

M66311P/FP

16-Bit LED Driver with Shift Register and Latch

REJ03F0177-0201
Rev.2.01
Mar 31, 2008

Description

M66311P/FP is a LED array driver having a 16 bit serial-input and parallel output shiftregister function with direct coupled reset input and output latch function.

This product guarantees the output electric current of 24 mA which is sufficient for anode common LED drive, capable of flowing 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 lay-out ensures the realization of an easy printed circuit.

Features

- Anode common LED drive
- High output current all parallel output $I_{OL} = 24$ mA simultaneous lighting available
- Low power dissipation: 100 μ W/package (max)
($V_{CC} = 5$ V, $T_a = 25^\circ\text{C}$, 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)
- Wide operating temperature range: $T_a = -40$ to $+85^\circ\text{C}$
- Pin lay-out facilitates printed circuit wiring. (This lay-out facilitates cascade connection and LED connection.)

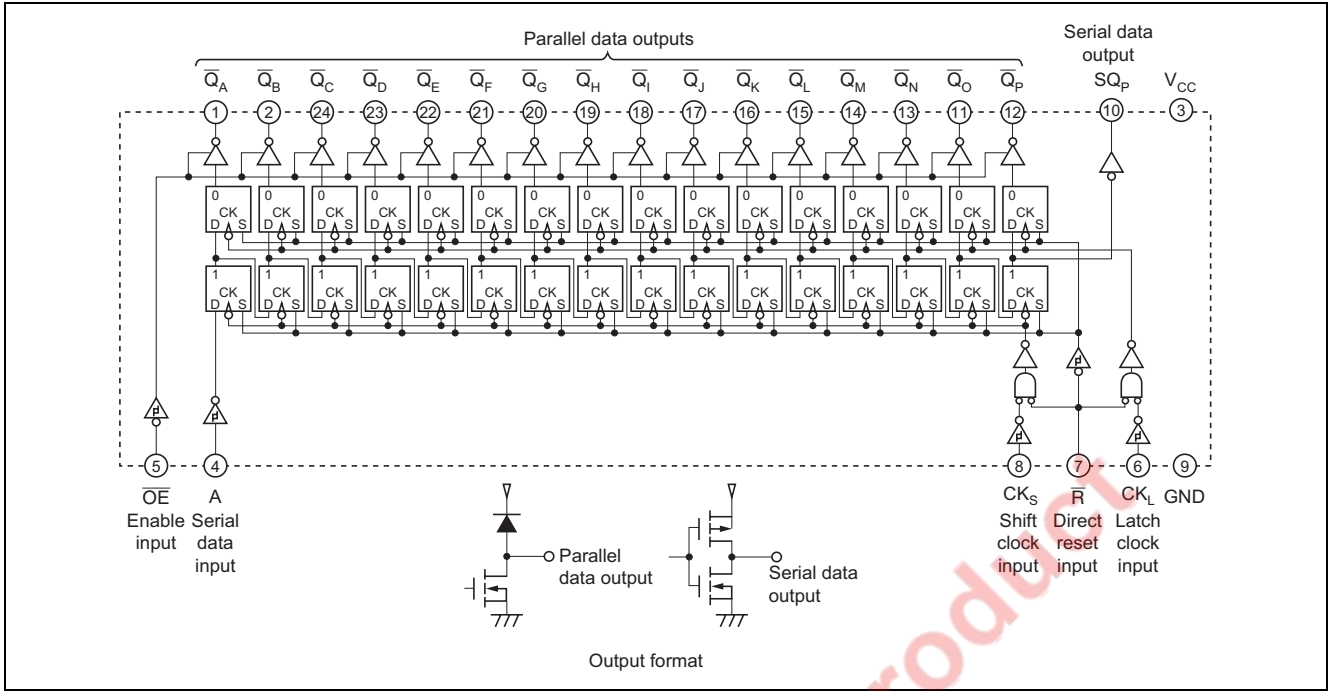
Application

LED array drive of BUTTON TELEPHONE

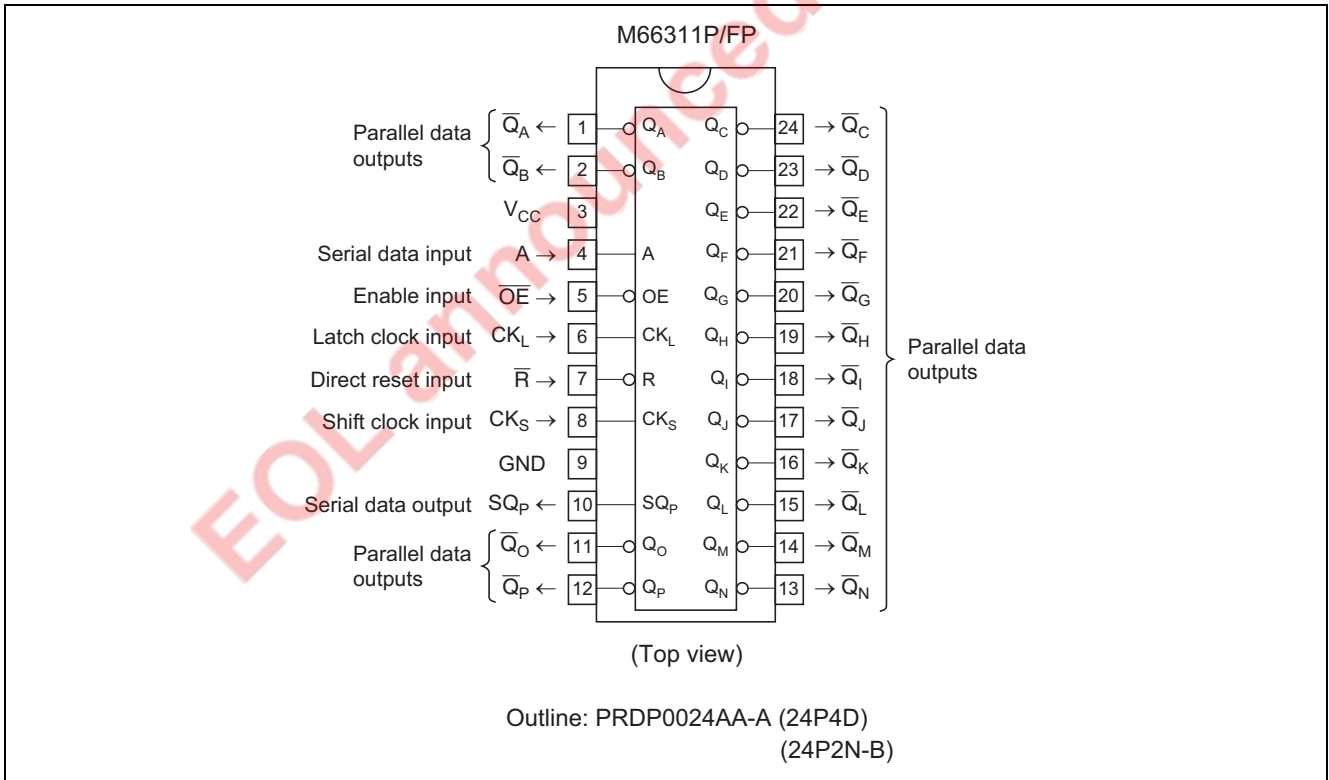
LED array drive of ERASER of a PPC copier

Other various LED modules

Logic Diagram



Pin Arrangement



Functional Description

As M66311P/FP 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 shiftregister consists of two flip-flops having independent clocks for shifting and latching.

As for clock input, shift clock input CK_S and latch clock input CK_L 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 shiftregister and the signal of A shifts shifting registers one by one when a pulse is impressed to CK_S. When A is “H”, the signal of “L” shifts.

When the pulse is impressed to CK_L, the contents of the shifting register at that time are stored in a latching register, and they appear in the outputs from Q_A to Q_P.

Outputs from Q_A to Q_P are open drain outputs.

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

If CK_S and CK_L are connected, the state of the shifting register with one clock delay is outputted to Q_A to Q_P.

When reset input R is changed to “L”, Q_A to Q_P and SQ_P are reset. In this case, shifting and latching registers are set.

If “H” is impressed to output enable input OE, Q_A to Q_P reaches the high impedance state, but SQ_P does not reach the high impedance state. Furthermore, change in OE does not affect shift operation.

Function Table (Note)

Operation Mode	Input					Parallel Data Output																Serial Data Output SQ _P	Remarks		
	R	CK _S	CK _L	A	OE	Q _A	Q _B	Q _C	Q _D	Q _E	Q _F	Q _G	Q _H	Q _I	Q _J	Q _K	Q _L	Q _M	Q _N	Q _O	Q _P				
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	Q _A ⁰	Q _B ⁰	Q _C ⁰	Q _D ⁰	Q _E ⁰	Q _F ⁰	Q _G ⁰	Q _H ⁰	Q _I ⁰	Q _J ⁰	Q _K ⁰	Q _L ⁰	Q _M ⁰	Q _N ⁰	Q _O ⁰	Q _P ⁰	q _O ⁰	Output lighting "H"	
	Latch t2	H	X	↑	X	L	L	q _A ⁰	q _B ⁰	q _C ⁰	q _D ⁰	q _E ⁰	q _F ⁰	q _G ⁰	q _H ⁰	q _I ⁰	q _J ⁰	q _K ⁰	q _L ⁰	q _M ⁰	q _N ⁰	q _O ⁰	q _O ⁰	–	
	Shift t1	H	↑	X	L	L	Q _A ⁰	Q _B ⁰	Q _C ⁰	Q _D ⁰	Q _E ⁰	Q _F ⁰	Q _G ⁰	Q _H ⁰	Q _I ⁰	Q _J ⁰	Q _K ⁰	Q _L ⁰	Q _M ⁰	Q _N ⁰	Q _O ⁰	Q _P ⁰	q _O ⁰	Output lights-out "L"	
	Latch t2	H	X	↑	X	L	Z	q _A ⁰	q _B ⁰	q _C ⁰	q _D ⁰	q _E ⁰	q _F ⁰	q _G ⁰	q _H ⁰	q _I ⁰	q _J ⁰	q _K ⁰	q _L ⁰	q _M ⁰	q _N ⁰	q _O ⁰	q _O 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	q _P	–

- Note
- ↑: Change from low-level to high-level
 - Q⁰: Output state Q before CK_L changed
 - X: Irrelevant
 - q⁰: Contents of shift register before CK_S changed
 - q: Contents of shift register
 - t₁, t₂: t₂ is set after t₁ is set
 - Z: High impedance

Absolute Maximum Ratings

(Ta = -40 to +85°C, unless otherwise noted)

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	V _{CC}	-0.5 to +7.0	V	
Input voltage	V _I	-0.5 to V _{CC} + 0.5	V	
Output voltage	V _O	-0.5 to V _{CC} + 0.5	V	
Input protection diode current	I _{IK}	-20	mA	V _I < 0 V
		20		V _I > V _{CC}
Output parasitic diode current	I _{OK}	-20	mA	V _O < 0 V
		20		V _O > V _{CC}
Output current per output pin	\bar{Q}_A to \bar{Q}_P	50	mA	
	SQ _P	±25		
Supply/GND current	I _{CC}	-20, +410	mA	V _{CC} , GND
Power dissipation	P _d	500	mW	(Note)
Storage temperature range	T _{stg}	-65 to +150	°C	

Note: M66311FP; Ta = -40 to +70°C, Ta = 70 to 85°C are derated at -6 mW/°C.

Recommended Operating Conditions

(Ta = -40 to +85°C, unless otherwise noted)

Item	Symbol	Limits			Unit
		Min	Typ	Max	
Supply voltage	V _{CC}	4.5	5	5.5	V
Input voltage	V _I	0	—	V _{CC}	V
Output voltage	V _O	0	—	V _{CC}	V
Operating temperature range	T _{opr}	-40	—	+85	°C

Electrical Characteristics

(V_{CC} = 4.5 to 5.5V, unless otherwise noted)

Item	Symbol	Limits					Unit	Conditions	
		Ta = 25°C			Ta = -40 to +85°C				
		Min	Typ	Max	Min	Max			
Positive-going threshold voltage	V _{T+}	0.35×V _{CC}	—	0.7×V _{CC}	0.35×V _{CC}	0.7×V _{CC}	V	V _O = 0.1 V, V _{CC} = 0.1 V I _O = 20 μA	
Negative-going threshold voltage	V _{T-}	0.2×V _{CC}	—	0.55×V _{CC}	0.2×V _{CC}	0.55×V _{CC}	V	V _O = 0.1 V, V _{CC} = 0.1 V I _O = 20 μA	
Low-level output voltage Q _A to Q _P	V _{OL}	—	—	0.1	—	0.1	V	V _I = V _{T+} , V _{T-} V _{CC} = 4.5 V	I _{OL} = 20 μA
		—	—	0.44	—	0.53			I _{OL} = 24 mA
		—	—	0.73	—	0.94			I _{OL} = 40 mA (Note)
High-level output voltage SQ _P	V _{OH}	V _{CC} - 0.1	—	—	V _{CC} - 0.1	—	V	V _I = V _{T+} , V _{T-} V _{CC} = 4.5 V	I _{OH} = -20 μA
		3.83	—	—	3.66	—			I _{OH} = -4 mA
Low-level output voltage SQ _P	V _{OL}	—	—	0.1	—	0.1	V	V _I = V _{T+} , V _{T-} V _{CC} = 4.5 V	I _{OL} = 20 μA
		—	—	0.44	—	0.53			I _{OL} = 4 mA
High-level input current	I _{IH}	—	—	0.5	—	5.0	μA	V _I = V _{CC} , V _{CC} = 5.5 V	
Low-level input current	I _{IL}	—	—	-0.5	—	-5.0	μA	V _I = GND, V _{CC} = 5.5 V	
Maximum output leakage current Q _A to Q _P	I _O	—	—	1.0	—	10.0	μA	V _I = V _{T+} , V _{T-} V _{CC} = 5.5 V	V _O = V _{CC}
		—	—	-1.0	—	-10.0			V _O = GND
Quiescent supply current	I _{CC}	—	—	20.0	—	200.0	μA	V _I = V _{CC} , GND, V _{CC} = 5.5 V	

Note: M66311 is used under the condition of an output current I_{OL} = 40 mA, the number of simultaneous drive outputs is restricted as shown in the Duty Cycle-I_{OL} of Standard characteristics.

Switching Characteristics

(V_{CC} = 5 V)

Item	Symbol	Limits					Unit	Conditions
		Ta = 25°C			Ta = -40 to +85°C			
		Min	Typ	Max	Min	Max		
Maximum clock frequency	f _{max}	5	—	—	4	—	MHz	C _L = 50 pF R _L = 1 kΩ (Note 2)
Low-level to high-level and high-level to low-level output propagation time (CK _S -SQ _P)	t _{PLH}	—	—	100	—	130	ns	
	t _{PHL}	—	—	100	—	130	ns	
High-level to low-level output propagation time (\bar{R} -SQ _P)	t _{PHL}	—	—	100	—	130	ns	
Low-level to high-level output propagation time (\bar{R} - \bar{Q}_A to \bar{Q}_P)	t _{PLZ}	—	—	150	—	200	ns	
Low-level to high-level and high-level to low-level output propagation time (CK _L - \bar{Q}_A to \bar{Q}_P)	t _{PZL}	—	—	100	—	130	ns	
	t _{PLZ}	—	—	150	—	200	ns	
Output enable time to low-level and high-level ($\bar{O}\bar{E}$ - \bar{Q}_A to \bar{Q}_P)	t _{PZL}	—	—	100	—	130	ns	
	t _{PLZ}	—	—	150	—	200	ns	
Input Capacitance	C _I	—	—	10	—	10	pF	
Output Capacitance	C _O	—	—	15	—	15	pF	$\bar{O}\bar{E} = V_{CC}$
Power dissipation Capacitance (Note 1)	C _{PD}	—	5	—	—	—	pF	

Note: 1. C_{PD} is the internal capacitance of the IC calculated from operation supply current under no-load conditions. (per latch)

The power dissipated during operation under no-load conditions is calculated using the following formula:

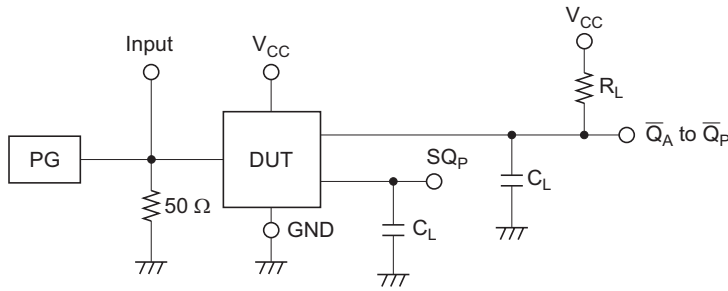
$$P_D = C_{PD} \cdot V_{CC}^2 \cdot f_I + I_{CC} \cdot V_{CC}$$

Timing Requirements

(V_{CC} = 5 V)

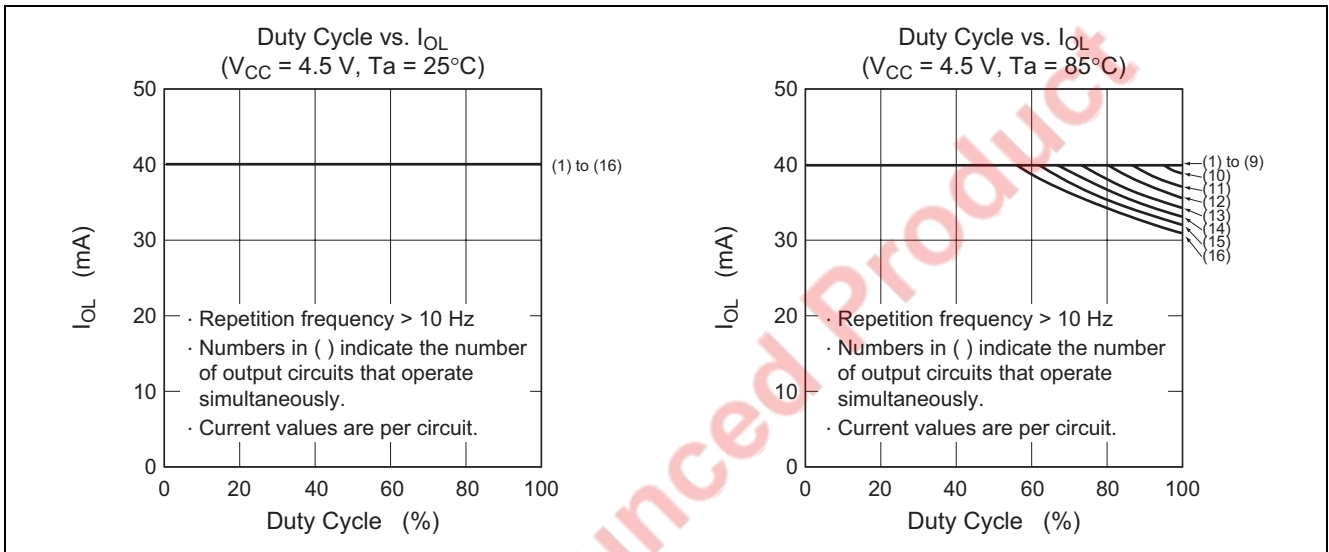
Item	Symbol	Limits					Unit	Conditions
		Ta = 25°C			Ta = -40 to +85°C			
		Min	Typ	Max	Min	Max		
CK _S , CK _L , \bar{R} pulse width	t _w	100	—	—	130	—	ns	(Note 2)
A setup time with respect to CK _S	t _{su}	100	—	—	130	—	ns	
CK _S setup time with respect to CK _L	t _{su}	100	—	—	130	—	ns	
A hold time with respect to CK _S	t _h	10	—	—	15	—	ns	
\bar{R} , recovery time with respect to CK _S , CK _L	t _{rec}	50	—	—	70	—	ns	

Note: 2. Test Circuit

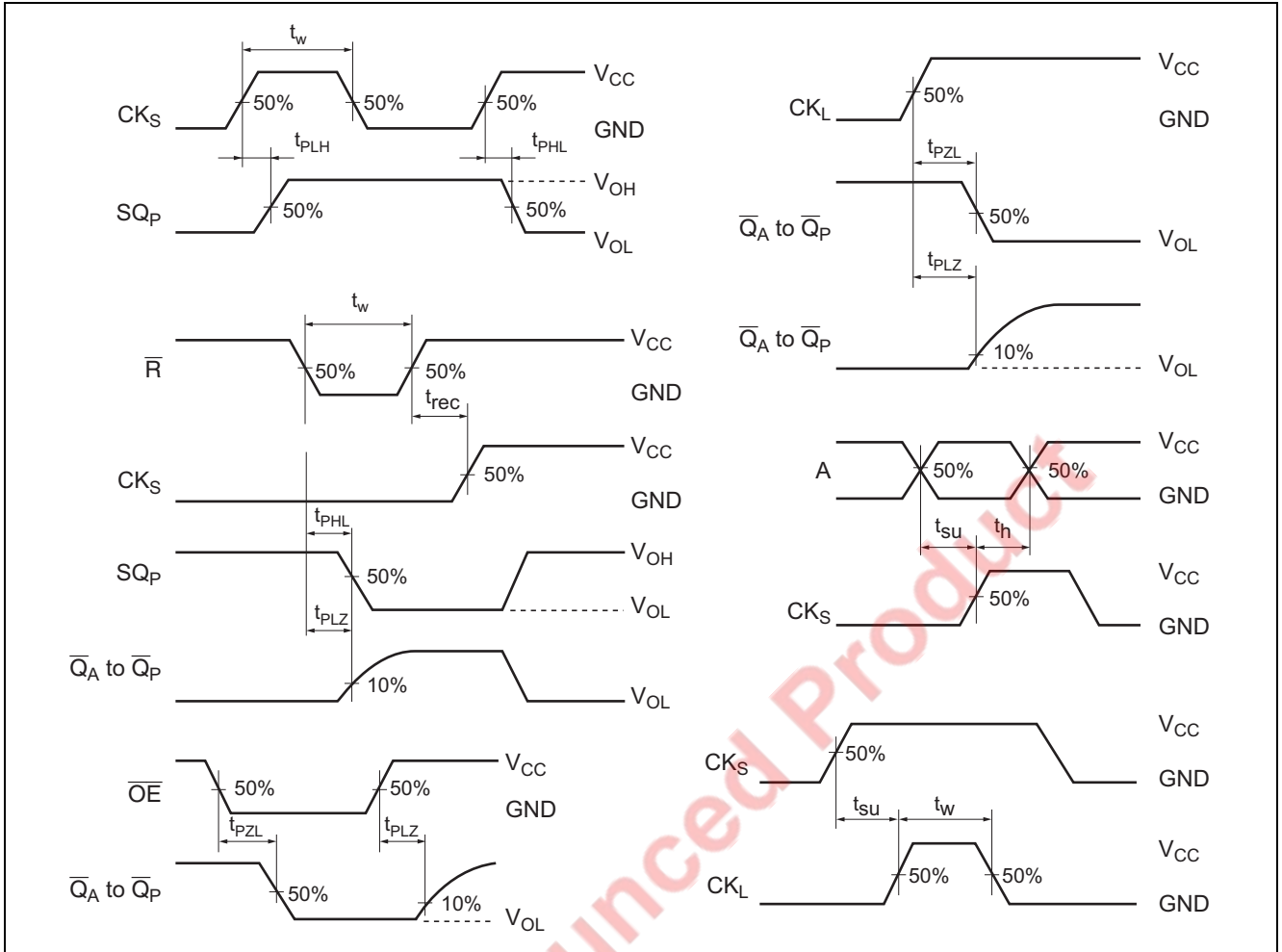


- (1) The pulse generator (PG) has the following characteristics (10% to 90%): $t_r = 6 \text{ ns}$, $t_f = 6 \text{ ns}$
- (2) The capacitance C_L includes stray wiring capacitance and the probe input capacitance.

Typical Characteristics

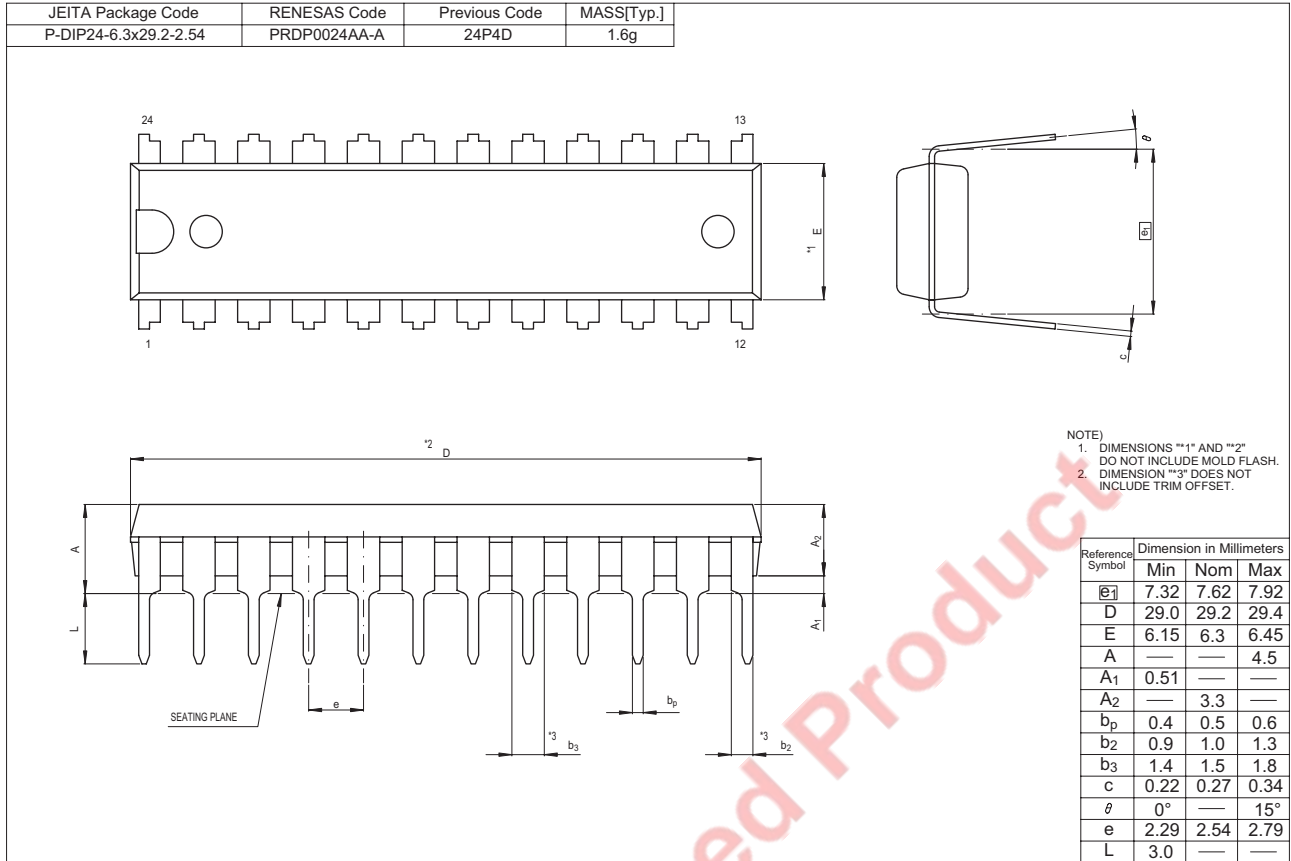


Timing Chart



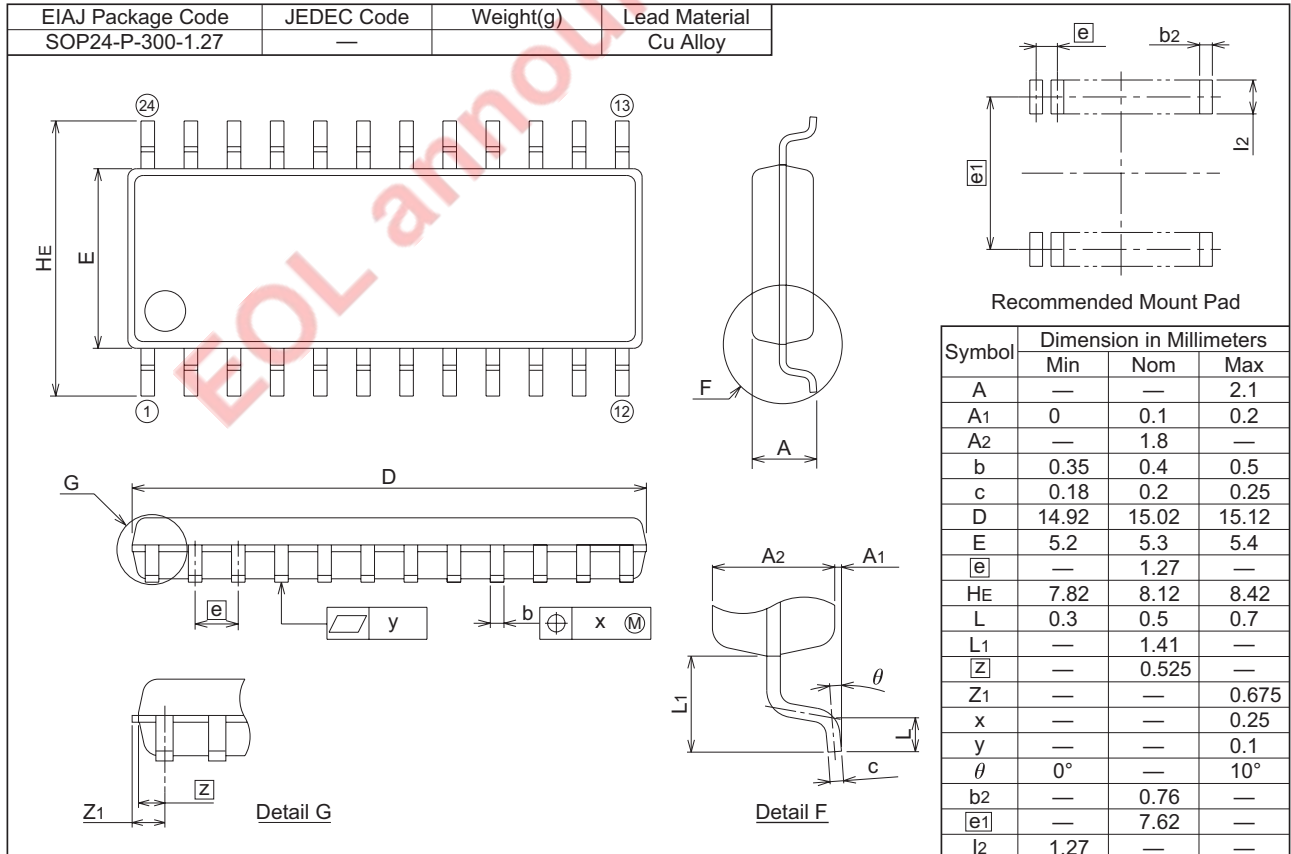
EOL announced Product

Package Dimensions



24P2N-B

Plastic 24pin 300mil SOP



Notes:

1. This document is provided for reference purposes only so that Renesas customers may select the appropriate Renesas products for their use. Renesas neither makes warranties or representations with respect to the accuracy or completeness of the information contained in this document nor grants any license to any intellectual property rights or any other rights of Renesas or any third party with respect to the information in this document.
2. Renesas shall have no liability for damages or infringement of any intellectual property or other rights arising out of the use of any information in this document, including, but not limited to, product data, diagrams, charts, programs, algorithms, and application circuit examples.
3. You should not use the products or the technology described in this document for the purpose of military applications such as the development of weapons of mass destruction or for the purpose of any other military use. When exporting the products or technology described herein, you should follow the applicable export control laws and regulations, and procedures required by such laws and regulations.
4. All information included in this document such as product data, diagrams, charts, programs, algorithms, and application circuit examples, is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas products listed in this document, please confirm the latest product information with a Renesas sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas such as that disclosed through our website. (<http://www.renesas.com>)
5. Renesas has used reasonable care in compiling the information included in this document, but Renesas assumes no liability whatsoever for any damages incurred as a result of errors or omissions in the information included in this document.
6. When using or otherwise relying on the information in this document, you should evaluate the information in light of the total system before deciding about the applicability of such information to the intended application. Renesas makes no representations, warranties or guarantees regarding the suitability of its products for any particular application and specifically disclaims any liability arising out of the application and use of the information in this document or Renesas products.
7. With the exception of products specified by Renesas as suitable for automobile applications, Renesas products are not designed, manufactured or tested for applications or otherwise in systems the failure or malfunction of which may cause a direct threat to human life or create a risk of human injury or which require especially high quality and reliability such as safety systems, or equipment or systems for transportation and traffic, healthcare, combustion control, aerospace and aeronautics, nuclear power, or undersea communication transmission. If you are considering the use of our products for such purposes, please contact a Renesas sales office beforehand. Renesas shall have no liability for damages arising out of the uses set forth above.
8. Notwithstanding the preceding paragraph, you should not use Renesas products for the purposes listed below:
 - (1) artificial life support devices or systems
 - (2) surgical implantations
 - (3) healthcare intervention (e.g., excision, administration of medication, etc.)
 - (4) any other purposes that pose a direct threat to human lifeRenesas shall have no liability for damages arising out of the uses set forth in the above and purchasers who elect to use Renesas products in any of the foregoing applications shall indemnify and hold harmless Renesas Technology Corp., its affiliated companies and their officers, directors, and employees against any and all damages arising out of such applications.
9. You should use the products described herein within the range specified by Renesas, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas shall have no liability for malfunctions or damages arising out of the use of Renesas products beyond such specified ranges.
10. Although Renesas endeavors to improve the quality and reliability of its products, IC products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Please be sure to implement safety measures to guard against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other applicable measures. Among others, since the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
11. In case Renesas products listed in this document are detached from the products to which the Renesas products are attached or affixed, the risk of accident such as swallowing by infants and small children is very high. You should implement safety measures so that Renesas products may not be easily detached from your products. Renesas shall have no liability for damages arising out of such detachment.
12. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written approval from Renesas.
13. Please contact a Renesas sales office if you have any questions regarding the information contained in this document, Renesas semiconductor products, or if you have any other inquiries.



RENESAS SALES OFFICES

<http://www.renesas.com>

Refer to "<http://www.renesas.com/en/network>" for the latest and detailed information.

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, AZIA Center, 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