FAN2591

350mA CMOS LDO with Shutdown, Bypass and Independent Voltage Detector with Delayed Reset Output

Features

- LDO with Integrated Microprocessor Reset Control
- Low Supply Current (70µA typ)
- Ultra-Low Dropout Voltage (0.9mV/mA)
- Guaranteed 350mA Output
- Output Voltage Range from 1.3V to 6.2V
- Bypass Input Capacitor for Low Noise Operation
- Active LOW or Active HIGH or Open Drain RESET output
- 150msec Guaranteed Minimum RESET Output with NO external components
- Factory Programmable V_{TH} for Voltage Detector from 1.5V to 4.8V
- MSOP-8 and 3x3 MLP-8 Package

Applications

- Battery-Operated Systems
- Portable Computers
- Computers & Printers, Controllers
- Critical Microprocessor Power Monitoring
- Intelligent Instruments
- Pagers

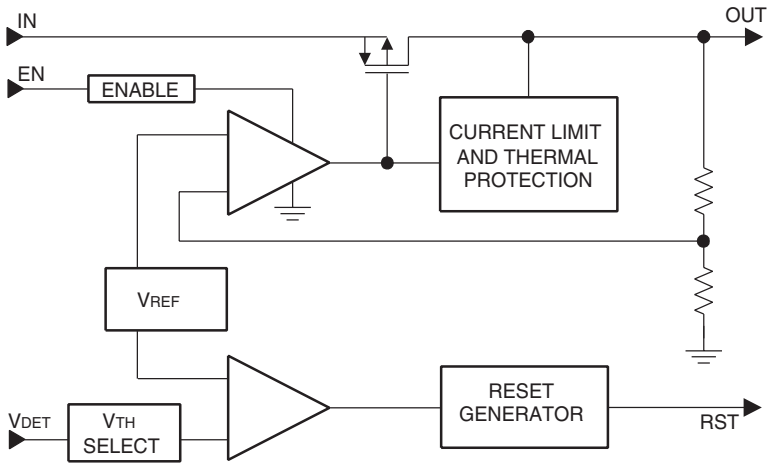
General Description

The FAN2591 family of Low supply current and high-precision LDOs feature very low dropout voltage, delayed microprocessor reset circuitry without external components, and continuous 350mA load current capability. An External Bypass Capacitor can be added to reduce the output noise of the Fixed Output version. Voltage detector input, V_{DET}, and power supply input V_{IN} can be connected together. In this case, the RST output can be used for low battery detection, otherwise the V_{DET} input can be used independently from V_{IN}, in order to detect any voltage threshold within the factory programmable range (1.5V to 4.8V).

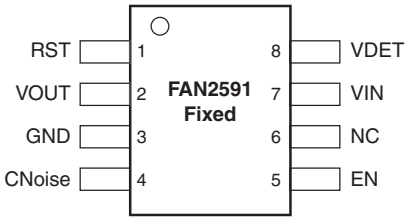
The FAN2591 incorporates both over-temperature and over-current protection. Output is stable with 22µF or more, tantalum capacitor.

The FAN2591 is available in space saving MSOP-8 and 3x3 MLP-8 packages.

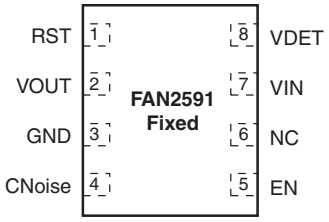
Block Diagram



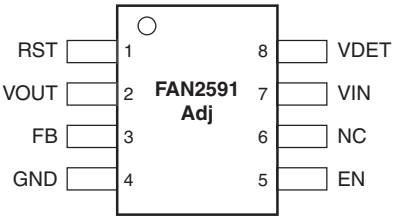
Pin Configuration, Top View



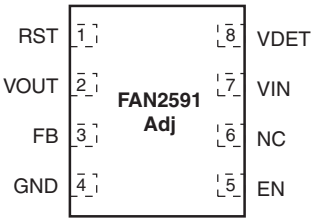
MSOP-8



8 Lead MLP 3x3



MSOP-8



8 Lead MLP 3x3

Pin Definitions

Pin Name	Pin Function Description
RST	**Reset Output.** Active “H” or Active “L” or “Open Drain”
VOUT	**Regulated Voltage Output.**
GND	**Ground Connection.**
CNoise	**Reference Voltage Bypass Input.**
EN	**Chip Enable Input.** The regulator is fully enabled when a logic “H” is applied to this input.The regulator enters into shutdown mode when logic “L” is applied to this input. During shutdown, the regulator output falls to zero, RST output goes HIGH and the supply current is reduced below 10µA, if there is no voltage applied to VDET.
NC	**Not Connected.**
VIN	**Power Supply Input.**
VDET	**Voltage Detector Input.** VDET and VIN can be connected together to detect low power supply voltage.
FB	Input to set the adjustable output voltage. Do not connect a capacitor to this pin.

Pin Assignments

Pin Number	FAN2591 Fixed Output Voltage	FAN2591 Adjustable Output Voltage
1	RST	RST
2	VOUT	VOUT
3	GND	FB
4	CNoise	GND
5	EN	EN
6	NC	NC
7	VIN	VIN
8	VDET	VDET

Absolute Maximum Ratings

Absolute maximum ratings are the values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Parameter	Min.	Max.	Units
Supply Voltage, V_{IN} to GND		7	V
Voltage on any Other Pin	-0.3	V_{IN} + 0.3	V
Junction Temperature (T_J)	–55	150	°C
Storage Temperature	–65	150	°C
Lead Soldering Temperature, 5 seconds		260	°C
Electrostatic Discharge Protection (Human Body Model)	4		kV

Recommended Operating Conditions

Parameter	Conditions	Min	Typ	Max	Units
Supply Voltage, V_{IN}		V_{OUT} + V_{DO}	V_{OUT} + 1	6.5	V
Load Current	T_J < 150°C			350	mA
Ambient Operating Temperature		–40		+85	°C

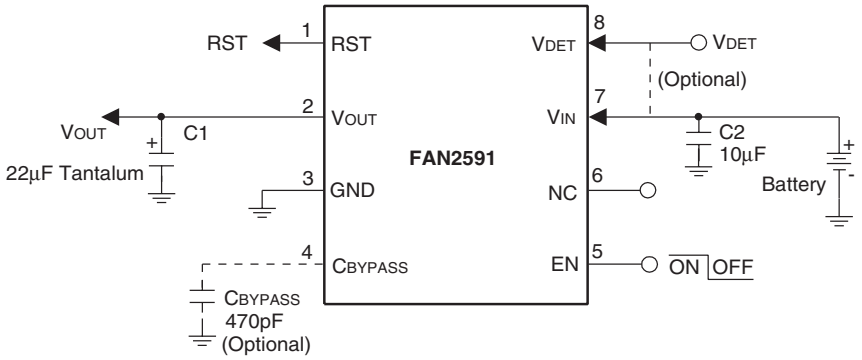


Figure 1. Test Circuit for Fixed Output Version

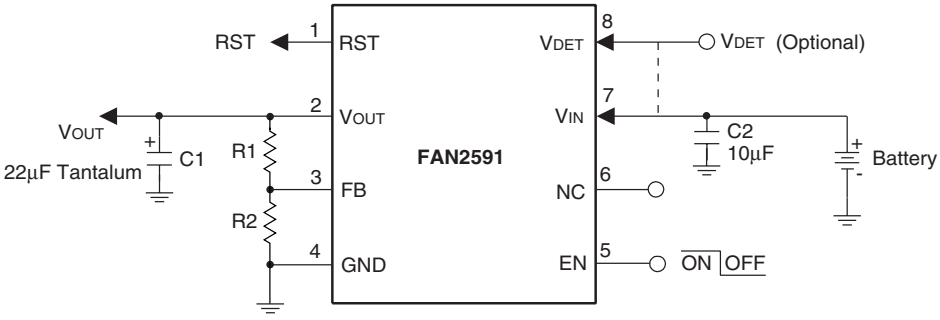


Figure 2. Test Circuit for ADJ Output Version

Electrical Specifications

($V_{IN} = V_{OUT} + 1V$, $I_{OUT} = 0.1mA$, $V_{IN} = V_{EN}$, and $T_A = +25°C$, using circuit in Figure 1 or Figure 2, unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OUT}	Output Voltage (Note 1)	$-40°C \le T_A \le 85°C$	$0.97V_{NOM}$	V_{NOM}	$1.03V_{NOM}$	V
V_{TH}	Threshold Voltage (Note 1)	RST Changes Logic Status	$0.95V_{TH}$ NOM	V_{TH} NOM	$1.05V_{TH}$ NOM	V
$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	$V_{IN} = (V_{OUT} + 1)$ to $V_{IN} = 6.5V$		0.1	0.4	% / V
$\frac{\Delta V_{OUT}}{V_{OUT}}$	Load Regulation	$I_{OUT} = 1$ to 350mA		0.1	0.3	%
V_{DO}	Dropout Voltage (Note 2)	$I_{OUT} = 350mA$		300	350	mV
V_{FB}	Feedback Voltage (ADJ)	$I_{FB} < 10$ nA	1.19	1.235	1.26	V
I_{GND}	Ground Current	$I_{OUT} = 0$		70	80	µA
		$I_{OUT} = 350mA$		70	80	µA
I_{SD}	Shut-Down Current	$V_{EN} = 0$		10	14	µA
I_{SC}	Output Short Circuit Current	$V_{OUT} = 0$		1.2		A_{peak}
Enable Input						
V_{EL}	Logic Low Voltage			0.7		V
V_{EH}	Logic High Voltage			1.7		V
I_{EH}	Input Current High	$V_{EN} = V_{IN}$		10		µA
I_{EL}	Input Current Low	$V_{EN} = 0$		0.01		µA
Voltage Detector Input						
I_{VDH}	Input Current High	$V_{DET} = 5.5V$		1.9	3	µA
I_{VDL}	Input Current Low	$V_{DET} = 1.5V$		0.5	1	µA
RST Output						
I_{OH}	Current sourced HIGH Active Low or High	$V_{RST} = V_{IN} - 1.5V$ RST = High	3	4.5	6	mA
I_{LEAK}	Leakage Current Open Drain	$V_{RST} = 6.5V$ $V_{DET} > V_{TH}$			2	µA
I_{OL}	Current sinked LOW	$V_{RST} = 0.5V$ RST = Low	3	3.5	5	mA
t_R	Reset Timeout Period	$V_{DET} < V_{TH}$	150	200	250	mS

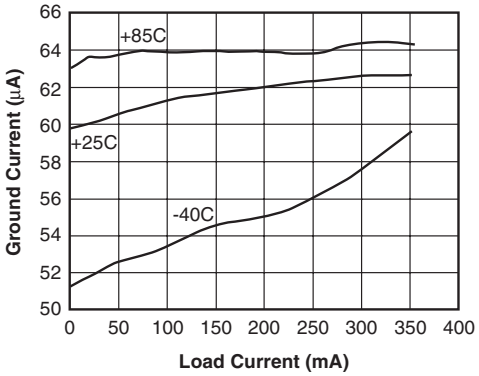
Notes:

1. V_{NOM} and V_{THNOM} are the nominal Output and Threshold Voltages, selected by the customer, respectively. For specific fixed voltages please refer to the table Ordering Information, on the last page of this data sheet. Custom fixed voltages, not listed in the table, are also available on request.
2. Dropout voltage is defined as the input to output differential at which the output voltage drops to 1% below the value measured at 1V input – output differential.

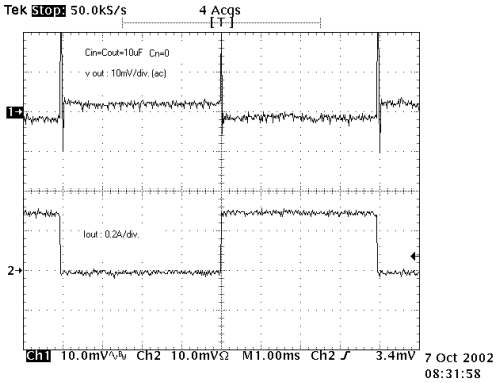
Typical Characteristics

Unless otherwise specified T_A = 25°C, $V_{IN} = V_{OUTnom}$ + 1V, $V_{IN} = V_{EN}$, I_{load} = 0.1mA, using Test Circuit Figure 1

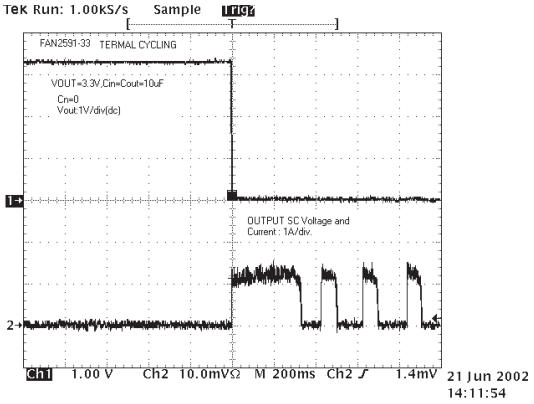
Ground Current vs. Load Current



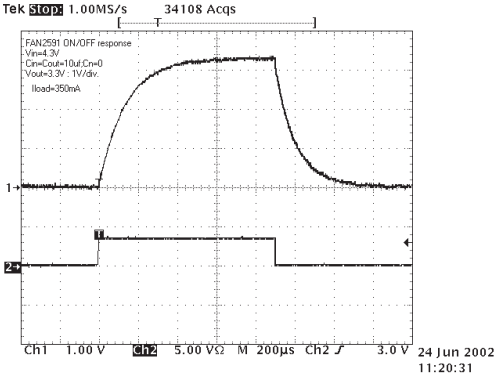
Load Transient Response



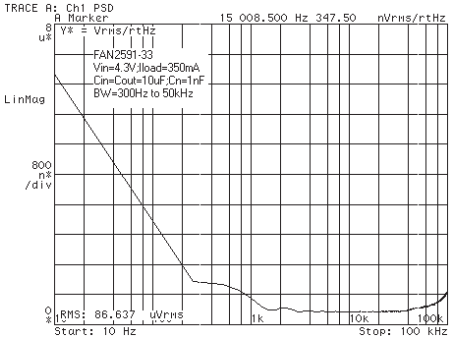
Termal Cycling under Short Circuit Condition



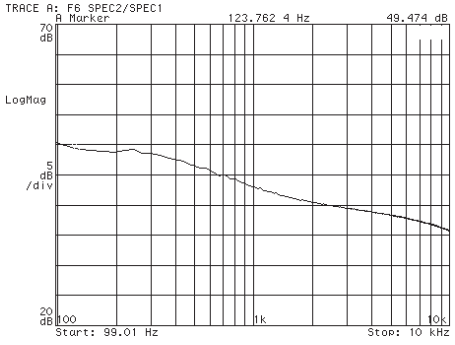
ON/OFF Transient Response



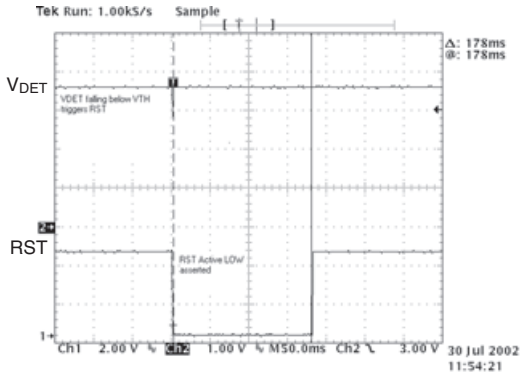
Spectral Noise Density and Noise Voltage



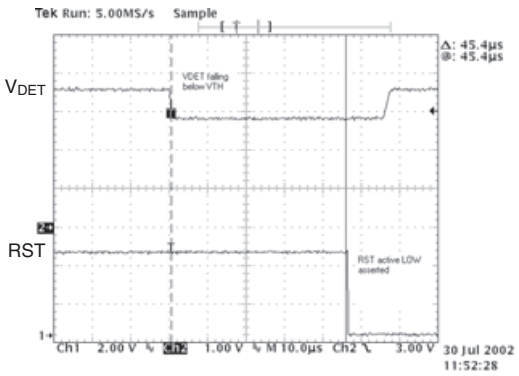
Ripple Rejection vs. Frequency



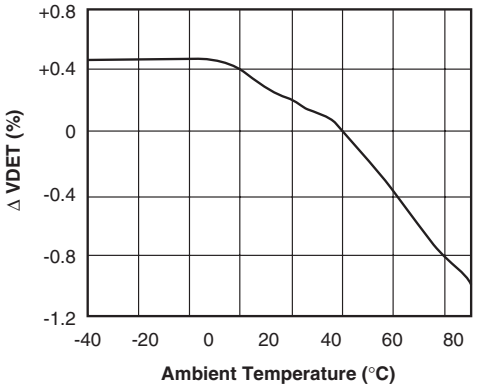
RST Timeout Period



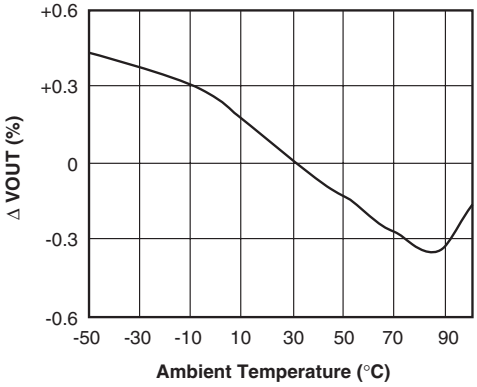
V_{DET} to RST Delay



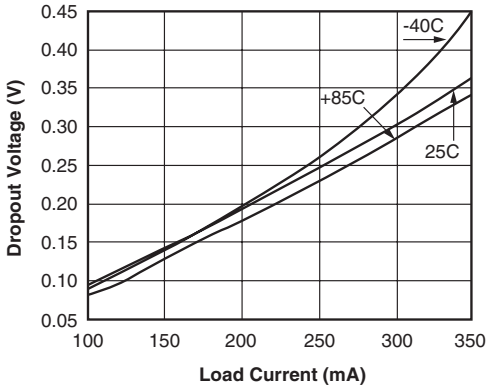
Threshold Voltage vs. Temperature



Output Voltage vs. Temperature



Dropout Voltage vs. Load Current



Application Information

Detailed Description

The FAN2591 is a combination of a fixed voltage output, low dropout CMOS voltage regulator and a voltage detector with factory programmable V_{TH}, for low battery indication or microprocessor reset control. Features low supply current, which does not increase with the load current, remains at the low level with the highest load, providing continuous 350mA load current. V_{OUT} remains stable and within regulation also in very low load current, at the level of 100µA, which is crucial in RTC and CMOS RAM battery back-up application.

Output and Input Capacitors

A 22µF (min.) Tantalum capacitor with ESR in the range 0.8Ω to 5Ω from V_{OUT} to ground is required. 10µF is acceptable for ambient temperatures above 0°C. Capacitances less than 10µF are not recommended because they require careful selection of ESR to ensure stability. A min 10µF capacitor should also be connected from V_{IN} to GND.

When operating from sources other than batteries, supply noise rejection and transient response can be improved by increasing the value of the input and output capacitors and utilizing passive filtering techniques.

Bypass Input Capacitor (optional, fixed output voltage only)

A 470pF or more capacitor connected from the Cnoise input to ground reduces noise present on the internal reference, which in turn significantly reduces output noise. This input may be left unconnected. Larger capacitor values may be used, depending on the sensitivity to output noise in the application, but this will result in a longer time period to reach the steady state.

Adjustable Output Voltage

The FAN2591ADJ version includes an FB input which allows the user to select an output voltage in the range of 1.3V to 6.2V, determined by R_1 and R_2 (Figure 2) according to the relation:

$$V_{OUT} = V_{FB}\left(1 + \frac{R_1}{R_2}\right)$$

For best results we recommend:

$$\frac{R_1 \bullet R_2}{R_1 + R_2} \leq 250k\Omega$$

Thermal Shutdown

Integrated thermal protection circuitry shuts the regulator off when die temperature exceeds 150°C. The regulator remains off until the die temperature drops to approximately 130°C.

Voltage Detector

The Threshold Voltage V_{TH} for Voltage Detector is preset by the factory within the range 1.5V to 4.8V, for any specific user request. RST output available for user request can be in Active HIGH or Active LOW, or Open Drain version. The RST output is guaranteed to remain asserted for a minimum of 150ms after V_{DET} has risen above the designated preset threshold. Also, V_{IN} and V_{DET} can be connected together.

Microprocessor Reset

The RST pin is asserted whenever VDET falls below the preset threshold voltage. The reset pin remains asserted for a typical time period of 200ms after V_{IN} has risen above the preset threshold voltage (fig. 2). The reset function ensures the microprocessor is properly reset and powers up into a known condition after a power failure. RST will remain valid with VDET as low as 1.4V.

VDET Transients

The FAN2591 are relatively immune to negative-going V_{DET} glitches below the preset threshold. Typically, a negative-going transient 125mV below the detection threshold with a duration of 35µs or less will not cause an unwanted reset.

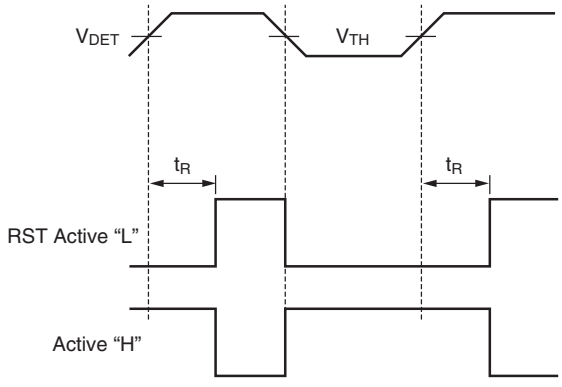
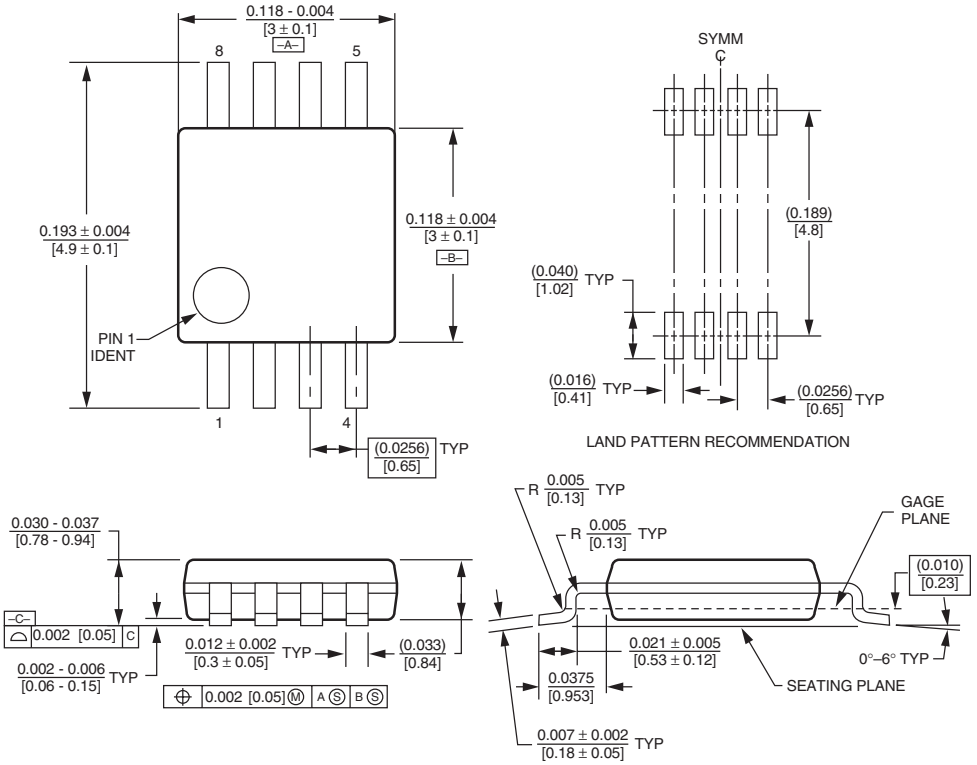


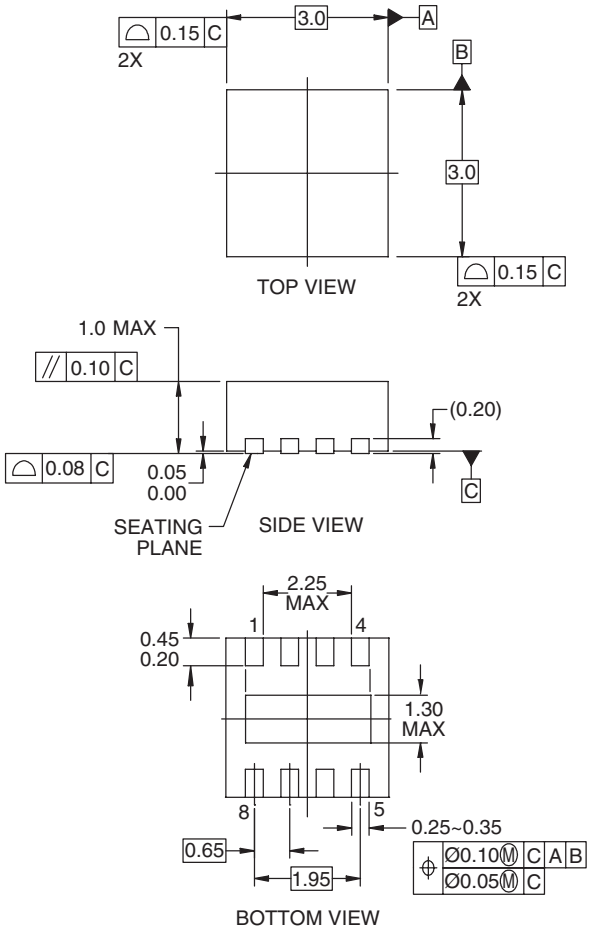
Figure 3. Timing Diagram

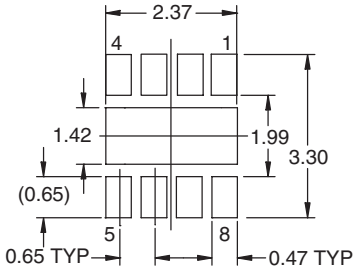
Package Dimensions

8-Pin MSOP



8-Pin MLP 3x3





RECOMMENDED LAND PATTERN

NOTES:
A. CONFORMS TO JEDEC REGISTRATION MO-229, VARIATION VCCD–3, DATED 11/2001
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

Ordering Information for (-40°C to +85°C) Temperature Range

Part Number	Nominal Output Voltage (V)	Nominal Threshold Voltage (V)	RST Configuration	Package	Package Marking
FAN2591MU33TLX	3.3	3.08	Active LOW	MSOP-8	591CTL
FAN2591MU30RLX	3	2.63	Active LOW	MSOP-8	591ERL
FAN2591MP33TLX	3.3	3.08	Active LOW	MLP3x3-8	591CTL
FAN2591MP30RLX	3	2.63	Active LOW	MLP3x3-8	591ERL
FAN2591MUADJROX	Adj	2.63	Open Drain Active LOW	MSOP-8	591RRL
FAN2591MPADJROX	Adj	2.63	Open Drain Active LOW	MLP3x3-8	591RRL

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Stock#DS30002591