

DESCRIPTION

R8A66160 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 cathode 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. R8A66160 is the succession product of M66310.

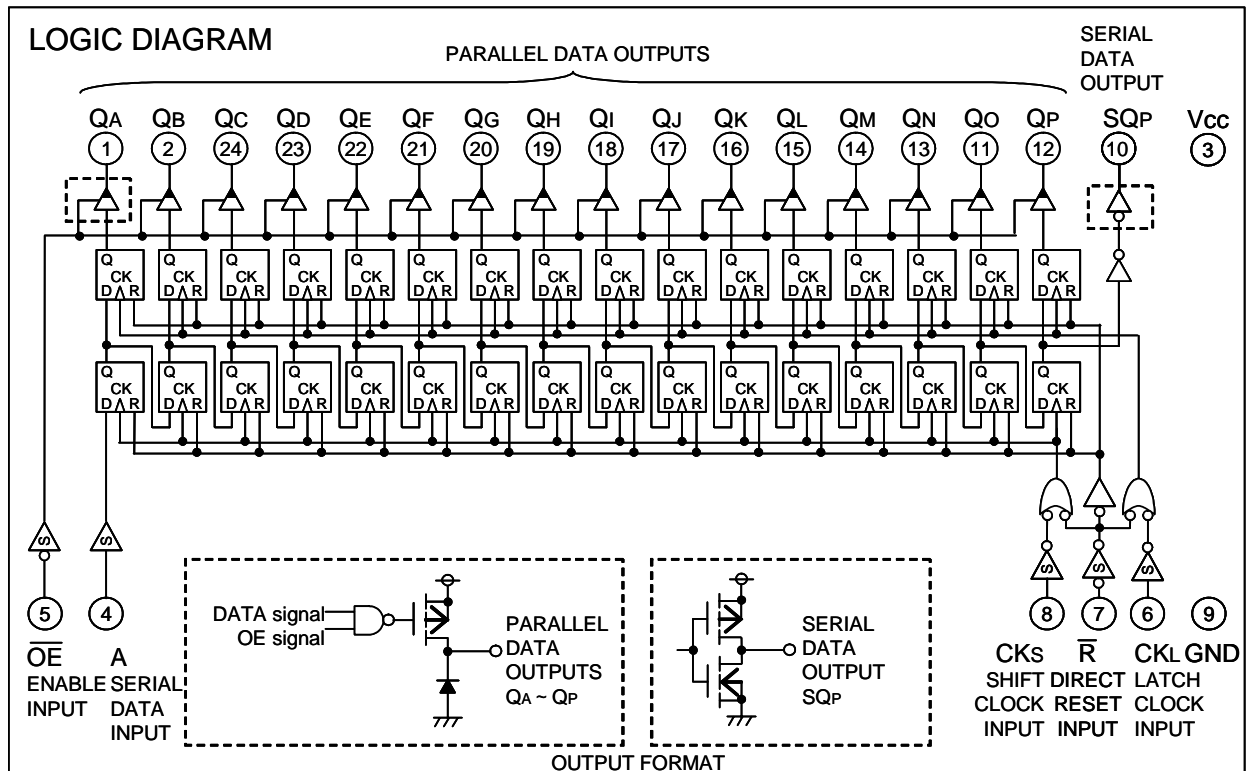
FEATURES

- Cathode common LED drive
- Vcc 5V or 3.3V single power supply
- High output current: all parallel outputs QA~QP IOH=-24mA (at VCC =5.0V) IOH=-12mA (at VCC =3.3V) simultaneous lighting available
- Low power dissipation: 100uW/package (max) (Vcc=5.0V, Ta=25°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: Ta=-40°C~+85°C
- Pin layout facilitates printed circuit wiring. (This layout facilitates cascade connection and LED connection)

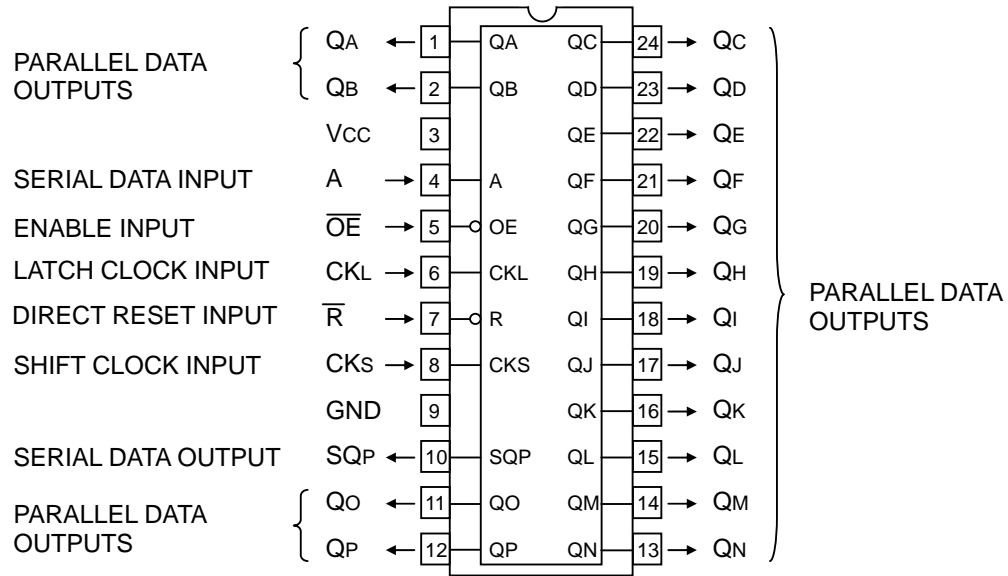
APPLICATION

- 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 R8A66160 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 "L", 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 \bar{R} is changed to "L", QA ~ QP and SQP are reset. In this case, shifting and latching register are reset.

If "H" is impressed to output enable input \overline{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	
	\bar{R}	CKs	CKL	A	\overline{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 ⁰	QB ⁰	QC ⁰	QD ⁰	QE ⁰	QF ⁰	QG ⁰	QH ⁰	QI ⁰	QJ ⁰	QK ⁰	QL ⁰	QM ⁰	QN ⁰	QO ⁰	QP ⁰	qC ⁰	Output lighting "H"
	Latch t2	H	X		X	L	H	qA ⁰	qB ⁰	qC ⁰	qD ⁰	qE ⁰	qF ⁰	qG ⁰	qH ⁰	qI ⁰	qJ ⁰	qK ⁰	qL ⁰	qM ⁰	qN ⁰	qO ⁰	qP ⁰	qC ⁰
	Shift t1	H		X	L	L	QA ⁰	QB ⁰	QC ⁰	QD ⁰	QE ⁰	QF ⁰	QG ⁰	QH ⁰	QI ⁰	QJ ⁰	QK ⁰	QL ⁰	QM ⁰	QN ⁰	QO ⁰	QP ⁰	qC ⁰	Output lights-out "L"
	Latch t2	H	X		X	L	Z	qA ⁰	qB ⁰	qC ⁰	qD ⁰	qE ⁰	qF ⁰	qG ⁰	qH ⁰	qI ⁰	qJ ⁰	qK ⁰	qL ⁰	qM ⁰	qN ⁰	qO ⁰	qP ⁰	qC ⁰
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
- Q⁰ : Output state Q before CKL changed
- X : Irrelevant
- q⁰ : 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 ($T_a = -40 \sim +85^\circ\text{C}$, 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	-410, +20	mA
Pd	Power dissipation	(Note 2)	500	mW
Tstg	Storage temperature range		-65 ~ +150	$^\circ\text{C}$

Note 2: R8A66160SP; $T_a = -40 \sim +70^\circ\text{C}$, $T_a = +70 \sim +85^\circ\text{C}$ are derated at $-6\text{mW}/^\circ\text{C}$.

RECOMMENDED OPERATING CONDITIONS ($T_a = -40 \sim +85^\circ\text{C}$, 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	$^\circ\text{C}$	

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
VOH	High-level output voltage	QA ~ QP VI=VT+,VT- VCC=4.5V (Note3)	IOH= -20uA	VCC-0.1		V
			IOH= -24mA	3.66		
			IOH= -40mA	3.25		
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	
IiH	High-level input current	VI=VCC, VCC=5.5V			5	uA
IiL	Low-level input current	VI=GND, VCC=5.5V			-5	uA
IO	Maximum output leakage current	QA ~ 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: R8A66160 is used under the condition of an output current IOH=-40mA, the number of simultaneous drive outputs is restricted as shown in the Duty Cycle – IOH 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
VOH	High-level output voltage	QA ~ QP VI=VT+,VT- VCC=3.0V	IOH= -20uA	VCC-0.1		V
			IOH= -12mA	2.34		
			IOH= -20mA	2.08		
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	
IiH	High-level input current	VI=VCC, VCC=3.6V			5	uA
IiL	Low-level input current	VI=GND, VCC=3.6V			-5	uA
IO	Maximum output leakage current	QA ~ 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

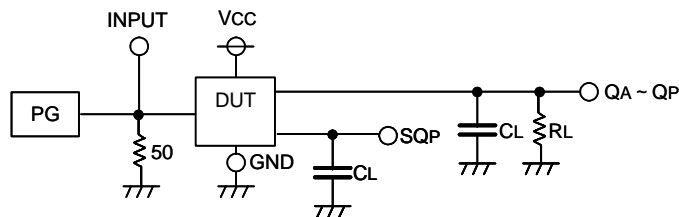
SWITCHING CHARACTERISTICS ($T_a = -40 \sim +85^\circ\text{C}$, $V_{cc} = 5.0\text{V}$ or 3.3V)

Symbol	Parameter	Test conditions	5.0V specification			3.3V specification			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
f _{max}	Maximum clock frequency				4			3.3	MHz
t _{PLH}	Output "L"-"H" and "H"-"L" propagation time	CKS - SQP			125			150	ns
t _{PHL}	Output "H"-"L" propagation time	\bar{R} - SQP			125			150	ns
t _{PHZ}	Output "H"-"Z" propagation time	\bar{R} - QA ~ QP (turned off)			200			220	ns
t _{PZH}	Output "Z"-"H" propagation time	CKL - QA ~ QP (turned on)			125			150	ns
t _{PHZ}	Output "H"-"Z" propagation time	CKL - QA ~ QP (turned off)			200			220	ns
t _{PZH}	Output "Z"-"H" propagation time	\overline{OE} - QA ~ QP (turned on)			125			150	ns
t _{PHZ}	Output "H"-"Z" propagation time	\overline{OE} - QA ~ QP (turned off)			200			220	ns
CI	Input capacitance				10			10	pF

TIMING REQUIREMENTS ($T_a = -40 \sim +85^\circ\text{C}$, $V_{cc} = 5.0\text{V}$ or 3.3V)

Symbol	Parameter	Test conditions	5.0V specification			3.3V specification			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
t _w	CKS, CKL, \bar{R} pulse width		125			150			ns
t _{su}	A setup time with respect to CKS		125			150			ns
t _{su}	CKS setup time with respect to CKL	(Note 4)	125			150			ns
t _h	A hold time with respect to CKS		15			20			ns
t _{rec}	\bar{R} recovery time with respect to CKS, CKL		70			80			ns

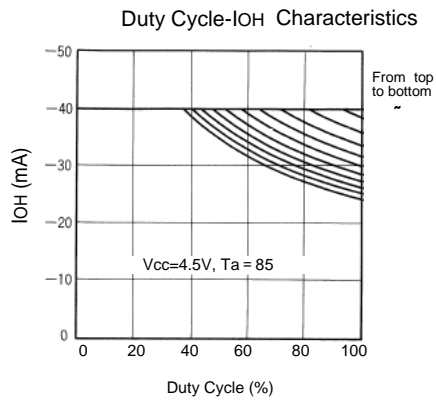
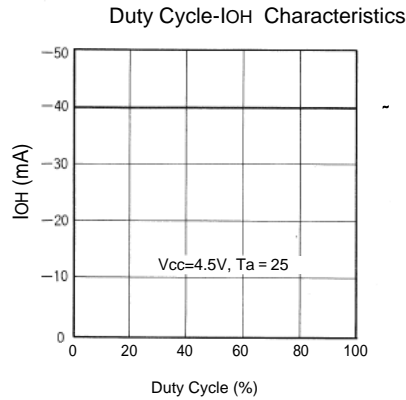
Note4 : Test Circuit



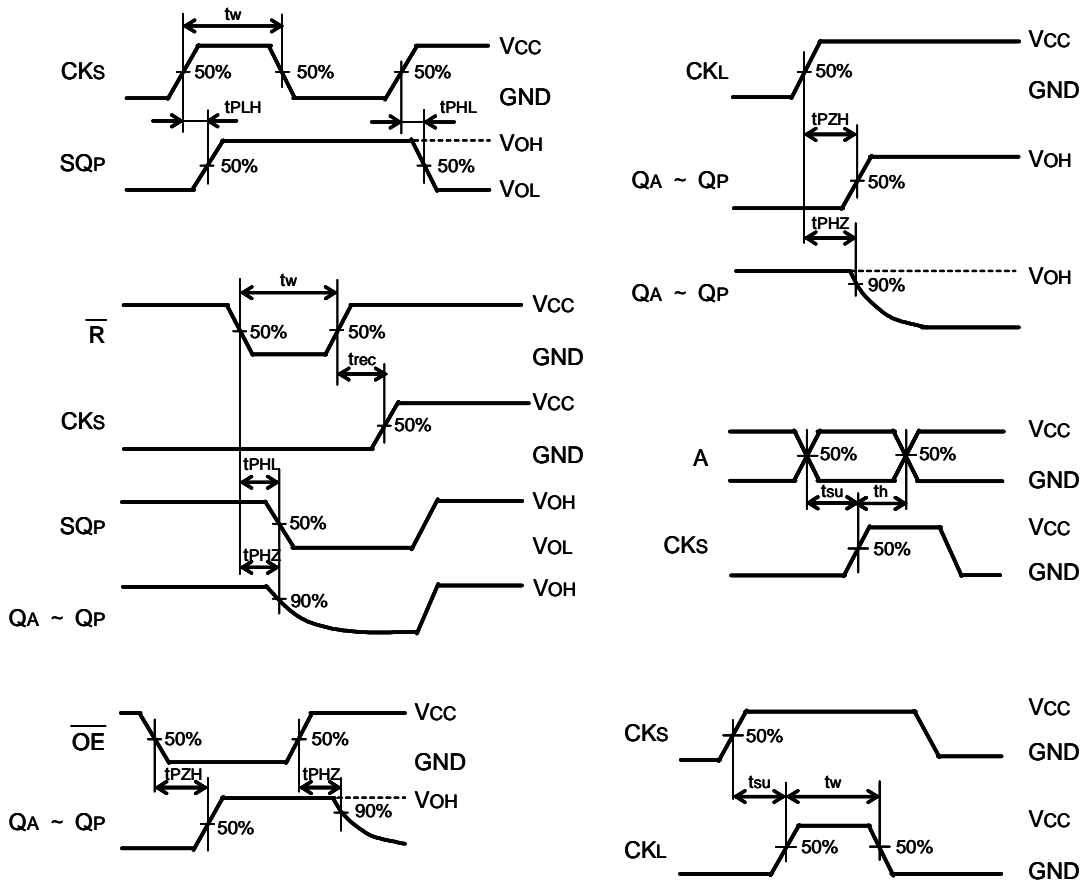
- (1) The pulse generator (PG) has the following characteristics (10%~90%) : $t_r = 6\text{ns}$, $t_f = 6\text{ns}$
- (2) The capacitance CL includes stray wiring capacitance and the probe input capacitance.

TYPICAL CHARACTERISTICS

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

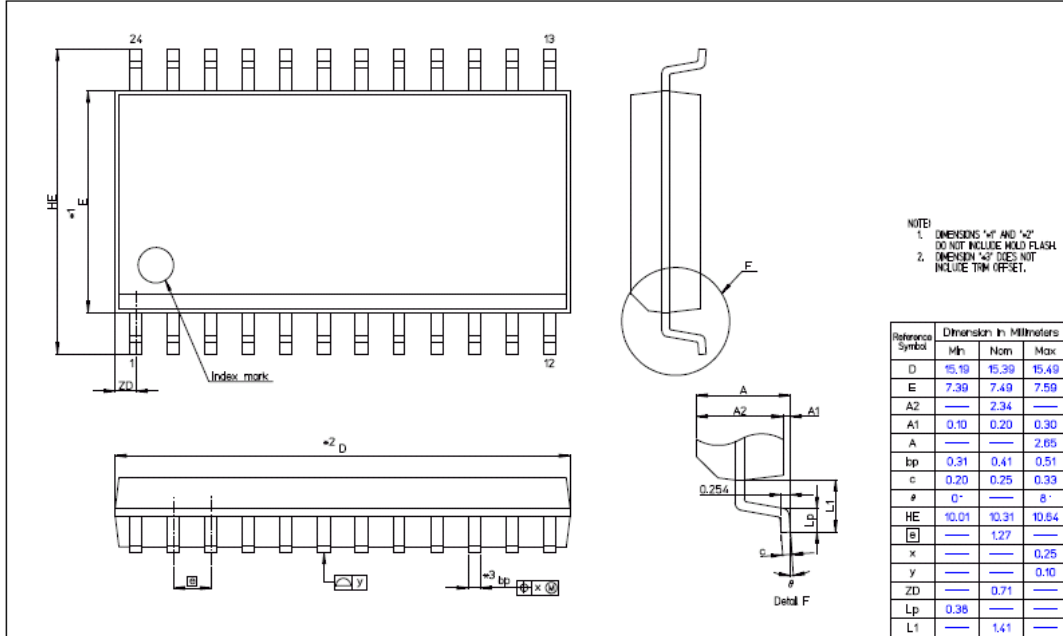
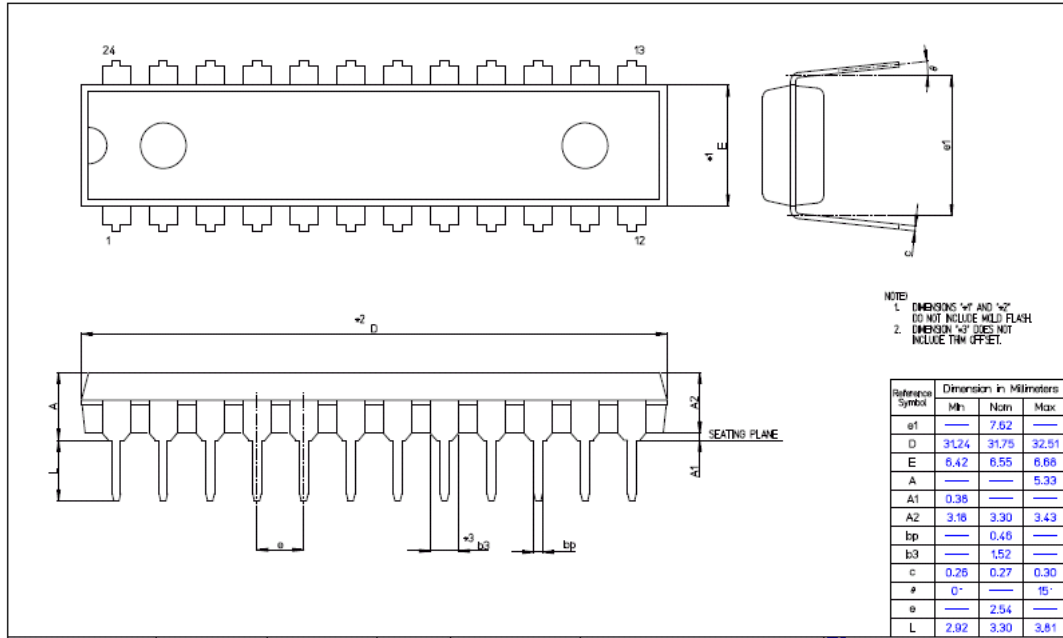


TIMING DIAGRAM



PACKAGE OUTLINE

Product name	Package	RENESAS Code	Previous Code
R8A66160DD	24pin DIP	PRDP0024AF-A	24P4X-A
R8A66160SP	24pin SOP	PRSP0024DF-A	24P2X-B



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450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

Renesas Technology Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

Renesas Technology (Shanghai) Co., Ltd.
Unit 204, 205, AZIACenter, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120
Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7858/7898

Renesas Technology Hong Kong Ltd.
7th Floor, North Tower, World Finance Centre, Harbour City, Canton Road, Tsimshatsui, Kowloon, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2377-3473

Renesas Technology Taiwan Co., Ltd.
10th Floor, No.99, Fushing North Road, Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 3518-3399

Renesas Technology Singapore Pte. Ltd.
1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

Renesas Technology Korea Co., Ltd.
Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea
Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

Renesas Technology Malaysia Sdn. Bhd
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: <603> 7955-9390, Fax: <603> 7955-9510