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LOW EMI CLOCK GENERATOR

MK1707D

Description

The MK1707D generates a low EMI output clock from a crystal clock input. The part is designed to dither the LCD interface clock for flat panel graphics controllers. The device uses ICS' proprietary mix of analog and digital Phase-Locked Loop (PLL) technology to spread the frequency spectrum of the output, thereby reducing the frequency amplitude peaks by several dB.

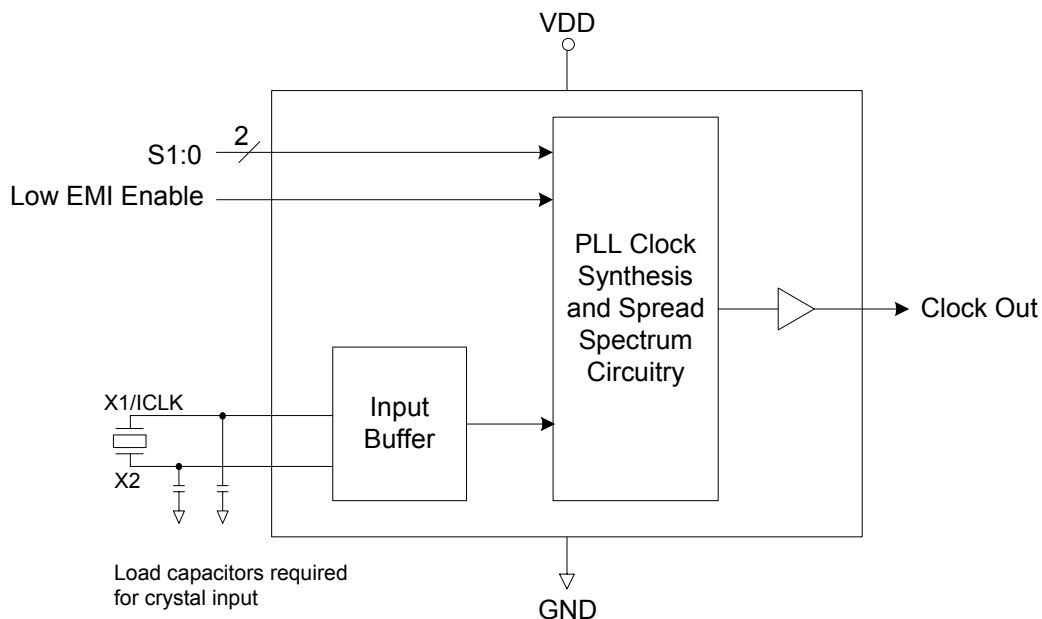
The MK1707D offers centered spread from a wide range of input clock frequencies.

ICS offers many other clocks for computers and computer peripherals. Consult ICS when you need to replace multiple crystals and oscillators from your board.

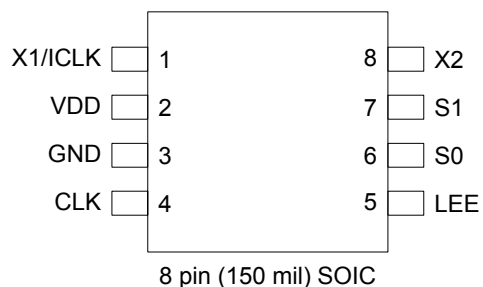
Features

- Packaged in 8-pin SOIC
- Available in Pb (lead) free package
- Provides a spread spectrum output clock
- Supports flat panel controllers
- Accepts a crystal or clock input to provide same frequency dithered output
- Input operating frequencies of 25-54 and 50-108 MHz
- Peak reduction by 7dB to 14dB typical on 3rd through 19th odd harmonics
- Low EMI feature can be disabled
- Includes power down
- Operating voltage of 3.3 V
- Industrial temperature range available
- Advanced, low-power CMOS process

Block Diagram



Pin Assignment



Spread Selection Table (MHz)

| S1 Pin 7 | S0 Pin 6 | Spread Direction | Spread (%) | Input Frequency |
|-------------|-------------|---------------------|------------|--------------------|
| 0 | 0 | Center | ±1.15 | 25-54 |
| 0 | M | Center | ±0.95 | 25-54 |
| 0 | 1 | Center | ±1.9 | 50-108 |
| 1 | 0 | Center | ±1.6 | 25-54 |
| 1 | M | Center | ±1.9 | 25-54 |
| 1 | 1 | Center | ±0.6 | 50-108 |

0 = connect to GND

M = unconnected (floating) has internal resistor network
Leave it open (unconnected)

1 = connect to VDD

Pin Descriptions

| Pin Number | Pin Name | Pin Type | Pin Description |
|------------|----------|----------|---|
| 1 | X1/ICLK | Input | Crystal connection. Connect crystal or clock input. |
| 2 | VDD | Power | Connect to +3.3 V. |
| 3 | GND | Power | Connect to ground. |
| 4 | CLK | Output | Spread spectrum clock output per table above. |
| 5 | LEE | Input | Low EMI enable. Turns on spread spectrum when high. Internal pull-up resistor. Disables the spread spectrum feature when low. |
| 6 | S0 | Input | Function select input. Selects spread amount and direction per table above. Internal mid-level. |
| 7 | S1 | Input | Function select 1 input. Selects spread amount and direction per table above. Internal mid-level. |
| 8 | X2 | XO | Crystal connection. Leave unconnected for clock input. |

External Components

The MK1707D requires a minimum number of external components for proper operation.

Decoupling Capacitor

A decoupling capacitor of 0.01 μ F must be connected between VDD and GND on pins 2 and 3, as close to these pins as possible. For optimum device performance, the decoupling capacitor should be mounted on the component side of the PCB. Avoid the use of vias in the decoupling circuit.

Series Termination Resistor

When the PCB trace between the clock output and the load is over 1 inch, series termination should be used. To series terminate a 50 Ω trace (a commonly used trace impedance), place a 33 Ω resistor in series with the clock line, as close to the clock output pin as possible. The nominal impedance of the clock output is 20 Ω .

Select Pin Operation

The S1, S0 select pins are 2-level, meaning they have three separate states to make the selections shown in the table on page 2.

PCB layout Recommendations

For optimum device performance and lowest output phase noise, the following guidelines should be observed.

- 1) The 0.01 μ F decoupling capacitor should be mounted on the component side of the board as close to the VDD pin as possible. No vias should be used between the decoupling capacitor and VDD pin. The PCB trace to VDD pin should be kept as short as possible, as should the PCB trace to the ground via.
- 2) To minimize EMI, the 33 Ω series termination resistor (if needed) should be placed close to the clock output.
- 3) An optimum layout is one with all components on the same side of the board, minimizing vias through other signal layers. Other signal traces should be routed away from the MK1707D. This includes signal traces just underneath the device, or on layers adjacent to the ground plane layer used by the device.

Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the MK1707D. These ratings, which are standard values for ICS commercially rated parts, are stress ratings only. Functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods can affect product reliability. Electrical parameters are guaranteed only over the recommended operating temperature range.

| Item | Rating |
|--|---------------------|
| Supply Voltage, VDD | 7 V |
| All Inputs and Outputs | -0.5 V to VDD+0.5 V |
| Ambient Operating Temperature (commercial) | 0 to +70°C |
| Ambient Operating Temperature (industrial) | -40 to +85°C |
| Storage Temperature | -65 to +150°C |
| Junction Temperature | 125°C |
| Soldering Temperature | 260°C |

Recommended Operation Conditions

| Parameter | Min. | Typ. | Max. | Units |
|---|--------|------|--------|-------|
| Ambient Operating Temperature (commercial) | 0 | | +70 | °C |
| Ambient Operating Temperature (industrial) | -40 | | +85 | °C |
| Power Supply Voltage (measured in respect to GND) | +3.135 | 3.3 | +3.465 | V |

DC Electrical Characteristics

Unless stated otherwise, **VDD = 3.3 V ±5%**, Ambient Temperature 0 to +70°C

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Units |
|---------------------|-----------------|-------------------------------|---------|------|-------|-------|
| Operating Voltage | VDD | | 3.135 | 3.3 | 3.465 | V |
| Input Low Voltage | V _{IL} | S0, S1 pins | | | 0.5 | V |
| Input High Voltage | V _{IH} | S0, S1 pins | 2.7 | | | V |
| Supply Current | IDD | No load, at 3.3 V | | 20 | | mA |
| Input High Voltage | V _{IH} | LEE pins | 2.0 | | | V |
| Input Low Voltage | V _{IL} | LEE pins | | | 0.5 | V |
| Output High Voltage | V _{OH} | CMOS, I _{OH} = -4 mA | VDD-0.4 | | | V |
| Output High Voltage | V _{OH} | I _{OH} = -12 mA | 2.4 | | | V |
| Output Low Voltage | V _{OL} | I _{OL} = -12 mA | | | 0.4 | V |
| Input Capacitance | C _{IN} | S0, S1, LEE pins | | 5 | | pF |

AC Electrical Characteristics

Unless stated otherwise, VDD = 3.3 V ±5%, Ambient Temperature 0 to +70° C

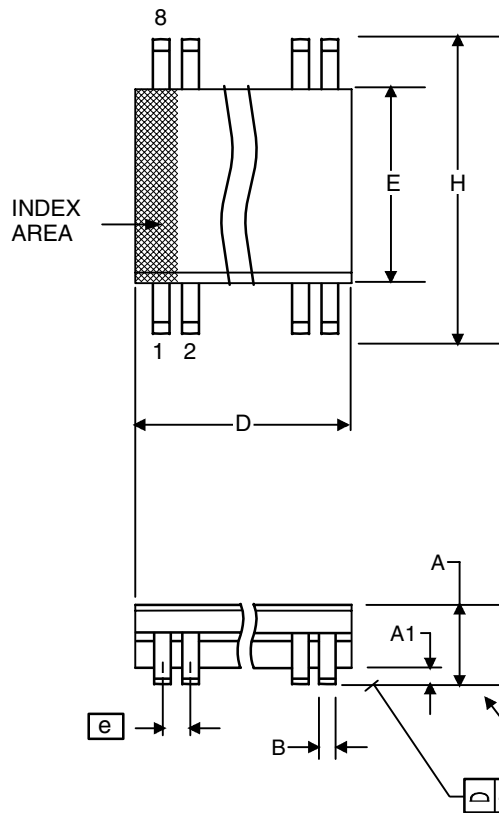
| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Units |
|------------------------------|-----------------|--------------------------------|------|---------|------|-------|
| Input/Output Clock Frequency | | | 25 | | 108 | MHz |
| Input Clock Duty Cycle | | Time above VDD/2 | 20 | | 80 | % |
| Output Clock Duty Cycle | | Time above 1.5 V | 40 | 50 | 60 | % |
| Output Rise Time | t _{OR} | 0.8 to 2.0 V | | 1.5 | | ns |
| Output Fall Time | t _{OF} | 2.0 to 0.8 V | | 1.5 | | ns |
| EMI Peak Frequency Reduction | | 3rd through 19th odd harmonics | | 7 to 14 | | dB |

Thermal Characteristics

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Units |
|--|-----------------|----------------|------|------|------|-------|
| Thermal Resistance Junction to Ambient | θ _{JA} | Still air | | 150 | | °C/W |
| | θ _{JA} | 1 m/s air flow | | 140 | | °C/W |
| | θ _{JA} | 3 m/s air flow | | 120 | | °C/W |
| Thermal Resistance Junction to Case | θ _{JC} | | | 40 | | °C/W |

Package Outline and Package Dimensions (8-pin SOIC, 150 Mil. Body)

Package dimensions are kept current with JEDEC Publication No. 95



| Symbol | Millimeters | | Inches | |
|----------|-------------|------|-------------|-------|
| | Min | Max | Min | Max |
| A | 1.35 | 1.75 | .0532 | .0688 |
| A1 | 0.10 | 0.25 | .0040 | .0098 |
| B | 0.33 | 0.51 | .013 | .020 |
| C | 0.19 | 0.25 | .0075 | .0098 |
| D | 4.80 | 5.00 | .1890 | .1968 |
| E | 3.80 | 4.00 | .1497 | .1574 |
| e | 1.27 BASIC | | 0.050 BASIC | |
| H | 5.80 | 6.20 | .2284 | .2440 |
| h | 0.25 | 0.50 | .010 | .020 |
| L | 0.40 | 1.27 | .016 | .050 |
| α | 0° | 8° | 0° | 8° |

Ordering Information

| Part / Order Number | Marking | Shipping Packaging | Package | Temperature |
|---------------------|---------|--------------------|------------|---------------|
| MK1707D | MK1707D | Tubes | 8-pin SOIC | 0 to +70° C |
| MK1707DTR | MK1707D | Tape and Reel | 8-pin SOIC | 0 to +70° C |
| MK1707DLF | 1707DLF | Tubes | 8-pin SOIC | 0 to +70° C |
| MK1707DLFTR | 1707DLF | Tape and Reel | 8-pin SOIC | 0 to +70° C |
| MK1707DI | 1707DI | Tubes | 8-pin SOIC | -40 to +85° C |
| MK1707DITR | 1707DI | Tape and Reel | 8-pin SOIC | -40 to +85° C |
| MK1707DILF | 1707DIL | Tubes | 8-pin SOIC | -40 to +85° C |
| MK1707DILFTR | 1707DIL | Tape and Reel | 8-pin SOIC | -40 to +85° C |

“LF” denotes Pb (lead) free packaging.

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