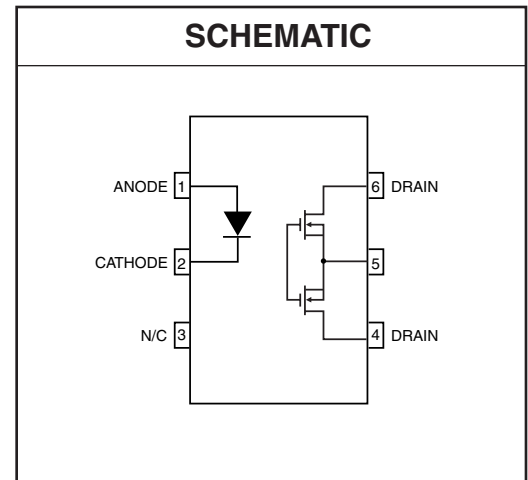
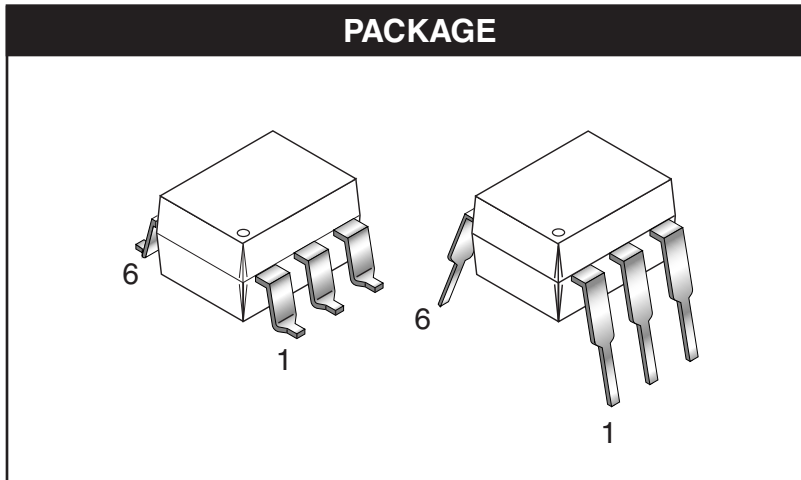


**HSR312**

**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

<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_A = 25^\circ\text{C}$ 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**

**HSR312L**

**HSR412**

**HSR412L**

**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	$V_{OPR}$	Max	250	250	400	400	$V_{DC}$ or $V_{AC(PEAK)}$
Load Current $T_A = +40^\circ\text{C}$ , 5mA control (see fig. 1 & 2)	Series	$I_L$	Max	190	170	140	120	mA
	Parallel		Max	320	300	210	200	
On-State Resistance $T_A = 25^\circ\text{C}$ , 50mA pulsed load, 5mA control	Series	$R_{ON}$	Max	10	15	27	35	$\Omega$
	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	$I_l$	Max	1.0	1.0	1.0	1.0	$\mu\text{A}$
Current Limit $T_A = +25^\circ\text{C}$ , 5mA control	Series	$I_{LMT}$	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 $T_A = +25^\circ\text{C}$ for 50mA, 100VDC load, 5mA control	Series or Parallel	$T_{ON}$	Max	3.0	3.0	2.0	2.0	mS
Turn-Off Time $T_A = +25^\circ\text{C}$ for 50mA, 100VDC load, 5mA control	Series or Parallel	$T_{OFF}$	Max	0.5	0.5	0.5	0.5	mS
Thermal Offset Voltage 5mA control	Series or Parallel	$V_l$	Max	N/A	N/A	0.5	0.5	mV
Output Capacitance $5V_{DC}$	Series or Parallel	$C_O$	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

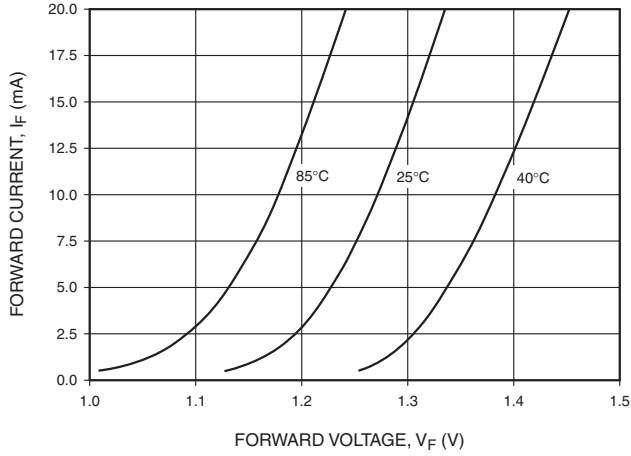
**HSR312**

**HSR312L**

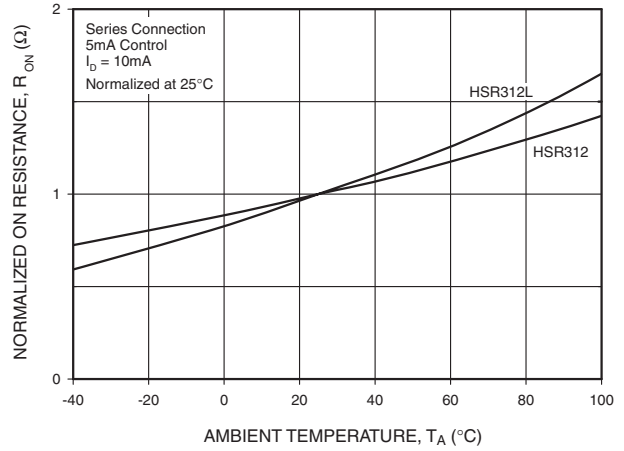
**HSR412**

**HSR412L**

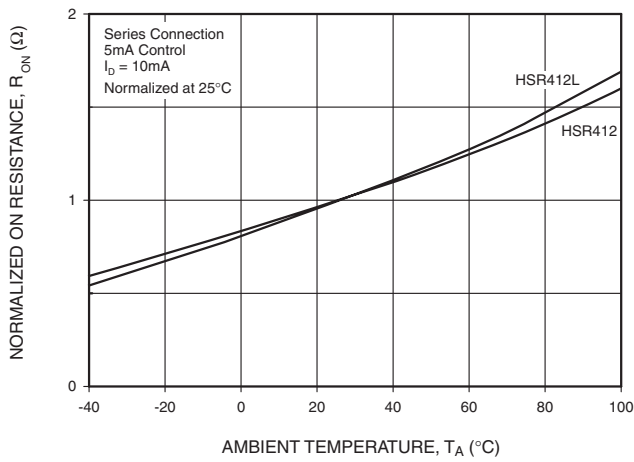
**Figure 1. Forward Current vs. Forward Voltage**



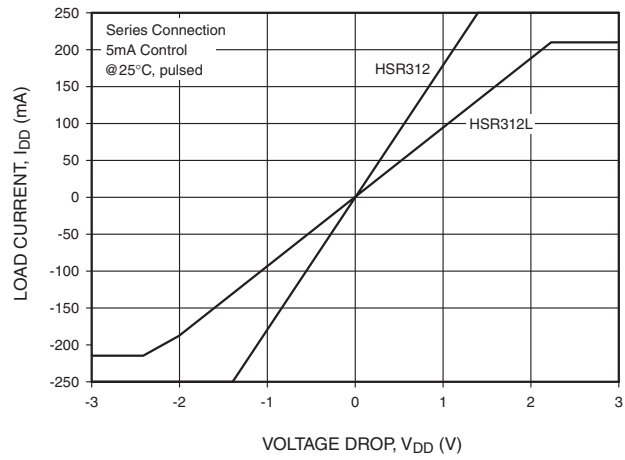
**Figure 2. Normalized on Resistance vs. Ambient Temperature**



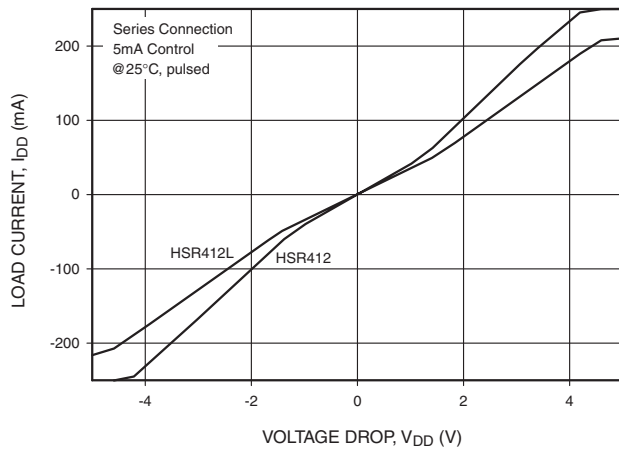
**Figure 3. Normalized on Resistance vs. Ambient Temperature**



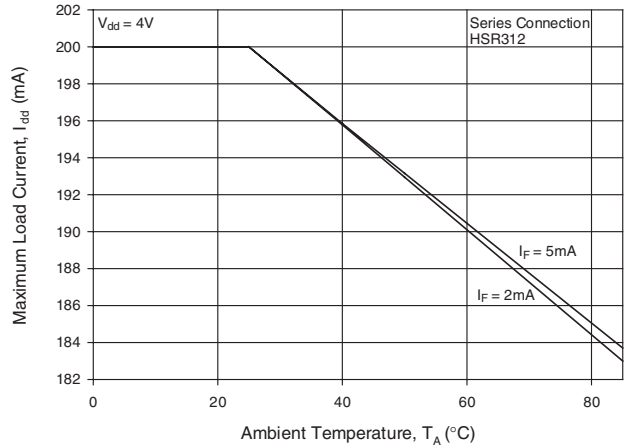
**Figure 4. Load Current vs. Voltage Drop**



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



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



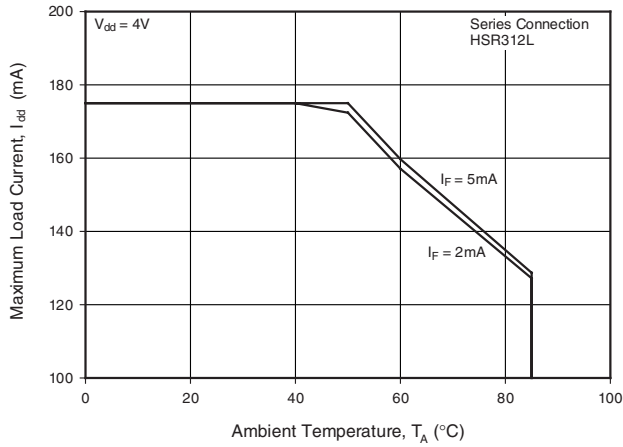
**HSR312**

**HSR312L**

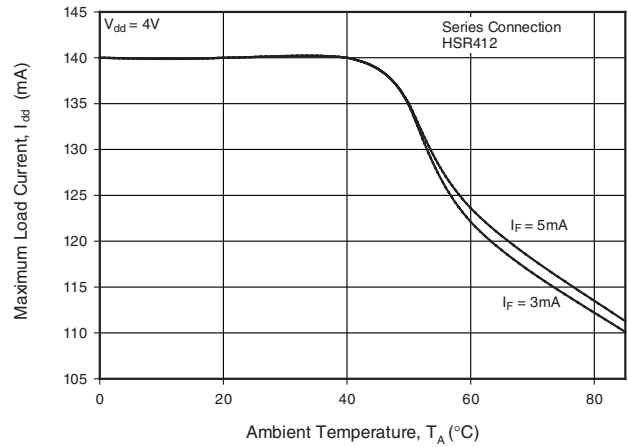
**HSR412**

**HSR412L**

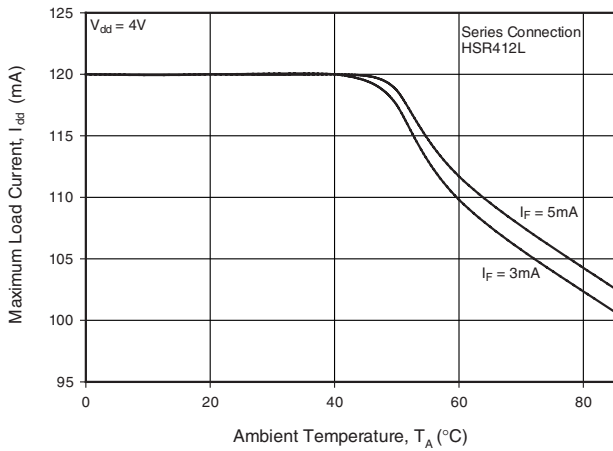
**Figure 7. Maximum Load Current Vs Ambient Temperature**



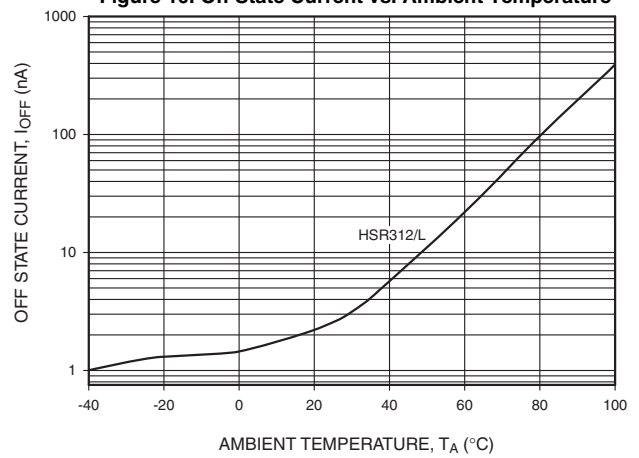
**Figure 8. Maximum Load Current Vs Ambient Temperature**



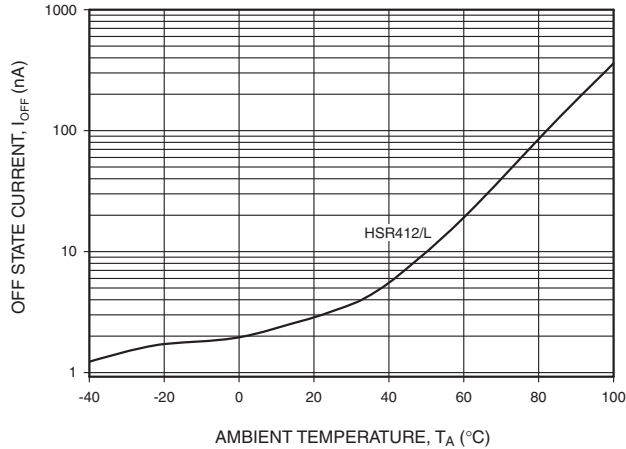
**Figure 9. Maximum Load Current Vs Ambient Temperature**



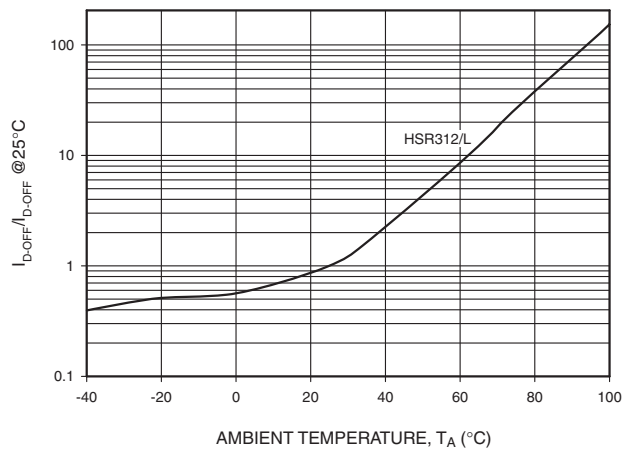
**Figure 10. Off State Current vs. Ambient Temperature**



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



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



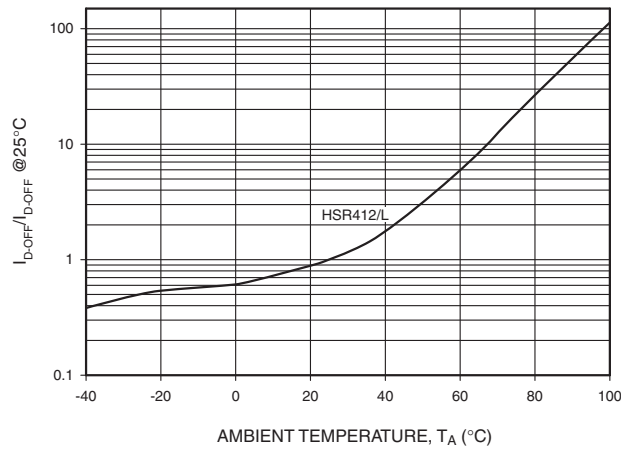
HSR312

HSR312L

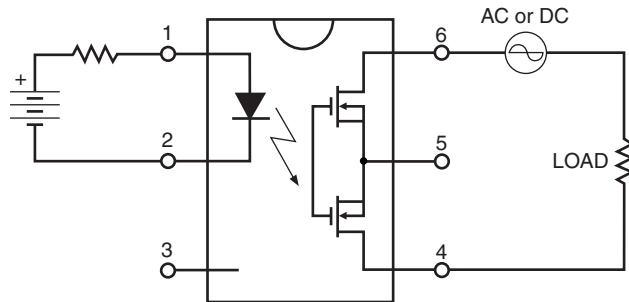
HSR412

HSR412L

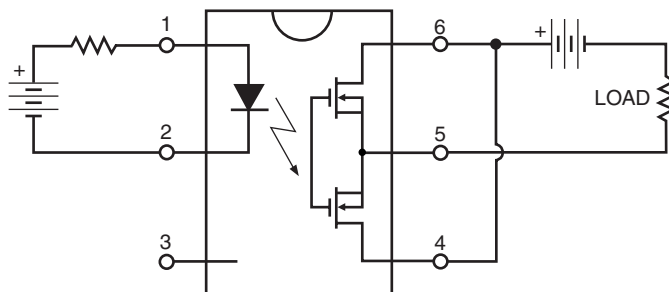
Figure 13. Normalized Off State Leakage vs. Ambient Temperature



Series Connection



Parallel Connection



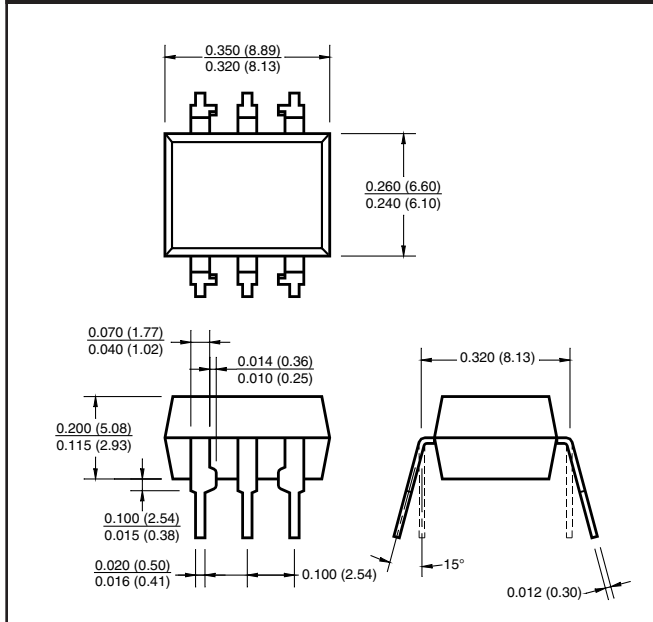
**HSR312**

**HSR312L**

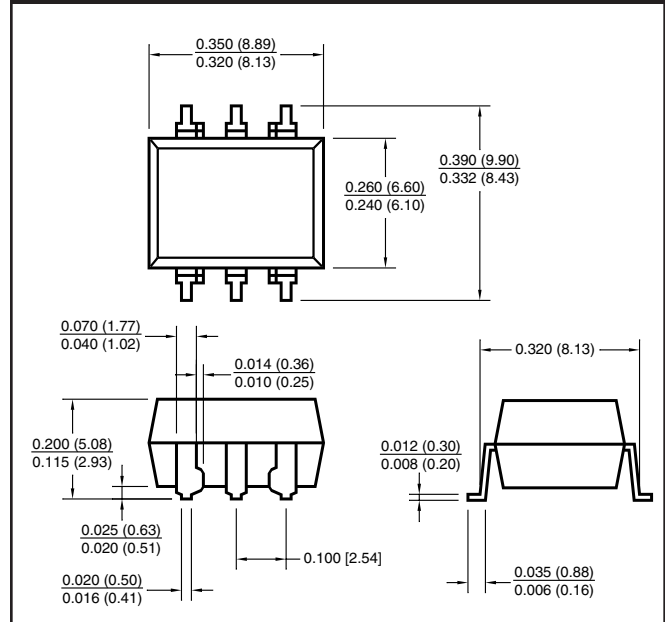
**HSR412**

**HSR412L**

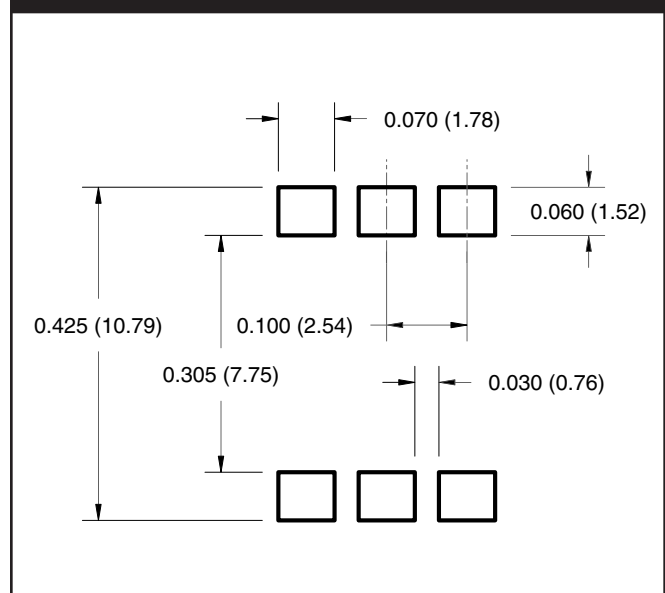
**Package Dimensions (Through Hole)**



**Package Dimensions (Surface Mount)**



**Recommended Pad Layout for  
Surface Mount Leadform**



**NOTE**

All dimensions are in inches (millimeters)

**HSR312**

**HSR312L**

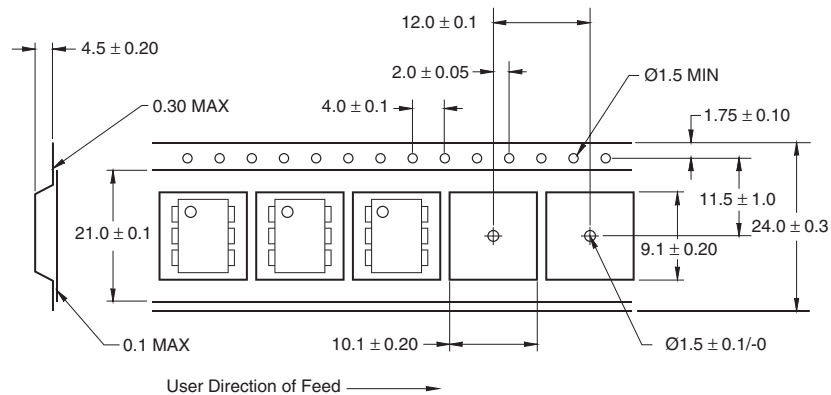
**HSR412**

**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" Tapin Orientation)**



**NOTE**

All dimensions are in inches (millimeters)

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**HSR312**

**HSR312L**

**HSR412**

**HSR412L**

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