

# SN55110A, SN75110A, SN75112 DUAL LINE DRIVERS

SLLS106E – DECEMBER 1975 – REVISED APRIL 2000

- Improved Stability Over Supply Voltage and Temperature Ranges
- Constant-Current Outputs
- High Speed
- Standard Supply Voltages
- High Output Impedance
- High Common-Mode Output Voltage Range  
... -3 V to 10 V
- TTL-Input Compatibility
- Inhibitor Available for Driver Selection
- Glitch-Free During Power Up/Power Down
- SN75112 and External Circuit Meets or Exceeds the Requirements of CCITT Recommendation V.35
- Package Options Include Plastic Small-Outline (D), Package, and Ceramic Chip Carriers (FK), Standard Plastic (N) and Ceramic (J) DIPs

## description

The SN55110A, SN75110A, and SN75112 dual line drivers have improved output current regulation with supply voltage and temperature variations. In addition, the higher current of the SN75112 (27 mA) allows data to be transmitted over longer lines. These drivers offer optimum performance when used with the SN55107A, SN75107A, and SN75108A line receivers.

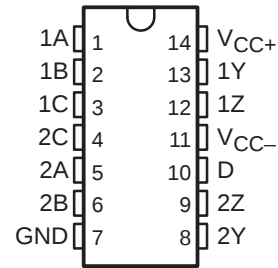
These drivers feature independent channels with common voltage supply and ground terminals. The significant difference between the three drivers is in the output-current specification. The driver circuits feature a constant output current that is switched to either of two output terminals by the appropriate logic levels at the input terminals. The output current can be switched off (inhibited) by low logic levels on the enable inputs. The output current is nominally 12 mA for the '110A devices, and is 27 mA for the SN75112.

The enable/inhibit feature is provided so the circuits can be used in party-line or data-bus applications. A strobe or inhibitor (enable D), common to both drivers, is included for increased driver-logic versatility. The output current in the inhibited mode,  $I_{O(off)}$ , is specified so that minimum line loading is induced when the driver is used in a party-line system with other drivers. The output impedance of the driver in the inhibited mode is very high. The output impedance of a transistor is biased to cutoff.

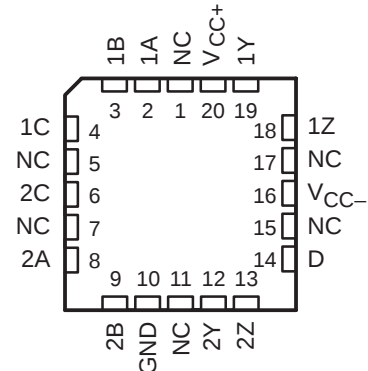
The driver outputs have a common-mode voltage range of -3 V to 10 V, allowing common-mode voltage on the line without affecting driver performance.

All inputs are diode clamped and are designed to satisfy TTL-system requirements. The inputs are tested at 2 V for high-logic-level input conditions and 0.8 V for low-logic-level input conditions. These tests ensure 400-mV noise margin when interfaced with TTL Series 54/74.

SN55110A ... J OR W PACKAGE  
SN75110A, SN75112 ... D OR N PACKAGE  
(TOP VIEW)



SN55110A ... FK PACKAGE  
(TOP VIEW)



NC – No internal connection



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**TEXAS  
INSTRUMENTS**

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# SN55110A, SN75110A, SN75112 DUAL LINE DRIVERS

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The SN55110A is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN75110A and SN75112 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

## AVAILABLE OPTIONS

| T <sub>A</sub>                                 | PACKAGED DEVICES                |                                 |                    |                       |                            |
|------------------------------------------------|---------------------------------|---------------------------------|--------------------|-----------------------|----------------------------|
|                                                | PLASTIC<br>SMALL OUTLINE<br>(D) | PLASTIC<br>CHIP CARRIER<br>(FK) | CERAMIC DIP<br>(J) | PLASTIC DIP<br>(N)    | CERAMIC<br>FLATPACK<br>(W) |
| $0^{\circ}\text{C}$ to $70^{\circ}\text{C}$    | SN75110AD<br>SN75112D           |                                 |                    | SN75110AN<br>SN75112N |                            |
| $-55^{\circ}\text{C}$ to $125^{\circ}\text{C}$ |                                 | SN5510AFK                       | SN55110AJ          |                       | SN55110AW                  |

The D package is available taped and reeled. Add the suffix R to the device type (e.g., SN75110ADR).

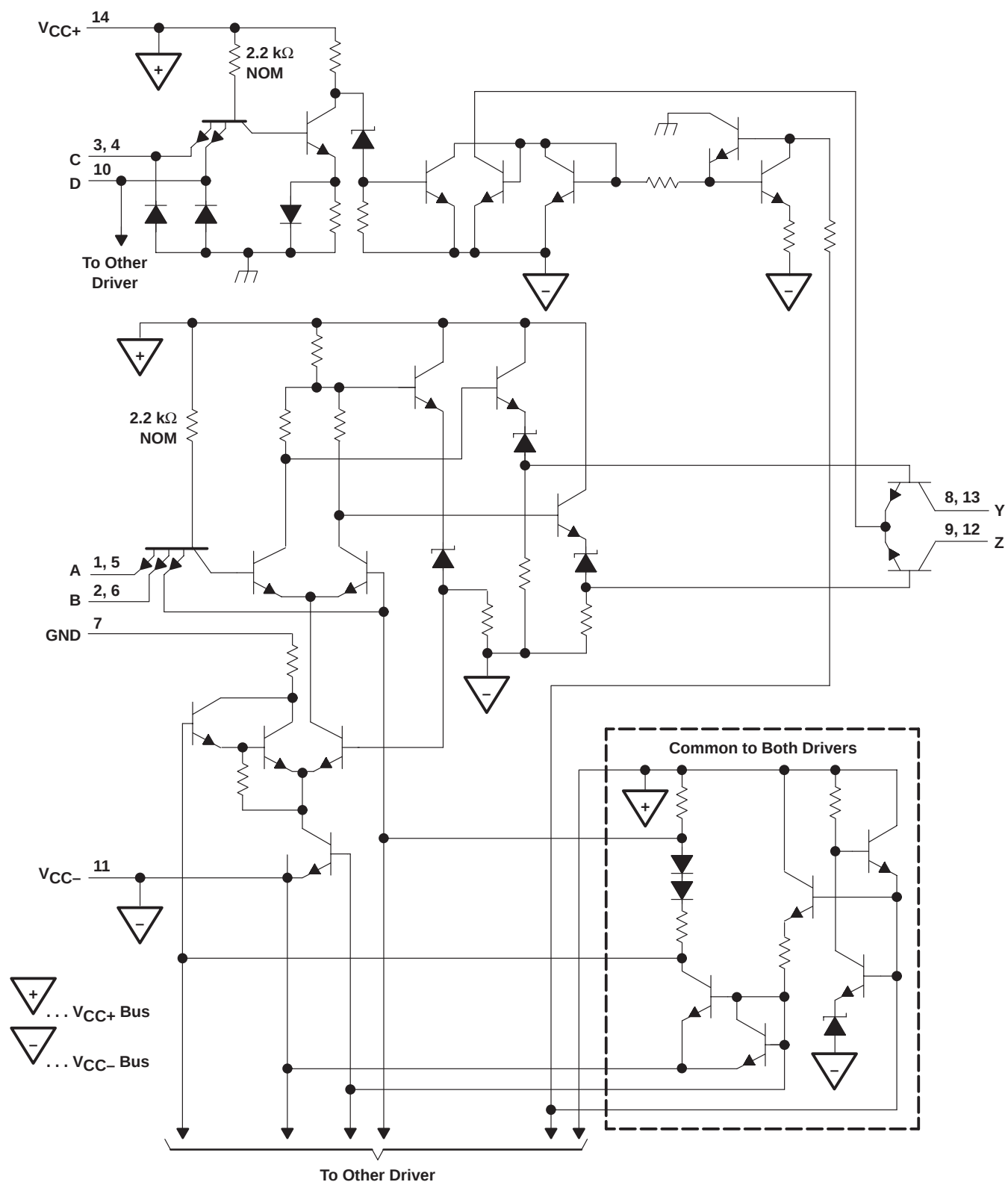
## FUNCTION TABLE (each driver)

| LOGIC<br>INPUTS |   | ENABLE<br>INPUTS |   | OUTPUTS <sup>†</sup> |     |
|-----------------|---|------------------|---|----------------------|-----|
| A               | B | C                | D | Y                    | Z   |
| X               | X | L                | X | Off                  | Off |
| X               | X | X                | L | Off                  | Off |
| L               | X | H                | H | On                   | Off |
| X               | L | H                | H | On                   | Off |
| H               | H | H                | H | Off                  | On  |

H = high level, L = low level, X = irrelevant

<sup>†</sup> When using only one channel of the line drivers, the other channel should be inhibited and/or have its outputs grounded.

## schematic (each driver)



Pin numbers shown are for the D, J, N, and W packages.

# SN55110A, SN75110A, SN75112

## DUAL LINE DRIVERS

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### absolute maximum ratings over operating free-air temperature (unless otherwise noted)<sup>†</sup>

|                                                                              |                              |
|------------------------------------------------------------------------------|------------------------------|
| Supply voltage, $V_{CC+}$ (see Note 1)                                       | 7 V                          |
| Supply voltage, $V_{CC-}$                                                    | –7 V                         |
| Input voltage, $V_I$                                                         | 5.5 V                        |
| Output voltage range, $V_O$                                                  | –5 V to 12 V                 |
| Package thermal impedance, $\theta_{JA}$ (see Note 2): D package             | 86°C/W                       |
| N package                                                                    | 80°C/W                       |
| Continuous total power dissipation (see Note 3)                              | See Dissipation Rating Table |
| Case temperature for 60 seconds: FK package                                  | 260°C                        |
| Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J or W package | 300°C                        |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or N package | 260°C                        |
| Storage temperature range, $T_{stg}$                                         | –65°C to 150°C               |

<sup>†</sup> Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. Voltage values are with respect to network ground terminal.
  2. The package thermal impedance is calculated in accordance with JESD 51.
  3. In the FK, J, or W package, SN55110A chips are either silver glass or alloy mounted; SN75110A and SN75112 chips are glass mounted.

DISSIPATION RATING TABLE

| PACKAGE | $T_A \leq 25^\circ\text{C}$<br>POWER RATING | DERATING FACTOR<br>ABOVE $T_A = 25^\circ\text{C}$ | $T_A = 70^\circ\text{C}$<br>POWER RATING | $T_A = 125^\circ\text{C}$<br>POWER RATING |
|---------|---------------------------------------------|---------------------------------------------------|------------------------------------------|-------------------------------------------|
| FK      | 1375 mW                                     | 11 mW/°C                                          | 880 mW                                   | 275 mW                                    |
| J       | 1375 mW                                     | 11 mW/°C                                          | 880 mW                                   | 275 mW                                    |
| W       | 1000 mW                                     | 8 mW/°C                                           | 640 mW                                   | 200 mW                                    |

### recommended operating conditions (see Note 4)

|                                       | SN55110A |     |      | SN75110A<br>SN75112 |     |       | UNIT |
|---------------------------------------|----------|-----|------|---------------------|-----|-------|------|
|                                       | MIN      | NOM | MAX  | MIN                 | NOM | MAX   |      |
| Supply voltage, $V_{CC+}$             | 4.5      | 5   | 5.5  | 4.75                | 5   | 5.25  | V    |
| Supply voltage, $V_{CC-}$             | –4.5     | –5  | –5.5 | –4.75               | –5  | –5.25 | V    |
| Positive common-mode output voltage   | 0        |     | 10   | 0                   |     | 10    | V    |
| Negative common-mode output voltage   | 0        |     | –3   | 0                   |     | –3    | V    |
| High-level input voltage, $V_{IH}$    | 2        |     |      | 2                   |     |       | V    |
| Low-level output current, $V_{IL}$    |          |     | 0.8  |                     |     | 0.8   | V    |
| Operating free-air temperature, $T_A$ | –55      |     | 125  | 0                   |     | 70    | °C   |

NOTE 4: When using only one channel of the line drivers, the other channel should be inhibited and/or have its outputs grounded.



electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER             |                                                       | TEST CONDITIONS†                                                                                  | SN55110A<br>SN75110A |      |     | SN75112 |      |     | UNIT          |
|-----------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------------------|----------------------|------|-----|---------|------|-----|---------------|
|                       |                                                       |                                                                                                   | MIN                  | TYP‡ | MAX | MIN     | TYP‡ | MAX |               |
| $V_{IK}$              | Input clamp voltage                                   | $V_{CC\pm} = \text{MIN}$ , $I_L = -12 \text{ mA}$                                                 | -0.9                 | -1.5 |     | -0.9    | -1.5 |     | V             |
| $I_{O(\text{on})}$    | On-state output current                               | $V_{CC\pm} = \text{MAX}$ , $V_O = 10 \text{ V}$                                                   | 12                   | 15   |     | 27      | 36   |     | mA            |
|                       |                                                       | $V_{CC} = \text{MIN to MAX}$ ,<br>$V_O = -1 \text{ V to } 1 \text{ V}$ , $T_A = 25^\circ\text{C}$ |                      |      |     | 24      | 28   | 32  |               |
|                       |                                                       | $V_{CC\pm} = \text{MIN}$ , $V_O = -3 \text{ V}$                                                   | 6.5                  | 12   |     | 18      | 27   |     |               |
| $I_{O(\text{off})}$   | Off-state output current                              | $V_{CC\pm} = \text{MIN}$ , $V_O = 10 \text{ V}$                                                   |                      |      | 100 |         |      | 100 | $\mu\text{A}$ |
| $I_I$                 | Input current at maximum input voltage                | A, B, or C inputs                                                                                 |                      |      | 1   |         |      | 1   | mA            |
|                       |                                                       | D input                                                                                           |                      |      | 2   |         |      | 2   |               |
| $I_{IH}$              | High-level input current                              | A, B, or C inputs                                                                                 |                      |      | 40  |         |      | 40  | $\mu\text{A}$ |
|                       |                                                       | D input                                                                                           |                      |      | 80  |         |      | 80  |               |
| $I_{IL}$              | Low-level input current                               | A, B, or C inputs                                                                                 |                      |      | -3  |         |      | -3  | mA            |
|                       |                                                       | D input                                                                                           |                      |      | -6  |         |      | -6  |               |
| $I_{CC+(\text{on})}$  | Supply current from $V_{CC}$ with driver enabled      | $V_{CC\pm} = \text{MAX}$ ,<br>A and B inputs at 0.4 V,<br>C and D inputs at 2 V                   | 23                   | 35   |     | 25      | 40   |     | mA            |
| $I_{CC-(\text{on})}$  | Supply current from $V_{CC-}$ with driver enabled     | $V_{CC\pm} = \text{MAX}$ ,<br>A and B inputs at 0.4 V,<br>C and D inputs at 2 V                   | -34                  | -50  |     | -65     | -100 |     | mA            |
| $I_{CC+(\text{off})}$ | Supply current from $V_{CC-}$ with driver inhibited   | $V_{CC\pm} = \text{MAX}$ ,<br>A, B, C, and D inputs at 0.4 V                                      | 21                   |      |     | 30      |      |     | mA            |
| $I_{CC-(\text{off})}$ | Supply current from $V_{CC\pm}$ with driver inhibited | $V_{CC\pm} = \text{MAX}$ ,<br>A, B, C, and D inputs at 0.4 V                                      | -17                  |      |     | -32     |      |     | mA            |

† For conditions shown as MIN or MAX, use appropriate value specified under recommended operating conditions.

‡ All typical values are at  $V_{CC+} = 5 \text{ V}$ ,  $V_{CC-} = -5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

switching characteristics,  $V_{CC\pm} = \pm 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$

| PARAMETER§       | FROM<br>(INPUT) | TO<br>(OUTPUT) | TEST CONDITIONS                                                   | MIN | TYP | MAX | UNIT |
|------------------|-----------------|----------------|-------------------------------------------------------------------|-----|-----|-----|------|
| t <sub>PLH</sub> | A or B          | Y or Z         | C <sub>L</sub> = 40 pF,    R <sub>L</sub> = 50 Ω,    See Figure 1 | 9   | 15  | ns  |      |
| t <sub>PHL</sub> |                 |                |                                                                   | 9   | 15  |     |      |
| t <sub>PLH</sub> | C or D          | Y or Z         |                                                                   | 16  | 25  | ns  |      |
| t <sub>PHL</sub> |                 |                |                                                                   | 13  | 25  |     |      |

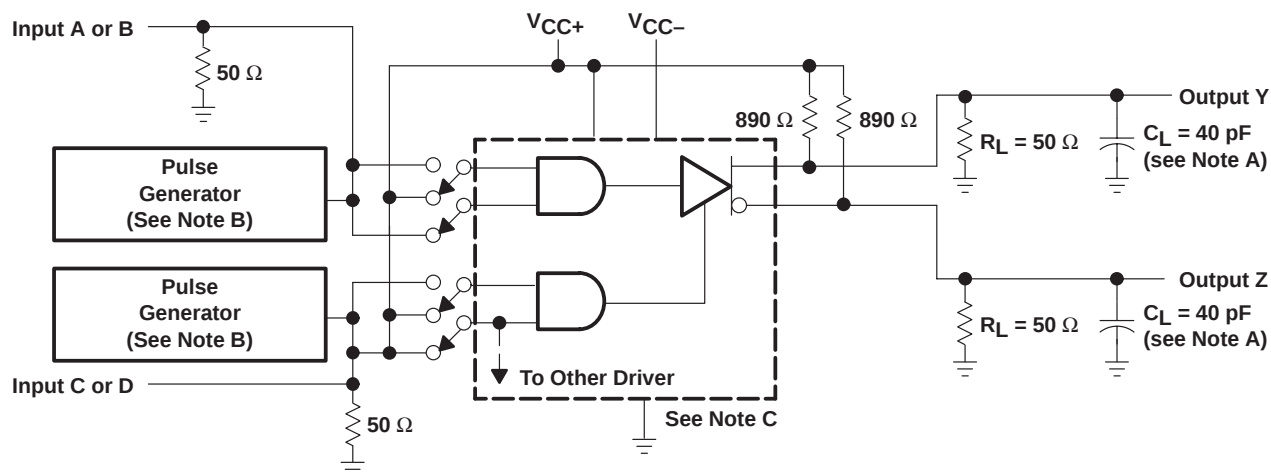
§  $t_{PLH}$  = Propagation delay time, low-to-high-level output

$t_{PHL}$  = Propagation delay time, high-to-low-level output

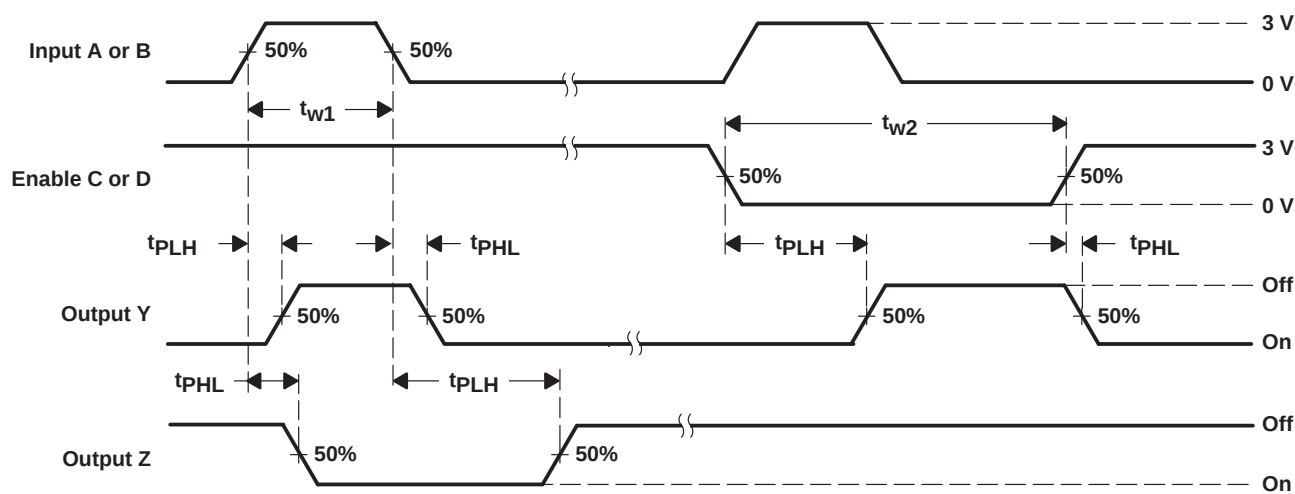
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## PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

- NOTES:
- A.  $C_L$  includes probe and jig capacitance.
  - B. The pulse generators have the following characteristics:  $Z_O = 50 \Omega$ ,  $t_r = t_f = 10 \pm 5 \text{ ns}$ ,  $t_{W1} = 500 \text{ ns}$ ,  $\text{PRR} \leq 1 \text{ MHz}$ ,  $t_{W2} = 1 \mu\text{s}$ ,  $\text{PRR} \leq 500 \text{ kHz}$ .
  - C. For simplicity, only one channel and the enable connections are shown.

Figure 1. Test Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS

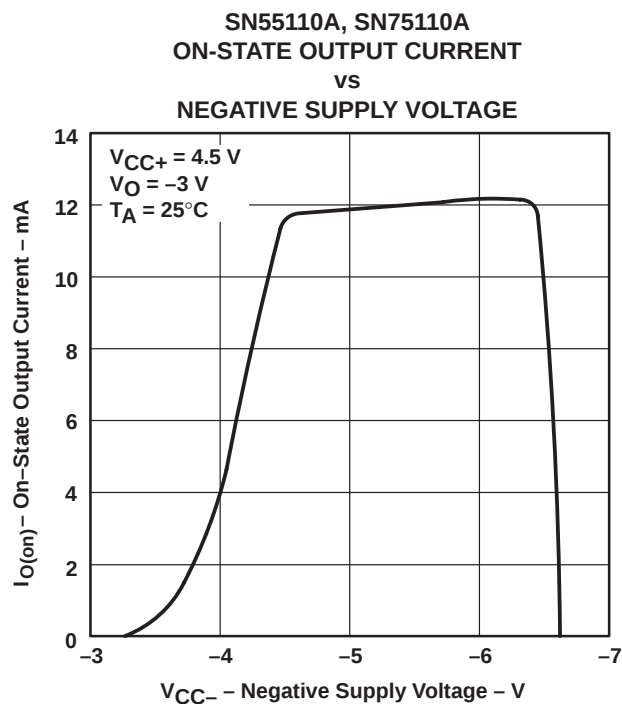


Figure 2

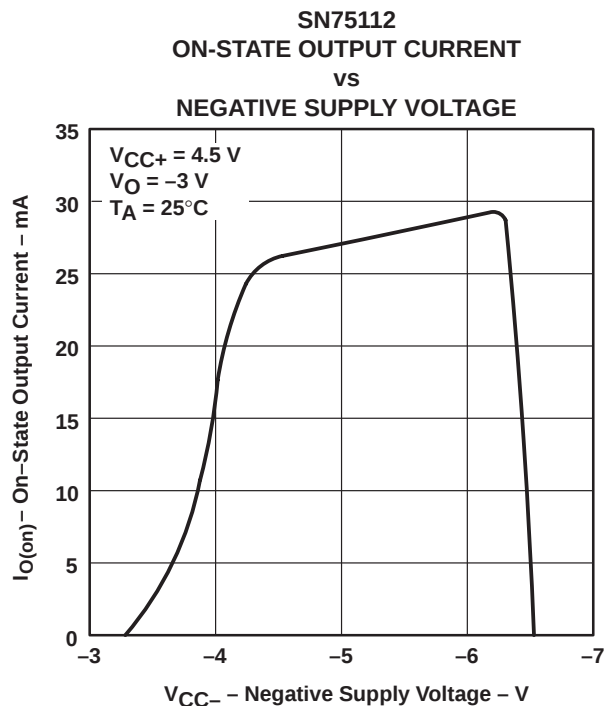
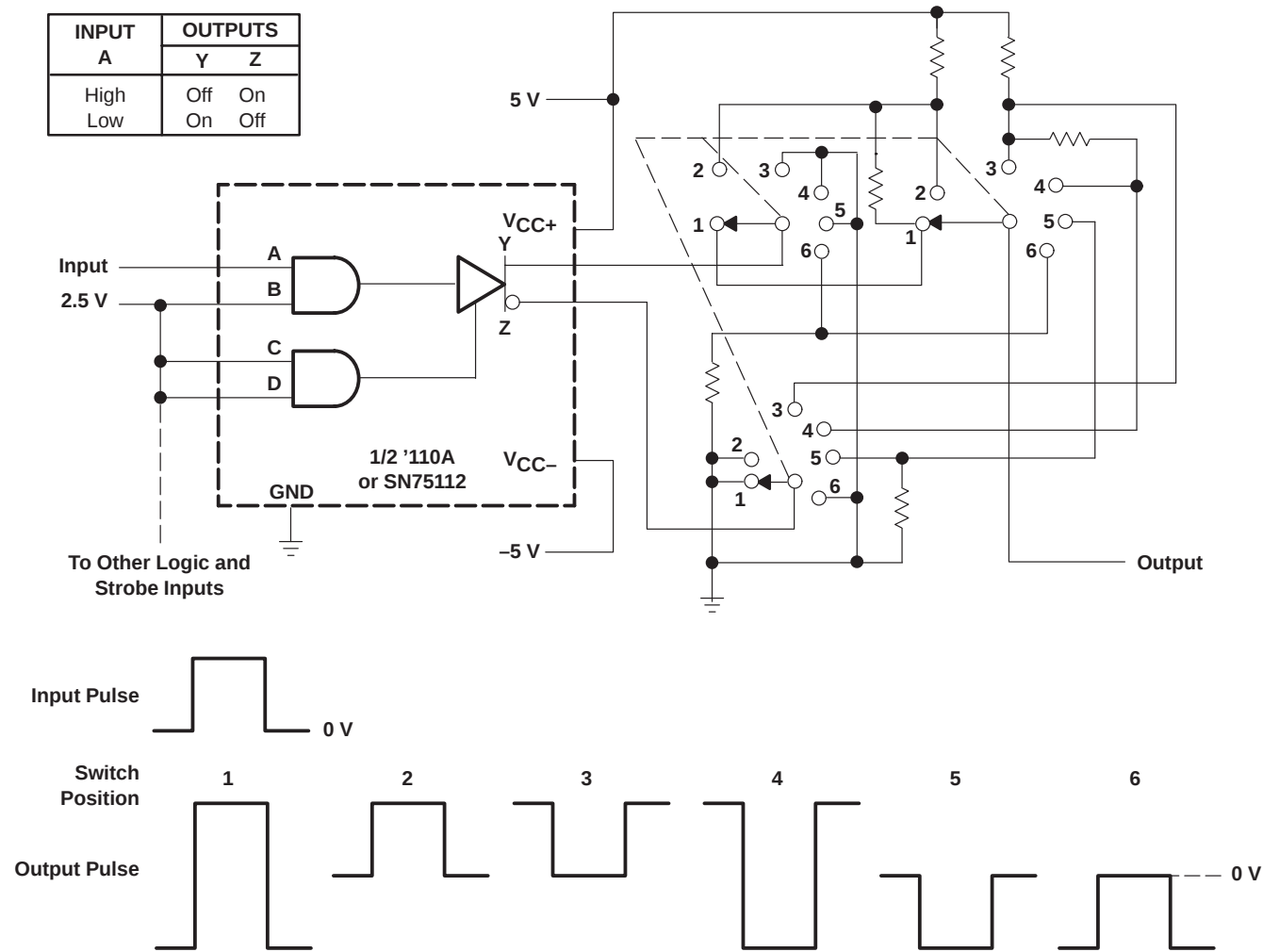


Figure 3

APPLICATION INFORMATION

special pulse-control circuit

Figure 4 shows a circuit that can be used as a pulse-generator output or in many other testing applications.



### using the SN75112 as a CCITT-recommended V.35 line driver

### Table 1. CCITT V.35 Electrical Requirements

| GENERATOR                                    | MIN                         | MAX | UNIT     |
|----------------------------------------------|-----------------------------|-----|----------|
| Source impedance, $Z_{\text{source}}$        | 50                          | 150 | $\Omega$ |
| Resistance to ground, R                      | 135                         | 165 | $\Omega$ |
| Differential output voltage, $V_{\text{OD}}$ | 440                         | 660 | mV       |
| 10% to 90% rise time, $t_r$                  | 40                          |     | ns       |
| or                                           | $0.01 \times u_i^{\dagger}$ |     |          |
| Common-mode output voltage, $V_{\text{OC}}$  | -0.6                        | 0.6 | V        |
| LOAD (RECEIVER)                              | MIN                         | MAX | UNIT     |
| Input impedance, $Z_i$                       | 90                          | 110 | $\Omega$ |
| Resistance to ground, R                      | 135                         | 165 | $\Omega$ |

[illegible]

All resistors are 5%, 1/4 W.

### Figure 5. CCITT-Recommended V.35 Interface Using the SN75112 and SN75107A

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