

## GENERAL DESCRIPTION

EM19101 is a 8-bit CMOS A/D converter for scanner use. The adoption of a 2-step parallel system achieves low consumption at a maximum conversion speed of 7 MSPS.

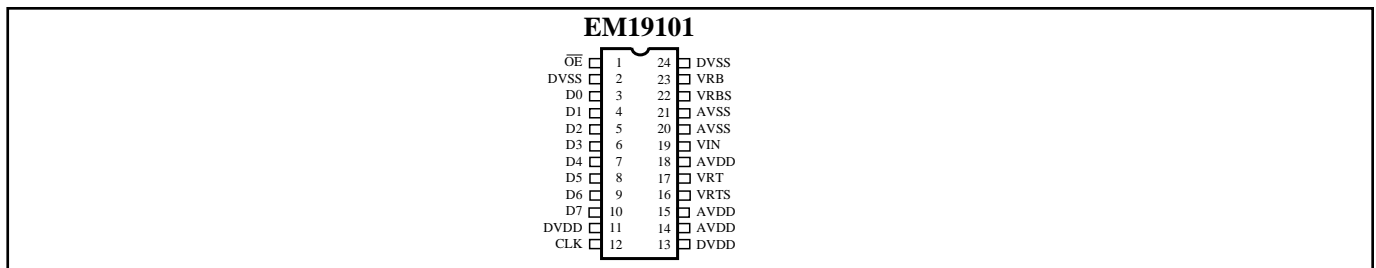
## FEATURES

- 7MSPS maximum conversion speed
- Build-in sampling and hold circuit
- Internal self-bias reference voltage
- 45 mW very low power dissipation at 5MSPS
- +5V single power supply
- Available in 24 pin SOP
- Series
  - EM19101M for 300 mil SOP
  - EM19101S for 209 mil SOP

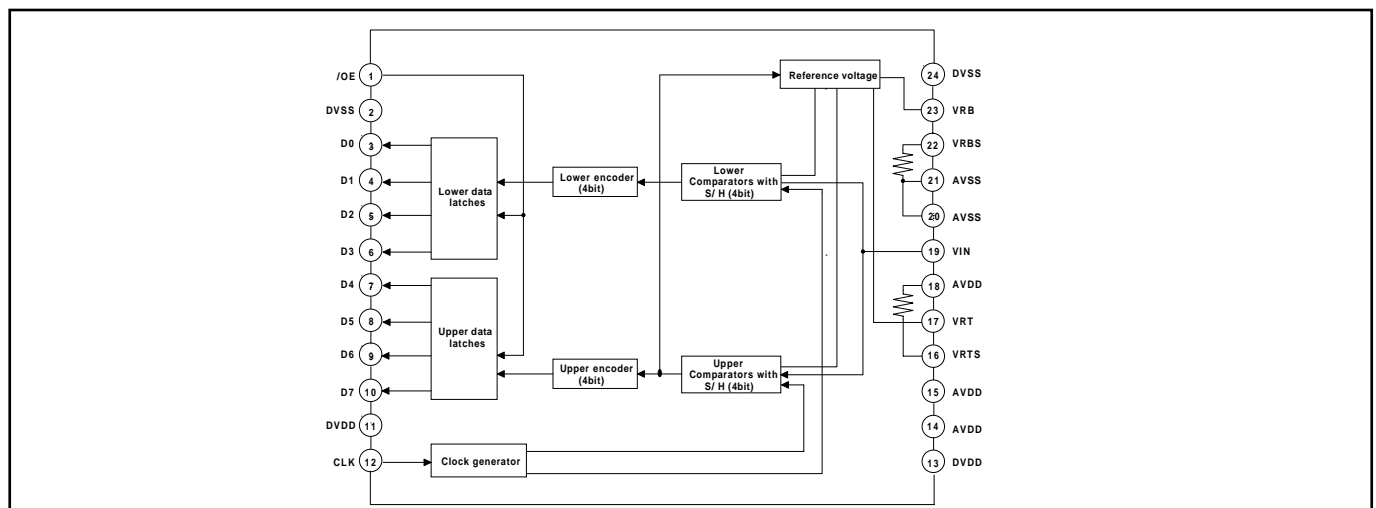
## APPLICATION

Scanner and a wide range of fields where high speed A/D conversion is required in the digital communication.

## PIN ASSIGNMENT



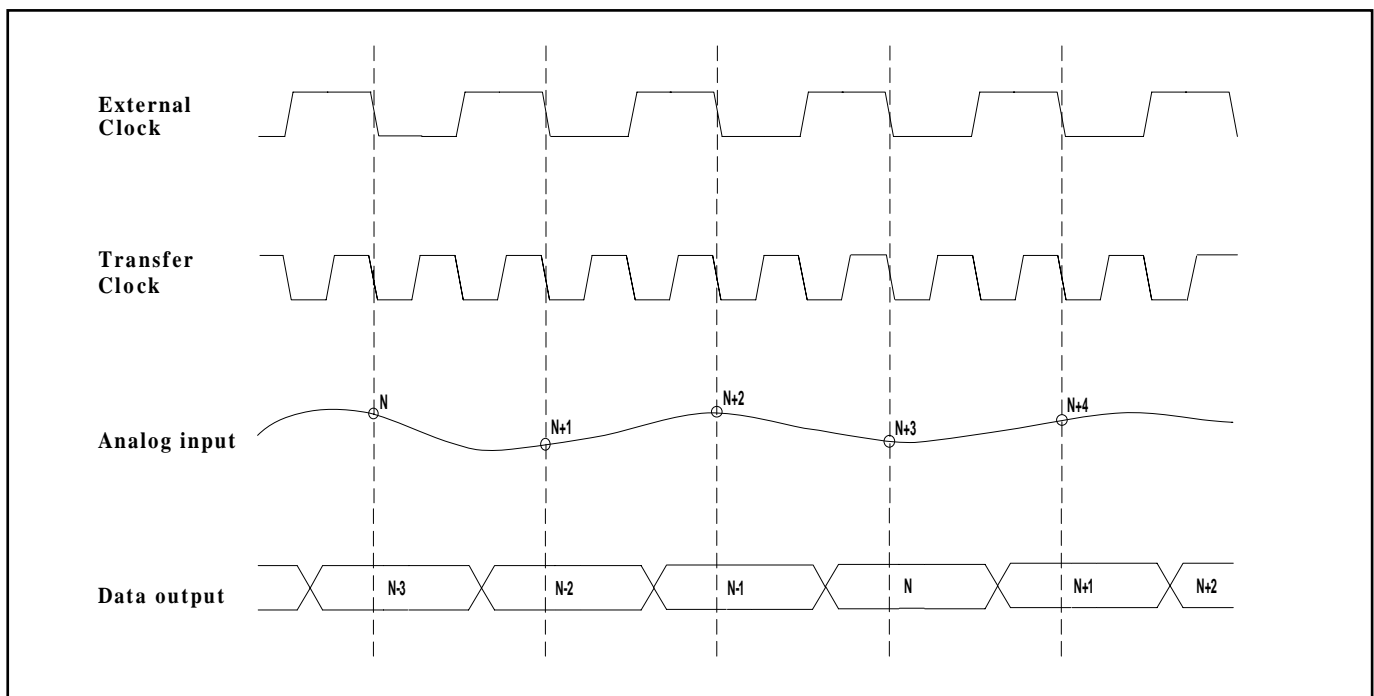
## FUNCTIONAL BLOCK DIAGRAM



### PIN DESCRIPTIONS

Symbol	Function
$\overline{OE}$	Output enable
DVSS	Digital ground
D0	Data output bit 0 (LSB)
D1	Data output bit 1
D2	Data output bit 2
D3	Data output bit 3
D4	Data output bit 4
D5	Data output bit 5
D6	Data output bit 6
D7	Data output bit 7 (MSB)
DVDD	Digital power supply
CLK	Clock input
DVDD	Digital power supply
AVDD	Analog power supply
AVDD	Analog power supply
VRTS	Top internal reference voltage
VRT	Top reference voltage
AVDD	Analog power supply
VIN	Analog input voltage
AVSS	Analog ground
AVSS	Analog ground
VRBS	Bottom internal reference voltage
VRB	Bottom reference voltage
DVSS	Digital ground

### TIMING DIAGRAM



\* This specification are subject to be changed without notice.

### OUTPUT CODING

Step	Analog Input (V)	Digital Output Code	Conditions
0	0.607815	00000000	VRB=0.6V
1	0.607815~0.6156250	00000001	VRT=2.6V
2	0.6156250~0.6234375	00000010	1LSB=7.8125mV
....	....	....	
124	1.6000000~1.6078125	10000000	
125	1.6078125~1.6156250	10000001	
....	....	....	
254	2.5843750~2.5921875	11111110	
255	2.5921875~	11111111	

### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub>=25°C)

Items	Sym.	Rating	Unit
Supply voltage	V <sub>DD</sub>	7	V
Operating temperature	T <sub>OPR</sub>	-20 to +65	°C
Input voltage	V <sub>IN</sub>	V <sub>SS</sub> to V <sub>DD</sub>	V
Ref, Input voltage	V <sub>RT</sub> , V <sub>RB</sub>	V <sub>SS</sub> to V <sub>DD</sub>	V

### Recommended Poerating Conditions

Items	Sym.	Rating	Unit
Supply voltage	AV <sub>DD</sub> , AV <sub>SS</sub>	4.75 TO 5.25	V
	DV <sub>DD</sub> , DV <sub>SS</sub>		
	DGND-AGND	0 to 100	mV
Reference input voltage	V <sub>RB</sub>	0 and above	V
	V <sub>RT</sub>	V <sub>DD</sub> and below	V
	V <sub>RT</sub> - V <sub>RB</sub>	1.0 to 3.0	V
Analog input voltage	V <sub>IN</sub>	V <sub>RB</sub> to V <sub>RT</sub>	V

(F<sub>C</sub>=5MPS, V<sub>DD</sub>=5V, V<sub>RB</sub>=0.5V, V<sub>RT</sub>=2.5V, T<sub>A</sub>=25°C External clock duty=40 to 60%)

Parameter	Sym.	Conditions	Min.	Typ.	Max.	Unit
Maximum Conversion Speed	F <sub>C</sub>	Vin=0.6V to 2.6V fin=1kHz ramp		5		MSPS
Supply current	I <sub>DD</sub>	F <sub>C</sub> =5MSPS NTSC ramp wave input		10	15	mA
Reference pin current	I <sub>REF</sub>		5.7	8.0	9.1	mA
Analog input bandwidth	BW			1		MHz
Analog input capacitance	C <sub>IN</sub>	V <sub>IN</sub> =1.5V+0.07Vrms		11		pF
Reference resistance	R <sub>REF</sub>		220	250	350	Ω
Internal bias	V <sub>RB</sub>	Short V <sub>RB</sub> and V <sub>RBS</sub>	0.55	0.6	0.65	V
	V <sub>RT</sub> -V <sub>RB</sub>	Short V <sub>RT</sub> and V <sub>RTS</sub>	1.9	2.0	2.1	
Offset Voltage	E <sub>OT</sub>		-10	-35	-60	mV
	E <sub>OB</sub>		0	15	45	
Digital input voltage	V <sub>IH</sub>		4.0			V
	V <sub>IL</sub>				1.0	
Digital input current	I <sub>IH</sub>	V <sub>DD</sub> =max.			5	uA
	I <sub>IL</sub>				5	

Parameter	Sym.	Conditions	Min.	Typ.	Max.	Unit
Digital output current	$I_{OH}$	$OE=V_{SS}$ , $V_{OH}=V_{DD}-0.5V$	-1.1			mA
	$I_{OL}$	$V_{DD}=\text{min.}$ , $V_{OL}=0.4V$	3.7			
Digital output current	$I_{OZH}$	$OE=V_{DD}$ , $V_{OH}=V_{DD}$			16	$\mu A$
		$V_{OL}=0V$			16	
Output data delay	$T_{DL}$			25	40	ns
Integral nonlinearity	EL	$F_C=5\text{MSPS}$ $V_{IN}=0.6V$ to $2.6V$		0.5	1.3	LSB
Differential nonlinearity	ED	$F_C=5\text{MSPS}$ $V_{IN}=0.6V$ to $2.6V$		$\pm 0.3$	$\pm 0.5$	LSB
Differential gain error	DG	NTSC 40 IRE mod ramp, $F_C=14.3\text{MSPS}$		1.0		%
Differential phase error	$D_p$			0.5		$^\circ C$
Aperture jitter	$t_{AJ}$			30		ps
Sampling delay	$t_{DS}$			4		ns

## Application Note

$V_{DD}, V_{SS}$

To reduce noise effects, separate the analog and digital systems close to the device. For both the digital and analog  $V_{DD}$  pins, use a ceramic capacitor of about 0.1 $\mu F$  set as close as possible to the pin to bypass to the respective GND's.

### Analog input

Compared with the flash type A/D converter, the input capacitance of the analog input is rather small. However it is necessary to conduct the drive with an amplifier featuring sufficient band and drive capability. When driving with an amplifier of low output impedance, parasite oscillation may occur. That may be prevented by inserting a resistance of about 100 $\Omega$  in series between the amplifier output and A/D input.

### Clock input

The clock line wiring should be as short as possible also, to avoid any interference with other signals, separate it from other circuits

### Reference input

Voltage between  $V_{RT}$  to  $V_{RB}$  is compatible with the dynamic range of the analog input. Bypassing  $V_{RT}$  and  $V_{RB}$  pins to GND, by means of a capacitor about 0.1 $\mu F$ , stable characteristics are obtained. By shorting  $V_{RT}$  and  $V_{RTS}$ ,  $V_{RB}$  and VRBS, the self bias function that generates  $V_{RT}=2.6V$  and  $V_{RB}=0.6V$ , is activated.

### Timing

Analog input is sampled with the falling edge of external clock and output as digital data with a delay of 2.5 clocks and with the following rising edge. The delay from the clock rising edge to the data output is about 25ns.

### $\overline{OE}$ pin

By connecting  $\overline{OE}$  to GND output mode is obtained. By connecting to  $V_{DD}$  high impedance is obtained.

#### About latch up

It is necessary that  $AV_{DD}$  and  $DV_{DD}$  pins be the common source of power supply. This is to avoid latch up due to the voltage difference between  $AV_{DD}$  and  $DV_{DD}$  pins when power is ON.

### Application Circuit

