ACE533J

500mA, Micropower, VLDO Linear Regulator

Description

The ACE533J series are VLDO (very low dropout) linear regulators designed for low power portable applications. Typical output noise is only 100μV_{RMS} (Fixed Output, V_{OUT}=1.0V) and maximum dropout is just 320mV at the load current of 500mA.The internal P-channel MOSFET pass transistor requires no base current, allowing the device to draw only 250μA during normal operation at the maximum load current of 500mA.

Other features include high output voltage accuracy, excellent transient response, under voltage lockout, stability with ultra low ESR ceramic capacitors as small as 1μF, short-circuit and thermal overload protection and output current limiting.

Features

- Very Low Dropout: 320mV (Max) at 500mA
- Maximum Input Voltage: 6.0V
- Low Noise (10Hz to 100kHz): 100μVRMS (Fixed Output, VOUT=1.0V);
  60μVRMS (Adjustable Output, VOUT=1.0V);
  200μVRMS (Adjustable Output, VOUT=3.3V);
  305μVRMS (Adjustable Output, VOUT=5.0V)
- ±2% Voltage Accuracy at 500mA
- Fast Transient Response
- Under Voltage Lockout
- Fixed Output Voltage of ACE533J: 1.0V to 4.0V with 0.1V Interval
- Adjustable Output Voltage
- Output Current Limit
- Stable with 1μF Output Capacitor
- Short-Circuit and Thermal Overload Protection

Application

- Bluetooth/802.11 Cards
- PDAs and Notebook Computers
- Portable Instruments and Battery-Powered Systems
- Cellular Phones

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value	Unit
V_{IN}	Supply Voltage on VIN Pin	-0.3 to 7.5	V
$V_{\overline{SHDN}}$	Voltage on $\overline{SHDN}$ Pin	-0.3 to 7.5	V
V_{OUT}	Voltage on VOUT Pin	-0.3 to 7.5	V
V_{FB}	Voltage on FB Pin	-0.3 to 7.5	V
T_J	Operating Junction Temperature (Note 2, 3)	-40 to 125	°C
T_{STG}	Storage Temperature Range	-65 to 150	°C
T_L	Lead Temperature for Soldering 10 Seconds	300	°C
PD (Note 4)	Power Dissipation @ 25°C	0.9	W
θ_{JA}	Package Thermal Resistance	110	°C/W

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

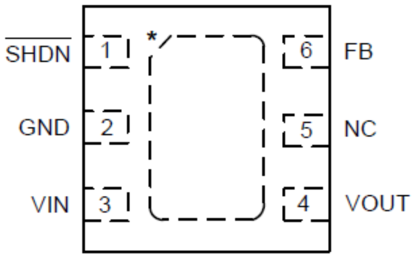
Note 2: The ACE533J is tested and specified under pulse load conditions such that $T_J \approx T_A$. Specifications over the -40°C to 125°C operating junction temperature range are assured by design, characterization and correlation with statistical process controls.

Note 3:This IC includes over-temperature protection that is intended to protect the device during momentary overload conditions. Junction temperature will exceed 125°C when over-temperature protection is active. Continuous operation above the specified maximum operating junction temperature may impair device reliability.

Note 4: The maximum allowable power dissipation of any T_A (ambient temperature) is $PDMAX=(T_{JMAX}-T_A)/\theta_{JA}$. Exceeding the maximum allowable power dissipation will result in excessive die temperature and the regulator will go into thermal shutdown.

Packaging Type

DFN2*2-6L



Pin Number	Symbol	Function
1	$\overline{SHDN}$	Shutdown Input: High=Activate LDO, Low=Shutdown LDO
2	GND	Ground
3	VIN	Power Supply
4	VOUT	Voltage Regulated Output
5	NC	Not Connected
6	FB	Output Voltage Feedback

Ordering information

ACE533J XX + H

- Halogen - free
- Pb - free
- MN: DFN2*2-6L

Electrical Characteristics

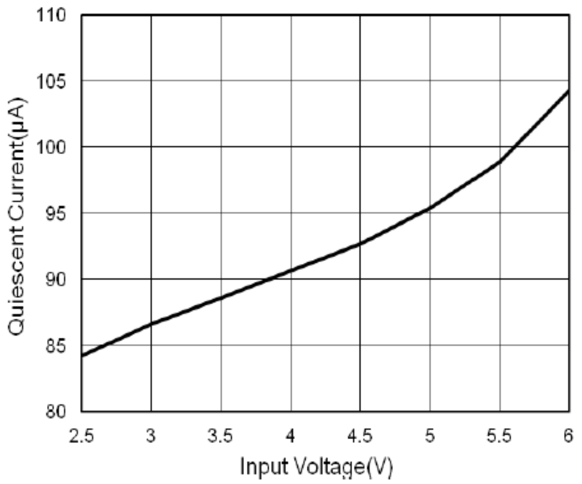
Over recommended operating free-air temperature range (unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}	Input Voltage Range		2.5		6.0	V
V_{UVLO}	Input Under Voltage Lockout	V_{IN} Falling	1.8		2.4	V
I_Q	Operating Quiescent Current	V_{IN}=4.2V, I_{OUT}=0mA		100	150	μA
		V_{IN}=4.2V, I_{OUT}=500mA		250	300	
$I_{\overline{SHDN}}$	Shutdown Leakage Current				1	μA
I_{OUT}	Output Current		500			mA
V_{FB}	FB Voltage	I_{OUT}=1mA		1		V
	Output Voltage Accuracy	1mA≤I_{OUT}≤500mA, T_A=-25°C	-2		+2	%
ΔV_{DO}	Dropout Voltage	I_{OUT}=500mA，2.5V≤V_{OUT}		220	320	mV
I_{LIMT}	Output Current Limit	V_{IN}≥2.5V	700			mA
t	Startup Time Response	R_L=68Ω, C_{OUT}=1μF		40		μs
V_{IL}	$\overline{SHDN}$ Input Low Voltage	2.5V≤V_{IN}≤6.0V			0.4	V
V_{IH}	$\overline{SHDN}$ Input High Voltage	2.5V≤V_{IN}≤6.0V	2.0			V
	$\overline{SHDN}$ Input Current	$\overline{SHDN}$ =V_{IN} or GND	-1		+1	μA
T_{SHDN}	Thermal-Shutdown Temperature			160		°C
ΔT_{SHDN}	Thermal-Shutdown Hysteresis			25		°C
	Line Regulation	V_{OUT}+1V≤V_{IN}≤6.0V (2.5V≤V_{IN}) I_{OUT}=10mA		0.09		%/V
	Load Regulation	V_{IN}=V_{OUT}+1V (2.5V≤V_{IN}) 1mA≤I_{OUT}≤500mA		0.2		%
	Output Voltage Noise	10Hz to 100kHz, C_{IN}=1.0μF, I_{OUT}=100mA; Adjustable Output, V_{OUT}=1.0V		60		μVRMS
		Adjustable Output, V_{OUT}=3.3V		194		
		Adjustable Output, V_{OUT}=5.0V		305		
PSRR	Power Supply Ripple Rejection	V_{IN}=V_{OUT}+1V I_{OUT}=10mA; f=100Hz		65		dB
		f=1kHz		60		
		f=10kHz		45		

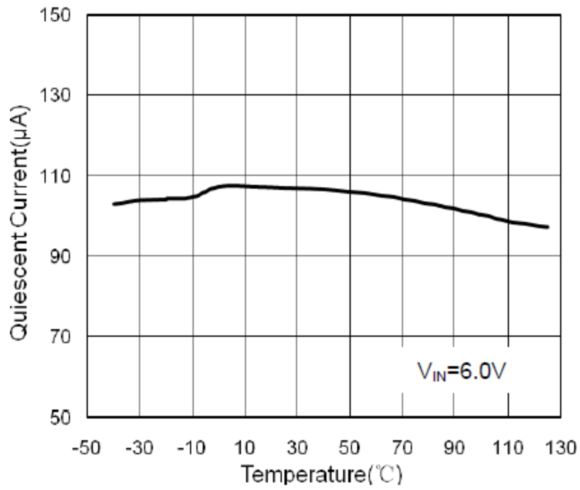
Typical Performance Characteristics (shown for 1.1V output option)

(C_{IN}=1.0μF, C_{OUT}=1.0μF, T_A=25°C, unless otherwise specified.)

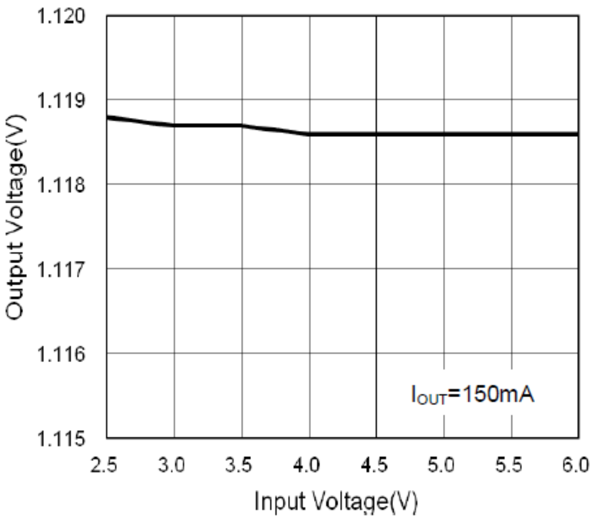
Quiescent Current vs. Input Voltage



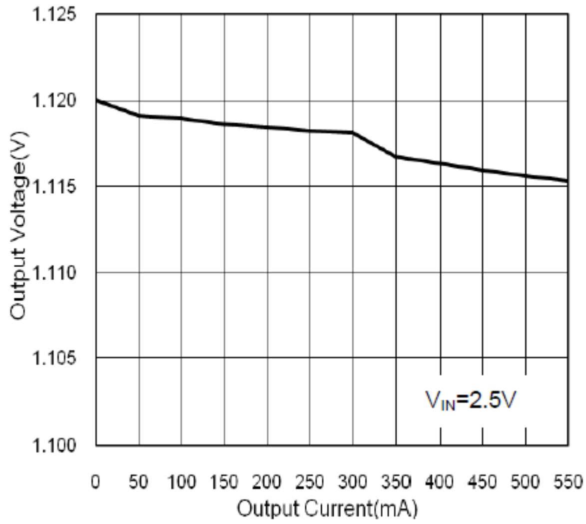
Quiescent Current vs. Temperature



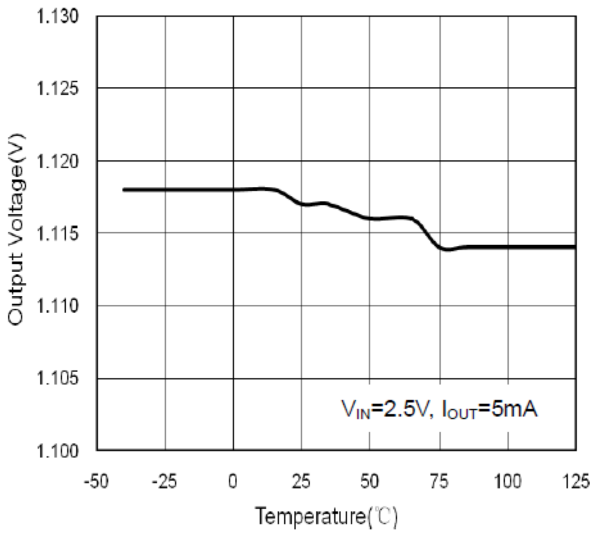
Output Voltage vs. Input Voltage



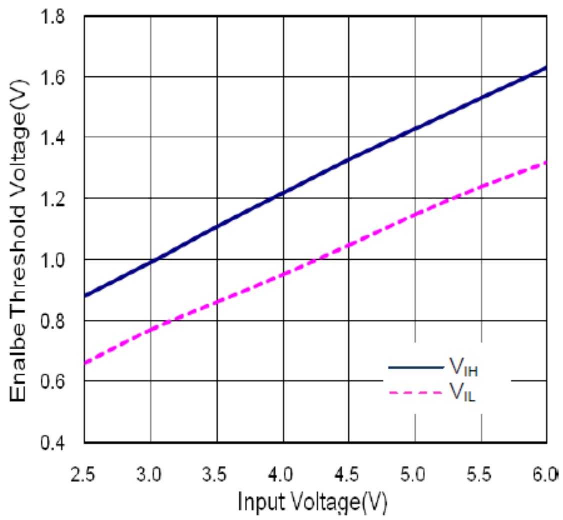
Output Voltage vs. Output Current



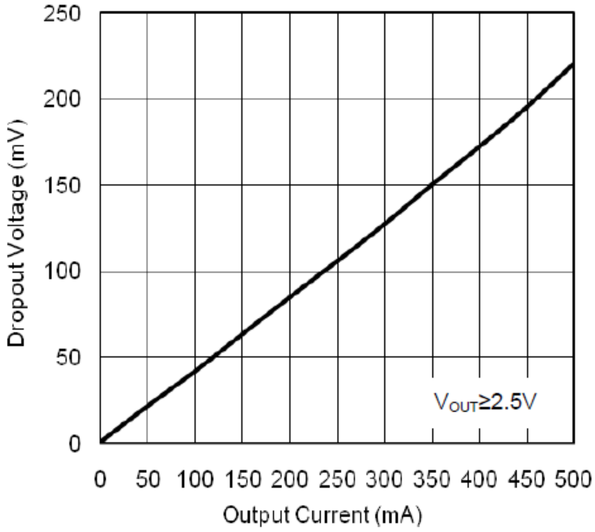
Output Voltage vs. Temperature



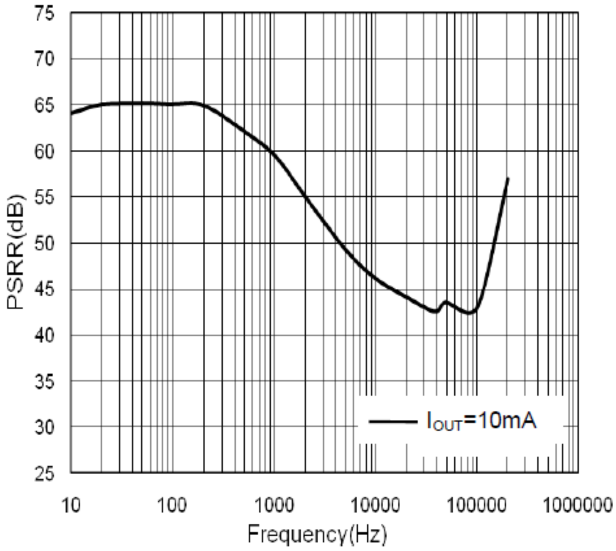
Enable Threshold Voltage vs. Input Voltage



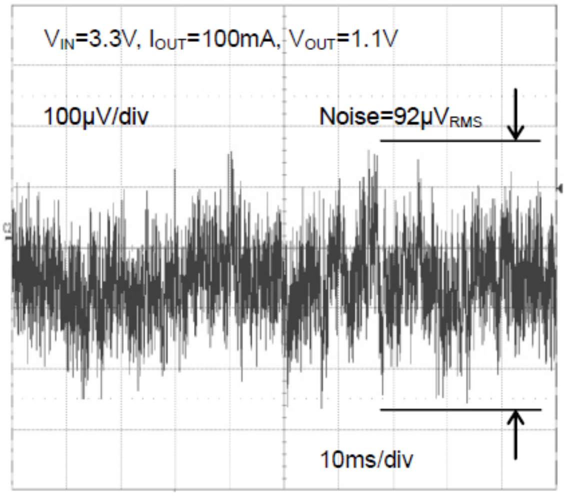
Dropout Voltage vs. Output Current



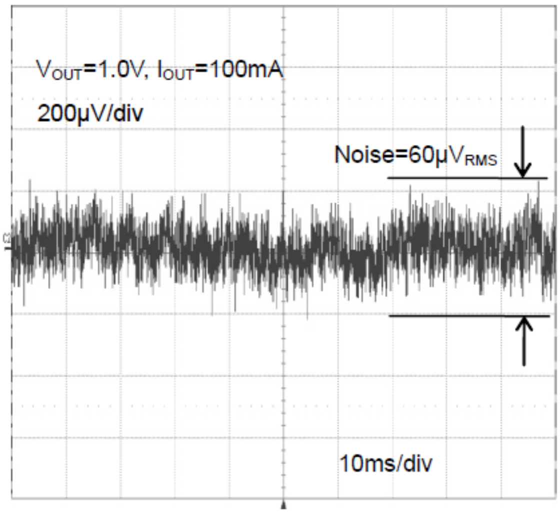
PSRR vs. Frequency



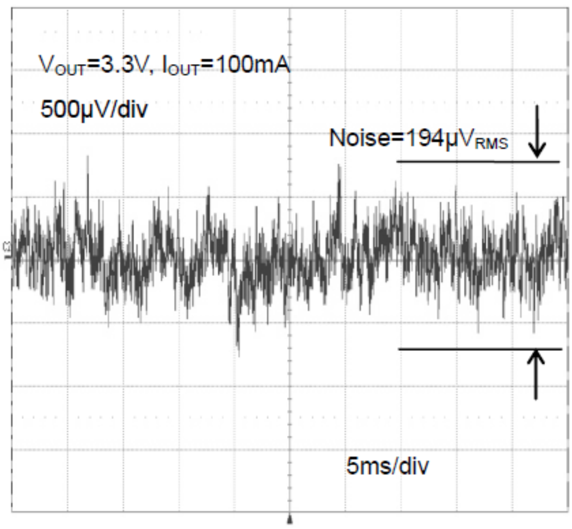
Noise



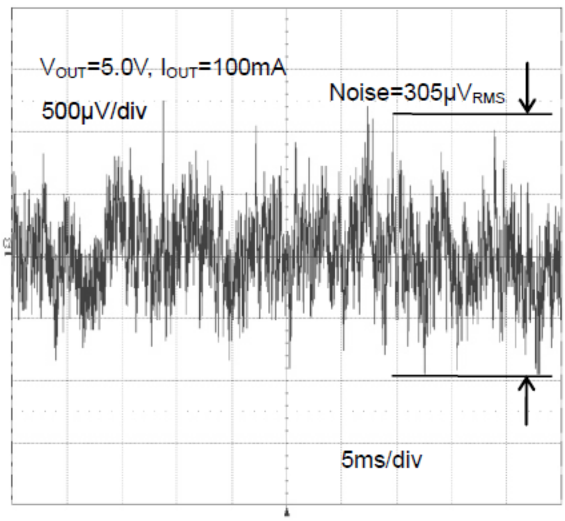
Noise



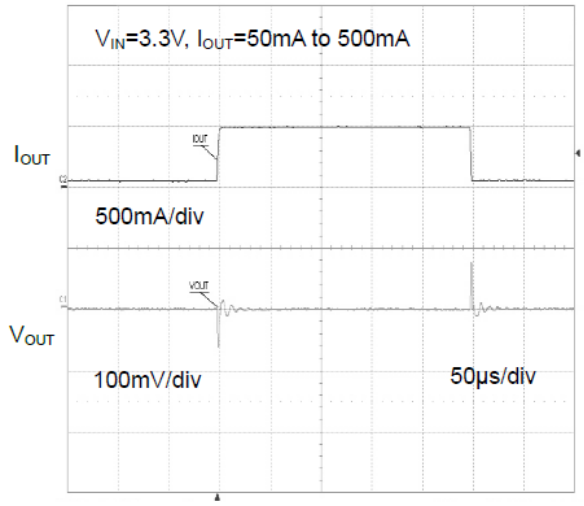
Noise



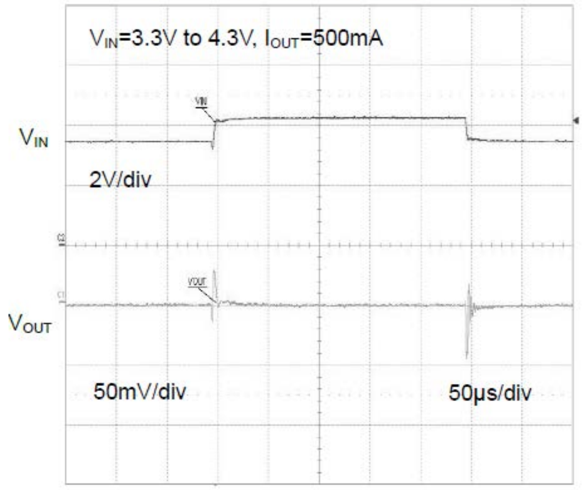
Noise



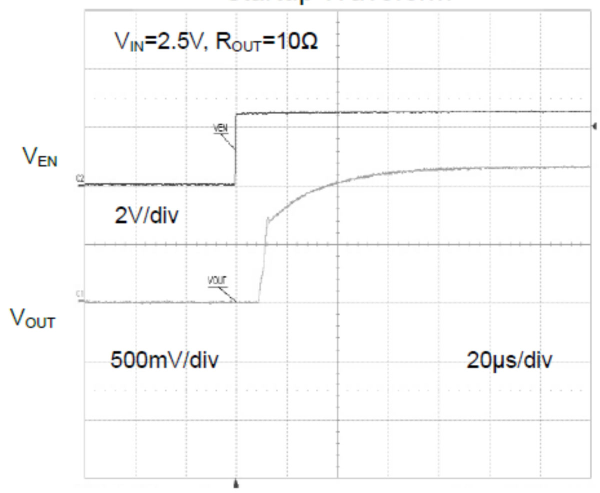
Load Transient Response



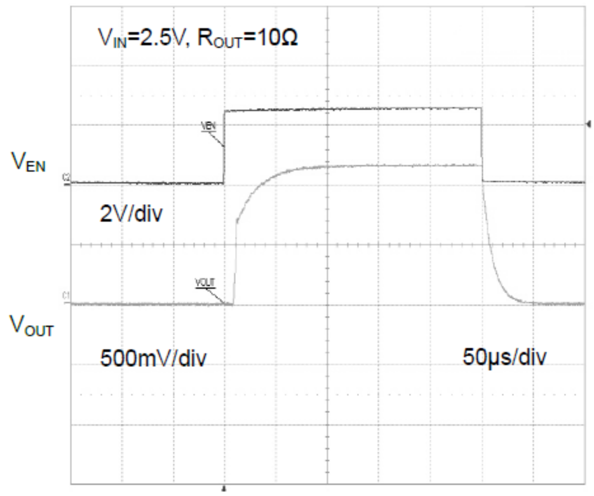
Line Transient Response



Startup Waveform



Shutdown Waveform



Pin Function

$\overline{\text{SHDN}}$: Shutdown, Active Low. This pin is used to put the ACE533J into shutdown. The SHDN pin cannot be left floating and must be tied to the input pin if not used.

GND: Ground and Heat Sink. Solder to a ground plane or large pad to maximize heat dissipation. VIN: Power for ACE533J and Load. Power is supplied to the devices through the VIN pin. The VIN pin should be locally bypassed to ground if the ACE533J series are more than a few inches away from another source of bulk capacitance.

VOUT: Voltage Regulated Output. The VOUT pin supplies power to the load. A minimum output capacitor of 1μF is required to ensure stability. Larger output capacitors may be required for applications with large transient loads to limit peak voltage transients.

NC: Not Connected.

FB: Output voltage feedback. This terminal is used to set the output voltage.

Output Voltage Setting

The output voltage of the ACE533J adjustable regulator is programmed using an external resistor divider as shown in Figure 2. The output voltage is calculated using:

$$V_{OUT} = V_{FB}\left(1 + \frac{R1}{R2}\right)$$

Where: V_{FB}=1.00V (Typ) (the internal reference voltage)

Resistors R1 and R2 should be chosen for approximately 3-5μA divider current. Lower value resistors can be used but offer no inherent advantage and waste more power. Higher values should be avoided, as leakage currents at FB increase the output voltage error. The recommended design procedure is to choose R2=200kΩ to set the divider current at 5μA and then calculate R1 using:

$$R1 = \left(\frac{V_{OUT}}{V_{FB}} - 1\right) \times R2$$

Where: V_{FB}=1.00V (Typ).

Typical Application Circuit

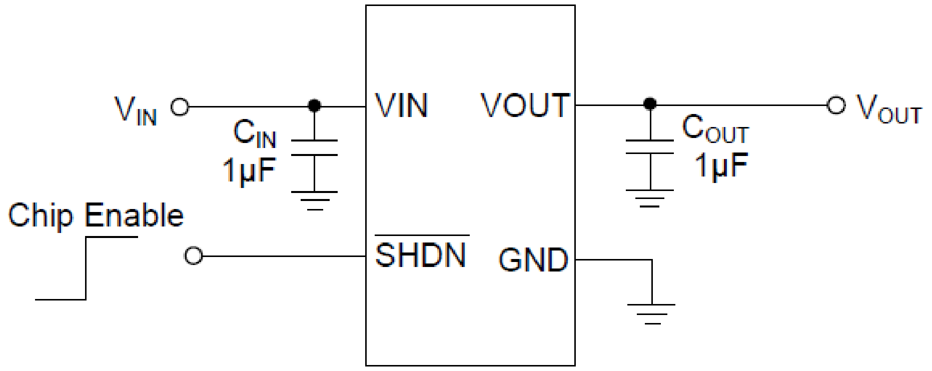


Figure 1. Fixed Output Voltage Application Circuit

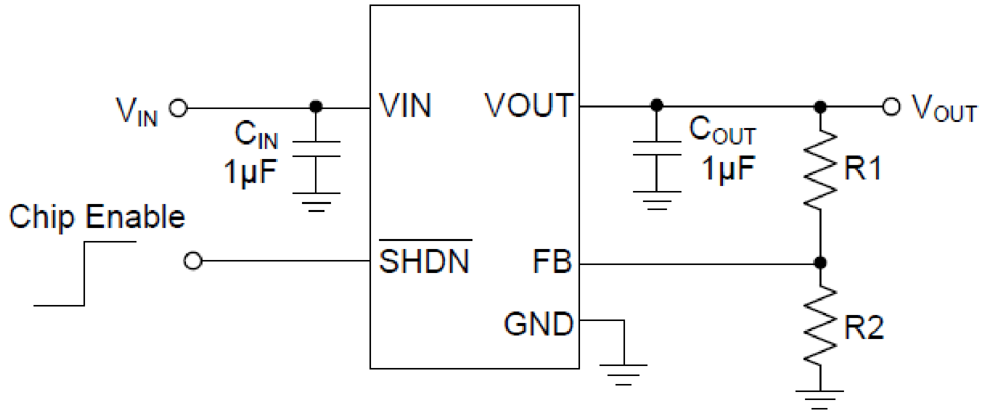
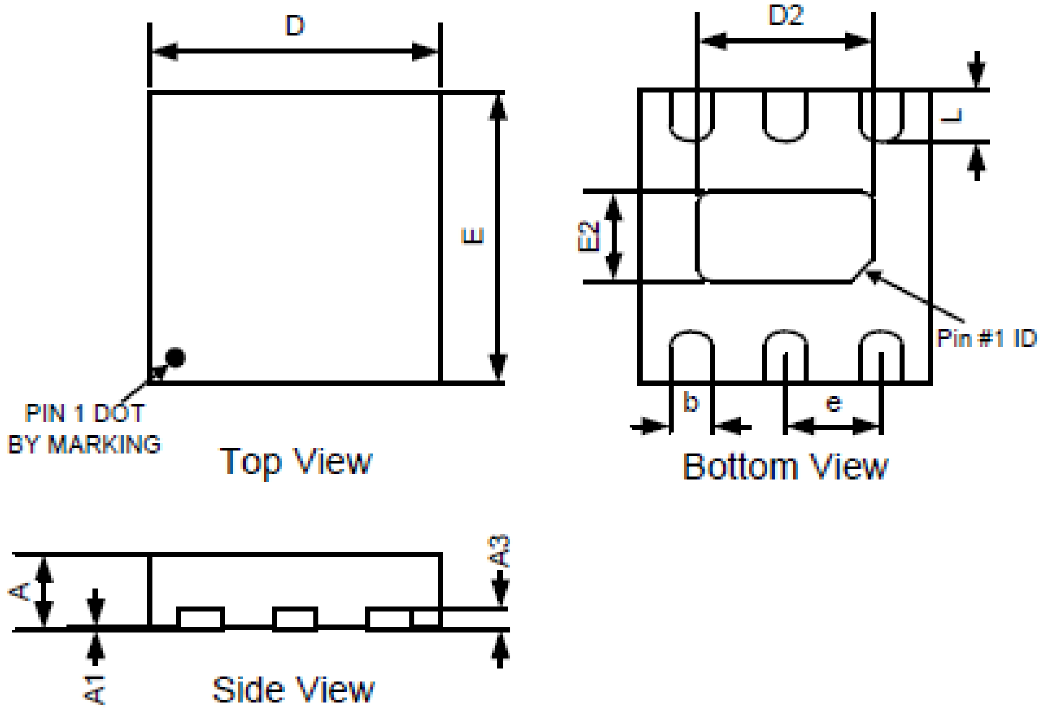


Figure 2. Adjustable Output Voltage Application Circuit

Packing Information

DFN2*2-6L



Symbol	Millimeters			Inches		
	Min	Typ	Max	Min	Typ	Max
A	0.55		0.80	0.022		0.031
A1	0.00		0.05	0.000		0.002
A3	0.20REF			0.008REF		
b	0.25	0.30	0.35	0.010	0.012	0.014
D	1.924	2.00	2.076	0.076	0.079	0.082
D2	1.35		1.75	0.053		0.069
E	1.924	2.00	2.076	0.076	0.079	0.082
E2	0.65		1.06	0.026		0.042
e	0.65BSC			0.026BSC		
L	0.224		0.45	0.009		0.018

Notes

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1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and shoes failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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