

HSR312, HSR312L, HSR412, HSR412L Photovoltaic Solid-State Relay Optocouplers

Features

- 4,000 VRMS Isolation
- Wide operating voltage range
- 250 V (HSR312, HSR312L)
- 400 V (HSR412, HSR412L)
- Solid-State Reliability
- Bounce-Free Operation
- 4000 V ESD Rating (HBM)
- UL and CSA approved

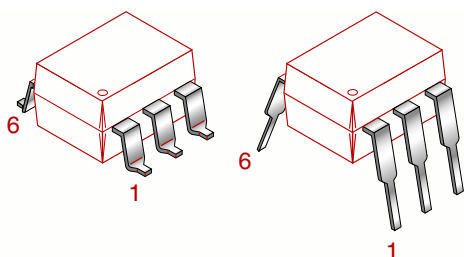
Applications

- On/Off Hook Switch
- Replacement for Mechanical Relays
- Dial Out Relay
- Ring Injection Relay
- General Switching
- Ground Start

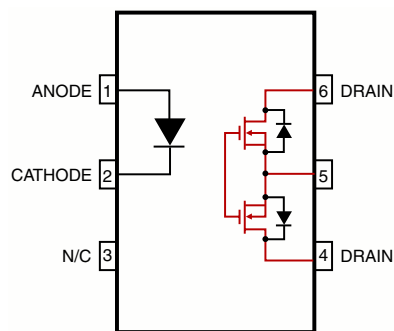
Description

The HSR312 and HSR412 devices consist of a AlGaAs infrared emitting diode optically coupled to a power MOSFET detector which is driven by a photovoltaic generator. The devices are housed in a 6-pin dual-in-line package. The HSR312L and HSR412L employ an active current limit circuitry enabling the device to withstand current surge transients.

Package



Schematic



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

Symbol	Parameters	Device	Value	Units
TOTAL DEVICE				
T_{STG}	Storage Temperature	All	-40 to +100	$^\circ\text{C}$
T_{OPR}	Operating Temperature	All	-40 to +85	$^\circ\text{C}$
T_{SOL}	Lead Solder Temperature	All	260 for 10 sec	$^\circ\text{C}$
V_{ISO}	Isolation Surge Voltage	All	4000	Vac(RMS)
C_{IO}	Maximum Input/Output Capacitance	All	1.0	pF
R_{IO}	Maximum Input/Output Resistance	All	10^{12}	Ω

Electrical Characteristics ($T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ Unless otherwise specified)

Input Characteristics

Symbol	Parameters/ Test Conditions	Connection	Limit	HSR312	HSR312L	HSR412	HSR412L	Units
$I_{F(ON)}$	Control Current	Series or Parallel	Max	2.0	2.0	3.0	3.0	mA
$I_{F(OFF)}$	Control Current for Off-State Resistance	Series or Parallel	Min	0.4	0.4	0.4	0.4	mA
I_F	Control Current Range	Series or Parallel	Min	2.0	2.0	3.0	3.0	mA
			Max	25	25	25	25	
V_R	Reverse Voltage	Series or Parallel	Min	7	7	7	7	V
V_F	Forward Voltage ($I_F = 10\text{ mA}$)	Series or Parallel	Max	1.6	1.6	1.6	1.6	V

Output Characteristics

Symbol	Parameters/ Test Conditions	Connection	Limit	HSR312	HSR312L	HSR412	HSR412L	Units
V_{OPR}	Operating Voltage Range	Series or Parallel	Max	250	250	400	400	V_{DC} or $V_{AC(PEAK)}$
I_L	Load Current $T_A = +40^\circ\text{C}$, 5mA control (see fig. 1 & 2)	Series	Max	190	170	140	120	mA
		Parallel	Max	320	300	210	200	
R_{ON}	On-State Resistance $T_A = 25^\circ\text{C}$, 50mA pulsed load, 5mA control	Series	Max	10	15	27	35	Ω
		Parallel	Max	3	4.25	7	9	
—	Off-State Leakage Current $T_A = 25^\circ\text{C}$, $\pm 250\text{V}$ for HSR312/L, $\pm 400\text{V}$ for HSR412/L	Series or Parallel	Max	1.0	1.0	1.0	1.0	μA
I_{LMT}	Current Limit $T_A = +25^\circ\text{C}$, 5mA control	Series	Min	N/A	190	N/A	130	mA
			Max	N/A	300	N/A	220	
		Parallel	Min	N/A	330	N/A	260	
			Max	N/A	560	N/A	440	

Output Characteristics (Continued)

Symbol	Parameters/ Test Conditions	Connection	Limit	HSR312	HSR312L	HSR412	HSR412L	Units
T_{ON}	Turn-On Time $T_A = +25^{\circ}\text{C}$ for 50mA, 100VDC load, 5mA control	Series or Parallel	Max	3.0	3.0	2.0	2.0	mS
T_{OFF}	Turn-Off Time $T_A = +25^{\circ}\text{C}$ for 50mA, 100VDC load, 5mA control	Series or Parallel	Max	0.5	0.5	0.5	0.5	mS
—	Thermal Offset Voltage 5mA control	Series or Parallel	Max	N/A	N/A	0.5	0.5	mV
C_O	Output Capacitance 5V _{DC}	Series or Parallel	Max	50	50	12	12	pF

Isolation Characteristics

Symbol	Characteristics	Test Conditions	Limit	HSR312	HSR312L	HSR412	HSR412L	Units
V_{ISO}	Input-Output Isolation Voltage	$I_{I-O} \leq 2 \mu\text{A}$	Max	4000	4000	4000	4000	V

Typical Performance Curves

Figure 1. Forward Current vs. Forward Voltage

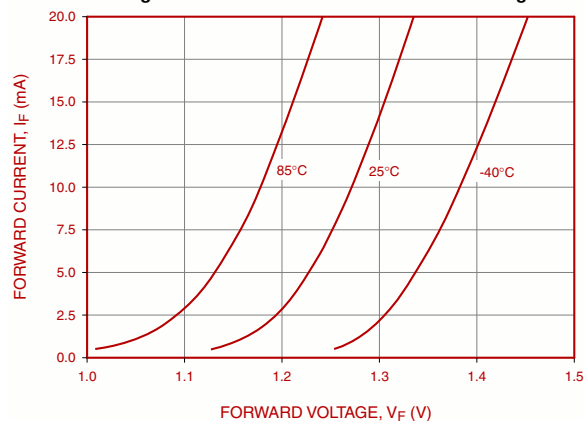


Figure 2. Normalized on Resistance vs. Ambient Temperature

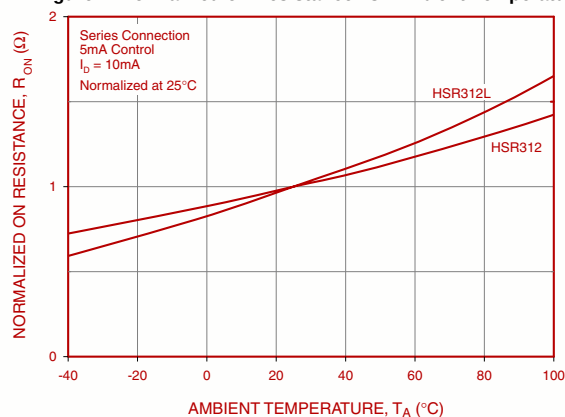


Figure 3. Normalized on Resistance vs. Ambient Temperature

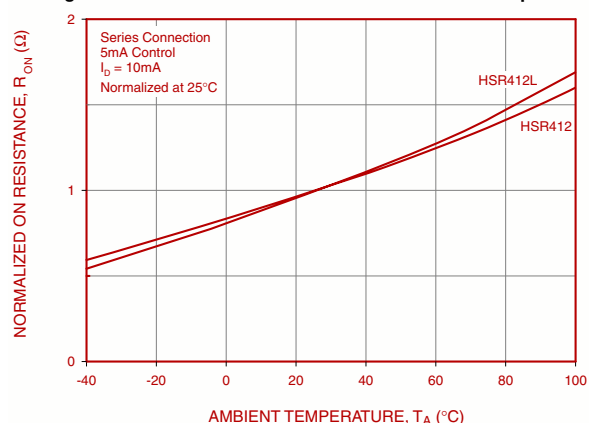


Figure 4. Load Current vs. Voltage Drop

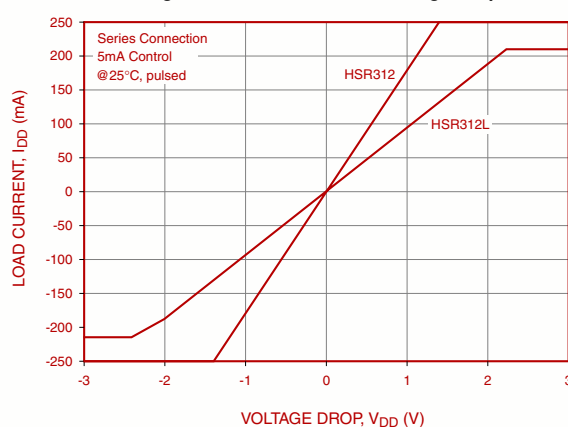


Figure 5. Load Current vs. Voltage Drop

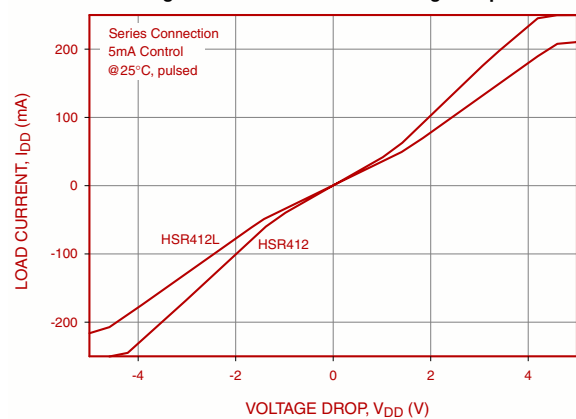


Figure 6. Maximum Load Current Vs Ambient Temperature

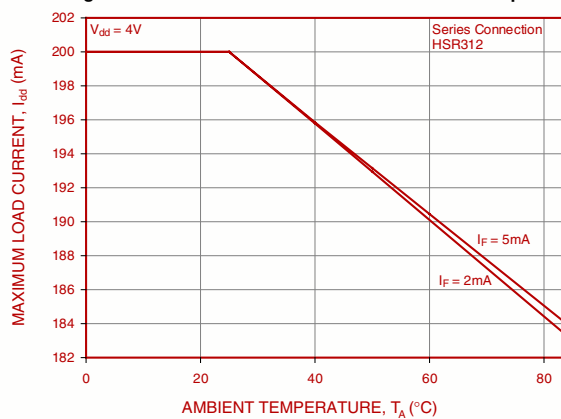


Figure 7. Maximum Load Current Vs Ambient Temperature

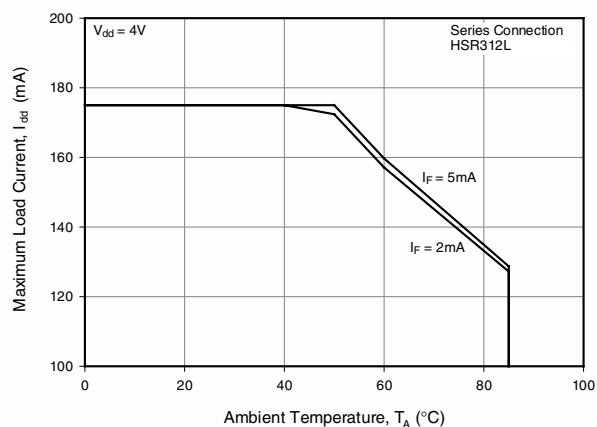


Figure 8. Maximum Load Current Vs Ambient Temperature

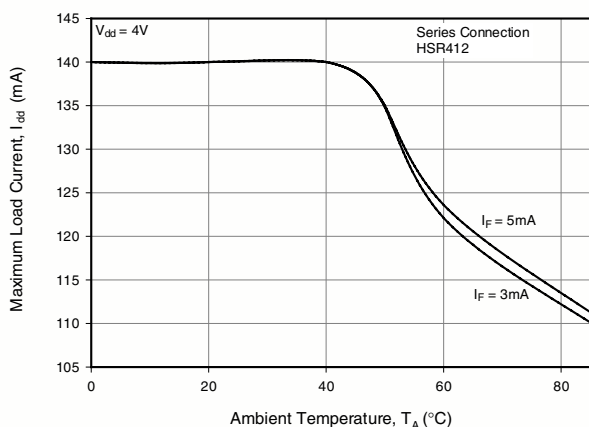


Figure 9. Maximum Load Current Vs Ambient Temperature

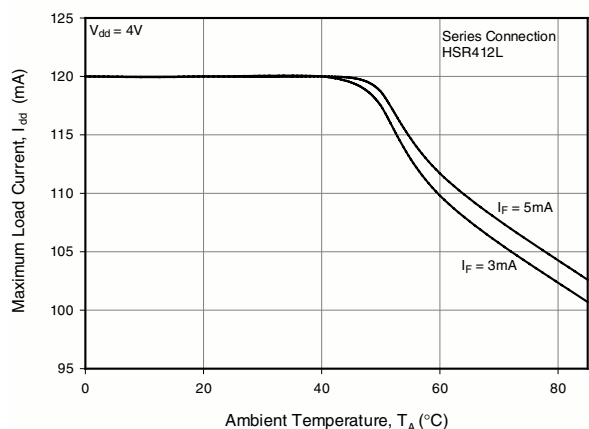


Figure 10. Off State Current vs. Ambient Temperature

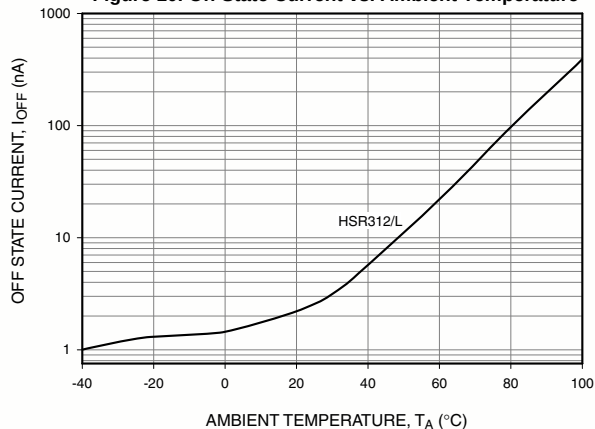


Figure 11. Off State Current vs. Ambient Temperature

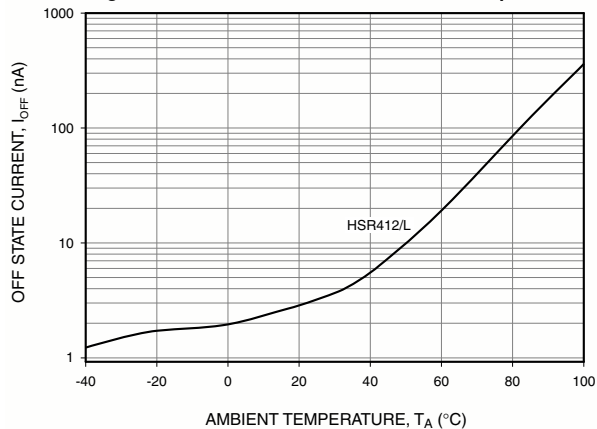


Figure 12. Normalized Off State Leakage vs. Ambient Temperature

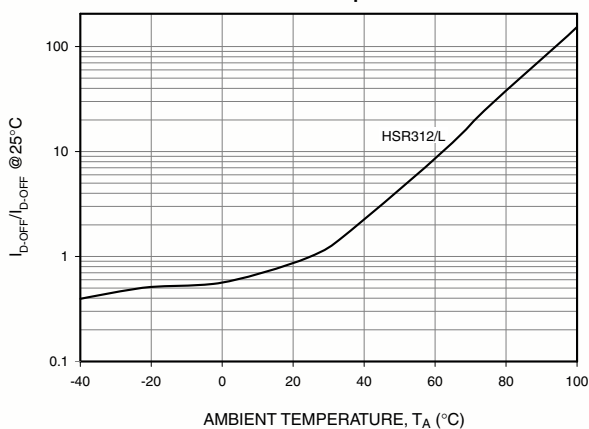
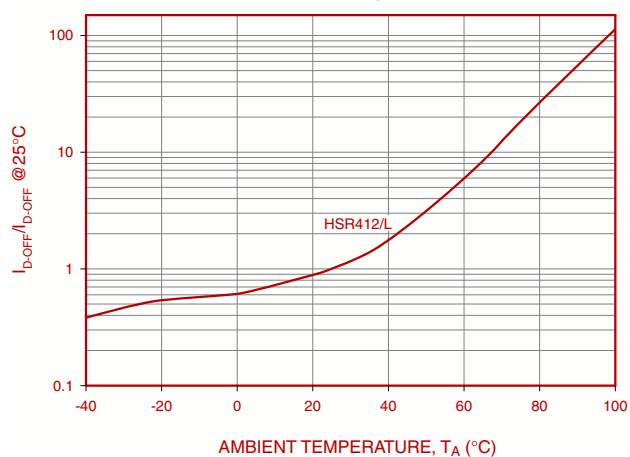
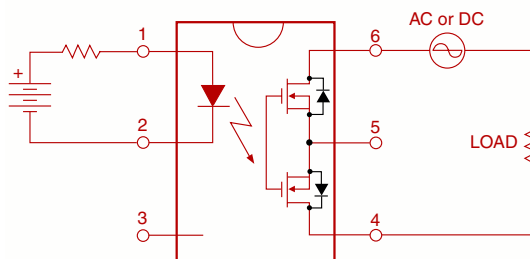


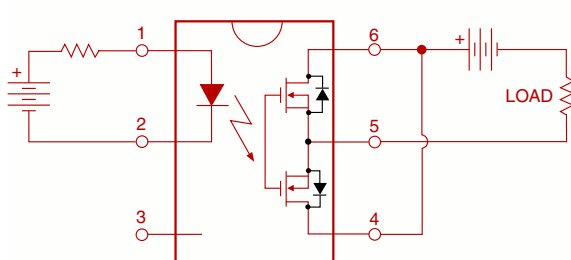
Figure 13. Normalized Off State Leakage vs. Ambient Temperature



Series Connection

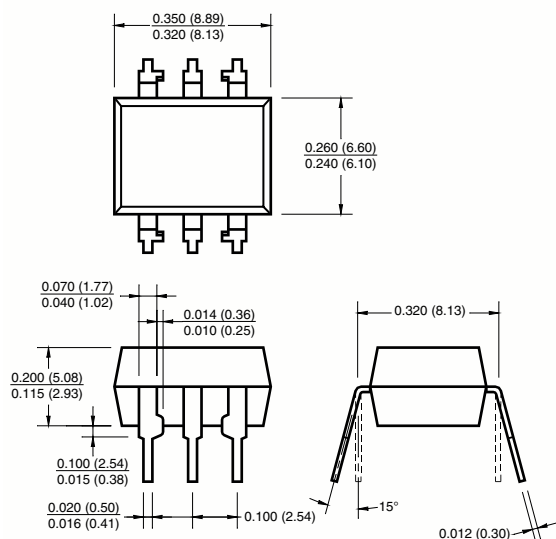


Parallel Connection

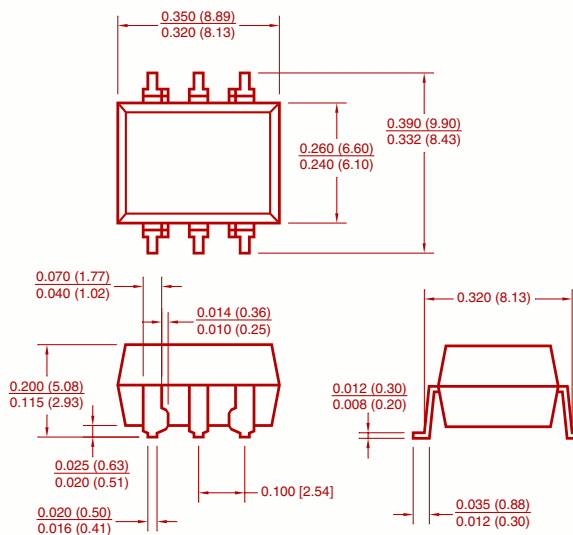


Package Dimensions

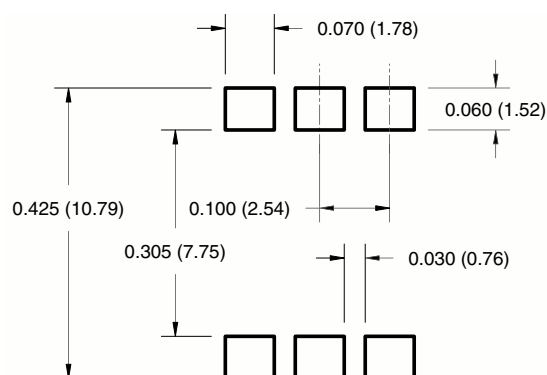
Through Hole



Surface Mount



Recommended Pad Layout for Surface Mount Leadform



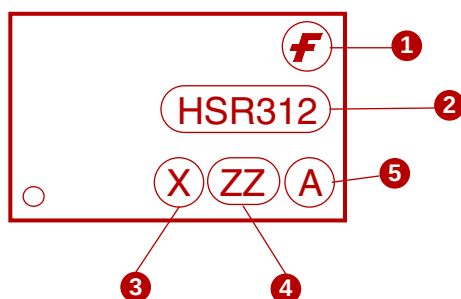
Note:

All dimensions are in inches (millimeters)

Ordering Information

Option	Part Number Example	Description
S	HSR312S	Surface Mount Lead Bend
SR2	HSR312SR2	Surface Mount; Tape and reel

Marking Information



Definitions	
1	Fairchild logo
2	Device number
3	One digit year code
4	Two digit work week ranging from '01' to '53'
5	Assembly package code

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