

# M62440FP

## Electric Volume Control with Tone Controller for 4-Speaker Applications

REJ03F0211-0201

Rev.2.01

Mar 31, 2008

### Description

The M62440FP is an IC developed for car audio, it has a built-in 4ch input selector, master volume, loudness, tone control and fader volume blocks. All of these blocks are controlled via serial data. Thank to the used zero crossing detector, very low click noise are obtained.

### Features

- Built-in zero cross detector prevents click noise
- 4-input selector
- Loudness
- Tone control bass/Mid/Treble
- Master volume/Fader Volume
- Serial data control

### Recommended Operating Conditions

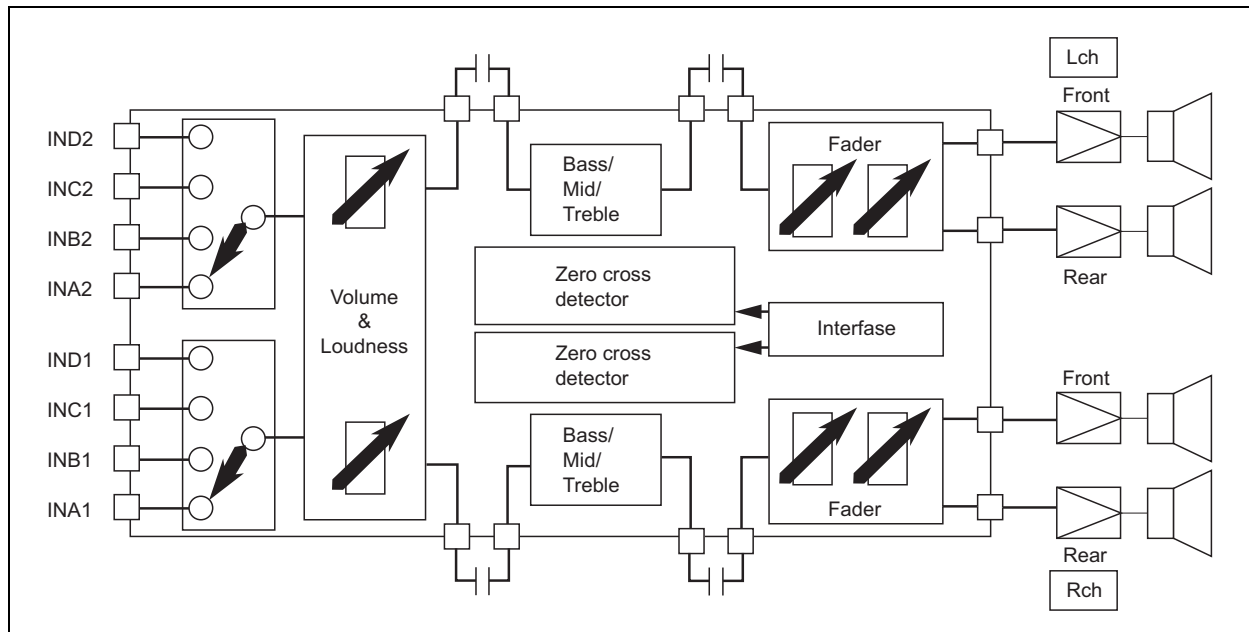
Supply voltage range:  $V_{CC} = 6$  to  $9$  V

$V_{DD} = 4$  to  $6$  V

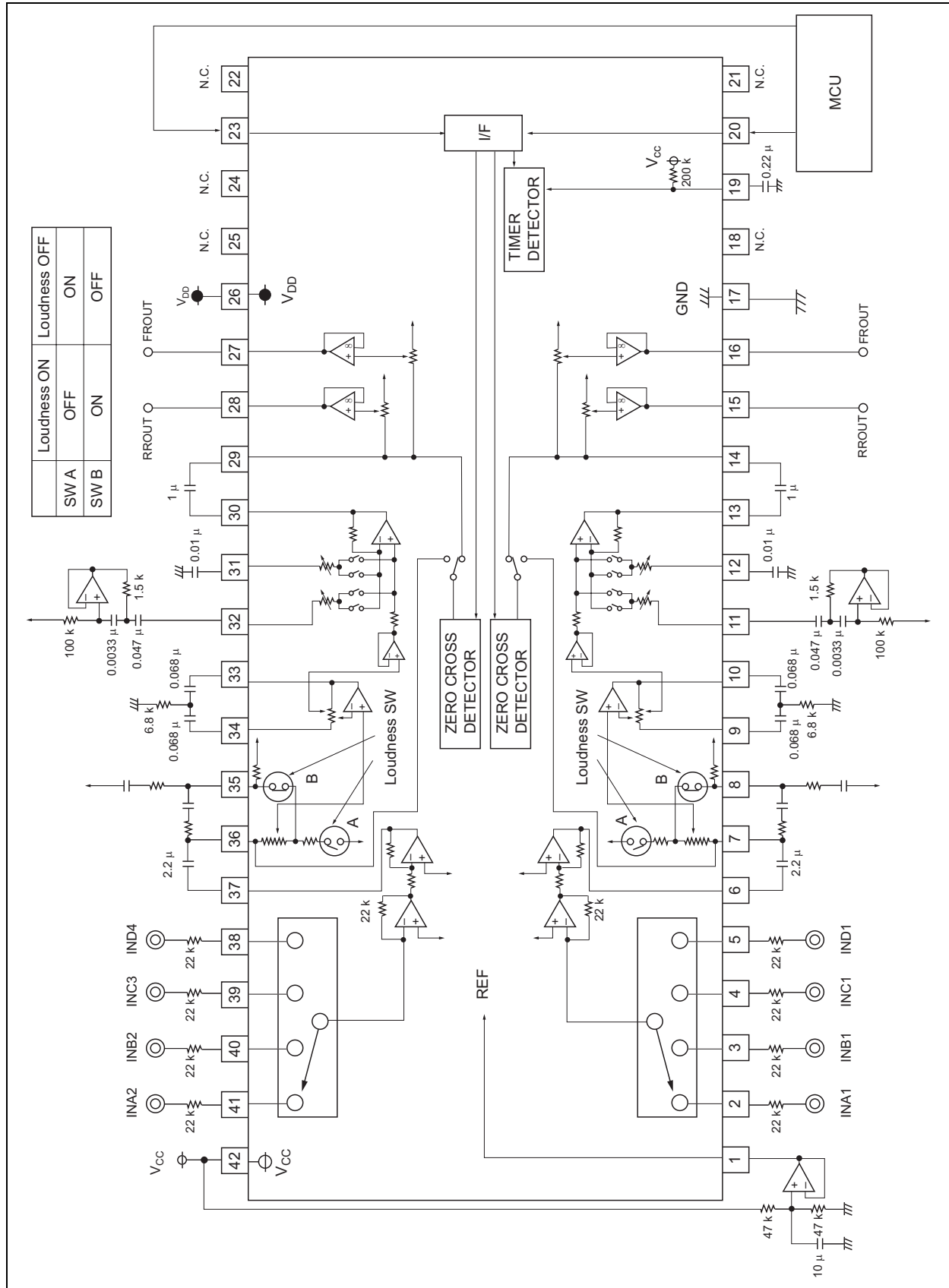
Rated supply voltage:  $V_{CC} = 8$  V

$V_{DD} = 5$  V

### Block Diagram



Pin Configuration and Application Example

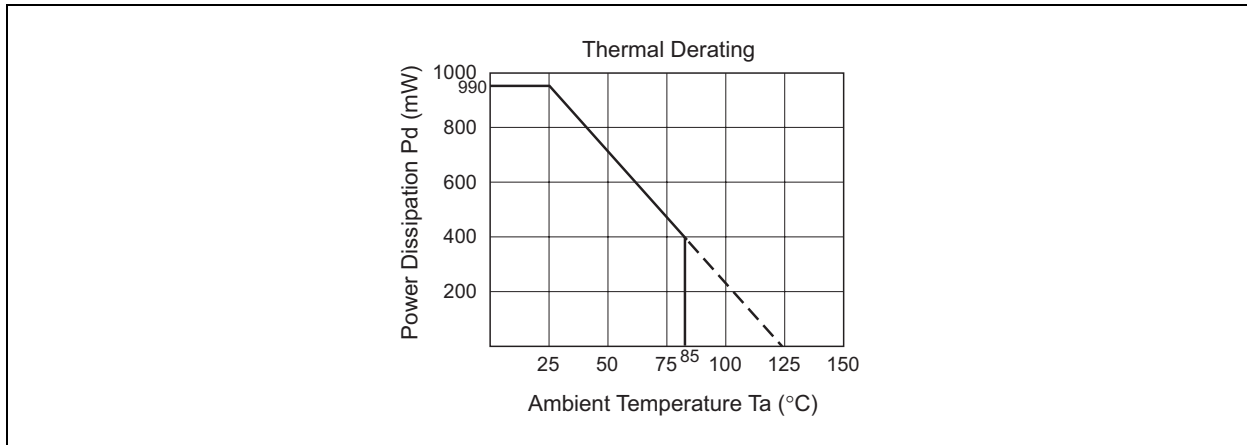


## Pin Description

Pin No.	Symbol	Function
1	REF	IC signal ground. Apply 1/2 V <sub>CC</sub>
2	INA1	Input pin for channel 1 of the input selector switch block
3	INB1	
4	INC1	
5	IND1	
6	SELECT OUT1	
7	VOL IN1	Input pin of the volume block
8	LOUD IN1	Pin for setting the frequency characteristics of the loudness block
9	BASSA1	Pin for setting the frequency characteristics of the tone (Bass) block
10	BASSB1	
11	MID1	R-ladder terminal of tone (Mid)
12	TRE1	R-ladder terminal of tone (Treble)
13	TONE OUT1	Output pin of the tone block
14	FADER IN1	Input pin of the fader volume
15	REAR OUT1	Output pin of the fader volume (Rear)
16	FRONT OUT1	Output pin of the fader volume (Front)
17	GND	Ground
18	N.C.	Non Connection
19	TIM1	Timer setting terminal The relationship between outside parts C and setting time is $T = 13.8 \times 10^4 \cdot C$ (s).
20	DATA	Input pin of the control data This pin inputs data in synchronization with CLOCK
21	N.C.	Non Connection
22	N.C.	Non Connection
23	CLOCK	Clock input pin for serial data transfer
24	N.C.	Non Connection
25	N.C.	Non Connection
26	V <sub>DD</sub>	Digital power supply pin, normally +5 V
27	FRONT OUT2	Output pin of the fader volume (Front)
28	REAR OUT2	Output pin of the fader volume (Rear)
29	FADER IN2	Input pin of the fader volume
30	TONE OUT2	Output pin of the tone block
31	TRE2	R-ladder terminal of tone (Treble)
32	MID2	R-ladder terminal of tone (Mid)
33	BASSB2	Pin for setting the frequency characteristics of the tone (Bass) block
34	BASSA2	
35	LOUD IN2	Pin for setting the frequency characteristics of the loudness block
36	VOL IN2	Input pin of the volume block
37	SELECT OUT2	Output pin of the input selector switch block
38	IND2	Input pin for channel 2 of the input selector switch block
39	INC2	
40	INB2	
41	INA2	
42	V <sub>CC</sub>	

## Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	$V_{CC}, V_{DD}$	10, 7	V	—
Power dissipation	$P_d$	990	mW	$T_a \leq 25^\circ\text{C}$
Thermal derating ratio	$K_\theta$	9.9	mW/ $^\circ\text{C}$	$T_a \geq 25^\circ\text{C}$
Operating temperature	$T_{opr}$	-30 to 85	$^\circ\text{C}$	—
Storage temperature	$T_{stg}$	-55 to 125	$^\circ\text{C}$	—

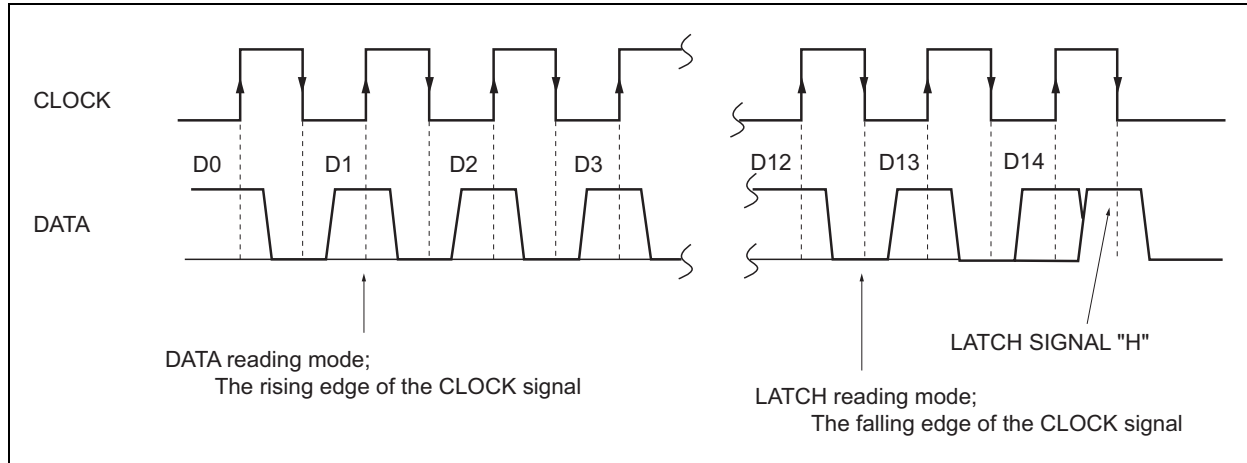


## Electrical Characteristics

$T_a = 25^\circ\text{C}$ ,  $V_{CC} = 8\text{ V}$ ,  $V_{DD} = 5\text{ V}$ , VOL/FADER = 0 dB, TONE/FLAT, Loudness OFF unless otherwise noted

Item	Symbol	Limits			Unit	Test Conditions
		Min	Typ	Max		
Circuit current	$I_{CC}$	—	20	35	mA	No input signal
Pass gain	$G_V$	-3.5	0	3.5	dB	Outside resistor 22 k $\Omega$ of pin 2 to 5, pin 38 ~ 41
Maximum attenuation	$A_{TT}$ (VOL)	-32.5	-30	-27.5	dB	$V_i = 1\text{ V}_{rms}$ , $f = 1\text{ kHz}$ ATT (VOL) = -30 dB
Attenuation error	$\Delta A_{TT}$ (VOL)	-2.5	0	2.5	dB	ATT (VOL) = 0 dB
Maximum input voltage	$V_{IM}$	1.8	2.2	—	V <sub>rms</sub>	$f = 1\text{ kHz}$ , BW: 400 ~ 30 kHz THD = 1%
Bass boost	G (Bass) B	13	16	19	dB	$f = 100\text{ Hz}$
Bass cut	G (Bass) C	-15	-12	-9	dB	$f = 100\text{ Hz}$
MID boost	G (MID) B	9	12	15	dB	$f = 1\text{ kHz}$
MID cut	G (MID) C	-15	-12	-9	dB	$f = 1\text{ kHz}$
Treble boost	G (Tre) B	9	12	15	dB	$f = 10\text{ kHz}$
Treble cut	G (Tre) C	-15	-12	-9	dB	$f = 10\text{ kHz}$
Maximum attenuation	$A_{TT}$ (FED)	—	-90	-80	dB	$V_i = 1\text{ V}_{rms}$ , $f = 1\text{ kHz}$ ATT (FED) = $-\infty$ dB
Maximum output voltage	$V_{OM}$	1.8	2.2	—	V <sub>rms</sub>	$f = 1\text{ kHz}$ , BW: 400 to 30 kHz THD = 1%
Output noise voltage	$V_{no1}$	—	10	18	$\mu\text{V}_{rms}$	$R_g = 0$ , DIN-AUDIO
	$V_{no2}$	—	3	8		ATT (VOL) = -30 dB ATT (FED) = $-\infty$ dB $R_g = 0$ , DIN-AUDIO
Total harmonic distortion	THD	—	0.01	0.05	%	$f = 1\text{ kHz}$ , $V_o = 0.5\text{ V}_{rms}$ BW: 400 Hz to 30 kHz
Channel separation	CS	—	-90	-80	dB	$f = 1\text{ kHz}$
Cross talk of input selector	CT	—	-75	-65	dB	$f = 1\text{ kHz}$
Voltage gain of loudness	G (LOUD) L	7.0	11.0	15.0	dB	Loudness ON $f = 100\text{ Hz}$ , ATT (VOL) = -30 dB
	G (LOUD) H	3.5	6.5	9.5		Loudness ON $f = 10\text{ kHz}$ , ATT (VOL) = -30 dB

## Relationship between Data and Clock



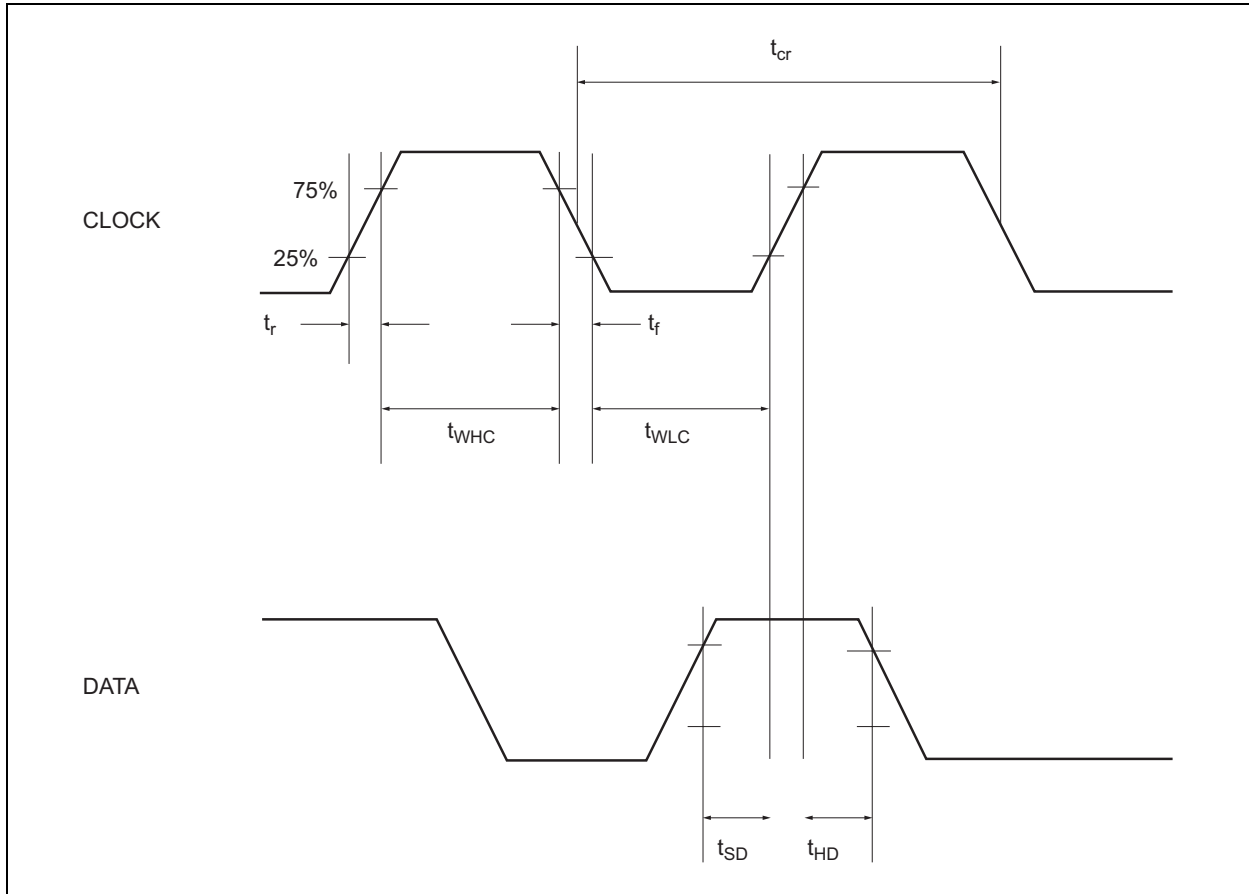
## Digital Circuit DC Characteristics

Item	Symbol	Limits			Unit	Test Conditions	
		Min	Typ	Max			
"L" level input voltage	$V_{IL}$	0	~	$0.2 V_{DD}$	V	DATA, CLOCK pins	
"H" level input voltage	$V_{IH}$	$0.8 V_{DD}$	~	$V_{DD}$			
"L" level input current	$I_{iL}$	-10	—	10	$\mu A$	$V_I = 0$	DATA, CLOCK pins
"H" level input current	$I_{iH}$	—	—	10		$V_I = V_{DD}$	

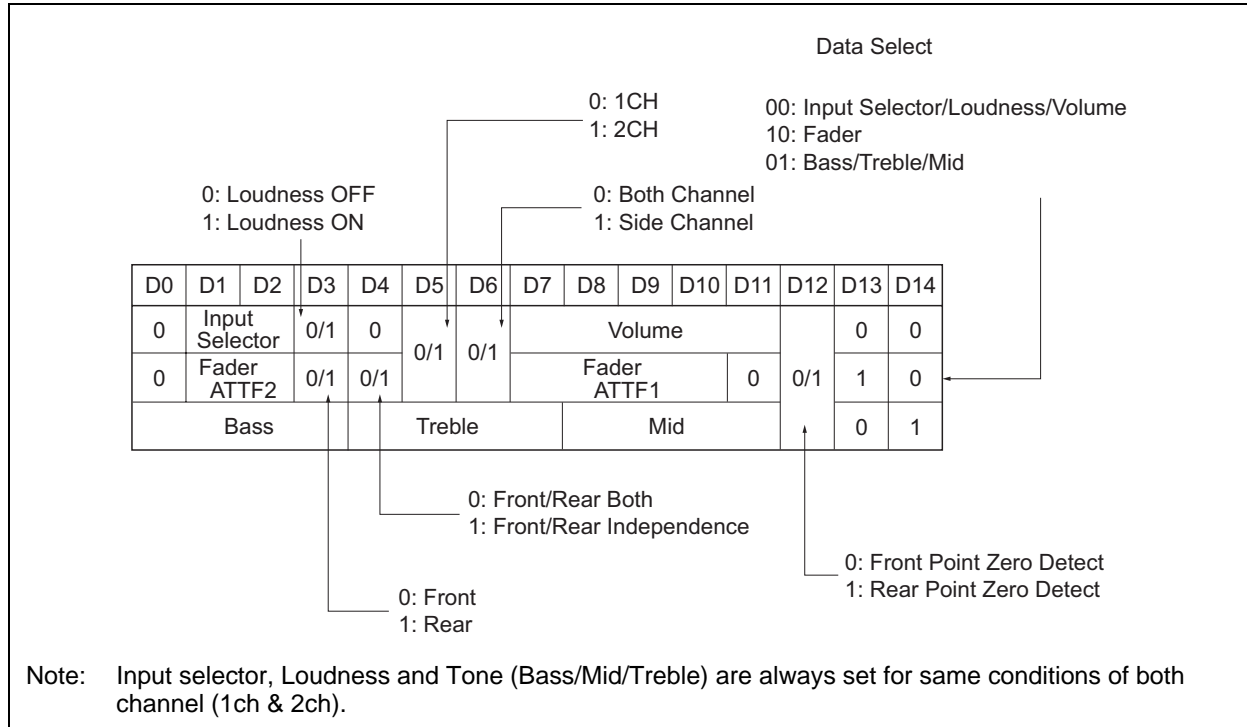
## Digital Circuit AC Characteristics

Item	Symbol	Limits			Unit
		Min	Typ	Max	
CLOCK cycle time	$t_{cr}$	4	—	—	$\mu s$
CLOCK pulse width ("H" level)	$t_{whc}$	1.6	—	—	
CLOCK pulse width ("L" level)	$t_{wlc}$	1.6	—	—	
CLOCK rise time	$t_r$	—	—	0.4	
CLOCK fall time	$t_f$	—	—	0.4	
DATA setup time	$t_{SD}$	0.8	—	—	
DATA hold time	$t_{HD}$	0.8	—	—	

## Clock Data Timing



## Data Input Format



## Volume Code

ATT V1	D7	D8	D9
0 dB	1	0	1
-4 dB	0	0	1
-8 dB	1	1	0
-12 dB	0	1	0
-16 dB	1	0	0
-20 dB	0	0	0
-24 dB	0	1	1
-28 dB	1	1	1

ATT V2	D10	D11
0 dB	1	1
-1 dB	0	1
-2 dB	1	0
-3 dB	0	0

## Fader Code

ATT F1	D7	D8	D9	D10
0 dB	1	0	0	1
-8 dB	1	1	1	0
-16 dB	0	1	1	0
-24 dB	1	0	1	0
-32 dB	0	0	1	0
-40 dB	1	1	0	0
-48 dB	0	1	0	0
-56 dB	1	0	0	0
-∞ dB	0	0	0	0

ATT F2	D1	D2
0 dB	1	1
-2 dB	0	1
-4 dB	1	0
-6 dB	0	0



## Tone Code

Bass	D0	D1	D2	D3
16 dB	0	0	0	1
14 dB	1	1	1	0
12 dB	0	1	1	0
10 dB	1	0	1	0
8 dB	0	0	1	0
6 dB	1	1	0	0
4 dB	0	1	0	0
2 dB	1	0	0	0
0 dB	0	0	0	0
-2 dB	1	0	0	1
-4 dB	0	1	0	1
-6 dB	1	1	0	1
-8 dB	0	0	1	1
-10 dB	1	0	1	1
-12 dB	0	1	1	1

Treble	D4	D5	D6	D7
12 dB	0	1	1	0
10 dB	1	0	1	0
8 dB	0	0	1	0
6 dB	1	1	0	0
4 dB	0	1	0	0
2 dB	1	0	0	0
0 dB	0	0	0	0
-2 dB	1	0	0	1
-4 dB	0	1	0	1
-6 dB	1	1	0	1
-8 dB	0	0	1	1
-10 dB	1	0	1	1
-12 dB	0	1	1	1

Mid	D8	D9	D10	D11
12 dB	0	1	1	0
10 dB	1	0	1	0
8 dB	0	0	1	0
6 dB	1	1	0	0
4 dB	0	1	0	0
2 dB	1	0	0	0
0 dB	0	0	0	0
-2 dB	1	0	0	1
-4 dB	0	1	0	1
-6 dB	1	1	0	1
-8 dB	0	0	1	1
-10 dB	1	0	1	1
-12 dB	0	1	1	1

## Input Selector

Input Selector	D1	D2
D (5, 38 pin)	1	1
C (4, 39 pin)	1	0
B (3, 40 pin)	0	1
A (2, 41 pin)	0	0

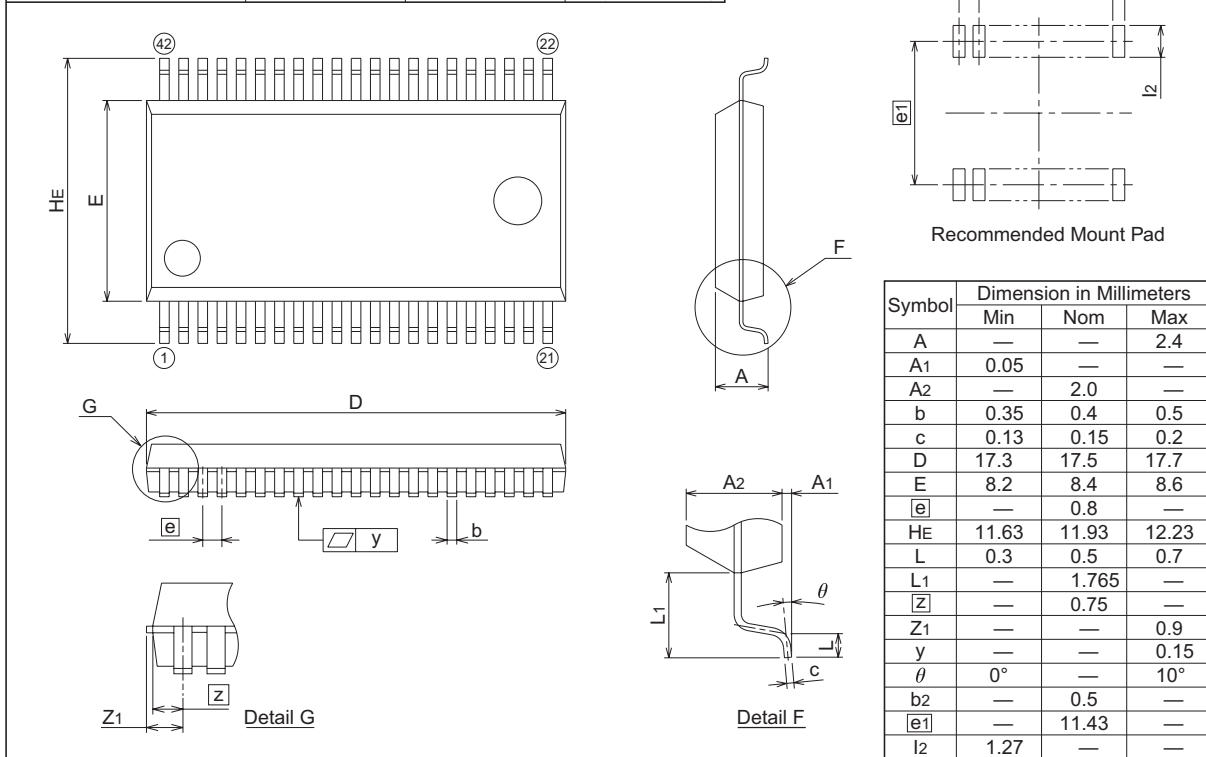
Package Dimensions

42P2R-A

(MMP)

Plastic 42pin 450mil SSOP

EIAJ Package Code	JEDEC Code	Weight(g)	Lead Material
SSOP42-P-450-0.80	—	0.63	Alloy 42/Cu Alloy



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