

# AN5441S

## Deflection distortion correction IC

### ■ Overview

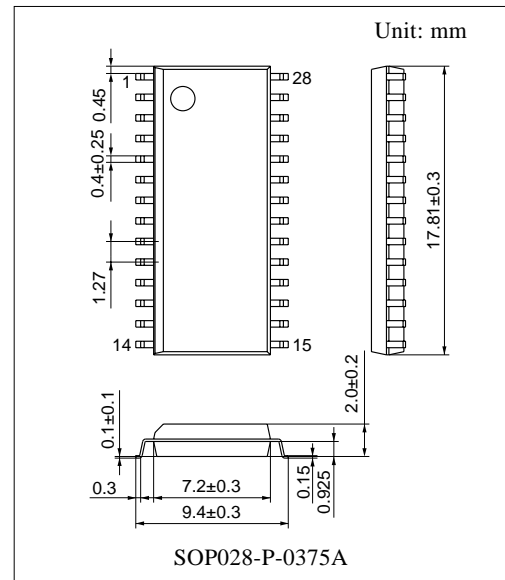
The AN5441S is a distortion correction processing IC for deflection system of color televisions and wide screen televisions.

### ■ Features

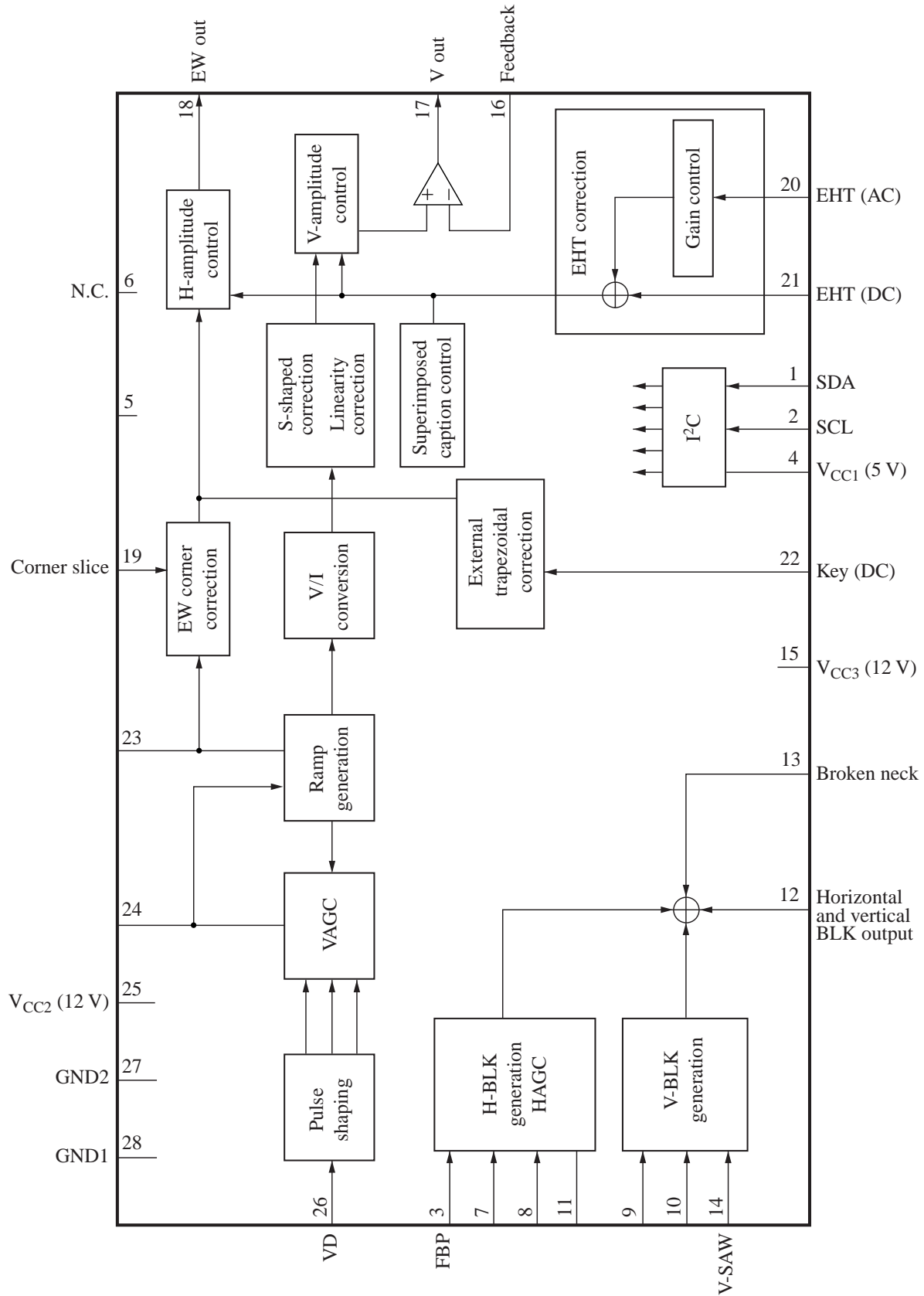
- Distortion correcting functions
  - Vertical amplitude
  - Vertical linearity
  - Vertical S-shape
  - Vertical position
  - Vertical EHT
  - Horizontal amplitude
  - EW parabola
  - Trapezoidal
  - Upper/lower EW corner
  - Horizontal EHT
- Built-in horizontal and vertical blanking pulse generation circuit
- Supports I<sup>2</sup>C bus control

### ■ Applications

- Color televisions and wide screen televisions



■ Block Diagram



### ■ Pin Descriptions

Pin No.	Description	Pin No.	Description
1	I <sup>2</sup> C SDA input	15	V <sub>CC3</sub> (12 V)
2	I <sup>2</sup> C SCL input	16	Vertical feedback input
3	Horizontal FBP input	17	Vertical pre-drive output
4	V <sub>CC1</sub> (5 V)	18	EW output
5	Test pin	19	Corner slice voltage
6	N.C.	20	EHT-AC input
7	H-BLK high-level slice voltage	21	EHT-DC input
8	H-BLK low-level slice voltage	22	Control for keystone correction
9	V-BLK high-level slice voltage	23	Capacitor for ramp generation
10	V-BLK low-level slice voltage	24	Capacitor for V-AGC
11	Capacitor for H-AGC	25	V <sub>CC2</sub> (12 V)
12	Horizontal and vertical BLK output	26	VD pulse input
13	Broken neck detection	27	GND2
14	V-BLK sawtooth input	28	GND1

### ■ Absolute Maximum Ratings

Parameter	Symbol		Rating	Unit
Supply voltage	V <sub>CC</sub>	V <sub>CC1</sub>	5.6	V
		V <sub>CC2</sub> , V <sub>CC3</sub>	13.4	
Supply current	I <sub>CC</sub>	I <sub>CC1</sub>	24.5	mA
		I <sub>CC2</sub>	24.0	
		I <sub>CC3</sub>	3.2	
Power dissipation *2	P <sub>D</sub>		449	mW
Operating ambient temperature *2	T <sub>opr</sub>		-20 to +70	°C
Storage temperature *1	T <sub>stg</sub>		-55 to +150	°C

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

\*2 : The power dissipation shown is the value for T<sub>a</sub> = 70°C.

### ■ Recommended Operating Range

Parameter	Symbol	Range	Unit
Supply voltage	V <sub>CC1</sub>	4.5 to 5.5	V
	V <sub>CC2</sub>	10.8 to 13.2	
	V <sub>CC3</sub>	10.8 to 13.2	

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Circuit current $I_{CC1}$	$I_4$	$V_{CC1} = 5\text{ V}, V_{CC2} = 12\text{ V}, V_{CC3} = 12\text{ V}$	11.7	17.0	20.2	mA
Circuit current $I_{CC2}$	$I_{25}$	$V_{CC1} = 5\text{ V}, V_{CC2} = 12\text{ V}, V_{CC3} = 12\text{ V}$	13.1	16.6	20.2	mA
Circuit current $I_{CC3}$	$I_{15}$	$V_{CC1} = 5\text{ V}, V_{CC2} = 12\text{ V}, V_{CC3} = 12\text{ V}$	1.8	2.1	2.3	mA
EHT-AC input pin voltage	$V_{20-27, 28}$	$V_{CC1} = 5\text{ V}, V_{CC2} = 12\text{ V}, V_{CC3} = 12\text{ V}$	2.6	3.0	3.4	V
Vertical pull-in frequency 1	$f_{V1}$	$f_V = 50\text{ Hz}$ input	45	50	55	Hz
Vertical pull-in frequency 2	$f_{V2}$	$f_V = 60\text{ Hz}$ input	55	60	65	Hz
Typical vertical output amplitude	$e_{V(\text{typ})}$	typ.	2.3	2.7	3.1	V[p-p]
Typical EW output amplitude	$e_{E(\text{typ})}$	typ.	1.42	1.82	2.22	V[p-p]
Vertical BLK output pulse width	$t_{VB}$	Wide	3.3	4.8	6.2	ms
Horizontal BLK output pulse width 1	$t_{HB(1)}$	Normal	11.7	12.2	12.7	$\mu\text{s}$
Horizontal BLK output pulse width 2	$t_{HB(2)}$	Wide	37	39	41	$\mu\text{s}$
Vertical output amplitude change ratio (max.)	$\frac{e_{V(\text{max})}}{e_{V(\text{typ})}}$	V amplitude typ. $\rightarrow$ max. ratio	42	48	54	%
Vertical output amplitude change ratio (min.)	$\frac{e_{V(\text{min})}}{e_{V(\text{typ})}}$	V amplitude typ. $\rightarrow$ min. ratio	-54	-48	-42	%
Vertical output S-shape change ratio 1	$\Delta e_{VS1}$	Vertical S-shape min. $\rightarrow$ max. ratio	-20	-13	-6	%
Vertical output S-shape change ratio 2	$\Delta e_{VS2}$	Vertical S-shape min. $\rightarrow$ max. ratio (change of V out 40% to 60% point)	—	1.5	6.0	%
Vertical output (upper side) linearity change ratio 1	$\Delta e_{VC1}$	Vertical linearity (upper side) typ. $\rightarrow$ max.	6	10	14	%
Vertical output (upper side) linearity change ratio 2	$\Delta e_{VC2}$	Vertical linearity (upper side) typ. $\rightarrow$ max.	-14	-10	-6	%
Vertical output position change amount (max.)	$\Delta e_{VP(\text{max})}$	Vertical position typ. $\rightarrow$ max.	-1.0	-0.8	-0.6	V
Vertical output position change amount (min.)	$\Delta e_{VP(\text{min})}$	Vertical position typ. $\rightarrow$ min.	0.5	0.7	0.9	V
Vertical output (lower side) linearity change ratio 1	—	Vertical linearity (lower side) typ. $\rightarrow$ max.	8	12	16	%
Vertical output (lower side) linearity change ratio 2	—	Vertical linearity (lower side) typ. $\rightarrow$ min.	-16	-12	-8	%
Vertical output EHT-DC change	$\Delta e_{VED}$	EHT-DC = 6 V, vertical EHT, min. $\rightarrow$ max.	-24.8	-21.8	-18.8	%
Vertical output EHT-AC change 1	$\Delta e_{VEA(1)}$	EHT-AC = 2 V, VEHT: max., EHT gain, min. $\rightarrow$ max.	-16	-12	-8	%
Vertical output EHT-AC change 2	$\Delta e_{VEA(2)}$	EHT-AC = 4 V, VEHT: max., EHT gain, min. $\rightarrow$ max.	9	13	17	%
Vertical output superimposed caption change 1	$\Delta e_{VJ(1)}$	Vertical superimposed caption min. $\rightarrow$ max.	-13	-10	-7	%
Vertical output superimposed caption change 2	$\Delta e_{VJ(2)}$	Vertical superimposed caption min. $\rightarrow$ max., V amplitude typ. $\rightarrow$ min.	-15	-11	-7	%

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Vertical output amplitude (max.)	$\Delta e_{V(\max)}$	V amplitude max.	3.5	3.9	4.3	V
Vertical output amplitude (min.)	$\Delta e_{V(\min)}$	V amplitude min.	1.1	1.4	1.7	V
Vertical output center DC level	$\Delta e_{VDC}$	typ.	4.5	4.9	5.3	V
EW output parabolic amplitude change (min.)	$e_{E(\min)}$	Parabolic amplitude min.	0	0.1	0.5	V[p-p]
EW output parabolic amplitude change (max.)	$e_{E(\max)}$	Parabolic amplitude max.	2.5	3.5	4.5	V[p-p]
EW output horizontal amplitude change (min.)	$e_{ED(\min)}$	Horizontal amplitude min.	5.45	6.0	6.93	V
EW output horizontal amplitude change (max.)	$e_{ED(\max)}$	Horizontal amplitude max.	0.7	2.0	2.6	V
EW output trapezoidal change (min.)	$\Delta e_{ET(\min)}$	Trapezoidal SW : On, trapezoidal typ. → min.	64	96	126	%
EW output trapezoidal change (max.)	$\Delta e_{ET(\max)}$	Trapezoidal SW : On, trapezoidal typ. → max.	-130	-100	-68	%
EW output upper corner change (min.)	$\Delta e_{ECT(\min)}$	Upper corner min.	-95	-65	-35	%
EW output upper corner change (max.)	$\Delta e_{ECT(\max)}$	Upper corner max.	30	60	90	%
EW output lower corner change (min.)	$\Delta e_{ECB(\min)}$	Lower corner min.	-95	-65	-35	%
EW output lower corner change (max.)	$\Delta e_{ECB(\max)}$	Lower corner max.	25	55	85	%
EW output (bottom voltage) EHT-DC change	$\Delta e_{EED}$	EHT-DC: 6 V Horizontal EHT min. → max.	2.1	2.6	3.1	V
EW output (bottom voltage) EHT-AC change 1	$\Delta e_{EEA(1)}$	EHT-AC: 2 V, horizontal EHT: max., EHT gain min. → max.	1.2	1.4	1.6	V
EW output (bottom voltage) EHT-AC change 2	$\Delta e_{EEA(2)}$	EHT-AC: 4 V, horizontal EHT: max., EHT gain min. → max.	-1.8	-1.5	-1.2	V
EW output (EW amplitude) KEY change 1 (min.)	$\Delta e_{EK(\min1)}$	KEY = 2 V, trapezoidal SW: On, trapezoidal max. → min.	95	120	145	%
EW output (EW amplitude) KEY change 1 (max.)	$\Delta e_{EK(\max1)}$	KEY = 3.2 V, trapezoidal SW: On, trapezoidal min. → max.	-145	-120	-95	%
EW output parabolic DC level	$e_{EB}$	typ.	2.9	4.0	5.1	V
EW output (EW amplitude) KEY change 2 (min.)	$\Delta e_{EK(\min2)}$	KEY = 2 V, trapezoidal SW: Off, trapezoidal max. → min.	-145	-120	-95	%
EW output (EW amplitude) KEY change 2 (max.)	$\Delta e_{EK(\max2)}$	KEY = 3.2 V, trapezoidal SW: Off, trapezoidal min. → max.	95	120	145	%
EW output drive current 1	$I_{EW(1)}$	Pin 18: 11 V	0.7	1.1	1.5	mA
V-AGC input and output current	$I_{VAGC}$		0.5	0.8	1.1	mA
H-AGC input and output current	$I_{HAGC}$		0.7	1.0	1.3	mA

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

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Ramp discharge current	$I_{RD}$		6.7	8.9	11.1	mA
Ramp charge current 1	$I_{RC(1)}$	Pin 24: 1 V	40	45	52	$\mu\text{A}$
Vertical output at service SW	$V_{SSW}$		4.55	4.95	5.35	V
Broken neck threshold voltage	$V_{Neck}$	Service SW: Off	0.5	0.7	0.9	V
BLK output amplitude	$V_{BO}$		2.8	3.1	3.4	V
H-AGC voltage 1	$V_{HAGC(1)}$	HD: 14 kHz	2.6	3.25	3.9	V
H-AGC voltage 2	$V_{HAGC(2)}$	HD: 17 kHz	3.1	3.85	4.6	V
H-AGC pulse width	$f_{HA}$	3 k $\Omega$ resistor between pin 11 and GND	1.5	2.2	3.0	$\mu\text{s}$
V-AGC pulse width	$f_{VA}$	3 k $\Omega$ resistor between pin 24 and GND	75	110	150	$\mu\text{s}$
EW output drive current 2	$I_{EW(2)}$	Pin 18: 1 V	-1.3	-0.9	-0.5	mA
Ramp charge current 2	$I_{RC(2)}$	Pin 24: 10 V	7	10	13	$\mu\text{A}$
H-AGC current $\Delta V$	$V_{HAGC\Delta V}$	HD: 17 kHz $\Delta V$	0.2	0.6	1.1	V
VD input threshold value	$V_{VD}$		0.9	1.3	1.7	V
FBP input threshold value	$V_{FBP}$		0.5	0.7	0.9	V
High-level I <sup>2</sup> C SDA input	$V_{SDA(H)}$		4.0	—	$V_{CC1}$	V
low-level I <sup>2</sup> C SDA input	$V_{SDA(L)}$		0	—	0.7	V
High-level I <sup>2</sup> C SCL input	$V_{SCL(H)}$		4.0	—	$V_{CC1}$	V
Low-level I <sup>2</sup> C SCL input	$V_{SCL(L)}$		0	—	0.7	V
Maximum input allowable frequency	$f_{i\max}$		100	—	—	kHz
Vertical output amplitude with supply voltage fluctuation	$\Delta e_{V-V_{CC}}$	Difference of $V_{CC(\max)} - V_{CC(\min)}$	0	0.1	0.5	V
Vertical output with DC supply voltage fluctuation	$\Delta e_{VD-V_{CC}}$	Difference of $V_{CC(\max)} - V_{CC(\min)}$	0.5	1.0	1.5	V
EW output amplitude with supply voltage fluctuation	$\Delta e_{E-V_{CC}}$	Difference of $V_{CC(\max)} - V_{CC(\min)}$	0	0.1	0.5	V
EW output with DC supply voltage fluctuation	$\Delta e_{ED-V_{CC}}$	Difference of $V_{CC(\max)} - V_{CC(\min)}$	0.4	1.0	1.6	V
Sink current at ACK	$I_{ACK}$	Maximum value of pin 1 sink current at ACK	—	2.5	—	mA
3-bit, 4-bit, 6-bit, 7-bit DAC DNLE	$L_{3, 4, 6, 7}$	1LSB = {data (max.) - data (00)}/ 7, 15, 63, 127	0.1	1.0	1.9	LSB/ step
Vertical output drive current	$I_{V\text{Out}}$		7	11	15	mA

■ Terminal Equivalent Circuits

Pin No.	Equivalent circuit	Description	Voltage
1		<p>I<sup>2</sup>C bus data input pin: Sink current: typ. 2.5 mA</p>	<p>AC (Pulse)</p>
2		<p>I<sup>2</sup>C bus clock input pin</p>	<p>AC (Pulse)</p>
3		<p>FBP input pin:</p>	<p>AC (Pulse)</p>
4	<p>—</p>	<p>V<sub>CC1</sub> (typ. 5 V): For I<sup>2</sup>C circuit</p>	<p>DC 5 V</p>
5		<p>Test pin: Attach a capacitor (0.082 µF) for filter to GND.</p>	<p>DC 10.6 V</p>

■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Description	Voltage
6	—	N.C	N.C.
7		<p>HBLK high-level slice voltage:</p>	<p>DC typ. 0 V to 4 V</p>
8		<p>HBLK low-level slice voltage:</p>	<p>DC typ. 0 V to 4 V</p>
9		<p>VBLK high-level slice voltage: For I<sup>2</sup>C circuit</p>	<p>DC typ. 0 V to 10 V</p>
10		<p>VBLK low-level slice voltage:</p>	<p>DC 0 V to 10 V</p>



■ Terminal Equivalent Circuits (continued)

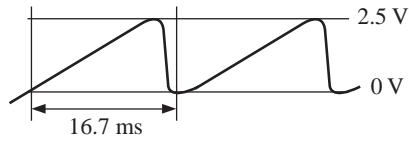
Pin No.	Equivalent circuit	Description	Voltage
11		H sawtooth AGC voltage pin	DC 1.5 V to 10 V
12		Blanking pulse output pin: Horizontal/vertical BLK output pin Blanking output high-level with neck input low-level	AC (Pulse)
13		Broken neck detection pin: Normal; High-level (apply 1 V or more) Abnormal; Low-level (apply 0.4 V or more) (Broken neck mode) There is no broken neck operation when service SW is on.	DC
14	Refer to pin 9 and pin 10 equivalent circuit.	Sawtooth input pin for V-BLK:  	AC
15	—	$V_{CC3}$ (typ. 12 V): For BLK pulse generation circuit.	DC 12 V

### ■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Description	Voltage
16		<p>Vertical feedback input pin:</p> <p>V out</p> <p>Short-circuit this pin with pin 17 in normal use</p>	AC
17		<p>Vertical output pin:</p> <p>V out</p> <p>Short-circuit this pin with pin 16 in normal use</p>	AC
18		<p>EW output pin:</p> <p>EW out</p>	AC
19		<p>Upper and lower corner slice voltage input pin</p>	DC 0 V to 1.5 V

■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Description	Voltage
20		EHT-AC input pin	AC Open approx. 2.9 V
21		EHT-DC input pin	DC 6 V to 10 V (typ. 8 V)
22		External shape trapezoidal correction DC control pin	DC 1.5 V to 3.5 V (typ. 2.5 V)
23		Ramp reference waveform generation pin:	AC



### ■ Terminal Equivalent Circuits (continued)

Pin No.	Equivalent circuit	Description	Voltage
24		AGC pin for ramp	AC
25	—	$V_{CC2}$ (typ. 12 V): For I <sup>2</sup> C circuit and correction system circuit	DC
26		V pulse input pin: 	AC (Pulse)
27	—	GND2: For analog circuit block	DC
28	—	GND1: For digital circuit block	DC

■ Application Circuit Example

