



# 74VCX163245

## 16-BIT DUAL SUPPLY BUS TRANSCEIVER LEVEL TRANSLATOR

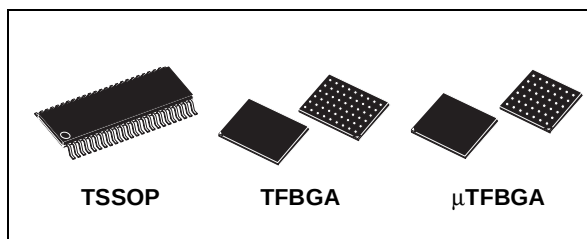
### TARGET DATA

- HIGH SPEED:  $t_{PD} = 4.4ns$  (MAX.) at  $T_A=85^{\circ}C$   
 $V_{CCA} = 3.0V$   $V_{CCB} = 2.3V$
- LOW POWER DISSIPATION:  
 $I_{CCA} = I_{CCB} = 20\mu A$  (MAX.) at  $T_A=85^{\circ}C$
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OHA}| = I_{OLA} = 12mA$  MIN at  
 $V_{CCA} = 3.0V$   $V_{CCB} = 1.65V$  or  $2.3V$   
 $|I_{OHA}| = I_{OLA} = 8mA$  MIN at  
 $V_{CCA} = 2.3V$   $V_{CCB} = 1.65V$
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \approx t_{PHL}$
- POWER DOWN PROTECTION ON INPUTS  
AND OUTPUTS
- OPERATING VOLTAGE RANGE:  
 $V_{CCA}(OPR) = 2.3V$  to  $3.6V$  (1.2V Data Retention)  
 $V_{CCB}(OPR) = 1.65V$  to  $2.7V$  (1.2V Data Retention)
- PIN AND FUNCTION COMPATIBLE WITH  
74 SERIES 16245
- LATCH-UP PERFORMANCE EXCEEDS  
500mA (JESD 17)
- ESD PERFORMANCE:  
HBM > 2000V (MIL STD 883 method 3015);  
MM > 200V

### DESCRIPTION

The 74VCX163245 is a dual supply low voltage CMOS 16-BIT BUS TRANSCEIVER fabricated with sub-micron silicon gate and five-layer metal wiring C<sup>2</sup>MOS technology. Designed for use as an interface between a 3.3V bus and a 2.5V or 1.8V bus in a mixed 3.3V/1.8V, 3.3V/2.5V and 2.5V/1.8V supply systems, it achieves high speed operation while maintaining the CMOS low power dissipation.

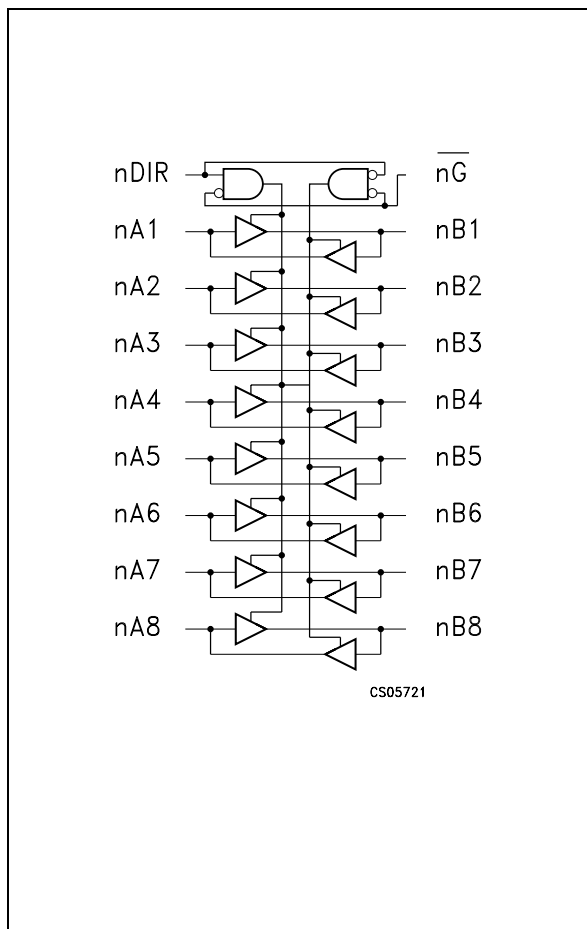
This IC is intended for two-way asynchronous communication between data buses and the direction of data transmission is determined by nDIR inputs. The enable inputs  $\overline{nOE}$  can be used to disable the device so that the buses are effectively isolated. The A-port interfaces with the 3V bus, the B-port with the 2.5V and 1.8V bus. All inputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage. All floating bus terminals during High Z State must be held HIGH or LOW.



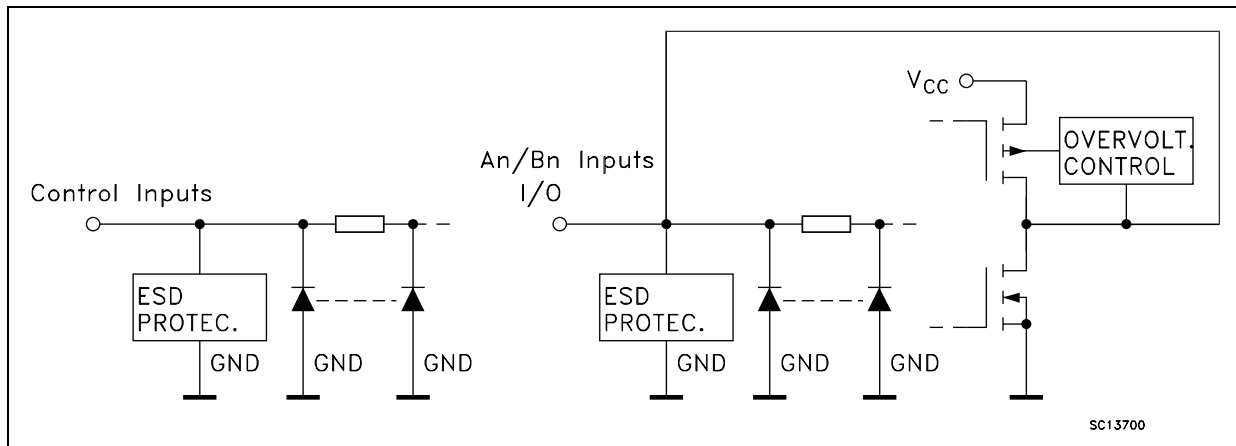
### ORDER CODES

| PACKAGE  | TRAY          | T & R          |
|----------|---------------|----------------|
| TSSOP48  |               | 74VCX163245TTR |
| TFBGA54  | 74VCX163245LB | 74VCX163245LBR |
| μTFBGA42 | 74VCX163245TB | 74VCX163245TBR |

### LOGIC DIAGRAM

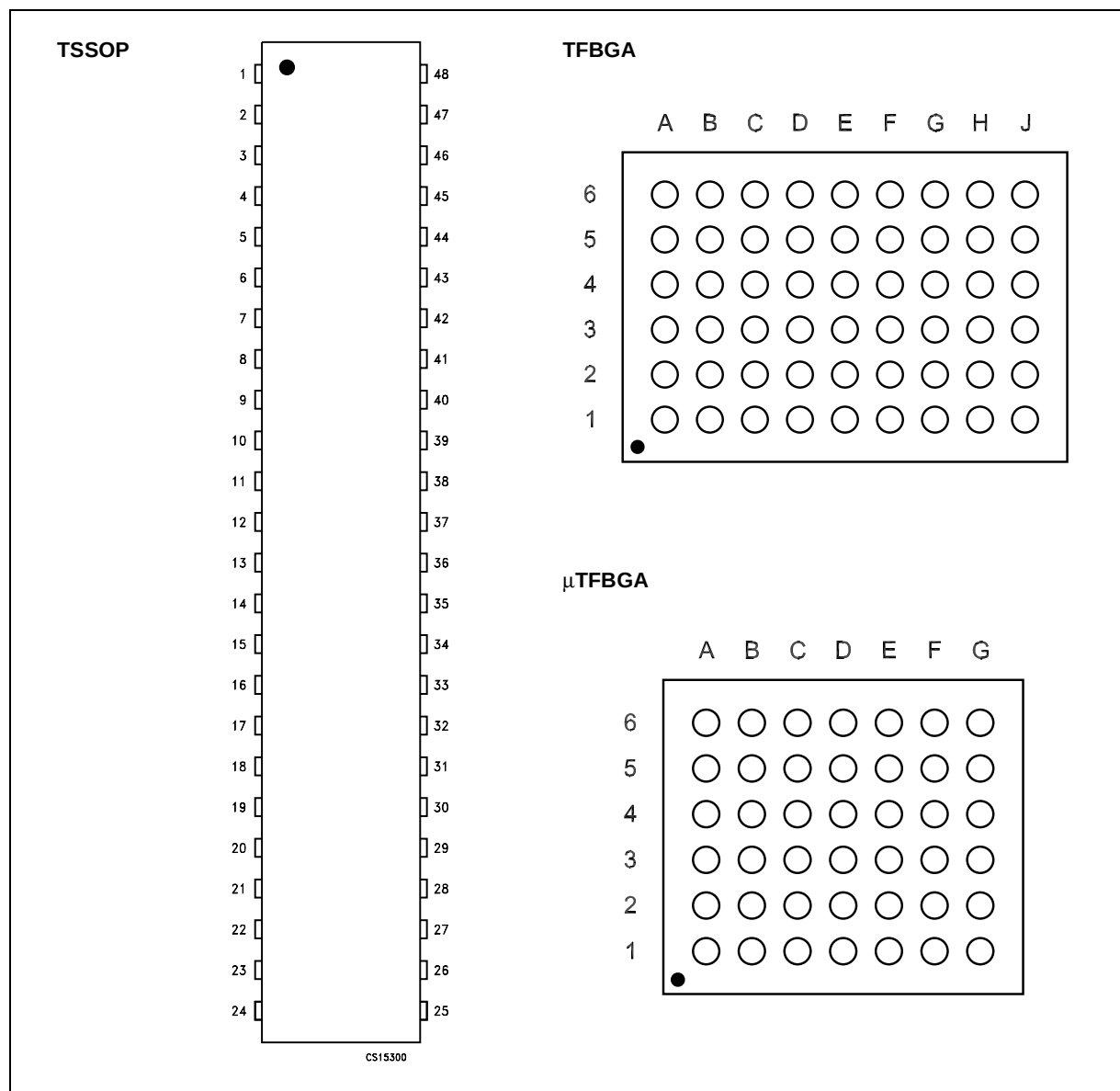


## INPUT AND OUTPUT EQUIVALENT CIRCUIT



## PIN DESCRIPTION

| TFBGA54 PIN N°                 | μTFBGA42 PIN N°                | TSSOP PIN N°                   | SYMBOL           | NAME AND FUNCTION       |
|--------------------------------|--------------------------------|--------------------------------|------------------|-------------------------|
| A3                             | B3                             | 1                              | 1DIR             | Directional Controls    |
| J3                             | F3                             | 24                             | 2DIR             | Directional Controls    |
| A6, B5, B6, C5, C6, D5, D6, E5 | A4, A5, A6, B5, B6, C5, C6, D5 | 47, 46, 44, 43, 41, 40, 38, 37 | 1A1 to 1A8       | Data Inputs/Outputs     |
| E6, F5, F6, G5, G6, H5, H6, J6 | D6, E5, E6, F5, F6, G4, G5, G6 | 36, 35, 33, 32, 30, 29, 27, 26 | 2A1 to 2A8       | Data Inputs/Outputs     |
| A1, B2, B1, C2, C1, D2, D1, E2 | A3, A2, A1, B2, B1, C2, C1, D2 | 2, 3, 5, 6, 8, 9, 11, 12       | 1B1 to 1B8       | Data Inputs/Outputs     |
| E1, F2, F1, G2, G1, H2, H1, J1 | D1, E2, E1, F2, F1, G3, G2, G1 | 13, 14, 16, 17, 19, 20, 22, 23 | 2B1 to 2B8       | Data Inputs/Outputs     |
| J4                             | F4                             | 25                             | G2               | Output Enable Inputs    |
| A4                             | B4                             | 48                             | G1               | Output Enable Inputs    |
| D3, D4, E3, E4, F3, F4         | C3, C4, E3, E4                 | 4, 10, 15, 21, 28, 34, 39, 45  | GND              | Ground (0V)             |
| A2, A5, B3, B4, H3, H4, J2, J5 | -                              | -                              | NC               | No Connected            |
| C4, G4                         | D4                             | 42, 31                         | V <sub>CCA</sub> | Positive Supply Voltage |
| C3, G3                         | D3                             | 7, 18                          | V <sub>CCB</sub> | Positive Supply Voltage |

**PIN CONNECTION** (top view for TSSOP, bottom view for BGA)**TRUTH TABLE**

| INPUTS         |     | FUNCTION |        | OUTPUT |
|----------------|-----|----------|--------|--------|
| $\overline{G}$ | DIR | A BUS    | B BUS  |        |
| L              | L   | OUTPUT   | INPUT  | A = B  |
| L              | H   | INPUT    | OUTPUT | B = A  |
| H              | X   | Z        | Z      | Z      |

X=Don't care; Z=High Impedance

## ABSOLUTE MAXIMUM RATINGS

| Symbol     | Parameter                        | Value                   | Unit |
|------------|----------------------------------|-------------------------|------|
| $V_{CCA}$  | Supply Voltage                   | -0.5 to +4.6            | V    |
| $V_{CCB}$  | Supply Voltage                   | -0.5 to +4.6            | V    |
| $V_I$      | DC Input Voltage                 | -0.5 to +4.6            | V    |
| $V_{I/OA}$ | DC I/O Voltage (Output disabled) | -0.5 to +4.6            | V    |
| $V_{I/OB}$ | DC I/O Voltage (Output disabled) | -0.5 to +4.6            | V    |
| $V_{I/OA}$ | DC I/O Voltage                   | -0.5 to $V_{CCA} + 0.5$ | V    |
| $V_{I/OB}$ | DC I/O Voltage                   | -0.5 to $V_{CCB} + 0.5$ | V    |
| $I_{IK}$   | DC Input Diode Current           | - 20                    | mA   |
| $I_{OK}$   | DC Output Diode Current          | - 50                    | mA   |
| $I_{OA}$   | DC Output Current                | $\pm 50$                | mA   |
| $I_{OB}$   | DC Output Current                | $\pm 50$                | mA   |
| $I_{CCA}$  | DC $V_{CC}$ or Ground Current    | $\pm 100$               | mA   |
| $I_{CCB}$  | DC $V_{CC}$ or Ground Current    | $\pm 100$               | mA   |
| $P_d$      | Power Dissipation                | 400                     | mW   |
| $T_{stg}$  | Storage Temperature              | -65 to +150             | °C   |
| $T_L$      | Lead Temperature (10 sec)        | 300                     | °C   |

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

(\*) 500mW:  $\approx$  65°C derated to 300mW by 10mW/°C: 65°C to 85°C

## RECOMMENDED OPERATING CONDITIONS

| Symbol     | Parameter                         | Value          | Unit |
|------------|-----------------------------------|----------------|------|
| $V_{CCA}$  | Supply Voltage                    | 2.3 to 3.6     | V    |
| $V_{CCB}$  | Supply Voltage                    | 1.65 to 2.7    | V    |
| $V_I$      | Input Voltage (Dir, OE)           | 0 to $V_{CCB}$ | V    |
| $V_{I/OA}$ | I/O Voltage                       | 0 to $V_{CCA}$ | V    |
| $V_{I/OB}$ | I/O Voltage                       | 0 to $V_{CCB}$ | V    |
| $T_{op}$   | Operating Temperature             | -40 to 85      | °C   |
| dt/dv      | Input Rise and Fall Time (note 1) | 0 to 10        | ns/V |

1)  $V_{IN}$  from 0.8V to 2.0V at  $V_{CC} = 3.0V$

DC SPECIFICATION FOR  $V_{CCA}$ 

| Symbol                | Parameter                                     | Test Condition                 |                                |                                                                                                                  | Value                  |      |       |              |       | Unit |
|-----------------------|-----------------------------------------------|--------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------|------------------------|------|-------|--------------|-------|------|
|                       |                                               | V <sub>CCB</sub><br>(*)<br>(V) | V <sub>CCA</sub><br>(*)<br>(V) |                                                                                                                  | T <sub>A</sub> = 25 °C |      |       | -40 to 85 °C |       |      |
|                       |                                               |                                |                                |                                                                                                                  | Min.                   | Typ. | Max.  | Min.         | Max.  |      |
| V <sub>IHA</sub>      | High Level Input Voltage (An)                 | 1.8                            | 2.5                            |                                                                                                                  | 1.6                    |      |       | 1.6          |       | V    |
|                       |                                               | 1.8                            | 3.3                            |                                                                                                                  | 2.0                    |      |       | 2.0          |       |      |
|                       |                                               | 2.5                            | 3.3                            |                                                                                                                  | 2.0                    |      |       | 2.0          |       |      |
| V <sub>ILA</sub>      | Low Level Input Voltage (An)                  | 1.8                            | 2.5                            |                                                                                                                  |                        |      | 0.7   |              | 0.7   | V    |
|                       |                                               | 1.8                            | 3.3                            |                                                                                                                  |                        |      | 0.8   |              | 0.8   |      |
|                       |                                               | 2.5                            | 3.3                            |                                                                                                                  |                        |      | 0.8   |              | 0.8   |      |
| V <sub>OHA</sub>      | High Level Output Voltage                     | 2.3                            | 3.0                            | I <sub>O</sub> =-100 μA                                                                                          | 2.8                    |      |       | 2.8          |       | V    |
|                       |                                               | 2.3                            | 3.0                            | I <sub>O</sub> =-24 mA                                                                                           | 2.2                    |      |       | 2.2          |       |      |
|                       |                                               | 1.65                           | 3.0                            | I <sub>O</sub> =-24 mA                                                                                           | 2.2                    |      |       | 2.2          |       |      |
|                       |                                               | 1.65                           | 2.3                            | I <sub>O</sub> =-18 mA                                                                                           | 1.7                    |      |       | 1.7          |       |      |
| V <sub>OLA</sub>      | Low Level Output Voltage                      | 2.3                            | 3.0                            | I <sub>O</sub> =100 μA                                                                                           |                        |      | 0.2   |              | 0.2   | V    |
|                       |                                               | 2.3                            | 3.0                            | I <sub>O</sub> =24 mA                                                                                            |                        |      | 0.55  |              | 0.55  |      |
|                       |                                               | 1.65                           | 3.0                            | I <sub>O</sub> =24 mA                                                                                            |                        |      | 0.55  |              | 0.55  |      |
|                       |                                               | 1.65                           | 2.3                            | I <sub>O</sub> =18 mA                                                                                            |                        |      | 0.60  |              | 0.60  |      |
| I <sub>IA</sub>       | Input Leakage Current                         | 2.7                            | 3.6                            | V <sub>I</sub> = V <sub>CC</sub> or GND                                                                          |                        |      | ± 0.5 |              | ± 5   | μA   |
| I <sub>OZA</sub>      | High Impedance Output Leakage Current         | 2.7                            | 3.6                            | V <sub>IA</sub> = Gnd or 3.6V<br>V <sub>IB</sub> = V <sub>IHB</sub> or V <sub>ILB</sub><br>OE = V <sub>CCB</sub> |                        |      | ± 1.0 |              | ± 10  | μA   |
| I <sub>IA(HOLD)</sub> | Input Hold Current                            | 1.65                           | 2.3                            | V <sub>I</sub> = 0.57V                                                                                           | 25                     |      |       | 25           |       | μA   |
|                       |                                               | 1.65                           | 2.3                            | V <sub>I</sub> = 1.07V                                                                                           | -25                    |      |       | -25          |       |      |
|                       |                                               | 1.65                           | 3.0                            | V <sub>I</sub> = 0.57V                                                                                           | 25                     |      |       | 25           |       | μA   |
|                       |                                               | 1.65                           | 3.0                            | V <sub>I</sub> = 1.07V                                                                                           | -25                    |      |       | -25          |       |      |
|                       |                                               | 2.3                            | 3.0                            | V <sub>I</sub> = 0.7V                                                                                            | 45                     |      |       | 45           |       | μA   |
|                       |                                               | 2.3                            | 3.0                            | V <sub>I</sub> = 1.6V                                                                                            | -45                    |      |       | -45          |       |      |
|                       |                                               | 2.7                            | 3.6                            | V <sub>IB</sub> = 0 to 2.7V                                                                                      |                        |      |       |              | ± 300 |      |
| I <sub>OFF</sub>      | Power Off Leakage Current                     | 0                              | 0                              | V <sub>IA</sub> = Gnd to 3.6V<br>V <sub>IB</sub> = Gnd to 3.6V<br>G, Dir = GND to 3.6V                           |                        |      | ± 1.0 |              | ± 10  | μA   |
| I <sub>CCIA</sub>     | Quiescent Supply Current                      | 1.95                           | 3.6                            | V <sub>IA</sub> =V <sub>CCA</sub> or GND<br>V <sub>IB</sub> =V <sub>CCB</sub> or GND                             |                        |      | 2     |              | 20    | μA   |
|                       |                                               | 1.95                           | 2.7                            |                                                                                                                  |                        |      |       |              |       |      |
|                       |                                               | 2.7                            | 3.6                            |                                                                                                                  |                        |      |       |              |       |      |
| ΔI <sub>CCIA</sub>    | Maximum Quiescent Supply Current / Input (An) | 2.7                            | 3.6                            | V <sub>IA</sub> =V <sub>CCA</sub> - 0.6V<br>V <sub>IB</sub> =V <sub>CCB</sub> or GND                             |                        |      |       |              | 0.75  | mA   |
|                       |                                               | 1.95                           | 3.6                            |                                                                                                                  |                        |      |       |              |       |      |
|                       |                                               | 1.95                           | 2.7                            |                                                                                                                  |                        |      |       |              |       |      |

DC SPECIFICATION FOR  $V_{CCB}$ 

| Symbol                | Parameter                                              | Test Condition                 |                                |                                                                                                                 | Value                  |      |                      |                      |                      | Unit |
|-----------------------|--------------------------------------------------------|--------------------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------|------------------------|------|----------------------|----------------------|----------------------|------|
|                       |                                                        | V <sub>CCB</sub><br>(V)<br>(*) | V <sub>CCA</sub><br>(V)<br>(*) |                                                                                                                 | T <sub>A</sub> = 25 °C |      |                      | -40 to 85 °C         |                      |      |
|                       |                                                        |                                |                                |                                                                                                                 | Min.                   | Typ. | Max.                 | Min.                 | Max.                 |      |
| V <sub>IHB</sub>      | High Level Input Voltage (Bn, Dir, OE)                 | 1.8                            | 2.5                            |                                                                                                                 | 0.65V <sub>CCB</sub>   |      |                      | 0.65V <sub>CCB</sub> |                      | V    |
|                       |                                                        | 1.8                            | 3.3                            |                                                                                                                 | 0.65V <sub>CCB</sub>   |      |                      | 0.65V <sub>CCB</sub> |                      |      |
|                       |                                                        | 2.5                            | 3.3                            |                                                                                                                 | 1.6                    |      |                      | 1.6                  |                      |      |
| V <sub>ILB</sub>      | Low Level Input Voltage (Bn, Dir, OE)                  | 1.8                            | 2.5                            |                                                                                                                 |                        |      | 0.35V <sub>CCB</sub> |                      | 0.35V <sub>CCB</sub> | V    |
|                       |                                                        | 1.8                            | 3.3                            |                                                                                                                 |                        |      | 0.35V <sub>CCB</sub> |                      | 0.35V <sub>CCB</sub> |      |
|                       |                                                        | 2.5                            | 3.3                            |                                                                                                                 |                        |      | 0.7                  |                      | 0.7                  |      |
| V <sub>OHB</sub>      | High Level Output Voltage                              | 2.3                            | 3.0                            | I <sub>O</sub> =-100 μA                                                                                         | 2.8                    |      |                      | 2.8                  |                      | V    |
|                       |                                                        | 2.3                            | 3.0                            | I <sub>O</sub> =-18 mA                                                                                          | 1.7                    |      |                      | 1.7                  |                      |      |
|                       |                                                        | 1.65                           | 3.0                            | I <sub>O</sub> =-6 mA                                                                                           | 1.25                   |      |                      | 1.25                 |                      |      |
|                       |                                                        | 1.65                           | 2.3                            | I <sub>O</sub> =-6 mA                                                                                           | 1.25                   |      |                      | 1.25                 |                      |      |
| V <sub>OLB</sub>      | Low Level Output Voltage                               | 2.3                            | 3.0                            | I <sub>O</sub> =100 μA                                                                                          |                        |      | 0.2                  |                      | 0.2                  | V    |
|                       |                                                        | 2.3                            | 3.0                            | I <sub>O</sub> =18 mA                                                                                           |                        |      | 0.60                 |                      | 0.60                 |      |
|                       |                                                        | 1.65                           | 3.0                            | I <sub>O</sub> =6 mA                                                                                            |                        |      | 0.30                 |                      | 0.30                 |      |
|                       |                                                        | 1.65                           | 2.3                            | I <sub>O</sub> =6 mA                                                                                            |                        |      | 0.30                 |                      | 0.30                 |      |
| I <sub>IB</sub>       | Input Leakage Current                                  | 2.7                            | 3.6                            | V <sub>I</sub> = V <sub>CC</sub> or GND                                                                         |                        |      | ± 0.5                |                      | ± 5                  | μA   |
| I <sub>OZB</sub>      | High Impedance Output Leakage Current                  | 2.7                            | 3.6                            | V <sub>IA</sub> = V <sub>IHA</sub> or V <sub>ILA</sub><br>V <sub>IB</sub> = GND or 2.7V<br>G = V <sub>CCB</sub> |                        |      | ± 1.0                |                      | ± 10                 | μA   |
| I <sub>IB(HOLD)</sub> | Input Hold Current                                     | 1.65                           | 2.3                            | V <sub>I</sub> = 0.57V                                                                                          | 25                     |      |                      | 25                   |                      | μA   |
|                       |                                                        | 1.65                           | 2.3                            | V <sub>I</sub> = 1.07V                                                                                          | -25                    |      |                      | -25                  |                      |      |
|                       |                                                        | 1.65                           | 3.0                            | V <sub>I</sub> = 0.57V                                                                                          | 25                     |      |                      | 25                   |                      | μA   |
|                       |                                                        | 1.65                           | 3.0                            | V <sub>I</sub> = 1.07V                                                                                          | -25                    |      |                      | -25                  |                      |      |
|                       |                                                        | 2.3                            | 3.0                            | V <sub>I</sub> = 0.7V                                                                                           | 45                     |      |                      | 45                   |                      | μA   |
|                       |                                                        | 2.3                            | 3.0                            | V <sub>I</sub> = 1.6V                                                                                           | -45                    |      |                      | -45                  |                      |      |
|                       |                                                        | 2.7                            | 3.6                            | V <sub>IB</sub> = 0 to 2.7V                                                                                     |                        |      |                      |                      | ± 300                |      |
| I <sub>CCIB</sub>     | Quiescent Supply Current                               | 1.95                           | 3.6                            | V <sub>IA</sub> =V <sub>CCA</sub> or GND                                                                        |                        |      | 2                    |                      | 20                   | μA   |
|                       |                                                        | 1.95                           | 2.7                            | V <sub>IB</sub> =V <sub>CCB</sub> or GND                                                                        |                        |      |                      |                      |                      |      |
|                       |                                                        | 2.7                            | 3.6                            | Dir or G=V <sub>CCB</sub> or GND                                                                                |                        |      |                      |                      |                      |      |
| ΔI <sub>CCIB</sub>    | Maximum Quiescent Supply Current / Input (Bn, DIR, OE) | 2.7                            | 3.6                            | V <sub>IB</sub> =V <sub>CCB</sub> - 0.6V<br>V <sub>IA</sub> =V <sub>CCA</sub> or GND                            |                        |      |                      |                      | 0.75                 | mA   |
|                       |                                                        | 1.95                           | 3.6                            |                                                                                                                 |                        |      |                      |                      |                      |      |
|                       |                                                        | 1.95                           | 2.7                            |                                                                                                                 |                        |      |                      |                      |                      |      |

## DYNAMIC SWITCHING CHARACTERISTICS

| Symbol            | Parameter                            | Test Condition          |                         |                                                                              | Value                  |       |      |              |      | Unit |
|-------------------|--------------------------------------|-------------------------|-------------------------|------------------------------------------------------------------------------|------------------------|-------|------|--------------|------|------|
|                   |                                      | V <sub>CCB</sub><br>(V) | V <sub>CCA</sub><br>(V) |                                                                              | T <sub>A</sub> = 25 °C |       |      | -40 to 85 °C |      |      |
|                   |                                      |                         |                         |                                                                              | Min.                   | Typ.  | Max. | Min.         | Max. |      |
| V <sub>OLPA</sub> | Dynamic Low Level<br>Quiet An Output | 1.8                     | 2.5                     | C <sub>L</sub> =30pF<br>V <sub>IL</sub> =0V V <sub>IH</sub> =V <sub>CC</sub> |                        | 0.25  |      |              |      | V    |
|                   |                                      | 1.8                     | 3.3                     |                                                                              |                        | 0.25  |      |              |      |      |
|                   |                                      | 2.5                     | 3.3                     |                                                                              |                        | 0.6   |      |              |      |      |
| V <sub>OLPB</sub> | Dynamic Low Level<br>Quiet Bn Output | 1.8                     | 2.5                     | C <sub>L</sub> =30pF<br>V <sub>IL</sub> =0V V <sub>IH</sub> =V <sub>CC</sub> |                        | 0.6   |      |              |      | V    |
|                   |                                      | 1.8                     | 3.3                     |                                                                              |                        | 0.8   |      |              |      |      |
|                   |                                      | 2.5                     | 3.3                     |                                                                              |                        | 0.8   |      |              |      |      |
| V <sub>OLVA</sub> | Dynamic Low Level<br>Quiet An Output | 1.8                     | 2.5                     | C <sub>L</sub> =30pF<br>V <sub>IL</sub> =0V V <sub>IH</sub> =V <sub>CC</sub> |                        | -0.6  |      |              |      | V    |
|                   |                                      | 1.8                     | 3.3                     |                                                                              |                        | -0.8  |      |              |      |      |
|                   |                                      | 2.5                     | 3.3                     |                                                                              |                        | -0.8  |      |              |      |      |
| V <sub>OLVB</sub> | Dynamic Low Level<br>Quiet Bn Output | 1.8                     | 2.5                     | C <sub>L</sub> =30pF<br>V <sub>IL</sub> =0V V <sub>IH</sub> =V <sub>CC</sub> |                        | -0.25 |      |              |      | V    |
|                   |                                      | 1.8                     | 3.3                     |                                                                              |                        | -0.25 |      |              |      |      |
|                   |                                      | 2.5                     | 3.3                     |                                                                              |                        | -0.6  |      |              |      |      |
| V <sub>OHVA</sub> | Dynamic Low Level<br>Quiet An Output | 1.8                     | 2.5                     | C <sub>L</sub> =30pF<br>V <sub>IL</sub> =0V V <sub>IH</sub> =V <sub>CC</sub> |                        | 1.7   |      |              |      | V    |
|                   |                                      | 1.8                     | 3.3                     |                                                                              |                        | 2.0   |      |              |      |      |
|                   |                                      | 2.5                     | 3.3                     |                                                                              |                        | 2.0   |      |              |      |      |
| V <sub>OHVB</sub> | Dynamic Low Level<br>Quiet Bn Output | 1.8                     | 2.5                     | C <sub>L</sub> =30pF<br>V <sub>IL</sub> =0V V <sub>IH</sub> =V <sub>CC</sub> |                        | 1.3   |      |              |      | V    |
|                   |                                      | 1.8                     | 3.3                     |                                                                              |                        | 1.3   |      |              |      |      |
|                   |                                      | 2.5                     | 3.3                     |                                                                              |                        | 1.7   |      |              |      |      |

## AC ELECTRICAL CHARACTERISTICS

| Symbol                                 | Parameter                                | Test Condition          |                         |                                                  | Value        |      | Unit |
|----------------------------------------|------------------------------------------|-------------------------|-------------------------|--------------------------------------------------|--------------|------|------|
|                                        |                                          | V <sub>CCB</sub><br>(V) | V <sub>CCA</sub><br>(V) |                                                  | -40 to 85 °C |      |      |
|                                        |                                          |                         |                         |                                                  | Min.         | Max. |      |
| t <sub>PLH</sub> t <sub>PHL</sub>      | Propagation Delay Time<br>An to Bn       | 1.8 ± 0.15              | 2.5 ± 0.2               | C <sub>L</sub> = 30 pF<br>R <sub>L</sub> = 500 Ω | 1.0          | 5.8  | ns   |
|                                        |                                          | 1.8 ± 0.15              | 3.3 ± 0.3               |                                                  | 1.0          | 6.2  |      |
|                                        |                                          | 2.5 ± 0.2               | 3.3 ± 0.3               |                                                  | 1.0          | 4.4  |      |
| t <sub>PLH</sub> t <sub>PHL</sub>      | Propagation Delay Time<br>Bn to An       | 1.8 ± 0.15              | 2.5 ± 0.2               | C <sub>L</sub> = 30 pF<br>R <sub>L</sub> = 500 Ω | 1.0          | 5.5  | ns   |
|                                        |                                          | 1.8 ± 0.15              | 3.3 ± 0.3               |                                                  | 1.0          | 5.1  |      |
|                                        |                                          | 2.5 ± 0.2               | 3.3 ± 0.3               |                                                  | 1.0          | 4.0  |      |
| t <sub>PZL</sub> t <sub>PZH</sub>      | Output Enable Time<br>OE to An           | 1.8 ± 0.15              | 2.5 ± 0.2               | C <sub>L</sub> = 30 pF<br>R <sub>L</sub> = 500 Ω | 1.0          | 5.3  | ns   |
|                                        |                                          | 1.8 ± 0.15              | 3.3 ± 0.3               |                                                  | 1.0          | 5.1  |      |
|                                        |                                          | 2.5 ± 0.2               | 3.3 ± 0.3               |                                                  | 1.0          | 4.0  |      |
| t <sub>PZL</sub> t <sub>PZH</sub>      | Output Enable Time<br>OE to Bn           | 1.8 ± 0.15              | 2.5 ± 0.2               | C <sub>L</sub> = 30 pF<br>R <sub>L</sub> = 500 Ω | 1.0          | 8.3  | ns   |
|                                        |                                          | 1.8 ± 0.15              | 3.3 ± 0.3               |                                                  | 1.0          | 8.2  |      |
|                                        |                                          | 2.5 ± 0.2               | 3.3 ± 0.3               |                                                  | 1.0          | 4.6  |      |
| t <sub>PLZ</sub> t <sub>PHZ</sub>      | Output Disable Time<br>OE to An          | 1.8 ± 0.15              | 2.5 ± 0.2               | C <sub>L</sub> = 30 pF<br>R <sub>L</sub> = 500 Ω | 1.0          | 5.2  | ns   |
|                                        |                                          | 1.8 ± 0.15              | 3.3 ± 0.3               |                                                  | 1.0          | 5.6  |      |
|                                        |                                          | 2.5 ± 0.2               | 3.3 ± 0.3               |                                                  | 1.0          | 4.5  |      |
| t <sub>PLZ</sub> t <sub>PHZ</sub>      | Output Disable Time<br>OE to Bn          | 1.8 ± 0.15              | 2.5 ± 0.2               | C <sub>L</sub> = 30 pF<br>R <sub>L</sub> = 500 Ω | 1.0          | 4.6  | ns   |
|                                        |                                          | 1.8 ± 0.15              | 3.3 ± 0.3               |                                                  | 1.0          | 4.5  |      |
|                                        |                                          | 2.5 ± 0.2               | 3.3 ± 0.3               |                                                  | 1.0          | 4.4  |      |
| t <sub>OSLH</sub><br>t <sub>OSHL</sub> | Output To Output Skew<br>Time (note1, 2) | 1.8 ± 0.15              | 2.5 ± 0.2               | C <sub>L</sub> = 30 pF<br>R <sub>L</sub> = 500 Ω |              | 0.5  | ns   |
|                                        |                                          | 1.8 ± 0.15              | 3.3 ± 0.3               |                                                  |              | 0.5  |      |
|                                        |                                          | 1.8 ± 0.15              | 3.3 ± 0.3               |                                                  |              | 0.75 |      |

## AC ELECTRICAL CHARACTERISTICS

| Symbol                                 | Parameter                             | Test Condition T <sub>A</sub> = -40 to 85 °C |      |                                |      |                               |      | Unit |
|----------------------------------------|---------------------------------------|----------------------------------------------|------|--------------------------------|------|-------------------------------|------|------|
|                                        |                                       | V <sub>CCB</sub> = 1.8 ± 0.15V               |      | V <sub>CCB</sub> = 1.8 ± 0.15V |      | V <sub>CCB</sub> = 2.5 ± 0.2V |      |      |
|                                        |                                       | V <sub>CCA</sub> = 2.5 ± 0.2V                |      | V <sub>CCA</sub> = 3.3 ± 0.3V  |      | V <sub>CCA</sub> = 3.3 ± 0.3V |      |      |
|                                        |                                       | Min.                                         | Max. | Min.                           | Max. | Min.                          | Max. |      |
| t <sub>PLH</sub> , t <sub>PHL</sub>    | Propagation Delay Time An to Bn       | 1.0                                          | 5.8  | 1.0                            | 6.2  | 1.0                           | 4.4  | ns   |
| t <sub>PLH</sub> , t <sub>PHL</sub>    | Propagation Delay Time Bn to An       | 1.0                                          | 5.5  | 1.0                            | 5.1  | 1.0                           | 4.0  |      |
| t <sub>PZL</sub> , t <sub>PZH</sub>    | Output Enable Time <u>OE</u> to An    | 1.0                                          | 5.3  | 1.0                            | 5.1  | 1.0                           | 4.0  | ns   |
| t <sub>PZL</sub> , t <sub>PZH</sub>    | Output Enable Time <u>OE</u> to Bn    | 1.0                                          | 8.3  | 1.0                            | 8.2  | 1.0                           | 4.6  |      |
| t <sub>PLZ</sub> , t <sub>PHZ</sub>    | Output Disable Time <u>OE</u> to An   | 1.0                                          | 5.2  | 1.0                            | 5.6  | 1.0                           | 4.8  | ns   |
| t <sub>PLZ</sub> , t <sub>PHZ</sub>    | Output Disable Time <u>OE</u> to Bn   | 1.0                                          | 4.6  | 1.0                            | 4.5  | 1.0                           | 4.4  |      |
| t <sub>OSLH</sub><br>t <sub>OSHL</sub> | Output To Output Skew Time (note1, 2) |                                              | 5.0  |                                | 0.5  |                               | 0.75 | ns   |

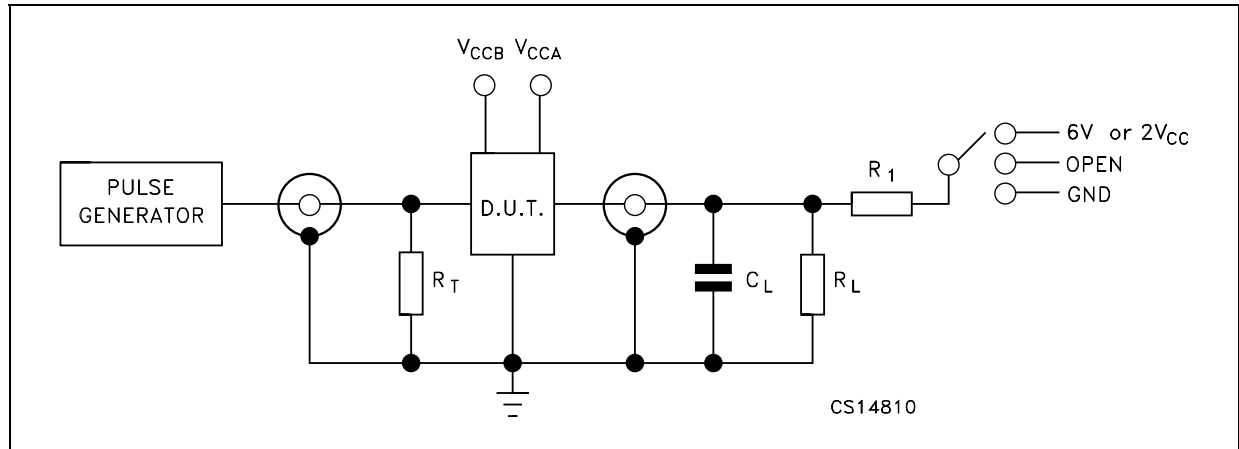
1) Skew is defined as the absolute value of the difference between the actual propagation delay for any two outputs of the same device switching in the same direction, either HIGH or LOW ( $t_{OSLH} = |t_{PLHm} - t_{PLHn}|$ ,  $t_{OSHL} = |t_{PHLm} - t_{PHLn}|$ )  
 2) Parameter guaranteed by design

## CAPACITANCE CHARACTERISTICS

| Symbol           | Parameter                     | Test Condition          |                         |         | Value                  |      |      |              |      | Unit |
|------------------|-------------------------------|-------------------------|-------------------------|---------|------------------------|------|------|--------------|------|------|
|                  |                               | V <sub>CCB</sub><br>(V) | V <sub>CCA</sub><br>(V) |         | T <sub>A</sub> = 25 °C |      |      | -40 to 85 °C |      |      |
|                  |                               |                         |                         |         | Min.                   | Typ. | Max. | Min.         | Max. |      |
| C <sub>INA</sub> | Input Capacitance             | open                    | open                    |         |                        | 5    |      |              |      | V    |
| C <sub>I/O</sub> | Input/Output Capacitance      | 2.5                     | 3.3                     |         |                        | 6    |      |              |      | V    |
| C <sub>PD</sub>  | Power Dissipation Capacitance | 2.5                     | 3.3                     | f=10MHz |                        | 20   |      |              |      | V    |

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 current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/16$  (per circuit)

## TEST CIRCUIT

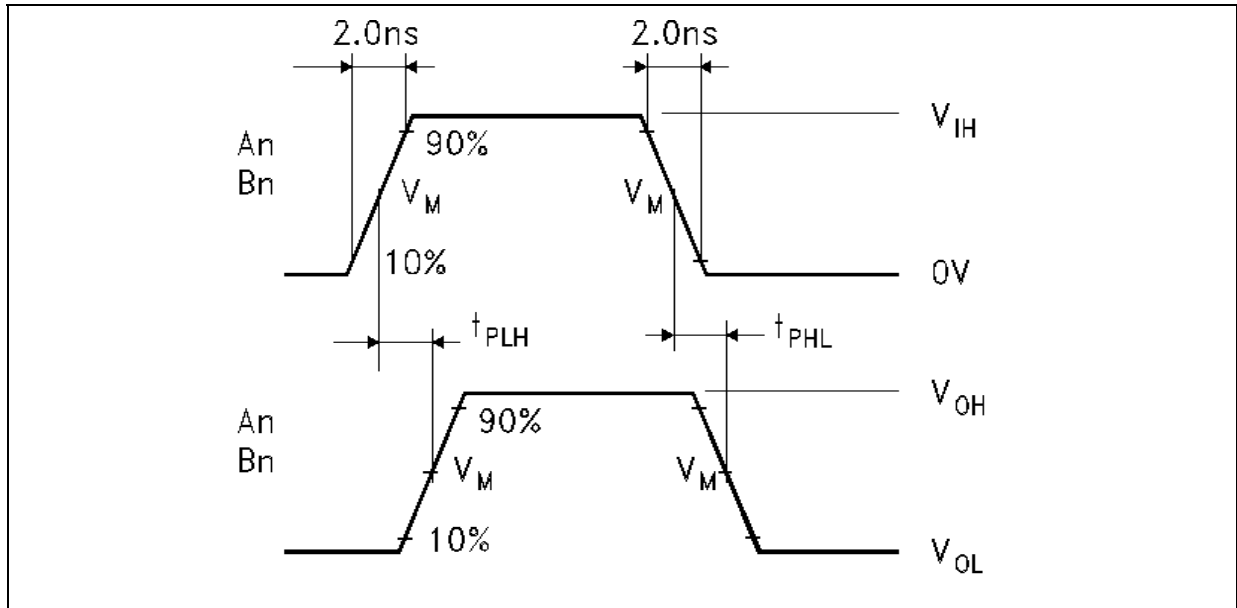
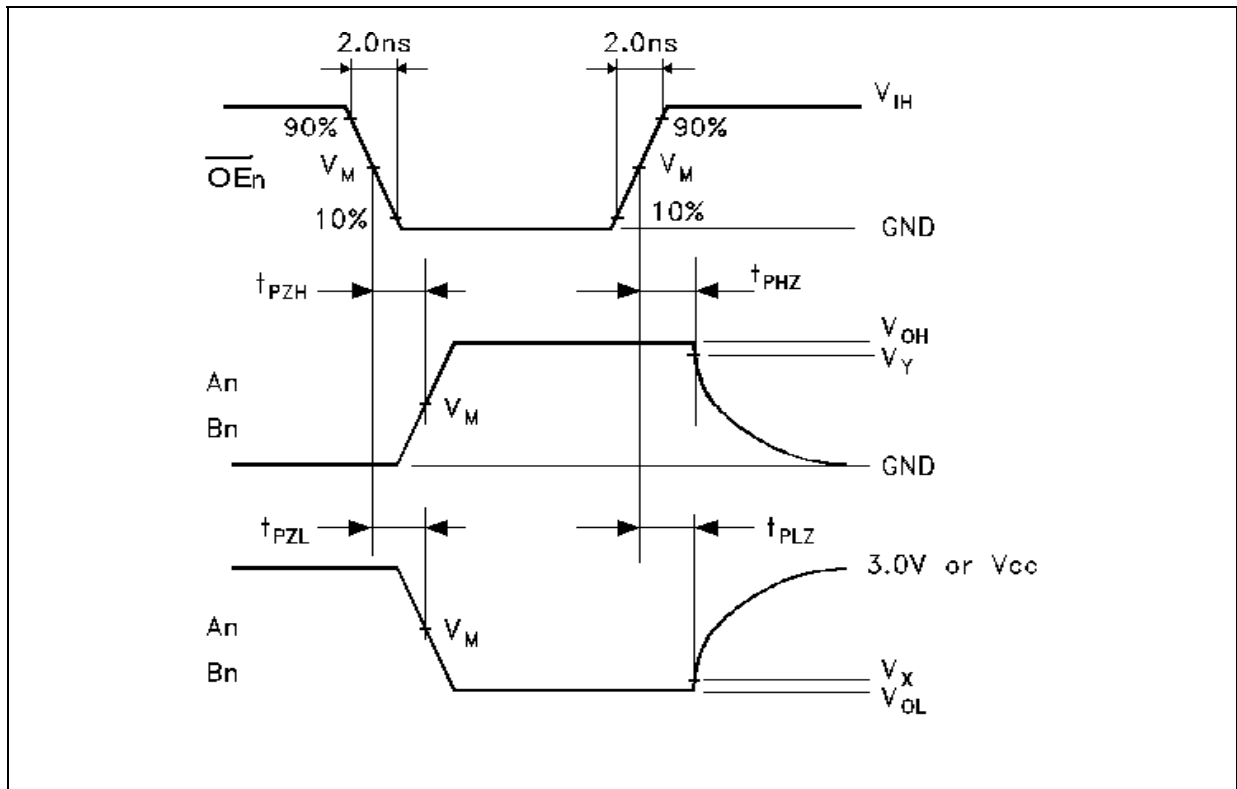


| TEST                                                                             | SWITCH    |
|----------------------------------------------------------------------------------|-----------|
| $t_{PLH}$ , $t_{PHL}$                                                            | Open      |
| $t_{PZL}$ , $t_{PLZ}$ ( $V_{CC} = 3.0$ to $3.6V$ )                               | 6V        |
| $t_{PZL}$ , $t_{PLZ}$ ( $V_{CC} = 2.3$ to $2.7V$ or $V_{CC} = 1.65$ to $1.95V$ ) | $2V_{CC}$ |
| $t_{PZH}$ , $t_{PHZ}$                                                            | GND       |

$C_L = 30pF$  or equivalent (includes jig and probe capacitance)  
 $R_L = R_1 = 500\Omega$  or equivalent  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50\Omega$ )

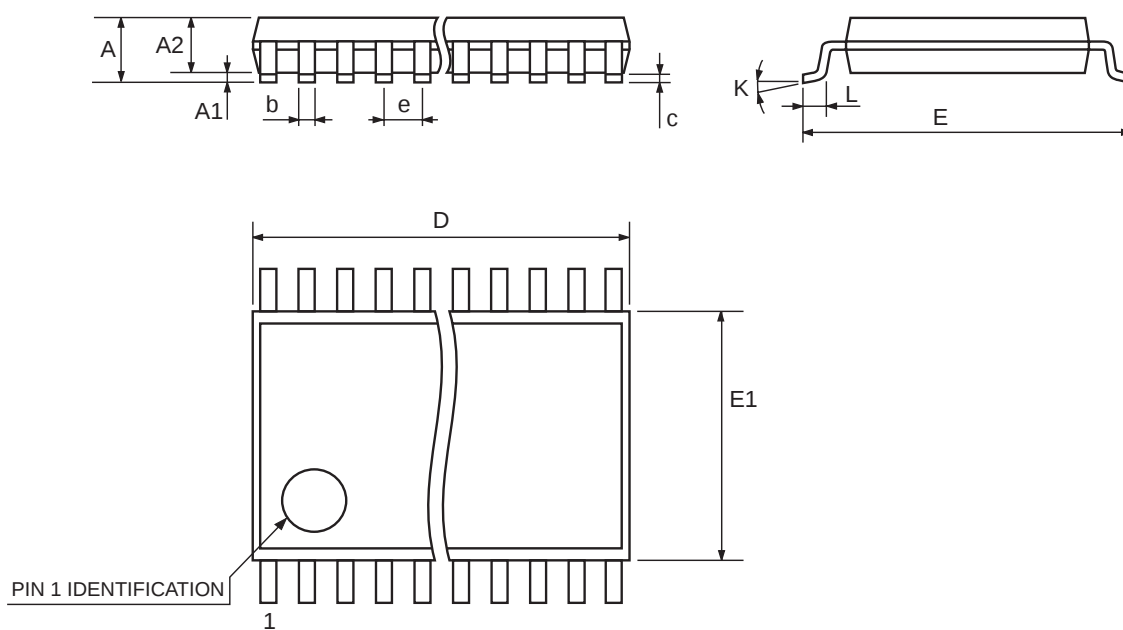
## WAVEFORM SYMBOL VALUE

| Symbol   | $V_{CC}$        |                  |                  |
|----------|-----------------|------------------|------------------|
|          | 3.0 to 3.6V     | 2.3 to 2.7V      | 1.65 to 1.95V    |
| $V_{IH}$ | $V_{CC}$        | $V_{CC}$         | $V_{CC}$         |
| $V_M$    | 1.5V            | $V_{CC}/2$       | $V_{CC}/2$       |
| $V_X$    | $V_{OL} + 0.3V$ | $V_{OL} + 0.15V$ | $V_{OL} + 0.15V$ |
| $V_Y$    | $V_{OL} - 0.3V$ | $V_{OL} - 0.15V$ | $V_{OL} - 0.15V$ |

**WAVEFORM 1: PROPAGATION DELAY** ( $f=1\text{MHz}$ ; 50% duty cycle)**WAVEFORM 2: OUTPUT ENABLE AND DISABLE TIME** ( $f=1\text{MHz}$ ; 50% duty cycle)

## TSSOP48 MECHANICAL DATA

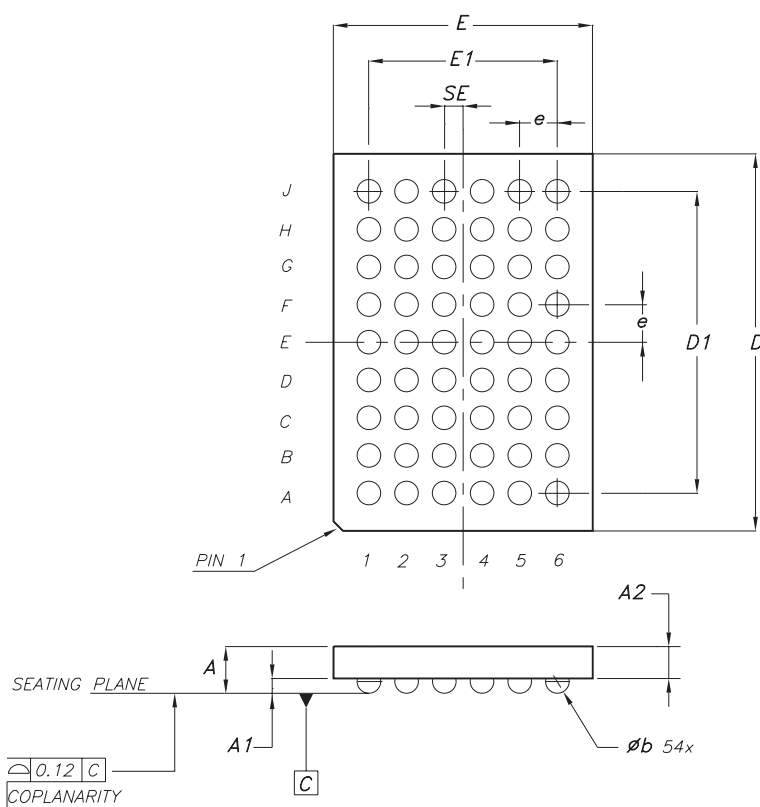
| DIM. | mm.  |         |      | inch   |            |        |
|------|------|---------|------|--------|------------|--------|
|      | MIN. | TYP     | MAX. | MIN.   | TYP.       | MAX.   |
| A    |      |         | 1.2  |        |            | 0.047  |
| A1   | 0.05 |         | 0.15 | 0.002  |            | 0.006  |
| A2   |      | 0.9     |      |        | 0.035      |        |
| b    | 0.17 |         | 0.27 | 0.0067 |            | 0.011  |
| c    | 0.09 |         | 0.20 | 0.0035 |            | 0.0079 |
| D    | 12.4 |         | 12.6 | 0.488  |            | 0.496  |
| E    |      | 8.1 BSC |      |        | 0.318 BSC  |        |
| E1   | 6.0  |         | 6.2  | 0.236  |            | 0.244  |
| e    |      | 0.5 BSC |      |        | 0.0197 BSC |        |
| K    | 0°   |         | 8°   | 0°     |            | 8°     |
| L    | 0.50 |         | 0.75 | 0.020  |            | 0.030  |



7065588C

## TFBGA54 MECHANICAL DATA

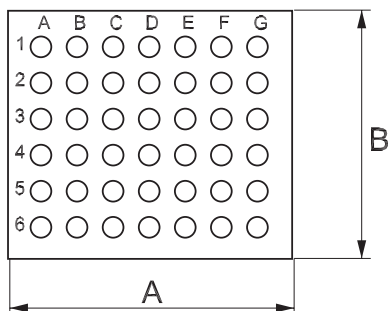
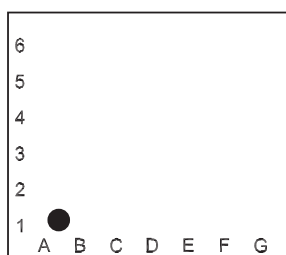
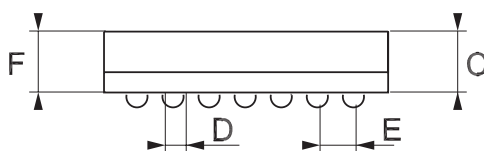
| DIM. | mm.  |     |      | mils  |       |       |
|------|------|-----|------|-------|-------|-------|
|      | MIN. | TYP | MAX. | MIN.  | TYP.  | MAX.  |
| A    |      |     | 1.2  |       |       | 47.2  |
| A1   | 0.25 |     |      | 9.8   |       |       |
| A2   | 0.85 |     |      | 33.5  |       |       |
| B    | 0.45 |     | 0.55 | 17.7  |       | 21.7  |
| D    | 7.9  |     | 8.1  | 311.0 |       | 318.9 |
| D1   |      | 6.4 |      |       | 252.0 |       |
| E    | 5.4  | 5.5 | 5.6  | 212.6 | 216.5 | 220.5 |
| E1   |      | 4   |      |       | 157.5 |       |
| e    |      | 0.8 |      |       | 31.5  |       |
| SE   |      | 0.4 |      |       | 15.7  |       |



0051434/E

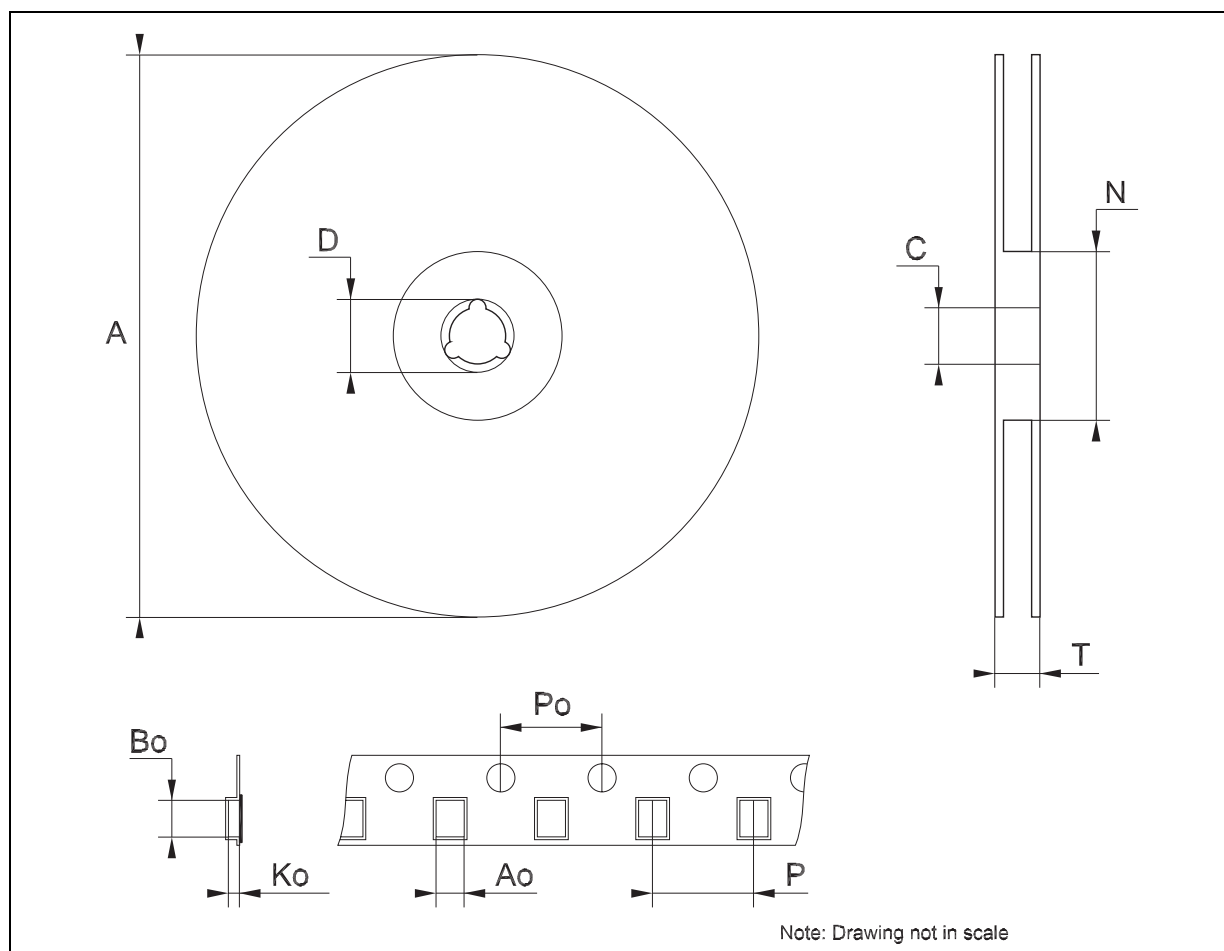
# μFBGA42 MECHANICAL DATA

| DIM. | mm.  |      |      | mils  |      |       |
|------|------|------|------|-------|------|-------|
|      | MIN. | TYP  | MAX. | MIN.  | TYP. | MAX.  |
| A    | 3.90 |      | 4.10 | 153.5 |      | 161.4 |
| B    | 3.40 |      | 3.60 | 133.9 |      | 141.7 |
| C    |      | 1.07 | 1.16 |       | 42.1 | 45.6  |
| D    |      | 0.3  |      |       | 11.8 |       |
| E    |      | 0.5  |      |       | 19.7 |       |
| F    | 0.78 |      | 0.86 | 30.7  |      | 33.9  |



### Tape & Reel TSSOP48 MECHANICAL DATA

| DIM. | mm.  |     |      | inch  |      |        |
|------|------|-----|------|-------|------|--------|
|      | MIN. | TYP | MAX. | MIN.  | TYP. | MAX.   |
| A    |      |     | 330  |       |      | 12.992 |
| C    | 12.8 |     | 13.2 | 0.504 |      | 0.519  |
| D    | 20.2 |     |      | 0.795 |      |        |
| N    | 60   |     |      | 2.362 |      |        |
| T    |      |     | 30.4 |       |      | 1.197  |
| Ao   | 8.7  |     | 8.9  | 0.343 |      | 0.350  |
| Bo   | 13.1 |     | 13.3 | 0.516 |      | 0.524  |
| Ko   | 1.5  |     | 1.7  | 0.059 |      | 0.067  |
| Po   | 3.9  |     | 4.1  | 0.153 |      | 0.161  |
| P    | 11.9 |     | 12.1 | 0.468 |      | 0.476  |



Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

© The ST logo is a registered trademark of STMicroelectronics

© 2003 STMicroelectronics - Printed in Italy - All Rights Reserved  
STMicroelectronics GROUP OF COMPANIES

Australia - Brazil - Canada - China - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco  
Singapore - Spain - Sweden - Switzerland - United Kingdom - United States.

© <http://www.st.com>

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- Конкурентоспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



Тел: +7 (812) 336 43 04 (многоканальный)

Email: [org@lifeelectronics.ru](mailto:org@lifeelectronics.ru)

[www.lifeelectronics.ru](http://www.lifeelectronics.ru)