To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

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R8A66161DD/SP

16-BIT LED DRIVER WITH SHIFT REGISTER AND LATCH

REJ03F0262-0100
Rev. 1.00
Jan. 16. 2008

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.

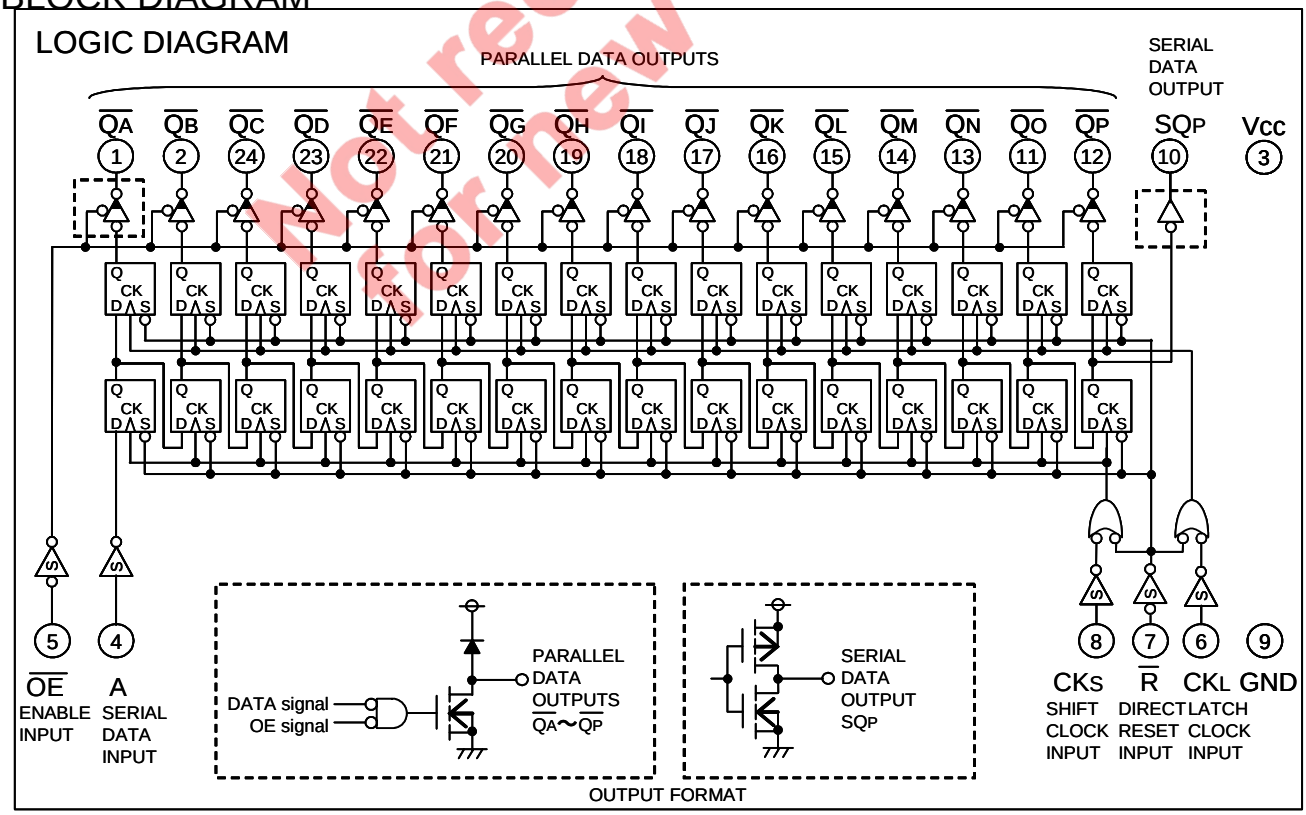
FEATURES

- Anode common LED drive
- Vcc 5V or 3.3V single power supply
- High output current: all parallel outputs $\overline{QA}$~ $\overline{QP}$ IOL=24mA (at Vcc =5.0V) IOL=12mA (at Vcc =3.3V) simultaneous lighting available
- Low power dissipation: 100uW/package (max) (Vcc=5.0V, Ta=25℃, 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



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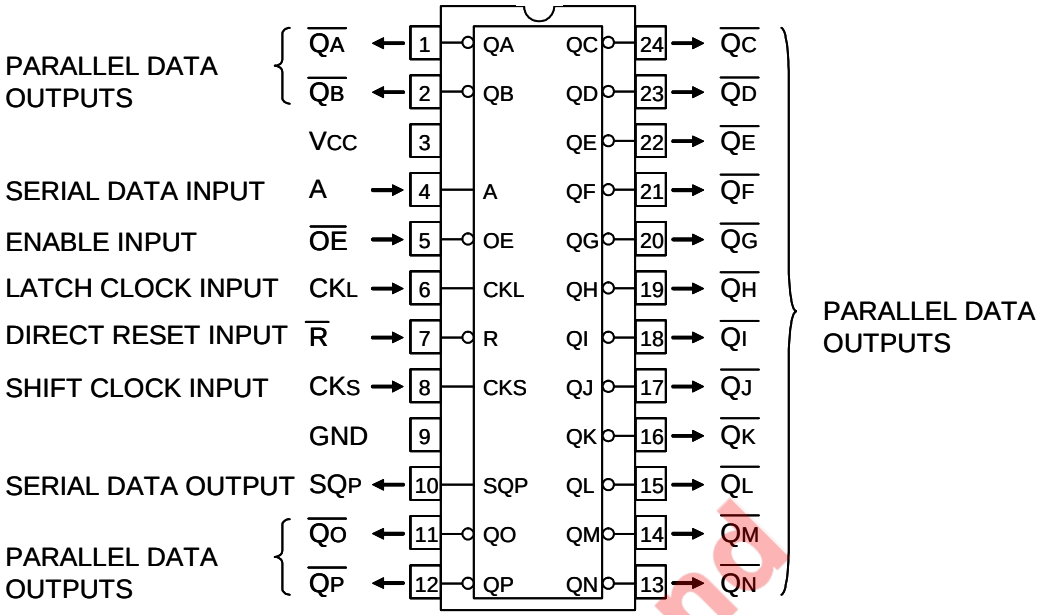
PIN CONFIGURATION (TOP VIEW)



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 $\overline{QA}$ ~ $\overline{QP}$.
Outputs $\overline{QA}$ ~ $\overline{QP}$ 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 $\overline{R}$ is changed to “L”, $\overline{QA}$ ~ $\overline{QP}$ and SQP are reset. In this case, shifting and latching register are set.
If “H” is impressed to output enable input $\overline{OE}$, $\overline{QA}$ ~ $\overline{QP}$ reaches the high impedance state, but SQP does not reach the high impedance state. Furthermore, change in $\overline{OE}$ does not affect shift operation.

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FUNCTION TABLE (Note: 1)

Operation mode		Input					Parallel data output															Serial data output	Remarks
		$\overline{R}$	CKS	CKL	A	$\overline{OE}$	$\overline{QA}$	$\overline{QB}$	$\overline{QC}$	$\overline{QD}$	$\overline{QE}$	$\overline{QF}$	$\overline{QG}$	$\overline{QH}$	$\overline{QI}$	$\overline{QJ}$	$\overline{QK}$	$\overline{QL}$	$\overline{QM}$	$\overline{QN}$	$\overline{QO}$	$\overline{QP}$	SQP	
Reset		L	X	X	X	X	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	L	—
Shift Latch operation	Shift t_1	H	↑	X	H	L	$\overline{QA}^0$	$\overline{QB}^0$	$\overline{QC}^0$	$\overline{QD}^0$	$\overline{QE}^0$	$\overline{QF}^0$	$\overline{QG}^0$	$\overline{QH}^0$	$\overline{QI}^0$	$\overline{QJ}^0$	$\overline{QK}^0$	$\overline{QL}^0$	$\overline{QM}^0$	$\overline{QN}^0$	$\overline{QO}^0$	$\overline{QP}^0$	qo^0	Output Lighting “H”
	Latch t_2	H	X	↑	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	qO^0	
	Shift t_1	H	↑	X	L	L	$\overline{QA}^0$	$\overline{QB}^0$	$\overline{QC}^0$	$\overline{QD}^0$	$\overline{QE}^0$	$\overline{QF}^0$	$\overline{QG}^0$	$\overline{QH}^0$	$\overline{QI}^0$	$\overline{QJ}^0$	$\overline{QK}^0$	$\overline{QL}^0$	$\overline{QM}^0$	$\overline{QN}^0$	$\overline{QO}^0$	$\overline{QP}^0$	qo^0	Output Lights-out “L”
	Latch t_2	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	qO^0	
Output disable		X	X	X	X	H	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	qP	—

Note1: ↑ : Change from low-level to high-level
$\overline{Q}^0$: Output state $\overline{Q}$ before CKL changed
X : Irrelevant
q^0 : Contents of shift register before CKS changed
q : Contents of shift register
t_1, t_2 : t_2 is set after t_1 is set
Z : High impedance

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

Symbol	Parameter		Conditions	Ratings	Unit
V_{CC}	Supply voltage			-0.5 ~ +7.0	V
V_I	Input voltage			-0.5 ~ V_{CC}+0.5	V
V_O	Output voltage			-0.5 ~ V_{CC}+0.5	V
I_O	Output current per output pin	$\overline{QA}$ ~ $\overline{QP}$		50	mA
		SQP		±25	
I_{CC}	Supply / GND current		V_{CC}, 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.	
V_{CC}	Supply voltage	5.0V support	4.5	5.0	5.5	V
		3.3V support	3.0	3.3	3.6	V
V_I	Input voltage		0		V_{CC}	V
V_O	Output voltage		0		V_{CC}	V
Topr	Operating temperature range		-40		+85	℃

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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	$\overline{QA}$ ~ $\overline{QP}$	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	
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	$\overline{QA}$ ~ $\overline{QP}$	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
VVOL	Low-level output voltage	$\overline{QA}$ ~ $\overline{QP}$	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	
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	$\overline{QA}$ ~ $\overline{QP}$	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

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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						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

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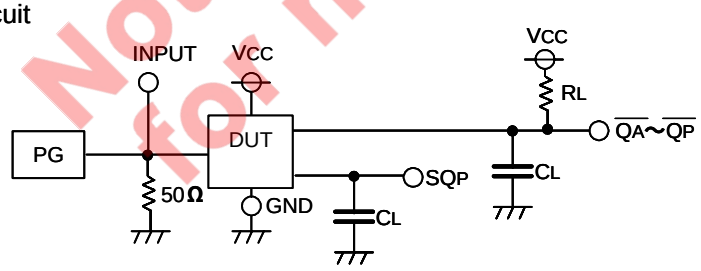
Note 4 : Test Circuit

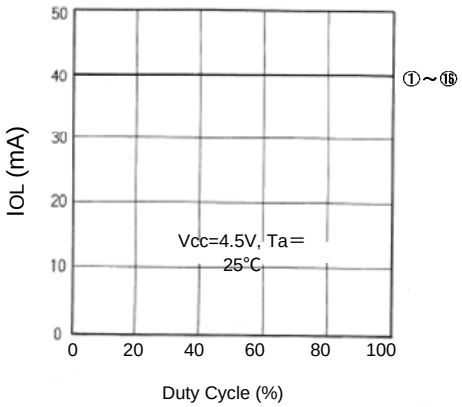


(1) The pulse generator (PG) has the following characteristics (10%~90%). :tr = 6ns, tf = 6ns.
(2) The capacitance CL includes stray wiring capacitance and the probe input capacitance.

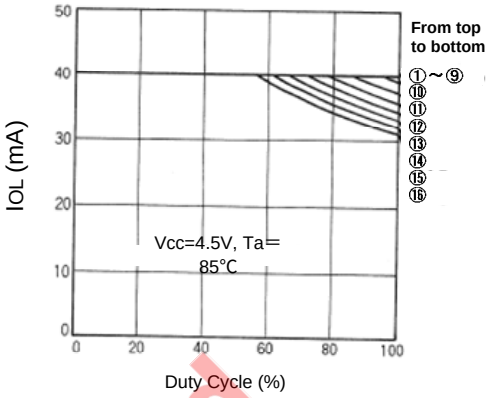
TYPICAL CHARACTERISTICS

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

Duty Cycle-IOL Characteristics



Duty Cycle-IOL Characteristics



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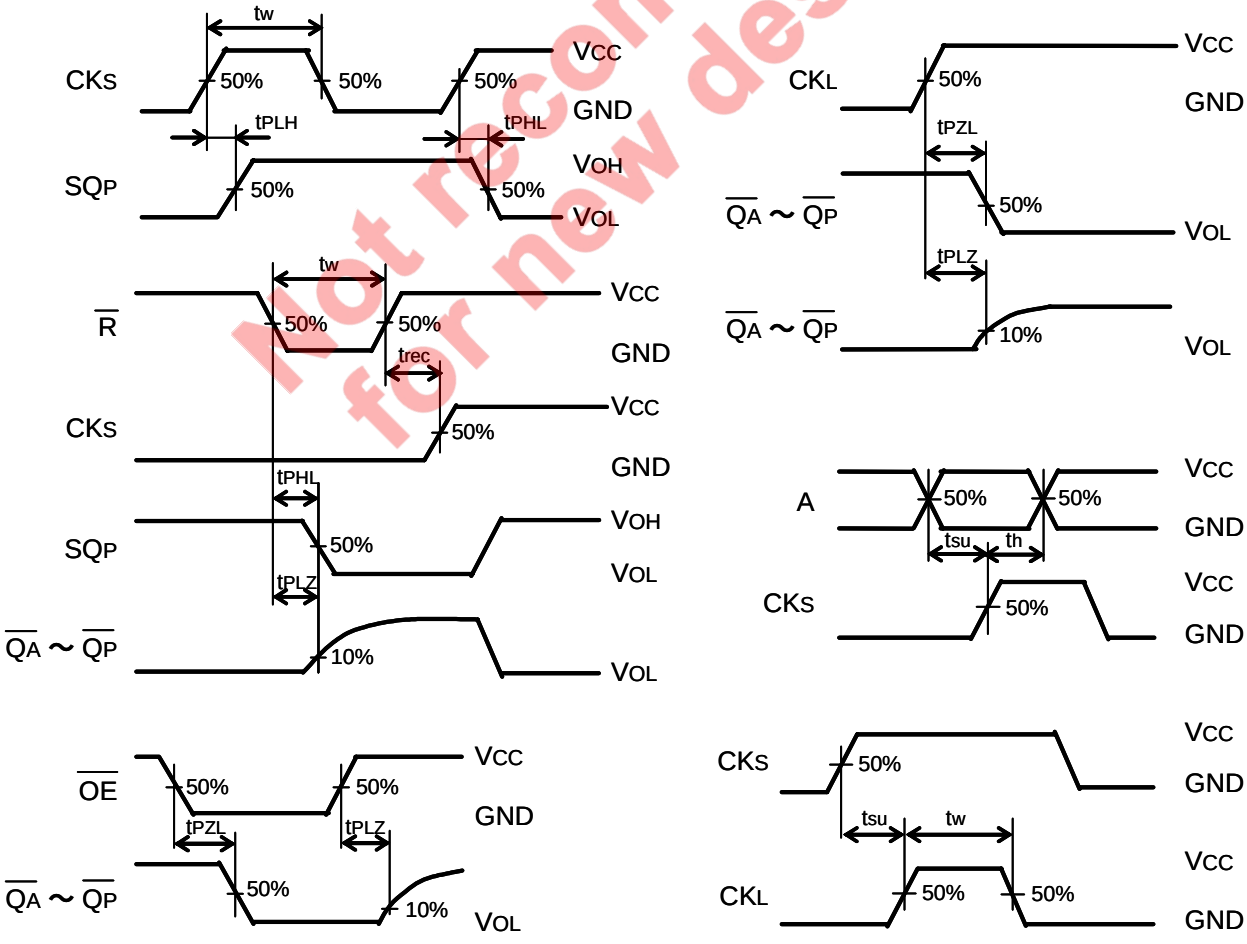
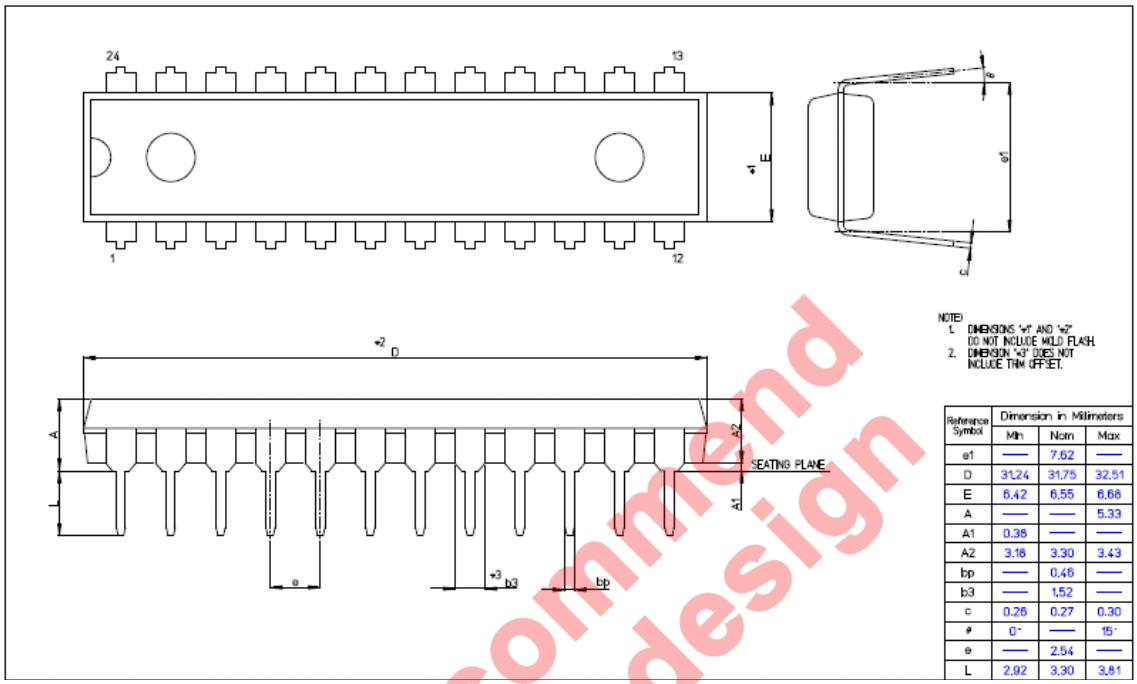
TIMING DIAGRAM

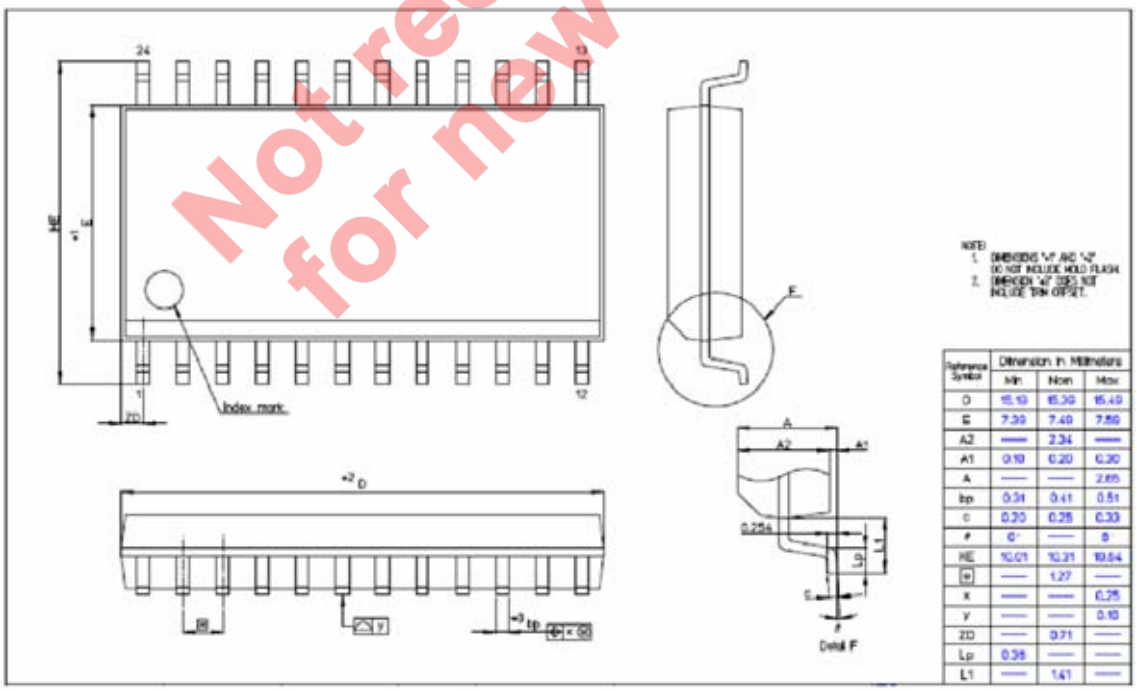


PACKAGE OUTLINE

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



Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
e1	—	7.62	—
D	31.24	31.75	32.51
E	6.42	6.55	6.68
A	—	—	5.33
A1	0.38	—	—
A2	3.18	3.30	3.43
bp	—	0.46	—
b3	—	1.52	—
c	0.26	0.27	0.30
θ	0°	—	15°
e	—	2.54	—
L	2.92	3.30	3.81



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Renesas Technology America, Inc.
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

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