ON Semiconductor®

# PCS3P8504A

# General Purpose Peak EMI Reduction IC

## General Features

- 1x, LVCMOS Peak EMI Reduction
- Input frequency:
  - 15MHz - 40MHz @ 2.5V
  - 15MHz - 50MHz @ 3.3V
- Output frequency :
  - 15MHz - 40MHz @ 2.5V
  - 15MHz - 50MHz @ 3.3V
- Analog Deviation Selection
- ModRate selection option
- Spread Spectrum Enable/Disable
- Supply Voltage: 2.5V ± 0.2V
  - 3.3V ± 0.3V
- 8pin TSSOP, TDFN (2mmX2mm) Packages
- Commercial and Industrial temperature range

## Functional Description

PCS3P8504A is a versatile, 3.3V/2.5V Peak EMI reduction IC. PCS3P8504A accepts an input clock either from a fundamental Crystal or from an external reference (AC or DC coupled to XIN / CLKIN) and locks on to it delivering a 1x modulated clock output. PCS3P8504A has a SSON pin for enabling and disabling Spread Spectrum function.

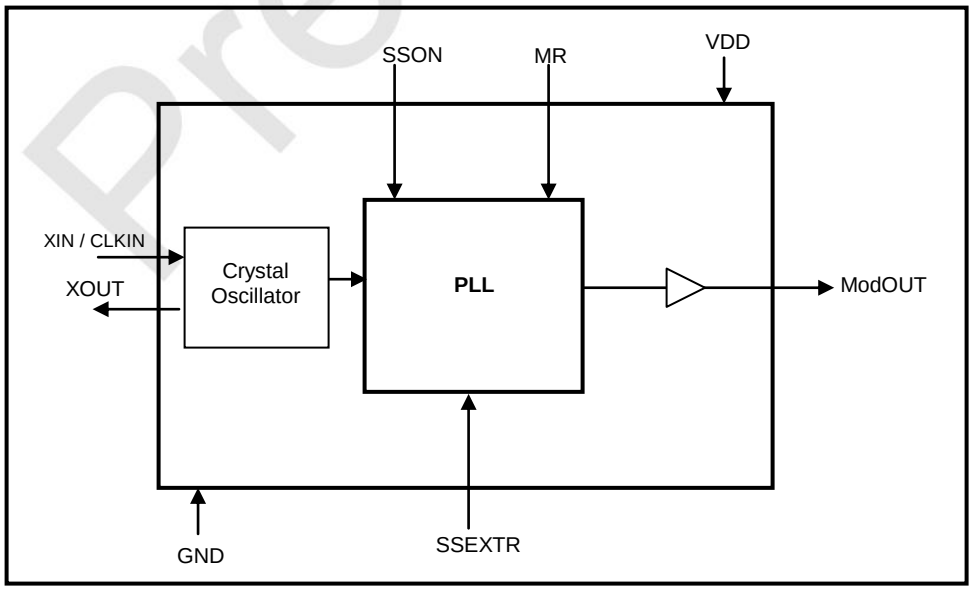
PCS3P8504A has an SSEXTR pin to select different deviations depending upon the value of an external resistor connected between SSEXTR and GND. Modulation Rate (MR) control selects one of the two different Modulation Rates.

PCS3P8504A operates from a 3.3V/2.5V supply, and is available in an 8 pin TSSOP and TDFN (2mmX2mm) packages, over Commercial and Industrial temperature range.

## Application

PCS3P8504A is targeted for consumer electronics application like DPF, MFP.

## Block Diagram

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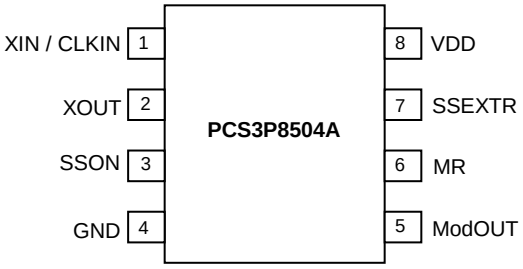
JANUARY 2010 – Rev. 1

Publication Order Number:
PCS3P8504/D

## Pin Configuration




## Pin Description

| Pin # | Pin Name | Pin Type | Description |
|---|---|---|---|
| 1 | XIN / CLKIN | I | Crystal connection or External reference clock input. |
| 2 | XOUT | O | Crystal connection. If using an external reference, this pin should be left open. |
| 3 | SSON | I | Spread Spectrum ON/OFF. Spread Spectrum function enabled when HIGH, disabled when LOW. Has an internal pull-up resistor inside. |
| 4 | GND | P | Ground. |
| 5 | ModOUT | O | Modulated clock output. |
| 6 | MR | I | Modulation Rate Select. When LOW selects Low Modulation Rate. Selects High Modulation Rate when pulled HIGH. Has an internal pull-up resistor inside. |
| 7 | SSEXTR | I | Analog Deviation Selection through external resistor to GND. |
| 8 | VDD | P | 2.5V/3.3V supply Voltage. |

## Frequency Selection table

| VDD (V) | Frequency (MHz) |
|---|---|
| 2.5 | 15-40 |
| 3.3 | 15-50 |

## Operating Conditions

| Parameter | Description | | Min | Max | Unit |
|---|---|---|---|---|---|
| VDD | Supply Voltage | | 2.3 | 3.6 | V |
| $T_A$ | Operating Temperature | Commercial | 0 | +70 | °C |
| | | Industrial | -40 | +85 | |
| $C_L$ | Load Capacitance | | | 10 | pF |
| $C_{IN}$ | Input Capacitance | | | 7 | pF |

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### Absolute Maximum Rating

| Symbol | Parameter | Rating | Unit |
|---|---|---|---|
| VDD, $V_{IN}$ | Voltage on any input pin with respect to Ground | -0.5 to +4.6 | V |
| $T_{STG}$ | Storage temperature | -65 to +125 | °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 for 2.5V

| Parameter | Description | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| VDD | Supply Voltage | | 2.3 | 2.5 | 2.7 | V |
| $V_{IL}$ | Input LOW Voltage | | | | 0.7 | V |
| $V_{IH}$ | Input HIGH Voltage | | 1.7 | | | V |
| $I_{IL}$ | Input LOW Current | $V_{IN}$ = 0V | | | 25 | µA |
| $I_{IH}$ | Input HIGH Current | $V_{IN}$ = $V_{DD}$ | | | 25 | µA |
| $V_{OL}$ | Output LOW Voltage | $I_{OL}$ = 8mA | | | 0.6 | V |
| $V_{OH}$ | Output HIGH Voltage | $I_{OH}$ = -8mA | 1.8 | | | V |
| $I_{CC}$ | Static Supply Current | XIN / CLKIN pulled low | | | 50 | µA |
| $I_{DD}$ | Dynamic Supply Current | Unloaded Output | | | 14 | mA |
| $Z_o$ | Output Impedance | | | 35 | | Ω |

### Switching Characteristics for 2.5V

| Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Input Frequency[1] / ModoUT | | 15 | | 40 | MHz |
| Duty Cycle[2, 3] | Measured at $V_{DD}$ /2 | 45 | 50 | 55 | % |
| Output Rise Time[2, 3] | Measured between 20% to 80% | | | 2.2 | nS |
| Output Fall Time[2, 3] | Measured between 80% to 20% | | | 2 | nS |
| Cycle-to-Cycle Jitter[3] | Unloaded output with SSEXTR OPEN @ 27MHz | | ±175 | | pS |
| PLL Lock Time[3] | Stable power supply, valid clock presented on XIN / CLKIN | | | 3 | mS |

Notes: 1. Functionality with Crystal is guaranteed by design and characterization. Not 100% tested in production.
2. All parameters are specified with 10pF loaded outputs.
3. Parameter is guaranteed by design and characterization. Not 100% tested in production.

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**DC Electrical Characteristics for 3.3V**

| Parameter | Description | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| VDD | Supply Voltage | | 3.0 | 3.3 | 3.6 | V |
| $V_{IL}$ | Input LOW Voltage | | | | 0.8 | V |
| $V_{IH}$ | Input HIGH Voltage | | 2.0 | | | V |
| $I_{IL}$ | Input LOW Current | $V_{IN}$ = 0V | | | 25 | µA |
| $I_{IH}$ | Input HIGH Current | $V_{IN}$ = $V_{DD}$ | | | 25 | µA |
| $V_{OL}$ | Output LOW Voltage | $I_{OL}$ = 8mA | | | 0.4 | V |
| $V_{OH}$ | Output HIGH Voltage | $I_{OH}$ = -8mA | 2.4 | | | V |
| $I_{CC}$ | Static Supply Current | XIN / CLKIN pulled low | | | 50 | µA |
| $I_{DD}$ | Dynamic Supply Current | Unloaded Output | | | 20 | mA |
| $Z_o$ | Output Impedance | | | 30 | | Ω |

**Switching Characteristics for 3.3V**

| Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Input Frequency[1] / ModOUT | | 15 | | 50 | MHz |
| Duty Cycle[2, 3] | Measured at $V_{DD}$ /2 | 45 | 50 | 55 | % |
| Output Rise Time[2, 3] | Measured between 20% to 80% | | | 1.8 | nS |
| Output Fall Time[2, 3] | Measured between 80% to 20% | | | 1.6 | nS |
| Cycle-to-Cycle Jitter[3] | Unloaded output with SSEXTR OPEN @ 27MHz | | ±150 | | pS |
| PLL Lock Time[3] | Stable power supply, valid clock presented on XIN / CLKIN | | | 3 | mS |

Notes: 1. Functionality with Crystal is guaranteed by design and characterization. Not 100% tested in production.
2. All parameters are specified with10pF loaded outputs.
3. Parameter is guaranteed by design and characterization. Not 100% tested in production.

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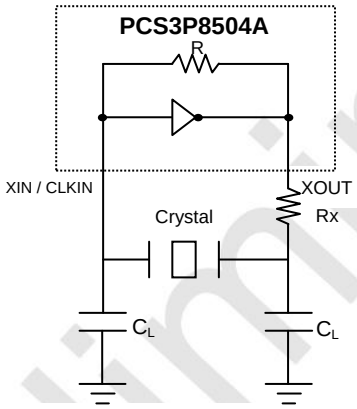
### Typical Crystal Specifications

| Fundamental AT cut parallel resonant crystal | |
|---|---|
| Nominal frequency | 27MHz |
| 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($C_P$) | 18pF |
| Shunt capacitance | 7pF maximum |
| ESR | 25 Ω |

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

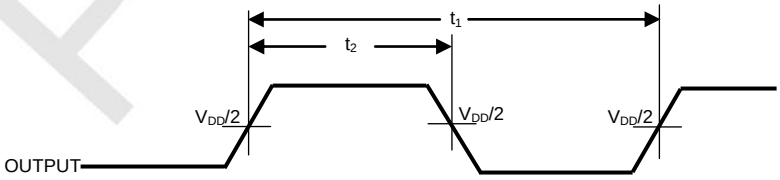
### Typical Crystal Interface Circuit



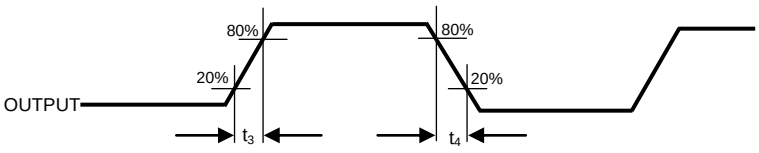

$C_L = 2*(C_P – C_S)$,
Where $C_P$ = Load capacitance of crystal from crystal vendor datasheet.
$C_S$ = Stray capacitance due to $C_{IN,}$ PCB, Trace, etc.

### Switching Waveforms

#### *Duty Cycle Timing*




#### *Output Rise/Fall Time*

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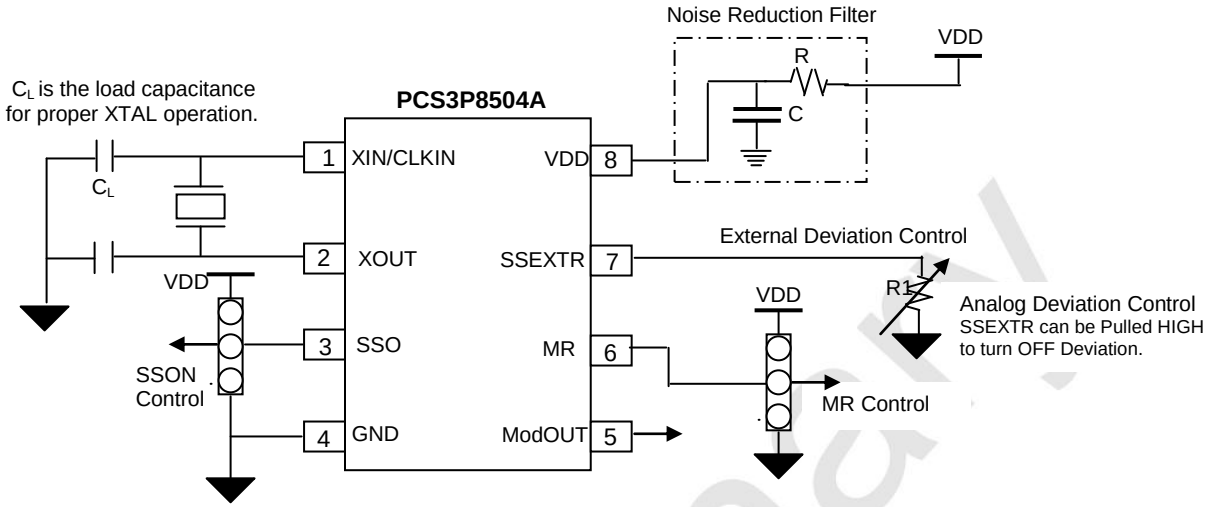
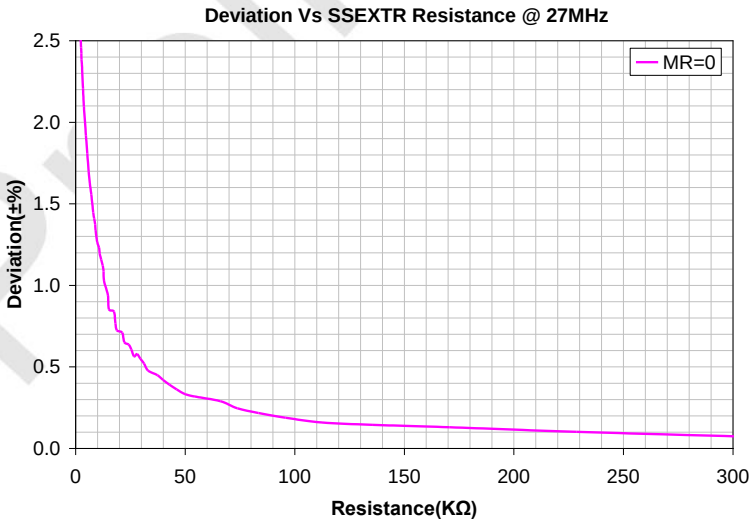
## Application Schematic

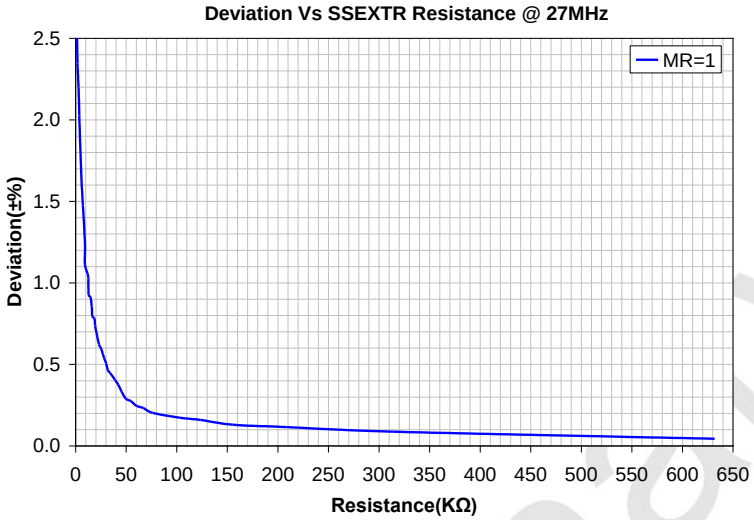



Note: SSON (Pin#3) MR (Pin#6): Connect to VDD or GND
Refer to Pin Description table for Functionality details.

Note: For AC Coupled Interface refer to Application Brief: CT100801.

## Deviation Vs SSEXTR resistance Charts at 27MHz






**Note: Device to Device variation of Deviation is ±10%.**

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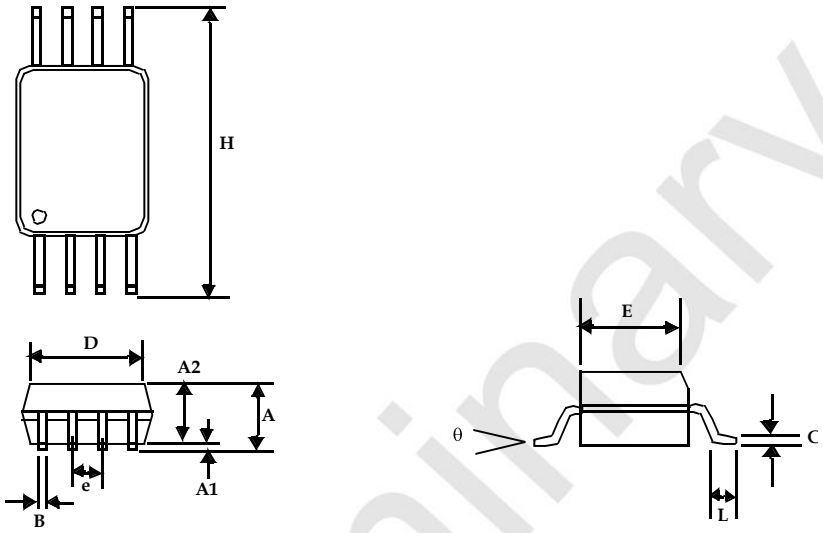
## Package Information

**8-lead TSSOP 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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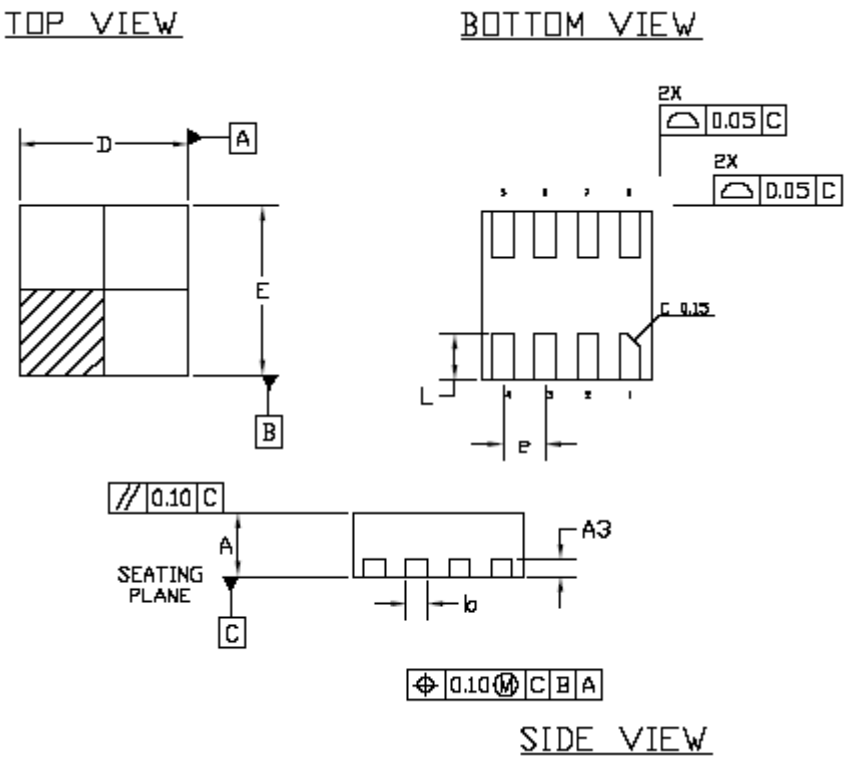
**TDFN (2mmx2mm) 8L package Outline drawing**



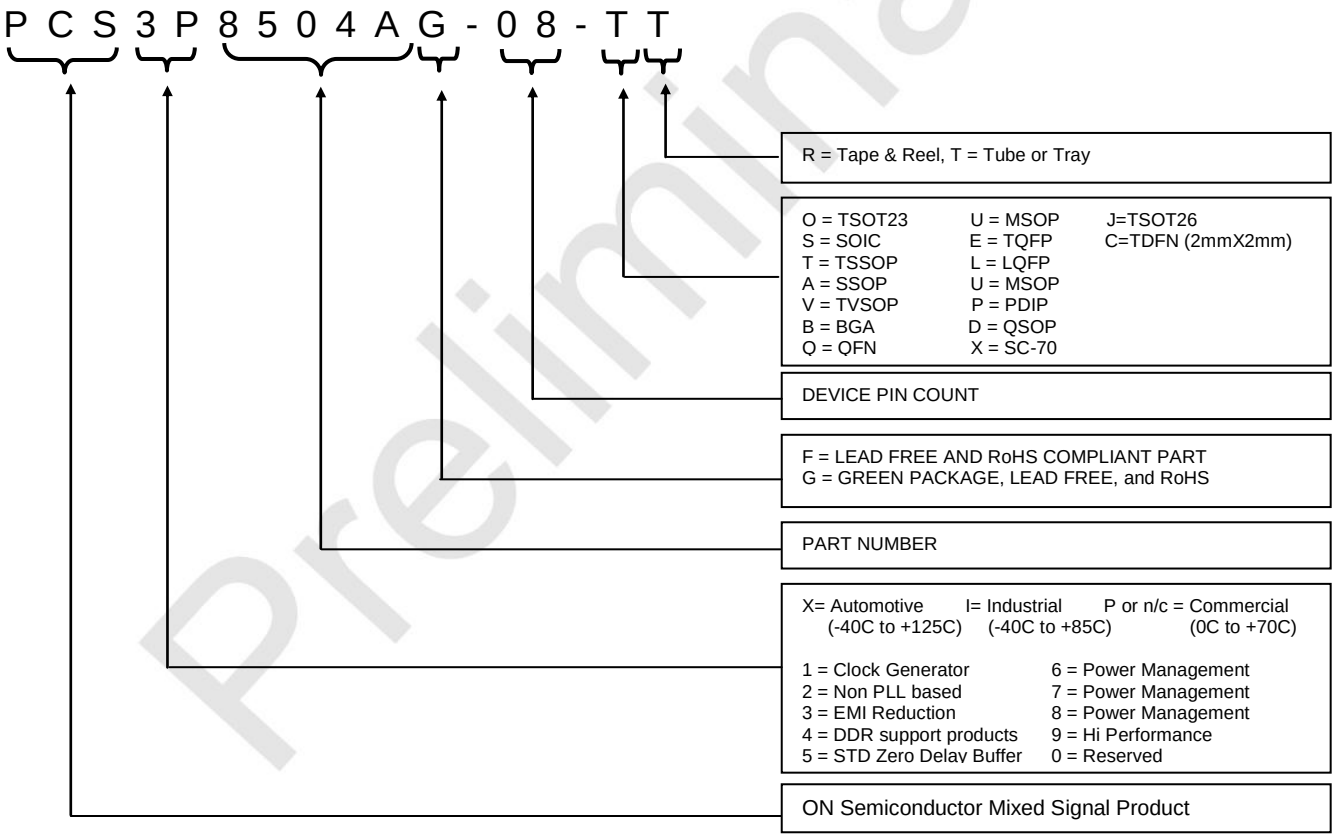

| Symbol | Dimensions | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| A | 0.027 | 0.0315 | 0.70 | 0.80 |
| A3 | 0.008 BSC | | 0.203 BSC | |
| b | 0.008 | 0.012 | 0.20 | 0.30 |
| D | 0.079 BSC | | 2.00 BSC | |
| E | 0.078 BSC | | 2.00 BSC | |
| e | 0.020 BSC | | 0.50 BSC | |
| L | 0.020 | 0.024 | 0.50 | 0.60 |

### Ordering Code

| Part Number | Marking | Package | Temperature |
|---|---|---|---|
| PCS3P8504AG -08-TR | 3P8504AG | 8-pin TSSOP, TAPE AND REEL, Green | Commercial |
| PCS3P8504AG -08-TT | 3P8504AG | 8-pin TSSOP, TUBE, Green | Commercial |
| PCS3P8504AG -08CR | BW1<br>LLYW | 8- pin 2-mm TDFN COL - TAPE & REEL, Green | Commercial |
| PCS3I8504AG -08-TR | 3I8504AG | 8-pin TSSOP, TAPE AND REEL, Green | Industrial |
| PCS3I8504AG -08-TT | 3I8504AG | 8-pin TSSOP, TUBE, Green | Industrial |
| PCS3I8504AG -08-CR | BW2<br>LLYW | 8- pin 2-mm TDFN COL - TAPE & REEL, Green | Industrial |

LL = 2 Character LOT #
YW=Year and Work Week Code

### Device Ordering Information

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