2.5V/3.3V 1:10 DIFFERENTIAL LVPECL/LVECL/HSTL CLOCK DRIVER

FEATURES

- **2.5V and 3.3V power supply options**
- **Guaranteed AC parameters over temperature:**
  - **f_{MAX} = 3GHz**
  - **< 25ps output-to-output skew**
  - **< 320ps t_r / t_f**
  - **< 475ps propagation delay**
- **Wide temperature range: –40°C to +85°C**
- **Differential design**
- **V_{BB} output for single-ended input applications**
- **Fully compatible with industry standard 100K I/O levels**
- **Available in 32-pin TQFP Package**

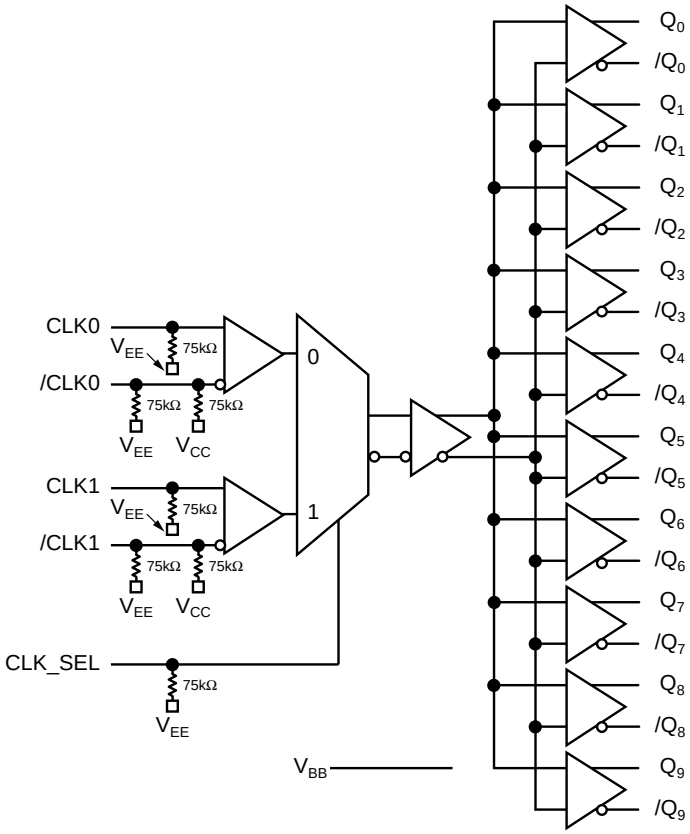
DESCRIPTION

The SY100EP111U is a high-speed, low skew 1-to-10 differential fanout buffer designed for clock distribution in new, high-performance systems. The internal 2:1 mux allows the input to select between two differential clock sources.

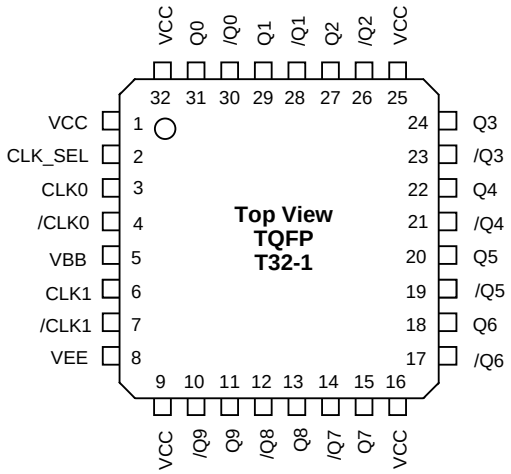
The device is specifically designed for low skew. The interconnect scheme and metal layout are carefully optimized for minimal gate-to-gate skew within the device. Wafer characterization and process control ensure consistent distribution of propagation delay from lot to lot.

The V_{BB} output is intended for use as a reference voltage for single-ended reception of ECL signals to that device only. When using V_{BB} for this purpose, it is recommended that V_{BB} is decoupled to V_{CC} via a 0.01µF capacitor.

BLOCK DIAGRAM



PIN CONFIGURATION



Rev.: A Amendment: /3
Issue Date: September 2001

PIN NAMES

Pin	Function
CLK0, /CLK0	LVPECL, LVECL, HSTL Clock Inputs: CLK0 input includes a 75kΩ pull-down. Default is low if left floating. /CLK0 includes an internal 75kΩ pull-up and pull-down. Default state is V_{CC}/2.
CLK1, /CLK1	LVPECL, LVECL, HSTL Clock Inputs: CLK input includes a 75kΩ pull-down. Default is low if left floating. /CLK includes an internal 75kΩ pull-up and pull-down. Default state is V_{CC}/2.
Q0 to Q9	LVPECL/LVECL Outputs.
/Q0 to /Q9	Complementary LVPECL/LVECL Outputs.
CLK_SEL	LVPECL/LVECL Clock Select Input: Internal 75kΩ resistor connected to V_{EE}. When left floating, the default condition is LOW.
V_{BB}	Reference Voltage: AC coupled or single-ended input applications.
V_{CC}	Positive Power Supply: Bypass with 0.1µF// 0.01µF low ESR capacitors.
V_{EE}	Negative Power Supply: LVPECL operation, connect to GND.

FUNCTION TABLE

CLK_SEL	Active Input
0	CLK0, /CLK0
1	CLK1, /CLK1

ABSOLUTE MAXIMUM RATINGS[1]

Symbol	Rating		Value	Unit
$V_{CC} - V_{EE}$	Power Supply Voltage		6.0	V
V_{IN}	Input Voltage (V_{CC} = 0V, V_{IN} not more negative than V_{EE}) Input Voltage (V_{EE} = 0V, V_{IN} not more positive than V_{CC})		–6.0 to 0 +6.0 to 0	V
I_{OUT}	Output Current	–Continuous –Surge	50 100	mA
I_{BB}	V_{BB} Sink/Source Current[2]		±0.5	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	50 42	°C/W
θ_{JC}	Package Thermal Resistance (Junction-to-Case)		20	°C/W

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. Due to the limited drive capability, use for inputs of same package only.

DC ELECTRICAL CHARACTERISTICS[1]

Symbol	Parameter	T_A = –40°C			T_A = +25°C			T_A = +85°C			Unit	Condition
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.		
V_{CC}	Power Supply Voltage											
	(LVPECL)	2.375	—	3.8	2.375	—	3.8	2.375	—	3.8	V	
	(LVECL)	–3.8	—	–2.375	–3.8	—	–2.375	–3.8	—	–2.375	V	
I_{EE}	Power Supply Current	—	55	120	—	70	120	—	85	120	mA	
I_{IH}	Input HIGH Current	—	—	150	—	—	150	—	—	150	µA	$V_{IN} = V_{IH}$
I_{IL}	Input LOW Current											
	CLK0, CLK1	0.5	—	—	0.5	—	—	0.5	—	—	µA	$V_{IN} = V_{IL}$
	/CLK0, /CLK1	–150	—	—	–150	—	—	–150	—	—	µA	$V_{IN} = V_{IL}$
C_{IN}	Input Capacitance	—	—	—	—	2	—	—	—	—	pF	

NOTES:

1. 100KEP circuits are designed to meet the DC specifications shown in the above table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and traverse airflow greater than 500lfpm is maintained.

LVPECL DC ELECTRICAL CHARACTERISTICS[1]

V_{CC} = 3.3V ±10%; V_{EE} = 0V

Symbol	Parameter	T_A = –40°C			T_A = +25°C			T_A = +85°C			Unit	Condition
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.		
V_{IH}	Input HIGH Voltage (Single-Ended)	2135	—	2420	2135	—	2420	2135	—	2420	mV	
V_{IL}	Input LOW Voltage (Single-Ended)	1355	—	1675	1355	—	1675	1355	—	1675	mV	
V_{OL}	Output LOW Voltage	1355	1480	1605	1355	1480	1605	1355	1480	1605	mV	50Ω to V_{CC}–2V
V_{OH}	Output HIGH Voltage	2155	2280	2405	2155	2280	2405	2155	2280	2405	mV	50Ω to V_{CC}–2V
V_{BB}	Reference Voltage[2]	1775	1875	1975	1775	1875	1975	1775	1875	1975	mV	
V_{IHCMR}	Input HIGH Voltage Common Mode Range[3]	1.2	—	V_{CC}	1.2	—	V_{CC}	1.2	—	V_{CC}	V	

NOTES:

1. 100KEP circuits are designed to meet the DC specifications shown in the above table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and traverse airflow greater than 500lfpm is maintained. Input and output varies 1:1 with V_{CC}.
2. Single-ended input operation is limited $V_{CC} \geq 3.0V$ in LVPECL mode. V_{BB} reference varies 1:1 with V_{CC}.
3. V_{IHCMR} (Min) varies 1:1 with V_{EE}, V_{IHCMR} (Max) varies 1:1 with V_{CC}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

LVPECL DC ELECTRICAL CHARACTERISTICS[1]

V_{CC} = 2.5V ±5%, V_{EE} = 0V

Symbol	Parameter	T_A = –40°C			T_A = +25°C			T_A = +85°C			Unit	Condition
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.		
V_{IH}	Input HIGH Voltage (Single-ended)	1335	—	1620	1335	—	1620	1335	—	1620	mV	
V_{IL}	Input LOW Voltage (Single-ended)	555	—	875	555	—	875	555	—	875	mV	
V_{OL}	Output LOW Voltage	555	680	805	555	680	805	555	680	805	mV	50Ω to V_{CC}–2V
V_{OH}	Output HIGH Voltage	1355	1480	1605	1355	1480	1605	1355	1480	1605	mV	50Ω to V_{CC}–2V
V_{IHCMR}	Input HIGH Voltage Common Mode Range[2]	1.2	—	V_{CC}	1.2	—	V_{CC}	1.2	—	V_{CC}	V	

NOTES:

1. 100KEP circuits are designed to meet the DC specifications shown in the above table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and traverse airflow greater than 500lfpm is maintained. Input and output varies 1:1 with V_{CC}.
2. V_{IHCMR} (Min) varies 1:1 with V_{EE}, V_{IHCMR} (Max) varies 1:1 with V_{CC}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

LVECL DC ELECTRICAL CHARACTERISTICS[1]

V_{EE} = –2.375V to –3.8V; V_{CC} = 0V

Symbol	Parameter	T_A = –40°C			T_A = +25°C			T_A = +85°C			Unit	Condition
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.		
V_{IL}	Input LOW Voltage (Single-ended)	–1945	—	–1625	–1945	—	–1625	–1945	—	–1625	mV	
V_{IH}	Input HIGH Voltage (Single-ended)	–1165	—	–0880	–1165	—	–0880	–1165	—	–0880	mV	
V_{OL}	Output LOW Voltage	–1945	–1820	–1695	–1945	–1820	–1695	–1945	–1820	–1695	mV	50Ω to V_{CC}–2V
V_{OH}	Output HIGH Voltage	–1145	–1020	–0895	–1145	–1020	–0895	–1145	–1020	–0895	mV	50Ω to V_{CC}–2V
V_{BB}	Output Reference Voltage[2]	–1525	–1425	–1325	–1525	–1425	–1325	–1525	–1425	–1325	mV	
V_{IHCMR}	Input HIGH Voltage Common Mode Range[3]	V_{EE} +1.2		0.0	V_{EE} +1.2		0.0	V_{EE} +1.2		0.0	V	

NOTES:

1. 100KEP circuits are designed to meet the DC specifications shown in the above table after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and traverse airflow greater than 500lfpm is maintained.
2. Single-ended input operation is limited $V_{EE} \leq$ –3.0V in LVECL mode.
3. V_{IHCMR} (Min) varies 1:1 with V_{EE}. The V_{IHCMR} range is referenced to the most positive side of the differential input signal.

HSTL DC ELECTRICAL CHARACTERISTICS

V_{CC} = 2.375V to 3.8V; V_{EE} = 0V

Symbol	Parameter	T_A = –40°C			T_A = +25°C			T_A = +85°C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{IH}	Input HIGH Voltage	1200	—	—	1200	—	—	1200	—	—	mV
V_{IL}	Input LOW Voltage	—	—	400	—	—	400	—	—	400	mV
V_X	Input Crossover Voltage	680	—	900	680	—	900	680	—	900	mV

AC ELECTRICAL CHARACTERISTICS

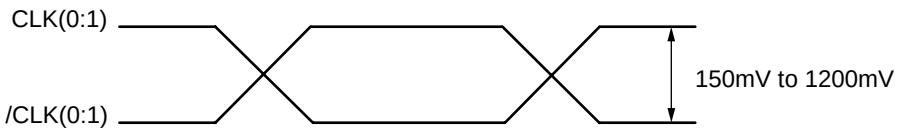
(LVPECL) V_{CC} = 2.375 to 3.8V, V_{EE} = 0V; (LVECL) V_{EE} = –2.375V to –3.8V, V_{CC} = 0V

Symbol	Parameter	T_A = –40°C			T_A = +25°C			T_A = +85°C			Unit	Condition
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.		
f_{MAX}	Maximum Frequency(1)	3	—	—	3	—	—	3	—	—	GHz	
t_{PLH} t_{PHL}	Propagation Delay (Diff.)	325	400	475	325	400	475	325	400	475	ps	
t_{SKEW}	Within-Device Skew	—	20	25	—	20	25	—	20	25	ps	(2)
	Part-to-Part Skew	—	85	150	—	85	150	—	85	150	ps	(3)
t_{JITTER}	Cycle-to-Cycle Jitter (rms)	—	0.2	< 1	—	0.2	< 1	—	0.2	< 1	ps	
V_{PP}	Minimum Input Swing(4)	150	800	1200	150	800	1200	150	800	1200	mV	
t_r, t_f	Output Rise/Fall Time (20% to 80%)	105	180	255	105	200	275	105	230	320	ps	

NOTES:

1. Measured with 750mV clock signal, 50% duty cycle. All loading with a 50Ω to V_{CC} –2.0V.
2. Input clock to any output (Q0 to Q9); Differential.
3. Measured for same transitions.
4. See “Timing Waveform.”

TIMING WAVEFORM



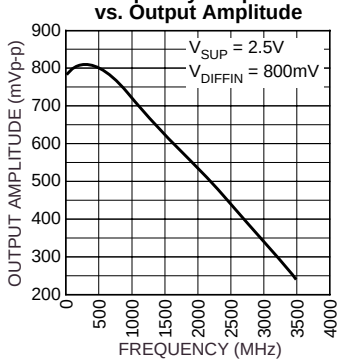
PRODUCT ORDERING CODE

Ordering Code	Package Type	Operating Range	Package Marking
SY100EP111UTI	T32-1	Industrial	XEP111U
SY100EP111UTITR*	T32-1	Industrial	XEP111U

*Tape and Reel

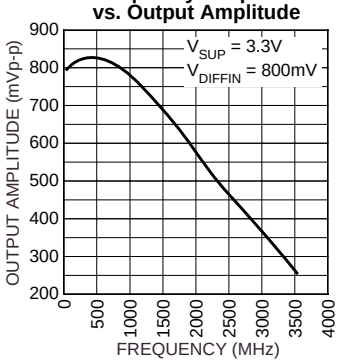
TYPICAL CHARACTERISTICS

Frequency Response vs. Output Amplitude



Frequency Response vs. Output Amplitude @2.5V

Frequency Response vs. Output Amplitude



Frequency Response vs. Output Amplitude @3.3V

TERMINATION RECOMMENDATIONS

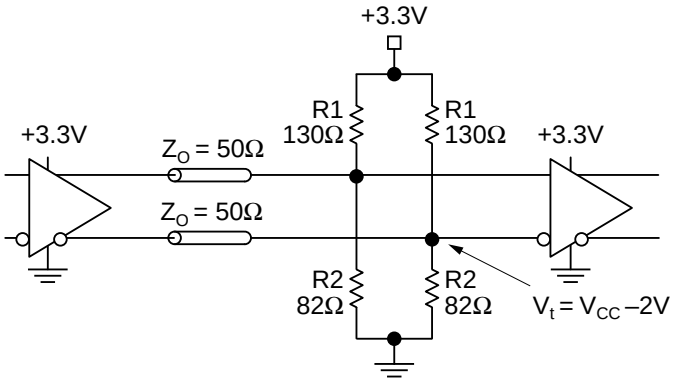


Figure 1. Parallel Termination–Thevenin Equivalent

Notes:

1. For +2.5V systems:
   R1 = 250Ω
   R2 = 62.5Ω

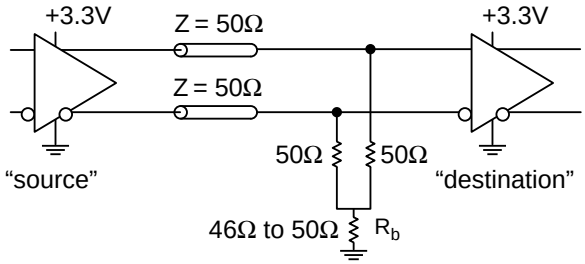


Figure 2. Three-Resistor "Y–Termination"

Notes:

1. Power-saving alternative to 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.

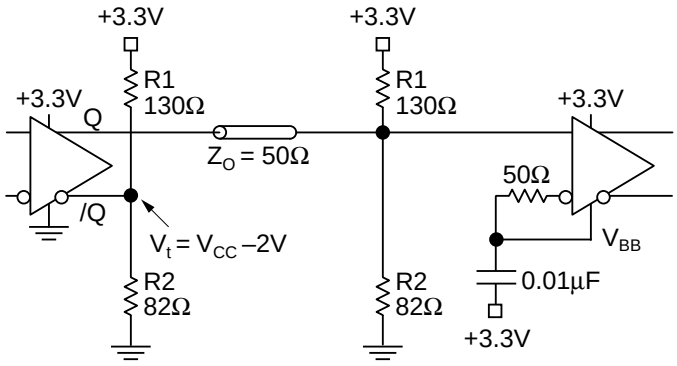
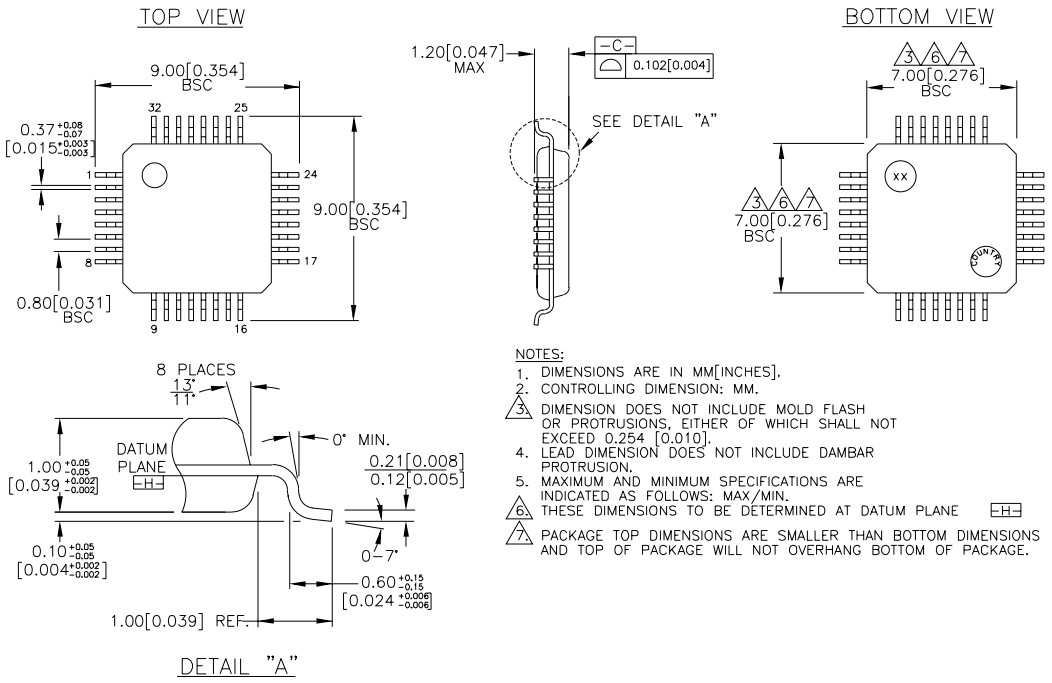


Figure 3. Terminating Unused I/O

Notes:

1. Unused output (/Q) must be terminated to balance the output.
2. Micrel's differential I/O logic devices include a V_{BB} reference pin .
3. Connect unused input through 50Ω to V_{BB}. Bypass with a 0.01µF capacitor to V_{CC}, not GND.
4. For +2.5V systems: R1 = 250Ω, R2 = 62.5Ω.

32 LEAD THIN QUAD FLATPACK (T32-1)



NOTES:
1. DIMENSIONS ARE IN MM[INCHES].
2. CONTROLLING DIMENSION: MM.
3. DIMENSION DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS, EITHER OF WHICH SHALL NOT EXCEED 0.254 [0.010].
4. LEAD DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSION.
5. MAXIMUM AND MINIMUM SPECIFICATIONS ARE INDICATED AS FOLLOWS: MAX/MIN.
6. THESE DIMENSIONS TO BE DETERMINED AT DATUM PLANE -H-
7. PACKAGE TOP DIMENSIONS ARE SMALLER THAN BOTTOM DIMENSIONS AND TOP OF PACKAGE WILL NOT OVERHANG BOTTOM OF PACKAGE.

Rev. 01

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