



## Low Voltage 1:18 Clock Distribution Chip

### Features

- LVPECL Clock Input
- 2.5V LVCMOS Outputs for Pentium II™ Microprocessor Support
- 200pS Maximum Targeted Output-to-Output Skew
- Maximum Output Frequency of 250MHz @3.3 V<sub>CC</sub>
- 32-Lead LQFP and TQFP Packaging
- Single 3.3V or 2.5V Supply
- Pin and Function compatible with MPC942P

### Functional Description

The ASM2I9942P is a 1:18 low voltage clock distribution chip with 2.5V or 3.3V LVCMOS output capabilities. The device is offered in two versions; the ASM2I9942C has an LVCMOS input clock while the ASM2I9942P has a LVPECL input clock. The 18 outputs are 2.5V or 3.3V LVCMOS compatible and feature the drive strength to drive 50Ω series or parallel terminated transmission lines. With output-to-output skews of 200pS, the ASM2I9942P is ideal as a clock distribution chip for the most demanding of synchronous systems. The 2.5V outputs also make the device ideal for supplying clocks for a high performance Pentium II™ microprocessor based design.

\* Pentium II is a trademark of Intel Corporation

With low output impedance ( $\approx 12\Omega$ ), in both the HIGH and LOW logic states, the output buffers of the ASM2I9942P are ideal for driving series terminated transmission lines. With an output impedance of  $12\Omega$ , the ASM2I9942P can drive two series terminated transmission lines from each output. This capability gives the ASM2I9942P an effective fanout of 1:36. The ASM2I9942P provides enough copies of low skew clocks for most high performance synchronous systems.

The differential LVPECL inputs of the ASM2I9942P allow the device to interface directly with a LVPECL fanout buffer to build very wide clock fanout trees or to couple to a high frequency clock source. The OE pins will place the outputs into a high impedance state. The OE pin has an internal pullup resistor.

The ASM2I9942P is a single supply device. The V<sub>CC</sub> power pins require either 2.5V or 3.3V. The 32 lead LQFP and TQFP package is chosen to optimize performance, board space and cost of the device. The 32-lead LQFP and TQFP have a 7x7mm<sup>2</sup> body size with conservative 0.8mm pin spacing.

### Block Diagram

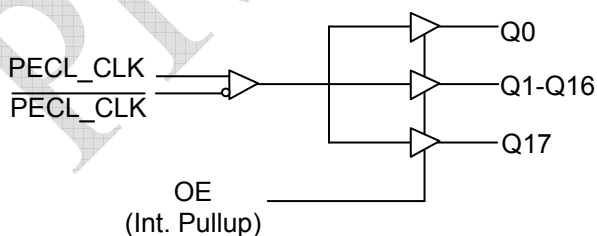


Table 1. Function Table

OE	Output
0	HIGH IMPEDANCE
1	OUTPUTS ENABLED



rev 0.3  
Pin Diagram

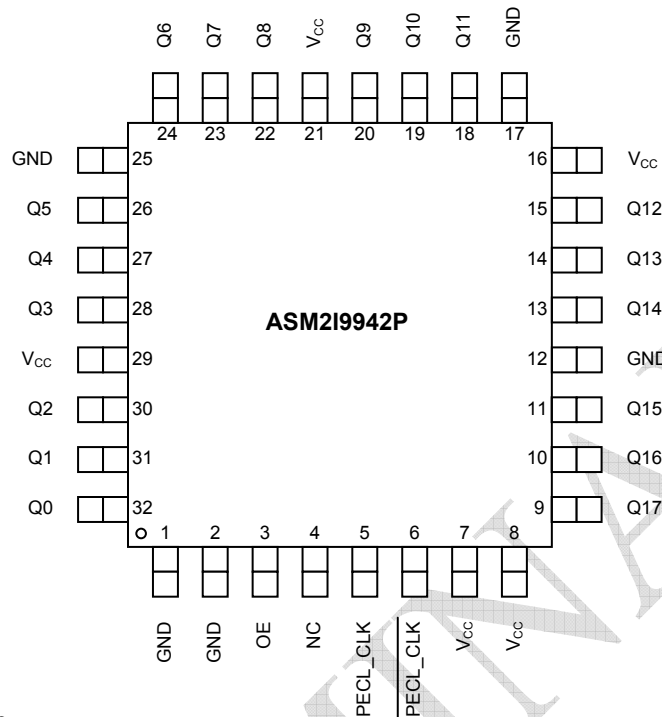


Table 2. Pin Description

Pin #	Pin Name	I/O	Type	Function
5 6	PECL_CLK, PECL_CLK	Input	LVPECL	LVPECL Clock Inputs
3	OE	Input	LVC MOS	Output enable/disable (high-impedance tristate)
4	NC	-	-	No connect
32,31,30,28,27,26,24,23,22,20,19,18,15, 14,13,11,10,9	Q0 – Q17	Output	LVC MOS	Clock outputs
1,2,12,17,25	GND	Supply	Ground	Negative power supply (GND) for I/O and core.
7,8,16,21,29	V <sub>CC</sub>	Supply	V <sub>CC</sub>	Positive power supply for I/O and core. All V <sub>CC</sub> pins must be connected to the positive power supply for correct operation

Table 3. Absolute Maximum Rating<sup>1</sup>

Symbol	Parameter	Min	Max	Unit
V <sub>CC</sub>	Supply Voltage	-0.3	3.6	V
V <sub>I</sub>	Input Voltage	-0.3	V <sub>CC</sub> + 0.3	V
I <sub>IN</sub>	Input Current		±20	mA
T <sub>Stor</sub>	Storage Temperature Range	-40	125	°C

Note: 1. 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.



## rev 0.3

**Table 4. DC Characteristics** ( $T_A = 0^\circ\text{ to }70^\circ\text{C}$ ,  $V_{CC} = 2.5\text{V} \pm 5\%$ )

Symbol	Characteristic	Min	Typ	Max	Unit	Condition
$V_{IH}$	Input HIGH Voltage	2.0		$V_{CC}$	V	
$V_{IL}$	Input LOW Voltage			0.8	V	
$V_{PP}$	Input Swing PECL_CLK	0.6		1.0	V	
$V_X$	Input Crosspoint PECL_CLK	$V_{CC}-1.0$		$V_{CC}-0.6$	V	
$V_{OH}$	Output HIGH Voltage	2.0			V	$I_{OH} = -16\text{ mA}$
$V_{OL}$	Output LOW Voltage			0.5	V	$I_{OL} = 16\text{ mA}$
$I_{IN}$	Input Current			$\pm 200$	$\mu\text{A}$	
$C_{IN}$	Input Capacitance		4.0		pF	
$C_{PD}$	Power Dissipation Capacitance		14		pF	Per Output
$Z_{OUT}$	Output Impedance		12		$\Omega$	
$I_{CC}$	Maximum Quiescent Supply Current		0.5	5.0	mA	

**Table 5. AC Characteristics** ( $T_A = 0^\circ\text{ to }70^\circ\text{C}$ ,  $V_{CC} = 2.5\text{V} \pm 5\%$ )

Symbol	Characteristic	Min	Typ	Max	Unit	Condition
$F_{max}$	Maximum Frequency			200	MHz	
$t_{PLH}$	Propagation Delay	1.8		4.0	nS	
$t_{PHL}$	Propagation Delay	2.0		4.3	nS	
$t_{sk(o)}$	Output-to-Output Skew within one bank			150	pS	
$t_{sk(pr)}^1$	Part-to-Part Skew <sup>1</sup>			2.2	nS	
$t_{sk(pr)}^2$	Part-to-Part Skew <sup>2</sup>			1.3	pS	
$t_r, t_f$	Output Rise/Fall Time	0.1		1.0	nS	

Note: 1. Across temperature and voltage ranges, includes output skew.  
 2. For a specific temperature and voltage, includes output skew.

**Table 6. DC Characteristics** ( $T_A = 0^\circ\text{ to }70^\circ\text{C}$ ,  $V_{CC} = 3.3\text{V} \pm 5\%$ )

Symbol	Characteristic	Min	Typ	Max	Unit	Condition
$V_{IH}$	Input HIGH Voltage	2.4		$V_{CC}$	V	
$V_{IL}$	Input LOW Voltage			0.8	V	
$V_{PP}$	Input Swing PECL_CLK	0.6		1.0	V	
$V_X$	Input Crosspoint PECL_CLK	$V_{CC}-1.0$		$V_{CC}-0.6$	V	
$V_{OH}$	Output HIGH Voltage	2.4			V	$I_{OH} = -20\text{ mA}$
$V_{OL}$	Output LOW Voltage			0.6	V	$I_{OL} = 20\text{ mA}$
$I_{IN}$	Input Current			$\pm 200$	$\mu\text{A}$	
$C_{IN}$	Input Capacitance		4.0		pF	
$C_{PD}$	Power Dissipation Capacitance		14		pF	Per Output
$Z_{OUT}$	Output Impedance		12		$\Omega$	
$I_{CC}$	Maximum Quiescent Supply Current		0.5	5.0	mA	



## rev 0.3

**Table 7. AC Characteristics** ( $T_A = 0^\circ\text{to } 70^\circ\text{C}$ ,  $V_{CC} = 3.3\text{V} \pm 5\%$ )

Symbol	Characteristic	Min	Typ	Max	Unit	Condition
$F_{\max}$	Maximum Frequency			250	MHz	
$t_{PLH}$	Propagation Delay	1.5		3.2	nS	
$t_{PHL}$	Propagation Delay	1.5		3.6	nS	
$t_{sk(o)}$	Output-to-output Skew within one bank			150	pS	
$t_{sk(pr)}$	Part-to-Part Skew <sup>1</sup>			1.7	nS	
$t_{sk(pr)}$	Part-to-Part Skew <sup>2</sup>			1.0	pS	
$t_r, t_f$	Output Rise/Fall Time	0.1		1.0	nS	

Note: 1. Across temperature and voltage ranges, includes output skew.

2. For a specific temperature and voltage, includes output skew.

PRELIMINARY



## rev 0.3

### Power Consumption of the ASM2I9942P and Thermal Management

The ASM2I9942P AC specification is guaranteed for the entire operating frequency range up to 250MHz. The ASM2I9942P power consumption and the associated long-term reliability may decrease the maximum frequency limit, depending on operating conditions such as clock frequency, supply voltage, output loading, ambient temperature, vertical convection and thermal conductivity of package and board. This section describes the impact of these parameters on the junction temperature and gives a guideline to estimate the ASM2I9942P die junction temperature and the associated device reliability.

**Table 8. Die junction temperature and MTBF**

Junction temperature (°C)	MTBF (Years)
100	20.4
110	9.1
120	4.2
130	2.0

Increased power consumption will increase the die junction temperature and impact the device reliability (MTBF). According to the system-defined tolerable MTBF, the die junction temperature of the ASM2I9942P needs to be controlled and the thermal impedance of the board/package should be optimized. The power dissipated in the ASM2I9942P is represented in equation 1.

Where  $I_{CCQ}$  is the static current consumption of the ASM2I9942P,  $C_{PD}$  is the power dissipation capacitance

$$P_{TOT} = \left[ I_{CCQ} + V_{CC} \cdot f_{CLOCK} \cdot \left( N \cdot C_{PD} + \sum_M C_L \right) \right] \cdot V_{CC} \quad \text{Equation 1}$$

$$P_{TOT} = V_{CC} \cdot \left[ I_{CCQ} + V_{CC} \cdot f_{CLOCK} \cdot \left( N \cdot C_{PD} + \sum_M C_L \right) \right] + \sum_P \left[ DC_Q \cdot I_{OH} (V_{CC} - V_{OH}) + (1 - DC_Q) \cdot I_{OL} \cdot V_{OL} \right] \quad \text{Equation 2}$$

$$T_J = T_A + P_{TOT} \cdot R_{thja} \quad \text{Equation 3}$$

$$f_{CLOCKMAX} = \frac{1}{C_{PD} \cdot N \cdot V_{CC}^2} \cdot \left[ \frac{T_{JMAX} - T_A}{R_{thja}} - (I_{CCQ} \cdot V_{CC}) \right] \quad \text{Equation 4}$$

per output,  $(M)\Sigma C_L$  represents the external capacitive output load,  $N$  is the number of active outputs ( $N$  is always 12 in case of the ASM2I9942P). The ASM2I9942P supports driving transmission lines to maintain high signal integrity and tight timing parameters. Any transmission line will hide the lumped capacitive load at the end of the board trace, therefore,  $\Sigma C_L$  is zero for controlled transmission line systems and can be eliminated from equation 1. Using parallel termination output termination results in equation 2 for power dissipation.

In equation 2,  $P$  stands for the number of outputs with a parallel or thevenin termination,  $V_{OL}$ ,  $I_{OL}$ ,  $V_{OH}$  and  $I_{OH}$  are a function of the output termination technique and  $DC_Q$  is the clock signal duty cycle. If transmission lines are used  $\Sigma C_L$  is zero in equation 2 and can be eliminated. In general, the use of controlled transmission line techniques eliminates the impact of the lumped capacitive loads at the end lines and greatly reduces the power dissipation of the device. Equation 3 describes the die junction temperature  $T_J$  as a function of the power consumption.

Where  $R_{thja}$  is the thermal impedance of the package (junction to ambient) and  $T_A$  is the ambient temperature. According to Table 8, the junction temperature can be used to estimate the long-term device reliability. Further, combining equation 1 and equation 2 results in a maximum operating frequency for the ASM2I9942P in a series terminated transmission line system, equation 4.



## rev 0.3

$T_{J,MAX}$  should be selected according to the MTBF system requirements and Table 8.  $R_{thja}$  can be derived from Table 9. The  $R_{thja}$  represent data based on 1S2P boards, using 2S2P boards will result in lower thermal impedance than indicated below.

**Table 9. Thermal package impedance of the 32LQFP**

Convection, LFPM	$R_{thja}$ (1P2S board), °C/W	$R_{thja}$ (2P2S board), °C/W
Still air	86	61
100 lfpm	76	56
200 lfpm	71	54
300 lfpm	68	53
400 lfpm	66	52
500 lfpm	60	49

If the calculated maximum frequency is below 350 MHz, it becomes the upper clock speed limit for the given application conditions. The following eight derating charts describe the safe frequency operation range for the ASM2I9942P. The charts were calculated for a maximum tolerable die junction temperature of 110°C (120°C), corresponding to an estimated MTBF of 9.1 years

(4 years), a supply voltage of 3.3V and series terminated transmission line or capacitive loading. Depending on a given set of these operating conditions and the available device convection a decision on the maximum operating frequency can be made.

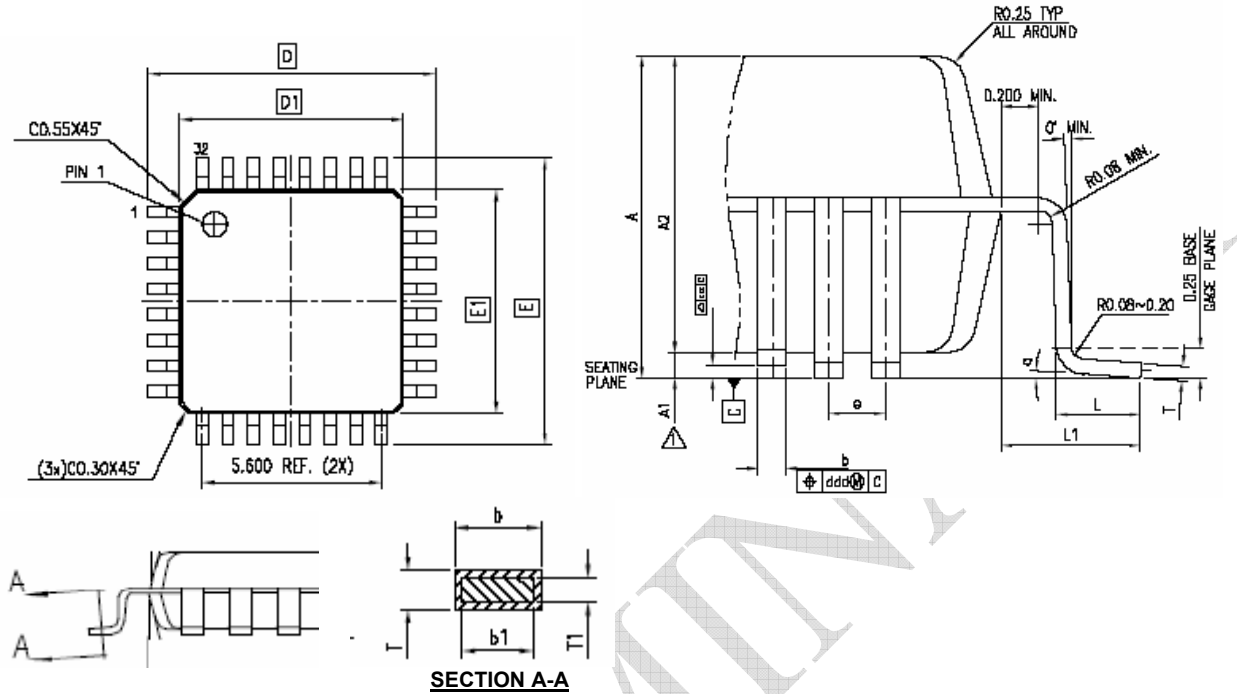
PRELIMINARY



rev 0.3

Package Information

32-lead TQFP Package

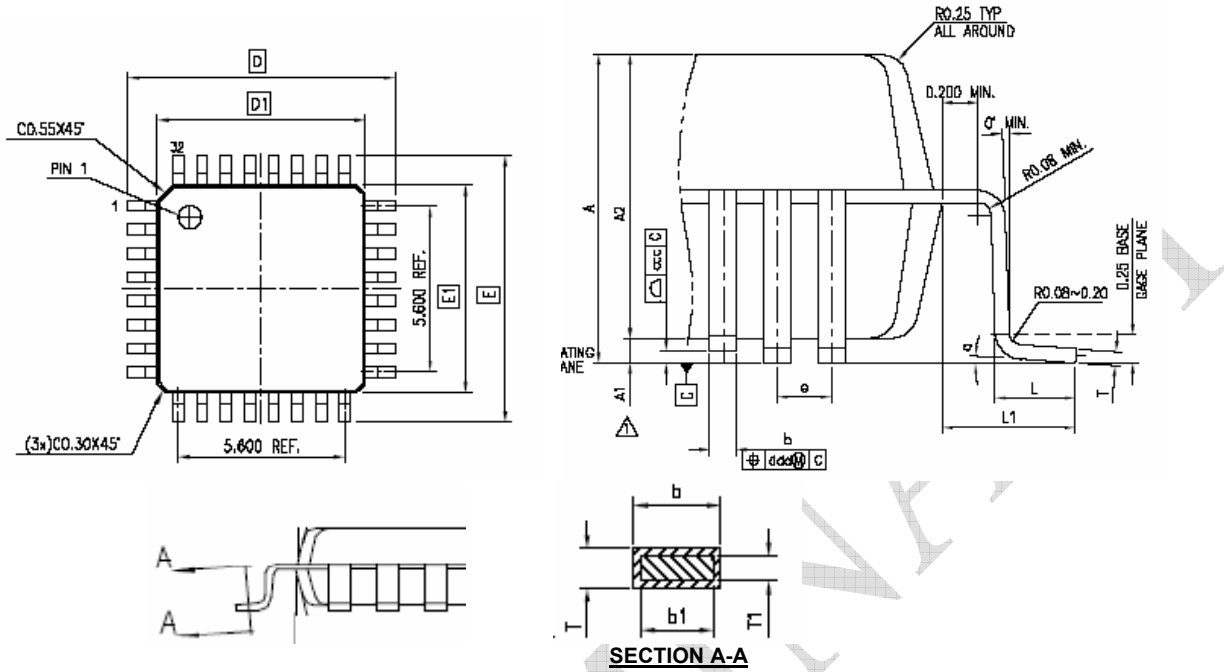


Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	....	0.0472	...	1.2
A1	0.0020	0.0059	0.05	0.15
A2	0.0374	0.0413	0.95	1.05
D	0.3465	0.3622	8.8	9.2
D1	0.2717	0.2795	6.9	7.1
E	0.3465	0.3622	8.8	9.2
E1	0.2717	0.2795	6.9	7.1
L	0.0177	0.0295	0.45	0.75
L1	0.03937 REF		1.00 REF	
T	0.0035	0.0079	0.09	0.2
T1	0.0038	0.0062	0.097	0.157
b	0.0118	0.0177	0.30	0.45
b1	0.0118	0.0157	0.30	0.40
R0	0.0031	0.0079	0.08	0.2
a	0°	7°	0°	7°
e	0.031 BASE		0.8 BASE	





32-lead LQFP Package



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	....	0.0630	...	1.6
A1	0.0020	0.0059	0.05	0.15
A2	0.0531	0.0571	1.35	1.45
D	0.3465	0.3622	8.8	9.2
D1	0.2717	0.2795	6.9	7.1
E	0.3465	0.3622	8.8	9.2
E1	0.2717	0.2795	6.9	7.1
L	0.0177	0.0295	0.45	0.75
L1	0.03937 REF		1.00 REF	
T	0.0035	0.0079	0.09	0.2
T1	0.0038	0.0062	0.097	0.157
b	0.0118	0.0177	0.30	0.45
b1	0.0118	0.0157	0.30	0.40
R0	0.0031	0.0079	0.08	0.20
e	0.031 BASE		0.8 BASE	
a	0°	7°	0°	7°



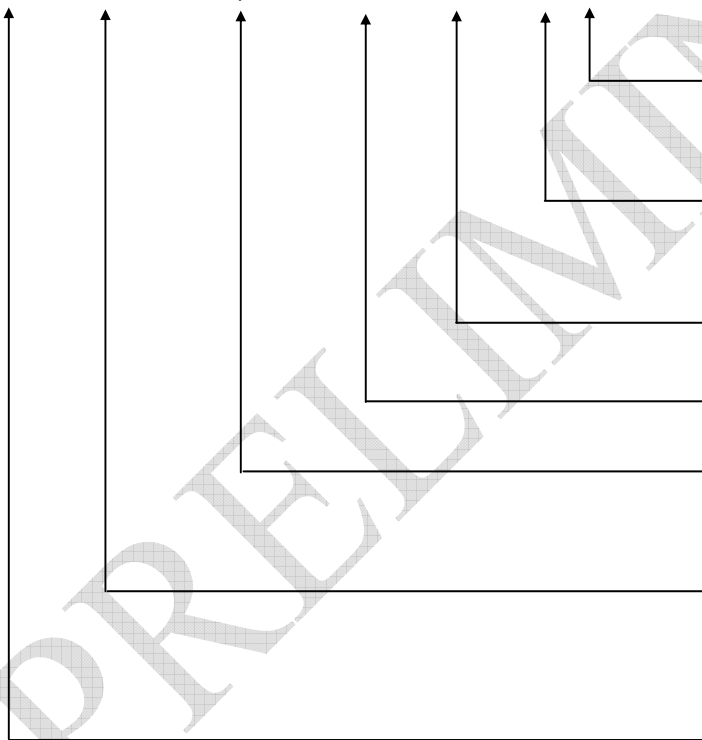


rev 0.3  
Ordering Information

Ordering Code	Marking	Package Type	Operating Range
ASM219942P-32-LT	ASM219942PL	32-pin LQFP, Tray	Industrial
ASM219942P-32-LR	ASM219942PL	32-pin LQFP, Tape and Reel	Industrial
ASM219942PG-32-LT	ASM219942PGL	32-pin LQFP, Tray, Green	Industrial
ASM219942PG-32-LR	ASM219942PGL	32-pin LQFP, Tape and Reel, Green	Industrial
ASM219942P-32-ET	ASM219942PE	32-pin TQFP, Tray	Industrial
ASM219942P-32-ER	ASM219942PE	32-pin TQFP, Tape and Reel	Industrial
ASM219942PG-32-ET	ASM219942PGE	32-pin TQFP, Green	Industrial
ASM219942PG-32-ER	ASM219942PGE	32-pin TQFP, Tape and Reel, Green	Industrial

Device Ordering Information

A S M 2 1 9 9 4 2 P G - 3 2 - L R



R = Tape & reel, T = Tube or Tray	
O = SOT S = SOIC T = TSSOP A = SSOP V = TVSOP B = BGA Q = QFN	U = MSOP E = TQFP L = LQFP U = MSOP P = PDIP D = QSOP X = SC-70
DEVICE PIN COUNT	
F = LEAD FREE AND RoHS COMPLIANT PART G = GREEN PACKAGE	
PART NUMBER	
X= Automotive (-40C to +125C)    I= Industrial (-40C to +85C)    P or n/c = Commercial (0C to +70C)	
1 = Reserved 2 = Non PLL based 3 = EMI Reduction 4 = DDR support products 5 = STD Zero Delay Buffer	6 = Power Management 7 = Power Management 8 = Power Management 9 = Hi Performance 0 = Reserved
ALLIANCE SEMICONDUCTOR MIXED SIGNAL PRODUCT	

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



Alliance Semiconductor Corporation  
2575, Augustine Drive,  
Santa Clara, CA 95054  
Tel# 408-855-4900  
Fax: 408-855-4999  
www.alsc.com

Copyright © Alliance Semiconductor  
All Rights Reserved  
Part Number: ASM2I9942P  
Document Version: 0.3

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

© Copyright 2003 Alliance Semiconductor Corporation. All rights reserved. Our three-point logo, our name and Intelliwatt are trademarks or registered trademarks of Alliance. All other brand and product names may be the trademarks of their respective companies. Alliance reserves the right to make changes to this document and its products at any time without notice. Alliance assumes no responsibility for any errors that may appear in this document. The data contained herein represents Alliance's best data and/or estimates at the time of issuance. Alliance reserves the right to change or correct this data at any time, without notice. If the product described herein is under development, significant changes to these specifications are possible. The information in this product data sheet is intended to be general descriptive information for potential customers and users, and is not intended to operate as, or provide, any guarantee or warranty to any user or customer. Alliance does not assume any responsibility or liability arising out of the application or use of any product described herein, and disclaims any express or implied warranties related to the sale and/or use of Alliance products including liability or warranties related to fitness for a particular purpose, merchantability, or infringement of any intellectual property rights, except as express agreed to in Alliance's Terms and Conditions of Sale (which are available from Alliance). All sales of Alliance products are made exclusively according to Alliance's Terms and Conditions of Sale. The purchase of products from Alliance does not convey a license under any patent rights, copyrights; mask works rights, trademarks, or any other intellectual property rights of Alliance or third parties. Alliance does not authorize its products for use as critical components in life-supporting systems where a malfunction or failure may reasonably be expected to result in significant injury to the user, and the inclusion of Alliance products in such life-supporting systems implies that the manufacturer assumes all risk of such use and agrees to indemnify Alliance against all claims arising from such use.