

## 阅读申明

- 1.本站收集的数据手册和产品资料都来自互联网，版权归原作者所有。如读者和版权方有任何异议请及时告之，我们将妥善解决。
- 2.本站提供的中文数据手册是英文数据手册的中文翻译，其目的是协助用户阅读，该译文无法自动跟随原稿更新，同时也可能存在翻译上的不当。建议读者以英文原稿为参考以便获得更精准的信息。
- 3.本站提供的产品资料，来自厂商的技术支持或者使用者的心得体会等，其内容可能存在描述上的差异，建议读者做出适当判断。
- 4.如需与我们联系，请发邮件到marketing@iczoom.com，主题请标有“数据手册”字样。

## Read Statement

1. The datasheets and other product information on the site are all from network reference or other public materials, and the copyright belongs to the original author and original published source. If readers and copyright owners have any objections, please contact us and we will deal with it in a timely manner.
2. The Chinese datasheets provided on the website is a Chinese translation of the English datasheets. Its purpose is for reader's learning exchange only and do not involve commercial purposes. The translation cannot be automatically updated with the original manuscript, and there may also be improper translations. Readers are advised to use the English manuscript as a reference for more accurate information.
3. All product information provided on the website refer to solutions from manufacturers' technical support or users the contents may have differences in description, and readers are advised to take the original article as the standard.
4. If you have any questions, please contact us at marketing@iczoom.com and mark the subject with "Datasheets" .

## General Description

The 843001I-22 is a highly versatile, low phase noise LVPECL/LVCMOS Synthesizer which can generate low jitter reference clocks for a variety of communications applications and is a member of the family of high performance clock solutions from IDT. The dual crystal interface allows the synthesizer to support up to two communication standards in a given application (i.e. 1Gb Ethernet with a 25MHz crystal and 1Gb Fibre Channel using a 26.5625MHz crystal). The rms phase jitter performance is typically less than 1ps, thus making the device acceptable for use in demanding applications such as OC48 SONET and 10Gb Ethernet. The 843001I-22 is packaged in a small 24-pin TSSOP package.

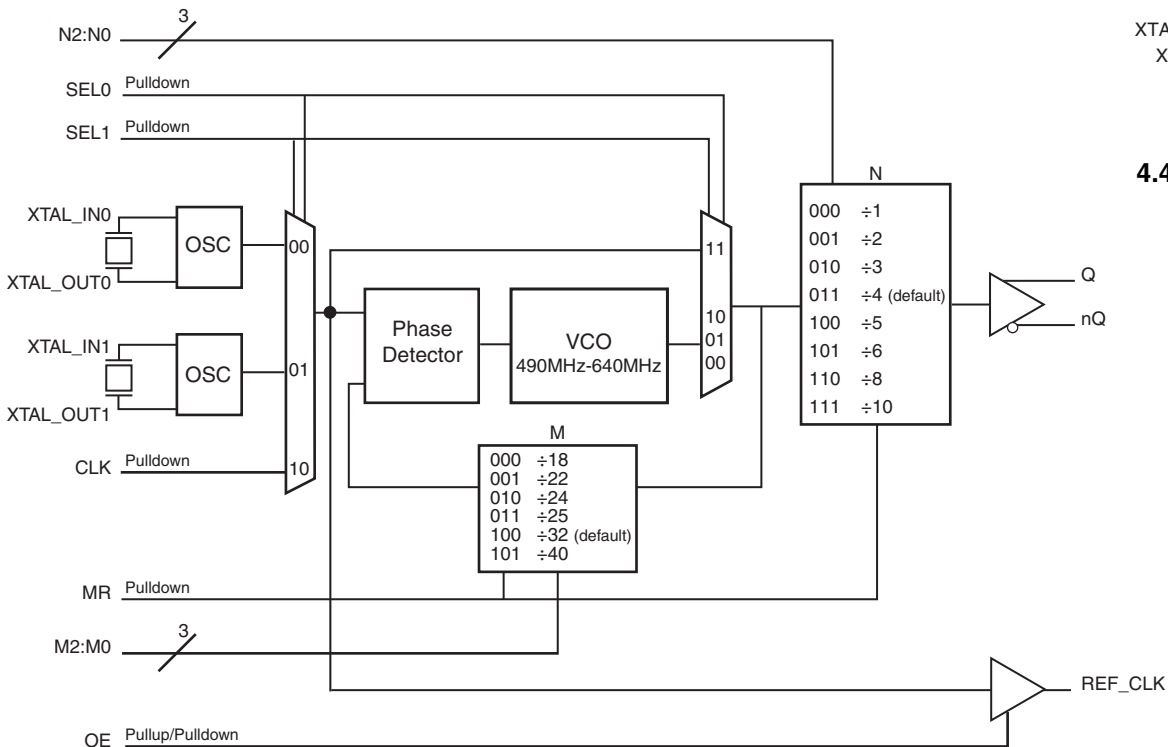
### Control Input Function Table

Input	Outputs	
OE	Q/nQ	REF_OUT
0	High-Impedance	High-Impedance
1	High-Impedance	Active
FLOAT	Active	High-Impedance

## Features

- One 3.3V differential LVPECL output pair and one LVCMOS/LVTTL single-ended reference clock output
- Selectable crystal oscillator interface or LVCMOS/LVTTL single-ended input
- VCO range: 490MHz – 640MHz
- Output frequency range: 49MHz – 640MHz
- Supports the following applications: SONET, Ethernet, Fibre Channel, Serial ATA, and HDTV
- RMS phase jitter @ 125MHz (1.875MHz - 20MHz): 0.50ps (typical)
- Full 3.3V or 2.5V supply mode
- -40°C to 85°C ambient operating temperature
- Available in lead-free (RoHS 6) package

## Block Diagram



## Pin Assignment

VCCO_LVCMOS	1	24	REF_OUT
N0	2	23	VEE
N1	3	22	OE
N2	4	21	M2
VCCO_LVPECL	5	20	M1
Q	6	19	M0
nQ	7	18	MR
VEE	8	17	SEL1
VCCA	9	16	SEL0
VCC	10	15	CLK
XTAL_OUT1	11	14	XTAL_IN0
XTAL_IN1	12	13	XTAL_OUT0

**843001I-22**  
**24-Lead TSSOP**  
**4.4mm x 7.8mm x 0.925mm**  
**package body**  
**G Package**  
**Top View**

**Table 1. Pin Descriptions**

Number	Name	Type		Description
1	V <sub>CCO_LVCMOS</sub>	Power		Output supply pin for REF_CLK output.
2, 3	N0, N1	Input	Pullup	Output divider select pins. Default ÷4. LVCMOS/LVTTL interface levels. See Table 3C.
4	N2	Input	Pulldown	
5	V <sub>CCO_LVPECL</sub>	Power		Output supply pin for LVPECL output.
6, 7	Q, nQ	Output		Differential output pair. LVPECL interface levels.
8, 23	V <sub>EE</sub>	Power		Negative supply pins.
9	V <sub>CCA</sub>	Power		Analog supply pin.
10	V <sub>CC</sub>	Power		Core supply pin.
11, 12	XTAL_OUT1, XTAL_IN1	Input		Parallel resonant crystal interface. XTAL_OUT1 is the output, XTAL_IN1 is the input.
13, 14	XTAL_OUT0, XTAL_IN0	Input		Parallel resonant crystal interface. XTAL_OUT0 is the output, XTAL_IN0 is the input.
15	CLK	Input	Pulldown	LVCMOS/LVTTL clock input.
16, 17	SEL0, SEL1	Input	Pulldown	Input MUX select pins. LVCMOS/LVTTL interface levels. See Table 3D.
18	MR	Input	Pulldown	Active HIGH Master Reset. When logic HIGH, the internal dividers are reset causing the true output Q to go low and the inverted output nQ to go high. When logic LOW, the internal dividers and the outputs are enabled. LVCMOS/LVTTL interface levels.
19, 20	M0, M1	Input	Pulldown	Feedback divider select pins. Default value = ÷32. See Table 3B. LVCMOS/LVTTL interface levels.
21	M2	Input	Pullup	
22	OE	Input		3-State clock output enable, (High/Low/Float). See page 1, <i>Control Input Function Table</i> .
24	REF_OUT	Output		Reference clock output. LVCMOS/LVTTL interface levels.

NOTE: *Pullup* and *Pulldown* refer to internal input resistors. See Table 2, *Pin Characteristics*, for typical values.

**Table 2. Pin Characteristics**

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
C <sub>IN</sub>	Input Capacitance			4		pF
R <sub>PULLUP</sub>	Input Pullup Resistor			51		kΩ
R <sub>PULLDOWN</sub>	Input Pulldown Resistor			51		kΩ
R <sub>OUT</sub>	Output Impedance	REF_OUT		15		Ω

## Function Tables

**Table 3A. Common Configuration Table**

Input Reference Clock (MHz)	M Divider Value	N Divider Value	VCO (MHz)	Output Frequency (MHz)	Application
27	22	8	594	74.25	HDTV
22.4	25	8	560	70	
24.75	24	8	594	74.25	HDTV
25	24	3	600	200	Processor
14.8351649	40	8	593.4066	74.1758245	HDTV
19.44	32	4	622.08	155.52	SONET
19.44	32	8	622.08	77.76	SONET
19.44	32	1	622.08	622.08	SONET
19.44	32	2	622.08	311.04	SONET
19.53125	32	4	625	156.25	10 GigE
20	25	2	500	250	Ethernet
25	25	5	625	125	1 GigE
25	25	10	625	62.5	1 GigE
25	24	6	600	100	PCI Express
25	24	4	600	150	SATA
25	24	8	600	75	SATA
26.5625	24	6	637.5	106.25	Fibre Channel 1
26.5625	24	3	637.5	212.5	4 Gig Fibre Channel
26.5625	24	4	637.5	159.375	10 Gig Fibre Channel
31.25	18	3	562.5	187.5	12 GigE

**Table 3B. Programmable M Output Divider Function Table**

Inputs			M Divider Value	Input Frequency (MHz)	
M2	M1	M0		Minimum	Maximum
0	0	0	18	27.22	35.56
0	0	1	22	22.27	29.09
0	1	0	24	20.41	26.67
0	1	1	25	19.6	25.6
1	0	0	32	15.31	20
1	0	1	40	12.25	16

**Table 3C. Programmable N Output Divider Function Table**

Inputs			M Divider Value
N2	N1	N0	
0	0	0	1
0	0	1	2
0	1	0	3
0	1	1	4 (default)
1	0	0	5
1	0	1	6
1	1	0	8
1	1	1	10

**Table 3D. Bypass Mode Function Table**

Inputs		Reference	PLL Mode
SEL1	SEL0		
0	0	XTAL0	Active
0	1	XTAL1	Active
1	0	CLK	Active
1	1	CLK	Bypass

## Absolute Maximum Ratings

NOTE: Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These ratings are stress specifications only. Functional operation of product at these conditions or any conditions beyond those listed in the *DC Characteristics* or *AC Characteristics* is not implied. Exposure to absolute maximum rating conditions for extended periods may affect product reliability.

Item	Rating
Supply Voltage, $V_{CC}$	4.6V
Inputs, $V_I$	-0.5V to $V_{CC} + 0.5V$
Outputs, $I_O$ (LVPECL) Continuous Current Surge Current	50mA 100mA
Outputs, $V_O$ (LVCMOS)	-0.5V to $V_{CCO\_LVCMOS} + 0.5V$
Package Thermal Impedance, $\theta_{JA}$	70°C/W (0 mps)
Storage Temperature, $T_{STG}$	-65°C to 150°C

## DC Electrical Characteristics

**Table 4A. Power Supply DC Characteristics,  $V_{CC} = V_{CCO\_LVCMOS} = V_{CCO\_LVPECL} = 3.3V \pm 10\%$ ,  $V_{EE} = 0V$ ,  $T_A = -40^\circ C$  to  $85^\circ C$**

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$V_{CC}$	Core Supply Voltage		2.97	3.3	3.63	V
$V_{CCA}$	Analog Supply Voltage		2.97	3.3	3.63	V
$V_{CCO\_PECL}$ , $V_{CCO\_CMOS}$	Output Supply Voltage		2.97	3.3	3.63	V
$I_{EE}$	Power Supply Current				160	mA
$I_{CCO\_LVPECL} +$ $I_{CCO\_LVCMOS}$	Output Supply Current				8	mA

**Table 4B. Power Supply DC Characteristics,  $V_{CC} = V_{CCO\_LVCMOS} = V_{CCO\_LVPECL} = 2.5V \pm 5\%$ ,  $V_{EE} = 0V$ ,  $T_A = -40^\circ C$  to  $85^\circ C$**

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$V_{CC}$	Core Supply Voltage		2.375	2.5	2.625	V
$V_{CCA}$	Analog Supply Voltage		2.375	2.5	2.625	V
$V_{CCO\_PECL}$ , $V_{CCO\_CMOS}$	Output Supply Voltage		2.375	2.5	2.625	V
$I_{EE}$	Power Supply Current				155	mA
$I_{CCO\_LVPECL} +$ $I_{CCO\_LVCMOS}$	Output Supply Current				8	mA

**Table 4C. LVCMOS/LVTTL DC Characteristics,  $V_{CC} = V_{CCO\_LVCMOS} = 3.3V \pm 10\%$  or  $2.5V \pm 5\%$ ,  $V_{EE} = 0V$ ,  $T_A = -40^\circ C$  to  $85^\circ C$** 

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$V_{IH}$	Input High Voltage	$V_{CC} = 3.63V$	2		$V_{CC} + 0.3$	V
		$V_{CC} = 2.625V$	1.7		$V_{CC} + 0.3$	V
$V_{IM}$	Input Medium Voltage	$V_{CC} = 3.63V$				V
		$V_{CC} = 2.625V$				V
$V_{IL}$	Input Low Voltage	$V_{CC} = 3.63V$	-0.3		0.8	V
		$V_{CC} = 2.625V$	-0.3		0.7	V
$I_{IH}$	Input High Current	CLK, M0, M1, N2, MR, OE, SEL0, SEL1	$V_{CC} = V_{IN} = 3.63V$ or $2.625V$		150	$\mu A$
		M2, N0, N1	$V_{CC} = V_{IN} = 3.63V$ or $2.625V$		5	$\mu A$
$I_{IM}$	Input Medium Current					$\mu A$
$I_{IL}$	Input Low Current	CLK, M0, M1, N2, MR, OE, SEL0, SEL1	$V_{CC} = 3.63V$ or $2.625V$ , $V_{IN} = 0V$	-5		$\mu A$
		M2, N0, N1, OE	$V_{CC} = 3.63V$ or $2.625V$ , $V_{IN} = 0V$	-150		$\mu A$
$V_{OH}$	Output High Voltage: NOTE 1	REF_OUT	$V_{CCO\_LVCMOS} = 3.63V$	2.6		V
			$V_{CCO\_LVCMOS} = 2.625V$	1.8		V
$V_{OL}$	Output Low Voltage: NOTE 1	REF_OUT	$V_{CCO\_LVCMOS} = 3.63V$ or $2.625V$		0.5	V

NOTE 1: Output terminated with  $50\Omega$  to  $V_{CCO\_LVCMOS}/2$ . See Parameter Measurement Information Section, "3.3V LVCMOS Output Load Test Circuit Diagram".

**Table 4D. LVPECL DC Characteristics,  $V_{CC} = V_{CCO\_LVPECL} = 3.3V \pm 10\%$  or  $2.5V \pm 5\%$ ,  $V_{EE} = 0V$ ,  $T_A = -40^\circ C$  to  $85^\circ C$** 

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$V_{OH}$	Output High Current; NOTE 1		$V_{CCO} - 1.4$		$V_{CCO} - 0.9$	$\mu A$
$V_{OL}$	Output Low Current; NOTE 1		$V_{CCO} - 2.0$		$V_{CCO} - 1.7$	$\mu A$
$V_{SWING}$	Peak-to-Peak Output Voltage Swing		0.6		1.0	V

NOTE 1: Outputs termination with  $50\Omega$  to  $V_{CCO\_LVPECL} - 2V$ .

**Table 5. Crystal Characteristics**

Parameter	Test Conditions	Minimum	Typical	Maximum	Units
Mode of Oscillation		Fundamental			
Frequency		14		35.55	MHz
Equivalent Series Resistance (ESR)				50	$\Omega$
Shunt Capacitance				7	pF
Drive Level				1	mW

NOTE: Characterized using an 18pF parallel resonant crystal.

**Table 6. Input Frequency Characteristics,  $V_{CC} = V_{CCO\_LVCMOS} = V_{CCO\_LVPECL} = 3.3V \pm 10\%$ ,  $V_{EE} = 0V$ ,  $T_A = -40^\circ C$  to  $85^\circ C$** 

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$f_{IN}$	Input Frequency	CLK	SEL1 = 1, SEL0 = 0	14	35.55	MHz
		CLK	SEL1 = 1, SEL0 = 0	DC	250	MHz

## AC Electrical Characteristics

**Table 7A. AC Characteristics,  $V_{CC} = V_{CCO\_LVCMOS} = V_{CCO\_LVPECL} = 3.3V \pm 10\%$ ,  $V_{EE} = 0V$ ,  $T_A = -40^\circ C$  to  $85^\circ C$** 

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$f_{OUT}$	Output Frequency		49		640	MHz
$f_{jit}(\emptyset)$	RMS Phase Jitter, (Random); NOTE 1	125MHz, (1.875MHz – 20MHz)		0.50		ps
$f_{VCO}$	PLL VCO Lock Range		490		640	MHz
$t_R / t_F$	Output Rise/Fall Time	Q/nQ	20% to 80%	200	500	ps
		REF_OUT	20% to 80%	200	700	ps
odc	Output Duty Cycle	Q/nQ		45	55	%
		REF_OUT	$f \leq 250\text{MHz}$	44	56	%

NOTE: Electrical parameters are guaranteed over the specified ambient operating temperature range, which is established when the device is mounted in a test socket with maintained transverse airflow greater than 500 lfm. The device will meet specifications after thermal equilibrium has been reached under these conditions.

NOTE 1: Phase jitter measured using a crystal interface.



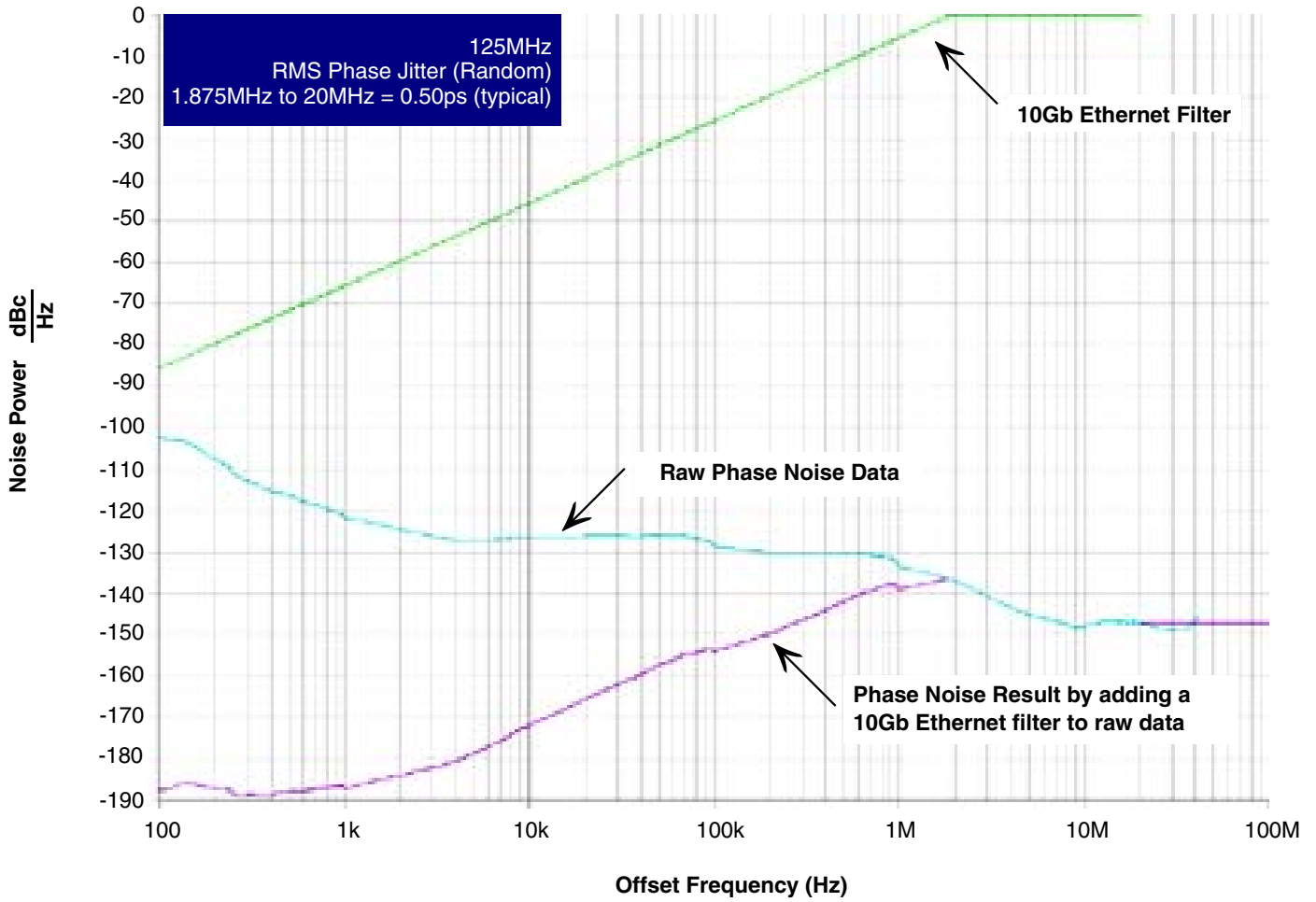
**Table 7B. AC Characteristics,  $V_{CC} = V_{CCO\_LVCMOS} = V_{CCO\_LVPECL} = 2.5V \pm 5\%$ ,  $V_{EE} = 0V$ ,  $T_A = -40^{\circ}C$  to  $85^{\circ}C$** 

Symbol	Parameter	Test Conditions	Minimum	Typical	Maximum	Units
$f_{OUT}$	Output Frequency		49		640	MHz
$\text{jit}(\emptyset)$	RMS Phase Jitter, (Random); NOTE 1	125MHz, (1.875MHz – 20MHz)		0.50		ps
$f_{VCO}$	PLL VCO Lock Range		490		640	MHz
$t_R / t_F$	Output Rise/Fall Time	Q/nQ	20% to 80%	200	500	ps
		REF_OUT	20% to 80%	300	800	ps
odc	Output Duty Cycle	Q/nQ		45	55	%
		REF_OUT	$f \leq 250\text{MHz}$	44	56	%

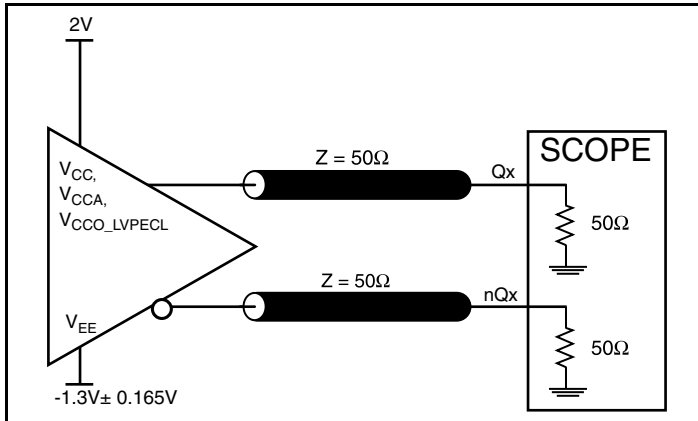
NOTE: Electrical parameters are guaranteed over the specified ambient operating temperature range, which is established when the device is mounted in a test socket with maintained transverse airflow greater than 500 lfm. The device will meet specifications after thermal equilibrium has been reached under these conditions.

NOTE 1: Phase jitter measured using a crystal interface.

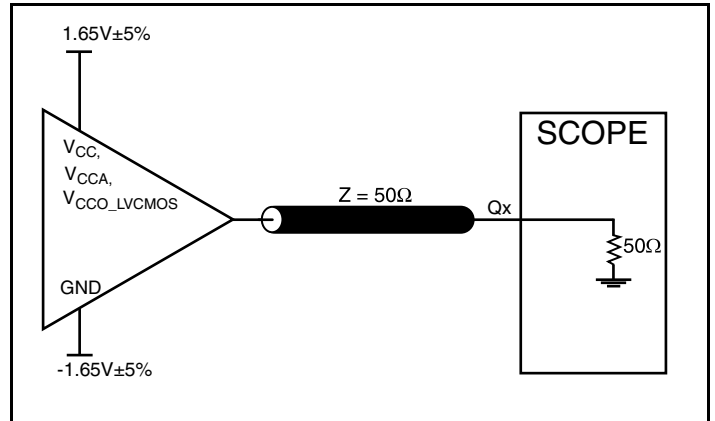
## Typical Phase Noise at 125MHz



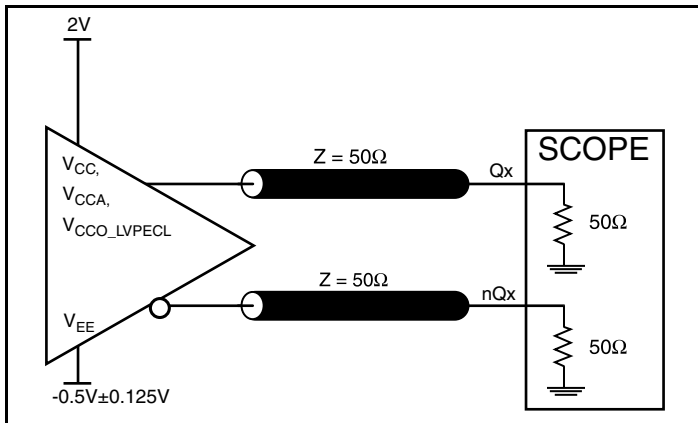
### Parameter Measurement Information



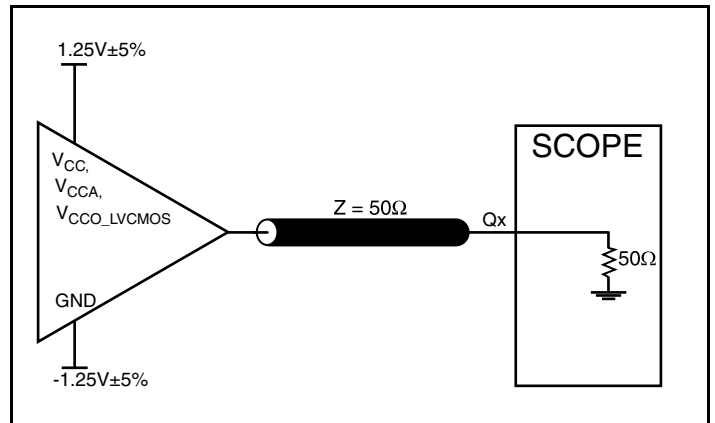
3.3V LVPECL Output Load AC Test Circuit



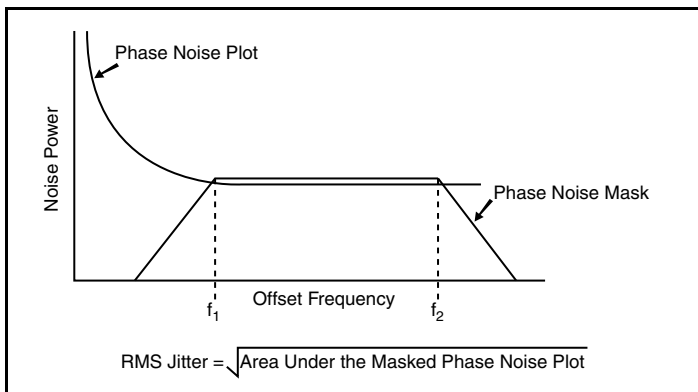
3.3V LVCMOS Output Load AC Test Circuit



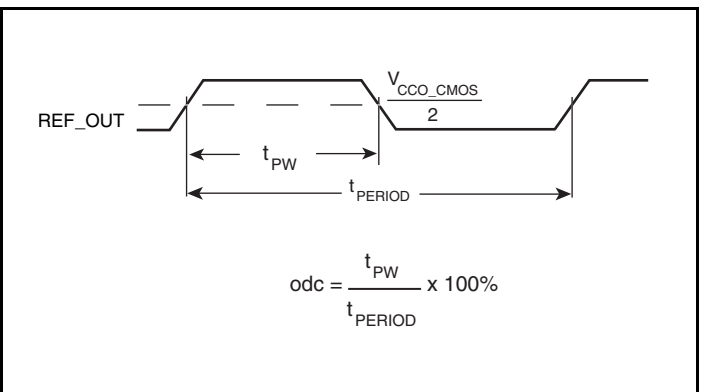
2.5V LVPECL Output Load AC Test Circuit



2.5V LVCMOS Output Load AC Test Circuit

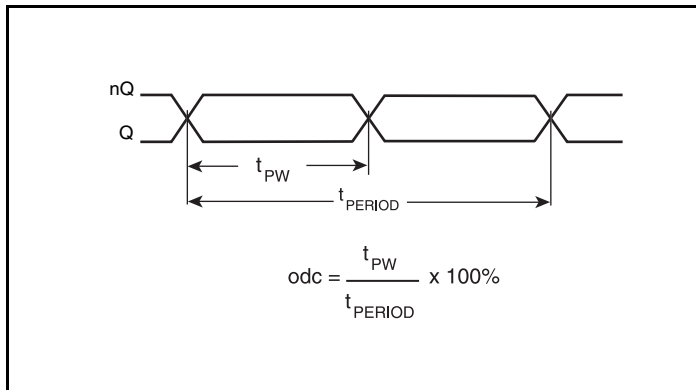


RMS Phase Jitter

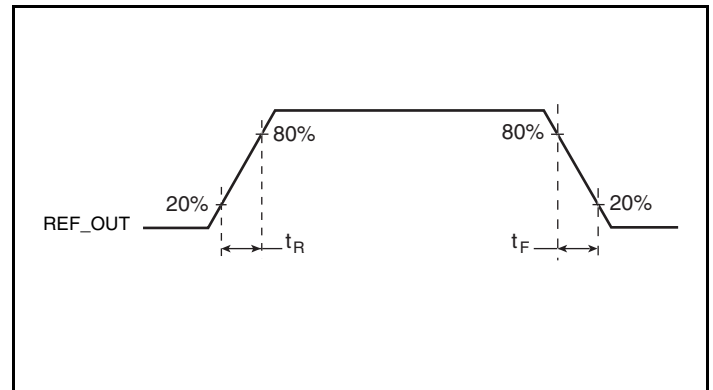


LVCMOS Output Duty Cycle/Pulse Width/Period

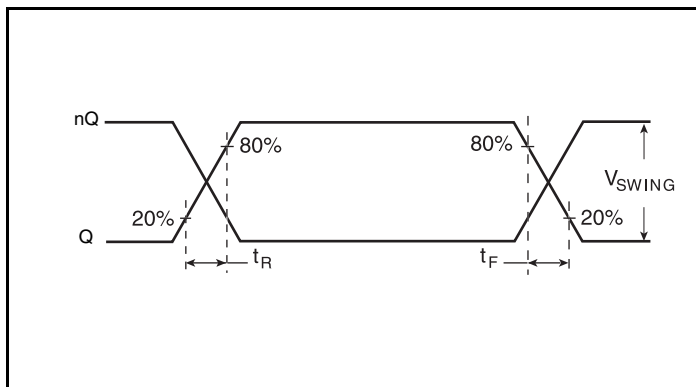
## Parameter Measurement Information, continued



LVPECL Output Duty Cycle/Pulse Width/Period



LVCMOS Output Rise/Fall Time



LVPECL Output Rise/Fall Time

## Application Information

### Power Supply Filtering Technique

As in any high speed analog circuitry, the power supply pins are vulnerable to random noise. To achieve optimum jitter performance, power supply isolation is required. The 8430011-22 provides separate power supplies to isolate any high switching noise from the outputs to the internal PLL.  $V_{CC}$ ,  $V_{CCA}$ ,  $V_{CCO\_X}$  should be individually connected to the power supply plane through vias, and  $0.01\mu\text{F}$  bypass capacitors should be used for each pin. *Figure 1* illustrates this for a generic  $V_{CC}$  pin and also shows that  $V_{CCA}$  requires that an additional  $10\Omega$  resistor along with a  $10\mu\text{F}$  bypass capacitor be connected to the  $V_{CCA}$  pin.

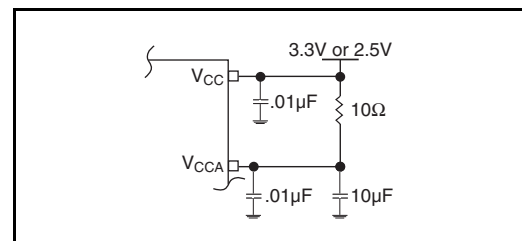
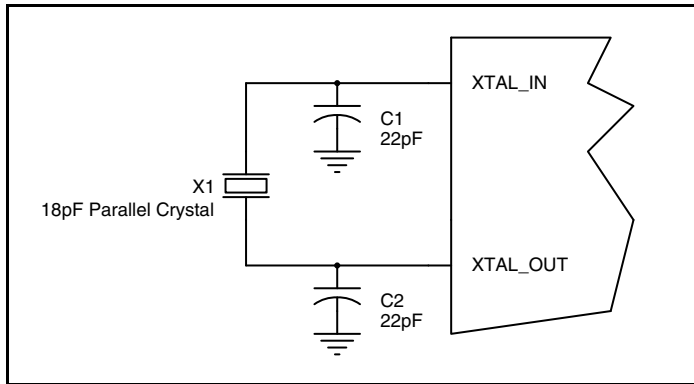


Figure 1. Power Supply Filtering

## Crystal Input Interface

The 843001I-22 has been characterized with 18pF parallel resonant crystals. The capacitor values shown in *Figure 2* below were

determined using a 26.5625MHz, 18pF parallel resonant crystal and were chosen to minimize the ppm error.

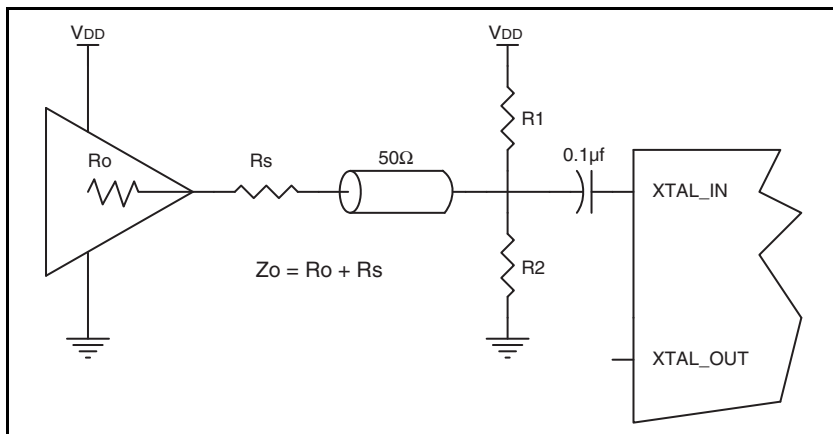


**Figure 2. Crystal Input Interface**

## LVC MOS to XTAL Interface

The XTAL\_IN input can accept a single-ended LVC MOS signal through an AC coupling capacitor. A general interface diagram is shown in *Figure 3*. The XTAL\_OUT pin can be left floating. The input edge rate can be as slow as 10ns. For LVC MOS signals, it is recommended that the amplitude be reduced from full swing to half swing in order to prevent signal interference with the power rail and to reduce noise. This configuration requires that the output impedance of the driver ( $R_o$ ) plus the series resistance ( $R_s$ ) equals

the transmission line impedance. In addition, matched termination at the crystal input will attenuate the signal in half. This can be done in one of two ways. First,  $R_1$  and  $R_2$  in parallel should equal the transmission line impedance. For most 50Ω applications,  $R_1$  and  $R_2$  can be 100Ω. This can also be accomplished by removing  $R_1$  and making  $R_2$  50Ω. By overdriving the crystal oscillator, the device will be functional, but note, the device performance is guaranteed by using a quartz crystal.



**Figure 3. General Diagram for LVC MOS Driver to XTAL Input Interface**

## Recommendations for Unused Input and Output Pins

### Inputs:

#### Crystal Inputs

For applications not requiring the use of the crystal oscillator input, both XTAL\_IN and XTAL\_OUT can be left floating. Though not required, but for additional protection, a 1k $\Omega$  resistor can be tied from XTAL\_IN to ground.

#### CLK Input

For applications not requiring the use of the clock input, it can be left floating. Though not required, but for additional protection, a 1k $\Omega$  resistor can be tied from the CLK input to ground.

#### LVC MOS Control Pins

All control pins have internal pullups or pulldowns; additional resistance is not required but can be added for additional protection. A 1k $\Omega$  resistor can be used.

### Outputs:

#### LVPECL Outputs

The unused LVPECL output pair can be left floating. We recommend that there is no trace attached. Both sides of the differential output pair should either be left floating or terminated.

#### LVC MOS Output

All unused LVC MOS output can be left floating. We recommend that there is no trace attached.

## Termination for 3.3V LVPECL Outputs

The clock layout topology shown below is a typical termination for LVPECL outputs. The two different layouts mentioned are recommended only as guidelines.

The differential outputs are low impedance follower outputs that generate ECL/LVPECL compatible outputs. Therefore, terminating resistors (DC current path to ground) or current sources must be used for functionality. These outputs are designed to drive 50 $\Omega$

transmission lines. Matched impedance techniques should be used to maximize operating frequency and minimize signal distortion.

*Figures 4A and 4B* show two different layouts which are recommended only as guidelines. Other suitable clock layouts may exist and it would be recommended that the board designers simulate to guarantee compatibility across all printed circuit and clock component process variations.

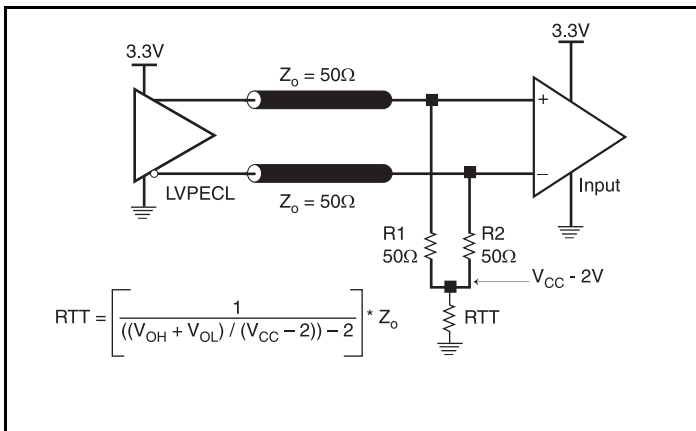


Figure 4A. 3.3V LVPECL Output Termination

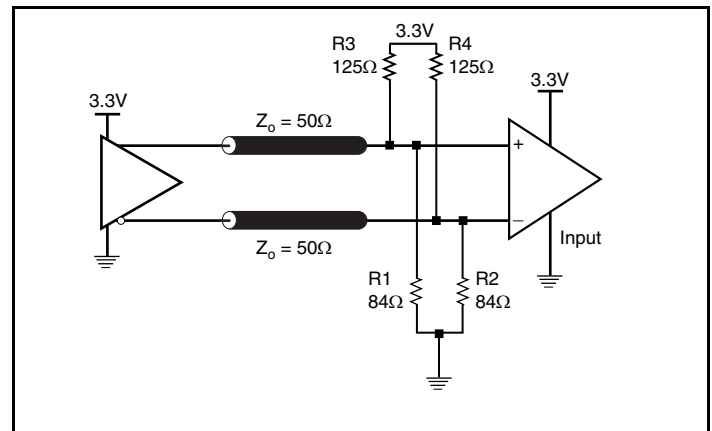


Figure 4B. 3.3V LVPECL Output Termination

### Termination for 2.5V LVPECL Outputs

Figure 5A and Figure 5B show examples of termination for 2.5V LVPECL driver. These terminations are equivalent to terminating  $50\Omega$  to  $V_{CC} - 2V$ . For  $V_{CC} = 2.5V$ , the  $V_{CC} - 2V$  is very close to ground

level. The R3 in Figure 5B can be eliminated and the termination is shown in Figure 5C.

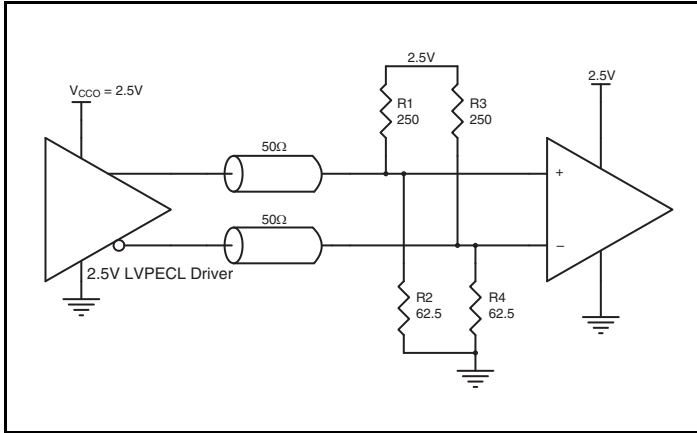


Figure 5A. 2.5V LVPECL Driver Termination Example

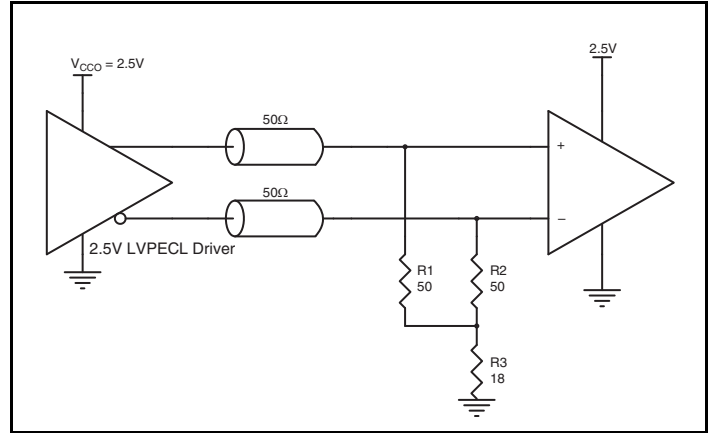


Figure 5B. 2.5V LVPECL Driver Termination Example

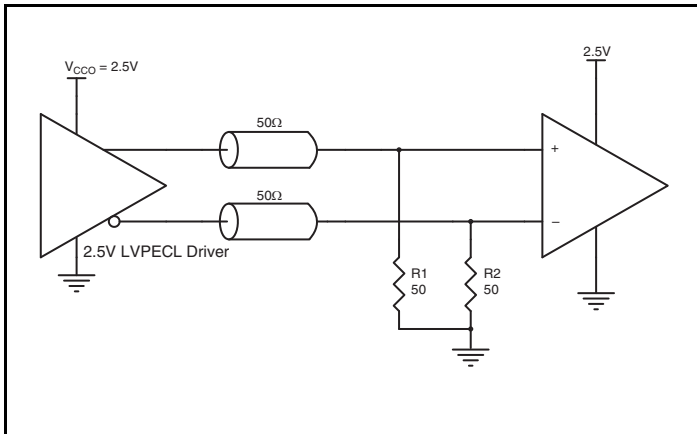
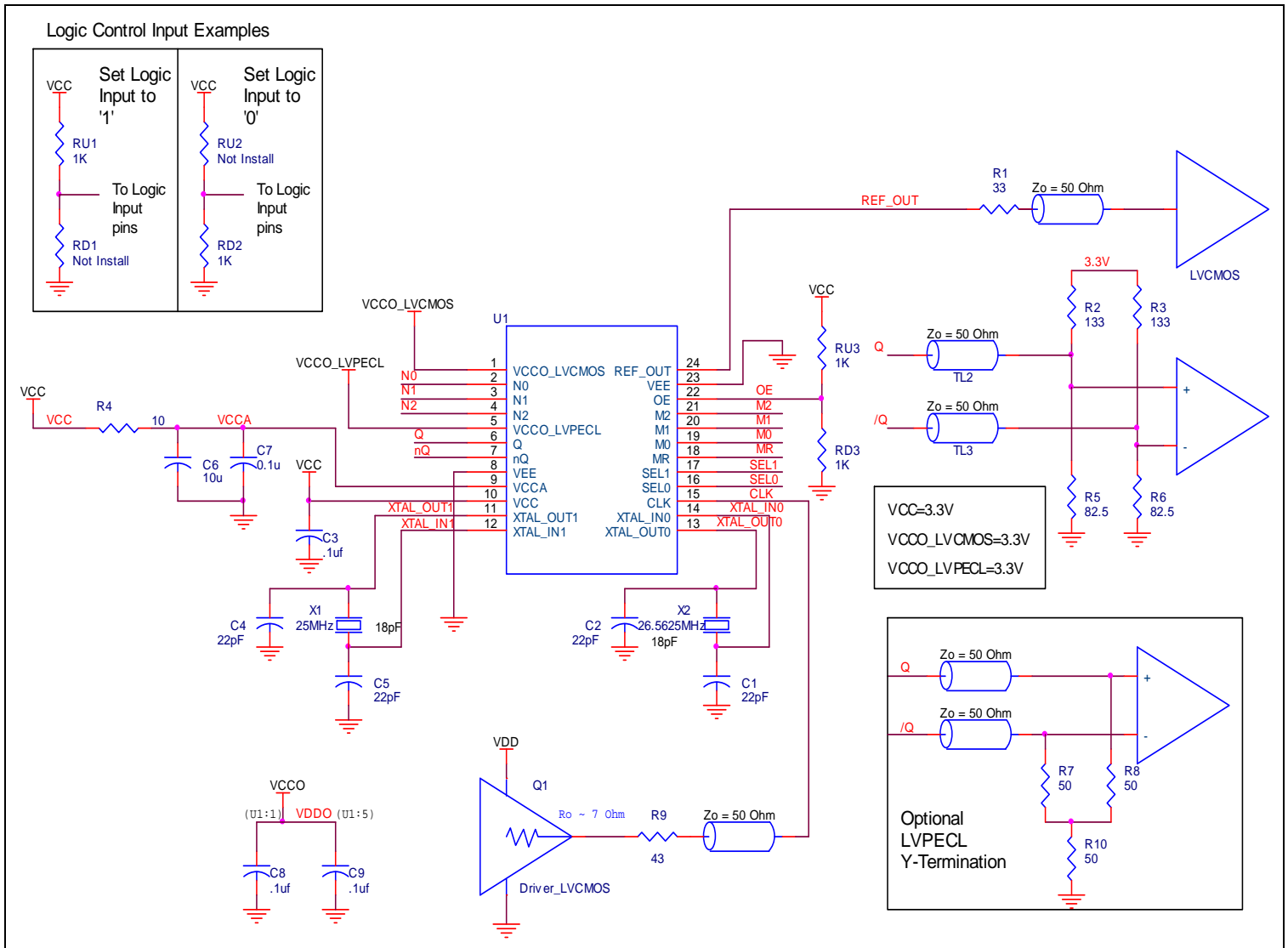


Figure 5C. 2.5V LVPECL Driver Termination Example

# Schematic Layout

Figure 6 shows an example of 8430011-22 application schematic. In this example, the device is operated at  $V_{CC} = V_{CCO\_LVC MOS} = V_{CCO\_LVPECL} = 3.3V$ . The 18pF parallel resonant 25MHz crystal is used. The  $C1 = C2 = 22pF$  and  $C4 = C5 = 22pF$  are recommended for frequency accuracy. For different board layouts, the  $C1, C2, C4$

and  $C5$  may be slightly adjusted for optimizing frequency accuracy. Two examples of LVPECL terminations and one example of LVCMOS are shown in this schematic. Additional termination approaches are shown in the LVPECL Termination Application Note.



8430011-22 Layout Example



## Power Considerations

This section provides information on power dissipation and junction temperature for the 8430011-22. Equations and example calculations are also provided.

### 1. Power Dissipation.

The total power dissipation for the 8430011-22 is the sum of the core power plus the power dissipated in the load(s). The following is the power dissipation for  $V_{CC} = 3.3V + 5\% = 3.465V$ , which gives worst case results.

NOTE: Please refer to Section 3 for details on calculating power dissipated in the load.

- Power (core)<sub>MAX</sub> =  $V_{CC\_MAX} * I_{EE\_MAX} = 3.465V * 160mA = 554.4mW$
- Power (outputs)<sub>MAX</sub> = **30mW/Loaded Output pair**

**Total Power<sub>MAX</sub>** (3.3V, with all outputs switching) =  $554.4mW + 30mW = 584.4mW$

### 2. Junction Temperature.

Junction temperature,  $T_j$ , is the temperature at the junction of the bond wire and bond pad and directly affects the reliability of the device. The maximum recommended junction temperature for HiPerClockS devices is 125°C.

The equation for  $T_j$  is as follows:  $T_j = \theta_{JA} * Pd\_total + T_A$

$T_j$  = Junction Temperature

$\theta_{JA}$  = Junction-to-Ambient Thermal Resistance

$Pd\_total$  = Total Device Power Dissipation (example calculation is in section 1 above)

$T_A$  = Ambient Temperature

In order to calculate junction temperature, the appropriate junction-to-ambient thermal resistance  $\theta_{JA}$  must be used. Assuming a moderate air flow of 1 meter per second and a multi-layer board, the appropriate value is 65°C/W per Table 8 below.

Therefore,  $T_j$  for an ambient temperature of 85°C with all outputs switching is:

$$85^\circ C + 0.584W * 65^\circ C/W = 123^\circ C. \text{ This is below the limit of } 125^\circ C.$$

This calculation is only an example.  $T_j$  will obviously vary depending on the number of loaded outputs, supply voltage, air flow and the type of board (single layer or multi-layer).

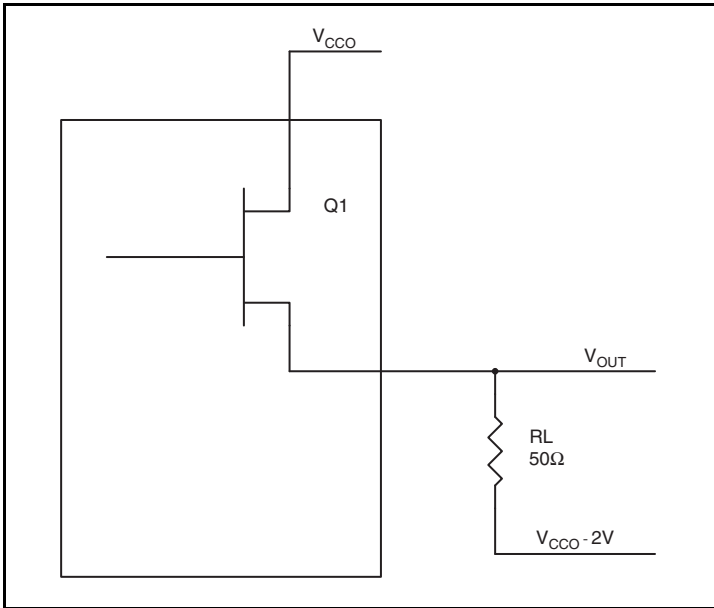
**Table 8. Thermal Resistance  $\theta_{JA}$  for 24 Lead TSSOP, Forced Convection**

$\theta_{JA}$ vs. Air Flow			
Meters per Second	0	1	2.5
Multi-Layer PCB, JEDEC Standard Test Boards	70°C/W	65°C/W	62°C/W

### 3. Calculations and Equations.

The purpose of this section is to derive the power dissipated into the load.

LVPECL output driver circuit and termination are shown in *Figure 7*.



**Figure 7. LVPECL Driver Circuit and Termination**

To calculate worst case power dissipation into the load, use the following equations which assume a 50Ω load, and a termination voltage of  $V_{CCO} - 2V$ .

- For logic high,  $V_{OUT} = V_{OH\_MAX} = V_{CCO\_MAX} - 0.9V$   
 $(V_{CCO\_MAX} - V_{OH\_MAX}) = 0.9V$
- For logic low,  $V_{OUT} = V_{OL\_MAX} = V_{CCO\_MAX} - 1.7V$   
 $(V_{CCO\_MAX} - V_{OL\_MAX}) = 1.7V$

$Pd\_H$  is power dissipation when the output drives high.

$Pd\_L$  is the power dissipation when the output drives low.

$$Pd\_H = [(V_{OH\_MAX} - (V_{CCO\_MAX} - 2V))/R_L] * (V_{CCO\_MAX} - V_{OH\_MAX}) = [(2V - (V_{CCO\_MAX} - V_{OH\_MAX}))/R_L] * (V_{CCO\_MAX} - V_{OH\_MAX}) = [(2V - 0.9V)/50\Omega] * 0.9V = \mathbf{19.8mW}$$

$$Pd\_L = [(V_{OL\_MAX} - (V_{CCO\_MAX} - 2V))/R_L] * (V_{CCO\_MAX} - V_{OL\_MAX}) = [(2V - (V_{CCO\_MAX} - V_{OL\_MAX}))/R_L] * (V_{CCO\_MAX} - V_{OL\_MAX}) = [(2V - 1.7V)/50\Omega] * 1.7V = \mathbf{10.2mW}$$

$$\text{Total Power Dissipation per output pair} = Pd\_H + Pd\_L = \mathbf{30mW}$$

## Reliability Information

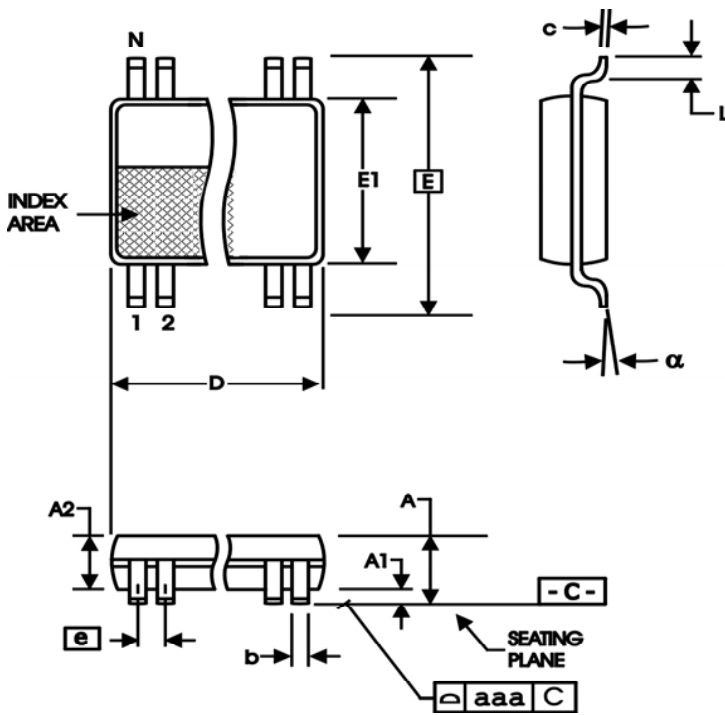
**Table 9.  $\theta_{JA}$  vs. Air Flow Table for a 24 Lead TSSOP**

$\theta_{JA}$ vs. Air Flow			
Meters per Second	0	1	2.5
Multi-Layer PCB, JEDEC Standard Test Boards	70°C/W	65°C/W	62°C/W

## Transistor Count

The transistor count for 843001I-22 is: 3881

## Package Outline and Package Dimensions

**Package Outline - G Suffix for 24 Lead TSSOP**


**6.10 mm. Body, 0.65 mm. Pitch TSSOP**  
 (240 mil)\* (25.6mil)\*

**Table 10. Package Dimensions**

All Dimensions in Millimeters		
Symbol	Minimum	Maximum
N	24	
A		1.20
A1	0.5	0.15
A2	0.80	1.05
b	0.19	0.30
c	0.09	0.20
D	7.70	7.90
E	6.40 Basic	
E1	4.30	4.50
e	0.65 Basic	
L	0.45	0.75
$\alpha$	0°	8°
aaa		0.10

Reference Document: JEDEC Publication 95, MO-153

## Ordering Information

**Table 11. Ordering Information**

Part/Order Number	Marking	Package	Shipping Packaging	Temperature
843001AGI-22LF	ICS43001AI22L	"Lead-Free" 24 Lead TSSOP	Tube	-40°C to 85°C
843001AGI-22LFT	ICS43001AI22L	"Lead-Free" 24 Lead TSSOP	2500 Tape & Reel	-40°C to 85°C

NOTE: "LF" suffix to the part number are the Pb-Free configuration and are RoHS compliant.

## Revision History Sheet

Rev	Table	Page	Description of Change	Date
A		1	General Description - corrected crystal frequency from 25.5625MHz crystal to 26.5625MHz crystal.	3/23/07
		12	Added <i>LVC MOS to XTAL Interface</i> section. Updated format throughout the datasheet.	
A	T11	16	Power Considerations - Changed Ambient Temperature from 70° to 85°	2/19/09
		19	Ordering Information - Removed "ICS" from Part/Order Number	
B		1	Corrected block diagram. When updated format on 3/23/07, block diagram was not duplicated correctly.	6/25/09
		15	Added Schematic layout. Updated header/footer.	
B	T11	19	Removed leaded orderable parts from Ordering Information table	11/14/12
B			Updated data sheet format.	11/16/15



**Corporate Headquarters**  
6024 Silver Creek Valley Road  
San Jose, CA 95138 USA

**Sales**  
1-800-345-7015 or 408-284-8200  
Fax: 408-284-2775  
www.IDT.com

**Tech Support**  
email: [clocks@idt.com](mailto:clocks@idt.com)

DISCLAIMER Integrated Device Technology, Inc. (IDT) and its subsidiaries reserve the right to modify the products and/or specifications described herein at any time and at IDT's sole discretion. All information in this document, including descriptions of product features and performance, is subject to change without notice. Performance specifications and the operating parameters of the described products are determined in the independent state and are not guaranteed to perform the same way when installed in customer products. The information contained herein is provided without representation or warranty of any kind, whether express or implied, including, but not limited to, the suitability of IDT's products for any particular purpose, an implied warranty of merchantability, or non-infringement of the intellectual property rights of others. This document is presented only as a guide and does not convey any license under intellectual property rights of IDT or any third parties.

IDT's products are not intended for use in applications involving extreme environmental conditions or in life support systems or similar devices where the failure or malfunction of an IDT product can be reasonably expected to significantly affect the health or safety of users. Anyone using an IDT product in such a manner does so at their own risk, absent an express, written agreement by IDT.

While the information presented herein has been checked for both accuracy and reliability, Integrated Device Technology (IDT) assumes no responsibility for either its use or for the infringement of any patents or other rights of third parties, which would result from its use. No other circuits, patents, or licenses are implied. This product is intended for use in normal commercial applications. Any other applications, such as those requiring extended temperature ranges, high reliability or other extraordinary environmental requirements are not recommended without additional processing by IDT. IDT reserves the right to change any circuitry or specifications without notice. IDT does not authorize or warrant any IDT product for use in life support devices or critical medical instruments.

Integrated Device Technology, IDT and the IDT logo are registered trademarks of IDT. Product specification subject to change without notice. Other trademarks and service marks used herein, including protected names, logos and designs, are the property of IDT or their respective third party owners.

Copyright ©2015 Integrated Device Technology, Inc.. All rights reserved.