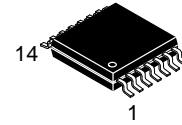


# 4-Channel LVTTTL to GTL Transceiver

## FXGL2014



TSSOP-14 WB  
CASE 948G

### Description

The FXGL2014 is a 4-channel translator to interface between 3.3-V LVTTTL chip set I/O and Xeon processor GTL-/GTL/GTL+ I/O.

The FXGL2014 integrates ESD protection cells on all terminals and is available in a TSSOP package (5.0 mm x 4.4 mm). The device is characterized over free air temperature range of -40 °C to 85 °C.

### Features

- Operates as a 4-bit GTL-/GTL/GTL+ Sampling Receiver or as a LVTTTL to GTL-/GTL/GTL+ Driver
- 3.0 V to 3.6 V Operation with 5 V Tolerant LVTTTL Input
- GTL Input and Output 3.6 V Tolerant
- Vref Adjustable from 0.5 V to VCC / 2
- Partial Power-down Permitted
- Under-Voltage Lockout (UVLO)
- ESD Protection Exceeds 2000 V HBM per JESD22-A114 and 1000 V CDM per JESD22-CC101
- Latch-up Protection Exceeds 500 mA per JESD78
- Package Offered: TSSOP14
- -40 °C to 85 °C Operating Temperature Range

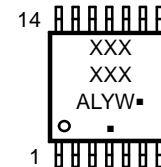
### Applications

- Server
- Base Station
- Wire-line Communication

### FUNCTIONAL DESCRIPTION

INPUT	INPUT/OUTPUT	
	A (LVTTTL)	B (GTL)
High Voltage	Input	Bn = An
Low Voltage	An = Bn	Input

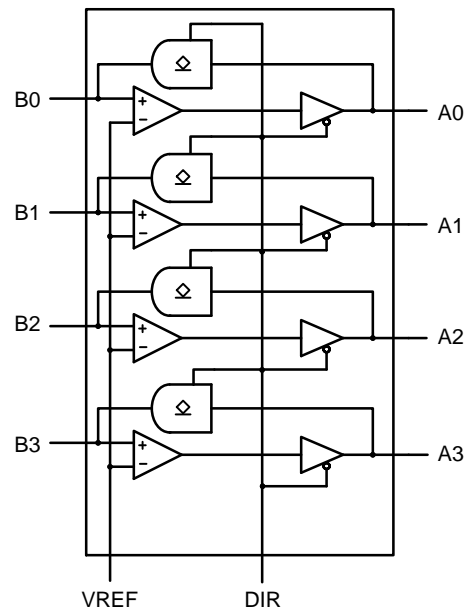
### MARKING DIAGRAM



- XXX = Specific Device Code
- A = Assembly Location
- L = Wafer Lot
- Y = Year
- W = Work Week
- = Pb-Free Package

(Note: Microdot may be in either location)

### ANALOG SYMBOLS



### ORDERING INFORMATION

See detailed ordering and shipping information on page 9 of this data sheet.

# FXGL2014

## PIN CONFIGURATION

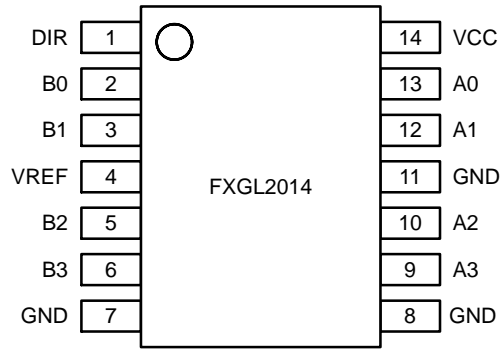


Figure 1. Pin Assignment (Top Through View)

## PIN DESCRIPTION

Pin Name	Pin #	Description
A0	13	LVTTTL Data Input / Output
A1	12	
A2	10	
A3	9	
B0	2	GTL Data Input / Output
B1	3	
B2	5	
B3	6	
DIR	1	Direction Control Input (LVTTTL)
GND	7	Ground
	8	
	11	
VCC	14	Supply Voltage
VREF	4	GTL Reference Voltage

**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Min	Max	Unit
V <sub>CC</sub>	Supply Voltage	-0.5	4.6	V
I <sub>IK</sub>	Input Clamping Current, V <sub>I</sub> < 0 V	-	-50	mA
V <sub>DIR</sub>	Input Control Voltages DIR	-0.5	6	V
V <sub>I</sub>	Input Voltage	A Port	6.5	V
		B Port	4.6	
I <sub>CK</sub>	Control Input Clamp Current, V <sub>O</sub> < 0 V	-	-50	mA
V <sub>O</sub>	Output Voltage in Off-State	A Port	6.5	V
		B Port	4.6	
I <sub>OL</sub>	Current into Any Output in the Low State	A Port	40	mA
		B Port	80	
I <sub>OH</sub>	Current into Any Output in the High State	-	-40	mA
T <sub>stg</sub>	Storage Temperature Range	-55	150	°C
V <sub>ESD</sub>	Human Body Model (HBM), JEDEC: JESD22-A114	All Pins	2	kV
	Charged Device Model, JEDEC: JESD22-C101	All Pins	1	

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

**RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Min	Typ	Max	Unit	
V <sub>CC</sub>	Supply Voltage	3.0	3.3	3.6	V	
V <sub>TT</sub>	Termination Voltage	GTL-	0.85	0.90	0.95	V
		GTL	1.14	1.20	1.26	
		GTL+	1.35	1.50	1.65	
V <sub>REF</sub>	Reference Voltage	Overall	0.5	2/3 V <sub>TT</sub>	V <sub>CC</sub> /2	V
		GTL-	0.50	0.60	0.63	
		GTL	0.76	0.80	0.84	
		GTL+	0.87	1.00	1.10	
V <sub>I</sub>	Input Voltage	A Port	0	3.3	5.5 (Note 3)	V
		B Port	0	V <sub>TT</sub>	3.6	
V <sub>IH</sub>	High-level Input Voltage	A Port and DIR	2	-	-	V
		B Port	V <sub>REF</sub> + 50 mV	-	-	
V <sub>IL</sub>	Low-level Input Voltage	A Port and DIR	-	-	0.8	V
		B Port	-	-	V <sub>REF</sub> - 50 mV	
I <sub>OL</sub>	Low-level Output Current	A Port	-	-	20	mA
		B Port	-	-	50	
I <sub>OH</sub>	High-level Output Current	-	-	-20	mA	

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

- Over operating free-air temperature range (unless otherwise noted).
- All unused control inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation.
- The V<sub>I</sub> (max) of LVTTTL port is 3.6 V if configured as output (DIR=L).

**THERMAL INFORMATION**

Thermal Metric		Value	Unit
R <sub>θJA</sub>	Junction-to-Ambient Thermal Resistance	116	°C/W
R <sub>θJC(top)</sub>	Junction-to-Case (Top) Thermal Resistance	17	

# FXGL2014

## DC ELECTRICAL CHARACTERISTICS (Specified at $T_A = -40\text{ }^\circ\text{C}$ to $85\text{ }^\circ\text{C}$ (unless otherwise noted))

Symbol	Parameter	Conditions	-40 °C to 85 °C			Unit
			Min	Typ	Max	
$V_{OH}$	A Port	$V_{CC} = 3$ to $3.6\text{ V}$ , $I_{OH} = -100\text{ }\mu\text{A}$	$V_{CC} - 0.2$	-	-	V
		$V_{CC} = 3\text{ V}$ , $I_{OH} = -16\text{ mA}$	2.0	-	-	
$V_{OL}$	A Port	$V_{CC} = 3\text{ V}$ , $I_{OL} = 8\text{ mA}$	-	0.28	0.40	V
	A Port	$V_{CC} = 3\text{ V}$ , $I_{OL} = 12\text{ mA}$	-	0.42	0.60	
	A Port	$V_{CC} = 3\text{ V}$ , $I_{OL} = 16\text{ mA}$	-	0.55	0.80	
	B Port	$V_{CC} = 3\text{ V}$ , $I_{OL} = 40\text{ mA}$	-	0.23	0.40	
$I_I$	A Port	$V_{CC} = 3.6\text{ V}$ , $V_I = V_{CC}$	-	-	$\pm 1$	$\mu\text{A}$
		$V_{CC} = 3.6\text{ V}$ , $V_I = 0\text{ V}$	-	-	$\pm 1$	
		$V_{CC} = 3.6\text{ V}$ , $V_I = 5.5\text{ V}$	-	-	5	
	B Port	$V_{CC} = 3.6\text{ V}$ , $V_I = V_{TT}$ or GND	-	-	$\pm 1$	$\mu\text{A}$
	Control Pin	$V_{CC} = 3.6\text{ V}$ , $V_I = V_{CC}$ or $0\text{ V}$	-	-	$\pm 1$	$\mu\text{A}$
$I_{off}$	OFF-State Output Current on A Port	$V_{CC} = 0\text{ V}$ , $V_{IO} = 0$ to $3.6\text{ V}$	-	-	$\pm 10$	$\mu\text{A}$
	OFF-State Output Current on A Port	$V_{CC} = 0\text{ V}$ , $V_{IO} = 3.6$ to $5.5\text{ V}$	-	-	$\pm 100$	
	OFF-State Output Current on B Port	$V_{CC} = 0\text{ V}$ , $V_{IO} = 0$ to $3.6\text{ V}$	-	-	$\pm 10$	
$I_{CC}$	A Port	$V_{CC} = 3.6\text{ V}$ , $V_I = V_{CC}$ or GND, $I_O = 0$	-	3	10	mA
	B Port	$V_{CC} = 3.6\text{ V}$ , $V_I = V_{TT}$ or GND, $I_O = 0$	-	3	10	mA
$\Delta I_{CC}$	A Port or Control Input	$V_{CC} = 3.6\text{ V}$ , $V_I = V_{CC} - 0.6\text{ V}$	-	-	500	$\mu\text{A}$
$V_{UVLO}$ (Note 4)	Under-Voltage Lockout Threshold	$V_{CC} = 0$ to $3\text{ V}$	1.5	-	-	V
$C_I$ (Note 4)	Input Capacitance of Control Pin	$V_{CC} = 3$ to $3.6\text{ V}$ , $V_I = 3.0\text{ V}$ or $0\text{ V}$	-	2.0	-	pF
$C_{IO}$ (Note 4)	A Port	$V_{CC} = 3$ to $3.6\text{ V}$ , $V_O = 3.0\text{ V}$ or $0\text{ V}$	-	4.0	-	pF
	B Port	$V_{CC} = 3$ to $3.6\text{ V}$ , $V_O = V_{TT}$ or $0\text{ V}$	-	5.46	-	

4. Guaranteed by characterization and / or design. Not production tested.

## AC ELECTRICAL CHARACTERISTICS (Over-operating range, $T_A = -40\text{ }^\circ\text{C}$ to $85\text{ }^\circ\text{C}$ , $V_{CC} = 3.0$ to $3.6\text{ V}$ , GND = $0\text{ V}$ for GTL)

Symbol	Parameter		GTL-			GTL			GTL+			Unit
			$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$			$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$			$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$			
			$V_{REF} = 0.6\text{ V}$			$V_{REF} = 0.8\text{ V}$			$V_{REF} = 1\text{ V}$			
			$V_{TT} = 0.9\text{ V}$			$V_{TT} = 1.2\text{ V}$			$V_{TT} = 1.5\text{ V}$			
			Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
$t_{PLH}$	Low to High Propagation Delay (Note 5)	An to Bn	-	2.8	5.0	-	2.8	5.0	-	2.8	5.0	ns
$t_{PHL}$	High to Low Propagation Delay (Note 5)		-	3.3	7.0	-	3.4	7.0	-	3.4	7.0	
$t_{PLH}$	Low to High Propagation Delay (Note 5)	Bn to An	-	5.3	8.0	-	5.2	8.0	-	5.1	8.0	ns
$t_{PHL}$	High to Low Propagation Delay (Note 5)		-	5.2	8.0	-	4.9	7.0	-	4.7	7.0	

5. Guaranteed by characterization and / or design. Not production tested.

TYPICAL CHARACTERISTICS

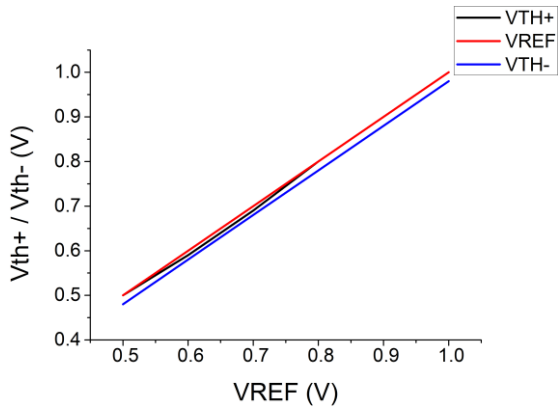


Figure 2. GTL Vth+ and Vth- vs. VREF (-40 °C)

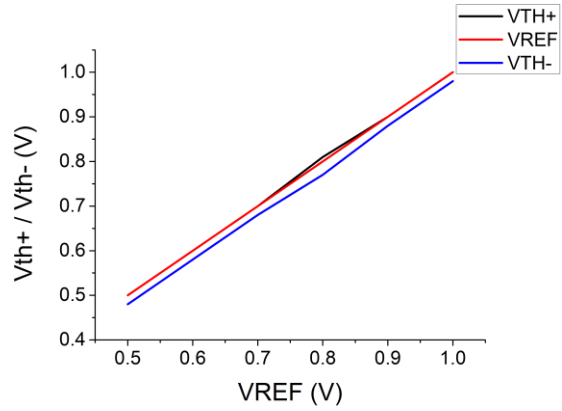


Figure 3. GTL Vth+ and Vth- vs. VREF (25 °C)

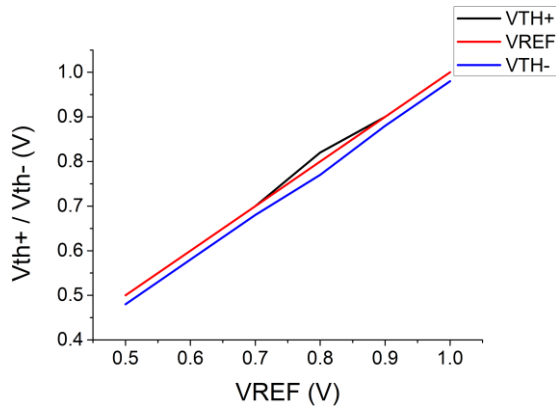


Figure 4. GTL Vth+ and Vth- vs. VREF (85 °C)

TEST INFORMATION

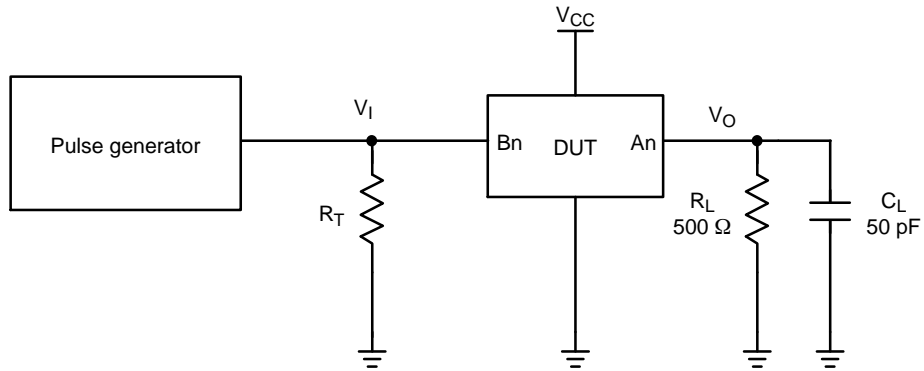


Figure 5. Load Circuit for A Port

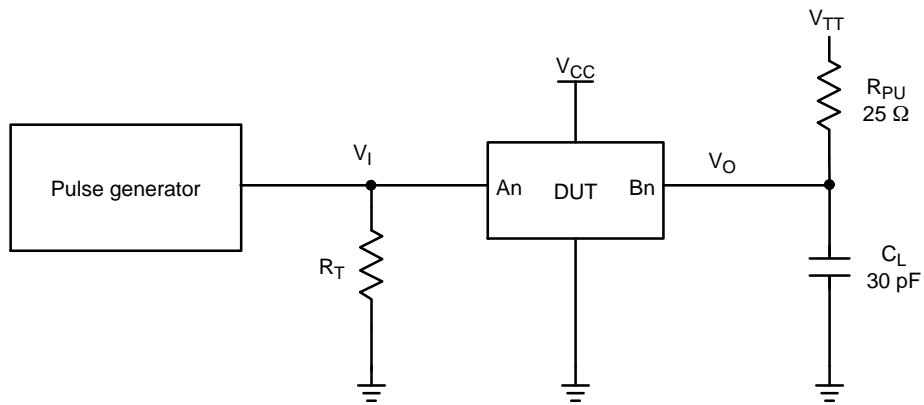


Figure 6. Load Circuit for A Port

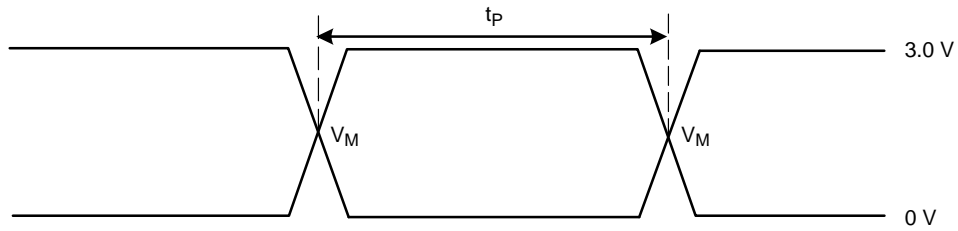
$R_T$  – Termination resistance; should be equal to output impedance of pulse generators.  
 $R_L$  – Load resistor.  
 $C_L$  – Load capacitance; includes jig and probe capacitance.

# FXGL2014

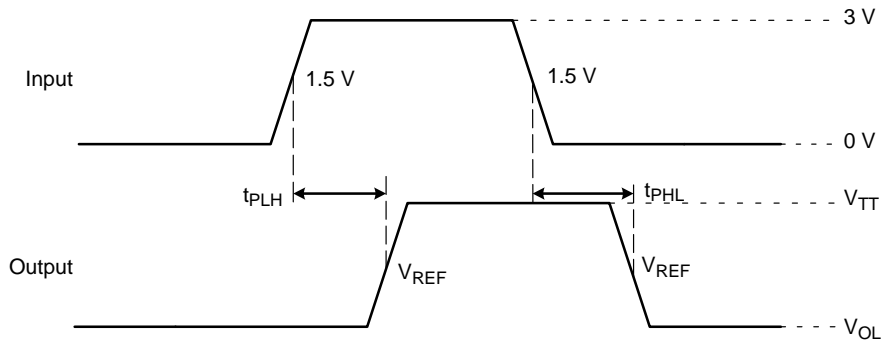
## WAVEFORMS

$V_M = 1.5\text{ V}$  at  $V_{CC} \geq 3.0\text{ V}$ ;  $V_M = V_{CC}$  at  $V_{CC} \geq 2.7\text{ V}$  for A ports and control pins.

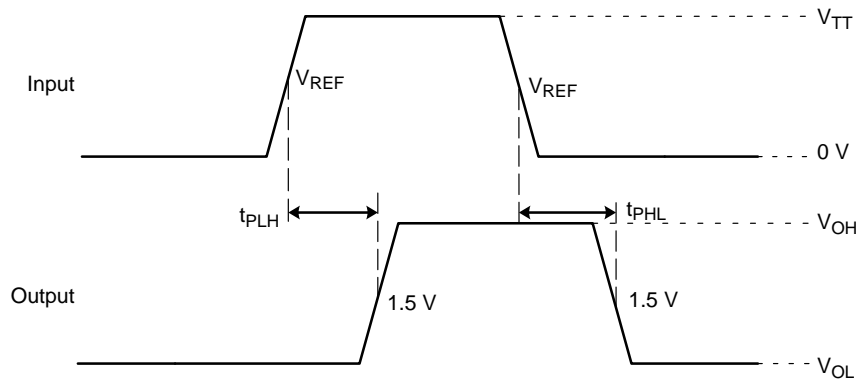
$V_M = V_{REF}$  for B ports.



$V_M = 1.5\text{ V}$  for A port and  $V_{REF}$  for B port  
Pulse duration



A port to B port  
Propagation delay times



B port to A port  
Propagation delay times

**Figure 7. Voltage Waveforms**

- A. All control inputs are LVTTTL levels.
- B.  $C_L$  includes probe and jig capacitance.
- C. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r \leq 2.5\text{ ns}$ ,  $t_f \leq 2.5\text{ ns}$ .
- D. The outputs are measured one at a time, with one transition per measurement.

**APPLICATION INFORMATION**

**Application Overview**

The FXGL2014 is a 4-channel translating transceiver designed for 3.3-V LVTTTL system interface with a GTL-/GTL/GTL+ bus, where GTL-/GTL/GTL+ refers to the reference voltage of the GTL bus and the input/output voltage thresholds associated with it.

The direction pin allows the part to function as either a GTL-to-LVTTTL sampling receiver or as a LVTTTL-to-GTL interface.

The FXGL2014 performs translation in two directions. One direction is GTL-/GTL/GTL+ to LVTTTL when DIR is tied to GND. With appropriate  $V_{REF}$  set up, the GTL input can be compliant with GTL-/GTL/GTL+. Another direction is LVTTTL to GTL-/GTL/GTL+ when DIR is tied to VCC. 3.6 V tolerance on the GTL output allows the GTL outputs to pull up to any voltage level under 3.6 V.

**Feature Description**

*5 V Tolerance on LVTTTL Input*

The FXGL2014 LVTTTL inputs (only) are tolerant up to 5.5 V and allow direct access to TTL or 5 V CMOS inputs. The LVTTTL outputs are not 5.5 V tolerant.

*3.6 V Tolerance on GTL Input / Output*

The FXGL2014 GTL inputs and outputs operate up to 3.6 V, allowing the device to be used in higher voltage open-drain output applications.

*Ultra-Low  $V_{REF}$  and High Bandwidth*

FXGL2014's  $V_{REF}$  tracks down to 0.5 V for low voltage CPUs with excellent propagation delay performance. This feature allows the FXGL2014 to support high data rates with the GTL- bus.

*Under-Voltage Lockout (UVLO)*

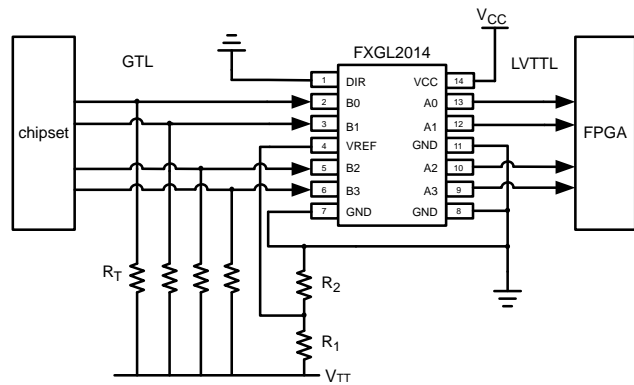
Under-voltage lockout circuit is integrated internal. This feature makes sure the data transferred effectively when power unstable.

**Typical Application**

*GTL-/GTL/GTL+ to LVTTTL*

Select appropriate  $V_{TT}/V_{REF}$  based upon GTL-/GTL/GTL+. The parameters in Recommended Operating Conditions are compliant to the GTL specification.

The FXGL2014 requires industrial standard LVTTTL and GTL inputs. The design example in the Application Information shows standard voltage level and typical resistor values.



**Figure 8. Application Diagram for GTL to LVTTTL**

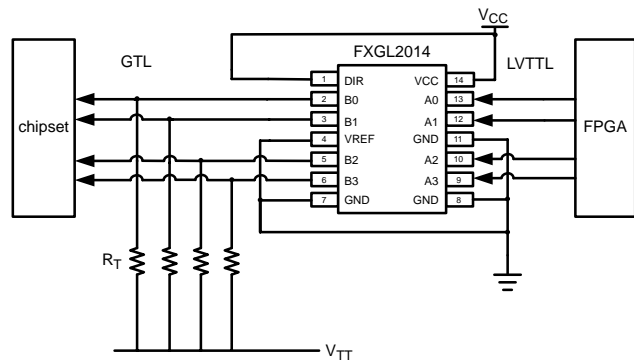
**Table 1. APPLICATION TABLE FOR GTL TO LVTTTL**

	Port B to Port A
	GTL to LVTTTL
$V_{CC}$	3.3 V
$V_{REF}$	$2 \times V_{TT}/3$
$V_{TT}$	1.0 V
DIR	GND
$R_T$	75 $\Omega$
$R_1$	49.9 $\Omega$
$R_2$	100 $\Omega$

*LVTTTL to GTL-/GTL/GTL+*

Because GTL is an open-drain interface, the selection of the pull-up resistor depends on the application requirement (for example, data rate) and PCB trace capacitance.

The FXGL2014 requires industrial standard LVTTTL and GTL inputs. The design example in the Application Information section show standard voltage level and typical resistor values.



**Figure 9. Application Diagram for LVTTTL to GTL**



# FXGL2014

Table 2. APPLICATION TABLE FOR LVTTTL TO GTL

	Port A to Port B
	LVTTTL to GTL
$V_{CC}$	3.3 V
$V_{REF}$	GND
$V_{TT}$	1.0 V
DIR	GND
$R_T$	75 $\Omega$
$R_1$	Not Available
$R_2$	Not Available

## ORDERING INFORMATION

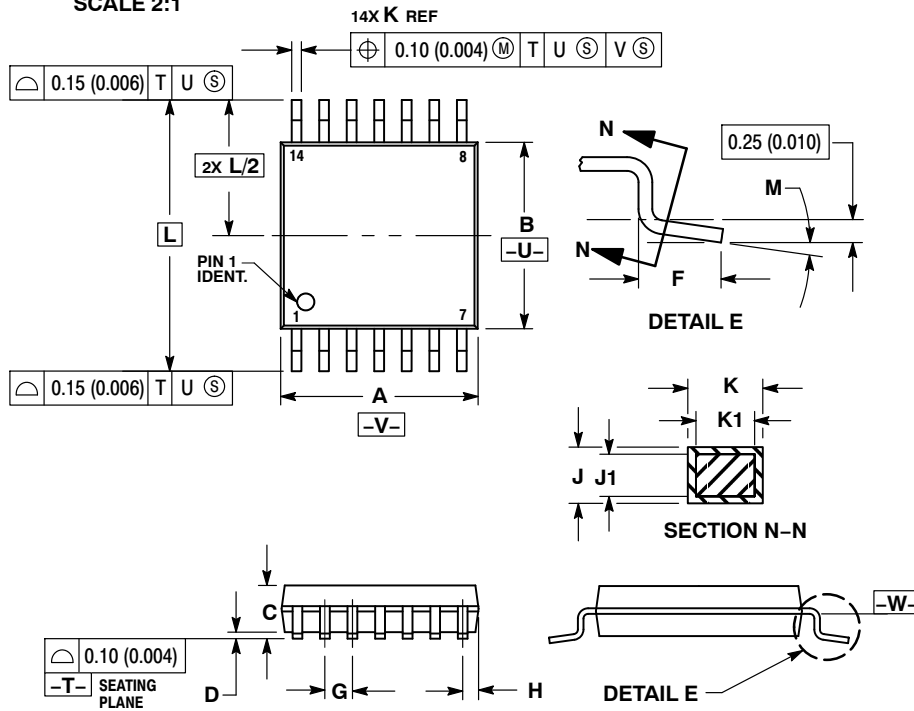
Part Number	Operating Temperature Range	Package	Shipping <sup>†</sup>
FXGL2014MTCX	-40 °C to 85 °C	5.0 mm x 4.4 mm, 0.65 mm Pitch, 14 Lead TSSOP Package (Pb-Free)	2500 / Tape & Reel

<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.



TSSOP-14 WB  
CASE 948G  
ISSUE C

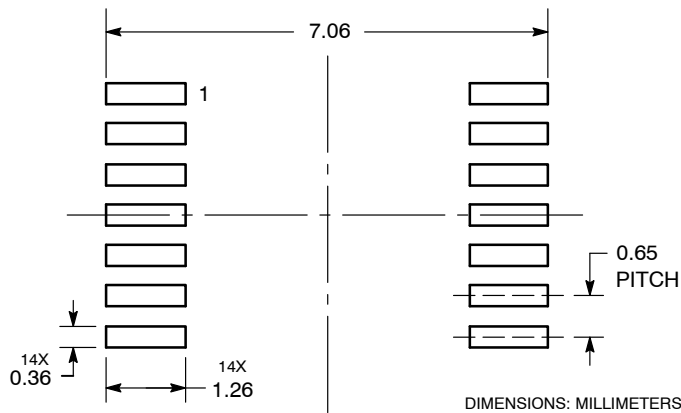
DATE 17 FEB 2016



- NOTES:
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  - 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.
  - DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
  - DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
  - TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
  - DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

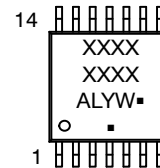
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.50	0.60	0.020	0.024
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

RECOMMENDED  
SOLDERING FOOTPRINT\*



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

GENERIC  
MARKING DIAGRAM\*



- A = Assembly Location
- L = Wafer Lot
- Y = Year
- W = Work Week
- = Pb-Free Package

(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

DOCUMENT NUMBER:	98ASH70246A	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	TSSOP-14 WB	PAGE 1 OF 1

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi 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. onsemi does not convey any license under its patent rights nor the rights of others.

**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** 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. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** 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. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** 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 **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at [www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)