Maximum 2A, Ultra Low Dropout LDO

General Description

The RT9025 is a high performance positive voltage regulator designed for use in applications requiring very low Input voltage and extremely low dropout voltage at up to 2A(Peak). It operates with a VIN as low as 1.0V and VDD voltage 3V with programmable output voltage as low as 0.8V. The RT9025 features ultra low dropout that is ideal for applications where VOUT is very close to VIN. Additionally, it has an enable pin to further reduce power dissipation while shutdown and provides excellent regulation over variations in line, load and temperature. The RT9025 provides a power good signal to indicate if the voltage level of Vo reaches 90% of its rating value. The RT9025 is available in the SOP-8 and SOP-8 (Exposed Pad) package with 1.05V, 1.2V, 1.5V, 1.8V and 2.5V internally preset outputs that are also adjustable by using external resistors.

Ordering Information

RT9025-□□□□

- Package Type
  - S : SOP-8
  - SP : SOP-8 (Exposed Pad)
- Operating Temperature Range
  - P : Pb Free with Commercial Standard
  - G : Green (Halogen Free with Commercial Standard)
- Output Voltage
  - 1K : 1.05V/Adj
  - 12 : 1.2V/Adj
  - 15 : 1.5V/Adj
  - 18 : 1.8V/Adj
  - 25 : 2.5V/Adj

Note :

RichTek Pb-free and Green products are :

- RoHS compliant and compatible with the current requirements of IPC/JEDEC J-STD-020.
- Suitable for use in SnPb or Pb-free soldering processes.
- 100% matte tin (Sn) plating.

Features

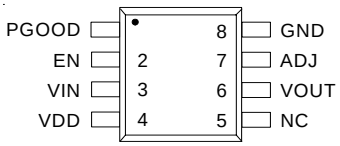
- **Maximum 2A Low-Dropout Voltage Regulator**
- **High Accuracy Output Voltage 1.5%**
- **Dropout Voltage Typical 230mV at 2A**
- **Power Good Output**
- **Output Voltage Pull Low Resistance when Disable**
- **Thermal and Over Current Protection**
- **RoHS Compliant and 100% Lead (Pb)-Free**

Applications

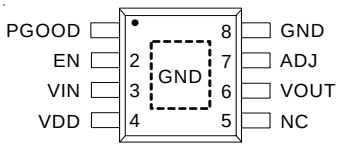
- Note Book PC Applications
- Motherboard Applications

Pin Configurations

(TOP VIEW)



SOP-8



SOP-8 (Exposed Pad)

Typical Application Circuit

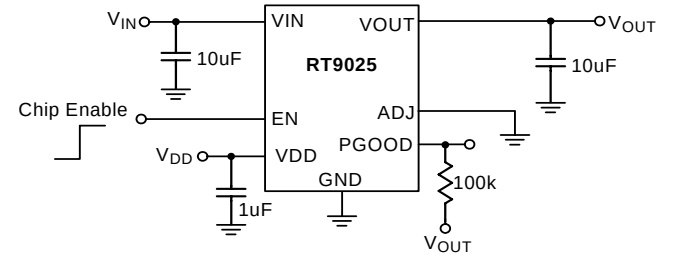


Figure 1. Fixed Voltage Regulator

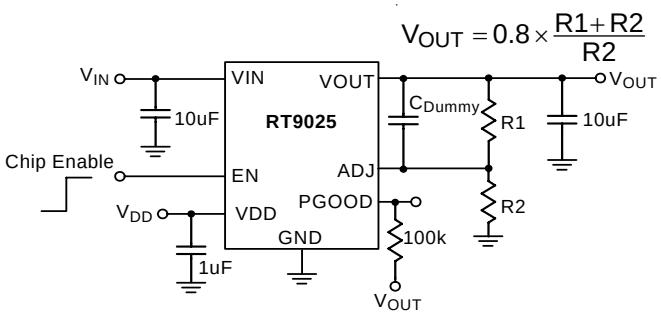
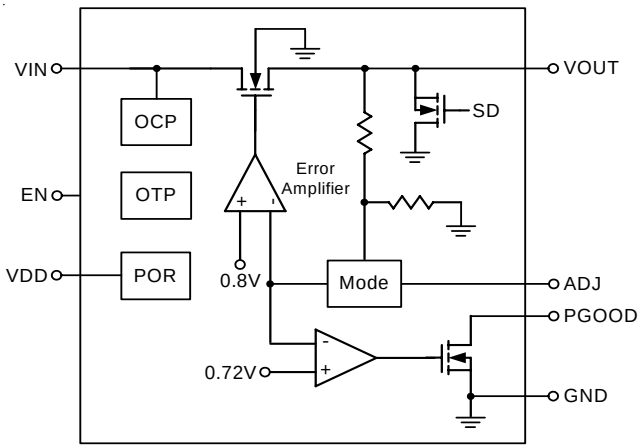


Figure 2. Adjustable Voltage Regulator

Functional Pin Description

Pin No.	Pin Name	Pin Function
1	PGOOD	Power Good Open Drain Output.
2	EN	Chip Enable (Active High).
3	VIN	Supply Input Voltage.
4	VDD	Supply Voltage of Control Circuit.
5	NC	No Internal Connection.
6	VOUT	Output Voltage.
7	ADJ	Set the output voltage by the internal feedback resistors when ADJ is grounded. If external feedback resistors is used, V_{OUT} = 0.8V x (R2+R1)/R2.
8 Exposed Pad	GND	Ground. Exposed pad should be soldered to PCB board and connected to GND.

Function Block Diagram



Absolute Maximum Ratings (Note 1)

- Supply Input Voltage, V_{IN} ---------- 6V
- Control Voltage ---------- 6V
- Output Voltage ---------- 6V
- Power Dissipation, P_D @ T_A = 25°C
  - SOP-8 ---------- 0.833W
  - SOP-8 (Exposed Pad) ---------- 1.333W
- Package Thermal Resistance (Note 4)
  - SOP-8, θ_{JA} ---------- 120°C/W
  - SOP-8, θ_{JC} ---------- 60°C/W
  - SOP-8 (Exposed Pad), θ_{JA} ---------- 75°C/W
  - SOP-8 (Exposed Pad), θ_{JC} ---------- 15°C/W
- Lead Temperature (Soldering, 10 sec.) ---------- 260°C
- Junction Temperature ---------- 150°C
- Storage Temperature Range ---------- –65°C to 150°C
- ESD Susceptibility (Note 2)
  - HBM (Human Body Mode) ---------- 2kV
  - MM (Machine Mode) ---------- 200V

Recommended Operating Conditions (Note 3)

- Supply Input Voltage, V_{IN} ---------- 1.4V to 5V
- Control Voltage, V_{DD} ---------- 4.5V to 5.5V
- Junction Temperature Range ---------- –40°C to 125°C
- Ambient Temperature Range ---------- –40°C to 85°C

Electrical Characteristics

(V_{IN} = V_{OUT} + 500mV, V_{EN} = V_{DD} = 5V, C_{IN} = C_{OUT} = 10µF, T_A = 25°C, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
VIN						
Input Voltage Range	V_{IN}		1.4	--	5	V
Quiescent Current (GND Current) (Note 5)	I_Q	V_{DD} = 5V	--	0.6	1.2	mA
VDD						
VDD Operation Range	V_{DD}	V_{DD} Input Range	4.5	--	5.5	V
VOUT						
Fixed Output Voltage		V_{DD} = 5V	–1.5	0	1.5	%
V_{OUT} Load Regulation (Note 6)	ΔV_{LOAD}	V_{DD} = 5V, I_{OUT} = 2A, V_{IN} = V_{OUT} + 1V	--	0.2	1	%
V_{OUT} Line Regulation (V_{IN})	ΔV_{LINE_IN}	V_{DD} = 5V, V_{IN} = V_{OUT} + 1V to 5V I_{OUT} = 1mA	--	0.2	0.6	%
Dropout Voltage (Note 7)	V_{DROP}	V_{DD} = 5V, I_{OUT} = 2A	--	230	300	mV
		V_{DD} = 5V, I_{OUT} = 1A	--	115	150	

To be Continued

Parameter		Symbol	Test Conditions	Min	Typ	Max	Units
Current Limit		I_{LIM}	V_{DD} = 5V, V_{IN} = 3.6V	--	3.5	--	A
Short Circuit Current			V_{DD} = 5V , V_{OUT} < 0.2V	0.5	1.8	--	A
In-rush Current			V_{DD} = 5V, C_{OUT} = 10uF, Enable Start-up, I_{LOAD} = 2A	--	0.5	--	A
V_{OUT} Pull Low Resistance			V_{EN} = 0V	--	150	--	Ω
ADJ							
Reference Voltage (Adj)			V_{DD} = 5V, V_{OUT} = 2.5V	0.788	0.8	0.812	V
ADJ Pin Threshold				--	0.2	--	V
Power-On Reset							
POR Threshold				2.4	2.7	3.0	V
POR Falling Hysteresis				0.15	0.2	--	V
Power Good							
Power Good Rising Threshold			V_{DD} = 5V	--	90	--	%
Power Good Hysteresis			V_{DD} = 5V	--	10	--	%
Power Good Sink Capability			V_{DD} = 5V, I_{OUT} = 10mA	--	0.2	0.4	V
Chip Enable							
EN Threshold	Logic-Low Voltage	V_{EN_L}	V_{DD} = 5V	--	--	0.6	V
	Logic-High Voltage	V_{EN_H}	V_{DD} = 5V	1.2	--	--	V
EN Pin Bias Current		I_{EN}	V_{EN} = 5V	--	12	--	μA
V_{DD} Shutdown Current		I_{SHDN}	V_{DD} = 5V, V_{EN} = 0V	--	--	1	μA
Over Temperature Protection							
Thermal Shutdown Temperature		T_{SD}		--	160	--	°C
Thermal Shutdown Returned Temperature				--	90	--	°C

Note 1. Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

Note 2. Devices are ESD sensitive. Handling precaution recommended.

Note 3. The device is not guaranteed to function outside its operating conditions.

Note 4. θ_{JA} is measured in the natural convection at T_A = 25°C on a high effective thermal conductivity test board (4 Layers, 2S2P) of JEDEC 51-7 thermal measurement standard. The case point of θ_{JC} is on the expose pad for SOP-8 (Exposed Pad) package.

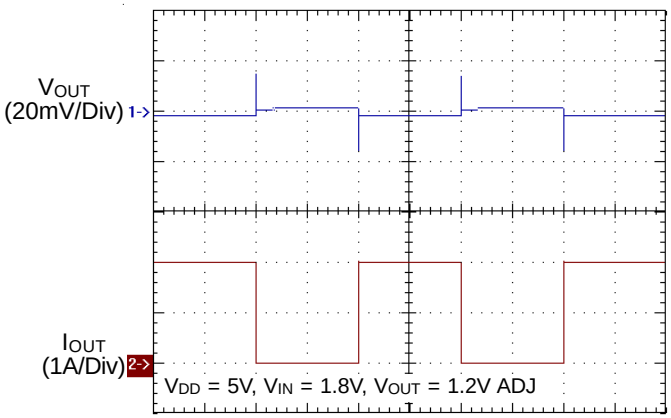
Note 5. Quiescent, or ground current, is the difference between input and output currents. It is defined by $I_Q = I_{IN} - I_{OUT}$ under no load condition (I_{OUT} = 0mA).

Note 6. Regulation is measured at constant junction temperature by using a 2ms current pulse. Devices are tested for load regulation in the load range from 1mA to 2A.

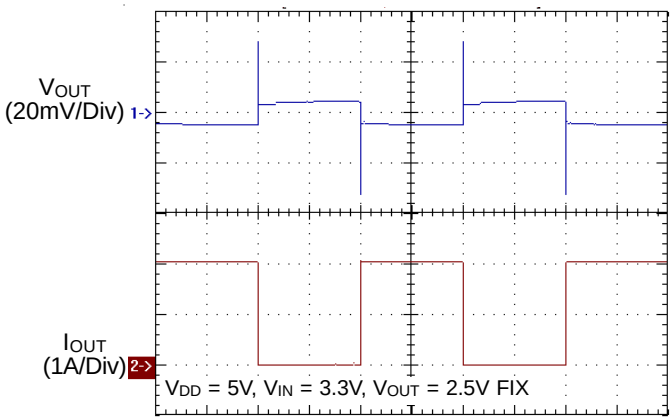
Note 7. The dropout voltage is defined as V_{IN} -V_{OUT}, which is measured when V_{OUT} is $V_{OUT(NORMAL)}$ – 100mV.

Typical Operating Characteristics

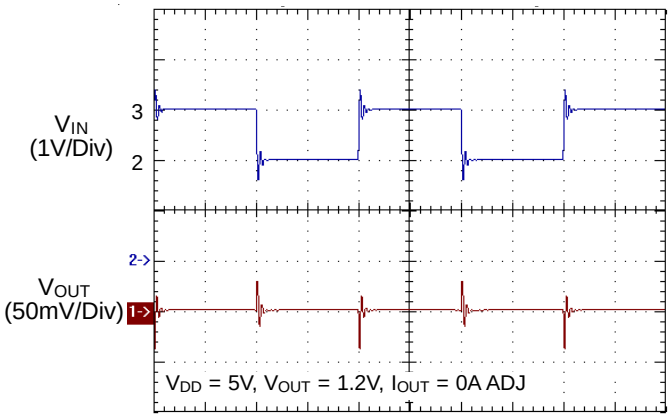
Load Transient Response



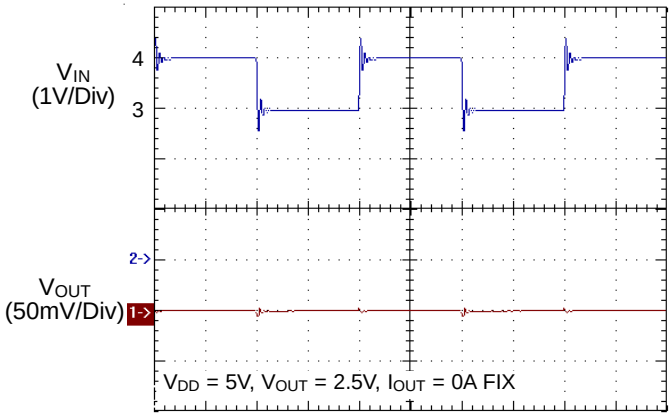
Load Transient Response



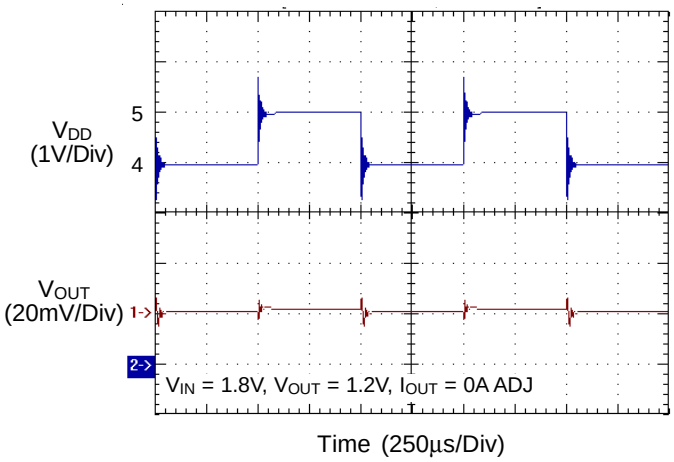
V_{IN} Line Transient Response



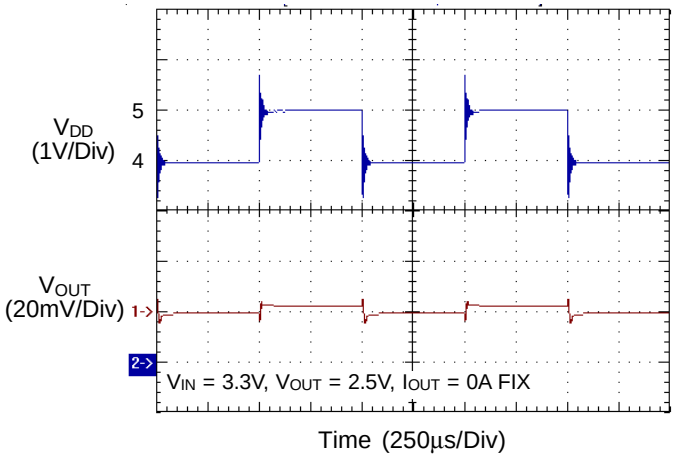
V_{IN} Line Transient Response



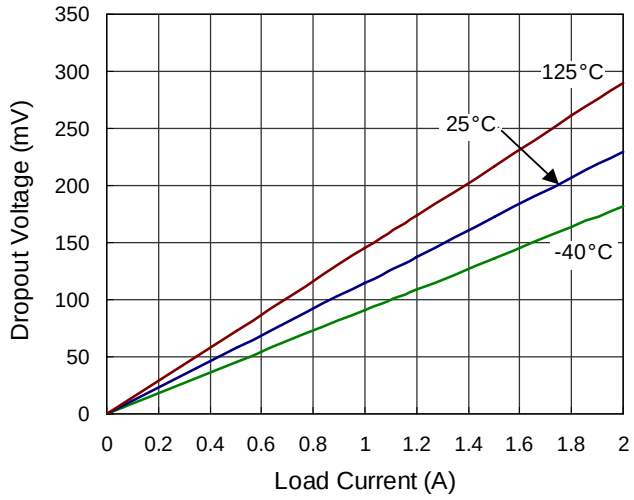
V_{DD} Line Transient Response



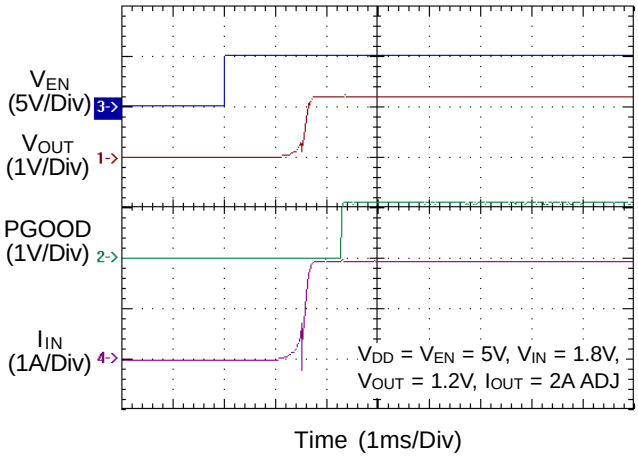
V_{DD} Line Transient Response



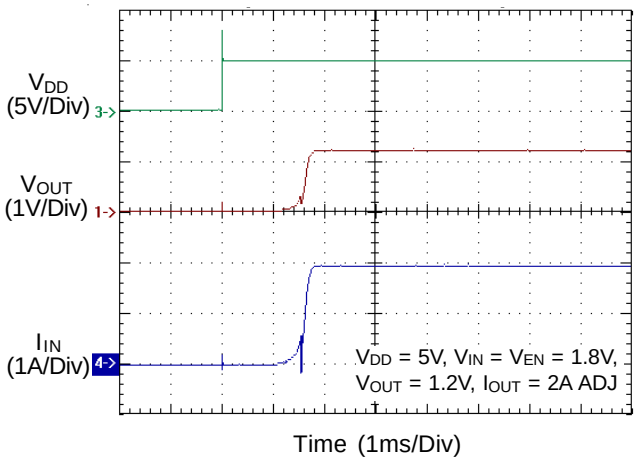
Dropout Voltage vs. Load Current



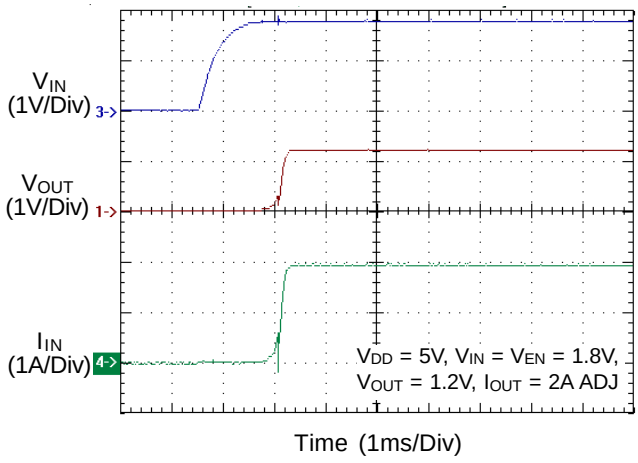
Start Up from Enable and PGOOD Delay



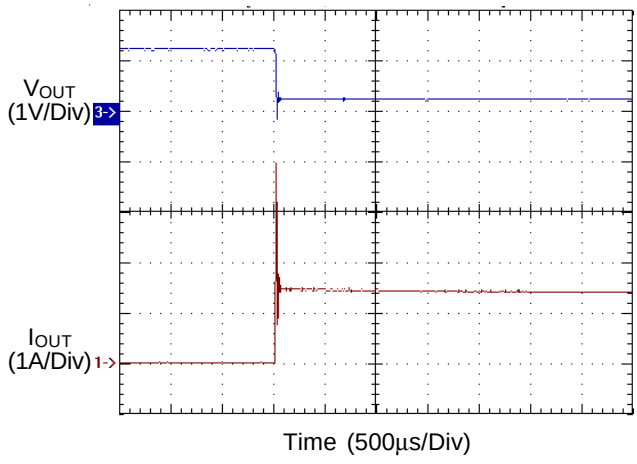
Start Up from V_{DD}



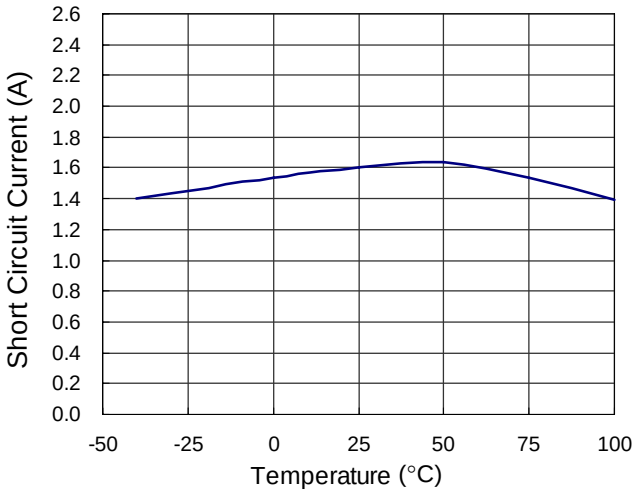
Start Up from V_{IN}



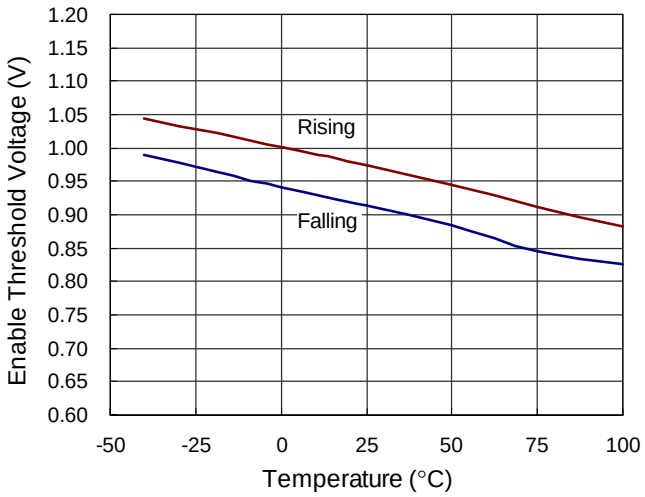
Short Circuit Protection



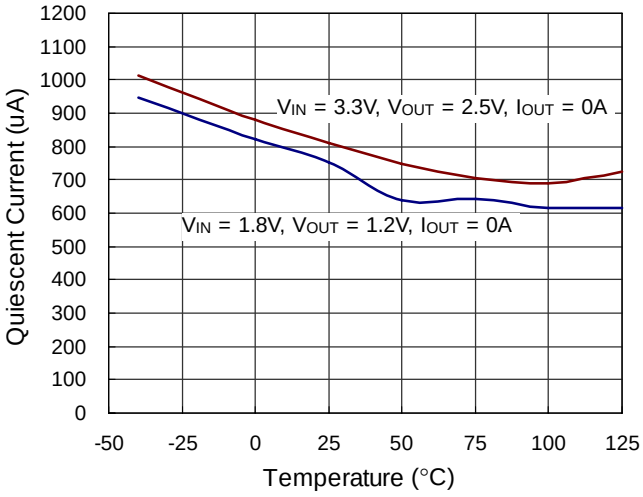
Short Circuit Current vs. Temperature



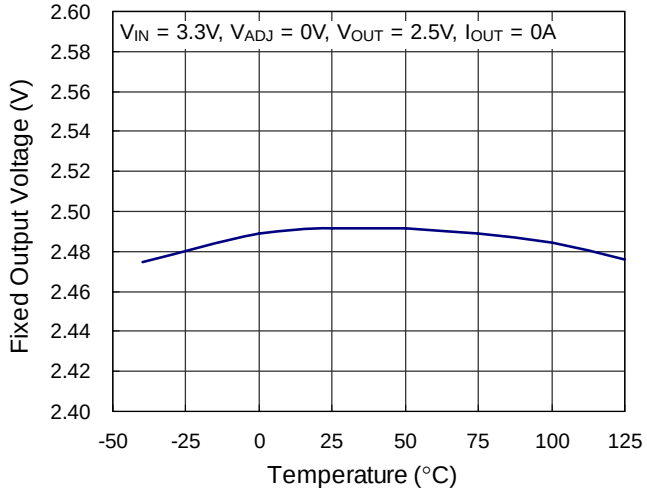
Enable Threshold Voltage vs. Temperature



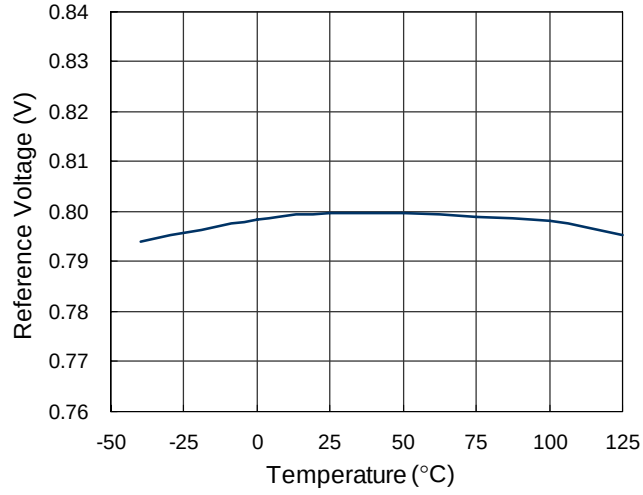
Quiescent Current vs. Temperature



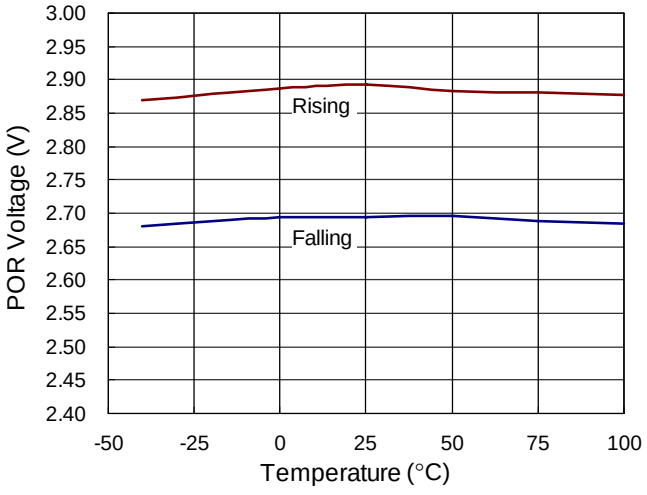
Fixed Output Voltage Range vs. Temperature



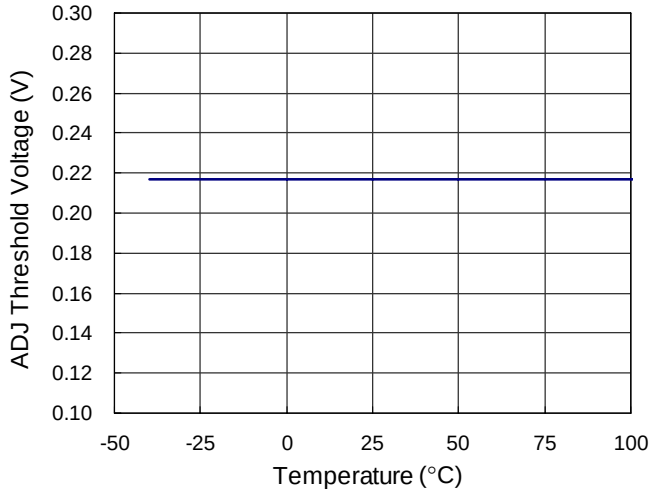
Reference Voltage vs. Temperature



VDD POR Threshold Voltage vs. Temperature



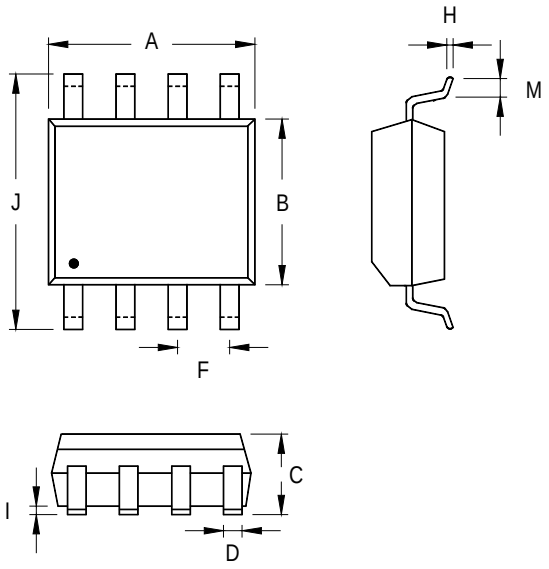
ADJ Threshold Voltage Range vs. Temperature



Datasheet Revision History

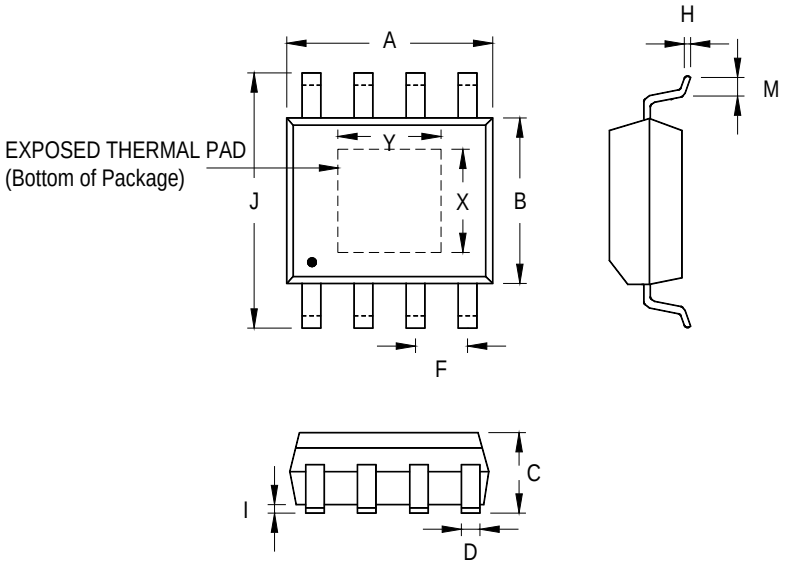
Version	Data	Page No.	Item	Description
00C	2006/12/15			first edition
01C	2006/12/27		Ordering Information Function Block Diagram Absolute Maximum Ratings Electrical Characteristics	Modify
02C	2006/12/28		Ordering Information	Modify
03C	2007/2/14			Modify Logo

Outline Dimension



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.801	5.004	0.189	0.197
B	3.810	3.988	0.150	0.157
C	1.346	1.753	0.053	0.069
D	0.330	0.508	0.013	0.020
F	1.194	1.346	0.047	0.053
H	0.170	0.254	0.007	0.010
I	0.050	0.254	0.002	0.010
J	5.791	6.200	0.228	0.244
M	0.400	1.270	0.016	0.050

8-Lead SOP Plastic Package



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A	4.801	5.004	0.189	0.197
B	3.810	4.000	0.150	0.157
C	1.346	1.753	0.053	0.069
D	0.330	0.510	0.013	0.020
F	1.194	1.346	0.047	0.053
H	0.170	0.254	0.007	0.010
I	0.000	0.152	0.000	0.006
J	5.791	6.200	0.228	0.244
M	0.406	1.270	0.016	0.050
X	1.900	2.700	0.075	0.106
Y	1.900	3.600	0.075	0.142

8-Lead SOP (Exposed Pad) Plastic Package

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