

# SN74SSTL16837A 20-BIT SSTL\_3 INTERFACE UNIVERSAL BUS DRIVER WITH 3-STATE OUTPUTS

SCBS675G – SEPTEMBER 1996 – REVISED SEPTEMBER 1998

- Member of the Texas Instruments *Widebus™* Family
- Supports SSTL\_3 Signal Inputs and Outputs
- Flow-Through Architecture Optimizes PCB Layout
- Meets SSTL\_3 Class I and Class II Specifications
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- Packaged in Plastic Thin Shrink Small-Outline Package

## description

This 20-bit universal bus driver is designed for 3-V to 3.6-V  $V_{CC}$  operation and SSTL\_3 or LVTTTL I/O levels.

Data flow from A to Y is controlled by the output-enable ( $\overline{OE}$ ) input. The device operates in the transparent mode when latch enable (LE) is high. The A data is latched if LE is low and clock (CLK) is held at a high or low logic level. If LE is low, the A data is stored in the latch/flip-flop on the low-to-high transition of CLK. When  $\overline{OE}$  is high, the outputs are in the high-impedance state.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

The SN74SSTL16837A is characterized for operation from 0°C to 70°C.

## DGG PACKAGE (TOP VIEW)

Y1	1	64	A1
Y2	2	63	A2
GND	3	62	GND
Y3	4	61	A3
Y4	5	60	A4
$V_{DDQ}$	6	59	$V_{CC}$
Y5	7	58	A5
Y6	8	57	A6
GND	9	56	GND
Y7	10	55	A7
Y8	11	54	A8
$V_{DDQ}$	12	53	$V_{CC}$
Y9	13	52	A9
Y10	14	51	A10
GND	15	50	GND
$\overline{OE}$	16	49	CLK
$V_{REF}$	17	48	LE
GND	18	47	GND
Y11	19	46	A11
Y12	20	45	A12
$V_{DDQ}$	21	44	$V_{CC}$
Y13	22	43	A13
Y14	23	42	A14
GND	24	41	GND
Y15	25	40	A15
Y16	26	39	A16
$V_{DDQ}$	27	38	$V_{CC}$
Y17	28	37	A17
Y18	29	36	A18
GND	30	35	GND
Y19	31	34	A19
Y20	32	33	A20



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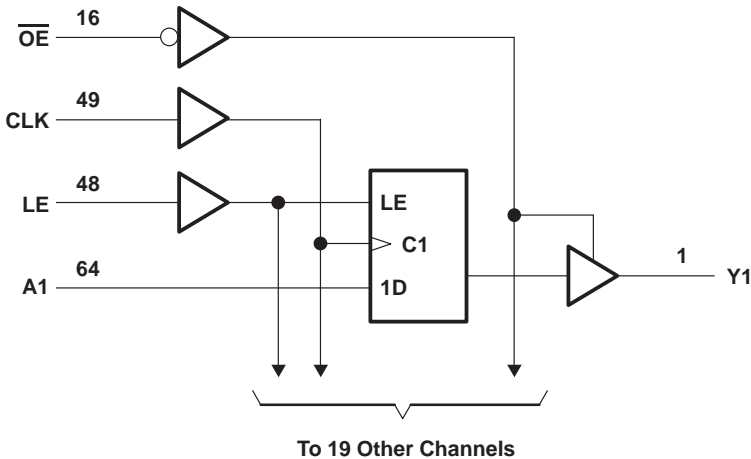
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FUNCTION TABLE				
INPUTS				OUTPUT Y
$\overline{OE}$	LE	CLK	A	
L	H	X	H	H
L	H	X	L	L
L	L	$\uparrow$	H	H
L	L	$\uparrow$	L	L
L	L	H	X	$Y_0^\dagger$
L	L	L	X	$Y_0^\ddagger$
H	X	X	X	Z

$^\dagger$  Output level before the indicated steady-state input conditions were established, provided that CLK was high before LE went low

$^\ddagger$  Output level before the indicated steady-state input conditions were established

logic diagram (positive logic)



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

Supply voltage range, $V_{CC}$ or $V_{DDQ}$	–0.5 V to 4.6 V
Input voltage range, $V_I$ (see Note 1)	–0.5 V to $V_{CC} + 0.5$ V
Output voltage range, $V_O$ (see Notes 1 and 2)	–0.5 V to $V_{DDQ} + 0.5$ V
Input clamp current, $I_{IK}$ ( $V_I < 0$ )	–50 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ )	–50 mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{DDQ}$ )	$\pm 50$ mA
Continuous current through each $V_{CC}$ , $V_{DDQ}$ , or GND	$\pm 100$ mA
Package thermal impedance, $\theta_{JA}$ (see Note 3)	73°C/W
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. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
  2. This current flows only when the output is in the high state and  $V_O > V_{DDQ}$ .
  3. The package thermal impedance is calculated in accordance with JESD 51.



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### recommended operating conditions (see Note 4)

		MIN	NOM	MAX	UNIT
V <sub>CC</sub>	Supply voltage	V <sub>DDQ</sub>		3.6	V
V <sub>DDQ</sub>	Output supply voltage	3		3.6	V
V <sub>REF</sub>	Reference voltage (V <sub>REF</sub> = 0.45 × V <sub>DDQ</sub> )	1.3	1.5	1.7	V
V <sub>TT</sub>	Termination voltage (V <sub>REF</sub> = V <sub>TT</sub> = 0.45 × V <sub>DDQ</sub> )	V <sub>REF</sub> –50mV	V <sub>REF</sub>	V <sub>REF</sub> +50mV	V
V <sub>I</sub>	Input voltage	0		V <sub>CC</sub>	V
V <sub>IH</sub>	AC high-level input voltage	All inputs		V <sub>REF</sub> +400mV	V
V <sub>IL</sub>	AC low-level input voltage	All inputs		V <sub>REF</sub> –400mV	V
V <sub>IH</sub>	DC high-level input voltage	All inputs		V <sub>REF</sub> +200mV	V
V <sub>IL</sub>	DC low-level input voltage	All inputs		V <sub>REF</sub> –200mV	V
I <sub>OH</sub>	High-level output current			–20	mA
I <sub>OL</sub>	Low-level output current			20	
T <sub>A</sub>	Operating free-air temperature	0		70	°C

NOTE 4: All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

PARAMETER		TEST CONDITIONS		V <sub>CC</sub>	MIN	TYP†	MAX	UNIT
V <sub>IK</sub>		I <sub>I</sub> = −18 mA		3 V			−1.2	V
V <sub>OH</sub>		I <sub>OH</sub> = −100 μA		3 V to 3.6 V	V <sub>CC</sub> −0.2			V
		I <sub>OH</sub> = −16 mA		3 V	2.2			
		I <sub>OH</sub> = −20 mA			2.1			
V <sub>OL</sub>		I <sub>OL</sub> = 100 μA		3 V to 3.6 V	0.2		V	
		I <sub>OL</sub> = 16 mA		3 V	0.5			
		I <sub>OL</sub> = 20 mA			0.55			
I <sub>I</sub>	LE	V <sub>I</sub> = 2.1 V or 0.9 V	V <sub>REF</sub> = 1.3 V or 1.7 V	3.6 V	±40		μA	
		V <sub>I</sub> = 3.6 V or 0			±1.2		mA	
	Data inputs, $\overline{\text{OE}}$	V <sub>I</sub> = 2.1 V or 0.9 V	V <sub>REF</sub> = 1.3 V or 1.7 V	3.6 V	±5		μA	
		V <sub>I</sub> = 3.6 V or 0			±5			
	CLK	V <sub>I</sub> = 2.1 V or 0.9 V	V <sub>REF</sub> = 1.3 V or 1.7 V	3.6 V	±150		mA	
		V <sub>I</sub> = 3.6 V or 0			±4			
	V <sub>REF</sub>		V <sub>REF</sub> = 1.3 V or 1.7 V		3.6 V	±150		μA
I <sub>OZ</sub>		V <sub>O</sub> = 0.9 V or 2.1 V		3.6 V	±10		μA	
		V <sub>O</sub> = 0 or 3.6 V			±10			
I <sub>CC</sub>		V <sub>I</sub> = 2.1 V or 0.9 V	I <sub>O</sub> = 0	3.6 V	90		mA	
		V <sub>I</sub> = 3.6 V or 0			90			
C <sub>i</sub>	Control inputs	V <sub>I</sub> = 2.1 V or 0.9 V		3.3 V	2.5		pF	
	A port				2			
C <sub>O</sub>	Y port	V <sub>O</sub> = 2.1 V or 0.9 V		3.3 V	3		pF	

† All typical values are at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C.



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timing requirements over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

				$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		UNIT
				MIN	MAX	
$f_{\text{clock}}$	Clock frequency			200		MHz
$t_w$	Pulse duration	LE high		2.5		ns
		CLK high or low		2.5		
$t_{\text{su}}$	Setup time	A before CLK $\uparrow$	LE low	1.5		ns
		A before LE $\downarrow$	CLK high	1.5		
			CLK low	2		
$t_h$	Hold time	A after CLK $\uparrow$	LE low	1		ns
		A after LE $\downarrow$		1		

switching characteristics over recommended operating free-air temperature range,  
Class I,  $V_{\text{REF}} = V_{\text{TT}} = V_{\text{DDQ}} \times 0.45$  and  $C_L = 10\text{ pF}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		UNIT
			MIN	MAX	
$f_{\text{max}}$			200		MHz
$t_{\text{pd}}$	A	Y	1.1	4	ns
	LE		1.5	4.1	
	CLK		1	3	
$t_{\text{en}}$	$\overline{\text{OE}}$	Y	1.8	5.5	ns
$t_{\text{dis}}$	$\overline{\text{OE}}$	Y	1.8	6	ns

switching characteristics over recommended operating free-air temperature range,  
Class II,  $V_{\text{REF}} = V_{\text{TT}} = V_{\text{DDQ}} \times 0.45$  and  $C_L = 30\text{ pF}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$		UNIT
			MIN	MAX	
$f_{\text{max}}$			200		MHz
$t_{\text{pd}}$	A	Y	1.1	4.2	ns
	LE		1.5	4.3	
	CLK		1	3.2	
$t_{\text{en}}$	$\overline{\text{OE}}$	Y	1.8	5.5	ns
$t_{\text{dis}}$	$\overline{\text{OE}}$	Y	1.8	6	ns

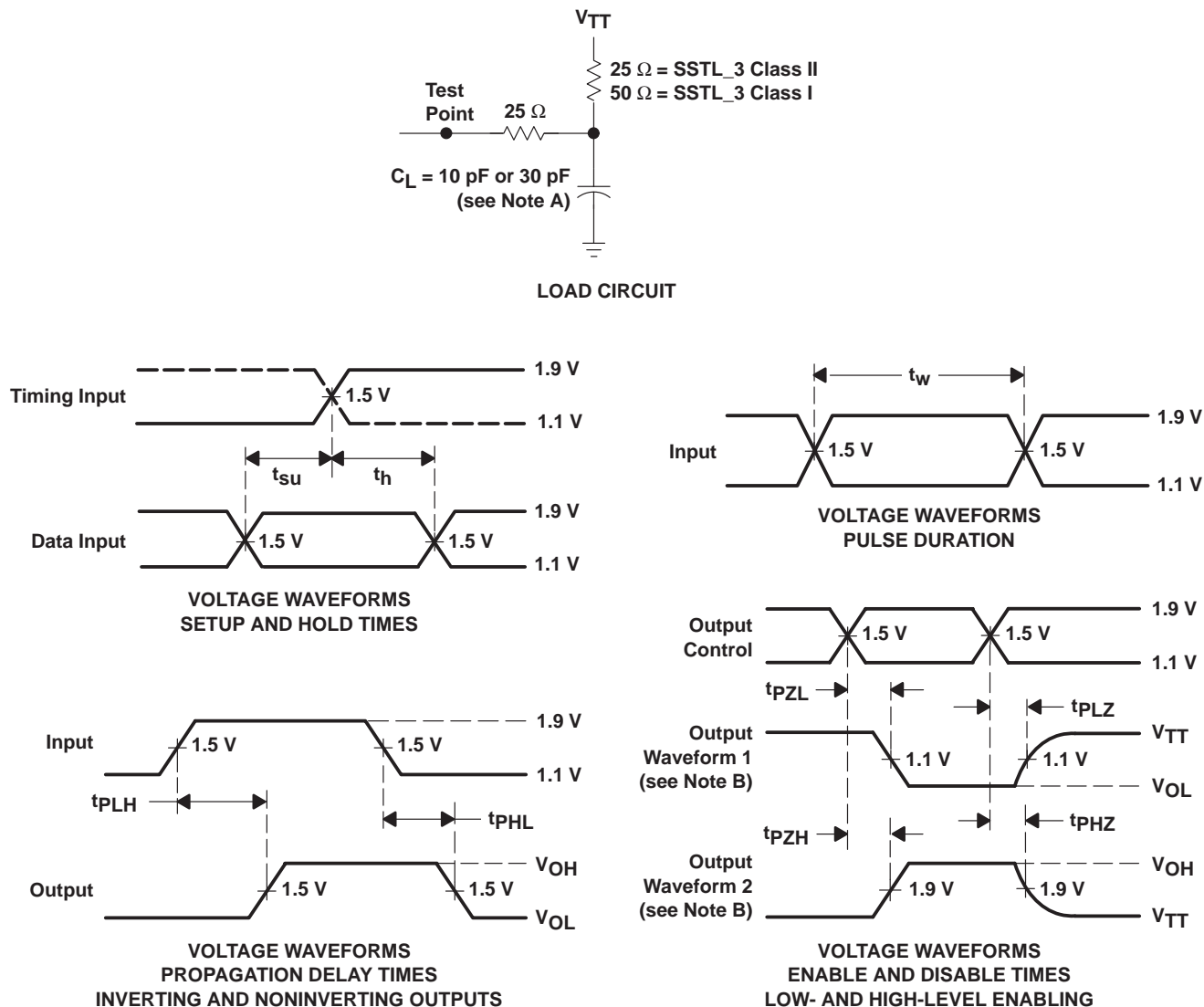
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#### PARAMETER MEASUREMENT INFORMATION



- NOTES:
- A.  $C_L$  includes probe and jig capacitance.
  - B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
  - C. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 1 \text{ ns}$ ,  $t_f \leq 1 \text{ ns}$ .
  - D. The outputs are measured one at a time with one transition per measurement.
  - E.  $V_{TT} = V_{REF} = V_{CC} \times 0.45$
  - F.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - G.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - H.  $t_{PHL}$  and  $t_{PLH}$  are the same as  $t_{pd}$ .

Figure 1. Load Circuit and Voltage Waveforms

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