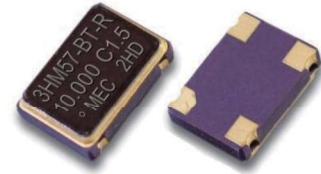


# EMI Reduction Spread Spectrum Clock Oscillators

A Drop-in Replacement Solution For Your EMI / EMC Compliance Problem

The principle sources of the EMI problems come from the system clocks. Therefore, rather than patching the problem with ferrite beads, EMI filters, ground plane and metal shielding, the most efficient and economical way to reduce the peak radiation energy is to use a spread spectrum clock oscillator.



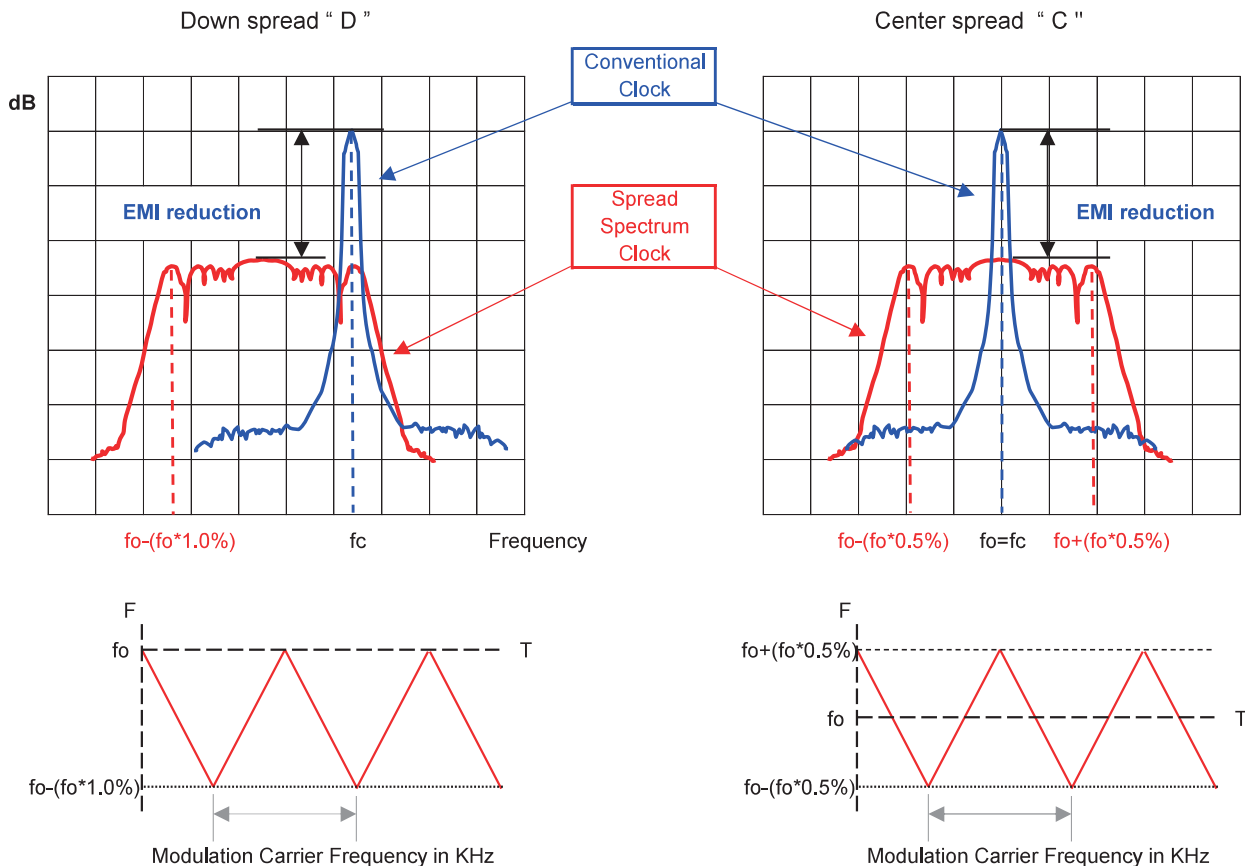
Compared with conventional clock oscillator, Mercury's HM series spread spectrum (dithered) clock oscillator can reduce EMI as much as 12dB.

The beauty is that it is a drop-in replacement for your existing 7 x 5mm, 5 x 3.2mm or 3.2 x 2.5 mm clock oscillator. No need to re-spin the board.

## Applications :

- Printers; Multiple function printers (MPCs)
- Digital copiers; PDAs
- Networking; LAN / WAN; Routers
- Storage systems (CD-ROM, VCD, DVD and HDD)
- Scanner; Modems; projectors
- Hand-held ID readers
- Embedded systems; Electrical musical instrument
- Automotive; GPS car navigation systems
- LCD PC monitors / LCD TVs
- ADSL; PCMCIA
- Still Digital cameras (SDCs)

**Modulation Types :** [ Output amplitude (dB) vs frequency span (MHz) ]



## Spread Spectrum Clock (SSC) :

Unlike a conventional clock, the mode energy of a spread spectrum clock is spread over a wider bandwidth, resulting from the **frequency modulation** technique.

The modulation carrier frequency is in the KHz range which makes the modulation process transparent to the oscillator frequency.

The controlled modulation process can be all on one side of the nominal frequency (**down spread**) or 50% higher and 50% lower

(**center spread**) of the nominal frequency. Down spread is preferred if over-clocking is a problem to the system.

**Mercury** [www.mercury-crystal.com](http://www.mercury-crystal.com)

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# EMI Reduction Spread Spectrum Clock Oscillators

HM\_x

EMI Reduction Spread Spectrum Clock Oscillators

R group

Y group

P group

Thru-Hole

SMD

TTL

CMOS

3.3V

Min.

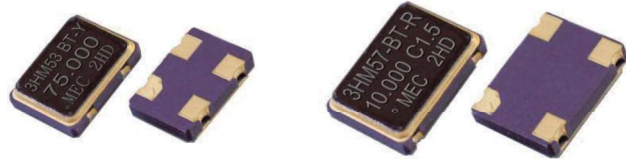
3.5 MHz

Max.

220 MHz

General specifications of all available packages

at Ta=+25°C , CL=15pF



Oscillators

Group	R group			Y group				P group		
Available Packages	3HM572 - R ( 7.0 * 5.0 * 1.4 mm ) ( 3.5 ~ 165.0 MHz )			3HM572 - Y ( 7.0 * 5.0 * 1.4 mm ) ( 8.0 ~ 165.0 MHz )				3HM57 - P ( 7.0 * 5.0 * 1.8 mm )		
Frequency Range	3HM53 - R ( 5.0 * 3.2 * 1.2 mm ) ( 6.0 ~ 160.0 MHz )			3HM53 - Y ( 5.0 * 3.2 * 1.2 mm ) ( 10.0 ~ 160.0 MHz )				( 13.0 ~ 220.0 MHz )		
Spread Type	Total%	Down Spread	Center Spread	Type	Total%	Down Spread	Center Spread	Total%	Down Spread	Center Spread
Spread Percentage	0.5%	-0.5% ( D0.5 )	± 0.25% ( C0.25 )	3HM53	1.0%	-1.0% ( D1.0 )	± 0.5% ( C0.5 )	0.5%	-0.5% ( D0.5 )	± 0.25% ( C0.25 )
		Not available if Tri-state chosen			3.0%	-3.0% ( D3.0 )	± 1.5% ( C1.5 )	0.75%	-0.75% ( D0.75 )	± 0.375% ( C0.375 )
	1.0%	-1.0% ( D1.0 )	± 0.5% ( C0.5 )	3HM57	1.0%	-1.0% ( D1.0 )	± 0.5% ( C0.5 )	1.25%	-1.25% ( D1.25 )	± 0.625% ( C0.625 )
		-3.0% ( D3.0 )	± 1.5% ( C1.5 )		2.0%	-2.0% ( D2.0 )	± 1.0% ( C1.0 )	2.0%	-2.0% ( D2.0 )	± 1.0% ( C1.0 )
	3.0%	-3.0% ( D3.0 )	± 1.5% ( C1.5 )		3.0%	-3.0% ( D3.0 )	± 1.5% ( C1.5 )	3.0%	-3.0% ( D3.0 )	± 1.5% ( C1.5 )
					3.75%	-3.75% ( D3.75 )	± 1.875% ( C1.875 )	3.75%	-3.75% ( D3.75 )	± 1.875% ( C1.875 )
EMI Reduction ( EMI reduction applies to the whole spectrum. )	7 dB (min.) , 100MHz at C0.25 9 dB (min.) , 100MHz at C0.5 15 dB (min.) , 100MHz at C1.5			9 dB (min.) , 100MHz at C0.5 12 dB (min.) , 100MHz at C1.0 15 dB (min.) , 100MHz at C1.5				7 to 16 dB ( typical ) for the main mode		
Modulation Carrier Freq. ( Dither rate )	6.9 KHz (min.) ; 55.5 KHz (max.) Frequency dependent . Call for details			12 KHz (min.) ; 42 KHz (max.) Frequency dependent . Call for details				25.3 KHz (min.) ; 58.6 KHz (max.) Frequency dependent . Call for details		
Output Logic	CMOS ( Square Wave )			CMOS ( Square Wave )				CMOS ( Square Wave )		
Input Voltage ( V <sub>DD</sub> )	V <sub>DD</sub> = +3.3V D.C. ±5%			V <sub>DD</sub> = +3.3V D.C. ±5%				V <sub>DD</sub> = +3.3V D.C. ±5%		
Output Logic " High " , " 1 "	2.4V (min.) [ at 90% V <sub>DD</sub> ]			2.4V (min.) ; 3.2V (typ.) [ at 90% V <sub>DD</sub> ]				2.4V (min.) [ at 90% V <sub>DD</sub> ]		
Output Logic " Low " , " 0 "	0.5V (max.) [ at 10% V <sub>DD</sub> ]			0.5V (max.) ; 0.2V (typ.) [ at 10% V <sub>DD</sub> ]				0.4V (max.) [ at 10% V <sub>DD</sub> ]		
Rise Time / Fall Time	4n sec. (max.) [ 10% V <sub>DD</sub> ↔ 90% V <sub>DD</sub> ]			6n sec. (max.) [ 10% V <sub>DD</sub> ↔ 90% V <sub>DD</sub> ]				4n sec. (max.) [ 10% V <sub>DD</sub> ↔ 90% V <sub>DD</sub> ]		
Load	15pF			15pF				15pF		
Start-up Time	2 m sec. (typ.) ; 5 m sec. ( max. )			2 m sec. (typ.) ; 5 m sec. ( max. )				2 m sec. (typ.) ; 5 m sec. ( max. )		
Current Consumption	10.0 ~ 50.000 MHz : 10mA (typ.) 50.0 ~ 100.0 MHz : 18mA (typ.) 100.0 ~ 160.0 MHz : 35mA (typ.)			10.0 ~ 50.000 MHz : 10mA (typ.) 50.0 ~ 125.0 MHz : 27mA (typ.) , 44mA (max.)				25mA (typ.) ; Frequency dependent		
Duty Cycle	50% ± 5%			50% ± 5%				50% ± 5%		
Cycle-to-Cycle Jitter	±250 ps (typ.) ; ±300 ps (max.)			±100 ps (typ.) ; ±150 ps (max.)				±100 ps (typ.)		
Storage Temperature	-55°C to + 125°C			-55°C to + 125°C				-55°C to + 125°C		
Aging	± 5 ppm per year (max.) ; Ta = +25°C			± 5 ppm per year (max.) ; Ta = +25°C				± 5 ppm per year (max.) ; Ta = +25°C		
Pin 1 Option	Tri-State enable high. Output is high impedance when taken low . Enable / disable time: 100 ms max.						Do not make connection to this pad . No Tri-State option available.			
Frequency Stability Codes ( exclude modulation )	Freque. Stability over Operating Temperature Range				± 25 ppm		± 50 ppm		± 100 ppm	
	Commercial ( -10°C to +70°C )				A		B		C	
	Industrial ( -40°C to +85°C )				D		E		F	
Static Discharge Voltage	>2,000V ( per MIL-STD-883 , method 3015 )									
Packaging	16mm tape and reel . 1000pcs per reel									

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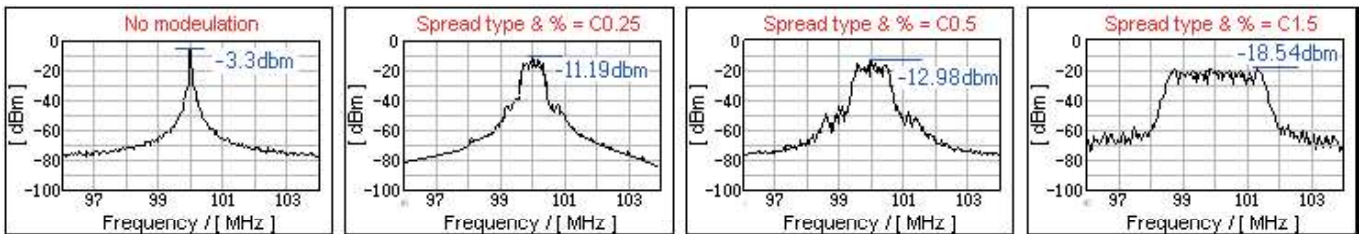
# EMI Reduction Spread Spectrum Clock Oscillators

## Part Number Format and Example

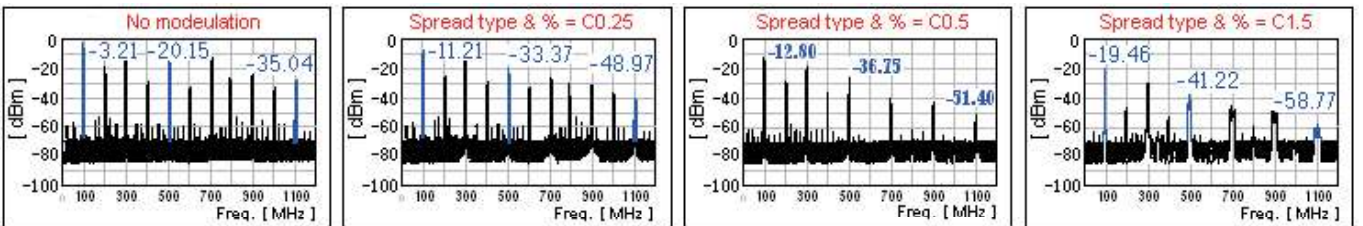
		[ 1 ]	[ 2 ]		[ 3 ]	[ 4 ]		[ 5 ]	[ 6 ]		[ 7 ]
		Supply Voltage	Holder Type	-	Frequency Stability	T	-	Center Frequency	Group Type	-	Spread type Percentage
Examples	(1)	3	HM 572	-	B	T	-	10.000	R	-	C1.5
	(2)	3	H M 53	-	F	T	-	75.000	Y	-	D1.0
	(3)	3	H M 43	-	D		-	100.000	P	-	D3.0

[ 1 ]	Supply voltage code : " 3 " for +3.3V
[ 2 ]	Holder Type ( HM32 , HM53 , HM57 , HM572 or HM43 )
[ 3 ]	-10°C ~ 70 °C " A " ± 25ppm ; " B " ± 50ppm ; " C " ± 100ppm ;
	-40°C ~ 85 °C " D " ± 25ppm ; " E " ± 50ppm ; " F " ± 100ppm ;
[ 4 ]	" T " for Tri-state , " T " is standard for all grounds except for group P .
[ 5 ]	Frequency in MHz
[ 6 ]	Group " R " , " P " or " Y "
[ 7 ]	Spread type & percentage ; " C " for center spread , " D " for down spread

## EMI Test Data : 3HM57-B-100.000R , 100.0MHz Group " R " , Modulation Carrier Frequency = 34.687KHz

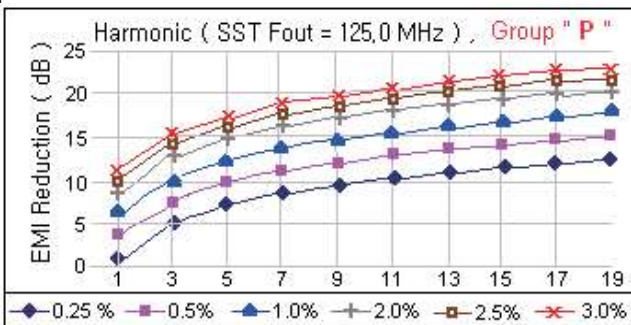


## Whole Spectrum EMI Data : 3HM57-B-100.000R , 100.0MHz Group " R " , Modulation Carrier Frequency = 34.687KHz



### EMI Test Data ( " P " group )

125.0 MHz at various spread percentages.  
Modulation Carrier Frequency : 48.8 KHz



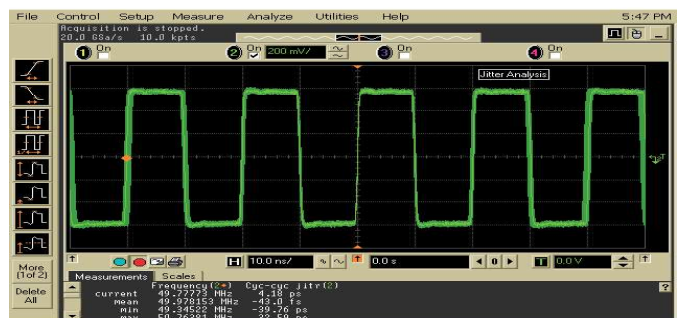
**Main mode :**  
EMI reduction (dB) =  $10 \text{ Log } \left( \frac{\text{total \%} * \text{frequency (MHz)}}{0.12} \right)$

**3rd Harmonic :**  
EMI reduction (dB) =  $10 \text{ Log } \left( \frac{\text{total \%} * \text{frequency (MHz)} * 3}{0.12} \right)$

**5th Harmonic :**  
EMI reduction (dB) =  $10 \text{ Log } \left( \frac{\text{total \%} * \text{frequency (MHz)} * 5}{0.12} \right)$

### Jitter Test Data ( " P " group )

" P " group , cycle to cycle jitter .  
32.59 ps ( min. ) ; 39.76 ps ( max. )



Sample rate : 20.0 G Sa/sec.; No. of sample : 1000; Edge Direction: Rising edges

For more technical information please visit the following web site :

[www.mercury-crystal.com](http://www.mercury-crystal.com) and download our technical note

TN-020 ( Title : Low EMI Spread Spectrum Clock Oscillators )

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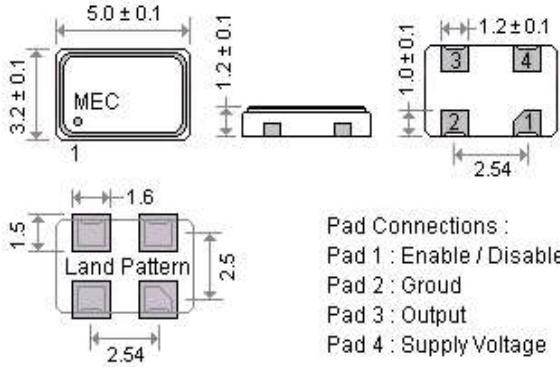
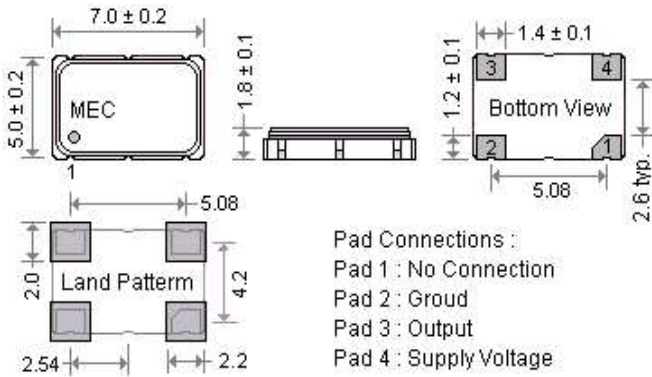
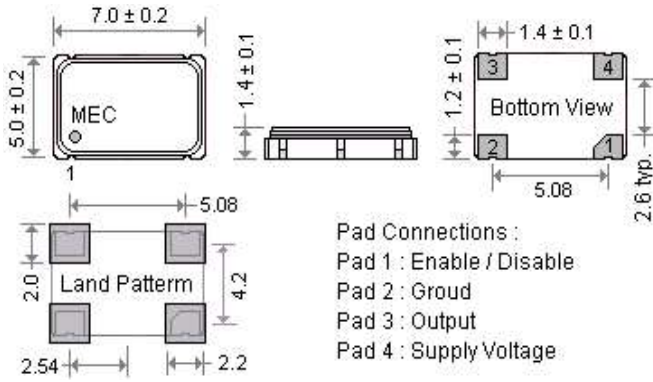
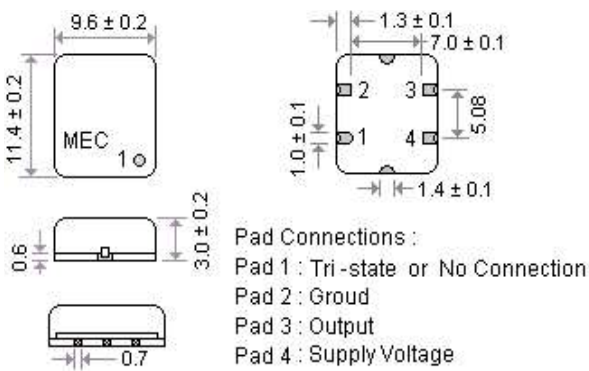
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# EMI Reduction Spread Spectrum Clock Oscillators

Outline Dimensions ( Unit : mm ) , Suggested pad Layout for SMDs

Oscillators

[ HM 53 ]	For group :	R	Y	[ HM 57 ]	For group :	P	
 <p style="margin-top: 10px;">Pad Connections :                      Pad 1 : Enable / Disable                      Pad 2 : Groud                      Pad 3 : Output                      Pad 4 : Supply Voltage</p>				 <p style="margin-top: 10px;">Pad Connections :                      Pad 1 : No Connection                      Pad 2 : Groud                      Pad 3 : Output                      Pad 4 : Supply Voltage</p>			
[ HM 572 ]	For group :	R	Y	[ HM 43 ]	For group :	R	Y
 <p style="margin-top: 10px;">Pad Connections :                      Pad 1 : Enable / Disable                      Pad 2 : Groud                      Pad 3 : Output                      Pad 4 : Supply Voltage</p>				 <p style="margin-top: 10px;">Pad Connections :                      Pad 1 : Tri-state or No Connection                      Pad 2 : Groud                      Pad 3 : Output                      Pad 4 : Supply Voltage</p>			