

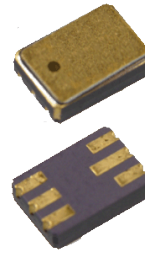


# THE DATASHEET OF 4N49UTX



# Surface Mount Optically Coupled Isolator

## 4N24U, 4N47U, 4N49U (TX)



### 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 (Obsolete)	1	10 / 40	35	COTS
4N22UTX (Obsolete)				486
4N22UTXV (Obsolete)				COTS
4N23U (Obsolete)				486
4N23UTX (Obsolete)				COTS
4N23UTXV (Obsolete)				486
4N24U		1 / 40	40	COTS
4N24UTX (Obsolete)				486
4N24UTXV (Obsolete)				COTS
4N47U				548
4N47UTX (Obsolete)				COTS
4N47UTXV (Obsolete)				548
4N48U (Obsolete)	COTS	40	COTS	
4N48UTX (Obsolete)			548	
4N48UTXV (Obsolete)			COTS	
4N49U	COTS	40	COTS	
4N49UTX			548	
4N49UTXV (Obsolete)			COTS	

### General Note

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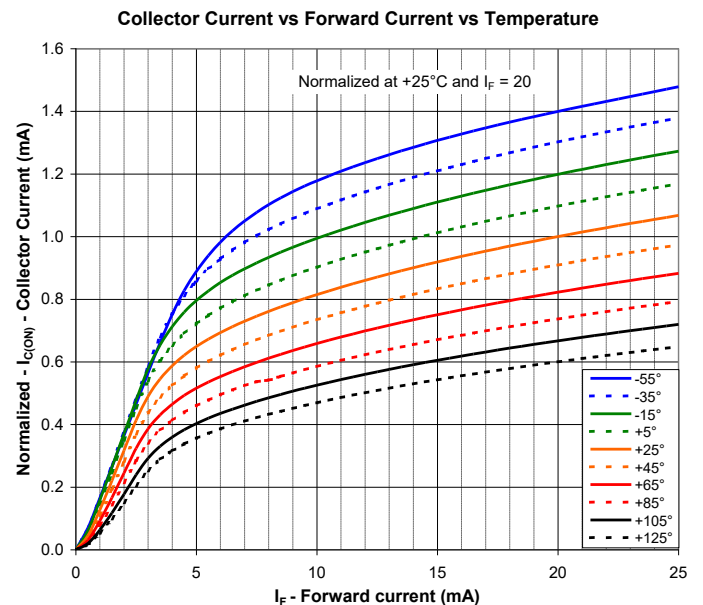
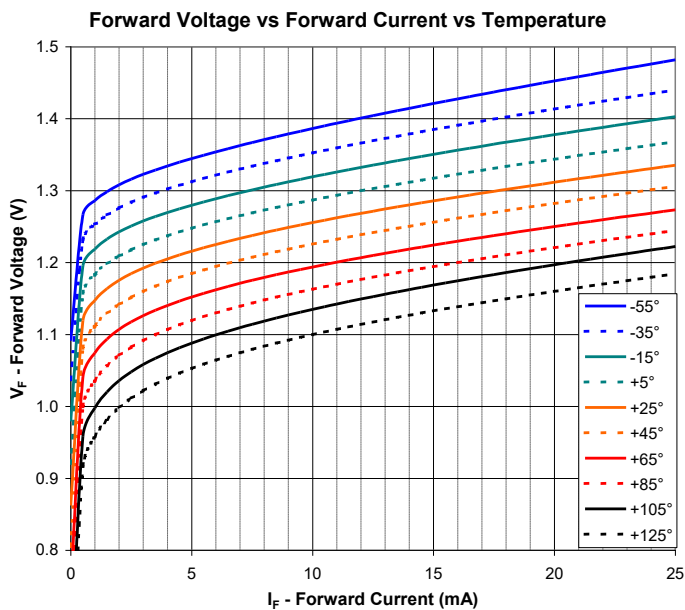
### Electrical Specifications

**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.



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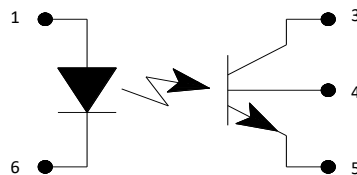
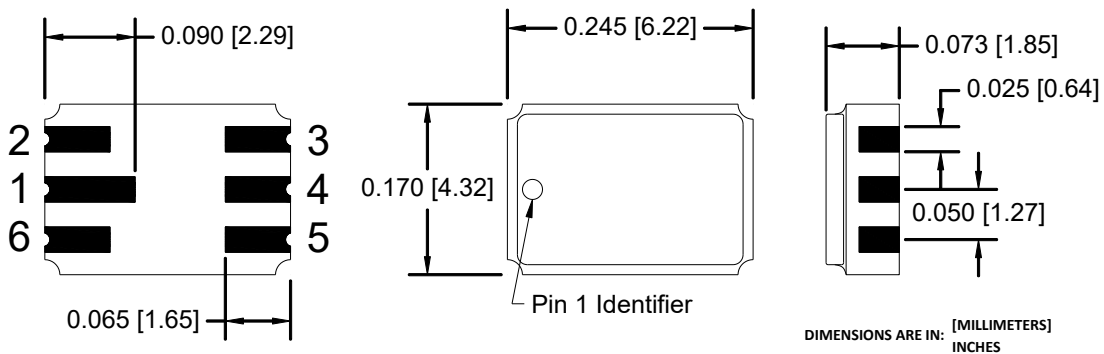
## 4N24U, 4N47U, 4N49U (TX)



### Electrical Specifications

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

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS	
<b>Input LED</b>							
$V_F$	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		$I_F = 10.0\text{ mA}$	
$I_R$	Reverse Current	4N47U, 4N48U, 4N49U (TX, TXV)	1.00	-	1.70		$I_F = 10.0\text{ mA}, T_A = -55^\circ\text{C}$
		4N47U, 4N48U, 4N49U (TX, TXV)	0.70	-	1.30		$I_F = 10.0\text{ mA}, T_A = -100^\circ\text{C}$
			-	-	100	$\mu\text{A}$	$V_R = 2.0\text{ V}$
<b>Output Phototransistor</b>							
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage						
	4N22U Series 4N47U Series	35 40	80 90	- -	V	$I_C = 100\ \mu\text{A}, I_F = 0$	
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage						
	4N22U Series 4N47U Series	4 7	6 10	- -	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	$I_F = 20\text{ mA}, I_C = 2\text{ mA}$	



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

## 4N24U, 4N47U, 4N49U (TX)



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	-	-		
		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	$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA}, T_A = 25^\circ \text{ C}$
			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	-	-		$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA}, T_A = -55^\circ \text{ C}$
			2.5	-	-		$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA}, T_A = 100^\circ \text{ C}$
		4N24U	0.4	-	-	mA	$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA}, T_A = 25^\circ \text{ C}$
			10.0	-	-		$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA}, T_A = 25^\circ \text{ C}$
			4.0	-	-		$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA}, T_A = -55^\circ \text{ C}$
			4.0	-	-		$V_{CE} = 10 \text{ V}, I_B = 0, I_F = 10.0 \text{ mA}, T_A = 100^\circ \text{ C}$
4N47U	0.5	-	-	mA	$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 1.0 \text{ mA}, T_A = 25^\circ \text{ C}$		
	0.7	-	-		$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA}, T_A = -55^\circ \text{ C}$		
	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	-	-		$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA}, T_A = -55^\circ \text{ C}$		
	1.0	-	-		$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA}, T_A = 100^\circ \text{ C}$		
4N49U	2.0	-	10.0	mA	$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 1.0 \text{ mA}, T_A = 25^\circ \text{ C}$		
	2.8	-	-		$V_{CE} = 5 \text{ V}, I_B = 0, I_F = 2.0 \text{ mA}, T_A = -55^\circ \text{ C}$		
	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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## 4N24U, 4N47U, 4N49U (TX)



### 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 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:

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