

LM9036

Ultra-Low Quiescent Current Voltage Regulator

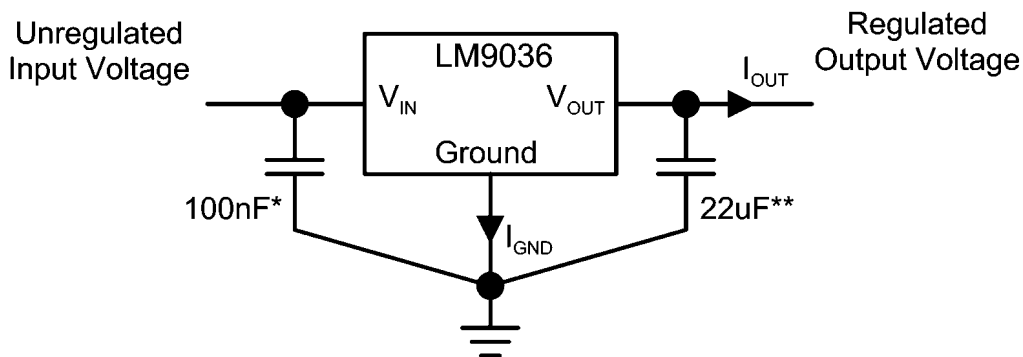
General Description

The LM9036 ultra-low quiescent current regulator features low dropout voltage and low current in the standby mode. With less than 25µA Ground Pin current at a 0.1mA load, the LM9036 is ideally suited for automotive and other battery operated systems. The LM9036 retains all of the features that are common to low dropout regulators including a low dropout PNP pass device, short circuit protection, reverse battery protection, and thermal shutdown. The LM9036 has a 40V maximum operating voltage limit, a -40°C to +125°C operating temperature range, and ±5% output voltage tolerance over the entire output current, input voltage, and temperature range.

Features

- Ultra low Ground Pin current ($I_{GND} \leq 25\mu A$ for $I_{OUT} = 0.1mA$)
- Fixed 5V, 3.3V, 50mA output
- Output tolerance ±5% over line, load, and temperature
- Dropout voltage typically 200mV @ $I_{OUT} = 50mA$
- -45V reverse transient protection
- Internal short circuit current limit
- Internal thermal shutdown protection
- 40V operating voltage limit

Typical Application

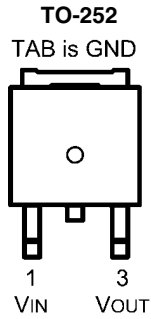


* Required if regulator is located more than 2" from power supply filter capacitor.

** Required for stability. Must be rated over intended operating temperature range. Effective series resistance (ESR) is critical, see Electrical Characteristics. Locate capacitor as close as possible to the regulator output and ground pins. Capacitance may be increased without bound.

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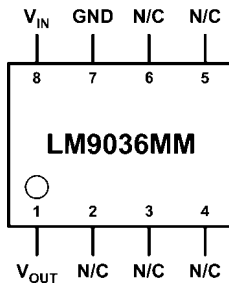
Connection Diagrams



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Top View

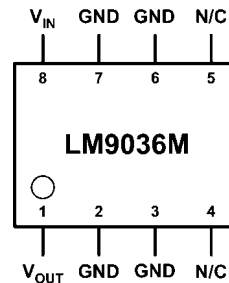
**Order Number LM9036DT-5.0, LM9036DTX-5.0,
LM9036DT-3.3, LM9036DTX-3.3
See NS Package Number TD03B**



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Top View

**LM9036MM-3.3, LM9036MMX-3.3, LM9036MM-5.0,
LM9036MMX-5.0
See NS Package Number MUA08A**



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Top View

**LM9036M-3.3, LM9036MX-3.3, LM9036M-5.0, LM9036MX-5.0
See NS Package Number M08A**

Ordering Information

Output Voltage	Order	Package Type	Package Drawing	Transport Media
3.3V	LM9036M-3.3	8-Lead SOIC	M08A	Rail
	LM9036MX-3.3	8-Lead SOIC	M08A	Tape/Reel
	LM9036DT-3.3	TO-252	TD03B	Rail
	LM9036DTX-3.3	TO-252	TD03B	Tape/Reel
	LM9036MM-3.3	8-Lead Mini SOIC	MUA08A	Rail
	LM9036MMX-3.3	8-Lead Mini SOIC	MUA08A	Tape/Reel
5.0V	LM9036M-5.0	8-Lead SOIC	M08A	Rail
	LM9036MX-5.0	8-Lead SOIC	M08A	Tape/Reel
	LM9036DT-5.0	TO-252	TD03B	Rail
	LM9036DTX-5.0	TO-252	TD03B	Tape/Reel
	LM9036MM-5.0	8-Lead Mini SOIC	MUA08A	Rail
	LM9036MMX-5.0	8-Lead Mini SOIC	MUA08A	Tape/Reel

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Input Voltage (Survival)	+55V, -45V
ESD Susceptibility (Note 2)	±1.9kV
Power Dissipation (Note 3)	Internally limited
Junction Temperature (T_{Jmax})	150°C
Storage Temperature Range	-65°C to +150°C

Lead Temperature (Soldering, 10 sec.)

260°C

Operating Ratings

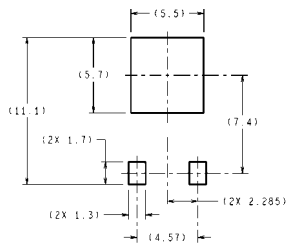
Operating Temperature Range	-40°C to +125°C
Maximum Input Voltage (Operational)	40V
SO-8 (M08A) θ_{JA} (Note 7)	140°C/W
TO-252 (TD03B) θ_{JA} (Note 7)	125°C/W
TO-252 (TD03B) θ_{JA} (Note 8)	50°C/W
TO-252 (TD03B) θ_{JC} (Note 7)	11°C/W
MSO-8 (MUA08A) θ_{JA} (Note 7)	200°C/W

Electrical Characteristics - LM9036-5.0

$V_{IN} = 14V$, $I_{OUT} = 10\text{ mA}$, $T_J = 25^\circ\text{C}$, unless otherwise specified. **Boldface** limits apply over entire operating temperature range

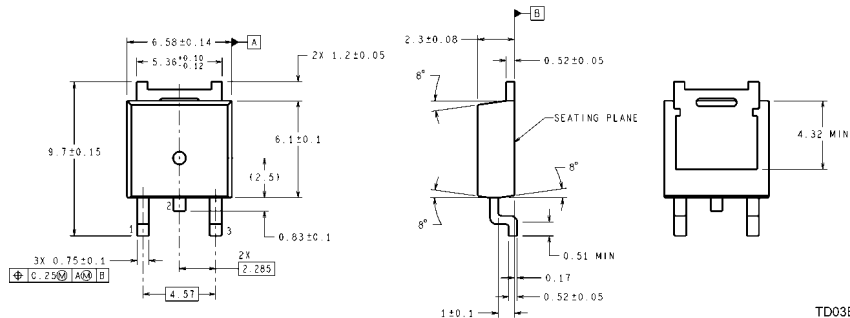
Parameter	Conditions	Min (Note 5)	Typical (Note 4)	Max (Note 5)	Units
Output Voltage (V_{OUT})		4.80	5.00	5.20	V
	$5.5V \leq V_{IN} \leq 26V$, $0.1\text{mA} \leq I_{OUT} \leq 50\text{mA}$ (Note 6)	4.75	5.00	5.25	
Quiescent Current (I_{GND})	$I_{OUT} = 0.1\text{mA}$, $8V \leq V_{IN} \leq 24V$		20	25	μA
	$I_{OUT} = 1\text{mA}$, $8V \leq V_{IN} \leq 24V$		50	100	
	$I_{OUT} = 10\text{mA}$, $8V \leq V_{IN} \leq 24V$		0.3	0.5	mA
	$I_{OUT} = 50\text{mA}$, $8V \leq V_{IN} \leq 24V$		2.0	2.5	
Line Regulation (ΔV_{OUT})	$6V \leq V_{IN} \leq 40V$, $I_{OUT} = 1\text{mA}$		10	30	mV
Load Regulation (ΔV_{OUT})	$0.1\text{mA} \leq I_{OUT} \leq 5\text{mA}$		10	30	mV
	$5\text{mA} \leq I_{OUT} \leq 50\text{mA}$		10	30	mV
Dropout Voltage (ΔV_{OUT})	$I_{OUT} = 0.1\text{mA}$		0.05	0.10	V
	$I_{OUT} = 50\text{mA}$		0.20	0.40	V
Short Circuit Current (I_{SC})	$V_{OUT} = 0V$	65	120	250	mA
Ripple Rejection (PSRR)	$V_{ripple} = 1V_{rms}$, $F_{ripple} = 120\text{Hz}$	-40	-60		dB
Output Bypass Capacitance (C_{OUT})	$0.3\Omega \leq ESR \leq 8\Omega$ $0.1\text{mA} \leq I_{OUT} \leq 50\text{mA}$	10	22		μF

Physical Dimensions inches (millimeters) unless otherwise noted



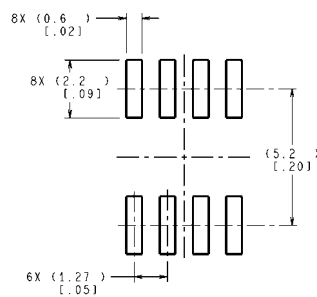
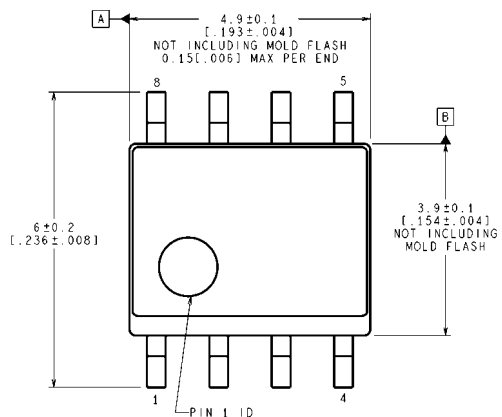
DIMENSIONS ARE IN MILLIMETERS

LAND PATTERN RECOMMENDATION

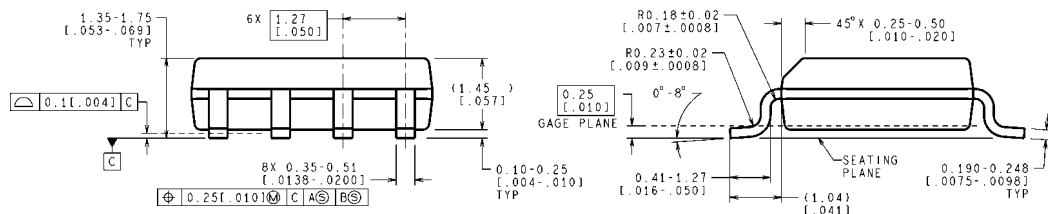


TD03B (Rev C)

**TO-252 Package (DT)
NS Package Number TD03B**



RECOMMENDED LAND PATTERN



CONTROLLING DIMENSION IS MILLIMETER
VALUES IN [] ARE INCHES
DIMENSIONS IN () FOR REFERENCE ONLY

M08A (Rev L)

**8 Lead Small Outline Molded Package (M)
NS Package Number M08A**