



## L88M00T Series

### 3.3 to 12 V, 0.5 A Low Dropout Voltage Regulator

## Overview

The L88M00T Series are low dropout voltage regulator ICs with output current of 0.5 A. Because they can operate with a low input-output voltage difference, they contribute to smaller and more efficient set power supplies, and are optimum for audio-visual and office automation equipment.

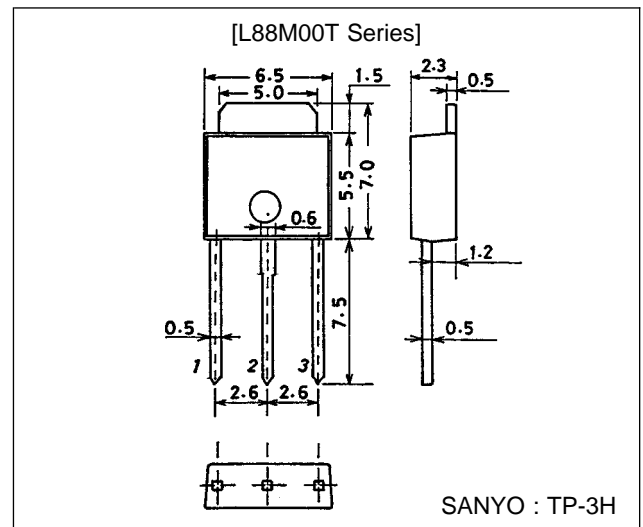
## Functions and Features

- Output voltage L88M33T: 3.3 V L88M05T: 5 V  
L88M09T: 9 V L88M12T: 12 V
- 500 mA output current
- Low minimum input-output voltage differential (0.4 V typ) enables to save energy and miniaturize transformer size.
- Set size can be miniaturized with compact TP-3H power package.
- Surface mounting on board permits allowable power dissipation to be raised.
- Enhanced mount flexibility with range of formed products.

## Package Dimensions

unit : mm

### 3103-TP-3H



## Specifications

### Maximum Ratings at $T_a = 25^\circ\text{C}$ (common to L88M00T series)

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage	$V_{IN}$ max		18	V
Allowable power dissipation	$P_d$ max	$T_a \leq 25^\circ\text{C}$ , no heat sink	1	W
		$T_c = 25^\circ\text{C}$ , with infinite heat sink	6.25	W
Thermal resistance (junction-atmosphere)	$\theta_{j-a}$		125	$^\circ\text{C}/\text{W}$
Thermal resistance (junction-to-case)	$\theta_{j-c}$		20	$^\circ\text{C}/\text{W}$
Operating temperature	$T_{opr}$		-20 to +85	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-55 to +150	$^\circ\text{C}$

■ Any and all SANYO products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your SANYO representative nearest you before using any SANYO products described or contained herein in such applications.

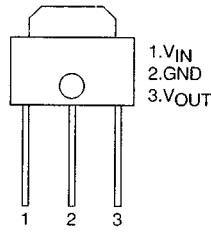
■ SANYO assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO products described or contained herein.

**SANYO Electric Co., Ltd. Semiconductor Business Headquarters**

TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

## L88M00T Series

### Pin Assignment



Top view

### [L88M33T]

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

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage	$V_{IN}$		4 to 17	V
Output current	$I_{OUT}$		0 to 500	mA

#### Operating Characteristics at $T_j = 25\text{ }^\circ\text{C}$ , $V_{IN} = 6.3\text{ V}$ , $I_O = 500\text{ mA}$ , $C_{OUT} = 100\text{ }\mu\text{F}$ , $C_{IN} = 1\text{ }\mu\text{F}$ , see specified Test Circuit.

Parameter	Symbol	Conditions	min	typ	max	Unit
Output voltage	$V_{OUT}$		3.2	3.3	3.4	V
Dropout voltage	$V_{DROP1}$			0.4	0.6	V
	$V_{DROP2}$	$I_O = 150\text{ mA}$		0.2	0.3	V
Line regulation	$\Delta V_{OLN}$	$4\text{ V} \leq V_{IN} \leq 17\text{ V}$		10	50	mV
Load regulation	$\Delta V_{OLD}$	$5\text{ mA} \leq I_{OUT} \leq 500\text{ mA}$		24	80	mV
Peak output current	$I_{OP}$		600	900		mA
Output short-circuit current	$I_{OSC}$			100	300	mA
Quiescent current	$I_{Q1}$	$I_{OUT} = 0$		1.9	5.0	mA
	$I_{Q2}$			24	50	mA
Output noise voltage	$V_{NO}$	$10\text{ Hz} \leq f \leq 100\text{ kHz}$		30		$\mu\text{Vrms}$
Temperature coefficient of output voltage	$\Delta V_{OUT}/\Delta T_j$	$T_j = 25\text{ to }125\text{ }^\circ\text{C}$		$\pm 0.4$		$\text{mV}/^\circ\text{C}$
Ripple rejection	Rrej	$f = 120\text{ Hz}$ , $4.3\text{ V} \leq V_{IN} \leq 17\text{ V}$		65		dB

### [L88M05T]

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

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage	$V_{IN}$		5.8 to 17	V
Output current	$I_{OUT}$		0 to 500	mA

#### Operating Characteristics at $T_j = 25\text{ }^\circ\text{C}$ , $V_{IN} = 8\text{ V}$ , $I_O = 500\text{ mA}$ , $C_{OUT} = 100\text{ }\mu\text{F}$ , $C_{IN} = 1\text{ }\mu\text{F}$ , see specified Test Circuit.

Parameter	Symbol	Conditions	min	typ	max	Unit
Output voltage	$V_{OUT}$		4.85	5.0	5.15	V
Dropout voltage	$V_{DROP1}$			0.4	0.6	V
	$V_{DROP2}$	$I_O = 150\text{ mA}$		0.2	0.3	V
Line regulation	$\Delta V_{OLN}$	$5.8\text{ V} \leq V_{IN} \leq 17\text{ V}$		10	50	mV
Load regulation	$\Delta V_{OLD}$	$5\text{ mA} \leq I_{OUT} \leq 500\text{ mA}$		30	100	mV
Peak output current	$I_{OP}$		600	900		mA
Output short-circuit current	$I_{OSC}$			100	300	mA
Quiescent current	$I_{Q1}$	$I_{OUT} = 0$		2.0	5.0	mA
	$I_{Q2}$			24	50	mA
Output noise voltage	$V_{NO}$	$10\text{ Hz} \leq f \leq 100\text{ kHz}$		40		$\mu\text{Vrms}$
Temperature coefficient of output voltage	$\Delta V_{OUT}/\Delta T_j$	$T_j = 25\text{ to }125\text{ }^\circ\text{C}$		$\pm 0.5$		$\text{mV}/^\circ\text{C}$
Ripple rejection	Rrej	$f = 120\text{ Hz}$ , $6\text{ V} \leq V_{IN} \leq 17\text{ V}$		65		dB

## L88M00T Series

### [L88M09T]

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

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage	$V_{IN}$		9.9 to 17	V
Output current	$I_{OUT}$		0 to 500	mA

#### Operating Characteristics at $T_j = 25\text{ }^\circ\text{C}$ , $V_{IN} = 12\text{ V}$ , $I_O = 500\text{ mA}$ , $C_{OUT} = 100\text{ }\mu\text{F}$ , $C_{IN} = 1\text{ }\mu\text{F}$ , see specified Test Circuit.

Parameter	Symbol	Conditions	min	typ	max	Unit
Output voltage	$V_{OUT}$		8.73	9.0	9.27	V
Dropout voltage	$V_{DROP1}$			0.4	0.6	V
	$V_{DROP2}$	$I_O = 150\text{ mA}$		0.2	0.3	V
Line regulation	$\Delta V_{OLN}$	$9.9\text{ V} \leq V_{IN} \leq 17\text{ V}$		10	50	mV
Load regulation	$\Delta V_{OLD}$	$5\text{ mA} \leq I_{OUT} \leq 500\text{ mA}$		54	180	mV
Peak output current	$I_{OP}$		600	900		mA
Output short-circuit current	$I_{OSC}$			100	300	mA
Quiescent current	$I_{Q1}$	$I_{OUT} = 0$		2.3	5.0	mA
	$I_{Q2}$			24	50	mA
Output noise voltage	$V_{NO}$	$10\text{ Hz} \leq f \leq 100\text{ kHz}$		40		$\mu\text{Vrms}$
Temperature coefficient of output voltage	$\Delta V_{OUT}/\Delta T_j$	$T_j = 25\text{ to }125\text{ }^\circ\text{C}$		$\pm 0.9$		$\text{mV}/^\circ\text{C}$
Ripple rejection	Rrej	$f = 120\text{ Hz}$ , $10\text{ V} \leq V_{IN} \leq 17\text{ V}$		59		dB

### [L88M12T]

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

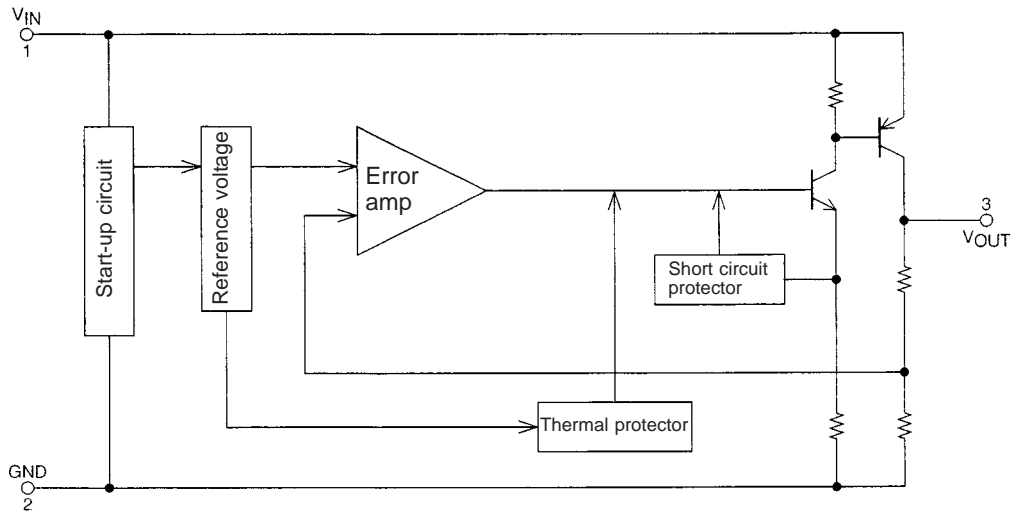
Parameter	Symbol	Conditions	Ratings	Unit
Input voltage	$V_{IN}$		13 to 17	V
Output current	$I_{OUT}$		0 to 500	mA

#### Operating Characteristics at $T_j = 25\text{ }^\circ\text{C}$ , $V_{IN} = 15\text{ V}$ , $I_O = 500\text{ mA}$ , $C_{OUT} = 100\text{ }\mu\text{F}$ , $C_{IN} = 1\text{ }\mu\text{F}$ , see specified Test Circuit.

Parameter	Symbol	Conditions	min	typ	max	Unit
Output voltage	$V_{OUT}$		11.64	12.0	12.36	V
Dropout voltage	$V_{DROP1}$			0.4	0.6	V
	$V_{DROP2}$	$I_O = 150\text{ mA}$		0.2	0.3	V
Line regulation	$\Delta V_{OLN}$	$13\text{ V} \leq V_{IN} \leq 17\text{ V}$		10	50	mV
Load regulation	$\Delta V_{OLD}$	$5\text{ mA} \leq I_{OUT} \leq 500\text{ mA}$		70	240	mV
Peak output current	$I_{OP}$		600	900		mA
Output short-circuit current	$I_{OSC}$			100	300	mA
Quiescent current	$I_{Q1}$	$I_{OUT} = 0$		2.6	5.0	mA
	$I_{Q2}$			24	50	mA
Output noise voltage	$V_{NO}$	$10\text{ Hz} \leq f \leq 100\text{ kHz}$		40		$\mu\text{Vrms}$
Temperature coefficient of output voltage	$\Delta V_{OUT}/\Delta T_j$	$T_j = 25\text{ to }125\text{ }^\circ\text{C}$		$\pm 1.2$		$\text{mV}/^\circ\text{C}$
Ripple rejection	Rrej	$f = 120\text{ Hz}$ , $13\text{ V} \leq V_{IN} \leq 17\text{ V}$		58		dB

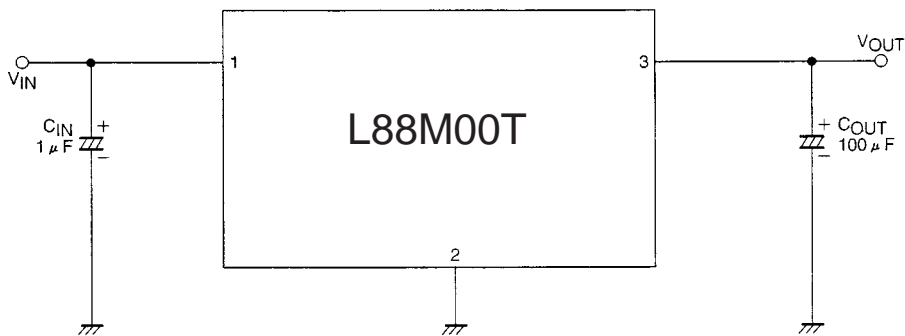
## L88M00T Series

### Equivalent Circuit Block Diagram (Common to L88M00T Series)



A10243

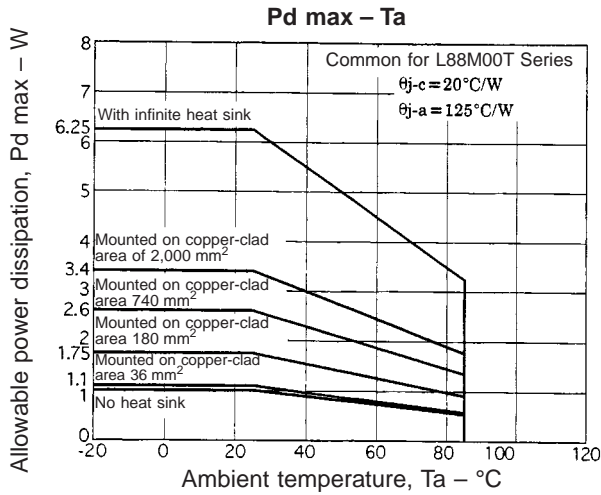
### Test Circuit (Common to L88M00T Series)



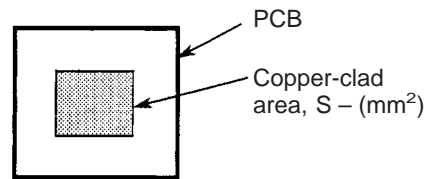
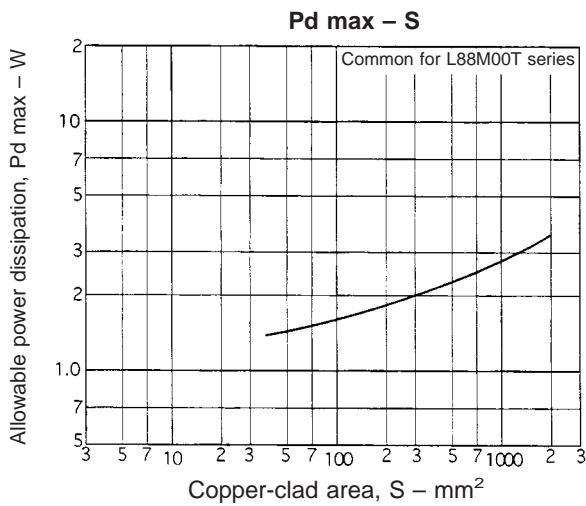
A10244

- Notes:
1. To ensure operational stability,  $C_{IN}$  and  $C_{OUT}$  should be placed as close to the IC as possible.
  2. Because the output capacitor  $C_{OUT}$  is set at over 100  $\mu\text{F}$  to prevent oscillation at low temperatures, a capacitor that exhibits little change in capacity with temperature variations should be used (such as a tantalum capacitor).
  3. When  $V_{IN}$  is minus (-) and GND is plus (+) (reversed connection), excessive current flow will occur.

# L88M00T Series

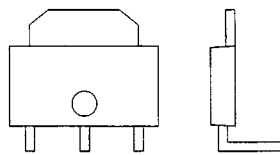


- 1) The allowable power dissipation is 1.0 W ( $T_a = 25^\circ\text{C}$ ) with no fin attached, but when mounted on a hybrid IC board or printed circuit board, high allowable power dissipation is achieved, despite the compact package. The graph below depicts the relationship between the copper-clad area and allowable power dissipation when mounted on a glass epoxy board ( $50 \times 50 \times 0.8 \text{ mm}^3$ ) with a copper thickness of 18  $\mu\text{m}$ .



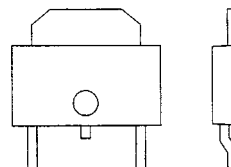
- 2) Pd is the value for when the solder on the surface of the IC heat sink has melted completely and the surface mount is horizontal.
- 3) Please be advised that the flow solder application system (full-heat method) cannot be recommended.

## Lead Formings



LR forming

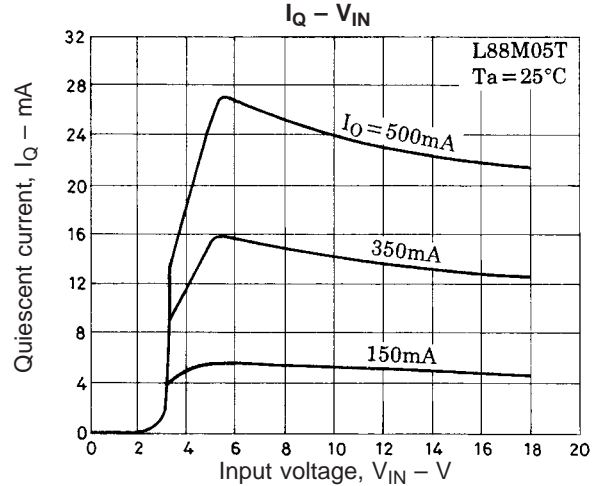
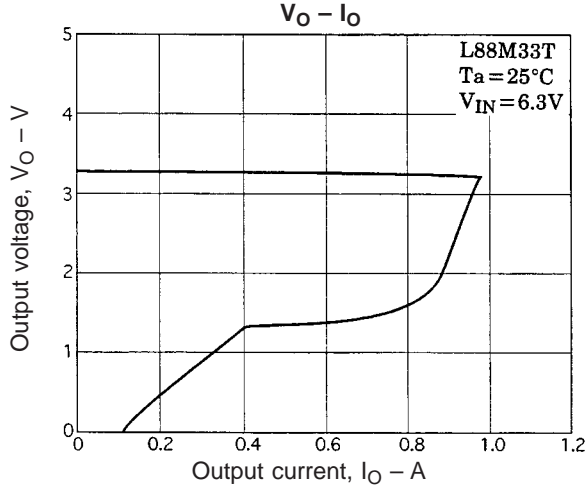
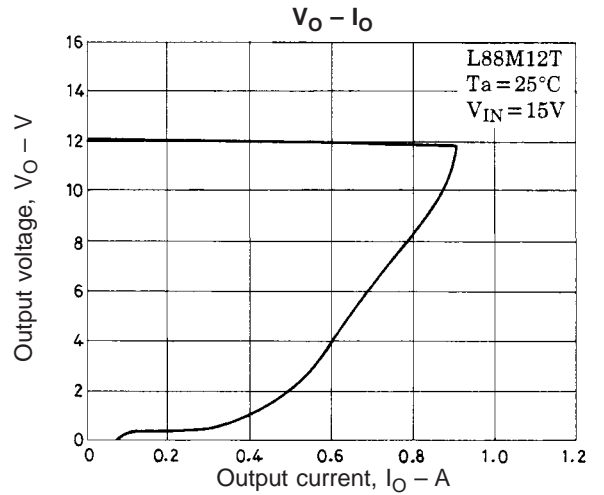
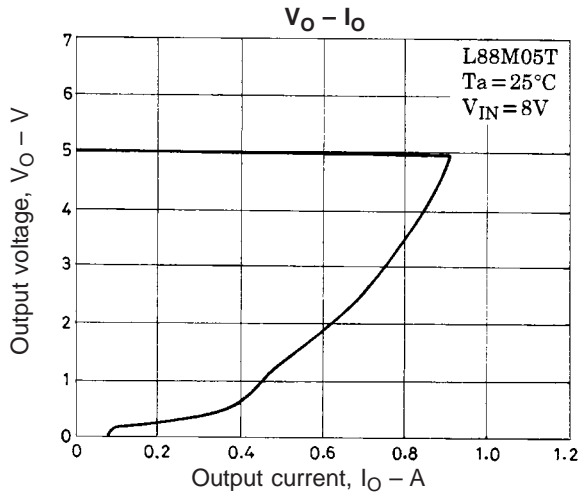
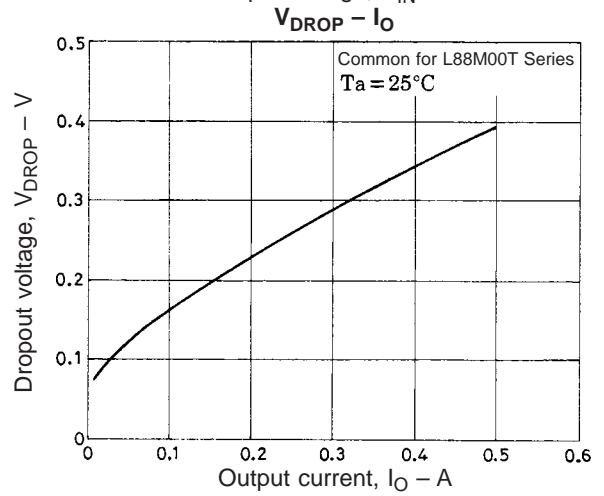
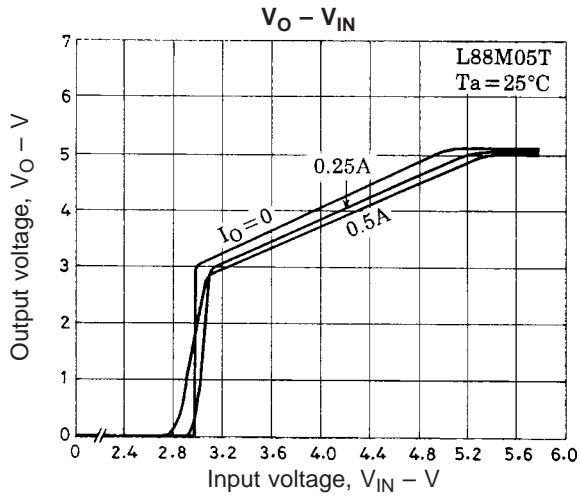
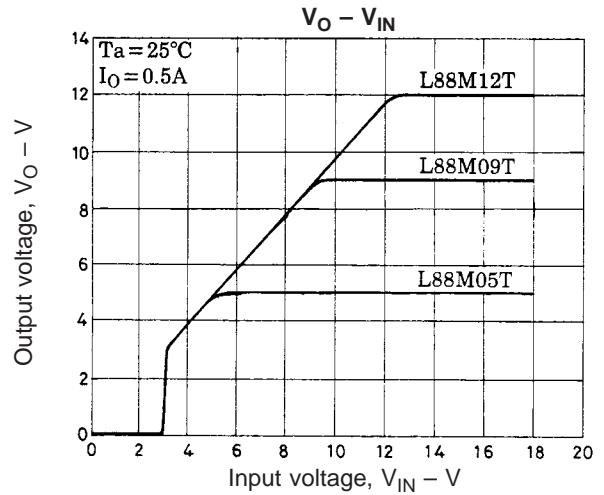
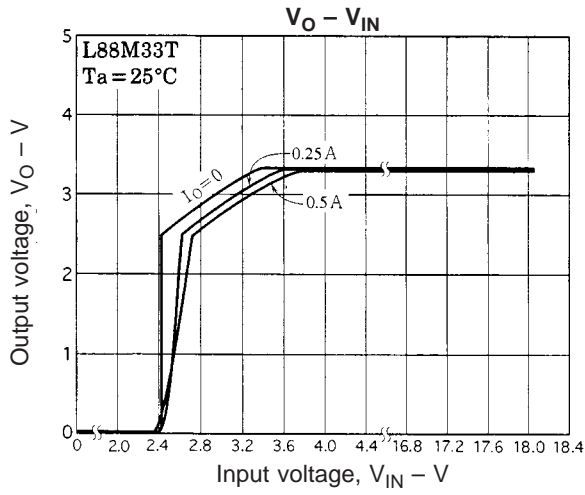
A10245



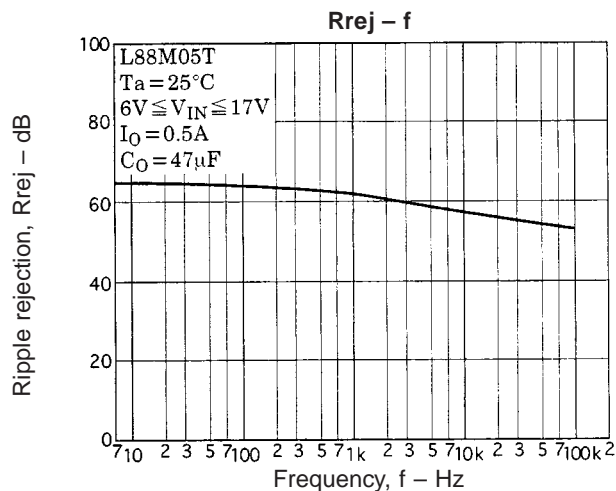
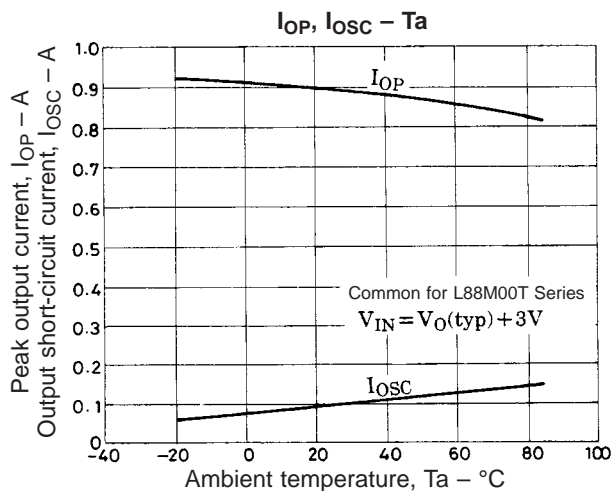
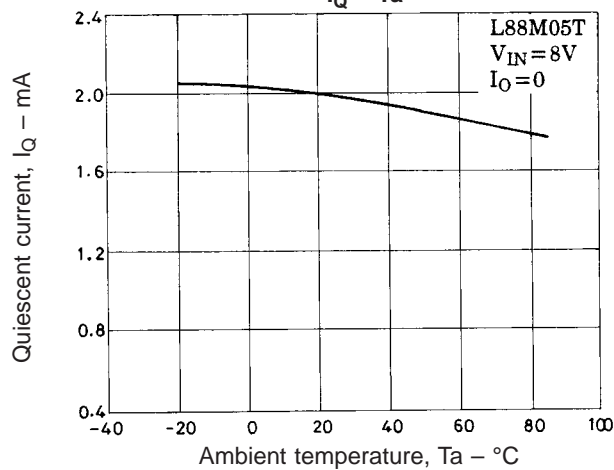
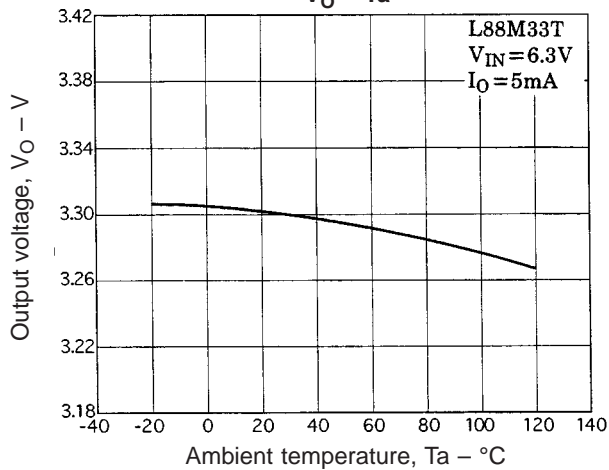
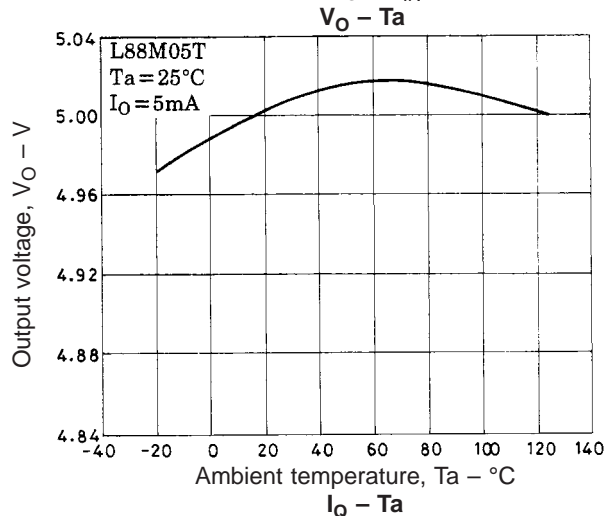
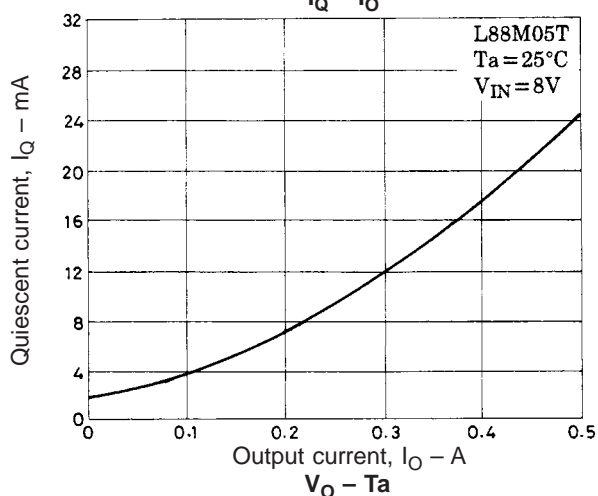
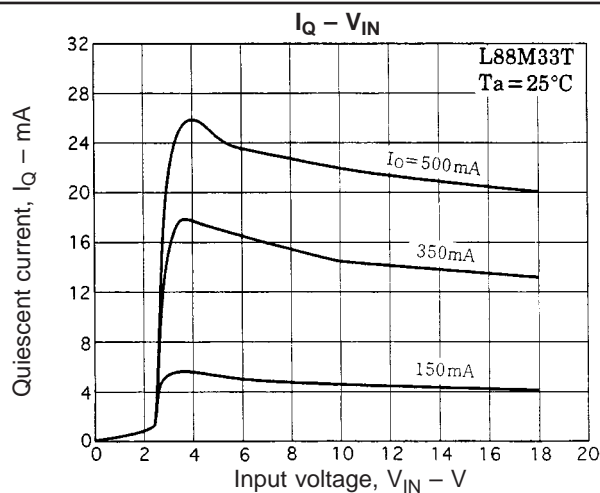
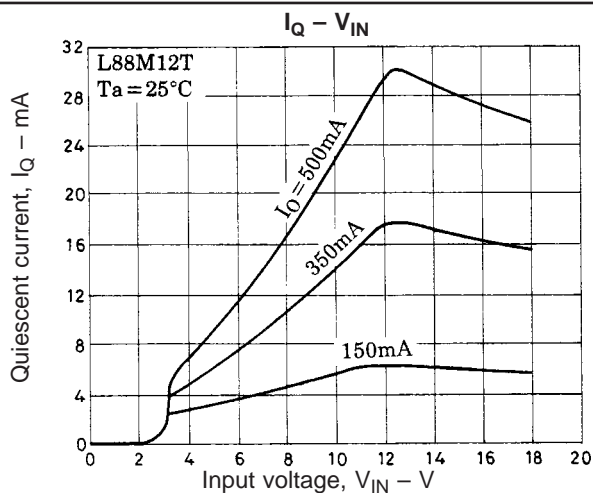
FA forming

A10246

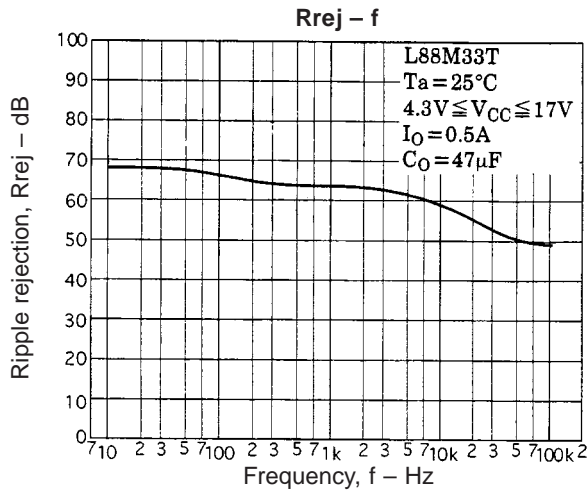
# L88M00T Series



# L88M00T Series



## L88M00T Series



- Specifications of any and all SANYO products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.
- SANYO Electric Co., Ltd. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all SANYO products (including technical data, services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written permission of SANYO Electric Co., Ltd.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO product that you intend to use.
- Information (including circuit diagrams and circuit parameters) herein is for example only; it is not guaranteed for volume production. SANYO believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

This catalog provides information as of December, 1998. Specifications and information herein are subject to change without notice.