National Semiconductor

# MICROCIRCUIT DATA SHEET

## MJLM140-12-H REV 0B0

Original Creation Date: 05/10/95
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# VOLTAGE REGULATOR, +12 VOLTS AT 0.5A

## General Description

The LM140 monolithic 3-terminal positive voltage regulators employ internal current limiting, thermal shutdown and safe-area compensation, making them essentially indestructible. If adequate heat sinking is provided, they can deliver over 0.5A output current. They are intended as fixed voltage regulators in a wide range of applications including local (on-card) regulation for elimination of noise and distribution problems associated with single-point regulation. In addition to use as fixed voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents.

Considerable effort was expended to make the entire series of regulators easy to use and minimize the number of external components. It is not necessary to bypass the output, although this does improve transient response. Input bypassing is needed only if the regulator is located far from the filter capacitor of the power supply.

## Industry Part Number

LM140

## NS Part Numbers

JL140-12BXA
JL140-12SXA

## Prime Die

LM141

## Controlling Document

38510/10703  REV C

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## Processing

MIL-STD-883, Method 5004

## Quality Conformance Inspection

MIL-STD-883, Method 5005

| Subgrp | Description | Temp ($^{o}$C) |
|---|---|---|
| 1 | Static tests at | +25 |
| 2 | Static tests at | +125 |
| 3 | Static tests at | -55 |
| 4 | Dynamic tests at | +25 |
| 5 | Dynamic tests at | +125 |
| 6 | Dynamic tests at | -55 |
| 7 | Functional tests at | +25 |
| 8A | Functional tests at | +125 |
| 8B | Functional tests at | -55 |
| 9 | Switching tests at | +25 |
| 10 | Switching tests at | +125 |
| 11 | Switching tests at | -55 |

## Features

- Output current in excess of 0.5A
- No external components
- Internal thermal overload protection
- Internal short circuit current-limiting
- Output transistor safe-area compensation

## (Absolute Maximum Ratings)
(Note 1)

| | |
|---|---|
| DC Input Voltage | 35V |
| Internal Power Dissipation (Note 2) | Internally Limited |
| Maximum Junction Temperature | 150 C |
| Storage Temperature Range | -65 C to +150 C |
| Lead Temperature | |
| Soldering, (10 seconds) | 300 C |
| Thermal Resistance | |
| ThetaJA | |
| (Still Air) | 232 C/W |
| (500 LF/Min Air Flow) | 77 C/W |
| ThetaJC | 15 C/W |
| ESD Susceptibility (Note 3) | 2KV |

Note 1: Absolute Maximum Ratings are limits beyond which damage to the device may occur. Operating Conditions are conditions under which the device functions but the specification might not be guaranteed. For guaranteed specifications and test conditions see the Electrical Characteristics.
Note 2: The Maximum allowable power dissipation at any ambient temperature is a function of the maximum junction temperature for operation (TjMAX = 150 C), the junction-to-ambient thermal resistance (ThetaJA), and the ambient temperature (TA). PDMAX = (TjMAX - TA)/ThetaJA. If this dissipation is exceeded, the die temperature will rise above TjMAX and the electrical specifications do not apply. If the die temperature rises above 150 C, the device will go into thermal shutdown.
Note 3: Human body model, 100pF discharged through 1.5K Ohms

## Recommended Operating Conditions
(Note 1)

| | |
|---|---|
| Temperature Range (TA) (Note 2) | -55 C to +125 C |

Note 1: Absolute Maximum Ratings are limits beyond which damage to the device may occur. Operating Conditions are conditions under which the device functions but the specification might not be guaranteed. For guaranteed specifications and test conditions see the Electrical Characteristics.
Note 2: The Maximum allowable power dissipation at any ambient temperature is a function of the maximum junction temperature for operation (TjMAX = 150 C), the junction-to-ambient thermal resistance (ThetaJA), and the ambient temperature (TA). PDMAX = (TjMAX - TA)/ThetaJA. If this dissipation is exceeded, the die temperature will rise above TjMAX and the electrical specifications do not apply. If the die temperature rises above 150 C, the device will go into thermal shutdown.

# Electrical Characteristics

## DC PARAMETERS

| SYMBOL | PARAMETER | CONDITIONS | NOTES | PIN-NAME | MIN | MAX | UNIT | SUB-GROUPS |
|---|---|---|---|---|---|---|---|---|
| Vout (1) | Output Voltage | Vin = 15V, Il = -5mA | | | 11.4 | 12.6 | V | 1, 2, 3 |
| | | Vin = 15V, Il = -0.5A | | | 11.4 | 12.6 | V | 1, 2, 3 |
| | | Vin = 27V, Il = -5mA | | | 11.4 | 12.6 | V | 1, 2, 3 |
| | | Vin = 27V, Il = -0.5A | | | 11.4 | 12.6 | V | 1, 2, 3 |
| | | Vin = 35V, Il = -5mA | | | 11.4 | 12.6 | V | 1, 2, 3 |
| | | Vin = 35V, Il = -50mA | | | 11.4 | 12.6 | V | 1, 2, 3 |
| VRLINE | Line Regulation | 15V ≤ Vin ≤ 35V, Il = -50mA | | | -360 | 360 | mV | 1, 2, 3 |
| | | 15V ≤ Vin ≤ 32V, Il = -350mA | | | -120 | 120 | mV | 1, 2, 3 |
| VRLOAD | Load Regulation | Vin = 17V, -500mA ≤ Il ≤ -5mA | | | -240 | 240 | mV | 1, 2, 3 |
| | | Vin = 35V, -50mA ≤ Il ≤ -5mA | | | -360 | 360 | mV | 1, 2, 3 |
| ISCD | Stand by Current Drain | Vin = 17V, Il = -5mA | | | -7 | -0.5 | mA | 1, 2, 3 |
| | | Vin = 35V, Il = -5mA | | | -8 | -0.5 | mA | 1, 2, 3 |
| Delta ISCD (LINE) | Stand by Current Drain vs. Line Voltage | 15V ≤ Vin ≤ 35V, Il = -5mA | | | -1 | 1 | mA | 1, 2, 3 |
| Delta ISCD (LOAD) | Stand by Current Drain vs. Load Current | Vin = 17V, -500mA ≤ Il ≤ -5mA | | | -.5 | 0.5 | mA | 1, 2, 3 |
| Iol | Peak Output Current | Vin = 15V, Delta/Vout = -1.13V | | | -2 | -0.5 | A | 1, 2, 3 |
| Ios | Output Short Circuit Current | Vin = 17V | | | -1.75 | -0.01 | A | 1, 2, 3 |
| | | Vin = 32V | | | -1.25 | -0.01 | A | 1, 2, 3 |
| | | Vin = 35V | | | -1.00 | -0.01 | A | 1, 2, 3 |
| Vout (2) | Output Voltage | Vin = 17V, Il = -5mA | 1 | | 11.28 | 12.72 | V | 2 |
| Vout (3) | Output Voltage | Vin = 17V, Il = -5mA | 2 | | 11.4 | 12.6 | V | 7, 8A, 8B |

# Electrical Characteristics

## DC PARAMETERS(Continued)

| SYMBOL | PARAMETER | CONDITIONS | NOTES | PIN-NAME | MIN | MAX | UNIT | SUB-GROUPS |
|---|---|---|---|---|---|---|---|---|
| Delta Vout/ Delta T | Average Temperature Coefficient Output Voltage | 25 C ≤ TA ≤ +125 C, Vin = 17V, Il = -5mA | 3 | | -3 | 3 | mV/C | 8A |
| | | -55 C ≤ TA ≤ 25 C, Vin = 17V, Il = -5mA | 3 | | -3 | 3 | mV/C | 8B |

## AC PARAMETERS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| NO | Output Noise Voltage | Vin = 17V, Il = -50mA | | | | 250 | uVrms | 7 |
| Delta Vout/ Delta Il | Transient Load Response | Vin = 17V, Il = -50mA, Delta Il = -200mA | | | | 2.5 | mV/mA | 7 |
| Delta Vout/Delta Vin | Transient Line Response | Vin = 17V, VPulse = 3V, Il = -5mA | | | | 30 | mV/V | 7 |
| Delta Vin/Delta Vout | Ripple Rejection | Vin = 17V, ei = 1Vrms at f = 2400Hz, Il = -125mA | | | 55 | | dB | 4 |

## DC PARAMETERS: DRIFT VALUES

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: "Delta calculations performed on JAN S and QMLV devices at group B, subgroup 5 only".

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Vout | Output Voltage | Vin = 15V, Il = -5mA | | | -0.06 | 0.06 | V | 1 |
| | | Vin = 15V, Il = -0.5A | | | -0.06 | 0.06 | V | 1 |
| | | Vin = 27V, Il = -5mA | | | -0.06 | 0.06 | V | 1 |
| | | Vin = 27V, Il = -0.5A | | | -0.06 | 0.06 | V | 1 |
| | | Vin = 35V, Il = -5mA | | | -0.06 | 0.06 | V | 1 |
| | | Vin = 35V, Il = -50mA | | | -0.06 | 0.06 | V | 1 |
| ISCD | Stand by Current Drain | Vin = 17V, Il = -5mA | | | -20 | 20 | % | 1 |

Note 1: Tested at TA = 125 C, correlated to TA = 150 C.
Note 2: Tested at extremes as a set up for Delta Vout/Delta T tests.
Note 3: Calculated parameter. For calculations use Vout test at Vin = 17V, Il = -5mA (NOTE 2)

## Graphics and Diagrams

| GRAPHICS# | DESCRIPTION |
|---|---|
| H03ARC | (blank) |

**See attached graphics following this page.**