

**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).

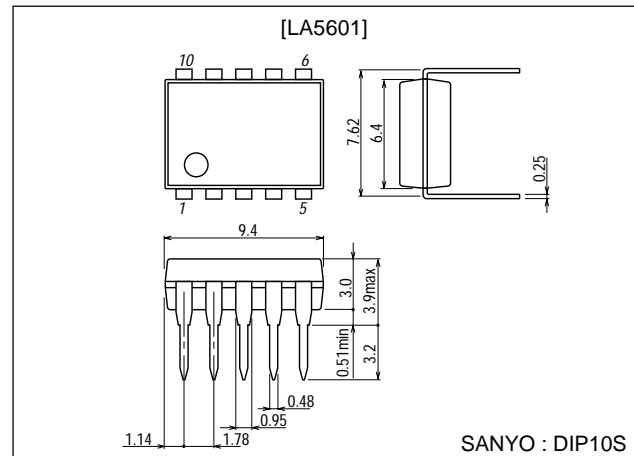
Features

- 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 $T_a = 25^\circ\text{C}$

| Parameter | Symbol | Conditions | Ratings | Unit |
|-----------------------------|---------------|------------|--------------|------------------|
| Input voltage | V_{IN} max | | 15 | V |
| Enable pin voltage | V_{EN} max | | V_{IN} max | V |
| Reset output pin voltage | V_{RES} max | | 15 | V |
| Driver output voltage | V_{OD} max | | 15 | V |
| Driver input voltage | V_{ID} max | | 15 | V |
| Allowable power dissipation | P_d max | | 1 | W |
| Operating temperature | T_{opr} | | -30 to +80 | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | | -55 to +150 | $^\circ\text{C}$ |

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

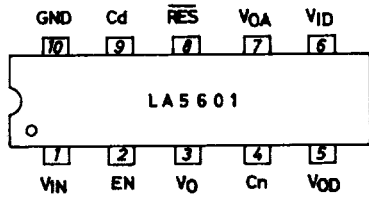
| Parameter | Symbol | Conditions | Ratings | Unit |
|------------------------------------|---------------|------------------------------|--------------|---------------|
| Input voltage | V_{IN} | | 5.9 to 14 | V |
| Output current | I_{OUT} | | 0 to 250 | mA |
| H-level reset output current | I_{ORH} | | 0 to 200 | μA |
| L-level reset output current | I_{ORL} | | 0 to 2 | mA |
| Auxiliary regulator output current | I_{OA} | | 0 to 10 | mA |
| Driver output voltage | V_{OD} max | | 14 | V |
| L-level driver output current | I_{ODL} max | | 120 | mA |
| H-level driver input voltage | V_{IDH} | $I_{ODL}=120\text{mA}$ | 3 to 14 | V |
| L-level driver input voltage | V_{IDL} | $I_{ODL}\leq 100\mu\text{A}$ | -0.3 to +0.3 | V |

Operating Characteristics at $T_j = 25^\circ\text{C}$, $V_{IN}=6\text{V}$, $I_{OUT}=200\text{mA}$, See specified Test Circuit.

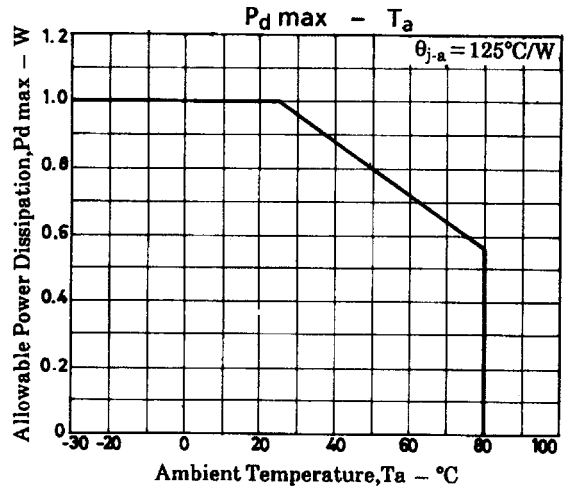
| Parameter | Symbol | Conditions | Ratings | | | Unit |
|--|----------------------------------|---|---------|------|-----------------|-------|
| | | | min | typ | max | |
| [Main regulator : Output ON-state, V _{EN} ='H' or open] | | | | | | |
| Output voltage | V _O | | 5.0 | 5.2 | 5.4 | V |
| Dropout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

LA5601

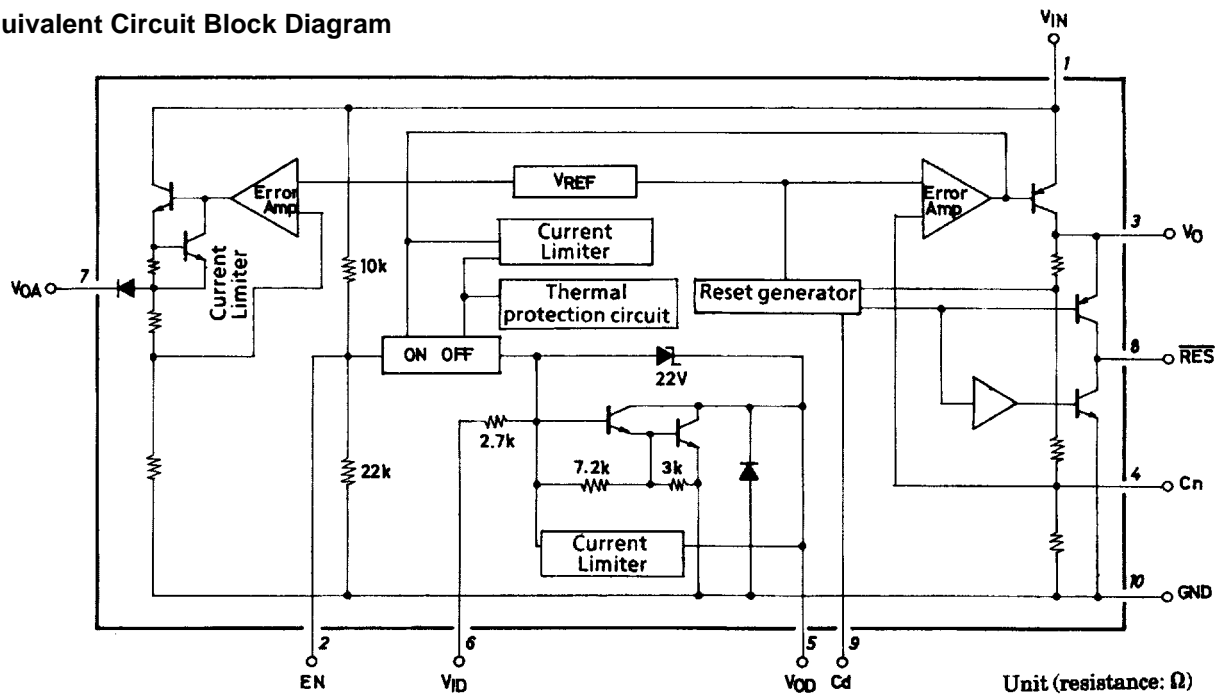
Pin Assignment



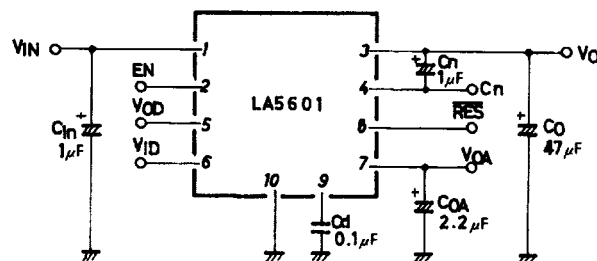
Top view



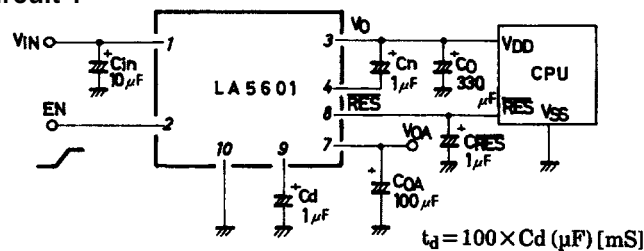
Equivalent Circuit Block Diagram



Specified Test Circuit



Sample Application Circuit 1

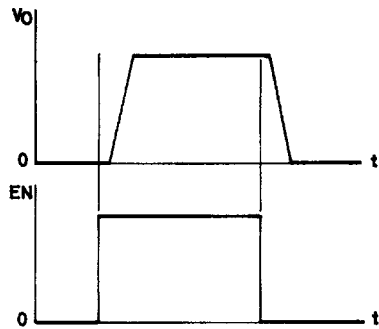


- Note) 1. Capacitors C_n and C_{RES} are only required if problems are experienced with noise from external sources.
 2. If capacitor C_n is present, ensure that C_o is at least more than one-third of the value of C_n in order to prevent output noise at power-down due to capacitor discharge timing.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

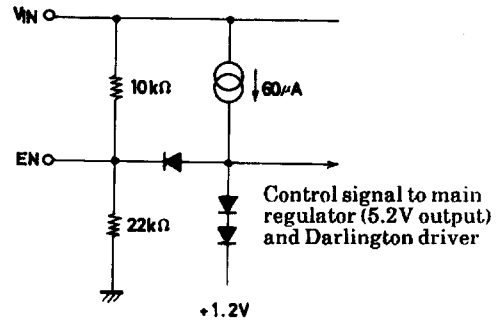
Function Table

| V_{EN} | V_O | Driver |
|----------|-------|--------|
| L | L | OFF |
| H | H | ON |

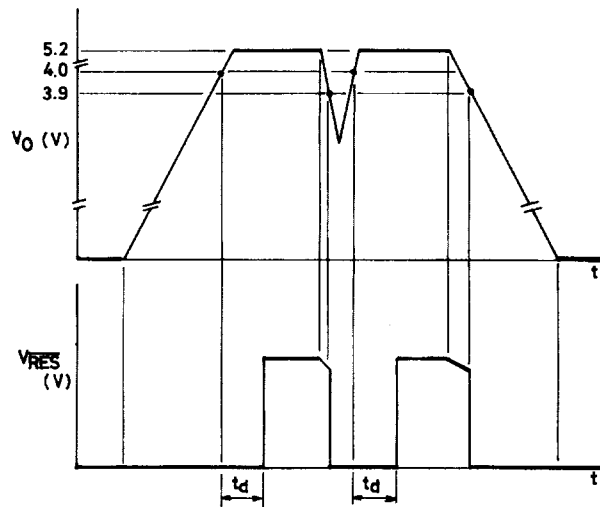
V_{EN} ='H' or open.



Enable Circuit

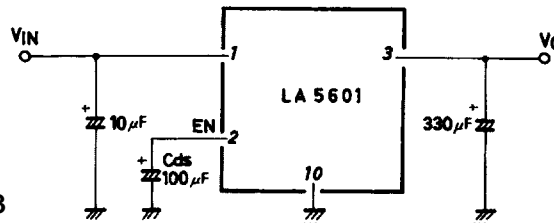


Reset Operation



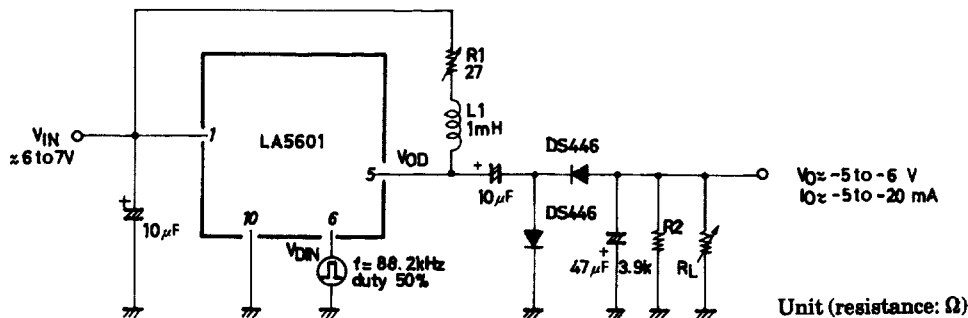
Sample Application Circuit 2

(Delay start regulator)

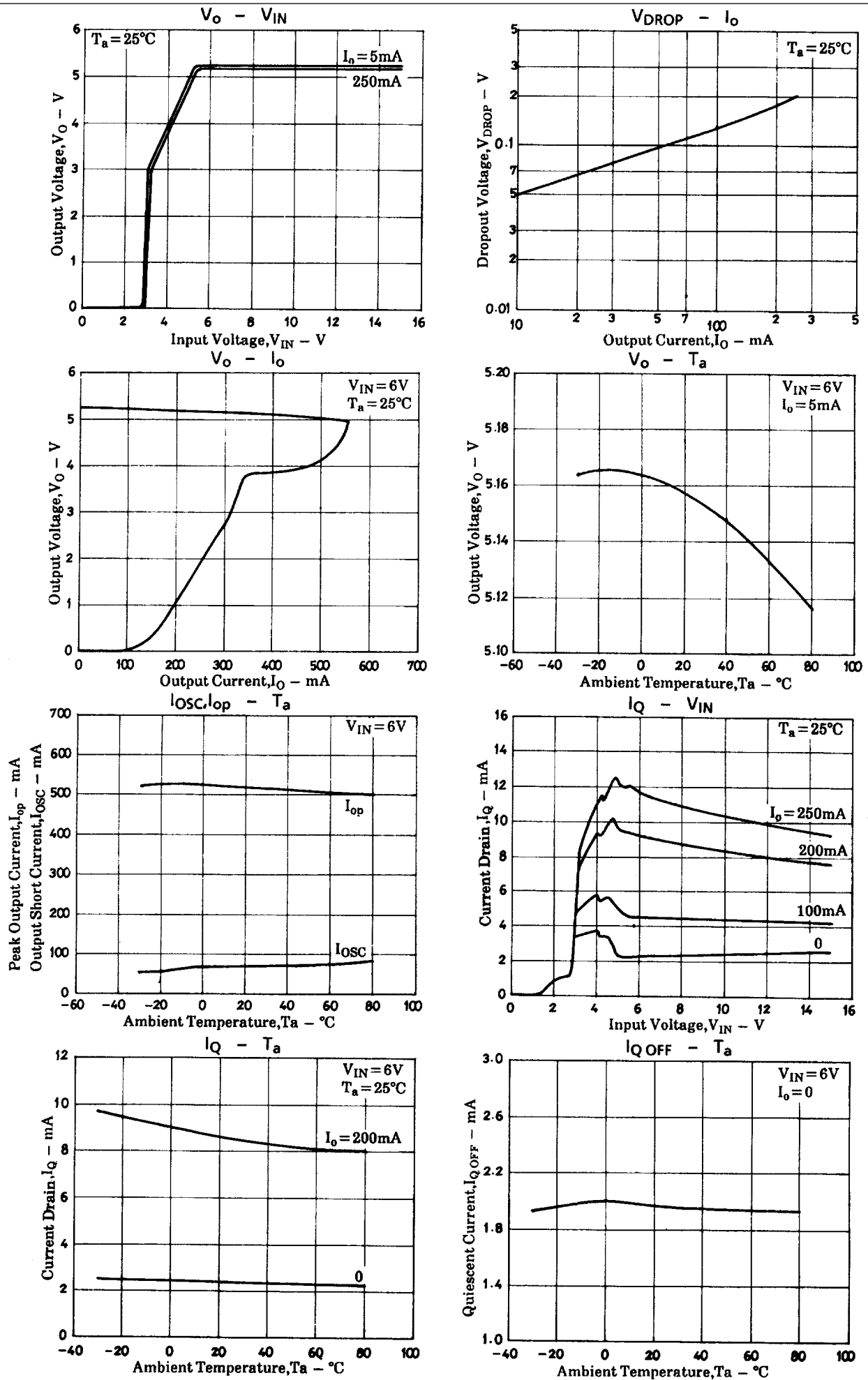


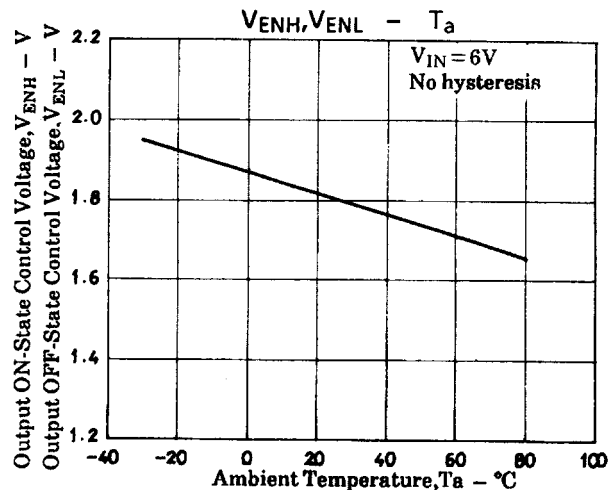
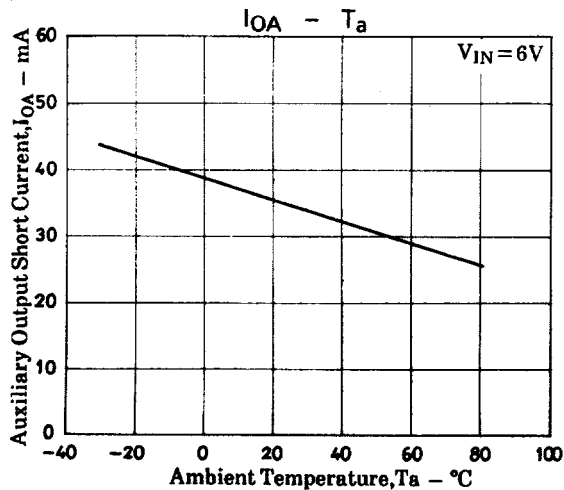
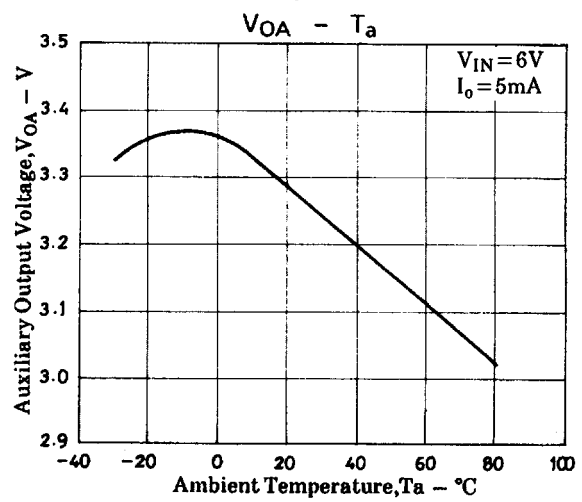
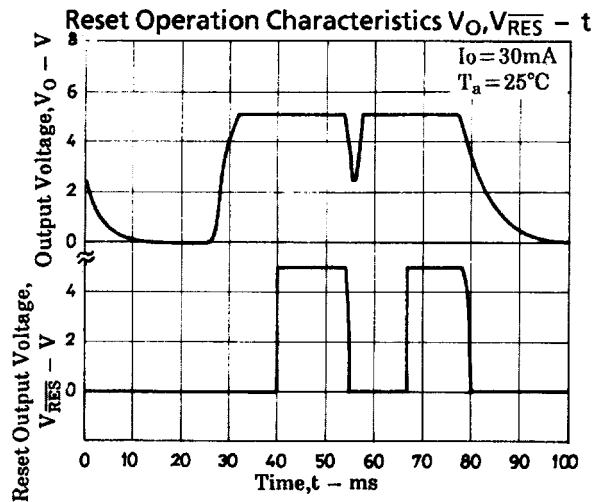
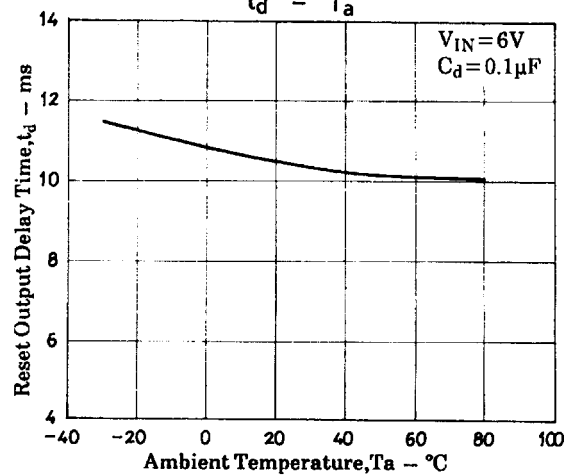
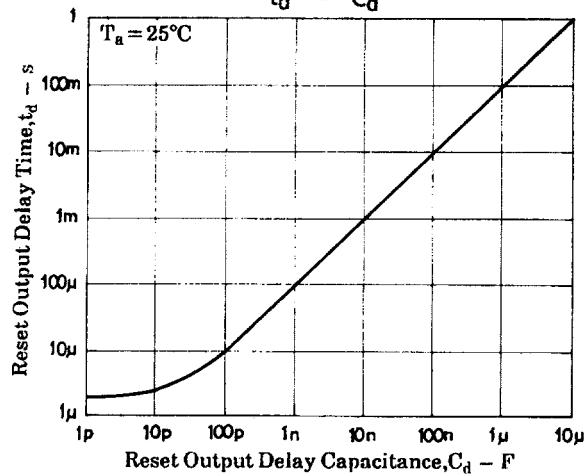
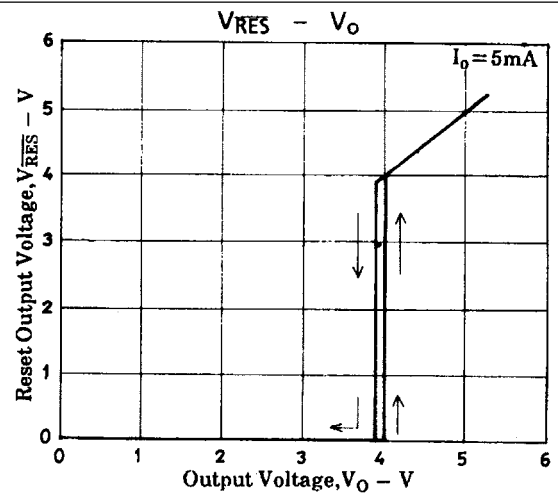
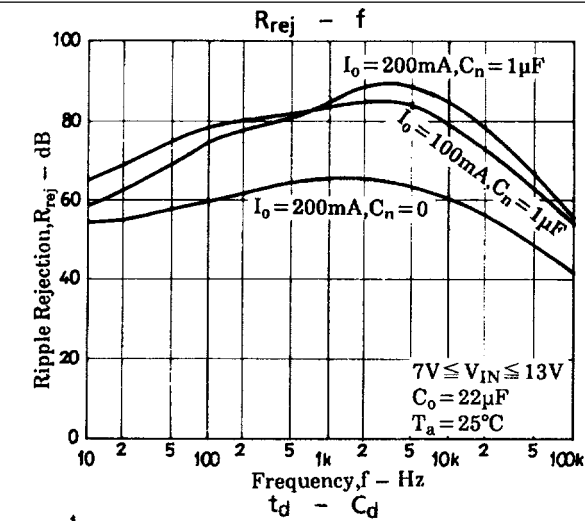
Sample Application Circuit 3

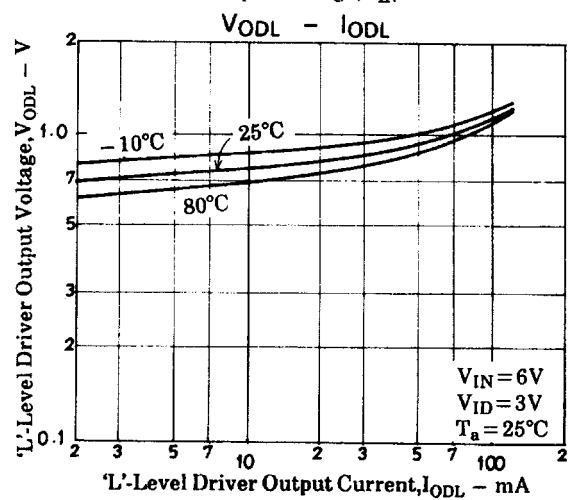
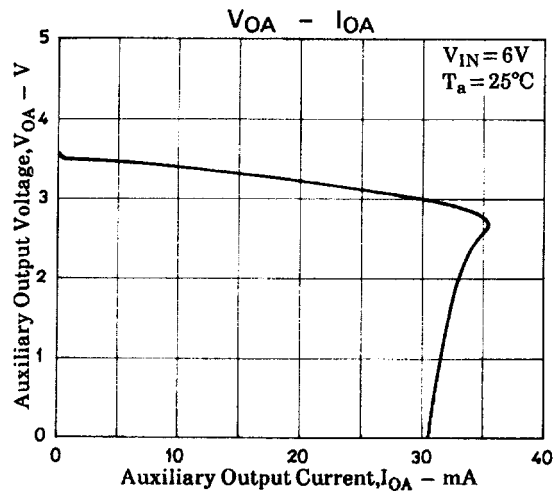
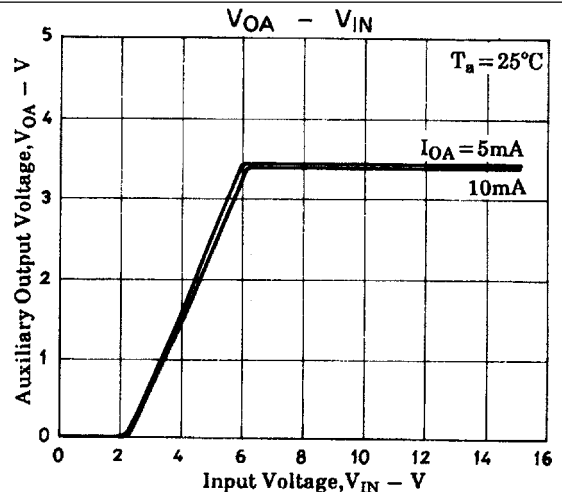
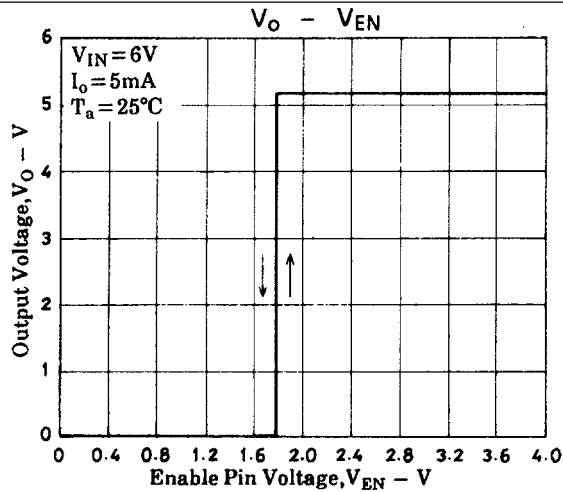
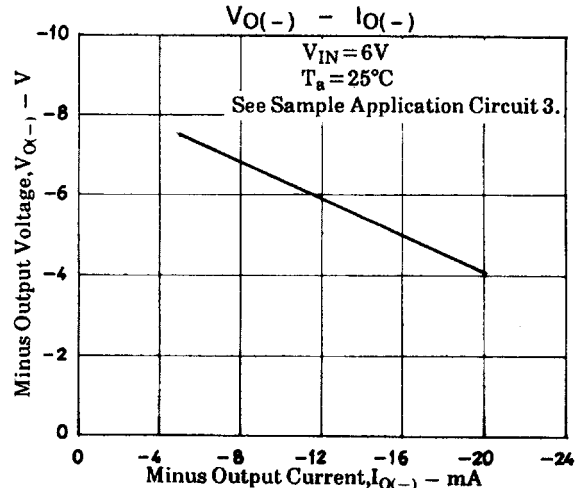
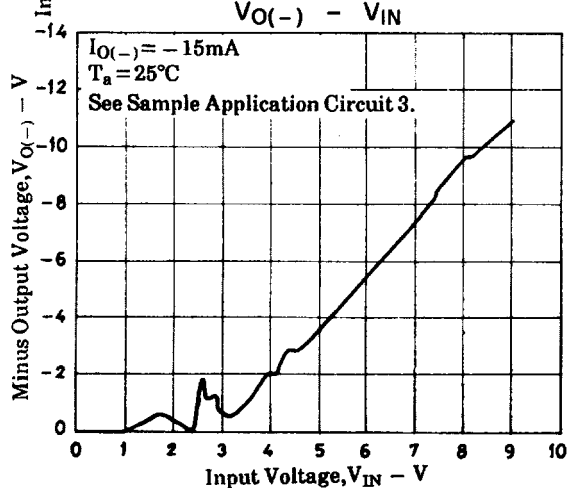
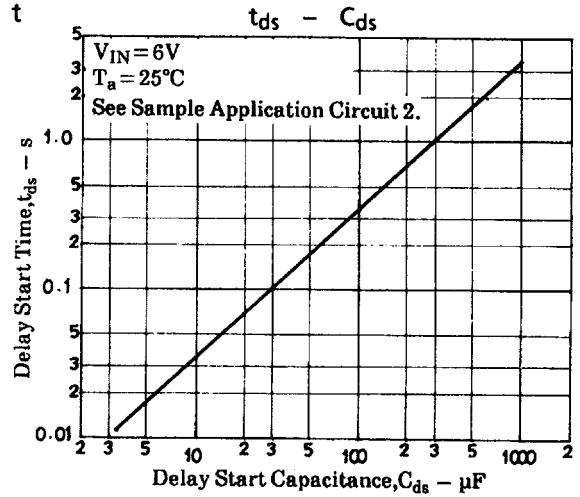
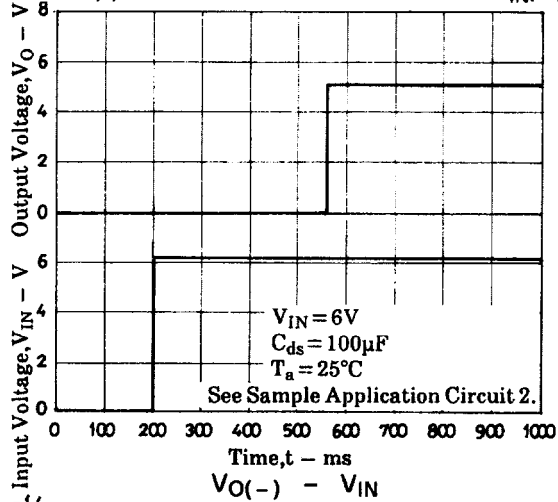
(Positive-to-negative DC converter)



- 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_{IN} , R1 and L1 so that $V_{ODL} < 14V$, and $I_{ODL} < 120mA$. The component values shown require that V_{IN} never exceeds 9V.





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

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