20 MHz to 6.0 GHz GaAs SPDT Switch

Applications

- WLAN 802.11 a/b/g/n networks
- WLAN repeaters
- ISM band radios
- Low power transmit receive systems

Features

- Positive voltage control (0 and 1.8 V to 0 and 5.0 V)
- Broadband frequency range: 20 MHz to 6.0 GHz
- Very low insertion loss, 0.35 dB typical @ 2.45 GHz
- High isolation, 24 dB typical @ 2.45 GHz
- Excellent linearity performance, IP0.5dB = +30 dBm
- Ultra-miniature, MLPD (6-pin, 1 x 1 mm) package (MSL1, 260 °C per JEDEC J-STD-020)

Ordering Information

P/N: ASRS13351ML-R

Note: "ML" stands for package. "ML": MLPD1*1-6.
Note: "R" stands for Packing, Tape&Reel. 3000pcs/Reel.

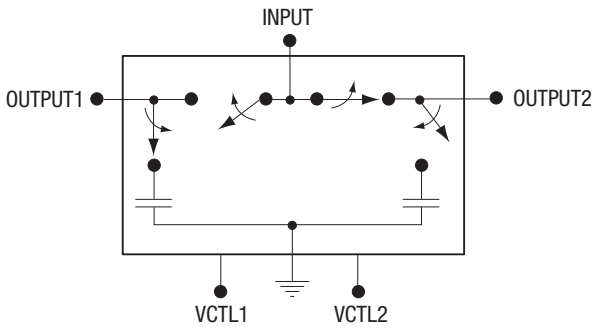


Figure 1. ASRS13351 Block Diagram

Description

The ASRS13351 is a pHEMT GaAs FET I/C switch. The switch may be used in transmit/receive applications by connecting the RF common port (INPUT, pin 5) to either the OUTPUT1 or OUTPUT2 port (pin 1 or 3, respectively) using a low loss path (i.e., a positive voltage applied to either VCTL1 or VCTL2 pins). The switch is “reflective short” on the isolated port.

The switch is manufactured in a compact, 1 x 1 mm, 6-pin exposed pad plastic Micro Leadframe Package Dual (MLPD) package.

A functional block diagram is shown in Figure 1. The pin configuration and package are shown in Figure 2. Signal pin assignments and functional pin descriptions are provided in Table 1.

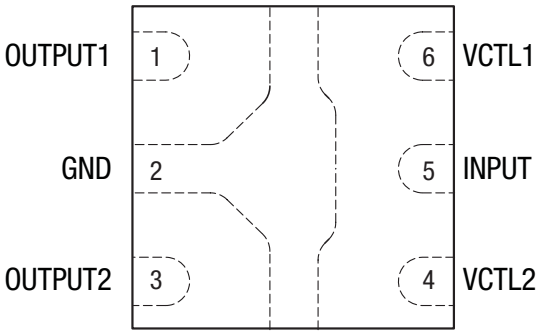


Figure 2. ASRS13351 Pinout (Top View)

Table 1. ASRS13351 Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	OUTPUT1	RF port. Must be DC blocked.	4	VCTL2	DC control voltage
2	GND	Ground	5	INPUT	RF port. Must be DC blocked
3	OUTPUT2	RF port. Must be DC blocked.	6	VCTL1	DC control voltage

Electrical and Mechanical Specifications

The absolute maximum ratings of the ASRS13351 are provided in Table 2. The recommended operating conditions are specified in Table 3 and electrical specifications are provided in Table 4.

Typical performance characteristics of the ASRS13351 are illustrated in Figures 3 through 9.

The state of the ASRS13351 is determined by the logic provided in Table 5.

Table 2. ASRS13351 Absolute Maximum Ratings[1]

Parameter	Symbol	Minimum	Maximum	Units
Input power: >500 MHz, 5 V, CW >500 MHz, 2.7 V, CW 802.11g, 54 Mbps, 64 QAM, 2.4-2.5 GHz 802.11g, 54 Mbps, 64 QAM, 5.2-5.8 GHz	P_{IN}		 +32 +31 +26 +25	 dBm dBm dBm dBm
Storage temperature	T_{STG}	−65	+150	°C
Operating temperature	T_{OP}	−40	+85	°C

[1] Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

ESD HANDLING: *Although this device is designed to be as robust as possible, electrostatic discharge (ESD) can damage this device. This device must be protected at all times from ESD when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD handling precautions should be used at all times.*

Table 3. ASRS13351 Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Units
Frequency	f	0.02		6.0	GHz
Control voltage: low high	 V_{CTL_L} V_{CTL_H}	 0 1.8		 0.2 5.0	 V V
Operating temperature	T_{OP}		+25		°C

Table 4. ASRS13351 Electrical Specifications[1]
(V_{CTL} = 0 V and +2.7 V, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Z_0] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Frequency	f		0.02		6.0	GHz
Insertion loss	IL	0.02 to 3.0 GHz 3.0 to 6.0 GHz		0.35 0.50	0.50 0.65	dB dB
Isolation	Iso	0.02 to 3.0 GHz 3.0 to 6.0 GHz	22 22	24 26		dB dB
Return loss (insertion loss state)		0.02 to 3.0 GHz 3.0 to 6.0 GHz		25 15		dB dB
Switching characteristics: Rise/fall time On/off time		 10/90% or 90/10% RF 50% V_{CTL} to 90/10% RF		 40 100		 ns ns
Video feedthrough				25		mV
0.5 dB input compression point	IP0.5dB	V_{CTL} = 0 and 1.8 V @ 2.45 GHz V_{CTL} = 0 and 2.7 V @ 2.45 GHz V_{CTL} = 0 and 2.7 V @ 48 MHz	+21 +29	+22 +30 +26		dBm dBm dBm
Input IP3	IIP3	P_{IN} = +20 dBm/tone V_{CTL} = 0 and 1.8 V @ 2.45 GHz V_{CTL} = 0 and 2.7 V @ 2.45 GHz V_{CTL} = 1.8 V @ 5.8 GHz V_{CTL} = 2.7 V @ 5.8 GHz	+30 +46	+32 +50 +30 +46		dBm dBm dBm dBm
Error vector magnitude	EVM	802.11a, 54 Mbps, P_{IN} = <+24 dBm, V_{CTL} = 2.7 V 802.11g, 54 Mbps, P_{IN} = <+25.5 dBm, V_{CTL} = 2.7 V		2.5 2.5		% %
Control voltage: Low High	 V_{CTL_L} V_{CTL_H}		 0 1.8	 2.7	 0.2 5.0	 V V
Supply current	I_{CC}	V_{CTL_L} = 0 V V_{CTL_H} = 5 V		5 5		µA µA

1 Performance is guaranteed only under the conditions listed in this table.

Typical Performance Characteristics

(V_{CTL} = 0 V and +2.7 V, T_{OP} = +25 °C, P_{IN} = 0 dBm, Characteristic Impedance [Zo] = 50 Ω, Blocking Capacitors = 100 pF, Bypass Capacitors = 33 pF, Unless Otherwise Noted)

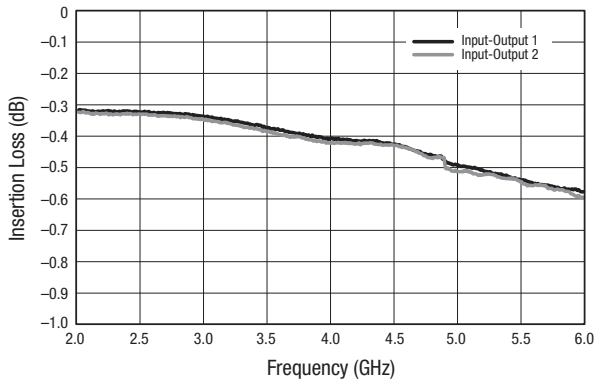


Figure 3. Typical Insertion Loss

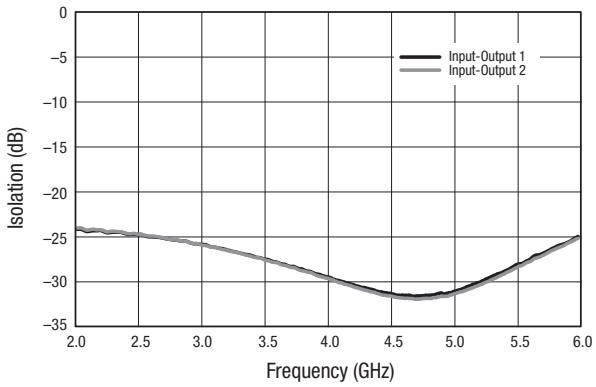


Figure 4. Typical Isolation

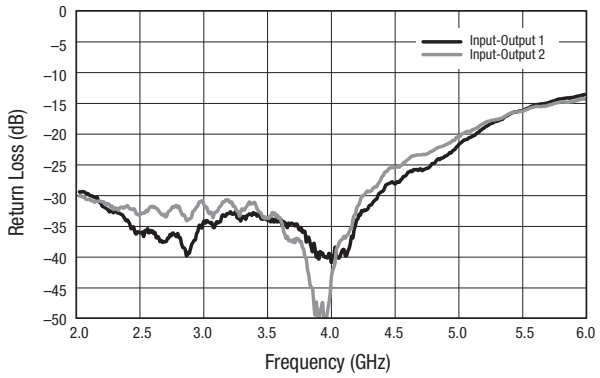


Figure 5. Typical Return Loss

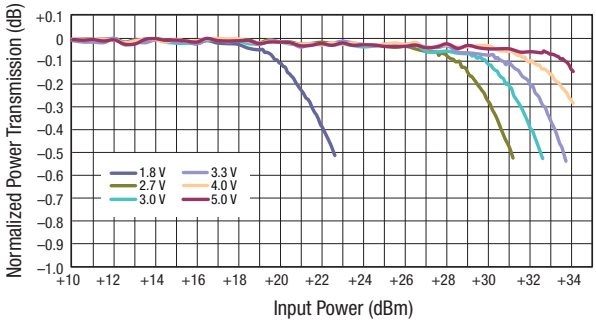


Figure 6. Compression vs Control Voltage (2450 MHz)

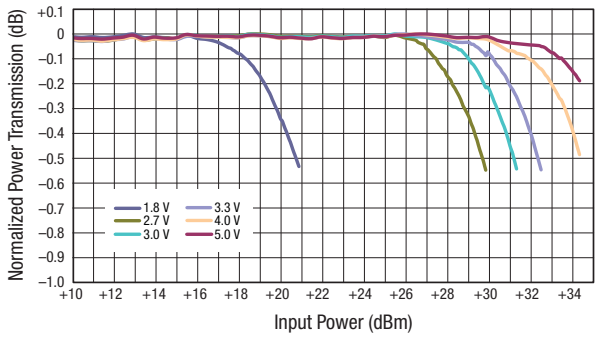


Figure 7. Compression vs Control Voltage (5.2 to 5.8 GHz)

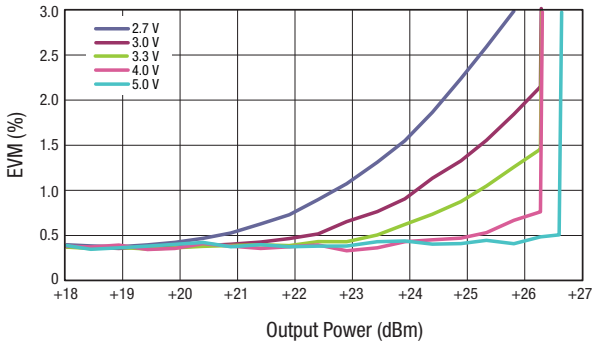


Figure 8. 802.11g EVM vs Output Power @ 2.45 GHz, 54 Mbps

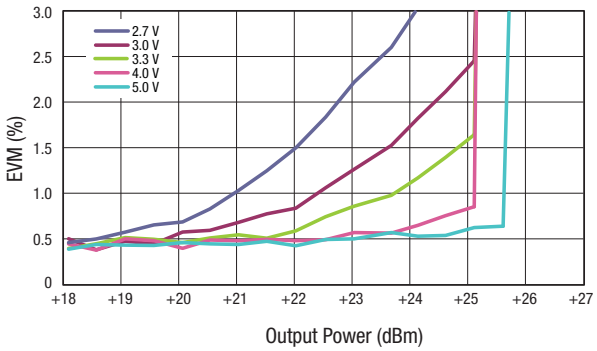


Figure 9. 802.11a EVM vs Output Power, 5.2-5.8 GHz, 54 Mbps

Table 5. ASRS13351 Truth Table[1]

VCTL1 (Pin 6)	VCTL2 (Pin 4)	INPUT to OUTPUT1 Path	INPUT to OUTPUT2 Path
1	0	Isolation	Insertion loss
0	1	Insertion loss	Isolation

1 "1" = +1.8 V to +5 V. "0" = 0 V to +0.2 V.
Any state other than described in this table places the switch into an undefined state.
An undefined state will not damage the device.

Evaluation Board Description

The ASRS13351 Evaluation Board is used to test the performance of the ASRS13351 SPDT Switch. An Evaluation Board schematic diagram is provided in Figure 10. An assembly drawing for the Evaluation Board is shown in Figure 11.

Package Dimensions

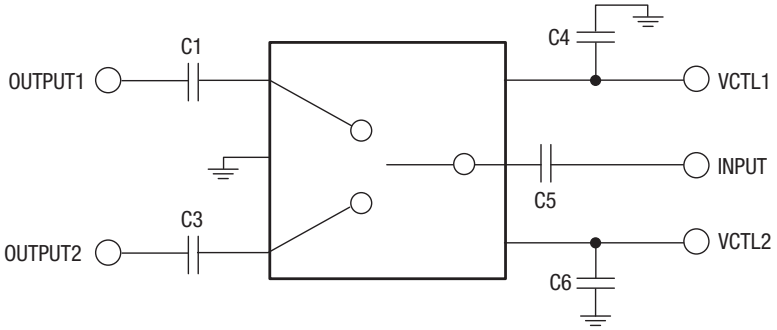
The PCB layout footprint for the ASRS13351 is provided in Figure 12. Typical part markings are shown in Figure 13. Package dimensions are shown in Figure 14, and tape and reel dimensions are provided in Figure 15.

Package and Handling Information

Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The ASRS13351 is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Application Note, *Solder Reflow Information*, document number 200164.

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.



C1, C3, and C5 are DC blocking capacitors (100 pF)
C4 and C6 are bypass capacitors (33 pF)

Use 10 nF DC blocking capacitors (C1, C3, and C5) for <50 MHz operation.

Figure 10. ASRS13351 Evaluation Board Schematic

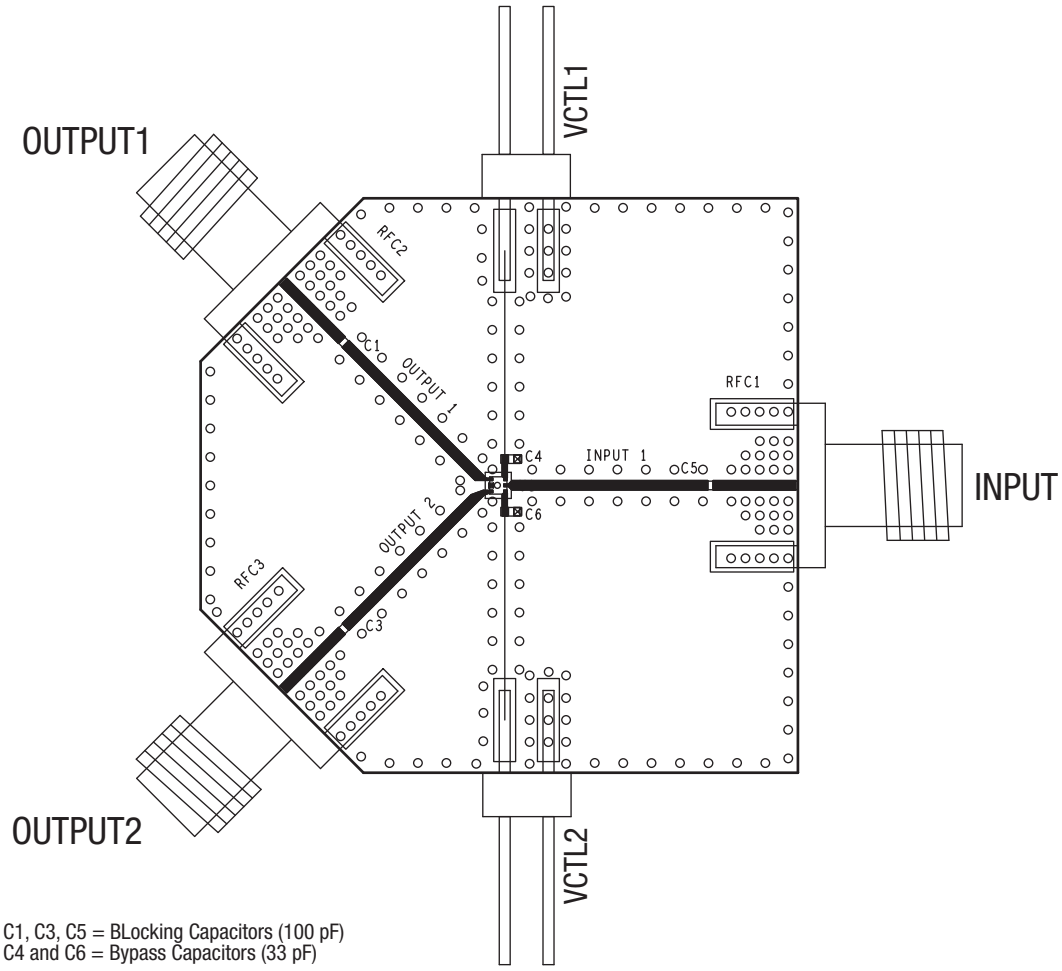
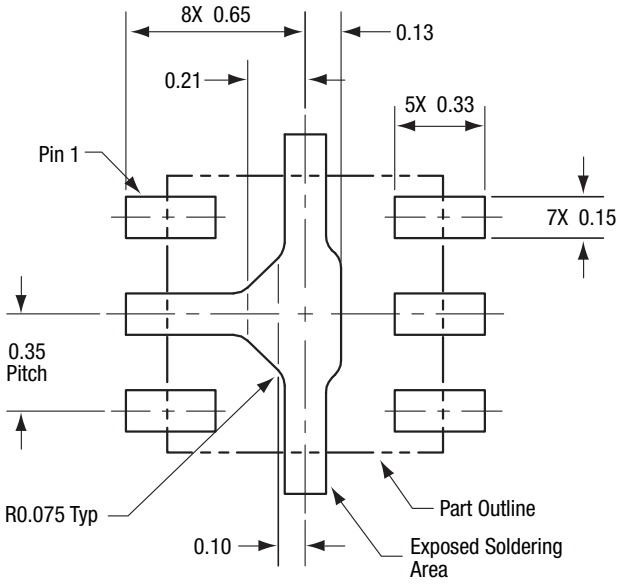


Figure 11. ASRS13351 Evaluation Board Assembly Diagram



All measurements in millimeters

Figure 12. ASRS13351 PCB Layout Footprint
(Top View)

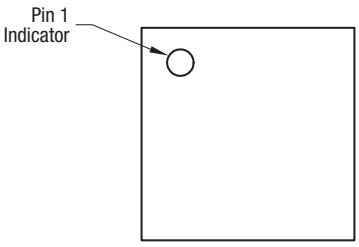


Figure 13. Typical Part Markings
(Top View)

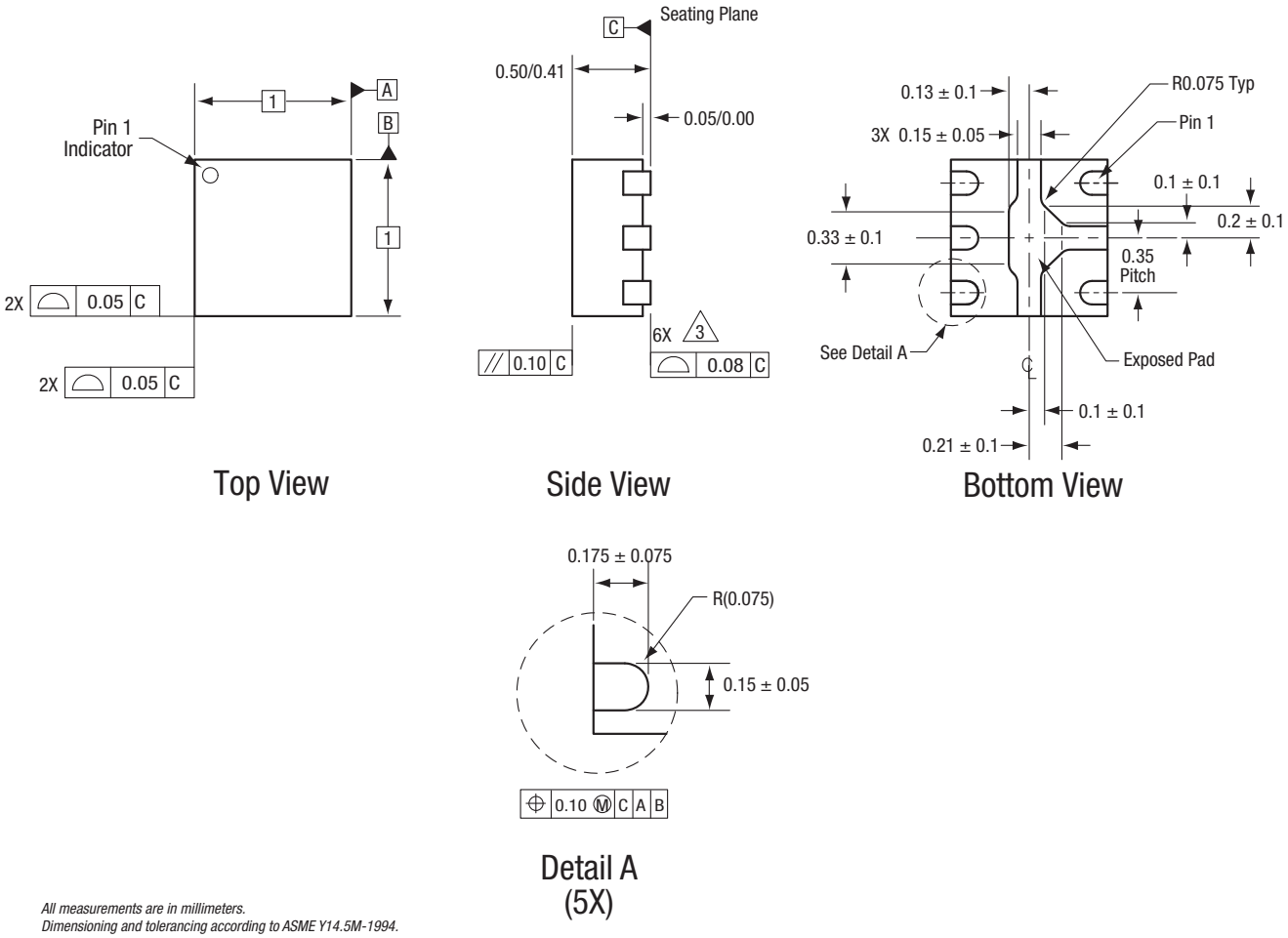
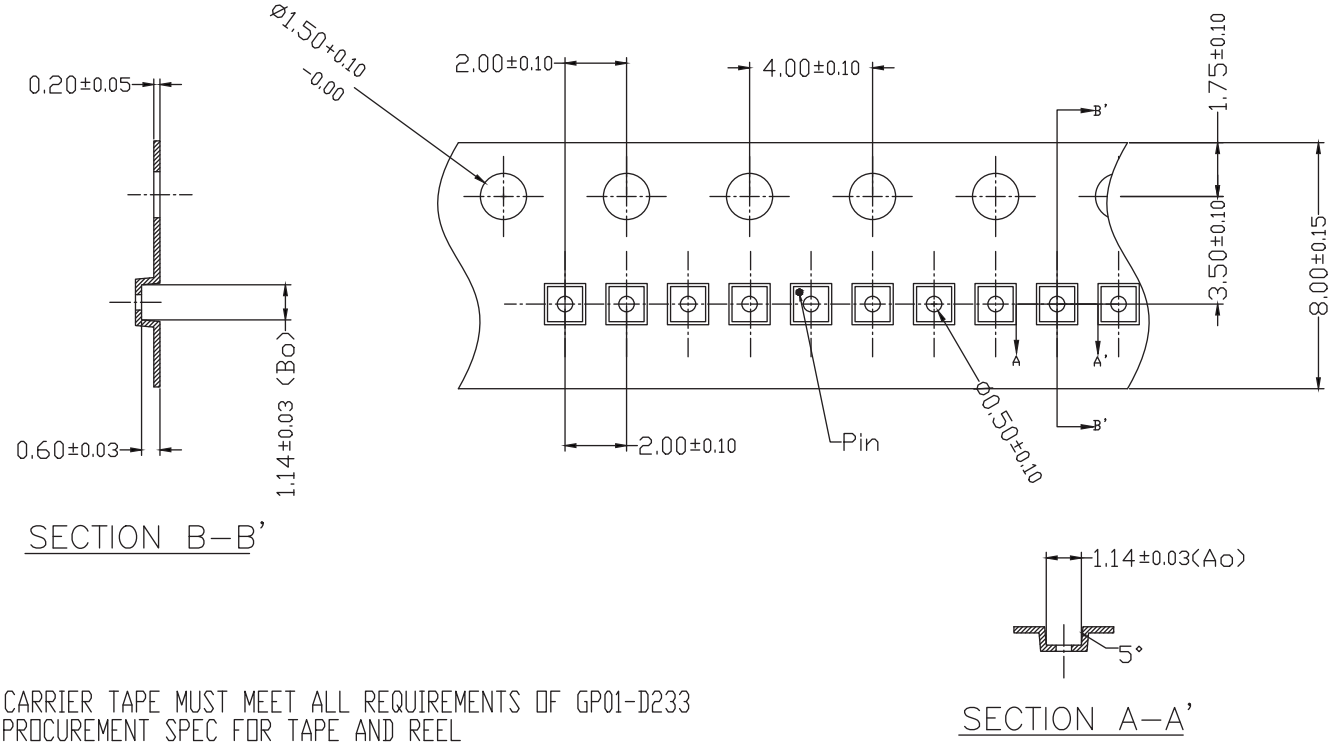


Figure 14. ASRS13351 Package Dimensions



1. CARRIER TAPE MUST MEET ALL REQUIREMENTS OF GP01-D233 PROCUREMENT SPEC FOR TAPE AND REEL
2. CARRIER TAPE SHALL BE BLACK CONDUCTIVE POLYCARBONATE.
3. COVER TAPE SHALL BE TRANSPARENT CONDUCTIVE MATERIAL
4. ESD-SURFACE RESISTIVITY SHALL MEET GP01-D233
5. 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE : ±0.20mm
6. Ao & Bo MEASURED ON PLANE 0.30mm ABOVE THE BOTTOM OF THE POCKET.
7. ALL DIMENSIONS ARE IN MILLIMETERS.

Figure 15. ASRS13351 Tape and Reel Dimensions

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