Z89332

DIGITAL TELEVISION CONTROLLER

FEATURES

Device	ROM (KW)	RAM* (Words)	PWM (8-Bit)	Voltage Range
Z89332	24	640	8	4.5 to 5.5V

Note: *General-Purpose

- 42-Pin SDIP and 48-Pin Ceramic Packages with 42- to 48-Pin Adapter Socket
- 0°C to +70°C Temperature Range
- Fully Customized Character Set
- Character-Control and Closed-Caption Modes
- Keypad User Control
- TV Tuner Serial Interface
- Direct Video Signals
- Speed: 12 MHz

GENERAL DESCRIPTION

The Z89332 Digital Television Controller is designed to provide complete audio and video control of television receivers, video recorders, and advanced on-screen display facilities. The television controller features a Z89C00 RISC processor core that controls the on-board peripheral functions and registers using the standard processor instruction set.

Character attributes can be controlled through two modes: the on-screen display Character-Control Mode and the Closed-Caption Mode. The Character-Control Mode provides access to the full set of attribute controls, allowing the modification of attributes on a character-by-character basis. The insertion of control characters permits direction of other character attributes. Closed-caption text can be decoded directly from the composite video signal and displayed on-screen with the assistance of the processor's digital signal processing (DSP) capabilities.

The fully customized 512 character set, formatted in two 256 character banks, can be displayed with a host of display attributes that include underlining, italics, blinking, eight foreground/background colors, character position offset delay, and background transparency.

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.

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.

Notes:
All Signals with a preceding front slash, "/", are active Low, e.g.: B//W (WORD is active Low); /B/W (BYTE is active Low, only).

Power connections follow conventional descriptions below:

Connection	Circuit	Device
Power	V_{CC}	V_{DD}
Ground	GND	V_{SS}

GENERAL DESCRIPTION (Continued)

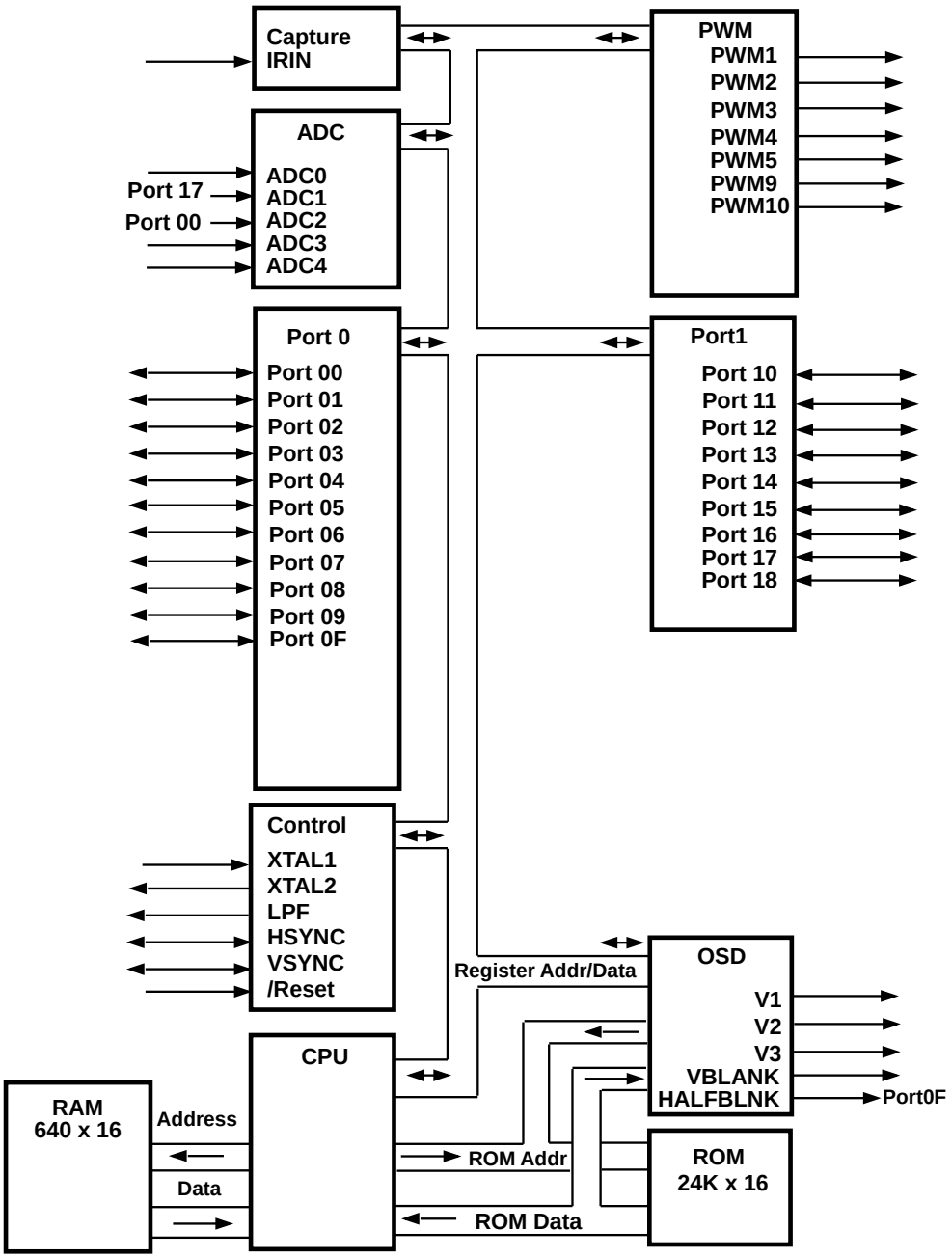

Figure 1. Functional Block Diagram

PIN DESCRIPTION

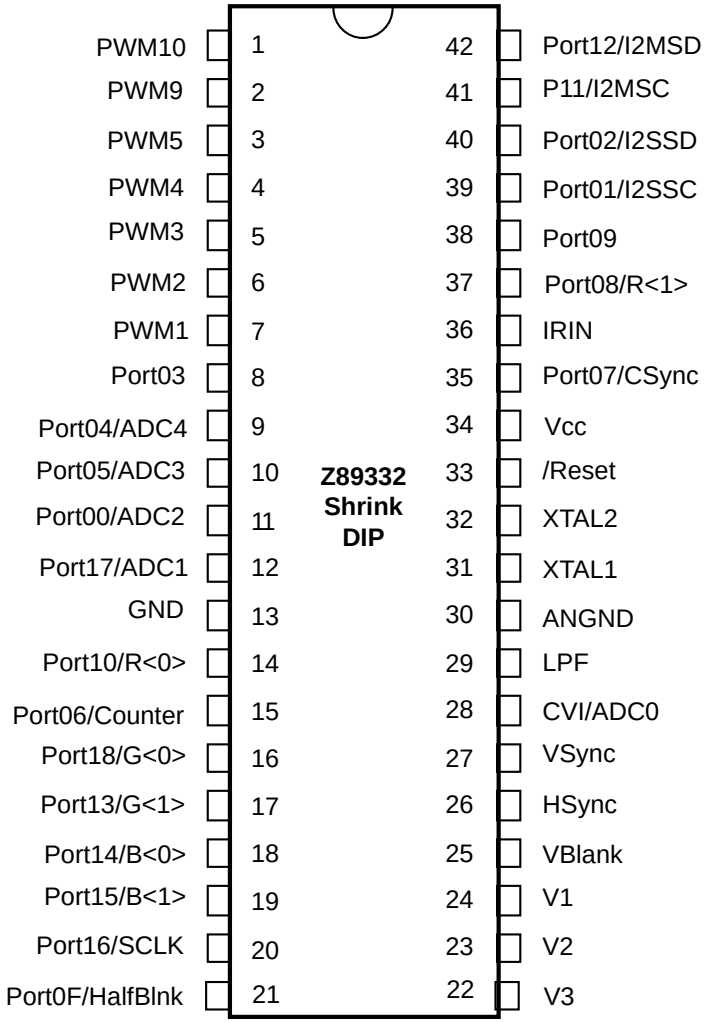

Figure 2. 42-Pin Shrink DIP and 48-Pin Ceramic Pin Configurations with 42- to 48-Pin Adapter Footprint

Table 1. 42-Pin SDIP Pin Identification

Name	Function	Z89332	Direction	Reset	Notes
V_{CC}	+ 5 Volts	34	PWR	–	
GND	0 Volts	13, 30	PWR	–	
IRIN	Infrared Remote Capture Input	36	I	I	
ADC[4:0]	4-Bit A/D Converter Input	9, 10, 11, 12, 28	AI	I	
PWM10, PWM9	14-Bit Pulse Width Modulator Output	1, 2	O	O	
PWM[5:1]	8-Bit Pulse Width Modulator Output	3, 4, 5, 6, 7	OD/O*	O	
Port0[F:0]	Bit Programmable Input/Output Ports	21, -, -, -, -, -, 38, 37, 35, -, -, 15, 8, 40, 39, 11	B	I	[1]
Port1[8:0]	Bit Programmable Input/Output Ports	16, 12, 20, 19, 18, 17, 42, 41, 14	B	I	
SCL	I^2C Clock I/O	39 or 41	BOD		[2]
SCD	I^2C Data I/O	40 or 42	BOD		[3]
XTAL1	Crystal Oscillator Input	31	AI	I	
XTAL2	Crystal Oscillator Output	32	AO	O	
LPF	Loop Filter	29	AB	O	
HSYNC	H_SYNC	26	B	I	
VSYNC	V_SYNC	27	B	I	
/Reset	Device Reset	33	I	I	
V[3:1]	OSD Video Output Typically Drive B, G, and R Outputs	22, 23, 24	O	O	
Blank	OSD Blank Output	25	O	O	
HalfBlank	OSD Half-Blank Outpu	21	O		[4]
RGB Digital Outputs	R[1:0], G[1:0], and B[1:0] Outputs of the RGB Matrix	37, 14, 17, 16, 19, 18	O		[5]
SCLK	Internal Processor SCLK	20	O		[6]

Notes:
1) Port 0 [E:A] is not available on the 42-pin SDIP version.
2) SCL I/O pin is shared with Port 0 or Port 11.
3) SCD I/O pin is shared with Port 02 or Port 12.
4) Half Blank output is a function shared with Port 0F.
5) Digital RGB outputs and the internal SCLK are shared with Port 1 [5:0].
6) Internal processor SCLK is shared with Port 16.
* PWM outputs are push/pull in Revision Z89332EA and later.

V1, V2, V3 ANALOG OUTPUT

Specifications V_{CC} = 5.25V and V_{CC} = 4.75V

V_{CC} = 5.25V	Condition	Limit
Output Voltage	Bit = 11	4.2V ± 0.4V
	Bit = 10	45% – 0.15V to 55% of actual data = 11 value
	Bit = 01	0.60 V ± 0.4V
	Bit = 00	74% to 89% of actual data = 11 value
Setting Time	70% of DC Level, 10 pF Load	< 50 nsec

V_{CC} = 4.75V	Condition	Limit
Output Voltage	Bit = 11	3.6V ± 0.4V
	Bit = 10	45% – 0.15V to 55% of actual data = 11 value
	Bit = 01	0.60V ± 0.4V
	Bit = 00	74% to 89% of actual data = 11 value
Setting Time	70% of DC Level, 10 pF Load	< 50 nsec

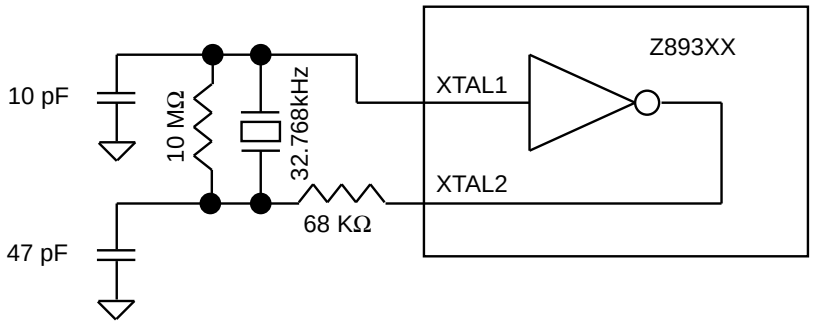

Figure 3. 32K Oscillator Recommended Circuit

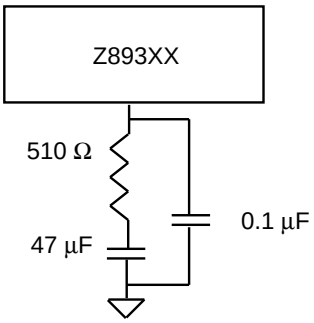

Figure 4. Recommended Low Pass Filter Circuit

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		Open-Drain PWM Outputs (PWM1...PWM8)
V_O	Output Voltage	–0.3	V_{CC} +0.3	V	Push/Pull PWM Outputs (PWM1...PWM8) = Z89332EA and Later Revisions
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} = 4.5V to + 5.5V; 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	0.7 V_{CC}	V_{CC}	3.6	V	
V_{PU}	Max. Pull-Up Voltage		V_{CC} +0.3		V	All Pins
V_{OL}	Output Voltage Low		0.4	0.16	V	@ I_{OL} = 1 mA
V_{OH}	Output Voltage High	V_{CC} –0.4		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} = 0V
I_{IL}	Input Leakage	–3.0	3.0	0.01	µA	@ 0V and V_{CC}
I_{CC}	Supply Current		100	60	mA	
I_{ADC}	Input Current		0.5		mA	AE Revision
I_{ADC}	Input Current		10		µA	CC,CA,EA & Later Rev.

Notes:

A) The Z89332 should not be operated for extended periods with the crystal oscillator disconnected, except in the defined power-down modes. In the event that the Z89332 is operated with the oscillator disconnected, the device may draw higher than typical current.

B) Each line of the on-screen display can consist of any number of characters, up to a maximum of 30 characters.

AC CHARACTERISTICS

T_A = 0°C to + 70°C; V_{CC} = 4.5V to 5.5V; 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	Sec

AC CHARACTERISTICS

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

Symbol	Parameter	Min	Max	Typical	Units
T_WRES	Power-On Reset Min. Width		5 TPC		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

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