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APPLICATION
BRIEF

80186/80188 EFI Drive and Oscillator Operation

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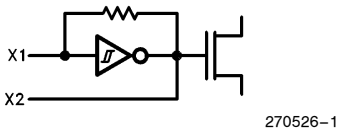
There has been some confusion in the past regarding the correct input for EFI (External Frequency Input) use and what parameters should be used for crystal selection. This Application Brief discusses the tradeoffs with each input so that one can decide which input suits his design and also lists the parameters for crystal selection.

EFI Operation

The oscillator circuit on the 186/188 is as shown in Figure 1 (simplified). Either input may be used for an EFI signal. Using X1 requires very little drive from an external oscillator since it is essentially the gate of an NMOS transistor. Clock operation works fine using this input, but at higher frequencies the stray capacitance on X2 begins to change the duty cycle of the clock. This will eventually cause the part to fail.



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NOTE:
Driving X_2 does not allow compatibility with future CMOS designs.

Figure 1. Oscillator Circuit on the 186/188

Using X2 as an EFI gives a broader frequency range but places a more stringent requirement on the drive capability of the external oscillator. Since X1 is an input, it may be grounded to minimize the capacitance. This in turn allows for a higher frequency range since the duty cycle remains closer to 50%. But with X1 grounded, the output of the inverter (which is directly connected to X2) is always trying to output a high. This means the oscillator driving X2 must be capable of sinking up to 15 mA at cold temperatures when trying to drive it low. If the external oscillator is capable of supplying 15 mA, then this method is preferred. Otherwise, X1 should be used as an EFI.

Caution: using X2 for EFI does not allow for CMOS compatibility at a future date.

Crystal Operation

The oscillator circuit is a single stage amplifier connected as a Pierce oscillator. There are no passive components in the oscillator circuit, only a unique combination of depletion and enhancement mode FET's. Characterization of the oscillator circuit showed that operation was optimum with crystal parameters as follows:

ESR (Equivalent Series Resistance)	30 ohms maximum
Co (Shunt Capacitance)	7.0 pf max.
C1 (Load Capacity)	20 pf ±2 pf
Drive Level	1 mW max.

This characterization data was supplied by:

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