

**PRELIMINARY**  
 Notice : This is not a final specification.  
 some parametric limits are subject to change.

# M62440FP

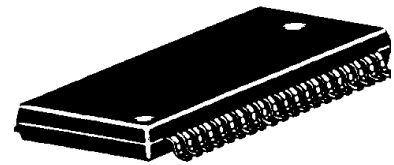
## ELECTRIC VOLUME CONTROL WITH TONE CONTROLLER FOR 4-SPEAKER APPLICATIONS

### 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



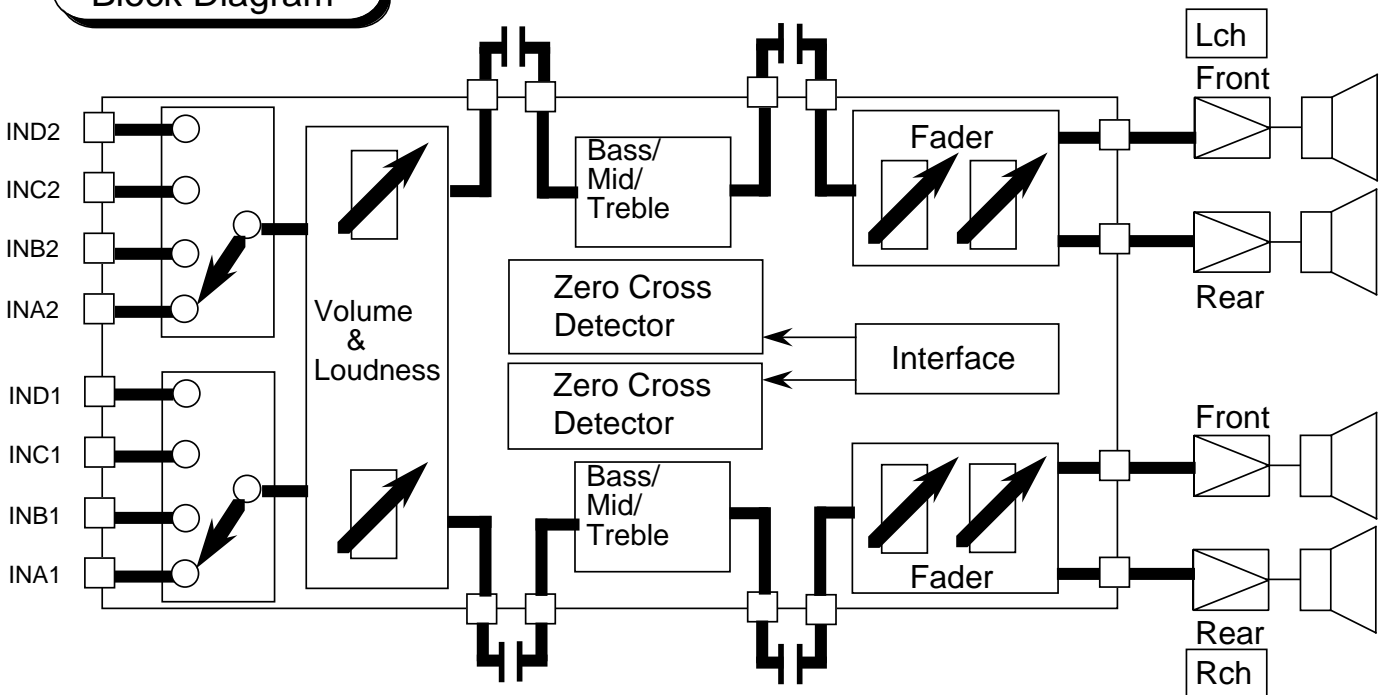
Outline 42P2R

### Recommended Operating Conditions

Supply voltage range.....Vcc=6 ~ 9V  
 VDD=4 ~ 6V

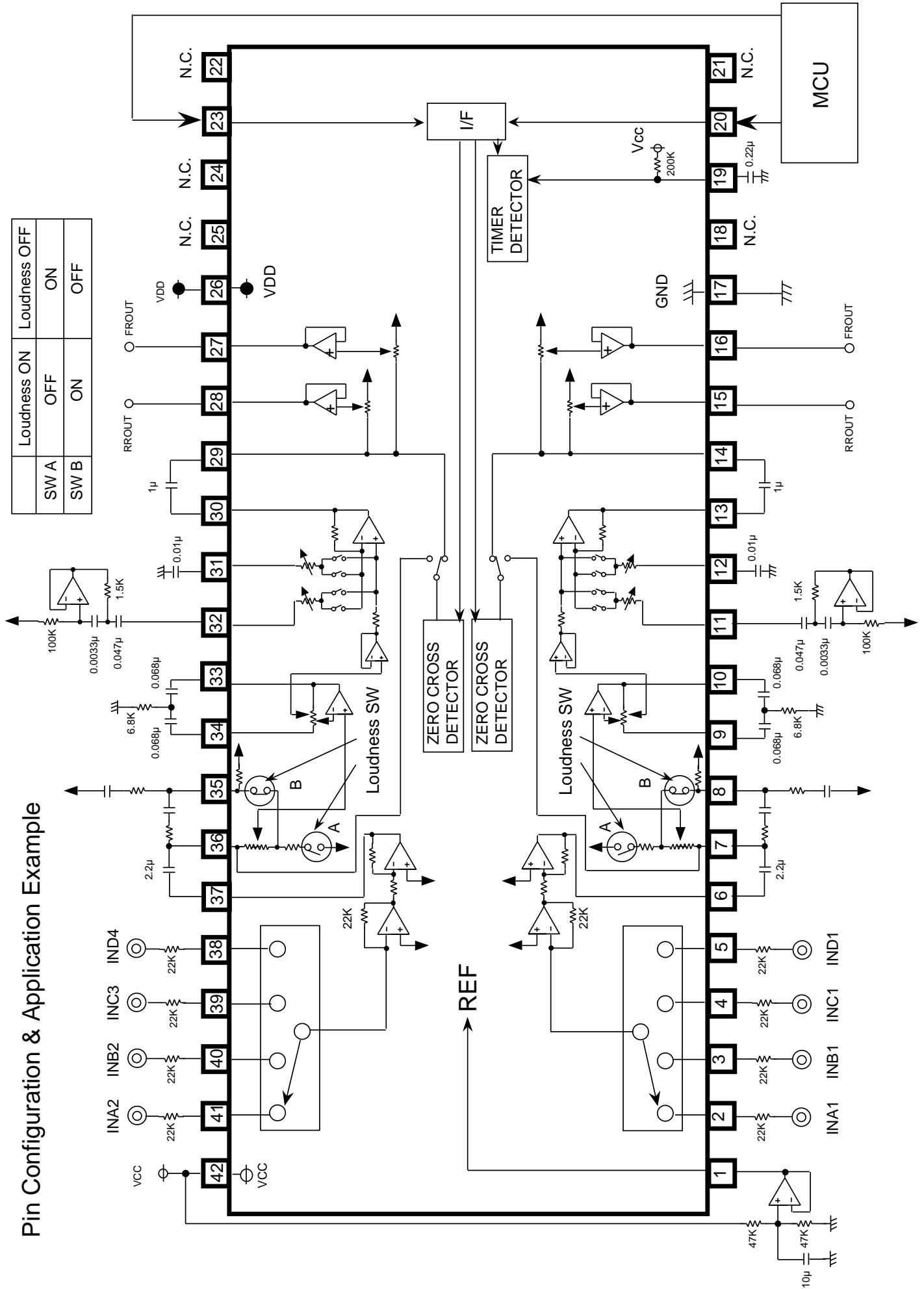
Rated supply voltage.....Vcc=8V  
 VDD=5V

### Block Diagram



# Pin Configuration & Application Example

	Loudness ON	Loudness OFF
SW A	OFF	ON
SW B	ON	OFF



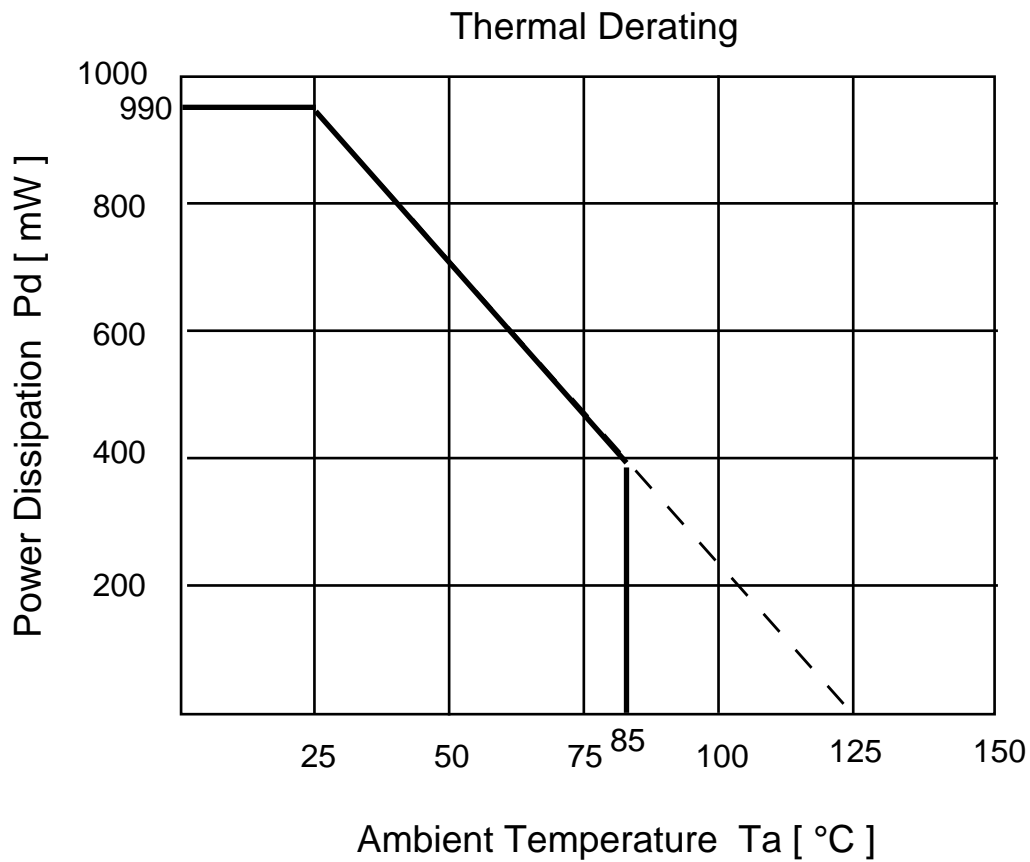
## Pin Description

Pin No.	Symbol	Function
1	REF	IC signal ground. Apply 1/2 Vcc
2	INA1	Input pin for channel 1 of the input selector switch block
3	INB1	
4	INC1	
5	IND1	
6	SELECT OUT1	Output pin of the input selector switch block
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 $T=13.8 \times 10^4 \cdot C(\text{sec})$ .
20	DATA	Input pin of the control data This pin inputs data in synchronization with CLOCK
21	N.C.	Non Connection

Pin No.	Symbol	Function
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 +5V
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>	Analog power supply pin

## Absolute Maximum Ratings

Symbol	Parameter	Conditions	Ratings	Unit
$V_{CC}, V_{DD}$	Supply Voltage		10 , 7	V
$P_d$	Power Dissipation	$T_a$ 25	990	mW
$K_{\theta}$	Thermal Derating Ratio	$T_a$ 25	9.9	mW/°C
$T_{opr}$	Operating Temperature		-30 ~ 85	°C
$T_{stg}$	Storage Temperature		-55 ~ 125	°C

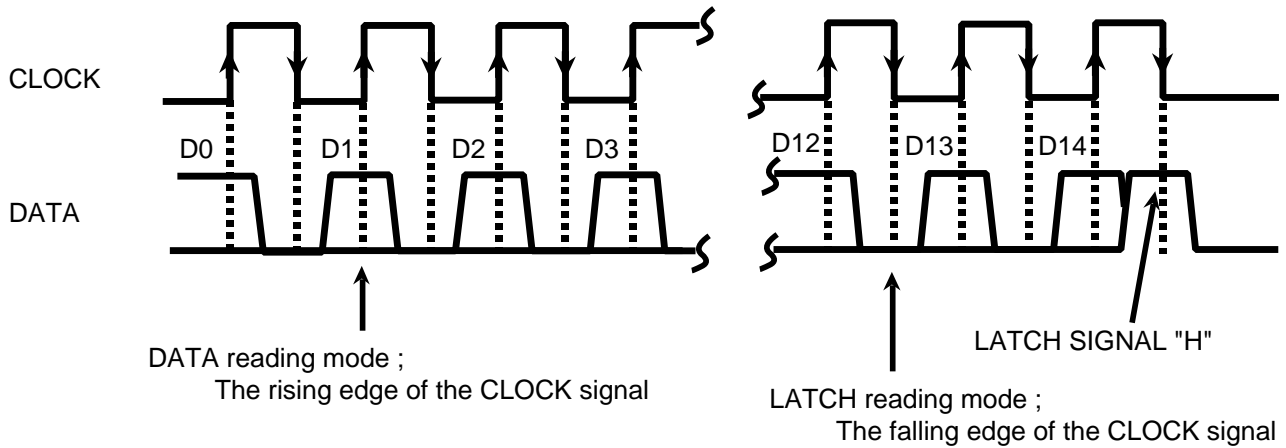


## Electrical Characteristics

Ta=25°C, Vcc=8V, VDD=5V, VOL/FADER=0dB, TONE/FLAT, Loudness OFF unless otherwise noted

Symbol	Parameter	Test Conditions	Limits			Unit
			Min	typ	Max	
Icc	Circuit current	No input signal	—	20	35	mA
Gv	Pass Gain	Outside resistor 22K of pin 2~5, pin 38~41	-3.5	0	3.5	dB
ATT(VOL)	Maximum Attenuation	Vi=1Vrms, f=1KHz ATT(VOL)=-30dB	-32.5	-30	-27.5	dB
ATT(VOL)	Attenuation Error	ATT(VOL)= 0dB	-2.5	0	2.5	dB
VIM	Maximum Input Voltage	f=1KHz, BW:400~30KHz THD=1%	1.8	2.2	—	Vrms
G(Bass)B	Bass Boost	f=100Hz	13	16	19	dB
G(Bass)C	Bass Cut	f=100Hz	-15	-12	-9	dB
G(MID)B	MID Boost	f=1KHz	9	12	15	dB
G(MID)C	MID Cut	f=1KHz	-15	-12	-9	dB
G(Tre)B	Treble Boost	f=10KHz	9	12	15	dB
G(Tre)C	Treble Cut	f=10KHz	-15	-12	-9	dB
A TT(FED)	Maximum Attenuation	Vi=1Vrms, f=1KHz ATT(FED)= - dB	—	-90	-80	dB
VOM	Maximum Output Voltage	f=1KHz, BW:400~30KHz THD=1%	1.8	2.2	—	Vrms
Vno 1	Output Noise Voltage	Rg=0, DIN-AUDIO	—	10	18	μVrms
Vno 2		ATT(VOL)= -30dB ATT(FED)= - dB Rg=0, DIN-AUDIO	—	3	8	
THD	Total Harmonic Distortion	f=1KHz, Vo=0.5Vrms BW:400Hz~30KHz	—	0.01	0.05	%
CS	Channel Separation	f=1KHz	—	-90	-80	dB
CT	Cross Talk of Input Selector	f=1KHz	—	-75	-65	dB
G(LOUD)L	Voltage Gain of Loudness	Loudness ON f=100Hz, ATT(VOL)=-30dB	7.0	11.0	15.0	dB
G(LOUD)H		Loudness ON f=10KHz, ATT(VOL)=-30dB	3.5	6.5	9.5	

## RELATIONSHIP BETWEEN DATA AND CLOCK



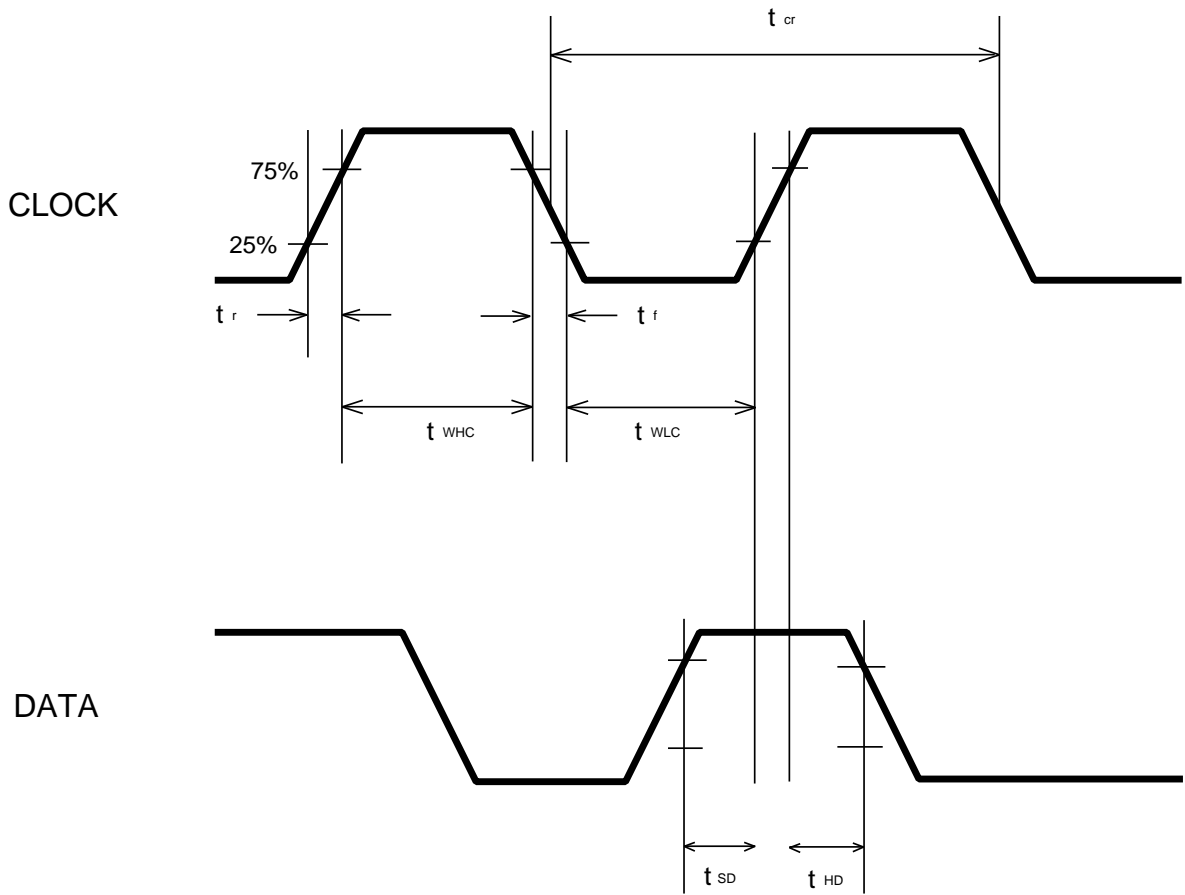
## DIGITAL CIRCUIT DC CHARACTERISTICS

Symbol	Parameter	Test conditions	Limits			Unit	
			Min	typ	Max		
$V_{IL}$	"L" level input voltage	DATA, CLOCK pins	0	~	$0.2V_{DD}$	V	
$V_{IH}$	"H" level input voltage		$0.8V_{DD}$	~	$V_{DD}$		
$I_{IL}$	"L" level input current	$V_i = 0$	DATA, CLOCK pins	-10	-	10	$\mu A$
$I_{IH}$	"H" level input current	$V_i = V_{DD}$		-	-	10	

## DIGITAL CIRCUIT AC CHARACTERISTICS

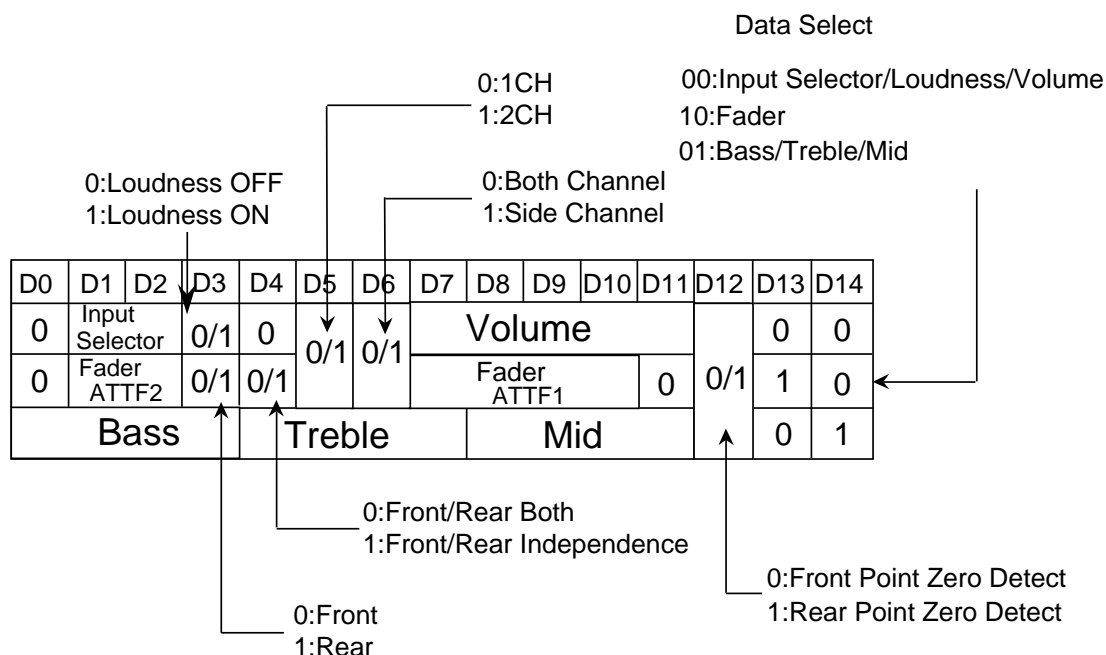
Symbol	Parameter	Limits			Unit
		Min	typ	Max	
$f_{cr}$	CLOCK Cycle time	4	-	-	$\mu S$
$f_{whc}$	CLOCK pulse width ("H" level)	1.6	-	-	
$f_{wlc}$	CLOCK pulse width ("L" level)	1.6	-	-	
$f_r$	CLOCK rise time	-	-	0.4	
$f_f$	CLOCK fall time	-	-	0.4	
$f_{sd}$	DATA setup time	0.8	-	-	
$f_{hd}$	DATA hold time	0.8	-	-	

# CLOCK DATA TIMING





## Data Input Format



\*Input selector, Loudness and Tone(Bass/Mid/Treble) are always set for same conditions of both channel(1ch & 2ch).

## Volume Code

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

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

## Fader Code

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

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

## Tone Code

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

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

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

## Input Selector

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