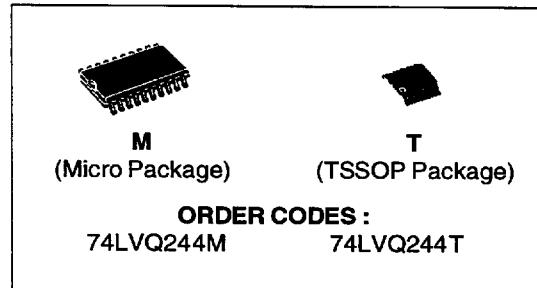


LOW VOLTAGE OCTAL BUS BUFFER
 WITH 3 STATE OUTPUTS (NON-INVERTED)

- HIGH SPEED:
 $t_{PD} = 6 \text{ ns (TYP.)}$ at $V_{CC} = 3.3V$
- INPUT & OUTPUT TTL COMPATIBLE LEVELS
- LOW POWER DISSIPATION:
 $I_{CC} = 4 \mu\text{A (MAX.)}$ at $T_A = 25^\circ\text{C}$
- LOW NOISE:
 $V_{OLP} = 0.4V (\text{TYP.})$ at $V_{CC} = 3.3V$
- 75Ω TRANSMISSION LINE OUTPUT DRIVE CAPABILITY
- SYMMETRICAL OUTPUT IMPEDANCE:
 $|I_{OHL}| = |I_{OL}| = 12 \text{ mA (MIN)}$
- PCI BUS LEVELS GUARANTEED AT 24mA
- BALANCED PROPAGATION DELAYS:
 $t_{PLH} \approx t_{PHL}$
- OPERATING VOLTAGE RANGE:
 $V_{CC} (\text{OPR}) = 2V \text{ to } 3.6V$ (1.2V Data Retention)
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 244
- IMPROVED LATCH-UP IMMUNITY

DESCRIPTION

The LVQ244 is a low voltage CMOS OCTAL BUS BUFFER fabricated with sub-micron silicon gate and double-layer metal wiring C²MOS

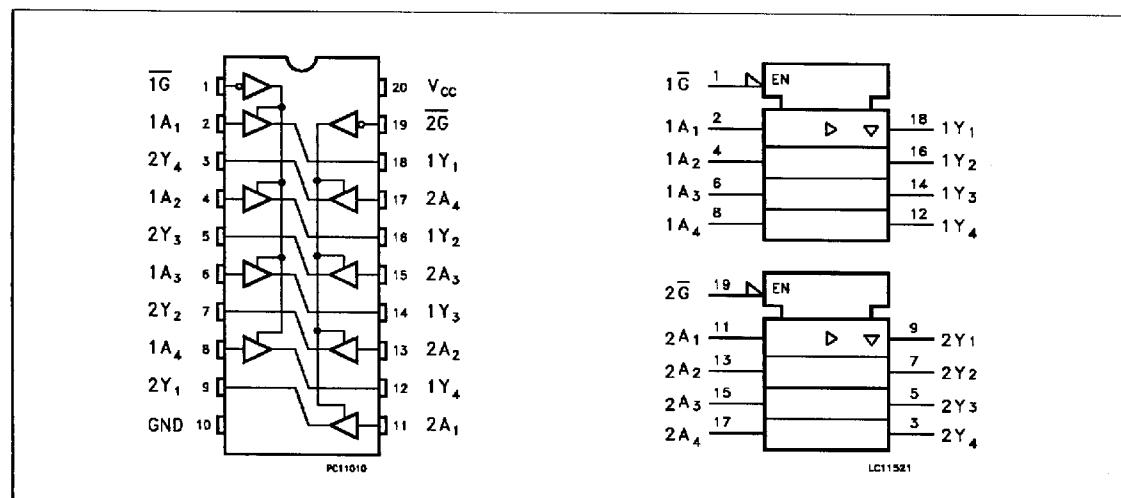


technology. It is ideal for low power and low noise 3.3V applications.

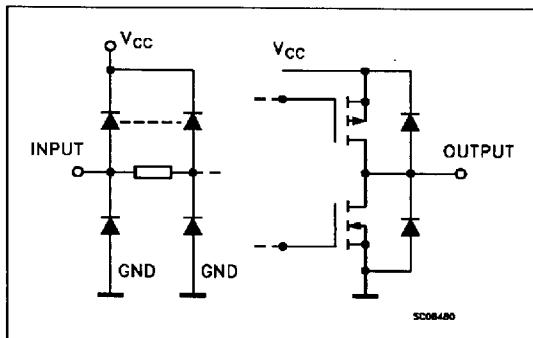
It has better speed performance at 3.3V than 5V LSTTL family combined with the true CMOS low power consumption.

G control output governs four BUS BUFFERS. This device is designed to be used with 3 state memory address drivers, etc.

All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

PIN CONNECTION AND IEC LOGIC SYMBOLS


INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
1	1G	Output Enable Input
2, 4, 6, 8	1A1 to 1A4	Data Inputs
9, 7, 5, 3	2Y1 to 2Y4	Data Outputs
11, 13, 15, 17	2A1 to 2A4	Data Inputs
18, 16, 14, 12	1Y1 to 1Y4	Data Outputs
19	2G	Output Enable Input
10	GND	Ground (0V)
20	V _{CC}	Positive Supply Voltage

TRUTH TABLE

INPUT		OUTPUT
\bar{G}	A_n	Y_n
L	L	L
L	H	H
H	X	Z

X: "H" or "L"
Z: High impedance

ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	-0.5 to +7	V
V_I	DC Input Voltage	-0.5 to V_{CC} + 0.5	V
V_O	DC Output Voltage	-0.5 to V_{CC} + 0.5	V
I_{IK}	DC Input Diode Current	± 20	mA
I_{OK}	DC Output Diode Current	± 20	mA
I_O	DC Output Current	± 50	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 400	mA
T_{STG}	Storage Temperature	-65 to +150	°C
T_L	Lead Temperature (10 sec)	300	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage (note 1)	2 to 3.6	V
V_I	Input Voltage	0 to V_{CC}	V
V_O	Output Voltage	0 to V_{CC}	V
T_{OP}	Operating Temperature:	-40 to +85	°C
dI/dV	Input Rise and Fall Time ($V_{CC} = 3V$) (note 2)	0 to 10	ns/V

1) Truth Table guaranteed: 1.2V to 3.6V

2) V_{IN} from 0.8V to 2V

DC SPECIFICATIONS

Symbol	Parameter	Test Conditions		Value					Unit	
		V _{CC} (V)		T _A = 25 °C			-40 to 85 °C			
				Min.	Typ.	Max.	Min.	Max.		
V _{IH}	High Level Input Voltage	3.0 to 3.6		2.0			2.0		V	
V _{IL}	Low Level Input Voltage					0.8		0.8	V	
V _{OH}	High Level Output Voltage	3.0	V _I ^(*) = V _{IH} or V _{IL}	I _O =-50 μA	2.9	2.99		2.9	V	
				I _O =-12 mA	2.58			2.48		
				I _O =-24 mA				2.2		
V _{OL}	Low Level Output Voltage	3.0	V _I ^(*) = V _{IH} or V _{IL}	I _O =50 μA		0.002	0.1		V	
				I _O =12 mA		0	0.36			
				I _O =24 mA				0.44		
								0.55		
I _I	Input Leakage Current	3.6	V _I =V _{CC} or GND			±0.1		±1	μA	
I _{OZ}	3 State Output Leakage Current	3.6	V _I =V _{IH} or V _{IL} V _O =V _{CC} or GND			±0.5		±5	μA	
I _{CC}	Quiescent Supply Current	3.6	V _I =V _{CC} or GND			4		40	μA	
I _{OLD}	Dynamic Output Current (note 1, 2)	3.6	V _{OLD} =0.8 V max				36		mA	
I _{OHD}			V _{OHD} =2 V min				-25		mA	

1) Maximum test duration 2ms, one output loaded at time

2) Incident wave switching is guaranteed on transmission lines with impedances as low as 50 Ω.

(*) All outputs loaded.

DYNAMIC SWITCHING CHARACTERISTICS

Symbol	Parameter	Test Conditions		Value					Unit	
		V _{CC} (V)		T _A = 25 °C			-40 to 85 °C			
				Min.	Typ.	Max.	Min.	Max.		
V _{OLP}	Dynamic Low Voltage Quiet Output (note 1, 2)	3.3	C _L =50 pF		0.4	0.8			V	
V _{OLV}				-0.8	-0.5					
V _{IHD}	Dynamic High Voltage Input (note 1, 3)					2				
V _{ILD}	Dynamic Low Voltage Input (note 1, 3)			0.8						

1) Worst case package

2) Max number of outputs defined as (n). Data inputs are driven 0V to 3.3V, (n-1) outputs switching and one output at GND

3) max number of data inputs (n) switching. (n-1) switching 0V to 3.3V. Inputs under test switching: 3.3V to threshold (V_{ILD}), 0V to threshold (V_{IHD}). f=1MHz

AC ELECTRICAL CHARACTERISTICS ($C_L = 50 \text{ pF}$, $R_L = 500 \Omega$, Input $t_r = t_f = 3 \text{ ns}$)

Symbol	Parameter	Test Condition		Value					Unit	
		V_{CC} (V)		$T_A = 25^\circ\text{C}$			$-40 \text{ to } 85^\circ\text{C}$			
				Min.	Typ.	Max.	Min.	Max.		
t_{PLH}	Propagation Delay Time	2.7			7	13		14	ns	
		3.3 ^(*)			6	9		9.5		
t_{PZL}	Output Enable Time	2.7			8.5	17		18	ns	
		3.3 ^(*)			7	12		12.5		
t_{PLZ}	Output Disable Time	2.7			9	19		20	ns	
		3.3 ^(*)			7.5	13.5		14		
t_{OSLZ}	Output to Output Skew Time (note 1, 2)	2.7			0.5	1.5		1.5	ns	
		3.3 ^(*)			0.5	1.5		1.5		

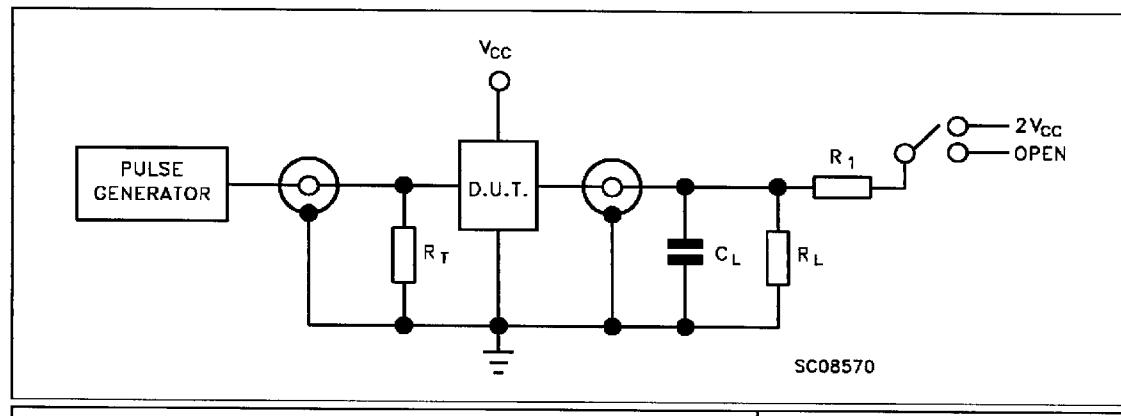
- 1) Skew is defined as the absolute value of the difference between the actual propagation delay for any two outputs of the same device switching in the same direction, either HIGH or LOW
 2) Parameter guaranteed by design
 (*) Voltage range is $3.3V \pm 0.3V$

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Conditions		Value					Unit	
		V_{CC} (V)		$T_A = 25^\circ\text{C}$			$-40 \text{ to } 85^\circ\text{C}$			
				Min.	Typ.	Max.	Min.	Max.		
C_{IN}	Input Capacitance	3.3			5				pF	
C_{PD}	Power Dissipation Capacitance (note 1)	3.3	$f_{IN} = 10 \text{ MHz}$		15				pF	

1) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. $I_{CC(\text{opr})} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{OD}/n$ (per circuit)

TEST CIRCUIT

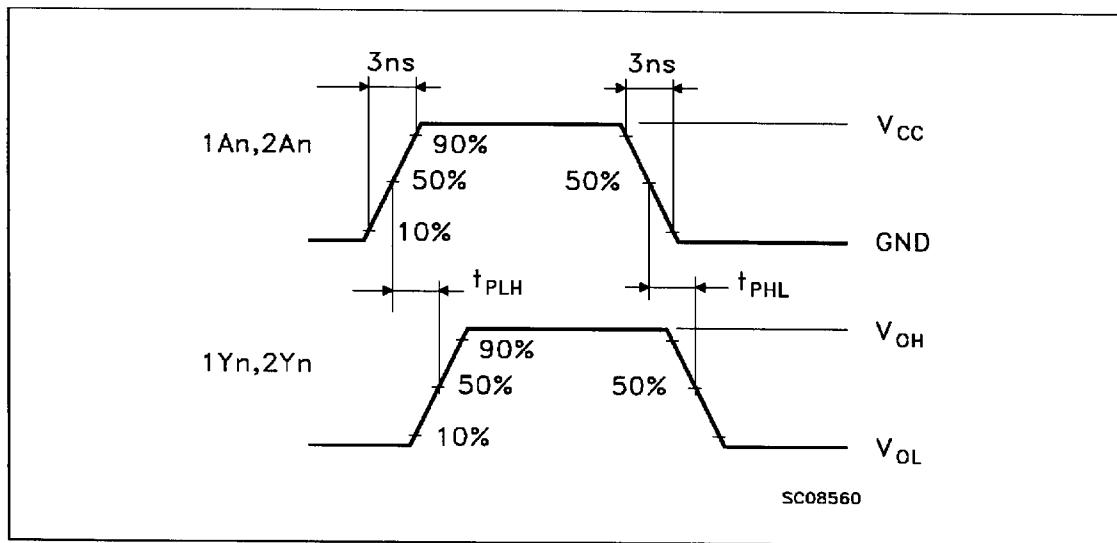
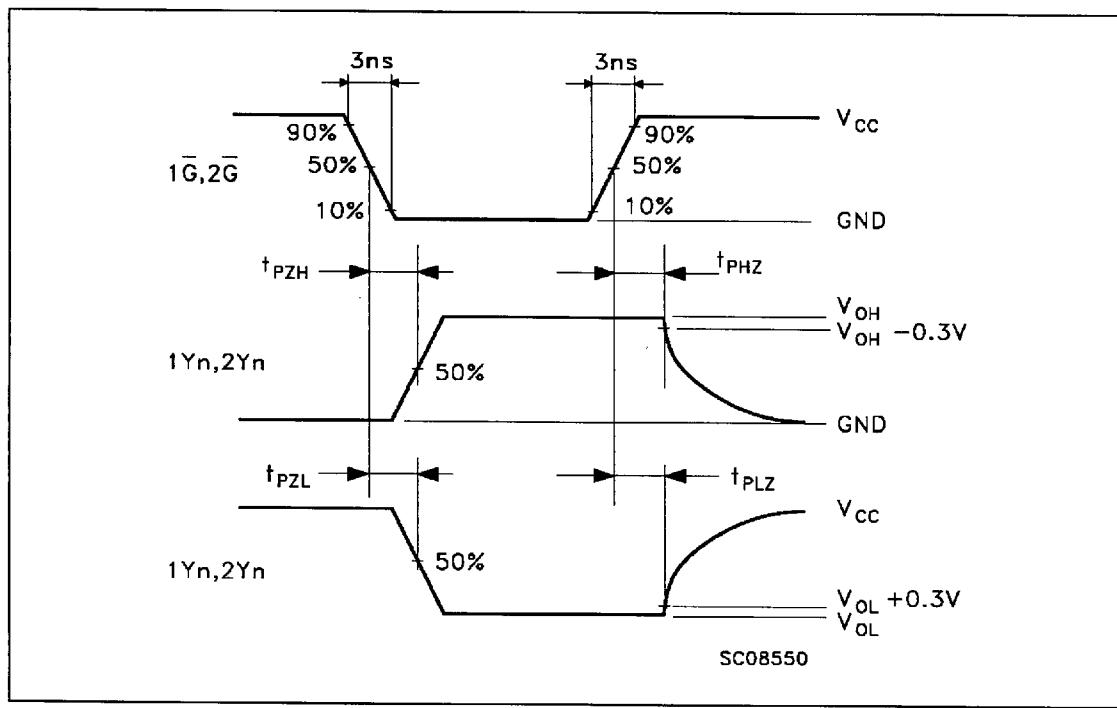


TEST	SWITCH
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	$2V_{CC}$
t_{PZH}, t_{PHZ}	GND

$C_L = 50 \text{ pF}$ or equivalent (Includes jig and probe capacitance)

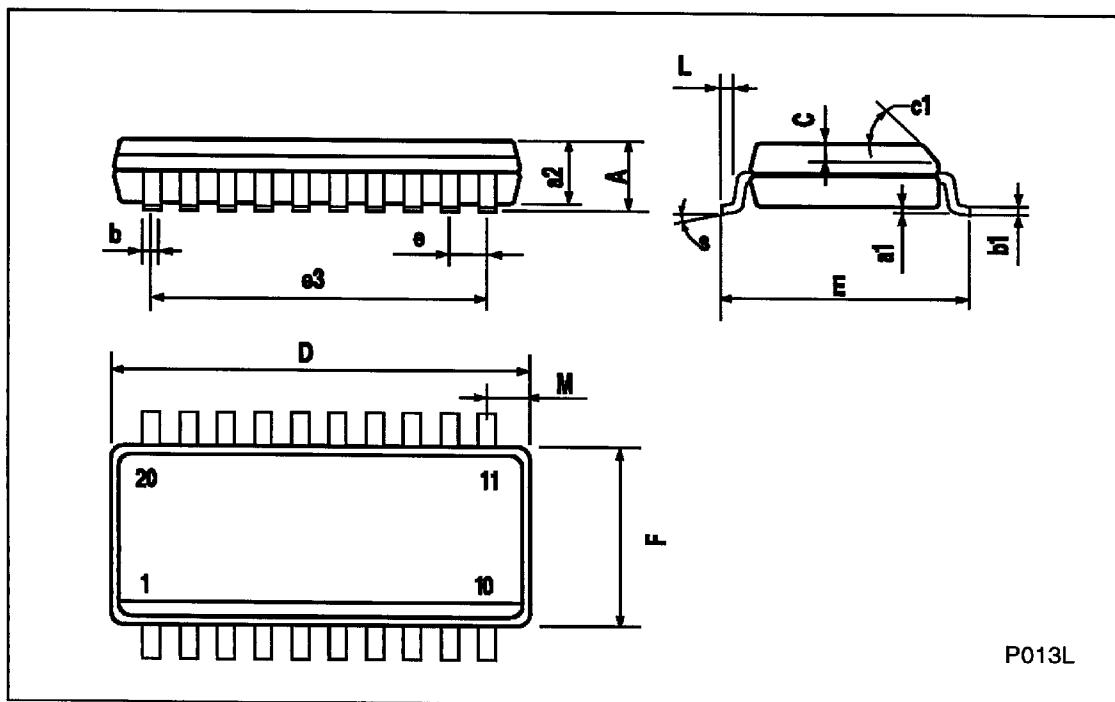
$R_L = R_1 = 500 \Omega$ or equivalent

$R_T = Z_{out}$ of pulse generator (typically 50Ω)

WAVEFORM 1: PROPAGATION DELAYS (f=1MHz; 50% duty cycle)**WAVEFORM 2: OUTPUT ENABLE AND DISABLE TIME (f=1MHz; 50% duty cycle)**

SO20 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.10		0.20	0.004		0.007
a2			2.45			0.096
b	0.35		0.49	0.013		0.019
b1	0.23		0.32	0.009		0.012
C		0.50			0.020	
c1		45° (typ.)				
D	12.60		13.00	0.496		0.512
E	10.00		10.65	0.393		0.419
e		1.27			0.050	
e3		11.43			0.450	
F	7.40		7.60	0.291		0.299
L	0.50		1.27	0.19		0.050
M			0.75			0.029
S		8° (max.)				



TSSOP20 MECHANICAL DATA

DIM.	mm			Inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.1			0.433
A1	0.05	0.10	0.15	0.002	0.004	0.006
A2		0.9			0.354	
b	0.18		0.30	0.0071		0.0118
c	0.09		0.18	0.0035		0.0071
D	6.4	6.5	6.6	0.252	0.256	0.260
E	6.25	6.4	6.5	0.246	0.252	0.256
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65 BSC			0.0256 BSC	
K	0°	4°	8°	0°	4°	8°
L	0.50	0.60	0.70	0.020	0.024	0.028

