



# LA5601

## Low Saturation Regulator with Reset

### Overview

The LA5601 is a voltage regulator with a low-voltage detector and reset controller for use in microprocessor-based systems. It generates a reset signal for low power supply voltage. It also features a low 0.25V (typ.) saturation voltage for reduced power dissipation and power supply size. Applications include microprocessor-controlled consumer electronic equipment such as CD players, tuners and receivers, and preamplifiers.

### Functions

- Low saturation regulator with 250mA and 5.2V output.
- Power supply reset generator function.
- Supports on-off control of 5.2V using equipped enable pin (high active).
- Built-in Darlington driver (120mA).
- Built-in auxiliary regulator (5.2V, 250mA).

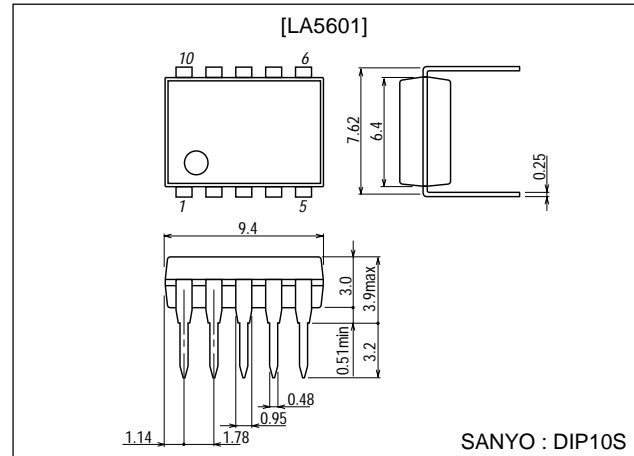
### Features

- Low minimum input-output voltage difference (0.3V typ).
- Supports setting of reset output delay time using external capacitor.
- Built-in fold-back current limiting circuit and excessive heat protection circuit.
- Reset output using active pull-up for simpler noise reduction and use with internal pull-down logic circuits.
- Error amplifier noise filter pin.
- Auxiliary regulator with reverse current protection.

### Package Dimensions

unit:mm

3098B-DIP10S



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## Specifications

### Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage	V <sub>IN</sub> max		15	V
Enable pin voltage	V <sub>EN</sub> max		V <sub>IN</sub> max	V
Reset output pin voltage	V <sub>RES</sub> max		15	V
Driver output voltage	V <sub>OD</sub> max		15	V
Driver input voltage	V <sub>ID</sub> max		15	V
Allowable power dissipation	Pd max		1	W
Operating temperature	Topr		-30 to +80	°C
Storage temperature	Tstg		-55 to +150	°C

### Operating Conditions at Ta = 25°C

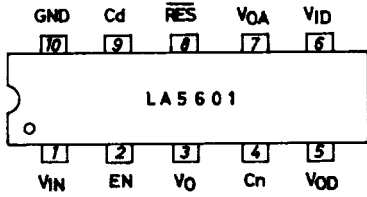
Parameter	Symbol	Conditions	Ratings	Unit
Input voltage	V <sub>IN</sub>		5.9 to 14	V
Output current	I <sub>OUT</sub>		0 to 250	mA
H-level reset output current	I <sub>ORH</sub>		0 to 200	μA
L-level reset output current	I <sub>ORL</sub>		0 to 2	mA
Auxiliary regulator output current	I <sub>OA</sub>		0 to 10	mA
Driver output voltage	V <sub>OD</sub> max		14	V
L-level driver output current	I <sub>ODL</sub> max		120	mA
H-level driver input voltage	V <sub>IDH</sub>	I <sub>ODL</sub> =120mA	3 to 14	V
L-level driver input voltage	V <sub>IDL</sub>	I <sub>ODL</sub> ≤100μA	-0.3 to +0.3	V

### Operating Characteristics at Tj = 25°C, V<sub>IN</sub>=6V, I<sub>OUT</sub>=200mA, See specified Test Circuit.

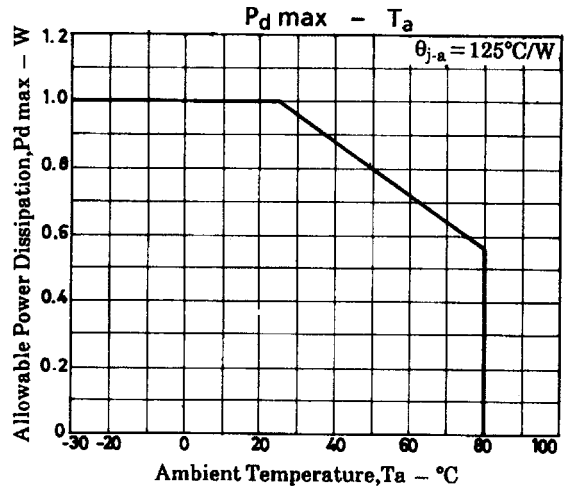
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[Main regulator : Output ON-state, V <sub>EN</sub> =H' or open]						
Output voltage	V <sub>O</sub>		5.0	5.2	5.4	V
Dropout voltage	V <sub>DROP</sub>	I <sub>OUT</sub> =250mA		0.25	0.5	V
Line regulation	ΔV <sub>OLN1</sub>	5.5V≤V <sub>IN</sub> ≤14V		30	80	mV
	ΔV <sub>OLN2</sub>	6V≤V <sub>IN</sub> ≤14V		20	40	mV
Load regulation	ΔV <sub>OLD1</sub>	5mA≤I <sub>OUT</sub> ≤250mA		40	100	mV
	ΔV <sub>OLD2</sub>	5mA≤I <sub>OUT</sub> ≤100mA		14	50	mV
Peak output current	I <sub>OP</sub>		250	500		mA
Output short current	I <sub>OSC</sub>			80	300	mA
Current drain	I <sub>Q1</sub>	I <sub>OUT</sub> =0		2.2	6	mA
	I <sub>Q2</sub>			10	30	mA
Output noise voltage	V <sub>NO</sub>	10Hz≤f≤100kHz		70		μVrms
Temperature coefficient of output voltage	ΔV <sub>O</sub> /ΔTj	Tj=25 to 80°C		-0.7		mV/°C
Ripple rejection	Rrej	f=120Hz, 7V≤V <sub>IN</sub> ≤13V		74		dB
Output ON-state control voltage	V <sub>ENH</sub>	Main regulator, driver ON	2.6		V <sub>IN</sub>	V
[Main regulator : Output OFF-state, V <sub>EN</sub> =L']						
L-level output voltage	V <sub>O OFF</sub>	V <sub>EN</sub> =0		50	200	mV
Quiescent current	I <sub>Q OFF</sub>	V <sub>EN</sub> =0		1.5	4	mA
Output OFF-state control voltage	V <sub>ENL</sub>	Main regulator, driver OFF			1.0	V
[Reset circuit]						
H-level reset output voltage	V <sub>ORH</sub>	I <sub>ORH</sub> =200μA	4.97	5.17	5.37	V
L-level reset output voltage	V <sub>ORL</sub>	I <sub>ORL</sub> =2mA, V <sub>IN</sub> =3.7V		90	200	mV
Reset threshold voltage	V <sub>RT</sub>	I <sub>OUT</sub> =5mA	3.7	3.9	4.1	V
Reset hysteresis voltage	V <sub>hys</sub>	I <sub>OUT</sub> =5mA	50	150	300	mV
Reset output delay time	t <sub>d</sub>	Cd=0.1μF	7.5	10	12.5	ms
[Auxiliary regulator]						
Output voltage	V <sub>OA</sub>	I <sub>OA</sub> =5mA	3.2	3.4	3.6	V
Line regulation	ΔV <sub>OA LN</sub>	6V≤V <sub>IN</sub> ≤14V, I <sub>OA</sub> =5mA		15	40	mV
Load regulation	ΔV <sub>OA LD</sub>	2mA≤I <sub>OA</sub> ≤10mA		130	200	mV
Output short current	I <sub>OASC</sub>		10	30		mA
Output pin leakage current	I <sub>OA LEAK</sub>	V <sub>IN</sub> =0, V <sub>OA</sub> =6V			2	μA
[Darlington driver]						
L-level driver output voltage	V <sub>ODL1</sub>	I <sub>ODL</sub> =80mA, V <sub>ID</sub> =3V		1.1	1.6	V
	V <sub>ODL2</sub>	I <sub>ODL</sub> =120mA, V <sub>ID</sub> =3V		1.2	1.8	V
H-level driver input current	I <sub>IDH</sub>	I <sub>ODL</sub> =120mA, V <sub>ID</sub> =3V		0.4	1	mA
Output pin leakage current	I <sub>ODH</sub>	V <sub>IH</sub> =14V, V <sub>OD</sub> =14V, V <sub>ID</sub> =0.3V			50	μA

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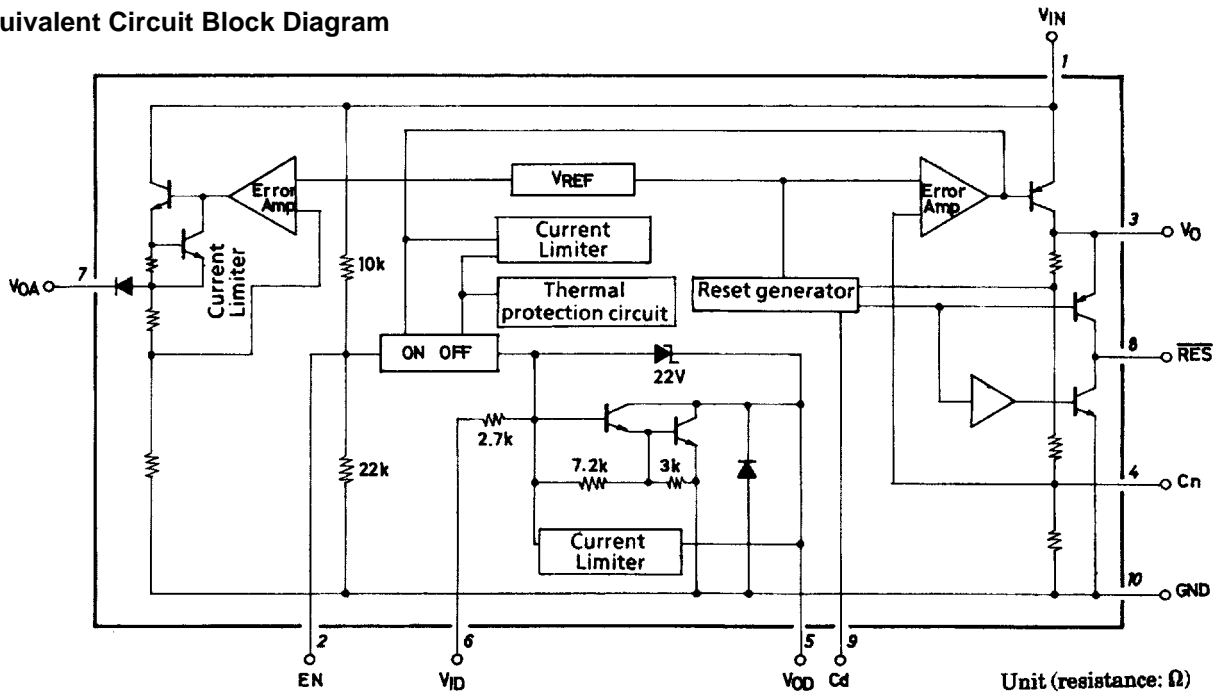
## Pin Assignment



Top view

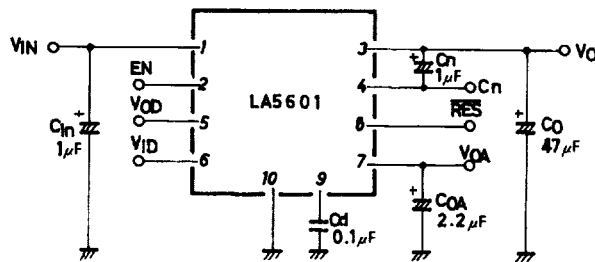


## Equivalent Circuit Block Diagram

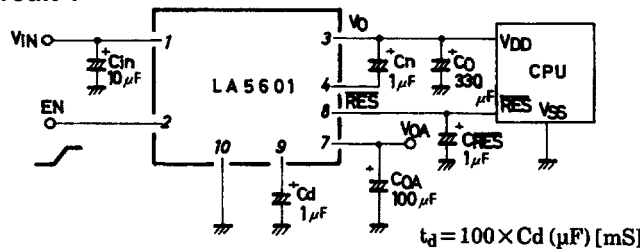


Unit (resistance:  $\Omega$ )

## Specified Test Circuit



## Sample Application Circuit 1



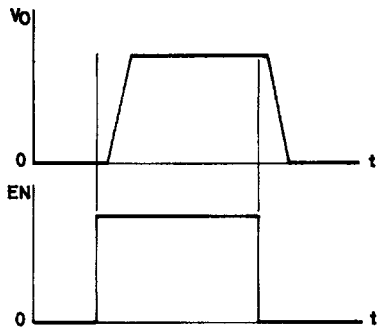
$$t_d = 100 \times C_d (\mu F) [mS]$$

- Note ) 1. Capacitors  $C_n$  and  $C_{RES}$  are only required if problems are experienced with noise from external sources.
2. If capacitor  $C_n$  is present, ensure that  $C_o$  is at least more than one-third of the value of  $C_{in}$  in order to prevent output noise at power-down due to capacitor discharge timing.
3. The minimum recommended value of output capacitor  $C_o$  is  $47\mu F$ .
4. Use low temperature coefficient capacitor for the delay time capacitor  $C_d$ .

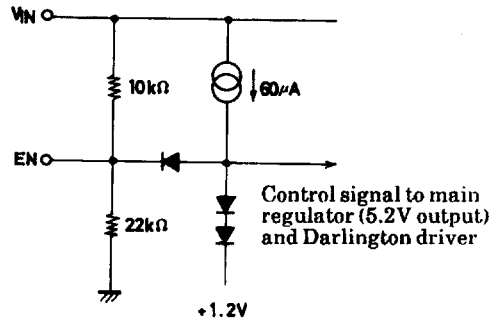
Function Table

V <sub>EN</sub>	V <sub>O</sub>	Driver
L	L	OFF
H	H	ON

V<sub>EN</sub>='H' or open.

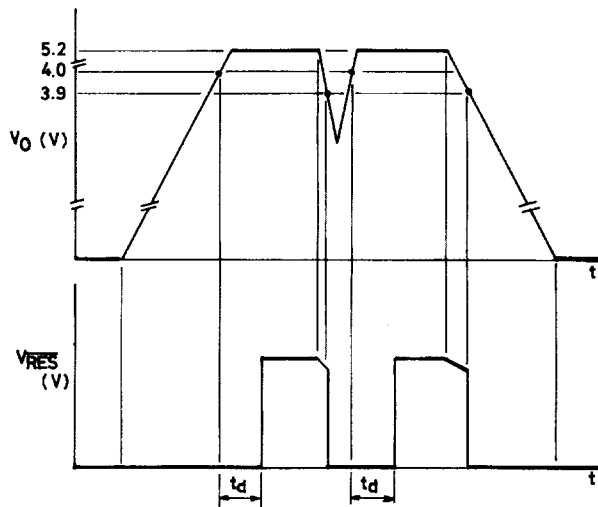


Enable Circuit



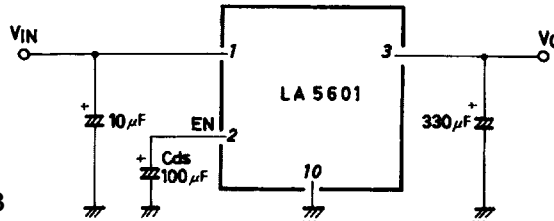
Control signal to main regulator (5.2V output) and Darlington driver

Reset Operation



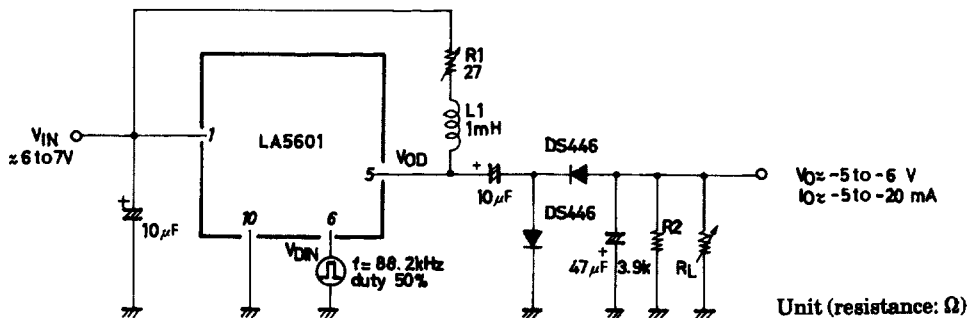
Sample Application Circuit 2

(Delay start regulator)



Sample Application Circuit 3

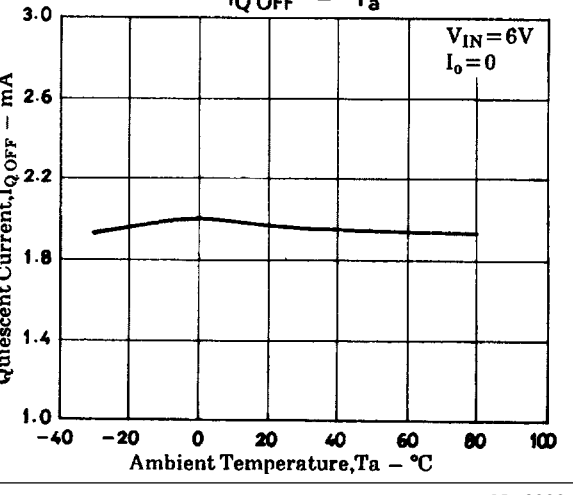
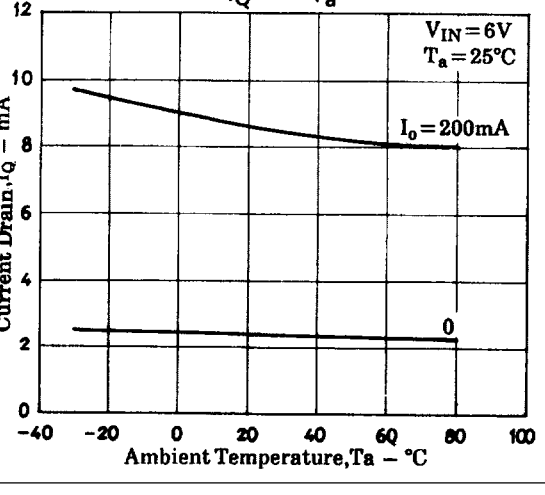
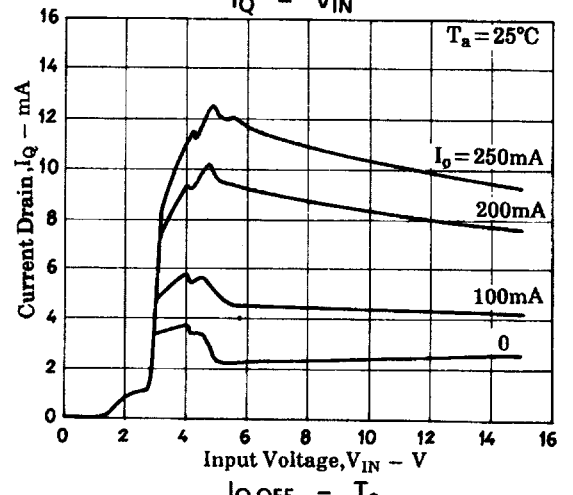
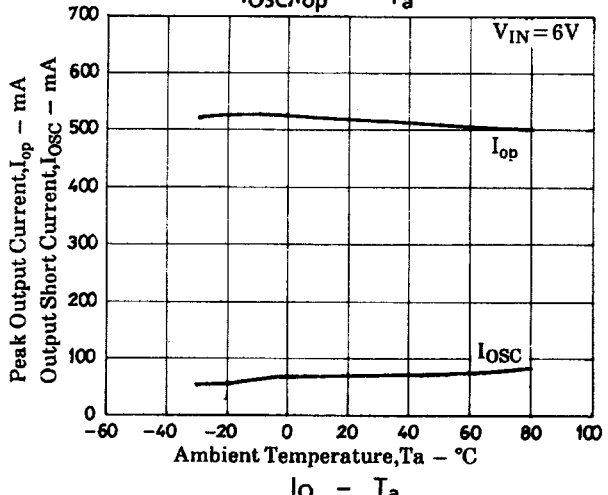
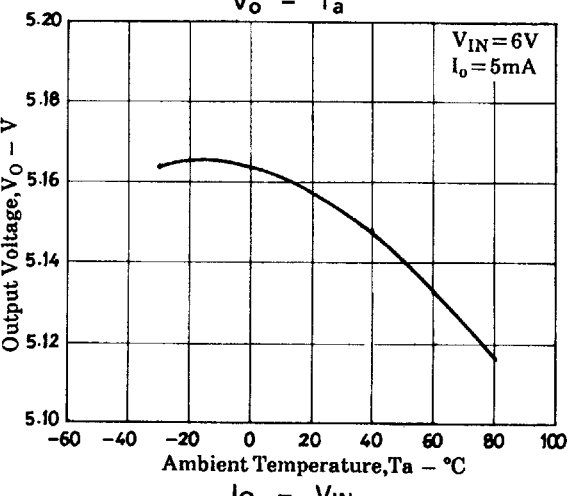
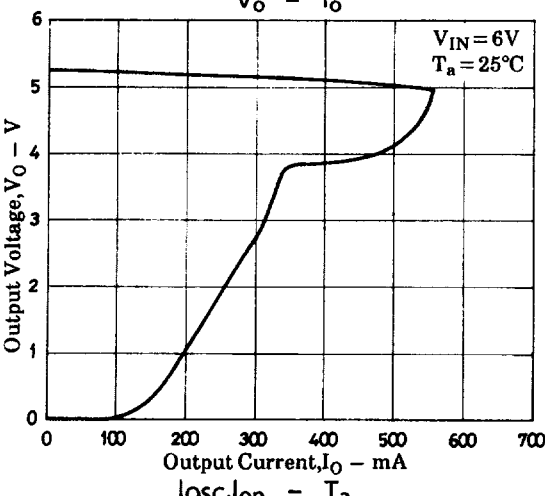
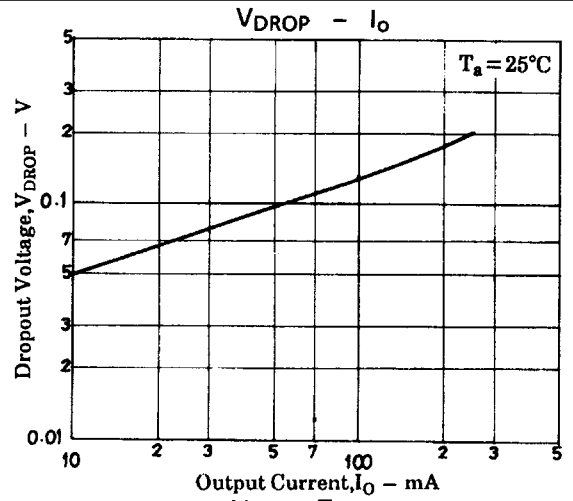
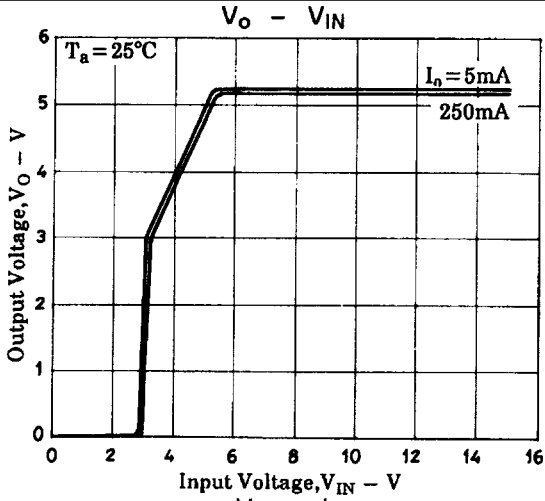
(Positive-to-negative DC converter)



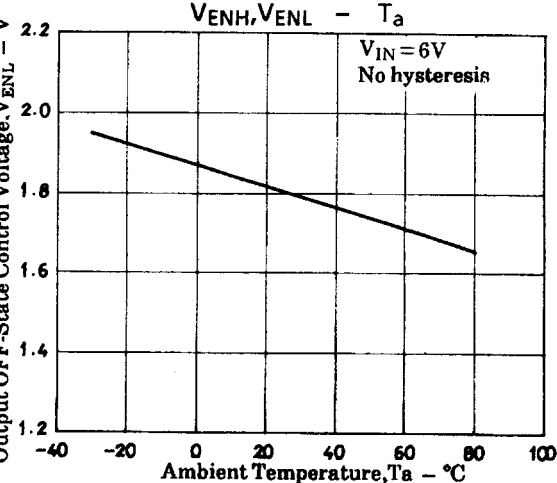
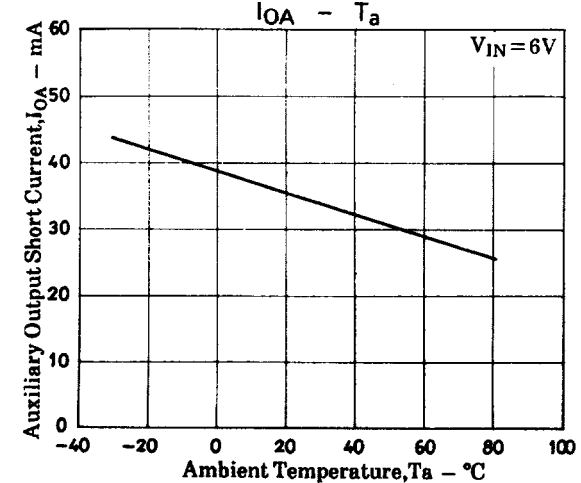
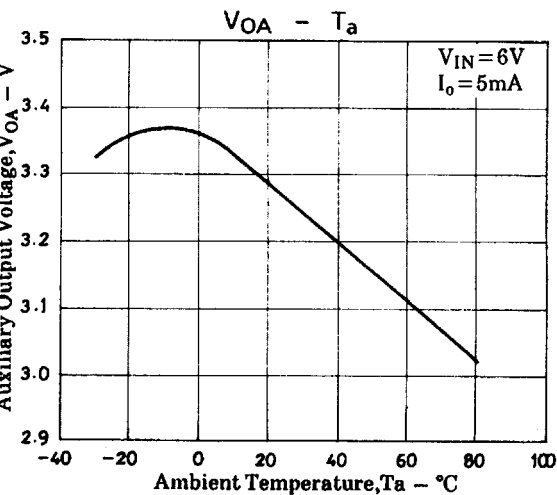
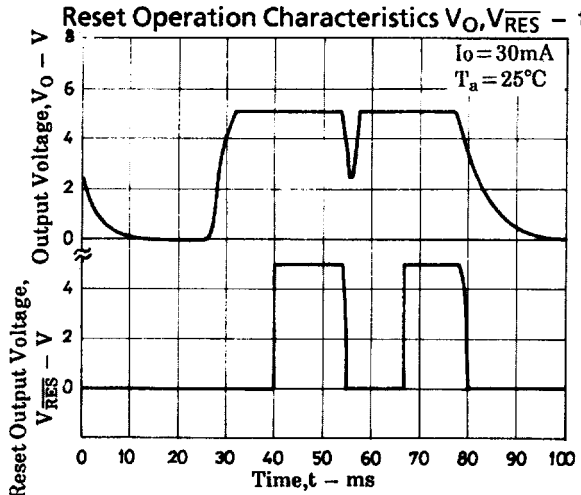
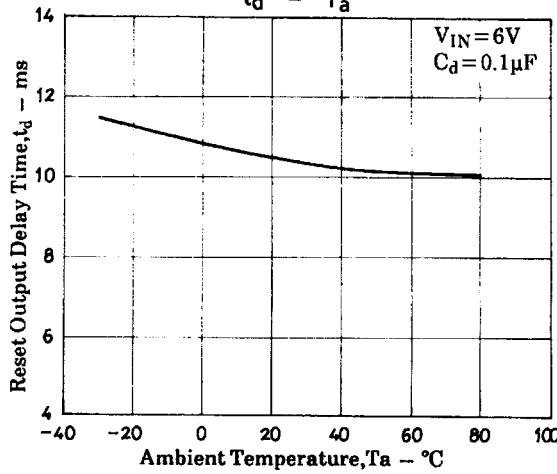
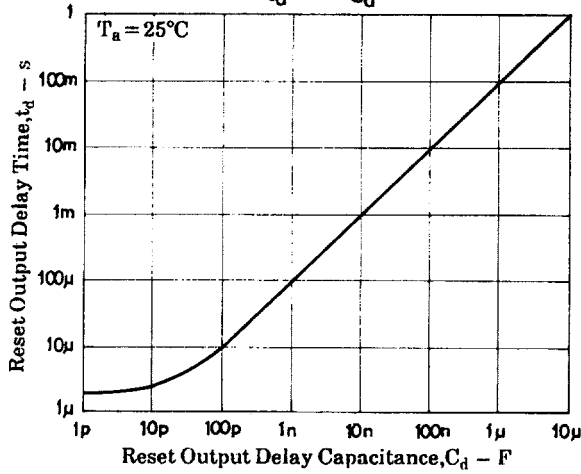
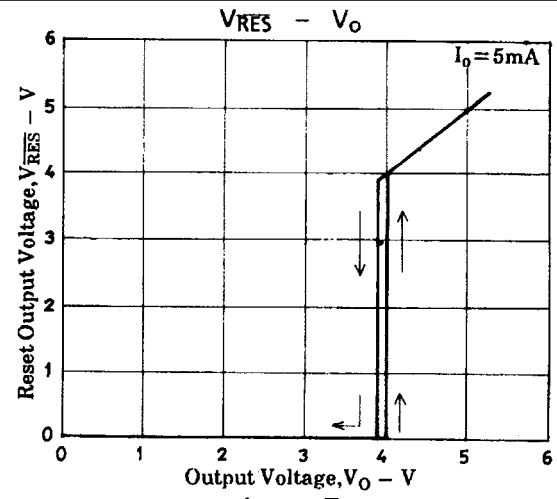
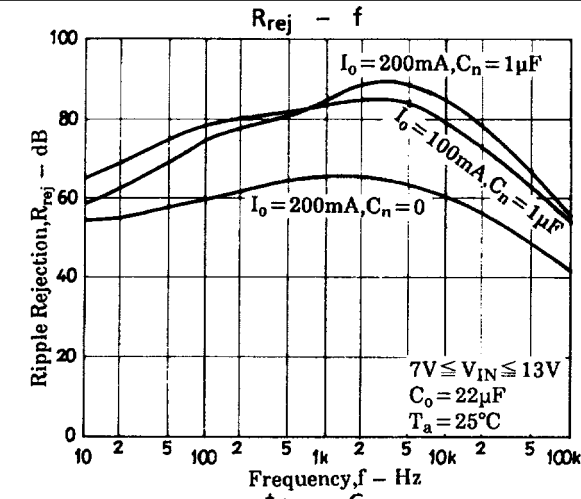
Unit (resistance: Ω)

- Note ) 1. The output voltage can be fine-trimmed by adjusting R1. To protect the output transistor against overvoltage, ensure that either R1 is non zero or use a low-Q coil for L1.
- 2. A load must always be present on power-up. To safeguard against excessive output voltages that occur when the circuit is powered up without a load, a dummy load resistor is recommended. This is shown on the circuit as R2.
- 3. Select V<sub>IN</sub>, R1 and L1 so that V<sub>ODL</sub> < 14V, and I<sub>ODL</sub> < 120mA. The component values shown require that V<sub>IN</sub> never exceeds 9V.

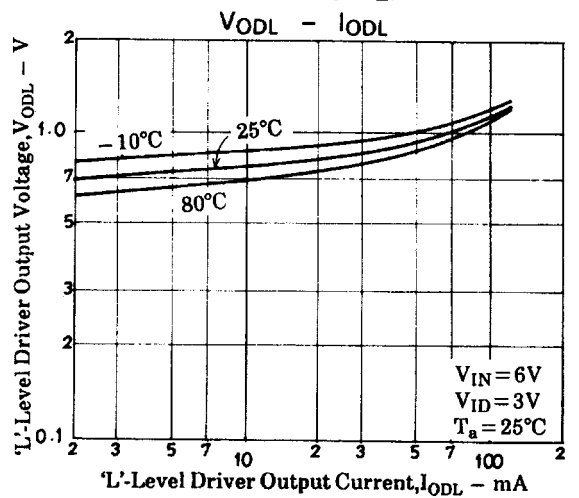
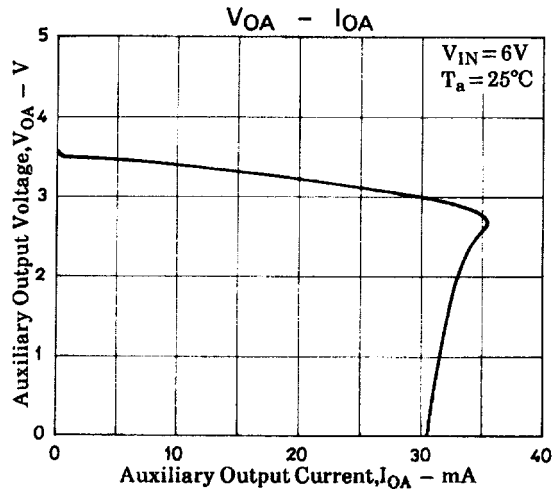
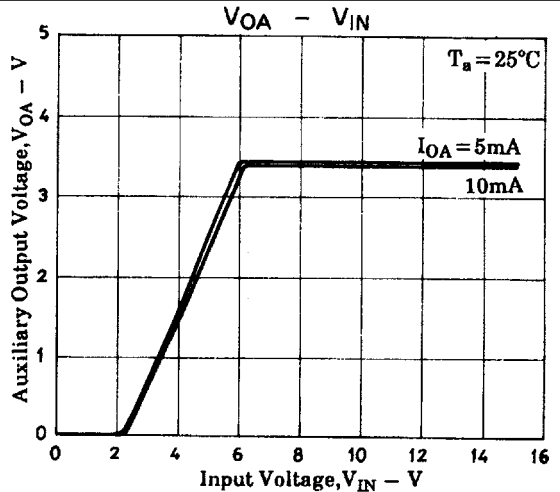
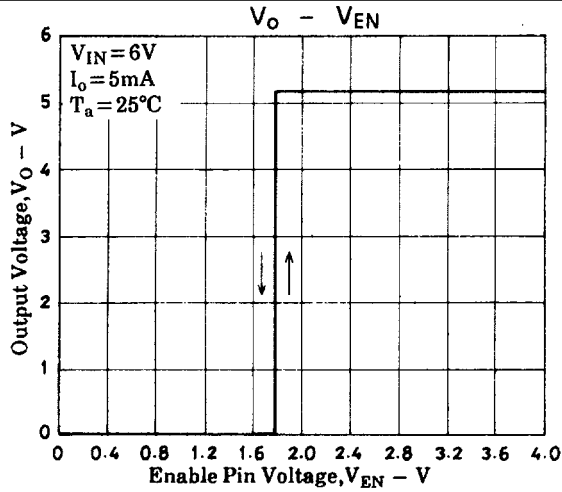
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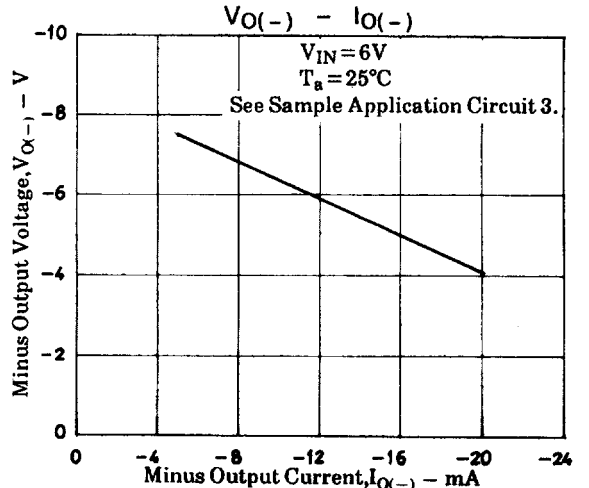
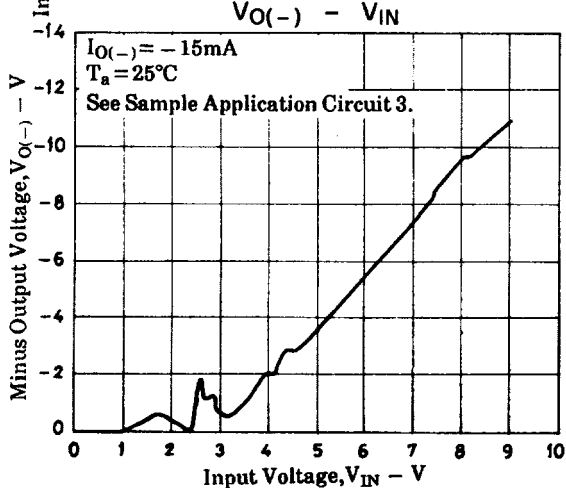
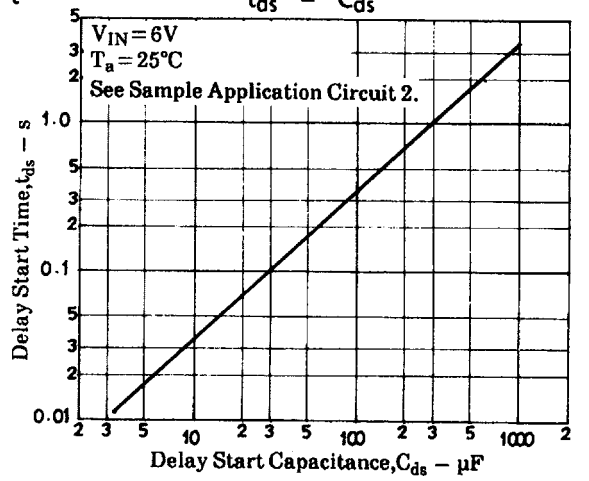
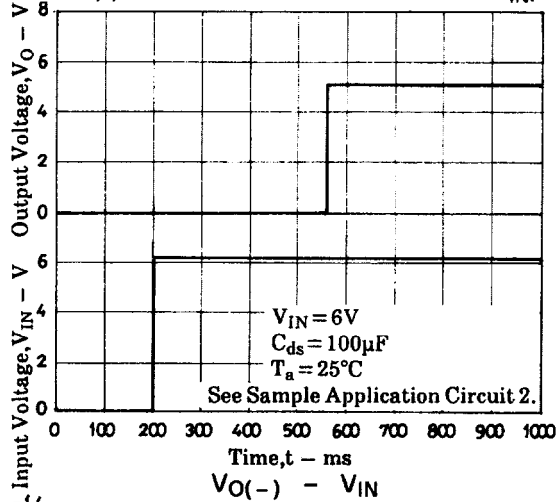
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Delay Start Application Circuit Characteristics  $V_{IN}, V_O - t$



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