SPDT 20 W CW / 60 W Peak Power Switch 1 MHz to 7.2 GHz

Features

- Frequency Range 1 MHz to 7.2 GHz
- Low insertion loss:
  0.20 dB @ 1.0 GHz
  0.40 dB @ 4.5 GHz
  0.60 dB @ 7.0 GHz
- High isolation:
  30 dB @ 3.0 GHz
  20 dB @ 6.0 GHz
- 20 W CW power, 60 W 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 V – 5.25 V power supply
- No need to supply negative voltages
- Integrated ESD protection on all RF ports, IEC 61000-4-2 4 kV contact discharge

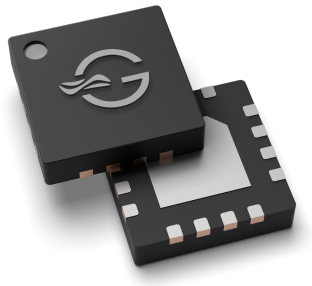


Figure 1: TS84235K in 3.0 x 3.0 mm^2 QFN 16-pin package.

Applications

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

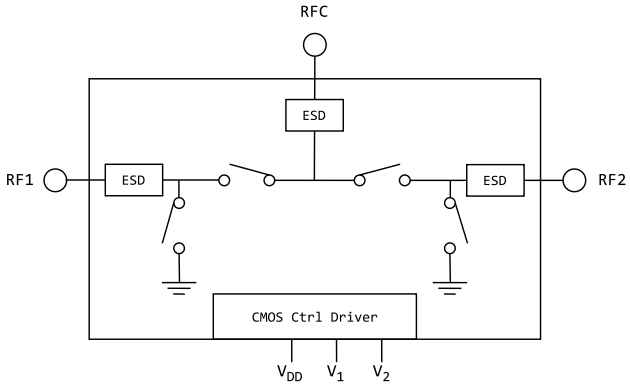


Figure 2: TS84235K functional diagram

General Description

The TS84235K is a 2nd Generation symmetrical reflective Single Pole Double Throw (SPDT) switch designed for medium power switching applications. Covering a bandwidth of 1 MHz to 7.2 GHz, the TS84235K provides low insertion loss, high isolation, and high linearity in a small package size. The switch handles 20 W of CW power with a peak power capability of 60 W, making it well suited for demanding medium power applications. The TS84235K is a derivative of the TS8423K, offering higher ESD robustness: integrated ESD protection on all RF ports (RFC, RF1 and RF2). The internal charge pump voltage is not routed out: pin 1 is not internally bonded, so there is no V_{CP} pin and no external V_{CP} capacitor or supply is needed. For applications requiring quiet operation below 250 MHz, please consider the TS84230K, which has the internal charge pump disabled.

The TS84235K is housed in a compact 3.0×3.0 mm^2 16-lead Quad Flat No-lead (QFN) plastic package.

RoHS

RoHS10/REACH/Halogen free

Contents

Features 1
Applications 1
General Description 1
Ordering information 3
Pin Assignment 4
Absolute Maximum Ratings 5
Electrical Specifications 6
Switching time definition . . . 9
Switch Control table 10
Theory of Operation 11
Isolation modes . . . 11
Device powered off . . . 11
Device powered, ISO state . . . 11
ESD protection . . . 11
Internal charge pump, no V_{CP} pin . . . 11
Application Information 11
Schematics and Evaluation Board 12
Unmatched EVB (IDX00), up to 5.0 GHz . . . 13
Matching example (IDX01), up to 7.2 GHz . . . 15
Typical characteristics 16
Performance up to 5.0 GHz, unmatched . . . 16
Performance up to 7.2 GHz, matching applied to EVB . . . 19
Peak power handling with modulated signals . . . 22
Peak-to-average power ratio of QAM signals . . . 22
Crest factor reduction for OFDM . . . 23
Average power capability with modulated signals . . . 23
Power Derating . . . 25
Device Package information 26
PCB Land Design 28
PCB Stencil Design 30
Tape and Reel Information 31
Glossary 32
Changelog . . . 32
Legal Information 34
Published by . . . 34
Legal Disclaimer . . . 34
Sales Contact . . . 34
Buy TS84235K directly . . . 34
TS84235K Product information . . . 34
TagoreTech Inc. Product Brochure and datasheets . . . 34

©2024-2026 TagoreTech Inc.

Ordering information

Table 1: Ordering Information

Device Part Number	Package Type	Notes
TS84235K	16 Pin 3.0x3.0x0.75 mm^3 QFN	Core part number
TS84235K-EVB	Evaluation Board	Unmatched (IDX00)
TS84235KMTRPBF[1]	330 mm reel, 3 000 pcs	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

©2024-2026 TagoreTech Inc.

Pin Assignment

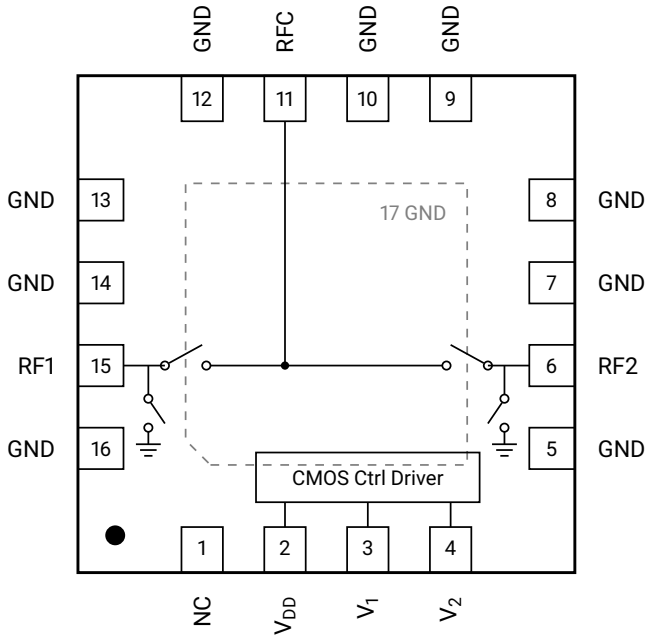


Figure 3: TS84235K pin assignment [top view]

Table 3: Pin Definition

Pin Number	Pin Name	Description
1	NC	Not internally bonded (no V_{CP} pin); leave open or connect to ground
2	V_{DD}	DC Power Supply
3	V_1	Switch control input 1
4	V_2	Switch control input 2
6	RF2	RF port 2, ESD protected
5,7,8,9,10,12,13,14,16	GND	Connect to ground[2]
11	RFC	RF Common port, ESD protected
15	RF1	RF port 1, ESD protected
17 [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.

©2024-2026 TagoreTech Inc.

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 / RFC	44	dBm
Maximum RF peak input power, 1% duty cycle, 10μs pulse [2]	RFx / RFC	49	dBm
Thermal Ratings			
Thermal Resistance (junction-to-case) – Bottom side	$R_{\theta jc}$	9.9	°C/W
Soldering Temperature	T_{solder}	+260	°C
ESD Ratings			
RF ports (RFC, RF1, RF2), IEC 61000-4-2, contact discharge	Level 2	4	kV
Human Body Model (HBM), DC and control pins	Level 1B	500 – $<$1000	V
Charged Device Model (CDM)	Level C3	$\geq$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 800 MHz.
[3] See Power Derating table for low frequencies.
[4] Tagore recommends to store parts in moisture barrier bags to preserve solderability.

©2024-2026 TagoreTech Inc.

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		7200	MHz
Insertion loss	30 MHz		0.17		dB
unmatched, up to 5 GHz	1.0 GHz		0.22	0.30	dB
RFC – RFx	3.0 GHz		0.37		dB
	5.0 GHz		0.51		dB
Insertion loss[1]	30 MHz		0.15		dB
matched up to 7.2 GHz	1.0 GHz		0.20		dB
RFC – RFx	3.0 GHz		0.40		dB
	5.0 GHz		0.50		dB
	6.0 GHz		0.55		dB
	7.2 GHz		0.65		dB
Isolation	30 MHz		72		dB
unmatched, up to 5 GHz	1.0 GHz	40	42		dB
RFC – RFx	3.0 GHz		30		dB
	5.0 GHz		22		dB
Isolation[1]	30 MHz		60		dB
matched up to 7.2 GHz	1.0 GHz		43		dB
RFC – RFx	3.0 GHz		30		dB
	5.0 GHz		22		dB
	6.0 GHz		18		dB
	7.2 GHz		15		dB
Isolation	30 MHz		65		dB
Isolation state	1.0 GHz		36		dB
RFC – RFx	3.0 GHz		25		dB
	5.0 GHz		19		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.

©2024-2026 TagoreTech Inc.

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		7200	MHz
Return Loss	30 MHz		-37		dB
unmatched, up to 5 GHz	1.0 GHz		-35	-25	dB
$RFC - RFx$	3.0 GHz		-19		dB
	5.0 GHz		-18		dB
Return Loss[1]	30 MHz		-30		dB
matched up to 7.2 GHz	1.0 GHz		-30	-25	dB
$RFC - RFx$	3.0 GHz		-18		dB
	5.0 GHz		-18		dB
	6.0 GHz		-15		dB
	7.2 GHz		-13		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.

©2024-2026 TagoreTech Inc.

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		7200	MHz
Harmonic Distortion					
H_2	800 MHz, P_{in} =40 dBm		-92		dBc
H_3	800 MHz, P_{in} =40 dBm		-95		dBc
IIP3	800 MHz		77		dBm
Power and Compression point					
P_{maxCW}[2]	Max RF CW Power		43		dBm
$P_{maxpeak}$	Max RF Peak Power		48		dBm
$P_{0.1dB}$	800 MHz, CW	43	45		dBm
$P_{peak0.1dB}$	800 MHz, 1% duty cycle, 10 μs pulse		48		dBm
P_{1dB}[1]	800 MHz, CW		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

[1] $P_{1\,dB}$ has been given for comparison reasons only. Please do not exceed Absolute Maximum ratings.
[2] See Power Derating table.
[5] Dependent on thermal design and surrounding circuits.

Table 8: Electrical Specifications $T_A = +25°C; V_{DD} = +3.3V; 50\Omega$ Source/Load.

Parameter	Condition	Minimum	Typical	Maximum	Unit
Noise					
CP switching noise[4]	RBW=1 kHz		-140		dBm
Switching Time					
t_{ON}[8]	Switch ON time		900	1300	ns
t_{OFF}[8]	Switch OFF time		900	1300	ns
t_{RISE}[8]	Switch RISE time		500	600	ns
t_{FALL}[8]	Switch FALL time		500	600	ns
t_{wON}	Minimum Switch ON time		3.6		μs
t_{wOFF}	Minimum Switch OFF time		3.6		μs
f_{PRR}	Maximum pulse repetition rate		1		kHz
$t_{startup}$	Start-up time		0.8		ms
Power Supply, DC					
Control voltage	Power Supply V_{DD}	2.6	3.3	5.25	V
	All control pins high[7], 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	μA
	All control pins low, I_{il}		0		μA
Current consumption	I_{DD}, active mode (V_{DD} on)		160	260	μA

[4] Above 250 MHz. For operation at VHF frequencies, below 250 MHz, consider charge pump bypass switch version, if charge pump noise is critical for your application. Please contact TagoreTech for more information.
[7] Control voltage V_{ih} cannot be higher than V_{DD} (to avoid forward biasing of ESD diode)
[8] Switching time characterization done at 30 Hz and 500 Hz pulse repetition rate (rate to change switch state, for example between RFC-RF1 and RFC-RF2).

©2024-2026 TagoreTech Inc.

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 impedance. Let's assume that the 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 0.3 dB 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 $\mathrm{V_{ihlow}}$. In certain measurements when control signal rise time is significantly shorter than RF output signal, we approximate start of the clock with the 50% point of the control signal.

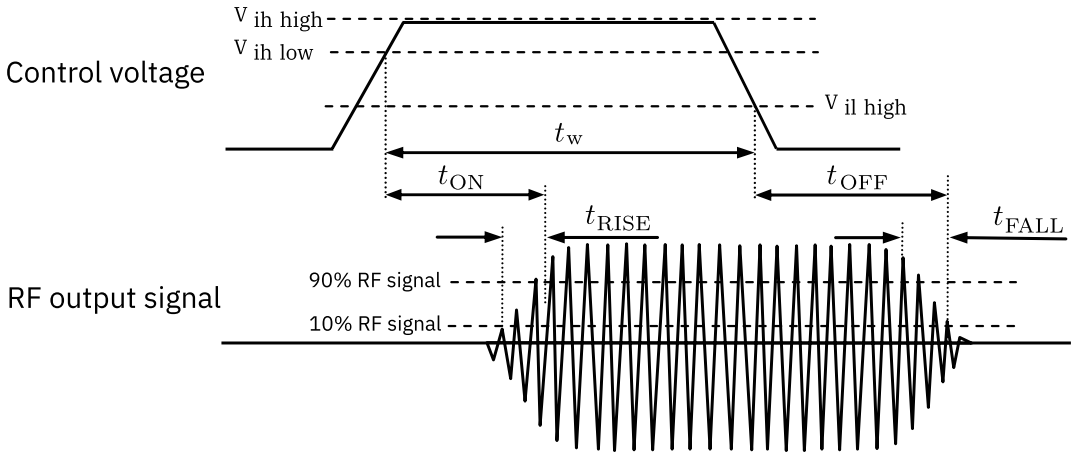


Figure 4: Switching time definition, t_{ON}, t_{OFF}, t_{RISE}, t_{FALL}. Minimum pulse width t_{w}.

Our component uses an integrated charge pump. Maximum pulse repetition rate f_{PRR} defines the maximum frequency for switching events. Please do not exceed the given maximum frequency. Unlike the TS8423K, the TS84235K has no external $\mathrm{V_{CP}}$ pin (pin 1 is not internally bonded), so the pulse repetition rate cannot be increased by feeding an external -18 V supply, and no charge pump capacitor is needed.

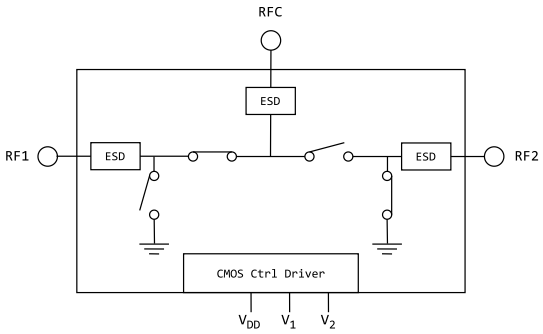
©2024-2026 TagoreTech Inc.

Switch Control table

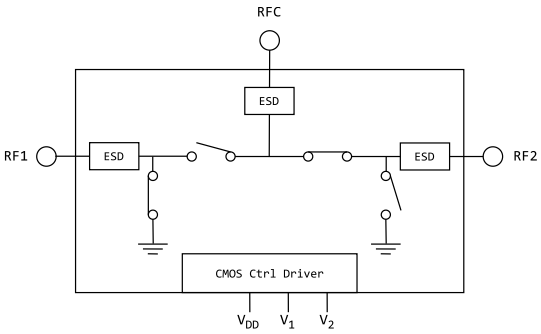
Table 9: Switch Control Table

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

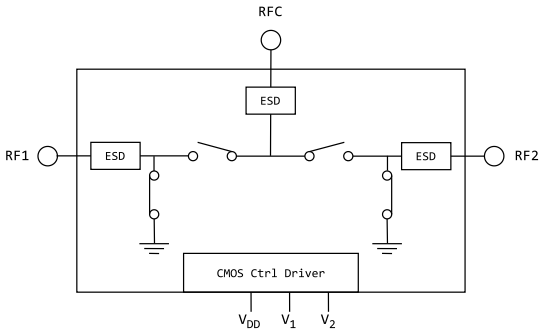
[1] V_{DD} should be applied first before V_1 and V_2, otherwise may cause damage to the device.
[2] There are internal pull-downs to ground on both V_1 and V_2 control pins, the state at start-up without any control voltage applied will be $RFC - RF1$ ON.
[3] If ISO state is not used, the switch can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



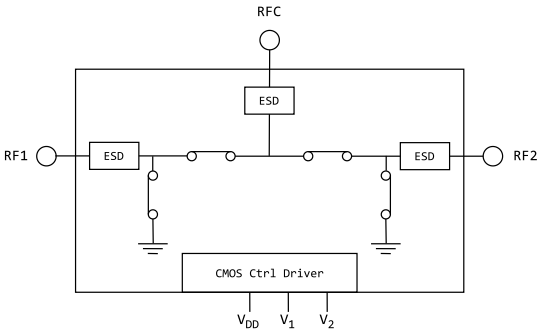
RFC-RF1 ON



RFC-RF2 ON



ISO (Isolation state)



V_{DD} off state

©2024-2026 TagoreTech Inc.

Theory of Operation

Isolation modes

TS84235K 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 MOSFETs 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 65 dB (measured, 30 MHz) as basically there is DC block due to open FETs.

ESD protection

All RF ports of the TS84235K, the common port RFC and the two throws RF1 and RF2, have integrated ESD protection (functional diagram). The RF ports are rated to IEC 61000-4-2, level 2, 4 kV contact discharge, see Absolute Maximum Ratings. The ESD protection does not require any external components and does not limit the RF power handling of the switch.

Internal charge pump, no V_{CP} pin

The TS84235K is based on the TS8423K die and generates the negative gate voltage of the switch with an internal charge pump. Unlike on the TS8423K, the charge pump output is not bonded to pin 1. The charge pump therefore works without an external C_{VCP} capacitor, and an external -18 V supply cannot be fed in; the pulse repetition rate f_{PRR} and the start-up time are those of the internal charge pump (Electrical Specifications).

Application Information

TS84235K is offering 20 W CW and 60 W peak power capability from 1 MHz to 7.2 GHz. 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, TS84235K significantly reduces design complexity for such RF switching needs. TS84235K works well up to 5 GHz frequency without external matching components; for frequencies above 5 GHz, matching is recommended. All RF ports are ESD protected (IEC 61000-4-2, 4 kV contact discharge), which makes the TS84235K well suited for switches directly connected to an antenna. Datasheet provides an example matching and its performance.

©2024-2026 TagoreTech Inc.

Schematics and Evaluation Board

S-parameters of both presented EVB configurations can be downloaded from this link: Download TS84235K S-parameters

Table 10: 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

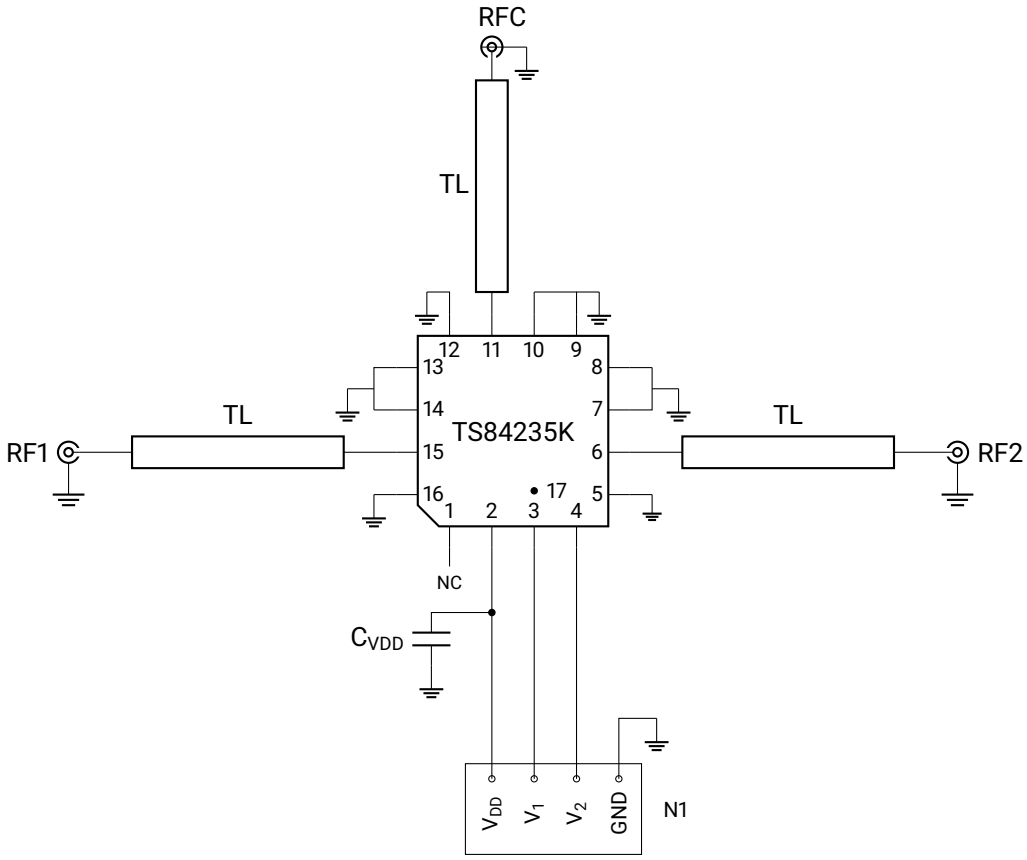
Content of s-parameter repository:

```
TS84235K.zip
├── IDX_00 ..... Directory for s-parameters without matching components
│   ├── Readme.txt
│   ├── TS84235K_ISO_3PORT.s3p ..... S3P file for ISO mode
│   ├── TS84235K_RF1ON_3PORT.s3p ..... S3P file for RFC-RF1ON mode
│   └── TS84235K_RF2ON_3PORT.s3p ..... S3P file for RFC-RF2ON mode
└── IDX_01 ..... Directory for s-parameters with matching components, 7.2 GHz (TS8423K measurement)
    ├── Readme.txt
    ├── TS84235K_ISO_3PORT.s3p ..... S3P file for ISO mode
    ├── TS84235K_OFF_3PORT.s3p ..... S3P file for VDD off mode
    ├── TS84235K_RF1ON_3PORT.s3p ..... S3P file for RFC-RF1ON mode
    └── TS84235K_RF2ON_3PORT.s3p ..... S3P file for RFC-RF2ON mode
```


©2024-2026 TagoreTech Inc.

Unmatched EVB (IDX00), up to 5.0 GHz

TS84235K shows best performance up to 5 GHz frequency without any matching components. Only one external component is recommended, 10 nF for the V_{DD} line. Pin 1 is not internally bonded and is left open on the EVB; pin 17 in the schematic refers to the center (thermal) pad of the device.



Schematic of TS84235K-EVB, unmatched (IDX00)

Table 11: Components used for TS84235K-EVB

Reference	Part number / Value	Description	Notes
C_{VDD}	10 nF	Capacitor	

©2024-2026 TagoreTech Inc.

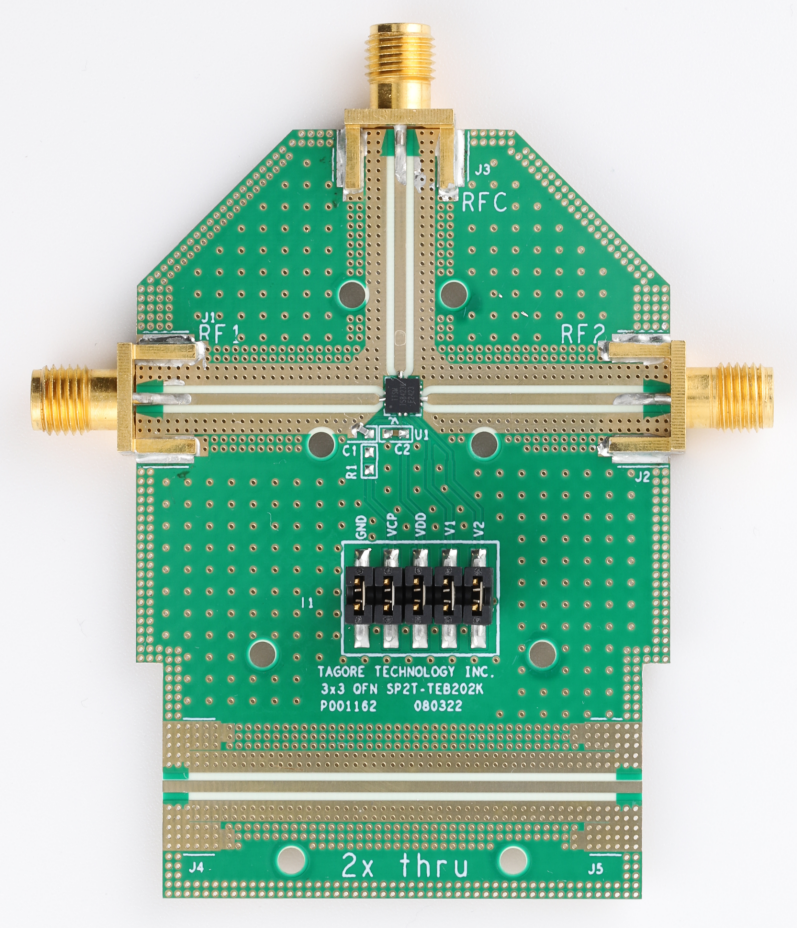
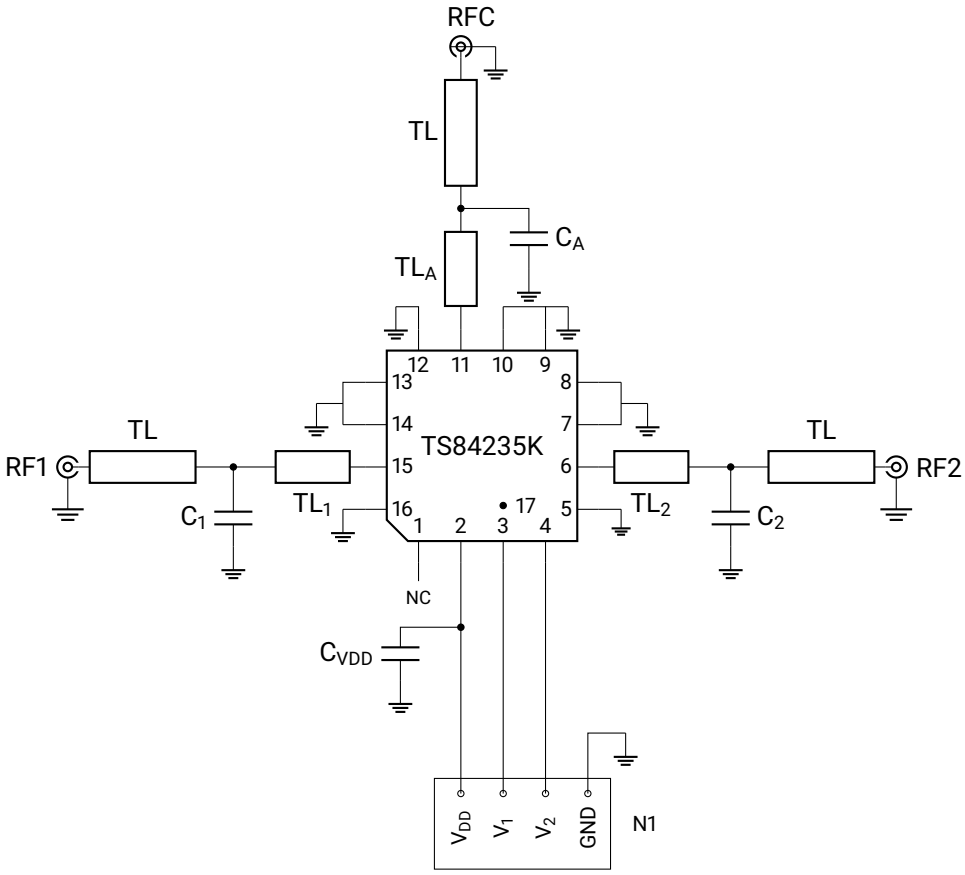


Photo of TS84235K-EVB

©2024-2026 TagoreTech Inc.

Matching example (IDX01), up to 7.2 GHz

The matching example uses a short CPW line and a shunt capacitor at each RF port (Table 12). The matching example and its measurements are from the TS8423K, which is the same switch without the ESD protection; the same matching principle works also for the TS84235K, as the part is very similar, only the ESD protection is added.



Schematic of TS84235K-EVB with 7.2 GHz matching (IDX01)

Table 12: Matching components used for 7.2 GHz performance

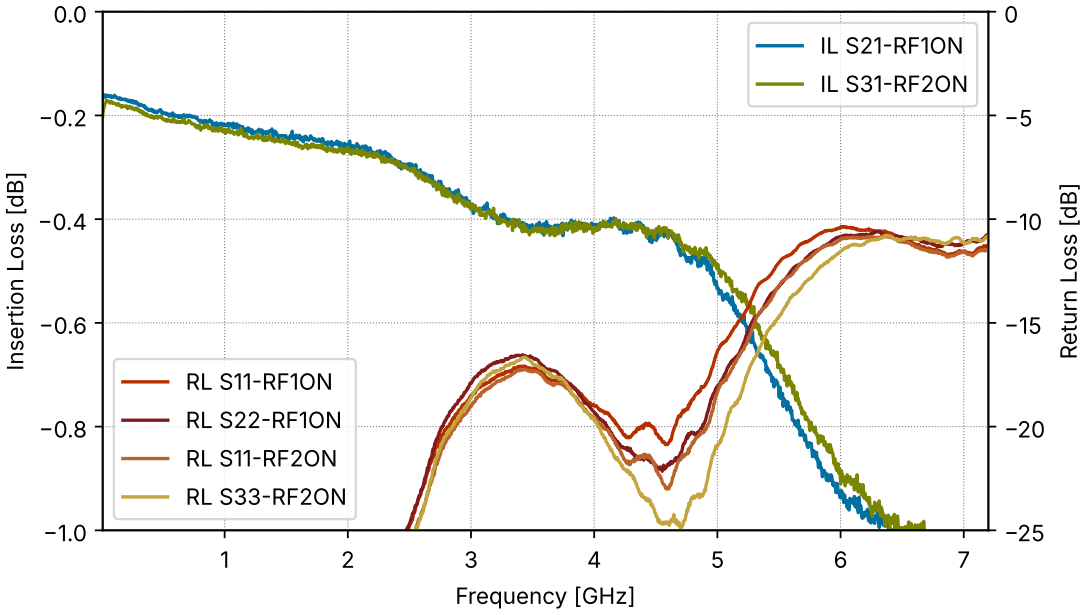
Reference	Part number / Value	Description	Notes
TL_A	3.0 mm	CPW length	Edge of SW to center of capacitor
C_A	0603N0R1BW251	Ceramic capacitor	0.1 pF, 250 V, ±0.1 pF
TL_1	0.9 mm	CPW length	Edge of SW to center of capacitor
C_1	0603N0R2BW251	Ceramic capacitor	0.2 pF, 250 V, ±0.1 pF
TL_2	0.9 mm	CPW length	Edge of SW to center of capacitor
C_2	0603N0R2BW251	Ceramic capacitor	0.2 pF, 250 V, ±0.1 pF
C_{VDD}	10 nF	Capacitor	

©2024-2026 TagoreTech Inc.

Typical characteristics

Performance up to 5.0 GHz, unmatched

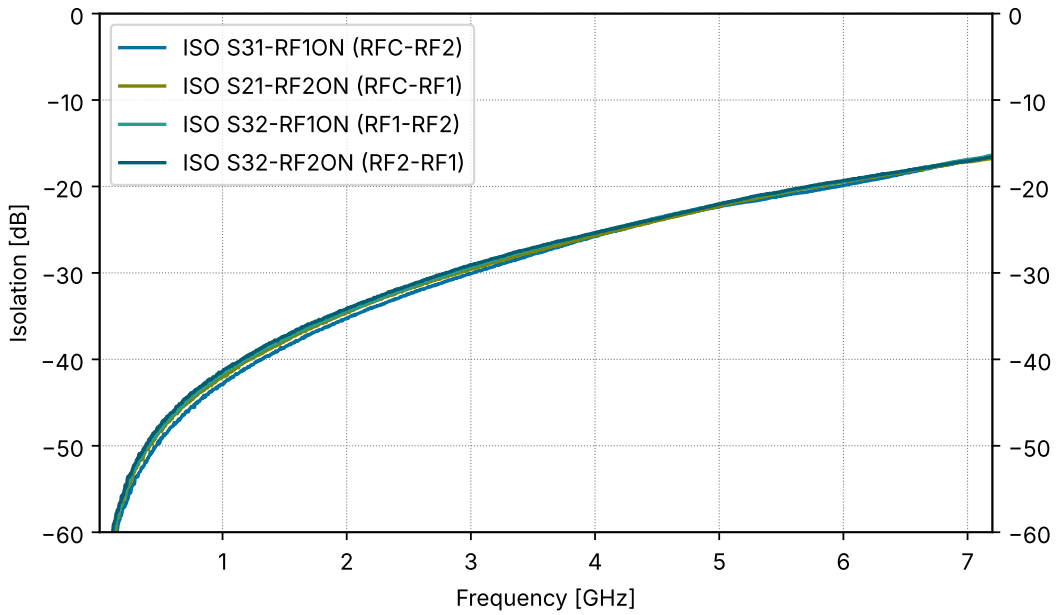
These measurements have been taken from the TS84235K-EVB without matching components (IDX00), $V_{DD} = 3.3\,V$, $T_A = +25°C$; CPW losses of the PCB have been de-embedded from the measurements. The plots run from 10 MHz to 7.2 GHz. The device does not require any matching components for operation up to 5 GHz. Going above 5 GHz, performance can be improved by adding matching to the ports. Our matching example shows excellent performance up to 7.2 GHz.



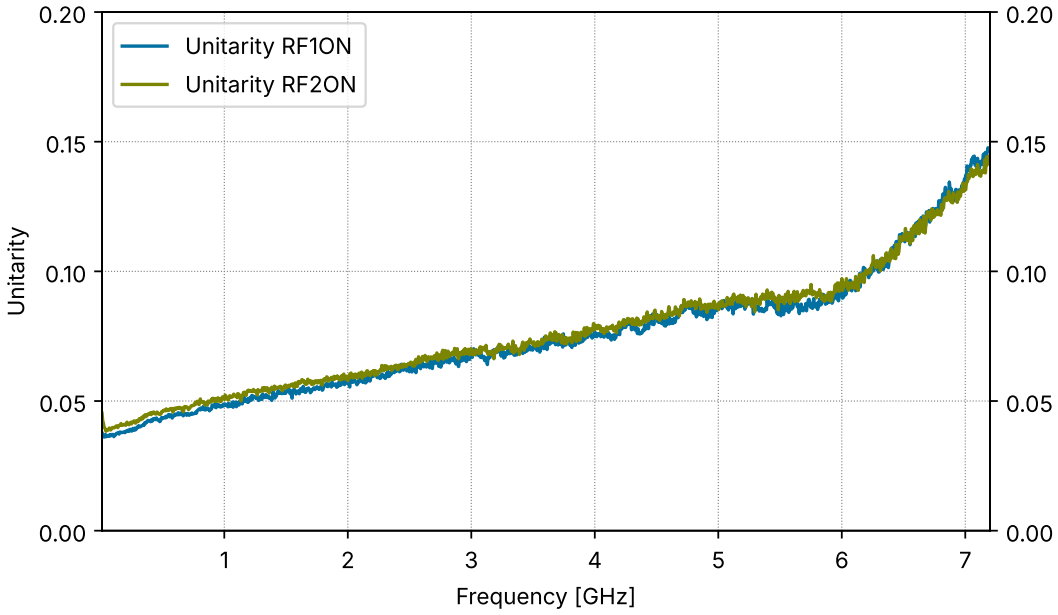
Insertion loss and Return loss, $RFC - RFx$.

Unitarity, i.e. the power absorption of the switch, describes the power converted to heat and the required cooling. With 20 W input power, a power absorption of 0.07 means that 1.4 W is converted to heat.

©2024-2026 TagoreTech Inc.

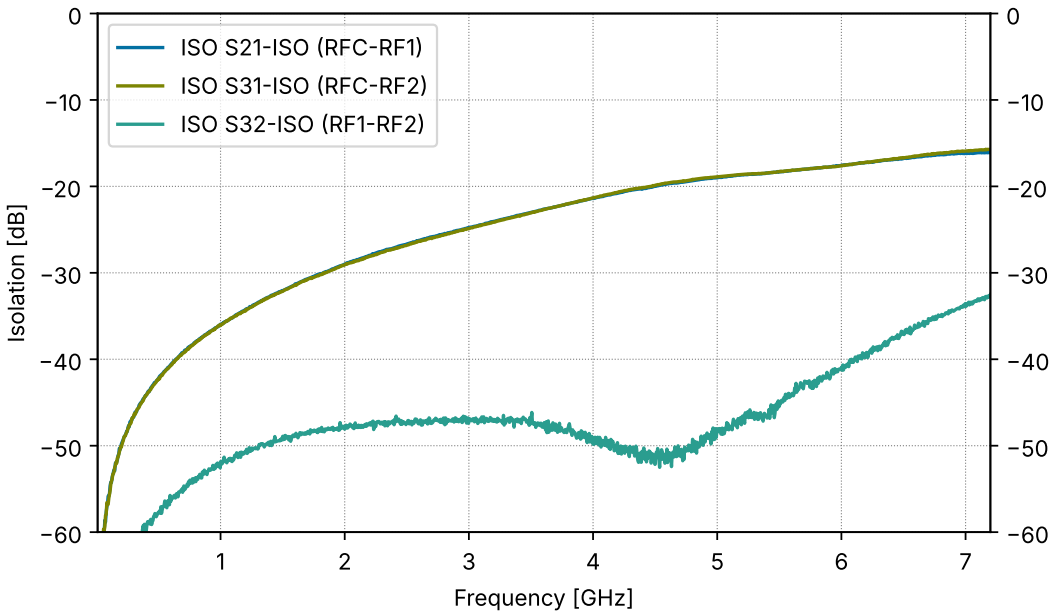


Isolation between RFC to non-active RFx and active RFx to non-active RFx.

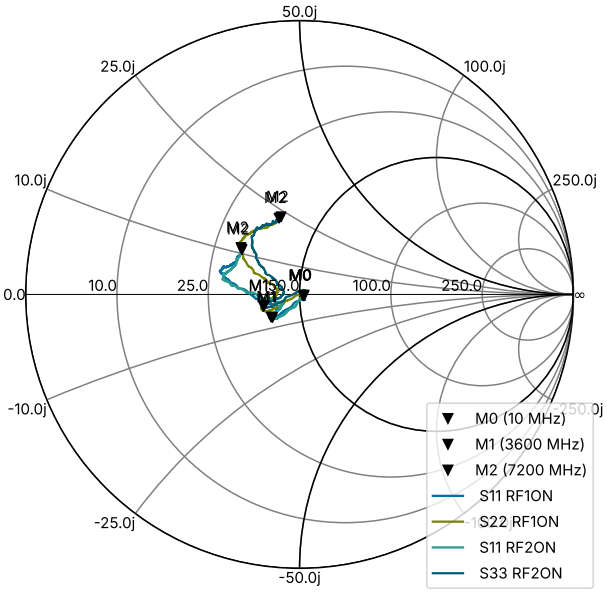


Power absorption of the switch $1 - |S_{11}|^2 - |S_{21}|^2 - |S_{31}|^2$, RFC − RFx.

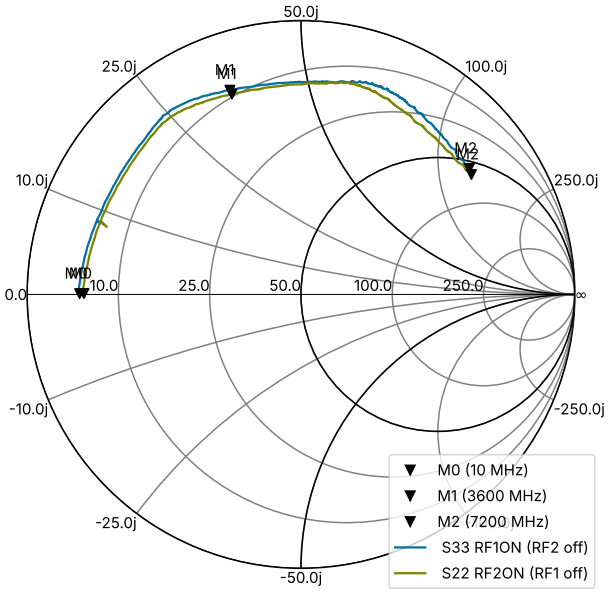
©2024-2026 TagoreTech Inc.



RFC – RFx and RF1 – RF2 isolation in the ISO state.



Active RF port impedance plotted to Smith chart.

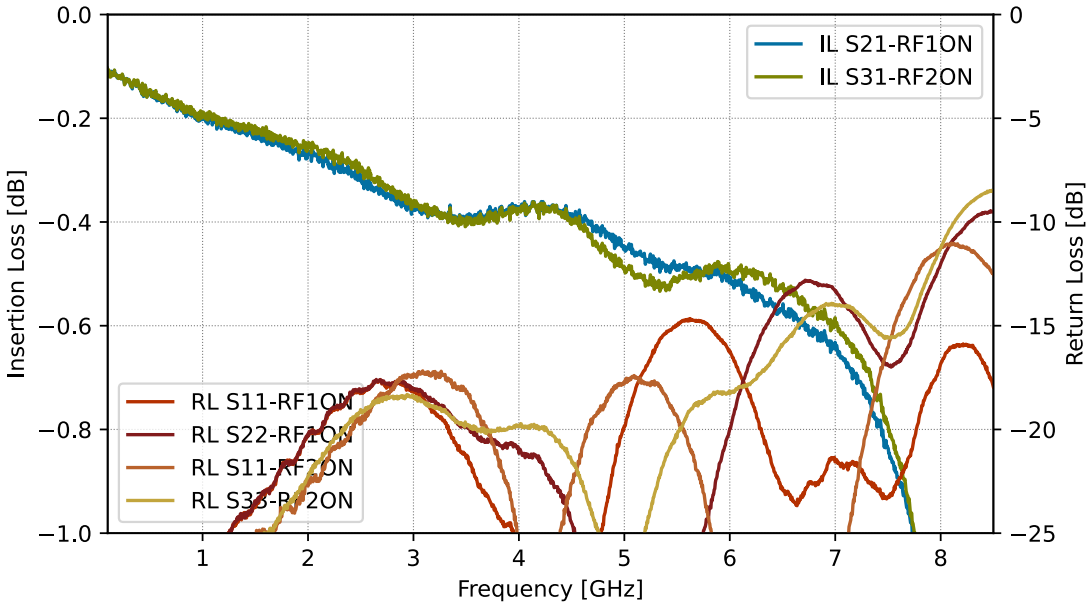


Non-active RF1 and RF2 termination impedance on Smith chart.

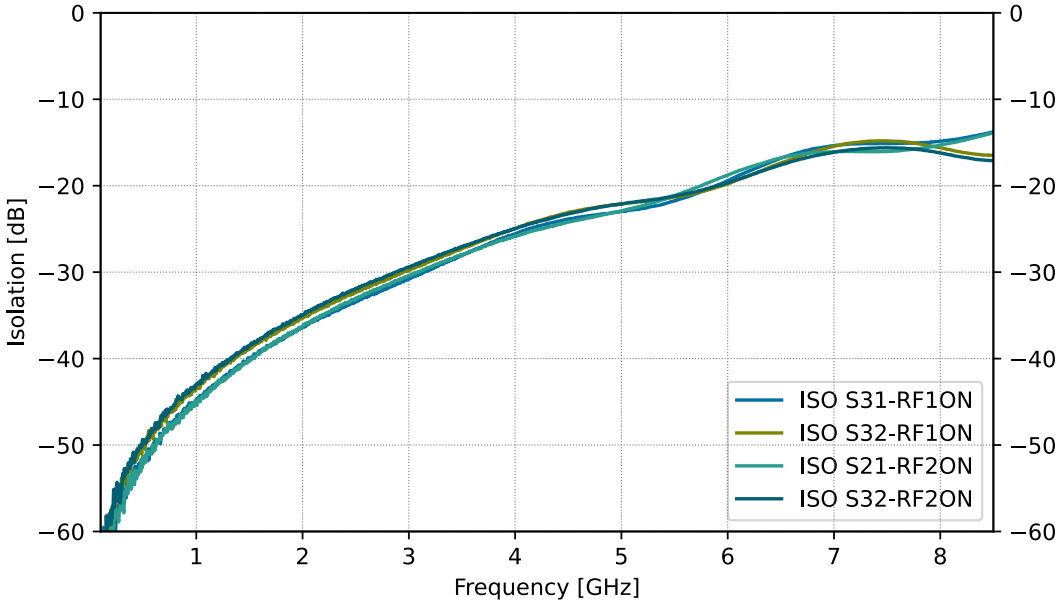
©2024-2026 TagoreTech Inc.

Performance up to 7.2 GHz, matching applied to EVB

The matched measurements in this section were taken on the TS8423K, which is the same switch without the ESD protection. The same matching principle works also for the TS84235K, as the part is very similar; only the ESD protection is added. The matching components were applied to the EVB; CPW losses have been de-embedded from the measurements, but matching component losses are present.



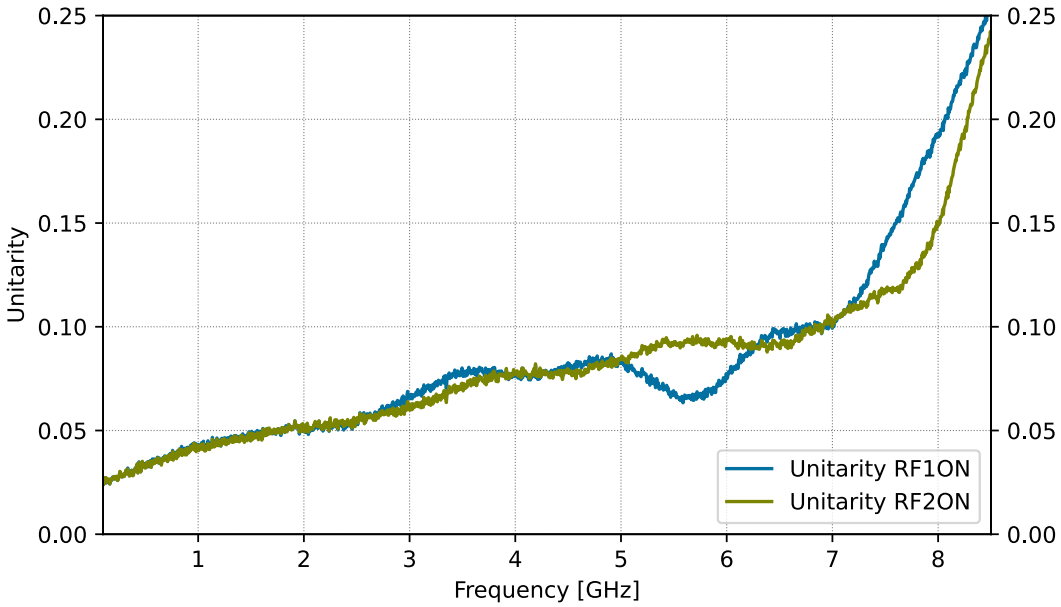
Insertion loss and Return loss, RFC – RFx.



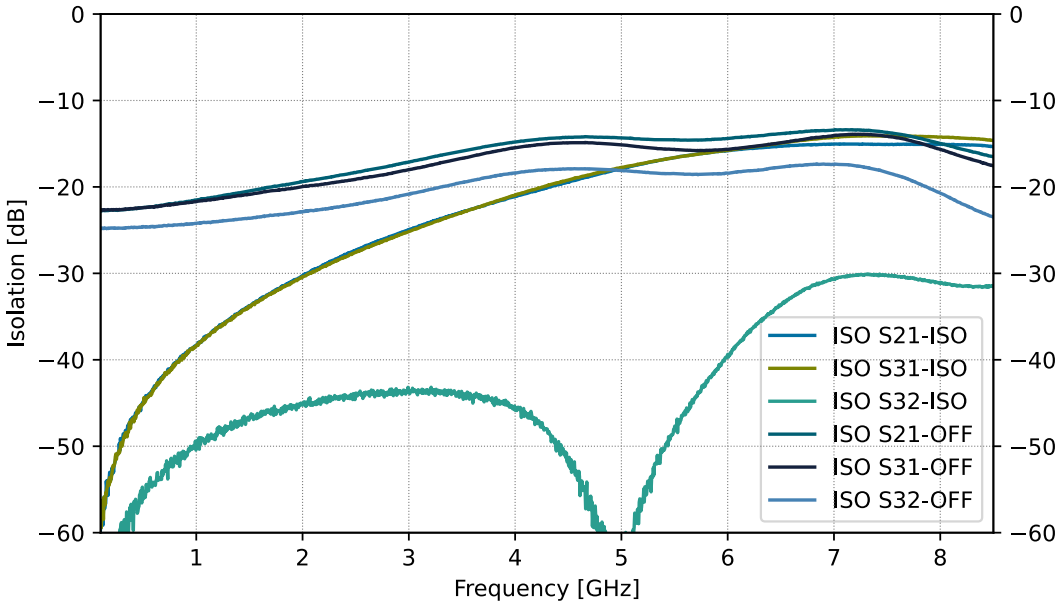
Isolation between RFC to non-active RFx and active RFx to non-active RFx.

Unitarity, i.e. the power absorption of the switch, describes the power converted to heat and the required cooling. With 20 W input power, a power absorption of 0.07 means that 1.4 W is converted to heat.

©2024-2026 TagoreTech Inc.

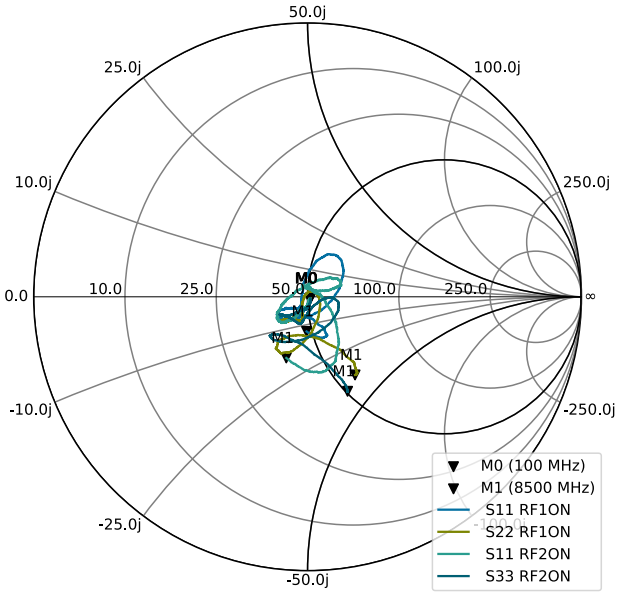


Power absorption of the switch $1 - |S_{11}|^2 - |S_{21}|^2 - |S_{31}|^2$, $\mathrm{RFC} - \mathrm{RFx}$.

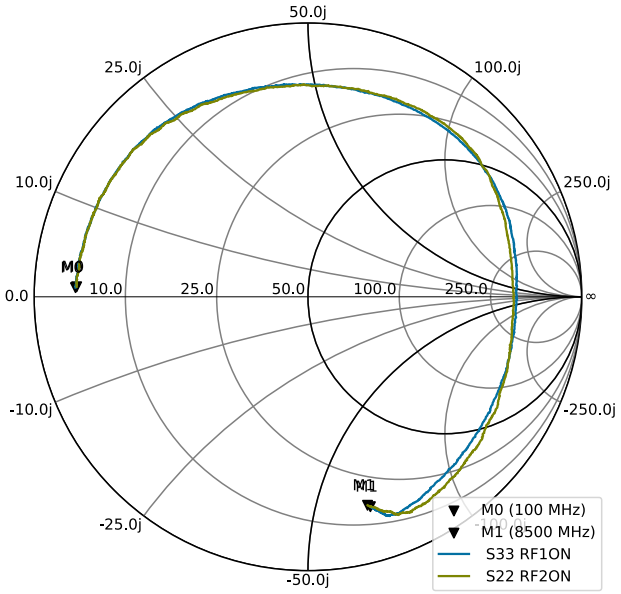


$\mathrm{RFC} - \mathrm{RFx}$ isolation at ISO mode and $\mathrm{V_{DD}}$ off (Isolation).

©2024-2026 TagoreTech Inc.



Active RF port impedance plotted to Smith chart



Non-active RF1 and RF2 termination impedance on Smith chart.

©2024-2026 TagoreTech Inc.

Peak power handling with modulated signals

The TS84235K is rated for 20 W (43 dBm) average power (CW, 100% duty cycle) and 63 W (48 dBm) peak power, where the peak power rating is characterized with 10 μs pulses at 1% duty cycle. The two ratings describe two different physical limits of the switch. The average power rating is a thermal limit: the power dissipated in the switch, and therefore the junction temperature, is set by the average RF power. The peak power rating is a voltage limit: the instantaneous RF voltage across the OFF-state transistors must remain below their breakdown voltage. At 63 W in a 50 Ω system, the RF peak voltage is 79 V.

Gallium Nitride is particularly well suited for this task. The high breakdown field of GaN allows a switch to sustain high RF peak voltages, so that the peak power capability of the TS84235K exceeds its average power rating by a factor of 3.2 (5 dB). A switch whose peak capability is equal to its average rating must be derated by the full peak-to-average ratio of the signal, whereas the TS84235K can handle the envelope peaks of single-carrier modulated signals with little or no back-off.

Peak-to-average power ratio of QAM signals

Quadrature amplitude modulation (QAM), such as 16-QAM, 64-QAM or 256-QAM, does not have a constant envelope. The instantaneous envelope power fluctuates around the average power, and its peaks can be several dB above the average. The peaks are statistical in nature: the higher the level, the smaller the fraction of time for which the envelope exceeds it. This behavior is described by the complementary cumulative distribution function (CCDF) of the signal. The peak-to-average power ratio (PAPR) at a probability p is the level, relative to the average power, which the envelope exceeds for a fraction p of the time.

For single-carrier QAM, the PAPR is set by the constellation and by the pulse-shaping filter: a smaller root-raised-cosine (RRC) roll-off factor α gives a narrower spectrum but higher envelope peaks. For OFDM, the sum of many independently modulated subcarriers produces a nearly Gaussian signal, and the PAPR is practically independent of the QAM order of the subcarriers. OFDM therefore has a clearly higher PAPR than single-carrier QAM.

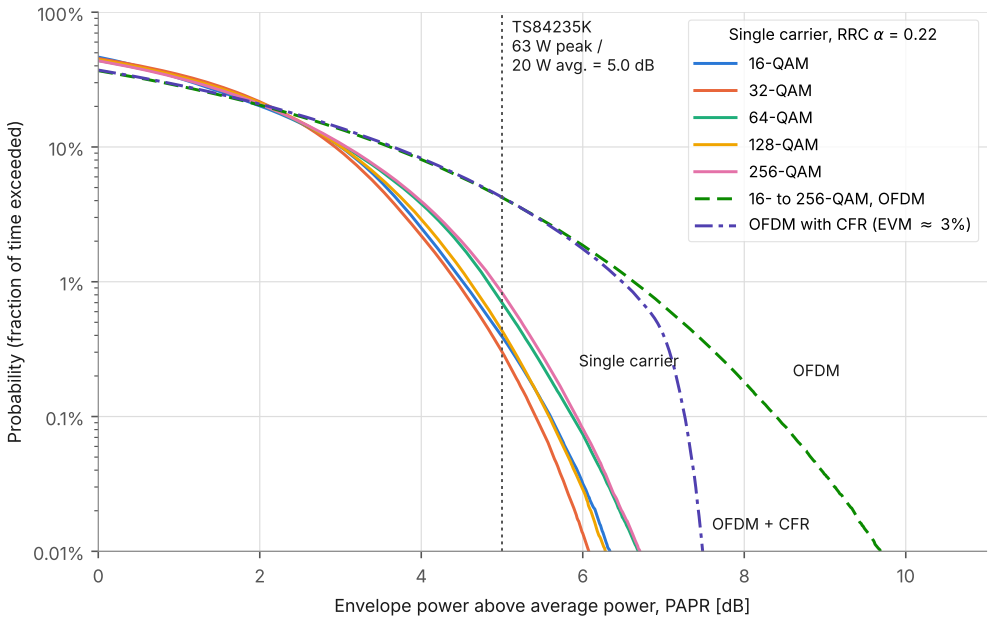


Figure 8: CCDF of the envelope power of QAM signals: fraction of time the envelope power exceeds the average power by the given PAPR. OFDM with CFR: iterative clipping and filtering, EVM ≈ 3%. The dotted line marks the 63 W / 20 W (5 dB) peak-to-average capability of the TS84235K.

©2024-2026 TagoreTech Inc.

Crest factor reduction for OFDM

Because the highest envelope peaks of an OFDM signal are rare, practical OFDM transmitters apply crest factor reduction (CFR) in the digital baseband before the power amplifier. A common method is iterative clipping and filtering: the envelope is limited to a threshold above its average, and the spectral regrowth caused by the clipping is filtered away, so that the transmitted spectrum and adjacent-channel leakage are preserved. The price is in-band distortion, expressed as an increase in error vector magnitude (EVM). The amount of CFR that can be applied is therefore set by the EVM budget of the modulation: 16-QAM tolerates considerably more distortion than 256-QAM. CFR removes only the rare, highest peaks; the PAPR at 1% to 10% probability is practically unchanged, while the PAPR at 0.1% is reduced by 0.4 dB to 1.9 dB for EVM contributions of 1.5% to 5%. Table 13 includes typical values for OFDM with CFR.

Average power capability with modulated signals

Typical PAPR values are listed in Table 13. Figure 8 shows the complete CCDF curves together with the 5 dB peak-to-average capability of the TS84235K. At the full 20 W average rating, the envelope of a single-carrier 16- to 256-QAM signal exceeds the 63 W peak level only 0.3% to 0.8% of the time, within the 1% duty cycle of the peak power rating, while an OFDM signal with or without CFR exceeds it about 4% of the time. To keep the envelope peaks of an OFDM signal within 63 W also at the 1% probability level, the average power is reduced by 1.6 dB; at the 0.1% probability level, the average power is limited to the values given in the last column of the table. The envelope peaks of modulated signals last only a fraction of a symbol period, which is much shorter than the 10 μs pulses used for the peak power characterization.

The QAM and OFDM information in this section is provided for information only. It is based on calculated signal statistics, has not been fully characterized on the TS84235K, and is not binding on TagoreTech; the ratings given in the Absolute Maximum Ratings and Electrical Specifications sections apply.

©2024-2026 TagoreTech Inc.

Table 13: Peak-to-average power ratio (PAPR) of QAM signals, exceeded for the given fraction of time.

Modulation	PAPR [dB] at probability[2]			TS84235K max. avg. power [W][1]
	10%	1%	0.1%	
Single carrier, RRC pulse shaping, $\alpha = 0.22$				
16-QAM	3.0	4.5	5.6	17.4
32-QAM	2.9	4.4	5.4	18.2
64-QAM	3.1	4.8	5.8	16.6
128-QAM	3.0	4.6	5.6	17.4
256-QAM	3.1	4.9	5.9	16.2
Single carrier, RRC pulse shaping, $\alpha = 0.35$				
16-QAM	3.0	4.4	5.1	19.5
32-QAM	3.0	4.2	4.8	20.0
64-QAM	3.0	4.8	5.6	17.4
128-QAM	3.0	4.5	5.2	19.1
256-QAM	3.1	4.8	5.7	17.0
OFDM, 1024 subcarriers, no crest factor reduction				
16-QAM	3.6	6.6	8.4	9.1
32-QAM	3.6	6.6	8.4	9.1
64-QAM	3.6	6.6	8.4	9.1
128-QAM	3.6	6.6	8.4	9.1
256-QAM	3.6	6.6	8.4	9.1
OFDM, 1024 subcarriers, with crest factor reduction (clipping and filtering)[3]				
CFR for EVM ≈ 1.5%, e.g. 256-QAM	3.6	6.6	8.0	10.0
CFR for EVM ≈ 3%, e.g. 64/128-QAM	3.7	6.5	7.3	11.7
CFR for EVM ≈ 5%, e.g. 16/32-QAM	3.7	6.2	6.5	14.1

[1] Average power at which the envelope peaks at the 0.1% probability level remain within the 63 W peak power rating, $P_{\text{avg}} = 63\,\text{W}/10^{\text{PAPR}_{0.1\%}/10}$, limited to the 20 W average power rating. Indicative values; in a mismatched load (VSWR > 1) the RF peak voltage increases and further back-off may be required.

[2] PAPR values are calculated from the envelope power of ideal, unclipped signals. Measured values depend on the transmitter, its filtering, and any crest factor reduction applied.

[3] Iterative clipping and filtering, 4 iterations, clipping level 8.0 dB, 7.0 dB and 6.0 dB above the average power; EVM is the in-band distortion added by the CFR only. The PAPR after CFR is practically independent of the QAM order; the QAM orders given are examples of modulations whose EVM budget typically allows the stated CFR. Actual CFR performance depends on the implementation.

©2024-2026 TagoreTech Inc.

Power Derating

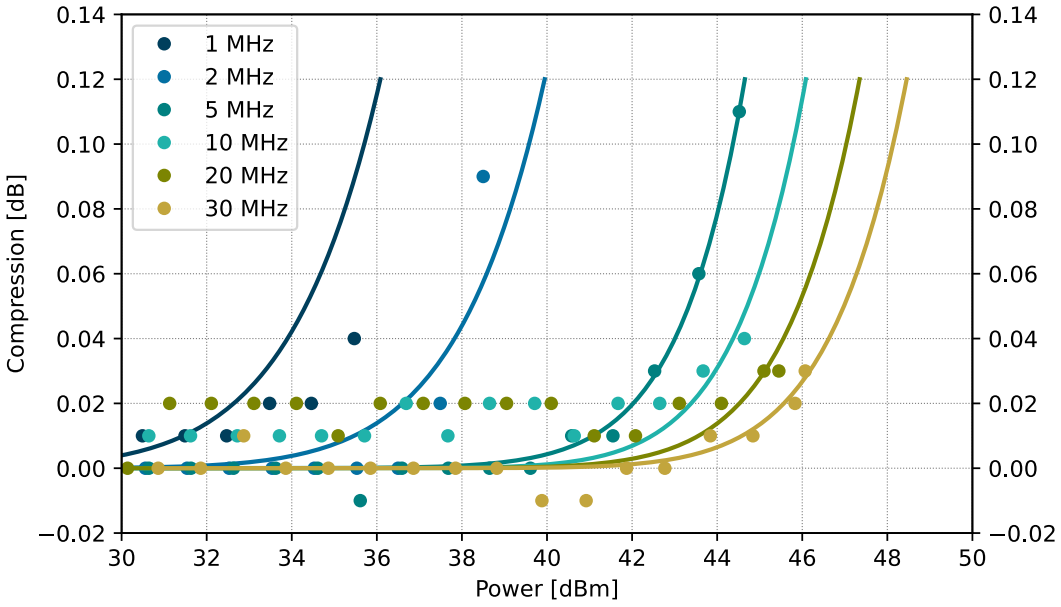
TS84235K has power handling derating below 10 MHz. The power derating table has been defined for a 50 Ω environment, CW signal.

Note: the power derating table and the compression measurements in this section are based on the TS8423K measurements. We expect very similar behavior for the TS84235K, as the part is the same switch with ESD protection added. This section will be updated once the TS84235K data are available.

Table 14: Power derating 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	$f_{\max}$	43	dBm

TS8423K Continuous Wave (CW) compression measurements are presented. Measurements are conducted at room temperature $T_A = +25$°C. Values of the derating table take into account manufacturing tolerances and margins. Measurements are presented as dot (•) and model and extrapolations presented as line (−).



TS8423K CW compression measurement at room temperature $T_A = +25$°C (TS84235K data to be added).

©2024-2026 TagoreTech Inc.

Device Package information

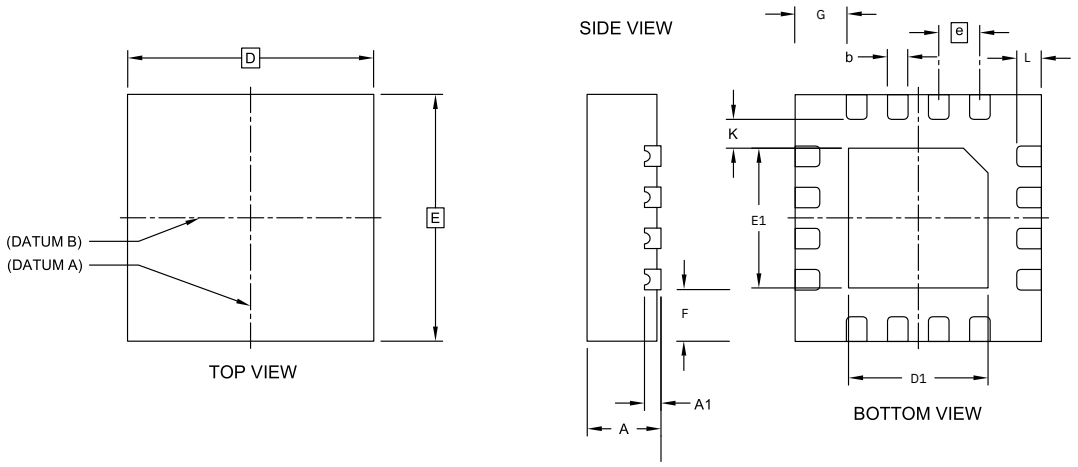


Figure 9: 16-pin QFN 3.0 x 3.0 x 0.75 mm^3 package drawing.

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

Table 15: Device Package Dimensions

Dimension	Value [mm]	Tolerance [mm]	Dimension	Value [mm]	Tolerance [mm]
A	0.75	±0.05	E	3.00 BSC	±0.05
A1	0.203	±0.02	E1	1.70	±0.05
b	0.25	+0.05/-0.07	F	0.625	±0.05
D	3.00 BSC	±0.05	G	0.625	±0.05
D1	1.70	±0.05	L	0.25	±0.05
e	0.50 BSC	±0.05	K	0.40	±0.05

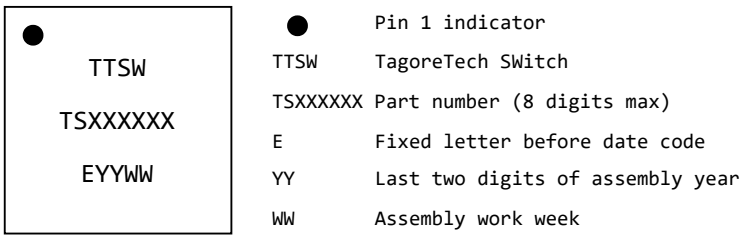


Figure 10: Part marking specification.

©2024-2026 TagoreTech Inc.

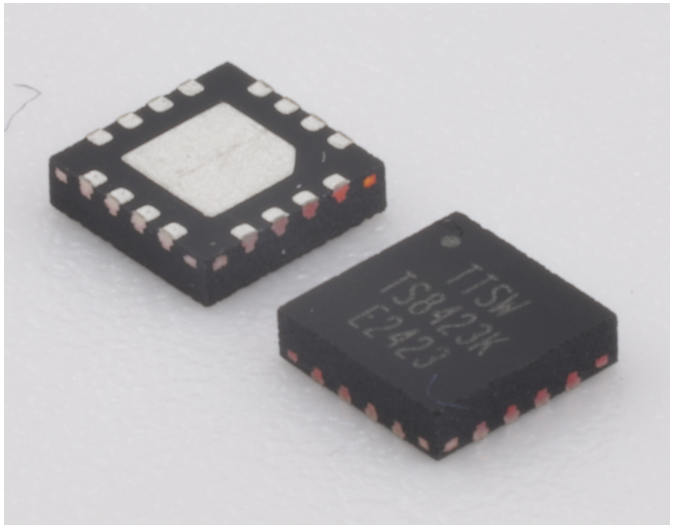


Figure 11: TS84235K photo, top and bottom side.

©2024-2026 TagoreTech Inc.

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.

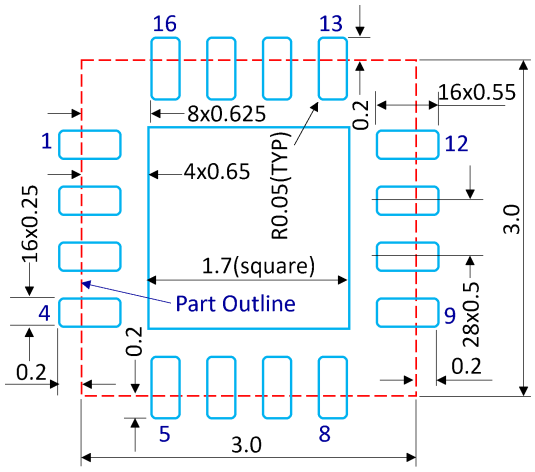


Figure 12: PCB land pattern, dimensions in [mm].

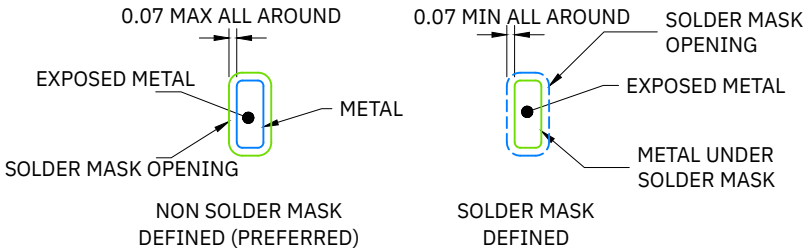


Figure 13: Solder mask opening, dimensions in [mm].

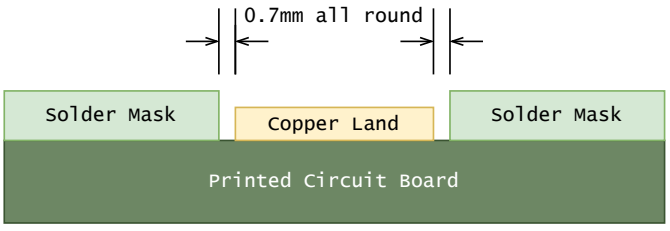


Figure 14: Preferred solder mask opening, side view, dimensions in [mm].

©2024-2026 TagoreTech Inc.

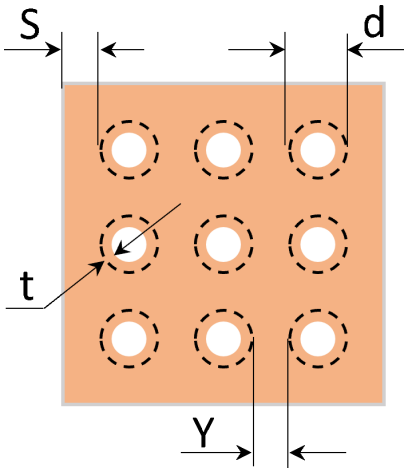


Figure 15: Thermal Via Pattern, Recommended Values: S≥0.15mm; Y≥0.20mm; d=0.2mm; Plating Thickness t=25μm or 50μm.

©2024-2026 TagoreTech Inc.

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 125μm.

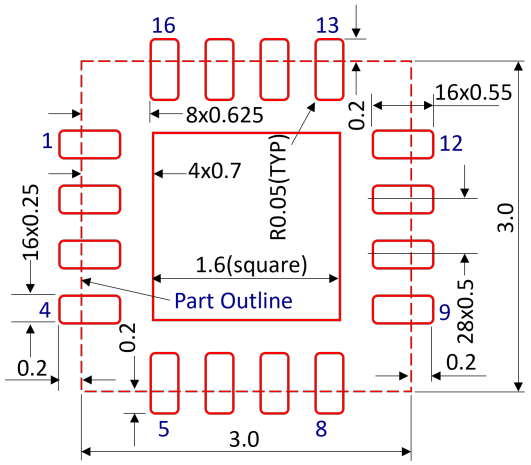


Figure 16: Stencil Openings, dimensions in [mm].

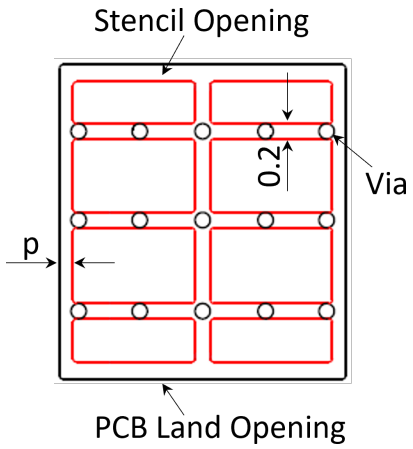
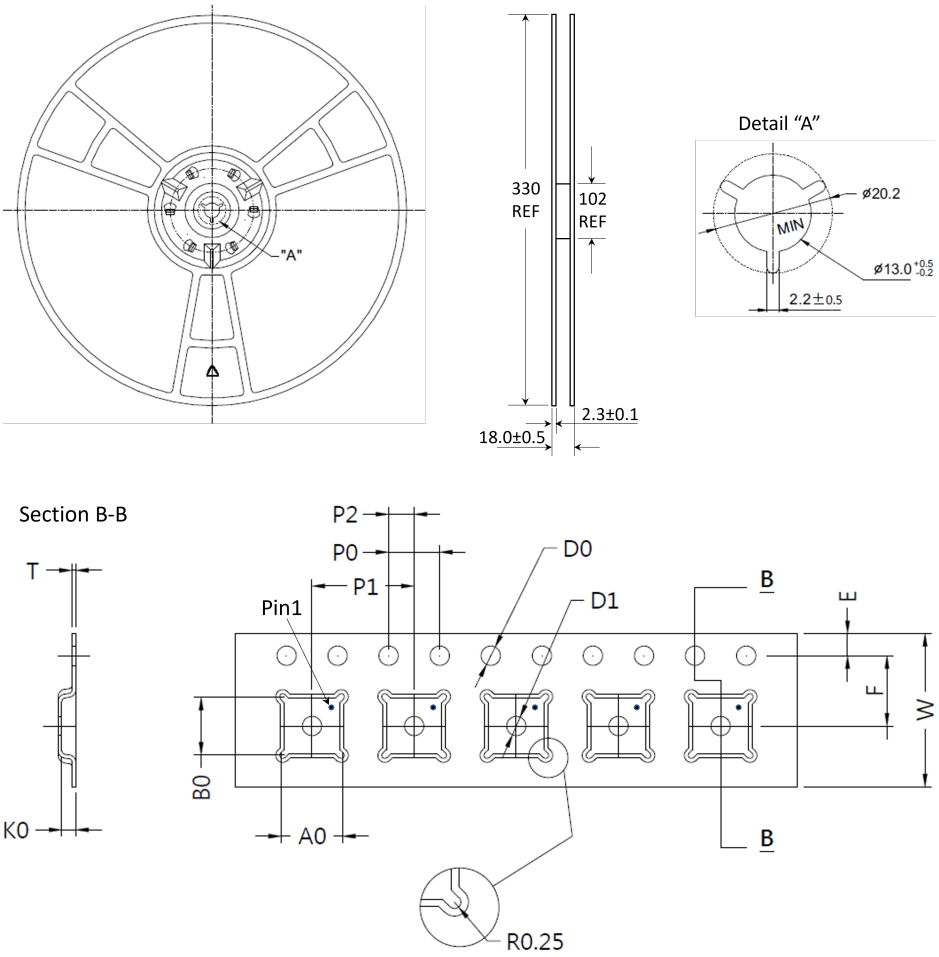


Figure 17: Stencil Openings Shall not Cover Via Areas If Possible, dimensions in [mm].

©2024-2026 TagoreTech Inc.

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]
3.30	3.30	1.50	1.50	1.75	5.50	1.10	4.00	8.00	2.00	0.30	12.00

©2024-2026 TagoreTech Inc.

Glossary

IL	Insertion loss
ISO	Isolation
RL	Return loss
VSWR	Voltage Standing Wave Ratio
RFC	Antenna port or common port, referred as RFC
RFx	RF Port number x
ISO state	Isolation state: RFC port open, RF ports shorted ($\mathrm{V}_2 = 1$, $\mathrm{V}_1 = 0$)
NC	Not connected; pin 1 is not internally bonded
V_{CP}	Charge pump voltage; internal only on the TS84235K
f_{PRR}	Pulse repetition rate (maximum rate of switching events)
Unitarity	Describes power absorption of the component, $1 - \lvert S_{11}\rvert^2 - \lvert S_{21}\rvert^2 - \lvert S_{31}\rvert^2$
ESD, HBM, CDM	Electrostatic discharge, human body model, charged device model
IEC 61000-4-2	ESD immunity test standard (contact and air discharge)
IDX	EVB configuration index of the S-parameter files (IDX00: no matching components, IDX01: 7.2 GHz matching)
CPW	Coplanar waveguide
CCDF	Complementary cumulative distribution function
CFR	Crest factor reduction
EVM	Error vector magnitude
OFDM	Orthogonal frequency-division multiplexing
PAPR	Peak-to-average power ratio
QAM	Quadrature amplitude modulation
RRC	Root-raised-cosine (pulse-shaping filter)
EVB	Evaluation board

©2024-2026 TagoreTech Inc.

Changelog

Table 16: Changelog

Date	Revision	Notes
09/22/2026	3.01	First publication, derivative product of TS8423K with improved ESD robustness.
11/06/2026	3.10	Typical characteristics without matching components from the measured TS84235K S-parameters (house-style plots, 10 MHz to 7.2 GHz), unmatched typical values of the electrical specifications updated to the measurements; the matched example is the TS8423K measurement (same switch without ESD protection); comparison plots of the matched and unmatched switch removed; power derating marked as based on TS8423K data. House style update: integrated ESD protection on all RF ports (functional diagrams and ESD ratings as TS8546L), front-page rendering, pin assignment drawing with pin 1 not internally bonded (NC), EVB schematics redrawn, theory of operation on the internal charge pump without V_{CP} pin, peak power handling with modulated signals (PAPR of QAM and OFDM signals, crest factor reduction, CCDF plot), application information, links to application notes TN-001/TN-002, QR code link to the latest datasheet, distributor table format, glossary extended, charge-pump-disabled alternative corrected to TS84230K. No data changes.

©2024-2026 TagoreTech Inc.

Legal Information

Published by

TagoreTech Inc.
601 Campus Drive, Suite B3
Arlington Heights, IL 60004, USA

©2024-2026 All Rights Reserved

TagoreTech is a fabless US semiconductor company specializing in GaN RF solutions: high-power RF switches in unique GaN-on-Si technology, RF power amplifiers in GaN-on-SiC, and reconfigurable front-end solutions — such as tunable power amplifiers and antenna tuning — that combine the two. TagoreTech serves defense, radar, datalink, 5G infrastructure, and public safety markets.

Legal Disclaimer

The information provided in this document is believed to be accurate and reliable, but shall in no event be regarded as a guarantee of conditions or characteristics. TagoreTech makes no warranties, express or implied, including without limitation any implied warranty of merchantability or fitness for a particular purpose. TagoreTech assumes no responsibility for the consequences of the use of this information, nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of TagoreTech. Customers are responsible for validating the suitability of TagoreTech products in their own applications and for compliance with all applicable laws and regulations, including export control requirements. Specifications are subject to change without notice. Errors and omissions excepted.

Use in critical applications. TagoreTech products are not designed or authorized for use in life-support devices or systems, safety-critical applications, or applications where failure could reasonably be expected to cause personal injury, unless expressly agreed in writing by an authorized representative of TagoreTech. Any such use is at the customer's own risk.

Sales Contact

For further information on technology, delivery terms, conditions, and prices, please contact TagoreTech: support@tagoretech.com or contact our distributors or representatives as listed at TagoreTech website.
Please click the blue links.

Buy TS84235K directly

TS84235K samples and evaluation boards are available through TagoreTech support@tagoretech.com and our distributors.

TS84235K Product information

Please visit TS84235K product page for further information TS84235K Product Page

Latest version of TS84235K datasheet is available for download: TS84235K Datasheet

TagoreTech Inc. Product Brochure and datasheets

Tagore Product Brochure and links to all available datasheets is available for download:
TagoreTech Product Brochure

Scan for the latest datasheet