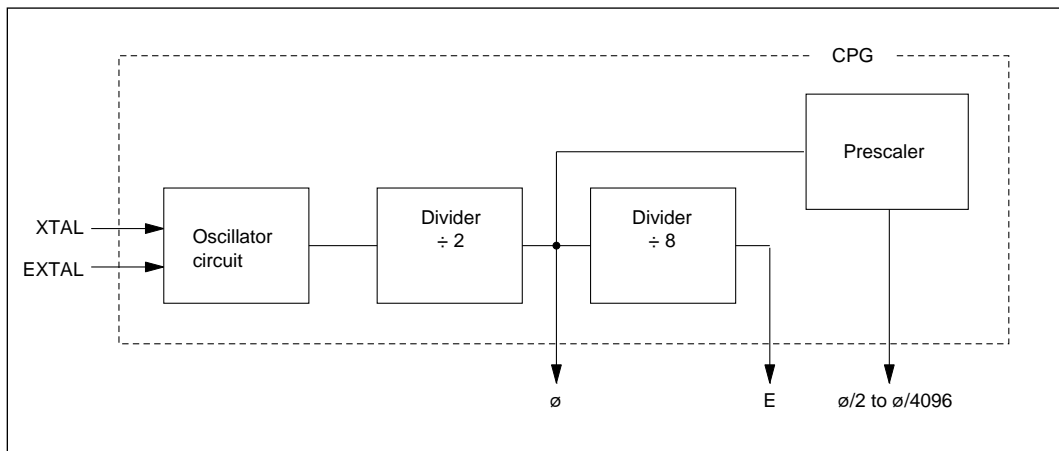


# Section 8 Clock Pulse Generator

## 8.1 Overview

The H8/532 chip has a built-in clock pulse generator (CPG) consisting of an oscillator circuit, a system ( $\emptyset$ ) clock divider, an E clock divider, and a group of prescalers. The prescalers generate clock signals for the on-chip supporting modules.

### 8.1.1 Block Diagram



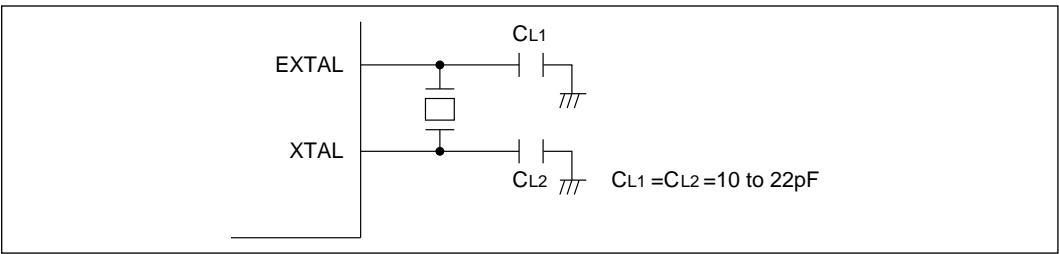
**Figure 8-1 Block Diagram of Clock Pulse Generator**

## 8.2 Oscillator Circuit

If an external crystal is connected across the EXTAL and XTAL pins, the on-chip oscillator circuit generates a clock signal for the system clock divider. Alternatively, an external clock signal can be applied to the EXTAL pin.

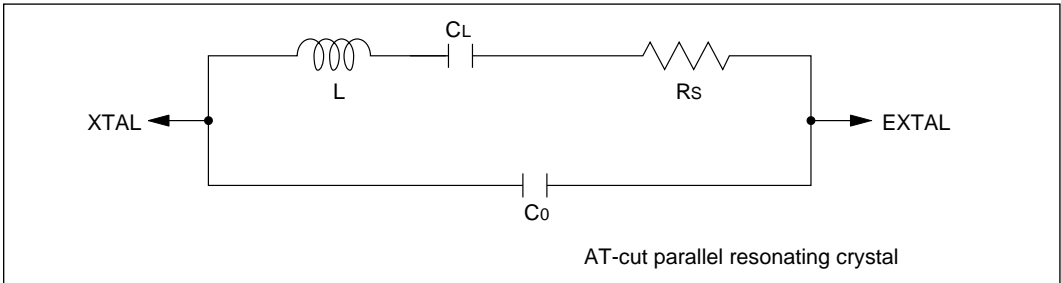
### Connecting an External Crystal

- (1) **Circuit Configuration:** An external crystal can be connected as in the example in figure 8-2. An AT-cut parallel resonating crystal should be used.



**Figure 8-2 Connection of Crystal Oscillator (Example)**

(2) **Crystal Oscillator:** The external crystal should have the characteristics listed in table 8-1.



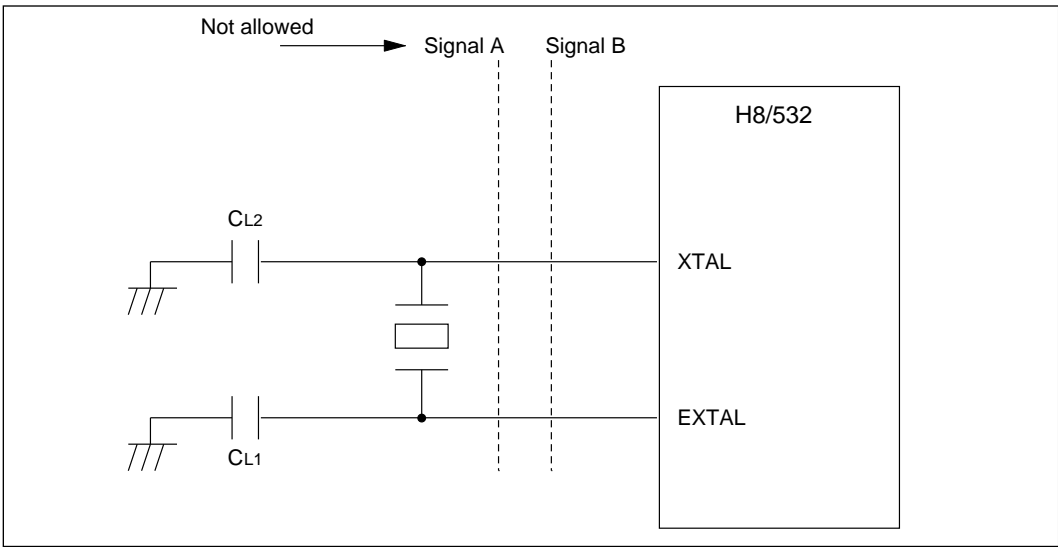
**Figure 8-3 Crystal Oscillator Equivalent Circuit**

**Table 8-1 External Crystal Parameters**

Frequency (MHz)	2	4	8	12	16	20
Rs max ( $\Omega$ )	500	120	60	40	30	20
C0 (pF)	7pF max					

(3) **Note on Board Design:** When an external crystal is connected, other signal lines should be kept away from the crystal circuit to prevent induction from interfering with correct oscillation. See figure 8-4.

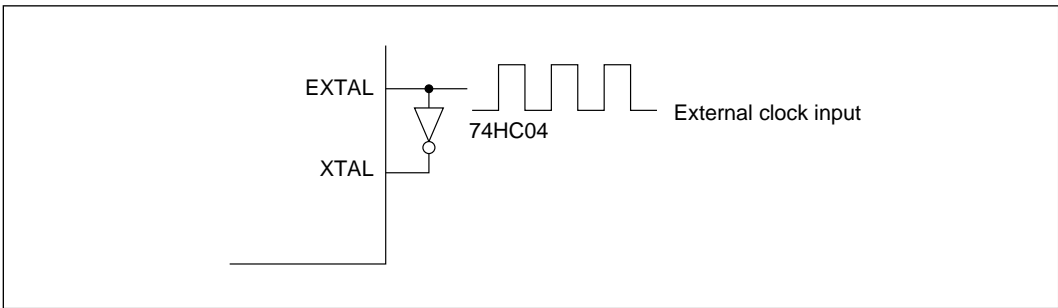
When the board is designed, the crystal and its load capacitors should be placed as close as possible to the XTAL and EXTAL pins.



**Figure 8-4 Notes on Board Design around External Crystal**

### Input of External Clock Signal

- (1) **Circuit Configuration:** An external clock signal can be input at the EXTAL and XTAL pins as shown in the example in figure 8-5.



**Figure 8-5 External Clock Input (Example)**

**Note:** When using make ROM, an external clock can be input at the EXTAL pin while leaving the XTAL pin open. Also when using ZTAT, an external clock under 16 MHz can be input at the EXTAL pin while leaving the XTAL pin open.

## (2) External Clock Input

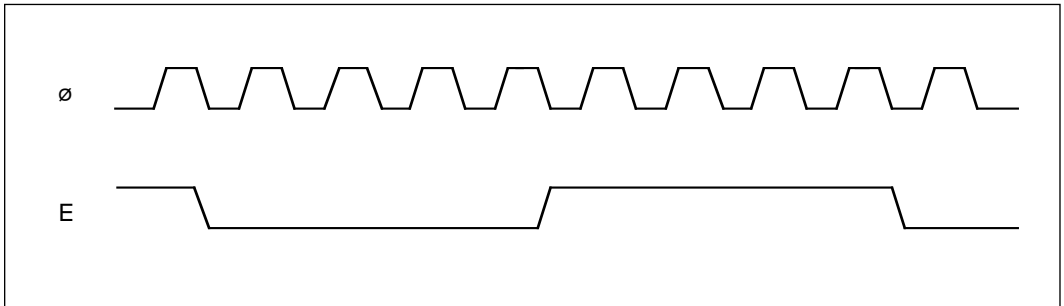
Frequency	Double the system clock ( $\emptyset$ ) frequency
Duty factor	45% to 55%

### 8.3 System Clock Divider

The system clock divider divides the crystal oscillator or external clock frequency ( $f_{osc}$ ) by 2 to create the  $\emptyset$  clock.

An E clock signal is created by dividing the  $\emptyset$  clock by 8. The E clock is used for interfacing to E clock based devices.

Figure 8-6 shows the phase relationship of the E clock to the  $\emptyset$  clock.



**Figure 8-6 Phase Relationship of  $\emptyset$  Clock and E Clock**