National Semiconductor

June 1999

LM3490
100 mA, SOT-23, Quasi Low-Dropout Linear Voltage Regulator with Logic-Controlled ON/OFF

General Description

The LM3490 is an integrated linear voltage regulator. It features operation from an input as high as 30V and a guaranteed maximum dropout of 1.2V at the full 100 mA load. Standard packaging for the LM3490 is the 5-lead SOT-23 package. A logic-controlled ON/OFF feature makes the LM3490 ideal for powering subsystems ON and OFF as needed.

The 5, 12, and 15V members of the LM3490 series are intended as tiny alternatives to industry standard LM78LXX series and similar devices. The 1.2V quasi low dropout of LM3490 series devices makes them a nice fit in many applications where the 2 to 2.5V dropout of LM78LXX series devices precludes their (LM78LXX series devices) use.

The LM3490 series features a 3.3V member. The SOT packaging and quasi low dropout features of the LM3490 series converge in this device to provide a very nice, very tiny 3.3V, 100 mA bias supply that regulates directly off the system 5V±5% power supply.

Key Specifications

- 30V maximum input for operation
- 1.2V guaranteed maximum dropout over full load and temperature ranges
- 100 mA guaranteed load current
- ±5% guaranteed output voltage tolerance over full load and temperature ranges
- −40 to +125˚C junction temperature range for operation

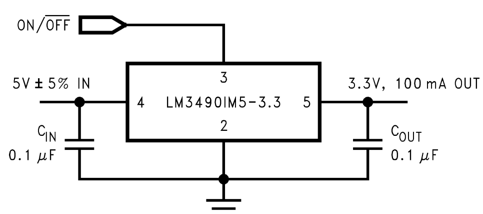
Features

- 3.3, 5, 12, and 15V versions available
- Logic-controlled ON/OFF
- Packaged in the tiny 5-lead SOT-23 package

Applications

- Tiny alternative to LM78LXX series and similar devices
- Tiny 5V±5% to 3.3V, 100 mA converter
- Post regulator for switching DC/DC converter
- Bias supply for analog circuits

Typical Application Circuit



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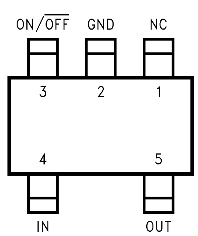
Connection Diagram



DS100071-1

Top View
SOT-23 Package
5-Lead, Molded-Plastic Small-Outline Transistor (SOT) Package
Package Code MA05B(Note 1)

 DS100071

Ordering Information

Output Voltage (V)	**Order Number** (Note 2)	**Package Marking** (Note 3)	**Comments**
3.3	LM3490IM5-3.3	L78B	250 Units on Tape and Reel
3.3	LM3490IM5X-3.3	L78B	3k Units on Tape and Reel
5	LM3490IM5-5.0	L79B	250 Units on Tape and Reel
5	LM3490IM5X-5.0	L79B	3k Units on Tape and Reel
12	LM3490IM5-12	L80B	250 Units on Tape and Reel
12	LM3490IM5X-12	L80B	3k Units on Tape and Reel
15	LM3490IM5-15	L81B	250 Units on Tape and Reel
15	LM3490IM5X-15	L81B	3k Units on Tape and Reel

Absolute Maximum Ratings (Note 4)

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

Input Voltage (IN to GND)	35V
Voltage ON/$\overline{OFF}$ to GND	5.5V
Power Dissipation (Note 5)	400 mW
Junction Temp. (T_J) (Note 5)	+150˚C
Ambient Storage Temp.	−65 to +150˚C
Soldering Time, Temp. (Note 6)	
Wave	4sec., 260˚C
Infrared	10sec., 240˚C
Vapor Phase	75sec., 219˚C
ESD (Note 7)	
ON/$\overline{OFF}$	1.0kV
All Other Pins	2.0kV

Operating Ratings (Note 4)

Maximum Input Voltage (IN to GND)	30V
Voltage ON/$\overline{OFF}$ to GND	0 to 5V
Junction Temperature (T_J)	−40 to +125˚C
Maximum Power Dissipation (Note 8)	300 mW

Electrical Characteristics

LM3490-3.3, LM3490-5.0

$V_{IN} = V_{NOM}$ + 1.5V unless otherwise noted. Typicals and limits appearing in normal type apply for $T_A = T_J$ = 25˚C. Limits appearing in boldface type apply over the entire junction temperature range for operation, −40 to +125˚C. (Notes 9, 10, 11)

Nominal Output Voltage (V_{NOM})			3.3V		5.0V		Units
Symbol	**Parameter**	**Conditions**	**Typical**	**Limit**	**Typical**	**Limit**	
V_{OUT}	Output Voltage	1 mA ≤ I_{OUT} ≤ 100 mA	3.30		5.00		V
				3.17		4.80	V(min)
				3.14		**4.75**	V(min)
				3.43		5.20	V(max)
				3.46		**5.25**	V(max)
ΔV_{OUT}	Line Regulation	V_{NOM} + 1.5V ≤ V_{IN} ≤ 30V,	7		9		mV
		I_{OUT} = 1 mA		**25**		**25**	mV(max)
ΔV_{OUT}	Load Regulation	10 mA ≤ I_{OUT} ≤ 100 mA	15		15		mV
				40		**40**	mV(max)
I_{GND}	Ground Pin Current	V_{NOM} + 1.5V ≤ V_{IN} ≤ 30V, No Load					
		$V_{ON/\overline{OFF}}$ = 5V	2		2		mA
				4		**4**	mA(max)
		$V_{ON/\overline{OFF}}$ = 0V	0.1		0.1		µA
				5		**5**	µA(max)
V_{IN} - V_{OUT}	Dropout Voltage	I_{OUT} = 10 mA	0.7		0.7		V
				0.9		0.9	V(max)
				1.0		**1.0**	V(max)
		I_{OUT} = 100 mA	0.9		0.9		V
				1.1		1.1	V(max)
				1.2		**1.2**	V(max)
e_n	Output Noise Voltage	V_{IN} = 10V, Bandwidth: 10 Hz to 100 kHz	100		150		μV_{rms}
V_{IL}	Maximum Low Level Input Voltage at ON/$\overline{OFF}$			**0.2**		**0.2**	V(max)
V_{IH}	Minimum High Level Input Voltage at ON/$\overline{OFF}$			**2.0**		**2.0**	V(min)
I_{IL}		$V_{ON/\overline{OFF}}$ = 0V		**−1**		**−1**	µA(max)
I_{IH}		$V_{ON/\overline{OFF}}$ = 5V	1		1		µA
				20		**20**	µA(max)

LM3490-12, LM3490-15

V_{IN} = V_{NOM} + 1.5V unless otherwise noted. Typicals and limits appearing in normal type apply for T_A = T_J = 25˚C. Limits appearing in boldface type apply over the entire junction temperature range for operation, −40 to +125˚C. (Notes 9, 10, 11)

Nominal Output Voltage (V_{NOM})			12V		15V		Units
Symbol	**Parameter**	**Conditions**	**Typical**	**Limit**	**Typical**	**Limit**	
V_{OUT}	Output Voltage	1 mA ≤ I_{OUT} ≤ 100 mA	12.00		15.00		V
				11.52		14.40	V(min)
				11.40		**14.25**	V(min)
				12.48		15.60	V(max)
				12.60		**15.75**	V(max)
ΔV_{OUT}	Line Regulation	V_{NOM} + 1.5V ≤ V_{IN} ≤ 30V, I_{OUT} = 1 mA	14		16		mV
				40		**40**	mV(max)
ΔV_{OUT}	Load Regulation	10 mA ≤ I_{OUT} ≤ 100 mA	36		45		mV
				60		**75**	mV(max)
I_{GND}	Ground Pin Current	V_{NOM} + 1.5V ≤ V_{IN} ≤ 30V, No Load					
		$V_{ON/\overline{OFF}}$ = 5V	2		2		mA
				4		**4**	mA(max)
		$V_{ON/\overline{OFF}}$ = 0V	0.1		0.1		µA
				5		**5**	µA(max)
V_{IN} - V_{OUT}	Dropout Voltage	I_{OUT} = 10 mA	0.7		0.7		V
				0.9		0.9	V(max)
				1.0		**1.0**	V(max)
		I_{OUT} = 100 mA	0.9		0.9		V
				1.1		1.1	V(max)
				1.2		**1.2**	V(max)
e_n	Output Noise Voltage	V_{IN} = 10V, Bandwidth: 10 Hz to 100 kHz	360		450		μV_{rms}
V_{IL}	Maximum Low Level Input Voltage at ON/$\overline{OFF}$			**0.2**		**0.2**	V(max)
V_{IH}	Minimum High Level Input Voltage at ON/$\overline{OFF}$			**2.0**		**2.0**	V(min)
I_{IL}		$V_{ON/\overline{OFF}}$ = 0V		**−1**		**−1**	µA(max)
I_{IH}		$V_{ON/\overline{OFF}}$ = 5V	1		1		µA
				20		**20**	µA(max)

Note 1: The package code MA05B is internal to National Semiconductor Corporation and indicates a specific version of the SOT-23 package and associated mechanical drawings.

Note 2: The suffix "I" indicates the junction temperature range for operation is the industrial temperature range, −40 to +125˚C. The suffix "M5" indicates the die is packaged in the 5-lead SOT-23 package. The suffix "X" indicates the devices will be supplied in blocks of 3k units as opposed to blocks of 250 units.

Note 3: Because the entire part number does not fit on the SOT-23 package, the SOT-23 package is marked with this code instead of the part number.

Note 4: Absolute Maximum Ratings are limits beyond which damage to the device may occur. Operating Ratings are conditions under which operation of the device is guaranteed. Operating Ratings do not imply guaranteed performance limits. For guaranteed performance limits and associated test conditions, see the Electrical Characteristics tables.

Note 5: The Absolute Maximum power dissipation depends on the ambient temperature and can be calculated using P = (T_J - T_A)/θ_{JA} where T_J is the junction temperature, T_A is the ambient temperature, and θ_{JA} is the junction-to-ambient thermal resistance. The 400 mW rating results from substituting the Absolute Maximum junction temperature, 150˚C, for T_J , 50˚C for T_A, and 250˚C/W for θ_{JA}. More power can be safely dissipated at lower ambient temperatures. Less power can be safely dissipated at higher ambient temperatures. The Absolute Maximum power dissipation can be increased by 4 mW for each ˚C below 50˚C ambient. It must be derated by 4 mW for each ˚C above 50˚C ambient. A θ_{JA} of 250˚C/W represents the worst-case condition of no heat sinking of the 5-lead plastic SOT-23 package. Heat sinking enables the safe dissipation of more power. The LM3490 actively limits its junction temperature to about 150˚C.

Note 6: Times shown are dwell times. Temperatures shown are dwell temperatures. For detailed information on soldering plastic small-outline packages, refer to the *Packaging Databook* available from National Semiconductor Corporation.

Note 7: For testing purposes, ESD was applied using the human-body model, a 100 pF capacitor discharged through a 1.5 kΩ resistor.

Note 8: As with the Absolute Maximum power dissipation, the maximum power dissipation for operation depends on the ambient temperature. The 300 mW rating appearing under Operating Ratings results from substituting the maximum junction temperature for operation, 125˚C, for T_J, 50˚C for T_A, and 250˚C/W for θ_{JA} in P = (T_J − T_A)/θ_{JA}. More power can be dissipated at lower ambient temperatures. Less power can be dissipated at higher ambient temperatures. The maximum power dissipation for operation appearing under Operating Ratings can be increased by 4 mW for each ˚C below 50˚C ambient. It must be derated by 4 mW for each ˚C above 50˚C ambient. A θ_{JA} of 250˚C/W represents the worst-case condition of no heat sinking of the 5-lead plastic SOT-23 package. Heat sinking enables the dissipation of more power during operation.

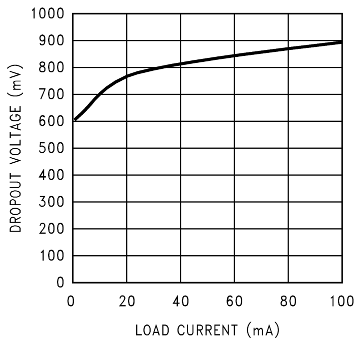
Note 9: A typical is the center of characterization data taken with $T_A = T_J = 25˚C$. Typicals are not guaranteed.

Note 10: All limits are guaranteed. All electrical characteristics having room-temperature limits are tested during production with $T_A = T_J = 25˚C$. All hot and cold limits are guaranteed by correlating the electrical characteristics to process and temperature variations and applying statistical process control.

Note 11: All voltages except dropout are with respect to the voltage at the GND pin.

Typical Performance Characteristics
Unless indicated otherwise, $V_{IN} = V_{NOM} + 1.5V$, $C_{IN} = 0.1\ \mu F$, $C_{OUT} = 0.1\ \mu F$, and $T_A = 25^{\circ}C$.

Dropout Voltage vs Load Current



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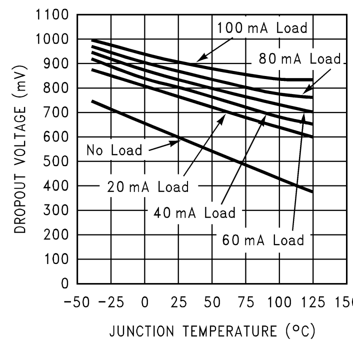
Dropout Voltage vs Junction Temperature



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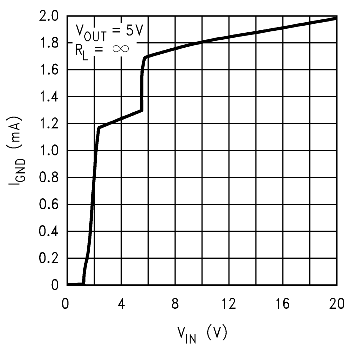
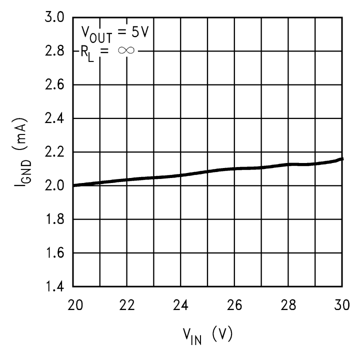
Ground Pin Current vs Input Voltage



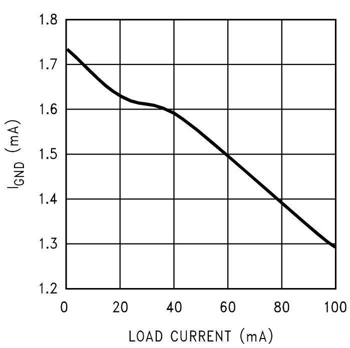
DS100071-9

Ground Pin Current vs Input Voltage



DS100071-10

Ground Pin Current vs Load Current



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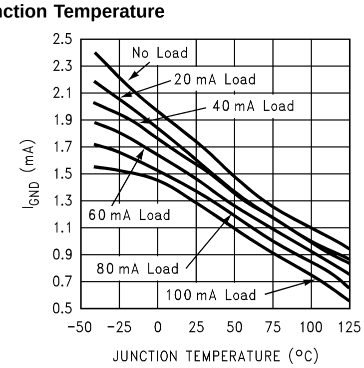
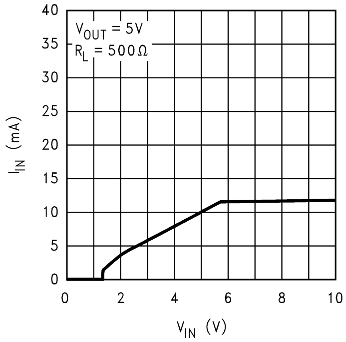
Ground Pin Current vs Junction Temperature



DS100071-22

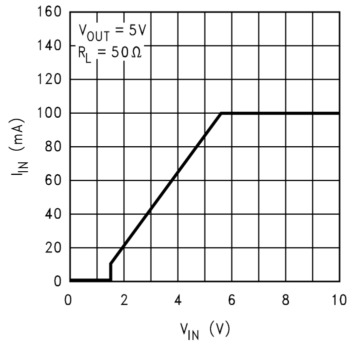
Typical Performance Characteristics Unless indicated otherwise, $V_{IN} = V_{NOM} + 1.5V$, $C_{IN} = 0.1\ \mu F$, $C_{OUT} = 0.1\ \mu F$, and $T_A = 25^\circ C$. (Continued)

Input Current vs Input Voltage



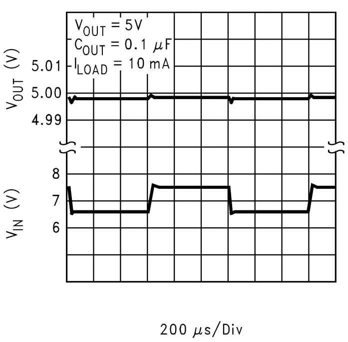
DS100071-11

Input Current vs Input Voltage



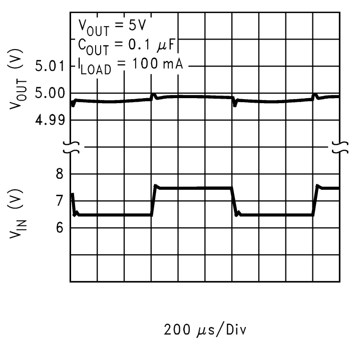
DS100071-12

Line Transient Response



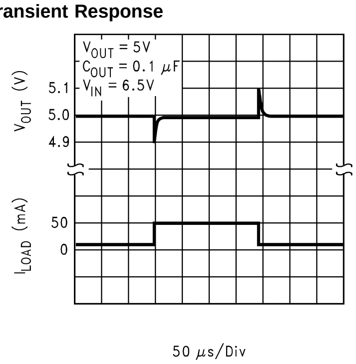
DS100071-3

Line Transient Response



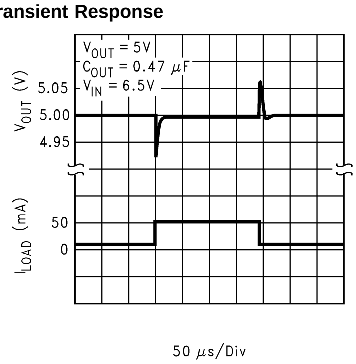
DS100071-4

Load Transient Response



DS100071-5

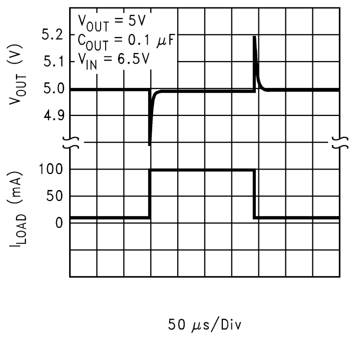
Load Transient Response



DS100071-6

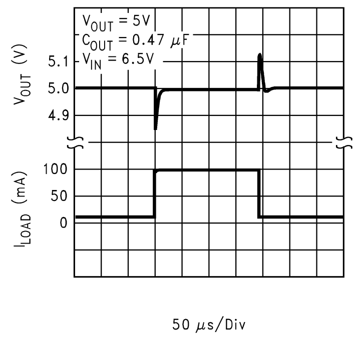
Typical Performance Characteristics Unless indicated otherwise, $V_{IN} = V_{NOM} + 1.5V$, $C_{IN} = 0.1\ \mu F$, $C_{OUT} = 0.1\ \mu F$, and $T_A = 25°C$. (Continued)

Load Transient Response



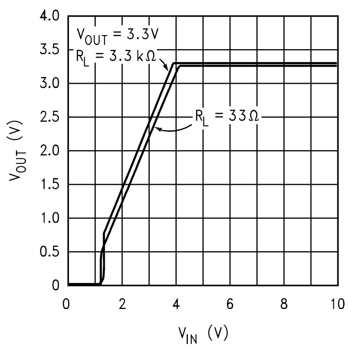
DS100071-7

Load Transient Response



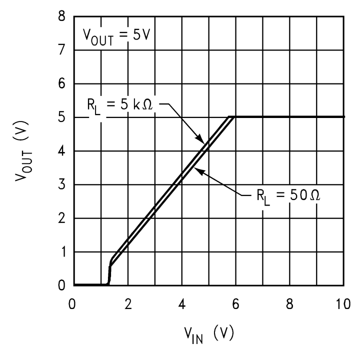
DS100071-8

Output Voltage vs Input Voltage



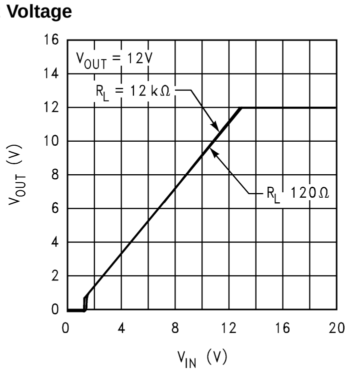
DS100071-13

Output Voltage vs Input Voltage



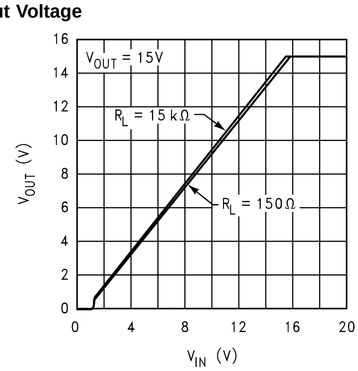
DS100071-14

Output Voltage vs Input Voltage



DS100071-15

Output Voltage vs Input Voltage

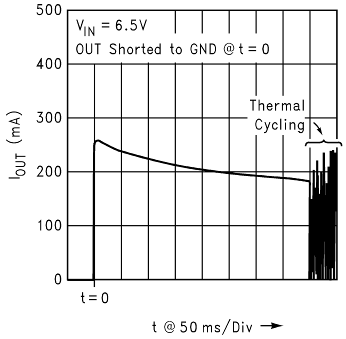


DS100071-16

Typical Performance Characteristics

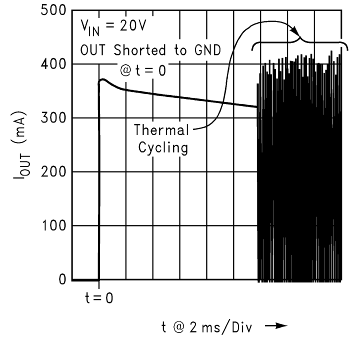
Unless indicated otherwise, $V_{IN} = V_{NOM} + 1.5V$, $C_{IN} = 0.1\ \mu F$, $C_{OUT} = 0.1\ \mu F$, and $T_A = 25°C$. (Continued)

Output Short-Circuit Current



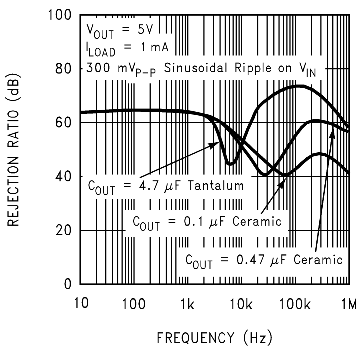
DS100071-17

Output Short-Circuit Current



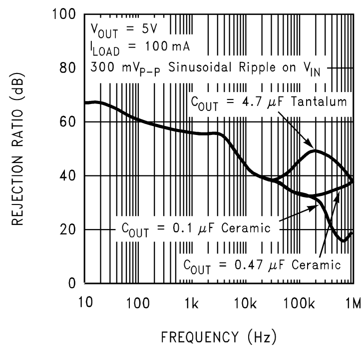
DS100071-18

Power Supply Rejection Ratio



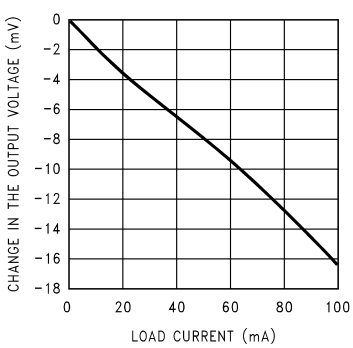
DS100071-24

Power Supply Rejection Ratio



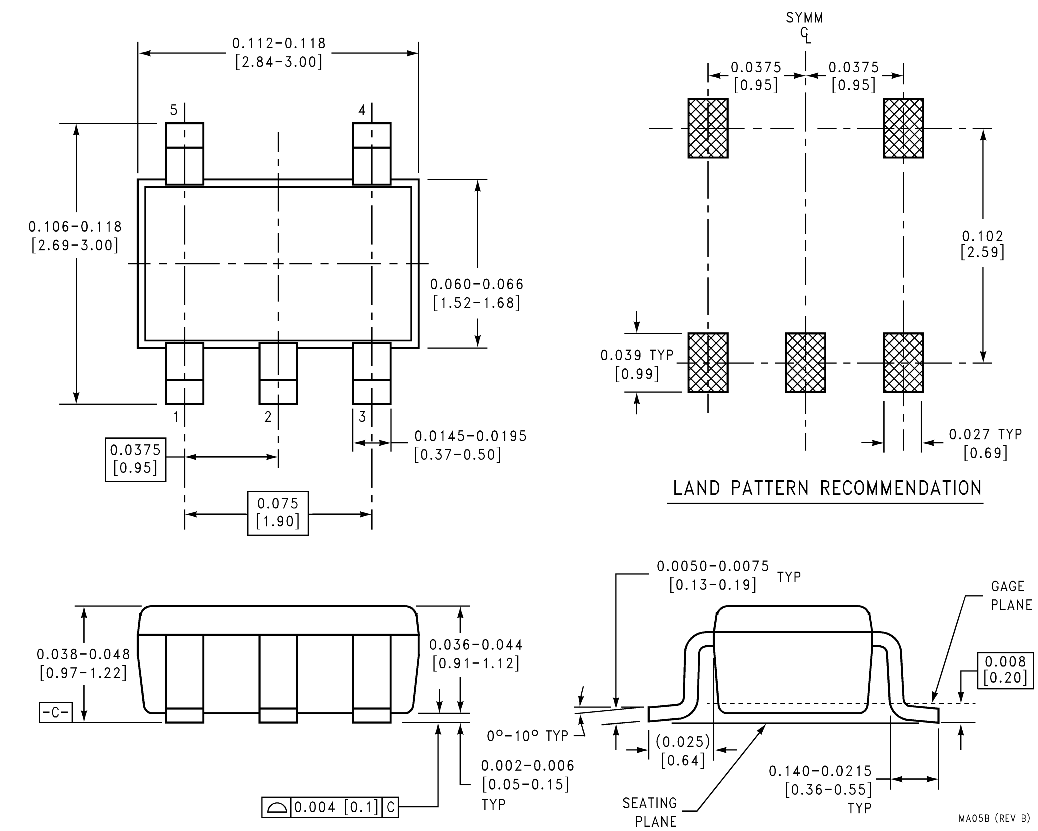
DS100071-25

DC Load Regulation



DS100071-23

Physical Dimensions inches (millimeters) unless otherwise noted



SOT-23 Package
5-Lead Small-Outline Package (M5)
For Ordering, Refer to Ordering Information Table
NS Package Number MA05B

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