



Z89340 DIGITAL WAVETABLE ENGINE

FEATURES

- n 64 High-Speed Audio Processing Units (APUs) or 128 Half-Speed APUs
- n 3-D Sound Capability
- n Downloadable Sample Capability
- n 8-Channel, 20-Bit Linear PCM Audio Generator
- n Output Sampling Rates up to 50 kHz
- n Supports 16-, 18-, and 20-Bit Serial DACS - greater than 96 Db Dynamic Range
- n Supports 16- and 8-Bit Linear PCM Sampling, ADPCM, and Wavetable Synthesis, Variable Playback Rates for ADPCM
- n Internal 24-bit Audio Accumulators
- n Addresses 16M x 16 Sample ROM Directly (No Paging Necessary)
- n Jumperless Configurable ISA Bus Interface
- n Sound Blaster and OPL3 Register Compatibility, MPU401 UART Mode Compatible
- n Built-In, 64-Channel, Bus-Mastering DMA Controller
- n FM Emulation

GENERAL DESCRIPTION

The Z89340 is a high-performance, programmable wavetable engine designed for musical instruments, general MIDI sound modules, digital mixing consoles with high-quality PC sound cards, and computer-controlled multimedia applications.

This chip features a 24-bit address bus for addressing 16-bit sample-storage ROM and DRAM (DRAM refresh controller on-board), a 12 x 16 two's-complement scaler, eight 24-bit accumulators with clipping circuitry, a patented 2 x 8 x 16 interpolator to allow a high resolution of phase angles between input samples, CD-quality sampling rates, and 64 high-speed audio processing units (APUs) can be split into two low-speed APUs that operate at half the sampling rate, allowing up to 128 notes to play simultaneously. All APUs are independent and can address any part of data storage at any time.

The Z89340 can operate at output sampling rates up to 50 kHz, and offers eight channels of 16- to 20-bit serial

output data. The microprocessor interface allows full control of frequency, amplitude, and sample data input to each oscillator. The Z89340 has eight output registers whose data can be sent to DAC or CODEC. Four of these can be used for quadrasonic output, and have a panning mechanism called Polar Pan that supports motion in all four quadrants. The other four output registers are used internally as effects channels, but can still send their streams to a DAC, a second Z89340, or other digital signal processor. The Z89340 also has eight serial input registers whose data can be accessed and processed. In addition, there are 24 stereo submix register pairs for use in sending output data from one APU to be used as the input to another.

In particular, the Z89340 is well-suited for 8- and 16-bit linear PCM recording/playback, wave synthesis, Sound Blaster command set, and ADPCM (IMA/DVI) real-time decompression.

GENERAL DESCRIPTION (Continued)

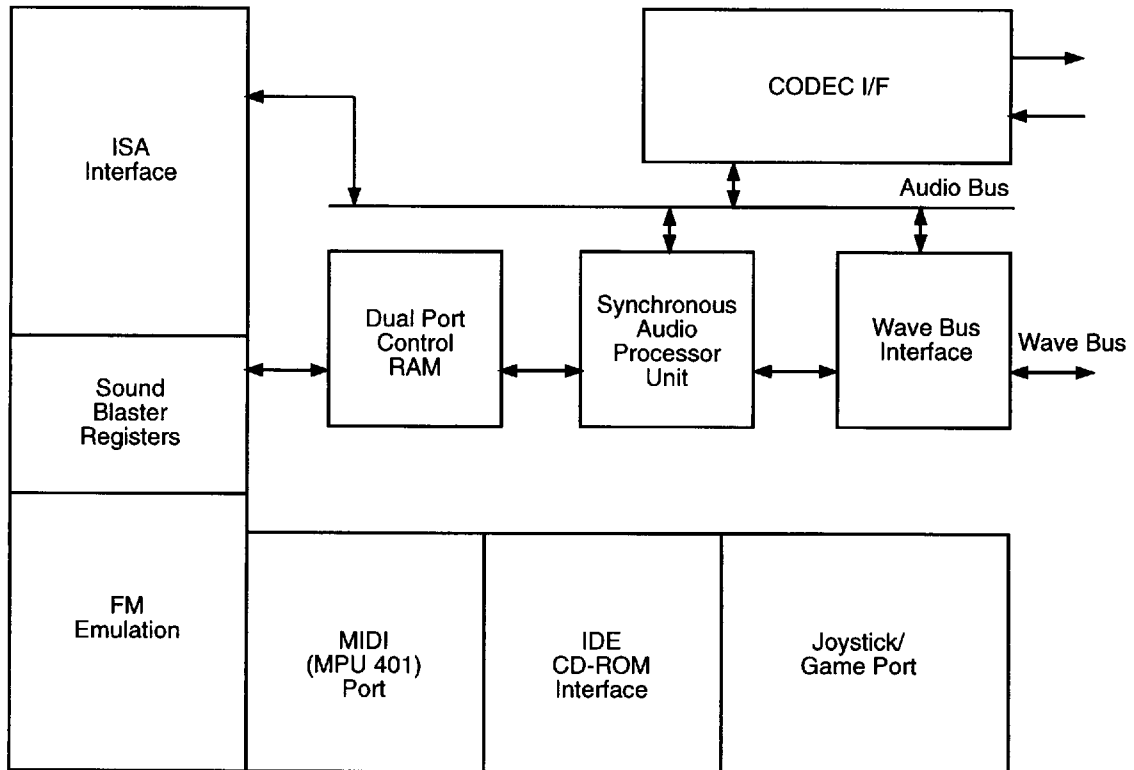


Figure 1. Z89340 Simplified Functional Block Diagram

PIN IDENTIFICATION

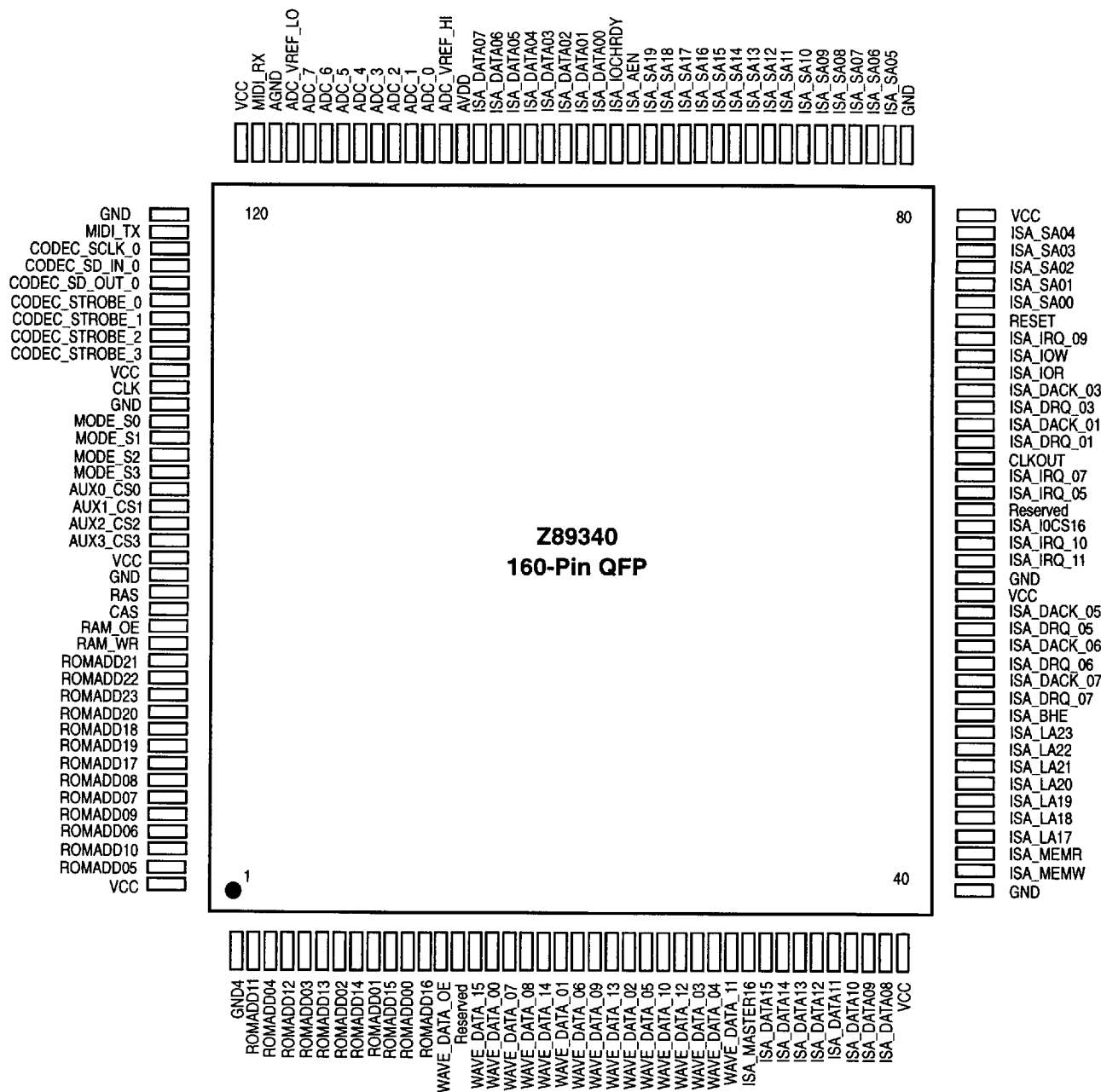


Figure 2. 160-Pin QFP Pin Configuration

PIN IDENTIFICATION (Continued)

Table 1. 160-Pin QFP Pin Identification

Pin #	Symbol	Function	Direction
1	GND	Ground	
2	ROMADD11	Wavetable ROM Address Bus	Output
3	ROMADD04	Wavetable ROM Address Bus	Output
4	ROMADD12	Wavetable ROM Address Bus	Output
5	ROMADD03	Wavetable ROM Address Bus	Output
6	ROMADD13	Wavetable ROM Address Bus	Output
7	ROMADD02	Wavetable ROM Address Bus	Output
8	ROMADD14	Wavetable ROM Address Bus	Output
9	ROMADD01	Wavetable ROM Address Bus	Output
10	ROMADD15	Wavetable ROM Address Bus	Output
11	ROMADD00	Wavetable ROM Address Bus	Output
12	ROMADD16	Wavetable ROM Address Bus	Output
13	WAVE_DATA_OE	Ext. Memory Output Enable	Output
14	Reserved	Reserved	N/A
15	WAVE_DATA_15	External Waveform Mem. Data Bus	Input/Output
16	WAVE_DATA_00	External Waveform Mem. Data Bus	Input/Output
17	WAVE_DATA_07	External Waveform Mem. Data Bus	Input/Output
18	WAVE_DATA_08	External Waveform Mem. Data Bus	Input/Output
19	WAVE_DATA_14	External Waveform Mem. Data Bus	Input/Output
20	WAVE_DATA_01	External Waveform Mem. Data Bus	Input/Output
21	WAVE_DATA_06	External Waveform Mem. Data Bus	Input/Output
22	WAVE_DATA_09	External Waveform Mem. Data Bus	Input/Output
23	WAVE_DATA_13	External Waveform Mem. Data Bus	Input/Output
24	WAVE_DATA_02	External Waveform Mem. Data Bus	Input/Output
25	WAVE_DATA_05	External Waveform Mem. Data Bus	Input/Output
26	WAVE_DATA_10	External Waveform Mem. Data Bus	Input/Output
27	WAVE_DATA_12	External Waveform Mem. Data Bus	Input/Output
28	WAVE_DATA_03	External Waveform Mem. Data Bus	Input/Output
29	WAVE_DATA_04	External Waveform Mem. Data Bus	Input/Output
30	WAVE_DATA_11	External Waveform Mem. Data Bus	Input/Output
31	ISA_MASTER16	ISA Master 16-Bit Transfer	Tri. Input
32-39	ISA_SD_15-8	ISA Data Bus	Input/Output
40	VCC	Power Supply	—
41	GND	GND	—
42	ISA_MEMW	ISA Memory Write	Input/Output
43	ISA_MEMR	ISA Memory Read	Input/Output
44-50	ISA_LA 17-23	ISA Address Bus	Tri. Output
51	ISA_BHE	ISA Bus High Byte Enable	Input/Output
52	ISA_DRQ_07	ISA DMA Request 07	Tri. Output
53	ISA_DACK_07	ISA DMA Acknowledge 07	Input
54	ISA_DRQ_06	ISA DMA Request 06	Tri. Output
55	ISA_DACK_06	ISA DMA Acknowledge 06	Input

Table 1. 160-Pin QFP Pin Identification (Continued)

Pin #	Symbol	Function	Direction
56	ISA_DRQ_05	ISA DMA Request 05	Tri. Output
57	ISA_DACK_05	ISA DMA Acknowledge 05	Input
58	VCC	Power Supply	Input
59	GND	Ground	
60	ISA_IRQ_11	ISA Interrupt Request 11	Tri. Output
61	ISA_IRQ_10	ISA Interrupt Request 10	Tri. Output
62	ISA_IOCS16	ISA I/O Select 16-Bit Transfer	Tri. Output
63	Reserved	Reserved	N/A
64	ISA_IRQ_05	ISA Interrupt Request 05	Tri. Output
65	ISA_IRQ_07	ISA Interrupt Request 07	Output
66	CLKOUT	Clock Output	Output
67	ISA_DRQ_01	ISA DMA Request 01	Tri. Output
68	ISA_DACK_01	ISA DMA Acknowledge 01	Input
69	ISA_DRQ_03	ISA DMA Request 03	Tri. Output
70	ISA_DACK_03	ISA DMA Acknowledge 03	Input
71	ISA_IOR	ISA I/O Read	Input/Output
72	ISA_IOW	ISA I/O Write	Input/Output
73	ISA_IRQ_09	ISA Interrupt Request 09	Tri. Output
74	RESET	Chip Reset	Input
75–79	ISA_SA00–SA04	ISA Address Bus	Input/Output
80	VCC	Power Supply	—
81	GND	Ground	—
82–96	ISA_SA05–SA19	Address Bus	82–92: I/O; 93–96: Tri O
97	ISA_AEN	ISA Bus Address Enable	Input
98	ISA_IOCHRDY	ISA Channel Ready	Open-Drain Output
99–106	ISA_SD_00–07	ISA Data Bus	Input/Output
107	AVDD	Analog Supply	—
108	ADC_VREF_HI	ADC Voltage Reference High	Input
109–112	ADC_0–3	Joystick Button 00–03	Input/Output
113–116	ADC_4–7	Gameport ADC 04–07	Input
117	ADC_VREF_LO	ADC Voltage Reference Low	Input
118	AGND	Analog Ground	—
119	MIDI_RX	MIDI Input	Input
120	VCC	Power Supply	—
121	GND	Ground	—
122	MIDI_TX	MIDI Output	Output
123	CODEC_SCLK	Serial Clock Signal	Output
124	CODEC_SD_IN	Serial Data In	Input
125	CODEC_SD_OUT	Serial Data Out	Output

PIN IDENTIFICATION (Continued)

Table 1. 160-Pin QFP Pin Identification (Continued)

Pin #	Symbol	Function	Direction
126–129	CODEC_STROBE_0–3	Serial CODEC Chip Select Strobe	Output
130	VCC	Power Supply	—
131	CLK	System Clock	Input
132	GND	Ground	—
133–136	MODE_S0–S3	Operation Mode Select 00–S3	Input
137–140	AUX_CS0–3	Auxiliary Chip Select 00–03	Output
141	VCC	Power Supply	Input
142	GND	Ground	—
143	RAS	Ext. DRAM Row Address Strobe	Output
144	CAS	Ext. DRAM Col. Address Strobe	Output
145	RAM_OE	Ext. DRAM Output Enable	Output
146	RAM_WR	Ext. DRAM Write Enable	Output
147–149	ROMADD21–23	Wavetable ROM Address Bus	Output
150	ROMADD20	Wavetable ROM Address Bus	Output
151–153	ROMADD18,19, 17	Wavetable ROM Address Bus	Output
154	ROMADD08	Wavetable ROM Address Bus	Output
155	ROMADD07	Wavetable ROM Address Bus	Output
156	ROMADD09	Wavetable ROM Address Bus	Output
157	ROMADD06	Wavetable ROM Address Bus	Output
158	ROMADD10	Wavetable ROM Address Bus	Output
159	ROMADD05	Wavetable ROM Address Bus	Output
160	VCC	Power Supply	—

ABSOLUTE MAXIMUM RATINGS

Sym	Description	Min	Max	Units
V _{CC}	Supply Voltage	-0.5	+6.5	V
T _{STG}	Storage Temp	-65	+150	°C
-	Voltage on any Pin	-0.5	V _{CC}	V
I _{OL}	Maximum Output Leakage per I/O Pin			mA
T _A	Oper. Ambient Temp	0	70	°C

Stresses greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; operation of the device at any condition above those indicated in the operational sections of these specifications is not implied. Exposure to absolute maximum rating conditions for an extended period may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

Sym	Description	Min	Max	Units
V _{CC}	Supply Voltage	4.75	+5.25	V
T _A	Oper Ambient Temp	0	70	°C

DC CHARACTERISTICS

V_{CC} = 4.5 V to 5.5V @ 0°C to +70°C

Sym	Parameter	Min	Typ.	Max	Unit
V _{IL}	Low-Level Input Voltage	-0.5	-	0.8	V
V _{IH}	High-Level Input Voltage	2.0	-	V _{CC}	V
V _{OL}	Low-Level Output Voltage	-	-	0.4	V
V _{OH}	High-Level Output Voltage	2.4	-	-	V
I _{CC}	Power Supply Current (Crystal freq. = 50 MHz)	-	25	TBD	mA