

### SPREAD SPECTRUM CLOCK GENERATOR

**ICS7152** 

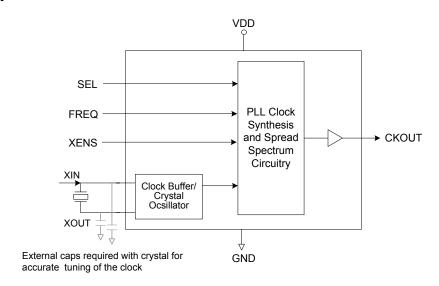
## **Description**

The ICS7152-01, -02, -11, and -12 are clock generators for EMI (Electro Magnetic Interference) reduction (see below for frequency ranges and multiplier ratios). Spectral peaks can be attenuated by slightly modulating the oscillation frequency. Both down and center spread profiles are selectable. Center spread maintains an average frequency equal to an unspread clock. Down spread meets maximum frequency specs over the entire modualtion cycle.

#### **Features**

- Operating voltage of 3.3 V ±0.3 V
- Packaged in 8-pin SOIC
- Input frequency range of 16.6 to 134.0 MHz
- Output frequency range of 16.6 to 134.0 MHz
- Provides a spread spectrum clock output (±0.5%, ±1.5% center spread; -1.0%, -3.0% down spread)
- Advanced, low-power CMOS process
- Industrial temperature range available
- · Pb (lead) free package, RoHS compliant

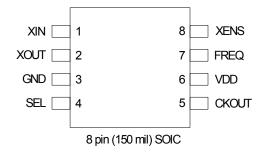
### **Block Diagram**



## **Product Lineup**

Product	Input Frequency Range	Modulation Type	Modulation Enable Pin
ICS7152M-01, ICS7152MI-01	16.6 MHz to 67 MHz	Down oproad	
ICS7152M-02, ICS7152MI-02	40.0 MHz to 134.0 MHz	Down spread	Vaa
ICS7152M-11, ICS7152MI-11	16.6 MHz to 67.0 MHz	Contar aproad	Yes
ICS7152M-12, ICS7152MI-12	40.0 MHz to 134.0 MHz	Center spread	

# **Pin Assignment**



## **Modulation Enable Setting Table**

XENS Pin 8	Spread Spectrum
0	ON
1	OFF

# **SEL Modulation Rate Setting Table**

SEL Pin 4 (note1)	Spread Direction	Spread Percentage (%)	Part Number
0	Center	±0.5	ICS7152M-11, ICS7152M-12
	Down	-1.0	ICS7152M-01, ICS7152M-02
1	Center	±1.5	ICS7152M-11, ICS7152M-12
	Down	-3.0	ICS7152M-01, ICS7152M-02

# **Frequency Setting Table**

FREQ Pin 7	Freq	Frequency					
0	16.6 to 40 MHz	ICS7152M-01, ICS7152M-11					
	40 to 80 MHz	ICS7152M-02, ICS7152M-12					
1	33 to 67 MHz	ICS7152M-01, ICS7152M-11					
	66 to 134 MHz	ICS7152M-02, ICS7152M-12					

# **Pin Descriptions**

Pin Number	Pin Name	Pin Type	Pin Description
1	XIN	Input	Crystal resonator connection pin/clock input pin.
2	XOUT	Output	Crystal resonator connection pin.
3	GND	Power	Connect to ground.
4	SEL	Input	Modulation rate setting pin.
5	CKOUT	Output	Modulated clock output pin.
6	VDD	Power	Connect to +3.3 V.
7	FREQ	Input	Frequency setting pin.
8	XENS	Input	Modulation enable setting pin.

### **External Components**

The ICS7152 requires a minimum number of external components for proper operation.

#### **Decoupling Capacitor**

A decoupling capacitor of  $0.01\mu F$  must be connected between GND and VDD on pin 6, as close to this pin 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**

Series termination should be used on the clock output. To series terminate a  $50\Omega$  trace (a commonly used trace impedance) place a  $27\Omega$  resistor in series with the clock line, as close to the clock output pin as possible. The nominal impedance of the clock output is  $25\Omega$ 

### **PCB Layout Recommendations**

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

1) 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 ICS7152. This includes signal traces just underneath the device, or on layers adjacent to the ground plane layer used by the device.

### **Crystal Information**

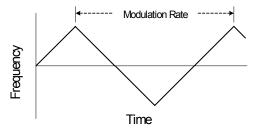
The crystal used should be a fundamental mode, parallel resonant. Crystal capacitors should be connected from pins X1 to ground and X2 to ground to optimize the initial accuracy. The value of these capacitors is given by the following equation:

Crystal caps (pF) = 
$$(C_1 - 6) \times 2$$

In the equation,  $C_L$  is the crystal load capacitance. So, for a crystal with a 16 pF load capacitance, two 20 pF [(16-6) x 2] capacitors should be used.

### **Spread Spectrum Profile**

The ICS7152 low EMI clock generator uses a triangular frequency modulation profile for optimal down stream tracking of zero delay buffers and other PLL devices. The frequency modulation amplitude is constant with variations of the input frequency.

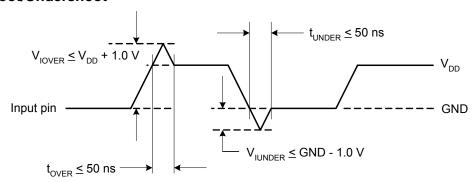


## **Absolute Maximum Ratings**

Stresses above the ratings listed below can cause permanent damage to the ICS7152. 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 (referenced to GND)	-0.5 V to VDD+0.5 V
Ambient Operating Temperature	-40 to +85° C
Storage Temperature	-55 to +125° C
Junction Temperature	-40 to +125° C
Soldering Temperature	260° C
Overshoot (V <sub>IOVER</sub> )	VDD + 1.0 V (t <sub>OVER</sub> ≤ 50 ns) max
Undershoot (V <sub>IUNDER</sub> )	GND - 1.0 V (t <sub>UNDER</sub> ≤ 50 ns) min

#### Overshoot/Undershoot



## **Recommended Operation Conditions**

Parameter	Min.	Тур.	Max.	Units
Ambient Operating Temperature	-40		+85	°C
Power Supply Voltage (measured in respect to GND)	+3.0	3.3	3.6	V

## **DC Electrical Characteristics**

Unless stated otherwise, VDD = 3.3 V ±0.3 V, Ambient Temperature -40 to +85° C

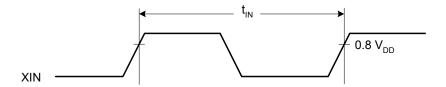
Parameter	Symbol	Conditions	Min.	Тур.	Max.	Units
Operating Voltage	VDD		3.0	3.3	3.6	V
Supply Current	IDD	No load, at 3.3 V		14	28	mA
Input High Voltage	V <sub>IH</sub>	SEL, FREQ, XENS	VDD x 0.8		VDD + 0.3	V
		XIN, Input slew rate 3 V/ns, 16.6 to 100 MHz	VDD x 0.8		VDD + 0.3	V
		XIN, Input slew rate 3 V/ns, 100 to 134 MHz	VDD x 0.9		VDD + 0.3	V
Input Low Voltage	V <sub>IL</sub>	SEL, FREQ, XENS	GND		VDD x 0.20	V
		XIN, Input slew rate 3 V/ns, 16.6 to 100 MHz	GND		VDD x 0.20	V
		XIN, Input slew rate 3 V/ns, 100 to 134 MHz	GND		VDD x 0.10	V
Output High Voltage	V <sub>OH</sub>	CKOUT, I <sub>OH</sub> = -4 mA	VDD - 0.5		VDD	V
Output Low Voltage	V <sub>OL</sub>	CKOUT, I <sub>OL</sub> = 4 mA	GND		0.4	V
Input Capacitance	C <sub>IN</sub>	XIN, SEL, XENS			16	pF
		CKOUT, 16.6 to 67 MHz			15	pF
Load Capacitance	CL	CKOUT, 67 to 100 MHz			10	pF
		CKOUT, 100 to 134 MHz			7	pF
Output Impedance	Z <sub>O</sub>	CKOUT, 16.6 to 134 MHz		25		Ω

## **AC Electrical Characteristics**

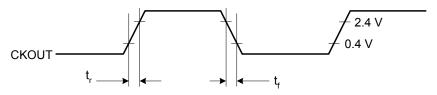
Unless stated otherwise, VDD = 3.3 V ±0.3 V, Ambient Temperature -40 to +85° C

Parameter	Symbol	Conditions	Min.	Тур.	Max.	Units
Input Crystal Frequency			16.6		40	MHz
Input Clock Frequency	f <sub>IN</sub>	ICS7152-01, -11	16.6		67	MHz
		ICS7152-02, -12	40		134	MHz
Output Frequency	f <sub>OUT</sub>	CKOUT, ICS7152-01, -11	16.6		67	MHz
		CKOUT, ICS7152-02, -12	40		134	MHz
Input Clock Duty Cycle	t <sub>DCI</sub>	XIN, 16.6 to 100 MHz	40	50	60	%
		XIN, 100 to 134 MHz	45	50	55	%
Output Clock Duty Cycle	t <sub>DCC</sub>	CKOUT, 1.5 V	40		60	%
Output Slew Rate		CKOUT, 0.4 to 2.4 V, CL = 15 pF	0.5		3.0	V/ns
		No load, spread off, ICS7152-01, -02			150	
Cycle-to-Cycle Jitter	t <sub>JC</sub>	No load, spread off, ICS7152-11, -12			250	ps
		No load, spread off, ICS7152-01, 33.33 MHz, SEL = 0, FREQ = 1			120	
Power-up Time		PLL lock-time from power-up to 1% of final value		2	5	ms
Modulation Frequency	f <sub>MOD</sub>	CKOUT		33		kHz

## Input Frequency ( $f_{IN} = 1/t_{IN}$ )



### **Output Slew Rate**



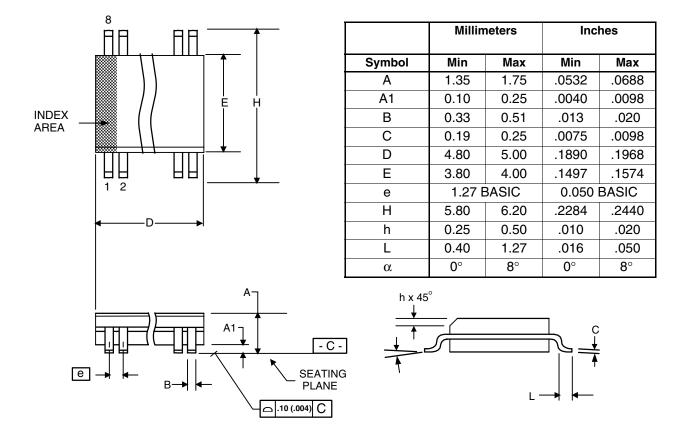
 $SR = (2.4 - 0.4) / t_r$ ,  $SR = (2.4 - 0.4) / t_f$ 

## **Thermal Characteristics 8 SOIC**

Parameter	Symbol	Conditions	Min.	Тур.	Max.	Units
Thermal Resistance Junction to	$\theta_{JA}$	Still air		150		° C/W
Ambient	$\theta_{JA}$	1 m/s air flow		140		° C/W
	$\theta_{JA}$	3 m/s air flow		120		° C/W
Thermal Resistance Junction to Case	$\theta_{JC}$			40		° C/W

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

Package dimensions are kept current with JEDEC Publication No. 95



## **Ordering Information**

Part / Order Number	Marking	<b>Shipping Packaging</b>	Package	Temperature
7152M-01LF	7152M01L	Tubes	8-pin SOIC	0 to +70° C
7152M-01LFT	7152M01L	Tape and Reel	8-pin SOIC	0 to +70° C
7152MI-01LF	7152l01L	Tubes	8-pin SOIC	-40 to +85° C
7152MI-01LFT	7152I01L	Tape and Reel	8-pin SOIC	-40 to +85° C
7152M-02LF	7152M02L	Tubes	8-pin SOIC	0 to +70° C
7152M-02LFT	7152M02L	Tape and Reel	8-pin SOIC	0 to +70° C
7152MI-02LF	7152I02L	Tubes	8-pin SOIC	-40 to +85° C
7152MI-02LFT	7152l02L	Tape and Reel	8-pin SOIC	-40 to +85° C
7152M-11LF	7152M11L	Tubes	8-pin SOIC	0 to +70° C
7152M-11LFT	7152M11L	Tape and Reel	8-pin SOIC	0 to +70° C
7152MI-11LF	7152l11L	Tubes	8-pin SOIC	-40 to +85° C
7152MI-11LFT	7152I11L	Tape and Reel	8-pin SOIC	-40 to +85° C
7152M-12LF	7152M12L	Tubes	8-pin SOIC	0 to +70° C
7152M-12LFT	7152M12L	Tape and Reel	8-pin SOIC	0 to +70° C
7152MI-12LF	7152l12L	Tubes	8-pin SOIC	-40 to +85° C
7152MI-12LFT	7152I12L	Tape and Reel	8-pin SOIC	-40 to +85° C

#### "LF" suffix to the part number are the Pb-Free configuration and are RoHS compliant.

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.

# Innovate with IDT and accelerate your future networks. Contact:

www.IDT.com

**For Sales** 

800-345-7015 408-284-8200 Fax: 408-284-2775 For Tech Support

www.idt.com/go/clockhelp

#### **Corporate Headquarters**

Integrated Device Technology, Inc. www.idt.com

