

# AN22011A

## 3-beam MD system pre-amplifier

### Overview

The AN22011A incorporates such functions as RF signal processing, servo signal processing, ADIP signal processing and laser control. This is an RF IC that can constitute the MD system using 3-beam pick-up in combination with the digital signal processing LSI MN66621.

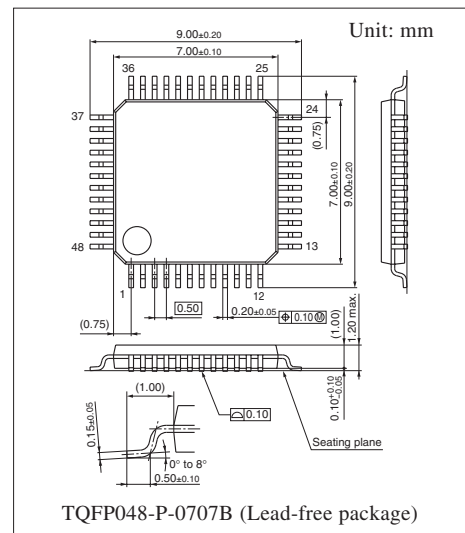
The IC allows us to achieve a considerable low power dissipation as well as its low supply voltage operation ( $V_{CC} = 2.1 \text{ V}$  to  $3.6 \text{ V}$ ) due to our introduction of digital matrix ( $P_D = 11 \text{ mW}$  at  $V_{CC} = 2.1 \text{ V}$ ). The IC can be used in a wide range of applications from a stand-alone system to a portable system.

### Features

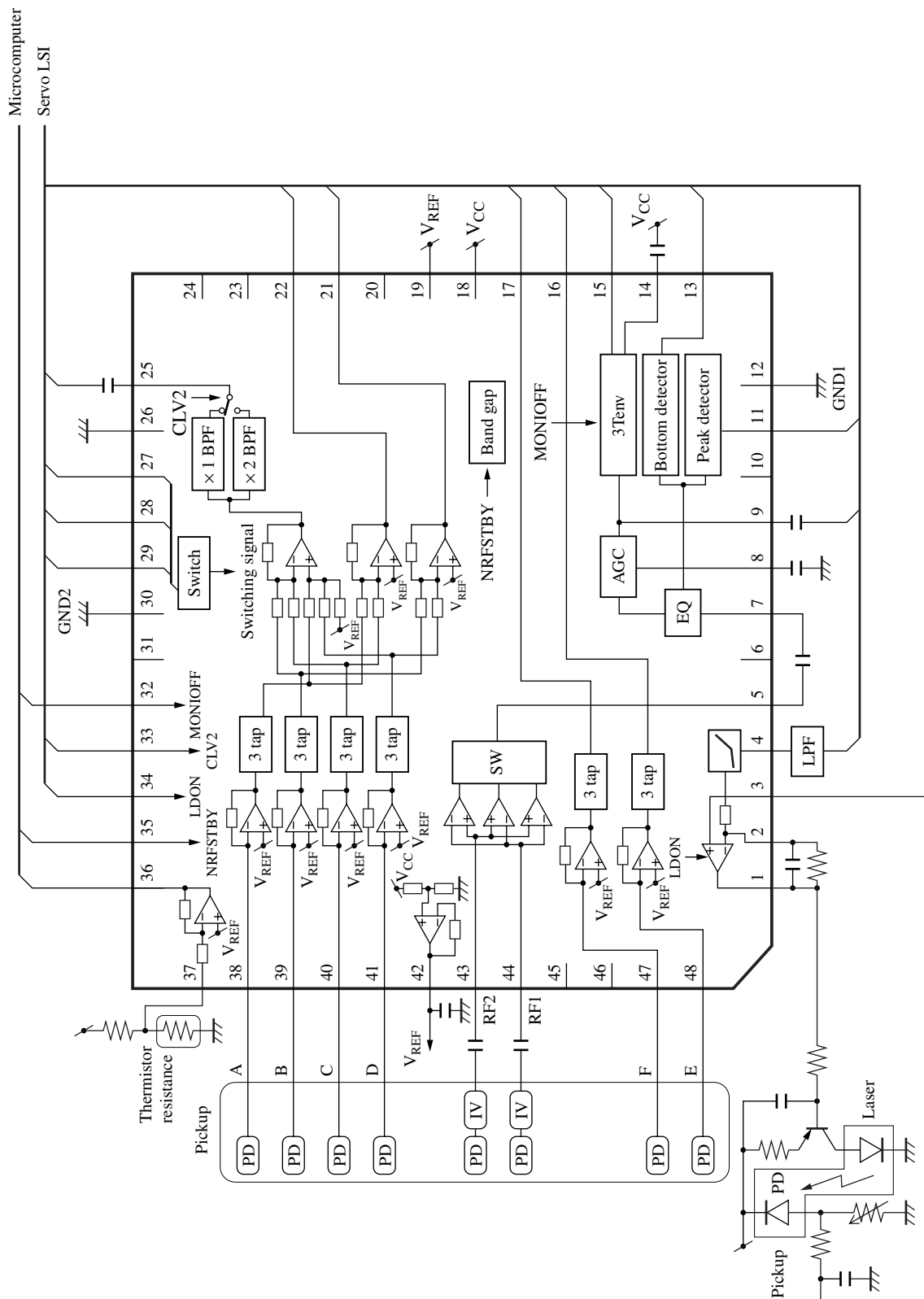
- 3-beam system pick-up
- RF signal processing
- Servo signal processing
- Laser power control function
- Low supply voltage operation (2.1 V to 3.6 V)
- Ultra low power consumption (min. 11 mW)
- Thin package adopted (Mold thickness: 1 mm)

### Applications

- MD player/recorder
  - Home audio systems/mini systems
  - Portable audio
  - Car audio



### ■ Block Diagram



## ■ Pin Descriptions

| Pin No. | Symbol          | Description                               | Pin No. | Symbol           | Description                                     |
|---------|-----------------|-------------------------------------------|---------|------------------|-------------------------------------------------|
| 1       | LDO             | LD amplifier output pin                   | 26      | OFSON            | Te stray light canceling operation setting pin  |
| 2       | LDIN            | LD amplifier reverse input pin            |         |                  |                                                 |
| 3       | APCPD           | Photo diode light quantity detector pin   | 27      | NREC             | Rec/playback switching signal input pin         |
| 4       | APCREP          | APC amplifier reference voltage input pin | 28      | RFSWHL           | Reflection ratio H/L switching signal input pin |
| 5       | ARFO            | RF amplifier output pin                   |         |                  |                                                 |
| 6       | N.C.            | —                                         | 29      | RFSWPG           | Pit/Grv switching signal input pin              |
| 7       | EQIN            | EQ input pin                              | 30      | GND2             | GND pin 2                                       |
| 8       | CRFAGC          | RFAGC capacitor pin                       | 31      | N.C.             | —                                               |
| 9       | OUTRF           | EFM output pin                            | 32      | MONIOFF          | 3TMON circuit control signal input pin          |
| 10      | N.C.            | —                                         | 33      | CLV2             | ADIP BPF switching signal input pin             |
| 11      | PEAK            | EFM bright level detection output pin     | 34      | LDON             | APC circuit control signal input pin            |
| 12      | GND1            | GND pin 1                                 | 35      | NRFSTBY          | Standby control signal input pin                |
| 13      | BOTM            | EFM dark level detection output pin       | 36      | TEMP             | Temperature sensor amplifier output pin         |
| 14      | CEA             | 3T envelope detection capacitor pin       | 37      | TEMPIN           | Temperature sensor amplifier input pin          |
| 15      | MON3T           | 3T envelope output pin                    | 38      | A                | A signal input pin                              |
| 16      | EE              | E signal I-V converting output pin        | 39      | B                | B signal input pin                              |
| 17      | FF              | F signal I-V converting output pin        | 40      | C                | C signal input pin                              |
| 18      | V <sub>CC</sub> | V <sub>CC</sub> pin                       | 41      | D                | D signal input pin                              |
| 19      | OFSIN           | Te stray light canceling pin              | 42      | V <sub>REF</sub> | Reference signal output pin                     |
| 20      | N.C.            | —                                         | 43      | RF2              | RF2 signal input pin                            |
| 21      | FF2             | (A+C) signal I-V converting output pin    | 44      | RF1              | RF1 signal input pin                            |
| 22      | FF1             | (B+D) signal I-V converting output pin    | 45      | N.C.             | —                                               |
| 23      | N.C.            | —                                         | 46      | N.C.             | —                                               |
| 24      | N.C.            | —                                         | 47      | F                | F signal input pin                              |
| 25      | ADIP            | ADIP signal output pin                    | 48      | E                | E signal input pin                              |

## ■ Absolute Maximum Ratings

| Parameter                                   | Symbol           | Rating      | Unit |
|---------------------------------------------|------------------|-------------|------|
| Supply voltage                              | V <sub>CC</sub>  | 4.0         | V    |
| Supply current                              | I <sub>CC</sub>  | 7.5         | mA   |
| Setting pin upper limit <sup>*2</sup>       | V <sub>INH</sub> | 3.6         | V    |
| Power dissipation <sup>*1</sup>             | P <sub>D</sub>   | 30          | mW   |
| Operating ambient temperature <sup>*1</sup> | T <sub>opr</sub> | −30 to +85  | °C   |
| Storage temperature <sup>*1</sup>           | T <sub>stg</sub> | −55 to +125 | °C   |

Note) \*1: Except for power dissipation, operating ambient temperature and storage temperature, all ratings are for T<sub>a</sub> = 25°C.

\*2: Setting pin refers to OFSON (pin 26), NREC (pin 27), RFSWHL (pin 28), RFSWPG (pin 29), MONIOFF (pin 32), CLV2 (pin 33), LDON (pin 34), NRFSTBY (pin 35).

## ■ Recommended Operating Range

| Parameter      | Symbol   | Range      | Unit |
|----------------|----------|------------|------|
| Supply voltage | $V_{CC}$ | 2.1 to 3.6 | V    |

## ■ Electrical Characteristics at $T_a = 25^\circ\text{C}$

| Parameter                                           | Symbol            | Conditions                                                           | Min  | Typ  | Max   | Unit             |
|-----------------------------------------------------|-------------------|----------------------------------------------------------------------|------|------|-------|------------------|
| No load consumption current 1                       | $I_{TOTAL1}$      | Normal mode                                                          | 4.5  | 5.5  | 6.5   | mA               |
| No load consumption current 2                       | $I_{TOTAL2}$      | Sleep mode                                                           | 200  | 300  | 400   | $\mu\text{A}$    |
| $V_{REF}$ offset                                    | $\Delta V_{OVb}$  | Normal mode                                                          | -50  | 0    | 50    | mV               |
| $V_{REF}$ output impedance                          | $Z_{VB}$          | $I_{42} = \pm 1.5 \text{ mA}$                                        | —    | —    | 5     | $\Omega$         |
| LD amplifier OFF operation                          | $V_{LDOFF}$       | APC OFF mode                                                         | —    | —    | 0.2   | V                |
| LD amplifier gain playback mode                     | $G_{LDP}$         | APC ON mode                                                          | -23  | -20  | -17   | dB               |
| LD amplifier gain recording mode                    | $G_{LDR}$         | APC ON mode                                                          | -5.5 | -2.5 | 0.5   | dB               |
| Temperature amplifier gain                          | $G_{TM}$          | $V_{37} = V_{REF} \pm 0.75 \text{ V}$                                | -2   | 0    | 2     | dB               |
| FF1 offset                                          | $\Delta V_{F1}$   | Pit high reflection ratio mode                                       | -100 | 0    | 100   | mV               |
| FF2 offset                                          | $\Delta V_{F2}$   | Pit high reflection ratio mode                                       | -100 | 0    | 100   | mV               |
| FF1 gain<br>pit high reflection ratio mode          | $Z_{FIRO}$        | Pit high reflection ratio mode                                       | 46.2 | 57.7 | 69.2  | $\text{k}\Omega$ |
| FF1 gain<br>pit low reflection ratio mode           | $Z_{FIRA}$        | Pit low reflection ratio mode                                        | 197  | 250  | 303   | $\text{k}\Omega$ |
| FF1 gain record mode                                | $Z_{FIRE}$        | Record mode                                                          | 17.5 | 21.9 | 26.3  | $\text{k}\Omega$ |
| FF2 relative gain<br>pit high reflection ratio mode | $\Delta Z_{F2RO}$ | Pit high reflection ratio mode                                       | -2   | 0    | 2     | dB               |
| FF2 relative gain<br>pit low reflection ratio mode  | $\Delta Z_{F2RA}$ | Pit low reflection ratio mode                                        | -2   | 0    | 2     | dB               |
| FF2 relative gain record mode                       | $\Delta Z_{F2RE}$ | Record mode                                                          | -2   | 0    | 2     | dB               |
| FF1 frequency characteristic                        | $\Delta G_{F1}$   | Pit high reflection ratio mode<br>$V_{38}$ : 3 kHz, 30 kHz Sine wave | -9   | -6   | -3    | dB               |
| FF2 frequency characteristic                        | $\Delta G_{F2}$   | Pit high reflection ratio mode<br>$V_{39}$ : 3 kHz, 30 kHz Sine wave | -9   | -6   | -3    | dB               |
| EE offset                                           | $\Delta V_{EE}$   | Pit high reflection ratio mode                                       | -750 | -600 | -450  | mV               |
| FF offset                                           | $\Delta V_{FF}$   | Pit high reflection ratio mode                                       | -750 | -600 | -450  | mV               |
| EE gain<br>pit high reflection ratio mode           | $Z_{EERO}$        | Pit high reflection ratio mode                                       | 148  | 185  | 222   | $\text{k}\Omega$ |
| EE gain<br>pit low reflection ratio mode            | $Z_{EERA}$        | Pit low reflection ratio mode                                        | 776  | 970  | 1 164 | $\text{k}\Omega$ |
| EE gain record mode                                 | $Z_{EERE}$        | Record mode                                                          | 88   | 110  | 132   | $\text{k}\Omega$ |
| FF relative gain<br>pit high reflection ratio mode  | $\Delta Z_{FFRO}$ | Pit high reflection ratio mode                                       | -2   | 0    | 2     | dB               |
| FF relative gain<br>pit low reflection ratio mode   | $\Delta Z_{FFRA}$ | Pit low reflection ratio mode                                        | -2   | 0    | 2     | dB               |

■ Electrical Characteristics at  $T_a = 25^\circ\text{C}$  (continued)

| Parameter                                                             | Symbol                   | Conditions                                                             | Min   | Typ  | Max  | Unit          |
|-----------------------------------------------------------------------|--------------------------|------------------------------------------------------------------------|-------|------|------|---------------|
| FF relative gain record mode                                          | $\Delta Z_{\text{FFRE}}$ | Record mode                                                            | -2    | 0    | 2    | dB            |
| EE frequency characteristics                                          | $\Delta G_{\text{EE}}$   | Pit high reflection ratio mode<br>$V_{48}$ : 1.5 kHz, 15 kHz Sine wave | -6    | -3   | -0.5 | dB            |
| FF frequency characteristics                                          | $\Delta G_{\text{FF}}$   | Pit high reflection ratio mode<br>$V_{47}$ : 1.5 kHz, 15 kHz Sine wave | -6    | -3   | -0.5 | dB            |
| Te stray light canceling operation                                    | $\Delta\text{TOFS}$      | Ram mode<br>Stray light canceling mode                                 | 0.4   | 0.5  | 0.6  | —             |
| ADIP gain                                                             | $G_{\text{AD1}}$         | Record mode<br>Line double speed mode                                  | 24.0  | 27.0 | 30.0 | dB            |
| ADIP center frequency                                                 | $F_{\text{AD1}}$         | Record mode<br>Line double speed mode                                  | 35.2  | 44.0 | 52.8 | kHz           |
| ADIP band width                                                       | $\Delta F_{\text{AD1}}$  | Record mode<br>Line double speed mode                                  | 23.7  | 29.6 | 35.5 | kHz           |
| ADIP relative gain typical speed mode                                 | $\Delta G_{\text{AD2}}$  | Record mode<br>Typical speed mode                                      | -3    | 0    | 3    | dB            |
| RF amplifier gain groove mode                                         | $G_{\text{RFG}}$         | $V_{43}$ : 100 kHz Sine wave<br>Groove mode                            | 19    | 22   | 25   | dB            |
| RF amplifier gain pit low reflection ratio mode                       | $G_{\text{RFPL}}$        | $V_{43}$ : 100 kHz Sine wave<br>Pit low reflection ratio mode          | 3     | 6    | 9    | dB            |
| RF amplifier gain pit high reflection ratio mode                      | $G_{\text{RFPH}}$        | $V_{43}$ : 100 kHz Sine wave<br>Pit high reflection ratio mode         | -11.5 | -8.5 | -5.5 | dB            |
| RF amplifier frequency characteristics groove mode                    | $\Delta G_{\text{RFG}}$  | $V_{43}$ : 5 MHz Sine wave<br>Groove mode                              | -3    | —    | —    | dB            |
| RF amplifier frequency characteristics pit low reflection ratio mode  | $\Delta G_{\text{RFPL}}$ | $V_{43}$ : 5 MHz Sine wave<br>Pit low reflection ratio mode            | -3    | —    | —    | dB            |
| RF amplifier frequency characteristics pit high reflection ratio mode | $\Delta G_{\text{RFPH}}$ | $V_{43}$ : 5 MHz Sine wave<br>Pit high reflection ratio mode           | -3    | —    | —    | dB            |
| EQ boost gain                                                         | $\Delta G_{\text{EQ}}$   | $V_7$ : 400 kHz, 1.44 MHz Sine wave<br>$V_8 = V_{\text{REF}}$          | 2.5   | 3.5  | 4.5  | dB            |
| AGC operation                                                         | $V_{\text{OMRFV}}$       | $V_7$ : 500 kHz Sine wave                                              | 0.4   | 0.5  | 0.6  | V[p-p]        |
| AGC discharge current                                                 | $I_{\text{AGC1}}$        | $V_7$ : sin 500 mV[p-p], 720 kHz<br>$V_8 = V_{\text{REF}}$             | -140  | -110 | -80  | $\mu\text{A}$ |
| AGC charging current                                                  | $I_{\text{AGC2}}$        | $V_7 = V_{\text{REF}}$ , $V_8 = V_{\text{REF}}$                        | 0.1   | 0.4  | 0.7  | $\mu\text{A}$ |
| EFM Peak peak detecting offset                                        | $\Delta V_{\text{PE}}$   | $V_7 = V_{\text{REF}}$                                                 | -200  | 0    | 200  | mV            |
| EFM Peak peak detecting level                                         | $V_{\text{PEAK}}$        | $V_7$ : 720 kHz AM modulation<br>Sine wave (1 kHz, 30%)                | 80    | 110  | 140  | mV[p-p]       |
| EFM bottom detecting offset                                           | $\Delta V_{\text{BO}}$   | $V_7 = V_{\text{REF}}$                                                 | -200  | 0    | 200  | mV            |
| EFM bottom detecting relative level                                   | $\Delta V_{\text{BOTM}}$ | $V_7$ : 720 kHz AM modulation<br>Sine wave (1 kHz, 30%)                | -20   | 0    | 20   | mV[p-p]       |
| 3T element envelope extracting level                                  | $V_{\text{3TMON}}$       | $V_7$ : 720 kHz AM modulation<br>Sine wave (5 kHz, 5%)                 | 125   | 185  | 245  | mV[p-p]       |

## ■ Usage Notes

### 1. Operation mode setting

#### • Gain switch setting

| NREC (Pin27) | RFSWHL (Pin28) | RFSWPG (Pin29) | Operation mode                 |
|--------------|----------------|----------------|--------------------------------|
| H            | H              | H              | Pit high reflection ratio mode |
| H            | L              | H              | Pit low reflection ratio mode  |
| H            | L              | L              | Groove mode                    |
| L            | L              | L              | Record mode                    |

#### • 3T detection circuit mode switch setting

| MONIOFF (Pin32) | Operation mode           |
|-----------------|--------------------------|
| H               | 3T detection circuit off |
| L               | 3T detection circuit on  |

#### • ADIP BPF mode switch setting

| CLV2 (Pin33) | Operation mode         | BPF center frequency     |
|--------------|------------------------|--------------------------|
| H            | Typical speed mode     | $f_O = 22.0 \text{ kHz}$ |
| L            | Line double speed mode | $f_O = 44.0 \text{ kHz}$ |

Note) The values shown on the list are for design purpose.

#### • APC mode setting

| LDON (Pin34) | Operation mode  |
|--------------|-----------------|
| H            | APC circuit on  |
| L            | APC circuit off |

#### • Power saving mode setting

| NRFSTBY (Pin35) | Operation mode         |
|-----------------|------------------------|
| H               | Normal operation       |
| L               | Power saving operation |

#### • Te stray light cancellation setting

| OFSON (Pin26) | Operation mode           |
|---------------|--------------------------|
| H             | Cancellation circuit on  |
| L             | Cancellation circuit off |

Note) This function is valid only for reading on the writable disk.

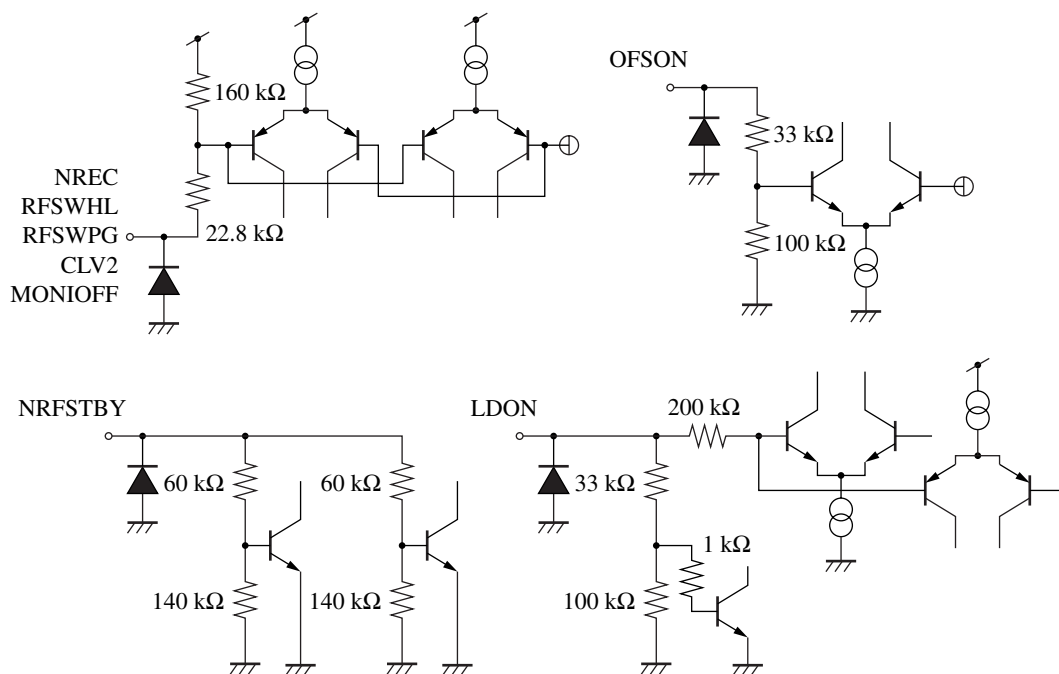
## ■ Usage Notes (continued)

### 2. Setting pin input voltage

Set the input voltages for OFSON (Pin26), NREC (Pin27), RFSWHL (Pin28), RFSWPG (Pin29), MONIOFF (Pin32), CLV2 (Pin33), LDON (Pin34) and NRFSTBY (Pin35). As listed below.

| Setting | Input voltage  |
|---------|----------------|
| H       | 1.4 V to 3.6 V |
| L       | 0.7 V or less  |

The related equivalent circuits are as follows.



Note) The resistance values are for designing.

## Request for your special attention and precautions in using the technical information and semiconductors described in this book

- (1) An export permit needs to be obtained from the competent authorities of the Japanese Government if any of the products or technologies described in this book and controlled under the "Foreign Exchange and Foreign Trade Law" is to be exported or taken out of Japan.
- (2) The technical information described in this book is limited to showing representative characteristics and applied circuits examples of the products. It neither warrants non-infringement of intellectual property right or any other rights owned by our company or a third party, nor grants any license.
- (3) We are not liable for the infringement of rights owned by a third party arising out of the use of the product or technologies as described in this book.
- (4) The products described in this book are intended to be used for standard applications or general electronic equipment (such as office equipment, communications equipment, measuring instruments and household appliances).  
Consult our sales staff in advance for information on the following applications:
  - Special applications (such as for airplanes, aerospace, automobiles, traffic control equipment, combustion equipment, life support systems and safety devices) in which exceptional quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or harm the human body.
  - Any applications other than the standard applications intended.
- (5) The products and product specifications described in this book are subject to change without notice for modification and/or improvement. At the final stage of your design, purchasing, or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.
- (6) When designing your equipment, comply with the guaranteed values, in particular those of maximum rating, the range of operating power supply voltage, and heat radiation characteristics. Otherwise, we will not be liable for any defect which may arise later in your equipment.  
Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.
- (7) When using products for which damp-proof packing is required, observe the conditions (including shelf life and amount of time let standing of unsealed items) agreed upon when specification sheets are individually exchanged.
- (8) This book may be not reprinted or reproduced whether wholly or partially, without the prior written permission of Matsushita Electric Industrial Co., Ltd.