National Semiconductor

DS34F87/DS35F87
RS-422 Quad Line Driver with TRI-STATE® Outputs

General Description

The DS34F87/DS35F87 RS-422 Quad Line Driver features four independent drivers which comply with EIA Standards for the electrical characteristics of balanced voltages digital interface circuits. The outputs are TRI-STATE structures which are forced to a high impedance state when the appropriate output control lead reaches a logic zero condition. All input leads are PNP buffered to minimize input loading for either logic one or logic zero inputs. In addition, internal circuitry assures a high impedance output state during the transition between power-up and power-down.

The DS34F87/DS35F87 offers improved performance due to the use of state-of-the-art L-FAST bipolar technology. The L-FAST technology allows for higher speeds and lower currents by utilizing extremely short gate delay times. Thus, the DS34F87/DS35F87 features lower power, extended temperature range, and improved specifications.

The DS34F87/DS35F87 offers optimum performance when used with the DS34F86/DS35F86 Quad Line Receiver.

Features

- Military temperature range
- Four independent drivers
- TRI-STATE outputs
- PNP high impedance inputs
- Fast propagation time
- TTL compatible
- 5.0V supply
- Output rise and falls times less than 15 ns
- Lead compatible and interchangeable with MC3487 and DS3487

Block and Connection Diagrams

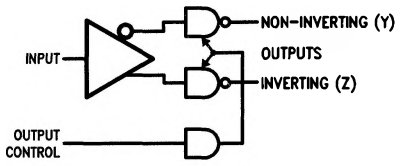

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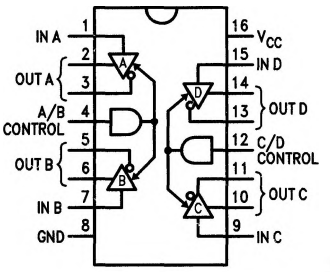
FIGURE 1

16-Lead DIP



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Top View

Order Number DS34F87J, DS34F87N or DS35F87J
See NS Package Number J16A or N16A

Function Table (Each Driver)

Input	Enable	Output	
		Y	Z
H	H	H	L
L	H	L	H
X	L	Z	Z

H = High Level
L = Low Level
X = Immaterial
Z = High Impedance (off)

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Storage Temperature Range	
Ceramic DIP	−65°C to +175°C
Lead Temperature	
Ceramic DIP (soldering, 60 sec.)	300°C
Supply Voltage	8.0V
Input Voltage	5.5V

Maximum Power Dissipation* at 25°C	
Cavity Package	1500 mW

*Derate cavity package 10 mW/°C above 25°C.

Operating Range

DS34F87	
Temperature	0°C to +70°C
Supply Voltage	4.75V to 5.25V
DS35F87	
Temperature	−55°C to +125°C
Supply Voltage	4.5V to 5.5V

Electrical Characteristics over operating range, unless otherwise specified (Notes 2 & 3)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_{IL}	Input Voltage LOW				0.8	V
V_{IH}	Input Voltage HIGH		2.0			V
I_{IL}	Input Current LOW	V_{IL} = 0.5V			−200	μA
I_{IH}	Input Current HIGH	V_{IH} = 2.7V			+50	μA
		V_{IH} = 5.5V			+100	
V_{IC}	Input Clamp Voltage	I_I = −18 mA			−1.5	V
V_{OL}	Output Voltage LOW	I_{OL} = 48 mA			0.5	V
V_{OH}	Output Voltage HIGH	I_{OH} = −20 mA	2.5			V
I_{OS}	Output Short Circuit Current (Note 4)	V_{IH} = 2.0V	−40		−140	mA
I_{OZ}	Output Leakage Current Hi-Z State	V_{IL} = 0.5V, V_{IL} (z) = 0.8V			±100	μA
		V_{IH} = 2.7V, V_{IL} (z) = 0.8V			±100	
$I_{OL(off)}$	Output Leakage Current Power Off	V_{OH} = 6.0V, V_{CC} = 0V			+100	μA
		V_{OL} = −0.25V, V_{CC} = 0V			−100	
V_{OS}-$\overline{V}_{OS}$	Output Offset Voltage Difference (Note 5)				±0.4	V
V_{OD}	Output Differential Voltage (Note 5)		2.0			V
ΔV_{OD}	Output Differential Voltage Change				±0.4	V
I_{CCX}	Supply Current	Control Leads Gnd			50	mA
I_{CC}		Control Leads 2.0V			40	mA

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The tables of "Electrical Characteristics" provide conditions for actual device operation.

Note 2: Unless otherwise specified min/max limits apply across the −55°C to +125°C temperature range for the DS35F87 and across the 0°C to +70°C range for the DS34F87. All typicals are given for V_{CC} = 5V and T_A = 25°C.

Note 3: All currents into the device are positive; all currents out of the device pins are negative. All voltages are referenced to ground unless otherwise specified.

Note 4: Only one output at a time should be shorted.

Note 5: Refer to EIA RS-422/3 for exact conditions.

Switching Characteristics V_{CC} = 5.0 V, T_A = 25°C (Note 1)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{PHL}	Propagation Delay Times	High to Low Input			20	ns
t_{PLH}		Low to High Input			15	ns
t_{THL}	Output Transition Times—Differential	High to Low Input			15	ns
t_{TLH}		Low to High Input			15	ns
$t_{PHZ(E)}$	Propagation Delay Control to Output	R_L = 200, C_L = 50 pF			35	ns
$t_{PLZ(E)}$		R_L = 200, C_L = 50 pF			35	ns
$t_{PZH(E)}$		R_L = ∞, C_L = 50 pF			35	ns
$t_{PZL(E)}$		R_L = 200, C_L = 50 pF			35	ns
SKEW	Output to Output	Note 2			4.5	ns

Note 1: C_L = 50 pF, V_I = 1.5V to V_O = 1.5V, V_{PULSE} = 0V to +3.0V.

Note 2: Skew is defined as the difference in propagation delays between complementary outputs at the 50% point.

Parameter Measurement Information

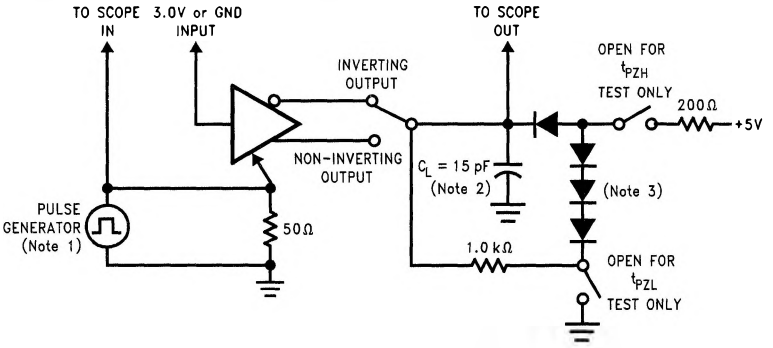

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FIGURE 2. TRI-STATE Enable Test Circuit and Waveforms

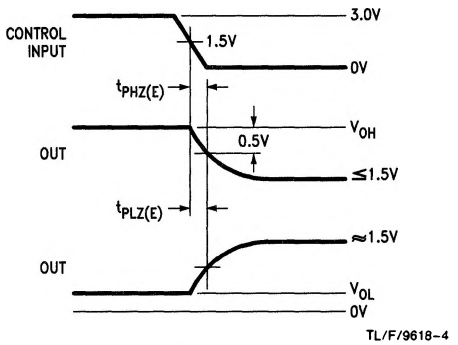

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FIGURE 2a

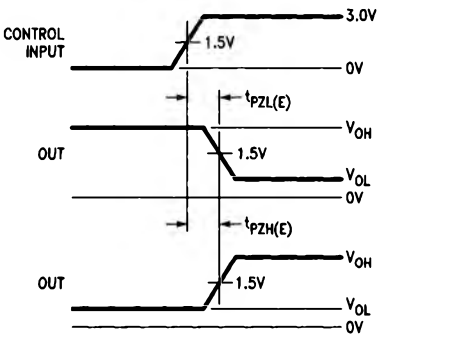

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FIGURE 2b

Parameter Measurement Information (Continued)

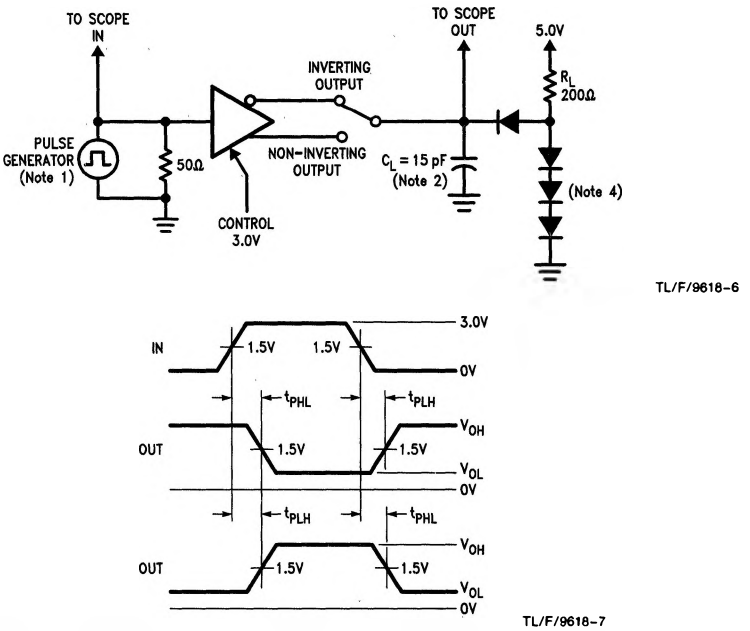

FIGURE 3. Propagation Delay Times Input to Output Waveforms and Test Circuit

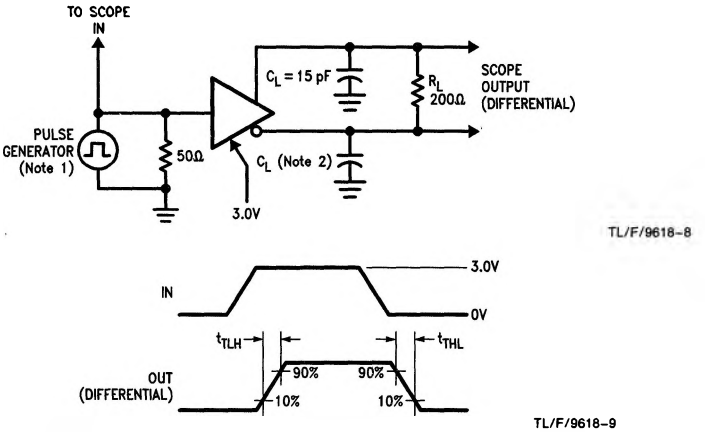

FIGURE 4. Output Transition Times Circuit and Waveforms

Note 1: The input pulse is supplied by a generator having the following characteristics: PRR = 1.0 MHz, 50% duty cycle, $t_{TLH} = t_{THL} \leq 5.0$ ns (10% to 90%), $Z_O \approx 50\Omega$.

Note 2: C_L includes probe and jig capacitance.

Note 3: All diodes are IN3064 or equivalent.

Note 4: All diodes are IN914 or equivalent.