



L78LR05

150mA, 5V 5-Pin Voltage Regulator with Reset Function

Overview

The L78LR05 is voltage regulator IC that performs the reset signal generating function when the power supply of a microcomputer system is turned ON/OFF. The L78LR05 is convenient for battery backup system at the time of power failure. The reset threshold voltage V_{RT} is ranked as shown below.

| | | | | | | | |
|---------------|----------------|----------------|----------------|-----|----------------|----------------|----------------|
| V_{RT} rank | B | C | D | E | F | G | H |
| V_{RT} (V) | 4.8 | 4.5 | 4.2 | 3.9 | 3.6 | 3.3 | 3.0 |

Applications

- Prevention of malfunction that may occur when the power supply of a microcomputer is turned ON/OFF.
- Measures taken against abnormal operations that may occur at the time of instantaneous break of power supply.
- Direct battery backup for SRAM.

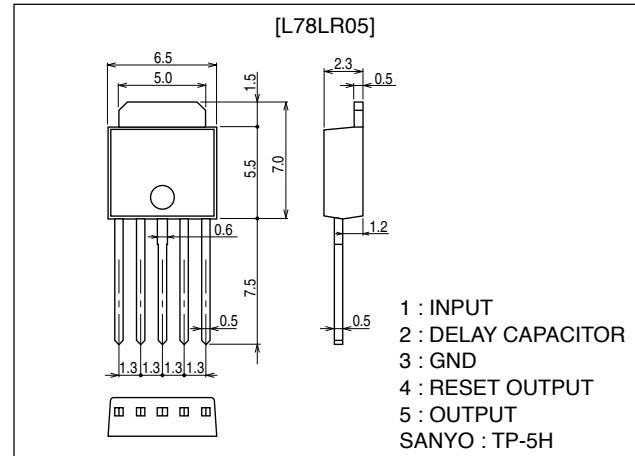
Features

- 5V, 150mA output.
- Capable of generating a microcomputer reset signal.
- No battery-regulator switching circuit required at the battery backup mode (Output leakage current : 2 μ A or less).
- An external capacitor can be used to set the reset output delay time.
- Applicable to the power supply of CMOS, NMOS microcomputers.
- Especially suited for use as an on-board regulator for a microcomputer system.
- Small-sized power package TP-5H permitting the equipment to be made compact.
- The allowable power dissipation can be increased by being surface-mounted on the board.
- Capable of being mounted in a variety of methods because of various lead forming versions available.
- On-chip protectors (overcurrent limiter, ASO protector, thermal protector).

Package Dimensions

unit:mm

3103



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Specifications

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

| Parameter | Symbol | Conditions | Ratings | Unit |
|-----------------------------|---------------------|------------|-------------|------------------|
| Maximum Input Voltage | $V_{IN\text{ max}}$ | | 25 | V |
| Allowable Power Dissipation | $P_d\text{ max}$ | (No fin) | 1.0 | W |
| Operating Temperature | T_{opr} | | -30 to +80 | $^\circ\text{C}$ |
| Storage Temperature | T_{stg} | | -55 to +150 | $^\circ\text{C}$ |

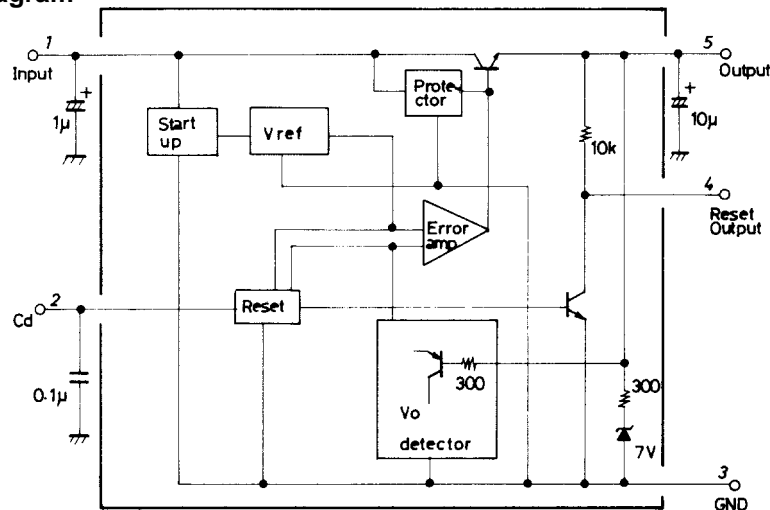
Operating Conditions at $T_a = 25^\circ\text{C}$

| Parameter | Symbol | Conditions | Ratings | Unit |
|----------------|-----------|------------|-----------|------|
| Input Voltage | V_{IN} | | 7.5 to 20 | V |
| Output Current | I_{OUT} | | 1 to 150 | mA |

Operating Characteristics at $T_a = 25^\circ\text{C}$, $V_{IN}=10\text{V}$, $I_{OUT}=40\text{mA}$, $c_{in}=1\mu\text{F}$, $c_o=10\mu\text{F}$

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|-----------------------------|---|-----------|-----------|------|----------------------------|
| | | | min | typ | max | |
| Output Voltage | V_{OUT1} | $T_j=25^\circ\text{C}$ | 4.8 | 5.0 | 5.2 | V |
| | V_{OUT2} | $7\text{V}\leq V_{IN}\leq 20\text{V}$, $1\text{mA}\leq I_{OUT}\leq 70\text{mA}$ | 4.75 | | 5.25 | V |
| Line Regulation | $\Delta V_o\text{ LINE1}$ | $T_j=25^\circ\text{C}$, $7\text{V}\leq V_{IN}\leq 20\text{V}$ | | 6.0 | 75 | mV |
| | $\Delta V_o\text{ LINE2}$ | $T_j=25^\circ\text{C}$, $8\text{V}\leq V_{IN}\leq 20\text{V}$ | | 3.0 | 50 | mV |
| Load Regulation | $\Delta V_o\text{ LOAD1}$ | $T_j=25^\circ\text{C}$, $1\text{mA}\leq I_{OUT}\leq 100\text{mA}$ | | 9.0 | 60 | mV |
| | $\Delta V_o\text{ LOAD2}$ | $T_j=25^\circ\text{C}$, $1\text{mA}\leq I_{OUT}\leq 40\text{mA}$ | | 3.0 | 30 | mV |
| Current Dissipation | I_{CC} | $T_j=25^\circ\text{C}$, $I_{OUT}=100\text{mA}$ | | 1.4 | 3.4 | mA |
| Current Dissipation Variation | $\Delta I_{CC}\text{ LINE}$ | $8\text{V}\leq V_{IN}\leq 20\text{V}$ | | 0.12 | 1.5 | mA |
| | $\Delta I_{CC}\text{ LOAD}$ | $1\text{mA}\leq I_{OUT}\leq 40\text{mA}$ | | 0.01 | 0.1 | mA |
| Output Noise Voltage | V_{NO} | $10\text{Hz}\leq f\leq 100\text{kHz}$, $I_o=1\text{mA}$ | | 80 | | μV |
| Temperature Coefficient of Output Voltage | $\Delta V_{OUT}/\Delta T_j$ | $I_{OUT}=1\text{mA}$, $T_j=25$ to 125°C | | ± 0.5 | | $\text{mV}/^\circ\text{C}$ |
| Ripple Rejection | R_{rej} | $T_j=25^\circ\text{C}$, $f=120\text{Hz}$, $8\text{V}\leq V_{IN}\leq 18\text{V}$ | | 79 | | dB |
| Dropout Voltage | V_{DROP} | $T_j=25^\circ\text{C}$ | | 1.5 | 2.2 | V |
| Output Short Current | I_{OSC} | $T_j=25^\circ\text{C}$ | 150 | 300 | 450 | mA |
| "H"-Reset Output Voltage | V_{ORH} | $T_j=25^\circ\text{C}$ | 4.8 | 5.0 | 5.2 | V |
| "L"-Reset Output Voltage | V_{ORL} | $T_j=25^\circ\text{C}$, $V_{IN}=3\text{V}$, $I_o=1\text{mA}$ | | 10 | 200 | mV |
| Reset Threshold Voltage | V_{RT} | B, $T_j=25^\circ\text{C}$ | 4.60 | 4.8 | 4.95 | V |
| | | C, $T_j=25^\circ\text{C}$ | 4.30 | 4.5 | 4.65 | V |
| | | D, $T_j=25^\circ\text{C}$ | 4.00 | 4.2 | 4.35 | V |
| | | E, $T_j=25^\circ\text{C}$ | 3.70 | 3.9 | 4.05 | V |
| | | F, $T_j=25^\circ\text{C}$ | 3.40 | 3.6 | 3.75 | V |
| | | G, $T_j=25^\circ\text{C}$ | 3.10 | 3.3 | 3.45 | V |
| | | H, $T_j=25^\circ\text{C}$ | 2.80 | 3.0 | 3.15 | V |
| | | Reset Threshold Hysteresis Voltage | V_{RTH} | | 50 | 100 |
| Reset Output Delay Time | t_d | $c_d=0.1\mu\text{F}$ | 7.5 | 10 | 12.5 | ms |
| Output Pin Leakage Current | $I_{O\text{ LEAK}}$ | $V_{IN}=0$, $V_o=6\text{V}$ | | 0.001 | 2 | μA |
| Reset Output Pin Leakage Current | $I_{OR\text{ LEAK}}$ | $V_{IN}=0$, $V_{OR}=6\text{V}$ | | 0.001 | 2 | A |

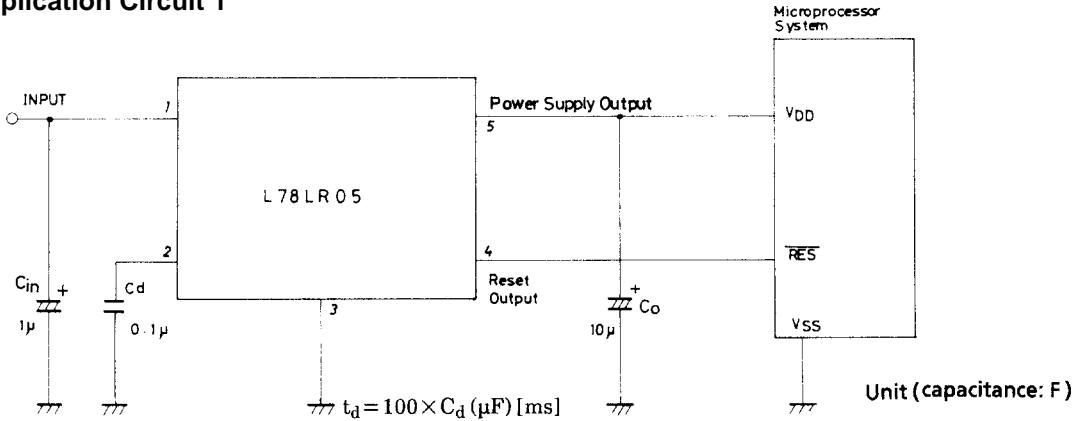
Equivalent Circuit Block Diagram



Unit (resistance: Ω , capacitance: F)

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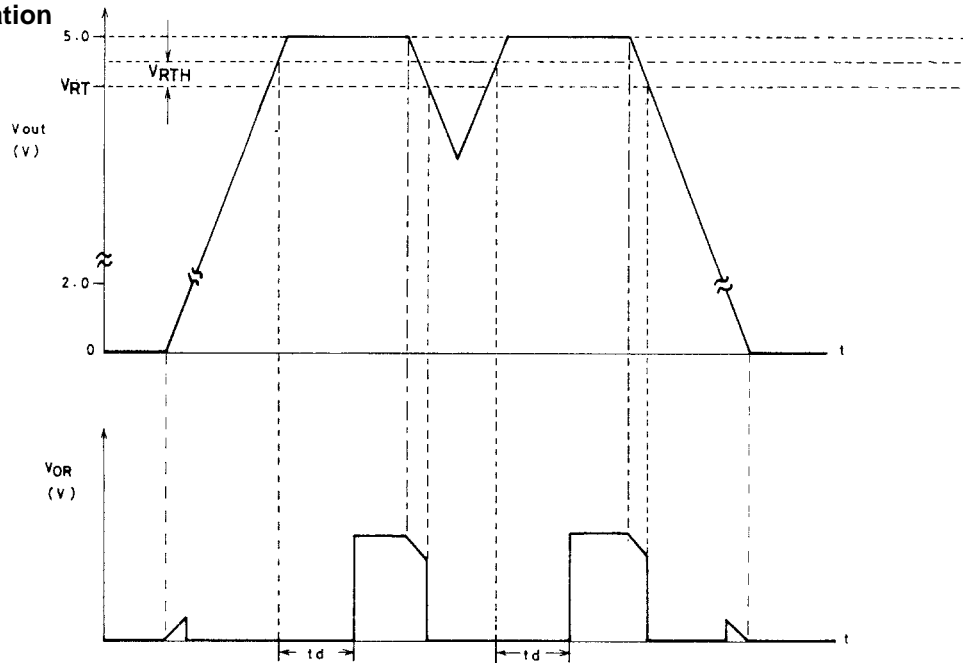
Sample Application Circuit 1



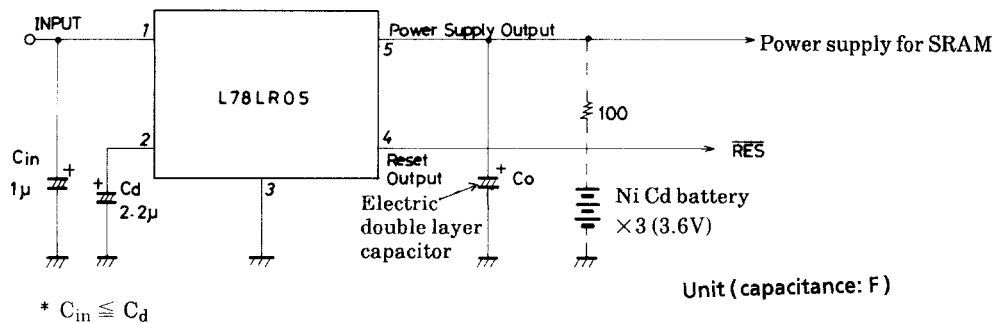
Note 1 : When the capacitance of C_d is large, the capacitor may not discharge completely, causing t_d to be made shorter than a set value. If this is a problem, either connect a high speed diode (DS442) between pin2 (anode side) and pin5 (cathode side) or ensure an adequate discharge time by using values for capacitors C_{in} and C_d such that $C_{in} > C_d$.

Note 2 : If a pull-up resistor is connected to the reset output pin externally, it is possible to cause a sink current up to 4mA to flow.

Reset Operation



Sample Application Circuit 2 (Direct battery backup)



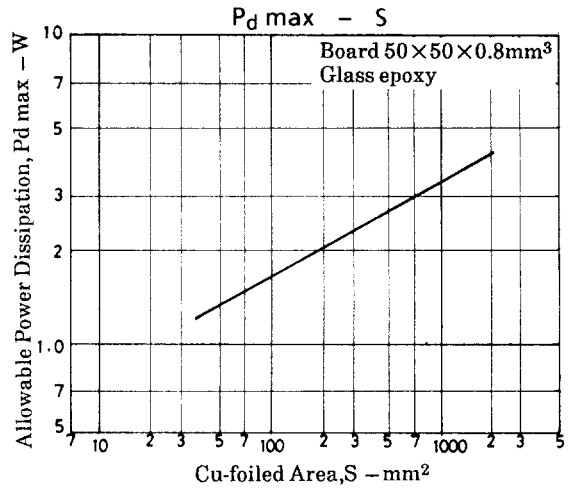
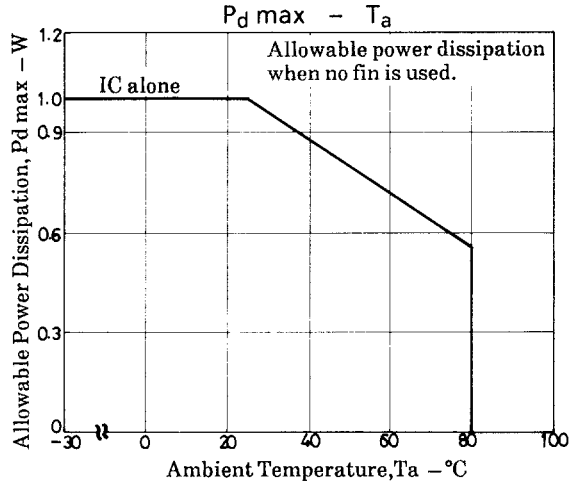
Since the leakage current at the output pin (pin5) of the L78LR05 is so low as 2µA or less, a backup circuit can be implemented by connecting an electric double layer capacitor (super capacitor : NEC, gold capacitor : Matsushita Electric) or a Ni Cd battery direct to the output pin. Since a reverse blocking diode, which has been so far connected to the output pin, is not required, a regulated power-supply voltage can be supplied to a load during the steady-state operation, without voltage drop caused by the diode and effects of temperature characteristics, current characteristics of the diode. No battery-regulator switching circuit is required at the battery backup start mode.

Note 3 : The capacitance of reset output signal delay capacitor C_d must exceed that of input capacitor C_{in} . If the capacitance of C_d is small, a reset pulse signal may be generated once when the main power source is turned off (at the battery backup start mode).

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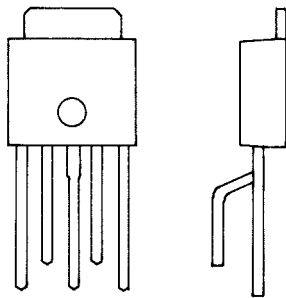
Allowable Power Dissipation

The allowable power dissipation is 1.0W ($T_a=25^\circ\text{C}$) with fin attached. When the L78LR05 is surface-mounted on a hybrid IC board or printed circuit board, a high allowable power dissipation can be obtained, though it is placed in a small-sized package. Shown below is the relationship between the Cu-foiled area the allowable power dissipation when the L78LR05 is surface-mounted on a glass epoxy board ($50\times 50\times 0.8\text{mm}^3$).

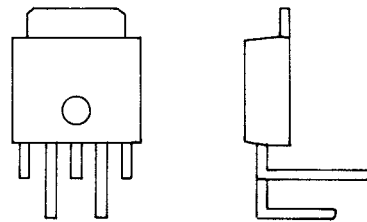


* The measured values of P_d represent the values measured when solder on the Cu-foiled area is all wet.

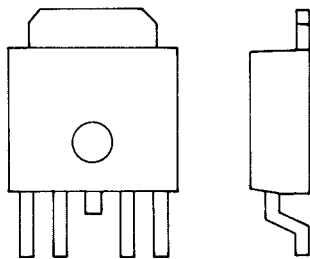
Lead Forming



MA forming

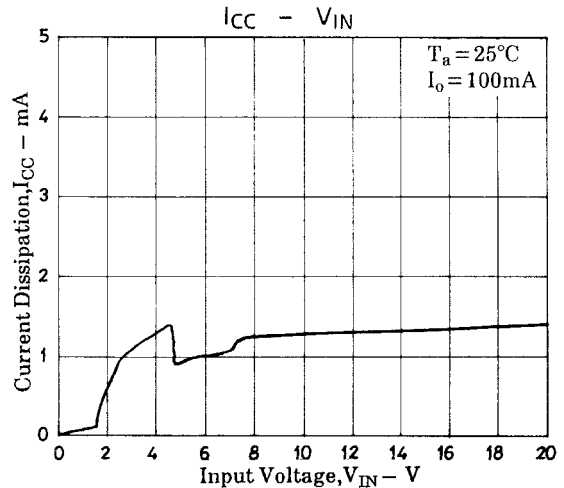
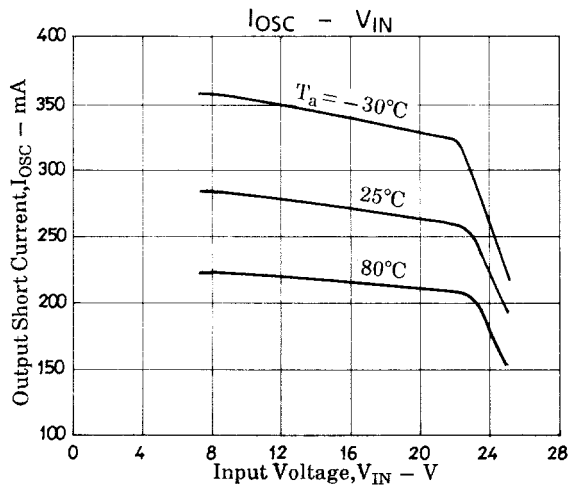
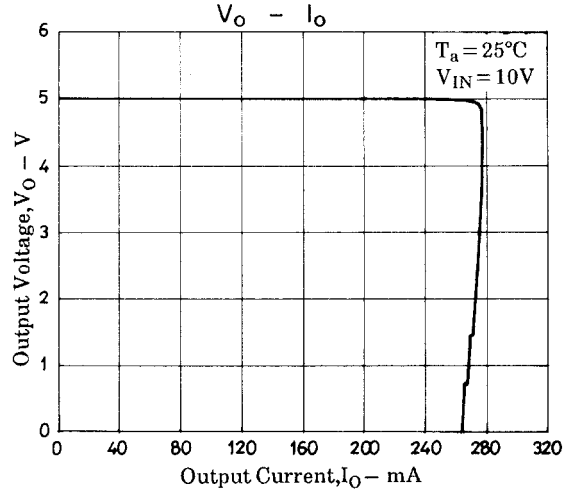
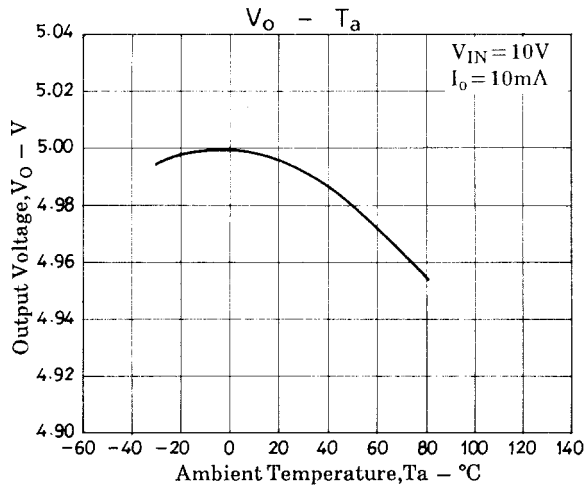
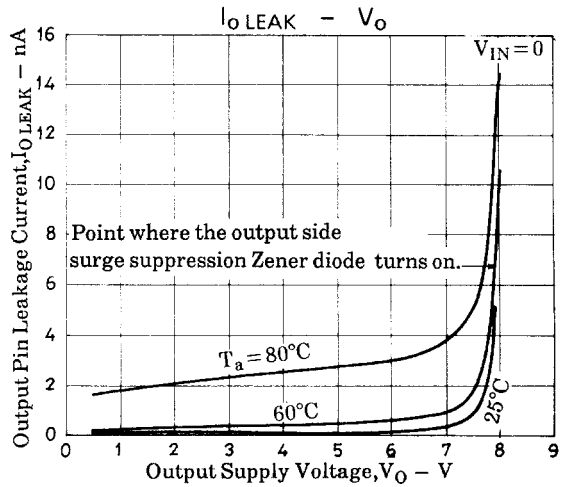
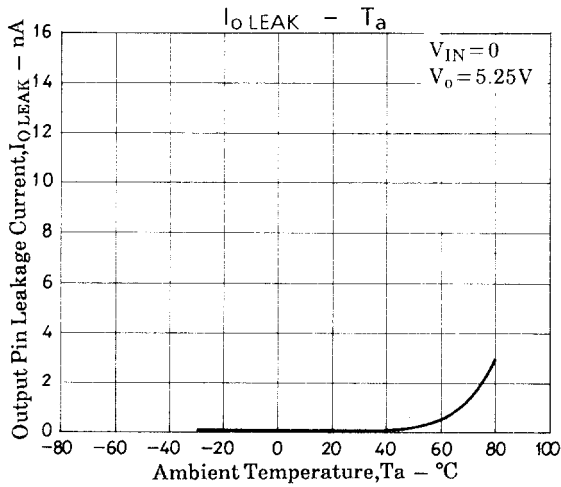
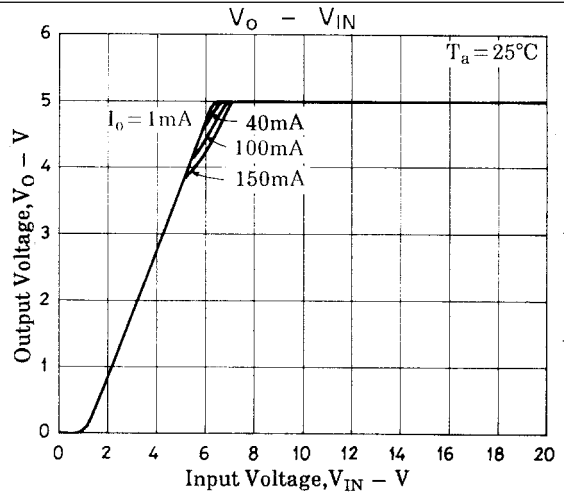
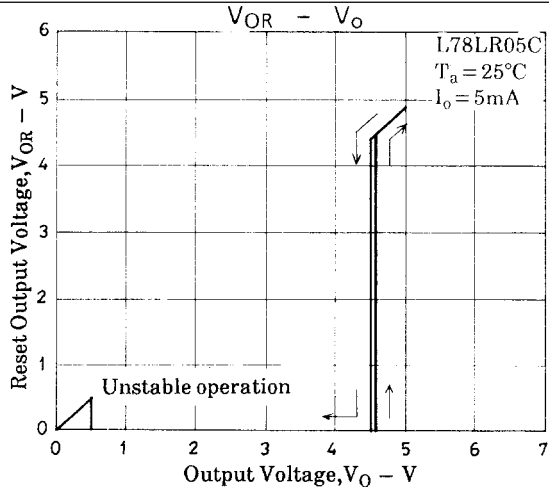


LR forming

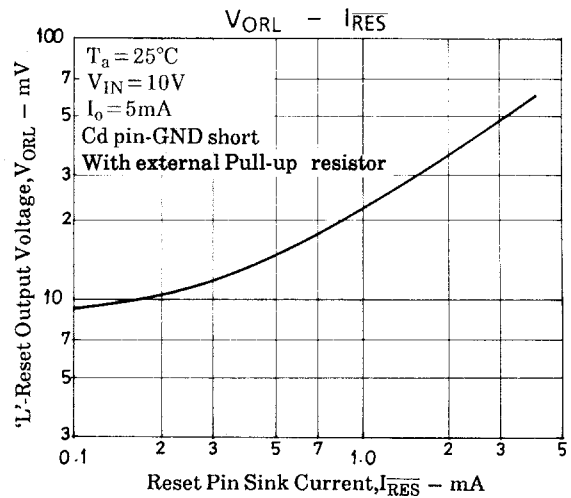
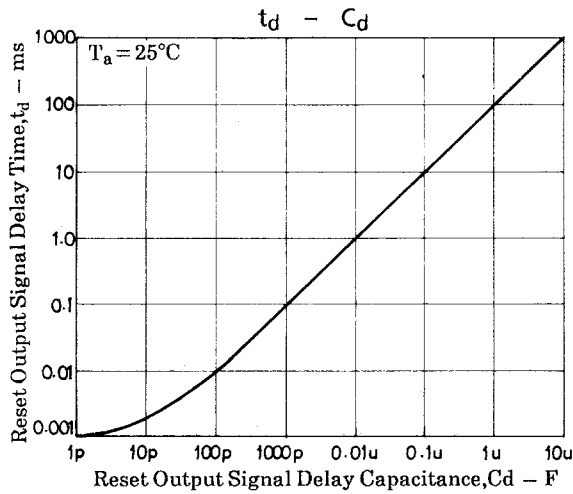
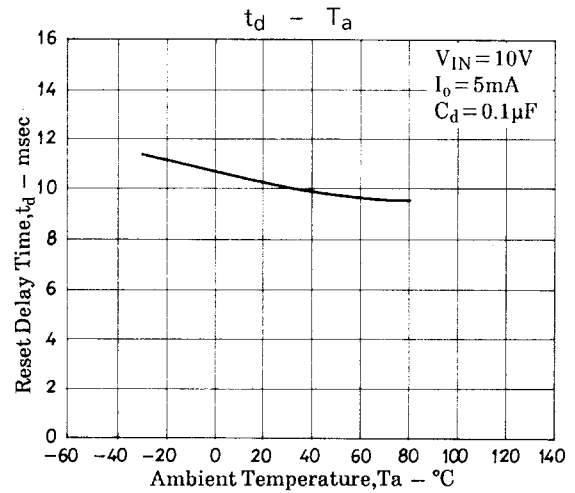
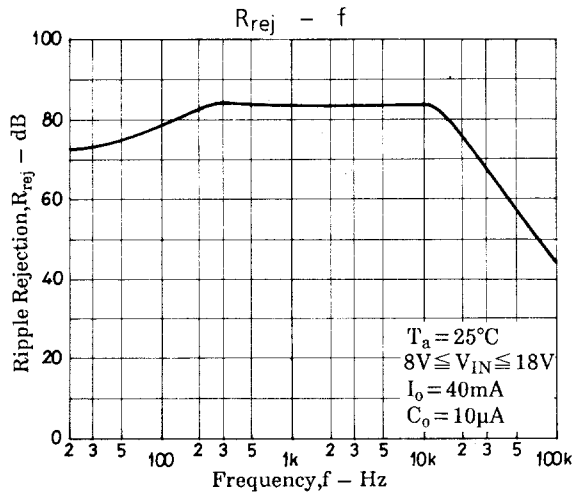


FA forming

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