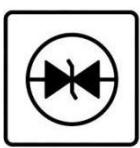




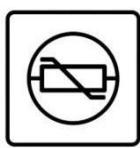
ESD



TVS



TSS



MOV



GDT



PLED

**MTXS0102**

**Product specification**

## Description

This two-bit non-inverting translator which is a bidirectional voltage-level translator and can be used to build digital switching compatibility between multi voltage systems. This IC uses two separate configurable power supply tracks that including A ports supporting operating voltages from 1.65 V to 3.6 V with tracking  $V_{CCA}$  supply, and also including B ports supporting operating voltages from 2.3 V to 5.5 V with tracking  $V_{CCB}$  supply.

The advantage above provides the support of both lower and higher logic signal levels while providing bidirectional translation capabilities between any of the 1.8-V, 2.5-V, 3.3-V, and 5-V voltage circuit points.

Placing output-enable (OE) input to low level, all I/Os are forced to high-impedance state that significantly lower the quiescent current consumption. In order to ensure the high-impedance state during power up or power down, OE pin should be tied to GND via a pulldown resistor; the minimum value of the resistor is determined by the current-sourcing capability of the driver.

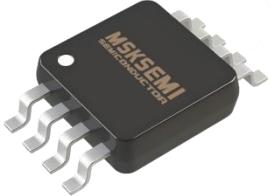
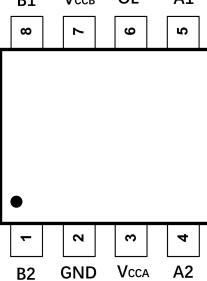
## Features

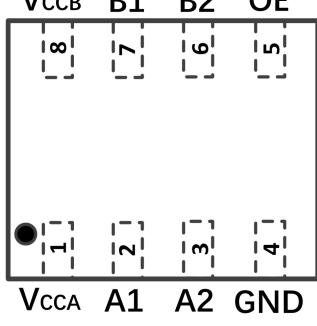
- No direction -control
- Data rates
  - 24 Mbps (Push Pull)
  - 2 Mbps (Open)
- 1.65 V to 3.6 V on A port and 2.3 V to 5.5 V on B port ( $V_{CCA} \leq V_{CCB}$ )
- VCC isolation feature: If either VCC input is at GND, both ports are in the high -impedance state
- No power -supply sequencing required: either  $V_{CCA}$  or  $V_{CCB}$  can be ramped first
- $I_{off}$  supports partial -power -down mode operation
- Operating temperature range: -40°C to +85°C

## Applications

- Handset/Smartphone
- MART
- IPC
- GPIO

## Reference News

| MTXS0102DCUR   | Pinning and Package   | Marking   |           |    |    |   |   |   |   |   |  |  |  |   |   |   |   |    |     |           |    |  |
|--|---|-----------|-----------|----|----|---|---|---|---|---|--|--|--|---|---|---|---|----|-----|-----------|----|--|
| <br>VSSOP-8 | <br><table border="1"> <tr> <td>B1</td> <td><math>V_{CCB}</math></td> <td>OE</td> <td>A1</td> </tr> <tr> <td>8</td> <td>7</td> <td>6</td> <td>5</td> </tr> <tr> <td>•</td> <td></td> <td></td> <td></td> </tr> <tr> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>B2</td> <td>GND</td> <td><math>V_{CCA}</math></td> <td>A2</td> </tr> </table> | B1        | $V_{CCB}$ | OE | A1 | 8 | 7 | 6 | 5 | • |  |  |  | 1 | 2 | 3 | 4 | B2 | GND | $V_{CCA}$ | A2 | <br>FE NZ MSK |
| B1   | $V_{CCB}$   | OE        | A1        |    |    |   |   |   |   |   |  |  |  |   |   |   |   |    |     |           |    |  |
| 8  | 7   | 6         | 5         |    |    |   |   |   |   |   |  |  |  |   |   |   |   |    |     |           |    |  |
| •  |   |           |           |    |    |   |   |   |   |   |  |  |  |   |   |   |   |    |     |           |    |  |
| 1  | 2   | 3         | 4         |    |    |   |   |   |   |   |  |  |  |   |   |   |   |    |     |           |    |  |
| B2   | GND   | $V_{CCA}$ | A2        |    |    |   |   |   |   |   |  |  |  |   |   |   |   |    |     |           |    |  |

| MTXS0102DQER   | Pinning and Package   | Marking   |     |    |    |   |   |   |   |   |   |   |   |           |    |    |     |  |
|--|---|-----------|-----|----|----|---|---|---|---|---|---|---|---|-----------|----|----|-----|--|
| <br>X2-SON-8(1x1.4) | <br><table border="1"> <tr> <td><math>V_{CCB}</math></td> <td>B1</td> <td>B2</td> <td>OE</td> </tr> <tr> <td>8</td> <td>7</td> <td>6</td> <td>5</td> </tr> <tr> <td>•</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td><math>V_{CCA}</math></td> <td>A1</td> <td>A2</td> <td>GND</td> </tr> </table> | $V_{CCB}$ | B1  | B2 | OE | 8 | 7 | 6 | 5 | • | 1 | 2 | 3 | $V_{CCA}$ | A1 | A2 | GND | <br>0102 **** |
| $V_{CCB}$  | B1  | B2        | OE  |    |    |   |   |   |   |   |   |   |   |           |    |    |     |  |
| 8  | 7   | 6         | 5   |    |    |   |   |   |   |   |   |   |   |           |    |    |     |  |
| •  | 1   | 2         | 3   |    |    |   |   |   |   |   |   |   |   |           |    |    |     |  |
| $V_{CCA}$  | A1  | A2        | GND |    |    |   |   |   |   |   |   |   |   |           |    |    |     |  |

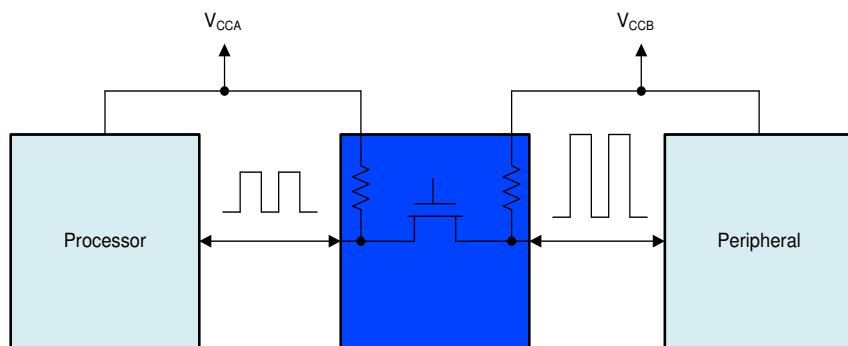
## Device Summary, Pin and Packages (Continued)

| Pin  |     |      |      | I/O | Function   |
|------|-----|------|------|-----|--|
| Name | YH8 | DQER | DCUR |     |  |
| VCCB | 1   | 8    | 7    | -   | B Port Supply Voltage. $2.3V \leq VCCB \leq 5.5V$  |
| B1   | 2   | 7    | 8    | I/O | Input/Output B1. Referenced to VCCB.   |
| B2   | 3   | 6    | 1    | I/O | Input/Output B2. Referenced to VCCB.   |
| OE   | 4   | 5    | 6    | I   | Output Enable (Active High). Pull OE low to place all outputs in 3-state mode. Referenced to VCCA. |
| GND  | 5   | 4    | 2    | -   | Ground   |
| A2   | 6   | 3    | 4    | I/O | Input/Output A2. Referenced to VCCA.   |
| A1   | 7   | 2    | 5    | I/O | Input/Output A1. Referenced to VCCA.   |
| VCCA | 8   | 1    | 3    | -   | A Port Supply Voltage. $1.65V \leq VCCA \leq 3.6V$ and $VCCA \leq VCCB$ .                          |

## Order information

| Orderable Device | Package         | Packing Option |
|------------------|-----------------|----------------|
| MTXS0102DCUR     | VSSOP-8         | 3000PCS        |
| MTXS0102DQER     | X2-SON-8(1x1.4) | 5000PCS        |

## Circuit Diagram



## Absolute Maximum Ratings

| Parameters  |           | Min  | Max           | Unit |
|---|-----------|------|---------------|------|
| Supply voltage, $V_{CCA}$   |           | -0.3 | 6.0           | V    |
| Supply voltage, $V_{CCB}$   |           | -0.3 | 6.0           | V    |
| Input voltage range, $V_I$  | A port    | -0.3 | 6.0           | V    |
|   | B port    | -0.3 | 6.0           |      |
| Voltage range applied to any output in the high-impedance or power-off state, $V_O$ | A port    | -0.3 | 6.0           | V    |
|   | B port    | -0.3 | 6.0           |      |
| Voltage range applied to any output in the high or low state, $V_O$                 | A port    | -0.3 | $V_{CCA}+0.3$ | V    |
|   | B port    | -0.3 | $V_{CCA}+0.3$ |      |
| Input clamp current, $I_{IK}$   | $V_I < 0$ |      | -50           | mA   |
| Output clamp current, $I_{OK}$  | $V_O < 0$ |      | -50           | mA   |
| Continuous output current, $I_O$  |           |      | $\pm 50$      | mA   |
| Continuous current through $V_{CCA}$ , $V_{CCB}$ or GND                             |           |      | $\pm 100$     | mA   |
| Maximum junction temperature  |           |      | 150           | °C   |
| Storage temperature range   |           | -65  | 150           | °C   |

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

(2) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed

(3) The value of  $V_{CCA}$  and  $V_{CCB}$  are provided in the recommended operating conditions table.

## ESD Ratings

| ESD    |                         | Value                                     | Unit |
|--------|-------------------------|---|------|
| V(ESD) | Electrostatic Discharge | Human-Body Model (HBM) <sup>(1)</sup>     | ±5K  |
|        |                         | Charged-Device Model (CDM) <sup>(2)</sup> | ±2K  |

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

## Recommended Operating Conditions

$V_{CCI}$  is the supply voltage associated with the input port.  $V_{CCO}$  is the supply Voltage associated with the output port.

| Parameter   | Conditions                    |  | Min                  | Typ | Max                   | Unit |
|---|-------------------------------|--|----------------------|-----|-----------------------|------|
| Supply voltage <sup>(1)</sup>                             | $V_{CCA}$                     |  | 1.65                 |     | 3.6                   | V    |
|   | $V_{CCB}$                     |  | 2.3                  |     | 5.5                   |      |
| High-level input voltage( $V_{IH}$ )                      | A-port I/Os                   | $V_{CCA}=1.65\text{ V to }1.95\text{ V}$<br>$V_{CCB}=2.3\text{ V to }5.5\text{ V}$ | $V_{CCI}-0.2$        |     | $V_{CCI}$             | V    |
|   |                               | $V_{CCA}=2.3\text{ V to }3.6\text{ V}$<br>$V_{CCB}=2.3\text{ V to }5.5\text{ V}$   | $V_{CCI}-0.4$        |     | $V_{CCI}$             |      |
|   | B-port I/Os                   | $V_{CCA}=1.65\text{ V to }3.6\text{ V}$<br>$V_{CCB}=2.3\text{ V to }5.5\text{ V}$  | $V_{CCI}-0.4$        |     | $V_{CCI}$             |      |
|   | OE input                      | $V_{CCA}=1.65\text{ V to }3.6\text{ V}$<br>$V_{CCB}=2.3\text{ V to }5.5\text{ V}$  | $V_{CCI} \times 0.8$ |     | 5.5                   |      |
| Low-level input voltage( $V_{IL}$ ) <sup>(2)</sup>        | A-port I/Os                   | $V_{CCA}=1.65\text{ V to }1.95\text{ V}$<br>$V_{CCB}=2.3\text{ V to }5.5\text{ V}$ | 0                    |     | 0.15                  | V    |
|   | B-port I/Os                   | $V_{CCA}=1.65\text{ V to }3.6\text{ V}$<br>$V_{CCB}=2.3\text{ V to }5.5\text{ V}$  | 0                    |     | 0.15                  |      |
| OE  | OE input                      | $V_{CCA}=1.65\text{ V to }3.6\text{ V}$<br>$V_{CCB}=2.3\text{ V to }5.5\text{ V}$  | 0                    |     | $V_{CCA} \times 0.25$ | V    |
| Input transition rise or fall rate( $\Delta t/\Delta v$ ) | A-port I/Os push-pull driving |  |                      |     | 10                    | ns/V |
|   | B-port I/Os push-pull driving |  |                      |     | 10                    |      |
|   | Control input                 |  |                      |     | 10                    |      |
| TA Operating free- air temperature                        | -                             |  | -40                  |     | 85                    | °C   |

(1)  $V_{CCA}$  must be less than or equal to  $V_{CCB}$ .

(2) The maximum  $V_{IL}$  value is provided to ensure that a valid  $V_{OL}$  is maintained. The  $V_{OL}$  value is  $V_{IL}$  plus the voltage drop across the pass gate transistor.

## Electrical Characteristics

over recommended operating free-air temperature range (unless otherwise noted) <sup>(1)(2)(3)</sup>

| Parameter                           |                                      | Conditions  | V <sub>CCA</sub>          | V <sub>CCB</sub> | Temp  | Min                           | Typ | Max       | Unit    |
|-------------------------------------|--------------------------------------|---|---------------------------|------------------|-------|-------------------------------|-----|-----------|---------|
| V <sub>OHA</sub>                    | PortA Output High Voltage            | I <sub>OH</sub> =20 $\mu$ A<br>V <sub>IB</sub> $\geq$ V <sub>CCB</sub> - 0.4V | 1.65V to 3.6V             | 2.3V to 5.5V     | Full  | V <sub>CCA</sub> $\times$ 0.7 |     |           | V       |
| V <sub>OLA</sub>                    | PortA Output Low Voltage             | I <sub>OL</sub> =1mA<br>V <sub>IA</sub> $\leq$ 0.15 V                         | 1.65V to 3.6V             | 2.3V to 5.5V     | Full  |                               |     | 0.3       | V       |
| V <sub>OHB</sub>                    | PortB Output High Voltage            | I <sub>OH</sub> =20 $\mu$ A<br>V <sub>IA</sub> $\geq$ V <sub>CCA</sub> - 0.4V | 1.65V to 3.6V             | 2.3V to 5.5V     | Full  | V <sub>CCA</sub> $\times$ 0.7 |     |           | V       |
| V <sub>OLB</sub>                    | PortB Output Low Voltage             | I <sub>OL</sub> =1mA<br>V <sub>IA</sub> $\leq$ 0.15 V                         | 1.65V to 3.6V             | 2.3V to 5.5V     | Full  |                               |     | 0.3       | V       |
| I                                   | Input Leakage Current                | OE  | 1.65V to 3.6V             | 2.3V to 5.5V     | +25°C |                               |     | $\pm$ 1   | $\mu$ A |
|                                     |                                      |   |                           |                  | Full  |                               |     | $\pm$ 1.5 |         |
| I <sub>bf</sub>                     | Partial Power Down Current           | A Ports   | 0V                        | 0V to 5.5V       | +25°C |                               |     | $\pm$ 0.5 | $\mu$ A |
|                                     |                                      |   |                           |                  | Full  |                               |     | $\pm$ 1   |         |
|                                     |                                      | B Ports   | 0V to 3.6V                | 0V               | +25°C |                               |     | $\pm$ 0.5 |         |
|                                     |                                      |   |                           |                  | Full  |                               |     | $\pm$ 1   |         |
| I <sub>OZ</sub>                     | High-impedance State Output Current  | A or B port<br>OE=0V  | 1.65V to 3.6V             | 2.3V to 5.5V     | +25°C |                               |     | $\pm$ 0.5 | $\mu$ A |
|                                     |                                      |   |                           |                  | Full  |                               |     | $\pm$ 1   |         |
| I <sub>CCA</sub>                    | V <sub>CCA</sub> Supply Current      | V <sub>I</sub> =V <sub>O</sub> =open<br>I <sub>O</sub> =0                     | 1.65V to V <sub>CCB</sub> | 2.3V to 5.5V     | Full  |                               |     | 2.5       | $\mu$ A |
|                                     |                                      |   | 3.6V                      | 0V               | Full  |                               |     | 2.5       |         |
|                                     |                                      |   | 0V                        | 5.5V             | Full  |                               |     | -1        |         |
| I <sub>CCB</sub>                    | V <sub>CCB</sub> Supply Current      | V <sub>I</sub> =V <sub>O</sub> =open<br>I <sub>O</sub> =0                     | 1.65V to V <sub>CCB</sub> | 2.3V to 5.5V     | Full  |                               |     | 10        | $\mu$ A |
|                                     |                                      |   | 3.6V                      | 0V               | Full  |                               |     | -1        |         |
|                                     |                                      |   | 0V                        | 5.5V             | Full  |                               |     | 1         |         |
| I <sub>CCA</sub> + I <sub>CCB</sub> | Combined Supply Current              | V <sub>I</sub> =V <sub>CC</sub> or GND<br>I <sub>O</sub> =0                   | 1.65V to V <sub>CCB</sub> | 2.3V to 5.5V     | Full  |                               |     | 13        | $\mu$ A |
| I <sub>CCZA</sub>                   | V <sub>CCA</sub> Supply Current      | V <sub>I</sub> =V <sub>CC</sub> or 0V<br>I <sub>O</sub> =0, OE=0V             | 1.65V to V <sub>CCB</sub> | 2.3V to 5.5V     | Full  |                               |     | 1         | $\mu$ A |
| I <sub>CCZB</sub>                   | V <sub>CCB</sub> Supply Current      | V <sub>I</sub> =V <sub>CC</sub> or 0V<br>I <sub>O</sub> =0, OE=0V             | 2.3V to 3.6V              | 2.3V to 5.5V     | Full  |                               |     | 1         | $\mu$ A |
| C <sub>i</sub>                      | Input Capacitance                    | OE  | 3.3V                      | 3.3V             | +25°C |                               | 2.5 |           | PF      |
| C <sub>io</sub>                     | Input-to-output Internal Capacitance | A Port  | 3.3V                      | 3.3V             | +25°C |                               | 5   |           | PF      |
|                                     |                                      | B Port  | 3.3V                      | 3.3V             | +25°C |                               | 5   |           |         |

(1) V<sub>CC</sub> is the VCC associated with the input port.

(2) V<sub>CC</sub> is the VCC associated with the output port

(3) V<sub>CCA</sub> must be less than or equal to V<sub>CCB</sub>.

## Timing Requirements

 **$V_{CCA}=1.8V \pm 0.15V$** 

|                           |                                  | $V_{CCB}=2.5V \pm 0.2V$ | $V_{CCB}=3.3V \pm 0.2V$ | $V_{CCB}=5V \pm 0.2V$ | <b>Unit</b> |
|---------------------------|----------------------------------|-------------------------|-------------------------|-----------------------|-------------|
|                           |                                  | <b>Typ</b>              | <b>Typ</b>              | <b>Typ</b>            |             |
| <b>Data Rate</b>          | Push-pull Driving                | 21                      | 22                      | 24                    | <b>Mbps</b> |
|                           | Open-drain Driving               | 2                       | 2                       | 2                     |             |
| <b>Pulse Duration(tw)</b> | Push-pull Driving (Data Inputs)  | 47                      | 45                      | 41                    | <b>ns</b>   |
|                           | Open-drain Driving (Data Inputs) | 500                     | 500                     | 500                   |             |

 **$V_{CCA}=2.5V \pm 0.15V$** 

|                           |                                  | $V_{CCB}=2.5V \pm 0.2V$ | $V_{CCB}=3.3V \pm 0.2V$ | $V_{CCB}=5V \pm 0.2V$ | <b>Unit</b> |
|---------------------------|----------------------------------|-------------------------|-------------------------|-----------------------|-------------|
|                           |                                  | <b>Typ</b>              | <b>Typ</b>              | <b>Typ</b>            |             |
| <b>Data Rate</b>          | Push-pull Driving                | 20                      | 22                      | 24                    | <b>Mbps</b> |
|                           | Open-drain Driving               | 2                       | 2                       | 2                     |             |
| <b>Pulse Duration(tw)</b> | Push-pull Driving (Data Inputs)  | 50                      | 45                      | 41                    | <b>ns</b>   |
|                           | Open-drain Driving (Data Inputs) | 500                     | 500                     | 500                   |             |

 **$V_{CCA}=3.3V \pm 0.15V$** 

|                           |                                  | $V_{CCB}=3.3V \pm 0.2V$ | $V_{CCB}=5V \pm 0.2V$ | <b>Unit</b> |
|---------------------------|----------------------------------|-------------------------|-----------------------|-------------|
|                           |                                  | <b>Typ</b>              | <b>Typ</b>            |             |
| <b>Data Rate</b>          | Push-pull Driving                | 23                      | 24                    | <b>Mbps</b> |
|                           | Open-drain Driving               | 2                       | 2                     |             |
| <b>Pulse Duration(tw)</b> | Push-pull Driving (Data Inputs)  | 43                      | 41                    | <b>ns</b>   |
|                           | Open-drain Driving (Data Inputs) | 500                     | 500                   |             |

**Switching Characteristics:  $V_{CC}=1.8V \pm 0.15V$** 

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

| Parameter         |  | Conditions              |                    | $V_{CCB}=2.5V \pm 0.2V$ | $V_{CCB}=3.3V \pm 0.2V$ | $V_{CCB}=5V \pm 0.2V$ | Units |
|-------------------|--|-------------------------|--------------------|-------------------------|-------------------------|-----------------------|-------|
|                   |  |                         |                    | Typ                     | Typ                     | Typ                   |       |
| $t_{PHL}$         | Propagation Delay Time<br>High-to-low Output | A to B                  | Push-pull Driving  | 5.6                     | 5                       | 5                     | ns    |
|                   |  |                         | Open-drain Driving | 7.5                     | 7.9                     | 8.3                   |       |
| $t_{PLH}$         | Propagation Delay Time<br>low-to-high Output | A to B                  | Push-pull Driving  | 10.0                    | 9.5                     | 9                     | ns    |
|                   |  |                         | Open-drain Driving | 181                     | 170                     | 154                   |       |
| $t_{PHL}$         | Propagation Delay Time<br>High-to-low Output | B to A                  | Push-pull Driving  | 7                       | 7.1                     | 7.2                   | ns    |
|                   |  |                         | Open-drain Driving | 7.6                     | 8.1                     | 9.2                   |       |
| $t_{PLH}$         | Propagation Delay Time<br>low-to-high Output | B to A                  | Push-pull Driving  | 7.6                     | 6.9                     | 6                     | ns    |
|                   |  |                         | Open-drain Driving | 163                     | 145                     | 118                   |       |
| $t_{en}$          | Enable Time                                  | OE to A or B            |                    | 135                     | 159                     | 182                   | ns    |
| $t_{dis}$         | Disable Time                                 | OE to A or B            |                    | 170                     | 174                     | 181                   | ns    |
| $t_{rA}$          | Input Rise Time                              | A port rise time        | Push-pull Driving  | 13.4                    | 11.9                    | 10.6                  | ns    |
|                   |  |                         | Open-drain Driving | 68                      | 66                      | 62                    |       |
| $t_{rB}$          | Input Rise Time                              | B port rise time        | Push-pull Driving  | 13                      | 12                      | 11.6                  | ns    |
|                   |  |                         | Open-drain Driving | 66                      | 65                      | 50                    |       |
| $t_{fA}$          | Input Fall Time                              | A port fall time        | Push-pull Driving  | 5.6                     | 4.7                     | 4.0                   | ns    |
|                   |  |                         | Open-drain Driving | 5.0                     | 5.1                     | 5.2                   |       |
| $t_{fB}$          | Input Fall Time                              | B port fall time        | Push-pull Driving  | 3.0                     | 3.0                     | 2.9                   | ns    |
|                   |  |                         | Open-drain Driving | 6.1                     | 5.6                     | 4.4                   |       |
| $t_{sk(o)}$       | Skew(time), Output                           | Channel-to-Channel Skew |                    | 0.5                     | 0.5                     | 0.5                   | ns    |
| Maximum Data Rate |  | Push-pull Driving       |                    | 22                      | 23                      | 24                    | Mbps  |
|                   |  | Open-drain Driving      |                    | 2                       | 2                       | 2                     |       |

**Switching Characteristics: V<sub>cc</sub>=2.5V±0.15V**

over operating free-air temperature range (unless otherwise noted)

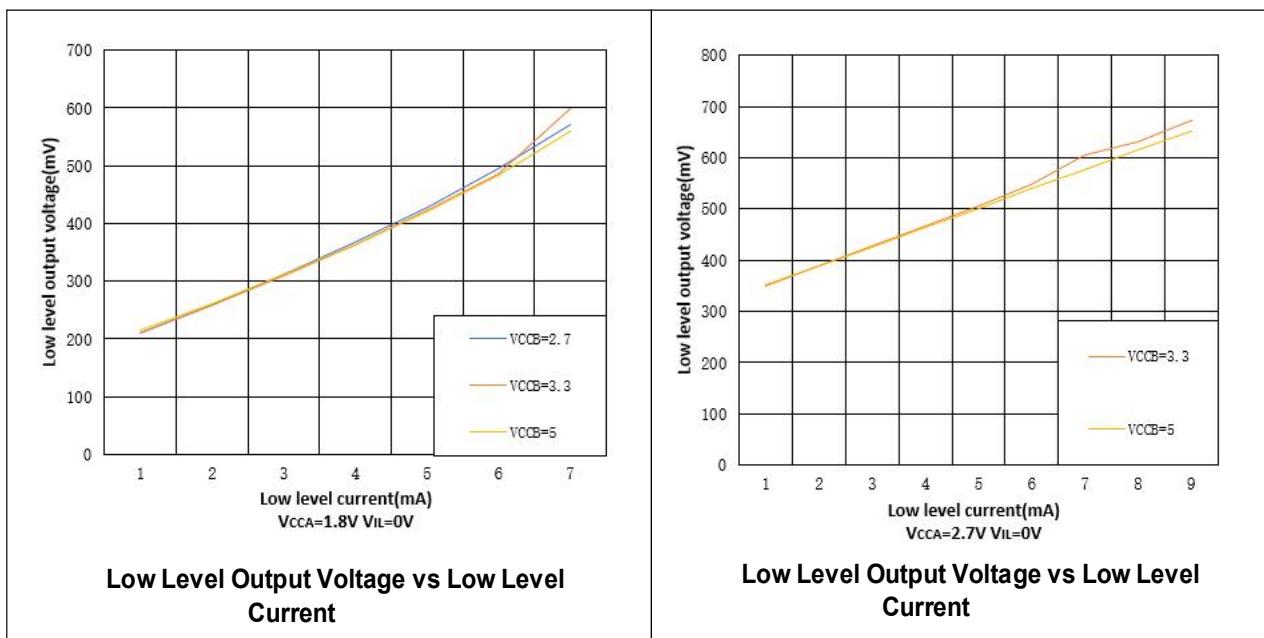
| Parameter          |  | Conditions              |                    | V <sub>ccB</sub> =2.5V±0.2V | V <sub>ccB</sub> =3.3V±0.2V | V <sub>ccB</sub> =5V±0.2V | Units |
|--------------------|--|-------------------------|--------------------|-----------------------------|-----------------------------|---------------------------|-------|
|                    |  |                         |                    | Typ                         | Typ                         | Typ                       |       |
| t <sub>PHL</sub>   | Propagation Delay Time<br>High-to-low Output | A to B                  | Push-pull Driving  | 3.5                         | 3.5                         | 3.2                       | ns    |
|                    |  |                         | Open-drain Driving | 6.3                         | 6.5                         | 6.7                       |       |
| t <sub>PLH</sub>   | Propagation Delay Time<br>low-to-high Output | A to B                  | Push-pull Driving  | 4.5                         | 4.9                         | 4.7                       | ns    |
|                    |  |                         | Open-drain Driving | 158                         | 152                         | 142                       |       |
| t <sub>PHL</sub>   | Propagation Delay Time<br>High-to-low Output | B to A                  | Push-pull Driving  | 3.7                         | 3.9                         | 4.6                       | ns    |
|                    |  |                         | Open-drain Driving | 6                           | 6.6                         | 7.7                       |       |
| t <sub>PLH</sub>   | Propagation Delay Time<br>low-to-high Output | B to A                  | Push-pull Driving  | 4.8                         | 4                           | 2.5                       | ns    |
|                    |  |                         | Open-drain Driving | 153                         | 138                         | 116                       |       |
| t <sub>en</sub>    | Enable Time                                  | OE to A or B            |                    | 7.7                         | 41.8                        | 130                       | ns    |
| t <sub>dis</sub>   | Disable Time                                 | OE to A or B            |                    | 175                         | 181                         | 182                       | ns    |
| t <sub>rA</sub>    | Input Rise Time                              | A port<br>Rise Time     | Push-pull Driving  | 9.8                         | 8.6                         | 7.5                       | ns    |
|                    |  |                         | Open-drain Driving | 79                          | 77                          | 65                        |       |
| t <sub>rB</sub>    | Input Rise Time                              | B port<br>Rise Time     | Push-pull Driving  | 9.8                         | 8.7                         | 8.1                       | ns    |
|                    |  |                         | Open-drain Driving | 93                          | 68                          | 53                        |       |
| t <sub>fA</sub>    | Input Fall Time                              | Aport Fall<br>Time      | Push-pull Driving  | 4.6                         | 4.1                         | 3.6                       | ns    |
|                    |  |                         | Open-drain Driving | 5.1                         | 5.1                         | 5.2                       |       |
| t <sub>fB</sub>    | Input Fall Time                              | Bport Fall<br>Time      | Push-pull Driving  | 4.5                         | 4.0                         | 4.0                       | ns    |
|                    |  |                         | Open-drain Driving | 6.9                         | 7.4                         | 7.8                       |       |
| t <sub>sk(o)</sub> | Skew(time), Output                           | Channel-to-Channel Skew |                    | 0.5                         | 0.5                         | 0.5                       | ns    |
| Maximum Data Rate  |  | Push-pull Driving       |                    | 22                          | 24                          | 24                        | Mbps  |
|                    |  | Open-drain Driving      |                    | 2                           | 2                           | 2                         |       |

**Switching Characteristics: V<sub>cc</sub>=3.3V±0.15V**

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

| Parameter          |  | Conditions              |                    | V <sub>ccB</sub> =3.3V±0.2V | V <sub>ccB</sub> =5V±0.2V | Units |
|--------------------|--|-------------------------|--------------------|-----------------------------|---------------------------|-------|
|                    |  |                         |                    | TYP                         | TYP                       |       |
| t <sub>PHL</sub>   | Propagation Delay Time<br>High-to-low Output | A to B                  | Push-pull Driving  | 2.1                         | 2.2                       | ns    |
|                    |  |                         | Open-drain Driving | 5.9                         | 6.1                       |       |
| t <sub>PLH</sub>   | Propagation Delay Time<br>High-to-low Output | A to B                  | Push-pull Driving  | 1                           | 3.3                       | ns    |
|                    |  |                         | Open-drain Driving | 138                         | 131                       |       |
| t <sub>PHL</sub>   | Propagation Delay Time<br>High-to-low Output | B to A                  | Push-pull Driving  | 2.3                         | 2.6                       | ns    |
|                    |  |                         | Open-drain Driving | 5.4                         | 6.6                       |       |
| t <sub>PLH</sub>   | Propagation delay time<br>low-to-high Output | B to A                  | Push-pull Driving  | 1.0                         | 1.0                       | ns    |
|                    |  |                         | Open-drain Driving | 133                         | 115                       |       |
| t <sub>en</sub>    | Enable Time                                  | OE to A or B            |                    | 4.7                         | 5.2                       | ns    |
| t <sub>dis</sub>   | Disable Time                                 | OE to A or B            |                    | 174                         | 182                       | ns    |
| t <sub>rA</sub>    | Input Rise Time                              | A port<br>Rise Time     | Push-pull Driving  | 7.4                         | 6.6                       | ns    |
|                    |  |                         | Open-drain Driving | 75                          | 67                        |       |
| t <sub>rB</sub>    | Input Rise Time                              | B port<br>Rise Time     | Push-pull Driving  | 7.7                         | 7.1                       | ns    |
|                    |  |                         | Open-drain Driving | 70                          | 65                        |       |
| t <sub>fA</sub>    | Input Fall Time                              | Aport Fall<br>Time      | Push-pull Driving  | 3.4                         | 3.0                       | ns    |
|                    |  |                         | Open-drain Driving | 5.1                         | 5.1                       |       |
| t <sub>fB</sub>    | Input Fall Time                              | Bport Fall<br>Time      | Push-pull Driving  | 3.5                         | 3.2                       | ns    |
|                    |  |                         | Open-drain Driving | 6.8                         | 6.7                       |       |
| t <sub>sk(o)</sub> | Skew(time), Output                           | Channel-to-Channel Skew |                    | 0.5                         | 0.5                       | ns    |
| Maximum Data Rate  |  | Push-pull Driving       |                    | 24                          | 24                        | Mbps  |
|                    |  | Open-drain Driving      |                    | 2                           | 2                         |       |

## Typical Characteristics

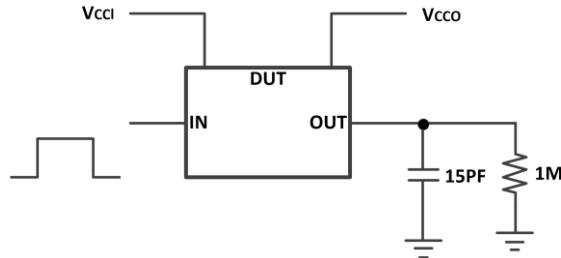


## Parameter Measurement Information

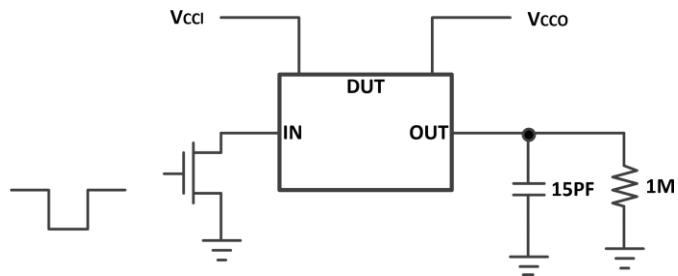
Unless otherwise noted, all input pulsed are supplied by generators having the following characteristics:

- PSRR 10MHz
- $Z_o=50\ \Omega$
- $dv/dt \geq 1V/ns$

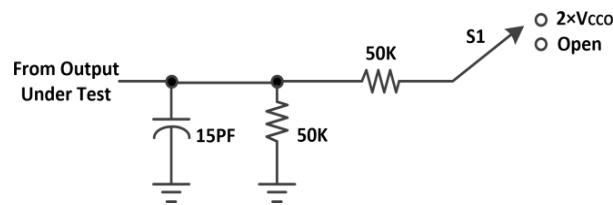
Note: All input pulses are measured one at a time with one transition per measurement



**Data Rate, Pulse Duration, Propagation Delay, Output Rise and Fall Time Measurement Using a Push-Pull Driver**



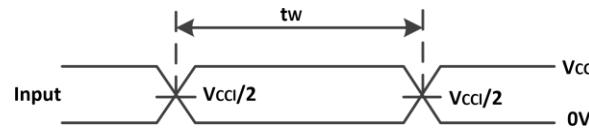
**Data Rate, Pulse Duration, Propagation Delay, Output Rise and Fall Time Measurement Using an Open-Drain Driver**

**Parameter Measurement Information (Continued)**

**Load Circuit for Enable/Disable Time Measurement**
**Switch Configuration for Enable/Disable Timing**

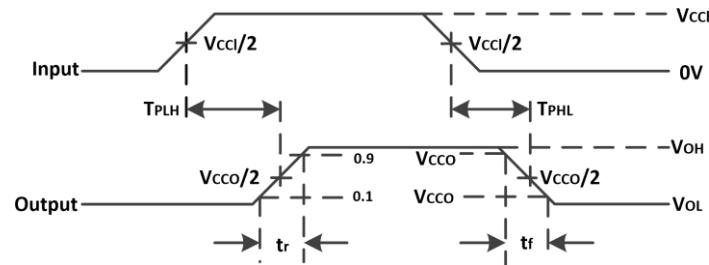
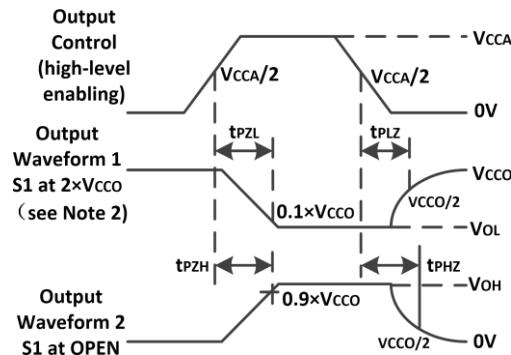
| Test                            | S1                 |
|---------------------------------|--------------------|
| $t_{PLZ}^{(1)}, t_{PLZ}^{(2)}$  | $2 \times V_{CC0}$ |
| $t_{PHZL}^{(1)}, t_{PHZ}^{(2)}$ | Open               |

(1)  $t_{PLZ}$  and  $t_{PHZ}$  are the same as ten.

(2)  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .



(1) All input pulses are measured one at a time, with one transition per measurement.

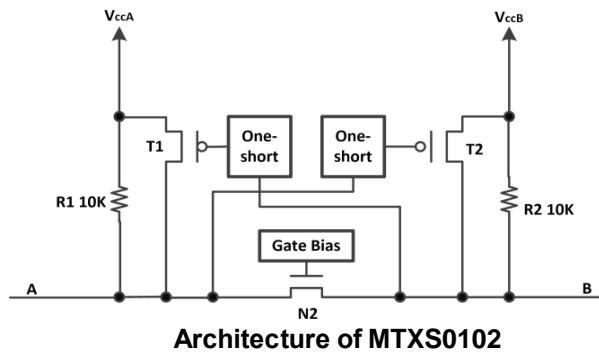
**Voltage Waveforms Pulse Duration**

**Voltage Waveforms Propagation Delay Times**

**Voltage Waveforms Enable and Disable**

## Overview

The MTXS0102 IC is a Bi-direction voltage-level translator specifically designed for translating logic voltage levels. The A port can accept I/O voltages that cover from 1.65 V to 3.6 V range; The B port can accept I/O voltages from 2.3 V to 5.5 V. The device is a pass-gate architecture with edge-rate accelerators (one-shots) to improve the overall data rate. 10-k $\Omega$  pullup resistors that usually used in open-drain applications have been integrated inside IC with the advantage saving an external resistor. Not only the IC is designed for open-drain applications, but also this device can translate push-pull CMOS logic outputs.

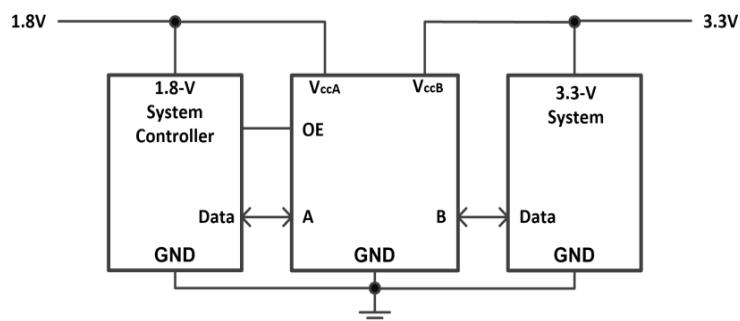
## Architecture

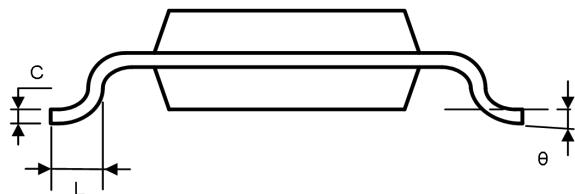
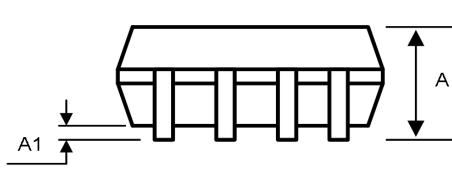
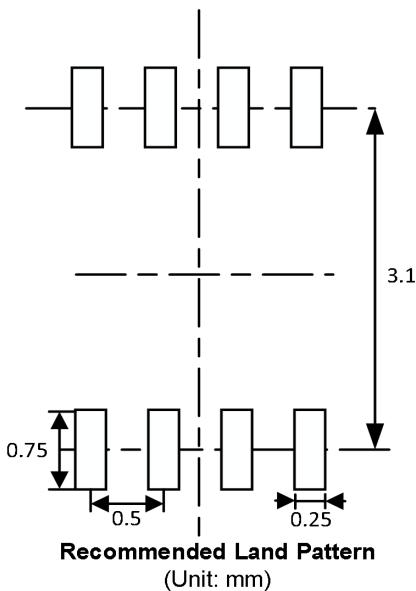
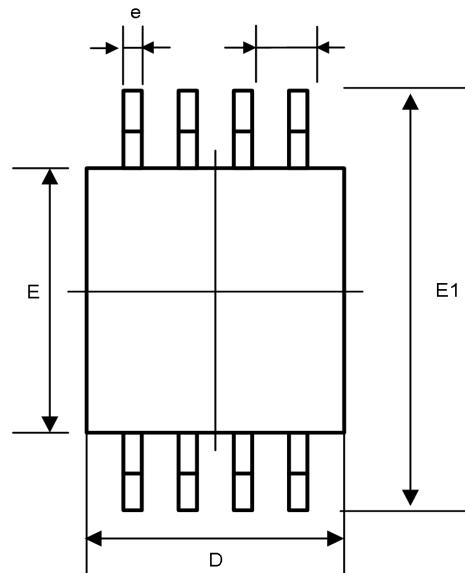
The MTXS0102 architecture (see Figure below) is a translator with Bi-direction-Sensing function that means a direction-control mechanism to control the direction of data flow from A to B or from B to A is not needed. These two bidirectional channels independently determine the direction of data flow without a direction-control signal. This auto-direction feature is realized by each I/O pin can be automatically reconfigured as either an input or an output.



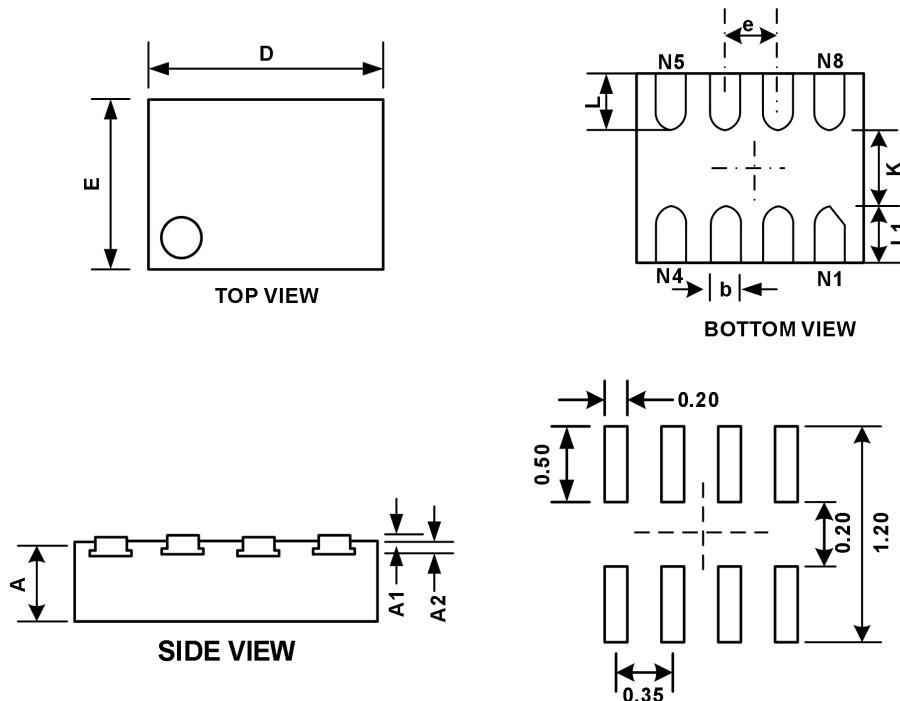
## Application Information

The MTXS0102 device can be used to bridge the digital-switching compatibility gap between two voltage nodes to successfully interface logic threshold levels found in electronic systems. It should be used in a point-to-point topology for interfacing devices or systems operating at different interface voltages with one another. Its primary target application use is for interfacing with open-drain drivers on the data I/Os such as I2C or 1-wire, where the data is bidirectional and no control signal is available. The device can also be used in applications where a push-pull driver is connected to the data I/Os, but the MTXS0108E might be a better option for such push-pull applications.



**Package Outline Dimension  
VSSOP-8**


| Symbol | Dimensions in Millimeters |        | Dimensions in Inches |        |
|--------|---------------------------|--------|----------------------|--------|
|        | Min                       | Max    | Min                  | Max    |
| A      | 0.6000                    | 0.9000 | 0.0240               | 0.0850 |
| A1     | .0000.                    | .1000. | .0000.               | .0040. |
| b      | 1700.                     | 2500.  | 0070.                | 0100.  |
| c      | 1001.                     | 2002.  | 0040.                | 0080.  |
| D      | 900                       | 100    | 075                  | 083    |
| e      | 0.500(BSC)                |        | 0.020(BSC)           |        |
| E1     | 3.0002                    | 3.2002 | 0.1180               | 0.1260 |
| E      | .2000.                    | .4000. | .0870.               | .0950. |
| L      | 200                       | 350    | 008                  | 014    |
| θ      | 0°                        | 6°     | 0°                   | 6°     |

**Package Outline Dimension**
**DFN1.4\*1-8L**

**RECOMMENDED LAND PATTERN (Unit:mm)**

| Symbol | Dimensions in Millimeters |          | Dimensions in Inches |       |
|--------|---------------------------|----------|----------------------|-------|
|        | Min                       | Max      | Min                  | Max   |
| A      | 0.                        | 0.       | 0.                   | 0.    |
| A1     | 3400.                     | 4000.    | 0130.                | 0160. |
| A2     | 000                       | 0.110REF | 050                  | 000   |
| D      | 1.350                     | 1.450    | 0.053                | 0.057 |
| E      | 0.950                     | 1.050    | 0.037                | 0.041 |
| k      | 0.200MIN                  |          | 0.008MIN             |       |
| b      | 0.150                     | 0.200    | 0.006                | 0.008 |
| e      | 0.350TYP                  |          | 0.014TYP             |       |
| L      | 0.250                     | 0.350    | 0.010                | 0.014 |
| L1     | 0.350                     | 0.450    | 0.014                | 0.018 |

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