



CMOS 18-BIT TTL/GTLP UNIVERSAL BUS TRANSCEIVER

**IDT74GTLP16612
PRELIMINARY**

FEATURES:

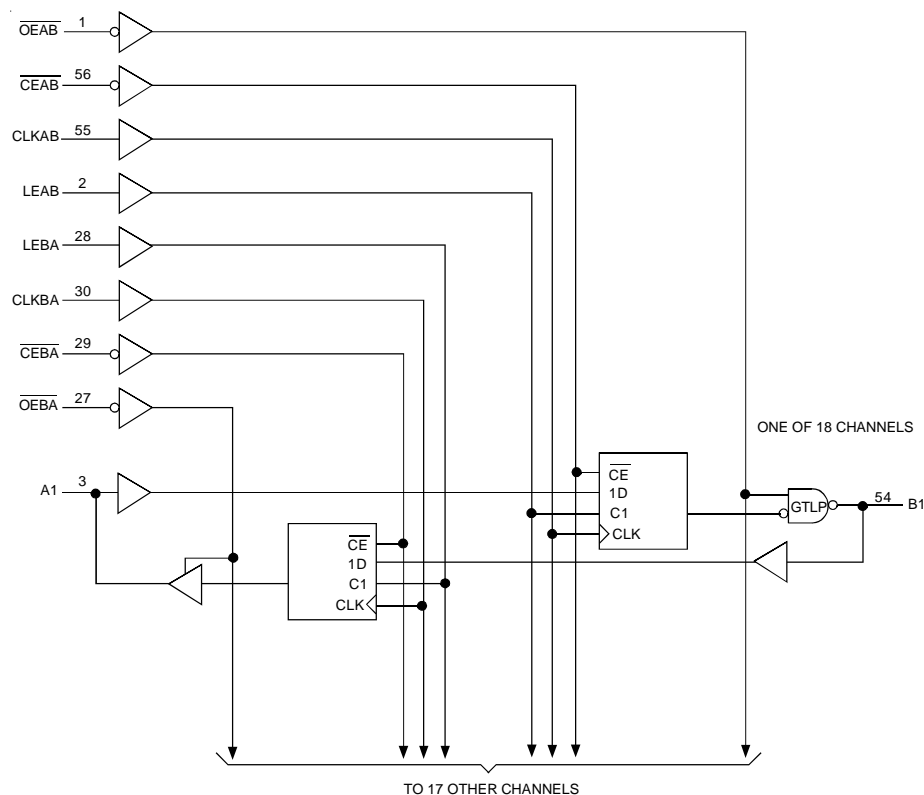
- Bidirectional interface between GTLP and TTL logic levels
- Edge Rate Control Circuit reduces output noise
- VREF pin provides reference voltage for receiver threshold
- CMOS technology for low power dissipation
- Special PVT Compensation circuitry to provide consistent performance over variations of process, supply voltage, and temperature
- 5V tolerant inputs and outputs on A-Port
- Bus-Hold to eliminate the need for external pull-up resistors for unused inputs to A-Port
- Power up/down high-impedance
- TTL-compatible Driver and Control inputs
- High Output source/sink $\pm 32\text{mA}$ on A-Port pins
- Flow-through architecture optimizes system layout
- D-type latch and flip-flop architecture for data flow in clocked, transparent, or latched mode
- Open drain on GTLP to support wired OR connection
- Available in SSOP and TSSOP packages

DESCRIPTION:

The GTLP16612 is an 18-bit universal bus transceiver. It provides signal level translation, from TTL to GTLP, for applications requiring a high-speed interface between cards operating at TTL logic levels and back-planes operating at GTLP logic levels. GTLP provides reduced output swing ($<1\text{V}$), reduced input threshold levels, and output edge-rate control to minimize signal setting times. The GTLP16612 is a derivative of the Gunning Transceiver Logic (GTL) JEDEC standard JESD8-3 and incorporates internal edge-rate control, which is process, voltage, and temperature (PVT) compensated.

GTLP output low voltage is less than 0.5V . The output high is 1.5V , and the receiver threshold is 1V .

FUNCTIONAL BLOCK DIAGRAM

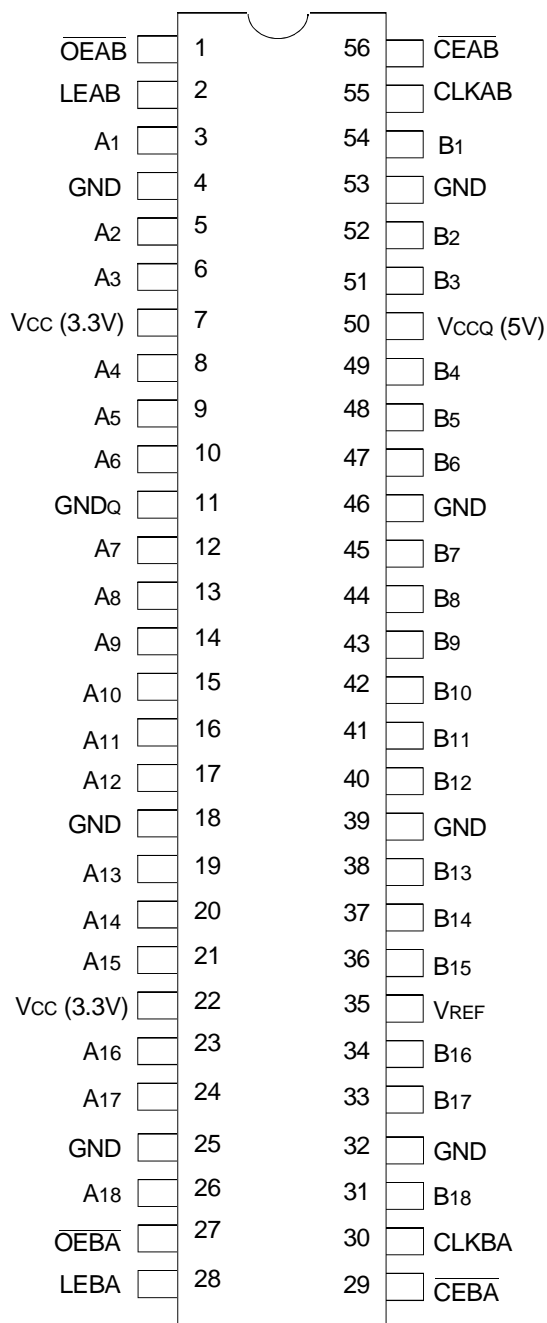


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INDUSTRIAL TEMPERATURE RANGE

OCTOBER 1999

PIN CONFIGURATION



SSOP/ TSSOP
TOP VIEW

ABSOLUTE MAXIMUM RATINGS^(1,2)

Symbol	Rating	Max.	Unit
V _{CC}	Supply Voltage	-0.5 to +7	V
V _{CCQ}			
V _I	DC Input Voltage	-0.5 to +7	V
V _O	DC Output Voltage, 3-State	-0.5 to +7	V
V _O	DC Output Voltage, Active	-0.5 to V _{CC} + 0.5	V
I _{OL}	DC Output Sink Current into A-port	64	mA
I _{OH}	DC Output Source Current from A-port	-64	mA
I _{OL}	DC Output Sink Current into B-port (in the LOW state)	80	mA
I _{IK}	DC Input Diode Current V _I < 0V	-50	mA
I _{OK}	DC Output Diode Current V _O < 0V	-50	mA
I _{OK}	DC Output Diode Current V _O > V _{CC}	+50	mA
T _{STG}	Storage Temperature	-65 to +150	°C

NOTES:

- Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
- Unused inputs without Bus-Hold must be held HIGH or LOW.

CAPACITANCE (T_A = +25°C, f = 1.0MHz)

Symbol	Parameter ⁽¹⁾	Conditions	Typ. ⁽²⁾	Max.	Unit
C _{IN}	Control Pins	V _I = V _{CCQ} or 0	8	—	pF
C _{I/O}	A-Port	V _I = V _{CCQ} or 0	9	—	pF
C _{I/O}	B-Port	V _I = V _{CCQ} or 0	6	—	pF

NOTES:

- As applicable to the device type.
- All typical values are at V_{CC} = 3.3V and V_{CCQ} = 5V.

PIN DESCRIPTION

Pin Names	Description ⁽¹⁾
\overline{OEAB}	A-to-B Output Enable (Active LOW)
\overline{OEBA}	B-to-A Output Enable (Active LOW)
\overline{CEAB}	A-to-B Clock Enable (Active LOW)
\overline{CEBA}	B-to-A Clock Enable (Active LOW)
LEAB	A-to-B Latch Enable (Transparent HIGH)
LEBA	B-to-A Latch Enable (Transparent HIGH)
CLKAB	A-to-B Clock Pulse
CLKBA	B-to-A Clock Pulse
V _{REF}	GTLP Input Reference Voltage
A1 - A18	A-to-B TTL Data Inputs or B-to-A 3-State Outputs
B1 - B18	B-to-A GTLP Data Inputs or A-to-B Open Drain Outputs

NOTE:

- A-Port pins have Bus-Hold. All other pins are standard input, output, or I/O.

RECOMMENDED OPERATING CONDITIONS⁽¹⁾

Symbol	Rating	Recommended	Unit
V _{CC}	Supply Voltage	3.15 to 3.45	V
V _{CC0}		4.75 to 5.25	
V _{TT}	Bus Termination Voltage	1.35 to 1.65	V
V _I	Input Voltage on A-Port and Control Pins	0 to 5.5	V
I _{OH}	HIGH Level Output Current (A-Port)	-32	mA
I _{OL}	LOW Level Output Current (A-Port)	+32	mA
I _{OL}	LOW Level Output Current (B-Port)	+34	mA
T _A	Operating Temperature	-40 to +85	°C

NOTE:

1. Unused inputs without Bus-Hold must be held HIGH or LOW.

FUNCTIONAL DESCRIPTION:

The GTLP16612 combines a universal transceiver function with a TTL to GTLP translation. The A-Port and control pins operate at LVTTTL or 5V TTL levels while the B-Port operates at GTLP levels. The transceiver logic includes D-type latches and D-type flip-flops to allow data flow in transparent, latched, and clock mode.

FUNCTION TABLE^(1,2)

Inputs					Outputs	Mode
\overline{CEAB}	\overline{OEAB}	LEAB	CLKAB	Ax	Bx	
X	H	X	X	X	Z	Latched storage of A data
L	L	L	H	X	B ₀ ⁽³⁾	
L	L	L	L	X	B ₀ ⁽⁴⁾	
X	L	H	X	L	L	Transparent
X	L	H	X	H	H	
L	L	L	↑	L	L	Clocked storage of A data
L	L	L	↑	H	H	
H	L	L	X	X	B ₀ ⁽⁴⁾	Clock Inhibit

NOTES:

1. H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care
↑ = LOW-to-HIGH Transition
2. A-to-B data flow is shown. B-to-A data flow is similar, but uses \overline{OEBA} , LEBA, CLKBA, and \overline{CEBA} .
3. Output level before the indicated steady-state input conditions were established, provided that CLKAB was HIGH before LEAB went LOW.
4. Output level before the indicated steady-state input conditions were established.

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Industrial: $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{REF} = 1\text{V}$, $V_{CC} = 3.3\text{V} \pm 5\%$, $V_{CCQ} = 5\text{V} \pm 5\%$

Symbol	Parameter	Test Conditions	Min.	Typ. ⁽¹⁾	Max.	Unit	
V_{IH}	B-Port	—	$V_{REF} + 0.1$	—	V_{TT}	V	
	All Other ports	—	2	—	—		
V_{IL}	B-Port	—	0	—	$V_{REF} - 0.1$	V	
	All Other ports	—	—	—	0.8		
V_{REF}	—	—	—	1	—	V	
V_{IK}	—	$V_{CC} = 3.15\text{V}$ $V_{CCQ} = 4.75\text{V}$ $I_I = -18\text{mA}$	—	—	-1.2	V	
V_{OH}	A-Port	$V_{CC}, V_{CCQ} = \text{Min to Max}^{(2)}$	$I_{OH} = -100\mu\text{A}$	$V_{CC} - 0.2$	—	—	V
		$V_{CC} = 3.15\text{V}$ $V_{CCQ} = 4.75\text{V}$	$I_{OH} = -8\text{mA}$	2.4	—	—	
		$V_{CC} = 3.15\text{V}$ $V_{CCQ} = 4.75\text{V}$	$I_{OH} = -32\text{mA}$	2	—	—	
V_{OH}	A-Port	$V_{CC}, V_{CCQ} = \text{Min to Max}^{(2)}$	$I_{OL} = 100\mu\text{A}$	—	—	0.2	V
		$V_{CC} = 3.15\text{V}$ $V_{CCQ} = 4.75\text{V}$	$I_{OL} = 32\text{mA}$	—	—	0.5	
	B-Port	$V_{CC} = 3.15\text{V}$ $V_{CCQ} = 4.75\text{V}$	$I_{OL} = 34\text{mA}$	—	—	0.65	
I_I	Control Pins	$V_{CC}, V_{CCQ} = 0$ or Max	$V_I = 5.5\text{V}$ or 0V	—	—	± 10	μA
	A-Port	$V_{CC} = 3.45\text{V}$ $V_{CCQ} = 5.25\text{V}$	$V_I = 5.5\text{V}$	—	—	20	
			$V_I = V_{CC}$	—	—	1	
			$V_I = 0$	—	—	-30	
	B-Port	$V_{CC} = 3.45\text{V}$ $V_{CCQ} = 5.25\text{V}$	$V_I = V_{CCQ}$	—	—	5	
$V_I = 0$			—	—	-5		
I_{OFF}	A-Port	$V_{CC} = V_{CCQ} = 0$	V_I or $V_O = 0$ to 4.5V	—	—	100	μA
$I_{I(HOLD)}$	A-Port	$V_{CC} = 3.15\text{V}$ $V_{CCQ} = 4.75\text{V}$	$V_I = 0.8\text{V}$	75	—	—	μA
			$V_I = 2\text{V}$	-20	—	—	
I_{OZH}	A-Port	$V_{CC} = 3.45\text{V}$	$V_O = 3.45\text{V}$	—	—	1	μA
	B-Port	$V_{CCQ} = 5.25\text{V}$	$V_O = 1.5\text{V}$	—	—	5	
I_{OZL}	A-Port	$V_{CC} = 3.45\text{V}$	$V_O = 0$	—	—	-20	μA
	B-Port	$V_{CCQ} = 5.25\text{V}$	$V_O = 0.65\text{V}$	—	—	-10	
$I_{CCQ}(V_{CCQ})$	A or B Ports	$V_{CC} = 3.45\text{V}$ $V_{CCQ} = 5.25\text{V}$ $I_O = 0$ $V_I = V_{CCQ}$ or GND	Outputs HIGH	—	30	40	mA
			Outputs LOW	—	30	40	
			Outputs Disabled	—	30	40	
$I_{CC}(V_{CC})$	A or B Ports	$V_{CC} = 3.45\text{V}$ $V_{CCQ} = 5.25\text{V}$ $I_O = 0$ $V_I = V_{CCQ}$ or GND	Outputs HIGH	—	0	1	mA
			Outputs LOW	—	0	1	
			Outputs Disabled	—	0	1	
$\Delta I_{CC}^{(3)}$	A-Port and Control Pins	$V_{CC} = 3.45\text{V}$ $V_{CCQ} = 5.25\text{V}$ A or Control Inputs at V_{CC} or GND	One Input at 2.7V	—	0	1	mA

NOTES:

- All typical values are at $V_{CC} = 3.3\text{V}$, $V_{CCQ} = 5\text{V}$, and $T_A = 25^{\circ}\text{C}$.
- For conditions shown as Max. or Min., use appropriate value specified under Recommended Operating Conditions.
- ΔI_{CC} is the increase in supply current for each input that is at the specified TTL voltage level rather than V_{CC} or GND.

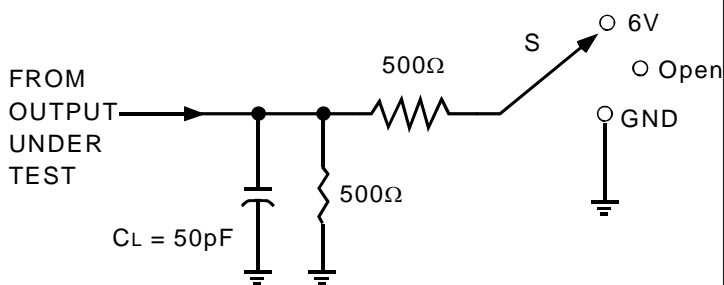
SWITCHING CHARACTERISTICS OVER OPERATING RANGE (1,2)

Symbol	Parameter	IDT74GTL16612			Unit
		Min.	Typ. ⁽³⁾	Max.	
f _{CLOCK}	Max Clock Frequency	175	—	—	MHz
t _w	Pulse Duration, LEAB or LEBA HIGH	3	—	—	ns
t _w	Pulse Duration, CLKAB or CLKBA HIGH or LOW	3.2	—	—	
t _s	Setup Time, Ax before CLKAB ↑	0.5	—	—	ns
t _s	Setup Time, Bx before CLKBA ↑	3.1	—	—	
t _s	Setup Time, Ax before LEAB ↓	1.3	—	—	
t _s	Setup Time, Bx before LEBA ↓	3.7	—	—	
t _s	Setup Time, \overline{CEAB} before CLKAB ↑	0.4	—	—	
t _s	Setup Time, \overline{CEBA} before CLKBA ↑	1	—	—	
t _h	Hold Time, Ax after CLKAB ↑	1.5	—	—	ns
t _h	Hold Time, Bx after CLKBA ↑	0	—	—	
t _h	Hold Time, Ax after LEAB ↓	0.5	—	—	
t _h	Hold Time, Bx after LEBA ↓	0	—	—	
t _h	Hold Time, \overline{CEAB} after CLKAB ↑	1.5	—	—	
t _h	Hold Time, \overline{CEBA} after CLKBA ↑	1.7	—	—	
t _{PLH}	Ax to Bx	1	4.3	6.5	ns
t _{PHL}		1	5	8.2	
t _{PLH}	LEAB to Bx	1.8	4.5	6.7	ns
t _{PHL}		1.5	5.3	8.6	
t _{PLH}	CLKAB to Bx	1.8	4.6	6.7	ns
t _{PHL}		1.5	5.4	8.7	
t _{PLH}	\overline{OEAB} to Bx	1.6	4.4	6.2	ns
t _{PHL}		1.3	6.1	9.8	
t _{RISE} t _{FALL}	Transition Time, B outputs (20% to 80%)	—	2.6	—	ns
t _{PLH}	Bx to Ax	2	5.6	8.2	ns
t _{PHL}		1.4	5	7.2	
t _{PLH}	LEBA to Ax	2.1	4.2	6.3	ns
t _{PHL}		1.9	3.3	5	
t _{PLH}	CLKBA to Ax	2.3	4.4	6.8	ns
t _{PHL}		2.2	3.5	5.2	
t _{PZH} t _{PZL}	\overline{OEBA} to Ax	1.5	5	6.2	ns
t _{PHZ} t _{PLZ}		1.9	3.9	7.9	

NOTES:

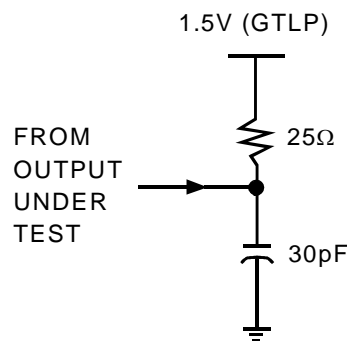
1. See Test Circuits and Waveforms. T_A = -40°C to +85°C.
2. Unless otherwise noted, V_{REF} = 1V, C_L = 30pF for B-Port, and C_L = 50pF for A-Port.
3. Typical values are at V_{CC} = 3.3V, V_{CC0} = 5V, and T_A = 25°C.

TEST CIRCUITS AND WAVEFORMS



NOTE:
1. CL includes probes and jig capacitance.

Test Circuit for A Outputs⁽¹⁾

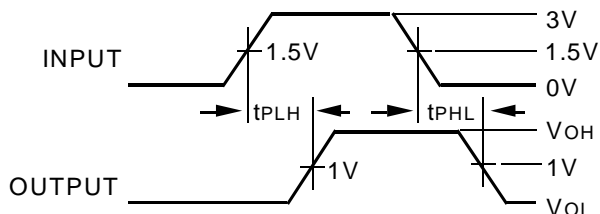


NOTE:
1. CL includes probes and jig capacitance. For B-Port outputs, CL = 30pF is used for worst case edge rate.

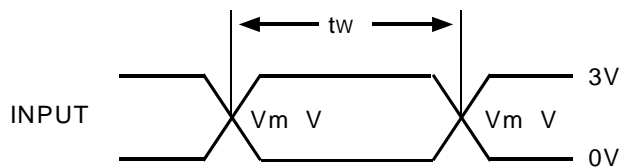
Test Circuit for B Outputs⁽¹⁾

SWITCH POSITION

Test	Switch
Open Drain Disable Low Enable Low	6V
Disable High Enable High	GND
All Other Tests	Open



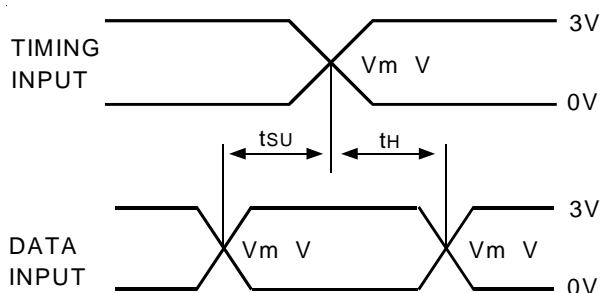
*Voltage Waveforms Propagation Delay Times
(A-Port to B-Port)*



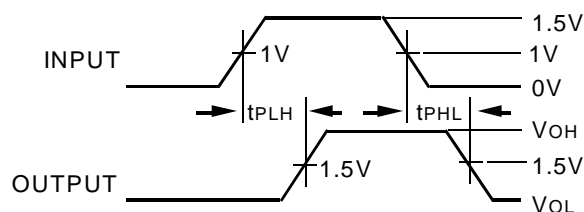
*Voltage Waveforms Pulse Duration
(Vm = 1.5V for A-Port and 1V for B-Port)*

NOTE:
All input pulses have the following characteristics: frequency = 10 MHz, tr = tr = 2 ns, Zo = 50Ω. The outputs are measured one at a time with one transition per measurement.

TEST CIRCUITS AND WAVEFORMS

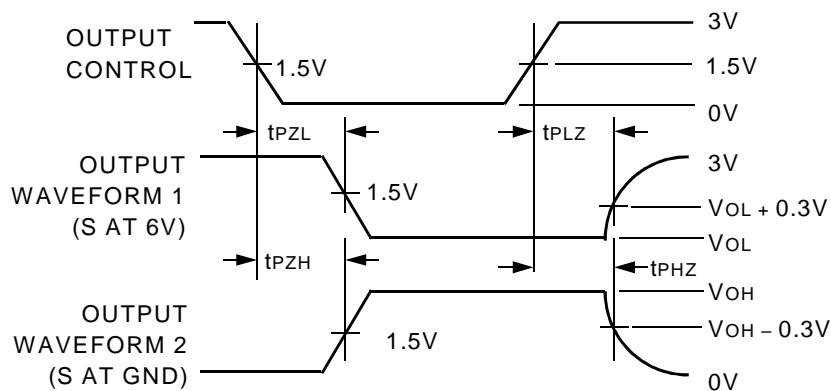


*Voltage Waveforms Setup and Hold Times
($V_m = 1.5V$ for A-Port and $1V$ for B-Port)*



*Voltage Waveforms Propagation Delay Times
(B-Port to A-Port)*

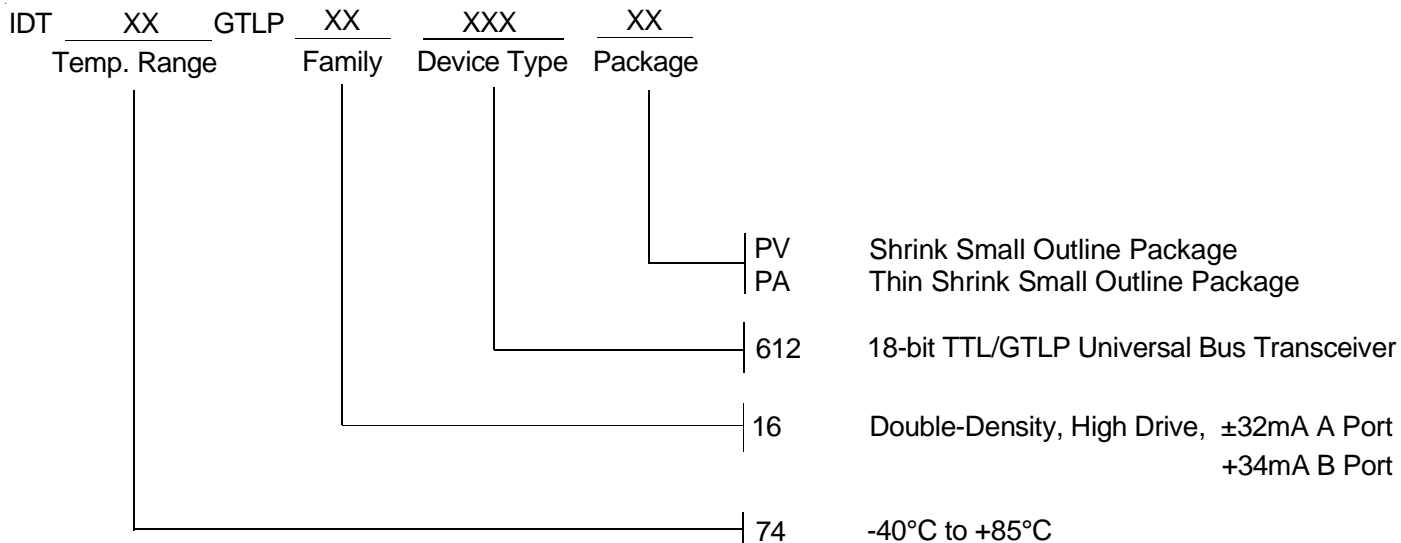
NOTE:
All input pulses have the following characteristics: frequency = 10 MHz, $t_r = t_f = 2$ ns, $Z_o = 50\Omega$. The outputs are measured one at a time with one transition per measurement.



*Voltage Waveforms Enable and Disable Times
(A-Port)*

NOTE:
Waveform 1 is for an output with internal conditions such that the output is LOW except when disabled by the output control.
Waveform 2 is for an output with internal conditions such that the output is HIGH except when disabled by the output control.
All input pulses have the following characteristics: frequency = 10 MHz, $t_r = t_f = 2$ ns, $Z_o = 50\Omega$. The outputs are measured one at a time with one transition per measurement.

ORDERING INFORMATION



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