National Semiconductor

November 1992

LM2567
LAN DC/DC Converter

General Description

The LM2567 DC/DC converter is intended for use in LAN applications as a power supply for the DP8392 Coaxial Transceiver. The converter may be operated from an input voltage of 5V (±10%) to 15V. It provides an isolated output of −9V for loads of up to 180 mA, with an efficiency of 78% (typical). The few external components required for the converter are completely specified within this datasheet.

Protection features for the LM2567-based DC/DC converter include thermal and current limit. Undervoltage lockout and soft-start are incorporated to minimize the inrush current during start-up.

Features

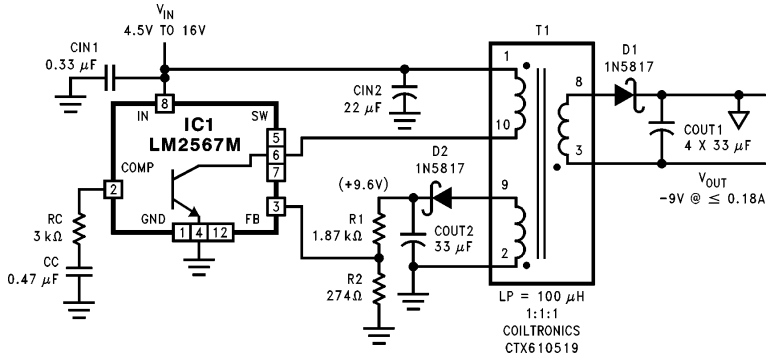
- Wide input voltage range, 5V to 15V
- Tight line regulation, 0.5% (typ)
- Output voltage tolerance ±5%
- Few external components required
- Surface-mount packaging
- Fixed switching frequency of 52 kHz
- Current-mode operation for improved transient response

Typical Applications

- Power supply for DP8392 (LAN) coaxial transceiver: Isolated −9V output for up to 180 mA load

Typical Application

DC-to-DC Converter for DP8392 Coaxial Transceiver



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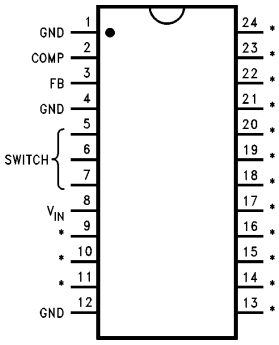
Connection Diagram and Ordering Information

24-Lead Surface Mount (M)



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*No internal connection

Top View

Order Number LM2567M
See NS Package Number M24B

RRD-B30M115/Printed in U. S. A.

Absolute Maximum Ratings (Note 1)

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

Supply Voltage	40V
Output Switch Voltage	50V
Output Switch Current	6.0A
Power Dissipation	Internally Limited
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 10 sec.)	260°C
Maximum Junction Temperature	150°C
Minimum ESD Rating (C = 100 pF, R = 1.5 kΩ)	2 kV

Operating Ratings

Supply Voltage	$3.5V \le V_{IN} \le 35V$
Output Switch Voltage	$0V \le V_{SW} \le 45V$
Output Switch Current	$I_{SW} \le 3.0A$
Junction Temperature Range	$0°C \le T_J \le +125°C$
Ambient Temperature Range	$0°C \le T_A \le +70°C$

Electrical Characteristics

Specifications with standard type face are for T_J = 25°C, and those in **bold typeface** apply over full **Operating Temperature Range.** Unless otherwise specified, V_{IN} = 5V, $V_{FB} = V_{REF}$, and I_{SWITCH} = 0. (Note 2)

Symbol	Parameter	Conditions	Typ	Min	Max	Units
GENERAL DEVICE PARAMETERS						
I_S	Input Supply Current	V_{FB} = 1.5V (Switch Off)	7.5		10.0 **14.0**	mA mA
		I_{SW} = 2.0A V_{COMP} = 2.0V (Max. Duty Cycle)	20		50 **85**	mA mA
V_{UV}	Input Supply Undervoltage Lockout	I_{SW} = 100 mA V_{COMP} = 1.2V	2.90	2.60 **2.55**	3.10 **3.15**	V V
f_O	Oscillator Frequency	Measured at Switch Pin I_{SW} = 100 mA	52	48 **42**	56 **62**	kHz kHz
V_{REF}	Reference Voltage	Measured at Feedback Pin V_{IN} = 3.5V to 35V V_{COMP} = 1.0V	1.230	1.214 **1.206**	1.246 **1.254**	V V
$\Delta V_{REF}/\Delta V_{IN}$	Reference Voltage Line Regulation	V_{IN} = 3.5V to 35V	0.5			mV
θ_{JA}	Thermal Resistance	Junction-to-Ambient (Note 3)	100			°C/W
ERROR AMPLIFIER PARAMETERS						
I_B	Error Amp Input Bias Current	V_{COMP} = 1.0V	100		300 **800**	nA nA
G_M	Error Amp Transconductance	I_{COMP} = −30 μA to +30 μA V_{COMP} = 1.0V	3700	2400 **1600**	4800 **5800**	μmho μmho
A_V	Error Amp Voltage Gain	V_{COMP} = 1.1V to 1.6V R_{COMP} = 1.0 MΩ (Note 4)	800	500 **250**		V/V V/V
	Error Amp Output Swing	Upper Limit V_{FB} = 1.0V	2.4	2.2 **2.0**		V V
		Lower Limit V_{FB} = 1.5V	0.3		0.40 **0.55**	V V
	Error Amp Output Current	V_{FB} = 1.0V to 1.5V V_{COMP} = 1.0V	±200	±130 ±**90**	±300 ±**400**	μA μA
I_{SS}	Soft Start Current	V_{FB} = 1 0V V_{COMP} = 0V	5.0	2.5 **1.5**	7.5 **9.5**	μA μA
D	Maximum Duty Cycle	V_{COMP} = 1.2V ISW = 100 mA	95	93 **88**		% %

Electrical Characteristics (Continued)

Specifications with standard type face are for T_J = 25°C, and those in **bold typeface** apply over full **Operating Temperature Range.** Unless otherwise specified, V_{IN} = 5V, V_{FB} = V_{REF}, and I_{SWITCH} = 0. (Note 2)

Symbol	Parameter	Conditions	Typ	Min	Max	Units
SWITCH PARAMETERS						
$\Delta I_{SWITCH}/\Delta V_{COMP}$	Switch Transconductance		12.5			A/V
I_L	Switch Leakage Current	Switch Off (V_{FB} = 1.5V) V_{SW} = 50V	10		300 **600**	μA μA
V_{SAT}	Switch Saturation Voltage	I_{SW} = 2.0A V_{COMP} = 1.2V	0.5		0.75 **1.0**	V V
I_{CL}	NPN Switch Current Limit	V_{COMP} = 2.0V	4.3	3.7 **3.0**	5.3 **6.0**	A A

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating ratings indicate conditions the device is intended to be functional, but device parameter specifications may not be guaranteed under these conditions. For guaranteed specifications and test conditions, see the Electrical Characteristics.

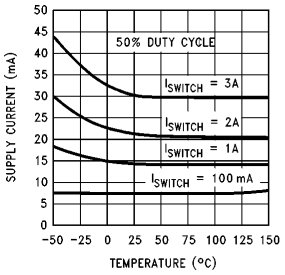
Note 2: All limits guaranteed at room temperature (standard typeface) and at temperature extremes (**boldface type**). All room temperature limits are 100% production tested. All limits at temperature extremes are guaranteed via correlation using standard Statistical Quality Control (SQC) methods.

Note 3: Junction-to-Ambient thermal resistanoe with approximately 1 square inch of p.c. board copper surrounding the leads. Additional copper area will lower thermal resistance further.

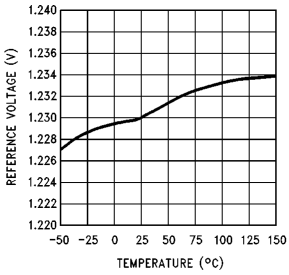
Note 4: A 1.0 MΩ resistor is connected to the compensation pin (which is the error amplifier's output) to ensure accuracy in measuring A_{VOL}. In actual applications, this pin's load resistance should be ≥10 MΩ, resulting in A_{VOL} that is typically twice the guaranteed minimum limit.

Typical Performance Characteristics

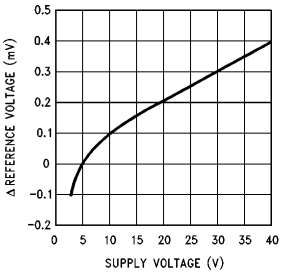
Supply Current vs Temperature



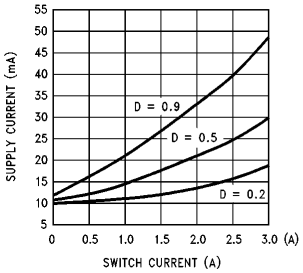
Reference Voltage vs Temperature



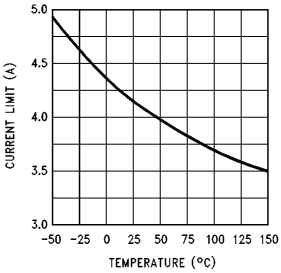
Δ Reference Voltage vs Supply Voltage



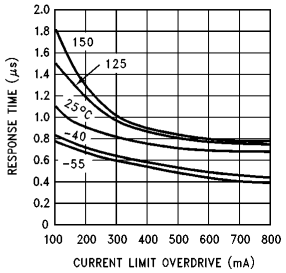
Supply Current vs Switch Current



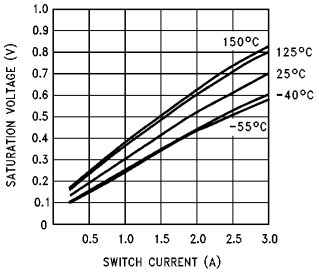
Current Limit vs Temperature



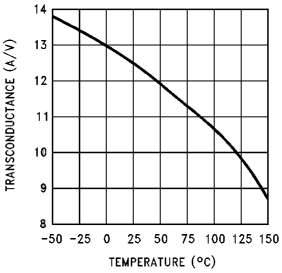
Current Limit Response Time vs Overdrive



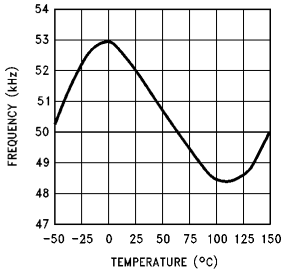
Switch Saturation Voltage vs Switch Current



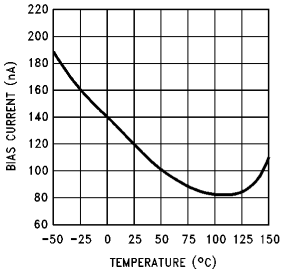
Switch Transconductance vs Temperature



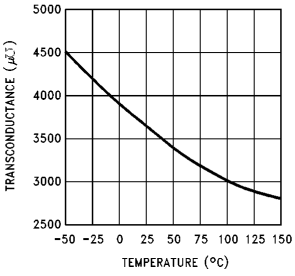
Oscillator Frequency vs Temperature



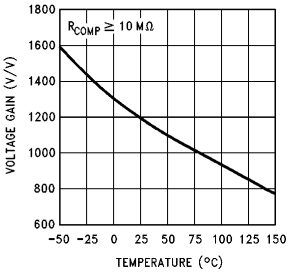
Feedback Pin Bias Current vs Temperature



Error Amp Transconductance vs Temperature



Error Amp Voltage Gain vs Temperature



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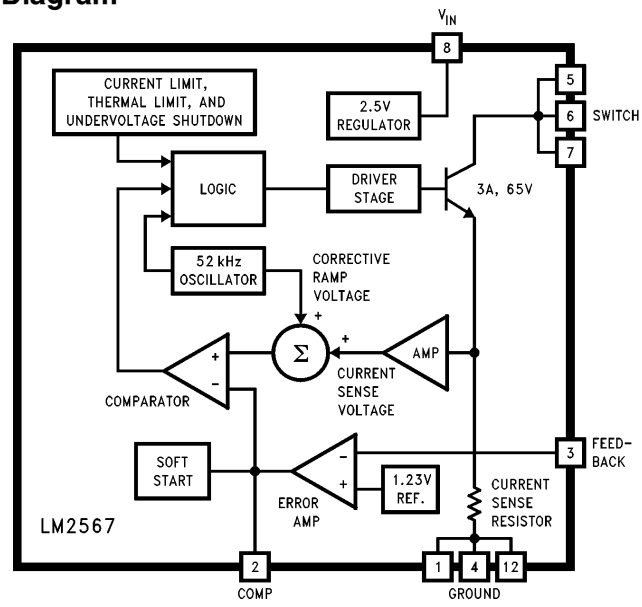
LM2567 Block Diagram



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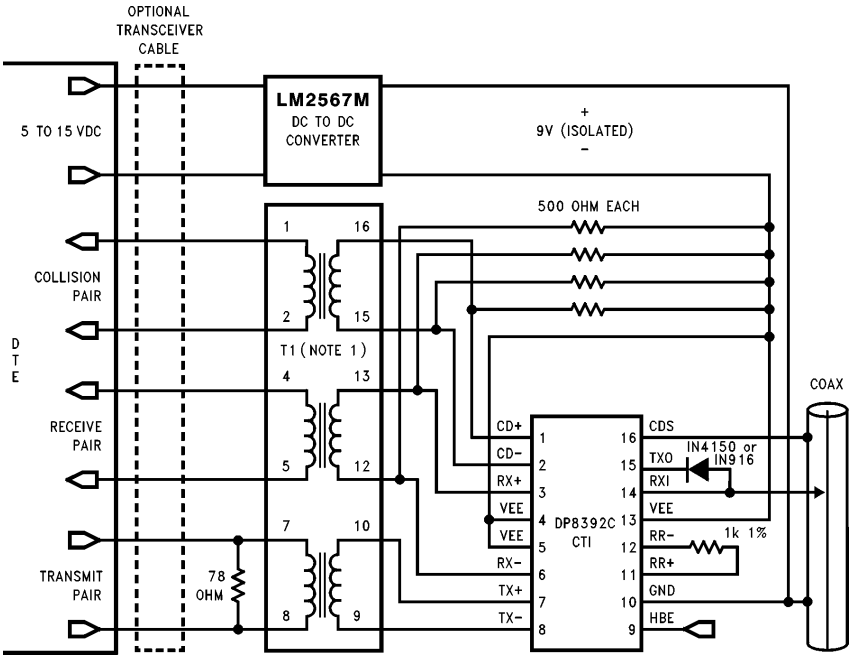
LM2567 DC-to-DC Converter* in DP8392C Typical Application

(*See Typical Application on Front Page of this Datasheet.)



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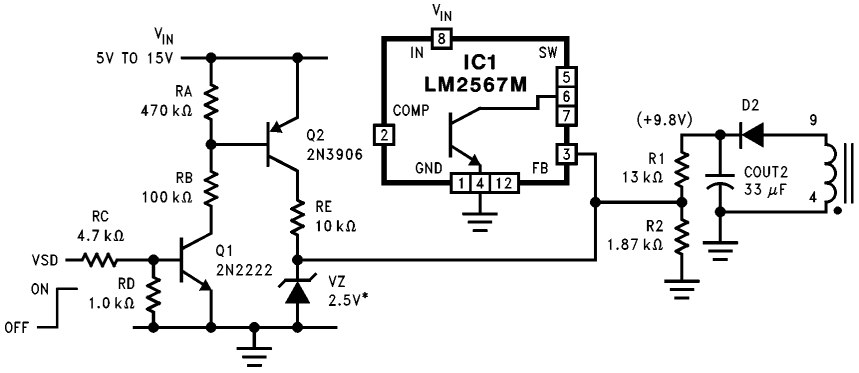
Note: T1 is a 1:1 pulse transformer, L = 100 μH
Pulse Engineering (San Diego) Part No. 64103
Valor Electronics (San Diego) Part No. LT6003 or equivalent

Auxiliary Circuits

Regulator Shutdown Control from Totem-Pole Logic†



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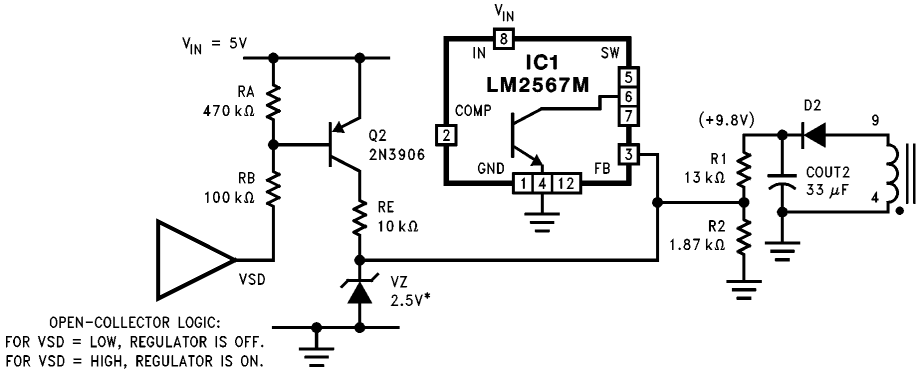
*BZX84C2V7 (in SOT-23) available from Zetex and Phillips

†Partial regulator circuit shown.

Regulator Shutdown Control from Open-Collector Logic†



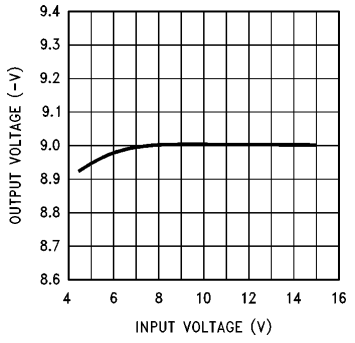
TL/H/11731–10

*BZX84C2V7 (in SOT-23) available from Zetex and Phillips

†Partial regulator circuit shown.

Typical Performance Characteristics of LM2567 DC-to-DC Converter

Line Regulation



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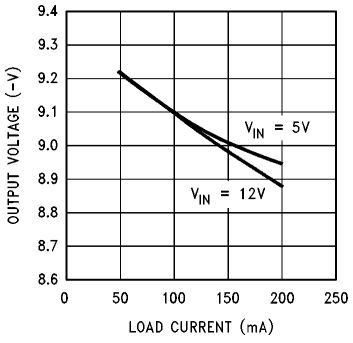
Load Regulation



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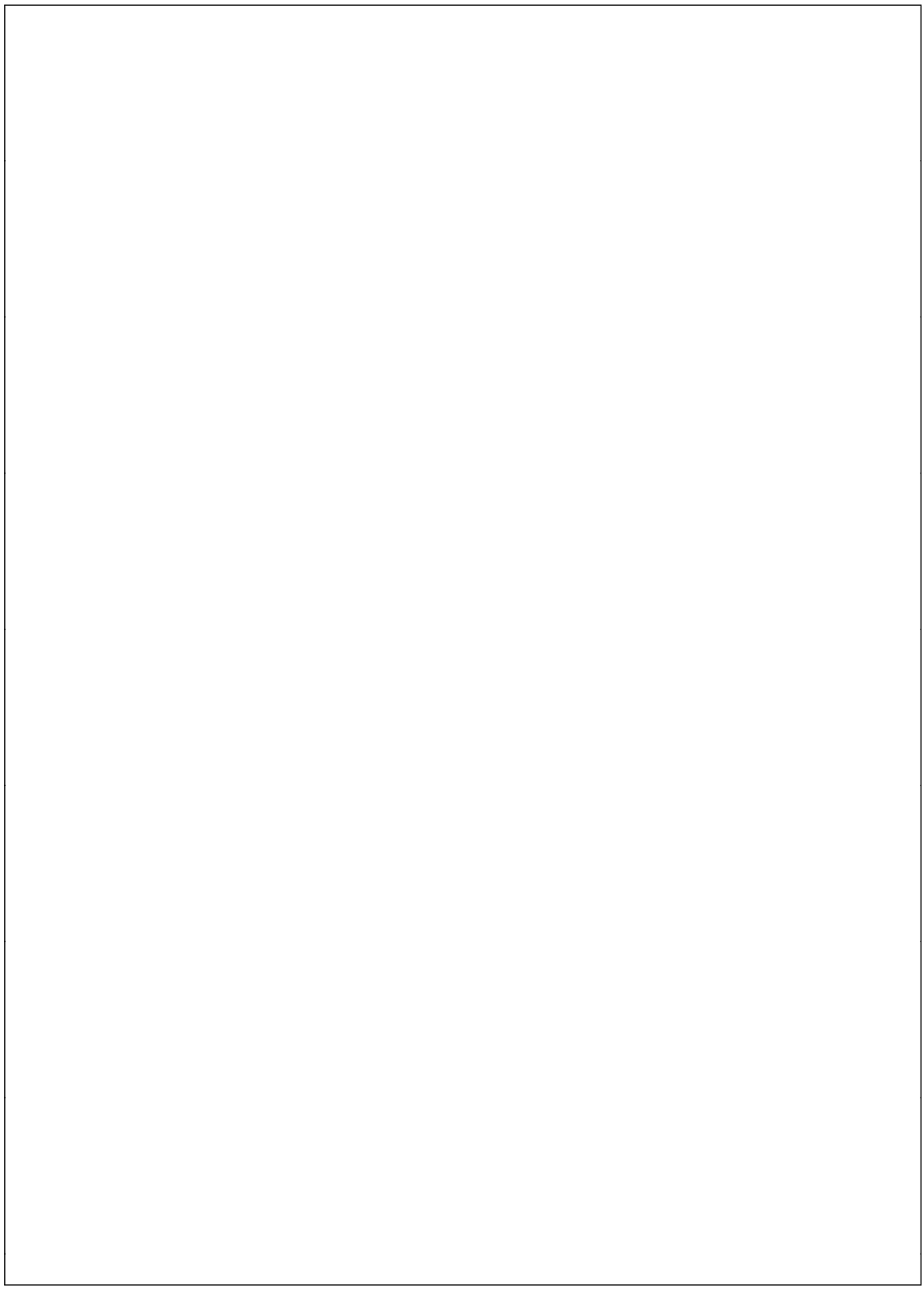
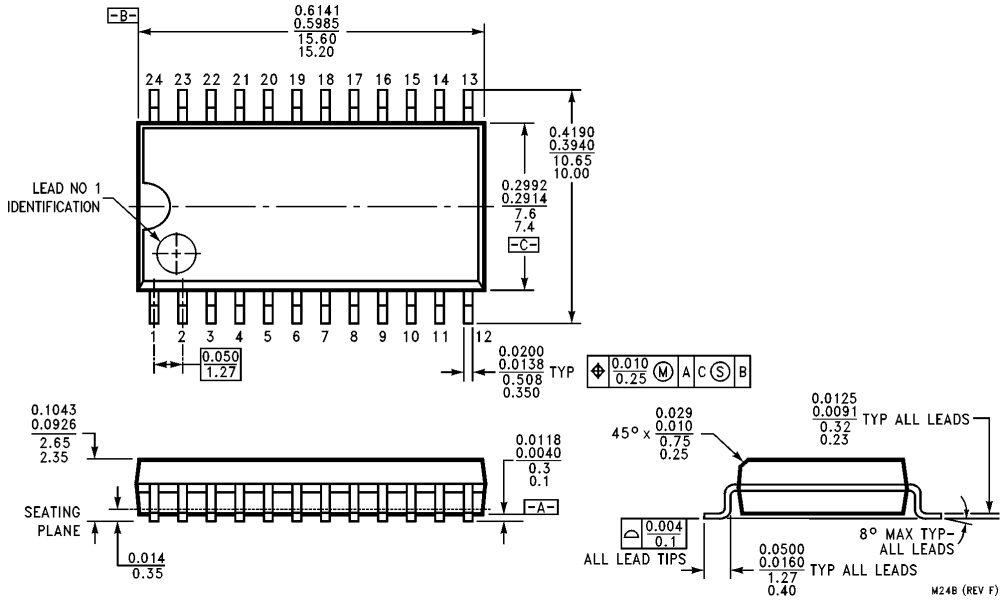


Physical Dimensions inches (millimeters)



0.300 Wide SO Package (M)
Order Number LM2567M
NS Package Number M24B

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