

FEATURES

- 3.3V and 5V $\pm 10\%$ power supply options
- Guaranteed AC parameters over temperature:
 - $f_{MAX} = 800\text{MHz}$
 - $< 200\text{ps}$ differential propagation delay (D to Q_{FB})
 - $< 730\text{ps}$ differential propagation delay (D to Q_{HG})
 - $< 250\text{ps}$ t_r / t_f
- Low gain feedback path $Q_{FB} = +10\text{V/V}$
- Output enable
- V_{BB} reference output voltage
- Wide temperature range: -40°C to $+85^\circ\text{C}$
- Available in 10-pin (3x3mm) MSOP

DESCRIPTION

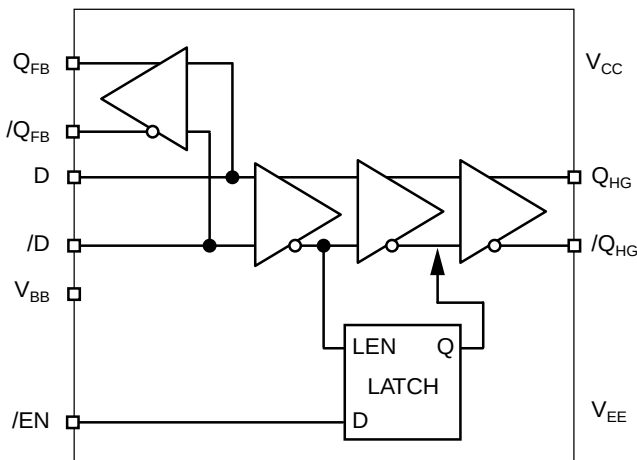
The SY100EL16VO is a differential receiver amplifier optimized for crystal oscillator applications. The device includes an additional low gain ($+10\text{V/V}$) output stage (Q_{FB}) ideal for feedback applications common in crystal oscillator gain blocks. The SY100EL16VO is fully differential, with a bandwidth $> 800\text{MHz}$ over temperature and voltage. For applications that require output disable control, an Enable pin ($/\text{EN}$) will force the differential output into a fixed logic state. The SY100EL16VO also includes a V_{BB} reference voltage for single-ended or AC-coupled applications.

The SY100EL16VO PECL logic is 100k ECL compatible. Operation is guaranteed over the -40°C to $+85^\circ\text{C}$ temperature range and 3.3V to 5V nominal supply voltage range.

TRUTH TABLE

$/\text{EN}$	Q_{HG} Out	$/Q_{HG}$ Out
0	Data	$/\text{Data}$
1	Logic Low	Logic High

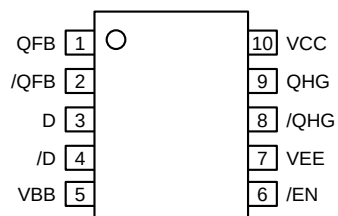
BLOCK DIAGRAM



PIN NAMES

Pin	Function
$Q_{FB}, /Q_{FB}$	Differential clock outputs for feedback path: Nominal DC gain +10.
D, /D	PECL, LVPECL, ECL, LVECL differential inputs: Internal 75k Ω pull-down resistor.
V_{BB}	$V_{CC} - 1.32\text{V}$ reference voltage for single-ended inputs: It provides the switching reference for the input differential amplifier. When unused, it can be left open. For single-ended PECL applications connect V_{BB} to /D input, and bypass with a 0.01 μF capacitor to V_{CC} .
$/\text{EN}$	Enable: PECL compatible input control with internal 75k Ω pull-down resistor. It controls the high-gain output (Q_{HG}). When HIGH, Q_{HG} is low and $/Q_{HG}$ is high. $/\text{EN}$ is synchronous so that the outputs will only be enabled/disabled when they are in the LOW state.
V_{EE}	Negative power supply: For ECL/LVECL operation, connect to negative supply. For PECL/ LVPECL operation, connect to GND.
$Q_{HG}, /Q_{HG}$	Differential high-gain outputs: Nominal DC gain is greater than +200.
V_{CC}	Positive power supply: For ECL/LVECL operation, connect to $V_{CC} = 0\text{V}$. For PECL/ LVPECL operation, connect to either 3.3V or 5.0V. Bypass with 0.1 μF // 0.01 μF low ESR capacitors.

PACKAGE/ORDERING INFORMATION



10-Pin MSOP (K10-1)

Ordering Information⁽¹⁾

Part Number	Package Type	Operating Range	Package Marking	Lead Finish
SY100EL16VOKC	K10-1	Commercial	X16VO	Sn-Pb
SY100EL16VOKCTR ⁽²⁾	K10-1	Commercial	X16VO	Sn-Pb
SY100EL16VOKI	K10-1	Industrial	X16VO	Sn-Pb
SY100EL16VOKITR ⁽²⁾	K10-1	Industrial	X16VO	Sn-Pb
SY100EL16VOKG ⁽³⁾	K10-1	Industrial	X16VO with Pb-Free bar-line indicator	NiPdAu Pb-Free
SY100EL16VOKGTR ^(2, 3)	K10-1	Industrial	X16VO with Pb-Free bar-line indicator	NiPdAu Pb-Free
SY100EL16VOKG ⁽³⁾	K10-1	Industrial	X16VO with Pb-Free bar-line indicator	NiPdAu Pb-Free
SY100EL16VOKGTR ^(2, 3)	K10-1	Industrial	X16VO with Pb-Free bar-line indicator	NiPdAu Pb-Free

Notes:

1. Contact factory for die availability. Dice are guaranteed at $T_A = 25^\circ\text{C}$, DC Electricals only.
2. Tape and Reel.
3. Pb-Free package is recommended for new designs.

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

Symbol	Rating	Value	Unit
$V_{CC} - V_{EE}$	Power Supply Voltage	+6.0	V
V_{IN}	PECL Input Voltage	0 to $V_{CC} + 0.5$	V
V_{OUT}	Voltage Applied to Output at High State ($V_{EE} = 0V$)	-0.5 to +5.5	V
I_{OUT}	Output Current –Continuous –Surge	50 100	mA
T_A	Operating Temperature Range	-40 to +85	°C
T_{store}	Storage Temperature Range	-65 to +150	°C
θ_{JA}	Package Thermal Resistance (Junction-to-Ambient) –Still-Air –500lfpm	113 96	°C/W
θ_{JC}	Package Thermal Resistance (Junction-to-Case)	42	°C/W

Note:

- 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.

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	$T_A = -40^\circ\text{C}$			$T_A = +25^\circ\text{C}$			$T_A = +85^\circ\text{C}$			Unit	Condition
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.		
V_{CC}	Power Supply Voltage										V	$V_{EE} = \text{GND}$
	(PECL)	4.5	5.0	5.5	4.5	5.0	5.5	4.5	5.0	5.5		
	(LVPECL)	3.0	3.3	3.8	3.0	3.3	3.8	3.0	3.3	3.8		
	(ECL)	-5.5	-5.0	-4.5	-5.5	-5.0	-4.5	-5.5	-5.0	-4.5	V	$V_{CC} = \text{GND}$
	(LVECL)	-3.8	-3.3	-3.0	-3.8	-3.3	-3.0	-3.8	-3.3	-3.0		
I_{CC}	Power Supply Current	—	—	46	—	—	46	—	—	46	mA	$V_{CC} = 5.5V$
V_{BB}	Reference Voltage	$V_{CC}-1.26$	$V_{CC}-1.32$	$V_{CC}-1.38$	$V_{CC}-1.26$	$V_{CC}-1.32$	$V_{CC}-1.38$	$V_{CC}-1.26$	$V_{CC}-1.32$	$V_{CC}-1.38$	V	
I_{IH}	Input HIGH Current	—	—	150	—	—	150	—	—	150	μA	$V_{IN} = V_{IH}(\text{Max})$
I_{IL}	Input LOW Current	0.5	—	—	0.5	—	—	0.5	—	—	μA	$V_{IN} = V_{IL}(\text{Min})$
C_{IN}	Input Capacitance	—	—	—	—	0.75	—	—	—	—	pF	

100K 5V PECL DC ELECTRICAL CHARACTERISTICS
 $V_{CC} = 5.0V \pm 10\%$; $V_{EE} = GND$

Symbol	Parameter	$T_A = -40^\circ C$			$T_A = +25^\circ C$			$T_A = +85^\circ C$			Unit	Condition
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.		
V_{OH}	Output High Voltage ⁽¹⁾	3.915	4.005	4.120	3.975	4.005	4.12	3.975	4.005	4.12	V	50Ω to $V_{CC} - 2V$
V_{OL}	Output Low Voltage ⁽¹⁾	3.170	3.305	3.445	3.190	3.295	3.380	3.190	3.295	3.380	V	50Ω to $V_{CC} - 2V$
V_{IH}	Input HIGH Voltage ⁽¹⁾	3.835	—	4.120	3.835	—	4.120	3.835	—	4.120	V	
V_{IL}	Input LOW Voltage ⁽¹⁾	3.525	—	3.819	3.525	—	3.819	3.525	—	3.819	V	
V_{IHCMR}	Input High Voltage ⁽²⁾ Common Mode Range	2.0	—	$V_{CC} - 0.8$	2.0	—	$V_{CC} - 0.8$	2.0	—	$V_{CC} - 0.8$	V	

Notes:

1. Input and output parameters are at $V_{CC} = +5.0V$. Level specifications will vary 1:1 with V_{CC} .
2. V_{IHCMR} is referenced to the most positive side of the differential input signal.

100K 3V PECL DC ELECTRICAL CHARACTERISTICS
 $V_{CC} = 3.3V \pm 10\%$; $V_{EE} = GND$

Symbol	Parameter	$T_A = -40^\circ C$			$T_A = +25^\circ C$			$T_A = +85^\circ C$			Unit	Condition
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.		
V_{OH}	Output High Voltage ⁽¹⁾	2.215	—	2.42	2.275	2.305	2.42	2.275	2.305	2.42	V	50Ω to $V_{CC} - 2V$
V_{OL}	Output Low Voltage ⁽¹⁾	1.470	—	1.745	1.490	1.595	1.680	1.490	1.595	1.680	V	50Ω to $V_{CC} - 2V$
V_{IH}	Input HIGH Voltage ⁽¹⁾	2.135	—	2.420	2.135	—	2.420	2.135	—	2.420	V	
V_{IL}	Input LOW Voltage ⁽¹⁾	1.490	—	1.825	1.490	—	1.825	1.490	—	1.825	V	
V_{IHCMR}	Input High Voltage ⁽²⁾ Common Mode Range	2.0	—	$V_{CC} - 0.8$	2.0	—	$V_{CC} - 0.8$	2.0	—	$V_{CC} - 0.8$	V	

Notes:

1. Input and output parameters are at $V_{CC} = +3.3V$. Level specifications will vary 1:1 with V_{CC} .
2. V_{IHCMR} is referenced to the most positive side of the differential input signal.

100K ECL/LVECL DC ELECTRICAL CHARACTERISTICS
 $V_{EE} = -3.0V$ to $-5.5V$; $V_{CC} = GND$

Symbol	Parameter	$T_A = -40^\circ C$			$T_A = +25^\circ C$			$T_A = +85^\circ C$			Unit	Condition
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.		
V_{OH}	Output High Voltage	-1.085	-1.005	-0.880	-1.025	-0.955	-0.880	-1.025	-0.955	-0.880	V	50Ω to $V_{CC} - 2V$
V_{OL}	Output Low Voltage	-1.830	-1.695	-1.555	-1.810	-1.705	-1.620	-1.810	-1.705	-1.620	V	50Ω to $V_{CC} - 2V$
V_{IH}	Input HIGH Voltage	-1.165	—	-0.880	-1.165	—	-0.880	-1.165	—	-0.880	V	
V_{IL}	Input LOW Voltage	-1.181	—	-1.475	-1.181	—	-1.475	-1.181	—	-1.475	V	
V_{IHCMR}	Input High Voltage Common Mode Range ⁽¹⁾	$V_{EE} + 2.0$	—	-0.8	$V_{EE} + 2.0$	—	-0.8	$V_{EE} + 2.0$	—	-0.8	V	

Note:

1. V_{IHCMR} is referenced to the most positive side of the differential input signal.

AC ELECTRICAL CHARACTERISTICS

$V_{CC} = 3.0$ to $5.5V$; $V_{EE} = GND$; $V_{EE} = -3.0$ to $-5.5V$; $V_{CC} = GND$

Symbol	Parameter	$T_A = -40^\circ C$			$T_A = +25^\circ C$			$T_A = +85^\circ C$			Unit	Condition
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.		
f_{MAX}	Maximum Frequency	800	—	—	800	—	—	800	—	—	MHz	
t_{PD}	Propagation Delay to Q_{FB} , $/Q_{FB}$ (Diff.)	—	—	200	—	—	200	—	—	200	ps	
	(Single)	—	—	230	—	—	230	—	—	230	ps	
	to Q_{HG} , $/Q_{HG}$ (Diff.)	—	—	650	—	—	650	—	—	730	ps	
	(Single)	—	—	700	—	—	700	—	—	780	ps	
t_S	Set-Up Time ⁽¹⁾	150	—	—	150	—	—	150	—	—	ps	Enable Pin
t_H	Hold Time ⁽¹⁾	150	—	—	150	—	—	150	—	—	ps	Enable Pin
t_{JITTER}	Cycle-to-Cycle Jitter	—	0.2	—	—	0.2	—	—	0.2	—	ps	RMS
t_{SKEW}	Duty Cycle Skew ⁽²⁾	—	5	20	—	5	20	—	5	20	ps	
V_{PP}	Minimum Input Swing ⁽³⁾	150	—	—	150	—	—	150	—	—	mV	
t_r t_f	Output Rise/Fall Times (20% to 80%)	—	—	250	—	—	250	—	—	250	ps	

Notes:

1. See "Timing Waveform."
2. Duty cycle skew is the difference between t_{PLH} and t_{PHL} propagation delay through the device.
3. The device has a DC gain of 10 for Q , $/Q$ outputs, and DC gain of 200 or higher for Q_{HG} , $/Q_{HG}$. See "Timing Waveform" minimum input swing.

TIMING WAVEFORMS

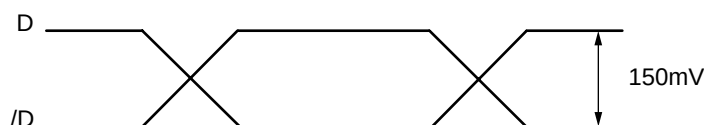


Figure 1. Minimum Input Swing

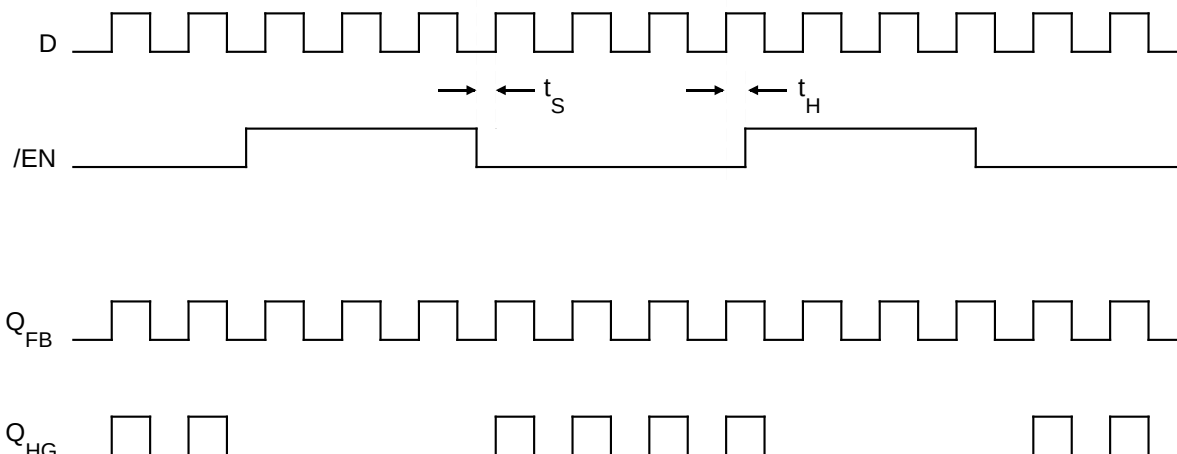


Figure 2. Set-Up and Hold Timing

TERMINATION RECOMMENDATIONS

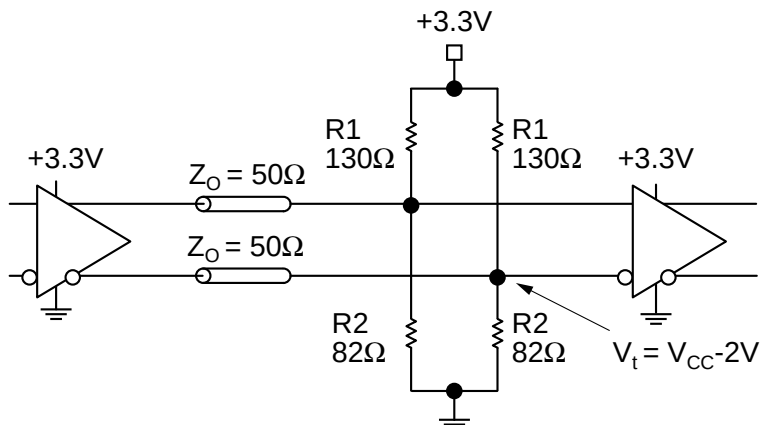


Figure 3. Parallel Termination-Thevenin Equivalent

Notes:

1. For +5V systems:

$R1 = 82\Omega$

$R2 = 130\Omega$

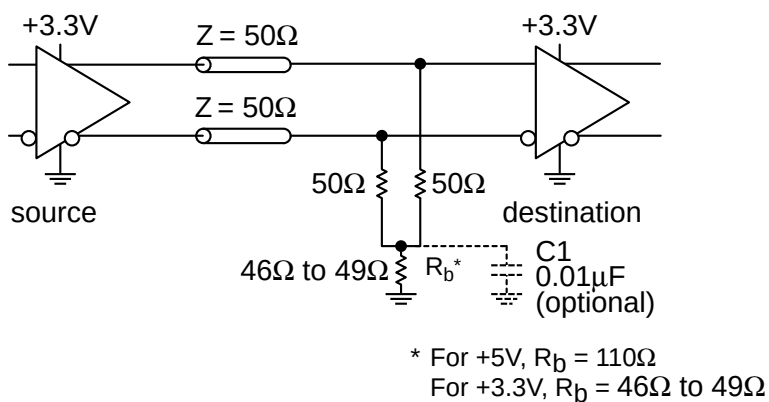
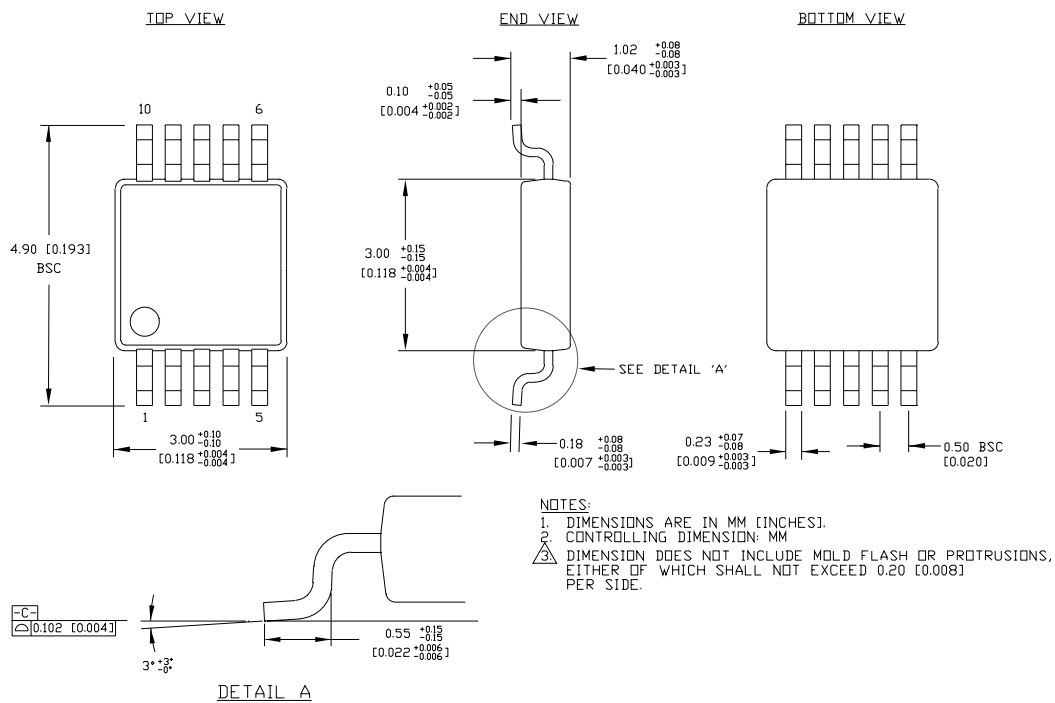


Figure 4. Three-Resistor "Y-Termination"

Notes:

1. Power-saving alternative to 4-resistor, Thevenin termination.
2. Place termination resistors as close to destination inputs as possible.
3. R_b resistor sets the DC bias voltage, equal to V_t . For +5V, $R_b = 100\Omega$

10-PIN MSOP (K10-1)



Rev. 00

MICREL, INC. 2180 FORTUNE DRIVE SAN JOSE, CA 95131 USA

TEL + 1 (408) 944-0800 FAX + 1 (408) 474-1000 WEB <http://www.micrel.com>

The information furnished by Micrel in this datasheet is believed to be accurate and reliable. However, no responsibility is assumed by Micrel for its use. Micrel reserves the right to change circuitry and specifications at any time without notification to the customer.

Micrel Products are not designed or authorized for use as components in life support appliances, devices or systems where malfunction of a product can reasonably be expected to result in personal injury. Life support devices or systems are devices or systems that (a) are intended for surgical implant into the body or (b) support or sustain life, and whose failure to perform can be reasonably expected to result in a significant injury to the user. A Purchaser's use or sale of Micrel Products for use in life support appliances, devices or systems is at Purchaser's own risk and Purchaser agrees to fully indemnify Micrel for any damages resulting from such use or sale.

© 2005 Micrel, Incorporated.