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 Filters".

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 bandwith 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 piezoelastic 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 transadmittance 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 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.