

UHF, VHF Hyperabrupt Tuning Varactors

MA4ST520, MA4ST530 Series

V 2.00

Features

- A Superior Ion Implantation Process Results in More Repeatable C-V Characteristics Within Specified Capacitance Tolerances
- High Q
- Usable Capacitance Change Ratios as High as 8:1. (MA4ST520 Series)

Description

M/A-COM's silicon hyperabrupt tuning varactors combine advantages of a repeatable ion-implant process with excellent passivation and low series resistance. The resulting diodes exhibit a C-V characteristic that is consistent from lot to lot and stable within close tolerances, over time and temperature.

Applications

The MA4ST520 series was developed for VCO tuning in the VHF through UHF ranges. Applications are high volume fixed tuned and frequency hopping military radios where low cost and lot-to-lot C-V repeatability are critical. The MA4ST530 family has a faster change of capacitance with voltage.

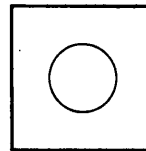
Ordering Information

When ordering diodes, use the appropriate M/A-COM model number and add case style suffix where appropriate. (For example, MA4ST520B is an 18-22 pF (@ 4V) varactor in the standard glass package (case style 4). The MA4ST520B-132 is the unpackaged chip version.

Case Style (See appendix for complete dimensions)



4



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Maximum Ratings

Temperature Range Operating	-65°C to +125°C
Storage	-65°C to +150°C
Power Dissipation (Max.)	(derate linearly to zero at 150°C) 250 mW (Case Style 4)
Max. Reverse Voltage	Same as V_B
Forward Current	50 mAdc
Max. Leakage Current	@ 80% V_B = 100 nA max. @ +25°C

Specifications Subject to Change Without Notice.

High Tuning Ratio

Specifications @ $T_A = +25^\circ\text{C}$ Min. Reverse Voltage V_R 22 V @ 10 μA Max. Reverse Leakage Current I_R @ 18 V = 100 nAmps

Parameter	Diode Capacitance ¹ (pF)				Tuning Ratio		Figure of Merit	Chip Style ²
	F = 1 MHz				F = 1 MHz		F = 50 MHz	
	$V_R = 2.5$ Vdc	$V_R = 4.0$ Vdc	$V_R = 8.0$ Vdc	$V_R = 20$ Vdc	C (4V)/C (8V)	C (4V)/C (20V)	$V_R = 4$ Vdc	
Part Number	Min./Max.	Min./Max.	Min./Max.	Min./Max.	Min./Max.	Min./Max.	Typ.	
MA4ST520	25/29	18/22	—	—	—	—	150	132
MA4ST520B	—	18/22	7.5/10.5	3.1/3.9	—	4.6/7.1	300	132
MA4ST520D	—	19/21	7.8/9.2	3.1/3.9	2.0/2.7	4.8/6.8	300	132
MA4ST522	62/72	45/55	—	—	—	—	100	132
MA4ST522C	—	47.5/52.5	18.4/21.6	—	2.2/2.8	—	200	132
MA4ST522D	—	47.5/52.5	18.4/21.6	7.3/9.2	2.2/2.8	5.2/6.9	200	132
MA4ST523	135/160	100/120	—	—	—	—	65	200
MA4ST523C	—	104.5/115.5	41.4/48.6	—	2.15/2.8	—	125	200
MA4ST523D	—	104.5/115.5	41.4/48.6	16/20	2.15/2.8	5.2/7.3	125	200
MA4ST524	195/225	140/170	—	—	—	—	50	200
MA4ST524C	—	147/163	59.8/70.2	—	2.1/2.8	—	100	200
MA4ST524D	147/163	147/163	59.8/70.2	22.5/28	2.1/2.8	5.2/7.2	100	200

Note:

- The capacitance values and tuning ratios are given for diodes in case style 4. Chip diodes may have slightly different values.

Specifications @ $T_A = +25^\circ\text{C}$

Parameter	Reverse Breakdown Voltage (Vdc)	Diode Capacitance ¹ (pF)				Tuning Ratio		Figure of Merit
		F = 1 MHz				F = 1 MHz		F = 50 MHz
		@ 10 μA dc	$V_R = 1.25$ Vdc	$V_R = 3.0$ Vdc	$V_R = 8.0$ Vdc	$V_R = 20$ Vdc	C (3V)/C (8V)	C (3V)/C (20V)
Part Number	Min.	Min./Max.	Min./Max.	Min./Max.	Min./Max.	Min./Max.	Min./Max.	Typ.
MA4ST533	15	14/17.5	10.5/12.5	—	—	—	—	200
MA4ST533B	22	—	10.5/12.5	4.3/4.7	2.0/2.4	—	4.4/6.3	300
MA4ST533C	22	—	10.5/12.5	4.3/4.7	2.0/2.3	—	4.6/6.3	450
MA4ST534B	22	—	25/31	10/13.5	4.5/5.3	—	4.7/6.9	200
MA4ST534C	22	—	25/31	10/13.5	4.5/5.1	—	4.9/6.9	300

Notes:

- For all model numbers listed above the reverse leakage current at 80% of related V_B Max. is 100 nAmps Max.
- All model numbers listed above are available in axial lead Case Style 4 and Chip Style 132. To order chip style 132, add the case style suffix to the part number, ie: MA4ST533-132.

Specifications Subject to Change Without Notice.

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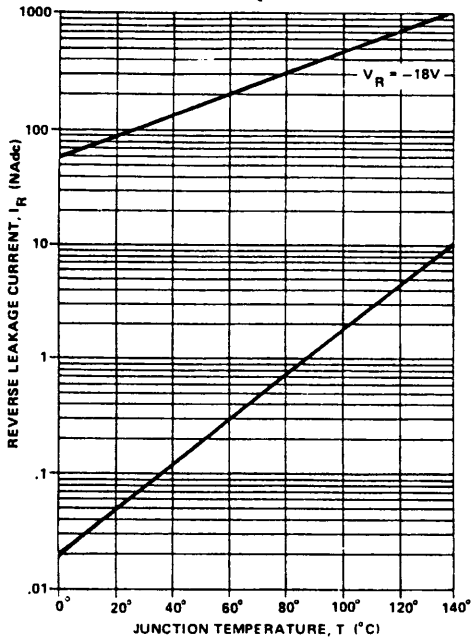
North America: Tel. (800) 366-2266
Fax (800) 618-8883

Asia/Pacific: Tel. +81 (03) 3226-1671
Fax +81 (03) 3226-1451

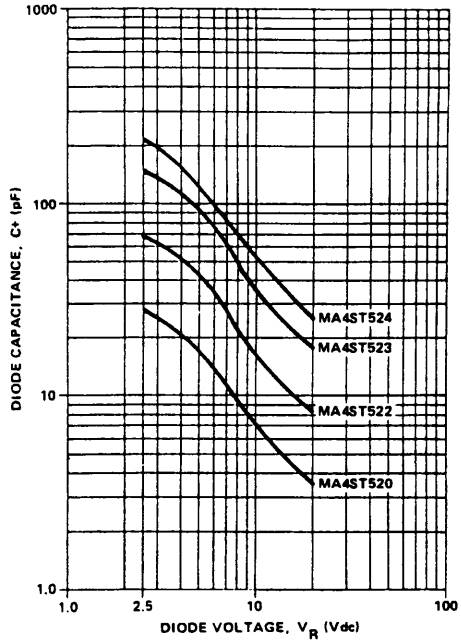
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Typical Performance Curves MA4ST520 Series

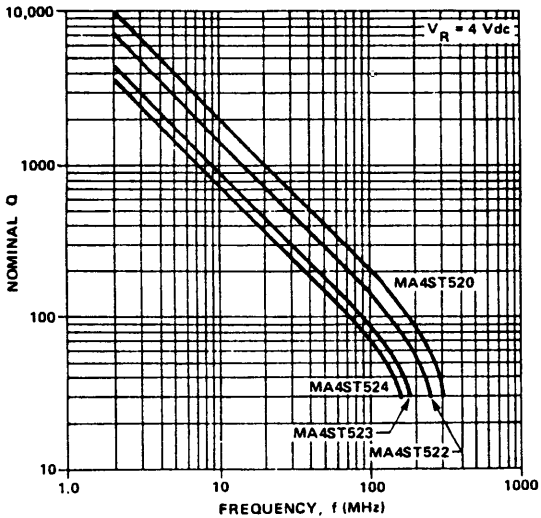
REVERSE LEAKAGE CURRENT @ -18V vs JUNCTION TEMPERATURE



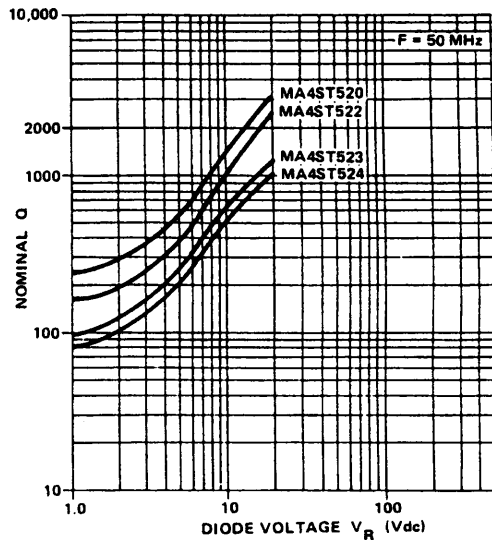
NOMINAL CAPACITANCE vs TUNING VOLTAGE $T_A = +25^\circ C$



NOMINAL Q vs FREQUENCY



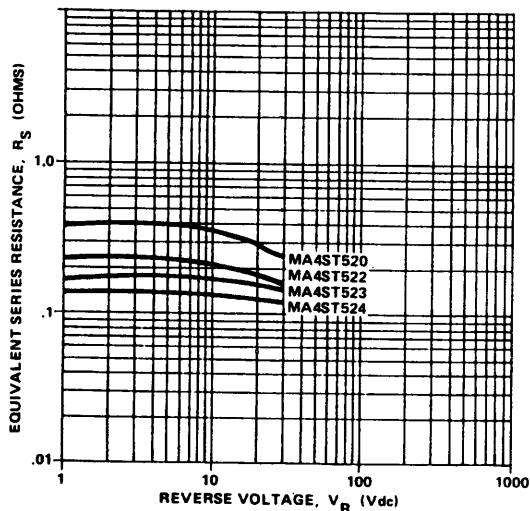
NOMINAL Q vs TUNING VOLTAGE



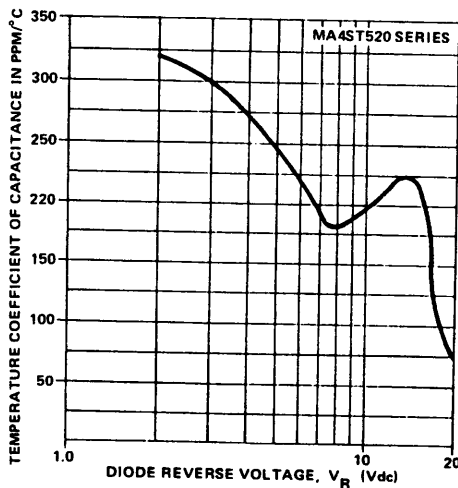
Specifications Subject to Change Without Notice.

Typical Performance Curves MA4ST520 Series (Cont'd)

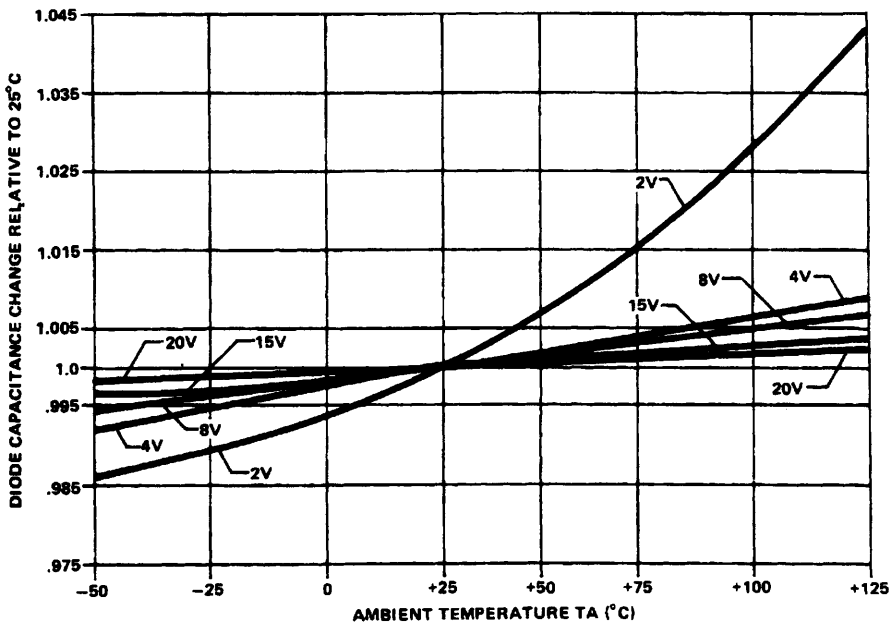
EQUIVALENT SERIES RESISTANCE vs VARACTOR VOLTAGE ($T_A = +25^\circ\text{C}$)



TEMPERATURE COEFFICIENT OF CAPACITANCE IN PPM/°C vs TUNING VOLTAGE



CAPACITANCE CHANGE vs AMBIENT TEMPERATURE



Specifications Subject to Change Without Notice.

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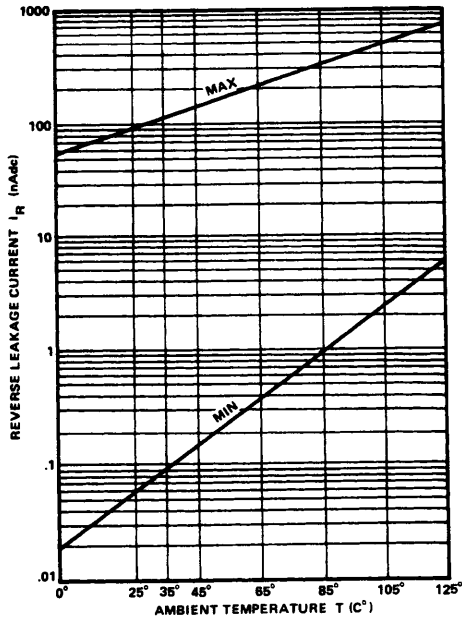
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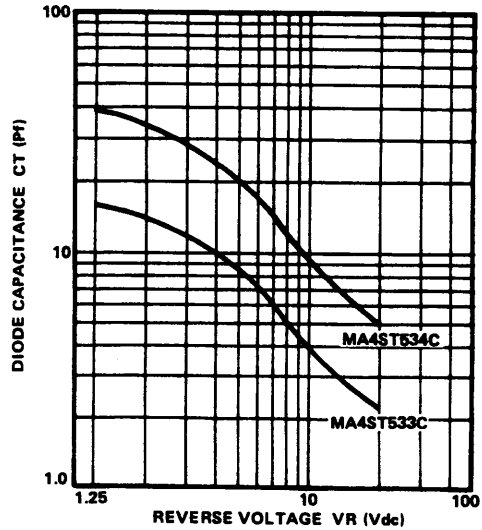
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Typical Performance Curves MA4ST530 Series

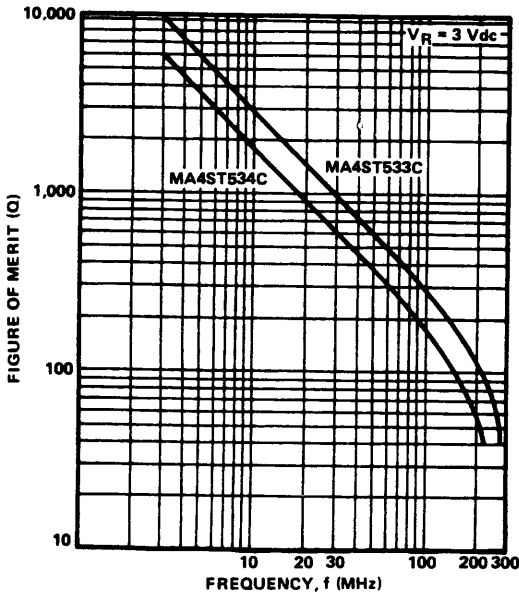
REVERSE LEAKAGE CURRENT @ 80% V_B vs AMBIENT TEMPERATURE



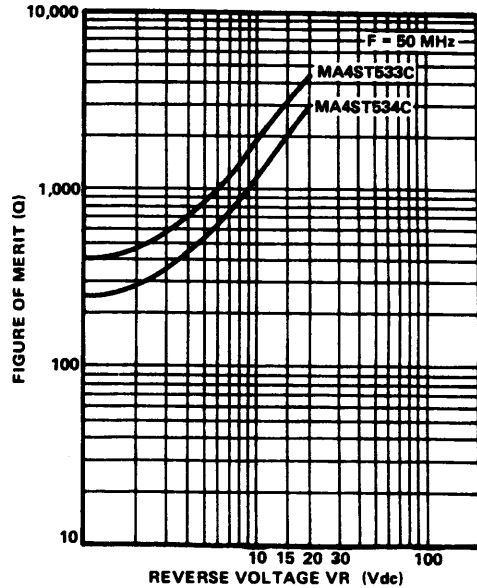
NOMINAL CAPACITANCE vs TUNING VOLTAGE $T_A = +25^\circ\text{C}$



NOMINAL Q vs FREQUENCY



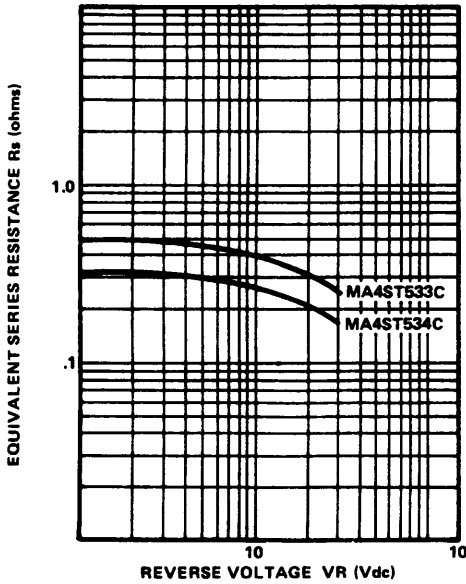
NOMINAL Q vs TUNING VOLTAGE



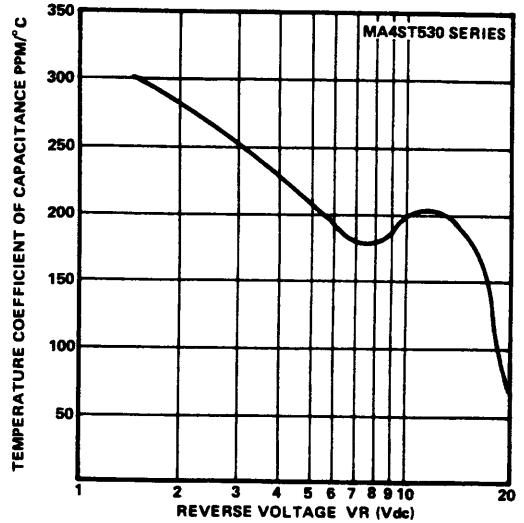
Specifications Subject to Change Without Notice.

Typical Performance Curves MA4ST530 Series (Cont'd)

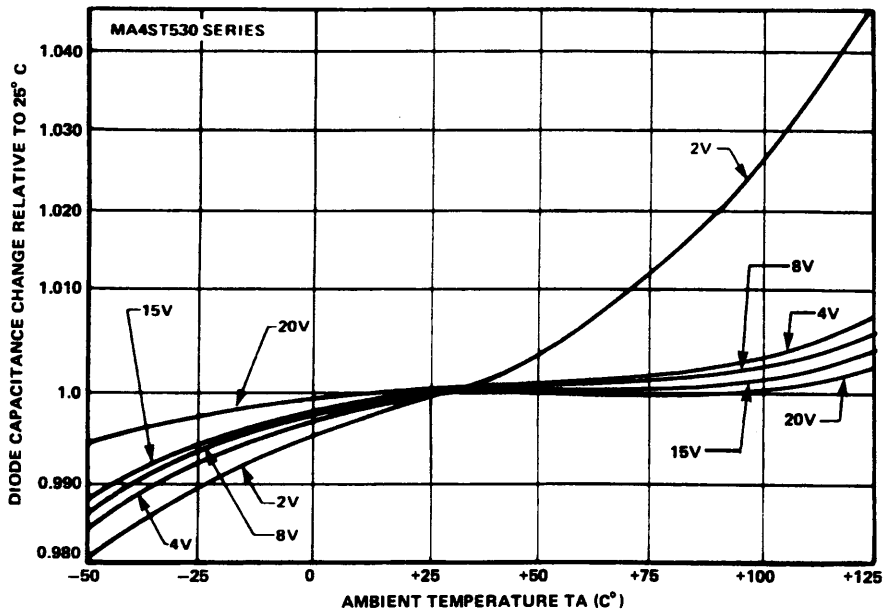
EQUIVALENT SERIES RESISTANCE vs VARACTOR VOLTAGE ($T_A = 25^\circ\text{C}$)



TEMPERATURE COEFFICIENT OF CAPACITANCE IN PPM/°C vs TUNING VOLTAGE



CAPACITANCE CHANGE vs AMBIENT TEMPERATURE



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Specifications Subject to Change Without Notice.

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High Q Hyperabrupt Tuning Varactors

MA4ST550 Series

V 2.00

Features

- High Q
- Usable Capacitance Change of 7:1
- Low Reverse Leakage for Good Post Tuning Drift Characteristics
- Reproducible C-V Curves

Description

The MA4ST550 family of high Q Silicon Hyperabrupt Tuning Varactors is available in a series of low parasitic capacitance microwave packages or in chip form. The MA4ST550 series of diodes is available with junction capacitances of approximately 0.8 pF to 8.2 pF at -4 volts. These diodes have capacitance change ratios as high as 7:1.

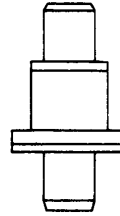
Applications

The MA4ST550 series is appropriate for use in VCOs with frequencies within the range of approximately 1-14 GHz where a large capacitance change is required. These diodes are suited for VCOs in missile seekers, telecommunication systems and electronic warfare systems with critical post tuning drift specifications.

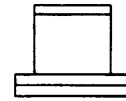
Environmental Performance

All tuning varactors in ceramic packages are capable of meeting the performance tests dictated by the methods and procedures of the latest revisions of MIL-S-19500, MIL-STD-202 and MIL-STD-750 which specify mechanical, electrical, thermal and other environmental tests common to semiconductor products.

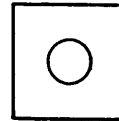
Case Styles



30



31



134

Maximum Ratings

Reverse Voltage	Same as Breakdown Voltage
Operating Temperature	- 65°C to +150°C
Storage Temperature	- 65°C to +200°C
Temperature Coefficient	400 ppm/°C at -4 Volts

Specifications @ TA= +25°C

Breakdown Voltage = 22 Volts Minimum @ 10 Microamps

Reverse Current = 50 nAmps Maximum @ 20 Volts and 25°C

Model Number	Case ¹ Style	Total Capacitance ^{2,3} @ - 4V (pF) Min./Max.	Total Capacitance ^{2,3} @ - 20V (pF) Min./Max.	Typical @ - 4 Volts 50 MHz
MA4ST551	30	0.72-0.88	0.30-0.38	650
MA4ST552	30	0.90-1.10	0.34-0.42	650
MA4ST553	30	1.08-1.32	0.38-0.48	600
MA4ST554	30	1.35-1.65	0.43-0.58	600
MA4ST555	30	1.62-1.98	0.51-0.68	550
MA4ST556	30	1.98-2.42	0.58-0.78	550
MA4ST557	30	2.43-2.97	0.68-0.88	500
MA4ST558	30	2.97-3.63	0.82-1.02	500
MA4ST559	30	3.51-4.29	0.93-1.18	450
MA4ST560	30	4.23-5.16	1.13-1.43	450
MA4ST561	30	5.04-6.16	1.33-1.63	450
MA4ST562	30	6.12-7.48	1.58-1.98	400
MA4ST563	30	7.38-9.02	1.88-2.38	400

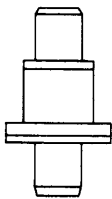
Notes:

1. The standard case style is 30. Other packages and chips shown at the bottom of this page are available. When ordering, specify the desired case style by adding the case designation as a suffix to the model number, i.e. MA4ST552-134 is a 15 X 15 mil chip diode. See appendix for complete dimensions.

2. Capacitance is measured at 1 MHz.

3. The total capacitance values shown are for devices housed in case style 30. Other case styles will result in different values due to different case parasitics. Case parasitics (C_p and L_S) are given for available case styles along with the outline drawings in the appendix.

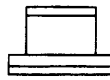
Case Styles



30



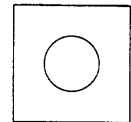
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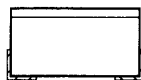
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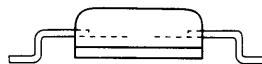
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134



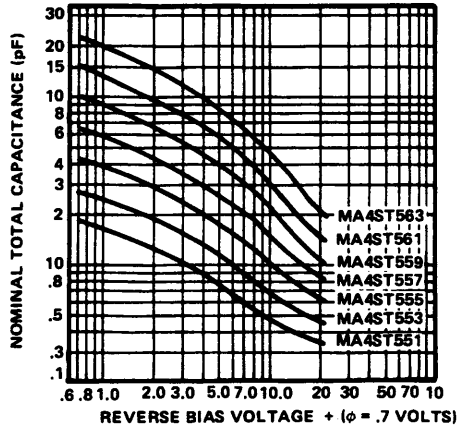
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Typical Performance Curves

CAPACITANCE vs REVERSE BIAS VOLTAGE
(CASE STYLE 30)



CAPACITANCE vs REVERSE BIAS VOLTAGE
(CASE STYLE 30)

