M62490FP

Electric Volume Control with Tone Controller for 4-Speaker Applications

REJ03F0213-0200
Rev.2.00
Sep 14, 2006

Description

- Developed for car audio
- Uses it for analog small signal handling of stage before power amplifier
- Use to Home audio system, television are thought about other than car audio system

Features

- Built-in zero cross detector prevents click noise
- Differential Amplifier
- Loudness
- Tone Control Bass/Mid/Treble
- Master Volume/Fader Volume
- Serial Data Control

Recommended Operating Conditions

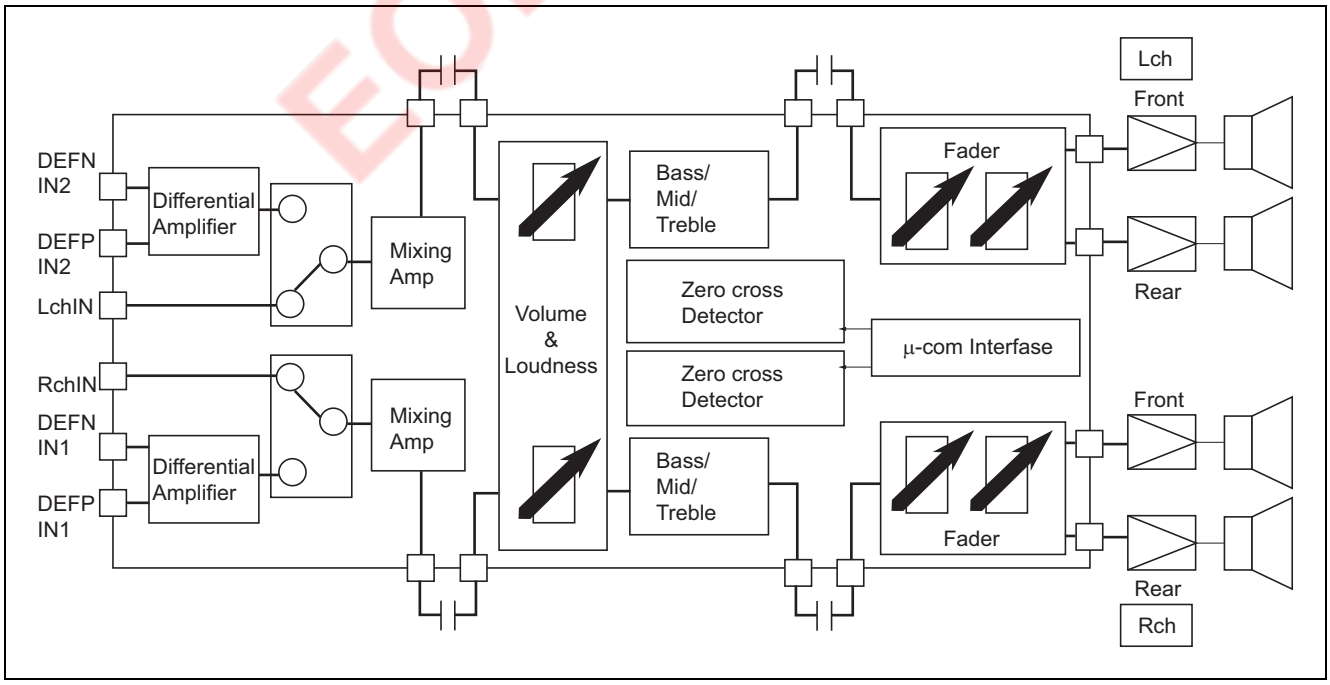
Supply voltage range: V_{CC} = 6 to 9 V

V_{DD} = 4 to 6 V

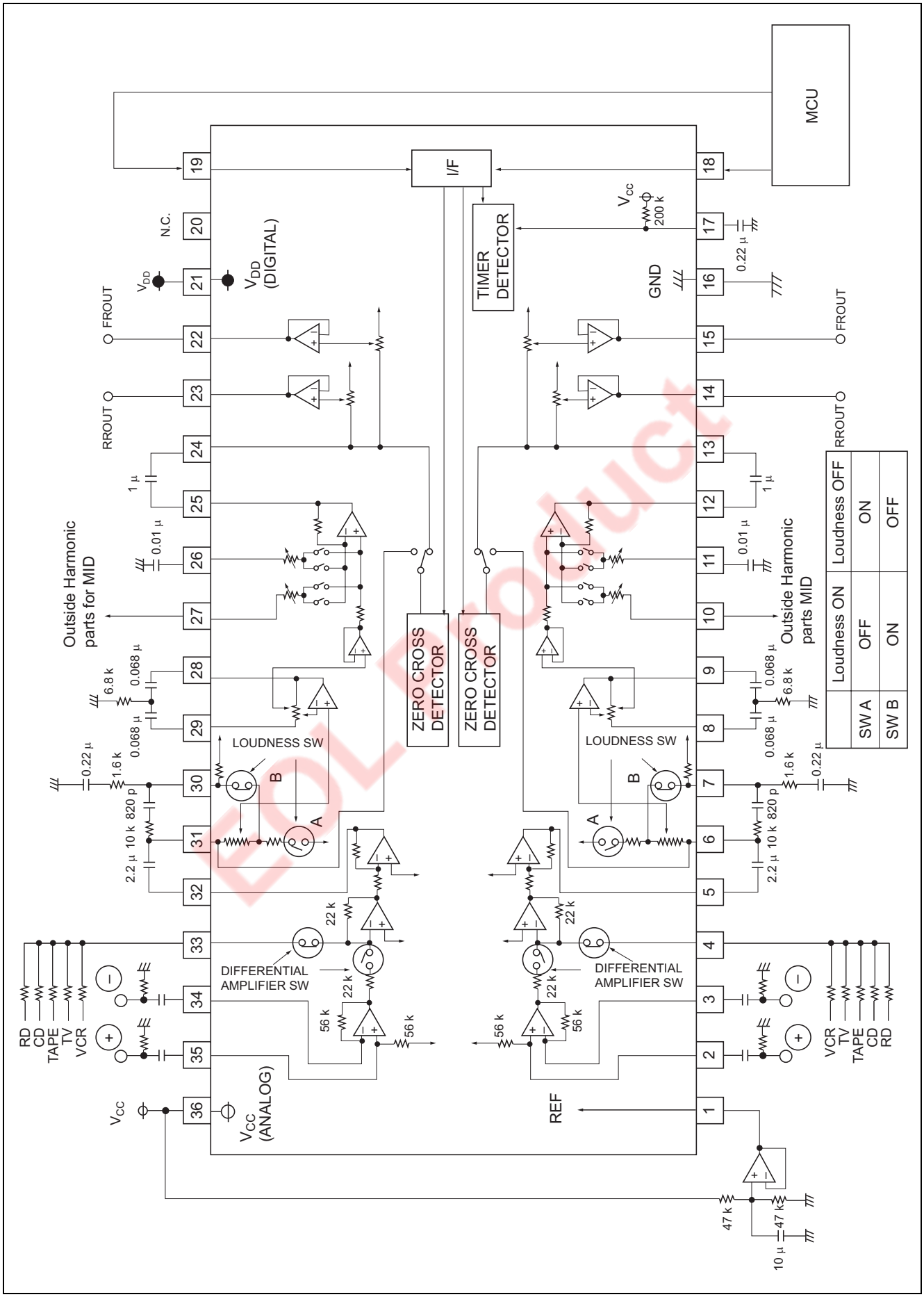
Rated supply voltage: V_{CC} = 8 V

V_{DD} = 5 V

Block Diagram



Pin Configuration and Application Example

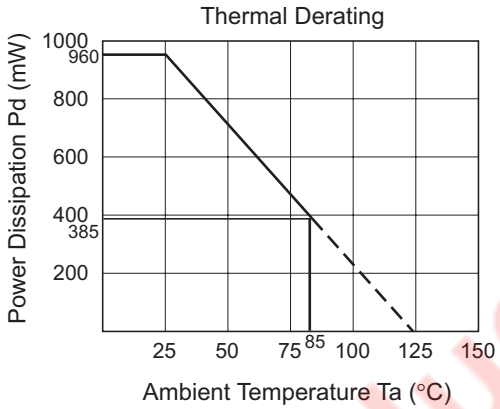


Pin Description

Pin No.	Symbol	Function
1	REF	IC signal ground. Apply 1/2 V_{CC}
2	DEFP IN1	Differential amplifier input +
3	DEFN IN1	Differential amplifier input –
4	MIX IN1	Mixing amplifier input –
5	MIX OUT1	Mixing amplifier input +
6	VOL IN1	Input pin of the volume block
7	LOUD IN1	Pin for setting the frequency characteristics of the loudness block
8	BASSA1	Pin for setting the frequency characteristics of the tone (Bass) block
9	BASSB1	
10	MID1	R-ladder terminal of tone (Mid)
11	TRE1	R-ladder terminal of tone (Treble)
12	TONE OUT1	Output pin of the tone block
13	FADER IN1	Input pin of the fader volume
14	REAR OUT1	Output pin of the fader volume (Rear)
15	FRONT OUT1	Output pin of the fader volume (Front)
16	GND	Ground
17	TIM1	Timer setting terminal The relationship between outside parts C and setting time is $T = 13.8 \times 10^4 \bullet C$ (s).
18	DATA	Input pin of the control data This pin inputs data in synchronization with CLOCK
19	CLOCK	Clock input pin for serial data transfer
20	N.C.	Non Connection
21	V_{DD}	Digital power supply pin, normally +5 V
22	FRONT OUT2	Output pin of the fader volume (Front)
23	REAR OUT2	Output pin of the fader volume (Rear)
24	FADER IN2	Input pin of the fader volume
25	TONE OUT2	Output pin of the tone block
26	TRE2	R-ladder terminal of tone (Treble)
27	MID2	R-ladder terminal of tone (Mid)
28	BASSB2	Pin for setting the frequency characteristics of the tone (Bass) block
29	BASSA2	
30	LOUD IN2	Pin for setting the frequency characteristics of the loudness block
31	VOL IN2	Input pin of the volume block
32	MIX OUT2	Mixing amplifier output
33	MIX IN2	Mixing amplifier input
34	DEFN IN2	Differential amplifier input –
35	DEFP IN2	Differential amplifier input +
36	V_{CC}	Analog power supply pin

Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	V_{CC}, V_{DD}	10, 7	V	
Power dissipation	Pd	990	mW	Ta ≤ 25°C
Thermal derating ratio	Kθ	9.9	mW/°C	Ta ≥ 25°C
Operating temperature	Topr	–30 to 85	°C	
Storage temperature	Tstg	–55 to 125	°C	

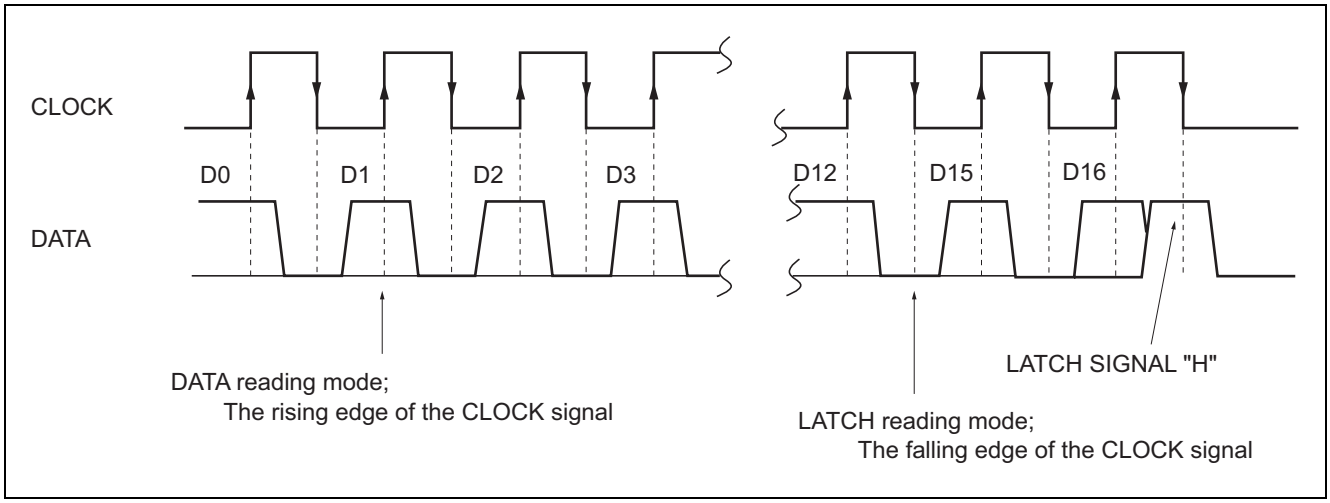


Electrical Characteristics

Ta = 25°C, V_{CC} = 8 V, V_{DD} = 5 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	Gv	–3.5	0	3.5	dB	Outside resister 22 kΩ of pin 4, 33 Outside resister 56 kΩ of pin 2, 3, 34, 35
Maximum attenuation	A_{TT} (VOL)	–32.5	–30	–27.5	dB	Vi = 1 Vrms, f = 1 kHz ATT (VOL) = –30 dB
Attenuation error	ΔA_{TT} (VOL)	–2.5	0	2.5	dB	ATT (VOL) = 0 dB
Maximum input voltage	V_{IM}	1.8	2.2	—	Vrms	f = 1 kHz, BW: 400 Hz to 30 kHz THD = 1%
Bass boost	G (Bass) B	13	16	19	dB	f = 100 Hz
Bass cut	G (Bass) C	–15	–12	–9	dB	f = 100 Hz
MID boost	G (MID) B	9	12	15	dB	f = 1 kHz (Outside harmonic amplifier)
MID cut	G (MID) C	–15	–12	–9	dB	f = 1 kHz (Outside harmonic amplifier)
Treble boost	G (Tre) B	9	12	15	dB	f = 10 kHz
Treble cut	G (Tre) C	–15	–12	–9	dB	f = 10 kHz
Maximum attenuation	A_{TT} (FED)	—	–90	–80	dB	Vi = 1 Vrms, f = 1 kHz ATT (FED) = –∞ dB
Maximum output voltage	V_{OM}	1.8	2.2	—	Vrms	f = 1 kHz, BW: 400 Hz to 30 kHz THD = 1%
Output noise voltage	$V_{no}1$	—	10	18	μVrms	Rg = 0, DIN-AUDIO
	$V_{no}2$	—	3	8		ATT (VOL) = –30 dB ATT (FED) = –∞ dB Rg = 0, DIN-AUDIO
Total harmonic distortion	THD	—	0.03	0.05	%	f = 1 kHz, Vo = 0.5 Vrms BW: 400 Hz to 30 kHz
Channel separation	CS	—	–90	–80	dB	f = 1 kHz
Cross talk of differential amplifier SW	CT	—	–75	–65	dB	f = 1 kHz
Voltage gain of loudness	G (LOUD) L	7.0	11.0	15.0	dB	Loudness ON f = 100 Hz, ATT (VOL) = –30 dB
	G (LOUD) H	3.5	6.5	9.5		Loudness ON f = 10 kHz, ATT (VOL) = –30 dB

Relationship between Data and Clock



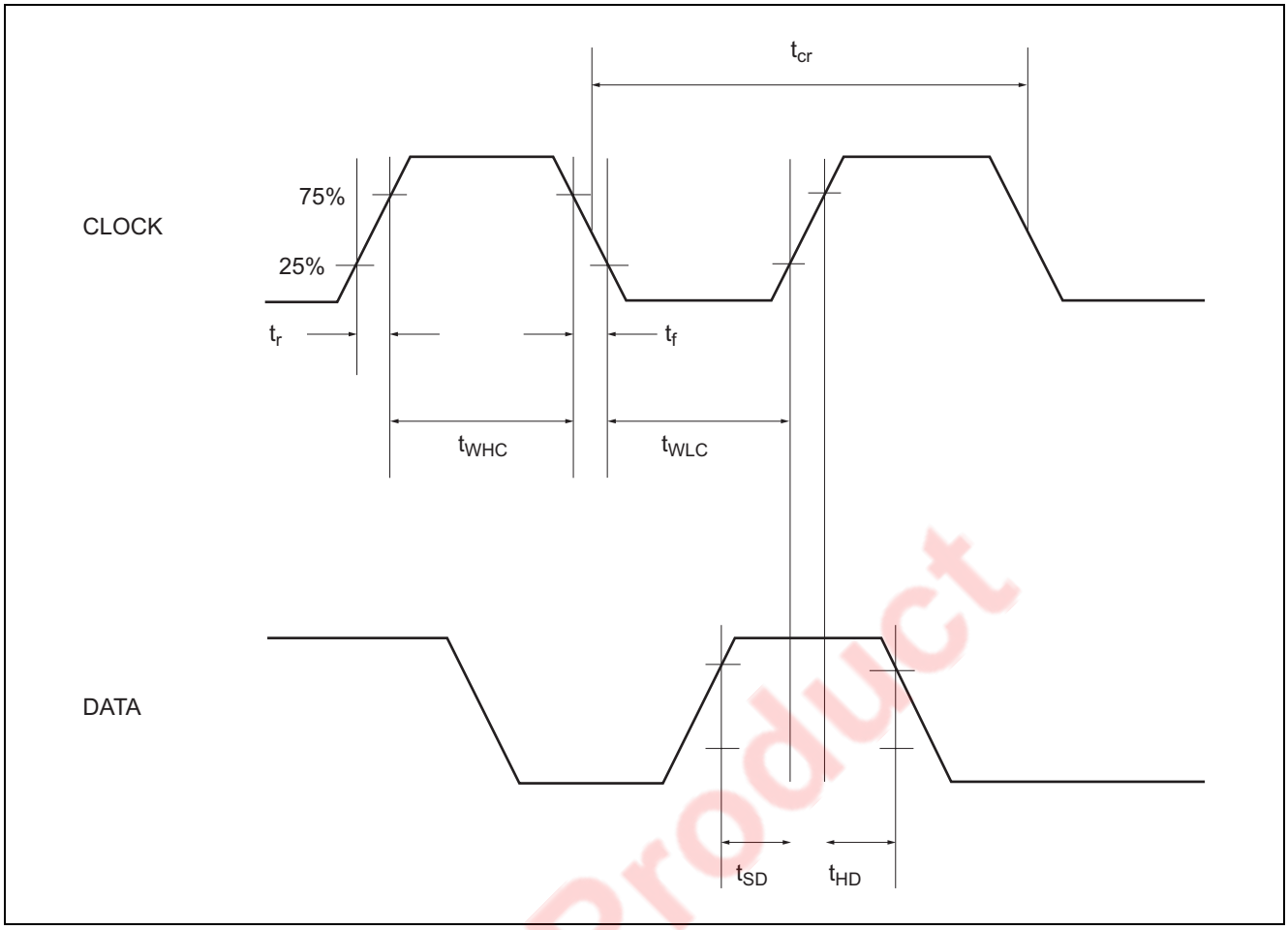
Digital Circuit DC Characteristics

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	µA	V_I = 0	DATA, CLOCK pins
"H" level input current	I_{IH}	—	—	10		V_I = V_{DD}	

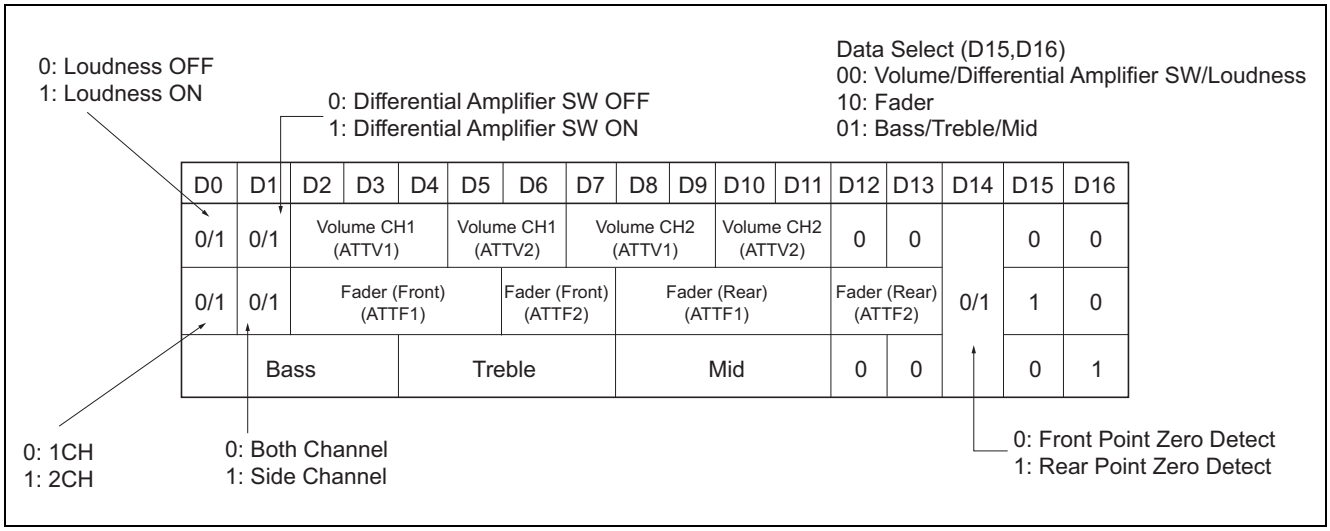
Digital Circuit AC Characteristics

Item	Symbol	Limits			Unit
		Min	Typ	Max	
CLOCK cycle time	t_{cr}	4	—	—	µs
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

ATTV1	CH1 / CH2	D2 / D7	D3 / D8	D4 / 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

ATTV2	CH1 / CH2	D5 / D10	D6 / D11
0 dB		1	1
–1 dB		0	1
–2 dB		1	0
–3 dB		0	0

Fader Code

ATTF1	FRONT / REAR	D2 / D8	D3 / D9	D4 / D10	D5 / D11
0 dB		1	0	0	1
–2 dB		0	0	0	1
–4 dB		0	1	0	1
–6 dB		1	1	0	1
–8 dB		1	1	1	0
–10 dB		0	0	1	1
–12 dB		1	0	1	1
–14 dB		0	1	1	1
–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

ATTF2	FRONT / REAR	D6 / D12	D7 / D13
0 dB		1	1
–2 dB		0	1
–4 dB		1	0
–6 dB		0	0

(Please keep ATTF2 to 0 dB when you set fader code from 0 dB to –16 dB)

Tone Code

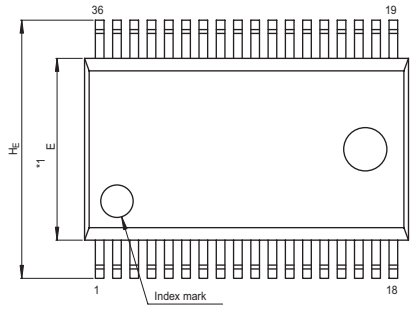
Bass	D0	D1	D2	D3
16 dB	0	0	0	1
14 dB	1	1	1	0
12 dB	0	1	1	0
10 dB	1	0	1	0
8 dB	0	0	1	0
6 dB	1	1	0	0
4 dB	0	1	0	0
2 dB	1	0	0	0
0 dB	0	0	0	0
–2 dB	1	0	0	1
–4 dB	0	1	0	1
–6 dB	1	1	0	1
–8 dB	0	0	1	1
–10 dB	1	0	1	1
–12 dB	0	1	1	1

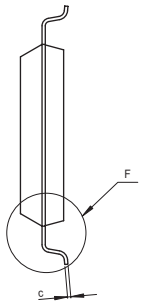
Treble	D4	D5	D6	D7
12 dB	0	1	1	0
10 dB	1	0	1	0
8 dB	0	0	1	0
6 dB	1	1	0	0
4 dB	0	1	0	0
2 dB	1	0	0	0
0 dB	0	0	0	0
–2 dB	1	0	0	1
–4 dB	0	1	0	1
–6 dB	1	1	0	1
–8 dB	0	0	1	1
–10 dB	1	0	1	1
–12 dB	0	1	1	1

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

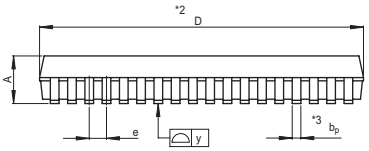
Package Dimensions

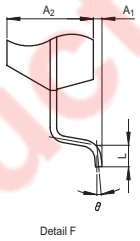
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SSOP36-8.4x15-0.80	PRSP0036GA-A	36P2R-A	0.5g





NOTE)
1. DIMENSIONS "*1" AND "*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION "*3" DOES NOT INCLUDE TRIM OFFSET.





Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	14.8	15.0	15.2
E	8.2	8.4	8.6
A_2	—	2.0	—
A	—	—	2.4
A_1	0.05	—	—
b_p	0.35	0.4	0.5
c	0.13	0.15	0.2
θ	0°	—	10°
H_E	11.63	11.93	12.23
e	0.65	0.8	0.95
y	—	—	0.15
L	0.3	0.5	0.7

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