

# M52318SP/M52323SP

PLL-SPLIT VIF/SIF

## DESCRIPTION

The M52318SP and M52323SP are IF signal-processing ICs for VCRs and color TVs. They enable the PLL detection system despite size as small as that of conventional quasi-synchronous VIF/SIF ICs.

The circuit includes VIF amplifier, video detector, VCO, APC detector, AFT, SIF detector, IF/RF AGC, SIF limiter, FM detector, QIF AGC, and EQ AMP.

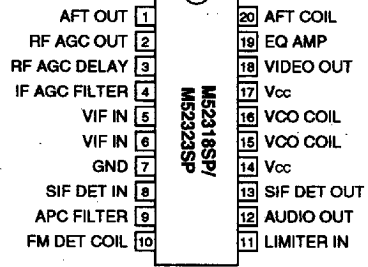
## FEATURES

- Video detection output is 2 V<sub>P-P</sub>. It has built-in EQ AMP.
- The package is a 20-pin shrink-DIP, suitable for space saving.
- The video detector uses PLL for full synchronous detection circuit. It produces excellent characteristics of DG, DP, 920-kHz beat, and cross color.
- Dynamic AGC realizes high speed response with only single filter.
- Video IF and sound IF signal processings are separated from each other. VCO output is used to obtain intercarrier. This PLL-SPLIT method and built-in QIF AGC provide good sound sensitivity and reduces buzz.

## APPLICATION

TV sets, VCR tuners

## PIN CONFIGURATION (TOP VIEW)



Outline 20P4B

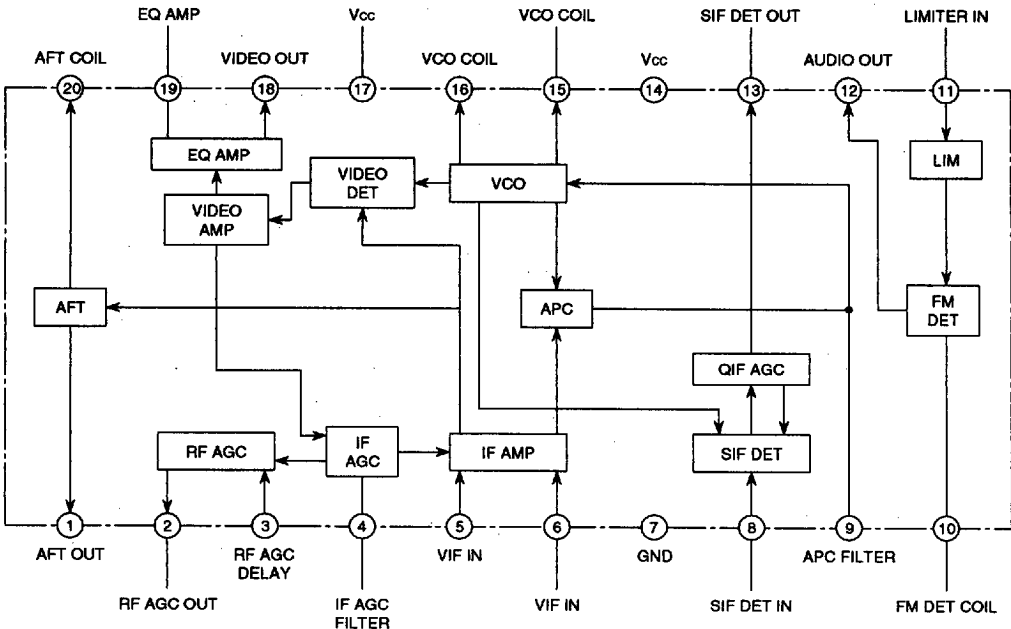
## RECOMMENDED OPERATING CONDITION

Recommended supply voltage(pins ⑭, ⑰).....9V (12V)

Supply voltage range(pins ⑭, ⑰).....8 ~ 10V (11 ~ 13V)

( ) For M52323SP

## BLOCK DIAGRAM



## M52318SP/M52323SP

PLL-SPLIT VIF/SIF

## ABSOLUTE MAXIMUM RATINGS

(Ta=25°C, For electrostatic discharge, capacitance is 200pF, and resistance is 0Ω, unless otherwise noted.)

| Symbol           | Parameter               | Test conditions | Ratings  | Unit |
|------------------|-------------------------|-----------------|----------|------|
| V <sub>cc</sub>  | Supply voltage          | Pins ⑭, ⑰       | 14       | V    |
| P <sub>d</sub>   | Power dissipation       |                 | 1000     | mW   |
| T <sub>opr</sub> | Operating temperature   |                 | -20~+75  | °C   |
| T <sub>stg</sub> | Storage temperature     |                 | -40~+125 | °C   |
| Surge            | Electrostatic discharge |                 | ±200     | V    |

ELECTRICAL CHARACTERISTICS (Ta=25°C, V<sub>cc</sub> = 9(12)V unless otherwise noted.)

| Symbol          | Parameter  | Test circuit | Test point  | Input pin | Input SG | Test conditions       |          |                                  | Limits        |               |               | Unit             |
|-----------------|--|--------------|-------------|-----------|----------|-----------------------|----------|----------------------------------|---------------|---------------|---------------|------------------|
|                 |  |              |             |           |          | External Power Supply |          | *Switch is usually set to 1.     | Min.          | Typ.          | Max.          |                  |
|                 |  |              |             |           |          | V3                    | V4       |                                  |               |               |               |                  |
| I <sub>cc</sub> | Circuit current                                  | 1            | A1          | —         | —        | 2                     | —        | V <sub>cc</sub> =9(12)V<br>SW1=2 | 34            | 47            | 60            | mA               |
| V18             | Video detection output DC voltage                | 1            | TP18        | —         | —        | 2                     | 0        | SW4=2                            | 6.1<br>(8.9)  | 6.7<br>(9.8)  | 7.3<br>(10.7) | V                |
| V18det          | Video detection output amplitude                 | 1            | TP18        | IN1       | SG1      | 2                     | —        |                                  | 1.98          | 2.2           | 2.42          | V <sub>P-P</sub> |
| S/N             | Video S/N  | 1            | TP18<br>LPF | IN1       | SG2      | 2                     | —        | SW18=2                           | 52            | 57            | —             | dB               |
| BW              | Video detection output frequency characteristics | 1            | TP18        | IN1       | SG3      | 2                     | Variable | SW4=1→2                          | 7.0           | 9.2           | —             | MHz              |
| VIN (Min.)      | Input sensitivity                                | 1            | TP18        | IN1       | SG4      | 2                     | —        |                                  | —             | 44            | 49            | dB μ             |
| VIN (Max.)      | Maximum allowable input                          | 1            | TP18        | IN1       | SG5      | 2                     | —        |                                  | 101           | 105           | —             | dB μ             |
| GF              | AGC control range                                | 1            | —           | —         | —        | —                     | —        |                                  | 54            | 61            | —             | dB               |
| V4H             | IF AGC maximum voltage                           | 1            | TP4         | —         | —        | 2                     | —        |                                  | 4.8           | 5.6           | —             | V                |
| V4 (80)         | IF AGC voltage (80dB μ)                          | 1            | TP4         | IN1       | SG6      | 2                     | —        |                                  | 2.6           | 3.0           | 3.4           | V                |
| V4L             | IF AGC minimum voltage                           | 1            | TP4         | IN1       | SG7      | 2                     | —        |                                  | 1.8           | 2.2           | 2.6           | V                |
| V2H             | RF AGC maximum voltage                           | 1            | TP2         | IN1       | SG2      | 0                     | —        |                                  | 7.8<br>(10.8) | 8.7<br>(11.7) | —             | V                |
| V2L             | RF AGC minimum voltage                           | 1            | TP2         | IN1       | SG2      | 3                     | —        |                                  | —             | 0.05          | 0.5           | V                |
| CL-U            | Capture range U                                  | 1            | TP18        | IN1       | SG8      | 2                     | —        |                                  | 0.6           | 1.1<br>(1.0)  | —             | MHz              |
| CL-L            | Capture range L                                  | 1            | TP18        | IN1       | SG8      | 2                     | —        |                                  | 1.3<br>(1.2)  | 1.9<br>(1.7)  | —             | MHz              |
| CL-T            | Capture range T                                  | 1            | —           | —         | —        | —                     | —        |                                  | 2.2<br>(2.0)  | 3.0<br>(2.7)  | —             | MHz              |
| V1              | AFT output voltage                               | 1            | TP1         | —         | —        | 2                     | 0        | SW4=2                            | 3.0<br>(4.0)  | 4.1<br>(5.4)  | 5.2<br>(6.8)  | V                |
| μ               | AFT detection sensitivity                        | 1            | TP1         | IN1       | SG9      | 2                     | —        |                                  | 48            | 70            | —             | mV/dB            |
| V1H             | AFT maximum voltage                              | 1            | TP1         | IN1       | SG10     | 2                     | —        |                                  | 8.0<br>(11.0) | 8.7<br>(11.7) | —             | V                |
| V1L             | AFT minimum voltage                              | 1            | TP1         | IN1       | SG10     | 2                     | —        |                                  | —             | 0.2           | 1.0           | V                |
| V1 defeat       | AFT defeat voltage                               | 1            | TP1         |           |          | 2                     | —        | SW20=2                           | 4.05<br>(5.4) | 4.5<br>(6.0)  | 4.95<br>(6.6) | V                |
| IM              | Intermodulation                                  | 1            | TP18        | IN1       | SG11     | 2                     | Variable | SW4=2                            | 30            | 35            | —             | dB               |
| DG              | DG   | 1            | TP18        | IN1       | SG12     | 2                     | —        |                                  | —             | 2             | 5             | %                |
| DP              | DP   | 1            | TP18        | IN1       | SG12     | 2                     | —        |                                  | —             | 2             | 5             | deg              |
| V18 - SYNC      | Sync tip level                                   | 1            | TP18        | IN1       | SG2      | 2                     | —        |                                  | 3.3<br>(6.1)  | 4.0<br>(7.3)  | 4.7<br>(8.5)  | V                |

( ) For M52323SP

ELECTRICAL CHARACTERISTICS (cont.)

| Symbol    | Parameter  | Test circuit | Test point | Input pin  | Input SG    | Test conditions       |    | Limits                       |          |          | Unit     |             |
|-----------|--|--------------|------------|------------|-------------|-----------------------|----|------------------------------|----------|----------|----------|-------------|
|           |  |              |            |            |             | External Power Supply |    | *Switch is usually set to 1. | Min.     | Typ.     |          | Max.        |
|           |  |              |            |            |             | V3                    | V4 |                              |          |          |          |             |
| RINV      | VIF input resistance                                   | 2            | ⓄPIN       |            |             |                       |    | —                            | 0.9      | —        | kΩ       |             |
| CINV      | VIF input capacitance                                  | 2            | ⓄPIN       |            |             |                       |    | —                            | 5.6      | —        | pF       |             |
| RINS      | SIF input resistance                                   | 2            | ⓄPIN       |            |             |                       |    | —                            | 1.1      | —        | kΩ       |             |
| CINS      | SIF input capacitance                                  | 2            | ⓄPIN       |            |             |                       |    | —                            | 5.4      | —        | pF       |             |
| V13-80    | SIF detector output<br>4.5 MHz amplitude<br>(80 dB μ)  | 1            | TP13       | IN1<br>IN2 | SG2<br>SG13 | 2                     | —  |                              | 94       | 99       | 104      | dB μ        |
| V13-100   | SIF detector output<br>4.5 MHz amplitude<br>(100 dB μ) | 1            | TP13       | IN1<br>IN2 | SG2<br>SG14 | 2                     | —  |                              | 94       | 99       | 104      | dB μ        |
| V12       | AF output DC voltage                                   | 1            | TP12       | —          | —           | 2                     | —  |                              | 4.1(5.3) | 4.7(6.1) | 5.3(6.9) | V           |
| V12 MUTE  | AF mute voltage  | 1            | TP12       | —          | —           | 2                     | —  | SW10=2                       | 3.9(5.5) | 4.4(6.0) | 4.9(6.5) | V           |
| V12 MAX   | AF output maximum amplitude                            | 1            | TP12       | IN3        | SG15        | 2                     | —  |                              | 200      | 270      | 340      | mV<br>r.m.s |
| THD AF    | AF output distortion                                   | 1            | TP12       | IN3        | SG15        | 2                     | —  |                              | —        | 0.4      | 1.2      | %           |
| LIN (Min) | Input limiting sensitivity                             | 1            | TP12       | IN3        | SG16        | 2                     | —  |                              | —        | 49       | 55       | dB μ        |
| AMR       | AMR  | 1            | TP12       | IN3        | SG17        | 2                     | —  |                              | 44       | 53       | —        | dB          |
| S/N       | AF S/N   | 2            | TP12       | IN3        | SG18        | 2                     | —  |                              | 60       | 70       | —        | dB          |

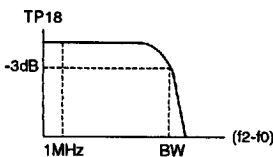
ELECTRICAL CHARACTERISTICS TEST METHODS  
S/N

Input signals of SG2 to VIF input (IN1) pin. Measure TP18-LPF noise in root-mean-square, from video detection output (Pin Ⓞ) through a low-pass filter of 5 MHz (-3dB).

$$S/N = 20 \log \left( \frac{0.7 \times V_{18 \text{ det}}}{\text{NOISE}} \right) \text{ dB}$$

BW

- Input signals of SG3 to VIF input (IN1) pin (set f2 to 57.75 MHz). Using a spectrum analyzer, measure 1 MHz component level at video detection output (TP18). At the same time, measure voltage at TP4. Set SW4 to 2. Adjust and fix V4 to the TP4 voltage.
- Decrease f2. Measure f2-f0 difference when f2-f0 component level is -3dB with reference to the 1 MHz component level.



VIN (Min.)

Input SG4 (Vi = 90 dB μ) to VIF input (IN1) pin. Gradually reduce Vi. When 20kHz component of video detection output (TP18) falls to -3 dB with reference to the V18 det, measure the input level.

VIN (Max.)

- Input SG5 (Vi = 90 dB μ) to VIF input (IN1) pin. Measure 20 kHz component level of video detection output.
- Gradually increase Vi. When the output falls to -3 dB, measure the input level.

GR

$$GR = VIN(\text{Max.}) - VIN(\text{Min.}) \text{ (dB)}$$

CL-U

- Increase SG8 frequency to let VCO unlocked.
- Gradually reduce SG8 frequency. When VCO is locked, measure the frequency as fU.

$$CL-U = fU - 58.75(\text{MHz})$$



**CL-L**

1. Reduce SG8 frequency to let VCO unlocked.
2. Gradually increase SG8 frequency. When VCO is locked, measure the frequency as  $f_L$ .

$$CL-L = 58.75 - f_L \text{ (MHz)}$$

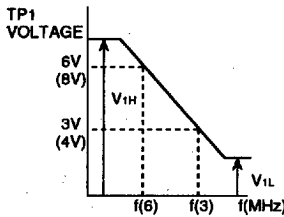
**CL-T**

$$CL-T = CL-U + CL-L \text{ (MHz)}$$

$\mu$ ,  $V_{1H}$ ,  $V_{1L}$

1. Adjust AFT coil to 58.75 MHz. ( See the section "Adjusting Coils.")
2. Input SG9 to VIF input (IN1) pin. Set SG9 frequency so that AFT output (TP1) voltage can be 6 V (8V).  $f(6)$  is this frequency.
3. Set SG9 frequency so that AFT output (TP1) voltage can be 3 V (4 V).  $f(3)$  is this frequency.

$$\mu = \frac{(4000)}{f(3) - f(6)} \frac{3000 \text{ (mV)}}{\text{(kHz)}} \text{ (mV / kHz)}$$



4. In the figure on this page,  $V_{1H}$  is the maximum DC voltage, and  $V_{1L}$  is the minimum DC voltage.

**ADJUSTING COILS**

**a. VCO coil**

Make VIF input (IN1) zero. Connect AGC filter (TP4) to GND. Measure APC filter voltage (VDCAPC). After that, input 58.75 MHz CW of 90 dB  $\mu$  to VIF input (IN1) pin. Adjust APC filter voltage to VDCAPC.

**b. AFT coil**

Input  $f = 58.75$  MHz CW of 90dB  $\mu$  to VIF input (IN1) pin. Adjust the coil so that AFT output (TP1) voltage can be about  $V_{cc}/2 = 4.5$  V (6.0 V).

**c. FM DET coil**

1. Connect FM DET coil pin (TP10) through 10k  $\Omega$  resistor to GND. Measure audio output (TP12) voltage.
2. Input  $f = 4.5$  MHz CW of 90 dB  $\mu$  to limiter input (IN3) pin. Adjust the coil to produce the previous audio output (TP12).

**IM**

1. Input SG11 to VIF input (IN1) pin. Observe video detection output (TP18) on the oscilloscope.
2. Adjust AGC filter voltage ( $V_4$ ) so that the minimum DC level of the output waveform can be 4 V (7.2 V).
3. Observe TP18 on the spectrum analyzer. Intermodulation is the ratio of 920 kHz component level to 3.58 MHz component level.

**LIM (Min.)**

1. Input SG16 ( $V_I = 90$  dB  $\mu$ ) to limiter input (IN3) pin. Measure 1 kHz component level at audio output (TP12).
2. Gradually decrease SG16 input level  $V_I$ . When 1 kHz component level at audio output falls to -3 dB with reference to the previous level, measure the SG16 level.

**AMR**

1. Input SG17 to limiter input (IN3) pin. Measure audio output (TP12) level. VAM is this level.

$$2. \text{ AMR} = 20 \log \left( \frac{V_{12} \text{ Max. (mV r.m.s)}}{VAM \text{ (mV r.m.s)}} \right) \text{ (dB)}$$

**S/N**

1. Input SG18 to limiter input (IN3) pin. Measure audio output (TP12) level. VN is this level.

$$2. \text{ S/N} = 20 \log \left( \frac{V_{12} \text{ Max. (mV r.m.s)}}{VN \text{ (mV r.m.s)}} \right) \text{ (dB)}$$

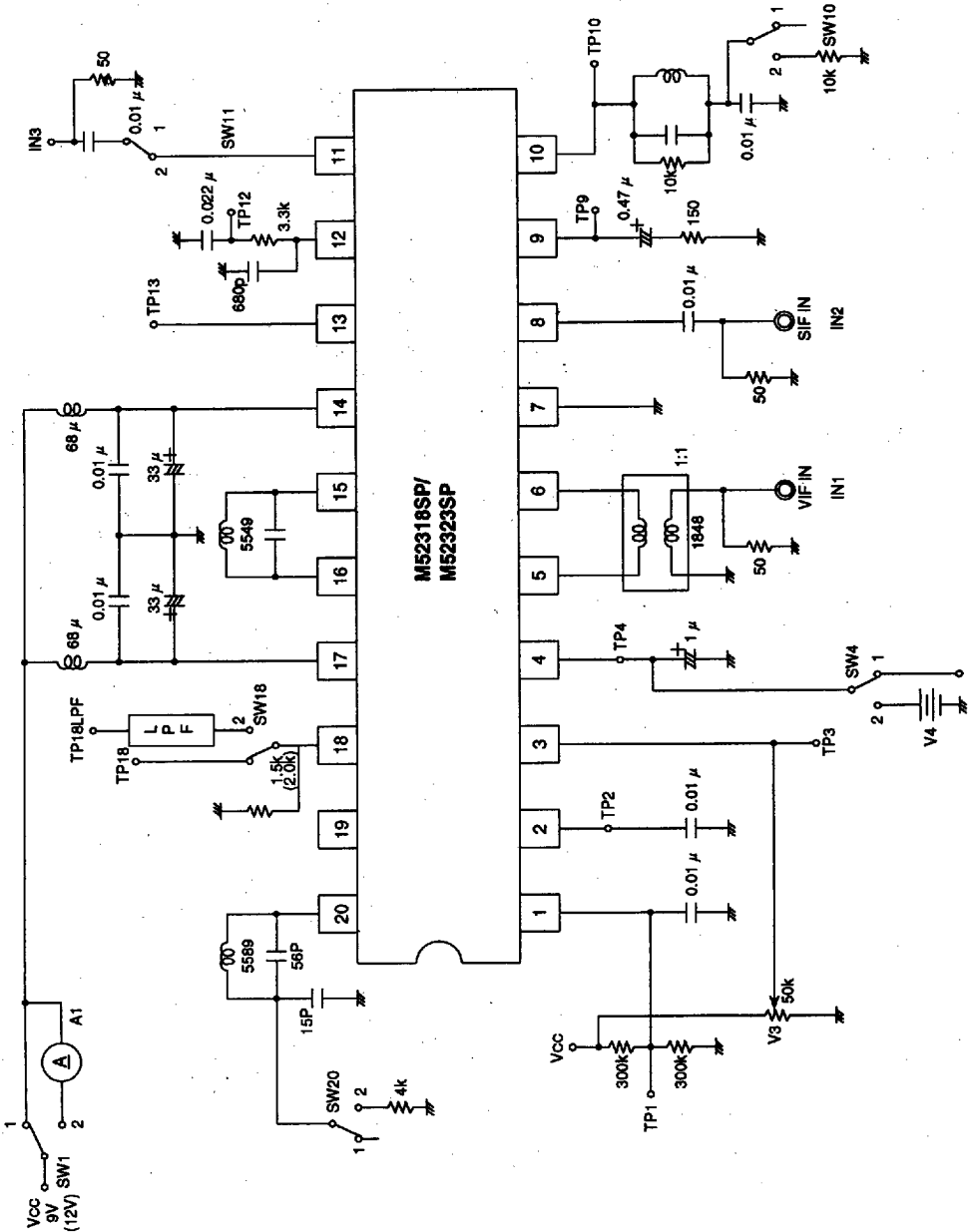
INPUT SIGNALS

| SG No. | fo(MHz)   | AM Modulation %       | FM Modulation (kHz)dev | Modulation Frequency (kHz) | V <sub>i</sub> (dB μ) | Remark                           |
|--------|-----------|-----------------------|------------------------|----------------------------|-----------------------|----------------------------------|
| ①      | 58.75     | 77.78                 | —                      | 20                         | 90                    |                                  |
| ②      | 58.75     | —                     | —                      | —                          | 90                    |                                  |
| ③      | 58.75     | —                     | —                      | —                          | 90                    | MIXED SIGNAL                     |
|        | Variable  | —                     | —                      | —                          | 70                    |                                  |
| ④      | 58.75     | 77.78                 | —                      | 20                         | Variable              |                                  |
| ⑤      | 58.75     | 16                    | —                      | 20                         | Variable              |                                  |
| ⑥      | 58.75     | —                     | —                      | —                          | 80                    |                                  |
| ⑦      | 58.75     | —                     | —                      | —                          | 120                   |                                  |
| ⑧      | Variable  | 77.78                 | —                      | 20                         | 90                    |                                  |
| ⑨      | 58.75±0.1 | —                     | —                      | —                          | 90                    |                                  |
| ⑩      | 58.75±5   | —                     | —                      | —                          | 90                    |                                  |
| ⑪      | 58.75     | —                     | —                      | —                          | 90                    | MIXED SIGNAL                     |
|        | 55.17     | —                     | —                      | —                          | 80                    |                                  |
|        | 54.25     | —                     | —                      | —                          | 80                    |                                  |
| ⑫      | 58.75     | 87.5 Video modulation | —                      | —                          | 90 Sync tip level     | Ten-stage modulation as standard |
| ⑬      | 54.25     | —                     | —                      | —                          | 80                    |                                  |
| ⑭      | 54.25     | —                     | —                      | —                          | 100                   |                                  |
| ⑮      | 4.5       | —                     | ±25                    | 1.0                        | 90                    |                                  |
| ⑯      | 4.5       | —                     | ±25                    | 1.0                        | Variable              |                                  |
| ⑰      | 4.5       | 30                    | —                      | 1.0                        | 90                    |                                  |
| ⑱      | 4.5       | —                     | —                      | —                          | 90                    |                                  |

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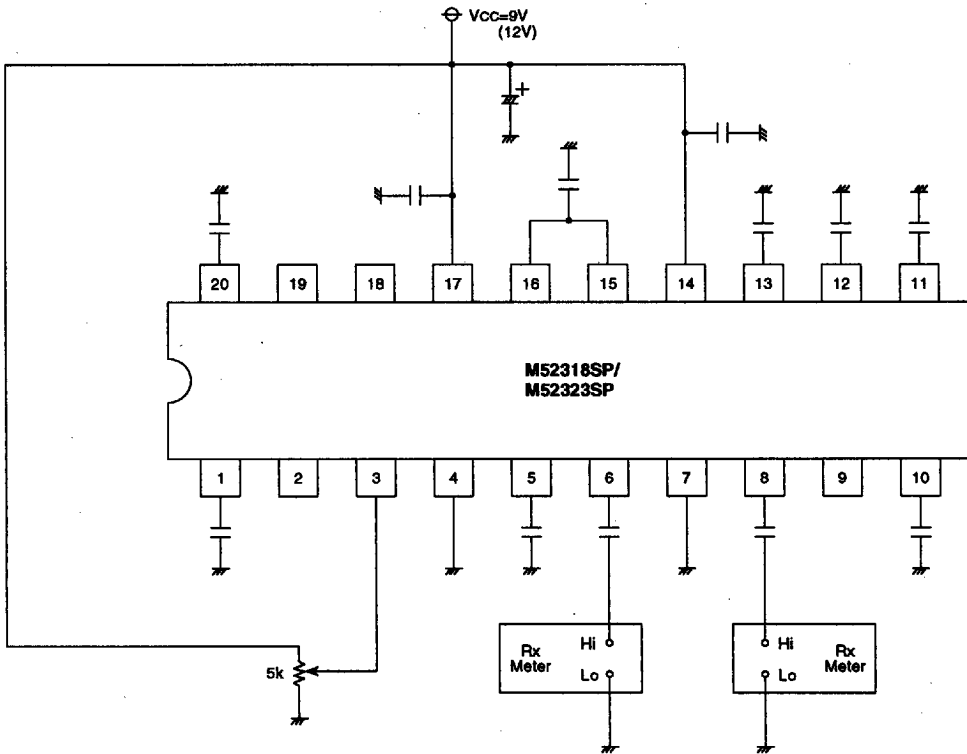
PLL-SPLIT VIF/SIF

## TEST CIRCUIT 1



Units Resistance: Ω  
 Capacitance: F  
 Reactance: H

TEST CIRCUIT 2



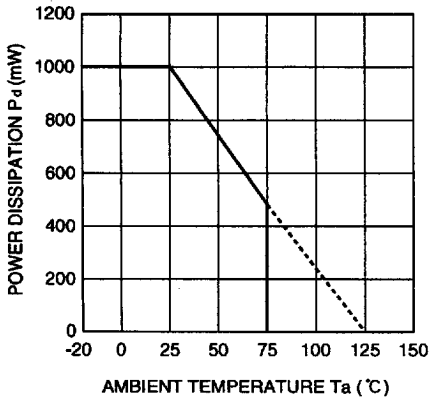
Capacitors of 0.01  $\mu$  Fare used unless noted otherwise.

Units Resistance:  $\Omega$

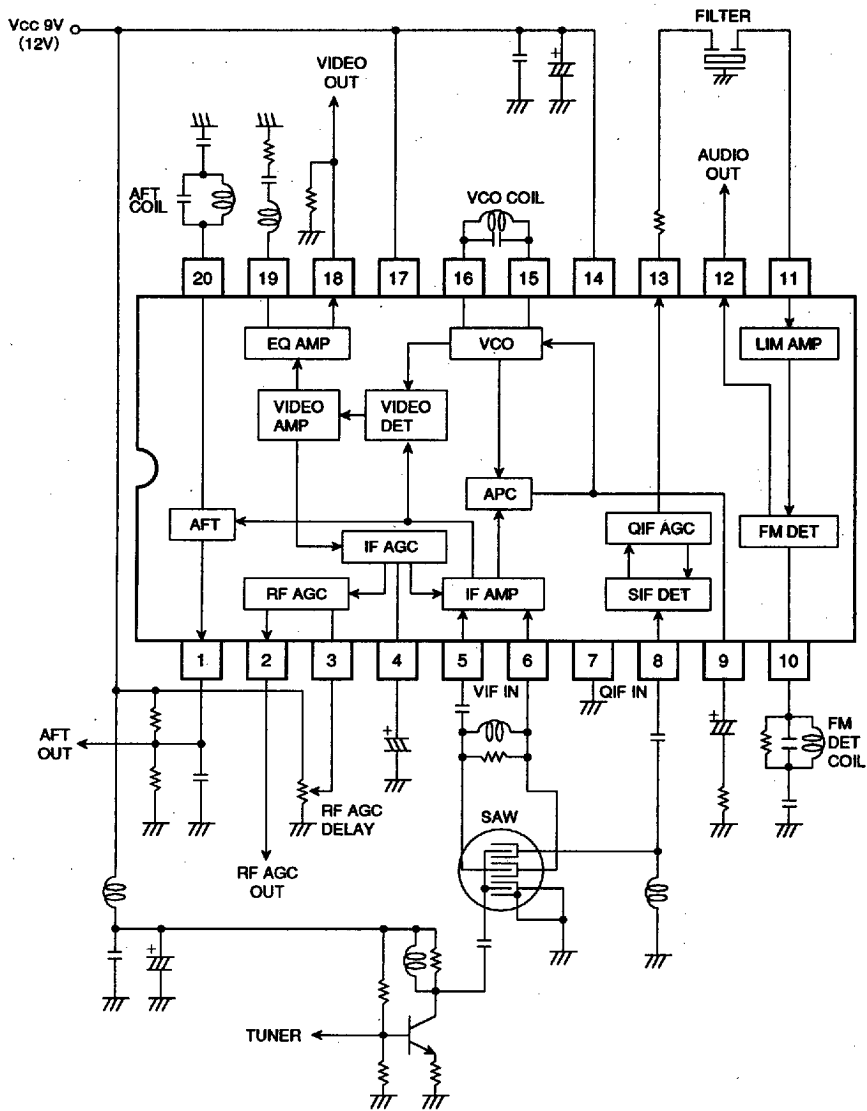
Capacitance: F

TYPICAL CHARACTERISTICS

THERMAL DERATING (MAXIMUM RATING)



APPLICATION EXAMPLE





DESCRIPTION OF PIN (cont.)

| Pin No. | Name          | Voltage and wave information | Peripheral circuit of pins   | Description of function   |
|---------|---------------|------------------------------|--|---|
| ①       | AFT OUT       | 4.5V<br>(6.0V)               | <p>The maximum outflow current is 0.5 mA.</p> <p>The maximum inflow current is 0.5 mA.</p> | <p>AFT output has high impedance. External resistors can be used to determine detection sensitivity.</p>        |
| ②       | RF AGC OUT    | —                            | <p>The maximum outflow current is 0.8 mA.</p> <p>The maximum inflow current is 0.8 mA.</p> |   |
| ③       | RF AGC DELAY  | —                            |  | <p>Voltage can be applied to this pin to change AGC delay point.</p>  |
| ④       | IF AGC FILTER | —                            |  | <p>Dynamic AGC circuit enables ①-pin filter to produce characteristics equivalent to those of ②-pin filter.</p> |



DESCRIPTION OF PIN (cont.)

| Pin No. | Name        | Voltage and wave information | Peripheral circuit of pins | Description of function   |
|---------|-------------|------------------------------|----------------------------|---|
| ⑤<br>⑥  | VIF IN      | —                            |                            | Design the circuit to enable impedance matching with SAW filter.  |
| ⑦       | GND         | 0V                           | —                          | Pin ⑦ is the only GND pin of this IC.   |
| ⑧       | SIT DET IN  | —                            |                            | Input impedance is 1.5 kΩ.  |
| ⑨       | APC FILTER  | —                            |                            | <p>Pin-⑨ output</p> <p>In the locked state, usually adjust frequency response with external resistors so that cut-off frequency can be in the range of 30 ~ 100 kHz.</p>  |
| ⑩       | FM DET COIL | —                            |                            | FM detector performs quadrature detection. Connect pin ⑩ to GND through a DC-cutting capacitor connected in series with tank coil. Instead of coil, ceramic discriminator can be used. Connecting this pin to GND makes sound mute. |



DESCRIPTION OF PIN (cont.)

| Pin No. | Name        | Voltage and wave information | Peripheral circuit of pins | Description of function   |
|---------|-------------|------------------------------|----------------------------|---|
| ⑪       | LIMITER IN  | —                            |                            | Input impedance is 1.5 kΩ.  |
| ⑫       | AUDIO OUT   | —                            |                            | This is audio output pin. This output has a series resistor of 500 Ω.   |
| ⑬       | SIT DET OUT | —                            |                            | Emitter follower produces this output.  |
| ⑭       | Vcc         | 9V(12V)                      | —                          | —   |
| ⑮<br>⑯  | VCO COIL    | —                            |                            | Connecting a coil and a capacitor with these pins enables oscillation. This oscillator must be used with oscillation frequency adjusted to fo. Since oscillation evolves to high level, it might interfere other pins, and cause malfunctions of VCO in the pull-in process. For these pins, lay out the external printed-circuit pattern compact enough to prevent interference. |
| ⑰       | Vcc         | 9V(12V)                      | —                          | —   |

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PLL-SPLIT VIF/SIF

DESCRIPTION OF PIN (cont.)

| Pin No. | Name      | Voltage and wave information | Peripheral circuit of pins | Description of function   |
|---------|-----------|------------------------------|----------------------------|---|
| 18      | EQ OUT    | —                            |                            | Output voltage swings positive. Video modulation of 87.5 % produces output of 2.2 V <sub>P-P</sub> .  |
| 19      | VIDEO OUT | —                            |                            | External circuit can be connected with this pin to determine frequency characteristics of EQ output. Connecting pin 19 through a resistor to pin 18 can reduce EQ output amplitude. |
| 20      | AFT COIL  | —                            |                            | Connecting this pin to GND enables mute function to make AFT mute.  |



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