



## Peak EMI Reducing Solution

### Features

- Generates an EMI optimized clock signal at the output.
- Integrated loop filter components.
- Operates with a 3.3 / 2.5V Supply.
- Operating current less than 5mA.
- CMOS design.
- Input frequency range: 30MHz to 50MHz for 2.5V  
30MHz to 50MHz for 3.3V
- Generates a 1X low EMI spread spectrum clock of the input frequency.
- Frequency deviation:  $\pm 0.75\%$  (Typ) @ 46MHz Input Frequency.
- Available in 6L-TSOP (6L-TSOT-23) Package.

### Product Description

The ASM3P2780A is a versatile spread spectrum frequency modulator designed specifically for a wide range of clock frequencies. The ASM3P2780A reduces electromagnetic interference (EMI) at the clock source, allowing system wide reduction of EMI of all clock dependent signals. The ASM3P2780A allows significant system cost savings by reducing the number of circuit board layers, ferrite beads and shielding that are traditionally required to pass EMI regulations.

The ASM3P2780A uses the most efficient and optimized modulation profile approved by the FCC and is implemented by using a proprietary all digital method.

The ASM3P2780A 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 results 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.’

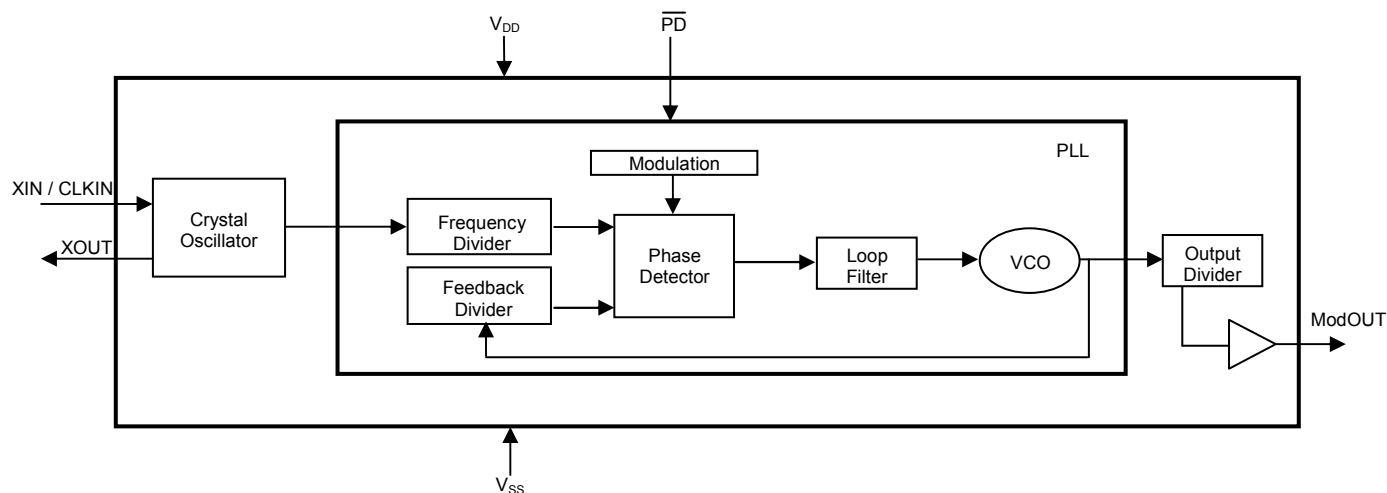
### Applications

The ASM3P2780A is targeted towards all portable devices like MP3 players and digital still cameras.

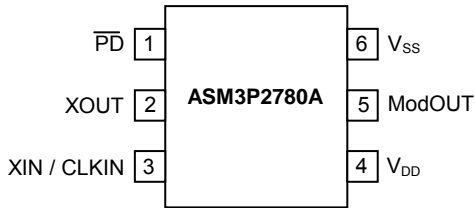
### Key Specifications

Description	Specification
Supply voltages	$V_{DD} = 3.3V / 2.5V$
Cycle-to-Cycle Jitter	$\pm 200pS$ (Typ)
Output Duty Cycle	45/55%
Modulation Rate Equation	$F_{IN}/1280$
Frequency Deviation	$\pm 0.75$ (Typ) @ 46MHz

### Block Diagram



## Pin Configuration (6L-TSOP Package)



## Pin Description

Pin#	Pin Name	Type	Description
1	$\overline{\text{PD}}$	I	Power-down control pin. Pull low to enable power-down mode. Connect to $V_{\text{DD}}$ if not used.
2	XOUT	O	Crystal connection. If using an external reference, this pin must be left unconnected.
3	XIN / CLKIN	I	Crystal connection or external reference frequency input. This pin has dual functions. It can be connected either to an external crystal or an external reference clock.
4	$V_{\text{DD}}$	P	Power supply for the entire chip.
5	ModOUT	O	Spread spectrum clock output.
6	$V_{\text{SS}}$	P	Ground connection.

## Specifications

Description	Specification
Frequency Range	30MHz < CLKIN < 50MHz
Modulation Equation	$F_{\text{IN}}/1280$
Frequency Deviation	$\pm 0.75\%$ (Typ) @ 46MHz

## Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
$V_{\text{DD}}, V_{\text{IN}}$	Voltage on any pin with respect to Ground	-0.5 to +4.6	V
$T_{\text{STG}}$	Storage temperature	-65 to +125	$^{\circ}\text{C}$
$T_{\text{s}}$	Max. Soldering Temperature (10 sec)	260	$^{\circ}\text{C}$
$T_{\text{J}}$	Junction Temperature	150	$^{\circ}\text{C}$
$T_{\text{DV}}$	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	2.375	3.6	V
$T_{\text{A}}$	Operating Temperature (Ambient Temperature)	-40	+85	$^{\circ}\text{C}$
$C_{\text{L}}$	Load Capacitance		15	pF
$C_{\text{IN}}$	Input Capacitance		7	pF

## DC Electrical Characteristics for 2.5V Supply

Symbol	Parameter	Min	Typ	Max	Unit
$V_{IL}$	Input low voltage	$V_{SS}-0.3$		0.8	V
$V_{IH}$	Input high voltage	2.0		$V_{DD}+0.3$	V
$I_{IL}$	Input low current			-35	$\mu A$
$I_{IH}$	Input high current			35	$\mu A$
$I_{XOL}$	XOUT output low current (@ 0.6V, $V_{DD} = 2.5V$ )		3		mA
$I_{XOH}$	XOUT output high current (@ 1.8V, $V_{DD} = 2.5V$ )		3		mA
$V_{OL}$	Output low voltage ( $V_{DD} = 2.5V$ , $I_{OL} = 8mA$ )			0.6	V
$V_{OH}$	Output high voltage ( $V_{DD} = 2.5V$ , $I_{OH} = 8mA$ )	1.8			V
$I_{DD}$	Static supply current <sup>1</sup>			10	$\mu A$
$I_{CC}$	Dynamic supply current (2.5V, 46MHz and no load)		4.0		mA
$V_{DD}$	Operating Voltage	2.375	2.5	2.625	V
$t_{ON}$	Power-up time (first locked cycle after power-up) <sup>2</sup>			5	mS
$Z_{OUT}$	Output impedance		50		$\Omega$

Note: 1. XIN / CLKIN pin and PD pin are pulled low.  
2.  $V_{DD}$  and XIN / CLKIN input are stable, PD pin is made high from low.

## AC Electrical Characteristics for 2.5V Supply

Symbol	Parameter	Min	Typ	Max	Unit
CLKIN	Input frequency	30		50	MHz
ModOUT	Output frequency	30		50	MHz
$f_d$	Frequency Deviation	Input Frequency = 30MHz	$\pm 1.10$		%
		Input Frequency = 50MHz	$\pm 0.65$		
$t_{LH}^1$	Output rise time (measured from 0.7V to 1.7V)	0.7	1.3	1.6	nS
$t_{HL}^1$	Output fall time (measured from 1.7V to 0.7V)	0.4	0.8	1.0	nS
$t_{JC}$	Jitter (cycle-to-cycle)		$\pm 200$		pS
$t_D$	Output duty cycle	45	50	55	%

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

## DC Electrical Characteristics for 3.3V Supply

Symbol	Parameter	Min	Typ	Max	Unit
$V_{IL}$	Input low voltage	$V_{SS}-0.3$		0.8	V
$V_{IH}$	Input high voltage	2.0		$V_{DD}+0.3$	V
$I_{IL}$	Input low current			-35	$\mu A$
$I_{IH}$	Input high current			35	$\mu A$
$I_{XOL}$	XOUT output low current (@ 0.4V, $V_{DD} = 3.3V$ )		3		mA
$I_{XOH}$	XOUT output high current (@ 2.5V, $V_{DD} = 3.3V$ )		3		mA
$V_{OL}$	Output low voltage ( $V_{DD} = 3.3V$ , $I_{OL} = 8mA$ )			0.4	V
$V_{OH}$	Output high voltage ( $V_{DD} = 3.3V$ , $I_{OH} = 8mA$ )	2.5			V
$I_{DD}$	Static supply current <sup>1</sup>			10	$\mu A$
$I_{CC}$	Dynamic supply current (3.3V, 46MHz and no load)		5.0		mA
$V_{DD}$	Operating Voltage	2.7	3.3	3.6	V
$t_{ON}$	Power-up time (first locked cycle after power-up) <sup>2</sup>			5	mS
$Z_{OUT}$	Output impedance		45		$\Omega$

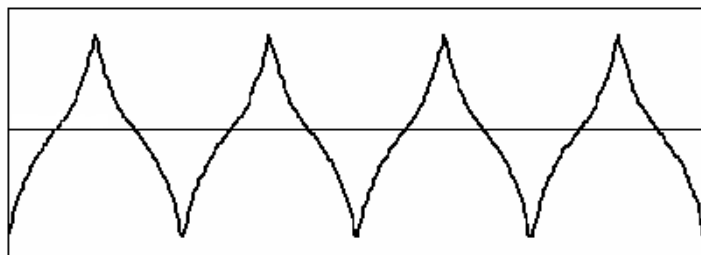
Notes: 1. XIN / CLKIN pin and PD pin are pulled low.  
2.  $V_{DD}$  and XIN / CLKIN input are stable, PD pin is made high from low.

## AC Electrical Characteristics for 3.3V Supply

Symbol	Parameter	Min	Typ	Max	Unit
CLKIN	Input frequency	30		50	MHz
ModOUT	Output frequency	30		50	MHz
$f_d$	Frequency Deviation	Input Frequency = 30MHz	$\pm 1.10$		%
		Input Frequency = 50MHz	$\pm 0.65$		
$t_{LH}^1$	Output rise time (measured from 0.8 to 2.0V)	0.5	1.1	1.4	nS
$t_{HL}^1$	Output fall time (measured at 2.0V to 0.8V)	0.3	0.8	1.1	nS
$t_{JC}$	Jitter (cycle-to-cycle)		$\pm 200$		pS
$t_D$	Output duty cycle	45	50	55	%

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

## Modulation Profile

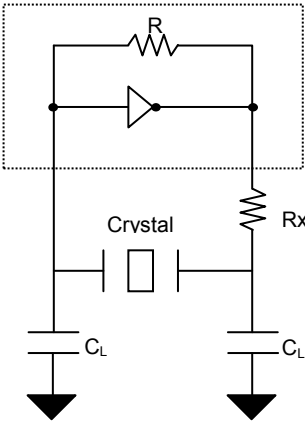


Typical Crystal Specifications

Fundamental AT cut parallel resonant crystal	
Nominal frequency	33MHz
Frequency tolerance	± 50 ppm or better at 25°C
Operating temperature range	-25°C to +85°C
Storage temperature	-40°C to +85°C
Load capacitance(C <sub>P</sub> )	18pF
Shunt capacitance	7pF maximum
ESR	25 Ω

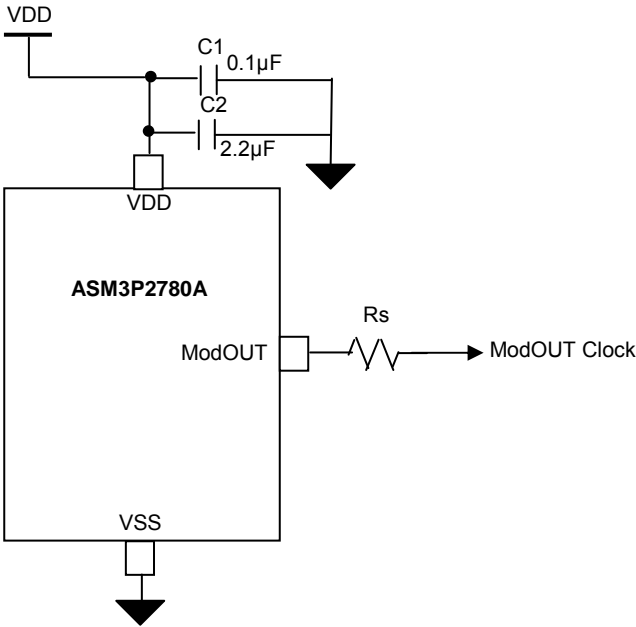
Note: Note: C<sub>L</sub> is Load Capacitance and Rx is used to prevent oscillations at overtone frequency of the Fundamental frequency.

Typical Crystal Interface Circuit



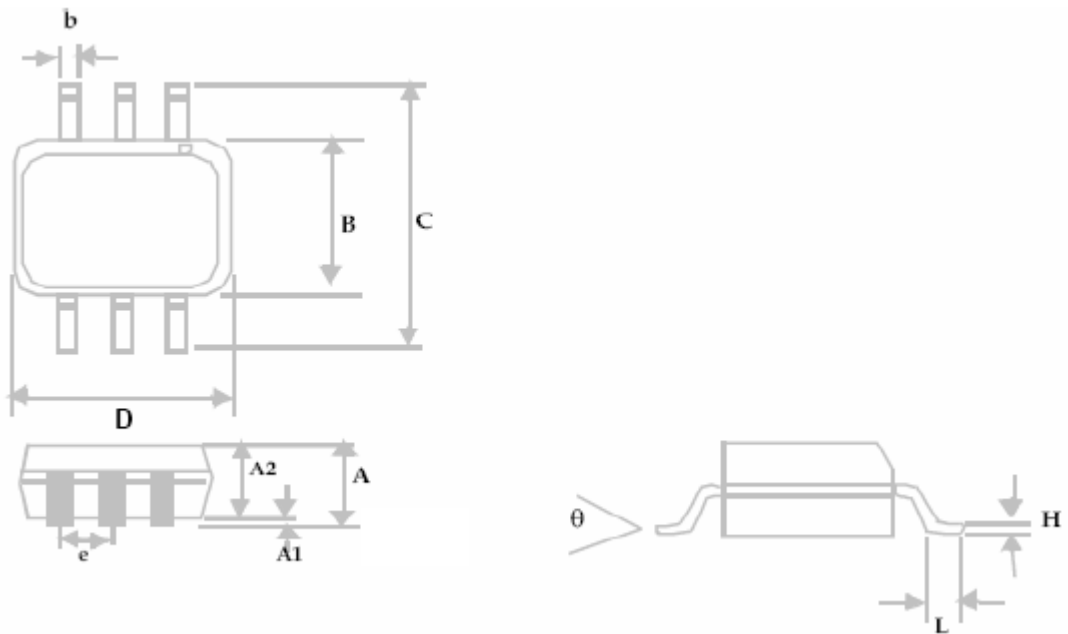
$C_L = 2 * (C_P - C_S)$ ,  
Where C<sub>P</sub> = Load capacitance of crystal  
C<sub>S</sub> = Stray capacitance due to C<sub>IN</sub>, PCB, Trace etc.

Typical Application Schematic



Package Information

6L-TSOP Package




Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A		0.04		1.00
A1	0.00	0.004	0.00	0.10
A2	0.033	0.036	0.84	0.90
b	0.012	0.02	0.30	0.50
H	0.005 BSC		0.127 BSC	
D	0.114 BSC		2.90 BSC	
B	0.06 BSC		1.60 BSC	
e	0.0374 BSC		0.950 BSC	
C	0.11 BSC		2.80 BSC	
L	0.0118	0.02	0.30	0.50
θ	0°	4°	0°	4°

## Ordering Information

Part Number	Marking	Package Type	Temperature
ASM3P2780AF-06OR	G4L	6L-TSOP (6L-TSOT-23), TAPE & 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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