



## Low Power Peak EMI Reducing Solution

### Features

- Generates an EMI optimized clock signal at the output.
- Integrated loop filter components.
- Operates with a 3.3 / 2.5V Supply.
- Operating current less than 4mA.
- Low power CMOS design.
- Input frequency range: 13MHz to 30MHz for 2.5V.  
: 13MHz to 30MHz for 3.3V.
- Generates a 1X low EMI spread spectrum clock of the input frequency.
- Frequency deviation:  $\pm 0.75\%$  ( Typ ) @ 22MHz Input Frequency.
- Available in 6-pin TSOT-23, 8-pin SOIC and 8-pin TSSOP Packages.

### Product Description

The ASM3P2870A is a versatile spread spectrum frequency modulator designed specifically for a wide range of clock frequencies. The ASM3P2870A reduces electromagnetic interference (EMI) at the clock source, allowing system wide reduction of EMI of all clock dependent signals. The ASM3P2870A allows significant system cost savings by reducing the number of circuit board layers ferrite beads, shielding that are traditionally required to pass EMI regulations.

The ASM3P2870A uses the most efficient and optimized modulation profile approved by the FCC and is implemented by using a proprietary all digital method.

The ASM3P2870A 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’.

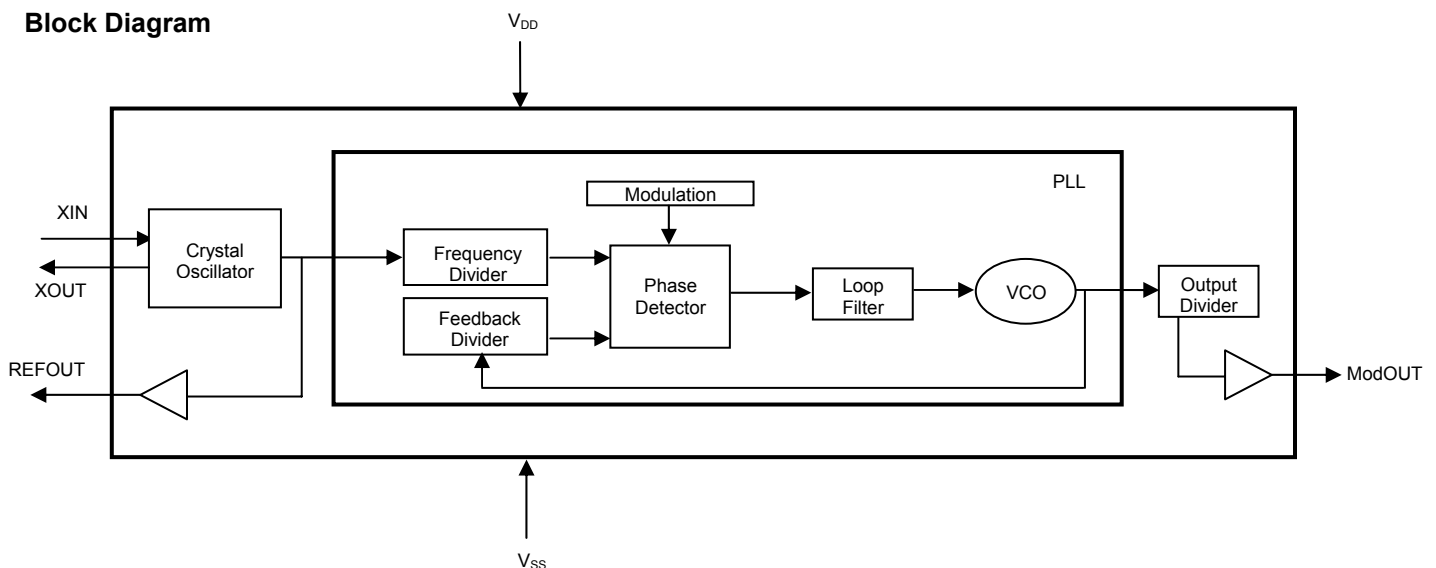
### Applications

The ASM3P2870A is targeted towards all portable devices with very low power requirements like MP3 players and digital still cameras.

### Key Specifications

Description	Specification
Supply voltages	$V_{DD} = 3.3V / 2.5V$
Cycle-to-Cycle Jitter	200pS (Max)
Output Duty Cycle	45/55%
Modulation Rate Equation	$F_{IN}/640$
Frequency Deviation	$\pm 0.75\%$ ( Typ ) @ 22MHz

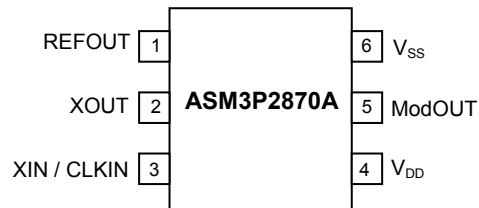
### Block Diagram





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## Pin Configuration (6-pin TSOT- 23 Package)



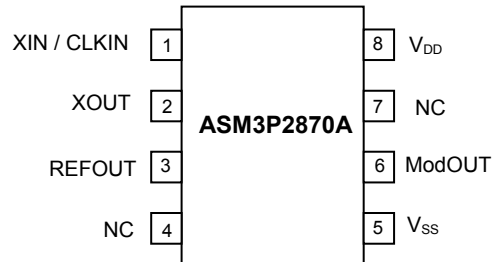
## Pin Description

Pin#	Pin Name	Type	Description
1	REFOUT	O	Buffered output of the input frequency
2	XOUT	O	Crystal connection. If using an external reference, this pin must be left unconnected.
3	XIN / CLKIN	I	Crystal connection or external reference frequency input. This pin has dual functions. It can be connected either to an external crystal or an external reference clock.
4	V <sub>DD</sub>	P	Power supply for the entire chip.
5	ModOUT	O	Spread spectrum clock output.
6	V <sub>SS</sub>	P	Ground connection.



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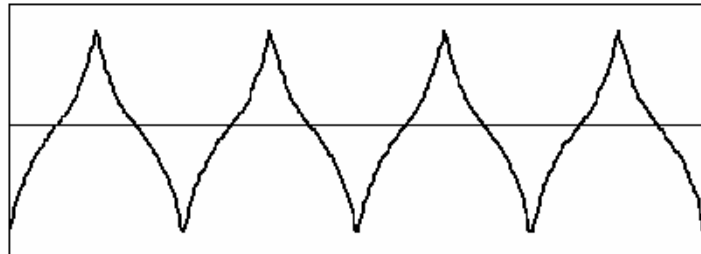
## Pin Configuration (8-pin SOIC and TSSOP Packages)



## Pin Description

Pin#	Pin Name	Type	Description
1	XIN/CLKIN	I	Crystal connection or external reference frequency input. This pin has dual functions. It can be connected either to an external crystal or an external reference clock.
2	XOUT	O	Crystal connection. If using an external reference, this pin must be left unconnected.
3	REFOUT	O	Buffered output of the input frequency
4	NC	-	No connect.
5	V <sub>SS</sub>	P	Ground connection.
6	ModOUT	O	Spread spectrum clock output.
7	NC	-	No connect.
8	V <sub>DD</sub>	P	Power supply for the entire chip.

## Modulation Profile



## Specifications

Description		Specification
Frequency Range	For 2.5V Supply	13MHz < CLKIN < 30MHz
	For 3.3V Supply	
Modulation Equation		$F_{IN}/640$
Frequency Deviation		$\pm 0.75\%$ (Typ) @22MHz



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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 (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 Supply

(Test condition: All parameters are measured at room temperature (+25°C) unless otherwise stated)

Symbol	Parameter	Min	Typ	Max	Unit
$V_{IL}$	Input low voltage	$V_{SS} - 0.3$	-	0.8	V
$V_{IH}$	Input high voltage	2.0	-	$V_{DD} + 0.3$	V
$I_{IL}$	Input low current	-	-	-35	μA
$I_{IH}$	Input high current	-	-	35	μA
$I_{XOL}$	XOUT output low current (@0.5V, $V_{DD}=2.5V$ )	-	3	-	mA
$I_{XOH}$	XOUT output high current (@1.8V, $V_{DD}=2.5V$ )	-	3	-	mA
$V_{OL}$	Output low voltage ( $V_{DD} = 2.5 V, I_{OL} = 8mA$ )	-	-	0.6	V
$V_{OH}$	Output high voltage ( $V_{DD} = 2.5 V, I_{OH} = 8mA$ )	1.8	-	-	V
$I_{DD}$	Static supply current*	-	1.0	-	mA
$I_{CC}$	Dynamic supply current (2.5V, 22MHz and no load)	-	3.0	-	mA
$V_{DD}$	Operating Voltage	2.375	2.5	2.625	V
$t_{ON}$	Power-up time (first locked cycle after power-up)	-	-	5	mS
$Z_{OUT}$	Output impedance	-	50	-	Ω

\* XIN /CLKIN pin is pulled low

## AC Electrical Characteristics for 2.5V Supply

Symbol	Parameter	Min	Typ	Max	Unit	
CLKIN	Input frequency	13	-	30	MHz	
ModOUT	Output frequency	13	-	30	MHz	
$f_d$	Frequency Deviation	Input Frequency = 13MHz	-	± 1.20	-	%
		Input Frequency = 30MHz	-	± 0.5	-	
$t_{LH}^*$	Output rise time (measured from 0.7V to 1.7V)	0.7	1.4	1.6	nS	
$t_{HL}^*$	Output fall time (measured from 1.7V to 0.7V)	0.4	0.8	1.0	nS	
$t_{JC}$	Jitter (cycle to cycle)	-	-	200	pS	
$t_D$	Output duty cycle	45	50	55	%	

\*  $t_{LH}$  and  $t_{HL}$  are measured into a capacitive load of 15pF



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**DC Electrical Characteristics for 3.3V Supply**

(Test condition: All parameters are measured at room temperature (+ 25°C) unless otherwise stated)

Symbol	Parameter	Min	Typ	Max	Unit
V <sub>IL</sub>	Input low voltage	V <sub>SS</sub> - 0.3	-	0.8	V
V <sub>IH</sub>	Input high voltage	2.0	-	V <sub>DD</sub> + 0.3	V
I <sub>IL</sub>	Input low current	-	-	-35	μA
I <sub>IH</sub>	Input high current	-	-	35	μA
I <sub>XOL</sub>	XOUT output low current (@0.4V, V <sub>DD</sub> =3.3V)	-	3	-	mA
I <sub>XOH</sub>	XOUT output high current (@2.5V, V <sub>DD</sub> =3.3V)	-	3	-	mA
V <sub>OL</sub>	Output low voltage (V <sub>DD</sub> = 3.3 V, I <sub>OL</sub> = 8mA)	-	-	0.4	V
V <sub>OH</sub>	Output high voltage (V <sub>DD</sub> = 3.3 V, I <sub>OH</sub> = 8mA)	2.5	-	-	V
I <sub>DD</sub>	Static supply current*	-	1.2	-	mA
I <sub>CC</sub>	Dynamic supply current (3.3V, 22MHz and no load)	-	4.0	-	mA
V <sub>DD</sub>	Operating Voltage	2.7	3.3	3.6	V
t <sub>ON</sub>	Power-up time (first locked cycle after power-up)**	-	-	5	mS
Z <sub>OUT</sub>	Output impedance	-	45	-	Ω

\* XIN /CLKIN pin is pulled low.

**AC Electrical Characteristics for 3.3V Supply**

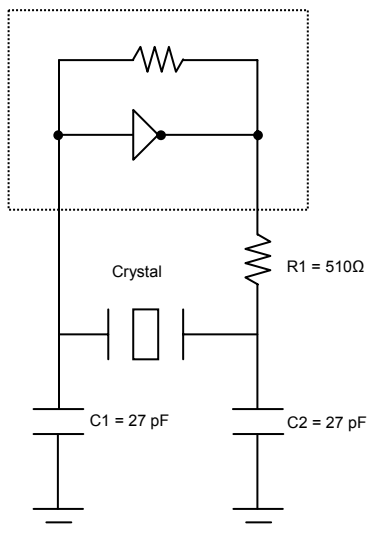
Symbol	Parameter	Min	Typ	Max	Unit	
CLKIN	Input frequency	13	-	30	MHz	
ModOUT	Output frequency	13	-	30	MHz	
f <sub>d</sub>	Frequency Deviation	Input Frequency = 13MHz	-	±1.20	-	%
		Input Frequency = 30MHz	-	± 0.5	-	
t <sub>LH</sub> *	Output rise time (measured from 0.8 to 2.0V)	0.4	1.2	1.5	nS	
t <sub>HL</sub> *	Output fall time (measured at 2.0V to 0.8V)	0.3	0.8	1.1	nS	
t <sub>JC</sub>	Jitter (cycle to cycle)	-	-	200	pS	
t <sub>D</sub>	Output duty cycle	45	50	55	%	

\*t<sub>LH</sub> and t<sub>HL</sub> are measured into a capacitive load of 15pF



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### Typical Crystal Oscillator Circuit



### Typical Crystal Specifications

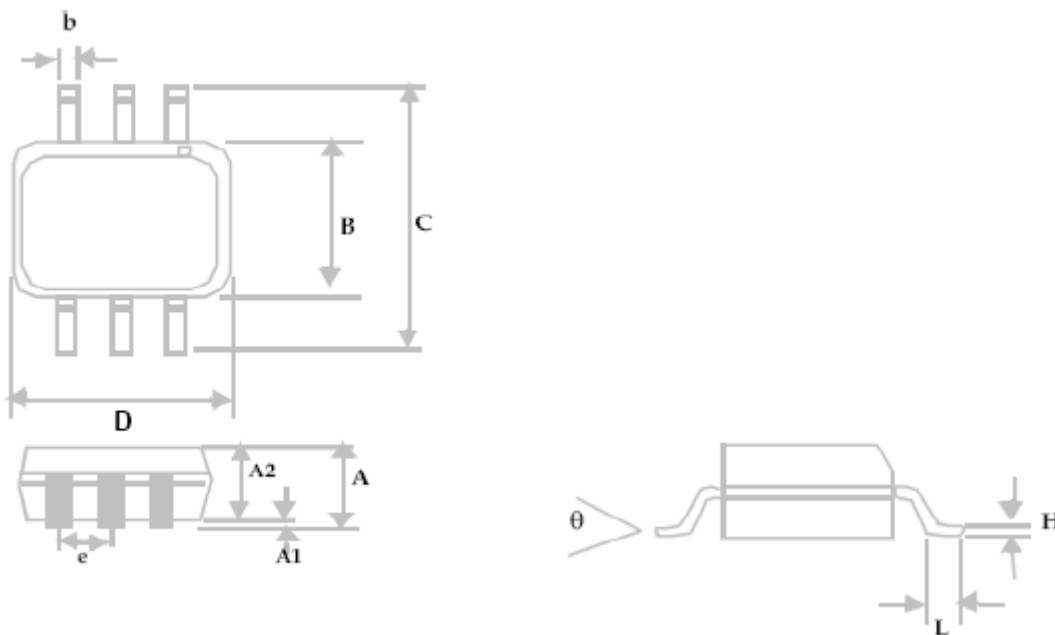
Fundamental AT cut parallel resonant crystal	
Nominal frequency	14.31818MHz
Frequency tolerance	± 50ppm or better at 25°C
Operating temperature range	-25°C to +85°C
Storage temperature	-40°C to +85°C
Load capacitance	18pF
Shunt capacitance	7pF maximum
ESR	25Ω



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## Package Information

## 6-pin TSOT-23 Package

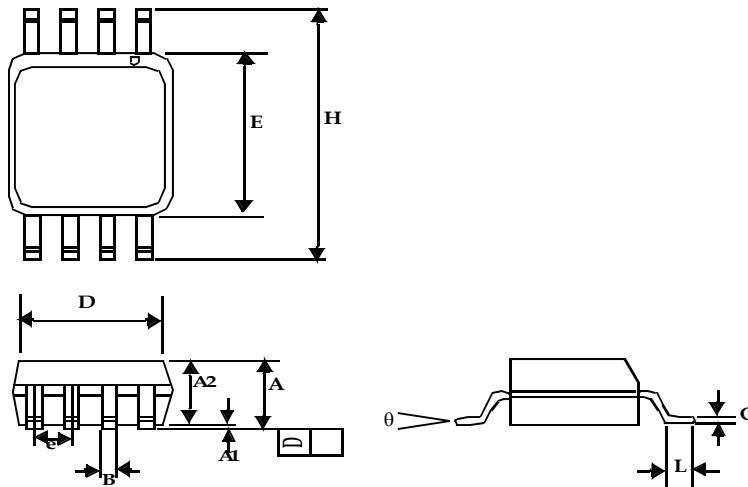


Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A		0.04		1.00
A1	0.00	0.004	0.00	0.10
A2	0.033	0.036	0.84	0.90
b	0.012	0.02	0.30	0.50
H	0.005 BSC		0.127 BSC	
D	0.114 BSC		2.90 BSC	
B	0.06 BSC		1.60 BSC	
e	0.0374 BSC		0.950 BSC	
C	0.11 BSC		2.80 BSC	
L	0.0118	0.02	0.30	0.50
θ	0°	4°	0°	4°



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## 8-Pin SOIC Package



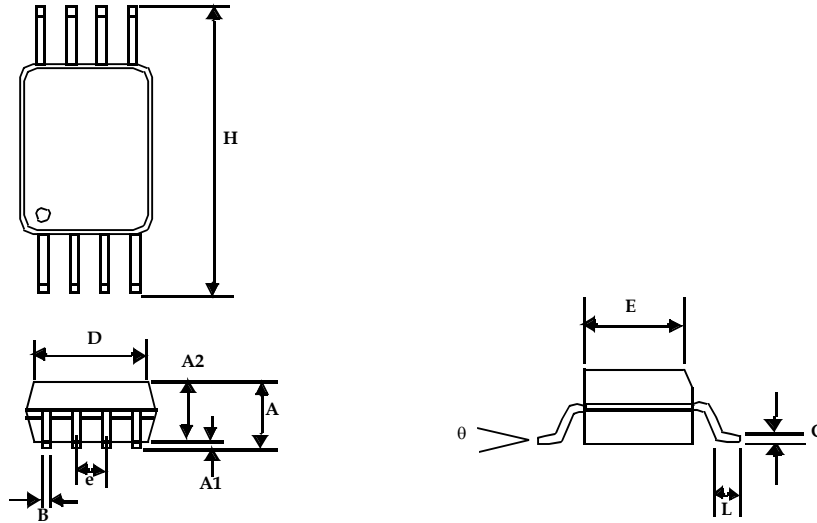
Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A1	0.004	0.010	0.10	0.25
A	0.053	0.069	1.35	1.75
A2	0.049	0.059	1.25	1.50
B	0.012	0.020	0.31	0.51
C	0.007	0.010	0.18	0.25
D	0.193 BSC		4.90 BSC	
E	0.154 BSC		3.91 BSC	
e	0.050 BSC		1.27 BSC	
H	0.236 BSC		6.00 BSC	
L	0.016	0.050	0.41	1.27
$\theta$	0°	8°	0°	8°





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## 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°



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Ordering Information

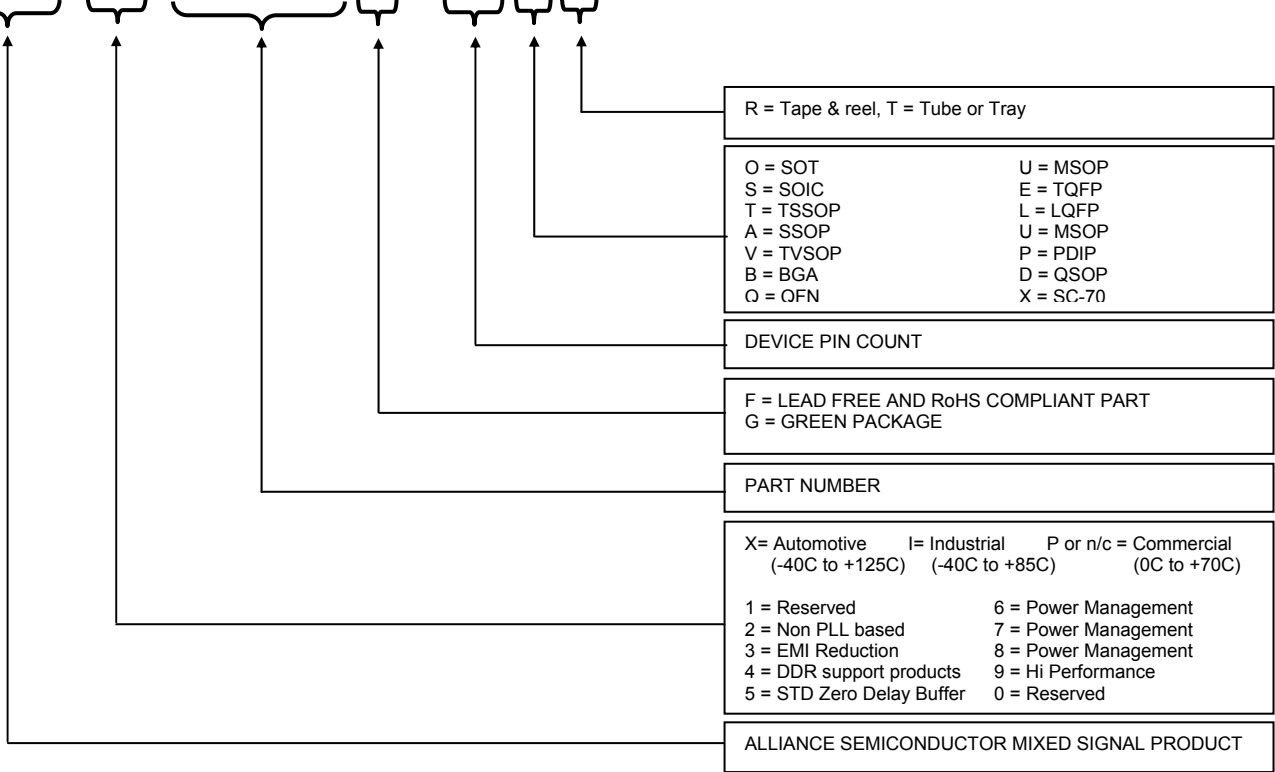
Part Number	Marking	Package Type	Temperature
ASM3P2870AF-06OR	C4LL	6-Pin TSOT-23, TAPE & REEL, Pb Free	Commercial
ASM3P2870AF-08TT	3P2870AF	8-Pin TSSOP, TUBE, Pb Free	Commercial
ASM3P2870AF-08TR	3P2870AF	8-Pin TSSOP, TAPE & REEL, Pb Free	Commercial
ASM3P2870AF-08ST	3P2870AF	8-Pin SOIC, TUBE, Pb Free	Commercial
ASM3P2870AF-08SR	3P2870AF	8-Pin SOIC, TAPE & REEL, Pb Free	Commercial
ASM3P2870AG-06OR	C3LL	6-Pin TSOT-23, TAPE & REEL, Green	Commercial
ASM3P2870AG-08TT	3P2870AG	8-Pin TSSOP, TUBE, Green	Commercial
ASM3P2870AG-08TR	3P2870AG	8-Pin TSSOP, TAPE & REEL, Green	Commercial
ASM3P2870AG-08ST	3P2870AG	8-Pin SOIC, TUBE, Green	Commercial
ASM3P2870AG-08SR	3P2870AG	8-Pin SOIC, TAPE & REEL, Green	Commercial
ASM3P2870A-06OR	C1LL	6-Pin TSOT-23, TAPE & REEL	Commercial
ASM3P2870A-08TT	3P2870A	8-Pin TSSOP, TUBE	Commercial
ASM3P2870A-08TR	3P2870A	8-Pin TSSOP, TAPE & REEL	Commercial
ASM3P2870A-08ST	3P2870A	8-Pin SOIC, TUBE	Commercial
ASM3P2870A-08SR	3P2870A	8-Pin SOIC, TAPE & REEL	Commercial
ASM3I2870AF-06OR	C5LL	6-Pin TSOT-23, TAPE & REEL, Pb Free	Industrial
ASM3I2870AF-08TT	3I2870AF	8-Pin TSSOP, TUBE, Pb Free	Industrial
ASM3I2870AF-08TR	3I2870AF	8-Pin TSSOP, TAPE & REEL, Pb Free	Industrial
ASM3I2870AF-08ST	3I2870AF	8-Pin SOIC, TUBE, Pb Free	Industrial
ASM3I2870AF-08SR	3I2870AF	8-Pin SOIC, TAPE & REEL, Pb Free	Industrial
ASM3I2870AG-06OR	C6LL	6-Pin TSOT-23, TAPE & REEL, Green	Industrial
ASM3I2870AG-08TT	3I2870AG	8-Pin TSSOP, TUBE, Green	Industrial
ASM3I2870AG-08TR	3I2870AG	8-Pin TSSOP, TAPE & REEL, Green	Industrial
ASM3I2870AG-08ST	3I2870AG	8-Pin SOIC, TUBE, Green	Industrial
ASM3I2870AG-08SR	3I2870AG	8-Pin SOIC, TAPE & REEL, Green	Industrial
ASM3I2870A-06OR	C2LL	6-Pin TSOT-23, TAPE & REEL	Industrial
ASM3I2870A-08TT	3I2870A	8-Pin TSSOP, TUBE	Industrial
ASM3I2870A-08TR	3I2870A	8-Pin TSSOP, TAPE & REEL	Industrial
ASM3I2870A-08ST	3I2870A	8-Pin SOIC, TUBE	Industrial
ASM3I2870A-08SR	3I2870A	8-Pin SOIC, TAPE & REEL	Industrial



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Device Ordering Information

A S M 3 P 2 8 7 0 A F - 0 8 T R



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

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