MC78LC00 Series

Micropower Voltage Regulator

The MC78LC00 series of fixed output low dropout linear regulators are designed for handheld communication equipment and portable battery powered applications which require low quiescent current. The MC78LC00 series features an ultra−low quiescent current of 1.1 μA. Each device contains a voltage reference unit, an error amplifier, a PMOS power transistor, and resistors for setting output voltage.

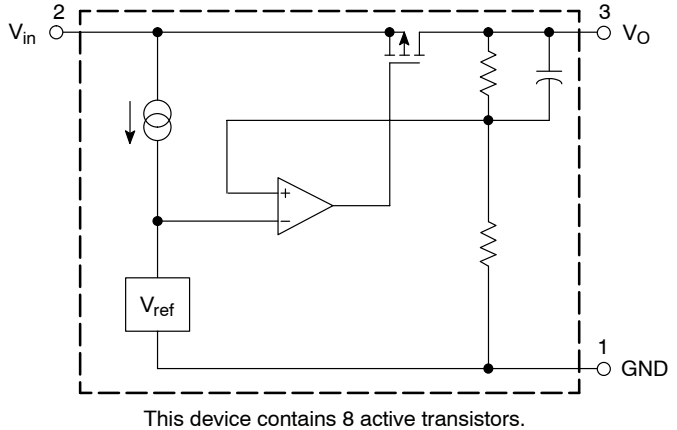
The MC78LC00 has been designed to be used with low cost ceramic capacitors and requires a minimum output capacitor of 0.1 μF. The device is housed in the micro−miniature Thin SOT23−5 surface mount package and SOT−89, 3 pin. Standard voltage versions are 1.5, 1.8, 2.5, 2.7, 2.8, 3.0, 3.3, 4.0, and 5.0 V. Other voltages are available in 100 mV steps.

Features

- Low Quiescent Current of 1.1 μA Typical
- Excellent Line and Load Regulation
- Maximum Operating Voltage of 12 V
- Low Output Voltage Option
- High Accuracy Output Voltage of 2.5%
- Industrial Temperature Range of −40°C to 85°C
- Two Surface Mount Packages (SOT−89, 3 Pin, or SOT−23, 5 Pin)
- These are Pb−Free Devices

Typical Applications

- Battery Powered Instruments
- Hand−Held Instruments
- Camcorders and Cameras



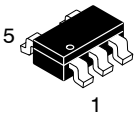
This device contains 8 active transistors.

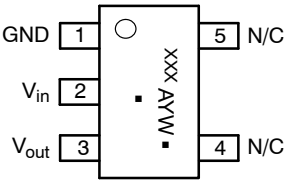
Figure 1. Representative Block Diagram

ON Semiconductor®

MARKING DIAGRAMS AND PIN CONNECTIONS

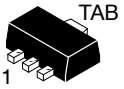
TSOP−5
NTR SUFFIX
CASE 483

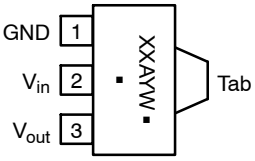




(Top View)

SOT−89
H SUFFIX
CASE 1213





(Top View)

(Tab is connected to Pin 2)

XXX = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
▪ = Pb−Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 10 of this data sheet.

Publication Order Number:
MC78LC00/D

PIN FUNCTION DESCRIPTION

Pin No.	Pin Name	Description
1	GND	Power supply ground
2	V_{in}	Positive power supply input voltage
3	V_{out}	Regulated Output
4	N/C	No Internal Connection
5	N/C	No Internal Connection

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Input Voltage	V_{in}	12	V
Output Voltage	V_{out}	−0.3 to V_{in} +0.3	V
Power Dissipation and Thermal Characteristics Case 483−01 (Thin SOT23−5) NTR Suffix Power Dissipation @ T_A = 85°C Thermal Resistance, Junction−to−Ambient Case 1213 (SOT−89) H Suffix Power Dissipation @ T_A = 25°C Thermal Resistance, Junction−to−Ambient	 P_D $R_{\theta JA}$ P_D $R_{\theta JA}$	 140 280 900 111	 mW °C/W mW °C/W
Operating Junction Temperature	T_J	+125	°C
Operating Ambient Temperature	T_A	−40 to +85	°C
Storage Temperature	T_{stg}	−55 to +150	°C
Lead Soldering Temperature @ 260°C	T_{solder}	10	sec

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

ELECTRICAL CHARACTERISTICS (V_{in} = $V_{out(nom.)}$ + 1.0 V, C_{in} = 1.0 μF, C_{out} = 1.0 μF, T_J = 25°C, unless otherwise noted.) (Note 11)

HT SUFFIX

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage					V
30HT1 Suffix (V_{in} = 5.0 V)		2.950	3.0	3.075	
33HT1 Suffix (V_{in} = 5.0 V)		3.218	3.3	3.382	
40HT1 Suffix (V_{in} = 6.0 V)		3.900	4.0	4.100	
50HT1 Suffix (V_{in} = 7.0 V)		4.875	5.0	5.125	
Line Regulation V_{in} = [V_O + 1.0] V to 10 V, I_O = 1.0 mA	Reg_{line}	–	0.05	0.2	%/V
Load Regulation (I_O = 1.0 to 10 mA)	Reg_{load}				mV
30HT1 Suffix (V_{in} = 5.0 V)		–	40	60	
33HT1 Suffix (V_{in} = 6.0 V)		–	40	60	
40HT1 Suffix (V_{in} = 7.0 V)		–	50	70	
50HT1 Suffix (V_{in} = 8.0 V)		–	60	90	
Output Current (Note 12)	I_O				mA
30HT1 Suffix (V_{in} = 5.0 V)		35	50	–	
33HT1 Suffix (V_{in} = 6.0 V)		35	50	–	
40HT1 Suffix (V_{in} = 7.0 V)		45	65	–	
50HT1 Suffix (V_{in} = 8.0 V)		55	80	–	
Dropout Voltage	$V_{in} - V_O$				mV
30HT1 Suffix (I_O = 1.0 mA)		–	40	60	
33HT1 Suffix (I_O = 1.0 mA)		–	35	53	
40HT1 Suffix (I_O = 1.0 mA)		–	25	38	
50HT1 Suffix (I_O = 1.0 mA)		–	25	38	
Quiescent Current	I_{CC}				μA
30HT1 Suffix (V_{in} = 5.0 V)		–	1.1	3.3	
33HT1 Suffix (V_{in} = 5.0 V)		–	1.1	3.3	
40HT1 Suffix (V_{in} = 6.0 V)		–	1.2	3.6	
50HT1 Suffix (V_{in} = 7.0 V)		–	1.3	3.9	
Output Voltage Temperature Coefficient	T_C	–	±100	–	ppm/°C

7. This device series contains ESD protection and exceeds the following tests:
   Human Body Model 2000 V per MIL−STD−883, Method 3015
   Machine Model Method 200 V
8. Latch up capability (85°C) ±100 mA
9. Maximum package power dissipation limits must be observed.

$$PD = \frac{T_{J(max)} - T_A}{R_{\theta JA}}$$

10. Low duty cycle pulse techniques are used during testing to maintain the junction temperature as close to ambient as possible.
11. Low duty pulse techniques are used during test to maintain junction temperature as close to ambient as possible.
12. Output Current is measured when V_{out} = V_{O1} − 3% where V_{O1} = V_{out} at I_{out} = 0 mA.

DEFINITIONS

Load Regulation

The change in output voltage for a change in output current at a constant temperature.

Dropout Voltage

The input/output differential at which the regulator output no longer maintains regulation against further reductions in input voltage. Measured when the output drops 3% below its nominal. The junction temperature, load current, and minimum input supply requirements affect the dropout level.

Maximum Power Dissipation

The maximum total dissipation for which the regulator will operate within its specifications.

Quiescent Current

The quiescent current is the current which flows through the ground when the LDO operates without a load on its output: internal IC operation, bias, etc. When the LDO becomes loaded, this term is called the Ground current. It is actually the difference between the input current (measured through the LDO input pin) and the output current.

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 technique such that the average chip temperature is not significantly affected.

Line Transient Response

Typical over and undershoot response when input voltage is excited with a given slope.

Maximum Package Power Dissipation

The maximum power package dissipation is the power dissipation level at which the junction temperature reaches its maximum operating value, i.e. 125°C. Depending on the ambient power dissipation and thus the maximum available output current.

ORDERING INFORMATION

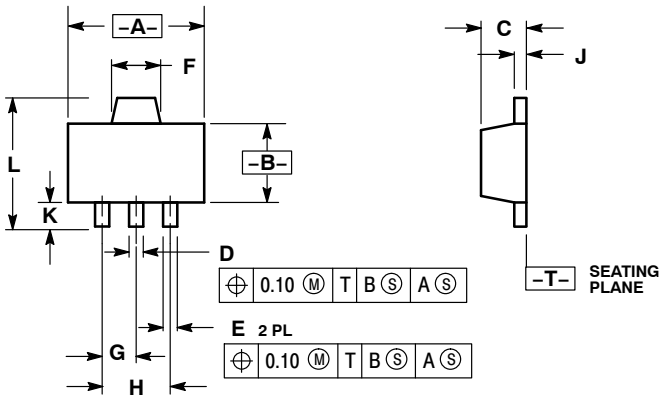
Device	Nominal Output Voltage	Marking	Package	Shipping†
MC78LC15NTR	1.5	LAG	Thin SOT23−5	3000 Units/7″ Tape & Reel
MC78LC15NTRG	1.5	LAG	Thin SOT23−5 (Pb−Free)	
MC78LC18NTR	1.8	LAH	Thin SOT23−5	
MC78LC18NTRG	1.8	LAH	Thin SOT23−5 (Pb−Free)	
MC78LC25NTR	2.5	LAI	Thin SOT23−5	
MC78LC25NTRG	2.5	LAI	Thin SOT23−5 (Pb−Free)	
MC78LC27NTR	2.7	LAJ	Thin SOT23−5	
MC78LC27NTRG	2.7	LAJ	Thin SOT23−5 (Pb−Free)	
MC78LC28NTR	2.8	LAK	Thin SOT23−5	
MC78LC28NTRG	2.8	LAK	Thin SOT23−5 (Pb−Free)	
MC78LC30NTR	3.0	LAL	Thin SOT23−5	
MC78LC30NTRG	3.0	LAL	Thin SOT23−5 (Pb−Free)	
MC78LC33NTR	3.3	LAM	Thin SOT23−5	
MC78LC33NTRG	3.3	LAM	Thin SOT23−5 (Pb−Free)	
MC78LC40NTR	4.0	LEC	Thin SOT23−5	
MC78LC40NTRG	4.0	LEC	Thin SOT23−5 (Pb−Free)	
MC78LC50NTR	5.0	LAN	Thin SOT23−5	
MC78LC50NTRG	5.0	LAN	Thin SOT23−5 (Pb−Free)	
MC78LC30HT1G	3.0	0C	SOT−89 (Pb−Free)	1000 Units Tape & Reel
MC78LC33HT1G	3.3	3C	SOT−89 (Pb−Free)	
MC78LC40HT1G	4.0	0D	SOT−89 (Pb−Free)	
MC78LC50HT1G	5.0	0E	SOT−89 (Pb−Free)	

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Additional voltages in 100 mV steps are available upon request by contacting your ON Semiconductor representative.

PACKAGE DIMENSIONS

SOT−89
H SUFFIX
CASE 1213−02
ISSUE C



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS
3. 1213−01 OBSOLETE, NEW STANDARD 1213−02.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.40	4.60	0.173	0.181
B	2.40	2.60	0.094	0.102
C	1.40	1.60	0.055	0.063
D	0.37	0.57	0.015	0.022
E	0.32	0.52	0.013	0.020
F	1.50	1.83	0.059	0.072
G	1.50 BSC		0.059 BSC	
H	3.00 BSC		0.118 BSC	
J	0.30	0.50	0.012	0.020
K	0.80	---	0.031	---
L	---	4.25	---	0.167