**Plessey Semiconductors**

# SL680C SL1680C

## CRYSTAL OSCILLATOR MAINTAINING CIRCUITS

The SL680C and SL1680C are bipolar integrated circuits designed to maintain the oscillation of an external series resonant crystal without significant degradation of frequency stability. The sinewave output has about 3% harmonic distortion and its level is independant of crystal activity. Crystals may be used in their fundamental or overtone modes with only minor circuit changes.

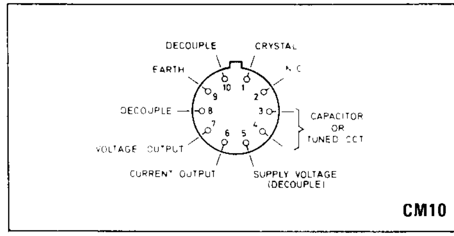


*Fig. 1 Pin connections, SL680C*

### FEATURES

- Insignificant Degradation of Crystal Frequency Stability.
- Frequency Range 100 kHz to 100 MHz
- Output Level Independent of Crystal Parameters.
- Overtone Crystals Can Be Used.
- Voltage and Current Outputs Provided.
- Harmonic Distortion Typically Less Than 3%.
- Very Low Crystal Power

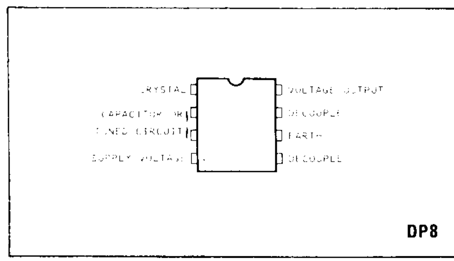


*Fig. 2 Pin connections, SL1680C*

### OPERATING NOTES

A block diagram of the SL680C/1680C is shown in Fig. 3. The circuit consists of a single transistor amplifier with the crystal decoupling its emitter. The output of this amplifier drives a fixed gain amplifier with an emitter follower output capable of voltage driving low impedance loads, and a free collector output for driving fixed impedances or tuned circuits (SL680C only).

The output from the fixed gain amplifier also goes to a detector and, via a variable attenuator, to the base of the single transistor amplifier. The variable attenuator is controlled by the detector output. The circuit contains an internal supply regulator, enabling it to be operated from a range of supply voltages.

In operation, the signal fed back to the tuned single transistor amplifier causes the system to oscillate at the resonant frequency of the crystal. A DC signal derived from the output level of the fixed gain amplifier and applied to the attenuator maintains the output at constant level irrespective of the activity of the crystal

The phase shift through the system has been kept as low as possible and, even more importantly, varies very little with temperature or power supply voltage. Since varying phase shift is the commonest cause of varying frequency in crystal oscillators (with the exception, of course, of variations in the crystals themselves) this low phase shift ensures that the oscillator's frequency variation with temperature and supply voltage will be minimal. The actual values will depend upon the crystal used but typical temperature variation is 10–3 ppm/°C over the

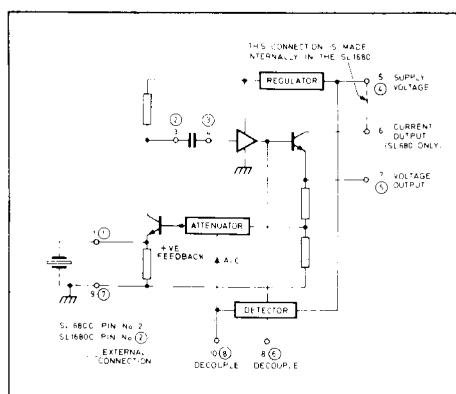


*Fig. 3 SL680C/1680C block diagram*

range —10 C to · 80 C and $10^{-1}$ ppm/V over a power supply range of 6 to 10 volts. These figures are independent of any variations due to the crystal itself.

Variations in the crystal are often caused by excessive power dissipation. The SL680C/SL1680C is unlikely to suffer from this problem since the crystal dissipation is held to the order of 0.5μ Watt.

Coupling between the tuned amplifier and the fixed gain amplifier is usually by a capacitor and the circuit oscillates at the crystal's fundamental frequency. If overtone operation is required the coupling must be by a high pass filter to ensure that the loop gain at the overtone exceeds the loop gain at the fundamental. For third Overtone operation this high pass filter may be as simple as a very small value capacitor but for higher overtones a tuned circuit of some sort is necessary.

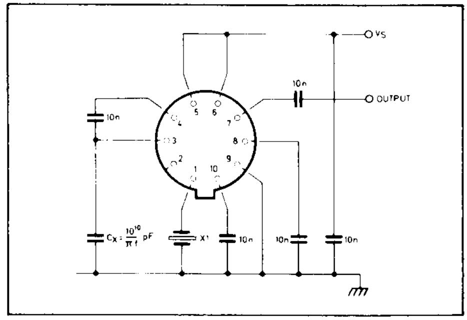


*Fig. 4 Fundamental test circuit*

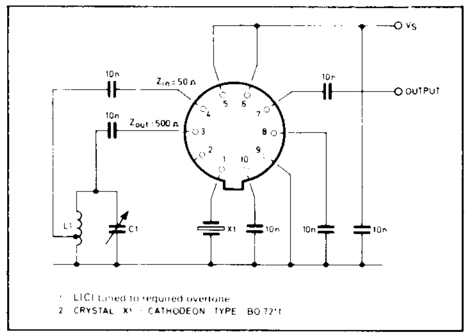


*Fig. 5 Third overtone test circuit*

## ELECTRICAL CHARACTERISTICS

**Test Conditions (unless otherwise stated):**

| | |
|---|---|
| Temperature | 22 C ± 2 C |
| Supply Voltage | 6V |
| Load Impedance | 500Ω |
| Crystal Fundamental | 16.3 MHz (series mode) |

| Characteristic | Value | | | Units | Conditions |
|---|---|---|---|---|---|
| | Min. | Typ. | Max. | | |
| Output Voltage | 0.1 | 0.15 | 0.2 | Vrms | SL680C |
| | 0.08 | 0.15 | 0.22 | Vrms | SL1680C |
| Supply Current | | 7 | 15 | mA | SL680C |
| | | 7 | | | SL1680C |
| Max. operating frequency | | 100 | | MHz | |
| Current output | | 1 | | mAp—p | SL680C |
| Harmonic output | | —30 | | dB | wrt 16.3MHz output |
| Frequency error (note 1) | | 5 | | ppm | |
| Frequency stability (note 2) | | 0.1 | | ppm/volt | Vs = 6V to 10V |
| | | $10^{-3}$ | | ppm/°C | —10 C to +80 C |
| Crystal dissipation | | 50Rs | | nW | Rs = Crystal series loss resistance |

NOTES

1. The frequency error is the difference between frequency of oscillation obtained using the SL680C/SL1680C and the frequency obtained in a zero phase measurement system such as described in BS9610
2. These stability figures are dependant on the crystal used and are given for guidance only

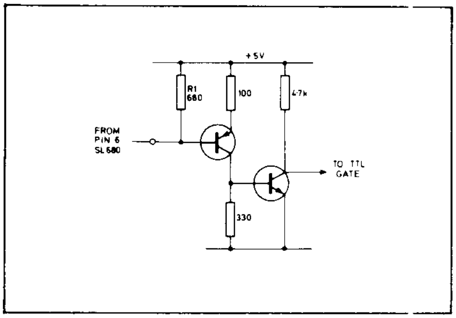


*Fig. 6 Buffer for driving TTL*

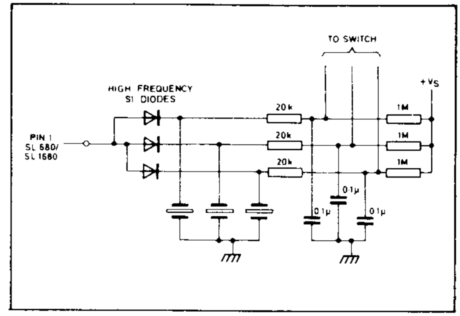


*Fig. 7 Crystal selection interface*

## Absolute Maximum Ratings

**(Non-simultaneous)**

Storage temperature: SL680C —55°C to +150°C
SL1680C —30°C to +85°C
Operating temperature: SL680C —55°C to +125°C
SL1680C —30°C to +70°C
Supply voltage +12V