PRECISION DEVICES knowles

Trimmers and Non-Magnetic Components

Knowles Precision Devices is a market leader and global provider of high-performance capacitors and radio frequency (“RF”) filtering products, serving the medtech, aerospace & defense, industrial and electrification markets.

Our expertise is the design and manufacture of components important to engineers in applications where function and reliability are key.

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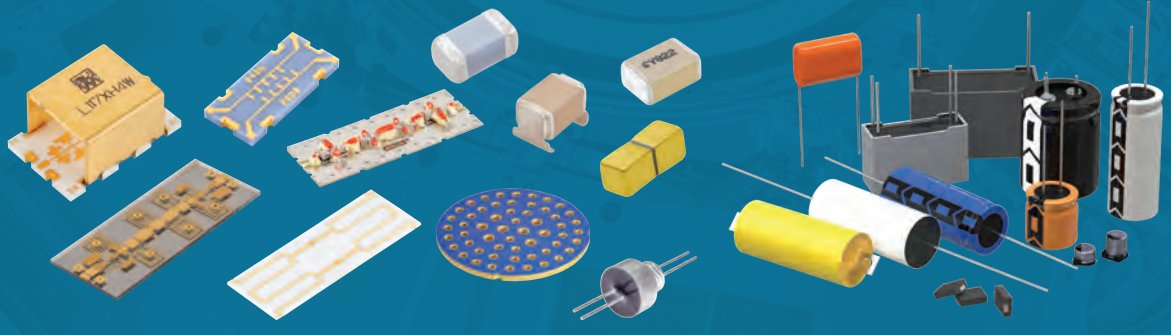
Our Products

Knowles designs, manufactures and sells special electronic components. Our products are used in medical, EV/automotive, aerospace & defense, electrification, and industrial applications where function and reliability are crucial.

- AEC-Q200 Qualified Capacitors
- Aluminum Electrolytic Capacitors
- Broadband Capacitors
- Capacitor Assemblies
- Custom Filters
- Discoidal Capacitors
- EMI Filters
- Feedthrough EMI Filters
- Film Capacitors
- Gain Equalizers
- High Q Capacitors
- Hi-Reliablity Products
- Hi-Rel and Specialty Products
- High Temperature Capacitors
- High Voltage Capacitors
- Leaded Capacitors
- Mica Capacitors
- Non-Magnetic Capacitors
- Planar Arrays
- Power Dividers
- Pulse Capacitors
- Resonators and Ceramic Resonators
- RF/MW Products
- Single Layer Capacitors
- Specialty Products
- Stacked Chips
- Supercapacitors
- X8R Capacitors
- 250Vac Chips
- 500Vac X7R Chips



DLI DIELECTRIC LABORATORIES

Johanson MANUFACTURING

NOVACAP

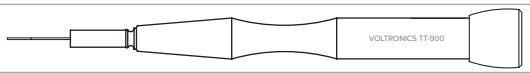
SYFER

Voltronics

Half Turn Ceramic SM Chip Trimmers Product Guide

Voltronics Product Line	Actual Size Length x Width x Height	Part Number	Cap. Range Min – Max pF	Temperature Coefficient	SRF GHz	Mounting	Page
JZ & JZ_HV*	0.177" x 0.126" x 0.059" 4.5mm x 3.2mm x 1.5mm	JZ030 JZ060 JZ100 JZ150 JZ200 JZ300 JZ400 JZ500	1.5 - 3.0 2.0 - 6.0 2.0 - 10.0 3.0 - 15.0 4.5 - 20.0 5.5 - 30.0 8.0 - 40.0 8.0 - 50.0	0±200 0±300 0±300 0±500 0±500 -1500±1000 -1500±1000 -1500±1000	2.1 1.5 1.16 0.92 0.81 0.7 0.6 0.53	Surface	4
*Note: We now offer the series in a HIGH VOLTAGE VERSION. The JZ_HV series specifications are identical to the specifications listed above with this important exception: DC Working Voltage 350DC, Withstanding Voltage 750.							
JR & JR_HV*	0.138" x 0.122" x 0.045" 3.5mm x 3.1mm x 1.15mm	JR030 JR060 JR100 JR150 JR200 JR300 JR400 JR500	1.5 - 3.0 2.0 - 6.0 2.0 - 10.0 3.0 - 15.0 4.5 - 20.0 5.5 - 30.0 8.0 - 40.0 8.0 - 50.0	0±200 0±300 0±300 0±500 0±500 -1500±1000 -1500±1000 -1500±1000	2.9 2.05 1.6 1.3 1.15 0.92 0.84	Surface	5

VOLTRONICS TUNING TOOLS

Trimmer Series	Diameter	Voltronics Part Number	Voltronics Part Number
JZ & JZ_HV JR & JR_HV	0.45	TT-400	TT-900 

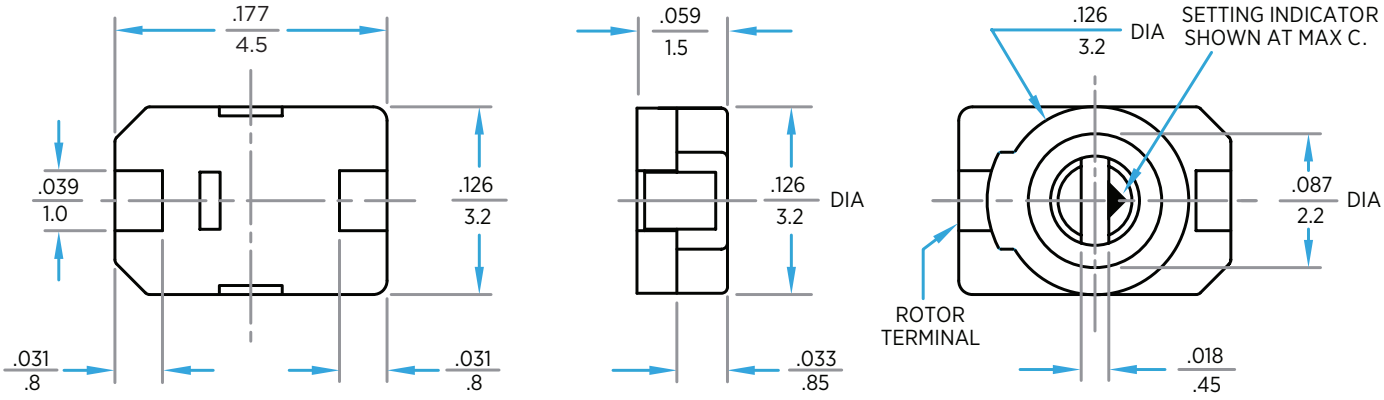
Johanson Product Line	Housing Size	Capacitance	Tuning Resolution	Min. Q @ 100 MHz	Color Codes
Thin-Trim®	0.125" (3.18mm)	0.25 to 25pF	90° or 180°	>300 to >3000	Red/Black/Blue/Brown
	0.200" (5.08mm)	1.0 to 50pF	180°	>200 to >1000	Red/Black/Blue/Brown
	0.300" (7.62mm)	1.65 to 100pF	180°	>1000 to >3000 @1MHz	Red/Black/Blue/Brown
Cera-Trim®	0.180" x 0.167" (4.57mm x 4.24mm)	0.6 to 25pF	180°	>300 to >3000	Red/Black/Blue Green/Amber
Seal-Trim®	0.180" (4.57mm)	0.6 to 25pF	180°	>300 to >1000	-
	0.270" (6.86mm)	1 to 50pF	180°	>200 to >1000	-
	0.390" (9.90mm)	1.65 to 100pF	180°	>1000 to >2000 @1MHz	-

JOHANSON TUNING TOOLS

Trimmer Series	Diameter	Johanson Part Number			
Thin-Trim®	4192	4193	2190		
Cera-Trim®	4192				
Seal-Trim®	4193	4192	2190		

Ceramic Chip Trimmers
JZ & JZ_HV Series

Dimensions – Drawing tolerances where not specified ± 0.008"/0.2mm



GENERAL SPECIFICATIONS

Part No. JZ Series	JZ030	JZ060	JZ100	JZ150	JZ200	JZ300	JZ400	JZ500
DC Working Voltage	125	125	125	125	125	125	125	125
DC Withstanding Voltage	220	220	220	220	220	220	220	220

Part No. JZ_HV Series	JZ030HV	JZ060HV	JZ100HV	JZ150HV	JZ200HV	JZ300HV	JZ400HV	JZ500HV
DC Working Voltage	350	350	350	350	350	350	350	350
DC Withstanding Voltage	770	770	770	770	770	770	770	770

Capacitance (pF)								
Minimum	1.5	2.0	2.0	3.0	4.5	5.5	8.0	8.0
Maximum	3.0 +50% – 0%	6.0 +50% – 0%	10.0 +100% – 0%	15.0 +100% – 0%	20.0 +100% – 0%	30.0 +100% – 0%	40.0 +100% – 0%	50.0 +100% – 0%

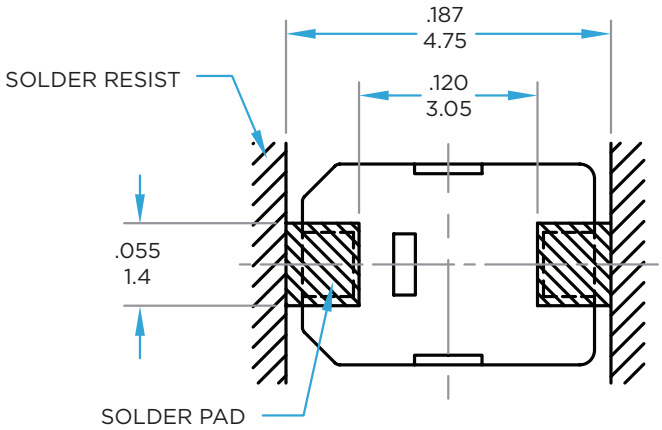
Marking Color*		Black	Blue	White	Pink	Red	Orange	Yellow	Green
Temperature Coefficient (ppm/°C)		0 ± 200	0 ± 300	0 ± 300	0 ± 500	0 ± 500	-1500 ± 1000	-1500 ± 1000	-1500 ± 1000
Approximate Self Resonant Frequency at Maximum Rated Capacitance	JZ & JZ_HV Series	2.1GHz	1.5GHz	1.16GHz	0.92GHz	0.81GHz	0.70GHz	0.60GHz	0.53GHz
Insulation Resistance		10^4 MΩ							
Operating Temperature		-40°C to +85°C (Tunable temp range -25°C to +85°C)							
Torque		0.14 to 1.0 in-oz							
Packaging		All parts furnished on 12mm tape and reel. 1,000 pcs. per reel.							

*HV parts are indicated by a second green dot.

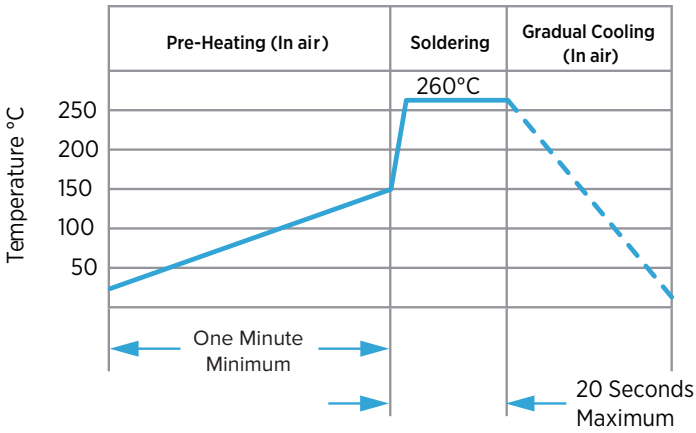
Ceramic Chip Trimmers
JZ & JZ_HV Series Continued

SOLDER PAD LAYOUT

Recommended thickness of solder paste 0.15mm

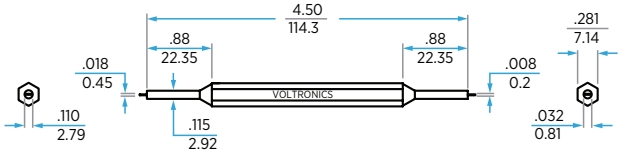


RECOMMENDED REFLOW SOLDER TEMPERATURE PROFILE

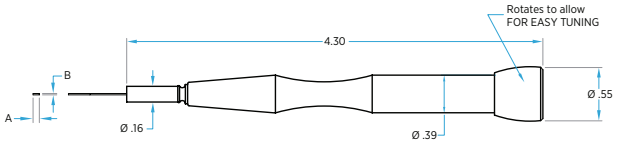


RECOMMENDED TUNING TOOLS

CERAMIC TIPPED: TT-400

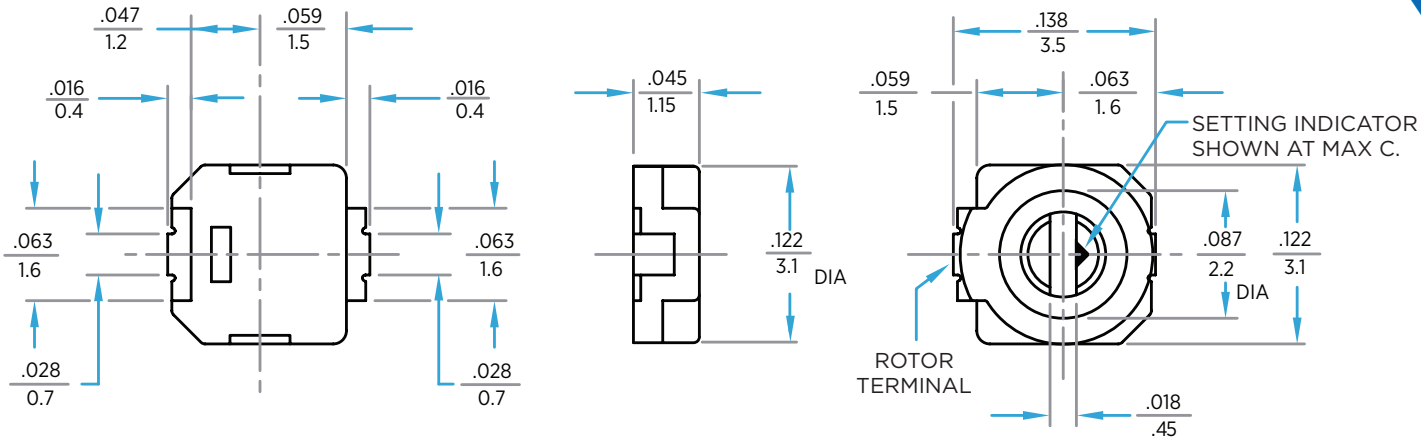


CERAMIC TIPPED: TT-900



Ceramic Chip Trimmers
JR & JR_HV Series

Dimensions – Drawing tolerances where not specified ± 0.008"/0.2mm



GENERAL SPECIFICATIONS

Part No. JR Series	JR030	JR060	JR100	JR150	JR200	JR300	JR400	JR500
DC Working Voltage	125	125	125	125	125	125	125	125
DC Withstanding Voltage	250	250	250	250	250	250	250	250

Part No. JR_HV Series	JR030HV	JR060HV	JR100HV	JR150HV	JR200HV	JR300HV	JR400HV	JR500HV
DC Working Voltage	350	350	350	350	350	350	350	350
DC Withstanding Voltage	700	700	700	700	700	700	700	700

Capacitance (pF)	Minimum	1.5		2.0		2.0		3.0		4.5		5.5		8.0		8.0	
	Maximum	3.0	+50% – 0%	6.0	+50% – 0%	10.0	+100% – 0%	15.0	+100% – 0%	20.0	+100% – 0%	30.0	+100% – 0%	40.0	+100% – 0%	50.0	+100% – 0%

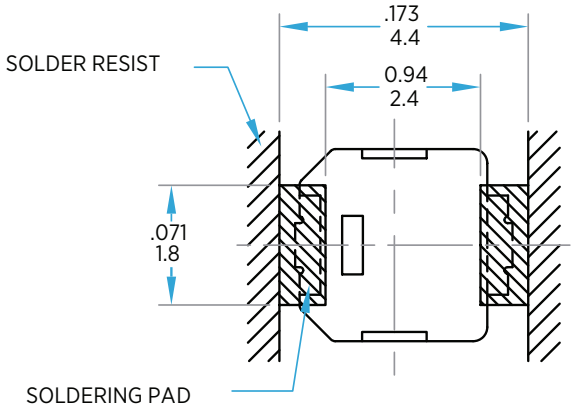
Marking Color*		Black	Blue	White	Pink	Red	Orange	Yellow	Green
Temperature Coefficient (ppm/°C)		0 ± 200	0 ± 300	0 ± 300	0 ± 500	0 ± 500	-1500 ± 1000	-1500 ± 1000	-1500 ± 1000
Approximate Self Resonant Frequency at Maximum Rated Capacitance	JR & JR_HV Series	2.9GHz	2.05GHz	1.6GHz	1.3GHz	1.15GHz	0.92GHz	0.84GHz	-
Insulation Resistance		10^4 MΩ							
Operating Temperature		-40°C to +85°C (Tunable temp range -25°C to +85°C)							
Torque		0.6 in-oz max.							
Packaging		All parts furnished on 12mm tape and reel. 1,000 pcs. per reel.							

*HV parts are indicated by a second green dot.

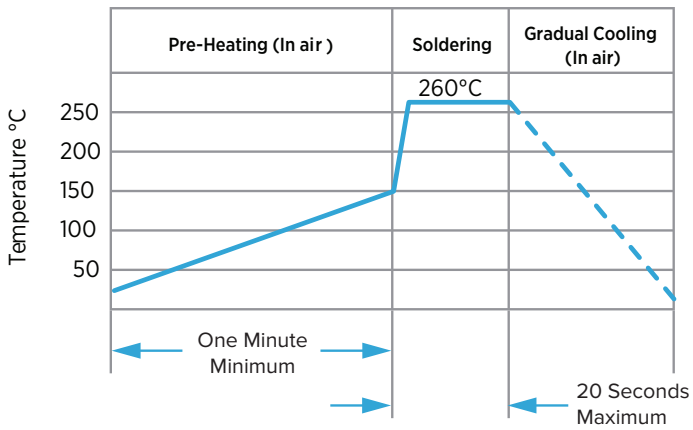
Ceramic Chip Trimmers
JR & JR_HV Series Continued

SOLDER PAD LAYOUT

Recommended thickness of solder paste 0.15mm

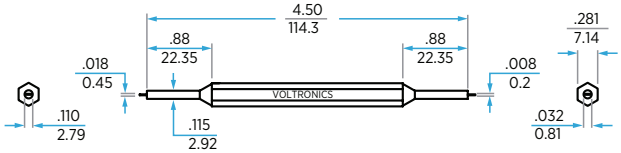


RECOMMENDED REFLOW SOLDER TEMPERATURE PROFILE

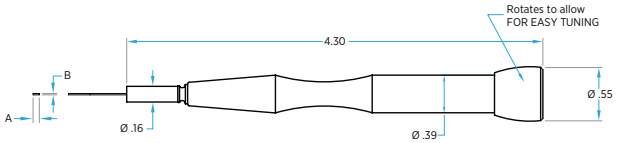


RECOMMENDED TUNING TOOLS

CERAMIC TIPPED: TT-400



CERAMIC TIPPED: TT-900



Thin-Trim® Trimmers 9701 Series

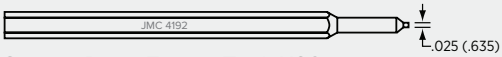
The Thin-Trim® 9701 Series capacitors are an advanced development in miniaturized trimmers for applications in circuits where size and performance are critical. These one-half turn ceramic capacitors feature high Q performance up to 2GHz and beyond.

The 9701 Series construction incorporates a butterfly electrode pattern that provides a series parallel capacitor with extremely low ESR and ESL. Knowles' square drive tuning mechanism ensures captive, non-slip, tamper-proof adjustments, eliminating backlash problems.

CHARACTERISTICS

Rated voltage: 250 VDC (test voltage 500 VDC)

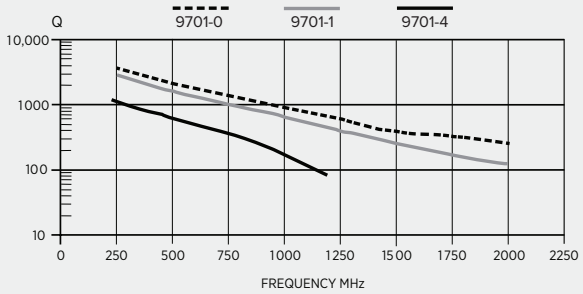
- Insulation resistance: >10^4 MΩ
- Operating temperature range: -55°C to +125°C
- Torque: 0.05 to 0.5 oz. in.
- Vibration: 15g, 10-2000 Hz
- Shock: 100g, 6 milliseconds
- Setting drift: <1%
- Moisture resistance: MIL-STD-202, Method 106
- Resistant to soldering heat: MIL-STD-202, Method 210, Test C
- Solderability: MIL-STD-202, Method 208
- Resistant to cleaning solvents: MIL-STD-202, Method 215
- RoHS compliant



JMC Square Drive Tuning Tool 4192

APPLICATIONS

- RF Amplifier
- LC Filters and Networks
- Broadband Wireless LAN
- Medical Devices
- Cordless and Cellular phones
- DR/Crystal Oscillators
- Microstrip Line Filters



PACKAGING

- Tape and reel available for SL products
- Add suffix to JMC P/N for reel packaging
- R1 = 1,500 pieces, R4 = 6,000 pieces

Series	Disk Size	Capacitance	Tuning Resolution	Min. Q @ 100 MHz	Drawing Figure
9701-0	0.125" (3.18mm)	0.25 to 0.7pF	90°	>1000	A
9701-0SL-1					B
9701-0SL-1B					E
9701-0SL-2					F
9701-0PC					D
9701-1		0.5 to 1.3pF			A
9701-1SL-1					B
9701-1SL-1B					E
9701-1SL-2					F
9701-1PC					D
9701-2		0.6 to 2.0pF			A
9701-2SL-1					B
9701-2SL-1B					E
9701-2SL-2					F
9701-2PC					D
9701-4		1.5 to 4.0pF		>500	A
9701-4SL-1					B
9701-4SL-1B					E
9701-4SL-2					F
9701-4PC					D

Thin-Trim® Trimmers 9701 Series Continued

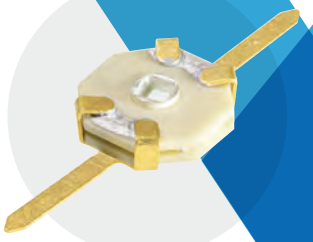
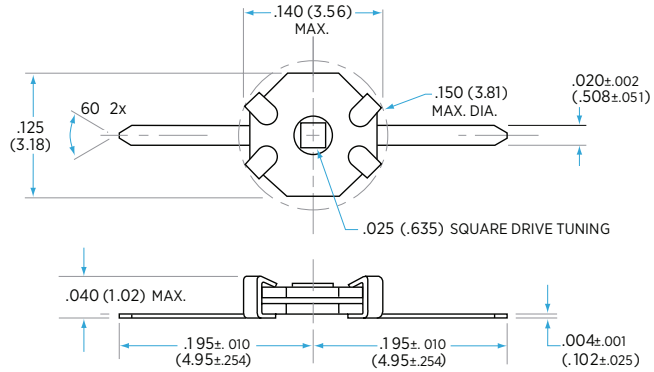
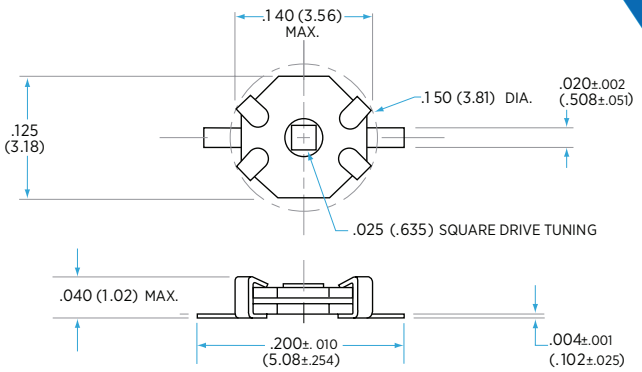


FIGURE A



Dimensions: inches (mm)

FIGURE B



Dimensions: inches (mm)

FIGURE C

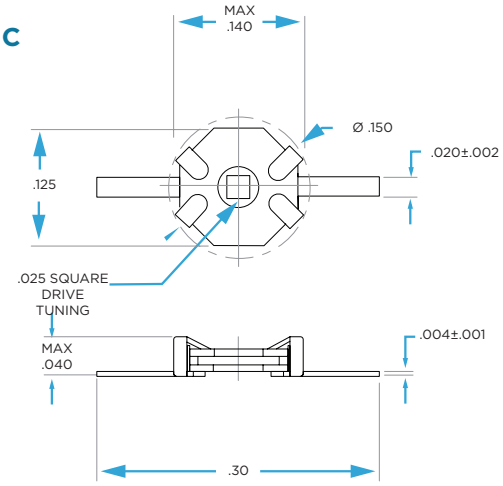


FIGURE D

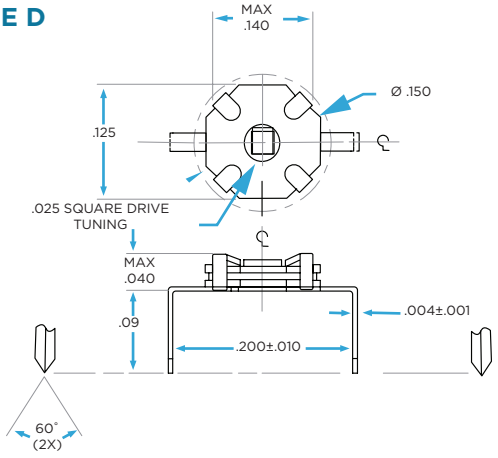


FIGURE E

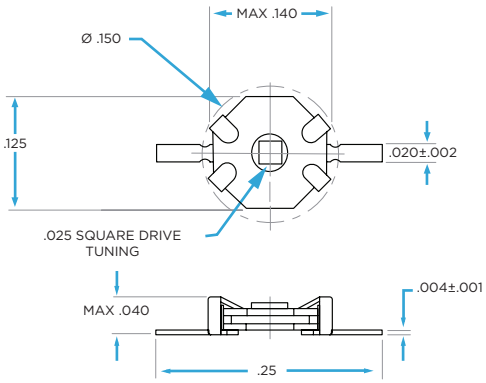
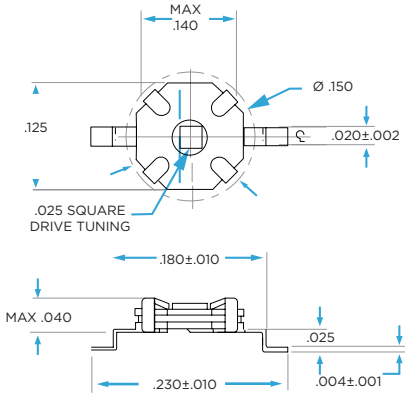


FIGURE F



Thin-Trim® Trimmers 9702 and 9710 Series

Thin-Trim® 9702 and 9710 Series capacitors are an advanced development in miniaturized trimmer capacitors for applications in circuits where size and performance are critical.

The Thin-Trim® capacitor embodies a radical reduction in size and weight over standard ceramic capacitors, with a proportional improvement in electrical characteristics. The capacitor consists of a metallic rotor suspended under spring pressure between two metalized dielectric disks. In addition to physically securing the assembly, the springs serve as both the internal electrical connection and the external terminals, simplifying the construction and further reducing size. The incorporation of the Johanson square drive tuning mechanism ensures captive, non-slip, tamper-proof adjustments that are not subject to backlash problems associated with screwdriver type adjustments.

CHARACTERISTICS

Rated voltage: 250 VDC (test voltage 500 VDC)

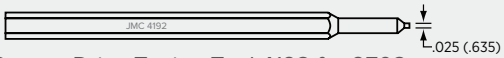
- Insulation resistance: >10^4 MΩ
- Operating temperature range: -55°C to +125°C
- Torque: 0.05 to 1.0 oz. in. for 9702 0.2 to 2.0 oz. in. for 9710
- Vibration: 15g, 10-2000 Hz
- Shock: 100g, 6 milliseconds
- Setting drift: <1%
- Moisture resistance: MIL-STD-202, Method 106
- Resistant to soldering heat: MIL-STD-202, Method 210, Test C
- Solderability: MIL-STD-202, Method 208
- Resistant to cleaning solvents: MIL-STD-202, Method 215

APPLICATIONS

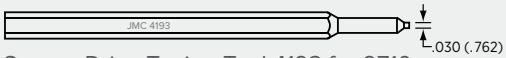
- RF Amplifier
- LC Filters and Networks
- Broadband Wireless LAN
- Medical Devices
- Cordless and Cellular phones
- DR/Crystal Oscillators
- Microstrip Line Filters

PACKAGING

- Tape and reel available for 9702-SL and 9710-SL products
- Add suffix to JMC P/N for reel packaging
- 9710-SL R7 = 3,000 pieces



JMC Square Drive Tuning Tool 4192 for 9702

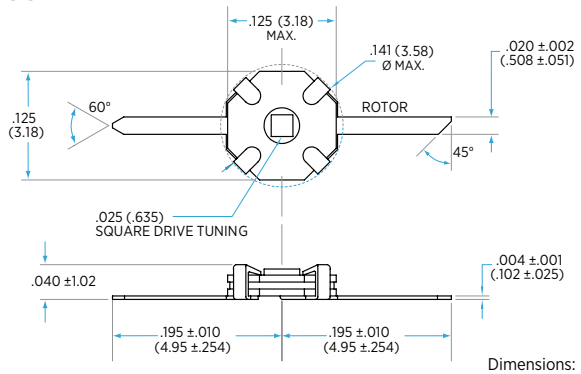


JMC Square Drive Tuning Tool 4193 for 9710

Series	Disk Size	Capacitance	Tuning Resolution	Min. Q @ 100 MHz	Color Code	Drawing Figure
9702-0	0.125" (3.18mm)	0.5 to 2.5pF	180°	3000	Red	A
9702-0SL-1	0.125" (3.18mm)					B
9702-1	0.125" (3.18mm)	1.0 to 5.0pF		1000	Black	A
9702-1SL-1	0.125" (3.18mm)					B
9702-2	0.125" (3.18mm)	2.5 to 10pF		1000	Blue	A
9702-2SL-1	0.125" (3.18mm)					B
9702-4	0.125" (3.18mm)	3.0 to 12pF		500	Brown	A
9702-4SL-1	0.125" (3.18mm)					B
9702-6	0.125" (3.18mm)	8.0 to 25pF		300	Yellow	A
9702-6SL-1	0.125" (3.18mm)					B
9702-8	0.125" (3.18mm)	5.0 to 15pF		750	None	A
9702-8SL-1	0.125" (3.18mm)					B
9702-9	0.125" (3.18mm)	7.0 to 18pF		500	Grey	A
9702-9SL-1	0.125" (3.18mm)					B
9710-0	0.125" (3.18mm)	1.0 to 4.5pF		1000	Red	C
9710-0SL-1	0.200" (5.08mm)					D
9710-1	0.200" (5.08mm)	2.5 to 10pF		1000	Black	C
9710-1SL-1	0.200" (5.08mm)					D
9710-2	0.200" (5.08mm)	4.0 to 18pF		700	Blue	C
9710-2SL-1	0.200" (5.08mm)					D
9710-3	0.200" (5.08mm)	6.0 to 35pF		200	Orange	C
9710-3SL-1	0.200" (5.08mm)					D
9710-4	0.200" (5.08mm)	7.0 to 40pF		200	Brown	C
9710-4SL-1	0.200" (5.08mm)					D
9710-5	0.200" (5.08mm)	10.0 to 50pF		200	Green	C
9710-5SL-1	0.200" (5.08mm)					D
9710-25	0.200" (5.08mm)	5.0 to 25pF		200	Yellow	C
9710-25SL-1	0.200" (5.08mm)					D

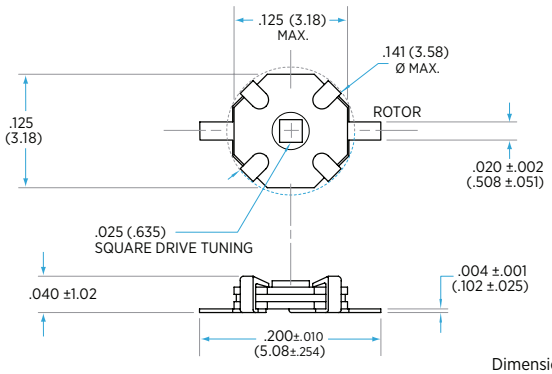
Thin-Trim® Trimmers
9702 and 9710 Series

FIGURE A



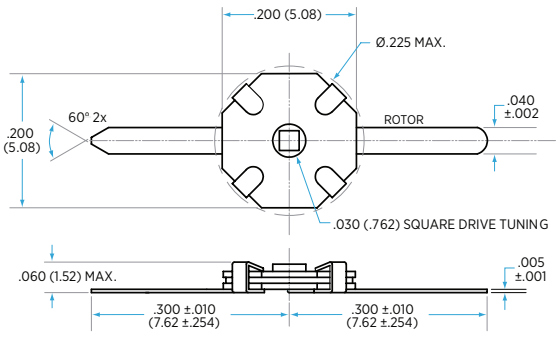
Dimensions: inches (mm)

FIGURE B



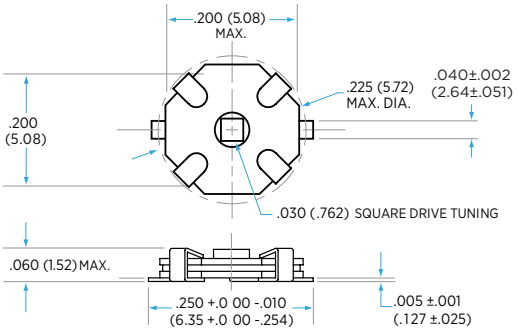
Dimensions: inches (mm)

FIGURE C



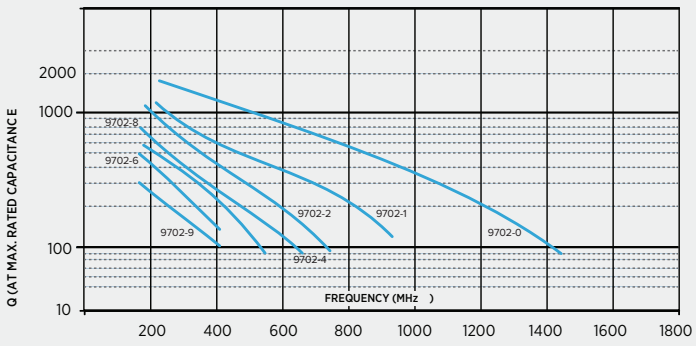
Dimensions: inches (mm)

FIGURE D

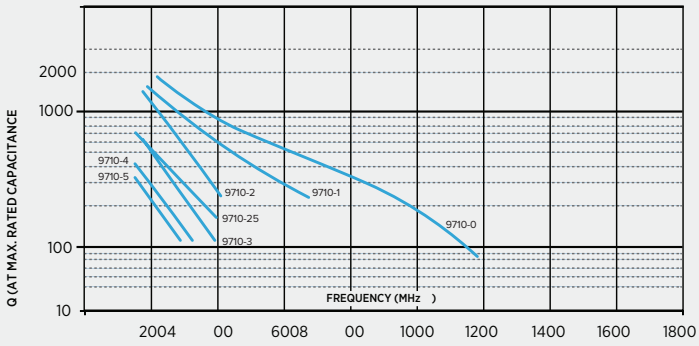


Dimensions: inches (mm)

Q VS. FREQUENCY 9702 SERIES



Q VS. FREQUENCY 9710 SERIES



Thin-Trim® Trimmers
9900 Series

Series	Disk Size	Capacitance	Tuning Resolution	Min. Q @ 100 MHz	Color Code	Drawing Figure
9911	0.300" (7.62mm)	1.65 to 17pF	180°	>3000	Black	E
9911PC						F
9912		6.0 to 25pF		>2000	Blue	E
9912PC						F
9912SL-2						G
9914		7.5 to 50pF		>1000	Brown	E
9914PC						F
9914SL-2						G
9917		20.0 to 90pF			White	E
9917PC						F
9917SL-2						G
9918		20.0 to 100pF			White	E
9918PC						F

FIGURE E

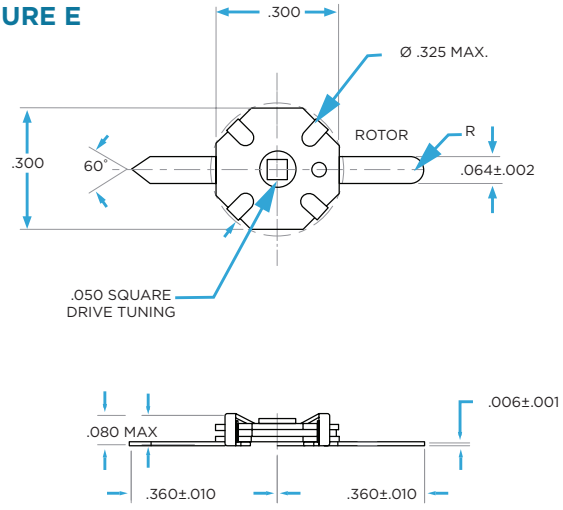


FIGURE F

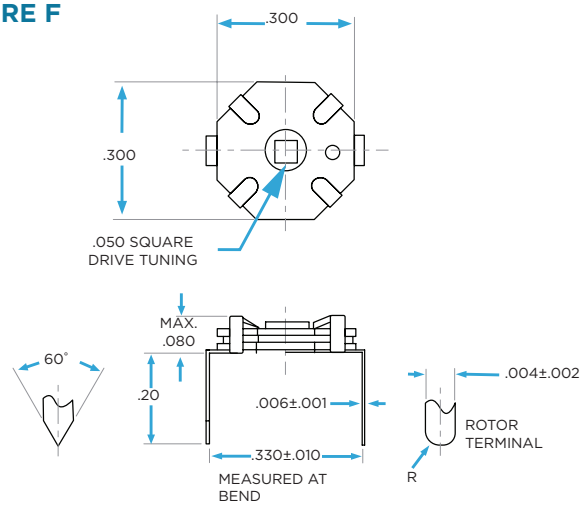
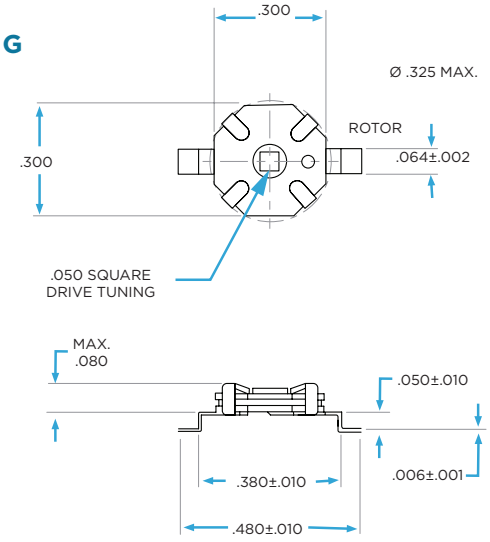
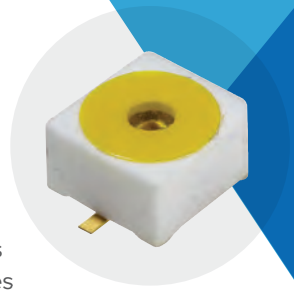


FIGURE G



Cera-Trim® Trimmers 2322 Series



Cera-Trim® is a high performance surface mount trimmer capacitor designed specifically to withstand harsh environments. These capacitors deliver exceptional performance through microwave frequencies at operating temperatures of -55°C to +125°C. The square drive tuning mechanism provides and assures complete compatibility with automated tuning devices for positive non-slip tamper-proof adjustments.

The Cera-Trim® design makes it possible to utilize tape and reel. The alumina housing provides mechanical strength with outstanding electrical and heat-resistant properties. The rugged construction renders it resistant to penetration of solder fluxes and cleaning solvents. Recommended handling instructions outlining soldering procedures are available in Knowles specification R-360.

CHARACTERISTICS

Rated voltage: 250 VDC (test voltage 500 VDC)

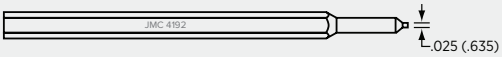
- Insulation resistance: >10^4 MΩ
- Operating temperature range: -55°C to +125°C
- Vibration: 15g, 10-2000 Hz, MIL-STD-202, Method 204, Condition B
- Shock: 100g, 6 milliseconds, MIL-STD-202, Method 213, Condition I
- Moisture resistance: MIL-STD-202, Method 106
- Resistant to soldering heat and flux: 260°C for 10 seconds
- Solderability: MIL-STD-202, Method 208
- Resistant to cleaning solvents: MIL-STD-202, Method 215
- Withstands up to 5 minutes total immersion in typical cleaning solvents at room temperature
- Conforms with specification MIL-PRF-81
- RoHS compliant Series

APPLICATIONS

- RF Amplifier
- LC Filters and Networks
- Broadband Wireless LAN
- Medical Devices
- Cordless and Cellular phones
- DR/Crystal Oscillators
- Microstrip Line Filters

PACKAGING

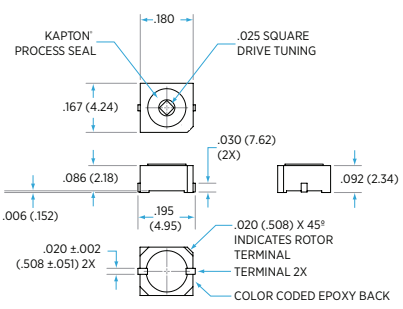
- Add suffix to JMC P/N for reel packaging
- R1 = 500 pieces, R2 = 2,500 pieces



JMC Square Drive Tuning Tool 4192 for 2322 Series

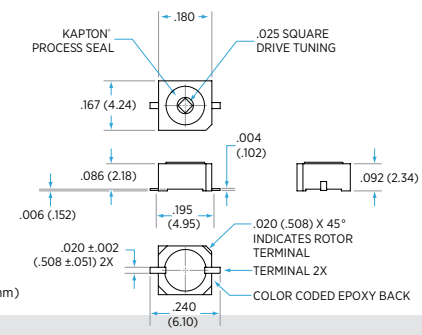
2322 RoHS Series	Housing Size	2322 RoHS Capacitance	Tuning Resolution	Min. Q @ 100 MHz	Drawing Figure	Color Code
2322-0G	0.180" x 0.167" (4.57mm x 4.24mm)	0.6 to 2.5pF	180°	3000	A	RED
2322-0GSL	0.180" x 0.167" (4.57mm x 4.24mm)				B	RED
2322-1G	0.180" x 0.167" (4.57mm x 4.24mm)	1.0 to 5pF		1000	A	BLUE
2322-1GSL	0.180" x 0.167" (4.57mm x 4.24mm)				B	BLUE
2322-2G	0.180" x 0.167" (4.57mm x 4.24mm)	2.5 to 10pF		1000	A	BLACK
2322-2GSL	0.180" x 0.167" (4.57mm x 4.24mm)				B	BLACK
2322-3G	0.180" x 0.167" (4.57mm x 4.24mm)	7.5 to 18pF		500	A	CLEAR
2322-3GSL	0.180" x 0.167" (4.57mm x 4.24mm)				B	CLEAR
2322-4G	0.180" x 0.167" (4.57mm x 4.24mm)	8.5 to 25pF		300	A	GREEN
2322-4GSL	0.180" x 0.167" (4.57mm x 4.24mm)				B	GREEN

SEALED FIGURE A



Dimensions: inches (mm)

SEALED SL FIGURE B



Dimensions: inches (mm)

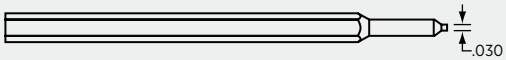
Seal-Trim® Trimmers 9810 Series

The Seal-Trim® is a high performance Thin-Trim® trimmer ceramic capacitor encapsulated in a polymer housing. This design resists intrusion of dirt, dust, solder flux and cleaning agents during assembly and atmospheric contamination during use. These capacitors offer low drift rates and high Q, making them ideal for higher frequency applications beyond the limits of ordinary ceramic trimmer capacitors. The incorporation of the Knowles square drive tuning mechanism ensures captive non-slip, tamper-proof adjustments that are not subject to backlash problems associated with screwdriver-type adjustment slots.

CHARACTERISTICS

Rated voltage: 250 VDC (test voltage 500 VDC) for 9810 & 9820

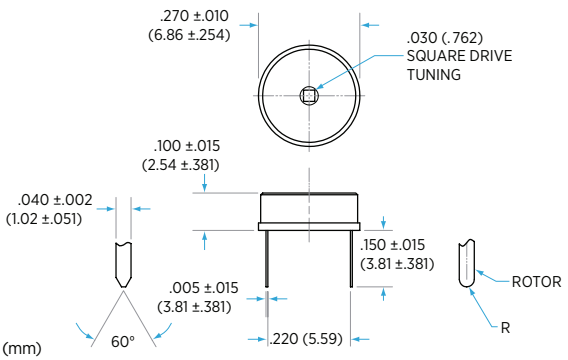
- Insulation resistance: $>10^4$ MΩ
- Operating temperature range: -55°C to +125°C
- Torque: 0.2 to 2.0 for 9810, 9894 0.05 to 1.0 for 9820
- Vibration: 15g, 10-2000 Hz, MIL-STD-202, Method 204
- Shock: 100g, 6 milliseconds, MIL-STD-202, Method 21
- Setting drift: <1%; <2% for 9816, 9894
- Moisture resistance: MIL-STD-202, Method 106
- Resistant to soldering heat: MIL-STD-202, Method 210, Test C
- Solderability: MIL-STD-202, Method 208
- Resistant to cleaning solvents: MIL-STD-202, Method 215
- RoHS compliant Series



JMC Drive Tuning Tool 4193 for 9810 and 9820 Series

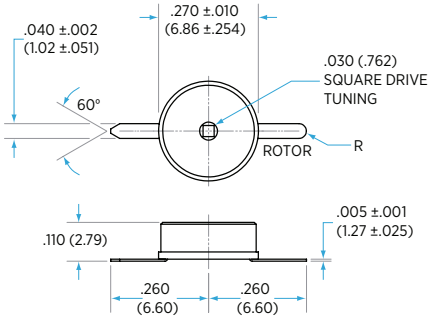
9810 RoHS Series	Housing Size	9810 RoHS Capacitance	Tuning Resolution	Min. Q @ 100 MHz	Drawing Figure
9810	0.270" (6.86mm)	1.0 to 4.5pF	180°	>1000	A
9810-SL					B
9811		2.5 to 10pF		>1000	A
9811-SL					B
9812		4.0 to 18pF		>700	A
9812-SL					B
9813		6.0 to 35pF		>200	A
9813-SL					B
9814		7.0 to 40pF		>200	A
9814-SL					B
9815		5.0 to 25pF		>200	A
9815-SL					B
9816		10.5 to 50pF		>200	A
9816-SL					B

FIGURE A



Dimensions: inches (mm)

FIGURE B

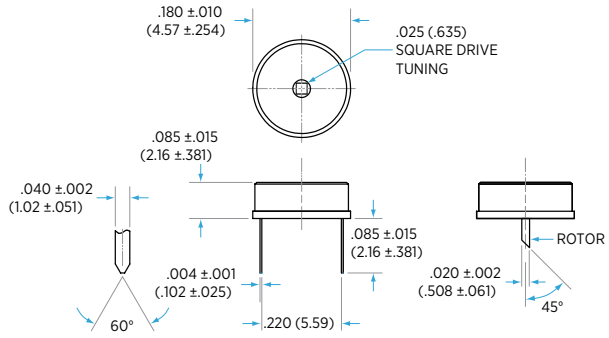


Dimensions: inches (mm)

Seal-Trim® Trimmers
9820 Series

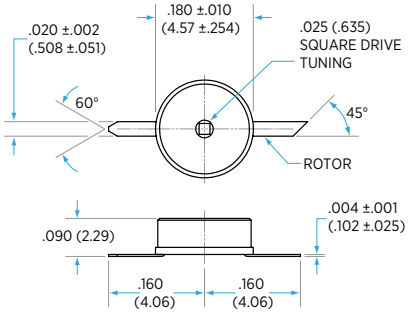
9820 RoHS Series	Housing Size	9820 RoHS Capacitance	Tuning Resolution	Min. Q @ 100 MHz	Drawing Figure
9820	0.180" (4.57mm)	0.5 to 2.5pF	180°	>1000	C
9820-SL	0.180" (4.57mm)				D
9821	0.180" (4.57mm)	1.0 to 5.0pF		>1000	C
9821-SL	0.180" (4.57mm)				D
9822	0.180" (4.57mm)	2.5 to 10pF		>1000	C
9822-SL	0.180" (4.57mm)				D
9826	0.180" (4.57mm)	8.5 to 25pF		>300	C
9826-SL	0.180" (4.57mm)				D
9828	0.180" (4.57mm)	5 to 15pF		>750	C
9828-SL	0.180" (4.57mm)				D
9829	0.180" (4.57mm)	7.5 to 20pF		>500	C
9829-SL	0.180" (4.57mm)				D

FIGURE C

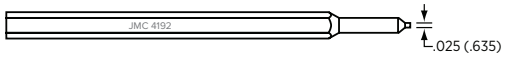


Dimensions: inches (mm)

FIGURE D



Dimensions: inches (mm)



JMC Square Drive Tuning Tool 4192 for 9820 Series

Seal-Trim® Trimmers
9890 Series

9890 RoHS Series	Housing Size	9890 RoHS Capacitance	Tuning Resolution	Min. Q @ 100 MHz	Drawing Figure
9891	0.390" (9.91mm)	1.65 to 17pF	180°	>3000	E
9891-SL					F
9892		6.0 to 25pF		>2000	E
9892-SL					F
9894		7.5 to 50pF		>1000	E
9894-SL					F
9897		20 to 90pF		>1000	E
9897-SL					F
9898		20 to 100pF		>1000	E
9898-SL					F

FIGURE E

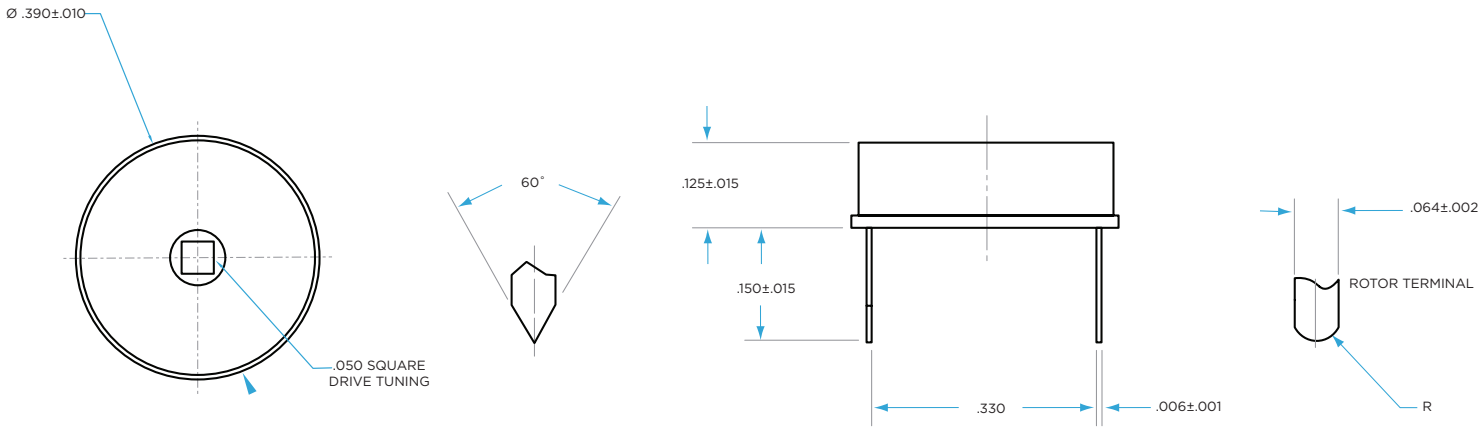
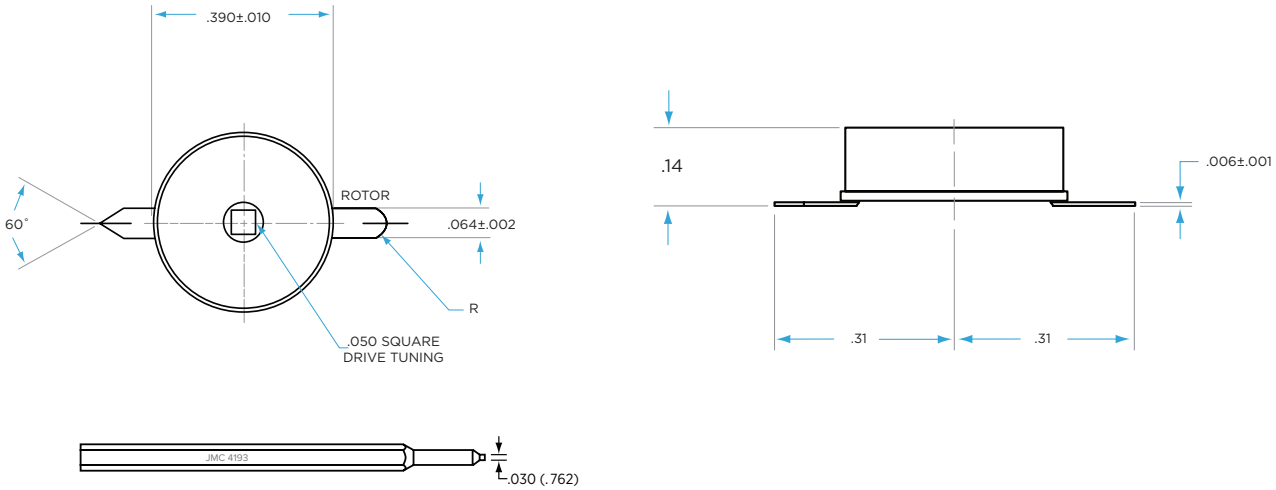


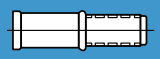
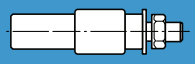
FIGURE F



JMC Square Drive Tuning Tool 2190 for 9894

Air and PTFE Trimmers Product Guide

Product Selection Guide - Consult Factory for Complete Catalog

	Product Series	Description	Options	Maximum Capacitance	DC Working Voltage	DC Dielectric Withstand Voltage	Typical Q Value	Page
A1_4/8 **A1_12**	A1 Line	Miniature PTFE Dielectric	Non-Mag, Standard	11pF	Up to 250V	Up to 500V	2000-4000	
	A1 Line HV	High Voltage Miniature PTFE Dielectric	Non-Mag, Standard	11pF	Up to 1000V	Up to 2000V	2000-4000	
A4_3 **A4_5**	A4 Line	Sub Miniature PTFE Dielectric	Non-Mag, Standard	5pF	125V	250V	2000-3000	
	A Line	Air Dielectric	Non-Mag, Standard	14pF	Up to 250V	Up to 500V	3000-5000	
A_HV	A Line HV	PTFE Dielectric	Non-Mag, Standard	55pF	Up to 1,000V	Up to 2,000V	2000	
A_HV EXT Range 	A Line HV Extended Voltage	High Voltage PTFE Dielectric	Non-Mag, Standard	20pF	2,000V	4,000V	780-2000	
K_HV	K Line	Reduced Size Air Dielectric	Non-Mag, Standard	10pF	250V	500V	5000	
	K Line HV	PTFE Dielectric HV Reduced Size	Non-Mag, Standard	15pF	up to 1,000V	Up to 2,000V	780-2000	
NT 	NMNT Line	Very High Voltage PTFE Dielectric	Non-Mag	95pF	Up to 10,000V	Up to 20,000V	2000	
GLASS	Glass	Glass Dielectric High Capacitance	Non-Mag, Standard, MIL-PRF-14409	250pF	Up to 1,250V	Up to 2,500V	250-1000	
QUARTZ	Quartz	Quartz Dielectric	Non-Mag, Standard, MIL-PRF-14409	24pF	Up to 1,250V	Up to 2,500V	2000	

Note: Most of the above trimmer capacitors can be ordered as non-magnetic - see non-magnetic section.

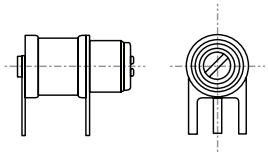
Air Trimmers Product Guide

Part Number	Capacitance Range (pF)	Number of Turns	Working Voltage (VDC)	Withstanding Voltage (VDC)	Tuning Torque (oz.in)	Q @ 100 HHz
5200	0.8 to 10pF	>6	250	500	1 - 5	>5000
5201						
5202						
5302	1 to 10pF	>10	500	1000	1 - 6	>2000
5400	1 to 14pF	>6	250	500	1 - 5	>3000
5401						
5402						
5451	1 to 16pF	>6	250		1 - 5	>3000
5453	1.5 to 16pF					
5500	1 to 20pF	>12	250		1 - 5	>1500
5501						
5502						
5600	1 to 30pF	>20	250		1 - 5	>800
5601						
5602						
5700	0.6 to 6pF	>7	250		0.4 - 4	>10000
5701						
5702						
5750	0.8 to 10pF	>8	250		0.4 - 4	>7500
5751						
5752						
5753	1 to 10pF					
5800	0.35 to 3.5pF	>9	250		0.3 - 3	>10000
5801						
5802						
5850	0.5 to 5pF	>12	250		0.3 - 3	>7500
5851						
5852						
5853	0.6 to 5pF					
8050	0.7 to 6pF	>7	250		0.4 - 4	>10000
8051	0.6 to 3.5pF	>10			0.3 - 3	
8052	1 to 10pF	>6			1 - 5	>5000
8053	1.5 to 14pF	>6				>3000
8054	1.5 to 20pF	>12				>1500
8090	1 to 10pF	>6	250		1 - 5	>2000
8091	1.5 to 14pF					
8092						
8093						

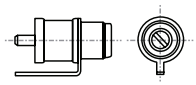
Air and PTFE Trimmers

LEAD STYLES

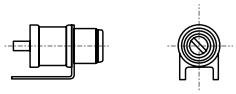
P LEAD STYLE



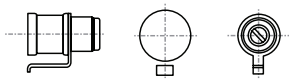
B LEAD STYLE



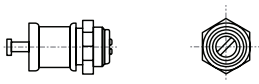
F LEAD STYLE



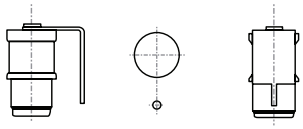
M LEAD STYLE



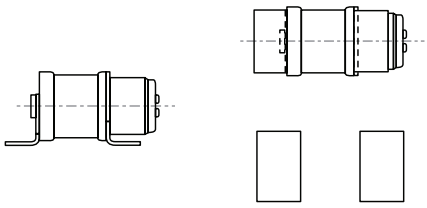
T LEAD STYLE



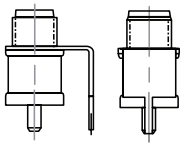
C LEAD STYLE



J LEAD STYLE

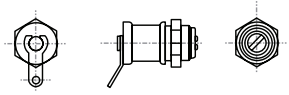


D LEAD STYLE



T LEAD STYLE WITH L OPTION

Note: All bushing threads are .234" -64



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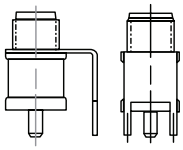
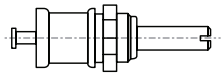
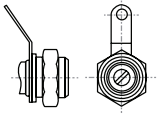


EXTENDED METAL SHAFT

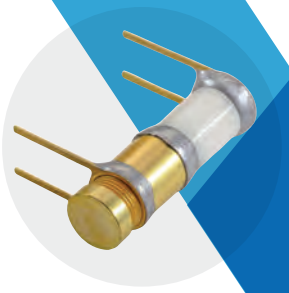


INSULATED BUSHING

Insert “I” in Part Number, e.g., AIT10L



Air Trimmers A Series



THE ONLY INTERNALLY SEALED AIR TRIMMER

Voltronics' concentric ring Air Trimmer capacitors are designed for use at frequencies up to 1.5 GHz.

They are ideal for applications such as mobile radios, aerospace communication, crystal oscillators and filters, radar, cable TV and innumerable other commercial and military programs. The unique internal O-ring seal makes wave soldering and vapor degreasing possible without the need to attach a separate cap.

"A" Series - Solder sealed and available to MIL-PRF-14409.

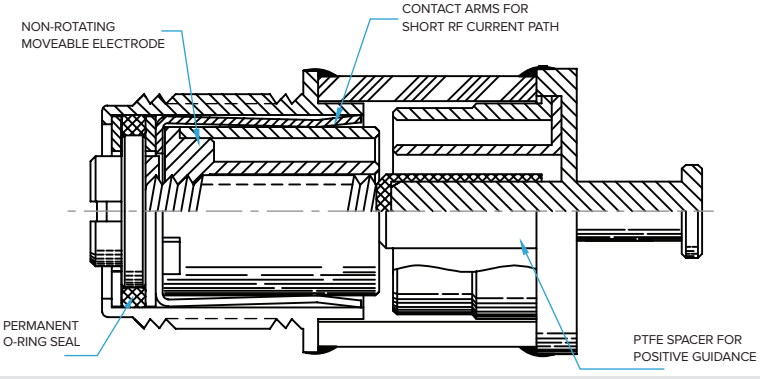
OTHER FEATURES INCLUDE:

- Ten full linear turns
- Internal stops
- Extreme stability under shock and vibration
- Screw head does not move in and out
- Extended shaft option of metal or plastic
- Long life with no dynamic tuning noise

Note: All parts shown here can be ordered as non-magnetic:
Add "NM" to Part Number, e.g., NMAP10

General Specifications	A_5	A_10	A_14
Capacitance Range	1.0 to 5pF	1.0 to 10pF	1.0 to 14pF
Q (min) at 100MHz @ Max. C*	5000	5000	3000
DC Working Voltage	250	250	125
DC Withstanding Voltage	500	500	250
Temperature Coefficient	50±50 ppm/°C	50±50 ppm/°C	50±50 ppm/°C
Insulation Resistance @ 25°C	10^6 MΩ	10^6 MΩ	10^6 MΩ
Seal	40 pounds/in^2	40 pounds/in^2	40 pounds/in^2
Operating Temperature	- 65°C to +125°C	65°C to +125°C	- 65°C to +125°C
Rotational Life	10,000 Turns	10,000 Turns	10,000 Turns
Tuning Torque	0.5 to 5.0 in-oz	0.5 to 5.0 in-oz	0.5 to 5.0 in-oz
Shock	1,500g, 0.5 milliseconds	1,500g, 0.5 milliseconds	1,500g, 0.5 milliseconds
Vibration	50g at 10 - 2000 Hz	50g at 10 - 2000 Hz	50g at 10 - 2000 Hz

*Self-resonant frequency and Q are assured with no terminals on parts.



Air Trimmers

FIGURE 1

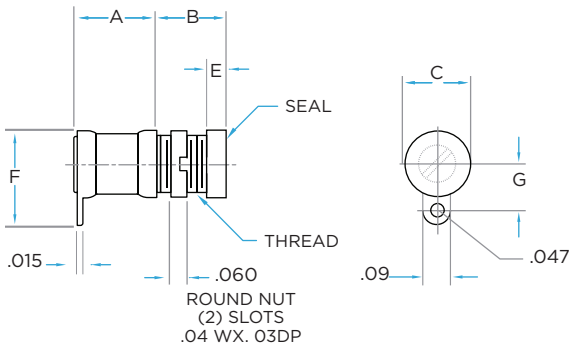
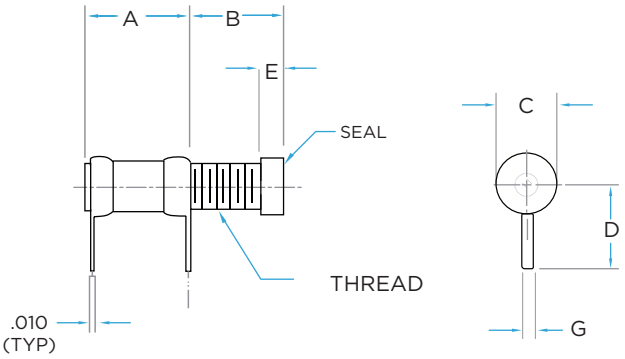


FIGURE 2



Part Number	Capacitance Range (pF)	Min. Q @ 100 MHz	Dimensions								Figure
			A	B	C	D	E	F	G	THREAD	
5801	0.35 to 3.5	>10000	0.28	0.215	.160/.150	0.22	0.06	-	0.03	.120-80	2
5851	0.5 to 5.0	>7500	0.28	0.245	.160/.150	0.22	0.06	-	0.03	.120-80	2
5700	0.6 to 6.0	>10000	0.27	0.21	.235/.215	-	0.06	0.32	0.16	190-64	1
5750	0.8 to 10.0	>7500	0.27	0.23	.235/.215	-	0.06	0.32	0.16	190-64	1

Dimensions (inches)

FIGURE 3

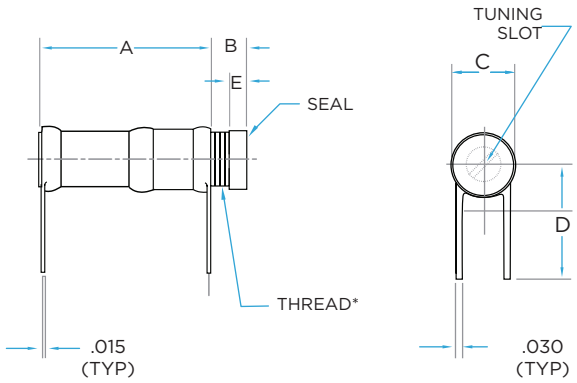
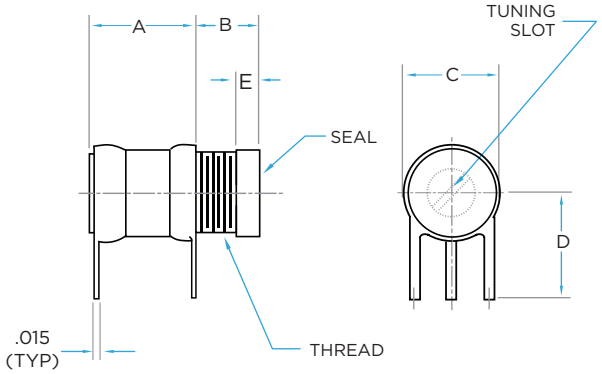


FIGURE 4



Part Number	Capacitance Range (pF)	Min. Q @ 100 MHz	Dimensions						Figure
			A	B	C	D	E	THREAD	
5701	0.6 to 6.0	>10000	0.29	0.19	.235/.215	0.25	0.06	.190-64	4
5201	0.8 to 10.0	>5000	0.32	0.19	.295/.275	0.31	0.08	.234-64	4
5751		>7500	0.29	0.22	.235/.215	0.25	0.06	.190-64	4
5401	1.0 to 14.0	>3000	0.32	0.19	.310/.290	0.50	0.08	.234-64	4
5451	1.0 to 16.0	>3000	0.32	0.19	.295/.275	0.31	0.08	.234-64	4
5501	1.0 to 20.0	>1500	0.58	0.16	.295/.275	0.50	0.08	.234-64	4
5601	1.0 to 30.0	>800	0.76	0.16	.295/.275	0.50	0.08	.234-64	3

Dimensions (inches)
Note: All Air Trimmers are available with or without hardware. Hardware may be purchased separately

Air Trimmers

FIGURE 1

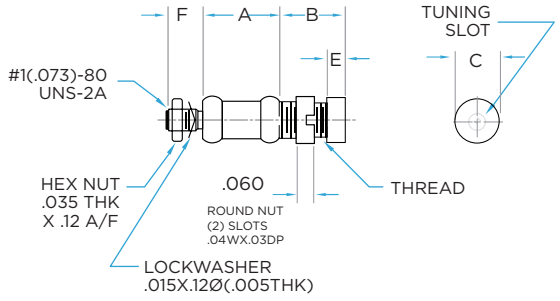
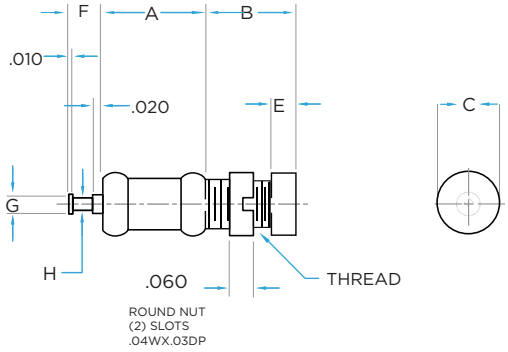


FIGURE 2



Part Number	Capacitance Range (pF)	Min. Q @ 100 MHz	Dimensions									Figure
			A	B	C	D	E	F	G	H	THREAD	
5800	0.35 to 3.5	>10000	0.27	0.23	.160/.150	-	0.06	0.125	-	-	.120-80	1
5802					.160/.150	-		0.08	0.045	0.030		2
5850	0.5 to 5.0	>7500		0.26	.160/.150	-		0.125	-	-		1
5852					.160/.150	-		0.08	0.045	0.030		2
5702	0.6 to 6.0	>10000		0.21	.235/.215	-		0.08	0.06	0.040	190-64	2
5752	0.8 to 10.0	>7500		0.23	.235/.215	-		0.08	0.06	0.040		2

Dimensions (inches)

FIGURE 3

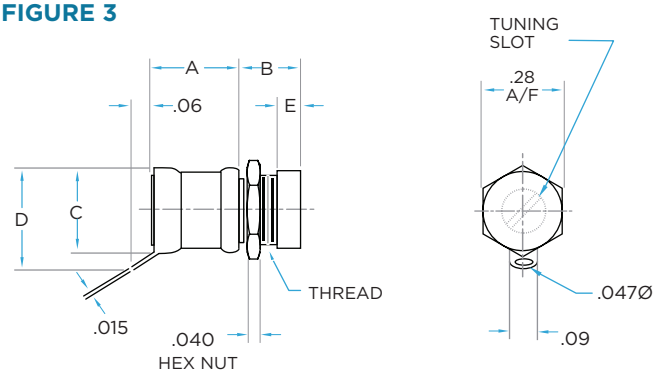
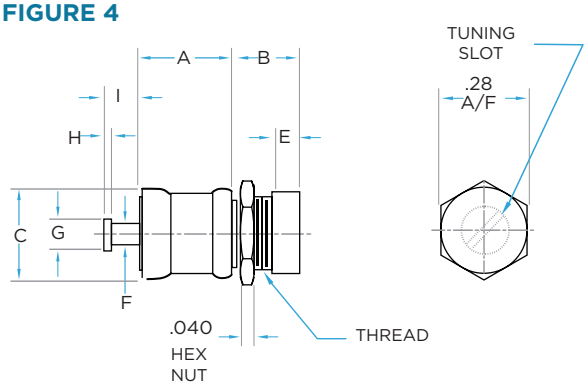


FIGURE 4



Part Number	Capacitance Range (pF)	Min. Q @ 100 MHz	Dimensions										Figure
			A	B	C	D	E	F	G	H	I	THREAD	
5200	0.8 to 10.0	>5000	0.30	0.21	0.295/0.275	0.35	0.08	-	-	-	-	.234-64	3
5202			0.29			-		0.06	0.09	0.02	0.11		4
5302	1.0 to 10.0	>2000	0.42	0.30	0.375/0.355	-	0.11	0.09	0.125	0.02	0.11	.312-64	4
5400	1.0 to 14.0	>3000	0.30	0.21	0.295/0.275	0.35	0.08	-	-	-	-	.234-64	3
5402			0.29			-		0.06	0.09	0.02	0.11		4
5500	1.0 to 20.0	>1500	0.49	0.25	0.295/0.275	0.35	0.08	-	-	-	-	.234-64	3
5502						-		0.06	0.09	0.02	0.11		4
5600	1.0 to 30.0	>800	0.68	0.25	0.295/0.275	0.35	0.08	-	-	-	-	.234-64	3
5602								0.06	0.09	0.02	0.11		4

Dimensions (inches)
Note: All Air Trimmers are available with or without hardware. Hardware may be purchased separately.

Air Trimmers

FIGURE 1

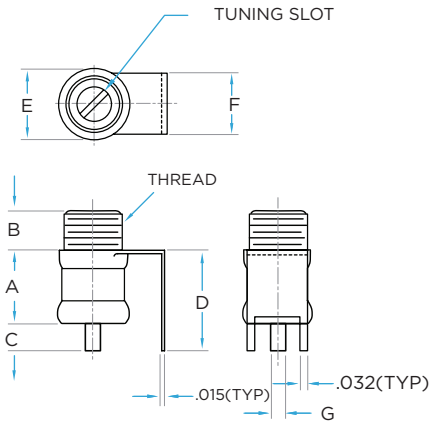


FIGURE 2

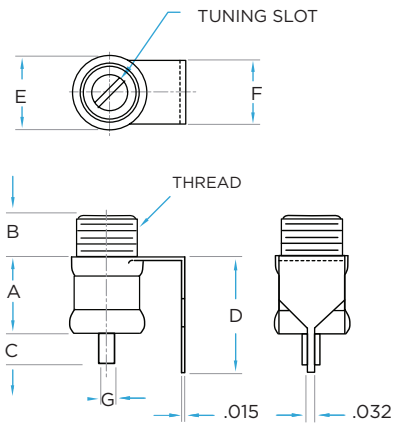


FIGURE 3

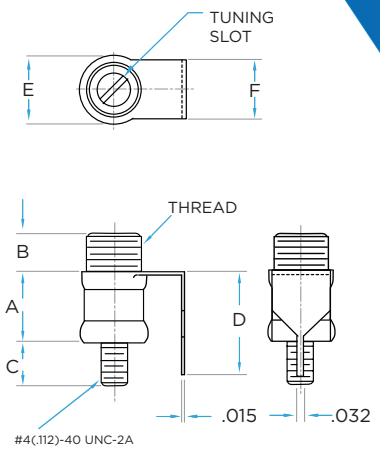


FIGURE 4

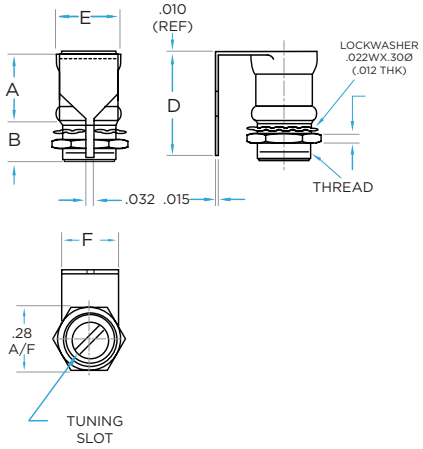


FIGURE 5

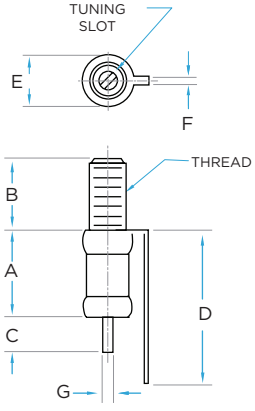
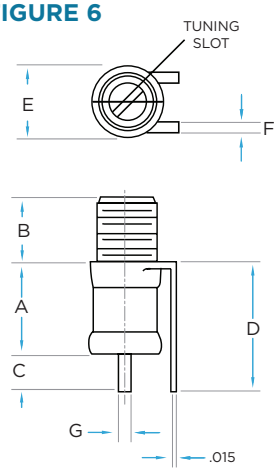


FIGURE 6



Part Number	Capacitance Range (pF)	Min. Q @ 100 MHz	Dimensions								Figure
			A	B	C	D	E	F	G	THREAD	
8051	0.6 to 3.5	>10000	0.28	0.195	0.11	0.48	.160/.150	0.02	0.03	.120-80	5
5853	0.6 to 5.0	>7500	0.28	0.225	0.11	0.48	.160/.150	0.02	0.03	.120-80	5
8050	0.7 to 6.0	>10000	0.29	0.17	0.11	0.40	.235/.215	0.03	0.04	.190-64	5
5753	1.0 to 10.0	>7500	0.29	0.20	0.11	0.40	.235/.215	0.03	0.04	.190-64	6
8052	1.0 to 10.0	>5000	0.30	0.16	0.11	0.40	.295/.275	0.04	0.062	.234-64	5
8090	1.0 to 10.0	>2000	0.30	0.16	0.188	0.44	.295/.275	0.25	-	.234-64	3
8053	1.5 to 14.0	>3000	0.30	0.16	0.11	0.40	.295/.275	0.24	0.062	.234-64	5
8091	1.5 to 14.0	>2000	0.30	0.175	-	0.44	.295/.275	0.25	-	.234-64	4
8092	1.5 to 14.0	>2000	0.30	0.16	0.11	0.41	.295/.275	0.25	0.062	.234-64	1
8093	1.5 to 14.0	>2000	0.30	0.16	0.11	0.44	.295/.275	0.25	0.062	.234-64	2
5453	1.5 to 16.0	>3000	0.30	0.19	0.11	0.43	.295/.275	0.03	0.062	.234-64	6
8054	1.5 to 20.0	>1500	0.58	0.125	0.11	0.70	.295/.275	0.04	0.062	.234-64	5

Dimensions (inches)
Note: All Air Trimmers are available with or without hardware. Hardware may be purchased separately.

Air Trimmers

K Series

FIGURE 1

FIGURE 2

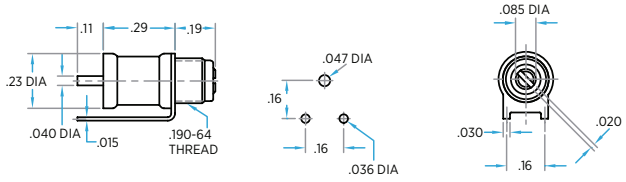


FIGURE 3

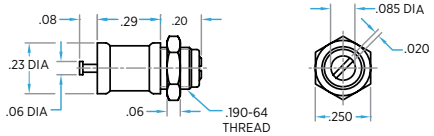


FIGURE 4

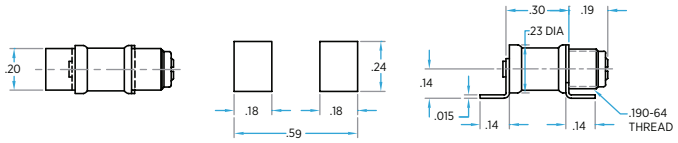


FIGURE 5

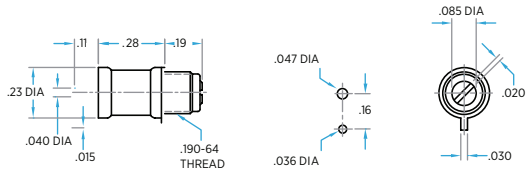
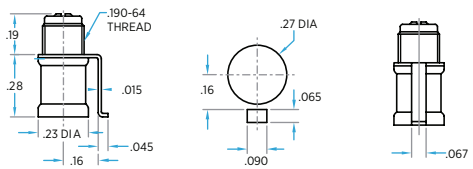


FIGURE 6



Part Number "K" Series	Capacitance Range (pF)		DC Working Voltage	Figure
	From Below	To Above		
KP6	0.8	6.0	250	1
KP8	0.8	8.0	250	1
KP10	0.8	10.0	125	1
KF8	0.6	8.0	250	2
KF10	0.6	10.0	125	2
KT6	0.6	6.0	250	3
KT8	0.6	8.0	250	3
KT10	0.6	10.0	125	3
KJ8	0.6	8.0	250	4
KJ10	0.6	10.0	125	4
KG8	0.6	8.0	250	5
KG10	0.6	10.0	125	5
KM8	0.6	8.0	250	6
KM10	0.6	10.0	125	6

Note: All Air Trimmers are available with or without hardware. Hardware may be purchased separately.

Air Dielectric Variable Trimmers

DESCRIPTION

- Concentric tubular design
- Torque mechanism insures low ESR and low dynamic noise
- Available in PC, panel mount, vertical mount and surface mount terminations
- High Reliability testing available

CHARACTERISTICS

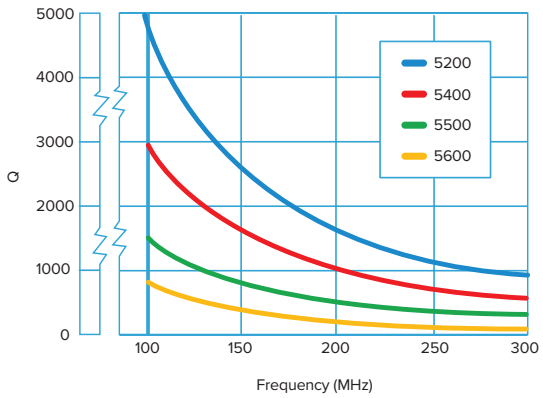
- Rated voltage: 250 VDC (5300 series 500 VDC)
- Insulation resistance: $>10^6 M\Omega$ @ 500 VDC
- Contact resistance: <.01 Ω
- Operating temperature: -65°C to +125°C
- Vibration: 60g, 10-2000 Hz
- Shock: 1500g, .5 milliseconds
- 574°F solder used in construction

APPLICATIONS

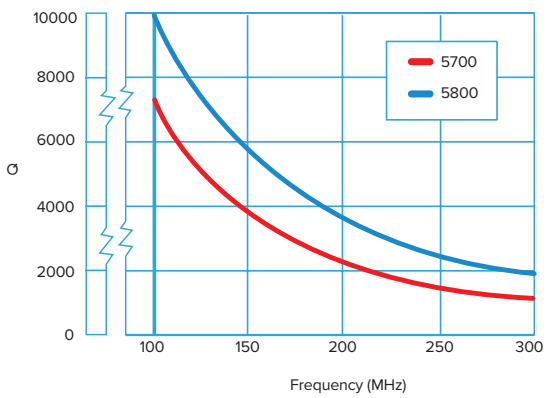
- RF amplifiers and oscillators
- Impedance matching
- Interstage coupling
- Filter tuning
- Crystal trimming

Note: The use of a Knowles tuning tool is recommended. Improper screwdriver size will cause internal thread damage.

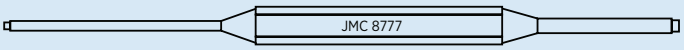
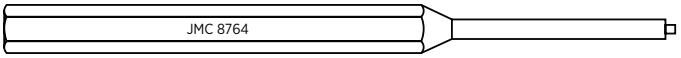
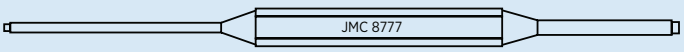
TYPICAL PERFORMANCE CURVES 5200/5400/5500/5600 SERIES



TYPICAL PERFORMANCE CURVES 5700/5800 SERIES



TUNING TOOLS

Trimmer Series	Diameter	Johanson Part Number	
5200, 5300, 5400, 5500, 5600, 5700	.130	8777	
		8764	
5800	.078	8777	

Non-Magnetic Air Trimmers

DESCRIPTION

- Non-Magnetic construction
- High stability and Q
- 250 VDC working voltage
- Utilizes self-locking constant torque drive mechanism

RECOMMENDED TUNING TOOL

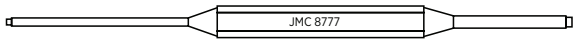


FIGURE 1

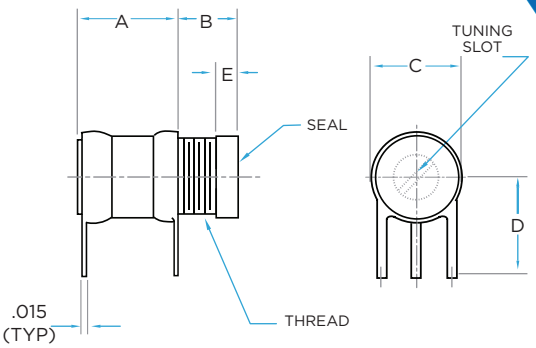


FIGURE 2

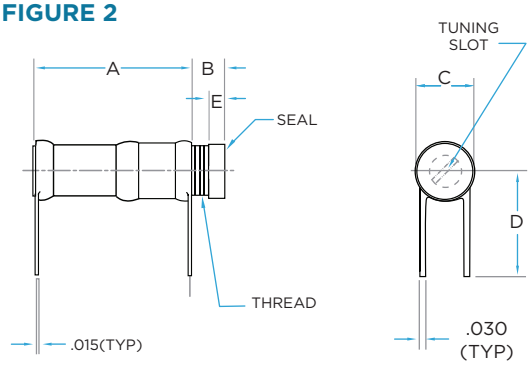


FIGURE 3

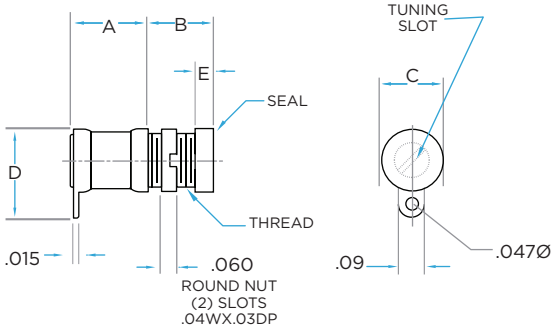


FIGURE 4

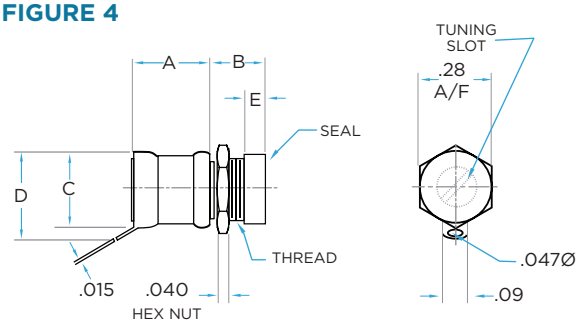
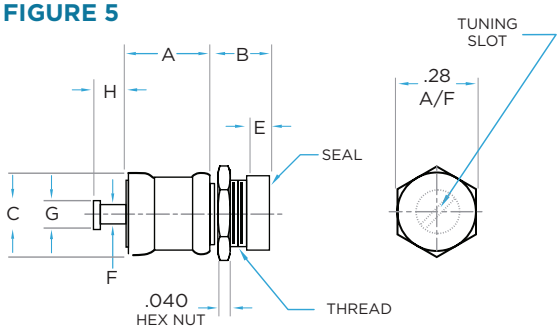


FIGURE 5



Part Number	Capacitance Range (pF)	Min. Q @ 100 MHz	Dimensions									Figure
			A	B	C	D	E	F	G	H	THREAD	
5862	0.4 to 3.5	>10000	0.27	0.225	.160/.150	-	0.06	0.03	0.045	0.080	.120-80	5*
5760	0.6 to 6.0	>10000	0.27	0.21	.235/.215	0.32		-	-	-	.190-64	3
5761			0.29	0.19		0.22		-	-	-		1
5762			0.27	0.21		-		0.04	0.06	0.080		5*
5240	0.8 to 10.0	>4000	0.30	0.21	.295/.275	0.35	0.08	-	-	-	.234-64	4
5241			0.32	0.19		0.31		-	-	-		1
5242			0.29	0.21		-		0.06	0.09	0.11		5
5640	1.0 to 30.0	>800	0.68	0.25	.295/.275	0.35		-	-	-	.234-64	4
5641			0.76	0.16		0.50		-	-	-		2
5642			0.68	0.25		-		0.06	0.09	0.11		5

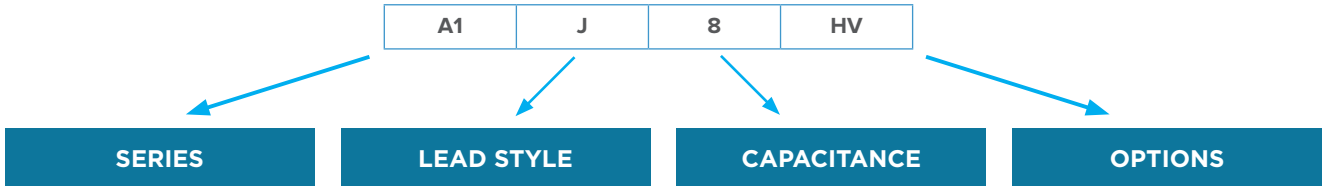
Dimensions (inches)
Note: All Air Trimmers are available with or without hardware. Hardware may be purchased separateley.

*5862 & 5762 are supplied with a round nut instead of a hexagon.

PTFE Trimmers
A1 Series

The Voltronics A1 Series of high reliability solid dielectric trimmer capacitors is an ideal economical replacement for conventional miniature air and sapphire dielectric trimmers and assures no intermittent noiseless performance.

High reliability solid dielectric, positive tuning stops and up to 13 full turns of linear tuning make the A1 Series an outstanding performer: 40 psi sealed, high voltage and non-magnetic versions are readily available.



OPTIONS:

The “HV” Option - high voltage applications:
Add “HV” to the part number, i.e., A1T4HV.

SPECIFICATIONS ARE AS FOLLOWS:

Capacitance	DC Volts Working	DC Volts Withstanding
4pF	1000	2000
8pF	500	1000
11pF	500	1000

NON-MAGNETIC OPTION:

Most parts shown can be ordered as non-magnetic.
Add “NM” to the part number, i.e., NMA1J8.

SEALED OPTION:

All parts shown can be ordered as 40 psi sealed.
Add “S” to the part number, i.e., A1M4S.

TAPE & REEL OPTIONS:

Consult Factory - M & J style only
Recommended Tuning Tool: TT-400

General Specifications	A1_4	A1_8	A1_12
Capacitance Range	0.45 to 4pF	0.5 to 8pF	0.8 to 11pF
DC Working Voltage	250	125	125
DC Withstanding Voltage	500	250	250
Self-Resonant Frequency*	2.3 GHz at 4pF	1.7 GHz at 8pF	1.2 GHz at 11pF
Number of Turns	7	7	13
Q (min) at 100 MHz @ Max. C*	4000	3000	2000
Temperature Coefficient	0±50ppm/°C	0±100ppm/°C	0±150ppm/°C
Insulation Resistance @ 25° C	10^6 MΩ		
Operating Temperature	-65°C to +125°C		
Tuning Torque	0.3 to 1.0 in - oz		
Shock	1,500g, 0.5 millisecs.		
Vibration	50g at 10 - 2000 Hz		

* Self-resonant frequency and Q are assured with no terminals on parts.

PTFE Trimmers
A1 Series

FIGURE 1

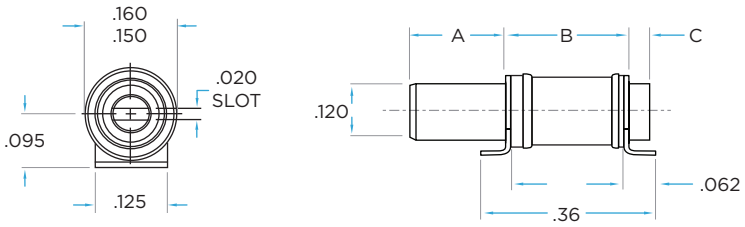


FIGURE 2

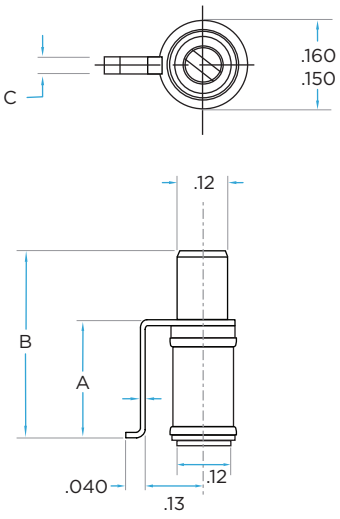
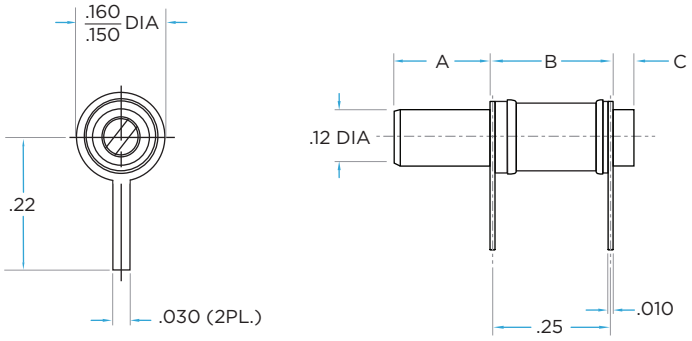


FIGURE 3



Part Number	Capacitance Range (pF)	Min. Q @ 100 MHz	Dimensions			Figure
			A	B	C	
A1J4	0.45 to 4.0	>4000	0.14	0.26	-	1
A1J8	0.5 to 8.0	>3000	0.14	0.26	-	1
A1J12	0.8 to 11.0	>2000	0.20	0.26	0.05	1
A1M4	0.45 to 4.0	>4000	0.26	0.40	0.03	2
A1M8	0.5 to 8.0	>3000	0.26	0.40	0.03	2
A1M12	0.8 to 11.0	>2000	0.30	0.50	0.02	2
A1P4	0.45 to 4.0	>4000	0.14	0.26	-	3
A1P8	0.5 to 8.0	>3000	0.14	0.26	-	3
A1P12	0.8 to 11.0	>2000	0.20	0.26	0.04	3

Miniature PTFE Trimmers
A4 Series

The Voltronics A4 Series unique design using minimal parts simplifies the manufacturing process to effect one of the most economical high performance trimmer capacitors available in the industry.

The Voltronics A4 Series also features a high reliability solid dielectric, positive tuning stops and up to 5 full turns of linear tuning in the shortest length of any similar trimmer capacitor. The Voltronics A4 is an ideal choice for tuning and impedance matching, high frequency and high power amplifier circuits.

A4	J	8	HV
SERIES	LEAD STYLE	CAPACITANCE	OPTIONS

OPTIONS:

The "HV" Option - high voltage applications:
Add "HV" to the part number, i.e., A4T4HV.

SPECIFICATIONS ARE AS FOLLOWS:

Part Number	DC Volts Working	DC Volts Withstanding
A4_3 HV	500	1000
A4_5 HV	500	1000

NON-MAGNETIC OPTION:

All parts can be ordered as non-magnetic. Add "NM" to the part number, i.e. NMA4J3

TAPE AND REEL OPTIONS:

Tape and Reel Options: Consult Factory
M style only

General Specifications	A4_3	A4_5
Capacitance Range	0.45 to 3pF	0.6 to 5pF
DC Working Voltage	125	125
DC Withstanding Voltage	250	250
Self-Resonant Frequency*	3 GHz at 3pF	1.8 GHz at 5pF
Number of Turns	4	5
Q (min) at 100 MHz @ Max. C*	3000	2000
Temperature Coefficient	0±100ppm/°C	0±300ppm/°C
Insulation Resistance @ 25° C	10^6 MΩ	
Operating Temperature	-65°C to +125°C	
Tuning Torque	0.3 to 1.0 in - oz	
Shock	1,500g, 0.5 millisecs.	
Vibration	50g at 10 - 2000 Hz	

* Self-resonant frequency and Q are assured with no terminals on parts.

Part Number	Capacitance Range (pF)	Min. Q @ 100 MHz	Dimensions		Figure
			A	B	
A4J3	0.45 to 3.0	>3000	0.225	-	1
A4J5	0.6 to 5.0	>2000	0.325	-	1
A4M3	0.45 to 3.0	>3000	0.225	0.22	2
A4M5	0.6 to 5.0	>2000	0.325	0.278	2
A4P3	0.45 to 3.0	>3000	0.225	-	3
A4P5	0.6 to 5.0	>2000	0.325	-	3

FIGURE 1

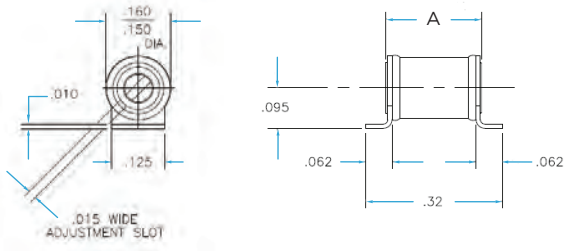
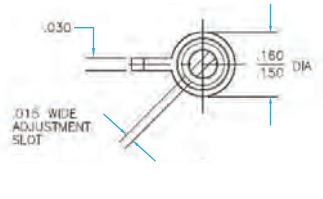


FIGURE 2



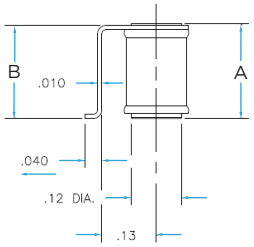
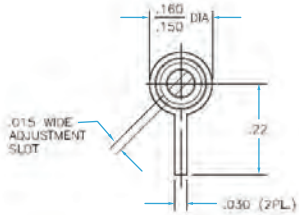
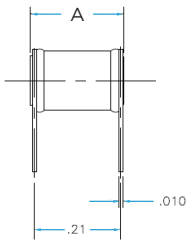


FIGURE 3





HV PTFE Trimmers
A_HV Series

THE ONLY INTERNALLY SEALED HIGH VOLTAGE PTFE TRIMMER

Voltronics' concentric ring PTFE dielectric trimmer capacitors are designed for use at frequencies up to 1.5 GHz. They are ideal for HIGH VOLTAGE applications. The solid internal PTFE dielectric prevents ionization, a major advantage in space, high altitude and high voltage applications. The unique internal O-ring seal makes wave soldering and vapor degreasing possible without the need to attach a separate cap.

A	J	8	HV
SERIES	LEAD STYLE Refer to page 21	CAPACITANCE	OPTIONS

General Specifications	A_4HV	A_10 HV	A_15 HV	A_25 HV	A_40 HV	A_55 HV
Capacitance Range	1 to 4pF	1 to 10pF	1 to 16pF	1 to 23pF	1.5 to 40pF	1.5 to 55pF
DC Working	1000	1000	1000	750	1000	600
DC Withstanding	2000	2000	2000	1500	2000	1200
Q (min) at 100MHz @ Max. C*	2000	2000	2000	2000	2000	-
Q (min) at 75MHz @ Max. C*	-	-	-	-	-	780
Temperature Coefficent - 0±100ppm/°C	0±100 ppm/°C	50±50 ppm/°C	50±50 ppm/°C	50±50 ppm/°C	0±100 ppm/°C	0±100 ppm/°C
Insulation Resistance @ 25°C	10^6 MΩ	10^6 MΩ	10^6 MΩ	10^6 MΩ	10^6 MΩ	10^6 MΩ
Seal	40 pounds/in²	40 pounds/in²	40 pounds/in²	40 pounds/in²	40 pounds/in²	40 pounds/in²
Operating Temperature	-65°C to +125°C	-65°C to +125°C	-65°C to +125°C	-65°C to +125°C	-65°C to +125°C	-65°C to +125°C
Rotational Life	600 Turns	600 Turns	600 Turns	600 Turns	600 Turns	600 Turns
Tuning Torque	.05 to 5.0 in-oz	.05 to 5.0 in-oz	.05 to 5.0 in-oz	.05 to 5.0 in-oz	.05 to 5.0 in-oz	.05 to 5.0 in-oz
Shock	1500g, 0.5 millisecs.	1500g, 0.5 millisecs.	1500g, 0.5 millisecs.	1500g, 0.5 millisecs.	1,500g, 0.5 millisecs.	1,500g, 0.5 millisecs.
Vibration	50g at 10-2000 Hz	50g at 10-2000 Hz	50g at 10-2000 Hz	50g at 10-2000 Hz	50g at 10-2000 Hz	50g at 10-2000 Hz

* Self-resonant frequency and Q are assured with no terminals on parts.

Part Number	Capacitance Range (pF)	Min. Q @ 100 MHz	Dimensions			Figure
			A	B	C	
AJ10HV	1.0 to 10.0	>2000	0.31	0.19	-	1
AJ15HV	1.0 to 16.0	>2000	0.31	0.19	-	1
AJ25HV	1.0 to 23.0	>2000	0.31	0.19	-	1
AJ40HV	1.5 to 40.0	>780	0.55	0.44	-	1
AJ55HV	1.5 to 55.0	>2000	0.55	0.44	-	1
AM10HV	1.0 to 10.0	>2000	-	-	-	2
AM15HV	1.0 to 16.0	>2000	-	-	-	2
AM25HV	1.0 to 23.0	>2000	-	-	-	2
AP10HV	1.0 to 10.0	>2000	0.31	0.19	0.28	3
AP15HV	1.0 to 16.0	>2000	0.31	0.19	0.28	3
AP25HV	1.0 to 23.0	>2000	0.31	0.19	0.28	3
AP40HV	1.5 to 40.0	>2000	0.56	0.44	0.54	3
AP55HV	1.5 to 55.0	>780	0.56	0.44	0.54	3

OTHER FEATURES INCLUDE:

- Ten or 29 linear turns
- Internal stops
- Extreme stability under shock & vibration
- Screw head does not move in and out
- Extended shaft option of metal or plastic
- Long life with no dynamic tuning noise

OPTIONS:

NON-MAGNETIC OPTION:
All parts can be ordered as non-magnetic.
Add "NM" to the part number, i.e. NMAM15HV

TAPE AND REEL OPTIONS:
Tape and Reel Options: Consult Factory M style only

EXTENDED SHAFT OPTIONS:
Add "E" to the part number, i.e. AM10HVE

FIGURE 1

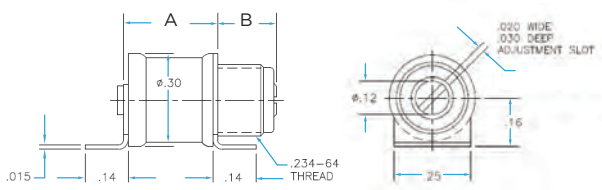


FIGURE 2

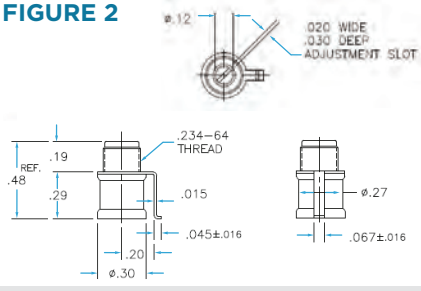
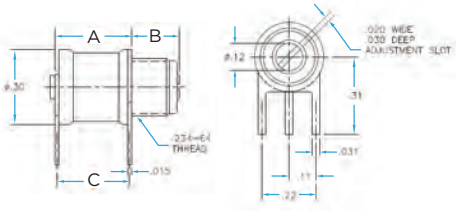


FIGURE 3



PTFE Trimmers
K_HV Series

FIGURE 1

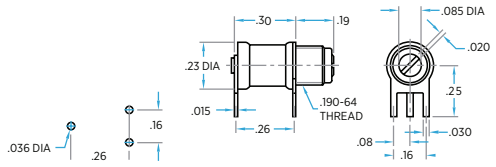


FIGURE 2

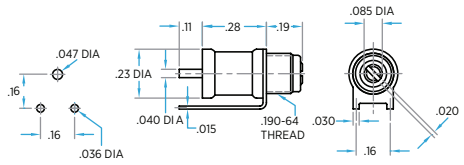


FIGURE 3

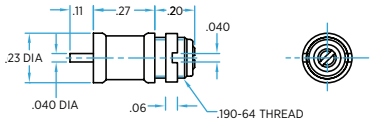


FIGURE 4

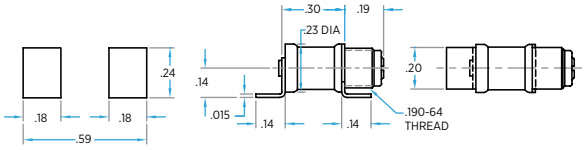
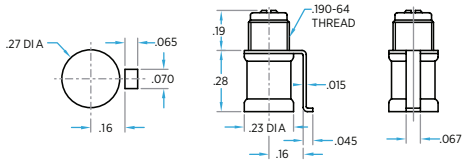
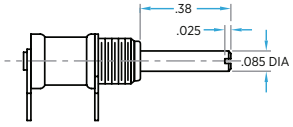


FIGURE 5



Note: All bushing threads are .190"-64

EXTENDED METAL SHAFT



Add "E" to Part Number, i.e., KP10HVE.

General Specifications	K_HV
Q at 100MHz at maximum rated C*	780 (1pF)
Q at 100MHz at maximum rated C*	2000 (4 & 9pF)
Temperature Coefficient	50±50ppm/°C
Insulation Resistance	10^6 MΩ
Seal	40 pounds/in^2
Operating Temperature	-65°C to +125°C
Rotational Life	600 turns
Torque	.05 to 5.0 in-oz
Vibration	50g at 10-2000 Hz
Shock	1500g, 0.5 millisecs.

* Self-resonant frequency and Q are measured with no terminals on parts.

Part Number "K" Series	DC Working Voltage	DC Withstanding Voltage	Capacitance Range (pF) From Below	Capacitance Range (pF) To Above	Figure
KP1HV	1000	2000	0.2	1	1
KP1SD	250	500	0.2	1	1
KP4HV	1000	2000	0.6	4	1
KP4SD	250	500	0.6	4	1
KP10HV	1000	2000	1.0	9	1
KF4HV	1000	2000	0.6	4	2
KF4SD	250	500	0.6	4	2
KF10HV	1000	2000	1.0	9	2
KT1HV	1000	2000	0.2	1	3
KT1SD	250	500	0.2	1	3
KT4HV	1000	2000	0.6	4	3
KT4SD	250	500	0.6	4	3
KT10HV	1000	2000	1.0	9	3
KJ1HV	1000	2000	0.2	1	4
KJ1SD	250	500	0.2	1	4
KJ4HV	1000	2000	0.6	4	4
KJ4SD	250	500	0.6	4	4
KJ10HV	1000	2000	1.0	9	4
KM4HV	1000	2000	0.6	4	5
KM4SD	250	500	0.6	4	5
KM10HV	1000	2000	1.0	9	5

Very High Voltage PTFE Trimmers

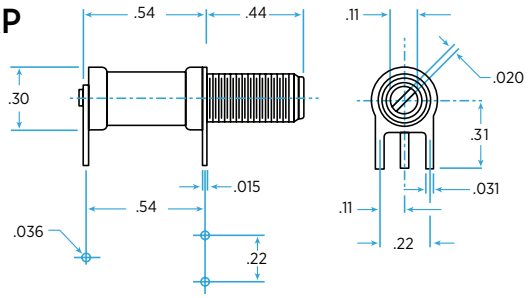
This range of Voltronics trimmer capacitors provides a further extension in voltage rating to the HV range. Working voltage is 2kV and dielectric withstand voltage is 4kV. The solid internal PTFE dielectric prevents ionization, a major advantage in space, high altitude and high voltage applications. The unique internal O-ring seal makes wave soldering and vapor degreasing possible without the need to attach a separate cap.

A	J	8	HV
SERIES	LEAD STYLE P, J & T Lead Styles Refer to page 21	CAPACITANCE	OPTIONS

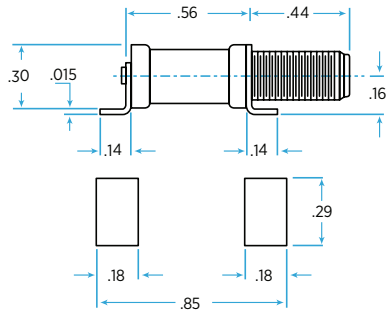
OPTIONS

Extended metal shaft.
Add 'E' to the part number i.e. AT10-4E

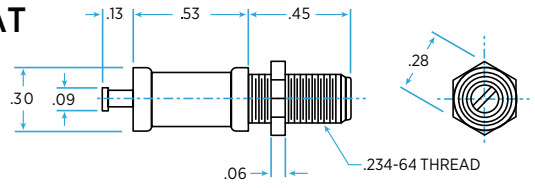
AP



AJ



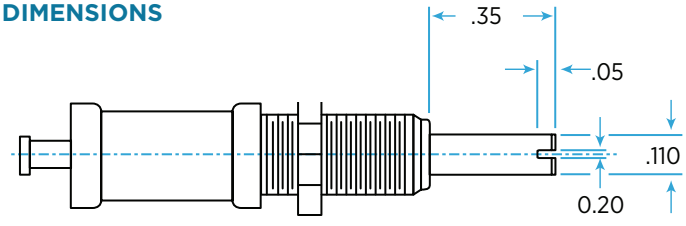
AT



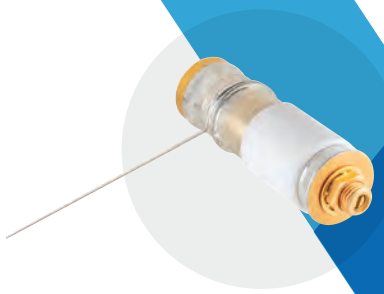
Note: Self Resonant frequency and Q are measured with no terminal on the part

General Specifications	A_10-4	A_20-4
Capacitance Range	0.8 to 10pF	0.8 to 20pF
DC Working Voltage	2000	2000
DC Withstanding Voltage	4000	4000
Self-Resonant Frequency*	4.25 GHz at 2pF	3 GHz at 3pF
Q (min) at 100 MHz © Max. C*	3000	3000
Temperature Coefficient	-50±-50 ppm/°C	0-100 ppm/°C
Insulation Resistance @ 25°C	10^6 MΩ	10^6 MΩ
Operating Temperature	-65°C to +125°C	-65°C to +125°C
Tuning Torque	0.5 to 5.0 in-oz	0.5 to 5.0 in-oz
Shock	1500g, 0.5 millisecs.	1500g, 0.5 millisecs.
Vibration	50g at 10-2000 Hz	50g at 10-2000 Hz

DIMENSIONS



Note: For Non-Magnetic parts add 'NM' to part number, i.e. NMAT10-4



Non-Magnetic PTFE Trimmers NMNT Series

4kV TO 10kV

Voltronics NMNT Series of PTFE trimmers are designed for applications requiring greater capacitance and voltage ratings than the popular smaller trimmers but without the large size and expense of vacuum capacitors.

THE NMNT SERIES OFFERS:

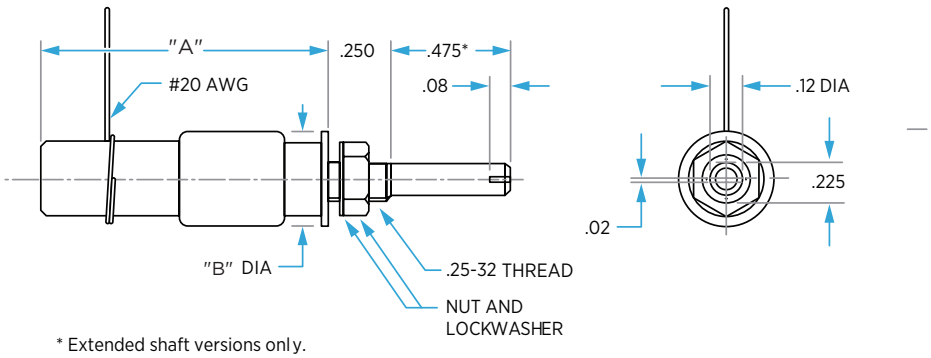
- High voltage
- Non-rotating piston, long life and no tuning noise
- Extremely stable under shock and vibration
- Non-translating screw head

Proven RF performance and power handling these high performance trimmer capacitors are utilized in MRI body coils, NMR equipment and RF power transfer applications.

Part Number	DC Working Voltage	DC Withstanding Voltage	Capacitance (pF) <	Capacitance (pF) >	"A" Dim	"B" Dim
NMNT5-8	4000	8000	1.0	5.0	1.13	0.38
NMNT5-18	8750	17500	1.0	5.0	2.0	0.75
NMNT10-6	3000	6000	1.0	10.0	1.15	0.38
NMNT10-12	6000	12000	2.0	10.0	1.85	.063
NMNT15	2000	4000	1.0	15.0	1.69	0.31
NMNT23-6	3000	6000	3.0	23.0	1.70	0.38
NMNT23-12	6000	12000	3.0	23.0	1.85	0.63
NMNT25-6	3000	6000	5.0	25.0	1.63	0.63
NMNT25-15	7500	15000	7.0	25.0	1.76	1.13
NMNT70-6	3000	6000	2.5	70.0	3.0	0.70
NMNT100-4	2500	3600	2.0	95.0	4.25	0.31

Note: Preferred parts. Others available but may be subject to an increased MOQ.
Additional voltage ratings are available. Contact customer service.

DIMENSIONS NMNT SERIES



* Extended shaft versions only.

High Voltage Trimmers

CHARACTERISTICS

- Rated voltage: 1250 VDC - test voltage 2500 VDC (52H02)
  1000 VDC - test voltage 2000 VDC (55H01) (55H02) (80H85)
- Q >1400@ 195 MHz (52H02)
- Q >1000@ 175 MHz (55H01) (55H02) (80H85)
- Insulation resistance: $>10^6$ MΩ
- Operating temperature range: -65°C to +125°C
- Torque: 1 to 10 oz. in.
- Contact resistance: <.01 Ω)
- Additional terminal configurations available. Contact facility

RECOMMENDED TUNING TOOL

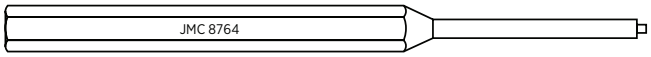


FIGURE 1

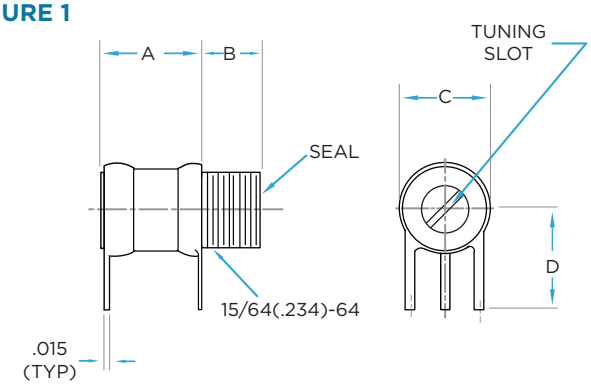


FIGURE 2

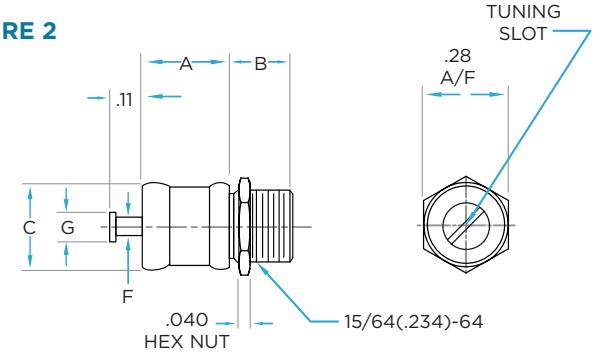
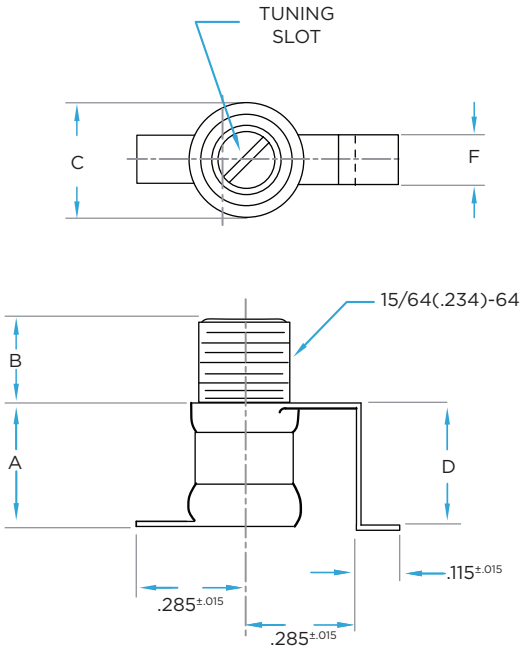


FIGURE 3



Part Number	Capacitance Range (pF)	Min. Q @ 100 MHz	Dimensions							Figure
			A	B	C	D	E	F	G	
52H01	1.5 to 10.0	>1400*	0.31	0.22	.295/.275	0.31	-	-	-	1
52H02						-		0.06	0.09	2
55H01	1.5 to 19.0	>1000	0.31	0.22	.295/.275	0.31	-	-	-	1
55H02	1.5 to 19.0	>1000	0.31	0.22	.295/.275	-	-	0.06	0.09	2
80H85	1.5 to 19.0	>1000	0.31	0.22	.295/.275	0.32	-	0.125	-	3

Notes: Dimensions (inches). *Q @ 195MHz.

Giga-Trim® Trimmers

DESCRIPTION

- Sapphire dielectric
- Ceramic dielectric
- Zirconia High K dielectric
- High Q
- 500 VDC working voltage
- Select part numbers available on tape and reel
- Utilizes the same constant torque drive mechanism as Knowles air capacitors and tuning elements

CHARACTERISTICS

- Rated voltage: 500 VDC
- Insulation resistance: $>10^6$ MΩ @ 500 VDC
- Rotational life exceeds Mil-C-14409
- Contact resistance: <.01 Ω
- Operating temperature: -65°C to +125°C
- Vibration: 15g, 10-2000 Hz
- Shock: 100g, 6 milliseconds

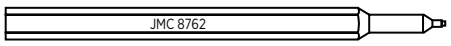
APPLICATIONS

- Impedance matching
- Crystal trimming
- Interstage coupling
- Base station amplifier

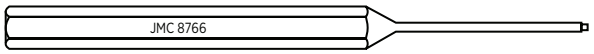
SEAL CAPS

Type	Part Number	Capacitor Type	Material
17273	P4446-2	"Poke-Thru" Seal Cap	Teflon®
27260 Thru 27265	P4445-1	Standard Seal Cap	Teflon®
27270 Thru 27295	P4445	Standard Seal Cap	Teflon®
27260 Thru 27265	P4446-1	"Poke-Thru" Seal Cap	Teflon®
27270 Thru 27295	P4446	"Poke-Thru" Seal Cap	Teflon®
47273 Thru 47285	P4446-2	"Poke-Thru" Seal Cap	Teflon®
57263	P4446-1	"Poke-Thru" Seal Cap	Teflon®

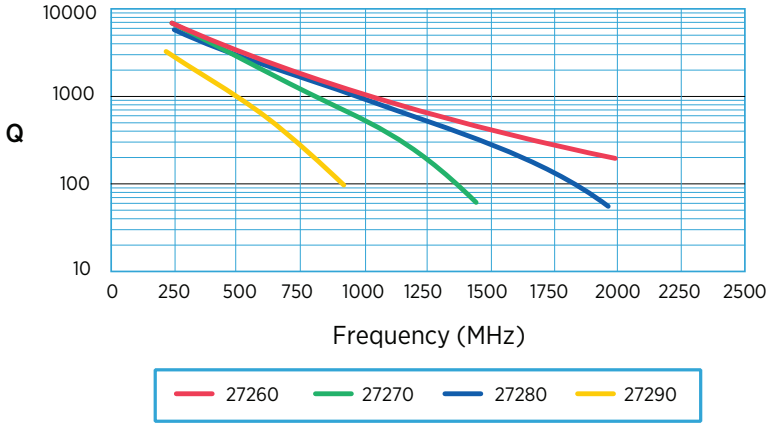
JMC Drive Tuning Tool 8762



JMC Drive Tuning Tool 8766



Note: The use of a Johanson tuning tool is recommended. Improper screwdriver size will cause internal thread damage.

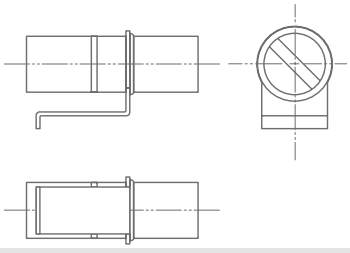


Set at Max. capacitance

Giga-Trim® Trimmers Selection Guide

Part Number	Capacitance Range (pF)	Number of Turns	Working Voltage (VDC)	Dielectric	Tuning Torque (oz in)	Q @ 250 MHz	Page Number
17273	0.6 to 4.5	>8	500	Sapphire	0.2 to 2	>2000	39
27261	0.3 to 1.2	>5	500	Sapphire	0.1 to 1	>5000	40
27261SL							
27263							39
27264							
27265							
27271	0.6 to 4.5	>8	500	Sapphire	0.2 to 2	>3000	40
27271SL							
27273							39
27274							
27275							
27281	0.4 to 2.5	>4	500	Sapphire	0.2 to 2	>4000	40
27281S L							
27283							39
27284							
27285							
27291	0.8 to 8.0	>16	500	Sapphire	0.2 to 2	>*3000	40
27291SL							
27293							39
27294							
27295							
47273	0.6 to 4.5	>8	500	Alumina	0.2 to 2	>3000	39
47473	2.0 to 6.0	>6				>1500	
47483	0.3 to 2.3	>4				>2000	
47285-3	0.4 to 2.5	>4				>**3000	40
57273	0.8 to 8.0	>8	500	Zirconia	0.2 to 2	>*2000	40
57285-3	0.8 to 4.5	>4				>**1000	40

*Q @ 100 MHz **@ 200 MHz



Part Number	Units/Reel	Carrier Tape
27273-3R5	400	24mm
27283-3R10	750	16mm
47275-1R11	500	32mm
47273-11R5	400	24mm
47273R5	400	24mm
47483R10	750	16mm
57273R5	400	24mm

Giga-Trim® Trimmers

FIGURE 1

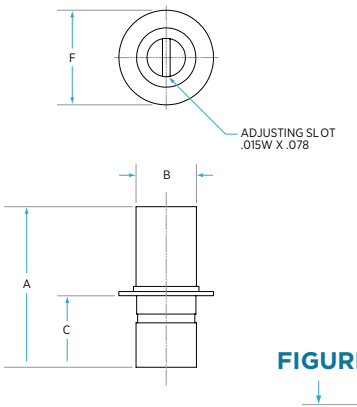


FIGURE 2

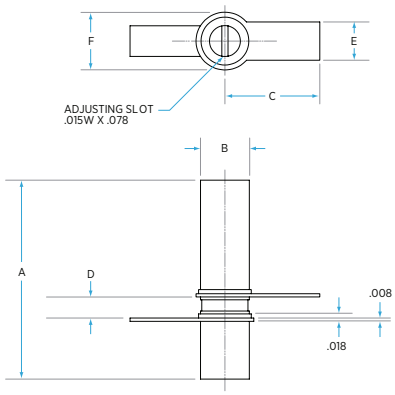
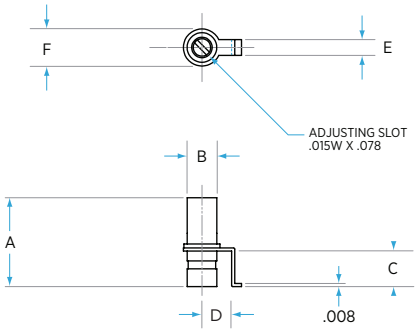


FIGURE 3



Cap Range	Part Number	A	B	C	D	E	F	Figure
0.3 to 1.2	27263	0.225	0.075	0.09	0.075	0.040	0.094	3
0.3 to 2.3	47483	0.230	0.118	0.09	0.110	0.040	0.15	3
0.4 to 2.5	27273	0.314	0.118	0.09	0.110	0.040	0.14	3
0.6 to 4.5	17273	0.330	0.118	0.16	0.110	0.040	0.15	3
	47273	0.330	0.118	0.16	0.110	0.040	0.15	3
	27283	0.314	0.118	0.16	0.110	0.040	0.14	3
0.9 to 4.5	57283	0.230	0.118	0.09	0.110	0.093	0.15	3
0.8 to 8.0	27273	0.330	0.118	0.16	0.110	0.093	0.15	3
0.8 to 8.0	27293	0.480	0.118	0.25	0.110	0.040	0.14	3
2.0 to 6.0	47473	0.330	0.118	0.16	0.110	0.040	0.15	3
0.3 to 1.2	27264	0.225	0.75	0.23	0.056	0.040	0.094	2
0.4 to 2.5	27274	0.225	0.118	0.23	0.056	0.093	0.14	2
0.6 to 4.5	27284	0.314	0.118	0.23	0.060	0.093	0.14	2
0.8 to 8.0	27294	0.480	0.118	0.23	0.051	0.093	0.14	2
0.3 to 1.2	27265	0.225	0.75	0.078	-	-	0.142	1
0.4 to 2.5	27275	0.225	0.118	0.09	-	-	0.185	1
0.6 to 4.5	27285	0.314	0.118	0.16	-	-	0.185	1
0.8 to 8.0	27295	0.480	0.118	0.25	-	-	0.185	1

Giga-Trim® Trimmers

FIGURE 1

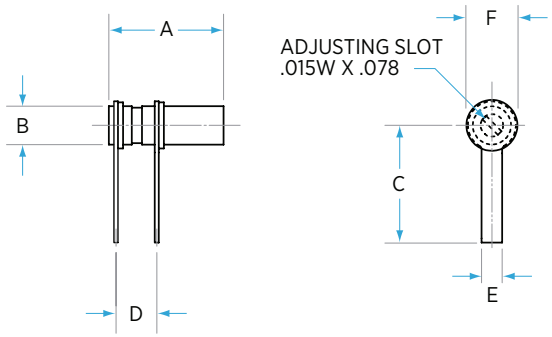


FIGURE 2

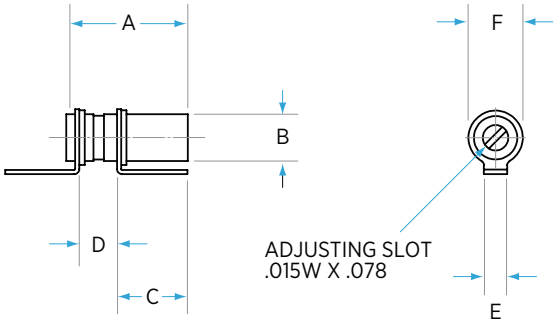
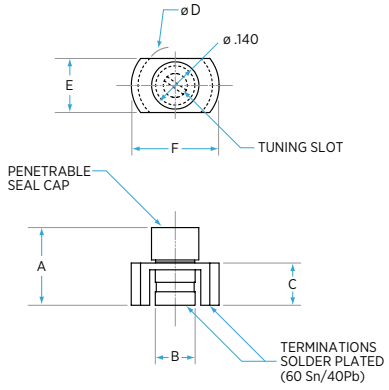


FIGURE 3



Cap Range	Part Number	A	B	C	D	E	F	Figure
0.3 to 1.2	27261	0.225	0.075	0.23	0.08	0.04	0.094	1
0.4 to 2.5	27281	0.225	0.118	0.23	0.08	0.04	0.14	1
0.6 to 4.5	27271	0.314	0.118	0.23	0.13	0.04	0.14	1
0.8 to 8.0	27291	0.480	0.118	0.23	0.25	0.04	0.14	1
0.3 to 1.2	27261SL	0.225	0.075	0.18	0.07	0.04	0.094	2
0.4 to 2.5	27281SL	0.225	0.118	0.16	0.07	0.04	0.14	2
0.6 to 4.5	27271SL	0.314	0.118	0.16	0.12	0.04	0.14	2
0.8 to 8.0	27292SL	0.480	0.118	0.16	0.24	0.04	0.14	2
0.4 to 2.5	47285-3	0.230	0.118	0.125	0.220	0.160	0.260	3
0.8 to 4.5	57285-3	0.230	0.118	0.125	0.220	0.160	0.260	3

Glass and Quartz Trimmers Specifications

DESIGN FEATURES

The unique Voltronics non-rotating precision trimmer capacitor design offers the following advantages over conventional rotating types:

- Linear tuning with no reversals
- A true high frequency device with high Q, low RF losses
  low constant inductance and high self-resonant frequencies
- A superior seal because the screw head and O-ring do not move in and out
- Much smaller sealed MIL sizes
- Ability to provide extended metal or plastic shafts

GENERAL SPECIFICATIONS

(where not specified on detail pages)

PISTON ACTION

Non-rotating.

BLIND HOLE TUNING

Screw head does not move in and out.

LINEARITY

± 1% with no capacitance reversals.

RESOLUTION

#2-72 tuning screw for fine tuning - approximatepico-farads per turn in active tuning range:

1. Annular band glass - 0.6 to 0.8
2. Embedded band glass - 2.3 to 3.0
3. Quartz - 0.3 to 0.36
4. “H” Series high range glass - 3.9 to 4.2

INSULATION RESISTANCE

Annular band glass and quartz:
10^6 MΩ at 25°C to 125°C
Embedded band glass:
10^6 MΩ at 25°C, 10^5 MΩ at 125°C

TUNING TORQUE

1 to 8 inch ounces.

TEMPERATURE COEFFICIENT

1. Annular band glass - ±50 ppm/°C
2. Embedded band glass - ±150 ppm/°C
3. Quartz - 0 to +50 ppm/°C

DIELECTRIC WITHSTANDING VOLTAGE

Twice DC working voltage (listed with each part).

CAPACITANCE TUNING RANGE

From below minimum to above maximum value listed for each part. Capacitance measured at 1 MHz.

TEMPERATURE RANGE

1. All glass dielectrics -55°C to 125°C
2. Quartz dielectrics -55°C to 150°C

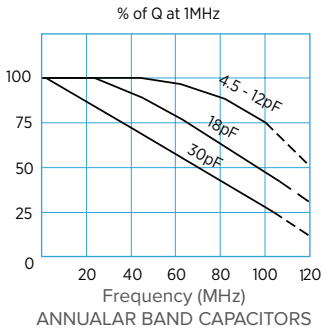
OTHER SPECIFICATIONS

All other specifications including vibration, shock, moisture and seal (where applicable) per MIL-PRF-14409.

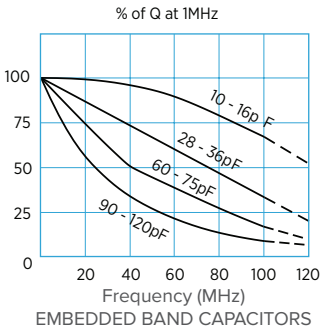
DRAWING TOLERANCES

(where not specified)
Decimal: XXX ±.016”
XX ±.03”

QUALITY FACTOR



ANNUALAR BAND CAPACITORS



EMBEDDED BAND CAPACITORS

Recommended Tuning Tools:
TT-100 or TT-600

DIELECTRIC

The dielectric is a tube which has been precision drawn in a vacuum so that its inner diameter is held within ±0.0002”. The choices are:

1. **Annular Band Glass:** A solid tube of a specially selected formulation of glass which is metallized on the outside.
2. **Embedded Band Glass:** Two tubes of glass fired together with a metallized silver band embedded between them. The inner tube is only 0.005” thick to provide much higher capacitance values.
3. **Quartz:** A pure-grade silicon oxide offering higher Q and voltage ratings in each size.

Smallest Sealed Glass Trimmers S Series

The PC17 styles are the only vertically mounted glass trimmers in MIL-PRF-14409.

Voltronics “S” Series are up to 40% shorter with 25% more range than any other sealed standard glass RC. trimmers. The use of Voltronics’ unique non-rotating piston design provides linear tuning, high “Q”, long life, and high self-resonant frequencies. The O-ring seal assures protection up to 40 p.s.i. against dust, moisture, flux, solder, and cleaning solvents.

FIGURE 1

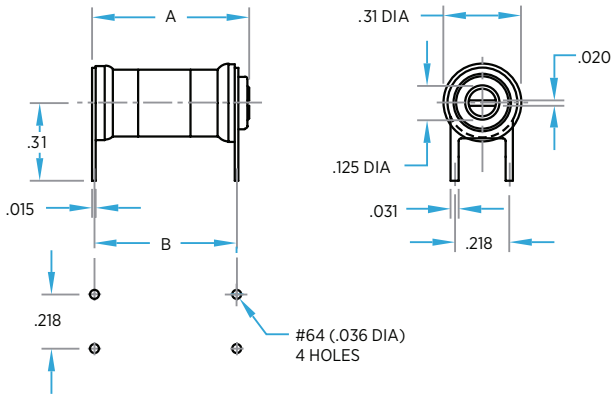


FIGURE 2

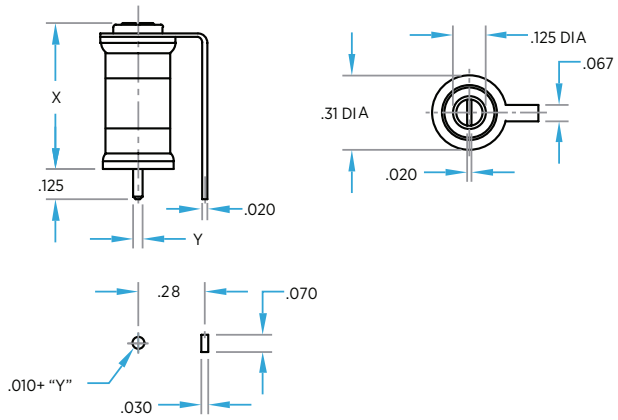
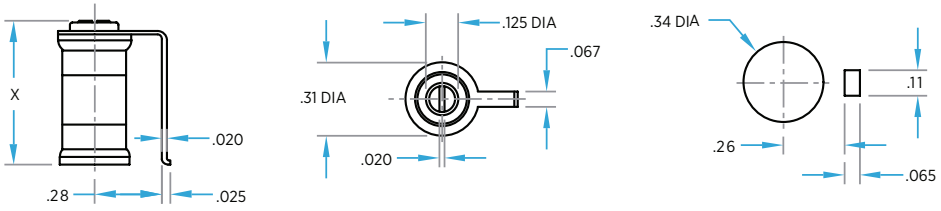


FIGURE 3



Dielectric	Capacitance Range (pF) From Below	Capacitance Range (pF) To Above	Q (Min.) at 1 MHz	Horizontal Mount Figure 1 Type	Horizontal Mount Figure 1 A ± .06	Horizontal Mount Figure 1 B ± .03	Vertical Mount* Figure 2 Type	Vertical Mount* Figure 2 X ± .03	Surface Mount Figure 3 Type	Surface Mount Figure 3 X ± .03
EMBEDDED BAND GLASS	1.5	10	800	SP10	.370	.300	SF10A	.340	SM10	.340
	1.5	20	800	SP20	.440	.370	SF20A	.410	SM20	.410
	1.5	30	800	SP30	.520	.450	SF30A	.490	SM30	.490
	1.5	40	800	SP40	.630	. 560	SF40A	.600	SM40	.600

“Y” dimension-standard - .040”. For non-standard, change “A” in type number to “B” for .063” or “C” for .093”.
*SF styles available with dual leads from top similar to AF styles on page 19.

General specifications on page 42 apply except:

1. DC Working Voltage: 250
2. Tuning torque: 0.5 to 5 inch ounces
3. Tolerance: XXX ± .005

Extended Range Glass Trimmers H Series

The “H” Series increases the standard maximum capacitance values of Voltronics’ glass trimmer capacitors by almost 100%. This is achieved by a new and unique technique which makes the wall of the inner glass tube thinner than was previously possible.

General specifications for the “H” Series are the same as those of standard embedded band glass trimmers (see Page 42) with the following exceptions:

DC Working Voltage: 125
Temperature Coefficient: -150 ±150 ppm/°C

Type	Capacitance Range (pF) From Below	Capacitance Range (pF) To Above	Q (Min.)at 1 MHz	Fig.	A ± .06	B ± .03
Horizontal Printed Circuit						
HSP19	2	19	1000	1	0.37	0.3
HSP34	2	34	900		0.44	0.37
HSP46	2	46	800		0.52	0.45
HSP64	2	64	700		0.63	0.56
HTP96C	2	96	600	2	0.91	0.88
HTP130C	2	130	500		1.16	1.13
HTP210C	2	210	350		1.75	1.73
HTP250C	2	250	250		1.98	1.95
Vertical Printed Circuit					A ± .03	
HSF19	2	19	1000	3	0.34	
HSF34	2	34	900		0.41	
HSF46	2	46	800		0.49	
HSF64	2	64	700		0.6	
Surface Mount						
HSM19	2	19	1000	4	0.34	
HSM34	2	34	900		0.41	
HSM46	2	46	800		0.49	
HSM64	2	64	700		0.6	
Panel Mount						
HTM19C	2	19	1000	5	0.37	
HTM34C	2	34	900		0.45	
HTM46C	2	46	800		0.52	
HTM64C	2	64	700		0.63	
HTM96C	2	96	600		0.92	
HTM130C	2	130	500		1.17	
HTM210C	2	210	350		1.77	
HTM250C	2	250	250		2	

FIGURE 1

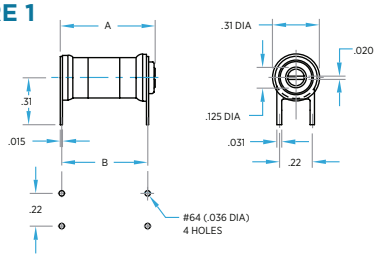


FIGURE 2

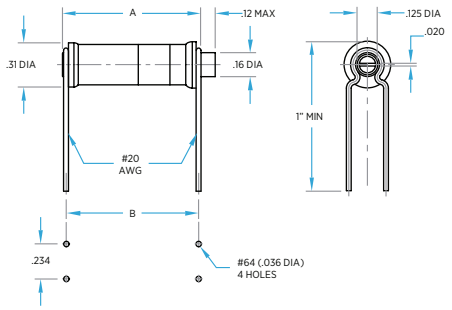


FIGURE 3

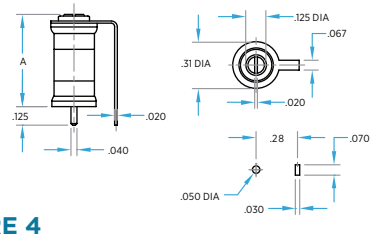


FIGURE 4

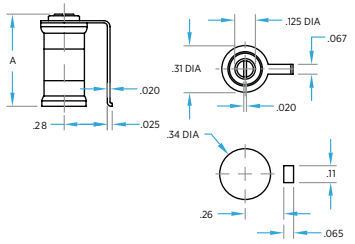
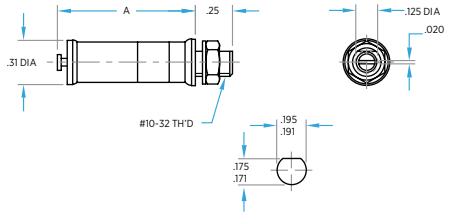
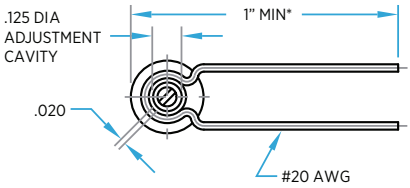
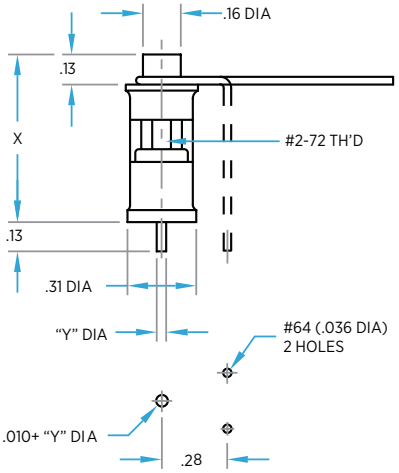


FIGURE 5



Vertical PC Mount Glass Trimmers TF Series

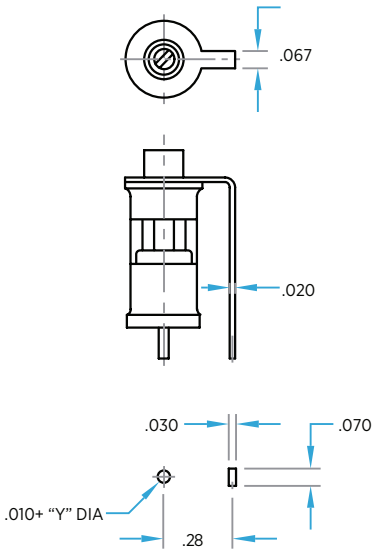




*1.25 in. on TF12, 17, 28 and 36 styles.
"Y" DIA: Standard units are .040. For different diameter pins substitute "B" .063 or "C" - .093 for "A" in type number.

ALTERNATE DESIGN WITH RIBBON LEAD

(add R to Type No.)



Type	Capacitance Range (pF)		X ± .03	Q (Min.) at 1 MHz	DCWV
	From Below	To Above			
Annular Band					
TF5A	0.8	4.5	0.47	650	750
TF6A	0.8	5.5	0.47	700	750
TF8A	1	8.5	0.62	700	750
TF9A	0.8	8.5	0.7	650	750
TF11A	1	11	0.7	700	750
TF12A	0.8	12	0.9	650	750
TF17A	0.8	16	0.9	700	750
Embedded Band					
TF10A	1.2	10	0.43	800	500
TF14A	1.5	14	0.53	700	1000
TF15A	1.2	16	0.48	800	500
TF16A	1	16	0.53	800	1000
TF22A	2	22	0.58	800	500
TF25A	2	25	0.58	800	500
TF28A	1	28	0.77	700	1000
TF36A	1	36	0.77	800	1000

General specifications on Page 42

Panel Mount Trimmers
TM & QM Series

These ranges are panel mount versions of Voltronics' glass and quartz dielectric trimmers. Available sealed or unsealed in Annular Band Glass, Embedded Band Glass and Quartz, the capacitance values are significant, up to 180pF max with 178pF of tunable range. All three dielectric options are also available in MIL Std versions featuring PC38, PC39 and PC48 designations.

FIGURE 1

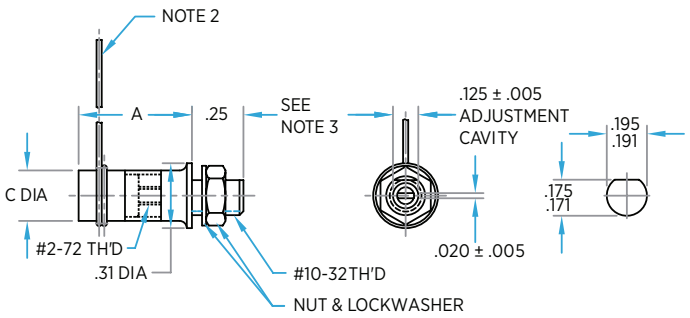


FIGURE 2

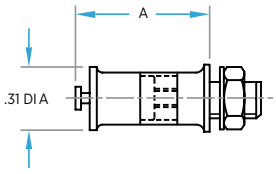


FIGURE 3

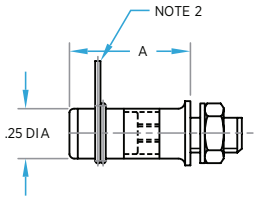
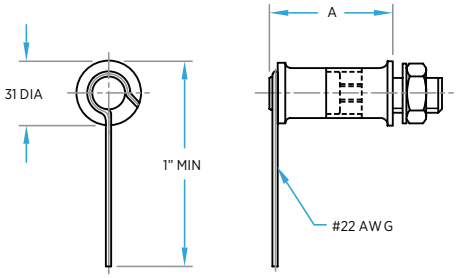


FIGURE 4

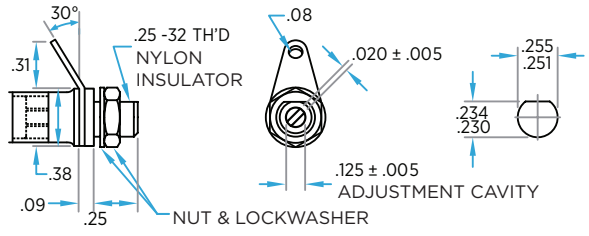


Notes:
1. Fig. 2, 3 and 4 parts have same end view as Fig. 1.
2. All leads #22 AWG and 2" Min. long except for all TM5-, TM6-, TM1O- and QM2- parts which are #24 AWG.
3. Mounting bushing #10-32 x .25 long except for all TM10- and TM15- parts which are #10-32 x .16 long.
4. C diameter of Fig. 1 parts .27 on embedded band units and .25 on all other parts.

Detailed General Specifications on Page 41.

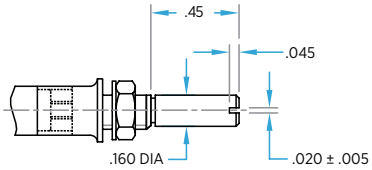
OPTIONAL CONFIGURATIONS

INSULATED BUSHING



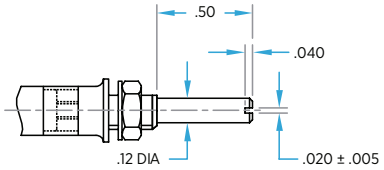
Insert "I" Between "T" and "M" in Type Number (eg. TIM9C)

EXTENDED PLASTIC SHAFT



Add "EI" to End of Type Number (eg. TM9EI)

EXTENDED METAL SHAFT



Add "E" to End of Type Number (eg. TM9CE)

Panel Mount Trimmers
TM & QM Series

GLASS ANNULAR BAND

Capacitance Range (pF)		Q (Min.)	Unsealed 750 DCWV (Fig. 1)			Sealed, Metal Cap 750 DCWV (Fig. 2)	Sealed, Glass End, 1,250 DCWV (Fig. 3)		
From Below	To Above	1 MHz	A±.03	Type	MIL Designation	A±.03	Type	A±.03	Type	MIL Designation
0.8	4.5	650	.31	TM5	PC40J4R5**	.41	TM5C	.36	TM5G	PC38J4R5**
0.8	5.5	700	.31	TM6	P050J5R5	.41	TM6C	.36	TM6G	PC48J5R5
0.8	8.5	650	.55	TM9	PC40J8R5**	.63	TM9C	.59	TM9G	PC38J8R5**
1.0	11.0	700	.55	TM11	PC50J110	.63	TM11C	.59	TM11G	PC48J11O
0.8	12.0	650	.75	TM12	PC40H120**	.83	TM12C	.81	TM12G	PC38H120**
0.8	16.0	700	.75	TM17	PC50H160	.83	TM17C	.81	TM17G	PC48H160
0.8	18.0	650	1.00	TM18	PC40H180**	1.09	TM18C	1.06	TM18G	PC38H180**
0.8	21.0	700	1.13	TM21	-	1.22	TM21C	-	-	-
0.8	23.0	700	1.00	TM23	PC50H230	1.09	TM23C	1.06	TM23G	PC48H230
0.8	30.0	650	1.59	TM30	PC40H300**	1.69	TM30C	1.66	1M30G	PC38H300**
0.8	38.0	700	1.59	TM38	PC50H380	1.69	TM38C	1.66	TM38G	PC48H380

GLASS EMBEDDED BAND

Capacitance Range (pF)		Q (Min.)	Unsealed 1,000 DCWV (Fig. 1)		SEALED, METAL CAP, TURRET TERMINAL 1,000 DCWV (Fig. 2)			SEALED, METAL CAP, 1,000 DCWV (Fig. 4)	
From Below	To Above	1 MHz	A±.016	Type	A±.03	Type	MIL Designation	A±.03	Type
2.0	10.0	800	.28	TM10*	.37	TM10C*	-	.35	TM10M*
1.5	14.0	700	.38	TM14	.47	TM14C	-	.45	TM14M
1.2	16.0	800	.33	TMI5*	.42	TM15C*	-	.40	TM15M*
1.0	16.0	800	.38	TM16	.47	TM16C	PC39G160	.45	TM16M
2.0	25.0	800	.42	TM25	.52	TM25C	-	.50	TM25M
1.0	28.0	700	.61	TM28	.70	TM28C	-	.69	TM28M
1.0	36.0	800	.61	TM36	.70	TM36C	PC39G360	.69	TM36M
1.0	42.0	700	.83	TM42	.92	TM42C	-	.91	TM42M
1.0	52.0	800	.83	TM52	.92	TM52C	PC39G520	.91	TM52M
1.0	60.0	650	1.08	TM60	1.17	TM60C	-	1.16	TM60M
1.0	75.0	700	1.08	TM75	1.17	TM75C	PC39G750	1.16	TM75M
1.0	90.0	600	1.67	TM90	1.77	TM90C	-	1.75	TM90M
1.0	120.0	600	1.67	TM120	1.77	TM120C	P039G121	1.75	TM120M
2.0	180.0	500	1.91	TM180*	2.00	TM180C*		1.98	TM180M*

QUARTZ

Capacitance Range (pF)		Q (Min.)	Unsealed 750 DCWV (Fig. 1)			Sealed, Quartz End, 1250 DCWV			
						Smaller (Fig. 3)		Larger MIL Size (Fig. 3)	
From Below	To Above	1 MHz	A±.03	Type	MIL Designation	A±.03	Type	A±.03	MIL Designation
0.6	1.8	2000	.30	QM2	PC40Q1R8	.36	QM2G	.63	PC38Q1R8
0.8	5.5	2000	.55	QM6	P040Q5R5	.63	QM6G	.89	PC38Q5R5
0.6	9.5	2000	.98	QM10	PC40Q9R5	1.06	QM10G	1.33	PC38Q9R5
0.8	16.0	2000	1.59	QM16	PC40Q160	1.66	QM16G	1.92	PC38Q160

*Parts Rated 500 DCWV
**MIL-C-14409B parts not listed in MIL-C-14409D

Horizontal Mount Trimmers
TP & QP Series

These ranges are horizontal mount versions of Voltronics glass and quartz dielectric trimmers. Available sealed or unsealed in Annular Band Glass, Embedded Band Glass and Quartz, the capacitance values are significant, up to 180pF max with 178pF of tunable range. All three dielectric options are also available in MIL Std versions featuring PC42, PC43 and PC52 designations.

FIGURE 1

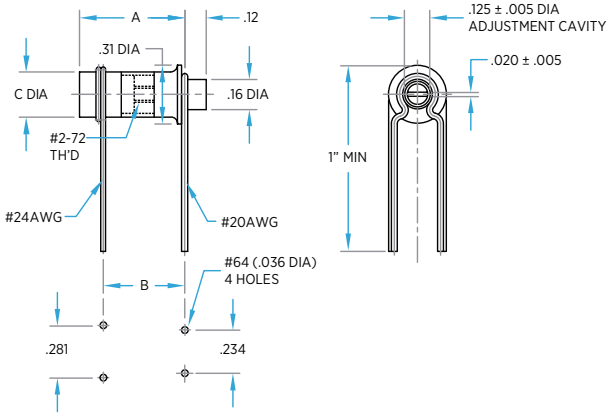


FIGURE 2

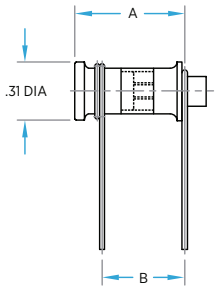


FIGURE 3

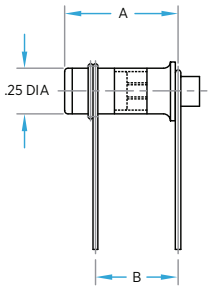
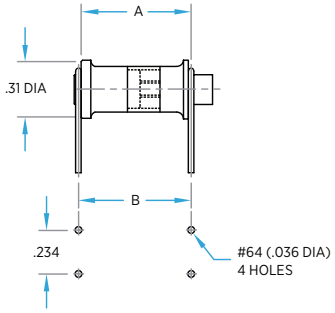


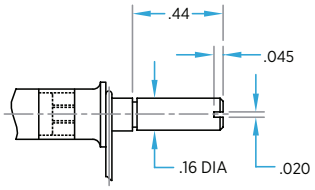
FIGURE 4



Notes:
1. All Fig. 2 thru Fig. 4 parts have same end view as Fig. 1. Fig's 2 and 3 have mounting dimensions of Fig. 1
2. C diameter of Fig. 1 parts .27 for embedded band and .25 on all other parts
Detailed General Specifications on Page 41.

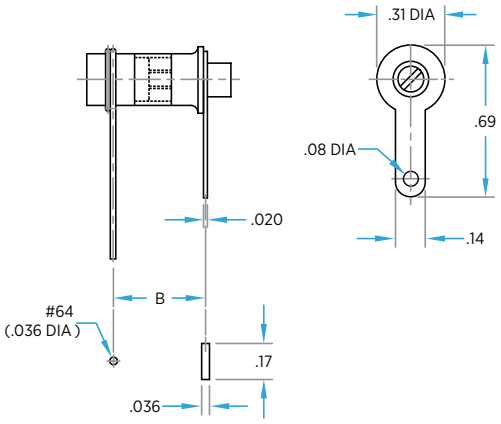
OPTIONAL CONFIGURATIONS

EXTENDED PLASTIC SHAFT



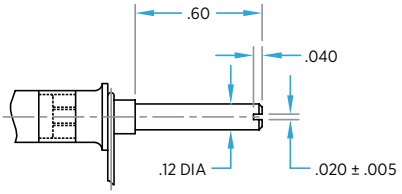
Add "El" to End of Type Number (eg. TP9CEl)

PRINTED CIRCUIT LUG



Add "L" to End of Type Number (eg. TP28L)

EXTENDED METAL SHAFT



Add "E" to End of Type Number (eg. TP9El)

Horizontal Mount Trimmers
TP & QP Series

GLASS ANNULAR BAND

Capacitance Range (pF)		Q (Min.)	Unsealed 750 DCWV (Fig. 1)			Sealed, Metal Cap 750 DCWV (Fig. 2)				Sealed, Glass End, 1,250 DCWV						
										Smaller (Fig. 3)			Larger MIL Size (Fig. 3)			
From Below	To Above	1 MHz	A±.03	B±.03	Type	MIL Designation	A±.03	B±.03	Type	A±.03	B±.03	Type	A±.06	B±.03	Type	MIL Designation
0.8	4.5	650	.31	.25	TP5	PC41J4R5**	-	-	-	.39	.25	TP5G	.63	.50	TP5GA	PC42J4R5**
0.8	5.5	700	.31	.25	TP6	PC51J5R5	-	-	-	.39	.25	TP6G	.59	.50	TP6GA	PC52J5R5
0.8	8.5	650	.56	.44	TP9	PC41J8R5**	.58	.44	TP9C	.61	.44	TP9G	.88	.70	TP9GA	PC42J8R5**
1.0	11.0	700	.56	.44	TP11	PC51J110	.58	.44	TP11C	.61	.44	TP11G	.84	.70	TP11GA	PC52J110
0.8	12.0	650	.77	.63	TP12	PC41H120**	.78	.63	TP12C	.83	.63	TP12G	1.08	.84	TP12GA	PC42H120**
0.8	16.0	700	.77	.63	TP17	PC51H160	.78	.63	TP17C	.83	.63	TP17G	1.05	.84	TP17GA	PC52H160
0.8	18.0	650	1.03	.88	TP18	PC41H180**	1.05	.88	TP18C	1.08	.88	TP18G	1.33	1.02	TP18GA	PC42H180**
0.8	21.0	700	1.14	1.00	TP21	-	1.17	1.00	TP21C	-	-	-	-	-	-	-
0.8	23.0	700	1.03	.88	TP23	PC51H230	1.05	.88	TP23C	1.08	.88	TP23G	1.30	1.02	TP23GA	PC52H230
0.8	30.0	650	1.61	1.38	TP30	PC41H300**	1.64	1.38	TP30C	1.67	1.38	TP30G	1.92	1.47	TP30GA	PC42H300**
0.8	38.0	700	1.61	1.38	TP38	PC51H380	1.64	1.38	TP38C	1.67	1.38	TP38G	1.89	1.47	TP38GA	PC52H380

GLASS EMBEDDED BAND

Capacitance Range (pF)		Q (Min.)	Unsealed 1,000 DCWV (Fig. 1)			Sealed, Metal Cap, Turret Terminal 1,000 DCWV (Fig. 4)			Sealed, Metal Cap, 1,000 DCWV Larger MIL Size (Fig. 4)			
From Below	To Above	1 MHz	A±.03	B±.03	Type	A±.03	B±.06	Type	A±.03	B±.06	Type	MIL Designation
2.0	10.0	800	.28	.25	TP10*	.35	.33	TP10C*	-	-	-	-
1.5	14.0	700	.39	.33	TP14	.45	.42	TP14C	.73	.69	TP14CA	-
1.2	16.0	800	.33	.28	TPI5*	.41	.39	TP15C*	-	-	-	-
1.0	16.0	800	.39	.33	TP16	.45	.42	TP16C	.73	.69	TP16CA	PC43G160
2.0	25.0	800	.44	.36	TP25	.50	.47	TP25C	-	-	-	-
1.0	28.0	700	.63	.50	TP28	.70	.67	TP28C	.97	.92	TP28CA	-
1.0	36.0	800	.63	.50	TP36	.70	.67	TP36C	.97	.92	TP36CA	PC43G360
1.0	42.0	700	.84	.73	TP42	.91	.88	TP42C	1.19	1.14	TP42CA	-
1.0	52.0	800	.84	.73	TP52	.91	.88	TP52C	1.19	1.14	TP52CA	PC43G520
1.0	60.0	650	1.09	.91	TP60	1.16	1.13	TP60C	1.42	1.38	TP60CA	-
1.0	75.0	700	1.09	.91	TP75	1.16	1.13	TP75C	1.42	1.38	TP75CA	PC43G750
1.0	90.0	600	1.69	1.52	TP90	1.75	1.73	TP90C	2.03	1.98	TP90CA	-
1.0	120.0	600	1.69	1.52	TP120	1.75	1.73	TP120C	2.03	1.98	TP120CA	PC43G121
2.0	180.0	500	1.92	1.73	TP180*	1.98	1.95	TP180C*	-	-	-	-

QUARTZ

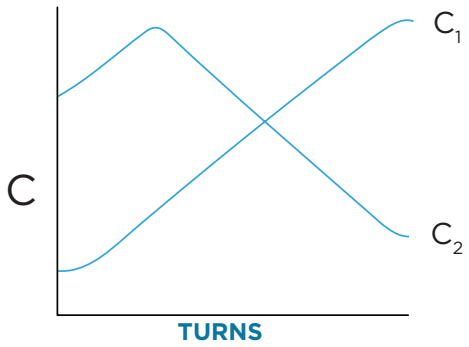
Capacitance Range (pF)		Q (Min.)	Unsealed 750 DCWV (Fig. 1)			Sealed, Quartz End, 1250 DCWV						
						Smaller (Fig. 3)			Larger MIL Size (Fig. 3)			
From Below	To Above	1 MHz	A±.03	B±.03	Type	MIL Designation	A±.03	B±.03	Type	A±.03	B±.06	Type	MIL Designation
0.8	1.8	2000	.31	.25	QP2	PC41Q1R8	.38	.25	QP2G	.63	.50	QP2GA	PC42Q1R8
0.6	5.5	2000	.56	.44	QP6	PC4IQ5R5	.64	.44	QP6G	.89	.70	QP6GA	PC42Q5R5
0.6	9.5	2000	1.00	.88	QP10	PC41Q9R5	1.09	.88	QP1OG	1.33	1.02	QP10GA	PC42Q9R5
0.8	16.0	2000	1.61	1.38	QP16	PC41Q160	1.69	1.39	QP16G	1.92	1.47	QP16GA	PC42Q160

*Parts Rated 500 DCWV **MIL-C-14409B parts not listed in MIL-C-14409D

Differential Glass Trimmers

For a differential trimmer capacitor, the capacitance of one element increases while the other element decreases, with the sum remaining approximately constant.

DIFFERENTIAL STYLES



Part Number	Figure	Capacitance Range (pF)				A	B	C
		Min. (1)	Min. (2)	Max. (1) (2)	Typical Crossover			
TM3D	1	1.5	2.0	3	2.4	.31	-	.09
TM8D	1	1.5	2.5	8	5.5	.55	-	.22
TM12D	1	1.5	3.0	12	7.7	.75	-	.31
TM16D	1	1.5	3.5	16	10.1	.94	-	.41
TM28D	1	1.5	5.0	26	16.0	1.44	-	.66
TP3D	2	1.5	2.0	3	2.4	.31	.28	.09
TP8D	2	1.5	2.5	8	5.5	.55	.45	.22
TP12D	2	1.5	3.0	12	7.7	.75	.61	.31
TP16D	2	1.5	3.5	16	10.1	.94	.75	.41
TP28D	2	1.5	5.0	26	16.0	1.44	1.13	.66

Note: For sealed versions, add “G” to part number, ie., TM8DG. The “A” dimension will be 0.11” longer.

FIGURE 1

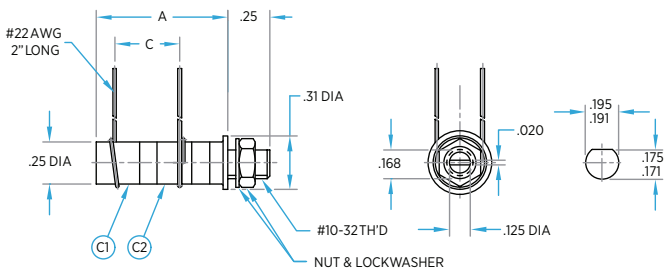
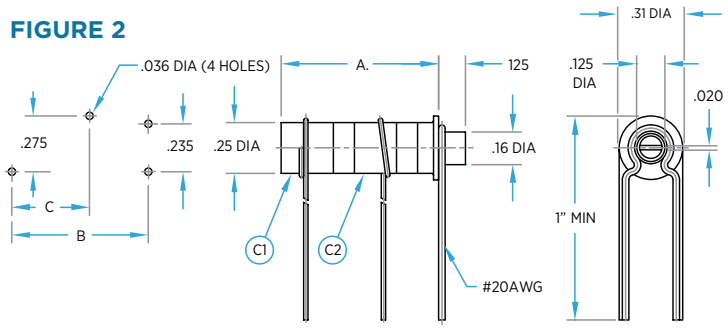


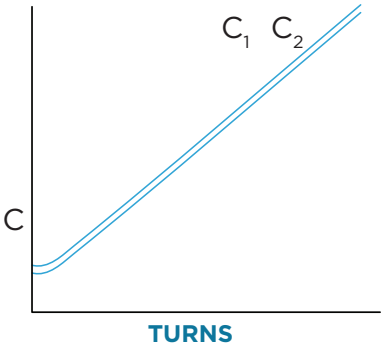
FIGURE 2



Split Stator Glass Trimmers

Both elements of a split stator trimmer tune at approximately the same rate.

SPILT STATOR STYLES



Type	Figure	Capacitance Range (pF)				A	B
		Plate/Plate		Plate/Brushing			
		Min.	Max.	Min.	Max.		
TM4S	1	0.8	2.0	0.8	4.2	.55	-
TM9S	1	1.5	4.5	0.8	9.0	1.02	-
TM14S	1	2.0	7.0	1.0	14.0	1.67	-
TP4S	2	0.8	2.0	0.8	4.2	.55	.47
TP9S	2	1.5	4.5	0.8	9.0	1.02	.91
TP14S	2	2.0	7.0	1.0	14.0	1.67	1.53

Note: For sealed versions, add “G” to part number, ie., TM4SG. The “A” dimension will be 0.11” longer.

FIGURE 1

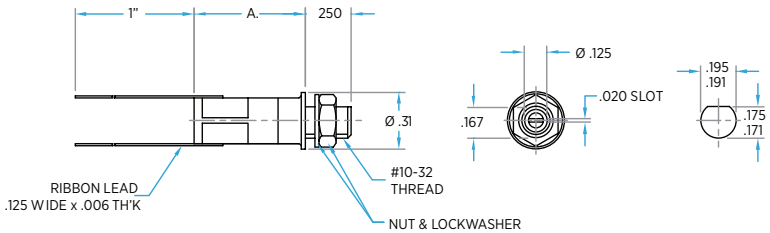
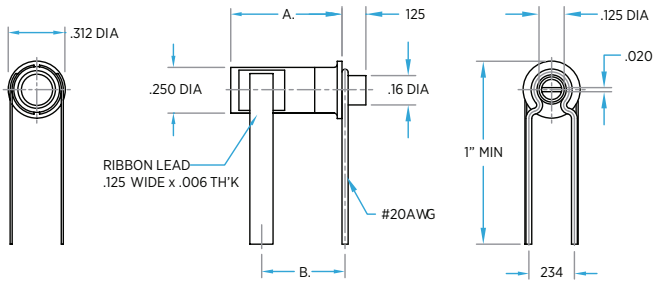


FIGURE 2



GENERAL SPECIFICATIONS ON PAGE 41 APPLY EXCEPT:

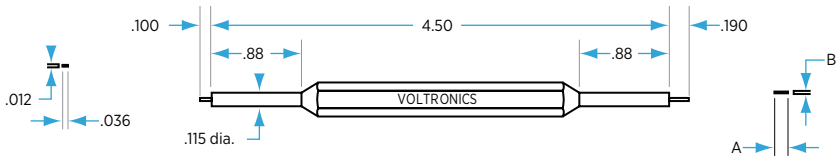
1. DC Working Voltage: 500
2. Temperature coefficient: 0±100 ppm/°C.

Tuning Tools

METAL (FIG.1)

Part Number	Tip A	Tip B	Capacitor Series
TT-100	.110 x .018	.070 x .012	A, K, DRO, Glass, NT
TT-200	.110 x .018	.032 x .088	A, K, DRO, Glass, NT___
TT-300	.060 x .018	.070 x .012	A1
TT-400	.060 x .018	.036 x .012	A1, A4

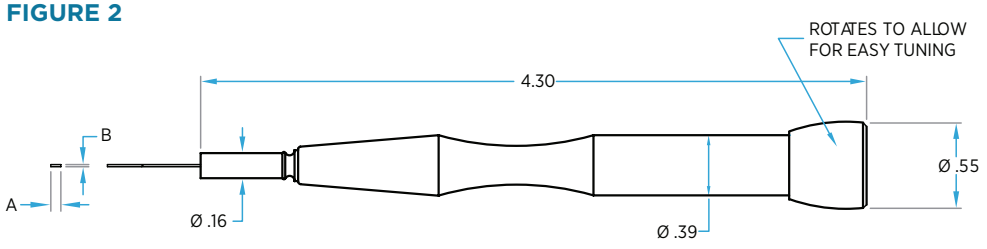
FIGURE 1



CERAMIC (FIG.2)

Part Number	Tip A	Capacitor Series
TT-500	.07 x .016	A1, A, K, DRO
TT-600	.10 x .016	Glass, NT
TT-900	.038 x .016	A4

FIGURE 2



Notes: The TT-500 thru TT-900 tuning tools are ideal for continual use. They fit into the hand with the rotatable top ixed in the palm. The tips are made of high strength ceramic. Use these tools where metal tips affect tuning.

Experience the benefits of our all-inclusive manufacturing complex.

With no outsourcing, our seamless operational setup allows you to individualize the services you need, do a combination, or select them all!

With ***"get it right the first time"*** accuracy, we deliver:

- » High Quality
- » Specialized Projects – we do things no one else can!
- » Everything under one roof, giving us end-to-end control of the project
- » Engineering support throughout your entire project
- » Catered to you! Pick the services you need!
- » Production Scaling

Certified System
SAI GLOBAL
ISO 9001
Quality

Choose the service you need - select one, multiple or all!

High Precision Tools Shop

Realize better yields and increased efficiencies with tools made to maintain tight tolerances and high quality.

Machining Center

We take on the smallest, most intricate parts with complex geometries.

Plating House

We excel at MIL-SPEC plating and handling difficult plating issues involving complex geometries. Our gold plating is known for its unparalleled strength!

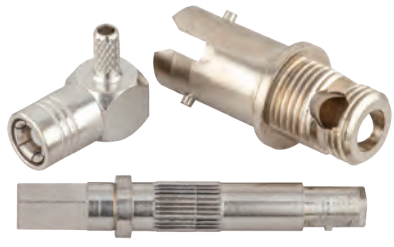
Electromechanical Assembly & Design

Design, prototype and production – we do it all in-house.

Engineering Services

With decades of experience, our engineers will help you find the right solution, no matter how challenging the requirement!

High Precision Tools Shop



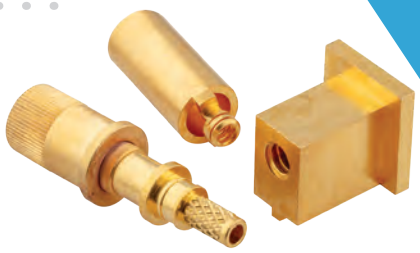
Precision tooling, the fabrication of components and assemblies to meet exact specifications for manufacturing, is crucial for consistency and efficiency of high-quality finished products.

Our tooling proficiency was born out of necessity – we make our own tools so that we can hold the tolerances, polishes and surface finished required to manufacture the high-quality, high-reliability products we make. We can do this for you, too!

Our dedicated team has worked with the most demanding industries, including medical, aerospace, defense, automotive, telecom and more, and are known to get things to fit the first time – saving time and money. From design to precision manufacture, the team's unparalleled expertise combined with our high quality tools and fixtures lead to high quality precision products. Our products are built to better tolerances, have a better surface finish, and have reduced defects.

High Precision Tools Shop

continued



The ability of our tools to maintain exact tolerances is well aligned with needs in the medical and defense industries. We have a variety of competencies – arbour press tooling, bend/forming, punch and cut, nested, Rockwell hardening – that make our tools second-to-none! We work together with you to design a tool that meets your requirements, no matter how challenging!

Capabilities:

- Work from customer-provided drawings, or we can draw
- Tools made for manual and automated equipment; hand-held or machine-operated
- Machine repair parts or refabricate equipment
- Produce all kinds of machine parts
- Surface finishing
- Fixtures
- Specialized components
- Die fabrication
- Tool hardening to perform in harsh environments

Benefits:

- Our tools are ready for immediate use
- Increase efficiencies and yield
- Increase quality levels
- Improve finished product
- Reduce equipment jams
- Cost effective and saves time!

Materials Used:

- Brass
- Steel
- Stainless Steels
- Invar
- Copper alloy C11000
- Aluminum
- Plastics
- Machineable ceramics
- Graphite

Close Precision Machining Center

Knowles Precision Devices has been fabricating various metal parts with Swiss Screw Manufacturing techniques since 1947. Our machinists have over 200 years of combined Swiss Screw experience.

Swiss machining is capable of producing extremely small intricate parts with little margin for error. Traditionally, Swiss machines have been used for parts like screws; however, they can also produce components that have no turned surfaces at all.

Our precision machining center focuses on concentricity, line-to-line fit and tolerance in order to provide the best performance. We have a reputation for taking on the smallest, most intricate parts with complex geometries for medical, aerospace and defense and industrial applications:

- Bone Screws
- Spinal rods
- RF connectors
- RF tuning components
- Precision valves and hose connectors
- Precise mechanical lock components for high security applications in national defense

Capabilities:

- Our equipment has 24 hr auto loading ability
- We can handle a variety of materials, including: Brass C26000 Half Hard, Phosphor Bronze, Teflon, Delrin, ABS Plastic, Titanium, Kovar, Invar 36, Alloy 42, Stainless Steel, (303, 416, 440), Copper Alloy, C11000, and Aluminium, 6061-T6, 2011-T3
- Threading up to 200 threads per in., thread diameters up to 32 mm
- Tolerance capability ± .0002” on diameters, ± .0005" on lengths
- Unlimited geometries with the milling, cross drilling, cross-tapping and saw slotting capabilities
- Standard tolerances: ± .0002” for diameters, and ± .0005” for lengths

Benefits:

- Extremely tight tolerances
- Complex parts
- Press-fit for dimension control
- Variety of materials for use

Specialist Plating House

Knowles Precision Devices has been barrel and rack plating components for over 60 years. Our experts are often sought out for their experience and ability to handle difficult plating issues. We work closely with you to adapt and customize our plating process to fit your requirements!

Capabilities:

- Plate exotic stackups that aren't readily available industry-wide
- Plate challenging geometries (for example, plating throws into a threaded hole or blind via)
- Thread Plating
- Temperature handling
- Our Gold plating exceeds all ASTM and MIL specifications for temperature withstanding and adhesion
- Plate a variety of materials, including: Invar, Kovar, Brass and Copper

Automated Barrel Plating:

- Gold, Copper, Silver, Bright Tin, Tin/Lead 60/40, Nickel, Electrodes Nickel, Passivation
- Military and American Society for Testing and Materials (ASTM) compliant
- Adhesion testing available
- Inspection and certification options
- Piece part size range from .002in^2 - 2.5in^2
- In-house chem lab ensures proper chemistry of plating solutions

MIL-SPEC Plating:

- Military specifications (MIL-SPECS) require products to meet tight tolerances and have the durability and reliability to withstand harsh environments. Our unmatched proficiency in plating parts with unique and complex geometries has earned Knowles Precision Devices the reputation as the go-to manufacturer for plating numerous Aerospace, Military & Defense projects.
- We are ISO 9001:2015 certified, and ASTM compliant.

Electromechanical Assembly Design & Prototyping

Not only can we design and prototype, we can produce the part! Since we manufacture our own tooling – allowing us to maintain excellent tolerances – standing up an assembly capability for a custom product is right in our wheelhouse!

- Off-the-shelf products such as trimmer capacitors
- Custom work:
  - Balun | Air Core inductors | Custom RF Connectors
- Press-fits, soldering, hand assembly

Engineering Services

Our experts are there for you every step of the way!
No matter what service you are interested in, our engineers are problem solvers and eager to help you find the right solution.

Visit our website at **www.knowlescapacitors.com** for more information.

Microwave Tuning Elements

Knowles Microwave Tuning Elements with the self-locking, constant torque drive mechanism, require no external locking devices and permit “one hand” tuning with virtually no dynamic tuning noise which could otherwise imperil associated solid state devices under “power on” conditions. This self-locking feature and high tuning resolutions assure unparalleled control over the most critical of complex circuit tuning adjustments. In many instances, the use of Knowles Tuning Elements has halved technical tuning time.

DESCRIPTION

- Variable reactance for microwave circuits
- Available with mounting bushing and/or individual tuning rotor
- High resolution tuning
- Exceeds MIL-PRF-14409 vibration requirements

FEATURES

- Self-locking torque mechanism, no lock nuts required
- Gold and chromate finish
- Available in metallic, dielectric and resistive versions

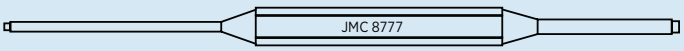
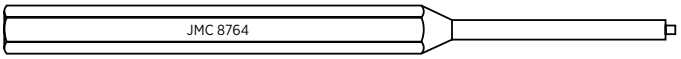
APPLICATIONS

- Combine applications
- Interdigital applications
- Impedance transformers
- Impatt and Gunn oscillators
- Microstrip and stripline circuits
- Attenuators
- Coaxial structures
- Waveguide circuitry

Contact factory for “Microwave Product Application Guide” brochure.

Tap Part Number	Thread (UNS-2)	Recommended Tap Drill
7054	.086-56	#51 (.067)
7059	.156-64	9/64 (.1406)
7060	.120-80	#36 (.1065)
7061	.190-64	#17 (.173)
7062	.234-64	7/32 (.2187)
7063	.250-64	15/64 (.2344)
7064	.094-80	#45 (.082)

RECOMMENDED TUNING TOOL

Tuning Element	Diameter	Johanson Part Number	
Microwave Type	.078/.130	8777	
Microwave Type	.130	8764	

Note: The use of a Knowles tuning tool is recommended, improper screw driver size will cause internal thread damage.

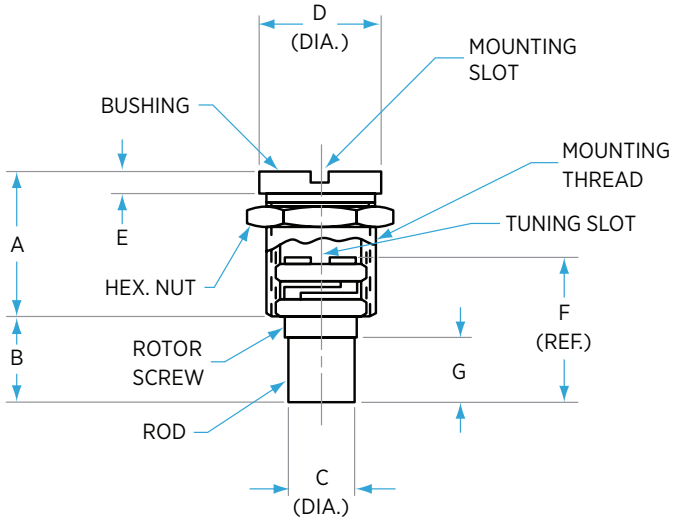
Dielectric Tuning Elements

DIELECTRIC

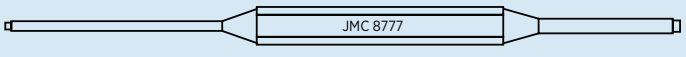
Part Number	Dimensions							Mounting			
	A	B	C	D	E	F	G	ROD MAT'L	THD. (UNS-2A)	Tuning Torque (oz. in)	Slot
6933-4	0.240	0.168	0.062	0.135	0.035	0.260	0.138	Sapphire	0.120-80	0.3 to 3.0	0.015W x 0.020DP
6933-5		0.130	0.035			0.222	0.100				
6934-3	0.359	1.205	0.152	0.267	0.145	1.309	1.175	Alumina	0.234-64	1 to 5	0.031W x 0.020DP
6934-4		1.105				1.209	1.075				
6934-5		0.905				1.009	0.875				
6934-6	0.219	0.115	0.152	0.267	0.035	0.219	0.085	Sapphire	0.234-64	1 to 5	0.031W x 0.025DP
6935-10	0.359	0.265			0.145	0.369	0.235				
6935-11	0.359	0.265	0.152	0.267	0.144	0.369	0.235	Alumina	0.234-64	1 to 5	0.031W x 0.025DP
6935-12	0.360	0.525		0.265	0.145	0.643	0.495				

RESISTIVE

Part Number	Dimensions							Mounting			
	A	B	C	D	E	F	G	ROD MAT'L	THD. (UNS-2A)	Torque (oz. in)	Slot
6950-2	0.240	0.168	0.062	0.135	0.035	0.260	0.138	Eccosorb	0.120-80	0.3 to 3.0	0.015W x 0.020DP
6950-3		0.130	0.078			0.222	0.100				
6952-1	0.360	0.250	0.152	0.265	0.145	0.368	0.220		0.234-64	1 to 5	0.031W x 0.025DP
6952-2	0.359	0.185		0.267	0.144	0.289	0.155				



RECOMMENDED TUNING TOOL

Tuning Element	Diameter	Johanson Part Number	
Dielectric & Resistive Type	.078/.130	8777	

Note: The use of a Knowles tuning tool is recommended, improper screw driver size will cause internal thread damage.

Metallic Tuning Elements

METALLIC

Part Number	Fig.	Dimensions A	B	C	D	E	F	G	Mounting THD. (UNS-2A)	Tuning Torque (oz. in)	Slot
6924-9	1	0.240	0.148	0.072	0.135	0.035	0.240	0.035 W x 0.156 A/F	0.120-80	0.3 to 3.0	0.015 W x 0.020 DP
6924-10		0.120	0.075				0.167				
6924-11		0.240									
6924-12		0.120	0.030				0.122				
6925-4		0.250	0.148	0.125	0.210	0.037	0.250	0.035 W x 0.218 A/F	0.190-64	0.4 to 4.0	0.031 W x 0.020 DP
6925-5		0.125	0.023				0.125				
6926-13		0.210	0.106	0.160	0.267	0.035	0.210	0.040 W x 0.281 A/F	0.234-64	1.0 to 5.0	0.031 W x 0.025 DP
6926-17			0.180				0.284				
6927-2		0.360	0.250		0.264	0.144	0.360				
6927-3			0.255				0.374				
6928-6		0.450	0.345		0.267	0.240	0.450				
6929-2		0552	0.450	0.125	0.210	0.042	0.552	0.035 W x 0.22 A/F	0.190-64	0.4 to 4.0	0.031 W x 0.020 DP
6965-1		0.720	0.500	0.345	0.531	0.040	0.720	0.078 W x 0.56 A/F	0375-64	1.0 to 8.0	0.031 W x 0.030 DP

LC TYPE

Part Number	Fig.	Dimensions A	B	C	D	E	F	G	Mounting THD. (UNS-2A)	Tuning Torque (oz. in)	Slot
6939-2	2	0.482	0.148	0.072	0.187	0.047	0.240	0.232	0.156-64	0.3 to 3.0	0.030 W x 0.025 DP
6940-1		0.555	0.450	0.125	0.265	0.045	0.552	0.230	0.234-64	0.4 to 4.0	
6941-1		1.230	0.350	0.160	0.280	0.047	0.450		0.250-64	1.0 to 5.0	

FIGURE 1

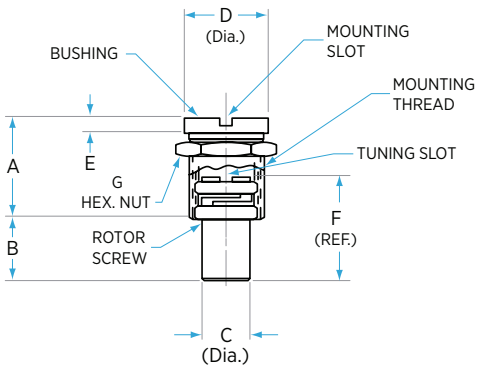
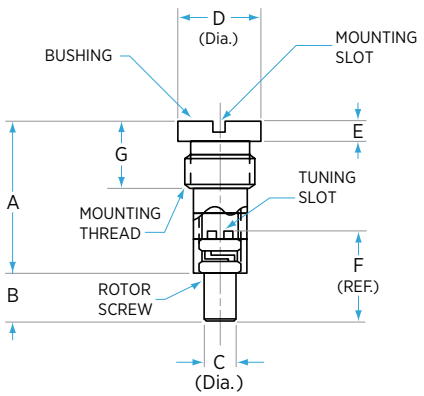
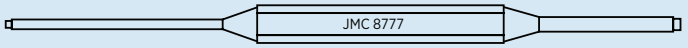


FIGURE 2



RECOMMENDED TUNING TOOL

Tuning Element	Diameter	Johanson Part Number	
Metallic & LC Type	.078/.130	8777	

Note: The use of a Knowles tuning tool is recommended, improper screw driver size will cause internal thread damage.

Tuning Screw Torque Bushings

Posi-torque Bushings are precision devices designed for applications requiring precision, low loss high resolution tuning.

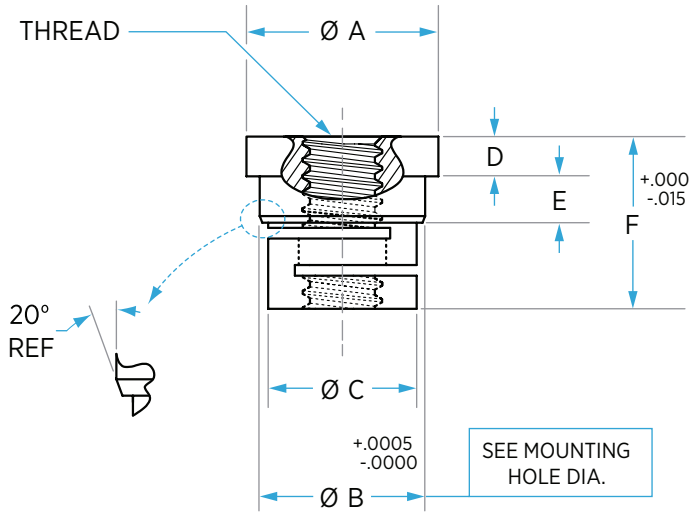
The self-locking, constant torque drive mechanism eliminates the need for locking nuts and assures stable, noise free adjustment in RF to Microwave frequencies.

Posi-Torque Bushings are universal and can be used with standard SI and US customary screws.

METAL FIGURE 1

Part No.	A	B	C	D	E	F	Thread	Mounting Hole (dia.)
LB1020-1	.145	.1247	.112	.030	.035	.130	#0(.060)-80	.1240/.1242
LB1021-1	.175	.1552	.140	.030	.035	.150	#2(.086)-56	1545/1547
LB1021-2	-	.1552	.140	-	.035	.130	#2(.086)-56	1545/1547
LB1022-1	.300	.2697	.250	.035	.090	.300	#4(.112)-40	.2690/.2692
LB1023-1	.330	.2997	.280	.035	.100	.335	#6(.138)-32	.2690/.2692
LB1023-2	-	.2997	.280	-	.100	300	#6(.138)-32	.2690/.2692
LB1024-1	.380	.3497	.330	.035	.100	.335	#10(.190)-32	.3490/3492
LB1025-1	.440	.4097	.390	.035	.100	.335	¼(.250)-28	.4090/4092
LB1025-2	-	.4097	.390	-	.100	.300	¼(.250)-28	.4090/4092
LB1026-1	.350	.3197	.300	.035	.100	.335	#8(.164)-32	.3190/3192

FIGURE 1



Tuning Rotors

METALLIC

Part Number	Fig.	Dimensions A	B	C	D	Mounting THD. (UNS-2A)	Tap P/N	ROD Material	Slot
L6316-1	1	0.165	0.075	0.072	0.018	0.120-80	7060	Brass	0.015 W x 0.090
L6316-2	2	0.223	0.155	-	0.020				
L6994-2		0.175	0.090	-		0.086-56	7054		0.015 W x 0.060
L6995-0	1	0.122	0.030	0.072		0.094-80	7064		
L6995-1		0.167	0.075						
L6995-2		0.240	0.148						
L6995-22		0.217	0.125						
L6996-1		0.250	0.148	0.125	0.010	0.156-64	7059		0.020 W x 0.120
L6996-5		0.295	0.193						
L6996-6		0.180	0.078						
L6997-0		0.554	0.450	0.160		0.190-64	7061		0.020 W x 0.145
L6997-2		0.360	0.256						
L6997-17		0.146	0.042						

LC TYPE

Part Number	Fig.	Dimensions A	B	C	D	Mounting THD. (UNS-2A)	Tap P/N	ROD Materual	Slot
6930-3	3	0.475	0.345	0.152	0.010	0.190-64	7061	ALUMINA	0.020 W x 0.145
6930-5		0.625	0.495						
6930-7		0.884	0.750						
6930-17		0.674	0.490	0.061	0.020				
6930-20		0.850	0.716	0.152	0.010				
6930-21		0.379	0.195	0.061	0.020				

FIGURE 1

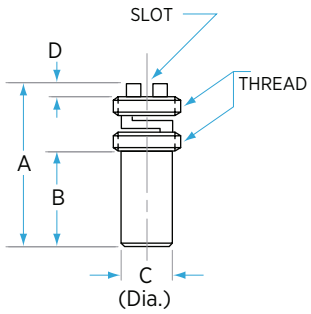


FIGURE 2

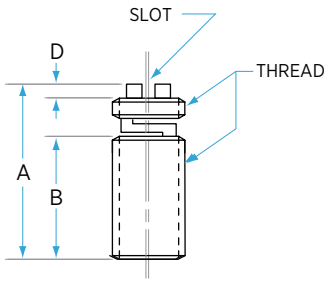
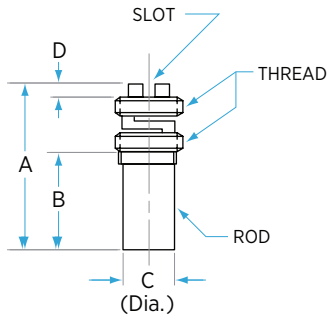


FIGURE 3



Dyna-Trim™ Dielectric Resonator Tuners

4000 SERIES

Part Number	Fig.	Dimensions A	B	C	D	E	F	G	NOM. FREQ. (GHz)
4003-1	1	0.360	0.245	0.320	0.02 W x 0.23	0.08 x 0.41	0.375-64	0.06 x 0.44	6
4005-1		0.335	0.150	0.210	0.02 W x 0.14	0.08 x 0.28	0.250-64	0.060 x 0.31	10
4007-4		0.270	0.084	0.130	0.15 W x 0.09	0.06 x 0.22	0.190-64	0.035 x 0.22	18

4010 SERIES

Part Number	Fig.	A	Rod Material	Disk Material	NOM. FREQ. (GHz)
4010-1	2	0.970	INVAR	BRASS	2
4011-1		0.750			3
4012-1		0.500			4
4012-2		0.625			
4014-1		0.250	INVAR (one-piece construction)		9

FIGURE 1

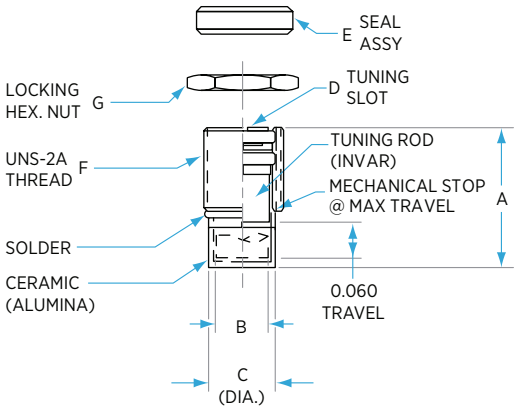
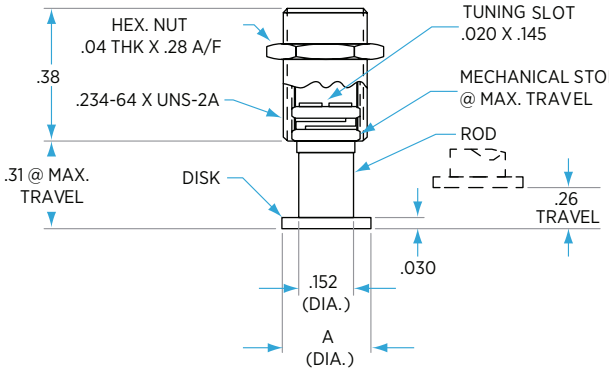


FIGURE 2



Non-Magnetic Fasteners and Hardware

Due to the severe non-magnetism requirements in the magnetic resonance industries, we use only high purity metals that exhibit no measurable magnetism. Commercial brass is simply not acceptable for these applications. Our strict traceability and testing regimes insure this essential parameter.

We can offer sizes, styles and lengths beyond those shown in the tables below – such as Cheese Head, Round Head and Set Screws. We also offer flat washers to complete your needs.

PAN HEAD

2-56 Thread	
48-109	5/64”
48-107	3/32”
48-105	3/16”
48-100	1/4”
48-106	5/16”
48-101	3/8”
48-102	1/2”
48-103	5/8”
48-104	3/4”
48-108	1”
48-500	Hex Nut

4-40 Thread	
48-115	3/16”
48-110	1/4”
48-116	5/16”
48-111	3/8”
48-112	1/2”
48-117	5/8”
48-113	3/4”
48-114	1”
48-118	2”
48-501	Hex Nut

6-32 Thread	
48-120	1/4”
48-124	5/16”
48-121	3/8”
48-122	1/2”
48-123	3/4”
48-125	1”
48-502	Hex Nut

8-32 Thread	
48-130	1/4”
48-131	3/8”
48-132	1/2”
48-133	3/4”
48-134	1-1/2”
48-503	Hex Nut

10-32 Thread	
48-140	1/4”
48-141	3/8”
48-142	1/2”
48-143	5/8”
48-144	3/4”
48-145	1”
48-505	Hex Nut

1/4-20 Thread	
48-150	3/8”
48-152	1/2”
48-151	1”
48-153	1-1/4”
48-506	Hex Nut

M2 x .4 Thread	
48-300	6mm
48-301	12mm
48-302	16mm
48-600	Hex Nut

M2.5 x .45 Thread	
48-310	8mm
48-601	Hex Nut

M3 x .5 Thread	
48-320	5mm
48-321	6mm
48-322	7.5mm
48-323	8mm
48-324	10mm
48-325	12mm
48-326	16mm
48-327	20mm
48-602	Hex Nut

M4 x .7 Thread	
48-330	8mm
48-331	10mm
48-332	12mm
48-333	16mm
48-334	20mm
48-335	25mm
48-603	Hex Nut

M5 x .8 Thread	
48-340	8mm
48-341	10mm
48-342	12mm
48-343	16mm
48-344	20mm
48-345	25mm
48-604	Hex Nut

COUNTERSINK FLAT HEAD

2-56 Thread	
48-205	9/64”
48-203	3/16”
48-200	1/4”
48-204	3/8”
48-201	1/2”
48-202	1”
48-500	Hex Nut

4-40 Thread	
48-210	1/4”
48-216	5/16”
48-211	3/8”
48-212	1/2”
48-213	3/4”
48-214	1”
48-215	1-1/4”
48-501	Hex Nut

6-32 Thread	
48-220	1/4”
48-221	3/8”
48-228	7/16”
48-222	1/2”
48-223	3/4”
48-224	1”
48-225	1-1/4”
48-229	1-3/8”
48-226	1-1/2”
48-227	1-3/4”
48-502	Hex Nut

8-32 Thread	
48-230	3/8”
48-231	1/2”
48-232	5/8”
48-233	3/4”
48-234	1-1/2”
48-503	Hex Nut

10-32 Thread	
48-240	3/8”
48-241	1/2”
48-242	5/8”
48-243	3/4”
48-244	1”
48-245	1-1/4”
48-505	Hex Nut

1/4-20 Thread	
48-250	3/4”
48-506	Hex Nut

M2 x .4 Thread	
48-400	5mm
48-401	10mm
48-600	Hex Nut

M3 x .5 Thread	
48-415	6mm
48-410	8mm
48-411	10mm
48-412	12mm
48-413	16mm
48-414	20mm
48-602	Hex Nut

M4 x .7 Thread	
48-420	8mm
48-421	10mm
48-422	12mm
48-423	16mm
48-424	20mm
48-603	Hex Nut

M5 x .8 Thread	
48-430	8mm
48-431	10mm
48-432	12mm
48-433	16mm
48-434	20mm
48-435	25mm
48-604	Hex Nut

Coils also require inserts, pins and other special shapes that are custom-designed to the customer’s specific requirements. The ability to quickly and precisely supply custom designs is part of our heritage and we are eager to sample our high quality hardware based on your requirements. As with the fasteners, we use only high purity metals that exhibit no measurable magnetism.

Non-Magnetic Variable Inductors

APPLICATIONS

- MRI / NMR Systems
- Radios / Jammers
- Power Amplifiers
- Radar
- Avionics Instrumentation
- Test Equipment

CHARACTERISTICS

- Precision machined design. US Patent No. 8,248,198
- 7mm high in SMD, Vertical SMD and thru-hole versions
- Nominal values of 33 to 345 nH, 2 to 19 turns
- Q as high as 199 @ 100 MHz SRF 0.31 to 1.2GHz
- Superb shock, vibration and thermal tolerances
- -40°C to +85°C
- Customized version requests welcomed

Surface Mount – Horizontal

PART NO.	L (nH) Min	L (nH) Nom	L (nH) Max	L (nH) No Core	Q (@ 100MHz)	SRF (GHz)	Turns	Thread Min (mm)
JLC02E030TRSM	32	33	34	39	90	1.2	2	6
JLC03E048TRSM	46	49	52	59	95	1	3	6
JLC04E065TRSM	60	64	68	78	101	0.9	4	6
JLC05E088TRSM	74	81	87	99	114	0.9	5	8
JLC06E110TRSM	94	107	119	123	119	0.7	6	8
JLC07E130TRSM	104	118	133	142	121	0.7	7	10
JLC09E160TRSM	122	139	170	191	162	0.58	9	13
JLC13E250TRSM	185	219	270	294	199	0.43	13	18
JLC19E375TRSM	281	345	436	457	171	0.31	19	25

Surface Mount – Vertical

PART NO.	L (nH) Min	L (nH) Nom	L (nH) Max	L (nH) No Core	Q (@ 100MHz)	SRF (GHz)	Turns	Thread Min (mm)
JLC02E030TRVSM	32	33	34	39	90	1.2	2	6
JLC03E048TRVSM	46	49	52	59	95	1	3	6
JLC04E065TRVSM	60	64	68	78	101	0.9	4	6
JLC05E088TRVSM	74	81	87	99	114	0.9	5	8
JLC06E110TRVSM	94	107	119	123	119	0.7	6	8
JLC07E130TRVSM	104	118	133	142	121	0.7	7	10

Thru Hole Mount – Vertical

PART NO.	L (nH) Min	L (nH) Nom	L (nH) Max	L (nH) No Core	Q (@ 100MHz)	SRF (GHz)	Turns	Thread Min (mm)
JLC02E030TRVPC	32	33	34	39	90	1.2	2	6
JLC03E048TRVPC	46	49	52	59	95	1	3	6
JLC04E065TRVPC	60	64	68	78	101	0.9	4	6
JLC05E088TRVPC	74	81	87	99	114	0.9	5	8
JLC06E110TRVPC	94	107	119	123	119	0.7	6	8
JLC07E130TRVPC	104	118	133	142	121	0.7	7	10

Non-Magnetic Capacitors — High Q, C0G/NP0, X5R and X7R — 16V to 7.2kV

MLC capacitors with silver/palladium (Ag/Pd) terminations have often been used in medical applications where non-magnetic components are required, for example in MRI equipment — however, conventional nickel barrier terminations are not suitable due to their magnetic properties. In addition, RoHS requirement to use lead-free solders would cause an increase in soldering temperatures and cause solder leaching problems for the Ag/Pd termination. This has meant alternatives have had to be found and one solution is to use a copper barrier instead of a nickel barrier, with a tin finish on top. This non-magnetic termination is offered with selected non-magnetic C0G/NP0, High Q, X5R and X7R dielectrics, providing a fully non-magnetic component (μr = 1.0000).

To meet high temperature 260°C soldering reflow profiles as detailed in J-STD-020, C0G/NP0 dielectrics are supplied with sintered termination for optimized HighQ/low ESR performance, while X5R and X7R dielectrics are supplied with our FlexiCap™ termination to minimize risk of mechanical cracking.

Available in chip or ribbon leaded format for certain case sizes (consult sales office).

'H' range BME parts are Ni free but have a small amount of residual magnetism. Testing in application may be advised.

HIGH Q, C0G/NP0 (PME RANGE) — MINIMUM/MAXIMUM CAPACITANCE VALUES

Chip Size	0402	0603	0805	1206	1210	1808	1812	2220
Min Cap	0.2pF	0.2pF	0.2pF	0.5pF	0.3pF	1.0pF	1.0pF	2.0pF
50V/63V	22pF	100pF	470pF	1.5nF	-	-	-	-
100V	15pF	100pF	330pF	1.0nF	2.2nF	2.2nF	4.7nF	10nF
150V	10pF	82pF	220pF	680pF	1.5nF	1.5nF	3.3nF	6.8nF
200V/250V	6.8pF	68pF	150pF	470pF	1.0nF	1.0nF	2.2nF	4.7nF
300V	-	27pF	120pF	390pF	820pF	820pF	1.8nF	3.9nF
500V	-	-	68pF	270pF	680pF	680pF	1.5nF	3.3nF
630V	-	-	-	150pF	390pF	390pF	1.0nF	2.2nF
1000V	-	-	-	82pF	220pF	220pF	680pF	1.5nF
2000V	-	-	-	18pF	68pF	68pF	150pF	470pF
3000V	-	-	-	-	-	-	68pF	150pF

Min Capacitance Tolerance
±0.05pF (<4.7pF)
0.1pF (≥4.7pF & <10pF)
±1% (≥10pF)

HIGH Q, C0G/NP0 (BME RANGE) — MINIMUM/MAXIMUM CAPACITANCE VALUES

Chip Size	0402	0603	0505	0805	1206	1210	1808
Min Cap	0.2pF	0.2pF	0.3pF	0.2pF	0.2pF	0.3pF	1.0pF
50V/63V	100pF	470pF	1.0nF	1.5nF	6.8nF	15nF	15nF
100V	100pF	470pF	560pF	1.0nF	2.7nF	4.7nF	4.7nF
150V	33pF	150pF	270pF	1.0nF	2.2nF	4.7nF	4.7nF
200V/250V	33pF	150pF	270pF	820pF	2.2nF	4.7nF	4.7nF
300V	-	150pF	240pF	430pF	1.5nF	1.8nF	1.8nF
500V	-	150pF	240pF	430pF	1.5nF	1.8nF	1.8nF
630V	-	-	-	47pF	560pF	820pF	820pF
1000V	-	-	-	47pF	560pF	820pF	820pF
2000V	-	-	-	-	100pF	270pF	390pF
3000V	-	-	-	-	-	-	-

Min Capacitance Tolerance
±0.05pF (<4.7pF)
0.1pF (≥4.7pF & <10pF)
±1% (≥10pF)

X7R/X5R — MINIMUM/MAXIMUM CAPACITANCE VALUES

Dielectric	Chip Size	0402	0603	0505	0805	1206	1210	1808	1812	2220	2225
	Min Cap	47pF	100pF	100pF	330pF	680pF	1.5nF	2.2nF	3.3nF	6.8nF	10nF
X5R	16V	22nF	100nF	-	330nF	1.0μF	1.5μF	1.5μF	3.3μF	5.6μF	6.8μF
	25V	15nF	100nF	-	330nF	1.0μF	1.2μF	1.2μF	2.2μF	4.7μF	5.6μF
X7R	50V/63V	10nF	100nF	100nF	150nF	470nF	1.0μF	680nF	1.5μF	3.3μF	3.3μF
	100V	4.7nF	22nF	47nF	100nF	270nF	560nF	330nF	1.0μF	1.5μF	1.5μF
	200V/250V	680pF	5.6nF	15nF	27nF	100nF	220nF	180nF	470nF	1.0μF	1.0μF
	500V	-	1.5nF	4.7nF	8.2nF	33nF	100nF	100nF	270nF	560nF	680nF
	630V	-	-	-	4.7nF	10nF	27nF	33nF	150nF	330nF	390nF
	1000V	-	-	-	3.3nF	4.7nF	15nF	18nF	56nF	120nF	150nF
	1200V	-	-	-	-	3.3nF	10nF	10nF	33nF	82nF	100nF
	1500V	-	-	-	-	2.7nF	6.8nF	6.8nF	22nF	47nF	68nF
	2000V	-	-	-	-	2.2nF	4.7nF	4.7nF	10nF	27nF	33nF

Min Capacitance Tolerance
±5%

HIGH Q, C0G/NP0 HIGH POWER RF RANGE - PME — MINIMUM/MAXIMUM CAPACITANCE VALUES

A range of ultra-low loss High Q ceramic capacitors with C0G/NP0 characteristics suitable for high power applications where minimal power loss and very low self-heating is demanded.

Common applications include MRI body coils and wireless charging systems operating in the kHz and MHz frequencies.

Available in chip or ribbon leaded format.

Chip Size	0505		1111†				2225		4040		7676	
Range	Q		H		Q		Q		Q		Q	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
50V	820pF	820pF	-	-	-	-	-	-	-	-	-	-
100V	680pF	680pF	2.0nF	4.7nF	1.6nF	2.2nF	-	-	-	-	-	-
150V	470pF	560pF	2.0nF	4.7nF	1.1nF	1.5nF	-	-	-	-	-	-
200V	330pF	390pF	2.0nF	4.7nF	-	-	6.2nF	10nF	16nF	27nF	-	-
250V	240pF	270pF	2.0nF	4.7nF	750pF	1.0nF	6.2nF	10nF	16nF	27nF	-	-
300V	120pF	220pF	910pF	1.8nF	620pF	680pF	-	-	-	-	-	-
500V	0.2pF	100pF	910pF	1.8nF	510pF	560pF	5.1nF	5.6nF	13nF	15nF	-	-
630V	-	-	910pF	1.8nF	240pF	470pF	3.6nF	4.7nF	11nF	12nF	-	-
1kV	-	-	910pF	1.8nF	110pF	220pF	2.7nF	3.3nF	9.1nF	10nF	-	-
1.5kV	-	-	430pF	820pF	75pF	100pF	-	-	-	-	-	-
2kV	-	-	1.0pF	390pF	0.4pF*/2.2pF	68pF	910pF	1.0nF	2.4nF	5.1nF	-	-
2.5kV						-	510pF	820pF	1.6nF	2.2nF		
3kV						-	110pF	470pF	910pF	1.5nF	5.6nF	10nF
3.6kV						-	1pF	47pF**/100pF	-	-	-	-
4kV						-	-	-	620pF	820pF	-	-
5kV						-	-	-	360pF	560pF	1.0nF	5.1nF
6kV						-	-	-	160pF	330pF	-	-
7kV/7.2kV						-	-	-	1pF	56pF***/150pF	-	-

*1111 2kV: Min value is 0.4pF for surface mount part and 2.2pF for ribbon leaded part

**2225 3.6kV: Values up to 47pF max. are dual rated 3.6kVdc and 2.5kVac @ 30MHz

***4040 7kV/7.2kV: Values up to 56pF max. are dual rated 7kV/7.2kVdc and 5kVac @ 30MHz

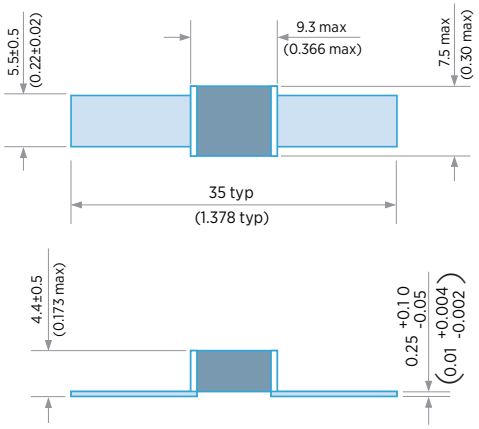
†Case size 1111 has thickness 2.0 ± 0.2mm (0.08 ± 0.008")

Non-Magnetic Capacitors — High Q, C0G/NP0, X5R and X7R — 16V to 7.2kV

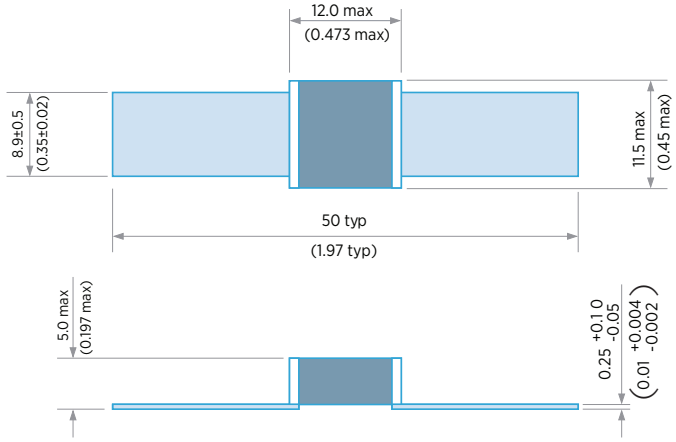
RIBBON LEADED

Silver plated copper ribbon attached with HMP solder - (MP greater than 260°C).

2225

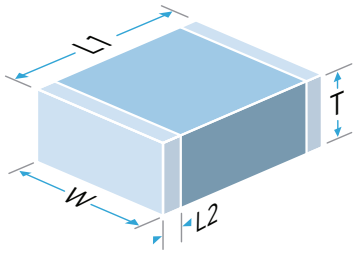


4040



SURFACE MOUNT

See MLC Caps catalogue for dimensions.



ORDERING INFORMATION — SYFER NON-MAGNETIC CAPACITORS

1206	2	500	0223	J	Q	T	-	-
4040	2	7K0	0470	G	Q	B	-	AF9
2225	B	3K0	6P80	G	Q	B	R	W221

Chip size	Termination or Coating	Voltage	Capacitance in picofarads (pF)	Capacitance tolerance	Dielectric	Packing	Lead Options	Suffix code
0402 **0603** **0505** **0805** **1206** **1111** **1210** **1808** **1812** **2220** **2225** **4040** **7676**	Termination (Chip) **2** = Sintered silver with copper barrier **3** = FlexiCap™ with copper barrier **4** = Sintered silver with copper barrier **5** = FlexiCap™ base with copper barrier **F** = Palladium silver Coating (Ribbon Leaded) **B** = Uncoated **V** = Coated with modified silicone laquer	**050** = 50V **100** = 100V **1K0** = 1kV **2K0** = 2kV **3K0** = 3kV **4K0** = 4kV **5K0** = 5kV **6K0** = 6kV **7K0** = 7kV	<10pF Insert a P for the decimal point, e.g., **2P20** = 2.2pF. >10pF. 1st digit is 0. 2nd and 3rd digits are significant figures of capacitance code. The 4th digit is number of zeros following e.g., **0470** = 47pF **0512** = 5100pF Values <1pF in 0.1pF steps, above this values are E24 series	<4.7pF **H** = ±0.05pF **B** = ±0.1pF **C** = ±0.25pF **D** = ±0.5pF ≥4.7pF ~ <10pF **B** = ±0.1pF **C** = ±0.25pF **D** = ±0.5pF ≥10pF **F** = ±1% **G** = ±2% **J** = ±5% **K** = ±10% **M** = ±20%	**Q** = COG - Hi Q/Low ESR (PME) **H** = COG - Hi Q/Low ESR (BME) **P** = X5R **X** = X7R (2R1)	**T** = 178mm (7") reel **R** = 330mm (13") reel **B** = Bulk pack — tubs or trays	**R** = Ribbon leaded **Blank** = SM chip	**W221** = Leaded **W211** = Leaded marked **AF9** = SM standard chip **AF9LM** = SM marked standard chip

Note: Not all options in the above table are avilable for all parts. To identify the required part number, use the Part Builder application on the Knowles website.

Non-Magnetic Capacitors, High Power RF — Porcelain High Q

SERIES OVERVIEW

Made from highly stable, low loss dielectric formulations, these traditional porcelain MLCs are known for their high RF power handling capability. Available in all industry common case sizes. The special silver-palladium termination and the proprietary ceramic formulations guarantee consistent non-magnetic performance. All MLCs in these series are RoHS compliant. Chips are available either with standard termination or can be fitted with ribbon leads, depending on your application.

DESCRIPTION

- Porcelain Capacitors
- Zero TC
- Low Noise
- Low ESR, High Q
- High Self-resonance
- Established Reliability
- Capacitance range 0.1pF to 5.1nF

FUNCTIONAL APPLICATIONS

- Impedance Matching
- DC Blocking
- Bypass
- Coupling
- Tuning and Feedback

HIGH POWER RF CAPACITORS — CF AND AH MATERIALS — MINIMUM/MAXIMUM CAPACITANCE VALUES — see ordering information

Chip Size	C11 0505		C17 1111		C18 1111		C22 2225		C40 3838	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
50V	-	-	680pF	1nF	680pF	1.0nF	-	-	-	-
100V	-	-	510pF	620pF	510pF	620pF	-	-	-	-
200V	36pF	100pF	220pF	470pF	220pF	470pF	-	-	-	-
250V	0.3pF	33pF	-	-	-	-	-	-	-	-
300V	-	-	-	-	-	-	2.0nF	2.7nF	-	-
500V	-	-	110pF	200pF	-	-	1.3nF	1.8nF	2.4nF	5.1nF
1kV	-	-	0.3pF	100pF	110pF	200pF	510pF	1.2nF	750pF	2.2nF
1.5kV	-	-	-	-	-	-	300pF	470pF	-	-
2kV	-	-	-	-	0.3pF	100pF	-	-	-	-
2.5kV	-	-	-	-	-	-	0.3pF	270pF	430pF	680pF
3.6kV	-	-	-	-	-	-	-	-	110pF	390pF
7.2kV	-	-	-	-	-	-	-	-	0.3pF	100pF

Note: Special capacitance values available upon request.

ORDERING INFORMATION — NON-MAGNETIC CAPACITORS (PORCELAIN HIGH Q)

C17	CF	470	J	7	W	A	X	0	B
Case size	Dielectric	Capacitance	Tolerance	Voltage	Termination	Lead Option	Test Level	Marking	Packaging
C11 0505 **C17** 1111 **C18** 1111 **C22** 2225 **C40** 3838	**AH** +90±20ppm/°C **CF** 0±15ppm/°C	0R3 0.3pF 100 10pF 101 100pF 102 1000pF	**A** ±0.05pF **B** ±0.1pF **C** ±0.25pF **D** ±0.5pF **F** ±1% **G** ±2% **J** ±5% **K** ±10%	**5** 50V **1** 100V **6** 200V **9** 250V **3** 300V **4** 500V **7** 1kV **A** 1.5kV **G** 2kV **B** 2.5kV **D** 3.6kV **H** 7.2kV	**W** Ag/Cu/Sn **P** Pd/Ag **M** Poly/Cu/Sn	**A** Axial Ribbon **N** SM Chip	**X** Commercial or Industrial **Y** Reduced Visual **A** MIL-PRF-55681 Group A **C** MIL-PRF-55681 Group C	**0** No marking **1** Single-side marked **2** Double-side marked **3** Large single-side marked **4** Large double-side marked **5** Vertical edge marked **9** Customer Specified	**B** Bulk **P** Plastic Box **T** 7" Reel Horizontal Orientation

Note: [1]Available in chip or ribbon leaded format.

REELED QUANTITIES

Chip Size	0402	0505	0603	0805	1206	1111/1210	1808	1812	2220	2225
7" Reel	10,000	2,500	4,000	3,000	2,500	1,000/2,000	1,500	500	500	500
13" Reel	13" reel quantities available on request						6,000	2,000	2,000	2,000

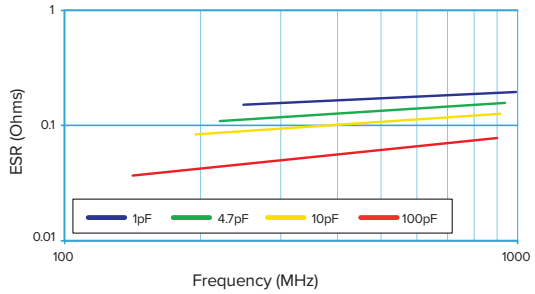
Note: Other capacitance values may become available; please contact the Sales Office if you need values other than those shown in the above tables.
For dimensions and soldering information, visit knowlescapacitors.com.

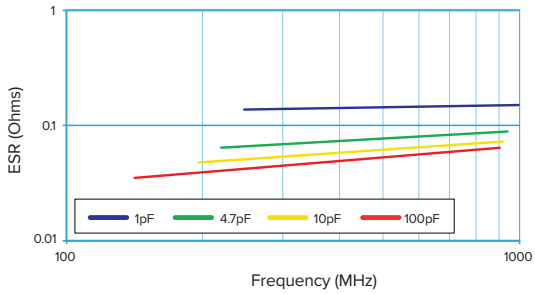
Non-Magnetic Capacitors, High Power RF — Porcelain High Q

TYPICAL PERFORMANCE DATA — CHIP SIZE 0805 HIGH Q

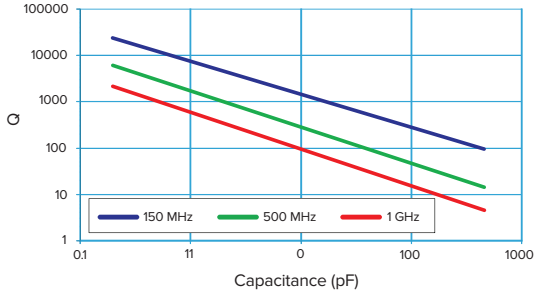
TYPICAL PERFORMANCE DATA — CHIP SIZE 1111 HIGH Q

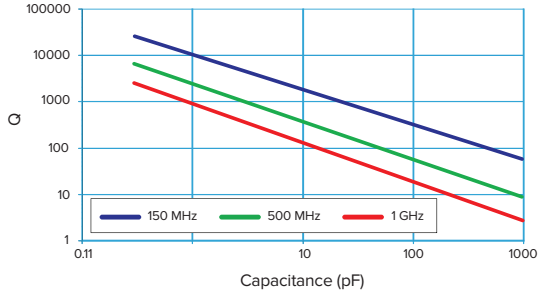
ESR VS FREQUENCY



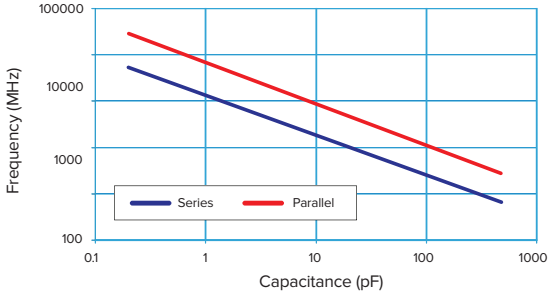


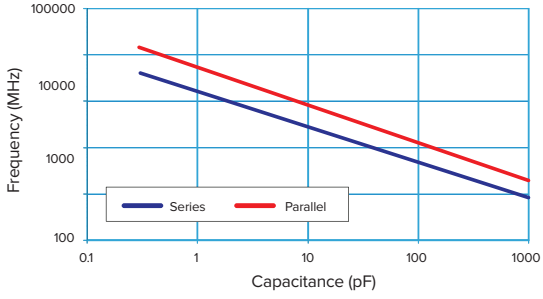
Q VS CAPACITANCE



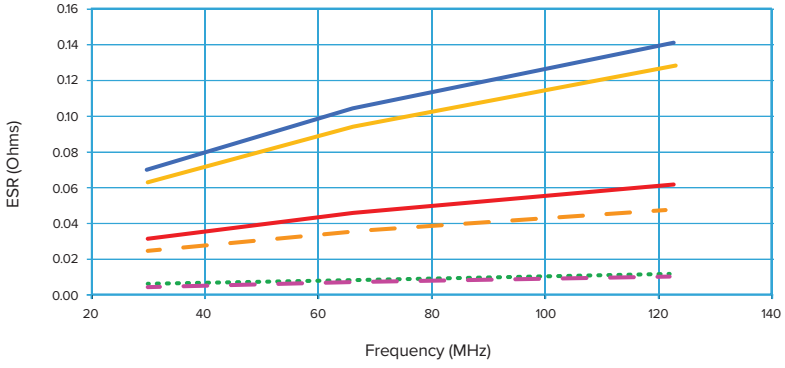


RESONANT FREQUENCY VS CAPACITANCE





TYPICAL ESR VS FREQUENCY



ESR MEASUREMENT

All ESR figures are measured using a VNA and 2m copper resonant tube and extrapolating to 30MHz by ratio. Measured data can be supplied on request. Measurement of ESR can vary with test method and components should only be compared when tested back-to-back on the same equipment under controlled conditions.

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