

LA8630MC

Monolithic Linear IC

Low Voltage and Current Dissipation Compandor IC



ON Semiconductor®

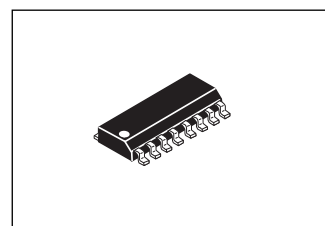
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Applications

- 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
[Expander] (Operational amplifier gain: 0dB)						
Output level	V_{orefe}	$V_{IN} = 0\text{dB}$ (Operational amplifier gain: -6dB)	-26.5	-24.5	-22.5	dBV
Gain error	V_{gee1}	$V_{IN} = +5\text{dB}$	-0.5	0	+0.5	dB
	V_{gee2}	$V_{IN} = -20\text{dB}$	-1.0	0	+1.0	dB
	V_{gee3}	$V_{IN} = -30\text{dB}$	-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 20000Hz		12	80	μVrms
Frequency characteristic	f	$V_{IN} = 0\text{dB}$, $f = 200$ to 3500Hz		0.0		dB
Maximum output voltage	$V_O \text{ max}$	$R_L = 10\text{k}\Omega$, $THD = 10\%$	0.6	1.0		Vrms
[Compressor] (Operational amplifier gain: 0dB)						
Output level	V_{orefc}	$V_{IN} = 0\text{dB}$	-23	-21	-19	dBV
Gain error	V_{gec1}	$V_{IN} = +20\text{dB}$	-0.5	0	+0.5	dB
	V_{gec2}	$V_{IN} = -20\text{dB}$	-0.5	0	+0.5	dB
	V_{gec3}	$V_{IN} = -40\text{dB}$	-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 20000Hz		0.3	0.7	mVrms
Frequency characteristic	f	$V_{IN} = 0\text{dB}$, $f = 200$ to 3500Hz		0.0		dB
[Muting circuit] (Operational amplifier gain: 0dB)						
Muting attenuation	$CT1$	$V_{IN} = 0\text{dB}$, $f = 1\text{kHz}$	60	90		dB
Threshold voltage	V_{thm}		1.25	1.35	1.45	V
[Analog switch circuit] (operational amplifier gain: 0dB)						
Crosstalk	$Ct2$	$V_{IN} = 0\text{dB}$, $f = 1\text{kHz}$	40	47		dB
Threshold voltage	V_{tha}		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.

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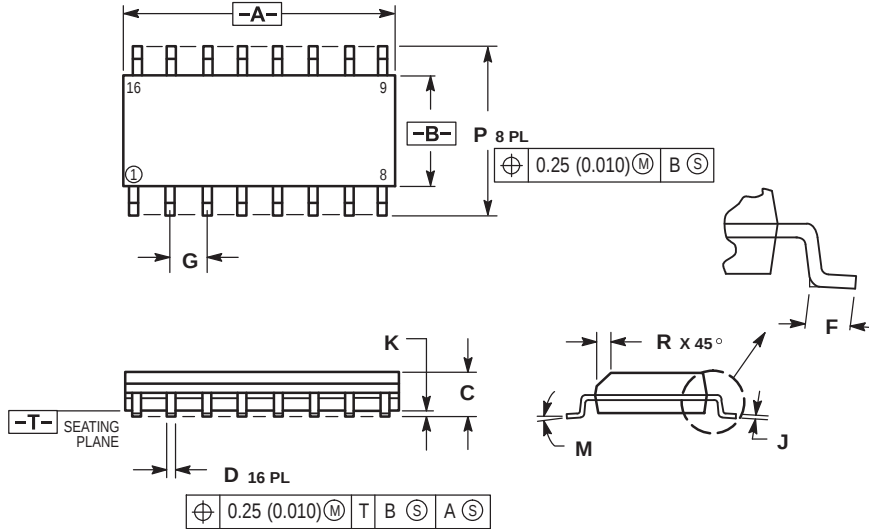
Package Dimensions

unit : mm

SOIC-16

CASE 751B-05

ISSUE K



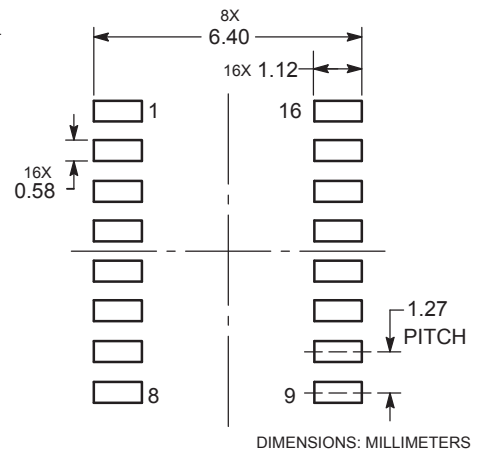
NOTES:

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

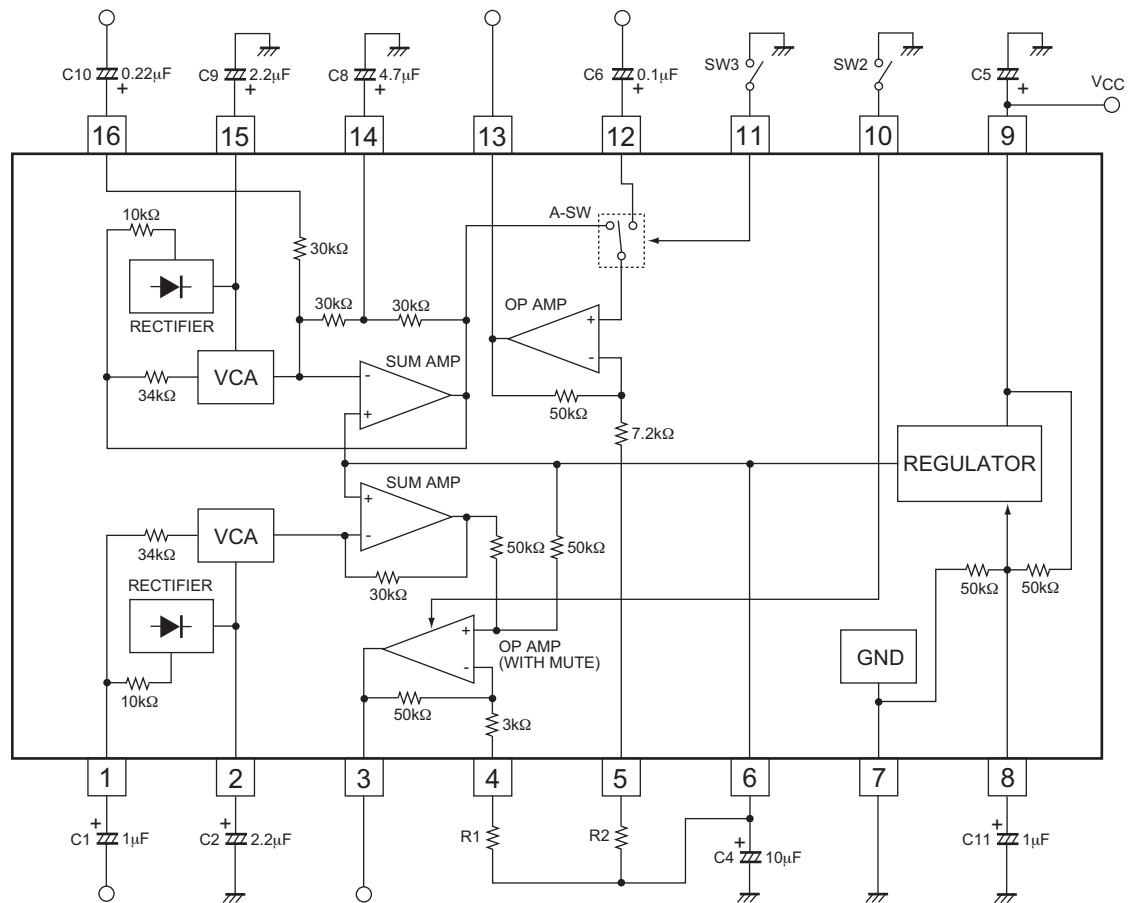
STYLE 1:	STYLE 2:	STYLE 3:	STYLE 4:
PIN 1. COLLECTOR	PIN 1. CATHODE	PIN 1. COLLECTOR, DYE #1	PIN 1. COLLECTOR, DYE #1
2. BASE	2. ANODE	2. BASE, #1	2. COLLECTOR, #1
3. EMITTER	3. NO CONNECTION	3. EMITTER, #1	3. COLLECTOR, #2
4. NO CONNECTION	4. CATHODE	4. COLLECTOR, #1	4. COLLECTOR, #2
5. EMITTER	5. CATHODE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

SOLDERING FOOTPRINT



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Equivalent circuit Block Diagram/Sample Application Circuit



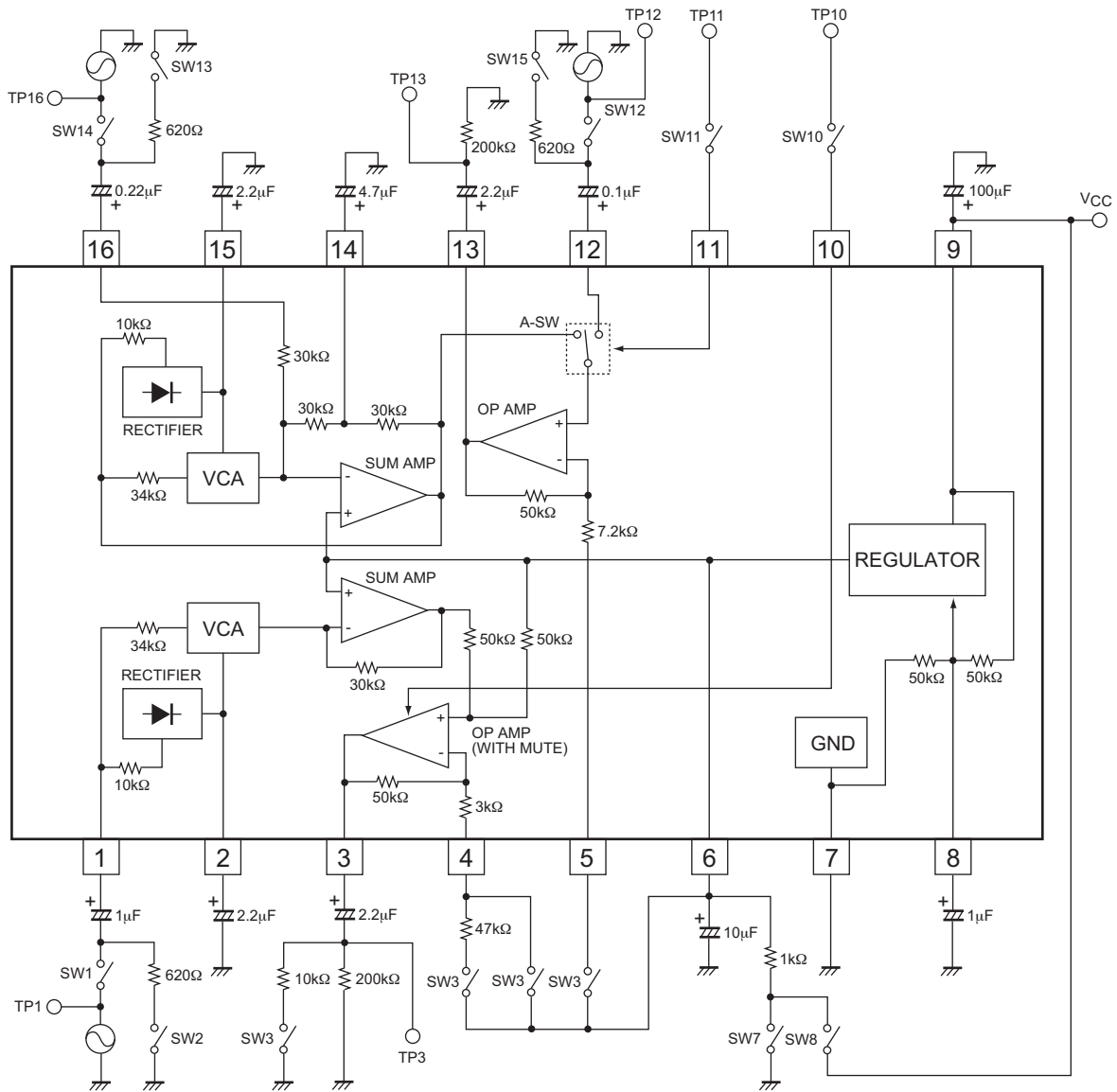
Pin Name

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

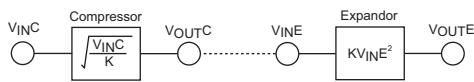
	Mode	Audio signal	Data
Pin 10	Open	Output	-
	[Low]	Mute	-
Pin 11	Open	Output	Mute
	[Low]	Mute	Output

Test Circuit



Summary of Compandor

(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

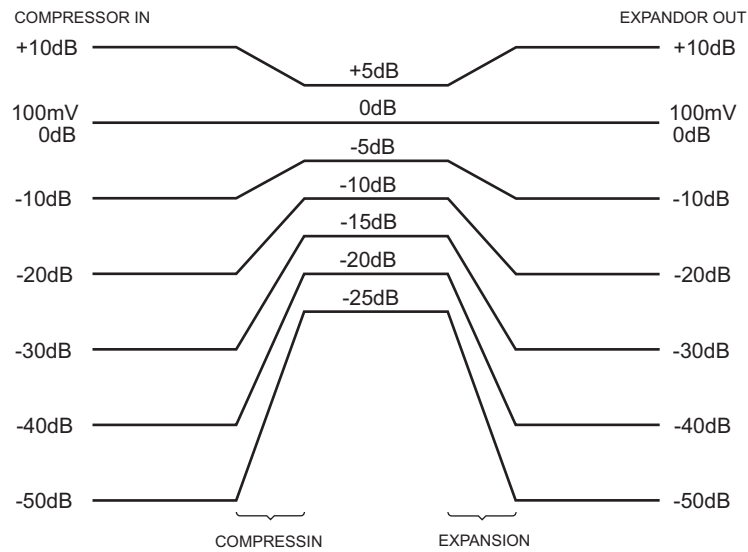
$V_{INC} > V_{REF}$ Compressor → Attenuator

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



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(2) Level Diagram

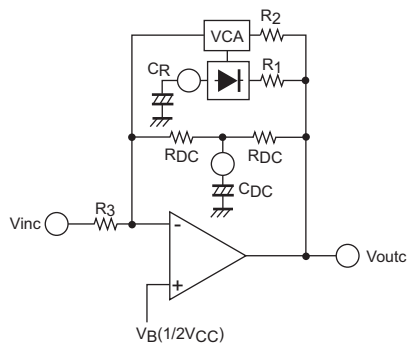


(3) Block Diagram

< Compressor >

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

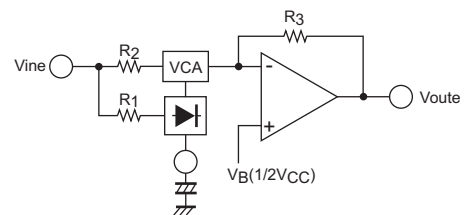
$$= \sqrt{\frac{1}{10}} V_{IN}$$



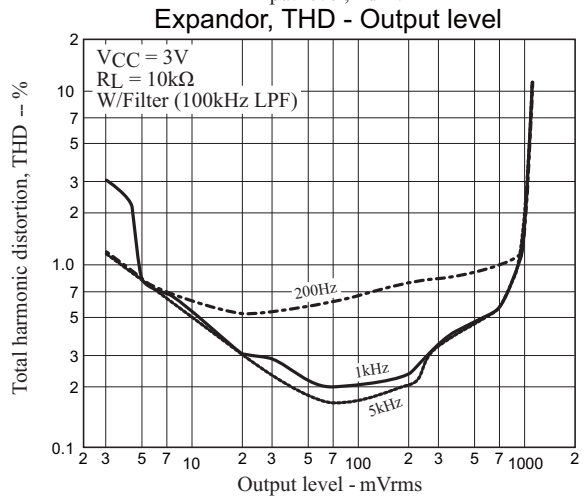
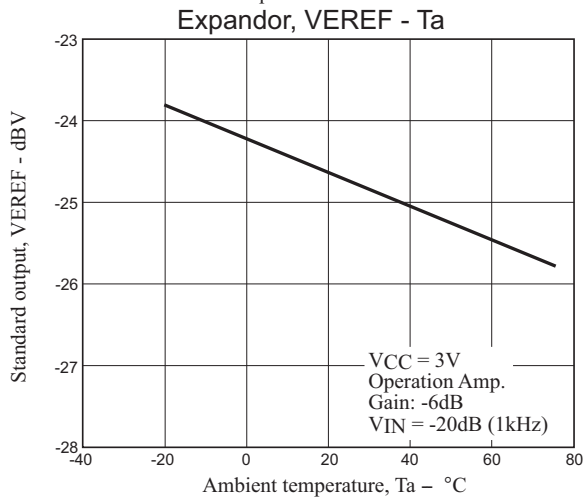
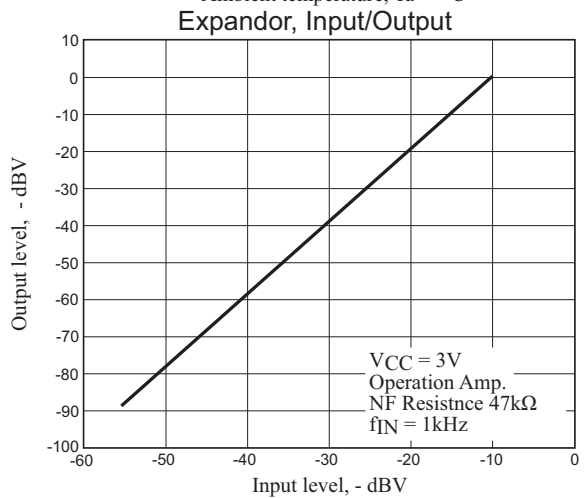
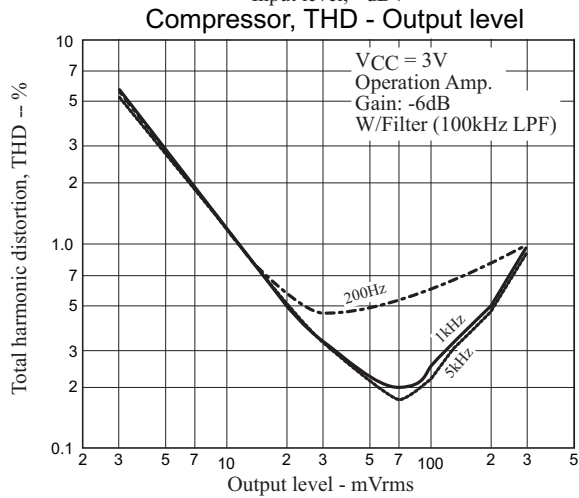
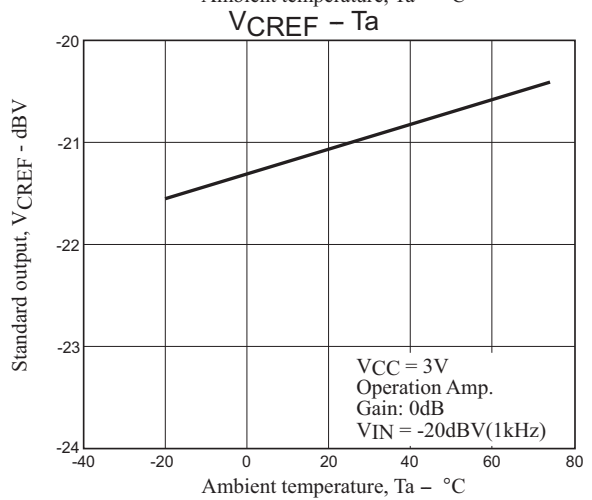
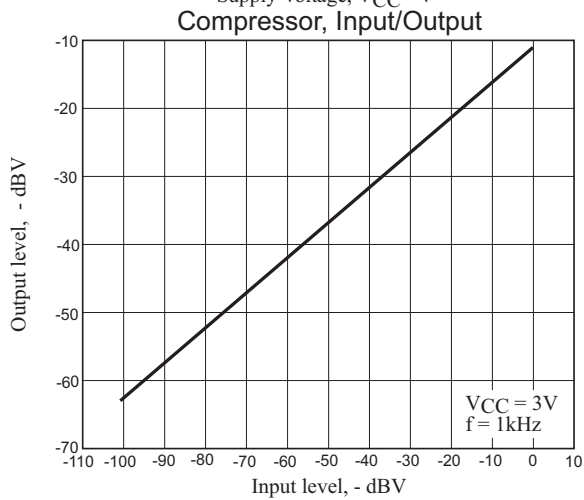
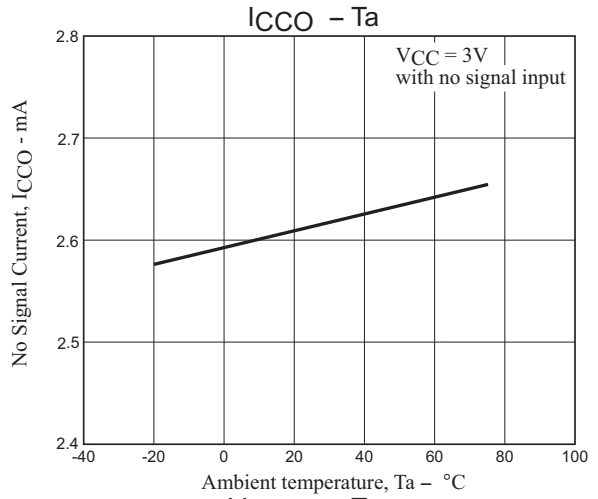
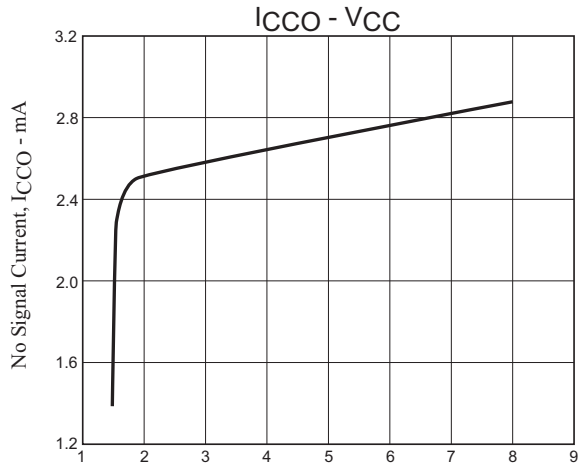
< Expander >

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

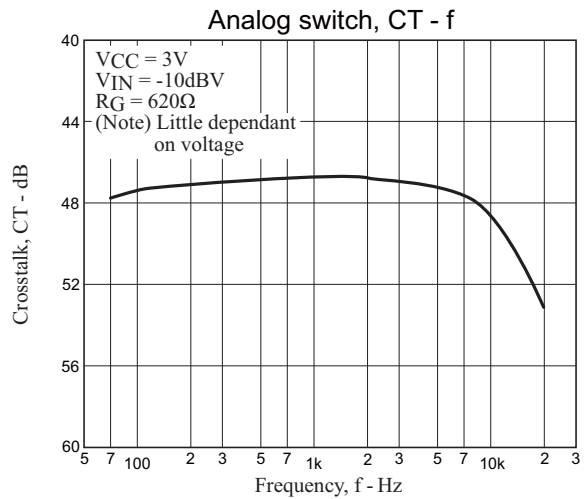
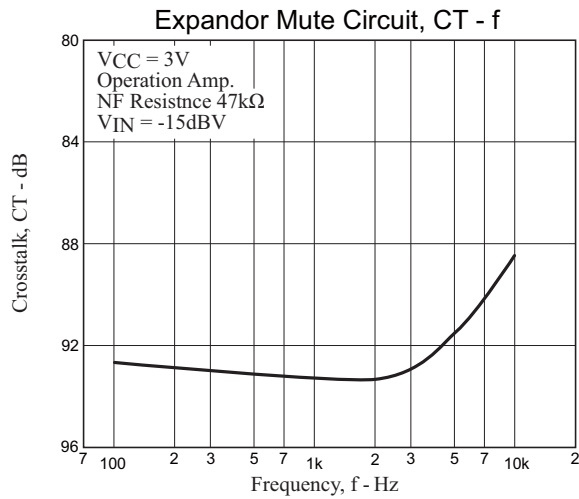
$$= 10 V_{INE}^2$$



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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

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