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ON Semiconductor®

November 2016

FXGL2014 — 4-Channel LVTTL to GTL Transceiver

Features

- Operates as a 4-bit GTL−/GTL/GTL+ Sampling receiver or as a LVTTL to GTL−/GTL/GTL+ Driver
- 3.0 V to 3.6 V Operation with 5 V Tolerant LVTTL 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

Description

The FXGL2014 is a 4-channel translator to interface between 3.3-V LVTTL 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 × 4.4 mm). The device is characterized over free air temperature range of –40°C to 85°C.

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Ordering Information

Part Number	Operating Temperature Range	Package	Packing Method
FXGL2014MTC	-40 to +85°C	5.0 mm × 4.4 mm, 0.65 mm Pitch, 14 Lead TSSOP Package	Tape & Reel

Analog Symbols

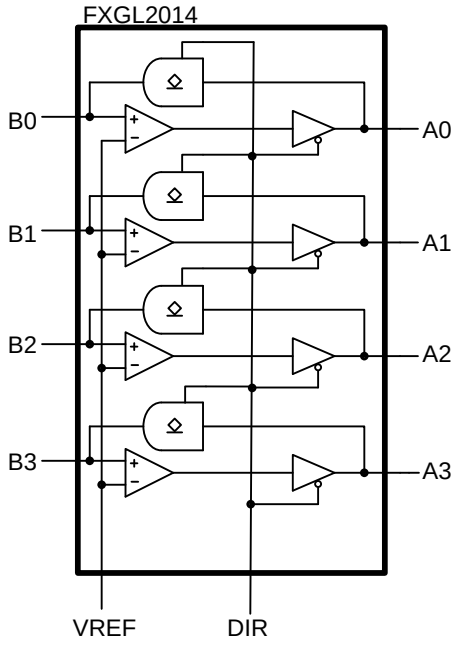


Figure 1. Analog Symbols

Functional Description

INPUT	INPUT/OUTPUT	
DIR	**A (LVTTL)**	**B (GTL)**
High Voltage	Input	Bn = An
Low Voltage	An = Bn	Input

Pin Configuration

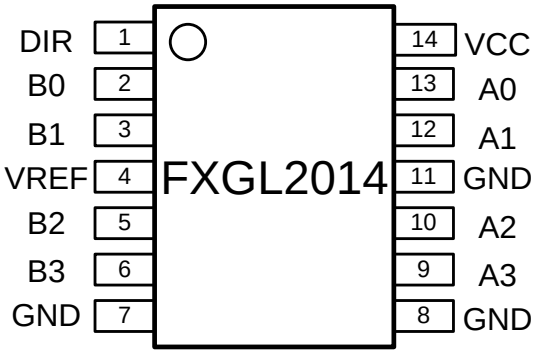


Figure 1. Pin Assignment (Top Through View)

Pin Descriptions

Pin Name	Pin #	Description
A0	13	LVTTL 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 (LVTTL)
GND	7	Ground
	8	
	11	
VCC	14	Supply Voltage
VREF	4	GTL Reference Voltage

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

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

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance. ON does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter		Min.	Typ.	Max.	Unit
V_{CC}	Supply Voltage		3.0	3.3	3.6	V
V_{TT}	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_{REF}	Reference Voltage	Overall	0.5	$2/3V_{TT}$	$V_{CC}/2$	V
		GTL-	0.50	0.60	0.63	
		GTL	0.76	0.80	0.84	
		GTL+	0.87	1.00	1.10	
V_I	Input Voltage	A Port	0	3.3	5.5(3)	V
		B Port	0	V_{TT}	3.6	
V_{IH}	High-level Input Voltage	A Port and DIR	2			V
		B Port	V_{REF} + 50 mV			
V_{IL}	Low-level Input Voltage	A Port and DIR			0.8	V
		B Port			V_{REF} – 50 mV	
I_{OL}	Low-level Output Current	A Port			20	mA
		B Port			50	
I_{OH}	High-level Output current	A Port			-20	mA

Notes:

1. Over operating free-air temperature range (unless otherwise noted).
2. All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation.
3. The V_I (max) of LVTTL port is 3.6 V if configured as output (DIR=L).

Thermal Information

Thermal Metric		Value	Unit
$R_{\theta JA}$	Junction-to-Ambient Thermal Resistance	116	°C/W
$R_{\theta JC(top)}$	Junction-to-Case (top) Thermal Resistance	17	

DC Electrical Characteristics

Specified at T_A = –40°C to 85°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 V, I_{OH} = –100 µA	V_{CC} – 0.2			V
		V_{CC} = 3 V, I_{OH} = –16 mA	2.0			
V_{OL}	A Port	V_{CC} = 3 V, I_{OL} = 8 mA		0.28	0.40	V
	A Port	V_{CC} = 3 V, I_{OL} = 12 mA		0.42	0.60	
	A Port	V_{CC} = 3 V, I_{OL} = 16 mA		0.55	0.80	
	B Port	V_{CC} = 3 V, I_{OL} = 40 mA		0.23	0.40	
I_I	A Port	V_{CC} = 3.6 V, V_I = V_{CC}			±1	µA
		V_{CC} = 3.6 V, V_I = 0 V			±1	
		V_{CC} = 3.6 V, V_I = 5.5 V			5	
	B Port	V_{CC} = 3.6 V, V_I = V_{TT} or GND			±1	µA
	Control Pin	V_{CC} = 3.6 V, V_I = V_{CC} or 0 V			±1	µA
I_{off}	OFF-State Output Current on A Port	V_{CC} = 0 V, V_{IO} = 0 to 3.6 V			±10	µA
	OFF-State Output Current on A Port	V_{CC} = 0 V, V_{IO} = 3.6 to 5.5 V			±100	
	OFF-State Output Current on B Port	V_{CC} = 0 V, V_{IO} = 0 to 3.6 V			±10	
I_{CC}	A Port	V_{CC} = 3.6 V, V_I = V_{CC} or GND, I_O = 0		3	10	mA
	B Port	V_{CC} = 3.6 V, V_I = V_{TT} or GND, I_O = 0		3	10	mA
ΔI_{CC}	A Port or Control Input	V_{CC} = 3.6 V, V_I = V_{CC} – 0.6 V			500	µA
V_{UVLO}[4]	Under-Voltage Lockout Threshold	V_{CC} = 0 to 3 V	1.5			V
C_I[4]	Input Capacitance of Control Pin	V_{CC} = 3 to 3.6 V, V_I = 3.0 V or 0 V		2.0		pF
C_{IO}[4]	A Port	V_{CC} = 3 to 3.6 V, V_O = 3.0 V or 0 V		4.0		pF
	B Port	V_{CC} = 3 to 3.6 V, V_O = V_{TT} or 0 V		5.46		

Note:

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

AC Electrical Characteristics

Over-operating range, T_A = –40°C to 85°C, V_{CC} = 3.0 to 3.6 V, GND = 0 V for GTL.

Symbol	Parameter		GTL−			GTL			GTL+			Unit
			V_{CC} = 3.3 V ± 0.3 V			V_{CC} = 3.3 V ± 0.3 V			V_{CC} = 3.3 V ± 0.3 V			
			V_{REF} = 0.6 V			V_{REF} = 0.8 V			V_{REF} = 1 V			
			V_{TT} = 0.9 V			V_{TT} = 1.2 V			V_{TT} = 1.5 V			
			Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
t_{PLH}	Low to High Propagation Delay[5]	An to Bn		2.8	5.0		2.8	5.0		2.8	5.0	ns
t_{PHL}	High to Low Propagation Delay[5]			3.3	7.0		3.4	7.0		3.4	7.0	
t_{PLH}	Low to High Propagation Delay[5]	Bn to An		5.3	8.0		5.2	8.0		5.1	8.0	ns
t_{PHL}	High to Low Propagation Delay[5]			5.2	8.0		4.9	7.0		4.7	7.0	

Note:

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

Typical characteristics

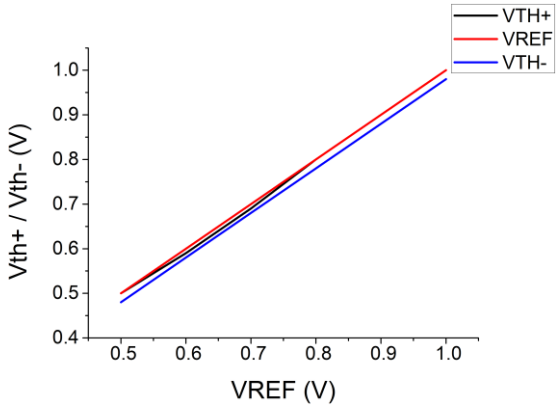


Figure 2. GTL Vth+ and Vth- vs. VREF (-40°C)

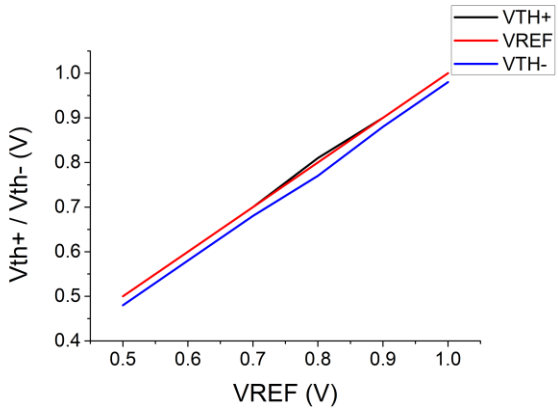


Figure 3. GTL Vth+ and Vth- vs. VREF (25°C)

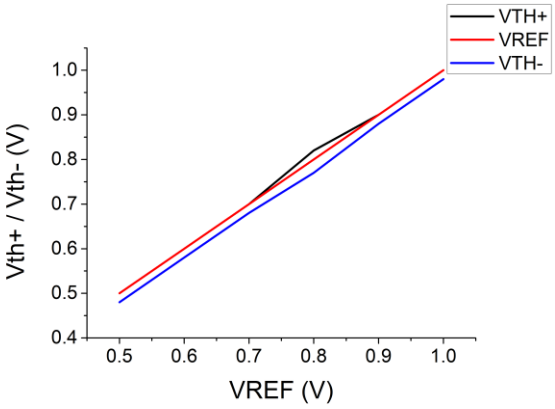


Figure 4. GTL Vth+ and Vth- vs. VREF (85°C)

Test Information

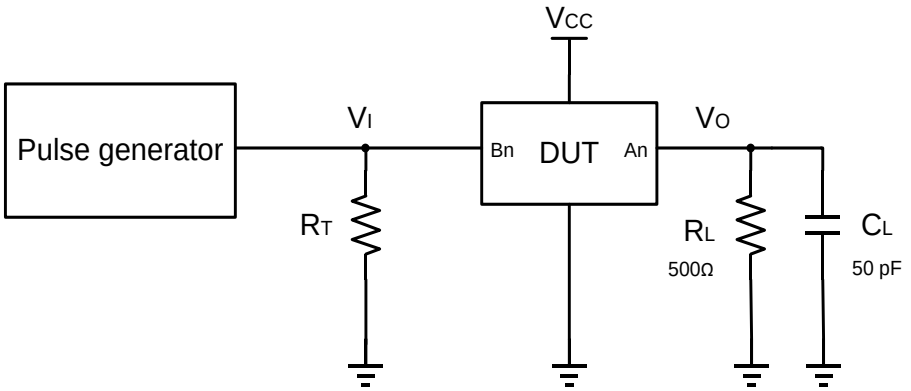


Figure 5. Load Circuit for A Port

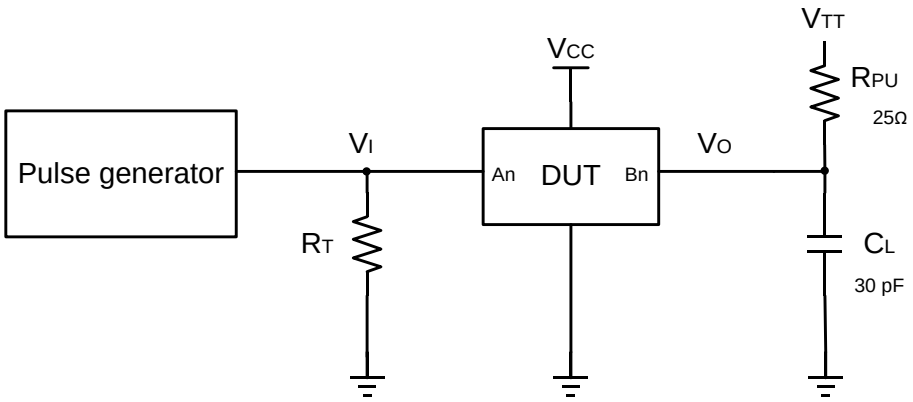


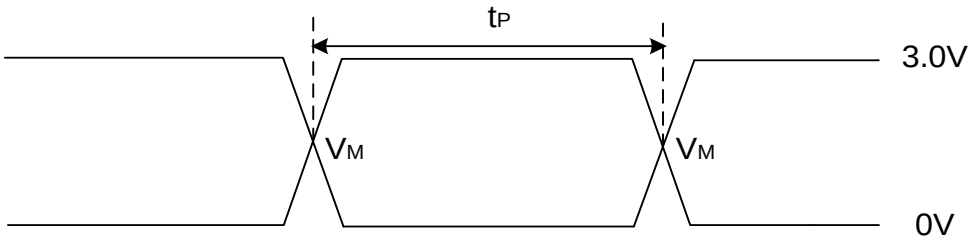
Figure 6. Load Circuit for B Port

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.

Waveforms

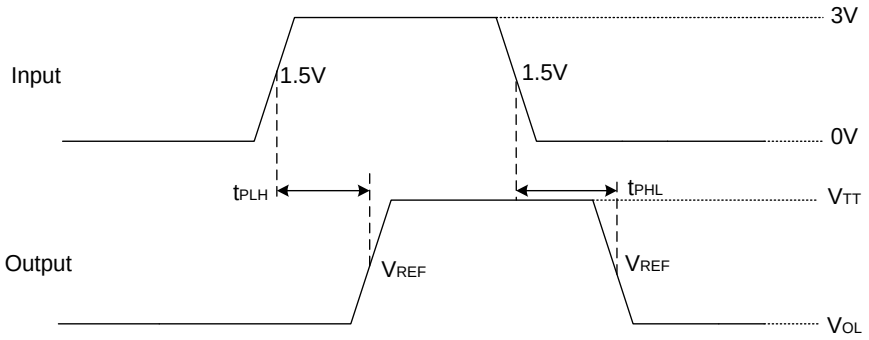
V_M = 1.5 V at V_{CC} ≥ 3.0 V; V_M = V_{CC} at V_{CC} ≤ 2.7 V for A ports and control pins.

V_M = V_{REF} for B ports.



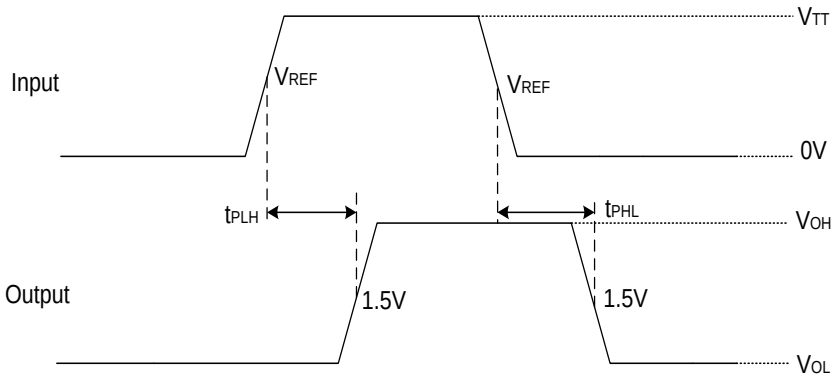
VM = 1.5V for A port and VREF for B port

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 LVTTL levels.
B. C_L includes probe and jig capacitance.
C. All input pulses are supplied by generators having the following characteristics: PRR≤ 10 MHz, Z_O = 50 Ω, t_r ≤ 2.5 ns, t_f ≤ 2.5 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 LVTTL 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-LVTTL sampling receiver or as a LVTTL-to-GTL interface.

The FXGL2014 performs translation in two directions. One direction is GTL–/GTL/GTL+ to LVTTL 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 LVTTL 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 LVTTL Input

The FXGL2014 LVTTL inputs (only) are tolerant up to 5.5 V and allow direct access to TTL or 5 V CMOS inputs. The LVTTL 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 LVTTL

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 LVTTL and GTL inputs. The design example in the Application Information shows standard voltage level and typical resistor values.

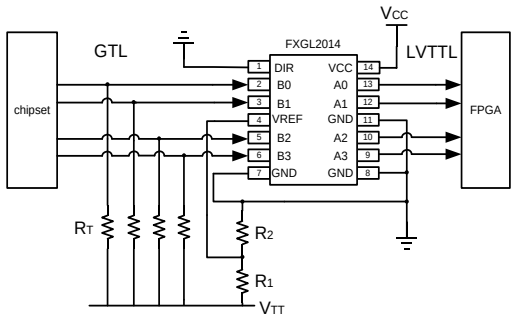


Figure 8. Application Diagram for GTL to LVTTL

Table 1. Application Table for GTL to LVTTL

	Port B to Port A
	GTL to LVTTL
VCC	3.3 V
VREF	2*VTT/3
VTT	1.0 V
DIR	GND
RT	75 Ω
R1	49.9 Ω
R2	100 Ω

LVTTL 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 LVTTL and GTL inputs. The design example in the Application Information section show standard voltage level and typical resistor values.

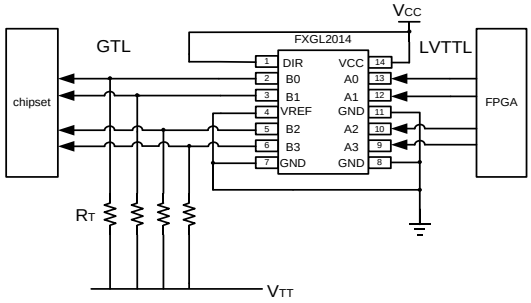
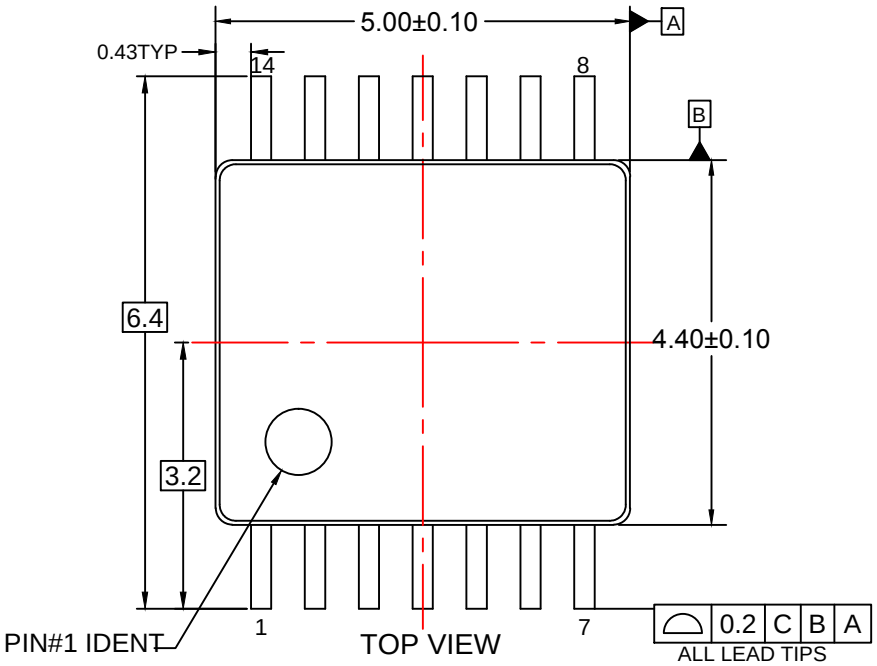


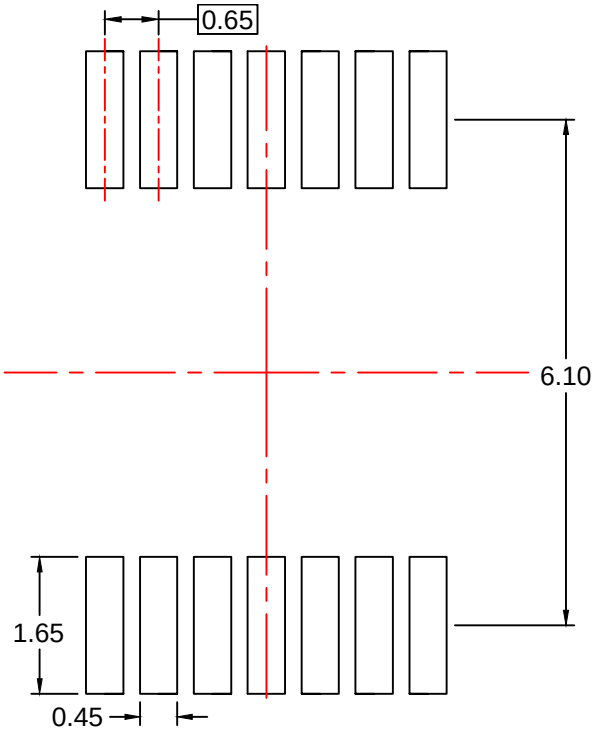
Figure 9. Application Diagram for LVTTL to GTL

Table 2. Application Table for LVTTL to GTL

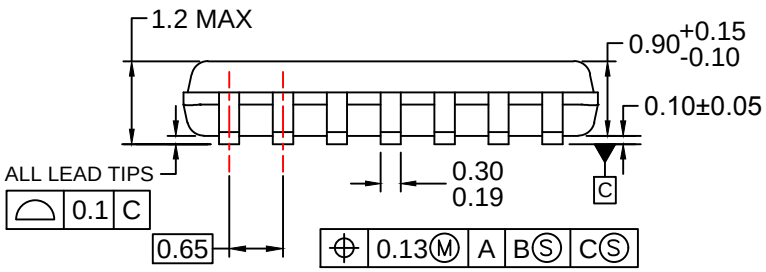
	Port A to Port B
	LVTTL to GTL
V_{CC}	3.3 V
V_{REF}	GND
V_{TT}	1.0 V
DIR	GND
R_T	75 Ω
R_1	Not Available
R_2	Not Available



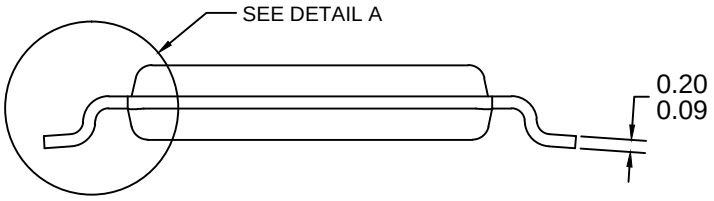
TOP VIEW

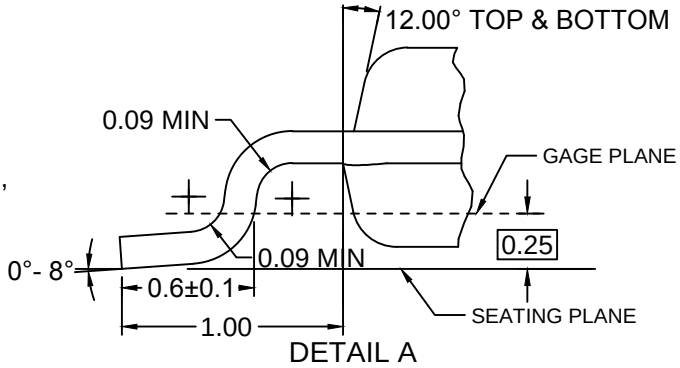


RECOMMENDED LAND PATTERN



FRONT VIEW





DETAIL A

NOTES:

A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS

D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 2009.

E. LANDPATTERN STANDARD: SOP65P640X110-14M.

F. DRAWING FILE NAME: MKT-MTC14rev7.

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