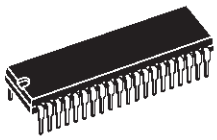
TDA7311

SERIAL BUS CONTROLLED AUDIO PROCESSOR

- INPUT MULTIPLEXER
  - TWO STEREO DIFFERENTIAL INPUTS
  - TWO STEREO SINGLE ENDED INPUTS
  - ONE MONO DIFFERENTIAL INPUT
- INPUT AND OUTPUT FOR EXTERNAL EQUALIZER OR NOISE REDUCTION SYSTEM
- VOLUME CONTROL IN 1.25dB STEPS
- TREBLE AND BASS CONTROL
- FOUR SPEAKER ATTENUATORS:
  - 4 INDEPENDENT SPEAKERS CONTROL IN 1.25dB STEPS FOR BALANCE AND FADER FACILITIES
  - INDEPENDENT MUTE FUNCTION
- ALL FUNCTIONS PROGRAMMABLE VIA SPI COMPATIBLE SERIAL BUS



DIP40

ORDERING NUMBER: TDA7311

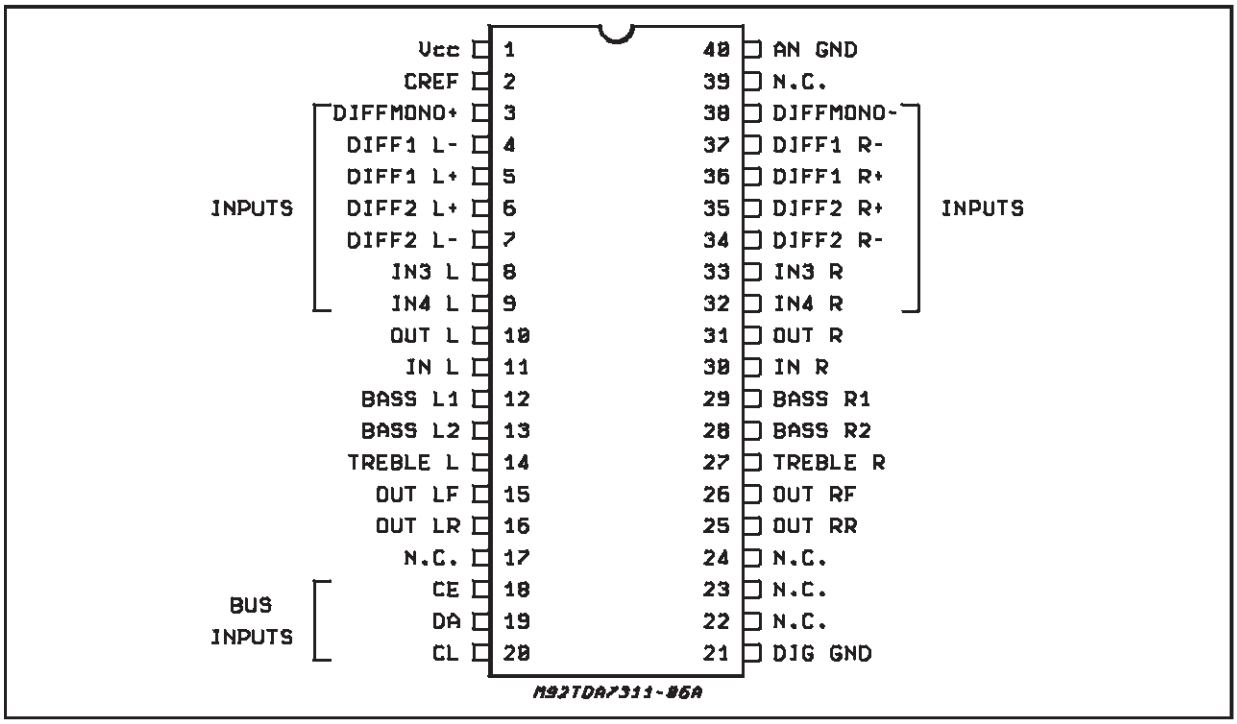
DESCRIPTION

The TDA7311 is a volume, tone (bass and treble) and fader (front/rear) processor for high quality audio applications in car radio and Hi-Fi systems.

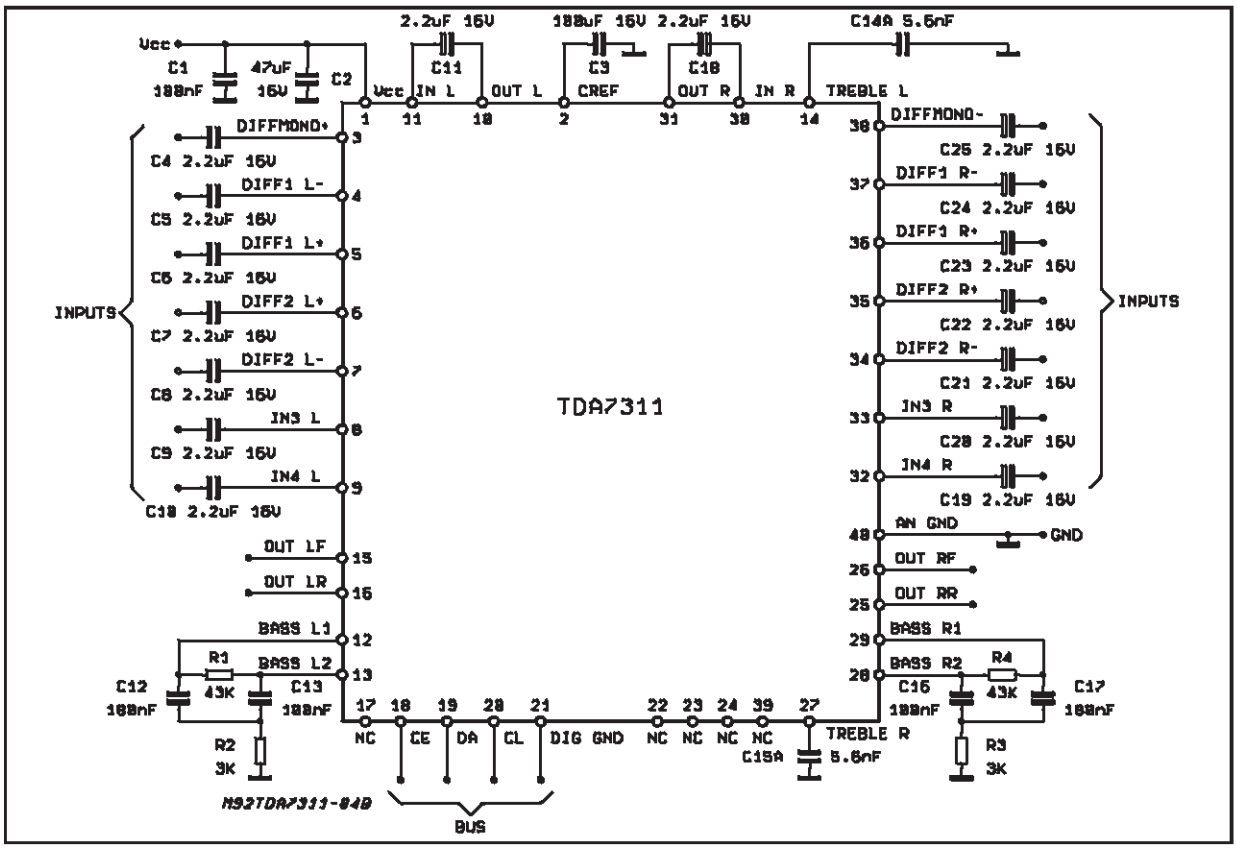
Control is accomplished by serial bus microprocessor interface.
The AC signal setting is obtained by resistor networks and switches combined with operational amplifiers.

Thanks to the used BIPOLAR/CMOS technology, low distortion, low noise and DC stepping are obtained.

PINS CONNECTION (Top view)



TEST CIRCUIT



THERMAL DATA

Symbol	Description		DIP40	Unit
$R_{th\ j\text{-}pins}$	Thermal Resistance Junction-pins	max	85	°C/W

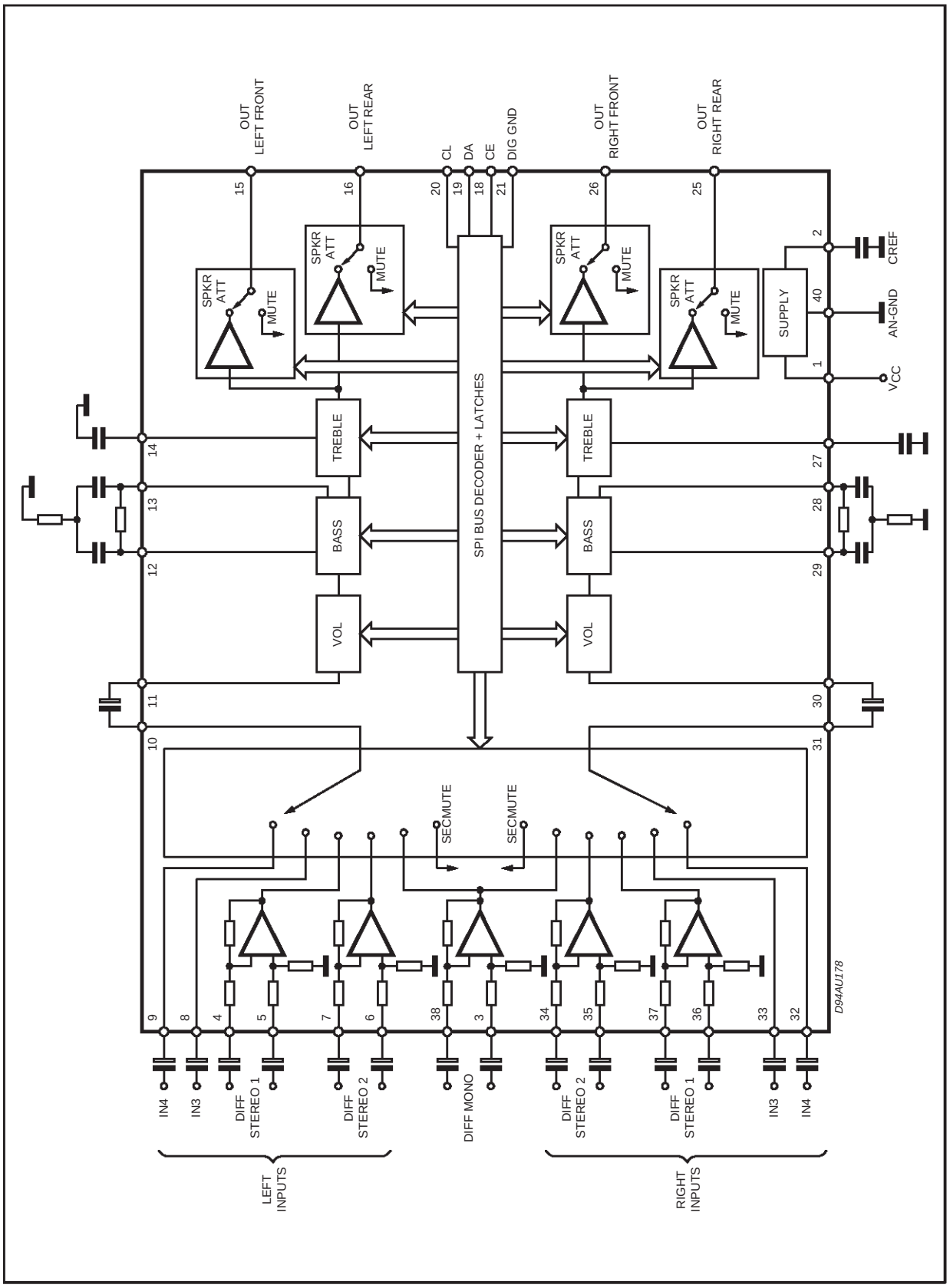
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_S	Operating Supply Voltage	11.2	V
T_{op}	Operating Temperature Range	-40 to 85	°C
T_{stg}	Storage Temperature Range	-55 to +150	°C

QUICK REFERENCE DATA

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_S	Supply Voltage	8	10	11	V
V_{CL}	Max. input signal handling	2.3			Vrms
THD	Total Harmonic Distortion V = 1Vrms f = 1KHz		0.01		%
S/N	Signal to Noise Ratio		106		dB
S_C	Channel Separation f = 1KHz		95		dB
	Volume Control 1.25dB step	-78.75		+11.25	dB
	Treble Control 2dB step	-14		+14	dB
BR_{SS}	Bass Control 2dB step	–20		+20	dB
	Fader and Balance Control 1.25dB step	-38.75		0	dB
	Mute Attenuation		92		dB

BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C, V_{CC} = 10V, R_L = 10KΩ, R_G = 600Ω, G_V=0dB, f = 1KHz unless otherwise specified) (refer to the test circuit)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
SUPPLY						
V_S	Supply Voltage		8	10	11	V
I_S	Supply Current			15	20	mA
SVR	Ripple Rejection		55	80		dB
INPUT SELECTORS						
R_{II}	Input Resistance	Single Ended inputs	30	50	70	KΩ
		Differential Inputs	10	20		KΩ
V_{CL}	Clipping Level	Single Ended Inputs	2.3	2.8		Vrms
		Differential Inputs	4.6	5.6		Vrms
CMRR	Common Mode Rejection	Differential Inputs		65		dB
INS	Input Separation (2)		70	90		dB
R_L	Output Load resistance		2			KΩ
C_L	Output Load capacitance				1	nF
R_O	Output Impedance			15	50	Ω
G_{IN}	Input Gain	Single Ended Inputs	-1	0	1	dB
		differential Inputs	-7	-6	-5	dB
VOLUME CONTROL						
R_{IN}	Input Resistance		15	30		kΩ
G_R	Control Range	Max. Attenuation		– 75		dB
		Max. Gain		+11.25		dB
A_{STEP}	Step Resolution			1.25		dB
E_A	Attenuation Set Error	A_V = +11.25 to -20dB A_V = -20 to -60dB	-1.25 -3	0	1.25 2	dB dB
E_T	Tracking Error				2	dB
V_{DC}	DC Steps	adjacent attenuation steps From 0dB to A_{Vmax}		0 1	3.0 10.0	mV mV
Vimax.	Max. Input Voltage		2.3	2.8		Vrms
SPEAKER ATTENUATORS						
A_R	Control Range			37.5		dB
A_{step}	Step Resolution			1.25		dB
E_A	Attenuation set error				1.5	dB
V_{DC}	DC Steps	adjacent att. steps from 0 to mute		0 1		mV mV
BASS CONTROL (1)						
	Control Range			±20		dB
	Step Resolution			2		dB
	Attenuation / Gain set error		–2.0		2.0	dB
TREBLE CONTROL (1)						
	Control Range			±14		dB
	Step Resolution			2.0		dB
	Attenuation / Gain set error		–1.0	0	1.0	dB

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
AUDIO OUTPUTS						
	Output Voltage	d = 0.3%	2.3	2.8		Vrms
	Output Load Resistance		2			KΩ
	Output Load Capacitance				10	nF
	Output resistance			25	75	Ω
	DC Voltage Level		4.6	5.0	5.4	V
GENERAL						
e_{NO}	Output Noise	BW = 20-20KHz, flat output muted all gains = 0dB Single Ended all gains = 0dB Diff. Inputs		 4 5 10	 15 30	 μV μV μV
S/N	Signal to Noise Ratio	all gains = 0dB; V_O = 1Vrms Single Ended Differential Inputs		 106 100		 dB dB
d	Distortion	V_{IN} = 1Vrms		0.01		%
Sc	Channel Separation left/right		70	95		dB
	Total Tracking error	A_V = 0 to -20dB A_V = -20 to -60 dB A_V = 0dB to 11.25dB		0 0 0	1 2 1	dB dB dB
	Output Attenuation	Mute Condition (3)	80	90		dB
BUS INPUTS						
V_{IL}	Input Low Voltage				1	V
V_{IH}	Input High Voltage		3			V

Notes:

(1) Bass and Treble response see attached diagram (fig.17). The center frequency and quality of the resonance behaviour can be choosen by the external circuitry. A standard first order bass response can be realized by a standard feedback network

(2) The selected input is grounded thru the 2.2μF capacitor.

(3) Condition obtained programming: mute on speaker attenuators (1X111111) followed by selection of SECMUTE (1XXXX111).

APPLICATION INFORMATION

SERIAL BUS INTERFACE

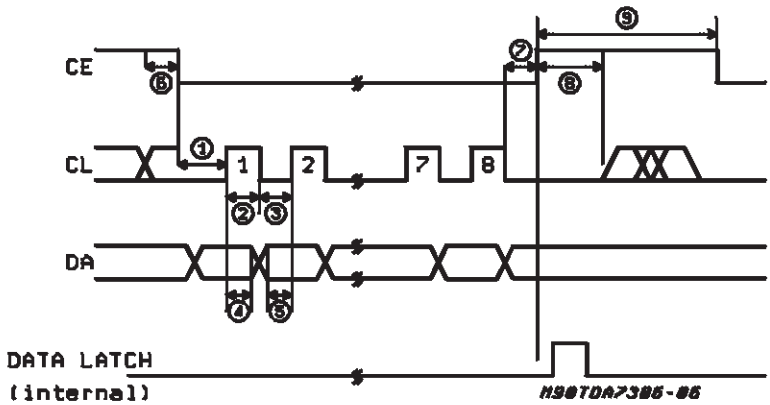
The serial bus interface is compatible to SPI bus systems.
During the LOW state of the chip enable signal (CE) the data on pin DA are clocked into the shift register at the LOW to HIGH transition of the clock signal CL.

At the LOW to HIGH transition of the CE signal the content of the internal shift register is stored into the addressed latches.

The transmission is separated into bytes with 8 bit according to the data specification of the audio-processor. After every byte a positive slope of the CE signal has to be generated in order to store the data byte.

A special clock counter enables the latch of the data byte only, if exactly 8 clocks were present during the LOW state of the CE signal. This results in a high immunity against spikes on the clock line and avoids a storage of wrong databytes.

Figure 1: BUS Timing



Nr.	Parameter	Min.	Max.	Units
	Clock Frequency		250	KHz
1	CE Lead time	4		µs
2	Clock High Time	2		µs
3	Clock Low Time	2		µs
4	Data Hold Time	1.8		µs
5	Data Setup Time	1.8		µs
6	Clock Setup Time	0		µs
7	CE lagtime	0		µs
8	Clock Hold Time	6		µs
9	CE High TIme	6		µs

STATUS AFTER POWER-ON RESET

Volume	–78.75dB
Speaker	Mute
Audio Switch	Mute
Bass	–20dB
Treble	–14dB

SOFTWARE SPECIFICATION
Data Bytes

FIRST BYTE

MSB							LSB	Function
0	0	0	0	X	X	X	X	VOL ATTENUATION
0	1	0	0	X	X	X	X	VOL GAIN
0	0	1	0	X	X	X	X	BASS
0	1	1	0	X	X	X	X	TREBLE
0	0	0	1	X	X	X	X	ATT RF (speaker)
0	1	0	1	X	X	X	X	ATT RR (speaker)
0	0	1	1	X	X	X	X	ATT LF (speaker)
0	1	1	1	0	X	X	X	ATT LR (speaker)
0	1	1	1	1	X	X	X	AUDIO SWITCH

SECOND BYTE

VOLUME ATTENUATION

MSB					LSB			
1	X	B2	B1	B0	A2	A1	A0	Volume 1.25dB Steps
					0	0	0	0
					0	0	1	-1.25
					0	1	0	-2.5
					0	1	1	-3.75
					1	0	0	-5.00
					1	0	1	-6.25
					1	1	0	-7.50
					1	1	1	-8.75
1	X	B2	B1	B0				Volume 10dB Steps
		0	0	0				0
		0	0	1				-10
		0	1	0				-20
		0	1	1				-30
		1	0	0				-40
		1	0	1				-50
		1	1	0				-60
		1	1	1				-70

SOFTWARE SPECIFICATION (continued)
VOLUME GAIN

MSB							LSB	1.25dB STEPS
1	X	X	X	0	0	0	0	0.00
1	X	X	X	0	0	0	1	1.25
1	X	X	X	0	0	1	0	2.50
1	X	X	X	0	0	1	1	3.75
1	X	X	X	0	1	0	0	5.00
1	X	X	X	0	1	0	1	6.25
1	X	X	X	0	1	1	0	7.50
1	X	X	X	0	1	1	1	8.75
1	X	X	X	1	0	0	0	10.00
1	X	X	X	1	0	0	1	11.25

SPEAKER ATTENUATION

MSB							LSB	1.25dB STEPS
1					0	0	0	0
1					0	0	1	-1.25
1					0	1	0	-2.50
1					0	1	1	-3.75
1					1	0	0	-5.00
1					1	0	1	-6.25
1					1	1	0	-7.50
1					1	1	1	-8.75
								10dB STEPS
1	X	0	0	0				0
1	X	0	0	1				-10
1	X	0	1	0				-20
1	X	0	1	1				-30
1	X	1	1	1	1	1	1	MUTE

AUDIO SWITCH

MSB							LSB	INPUT
1	X	X	X	X	0	0	0	MONO
1	X	X	X	X	0	0	1	DIFF1
1	X	X	X	X	0	1	0	DIFF2
1	X	X	X	X	0	1	1	IN3
1	X	X	X	X	1	0	0	IN4
1	X	X	X	X	1	1	1	SECMUTE

SOFTWARE SPECIFICATION (continued)
TREBLE

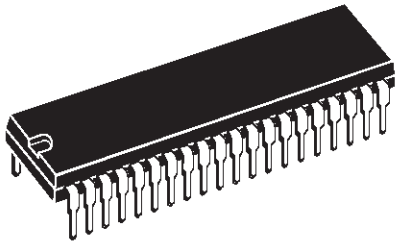
MSB							LSB	2dB STEPS
1	X	X	X	0	1	1	1	14
1	X	X	X	0	1	1	0	12
1	X	X	X	0	1	0	1	10
1	X	X	X	0	1	0	0	8
1	X	X	X	0	0	1	1	6
1	X	X	X	0	0	1	0	4
1	X	X	X	0	0	0	1	2
1	X	X	X	0	0	0	0	0
1	X	X	X	1	0	0	0	-0
1	X	X	X	1	0	0	1	-2
1	X	X	X	1	0	1	0	-4
1	X	X	X	1	0	1	1	-6
1	X	X	X	1	1	0	0	-8
1	X	X	X	1	1	0	1	-10
1	X	X	X	1	1	1	0	-12
1	X	X	X	1	1	1	1	-14

BASS

MSB							LSB	2dB STEPS
1	X	X	1	1	1	1	1	-20
1	X	X	1	1	0	0	1	-18
1	X	X	1	1	0	0	0	-16
1	X	X	1	0	1	1	1	-14
1	X	X	1	0	1	1	0	-12
1	X	X	1	0	1	0	1	-10
1	X	X	1	0	1	0	0	-8
1	X	X	1	0	0	1	1	-6
1	X	X	1	0	0	1	0	-4
1	X	X	1	0	0	0	1	-2
1	X	X	1	0	0	0	0	0
1	X	X	0	0	0	0	0	0
1	X	X	0	0	0	0	1	2
1	X	X	0	0	0	1	0	4
1	X	X	0	0	0	1	1	6
1	X	X	0	0	1	0	0	8
1	X	X	0	0	1	0	1	10
1	X	X	0	0	1	1	0	12
1	X	X	0	0	1	1	1	14
1	X	X	0	1	0	0	0	16
1	X	X	0	1	0	0	1	18
1	X	X	0	1	1	1	1	20

DIM.	mm			inch		
	MIN	TYP	MAX	MIN	TYP	MAX
a1		0.63			0.025	
b		0.45			0.018	
b1	0.23		0.31	0.009		0.012
b2		1.27			0.050	
D			52.58			2.070
E	15.2		16.68	0.598		0.657
e		2.54			0.100	
e3		48.26			1.900	
F			14.1			0.555
I		4.445			0.175	
L		3.3			0.130	

OUTLINE AND MECHANICAL DATA



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