# AK5482

## 10BIT 20MHz PIPELINE AD CONVERTER

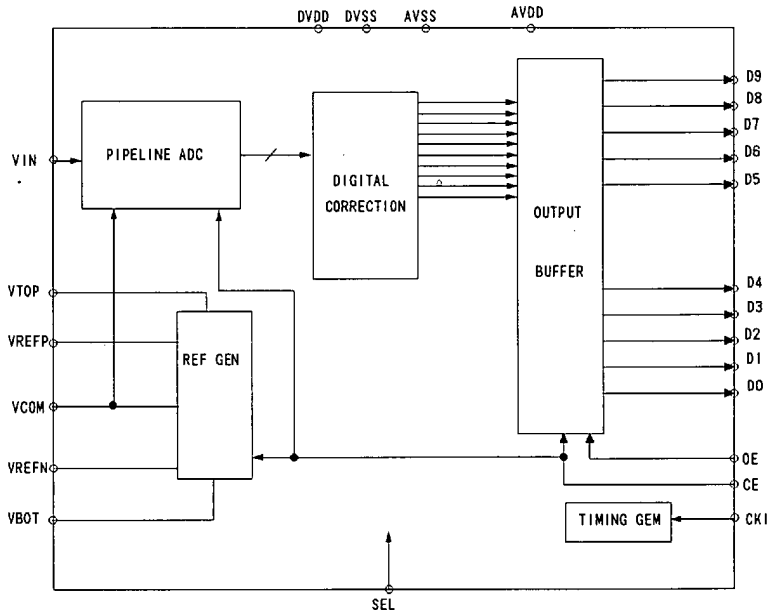
### General Description

AK5482 is a 10bit 20MHz AD Converter with Pipeline Architecture.
By advanced CMOS Technology, high conversion performance is realized under low power consumption at +3V single power supply.

### Features

- Monolithic CMOS A/D Converter
- Resolution :10Bit
- Sampling Rate :20MHz
- Integrated Sample & Hold Circuit
- Analog Input Range :1Vp-p (Single End)
- Low Voltage Single Power Supply :+3V (min.)
- Interface to CMOS logic
- Output Format :Binary (BOTTOM=000H , TOP=3FFH)
- Integrated Vref Circuit :(TYP. 1V(Bottom)..2V(Top))
- Tristate Digital Output available
- Stand-by mode
- Low power consumption :50mW(TYP. at 20MSPS)
  40mW(TYP. at 15MSPS)
  (EXCLUDING OUTPUT DRIVE CURRENT)
- No Calibrations required
- Linearity: Differential(DNL) +-0.5 LSB(TYP.)
  Integral (INL) +-1.5 LSB(TYP.)
- Compact Package : 24PIN VSOP

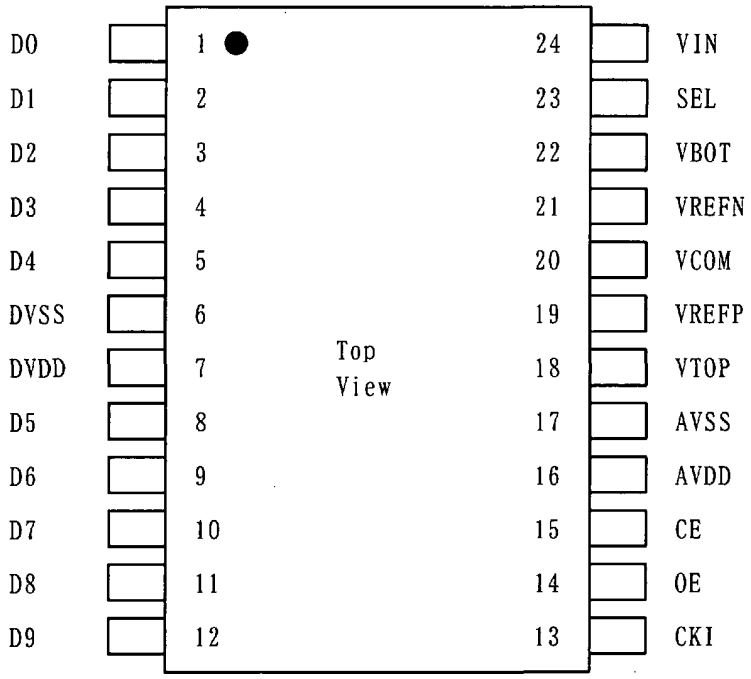
AK5482block Diagram



■ **Ordering Guide**

AK5482 -20°C+85°C 24pin VSOP(0.65mm pitch)

■ **Pin Layout**




**Specifications subject to change without notice

■ **Pin/Function**

| Pin No. | Pin Name | IO | Function |
|---|---|---|---|
| 1 | D0 | O | Digital Output D0(LSB)<br>Hi Impedance when OE or CE is high |
| 2 | D1 | O | Digital Output D1<br>Hi Impedance when OE or CE is high |
| 3 | D2 | O | Digital Output D2<br>Hi Impedance when OE or CE is high |
| 4 | D3 | O | Digital Output D3<br>Hi Impedance when OE or CE is high |
| 5 | D4 | O | Digital Output D4<br>Hi Impedance when OE or CE is high |
| 6 | DVSS | P | Digital Ground Pin |
| 7 | DVDD | P | Digital Power Supply Pin |
| 8 | D5 | O | Digital OUTPUT D5<br>Hi Impednace when OE or CE is high |
| 9 | D6 | O | Digital OUTPUT D6<br>Hi Impednace when OE or CE is high |
| 10 | D7 | O | Digital OUTPUT D7<br>Hi Impednace when OE or CE is high |
| 11 | D8 | O | Digital OUTPUT D8<br>Hi Impednace when OE or CE is high |
| 12 | D9 | O | Digital OUTPUT D9<br>Hi Impednace when OE or CE is high |
| 13 | CKI | I | Sampling Clock Input Pin |
| 14 | OE | I | Output Enable<br>Output (D0...D9) is active at OE=LOW, Hi Impedance when High |
| 15 | CE | I | Chip Enable (Power Down) Pin<br>Chip Operates at LOW, Power Down & Hi Impedance at High |
| 16 | AVDD | P | Analog Vdd<br>Analog Power Supply Pin |
| 17 | AVSS | P | ANALOG VSS<br>Analog Ground Pin |

| Pin No. | Pin Name | IO | Function |
|---|---|---|---|
| 18 | VTOP | IO | VREF Top Voltage IO Pin (TYP.2V)<br>Analog Input (VIN) Upper Limit Vref Pin<br>Assigned to Input Pin under EXT mode<br>Connected to AVSS with a 1uF capacitor at INT mode |
| 19 | VREFP | O | Vref Pin for Internal cIrcuit (VREFP = VCOM + 0.25V)<br>Normally connected to AVSS with 1uF Capacitor |
| 20 | VCOM | O | REFERENCE CENTER (ADC COMMON)<br>Intefnal Circuit Common Voltage Output (typ.1.5V)<br>Normally connected to AVSS with 1uF Capacitor |
| 21 | VREFN | O | Vref Pin for Internal Circuit (VREFN = VCOM - 0.25V)<br>Normally connected to AVSS with 1uF Capacitor |
| 22 | VBOT | IO | VREF Bottom Voltage IO Pin (TYP.1V)<br>Analog Input (VIN) Lower Limit Vref Pin<br>Assigned to Input Pin under EXT mode<br>Connected to AVSS with a 1uF capacitor at INT mode |
| 23 | SEL | I | Operation Mode Selection Pin<br>Vref mode and Maximum Sampling Frequency are determined<br>VSS: Internal Vref(INT)Mode & 20MHz Mode<br>VBOT: External Vref(EXT)Mode & 20MHz Mode<br>VDD: Internal Vref(INT)Mode & 15MHz Mode<br>VTOP: External Vref(EXT)Mode & 15MHz Mode |
| 24 | VIN | I | |

NOTE: I:INPUT O:OUTPUT IO:INPUT & OUTPUT P:POWER

## Absolute Maximum Rating

(AVSS,DVSS=0V,All Voltages with respect to ground)

| Parameter | Symbol | Condition | Rating | Unit |
|---|---|---|---|---|
| Power Supplies | | | | V |
| (Analog) | AVDD | | 6 | V |
| (Digital) | DVDD | | 6 | V |
| Analog Input Voltage(VIN) | VINA | | AVDD + 0.3 ~ AVSS - 0.3 | V |
| Digital Input Voltage | VINL | | DVDD + 0.3 ~ DVSS - 0.3 | V |
| Digital Output Voltage | VONL | | DVDD + 0.3 ~ DVSS - 0.3 | V |
| Reference Voltage | VINR | | AVDD +0.3 ~ AVSS - 0.3 | V |
| Temperature | | | | |
| (Ambient) | TA | | -20~85 | °C |
| (Storage) | Tstg | | -40~+125 | °C |

Warining: Operation at or beyond these limits may result in permanent damage to the device. Normal operation is not guaranteed at these extremes.

## Recommended Operating Conditions

(DVSS,AVSS=0V)

| Parameter | Symbol | Condition | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| Power Supply | AVDD | (note 1) | 3.0 | 3.3 | 3.6 | V |
| Voltage | DVDD | | 3.0 | 3.3 | 3.6 | V |
| Analog Input Range | AIN | INT mode | 0.85 | 0.95 | 1.05 | Vp-p |
| | | EXT mode | 0.9 | 1.0 | 1.1 | Vp-p |

(note 1):All voltages are with respect to Ground

## Electrical Characteristics

1)Digital Characteristics

(AVDD=DVDD=3.0..3.6V , AVSS=DVSS=0V, Ta=TAMIN~TAMAX°C
Measurement under static state.)

| Parameter | Symbol | Condition | min | typ | max | unit |
|---|---|---|---|---|---|---|
| Hi Level Input Voltage | VIH | | 0.7DVDD | | | V |
| Lo Level Input Voltage | VIL | | | | 0.3DVDD | V |
| Hi Level Output Voltage | VOH | IOH=-3mA | 0.7DVDD | | | V |
| Lo Level Output Voltage | VOL | IOL=3mA | | | 0.3DVDD | V |
| Hi Level Input Current | IIH | VIH=DVDD | -10 | | 10 | uA |
| Lo Level Input Current | IIL | VIL=0V | -10 | | 10 | uA |
| HI-Z Output Current(HI) | IOZH | OE= DVDD | | | 10 | uA |
| HI-Z Output Current(LO) | IOZL | OE= DVDD | -10 | | | uA |

2)Analog Characteristics

(AVDD,DVDD=3.0..3.6V , DVSS,AVSS=0V, Ta=25℃
;VTOP=2.0V VBOT=1.0V:)

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| Resolution | RES | | 10 | | | BITS |

2-1 DC Accuracy

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| Integral Non Linearity | INL | Fs=18MHz (@20MHz mode) | | +-1.5 | +-2.5 | LSB |
| Differential Non Linearity | DNL | Fs=15MHz (@15MHz mode) | | +-0.5 | +-1.0 | LSB |
| Offset Voltage | EOB<br>EOT | TO VBOT<br>TO VTOP(note2) | -100<br>-100 | | +100<br>+100 | mV<br>mV |
| Gain Error | | | | 1 | | %FS |

(note2 ) Offset Voltage shows the difference between VIN and VBOT(VTOP) at Digital Outputs are all zero(all one).

2-2 Power Supplies

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| Power Supply Current(Analog) | IA+ | Fin=1MHz<br>FS=20MHz<br>FS=15MHz* | | <br>14.5<br>11.0 | <br>18<br>14 | <br>mA<br>mA |
| Power Supply Current (Digital) | ID+ | Fin=1MHz NOTE3<br>FS=20MHz<br>FS=15MHz* | | <br>5.0<br>3.5 | <br>8.0<br>7.0 | <br>mA<br>mA |
| Power Down mode Current (Analog)<br>(Digital) | IAS<br>IDS | | | | 0.1<br>0.1 | mA<br>mA |

(note3 ) Measurement under CL=10pF to each D0..D9 Output Pin
*When 15MHz is selected by SEL pin

2-3 Analog Input

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| Analog Voltage Range (Single End) | AIN | INT mode<br>EXT mode | 0.85<br>0.9 | 0.95<br>1.0 | 1.05<br>1.1 | Vpp<br>Vpp |
| Analog Input Current | AIH | VIN=2.0V | | | 10 | uA |
| Analog Input Current | AIL | VIN=1.0V | -10 | | | uA |
| Input Capacitance | CIN | | | 10 | | pF |
| Analog Input Bandwidth | BW | -1dB | | 21 | | MHz |

2-4 Voltage Reference

2-4-1 Internal VREF Output (INT Mode)

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| Vref Output Voltage (Bottom) | VBOTI | | 0.85 | 0.95 | 1.05 | V |
| Vref Output Voltage (Top) | VTOPI | | 1.85 | 1.90 | 2.05 | V |
| Vref Output Current | AVR | | -0.1 | | 0.1 | mA |

2-4-2 External VREF Input Conditions(EXT Mode)

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| Vref Input Voltage Bot | VBOTE | (note 4) | 0.85 | 0.95 | 1.05 | V |
| Vref Input Voltage Top | VTOPE | (note 4) | 1.85 | 1.95 | 2.05 | V |
| Vref Input Impedance | ZTBE | VBOT - VTOP | 100 | 200 | | KOHM |

(note 4:Voltage from VBOTE to VTOPE are subjected to the same range of the Input Volage Range(item 2-3).

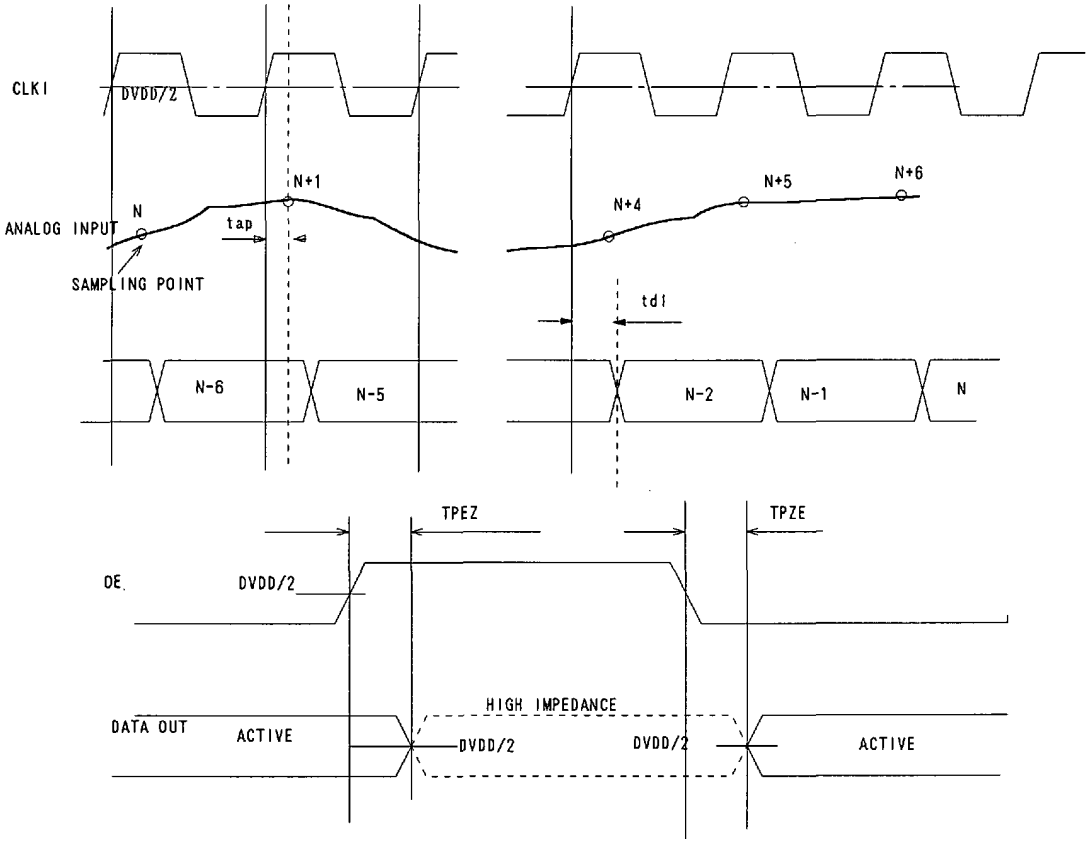
2-5 Dynamic Characterisitcs

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| S/(N+D) | SND | FS=18MHz Fin=1MHz | | 56 | | dB |
| S/N | SNR | FS=18MHZ FIN=1MHz | | 58 | | dB |

2-6 Switching Characteristics

(AVDD,DVDD=3.0....3.6 V, AVSS,DVSS=0V, Ta=TAMIN~TAMAX°C)

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| Max. Conversion Rate | Fcmax | | 18 | | | MHz |
| Min. Conversion Rate | Fcmin | | | | 0.5 | MHz |
| Clock HI period | tpw1 | 20MHZ mode | 25 | | | ns |
| Clock LO period | tpw0 | 20MHZ mode | 25 | | | ns |
| Clock Duty | DUTY | 15MHz mode | 45 | 50 | 55 | % |
| Pipeline Delay | tpd | | 6 | 6 | 6 | CLKIN |
| Sampling Delay | tap | | | 2 | 4 | ns |
| Date Output Delay | tdl | CL=20 pF | | 7 | 12 | ns |
| Tristate Disable Delay | TPEZ | ACTIVE->HI Z | | 20 | | ns |
| Tristate Enable Delay | TPZE | HI Z->ACTIVE | | 20 | | ns |



## Digital Logic

Digital Output

Relation between Input and Digital Output

| Input Voltage | | | | | | Digital Output Code | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | MSB | | | | | | | | | LSB |
| | | | | | | | | | | | | | | | |
| VTOP | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| : | | | | | | | | | | : | | | | | |
| : | | | | | | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| : | | | | | | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| : | | | | | | | | | | : | | | | | |
| VBOT | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Output Code with CE/OE setting

| OE | CE | | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LO | LO | | P | P | P | P | P | P | P | P | P | P |
| HI | LO | | Z | Z | Z | Z | Z | Z | Z | Z | Z | Z |
| LO | HI | | Z | Z | Z | Z | Z | Z | Z | Z | Z | Z |
| HI | HI | | Z | Z | Z | Z | Z | Z | Z | Z | Z | Z |

NOTE: P: Positive output
Z:High Impedance

Vref Mode Selection(by SEL pin)

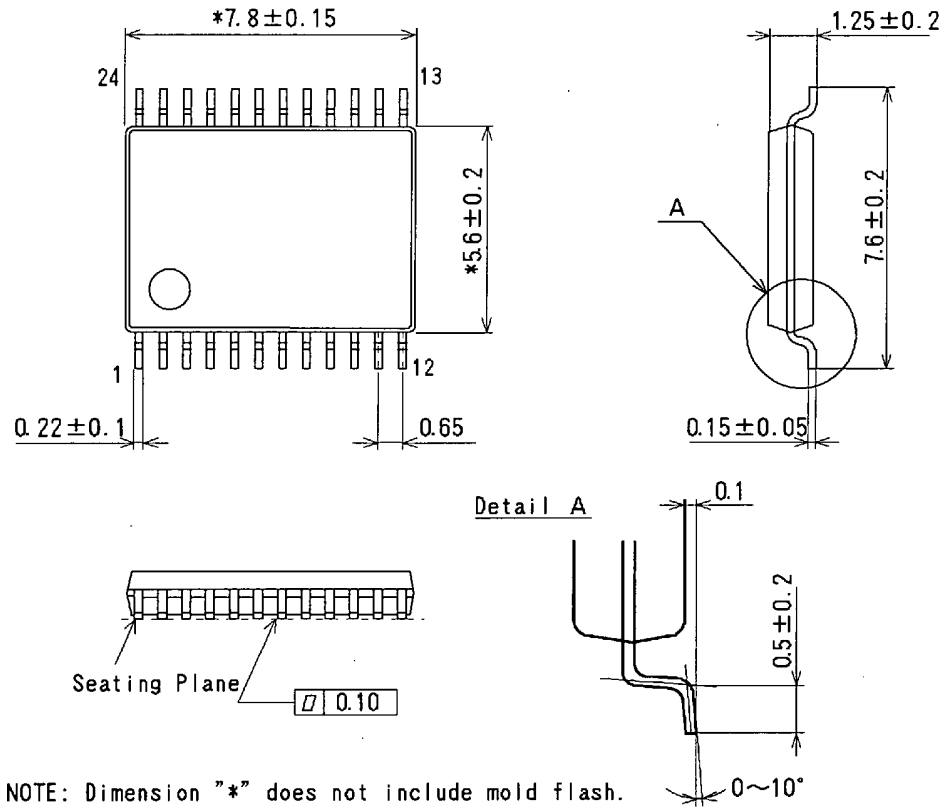
| Connection | MODE | Operation |
|---|---|---|
| VSS OR VDD | INT MODE | Input Range is determined by Internal Vref Circuit. Internal Vref voltages are supplied through VTOP (typ. 2V) and VBOT(typ. 1V). |
| VBOT OR VTOP | EXT MODE | AD Conversion is performed based on External Vref. External Vref voltages are fed through VTOP(typ. 2V) and VBOT(typ. 1V). |

Frequency Mode Selection(By SEL pin)

| Connection | MODE | Operation |
|---|---|---|
| VSS OR VBOT | 20MHz MODE | 20MHz Mode is selected<br>Fcmax is 20MHz |
| VDD OR VTOP | 15MHz MODE | 15MHz Mode is selected<br>Fcmax is 15MHz<br>Power consumption is lower than 20MHz mode |

## Package

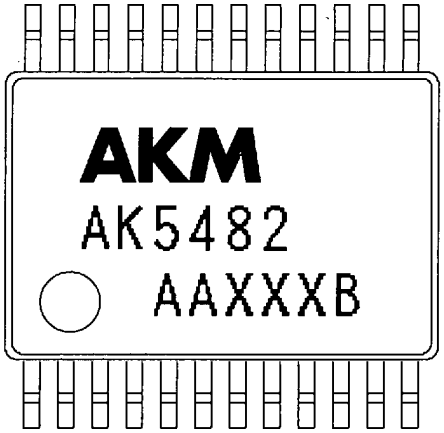
● **24pin VSOP (Unit: mm)**




■ **Package & Lead frame material**

| | |
|---|---|
| Package molding compound: | Epoxy |
| Lead frame material: | Cu |
| Lead frame surface treatment: | Solder plate |

## Marking



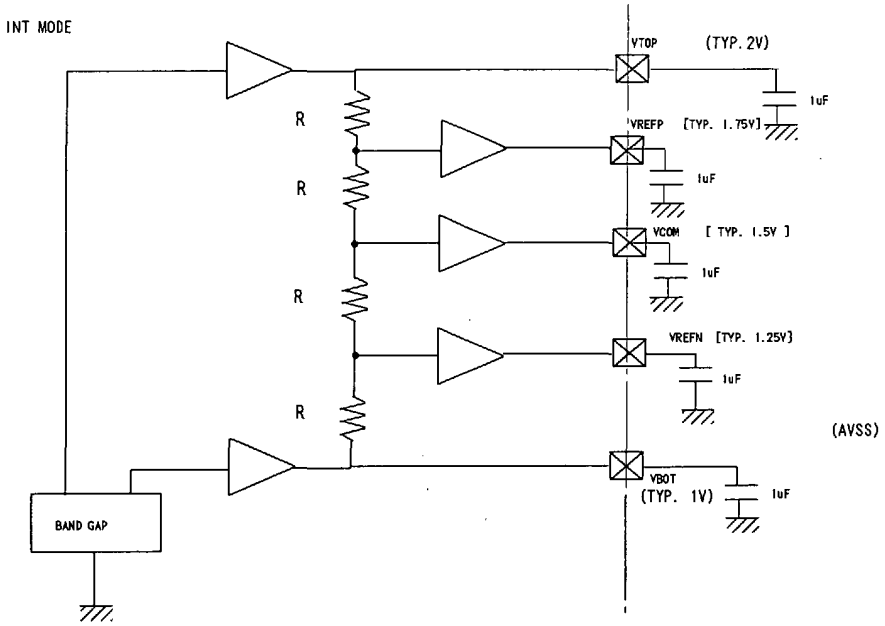

Contents of AAXXXB

AA: Lot#(alphabet)

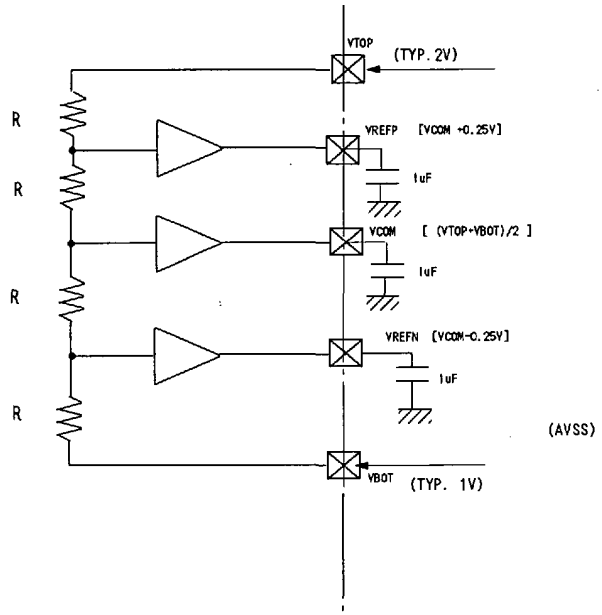
XXXB: Date Code(X:numbers,B:alphabet)

## System Design

INT MODE




EXT MODE




Rtotal= 4 * R =100 KΩ(MIN.)

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