Z90233, Z90234, and Z90231

eZVision 200 Television Controllers with OSD

Product Specification

PS010703-0502

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The Z90233/Z90234 and Z90231 are the ROM and OTP versions of the eZVision 200 television controller with OSD. Based on ZiLOG's powerful Z8 architecture, the Z90233/Z90234 and Z90231 contain 24 KB of program memory. The following enhanced features are included:

- Flexible inter-row spacing
- Higher character cell resolution (14 x 18)
- Background mesh effect
- Dedicated infrared capture registers
- On-chip analog-to-digital converter
- Hardware master mode I^2C interface

The familiar Z8 architecture, in combination with these advanced features, makes the eZVision 200 an ideal choice for midrange televisions in both PAL and NTSC markets.

The eZVision 200 family consists of three basic device types:

- The Z90233 and Z90234 masked ROM
- The Z90231 OTP
- The Z90239 In-Circuit Emulator (ICE) chip

The OTP supports a field-programmable 24 KB program ROM. The ICE chip is used in the Z90239 emulator and protopak. The Z90233/Z90234 masked ROM supports a 16/32-KB system ROM (selectable through a mask option).

The eZVision 200 family takes full advantage of the Z8 microcontroller's expanded register file space to offer greater flexibility in OSD creations that simulate bitmap graphics, icons, and animation.

Product Block Diagram

Figure 1 is the product block diagram for the eZVision 200 television controllers.

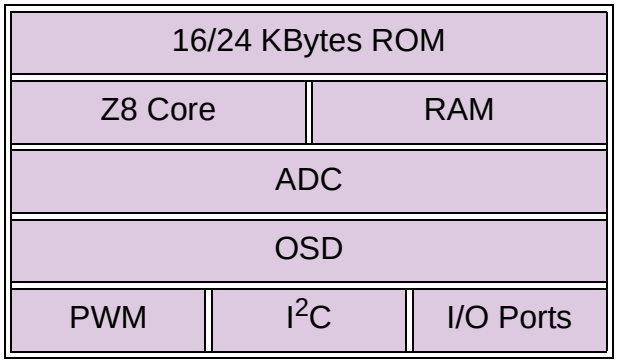

Figure 1. Product Block Diagram

On-Screen Display (OSD) Features

The eZVision 200 television controllers have the following OSD features:

- Displays of up to 10 rows by 24 columns with 256 characters
- Provides character cell resolution of 14 pixels by 18 scan lines
- Offers variable inter-row spacing from 0–15 horizontal scan lines
- Uses color palette table to program foreground and background of character

Microcontroller Features

The eZVision 200 television controllers have the following microcontroller features:

- Incorporates Z8® MCU core at 6 MHz
- Z90233 and Z90234 have 16K and 24K masked ROM, respectively
- 236 bytes of system RAM
- Ten 6-bit pulse width modulators
- One 14-bit pulse width modulator
- On-chip infrared (IR) capture registers

- Four channels of 4-bit analog-to-digital converter
- 27 general-purpose I/O pins
- Provides I^2C master serial communication port
- 42-pin SDIP and 44-pin PQFP packages
- Can be emulated with 124-pin PGA package (Z90239)

Block Diagram of eZVision 200

Figure 2 is a block diagram of the eZVision 200 family.

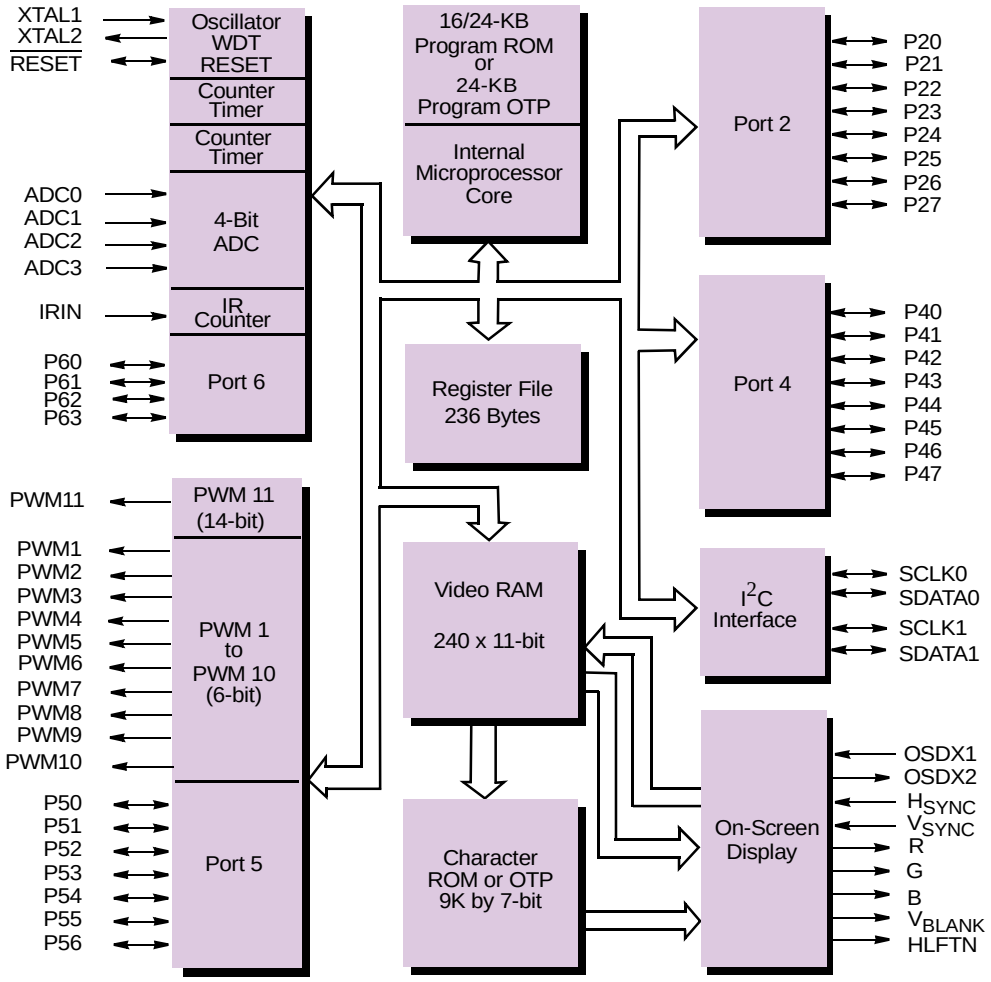

Figure 2. Block Diagram

Pin-Outs and Pin Direction

Figure 3 identifies the pins for the 42-pin shrink dual in-line package (SDIP); Figure 4 on page 6 identifies the pins for the 44-pin plastic quad flat package (PQFP). Table 6 on page 6 describes the pins.

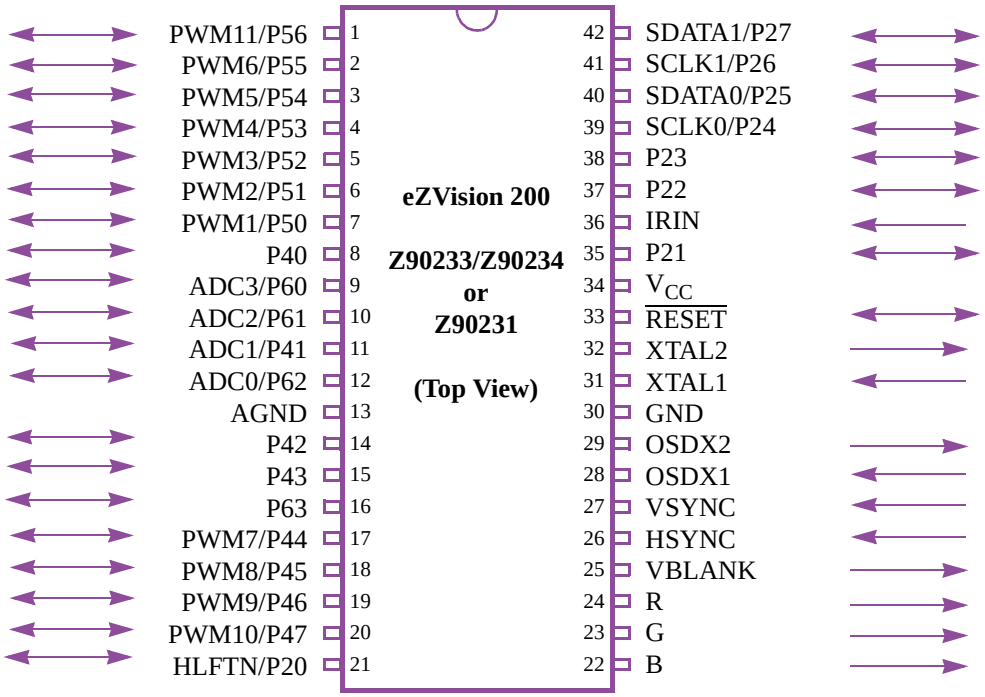

Figure 3. 42-Pin SDIP

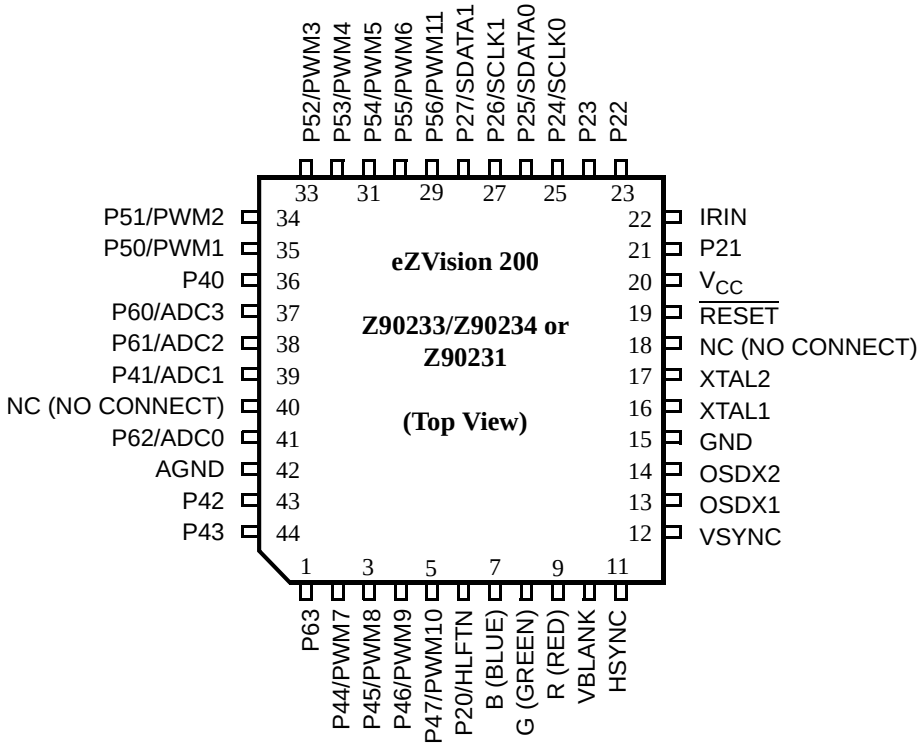

Figure 4. 44-Pin PQFP

Table 6. Pin Descriptions for the Z90233, Z90234, and Z90231

Name	42-Pin SDIP Pin Number	44-Pin PQFP Pin Number	Function	Direction	Reset State
V_{CC}	34	20	+5 Volts	PWR	PWR
GND, AGND	30, 13	15, 42	0 Volts	PWR	PWR
IRIN	36	22	Infrared remote capture input	I	I
PWM11	1	29	14-bit pulse width modulator output*	O	I
PWM10–PWM1	20, 19, 18, 17, 2, 3, 4, 5, 6, 7	5, 4, 3, 2, 30, 31, 32, 33, 34, 35	6-bit pulse width modulator output*	O	I
P56–P50	7, 6, 5, 4, 3, 2, 1	29, 30, 31, 32, 33, 34, 35	Bit-programmable input/output ports	I/O	I

Table 6. Pin Descriptions for the Z90233, Z90234, and Z90231 (Continued)

Name	42-Pin SDIP Pin Number	44-Pin PQFP Pin Number	Function	Direction	Reset State
P27–P20	42, 41, 40, 39, 38, 37, 35, 21	28, 27, 26, 25, 24, 23, 21, 6	Bit-programmable input/output ports	I/O	I
HLFTN	21	6	Half tone output	O	I
SDATA0, 1	40, 42	26, 28	I^2C data	I/O	I
SCLK0, 1	39, 41	25, 27	I^2C clock	I/O	I
P63–P60	16, 12, 10, 9	1, 41, 38, 37	Bit-programmable input/output ports	I/O	I
P47–P40	20, 19, 18, 17, 15, 14, 11, 8	5, 4, 3, 2, 44, 43, 39, 36	Bit-programmable input/output ports	I/O	I
XTAL1	31	16	Crystal oscillator input	I	I
XTAL2	32	17	Crystal oscillator output	O	O
OSDX1	28	13	Dot clock oscillator input	I	I
OSDX2	29	14	Dot clock oscillator output	O	O
HSYNC	26	11	Horizontal sync	I	I
VSYNC	27	12	Vertical sync	I	I
VBLANK	25	10	Video blank	O	O
R, G, B	24, 23, 22	9, 8, 7	Video R, G, B	O	O
ADC3–ADC0	9, 10, 11, 12	37, 38, 39, 41	4-bit analog-to-digital converter input	AI	I
RESET	33	19	Device reset	I/O	I

Note: *These pins are input on POR. They must be configured to be output ports for PWM applications.

Absolute Maximum Ratings

Stresses greater than those listed in Table 7 can cause permanent damage to the device. This rating 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 can affect device reliability.

Table 7. Absolute Maximum Ratings

Symbol	Parameters	Min	Max	Units	Notes
V_{DD}	Power Supply Voltage	–0.3	+7	V	
V_I	Input Voltage	–0.3	V_{DD}+0.3	V	
V_O	Output Voltage	–0.3	V_{DD}+0.3	V	
I_{OH}	Output Current High		–10	mA	per pin
I_{OH}	Output Current High		–100	mA	per device
I_{OL}	Output Current Low		20	mA	per pin
I_{OL}	Output Current Low		200	mA	per device
T_A	Operating Temperature	0	70	°C	
T_{STG}	Storage Temperature	–55	150	°C	

Standard Test Conditions

The characteristics listed below apply for standard test conditions as noted. All voltages are referenced to GND. Positive current flows into the referenced pin (see Figure 5).

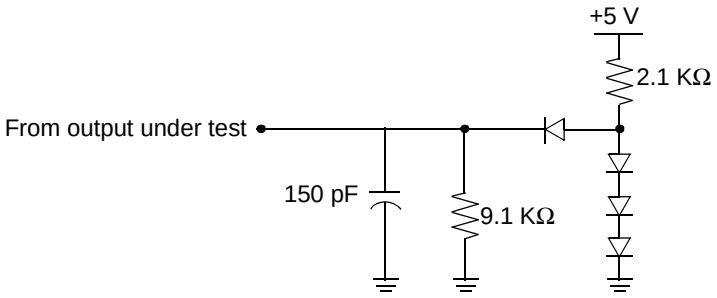

Figure 5. Test Load Diagram

DC Characteristics

Table 8 lists the DC characteristics.

Table 8. DC Characteristics

Symbol	Parameter	Min	Typical	Max	Units	Conditions
V_{DD}	Power Supply Voltage	4.5	5.00	5.5	V	
V_{IH}	Input Voltage High	$0.7V_{DD}$		V_{DD}	V	
V_{IL}	Input Voltage Low	0		$0.2V_{DD}$	V	
V_{IHC}	Input XTAL/Osc in High	$0.7V_{DD}$		VCC	V	
V_{ILC}	Input XTAL/Osc in Low	0		$0.07V_{DD}$	V	
V_{OH_ST}	Output Voltage High	V_{DD}–0.4	4.75		V	I_{OH}=–2 mA for standard drive
V_{OL_ST}	Output Voltage Low		0.16	0.4	V	I_{OL}=–2.00 mA for standard drive
V_{OH_LE}	Output Voltage High			V_{DD}–0.4	V	I_{OH}=–0.3 mA for low EMI drive
V_{OL_LE}	Output Voltage Low	0.4			V	I_{OL}=0.3 mA for low EMI drive
V_{OH_LE}	Output Voltage High	V_{DD}–0.4			V	I_{OH}=–0.2 mA for low EMI XTAL/Osc
V_{OL_LE}	Output Voltage Low			0.4	V	I_{OL}=0.2 mA for low EMI XTAL/Osc
V_{HY}	Schmitt Hysteresis	$0.1V_{DD}$	0.8		V	
I_{IR}	Reset Input Current		–46	–80	µA	V_{RL}=0 V
I_{IL}	Input Leakage	–3.0	0.01	3.0	µA	0 V, V_{DD}
I_{OL}	Tri-State Leakage	–3.0	0.02	3.0	µA	0 V, V_{DD}
I_{CC}	Supply Current		25	40	mA	All inputs at rail; outputs floating
I_{CC1}	HALT Mode Current		3.2	6	mA	All inputs at rail; outputs floating
I_{CC2}	STOP Mode Current			50	µA	All inputs at rail; outputs floating

Notes: T_A=0 °C to +70 °C; V_{DD}=+4.5 V to +5.5 V; F_{OSC}=6 MHz
Typical values measured at 25 °C.
Minimum and maximum values indicated from 0 °C to 70 °C.

AC Characteristics

Table 9 lists the AC characteristics. Figure 6 shows the AC timing diagram.

Table 9. AC Characteristics

No.	Symbol	Parameter	Minimum	Maximum	Units
1	T_pC	Input clock period	166	1000	ns
2	T_rC, T_fC	Clock input rise and fall		25	ns
3	T_wC	Input clock width	35		ns
4	$T_wH_{SYNC}L$	Timer input low width	70		ns
5	$T_wH_{SYNC}H$	Timer input high width	$3T_pC$		
6	T_pH_{SYNC}	Timer input period	$8T_pC$		
7	T_rH_{SYNC}, T_fH_{SYNC}	Timer input rise and fall		100	ns
8	T_wIL	Interrupt request input low	70		ns
9	T_wIH	Interrupt request input high	$3T_pC$		
10	T_dPOR	Power-on reset delay	5	25	ms
11	$T_dLVIRES$	Low-voltage detect to internal RESET condition	200		ns
12	T_wRES	Reset minimum width	$5T_pC$		
13	T_dH_sOl	H_{sync} start to V_{OSC} stop	$2T_pV$	$3T_pV$	
14	T_dH_sOh	H_{sync} start to V_{OSC} start		$1T_pV$	

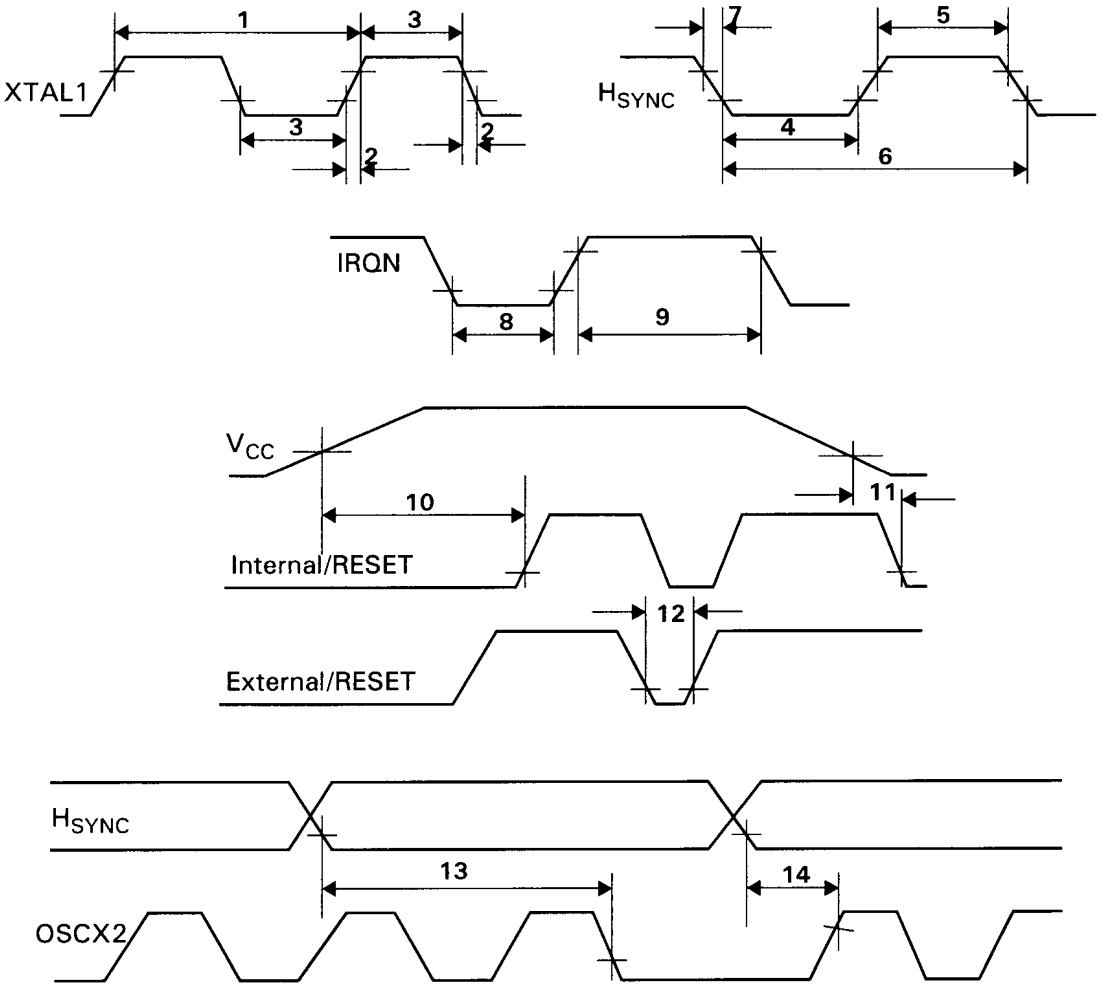

Figure 6. AC Timing Diagram

Development Tools and Support

Available in OTP and masked ROM versions, the Z90231 and Z90233/Z90234 fulfill prototype and production requirements. The Z90231 uses ICEbox™ (In-Circuit Emulator) tools (Z9025900ZEM) to make programming and debugging applications easy and convenient.

The ZiLOG Developer Studio (ZDS) is a complete software program that provides easy code generation and program management.

For code development, ZiLOG offers its specialized application program interface (API) for OSD. The API deals directly with proper sequencing and timing when interfacing with hardware, shielding the user application programmer from tedious and error-prone details.

The Z8933200ZCO, an OSD evaluation board, is used to synchronize the emulator with a video display. Refer to Figure 7 for a suggested code development environment.

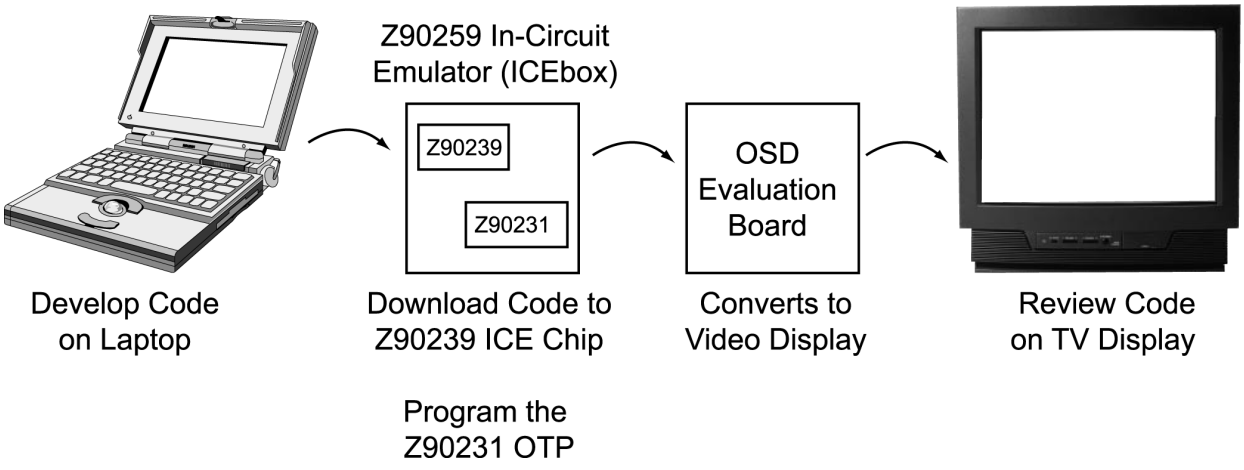

Figure 7. Code Development Environment

ZiLOG also offers the Z9020900TSC Protopak to verify code on a television.

Related Products

Table 10 lists the related TV controllers and vertical blanking interval (VBI) decoders.

Table 10. Related Products

Z9037x	eZVision 300 dual-scan TV controller for progressive scan and standard interlaced scan
Z9036x	eZVision 300 advanced TV controller with 32 KWords of ROM
Z86129	eZSelect closed caption decoder (CCD)
Z86229	eZSelect CCD with second I^2C address select
Z86131	eZSelect auto time set
Z86130	eZSelect smart V-chip
Z86230	eZSelect smart V-chip with second I^2C address select

Electrical Features Summary

- 40 mA maximum supply current
- 4.50 V to 5.50 V operating range

eZVision 200 Device Selection

Table 11 lists the differences among the eZVision 200 family television controllers.

Table 11. eZVision 200 Family Television Controllers

Device	Application	ROM (Bytes)	RAM (Bytes)	Pkg	I^2C	IR Capture	ADC	Bit I/O (max)	PWM (6/14-bit)
Z90233	TV receiver controller	16K	236	42-pin SDIP 44-pin PQFP	Yes	Yes	4 Ch.	27	10/2
Z90234	TV receiver controller	24K	236	42-pin SDIP 44-pin PQFP	Yes	Yes	4 Ch.	27	10/2
Z90231	TV receiver controller	24K OTP	236	42-pin SDIP 44-pin PQFP	Yes	Yes	4 Ch.	27	10/2
Z90255	TV receiver controller	32K	300	42-pin SDIP	Yes	Yes	4 Ch.	27	10/2
Z90251	TV receiver controller	32K OTP	300	42-pin SDIP	Yes	Yes	4 Ch.	27	10/2

Ordering Information

Table 12 lists the ordering information for the eZVision 200 television controllers.

Table 12. Ordering Information

Part	PSI	Description
Z90233	Z9023306PSC Rxxxx* Z9023306FSC Rxxxx*	16 KB masked ROM 42 SDIP 16 KB masked ROM 44 PQFP
Z90234	Z9023406PSC Rxxxx* Z9023406FSC Rxxxx*	24 KB masked ROM 42 SDIP 24 KB masked ROM 44 PQFP
Z90231	Z9023106PSC Z9023106FSC	24 KB OTP 42 SDIP 24 KB OTP 44 PQFP
Z90251	Z9025106PSC	32 KB OTP TV controller
Z90255	Z9025506PSC Rxxxx*	32 KB masked ROM TV controller
Z9025900ZEM	Z9025900ZEM	Emulator/programmer
Z9020900TSC	Z9020900TSC	Protopak
Z8933200ZCO	Z8933200ZCO	OSD evaluation board

* xxxx is a unique ROM number assigned to each customer code.