

Description

The MK1707 generates a low EMI output clock from a clock input. The part is designed to dither the LCD interface clock for flat panel graphics controllers. The device uses IDT's 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.

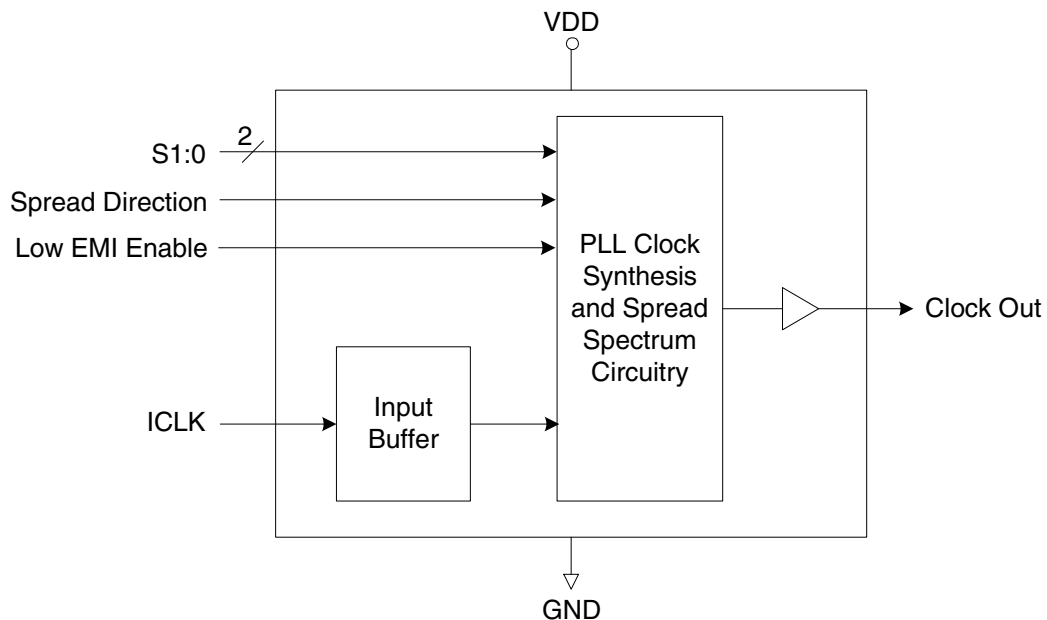
The MK1707 offers both centered and down spread from a high speed clock input. Refer to the MK1714-01/02 for a crystal input and the widest selection of input frequencies and multipliers.

IDT offers many other clocks for computers and computer peripherals. Consult us when you need to remove crystals and oscillators from your board.

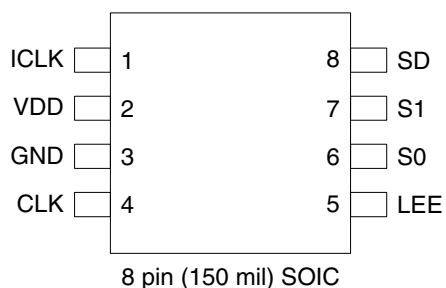
Features

- Packaged in 8-pin SOIC
- Pb-free package
- Industrial temperature range available
- Provides a spread spectrum output clock
- Supports ATI's flat panel controllers
- Guaranteed to +85° C operation
- Accepts a clock input, provides same frequency dithered output
- Good for all VGA modes from 80 to 167 MHz
- Peak reduction by 7dB - 14dB typical on 3rd - 19th odd harmonics
- Low EMI feature can be disabled
- Includes Power-down
- Operating voltage of 3.3 V or 5 V
- Advanced, low-power CMOS process

Block Diagram



Pin Assignment



Spread Direction and Percentage Select Table

SD Pin 8	S1 Pin 7	S0 Pin 6	Spread Direction	Spread Percentage (%)
0	0	0	Down	0.6
0	0	M	Down	0.8
0	0	1	Down	1.25
0	M	0	Down Center	+0.5, -1.5
0	M	M	Down	2
0	M	1	Down Center	+0.5, -2.5
0	1	0	Down Center	+0.5, -3
0	1	M	Down	5
0	1	1	Power Down	-
1	0	0	Center	±0.35
1	0	M	Center	±0.5
1	0	1	Center	±0.7
1	M	0	Center	±0.8
1	M	M	Center	±1.1
1	M	1	Center	±1.4
1	1	0	Test	Test
1	1	M	Center	±2.5
1	1	1	Power Down	-

0 = connect to GND

M = unconnected (floating)

1 = connect directly to VDD

Pin Descriptions

Pin Number	Pin Name	Pin Type	Pin Description
1	ICLK	Input	Connect to graphics input clock.
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.
6	S0	Input	Function select 0 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	SD	Input	Spread direction select input. Selects the direction of spread per table above. Internal pull-up resistor.

External Components

The MK1707 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 .

Tri-level Select Pin Operation

The S1, S0 select pins are tri-level, meaning they have three separate states to make the selections shown in the table on page 2. To select the M (mid) level, the connection to these pins must be eliminated by either floating them originally, or tri-stating the GPIO pins which drive the select pins.

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 MK1707. This includes signal traces just underneath the device, or on layers adjacent to the ground plane layer used by the device.

Powerup Considerations

To insure proper operation of the spread spectrum generation circuit, some precautions must be taken while utilizing the MK1707.

1. An input signal should not be applied to ICLK until VDD is stable (within 10% of its final value). This requirement can easily be met by operating the MK1707 and then ICLK source from the same power supply.
2. LEE should not be enabled (taken high) until after the power supplies and input clock are stable. This requirement can be met by direct control of LEE by system logic - for example, a "power good" signal. Another solution is to leave LEE unconnected to anything but a 0.01 μ F capacitor to ground. The internal pullup resistor on LEE will charge the capacitor and provide approximately a 700 μ s delay until spread spectrum is enabled.
3. If the input frequency is changed during operation, disable spread spectrum until the input clock stabilizes at the new frequency.

Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the MK1707. These ratings, which are standard values for IDT 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 +85° 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	0		+85	°C
Power Supply Voltage (measured in respect to GND)	+3.135		+5.5	V

DC Electrical Characteristics

Unless stated otherwise, VDD = 3.3 V, Ambient Temperature 0 to +85° C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Operating Voltage	VDD		3.135		5.5	V
Supply Current	IDD	No load, at 3.3 V		20		mA
	IDD	No load, at 5 V		31		mA
	IDDPD	S0=S1=SD=1		60		μA
Input High Voltage	V _{IH}	ICLK	(VDD/2) + 1	VDD/2		V
Input Low Voltage	V _{IL}	ICLK		VDD/2	(VDD/2) - 1	V
Input High Voltage	V _{IH}	S1, S0	VDD-0.5			V
Input High Voltage	V _{IH}	other inputs	2.5			V
Input Low Voltage	V _{IL}	S0, S1, SD, 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, SD, LEE pins		5		pF

AC Electrical Characteristics

Unless stated otherwise, $V_{DD} = 3.3\text{ V}$, Ambient Temperature 0 to $+85^{\circ}\text{ C}$

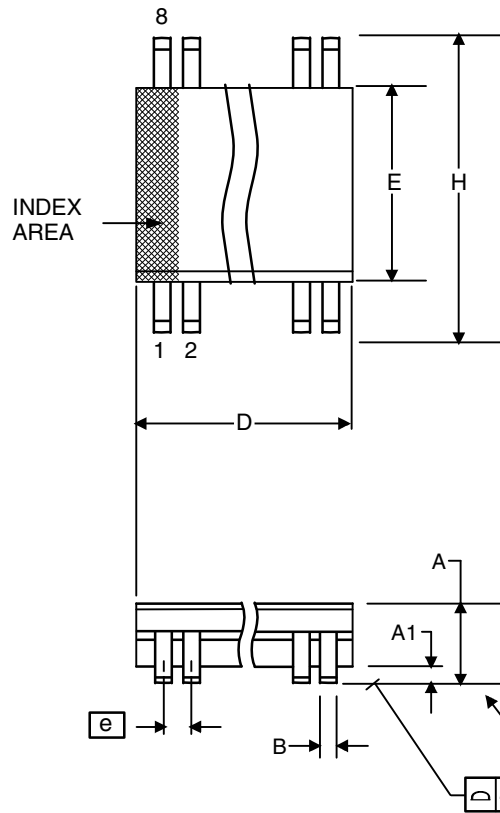
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input/Output Clock Frequency			80		167	MHz
Input Clock Duty Cycle		Time above $V_{DD}/2$	20		80	%
Output Clock Duty Cycle		Time above 1.5 V	40	50	60	%
Output Rise Time	t_{OR}	0.8 to 2.0 V		1.5		ns
Output Fall Time	t_{OF}	2.0 to 0.8 V		1.5		ns
Modulation Frequency			19		41	kHz
EMI Peak Frequency Reduction		3rd - 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		$^{\circ}\text{C/W}$
	θ_{JA}	1 m/s air flow		140		$^{\circ}\text{C/W}$
	θ_{JA}	3 m/s air flow		120		$^{\circ}\text{C/W}$
Thermal Resistance Junction to Case	θ_{JC}			40		$^{\circ}\text{C/W}$

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
MK1707SLF	MK1707SL	Tubes	8-pin SOIC	0 to +85° C
MK1707SLFTR	MK1707SL	Tape and Reel	8-pin SOIC	0 to +85° C
MK1707SILF	MK1707IL	Tubes	8-pin SOIC	-40 to +85° C
MK1707SILFTR	MK1707IL	Tape and Reel	8-pin SOIC	-40 to +85° C

Note: "LF" denotes Pb (lead) free package.

While the information presented herein has been checked for both accuracy and reliability, Integrated Device Technology (IDT) assumes no responsibility for either its use or for the infringement of any patents or other rights of third parties, which would result from its use. No other circuits, patents, or licenses are implied. This product is intended for use in normal commercial applications. Any other applications such as those requiring extended temperature range, high reliability, or other extraordinary environmental requirements are not recommended without additional processing by IDT. IDT reserves the right to change any circuitry or specifications without notice. IDT does not authorize or warrant any IDT product for use in life support devices or critical medical instruments.

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
 - "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.
 - "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.
6. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
10. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.

(Note2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.4.0-1 November 2017)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact/

Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.