# 3.3V Differential LVPECL/LVDS/CML to LVTTL/LVCMOS Translator

The MC100EPT21 is a Differential LVPECL/LVDS/CML to LVTTL/LVCMOS translator. Because LVPECL (Positive ECL), LVDS, and positive CML input levels and LVTTL/LVCMOS output levels are used, only +3.3 V and ground are required. The small outline 8–lead SOIC package makes the EPT21 ideal for applications which require the translation of a clock or data signal.

The  $V_{BB}$  output allows this EPT21 to be cap coupled in either single–ended or differential input mode. When single–ended cap coupled,  $V_{BB}$  output is tied to the  $\overline{D}$  input and D is driven for a non–inverting buffer, or  $V_{BB}$  output is tied to the D input and  $\overline{D}$  is driven for an inverting buffer. When cap coupled differentially,  $V_{BB}$  output is connected through a resistor to each input pin. If used, the  $V_{BB}$  pin should be bypassed to  $V_{CC}$  via a 0.01  $\mu F$  capacitor. For additional information see AND8020/D. For a single–ended direct connection use an external voltage reference source such as a resistor divider. Do not use  $V_{BB}$  for a single–ended direct connection or port to another device.

#### **Features**

- 1.4 ns Typical Propagation Delay
- Maximum Frequency > 275 MHz Typical
- LVPECL/LVDS/CML Inputs, LVTTL/LVCMOS Outputs
- 24 mA TTL outputs
- Operating Range: V<sub>CC</sub> = 3.0 V to 3.6 V with GND = 0 V
- The 100 Series Contains Temperature Compensation
- V<sub>BB</sub> Output
- Pb-Free Packages are Available



### ON Semiconductor®

http://onsemi.com

#### MARKING DIAGRAMS\*



SO-8 D SUFFIX CASE 751





TSSOP-8 DT SUFFIX CASE 948R





1

DFN8 MN SUFFIX CASE 506AA



A = Assembly Location

L = Wafer Lot

Y = Year

W = Work Week

M = Date Code

= Pb-Free Package

(Note: Microdot may be in either location)

\*For additional marking information, refer to Application Note AND8002/D.

#### **ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

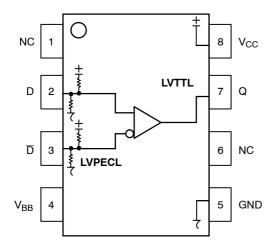


Figure 1. Logic Diagram and 8-Lead Pinout (Top View)

#### **Table 1. PIN DESCRIPTION**

PIN	FUNCTION			
Q	LVTTL/LVCMOS Output			
D*, <del>D</del> **	Differential LVPECL/LVDS/CML Input			
V <sub>CC</sub>	Positive Supply			
V <sub>BB</sub>	Output Reference Voltage			
GND	Ground			
NC No Connect				
EP	(DFN8 only) Thermal exposed pad must be connected to a sufficient thermal conduit. Electrically connect to the most negative supply (GND) or leave unconnected, floating open.			

- Pin will default to 1/2 of V<sub>CC</sub> when left open.
   Pin will default to 2/3 of V<sub>CC</sub> when left open.

**Table 2. ATTRIBUTES** 

Characteris	tics	Value			
Internal Input Pulldown Resistor	D	50 kΩ			
Internal Input Pulldown Resistor	75 kΩ				
Internal Input Pullup Resistor	D, $\overline{D}$	50 kΩ			
ESD Protection	Human Body Model Machine Model Charged Device Model	> 1.5 kV > 100 V > 2 kV			
Moisture Sensitivity, Indefinite Time C	Out of Drypack (Note 1)	Level 1			
Flammability Rating	UL 94 V-0 @ 0.125 in				
Transistor Count	81 Devices				
Meets or exceeds JEDEC Spec EIA/JESD78 IC Latchup Test					

<sup>1.</sup> For additional information, see Application Note AND8003/D.

**Table 3. MAXIMUM RATINGS** 

Symbol	Parameter	Condition 1	Condition 2	Rating	Unit
V <sub>CC</sub>	PECL Power Supply	GND = 0 V		3.8	V
V <sub>IN</sub>	PECL Input Voltage	GND = 0 V	$V_I \leq V_{CC}$	0 to 3.8	V
I <sub>BB</sub>	V <sub>BB</sub> Sink/Source			± 0.5	mA
T <sub>A</sub>	Operating Temperature Range			-40 to +85	°C
T <sub>stg</sub>	Storage Temperature Range			-65 to +150	°C
$\theta_{\sf JA}$	Thermal Resistance (Junction-to-Ambient)	0 lfpm 500 lfpm	SO-8 SO-8	190 130	°C/W
$\theta_{\sf JC}$	Thermal Resistance (Junction-to-Case)	Standard Board	SO-8	41 to 44	°C/W
$\theta_{\sf JA}$	Thermal Resistance (Junction-to-Ambient)	0 lfpm 500 lfpm	TSSOP-8 TSSOP-8	185 140	°C/W °C/W
$\theta_{\sf JC}$	Thermal Resistance (Junction-to-Case)	Standard Board	TSSOP-8	41 to 44	°C/W
$\theta_{\sf JA}$	Thermal Resistance (Junction-to-Ambient)	0 lfpm 500 lfpm	DFN8 DFN8	129 84	°C/W °C/W
T <sub>sol</sub>	Wave Solder Pb Pb-Free	< 2 to 3 sec @ 248°C <2 to 3 sec @ 260°C		265 265	°C
$\theta_{\sf JC}$	Thermal Resistance (Junction-to-Case)	(Note 2)	DFN8	35 to 40	°C/W

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

2.	JEDEC standard multilayer board – 2S2P (2 signal, 2 power)

Table 4. PECL INPUT DC CHARACTERISTICS V<sub>CC</sub> = 3.3 V, GND = 0.0 V (Note 3)

			-40°C			25°C			85°C		
Symbol	Characteristic	Min	Тур	Max	Min	Тур	Max	Min	Тур	Max	Unit
V <sub>IH</sub>	Input HIGH Voltage (Single-Ended)	2075		2420	2075		2420	2075		2420	mV
V <sub>IL</sub>	Input LOW Voltage (Single-Ended)	1355		1675	1355		1675	1355		1675	mV
V <sub>BB</sub>	Output Voltage Reference	1910	2035	2160	1910	2035	2160	1910	2035	2160	mV
V <sub>IHCMR</sub>	Input HIGH Voltage Common Mode Range (Differential Configuration) (Note 4)	1.2		3.3	1.2		3.3	1.2		3.3	V
I <sub>IH</sub>	Input HIGH Current			150			150			150	μΑ
I <sub>IL</sub>	Input LOW Current	-150			-150			-150			μΑ

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

- 3. Input parameters vary 1:1 with V<sub>CC</sub>.
- V<sub>IHCMR</sub> min varies 1:1 with GND, V<sub>IHCMR</sub> max varies 1:1 with V<sub>CC</sub>. The V<sub>IHCMR</sub> range is referenced to the most positive side of the differential input signal.

Table 5. LVTTL/LVCMOS OUTPUT DC CHARACTERISTICS  $V_{CC} = 3.3 \text{ V}$ , GND = 0.0 V,  $T_A = -40 ^{\circ}\text{C}$  to  $85 ^{\circ}\text{C}$ 

Symbol	Characteristic	Condition	Min	Тур	Max	Unit
V <sub>OH</sub>	Output HIGH Voltage	$I_{OH} = -3.0 \text{ mA}$	2.4			V
V <sub>OL</sub>	Output LOW Voltage	I <sub>OL</sub> = 24 mA			0.5	V
I <sub>CCH</sub>	Power Supply Current	Outputs set to HIGH	5	12	20	mA
I <sub>CCL</sub>	Power Supply Current	Outputs set to LOW	8	18	26	mA
Ios	Output Short Circuit Current		-130		-80	mA

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

Table 6. AC CHARACTERISTICS  $V_{CC} = 3.0 \text{ V}$  to 3.6 V, GND = 0.0 V (Note 5)

				-40°C			25°C			85°C		
Symbol	Characteristic		Min	Тур	Max	Min	Тур	Max	Min	Тур	Max	Unit
f <sub>max</sub>	Maximum Frequency (Figure 2)		275	350		275	350		275	350		MHz
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay to Output Differential		800 1200	1400 1400	2050 1800	800 1200	1400 1400	2250 1800	900 1100	1600 1300	2950 1900	ps
t <sub>SKEW</sub>	Duty Cycle Skew (Note 6)		45	50	55	45	50	55	45	50	55	%
t <sub>SKPP</sub>	Part-to-Part Skew (Note 6)				500			500			500	ps
t <sub>JITTER</sub>	Random Clock Jitter (RMS)			3.5	5		3.5	5		3.5	5	ps
$V_{PP}$	Input Voltage Swing (Differential Configuration)		150	800	1200	150	800	1200	150	800	1200	mV
t <sub>r</sub> t <sub>f</sub>	Output Rise/Fall Times (0.8V – 2.0V)	Q, $\overline{Q}$	250	600	900	250	600	900	250	600	900	ps

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

- 5. Measured with a 750 mV 50% duty-cycle clock source.  $R_L$  = 500  $\Omega$  to GND and  $C_L$  = 20 pF to GND. Refer to Figure 3.
- 6. Skews are measured between outputs under identical transitions. Duty cycle skew is measured between differential outputs using the deviations of the sum Tpw- and Tpw+.

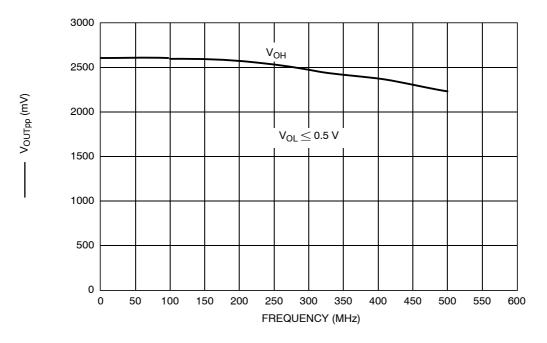


Figure 2. F<sub>max</sub>

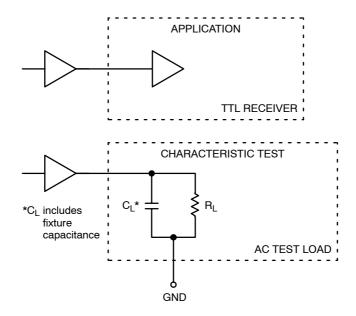


Figure 3. TTL Output Loading Used For Device Evaluation

#### **ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>		
MC100EPT21D	SOIC-8	98 Units / Rail		
MC100EPT21DG	SOIC-8 (Pb-Free)	98 Units / Rail		
MC100EPT21DR2	SOIC-8	2500 / Tape & Reel		
MC100EPT21DR2G	SOIC-8 (Pb-Free)	2500 / Tape & Reel		
MC100EPT21DT	TSSOP-8	100 Units / Rail		
MC100EPT21DTG	TSSOP-8 (Pb-Free)	100 Units / Rail		
MC100EPT21DTR2	TSSOP-8	2500 / Tape & Reel		
MC100EPT21DTR2G	TSSOP-8 (Pb-Free)	2500 / Tape & Reel		
MC100EPT21MNR4	DFN8	1000 / Tape & Reel		
MC100EPT21MNR4G	DFN8 (Pb-Free)	1000 / Tape & Reel		

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

#### **Resource Reference of Application Notes**

AN1405/D - ECL Clock Distribution Techniques

**AN1406/D** – Designing with PECL (ECL at +5.0 V)

AN1503/D - ECLinPS™ I/O SPiCE Modeling Kit

AN1504/D - Metastability and the ECLinPS Family

AN1568/D - Interfacing Between LVDS and ECL

AN1672/D - The ECL Translator Guide

AND8001/D - Odd Number Counters Design

AND8002/D - Marking and Date Codes

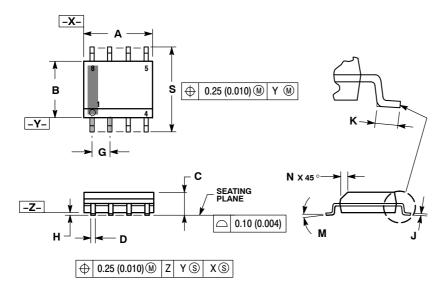
AND8020/D - Termination of ECL Logic Devices

AND8066/D - Interfacing with ECLinPS

AND8090/D - AC Characteristics of ECL Devices

#### PACKAGE DIMENSIONS

#### SOIC-8 NB CASE 751-07 **ISSUE AJ**



#### NOTES:

- DIMENSIONING AND TOLERANCING PER
- ANSI Y14.5M, 1982. CONTROLLING DIMENSION: MILLIMETER.
- 3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
- MOLD PROTRUSION.

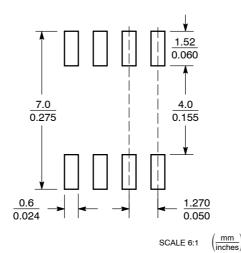
  4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.

  5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

  6. 751–01 THRU 751–06 ARE OBSOLETE. NEW STANDARD IS 751–07.

	MILLIN	IETERS	INC	HES	
DIM	MIN	MIN MAX		MAX	
Α	4.80	5.00	0.189	0.197	
В	3.80	4.00	0.150	0.157	
C	1.35 1.75		0.053	0.069	
D	0.33	0.51	0.013	0.020	
G	1.27	7 BSC	0.050 BSC		
Н	0.10 0.25		0.004	0.010	
J	J 0.19 0.25		0.007	0.010	
K	<b>(</b> 0.40 1.27		0.016	0.050	
М	0 °	8 °	0 °	8 °	
N	0.25	0.50	0.010	0.020	
S	5.80	6.20	0.228	0.244	

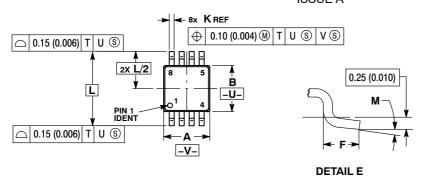
#### **SOLDERING FOOTPRINT\***

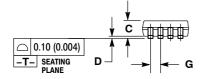


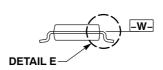
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

#### PACKAGE DIMENSIONS

#### TSSOP-8 **DT SUFFIX** PLASTIC TSSOP PACKAGE CASE 948R-02 **ISSUE A**







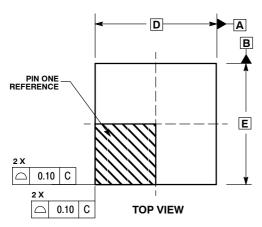
- NOTES:
  1. DIMENSIONING AND TOLERANCING PER ANSI
- Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
- DIMENSION A DOES NOT INCLUDE MOLD FLASH.
   PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
- 4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.

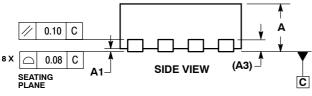
  5. TERMINAL NUMBERS ARE SHOWN FOR
- REFERENCE ONLY.
  6. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

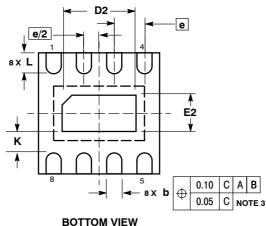
	MILLIN	IETERS	INC	HES
DIM	MIN	MAX	MIN	MAX
Α	2.90	3.10	0.114	0.122
В	2.90	3.10	0.114	0.122
С	0.80	1.10	0.031	0.043
D	0.05	0.15	0.002	0.006
F	0.40	0.70	0.016	0.028
G	0.65	BSC	0.026	BSC
K	0.25	0.40	0.010	0.016
L	4.90	4.90 BSC		BSC
M	0°	6 °	0°	6°

#### PACKAGE DIMENSIONS

#### DFN8 CASE 506AA-01 ISSUE D







# ECLinPS is a trademark of Semiconductor Components Industries, LLC (SCILLC).

ON Semiconductor and un are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice on semiconductor and war engineer trademarks of semiconductor components industries, Ite (SciLLC) solitate services are injective to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

#### **PUBLICATION ORDERING INFORMATION**

#### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor P.O. Box 5163, Denver, Colorado 80217 USA Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada Email: orderlit@onsemi.com

USA/Canada Europe, Middle East and Africa Technical Support: Phone: 421 33 790 2910 Japan Customer Focus Center Phone: 81-3-5773-3850

N. American Technical Support: 800-282-9855 Toll Free

ON Semiconductor Website: www.onsemi.com

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative

NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994 .
- CONTROLLING DIMENSION: MILLIMETERS. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.
- COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

	MILLIMETERS					
DIM	MIN	MAX				
Α	0.80	1.00				
A1	0.00	0.05				
А3	0.20	REF				
b	0.20	0.30				
D	2.00	BSC				
D2	1.10	1.30				
Е	2.00	BSC				
E2	0.70	0.90				
е	0.50	BSC				
K	0.20					
L	0.25	0.35				