



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 I²C 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.

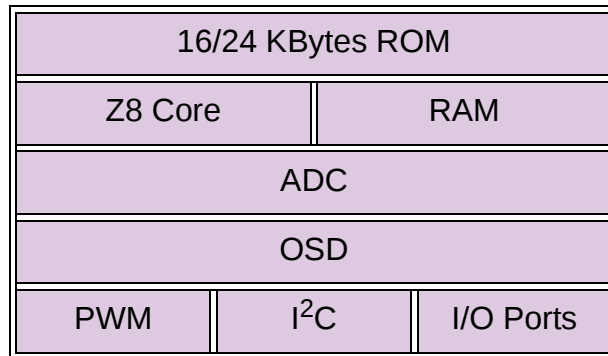


Figure 1. Product Block Diagram

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 I²C 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.

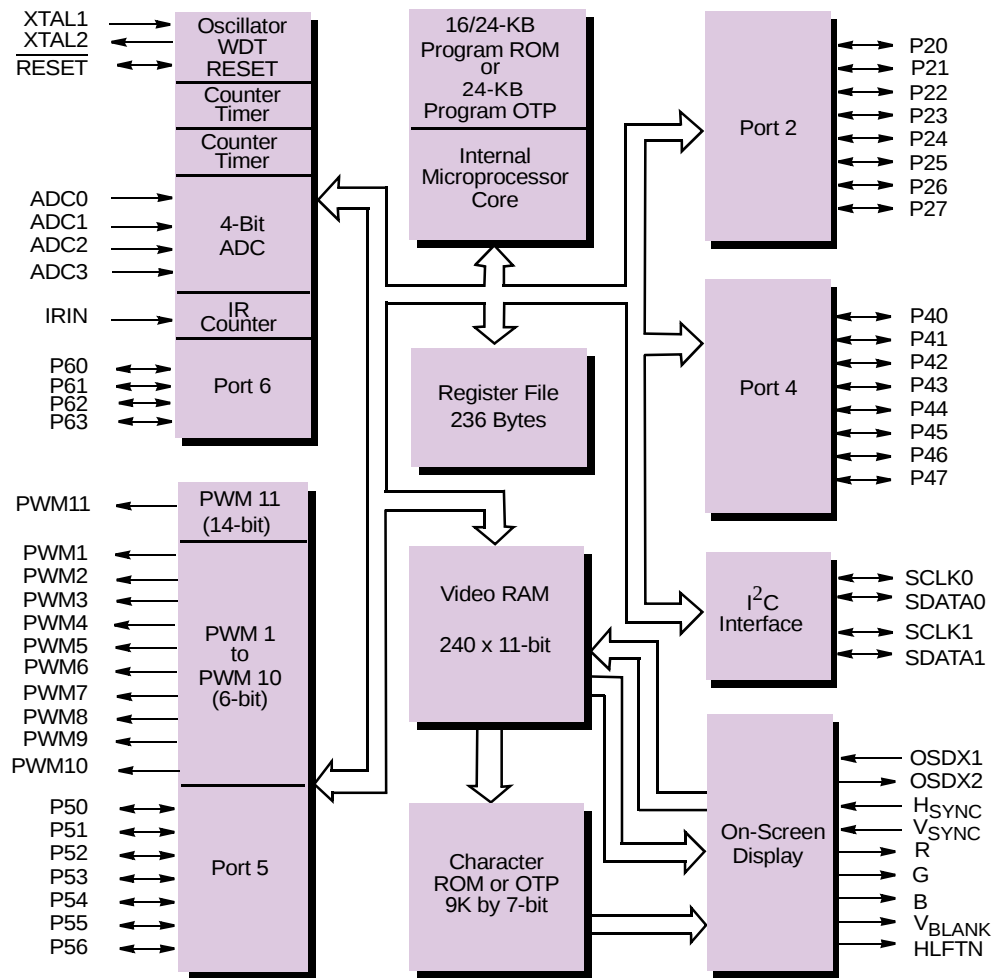


Figure 2. Block Diagram

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.

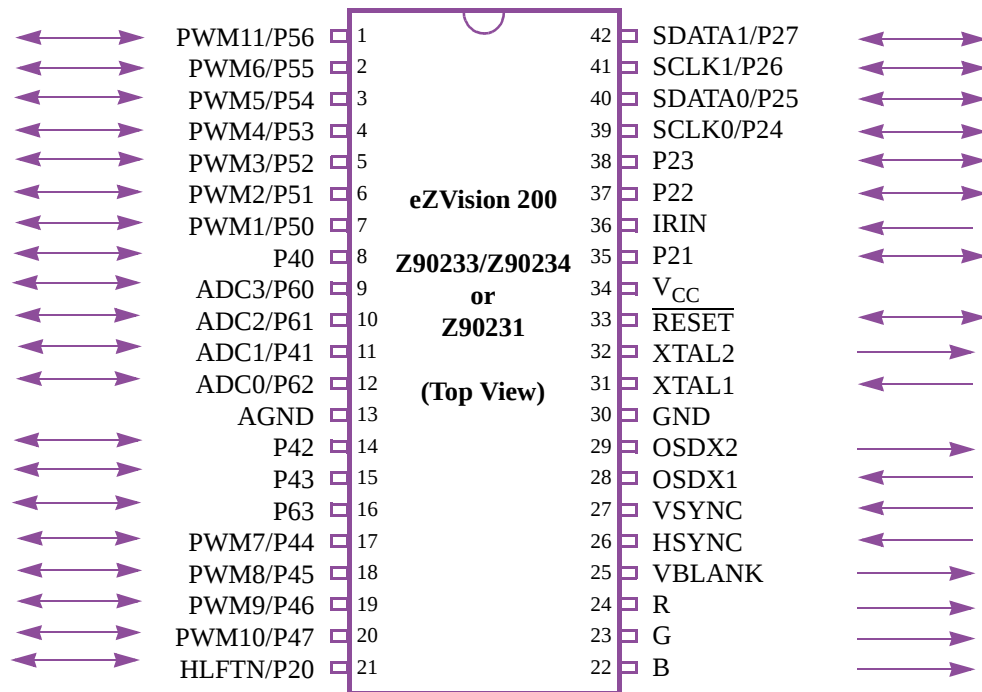


Figure 3. 42-Pin SDIP

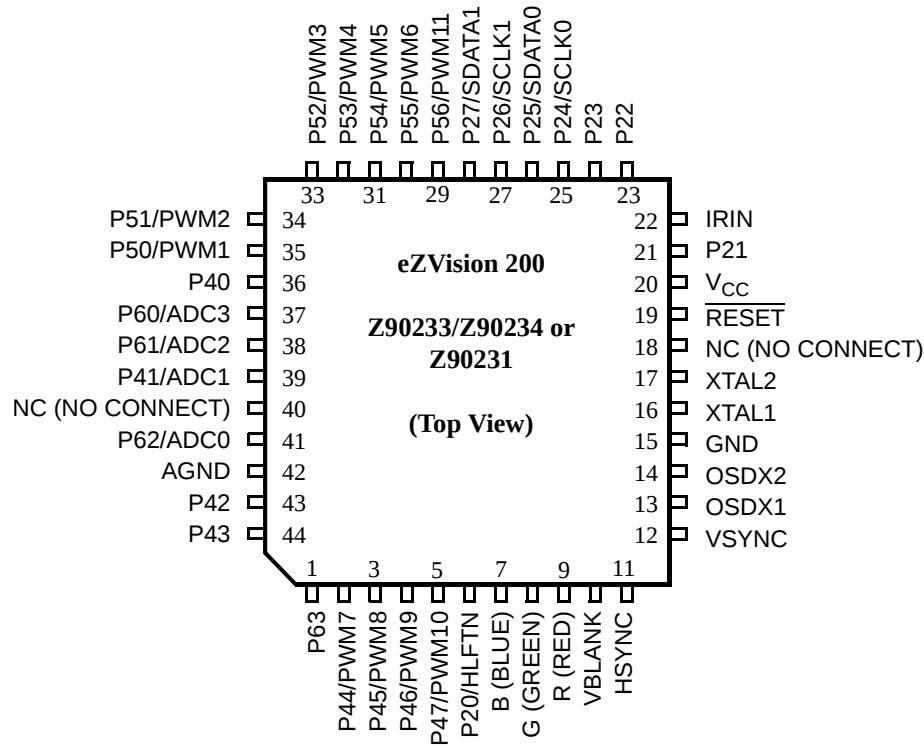


Figure 4. 44-Pin PQFP

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 ² C data	I/O	I
SCLK0, 1	39, 41	25, 27	I ² C 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
VBANK	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).

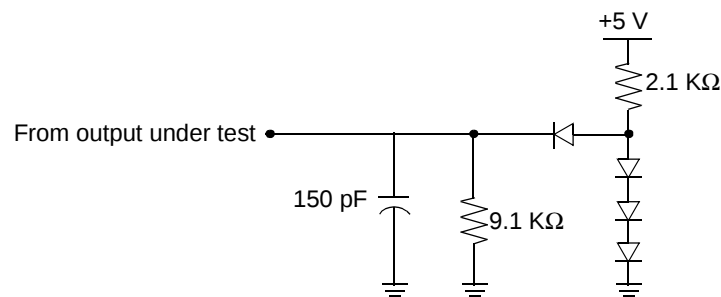


Figure 5. Test Load Diagram

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	μ A	$V_{RL}=0$ V
I_{IL}	Input Leakage	-3.0	0.01	3.0	μ A	0 V, V_{DD}
I_{OL}	Tri-State Leakage	-3.0	0.02	3.0	μ A	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	μ A	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_sOI}	H_{sync} start to V_{OSC} stop	$2T_{pV}$	$3T_{pV}$	
14	T_{dH_sOh}	H_{sync} start to V_{OSC} start		$1T_{pV}$	

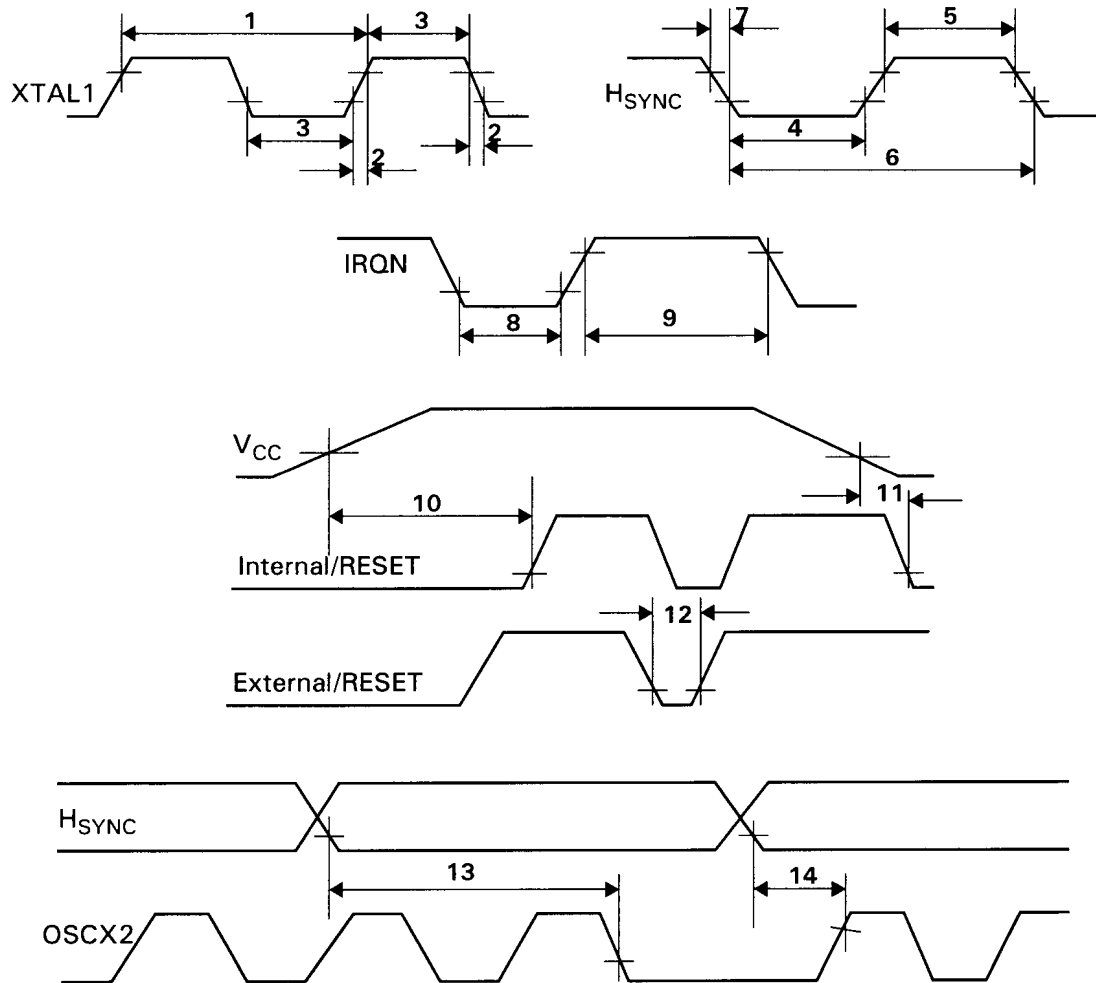


Figure 6. AC Timing Diagram

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.

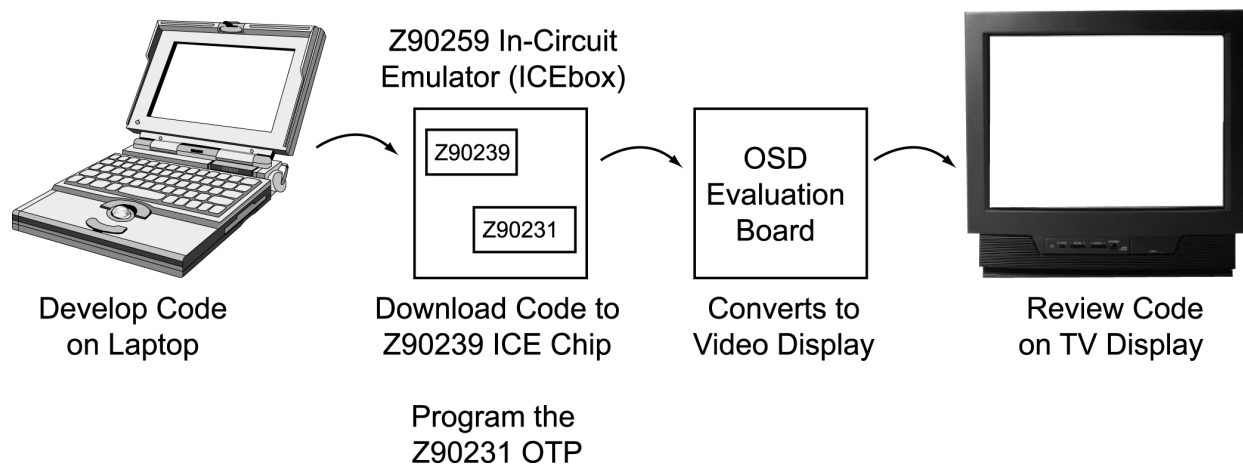


Figure 7. Code Development Environment

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 ² C address select
Z86131	eZSelect auto time set
Z86130	eZSelect smart V-chip
Z86230	eZSelect smart V-chip with second I ² C 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 ² C	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*	16 KB masked ROM 42 SDIP
	Z9023306FSC Rxxxx*	16 KB masked ROM 44 PQFP
Z90234	Z9023406PSC Rxxxx*	24 KB masked ROM 42 SDIP
	Z9023406FSC Rxxxx*	24 KB masked ROM 44 PQFP
Z90231	Z9023106PSC	24 KB OTP 42 SDIP
	Z9023106FSC	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.

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ZGP323HSH4804C	ZGP323LSH4804C	ZGP323LSH4808C	ZGP323HSH4808C	ZGP323HAH2016C
ZGP323HEH2016C	ZGP323HSH4832C	ZGP323LSH4832C	ZGP323LAH2016C	ZGP323LEH2016C
ZGP323HAP2016C	ZGP323LEP2016C	ZGP323HEP2016C	ZGP323LAP2016C	ZGP323LSS2008C
ZGP323HSS2004C	ZGP323LSS2004C	ZGP323HSS2008C	ZGP323HES2032C	ZGP323LES2032C
ZGP323HAS2032C	ZGP323LAS2032C	ZGP323HAS2016C	ZGP323LES2016C	ZGP323HES2016C
ZGP323LSH2832C	ZGP323LAS2016C	ZGP323HSH2832C	ZGP323HSP2004C	ZGP323HSP2008C
ZGP323LSP2004C	ZGP323LSP2008C	ZGP323HAS2004C	ZGP323HES2004C	ZGP323LES2008C
ZGP323LAS2008C	ZGP323LAS2004C	ZGP323HES2008C	ZGP323HAS2008C	ZGP323LES2004C
ZGP323LSS2816C	ZGP323HSS2816C	ZGP323LEP2032C	ZGP323LAP2032C	ZGP323HEP2032C
ZGP323HAP2032C	ZGP323HAH2008C	ZGP323HEH2008C	ZGP323LEH2008C	ZGP323HEH2004C
ZGP323HAH2004C	ZGP323LAH2004C	ZGP323LEH2004C	ZGP323LAH2008C	ZGP323LSS2832C
ZGP323HSS2832C	ZGP323LSP4004C	ZGP323HSP4004C	ZGP323LEH2816C	ZGP323LAH2816C
ZGP323HAH2816C	ZGP323HEH2816C	ZGP323LSP4008C	ZGP323HSP4008C	ZGP323LSS2016C
ZGP323HSS2016C	ZGP323HSS2032C	ZGP323LSS2032C	ZGP323LSH2016C	ZGP323HSH2016C
ZGP323HAH2832C	ZGP323LEH2832C	ZGP323LAH2832C	ZGP323HEH2832C	ZGP323LSP2016C
ZGP323HSP2016C	ZGP323LEH4832C	ZGP323LAH4832C	ZGP323HEH4832C	ZGP323HAH4832C
ZGP323LAP2832C	ZGP323HAP2832C	ZGP323HEP2832C	ZGP323LEP2832C	ZGP323LSS2808C
ZGP323HSS2808C	ZGP323LSS2804C	ZGP323HSS2804C	ZGP323HSP2804C	ZGP323LSP2804C
ZGP323HEP4032C	ZGP323HAP4032C	ZGP323LSP2808C	ZGP323LAP4032C	ZGP323LEP4032C
ZGP323HSP2808C	ZGP323HEP2004C	ZGP323HAP2004C	ZGP323LEP2008C	ZGP323LEP2004C