



SANYO Semiconductors

DATA SHEET

An ON Semiconductor Company

LA5693D LA5693MD

Monolithic Linear IC
with Watchdog Timer
Voltage Regulator Driver

Overview

The LA5693D and LA5693MD is a single-chip voltage regulator for microcomputer system monitor use that performs the functions of 5V output voltage control, watchdog timer, and voltage detector. Since the LA5693D and LA5693MD can hold the reset output, it is especially suited for use in peripheral control and monitor output applications (example: valves used in refrigeration equipment, hot water supply system).

Features

- An external PNP transistor can be used to provide a low-saturation voltage regulator.
- Since the CK input has no edge detector, a high degree of flexibility is allowed in applications.
- Variable detection voltage.
- The watchdog time can be made longer.

Functions

- Output voltage 5V control.
- Watchdog timer.
- Power-ON reset function.
- Reset hold output [RES (2)] (Cleared with CK re-input).

Applications

- Microcomputer system for car equipment, refrigeration/heating equipment, office automation equipment.

■ Any and all SANYO Semiconductor Co.,Ltd. products described or contained herein are, with regard to "standard application", intended for the use as general electronics equipment. The products mentioned herein shall not be intended for use for any "special application" (medical equipment whose purpose is to sustain life, aerospace instrument, nuclear control device, burning appliances, transportation machine, traffic signal system, safety equipment etc.) that shall require extremely high level of reliability and can directly threaten human lives in case of failure or malfunction of the product or may cause harm to human bodies, nor shall they grant any guarantee thereof. If you should intend to use our products for new introduction or other application different from current conditions on the usage of automotive device, communication device, office equipment, industrial equipment etc. , please consult with us about usage condition (temperature, operation time etc.) prior to the intended use. If there is no consultation or inquiry before the intended use, our customer shall be solely responsible for the use.

■ Specifications of any and all SANYO Semiconductor Co.,Ltd. products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.

LA5693D, LA5693MD

Specifications

Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Control pin voltage	$V_{\text{CONT max}}$	1s	60	V
			41	V
Control pin current	$I_{\text{CONT max}}$		11	mA
CK input voltage	$V_{\text{CK max}}$		25	V
Reset pin voltage	$V_{\overline{\text{RES}}(1) \text{ max,}}$ $V_{\overline{\text{RES}}(2) \text{ max}}$		41	V
Allowable power dissipation	$P_d \text{ max}$	LA5693D	500	mW
		LA5693MD	350	mW
Operating temperature	T_{opr}		-40 to +85	$^\circ\text{C}$
Storage temperature	T_{stg}		-55 to +150	$^\circ\text{C}$

* : A PNP transistor is connected to the LA5693D, LA5693M externally to provide a low-saturation voltage regulator.

Therefore, $I_{\text{CONT}} \approx 100\text{mA}$ will flow, as starting current, in the V_{CC} range where the output cannot be regulated.

Caution 1) Absolute maximum ratings represent the value which cannot be exceeded for any length of time.

Caution 2) Even when the device is used within the range of absolute maximum ratings, as a result of continuous usage under high temperature, high current, high voltage, or drastic temperature change, the reliability of the IC may be degraded. Please contact us for the further details.

Operating Conditions at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Control pin voltage	V_{CONT}		6 to 40	V
Control pin current	$I_{\text{CONT max}}$		10	mA
Reset output current	$V_{\overline{\text{RES}}(1) \text{ max,}}$ $V_{\overline{\text{RES}}(2) \text{ max}}$	External R pull-up	8	mA
Reset detection voltage	$V_{\text{S min}}$		4	V

Electrical Characteristics at $T_a = 25^\circ\text{C}$, $V_{\text{CC}} = 14\text{V}$, $I_{\text{O}} = 50\text{mA}$, unless otherwise specified.

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output voltage	V_{O}		4.8	5.0	5.2	V
Line regulation1	ΔV_{OLN1}	$9\text{V} \leq V_{\text{CC}} \leq 16\text{V}$		2	5	mV
Line regulation2	ΔV_{OLN2}	$6\text{V} \leq V_{\text{CC}} \leq 40\text{V}$		4	30	mV
Load regulation	ΔV_{OLD}	$1\text{mA} \leq I_{\text{O}} \leq 50\text{mA}$		4	30	mV
Current dissipation	I_{CC}	$I_{\text{O}} = 0$		4.4	6.5	mA
Output noise voltage	V_{NO}	$10\text{Hz} \leq f \leq 100\text{kHz}$, $V_{\text{CK}} = 0\text{V}$		150		μV
Temperature coefficient of output voltage	$\Delta V_{\text{O}}/\Delta T_a$	$I_{\text{O}} = 5\text{mA}$, $-40^\circ\text{C} \leq T_a \leq +85^\circ\text{C}$		± 0.2		$\text{mV}/^\circ\text{C}$
Reference voltage	V_{REF}		1.13	1.18	1.23	V
'H'-level CK input voltage	V_{IH}		2			V
'L'-level CK input voltage	V_{IL}				0.8	V
'H'-level CK input current	I_{IH}	$V_{\text{CK}} = 5\text{V}$		0.3	0.7	mA
'L'-level CK input current	I_{IL}	$V_{\text{CK}} = 0\text{V}$	-1.0	-0.1		μA
'H'-level reset output voltage	$V_{\overline{\text{ORH}}(1)}$ / $V_{\overline{\text{ORH}}(2)}$	$\overline{\text{RES}}(2)$: $10\text{k}\Omega$ pull-up	4.8	5.0	5.2	V
'L'-level reset output voltage 1	$V_{\overline{\text{ORL}}(1)1}$ / $V_{\overline{\text{ORL}}(2)1}$	$\overline{\text{RES}}(2)$: $10\text{k}\Omega$ pull-up		40	200	mV
'L'-level reset output voltage 2	$V_{\overline{\text{ORL}}(1)2}$ / $V_{\overline{\text{ORL}}(2)2}$	$I_{\overline{\text{RES}}(1)} = I_{\overline{\text{RES}}(2)} = 8\text{mA}$		0.16	0.8	V
CK input pulse width	t_{CKW}	$V_{\text{CK}} = 5\text{V}$	3			μs
Reset output delay time	t_{d}	$C_{\text{t}} = 1\mu\text{F}$	7.5	10	12.5	ms
Watchdog time	t_{WD}	$C_{\text{t}} = 1\mu\text{F}$	30	40	50	ms
Watchdog reset time	t_{WR}	$C_{\text{t}} = 1\mu\text{F}$	0.1	0.25	0.4	ms
Reset hysteresis voltage	V_{hys}	$V_{\text{S}} = 4.5\text{V}$	100	200	300	mV

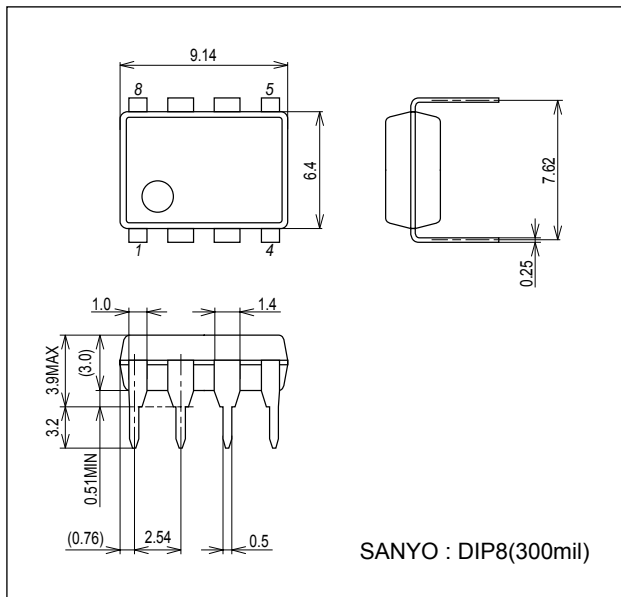
LA5693D, LA5693MD

Package Dimensions

unit : mm (typ)

3001D

[LA5693D]

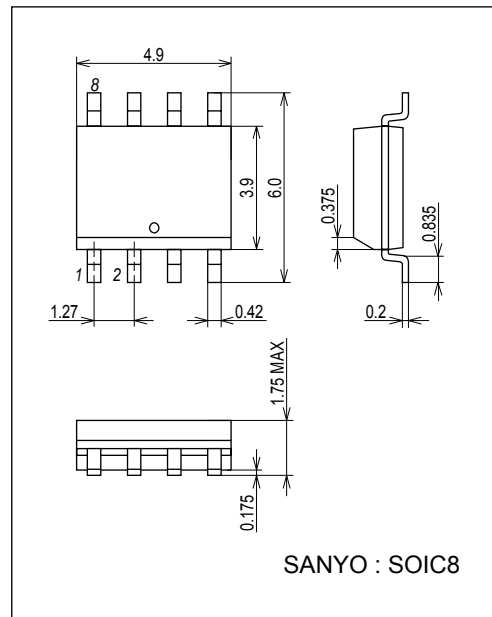


Package Dimensions

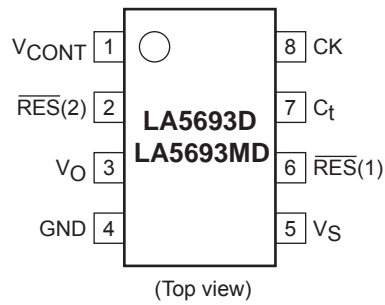
unit : mm (typ)

3424

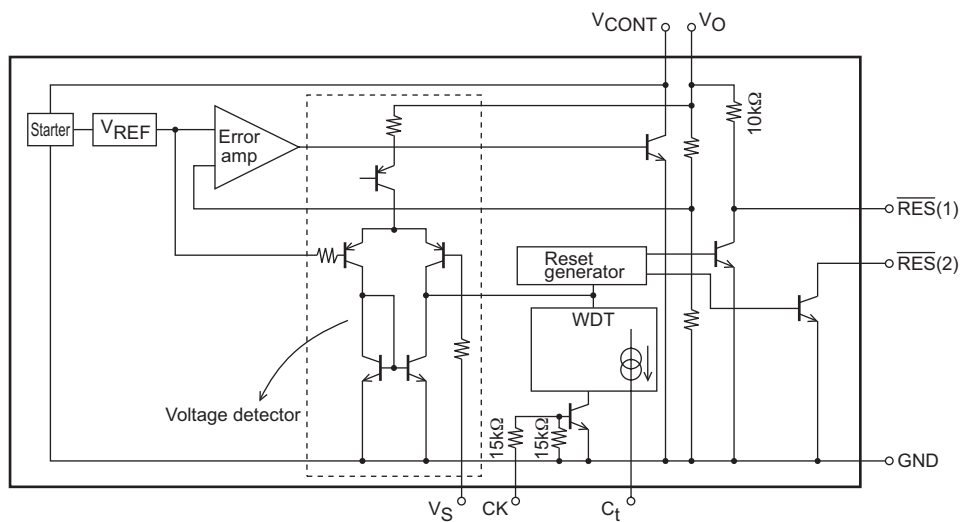
[LA5693MD]



Pin Assignment



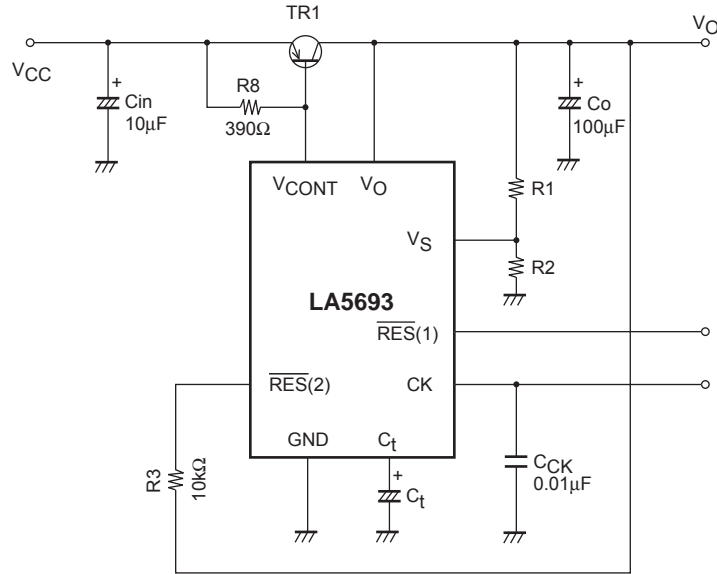
Block Diagram



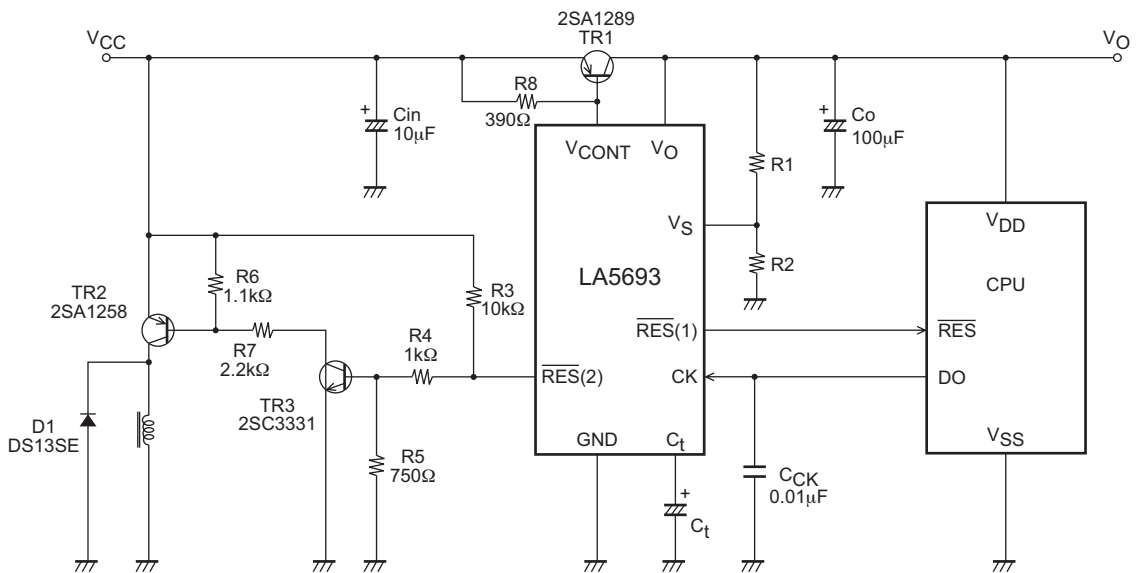
$\overline{\text{RES}}(1)$: Contains a pull-up resistor of 10k Ω .
 $\overline{\text{RES}}(2)$: Open collector.

LA5693D, LA5693MD

Test Circuit



Application Circuit Example



$$V_S = V_{REF} \times \left(\frac{R_1}{R_2} + 1 \right)$$

$$V_{REF} \approx 1.18[V]$$

$$t_d = 10 \times C_t (\mu F) \quad [ms]$$

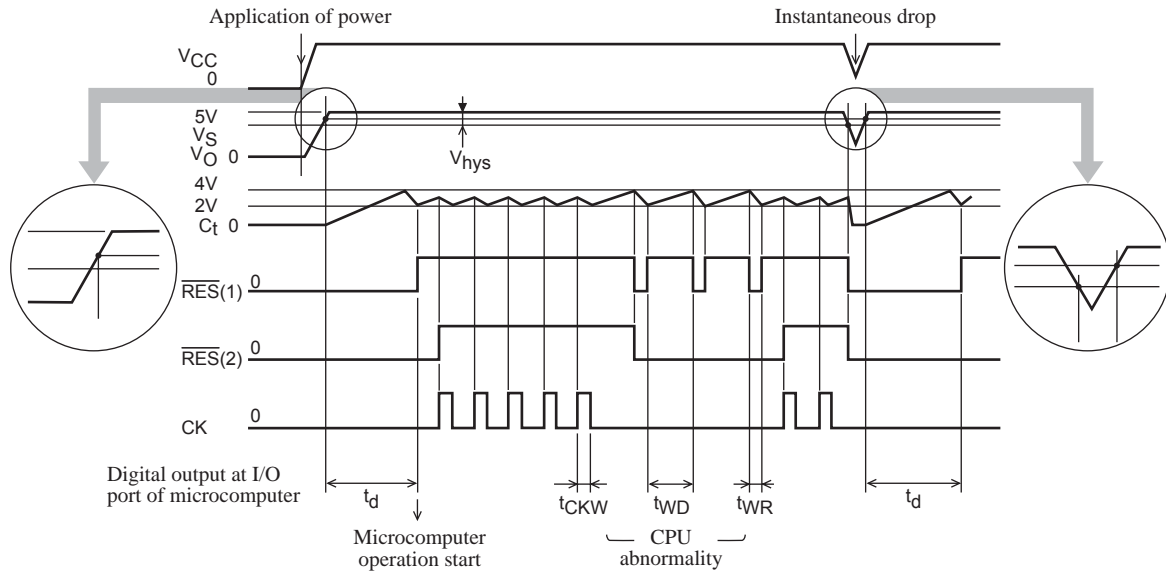
$$t_{WD} = 40 \times C_t (\mu F) \quad [ms]$$

$$t_{WR} = 0.25 \times C_t (\mu F) \quad [ms]$$

Note on application

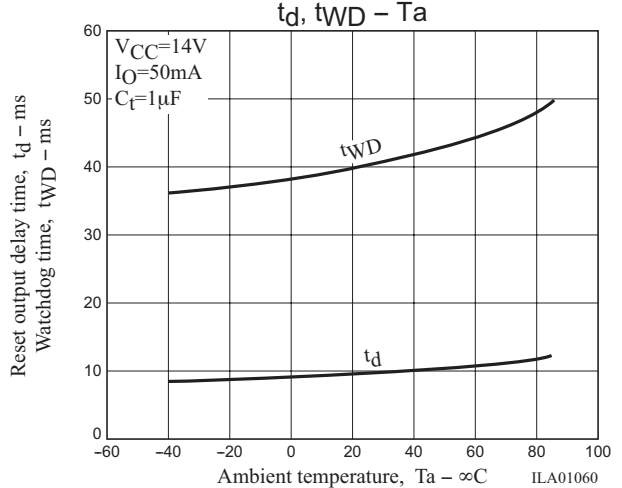
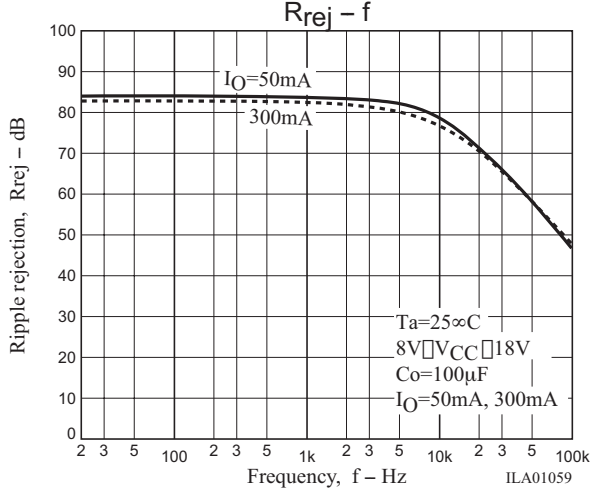
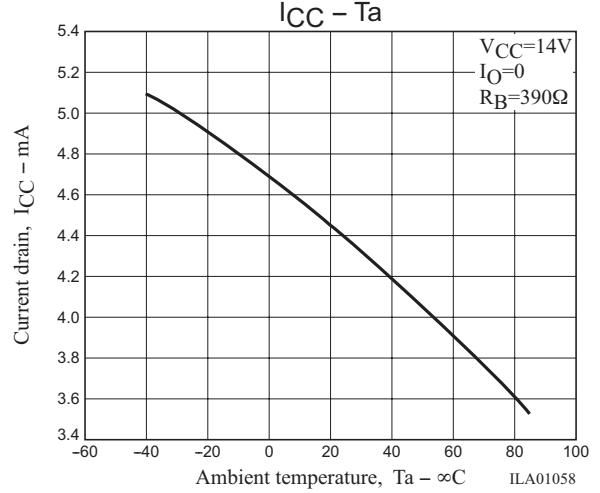
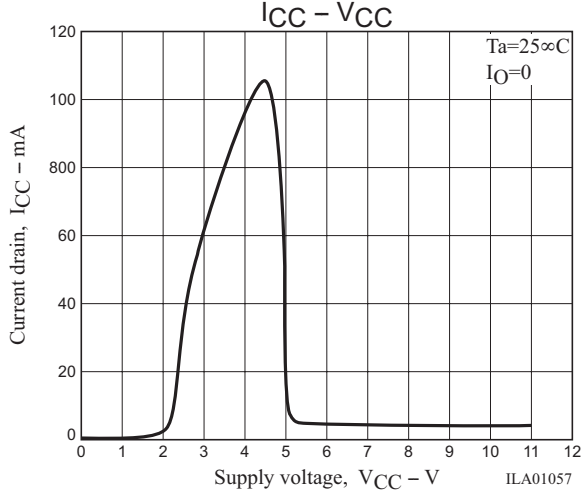
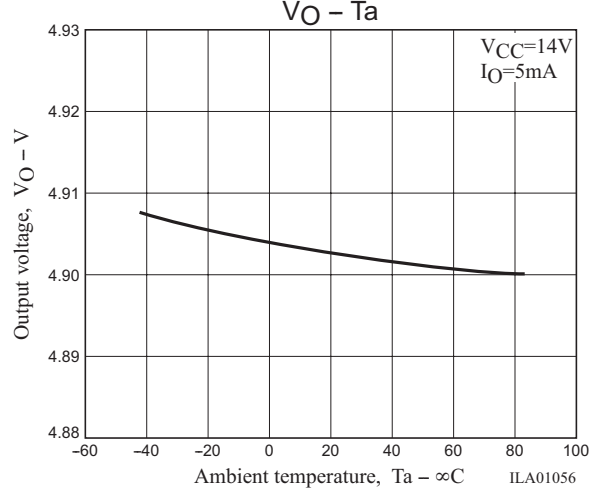
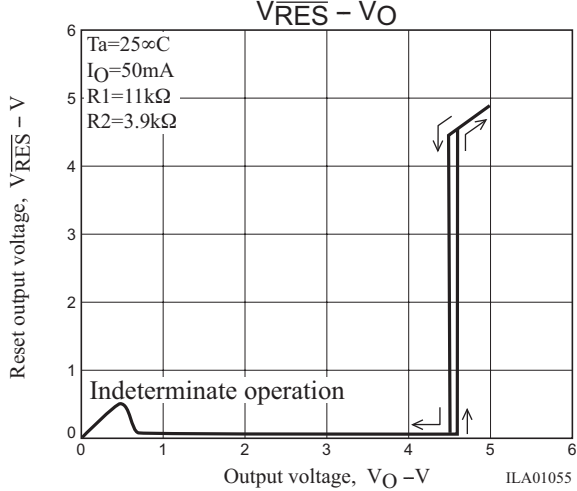
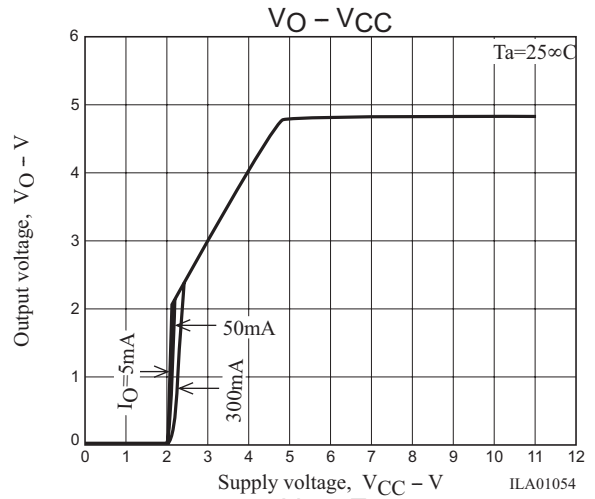
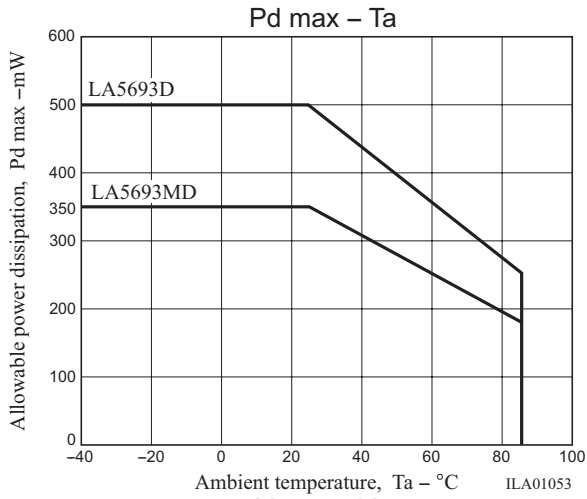
1. For stable operation, place C_{in} , C_O , and TR1 as near to the IC as possible.
2. When used in 0°C or below it, a capacitor of which impedance at high-frequency operation is low and has a good temperature characteristic (such as SANYO OS-CON capacitor or others) should be used to prevent oscillation.
3. Set V_S to the output voltage level where the circuit will be reset using external resistors R1 and R2. V_S should be set to 4V or greater due to internal circuit operation.
4. C_{CK} must be inserted to cut the high range element of clock noise to prevent it from becoming a reset output noise.
5. For C_t , a capacitor which less varies the capacitance according to the temperature should be used.

Timing Chart

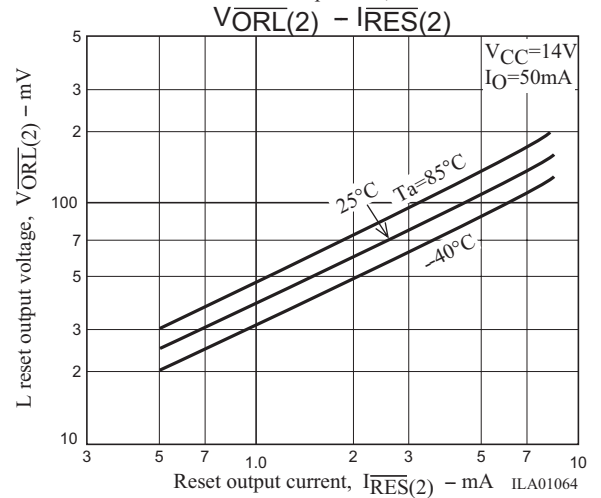
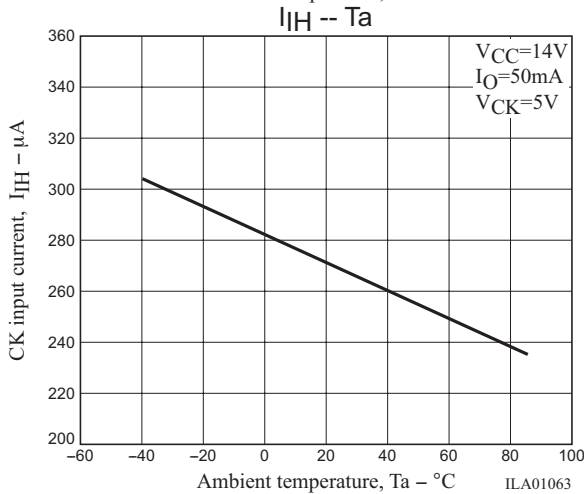
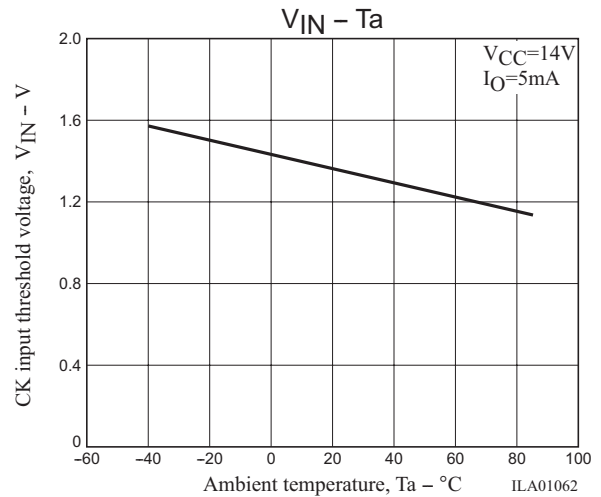
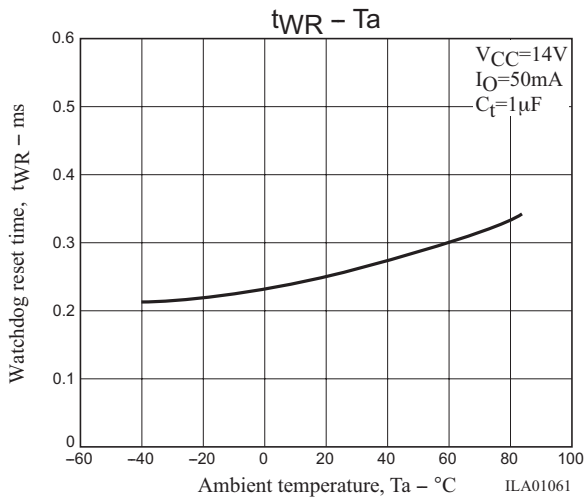


Note : Edge-triggered at the point indicated by the arrow of CK signal.

LA5693D, LA5693MD



LA5693D, LA5693MD



- SANYO Semiconductor Co.,Ltd. assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO Semiconductor Co.,Ltd. products described or contained herein.
- Regarding monolithic semiconductors, if you should intend to use this IC continuously under high temperature, high current, high voltage, or drastic temperature change, even if it is used within the range of absolute maximum ratings or operating conditions, there is a possibility of decrease reliability. Please contact us for a confirmation.
- SANYO Semiconductor Co.,Ltd. strives to supply high-quality high-reliability products, however, any and all semiconductor products fail or malfunction with some probability. It is possible that these probabilistic failures or malfunction could give rise to accidents or events that could endanger human lives, trouble that could give rise to smoke or fire, or accidents that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all SANYO Semiconductor Co.,Ltd. products described or contained herein are controlled under any of applicable local export control laws and regulations, such products may require the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written consent of SANYO Semiconductor Co.,Ltd.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO Semiconductor Co.,Ltd. product that you intend to use.
- Upon using the technical information or products described herein, neither warranty nor license shall be granted with regard to intellectual property rights or any other rights of SANYO Semiconductor Co.,Ltd. or any third party. SANYO Semiconductor Co.,Ltd. shall not be liable for any claim or suits with regard to a third party's intellectual property rights which has resulted from the use of the technical information and products mentioned above.

This catalog provides information as of Jun, 2012. Specifications and information herein are subject to change without notice.