P2042A

Product Preview
LCD Panel EMI Reduction IC

ON Semiconductor®

Product Description

The P2042A is a versatile spread spectrum frequency modulator designed specifically for digital flat panel applications. The P2042A reduces electromagnetic interference (EMI) at the clock source, allowing system wide reduction of EMI of down stream clock and data dependent signals. The P2042A allows significant system cost savings by reducing the number of circuit board layers, ferrite beads, shielding, and other passive components that are traditionally required to pass EMI regulations.

The P2042A uses the most efficient and optimized modulation profile approved by the FCC and is implemented in a proprietary all digital method.

The P2042A 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 P2042A is targeted towards digital flat panel applications for notebook PCs, palm−size PCs, office automation equipments, and LCD monitors.

Features

- FCC Approved Method of EMI Attenuation
- Provides up to 15 dB of EMI Suppression
- Generates a Low EMI Spread Spectrum Clock of the Input Frequency
- Input Frequency Range: 30 MHz to 110 MHz
- Optimized for 32.5 MHz, 54 MHz, 65 MHz and 108 MHz Pixel Clock Frequencies
- Internal Loop Filter Minimizes External Components and Board Space
- Eight Selectable High Spread Ranges up to ±1.9%
- SSON# Control Pin for Spread Spectrum Enable and Disable Options
- Low Cycle−to−Cycle Jitter
- 3.3 V ± 0.3 V Operating Range
- Low Power CMOS Design
- Supports Most Mobile Graphic Accelerator and LCD Timing Controller Specifications
- Available in 8−pin SOIC and TSSOP Packages
- These are Pb−Free Devices

SOIC−8
S SUFFIX
CASE 751BD

TSSOP−8
T SUFFIX
CASE 948AL

PIN CONFIGURATION

```
          1
CLKIN ⊏⊐  ○        ⊏⊐ VDD
  CP0 ⊏⊐            ⊏⊐ SR0
          P2042A
  CP1 ⊏⊐            ⊏⊐ ModOUT
  VSS ⊏⊐            ⊏⊐ SSON#
```

(Top View)
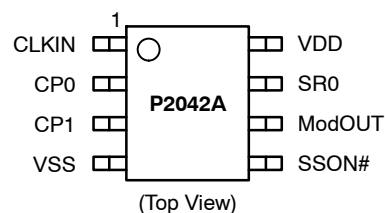
ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

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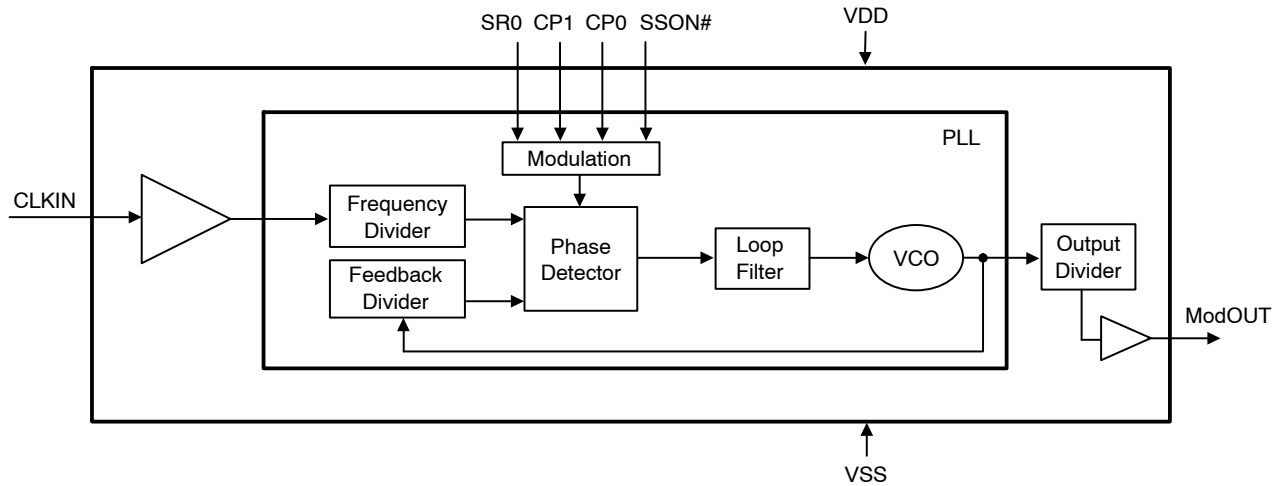**Figure 1. Block Diagram**

Table 1. ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Rating	Unit
VDD, V_{IN}	Voltage on any pin with respect to Ground	−0.5 to +4.6	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

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Table 2. PIN DESCRIPTION

Pin#	Pin Name	Type	Description
1	CLKIN	I	External reference frequency input. Connect to externally generated reference signal.
2	CP0	I	Digital logic input used to select charge pump current. This pin has an internal pull−up resistor. Refer to *Modulation Selection* Table.
3	CP1	I	Digital logic input used to select charge pump current. This pin has an internal pull−up resistor. Refer to *Modulation Selection* Table.
4	VSS	P	Ground to entire chip. Connect to system ground.
5	SSON#	I	Digital logic input used to enable Spread Spectrum function (Active LOW). Spread Spectrum function enabled when LOW, disabled when HIGH. 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. This pin has an internal pull−up resistor.
8	VDD	P	Power supply for the entire chip

Table 3. MODULATION SELECTION

CP0	CP1	SR0	Spreading Range (±%)					Modulation Rate (KHz)
			32.5 MHz	54 MHz	65 MHz	81 MHz	108 MHz	
0	0	0	0.56	1.05	1.00	0.98	0.80	
0	0	1	1.94	1.68	1.56	1.48	1.22	
0	1	0	1.36	1.05	1.00	0.92	0.67	
0	1	1	1.92	1.68	1.56	1.48	1.06	(FIN /40) * 62.49 KHz
1	0	0	1.24	0.81	0.66	0.40	0.27	
1	0	1	1.91	1.29	1.02	0.74	0.43	
1	1	0	0.91	0.45	0.34	0.05	0.15	
1	1	1	1.47	0.71	0.54	0.36	0.21	

Spread Spectrum Selection

The *Modulation Selection* Table defines 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 CLKIN, pin1).

For example, P2042A is designed for high−resolution, flat panel applications and is able to support an XGA (1024 x 768) flat panel operating at 65 MHz (FIN) clock speed. A spreading selection of CP0 = 0, CP1 = 1 and SR0 = 0 provides a percentage deviation of ±1.00% from F_{IN}. This results in the frequency on ModOUT being swept from 65.65 to 64.35 MHz at a modulation rate of 101.54 KHz. Refer to *Modulation Selection* Table. The example in the following illustration is a common EMI reduction method for a notebook LCD panel and has already been implemented by most of the leading OEM and mobile graphic accelerator manufacturers.
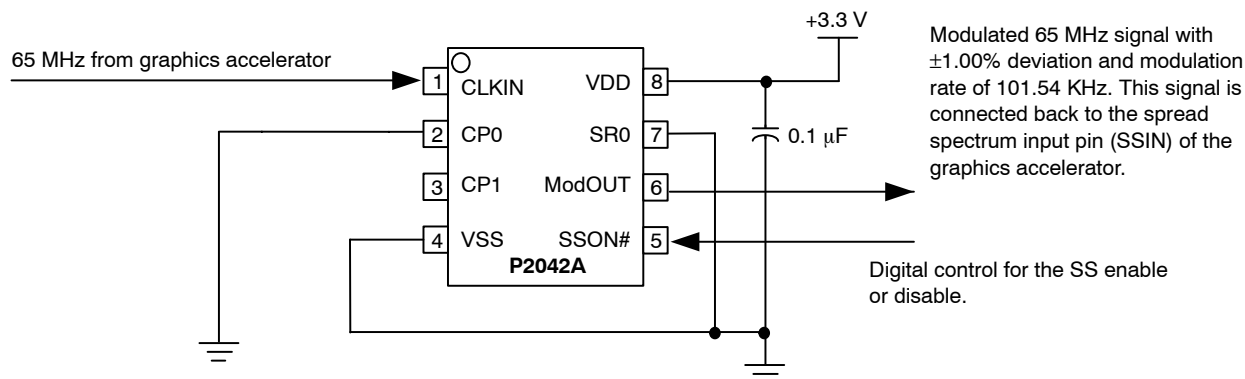

Figure 2. Application Schematic for Mobile LCD Graphics Controllers

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Table 4. OPERATING CONDITIONS

Symbol	Parameter			Min	Typ	Max	Unit
VDD	Supply Voltage with respect to Ground			3.0	3.3	3.6	V
T_A	Operating temperature	Commercial		0		+70	°C
		Industrial		−40		+85	
T_J	Junction temperature	Commercial	SOIC			82.39	°C
			TSSOP			79.8	
		Industrial	SOIC			97.39	
			TSSOP			94.8	
θ_{JC}	SOIC				156.5		°C/W
	TSSOP				124		

Table 5. DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Min	Typ	Max	Unit
V_{IL}	Input low voltage	VSS−0.3		0.8	V
V_{IH}	Input high voltage	2.0		VDD+0.3	V
I_{IL}	Input low current (pull−up resistor on inputs CP0, CP1 and SR0)			−35	μA
I_{IH}	Input high current (pull−down resistor on input SSON#)			35	μA
V_{OL}	Output low voltage (V_{DD} = 3.3 V, I_{OL} = 20 mA)			0.4	V
V_{OH}	Output high voltage (V_{DD} = 3.3 V, I_{OL} = 20 mA)	2.5			V
I_{DD}	Static supply current standby mode		0.6		mA
I_{CC}	Dynamic supply current (3.3 V and 10 pF loading)	9	16	22	mA
V_{DD}	Operating voltage	3.0	3.3	3.6	V
t_{ON}	Power−up time (first locked cycle after power up)		0.18		mS
Z_{OUT}	Clock output impedance		50		Ω

Table 6. AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Min	Typ	Max	Unit
f_{IN}	Input frequency	30	65	110	MHz
f_{OUT}	Output frequency	30	65	110	MHz
t_{LH} (Note 1)	Output rise time (measured at 0.8 V to 2.0 V)	0.7	0.9	1.1	nS
t_{HL} (Note 1)	Output fall time (measured at 2.0 V to 0.8 V)	0.6	0.8	1.0	nS
t_{JC}	Jitter (cycle−to−cycle)			360	pS
t_D	Output duty cycle	45	50	55	%

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

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PACKAGE DIMENSIONS

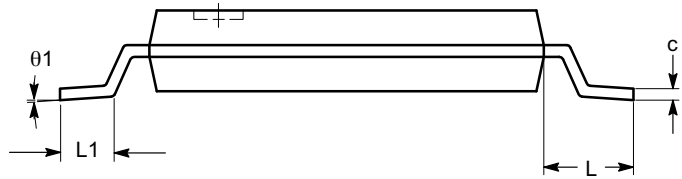**TSSOP8, 4.4x3**
CASE 948AL−01
ISSUE O
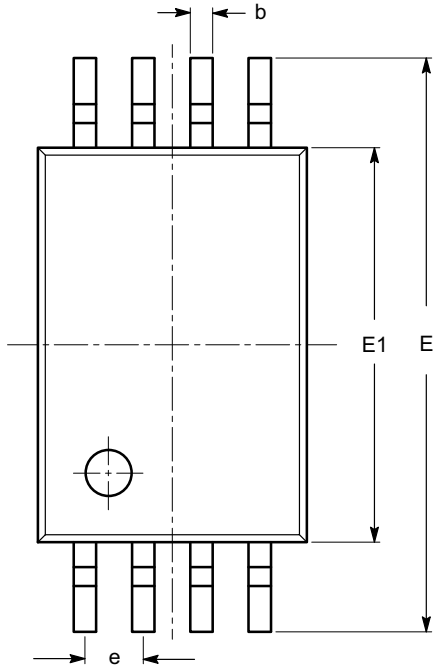
SYMBOL	MIN	NOM	MAX
A			1.20
A1	0.05		0.15
A2	0.80	0.90	1.05
b	0.19		0.30
c	0.09		0.20
D	2.90	3.00	3.10
E	6.30	6.40	6.50
E1	4.30	4.40	4.50
e	0.65 BSC		
L	1.00 REF		
L1	0.50	0.60	0.75
θ	0º		8º
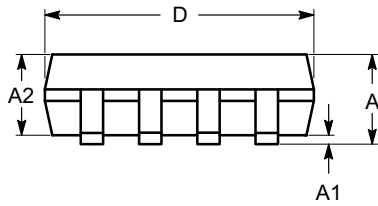
TOP VIEW

SIDE VIEW

END VIEW

Notes:

(1) All dimensions are in millimeters. Angles in degrees.
(2) Complies with JEDEC MO-153.

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PACKAGE DIMENSIONS

SOIC 8, 150 mils
CASE 751BD–01
ISSUE O

PIN # 1
IDENTIFICATION
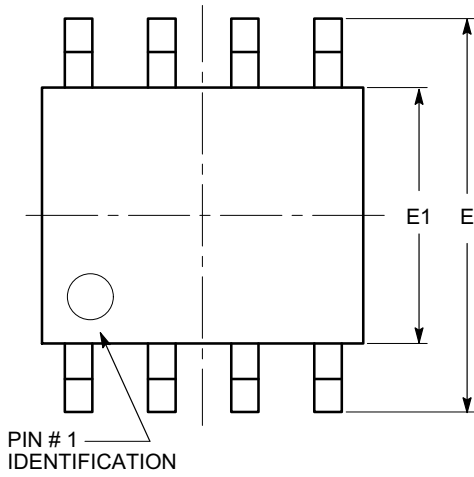
TOP VIEW

SYMBOL	MIN	NOM	MAX
A	1.35		1.75
A1	0.10		0.25
b	0.33		0.51
c	0.19		0.25
D	4.80		5.00
E	5.80		6.20
E1	3.80		4.00
e		1.27 BSC	
h	0.25		0.50
L	0.40		1.27
θ	0º		8º
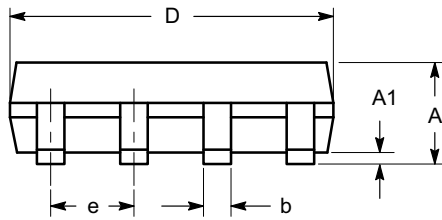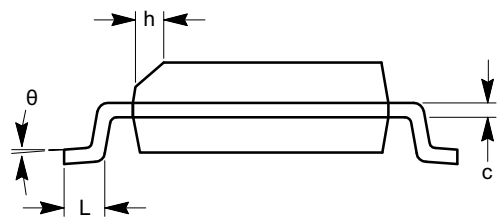
SIDE VIEW

END VIEW

Notes:

(1) All dimensions are in millimeters. Angles in degrees.
(2) Complies with JEDEC MS-012.

Table 7. ORDERING INFORMATION

Part Number	Marking	Package Type	Temperature
P2042AF−08ST	P2042AF	8−Pin SOIC, TUBE, Pb Free	Commercial
P2042AF−08SR	P2042AF	8−Pin SOIC, TAPE & REEL, Pb Free	Commercial
P2042AF−08TT	P2042AF	8−Pin TSSOP, TUBE, Pb Free	Commercial
P2042AF−08TR	P2042AF	8−Pin TSSOP, TAPE & REEL, Pb Free	Commercial
P2042AG−08ST	P2042AG	8−Pin SOIC, TUBE, Green	Commercial
P2042AG−08SR	P2042AG	8−Pin SOIC, TAPE & REEL, Green	Commercial
P2042AG−08TT	P2042AG	8−Pin TSSOP, TUBE, Green	Commercial
P2042AG−08TR	P2042AG	8−Pin TSSOP, TAPE & REEL, Green	Commercial
I2042AF−08ST	I2042AF	8−Pin SOIC, TUBE, Pb Free	Industrial
I2042AF−08SR	I2042AF	8−Pin SOIC, TAPE & REEL, Pb Free	Industrial
I2042AF−08TT	I2042AF	8−Pin TSSOP, TUBE, Pb Free	Industrial
I2042AF−08TR	I2042AF	8−Pin TSSOP, TAPE & REEL, Pb Free	Industrial
I2042AG−08ST	I2042AG	8−Pin SOIC, TUBE, Green	Industrial
I2042AG−08SR	I2042AG	8−Pin SOIC, TAPE & REEL, Green	Industrial
I2042AG−08TT	I2042AG	8−Pin TSSOP, TUBE, Green	Industrial
I2042AG−08TR	I2042AG	8−Pin TSSOP, TAPE & REEL, Green	Industrial