



# 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.

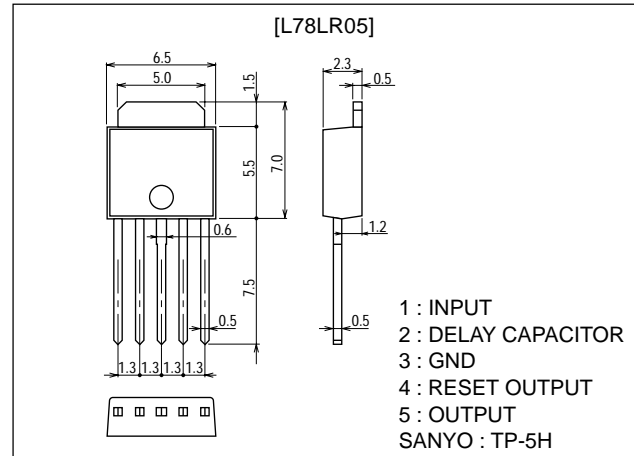
### Features

- 5V, 150mA output.
- Capable of generating a microcomputer reset signal.
- No battery-regulator switching circuit required at the battery backup mode (Output leakage current :  $2\mu\text{A}$  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	$^\circ\text{C}$

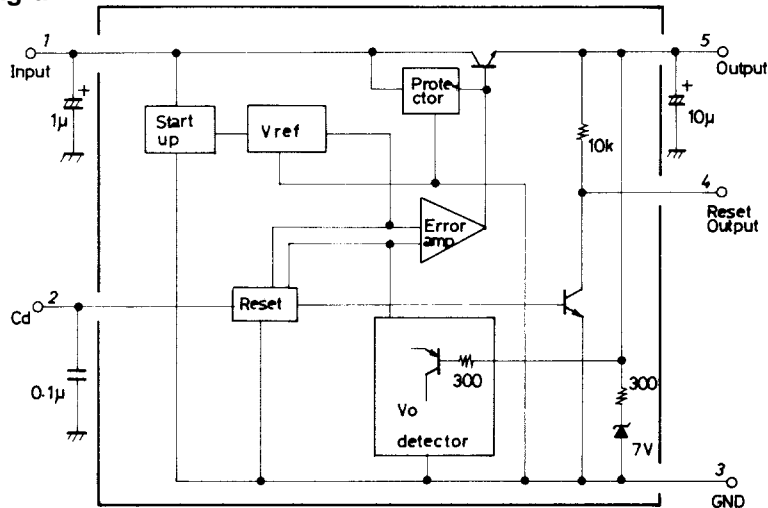
### Operating Conditions at $T_a = 25^\circ\text{C}$

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		$\mu\text{V}$
Temperature Coefficient of Output Voltage	$\Delta V_{OUT}/\Delta T_j$	$I_{OUT}=1\text{mA}$ , $T_j=25$ to $125^\circ\text{C}$		$\pm 0.5$		$\text{mV}/^\circ\text{C}$
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	$\mu\text{A}$
Reset Output Pin Leakage Current	$I_{OR\text{ LEAK}}$	$V_{IN}=0$ , $V_{OR}=6\text{V}$		0.001	2	A

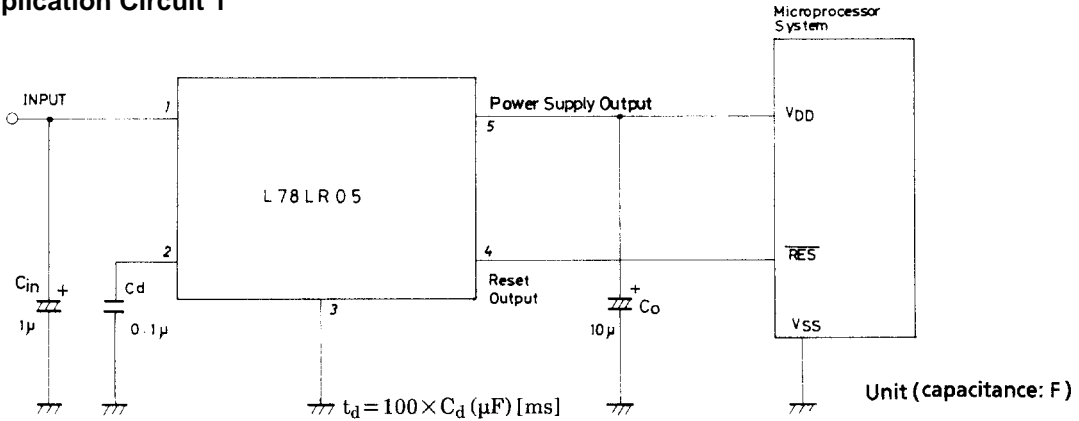
### Equivalent Circuit Block Diagram



Unit (resistance:  $\Omega$ , capacitance: F)

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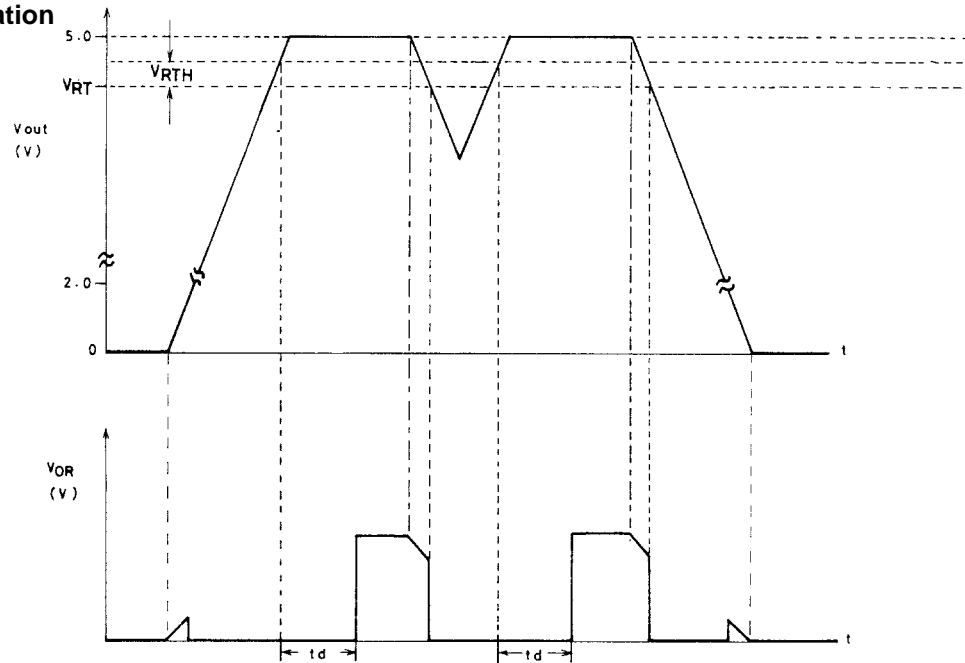
## Sample Application Circuit 1



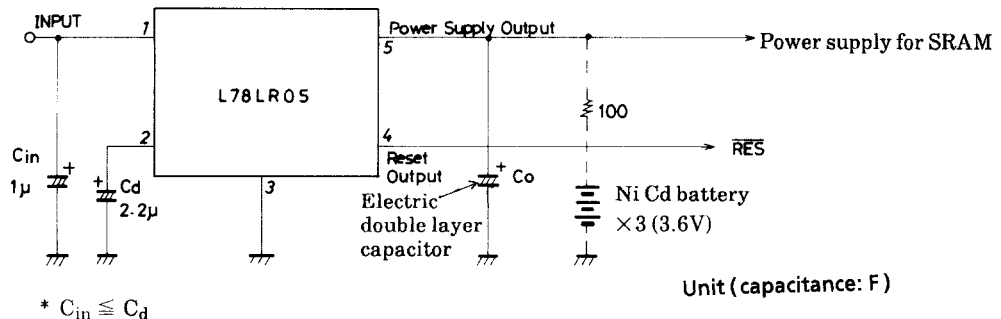
Note 1 : When the capacitance of  $C_d$  is large, the capacitor may not discharge completely, causing  $t_d$  to be made shorter than a set value. If this is a problem, either connect a high speed diode (DS442) between pin2 (anode side) and pin5 (cathode side) or ensure an adequate discharge time by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



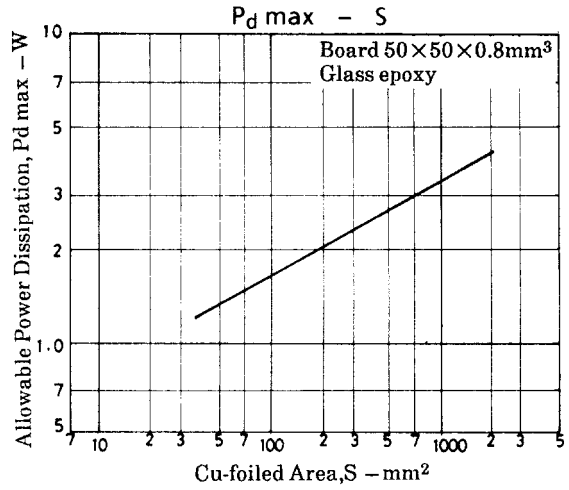
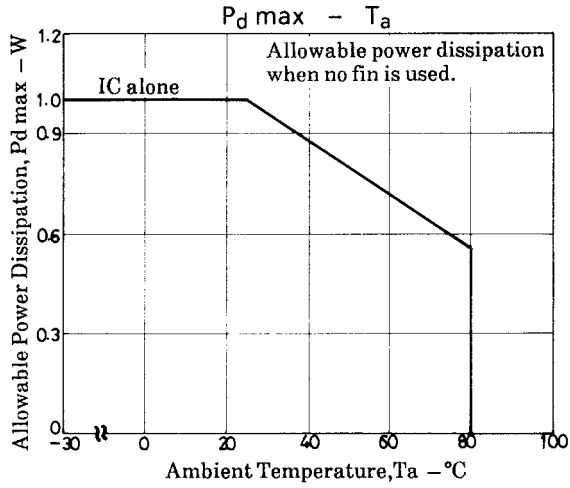
Since the leakage current at the output pin (pin5) of the L78LR05 is so low as  $2\mu A$  or less, a backup circuit can be implemented by connecting an electric double layer capacitor (super capacitor : NEC, gold capacitor : Matsushita Electric) or a Ni Cd battery direct to the output pin. Since a reverse 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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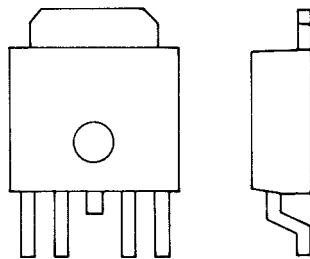
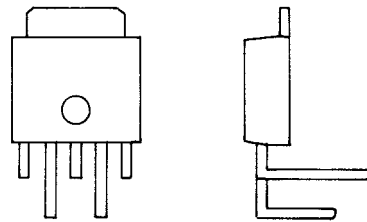
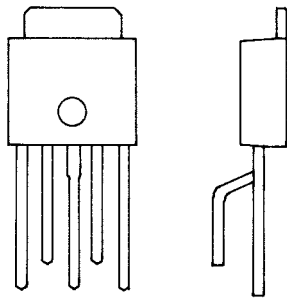
## Allowable Power Dissipation

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 ( $50\times 50\times 0.8\text{mm}^3$ ).

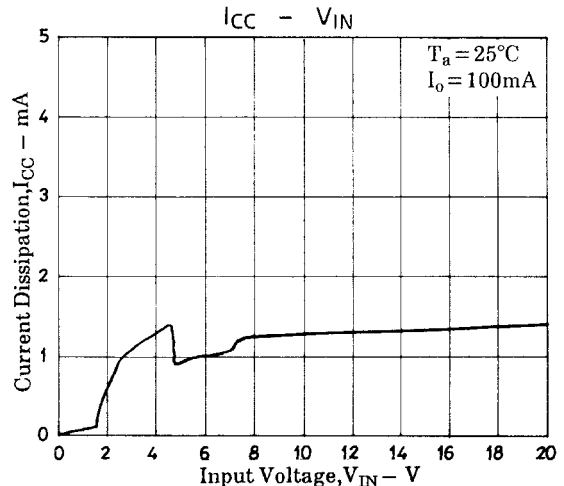
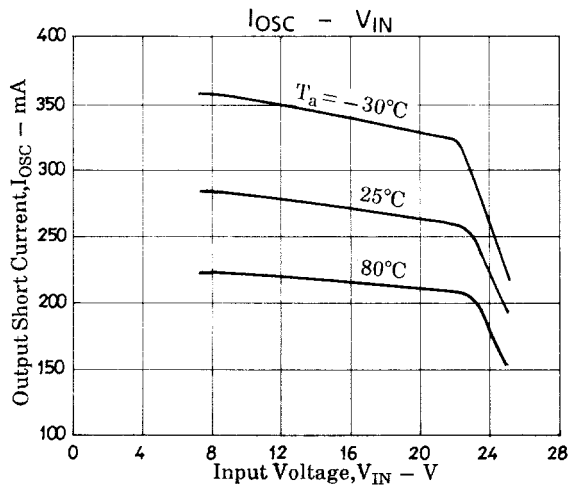
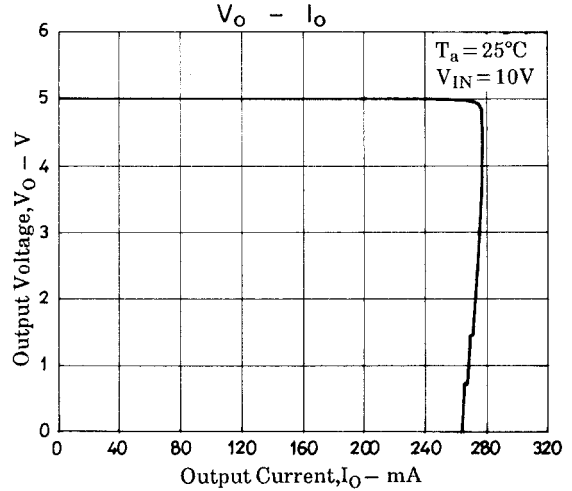
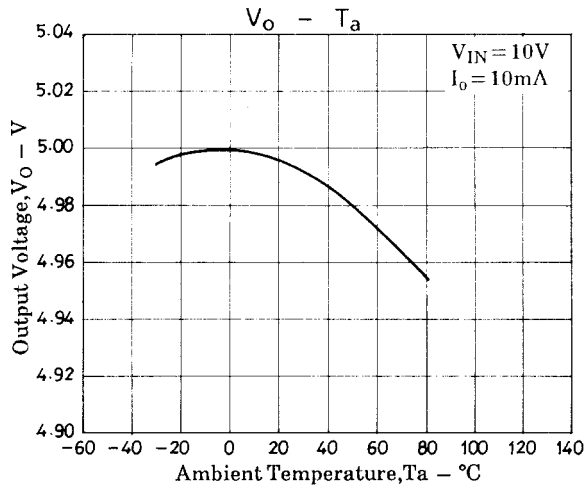
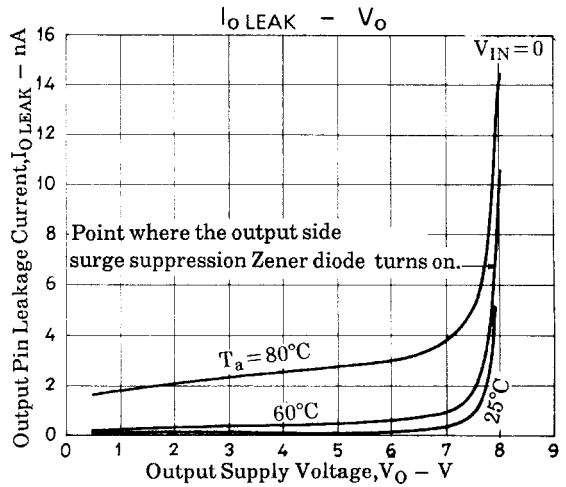
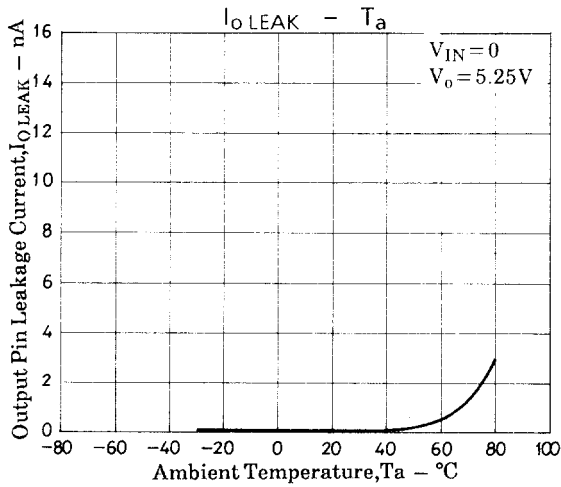
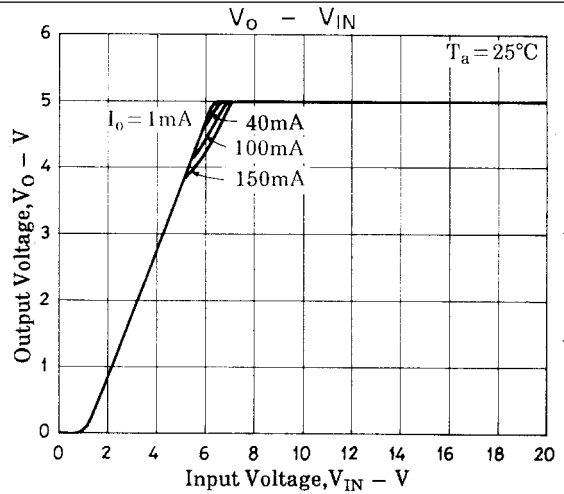
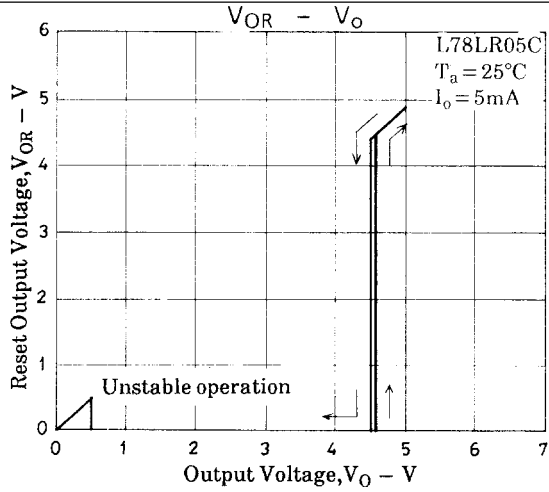


\* The measured values of  $P_d$  represent the values measured when solder on the Cu-foiled area is all wet.

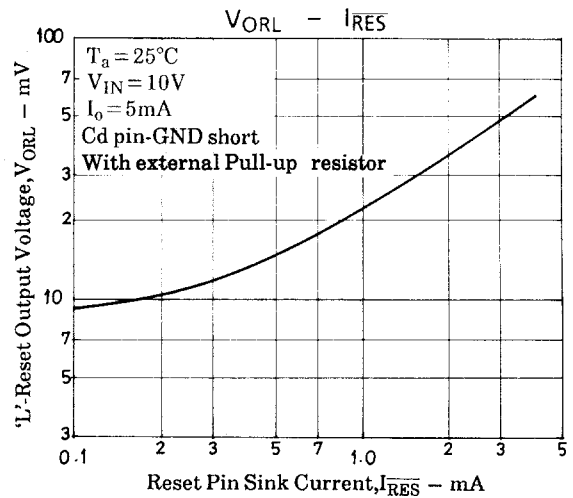
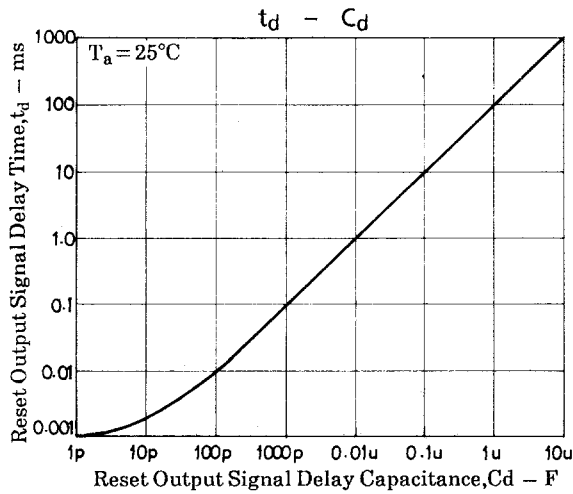
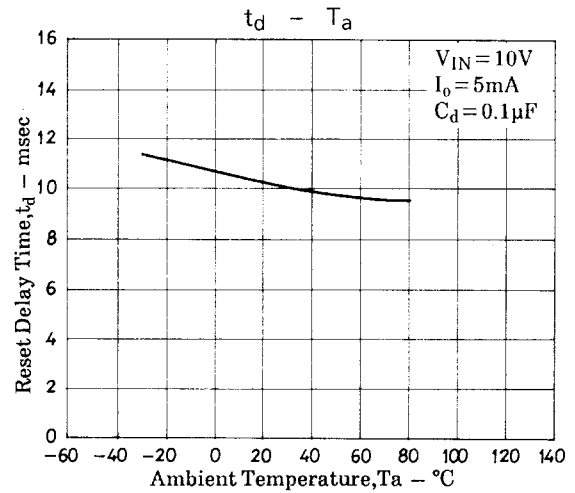
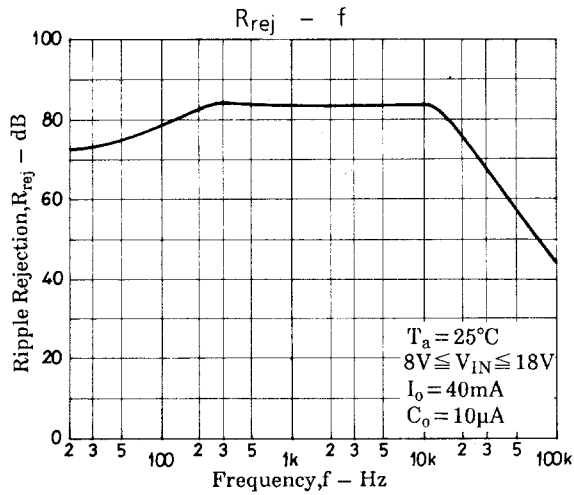
## Lead Forming



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