



# Spread Spectrum Clock Generator

## Features

- Generates a 1x (PCS3P25811), 2x (PCS3P25812) and 4x(PCS3P25814) low EMI spread spectrum clock of the input frequency
- Provides up to 15dB of EMI suppression
- Input Frequency: 4MHz - 32MHz
- Output Frequency:
  - PCS3P25811: 4MHz - 32MHz
  - PCS3P25812: 8MHz - 64MHz
  - PCS3P25814: 16MHz - 128MHz
- Selectable spread options: Down Spread and Center Spread
- Low Power Dissipation:
  - 3.3V: 20mW (typ) @ 6MHz
  - 3.3V: 24mW (typ) @ 12MHz
  - 3.3V: 30mW (typ) @ 24MHz
- Low inherent Cycle-to-Cycle Jitter
- Supply Voltage: 2.8V to 3.6V
- LVCMOS Input and output
- Functional and Pinout compatible to Cypress CY25811, CY25812 and CY25814
- Commercial and Industrial temperature range
- 8-pin SOIC, TSSOP and TDFN, COL(2X2) Packages

## Product Description

The PCS3P25811/12/14 devices are versatile spread spectrum frequency modulators designed specifically for a wide range of input clock frequencies from 4MHz to 32MHz.

The PCS3P25811/12/14 reduce electromagnetic interference (EMI) at the clock source, allowing system wide reduction of EMI of down stream clock and data dependent signals. It 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 PCS3P25811/12/14 can generate an EMI reduced clock from crystal, ceramic resonator, or system clock.

The PCS3P25811/12/14 modulate 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.’

The PCS3P25811/12/14 use the most efficient and optimized modulation profile approved by the FCC and is implemented in a proprietary all-digital method.

The PCS3P25811/12/14 have 2 pins S0 and S1 to control the selection of Center Spread, Down Spread and No-Spread functions. Additionally there is a 3 level logic control FSEL, for selecting one of the three different frequency ranges within the operating frequency range. Refer *Input/Output Frequency Range Selection Table*.

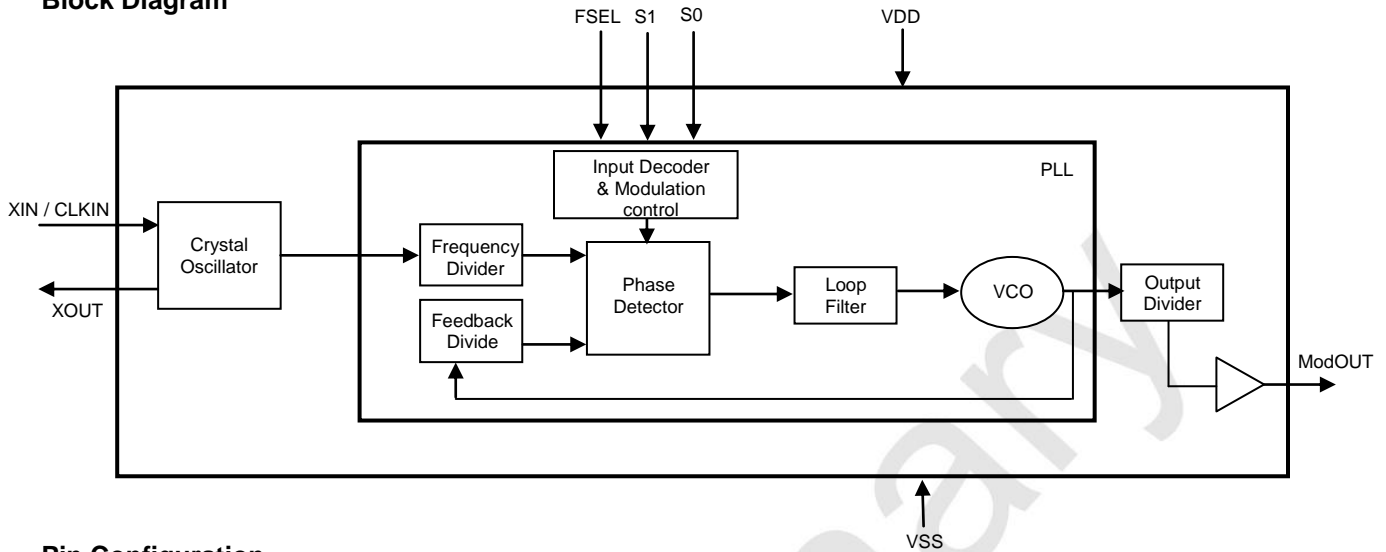
The PCS3P25811/12/14 operate from a 2.8V to 3.6V supply and are available in 8 pin SOIC, TSSOP and TDFN, COL(2X2) packages, over Commercial and Industrial temperature range.

## Applications

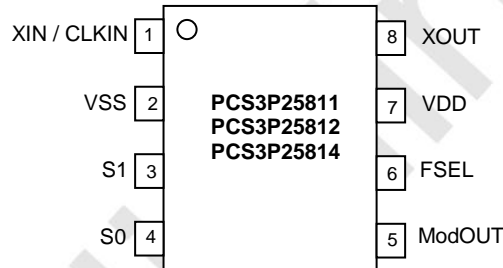
The PCS3P25811/12/14 are targeted towards EMI management in applications such as LCD Panels, MFPs, Digital copiers, Networking, PC peripheral devices, consumer electronics, and embedded controller systems.

# PCS3P25811 and PCS3P25812 and PCS3P25814

## Block Diagram



## Pin Configuration



## Pin Description

| Pin# | Pin Name    | Type | Description                                                                                                                                                                        |
|------|-------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | XIN / CLKIN | I    | Crystal connection or External Clock input.                                                                                                                                        |
| 2    | VSS         | P    | Ground to entire chip.                                                                                                                                                             |
| 3    | S1          | I    | Digital 3 level logic input (1-M-0) used to select Center, Down and No spread options. (Refer to <i>Frequency Deviation Selection Table</i> ). Default=M.                          |
| 4    | S0          | I    | Digital 3 level logic input (1-M-0) used to select Center, Down and No spread options. (Refer to <i>Frequency Deviation Selection Table</i> ). Default=M.                          |
| 5    | ModOUT      | O    | Spread Spectrum Clock Output.                                                                                                                                                      |
| 6    | FSEL        | I    | Frequency range select. Digital 3 level logic input (1-M-0) used to select Input Clock frequency range (Refer to <i>Input/Output Frequency Range Selection Table</i> ). Default=M. |
| 7    | VDD         | P    | Power supply for the entire chip (2.8V to 3.6V).                                                                                                                                   |
| 8    | XOUT        | O    | Crystal connection. If using an external reference, this pin must be left unconnected.                                                                                             |

# PCS3P25811 and PCS3P25812 and PCS3P25814

**Input/Output Frequency Range Selection Table**

| FSEL (pin 6) | Part Number     |              |                 |              |                 |              | Modulation Rate       |
|--------------|-----------------|--------------|-----------------|--------------|-----------------|--------------|-----------------------|
|              | PCS3P25811 (1x) |              | PCS3P25812 (2x) |              | PCS3P25814 (4x) |              |                       |
|              | Input (MHz)     | Output (MHz) | Input (MHz)     | Output (MHz) | Input (MHz)     | Output (MHz) |                       |
| 0            | 4-8             | 4-8          | 4-8             | 8-16         | 4-8             | 16-32        | Input Frequency / 128 |
| 1            | 8-16            | 8-16         | 8-16            | 16-32        | 8-16            | 32-64        | Input Frequency / 256 |
| M            | 16-32           | 16-32        | 16-32           | 32-64        | 16-32           | 64-128       | Input Frequency / 512 |

**Output Frequency Deviation Selection Table**

| CLKIN (MHz) | FSEL | S1=0<br>S0=0 | S1=0<br>S0=M | S1=0<br>S0=1 | S1=M<br>S0=0 | S1=1<br>S0=1 | S1=1<br>S0=0 | S1=M<br>S0=1 | S1=1<br>S0=M | S1=M<br>S0=M |
|-------------|------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
|             |      | Center       | Center       | Center       | Center       | Down         | Down         | Down         | Down         | No Spread    |
| 4-5         | 0    | ±1.4         | ±1.2         | ±0.6         | ±0.5         | -3           | -2.2         | -1.9         | -0.7         | 0            |
| 5-6         | 0    | ±1.3         | ±1.1         | ±0.5         | ±0.4         | -2.7         | -1.9         | -1.7         | -0.6         | 0            |
| 6-7         | 0    | ±1.2         | ±0.9         | ±0.5         | ±0.4         | -2.5         | -1.8         | -1.5         | -0.6         | 0            |
| 7-8         | 0    | ±1.1         | ±0.9         | ±0.4         | ±0.3         | -2.3         | -1.7         | -1.4         | -0.5         | 0            |
| 8-10        | 1    | ±1.4         | ±1.2         | ±0.6         | ±0.5         | -3           | -2.2         | -1.9         | -0.7         | 0            |
| 10-12       | 1    | ±1.3         | ±1.1         | ±0.5         | ±0.4         | -2.7         | -1.9         | -1.7         | -0.6         | 0            |
| 12-14       | 1    | ±1.2         | ±0.9         | ±0.5         | ±0.4         | -2.5         | -1.8         | -1.5         | -0.6         | 0            |
| 14-16       | 1    | ±1.1         | ±0.9         | ±0.4         | ±0.3         | -2.3         | -1.7         | -1.4         | -0.5         | 0            |
| 16-20       | M    | ±1.4         | ±1.2         | ±0.6         | ±0.5         | -3           | -2.2         | -1.9         | -0.7         | 0            |
| 20-24       | M    | ±1.3         | ±1.1         | ±0.5         | ±0.4         | -2.7         | -1.9         | -1.7         | -0.6         | 0            |
| 24-28       | M    | ±1.2         | ±0.9         | ±0.5         | ±0.4         | -2.5         | -1.8         | -1.5         | -0.6         | 0            |
| 28-32       | M    | ±1.1         | ±0.9         | ±0.4         | ±0.3         | -2.3         | -1.7         | -1.4         | -0.5         | 0            |

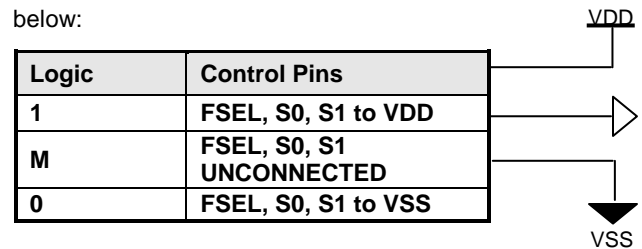
Note: Frequency Deviation given in the table is for the Input Frequency Range covering PCS3P25811/12 /14.

### 3 Level Digital Logic

S0, S1, and FSEL digital inputs are designed to sense 3 different logic levels designated as High “1”, Low “0” and Middle “M”. With this 3-Level digital input logic 9 different logic states can be detected.

S0, S1 and FSEL pins include an on chip 100K (50K/50K) resistor divider. No external application resistors are

needed to implement the 3-Level logic levels as shown below:



# PCS3P25811 and PCS3P25812 and PCS3P25814

## Operating Conditions

| Symbol          | Parameter                              | Min | Max | Unit |
|-----------------|----------------------------------------|-----|-----|------|
| VDD             | Voltage on any pin with respect to VSS | 2.8 | 3.6 | V    |
| T <sub>A</sub>  | Operating temperature                  | -40 | +85 | °C   |
| C <sub>L</sub>  | Load Capacitance                       |     | 15  | pF   |
| C <sub>IN</sub> | Input Capacitance                      |     | 7   | pF   |

## Absolute Maximum Ratings

| Symbol                            | Parameter                                              | Rating       | Unit |
|-----------------------------------|--------------------------------------------------------|--------------|------|
| V <sub>DD</sub> , V <sub>IN</sub> | Voltage on any pin with respect to Ground              | -0.5 to +4.6 | V    |
| T <sub>STG</sub>                  | Storage temperature                                    | -65 to +125  | °C   |
| T <sub>s</sub>                    | Max. Soldering Temperature (10 sec)                    | 260          | °C   |
| T <sub>J</sub>                    | Junction Temperature                                   | 150          | °C   |
| T <sub>DV</sub>                   | Static Discharge Voltage (As per JEDEC STD 22- 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 |
|-----------------|---------------------------------------------------|------------------------|---------------------|-----|----------------------|------|
| VDD             | Supply Voltage                                    |                        | 2.8                 | 3.3 | 3.6                  | V    |
| V <sub>IL</sub> | Input low voltage (S0, S1, FSEL Inputs)           | Commercial Temp.       | 0                   |     | 0.15V <sub>DD</sub>  | V    |
|                 |                                                   | Industrial Temp.       | 0                   |     | 0.13 V <sub>DD</sub> |      |
| V <sub>IM</sub> | Input Middle Voltage (S0, S1, FSEL Inputs)        |                        | 0.4VDD              |     | 0.60V <sub>DD</sub>  | V    |
| V <sub>IH</sub> | Input high voltage (S0, S1, FSEL Inputs)          |                        | 0.85VDD             |     | V <sub>DD</sub>      | V    |
| V <sub>OL</sub> | Output low voltage (ModOUT Output)                | I <sub>OL</sub> = 4mA  |                     |     | 0.4                  | V    |
|                 |                                                   | I <sub>OL</sub> = 10mA |                     |     | 1.2                  |      |
| V <sub>OH</sub> | Output high voltage (ModOUT Output)               | I <sub>OH</sub> = -4mA | 2.4                 |     |                      | V    |
|                 |                                                   | I <sub>OH</sub> = -6mA | 2                   |     |                      |      |
| C <sub>IN</sub> | Input Capacitance (XIN And XOUT)                  |                        | 6                   |     | 9                    | pF   |
| I <sub>DD</sub> | Dynamic supply current (Unloaded Output)          | Commercial Temp        | XIN / CLKIN = 12MHz |     | 8                    | mA   |
|                 |                                                   |                        | XIN / CLKIN = 24MHz |     | 10                   |      |
|                 |                                                   |                        | XIN / CLKIN = 32MHz |     | 13                   |      |
|                 |                                                   | Industrial Temp        | XIN / CLKIN = 12MHz |     | 10                   | mA   |
|                 |                                                   |                        | XIN / CLKIN = 24MHz |     | 12                   |      |
|                 |                                                   |                        | XIN / CLKIN = 32MHz |     | 15                   |      |
| I <sub>CC</sub> | Static supply current (XIN / CLKIN pulled to VSS) |                        |                     |     | 0.5                  | mA   |

Note. The voltage on any input or I/O pin cannot exceed the power pin during power up. All parameters are specified at Commercial and Industrial temperature unless stated otherwise.

# PCS3P25811 and PCS3P25812 and PCS3P25814

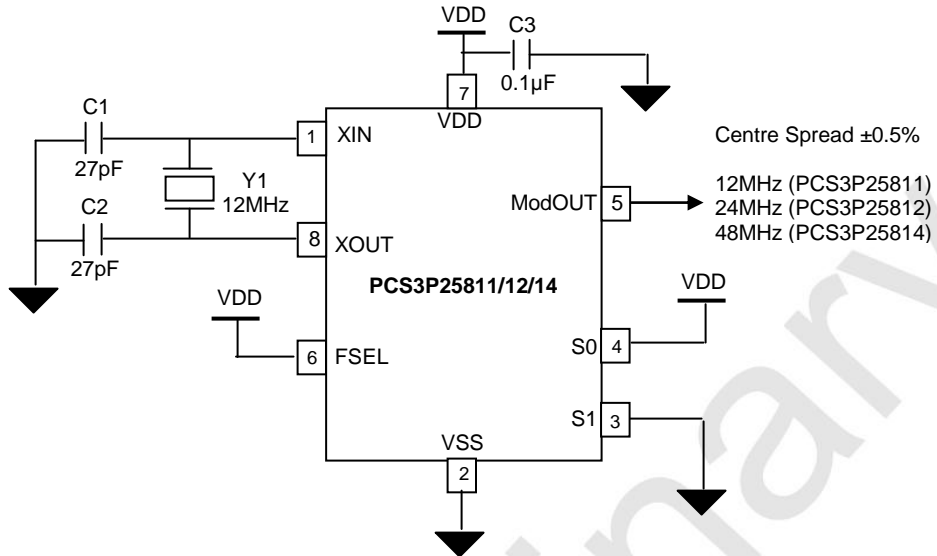
## AC Electrical Characteristics

| Symbol                                                                               | Parameter                                                                             |                           | Min    | Typ | Max | Unit |
|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------|--------|-----|-----|------|
| $f_{IN}$                                                                             | Input Clock frequency for PCS3P25811/12/14                                            |                           | 4      |     | 32  | MHz  |
| $f_{OUT}$                                                                            | ModOUT Clock frequency for PCS3P25811                                                 |                           | 4      |     | 32  | MHz  |
|                                                                                      | ModOUT Clock frequency for PCS3P25812                                                 |                           | 8      |     | 64  | MHz  |
|                                                                                      | ModOUT Clock frequency for PCS3P25814                                                 |                           | 16     |     | 128 | MHz  |
| $t_{LH}^{1,2}$                                                                       | ModOUT Rise time<br>(Measured from 20% to 80%)                                        | PCS3P25811/12/14          | 2      |     | 5   | nS   |
|                                                                                      |                                                                                       | PCS3P25814<br>When FSEL=M | 1      |     | 2.2 |      |
| $t_{HL}^{1,2}$                                                                       | ModOUT Fall time<br>(Measured from 80% to 20%)                                        | PCS3P25811/12/14          | 2      |     | 4.4 | nS   |
|                                                                                      |                                                                                       | PCS3P25814<br>When FSEL=M | 1      |     | 2.2 |      |
| TDCIN                                                                                | Input Clock Duty Cycle(XIN / CLKIN)                                                   |                           | 40     |     | 60  | %    |
| TDCOUT <sup>1,2</sup>                                                                | Output Clock Duty Cycle (ModOUT)                                                      |                           | 40     |     | 60  | %    |
| $T_{JC}^2$                                                                           | Cy-Cy Jitter,<br>For ModOUT<br>with Spread ON<br><br>(For Commercial<br>temperature)  | PCS3P25811                | 4MHz   |     | 600 | pS   |
|                                                                                      |                                                                                       |                           | 8MHz   |     | 450 |      |
|                                                                                      |                                                                                       | PCS3P25812                | 16MHz  |     | 400 |      |
|                                                                                      |                                                                                       |                           | 32MHz  |     | 380 |      |
|                                                                                      |                                                                                       | PCS3P25814                | 64MHz  |     | 380 |      |
|                                                                                      |                                                                                       |                           | 128MHz |     | 380 |      |
| Cy-Cy Jitter,<br>For ModOUT<br>with Spread ON<br><br>(For Industrial<br>temperature) | PCS3P25811                                                                            | CLKIN = 6MHz              |        | 500 | pS  |      |
|                                                                                      | PCS3P25812                                                                            | CLKIN = 12MHz             |        | 400 |     |      |
|                                                                                      | PCS3P25814                                                                            | CLKIN = 24MHz             |        | 380 |     |      |
| $t_{ON}^2$                                                                           | PLL Lock Time<br>(Stable power supply, valid input clock<br>to valid Clock on ModOUT) | Commercial<br>Temp.       |        |     | 2   | mS   |
|                                                                                      |                                                                                       | Industrial Temp.          |        |     | 3   |      |

Notes: 1. Parameters are specified with 15pF loaded outputs.  
2. Parameter is guaranteed by design and characterization. Not 100% tested in production.

# PCS3P25811 and PCS3P25812 and PCS3P25814

## Application Schematic

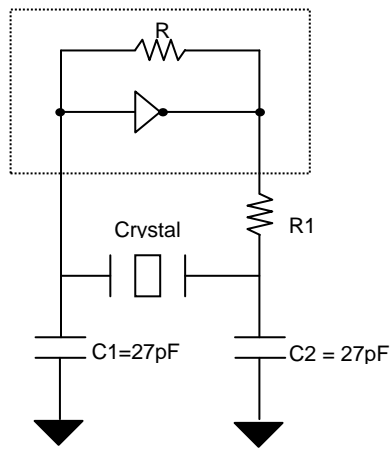


## Typical Crystal Specifications

| Fundamental AT cut parallel resonant crystal |                          |
|----------------------------------------------|--------------------------|
| Nominal frequency                            | 12MHz                    |
| Frequency tolerance                          | ±50ppm or better at 25°C |
| Operating temperature range                  | -25°C to +85°C           |
| Storage temperature                          | -40°C to +85°C           |
| Load capacitance                             | 18pF                     |
| Shunt capacitance                            | 7pF maximum              |
| ESR                                          | 25 Ω                     |

Note:  $C_L$  is Load Capacitance and R1 is used to prevent oscillations at overtone frequency of the Fundamental frequency.

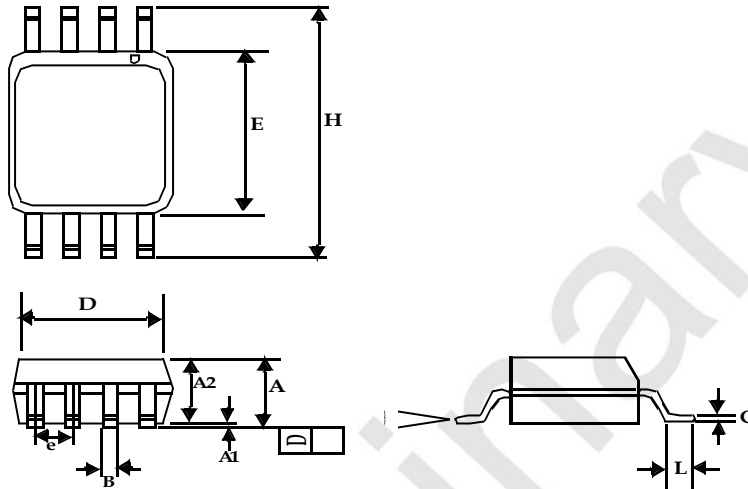
## Typical Crystal Interface Circuit



# PCS3P25811 and PCS3P25812 and PCS3P25814

## Package Information

### 8-Pin SOIC Package

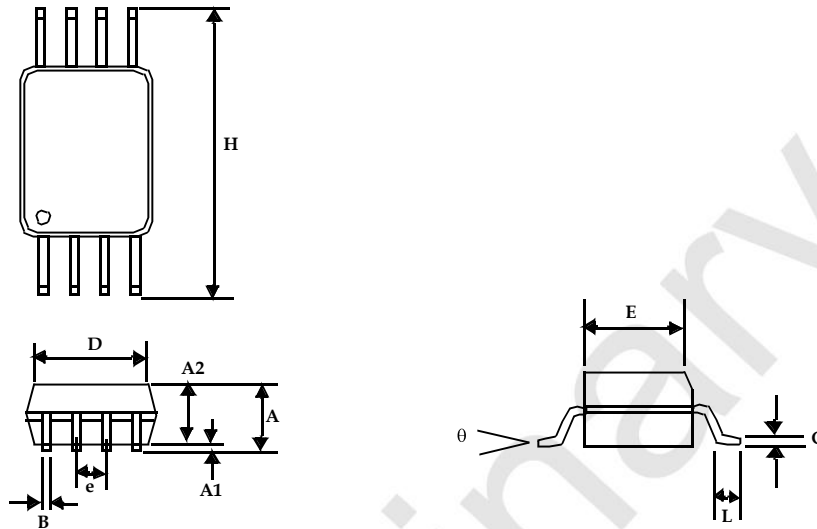


| Symbol | Dimensions |       |             |      |
|--------|------------|-------|-------------|------|
|        | Inches     |       | Millimeters |      |
|        | Min        | Max   | Min         | Max  |
| A1     | 0.004      | 0.010 | 0.10        | 0.25 |
| A      | 0.053      | 0.069 | 1.35        | 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°   |

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

# PCS3P25811 and PCS3P25812 and PCS3P25814

## 8-Pin TSSOP Package



| 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 |
| $\theta$ | 0°         | 8°    | 0°          | 8°   |

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

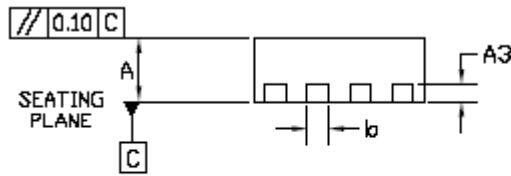
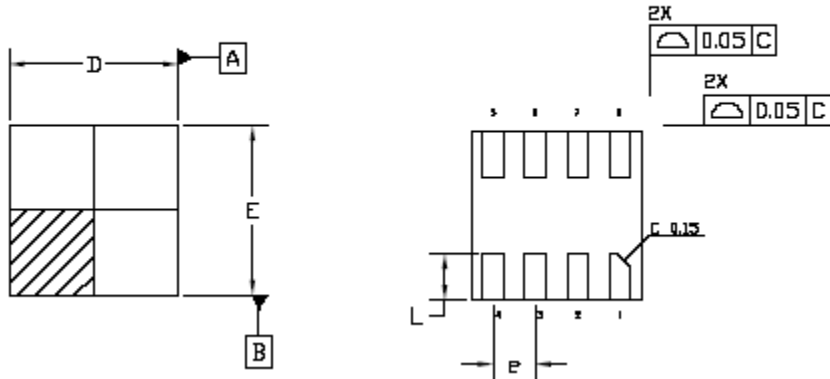


# PCS3P25811 and PCS3P25812 and PCS3P25814

TDFN COL 2x2 8L package

TOP VIEW

BOTTOM VIEW



⌀ 0.10 (M) C B A

SIDE VIEW

| Symbol | Dimensions |        |             |      |
|--------|------------|--------|-------------|------|
|        | Inches     |        | Millimeters |      |
|        | Min        | Max    | Min         | Max  |
| A      | 0.027      | 0.0315 | 0.70        | 0.80 |
| A3     | 0.008 BSC  |        | 0.203 BSC   |      |
| b      | 0.008      | 0.012  | 0.20        | 0.30 |
| D      | 0.077      | 0.080  | 1.95        | 2.05 |
| E      | 0.077      | 0.080  | 1.95        | 2.05 |
| e      | 0.020 BSC  |        | 0.50 BSC    |      |
| L      | 0.020      | 0.024  | 0.50        | 0.60 |

# PCS3P25811 and PCS3P25812 and PCS3P25814

## Ordering Code

| Part Number       | Marking     | Package Type                  | Temperature |
|-------------------|-------------|-------------------------------|-------------|
| PCS3P2581xAG-08SR | 3P2581xAGS  | SOIC – Tape & Reel, Green     | Commercial  |
| PCS3P2581xAG-08ST | 3P2581xAGS  | SOIC – Tube, Green            | Commercial  |
| PCS3P2581xAG-08TR | 3P2581xAGT  | TSSOP – Tape & Reel, Green    | Commercial  |
| PCS3P2581xAG-08TT | 3P2581xAGT  | TSSOP – Tube, Green           | Commercial  |
| PCS3P25811AG-08CR | BG1<br>LLYW | TDFN COL - TAPE & REEL, Green | Commercial  |
| PCS3P25812AG-08CR | BI1<br>LLYW | TDFN COL - TAPE & REEL, Green | Commercial  |
| PCS3P25814AG-08CR | BH1<br>LLYW | TDFN COL - TAPE & REEL, Green | Commercial  |
| PCS3I2581xAG-08SR | 3I2581xAGS  | SOIC – Tape & Reel, Green     | Industrial  |
| PCS3I2581xAG-08ST | 3I2581xAGS  | SOIC – Tube, Green            | Industrial  |
| PCS3I2581xAG-08TR | 3I2581xAGT  | TSSOP – Tape & Reel, Green    | Industrial  |
| PCS3I2581xAG-08TT | 3I2581xAGT  | TSSOP – Tube, Green           | Industrial  |
| PCS3I25811AG-08CR | BG2<br>LLYW | TDFN COL - TAPE & REEL, Green | Industrial  |
| PCS3I25812AG-08CR | BH2<br>LLYW | TDFN COL - TAPE & REEL, Green | Industrial  |
| PCS3I25814AG-08CR | BI2<br>LLYW | TDFN COL - TAPE & REEL, Green | Industrial  |

x=1 for 25811; x=2 for 25812; x=4 for 25814.

LL = 2 Character LOT #.

YW=Year and Work Week Code.

## Device Ordering Information


P C S 3 P 2 5 8 1 x A G - 0 8 S R

|                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R = Tape & Reel, T = Tube or Tray                                                                                                                                              |
| O = TSOT23      U = MSOP      J=TSOT26<br>S = SOIC        E = TQFP        C=TDFN (2X2) COL<br>T = TSSOP       L = LQFP<br>A = SSOP        U = MSOP<br>V = TVSOP       P = PDIP |
| DEVICE PIN COUNT                                                                                                                                                               |
| F = LEAD FREE AND RoHS COMPLIANT PART<br>G = GREEN PACKAGE, LEAD FREE, and RoHS                                                                                                |
| PART NUMBER                                                                                                                                                                    |
| X= Automotive    I= Industrial    P or n/c = Commercial<br>(-40C to +125C) (-40C to +85C) (0C to +70C)                                                                         |
| 1 = Clock Generator      6 = Power Management<br>2 = Non PLL based        7 = Power Management<br>3 = EMI Reduction        8 = Power Management                                |
| ON Semiconductor Mixed Signal Product                                                                                                                                          |

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

# PCS3P25811 and PCS3P25812 and PCS3P25814

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