

**HSR312**

**HSR312L**

**HSR412**

**HSR412L**

**DESCRIPTION**

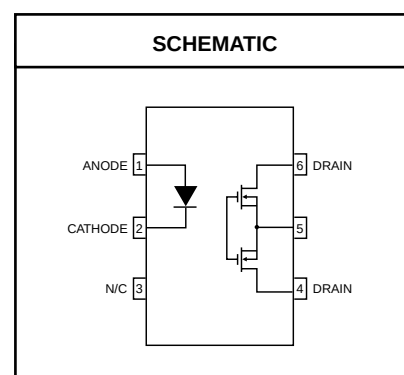
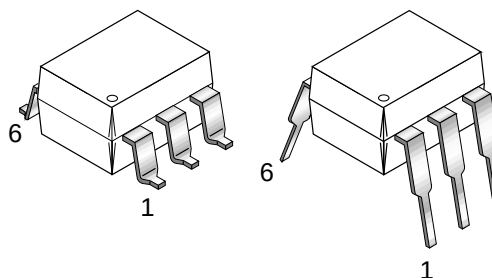
The HSR312 and HSR412 devices consist of a AlGaAs infrared emitting diode optically coupled to a power MOSFET detector which is driven by a photovoltaic generator. The devices are housed in a 6-pin dual-in-line package. The HSR312L and HSR412L employ an active current limit circuitry enabling the device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

**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, CSA and BABT approval pending

**APPLICATIONS**

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



**ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$  unless otherwise noted)**

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

**HSR312**

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

**INPUT CHARACTERISTICS**

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

**OUTPUT CHARACTERISTICS**

| Parameters / Test Conditions                                                                  | Connection         | Symbol           | Limit | HSR312 | HSR312L | HSR412 | HSR412L | Units                                       |
|-----------------------------------------------------------------------------------------------|--------------------|------------------|-------|--------|---------|--------|---------|---------------------------------------------|
| Operating Voltage Range                                                                       | Series or Parallel | V <sub>OPR</sub> | Max   | 250    | 250     | 400    | 400     | V <sub>DC</sub> or<br>V <sub>AC(PEAK)</sub> |
| Load Current<br>T <sub>A</sub> = +40°C, 5mA control<br>(see fig. 1 & 2)                       | Series             | I <sub>L</sub>   | Max   | 190    | 170     | 140    | 120     | mA                                          |
|                                                                                               | Parallel           |                  | Max   | 320    | 300     | 210    | 200     |                                             |
| On-State Resistance<br>T <sub>A</sub> = 25°C, 50mA pulsed load,<br>5mA control                | Series             | R <sub>ON</sub>  | Max   | 10     | 15      | 27     | 35      | Ω                                           |
|                                                                                               | Parallel           |                  | Max   | 3      | 4.25    | 7      | 9       |                                             |
| Off-State Leakage Current<br>T <sub>A</sub> = 25°C, ±250V for HSR312/L,<br>±400V for HSR412/L | Series or Parallel | —                | Max   | 1.0    | 1.0     | 1.0    | 1.0     | μA                                          |
| Current Limit<br>T <sub>A</sub> = +25°C, 5mA control                                          | Series             | I <sub>LMT</sub> | 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     |                                             |
| Turn-On Time<br>T <sub>A</sub> = +25°C for 50mA,<br>100V <sub>DC</sub> load, 5mA control      | Series or Parallel | T <sub>ON</sub>  | Max   | 3.0    | 3.0     | 2.0    | 2.0     | mS                                          |
| Turn-Off Time<br>T <sub>A</sub> = +25°C for 50mA,<br>100V <sub>DC</sub> load, 5mA control     | Series or Parallel | T <sub>OFF</sub> | Max   | 0.5    | 0.5     | 0.5    | 0.5     | mS                                          |
| Thermal Offset Voltage<br>5mA control                                                         | Series or Parallel | —                | Max   | N/A    | N/A     | 0.5    | 0.5     | μV                                          |
| Output Capacitance<br>5V <sub>DC</sub>                                                        | Series or Parallel | C <sub>O</sub>   | Max   | 50     | 50      | 12     | 12      | pF                                          |

**ISOLATION CHARACTERISTICS**

| Characteristics                | Test Conditions | Symbol    | Limit | HSR312 | HSR312L | HSR412 | HSR412L | Units |
|--------------------------------|-----------------|-----------|-------|--------|---------|--------|---------|-------|
| Input-Output Isolation Voltage |                 | $V_{ISO}$ | Max   | 4000   | 4000    | 4000   | 4000    | V     |

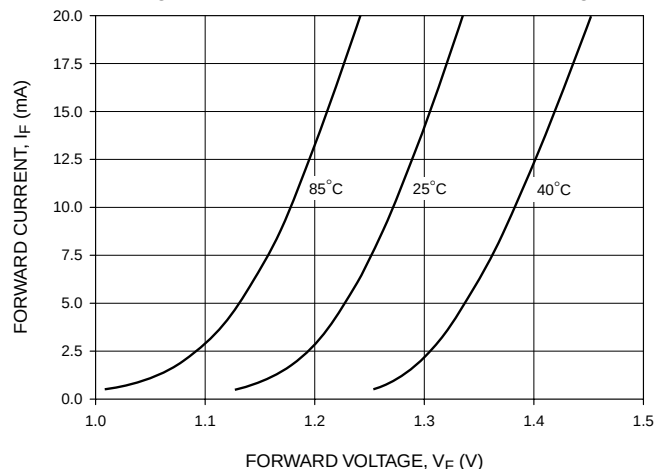
**HSR312**

**HSR312L**

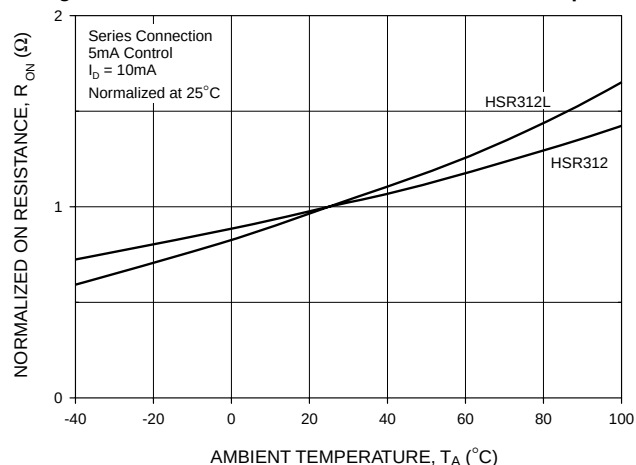
**HSR412**

**HSR412L**

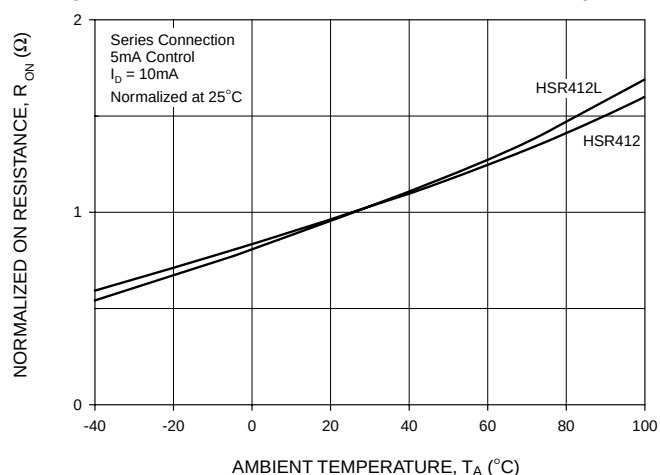
**Figure 1. Forward Current vs. Forward Voltage**



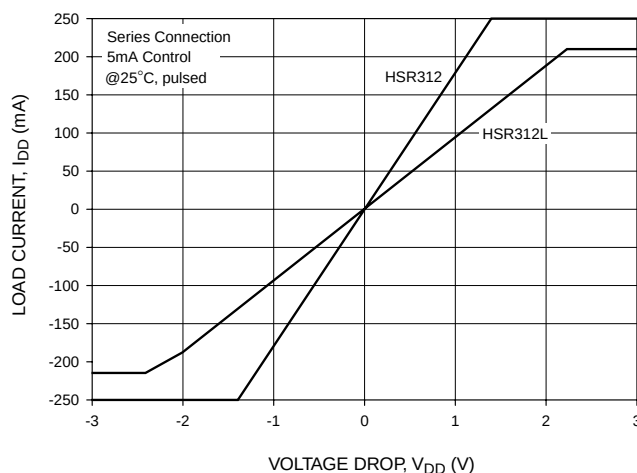
**Figure 2. Normalized on Resistance vs. Ambient Temperature**



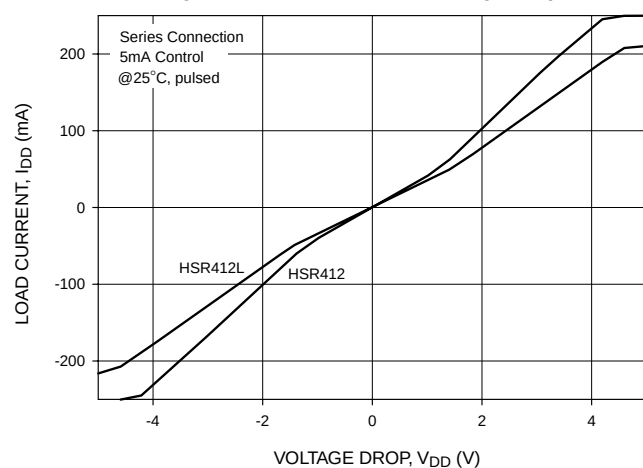
**Figure 3. Normalized on Resistance vs. Ambient Temperature**



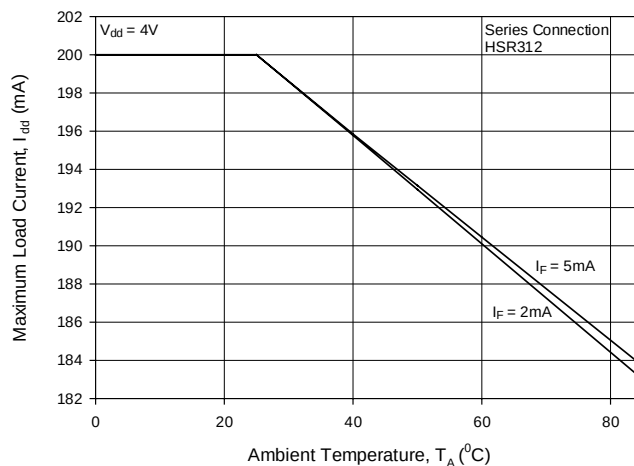
**Figure 4. Load Current vs. Voltage Drop**



**Figure 5. Load Current vs. Voltage Drop**



**Figure 6. Maximum Load Current Vs Ambient Temperature**



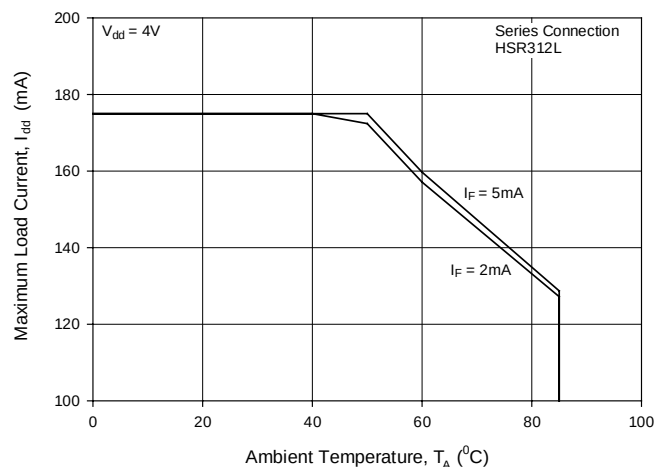
**HSR312**

**HSR312L**

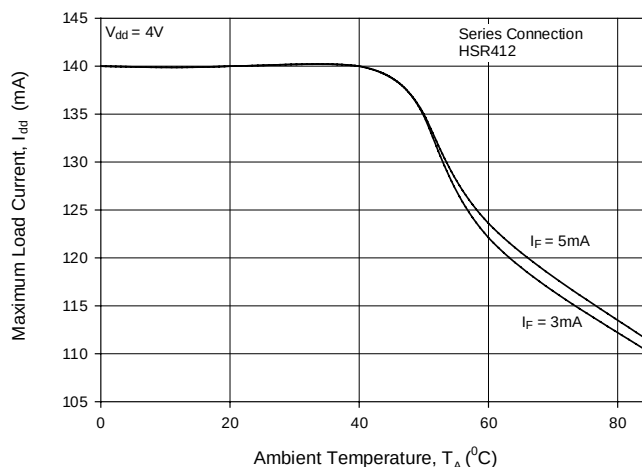
**HSR412**

**HSR412L**

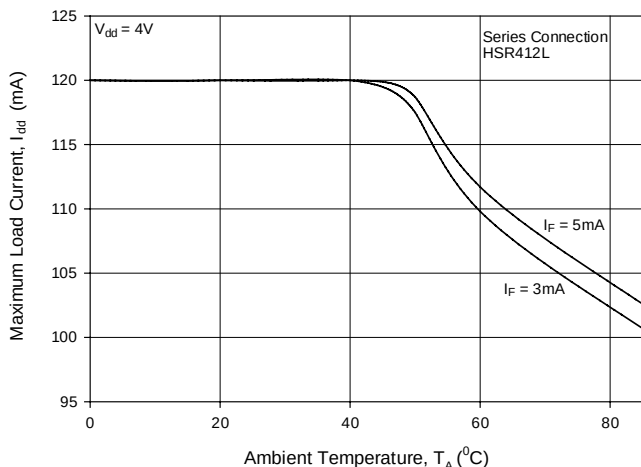
**Figure 7. Maximum Load Current Vs Ambient Temperature**



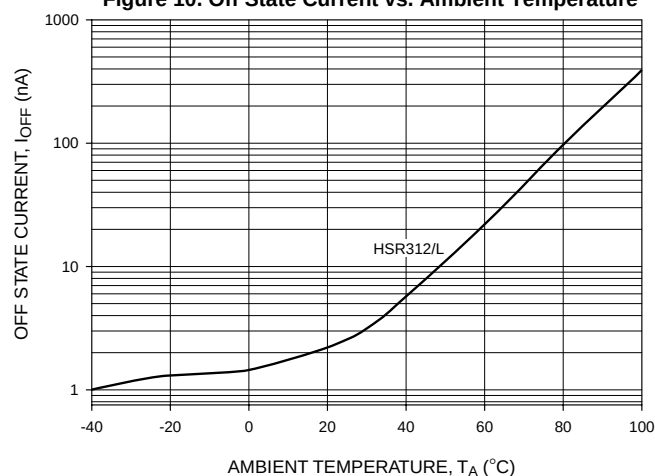
**Figure 8. Maximum Load Current Vs Ambient Temperature**



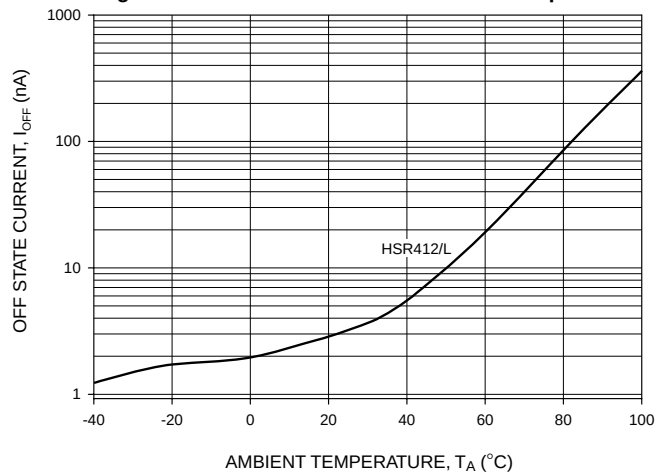
**Figure 9. Maximum Load Current Vs Ambient Temperature**



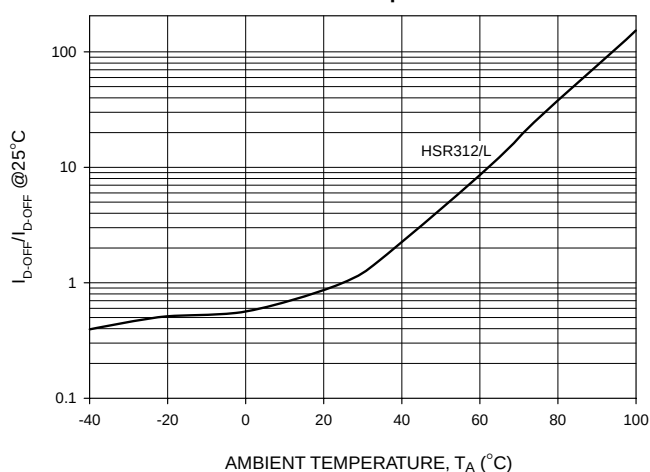
**Figure 10. Off State Current vs. Ambient Temperature**



**Figure 11. Off State Current vs. Ambient Temperature**



**Figure 12. Normalized Off State Leakage vs. Ambient Temperature**



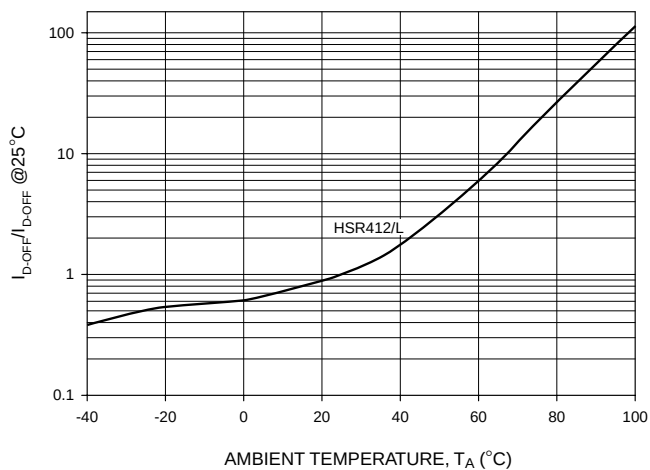
HSR312

HSR312L

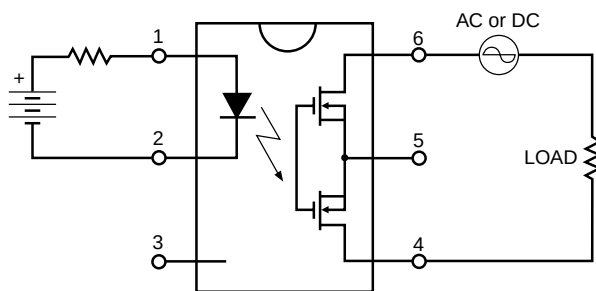
HSR412

HSR412L

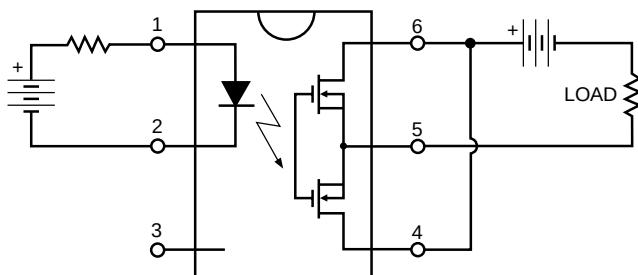
**Figure 13. Normalized Off State Leakage vs.  
Ambient Temperature**



**Series Connection**



**Parallel Connection**



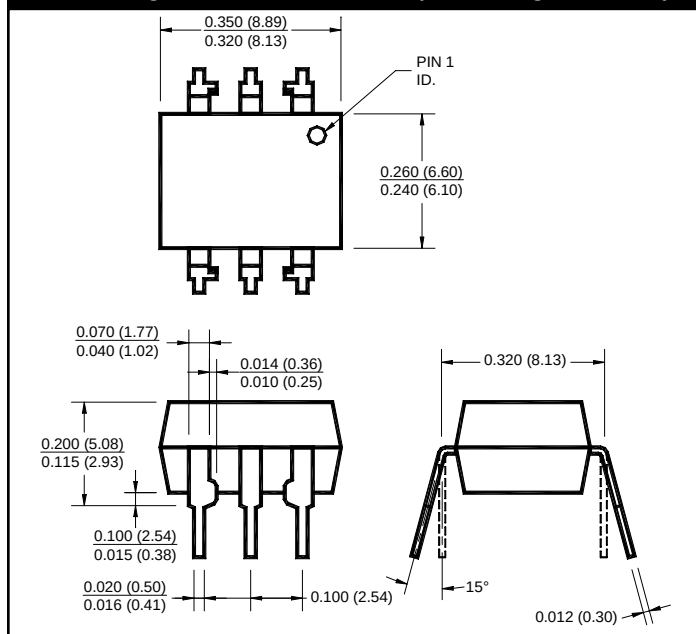
**HSR312**

**HSR312L**

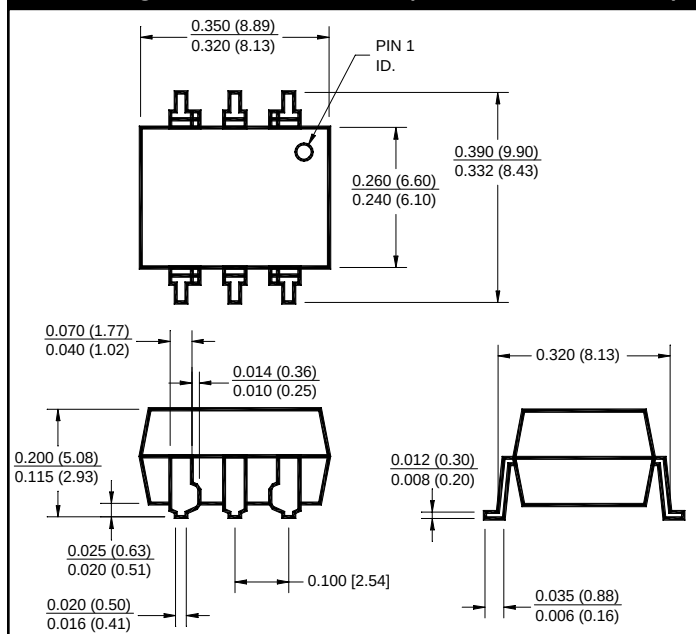
**HSR412**

**HSR412L**

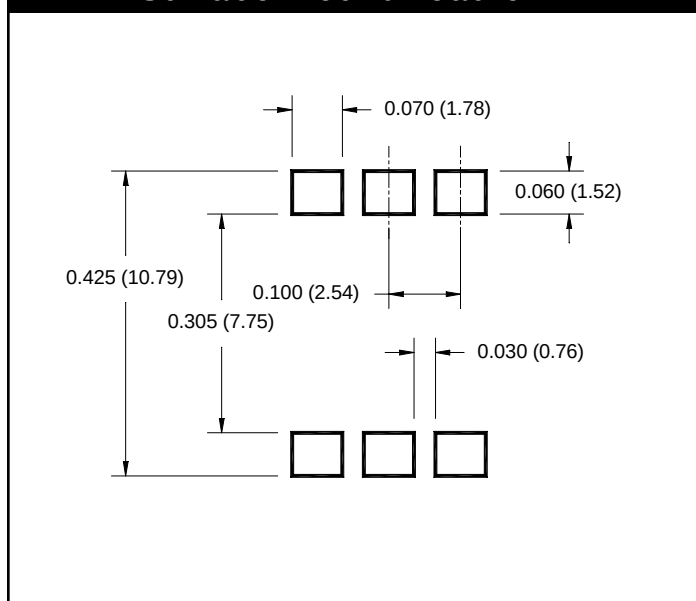
**Package Dimensions (Through Hole)**



**Package Dimensions (Surface Mount)**



**Recommended Pad Layout for  
Surface Mount Leadform**



**NOTE**

All dimensions are in inches (millimeters)

HSR312

HSR312L

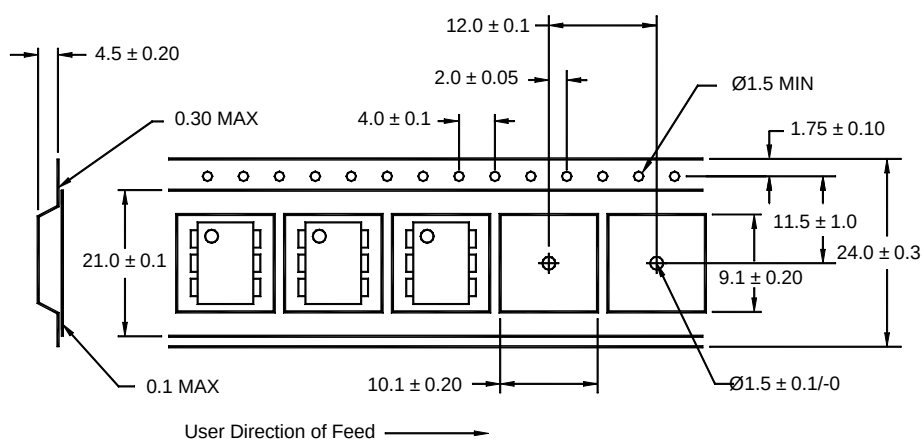
HSR412

HSR412L

## ORDERING INFORMATION

| Option | Order Entry Identifier | Description                  |
|--------|------------------------|------------------------------|
| S      | S                      | Surface Mount Lead Bend      |
| SR2    | SR2                    | Surface Mount; Tape and reel |

## Carrier Tape Specifications ("D" Taping Orientation)



## NOTE

All dimensions are in inches (millimeters)

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