



# Notebook LCD Panel EMI Reduction IC

## Features

- FCC approved method of EMI attenuation.
- Generates a low EMI spread spectrum clock of the input frequency.
- Optimized for frequency range from 50 to 110MHz.
- Internal loop filter minimizes external components and board space.
- Four selectable spread ranges.
- Low inherent cycle-to-cycle jitter.
- 3.3V operating voltage range.
- TTL or CMOS compatible inputs and outputs.
- CMOS design.
  - 8.46mA @ 3.3V, 54MHz
  - 9.79mA @ 3.3V, 65MHz
  - 12.06mA @ 3.3V, 81MHz
  - 16.51mA @ 3.3V, 108MHz
- Supports notebook VGA and other LCD timing controller applications.
- Pinout compatible to ICS MK1708 and Cypress CY25560.
- SSON / SBM pin for Spread Spectrum On/Off and Standby Mode controls.
- Available in 8-pin SOIC and TSSOP.

## Product Description

The P1708C is a versatile spread spectrum frequency modulator designed specifically for input clock frequencies. The P1708C reduces electromagnetic interference (EMI) at the clock source, allowing system wide reduction of EMI of down stream clock and data dependent signals. The P1708C allows significant system cost savings by reducing the number of circuit board layers, ferrite beads, shielding, and other passive components that are traditionally required to pass EMI regulations.

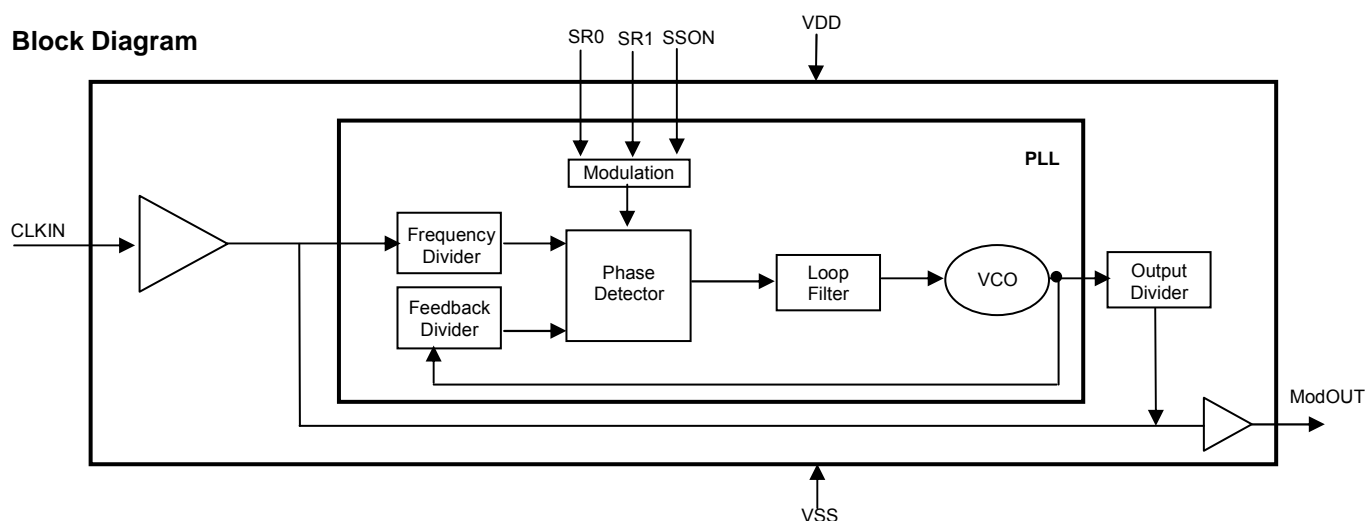
The P1708C modulates the output of a single PLL in order to "spread" the bandwidth of a synthesized clock, and more importantly, decreases the peak amplitudes of its harmonics. This result in significantly lower system EMI compared to the typical narrow band signal produced by oscillators and most frequency generators. Lowering EMI by increasing a signal's bandwidth is called 'spread spectrum clock generation.'

The P1708C uses the most efficient and optimized modulation profile approved by the FCC and is implemented in a proprietary all digital method.

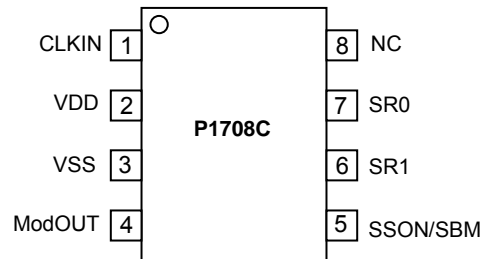
## Applications

The P1708C is targeted towards notebook LCD displays, and other displays using an LVDS interface, PC peripheral devices, and embedded systems.

## Block Diagram



## Pin Configuration



## Pin Description

| Pin# | Pin Name   | Type | Description  |
|------|------------|------|--|
| 1    | CLKIN      | I    | Connect to externally generated clock signal. To put the part into standby mode, disable the input clock signal to this pin and pull SSON / SBM (pin 5) low. Refer to <i>Standby Mode Selection</i> Table. |
| 2    | VDD        | P    | Connect to +3.3V.  |
| 3    | VSS        | P    | Ground Connection. Connect to system ground.   |
| 4    | ModOUT     | O    | Spread spectrum clock output.  |
| 5    | SSON / SBM | I    | Spread Spectrum On/Off and standby mode control. Refer to <i>Standby Mode Selection</i> Table. This pin has an internal pull-up resistor.  |
| 6    | SR1        | I    | Digital logic input used to select Spreading Range. Refer to <i>Spread Spectrum Selection</i> Table. This pin has an internal pull-up resistor.  |
| 7    | SR0        | I    | Digital logic input used to select Spreading Range. Refer to <i>Spread Spectrum Selection</i> Table. This pin has an internal pull-up resistor.  |
| 8    | NC         | -    | No connect.  |

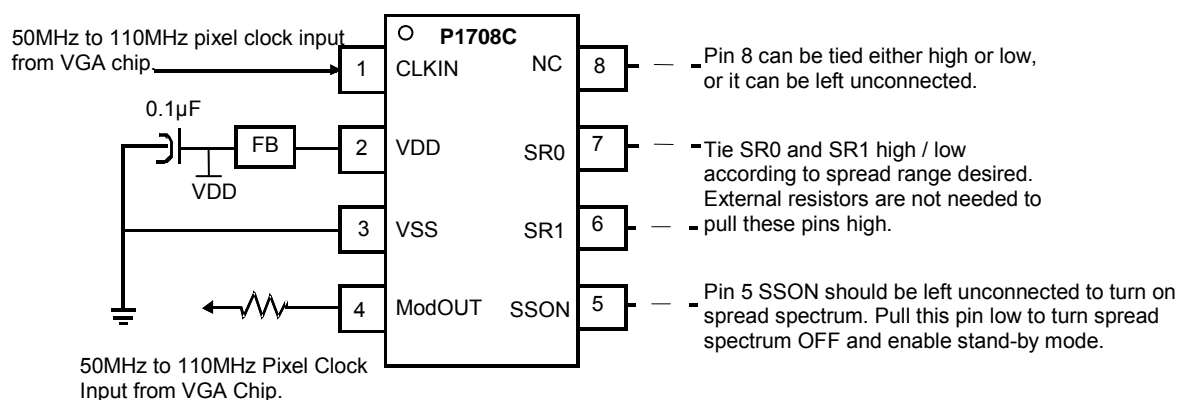
## Standby Mode Selection

| CLKIN    | SSON / SBM | Spread Spectrum | ModOUT    | PLL          | Mode         |
|----------|------------|-----------------|-----------|--------------|--------------|
| Disabled | 0          | N/A             | Disabled  | Disabled     | Standby      |
| Disabled | 1          | N/A             | Disabled  | Free Running | Free Running |
| Enabled  | 0          | Off             | Reference | Disabled     | Buffer out   |
| Enabled  | 1          | On              | Normal    | Normal       | Normal       |

## Spread Range Selection

| SR1 | SR0 | Spreading Range | Modulation Rate                 |
|-----|-----|-----------------|---------------------------------|
| 0   | 0   | ±1.00%          | $(F_{IN}/40) * 62.49\text{KHz}$ |
| 0   | 1   | ±2.00%          | $(F_{IN}/40) * 62.49\text{KHz}$ |
| 1   | 0   | ±0.25%          | $(F_{IN}/40) * 62.49\text{KHz}$ |
| 1   | 1   | ±0.75%          | $(F_{IN}/40) * 62.49\text{KHz}$ |

## Schematic for Notebook VGA Application



**Note:** To set the P1708C to standby mode, disable the input clock (pin 1 CLKIN) and pull SSON (pin 5) low. Refer to *Standby Mode Selection Table*.

## Absolute Maximum Ratings

| Symbol               | Parameter   | Rating       | Unit |
|----------------------|---|--------------|------|
| VDD, V <sub>IN</sub> | Voltage on any pin with respect to Ground             | -0.5 to +7.0 | V    |
| T <sub>STG</sub>     | Storage temperature                                   | -65 to +125  | °C   |
| T <sub>s</sub>       | Max. Soldering Temperature (10 sec)                   | 260          | °C   |
| T <sub>J</sub>       | Junction Temperature                                  | 150          | °C   |
| T <sub>DV</sub>      | Static Discharge Voltage (As per JEDEC STD22- A114-B) | 2            | KV   |

Note: These are stress ratings only and are not implied for functional use. Exposure to absolute maximum ratings for prolonged periods of time may affect device reliability.

## Operating Conditions

| Parameter       | Description                                 | Min | Max | Unit |
|-----------------|---|-----|-----|------|
| VDD             | Supply Voltage                              | 2.7 | 3.7 | V    |
| T <sub>A</sub>  | Operating Temperature (Ambient Temperature) | -40 | +85 | °C   |
| C <sub>L</sub>  | Load Capacitance                            |     | 15  | pF   |
| C <sub>IN</sub> | Input Capacitance                           |     | 7   | pF   |

#### DC Electrical Characteristics

| Symbol    | Parameter   | Min     | Typ  | Max                     | Unit     |
|-----------|---|---------|------|-------------------------|----------|
| $V_{IL}$  | Input low voltage   | GND-0.3 |      | 0.8                     | V        |
| $V_{IH}$  | Input high voltage  | 2.0     |      | $V_{DD}+0.3$            | V        |
| $I_{IL}$  | Input low current (pull-up resistors on inputs SR0, SR1 and SSON/SBM) |         |      | -35                     | $\mu A$  |
| $I_{IH}$  | Input high current  |         |      | 35                      | $\mu A$  |
| $I_{XOL}$ | $X_{OUT}$ output low current @ 0.4V, $V_{DD} = 3.3V$                  |         | 3    |                         | mA       |
| $I_{XOH}$ | $X_{OUT}$ output high current @ 2.5V, $V_{DD} = 3.3V$                 |         | 3    |                         | mA       |
| $V_{OL}$  | Output low voltage $V_{DD} = 3.3V$ , $I_{OL} = 20mA$                  |         |      | 0.4                     | V        |
| $V_{OH}$  | Output high voltage $V_{DD} = 3.3V$ , $I_{OH} = 20mA$                 | 2.5     |      |                         | V        |
| $I_{CC}$  | Dynamic supply current normal mode<br>3.3V and 10pF loading           | 7.90    | 9.79 | 17.53<br>$f_{IN} - max$ | mA       |
| $I_{DD}$  | Static supply current standby mode                                    |         | 0.6  |                         | mA       |
| $V_{DD}$  | Operating voltage   | 2.7     | 3.3  | 3.7                     | V        |
| $t_{ON}$  | Power up time (first locked clock cycle after power up)               |         | 0.18 |                         | mS       |
| $Z_{OUT}$ | Clock output impedance  |         | 50   |                         | $\Omega$ |

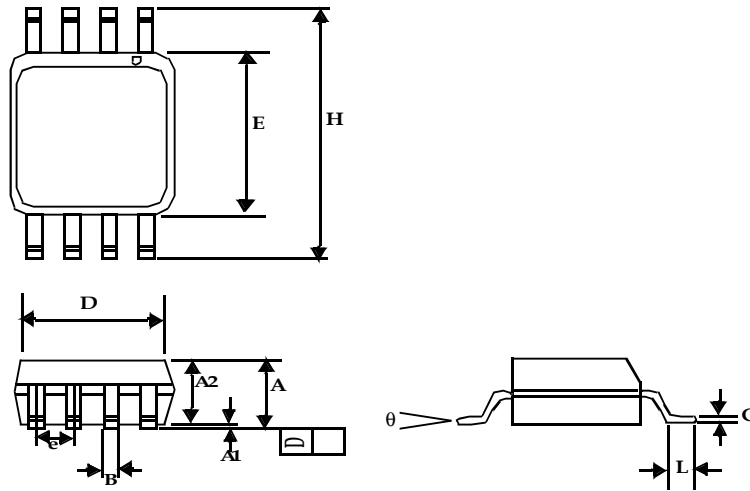
#### AC Electrical Characteristics

| Symbol     | Parameter                                    | Min | Typ | Max | Unit |
|------------|--|-----|-----|-----|------|
| $f_{IN}$   | Input frequency                              | 50  |     | 110 | MHz  |
| $f_{OUT}$  | Output frequency                             | 50  |     | 110 | MHz  |
| $t_{LH}^1$ | Output rise time<br>Measured at 0.8V to 2.0V | 0.7 | 0.9 | 1.1 | ns   |
| $t_H^1$    | Output fall time<br>Measured at 0.8V to 2.0V | 0.6 | 0.8 | 1.0 | ns   |
| $t_{JC}$   | Jitter (cycle-to-cycle)                      |     |     | 360 | ps   |
| $t_D$      | Output duty cycle                            | 45  | 50  | 55  | %    |

Note: 1.  $t_{LH}$  and  $t_{HL}$  are measured into a capacitive load of 15pF.

## Package Information

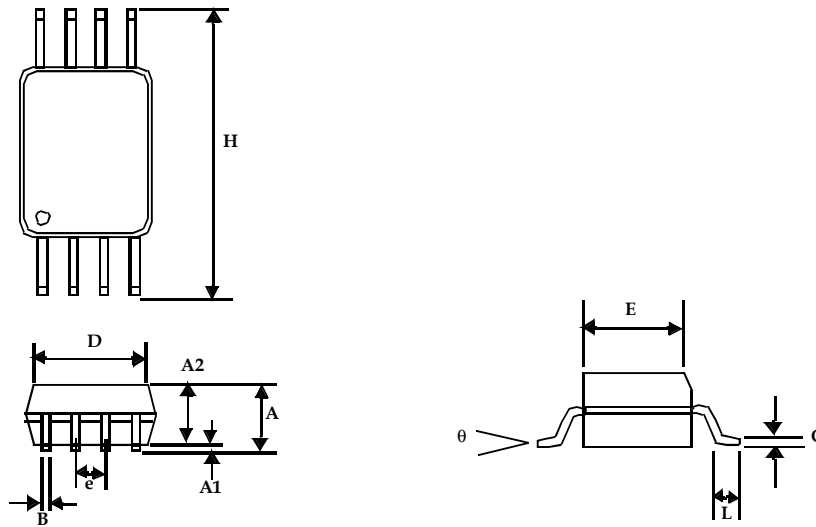
### 8-Pin SOIC Package



| Symbol | Dimensions |       |             |      |
|--------|------------|-------|-------------|------|
|        | Inches     |       | Millimeters |      |
|        | Min        | Max   | Min         | Max  |
| A1     | 0.004      | 0.010 | 0.10        | 0.25 |
| A      | 0.053      | 0.069 | 1.35        | 1.75 |
| A2     | 0.049      | 0.059 | 1.25        | 1.50 |
| B      | 0.012      | 0.020 | 0.31        | 0.51 |
| C      | 0.007      | 0.010 | 0.18        | 0.25 |
| D      | 0.193 BSC  |       | 4.90 BSC    |      |
| E      | 0.154 BSC  |       | 3.91 BSC    |      |
| e      | 0.050 BSC  |       | 1.27 BSC    |      |
| H      | 0.236 BSC  |       | 6.00 BSC    |      |
| L      | 0.016      | 0.050 | 0.41        | 1.27 |
| θ      | 0°         | 8°    | 0°          | 8°   |

Note: Controlling dimensions are millimeters.  
SOIC: 0.074 grams unit weight.

## 8-Pin TSSOP




| Symbol   | Dimensions |       |             |      |
|----------|------------|-------|-------------|------|
|          | Inches     |       | Millimeters |      |
|          | Min        | Max   | Min         | Max  |
| A        |            | 0.043 |             | 1.10 |
| A1       | 0.002      | 0.006 | 0.05        | 0.15 |
| A2       | 0.033      | 0.037 | 0.85        | 0.95 |
| B        | 0.008      | 0.012 | 0.19        | 0.30 |
| C        | 0.004      | 0.008 | 0.09        | 0.20 |
| D        | 0.114      | 0.122 | 2.90        | 3.10 |
| E        | 0.169      | 0.177 | 4.30        | 4.50 |
| e        | 0.026 BSC  |       | 0.65 BSC    |      |
| H        | 0.252 BSC  |       | 6.40 BSC    |      |
| L        | 0.020      | 0.028 | 0.50        | 0.70 |
| $\theta$ | 0°         | 8°    | 0°          | 8°   |

**Ordering Codes**

| Part number  | Marking | Package Type                        | Temperature  |
|--------------|---------|-------------------------------------|--------------|
| P1708CF-08SR | AAY     | 8-Pin SOIC, Tape and Reel, Pb Free  | 0°C to +70°C |
| P1708CF-08TR | AAY     | 8-Pin TSSOP, Tape and Reel, Pb Free | 0°C to +70°C |

A "microdot" placed at the end of last row of marking or just below the last row toward the center of package indicates Pb-free

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