

kHz Filters

Introduction

The kHz ceramic filters were originally designed for AM radio applications that used 450kHz or 455kHz as a radio IF frequency. In the past, engineers would use tunable coils to achieve the required IF filtering for AM radios. Ceramic filters replaced this type of tuned filter, offering a tuning free product that had excellent filter characteristics at a low cost. Murata's kHz ceramic IF filters are fundamentally ladder filters. You will see later that MHz filters are not ladder filters, but rather are monolithic in construction (multiple elements on one piece of ceramic).

A ladder filter uses series and parallel resonant elements (or resonators) to achieve a particular filtering characteristic (Figure 35).

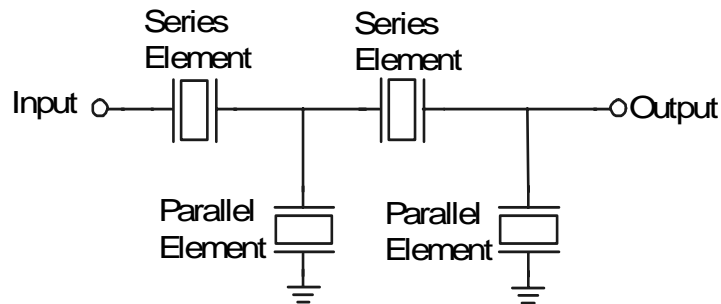


Figure 35: Connection Diagram of Resonate elements in kHz Filter

The more series and parallel elements in a ladder filter, the steeper the sides of the passband and the greater the ability of the filter to reject or attenuate the frequencies not in the pass-band of the filter.

How Does It Work

It has been mentioned that the filter uses resonators in a ladder configuration, but it can be hard to understand how a ceramic resonator may be used to construct a filter. To simplify the explanation, we will examine the operation of a two-element ladder filter (Figure 36).

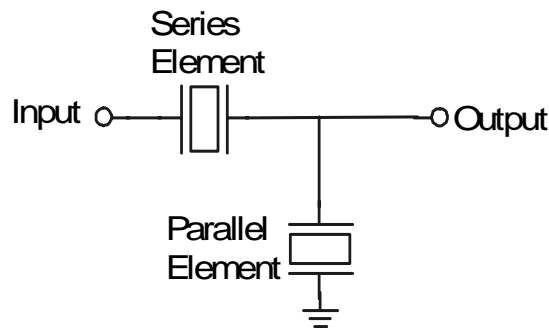


Figure 36: Two Element kHz Filter Example

To begin the discussion, one must have a basic understanding of the electrical characteristics of a resonator, specifically its impedance response. A ceramic resonator has the impedance response shown in Figure 37.

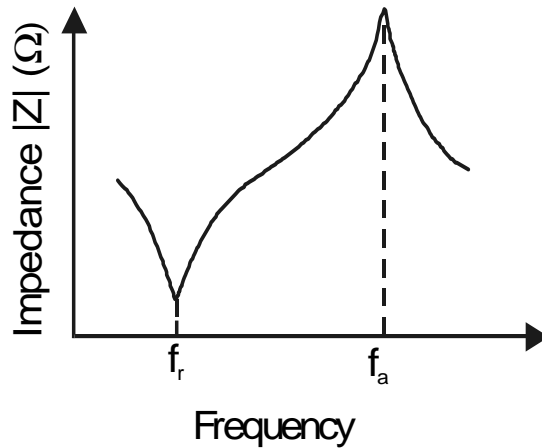


Figure 37: Impedance Plot of Ceramic Resonator

As can be seen from Figure 37, a ceramic resonator has two key impedance parameters: f_r and f_a . f_r is the frequency where the resonator's impedance is the lowest and f_a is the frequency where the resonator's impedance is the highest. For a normal resonator, the resonator will oscillate somewhere between these two frequencies, or, in other words, between the impedance minimum and maximum.

By combining two resonators in a ladder configuration where one resonator is the series element and one resonator is the parallel element of the filter, a band pass filter type of performance can be achieved. Figure 38 illustrates this.

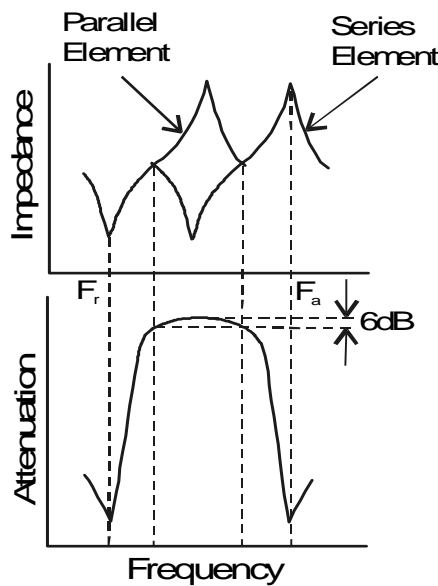


Figure 38: Resonators Combined to Achieve Bandpass Filter

As shown in Figure 38, the impedances at f_r and f_a of the parallel and series resonant elements are used to make the band pass characteristic. The impedance of the parallel element at f_r is used to make the band pass filter's attenuation point below the pass band. The impedances at f_a of the parallel element and at f_r of the series element make the band itself. Finally, the impedance at f_a of the series element is used to make the band pass filter's attenuation point above the pass band. By using these impedances, the basic band pass characteristics are achieved. By increasing the number of elements, the selectivity and stop-band attenuation are improved.

At any frequency below f_r and above f_a , resonators are electrically equivalent to capacitors. To attenuate frequencies in the stopband of the filter, the shunt capacitance of the parallel resonant elements must be much larger than that of the series resonant elements.

Parts

The following series of tables will cover the kHz filter part numbering structure, show the difference between the various kHz filter series, and provide a chart of electrical characteristics for each series

Figure 39 shows basic kHz filter part numbering structure.

Table 6 shows current available kHz filter series and describes each series generally. Some older series are shown for reference purposes, so all series with an asterisk (*) are not available for new designs and may be obsolete.

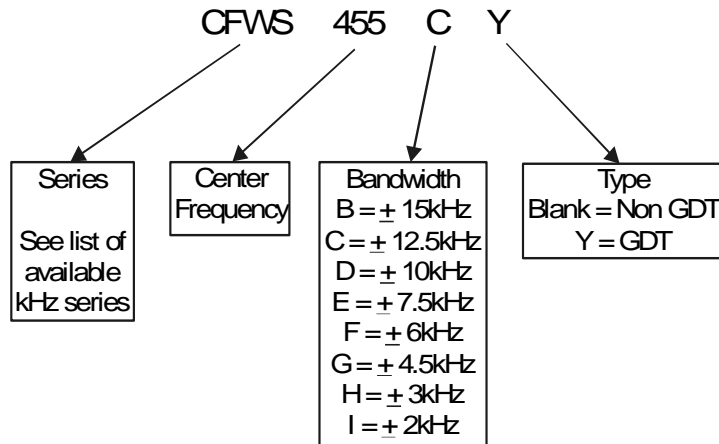


Figure 39: kHz Filter Part Numbering System

kHz Filter Series Type	Description	GDT Type	Metal or Plastic Case	SMD	Promoted In US
CFYM Series*	Miniature 2 element IF filter	N	P	N	N
CFU Series*	4 element IF filter	N	P	N	Y
CFUM Series	Miniature version of CFU series	N	P	N	Y
CFWM Series	Miniature version of CFW series	N	P	N	Y
CFWS Series	6 element IF filter. Lower profile than the CFW series Replaces CFW series filter.	N	P	N	Y
CFV Series*	7 element IF filter	N	P	N	N
CFVS Series*	7 element low profile version of the CFV series	N	P	N	N
CFVM Series*	Miniature version of the CFV series	N	P	N	Y
CFZM Series*	Miniature high performance 9 element IF filter	N	P	N	Y
CFUS...Y Series*	4 element GDT IF filter. Replaces SFG series	Y	P	N	Y
CFUM...Y Series	Miniature version of CFUS...Y series. Replaces SFGM series	Y	P	N	Y
CFWS...Y Series	6 element GDT IF filter. Replaces SFH series	Y	P	N	Y
CFWM...Y Series	Miniature version of CFWS...Y series. Replaces SFHM series	Y	P	N	Y
SFPC Series	Low cost (5mm) 4 element SMD IF filter	N	P	Y	Y
CFUCG Series	Low Profile (4mm) 4 element SMD IF filter. Typically narrower bandwidths only.	N	P	Y	Y
CFUCG...X Series	Low Profile (4mm) 4 element mid-GDT SMD IF filter. Typically narrower bandwidths only.	Y	P	Y	Y
SFGCG Series	Low Profile (4mm) 4 element GDT SMD IF filter. Typically wider bandwidths only.	Y	P	Y	Y

Table 6. kHz Filter Description (all SMD parts are on tape and part numbers end in "-TC")

CFUCJ Series*	Low Profile (4mm) 4 element SMD IF filter. Typically narrower bandwidths only. "Y" version (GDT) possible for wider bandwidths.	Y/N	P	Y	Limited
CFUCH Series	Low Profile (3mm) 4 element SMD IF filter. Typically narrower bandwidths only. "Y" version (GDT) possible for wider bandwidths.	Y/N	P	Y	Limited
CFWC Series	Low Profile (3mm) 6 element SMD IF filter. Typically narrower bandwidths only. "Y" version (GDT) possible for wider bandwidths.	Y/N	P	Y	Limited
CFZC Series	Low Profile (3mm) 8 element SMD IF filter. Typically narrower bandwidths only. "Y" version (GDT) possible for wider bandwidths.	Y/N	P	Y	Limited
CFUXC Series	Low Profile (2mm) 4 element SMD IF filter.	Y	P	Y	Y
CFJ Series*	11 element IF filter. 455kHz version only.	N	M	N	Y
CFG Series*	A miniature 7 element filter with performance like CFM Series. 455kHz version only.	N	M	N	Y
CFX Series*	A miniature 9 element filter with performance like CFL Series. 455kHz version only.	N	M	N	Y
CFL Series*	A miniature 9 element filter with performance like CFR Series. 455kHz version only.	N	M	N	Y
CFK Series*	A miniature 11 element filter with performance like CFS series. 455kHz version only	N	M	N	Y
CFM Series*	9 element filter. 455kHz version only	N	M	N	Y
CFR Series*	11 element filter. 455kHz version only.	N	M	N	Y
CFS Series*	Highest selectivity: 15 element filter. 455kHz version only.	N	M	N	Y
CFKR Series*	Highly selective GDT 11 element filter. For narrower bandwidths. 455kHz version only.	Y	M	N	Y
CFL...G series*	Highly selective GDT 9 element filter. For wider bandwidths. 455kHz version only.	Y	M	N	Y

Table 6. kHz Filter Description (all SMD parts are on tape and part numbers end in “-TC”)

Table 7 provides a more detailed performance description for the common kHz filter parts in each series.

Part Number (450kHz also available)	Nominal Center Frequency (kHz)	3dB Band- width (kHz) min.	6dB Band- width (kHz) min.	20 dB Band- width (kHz) max.	Attenuation 455+100kHz (dB) min.	Insertion Loss (dB)	Input/ output Impedance (Ω)	
CFYM Series*								
CFYM455B	455	-----	± 15	± 30	11	4	1,500	
CFYM455C	455	-----	± 12.5	± 24	12	4	1,500	
CFYM455D	455	-----	± 10	± 20	12	4	1,500	
CFYM455E	455	-----	± 7.5	± 15	12	4	1,500	
CFYM455F	455	-----	± 6	± 12.5	12	4	2,000	
				40 dB Band- width (kHz) max.				Ripple (dB) max.
CFU Series*								
CFU455B2	455 \pm 2	-----	± 15	± 30	27	4	1,500	3 (455 \pm 10)
CFU455C2	455 \pm 2	-----	± 12.5	± 24	27	4	1,500	4 (455 \pm 8)
CFU455D2	455 \pm 1.5	-----	± 10	± 20	27	4	1,500	2 (455 \pm 7)
CFU455E2	455 \pm 1.5	-----	± 7.5	± 15	27	6	1,500	1.5 (455 \pm 5)
CFU455F2	455 \pm 1.5	-----	± 6	± 12.5	27	6	2,000	1.5 (455 \pm 4)
CFU455G2	455 \pm 1	-----	± 4.5	± 10	25	6	2,000	1.5 (455 \pm 3)
CFU455H2	455 \pm 1	-----	± 3	± 9	25	6	2,000	2 (455 \pm 2)
CFU455I2	455 \pm 1	-----	± 2	± 7.5	25	6	2,000	2 (455 \pm 1.5)
CFU455HT	455 \pm 1	-----	± 3	± 9	35	6	2,000	2 (455 \pm 2)
CFU455IT	455 \pm 1	-----	± 2	± 7.5	35	6	2,000	2 (455 \pm 1.5)

Table 7. kHz Filters (455kHz shown, but 450kHz version also available for most filters)

CFUM Series									
CFUM455B	455	-----	± 15	± 30	27	4	1,500	-----	
CFUM455C	455	-----	± 12.5	± 24	27	4	1,500	-----	
CFUM455D	455	-----	± 10	± 20	27	4	1,500	2 (455 \pm 7)	
CFUM455E	455	-----	± 7.5	± 15	27	6	1,500	1.5 (455 \pm 5)	
CFUM455F	455	-----	± 6	± 12.5	27	6	2,000	1.5 (455 \pm 4)	
CFUM455G	455	-----	± 4.5	± 10	25	6	2,000	1.5 (455 \pm 3)	
CFUM455H	455	-----	± 3	± 9	35	6	2,000	1.5 (455 \pm 2)	
CFUM455I	455	-----	± 2	± 7.5	35	7	2,000	2 (455 \pm 1.5)	
CFWS Series									
CFWS455B	455	-----	± 15	± 30	35	4	1,500	3 (455 \pm 10)	
CFWS455C	455	-----	± 12.5	± 24	35	4	1,500	3 (455 \pm 8)	
CFWS455D	455	-----	± 10	± 20	35	4	1,500	3 (455 \pm 7)	
CFWS455E	455	-----	± 7.5	± 15	35	6	1,500	3 (455 \pm 5)	
CFWS455F	455	-----	± 6	± 12.5	35	6	2,000	3 (455 \pm 4)	
CFWS455G	455	-----	± 4.5	± 10	35	6	2,000	2 (455 \pm 3)	
CFWS455HT	455	-----	± 3	± 9	60	6	2,000	2 (455 \pm 2)	
CFWS455IT	455	-----	± 2	± 7.5	60	6	2,000	2 (455 \pm 1.5)	
CFWM Series									
CFWM455B	455	-----	± 15	± 30	35	4	1,500	3 (455 \pm 10)	
CFWM455C	455	-----	± 12.5	± 24	35	4	1,500	3 (455 \pm 8)	
CFWM455D	455	-----	± 10	± 20	35	4	1,500	3 (455 \pm 7)	
CFWM455E	455	-----	± 7.5	± 15	35	6	1,500	3 (455 \pm 5)	
CFWM455F	455	-----	± 6	± 12.5	35	6	2,000	3 (455 \pm 4)	
CFWM455G	455	-----	± 4.5	± 10	35	6	2,000	2 (455 \pm 3)	
CFWM455H	455	-----	± 3	± 9	55	6	2,000	2 (455 \pm 2)	
CFWM455I	455	-----	± 2	± 7.5	55	7	2,000	2 (455 \pm 1.5)	
CFV Series*				60 dB Band-width (kHz) max.					Spurious 0.1-1 MHz (dB) min.
CFV455B	455	± 10	± 15	± 25	50	4	1,000	3	25
CFV455C	455	± 9	± 13	± 23	50	4	1,000	3	25
CFV455D	455	± 7	± 10	± 20	50	4	1,500	3	25
CFV455E	455	± 5.5	± 8	± 16	50	6	1,500	3	25
CFV455E10	455	± 5	± 7	± 12.5	50	6	1,500	3	25
CFV455F	455	± 4.2	± 6	± 12	50	6	1,500	3	25
CFV455G	455	-----	± 4	± 10	50	6	1,500	3	25
CFV455H	455	-----	± 3	± 7.5	50	6	1,500	3	25
CFV455I	455	-----	± 2	± 5	50	6	2,000	3	25
CFVS Series*									
CFVS455D	455	± 7	± 10	± 20	50	4	1,500	3	25
CFVS455E	455	± 5.5	± 8	± 16	50	6	1,500	3	25
CFVS455E10	455	± 5	± 7	± 12.5	50	6	1,500	3	25
CFVS455F	455	± 4.2	± 6	± 12	50	6	1,500	3	25
CFVS455G	455	-----	± 4	± 10	50	6	1,500	3	25
CFVS455H	455	-----	± 3	± 7.5	50	6	1,500	3	25
CFVM Series*									
CFVM455B	455	± 10	± 15	± 25	50	4	1,000	3	25
CFVM455C	455	± 9	± 13	± 23	50	4	1,000	3	25
CFVM455D	455	± 7	± 10	± 20	50	4	1,500	3	25
CFVM455E	455	± 5.5	± 8	± 16	50	6	1,500	3	25

Table 7. kHz Filters (455kHz shown, but 450kHz version also available for most filters)

CFVM455E10	455	± 5	± 7	± 12.5	50	6	1,500	3	25	
CFVM455F	455	± 4.2	± 6	± 12	50	6	1,500	3	25	
CFVM455G	455	-----	± 4	± 10	50	6	1,500	3	25	
CFVM455H	455	-----	± 3	± 7.5	50	6	1,500	3	25	
CFZM Series*				70 dB Bandwidth (kHz) max.						
CFZM455B	455	± 10	± 15	± 25	70	4	1,000	3	40	
CFZM455C	455	± 9	± 13	± 23	70	4	1,000	3	40	
CFZM455D	455	± 7	± 10	± 20	70	4	1,500	3	40	
CFZM455E	455	± 5.5	± 8	± 16	70	6	1,500	3	40	
CFZM455E10	455	± 5	± 7	± 12.5	70	6	1,500	3	40	
CFZM455F	455	± 4.2	± 6	± 12	70	6	1,500	3	50	
CFZM455G	455	-----	± 4	± 10	70	6	1,500	3	50	
CFZM455H	455	-----	± 3	± 7.5	70	7	1,500	3	50	
CFUS...Y Series*				40 dB Bandwidth (kHz) max.						G.D.T. Deviation Typical (μS)
CFUS455BY	455±1.5	-----	± 15	± 35	25	5	1,500	1	-----	(15) (± 10kHz)
CFUS455CY	455±1.5	-----	± 12.5	± 30	25	6	1,500	1	-----	(15) (± 8kHz)
CFUS455DY	455±1	-----	± 10	± 25	23	7	1,500	1	-----	(20) (± 7kHz)
CFUS455EY	455±1	-----	± 7.5	± 20	23	8	1,500	1	-----	(20) (± 5kHz)
CFUS455FY	455±1	-----	± 6	± 17.5	23	9	2,000	1	-----	(20) (± 4kHz)
CFUS455GY	455±1	-----	± 4.5	± 15	23	10	2,000	1	-----	(20) (± 3kHz)
CFUM...Y Series										
CFUM455BY	455±1.5	-----	± 15	± 35	25	5	1,500	-----	-----	(15) (± 10kHz)
CFUM455CY	455±1.5	-----	± 12.5	± 30	25	6	1,500	-----	-----	(15) (± 8kHz)
CFUM455DY	455±1	-----	± 10	± 25	23	7	1,500	-----	-----	(20) (± 7kHz)
CFUM455EY	455±1	-----	± 7.5	± 20	23	8	1,500	-----	-----	(20) (± 5kHz)
CFUM455FY	455±1	-----	± 6	± 17.5	23	9	2,000	-----	-----	(20) (± 4kHz)
CFUM455GY	455±1	-----	± 4.5	± 15	20	10	2,000	-----	-----	(20) (± 3kHz)
CFWS...Y Series				50 dB Bandwidth (kHz) max.						
CFWS455BY	455±1.5	-----	± 15	± 35	35	6	1,500	-----	-----	(30) (± 10kHz)
CFWS455CY	455±1.5	-----	± 12.5	± 30	35	7	1,500	-----	-----	(30) (± 8kHz)
CFWS455DY	455±1	-----	± 10	± 25	35	8	1,500	-----	-----	(30) (± 7kHz)
CFWS455EY	455±1	-----	± 7.5	± 20	35	9	1,500	-----	-----	(30) (± 5kHz)
CFWS455FY	455±1	-----	± 6	± 17.5	35	10	2,000	-----	-----	(40) (± 4kHz)
CFWS455GY	455±1	-----	± 4.5	± 15	35	13	2,000	-----	-----	(40) (± 3kHz)
CFUXC Series										
CFUXC450A100H	450	-----	± 17.5	± 55	50	5	2,000	0.5	40	(15) (± 12kHz)
CFUXC450B100H	450	-----	± 15	± 50	47	6	2,000	0.5	40	(15) (± 10kHz)
CFUXC450C100H	450	± 9 to ± 12	-----	± 35	47	6	2,000	0.5	40	(27) (± 10.5kHz)
CFWM...Y Series										
CFWM455BY	455±1.5	-----	± 15	± 35	35	6	1,500	-----	-----	(30) (± 10kHz)
CFWM455CY	455±1.5	-----	± 12.5	± 30	35	7	1,500	-----	-----	(30) (± 8kHz)
CFWM455DY	455±1	-----	± 10	± 25	35	8	1,500	-----	-----	(30) (± 7kHz)
CFWM455EY	455±1	-----	± 7.5	± 20	35	9	1,500	-----	-----	(30) (± 5kHz)
CFWM455FY	455±1	-----	± 6	± 17.5	35	10	2,000	-----	-----	(40) (± 4kHz)
CFWM455GY	455±1	-----	± 4.5	± 15	35	13	2,000	-----	-----	(40) (± 3kHz)

Table 7. kHz Filters (455kHz shown, but 450kHz version also available for most filters)

SFPC Series				40 dB Bandwidth (kHz) max.						
SFPC455D	455±1.5	-----	± 10	± 20	27	4	1,500	2	-----	-----
SFPC455E	455±1.5	-----	± 7.5	± 15	27	6	1,500	1.5	-----	-----
SFPC455F	455±1.5	-----	± 6	± 12.5	27	6	1,500	1.5	-----	-----
SFPC455G	455±1	-----	± 4.5	± 10	25	6	1,500	1.5	-----	-----
SFPC455H	455±1	-----	± 3	± 9	25	6	2,000	1.5	-----	-----
CFUCG Series										
CFUCG455D	455±1.5	-----	± 10	± 20	27	4	1,500	2	-----	-----
CFUCG455E	455±1.5	-----	± 7.5	± 15	27	6	1,500	1.5	-----	-----
CFUCG455F	455±1.5	-----	± 6	± 12.5	27	6	1,500	1.5	-----	-----
CFUCG455G	455±1	-----	± 4.5	± 10	25	6	1,500	1.5	-----	-----
CFUCG...X Series										G.D.T. Deviation (µS) max.
CFUCG455EX	455±1.5	-----	± 7.5	± 17.5	27	6	1,500	1	-----	25
CFUCG455FX	455±1.5	-----	± 6	± 15	27	6	1,500	1	-----	25
CFUCG455GX	455±1	-----	± 4.5	± 12.5	25	6	1,500	1	-----	25
CFUCG455HX	455±1	-----	± 3	± 10	25	7	1,500	1	-----	25
SFGCG Series										
SFGCG455AX	455±2	-----	± 17.5	± 40	25	4	1,000	1	-----	15
SFGCG455BX	455±1.5	-----	± 15	± 35	25	5	1,000	1	-----	15
SFGCG455CX	455±1.5	-----	± 12.5	± 30	25	6	1,000	1	-----	15
SFGCG455DX	455±1	-----	± 10	± 25	23	7	1,500	1	-----	20
SFGCG455EX	455±1	-----	± 7.5	± 20	23	8	1,500	1	-----	20
CFWC Series				50 dB Bandwidth (kHz) max.						
CFWC455C	455	-----	± 12.5	± 24	45	4	1,500	3 (455±8)	-----	-----
CFWC455D	455	-----	± 10	± 20	50	4	1,500	3 (455±7)	-----	-----
CFWC455E	455	-----	± 7.5	± 15	50	6	1,500	3 (455±5)	-----	-----
CFWC455F	455	-----	± 6	± 12.5	50	6	1,500	3 (455±4)	-----	-----
CFWC455G	455	-----	± 4.5	± 11	50	6	1,500	2 (455±3)	-----	-----
CFJ Series*				60 dB Bandwidth (kHz) max.						
CFJ455	455	-----	2.4 (Total)	4.5 (Total)	-----	6	2,000	2	60 (40 at 600 - 700 kHz)	-----
CFJ455	455	-----	±1.1 - ±1.3	4.5 (Total)	-----	7	2,000	2	60 (40 at 600 - 700 kHz)	-----
CFJ455	455	-----	1.0 (Total)	3.0 (Total)	60	8	2,000	1.5	-----	-----
CFG Series*										
CFG455B	455	± 10	± 15	± 25	50	4	1,000	3	25	-----
CFG455C	455	± 9	± 13	± 23	50	4	1,000	3	25	-----
CFG455D	455	± 7	± 10	± 20	50	4	1,000	3	25	-----
CFG455E	455	± 5.5	± 8	± 16	50	6	1,500	3	25	-----
CFG455E10	455	± 5	± 7	± 12.5	50	6	1,500	3	25	-----
CFG455F	455	± 4.2	± 6	± 12	50	6	1,500	3	25	-----
CFG455G	455	-----	± 4	± 10	50	6	1,500	3	25	-----
CFG455H	455	-----	± 3	± 7.5	50	6	1,500	3	25	-----
CFG455I	455	-----	± 2	± 5	50	6	2,000	3	25	-----
CFG455J	455	-----	± 1.5	± 4.5	50	8	2,000	3	25	-----
CFX Series*										

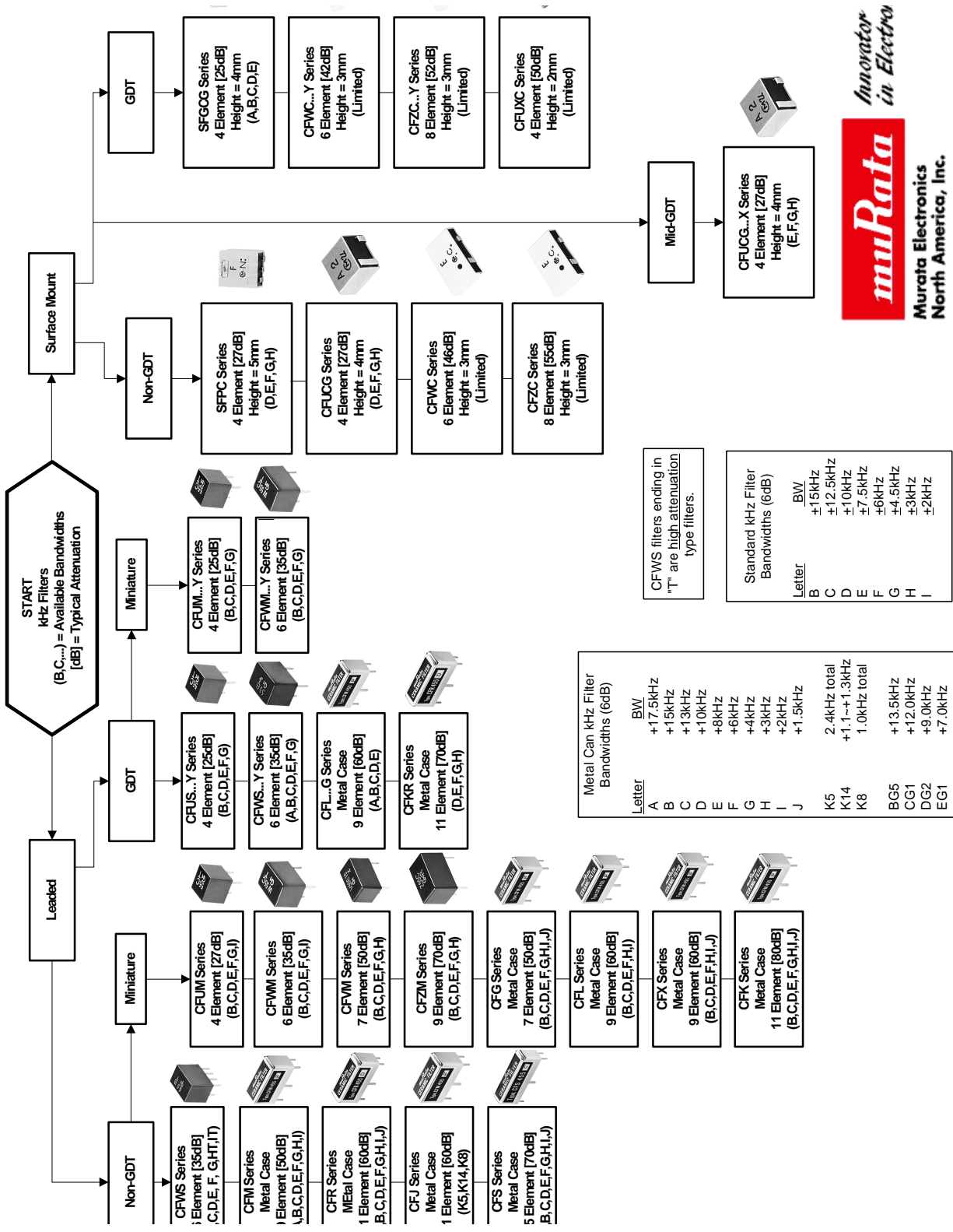
Table 7. kHz Filters (455kHz shown, but 450kHz version also available for most filters)

CFX455B	455	± 10	± 15	± 25	70	4	1,000	3	40	-----
CFX455C	455	± 9	± 13	± 23	70	4	1,000	3	40	-----
CFX455D	455	± 7	± 10	± 20	70	4	1,500	3	40	-----
CFX455E	455	± 5.5	± 8	± 16	70	6	1,500	3	40	-----
CFX455E10	455	± 5	± 7	± 12.5	70	6	1,500	3	40	-----
CFX455F	455	± 4.2	± 6	± 12	70	6	1,500	3	50	-----
CFX455G	455	-----	± 4	± 10	70	6	1,500	3	50	-----
CFX455H	455	-----	± 3	± 7.5	70	7	1,500	3	50	-----
CFX455I	455	-----	± 2	± 5	70	8	2,000	3	50	-----
CFX455J	455	-----	± 1.5	± 4.5	70	8	2,000	3	50	-----
CFL Series*										
CFL455B	455	± 10	± 15	± 25	60	4	1,000	3	40	-----
CFL455C	455	± 9	± 13	± 23	60	4	1,000	3	40	-----
CFL455D	455	± 7	± 10	± 20	60	4	1,500	3	40	-----
CFL455E	455	± 5.5	± 8	± 16	60	6	1,500	3	40	-----
CFL455E10	455	± 5	± 7	± 12.5	60	6	1,500	3	40	-----
CFL455F	455	± 4.2	± 6	± 12	60	6	1,500	3	40	-----
CFL455G	455	-----	± 4	± 10	60	6	1,500	3	40	-----
CFL455H	455	-----	± 3	± 7.5	60	7	1,500	3	40	-----
CFL455I	455	-----	± 2	± 5	60	8	2,000	3	40	-----
CFK Series*										
CFK455B	455	± 10	± 15	± 25	80	4	1,000	3	50	-----
CFK455C	455	± 9	± 13	± 23	80	4	1,000	3	50	-----
CFK455D	455	± 7	± 10	± 20	80	4	1,500	3	50	-----
CFK455E	455	± 5.5	± 8	± 16	80	6	1,500	3	50	-----
CFK455E10	455	± 5	± 7.5	± 12.5	80	6	1,500	3	50	-----
CFK455F	455	± 4.2	± 6	± 12	80	6	2,000	3	50	-----
CFK455G	455	-----	± 4	± 10	80	6	2,000	3	50	-----
CFK455H	455	-----	± 3	± 7.5	80	7	2,000	3	50	-----
CFK455I	455	-----	± 2	± 5	70	8	2,000	3	50	-----
CFK455J	455	-----	± 1.5	± 4.5	70	8	2,000	3	50	-----
CFM Series*										
CFM455A	455	± 13	± 17.5	± 30	50	3	1,000	3	30	-----
CFM455B	455	± 10	± 15	± 25	50	3	1,000	3	30	-----
CFM455C	455	± 9	± 13	± 23	50	3	1,000	3	30	-----
CFM455D	455	± 7	± 10	± 20	50	3	1,500	3	30	-----
CFM455E	455	± 5.5	± 8	± 16	45	5	1,500	3	30	-----
CFM455F	455	± 4.2	± 6	± 12	45	6	2,000	3	30	-----
CFM455G	455	-----	± 4	± 10	45	6	2,000	3	30	-----
CFM455H	455	-----	± 3	± 7.5	45	6	2,000	3	30	-----
CFM455I	455	-----	± 2	± 5	45	7	2,000	3	30	-----
CFR Series*										
CFR455A	455	± 13	± 17.5	± 30	60	4	1,000	3	40	-----
CFR455B	455	± 10	± 15	± 25	60	4	1,000	3	40	-----
CFR455C	455	± 9	± 13	± 23	60	4	1,000	3	40	-----
CFR455D	455	± 7	± 10	± 20	60	4	1,500	3	40	-----
CFR455E	455	± 5.5	± 8	± 16	55	6	1,500	3	40	-----
CFR455F	455	± 4.2	± 6	± 12	55	6	2,000	3	40	-----
CFR455G	455	-----	± 4	± 10	55	6	2,000	3	40	-----
CFR455H	455	-----	± 3	± 7.5	55	7	2,000	3	40	-----
CFR455I	455	-----	± 2	± 5	55	8	2,000	3	40	-----
CFR455J	455	-----	± 1.5	± 4.5	55	8	2,000	3	40	-----
CFS Series*										
CFS455	455	± 13	± 17.5	± 30	70	4	1,500	3	50	-----

Table 7. kHz Filters (455kHz shown, but 450kHz version also available for most filters)

CFS455	455	± 10	± 15	± 25	70	4	1,500	3	50	-----
CFS455	455	± 9	± 13	± 23	70	4	1,500	3	50	-----
CFS455	455	± 7	± 10	± 20	70	4	1,500	3	50	-----
CFS455	455	± 5.5	± 8	± 16	70	6	1,500	3	50	-----
CFS455	455	± 5	± 7	± 12.5	70	6	1,500	3	50	-----
CFS455	455	± 4.2	± 6	± 12	70	6	2,000	3	50	-----
CFS455	455	-----	± 4	± 10	70	6	2,000	3	50	-----
CFS455	455	-----	± 3	± 7.5	70	7	2,000	3	50	-----
CFS455	455	-----	± 2	± 5	70	8	2,000	3	50	-----
CFS455	455	-----	± 1.5	± 4.5	60	8	2,000	3	50	-----
CFKR Series*				Stop Bandwidth (kHz) max.						
CFRK455E1	455	± 5.8	-----	± 17 (70dB BW)	70	4	1,500	-----	-----	40 (± 6kHz)
CFRK455G1	455	± 3	± 4	± 11.5 (60dB BW)	70	6	1,500	-----	-----	35 (± 4kHz)
CFRK455H3	455	-----	± 3.5	± 11.2 (60dB BW)	60	6	1,500	-----	-----	25 (± 3.5kHz)
CFL...G Series*				60 dB Bandwidth (kHz) max.						
CFL455AG2	455± 1.0	-----	± 17.5 - ±19.5	48dBmin. (± 29kHz)	65 (± 40kHz)	7.5	1,000	-----	40	40 (± 15kHz)
CFL455BG2	455 Nominal	± 10.5	± 13.5	± 27.5	60	10	1,000	-----	30	25 (± 10.5kHz)
CFL455CG1	455 Nominal	± 9.5	± 12	± 25.5	60	10	1,000	-----	30	35 (± 9.5kHz)
CFL455DG2	455 Nominal	± 7	± 9	± 21	60	11	1,000	-----	30	35 (± 7kHz)
CFL455EG1	455 Nominal	± 5	± 7	± 18	60	13	1,500	-----	30	30 (± 5kHz)

Table 7. kHz Filters (455kHz shown, but 450kHz version also available for most filters)



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Figure 40: kHz Filter Selection Chart