

# LA8630MC

Monolithic Linear IC

## Low Voltage and Current Dissipation Compandor IC



ON Semiconductor®

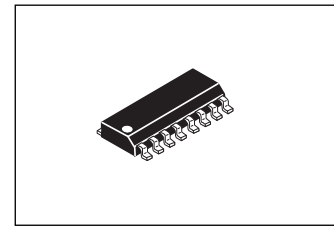
www.onsemi.com

### Applications

- Cordless telephone
- FM transceiver

### Functions

- Compressor (VCA circuit, full-wave rectifying circuit, adder amplifier)
- Expander (VCA circuit, full-wave rectifying circuit, adder amplifier)
- Operational amplifier (in the compressor)
- Operational amplifier with muting function (in the expander)
- Analog switch for data signal input (in the compressor)
- Regulator



SOIC-16

### Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC \text{ max}}$		8	V
Allowable power dissipation	$P_d \text{ max}$	$T_a \leq 75^\circ\text{C}$	100	mW
Operating temperature	$T_{opr}$		-20 to +75	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-40 to +125	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	$V_{CC}$		3	V
Operating voltage range	$V_{CC \text{ op}}$		2.2 to 6.0	V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

### ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

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**Electrical Characteristics** at  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 3.0\text{V}$ ,  $f = 1\text{kHz}$ ,  $V_{IN} = 100\text{mVrms}$  (0dB)

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain	$I_{CC}$	With no signal input		2.5	3.7	mA
Input reference voltage	$V_{INref}$			100		mVrms
<b>[Expander] (Operational amplifier gain: 0dB)</b>						
Output level	Vorefe	$V_{IN} = 0\text{dB}$ (Operational amplifier gain: -6dB)	-26.5	-24.5	-22.5	dBV
Gain error	Vgee1	$V_{IN} = +5\text{dB}$	-0.5	0	+0.5	dB
	Vgee2	$V_{IN} = -20\text{dB}$	-1.0	0	+1.0	dB
	Vgee3	$V_{IN} = -30\text{dB}$	-1.5	0	+2.0	dB
Distortion factor	THDe	$V_{IN} = 0\text{dB}$		0.35	1.0	%
Output noise voltage	$V_{NOe}$	$V_{IN} = -\infty$ , $R_g = 620\Omega$ , $f = 20$ to $20000\text{Hz}$		12	80	$\mu\text{Vrms}$
Frequency characteristic	f	$V_{IN} = 0\text{dB}$ , $f = 200$ to $3500\text{Hz}$		0.0		dB
Maximum output voltage	$V_O$ max	$R_L = 10\text{k}\Omega$ , THD = 10%	0.6	1.0		Vrms
<b>[Compressor] (Operational amplifier gain: 0dB)</b>						
Output level	Vorefc	$V_{IN} = 0\text{dB}$	-23	-21	-19	dBV
Gain error	Vgec1	$V_{IN} = +20\text{dB}$	-0.5	0	+0.5	dB
	Vgec2	$V_{IN} = -20\text{dB}$	-0.5	0	+0.5	dB
	Vgec3	$V_{IN} = -40\text{dB}$	-1.0	0	+1.0	dB
Distortion factor	THDc	$V_{IN} = 0\text{dB}$		0.35	1.0	%
Output noise voltage	$V_{NOc}$	$V_{IN} = -\infty$ , $R_g = 620\Omega$ , $f = 20$ to $20000\text{Hz}$		0.3	0.7	mVrms
Frequency characteristic	f	$V_{IN} = 0\text{dB}$ , $f = 200$ to $3500\text{Hz}$		0.0		dB
<b>[Muting circuit] (Operational amplifier gain: 0dB)</b>						
Muting attenuation	CT1	$V_{IN} = 0\text{dB}$ , $f = 1\text{kHz}$	60	90		dB
Threshold voltage	Vthm		1.25	1.35	1.45	V
<b>[Analog switch circuit] (operational amplifier gain: 0dB)</b>						
Crosstalk	Ct2	$V_{IN} = 0\text{dB}$ , $f = 1\text{kHz}$	40	47		dB
Threshold voltage	Vtha		1.25	1.35	1.45	V

\*: Be careful that the threshold voltage is determined by  $V_{CC}$  ( $V_{TH} = 0.45V_{CC}$ )

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

# LA8630MC

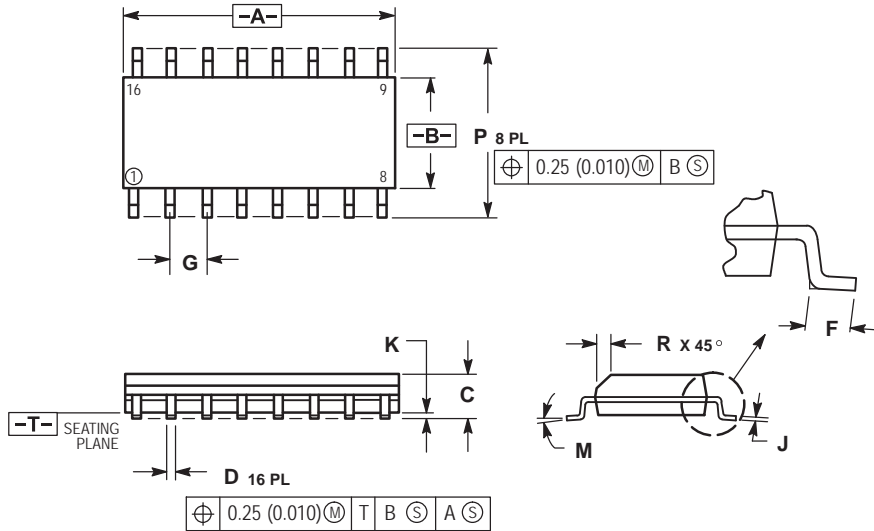
## Package Dimensions

unit : mm

SOIC-16

CASE 751B-05

ISSUE K



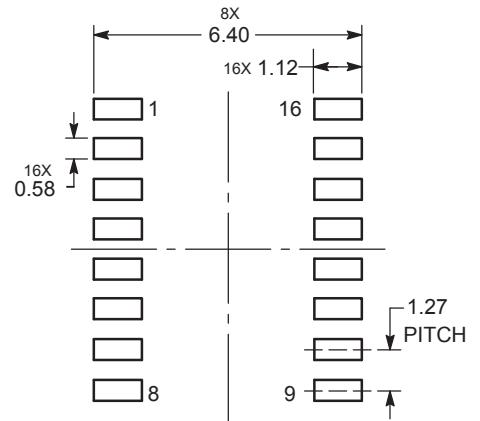
**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

- |   |   |   |   |
|---|---|---|---|
| <p><b>STYLE 1:</b></p> <p>PIN 1. COLLECTOR</p> <p>2. BASE</p> <p>3. EMITTER</p> <p>4. NO CONNECTION</p> <p>5. EMITTER</p> <p>6. BASE</p> <p>7. COLLECTOR</p> <p>8. COLLECTOR</p> <p>9. BASE</p> <p>10. EMITTER</p> <p>11. NO CONNECTION</p> <p>12. EMITTER</p> <p>13. BASE</p> <p>14. COLLECTOR</p> <p>15. EMITTER</p> <p>16. COLLECTOR</p>                           | <p><b>STYLE 2:</b></p> <p>PIN 1. CATHODE</p> <p>2. ANODE</p> <p>3. NO CONNECTION</p> <p>4. CATHODE</p> <p>5. CATHODE</p> <p>6. NO CONNECTION</p> <p>7. ANODE</p> <p>8. CATHODE</p> <p>9. CATHODE</p> <p>10. ANODE</p> <p>11. NO CONNECTION</p> <p>12. CATHODE</p> <p>13. CATHODE</p> <p>14. NO CONNECTION</p> <p>15. ANODE</p> <p>16. CATHODE</p> | <p><b>STYLE 3:</b></p> <p>PIN 1. COLLECTOR, DYE #1</p> <p>2. BASE, #1</p> <p>3. EMITTER, #1</p> <p>4. COLLECTOR, #1</p> <p>5. COLLECTOR, #2</p> <p>6. BASE, #2</p> <p>7. EMITTER, #2</p> <p>8. COLLECTOR, #2</p> <p>9. COLLECTOR, #3</p> <p>10. BASE, #3</p> <p>11. EMITTER, #3</p> <p>12. COLLECTOR, #3</p> <p>13. COLLECTOR, #4</p> <p>14. BASE, #4</p> <p>15. EMITTER, #4</p> <p>16. COLLECTOR, #4</p>   | <p><b>STYLE 4:</b></p> <p>PIN 1. COLLECTOR, DYE #1</p> <p>2. COLLECTOR, #1</p> <p>3. COLLECTOR, #2</p> <p>4. COLLECTOR, #2</p> <p>5. COLLECTOR, #3</p> <p>6. COLLECTOR, #3</p> <p>7. COLLECTOR, #4</p> <p>8. COLLECTOR, #4</p> <p>9. BASE, #4</p> <p>10. EMITTER, #4</p> <p>11. BASE, #3</p> <p>12. EMITTER, #3</p> <p>13. BASE, #2</p> <p>14. EMITTER, #2</p> <p>15. BASE, #1</p> <p>16. EMITTER, #1</p> |
| <p><b>STYLE 5:</b></p> <p>PIN 1. DRAIN, DYE #1</p> <p>2. DRAIN, #1</p> <p>3. DRAIN, #2</p> <p>4. DRAIN, #2</p> <p>5. DRAIN, #3</p> <p>6. DRAIN, #3</p> <p>7. DRAIN, #4</p> <p>8. DRAIN, #4</p> <p>9. GATE, #4</p> <p>10. SOURCE, #4</p> <p>11. GATE, #3</p> <p>12. SOURCE, #3</p> <p>13. GATE, #2</p> <p>14. SOURCE, #2</p> <p>15. GATE, #1</p> <p>16. SOURCE, #1</p> | <p><b>STYLE 6:</b></p> <p>PIN 1. CATHODE</p> <p>2. CATHODE</p> <p>3. CATHODE</p> <p>4. CATHODE</p> <p>5. CATHODE</p> <p>6. CATHODE</p> <p>7. CATHODE</p> <p>8. CATHODE</p> <p>9. ANODE</p> <p>10. ANODE</p> <p>11. ANODE</p> <p>12. ANODE</p> <p>13. ANODE</p> <p>14. ANODE</p> <p>15. ANODE</p> <p>16. ANODE</p>                                 | <p><b>STYLE 7:</b></p> <p>PIN 1. SOURCE N-CH</p> <p>2. COMMON DRAIN (OUTPUT)</p> <p>3. COMMON DRAIN (OUTPUT)</p> <p>4. GATE P-CH</p> <p>5. COMMON DRAIN (OUTPUT)</p> <p>6. COMMON DRAIN (OUTPUT)</p> <p>7. COMMON DRAIN (OUTPUT)</p> <p>8. SOURCE P-CH</p> <p>9. SOURCE P-CH</p> <p>10. COMMON DRAIN (OUTPUT)</p> <p>11. COMMON DRAIN (OUTPUT)</p> <p>12. COMMON DRAIN (OUTPUT)</p> <p>13. GATE N-CH</p> <p>14. COMMON DRAIN (OUTPUT)</p> <p>15. COMMON DRAIN (OUTPUT)</p> <p>16. SOURCE N-CH</p> |   |

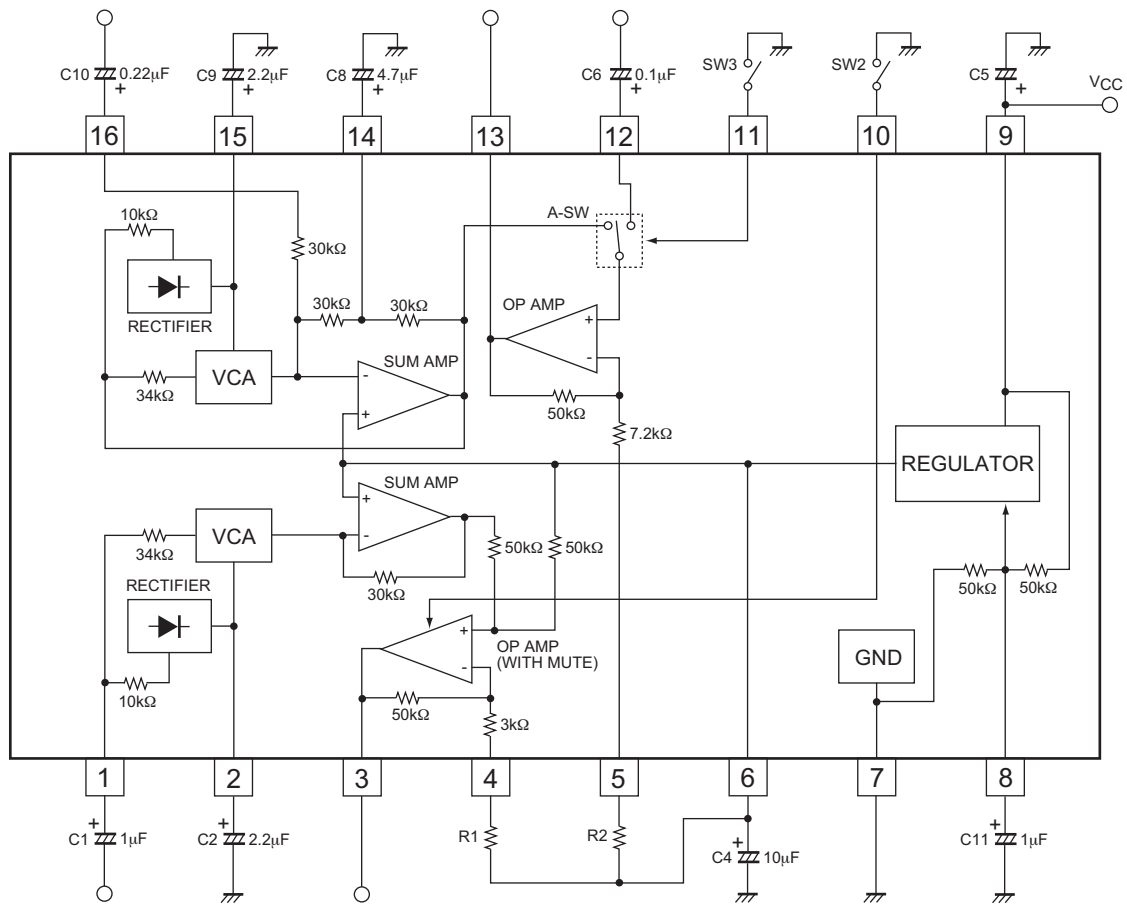
**SOLDERING FOOTPRINT**



DIMENSIONS: MILLIMETERS

# LA8630MC

## Equivalent circuit Block Diagram/Sample Application Circuit



### Pin Name

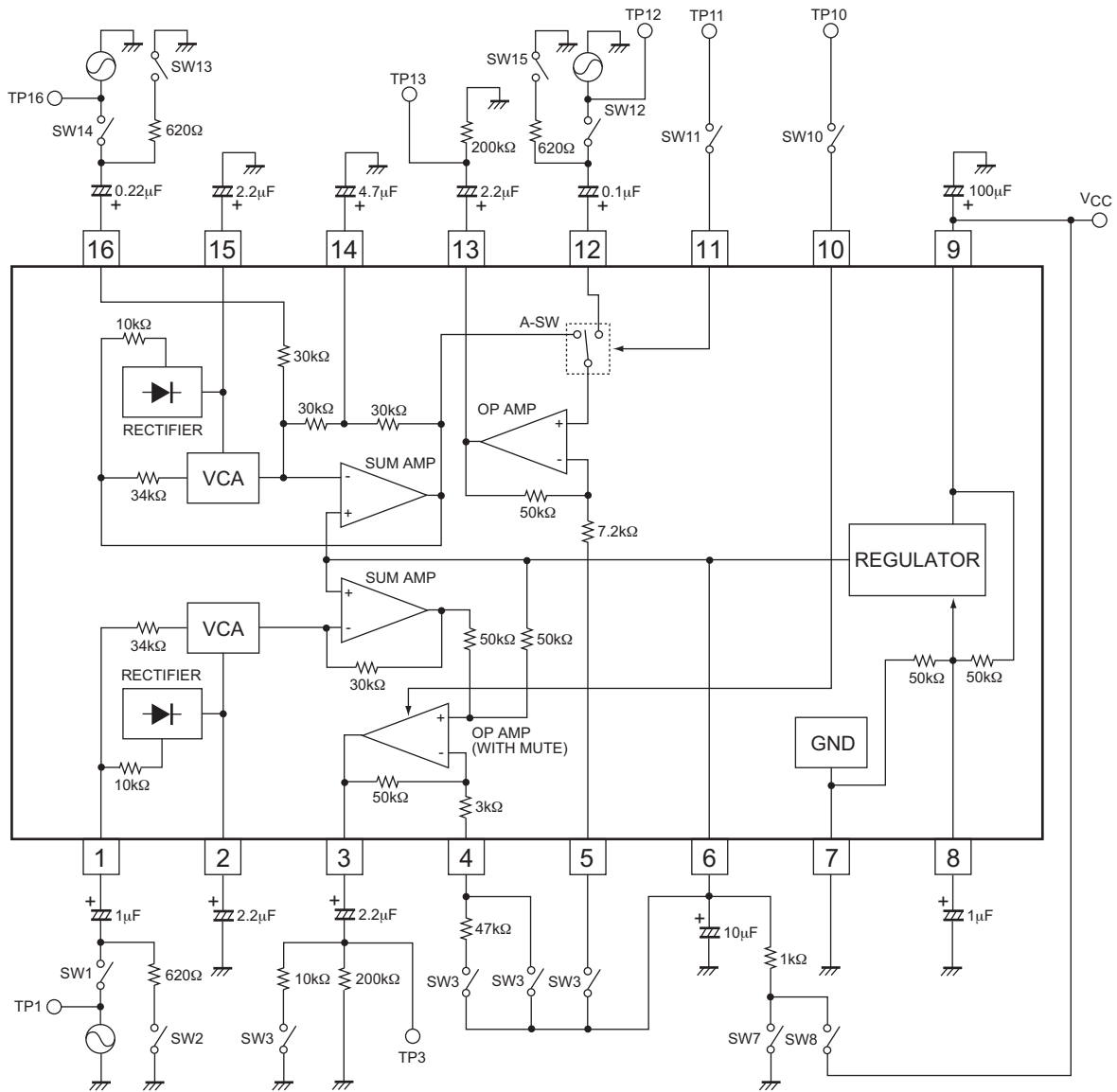
Pin No.	Name
1	EXP. $V_{IN}$
2	EXP. $V_{REC}$
3	EXP. $V_{OUT}$
4	OP. AMP NF (EXP.)
5	OP. AMP NF (COMP.)
6	$V_{REF}$
7	GND
8	$1/2V_{CC}$
9	$V_{CC}$
10	MUTE CONT.
11	DATA CONT.
12	DATA IN
13	COMP. $V_{OUT}$
14	COMP. NF
15	COMP. $V_{REC}$
16	COMP. $V_{IN}$

### Control Mode

	Mode	Audio signal	Data
Pin 10	Open	Output	-
	[Low]	Mute	-
Pin 11	Open	Output	Mute
	[Low]	Mute	Output

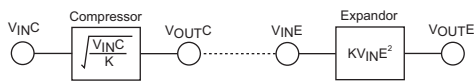
# LA8630MC

## Test Circuit



## Summary of Compressor

### (1) Operation



< for example >

$$V_{REF} = 100\text{mV}$$

$$K = 10$$

$$V_{INC} = 1\text{mV}$$

$$(-40\text{dB})$$

$$V_{INE} = 10\text{mV}$$

$$V_{OUTC} = \sqrt{\frac{1}{10} \times 1 \times 10^{-3}} \approx 10\text{mV} = -20\text{dB}$$

$$V_{OUTE} = (10 \times 10^{-3})^2 \times 10 = 1\text{mV} = -40\text{dB}$$

$$V_{OUTC} = \sqrt{V_{INC} / K}$$

$$V_{INE} = V_{OUTC}$$

$$V_{OUTE} = K V_{INE}^2 = K \sqrt{\frac{V_{INC}}{K}} = V_{INC}$$

At reference level ( $V_{REF}$ )  $V_{INC} = V_{OUTC}$ ,  $V_{INE} = V_{OUTE}$

$V_{INC} < V_{REF}$  Compressor → Amplifier

$V_{INE} < V_{REF}$  Expander → Attenuator

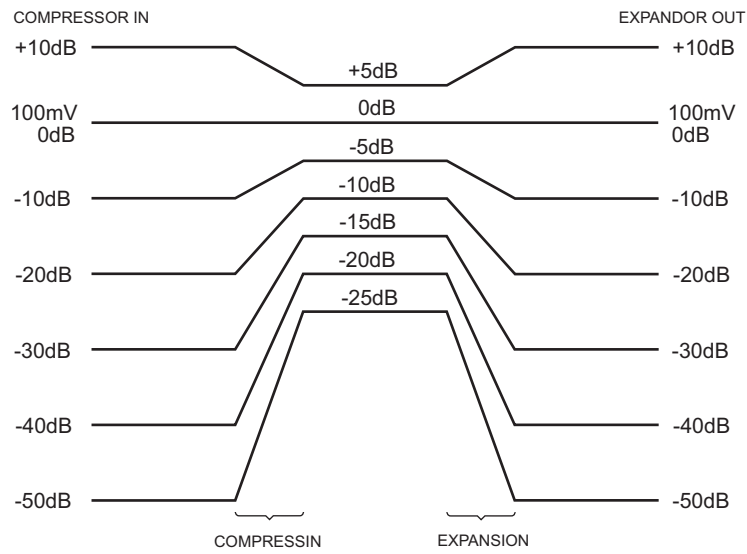
$V_{INC} > V_{REF}$  Compressor → Attenuator

$V_{INE} > V_{REF}$  Expander → Amplifier



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## (2) Level Diagram

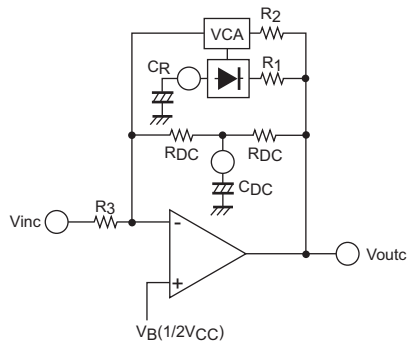


## (3) Block Diagram

< Compressor >

$$V_{OUTC} = \sqrt{\frac{R_1 R_2 I_1}{2 R_3}} V_{INC}$$

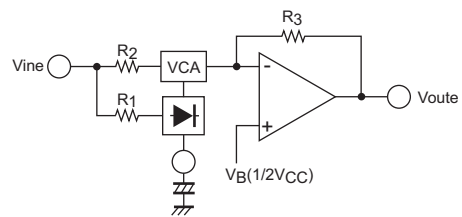
$$= \sqrt{\frac{1}{10}} V_{IN}$$



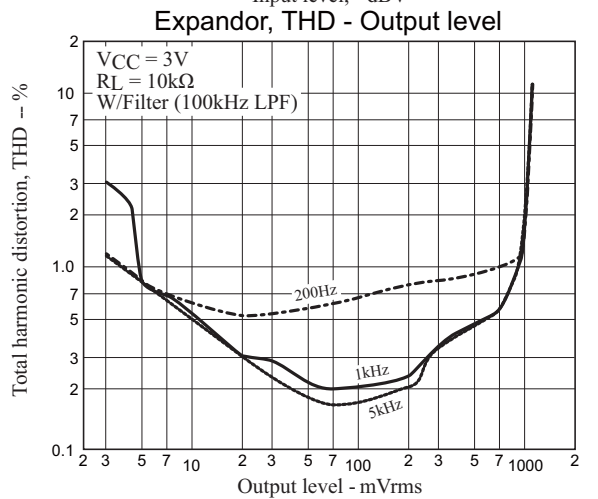
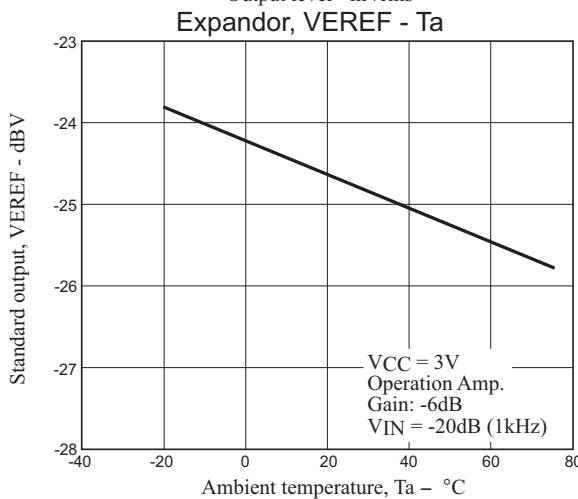
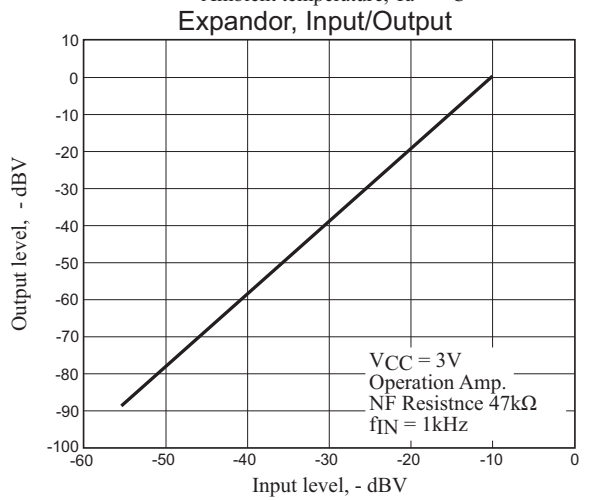
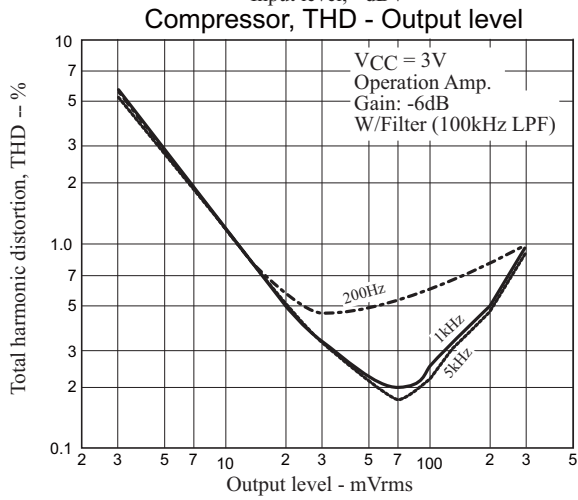
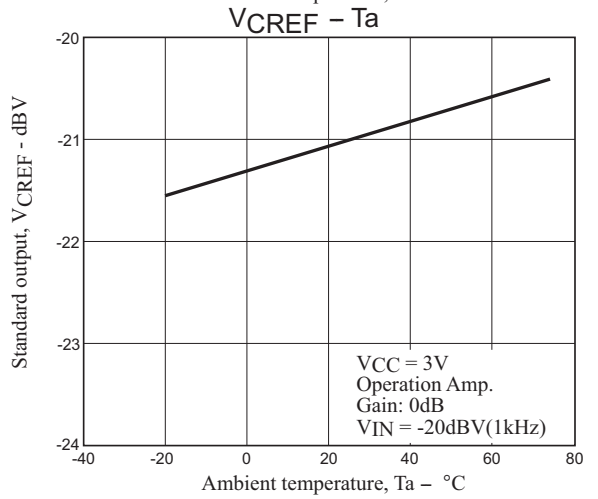
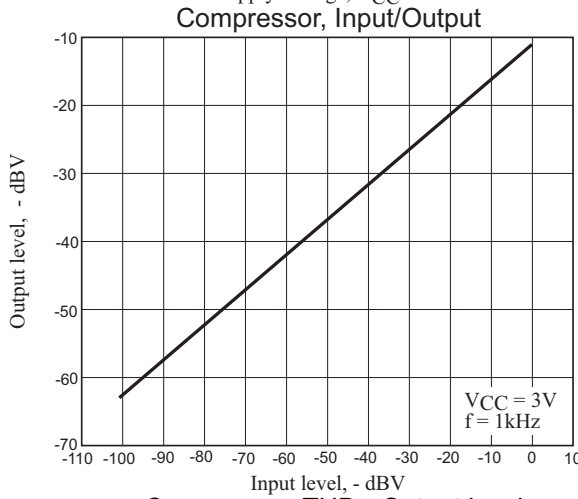
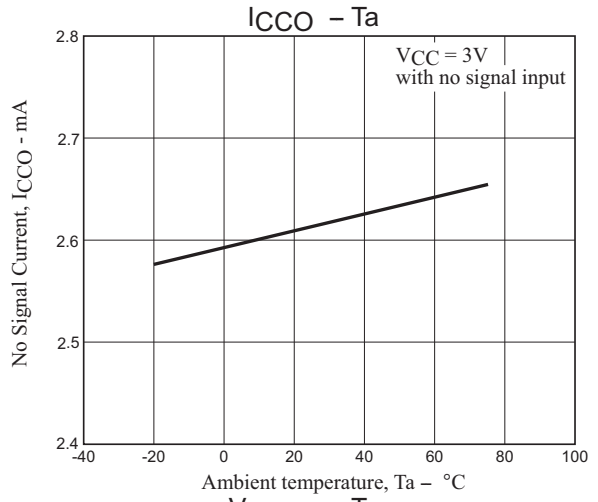
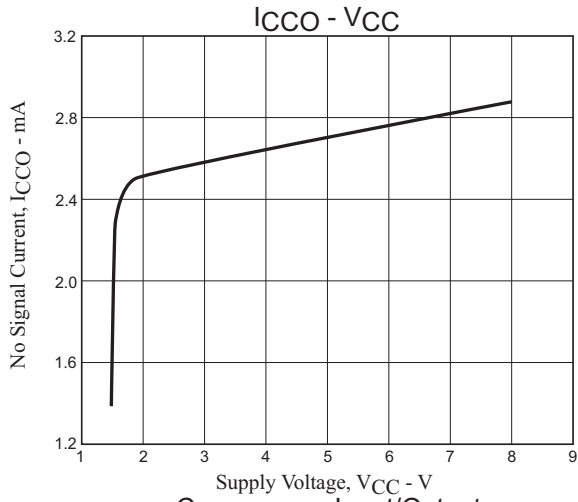
< Expander >

$$V_{OUTE} = \sqrt{\frac{2 R_3}{R_1 R_2 I_1}} V_{INE}^2$$

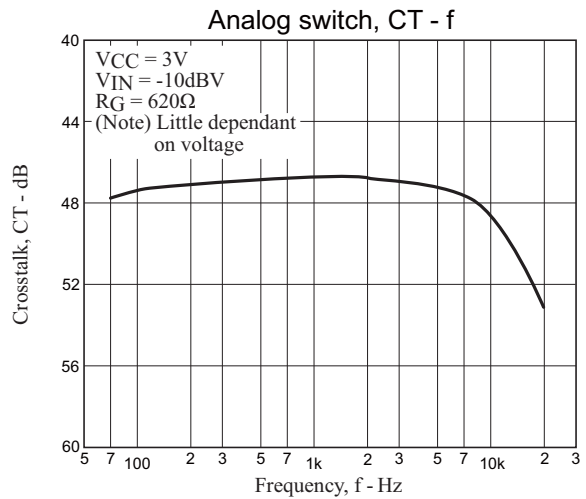
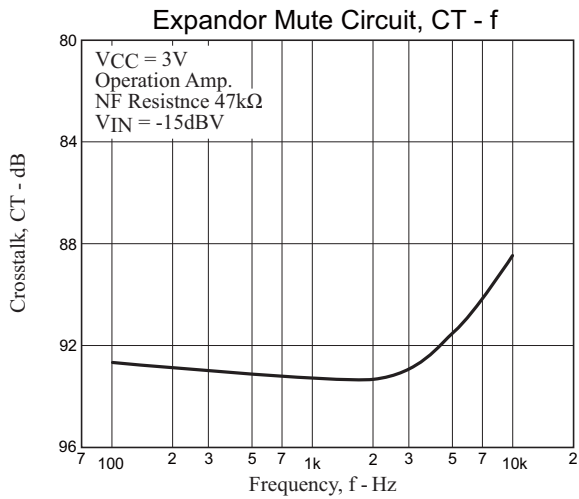
$$= 10 V_{INE}^2$$



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## ORDERING INFORMATION

Device	Package	Shipping (Qty / Packing)
LA8630MC-AH	SOIC-16 (Pb-Free / Halogen Free)	2500 / Tape & Reel

† For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D. [http://www.onsemi.com/pub\\_link/Collateral/BRD8011-D.PDF](http://www.onsemi.com/pub_link/Collateral/BRD8011-D.PDF)

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