Am2615/9615

Dual Differential Line Receivers

Distinctive Characteristics:

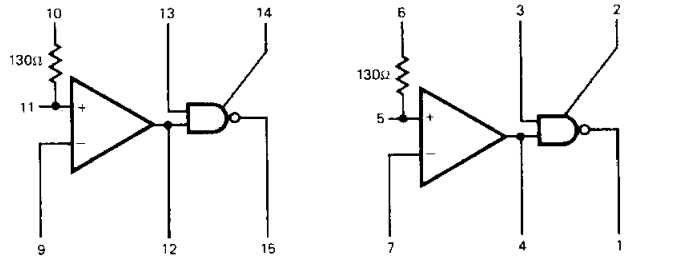
- Dual differential receiver (Am9615) pin-for-pin equivalent to the Fairchild 9615
- Dual differential receiver for single-ended data (Am2615)
- Single 5-volt supply
- High common-mode voltage range (±15 volts)
- Frequency response control, strobe, and internal terminating resistor
- Am2615 has fail safe capability
- Choice of uncommitted collector or active pull-up outputs
- 100% reliability assurance testing in compliance with MIL-STD-883

FUNCTIONAL DESCRIPTION

The Am2615 and Am9615 are dual differential line receivers designed to receive digital data from transmission lines and operate over the military and industrial temperature ranges using a single 5 volt supply. The Am2615 can receive 3 volt single ended and the Am9615 ±500 mV differential data in the presence of high level (±15 V) common mode voltages and deliver undisturbed logic levels to the following DTL or TTL circuitry. The response time of each receiver and thereby immunity to AC noise can be controlled by an external capacitor. A strobe is provided for each receiver together with a 130Ω input terminating resistor. Each output has an uncommitted collector with an active pull-up network available on an adjacent pin.

The Am2615 is identical to the Am9615 except for the input offset (threshold) voltage. The Am2615 has an input threshold of ~1.5 V compatible with DTL & TTL logic. The Am9615 has an input threshold of ~0 V. The Am2615 can directly replace the Am9615 and give fail safe protection in differential systems where the input difference is >2.0 V.

LOGIC DIAGRAM



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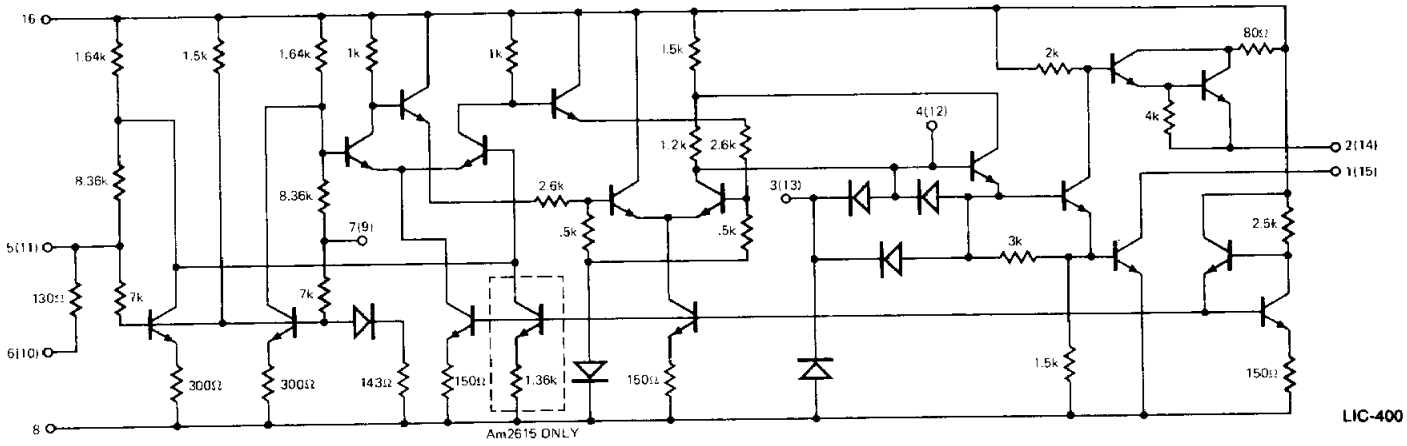
V_{CC} = PIN 16
GND = PIN 8

CIRCUIT DIAGRAM



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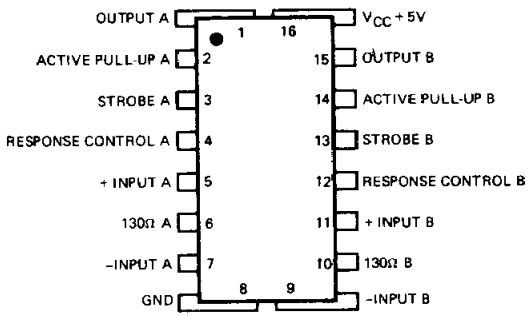
ORDERING INFORMATION

Part Number	Package Type	Temperature Range	Order Number
Am2615	Hermetic DIP	–55°C to +125°C	AM2615DM
	Flat Pak	–55°C to +125°C	AM2615FM
	Dice	–55°C to +125°C	AM2615XM
	Hermetic DIP	0°C to +75°C	AM2615DC
	Molded DIP	0°C to +75°C	AM2615PC
	Dice	0°C to +75°C	AM2615XC
Am9615	Hermetic DIP	–55°C to +125°C	9615DM
	Flat Pak	–55°C to +125°C	9615FM
	Dice	–55°C to +125°C	AM9615XM
	Hermetic DIP	0°C to +75°C	9615DC
	Molded DIP	0°C to +75°C	9615PC
	Dice	0°C to +75°C	AM9615XC

CONNECTION DIAGRAM
Top View



NOTE: PIN 1 is marked for orientation.

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MAXIMUM RATINGS (Above which the useful life may be impaired)

Storage Temperature	−65°C to +150°C
Temperature (Ambient) Under Bias	−55°C to +125°C
Supply Voltage to Ground Potential (Pin 16 to Pin 8) Continuous	−0.5 V to +7 V
DC Voltage Applied to Outputs for HIGH Output State	−0.5 V to +13.2 V
DC Strobe Input Voltage	−0.5 V to +5.5 V
DC Data Input Voltage	−20 V to +20 V
Output Current, Into Outputs	30 mA
DC Input Current	maximum current is defined by DC Input Voltage

Am2615 ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Am2615XM V_{CC} = 4.5V to 5.5V T_A = −55°C to +125°C (MIL grade)
Am2615XC V_{CC} = 4.75V to 5.25V T_A = 0°C to +75°C (COM'L grade)

Parameters	Description	Test Conditions		LIMITS T_A = Min Min	Max	T_A = 25°C Min	Typ	Max	T_A = Max Min	Max	Units
V_{OH}	Output HIGH Voltage	V_{CC} = MIN, I_{OH} = −5.0 mA, V_{IN+} = +0.8 V, V_{IN-} = 0 V		2.4		2.4	3.2		2.4		Volts
V_{OL}	Output LOW Voltage	V_{CC} = MAX, I_{OH} = 15.0 mA, V_{IN+} = +2.0 V, V_{IN-} = 0 V	MIL grade		0.40		.18	0.40		0.40	Volts
			COM'L grade		0.45		.25	0.45		0.45	
I_{CEX}	Output Leakage Current	V_{CC} = MIN, V_{IN+} = 0 V, V_{IN-} = 4.5 V, V_{CEX} = 12 V	MIL grade		100			100		200	μA
		V_{CC} = MIN, V_{IN+} = 0 V, V_{IN-} = 4.5 V, V_{CEX} = 5.25 V	COM'L grade								
I_{SC}	Output Short Circuit Current	V_{CC} = MAX, V_{OUT} = 0 V, V_{IN+} = +0.8 V, V_{IN-} = 0 V	MIL grade	−15	−80	−15	−39	−80	−15	−80	mA
			COM'L grade	−14	−100	−14	−39	−100	−14	−100	
I_{IL}	Input Load Current	V_{CC} = MAX, V_{IN} = $V_{OL\ MAX}$, other input = V_{CC}			−0.9		−0.49	−0.7		−0.7	mA
$I_{IL(ST)}$	Strobe Input Low Current	V_{CC} = MAX, V_{ST} = V_{OL} MAX, V_{IN+} = +2.0 V, V_{IN-} = 0 V			−2.4		−1.15	−2.4		−2.4	mA
$I_{IL(RC)}$	Response Control Input Load Current	V_{CC} = MAX, V_{RC} = V_{OL} MAX, V_{IN+} = +2.0 V, V_{IN-} = 0 V				−1.2	−3.4				mA
V_{CM}	Common Mode Voltage	V_{CC} = 5.0 V, V_{IN+} − V_{IN-} = 0.4 or 2.4 V		−15	+15	−15	±17.5	+15	−15	+15	V
$I_{IH(ST)}$	Strobe Input HIGH Current	V_{CC} = MIN, V_{ST} = 4.5 V, V_{IN+} = +0.8 V, V_{IN-} = 0 V	MIL grade					2.0		5.0	μA
			COM'L grade					5.0		10.0	
R_{IN}	Input Resistor	V_{CC} = 5.0 V, V_{IN+} = 0 V, V_{RES} = 1.0 V	MIL grade			77	130	167			Ω
			COM'L grade			74	130	179			
V_{TH}	Differential Input Threshold Voltage	V_{CM} = 0 V		+0.8	+2.0	+0.8	+1.5	+2.0	+0.8	+2.0	V
I_{CC}	Power Supply Current	V_{CC} = MAX, V_{IN+} = +2.0 V, V_{IN-} = 0 V	MIL grade		50		28.7	50		50	mA
			COM'L grade		50		28.7	50		50	

Switching Characteristics (T_A = 25°C)

Parameters	Test Conditions	Am2615XM Min	Typ	Max	Am2615XC Min	Typ	Max	Units
t_{pd+} Turn Off Delay R_L = 3.9 kΩ	V_{CC} = 5.0 V, C_L = 30 pF, Refer to figure 4		30	50		30	75	ns
t_{pd-} Turn On Delay R_L = 390 Ω			30	50		30	75	
t_{pd+} Turn Off Delay Strobe to Output	R_L = 3.9 kΩ, C_L = 30 pF		7	12		7	15	ns
t_{pd-} Turn On Delay Strobe to Output	R_L = 390 Ω		10	15		10	20	

Am9615 ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Am9615XM V_{CC} = 4.5V to 5.5V T_A = −55°C to +125°C (MIL grade)
Am9615XC V_{CC} = 4.75V to 5.25V T_A = 0°C to +75°C (COM'L grade)

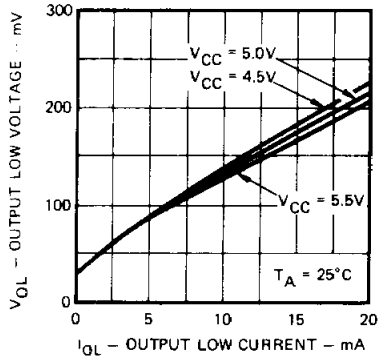
Parameters	Description	Test Conditions		LIMITS T_A = Min Min	Max	T_A = 25°C Min	Typ	Max	T_A = Max Min	Max	Units
V_{OH}	Output HIGH Voltage	V_{CC} = MIN, I_{OH} = −5.0 mA, V_{IN+} = −0.5 V, V_{IN-} = 0 V		2.4		2.4	3.2		2.4		Volts
V_{OL}	Output LOW Voltage	V_{CC} = MAX, I_{OH} = 15.0 mA, V_{IN+} = +0.5 V, V_{IN-} = 0	MIL grade		0.40		.18	0.40		0.40	Volts
			COM'L grade		0.45		.25	0.45		0.45	
I_{CEX}	Output Leakage Current	V_{CC} = MIN, V_{IN+} = 0 V, V_{IN-} = V_{CC}, V_{CEX} = 12 V	MIL grade		100			100		200	μA
		V_{CEX} = 5.25 V	COM'L grade								
I_{SC}	Output Short Circuit Current	V_{CC} = MAX, V_{OUT} = 0 V, V_{IN+} = −0.5 V, V_{IN-} = 0 V	MIL grade	−15	−80	−15	−39	−80	−15	−80	mA
			COM'L grade	−14	−100	−14	−39	−100	−14	−100	
I_{IL}	Input Load Current	V_{CC} = MAX, V_{IN} = $V_{OL\ MAX}$, other input = V_{CC}			−0.9		−0.49	−0.7		−0.7	mA
$I_{IL(ST)}$	Strobe Input Low Current	V_{CC} = MAX, V_{ST} = $V_{OL\ MAX}$, V_{IN+} = +0.5 V, V_{IN-} = 0 V			−2.4		−1.15	−2.4		−2.4	mA
$I_{IL(RC)}$	Response Control Input Load Current	V_{CC} = MAX, V_{RC} = $V_{OL\ MAX}$, V_{IN+} = +0.5 V, V_{IN-} = 0 V					−1.2	−3.4			mA
V_{CM}	Common Mode Voltage	V_{CC} = 5.0 V, V_{IN+} - V_{IN-} = ±2.0 V		−15	+15	−15	±17.5	+15	−15	+15	V
$I_{IH(ST)}$	Strobe Input HIGH Current	V_{CC} = MIN, V_{ST} = 4.5 V, V_{IN+} = −0.5 V, V_{IN-} = 0 V	MIL grade					2.0		5.0	μA
			COM'L grade					5.0		10.0	
R_{IN}	Input Resistor	V_{CC} = 5.0 V, V_{IN+} = 0 V, V_{RES} = 1.0 V	MIL grade			77	130	167			Ω
			COM'L grade			74	130	179			
V_{TH}	Differential Input Threshold Voltage	V_{CM} = 0 V		−0.5	+0.5	−0.5	±0.02	+0.5	−0.5	+0.5	V
I_{CC}	Power Supply Current	V_{CC} = MAX, V_{IN+} = +0.5 V, V_{IN-} = 0 V	MIL grade		50		28.7	50		50	mA
			COM'L grade		50		28.7	50		50	

Switching Characteristics (T_A = 25°C)

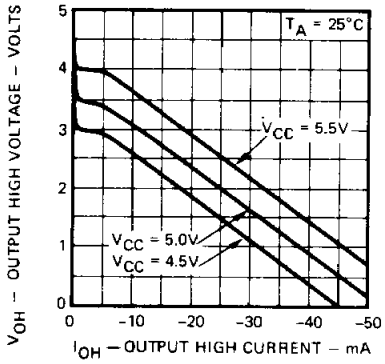
Parameters	Test Conditions	Am9615XM Min	Typ	Max	Am9615XC Min	Typ	Max	Units
t_{pd+} Turn Off Delay R_L = 3.9 kΩ	V_{CC} = 5.0 V, C_L = 30 pF, Refer to figure 4		30	50		30	75	ns
t_{pd-} Turn On Delay R_L = 390 Ω			30	50		30	75	
t_{pd+} Turn Off Delay Strobe to Output	R_L = 3.9 kΩ, C_L = 30 pF		7	12		7	15	ns
t_{pd-} Turn On Delay Strobe to Output	R_L = 390 Ω		10	15		10	20	

D. C. CHARACTERISTICS

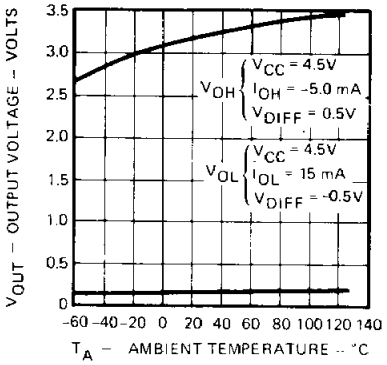
Output Low Voltage Versus Output Low Current



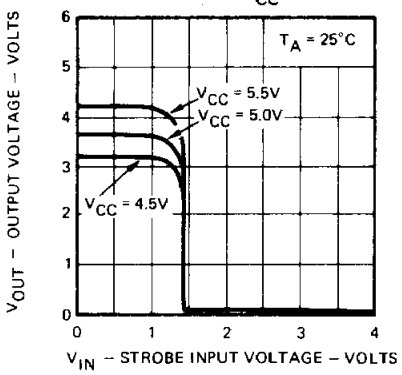
Output High Voltage Versus Output High Current



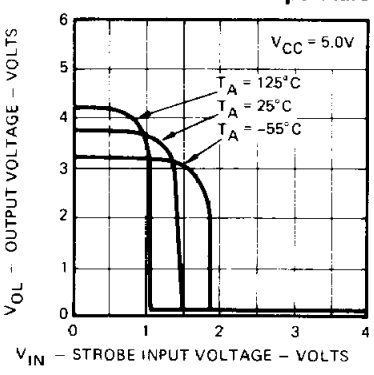
Output Voltage Versus Ambient Temperature



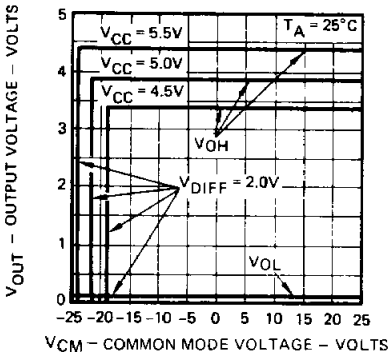
Strobe Input-Output Transfer Characteristic Versus V_{CC}



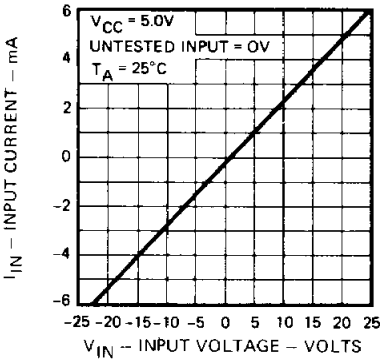
Strobe Input-Output Transfer Characteristic Versus Ambient Temperature



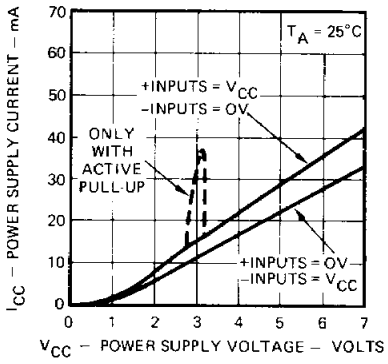
Output Voltage Versus Common Mode Voltage (Am9615)



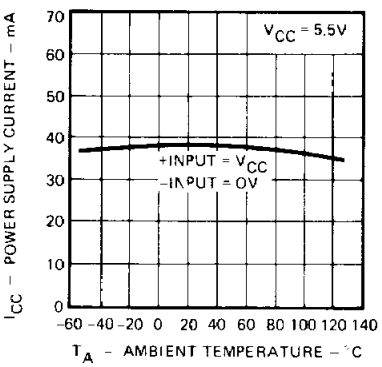
Input Current Versus Input Voltage



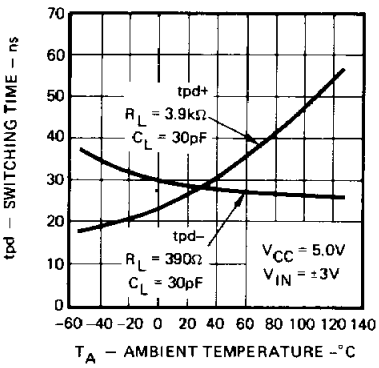
Power Supply Current Versus Power Supply Voltage



Power Supply Current Versus Ambient Temperature



Switching Time Versus Ambient Temperature



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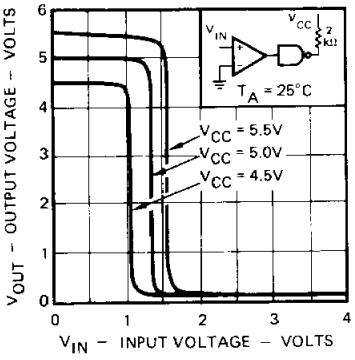
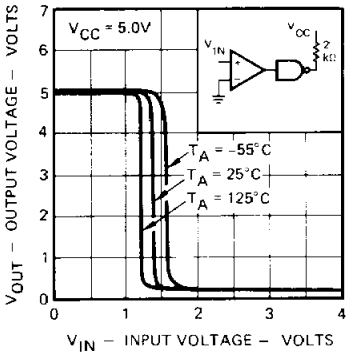
THRESHOLD CHARACTERISTICS

Am2615

Input-Output Transfer Characteristic Versus V_{CC}

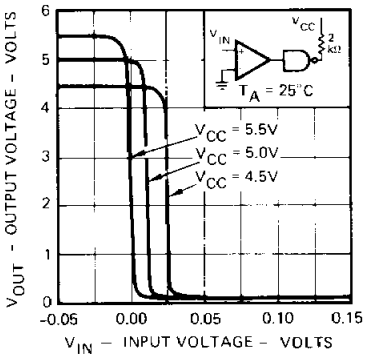


Input-Output Transfer Characteristic Versus Temperature

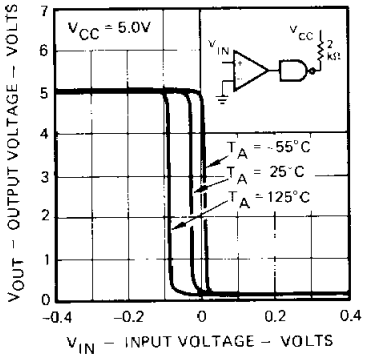


Am9615

Input-Output Transfer Characteristic Versus V_{CC}

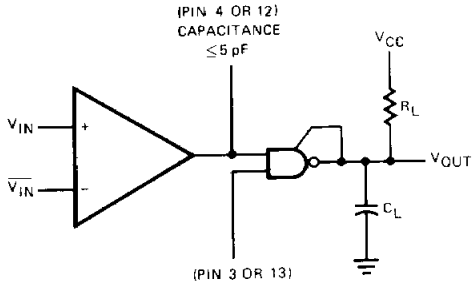


Input-Output Transfer Characteristic Versus Temperature



LIC-403

SWITCHING TIME TEST CIRCUIT & WAVEFORMS



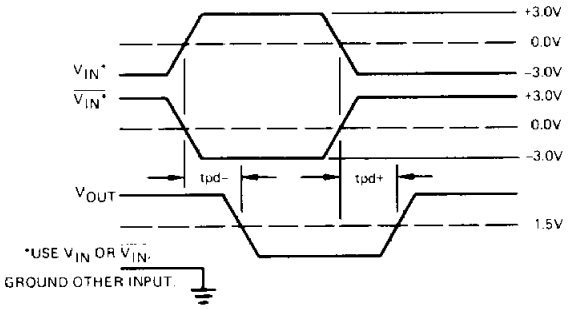


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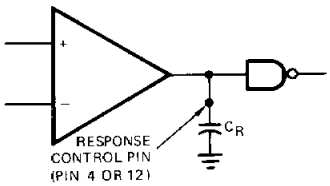
Figure 4

LIC-405

FREQUENCY RESPONSE CONTROL



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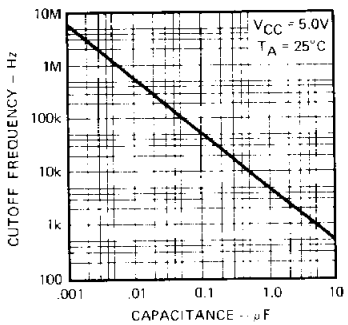
Frequency Response Versus Capacitance



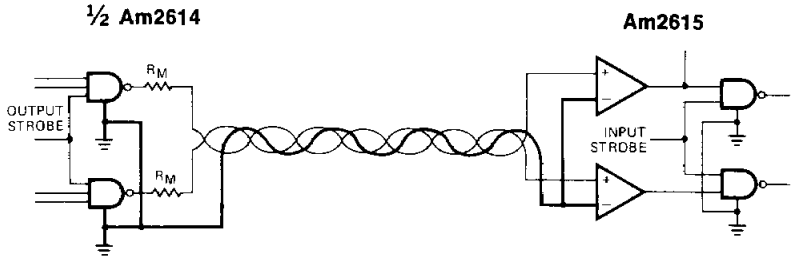
LIC-407

Am2615/9615 LOADING RULES

	Input/Output	Pin No.'s	Input Unit Load	Fanout Output HIGH	Fanout Output LOW
Receiver A	Out	1	—	o/c	10
	Active Pull-Up	2	—	83	—
	Response Control	3	—	—	—
	Strobe	4	1.5	—	—
	+ In	5	0.5	—	—
	130 Ω	6	—	—	—
	– In	7	0.5	—	—
	GND	8	—	—	—
Receiver B	– In	9	0.5	—	—
	130 Ω	10	—	—	—
	+ In	11	0.5	—	—
	Response Control	12	—	—	—
	Strobe	13	1.5	—	—
	Active Pull-Up	14	—	83	—
	Out	15	—	o/c	10
	V_{CC}	16	—	—	—

Am2615 STANDARD USAGE

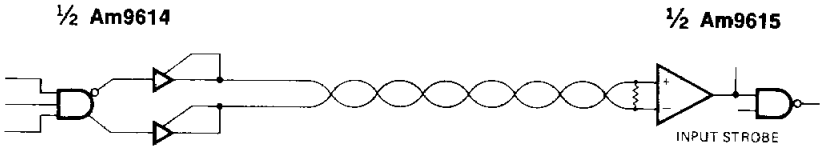
Single-Ended-Back Matched Operation With Common Ground



LIC-408

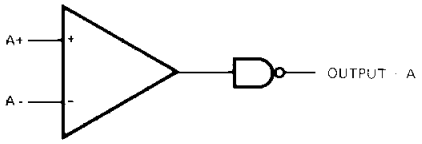
Am9615 STANDARD USAGE

Differential Operation



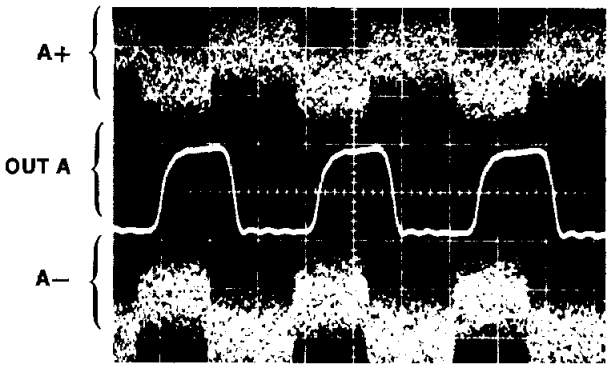
LIC-409

Photograph of an Am9615 switching differential data in the presence of high common mode noise.

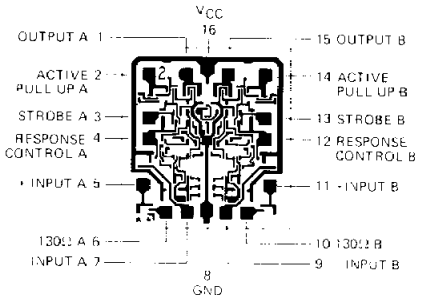


LIC-410

Vertical = 2.0 V/Div. Horizontal = 50 ns/Div.



Metallization and Pad Layout



53 X 58 Mils