



SANYO Semiconductors

DATA SHEET

LA1828 — Monolithic Linear IC For Portable Radio/Cassette Recorders with Manual Tuning Single-Chip Tuner IC

Overview

The LA1828 is a single-chip tuner IC for FM and AM with built-in MPX-VCO which requires no adjustment and no external parts.

Features

- Single-chip tuner with AM, FM-FE/FM-IF, MPX circuitry
- Built-in adjustment-free MPX-VCO (noceramic oscillator required)
- Reduced FM-FE oscillation level
- FM stereo indication and AM/FM tuning indication outputs can directly drive LEDs

Functions

- AM : RF amplifier, mixer, oscillator, IF amplifier, detector, AGC, tuning display output
- FM-FE : RF amplifier, mixer, oscillator
- FM-IF : IF amplifier, quadrature detector, signal strength meter, tuning display output
- MPX : PLL stereo decoder, stereo display output, forced mono, internal VCO

Specifications

Maximum Ratings at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|-----------------------------|---------------------|------------|-------------|------|
| Maximum supply voltage | V _{CC} max | | 7.0 | V |
| Indicator drive current | I _{LED} | pins 8, 9 | 20 | mA |
| Allowable power dissipation | P _d max | Ta ≤ 70°C | 300 | mW |
| Operating temperature | T _{opr} | | -20 to +70 | °C |
| Storage temperature | T _{stg} | | -40 to +125 | °C |

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LA1828

Operating Conditions at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|--------------------------------|--------------------|------------|------------|------|
| Recommended supply voltage | V _{CC} | | 4.5 | V |
| Operating supply voltage range | V _{CC op} | | 2.5 to 6.0 | V |

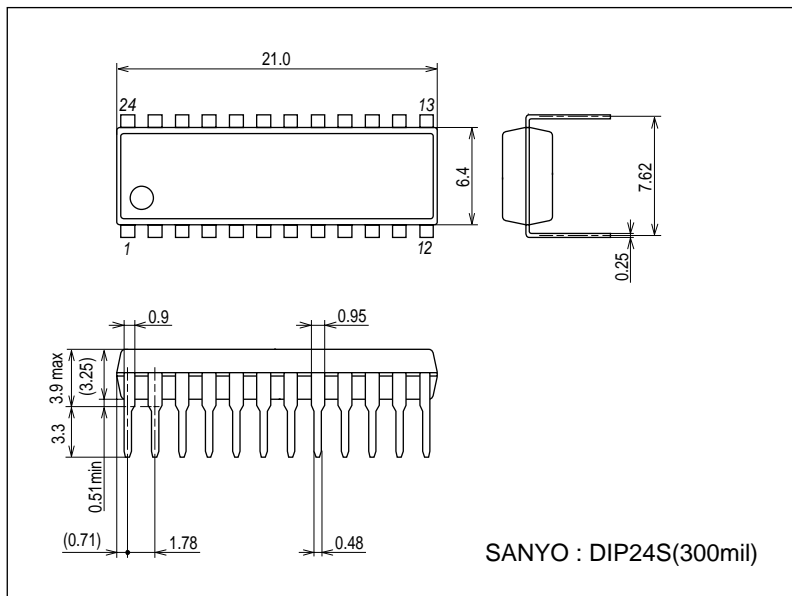
Electrical Characteristics at Ta = 25°C, V_{CC} = 4.5V, in specified test circuit, using Yamaichi Electronics socket IC-179-2

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---------------------------------------------------------------------------------------|-----------------------|--------------------------------------------------------------------------------------|---------|-----|-----|-------|
| | | | min | typ | max | |
| FM-FE characteristics fc = 98MHz, fm = 1kHz, 30% mod. | | | | | | |
| Local oscillator voltage | V _{OSC} | f _{OSC} = 108.7MHz, pin 20 output *Measured with FET buffer (-10dB gain) | 40 | 80 | 160 | mVrms |
| 3dB sensitivity | 3dB LS | 60dBμ, 30% mod. output, -3dB input | | 13 | | dBμ |
| Effective sensitivity | Qs | Input for S/N = 30dB | | 12 | | dBμ |
| FM-IF monaural characteristics fc = 10.7MHz, fm = 1kHz, 100% mod. | | | | | | |
| Quiescent current | I _{CCO} (FM) | No input | 8 | 16 | 23 | mA |
| Demodulator output | V _O | 100dBμ, pin 16 output | 130 | 190 | 260 | mVrms |
| Signal-to-noise ratio | S/N | 100dBμ, pin 16 output | 62 | 70 | | dB |
| Total harmonic distortion (mono) | THD | 100dBμ, pin 16 output | | 0.4 | 1.2 | % |
| 3dB sensitivity | 3dB LS | 100dBμ, 100% mod. output, -3dB input | 21 | 32 | 42 | dBμ |
| TU-LED sensitivity | SD-ON | | | 33 | | dBμ |
| FM-IF stereo characteristics fc = 10.7MHz, fm = 1kHz, L + R = 90%, pilot = 10% | | | | | | |
| Separation | SEP | 100dBμ, L-mod, pin 16/pin 17 output | 25 | 40 | | dB |
| ST-LED sensitivity | ST-ON | 100dBμ, pilot modulation for pin 8 voltage < 0.5V | 1.5 | 3.5 | 6.3 | % |
| Total harmonic distortion (main) | THD | 100dBμ, main modulation, pin 16 output | | 0.5 | 1.2 | % |
| AM characteristics fc = 1000kHz, fm = 1kHz, 30% mod. | | | | | | |
| Quiescent current | I _{CCO} (AM) | No input | 5 | 8.5 | 15 | mA |
| Demodulator output | V _{O1} | 23dBμ, pin 16 output | 18 | 40 | 70 | mVrms |
| | V _{O2} | 80dBμ, pin 16 output | 50 | 85 | 130 | mVrms |
| Signal-to-noise ratio | S/N1 | 23dBμ, pin 16 output | 15 | 20 | | dB |
| | S/N2 | 80dBμ, pin 16 output | 47 | 53 | | dB |
| Total harmonic distortion | THD1 | 80dBμ, pin 16 output | | 0.5 | 1.3 | % |
| | THD2 | 107dBμ, pin 16 output | | 0.5 | 1.5 | % |
| TU-LED sensitivity | SD-ON | | | 26 | | dBμ |

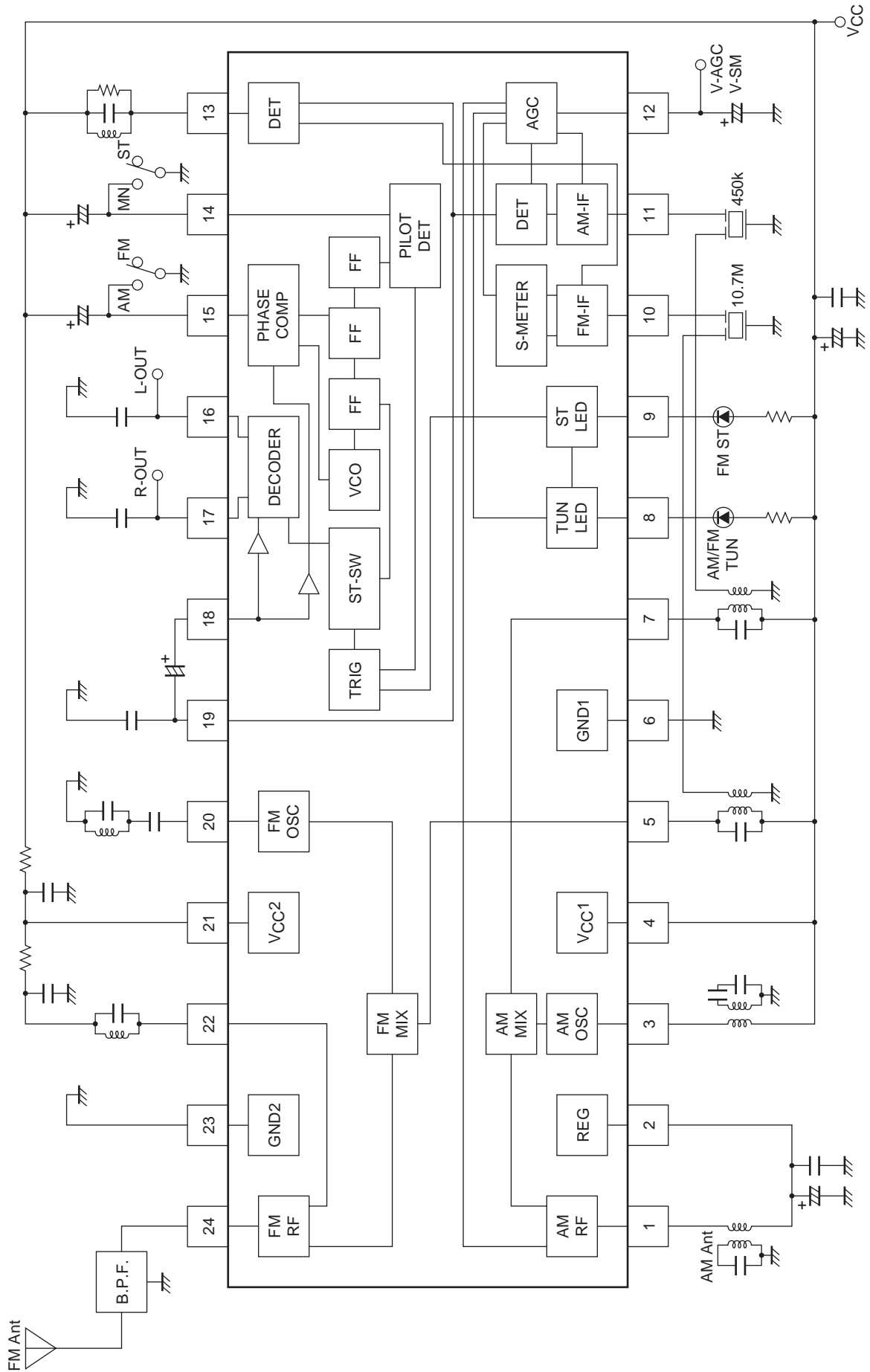
Package Dimensions

unit : mm (typ)

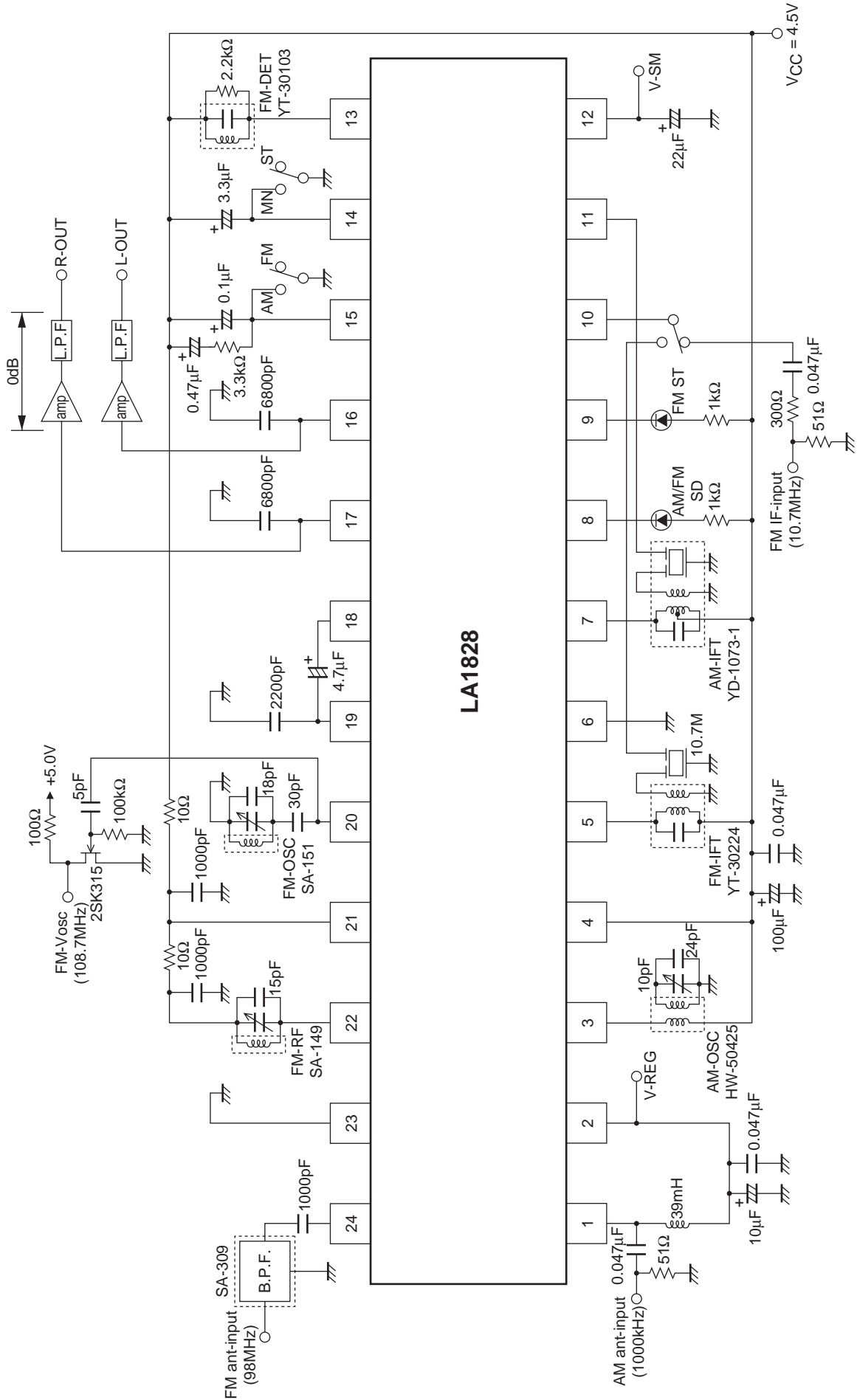
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Block Diagram

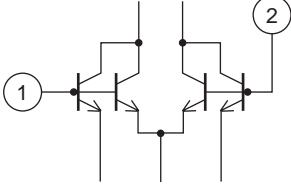
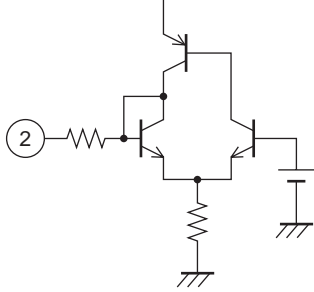
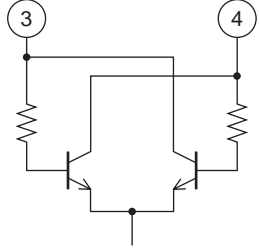
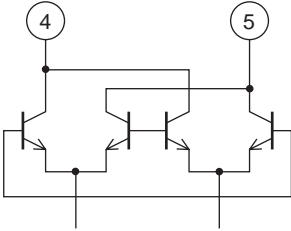
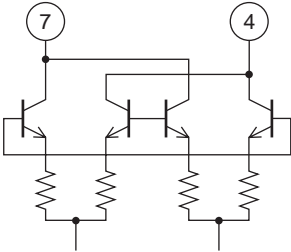
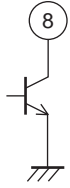


Test Circuit



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Pin Description and Quiescent Voltage at $V_{CC} = 4.5V$

| Pin No. | Pin function | Quiescent voltage (V) | | Description | Equivalent circuit |
|---------|-----------------|-----------------------|-----|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| | | AM | FM | | |
| 1 | AM RF input | 1.3 | 1.3 | AM antenna coil connected between pins 1 and 2 (reg). |  |
| 2 | Reg | 1.3 | 1.3 | $V_{reg} = 1.3V$ |  |
| 3 | AM-OSC | 4.5 | 4.5 | Oscillator coil connected between pins 3 and 4 (V_{CC1}). |  |
| 4 | V_{CC1} | 4.5 | 4.5 | AM/FM-IN/MPX block V_{CC} | |
| 5 | FM mixer output | 4.5 | 4.5 | Mixer coil connected between pins 5 and 4 (V_{CC1}). |  |
| 6 | GND1 | 0 | 0 | AM/FM-IN/MPX section ground | |
| 7 | AM mixer output | 4.5 | 4.5 | Mixer coil connected between pins 7 and 4 (V_{CC1}). |  |
| 8 | Tu-LED output | 4.5 | 4.5 | Active low Open-collector output can directly drive LED ($I_C \text{ max} = 20mA$) |  |

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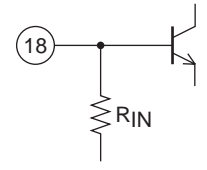
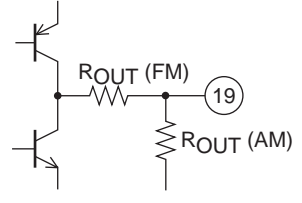
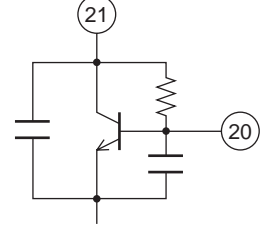
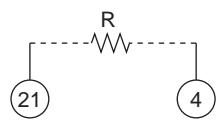
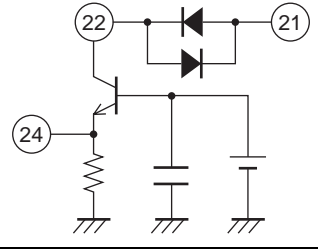
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| Pin No. | Pin function | Quiescent voltage (V) | | Description | Equivalent circuit |
|----------|------------------------------------------------------|-----------------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| | | AM | FM | | |
| 9 | ST-LED output and AM-IF output | 4.5 | 4.5 | Active low Open-collector output can directly drive LED ($I_C \text{ max} = 20\text{mA}$) In AM operation, AM-IF signal (450kHz) is output here. | |
| 10 | FM-IF input | 1.3 | 1.3 | $R_{IN} = 330\Omega$ | |
| 11 | AM-IF input | 1.3 | 1.3 | $R_{IN} = 2k\Omega$ | |
| 12 | AM-AGC output and FM S meter output | 0.7 | 0.2 | Internal load resistance $R = 16.6k\Omega$ | |
| 13 | FM detector | 4.5 | 4.5 | Detector coil connected between pins 13 and 4 (V_{CC1}). | |
| 14 | Pilot tone detector filter and forced mono switching | 2.9 | 3.8 | Mono mode is forced on by connecting pin 14 to ground. | |
| 15 | Phase comparator filter and AM/FM switching | 0 | 3.8 | FM reception mode is enabled when pin 15 is open. AM reception mode is enabled when pin 15 is connected to ground. | |
| 16 17 | L output R output | 1.4 | 1.4 | $R_{OUT} = 7.5k\Omega$ | |

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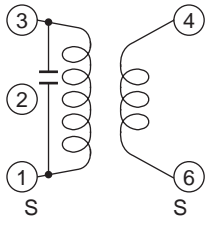
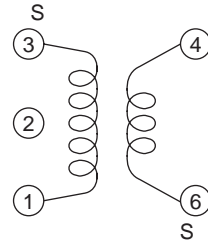
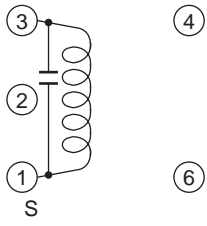
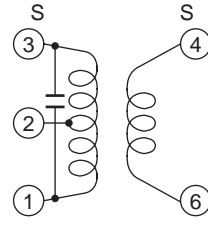
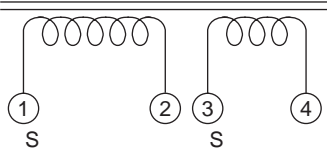
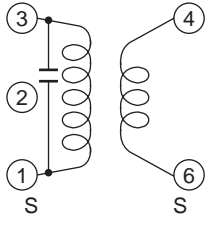
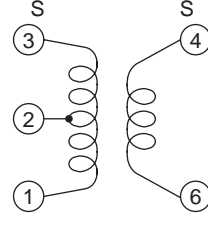
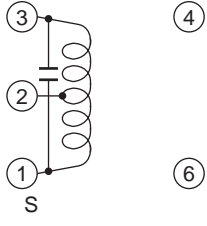
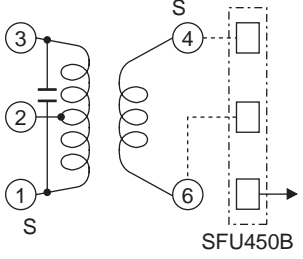
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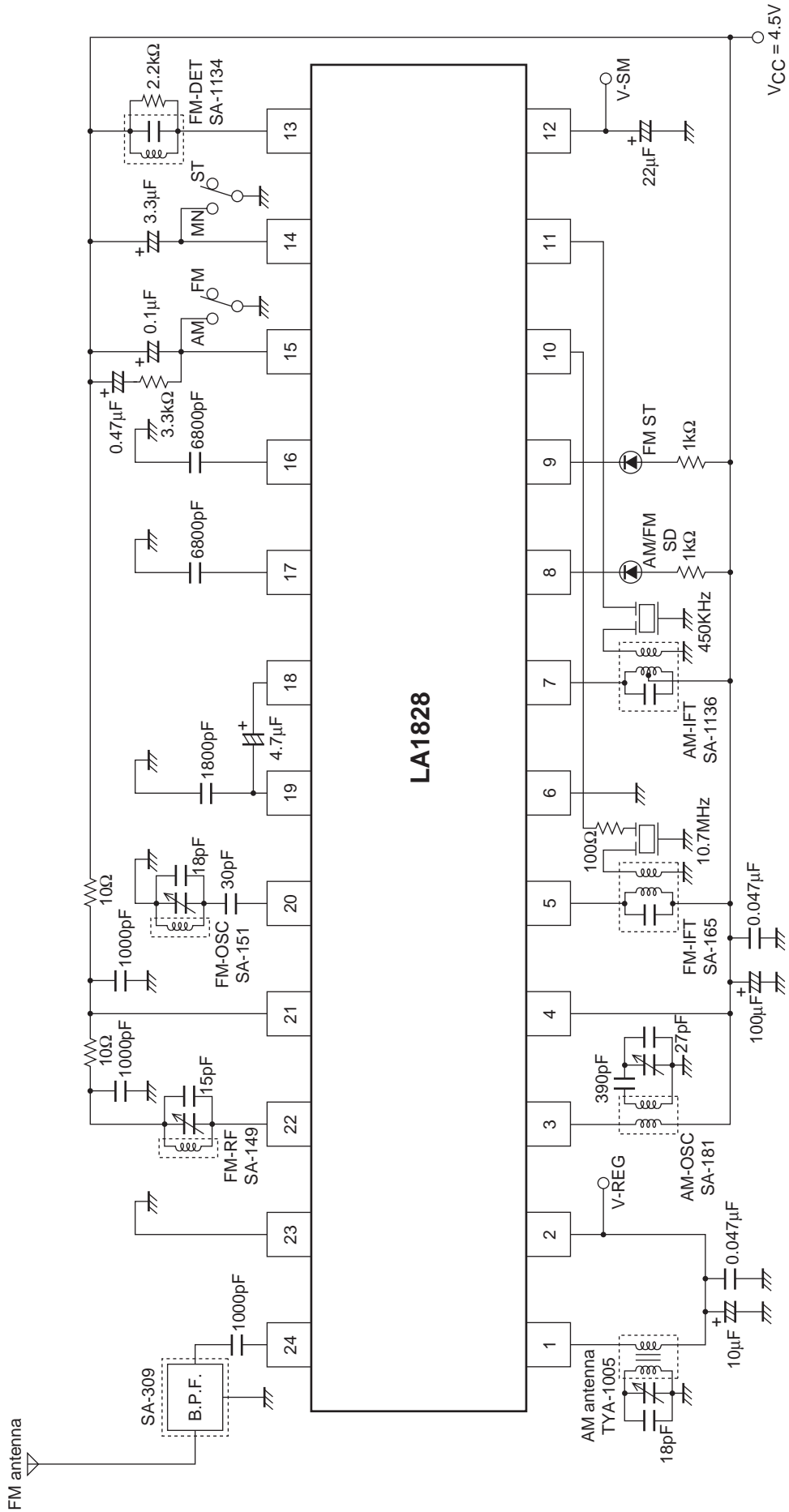
| Pin No. | Pin function | Quiescent voltage (V) | | Description | Equivalent circuit |
|---------|-------------------------------------------|-----------------------|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| | | AM | FM | | |
| 18 | MPX input | 1.3 | 1.3 | $R_{IN} = 50k\Omega$ |  |
| 19 | FM detector output and AM detector output | 0.5 | 1.5 | Output impedance AM : $R_{OUT} = 50k\Omega$ FM : $R_{OUT} = 500\Omega$ Capacitance between pin 19 and ground should be optimized for the best separation characteristics. |  |
| 20 | FM-OSC | 4.5 | 4.4 | Colpitts oscillator circuit FM oscillator coil is connected to pin 20. |  |
| 21 | V _{CC2} | 4.5 | 4.4 | FM-FE block V _{CC} Power is supplied from pin 4 (V _{CC1}) via external resistor (10Ω). |  |
| 22 | FM-RF output | 4.5 | 4.4 | FM RF coil is connected between pins 22 and 21 (V _{CC2}). |  |
| 24 | FM-RF input | 0 | 1.0 | $R_{IN} = 1.8k\Omega$ | |
| 23 | GND2 | 0 | 0 | FM-FE block ground | |

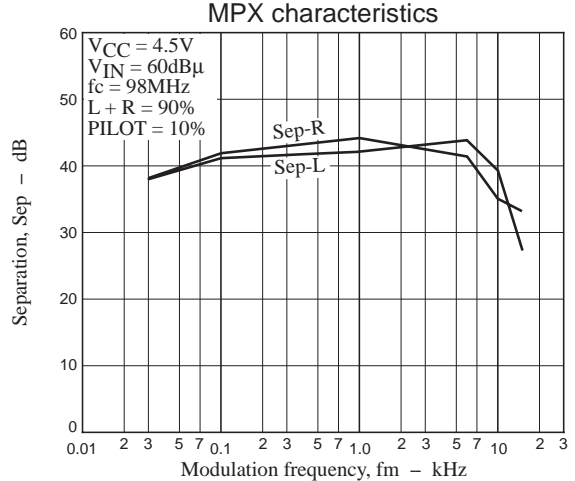
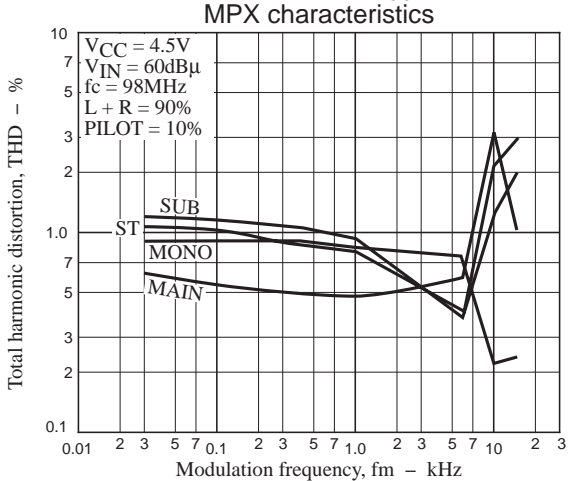
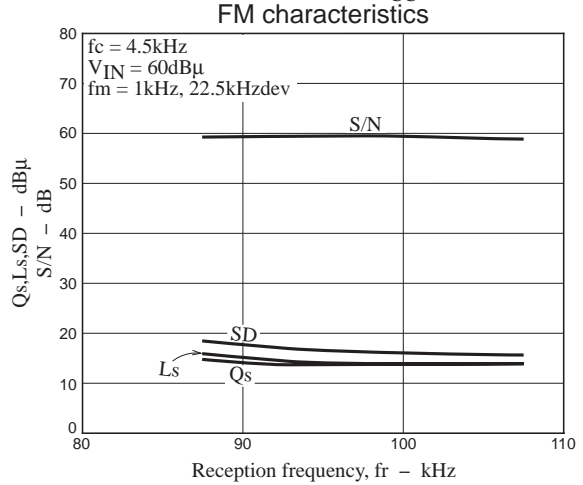
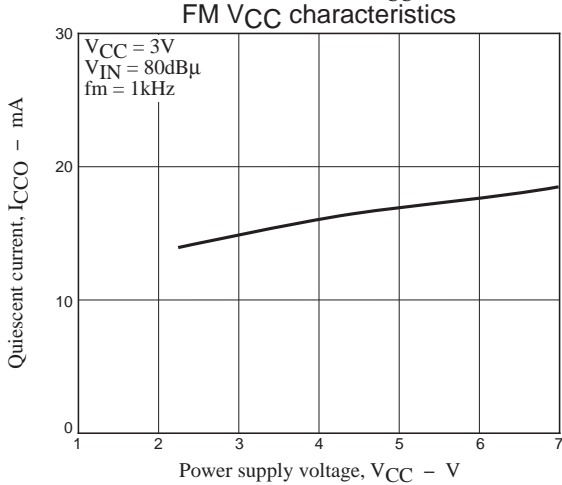
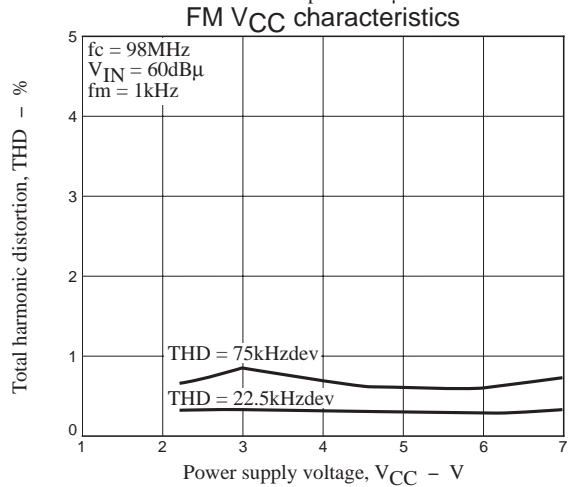
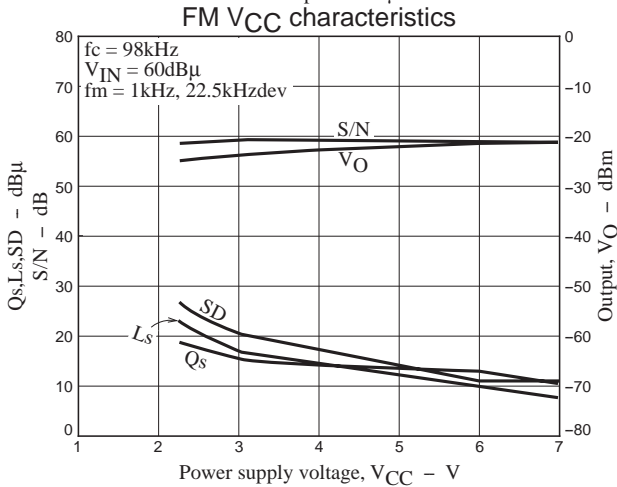
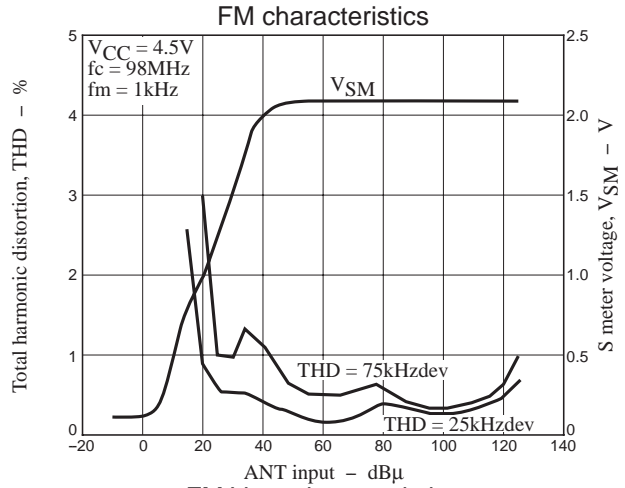
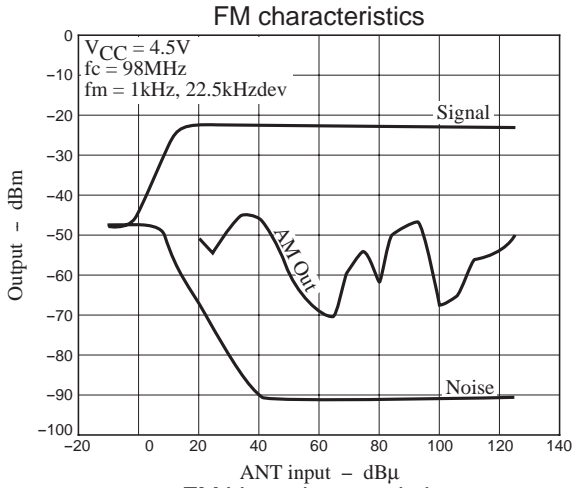
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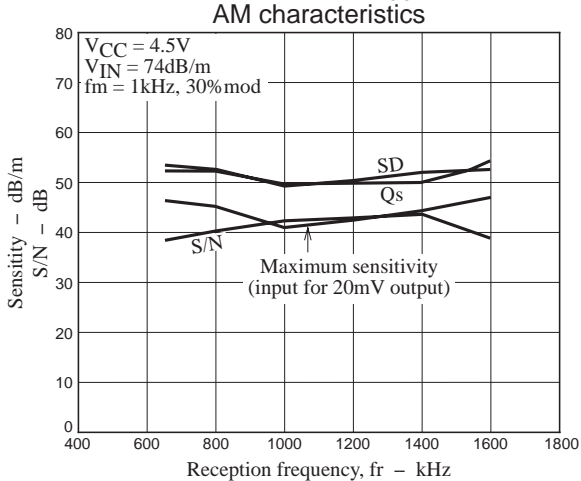
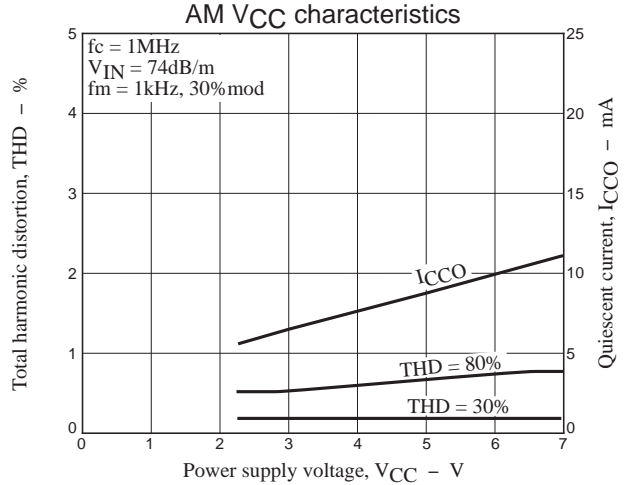
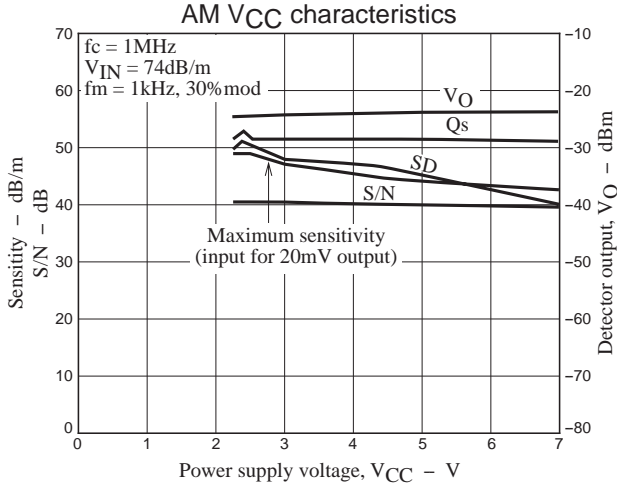
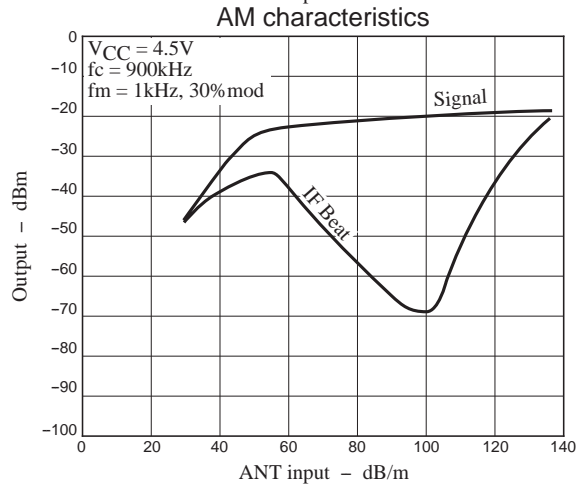
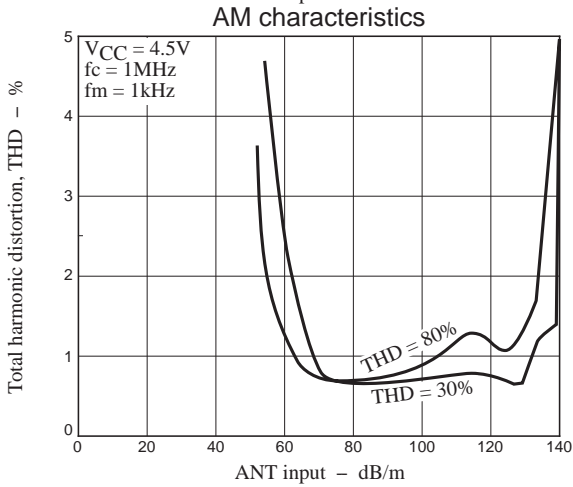
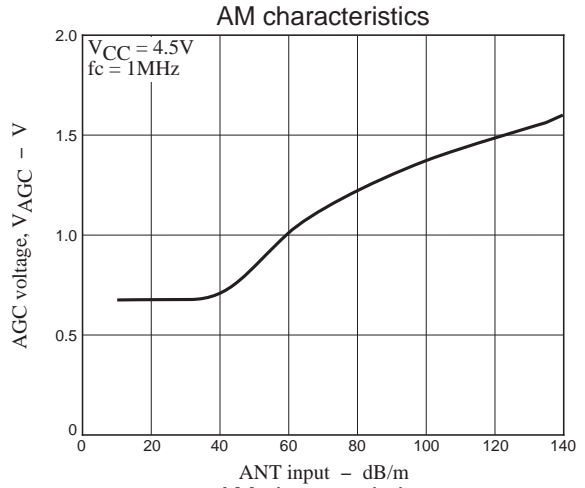
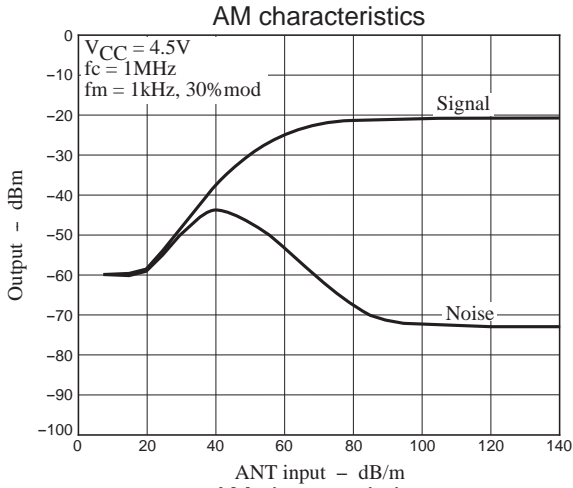
Coil specifications (bottom view)

| | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| •FM-BPF : SA-309 (Sumida) 88 to 108MHz | |
| •FM-RF : SA-149 (Sumida) 3.6mm dia., air core, 0.6mm wire, 4 1/2 T | |
| •FM-OSC : SA-151 (Sumida) 3.6mm dia., air core, 0.6mm wire, 3 1/2 T | |
| <p>•FM-Mix : SA-165 (Sumida)</p>  <p>4-6 2T 3-1 12T 0.12UEW fo = 10.7MHz Qo ≥ 50 With 100pF internal capacitor</p> | <p>•AM-OSC : SA-181 (Sumida)</p>  <p>6-4 37T 3-1 74T 0.06UEW fo = 796kHz Qo ≥ 80 L = 140μH</p> |
| <p>•FM-Det : SA-1134 (Sumida)</p>  <p>1-3 12T 0.10UEW fo = 10.7MHz Qo ≥ 70 With 82pF internal capacitor</p> | <p>•AM-IFT : SA-1136 (Sumida)</p>  <p>3-2 122T 4-6 9T 2-1 62T 0.06UEW fo = 450kHz Qo ≥ 65 With 82pF internal capacitor</p> |
| •FM-IF filter : SFE10.7MS2 (Murata) | |
| •AM-IF filter : SFU450B (Murata) | |
| •Poly-varicon : FT-2217 (Toko) or PVC-22KTL (Mitsumi) | |
| •MW bar antenna : TYA-1005 (Mitsumi) | |
|  <p>1-2 68T 3-4 9T fo = 796kHz Qo ≥ 230 L = 260μH</p> | |
| <p>•FM-Mix : YT-30224 (Mitsumi) for DUT</p>  <p>6-4 2T 1-3 8T 0.12UEW fo = 10.7MHz Qo ≥ 80 With 150pF internal capacitor</p> | <p>•AM-OSC : HW-50425 (Mitsumi) for DUT</p>  <p>3-2 2T 4-6 9T 2-1 86T Qo ≥ 80 L = 270μH</p> |
| <p>•FM-Det : YT-30103 (Mitsumi) for DUT</p>  <p>1-3 10T fo = 10.7MHz Qo ≥ 90 With 82pF internal capacitor</p> | <p>•AM-IFT : YD-1073-1 (Mitsumi) for DUT</p>  <p>1-2 58T 4-6 7T 2-3 94T fo = 450kHz With 180pF internal capacitor</p> |

Sample Application Circuit







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