB) output. Nominal voltage is 1.5 V.

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Number	Name	Equivalent circuit	Description
16	EMUTE		Expander mute control input. Nominal voltage is 3 V.
17	CMUTE		Compressor mute control input. Nominal voltage is 3 V.
18	LPF2OUT		Lowpass filter 2 buffer amplifier (class AB) output. Nominal voltage is 1.5 V.
19	LPF2IN		Lowpass filter 2 buffer amplifier (class AB) input. Nominal voltage is 1.5 V.
21	CVREC		Compressor full-wave rectifier capacitor
22	CNF		Compressor negative feedback capacitor connection. Nominal voltage is 1.5 V.
23	PRENF		Compressor preamplifier negative feedback network connection. Nominal voltage is 1.5 V.
24	PREIN		Compressor preamplifier input. Nominal voltage is 1.5 V.

## SPECIFICATIONS

### Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	8	V
Power dissipation	$P_D$	300	mW
Operating temperature range	$T_{opr}$	-20 to 75	°C
Storage temperature range	$T_{stg}$	-40 to 125	°C

### Recommended Operating Conditions

$T_a = 25\text{ °C}$

Parameter	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	3	V
Supply voltage range	$V_{CC}$	1.8 to 6.0	V

### Electrical Characteristics

#### Supply current

$V_{CC} = 3\text{ V}$ ,  $T_a = 25\text{ °C}$ ,  $V_{BI} = 1.2\text{ V}$ ,  $f = 1\text{ kHz}$

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Quiescent supply current	$I_{CC1}$		2.5	3.4	5.0	mA
Standby supply current	$I_{CC2}$	No signal. CHGCTL is HIGH. STBY is LOW.	300	500	700	μA

#### Compressor

$V_{CC} = 3\text{ V}$ ,  $T_a = 25\text{ °C}$ ,  $V_{BI} = 1.2\text{ V}$ ,  $f = 1\text{ kHz}$ ,  $0\text{ dB} = 10\text{ mV}$ ,  $A_{PV} = 20\text{ dB}$ ,  $R_L = 10\text{ k}\Omega$

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Input impedance	$R_I$		-	50	-	kΩ
COU <sub>T</sub> rms output voltage	$V_O$	$V_I = 0\text{ dB}$	210	265	335	mV
Gain error	$A_{err}$	$V_I = -20\text{ dB}$	-0.5	0.0	0.5	dB
		$V_I = -40\text{ dB}$	-1.0	0.0	1.0	
Total harmonic distortion	THD	$V_I = 0\text{ dB}$	-	0.25	1.00	%
COU <sub>T</sub> rms output noise voltage	$V_{NO}$	$R_g = 620\ \Omega$ , $f = 20\text{ Hz to } 20\text{ kHz}$	-	1.5	3.0	mV
Limiting voltage	$V_L$		1.25	1.40	1.55	$V_{PP}$
Maximum preamplifier voltage gain	$A_{PV}$		-	28	-	dB
Data voltage gain	$A_{DV}$		-2	0	2	dB
Mute attenuation	$\alpha$	$V_I = 0\text{ dB}$ . CMUTE is HIGH.	-60	-73	-	dB
Crosstalk	CT	Expander rms input voltage = 100 mV	-25	-34	-	dB

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### Expander

$V_{CC} = 3\text{ V}$ ,  $T_a = 25\text{ }^\circ\text{C}$ ,  $V_{BI} = 1.2\text{ V}$ ,  $f = 1\text{ kHz}$ ,  $0\text{ dB} = 100\text{ mV}$ , LPF1 gain =  $0\text{ dB}$ ,  $R_L = 10\text{ k}\Omega$

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Expander rms output voltage	$V_O$	$V_I = 0\text{ dB}$	100	125	160	mV
Maximum expander rms output voltage	$V_O\text{ max}$	THD = 10%, $R_L = 10\text{ k}\Omega$	0.6	1.0	–	V
Gain error	$A_{err}$	$V_I = 5\text{ dB}$	–0.5	0	0.5	dB
		$V_I = -20\text{ dB}$	–1.0	0	1.0	
		$V_I = -30\text{ dB}$	–1.5	0	2.0	
Total harmonic distortion	THD	$V_I = 0\text{ dB}$ , CHGCTL is HIGH.	–	0.40	1.00	%
Expander rms output noise voltage	$V_{NO}$	$R_g = 620\ \Omega$ , $f = 20\text{ Hz to } 20\text{ kHz}$	–	13	80	$\mu\text{V}$
Mute attenuation	$\alpha$	$V_I = 0\text{ dB}$ , EMUTE is HIGH.	–60	–70	–	dB
Crosstalk	CT	Compressor rms input voltage = $10\text{ mV}$	–60	–83	–	dB

### Compressor lowpass filter

$V_{CC} = 3\text{ V}$ ,  $T_a = 25\text{ }^\circ\text{C}$ ,  $V_{BI} = 1.2\text{ V}$ ,  $f = 1\text{ kHz}$  unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Attenuation	$\alpha$	$f = 3.4\text{ kHz}$	–	–3	–	dB
		$f > 3.4\text{ kHz}$	–	–18	–	dB/octave
Total harmonic distortion	THD	$V_{TXIN} = 10\text{ mV}$	–	0.15	1.00	%
Maximum LPF2OUT rms output voltage	$V_O\text{ max}$	THD = 10%, $R_L = 10\text{ k}\Omega$	0.6	1.0	–	V

### Expander lowpass filter

$V_{CC} = 3\text{ V}$ ,  $T_a = 25\text{ }^\circ\text{C}$ ,  $V_{BI} = 1.2\text{ V}$ ,  $f = 1\text{ kHz}$  unless otherwise noted

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Attenuation	$\alpha$	$f = 3.4\text{ kHz}$	–	–3	–	dB
		$f > 3.4\text{ kHz}$	–	–18	–	dB/octave
Total harmonic distortion	THD	$V_{LPF1IN} = 100\text{ mV}$	–	0.35	1.00	%
Maximum LPF1OUT rms output voltage	$V_O\text{ max}$	THD = 10%, $R_L = 7.7\text{ k}\Omega$	0.20	0.34	–	V

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### Frequency-shifted keyed comparator

$V_{CC} = 3\text{ V}$ ,  $T_a = 25\text{ }^\circ\text{C}$ ,  $V_{B1} = 1.2\text{ V}$ ,  $f = 1\text{ kHz}$

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
CHGCTL duty cycle	Duty	$V_{IN} = 100\text{ mV}$	43	48	53	%
CHGCTL ON voltage	$V_{ON}$		1	–	–	V
CHGCTL OFF voltage	$V_{OFF}$		–	–	0.4	V
CHGCTL input impedance	$R_i$		–	200	–	$k\Omega$
VHOLD input/output current	$I_{IO}$	$V_{CHGCTL} = 2\text{ V}$	–	80	–	$\mu\text{A}$
FSKOUT LOW-level output voltage	$V_{OL}$	$R_L = 100\text{ k}\Omega$	–	–	0.3	V
FSKOUT HIGH-level output voltage	$V_{OH}$	$R_L = 100\text{ k}\Omega$	2.8	–	–	V

### Standby mode characteristics

$V_{CC} = 3\text{ V}$ ,  $T_a = 25\text{ }^\circ\text{C}$ ,  $V_{B1} = 1.2\text{ V}$ ,  $f = 1\text{ kHz}$

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
STBY voltage	$V_{STBY}$		–	–	0.7	V
STBY output current	$I_o$		–	–	50	$\mu\text{A}$

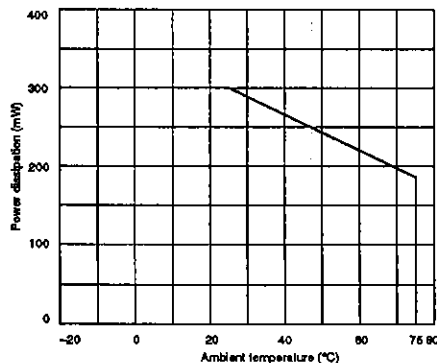
### Digital input characteristics

$V_{CC} = 3\text{ V}$ ,  $T_a = 25\text{ }^\circ\text{C}$ ,  $V_{B1} = 1.2\text{ V}$ ,  $f = 1\text{ kHz}$

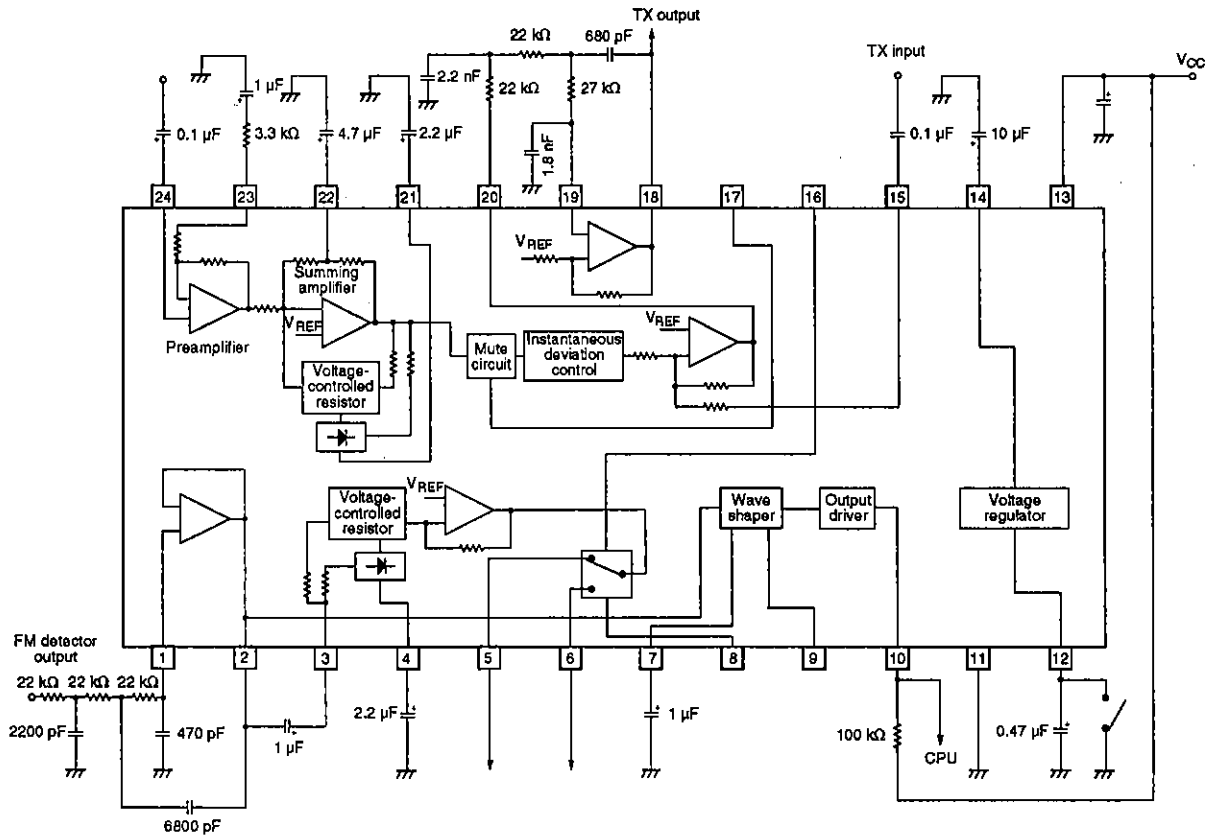
Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
EMUTCTL and CMUTCTL LOW-level input voltage	$V_{IL}$		–	–	0.65	V
EMUTCTL and CMUTCTL HIGH-level input voltage	$V_{IH}$		$0.6V_{CC}$	–	–	V
EMUTCTL and CMUTCTL LOW-level input current	$I_{IL}$	$V_i = 0.2\text{ V}$	–	–	100	$\mu\text{A}$
EMUTCTL and CMUTCTL HIGH-level input current	$I_{IH}$	$V_i = 2\text{ V}$	–	–	5	$\mu\text{A}$

### Typical Performance Characteristics

#### Power dissipation vs. ambient temperature



## TYPICAL APPLICATION



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