μA9615 Dual Differential Line Receiver

Linear Division Interface Products

Description

The μA9615 is a dual differential line receiver designed to receive differential digital data from transmission lines and operate over the extended and industrial temperature ranges using a single 5.0 V supply. It can receive differential data in the presence of high level (±15 V) common mode voltages and deliver undisturbed TTL logic to the output.

The response time can be controlled by use of an external capacitor. A strobe and a 130 Ω terminating resistor are provided at the inputs. The output has an uncommitted collector with an active pull-up available on an adjacent lead to allow either wired-OR or active pull-up TTL output configuration.

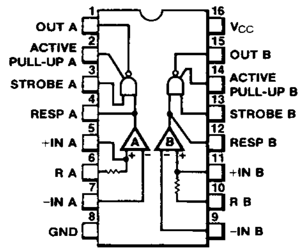
- **TTL Compatible Output**
- **High Common Mode Voltage Range**
- **Choice Of An Uncommitted Collector Or Active Pull-Up**
- **Strobe**
- **Extended Temperature Range**
- **Single 5.0 V Supply Voltages**
- **Frequency Response Control**
- **130 Ω Terminating Resistor**

Absolute Maximum Ratings

Storage Temperature Range	
Ceramic DIP	−65°C to +175°C
Molded DIP	−65°C to +150°C
Operating Temperature Range	
Extended (μA9615M)	−55°C to +125°C
Commercial (μA9615C)	0°C to +70°C
Lead Temperature	
Ceramic DIP (soldering, 60 s)	300°C
Molded DIP (soldering, 10 s)	265°C
Internal Power Dissipation[1,2]	
16L-Ceramic DIP	1.50 W
16L-Molded DIP	1.04 W
V_{CC} Lead Potential to Ground Lead	−0.5 V to +7.0 V
Input Voltage Referred to Ground	±20 V
Voltage Applied to Outputs for High Output State without Active Pull-up	−0.5 V to +13.2 V
Voltage Applied to Strobe	−0.5 V to +5.5 V

Note
1. $T_{J\,Max}$ = 175°C for the Ceramic DIP, and 150°C for the Molded DIP.
2. Ratings apply to ambient temperature at 25°C. Above this temperature, derate the 16L-Ceramic DIP at 10 mW/°C, and the 16L-Molded DIP at 8.3 mW/°C.

Connection Diagram 16-Lead DIP (Top View)



Order Information

Device Code	Package Code	Package Description
μA9615DM	6B	Ceramic DIP
μA9615DC	6B	Ceramic DIP
μA9615PC	9B	Molded DIP

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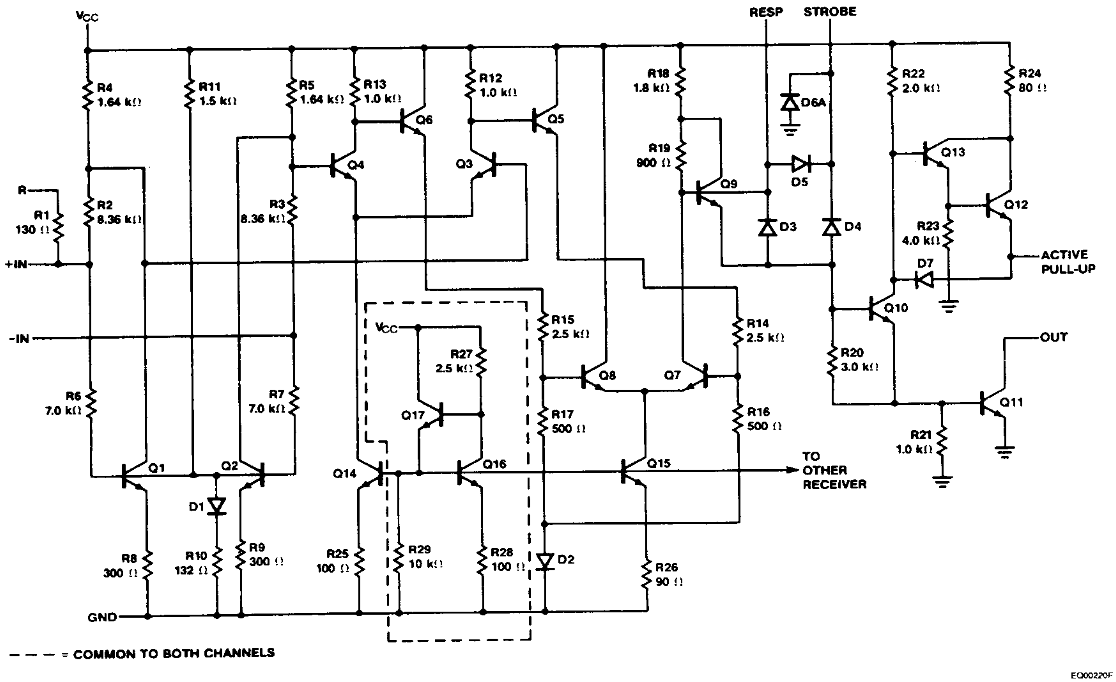
Equivalent Circuit (1/2 of Circuit)



μA9615
Electrical Characteristics V_{CC} = 5.0 V ± 10%, T_A = −55°C to +125°C, unless otherwise specified.

Symbol	Characteristic	Condition[1]	T = −55°C Min	T = −55°C Max	T = 25°C Min	T = 25°C Typ	T = 25°C Max	T = +125°C Min	T = +125°C Max	Unit
V_{OL}	Output Voltage LOW	V_{CC} = 4.5 V, V_O = (Note 2), I_{OL} = 15.0 mA, V_{DIFF} = 0.5 V		0.40		0.18	0.40		0.40	V
V_{OH}	Output Voltage HIGH	V_{CC} = 4.5 V, V_O = (Note 2), I_{OH} = −5.0 mA, V_{DIFF} = −0.5 V	2.2		2.4	3.2		2.4		V
I_{CEX}	Output Leakage Current	V_{CC} = 4.5 V, V_{CEX} = 12 V, V_{DIFF} = V_{CC}					100		200	μA
I_{OS}	Output Short Circuit Current	V_{CC} = 5.5 V, V_{OS} = 0 V[2], V_{DIFF} = −0.5 V			−15	−39	−80			mA
I_I	Input Current	V_{CC} = 5.5 V, V_I = 0.4 V, Other input = 5.5 V		−0.9		−0.49	−0.7		−0.7	mA
$I_{I(ST)}$	Strobe Input Current	V_{CC} = 5.5 V, V_I = 0.4 V, V_{DIFF} = 0.5 V				−1.15	−2.4			mA
$I_{I(R-C)}$	Response Control Input Current	V_{CC} = 5.5 V, $V_{I(R-C)}$ = 0.4 V, V_{DIFF} = 0.5 V			−1.2	−3.4				mA
V_{CM}	Common Mode Voltage	V_{CC} = 5.0 V, V_{DIFF} = 1.0 V	−15	+15	−15	±17.5	+15	−15	+15	V
$I_{R(ST)}$	Strobe Input Leakage Current	V_{CC} = 4.5 V, V_R = 4.5 V, V_{DIFF} = −0.5 V					2.0		5.0	μA
R_I	Input Resistance	V_{CC} = 5.0 V, $V_{I(R)}$ = 1.0 V, +Input = GND			77	130	167			Ω
V_{TH}	Differential Input Threshold Voltage[3]	V_{CC} = 5.0 V ± 10%, V_{CM} = 0 V	−500	+500	−500	+80	+500	−500	+500	mV
		V_{CC} = 5.0 V ± 10%, −15 V ≤ V_{CM} ≤ +15 V	−1.0	+1.0	−1.0		+1.0	−1.0	+1.0	V
I_{CC}	Supply Current	V_{CC} = 5.5 V, −Inputs = 0 V, +Inputs = 0.5 V				28.7	50			mA
t_{PLH}	Turn-Off Time	V_{CC} = 5.0 V, R_L = 3.9 kΩ, C_L = 30 pF, *Figure 1*				30	50			ns

μA9615 (Cont.)
Electrical Characteristics V_{CC} = 5.0 V ± 10%, T_A = −55°C to +125°C, unless otherwise specified.

Symbol	Characteristic	Condition[1]	T = −55°C Min	T = −55°C Max	T = 25°C Min	T = 25°C Typ	T = 25°C Max	T = +125°C Min	T = +125°C Max	Unit
t_{PHL}	Turn-On Time	V_{CC} = 5.0 V, R_L = 390 Ω, C_L = 30 pF, *Figure 1*				30	50			ns

μA9615C
Electrical Characteristics V_{CC} = 5.0 V ± 5%, T_A = 0°C to 70°C, unless otherwise specified.

Symbol	Characteristic	Condition[1]	T = 0°C Min	T = 0°C Max	T = 25°C Min	T = 25°C Typ	T = 25°C Max	T = 70°C Min	T = 70°C Max	Unit
V_{OL}	Output Voltage LOW	V_{CC} = 4.75 V, V_O = (Note 2), I_{OL} = 15.0 mA, V_{DIFF} = 0.5 V		0.45		0.25	0.45		0.45	V
V_{OH}	Output Voltage HIGH	V_{CC} = 4.75 V, V_O = (Note 2), I_{OH} = −5.0 mA, V_{DIFF} = −0.5 V	2.4		2.4	3.3		2.4		V
I_{CEX}	Output Leakage Current	V_{CC} = 4.75 V, V_{CEX} = 5.25 V, V_{DIFF} = V_{CC}					100		200	µA
I_{OS}	Output Short Circuit Current	V_{CC} = 5.25 V, V_{OS} = 0 V[2], V_{DIFF} = −0.5 V			−14		−100			mA
I_I	Input Current	V_{CC} = 5.25 V, V_I = 0.45 V, Other Input = 5.25 V		−0.9		−0.49	−0.7		−0.7	mA
$I_{I(ST)}$	Strobe Input Current	V_{CC} = 5.25 V, V_I = 0.45 V, V_{DIFF} = 0.5 V				−1.15	−2.4			mA
$I_{I(R-C)}$	Response Control Input Current	V_{CC} = 5.25 V, $V_{I(R-C)}$ = 0.4 V, V_{DIFF} = 0.5 V			−1.2	−3.4				mA
V_{CM}	Common Mode Voltage	V_{CC} = 5.0 V, V_{DIFF} = 1.0 V	−15	+15	−15	±17.5	+15	−15	+15	V
$I_{R(ST)}$	Strobe Input Leakage Current	V_{CC} = 4.75 V, V_R = 4.5 V, V_{DIFF} = −0.5 V					5.0		10	µA

μA9615C (Cont.)

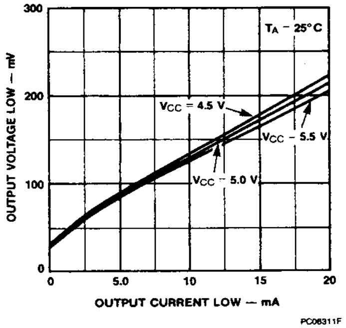
Electrical Characteristics V_{CC} = 5.0 V ±5%, T_A = °C to 70°C, unless otherwise specified.

Symbol	Characteristic	Condition[1]	T = 0°C		T = 25°C			T = 70°C		Unit
			Min	Max	Min	Typ	Max	Min	Max	
R_I	Input Resistance	V_{CC} = 5.0 V, $V_{I(R)}$ = 1.0 V, +Input = GND			74	130	179			Ω
V_{TH}	Differential Input Threshold Voltage[3]	V_{CC} = 5.0 V ±5%, V_{CM} = 0 V	−500	+500	−500	+80	+500	−500	+500	mV
		V_{CC} = 5.0 V ±5%, −15 V ≤ V_{CM} ≤ +15 V	−1.0	+1.0	−1.0		+1.0	−1.0	+1.0	V
I_{CC}	Supply Current	V_{CC} = 5.25 V, +Inputs = 0.5 V, −Inputs = 0 V				28.7	50			mA
t_{PLH}	Turn-Off Time	V_{CC} = 5.0 V, R_L = 3.9 kΩ, C_L = 30 pF, *Figure 1*				30	75			ns
t_{PHL}	Turn-On Time	V_{CC} = 5.0 V, R_L = 390 Ω, C_L = 30 pF, *Figure 1*				30	75			ns

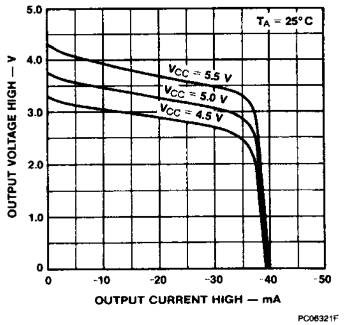
Notes
1. V_{DIFF} is a differential input voltage referred from +IN A to −IN A and from +IN B to −IN B.
2. Connect Output A to Active Pull-up A and Output B to Active Pull-up B.
3. See input output transfer characteristic graphs on following pages.

Typical Performance Curves for μA9615 and μA9615C

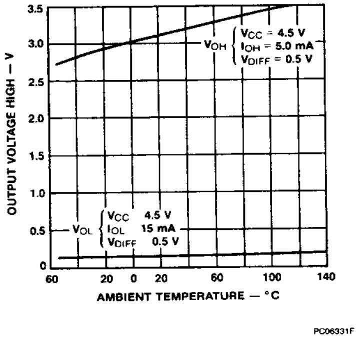
Output Voltage LOW vs Output Current LOW



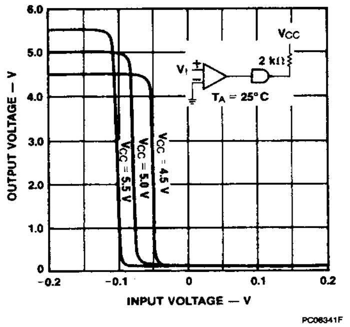
Output Voltage HIGH vs Output Current HIGH



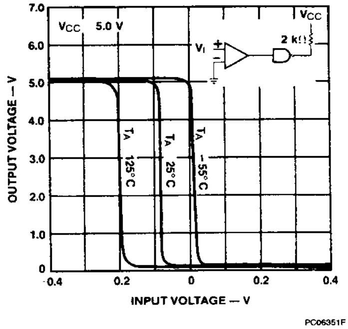
Output Voltage HIGH vs Ambient Temperature



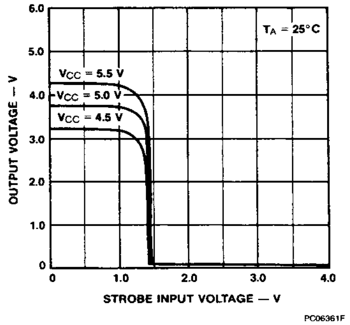
Input/Output Transfer Characteristics vs V_{CC}



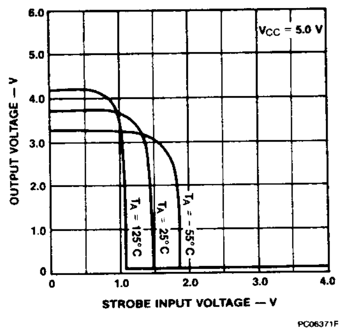
Input/Output Transfer Characteristics vs Temperature



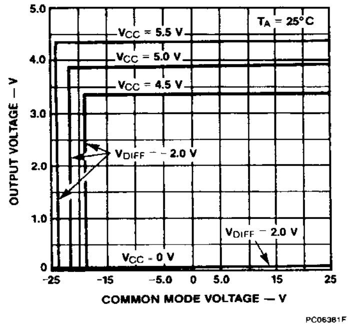
Strobe Input/Output Transfer Characteristics vs V_{CC}



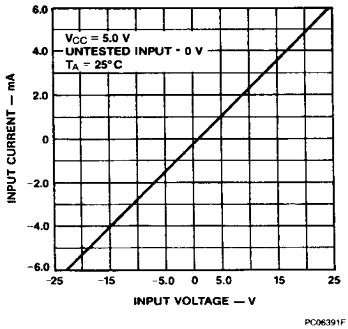
Strobe Input/Output Transfer Characteristic vs Ambient Temperature



Output Voltage vs Common Mode Voltage

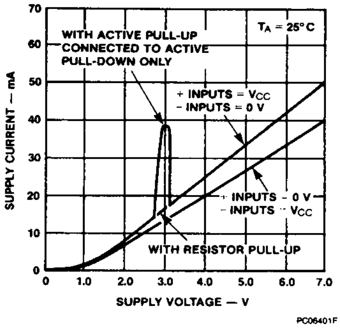


Input Current vs Input Voltage

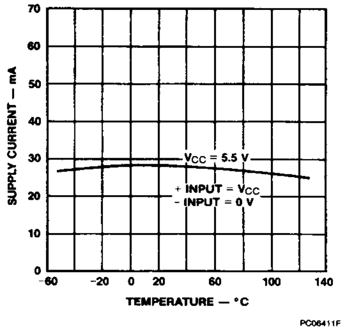


Typical Performance Curves for μA9615 and μA9615C (Cont.)

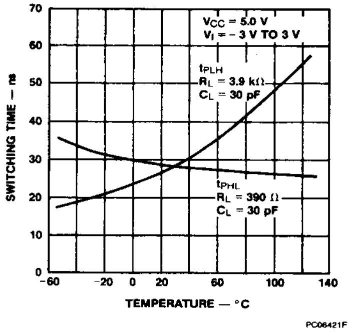
Supply Current vs Supply Voltage



Supply Current vs Ambient Temperature



Switching Time vs Ambient Temperature



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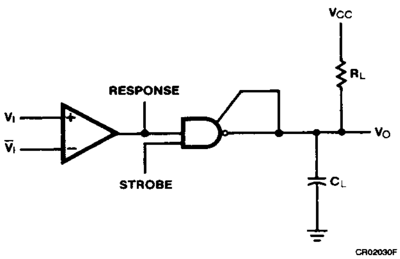
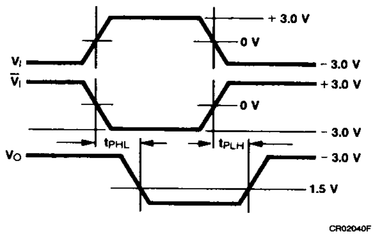
Switching Time Test Circuit and Waveforms (Note 1)

Figure 1

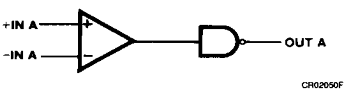




Note

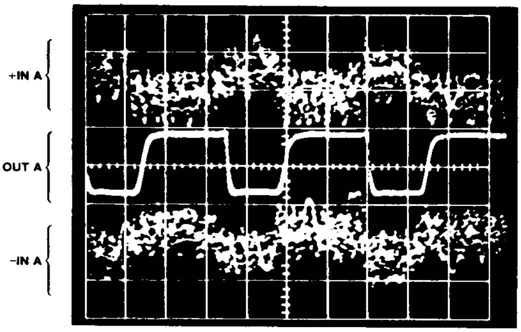
1. Use V_I or $\overline{V_I}$, ground other input.

Figure 2



Notes

1. For t_{PHL} measurement R_L = 390 Ω
2. For t_{PHL} measurement R_L = 3.9 kΩ
3. For input pulse: Width = 100 ns ± 10 ns,
   t_r, t_f = ≤ 5.0 ns
   PRR = 500 kHz
4. C_L = 30 pF including probe and jig capacitance
5. Response control open, maximum scocket capacitance = 5.0 pF



VERTICAL = 2.0 V/DIV. HORIZONTAL = 50 ns/DIV.

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Photograph of a μA9615 switching differential data in the presence of high common mode noise.

Typical Applications

Figure 3 Standard Usage

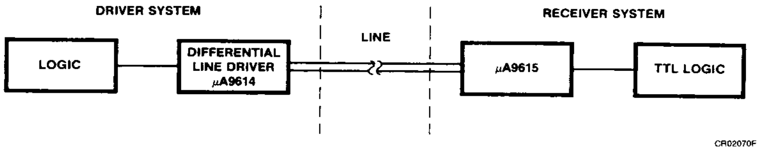
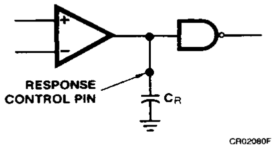


Figure 4 Frequency Response Control



Notes

$C_R > 0.01$ μF may cause slowing of rise and fall times of the output. Due to the mechanism of induction of differential noise, the use of the response control is not normally needed.

Frequency Response as a Function of Capacitance