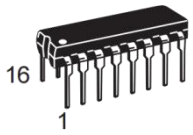
# DS34C87 CMOS Quad TRI-STATE ® Differential Line Driver

## General Description

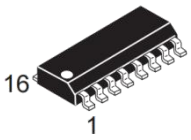
The DS34C87 is a quad differential line driver designed for digital data transmission over balanced lines. The DS34C87 meets all the requirements of EIA standard RS-422 while retaining the low power characteristics of CMOS. This en ables the construction of serial and terminal interfaces while maintaining minimal power consumption.

The DS34C87 accepts TTL or CMOS input levels and trans- lates these to Rs-422 output levels. This part uses special output circuitry that enables the individual drivers to power down without loading down the bus. The DS34C87 also in- cludes special power up and down circuitry which will TRI- STATE the outputs during power up or down, preventing spurious glitches on its outputs. This device has separate enable circuitry for each pair of the four drivers. The DS34C87 is pin compatible to the DS3487.

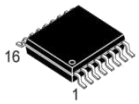
All inputs are protected against damage due to electrostatic discharge by diodes to Vcc and ground.




DIP-16




SOP-16




TSSOP-16

## Features

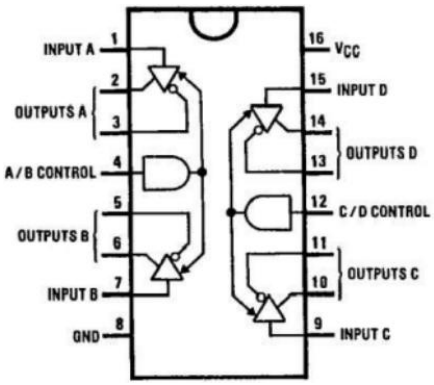
- TTL input compatible.
- Typical propagation delays: 8 ns.
- Typical output skew: 0.5 ns.
- Outputs won't load line when Vcc =0V.
- Meets the requirements of EIA standard RS-422.
- Operation from single 5V supply.
- TRI-STATE outputs for connection to system buses.
- Low quiescent current.

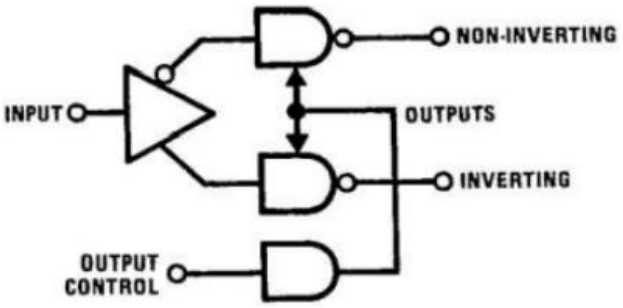
## Ordering Information

| DEVICE | Package Type | MARKING | Packing | Packing Qty |
|---|---|---|---|---|
| DS34C87PG | DIP-16 | DS34C87 | TUBE | 1000pcs/box |
| DS34C87DRG | SOP-16 | DS34C87 | REEL | 2500pcs/reel |
| DS34C87PWRG | TSSOP-16 | 34C87 | REEL | 2500pcs/reel |

## Connection and Logic Diagrams

**DIP-16/SOP-16/TSSOP-16**




## Truth Table

| INPUT | CONTROL INPUT | NON-INVERTING OUTPUT | INVERTING OUTPUT |
|---|---|---|---|
| H | H | H | L |
| L | H | L | H |
| X | L | Z | Z |

L=Low logic state H= High logic state

X=Irrelevant Z= TRI-STATE(high impedance)

## Absolute Maximum RatingS (Notes1&2)

| PARAMETER | LIMITS |
|---|---|
| Supply Voltage ($V_{CC}$) | -0.5 to 7.0V |
| DC Voltage ($V_{IN}$) | -1.5V to $V_{CC}$+1.5V |
| DC Output Voitage ($V_{OUT}$) | -0.5V to 7V |
| Clamp Diode Current($L_{IK}$,$L_{OK}$) | ±20 mA |
| DC Output Current, Per Pin($L_{OUT}$) | ±150 mA |
| DC $V_{CC}$ OR GND Current ($L_{CC}$) | ±150 mA |
| Storage Temperature Range($T_{STG}$) | -65°C to +150°C |
| Power Dissipation(note3)($P_O$) | 500 mW |
| lead temperature($T_L$)(soldering 10 sec) | 245°C |

## Operating Conditions

| | MIN | MAX | UNITS |
|---|---|---|---|
| Supply Voltqge(Vcc) | 4.50 | 5.50 | V |
| DC Input or Output Voitage(Vin Vout) | 0 | $V_{CC}$ | V |
| Operating Temperature Range ($t_A$) | -40 | +85 | ℃ |
| Input Rise Or Fall Times (tr ,tf) | | 500 | ns |

## DC ElectricalCharacteristics $V_{CC}$ = 5V ±10% (Unless Otherwise Specified) (Note4)

| SYMBOL | PARAMETER | CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| $V_{IH}$ | High Level Input Voitage | | | 2.0 | | | V |
| $V_{IL}$ | Low Level Input Voitage | | | | | 0.8 | V |
| $V_{OH}$ | High Level Output Voitage | $V_{IN}$ = $V_{IH}$ OR $V_{IL}$, $L_{OUT}$=-20 MA | | 2.5 | | | V |
| $V_{OL}$ | Low Level Output Voltage | $V_{IN}$ = $V_I$ OR VL $I_{OUT}$=48 MA | | | | 0.5 | V |
| $V_T$ | Differential Output Voltage | $R_L$=100Ω (NOTE 5) | | 2.0 | | | V |
| $\|V_T\|$-$\|\bar{V}_T\|$ | Difference In Differential Output | $R_L$=100Ω (NOTE 5) | | | | 0.4 | V |
| $V_{OS}$ | Common Mode Output Voltage | $R_L$=100Ω (NOTE 5) | | | | 3.0 | V |
| $\|V_{OS}$-$\bar{V}_{OS}\|$ | Difference In Common Mode Output | $R_L$=100Ω (NOTE 5) | | | | 0.4 | V |
| $I_{IN}$ | Input Current | $V_{IN}$ =$V_{CC}$, GND,$V_{IH}$, OR $V_{IL}$ | | | | ±10 | μA |
| $I_{CC}$ | Quiescent Supply Current | $I_{OUT}$ =0μA, $V_{IN}$ = $V_{CC}$ OR GND $V_{IN}$ =2.4$V_{OR}$ 0.5V(NOTE 6) | | | 200 0.8 | | μA MA |
| $I_{OZ}$ | Tri-State Output Leakage Current | $V_{OUT}$ = $V_{CC}$ OR GND CONTROL=$V_{IL}$ | | | ±0.5 | ±0.5 | μA |
| $I_{SC}$ | Output Short Circuit Current | $V_{IN}$ = $V_{CC}$ OR GND (NOTE 7) | | -30 | | -150 | MA |
| $I_{DFF}$ | Output Leakage Current Power Off | $V_{CC}$=0V | $V_{OUT}$ =6V $V_{OUT}$=-0.25V | | | 100 -100 | μA μA |

**Note1:**Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not ensured.

**Note 2:** Uniess otherwise specified, all votages are referenced to ground.all currents into dovice pins are positive; all currents out of device pins are negative.

**Note3:**Power Dissipation Temperature Derating "N" Package: -12 mW/℃ From 65℃ To 85℃.
"M" Packege: -12 mW/℃ From 100℃ To 125℃.

**Note4:**Unless Otherwise Specifted Min/Max Limits Apply Across The -40℃ To 85℃ Temperature Range.All Typicals Are Given For Vcc=5V And Ta =25℃.

**Note 5:** See Ela Specilication RS-422 For Exact Test Conditions.

**Note 6:** Moasured por input. All other inputs at vcc or gnd.

**Note 7:** Only one output at a time should be shorted.

## Switching Characteristics Vcc=5V±10%，tr = tf =6ns(Figures 1, 2, 3, and 4) (Note 4)

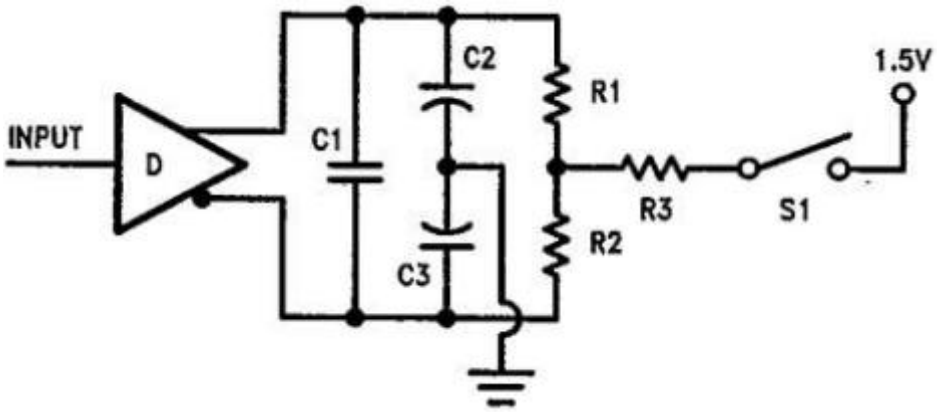
| SYMBOL | PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| $T_{PLH}$.$T_{PHL}$ | Propagation delay input to output | S1 Open | | 8 | | ns |
| SKEW | (note 8) | S1 Open | | 0.5 | | ns |
| $T_{TLH}$, $T_{THL}$ | Differential output rise and fall times | S1 Open | | 8 | | ns |
| $T_{PZH}$ | Output enable time | S1 Closed | | 13 | | ns |
| $T_{PZL}$ | Output enable time | S1 Closed | | 15 | | ns |
| $T_{PHZ}$ | Output disable time (note9) | S1 Closed | | 9 | | ns |
| $T_{PLZ}$ | Output disable time (note9) | S1 Closed | | 10 | | ns |
| $C_{PD}$ | Power dissipation capacitance (note 10) | | | 100 | | pF |
| $C_{IN}$ | Input capacitance | | | 10 | | pF |

**Note 8:**Skew isdefined as the difference in propagation delays between complementary oulputs at the 50% point.

**Note9:**Output isable time is the delay from ENABLE or $\overline{ENABE}$ being switched to the output transistors turning off. The actual disable times are less than indicated due to the delay added by the RC time constant of the load.

Note 10:Cppdeterminesthe no load dynamic power consumption,$P_{DC}=C_{PD}V^2ccf+Icc\ V_{CC}$ and the no load dynamic current consumption, Is=Cpd Vccf + Icc.

## AC Test Circuit and Switching Time Waveforms




Note:C1=C2=C3=40pF,R1=R2=50N,R3-5000Ω

**FIGURE 1.AC Test Circuit**

## AC Test Circuit and Switching Time Waveforms (Continued)

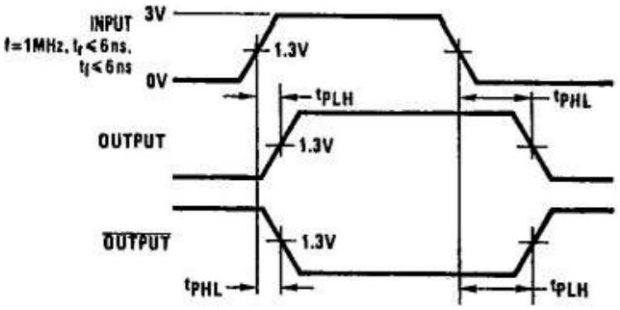



FIGURE 2. Propagation Delays

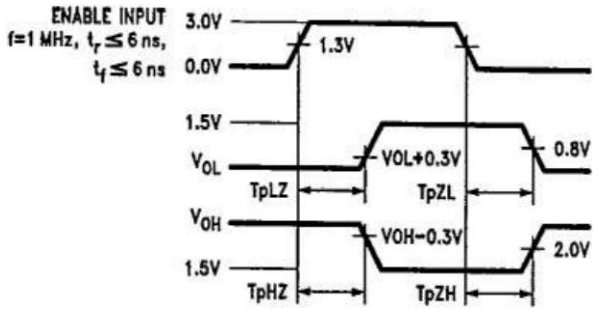



FIGURE 3. Enable and Disable Times

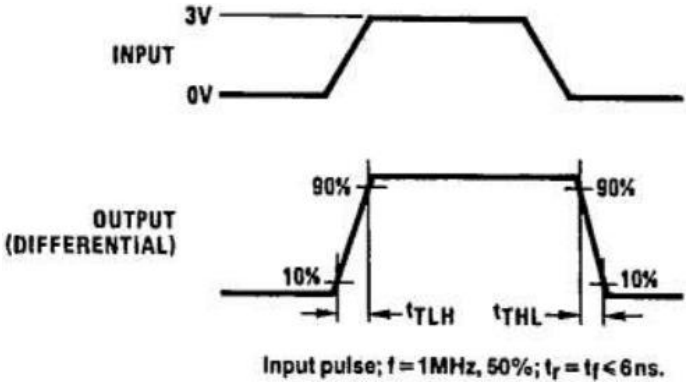
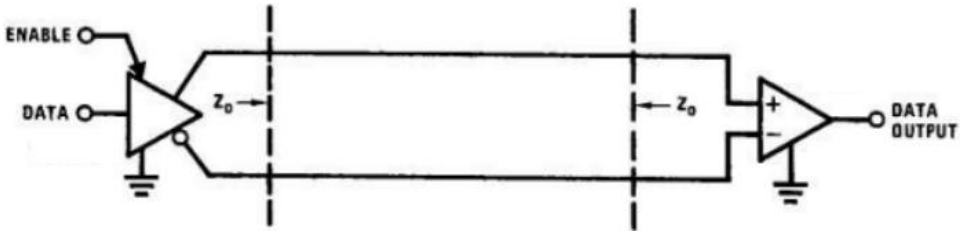



FIGURE 4. Differential Rise and Fall Times

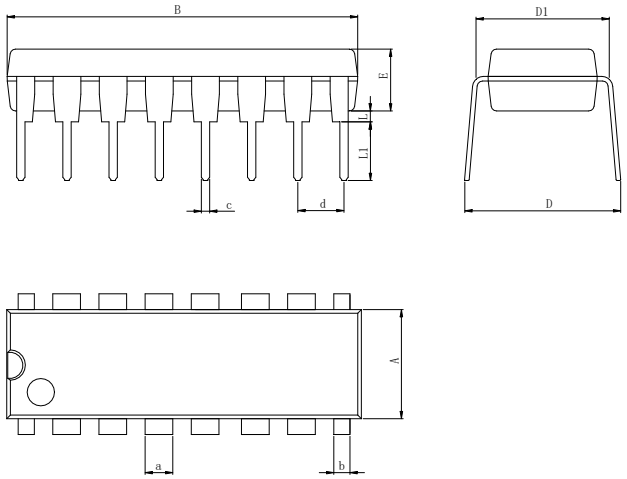
## Typical Applications

Two-Wire Balanced System,RS-422



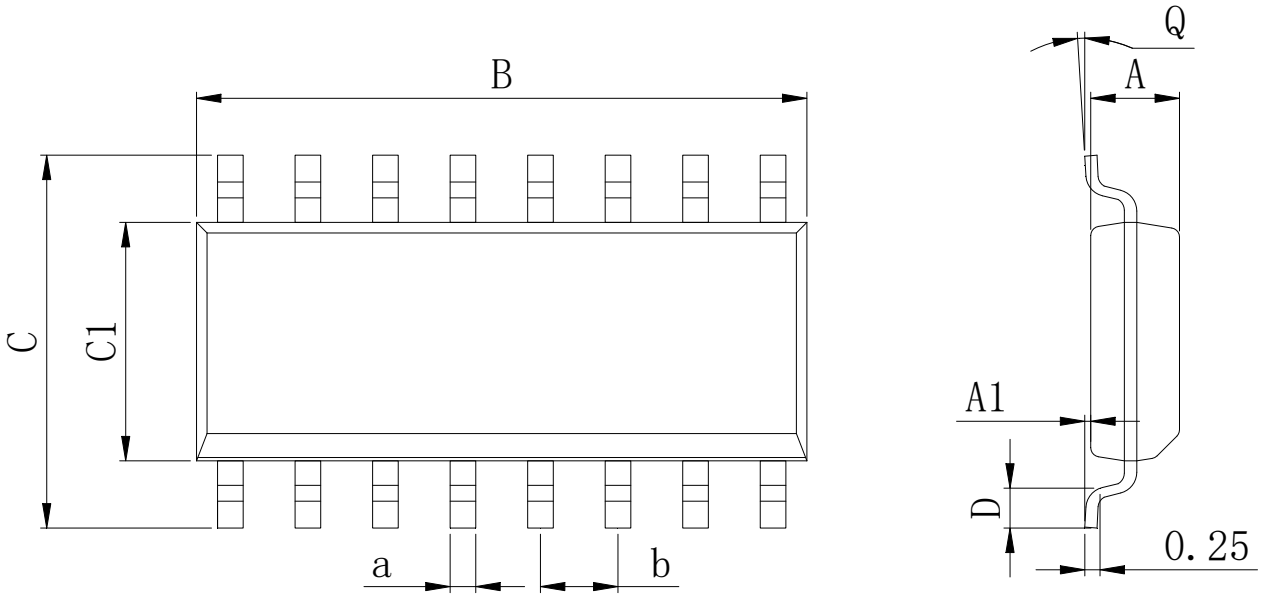
## Physical Dimensions

DIP-16




| Dimensions In Millimeters(DIP-16) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Symbol:** | A | B | D | D1 | E | L | L1 | a | b | c | d |
| **Min:** | 6.10 | 18.94 | 8.10 | 7.42 | 3.10 | 0.50 | 3.00 | 1.50 | 0.85 | 0.40 | 2.54 BSC |
| **Max:** | 6.68 | 19.56 | 10.9 | 7.82 | 3.55 | 0.70 | 3.60 | 1.55 | 0.90 | 0.50 | |

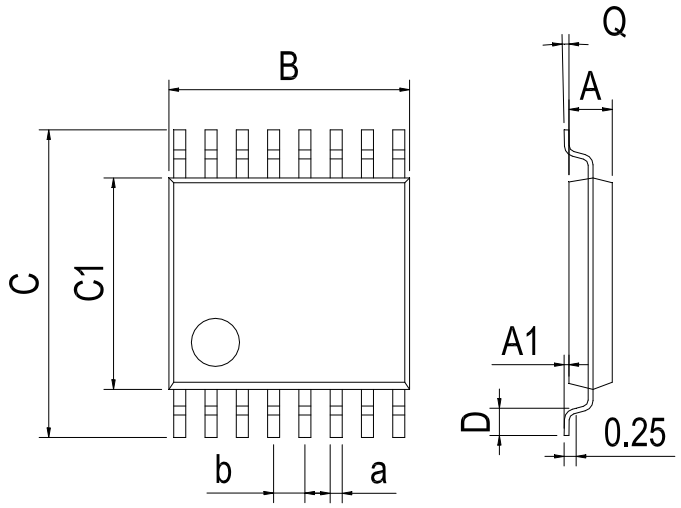
SOP-16




| Dimensions In Millimeters(SOP-16) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Symbol:** | A | A1 | B | C | C1 | D | Q | a | b |
| **Min:** | 1.35 | 0.05 | 9.80 | 5.80 | 3.80 | 0.40 | 0° | 0.35 | 1.27 BSC |
| **Max:** | 1.55 | 0.20 | 10.0 | 6.20 | 4.00 | 0.80 | 8° | 0.45 | |

## Physical Dimensions

TSSOP-16




| Dimensions In Millimeters(TSSOP-16) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Symbol:** | A | A1 | B | C | C1 | D | Q | a | b |
| **Min:** | 0.85 | 0.05 | 4.90 | 6.20 | 4.30 | 0.40 | 0° | 0.20 | 0.65 BSC |
| **Max:** | 0.95 | 0.20 | 5.10 | 6.60 | 4.50 | 0.80 | 8° | 0.25 | |

## Revision History

| DATE | REVISION | PAGE |
|---|---|---|
| 2017-1-9 | New | 1-9 |
| 2023-9-18 | Modify the package dimension diagramTSSOP-16、Update encapsulation type、Update Lead Temperature、Updated DIP-16 dimension、Add annotation for Maximum Ratings. | 1、2、6、8 |

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