SPSx Family

Battery Free Wireless Sensor

ON Semiconductor's family of Battery Free Wireless Sensors are UHF RFID wireless sensors which use the MagnusS2® Sensor IC and can perform either moisture/proximity or temperature/proximity sensing functions in a variety of applications where size and accessibility are at a premium.

Battery Free Wireless Sensors digitize sensed moisture detection/level or temperature information which can then be read by a standard UHF RFID Gen 2 compliant reader. Sensor tags function in either the FCC defined UHF band or the ETSI UHF band.

Features

- Single IC, Battery Free Wireless Sensing
- Small Form Factor Packages
- 64 bit TID and 128 bit EPC + 144 bit User Defined Memory
- EPC Class 1 Gen 2 v.2.0.0 ISO 18 000−6C Compliant
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Rating	Symbol	Max	Unit
Human Body Model (Note 1)	ESD	±1	kV

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Junction and Storage Temperature Range (Note 2)	T_J, T_{stg}	−40 to +85	°C

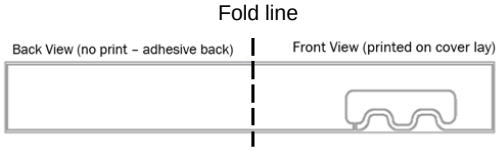
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Non−repetitive current pulse at T_A = 25°C, per JS−001 waveform.
2. Shelf Life − minimum 2 years from date of manufacturing.

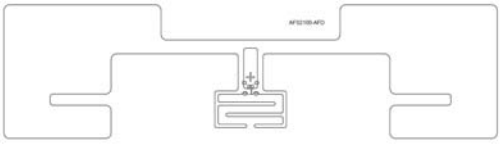
This document contains information on some products that are still under development. ON Semiconductor reserves the right to change or discontinue these products without notice.

ON Semiconductor®

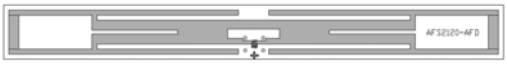
www.onsemi.com



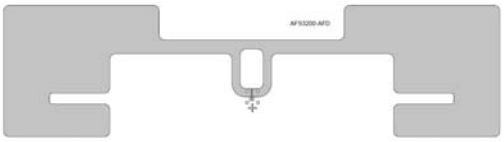
SPS1M001 − CASES 888AH/888AJ



SPS1M002 − CASES 888AD/888AE



SPS1M003 − CASES 888AB/888AC



SPS2T001 − CASES 888AF/888AG

ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Device	Frequency (MHz)		Read Sensitivity (dBm)	TID (Bits)	EPC (Bits)	ROM (Bits)
	Min	Max	Min	Min	Min	Min
SPS1M001	860	960	−16	64	128	144
SPS1M002	860	960	−16	64	128	144
SPS1M003	860	960	−16	64	128	144
SPS2T001	860	960	−16	64	128	176

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

SENSOR TAG DESCRIPTIONS

SPS1M001 – Quality Control Water Intrusion Sensor Tag

The quality control water intrusion sensor tag is specifically designed for the passive sensing of moisture in finished goods as a form of leak detection. The sensors can be placed in specific areas of the object and greatly simplifies the quality control test for leaks. This Battery Free Wireless Sensor can reduce the number of missed defects and significantly improve the quality manufacturing lines.

SPS1M002 − Moisture Level Detection Sensor Tag

The moisture level detection sensor tag is specifically designed for the passive sensing of moisture on various surfaces and finished goods such as plastics, wood, and plaster. The tag digitizes sensed moisture detection/level information which can be read by a standard UHF RFID Gen 2 compliant reader. This Battery Free Wireless Sensor can greatly enhance the reliability of the end product and offer many benefits for deployment in industrial settings.

SPS1M003 – High Sensitivity Moisture Level Detection Sensor Tag

The high sensitivity moisture level detection sensor tag is specifically designed for the passive sensing of moisture that does not touch the tag. This high sensitivity allows the tag to detect moisture through layers of material making it ideal for applications where the tag cannot be placed directly in the area of interest. The tag digitizes sensed moisture detection/level information which can be read by a standard UHF RFID Gen 2 compliant reader. This Battery Free Wireless Sensor can offer many benefits for deployment in a variety of settings.

SPS2T001 − Temperature Sensor Tag

The temperature sensor tag is specifically designed for the passive sensing of temperature experienced by the tag. The tag digitizes the sensed temperature which can be read by a standard UHF RFID Gen 2 compliant reader. This Battery Free Wireless Sensor can offer many benefits for deployment in industrial as well as agricultural settings.

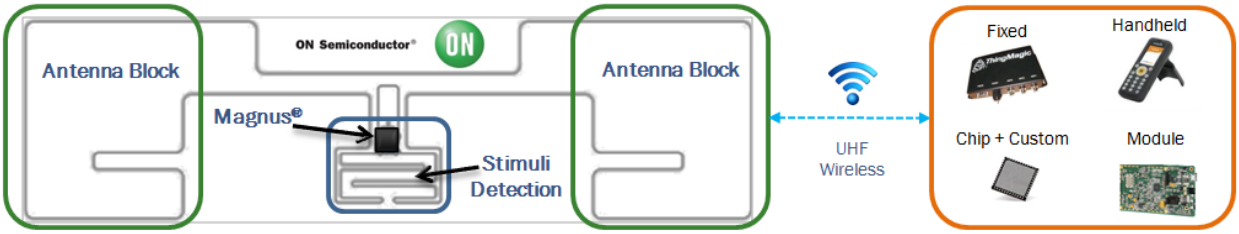


Figure 1. Battery Free Wireless Sensor Functional Block Diagram

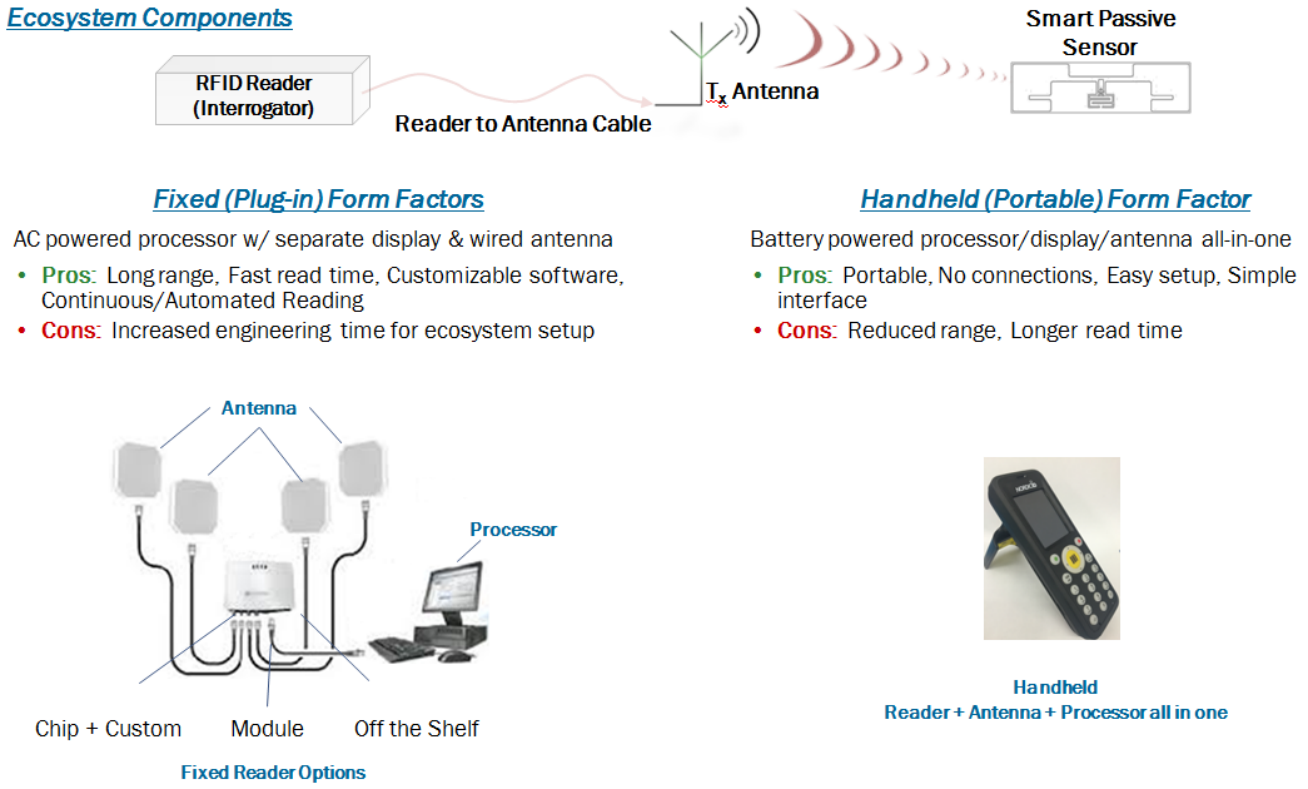


Figure 2. Battery Free Wireless Sensor Ecosystem Components

Evaluating the performance of sensor tags in final application can be done with the SPS1M−EVK Battery Free Wireless Sensor Handheld Evaluation. The system consists of the handheld reader, charger, cradle, and sample sensor tags. The reader is pre−loaded with application software which reads sensor tags and reports results with a single button click. If the reader sees more than one sensor tag, it will measure the tag with the highest reported received power, and ignore the others. For more detailed information on the operation of the SPS1M−EVK please refer to EVBUM2324/D.

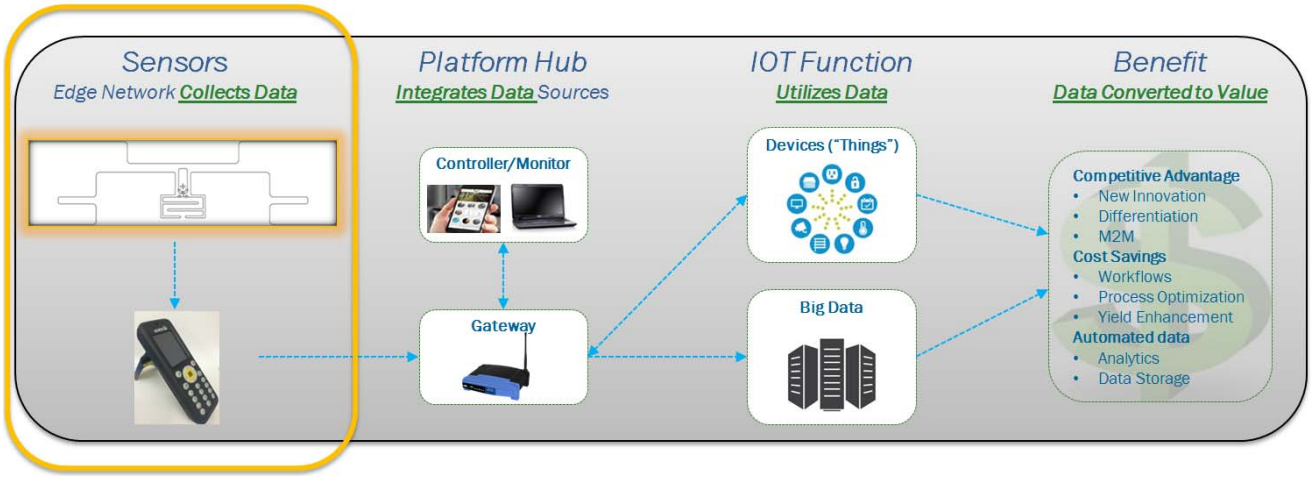


Figure 3. SPS1M−EVK Evaluation Kit within an IoT System

The SensorRF−GEVK IoT Development Platform enables the exploration and development of applications using battery−free wireless sensors built around the Magnus−S chip. \This development kit integrates the features of a platform hub which collects sensor data using an external antenna and then seamlessly incorporate this data into multiple backend network interfaces.

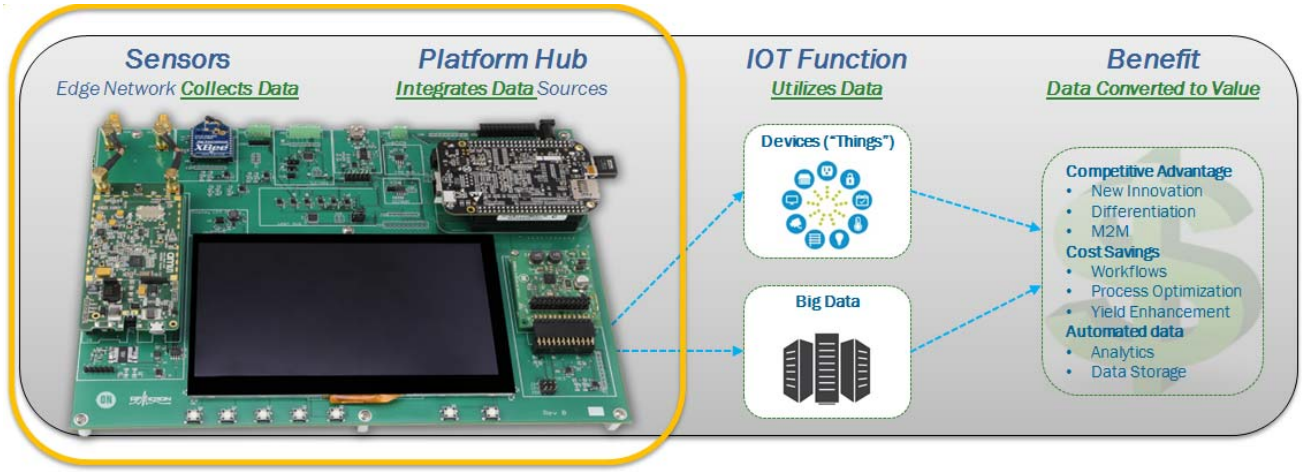


Figure 4. SensorRF−GEVK Developers Kit within an IoT System

Readers with Verified Functionality for ON Semiconductor Smart Passive Sensor Tags

Manufacturer	Model (click for link to full spec)	Type	Max Power (dBm)	Max Power (W)	Dimensions (mm)	# Antennas (Max)	Reads Temperature	Reads Moisture	Reads Pressure
NordicID	Morphic or SPS1M-EVK	Handheld	27	0.5	147 x 54 x 35	1	Yes	Yes	Yes
	Merlin	Handheld	30	1	250 x 105 x 175	1	Yes	Yes	Yes
	AR52	Fixed	30	1	210 x 121 x 31	16	Yes	Yes	Yes
ThingMagic	M6	Fixed	31.5	1.4	190 x 178 x 34	4	Lower Resolution[2]	Yes	Yes
	M6e	Module	31.5	1.4	69 x 43 x 7.5	4	Lower Resolution[2]	Yes	Yes
Impinj	Speedway	Fixed	32.5	1.8	190 x 175 x 30	4	Lower Resolution[2]	Yes	Yes
Zebra	FX9500	Fixed	33	2	273 x 184 x 50	8	Lower Resolution[5]	Yes	Yes
Thinkify	TR-265	Fixed	27	0.5	140 x 102 x 33	1	Yes	Yes	Yes
ON Semiconductor	SensorRF-GEVK	SPS Developer Kit	30	1	279 x 216 x 51	2	Yes	Yes	Yes

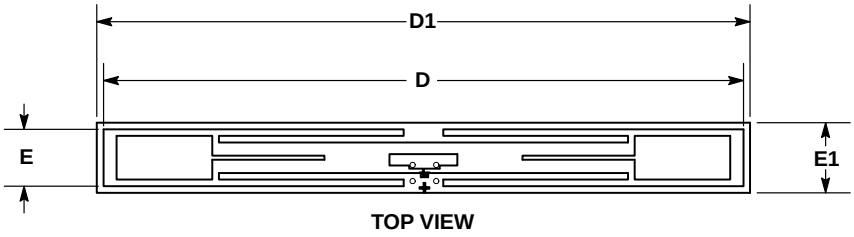
ORDERING INFORMATION

Device	Feature	UHF Band	Attach Material	Package Case Code	Shipping†
SPS1M001A	Moisture	FCC 902−928 MHz	Metal	888AJ	500 / Reel
SPS1M002A	Moisture		Non−metal	888AD	500 / Reel
SPS1M003A	Moisture		Non−metal	888AB	500 / Reel
SPS2T001A	Temperature		Non−metal	888AF	500 / Reel
SPS1M001B	Moisture	ETSI 866−868 MHz	Metal	888AH	500 / Reel
SPS1M002B	Moisture		Non−metal	888AE	500 / Reel
SPS1M003B	Moisture		Non−metal	888AC	500 / Reel
SPS2T001B	Temperature		Non−metal	888AG	500 / Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

PACKAGE DIMENSIONS

RF TAG 99.5x11.12mm
CASE 888AB
ISSUE O

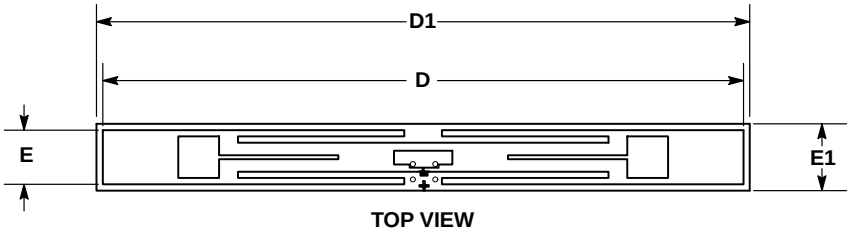


TOP VIEW

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. ANTENNA SIZE DETERMINED BY DIMENSIONS D AND E.
4. LABEL SIZE DETERMINED BY DIMENSIONS D1 AND E1.
5. LABEL IS 0.076 THICK PET TAPE. ANTENNA IS 0.009 THICK ALUMINUM.

	MILLIMETERS	
DIM	MIN	MAX
D	96.90	97.10
E	8.52	8.72
D1	98.50	99.50
E1	10.12	11.12

RF TAG 104.5x11.12mm
CASE 888AC
ISSUE O



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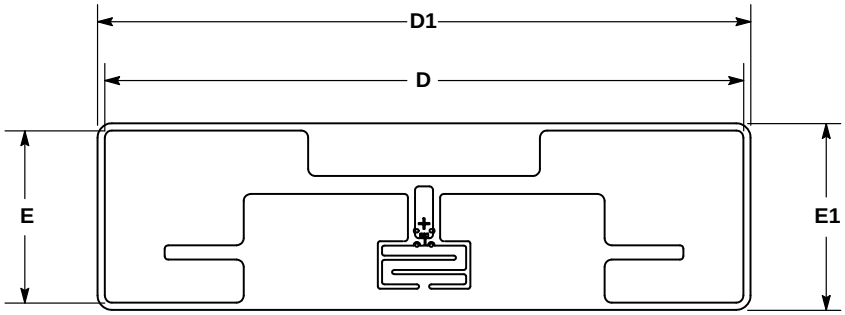
	MILLIMETERS	
DIM	MIN	MAX
D	101.90	102.10
E	8.52	8.72
D1	103.50	104.50
E1	10.12	11.12

PACKAGE DIMENSIONS

RF TAG 91.5x26.5mm
CASE 888AD
ISSUE O



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4. LABEL SIZE DETERMINED BY DIMENSIONS D1 AND E1.
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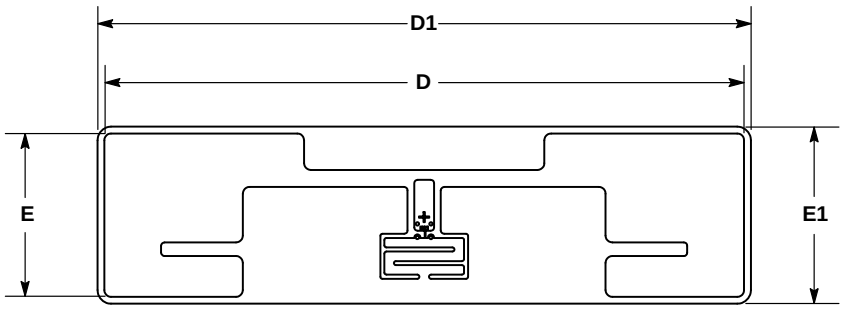
	MILLIMETERS	
DIM	MIN	MAX
D	88.90	89.10
E	23.90	24.10
D1	90.50	91.50
E1	25.50	26.50

RF TAG 96.5x26.5mm
CASE 888AE
ISSUE O



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4. LABEL SIZE DETERMINED BY DIMENSIONS D1 AND E1.
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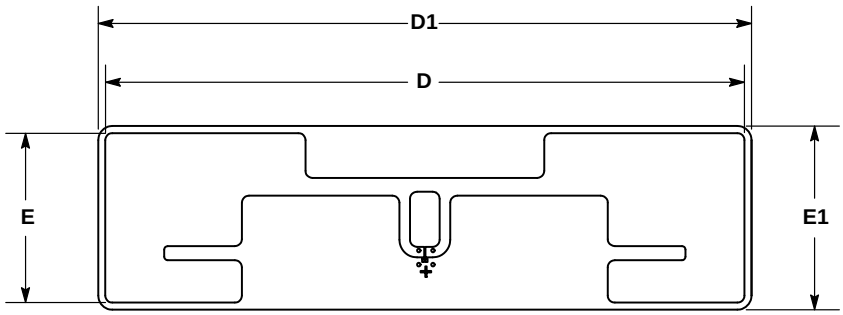
	MILLIMETERS	
DIM	MIN	MAX
D	93.90	94.10
E	23.90	24.10
D1	95.50	96.50
E1	25.50	26.50

PACKAGE DIMENSIONS

RF TAG 93x26.5mm
CASE 888AF
ISSUE O



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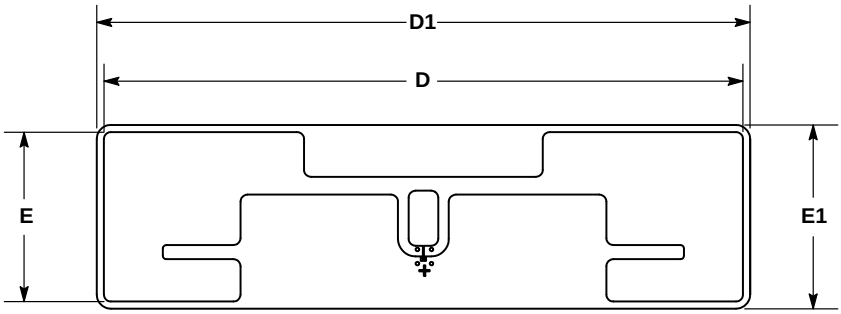
	MILLIMETERS	
DIM	MIN	MAX
D	90.40	90.60
E	23.90	24.10
D1	92.00	93.00
E1	25.50	26.50

RF TAG 93x26.5mm
CASE 888AG
ISSUE O



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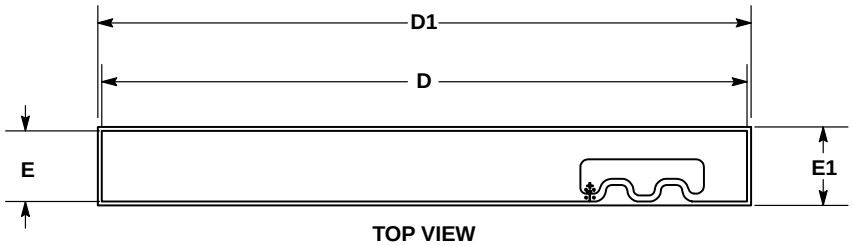
	MILLIMETERS	
DIM	MIN	MAX
D	90.40	90.60
E	23.90	24.10
D1	92.00	93.00
E1	25.50	26.50

PACKAGE DIMENSIONS

RF TAG 166.5x20mm
CASE 888AH
ISSUE O



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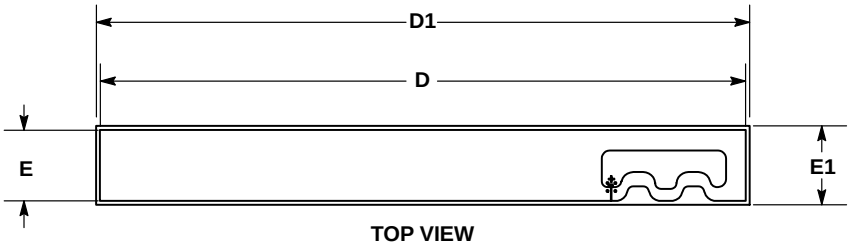
4. LABEL SIZE DETERMINED BY DIMENSIONS D1 AND E1.
5. LABEL IS 0.076 THICK PET TAPE. ANTENNA IS 0.009 THICK ALUMINUM.

	MILLIMETERS		
DIM	MIN	NOM	MAX
D	165.40	165.50	165.60
E	17.90	18.00	18.10
D1	166.40	166.50	166.60
E1	19.90	20.00	20.10

RF TAG 165x20mm
CASE 888AJ
ISSUE O



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	MILLIMETERS		
DIM	MIN	NOM	MAX
D	163.60	163.70	163.80
E	17.90	18.00	18.10
D1	165.60	165.70	165.80
E1	19.90	20.00	20.10

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PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
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