

**DESCRIPTION**

R8A66161 is a LED array driver having a 16-bit serial input and parallel output shift register function with direct coupled reset input and output latch function.

This product guarantees the output current of 24mA (Vcc =5V case) which is sufficient for anode common LED drive, capable of following 16-bits continuously at the same time. Parallel output is open drain output.

In addition, as this product has been designed in complete CMOS, power consumption can be greatly reduced when compared with conventional BIPOLAR or Bi-CMOS products. Furthermore, pin layout ensures the realization of an easy printed circuit. R8A66161 is the succession product of M66311.

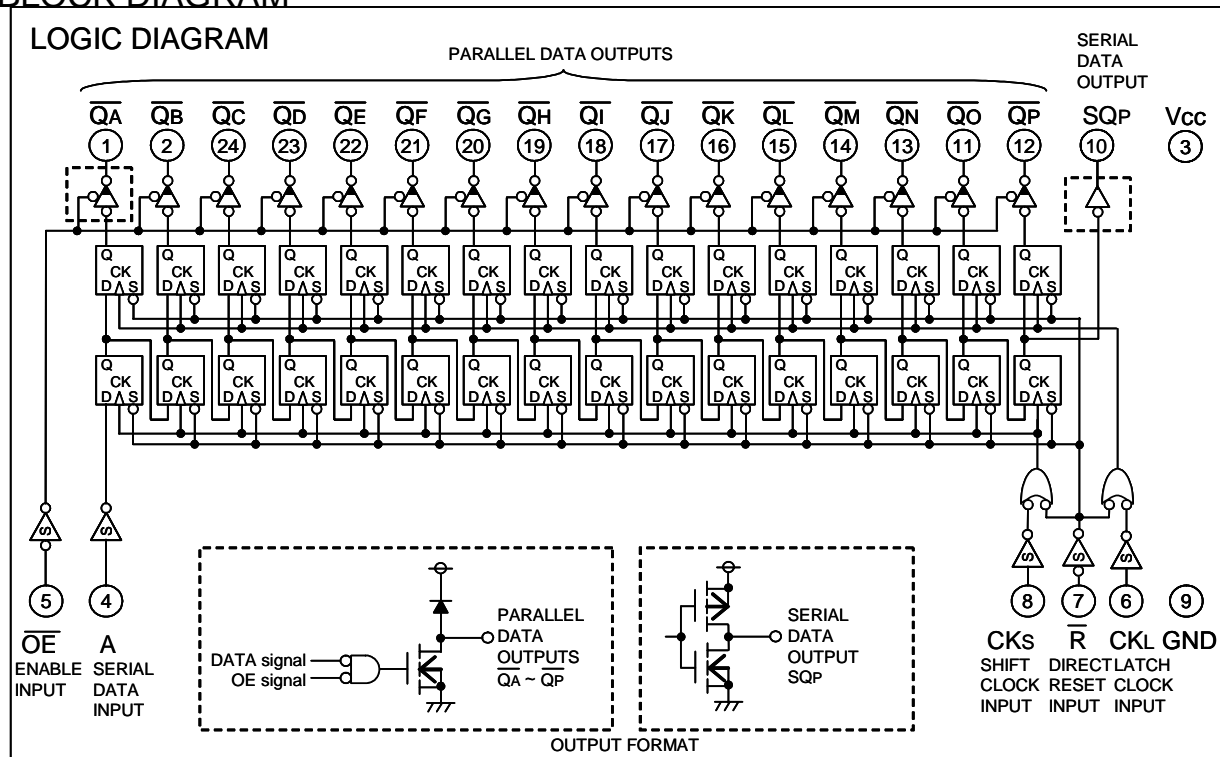
**FEATURES**

- Anode common LED drive
- Vcc 5V or 3.3V single power supply
- High output current: all parallel outputs  $\overline{QA} \sim \overline{QP}$   $I_{OL}=24mA$  (at  $V_{CC} =5.0V$ )  $I_{OL}=12mA$  (at  $V_{CC} =3.3V$ ) simultaneous lighting available
- Low power dissipation: 100uW/package (max) ( $V_{CC}=5.0V, T_a=25^\circ C$ , quiescent state)
- High noise margin: Schmitt input circuit provides responsiveness to a long line length
- Equipped with direct-coupled reset
- Open drain output: (except serial data output SQP)
- Wide operating temperature range:  $T_a=-40^\circ C \sim +85^\circ C$
- Pin layout facilitates printed circuit wiring. (This layout facilitates cascade connection and LED connection)

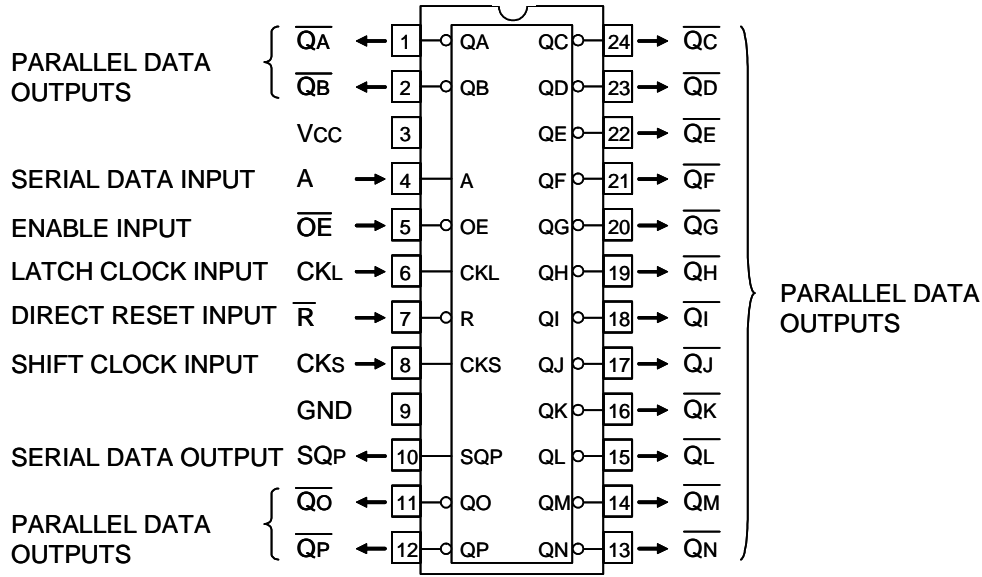
**APPLICATION**

- LED array drive, The various LED display modules
- PPC, Printer, VCR, Mini-compo, Button-Telephone etc. All of LED display equipment

**BLOCK DIAGRAM**



PIN CONFIGURATION ( TOP VIEW )



FUNCTIONAL DESCRIPTION

As R8A66161 uses silicon gate CMOS process. It realizes high-speed and high-output currents sufficient for LED drive while maintaining low power consumption and allowance for high noises.

Each bit of a shift register consists of two flip-flop having independent clocks for shifting and latching.

As for clock input, shift clock input CKs and latch clock input CKL are independent from each other, shift and latch operations being made when "L" changes to "H".

Serial data input A is the data input of the first-step shift register and the signal of A shifts shifting registers one by one when a pulse is impressed to CKs. When A is "H", the signal of "L" shifts.

When the pulse is impressed to CKL, the contents of the shifting register at that time are stored in a latching register, and they appear in the parallel data outputs from QA ~ QP.

Outputs QA ~ QP are open drain outputs.

To extend the number of bits, use the serial data output SQP which shows the output of the shifting register of the 16th bit.

When reset input R is changed to "L", QA ~ QP and SQP are reset. In this case, shifting and latching register are set.

If "H" is impressed to output enable input OE, QA ~ QP reaches the high impedance state, but SQP does not reach the high impedance state. Furthermore, change in OE does not affect shift operation.

FUNCTION TABLE (Note: 1)

Operation mode	Input					Parallel data output																Serial data output SQP	Remarks		
	R	CKs	CKL	A	OE	QA	QB	QC	QD	QE	QF	QG	QH	QI	QJ	QK	QL	QM	QN	QO	QP				
Reset	L	X	X	X	X	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	L	—	
Shift Latch operation	Shift t1	H		X	H	L	QA <sup>0</sup>	QB <sup>0</sup>	QC <sup>0</sup>	QD <sup>0</sup>	QE <sup>0</sup>	QF <sup>0</sup>	QG <sup>0</sup>	QH <sup>0</sup>	QI <sup>0</sup>	QJ <sup>0</sup>	QK <sup>0</sup>	QL <sup>0</sup>	QM <sup>0</sup>	QN <sup>0</sup>	QO <sup>0</sup>	QP <sup>0</sup>	q <sup>0</sup>	Output Lighting "H"	
	Latch t2	H	X		X	L	L	qA <sup>0</sup>	qB <sup>0</sup>	qC <sup>0</sup>	qD <sup>0</sup>	qE <sup>0</sup>	qF <sup>0</sup>	qG <sup>0</sup>	qH <sup>0</sup>	qI <sup>0</sup>	qJ <sup>0</sup>	qK <sup>0</sup>	qL <sup>0</sup>	qM <sup>0</sup>	qN <sup>0</sup>	qO <sup>0</sup>	qP <sup>0</sup>	q <sup>0</sup>	Output Lighting "H"
	Shift t1	H		X	L	L	QA <sup>0</sup>	QB <sup>0</sup>	QC <sup>0</sup>	QD <sup>0</sup>	QE <sup>0</sup>	QF <sup>0</sup>	QG <sup>0</sup>	QH <sup>0</sup>	QI <sup>0</sup>	QJ <sup>0</sup>	QK <sup>0</sup>	QL <sup>0</sup>	QM <sup>0</sup>	QN <sup>0</sup>	QO <sup>0</sup>	QP <sup>0</sup>	q <sup>0</sup>	Output Lighting-out "L"	
	Latch t2	H	X		X	L	Z	qA <sup>0</sup>	qB <sup>0</sup>	qC <sup>0</sup>	qD <sup>0</sup>	qE <sup>0</sup>	qF <sup>0</sup>	qG <sup>0</sup>	qH <sup>0</sup>	qI <sup>0</sup>	qJ <sup>0</sup>	qK <sup>0</sup>	qL <sup>0</sup>	qM <sup>0</sup>	qN <sup>0</sup>	qO <sup>0</sup>	qP <sup>0</sup>	q <sup>0</sup>	Output Lighting-out "L"
Output disable	X	X	X	X	H	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	—	

- Note1: : Change from low-level to high-level
- Q<sup>0</sup> : Output state Q before CKL changed
- X : Irrelevant
- q<sup>0</sup> : Contents of shift register before CKs changed
- q : Contents of shift register
- t1, t2 : t2 is set after t1 is set
- Z : High impedance

## ABSOLUTE MAXIMUM RATINGS (Ta=-40~+85 , unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
VCC	Supply voltage		-0.5 ~ +7.0	V
VI	Input voltage		-0.5 ~ VCC+0.5	V
VO	Output voltage		-0.5 ~ VCC+0.5	V
IO	Output current per output pin	QA ~ QP	50	mA
		SQP	±25	
ICC	Supply / GND current	VCC, GND	-20, +410	mA
Pd	Power dissipation	(Note 2)	500	mW
Tstg	Storage temperature range		-65 ~+150	

Note 2: R8A66161SP; Ta=-40 ~ +70 , Ta=+70 ~ +85 are derated at -6mW/ .

## RECOMMENDED OPERATING CONDITIONS (Ta=-40~+85 , unless otherwise noted)

Symbol	Parameter		Limits			Unit
			Min.	Typ.	Max.	
VCC	Supply voltage	5.0V support	4.5	5.0	5.5	V
		3.3V support	3.0	3.3	3.6	V
VI	Input voltage		0		VCC	V
VO	Output voltage		0		VCC	V
Topr	Operating temperature range		-40		+85	

## ELECTRICAL CHARACTERISTICS

## ■5.0V version support specifications (Ta=-40~+85°C, Vcc=4.5V~5.5V, unless otherwise noted)

Symbol	Parameter		Test conditions	Limits			Unit
				Min.	Typ.	Max.	
VT+	Positive-going threshold voltage		VO=0.1V, VCC=0.1V  IO =20uA	0.35xVCC		0.70xVCC	V
VT-	Negative-going threshold voltage		VO=0.1V, VCC=0.1V  IO =20uA	0.20xVCC		0.55xVCC	V
VOL	Low-level output voltage	$\overline{QA} \sim \overline{QP}$	VI=VT+, VT- VCC=4.5V (Note3)	IOL= 20uA		0.10	V
				IOL= 24mA		0.53	
				IOL= 40mA		0.94	
VOH	High-level output voltage	SQP	VI=VT+, VT- VCC=4.5V	IOH= -20uA	VCC-0.1		V
				IOH= -4mA	3.66		
VOL	Low-level output voltage	SQP	VI=VT+, VT- VCC=4.5V	IOL= 20uA		0.10	V
				IOL= 4mA		0.53	
I <sub>IH</sub>	High-level input current		VI=VCC, VCC=5.5V			5	uA
I <sub>IL</sub>	Low-level input current		VI=GND, VCC=5.5V			-5	uA
IO	Maximum output leakage current	$\overline{QA} \sim \overline{QP}$	VI=VT+, VT- VCC=5.5V	VO=VCC		10	uA
				VO=GND		-10	
ICC	Quiescent supply current		VI=VCC, GND, VCC=5.5V			200	uA

Note 3: R8A66161 is used under the condition of an output current IOL=40mA, the number of simultaneous drive outputs is restricted as shown in the Duty Cycle – IOL of TYPICAL CHARACTERISTICS.

## ■3.3V version support specifications (Ta=-40~+85°C, Vcc=3.0V~3.6V, unless otherwise noted)

Symbol	Parameter		Test conditions	Limits			Unit
				Min.	Typ.	Max.	
VT+	Positive-going threshold voltage		VO=0.1V, VCC=0.1V  IO =20uA	0.35xVCC		0.70xVCC	V
VT-	Negative-going threshold voltage		VO=0.1V, VCC=0.1V  IO =20uA	0.20xVCC		0.55xVCC	V
V <sub>VOL</sub>	Low-level output voltage	$\overline{QA} \sim \overline{QP}$	VI=VT+, VT- VCC=3.0V	IOL= 20uA		0.10	V
				IOL= 12mA		0.54	
				IOL= 20mA		0.72	
VOH	High-level output voltage	SQP	VI=VT+, VT- VCC=3.0V	IOH= -20uA	VCC-0.1		V
				IOH= -2mA	2.60		
VOL	Low-level output voltage	SQP	VI=VT+, VT- VCC=3.0V	IOL= 20uA		0.10	V
				IOL= 2mA		0.40	
I <sub>IH</sub>	High-level input current		VI=VCC, VCC=3.6V			5	uA
I <sub>IL</sub>	Low-level input current		VI=GND, VCC=3.6V			-5	uA
IO	Maximum output leakage current	$\overline{QA} \sim \overline{QP}$	VI=VT+, VT- VCC=3.6V	VO=VCC		10	uA
				VO=GND		-10	
ICC	Quiescent supply current		VI=VCC, GND, VCC=3.6V			200	uA

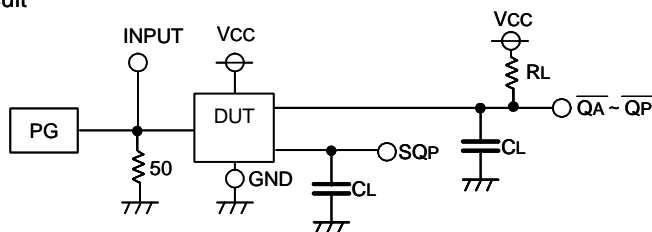
## SWITCHING CHARACTERISTICS (Ta=-40~+85°C, Vcc=5.0V or 3.3V)

Symbol	Parameter	Test conditions	5.0V specification			3.3V specification			Unit	
			Min.	Typ.	Max.	Min.	Typ.	Max.		
fmax	Maximum clock frequency	CL=50pF RL=1KΩ (Note 4)			4			3.3	MHz	
tPLH	Output "L"-"H" and "H"-"L" propagation time		CKS - SQP			125			150	ns
tPHL	Output "H"-"L" propagation time		$\overline{R}$ - SQP			125			150	ns
tPLZ	Output "L"-"Z" propagation time		$\overline{R}$ - $\overline{QA}$ - $\overline{QP}$ (turned off)			200			220	ns
tPZL	Output "Z"-"L" propagation time		CKL - $\overline{QA}$ - $\overline{QP}$ (turned on)			125			150	ns
tPLZ	Output "L"-"Z" propagation time		CKL - $\overline{QA}$ - $\overline{QP}$ (turned off)			200			220	ns
tPZL	Output "Z"-"L" propagation time		$\overline{OE}$ - $\overline{QA}$ - $\overline{QP}$ (turned on)			125			150	ns
tPLZ	Output "L"-"Z" propagation time		$\overline{OE}$ - $\overline{QA}$ - $\overline{QP}$ (turned off)			200			220	ns
CI	Input capacitance					10			10	pF

## TIMING REQUIREMENTS (Ta=-40~+85°C, Vcc=5.0V or 3.3V)

Symbol	Parameter	Test conditions	5.0V specification			3.3V specification			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
tw	CKS, CKL, $\overline{R}$ pulse width	(Note 4)	125			150			ns
tsu	A setup time with respect to CKS		125			150			ns
tsu	CKS setup time with respect to CKL		125			150			ns
th	A hold time with respect to CKS		15			20			ns
trec	$\overline{R}$ recovery time with respect to CKS, CKL		70			80			ns

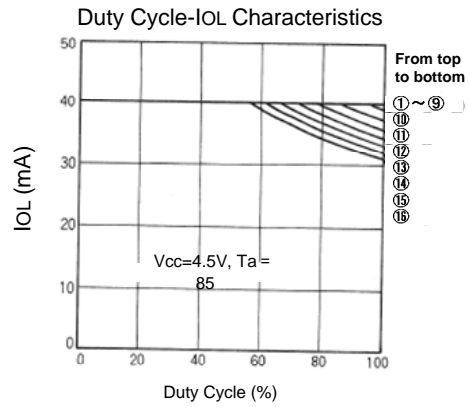
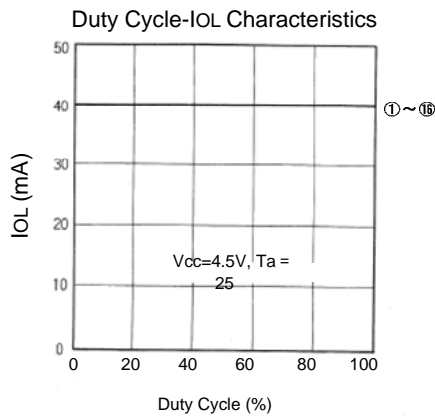
## Note 4 : Test Circuit



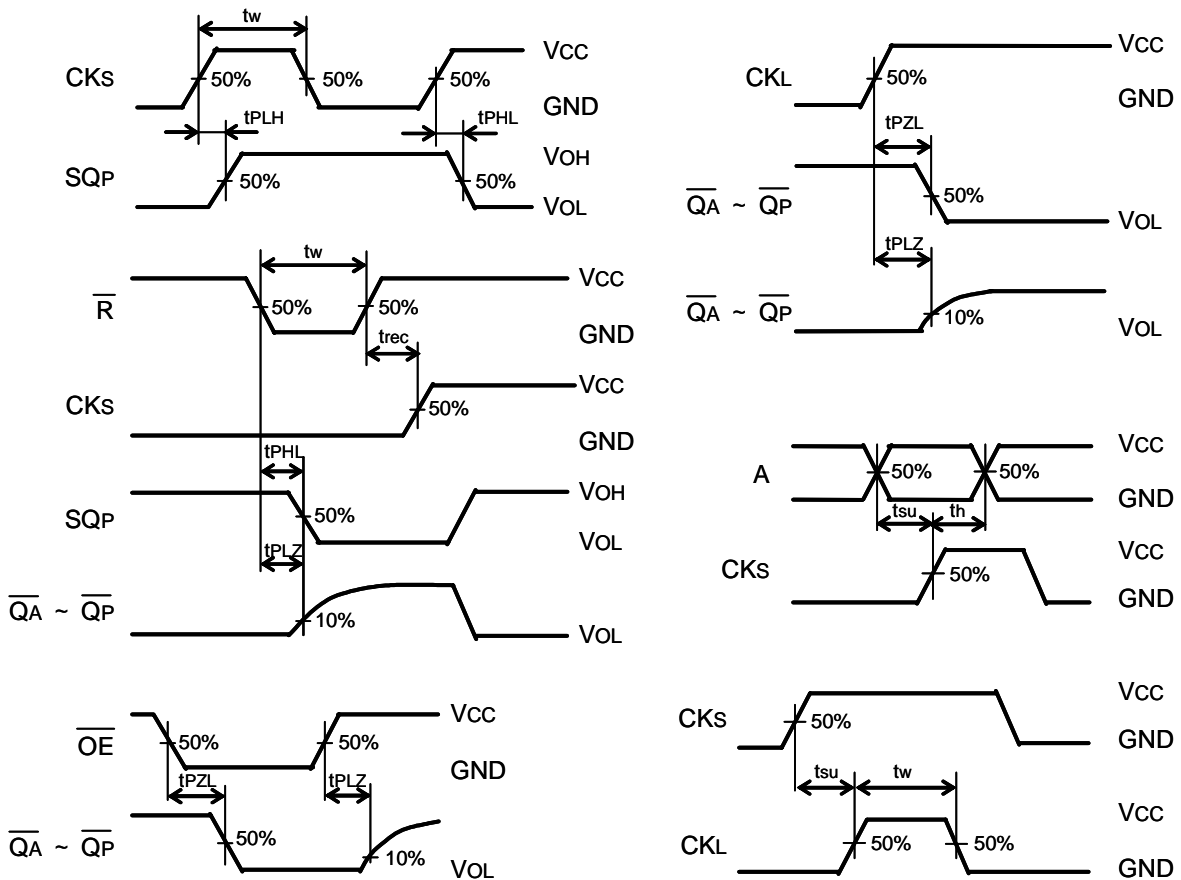
- (1) The pulse generator (PG) has the following characteristics (10%~90%). :tr = 6ns, tf = 6ns.
- (2) The capacitance CL includes stray wiring capacitance and the probe input capacitance.

## TYPICAL CHARACTERISTICS

- Repetition frequency > 10 Hz
- Numbers in ○ indicate the number of output circuits that operate simultaneously.
- Current values are per circuit.

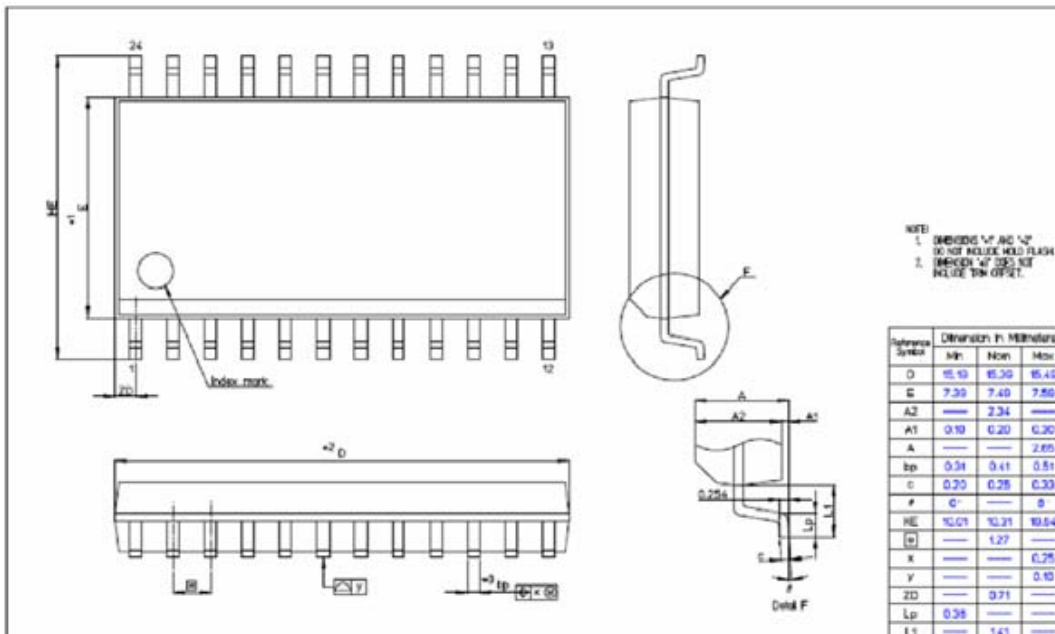
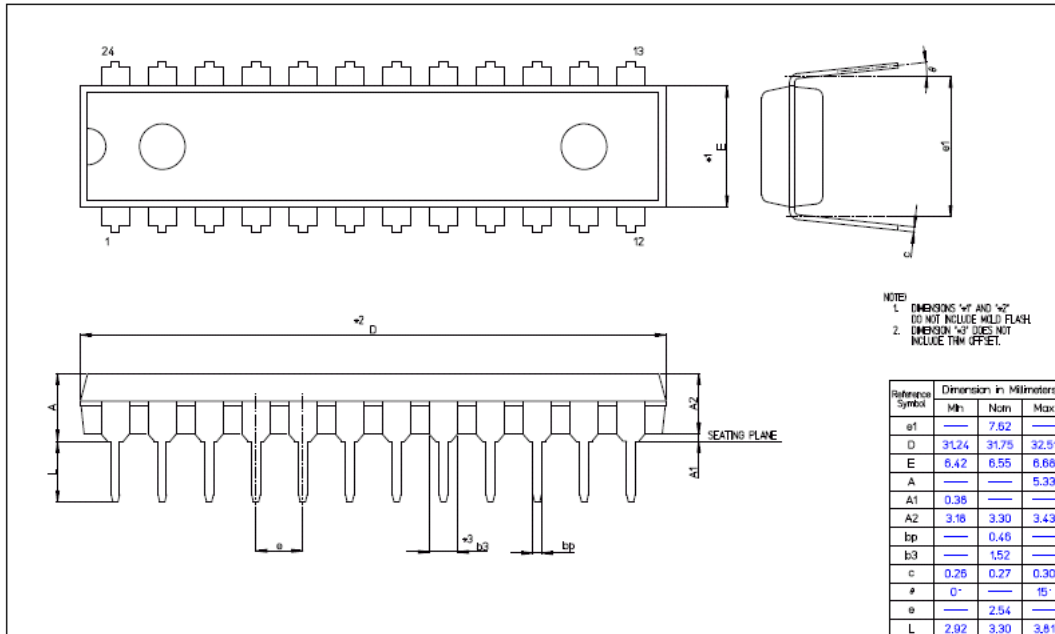


## TIMING DIAGRAM



PACKAGE OUTLINE

Product name	Package	RENESAS Code	Previous Code
R8A66161DD	24pin DIP	PRDP0024AF-A	24P4X-A
R8A66161SP	24pin SOP	PRSP0024DF-A	24P2X-B



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