

Micropower Voltage Regulator

The MC78FC00 series voltage regulators are specifically designed for use as a power source for video instruments, handheld communication equipment, and battery powered equipment.

The MC78FC00 series voltage regulator ICs feature a high accuracy output voltage and ultra-low quiescent current. Each device contains a voltage reference unit, an error amplifier, a driver transistor, and resistors for setting output voltage, and a current limit circuit. These devices are available in SOT-89 surface mount packages, and allow construction of an efficient, constant voltage power supply circuit.

MC78FC00 Series Features:

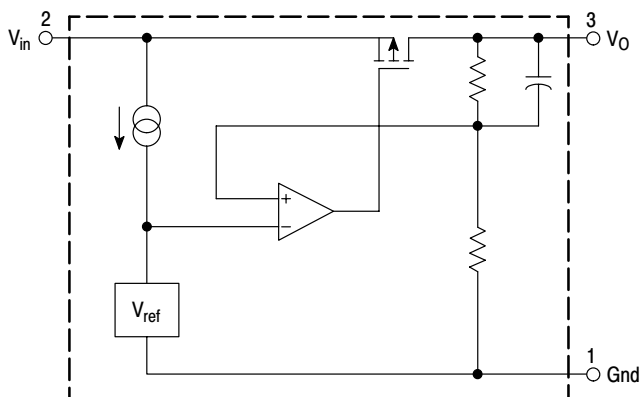
- Ultra-Low Quiescent Current of 1.1 μA Typical
- Ultra-Low Dropout Voltage (100 mV at 10 mA)
- Large Output Current (up to 120 mA)
- Excellent Line Regulation (0.1%)
- Wide Operating Voltage Range (2.0 V to 10 V)
- High Accuracy Output Voltage ($\pm 2.5\%$)
- Wide Output Voltage Range (2.0 V to 6.0 V)
- Surface Mount Package (SOT-89)

ORDERING INFORMATION

Device	Output Voltage	Operating Temperature Range	Package
MC78FC30HT1	3.0	$T_A = -30^\circ \text{ to } +80^\circ\text{C}$	SOT-89
MC78FC33HT1	3.3		
MC78FC40HT1	4.0		
MC78FC50HT1	5.0		

Other voltages from 2.0 to 6.0 V, in 0.1 V increments, are available upon request. Consult factory for information.

Representative Block Diagram

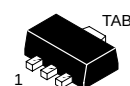


This device contains 11 active transistors.

MC78FC00 Series

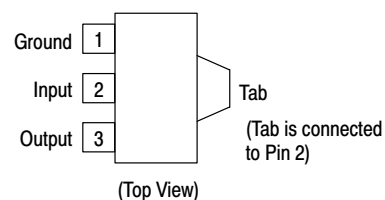
MICROPOWER ULTRA-LOW QUIESCENT CURRENT VOLTAGE REGULATORS

SEMICONDUCTOR TECHNICAL DATA

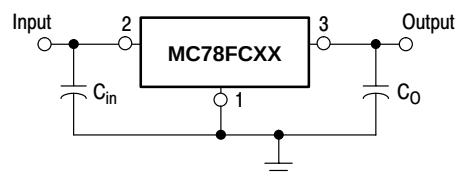


H SUFFIX
PLASTIC PACKAGE
CASE 1213
(SOT-89)

PIN CONNECTIONS



Standard Application



MC78FC00 Series

MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$, unless otherwise noted.)

Rating	Symbol	Value	Unit
Input Voltage	V_{CC}	10	Vdc
Power Dissipation and Thermal Characteristics Maximum Power Dissipation Case 1213 (SOT-89) H Suffix Thermal Resistance, Junction-to-Ambient	P_D $R_{\theta JA}$	300 333	mW $^\circ\text{C/W}$
Operating Junction Temperature	T_J	125	$^\circ\text{C}$
Operating Ambient Temperature	T_A	-30 to +80	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	-40 to +125	$^\circ\text{C}$

NOTE: ESD data available upon request.

ELECTRICAL CHARACTERISTICS ($V_{in} = V_O + 1.0\text{ V}$, $I_O = 10\text{ mA}$, $T_J = 25^\circ\text{C}$ [Note 1], unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage 30HT1 Suffix ($V_{in} = 5.0\text{ V}$) 33HT1 Suffix ($V_{in} = 6.0\text{ V}$) 40HT1 Suffix ($V_{in} = 7.0\text{ V}$) 50HT1 Suffix ($V_{in} = 8.0\text{ V}$)	V_O	2.925 3.218 3.900 4.875	3.0 3.3 4.0 5.0	3.075 3.382 4.100 5.125	V
Line Regulation $V_{in} = [V_O + 1.0]\text{ V}$ to 10 V , $I_O = 10\text{ mA}$	Reg_{line}	—	0.1	—	mV
Load Regulation $V_{in} = [V_O + 1.0]$, $I_O = 1.0$ to 10 mA	Reg_{load}	—	40	80	mV
Output Current 30HT1 Suffix ($V_{in} = 5.0\text{ V}$) 33HT1 Suffix ($V_{in} = 6.0\text{ V}$) 40HT1 Suffix ($V_{in} = 7.0\text{ V}$) 50HT1 Suffix ($V_{in} = 8.0\text{ V}$)	I_O	50 65 65 80	80 100 100 120	— — — —	mA
Dropout Voltage $I_O = 40\text{ mA}$	$V_{in} - V_O$	—	0.5	0.7	V
Quiescent Current 30HT1 Suffix ($V_{in} = 5.0\text{ V}$) 33HT1 Suffix ($V_{in} = 5.0\text{ V}$) 40HT1 Suffix ($V_{in} = 6.0\text{ V}$) 50HT1 Suffix ($V_{in} = 7.0\text{ V}$)	I_{CC}	— — — —	1.1 1.1 1.2 1.3	3.3 3.3 3.6 3.9	μA
Output Voltage Temperature Coefficient	T_C	—	± 100	—	ppm/ $^\circ\text{C}$

NOTE: 1. Low duty pulse techniques are used during test to maintain junction temperature as close to ambient as possible.

DEFINITIONS

Dropout Voltage – The input/output voltage differential at which the regulator output no longer maintains regulation against further reductions in input voltage. Measured when the output drops 100 mV below its nominal value (which is measured at 1.0 V differential), dropout voltage is affected by junction temperature, load current and minimum input supply requirements.

Line Regulation – The change in output voltage for a change in input voltage. The measurement is made under conditions of low dissipation or by using pulse techniques

such that average chip temperature is not significantly affected.

Load Regulation – The change in output voltage for a change in load current at constant chip temperature.

Maximum Power Dissipation – The maximum total device dissipation for which the regulator will operate within specifications.

Quiescent Bias Current – Current which is used to operate the regulator chip and is not delivered to the load.

MC78FC00 Series

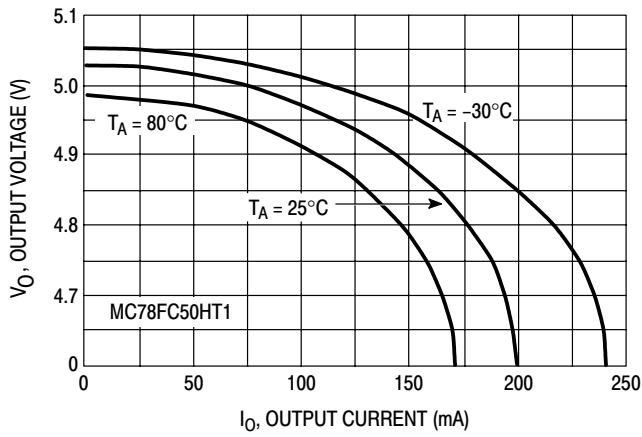


Figure 1. Output Voltage versus Output Current

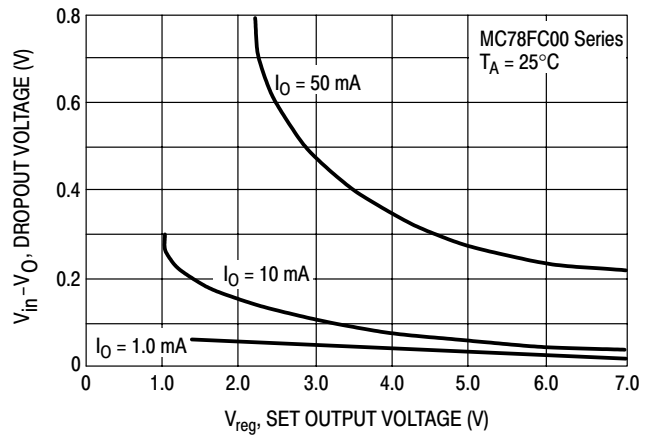


Figure 2. Dropout versus Set Output Voltage

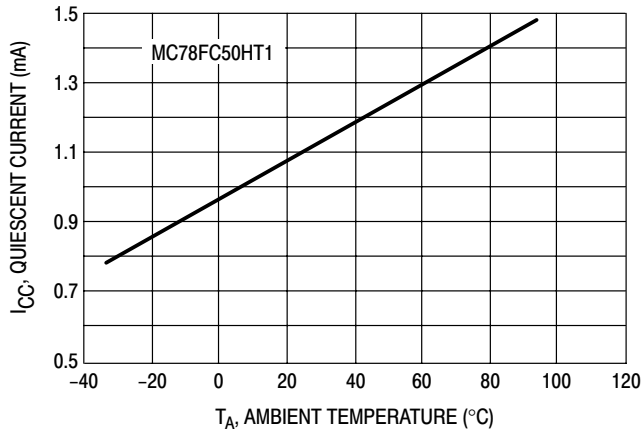


Figure 3. Quiescent Current versus Temperature

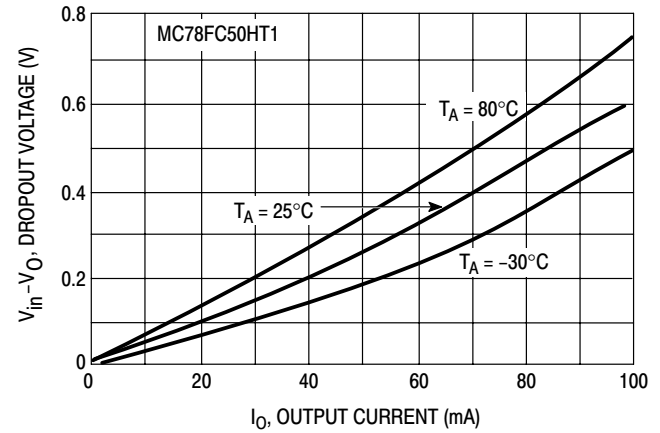


Figure 4. Dropout Voltage versus Output Current

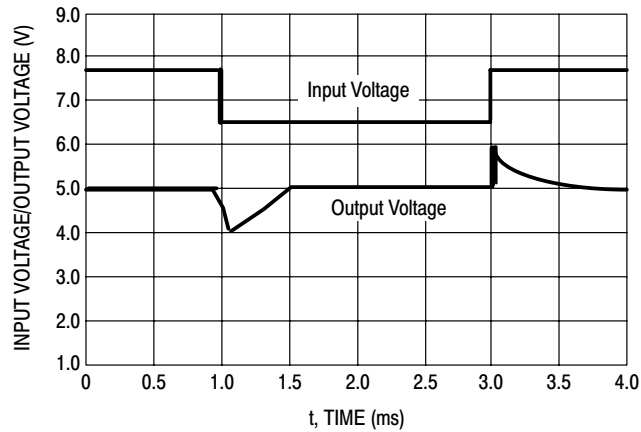


Figure 5. Line Transient Response

MC78FC00 Series

APPLICATIONS INFORMATION

Introduction

The MC78FC00 micropower voltage regulators are specifically designed with internal current limiting and low quiescent current making them ideal for battery powered applications. An input bypass capacitor is recommended if the regulator is located an appreciable distance (≥ 4 inches) from the input voltage source. These regulators require $0.1\ \mu\text{F}$ capacitance between the output terminal and ground for stability. Most types of aluminum, tantalum or multilayer ceramic will perform adequately. Solid tantalums or other appropriate capacitors are recommended for operation below 25°C . The bypass capacitors should be mounted with the shortest possible leads or track lengths directly across the regulator input and output terminals.

With economical electrolytic capacitors, cold temperature operation can pose a serious stability problem. As the electrolyte freezes, around -30°C , the capacitance will decrease and the equivalent series resistance (ESR) will increase drastically, causing the circuit to oscillate. Quality electrolytic capacitors with extended temperature ranges of -40° to $+85^\circ\text{C}$ are readily available. Solid tantalum capacitors may be the better choice if small size is a requirement. However, a maximum ESR limit of $3.0\ \Omega$ must be observed over temperature to maintain stability.

Figure 6 is a typical circuit application. Figure 7 is a current boost circuit which can deliver more than 600 mA. The circuit has no current limiting and the external transistor must be rated for the expected power dissipation.

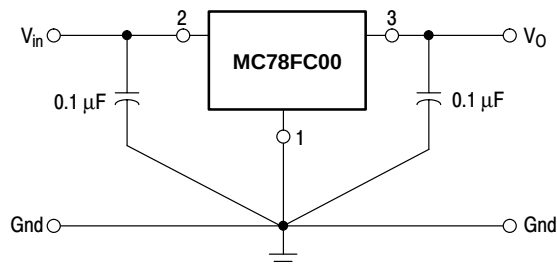


Figure 6. Typical Application

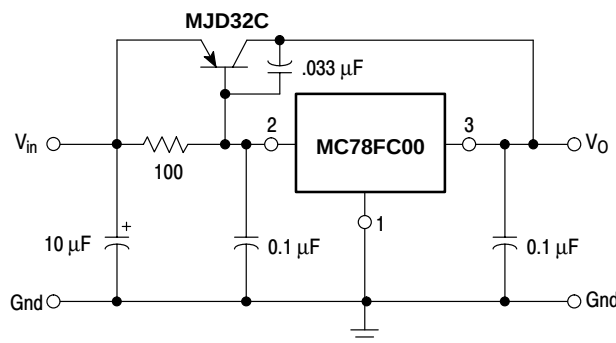
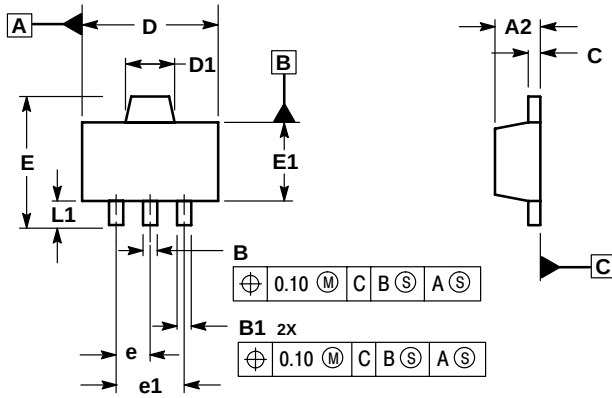


Figure 7. Current Boost Circuit

MC78FC00 Series

PACKAGE DIMENSIONS

H SUFFIX
 PLASTIC PACKAGE
 CASE 1213-01
 (SOT-89)
 ISSUE O



- NOTES:
1. DIMENSIONS ARE IN MILLIMETERS.
 2. INTERPRET DIMENSIONS AND TOLERANCING PER ASME Y14.5M, 1994.
 3. DATUM C IS A SEATING PLANE.

DIM	MILLIMETERS	
	MIN	MAX
A2	1.40	1.60
B	0.37	0.57
B1	0.32	0.52
C	0.30	0.50
D	4.40	4.60
D1	1.50	1.70
E	---	4.25
E1	2.40	2.60
e	1.50 BSC	
e1	3.00 BSC	
L1	0.80	---

Notes

Notes

MC78FC00 Series

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer.

PUBLICATION ORDERING INFORMATION

NORTH AMERICA Literature Fulfillment:

Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: ONlit@hibbertco.com
Fax Response Line: 303-675-2167 or 800-344-3810 Toll Free USA/Canada

N. American Technical Support: 800-282-9855 Toll Free USA/Canada

EUROPE: LDC for ON Semiconductor – European Support

German Phone: (+1) 303-308-7140 (Mon-Fri 2:30pm to 7:00pm CET)
Email: ONlit-german@hibbertco.com
French Phone: (+1) 303-308-7141 (Mon-Fri 2:00pm to 7:00pm CET)
Email: ONlit-french@hibbertco.com
English Phone: (+1) 303-308-7142 (Mon-Fri 12:00pm to 5:00pm GMT)
Email: ONlit@hibbertco.com

EUROPEAN TOLL-FREE ACCESS*: 00-800-4422-3781

*Available from Germany, France, Italy, UK, Ireland

CENTRAL/SOUTH AMERICA:

Spanish Phone: 303-308-7143 (Mon-Fri 8:00am to 5:00pm MST)
Email: ONlit-spanish@hibbertco.com
Toll-Free from Mexico: Dial 01-800-288-2872 for Access –
then Dial 866-297-9322

ASIA/PACIFIC: LDC for ON Semiconductor – Asia Support

Phone: 1-303-675-2121 (Tue-Fri 9:00am to 1:00pm, Hong Kong Time)
Toll Free from Hong Kong & Singapore:
001-800-4422-3781

Email: ONlit-asia@hibbertco.com

JAPAN: ON Semiconductor, Japan Customer Focus Center

4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-0031
Phone: 81-3-5740-2700
Email: r14525@onsemi.com

ON Semiconductor Website: <http://onsemi.com>

For additional information, please contact your local Sales Representative.