Z89303/05/07
DIGITAL TELEVISION CONTROLLER

GENERAL DESCRIPTION

The Z89303/05/07 Digital Television Controllers are application-specific controllers designed to provide complete audio and video control of television receivers, video recorders, with advanced on-screen display facilities. The Z89303/05/07 are 24K, 16K and 12K ROM versions in 52-pin SDIP packages. The powerful 12 MHz Z89C00 RISC processor core allows the user to control the on-board peripheral functions and registers using the standard processor instruction set.

The extensive character attributes can be controlled in two modes: by the on-screen display controller character control mode for maximum display control flexibility, and closed caption mode for optimum display of closed caption text.

Closed caption text can be decoded directly from the composite video signal with the assistance of the processor's digital signal processing capabilities and displayed on the screen. The character representation in this mode allows for a simple attribute control through the insertion of control characters, and each word of RAM specifies two displayed characters.

The character control mode provides access to the full set of attribute controls. Each word of RAM specifies a single displayed character and basic character attributes, allowing the modification of attributes on a character-by-character basis. The insertion of control characters permits direction of other character attributes.

The fully customized 512 character set, formatted in two 256 character banks, can be displayed with a host of display attributes that incude underlining, italics, blinking, eight foreground/background colors, character position offset delay, and background transparency. The 16-bit display character representation allows the modification of some key attributes on a character-by-character basis. A character's pixel array is stored as a 16- or 18-word representation in Character Graphics ROM (CGROM). The ROM contents are referenced by a 16-bit word stored in video RAM (VRAM) defining the character type and its key attributes.

Serial interfacing with the television tuner is provided through the tuner serial port. Other serial devices, such as digital channel tunning adjustments, may be accessed through the industry standard I^2C port.

Additional hardware provides the capability to display two times normal size characters. The smoothing logic contained in the on-screen display circuit improves the appearance of larger fonts. Fringing circuitry can be activated to improve the visibiity of text by surrounding the character lines with a one-pixel border.

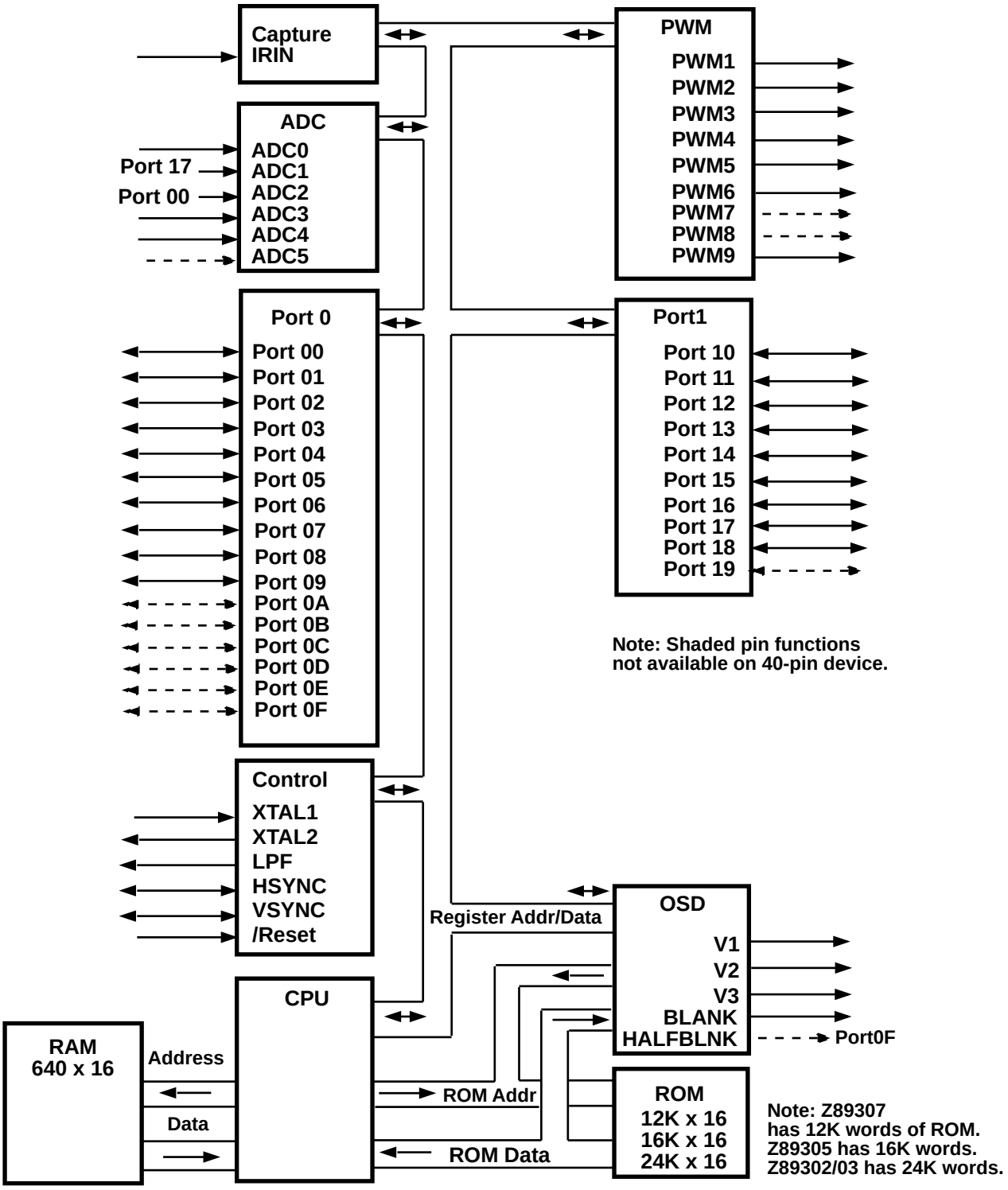
RGB outputs provide the direct video signals, and a blanking output is provided to control the video multiplexor. Dot clock and verticle line synchronization are normally obtained from H_FLYBACK and V_FLYBACK, but can be generated by the Z89303/05/047, and driven to the external deflection unit through the bidirectional SYNC ports when external video synchronization signals are not present.

User control can be monitored through the keypad scanning port, or the 16-bit remote control capture register. Receiver functions such as color and volume can be directly controlled by eight 8-bit pulse width modulated ports.

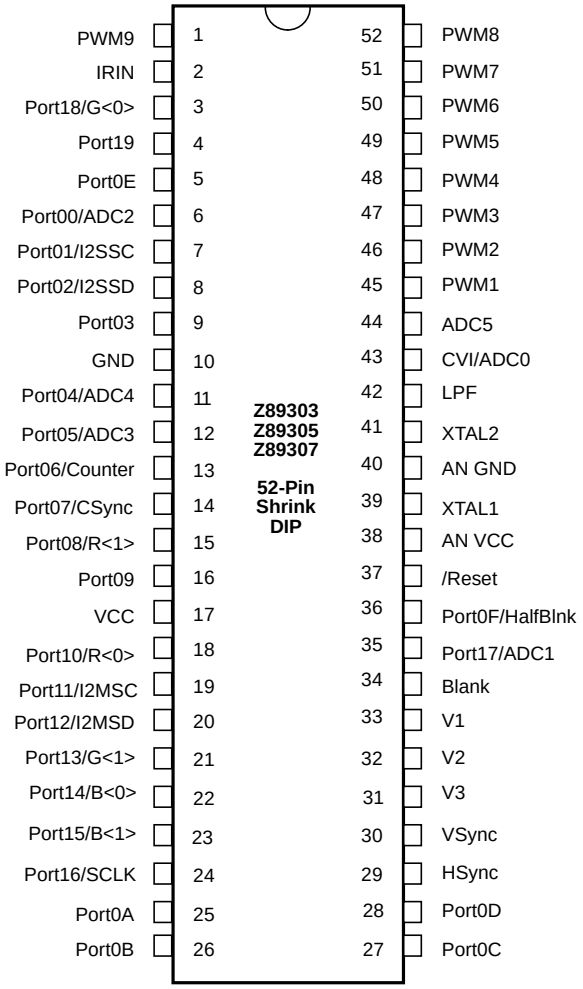
All nine PWM ports are available in the 52-pin package.

The Z89303/05/07 has two internal 12 MHz VCOs that are referenced to a 32 KHz internal oscillator to provide the system clock. In Sleep mode, the controller uses the 32 KHz clock for the system clock to reduce power consumption. The processor can be suspended by placing it into STOP mode when main power is not available for minimal power consumption.

GENERAL DESCRIPTION (Continued)



Functional Block Diagram



52-Pin Shrink DIP Configuration

PIN DESCRIPTIONS

Z89303/05/07

Pin Name	Function	Z89303/05/07 52-Pin	Configuration Direction	Reset
V_{CC}	+5 V	17,38		PWR
GND	0 V	10,40		PWR
IRIN	Infrared Remote Capture Input	2	I	I
ADC[5:0][a]	4-Bit Analog to Digital Converter Input[b]	44,11,12,6,35,43	nAI	I
PWM10, PWM9	14-Bit Pulse Width Modulator Output	–,1	OD	O
PWM[8:1][c]	8-Bit Pulse Width Modulator Output	52,51,50,49, 48,47,46,45	OD	O
Port0[F:0][d]	Bit Programmable Input/Output Ports	36,5,28,27,26,25, 16,15,14,13,12, 11,9,8,7,6	B	I
Port1[9:0][c]	Bit Programmable Input/Output Ports	4,3,35,24,23,22, 21,20,19,18	B	I
SCLf	12C Clock I/O	7 or 19	BOD	
SCD[g]	12C Data I/O	8 or 20	BOD	
XTAL1	Crystal Oscillator Input	39	AI	I
XTAL2	Crystal Oscillator Output	41	AO	O
LPF	Loop Filter	42	AB	O
HSYNC	H_Sync	29	B	I
VSYNC	V_Sync	30	B	I
/RESET	Device Reset	37	I	I
V[3:1] (Typically Drive B, G, and R Outputs)	OSD Video Output	31,32,33	O	O
Blank	OSD Blank Output	34	O	O
Half Blank[h]	OSD Half Blank Output	36	O	
RGB Digital Outputs[i]	R[1:0],G[1:0], and B[1:0] Outputs of the RGB Matrix	23,22,21, 18,15,3	O	
SCLK[k]	Internal Processor SCLK	24	O	

V1, V2, V3 ANALOG OUTPUT

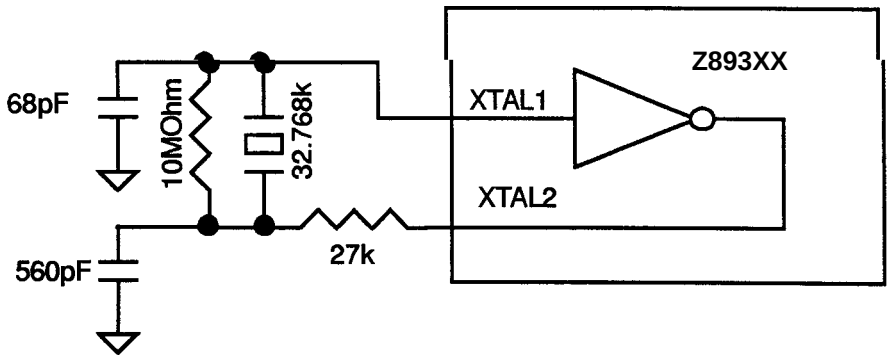
Specifications V_{CC} = 5.25 V

V_{CC} = 5.25 V	Condition	Limit
Output Voltage	Bit = 11	4.55 V +/– 0.25 V
	Bit = 10	3.205V +/– 0.2 V
	Bit = 01	1.95 V +/– 0.15 V
	Bit = 00	0.65 V +/– 0.1 V
Settling Time	70% of DC Level, 10pf Load	< 50 nsec

V1, V2, V3 ANALOG OUTPUT

Specifications V_{CC} = 4.75V

V_{CC} = 4.75V	Condition	Limit
Output Voltage	Bit = 11	3.90 V +/– 0.25 V
	Bit = 10	2.90 V +/– 0.2 V
	Bit = 01	1.90 V +/– 0.15 V
	Bit = 00	0.1 V +/– 0.1 V
Settling Time	70% of DC Level, 10pf Load	< 50 nsec



32K Oscillator Recommended Circuit

Notes:

c) PWM[8,7] is not available on the 40-pin DIP version.
d) Port0[F:A] is not available on the 40-pin DIP version.
e) Port19 is not available on the 40-pin DIP version.
f) SCL I/O pin is shared with Port0 or Port11.
g) SCD I/O pin is shared with Port02 or Port12.
h) Half Blank output is a function shared with Port0F.
Half Blank output is not available on the 40-pin DIP version.
i) Digital RGB outputs and the internal SCLK are shared with Port1[5:0].
k) Internal processor SCLK is shared with Port16.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Min	Max	Units	Conditions
V_{CC}	Power Supply Voltage	0	7	V	
V_{ID}	Input Voltage	–0.3	V_{CC} +0.3	V	Digital Inputs
V_{IA}	Input Voltage	–0.3	V_{CC} +0.3	V	Analog Inputs (A/D0...A/D4)
V_O	Output Voltage	–0.3	V_{CC} +0.3	V	All Push-Pull Digital Output
V_O	Output Voltage	–0.3	V_{CC} +8.0	V	Open-Drain PWM Outputs (PWM1...PWM8)
I_{OH}	Output Current High		–10	mA	One Pin
I_{OH}	Output Current High		–100	mA	All Pins
I_{OL}	Output Current Low		20	mA	One Pin
I_{OL}	Output Current Low		200	mA	All Pins
T_A	Operating Temperature	0	70	°C	
T_A	Storage Temperature	–65	150	°C	

DC CHARACTERISTICS

T_A = 0°C to + 70°C; V_{CC} = 4.5 V to + 5.5 V; F_{OSC} = 32.768 KHz

Symbol	Parameter	Min	Max	Typical	Units	Conditions
V_{IL}	Input Voltage Low	0	0.2 V_{CC}	0.4	V	
V_{IH}	Input Voltage High	0.6 V_{CC}	V_{CC}	3.6	V	
V_{PU}	Max. Pull-Up Voltage		12		V	PWM0...PWM8 Only
V_{OL}	Output Voltage Low		0.4	0.16	V	@ I_{OL} = 1 mA
V_{OL}	Output Voltage High	V_{CC} –0.9		4.75	V	@ I_{OL} = 0.75 mA
V_{XL}	Input Voltage XTAL1 Low		0.3 V_{CC}	1.0	V	External Clock
V_{XH}	Input Voltage XTAL1 High	V_{CC} –2.0		3.5	V	Generator Driven
V_{HY}	Schmitt Hysteresis	3.0	0.75	0.5	V	On XTAL1 Input Pin
I_{IR}	Reset Input Current		150	90	µA	V_{RL} = 0 V
I_{IL}	Input Leakage	–3.0	3.0	0.01	µA	@ 0 V and V_{CC}
I_{CC}	Supply Current		100	60	mA	
I_{CC1E}	Supply Current of the OTP		700	300	µA	Sleep Mode @ 32 KHz
I_{CC1}	Supply Current		300	100	µA	Sleep Mode @ 32 KHz
I_{CC2}	Supply Current		10	5	µA	Sleep Mode

AC CHARACTERISTICS

T_A = 0°C to + 70°C; V_{CC} = 4.5 V to 5.5 V; F_{OSC} = 32.768 KHz

Symbol	Parameter	Min	Max	Typical	Units
T_PC	Input Clock Period	16	100	32	µS
T_RC,T_FC	Clock Input Rise and Fall			12	µS
T_DPOR	Power On Reset Delay	0.8		1.2	s

AC CHARACTERISTICS

T_A = 0°C to + 70°C; V_{CC} = 4.5 V to 5.5 V; F_{OSC} = 32.768 KHz

Symbol	Parameter	Min	Max	Typical	Units
T_WRES	Power-On Reset Min. Width		5TPC		µS
T_DH_S	H_Sync Incoming Signal Width	5.5	12.5	11	µS
T_DV_S	V_Sync Incoming Signal Width	0.15	1.5	1.0	mS
T_DE_S	Time Delay Between Leading Edge of V_Sync and H_Sync in Even Field	–12	+12	0	µS
T_DO_S	Time Delay Between Leading Edge of H_Sync in Odd Field	20	44	32	µS
T_WHV_S	H_Sync/V_Sync Edge Width		2.0	0.5	µS

Notes:

All timing of the I^2C bus interface are defined by related specifications of the I^2C bus interface.

Development Projects:
Customer is cautioned that while reasonable efforts will be employed to meet performance objectives and milestone dates, development is subject to unanticipated problems and delays. No production release is authorized or committed until the Customer and Zilog have agreed upon a Customer Procurement Specification for this project.

Pre-Characterization Product:
The product represented by this CPS is newly introduced and Zilog has not completed the full characterization of the product. The CPS states what Zilog knows about this product at this time, but additional features or non-conformance with some aspects of the CPS may be found, either by Zilog or its customers in the course of further application and characterization work. In addition, Zilog cautions that delivery may be uncertain at times, due to start-up yield issues.

Zilog, Inc. 210 East Hacienda Ave.
Campbell, CA 95008-6600
Telephone (408) 370-8000
Telex 910-338-7621
FAX 408 370-8056