Versatile EMI Reduction IC

Features

- FCC approved method of EMI attenuation
- Provides up to 20dB of EMI suppression
- Generates a low EMI spread spectrum clock of the input frequency
- Optimized for 25MHz to 60MHz input frequency range
- Internal loop filter minimizes external components and board space
- 4 selectable spread ranges
- SSON control pin for spread spectrum enable and disable options
- Low Cycle-to-cycle jitter
- 3.3V or 5.0V operating voltage
- Low power CMOS design
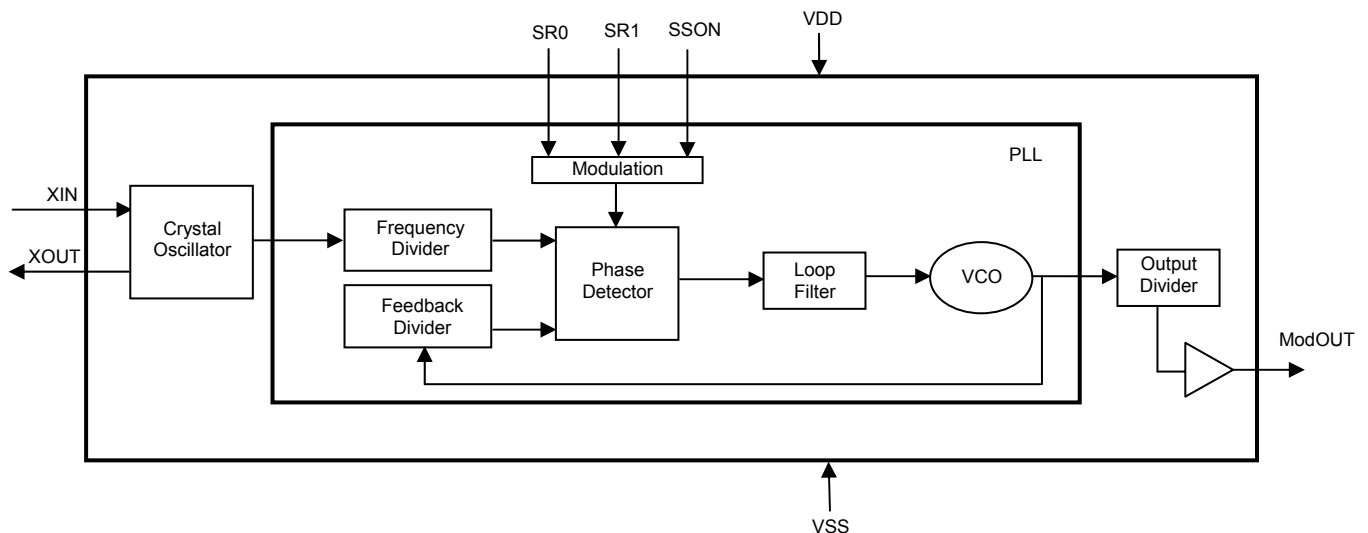- Available in 8 pin SOIC and TSSOP Packages

Product Description

The P2041A is a selectable spread spectrum frequency modulator designed specifically for PC peripheral and embedded controller markets. The P2041A reduces electromagnetic interference (EMI) at the clock source which provides system wide reduction of EMI of all clock dependent signals. The P2041A allows significant system cost savings by reducing the number of circuit board layers and shielding that are traditionally required to pass EMI regulations.

The P2041A uses the most efficient and optimized modulation profile approved by the FCC and is implemented in a proprietary all-digital method.

The P2041A 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 result 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 P2041A is targeted towards the embedded controller market and PC peripheral markets including scanners, MFP's, printers, PDA, IA , and GPS devices.
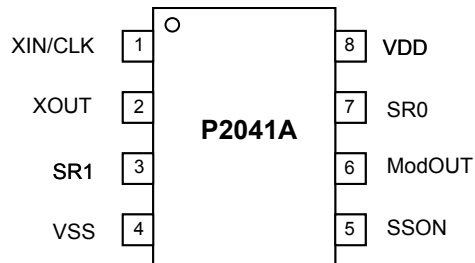
Block Diagram

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Pin Configuration

Pin Description

Pin#	Pin Name	Type	Description
1	XIN/CLK	I	Connect to crystal or externally generated clock signal.
2	XOUT	I	Connect to crystal. No connect if externally generated clock signal is used.
3	SR1	I	Digital logic input used to select Spreading Range (see Table 1). This pin has an internal pull-up resistor.
4	VSS	P	Ground Connection. Connect to system ground.
5	SSON	I	Digital logic input used to enable Spread Spectrum function (Active Low). Spread Spectrum function enable when low. This pin has an internal pull-low resistor.
6	ModOUT	O	Spread Spectrum Clock Output.
7	SR0	I	Digital logic input used to select Spreading Range (see Table 1). This pin has an internal pull-up resistor.
8	VDD	P	Connect to +3.3V or +5.0V

Table 1 - Spread Range Selection

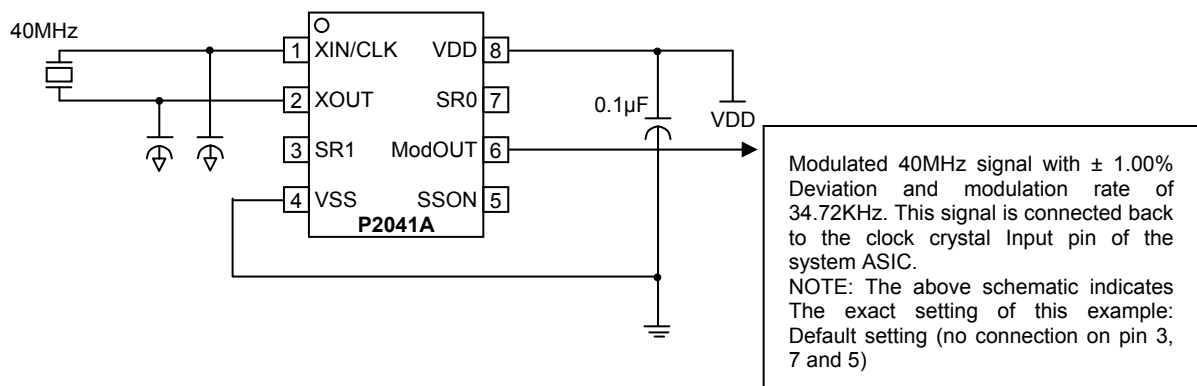| SR1	SR0	Spreading Range	Modulation rate
0	0	+/- 1.50%	(Fin/40)*34.72 KHz
0	1	+/- 2.50%	(Fin/40)*34.72 KHz
1	0	+/- 0.50%	(Fin/40)*34.72 KHz
1	1	+/- 1.00%	(Fin/40)*34.72 KHz

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Spread spectrum selection

Table 1 illustrates the possible spread spectrum options. The optimal setting should minimize system EMI to the fullest without affecting system performance. The spreading is described as a percentage deviation of the center frequency (Note: the center frequency is the frequency of the external reference input on XIN/CLK, Pin 1).

Example of a typical printer or scanner application that operates on a clock frequency of 40MHz:

A spreading selection of SR1=1 and SR0=1 provides a percentage deviation of +/-1.00%* (see Table 1) of Center Frequency. This results in the frequency on ModOUT being swept from 40.40MHz to 39.60MHz at a modulation rate of (40/40)*34.72 = 34.72KHz (see Table 1). This particular example (see Figure below) given here is a common EMI reduction method for scanners and has already been implemented by most of the leading manufacturers.

NOTE: Spreading range selection varies from different system manufacturers and their designs. The spreading range of P2041A can be set to +/-2.5% when working with certain scanner model.

P2041A Application Schematic for Flat-Bed Scanner

Modulated 40MHz signal with ± 1.00% Deviation and modulation rate of 34.72KHz. This signal is connected back to the clock crystal Input pin of the system ASIC.
NOTE: The above schematic indicates The exact setting of this example: Default setting (no connection on pin 3, 7 and 5)

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Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
VDD, V_{IN}	Voltage on any pin with respect to Ground	-0.5 to +7.0	V
T_{STG}	Storage temperature	-65 to +125	°C
T_A	Operating temperature	-40 to +85	°C
T_s	Max. Soldering Temperature (10 sec)	260	°C
T_J	Junction Temperature	150	°C
T_{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.			

DC Electrical Characteristics

(Test condition: All parameters are measured at room temperature (+25°C) unless otherwise stated)

Symbol	Parameter		Min	Typ	Max	Unit
V_{IL}	Input low Voltage	(For 3.3V Supply Voltage)	VSS –0.3	-	0.8	V
		(For 5V Supply Voltage)	-	-	1.5	
V_{IH}	Input low Voltage	(For 3.3V Supply Voltage)	2.0	-	VDD + 0.3	V
		(For 5V Supply Voltage)	3.5	-	-	
I_{IL}	Input Low Current (pull-up resistor on inputs SR0, SR1)	(For 3.3V Supply Voltage)	-	-	-35	µA
		(For 5V Supply Voltage)	-	-	-100	
I_{IH}	Input High Current (pull-down resistor on input SSON)	(For 3.3V Supply Voltage)	-	-	35	µA
		(For 5V Supply Voltage)	-	-	100	
I_{XOL}	XOUT Output Low Current (V_{XOL} @ 0.4V, VDD = 3.3V)		-	3	-	mA
I_{XOH}	XOUT Output High Current (V_{XOH}@ 2.5V, VDD = 3.3V)		-	3	-	mA
V_{OL}	Output Low Voltage	(VDD=3.3V, I_{OL} = 20 mA)	-	-	0.4	V
		(VDD=5V, I_{OL} = 20 mA)	-	-	0.5	
V_{OH}	Output High Voltage	(VDD=3.3V, I_{OH} = 20 mA)	2.5	-	-	V
		(VDD=5V, I_{OH} = 20 mA)	4.5	-	-	
I_{DD}	Static Supply Current		-	1.0	-	mA
I_{CC}	Dynamic Supply Current	3.3V and 15pF loading	-	-	22	mA
		5V and 15pF loading	-	-	35	
VDD	Operating Voltage		2.7	3.3	5.5	V

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AC Electrical Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
f_{IN}	Input Frequency	25	40	60	MHz
t_{LH}*	Output rise time (Measured at 0.8V to 2.0V)	0.7	1.0	1.3	nS
t_{HL}*	Output fall time (Measured at 2.0 to 0.8V)	0.6	0.8	1.0	nS
t_{JC}	Jitter (Cycle to cycle)	-	360	-	pS
t_D	Output duty cycle	45	50	55	%
*t_{LH} and t_{HL} are measured into a capacitive load of 15pF					

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Package Information

8-lead (150-mil) SOIC Package
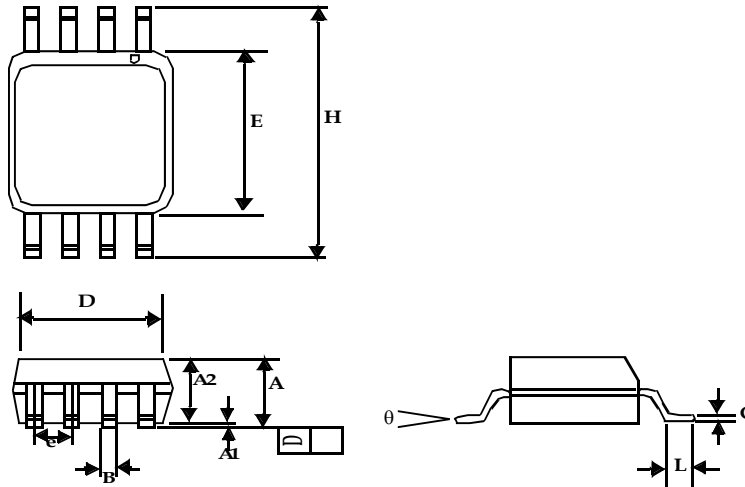
Symbol	Dimensions			
	Inches		**Millimeters**	
	Min	**Max**	**Min**	**Max**
A1	0.004	0.010	0.10	0.25
A	0.053	0.069	1.35	1.75
A2	0.049	0.059	1.25	1.50
B	0.012	0.020	0.31	0.51
C	0.007	0.010	0.18	0.25
D	0.193 BSC		4.90 BSC	
E	0.154 BSC		3.91 BSC	
e	0.050 BSC		1.27 BSC	
H	0.236 BSC		6.00 BSC	
L	0.016	0.050	0.41	1.27
θ	0°	8°	0°	8°

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8-lead Thin Shrunk Small Outline Package (4.40-MM Body)
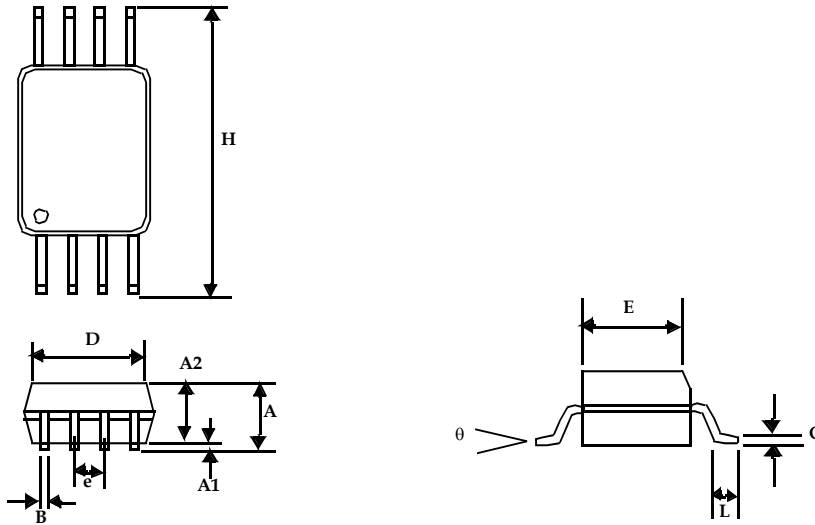
Symbol	Dimensions			
	Inches		Millimeters	
	Min	**Max**	**Min**	**Max**
A		0.043		1.10
A1	0.002	0.006	0.05	0.15
A2	0.033	0.037	0.85	0.95
B	0.008	0.012	0.19	0.30
c	0.004	0.008	0.09	0.20
D	0.114	0.122	2.90	3.10
E	0.169	0.177	4.30	4.50
e	0.026 BSC		0.65 BSC	
H	0.252 BSC		6.40 BSC	
L	0.020	0.028	0.50	0.70
θ	0°	8°	0°	8°

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Ordering Information

Part number	Marking	Package Configuration	Temperature Range
P2041A -08ST	P2041A	8-Pin SOIC,Tube	Commercial
P2041A -08SR	P2041A	8-Pin SOIC, Tape and Reel	Commercial
P2041AF-08ST	P2041AF	8-Pin SOIC, Tube, Pb Free	Commercial
P2041AF-08SR	P2041AF	8-Pin SOIC, Tape and Reel, Pb Free	Commercial
P2041AG-08ST	P2041AG	8-Pin SOIC, Tube, Green	Commercial
P2041AG-08SR	P2041AG	8-Pin SOIC, Tape and Reel, Green	Commercial
I2041A-08ST	I2041A	8-Pin SOIC, Tube	Industrial
I2041A-08SR	I2041A	8-Pin SOIC, Tape and Reel	Industrial
I2041AF-08ST	I2041AF	8-Pin SOIC, Tube, Pb Free	Industrial
I2041AF-08SR	I2041AF	8-Pin SOIC, Tape and Reel, Pb Free	Industrial
I2041AG-08ST	I2041AG	8-Pin SOIC, Tube, Green	Industrial
I2041AG-08SR	I2041AG	8-Pin SOIC, Tape and Reel, Green	Industrial
P2041A-08TT	P2041A	8-Pin TSSOP, Tube	Commercial
P2041A-08TR	P2041A	8-Pin TSSOP, Tape and Reel	Commercial
P2041AF-08TT	P2041AF	8-Pin TSSOP, Tube, Pb Free	Commercial
P2041AF-08TR	P2041AF	8-Pin TSSOP, Tape and Reel, Pb Free	Commercial
P2041AG-08TT	P2041AG	8-Pin TSSOP, Tube, Green	Commercial
P2041AG-08TR	P2041AG	8-Pin TSSOP, Tape and Reel, Green	Commercial
I2041A-08TT	I2041A	8-Pin TSSOP, Tube	Industrial
I2041A-08TR	I2041A	8-Pin TSSOP, Tape and Reel	Industrial
I2041AF-08TT	I2041AF	8-Pin TSSOP, Tube, Pb Free	Industrial
I2041AF-08TR	I2041AF	8-Pin TSSOP, Tape and Reel, Pb Free	Industrial
I2041AG-08TT	I2041AG	8-Pin TSSOP, Tube, Green	Industrial
I2041AG-08TR	I2041AG	8-Pin TSSOP, Tape and Reel, Green	Industrial

Device Ordering Information

P 2 0 4 1 A F - 0 8 X X

SR - SOIC, T/R
TT – TSSOP, TUBE
TR - TSSOP, T/R
ST – SOIC, TUBE

Pin Count

F =Lead Free and and RoHS compliant part
G = Green

Deviation (%) and Spread option Identifier

DEVICE NUMBER

Flow:
P = Commercial Temperature Range (0°C to 70°C)
I = Industrial Temperature Range (-40°C to 85°C)
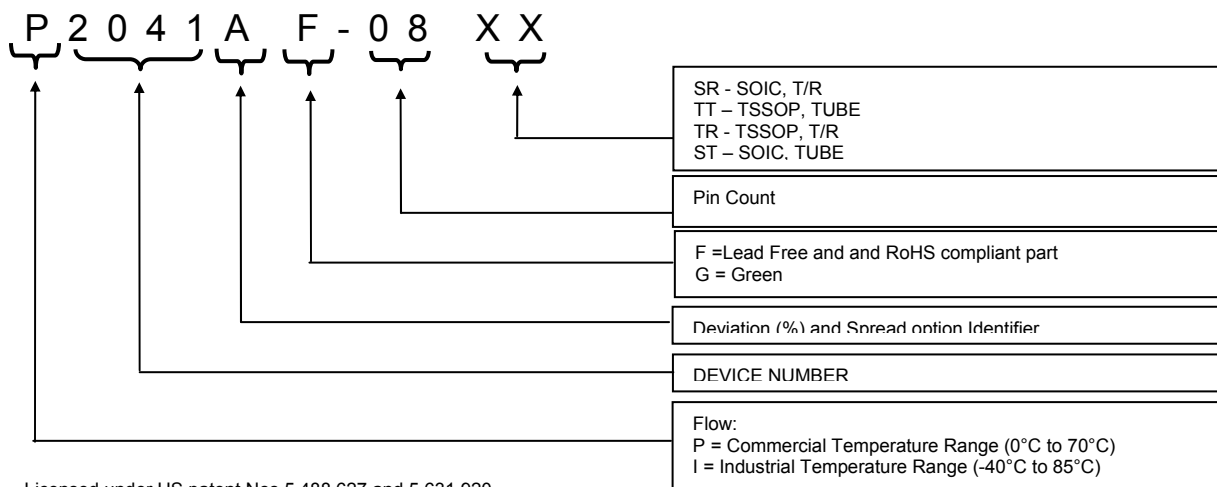
Licensed under US patent Nos 5,488,627 and 5,631,920.

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Note: This product utilizes US Patent # 6,646,463 Impedance Emulator Patent issued to Alliance Semiconductor, dated 11-11-2003

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