

# Hi-Reliability Optically Coupled Isolator



3C91C, 3C92C, 3N243, 3N244, 3N245, 3N261, 3N262, 3N263 (TX, TXV)



## Features:

- TO-72 hermetically sealed package
- 1 kVDC electrical isolation
- High current transfer ratio
- TX and TXV devices processed to MIL-PRF-19500

## Description:

Each device is a high reliability optically coupled isolator that consists of an infrared emitting diode and a NPN silicon phototransistor which are mounted in a hermetically sealed TO-72 package. The **3C91C** and **3C92C** have a 935 nm wavelength, whereas the **3N243**, **3N244**, **3N245**, **3N261**, **3N262** and **3N263** have an 880 nm wavelength. All devices have 0.50" (12.70 mm) leads. Electrical characteristics vary. The **3N261TX**, **3N262TX** and **3N263TX** devices are similar to JEDEC registered optically coupled isolators.

*TX and TXV devices are processed to OPTEK's military screening program patterned after MIL-PRF-19500.*

Please refer to Application Bulletins 208 and 210 for additional design information and reliability (degradation) data.

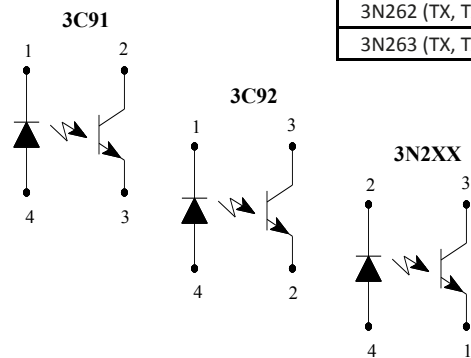
Contact your local representative or OPTEK for more information.

## Applications:

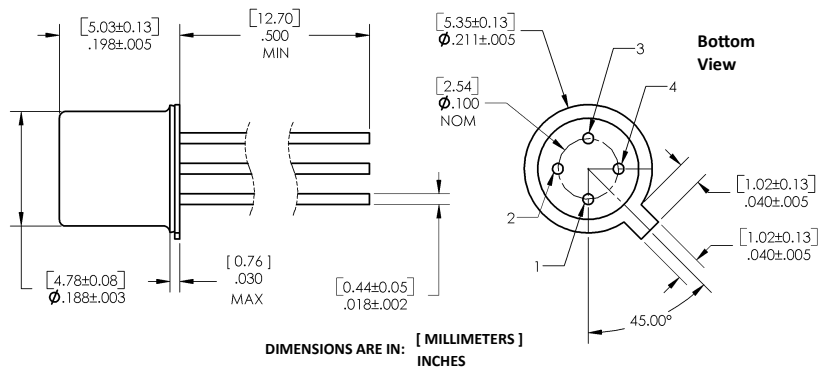
- High-voltage isolation between input and output
- Electrical isolation in dirty environments
- Industrial equipment
- Medical equipment
- Office equipment

| Part Number     | LED Peak Wavelength | Sensor     | Isolation Voltage (,000) | CTR Min / Max | I <sub>F</sub> (mA) Typ / Max | V <sub>CE</sub> (V) Typ / Max | Lead Length |
|-----------------|---------------------|------------|--------------------------|---------------|-------------------------------|-------------------------------|-------------|
| 3C91C (TX, TXV) | 935 nm              | Transistor | 1                        | 0.3 / 2.0     | 10 / 50                       | 10 / 50                       | 0.50"       |
| 3C92C (TX, TXV) |                     |            |                          |               |                               |                               |             |
| 3N243 (TX, TXV) | 0.15 / NA           |            |                          | 3 / 40        | 10 / 30                       |                               |             |
| 3N244 (TX, TXV) | 0.3 / NA            |            |                          |               |                               |                               |             |
| 3N245 (TX, TXV) | 0.6 / NA            |            |                          |               |                               |                               |             |
| 3N261 (TX, TXV) | .05 / NA            |            |                          | 1 / 40        | 5 / 30                        |                               |             |
| 3N262 (TX, TXV) | 1.0 / 5.0           |            |                          |               |                               |                               |             |
| 3N263 (TX, TXV) | 2.0 / 10.0          |            |                          |               |                               |                               |             |

Phototransistor Collector is connected to the Header-Base-Case for ALL versions



| Pin # | 3C91      | 3C92      | 3N2XX     |
|-------|-----------|-----------|-----------|
| 1     | Cathode   | Cathode   | Emitter   |
| 2     | Collector | Emitter   | Cathode   |
| 3     | Emitter   | Collector | Collector |
| 4     | Anode     | Anode     | Anode     |



## General Note

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## Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

|                                                                                             |                                             |
|---------------------------------------------------------------------------------------------|---------------------------------------------|
| Operating Temperature Range                                                                 | $-55^\circ\text{C}$ to $+125^\circ\text{C}$ |
| Storage Temperature Range                                                                   | $-65^\circ\text{C}$ to $+150^\circ\text{C}$ |
| Input to Output Isolation Voltage                                                           | $\pm 1\text{ kVDC}^{(1)}$                   |
| Lead Soldering Temperature [1/16 inch (1.6 mm) from case for 5 seconds with soldering iron] | $260^\circ\text{C}^{(2)}$                   |

## Input Diode

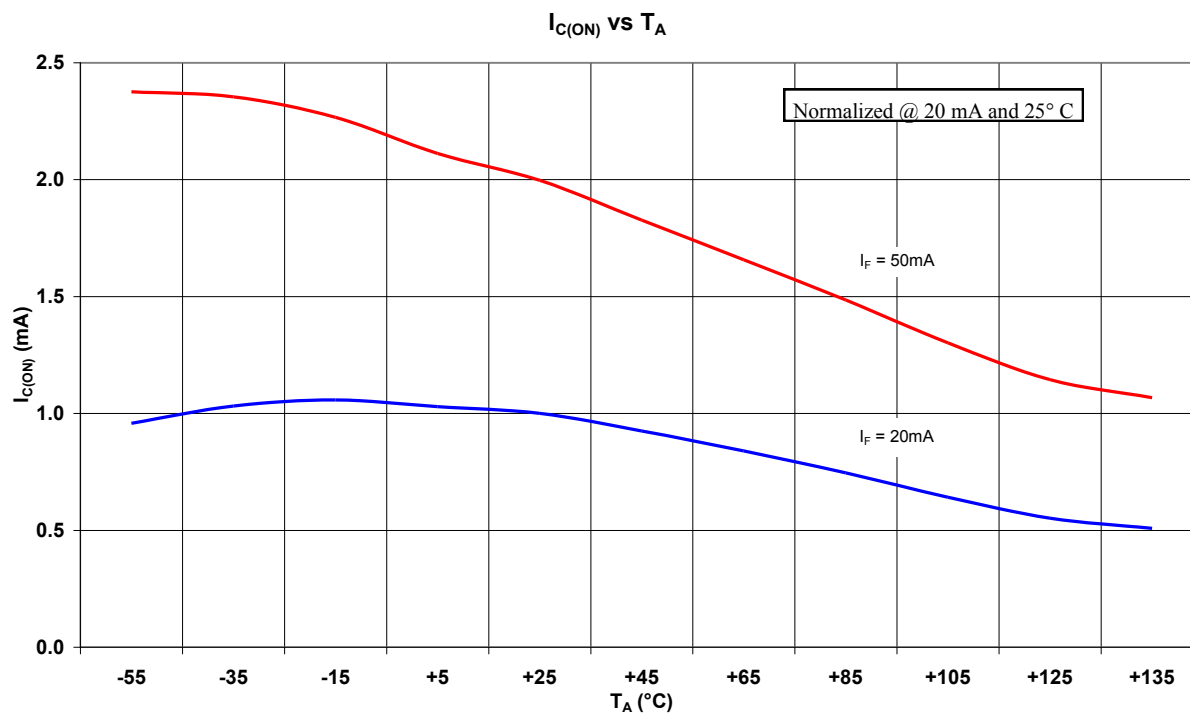
|                    |                      |
|--------------------|----------------------|
| Forward DC Current | 40 mA                |
| Reverse Voltage    | 2.0 V                |
| Power Dissipation  | $60\text{ mW}^{(3)}$ |

## Output Phototransistor

|                              |                       |
|------------------------------|-----------------------|
| Continuous Collector Current | 30 mA                 |
| Collector-Emitter Voltage    | 30 V                  |
| Emitter-Collector Voltage    | 5.0 V                 |
| Power Dissipation            | $200\text{ mW}^{(4)}$ |

### Notes:

1. Measured with input leads shorted together and output leads shorted together.
2. RMA flux is recommended. Duration can be extended to 10 seconds maximum when flow soldering.
3. Derate linearly  $2.0\text{ mW}/^\circ\text{C}$  above  $25^\circ\text{C}$ .
4. Derate linearly  $0.60\text{ mW}/^\circ\text{C}$  above  $65^\circ\text{C}$ .



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## Electrical Characteristics ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNITS | TEST CONDITIONS |
|--------|-----------|-----|-----|-----|-------|-----------------|
|--------|-----------|-----|-----|-----|-------|-----------------|

### Input Diode

|          |                               |     |    |     |               |                                                |
|----------|-------------------------------|-----|----|-----|---------------|------------------------------------------------|
| $V_F$    | Forward Voltage               |     |    |     |               |                                                |
|          | 3C91C, 3C92C (TX, TXV)        | -   | -  | 1.2 |               | $I_F = 2\text{ mA}$                            |
|          | 3C91C, 3C92C (TX, TXV)        | -   | -  | 1.5 |               | $I_F = 50\text{ mA}$                           |
|          | 3N243, 3N244, 3N245 (TX, TXV) | 0.8 | -  | 1.3 |               | $I_F = 10\text{ mA}$                           |
|          | 3N243, 3N244, 3N245 (TX, TXV) | 1.0 | -  | 1.5 | V             | $I_F = 10\text{ mA}, T_A = -55^\circ\text{C}$  |
|          | 3N243, 3N244, 3N245 (TX, TXV) | 0.7 | -  | 1.2 |               | $I_F = 10\text{ mA}, T_A = -100^\circ\text{C}$ |
|          | 3N261, 3N262, 3N263 (TX, TXV) | 0.8 | -  | 1.5 |               | $I_F = 10\text{ mA}$                           |
|          | 3N261, 3N262, 3N263 (TX, TXV) | 1.0 | -  | 1.7 |               | $I_F = 10\text{ mA}, T_A = -55^\circ\text{C}$  |
|          | 3N261, 3N262, 3N263 (TX, TXV) | 0.7 | -  | 1.3 |               | $I_F = 10\text{ mA}, T_A = -100^\circ\text{C}$ |
| $V_R$    | Reverse Voltage               |     |    |     |               |                                                |
|          | 3C91C, 3C92C (TX, TXV)        | 7   | -  | -   | V             | $I_R = 0.1\text{ mA}$                          |
| $I_R$    | Reverse Current               |     |    |     |               |                                                |
|          | 3C91C, 3C92C (TX, TXV)        | -   | -  | 1   | $\mu\text{A}$ | $V_R = 3.0\text{ V}$                           |
|          | 3N243, 3N244, 3N245 (TX, TXV) | -   | -  | 100 |               | $V_R = 2.0\text{ V}$                           |
|          | 3N261, 3N262, 3N263 (TX, TXV) | -   | -  | 100 |               | $V_R = 2.0\text{ V}$                           |
| $C_{IN}$ | Diode Capacitance             |     |    |     |               |                                                |
|          | 3C91C, 3C92C (TX, TXV)        | -   | 25 | -   | pF            | $V = 0, f = 1\text{ MHz}$                      |

### Output Phototransistor

|               |                                     |    |   |     |               |                                                   |
|---------------|-------------------------------------|----|---|-----|---------------|---------------------------------------------------|
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage |    |   |     |               |                                                   |
|               | 3C91C, 3C92C (TX, TXV)              | 50 | - | -   |               | $I_C = 10.0\text{ mA}$                            |
|               | 3N243, 3N244, 3N245 (TX, TXV)       | 30 | - | -   | V             | $I_C = 1.0\text{ mA}$                             |
|               | 3N261, 3N262, 3N263 (TX, TXV)       | 40 | - | -   |               | $I_C = 1.0\text{ mA}$                             |
| $V_{(BR)ECO}$ | Emitter-Collector Breakdown Voltage |    |   |     |               |                                                   |
|               | 3C91C, 3C92C (TX, TXV)              | 7  | - | -   |               | $I_C = 10\text{ }\mu\text{A}$                     |
|               | 3N243, 3N244, 3N245 (TX, TXV)       | 5  | - | -   | V             | $I_E = 100\text{ }\mu\text{A}$                    |
|               | 3N261, 3N262, 3N263 (TX, TXV)       | 7  | - | -   |               | $I_E = 100\text{ }\mu\text{A}$                    |
| $I_{CEO}$     | Collector Dark Current              |    |   |     |               |                                                   |
|               | 3C91C, 3C92C (TX, TXV)              | -  | - | 10  | nA            | $V_{CE} = 5\text{ V}$                             |
|               | 3C91C, 3C92C (TX, TXV)              | -  | - | 50  | nA            | $V_{CE} = 50\text{ V}$                            |
|               | 3N243, 3N244, 3N245 (TX, TXV)       | -  | - | 100 | nA            | $V_{CE} = 10.0\text{ V}$                          |
|               | 3N243, 3N244, 3N245 (TX, TXV)       | -  | - | 100 | $\mu\text{A}$ | $V_{CE} = 10.0\text{ V}, T_A = 100^\circ\text{C}$ |
|               | 3N261, 3N262, 3N263 (TX, TXV)       | -  | - | 100 | $\mu\text{A}$ | $V_{CE} = 10.0\text{ V}$                          |
|               | 3N261, 3N262, 3N263 (TX, TXV)       | -  | - | 100 | $\mu\text{A}$ | $V_{CE} = 10.0\text{ V}, T_A = 100^\circ\text{C}$ |
|               | 3N261, 3N262, 3N263 (TX, TXV)       | -  | - | 100 | $\mu\text{A}$ | $V_{CE} = 10.0\text{ V}, T_A = 100^\circ\text{C}$ |

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## Electrical Characteristics (T<sub>A</sub> = 25°C unless otherwise noted)

| SYMBOL               | PARAMETER                                | MIN | TYP | MAX | UNITS | TEST CONDITIONS                                                           |
|----------------------|------------------------------------------|-----|-----|-----|-------|---------------------------------------------------------------------------|
| <b>Coupled</b>       |                                          |     |     |     |       |                                                                           |
| I <sub>C(ON)</sub>   | On-State Collector Current               |     |     |     |       |                                                                           |
|                      | 3C91C, 3C92C (TX, TXV)                   | 4.0 | -   | -   |       | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 5 V                             |
|                      | 3C91C, 3C92C (TX, TXV)                   | 3.0 | -   | 20  |       | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 0.4 V                           |
|                      | 3N243 (TX, TXV)                          | 1.5 | -   | -   |       | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10.0 V                          |
|                      | 3N243 (TX, TXV)                          | 0.3 | -   | -   |       | I <sub>F</sub> = 3 mA, V <sub>CE</sub> = 10.0 V                           |
|                      | 3N243 (TX, TXV)                          | 0.5 | -   | -   |       | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10.0 V, T <sub>A</sub> = 55° C  |
|                      | 3N243 (TX, TXV)                          | 0.5 | -   | -   |       | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10.0 V, T <sub>A</sub> = 100° C |
|                      | 3N244 (TX, TXV)                          | 3.0 | -   | -   |       | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10.0 V                          |
|                      | 3N244 (TX, TXV)                          | 0.8 | -   | -   |       | I <sub>F</sub> = 3 mA, V <sub>CE</sub> = 10.0 V                           |
|                      | 3N244 (TX, TXV)                          | 1.0 | -   | -   |       | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10.0 V, T <sub>A</sub> = 55° C  |
|                      | 3N244 (TX, TXV)                          | 1.0 | -   | -   |       | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10.0 V, T <sub>A</sub> = 100° C |
|                      | 3N245 (TX, TXV)                          | 6.0 | -   | -   |       | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10.0 V                          |
|                      | 3N245 (TX, TXV)                          | 1.5 | -   | -   |       | I <sub>F</sub> = 3 mA, V <sub>CE</sub> = 10.0 V                           |
|                      | 3N245 (TX, TXV)                          | 1.5 | -   | -   |       | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10.0 V, T <sub>A</sub> = 55° C  |
|                      | 3N245 (TX, TXV)                          | 1.5 | -   | -   |       | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10.0 V, T <sub>A</sub> = 100° C |
|                      | 3N261 (TX, TXV)                          | 0.5 | -   | -   |       | I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 5.0 V                            |
|                      | 3N261 (TX, TXV)                          | 0.7 | -   | -   |       | I <sub>F</sub> = 2.0 mA, V <sub>CE</sub> = 5.0 V, T <sub>A</sub> = 55° C  |
|                      | 3N261 (TX, TXV)                          | 0.5 | -   | -   |       | I <sub>F</sub> = 2.0 mA, V <sub>CE</sub> = 5.0 V, T <sub>A</sub> = 100° C |
|                      | 3N262 (TX, TXV)                          | 1.0 | -   | 5   |       | I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 5.0 V                            |
|                      | 3N262 (TX, TXV)                          | 1.4 | -   | -   |       | I <sub>F</sub> = 2.0 mA, V <sub>CE</sub> = 5.0 V, T <sub>A</sub> = 55° C  |
|                      | 3N262 (TX, TXV)                          | 1.0 | -   | -   |       | I <sub>F</sub> = 2.0 mA, V <sub>CE</sub> = 5.0 V, T <sub>A</sub> = 100° C |
|                      | 3N263 (TX, TXV)                          | 2.0 | -   | 10  |       | I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 5.0 V                            |
|                      | 3N263 (TX, TXV)                          | 2.8 | -   | -   |       | I <sub>F</sub> = 2.0 mA, V <sub>CE</sub> = 5.0 V, T <sub>A</sub> = 55° C  |
|                      | 3N263 (TX, TXV)                          | 2.0 | -   | -   |       | I <sub>F</sub> = 2.0 mA, V <sub>CE</sub> = 5.0 V, T <sub>A</sub> = 100° C |
| V <sub>CE(SAT)</sub> | Collector-Emitter Saturation Voltage     |     |     |     |       |                                                                           |
|                      | 3C91C, 3C92C (TX, TXV)                   | -   | -   | 0.4 |       | I <sub>F</sub> = 50 mA, I <sub>C</sub> = 10 mA                            |
|                      | 3N243, 3N244, 3N245 (TX, TXV)            | -   | -   | 0.3 |       | I <sub>F</sub> = 20 mA, I <sub>C</sub> = 1.50 mA                          |
|                      | 3N243, 3N244, 3N245 (TX, TXV)            | -   | -   | 0.3 |       | I <sub>F</sub> = 20 mA, I <sub>C</sub> = 3.0 mA                           |
|                      | 3N243, 3N244, 3N245 (TX, TXV) 3N261,     | -   | -   | 0.3 |       | I <sub>F</sub> = 20 mA, I <sub>C</sub> = 6.0 mA                           |
|                      | 3N262, 3N263 (TX, TXV)                   | -   | -   | 0.3 |       | I <sub>F</sub> = 2.0 mA, I <sub>C</sub> = 0.50 mA                         |
|                      | 3N261, 3N262, 3N263 (TX, TXV)            | -   | -   | 0.3 |       | I <sub>F</sub> = 2.0 mA, I <sub>C</sub> = 1.0 mA                          |
|                      | 3N261, 3N262, 3N263 (TX, TXV)            | -   | -   | 0.3 |       | I <sub>F</sub> = 2.0 mA, I <sub>C</sub> = 2.0 mA                          |
| t <sub>ON</sub>      | Turn-on Time<br>3C91C, 3C92C (TX, TXV)   | -   | -   | 9   | μs    | V <sub>CC</sub> = 5 V, I <sub>C</sub> = 2 mA, R <sub>L</sub> = 100 Ω      |
| t <sub>IOFF</sub>    | Turn-off Time<br>3C91C, 3C92C (TX, TXV)) | -   | -   | 6   | μs    | V <sub>CC</sub> = 5 V, I <sub>C</sub> = 2 mA, R <sub>L</sub> = 100 Ω      |

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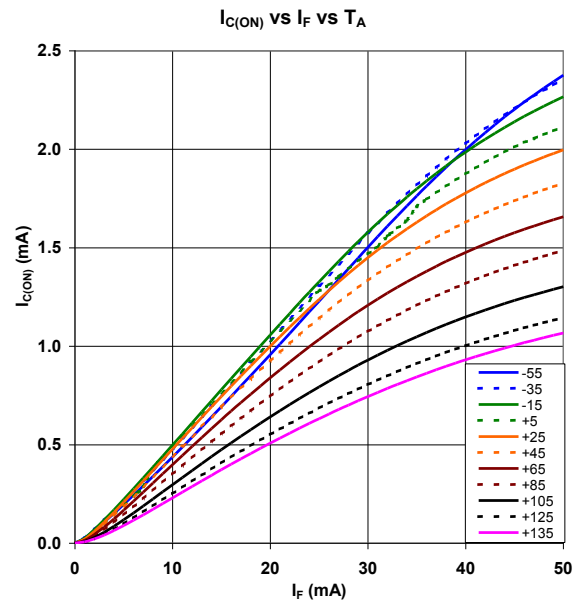
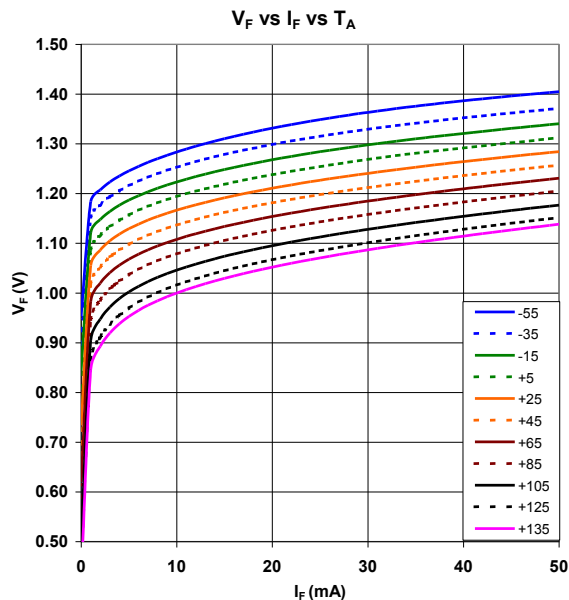


## Electrical Characteristics ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

| SYMBOL         | PARAMETER                                                                                                               | MIN    | TYP | MAX            | UNITS         | TEST CONDITIONS                                                                                                                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------------------|--------|-----|----------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Coupled</b> |                                                                                                                         |        |     |                |               |                                                                                                                                                                                                                             |
| $C_{IO}$       | Input-to-Output Capacitance<br>3C91C, 3C92C (TX, TXV)<br>3N243, 3N244, 3N245 (TX, TXV) 3N261,<br>3N262, 3N263 (TX, TXV) | -      | 2   | 2.5            | pF            | $f = 1\text{ MHz}$<br>$V_{IO} = 0\text{ V}, f = 1.00\text{ MHz}^{(1)}$<br>$V_{IO} = 0\text{ V}, f = 1.00\text{ MHz}^{(1)}$                                                                                                  |
| $I_{IO}$       | Leakage Input -to-Output<br>3N243, 3N244, 3N245 (TX, TXV) 3N261,<br>3N262, 3N263 (TX, TXV)                              | -      | -   | 100            | nA            | $V_{IO} = \pm 1.00\text{ kVDC}^{(1)}$<br>$V_{IO} = \pm 1.00\text{ kVDC}^{(1)}$                                                                                                                                              |
| $R_{IO}$       | Isolation Resistance<br>3C91C, 3C92C (TX, TXV)                                                                          | $10^9$ | -   | -              | $\Omega$      | $V_{IO} = +1\text{ kV}$                                                                                                                                                                                                     |
| $t_r$          | Output Rise Time<br>3N243, 3N244, 3N245 (TX, TXV)<br>3N261, 3N262 (TX, TXV)<br>3N263 (TX, TXV)                          | -      | -   | 10<br>20<br>25 | $\mu\text{s}$ | $V_{CC} = 10.0\text{ V}, I_F = 10.0\text{ mA}, R_L = 100\ \Omega^{(2)}$<br>$V_{CC} = 10.0\text{ V}, I_F = 5.0\text{ mA}, R_L = 100\ \Omega^{(2)}$<br>$V_{CC} = 10.0\text{ V}, I_F = 5.0\text{ mA}, R_L = 100\ \Omega^{(2)}$ |
| $t_f$          | Output Fall Time<br>3N243, 3N244, 3N245 (TX, TXV)<br>3N261, 3N262 (TX, TXV)<br>3N263 (TX, TXV)                          | -      | -   | 10<br>10<br>25 | $\mu\text{s}$ | $V_{CC} = 10.0\text{ V}, I_F = 10.0\text{ mA}, R_L = 100\ \Omega^{(2)}$<br>$V_{CC} = 10.0\text{ V}, I_F = 5.0\text{ mA}, R_L = 100\ \Omega^{(2)}$<br>$V_{CC} = 10.0\text{ V}, I_F = 5.0\text{ mA}, R_L = 100\ \Omega^{(2)}$ |

### Notes:

- Measured with input leads shorted together and output leads shorted together.
- The input waveform is supplied by a generator with the following characteristics:  $Z_{OUT} = 50\ \Omega$ ,  $t_r \leq 15\text{ ns}$ , duty cycle  $\sim 1\%$ , pulse width  $\sim 100\text{ ms}$



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