



## Low-Cost Notebook EMI Reduction IC

### Features

- Provides up to 15dB of EMI suppression
- FCC approved method of EMI attenuation
- Generates a 1X low EMI spread spectrum clock of the input frequency
- Operates between 20MHz and 38MHz input frequency range
- External loop filter for spread percentage adjustment
- Spreading ranges from  $\pm 0.25\%$  to  $\pm 2.5\%$
- Ultra low cycle-to-cycle jitter
- Zero-Cycle slip at small deviations
- 3.3 V Operating Voltage
- 10 mA output drives
- TTL or CMOS compatible outputs
- Low power CMOS design
- Available in 8-pin SOIC and TSSOP Packages
- Available for Industrial temperature operating range ( $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ )

### Product Description

The P2779A is a versatile spread spectrum frequency modulator designed specifically for mobile and digital camera and other digital video and imaging applications. The P2779A reduces electromagnetic interference (EMI) at

the clock source, which provides system-wide reduction of EMI of all clock dependent signals. The P2779A allows significant system cost savings by reducing the number of circuit board layers and shielding that are traditionally required to pass EMI regulations.

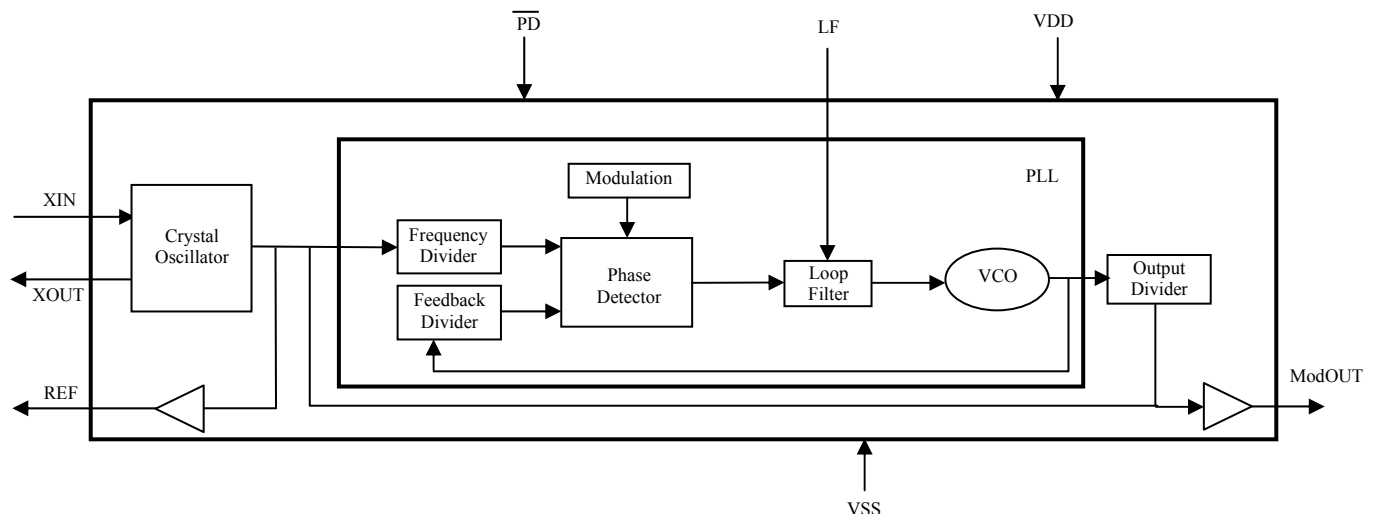
The P2779A uses the most efficient and optimized modulation profile approved by the FCC.

The P2779A 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

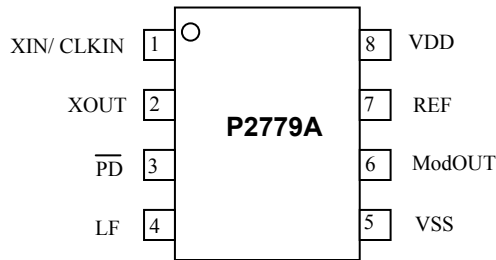
The P2779A is targeted toward mobile 3D graphics chip set applications.

### Block Diagram





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Pin Configuration

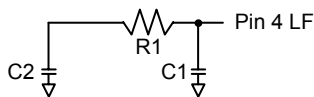


Pin Description

| Pin# | Pin Name               | Type | Description                                                                                                                                                                         |
|------|------------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | XIN / CLKIN            | I    | Connect to crystal or clock input.                                                                                                                                                  |
| 2    | XOUT                   | O    | Crystal output.                                                                                                                                                                     |
| 3    | $\overline{\text{PD}}$ | I    | Power-down control pin. Pull low to enable power-down mode. This pin has an internal pull-up resistor. <sup>1</sup>                                                                 |
| 4    | LF                     | I    | External loop filter for the PLL. By changing the value of the CRC circuit, the percentage spread can be adjusted accordingly. (See Loop Filter Selection Table for detail values.) |
| 5    | VSS                    | P    | Ground connection. Connect to system ground.                                                                                                                                        |
| 6    | ModOUT                 | O    | Spread spectrum clock output.                                                                                                                                                       |
| 7    | REF                    | O    | Provides a reference clock output of the input frequency.                                                                                                                           |
| 8    | VDD                    | P    | Connect to +3.3 V.                                                                                                                                                                  |

Note: 1. Connect to VDD if not used.

Loop Filter Selection Table VDD 3.3 V



| Input (MHz) | FS1 | FS0 | BW = ± 0.50% |         |        | BW = ± 0.75% |         |        | BW = ± 1.00% |         |         | BW = ± 1.25% |         |        |
|-------------|-----|-----|--------------|---------|--------|--------------|---------|--------|--------------|---------|---------|--------------|---------|--------|
|             |     |     | C1 (pF)      | C2 (pF) | R1 (Ω) | C1 (pF)      | C2 (pF) | R1 (Ω) | C1 (pF)      | C2 (pF) | R1 (Ω)  | C1 (pF)      | C2 (pF) | R1 (Ω) |
| 20          | 1   | 0   | 270          | 100,000 | 330    | 270          | 100,000 | 560    | 270          | 100,000 | 750     | 560          | 100,000 | 910    |
| 21-22       | 1   | 0   | 270          | 100,000 | 390    | 270          | 100,000 | 620    | 270          | 100,000 | 866(1%) | 560          | 100,000 | 1,100  |
| 23-24       | 1   | 0   | 270          | 100,000 | 510    | 270          | 100,000 | 750    | 270          | 10,000  | 1,000   | 680          | 6,800   | 1,200  |
| 25-26       | 1   | 0   | 270          | 100,000 | 560    | 270          | 100,000 | 820    | 270          | 12,000  | 1,200   | 470          | 4,700   | 1,200  |
| 27-28       | 1   | 0   | 270          | 100,000 | 620    | 270          | 100,000 | 1,000  | 270          | 6,800   | 1,200   | 330          | 3,300   | 1,200  |
| 29-30       | 1   | 0   | 270          | 100,000 | 750    | 270          | 100,000 | 1,100  | 270          | 3,900   | 1,200   | 330          | 3,300   | 1,500  |
| 31-32       | 1   | 0   | 270          | 100,000 | 820    | 270          | 100,000 | 1,200  | 270          | 12,000  | 2,200   | 680          | 6,800   | 2,200  |
| 33-34       | 1   | 0   | 270          | 100,000 | 910    | 270          | 100,000 | 1,300  | 270          | 10,000  | 2,200   | 390          | 3,900   | 2,200  |
| 35-36       | 1   | 0   | 270          | 100,000 | 1,000  | 270          | 100,000 | 1,500  | 270          | 5,600   | 2,200   | 270          | 2,700   | 2,200  |
| 37-38       | 1   | 0   | 270          | 100,000 | 1,200  | 270          | 100,000 | 1,600  | 270          | 3,300   | 2,200   | 270          | 2,700   | 2,700  |

Please contact factory for loop filter values if desired spread settings are not listed.



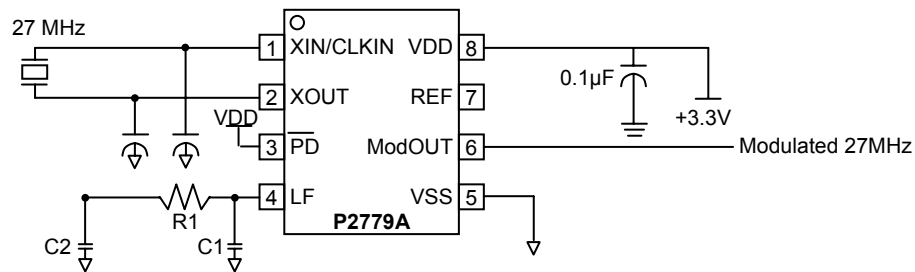
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## Spread Spectrum Selection

The P2779A performs zero cycle slip when set at low percentage spreading. This prevents any occurrence of system timing error. 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 that the center frequency is the frequency of the external reference input on XIN/CLKIN, pin 1.)

The P2779A is designed for PC peripheral, networking, notebook PC, and LCD monitor applications. It is optimized for operation from 20MHz to 38MHz. The P2779A's spread percentage selection is determined by the external LF value specified in the Loop Filter Selection Table. The external LF allows the user to fine tune the spread percentage to optimize the EMI reduction benefits of the spread spectrum.

## Application Schematic



PD selection: Power dissipation can be reduced by completely turning off the IC.



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**Absolute Maximum Ratings**

| Symbol           | Parameter                                                | Rating       | Unit |
|------------------|----------------------------------------------------------|--------------|------|
| $V_{DD}, V_{IN}$ | 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                                    | 0 to +70     | °C   |
| $T_s$            | Max. Soldering Temperature (10 sec)                      | 260          | °C   |
| $T_J$            | Junction Temperature                                     | 150          | °C   |
| $T_{DV}$         | Static Discharge Voltage<br>(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**

| 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                                         | -         | 60  | -         | μA   |
| $I_{IH}$  | Input high current                                        | -         | 0   | -         | μA   |
| $I_{XOL}$ | XOUT output low current (at 0.4 V, $V_{DD} = 3.3V$ )      | -         | 10  | -         | mA   |
| $I_{XOH}$ | XOUT output high current (at 2.5 V, $V_{DD} = 3.3V$ )     | -         | 10  | -         | mA   |
| $V_{OL}$  | Output low voltage ( $V_{DD} = 3.3V$ , $I_{OL} = 20$ mA)  | -         | -   | 0.4       | V    |
| $V_{OH}$  | Output high voltage ( $V_{DD} = 3.3V$ , $I_{OH} = 20$ mA) | 2.5       | -   | -         | V    |
| $I_{DD}$  | Static supply current                                     | -         | 3   | -         | mA   |
| $I_{CC}$  | Dynamic supply current<br>(3.3 V, 25 pF loading, 32 MHz)  | -         | 12  | -         | mA   |
| $V_{DD}$  | Operating voltage                                         | 3.0       | 3.3 | 3.6       | V    |
| $t_{ON}$  | Power-up time (first locked cycle after power up)         | -         | 7   | -         | mS   |
| $Z_{OUT}$ | Clock output impedance                                    | -         | 28  | -         | Ω    |

**AC Electrical Characteristics**

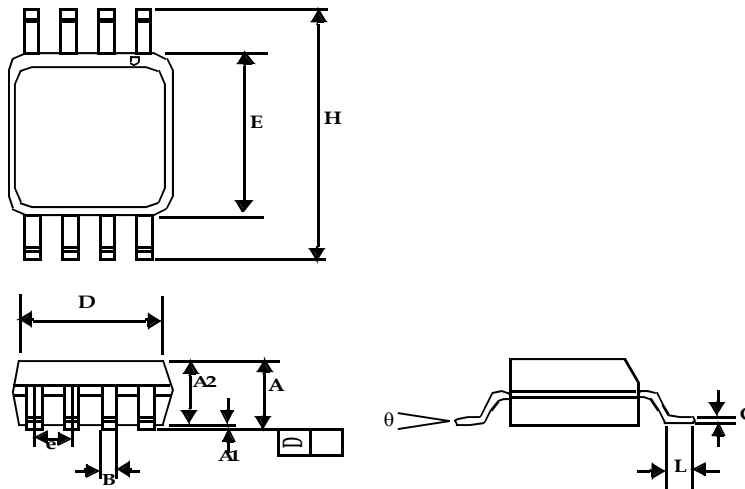
| Symbol     | Parameter                                     | Min | Typ  | Max | Unit |
|------------|-----------------------------------------------|-----|------|-----|------|
| $f_{IN}$   | Input frequency                               | 20  | -    | 38  | MHz  |
| $f_{OUT}$  | Output frequency                              | 20  | -    | 38  | MHz  |
| $t_{LH}^1$ | Output rise time (measured at 0.8 V to 2.0 V) | -   | 1    | -   | nS   |
| $t_{HL}^1$ | Output fall time (measured at 2.0 V to 0.8 V) | -   | 1    | -   | nS   |
| $t_{JC}$   | Jitter (Cycle to cycle)                       | -   | ±175 | -   | pS   |
| $t_D$      | Output duty cycle                             | 45  | 50   | 55  | %    |

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



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Package Information

8-lead (150-mil) SOIC Package

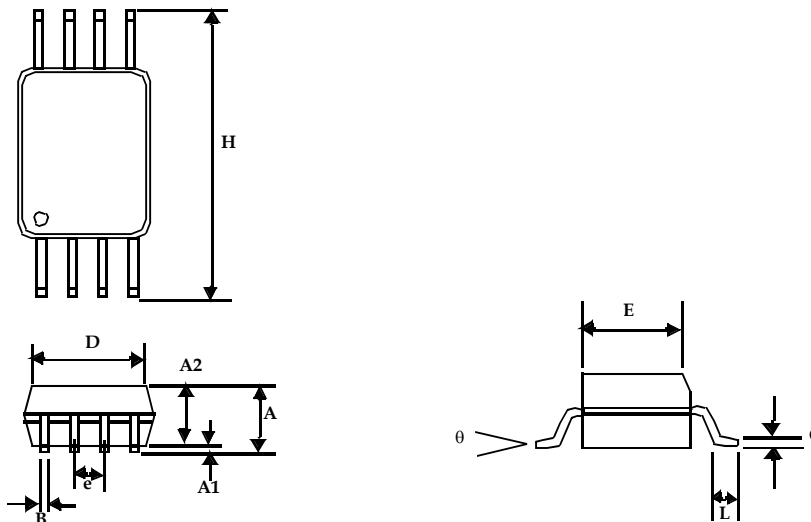


| Symbol   | Dimensions |       |             |      |
|----------|------------|-------|-------------|------|
|          | Inches     |       | Millimeters |      |
|          | Min        | Max   | Min         | Max  |
| A1       | 0.004      | 0.010 | 0.10        | 0.25 |
| A        | 0.053      | 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 |
| $\theta$ | 0°         | 8°    | 0°          | 8°   |

Note: Controlling dimensions are millimeters  
SOIC – 0.074 grams unit weight



8-lead Thin Shrunken 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°   |

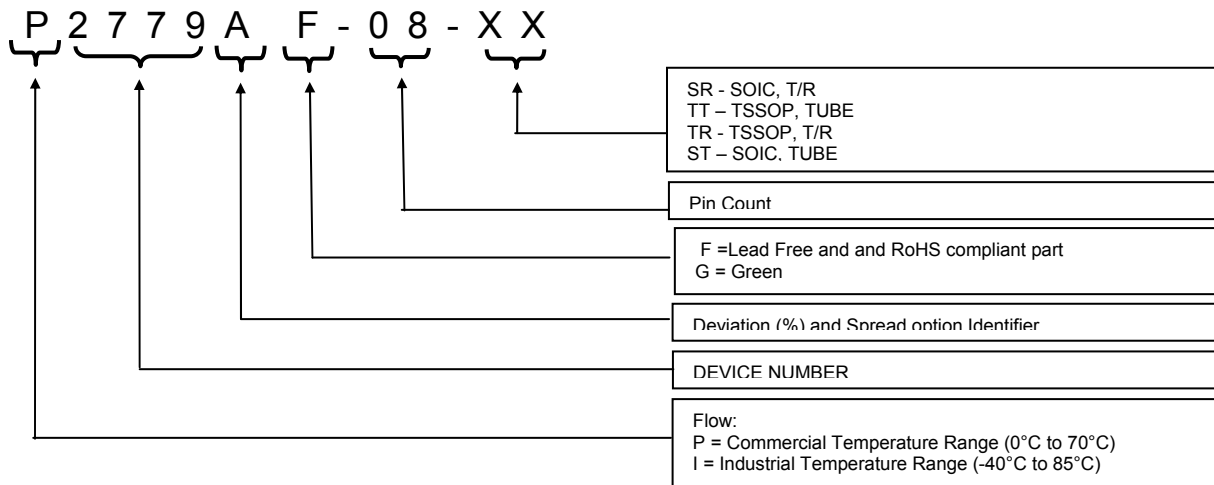
Note: Controlling dimensions are millimeters  
 TSSOP – 0.0325 grams unit weight



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Ordering Information

| Part number  | Marking | Package Configuration               | Temperature Range |
|--------------|---------|-------------------------------------|-------------------|
| P2779A -08ST | P2779A  | 8-Pin SOIC,Tube                     | Commercial        |
| P2779A -08SR | P2779A  | 8-Pin SOIC, Tape and Reel           | Commercial        |
| P2779AF-08ST | P2779AF | 8-Pin SOIC, Tube, Pb Free           | Commercial        |
| P2779AF-08SR | P2779AF | 8-Pin SOIC, Tape and Reel, Pb Free  | Commercial        |
| P2779AG-08ST | P2779AG | 8-Pin SOIC, Tube, Green             | Commercial        |
| P2779AG-08SR | P2779AG | 8-Pin SOIC, Tape and Reel, Green    | Commercial        |
| I2779A-08ST  | I2779A  | 8-Pin SOIC, Tube                    | Industrial        |
| I2779A-08SR  | I2779A  | 8-Pin SOIC, Tape and Reel           | Industrial        |
| I2779AF-08ST | I2779AF | 8-Pin SOIC, Tube, Pb Free           | Industrial        |
| I2779AF-08SR | I2779AF | 8-Pin SOIC, Tape and Reel, Pb Free  | Industrial        |
| I2779AG-08ST | I2779AG | 8-Pin SOIC, Tube, Green             | Industrial        |
| I2779AG-08SR | I2779AG | 8-Pin SOIC, Tape and Reel, Green    | Industrial        |
| P2779A-08TT  | P2779A  | 8-Pin TSSOP, Tube                   | Commercial        |
| P2779A-08TR  | P2779A  | 8-Pin TSSOP, Tape and Reel          | Commercial        |
| P2779AF-08TT | P2779AF | 8-Pin TSSOP, Tube, Pb Free          | Commercial        |
| P2779AF-08TR | P2779AF | 8-Pin TSSOP, Tape and Reel, Pb Free | Commercial        |
| P2779AG-08TT | P2779AG | 8-Pin TSSOP, Tube, Green            | Commercial        |
| P2779AG-08TR | P2779AG | 8-Pin TSSOP, Tape and Reel, Green   | Commercial        |
| I2779A-08TT  | I2779A  | 8-Pin TSSOP, Tube                   | Industrial        |
| I2779A-08TR  | I2779A  | 8-Pin TSSOP, Tape and Reel          | Industrial        |
| I2779AF-08TT | I2779AF | 8-Pin TSSOP, Tube, Pb Free          | Industrial        |
| I2779AF-08TR | I2779AF | 8-Pin TSSOP, Tape and Reel, Pb Free | Industrial        |
| I2779AG-08TT | I2779AG | 8-Pin TSSOP, Tube, Green            | Industrial        |
| I2779AG-08TR | I2779AG | 8-Pin TSSOP, Tape and Reel, Green   | Industrial        |

Device Ordering Information



Licensed under US patent #5,488,627, #6,646,463 and #5,631,920.



Alliance Semiconductor Corporation  
2575, Augustine Drive,  
Santa Clara, CA 95054  
Tel# 408-855-4900  
Fax: 408-855-4999  
www.alsc.com

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Document Version: v0.1

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

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