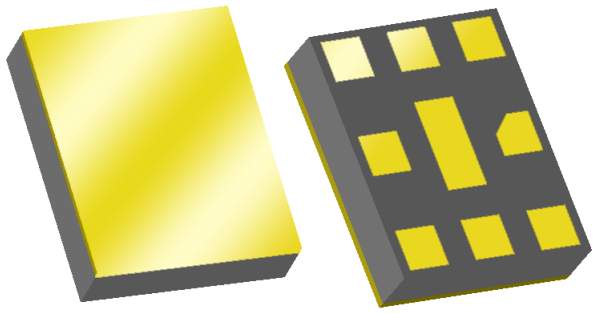
# 856979

## *806/847 MHz Duplexer*

## Applications

- For Band 20 LTE applications
- LTE Band 20 handsets, data cards, mobile routers

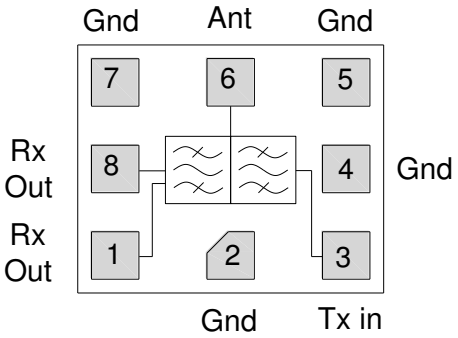


## Product Features

- Usable bandwidth 30 MHz (each band)
- Low loss
- High attenuation
- High Tx-Rx isolation
- Single-ended-Balanced Rx operation
- Ceramic chip-scale Package (CSP)
- Small Size 2.5 x 2.00 x 0.56 mm
- Hermetic **RoHS** compliant, **Pb**-free

## Functional Block Diagram

Top View




## General Description

856979 is a high-performance Temperature Compensated Surface Acoustic Wave (TC SAW) duplexer designed to meet the strict LTE requirements for use in Band 20.

The 856979 is specifically designed to meet the high performance expectations of insertion loss, isolation and linearity in LTE systems operating in Band 20 applications under all operating conditions. The use of TC SAW technology enables stable performance over the entire temperature range.

The 856979 uses common module packaging techniques to achieve the industry standard 2.5 x 2.0 footprint. The duplexer exhibits excellent power handling capabilities.

## Pin Configuration

| Pin # SE-Balanced | Description |
|---|---|
| 1,8 | Rx output |
| 3 | Tx input |
| 6 | Antenna/Phasing inductor |
| 2,4,5,7,9 | Ground |

## Ordering Information

| Part No. | Description |
|---|---|
| 856979 | packaged part |
| 856979-EVB | evaluation board |

Standard T/R size = 10,000 units/reel.

## TX – Electrical Specifications [1]

Specified Temperature Range: [2] -20 to +85 ºC

| Parameter [3] | Conditions | Min | Typical [4] | Max | Units |
|---|---|---|---|---|---|
| | **Ant-Tx Specification** | | | | |
| Center Frequency | | - | 847 | - | MHz |
| Maximum Insertion Loss [5] | 832 – 862 MHz | - | 2.5 | 3.0 | dB |
| Amplitude Variation[9] | 832 – 862 MHz | - | 0.6 | 1.5 | dB p-p |
| Absolute Attenuation [6] | 10 – 771 MHz | 30 | 35 | - | dB |
| | 771 – 791 MHz | 33 | 37 | - | dB |
| | 791 – 821 MHz | 43 | 48 | - | dB |
| | 821 – 825 MHz | 3 | 15 | - | dB |
| | 925 – 960 MHz | 28 | 33 | - | dB |
| | 1565.420 – 1573.374 MHz | 38 | 43 | - | dB |
| | 1573.374 – 1577.466 MHz | 40 | 45 | - | dB |
| | 1577.466 – 1585.420 MHz | 40 | 45 | - | dB |
| | 1597.5515 – 1605.886 MHz | 43 | 48 | - | dB |
| | 1664 - 1724 | 35 | 47 | - | dB |
| | 1805 – 1880 MHz | 30 | 45 | - | dB |
| | 1884.5 – 1919.6 MHz | 30 | 43 | - | dB |
| | 2110 – 2170 MHz | 30 | 40 | - | dB |
| | 2400 – 2500 MHz | 35 | 42 | - | dB |
| | 2500 – 2586 MHz | 35 | 40 | - | dB |
| | 2586– 2620 | 35 | 40 | - | dB |
| | 2620– 2690 | 30 | 38 | - | dB |
| | 3328– 4310 | 20 | 31 | - | dB |
| | 4992– 6000 | 15 | 22 | - | dB |
| Return Loss at Tx | 832 – 862 MHz | 8 | 10 | - | dB |
| Return Loss at Antenna | 832 – 862 MHz | 8 | 10 | - | dB |
| | **Tx-Rx Specification** | | | | |
| Isolation | 791 – 821 MHz (Differential) | 50 | 53 | - | dB |
| | 832.5 – 862 MHz (Differential)[8] | 54 | 56 | - | dB |
| | 791 – 821 MHz (Common-mode) | 45 | 50 | - | dB |
| | 832.5 – 862 MHz (Common-mode) | 50 | 55 | - | dB |
| | 1574 – 1577 MHz | 40 | 45 | - | dB |
| | 1664 – 1724 MHz | 20 | 48 | - | dB |
| | 2496 – 2586 MHz | 20 | 45 | - | dB |
| Tx Impedance (single-ended) [7] | | - | 50 | - | Ω |
| Ant Impedance (single-ended)[7] | | - | 50 | - | Ω |

Notes:
1. All specifications are based on the TriQuint schematic for the main reference design shown on page 4
2. In production, devices will be tested at room temperature to a guardbanded specification to ensure electrical compliance over temperature
3. Electrical margin has been built into the design to account for the variations due to temperature drift and manufacturing tolerances
4. Typical values are based on average measurements at room temperature
5. Design goal is to meet 3.0 dB Max. Need SPC data to determine actual performance
6. Relative to zero dB
7. This is the optimum impedance in order to achieve the performance shown
8. Target minimum is based on future design revision goals
9. Over any 5 MHz in-band

## RX – Electrical Specifications [1]

Specified Temperature Range: [2] -20 to +85 ºC

| Parameter [3] | Conditions | Min | Typical [4] | Max | Units |
|---|---|---|---|---|---|
| | **Ant-Rx Specification** | | | | |
| Center Frequency | | - | 806 | - | MHz |
| Maximum Insertion Loss | 791–821 MHz | - | 3.0 | 3.5 | dB |
| Amplitude Variation[8] | 791–821 MHz | - | 0.6 | 1.5 | dB p-p |
| Absolute Attenuation [5] | 10 – 760 MHz | 45 | 50 | - | dB |
| | 760 – 770 MHz | 25 | 40 | - | dB |
| | 832 – 862 MHz | 45 | 51 | - | dB |
| | 862 – 890 MHz | 40 | 44 | - | dB |
| | 890 – 910 MHz | 35 | 40 | - | dB |
| | 910 – 2500 MHz | 40 | 44 | - | dB |
| | 2500 – 6000 MHz | 30 | 35 | - | dB |
| Return Loss at Rx | 791–821 MHz | 7.5 | 9 | - | dB |
| Return Loss at Antenna | 791–821 MHz | 8 | 9.5 | - | dB |
| Output phase balance | 791–821 MHz | -7.0 | - | 8.0 | degree |
| Output amplitude balance[8] | 791–821 MHz | -2.3 | - | 0.5 | dB |
| IM2 product [6] (a,b) | | - | -106 | -104 | dBm |
| IM3 product [6] (c,d) | | - | -101 | -100 | dBm |
| ANT Impedance (single-ended ) [7] | | - | 50 | - | Ω |
| Rx Impedance (balanced) [7] | | - | 100 | - | Ω |

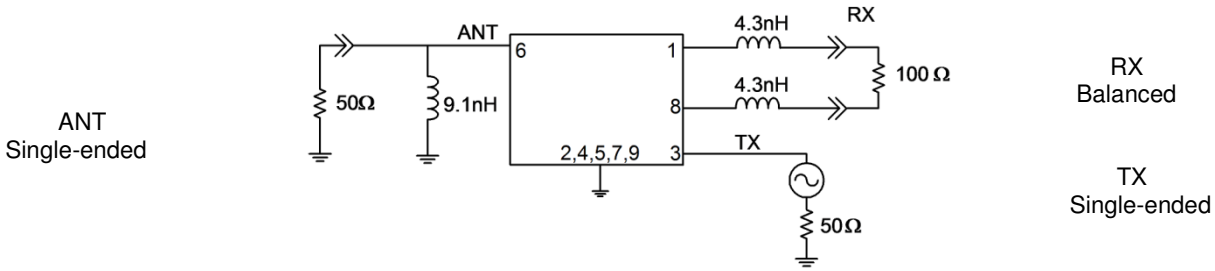
Notes:

1. All specifications are based on the TriQuint schematic for the main reference design shown on page 4
2. In production, devices will be tested at room temperature to a guardbanded specification to ensure electrical compliance over temperature
3. Electrical margin has been built into the design to account for the variations due to temperature drift and manufacturing tolerances
4. Typical values are based on average measurements at room temperature
5. Relative to zero dB
6. All power levels are referenced to the antenna port. Two CW tones are applied at frequencies f1 and f2, and the resultant intermodulation product in the Rx band is measured. The first tone is applied to the Tx port, in the range f1 = 832 to 862 MHz, at +21.5 dBm (referenced to the antenna port). The second tone is -15 dBm, applied to the antenna port at f2, with the following four cases:
   a. f2 = 41 MHz
   b. f2 = 2 * f1 - 41 MHz
   c. f2 = f1 + 41 MHz
   d. f2 = 3 * f1 - 41 MHz

   The intermodulation product is measured at f1 - 41 MHz.
7. This is the optimum impedance in order to achieve the performance shown
8. Over any 5 MHz in-band

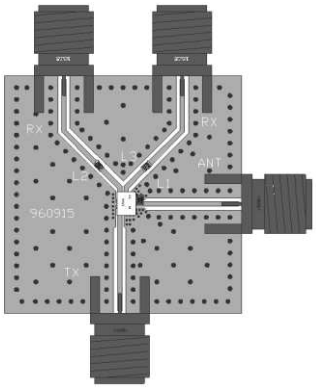
## Reference Design –Ant- 50Ω SE In, Tx-50Ω SE Out , Rx-100Ω Bal Out

## Schematic



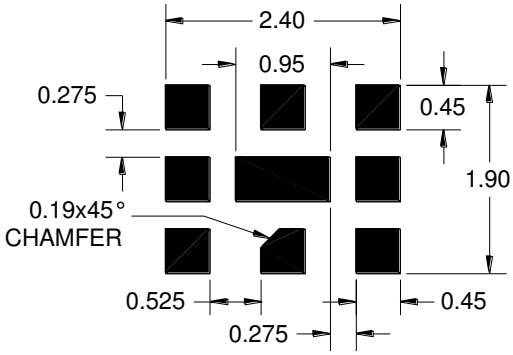

Notes:
1. Actual matching values may vary due to PCB layout and parasitic

## PC Board



Notes:
Top, middle & bottom layers: 1 oz copper
Substrates: FR4 dielectric, .031" thick
Finish plating: Nickel: 3-8µm thick, Gold: .03-.2µm thick
Hole plating: Copper min .0008µm thick

## Mounting Configuration



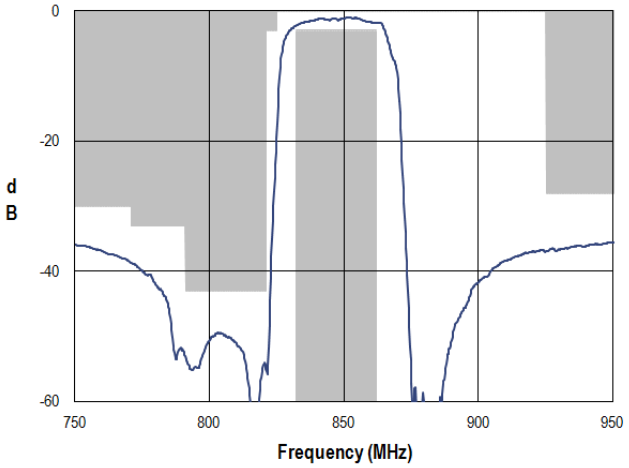

Notes:
1. All dimensions are in millimeters.
2. This footprint represents a recommendation only.

## Bill of Material

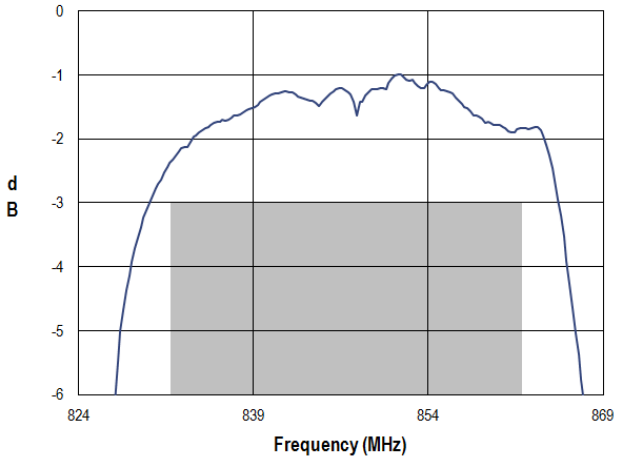
| Reference Design | Value | Description | Manufactur | Part Number |
|---|---|---|---|---|
| L1_ANT | 9.1 nH | Chip inductor, Wire wound, 0402, ±2% | MuRata | LQW15AN9N1G00 |
| L2 and L2 at Rx | 4.3 nH | Chip inductor, Wire-wound, 0402, ±3% | MuRata | LQW15AN4N3C00 |
| SMA | N/A | SMA connector | Radiall USA Inc. | 9602-1111-018 |
| PCB | N/A | 3-layer | Multiple | N/A |

## Tx - Typical Performance (at room temperature)

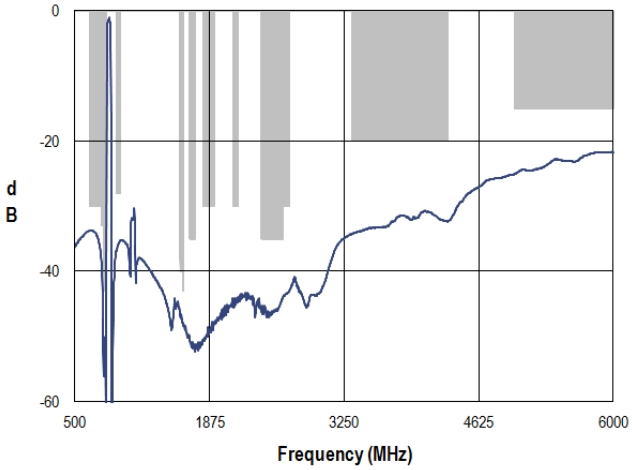
Tx Frequency Response



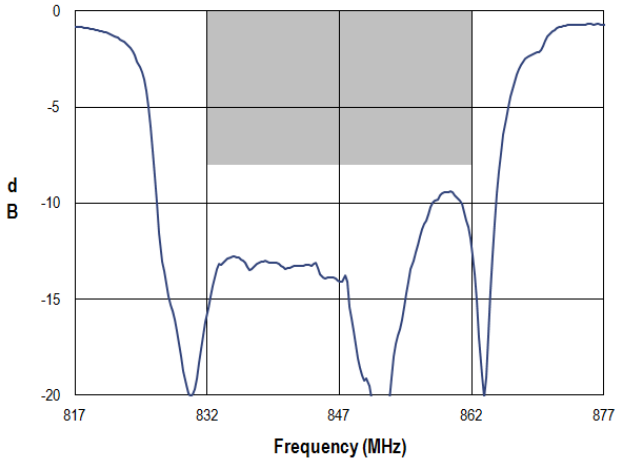

Tx Passband Response



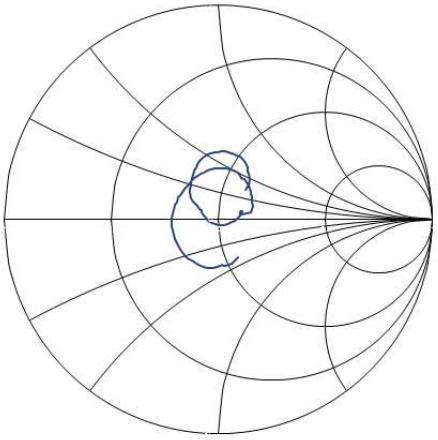

Tx Wideband Response



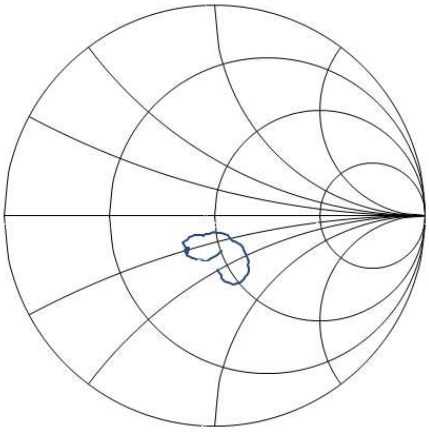

Tx Return Loss




Tx Path - Ant Port Impedance

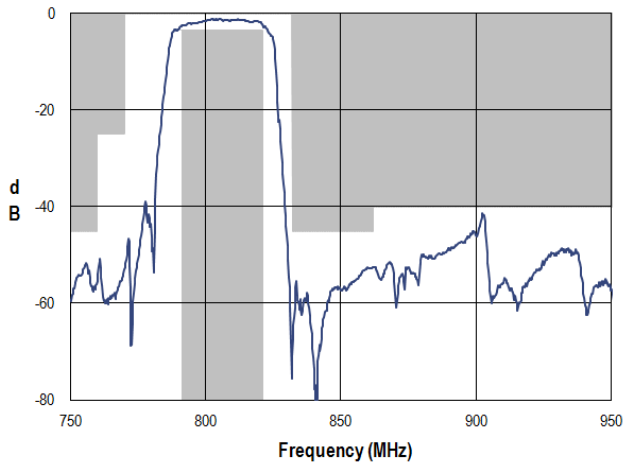


Tx Port Impedance

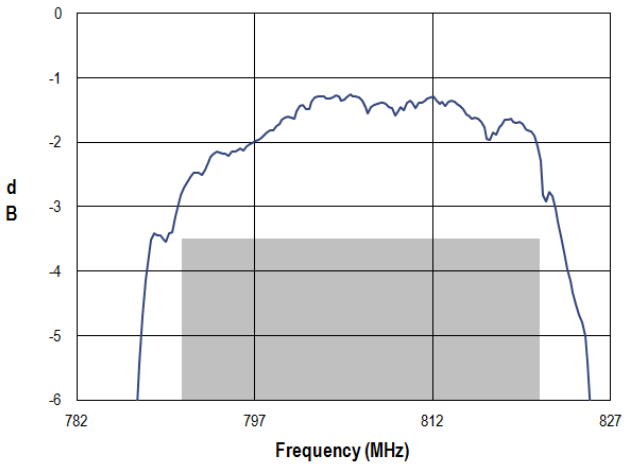


## Rx -Typical Performance (at room temperature)

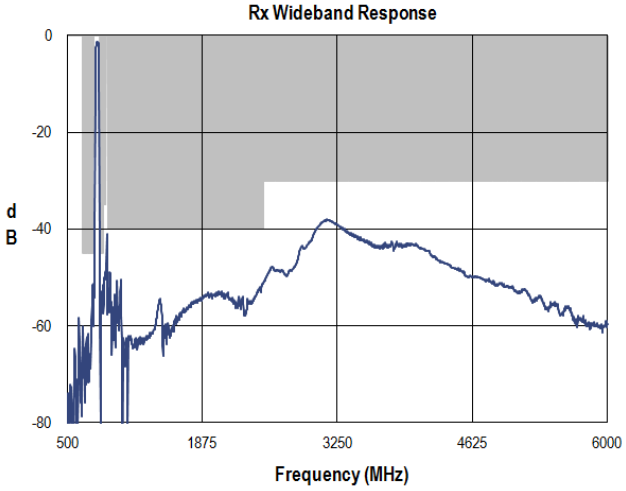
Rx Frequency Response



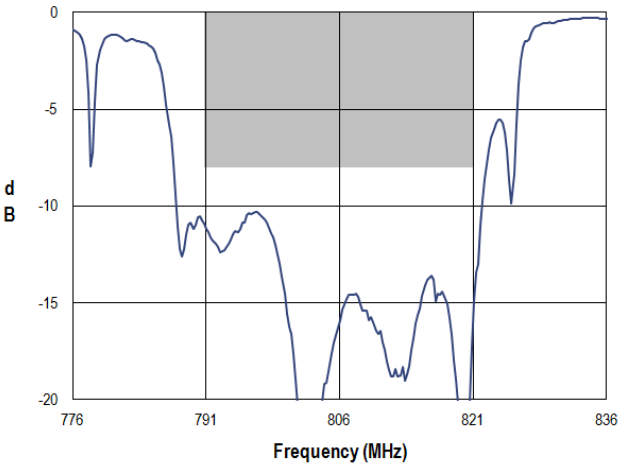

Rx Passband Response



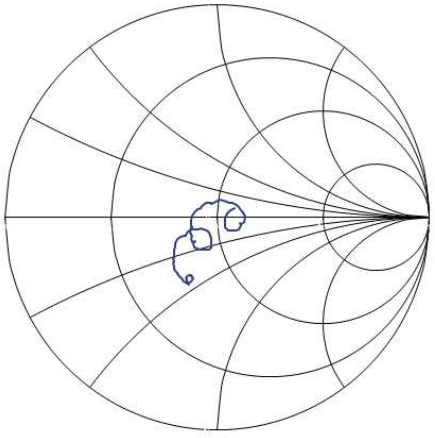

Rx Wideband Response



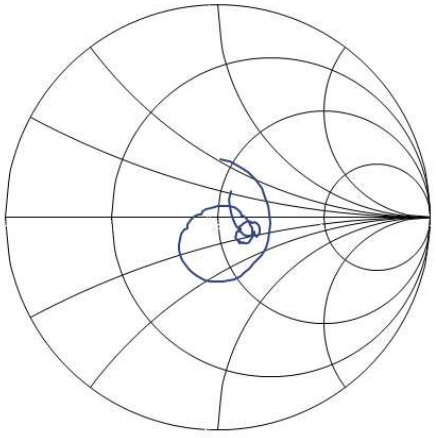

Rx Return Loss



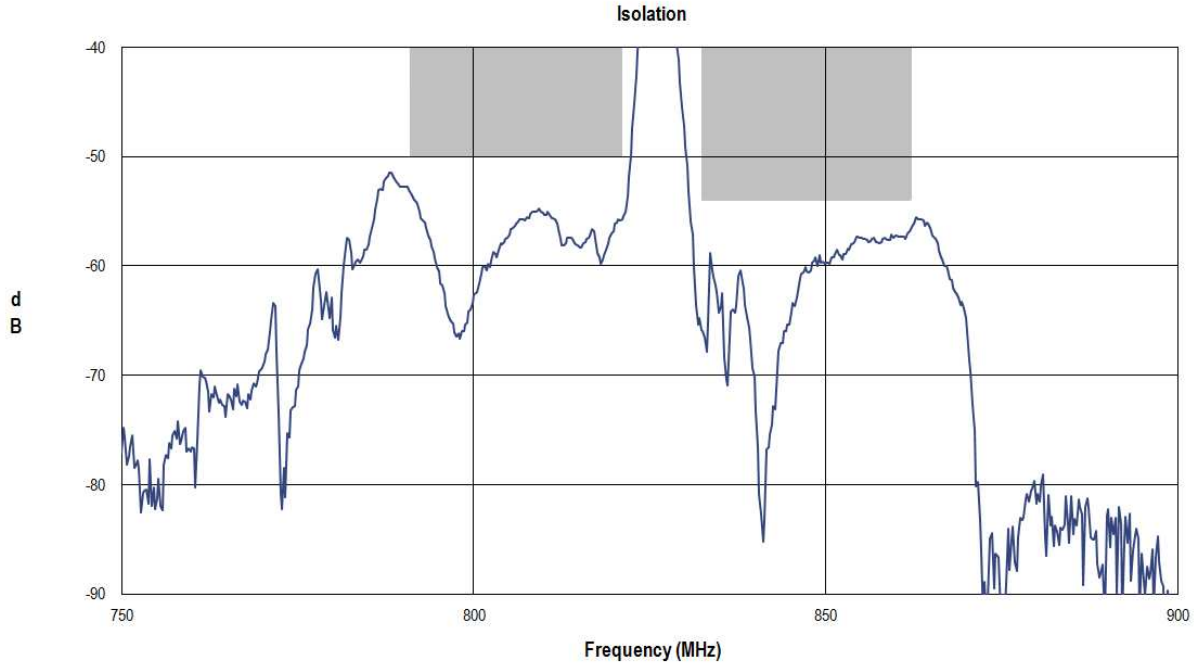

Rx Path - Ant Port Impedance

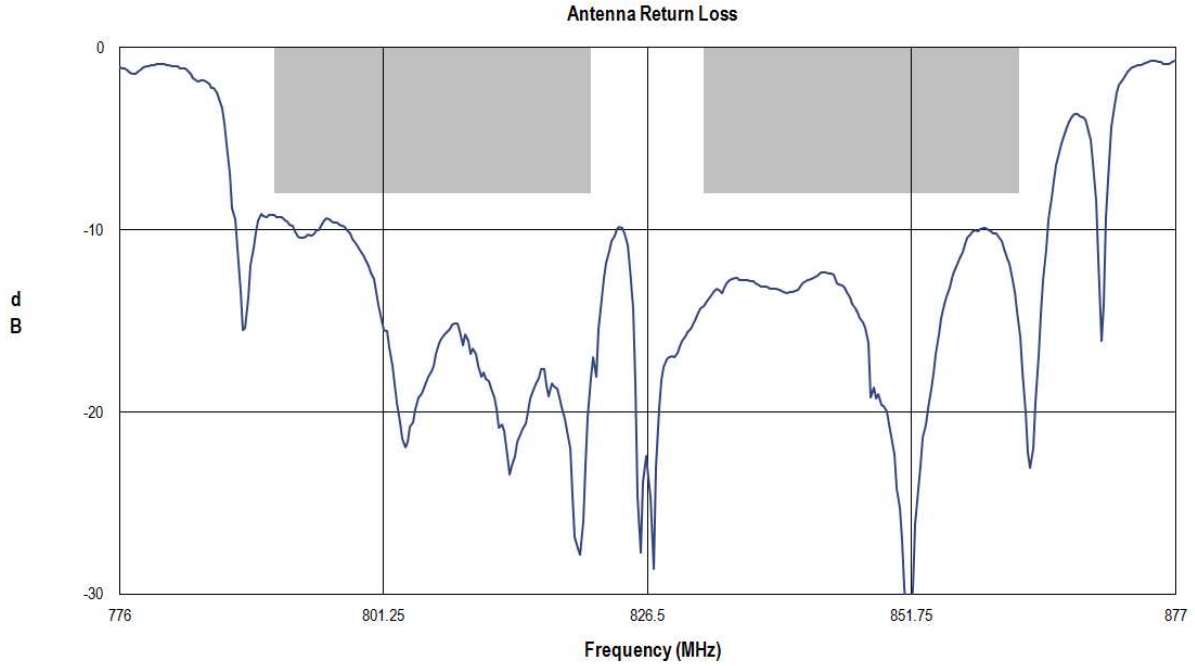


Rx Port Impedance



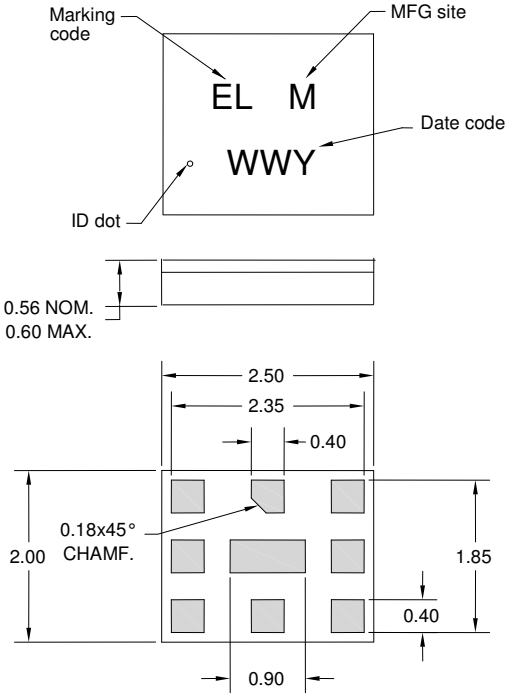
## TX – RX Isolation & Antenna RL Typical Performance (at room temperature)



## Mechanical Information

### Package Information, Dimensions and Marking




Package Style: CSP-10KT
Dimensions: 2.5 x 2.00 x 0.56 mm

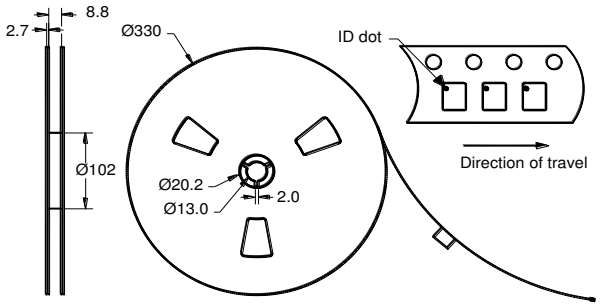
Body: $Al_2O_3$ ceramic
Lid: Kovar or Alloy 42, Au over Ni plated
Terminations: Au plating 0.5 - 1.0µm, over a 2-6µm Ni plating

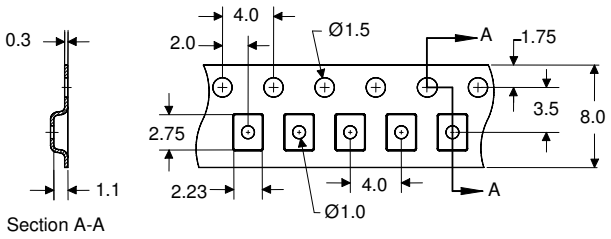
All dimensions shown are nominal in millimeters
All tolerances are ±0.15mm except overall length and width ±0.10mm

The date code consists of: WW = 2 digit week,
Y = last digit of year, M = manufacturing site code

## Tape and Reel Information

Standard T/R size = 10,000 units/reel. All dimensions are in millimeters




## Absolute Maximum Ratings

| Parameter | Rating |
|---|---|
| Operating Temperature | -20 to +90 °C |
| Storage Temperature | -40 to +90 °C |
| Input Power(1) at TX | +29 dBm |

(1) 55°C equivalent 5000 hours. All ports matched to 50 Ohms.

Operation of this device outside the parameter ranges given above may cause permanent damage.

# Product Compliance Information

## ESD Information

**Caution! ESD-Sensitive Device**

ESD Rating: Class 0
Value: Passes ≤ 150 V
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

ESD Rating: Class N/A
Value: Passes ≤ 100 V
Test: Machine Model (MM)
Standard: JEDEC Standard JESD22-A115

## MSL Rating

Devices are Hermetic, therefore MSL is not applicable.

## Solderability

Compatible with the latest version of J-STD-020, lead free solder, 260°C

Refer to **Soldering Profile** for recommended guidelines.

This part is compliant with EU 2002/95/EC RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

This product also has the following attributes:

- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_4O_2$) Free
- PFOS Free
- SVHC Free

# Contact Information

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