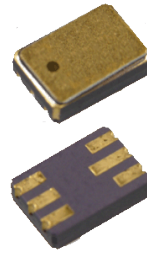


# Surface Mount Optically Coupled Isolator

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

4N47U, 4N48U, 4N49U (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-19500
4N22U	1	10 / 40	35	COTS
4N22UTX				486
4N22UTXV				COTS
4N23U				486
4N23UTX				COTS
4N23UTXV				486
4N24U		1 / 40	40	COTS
4N24UTX				548
4N24UTXV				COTS
4N47U				548
4N47UTX				COTS
4N47UTXV				548
4N48U	1	40	COTS	
4N48UTX			548	
4N48UTXV			COTS	
4N49U			548	
4N49UTX			COTS	
4N49UTXV			548	

## General Note

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# Surface Mount Optically Coupled Isolator

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

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



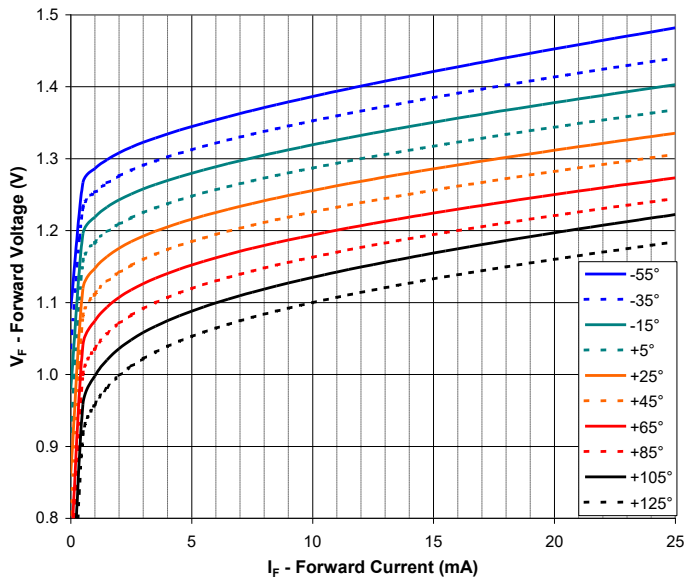
## Electrical Specifications

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)</sup>	± 1 kVDC
Lead Soldering Temperature (1/16" (1.6 mm) from case for 5 seconds with soldering iron) <sup>(2)</sup>	260° C
<b>Input Diode</b>	
Forward DC Current <sup>(3)</sup>	50 mA
Reverse DC Voltage	2 V
Power Dissipation <sup>(4)</sup>	100 mW
<b>Output Photosensor</b>	
Collector-Emitter Voltage	35 V
Emitter-Collector Voltage	7.0 V
Power Dissipation <sup>(5)</sup>	300 mW

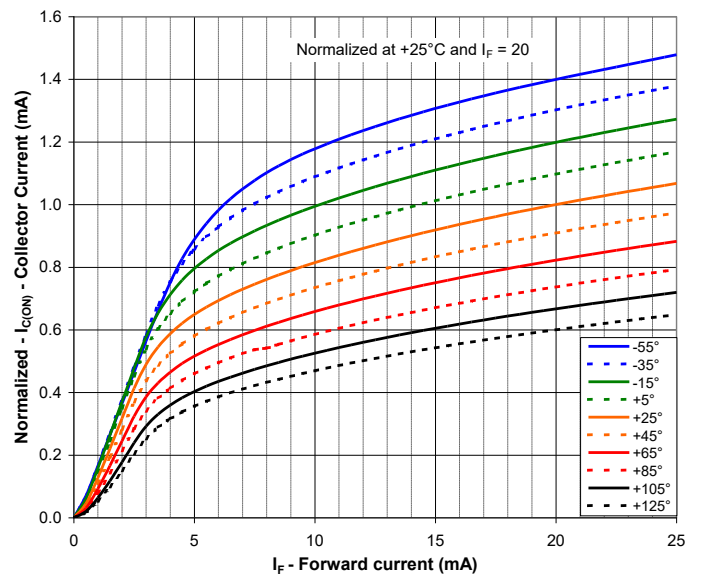
Notes:

- (1) Measured with input leads shorted together and output leads shorted together. Typical input/output capacitance is 0.06 pF.
- (2) RMA flux is recommended. The duration can be extended to 10 seconds maximum when flow soldering.
- (3) Derate linearly 0.67 mA/°C above 65°C.
- (4) Derate linearly 0.83 mW/°C above 25°C.
- (5) Derate linearly 1.67 mW/°C above 25°C.

Forward Voltage vs Forward Current vs Temperature



Collector Current vs Forward Current vs Temperature



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# Surface Mount Optically Coupled Isolator

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

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



## Electrical Specifications

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

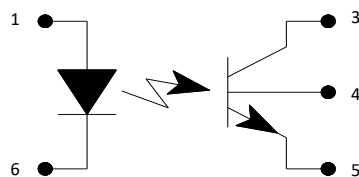
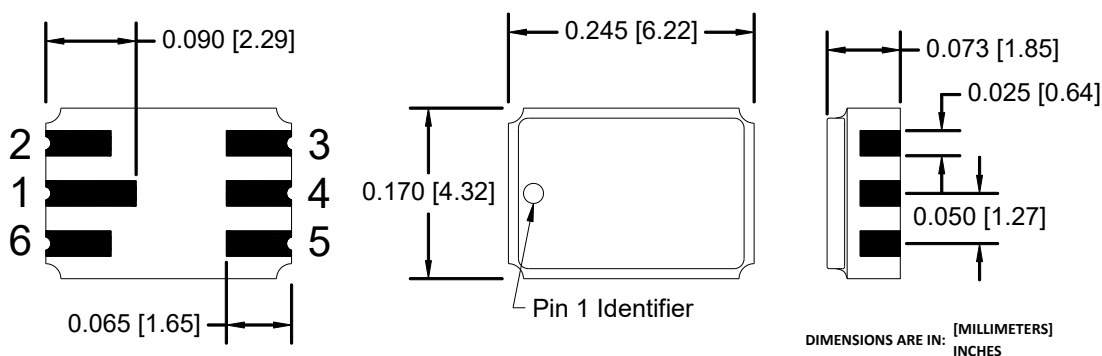
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
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### Input LED

$V_F$	Forward Voltage					
	4N22U, 4N23U, 4N24U (TX, TXV)	0.80	-	1.30		$I_F = 10.0\text{ mA}$
	4N22U, 4N23U, 4N24U (TX, TXV)	1.00	-	1.50		$I_F = 10.0\text{ mA}, T_A = -55^\circ\text{C}$
	4N22U, 4N23U, 4N24U (TX, TXV)	0.70	-	1.20	V	$I_F = 10.0\text{ mA}, T_A = -100^\circ\text{C}$
	4N47U, 4N48U, 4N49U (TX, TXV)	0.80	-	1.50		$I_F = 10.0\text{ mA}$
	4N47U, 4N48U, 4N49U (TX, TXV)	1.00	-	1.70		$I_F = 10.0\text{ mA}, T_A = -55^\circ\text{C}$
$I_R$	Reverse Current	-	-	100	$\mu\text{A}$	$V_R = 2.0\text{ V}$
	4N47U, 4N48U, 4N49U (TX, TXV)	0.70	-	1.30		$I_F = 10.0\text{ mA}, T_A = -100^\circ\text{C}$

### Output Phototransistor

$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage					
$V_{(BR)CEO}$	4N22U Series	35	80	-	V	$I_C = 100\ \mu\text{A}, I_F = 0$
	4N47U Series	40	90	-	V	$I_C = 100\ \mu\text{A}, I_F = 0$
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage					
	4N22U Series	4	6	-	V	$I_E = 100\ \mu\text{A}, I_F = 0$
$V_{(BR)ECO}$	4N47U Series	7	10	-	V	$I_E = 100\ \mu\text{A}, I_F = 0$
	$I_{CEO}$	Collector-Emitter Dark Current	-	20	100	nA
$I_{CEO}$		-	-	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



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

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# Surface Mount Optically Coupled Isolator

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

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



SYMBOL	PARAMETER	PART NUMBER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
<b>Coupled</b>							
$I_C/I_F$	DC Current Transfer Ratio	4N22U	25	-	-	%	$I_F = 10 \text{ mA}, V_{CE} = 5 \text{ V}$
		4N23U	60	-	-		
		4N24U	100	-	-	%	$I_F = 2 \text{ mA}, V_{CE} = 5 \text{ V}$
		4N47U	50	-	-		
		4N48U	100	-	-	%	$I_F = 2 \text{ mA}, V_{CE} = 5 \text{ V}$
		4N49U	200	-	-		
$I_{C(ON)}$	On-State Collector Current	4N22U	0.15	-	-	mA	$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = 25^\circ\text{C}$
			2.50	-	-		$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = 25^\circ\text{C}$
			1.00	-	-		$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = -55^\circ\text{C}$
			1.00	-	-		$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = 100^\circ\text{C}$
		4N23U	0.2	-	-	mA	$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = 25^\circ\text{C}$
			6.0	-	-		$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = 25^\circ\text{C}$
			2.5	-	-		$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = -55^\circ\text{C}$
4N24U	2.5	-	-	mA	$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = 100^\circ\text{C}$		
	4.0	-	-		$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = 25^\circ\text{C}$		
4N47U	10.0	-	-	mA	$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = 25^\circ\text{C}$		
	4.0	-	-		$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = -55^\circ\text{C}$		
4N48U	4.0	-	-	mA	$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA } T_A = 100^\circ\text{C}$		
	0.5	-	-		$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 1.0 \text{ mA } T_A = 25^\circ\text{C}$		
4N49U	0.7	-	-	mA	$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = -55^\circ\text{C}$		
	0.5	-	-		$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = 100^\circ\text{C}$		
4N48U	1.0	-	5.0	mA	$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 1.0 \text{ mA } T_A = 25^\circ\text{C}$		
	1.4	-	-		$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = -55^\circ\text{C}$		
4N49U	1.0	-	-	mA	$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = 100^\circ\text{C}$		
	2.0	-	10.0		$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 1.0 \text{ mA } T_A = 25^\circ\text{C}$		
4N49U	2.8	-	-	mA	$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = -55^\circ\text{C}$		
	2.0	-	-		$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA } T_A = 100^\circ\text{C}$		
$V_{CE(SAT)}$	Collector Saturation Voltage	4N22U	-	-	0.3	V	$I_C = 2.5 \text{ mA}, I_B = 0, I_F = 20 \text{ mA}$
		4N23U	-	-	0.3		$I_C = 5.0 \text{ mA}, I_B = 0, I_F = 20 \text{ mA}$
		4N24U	-	-	0.3		$I_C = 10.0 \text{ mA}, I_B = 0, I_F = 20 \text{ mA}$
		4N47U	-	-	0.3	V	$I_C = 0.5 \text{ mA}, I_B = 0, I_F = 2.0 \text{ mA}$
		4N48U	-	-	0.3		$I_C = 1.0 \text{ mA}, I_B = 0, I_F = 2.0 \text{ mA}$
4N49U	-	-	0.3	$I_C = 2.0 \text{ mA}, I_B = 0, I_F = 2.0 \text{ mA}$			
$h_{FE}$	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)		$10^{11}$	-	-	$\Omega$	$V_{I-O} = \pm 1,000 \text{ Vdc}^{(1)}$
$C_{IO}$	Capacitance (Input to Output)		-	-	5.0	pF	$V_{I-O} = 0 \text{ Vdc}, f = 1.0 \text{ MHz}^{(1)}$

**Notes:**

(1) Measured with input leads shorted together and output leads shorted together. Typical input/output capacitance is 0.06 pF.

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# Surface Mount Optically Coupled Isolator

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

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



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

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
I <sub>C(ON)</sub>	On-State Collector Current 4N22U, 4N22U (TX, TXV) 4N22U, 4N22U (TX, TXV) 4N22U, 4N22U (TX, TXV) 4N22U, 4N22U (TX, TXV)	0.15 2.50 1.00 1.00	- - - -	- - - -	mA	I <sub>F</sub> = 2.0 mA, V <sub>CE</sub> = 5 V, I <sub>B</sub> = 0 I <sub>F</sub> = 10.0 mA, V <sub>CE</sub> = 5 V, I <sub>B</sub> = 0 I <sub>F</sub> = 10.0 mA, V <sub>CE</sub> = 5 V, I <sub>B</sub> = 0, T <sub>A</sub> = -55° C I <sub>F</sub> = 10.0 mA, V <sub>CE</sub> = 5 V, I <sub>B</sub> = 0, T <sub>A</sub> = 100° C
	4N23U, 4N23U (TX, TXV) 4N23U, 4N23U (TX, TXV) 4N23U, 4N23U (TX, TXV) 4N23U, 4N23U (TX, TXV)	0.20 6.00 2.50 2.50	- - - -	- - - -		I <sub>F</sub> = 2.0 mA, V <sub>CE</sub> = 5 V, I <sub>B</sub> = 0 I <sub>F</sub> = 10.0 mA, V <sub>CE</sub> = 5 V, I <sub>B</sub> = 0 I <sub>F</sub> = 10.0 mA, V <sub>CE</sub> = 5 V, I <sub>B</sub> = 0, T <sub>A</sub> = -55° C I <sub>F</sub> = 10.0 mA, V <sub>CE</sub> = 5 V, I <sub>B</sub> = 0, T <sub>A</sub> = 100° C
	4N24U, 4N24U (TX, TXV) 4N24U, 4N24U (TX, TXV) 4N24U, 4N24U (TX, TXV) 4N24U, 4N24U (TX, TXV)	0.40 10.0 4.00 4.00	- - - -	- - - -		I <sub>F</sub> = 2.0 mA, V <sub>CE</sub> = 5 V, I <sub>B</sub> = 0 I <sub>F</sub> = 10.0 mA, V <sub>CE</sub> = 5 V, I <sub>B</sub> = 0 I <sub>F</sub> = 10.0 mA, V <sub>CE</sub> = 5 V, I <sub>B</sub> = 0, T <sub>A</sub> = -55° C I <sub>F</sub> = 10.0 mA, V <sub>CE</sub> = 5 V, I <sub>B</sub> = 0, T <sub>A</sub> = 100° C
	4N47U, 4N47U (TX, TXV) 4N47U, 4N47U (TX, TXV) 4N47U, 4N47U (TX, TXV)	0.50 0.70 0.50	- - -	- - -		I <sub>F</sub> = 1.0 mA, V <sub>CE</sub> = 5.0 V, I <sub>B</sub> = 0 I <sub>F</sub> = 2.0 mA, V <sub>CE</sub> = 5.0 V, I <sub>B</sub> = 0, T <sub>A</sub> = -55° C I <sub>F</sub> = 2.0 mA, V <sub>CE</sub> = 5.0 V, I <sub>B</sub> = 0, T <sub>A</sub> = 100° C
	4N48U, 4N48U (TX, TXV) 4N48U, 4N48U (TX, TXV) 4N48U, 4N48U (TX, TXV)	1.00 1.40 1.00	- - -	5 - -		I <sub>F</sub> = 1.0 mA, V <sub>CE</sub> = 5.0 V, I <sub>B</sub> = 0 I <sub>F</sub> = 2.0 mA, V <sub>CE</sub> = 5.0 V, I <sub>B</sub> = 0, T <sub>A</sub> = -55° C I <sub>F</sub> = 2.0 mA, V <sub>CE</sub> = 5.0 V, I <sub>B</sub> = 0, T <sub>A</sub> = 100° C
	4N49U, 4N49U (TX, TXV) 4N49U, 4N49U (TX, TXV) 4N49U, 4N49U (TX, TXV)	2.00 2.80 2.00	- - -	10 - -		I <sub>F</sub> = 1.0 mA, V <sub>CE</sub> = 5.0 V, I <sub>B</sub> = 0 I <sub>F</sub> = 2.0 mA, V <sub>CE</sub> = 5.0 V, I <sub>B</sub> = 0, T <sub>A</sub> = -55° C I <sub>F</sub> = 2.0 mA, V <sub>CE</sub> = 5.0 V, I <sub>B</sub> = 0, T <sub>A</sub> = 100° C
	I <sub>CB(ON)</sub>	On-State Collector Base 4N47U, 4N48U, 4N49U (TX, TXV)	30	-		-
V <sub>CE(SAT)</sub>	Collector-Emitter Saturation Voltage 4N22U, 4N23U, 4N24U (TX, TXV) 4N22U, 4N23U, 4N24U (TX, TXV) 4N22U, 4N23U, 4N24U (TX, TXV) 4N47U, 4N47U (TX, TXV) 4N48U, 4N48U (TX, TXV) 4N49U, 4N49U (TX, TXV)	- - - - - -	- - - - - -	0.30 0.30 0.30 0.30 0.30 0.30	V	I <sub>F</sub> = 20 mA, I <sub>C</sub> = 2.5 mA, I <sub>B</sub> = 0 I <sub>F</sub> = 20 mA, I <sub>C</sub> = 5.0 mA, I <sub>B</sub> = 0 I <sub>F</sub> = 20 mA, I <sub>C</sub> = 10.0 mA, I <sub>B</sub> = 0 I <sub>F</sub> = 2.0 mA, I <sub>C</sub> = 0.5 mA, I <sub>B</sub> = 0 I <sub>F</sub> = 2.0 mA, I <sub>C</sub> = 1.0 mA, I <sub>B</sub> = 0 I <sub>F</sub> = 2.0 mA, I <sub>C</sub> = 2.0 mA, I <sub>B</sub> = 0
H <sub>FE</sub>	DC Current Gain 4N22U, 4N22U (TX, TXV) 4N23U, 4N23U (TX, TXV) 4N24U, 4N24U (TX, TXV) 4N47U, 4N48U, 4N49U (TX, TXV)	200 300 400 100	- - - -	- - - -	V	V <sub>CE</sub> = 5.0 V, I <sub>C</sub> = 10.0 mA, I <sub>F</sub> = 0 mA V <sub>CE</sub> = 5.0 V, I <sub>C</sub> = 10.0 mA, I <sub>F</sub> = 0 mA V <sub>CE</sub> = 5.0 V, I <sub>C</sub> = 10.0 mA, I <sub>F</sub> = 0 mA V <sub>CE</sub> = 5.0 V, I <sub>C</sub> = 10.0 mA, I <sub>F</sub> = 0 mA
R <sub>IO</sub>	Resistance (Input-to-Output) 4N22U, 4N23U, 4N24U (TX, TXV) 4N47U, 4N48U, 4N49U (TX, TXV)	10 <sup>11</sup> 10 <sup>11</sup>	- -	- -	Ω	V <sub>I-O</sub> = ± 1,000 VDC <sup>(1)</sup> V <sub>I-O</sub> = ± 1,000 VDC <sup>(1)</sup>
C <sub>IO</sub>	Capacitance (Input-to-Output)	-	-	5	pF	V <sub>I-O</sub> = 0 V, f = 1.0 MHz <sup>(1)</sup>

### Notes:

- (1) Measured with input leads shorted together and output leads shorted together. Typical input/output capacitance is 0.06 pF.

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