



ESS Technology, Inc.

# ES690 Wavetable Music Synthesizer Product Brief

## DESCRIPTION

The ES690 is a single, highly integrated, high-performance, and economical wavetable music synthesizer for personal computers, delivering superior acoustic sound comparable to expensive professional synthesizers. The ES690 includes chorus and reverb special effects without need of external RAM. With its embedded microcontroller, the ES690 supports General MIDI, providing for 128 melodic instruments with the ability to play back 32 voices of 16-bit data at a sampling rate of 44.1 kHz. Music is produced in high fidelity with the realism of a live symphony orchestra.

The ES690 is used with the ES981 wavetable ROM chip to provide a complete wavetable solution. The ES981 provides digitally recorded sound samples of musical instruments, encoded in a ROM size of 512K x 16-bit.

The ES690 is designed to interface with the ES981 and with the ES1xxx ESS *AudioDrive*® chips without requiring any glue logic or external DAC. The ES690 will interface with the music DAC of the ES1xxx via the third serial port of the host chip, providing a cost-effective implementation of a complete wavetable music synthesizer.

Advanced power management features such as suspend/resume and automatic power-down when MIDI input is idle.

The ES690 is available in an industry-standard 52-pin Plastic Quad Flat Pack (PQFP) package.

## APPLICATIONS

- Multimedia PCs
- PC Games
- Music Synthesis
- Consumer Audio Equipment
- Karaoke Systems

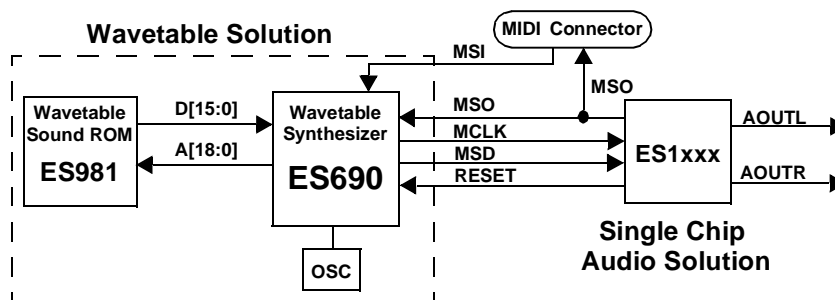
## FEATURES

- Single chip, high-performance wavetable music synthesizer
- Chorus and reverb special effects without external RAM
- Playback of 16-bit data at 44.1 kHz via ES1xxx DAC
- Stereo pan for each voice
- 32-voice polyphony
- MIDI serial port compatible with MPU-401 serial port of the ES1xxx
- General MIDI Instrument Set – 128 melodic and 47 rhythm instruments
- Digital serial interface to the ES1xxx
- Glueless interface with external wavetable ROM, 512K x 16-bit
- Context upload/download for suspend/resume
- Automatic power-down when MIDI input is idle
- 52-pin PQFP package

## IMPLEMENTATION PLATFORMS

- Desktop PCs
- Green PCs
- Notebooks
- Motherboards
- Multifunction Cards
- Sound Cards
- Combination Audio-Fax/Modem Cards

## TYPICAL APPLICATION



ES690 wavetable solution with ES1xxx



## ES690 PIN DESCRIPTIONS

Name	I/O	Description
VCC	I	Power supply voltage (4.5 to 5.5 V).
GND	I	Ground.
A[20:0]	O	External ROM address. (Word addresses).
D[15:0]	I	External ROM data.
RESET	I	Active-high reset input.
MSO	O	MIDI serial output for two-way connection to ES1xxx <i>AudioDrive</i> ®.
MSI	I	MIDI serial input from ES1xxx <i>AudioDrive</i> ®.
MERGE	I	Input with pull-up resistor. For one-way MIDI connection, this pin is left no-connect. For two-way MIDI connection, this pin is external MIDI input. Normally, this pin is internally connected to MSO pin.
MSD	O	Music serial data to the ES1xxx <i>AudioDrive</i> ®.
MCLK	I	Music serial clock to the ES1xxx <i>AudioDrive</i> ®.
XO	O	Oscillator output. Connect to 33.0 MHz crystal.
XI	I	Oscillator input. Connect to 33.0 MHz crystal.
TE	I	Test pin (reserved). Connect to GND for proper operation.

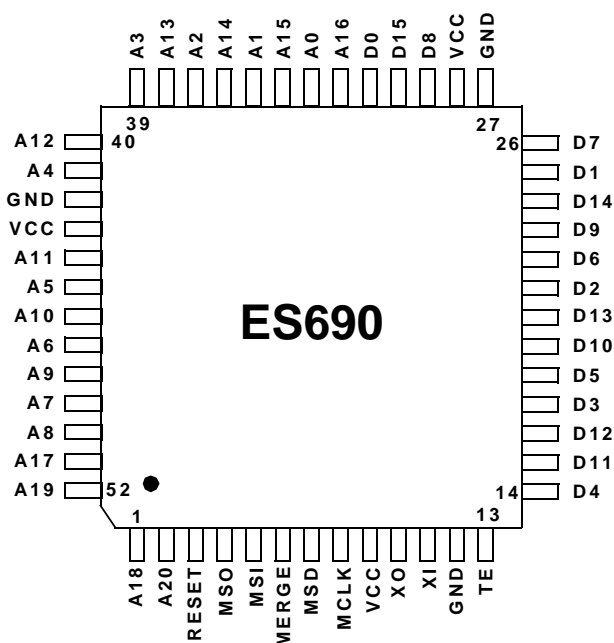
## ES690 MAXIMUM RATINGS

Ratings	Symbol	Value
Power supply voltage	VCC	-0.3 to 7.0 V
Input voltage	VIN	-0.3 to 7.0 V
Operating temperature range	TA	0 to 70 °C
Storage temperature range	TSTG	-50 to 125 °C

## ES690 ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Min	Max	Unit	Conditions
VCC	Operating voltage	4.5	5.5	V	
VIL	Input low voltage		0.8	V	VCC=5.0 V
VIH	Input high voltage: All except XI	2.0		V	VCC=5.0 V
VOL	Output low voltage: All outputs except XO		0.4	V	IOL=4 mA
VOH	Output high voltage: All outputs except XO	2.4		V	IOH=-3 mA
ICC	Operating current		75	mA	VCC=5.0 V
ICCP	Power-down supply current		7.5	mA	VCC=5.0 V
IILH1	Input leakage current high: All inputs except RESET	0	10	μA	VCC=5.0 V, VIN=5.0 V
IILH2	Input leakage current high: RESET	50	150	μA	VCC=5.0 V, VIN=5.0 V
ILL1	Input leakage current low: All inputs except XI, MERGE	0	10	μA	VCC=5.0 V, VIN=5.0 V
ILL2	Input leakage current low: XI, MERGE	25	100	μA	VCC=5.0 V, VIN=5.0 V

## ES690 PINOUT



# ES981 DESCRIPTION

The ES981 wavetable sound ROM is 16-bit mask Read-Only-Memory, designed to be a companion chip to the ES689 and ES690 wavetable music synthesizer chips. The ES981 is organized as 512K x 16-bit memory, with an access time of 150 ns.

The ROM offers automatic power-down, controlled by the chip enable (CEB) input. When CEB deselects the ROM, the ROM powers down automatically and remains in a low-power standby mode.

The ES981 is available in an industry-standard 44-pin Small Outline Package (SOP).

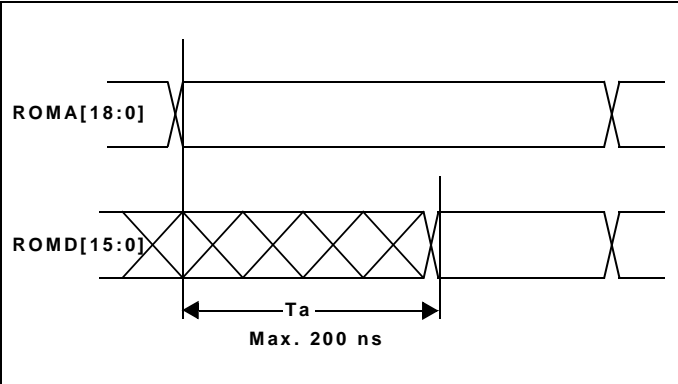
# ES981 FEATURES

- 512K x 16-bit CMOS wavetable mask ROM
- General MIDI Instrument Set – 128 melodic and 47 rhythm instruments
- 150 ns fast access time
- Total static operation
- Single +5 V power supply requirement
- Operating current of 60 mA
- Standby current of 100  $\mu$ A
- 44-pin Small Outline Package (SOP)

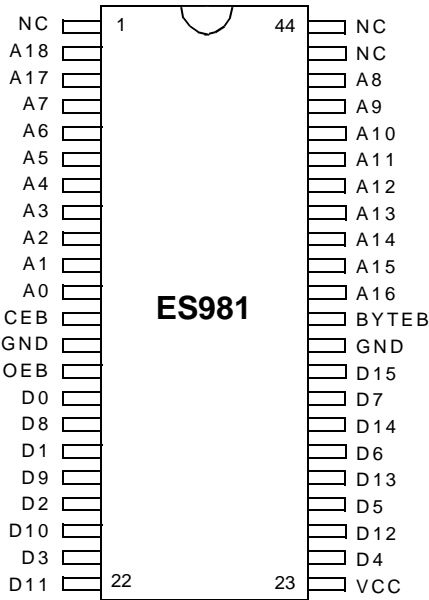
# ES981 PIN DESCRIPTION

Name	I/O	Description
VCC	I	Power supply voltage (4.5 to 5.5 V).
GND	I	Ground.
A[18:0]	I	ROM address. (Word addresses).
D[15:0]	O	ROM data.
CEB	I	Active low chip enable.
OEB	I	Active low output enable.
BYTEB	I	Word address selection. Connect to VCC.
NC		No connection.

# ES981 ROM ACCESS TIMING



# ES981 PINOUT



## ES981 ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Min	Max	Unit	Conditions
VCC	Operating voltage	4.5	5.5	V	
VIL	Input low voltage		0.8	V	VCC=5.0 V
VIH	Input high voltage	2.2		V	VCC=5.0 V
VOL	Output low voltage		0.4	V	IOL=2.1 mA
VOH	Output high voltage	2.4		V	IOH=1.0 mA
ICC	Operating current		60	mA	VCC=5.0 V
ICCP	Power-down supply current		100	μA	VCC=5.0 V, VIN=0 V
IIL	Input leakage current		10	μA	VCC=5.0V, VIN=5.0 V

## ES981 MAXIMUM RATINGS

Ratings	Symbol	Value
Power supply voltage	VCC	-0.3 to 7.0 V
Input voltage	VIN	-0.3 to 7.0 V
Operating temperature range	TA	0 to 70 °C
Storage temperature range	TSTG	-50 to 125 °C

## SERVICE & SUPPORT

- Evaluation Kit
- Manufacturing Kit
- Reference Design



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(P) U.S. Patent 4,214,125 and others, other patents pending.  
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