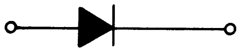
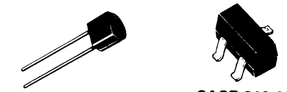
MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MMBV3700
MMBV3700L
MPN3700



SILICON PIN SWITCHING DIODE



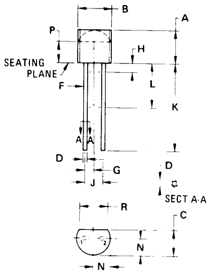
CASE 182-02
TO-226AC

CASE 318-02
TO-236AA
SOT-23

HIGH VOLTAGE SILICON PIN DIODE

... designed primarily for VHF band switching applications but also suitable for use in general-purpose switching and attenuator circuits. Supplied in a cost effective plastic package for economical, high-volume consumer and industrial requirements.

- Long Reverse Recovery Time
  t_{rr} = 300 ns (Typ)
- Rugged PIN Structure Coupled with Wirebond Construction for Optimum Reliability
- Low Series Resistance @ 100 MHz —
  R_S = 0.7 Ohms (Typ) @ I_F = 10 mAdc
- Reverse Breakdown Voltage = 200 V (Min)

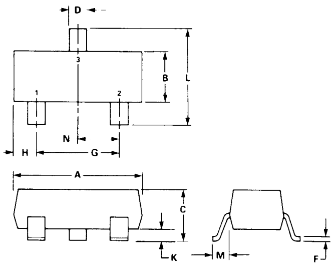


STYLE 1:
PIN 1. ANODE
2. CATHODE

CASE 182-02
TO-226AC

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	4.32	5.33	0.170	0.210
B	4.45	5.21	0.175	0.205
C	3.18	4.19	0.125	0.165
D	0.356	0.533	0.014	0.021
F	0.407	0.482	0.016	0.019
G	* 1.27 BSC		0.050 BSC	
H	–	1.27	–	0.050
J	2.54 BSC		0.100 BSC	
K	12.70	–	0.500	–
L	6.35	–	0.250	–
N	2.03	2.66	0.080	0.105
P	2.93	–	0.115	–
R	3.43	–	0.135	–

All JEDEC dimensions and notes apply



STYLE 8:
PIN 1. ANODE
2. NO CONNECTION
3. CATHODE

CASE 318-02
TO-236AA
SOT-23

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	2.80	3.04	0.1102	0.1197
B	1.20	1.40	0.0472	0.0551
C	0.85	1.20	0.033	0.0472
D	0.37	0.50	0.0150	0.020
F	0.085	0.130	0.0034	0.0051
G	1.78	2.04	0.0701	0.0807
H	0.45	0.60	0.0177	0.0236
K	0.10	0.25	0.0040	0.0098
L	2.10	2.50	0.0830	0.0984
M	0.45	0.60	0.0180	0.0236
N	0.89	1.02	0.0350	0.0401
K	0.013	0.10	0.0005	0.0040

*Low Profile = CASE 318-03 TO-236AB

MAXIMUM RATINGS

Rating	Symbol	MPN3700 Value	MMBV3700,L Value	Unit
Reverse Voltage	V_R	200		Volts
Total Device Dissipation @ T_A = 25°C	P_D	280	200	mW
Derate above 25°C		2.8	2.0	mW/°C
Junction Temperature	T_J	+125		°C
Storage Temperature Range	T_{stg}	−65 to +150		°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Reverse Breakdown Voltage (I_R = 10 μA)	$V_{(BR)R}$	200	—	—	Volts
Diode Capacitance (V_R = 20 Vdc, f = 1.0 MHz)	C_T	—	—	1.0	pF
Series Resistance (Figure 5) (I_F = 10 mA)	R_S	—	0.7	1.0	Ohms
Reverse Leakage Current (V_R = 150 Vdc)	I_R	—	—	0.1	μA
Reverse Recovery Time (I_F = I_R = 10 mA)	t_{rr}	—	300	—	ns

5

TYPICAL ELECTRICAL CHARACTERISTICS

FIGURE 1 — SERIES RESISTANCE

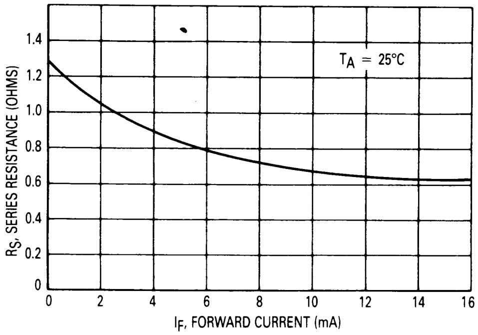


FIGURE 2 — FORWARD VOLTAGE

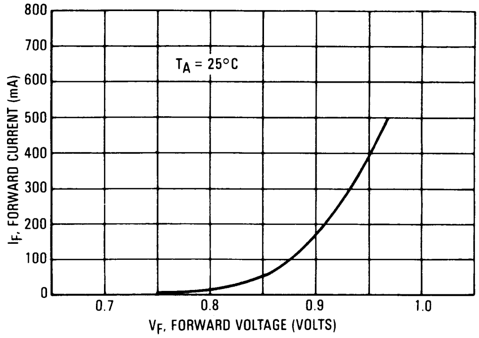


FIGURE 3 — DIODE CAPACITANCE

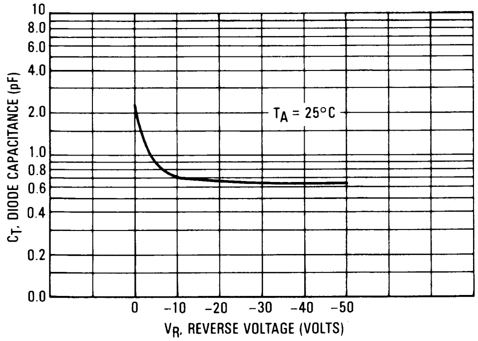


FIGURE 4 — LEAKAGE CURRENT

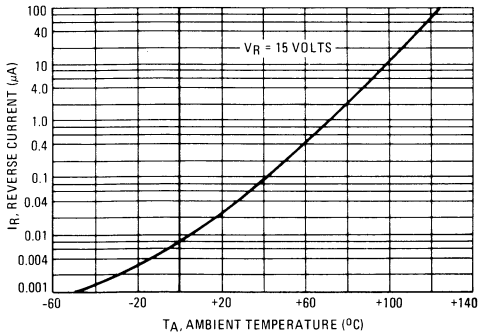
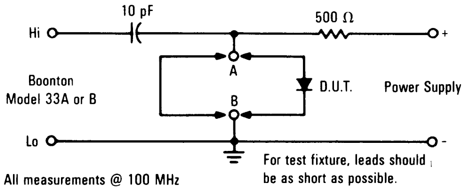


FIGURE 5 — FORWARD SERIES RESISTANCE TEST METHOD



To measure series resistance, a 10 pF capacitor is used to reduce the forward capacitance of the circuit and to prevent shorting of the external power supply through the bridge. The small signal from the bridge is prevented from shorting through the power supply by the 500-ohm resistor. The resistance of the 10 pF capacitor can be considered negligible for this measurement.

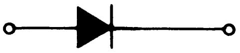
1. The RF Admittance Bridge (Boonton 33A or B) must be initially balanced, with the test circuit connected to the bridge test terminals. The conductance scale will be set at zero and the capacitance scale will be set at 120 pF, as required when using the 100 MHz test coil.
2. Use a short length of wire to short the test circuit from point "A" to "B". Then connect the power supply providing 10 mA of bias current to the test circuit.
3. Adjust the capacitance scale arm of the bridge and the "G" zero control for a minimum null on the "null meter". The null occurs at approximately 130 pF.
4. Replace the wire short with the device to be tested. Bias the device to a forward conductance state of 10 mA.
5. Obtain a minimum null on the "null meter", with the capacitance and conductance scale adjustment arms.
6. Read conductance (G) direct from the scale. Now read the capacitance value from the scale (≈130 pF) and subtract 120 pF which yields capacitance (C). The forward resistance (R_S) can now be calculated from:

$$R_S = \frac{2.533\ G}{C^2}$$

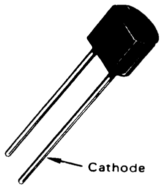
Where:
G — in micromhos,
C — in pF,
R_S — in ohms

5

MPN3404



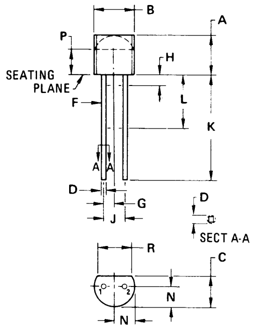
SILICON PIN SWITCHING DIODE



SILICON PIN DIODE

. . . designed primarily for VHF band switching applications but also suitable for use in general-purpose switching and attenuator circuits. Supplied in a cost effective TO-92 type plastic package for economical, high-volume consumer and industrial requirements.

- Rugged PIN Structure Coupled with Wirebond Construction for Optimum Reliability
- Low Series Resistance @ 100 MHz – R_S = 0.7 Ohms (Typ) @ I_F = 10 mAdc
- Sturdy TO-92 Style Package for Handling Ease



STYLE 1:
PIN 1. ANODE
2. CATHODE

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	4.32	5.33	0.170	0.210
B	4.45	5.21	0.175	0.205
C	3.18	4.19	0.125	0.165
D	0.356	0.533	0.014	0.021
F	0.407	0.482	0.016	0.019
G	1.27 BSC		0.050 BSC	
H	–	1.27	–	0.050
J	2.54 BSC		0.100 BSC	
K	12.70	–	0.500	–
L	6.35	–	0.250	–
N	2.03	2.66	0.080	0.105
P	2.93	–	0.115	–
R	3.43	–	0.135	–

All JEDEC dimensions and notes apply

CASE 182-02

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Reverse Voltage	V_R	20	Volts
Forward Power Dissipation @ T_A = 25°C Derate above 25°C	P_F	400 4.0	mW mW/°C
Junction Temperature	T_J	+125	°C
Storage Temperature Range	T_{stg}	-65 to +150	°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Reverse Breakdown Voltage (I_R = 10 μA)	$V_{(BR)R}$	20	–	–	Volts
Diode Capacitance (V_R = 15 Vdc, f = 1.0 MHz)	C_T	–	1.3	2.0	pF
Series Resistance (Figure 5) (I_F = 10 mA)	R_S	–	0.7	0.85	Ohms
Reverse Leakage Current (V_R = 15 Vdc)	I_R	–	–	0.1	μA

TYPICAL ELECTRICAL CHARACTERISTICS

FIGURE 1 – SERIES RESISTANCE

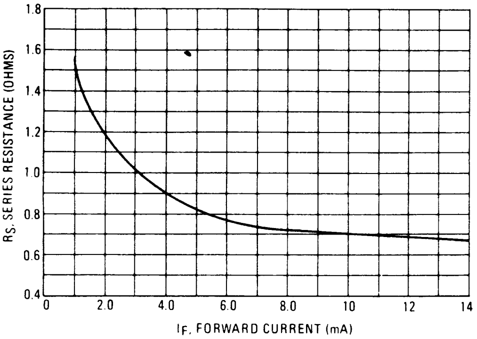


FIGURE 2 – FORWARD VOLTAGE

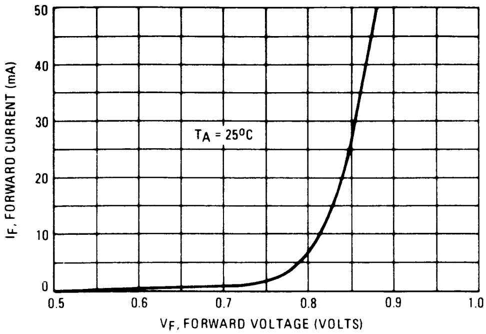


FIGURE 3 – DIODE CAPACITANCE

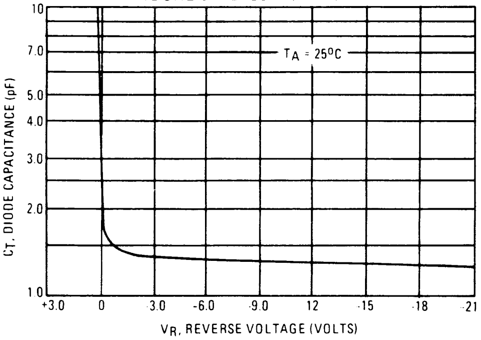


FIGURE 4 – LEAKAGE CURRENT

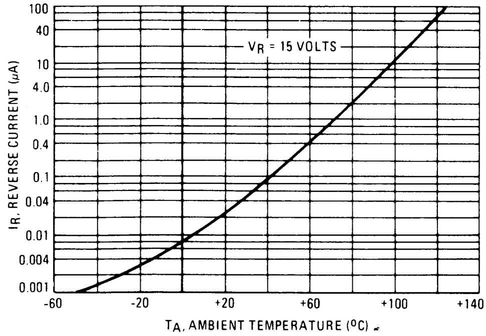
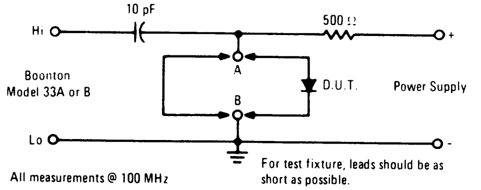


FIGURE 5 – FORWARD SERIES RESISTANCE TEST METHCD



To measure series resistance, a 10 pF capacitor is used to reduce the forward capacitance of the circuit and to prevent shorting of the external power supply through the bridge. The small signal from the bridge is prevented from shorting through the power supply by the 500-ohm resistor. The resistance of the 10 pF capacitor can be considered negligible for this measurement.

1. The RF Admittance Bridge (Boonton 33A or B) must be initially balanced, with the test circuit connected to the bridge test terminals. The conductance scale will be set at zero and the capacitance scale will be set at 120 pF, as required when using the 100 MHz test coil.
2. Use a short length of wire to short the test circuit from point "A" to "B". Then connect the power supply providing 10 mA of bias current to the test circuit.
3. Adjust the capacitance scale arm of the bridge and the "G" zero control for a minimum null on the "null meter". The null occurs at approximately 130 pF.
4. Replace the wire short with the device to be tested. Bias the device to a forward conductance state of 10 mA.
5. Obtain a minimum null on the "null meter", with the capacitance and conductance scale adjustment arms.
6. Read conductance (G) direct from the scale. Now read the capacitance value from the scale (≈ 130 pF) and subtract 120 pF which yields capacitance (C). The forward resistance (R_S) can now be calculated from:

$$R_S = \frac{2.533\,G}{C^2}$$

Where:
G – in micromhos,
C – in pF,
R_S – in ohms

5

MV104

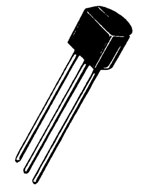
VVC

SILICON EPICAP DIODES

. . . designed for FM tuning, general frequency control and tuning, or any top-of-the-line application requiring back-to-back diode configurations for minimum signal distortion and detuning. This device is supplied in the popular TO-92 plastic package for high volume, economical requirements of consumer and industrial applications.

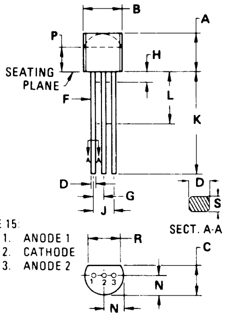
- High Figure of Merit – $Q = 140$ (Typ) @ $V_R = 3.0$ Vdc, f = 100 MHz
- Guaranteed Capacitance Range 37 – 42 pF @ $V_R = 3.0$ Vdc (MV104)
- Dual Diodes – Save Space and Reduce Cost
- TO-92 Package for Easy Handling and Mounting
- Monolithic Chip Provides Near Perfect Matching – Guaranteed ± 1% (Max) Over Specified Tuning Range.

DUAL VOLTAGE-VARIABLE CAPACITANCE DIODES



MAXIMUM RATINGS (Each Device)

Rating	Symbol	Value	Unit
Reverse Voltage	V_R	32	Volts
Forward Current	I_F	200	mA
Total Power Dissipation @ T_A = 25°C Derate above 25°C	P_D	280 2.8	mW mW/°C
Junction Temperature	T_J	+125	°C
Storage Temperature Range	T_{stg}	-65 to +150	°C



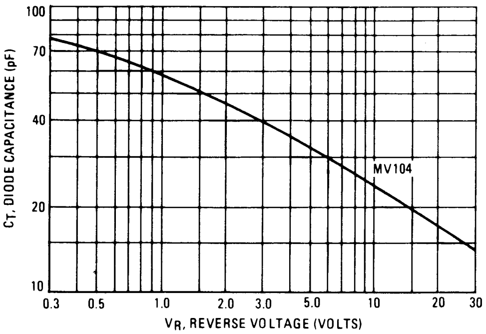
STYLE 15:
PIN 1. ANODE 1
2. CATHODE
3. ANODE 2

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	4.32	5.33	0.170	0.210
B	4.44	5.21	0.175	0.205
C	3.18	4.19	0.125	0.165
D	0.41	0.56	0.016	0.022
F	0.41	0.48	0.016	0.019
G	1.14	1.40	0.045	0.055
H	–	2.54	–	0.100
J	2.41	2.67	0.095	0.105
K	12.70	–	0.500	–
L	6.35	–	0.250	–
N	2.03	2.92	0.080	0.115
P	2.92	–	0.115	–
R	3.43	–	0.135	–
S	0.36	0.41	0.014	0.016

All JEDEC dimensions and notes apply.

CASE 29-02
TO-226AA

FIGURE 1 – DIODE CAPACITANCE (Each Device)



ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted, Each Device)

Characteristic—All Types	Symbol	Min	Typ	Max	Unit
Reverse Breakdown Voltage (I_R = 10 μAdc)	$V_{(BR)R}$	32	—	—	Vdc
Reverse Voltage Leakage Current T_A = 25°C (V_R = 30 Vdc) T_A = 60°C	I_R	— —	— —	50 500	nAdc
Diode Capacitance Temperature Coefficient (V_R = 4.0 Vdc, f = 1.0 MHz)	TC_C	—	280	—	ppm/°C

	C_T, Diode Capacitance V_R = 3.0 Vdc, f = 1.0 MHz pF		Q, Figure of Merit V_R = 3.0 Vdc f = 100 MHz		C_R, Capacitance Ratio C_3/C_{30} f = 1.0 MHz	
Device	Min	Max	Min	Typ	Min	Max
MV104	37	42	100	140	2.5	2.8

TYPICAL CHARACTERISTICS (Each Device)

FIGURE 2 — FIGURE OF MERIT versus VOLTAGE

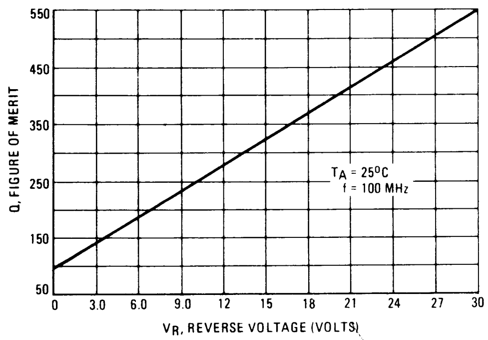


FIGURE 3 — FIGURE OF MERIT versus FREQUENCY

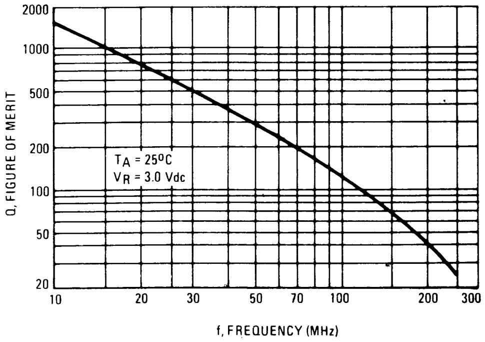


FIGURE 4 — DIODE CAPACITANCE versus TEMPERATURE

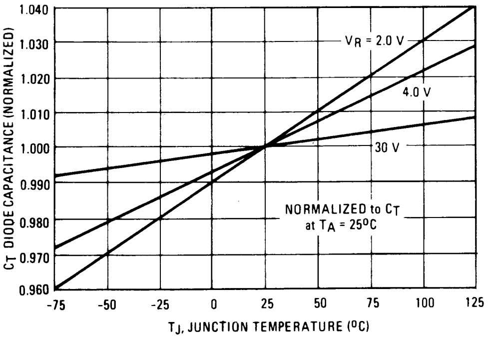
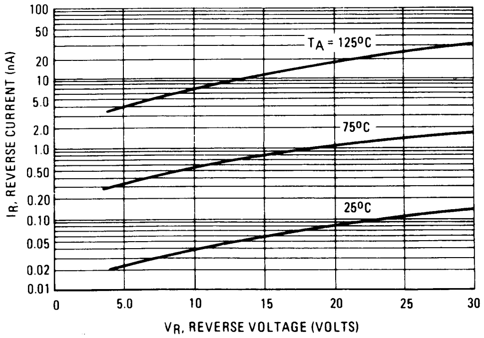


FIGURE 5 — REVERSE CURRENT versus REVERSE VOLTAGE



5

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MV1401, H
MV1403, H
MV1404, H
MV1405, H

Tuning Diodes

SILICON HYPER-ABRUPT TUNING DIODES

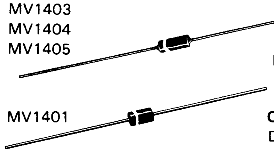
. . . designed with high capacitance and a capacitance change of greater than TEN TIMES for a bias change from 2 to 10 volts. Provides tuning over broad frequency ranges; tunes AM radio broadcast band, general AFC and tuning applications in lower RF frequencies.

- High Capacitance: 120–550 pF
- Large Capacitance Change with Small Bias Change
- Guaranteed High Q
- Available in Standard Axial Glass Packages
- H Suffix Devices with 100% Screening

HIGH TUNING RATIO VOLTAGE-VARIABLE CAPACITANCE DIODES

120-550 pF
12 VOLTS

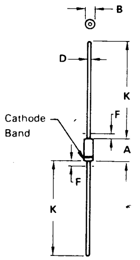
MV1403
MV1404
MV1405



CASE 51
DO-204AA
(DO-7)

MV1401

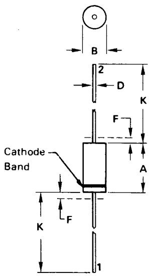
CASE 146
DO-204AB
(DO-14)



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	5.84	7.62	0.230	0.300
B	2.16	2.72	0.085	0.107
D	0.46	0.56	0.018	0.022
F	–	1.27	–	0.050
K	25.40	38.10	1.000	1.500

All JEDEC dimensions and notes apply

CASE 51-02



STYLE 1:
PIN 1. CATHODE
2. ANODE

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	5.84	7.62	0.230	0.300
B	2.74	3.56	0.108	0.140
D	0.46	0.56	0.018	0.022
F	–	1.27	–	0.050
K	25.40	–	1.000	–

All JEDEC dimensions and notes apply.

CASE 146-01

100% SCREENING FOR HIGH RELIABILITY

MV1401H, MV1403H, MV1404H, MV1405H are screened with the following tests:

Internal Visual Inspection
per 12M53957B (MIL-STD-750 METHOD 2072 PARAGRAPH 3.3 AND METHOD 2074 PARAGRAPH 3.1.3)

High Temperature Storage
T_A = 200°C, t ⩾ 48 hours

Thermal Shock (Temperature Cycling)
MIL-STD-202, Method 107, Condition C except 10 cycles continuously performed
t(extremes) = 15 minutes

Constant Acceleration
MIL-STD-750, Method 2006
20,000 G's (Y1 axis only)

Hermetic Seal
MIL-STD-750, Method 1071
Fine Leak - Condition G
Gross Leak - Condition C, Step 1

Electrical Test
I_R and C_T

High Temperature Reverse Bias
T_A = 120°C ± 5°C, t ⩾ 96 hours
V_R = 80% of $V_{(BR)R}$ MIN
Lower temperature till T_A = 30 ± 5°C.
Maintain this temperature prior to removal of Reverse Bias Voltage. Perform Electrical Test within 24 hours following bias removal.

Electrical Test
I_R and C_T

5

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Reverse Voltage	V_R	12	Volts
Forward Current	I_F	250	mA
Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	400 2.67	mW mW/°C
Junction Temperature	T_J	+175	°C
Storage Temperature Range	T_{stg}	-65 to +200	°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic — All Types	Symbol	Min	Typ	Max	Unit
Reverse Breakdown Voltage (I_R = 10 μAdc)	$V_{(BR)R}$	12	—	—	Vdc
Leakage Current at Reverse Voltage (V_R = 10 Vdc, T_A = 25°C)	I_R	—	—	0.10	μAdc
Series Inductance (f = 250 MHz, Lead Length ≈ 1/16″)	L_S	—	5.0	—	nH
Case Capacitance (f = 1.0 MHz, Lead Length ≈ 1/16″)	C_C	—	0.25	—	pF

	C_T, Diode Capacitance						Q, Figure of Merit	TR, Tuning Ratio	
	V_R = 1.0 Vdc, f = 1.0 MHz pF			V_R = 2.0 Vdc, f = 1.0 MHz pF			V_R = 2.0 Vdc, f = 1.0 MHz	C_1/C_{10} f = 1.0 MHz	C_2/C_{10} f = 1.0 MHz
Device	Min	Nom	Max	Min	Nom	Max	Min	Min	Min
MV1401, H	468	550	633	—	—	—	200	14	—
MV1403, H	—	—	—	140	175	210	200	—	10
MV1404, H	—	—	—	96	120	144	200	—	10
MV1405, H	—	—	—	200	250	300	200	—	10

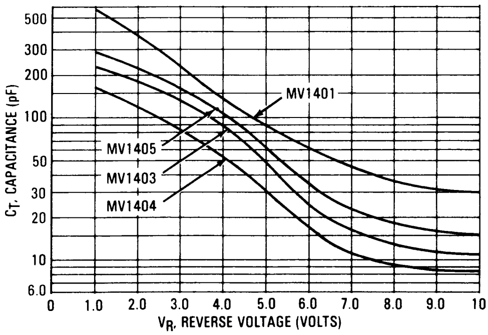
PARAMETER TEST METHODS

1. **L_S, SERIES INDUCTANCE**
   L_S is measured on a shorted package at 250 MHz using an impedance bridge (Boonton Radio Model 250A RX Meter).
2. **C_C, CASE CAPACITANCE**
   C_C is measured on an open package at 1.0 MHz using a capacitance bridge (Boonton Electronics Model 75A or equivalent).
3. **C_T, DIODE CAPACITANCE**
   ($C_T = C_C + C_J$) C_T is measured at 1.0 MHz using a capacitance bridge (Boonton Electronics Model 75A or equivalent).
4. **TR, TUNING RATIO**
   TR is the ratio of C_T measured at 2.0 Vdc (1.0 Vdc for MV1401) divided by C_T measured at 10 Vdc.
5. **Q, FIGURE OF MERIT**
   Q is calculated by taking the G and C readings of an admittance bridge at the specified frequency and substituting in the following equation:

$$Q = \frac{2\pi fC}{G}$$

(Boonton Electronics Model 33AS8). Use Lead Length ≈ 1/16″.

FIGURE 1 — DIODE CAPACITANCE versus REVERSE VOLTAGE



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MOTOROLA SEMICONDUCTOR TECHNICAL DATA

MVAM108 MVAM109 MVAM115 MVAM125

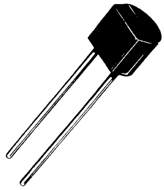
VVC

SILICON TUNING DIODE

. . . designed for electronic tuning of AM receivers and high capacitance, high tuning ratio applications.

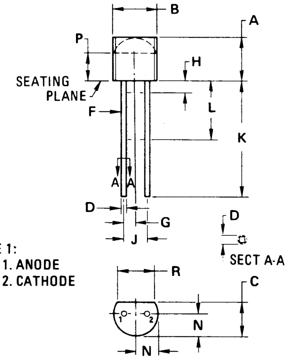
- High Capacitance Ratio — C_R = 15 (Min), MVAM 108, 115, 125
- Guaranteed Diode Capacitance — C_t = 440 pF (Min) — 560 pF (Max) @ V_R = 1.0 Vdc, f = 1.0 MHz, MVAM108, MVAM115, MVAM125
- Guaranteed Figure of Merit — Q = 150 (Min) @ V_R = 1.0 Vdc, f = 1.0 MHz.

TUNING DIODES WITH VERY HIGH CAPACITANCE RATIO



MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Reverse Voltage	V_R		Volts
MVAM108		12	
MVAM109		15	
MVAM115		18	
MVAM125		28	
Forward Current	I_F	50	mA
Power Dissipation @ T_A = 25°C Derate Above 25°C	P_D	280 2.8	mW mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +125	°C



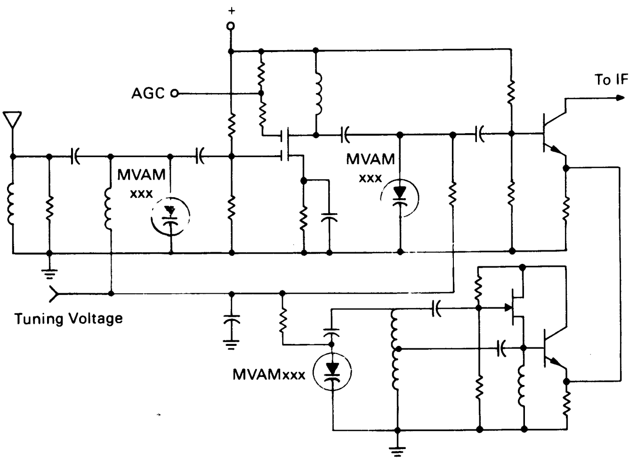
STYLE 1:
PIN 1. ANODE
2. CATHODE

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	4.32	5.33	0.170	0.210
B	4.45	5.21	0.175	0.205
C	3.18	4.19	0.125	0.165
D	0.356	0.533	0.014	0.021
F	0.407	0.482	0.016	0.019
G	1.27 BSC		0.050 BSC	
H	–	1.27	–	0.050
J	2.54 BSC		0.100 BSC	
K	12.70	–	0.500	–
L	6.35	–	0.250	–
N	2.03	2.66	0.080	0.105
P	2.93	–	0.115	–
R	3.43	–	0.135	–

All JEDEC dimensions and notes apply

CASE 182-02

FIGURE 1 — TYPICAL AM RADIO APPLICATION



ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted, Each Device)

Characteristic — All Types		Symbol	Min	Typ	Max	Unit
Breakdown Voltage (I_R = 10 μAdc)	MVAM108	$V_{(BR)R}$	12	—	—	Vdc
	MVAM109		15	—	—	
	MVAM115		18	—	—	
	MVAM125		28	—	—	
Reverse Current (V_R = 8.0 V)	MVAM108	I_R	—	—	100	nAdc
(V_R = 9.0 V)	MVAM109		—	—	100	
(V_R = 15 V)	MVAM115		—	—	100	
(V_R = 25 V)	MVAM125		—	—	100	
Diode Capacitance Temperature Coefficient (1) (V_R = 1.0 Vdc, f = 1.0 MHz, T_A = -40°C to +85°)		TC_C	—	435	—	ppm/°C
Case Capacitance (f = 1.0 MHz, Lead Length 1/16″)		C_C	—	0.18	—	pF
Diode Capacitance (2) (V_R = 1.0 Vdc, f = 1.0 MHz)	MVAM108, 115, 125	C_t	440	500	560	pF
	MVAM109		400	460	520	
Figure of Merit (f = 1.0 MHz, Lead Length 1/16″)		Q	150	—	—	—
Capacitance Ratio (f = 1.0 MHz)	MVAM108	C1/C8	15	—	—	—
	MVAM109	C1/C9	12	—	—	
	MVAM115	C1/C15	15	—	—	
	MVAM125	C1/C25	15	—	—	

Notes:

(1) The effect of increasing temperature 1.0°C, at any operating point, is equivalent to lowering the effective tuning voltage 1.25 mV. The percent change of capacitance per °C is nearly constant from -40°C to +100°C.

(2) Upon request, diodes are available in matched sets. All diodes in a set can be matched for capacitance to 3% or 2.0 pF (whichever is greater) at all points along the specified tuning range.

FIGURE 2 — CAPACITANCE versus REVERSE VOLTAGE

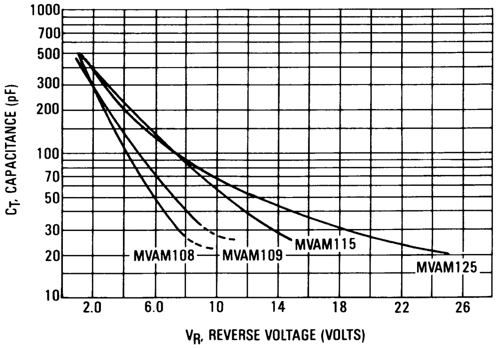
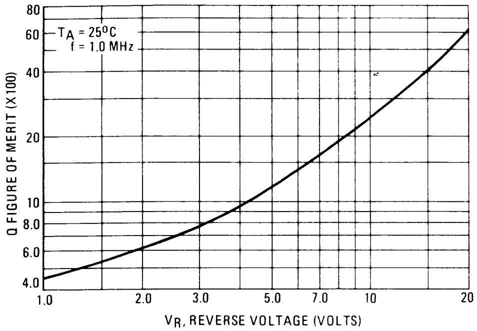


FIGURE 3 — FIGURE OF MERIT



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