2-channel PRE / REC amplifier with auto-tracking interface

BA7181FS

The BA7181FS is a PRE / REC amplifier developed for use in video cassette recorders. It has been designed for use in two-head decks and features built-in FB damping, two preamplifiers, a chroma output amplifier, an FM output amplifier (with AGC), an envelope detector, a constant-current BTL-drive REC amplifier (with AGC)and built-in channel and REC / PB switches on a single monolithic IC.

●Applications

VCRs

●Features

1) The playback amplifier has a total gain of 57dB (Typ.), and has a low-noise preamplifier. Designed for VHS-band operation with low external parts count. The IC has two circuits for two-head VCR applications.
2) Two playback output systems (through output and AGC output). The AGC output level is 300mV$_{P-P}$(Typ.); suitable for FM brightness signal output.
3) Auto-tracking interface is provided for automated tracking adjustment. The detector characteristic is linear, and the sensitivity can be adjusted using external components.
4) The recording amplifier uses constant-current BLT drive that handles load variations (i.e. head impedance)well, and gives stable recording characteristics. A single circuit is provided for two-head VCR use.
5) Built-in recording level AGC means adjustment of FM recording current is not necessary.
6) Head switches for two-channel PRE / REC system provided.
7) Operates off a single 5V power supply, with low power dissipation.

●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Applied voltage	V_{CC}	7.0	V
Power dissipation	Pd	937.5*	mW
Operating temperature	Topr	– 20 ~ + 65	°C
Storage temperature	Tstg	– 55 ~ + 150	°C

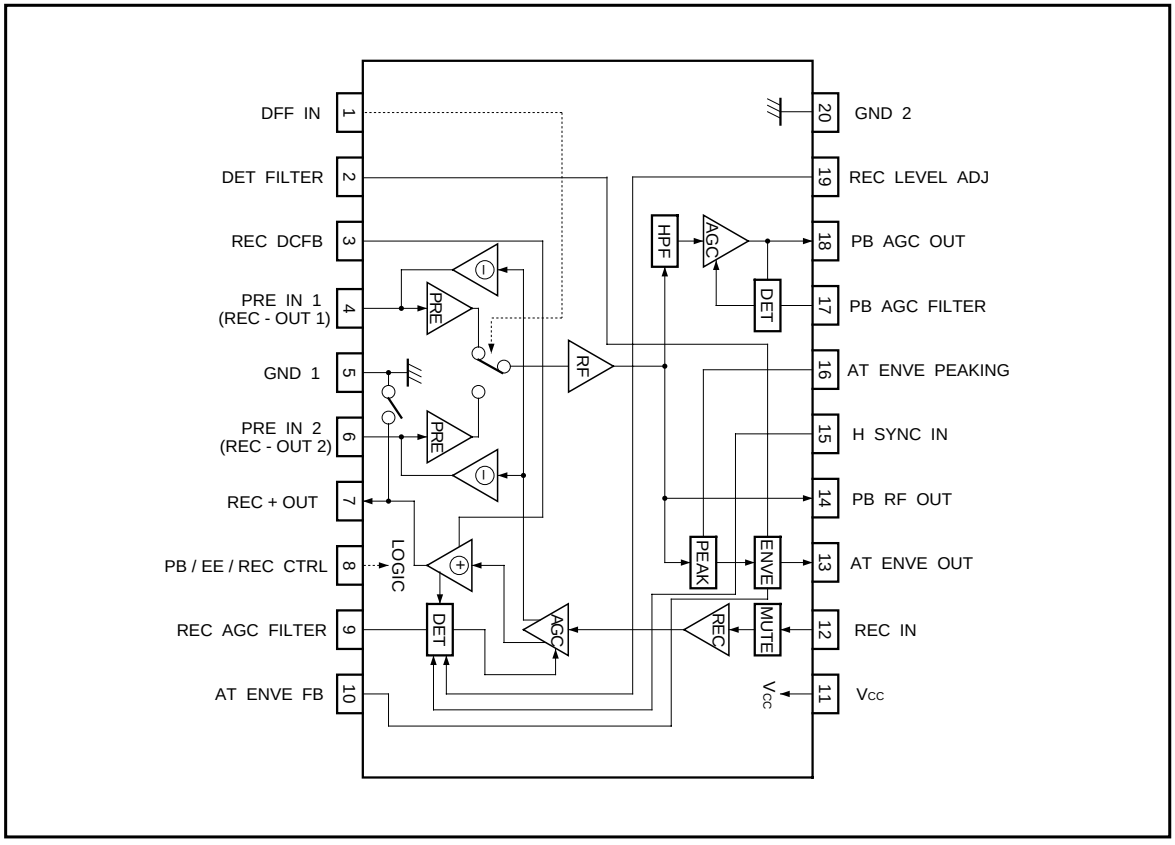
* When mounted on a 90mm × 50mm, t = 1.6mm glass epoxy board.
Reduced by 7.5mW for each increase in Ta of 1°C over 25°C.

●Recommended operating (Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Playback / recording (voltage range)	V_{CC}	4.5	5.0	5.5	V	11pin

○Not designed for radiation resistance.

●Block diagram



●Electrical characteristics (unless otherwise noted, Ta = 25°C, V_{CC} = 5.0V and f = 4.0MHz)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement circuit
〈Playback system〉 (Fig. 1 measurement circuit, pin 8: "H")							
Quiescent current	$I_{Q\,(P)}$	—	18	45	mA	No signal	Fig.1
Voltage gain CH-1	G_{VP1}	54	57	60	dB	Pin 4 input = 0.3mV_{P-P}, pin 1: L, pin 14 output measurement	Fig.1
Voltage gain CH-2	G_{VP2}	54	57	60	dB	Pin 6 input = 0.3mV_{P-P}, pin 1: H, pin 14 output measurement	Fig.1
Voltage gain differential	ΔG_{VP}	—	0	1	dB	$\Delta G_{VP} = \lvert G_{VP1} - G_{VP2} \rvert$	Fig.1
Frequency characteristic	ΔG_{Vf}	– 7	– 3	0	dB	Difference in pin 14 output level for f = 8.0 / 1.0MHz, V_{IN} = 0.3mV_{P-P}	Fig.1
2nd harmonic distortion*	$2HD_P$	—	– 45	—	dBc	V_{IN} = 0.3mV_{P-P}, 8.0MHz spurious	Fig.1
3rd harmonic distortion*	$3HD_P$	—	– 45	—	dBc	V_{IN} = 0.3mV_{P-P}, 12.0MHz spurious	Fig.1
Maximum output level	V_{OMP}	1.0	1.5	—	V_{P-P}	When pin 14 output 2nd harmonic distortion is –30dBc	Fig.1
Crosstalk	CT_P	—	– 38	– 32	dBc	Difference in pin 14 output level for pin 1: H / L	Fig.1

* Design reference values.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement circuit
⟨Playback system⟩ (Fig. 1 measurement circuit, pin 8: "H")							
Output DC offset	ΔV_{ODC}	—	0	150	mV_{P-P}	Pin 14 output DC offset for pin 1: H / L	Fig.1
Input conversion noise*	V_{NIN}	—	0.25	—	μV_{rms}	Rg = 10Ω, input conversion of pin 14 output noise	Fig.1
AGC output level	V_{AGC}	250	300	350	mV_{P-P}	V_{IN} = 0.3mV_{P-P}, pin 18 output measurement	Fig.1
AGC control sensitivity	ΔV_{AGC}	—	0.3	2.0	dB	Pin 18 output difference for V_{IN} = 0.15 ~ 0.6mV_{P-P}	Fig.1
AGC amp frequency characteristic*	ΔG_{VAF}	—	0.5	—	dB	Pin 18 output level difference for f = 8.0 / 1.0MHz, V_{IN} = 0.3mV_{P-P}	Fig.1
PB switch ON resistance*	R_{ON7}	—	4	—	Ω	Pin 7 impedance	Fig.1
PRE CH 2 threshold voltage	V_{TH1H}	3.5	—	V_{CC}	V	Pin 1 DC voltage for channel 2 operation	Fig.1
PRE CH 1 threshold voltage	V_{TH1L}	0	—	1.2	V	Pin 1 DC voltage for channel 1 operation	Fig.1
ENVE residual voltage	V_{ENV1}	—	0.7	1.0	V	Pin 13 output measurement with no signal	Fig.1
ENVE output level	V_{ENV2}	2.4	2.9	3.4	V	Pin 13 output measurement when pin 14 output = 400mV_{P-P}	Fig.1
ENVE saturation voltage	V_{ENV3}	4.0	4.5	—	V	Pin 13 output measurement for large signal	Fig.1
PB mode holding voltage	V_{TH10H}	3.8	—	V_{CC}	V	Pin 8 DC voltage for PB mode	Fig.1
EE mode holding voltage	V_{TH10M}	2.2	—	2.8	V	Pin 8 DC voltage for REC MUTE mode	Fig.1
REC mode holding voltage	V_{TH10L}	0	—	1.2	V	Pin 8 DC voltage for REC mode	Fig.1

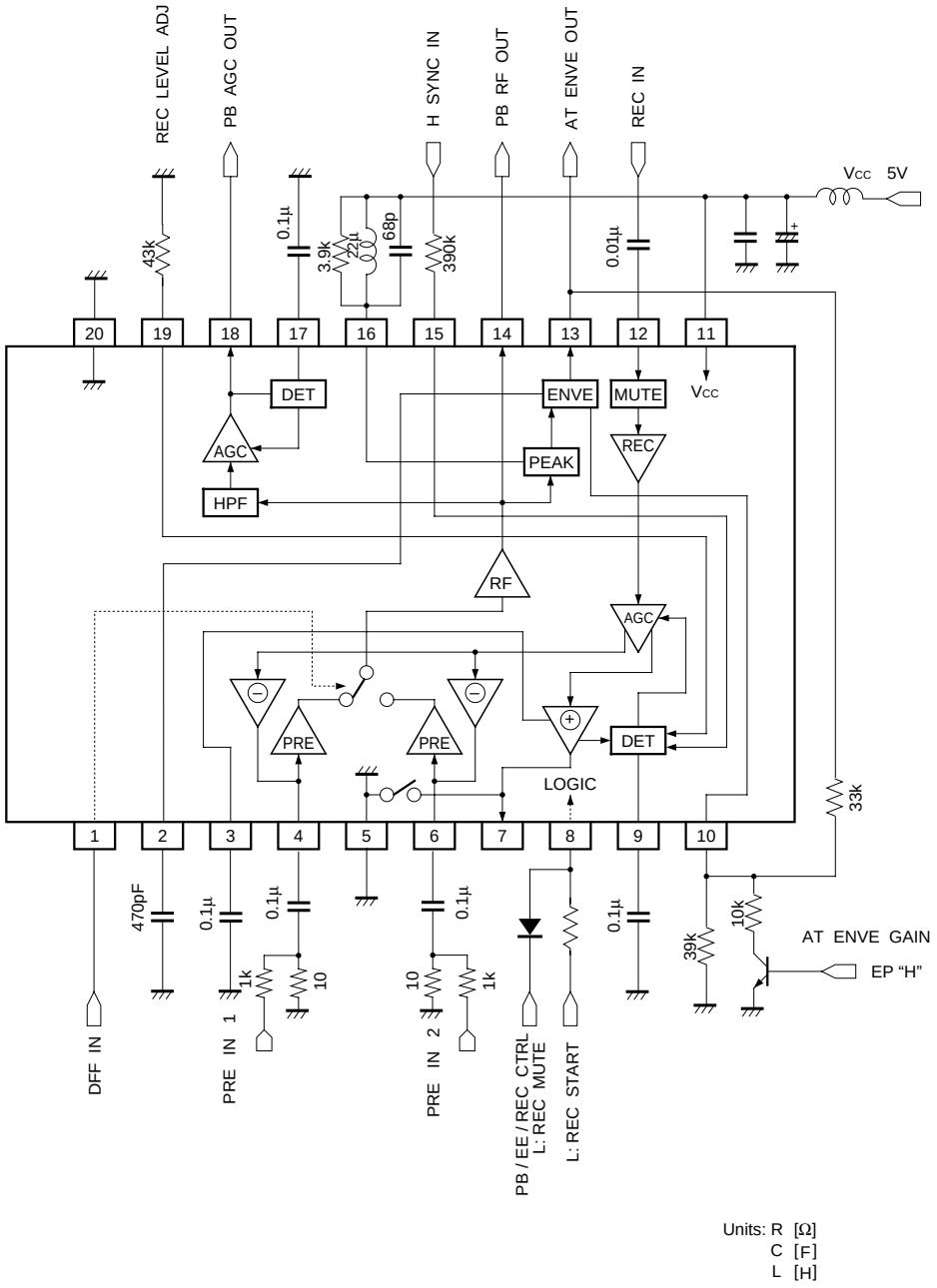
Note: dBc: dB below carrier (used to express relative level from carrier reference for convenience sake).
* Design reference values.

(unless otherwise noted, Ta = 25°C, V_{CC} = 5.0V, f = 4.0MHz and I_{OAR} = 30mA_{P-P})

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement circuit
⟨Recording system⟩ (Pin 8 in Fig. 2 measurement circuit "L")							
Supply current	$I_{q(R)}$	—	72	110	mA_{P-P}	No signal	Fig.2
Recording AGC level	I_{OAR}	27	30	33	mA	Pin 12 input = 125mV_{P-P}, pin 7 output measurement	Fig.2
AGC control sensitivity	ΔI_{OAR}	—	0.3	1.5	dB	Pin 7 output level difference for pin 12 input = 62.5mV_{P-P} and 250mV_{P-P}	Fig.2
REC Amp frequency characteristic*	ΔI_{OAF}	—	– 1.5	—	dB	Pin 7 output level difference for f = 8.0 / 1.0MHz, pin 12 input = 125mV_{P-P}	Fig.2
2nd harmonic distortion*	$2HD_R$	—	– 45	—	dBc	Pin 12 input = 125mV_{P-P}, 8MHz spurious	Fig.2
3rd harmonic distortion*	$3HD_R$	—	– 50	—	dBc	Pin 12 input = 125mV_{P-P}, 12.0MHz spurious	Fig.2
Cross modulation distortion*	CMD_R	—	– 50	—	dBc	4.0MHz ± 630kHz spurious	Fig.2
Maximum output level	I_{OMR}	40	50	—	mA_{P-P}	When pin 7 output 2nd harmonic distortion is – 30dB	Fig.2
Recording current load characteristic*	ΔI_{ORL}	—	– 0.35	—	dB	Pin 7 output level difference for load L: 8.2 ~ 12μH	Fig.2
Mute attenuation ratio	MU_R	—	– 45	– 38	dBc	Pin 7 output level difference for pin 8: M / H	Fig.2
AGC mode holding voltage	V_{TH15H}	2.7	—	V_{CC}	V	Pin 15 DC voltage to maintain recording AGC operation	Fig.2
$\overline{\text{AGC}}$ mode holding voltage	V_{TH15L}	0	—	1.2	V	Pin 15 DC voltage to maintain recording AGC stopped	Fig.2

* Design reference values.

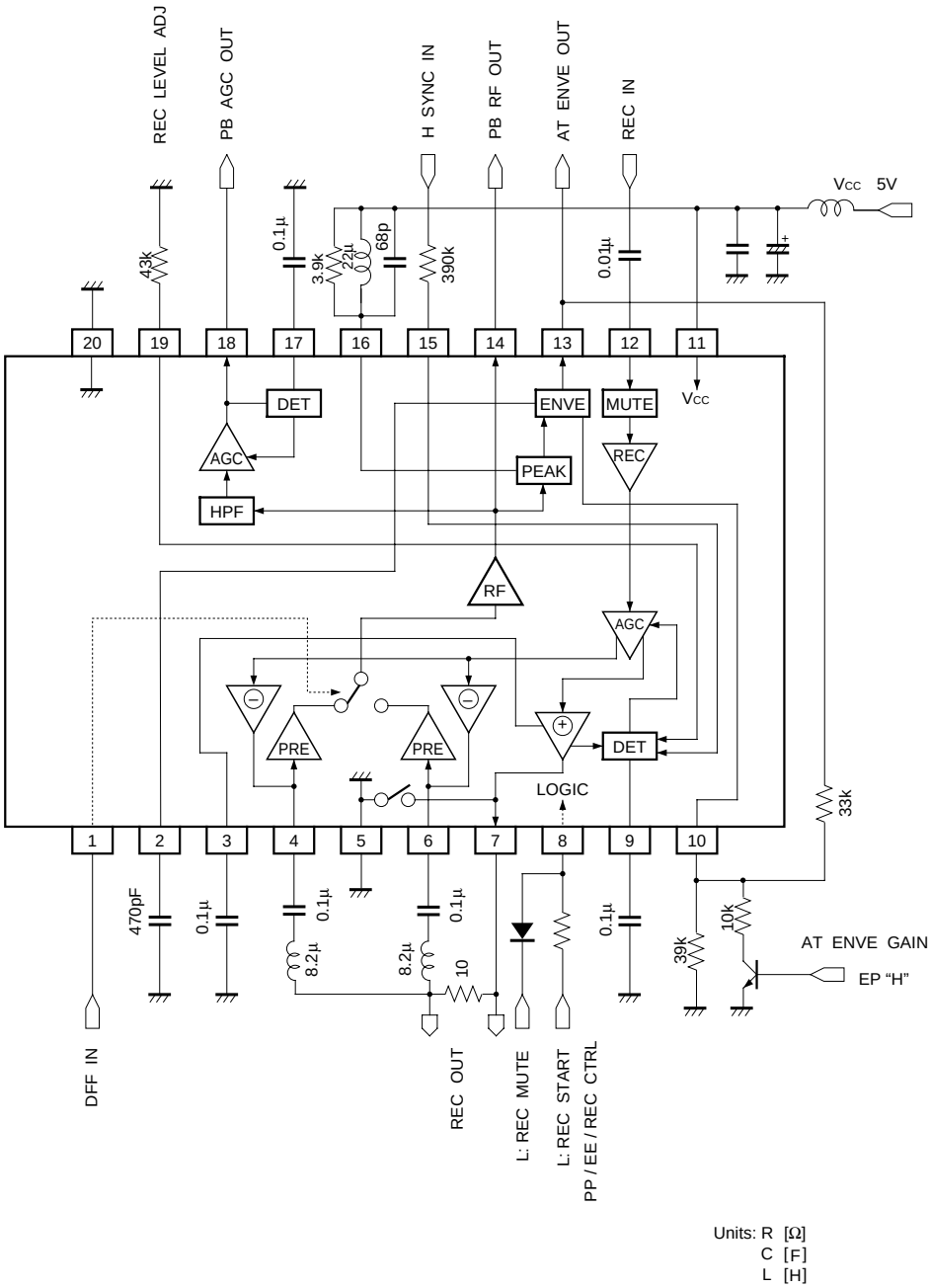
●Measurement circuits
(Playback system)



Units: R [Ω]
C [F]
L [H]

Fig.1

(Recording system)



Units: R [Ω]
C [F]
L [H]

Fig.2

●Control mode tables

(1) DFF IN (pin 1)

• Playback input selection (head switching)

Control pin	Function	Control voltage V_{CTRL1} [V]
DFF IN	Selected playback input	
H	Channel2 (PRE IN2 7pin)	3.5 ~ V_{CC}
L	Channel1 (PRE IN1 5pin)	0.0 ~ 1.2

(2) H SYNC IN (pin 15)

• Controls recording AGC detector block operation.

Control pin	Function	Control voltage V_{CTRL15} [V]
H SYNC	AGC detector	
H	ON	2.7 ~ V_{CC}
L	OFF	0.0 ~ 1.2

(3) PB / EE / REC CTRL (pin 8)

• Playback / recording mute / recording mode switching

Control pin	Mode	Function				Control voltage V_{CTRL9} [V]
PB / EE / REC		PRE AMP	AT ENVE	REC MUTE	REC AMP	
H	PB	ON	ON	OFF	OFF	3.8 ~ V_{CC}
M	REC MUTE	OFF	OFF	ON	ON	2.2 ~ 2.8
L	REC	OFF	OFF	OFF	ON	0.0 ~ 1.2

✻ Pin 8 is pulled up to V_{CC} via a 33kΩ resistor.

●Application example

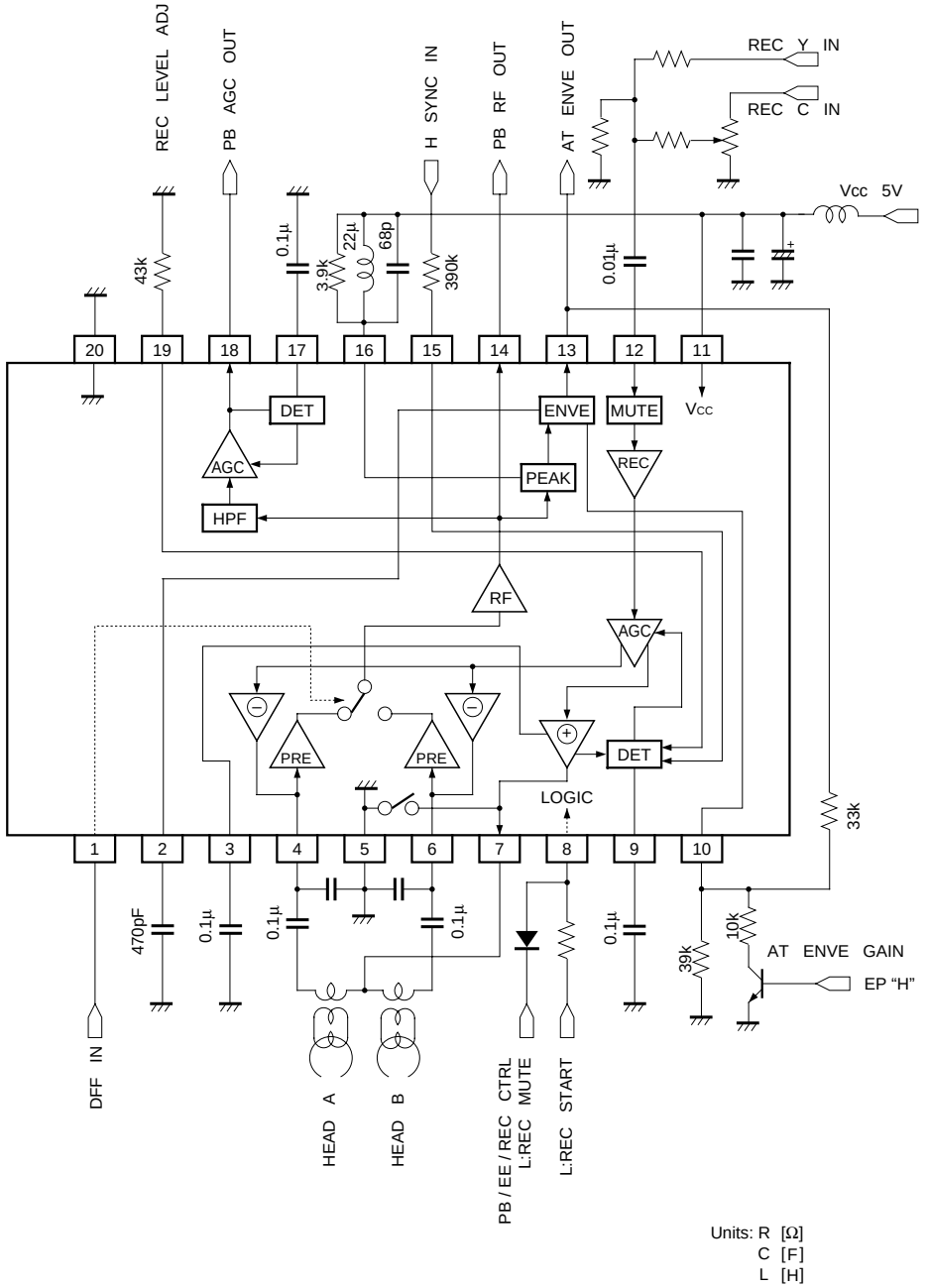
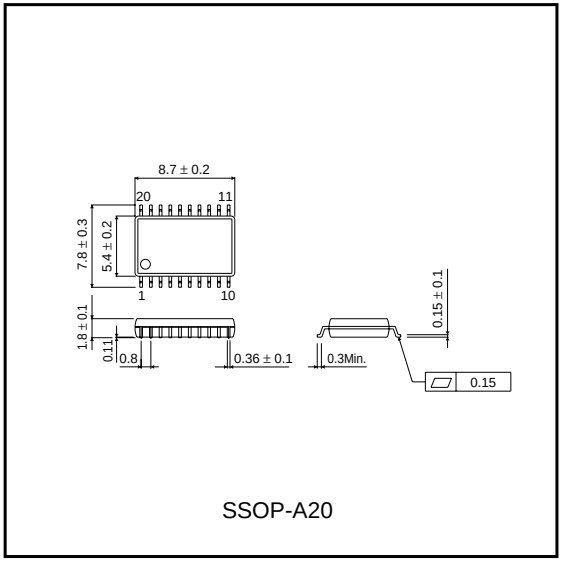


Fig.3

●External dimensions (Units: mm)



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