SYNERGY SEMICONDUCTOR

FREQUENCY SYNTHESIZER (60MHz to 1GHz)
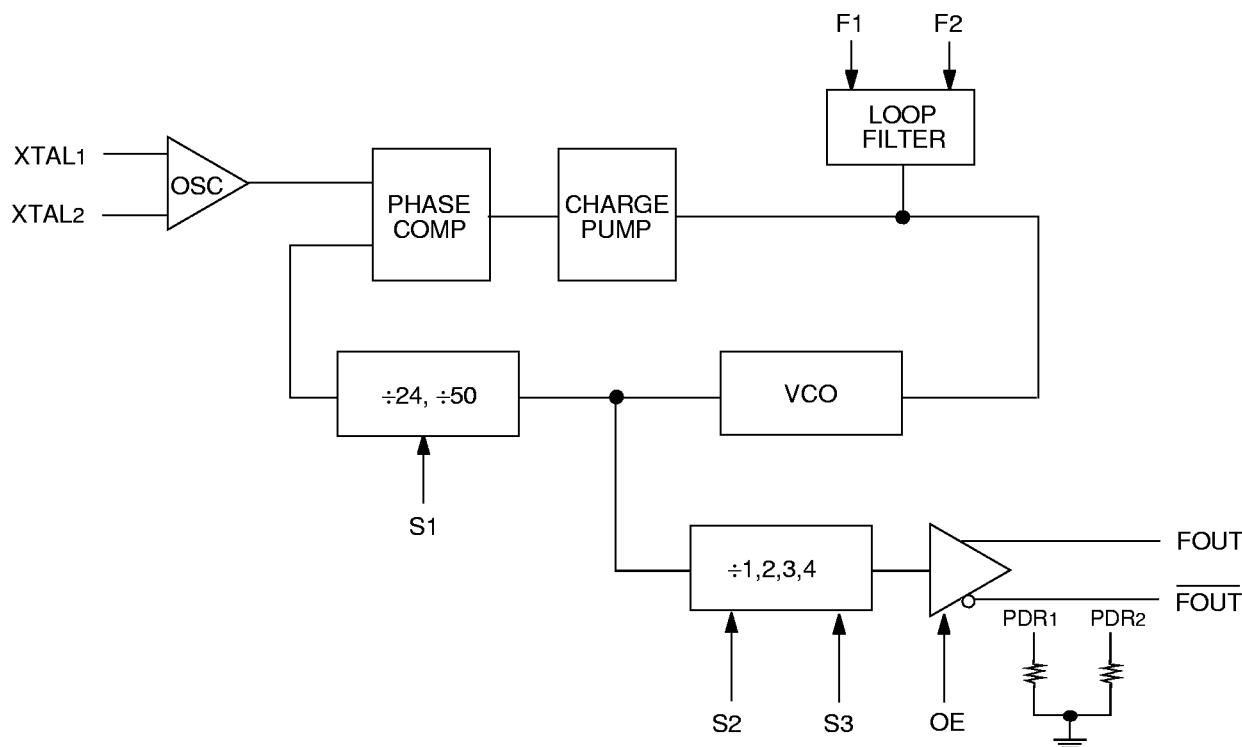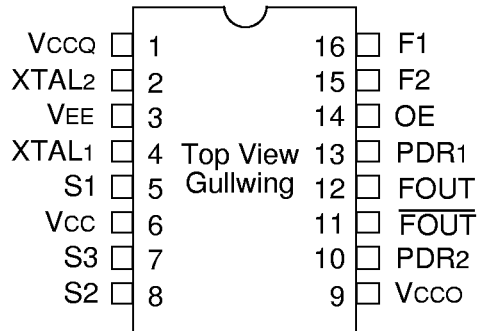
ClockWorks™
SY89424V

FEATURES

■ 3.3V and 5V power supply options

■ Up to 1GHz clock frequencies

■ Internal quartz reference oscillator driven by quartz crystal or PECL source

■ Low jitter PLL design

■ On-chip 20 ohm driver

■ Differential outputs with 600mV (min) swing

■ Optional pull-down resistors for AC-coupled outputs

■ Low power consumption

■ ESD protection of 2000V

■ External loop filter optimizes performance/cost

■ Available in 16-pin SOIC package

DESCRIPTION

The SY89424V is a low-power Phase Locked Loop (PLL) based frequency synthesizer. The device is capable of generating up to 1GHz clock frequencies with a low-cost 10–25MHz external series-resonant quartz crystal. One can also use PECL differential clock signals to drive this device instead of the quartz crystal. Operation of this chip is controlled by three select pins (S1, S2 and S3). S1 selects the divide ratio of 24 or 50 for the PLL. S2 and S3 select the output frequency. There are two pull-down resistor pins (PDR1 and PDR2). Each pin has an on-chip resistor that will control the output driver currents. When PDR1 and PDR2 pins are open, both outputs are normal open emitter PECL drivers. When PDR1 and PDR2 pins are shorted to the outputs, on-chip pull down currents of 25mA (40mA at 5V VCC) are provided. Both output drivers are capable of driving 20 ohm clock lines. An output enable (OE) pin is available and it can be HIGH or left open for normal operation. When OE is LOW, a built-in Disable Timing Synchronizer will force the FOUT output to LOW at the completion of the HIGH clock cycle. The $\overline{FOUT}$ output remains HIGH during that time.

BLOCK DIAGRAM

SYNERGY
SEMICONDUCTOR

PIN CONFIGURATION

```
          ┌───────∪───────┐
VCCQ  □  1│               │16  □  F1
XTAL2 □  2│               │15  □  F2
VEE   □  3│               │14  □  OE
XTAL1 □  4│  Top View  13 │    □  PDR1
S1    □  5│  Gullwing  12 │    □  FOUT
VCC   □  6│            11 │    □  FOUT
S3    □  7│            10 │    □  PDR2
S2    □  8│             9 │    □  VCCO
          └───────────────┘
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PIN NAMES

Pin	Function	I/O
XTAL1	Crystal Input 1 (PECL)	I/O
XTAL2	Crystal Input 2 (PECL)	I/O
F1	Filter Pin 1	—
F2	Filter Pin 2 (Reference)	—
VCCQ	Positive Power Supply (Charge Pump)	—
S1	Select Input 1 (TTL)	I
S2	Select Input 2 (TTL)	I
S3	Select Input 3 (TTL)	I
FOUT	Output (PECL)	O
$\overline{FOUT}$	Complement Output (PECL)	O
VCC	Positive Power Supply (Logic)	—
VCCO	Positive Power Supply (PECL Outputs)	—
OE	Output Enable (TTL)	I
VEE	Negative Power Suppy (0.0V)	—
PDR1	Pulldown Resistor (100Ω)	—
PDR2	Pulldown Resistor (100Ω)	—

FREQUENCY SELECTION TABLE

Input	S1	S2	S3	FOUT, $\overline{FOUT}$	Frequency Range MHz
FOSC[1]	0	0	0	24X FOSC	240 – 480
	0	0	1	12X FOSC	120 – 240
	0	1	0	8X FOSC	80 – 160
	0	1	1	6X FOSC	60 – 120
	1	0	0	50X FOSC	500 – 1000
	1	0	1	25X FOSC	250 – 500
	1	1	0	16.67X FOSC	167 – 333
	1	1	1	12.5X FOSC	125 – 250

NOTE:

1. FOSC = 10MHz to 25MHz.

ABSOLUTE MAXIMUM RATING[1]

Symbol	Parameter	Value	Unit
VCC	Power Supply Voltage	- 0.5 to +7.0	V
VI	TTL Input Voltage[2]	- 0.5 to 6.0	V
II	TTL Input Current[2]	- 30 to +5.0	mA
IOUT	ECL Output Current — Continuous — Surge	 50 100	mA
Tstore	Storage Temperature	- 65 to +150	˚C
Tamb	Operating Temperature	0 to +75	˚C

NOTES:

1. Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. This is a stress rating only and functional operation is not implied at conditions other than those detailed in the operational sections of this data sheet. Exposure to ABSOLUTE MAXIMUM RATING conditions for extended periods may affect device reliability.

2. Either voltage limit or current limit is sufficient to protect input.

5V DC ELECTRICAL CHARACTERISTICS

$V_{CC} = V_{CCQ} = V_{CCO} = 4.75V$ to $5.25V$

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
V_{CC}	Power Supply Voltage	4.75	—	5.25	V	$V_{CC} = V_{CCQ} = V_{CCO}$
I_{CC}	Power Supply Current (V_{CC})	—	—	80	mA	
I_{CCQ}	Power Supply Current (V_{CCQ})	—	—	10	mA	
I_{CCO}	Power Supply Current (V_{CCO})	—	—	20	mA	PECL outputs FOUT & $\overline{FOUT}$ are open

3.3V DC ELECTRICAL CHARACTERISTICS

$V_{CC} = V_{CCQ} = V_{CCO} = 3.0V$ to $5.25V$

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
V_{CC}	Power Supply Voltage	3.0	—	3.8	V	$V_{CC} = V_{CCQ} = V_{CCO}$
I_{CC}	Power Supply Current (V_{CC})	—	—	68	mA	
I_{CCQ}	Power Supply Current (V_{CCQ})	—	—	9	mA	
I_{CCO}	Power Supply Current (V_{CCO})	—	—	18	mA	PECL outputs FOUT & $\overline{FOUT}$ are open

PECL DC ELECTRICAL CHARACTERISTICS

$V_{CC} = V_{CCQ} = V_{CCO} = 3.0V$ to $5.25V$

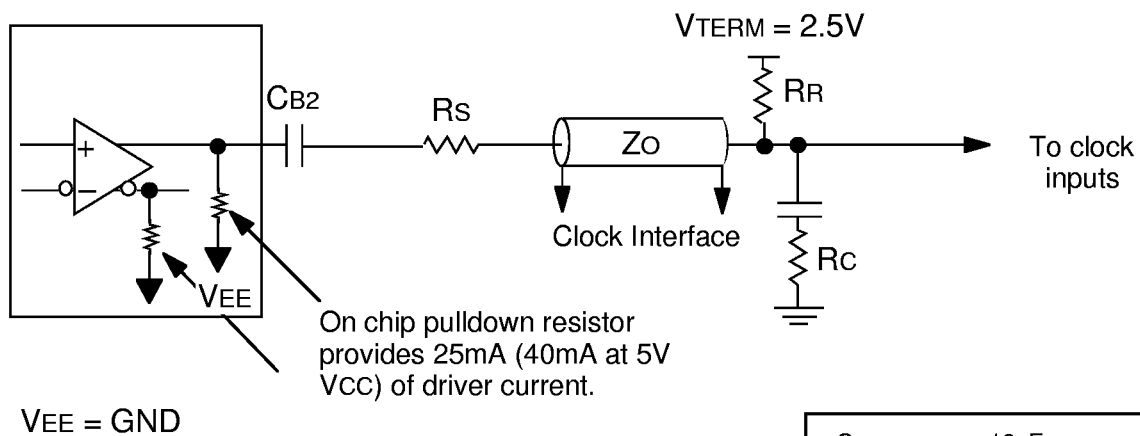| Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
V_O	Output Voltage Swing	0.55	0.85	1.15	V	Peak-to-Peak
V_{OH}	Output HIGH Voltage	$V_{CC} - 1.075$	—	$V_{CC} - 0.800$	V	FOUT & $\overline{FOUT}$ loaded with 50Ω to $V_{CC} - 2.0V$
V_{OL}	Output LOW Voltage	$V_{CC} - 1.860$	—	$V_{CC} - 1.570$	V	FOUT & $\overline{FOUT}$ loaded with 50Ω to $V_{CC} - 2.0V$
V_{IH}	Input HIGH Voltage[1]	$V_{CC} - 1.165$	—	$V_{CC} - 0.880$	V	
V_{IL}	Input LOW Voltage[1]	$V_{CC} - 1.810$	—	$V_{CC} - 1.475$	V	

NOTE:

1. Forcing voltage at XTAL1 and XTAL2

TTL DC ELECTRICAL CHARACTERISTICS

$V_{CC} = V_{CCQ} = V_{CCO} = 3.0V$ to $5.25V$

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
V_{IH}	Input HIGH Voltage	2.0	—	—	V	
V_{IL}	Input LOW Voltage	—	—	0.8	V	
I_{IH}	Input HIGH Current	—	—	20 / 100	μA	$V_{IN} = 2.7V$ / $V_{IN} = V_{CC}$
I_{IL}	Input LOW Current	—	—	- 0.2	mA	$V_{IN} = 0.5V$
V_{IK}	Input Clamp Voltage	—	—	- 1.2	V	$I_{IN} = - 18mA$

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AC ELECTRICAL CHARACTERISTICS

$V_{CC} = V_{CCQ} = V_{CCO} = 3.0V$ to $5.25V$

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
t_{JIT}	Jitter	—	—	10	ps	RMS
P_{PW}	Duty Cycle	45%	50%	55%		<500MHz
tr	Output Rise/Fall Time	100	300	500	ps	—
tf	20% to 80%	100	300	500		

APPLICATION

AC Coupled Load

$V_{TERM} = 2.5V$

C_{B2} R_S Z_O R_R

Clock Interface

R_C

To clock inputs

On chip pulldown resistor provides 25mA (40mA at 5V VCC) of driver current.

$V_{EE} = GND$

C_{B2}	=	10nF	±20%
R_S	=	6.8 Ohm	±5%
R_C	=	20 Ohm	±1%
R_R	=	5 KOhm	±5%
Z_O	=	20 Ohm	±2 Ohm

PRODUCT ORDERING CODE

Odering Code	Package Type	Operating Range
SY89424VZC	Z16-1	Commercial
SY89424VZCTR	Z16-1	Commercial

SYNERGY
SEMICONDUCTOR

16 LEAD PLASTIC SOIC .300" WIDE (Z16-1)

FILE/REV #: PD0015A03

PD/0015/ASCORP

PAGE 1 OF 1

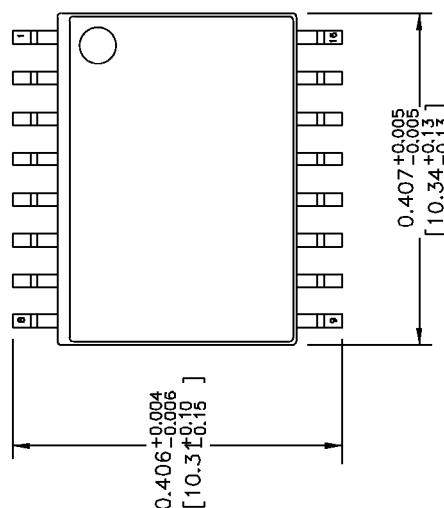| REV.	REVISION DESCRIPTION	DATE
00	NEW OUTLINE DRAWING	03/18/92
01	CONVERT TO DESIGNER VERSION 4.0 FORMAT	12/31/93
02	CONVERT DWG. TO AUTOCAD REL. 12. REFERENCE AMKOR DWG. NO. 00020 REV. 07. MAKE ⒶSAME AS JEDEC.	02/29/96
03	CONVERT DWG. TO REL. 13 AND ONE PAGE DOCUMENT.	02/06/98

BOTTOM VIEW

0.050[1.27] BSC

0.016 +0.003 -0.002 [0.41 +0.08 -0.05]

END VIEW

0.104[2.65]Ⓐ
0.093[2.35]

0.013 +0.003 -0.003 x45° [0.33 +0.08 -0.08]

SEE DETAIL "A"

0.010 +0.0025 -0.0009 [0.25 +0.07 -0.02]

0.009 +0.0025 -0.0040 [0.22 +0.07 -0.09]

0.296 +0.003 -0.004 [7.52 +0.07 -0.10]

TOP VIEW

0.407 +0.005 -0.005 [10.34 +0.13 -0.13]

0.406 +0.004 -0.006 [10.3 +0.10 -0.15]

-C-
◁ 0.004[0.10]

DETAIL "A"

0.032 +0.008 -0.009 /3\ [0.81 +0.25 -0.23]

5° +3° -5°
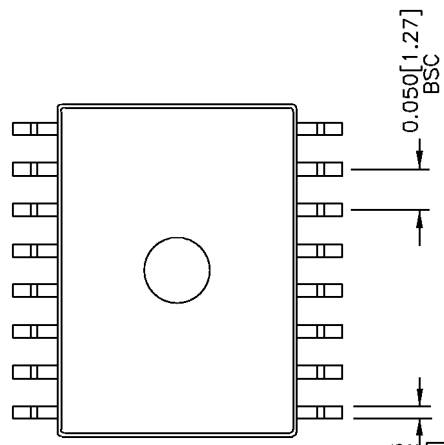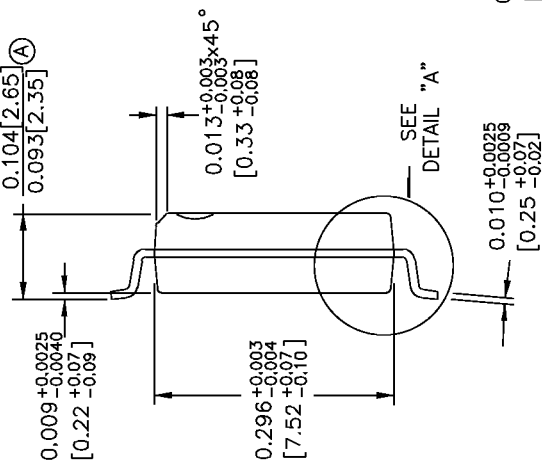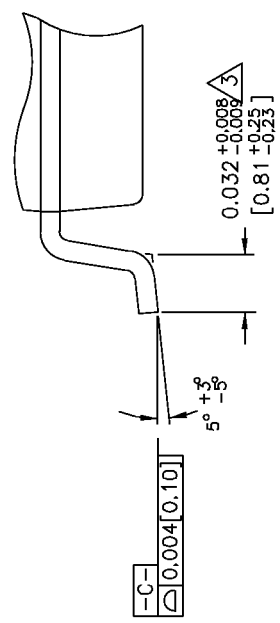
NOTES:
1. DIMENSIONS ARE IN INCHES[MM].
2. CONTROLLING DIMENSION: INCHES.
/3\ DIMENSION DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS, EITHER OF WHICH SHALL NOT EXCEED 0.006[0.15] PER SIDE.
4. MAXIMUM AND MINIMUM SPECIFICATIONS ARE INDICATED AS FOLLOWS: MAX / MIN

SYNERGY
SEMICONDUCTOR

3250 SCOTT BOULEVARD
SANTA CLARA, CA. 95054
TEL: 408-980-9191
FAX: 408-567-7878

16 LEAD PLASTIC SOIC (.300")
PACKAGE OUTLINE

SIZE	SCALE	REVISION
A	N/A	03

APPROVALS	DATE	APPROVALS	DATE
ORIGINATOR: FERMIN G. URRUTIA	02/23/98	QUALITY: MARSHALL WILDER	
CHK'D: WON CHANG		DOCUMENT CONTROL: BRIAN SANFILIPPO	
RELEASE DATE:			