



SANYO Semiconductors

# DATA SHEET

## LA2657M — Monolithic Linear IC Car Audio Electronic Volume and Tone Control IC with On-Chip BBE Sound Processor

### Overview

The LA2657M is a car audio signal processing IC that integrates a BBE sound processor with the functions of the SANYO LC75421 IC. The main functions provided by the LA2657M include an input block, input gain adjustment, tone controls, super bass, balance control, volume control, fader, and the BBE sound processor.

### Functions

- Input block : Four input systems [L, R] (Note that the LC75421 provides 5 systems)
- Input gain control (0 to 18.75dB in 1.25dB steps)
- Built-in BBE sound processor
- Tone control (Bass :  $\pm 11.9$ dB, treble :  $\pm 11.9$ dB (both in 1.7dB steps))
- Super bass (0 to 20dB in 2dB steps)
- Master volume (0 to -79dB in 1dB steps,  $-\infty$ )
- Balance control
- Fader (0 to -20dB in 2dB steps, -20 to -25dB in 5dB steps, -25 to -45dB in 10dB steps, -60dB,  $-\infty$ )
- C<sup>2</sup>B bus support (On/off control of the BBE function is not supported)

### Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC\ max}$	Pin 21	13	V
	$V_{DD\ max}$	Pin 47	11	V
Allowable power dissipation	$P_d\ max$	$T_a \leq 85^\circ\text{C}^*$	700	mW
Operating temperature	$T_{opr}$		-40 to +85	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-50 to +150	$^\circ\text{C}$

\* mounted on a specified board : 76.1mm $\times$ 114.3mm $\times$ 1.6mm, glass epoxy board.

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20707 MS PC B8-6242 / N1506 MS PC No.8078-1/8

# LA2657M

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

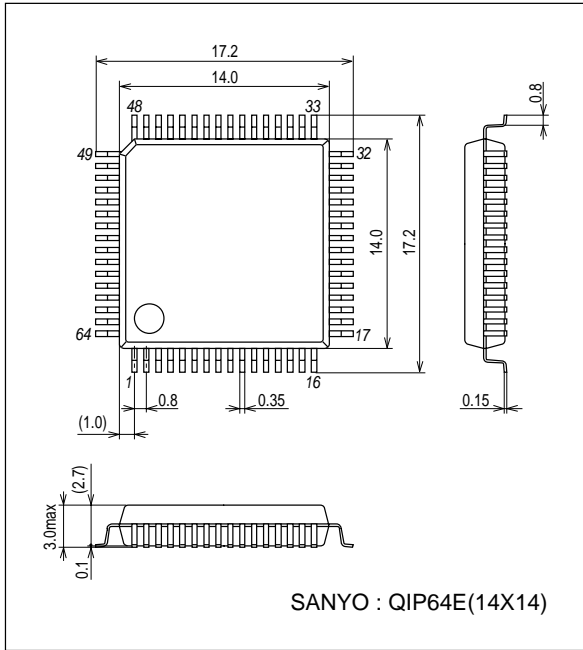
Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	$V_{CC}$	Pin 21	9.0	V
	$V_{DD}$	Pin 47	8.0	V
Operating supply voltage range	$V_{CC\text{ opg}}$	Pin 21	5.0 to 12.0	V
	$V_{DD\text{ opg}}$	Pin 47	7.5 to 10.0	V
Input high voltage	$V_{IH}$	CL (49), DI (50), CE (51)	4.0 to 10	V
		BBE (23)	2.0 to $V_{CC}$	V
Input low voltage	$V_{IL}$	CL (49), DI (50), CE (51), BBE (23)	0.0 to 1.0	V

## Electrical Characteristics at $T_a = 25^\circ\text{C}$ (In the specified AC test circuit)

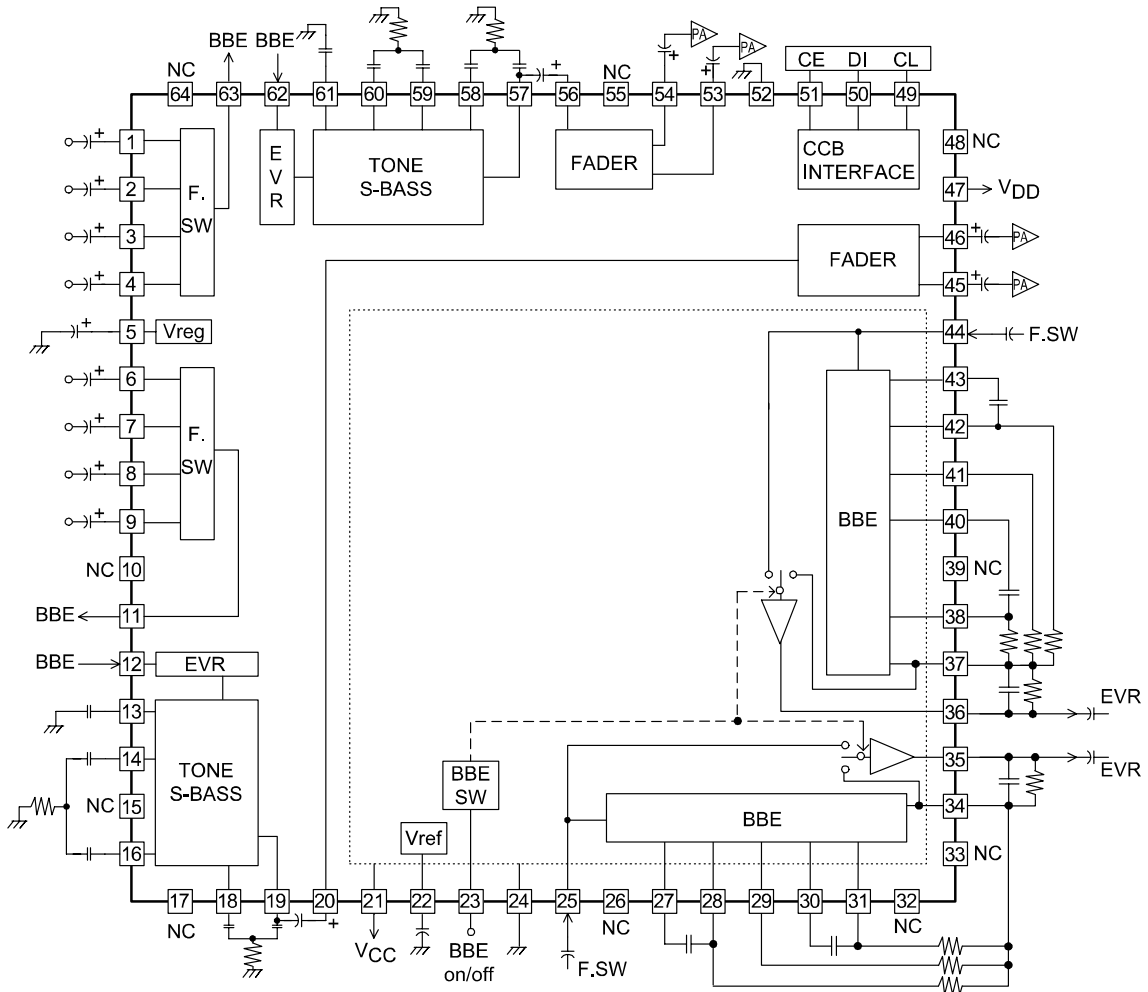
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[BBE Function] ( $V_{CC} = 9.0\text{V}$ , $f_{in} = 1\text{kHz}$ , $V_{IN} = 300\text{mVrms} = 0\text{dB}$ , $R_L = 40\text{k}\Omega$ )						
Quiescent current drain	$I_{CCO}$	Pin 21	4.5	6.0	8.0	mA
Output level deviation	VGB	BBE on	0.0	+2.5	+5.0	dB
	VGT	BBE off	-2.0	0.0	+2.0	dB
Maximum output voltage	$V_O\text{ maxB}$	BBE on THD = 1%	1.5	2.0		Vrms
	$V_O\text{ maxT}$	BBE on THD = 1%	1.5	2.0		Vrms
Total harmonic distortion	THDB	BBE on 400 to 30kBPf		0.04	0.1	%
	THDT	BBE off 400 to 30kBPf		0.04	0.1	%
Output noise voltage	VNOB	BBE on $R_g = 10\text{k}\Omega$ DIN AUDIO		-80	-75	dBv
	VNOT	BBE off $R_g = 10\text{k}\Omega$ DIN AUDIO		-90	-80	dBv
[EVR function] ( $V_{DD} = 8.0\text{V}$ , $f_{in} = 1\text{kHz}$ , $V_{IN} = 1\text{Vrms} = 0\text{dB}$ )						
Maximum input gain	$G_{in\text{ max}}$			$\pm 18.75$		dB
Bass range	$G_{bass}$	max Boost/Cut $f_{in} = f_o$	$\pm 10$	$\pm 11.9$	$\pm 14$	dB
Treble range	$G_{tre}$	max Boost/Cut $f_{in} = f_o$	$\pm 10$	$\pm 11.9$	$\pm 14$	dB
Super bass range	$G_{range}$	max Boost $f_{in} = f_o$		+20		dB
Total harmonic distortion	THDE	All controls flat		0.003	0.01	%
Crosstalk	CTE	All controls flat, $R_g = 1\text{k}\Omega$		-80.5		dB
Output at maximum attenuation	$V_O\text{ minE}$	Main volume : $-\infty$		-80		dB
Output noise voltage	VN-1	All controls flat (IHF-A) $R_g = 1\text{k}\Omega$		8		$\mu\text{V}$
	VN-2	All controls flat (DIN-AUDIO) $R_g = 1\text{k}\Omega$		10		$\mu\text{V}$

Package Dimensions

unit : mm (typ)  
3159A



Block Diagram



## Pin Functions

### BBE+LC75421 Combined IC Pin Assignment

No	Pin	[Pin Numbers for Each Chip]
1	L4 for the LC75421	[15]
2	L3 for the LC75421	[16]
3	L2 for the LC75421	[17]
4	L1 for the LC75421	[18]
5	Vref for the LC75421	[19]
6	R1 for the LC75421	[20]
7	R2 for the LC75421	[21]
8	R3 for the LC75421	[22]
9	R4 for the LC75421	[23]
10	NC	
11	RSELO for the LC75421	[25]
12	RIN for the LC75421	[26]
13	RTRE for the LC75421	[27]
14	RBASS1 for the LC75421	[28]
15	NC	
16	RBASS2 for the LC75421	[29]
17	NC	
18	RSB for the LC75421	[30]
19	ROUT for the LC75421	[31]
20	RFIN for the LC75421	[32]
21	V <sub>CC</sub> for the BBE chip	[19]
22	Vref for the BBE chip	[20]
23	CONT for the BBE chip	[1]
24	GND for the BBE chip	[2]
25	R-IN for the BBE chip	[3]
26	NC	
27	RC1 for the BBE chip	[4]
28	RC3 for the BBE chip	[5]
29	R-VOL2 for the BBE chip	[6]
30	RC2 for the BBE chip	[7]
31	R-VOL1 for the BBE chip	[8]
32	NC	

No	Pin	[Pin Numbers for Each Chip]
33	NC	
34	R-MIX for the BBE chip	[9]
35	R-OUT for the BBE chip	[10]
36	L-OUT for the BBE chip	[11]
37	L-MIX for the BBE chip	[12]
38	L-VOL1 for the BBE chip	[13]
39	NC	
40	LC2 for the BBE chip	[14]
41	L-VOL2 for the BBE chip	[15]
42	LC3 for the BBE chip	[16]
43	LC1 for the BBE chip	[17]
44	L-IN for the BBE chip	[18]
45	RFOUT for the LC75421	[33]
46	RROUT for the LC75421	[34]
47	V <sub>DD</sub> for the LC75421	[35]
48	NC	
49	CL for the LC75421	[36]
50	DI for the LC75421	[1]
51	CE for the LC75421	[2]
52	V <sub>SS</sub> for the LC75421	[3]
53	LROUT for the LC75421	[4]
54	LFOUT for the LC75421	[5]
55	NC	
56	LFIN for the LC75421	[6]
57	LOUT for the LC75421	[7]
58	LSB for the LC75421	[8]
59	LBASS2 for the LC75421	[9]
60	LBASS1 for the LC75421	[10]
61	LTRE for the LC75421	[11]
62	LIN for the LC75421	[12]
63	LSELO for the LC75421	[13]
64	NC	

\* : No connections whatsoever may be made to NC pins.

\* : The input function uses items 1 to 4.

\* : The BBE chip must be operated within ranges such that the pin 36 and pin 37 output levels never exceed 2.5V rms in bypass mode.

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## BBE Block Pin Functions

Pin No.	Pin	Pin voltage	Description	Equivalent circuit
21	V <sub>CC</sub>	V <sub>CC</sub>		
22	VREF	0.5V <sub>CC</sub>	Reference voltage	
23	BBE On/Off control	0	The BBE function will be on when a 3V level is applied. This voltage must not be applied when V <sub>CC</sub> is not applied.	
24	GND	0		
25	INPUT (R)	VREF	Input pins	
44	INPUT (L)			
27	BPF-LP (R)	VREF	Bandpass filter capacitor connection Amplifier inverting input	
43	BPF-LP (L)			
28	BPF-OUT (R)	VREF	Bandpass filter output	
42	BPF-OUT (L)			
29	HPF-OUT (R)	VREF	High-pass filter output NF resistor = 21.5kΩ	
41	HPF-OUT (L)			
30	LPF (R)	VREF	Low-pass filter capacitor connection Amplifier inverting input	
40	LPF (L)			

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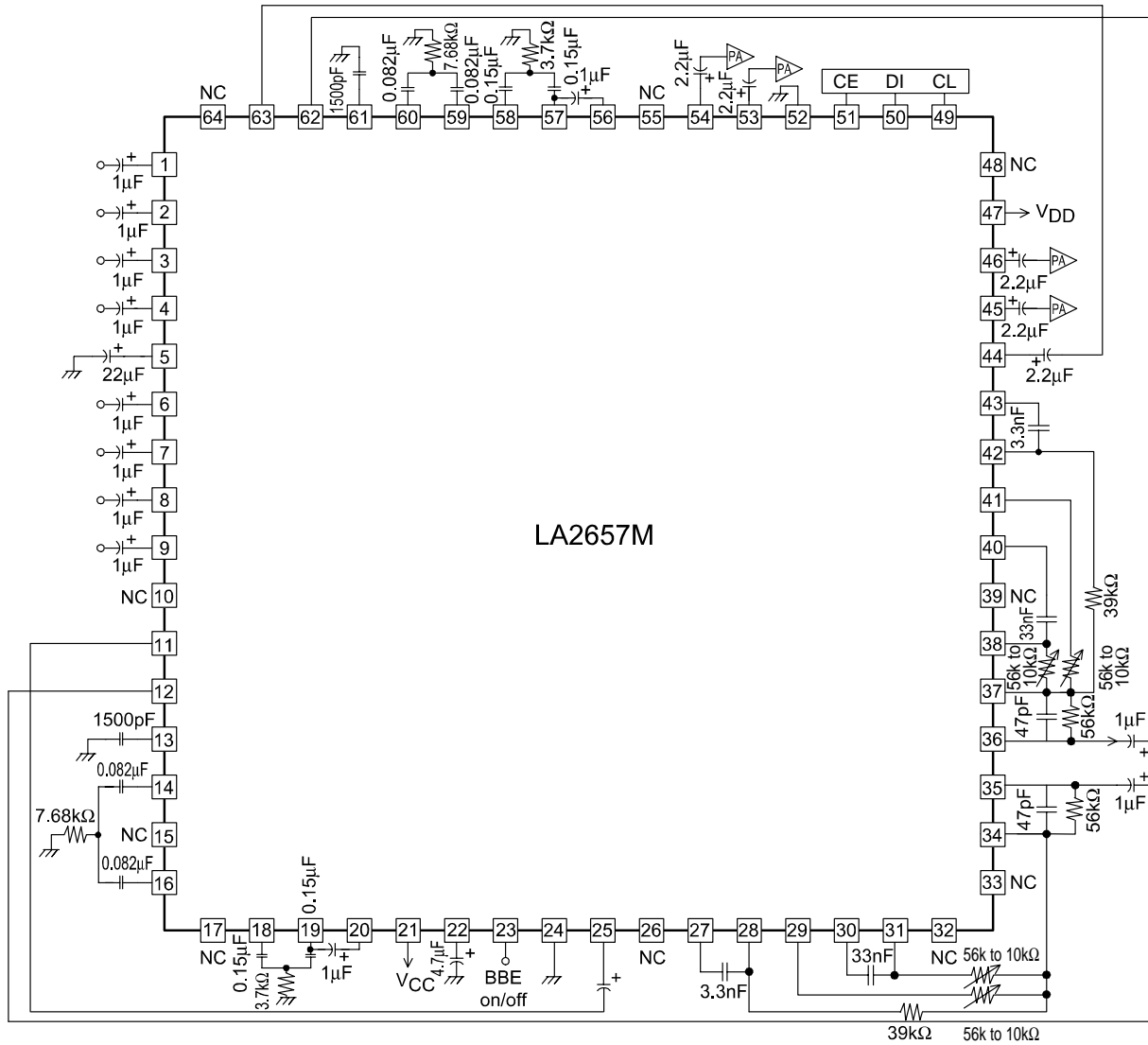
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Pin No.	Pin	Pin voltage	Description	Equivalent circuit
31	LPF-OUT (R)	VREF	Low-pass filter output	
38	LPF-OUT (L)			
34	MIX-IN (R)	VREF	Mixer amplifier input Amplifier inverting input	
37	MIX-IN (L)			
35	OUTPUT (R)	VREF	Output pins	
36	OUTPUT (L)			

\* : See the LC75421 datasheet for details on the EVR block pin functions.

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## Sample Application Circuit



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