

# SN55110A, SN75110A, SN75112 DUAL LINE DRIVERS

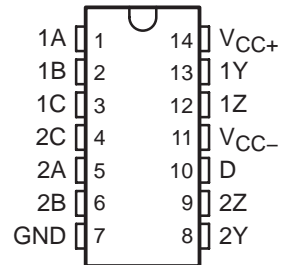
SLLS106G – DECEMBER 1975 – REVISED NOVEMBER 2004

- 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

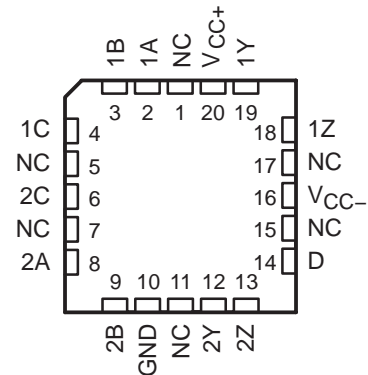
## description/ordering information

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.

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



SN55110A ... FK PACKAGE  
(TOP VIEW)



NC – No internal connection

## ORDERING INFORMATION

TA	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	PDIP (N)	Tube of 25	SN75110AN	SN75110AN
		Tube of 50	SN75112N	SN75112N
	SOIC (D)	Reel of 2500	SN75110AD	SN75110A
		Tube of 50	SN75112D	
		Reel of 2500	SN75112DR	SN75112
		Tube of 50	SN75110ADR	
SOP (NS)	Reel of 2000	SN75110ANSR	SN75110A	
-55°C to 125°C	CDIP (J)	Tube of 25	SN55110AJ	SN55110AJ
		Tube of 150	SNJ55110AJ	SNJ55110AJ
	CFP (W)	Tube of 150	SNJ55110AW	SNJ55110AW
	LCCC (FK)	Tube of 55	SNJ55110AFK	SNJ55110AFK

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



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 **TEXAS  
INSTRUMENTS**

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

# SN55110A, SN75110A, SN75112 DUAL LINE DRIVERS

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## description/ordering information (continued)

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 nominally is 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  $-3\text{ V}$  to  $10\text{ V}$ , 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  $2\text{ V}$  for high-logic-level input conditions and  $0.8\text{ V}$  for low-logic-level input conditions. These tests ensure  $400\text{-mV}$  noise margin when interfaced with TTL Series 54/74 devices.

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  $70^{\circ}\text{C}$ .

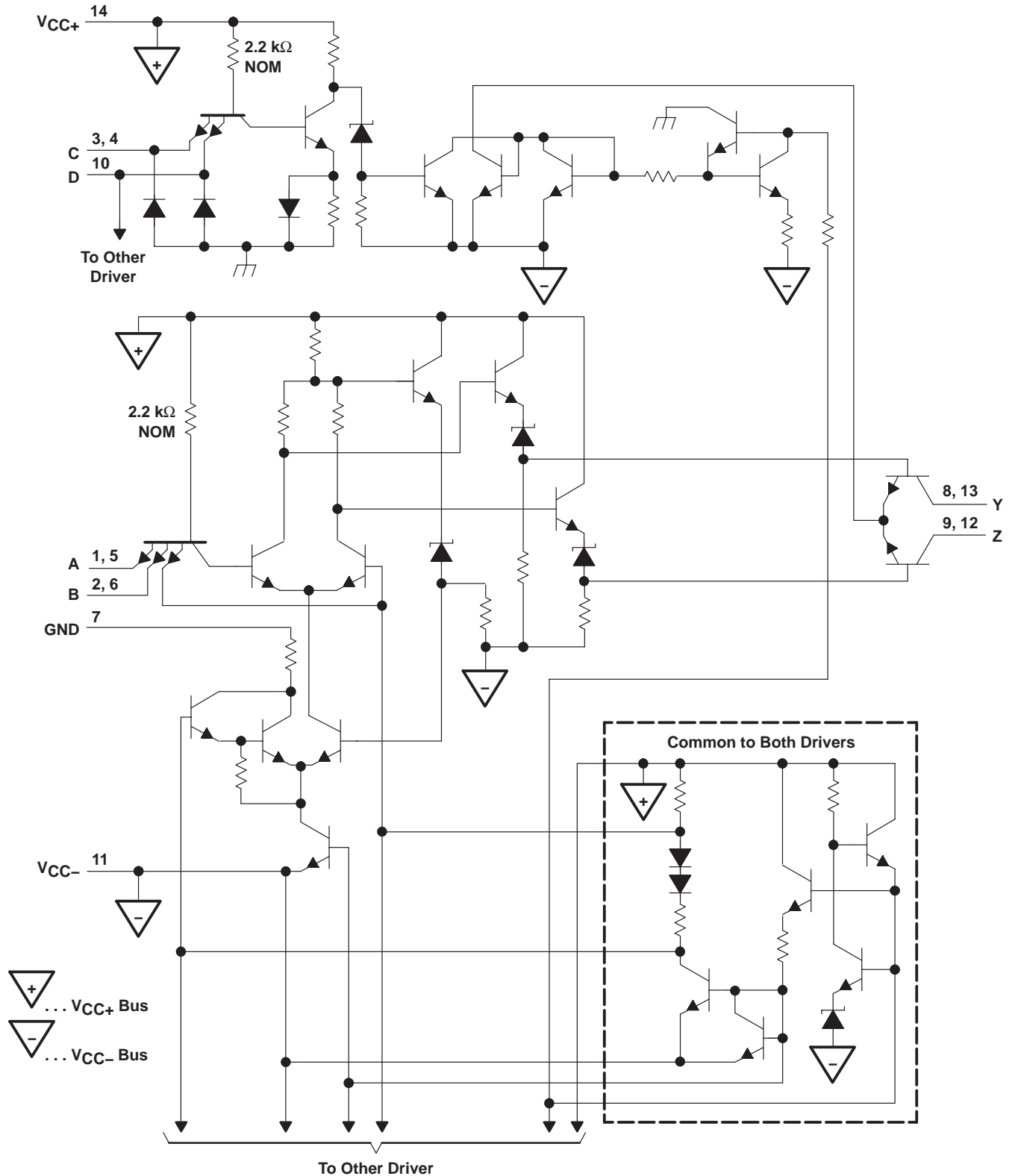
FUNCTION TABLE  
(each driver)

LOGIC INPUTS		ENABLE INPUTS		OUTPUTS†	
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

† 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, NS, and W packages.

# SN55110A, SN75110A, SN75112 DUAL LINE DRIVERS

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

Supply voltage: $V_{CC+}$ (see Note 1)	7 V
$V_{CC-}$ (see Note 1)	-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 Notes 2 and 3): D package	86°C/W
N package	80°C/W
NS package	76°C/W
Package thermal impedance, $\theta_{JC}$ (see Notes 4 and 5): FK package	13.42°C/W
J package	15.05°C/W
W package	14.65°C/W
Operating virtual junction temperature	150°C
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
Storage temperature range, $T_{stg}$	-65°C to 150°C

† 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. Maximum power dissipation is a function of  $T_J(\text{max})$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.
  3. The package thermal impedance is calculated in accordance with JESD 51-7.
  4. Maximum power dissipation is a function of  $T_J(\text{max})$ ,  $\theta_{JC}$ , and  $T_C$ . The maximum allowable power dissipation at any allowable case temperature is  $P_D = (T_J(\text{max}) - T_C)/\theta_{JC}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.
  5. The package thermal impedance is calculated in accordance with MIL-STD-883.

## recommended operating conditions (see Note 6)

	SN55110A			SN75110A SN75112			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC+}$ Supply voltage	4.5	5	5.5	4.75	5	5.25	V
$V_{CC-}$ Supply voltage	-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
$V_{IH}$ High-level input voltage	2			2			V
$V_{IL}$ Low-level output voltage			0.8			0.8	V
$T_A$ Operating free-air temperature	-55		125	0		70	°C

NOTE 6: When using only one channel of the line drivers, the other channel should be inhibited and/or have its outputs grounded.



# SN55110A, SN75110A, SN75112 DUAL LINE DRIVERS

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

PARAMETER		TEST CONDITIONS†	SN55110A 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	40	mA	
		$V_{CC} = \text{MIN to MAX}$ , $V_O = -1 \text{ V to } 1 \text{ V}$ , $T_A = 25^\circ\text{C}$				24	28		32
		$V_{CC\pm} = \text{MIN}$ , $V_O = -3 \text{ V}$	6.5	12		15	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	$V_{CC\pm} = \text{MAX}$ , $V_I = 5.5 \text{ V}$			1			1
		D input							
$I_{IH}$	High-level input current	A, B, or C inputs	$V_{CC\pm} = \text{MAX}$ , $V_I = 2.4 \text{ V}$			40			40
		D input							
$I_{IL}$	Low-level input current	A, B, or C inputs	$V_{CC\pm} = \text{MAX}$ , $V_I = 0.4 \text{ V}$			-3			-3
		D input							
$I_{CC+(\text{on})}$	Supply current from $V_{CC}$ with driver enabled	$V_{CC\pm} = \text{MAX}$ , A and B inputs at 0.4 V, C and D inputs at 2 V	23	35		25	40	mA	
$I_{CC-(\text{on})}$	Supply current from $V_{CC-}$ with driver enabled	$V_{CC\pm} = \text{MAX}$ , A and B inputs at 0.4 V, C and D inputs at 2 V	-34	-50		-65	-100	mA	
$I_{CC+(\text{off})}$	Supply current from $V_{CC-}$ with driver inhibited	$V_{CC\pm} = \text{MAX}$ , 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	$V_{CC\pm} = \text{MAX}$ , 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, $V_{CC\pm} = \pm 5 \text{ V}$ , $T_A = 25^\circ\text{C}$ (see Figure 1)

PARAMETERS§	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS		MIN	TYP	MAX	UNIT
$t_{PLH}$	A or B	Y or Z	$C_L = 40 \text{ pF}$ , $R_L = 50 \Omega$ ,		9	15	ns	
$t_{PHL}$								
$t_{PLH}$	C or D	Y or Z	$C_L = 40 \text{ pF}$ , $R_L = 50 \Omega$ ,		16	25	ns	
$t_{PHL}$								

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

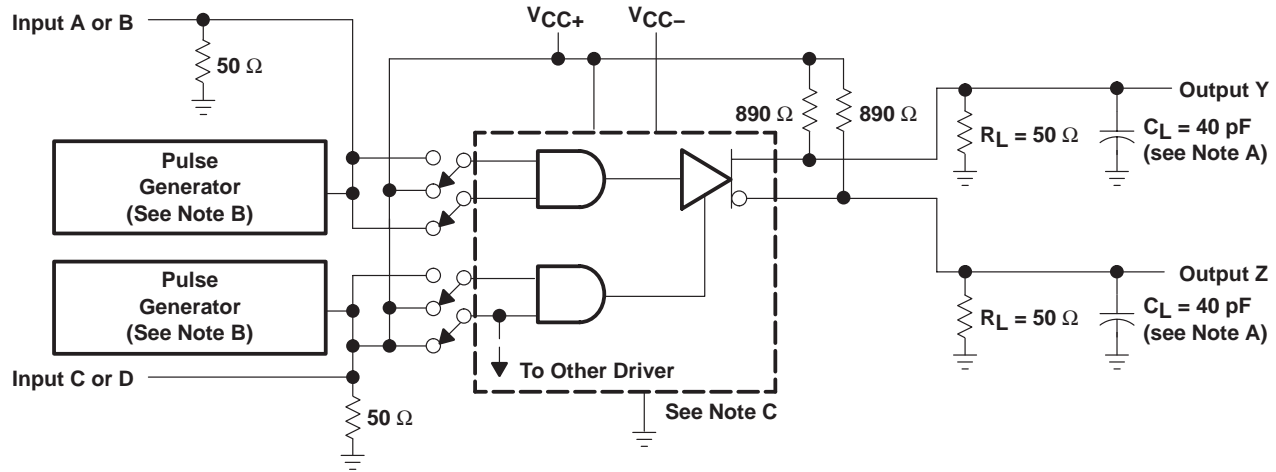
$t_{PHL}$  = propagation delay time, high- to low-level output



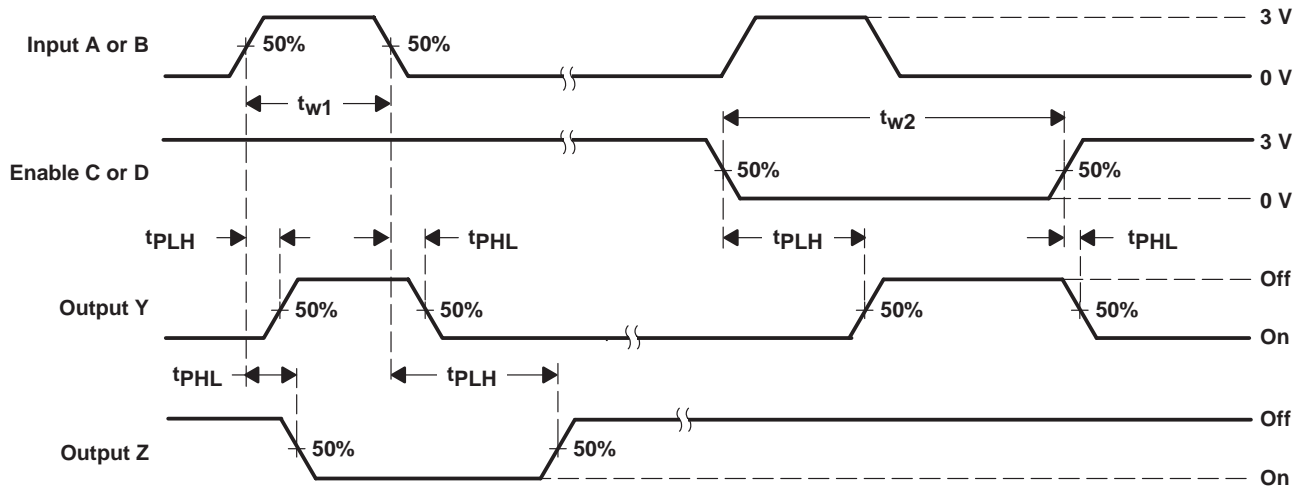
# SN55110A, SN75110A, SN75112 DUAL LINE DRIVERS

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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

SN55110A, SN75110A  
ON-STATE OUTPUT CURRENT  
vs  
NEGATIVE SUPPLY VOLTAGE

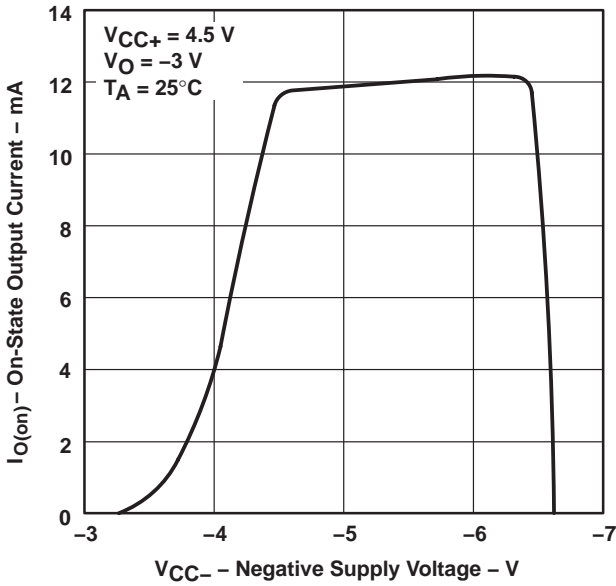


Figure 2

SN75112  
ON-STATE OUTPUT CURRENT  
vs  
NEGATIVE SUPPLY VOLTAGE

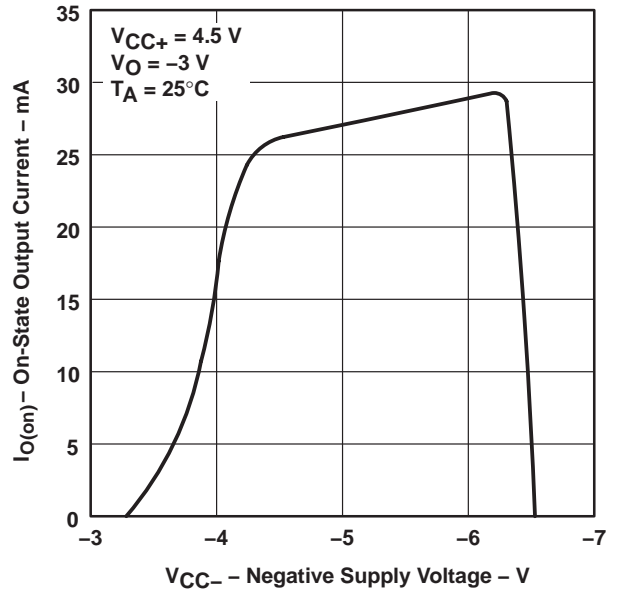


Figure 3

# SN55110A, SN75110A, SN75112 DUAL LINE DRIVERS

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## 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.

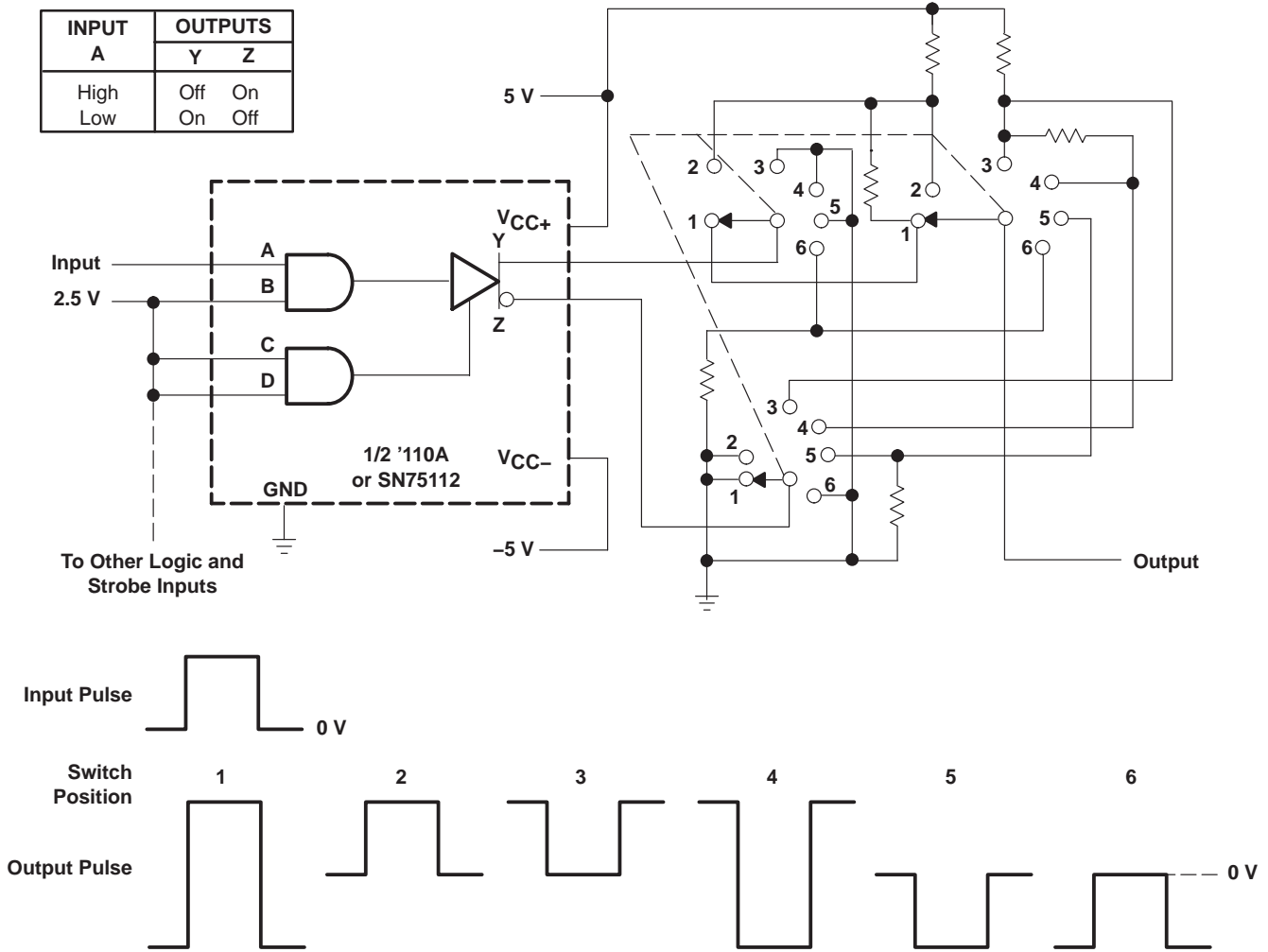


Figure 4. Pulse-Control Circuit



APPLICATION INFORMATION

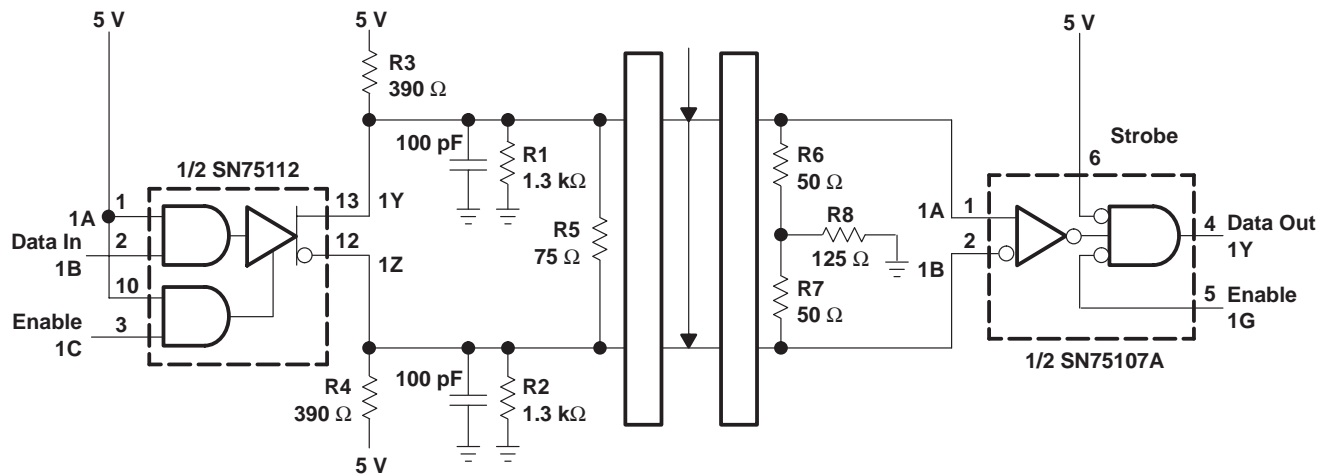
using the SN75112 as a CCITT-recommended V.35 line driver

The SN75112 dual line driver, the SN75107A dual line receiver, and some external resistors can be used to implement the data-interchange circuit of CCITT recommendation V.35 (1976) modem specification. The circuit of one channel is shown in Figure 5 and meets the requirement of the interface as specified by Appendix 11 of CCITT V.35 and is summarized in Table 1 (V.35 has been replaced by ITU V.11).

Table 1. CCITT V.35 Electrical Requirements

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

$\dagger ui$  = unit interval or minimum signal-element pulse duration



All resistors are 5%, 1/4 W.

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

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
5962-87547012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
5962-8754701CA	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
5962-8754701DA	ACTIVE	CFP	W	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN55110AJ	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SN75110AD	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75110ADE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75110ADG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75110ADR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75110ADRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75110ADRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75110AJ	OBSOLETE	CDIP	J	14		TBD	Call TI	Call TI
SN75110AN	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN75110ANE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN75110ANSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75110ANSRE4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75110ANSRG4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75112D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75112DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75112DG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75112DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75112DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75112DRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN75112N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN75112NE4	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SNJ55110AFK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ55110AJ	ACTIVE	CDIP	J	14	1	TBD	A42 SNPB	N / A for Pkg Type
SNJ55110AW	ACTIVE	CFP	W	14	1	TBD	A42 SNPB	N / A for Pkg Type

<sup>(1)</sup> The marketing status values are defined as follows:

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**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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**TAPE AND REEL INFORMATION**



**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN75110ADR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN75110ANSR	SO	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
SN75112DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN75110ADR	SOIC	D	14	2500	346.0	346.0	33.0
SN75110ANSR	SO	NS	14	2000	346.0	346.0	33.0
SN75112DR	SOIC	D	14	2500	346.0	346.0	33.0

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a metal lid.
  - D. The terminals are gold plated.
  - E. Falls within JEDEC MS-004

## MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

J (R-GDIP-T\*\*)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.



W (R-GDFP-F14)

CERAMIC DUAL FLATPACK





- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only.
  - E. Falls within MIL STD 1835 GDFP1-F14 and JEDEC MO-092AB

D (R-PDSO-G14)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  -  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
  -  Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
  - E. Reference JEDEC MS-012 variation AB.

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - $\triangle C$  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - $\triangle D$  The 20 pin end lead shoulder width is a vendor option, either half or full width.

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