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Saw Resistor Series

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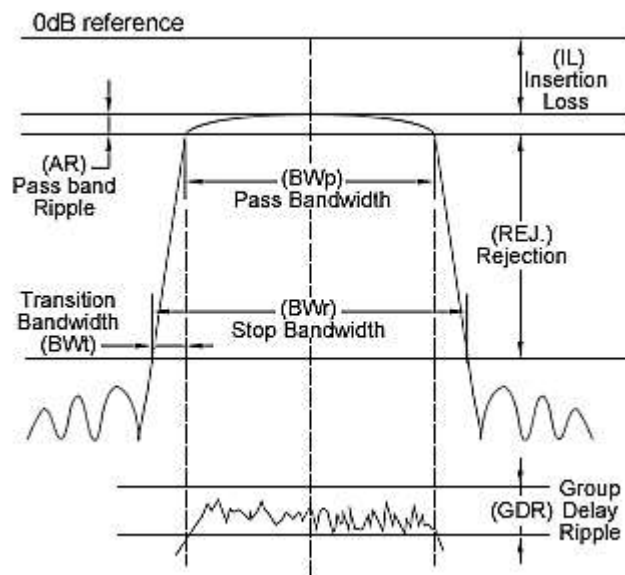


Required to effectively design a Saw Component

► Required to effectively design a Saw Component

Required to effectively design a Saw Component

Generally, a saw manufacturer will offer their most popular devices as standards creating a reference for Engineers to design from. Typically, a standard device is available for most common applications. However, for applications requiring parameters that are not currently considered industry standards. In this case, the following information is required to effectively design a filter:



Filter Group Delay Variation over Pass Bandwidth

1. Nominal Frequency (Fn)

The nominal values of the center frequency F_0 and is used as the reference frequency of related standard. Unit of nominal frequency is in MHz.

2. Insertion Loss (IL)

The logarithmic ratio of the power delivered to the load impedance before the filter is inserted to the power delivered to the load impedance after the filter is inserted. Unit of Insertion loss in is dB.

Advances in filter design techniques routinely allow for a design incorporating a specification of under 10dB Insertion Loss, however, the minimum attainable Insertion Loss is generally influenced by the Fractional Bandwidth and the influences of this ratio on the applicable substrate material. The Insertion Loss value will generally increase when approaching the fractional bandwidth limit of a substrate material. For instance, a Fractional Bandwidth value of 8% will generally produce lower Insertion Loss than a Fractional Bandwidth value of 30% using the same substrate material.

3. Pass Bandwidth (BWp)

The frequency interval in which the relative attenuation (the attenuation from the minimum insertion loss) is equal to the specified value 3dB.

4. Stop Bandwidth (BWr)

The frequency interval in which the relative attenuation (the attenuation from the minimum insertion loss) is equal to the specified value of "A" dB.

5. Transition Bandwidth (BWt)

Otherwise referred to as Skirts, the area between the Stop Band and the Pass band found on both sides of the Pass band.

6. Pass band Ripple (AR)

The difference between the minimum peak attenuation and the maximum peak attenuation within a pass band. Unit is in dB.

7. Group Delay Ripple (GDR)

The difference between the maximum and minimum value of the group delay in the specified range of the pass band. Unit in μ s.

8. Rejection (REJ.)

All ranges of the saw components not including the Pass band. The Rejection can also be referred to as the Rejection Range, or Stop Band. We can refer to this as the range in which the Relative Attenuation is larger than the specified Rejection side. With proper material selection and design, Rejection of 50dB, or greater, is possible within a wide selection of fractional bandwidths and shape factors.

9. Terminating Impedance (Zt)

Impedance presented to the filter by the source or by the load.

10. Package

Factors affecting the size of the package used in saw design include parameters associated with Center Frequency, Bandwidth, and Shape Factor, among other minor considerations. For instance, lower Frequencies require larger substrate, thereby increasing the size of the packages available to the designer. Consequently, an equally important challenge of package size reduction is always considered by Token Design Engineers in an attempt to meet the desired parameters in the smallest package possible. In selecting a package, we recommend stating general preferences. Without this input, Token will design using the most cost effective approach balancing parameter requirements with cost and manufacturability.



Saw Applications

▶ Saw Applications

Saw Applications for Telecommunications

Definition of Saw

Surface Acoustic Wave (SAW) is a wave propagating along the surface of an elastic substrate.

Frequency of Saw is:

$$F = V / \lambda$$

Where V is the velocity of SAW (~3,100m/s), λ is the IDT period.

Types of Saw Devices

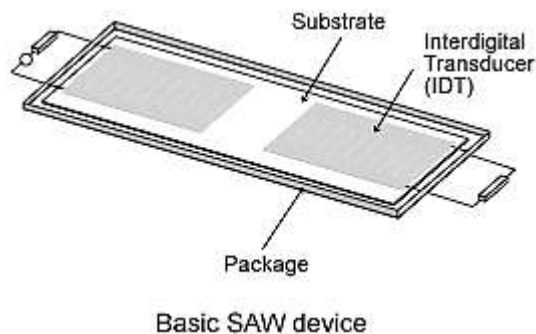


Figure-1 - Basic Saw Device

The device in (Figure-1) is a basic delay line, because the wave takes some time to travel between the transducers - typically 1 μ s for 3 mm of path length. This is very compact compared with EM waves which, in free space, need 300 m of path for 1 μ s delay. The device can also be used as a band pass filter, because the transducers operate most effectively when the saw wavelength equals the transducer pitch - at other frequencies the waves generated by individual gaps are not in phase, so the wave amplitude falls off as the frequency is changed.

Another basic device is the resonator. This uses arrays of metal strips, with pitch $\lambda/2$, as reflectors of the waves. These arrays can give strong Saw reflections, and two arrays can be used to form a saw cavity with high Q, up to 105. Such resonators are often used for high-stability oscillators.

The above devices are just some basic types. Many unique variations are possible for saw devices, and their applications range from piezoelectric strain gauges to pulse compression radar, to cellular handsets.

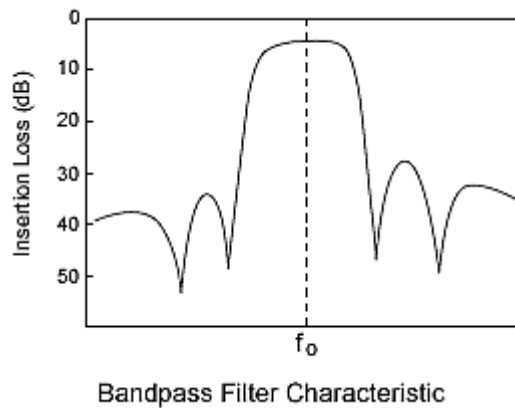


Figure-2 - Band pass Filter Characteristic

The most common group is band pass filters, which are in very widespread use in radio systems (including mobile phone handsets and base stations) and in domestic TV. There are many types with differing advantages, such as low shape factor, low insertion loss, small size, or high-frequency operation. The wide variety of types is possible because almost arbitrary shapes can be defined on the surface with very high precision, using lithography techniques similar to those for semiconductor processing. A typical saw Band pass characteristic is shown in (Figure-2).

Saw Applications

Surface acoustic wave filters play a key role in telecommunications. Because of their special features various products are being used more and more in different transmission systems:

- Passband filter typically as RF or IF filters for data processing in communication systems. A few examples for these applications are mobile phone basestations, point to multipoint systems, radio link systems, Professional Mobile Radio (PMR) systems and Wireless Local Loop (WLL) systems.
- Clock recovery filters for digital regeneration in fiber-optic systems, e.g. FDDI, ISDN, LAN, etc.
- Nyquist and Vestigial sideband filters in television transmission systems in TV transmitters and high quality receivers, modulators/demodulators, and converters of CATV head-ends, etc.
- Passband filters for basestations include filters for all worldwide standards (TDMA, CDMA, GSM, and W-CDMA). Filters for WLL systems are available for products based on CDMA, W-CDMA, DECT, GSM, and proprietary standards. Trunked radio filters for PMR basestation, mobile and handheld applications are offered for the digital standard TETRA.

Saw Package Dimensions

Encapsulation Type

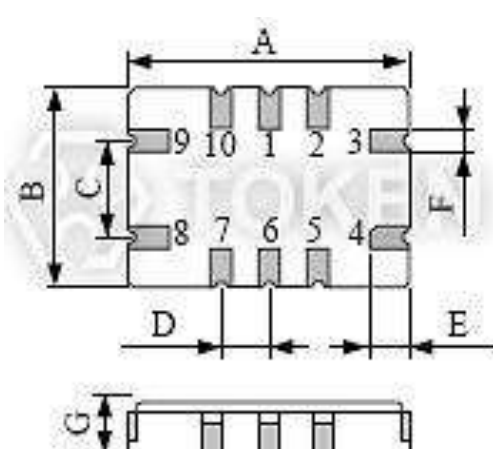
Saw Resonators & Filters Encapsulation Type

SMD Type		DIP Type	
Package Type	Code	Package Type	Code
SMP-03	S1	TO-39	D1
SMP-53	S2	F-11	D2
SMP-53-S	S3	D-11	D3
QCC8C	S4	SIP5T	D4
QCC4A	S5	TO39-2	D5
QCC8B	S6		
DCC6	S7		
QCC8D	S8		
DCC6C	S9		
ARC11A	S10		
F11SMD	S11		

SMP-03

Package Dimensions (Unit: mm) (SMP-03)

Type	A	B	C	D	E	F	G
SMP-03	7.0	5.0	2.54	1.27	1.0	0.6	1.5

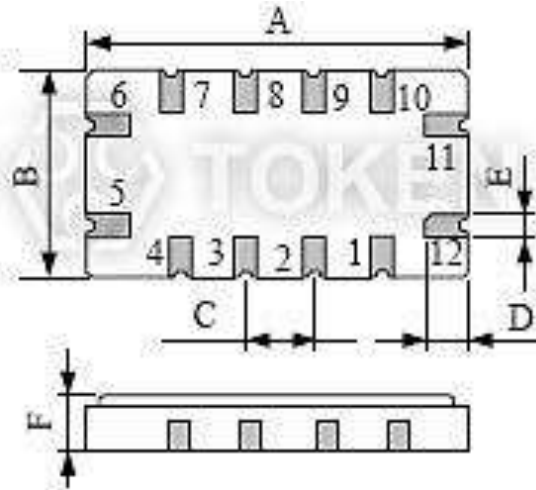


SAW (SMP-03) Dimensions

SMP-53

Package Dimensions (Unit: mm) (SMP-53)

Type	A	B	C	D	E	F
SMP-53	13.3	6.5	2.54	1.5	0.8	1.5

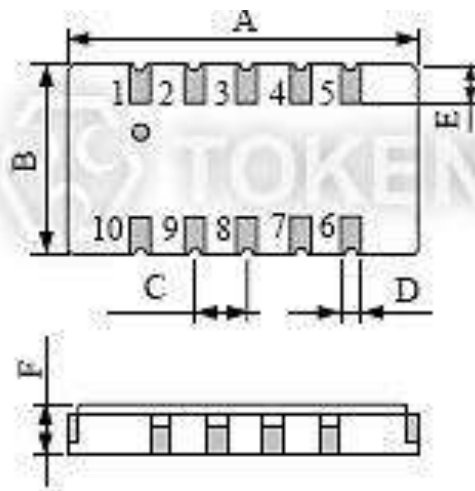


SAW (SMP-53) Dimensions

SMP-53-S

Package Dimensions (Unit: mm) (SMP-53-S)

Type	A	B	C	D	E	F
SMP-53-S	13.3	6.5	1.91	1.02	1.8	1.55

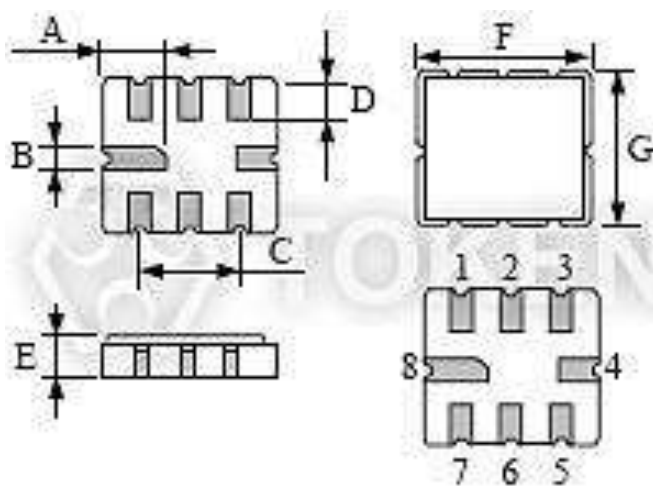


SAW (SMP-53-S) Dimensions

QCC8C

Package Dimensions (Unit: mm) (QCC8C)

Type	A	B	C	D	E	F	G
QCC8C	2.08	0.6	2.54	1.2	1.4	5.0	5.0

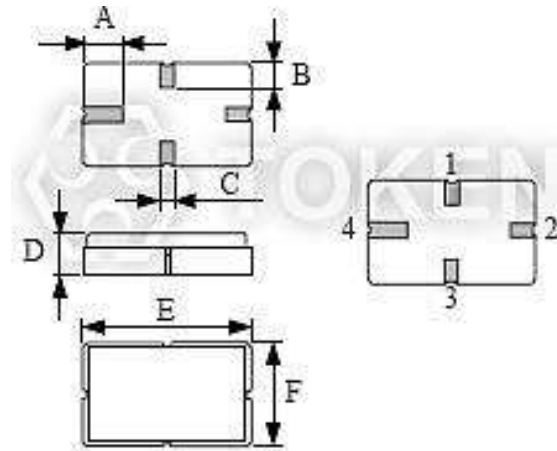


SAW (QCC8C) Dimensions

QCC4A

Package Dimensions (Unit: mm) (QCC4A)

Type	A	B	C	D	E	F
QCC4A	1.2	0.8×3	0.5×4	1.4	5.0	3.5

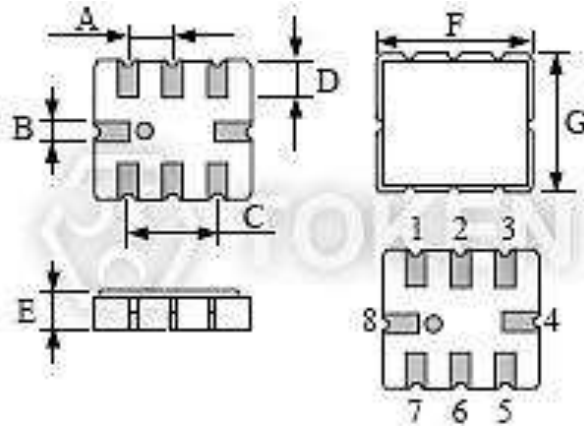


SAW (QCC4A) Dimensions

QCC8B

Package Dimensions (Unit: mm) (QCC8B)

Type	A	B	C	D	E	F	G
QCC8B	1.27	0.6	2.54	1.0	1.5	3.8	3.8

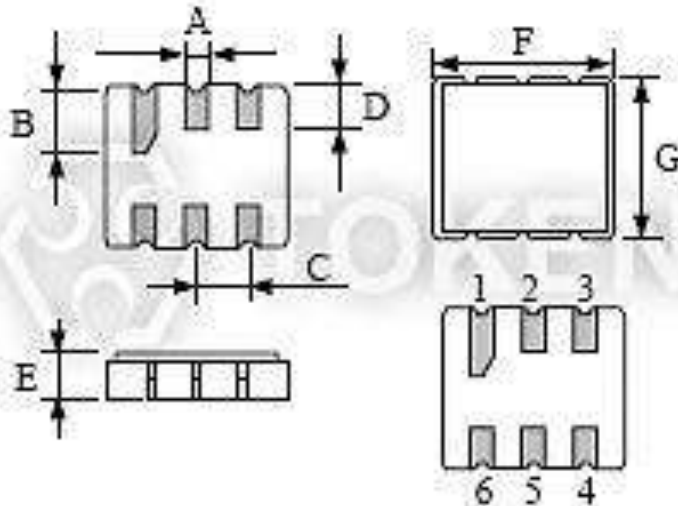


SAW (QCC8B) Dimensions

DCC6

Package Dimensions (Unit: mm) (DCC6)

Type	A	B	C	D	E	F	G
DCC6	0.64	1.9	1.27	1.0	1.4	3.8	3.8

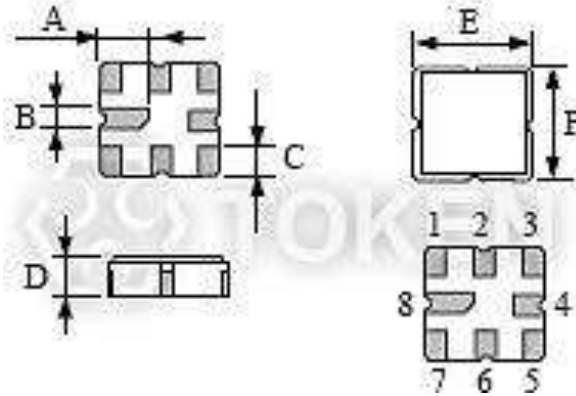


SAW (DCC6) Dimensions

QCC8D

Package Dimensions (Unit: mm) (QCC8D)

Type	A	B	C	D	E	F
QCC8D	1.2	0.6	0.75	1.1	3.0	3.0

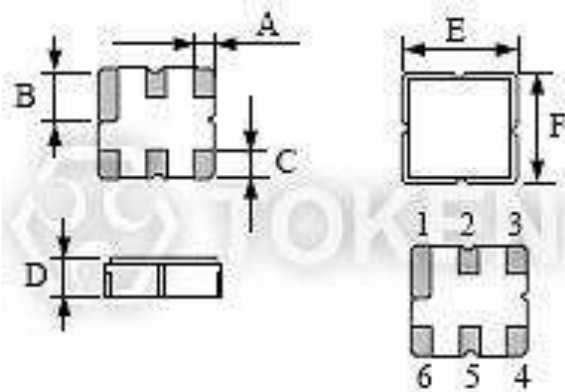


SAW (QCC8D) Dimensions

DCC6C

Package Dimensions (Unit: mm) (DCC6C)

Type	A	B	C	D	E	F
DCC6C	0.6	1.5	0.75	1.3	3.0	3.0

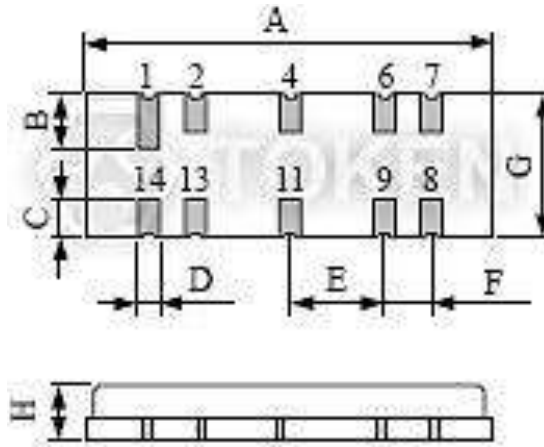


SAW (DCC6C) Dimensions

ARC11A

Package Dimensions (Unit: mm) (ARC11A)

Type	A	B	C	D	E	F	G	H
ARC11A	11.0	1.5	1.1	0.7	2.54	1.27	4.0	1.5

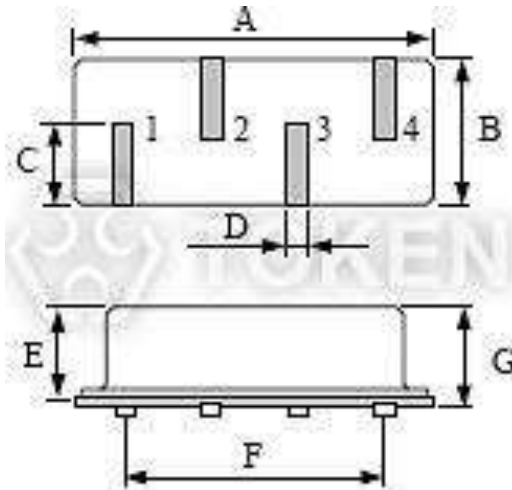


SAW (ARC11A) Dimensions

F11SMD

Package Dimensions (Unit: mm) (F11SMD)

Type	A	B	C	D	E	F	G
F11SMD	11.0	4.5	2.45	0.6	3.4	3×2.54	4.1

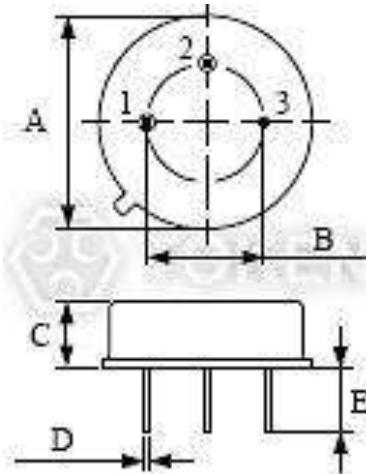


SAW (F11SMD) Dimensions

TO-39

Package Dimensions (Unit: mm) (TO-39)

Type	A	B	C	D	E
TO-39	Φ9.15	Φ5.08	3.3	Φ0.45	3.0

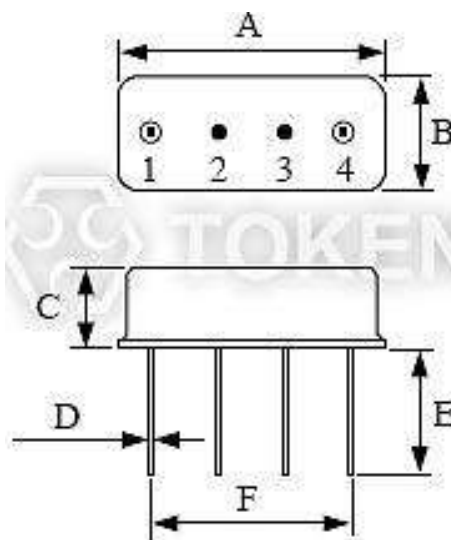


SAW (TO-39) Dimensions

F-11

Package Dimensions (Unit: mm) (F-11)

Type	A	B	C	D	E	F
F-11	11.0	4.5	3.4	Φ0.5	5.0	3×2.54

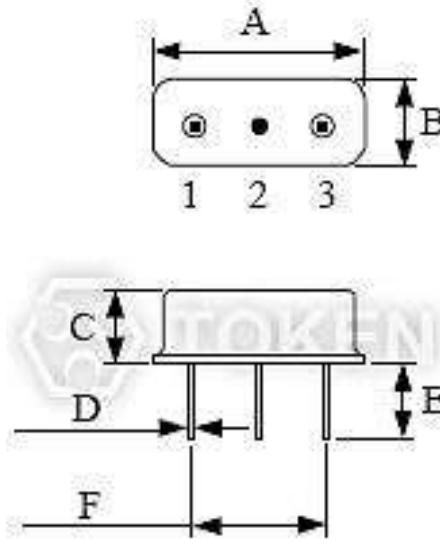


SAW (F-11) Dimensions

D-11

Package Dimensions (Unit: mm) (D-11)

Type	A	B	C	D	E	F
D-11	8.36	3.45	3.0	Φ0.45	3.0	2×2.54

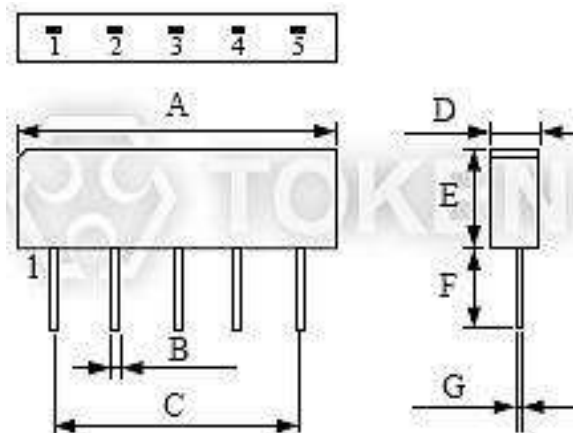


SAW (D-11) Dimensions

SIP5T

Package Dimensions (Unit: mm) (SIP5T)

Type	A	B	C	D	E	F	G
SIP5T	13.8	0.55	4×2.54	2.6	4.8	3.5	0.25

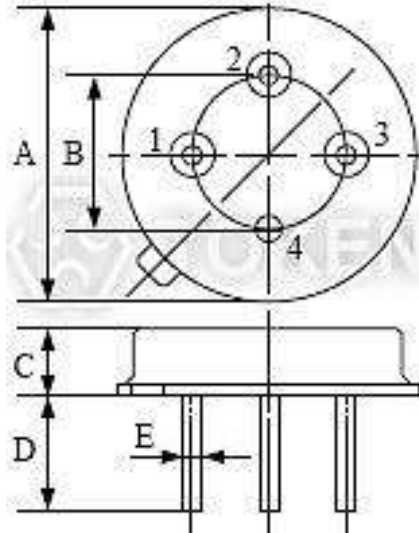


SAW (SIP5T) Dimensions

▶ TO39-2

Package Dimensions (Unit: mm) (TO39-2)

Type	A	B	C	D	E
TO39-2	9.35±0.10	5.08±0.10	3.40±0.10	3.00±0.20	4-Φ0.45±0.20



SAW (TO39-2) Dimensions

Saw Filters (TSF)

► Product Introduction

Token Saw Filters (TSF) Make New Waves in The Wireless World.

With the growth of wireless communications, surface acoustic wave technology filters have become a critical component for electronics manufacturers. Token develops and manufactures a complete line of our frequency control products utilizing industry standard packages in both Surface Mount and Through Hole designs.



Token provides innovative low-cost, space-saving and energy-efficient designs with high volume off-shore manufacturing, leading technology and superior engineering resources in design and process manufacturing.

Token's saw filters support all the major standards: EGSM, DCS, AMPS/CDMA/GSM850, PCS, WCDMA, WLAN, GPS, within the standard range of devices, offering a cost-effective solution for all applications.

A new compact range of Saw RF filters uses chip-scale packaging specifically to address the demanding miniaturization and performance requirements for new generations of mobile phones. Key features of the range include compatibility with lead-free (high-temperature) solder reflow while achieving high reliability against moisture, temperature, mechanical vibrations and shocks.

In modern remote control applications, Saw resonators and front end filters are key components which transmit in the USA typically at 315 or 915 MHz and in Europe at 433.92 MHz or 868-870 MHz. These remote controls are used in systems for Remote Keyless Entry (RKE, wireless operation of a car's central locking system), security alarms and garage door openers, electronic toll, RFID, short range data transmission, wireless Tire Pressure Monitoring (TPMS).

Token saw components provide stable frequencies for the RF carrier signal to transmit data over a range for the local oscillators of superhet receivers. The front-end filter in the receiver eliminates interference from the incoming RF signal, thus increasing selectivity and sensitivity in short-range devices.

Our experienced engineering team can support your Saw application from the initial design through production. Custom designs are available utilizing high technology mask designs, wafer fabrication, assembly and complete reliability testing.

For marketing discontinuations or second sourcing activities concerning RF Filter and IF Filter products, you are encouraged to contact our Sales Department so the request can be properly directed within Token. Contact us with your specific needs. For more information, please link to Token official website "[Saw Resistors](http://www.token.com.tw)".



► For Automotive Electronics & Remote Control

Front End Filter Typical Specification (TSF)

Part Number	Center Freq. (MHz)	IL(dB)	3dB BW(MHz)	Package	
				SMD Type	DIP Type
TSF295D00-D1	295	3.0	0.6		TO-39
TSF302D00A-S4	302	2.5	0.75	QCC8C	
TSF302D00B-S7	302	2.5	0.75	DCC6	
TSF303D825A-D1	303.825	3.0	0.6		TO-39
TSF303D825B-S4	303.825	3.0	0.6	QCC8C	
TSF303D875A-D1	303.875	3.0	0.6		TO-39
TSF303D875B-S4	303.875	3.0	0.6	QCC8C	
TSF310D00-S4	310	3.0	0.8	QCC8C	
TSF315D00A-D1	315	3.0	0.6		TO-39
TSF315D00B-D2	315	3.0	0.6		F-11
TSF315D00C-S4	315	3.0	0.6	QCC8C	
TSF315D00D-S4	315	2.5	1.3	QCC8C	
TSF315D00E-S6	315	2.5	1.3	QCC8B	
TSF315D50-D1	315.5	3.0	0.6		TO-39
TSF318D00-D1	318	3.0	0.6		TO-39
TSF319D50-D1	319.5	2.5	0.7		TO-39
TSF345D00A-S6	345	2.5	4.5	QCC8B	
TSF345D00B-S4	345	3.0	0.9	QCC8C	
TSF372D50-D1	372.5	3.0	0.6		TO-39
TSF390D00-S4	390	3.0	1.0	QCC8C	
TSF391D25-D1	391.25	2.5	0.6		TO-39
TSF395D00-S4	395	3.0	1.0	QCC8C	
TSF401D65-S4	401.65	3.0	0.6	QCC8C	
TSF401D90-D1	401.9	3.0	0.6		TO-39
TSF418D00A-D1	418	3.0	0.6		TO-39
TSF418D00B-S4	418	3.0	0.6	QCC8C	
TSF419D20-S4	419.2	3.0	1.2	QCC8C	
TSF430D50A-D1	430.5	3.0	0.6		TO-39
TSF430D50B-D2	430.5	3.0	0.6		F-11
TSF431D50A-D2	431.5	2.5	0.58		F-11
TSF431D50B-S4	431.5	2.5	0.58	QCC8C	
TSF433D42A-S4	433.42	3.5	0.6	QCC8C	
TSF433D42B-S7	433.42	3.0	0.9	DCC6	
TSF433D92A-D1	433.92	3.0	0.6		TO-39
TSF433D92B-D1	433.92	2.0	0.73		TO-39
TSF433D92C-D2	433.92	3.0	0.6		F-11
TSF433D92D-S4	433.92	3.0	0.6	QCC8C	
TSF433D92E-S4	433.92	2.0	0.73	QCC8C	
TSF433D92F-S4	433.92	2.5	0.6	QCC8C	
TSF433D92G-S4	433.92	2.5	0.95	QCC8C	
TSF433D92H-S4	433.92	2.2	0.7	QCC8C	



Part Number	Center Freq. (MHz)	IL(dB)	3dB BW(MHz)	Package	
				SMD Type	DIP Type
TSF433D92I-S6	433.92	2.8	6.0	QCC8B	
TSF433D92J-S6	433.92	2.3	0.56	QCC8B	
TSF433D92K-S6	433.92	2.3	0.56	QCC8B	
TSF433D92L-S9	433.92	2.8	1.0	DCC6C	
TSF433D92M-S7	433.92	2.3	0.56	DCC6	
TSF434D42A-D1	434.42	3.0	0.7		TO-39
TSF434D42B-S4	434.42	3.0	0.6	QCC8C	
TSF439D25-D1	439.25	3.0	0.6		TO-39
TSF451D25-D1	451.25	2.5	0.48		TO-39
TSF463D912-S4	463.912	2.5	1.2	QCC8C	
TSF499D25-D1	499.25	3.0	0.54		TO-39
TSF801D125A-S7	801.125	5.8	0.56	DCC6	
TSF801D125B-S6	801.125	5.0	0.58	QCC8B	
TSF859D15-D2	859.15	4.0	1.0		F-11
TSF868D00-S4	868	3.5	1.2	QCC8C	
TSF868D30-S4	868.3	4.0	1.2	QCC8C	
TSF868D35A-D2	868.35	4.0	1.2		F-11
TSF868D35B-S4	868.35	4.0	1.2	QCC8C	
TSF868D35C-S6	868.35	3.5	1.8	QCC8B	
TSF868D69-S4	868.69	3.8	1.9	QCC8C	
TSF868D95-S4	868.95	3.5	1.2	QCC8C	
TSF869D69-S4	869.69	3.8	1.8	QCC8C	
TSF902D30-S4	902.3	3.5	1.2	QCC8C	
TSF908D00-S6	908	3.0	2.0	QCC8B	
TSF914D50-D2	914.5	3.8	1.2		F-11
TSF915D00A-D1	915	3.5	1.2		TO-39
TSF915D00B-S4	915	4.0	1.2	QCC8C	
TSF915D00C-S7	915	3.8	1.8	DCC6	
TSF916D50A-D1	916.5	4.0	1.2		TO-39
TSF916D50B-D2	916.5	3.5	1.2		F-11
TSF916D50C-S4	916.5	4.0	1.2	QCC8C	
TSF916D50E-S4	916.5	4.0	1.2	QCC8C	
TSF916D50F-S6	916.5	4.8	1.35	QCC8B	
TSF921D60-S6	921.6	2.6	1.9	QCC8B	
TSF927D20-S7	927.2	3.0	1.45	DCC6	
TSF931D00-S4	931	3.5	1.8	QCC8C	

- **Front end filters for Automotive Electronics and Remote Control:**
 433.92 MHz in Europe.
 315 MHz or 915 MHz in the USA.
 868-870 MHz In modern remote control applications.



► For Satellite Receiver

Satellite Receiver Typical Specification (TSF)

Part Number	Center Freq. (MHz)	IL(dB)	3dB BW(MHz)	Application	Package	
					SMD Type	DIP Type
TSF480D00A-D5	480	21	18	One-channel, Satellite Filters		TO39-2
TSF480D00B-S4	480	21	18	One-channel, Satellite Filters	QCC8C	
TSF480D00C-D5	480	22.5	27	One-channel, Satellite Filters		TO39-2
TSF480D00D-S4	480	22.5	27	One-channel, Satellite Filters	QCC8C	
TSF480D00E-D5	480	20	27	One-channel, Satellite Filters		TO39-2
TSF480D00F-D5	480	21	36	One-channel, Satellite Filters		TO39-2
TSF480D00G-S4	480	21	36	One-channel, Satellite Filters	QCC8C	
TSF480D00H-D1	480	15	16	One-channel, Satellite Filters		TO-39
TSF480D00I-S4	480	12.5	15.3	One-channel, Satellite Filters	QCC8C	
TSF480D00J-D5	480	22	38.6	One-channel, Satellite Filters		TO39-2
TSF479D50A-D5	479.5	21.5	8	One-channel, Satellite Filters		TO39-2
TSF479D50B-S4	479.5	21.5	8	One-channel, Satellite Filters	QCC8C	
TSF479D50C-D5	479.5	18	6.5	One-channel, Satellite Filters		TO39-2
TSF479D50D-D2	479.5	22	16 (5.5 dB)	One-channel, Satellite Filters		F-11
TSF479D50E-S4	479.5	22	16 (5.5 dB)	One-channel, Satellite Filters	QCC8C	
TSF402D78B-S4	402.78	20.5 / 20.0	15.5 / 28.0	Two-channel, Satellite Filters	QCC8C	

- **Filters for Digital Satellite Broadcasting (DSB Receiver):**
 Superior sound and picture quality.
 More available channels to choose from.
 Progressively digitized worldwide of Television and radio broadcasting.

▶ For GPS

RF Filters for GPS Typical Specification (TSF) Mobile Communications

Part Number	Center Freq. (MHz)	BW(MHz)	IL(dB)	Package	
				SMD Type	DIP Type
TSF1542D50-S9	1542.50	40	3.5	DCC6C	
TSF1575D42A-S9	1575.42	2.4	1.6	DCC6C	
TSF1575D42B-S6	1575.42	2.4	1.6	QCC8B	

▶ For Wireless LAN

IF Filters for Wireless LAN Typical Specification (TSF) Mobile Communications

Part Number	Center Freq. (MHz)	3dB BW(MHz)	IL(dB)	Package	
				SMD Type	DIP Type
TSF280D00-S4	280	20	11	QCC8C	
TSF374D00A-D1	374	22	9		TO-39
TSF374D00B-D1	374	22	8.5		TO-39
TSF374D00C-S4	374	22	9	QCC8C	
TSF374D00D-S4	374	22	8.5	QCC8C	
TSF374D00E-S4	374	19	9	QCC8C	
TSF374D00F-S4	374	20.5	9	QCC8C	
TSF374D00G-S6	374	23	9	QCC8B	
TSF374D00H-S6	374	21	9	QCC8B	



► Applications

RF & IF Filters Applications (TSF)

Saw RF Filters (Front End Filters)

- The main key factor of insertion loss on system performance criticizes the application of resonant design principles such as LCRF (Longitudinally-Coupled Resonator Filter), IEF (Impedance Element Filter), and IEF balanced bridge filters. With many year's experience in Saw applications, Token takes advantages of these design principles for the development of low loss filters for front end applications.
- A combination of two port resonators can be described as an LCRF design. Typically, a parallel connection of 4 two port resonators is used. This advantage allows very low loss by reducing resistive losses and avoided waveguide effects.
- IEF composes the basic design principle for RF filters with one port resonators used as impedance elements. Resonators are constituted in a ladder configuration. The difference between the acoustic impedance of resonance and anti-resonance is used to achieved a filter performance. The resonators may be designed to have different resonant frequencies.
- For wide-band, low-loss filters, Token takes advantage of different cuts of higher coupling substate material (LiNbO3 / LiTaO3).

Saw IF Filters

- There are various different design principles which are suitable for the design of saw IF Filters. However, to meet the requirements perfectly is working on optimization.
- Precision filter design meets most of the requirements such as phase ripple, group delay and low amplitude in combination with high close-in rejection and fabulous selectivity. The disadvantage of precision filters is their high insertion loss. Token Saw Resonator design makes low insertion loss and miniaturized package size served better.
- SPUDT (Single Phase Unidirectional Transducer) filters combine transversal and resonant filter design principles to take advantage of optimization both. By optimizing the transduction and reflection of interdigital transducers, the filter performance can be improved while keeping the chip size the same. As a result of internal reflections, the signal length in the time domain is increased.
- Token utilizes SFIT(Slanted Finger Interdigital Transducer) filter to provide a low insertion loss with a wide bandwidth in Saw design. Token has developed a set of practical design tools to achieve low group delay ripple, and suppression of reflections including the triple transit signal.

► Order Codes

Order Codes (TSF)

TSF	302D00		A	S1
Part Number	Center Freq.(MHz)		Series No.	Package
302D00	302 MHz		None	S1
310D00	310 MHz		A	S2
391D25	391.25 MHz		B	D1
			C	D2
			D	D3



▶ Saw Glossary

Surface Acoustic Wave Glossary (TSF)

RF Filters / IF Filters Technology for Wireless Communications - The Choice is yours

What is SAW - Surface Acoustic Wave

- SAWs were first explained in 1885 by Lord Rayleigh, who described the surface acoustic mode of propagation and predicted its properties in his classic paper. Named after their discoverer, Rayleigh waves have a longitudinal and a vertical shear component that can couple with any media in contact with the surface. This coupling strongly affects the amplitude and velocity of the wave, allowing SAW sensors to directly sense mass and mechanical properties.

What is IDT - Interdigital Transducer

- The theory developed by Blotekjaer ET AL., (1973) is used to study a periodic system of conducting electrodes deposited upon the surface of a piezoelectric half space - a SAW IDT. It is assumed that some of the electrodes are fed by external voltage sources. Exact expressions are obtained for elements of the transmittance matrix, coupling currents and electrode potentials. Numerical and experimental results are presented.

Type of Saw devices

- Precision - Bidirectional, High Loss
- SPUdT - Single Phase Unidirectional Transducer
- TCRF - Transversely-Coupled Resonator filter
- LCRF - Longitudinally-Coupled Resonator Filter
- SFIT - Slanted Finger Interdigital Transducer
- IEF - Impedance Element Filter



Type of Saw Applications

- SONET - Synchronous Optical Network
- DECT - Digital European Cordless Telephone
- GSM - Global System for Mobile Communications
- VCO - Voltage Controlled Oscillator
- PCS - Personal Communication System
- IF - Intermediate Frequency Filter
- RF - Radio Frequency Filter
- 3G - Third Generation Systems
- PCN - Personal Communications Network
- PHS - Personal Handyphone System
- CDMA - Code Division Multiple Access
- SCDMA - Synchronous Code Division Multiple Access
- VOFDM - Vector Orthogonal Frequency Division Multiplexing
- TDMA - Time Division Multiple Access
- EGSM - Extended Global System for Mobile
- AMPS - Advanced Mobile Phone System
- GSM - Global System for Mobile Communications
- SDH - Synchronous Digital Hierarchy
- DCS - Digital Communications System
- PDC - Personal Digital Cellular

► For Cellular Phone

RF Filters for Cellular Phone (TSF) Mobile Communications

Part Number	Center Freq. (MHz)	BW(MHz)	IL(dB)	System	Package	
					SMD Type	DIP Type
TSF452D50-S7	452.5	5.0	2.1	CDMA450 TX	DCC6	
TSF462D50-S7	462.5	4.6	2.5	CDMA450 RX	DCC6	
TSF455D00-S7	455.0	5.0	2.1	CDMA450 TX	DCC6	
TSF465D00-S7	465.0	4.6	2.5	CDMA450 RX	DCC6	
TSF481D25-S7	481.25	4.5	1.8	CDMA450 TX	DCC6	
TSF491D25-S7	491.25	4.5	2.4	CDMA450 RX	DCC6	
TSF836D50-S9	836.5	25	2.7	AMPS / CDMA TX	DCC6C	
TSF881D50-S9	881.5	25	2.7	AMPS / CDMA RX	DCC6C	
TSF897D50A-S7	897.5	26	3.0	EGSM TX	DCC6	
TSF897D50B-S7	897.5	30	2.7	EGSM TX	DCC6	
TSF942D50-S7	942.5	30	2.7	EGSM RX	DCC6	
TSF900D00A-S7	900	30	2.7	EGSM TX	DCC6	
TSF900D00B-S9	900	30	2.7	EGSM TX	DCC6C	
TSF945D00A-S7	945	30	2.7	EGSM RX	DCC6	
TSF945D00B-S9	945	30	2.7	EGSM RX	DCC6C	
TSF902D50A-S9	902.5	30	2.7	GSM TX	DCC6C	
TSF902D50B-S7	902.5	25	3.0	GSM TX	DCC6	
TSF947D50A-S9	947.5	30	2.7	GSM RX	DCC6C	
TSF947D50B-S7	947.5	25	3.0	GSM RX	DCC6	
TSF1747D50-S9	1747.5	75	3.5	PCN / DCS TX	DCC6C	
TSF1842D50-S9	1842.5	75	3.5	PCN / DCS RX	DCC6C	
TSF1855D00-S9	1855.0	30	3.0	K-PCS RX	DCC6C	



▶ For ISM Band Cordless Phone

RF Filters for ISM Band Cordless Phone (TSF) Mobile Communications

Part Number	Center Freq. (MHz)	BW(MHz)	IL(dB)	Package	
				SMD Type	DIP Type
TSF903D65-S7	903.65	+2	3.8	DCC6	
TSF915D00A-S7	915	26	3.5	DCC6	
TSF915D00B-S9	915	26	3.5	DCC6C	
TSF915D00C-S9	915	26	3.5	DCC6C	
TSF915D00D-S7	915	26	3.5	DCC6	
TSF915D00E-S9	915	7	3.2	DCC6C	
TSF915D00F-S7	915	7	3.0	DCC6	
TSF926D25-S7	926.25	+2	3.5	DCC6	

- 1dB Bandwidth : 6.75 MHz (CH1~CH5) ; 6.50 MHz
- Insertion Loss : 23.0 dB typical ; 6.50 dB typical (NDF25C)
- Passband Ripple :+ 0.6 dB ;+ 1.0 dB (NDF25C)



► For Cordless Phone

Duplexers for Cordless Phone (TSF) Mobile Communications

Part Number	Lower Freq. (MHz)	Upper Freq. (MHz)	IL(dB)	System	Package	
					SMD Type	DIP Type
TSF908D50A-S4	886	931	3.5 / 3.5	CT1+	QCC8C	
TSF908D50B-S4	886	931	3.5 / 3.5	CT1+	QCC8C	
TSF908D50C-S6	886	931	3.5 / 3.5	CT1+	QCC8B	
TSF908D50D-S6	886	931	3.5 / 3.5	CT1+	QCC8B	
TSF915D00A-S6	903	927	3.5 / 3.5	ISM band	QCC8B	
TSF915D00B-S6	903	927	3.5 / 3.5	ISM band	QCC8B	
TSF914D95A-S6	903.45	926.45	3.5 / 3.5	ISM band	QCC8B	
TSF914D95B-S6	903.45	926.45	3.5 / 3.5	ISM band	QCC8B	
TSF914D95C-D1	903.75	926.25	3.5 / 3.5	ISM band		TO-39
TSF914D95D-D1	903.75	926.25	3.5 / 3.5	ISM band		TO-39
TSF914D95E-S4	903.75	926.25	3.5 / 3.5	ISM band	QCC8C	
TSF914D95F-S4	903.75	926.25	3.5 / 3.5	ISM band	QCC8C	
TSF914D95G-S6	903.75	926.25	3.5 / 3.5	ISM band	QCC8B	
TSF914D95H-S6	903.75	926.25	3.5 / 3.5	ISM band	QCC8B	
TSF937D00A-D1	914.5	959.5	3.5 / 3.5	CT1		TO-39
TSF937D00B-D1	914.5	959.5	3.5 / 3.5	CT1		TO-39
TSF937D00C-S4	914.5	959.5	3.5 / 3.5	CT1	QCC8C	
TSF937D00D-S4	914.5	959.5	3.5 / 3.5	CT1	QCC8C	
TSF937D00E-S6	914.5	959.5	3.5 / 3.5	CT1	QCC8B	
TSF937D00F-S6	914.5	959.5	3.5 / 3.5	CT1	QCC8B	

► **For Pager Appl.**

For Pager Applications (TSF) Mobile Communications

Part Number	Center Freq. (MHz)	BW(MHz)	IL(dB)	Package	
				SMD Type	DIP Type
TSF139D00-D2	139	+4.0	6.5 max.		F-11
TSF147D00A-D2	147	+4.0	6.5 max.		F-11
TSF147D00B-S4	147	+4.0	6.5 max.	QCC8C	
TSF155D00A-D2	155	+4.0	6.5 max.		F-11
TSF155D00B-S4	155	+4.0	6.5 max.	QCC8C	
TSF163D00A-D2	163	+4.0	6.5 max.		F-11
TSF163D00B-S4	163	+4.0	6.5 max.	QCC8C	
TSF171D00A-D2	171	+4.0	6.5 max.		F-11
TSF171D00B-S4	171	+4.0	6.5 max.	QCC8C	
TSF281D00A-D2	281	+3.1	4.5 max.		F-11
TSF281D00B-S4	281	+4.0	4.5 max.	QCC8C	
TSF930D50A-D2	930.5	+2.0	4.5 max.		F-11
TSF930D50B-S4	930.5	+2.0	4.5 max.	QCC8C	
TSF930D50C-S7	930.5	+2.0	4.5 max.	DCC6	



► For Comm. Equipment

For Communication Equipment (TSF) Mobile Communications

Part Number	Center Freq. (MHz)	BW(MHz)	IL(dB)	System	Package	
					SMD Type	DIP Type
TSF35D42-S2	35.42	1.9 (1dB)	17.5	GPS	SMP-53	
TSF96D00B-S3	96	5 (1dB)	13.5	3G Base Station	SMP-53-S	
TSF96D00C-S1	96	+10	8.5	3G Base Station	SMP-03	
TSF110D00A-S4	110	2.12 (3dB)	3.5	GPS	QCC8C	
TSF110D00B-S1	110	4.0 (3dB)	9.0	Wireless LAN / Bluetooth	SMP-03	
TSF110D00C-S1	110	0.66 (1dB)	12	SCDMA	SMP-03	
TSF110D592A-S4	110.592	+0.576	3.5	DECT	QCC8C	
TSF110D592B-S1	110.592	+0.576	3.5	DECT	SMP-03	
TSF130D38A-S6	130.38	+0.63 min.	5.5 max.	AMPS / ADC	QCC8B	
TSF130D38B-S7	130.38	+0.63 min.	5.5 max.	AMPS / ADC	DCC6	
TSF199D00-S3	199	+0.1	7.0 max.	GSM Base Station	SMP-53-S	
TSF204D00-S1	204	0.7 (1dB)	10	SCDMA	SMP-03	
TSF240D00-S4	240	+3.85	11	Broadband	QCC8C	
TSF243D95A-S7	243.95	+0.11	2.0	PHS	DCC6	
TSF243D95B-S7	243.95	+0.11	2.2	PHS	DCC6	
TSF243D95C-S9	243.95	+0.11	2.0	PHS	DCC6C	
TSFD243D95D-S8	243.95	+0.11	2.0	PHS	QCC8D	
TSF243D95E-S8	243.95	+0.11	2.2	PHS	QCC8D	
TSF265D55-S8	265.55	+0.11	2.3	PHS	QCC8D	
TSF426D00-S2	426	6.5 (3dB)	22	Broadband Access / VOFDM	SMP-53	



Order Codes

Order Codes (TSF)

TSF	302D00	A	S1
Part Number	Center Freq.(MHz)	Series No.	Package
302D00	302 MHz	None	S1
310D00	310 MHz	A	S2
391D25	391.25 MHz	B	D1
		C	D2
		D	D3

▶ General Information

Advantage of Token Saw Devices

Token Electronics has gained a successful development of Saw components, due to our flexible design capabilities and cost-optimizing production facilities. In addition to our extensive offering of standard Saw devices, Token has diverse Engineering experience spanning hundreds of custom designed saw components, Band pass Filters, Low Loss Filters and saw based subsystems.

As Token Company Spirit:

- Honesty is our business policy.
- Perfection is our quality system.
- Sharing cost saving with customers is our business target.

Token reliably deliver high-quality components according to the each customer special needs with respect to performance, costs, and technology modifications.



Saw Resonators (TSR)

► Product Introduction

Saw Resonators (TSR) Can Replace LC Elements and Quartz Crystals.

Token Saw Resonator employs surface acoustic wave, and is able to be applied to high frequency circuit where conventional crystal, ceramic resonators are not available, as resonator oscillates stably with its fundamental mode over frequency range from 200 MHz to around 1 GHz.

The resonator uses arrays of metal strips, with pitch $\lambda/2$, as reflectors of the waves. These arrays can give strong Saw reflections, and two arrays can be used to form a Saw cavity with high Q. Such resonators are often used for high-stability oscillators.



(TSR) can be applied to many types of high frequency devices including RF remote controls, CATV FSK demodulators and CATV 2nd local oscillators. (TSR) resonator is ideal for applications such as automotive keyless entry, tire pressure monitoring, gate and door openers, personal and home security, and automated meter readers, wireless point of sale terminals, identification tags, bar code readers, and computer peripherals.

Token offers 2 type Resonators in terms of 1-port and 2-port.

1-Port Type:

- One-port, typically one-pole, resonators are used in oscillator applications.
- Most of the application circuit is Colpitts or similar type that can be made with low cost.
- 1-port resonator is basically a 2 terminal device and its application is similar to that of quartz bulk wave resonator or ceramic resonator.
- Also, it is also applicable to VCO (Voltage Controlled Oscillator) application.

2-Port Type:

- 2-port resonator is a kind of very narrow, low loss band-pass filter.
- Oscillation circuit is mostly like a RF amplifier with feedback loop.
- There are many varieties of two-port (multi-pole) resonator structures in production.

The (TSR) Resonator series has high stability; good temperature characteristics provided by quartz crystal substrate and are developed with Saw technology accumulated for Saw filters through Token's experience. In addition, (TSR) Resonator can be customized designs and other frequency requirements available on request. Contact us with your specific needs. For more information, please link to Token official website "[Saw Resistors](http://www.token.com.tw)".



▶ One Port Resonators

For Automotive Electronics & Remote Control (TSR) One Port Type

Part Number	Center Freq. (MHz)	IL(dB)	Package	
			SMD Type	DIP Type
TSR224D50-D2	224.5	1.2		F-11
TSR224D70-D1	224.7	1.4		TO-39
TSR265D00-D1	265	1.8		TO-39
TSR288D00-D1	288	1.5		TO-39
TSR293D125-S5	293.125	1.6	QCC4A	
TSR295D00-D1	295	1.5		TO-39
TSR300D00A-D1	300	1.3		TO-39
TSR300D00B-S4	300	1.3	QCC8C	
TSR300D00C-S4	300	1.5	QCC8C	
TSR300D3625-S4	300.3625	1.3	QCC8C	
TSR303D75-D1	303.75	1.5		TO-39
TSR303D825A-S5	303.825	1.2	QCC4A	
TSR303D825B-D1	303.825	1.5		TO-39
TSR303D825C-D2	303.825	1.3		F-11
TSR303D825D-S4	303.825	1.4	QCC8C	
TSR303D875A-D1	303.875	1.5		TO-39
TSR303D875B-D2	303.875	1.3		F-11
TSR303D875C-S5	303.875	1.6	QCC4A	
TSR303D875D-S4	303.875	1.4	QCC8C	
TSR303D948A-S5	303.948	1.5	QCC4A	
TSR303D948B-S4	303.948	1.3	QCC8C	
TSR304D00-D1	304	1.2		TO-39
TSR304D30A-D1	304.3	1.4		TO-39
TSR304D30B-S11	304.3	1.5	F11SMD	
TSR304D30C-S5	304.3	1.5	QCC4A	
TSR305D675-D1	305.675	1.8		TO-39
TSR306D00-D2	306	1.2		F-11
TSR308D50-D1	308.5	1.2		TO-39
TSR309D00-D1	309	1.3		TO-39
TSR310D00A-D1	310	1.4		TO-39
TSR310D00B-S5	310	1.1	QCC4A	
TSR310D00C-S4	310	1.3	QCC8C	
TSR311D00A-D1	311	1.5		TO-39
TSR311D00B-S4	311	1.5	QCC8C	
TSR311D063A-S5	311.063	1.3	QCC4A	
TSR311D063B-S4	311.063	1.3	QCC8C	
TSR312D00A-D1	312	1.3		TO-39
TSR312D00B-S5	312	1.3	QCC4A	
TSR312D00C-S4	312	1.2	QCC8C	
TSR314D50A-D1	314.5	1.5		TO-39
TSR314D50B-D2	314.5	1.5		F-11



Part Number	Center Freq. (MHz)	IL(dB)	Package	
			SMD Type	DIP Type
TSR314D50C-S5	314.5	1.3	QCC4A	
TSR314D50D-S4	314.5	1.2	QCC8C	
TSR314D50E-S11	314.5	1.6	F11SMD	
TSR315D00A-D1	315	1.5		TO-39
TSR315D00B-D2	315	1.5		F-11
TSR315D00C-D3	315	1.0		D-11
TSR315D00D-S5	315	1.3	QCC4A	
TSR315D00E-S4	315	1.4	QCC8C	
TSR315D00F-S9	315	1.5	DCC6C	
TSR315D00G-S7	315	1.3	DCC6	
TSR315D00H-S11	315	1.6	F11SMD	
TSR315D50A-D1	315.5	1.2		TO-39
TSR315D50B-D2	315.5	1.3		F-11
TSR315D50C-D3	315.5	1.3		D-11
TSR315D50D-S5	315.5	1.5	QCC4A	
TSR315D50E-S5	315.5	1.6	QCC4A	
TSR315D50F-S4	315.5	1.5	QCC8C	
TSR315D50G-S7	315.5	1.5	DCC6	
TSR315D50H-S9	315.5	1.3	DCC6C	
TSR316D025-D1	316.025	1.2		TO-39
TSR316D65-D1	316.65	1.3		TO-39
TSR316D80A-D1	316.8	1.3		TO-39
TSR316D80B-D2	316.8	1.3		F-11
TSR316D80C-S5	316.8	1.2	QCC4A	
TSR317D50-S5	317.5	1.2	QCC4A	
TSR318D00A-D1	318	1.0		TO-39
TSR318D00B-D2	318	1.0		F-11
TSR318D00C-S5	318	1.2	QCC4A	
TSR318D00D-S4	318	1.5	QCC8C	
TSR319D00-S4	319	1.0	QCC8C	
TSR319D50A-S5	319.5	1.3	QCC4A	
TSR319D50B-S4	319.5	1.3	QCC8C	
TSR320D00-D1	320	1.5		TO-39
TSR324D00-S4	324	1.5	QCC8C	
TSR325D00A-D1	325	1.6		TO-39
TSR325D00B-D2	325	1.6		F-11
TSR330D00A-D1	330	1.2		TO-39
TSR330D00B-D2	330	1.0		F-11
TSR333D00A-D1	333	1.3		TO-39
TSR333D00B-D2	333	1.3		F-11
TSR334D50-D2	334.5	1.8		F-11
TSR336D00-D3	336	1.5		D-11
TSR340D00A-D1	340	1.0		TO-39
TSR340D00B-S4	340	1.3	QCC8C	
TSR345D00A-D1	345	1.4		TO-39



Part Number	Center Freq. (MHz)	IL(dB)	Package	
			SMD Type	DIP Type
TSR345D00B-S5	345	1.5	QCC4A	
TSR345D00C-S4	345	1.5	QCC8C	
TSR350D00A-D1	350	1.3		TO-39
TSR350D00B-D2	350	1.0		F-11
TSR350D00C-S4	350	1.5	QCC8C	
TSR360D00A-D1	360	1.5		TO-39
TSR360D00B-D2	360	1.2		F-11
TSR360D00C-S4	360	1.3	QCC8C	
TSR360D00D-S5	360	1.2	QCC4A	
TSR370D00-S4	370	1.2	QCC8C	
TSR372D00-S5	372	1.2	QCC4A	
TSR372D50A-D1	372.5	1.0		TO-39
TSR372D50B-S5	372.5	1.2	QCC4A	
TSR372D50C-S4	372.5	1.4	QCC8C	
TSR380D00-D2	380	1.2		F-11
TSR384D05-D2	384.05	1.3		F-11
TSR388D95-D2	388.95	1.2		F-11
TSR390D00A-D1	390	1.2		TO-39
TSR390D00B-D2	390	1.4		F-11
TSR390D00C-S4	390	1.2	QCC8C	
TSR390D00D-S4	390	1.3	QCC8C	
TSR392D85-S4	392.85	1.3	QCC8C	
TSR395D00A-D1	395	1.5		TO-39
TSR395D00B-D2	395	1.0		F-11
TSR395D00C-S5	395	1.5	QCC4A	
TSR395D50A-D1	395.5	1.2		TO-39
TSR395D50B-D2	395.5	1.3		F-11
TSR396D00-D1	396	1.3		TO-39
TSR403D55A-D1	403.55	1.2		TO-39
TSR403D55B-S5	403.55	1.3	QCC4A	
TSR403D55C-S4	403.55	1.3	QCC8C	
TSR403D966A-S5	403.966	1.3	QCC4A	
TSR403D966B-S4	403.966	1.5	QCC8C	
TSR407D30A-D1	407.3	1.3		TO-39
TSR407D30B-S4	407.3	1.3	QCC8C	
TSR417D50A-D1	417.5	1.4		TO-39
TSR417D50B-S4	417.5	1.5	QCC8C	
TSR418D00A-D1	418	1.5		TO-39
TSR418D00B-D2	418	1.6		F-11
TSR418D00A-S5	418	1.2	QCC4A	
TSR418D00B-S4	418	1.6	QCC8C	
TSR418D00C-S6	418	1.7	QCC8B	
TSR418D00D-S9	418	1.8	DCC6C	
TSR419D95-D2	419.95	1.4		F-11
TSR423D22A-D1	423.22	1.3		TO-39



Part Number	Center Freq. (MHz)	IL(dB)	Package	
			SMD Type	DIP Type
TSR423D22B-D2	423.22	1.5		F-11
TSR423D22C-S5	423.22	1.6	QCC4A	
TSR423D22D-S4	423.22	1.6	QCC8C	
TSR426D00-S4	426	1.5	QCC8C	
TSR426D55-S4	426.55	1.5	QCC8C	
TSR430D50A-D1	430.5	2.0		TO-39
TSR430D50B-D2	430.5	2.2		F-11
TSR430D50C-D3	430.5	1.6		D-11
TSR430D65-D1	430.65	2.0		TO-39
TSR432D00-D2	432	1.2		F-11
TSR432D92A-D1	432.92	1.3		TO-39
TSR432D92B-S4	432.92	1.3	QCC8C	
TSR433D00-D1	433	1.0		TO-39
TSR433D385-S4	433.385	1.3	QCC8C	
TSR433D42A-D1	433.42	1.8		TO-39
TSR433D42B-S5	433.42	1.3	QCC4A	
TSR433D42C-S4	433.42	1.5	QCC8C	
TSR433D42D-S9	433.42	1.6	DCC6C	
TSR433D62-S9	433.62	1.6	DCC6C	
TSR433D85-D2	433.85	1.6		F-11
TSR433D92A-D1	433.92	1.8		TO-39
TSR433D92B-D1	433.92	1.5		TO-39
TSR433D92C-D1	433.92	2.6		TO-39
TSR433D92D-D1	433.92	1.3		TO-39
TSR433D92E-D1	433.92	1.1		TO-39
TSR433D92F-D2	433.92	1.3		F-11
TSR433D92G-D2	433.92	1.5		F-11
TSR433D92H-D3	433.92	1.0		D-11
TSR433D92I-S5	433.92	1.5	QCC4A	
TSR433D92J-S4	433.92	1.2	QCC8C	
TSR433D92K-S4	433.92	1.6	QCC8C	
TSR433D92L-S4	433.92	2.0	QCC8C	
TSR433D92M-S4	433.92	2.0	QCC8C	
TSR433D92N-S4	433.92	1.8	QCC8C	
TSR433D92O-S9	433.92	1.6	DCC6C	
TSR433D92P-S7	433.92	1.5	DCC6	
TSR433D92Q-S6	433.92	1.5	QCC8B	
TSR433D92R-S11	433.92	1.8	F11SMD	
TSR433D97-D1	433.97	1.1		TO-39
TSR434D40-D1	434.4	1.3		TO-39
TSR434D42A-D1	434.42	1.3		TO-39
TSR434D42B-S5	434.42	1.8	QCC4A	
TSR434D42C-S4	434.42	2.0	QCC8C	
TSR435D00-D1	435	1.2		TO-39
TSR435D72A-S5	435.72	1.3	QCC4A	



Part Number	Center Freq. (MHz)	IL(dB)	Package	
			SMD Type	DIP Type
TSR435D72B-S4	435.72	2.8	QCC8C	
TSR435D80-D1	435.8	1.3		TO-39
TSR440D80-D1	440.8	2.5		TO-39
TSR441D20A-D1	441.2	2.7		TO-39
TSR441D20B-D2	441.2	2.8		F-11
TSR447D699A-S5	447.699	1.3	QCC4A	
TSR447D699B-S4	447.699	1.0	QCC8C	
TSR447D725A-D1	447.725	1.5		TO-39
TSR447D725B-S5	447.725	1.6	QCC4A	
TSR479D50A-D1	479.5	1.3		TO-39
TSR479D50B-D2	479.5	1.5		F-11
TSR499D50-S4	499.5	1.2	QCC8C	
TSR500D00-D2	500	1.1		F-11
TSR567D00-D1	567	5.0		TO-39
TSR585D00-D2	585	1.8		F-11
TSR622D08A-D1	622.08	1.5		TO-39
TSR622D08B-S7	622.08	1.5	DCC6	
TSR643D75-S4	643.75	1.5	QCC8C	
TSR680D00-D2	680	0.9		F-11
TSR755D00-S7	755	1.2	DCC6	
TSR801D125-S7	801.125	1.2	DCC6	
TSR809D00A-D1	809	1.2		TO-39
TSR809D00B-S4	809	1.3	QCC8C	
TSR820D00-S9	820	1.4	DCC6C	
TSR854D00-S7	854	1.2	DCC6	
TSR857D30-D1	857.3	1.0		TO-39
TSR857D65A-D1	857.65	2.8		TO-39
TSR857D65B-S5	857.65	1.2	QCC4A	
TSR858D00-S7	858	1.4	DCC6	
TSR863D00-D1	863	1.0		TO-39
TSR864D00-D1	864	1.0		TO-39
TSR868D00A-D1	868	1.2		TO-39
TSR868D00B-S4	868	1.5	QCC8C	
TSR868D00C-S9	868	1.3	DCC6C	
TSR868D30A-D1	868.3	1.2		TO-39
TSR868D30B-S4	868.3	1.5	QCC8C	
TSR868D30C-S9	868.3	1.5	DCC6C	
TSR868D35A-D1	868.35	1.2		TO-39
TSR868D35B-D2	868.35	1.3		F-11
TSR868D35C-D3	868.35	1.2		D-11
TSR868D35D-S4	868.35	1.6	QCC8C	
TSR868D35E-S6	868.35	1.0	QCC8B	
TSR868D35F-S9	868.35	1.5	DCC6C	
TSR868D35G-S5	868.35	1.7	QCC4A	
TSR868D75-S4	868.75	1.8	QCC8C	



Part Number	Center Freq. (MHz)	IL(dB)	Package	
			SMD Type	DIP Type
TSR868D95A-D1	868.95	1.3		TO-39
TSR868D95B-S4	868.95	1.8	QCC8C	
TSR868D95C-S9	868.95	1.6	DCC6C	
TSR902D30-S4	902.3	1.3	QCC8C	
TSR902D50-S4	902.5	1.3	QCC8C	
TSR904D30A-D1	904.3	2.8		TO-39
TSR904D30B-S5	904.3	3.4	QCC4A	
TSR905D80-S4	905.8	1.5	QCC8C	
TSR910D00-S4	910	1.2	QCC8C	
TSR912D00A-D1	912	1.3		TO-39
TSR912D00B-S4	912	1.5	QCC8C	
TSR912D00C-S7	912	1.0	DCC6	
TSR914D50A-S4	914.5	1.8	QCC8C	
TSR914D50B-S5	914.5	2.0	QCC4A	
TSR915D00A-D1	915	1.6		TO-39
TSR915D00B-S5	915	1.6	QCC4A	
TSR915D00C-S4	915	1.8	QCC8C	
TSR915D00D-S9	915	1.3	DCC6C	
TSR916D50A-D1	916.5	1.2		TO-39
TSR916D50B-S5	916.5	1.5	QCC4A	
TSR916D50C-S4	916.5	1.5	QCC8C	
TSR925D00-S4	925	2.4	QCC8C	
TSR927D00-S7	927	1.3	DCC6	
TSR927D20-S7	927.2	1.3	DCC6	
TSR930D50-D1	930.5	1.3		TO-39
TSR980D00A-D1	980	1.3		TO-39
TSR980D00B-S5	980	1.5	QCC4A	
TSR980D00C-S4	980	1.5	QCC8C	



▶ Two Port Resonators

For Automotive Electronics & Remote Control (TSR) Two Port Type

Part Number	Center Freq. (MHz)	IL(dB)	Package	
			SMD Type	DIP Type
TSR217D25-D1	217.25	4.5		TO-39
TSR284D00-D1	284	5.0		TO-39
TSR310D00-D1	310	5.5		TO-39
TSR315D00A-D1	315	5.0		TO-39
TSR315D00B-D2	315	5.0		F-11
TSR315D00C-S4	315	5.0	QCC8C	
TSR380D00A-D1	380	6.0		TO-39
TSR380D00B-S11	380	5.5	F11SMD	
TSR384D05-D1	384.05	6.0		TO-39
TSR392D00-D1	392	5.5		TO-39
TSR403D55A-D1	403.55	6.0		TO-39
TSR403D55B-S4	403.55	5.0	QCC8C	
TSR418D00A-D1	418	6.0		TO-39
TSR418D00B-S4	418	6.0	QCC8C	
TSR423D22-D1	423.22	6.0		TO-39
TSR433D42-D1	433.42	6.0		TO-39
TSR433D92A-D1	433.92	6.0		TO-39
TSR433D92B-D2	433.92	6.0		F-11
TSR433D92C-S4	433.92	6.0	QCC8C	
TSR433D92D-S5	433.92	6.0	QCC4A	
TSR433D92E-S7	433.92	6.5	DCC6	
TSR780D00-S4	780	6.5	QCC8C	
TSR824D25-D1	824.25	6.5		TO-39
TSR865D00-D1	865	6.0		TO-39
TSR868D30-D1	868.3	6.0		TO-39
TSR868D30-S4	868.3	6.0	QCC8C	
TSR868D35-S4	868.35	6.5	QCC8C	
TSR873D00-S4	873	7.0	QCC8C	
TSR906D00-D1	906	6.5		TO-39
TSR915D00-S4	915	6.5	QCC8C	
TSR916D50-S4	916.5	6.5	QCC8C	
TSR934D00-D1	934	7.0		TO-39
TSR1090D00-D1	1090	6.5		TO-39



Order Codes

Order Codes (TSR)

TSR	224D50		A	S1
Part Number	Center Freq.(MHz)		Series No.	Package
224D50	224.5 MHz		None	S1
306D00	306 MHz		A	S2
384D05	384.05 MHz		B	D1
			C	D2
			D	D3

▶ **General Information**

| **Advantage of Token Saw Devices**

Token Electronics has gained a successful development of Saw components, due to our flexible design capabilities and cost-optimizing production facilities. In addition to our extensive offering of standard Saw devices, Token has diverse Engineering experience spanning hundreds of custom designed saw components, Band pass Filters, Low Loss Filters and saw based subsystems.

As Token Company Spirit:

- Honesty is our business policy.
- Perfection is our quality system.
- Sharing cost saving with customers is our business target.

Token reliably deliver high-quality components according to the each customer special needs with respect to performance, costs, and technology modifications.

