

# Surface Mount Optically Coupled Isolator

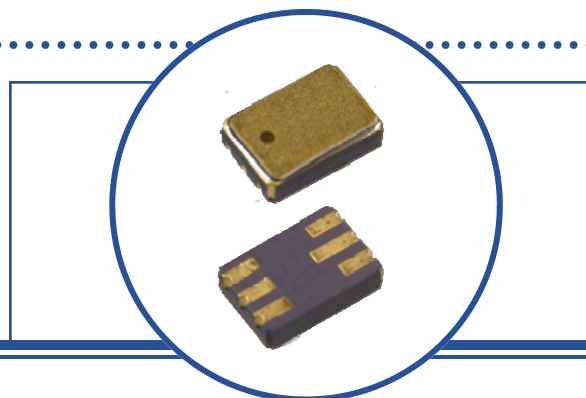
4N22U, 4N23U, 4N24U (COTS, TX, TXV)

4N47U, 4N48U, 4N49U (COTS, TX, TXV)



## Features:

- Surface Mount (SM), Leadless Chip Carrier (LCC)
- 1 kV electrical isolation
- Base contact provided for conventional transistor biasing
- TX and TXV devices processed to MIL-PRF-19500



## Description:

Each isolator in this series consists of an infrared emitting diode and a NPN silicon phototransistor, which are mounted in a hermetically sealed Surface Mount, 6 Pin package. Devices are designed for military and/or harsh environments.

The 4N22U, 4N23U and 4N24U (TX, TXV) devices are processed to MIL-PRF-19500/486. The 4N47U, 4N48U and 4N49U (TX, TXV) devices are processed to MIL-PRF-19500/548.

Please contact your local representative or OPTEK for more information.

## Applications:

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

Ordering Information				
Part Number	Isolation Voltage (kV)	I <sub>F</sub> (mA) Typ / Max	V <sub>CE</sub> (Volts) Max	Processing MIL-PRF-195000
4N22U	1	10 / 40	35	COTS
4N22UTX				486
4N22UTXV				
4N23U				COTS
4N23UTX				486
4N23UTXV				
4N24U				COTS
4N24UTX				486
4N24UTXV				
4N47U			45	COTS
4N47UTX				548
4N47UTXV				
4N48U				COTS
4N48UTX				548
4N48UTXV				
4N49U				COTS
4N49UTX				548
4N49UTXV				



RoHS

OPTEK reserves the right to make changes at any time in order to improve design and to supply the best product possible.

# Surface Mount Optically Coupled Isolator

4N22U, 4N23U, 4N24U (COTS, TX, TXV)  
4N47U, 4N48U, 4N49U (COTS, TX, TXV)



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

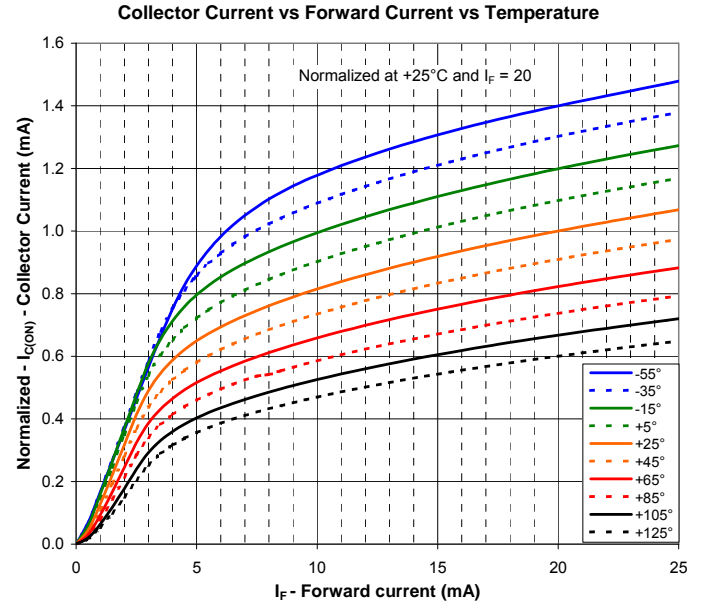
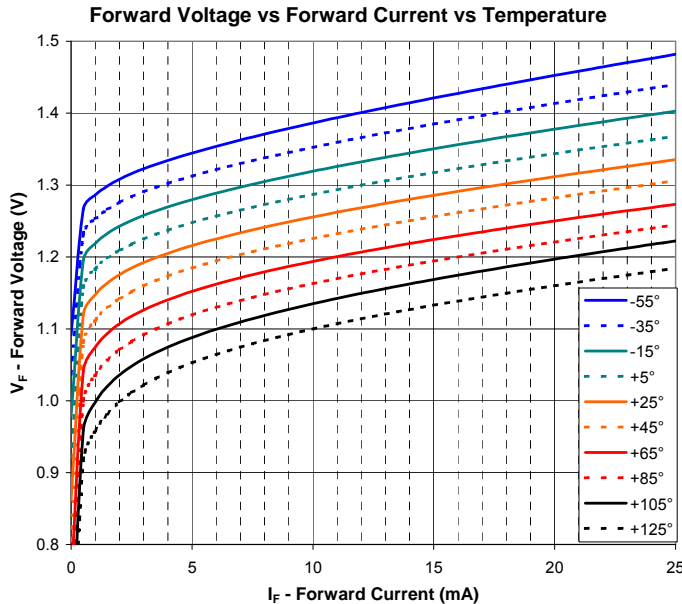
Storage Temperature	-65° C to +150° C
Operating Temperature	-55° C to +125° C
Input-to-Output Isolation Voltage <sup>(1)(2)</sup>	± 1 kVDC
Lead Soldering Temperature (1/16" (1.6 mm) from case for 5 seconds with soldering iron) <sup>(3)</sup>	260° C

### Input Diode

Forward DC Current <sup>(4)</sup>	50 mA
Reverse DC Voltage	2 V
Power Dissipation <sup>(5)</sup>	300 mW

### Output Photosensor

Collector-Emitter Voltage	35 V
Emitter-Collector Voltage	7.0 V
Power Dissipation <sup>(6)</sup>	100 mW



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**4N22U, 4N23U, 4N24U (COTS, TX, TXV)**  
**4N47U, 4N48U, 4N49U (COTS, TX, TXV)**



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

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
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**Input Diode** (See OP165 or OP265 for additional information - for reference only)

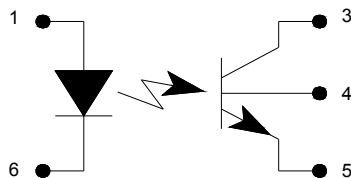
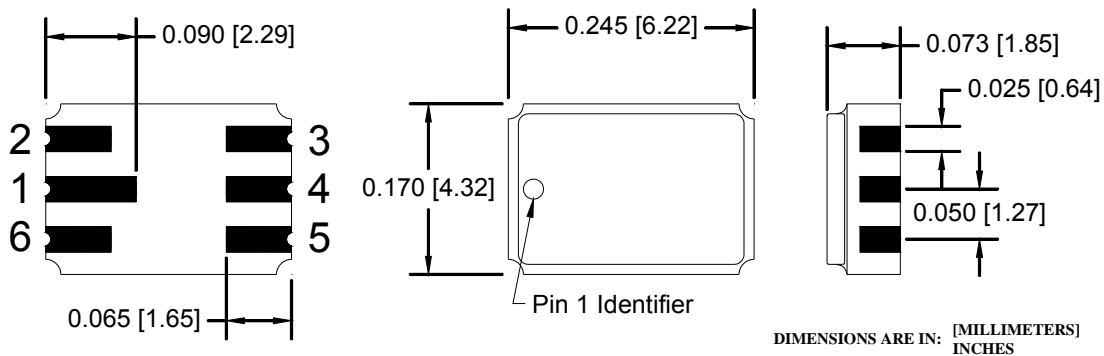
$V_F$	Forward Voltage					
	4N22, 4N23, 4N24 [A] (COTS, TX, TXV)	0.80	-	1.30		$I_F = 10.0\text{ mA}$
	4N22, 4N23, 4N24 [A] (COTS, TX, TXV)	1.00	-	1.50		$I_F = 10.0\text{ mA}, T_A = -55^\circ\text{C}^{(1)}$
	4N22, 4N23, 4N24 [A] (COTS, TX, TXV)	0.70	-	1.20	V	$I_F = 10.0\text{ mA}, T_A = -100^\circ\text{C}^{(1)}$
	4N47, 4N48, 4N49 [A] (COTS, TX, TXV)	0.80	-	1.50		$I_F = 10.0\text{ mA}$
	4N47, 4N48, 4N49 [A] (COTS, TX, TXV)	1.00	-	1.70		$I_F = 10.0\text{ mA}, T_A = -55^\circ\text{C}^{(1)}$
$I_R$	Reverse Current	-	-	100	$\mu\text{A}$	$V_R = 2.0\text{ V}$
	4N47, 4N48, 4N49 [A] (COTS, TX, TXV)	0.70	-	1.30		$I_F = 10.0\text{ mA}, T_A = -100^\circ\text{C}^{(1)}$

**Output Photosensor** (See OP505 for additional information - for reference only)

$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage					
	4N22U Series	35	80	-	V	$I_C = 100\ \mu\text{A}, I_F = 0$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage					
	4N22U Series	4	6	-	V	$I_E = 100\ \mu\text{A}, I_F = 0$
$I_{CEO}$	Collector-Emitter Dark Current	-	20	100	nA	$V_{CE} = 20\text{ V}, I_F = 0, I_B = 0, T_A = 25^\circ\text{C}$
		-	-	100	$\mu\text{A}$	$V_{CE} = 20\text{ V}, I_F = 0, I_B = 0, T_A = 100^\circ\text{C}$
$V_{CE(SAT)}$	Collector Saturation Voltage	-	0.2	0.3	V	$I_F = 20\text{ mA}, I_C = 2\text{ mA}$

**Notes:**

- (1) Measured with input and output leads shorted. Typical input/output capacitance is 0.06 pF.
- (2) UL recognition is for 3500 VAC for one minute.
- (3) RMA flux is recommended. The duration can be extended to 10 seconds maximum when flow soldering.
- (4) Derate linearly 0.67 mA/°C above 25°C.
- (5) Derate linearly 0.83 mA/°C above 25°C.
- (6) Derate linearly 1.67 mA/°C above 25°C.



Pin #	LED	Pin #	Transistor
2	N/A	3	Collector
1	Anode	4	Base
6	Cathode	5	Emitter

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**Coupled**

$I_C/I_F$	DC Current Transfer Ratio	4N22U	25	-	-	%	$I_F = 10 \text{ mA}, V_{CE} = 5 \text{ V}$
		4N23U	60	-	-		
		4N24U	100	-	-		
		4N47U	50	-	-	%	$I_F = 2 \text{ mA}, V_{CE} = 5 \text{ V}$
		4N48U	100	-	-		
		4N49U	200	-	-		
$I_{C(ON)}$	On-State Collector Current	4N22U	0.15	-	-	mA	$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = 25^\circ\text{C}$ $V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = 25^\circ\text{C}$ $V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = -55^\circ\text{C}$ $V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = 100^\circ\text{C}$
			2.50	-	-		
			1.00	-	-		
			1.00	-	-		
		4N23U	0.2	-	-	mA	$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = 25^\circ\text{C}$ $V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = 25^\circ\text{C}$ $V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = -55^\circ\text{C}$ $V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = 100^\circ\text{C}$
			6.0	-	-		
			2.5	-	-		
4N24U	0.4	-	-	mA	$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = 25^\circ\text{C}$ $V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = 25^\circ\text{C}$ $V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = -55^\circ\text{C}$ $V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = 100^\circ\text{C}$		
	10.0	-	-				
	4.0	-	-				
4N47U	0.5	-	-	mA	$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 1.0 \text{ mA } T_A = 25^\circ\text{C}$ $V_{CE} = 5 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = -55^\circ\text{C}$ $V_{CE} = 5 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = 100^\circ\text{C}$		
	0.7	-	-				
	0.5	-	-				
4N48U	1.0	-	5.0	mA	$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 1.0 \text{ mA } T_A = 25^\circ\text{C}$ $V_{CE} = 5 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = -55^\circ\text{C}$ $V_{CE} = 5 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = 100^\circ\text{C}$		
	1.4	-	-				
	1.0	-	-				
4N49U	2.0	-	10.0	mA	$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 1.0 \text{ mA } T_A = 25^\circ\text{C}$ $V_{CE} = 5 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = -55^\circ\text{C}$ $V_{CE} = 5 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = 100^\circ\text{C}$		
	2.8	-	-				
	2.0	-	-				
$V_{CE(SAT)}$	Collector Saturation Voltage	4N22U	-	-	0.3	V	$I_C = 2.5 \text{ mA}, I_B = 0, I_F = 20 \text{ mA}$ $I_C = 5.0 \text{ mA}, I_B = 0, I_F = 20 \text{ mA}$ $I_C = 10.0 \text{ mA}, I_B = 0, I_F = 20 \text{ mA}$
		4N23U	-	-	0.3		
		4N24U	-	-	0.3		
		4N47U	-	-	0.3	V	$I_C = 0.5 \text{ mA}, I_B = 0, I_F = 2.0 \text{ mA}$ $I_C = 1.0 \text{ mA}, I_B = 0, I_F = 2.0 \text{ mA}$ $I_C = 2.0 \text{ mA}, I_B = 0, I_F = 2.0 \text{ mA}$
		4N48U	-	-	0.3		
		4N49U	-	-	0.3		
$h_{FE}$	DC Current Gain	4N22U	200	-	-	-	$V_{CE} = 5 \text{ V}, I_C = 10 \text{ mA}, I_F = 0 \text{ mA}$
		4N23U	300	-	-		
		4N24U	400	-	-		
		4N47U	100	-	-		
		4N48U	100	-	-		
		4N49U	100	-	-		
$t_r$ & $t_f$	Rise and Fall Time	4N22U	-	-	15	$\mu\text{s}$	$V_{CC} = 10 \text{ V}, I_F = 10 \text{ mA}, R_L = 100\Omega,$ Pulse width = 100 ms, Duty cycle = 1%
		4N23U	-	-	15		
		4N24U	-	-	20		
		4N47U	-	-	20	$\mu\text{s}$	$V_{CC} = 10 \text{ V}, I_F = 5 \text{ mA}, R_L = 100\Omega,$ Pulse width = 100 ms, Duty cycle = 1%
		4N48U	-	-	20		
		4N49U	-	-	20		
$R_{IO}$	Resistance (Input to Output)		10 <sub>11</sub>	-	-	$\Omega$	$V_{IO} = \pm 1,000 \text{ Vdc}$
$C_{IO}$	Capacitance (Input to Output)		-	-	5.0	pF	$V_{IO} = 0 \text{ Vdc}, f = 1.0 \text{ MHz}$

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**4N22U, 4N23U, 4N24U (COTS, TX, TXV)**  
**4N47U, 4N48U, 4N49U (COTS, TX, TXV)**



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

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
<b>Coupled</b>						
$I_{C(ON)}$	On-State Collector Current					
	4N22, 4N22A (COTS, TX, TXV)	0.15	-	-		$I_F = 2.0\text{ mA}, V_{CE} = 5\text{ V}, I_B = 0$
	4N22, 4N22A (COTS, TX, TXV)	2.50	-	-		$I_F = 10.0\text{ mA}, V_{CE} = 5\text{ V}, I_B = 0$
	4N22, 4N22A (COTS, TX, TXV)	1.00	-	-		$I_F = 10.0\text{ mA}, V_{CE} = 5\text{ V}, I_B = 0, T_A = -55^\circ\text{C}^{(1)}$
	4N22, 4N22A (COTS, TX, TXV)	1.00	-	-		$I_F = 10.0\text{ mA}, V_{CE} = 5\text{ V}, I_B = 0, T_A = 100^\circ\text{C}^{(1)}$
	4N23, 4N23A (COTS, TX, TXV)	0.20	-	-		$I_F = 2.0\text{ mA}, V_{CE} = 5\text{ V}, I_B = 0$
	4N23, 4N23A (COTS, TX, TXV)	6.00	-	-		$I_F = 10.0\text{ mA}, V_{CE} = 5\text{ V}, I_B = 0$
	4N23, 4N23A (COTS, TX, TXV)	2.50	-	-		$I_F = 10.0\text{ mA}, V_{CE} = 5\text{ V}, I_B = 0, T_A = -55^\circ\text{C}^{(1)}$
	4N23, 4N23A (COTS, TX, TXV)	2.50	-	-		$I_F = 10.0\text{ mA}, V_{CE} = 5\text{ V}, I_B = 0, T_A = 100^\circ\text{C}^{(1)}$
	4N24, 4N24A (COTS, TX, TXV)	0.40	-	-		$I_F = 2.0\text{ mA}, V_{CE} = 5\text{ V}, I_B = 0$
	4N24, 4N24A (COTS, TX, TXV)	10.0	-	-		$I_F = 10.0\text{ mA}, V_{CE} = 5\text{ V}, I_B = 0$
	4N24, 4N24A (COTS, TX, TXV)	4.00	-	-		$I_F = 10.0\text{ mA}, V_{CE} = 5\text{ V}, I_B = 0, T_A = -55^\circ\text{C}^{(1)}$
	4N24, 4N24A (COTS, TX, TXV)	4.00	-	-		$I_F = 10.0\text{ mA}, V_{CE} = 5\text{ V}, I_B = 0, T_A = 100^\circ\text{C}^{(1)}$
	4N47, 4N47A (COTS, TX, TXV)	0.50	-	-		$I_F = 1.0\text{ mA}, V_{CE} = 5.0\text{ V}, I_B = 0$
	4N47, 4N47A (COTS, TX, TXV)	0.70	-	-		$I_F = 2.0\text{ mA}, V_{CE} = 5.0\text{ V}, I_B = 0, T_A = -55^\circ\text{C}^{(1)}$
	4N47, 4N47A (COTS, TX, TXV)	0.50	-	-		$I_F = 2.0\text{ mA}, V_{CE} = 5.0\text{ V}, I_B = 0, T_A = 100^\circ\text{C}^{(1)}$
4N48, 4N48A (COTS, TX, TXV)	1.00	-	5		$I_F = 1.0\text{ mA}, V_{CE} = 5.0\text{ V}, I_B = 0$	
4N48, 4N48A (COTS, TX, TXV)	1.40	-	-		$I_F = 2.0\text{ mA}, V_{CE} = 5.0\text{ V}, I_B = 0, T_A = -55^\circ\text{C}^{(1)}$	
4N48, 4N48A (COTS, TX, TXV)	1.00	-	-		$I_F = 2.0\text{ mA}, V_{CE} = 5.0\text{ V}, I_B = 0, T_A = 100^\circ\text{C}^{(1)}$	
4N49, 4N49A (COTS, TX, TXV)	2.00	-	10		$I_F = 1.0\text{ mA}, V_{CE} = 5.0\text{ V}, I_B = 0$	
4N49, 4N49A (COTS, TX, TXV)	2.80	-	-		$I_F = 2.0\text{ mA}, V_{CE} = 5.0\text{ V}, I_B = 0, T_A = -55^\circ\text{C}^{(1)}$	
4N49, 4N49A (COTS, TX, TXV)	2.00	-	-		$I_F = 2.0\text{ mA}, V_{CE} = 5.0\text{ V}, I_B = 0, T_A = 100^\circ\text{C}^{(1)}$	
$I_{CB(ON)}$	On-State Collector Base 4N47, 4N48, 4N49 [A] (COTS, TX, TXV)	30	-	-	$\mu\text{A}$	$V_{CB} = 5\text{ V}, I_E = 0, I_F = 10\text{ mA}$
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage					
	4N22, 4N23, 4N24 [A] (COTS, TX, TXV)	-	-	0.30		$I_F = 20\text{ mA}, I_C = 2.5\text{ mA}, I_B = 0$
	4N22, 4N23, 4N24 [A] (COTS, TX, TXV)	-	-	0.30		$I_F = 20\text{ mA}, I_C = 5.0\text{ mA}, I_B = 0$
	4N22, 4N23, 4N24 [A] (COTS, TX, TXV)	-	-	0.30		$I_F = 20\text{ mA}, I_C = 10.0\text{ mA}, I_B = 0$
	4N47, 4N47A (COTS, TX, TXV)	-	-	0.30		$I_F = 2.0\text{ mA}, I_C = 0.5\text{ mA}, I_B = 0$
	4N48, 4N48A (COTS, TX, TXV)	-	-	0.30		$I_F = 2.0\text{ mA}, I_C = 1.0\text{ mA}, I_B = 0$
4N49, 4N49A (COTS, TX, TXV)	-	-	0.30		$I_F = 2.0\text{ mA}, I_C = 2.0\text{ mA}, I_B = 0$	
$H_{FE}$	DC Current Gain					
	4N22, 4N22A (COTS, TX, TXV)	200	-	-		$V_{CE} = 5.0\text{ V}, I_C = 10.0\text{ mA}, I_F = 0\text{ mA}$
	4N23, 4N23A (COTS, TX, TXV)	300	-	-		$V_{CE} = 5.0\text{ V}, I_C = 10.0\text{ mA}, I_F = 0\text{ mA}$
	4N24, 4N24A (COTS, TX, TXV)	400	-	-		$V_{CE} = 5.0\text{ V}, I_C = 10.0\text{ mA}, I_F = 0\text{ mA}$
4N47, 4N48, 4N49 [A] (COTS, TX, TXV)	100	-	-		$V_{CE} = 5.0\text{ V}, I_C = 10.0\text{ mA}, I_F = 0\text{ mA}$	
$R_{IO}$	Resistance (Input-to-Output)					
	4N22, 4N23, 4N24 [A] (COTS, TX, TXV)	$10^{11}$	-	-	$\Omega$	$V_{IO} = \pm 1.0\text{ VDC}^{(3)}$
4N47, 4N48, 4N49 [A] (COTS, TX, TXV)	$10^{11}$	-	-		$V_{I-O} = \pm 1000\text{ VDC}^{(3)}$	
$C_{IO}$	Capacitance (Input-to-Output)	-	-	5	$\text{pF}$	$V_{I-O} = 0\text{ V}, f = 1.0\text{ MHz}^{(3)}$

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