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**MSM7512B**

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**1200 bps Half Duplex FSK Modem – ITU-T V.23**

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**GENERAL DESCRIPTION**

The MSM7512B is useful for the ITU-T V.23 modem, for examples, low cost built-in modems, telecontrol systems, home security systems, etc.

The family version, MSM7510 for ITU-T V.21, will be available following this device.

Oki has been mass-producing and delivering the MSM6926 and 6927 for a long time, but these devices need two power supplies, +5 V for digital and +12 V for analog.

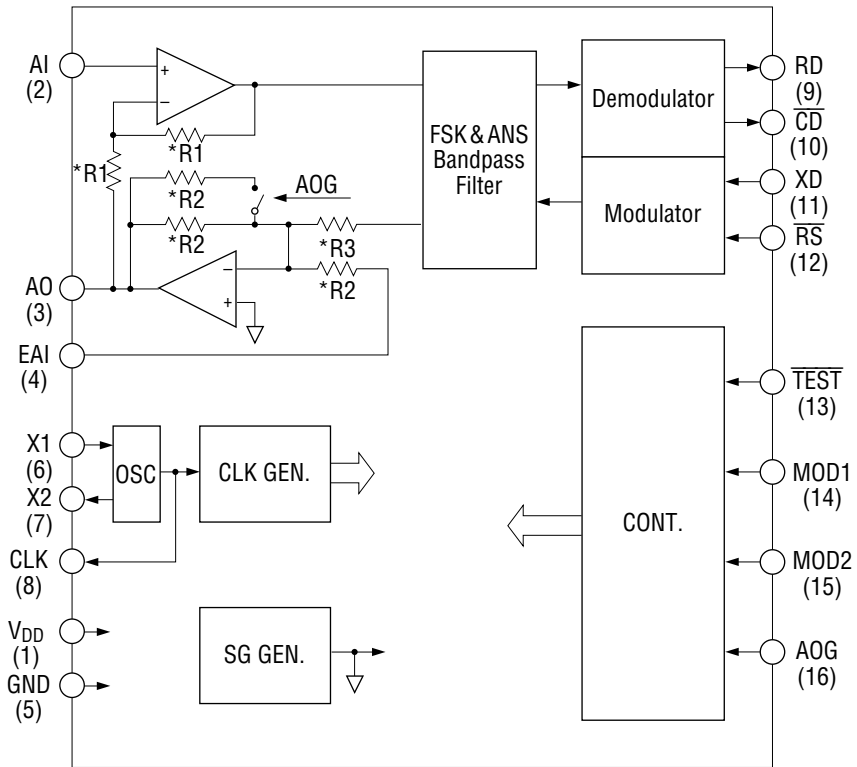
New generation devices, MSM7510/7512B, work with single rail +3 V to +5 V and low power consumption.

**FEATURES**

- Conforms to ITU-T V.23, 1200 bps Half Duplex
- Conforms to ITU-T V.23, 75 bps transmitter
- Single Power Supply: +3 V to +5 V
- Low Power Consumption
  - Operating Mode: 25 mW Typ.
  - Power Down Mode: 0.1 mW Max.
- Line Hybrid Circuit on Chip
- Line Direct Drive Capability of Analog Output
- 3.579545 MHz Crystal Oscillator
- Digital Interface: TTL
- Package options:
 

|                    |                      |                              |
|--------------------|----------------------|------------------------------|
| 16-pin plastic DIP | (DIP16-P-300-2.54)   | (Product name: MSM7512BRS)   |
| 24-pin plastic SOP | (SOP24-P-430-1.27-K) | (Product name: MSM7512BGS-K) |

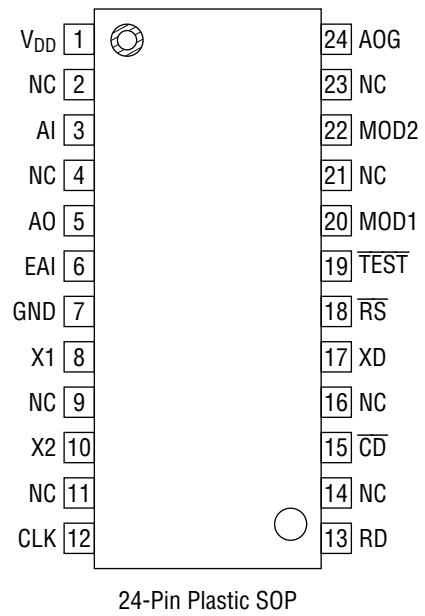
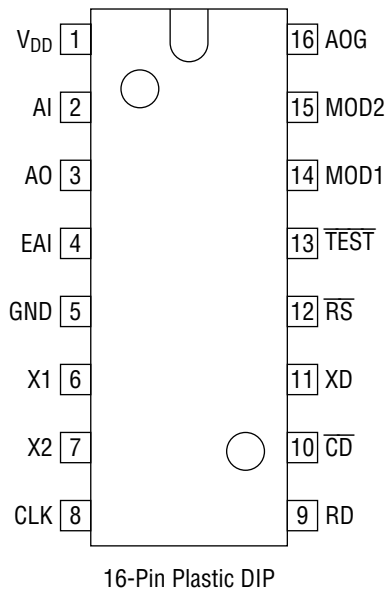
**BLOCK DIAGRAM**



\* R1 to R3 ≥ 50 kΩ

( ) : for MSM7512BRS

**PIN CONFIGURATION (TOP VIEW)**



NC : No connect pin

## PIN DESCRIPTION

| No. |       | Name                     | I/O | Description  |
|-----|-------|--------------------------|-----|--|
| RS  | GS-VK |                          |     |  |
| 1   | 1     | V <sub>DD</sub>          | —   | +3 V to +5 V Power Supply  |
| 2   | 3     | AI                       | I   | Analog receive signal input.   |
| 3   | 5     | AO                       | O   | Analog transmit signal output.   |
| 4   | 6     | EAI                      | I   | External analog signal input.<br>The signal applied to this pin is transmitted from AO via transmit output amplifier. When not using this pin, it should be left open.   |
| 5   | 7     | GND                      | —   | Ground, 0 V.   |
| 6   | 8     | X1                       | I   | 3.579545 MHz crystal resonator should be connected to X1 and X2.<br>When applying external clock 3.579545 MHz to the device, it should be applied to X2 (not X1) via an AC-coupling capacitor of 100 pF and X1 has to be opened. |
| 7   | 10    | X2                       | O   |  |
| 8   | 12    | CLK                      | O   | 3.579545 MHz clock signal output.  |
| 9   | 13    | RD                       | O   | Modem receive serial data output.<br>Digital "1" and "0" correspond to "Mark" and "Space", respectively. When $\overline{\text{CD}}$ (Carrier Detect) is off, RD is held at "Mark" state.  |
| 10  | 15    | $\overline{\text{CD}}$   | O   | FSK Receive signal and answer tone detect.<br>Digital "0" and "1" represent "Detect" and "Non-detect", respectively.   |
| 11  | 17    | XD                       | I*  | Modem transmit serial data input.<br>Digital "1" and "0" correspond to "Mark" and "Space", respectively.   |
| 12  | 18    | $\overline{\text{RS}}$   | I*  | FSK signal and answer tone transmit enable.<br>When digital "0" is applied to $\overline{\text{RS}}$ , transmitting becomes enable.  |
| 13  | 19    | $\overline{\text{TEST}}$ | I*  | Chip test input.<br>$\overline{\text{TEST}}$ should be open or digital "1".  |
| 14  | 20    | MOD1                     | I*  | Operation mode select.   |
| 15  | 22    | MOD2                     | I*  | Refer to Table 1.  |
| 16  | 24    | AOG                      | I*  | Analog transmit signal amplitude select.<br>Digital "1" → -10 dBm Typ. at AO<br>Digital "0" → -4 dBm Typ. at AO  |

Note : I\* : Internally pulled-up input pin.

**ABSOLUTE MAXIMUM RATINGS**

| Parameter            | Symbol    | Condition                  | Rating                 | Unit             |
|----------------------|-----------|----------------------------|------------------------|------------------|
| Power Supply Voltage | $V_{DD}$  | $T_a = 25^\circ\text{C}$ , | -0.3 to +7             | V                |
| Input Voltage        | $V_{IN}$  | With respect to GND        | -0.3 to $V_{DD} + 0.3$ | V                |
| Storage Temperature  | $T_{STG}$ | —                          | -55 to +150            | $^\circ\text{C}$ |

**RECOMMENDED OPERATING CONDITIONS**

| Parameter                 | Symbol                       | Condition             | Min.  | Typ.     | Max. | Unit             |          |
|---------------------------|------------------------------|-----------------------|---|----------|------|------------------|----------|
| Power Supply Voltage      | $V_{DD}$                     | —                     | +2.7  | —        | +5.5 | V                |          |
| Operating Temperature     | $T_{op}$                     | —                     | -40   | —        | +85  | $^\circ\text{C}$ |          |
| Input Clock Frequency     | $f_{CLK}$                    | $T_o$ 3.579545 MHz    | -0.1  | —        | +0.1 | %                |          |
| $V_{DD}$ Bypass Capacitor | $C_{VDD}$                    | $V_{DD} - \text{GND}$ | 10  | —        | —    | $\mu\text{F}$    |          |
| Crystal                   | Oscillation Frequency        | —                     | —   | 3.579545 | —    | MHz              |          |
|                           | Frequency Deviation          | —                     | +25 $^\circ\text{C}$ $\pm$ 5 $^\circ\text{C}$ | -100     | —    | +100             | ppm      |
|                           | Temperature Characteristics  | —                     | -40 $^\circ\text{C}$ to +85 $^\circ\text{C}$  | -50      | —    | +50              | ppm      |
|                           | Equivalent Series Resistance | —                     | —   | —        | —    | 50               | $\Omega$ |
|                           | Load Capacitance             | —                     | —   | —        | 16   | —                | pF       |

**ELECTRICAL CHARACTERISTICS**

**DC Characteristics**

( $V_{DD} = +2.7\text{ V to }+5.5\text{ V}$ ,  $T_{op} = -40^\circ\text{C to }+85^\circ\text{C}$ )

| Parameter                     | Symbol   | Condition                 | Min. | Typ. | Max.     | Unit          |
|-------------------------------|----------|---------------------------|------|------|----------|---------------|
| Power Supply Current          | $I_{DD}$ | Operating Mode            | —    | 5.0  | 10.0     | mA            |
|                               | $I_{SS}$ | Power Down Mode           | —    | 5.0  | 20.0     | $\mu\text{A}$ |
| Digital Input Voltage         | $V_{IL}$ | —                         | 0    | —    | 0.8      | V             |
|                               | $V_{IH}$ | —                         | 2.2  | —    | $V_{DD}$ | V             |
| Digital Input Leakage Current | $I_{IL}$ | $V_I = 0\text{ V}^*$      | -80  | —    | 10       | $\mu\text{A}$ |
|                               | $I_{IH}$ | $V_I = 5\text{ V}$        | -10  | —    | 10       | $\mu\text{A}$ |
| Digital Output Voltage        | $V_{OL}$ | $I_{OL} = 1.6\text{ mA}$  | 0    | 0.2  | 0.4      | V             |
|                               | $V_{OH}$ | $I_{OH} = -0.4\text{ mA}$ | 2.4  | —    | $V_{DD}$ | V             |

\* Internally pulled-up pins

**AC Characteristics**

Modulator/analog output (AO) characteristics

( $V_{DD} = +2.7\text{ V to }+5.5\text{ V}$ ,  $T_{op} = -40^{\circ}\text{C to }+85^{\circ}\text{C}$ )

| Parameter                                 | Symbol    | Condition                      |                  | Min. | Typ. | Max. | Unit     |
|---|-----------|--------------------------------|------------------|------|------|------|----------|
| FSK Transmit<br>Signal Frequency          | $f_{DM}$  | 1200 bps Transmit Mode         | XD = "1"         | 1296 | 1300 | 1304 | Hz       |
|   | $f_{DS}$  |                                | XD = "0"         | 2096 | 2100 | 2104 | Hz       |
|   | $f_{BM}$  | 75 bps Transmit Mode           | XD = "1"         | 386  | 390  | 394  | Hz       |
|   | $f_{BS}$  |                                | XD = "0"         | 446  | 450  | 454  | Hz       |
| FSK Transmit<br>Signal Amplitude          | $V_{AO1}$ | $V_O$                          | AOG = "0"        | -6   | -4   | -2   | dBm      |
| Answer Tone amplitude                     | $V_{AO2}$ |                                | AOG = "1"        | -12  | -10  | -8   | dBm      |
| Analog External<br>Input Signal Gain      | $V_{EA1}$ | $V_{AO} - V_{EAI}$             | AOG = "0"        | -2   | 0    | 2    | dB       |
|   | $V_{EA2}$ |                                | AOG = "1"        | -8   | -6   | -4   | dB       |
| FSK Transmit<br>Signal Amplitude<br>Ratio | $V_{AOD}$ | $V_{AO(MARK)} - V_{AO(SPACE)}$ |                  | -2   | 0    | 2    | dB       |
| Out-of-band<br>Energy                     | $V_{SPS}$ | P : In-band Signal<br>Energy   | 4 kHz to 8 kHz   | —    | —    | P-20 | dB       |
|   |           |                                | 8 kHz to 12 kHz  | —    | —    | P-40 | dB       |
|   |           |                                | More than 12 kHz | —    | —    | P-60 | dB       |
| Output Offset Voltage                     | $V_{OFF}$ | To $V_{DD}/2$                  |                  | -150 | —    | +150 | mV       |
| Output Load Resistance                    | $R_{AO}$  | —                              |                  | 600  | —    | —    | $\Omega$ |

\* 0 dBm = 0.775 Vrms

Demodulator analog input (AI, EAI) characteristics

( $V_{DD} = +2.7\text{ V to }+5.5\text{ V}$ ,  $T_{op} = -40^{\circ}\text{C to }+85^{\circ}\text{C}$ )

| Parameter   | Symbol    | Condition                    | Min.      | Typ. | Max. | Unit      |
|---|-----------|------------------------------|-----------|------|------|-----------|
| Receive Signal Amplitude                            | $V_{AI}$  | FSK Signal, at AI            | —         | —    | -6   | dBm       |
| Receive Signal Detect Amplitude ( $\overline{CD}$ ) | $V_{ON}$  | FSK Signal, (1:1) at AI      | OFF → ON  | —    | -42  | dBm       |
|   | $V_{OFF}$ |                              | OFF → OFF | -48  | —    | dBm       |
| Hysteresis ( $\overline{CD}$ )                      | $V_{HYS}$ | $V_{ON} \rightarrow V_{OFF}$ | —         | 2    | —    | dB        |
| $\overline{CD}$ Delay Time                          | $t_{CDD}$ | See Fig. 1                   | 5         | 15   | 20   | ms        |
| $\overline{CD}$ Hold Time                           | $t_{CDH}$ |                              | 20        | 40   | 60   | ms        |
| Receive Data ( $\overline{RD}$ ) Bias Distortion    | $D_{BS}$  | 1200 bps, 1:1 Pattern        | -10       | —    | 10   | %         |
| Input Resistance                                    | $R_{AI}$  | AI                           | —         | 10   | —    | $M\Omega$ |
|   | $R_{EAI}$ | EAI                          | 20        | —    | —    | $k\Omega$ |

\* 0 dBm = 0.775 Vrms

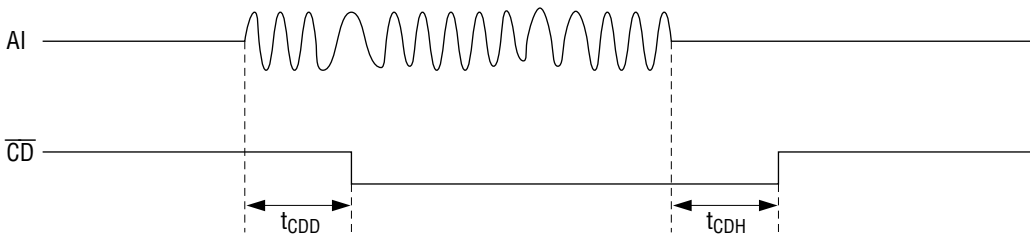
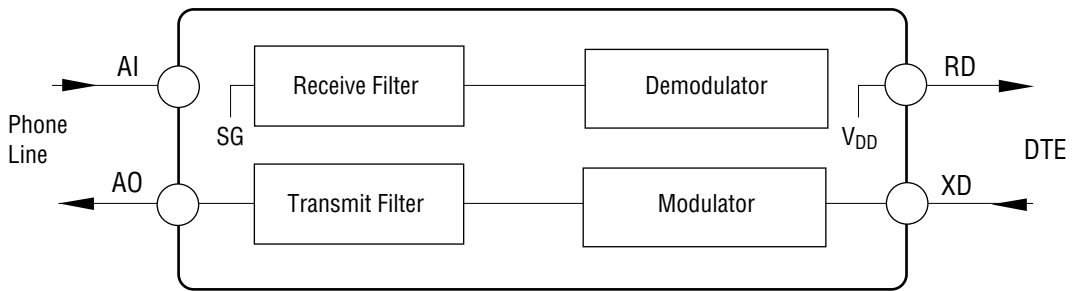


Figure 1 Carrier Detect ( $\overline{CD}$ ) Timing

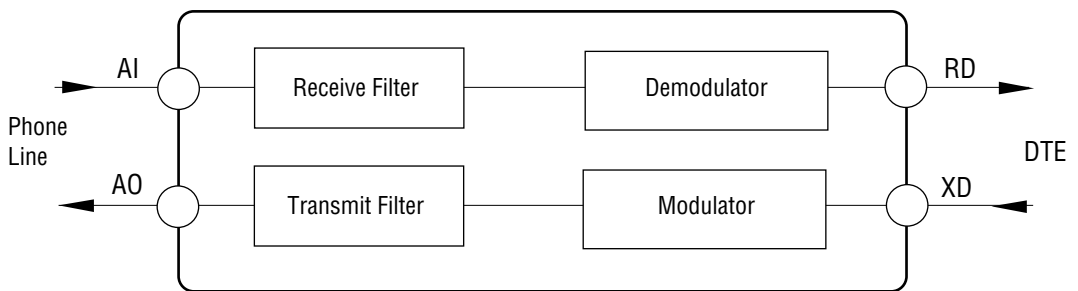
**OPERATION MODE**

**Table 1 Operation Mode**

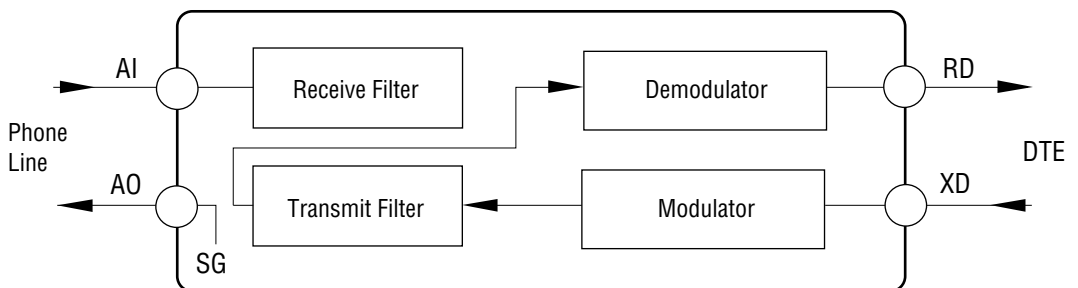
| MOD2 | MOD1 | Mode                                       |
|------|------|--|
| 0    | 0    | FSK Transmit Mode (Fig.2)                  |
| 0    | 1    | FSK Receive & 75 bps Transmit Mode (Fig.3) |
| 1    | 0    | Analog Loop Back Test Mode (Fig. 4)        |
| 1    | 1    | Power Down Mode                            |



**Figure 2 FSK Transmit Mode**



**Figure 3 FSK Receive Mode**

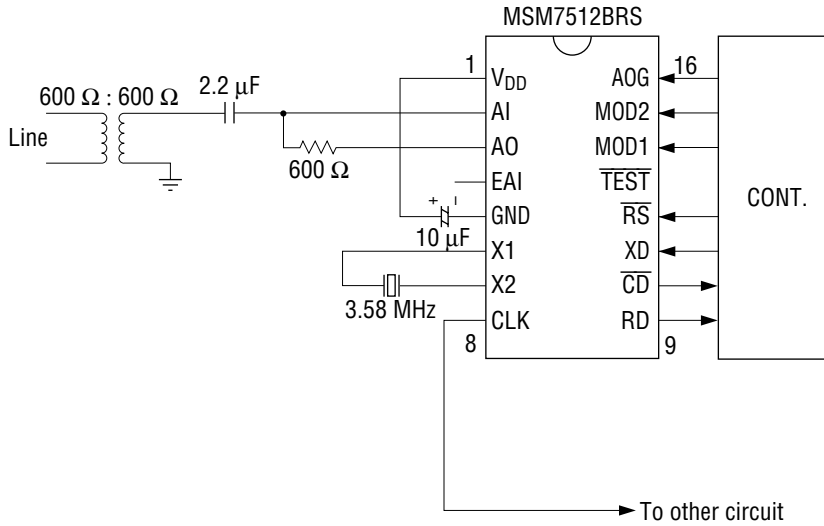


**Figure 4 Analog Loop Back Test Mode**

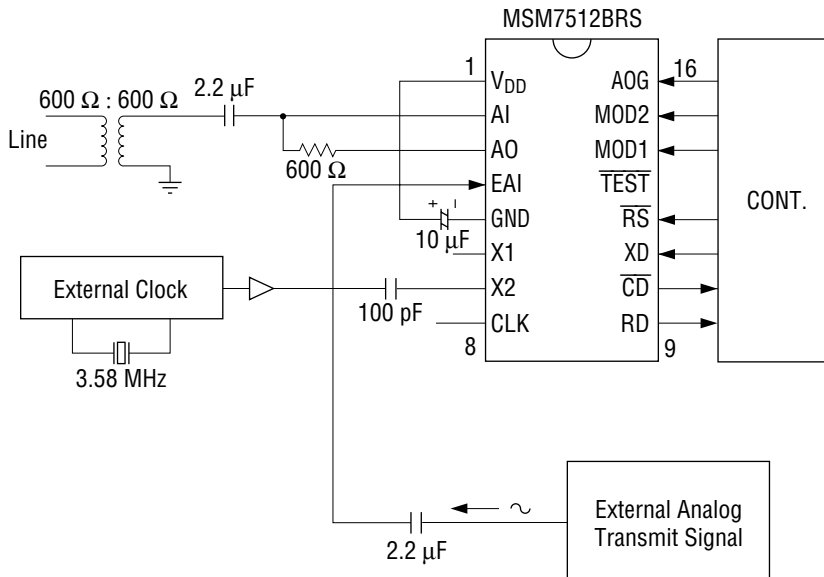


APPLICATION CIRCUIT

①

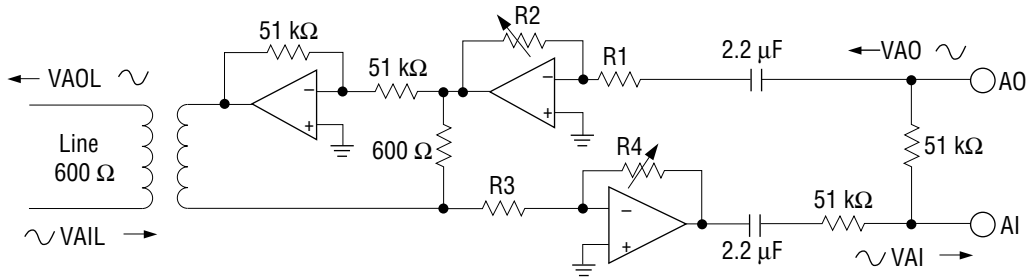


②



**An Example of the External Adjustment for a transmitting Level and detecting Level**

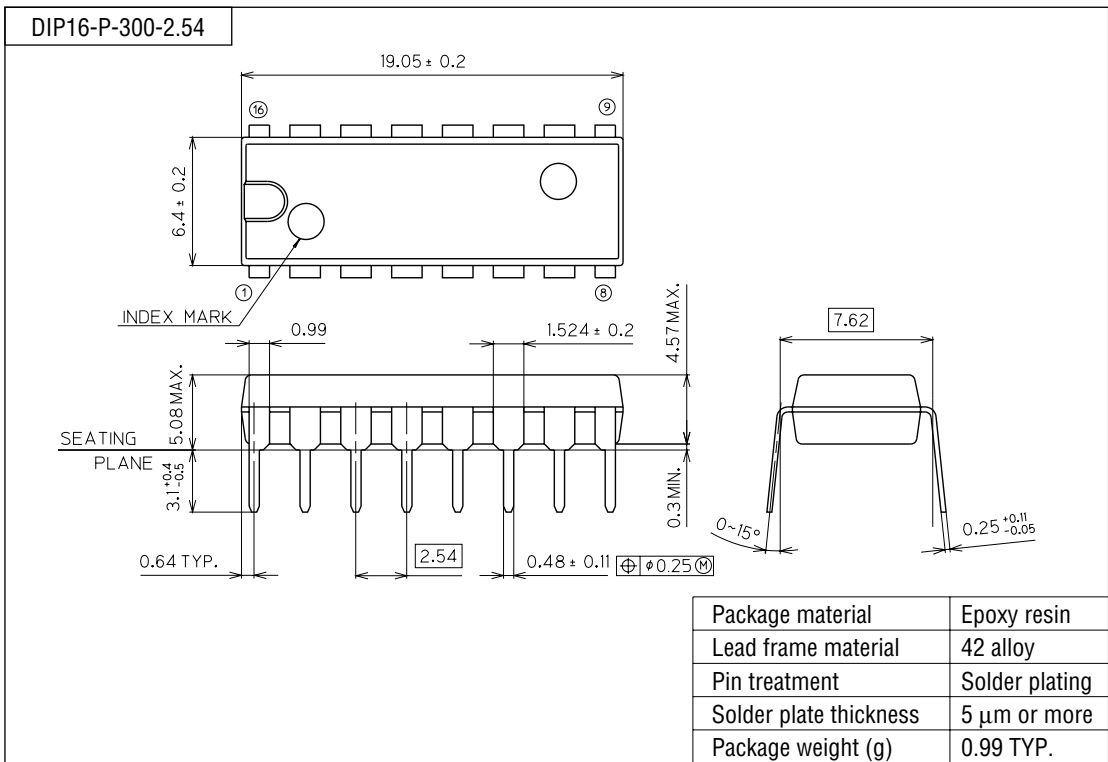
If you desire to change the transmitting level or detecting level, adjust the external circuit by referring to the following circuit.



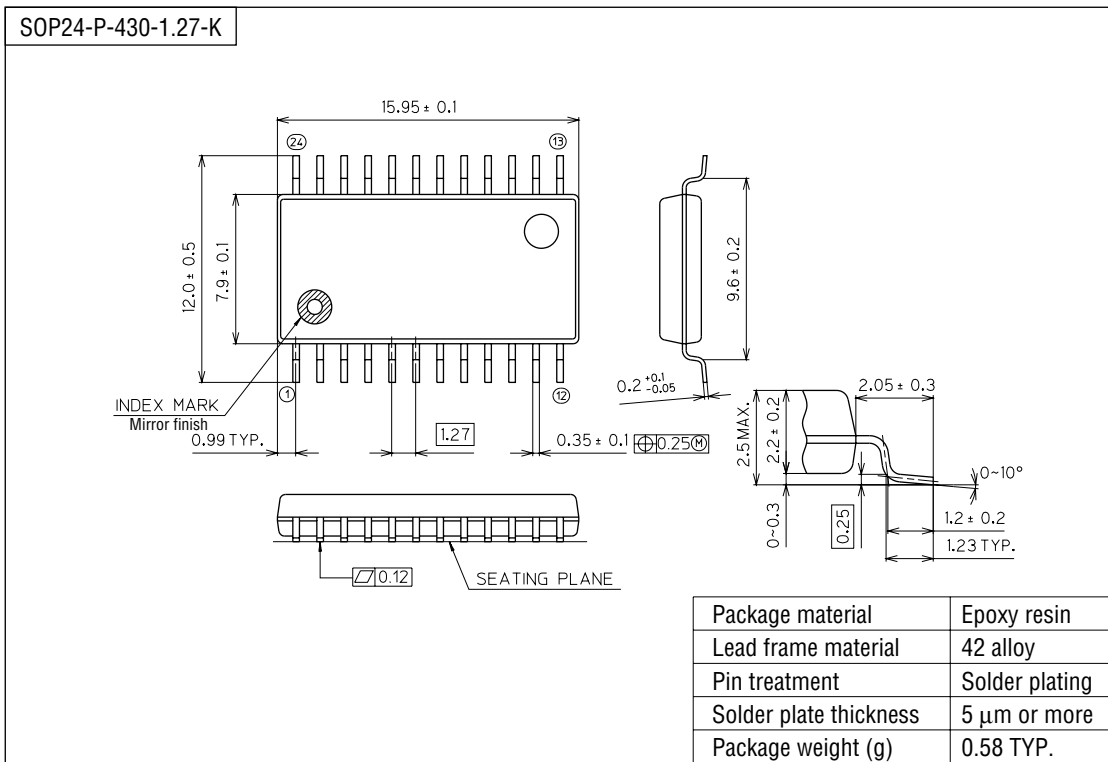
Line transmitting level :  $V_{AOL} = V_{AO} \times (R2/R1)$   
 IC input level :  $V_{AI} = V_{AIL} \times (R4/R3)$

PACKAGE DIMENSIONS

(Unit : mm)



(Unit : mm)



Notes for Mounting the Surface Mount Type Package

The SOP, QFP, TSOP, SOJ, QFJ (PLCC), SHP and BGA are surface mount type packages, which are very susceptible to heat in reflow mounting and humidity absorbed in storage. Therefore, before you perform reflow mounting, contact Oki's responsible sales person for the product name, package name, pin number, package code and desired mounting conditions (reflow method, temperature and times).

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