Ordering number:ENN2622B

Monolithic Linear IC

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.

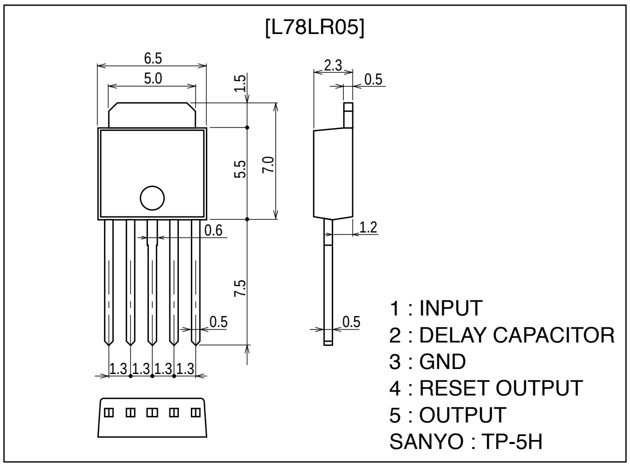
Features

- 5V, 150mA output.
- Capable of generating a microcomputer reset signal.
- No battery-regulator switching circuit required at the battery backup mode (Output leakage current : 2µA 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 methodes 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 Ta = 25˚C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum Input Voltage	V_{IN} max		25	V
Allowable Power Dissipation	Pd max	(No fin)	1.0	W
Operating Temperature	Topr		–30 to +80	˚C
Storage Temperature	Tstg		–55 to +150	˚C

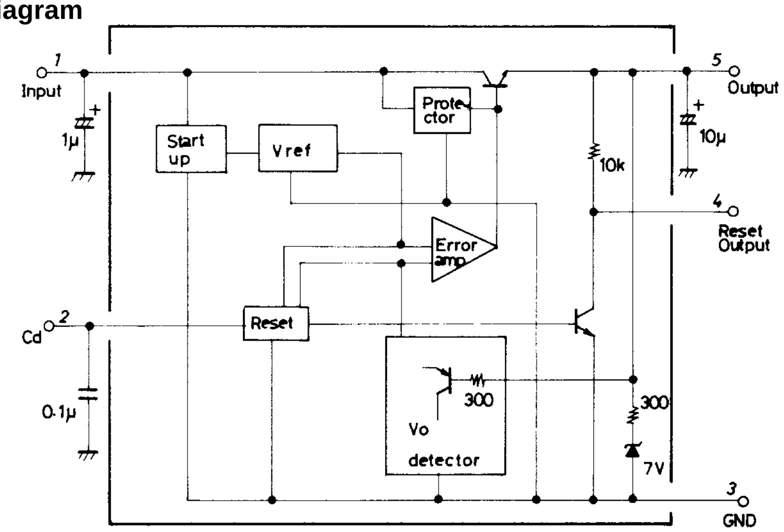
Operating Conditions at Ta = 25˚C

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

Operating Characteristics at Ta = 25˚C, V_{IN}=10V, I_{OUT}=40mA, c_{in}=1µF, c_o=10µF

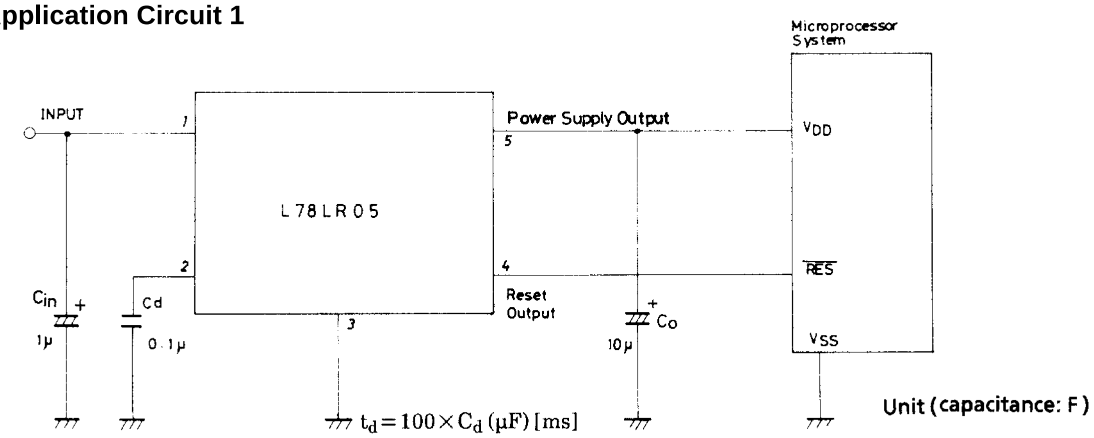
Parameter	Symbol	Conditions	Ratings min	Ratings typ	Ratings max	Unit
Output Voltage	V_{OUT1}	Tj=25°C	4.8	5.0	5.2	V
	V_{OUT2}	7V≤V_{IN}≤20V, 1mA≤I_{OUT}≤70mA	4.75		5.25	V
Line Regulation	$\Delta V_{O\ LINE1}$	Tj=25°C, 7V≤V_{IN}≤20V		6.0	75	mV
	$\Delta V_{O\ LINE2}$	Tj=25°C, 8V≤V_{IN}≤20V		3.0	50	mV
Load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

Equivalent Circuit Block Diagram



Unit (resistance: Ω, capacitance: F)

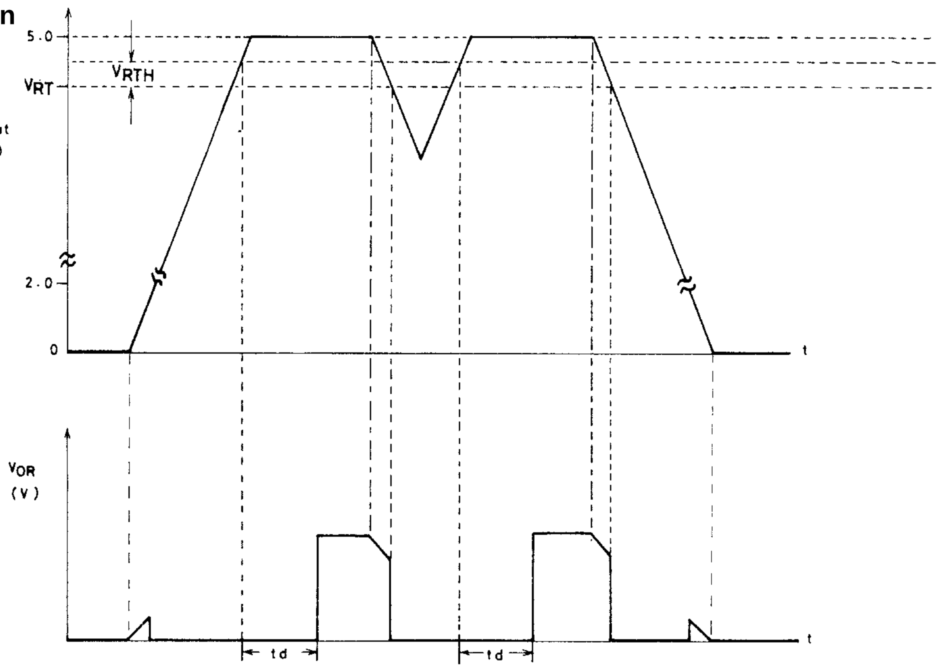
Sample Application Circuit 1



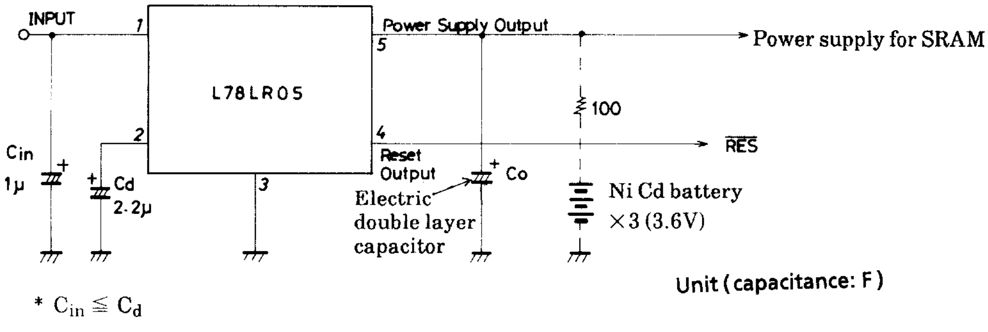
Note 1 : When the capacitance of Cd is large, the capacitor may not discharge completely, causing t_d to be made shorter than a set value. If this is a problem, either connect a high speed diode (DS442) between pin2 (anode side) and pin5 (cathode side) or ensure an adequate discharge time by using values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

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)

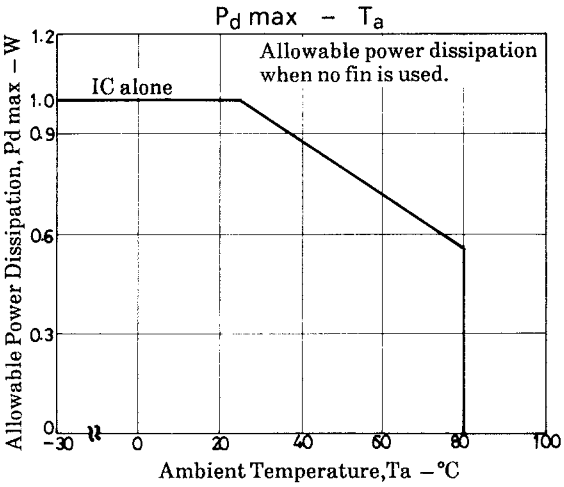


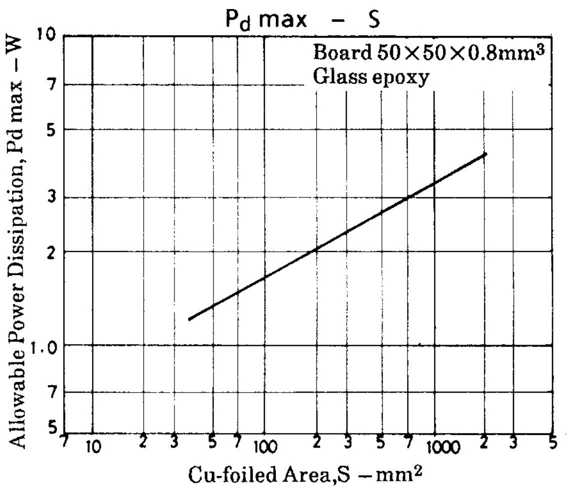
Since the leakage current at the output pin (pin5) of the L78LR05 is so low as 2µA or less, a backup circuit can be implemented by connectiong an electric double layer capacitor (super capacitor : NEC, gold capacitor : Matsushita Electric) or a Ni Cd battery direct to the output pin. Since a reverse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

Allowable Power Dissipation

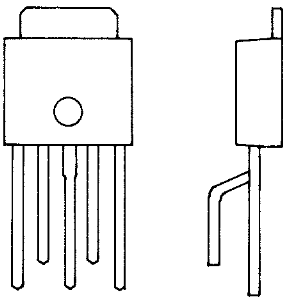
The allowable power dissipation is 1.0V (Ta=25°C) with fin attached. When the L78LR05 is surface-mounted on a hybrid IC board or printed circuit board, a high allowable power dissipation can be obtained, though it is placed in a small-sized package. Shown below is the relationship between the Cu-foiled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



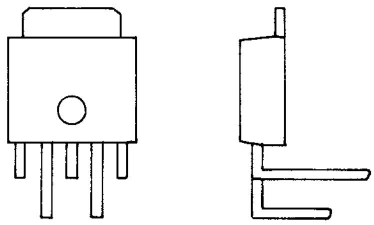


* The measured values of Pd represent the values measured when solder on the Cu-foiled area is all wet.

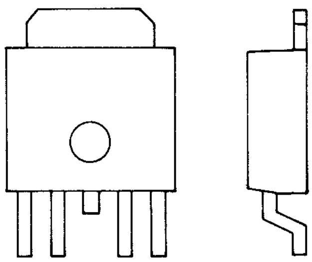
Lead Forming



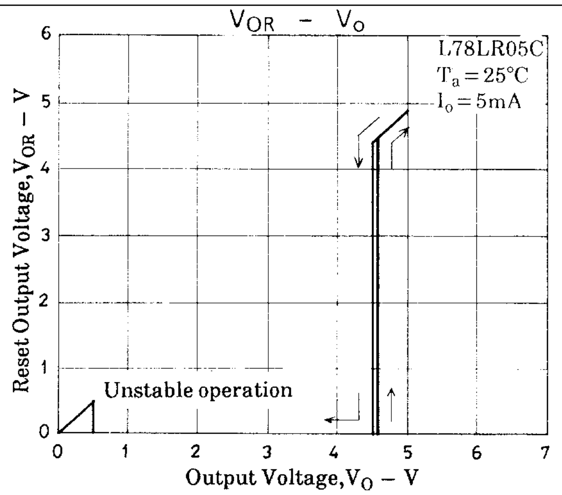
MA forming

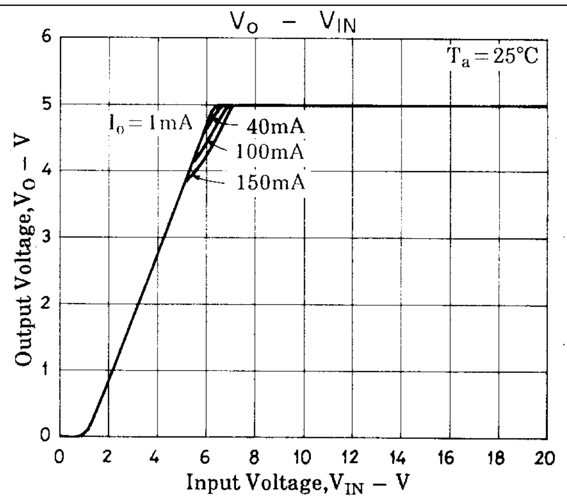


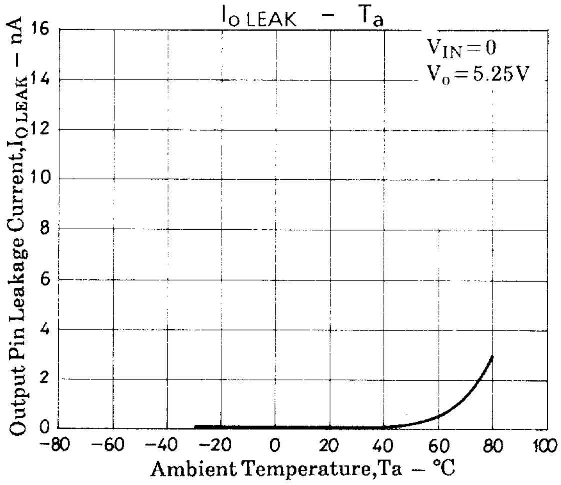
LR forming

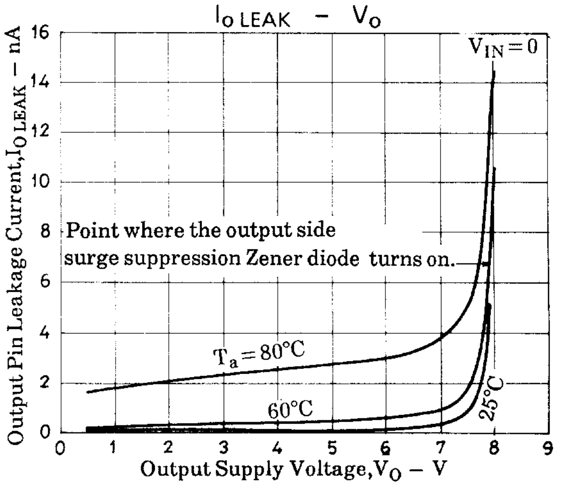


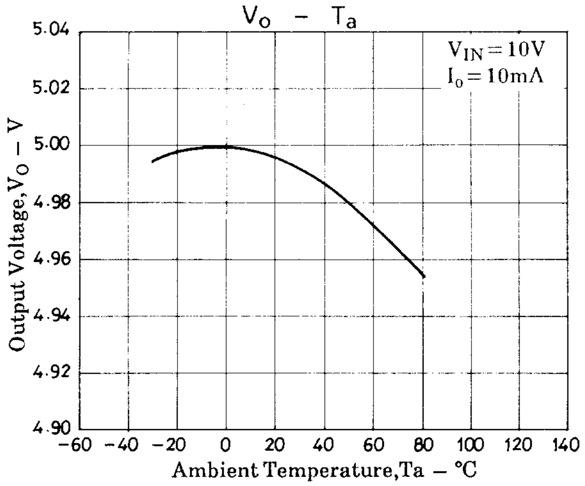
FA forming

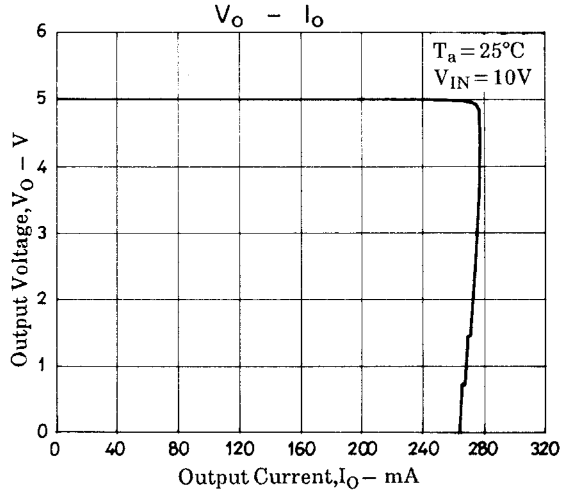

VOR – Vo
L78LR05C
Ta = 25°C
Io = 5mA
Unstable operation
Reset Output Voltage, VOR – V
Output Voltage, VO – V
0 1 2 3 4 5 6 7
0 1 2 3 4 5 6

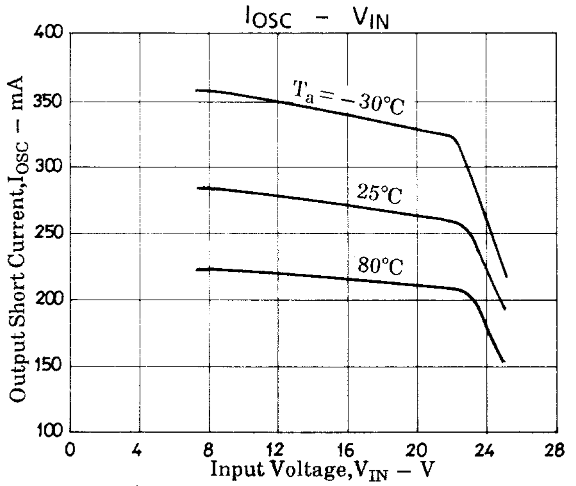

Vo – VIN
Ta = 25°C
Io = 1mA
40mA
100mA
150mA
Output Voltage, VO – V
Input Voltage, VIN – V
0 2 4 6 8 10 12 14 16 18 20
0 1 2 3 4 5 6

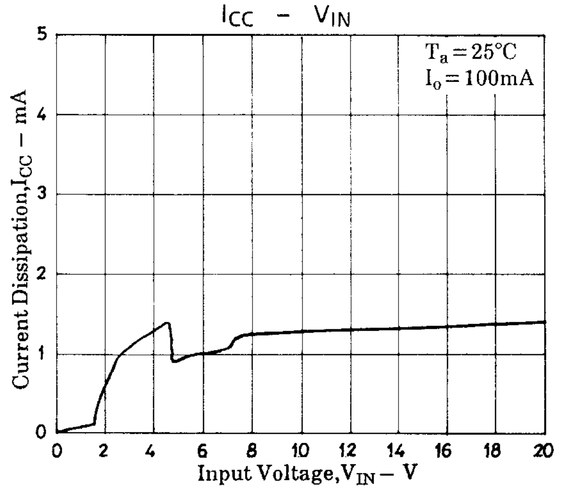

Io LEAK – Ta
VIN = 0
Vo = 5.25V
Output Pin Leakage Current, IO LEAK – nA
Ambient Temperature, Ta – °C
–80 –60 –40 –20 0 20 40 60 80 100
0 2 4 6 8 10 12 14 16

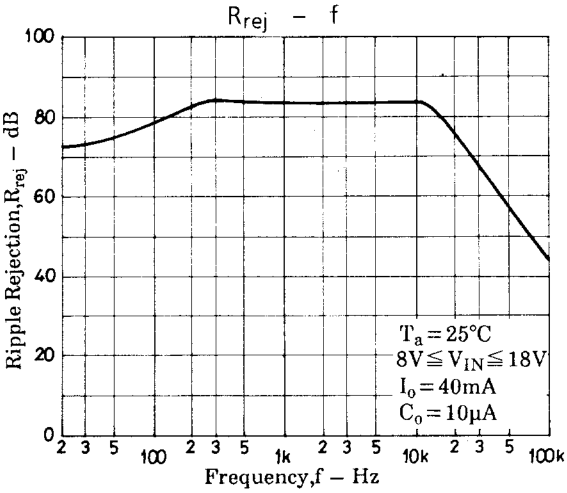

Io LEAK – Vo
VIN = 0
Point where the output side
surge suppression Zener diode turns on.
Ta = 80°C
60°C
25°C
Output Pin Leakage Current, IO LEAK – nA
Output Supply Voltage, VO – V
0 1 2 3 4 5 6 7 8 9
0 2 4 6 8 10 12 14 16

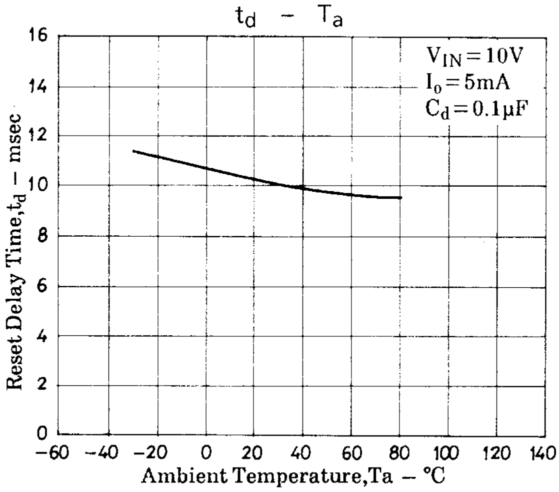

Vo – Ta
VIN = 10V
Io = 10mA
Output Voltage, VO – V
Ambient Temperature, Ta – °C
–60 –40 –20 0 20 40 60 80 100 120 140
4.90 4.92 4.94 4.96 4.98 5.00 5.02 5.04

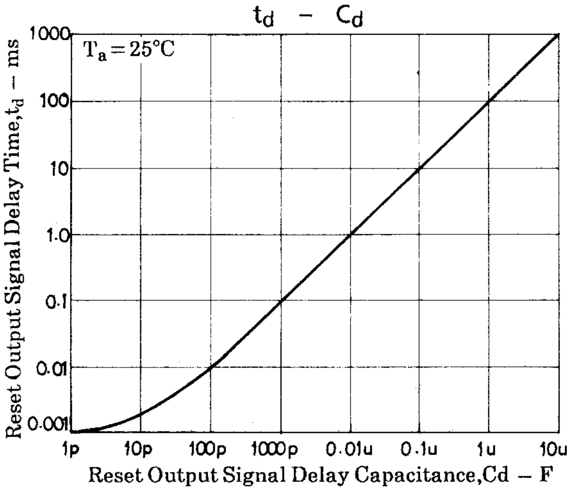

Vo – Io
Ta = 25°C
VIN = 10V
Output Voltage, VO – V
Output Current, IO – mA
0 40 80 120 160 200 240 280 320
0 1 2 3 4 5 6

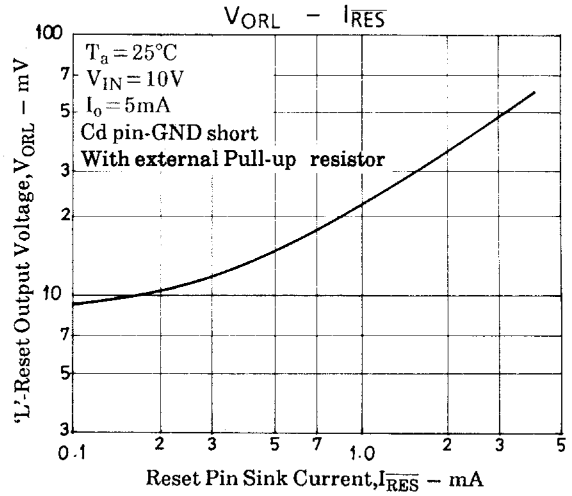

IOSC – VIN
Ta = –30°C
25°C
80°C
Output Short Current, IOSC – mA
Input Voltage, VIN – V
0 4 8 12 16 20 24 28
100 150 200 250 300 350 400


ICC – VIN
Ta = 25°C
Io = 100mA
Current Dissipation, ICC – mA
Input Voltage, VIN – V
0 2 4 6 8 10 12 14 16 18 20
0 1 2 3 4 5









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