

# M61545AFP

## Serial Data Control Dual Electronic Volume

REJ03F0162-0200  
 Rev.2.0  
 Dec 21, 2005

### Description

The M61545AFP is a dual channel electronic volume controlled with 2-wire serial data. The built-in reference and power regulator circuitries allow operation of an electronic volume with less external parts. M61545AFP is able to cater for large supply voltage range of 4.5 to 15.0V.

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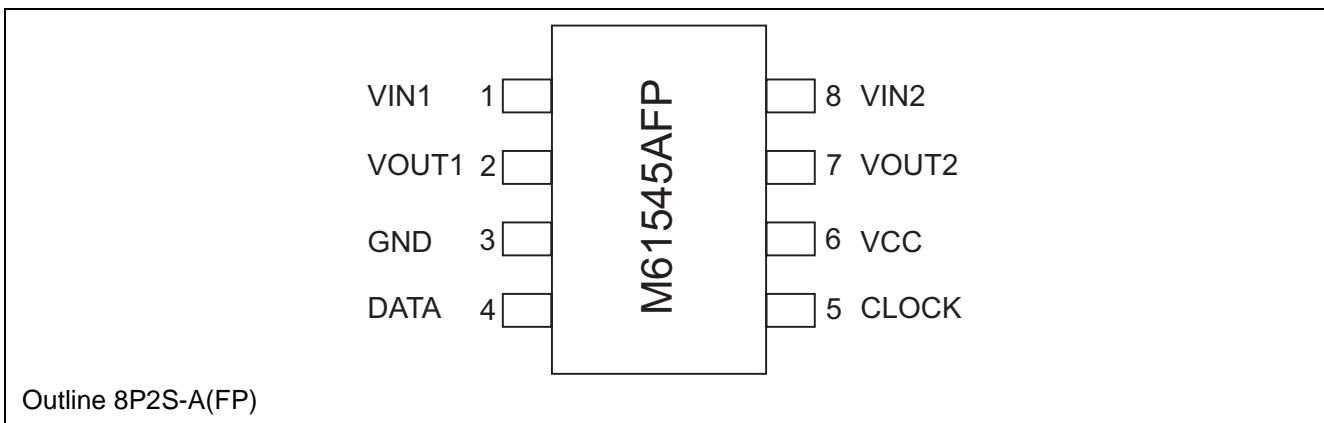
### Features

- Electronic volume      0 to -95dB/ 1-dB step, -∞dB  
                                          2-ch independent controllable electronic volume
- Low distortion            THD = 0.002% typ.  
                                           $V_{no} = 5.0\mu V_{rms}$  typ. (ATT = -∞, JIS-A network)
- Supply voltage range    Single power supply:  $V_{cc} = 4.5$  to 15V (regulated)  
                                          Supply to both digital & analog circuitries
- Serial data interface    2-wire type
- Package                    8 pin SOP/ 8 pin DIP
- Process                    0.5 $\mu$  BIC-DMOS
- Reference circuit        Built-in

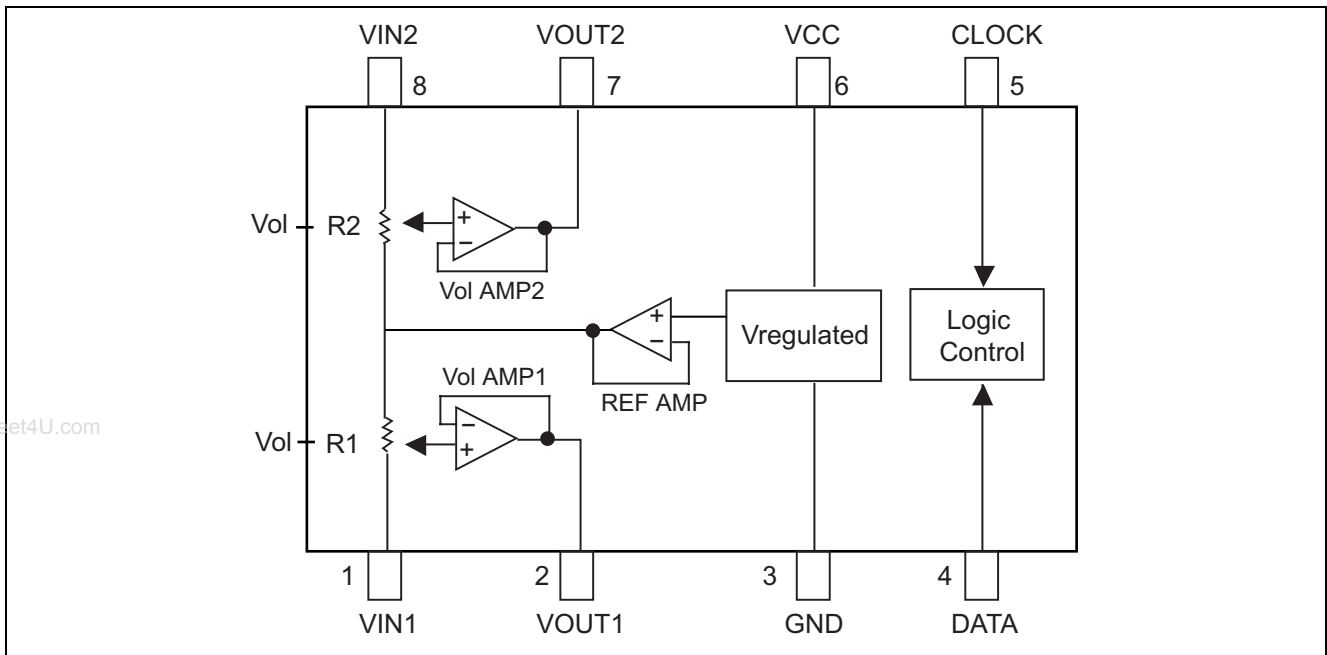
### Recommended Operating Condition

- Supply voltage range:  $V_{cc} = 4.5$  to 15.0V

### Pin Configuration



## IC Internal Block Diagram



## Pin Description

Pin	Symbol	Function
1	VIN1	1-ch input pin
2	VOUT1	1-ch output pin
3	GND	Ground pin
4	DATA	Control data input pin. Inputs data in synchronization with clock
5	CLOCK	Clock input pin for transferring serial data
6	VCC	Power supply pin. Stabilize the pin with decoupling capacitor
7	VOUT2	2-ch output pin
8	VIN2	2-ch input pin

## Absolute Maximum Ratings

Parameter	Symbol	Ratings	Units
Supply voltage	Vcc, Vdd	16.0	V
Power dissipation	Pd	385 <sup>*1</sup>	mW
Operating temperature	Topr	-40 to +85	°C
Storage temperature	Tstg	-55 to +125	°C

Note: \*1. These are the allowable values up to  $T_a = 31^\circ\text{C}$  mounting on 30% wiring density glass epoxy board.  
Derate by 7.14mW/°C above that temperature.

## Electrical Characteristics

(V<sub>CC</sub> = 14.0V, T<sub>a</sub> = 25°C, unless stated otherwise)

Parameter	Symbol	Limits			Unit	Test Conditions
		Min	Typ	Max		
Circuit current	I <sub>CC</sub>		8	10	mA	
Maximum attenuation	A <sub>TT</sub>	—	-90	-80	dB	A <sub>TT</sub> = -∞
Attenuation error	ΔA <sub>TT</sub>	-2.0	0	2.0	dB	A <sub>TT</sub> = 0dB
Maximum input voltage	V <sub>IM</sub>	—	5.4	—	V <sub>rms</sub>	THD = 1%, A <sub>TT</sub> = -6dB
Maximum output voltage	V <sub>OM</sub>	3.8	4.2	—	V <sub>rms</sub>	THD = 1%, A <sub>TT</sub> = 0dB
Output noise voltage	V <sub>NO1</sub>	—	1.5	5.0	μV <sub>rms</sub>	A <sub>TT</sub> = 0dB, R <sub>g</sub> = 0, JIS-A
	V <sub>NO2</sub>	—	7.0	12.0	μV <sub>rms</sub>	A <sub>TT</sub> = -∞, R <sub>g</sub> = 0, JIS-A
Total harmonic distortion	THD	—	0.002	0.009	%	F = 1kHz, V <sub>o</sub> = 0.5V <sub>rms</sub> , A <sub>TT</sub> = 0dB
Channel separation	CS	—	-80	-70	dB	F = 1kHz, JIS-A, A <sub>TT</sub> = 0dB

## Electrical Characteristics

(V<sub>CC</sub> = 10.0V, T<sub>a</sub> = 25°C, unless stated otherwise)

Parameter	Symbol	Limits			Unit	Test Conditions
		Min	Typ	Max		
Circuit current	I <sub>CC</sub>		NA	10	mA	
Maximum attenuation	A <sub>TT</sub>	—	-90	-80	dB	A <sub>TT</sub> = -∞
Attenuation error	ΔA <sub>TT</sub>	-2.0	0	2.0	dB	A <sub>TT</sub> = 0dB
Maximum input voltage	V <sub>IM</sub>	—	4.0	—	V <sub>rms</sub>	THD = 1%, A <sub>TT</sub> = -6dB
Maximum output voltage	V <sub>OM</sub>	2.4	2.9	—	V <sub>rms</sub>	THD = 1%, A <sub>TT</sub> = 0dB
Output noise voltage	V <sub>NO1</sub>	—	1.5	5.0	μV <sub>rms</sub>	A <sub>TT</sub> = 0dB, R <sub>g</sub> = 0, JIS-A
	V <sub>NO2</sub>	—	6.0	12.0	μV <sub>rms</sub>	A <sub>TT</sub> = -∞, R <sub>g</sub> = 0, JIS-A
Total harmonic distortion	THD	—	0.002	0.009	%	F = 1kHz, V <sub>o</sub> = 0.5V <sub>rms</sub> , A <sub>TT</sub> = 0dB
Channel separation	CS	—	-80	-70	dB	F = 1kHz, JIS-A, A <sub>TT</sub> = 0dB

## Electrical Characteristics

(V<sub>CC</sub> = 7.0V, T<sub>a</sub> = 25°C, unless stated otherwise)

Parameter	Symbol	Limits			Unit	Test Conditions
		Min	Typ	Max		
Circuit current	I <sub>CC</sub>		NA	10	mA	
Maximum attenuation	A <sub>TT</sub>	—	-90	-80	dB	A <sub>TT</sub> = -∞
Attenuation error	ΔA <sub>TT</sub>	-2.0	0	2.0	dB	A <sub>TT</sub> = 0dB
Maximum input voltage	V <sub>IM</sub>	—	2.9	—	V <sub>rms</sub>	THD = 1%, A <sub>TT</sub> = -6dB
Maximum output voltage	V <sub>OM</sub>	1.3	1.8	—	V <sub>rms</sub>	THD = 1%, A <sub>TT</sub> = 0dB
Output noise voltage	V <sub>NO1</sub>	—	1.5	5.0	μV <sub>rms</sub>	A <sub>TT</sub> = 0dB, R <sub>g</sub> = 0, JIS-A
	V <sub>NO2</sub>	—	5.0	12.0	μV <sub>rms</sub>	A <sub>TT</sub> = -∞, R <sub>g</sub> = 0, JIS-A
Total harmonic distortion	THD	—	0.002	0.009	%	F = 1kHz, V <sub>o</sub> = 0.5V <sub>rms</sub> , A <sub>TT</sub> = 0dB
Channel separation	CS	—	-80	-70	dB	F = 1kHz, JIS-A, A <sub>TT</sub> = 0dB

## Electrical Characteristics

( $V_{CC} = 5.0V$ ,  $T_a = 25^\circ C$ , unless stated otherwise)

Parameter	Symbol	Limits			Unit	Test Conditions
		Min	Typ	Max		
Circuit current	$I_{CC}$		NA	10	mA	
Maximum attenuation	$A_{TT}$	—	-90	-80	dB	$A_{TT} = -\infty$
Attenuation error	$\Delta A_{TT}$	-2.0	0	2.0	dB	$A_{TT} = 0dB$
Maximum input voltage	$V_{IM}$	—	2.0	—	V <sub>rms</sub>	THD = 1%, $A_{TT} = -6dB$
Maximum output voltage	$V_{OM}$	0.5	1.1	—	V <sub>rms</sub>	THD = 1%, $A_{TT} = 0dB$
Output noise voltage	$V_{NO1}$	—	1.5	5.0	$\mu V_{rms}$	$A_{TT} = 0dB$ , $R_g = 0$ , JIS-A
	$V_{NO2}$	—	5.0	12.0	$\mu V_{rms}$	$A_{TT} = -\infty$ , $R_g = 0$ , JIS-A
Total harmonic distortion	THD	—	0.01	0.05	%	$F = 1kHz$ , $V_o = 0.1V_{rms}$ , $A_{TT} = 0dB$
Channel separation	CS	—	-80	-70	dB	$F = 1kHz$ , JIS-A, $A_{TT} = 0dB$

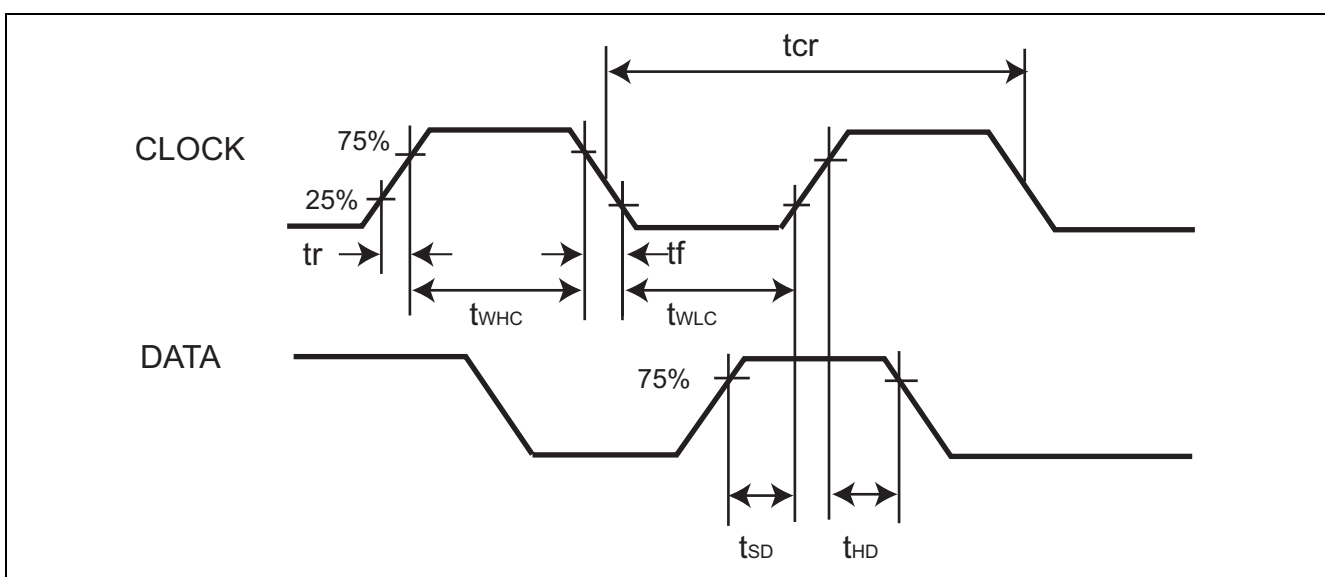
## DC Characteristics of Digital Block

Parameter	Symbol	Limits			Unit	Test Conditions
		Min	Typ	Max		
"L" level input voltage	$V_{IL}$	0	—	0.6	V	Data, clock pin
"H" level input voltage	$V_{IH}$	2.2	—	—	V	
"L" level input current	$I_{IL}$	-10	—	10	$\mu A$	$V_i = 0$ , Data, clock pin
"H" level input current	$I_{IH}$	—	—	10	$\mu A$	

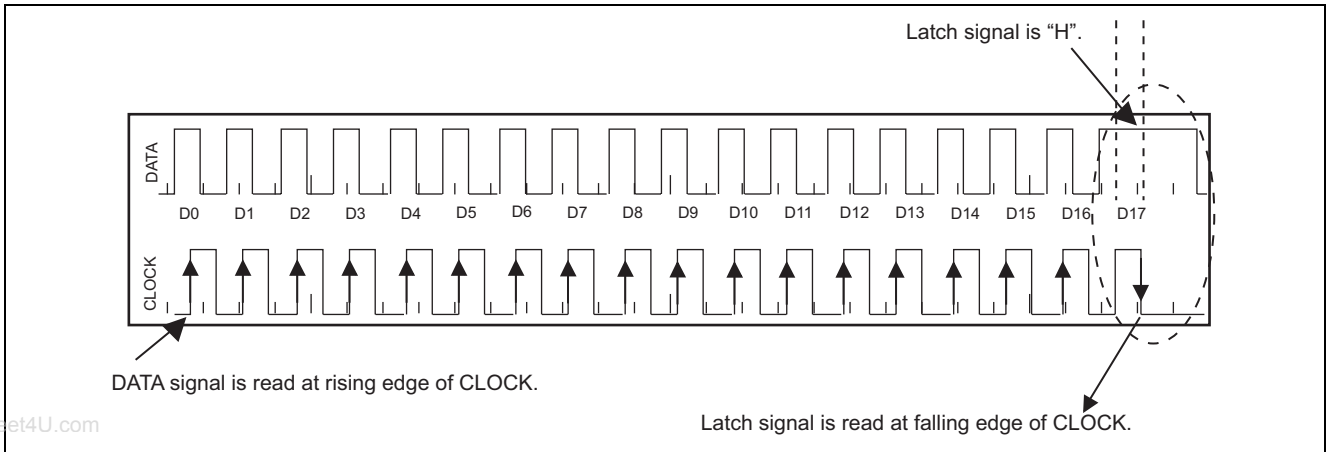
## AC Characteristics of Digital Block

Parameter	Symbol	Limits			Unit
		Min	Typ	Max	
CLOCK cycle time	$t_{cr}$	4	—	—	$\mu sec$
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	—	—	

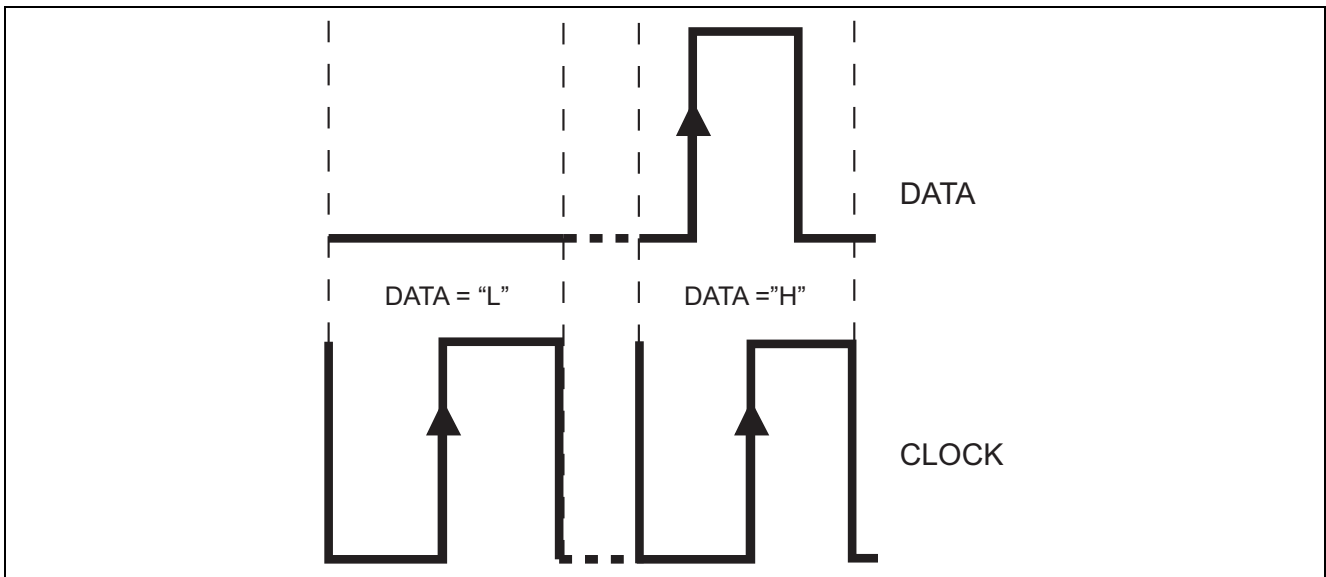
## Clock and Data Timings (Recommended Conditions)



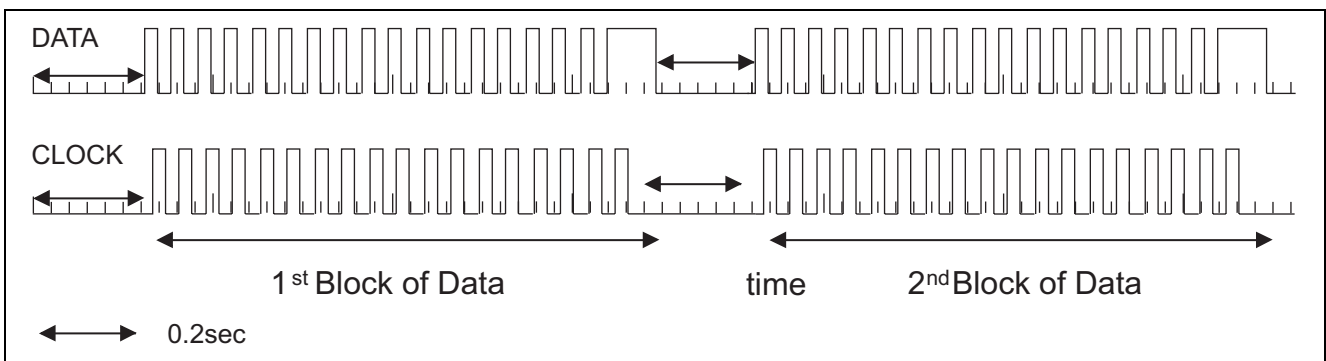
### Relationship Between Data, Clock



### Data Format for "H" & "L"



For initialization, 2 blocks of identical 18-bit data need to be sent. The 2 blocks of data would set the operation condition for M61545AFP. This shown in figure below,



There should be a delay of 0.2 second before the first block of Clock and Data appear. The interval between the 1st Block of data and the 2nd Block should be 0.2 second as well. This sequence is to ensure proper operation of M61545AFP due to the wide dynamic voltage range, which M61545AFP is made to cater for.

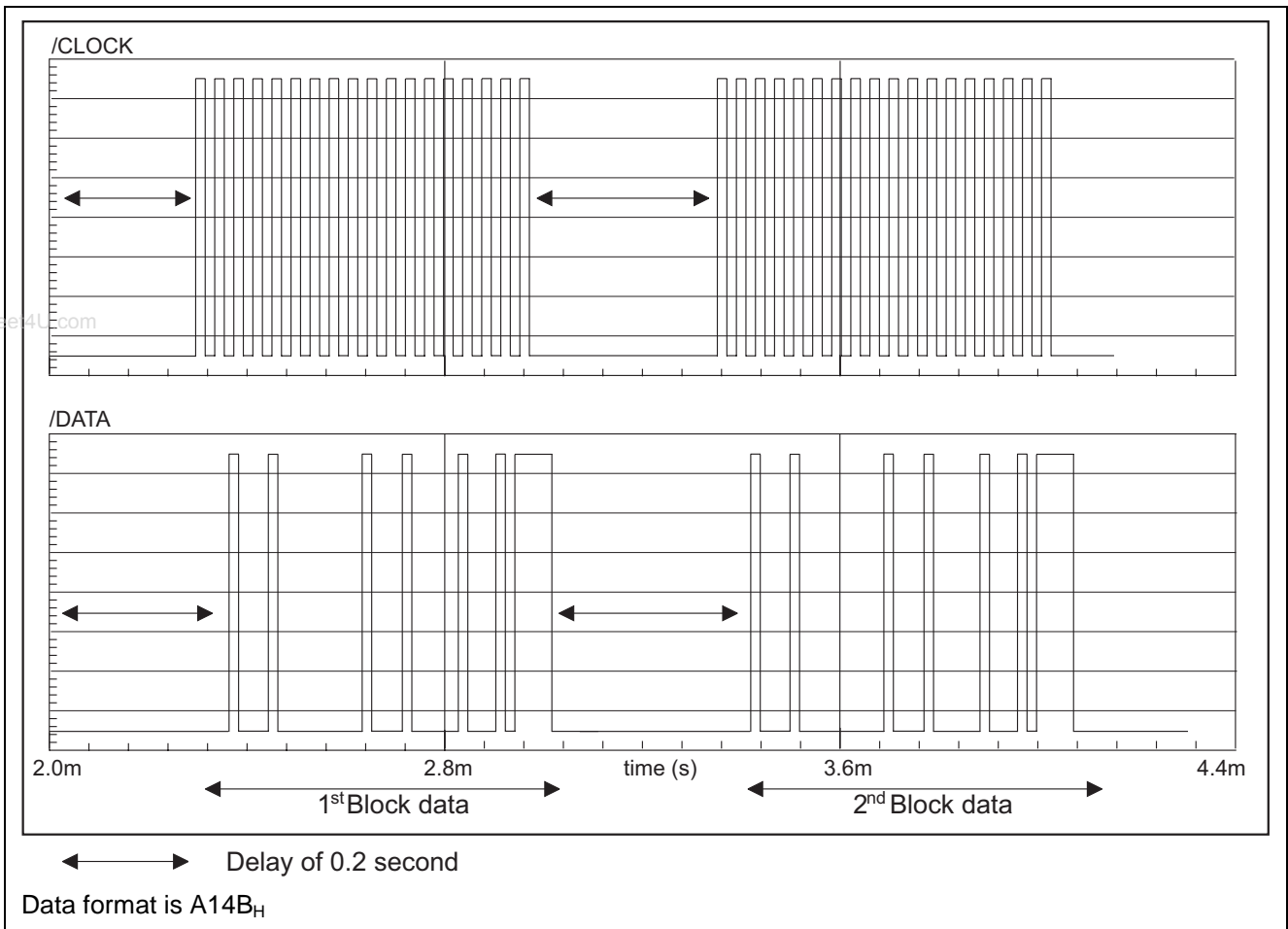
This format of initialization needs to be done once only during every powering up of M61545AFP.

It recommends to use external mute switch together because it might generate the shock noise during this initial setup timing.

### Initialization Examples

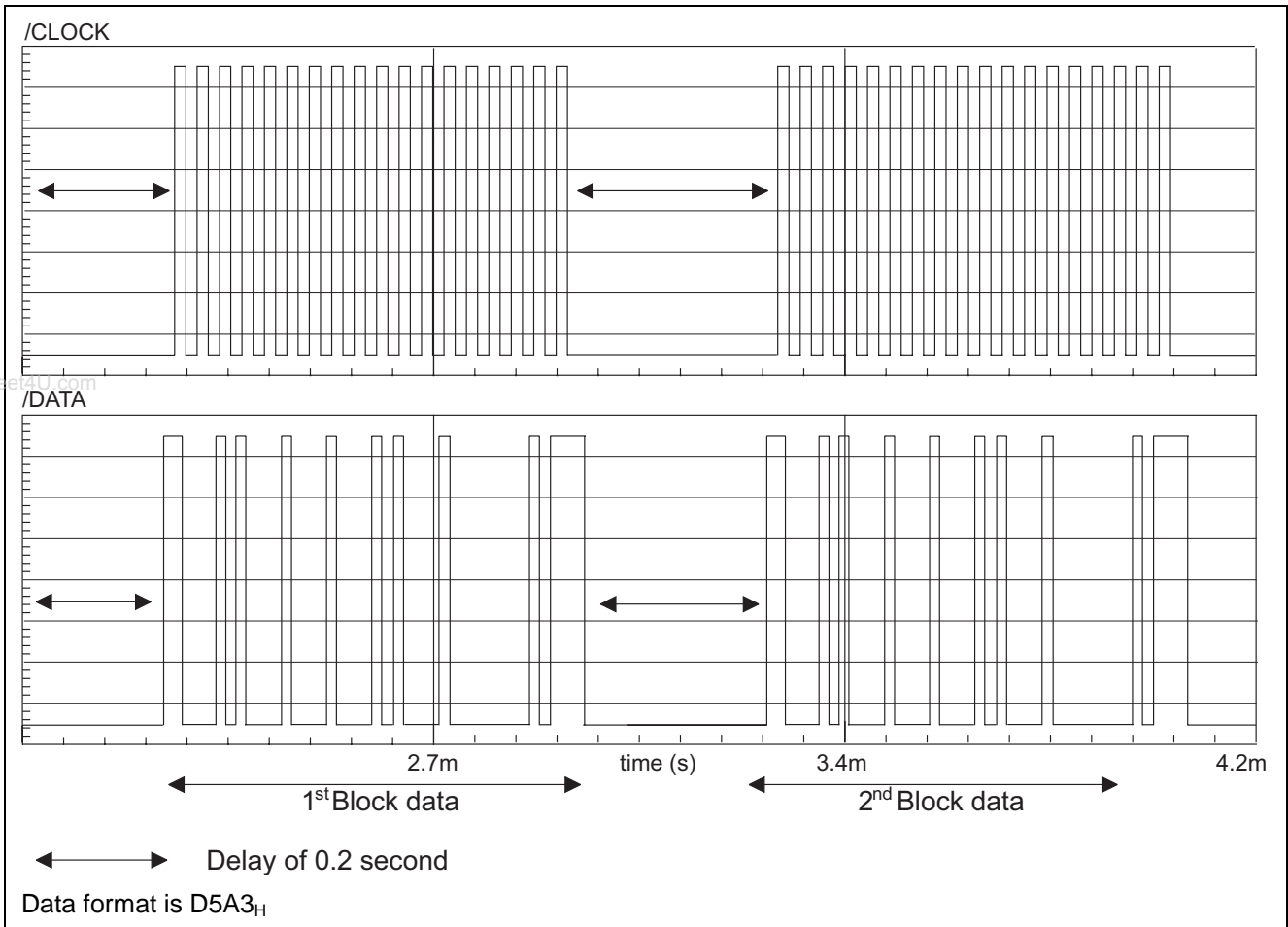
**Example 1:**

Setting supply of 9.0 to 12.0 V, and attenuation of -20dB (please refer to page 7 for data format)



**Example 2:**

Setting supply of 4.5V to 6.0V, and attenuation of -90dB (please refer to data format below)



**Data Input Format**

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17
Left Channel							Right Channel							DC Switch	1	1	

**DC Switch**

Supply Voltage (V)	D14	D15
12.0 to 15.0	1	1
9.0 to 12.0	1	0
6.0 to 9.0	0	1
4.5 to 6.0	0	0

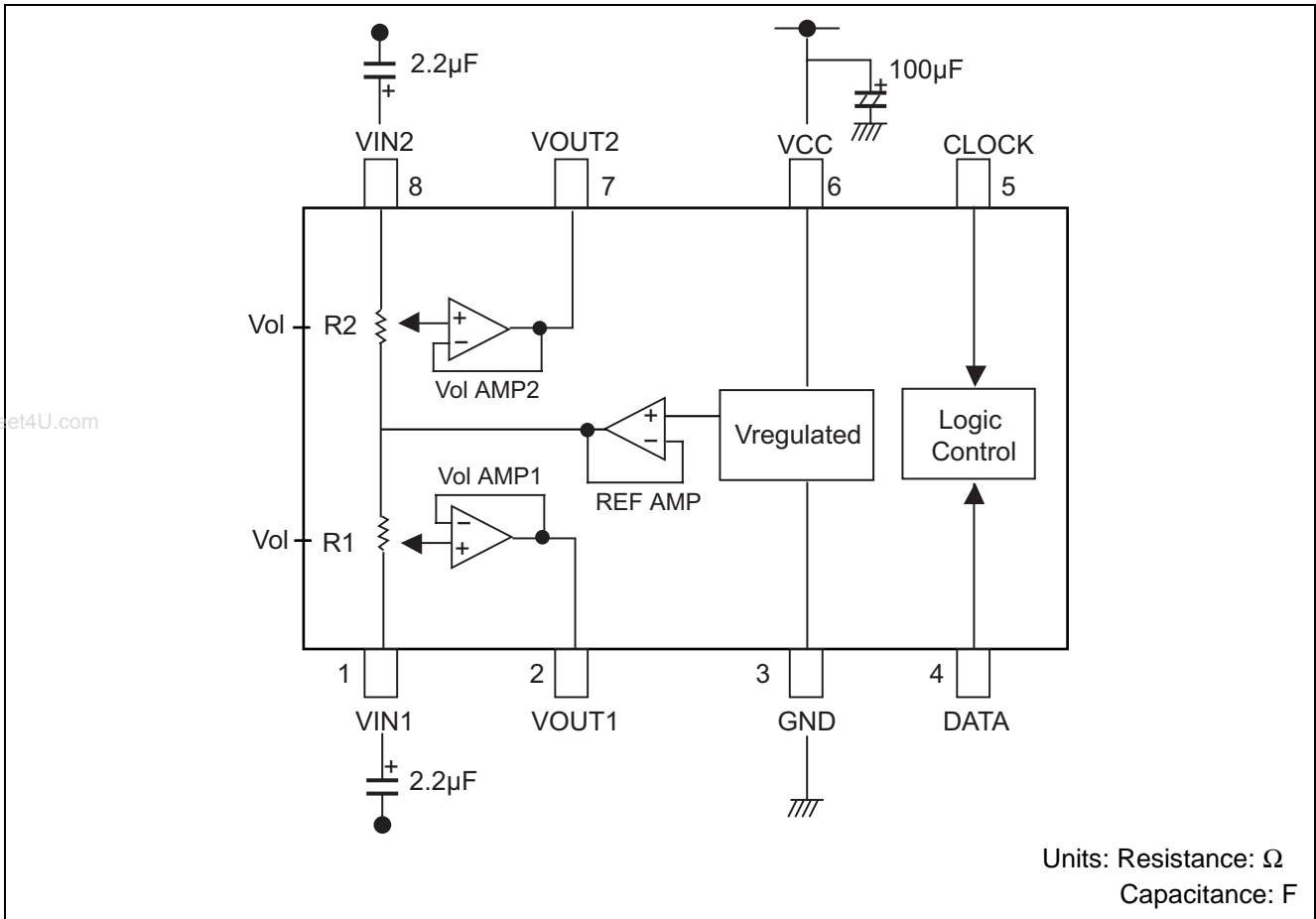
## Volume Code

ATT	D0	D1	D2	D3	D4	D5	D6	← Left Channel	← Right Channel
	D7	D8	D9	D10	D11	D12	D13		
0	L	L	L	L	L	L	L		
-1	L	L	L	L	L	L	H		
-2	L	L	L	L	L	H	L		
-3	L	L	L	L	L	H	H		
-4	L	L	L	L	H	L	L		
-5	L	L	L	L	H	L	H		
-6	L	L	L	L	H	H	L		
-7	L	L	L	L	H	H	H		
-8	L	L	L	H	L	L	L		
-9	L	L	L	H	L	L	H		
-10	L	L	L	H	L	H	L		
-11	L	L	L	H	L	H	H		
-12	L	L	L	H	H	L	L		
-13	L	L	L	H	H	L	H		
-14	L	L	L	H	H	H	L		
-15	L	L	L	H	H	H	H		
-16	L	L	H	L	L	L	L		
-17	L	L	H	L	L	L	H		
-18	L	L	H	L	L	H	L		
-19	L	L	H	L	L	H	H		
-20	L	L	H	L	H	L	L		
-21	L	L	H	L	H	L	H		
-22	L	L	H	L	H	H	L		
-23	L	L	H	L	H	H	H		
-24	L	L	H	H	L	L	L		
-25	L	L	H	H	L	L	H		
-26	L	L	H	H	L	H	L		
-27	L	L	H	H	L	H	H		
-28	L	L	H	H	H	L	L		
-29	L	L	H	H	H	L	H		
-30	L	L	H	H	H	H	L		
-31	L	L	H	H	H	H	H		
-32	L	H	L	L	L	L	L		
-33	L	H	L	L	L	L	H		
-34	L	H	L	L	L	H	L		
-35	L	H	L	L	L	H	H		
-36	L	H	L	L	H	L	L		
-37	L	H	L	L	H	L	H		
-38	L	H	L	L	H	H	L		
-39	L	H	L	L	H	H	H		
-40	L	H	L	H	L	L	L		
-41	L	H	L	H	L	L	H		
-42	L	H	L	H	L	H	L		
-43	L	H	L	H	L	H	H		
-44	L	H	L	H	H	L	L		
-45	L	H	L	H	H	L	H		
-46	L	H	L	H	H	H	L		
-47	L	H	L	H	H	H	H		
-48	L	H	H	L	L	L	L		
-49	L	H	H	L	L	L	H		



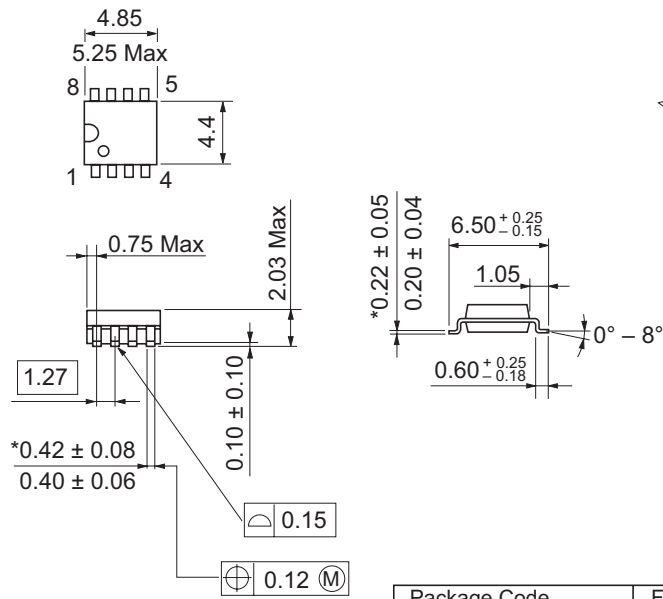
ATT	D0	D1	D2	D3	D4	D5	D6	← Left Channel ← Right Channel
	D7	D8	D9	D10	D11	D12	D13	
-50	L	H	H	L	L	H	L	
-51	L	H	H	L	L	H	H	
-52	L	H	H	L	H	L	L	
-53	L	H	H	L	H	L	H	
-54	L	H	H	L	H	H	L	
-55	L	H	H	L	H	H	H	
-56	L	H	H	H	L	L	L	
-57	L	H	H	H	L	L	H	
-58	L	H	H	H	L	H	L	
-59	L	H	H	H	L	H	H	
-60	L	H	H	H	H	L	L	
-61	L	H	H	H	H	L	H	
-62	L	H	H	H	H	H	L	
-63	L	H	H	H	H	H	H	
-64	H	L	L	L	L	L	L	
-65	H	L	L	L	L	L	H	
-66	H	L	L	L	L	H	L	
-67	H	L	L	L	L	H	H	
-68	H	L	L	L	H	L	L	
-69	H	L	L	L	H	L	H	
-70	H	L	L	L	H	H	L	
-71	H	L	L	L	H	H	H	
-72	H	L	L	H	L	L	L	
-73	H	L	L	H	L	L	H	
-74	H	L	L	H	L	H	L	
-75	H	L	L	H	L	H	H	
-76	H	L	L	H	H	L	L	
-77	H	L	L	H	H	L	H	
-78	H	L	L	H	H	H	L	
-79	H	L	L	H	H	H	H	
-80	H	L	H	L	L	L	L	
-81	H	L	H	L	L	L	H	
-82	H	L	H	L	L	H	L	
-83	H	L	H	L	L	H	H	
-84	H	L	H	L	H	L	L	
-85	H	L	H	L	H	L	H	
-86	H	L	H	L	H	H	L	
-87	H	L	H	L	H	H	H	
-88	H	L	H	H	L	L	L	
-89	H	L	H	H	L	L	H	
-90	H	L	H	H	L	H	L	
-91	H	L	H	H	L	H	H	
-92	H	L	H	H	H	L	L	
-93	H	L	H	H	H	L	H	
-94	H	L	H	H	H	H	L	
-95	H	L	H	H	H	H	H	
-∞	H	H	H	H	H	H	H	

Application Example



Package Dimensions

Unit: mm



\*Dimension including the plating thickness  
Base material dimension

Package Code	FP-8D
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.10 g

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