3.3V Zero Delay Buffer

Features

- Zero input - output propagation delay, adjustable by capacitive load on FBK input.
- Multiple configurations - Refer “ASM5P2304A Configurations Table”.
- Input frequency range: 15MHz to 133MHz
- Multiple low-skew outputs.
  - Output-output skew less than 200pS.
  - Device-device skew less than 500pS.
  - Two banks of four outputs.
- Less than 200pS Cycle-to-Cycle jitter (-1, -1H, -2, -2H).
- Available in space saving, 8 pin 150-mil SOIC packages.
- 3.3V operation.
- Advanced 0.35µ CMOS technology.
- Industrial temperature available.

Functional Description

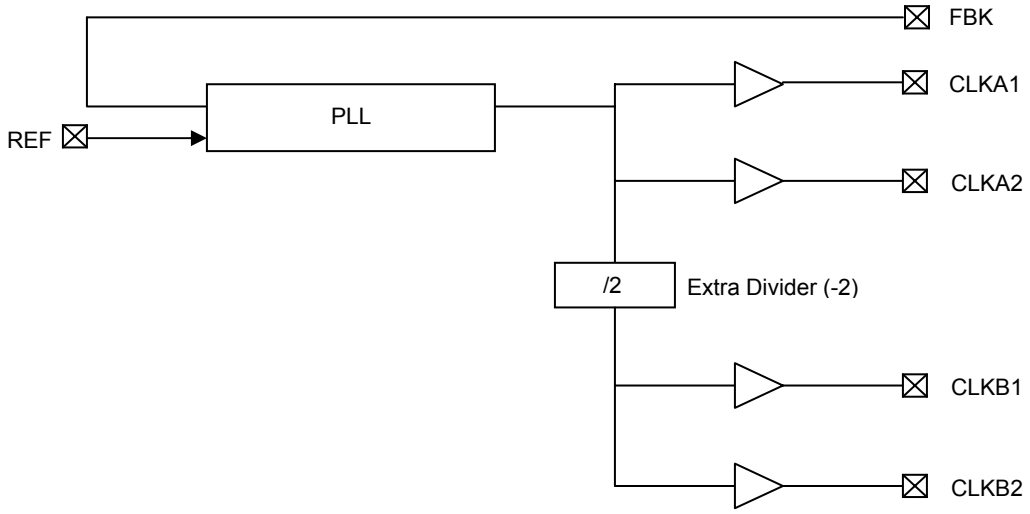
ASM5P2304A is a versatile, 3.3V zero-delay buffer designed to distribute high-speed clocks in PC, workstation, datacom, telecom and other high-performance applications. It is available in 8 pin package. The part has an on-chip PLL which locks to an input clock presented on the REF pin. The PLL feedback is required to be driven to FBK pin, and can be obtained from one of the outputs. The input-to-output propagation delay is guaranteed to be less than 250pS, and the output-to-output skew is guaranteed to be less than 200pS.

The ASM5P2304A has two banks of two outputs each. Multiple ASM5P2304A devices can accept the same input clock and distribute it. In this case the skew between the outputs of the two devices is guaranteed to be less than 500pS.

The ASM5P2304A is available in two different configurations (Refer “ASM5P2304A Configurations Table). The ASM5P2304A-1 is the base part, where the output frequencies equal the reference if there is no counter in the feedback path. The ASM5P2304A-1H is the high-drive version of the -1 and the rise and fall times on this device are much faster.

The ASM5P2304A-2 allows the user to obtain REF and 1/2X or 2X frequencies on each output bank. The exact configuration and output frequencies depend on which output drives the feedback pin.

Block Diagram

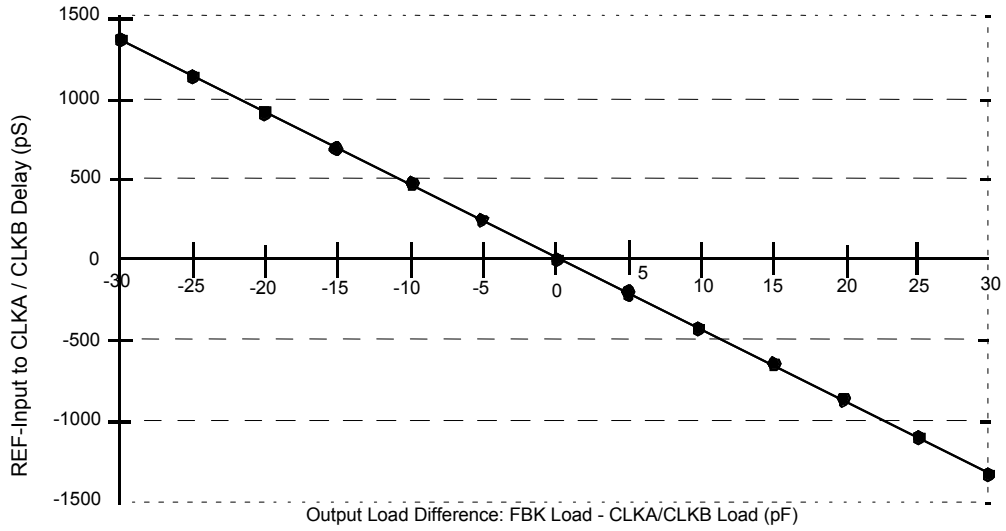


ASM5P2304A Configurations

Device	Feedback From	Bank A Frequency	Bank B Frequency
ASM5P2304A-1	Bank A or Bank B	Reference	Reference
ASM5P2304A-1H	Bank A or Bank B	Reference	Reference
ASM5P2304A-2	Bank A	Reference	Reference /2
ASM5P2304A-2	Bank B	2 X Reference	Reference
ASM5P2304A-2H	Bank A	Reference	Reference/2
ASM5P2304A-2H	Bank B	2 X Reference	Reference

Zero Delay and Skew Control

For applications requiring zero input-output delay, all outputs must be equally loaded.

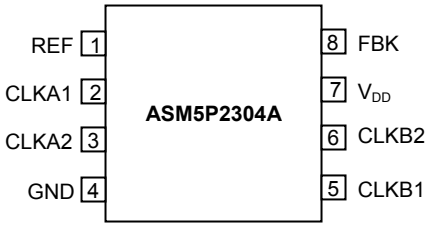


REF Input to CLKA/CLKB Delay Vs Difference in Loading between FBK pin and CLKA/CLKB pins

To close the feedback loop of the ASM5P2304A, the FBK pin can be driven from any of the four available output pins. The output driving the FBK pin will be driving a total load of 7pF plus any additional load that it drives. The relative loading of this output (with respect to the remaining outputs) can adjust the input output delay. This is shown in the above graph.

For applications requiring zero input-output delay, all outputs including the one providing feedback should be equally loaded. If input-output delay adjustments are required, use the above graph to calculate loading differences between the feedback output and remaining outputs. For zero output-output skew, be sure to load outputs equally.

Pin Configuration



Pin Description for ASM5P2304A

Pin #	Pin Name	Description
1	REF[1]	Input reference frequency, 5V tolerant input
2	CLKA1[2]	Buffered clock output, bank A
3	CLKA2[2]	Buffered clock output, bank A
4	GND	Ground
5	CLKB1[2]	Buffered clock output, bank B
6	CLKB2 [2]	Buffered clock output, bank B
7	V_{DD}	3.3V supply
8	FBK	PLL feedback input

Notes:
1. Weak pull-down.
2. Weak pull-down on all outputs.

Absolute Maximum Ratings

Parameter	Min	Max	Unit
Supply Voltage to Ground Potential	-0.5	+7.0	V
DC Input Voltage (Except REF)	-0.5	V_{DD} + 0.5	V
DC Input Voltage (REF)	-0.5	7	V
Storage Temperature	-65	+150	°C
Max. Soldering Temperature (10 sec)		260	°C
Junction Temperature		150	°C
Static Discharge Voltage (As per JEDEC STD22- A114-B)		2000	V

Note: These are stress ratings only and functional usage is not implied. Exposure to absolute maximum ratings for prolonged periods can affect device reliability.

Operating Conditions for ASM5P2304A Commercial Temperature Devices

Parameter	Description	Min	Max	Unit
V_{DD}	Supply Voltage	3.0	3.6	V
T_A	Operating Temperature (Ambient Temperature)	0	70	°C
C_L	Load Capacitance, from 15MHz to 100MHz		30	pF
C_L	Load Capacitance, from 100MHz to 133MHz		15	pF
C_{IN}	Input Capacitance[3]		7	pF

Note:
3. Applies to both Ref Clock and FBK.

Electrical Characteristics for ASM5P2304A Commercial Temperature Devices

Parameter	Description	Test Conditions	Min	Max	Unit
V_{IL}	Input LOW Voltage			0.8	V
V_{IH}	Input HIGH Voltage		2.0		V
I_{IL}	Input LOW Current	V_{IN} = 0V		50.0	µA
I_{IH}	Input HIGH Current	V_{IN} = V_{DD}		100.0	µA
V_{OL}	Output LOW Voltage [4]	I_{OL} = 8mA (-1, -2) I_{OH} = 12mA (-1H, -2H)		0.4	V
V_{OH}	Output HIGH Voltage [4]	I_{OL} = -8mA (-1, -2) I_{OH} = -12mA (-1H, -2H)	2.4		V
I_{DD}	Supply Current	Unloaded outputs 100MHz REF, Select inputs at V_{DD} or GND		45.0	mA
		Unloaded outputs, 66MHz REF (-1, -1H, -2, -2H)		32.0	
		Unloaded outputs, 33MHz REF (-1, -1H, -2, -2H)		18.0	

Note:
4. Parameter is guaranteed by design and characterization. Not 100% tested in production.

Switching Characteristics for ASM5P2304A Commercial Temperature Devices

Parameter	Description	Test Conditions	Min	Typ	Max	Unit
$1/t_1$	Output Frequency	30pF load, -1H, -2H devices	15		133	MHz
$1/t_1$	Output Frequency	15pF load, -1, -2 devices	15		133	MHz
	Duty Cycle[5]= (t_2 / t_1) * 100 (-1, -2, -1H, -2H)	Measured at 1.4V, F_{OUT} = 66.66MHz 30pF load	40.0	50.0	60.0	%
	Duty Cycle[5] = (t_2 / t_1) * 100 (-1, -2,-1H, -2H)	Measured at 1.4V, F_{OUT} = <50MHz 15 pF load	45.0	50.0	55.0	%
t_3	Output Rise Time[5] (-1, -2)	Measured between 0.8V and 2.0V 30pF load			2.20	nS
t_3	Output Rise Time[5] (-1, -2)	Measured between 0.8V and 2.0V 15pF load			1.50	nS
t_3	Output Rise Time[5] (-1H, -2H)	Measured between 0.8V and 2.0V 30pF load			1.50	nS
t_4	Output Fall Time [5] (-1, -2)	Measured between 2.0V and 0.8V 30pF load			2.20	nS
t_4	Output Fall Time [5] (-1, -2)	Measured between 2.0V and 0.8V 15pF load			1.50	nS
t_4	Output Fall Time[5] (-1H, -2H)	Measured between 2.0V and 0.8V 30pF load			1.25	nS
t_5	Output-to-output skew on same bank (-1, -2)[5]	All outputs equally loaded			200	pS
	Output-to-output skew (-1H, -2H)	All outputs equally loaded			200	
	Output bank A -to- output bank B skew (-1, -2H)	All outputs equally loaded			200	
	Output bank A to output Bank B skew (-2)	All outputs equally loaded			400	
t_6	Delay, REF Rising Edge to FBK Rising Edge[5]	Measured at V_{DD} /2		0	±250	pS
t_7	Device-to-Device Skew[5]	Measured at V_{DD}/2 on the FBK pins of the device		0	500	pS
t_8	Output Slew Rate[5]	Measured between 0.8V and 2.0V using Test Circuit #2	1			V/nS
t_J	Cycle-to-cycle jitter [5] (-1, -1H, -2H)	Measured at 66.67MHz, loaded outputs, 15pF load			175	pS
		Measured at 66.67MHz, loaded outputs, 30pF load			200	
		Measured at 25MHz, loaded outputs, 15pF load			100	
t_J	Cycle-to-cycle jitter [5] (-2)	Measured at 66.67MHz, loaded outputs, 30pF load			400	pS
		Measured at 66.67MHz, loaded outputs, 15pF load			375	
t_{LOCK}	PLL Lock Time [5]	Stable power supply, valid clock presented on REF and FBK pins			1.0	mS

Note:

5. Parameter is guaranteed by design and characterization. Not 100% tested in production.

Operating Conditions for ASM5I2304A Industrial Temperature Devices

Parameter	Description	Min	Max	Unit
V_{DD}	Supply Voltage	3.0	3.6	V
T_A	Operating Temperature (Ambient Temperature)	-40	85	°C
C_L	Load Capacitance, from 15MHz to 100MHz		30	pF
C_L	Load Capacitance, from 100MHz to 133MHz		15	pF
C_{IN}	Input Capacitance[6]		7	pF

Note:
6. Applies to both Ref Clock and FBK.

Electrical Characteristics for ASM5I2304A Industrial Temperature Devices

Parameter	Description	Test Conditions	Min	Max	Unit
V_{IL}	Input LOW Voltage			0.8	V
V_{IH}	Input HIGH Voltage		2.0		V
I_{IL}	Input LOW Current	V_{IN} = 0V		50.0	µA
I_{IH}	Input HIGH Current	V_{IN} = V_{DD}		100.0	µA
V_{OL}	Output LOW Voltage [7]	I_{OL} = 8mA (-1, -2) I_{OH} = 12mA (-1H, -2H)		0.4	V
V_{OH}	Output HIGH Voltage [7]	I_{OL} = -8mA (-1, -2) I_{OH} = -12mA (-1H, -2H)	2.4		V
I_{DD}	Supply Current	Unloaded outputs 100MHz REF, Select inputs at V_{DD} or GND		45.0	mA
		Unloaded outputs, 66MHz REF (-1, -2)		35.0	
		Unloaded outputs, 33MHz REF (-1, -2)		20.0	

Note:
7. Parameter is guaranteed by design and characterization. Not 100% tested in production.

Switching Characteristics for ASM5I2304A Industrial Temperature Devices

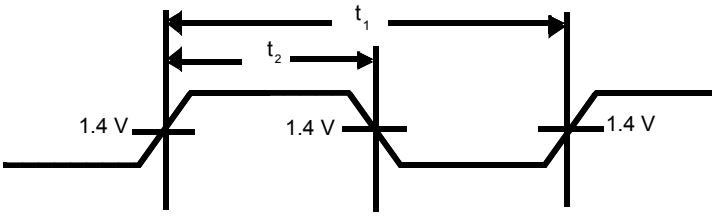
All parameters are specified with loaded outputs

Parameter	Description	Test Conditions	Min	Typ	Max	Unit
$1/t_1$	Output Frequency	30pF load, -1H, -2H devices	15		133	MHz
$1/t_1$	Output Frequency	15pF load, -1 and -2 devices	15		133	MHz
	Duty Cycle[8] = (t_2 / t_1) * 100 (-1, -2, -1H, -2H)	Measured at 1.4V, F_{OUT} = <66.66MHz 30pF load	40.0	50.0	60.0	%
	Duty Cycle[8]= (t_2 / t_1) * 100 (-1, -2, -1H, -2H)	Measured at 1.4V, F_{OUT} = <50 MHz 15pF load	45.0	50.0	55.0	%
t_3	Output Rise Time[8] (-1, -2)	Measured between 0.8V and 2.0V 30pF load			2.50	nS
t_3	Output Rise Time[8] (-1, -2)	Measured between 0.8V and 2.0V 15pF load			1.50	nS
t_3	Output Rise Time[8] (-1H, -2H)	Measured between 0.8V and 2.0V 30pF load			1.50	nS
t_4	Output Fall Time[8] (-1, -2)	Measured between 2.0V and 0.8V 30pF load			2.50	nS
t_4	Output Fall Time[8] (-1, -2)	Measured between 2.0V and 0.8V 15pF load			1.50	nS
t_4	Output Fall Time[8] (-1H, -2H)	Measured between 2.0V and 0.8V 30pF load			1.25	nS
t_5	Output-to-output skew on same bank (-1, -2)[8]	All outputs equally loaded			200	pS
	Output-to-output skew (-1H, -2H)	All outputs equally loaded			200	
	Output bank A -to- output bank B skew (-1, -2H)	All outputs equally loaded			200	
	Output bank A -to- output bank B skew (-2)	All outputs equally loaded			400	
t_6	Delay, REF Rising Edge to FBK Rising Edge[8]	Measured at V_{DD} /2		0	±250	pS
t_7	Device-to-Device Skew[8]	Measured at V_{DD}/2 on the FBK pins of the device		0	500	pS
t_8	Output Slew Rate[8]	Measured between 0.8V and 2.0V using Test Circuit #2	1			V/nS
t_J	Cycle-to-cycle jitter [8] (-1, -1H, -2H)	Measured at 66.67MHz, loaded outputs, 15pF load			180	pS
		Measured at 66.67MHz, loaded outputs, 30pF load			200	
		Measured at 25MHz, loaded outputs, 15pF load			100	
t_J	Cycle-to-cycle jitter[8] (-2)	Measured at 66.67MHz, loaded outputs, 30pF load			400	pS
		Measured at 66.67MHz, loaded outputs, 15pF load			380	
t_{LOCK}	PLL Lock Time[8]	Stable power supply, valid clock presented on REF and FBK pins			1.0	mS

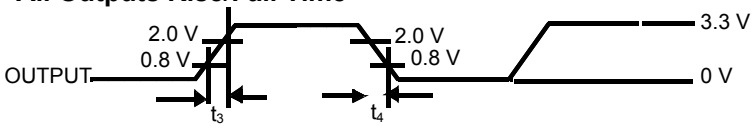
Note: 8. Parameter is guaranteed by design and characterization. Not 100% tested in production.

Switching Waveforms

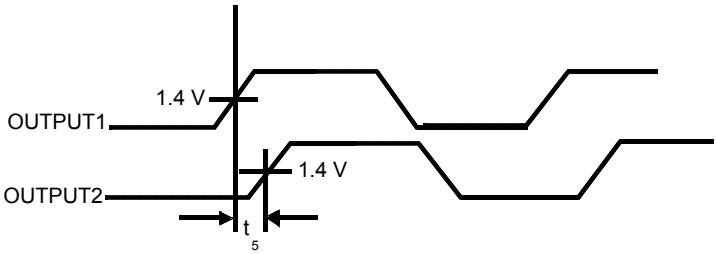
Duty Cycle Timing



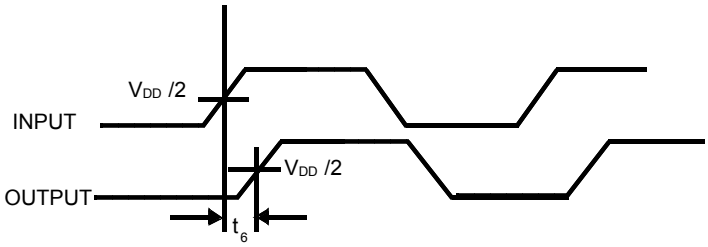
All Outputs Rise/Fall Time



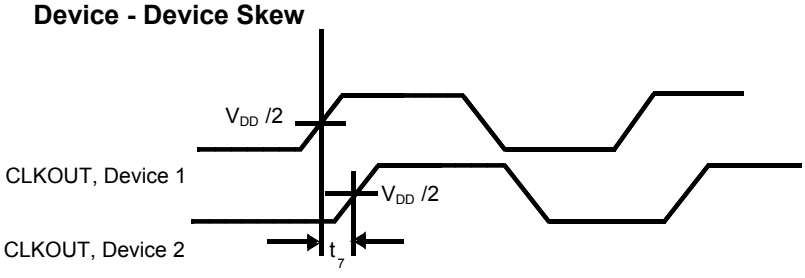
Output - Output Skew



Input - Output Propagation Delay

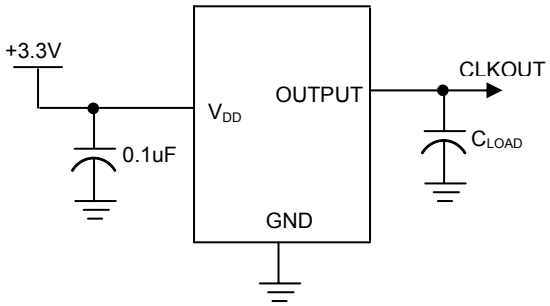


Device - Device Skew

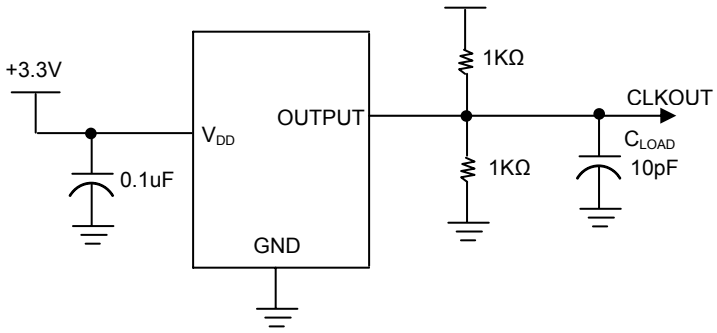


Test Circuits

TEST CIRCUIT #1



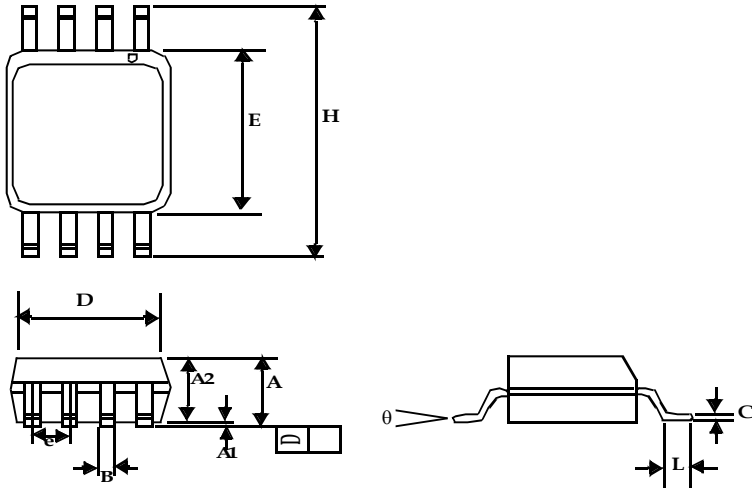
TEST CIRCUIT # 2



For parameter t_8 (output skew rate) on -1H devices

Package Information

8-lead (150-mil) SOIC Package

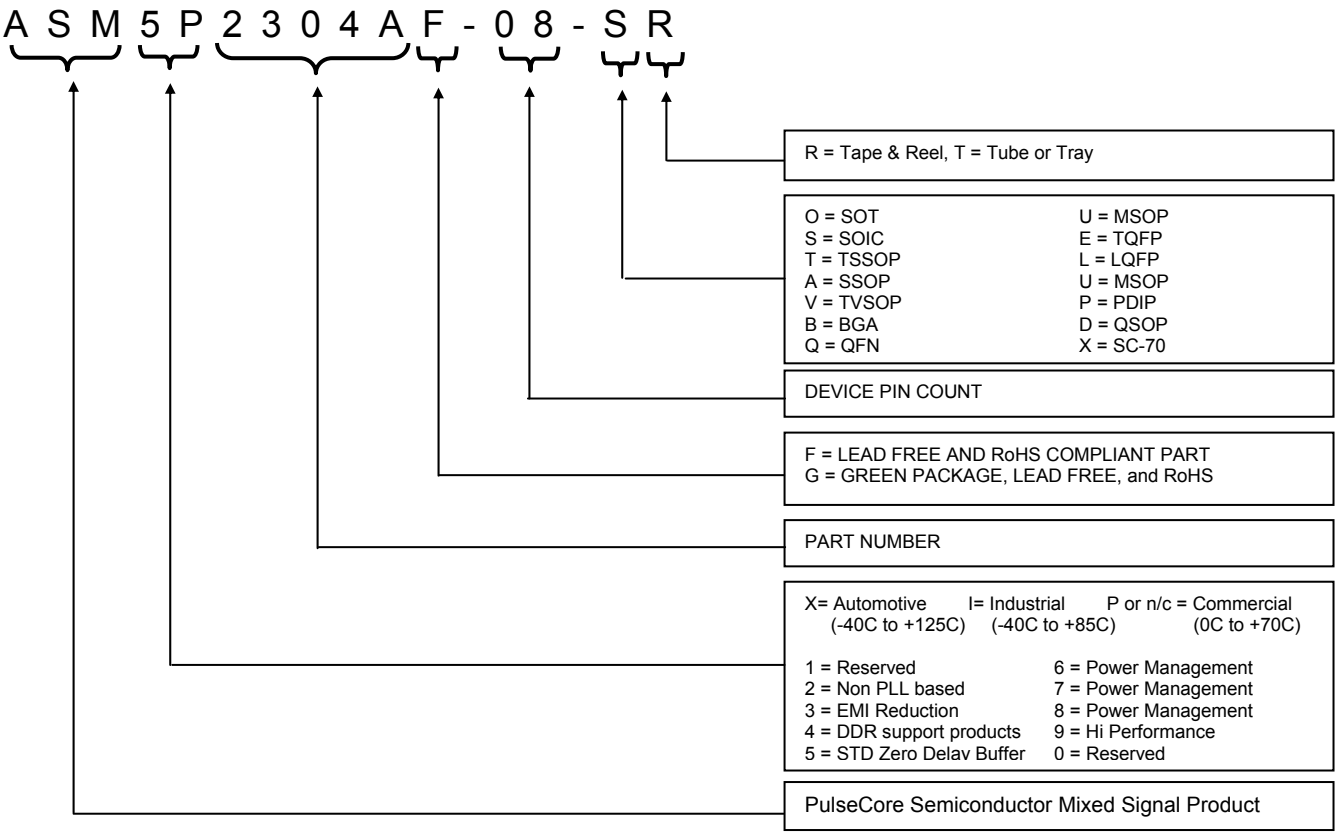


Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A1	0.004	0.010	0.10	0.25
A	0.053	0.069	1.35	1.75
A2	0.049	0.059	1.25	1.50
B	0.012	0.020	0.31	0.51
C	0.007	0.010	0.18	0.25
D	0.193 BSC		4.90 BSC	
E	0.154 BSC		3.91 BSC	
e	0.050 BSC		1.27 BSC	
H	0.236 BSC		6.00 BSC	
L	0.016	0.050	0.41	1.27
θ	0°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

Ordering Codes

Ordering Code	Marking	Package Type	Temperature
ASM5P2304AF-1-08-SR	5P2304AF-1	8-pin 150-mil SOIC-TAPE & REEL, Pb free	Commercial
ASM5P2304AF-1-08-ST	5P2304AF-1	8-pin 150-mil SOIC-TUBE, Pb free	Commercial
ASM5I2304AF-1-08-SR	5I2304AF-1	8-pin 150-mil SOIC-TAPE & REEL, Pb free	Industrial
ASM5I2304AF-1-08-ST	5I2304AF-1	8-pin 150-mil SOIC-TUBE, Pb free	Industrial
ASM5P2304AF-1H-08-SR	5P2304AF-1H	8-pin 150-mil SOIC-TAPE & REEL, Pb free	Commercial
ASM5P2304AF-1H-08-ST	5P2304AF-1H	8-pin 150-mil SOIC-TUBE, Pb free	Commercial
ASM5I2304AF-1H-08-SR	5I2304AF-1H	8-pin 150-mil SOIC-TAPE & REEL, Pb free	Industrial
ASM5I2304AF-1H-08-ST	5I2304AF-1H	8-pin 150-mil SOIC-TUBE, Pb free	Industrial
ASM5P2304AF-2-08-SR	5P2304AF-2	8-pin 150-mil SOIC-TAPE & REEL, Pb free	Commercial
ASM5P2304AF-2-08-ST	5P2304AF-2	8-pin 150-mil SOIC-TUBE, Pb free, Pb free	Commercial
ASM5I2304AF-2-08-SR	5I2304AF-2	8-pin 150-mil SOIC-TAPE & REEL, Pb free	Industrial
ASM5I2304AF-2-08-ST	5I2304AF-2	8-pin 150-mil SOIC-TUBE, Pb free	Industrial
ASM5P2304AF-2H-08-SR	5P2304AF-2H	8-pin 150-mil SOIC-TAPE & REEL, Pb free	Commercial
ASM5P2304AF-2H-08-ST	5P2304AF-2H	8-pin 150-mil SOIC-TUBE, Pb free	Commercial
ASM5I2304AF-2H-08-SR	5I2304AF-2H	8-pin 150-mil SOIC-TAPE & REEL, Pb free	Industrial
ASM5I2304AF-2H-08-ST	5I2304AF-2H	8-pin 150-mil SOIC-TUBE, Pb free	Industrial
ASM5P2304AG-1-08-SR	5P2304AG-1	8-pin 150-mil SOIC-TAPE & REEL, Green	Commercial
ASM5P2304AG-1-08-ST	5P2304AG-1	8-pin 150-mil SOIC-TUBE, Green	Commercial
ASM5I2304AG-1-08-SR	5I2304AG-1	8-pin 150-mil SOIC-TAPE & REEL, Green	Industrial
ASM5I2304AG-1-08-ST	5I2304AG-1	8-pin 150-mil SOIC-TUBE, Green	Industrial
ASM5P2304AG-1H-08-SR	5P2304AG-1H	8-pin 150-mil SOIC-TAPE & REEL, Green	Commercial
ASM5P2304AG-1H-08-ST	5P2304AG-1H	8-pin 150-mil SOIC-TUBE, Green	Commercial
ASM5I2304AG-1H-08-SR	5I2304AG-1H	8-pin 150-mil SOIC-TAPE & REEL, Green	Industrial
ASM5I2304AG-1H-08-ST	5I2304AG-1H	8-pin 150-mil SOIC-TUBE, Green	Industrial
ASM5P2304AG-2-08-SR	5P2304AG-2	8-pin 150-mil SOIC-TAPE & REEL, Green	Commercial
ASM5P2304AG-2-08-ST	5P2304AG-2	8-pin 150-mil SOIC-TUBE, Green	Commercial
ASM5I2304AG-2-08-SR	5I2304AG-2	8-pin 150-mil SOIC-TAPE & REEL, Green	Industrial
ASM5I2304AG-2-08-ST	5I2304AG-2	8-pin 150-mil SOIC-TUBE, Green	Industrial
ASM5P2304AG-2H-08-SR	5P2304AG-2H	8-pin 150-mil SOIC-TAPE & REEL, Green	Commercial
ASM5P2304AG-2H-08-ST	5P2304AG-2H	8-pin 150-mil SOIC-TUBE, Green	Commercial
ASM5I2304AG-2H-08-SR	5I2304AG-2H	8-pin 150-mil SOIC-TAPE & REEL, Green	Industrial
ASM5I2304AG-2H-08-ST	5I2304AG-2H	8-pin 150-mil SOIC-TUBE, Green	Industrial

Device Ordering Information



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