# SPDT 30W/60W$_{peak}$ Power Switch 1 MHz to 6.0 GHz

## Features

- Frequency Range 1 MHz to 6.0 GHz
- Low insertion loss:
  0.20 dB @ 1.0 GHz
  0.30 dB @ 3.0 GHz
  0.65 dB @ 6.0 GHz
- High isolation:
  28 dB @ 3.0 GHz
  16 dB @ 6.0 GHz
- 30 W CW Power, 60 $W_p$ Peak Power
- Low power consumption, less than 1 mW
- No external DC blocking capacitors on RF lines
- All RF ports OFF state
- Versatile 2.6...5.25 V power supply
- Charge pump disabled, -18 V supply needed
- Noise level better than -140 dBm/kHz

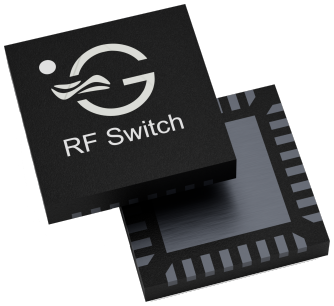



Figure 1: TS74230L in 4.0 x 4.0 mm$^2$ QFN 32-pin package.

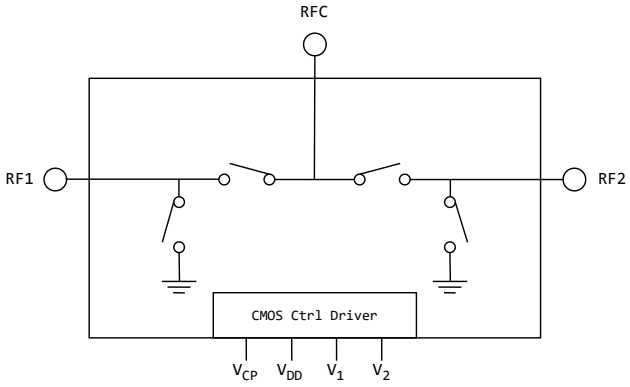



Figure 2: TS74230L functional diagram

## Applications

- Private mobile and defense radios
- Public safety handsets
- Cellular infrastructure
- Satellite terminals
- Datalinks

## General Description

The TS74230L is a 2nd Generation symmetrical reflective Single Pole Dual Throw (SPDT) switch designed for medium power switching applications. The TS74230L covers 1 MHz to 6.0 GHz bandwidth and provides low insertion loss, high isolation, and high linearity within a small package size. The TS74230L is a 30 W CW with peak power capability of 60 W, switch suitable for applications requiring low insertion loss, high isolation, and high linearity. TS74230L has charge pump disabled and requires-18V supply, offering better than140dBm/1kHznoise level.

The TS74230L is packaged into a compact Quad Flat No lead (QFN) 4.0x4.0 mm$^2$ 32 leads plastic package.

RoHS

RoHS10/Reach/Halogen free

# Ordering information

Table 1: Ordering Information

| Device Part Number | Package Type | Notes |
|---|---|---|
| TS74230L | 32 Pin 4.0x4.0x0.75 $mm^3$ QFN | Core part number |
| TS74230L-EVB | Evaluation Board | |
| TS74230LMTRPBF[1] | 330 mm reel, 3 000pcs | Full reel |

[1] MTRPBF - M: Manufacturing, TR: Tape and Reel, and PBF: lead free.

Table 2: Tape and Reel Information

| Form | Quantity | Reel Diameter | Reel Width |
|---|---|---|---|
| Tape and Reel | 3 000 | 13” (330mm) | 18mm |

## Pin Assignment

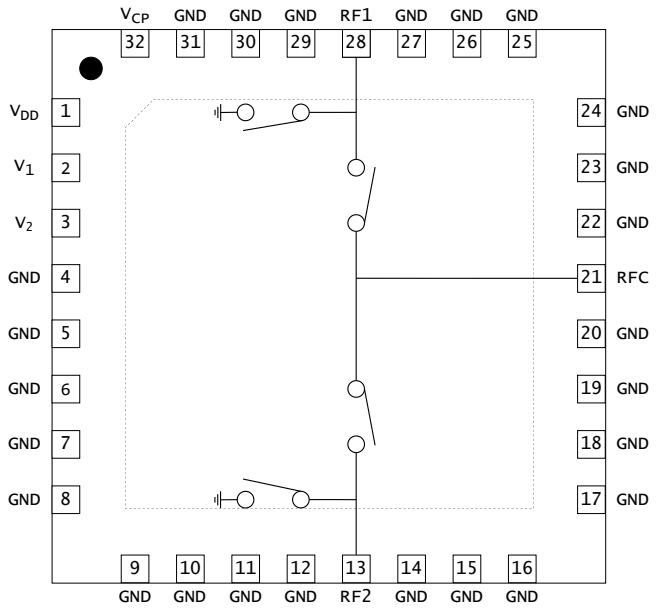



Figure 3: TS74230L pin assignment [top view]

Table 3: Pin Definition

| Pin Number | Pin Name | Decription |
|---|---|---|
| 32 | $V_{CP}$ | Internal charge pump voltage output, connect a 1nF capacitor to GND on this node. |
| 1 | $V_{DD}$ | DC Power Supply |
| 2 | $V_1$ | Switch control input 1 |
| 3 | $V_2$ | Switch control input 2 |
| 13 | RF2 | RF port 2 |
| 21 | RFC | RF Common port / Antenna port |
| 28 | RF1 | RF port 1 |
| 4,5,6,7,8,9,10,11,12 | GND | Connect to ground[2] |
| 14,15,16,17,18,19,20 | | |
| 22,23,24,25,26,27 | | |
| 29,30,31 | | |
| 33 [1] | GND | Ground thermal pad, please connect to GND |

[1] The backside ground (thermal) pad of the package must be grounded directly to the ground plane of PCB with multiple vias, and adequate heat sinking must be used to ensure proper operation and thermal management.
[2] These pins are NC pins inside the package. To avoid floating pins around RF lines, we request these to be connected to ground.

# Absolute Maximum Ratings

Table 4: Absolute Maximum Ratings $T_A = +25$°C unless otherwise specified[1].

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| **Electrical Ratings** | | | |
| Power Supply Voltage | $V_{DD}$ | 5.5 | V |
| Storage Temperature Range | $T_{st}$ | -55...+125 | °C |
| Operating Temperature Range | $T_{op}$ | -40...+85 | °C |
| Maximum Junction Temperature | $T_j$ | +140 | °C |
| Maximum RF CW input power[3] | RFx/ANT | 45.5 | dBm |
| Maximum RF peak input power, 1% duty cycle, 10$\mu$s pulse [2] | RFx/ANT | 49 | dBm |
| **Thermal Ratings** | | | |
| Thermal Resistance (junction-to-case) – Bottom side | $R_{\theta jc}$ | 9.0 | °C/W |
| Soldering Temperature | $T_{solder}$ | +260 | °C |
| **ESD Ratings** | | | |
| Human Body Model (HBM) | Level 1B | 500...<1000 | V |
| Charged Device Model (CDM) | Level C3 | ≥1000 | V |
| **Moisture Rating** | | | |
| Moisture Sensitivity Level[4] | MSL | 1 | |

[1] Maximum ratings are absolute ratings. Exposure to absolute maximum rating conditions for extended periods may affect device reliability and can cause permanent damage to the device. Exceeding one or a combination of the absolute maximum ratings may cause permanent and irreversible damage to the device and/or to surrounding circuit. Functional operation of the device is not implied in any conditions above those indicated in the Electrical Specifications section.
[2] Test frequency 800MHz.
[3] See Power De-rating table for low frequencies.
[4] Tagore recommends to store part in moisture barrier bags to preserve solderability.

## Electrical Specifications

Table 5: Electrical Specifications $T_A = +25°C; V_{DD} = +3.3V; 50\Omega$ Source/Load.

| Parameter | Condition | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| Operating frequency | $f$ | 1 | | 6000 | MHz |
| Insertion loss | 30 MHz | | 0.15 | | dB |
| unmatched, upto 4.5 GHz | 1.0 GHz | | 0.18 | 0.30 | dB |
| RFC – RFx | 3.0 GHz | | 0.30 | | dB |
| | 4.5 GHz | | 0.40 | | dB |
| Insertion loss[1] | 30 MHz | | 0.15 | | dB |
| matched upto 6.0 GHz | 1.0 GHz | | 0.20 | | dB |
| RFC – RFx | 3.0 GHz | | 0.30 | | dB |
| | 5.0 GHz | | 0.50 | | dB |
| | 6.0 GHz | | 0.65 | | dB |
| Isolation | 30 MHz | | 60 | | dB |
| unmatched, upto 4.5 GHz | 1.0 GHz | 40 | 43 | | dB |
| RFC – RFx | 3.0 GHz | | 28 | | dB |
| | 4.5 GHz | | 21 | | dB |
| Isolation[1] | 30 MHz | | 60 | | dB |
| matched upto 6.0 GHz | 1.0 GHz | | 43 | | dB |
| RFC – RFx | 3.0 GHz | | 28 | | dB |
| | 5.0 GHz | | 20 | | dB |
| | 6.0 GHz | | 16 | | dB |
| Isolation[1] | 30 MHz | | 60 | | dB |
| Isolation state | 1.0 GHz | | 37 | | dB |
| RFC – RFx | 3.0 GHz | | 24 | | dB |
| | 5.0 GHz | | 16 | | dB |

[1] Matched values are not guaranteed as they include performance of matching components. These components are beyond control of TagoreTech and therefore given values are indications, not guaranteed values.

Table 6: Electrical Specifications $T_A = +25°C; V_{DD} = +3.3V; 50\Omega$ Source/Load.

| Parameter | Condition | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| Operating frequency | $f$ | 1 | | 6000 | MHz |
| Return Loss | 30 MHz | | -30 | | dB |
| unmatched, upto 4.5 GHz | 1.0 GHz | | -30 | -25 | dB |
| $RFC - RFx$ | 3.0 GHz | | -22 | | dB |
| | 4.5 GHz | | -20 | | dB |
| Return Loss[1] | 30 MHz | | -30 | | dB |
| matched upto 6.0 GHz | 1.0 GHz | | -30 | -25 | dB |
| $RFC - RFx$ | 3.0 GHz | | -20 | | dB |
| | 5.0 GHz | | -22 | | dB |
| | 6.0 GHz | | -20 | | dB |

[1] Matched values are not guaranteed as they include performance of matching components. These components are beyond control of TagoreTech and therefore given values are indications, not guaranteed values.

Table 7: Electrical Specifications $T_A = +25°C; V_{DD} = +3.3V; 50\Omega$ Source/Load.

| Parameter | Condition | Minimum | Typical | Maximum | Unit |
|---|---|---|---|---|---|
| Operating frequency | $f$ | 1 | | 6000 | MHz |
| **Harmonic Distortion** | | | | | |
| $H_2$ | 800MHz, $P_{in}$ =40dBm | | -92 | | dBc |
| $H_3$ | 800MHz, $P_{in}$ =40dBm | | -95 | | dBc |
| IIP3 | 800MHz | | 77 | | dBm |
| **Power and Compression point** | | | | | |
| $P_{maxCW}$[2] | Max RF CW Power | | 43 | | dBm |
| $P_{maxpeak}$ | Max RF Peak Power | | 48 | | dBm |
| $P_{maxhot\ RFx}$[5] | Max RF CW Power, hot switching | | 37 | | dBm |
| $P_{maxhot\ RFC}$[5] | Max RF CW Power, hot switching | | 37 | | dBm |
| $P_{0.1dB}$ | 800MHz, CW | | 45 | | dBm |
| $P_{1dB}$[1] | 800MHz, CW | | 48 | | dBm |
| $P_{peak0.1dB}$ | 800MHz, 1% duty cycle, 10$\mu$s pulse | | 48 | | dBm |
| **Noise** | | | | | |
| CP switching noise[4] | RBW=1kHz | | -140 | | dBm |
| **Switching Time** | | | | | |
| $t_{ON}$ | Switch ON time | | 900 | 1170 | ns |
| $t_{OFF}$ | Switch OFF time | | 900 | 1170 | ns |
| $t_{RISE}$ | Switch RISE time | | 500 | 600 | ns |
| $t_{FALL}$ | Switch FALL time | | 500 | 600 | ns |
| $t_{wON}$ | Minimum Switch ON time | | 3.6 | | $\mu$s |
| $t_{wOFF}$ | Minimum Switch OFF time | | 3.6 | | $\mu$s |
| $f_{PRR}, V_{CPext} = -18$ V[6] | Maximum pulse repetition rate | | >20 | | kHz |
| $t_{startup}, C_{VCP}$ = ext $= -18$ V[6] | startup time | | 40 | | ms |
| **Power Supply, DC** | | | | | |
| Power Supply[7] | $V_{CP}$ | -19 | -18 | -17 | V |
| Power Supply | $I_{CP}$ | 100 | | | $\mu$A |
| Control voltage[8] | Power Supply $V_{DD}$ | 2.6 | 3.3 | 5.25 | V |
| | All control pins high, $V_{ih}$ | 1.0 | 3.3 | 5.25 | V |
| | All control pins low, $V_{il}$ | -0.3 | 0 | 0.5 | V |
| Control current | All control pins high, $I_{ih}$ | | | 7.5 | $\mu$A |
| | All control pins low, $I_{il}$ | | 0 | | $\mu$A |
| Current consumption | $I_{DD}$, active mode ($V_{DD}$ on) | | 160 | 260 | $\mu$A |

[1] $P_{1\,dB}$ has been given for comparison reasons only. Please do not exceed Absolute Maximum ratings.
[2] See Power De-rating table
[5] Dependent on thermal design and surrounding circuits.
[6] External -18 V applied to $V_{CP}$ pin. TS74230L has internal chargepump disabled and therefore requires external -18 V voltage.
[7] $V_{DD}$ should be applied first before $V_{CP}$. Minimum time between $V_{DD}$ and $V_{CP}$ should be 50 $\mu$s.
[8] Control voltage $V_{ih}$ cannot be higher than $V_{DD}$ (to avoid forward biasing of ESD diode)

## Switching time definition

Example of the definition by using 10 W/40 dBm signal. We apply 10W signal to RF port, stabilized with isolator. Isolator is needed as our switch shows to RF port approximately 4Ω impdance. Lets assume that that switch insertion loss is 0.3 dB. Therefore 90% of the RF signal is 39.55 dBm and 10% of the RF signal is 1W/30dBm. We need to take into account 0.3dB insertion loss, therefore numbers are 39.25 dBm and 29.7 dBm respectively. We change the control from low to high and our time reference point is when our control signal exceeds lower threshold value $V_{ihlow}$. In certain measurements when control signal rise time is significantly shorter than RF output signal, we approximate start of the clock with 50% point of of control signal.

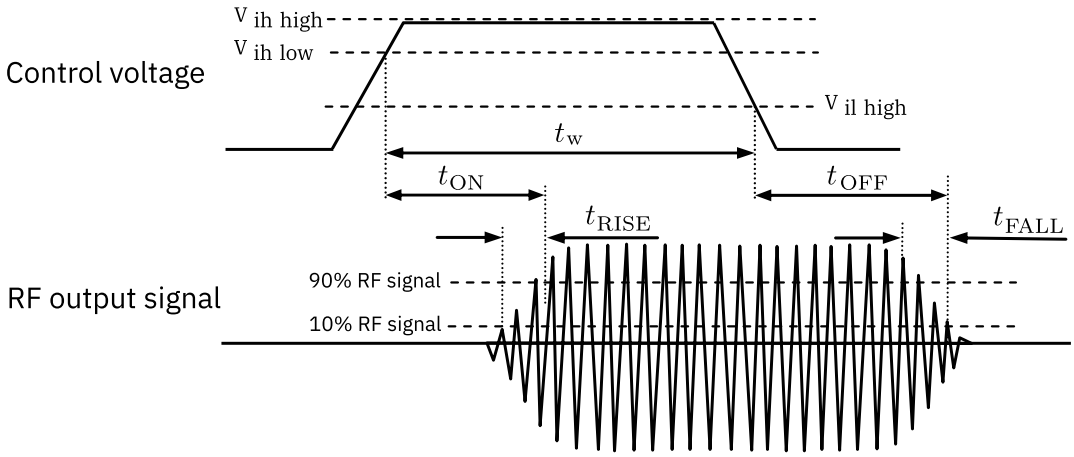



Figure 4: Switching time definition, $t_{ON}$, $t_{OFF}$, $t_{RISE}$, $t_{FALL}$. Minimum pulse width $t_w$.

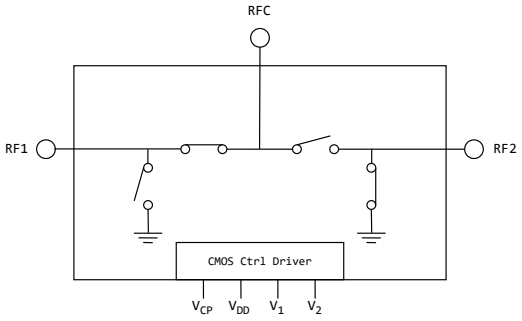
Our component uses integrated charge pump. Maximum pulse repetition rate defines what is maximum frequency for switching events. Please do not exceed given maximum frequency. By feeding external -18 V to $V_{CP}$, one can improve maximum pulse repetition rate $f_{PRR}$. Feeding external -18V to $V_{CP}$, one can drive switch at least to 20kHz $f_{PRR}$. Expect current consumption of 10mA of -18V.

## Switch Control table

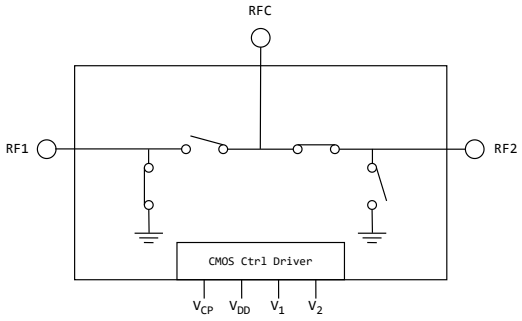
Table 8: Switch Control Table

| $V_{DD}$[1] | $V_2$ | $V_1$ | **Switch state** |
|---|---|---|---|
| 1 | 0 | 0 | $RFC - RF1$ ON[2] |
| 1 | 0 | 1 | $RFC - RF2$ ON |
| 1 | 1 | 0 | ISO (Isolation), $RFC$ port open, $RF$ ports shorted[3]. |
| 0 | 0 | 0 | $V_{DD}$ off (Isolation), all FETs are on, short shown to $RFC$ and $RF$ ports |

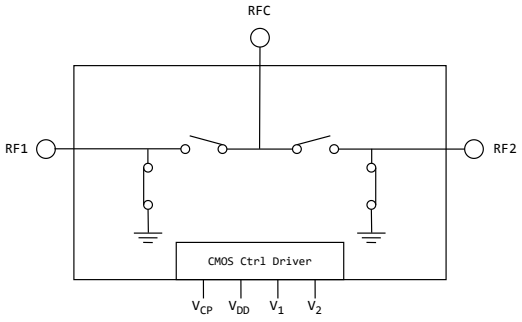
[1] $V_{DD}$ should be applied first before $V_1$ and $V_2$, otherwise may cause damage to the device.
[2] There are internal pull-downs to ground on both $V_1$ and $V_2$ control pins, the state at start-up without any control voltage applied will be $RFC - RF1$ ON.
[3] If ISO state is not used, the switch can be operated with single control pin $V_1$
[4] $V_{DD}$ should be applied first before $V_{CP}$. Minimum time between $V_{DD}$ and $V_{CP}$ should be 50 $\mu$s.



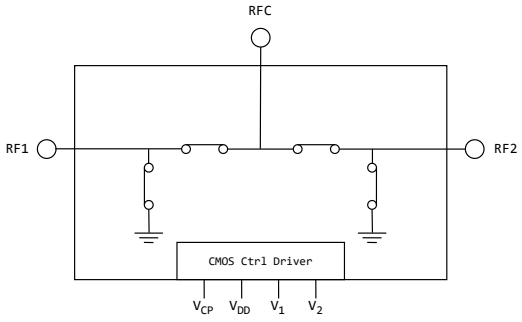

RFC-RF1 ON




RFC-RF2 ON




ISO (Isolation state)




$V_{DD}$ off state

# Theory of Operation

## Isolation modes

TS74230L has two isolation modes. Both Isolation mode measurements are shown at electrical performance section. Both modes described below.

## Device powered off

When $V_{DD}$ is 0 V, all switch RF transistors are on, ie. every MOSFET is on. This means that series MOSFETS and shunt MOSETs are conducting. Every RF port is essentially connected to ground, including RFC port. This is practical when device is directly connected to RFC, there is certain protection against induced electrical fields. This can partially protect radio equipment against electrical fields, when device is not in usage.

## Device powered, ISO state

In this state, series MOSFETs are OFF, ie. OPEN and shunt MOSFETs are on, ie. closed. RF1 to RF2 isolation is maximum and antenna is completely isolated. RFC port is open, whereas RFx ports are showing effectively short. Low frequency isolation in this case is approximately 60 dB as basically there is DC block due to open FETs.

# Applications

TS74230L is offering 30 W/60 $W_{peak}$ capability from 1 MHz to 6000 MHz frequency band. Applications include narrowband and multi-octave wideband radios, jammers, EMC testing, public mobile radios, industrial and scientific applications. In the past, such applications were covered with power hungry and complex PIN diodes, TS74230L significantly reduces design complexity for such RF switching needs. TS74230L works well upto 5 GHz frequency without external matching components, for frequency above 4.5 GHz, matching is recommended. Datasheet provides an example matching and its performance.

## Schematics and Evaluation Board

S-parameters of the both presented EVBs can be downloaded from link: Download TS74230L S-parameters

Table 9: Port definitions in s-parameter files and plots.

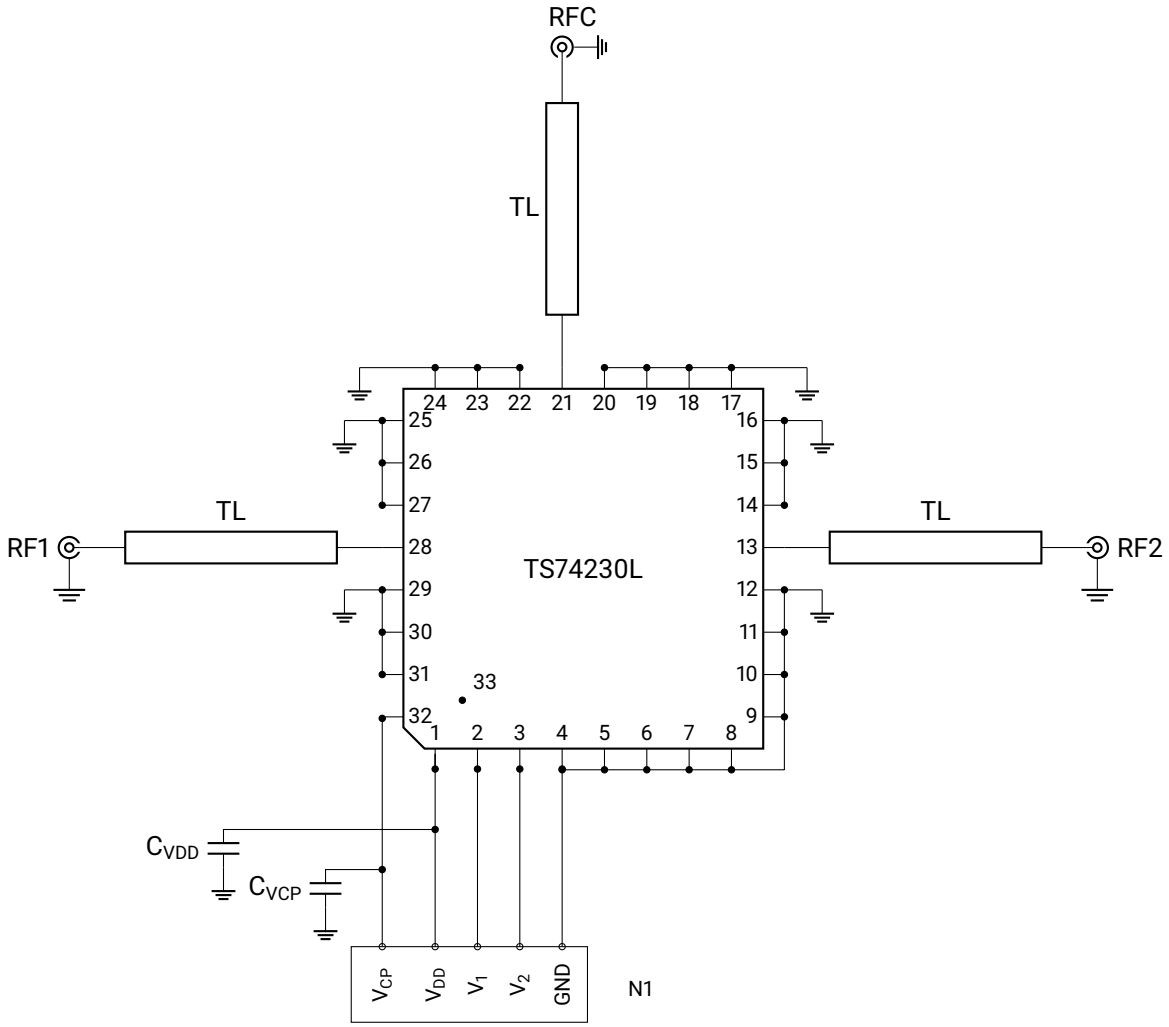
| PIN name | Port numbers | S-parameters | Function |
|---|---|---|---|
| RFC | 1 | S11 | |
| RF1 | 2 | S22 | |
| RF2 | 3 | S33 | |
| RF1ON | 12 | S21 | RFC-RF1 ON |
| RF2ON | 13 | S31 | RFC-RF2 ON |

Content of s-parameter repository:

```
TS74230L.zip
├── IDX_00_no_match ..... Directory for s-parameters without matching components
│   ├── Readme.txt
│   ├── TS74230L_RFOFF_3PORT.s3p ..... S3P file for ISO mode
│   ├── TS74230L_VDDOFF_3PORT.s3p ..... S3P file for VDD off mode
│   ├── TS74230L_RF1ON_3PORT.s3p ..... S3P file for RFC-RF1ON mode
│   └── TS74230L_RF2ON_3PORT.s3p ..... S3P file for RFC-RF2ON mode
└── IDX_01_wideband ..... Directory for s-parameters with matching components, 6.0 GHz
    ├── Readme.txt
    ├── TS74230L_RFOFF_3PORT.s3p ..... S3P file for ISO mode
    ├── TS74230L_VDDOFF_3PORT.s3p ..... S3P file for VDD off mode
    ├── TS74230L_RF1ON_3PORT.s3p ..... S3P file for RFC-RF1ON mode
    └── TS74230L_RF2ON_3PORT.s3p ..... S3P file for RFC-RF2ON mode
```

## Performance upto 4.5 GHz, unmatched

TS74230L shows best performance upto 4.5 GHz frequency without any matching components. Only two external components are recommended, 1 nF for $V_{CP}$ and 10nF for$V_{DD}$ lines for supporting charge pump and power supply.




Schematics of TS7423L EVB

Table 10: Components used for TS74230L EVB

| Reference | Part number / Value | Description | Notes |
|---|---|---|---|
| $C_{VDD}$ | 10 nF | Capacitor | |
| $C_{VCP}$ | 1 nF | Capacitor | |

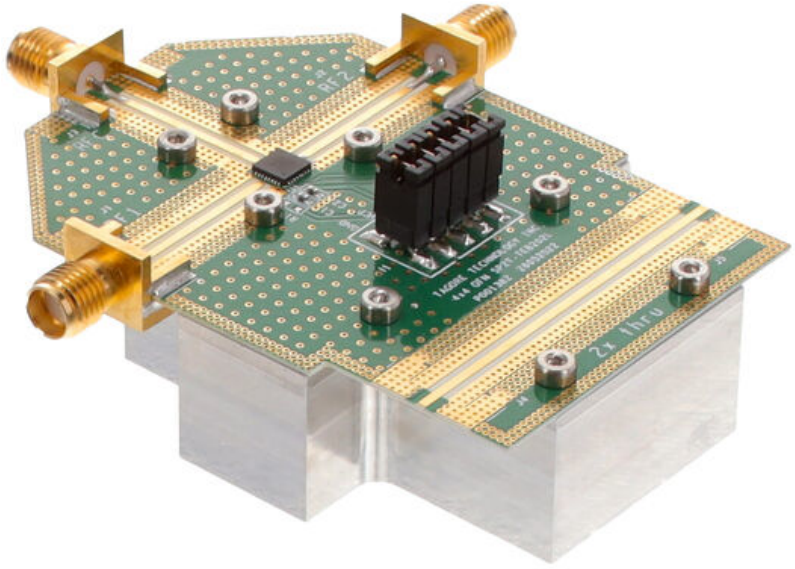


Photo of TS74230L EVB

## Performance upto 6.0 GHz, matched

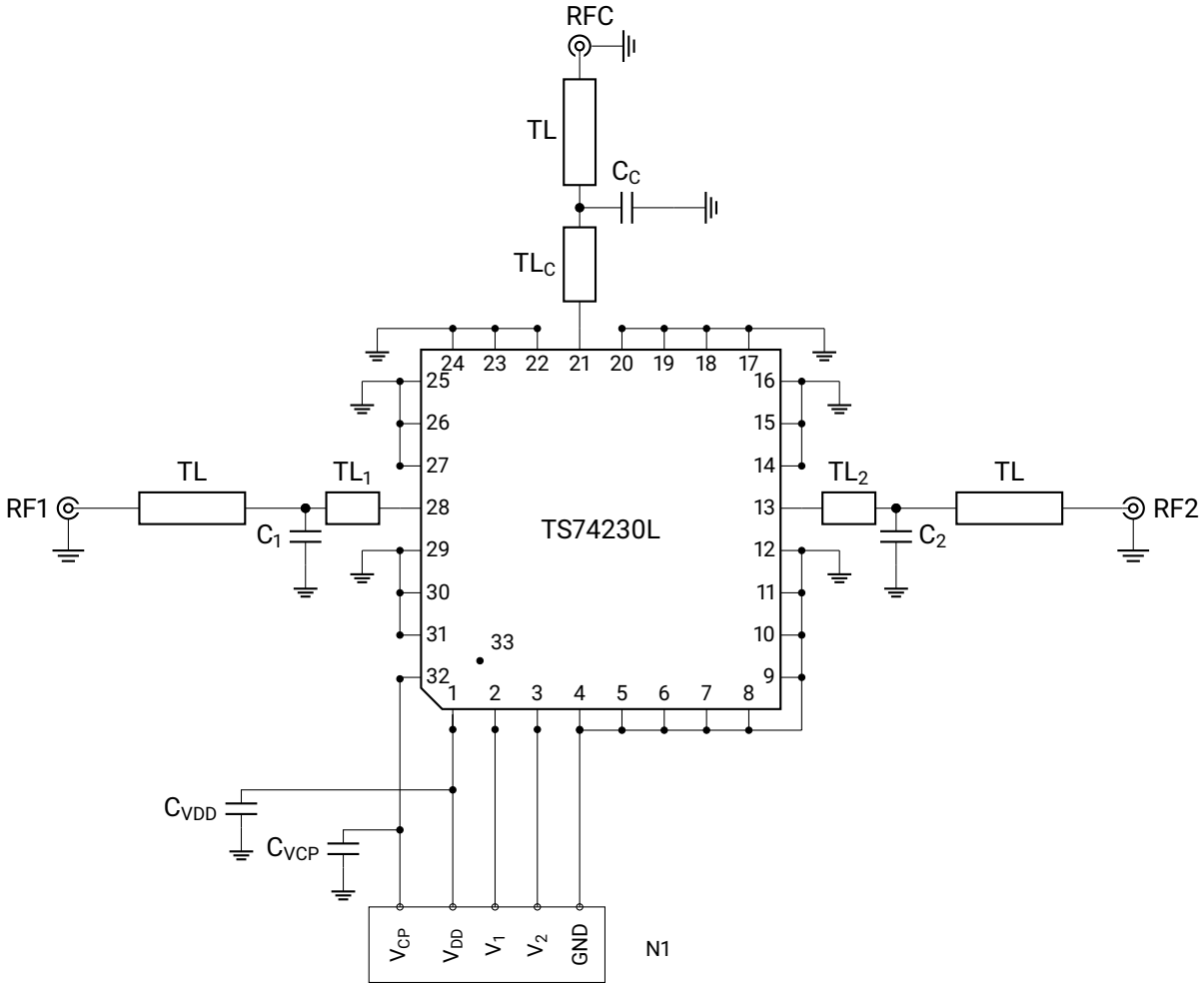


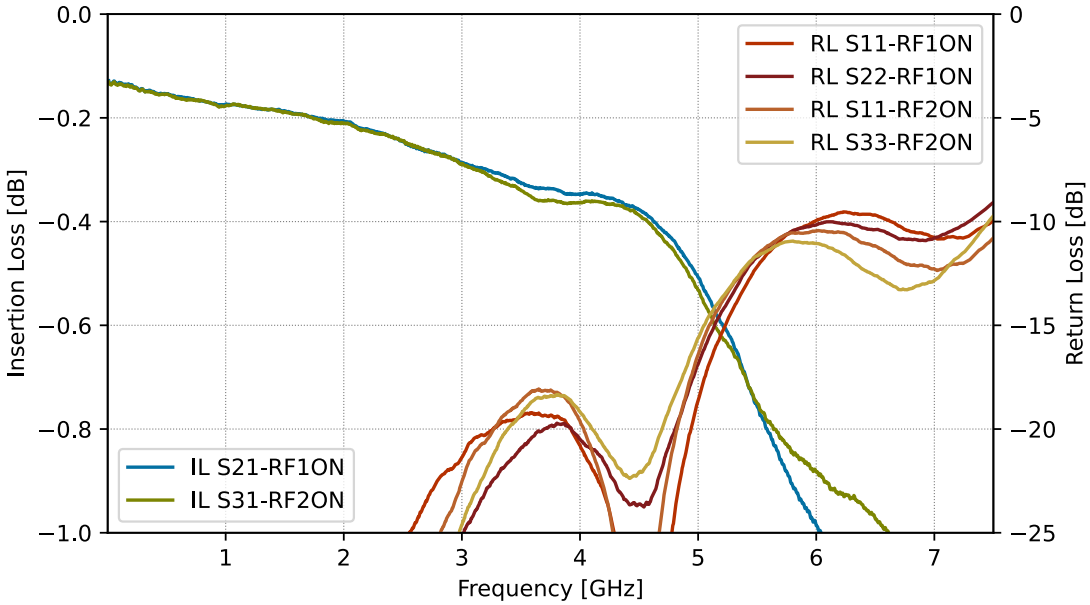

Table 11: Matching components used for 6.0 GHz matching

| Reference | Part number / Value | Description | Notes |
|---|---|---|---|
| $TL_C$ | 1.8 mm | CPW length | Edge of SW to edge of capacitor |
| $C_C$ | 0603N0R2BW251 | Ceramic capacitor | 0.2 pF, 250 V, ± 0.1 pF |
| $TL_1$ | 0.4 mm | CPW length | Edge of SW to edge of capacitor |
| $C_1$ | 0603N0R2BW251 | Ceramic capacitor | 0.2 pF, 250 V, ± 0.1 pF |
| $TL_2$ | 0.4 mm | CPW length | Edge of SW to edge of capacitor |
| $C_2$ | 0603N0R2BW251 | Ceramic capacitor | 0.2 pF, 250 V, ± 0.1 pF |
| $C_{VDD}$ | 10 nF | Capacitor | |
| $C_{VCP}$ | 1 nF | Capacitor | |

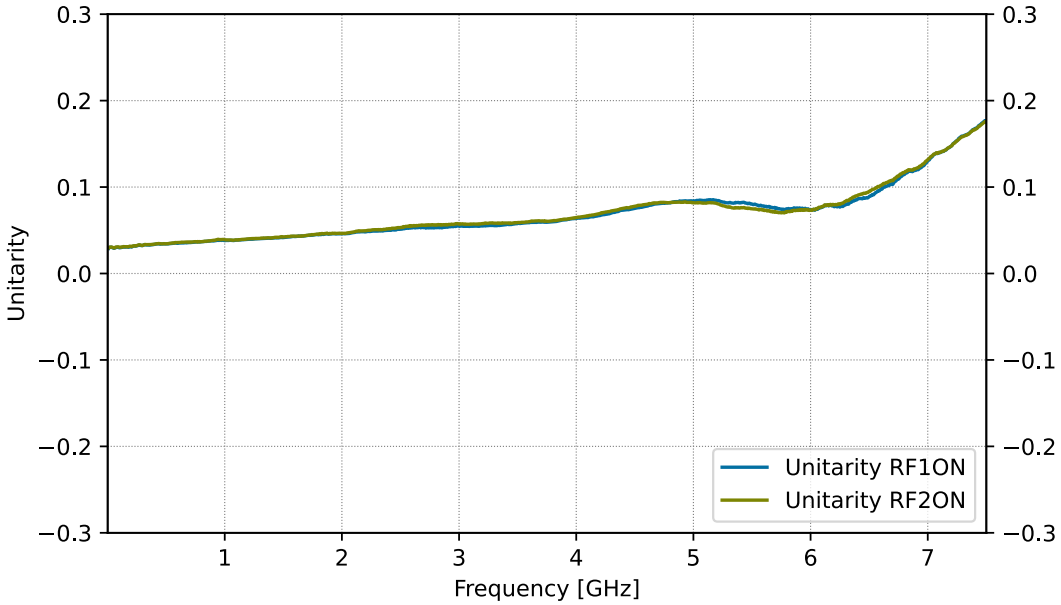
# Typical characteristics

## Performance upto 4.5 GHz, unmatched

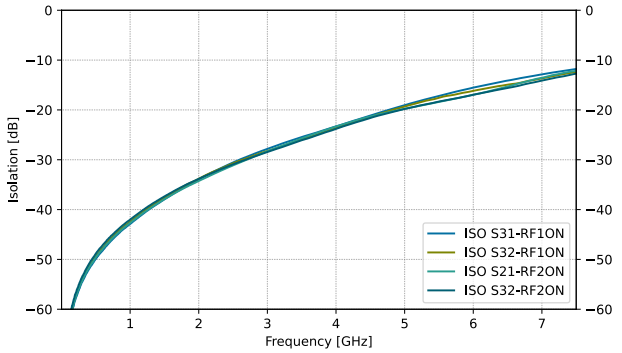
These measurements have been taken from TS74230L EVK, CPW losses have been de-embedded from the measurements. Device does not require any matching components for operation upto 4.5 GHz. Going above 4.5 GHz, performance can be improved by adding matching to ports. Our matching example shows excellent performance upto 6.0 GHz.



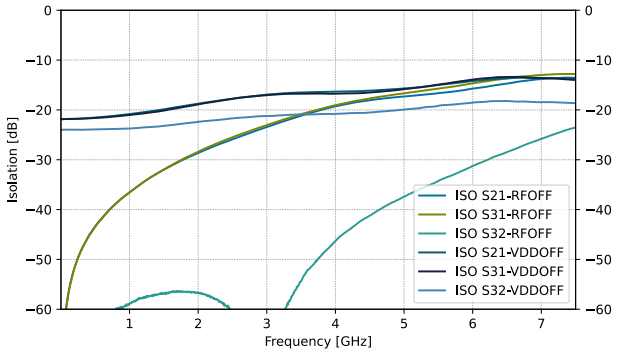

Insertion loss and Return loss, $\mathrm{RFC} - \mathrm{RFx}$.



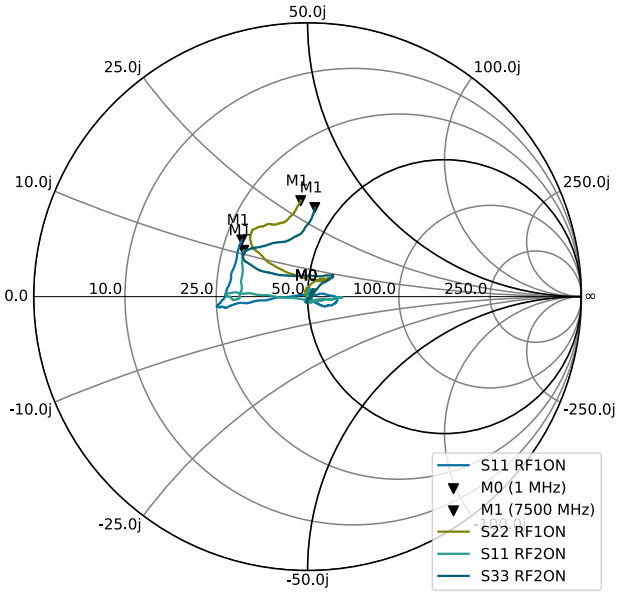

Power absorption of the switch $1 - |S_{11}|^2 - |S_{21}|^2 - |S_{31}|^2$, $\mathrm{RFC} - \mathrm{RFx}$.



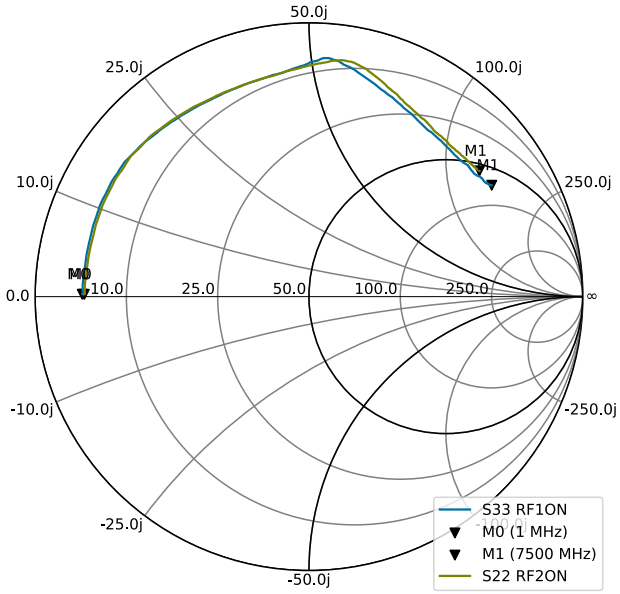

Isolation between RFC to non-active RFx and active RFx to non-active RFx.




RFC – RFx isolation and RFx – RFx isolation at ISO mode and $V_{DD}$ off (Isolation).



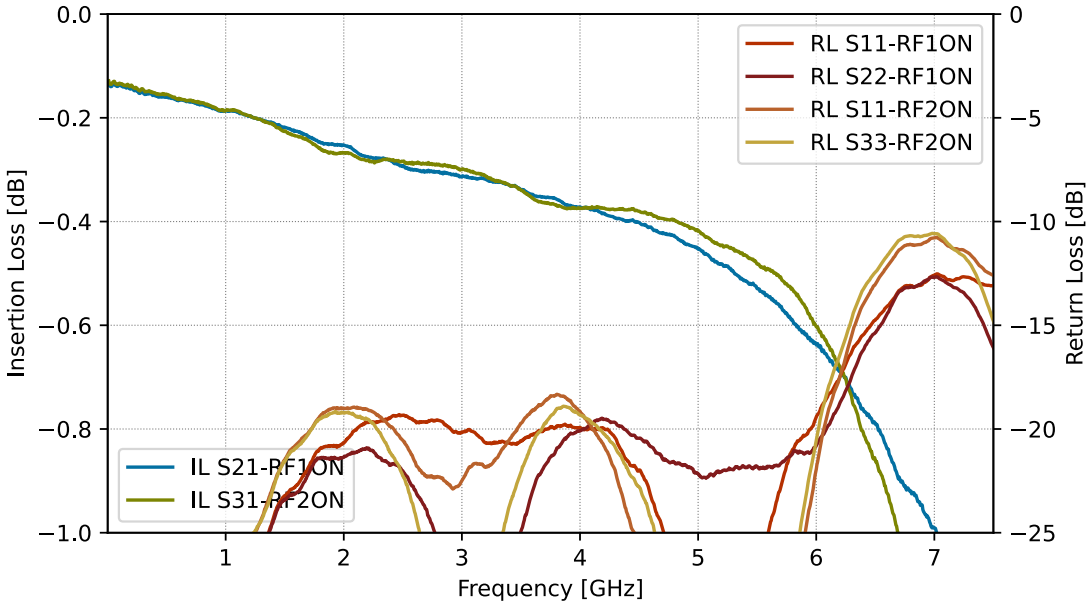

RFC and RFx matching at ON state.



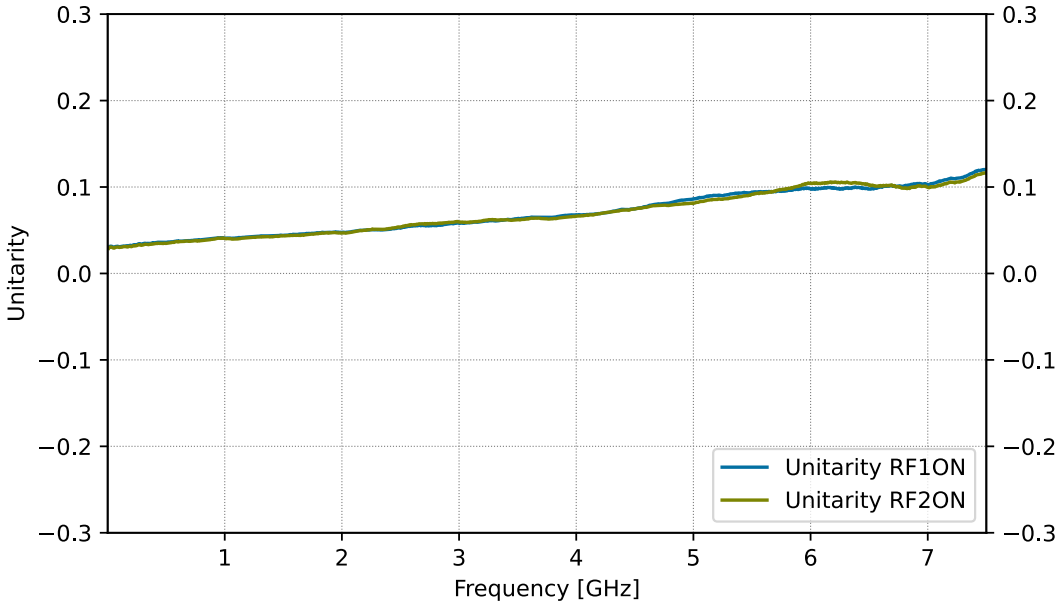

Non-active RFx port impedance. Low frequency starts from closed and circulates towards open at higher frequencies.

## Performance upto 6000 MHz, matching applied to EVK

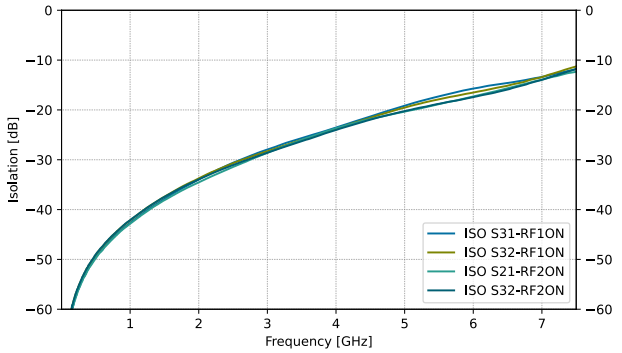
These measurements have been taken from TS74230L EVK, matching components applied. CPW losses have been de-embedded from the measurements, but matching component losses are present.



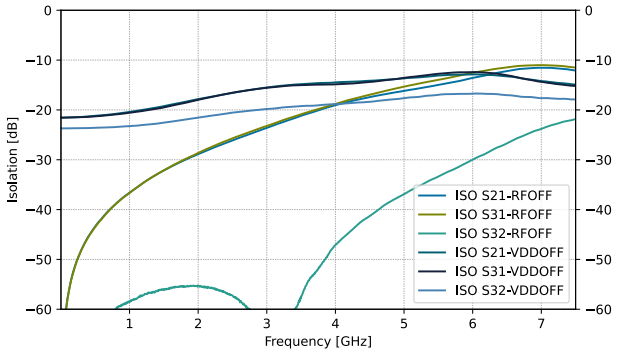

Insertion loss and Return loss, $\mathrm{RFC} - \mathrm{RFx}$.



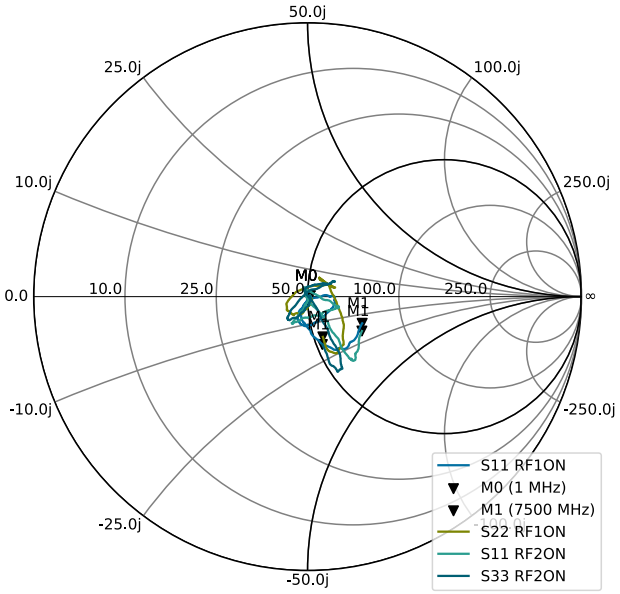

Power absorption of the switch $1 - |S_{11}|^2 - |S_{21}|^2 - |S_{31}|^2$, $\mathrm{ANT} - \mathrm{RFx}$.



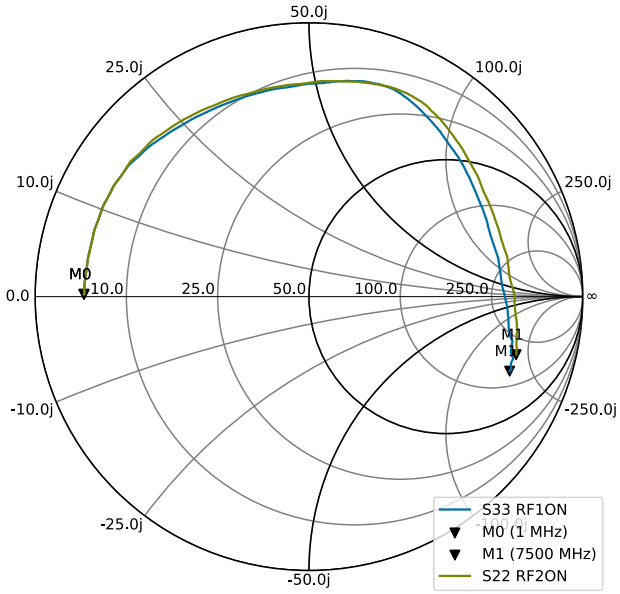

Isolation between RFC to non-active RFx and active RFx to non-active RFx.




RFC – RFx isolation and RFx – RFx isolation at ISO mode and $V_{DD}$ off (Isolation).



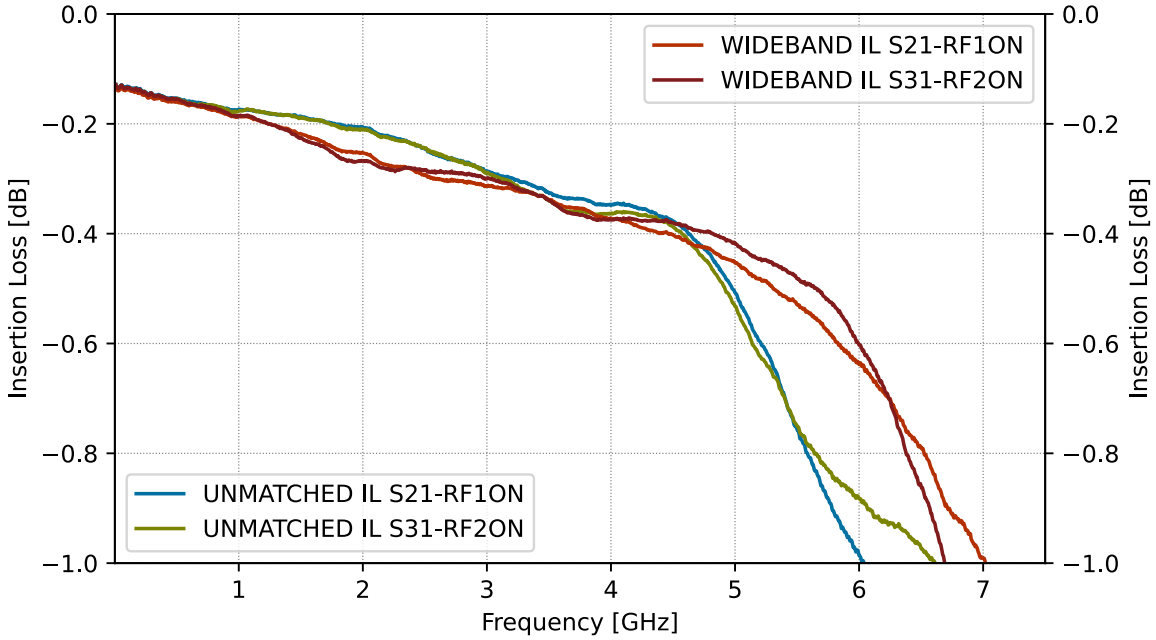

RFC and RFx matching at ON state.



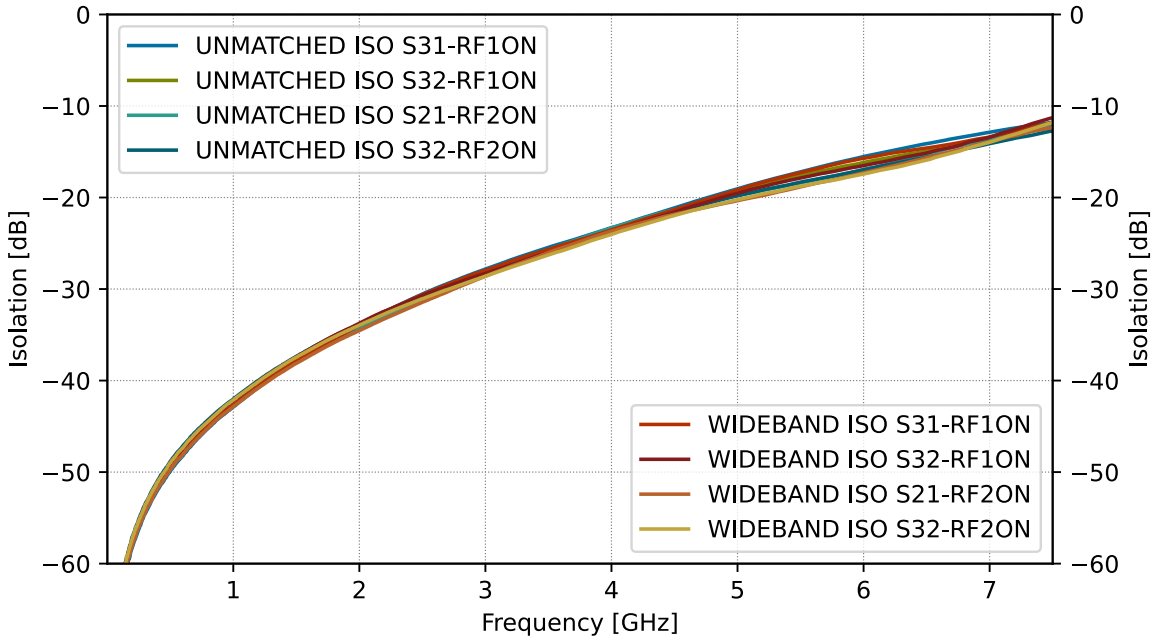

Non-active RFx port impedance. Low frequency starts from closed and circulates towards open at higher frequencies.

## Comparison plots of matched and unmatched switch.

Below Insertion Loss and Isolation comparison plots of matched and unmatched switch. Matching extends frequency response to 6.0 GHz without affecting isolation.




Insertion loss comparison of matched to 6.0 GHz and unmatched switch.




Isolation comparison of matched to 6.0 GHz and unmatched switch.

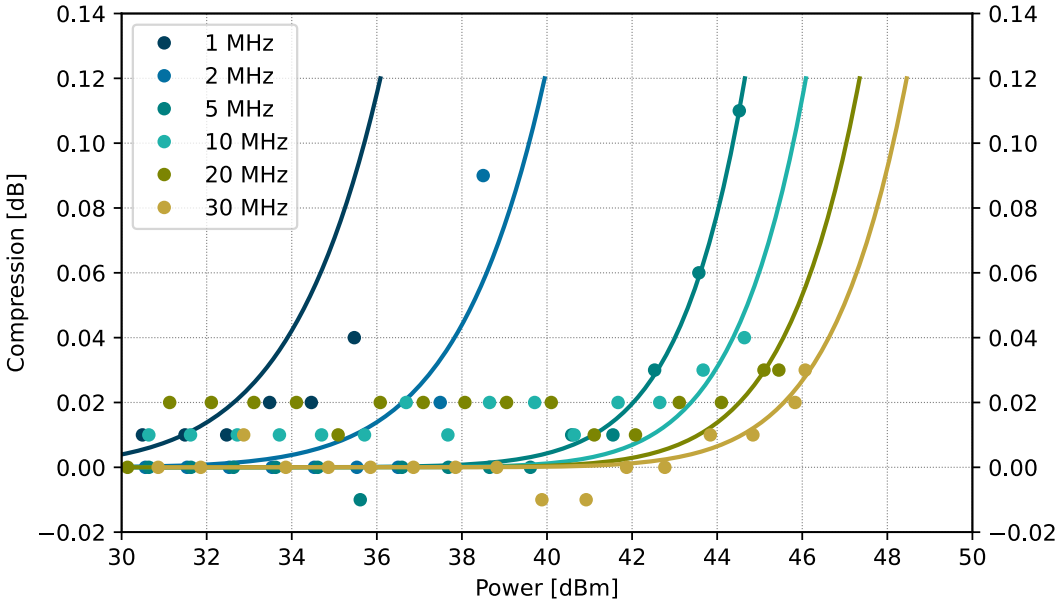
## Power De-rating

TS74230L has power handling de-rating below 30MHz. Power de-rating table has been defined for 50ohm environment.

Table 12: Power De-Rating table

| Start $f$ | Stop $f$ | Max Power | Unit |
|---|---|---|---|
| 1 MHz | 2 MHz | 34 | dBm |
| 2 MHz | 5 MHz | 36 | dBm |
| 5 MHz | 10 MHz | 42 | dBm |
| 10 MHz | 20 MHz | 44 | dBm |
| 20 MHz | $f_{\max}$ | 45 | dBm |

TS74230L Continuous Wave (CW) compression measurement are presented. Measurements are conducted in room temperature $T_A = +25$°C. Values of De-Rating table takes into account manufacturing tolerances and margins. Measurements are presented as dot (•) and model and extrapolations presented as line (–).




TS74230L CW Compression measurement in room temperature $T_A = +25$°C.

## Device Package information

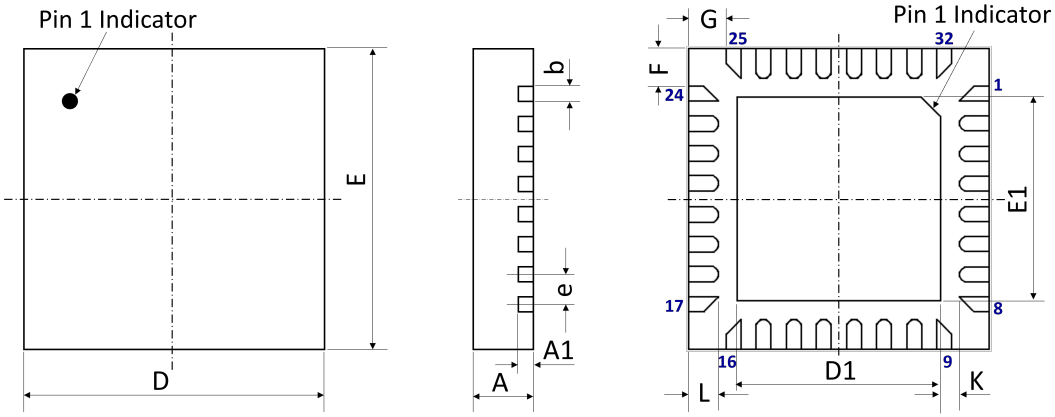



Figure 8: 32-pin QFN 4.0 x 4.0 x 0.75 $mm^3$ package drawing.

Please refer to application notes TN-001 and TN-002 at TagoreTech web page for PCB and soldering guidelines.

Table 13: Device Package Dimensions

| Dimension | Value [mm] | Tolerance [mm] | Dimension | Value [mm] | Tolerance [mm] |
|---|---|---|---|---|---|
| A | 0.75 | ±0.05 | E | 4.00 BSC | ±0.05 |
| A1 | 0.203 | ±0.02 | E1 | 2.70 | ±0.05 |
| b | 0.20 | +0.05/-0.07 | F | 0.50 | ±0.05 |
| D | 4.00 BSC | ±0.05 | G | 0.50 | ±0.05 |
| D1 | 2.70 | ±0.05 | L | 0.40 | ±0.05 |
| e | 0.40 BSC | ±0.05 | K | 0.25 | ±0.05 |

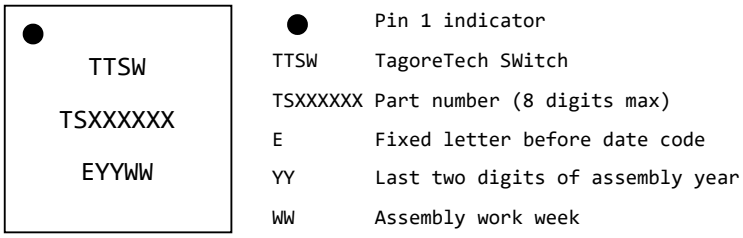



Figure 9: Part marking specification.

## PCB Land Design

**Notes:**

- 4-layer PCB is recommended.
- Via diameter is recommended to be 0.3mm to prevent solder wicking inside the vias.
- Thermal vias shall only be placed on the center pad.
- The maximum via number for the center pad is 11(X)×11(Y)=121.

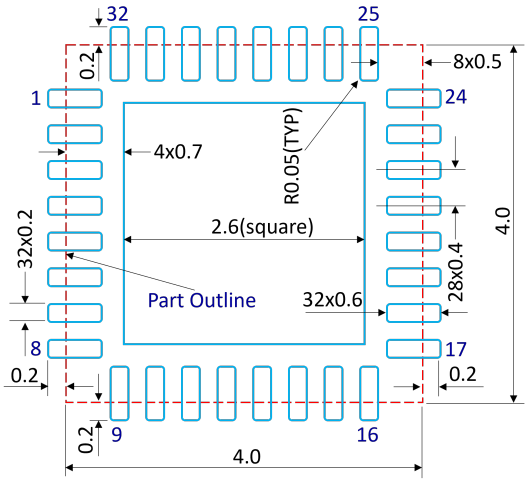



Figure 10: PCB land pattern, dimensions in [mm].

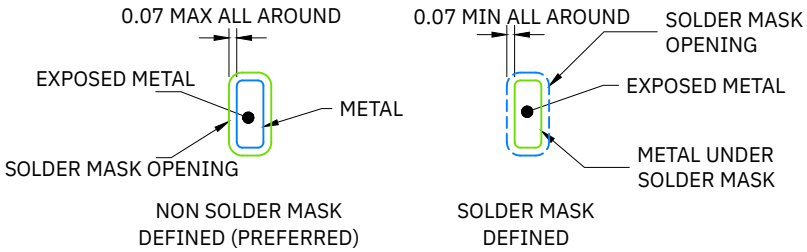



Figure 11: Solder mask opening, dimensions in [mm].

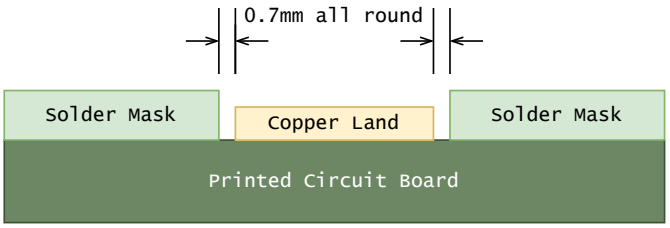



Figure 12: Preferred solder mask opening, side view, dimensions in [mm].

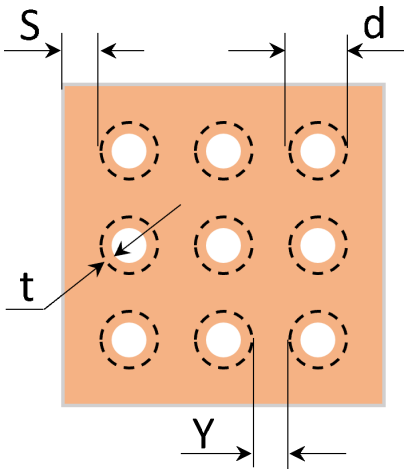



Figure 13: Thermal Via Pattern, Recommended Values: S≥0.15 mm; Y≥0.20 mm; d=0.2 mm; Plating Thickness t=25$\mu$m or 50$\mu$m.

## PCB Stencil Design

**Notes:**

- Laser-cut, stainless steel stencil is recommended with electro-polished trapezoidal walls to improve the paste release.
- Stencil thickness is recommended to be 125 $\mu$m.

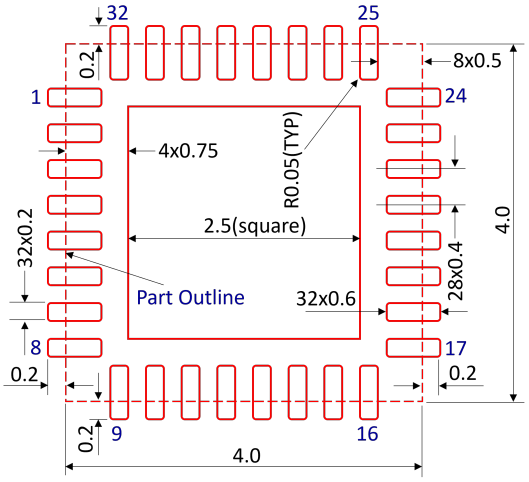



Figure 14: Stencil Openings, dimensions in [mm].

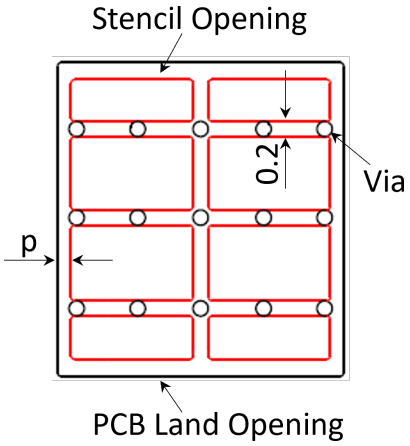
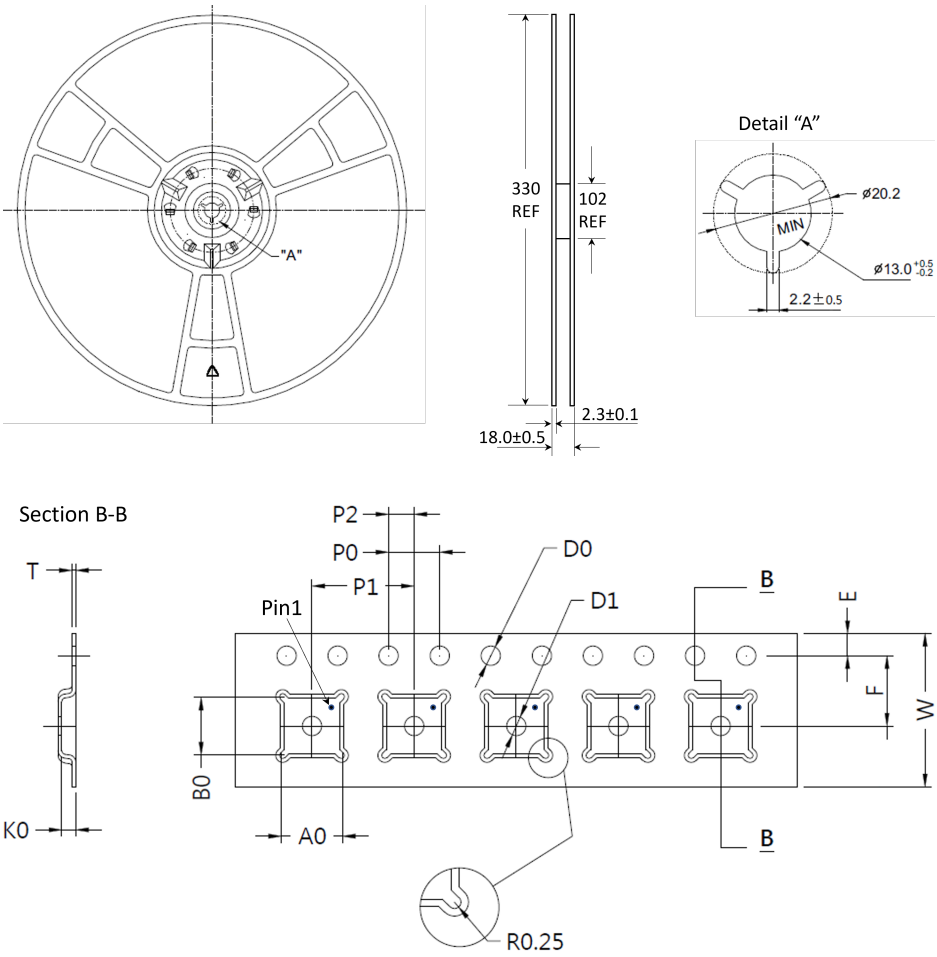



Figure 15: Stencil Openings Shall not Cover Via Areas If Possible, dimensions in [mm].

## Tape and Reel Information




| A0[mm] | B0[mm] | D0[mm] | D1[mm] | E[mm] | F[mm] | K0[mm] | P0[mm] | P1[mm] | P2[mm] | T[mm] | W[mm] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4.35 | 4.35 | 1.50 | 1.50 | 1.75 | 5.50 | 1.10 | 4.00 | 8.00 | 2.00 | 0.30 | 12.00 |

# Glossary

| | |
|---|---|
| IL | Insertion loss |
| ISO | Isolation |
| RL | Return loss |
| VSWR | Voltage Stading Wave Ratio |
| RFC | RF Common port, sometimes referred as ANT |
| RFx | RF Port number x |
| Unitarity | Describes power absorption of the component, $1 - \|S_{11}\|^2 - \|S_{21}\|^2 - \|S_{31}\|^2$ |

## Changelog

Table 14: Changelog

| Date | Revision | Notes |
|---|---|---|
| 10/10/2025 | 5.0 | New release with updated information, frequency range extended from 1 MHz to 6.0 GHz |
| 01/12/2026 | 5.01 | Low frequency compression measurement added |
| 01/29/2026 | 5.02 | Sequence guidance added : Minimum time between $V_{DD}$ and $V_{CP}$ should be 50 $\mu$s. |

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