LA8630MC

Monolithic Linear IC

Low Voltage and Current Dissipation Compandor IC

ON Semiconductor®

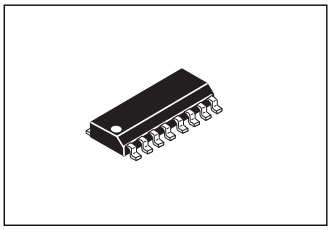
www.onsemi.com

Applications

- Cordless telephone
- FM transceiver

Functions

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



SOIC-16

Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		8	V
Allowable power dissipation	Pd max	Ta ≤ 75ºC	100	mW
Operating temperature	Topr		–20 to +75	ºC
Storage temperature	Tstg		–40 to +125	ºC

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 Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		3	V
Operating voltage range	V_{CC} 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.

Electrical Characteristics at Ta = 25°C, V_{CC} = 3.0V, f = 1kHz, V_{IN} = 100mVrms (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_{IN}ref			100		mVrms
[Expandor] (Operational amplifier gain: 0dB)						
Output level	Vorefe	V_{IN} = 0dB (Operational amplifier gain: -6dB)	−26.5	−24.5	−22.5	dBV
Gain error	Vgee1	V_{IN} = +5dB	−0.5	0	+0.5	dB
	Vgee2	V_{IN} = −20dB	−1.0	0	+1.0	dB
	Vgee3	V_{IN} = −30dB	−1.5	0	+2.0	dB
Distortion factor	THDe	V_{IN} = 0dB		0.35	1.0	%
Output noise voltage	V_{NO}e	V_{IN} = −∞, Rg = 620Ω, f = 20 to 20000Hz		12	80	μVrms
Frequency characteristic	f	V_{IN} = 0dB, f = 200 to 3500Hz		0.0		dB
Maximum output voltage	V_O max	R_L = 10kΩ, THD = 10%	0.6	1.0		Vrms
[Compressor] (Operational amplifier gain: 0dB)						
Output level	Vorefc	V_{IN} = 0dB	−23	−21	−19	dBV
Gain error	Vgec1	V_{IN} = +20dB	−0.5	0	+0.5	dB
	Vgec2	V_{IN} = −20dB	−0.5	0	+0.5	dB
	Vgec3	V_{IN} = −40dB	−1.0	0	+1.0	dB
Distortion factor	THDc	V_{IN} = 0dB		0.35	1.0	%
Output noise voltage	V_{NO}c	V_{IN} = −∞, Rg = 620Ω, f = 20 to 20000Hz		0.3	0.7	mVrms
Frequency characteristic	f	V_{IN} = 0dB, f = 200 to 3500Hz		0.0		dB
[Muting circuit] (Operational amplifier gain: 0dB)						
Muting attenuation	CT1	V_{IN} = 0dB, f = 1kHz	60	90		dB
Threshold voltage	Vthm		1.25	1.35	1.45	V
[Analog switch circuit] (operational amplifier gain: 0dB)						
Crosstalk	Ct2	V_{IN} = 0dB, f = 1kHz	40	47		dB
Threshold voltage	Vtha		1.25	1.35	1.45	V

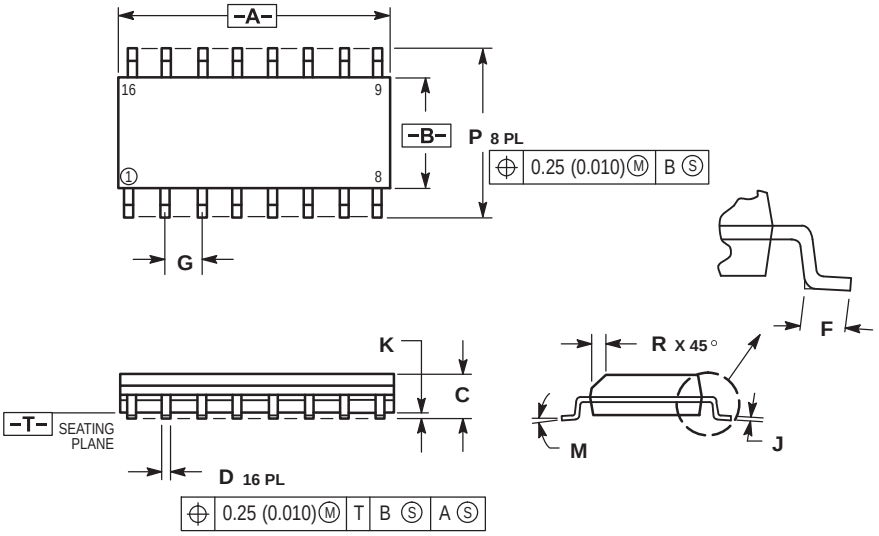
*: Be careful that the threshold voltage is determined by V_{CC} (V_{TH} = 0.45V_{CC})

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.

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.

	MILLIMETERS		INCHES	
DIM	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:
PIN 1. COLLECTOR
2. BASE
3. EMITTER
4. NO CONNECTION
5. EMITTER
6. BASE
7. COLLECTOR
8. COLLECTOR
9. BASE
10. EMITTER
11. NO CONNECTION
12. EMITTER
13. BASE
14. COLLECTOR
15. EMITTER
16. COLLECTOR

STYLE 2:
PIN 1. CATHODE
2. ANODE
3. NO CONNECTION
4. CATHODE
5. CATHODE
6. NO CONNECTION
7. ANODE
8. CATHODE
9. CATHODE
10. ANODE
11. NO CONNECTION
12. CATHODE
13. CATHODE
14. NO CONNECTION
15. ANODE
16. CATHODE

STYLE 3:
PIN 1. COLLECTOR, DYE #1
2. BASE, #1
3. EMITTER, #1
4. COLLECTOR, #1
5. COLLECTOR, #2
6. BASE, #2
7. EMITTER, #2
8. COLLECTOR, #2
9. COLLECTOR, #3
10. BASE, #3
11. EMITTER, #3
12. COLLECTOR, #3
13. COLLECTOR, #4
14. BASE, #4
15. EMITTER, #4
16. COLLECTOR, #4

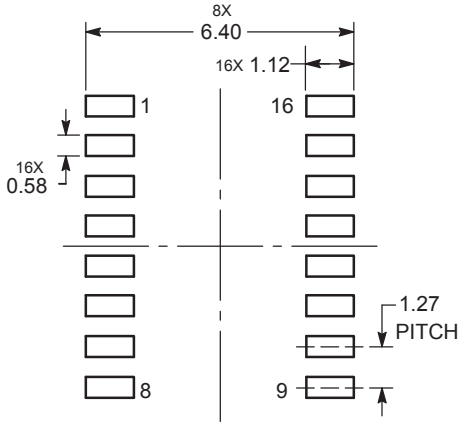
STYLE 4:
PIN 1. COLLECTOR, DYE #1
2. COLLECTOR, #1
3. COLLECTOR, #2
4. COLLECTOR, #2
5. COLLECTOR, #3
6. COLLECTOR, #3
7. COLLECTOR, #4
8. COLLECTOR, #4
9. BASE, #4
10. EMITTER, #4
11. BASE, #3
12. EMITTER, #3
13. BASE, #2
14. EMITTER, #2
15. BASE, #1
16. EMITTER, #1

STYLE 5:
PIN 1. DRAIN, DYE #1
2. DRAIN, #1
3. DRAIN, #2
4. DRAIN, #2
5. DRAIN, #3
6. DRAIN, #3
7. DRAIN, #4
8. DRAIN, #4
9. GATE, #4
10. SOURCE, #4
11. GATE, #3
12. SOURCE, #3
13. GATE, #2
14. SOURCE, #2
15. GATE, #1
16. SOURCE, #1

STYLE 6:
PIN 1. CATHODE
2. CATHODE
3. CATHODE
4. CATHODE
5. CATHODE
6. CATHODE
7. CATHODE
8. CATHODE
9. ANODE
10. ANODE
11. ANODE
12. ANODE
13. ANODE
14. ANODE
15. ANODE
16. ANODE

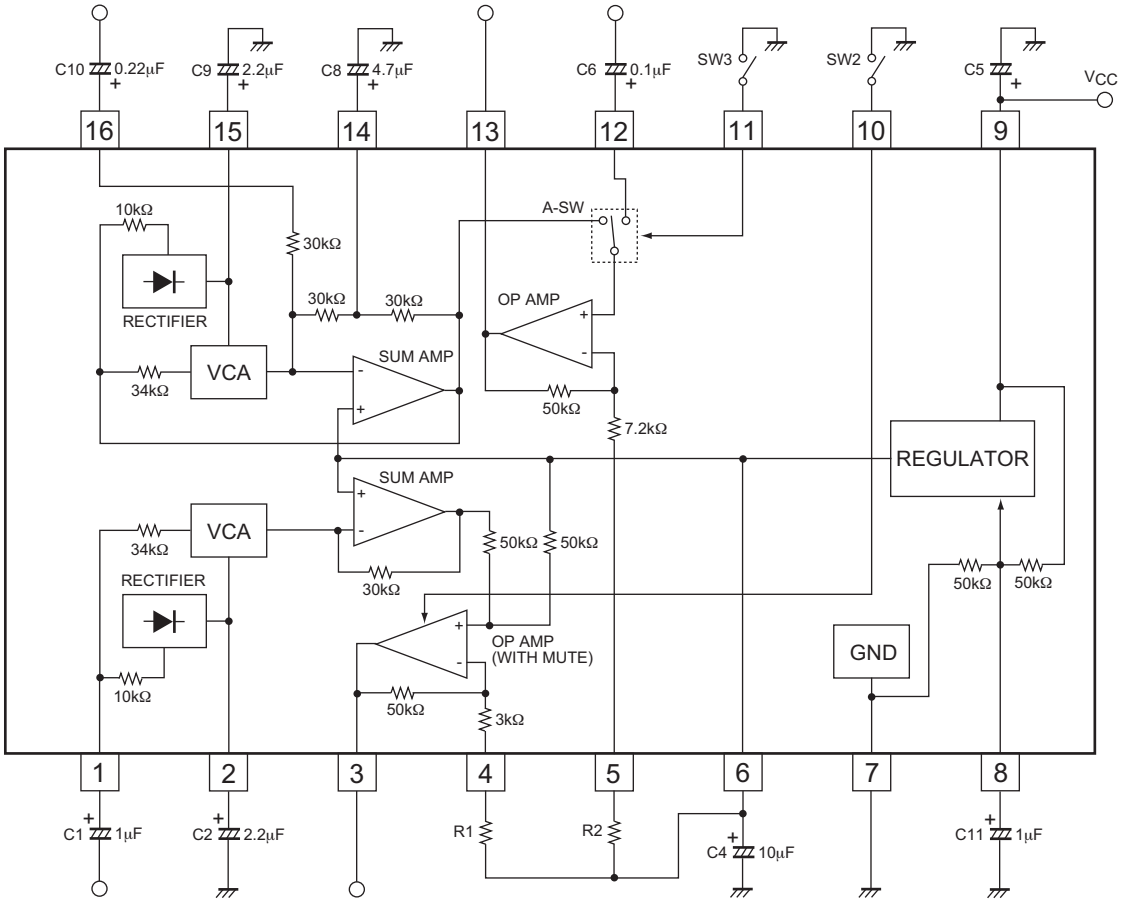
STYLE 7:
PIN 1. SOURCE N-CH
2. COMMON DRAIN (OUTPUT)
3. COMMON DRAIN (OUTPUT)
4. GATE P-CH
5. COMMON DRAIN (OUTPUT)
6. COMMON DRAIN (OUTPUT)
7. COMMON DRAIN (OUTPUT)
8. SOURCE P-CH
9. SOURCE P-CH
10. COMMON DRAIN (OUTPUT)
11. COMMON DRAIN (OUTPUT)
12. COMMON DRAIN (OUTPUT)
13. GATE N-CH
14. COMMON DRAIN (OUTPUT)
15. COMMON DRAIN (OUTPUT)
16. SOURCE N-CH

SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

Equivalent circuit Block Diagram/Sample Application Circuit



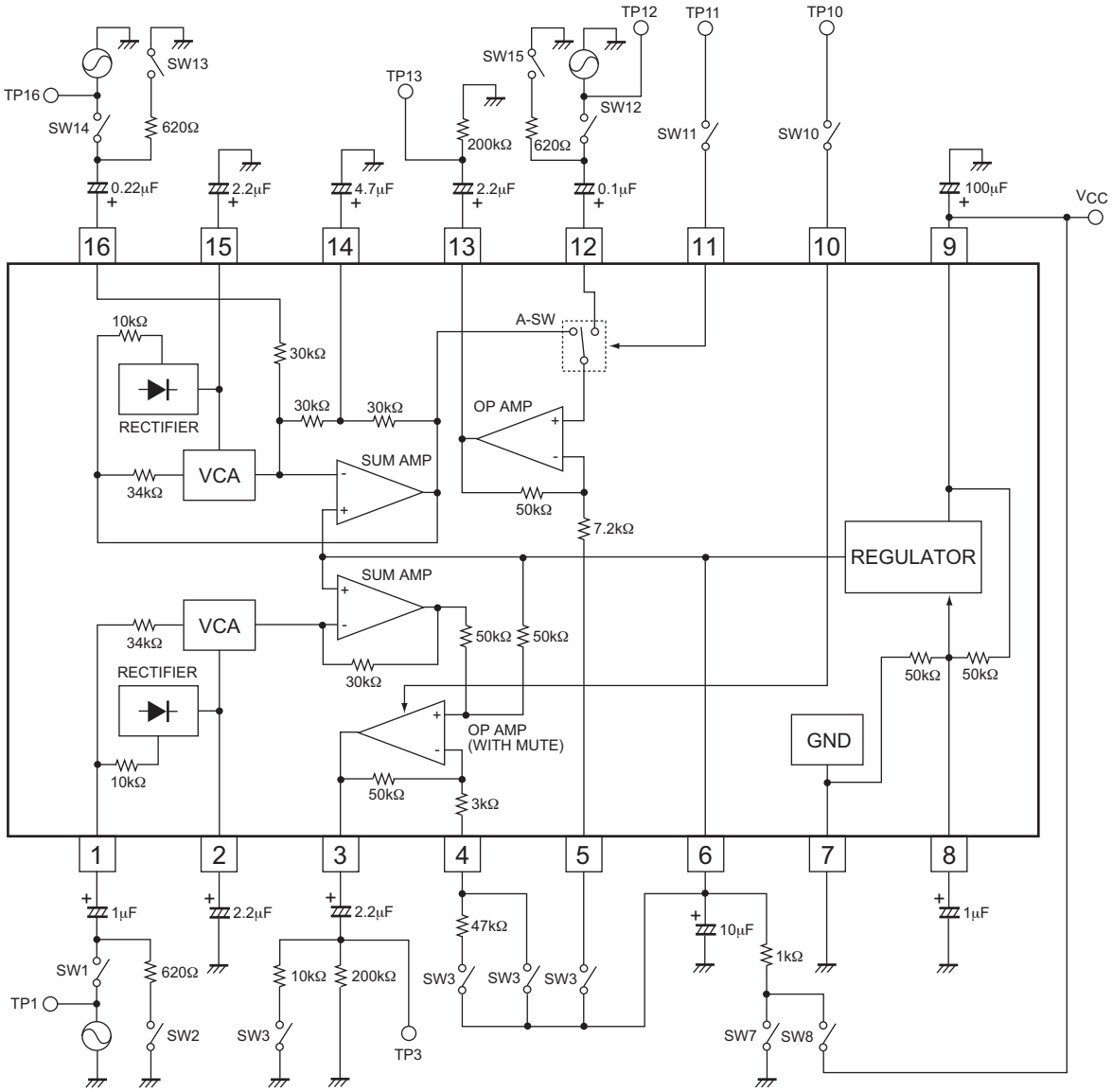
Pin Name

Pin No.	Name
1	EXP. V_{IN}
2	EXP. VREC
3	EXP. V_{OUT}
4	OP. AMP NF (EXP.)
5	OP. AMP NF (COMP.)
6	VREF
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. VREC
16	COMP. V_{IN}

Control Mode

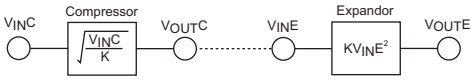
Mode		Audio signal	Data
Pin 10	Open	Output	-
	[Low]	Mute	-
Pin 11	Open	Output	Mute
	[Low]	Mute	Output

Test Circuit



Summary of Compandor

(1) Operation



< for example >

VREF = 100mV

K = IO

$V_{IN}C$ = 1mV (-40dB)

$V_{IN}E$ = 10mV

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

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

$V_{OUT}C = \sqrt{V_{IN}C / K}$

$V_{IN}E = V_{OUT}C$

$V_{OUT}E = KV_{IN}E^2 = K\sqrt{\frac{V_{IN}C}{K}} = V_{IN}C$

At reference level (VREF) $V_{IN}C = V_{OUT}C$, $V_{IN}E = V_{OUT}E$

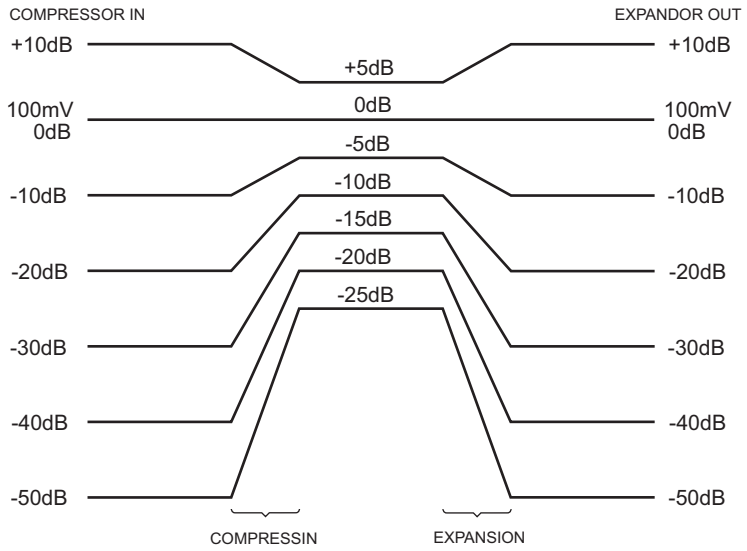
$V_{IN}C$ < VREF Compressor → Amplifier

$V_{IN}E$ < VREF Expandor → Attenuator

$V_{IN}C$ > VREF Compressor →Attenuator

$V_{IN}E$ > VREF Expandor → Amplifier

(2) Level Diagram

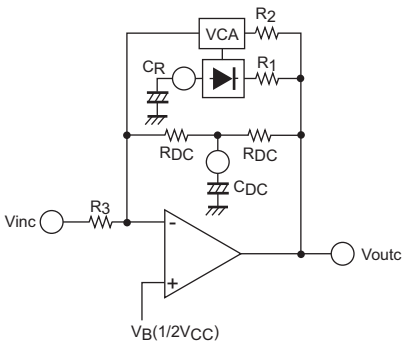


(3) Block Diagram

< Compressor >

$$VOUTC = \sqrt{\frac{R1R2I1}{2R3}\ VINC}$$

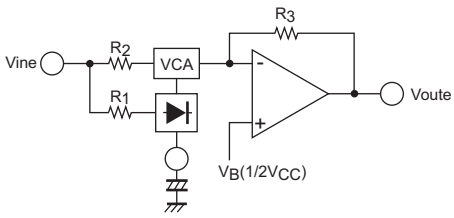
$$= \sqrt{\frac{1}{10}\ VIN}$$

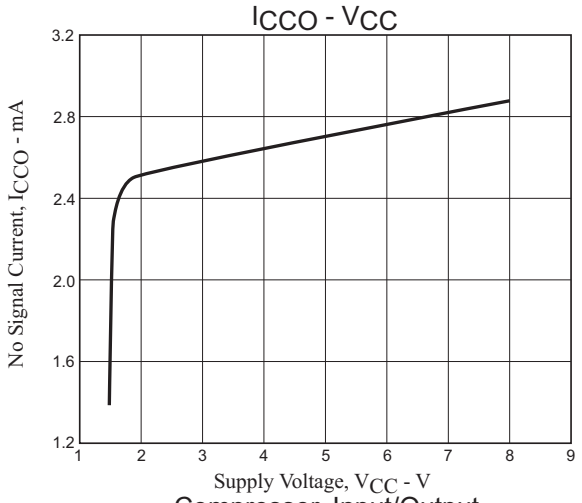


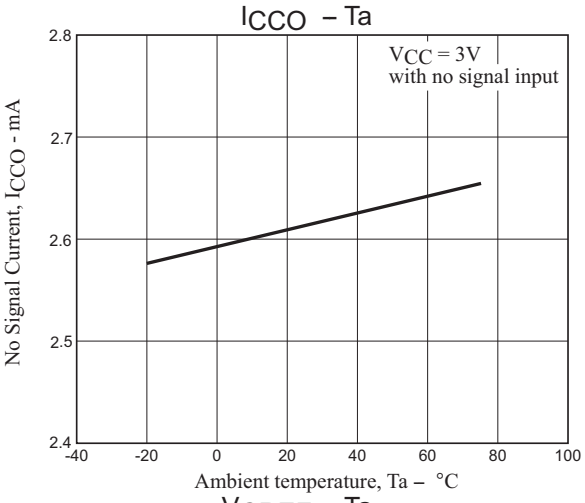
< Expandor >

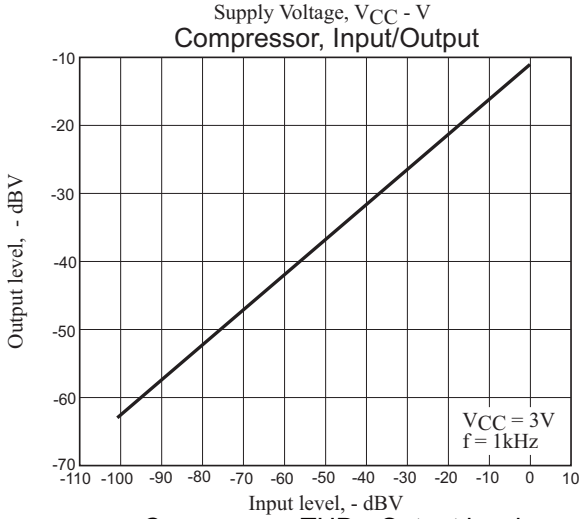
$$VOUTE = \sqrt{\frac{2R3}{R1R2I1}\ VINE^2}$$

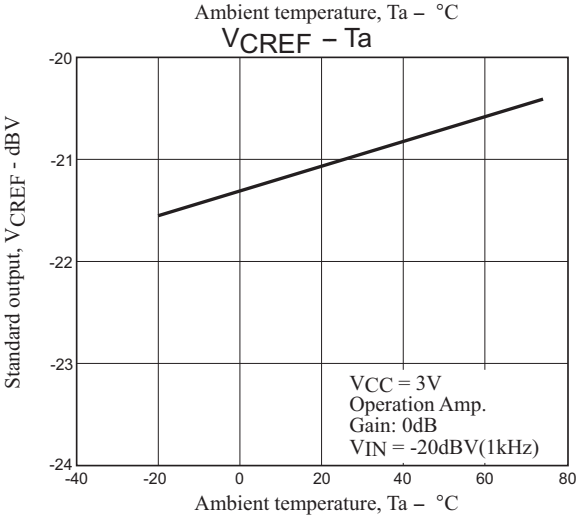
$$= 10VINE^2$$

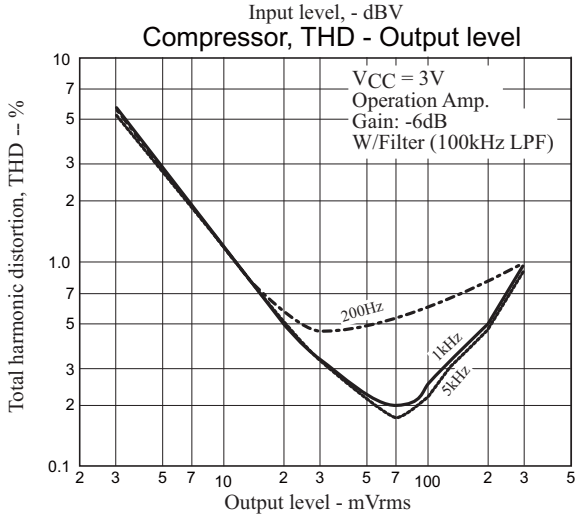


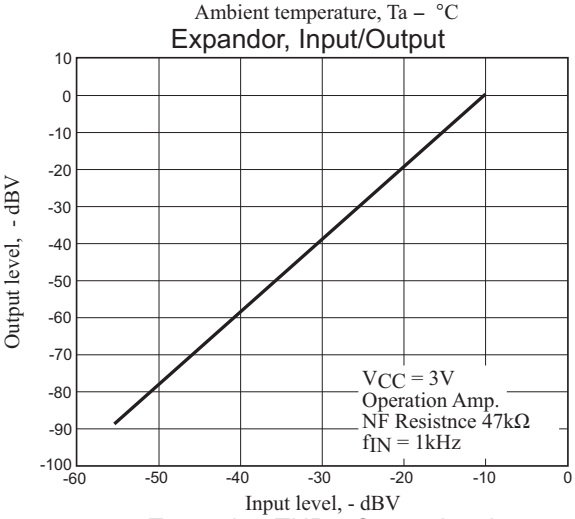

ICCO - VCC
No Signal Current, ICCO - mA
Supply Voltage, VCC - V

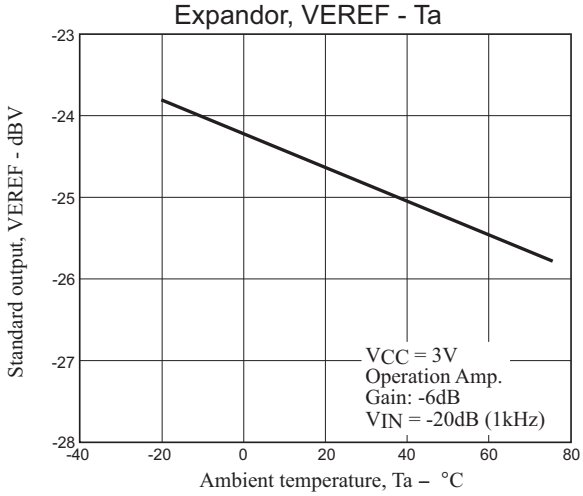

ICCO – Ta
VCC = 3V
with no signal input
No Signal Current, ICCO - mA
Ambient temperature, Ta – °C

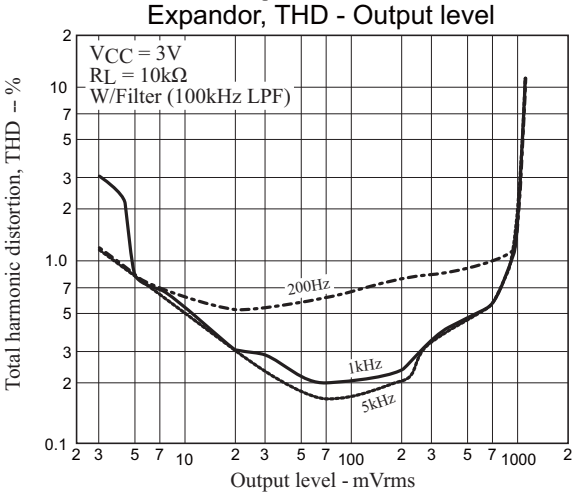

Compressor, Input/Output
Output level, - dBV
VCC = 3V
f = 1kHz
Input level, - dBV


VCREF – Ta
Standard output, VCREF - dBV
VCC = 3V
Operation Amp.
Gain: 0dB
VIN = -20dBV(1kHz)
Ambient temperature, Ta – °C

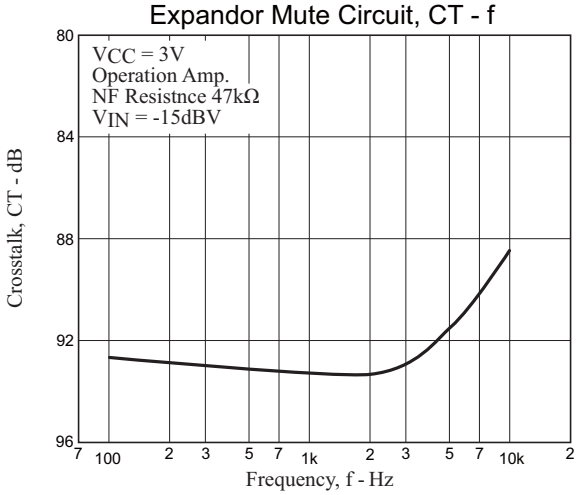

Compressor, THD - Output level
Total harmonic distortion, THD – %
VCC = 3V
Operation Amp.
Gain: -6dB
W/Filter (100kHz LPF)
200Hz
1kHz
5kHz
Output level - mVrms


Expandor, Input/Output
Output level, - dBV
VCC = 3V
Operation Amp.
NF Resistnce 47kΩ
fIN = 1kHz
Input level, - dBV

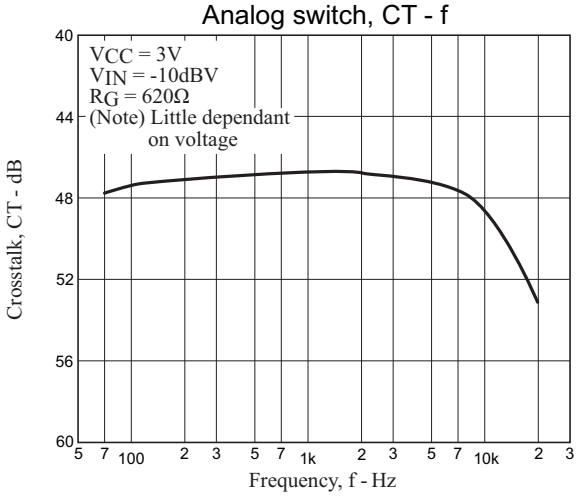

Expandor, VEREF - Ta
Standard output, VEREF - dBV
VCC = 3V
Operation Amp.
Gain: -6dB
VIN = -20dB (1kHz)
Ambient temperature, Ta – °C


Expandor, THD - Output level
Total harmonic distortion, THD – %
VCC = 3V
RL = 10kΩ
W/Filter (100kHz LPF)
200Hz
1kHz
5kHz
Output level - mVrms

Expandor Mute Circuit, CT - f



Analog switch, CT - f



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