ON Semiconductor®

**ASM3P2811A/B and ASM3P2812A/B and ASM3P2814A/B**

# Low Power EMI Reduction IC

## Features

- FCC approved method of EMI attenuation
- Provides up to 15dB EMI reduction
- Generates a 1x, 2x and 4x low EMI spread spectrum clock of the input frequency
  - 1x: ASM3P2811A/B
  - 2x: ASM3P2812A/B
  - 4x: ASM3P2814A/B
- Optimized for input frequency range from 10MHz to 40MHz
- Internal loop filter minimizes external components and board space
- Selectable spread options:
  - Down Spread and Center Spread
- 8 frequency deviation selections:
  - ±0.625% to -3.5%
- Low inherent Cycle-to-Cycle Jitter
- 3.3V Operating Voltage
- CMOS/TTL compatible inputs and outputs.
- Pin-out compatible with Cypress CY25811, CY25812 and CY25814
- Commercial and Industrial temperature range
- Available in 8-pin SOIC and TSSOP Packages

## Product Description

The ASM3P28XX devices are versatile spread spectrum frequency modulators designed specifically for a wide range of input clock frequencies from 10MHz to 40MHz. Refer to *Input/Output Frequency Range Selection Table*. The ASM3P28XX can generate an EMI reduced clock from crystal, ceramic resonator, or system clock. The ASM3P28XX-A and the ASM3P28XX-B offer various combinations of spread options and percentage deviations. Refer to *Frequency Deviation and Spread Selection Table.* These combinations include Down and Center Spread, and percentage deviation range from ±0.625% to -3.5%.

The ASM3P28XX reduces electromagnetic interference (EMI) at the clock source, allowing system wide reduction of EMI of down stream clock and data dependent signals. The ASM3P28XX 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 ASM3P28XX 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.’

The ASM3P28XX uses the most efficient and optimized modulation profile approved by the FCC and is implemented in a proprietary all-digital method.

## Applications

The ASM3P28XX is targeted towards EMI management for memory and LVDS interfaces in mobile graphic chipsets and high-speed digital applications such as PC peripheral devices, consumer electronics, and embedded controller systems.


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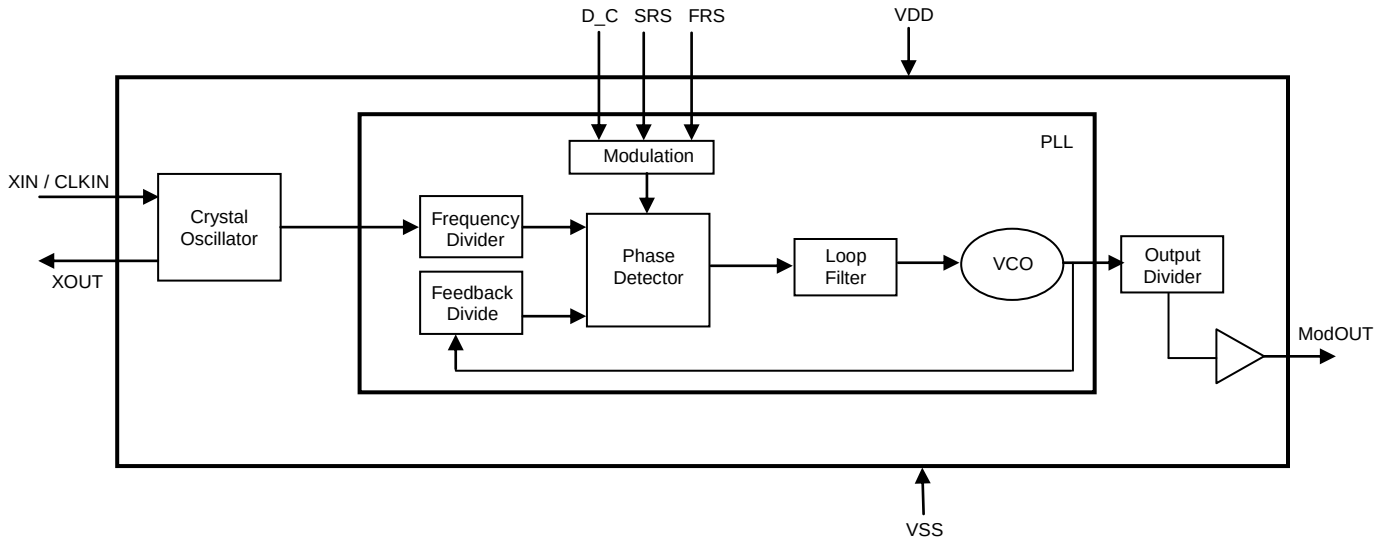
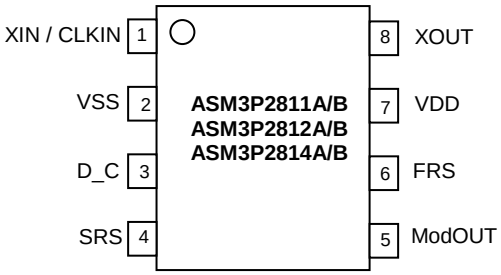
## Block Diagram




## 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 | D_C | I | Digital logic input used to select Down (LOW) or Center (HIGH) spread options. (Refer to *Frequency Deviation and Spread Selection Table).* This pin has an internal pull-up resistor. |
| 4 | SRS | I | Spread range select. Digital logic input used to select frequency deviation (Refer to *Frequency Deviation and Spread Selection Table).* This pin has an internal pull-up resistor. |
| 5 | ModOUT | O | Spread spectrum clock output |
| 6 | FRS | I | Frequency range select. Digital logic input used to select Input frequency range (Refer to *Input/Output Frequency Range Selection Table*). This pin has an internal pull-up resistor. |
| 7 | VDD | P | Power supply for the entire chip. |
| 8 | XOUT | O | Crystal connection. If using an external reference, this pin must be left unconnected. |

**Input/Output Frequency Range Selection Table**

| FRS (pin 6) | Part Number | | | | | | Modulation Rate |
|---|---|---|---|---|---|---|---|
| | ASM3P2811 (1x) | | ASM3P2812 (2x) | | ASM3P2814 (4x) | | |
| | Input (MHz) | Output (MHz) | Input (MHz) | Output (MHz) | Input (MHz) | Output (MHz) | |
| 0 | 10-20 | 10-20 | 10-20 | 20-40 | 10-20 | 40-80 | Input Frequency / 448 |
| 1 | 20-40 | 20-40 | 20-40 | 40-80 | 20-40 | 80-160 | Input Frequency / 896 |

**Output Frequency Deviation and Spread Selection Table**

| Part Number | D_C (pin 3) | SRS (pin 4) | Frequency Deviation[1] (%) | | | |
|---|---|---|---|---|---|---|
| | | | FS=0 | | FS=1 | |
| | | | 10/20/40 (MHz) | 20/40/80 (MHz) | 20/40/80 (MHz) | 40/80/160 (MHz) |
| ASM3P28XXA | 0 | 0 | -3 | -2.5 | -2.7 | -2.6 |
| | 0 | 1 | -3.7 | -3.4 | -3.8 | -3.6 |
| | 1 | 0 | ±1.5 | ±1.2 | ±1.5 | ±1.3 |
| | 1 | 1 | ±1.8 | ±1.6 | ±1.9 | ±1.8 |
| ASM3P28XXB | 0 | 0 | -1.7 | -1.0 | -1.5 | -1.4 |
| | 0 | 1 | -2.0 | -1.5 | -2.0 | -1.9 |
| | 1 | 0 | ±0.75 | ±0.6 | ±0.8 | ±0.7 |
| | 1 | 1 | ±1.0 | ±0.75 | ±1.0 | ±0.9 |

Note: 1. Frequency Deviation given in the table is for the Output Frequency Range covering ASM3P2811x / 12x / 14x.

**Absolute Maximum Ratings**

| Symbol | Parameter | Rating | Unit |
|---|---|---|---|
| $V_{DD}$, $V_{IN}$ | Voltage on any pin with respect to Ground | -0.5 to +4.6 | V |
| $T_{STG}$ | Storage temperature | -65 to +125 | °C |
| $T_s$ | Max. Soldering Temperature (10 sec) | 260 | °C |
| $T_J$ | Junction Temperature | 150 | °C |
| $T_{DV}$ | 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.

**Operating Conditions**

| Symbol | Parameter | Min | Max | Unit |
|---|---|---|---|---|
| VDD | Voltage on any pin with respect to GND | 3.0 | 3.6 | V |
| $T_A$ | Operating temperature | -40 | +85 | °C |
| $C_L$ | Load Capacitance | | 10 | pF |
| $C_{IN}$ | Input Capacitance | | 7 | pF |

**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 | | $V_{DD}$+0.3 | V |
| $I_{IL}$ | Input low current<br>(Inputs D_C, SRS and FRS are pulled high internally) | | | -50 | µA |
| $I_{IH}$ | Input high current | | | 50 | µA |
| $I_{XOL}$ | XOUT Output low current<br>($V_{XOL}$ @ 0.4V, $V_{DD}$ = 3.3V) | | | 3 | mA |
| $I_{XOH}$ | XOUT Output high current<br>($V_{XOH}$ @ 2.5V, $V_{DD}$ = 3.3V) | | | 3 | mA |
| $V_{OL}$ | Output low voltage ($V_{DD}$ = 3.3V, $I_{OL}$ = 5mA) | | | 0.4 | V |
| $V_{OH}$ | Output high voltage ($V_{DD}$ = 3.3V, $I_{OH}$ = -5mA) | 2.5 | | | V |
| $I_{CC}$ | Dynamic supply current (Unloaded Output) | 8 | | 18 | mA |
| $I_{DD}$ | Static supply current , Standby mode (CLKIN pulled to GND) | | | 4.5 | mA |
| VDD | Operating voltage | 3.0 | 3.3 | 3.6 | V |
| $t_{ON}$ | Power up time (first locked clock cycle after power up) | | | 500 | µS |
| $Z_{OUT}$ | Clock out impedance | | 76 | | Ω |

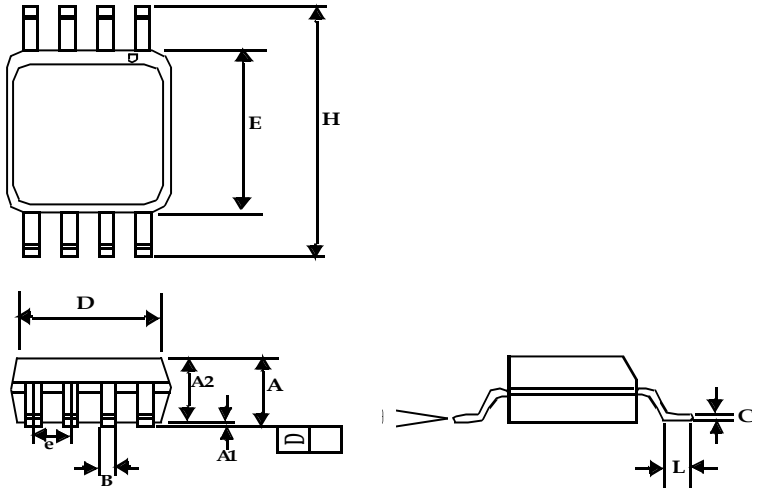
**AC Electrical Characteristics**

| Symbol | Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $f_{IN}$ | Input frequency for ASM3P2811/12/13/14 A/B | 10 | | 40 | MHz |
| $f_{OUT}$ | Output frequency for ASM3P2811A/B | 10 | | 40 | MHz |
| | Output frequency for ASM3P2812A/B | 20 | | 80 | MHz |
| | Output frequency for ASM3P2814A/B | 40 | | 160 | MHz |
| $t_{LH}$[1] | Output rise time (measured at 0.8V to 2.0V) | 0.5 | 0.9 | 1.2 | nS |
| $t_{HL}$[1] | Output fall time (measured at 2.0V to 0.8V) | 0.8 | 1.0 | 1.3 | nS |
| $t_{JC}$ | Cycle-to-Cycle Jitter (Unloaded Output) | | ±250 | | pS |
| $t_D$ | Output duty cycle | 45 | 50 | 55 | % |

Note: 1. $t_{LH}$ and $t_{HL}$ are measured into a capacitive load of 10pF.

## Package Information

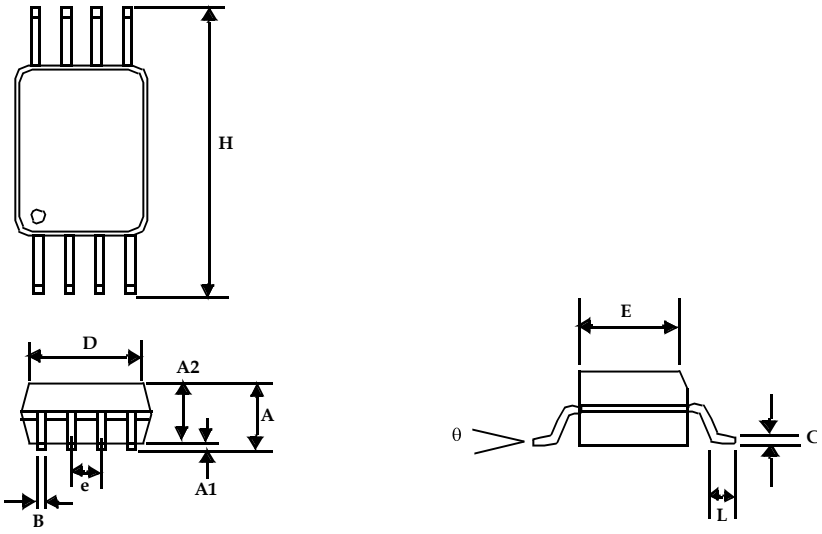
### 8-Pin SOIC Package




| 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.

## 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 |
| θ | 0° | 8° | 0° | 8° |

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

**Ordering Codes**

| Part Number | Marking | Package Type | Temperature |
|---|---|---|---|
| ASM3P2811AF-08SR | 3P2811AFS | SOIC – Tape & Reel, Pb free | Commercial |
| ASM3P2811AF-08ST | 3P2811AFS | SOIC – Tube, Pb free | Commercial |
| ASM3P2811AF-08TR | 3P2811AFT | TSSOP – Tape & Reel, Pb free | Commercial |
| ASM3P2811AF-08TT | 3P2811AFT | TSSOP – Tube, Pb free | Commercial |
| ASM3P2811BF-08SR | 3P2811BFS | SOIC – Tape & Reel, Pb free | Commercial |
| ASM3P2811BF-08ST | 3P2811BFS | SOIC – Tube, Pb free | Commercial |
| ASM3P2811BF-08TR | 3P2811BFT | TSSOP – Tape & Reel, Pb free | Commercial |
| ASM3P2811BF-08TT | 3P2811BFT | TSSOP – Tube, Pb free | Commercial |
| ASM3P2812AF-08SR | 3P2812AFS | SOIC – Tape & Reel, Pb free | Commercial |
| ASM3P2812AF-08ST | 3P2812AFS | SOIC – Tube, Pb free | Commercial |
| ASM3P2812AF-08TR | 3P2812AFT | TSSOP – Tape & Reel, Pb free | Commercial |
| ASM3P2812AF-08TT | 3P2812AFT | TSSOP – Tube, Pb free | Commercial |
| ASM3P2812BF-08SR | 3P2812BFS | SOIC – Tape & Reel, Pb free | Commercial |
| ASM3P2812BF-08ST | 3P2812BFS | SOIC – Tube, Pb free | Commercial |
| ASM3P2812BF-08TR | 3P2812BFT | TSSOP – Tape & Reel, Pb free | Commercial |
| ASM3P2812BF-08TT | 3P2812BFT | TSSOP – Tube, Pb free | Commercial |
| ASM3P2814AF-08SR | 3P2814AFS | SOIC – Tape & Reel, Pb free | Commercial |
| ASM3P2814AF-08ST | 3P2814AFS | SOIC – Tube, Pb free | Commercial |
| ASM3P2814AF-08TR | 3P2814AFT | TSSOP – Tape & Reel, Pb free | Commercial |
| ASM3P2814AF-08TT | 3P2814AFT | TSSOP – Tube, Pb free | Commercial |
| ASM3P2814BF-08SR | 3P2814BFS | SOIC – Tape & Reel, Pb free | Commercial |
| ASM3P2814BF-08ST | 3P2814BFS | SOIC – Tube, Pb free | Commercial |
| ASM3P2814BF-08TR | 3P2814BFT | TSSOP – Tape & Reel, Pb free | Commercial |
| ASM3P2814BF-08TT | 3P2814BFT | TSSOP – Tube, Pb free | Commercial |
| ASM3I2811AF-08SR | 3I2811AFS | SOIC – Tape & Reel, Pb free | Industrial |
| ASM3I2811AF-08ST | 3I2811AFS | SOIC – Tube, Pb free | Industrial |
| ASM3I2811AF-08TR | 3I2811AFT | TSSOP – Tape & Reel, Pb free | Industrial |
| ASM3I2811AF-08TT | 3I2811AFT | TSSOP – Tube, Pb free | Industrial |
| ASM3I2811BF-08SR | 3I2811BFS | SOIC – Tape & Reel, Pb free | Industrial |
| ASM3I2811BF-08ST | 3I2811BFS | SOIC – Tube, Pb free | Industrial |
| ASM3I2811BF-08TR | 3I2811BFT | TSSOP – Tape & Reel, Pb free | Industrial |
| ASM3I2811BF-08TT | 3I2811BFT | TSSOP – Tube, Pb free | Industrial |
| ASM3I2812AF-08SR | 3I2812AFS | SOIC – Tape & Reel, Pb free | Industrial |
| ASM3I2812AF-08ST | 3I2812AFS | SOIC – Tube, Pb free | Industrial |
| ASM3I2812AF-08TR | 3I2812AFT | TSSOP – Tape & Reel, Pb free | Industrial |
| ASM3I2812AF-08TT | 3I2812AFT | TSSOP – Tube, Pb free | Industrial |
| ASM3I2812BF-08SR | 3I2812BFS | SOIC – Tape & Reel, Pb free | Industrial |

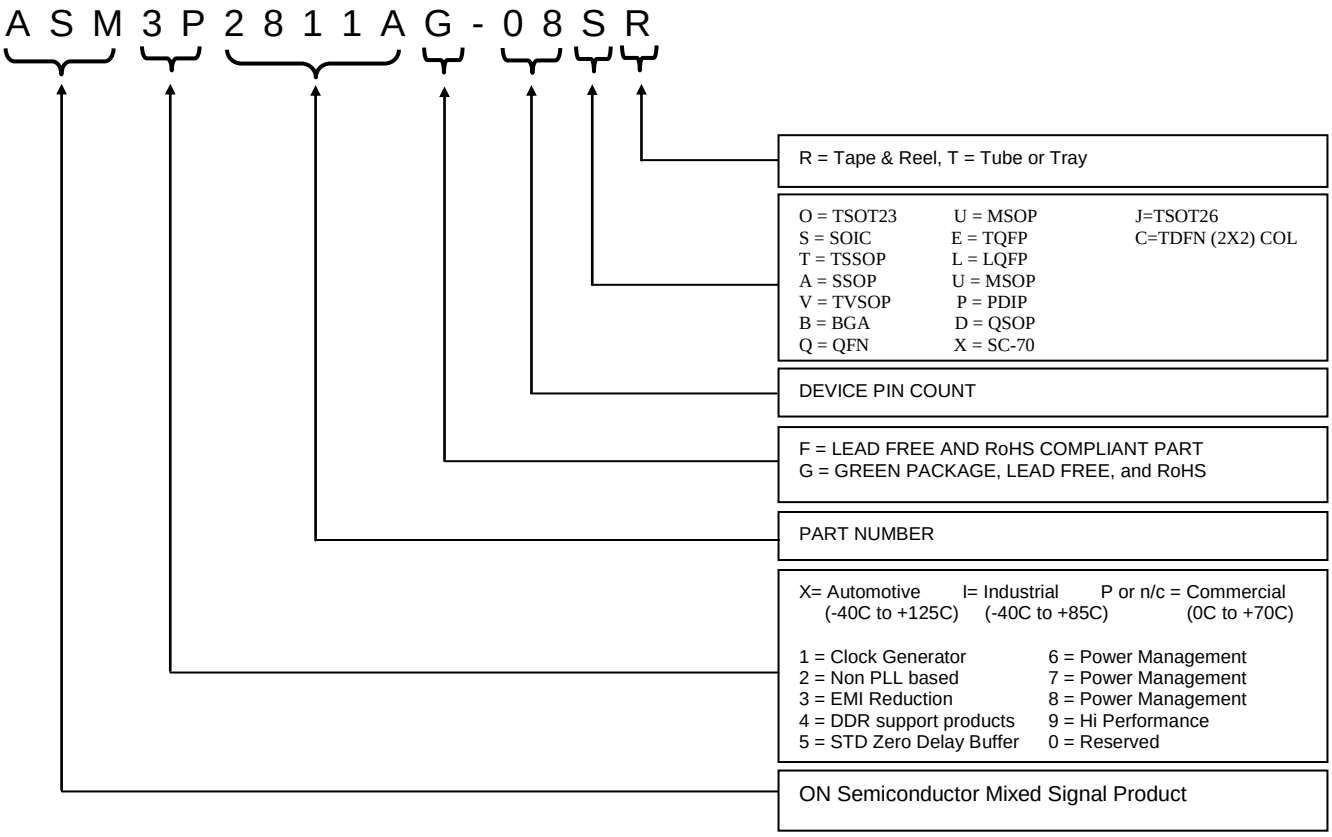
**Ordering Codes (cont'd)**

| Part Number | Marking | Package Type | Temperature |
|---|---|---|---|
| ASM3I2812BF-08ST | 3I2812BFS | SOIC - Tube, Pb free | Industrial |
| ASM3I2812BF-08TR | 3I2812BFT | TSSOP – Tape & Reel, Pb free | Industrial |
| ASM3I2812BF-08TT | 3I2812BFT | TSSOP – Tube, Pb free | Industrial |
| ASM3I2814AF-08SR | 3I2814AFS | SOIC - Tape & Reel, Pb free | Industrial |
| ASM3I2814AF-08ST | 3I2814AFS | SOIC - Tube, Pb free | Industrial |
| ASM3I2814AF-08TR | 3I2814AFT | TSSOP – Tape & Reel, Pb free | Industrial |
| ASM3I2814AF-08TT | 3I2814AFT | TSSOP – Tube, Pb free | Industrial |
| ASM3I2814BF-08SR | 3I2814BFS | SOIC - Tape & Reel, Pb free | Industrial |
| ASM3I2814BF-08ST | 3I2814BFS | SOIC - Tube, Pb free | Industrial |
| ASM3I2814BF-08TR | 3I2814BFT | TSSOP – Tape & Reel, Pb free | Industrial |
| ASM3I2814BF-08TT | 3I2814BFT | TSSOP – Tube, Pb free | Industrial |
| ASM3P2811AG-08SR | 3P2811AGS | SOIC – Tape & Reel, Green | Commercial |
| ASM3P2811AG-08ST | 3P2811AGS | SOIC – Tube, Green | Commercial |
| ASM3P2811AG-08TR | 3P2811AGT | TSSOP – Tape & Reel, Green | Commercial |
| ASM3P2811AG-08TT | 3P2811AGT | TSSOP – Tube, Green | Commercial |
| ASM3P2811BG-08SR | 3P2811BGS | SOIC – Tape & Reel, Green | Commercial |
| ASM3P2811BG-08ST | 3P2811BGS | SOIC – Tube, Green | Commercial |
| ASM3P2811BG-08TR | 3P2811BGT | TSSOP – Tape & Reel, Green | Commercial |
| ASM3P2811BG-08TT | 3P2811BGT | TSSOP – Tube, Green | Commercial |
| ASM3P2812AG-08SR | 3P2812AGS | SOIC – Tape & Reel, Green | Commercial |
| ASM3P2812AG-08ST | 3P2812AGS | SOIC – Tube, Green | Commercial |
| ASM3P2812AG-08TR | 3P2812AGT | TSSOP – Tape & Reel, Green | Commercial |
| ASM3P2812AG-08TT | 3P2812AGT | TSSOP – Tube, Green | Commercial |
| ASM3P2812BG-08SR | 3P2812BGS | SOIC – Tape & Reel, Green | Commercial |
| ASM3P2812BG-08ST | 3P2812BGS | SOIC – Tube, Green | Commercial |
| ASM3P2812BG-08TR | 3P2812BGT | TSSOP – Tape & Reel, Green | Commercial |
| ASM3P2812BG-08TT | 3P2812BGT | TSSOP – Tube, Green | Commercial |
| ASM3P2814AG-08SR | 3P2814AGS | SOIC – Tape & Reel, Green | Commercial |
| ASM3P2814AG-08ST | 3P2814AGS | SOIC – Tube, Green | Commercial |
| ASM3P2814AG-08TR | 3P2814AGT | TSSOP – Tape & Reel, Green | Commercial |
| ASM3P2814AG-08TT | 3P2814AGT | TSSOP – Tube, Green | Commercial |
| ASM3P2814BG-08SR | 3P2814BGS | SOIC – Tape & Reel, Green | Commercial |
| ASM3P2814BG-08ST | 3P2814BGS | SOIC – Tube, Green | Commercial |
| ASM3P2814BG-08TR | 3P2814BGT | TSSOP – Tape & Reel, Green | Commercial |
| ASM3P2814BG-08TT | 3P2814BGT | TSSOP – Tube, Green | Commercial |
| ASM3I2811AG-08SR | 3I2811AGS | SOIC – Tape & Reel, Green | Industrial |
| ASM3I2811AG-08ST | 3I2811AGS | SOIC – Tube, Green | Industrial |

**Ordering Codes (cont'd)**

| Part Number | Marking | Package Type | Temperature |
|---|---|---|---|
| ASM3I2811AG-08TR | 3I2811AGT | TSSOP – Tape & Reel, Green | Industrial |
| ASM3I2811AG-08TT | 3I2811AGT | TSSOP – Tube, Green | Industrial |
| ASM3I2811BG-08SR | 3I2811BGS | SOIC – Tape & Reel, Green | Industrial |
| ASM3I2811BG-08ST | 3I2811BGS | SOIC – Tube, Green | Industrial |
| ASM3I2811BG-08TR | 3I2811BGT | TSSOP – Tape & Reel, Green | Industrial |
| ASM3I2811BG-08TT | 3I2811BGT | TSSOP – Tube, Green | Industrial |
| ASM3I2812AG-08SR | 3I2812AGS | SOIC – Tape & Reel, Green | Industrial |
| ASM3I2812AG-08ST | 3I2812AGS | SOIC – Tube, Green | Industrial |
| ASM3I2812AG-08TR | 3I2812AGT | TSSOP – Tape & Reel, Green | Industrial |
| ASM3I2812AG-08TT | 3I2812AGT | TSSOP – Tube, Green | Industrial |
| ASM3I2812BG-08SR | 3I2812BGS | SOIC – Tape & Reel, Green | Industrial |
| ASM3I2812BG-08ST | 3I2812BGS | SOIC - Tube, Green | Industrial |
| ASM3I2812BG-08TR | 3I2812BGT | TSSOP – Tape & Reel, Green | Industrial |
| ASM3I2812BG-08TT | 3I2812BGT | TSSOP – Tube, Green | Industrial |
| ASM3I2814AG-08SR | 3I2814AGS | SOIC - Tape & Reel, Green | Industrial |
| ASM3I2814AG-08ST | 3I2814AGS | SOIC - Tube, Green | Industrial |
| ASM3I2814AG-08TR | 3I2814AGT | TSSOP – Tape & Reel, Green | Industrial |
| ASM3I2814AG-08TT | 3I2814AGT | TSSOP – Tube, Green | Industrial |
| ASM3I2814BG-08SR | 3I2814BGS | SOIC - Tape & Reel, Green | Industrial |
| ASM3I2814BG-08ST | 3I2814BGS | SOIC - Tube, Green | Industrial |
| ASM3I2814BG-08TR | 3I2814BGT | TSSOP – Tape & Reel, Green | Industrial |
| ASM3I2814BG-08TT | 3I2814BGT | TSSOP – Tube, Green | Industrial |

## Device Ordering Information

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

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



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