

# SN55451B, SN55452B, SN55453B, SN55454B SN75451B, SN75452B, SN75453B, SN75454B DUAL PERIPHERAL DRIVERS

SLRS021B – DECEMBER 1976 – REVISED SEPTEMBER 1999

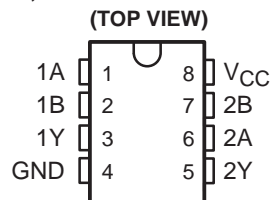
## PERIPHERAL DRIVERS FOR HIGH-CURRENT SWITCHING AT VERY HIGH SPEEDS

- Characterized for Use to 300 mA
- High-Voltage Outputs
- No Output Latch-Up at 20 V (After Conducting 300 mA)
- High-Speed Switching
- Circuit Flexibility for Varied Applications
- TTL-Compatible Diode-Clamped Inputs
- Standard Supply Voltages
- Plastic DIP (P) With Copper Lead Frame Provides Cooler Operation and Improved Reliability
- Package Options Include Plastic Small-Outline Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs

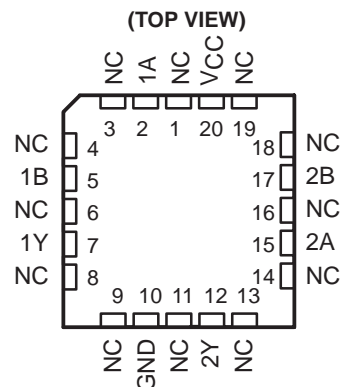
SUMMARY OF DEVICES

DEVICE	LOGIC OF COMPLETE CIRCUIT	PACKAGES
SN55451B	AND	FK, JG
SN55452B	NAND	JG
SN55453B	OR	FK, JG
SN55454B	NOR	JG
SN75451B	AND	D, P
SN75452B	NAND	D, P
SN75453B	OR	D, P
SN75454B	NOR	D, P

SN55451B, SN55452B,  
SN55453B, SN55454B . . . JG PACKAGE  
SN75451B, SN75452B,  
SN75453B, SN75454B . . . D OR P PACKAGE



SN55451B, SN55452B  
SN55453B, SN55454B . . . FK PACKAGE



NC – No internal connection

## description

The SN55451B through SN55454B and SN75451B through SN75454B are dual peripheral drivers designed for use in systems that employ TTL logic. This family is functionally interchangeable with and replaces the SN75450 family and the SN75450A family devices manufactured previously. The speed of the devices is equal to that of the SN75450 family, and the parts are designed to ensure freedom from latch-up. Diode-clamped inputs simplify circuit design. Typical applications include high-speed logic buffers, power drivers, relay drivers, lamp drivers, MOS drivers, line drivers, and memory drivers.

The SN55451B/SN75451B, SN55452B/SN75452B, SN55453B/SN75453B, and SN55454B/SN75454B are dual peripheral AND, NAND, OR, and NOR drivers, respectively (assuming positive logic), with the output of the logic gates internally connected to the bases of the npn output transistors.

The SN55' drivers are characterized for operation over the full military range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN75' drivers are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

**SN55451B, SN55452B, SN55453B, SN55454B  
SN75451B, SN75452B, SN75453B, SN75454B  
DUAL PERIPHERAL DRIVERS**

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**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)**

	SN55'	SN75'	UNIT
Supply voltage, $V_{CC}$ (see Note 1)	7	7	V
Input voltage, $V_I$	5.5	5.5	V
Inter-emitter voltage (see Note 2)	5.5	5.5	V
Off-state output voltage, $V_O$	30	30	V
Continuous collector or output current, $I_{OK}$ (see Note 3)	400	400	mA
Peak collector or output current, $I_I$ ( $t_W \leq 10$ ms, duty cycle $\leq 50\%$ , see Note 4)	500	500	mA
Continuous total power dissipation	See Dissipation Rating Table		
Operating free-air temperature range, $T_A$	-55 to 125	0 to 70	°C
Storage temperature range, $T_{stg}$	-65 to 150	-65 to 150	°C
Case temperature for 60 seconds	FK package	260	°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds	JG package	300	°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	D or P package		260 °C

- NOTES: 1. Voltage values are with respect to network GND, unless otherwise specified.  
 2. This is the voltage between two emitters of a multiple-emitter transistor.  
 3. This value applies when the base-emitter resistance ( $R_{BE}$ ) is equal to or less than 500  $\Omega$ .  
 4. Both halves of these dual circuits may conduct rated current simultaneously; however, power dissipation averaged over a short time interval must fall within the continuous dissipation rating.

**DISSIPATION RATING TABLE**

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ POWER RATING
D	725 mW	5.8 mW/°C	464 mW	—
FK	1375 mW	11.0 mW/°C	880 mW	275 mW
JG	1050 mW	8.4 mW/°C	672 mW	210 mW
P	1000 mW	8.0 mW/°C	640 mW	—

**recommended operating conditions**

	SN55'			SN75'			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, $V_{CC}$	4.5	5	5.5	4.75	5	5.25	V
High-level input voltage, $V_{IH}$	2			2			V
Low-level input voltage, $V_{IL}$	0.8			0.8			V
Operating free-air temperature, $T_A$	-55 125			0 70			°C



# SN55451B, SN55452B, SN55453B, SN55454B SN75451B, SN75452B, SN75453B, SN75454B DUAL PERIPHERAL DRIVERS

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## logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC publication 617-12.

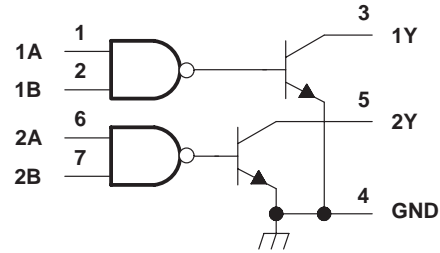
Pin numbers shown are for the D, JG, and P packages.

**FUNCTION TABLE**  
(each driver)

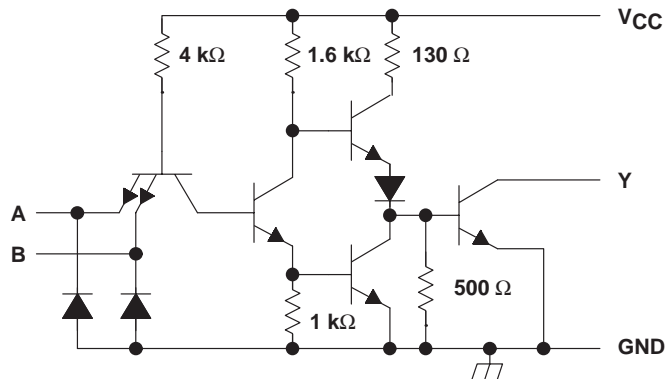
A	B	Y
L	L	L (on state)
L	H	L (on state)
H	L	L (on state)
H	H	H (off state)

positive logic:  
 $Y = AB$  or  $\overline{A+B}$

## logic diagram (positive logic)



## schematic (each driver)



Resistor values shown are nominal.

## electrical characteristics over recommended operating free-air temperature range

PARAMETER	TEST CONDITIONS‡	SN55451B			SN75451B			UNIT
		MIN	TYP§	MAX	MIN	TYP§	MAX	
$V_{IK}$ Input clamp voltage	$V_{CC} = \text{MIN}$ , $I_I = -12 \text{ mA}$	-1.2	-1.5		-1.2	-1.5		V
$V_{OL}$ Low-level output voltage	$V_{CC} = \text{MIN}$ , $V_{IL} = 0.8 \text{ V}$ , $I_{OL} = 100 \text{ mA}$	0.25	0.5		0.25	0.4		V
	$V_{CC} = \text{MIN}$ , $V_{IL} = 0.8 \text{ V}$ , $I_{OL} = 300 \text{ mA}$	0.5	0.8		0.5	0.7		
$I_{OH}$ High-level output current	$V_{CC} = \text{MIN}$ , $V_{IH} = \text{MIN}$ , $V_{OH} = 30 \text{ V}$			300			100	$\mu\text{A}$
$I_I$ Input current at maximum input voltage	$V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$			1			1	mA
$I_{IH}$ High-level input current	$V_{CC} = \text{MAX}$ , $V_I = 2.4 \text{ V}$			40			40	$\mu\text{A}$
$I_{IL}$ Low-level input current	$V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$	-1	-1.6		-1	-1.6		mA
$I_{CCH}$ Supply current, outputs high	$V_{CC} = \text{MAX}$ , $V_I = 5 \text{ V}$	7	11		7	11		mA
$I_{CCL}$ Supply current, outputs low	$V_{CC} = \text{MAX}$ , $V_I = 0$	52	65		52	65		mA

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

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

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ Propagation delay time, low-to-high-level output	$I_O \approx 200 \text{ mA}$ , $C_L = 15 \text{ pF}$ , $R_L = 50 \Omega$ , See Figure 1		18	25	ns
$t_{PHL}$ Propagation delay time, high-to-low-level output			18	25	
$t_{TLH}$ Transition time, low-to-high-level output			5	8	
$t_{THL}$ Transition time, high-to-low-level output			7	12	
$V_{OH}$ High-level output voltage after switching	SN55451B	$V_S - 6.5$			mV
	SN75451B	$V_S - 6.5$			

# SN55451B, SN55452B, SN55453B, SN55454B SN75451B, SN75452B, SN75453B, SN75454B DUAL PERIPHERAL DRIVERS

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## logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC publication 617-12.

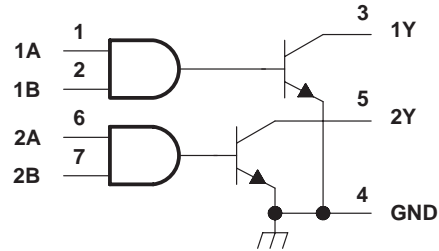
Pin numbers shown are for the D, JG, and P packages.

**FUNCTION TABLE**  
(each driver)

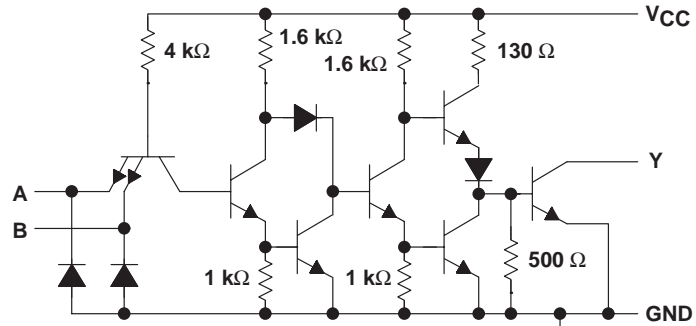
A	B	Y
L	L	H (off state)
L	H	H (off state)
H	L	H (off state)
H	H	L (on state)

positive logic:  
 $Y = \overline{AB}$  or  $\overline{A+B}$

## logic diagram (positive logic)



## schematic (each driver)



Resistor values shown are nominal.

## electrical characteristics over recommended operating free-air temperature range

PARAMETER	TEST CONDITIONS‡	SN55452B			SN75452B			UNIT
		MIN	TYP§	MAX	MIN	TYP§	MAX	
$V_{IK}$ Input clamp voltage	$V_{CC} = \text{MIN}$ , $I_I = -12 \text{ mA}$	-1.2	-1.5		-1.2	-1.5		V
$V_{OL}$ Low-level output voltage	$V_{CC} = \text{MIN}$ , $V_{IH} = \text{MIN}$ , $I_{OL} = 100 \text{ mA}$		0.25	0.5		0.25	0.4	V
	$V_{CC} = \text{MIN}$ , $V_{IH} = \text{MIN}$ , $I_{OL} = 300 \text{ mA}$		0.5	0.8		0.5	0.7	
$I_{OH}$ High-level output current	$V_{CC} = \text{MIN}$ , $V_{IL} = 0.8 \text{ V}$ , $V_{OH} = 30 \text{ V}$			300			100	$\mu\text{A}$
$I_I$ Input current at maximum input voltage	$V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$			1			1	mA
$I_{IH}$ High-level input current	$V_{CC} = \text{MAX}$ , $V_I = 2.4 \text{ V}$			40			40	$\mu\text{A}$
$I_{IL}$ Low-level input current	$V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$			-1.1			-1.1	mA
$I_{CCH}$ Supply current, outputs high	$V_{CC} = \text{MAX}$ , $V_I = 0$			11			11	mA
$I_{CCL}$ Supply current, outputs low	$V_{CC} = \text{MAX}$ , $V_I = 5 \text{ V}$			56			56	mA

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

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

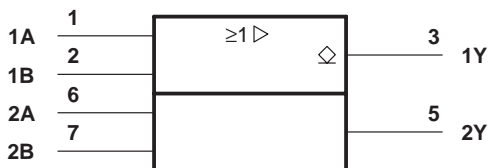
## switching characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ Propagation delay time, low-to-high-level output	$I_O \approx 200 \text{ mA}$ , $C_L = 15 \text{ pF}$ , $R_L = 50 \Omega$ , See Figure 1		26	35	ns
$t_{PHL}$ Propagation delay time, high-to-low-level output			24	35	
$t_{TLH}$ Transition time, low-to-high-level output			5	8	
$t_{THL}$ Transition time, high-to-low-level output			7	12	
$V_{OH}$ High-level output voltage after switching	SN55452B	$V_S - 6.5$			mV
	SN75452B	$V_S - 6.5$			

# SN55451B, SN55452B, SN55453B, SN55454B SN75451B, SN75452B, SN75453B, SN75454B DUAL PERIPHERAL DRIVERS

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## logic symbol†

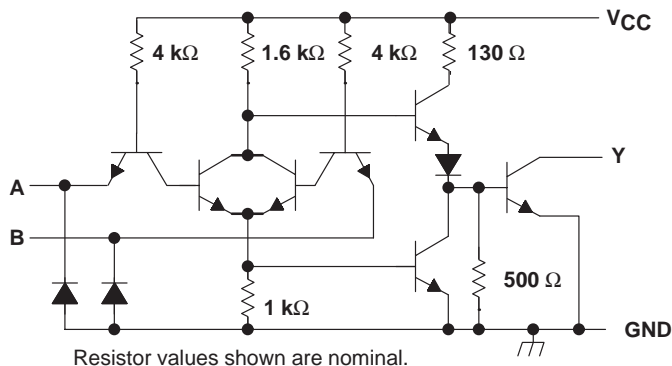


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC publication 617-12. Pin numbers shown are for the D, JG, and P packages.

## logic diagram (positive logic)



## schematic (each driver)



FUNCTION TABLE  
(each driver)

A	B	Y
L	L	L (on state)
L	H	H (off state)
H	L	H (off state)
H	H	H (off state)

positive logic:  
 $Y = A+B$  or  $\overline{A}\overline{B}$

## electrical characteristics over recommended operating free-air temperature range

PARAMETER	TEST CONDITIONS‡	SN55453B		SN75453B		UNIT	
		MIN	TYP§	MAX	MIN		TYP§
$V_{IK}$ Input clamp voltage	$V_{CC} = \text{MIN}$ , $I_I = -12 \text{ mA}$	-1.2		-1.5	-1.2		V
$V_{OL}$ Low-level output voltage	$V_{CC} = \text{MIN}$ , $V_{IL} = 0.8 \text{ V}$ , $I_{OL} = 100 \text{ mA}$	0.25		0.5	0.25		V
	$V_{CC} = \text{MIN}$ , $V_{IL} = 0.8 \text{ V}$ , $I_{OL} = 300 \text{ mA}$	0.5		0.8	0.5		
$I_{OH}$ High-level output current	$V_{CC} = \text{MIN}$ , $V_{IH} = \text{MIN}$ , $V_{OH} = 30 \text{ V}$			300		100	$\mu\text{A}$
$I_I$ Input current at maximum input voltage	$V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$			1		1	mA
$I_{IH}$ High-level input current	$V_{CC} = \text{MAX}$ , $V_I = 2.4 \text{ V}$			40		40	$\mu\text{A}$
$I_{IL}$ Low-level input current	$V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$	-1		-1.6	-1	-1.6	mA
$I_{CCH}$ Supply current, outputs high	$V_{CC} = \text{MAX}$ , $V_I = 5 \text{ V}$	8		11	8	11	mA
$I_{CCL}$ Supply current, outputs low	$V_{CC} = \text{MAX}$ , $V_I = 0$	54		68	54	68	mA

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

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

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$ Propagation delay time, low-to-high-level output	$I_O \approx 200 \text{ mA}$ , $C_L = 15 \text{ pF}$ , $R_L = 50 \Omega$ , See Figure 1		18	25	ns
$t_{PHL}$ Propagation delay time, high-to-low-level output			18	25	
$t_{TLH}$ Transition time, low-to-high-level output			5	8	
$t_{THL}$ Transition time, high-to-low-level output			7	12	
$V_{OH}$ High-level output voltage after switching	SN55453B	$V_S - 6.5$			mV
	SN75453B	$V_S - 6.5$			

# SN55451B, SN55452B, SN55453B, SN55454B SN75451B, SN75452B, SN75453B, SN75454B DUAL PERIPHERAL DRIVERS

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## logic symbol†



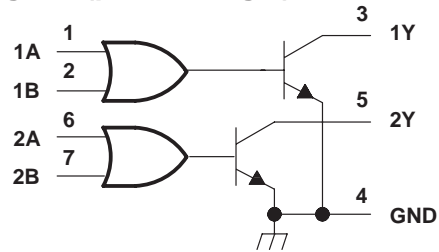
† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC publication 617-12. Pin numbers shown are for the D, JG, and P packages.

**FUNCTION TABLE**  
(each driver)

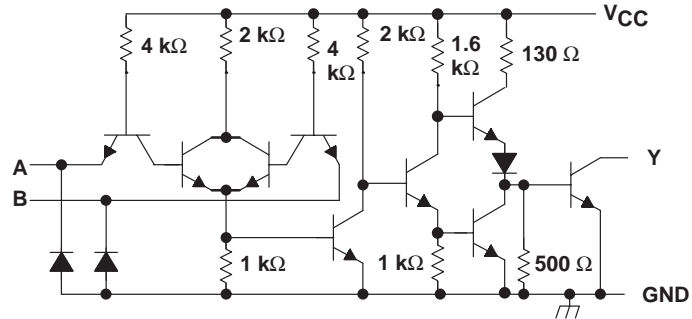
A	B	Y
L	L	H (off state)
L	H	L (on state)
H	L	L (on state)
H	H	L (on state)

positive logic:  
 $Y = A+B$  or  $\overline{AB}$

## logic diagram (positive logic)



## schematic (each driver)



Resistor values shown are nominal.

## electrical characteristics over recommended operating free-air temperature range

PARAMETER	TEST CONDITIONS‡	SN55454B			SN75454B			UNIT
		MIN	TYP§	MAX	MIN	TYP§	MAX	
$V_{IK}$ Input clamp voltage	$V_{CC} = \text{MIN}$ , $I_I = -12 \text{ mA}$	-1.2	-1.5		-1.2	-1.5		V
$V_{OL}$ Low-level output voltage	$V_{CC} = \text{MIN}$ , $V_{IH} = \text{MIN}$ , $I_{OL} = 100 \text{ mA}$	0.25	0.5		0.25	0.4		V
	$V_{CC} = \text{MIN}$ , $V_{IH} = \text{MIN}$ , $I_{OL} = 300 \text{ mA}$	0.5	0.8		0.5	0.7		
$I_{OH}$ High-level output current	$V_{CC} = \text{MIN}$ , $V_{OH} = 30 \text{ V}$ , $V_{IL} = 0.8 \text{ V}$			300			100	$\mu\text{A}$
$I_I$ Input current at maximum input voltage	$V_{CC} = \text{MAX}$ , $V_I = 5.5 \text{ V}$			1			1	mA
$I_{IH}$ High-level input current	$V_{CC} = \text{MAX}$ , $V_I = 2.4 \text{ V}$			40			40	$\mu\text{A}$
$I_{IL}$ Low-level input current	$V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$	-1	-1.6		-1	-1.6		mA
$I_{CCH}$ Supply current, outputs high	$V_{CC} = \text{MAX}$ , $V_I = 0$	13	17		13	17		mA
$I_{CCL}$ Supply current, outputs low	$V_{CC} = \text{MAX}$ , $V_I = 5 \text{ V}$	61	79		61	79		mA

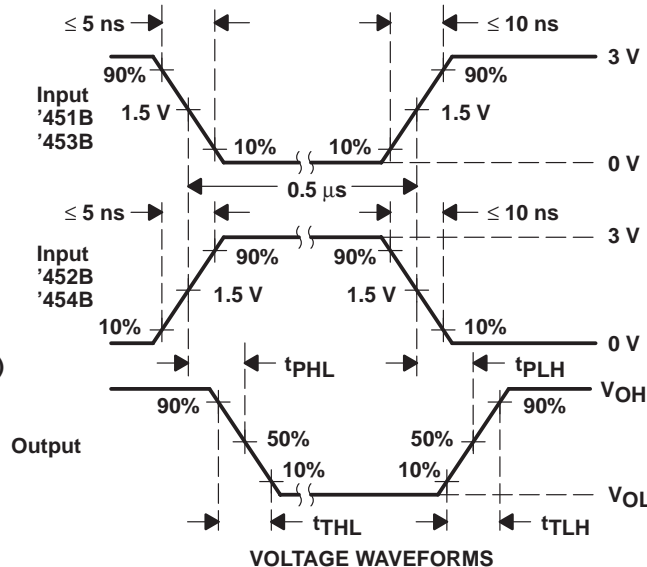
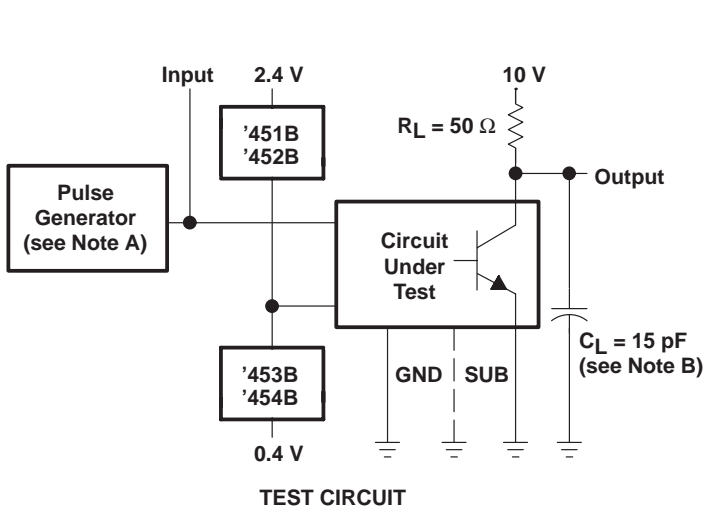
‡ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

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

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

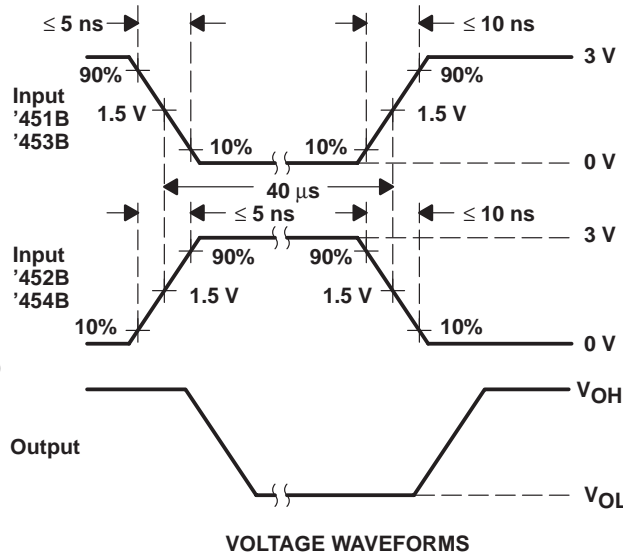
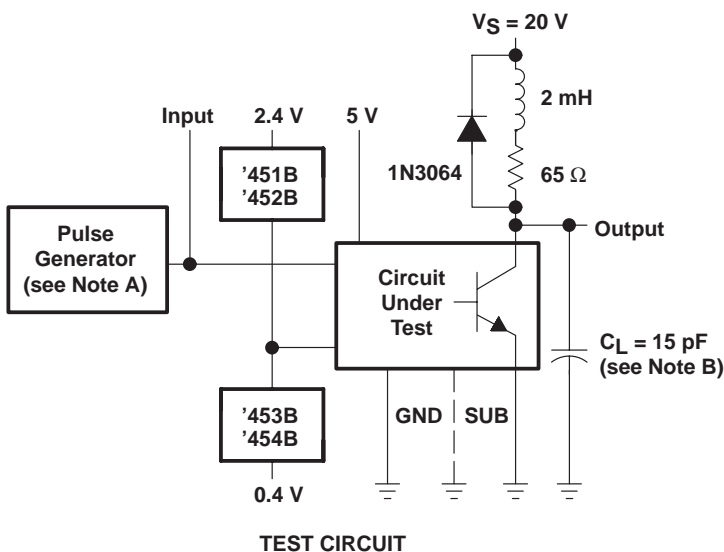
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
$t_{PLH}$ Propagation delay time, low-to-high-level output	$I_O \approx 200 \text{ mA}$ , $C_L = 15 \text{ pF}$ , $R_L = 50 \Omega$ , See Figure 1		27	35	ns	
$t_{PHL}$ Propagation delay time, high-to-low-level output			24	35		
$t_{TLH}$ Transition time, low-to-high-level output			5	8		
$t_{THL}$ Transition time, high-to-low-level output			7	12		
$V_{OH}$ High-level output voltage after switching	SN55454B	$V_S = 20 \text{ V}$ , $I_O \approx 300 \text{ mA}$ , See Figure 2			$V_S - 6.5$	mV
	SN75454B				$V_S - 6.5$	

PARAMETER MEASUREMENT INFORMATION



NOTES: A. The pulse generator has the following characteristics: PRR ≤ 1 MHz,  $Z_O = 50 \Omega$ .  
 B.  $C_L$  includes probe and jig capacitance.

Figure 1. Test Circuit and Voltage Waveforms, Complete Drivers

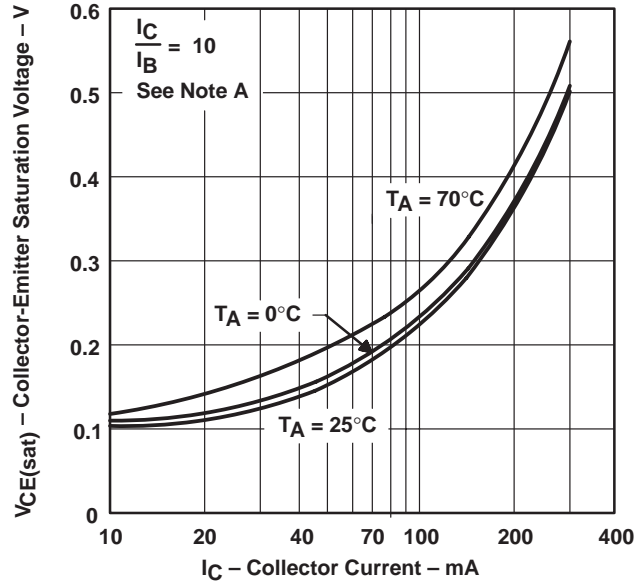


NOTES: A. The pulse generator has the following characteristics: PRR ≤ 12.5 kHz,  $Z_O = 50 \Omega$ .  
 B.  $C_L$  includes probe and jig capacitance.

Figure 2. Test Circuit and Voltage Waveforms for Latch-Up Test of Complete Drivers

TYPICAL CHARACTERISTICS

TRANSISTOR  
COLLECTOR-EMITTER SATURATION VOLTAGE  
vs  
COLLECTOR CURRENT



NOTE A: These parameters must be measured using pulse techniques,  $t_w = 300 \mu\text{s}$ , duty cycle  $\leq 2\%$ .

Figure 3



## IMPORTANT NOTICE

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## SN55453B, Dual Very-High Speed, High-Current Peripheral Drivers

DEVICE STATUS: **ACTIVE**

PARAMETER NAME	SN55453B	SN75453B
Output Voltage (max) (V)	30	30
Switching Voltage (max) (V)	20	20
Peak Output Current (mA)	500	500
Drivers Per Package	2	2
Output Clamp Diodes	No	No
Input Compatibility	TTL	TTL
Delay Time (typ) (ns)	18	18

### FEATURES

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#### PERIPHERAL DRIVERS FOR HIGH-CURRENT SWITCHING AT VERY HIGH SPEEDS

- Characterized for Use to 300 mA
- High-Voltage Outputs
- No Output Latch-Up at 20 V (After Conducting 300 mA)
- High-Speed Switching
- Circuit Flexibility for Varied Applications
- TTL-Compatible Diode-Clamped Inputs
- Standard Supply Voltages
- Plastic DIP (P) With Copper Lead Frame Provides Cooler Operation and Improved Reliability
- Package Options Include Plastic Small-Outline Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs

### DESCRIPTION

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The SN55451B through SN55454B and SN75451B through SN75454B are dual peripheral drivers designed for use in systems that employ TTL logic. This family is functionally interchangeable with and replaces the SN75450 family and the SN75450A family devices manufactured previously. The speed of the devices is equal to that of the SN75450 family, and the parts are designed to ensure freedom from latch-up. Diode-clamped inputs simplify circuit design. Typical applications include high-speed logic buffers, power drivers, relay drivers, lamp drivers, MOS drivers, line drivers, and memory drivers.

The SN55451B/SN75451B, SN55452B/SN75452B, SN55453B/SN75453B, and SN55454B/SN75454B are dual peripheral AND, NAND, OR, and NOR drivers, respectively (assuming positive logic), with the output of the logic gates internally connected to the bases of the npn output transistors.

The SN55' drivers are characterized for operation over the full military range of -55°C to 125°C. The SN75' drivers are characterized for operation from 0°C to 70°C.

### TECHNICAL DOCUMENTS

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To view the following documents, [Acrobat Reader 4.0](#) is required.

To download a document to your hard drive, right-click on the link and choose 'Save'.

### DATASHEET

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Full datasheet in Acrobat PDF: [sn55453b.pdf](#) (150 KB, Rev.B) (Updated: 09/03/1999)

### APPLICATION NOTES

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- [Analog Applications Journal \(Rev. A\)](#) (SLYT010A - Updated: 03/17/2000)

**MORE LITERATURE**

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- [Enhanced Plastic Portfolio Brochure](#) (SGZB004, 387 KB - Updated: 08/19/2002)
- [QML Class V Space Products Military Brief \(Rev. A\)](#) (SGZN001A, 257 KB - Updated: 10/07/2002)

**PRICING/AVAILABILITY/PKG**

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DEVICE INFORMATION Updated Daily							
ORDERABLE DEVICE	STATUS	PACKAGE TYPE   PINS	TEMP (°C)	DSCC NUMBER	PRODUCT CONTENT	BUDGETARY PRICING QTY   SUS	STD PACK QTY
5962-9563301Q2A	ACTIVE	<a href="#">LCCC (FK)</a>   20	-55 TO 125		<a href="#">View Contents</a>	1KU   11.21	1
5962-9563301QPA	ACTIVE	<a href="#">CDIP (JG)</a>   8	-55 TO 125		<a href="#">View Contents</a>	1KU   5.76	1
SN55453BJG	ACTIVE	<a href="#">CDIP (JG)</a>   8	-55 TO 125		<a href="#">View Contents</a>	1KU   1.60	1
SNJ55453BFK	ACTIVE	<a href="#">LCCC (FK)</a>   20	-55 TO 125	5962-9563301Q2A	<a href="#">View Contents</a>	1KU   11.21	1
SNJ55453BJG	ACTIVE	<a href="#">CDIP (JG)</a>   8	-55 TO 125	5962-9563301QPA	<a href="#">View Contents</a>	1KU   5.76	1

TI INVENTORY STATUS As Of 09:00 AM GMT, 17 Apr 2003		
IN STOCK	IN PROGRESS QTY   DATE	LEAD TIME
<a href="#">199*</a>	3513   20 May	7 WKS
	> 10k   27 May	
<a href="#">517*</a>	> 10k   20 May	7 WKS
<a href="#">0*</a>	233   05 May	7 WKS
	> 10k   20 May	
<a href="#">130*</a>	3580   20 May	7 WKS
	> 10k   27 May	
<a href="#">72*</a>	> 10k   20 May	7 WKS

REPORTED DISTRIBUTOR INVENTORY As Of 09:00 AM GMT, 17 Apr 2003		
DISTRIBUTOR COMPANY   REGION	IN STOCK	PURCHASE
None Reported <a href="#">View Distributors</a>		
None Reported <a href="#">View Distributors</a>		
<a href="#">Avnet</a>   Americas	421	<a href="#">BUY NOW</a>
<a href="#">EBV Elektronik</a>   Europe	100	<a href="#">BUY NOW</a>
<a href="#">Avnet-SILICA</a>   Europe	62	<a href="#">BUY NOW</a>
<a href="#">EBV Elektronik</a>   Europe	8	<a href="#">BUY NOW</a>
None Reported <a href="#">View Distributors</a>		

Table Data Updated on: 4/17/2003