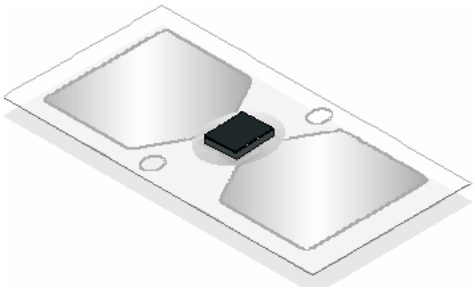
UHF Gen2 STRAP

FEATURES

- **Meets EPCglobal™ Gen2 (v. 1.0.9) and ISO/IEC 18000-6c**
- **860-MHz to 960-MHz Global Operating Frequency**
- **Supports Optional Gen2 Commands: Block Write and Block Erase**
- **192-Bit Memory: 96-Bit Electronic Product Code™ (EPC), 32-Bit Access Password, 32-Bit KILL Password, 32-Bit TID Memory (Factory Programmed and Locked)**
- **Designed for High-Performance, Low Power Consumption Based on the Most Advanced Silicon Process Node for Radio Frequency Identification (RFID) (130 nm)**
- **Fast Tag Singulation Using Most Advanced Anti-Collision Scheme**
- **Suitable for H-field and E-field Operation**
- **RoHS Compliant**

APPLICATIONS

- **Supply-Chain Management and Distribution Logistics**
- **Express Parcel Delivery**
- **Airline Baggage Handling**
- **Asset Tagging**



DESCRIPTION/ORDERING INFORMATION

Large retailers have issued mandates to their suppliers to ship cases and pallets of goods/products with radio frequency identification (RFID) smart labels attached. TI's Generation 2 (Gen2) Straps are intended to simplify the manufacture of inlays for conversion into Smart Labels for various applications. The Straps are based on the EPCGlobal™ Gen2 specification (v. 1.0.9) and ISO/IEC 18000-6C.

TI's Gen2 Straps operate with extremely low power and yet provide long read and write ranges, fast data transfer and high Smart Label throughput.

A detailed description of the command set, memory and operation of the Strap is given in the *UHF Gen2 Protocol Reference Guide* [literature number 11-09-21-700 (SCBU001)].

The TI UHF Gen2 Strap is available as listed in Table 1.

Table 1. Ordering Information

PART NUMBER	DESCRIPTION
RI-UHF-STRAP-08	EPCGlobal™ UHF Gen2 Strap

Absolute Maximum Ratings(1)

	NOTES	MIN	MAX	UNIT
Input current, pad to pad			1	mA
Input voltage to any pad (sustained)			1.5	V
Power dissipation	T_A = 25°C		1.5	mW
Storage temperature range	Single Strap	–40	85	°C
	On Reel	–40	45	
Operating temperature	Read	–40	65	°C
	Write	–25	65	
Assembly survival temperature	1 minute maximum		150	°C
RF Exposure	800 ~ 1000 MHz		10	dBm
ESD immunity	Charged-Device Model (CDM)	0.5		kV
	Human-Body Model (HBM)	2		kV

(1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Recommended Operating Conditions

		MIN	MAX	UNIT
T_A	Operating temperature	–40	65	°C
f_{res}	Carrier frequency	860	960	MHz

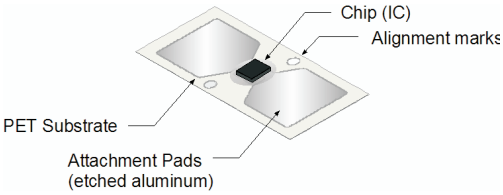
Electrical Characteristics

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
	Sensitivity	Reading	–9	–13		dBm
		Programming	–6	–9		
$\Delta\Gamma$	Change in modulator reflection coefficient			>0.2		
t_{DRET}	Data retention		10			Years
W&E	Write and erase endurance		100,000			Cycles
	Strap Parallel Impedance(1)	Typical Read (–13 dB)		380		Ω
				2.8		pF

(1) The values shown have been taken with a properly designed and matched antenna attached to the strap. For complete data on antenna matching, a *UHF Gen2 IC Antenna Reference Guide* (11-07-21-702) is available under NDA.

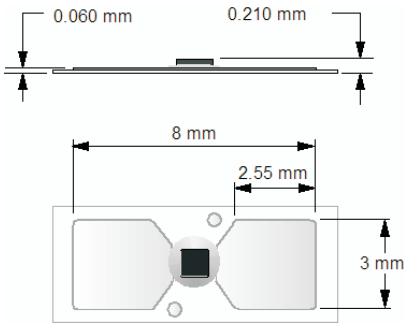
MECHANICAL SPECIFICATIONS

STRAP MECHANICAL SPECIFICATIONS



The mechanical details of each strap are shown below.

PARAMETER	VALUE
Substrate thickness (PET)	50 micron (2 mil)
Die height	150 micron (6 mil)
Aluminum layer thickness	10 micron (0.4 mil)
Substrate material	PET (Polyethylene Therephthalate)
Substrate elasticity (Young's modulus)	2~4 Gpa (290~580 kpsi)
Coefficient of thermal expansion (CTE)	20~80 $\times 10^{-6}$ °C^{-1}
Strap web width	9.00 mm ± 0.1 [0.35 in ± 0.004]
Strap pitch	$4.00\ \text{mm}\ {}^{+0.10}_{-0.40}$ $[0.16\ \text{in}\ {}^{+0.004}_{-0.016}]$

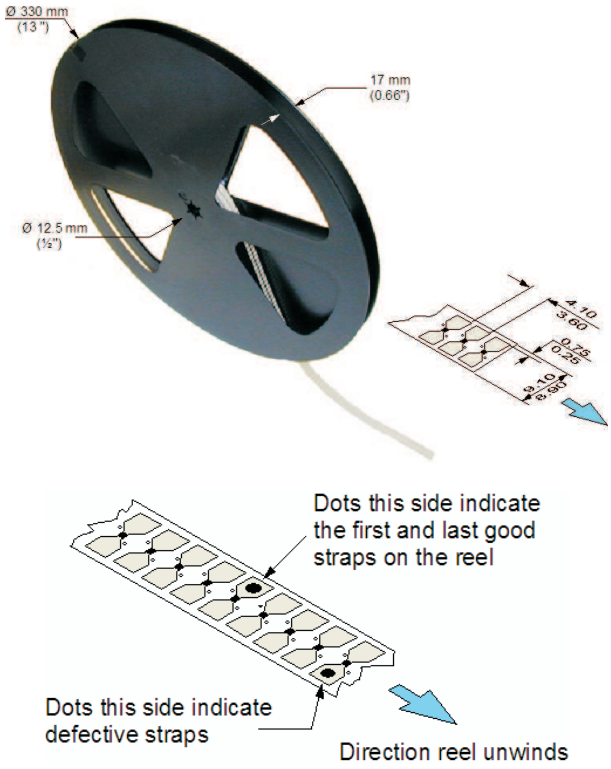


STRAP DELIVERY AND FURTHER HANDLING

STRAP DELIVERY

Straps are delivered on reels of 40,000 units. The reel details are shown below.

STRAP DELIVERY AND FURTHER HANDLING (continued)



LEADER/TAIL

Each reel has 1 m (39”) of chip-less Straps at the start (leader) and end (tail) of each reel. This allows the reel to be loaded onto a conversion machine without any loss of good product. The first and last good Straps are marked with ink dots as shown above.

DEFECTIVE STRAPS

Each Strap is 100% tested on the production line and any Strap found to be defective is ink marked as shown previously. For each defective Strap found, an additional Strap is added at the end of the good Straps on the reel.

SHEAR FORCE LIMITS

When handling the Straps, the shear force must not exceed 6 N.

Shear Force	6 N (1.35 lbf)

CHIP AREA PRESSURE

During the Strap conversion process, the pressure on the chip must not exceed 10 N/mm^2.

Pressure (per unit die area)	10 N/mm (1450 psi)

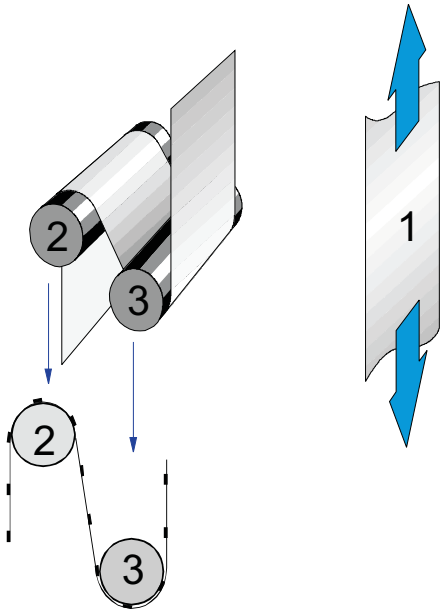
WARNING:

EXCESSIVE PRESSURE ON THE CHIP AREA WILL RESULT IN THE CHIP/SUBSTRATE CONDUCTOR CRACKING AND AN EXCESSIVE SHEAR FORCE COULD CAUSE THE CHIP TO SEPARATE FROM THE STRAP.

STRAP DELIVERY AND FURTHER HANDLING (continued)

TAPE TENSION AND BENDING

Three conditions exist and these are shown in the drawing below. Exceeding these limits will result in damage to the Straps.



1 Linear tension

2 Bending radius (chip bending away from centre of radius)

3 Bending radius (chip bending toward center of radius)

The recommended limits for these conditions are shown in the following table.

CONDITION		LIMIT
1	Maximum Linear Tension	6 N (1.35 lbf)
2	Minimum Bending Radius (away from center)	15 mm (0.6”)
3	Minimum Bending Radius (towards the center)	15 mm (0.6”)

ESD PRECAUTIONS

During winding and unwinding operations, the Strap tape can become electrostatically charged. The high current density of the electrostatic discharge (ESD) can severely damage the Straps’ chips. The amount of ESD very much depends on the winding speed and tension. We strongly advise that deionization equipment is installed at all wind/unwind points.

PARAMETER	VALUE
ESD Immunity	2 kV (Class 2 Human Body Model)
Deionizer Setting	2 KeV HM

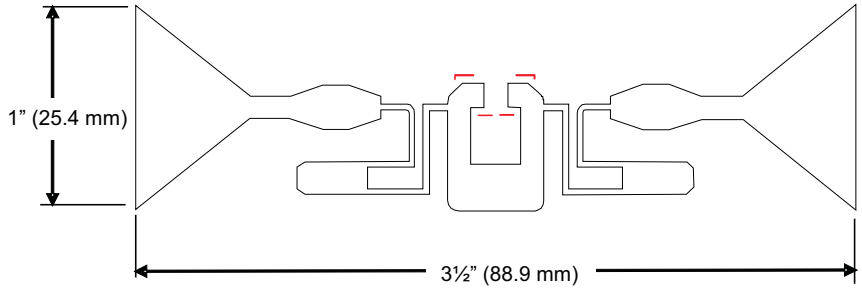
STORAGE CONDITIONS

Reels should be kept in the original packaging during storage.

ANTENNA DESIGN, POSITIONING, AND BONDING

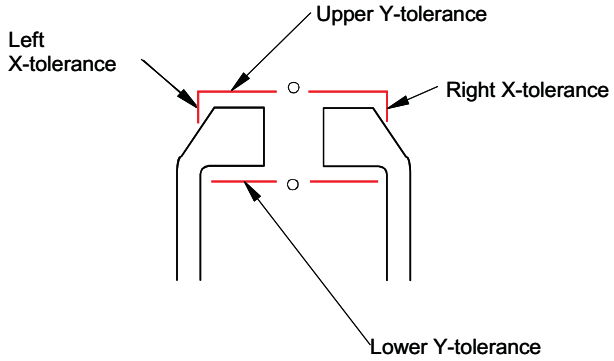
ANTENNA DESIGN

Texas Instruments can help you with a suitable antenna based on a reference design or assist you in a custom design.(1)

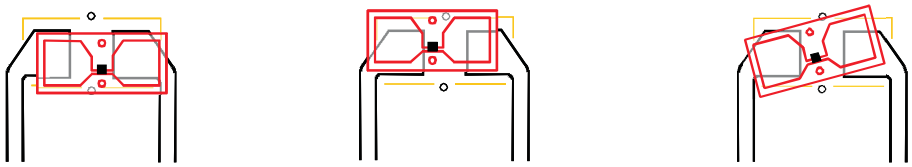


PLACEMENT TOLERANCES

Texas Instruments’ reference antenna is intended for a 75 micron PET substrate and has placement markings to ensure correct Strap alignment and to aid inspection and qualification. The pads of the Straps must fall within the tolerance marks outlined on the antenna to determine the correct positioning.



The drawings below show Straps, whose placement is within tolerance.

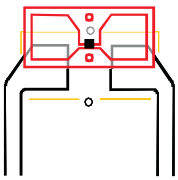


Off center – low and right | Off center – high and left | Skewed

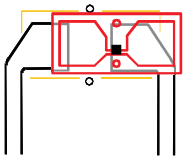
(1) Antenna design is beyond the scope of this document. Further information on antenna design is given in document *UHF Gen2 IC Antenna Design Reference Guide* (11-07-21-702) which is available under NDA.

ANTENNA DESIGN, POSITIONING, AND BONDING (continued)

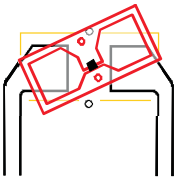
The drawings below show Straps with out-of-tolerance placements.



Out of vertical tolerance



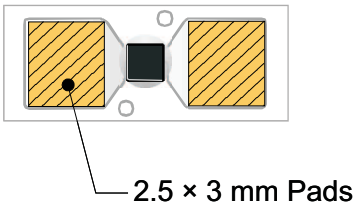
Out of horizontal tolerance



Out of skew tolerance

NON-TEXAS INSTRUMENTS DESIGN

When attaching Straps to non-TI antennas, it is important that 50% of each bonding pad is in contact with the antenna. The bonding area is shown below.



ANTENNA SUBSTRATE MATERIALS

With Straps, the creation of inlays is made much easier. Antennas can be produced on a variety of substrate materials including direct printing, using conductive inks onto non-conductive materials such as paper, cartons and thin film polymers. Texas Instruments uses Polyethylene Terephthalate (PET) as a substrate. This material is stable, clear, can be printed and has a melting point close to 250°C (480°F)

CREATING THE ANTENNA

The antenna tracks (traces) can be formed in a number of ways. These include:

- Printing using conductive inks (e.g., Silver)
- Etched copper on polymer film
- Etched aluminum on polymer film

STRAP BONDING

Bonding of the strap to the antenna can be done using a variety of methods. The techniques include:

- Anisotropic conductive film
- Heat curing epoxy
- UV curing epoxy
- Ultrasonic welding

Customers should contact the supplier or manufacturer of your strap attachment equipment for advice on creating the antenna and the recommended attachment technique and bonding adhesive.

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
RI-UHF-STRAP-08	ACTIVE	RFIDS	TSA	0	40000	Pb-Free (RoHS)	Call TI	N / A for Pkg Type

[1] The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

[2] Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

[3] MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Telephony	www.ti.com/telephony
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