Low Dropout, Ultra-Low Noise without Bypass Capacitor 300mA LDO Regulator

General Description

The iD9319 is a high performance, 300mA, low dropout and low noise linear regulator with high ripple rejection ratio. Its quiescent current is as low as 30μA further prolonging the battery life. It has fixed output voltage at 3.3V.

The iD9319 includes a reference voltage source, an error amplifier, driver transistors and an internal current limiter. The current limiter's holdback circuit operates as a short protection.

The iD9319 works well with low ESR ceramic capacitors, suitable for portable RF and wireless battery-powered applications with stringent space requirements and demanding performance. It also offers ultra low noise output and has low quiescent current.

Features

- Ultra-Low-Noise application
- Ultra-fast Response in Line/Load transient
- Wide 2.5V to 5.5V Operating Range
- Current Limiting Protection
- Thermal Shutdown Protection
- Low Dropout : 150mV @ 300mA
- High PSRR 70dB@100Hz,55dB@10kHz
- Auto Discharge

Applications

- Battery-Powered Equipment
- Portable Instruments
- Digital Camera
- WLAN Communication
- Hand-Held Instruments

Ordering Information

iD9319 - □□ □□□ □

Packing
R: Tape and Reel

Package:
C40:SC-82
A30:SOT-23-3
A50:SOT-23-5
FA4:UDFN-4

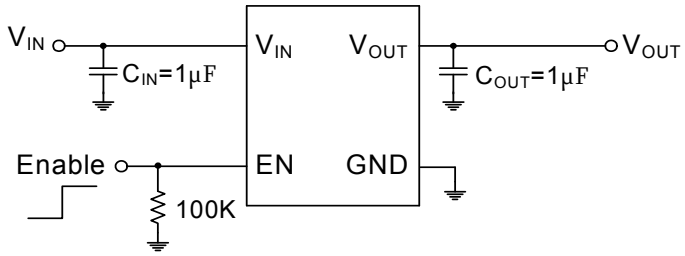
Output Voltage	Voltage Code
3.3	33

Other voltage outputs may be available. For further details, please contact an iDesyn sales or distributor.

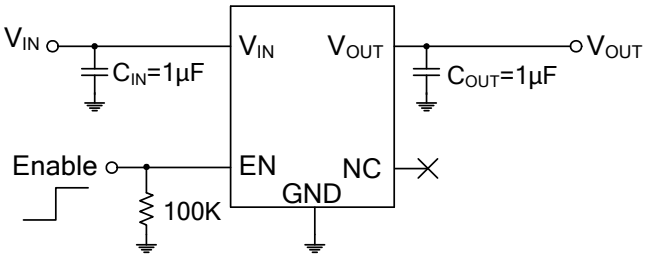
Marking Information

For marking information, please contact our sales representative directly or through distributor around your location.

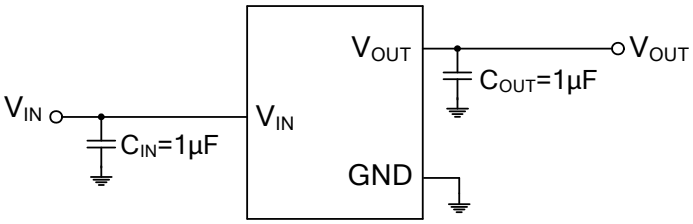
Typical Application Circuit



SC-82 / UDFN-4 PACKAGE



SOT-23-5 PACKAGE



SOT-23-3 PACKAGE

Absolute Maximum Ratings

Supply Voltage V_{IN}	6.0V
Power Dissipation, P_D @ T_A=25˚C	
SC-82	300mW
SOT-23-3 / SOT-23-5	400 mW
UDFN-4	400 mW
Ambient Operating Temperature	-40˚C to 85˚C
Thermal Resistance, θja	
SC-82	333˚C/W
SOT-23-3 / SOT-23-5	250˚C/W
UDFN-4	250˚C/W
Lead Temperature	260 ˚C
Storage Temperature	-65˚C to 150˚C
ESD Susceptibility	
HBM (Human Body Mode)	2kV
MM (Machine Mode)	200V

Recommended Operating Conditions

Input Voltage V_{IN}	2.5V to 5.5V
EN Input Voltage	0V to 5.5V
Junction Temperature	-40˚C to 125˚C

Electrical Characteristics (Unless otherwise specified $V_{IN}=V_{OUT}+V_{DROP}$, $T_A=25^{\circ}C$)

Parameters		Symbol	Condition	Min	Typ	Max	Units
Operating Voltage Range (Note 2)		V_{IN}		2.5		5.5	V
Supply Current Limit		I_{Limit}	R_{LOAD} = 1Ω		800		mA
Quiescent Current		I_Q	EN pull high, I_{OUT} = 0mA		30	50	μA
Shutdown Current		I_{SHDN}	EN pull Low, Shutdown		0.01	1	μA
Dropout Voltage (Note 3)		V_{DROP}	I_{OUT} = 300mA | V_{OUT} = 3.3V		150	200	mV
EN input Bias Current		I_{IBSD}	V_{EN} = GND or V_{IN}		0	100	nA
Line Regulation		ΔV_{LINE}	V_{IN} = (V_{OUT} +V_{DROP}) to 5.5V, I_{OUT} = 1mA			10	mV/V
Load Regulation		ΔV_{LOAD}	1mA < I_{OUT} < 300mA		25	50	mV
Fast Discharge N-MOSFET Turn On Resistance		$R_{DISCHARGE}$	V_{IN} = 4V, V_{EN} = 0V		35		Ω
Output Noise Voltage		eNO	10Hz to 100kHz, I_{OUT} = 1mA, C_{OUT} = 1μF		100		μV_{RMS}
Thermal Shutdown Temperature		T_{SD}			165		°C
Thermal Shutdown Temperature Hysteresis		ΔT_{SD}			30		°C
Output Voltage Accuracy		ΔV_{OUT}	I_{OUT} =1mA	-2		+2	%
EN Threshold	Logic-Low V	V_{IL}	V_{IN} = 2.5V to 5.5V,Shutdown			0.4	V
	Logic-High V	V_{IH}	V_{IN} = 2.5V to 5.5V,Start-Up	1.2			
Power Supply Rejection Rate	f = 100Hz	PSRR	C_{OUT} = 1μF, I_{OUT} = 10mA		-70		dB
	f = 10kHz				-55		

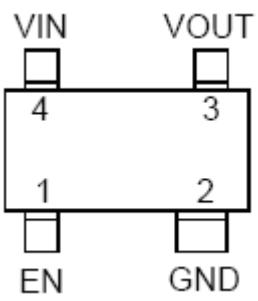
Note 1: Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

Note 2: $V_{IN(MIN)}=V_{OUT}+V_{DROPOUT}$

Note 3: The dropout voltage is defined as (V_{IN}-V_{OUT}) when V_{OUT} is 100mV below the target value of V_{OUT}.

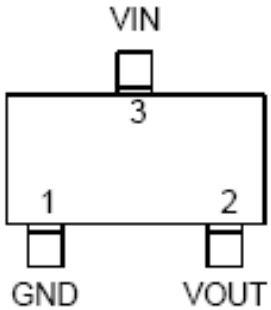
Pin Configurations

(Top View)



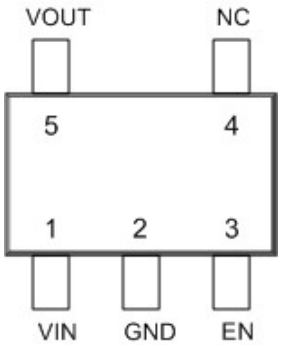
SC-82

(Top View)



SOT-23-3

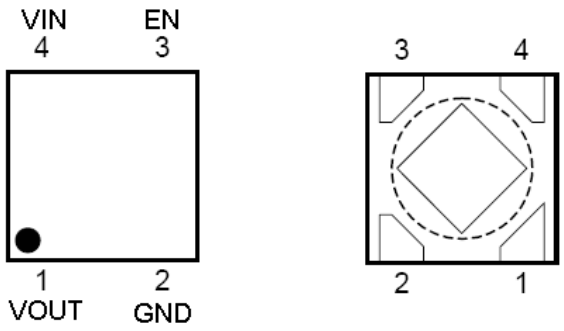
(Top View)



SOT-23-5

Pin Configurations (Cont.)

(Top View) (Bottom View)

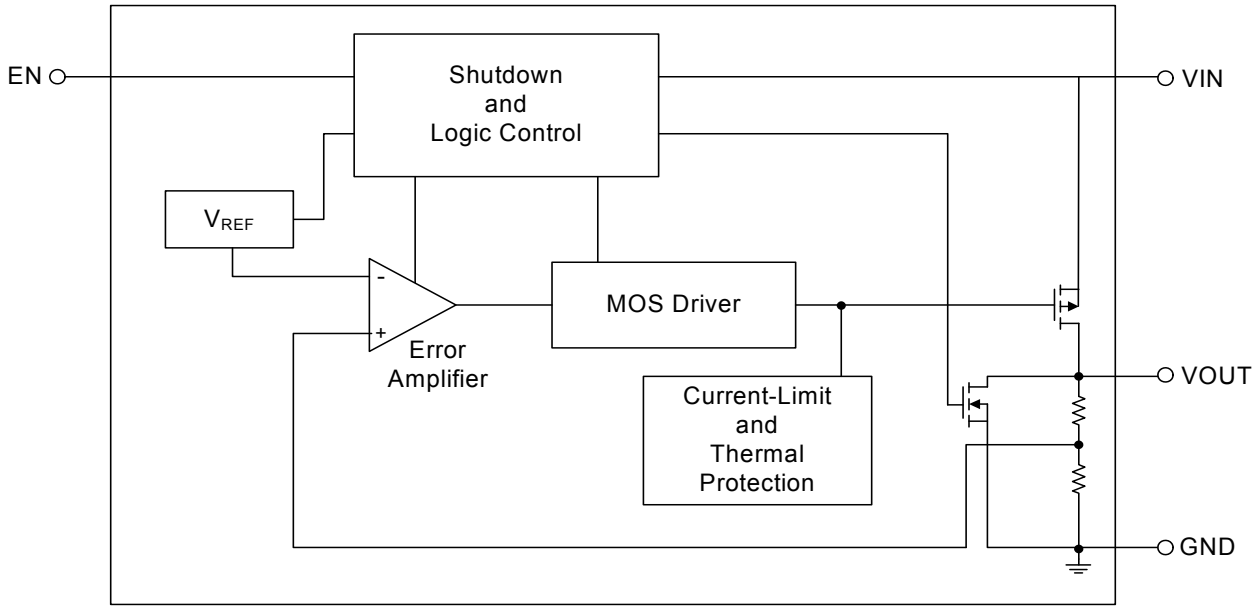


UDFN-4 UDFN-4

Pin Description

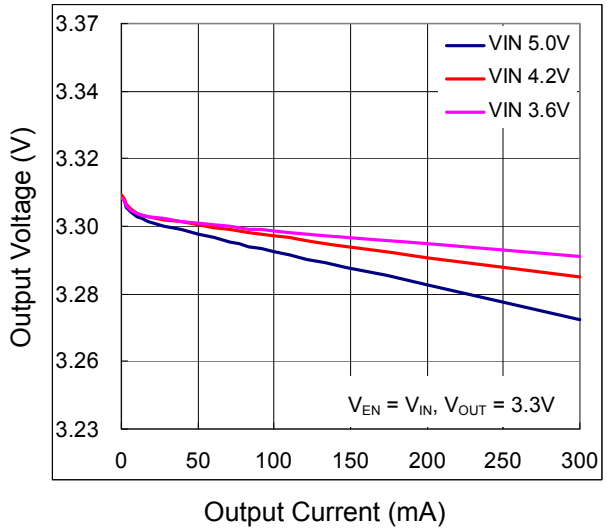
Pin Name	Pin Function
EN	Chip Enable (Active High). Note that this pin is high impedance. There should be a pull low 100kΩ resistor connected to GND when the control signal is floating.
GND	Ground
VOUT	Output Voltage
VIN	Input Voltage

Function Block Diagram

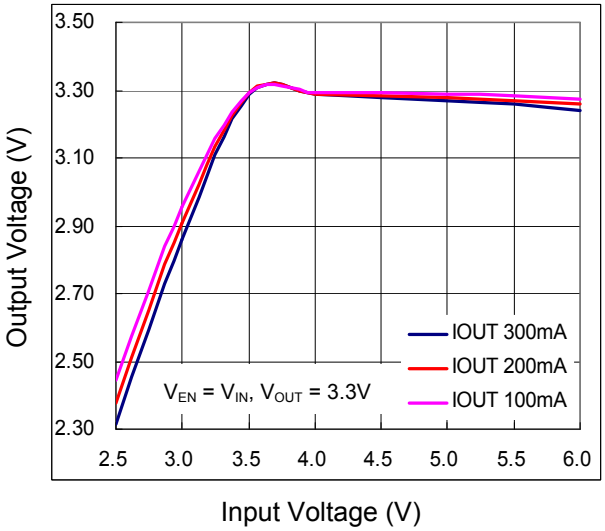


Typical Operating Characteristics

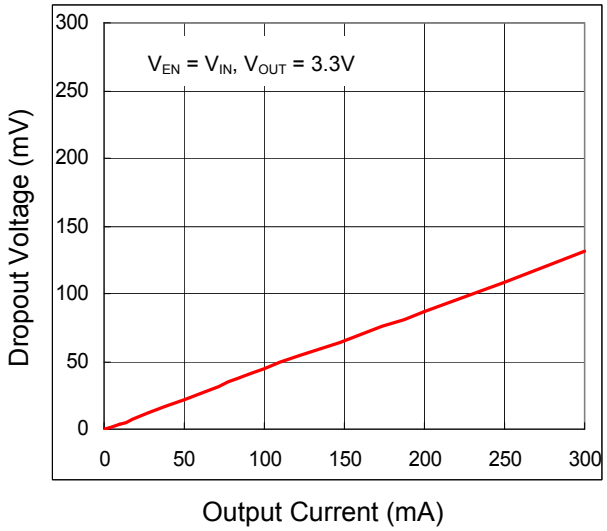
Load Regulation



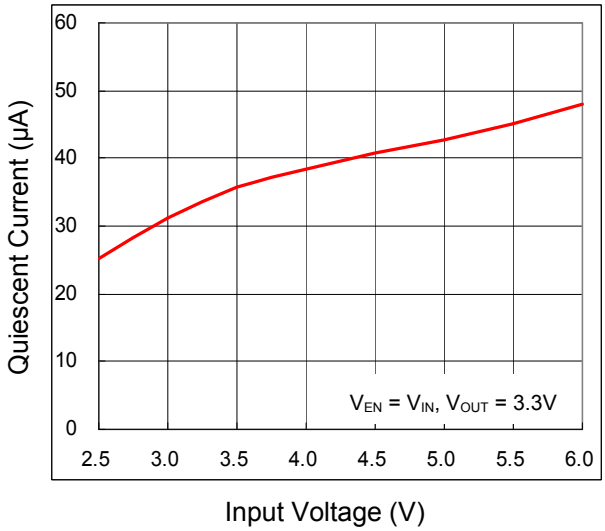
Line Regulation



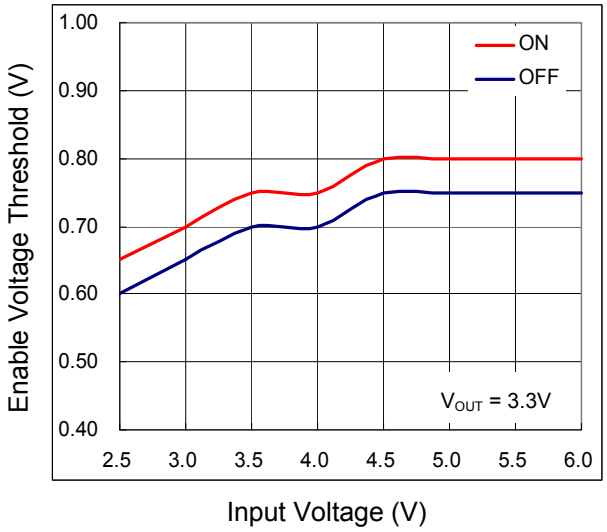
Dropout Voltage



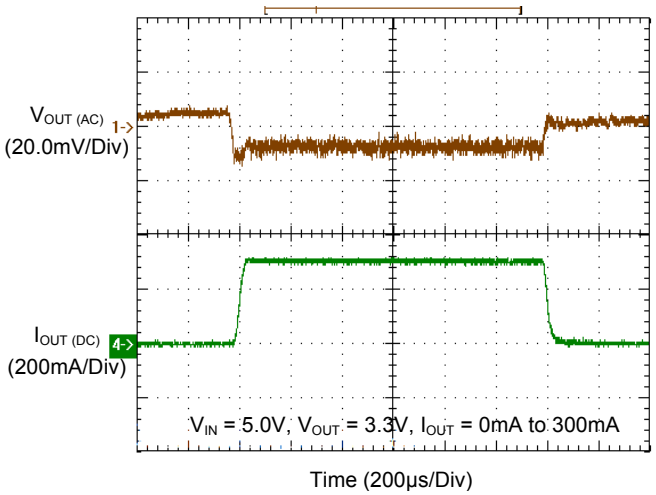
Quiescent Current



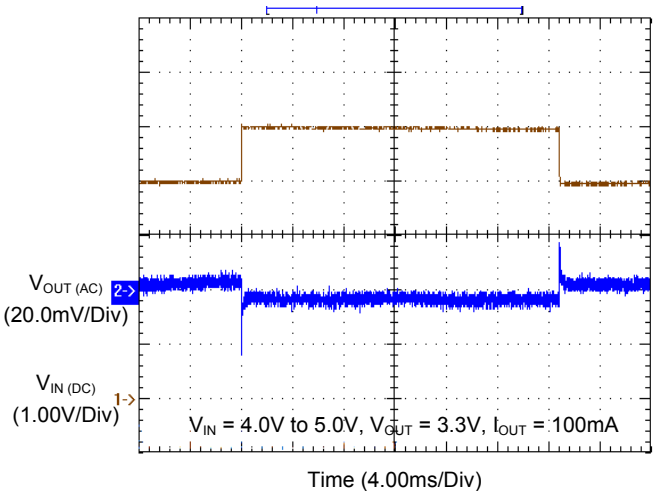
Enable Voltage Threshold



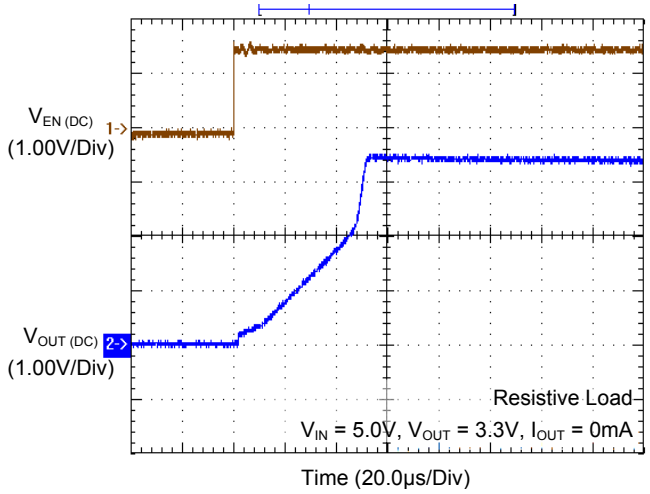
Load Transient Response



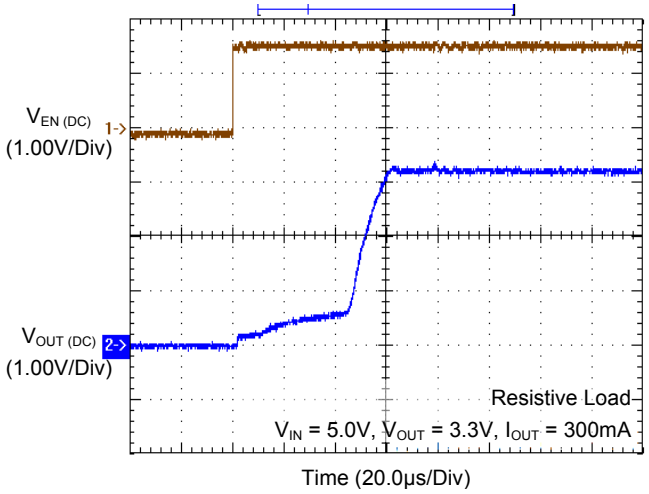
Line Transient Response



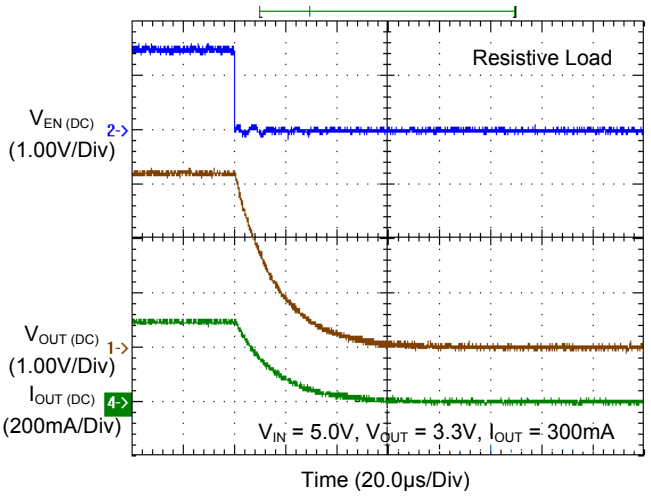
Start-up Test



Start-up Test



Shutdown Response



Application Information

Capacitor Selection and Regulator Stability

Input Capacitor

An input capacitance of 1μF is required between the device input pin and ground directly (the amount of the capacitance may be increased without limit). The input capacitor ***MUST*** be located less than 1 cm from the device to assure input stability. A lower ESR capacitor allows the use of less capacitance, while higher ESR type (like aluminum electrolytic) requires more capacitance. Capacitor types (aluminum, ceramic and tantalum) can be mixed in parallel, but the total equivalent input capacitance/ESR must be defined as above for stable operation. There are no requirements for the ESR on the input capacitor, but tolerance and temperature coefficient must be considered when selecting the capacitor to ensure the capacitance is 1 μF over the entire operating range.

Output Capacitor

The iD9319 is designed specifically to work with very small ceramic output capacitors. The minimum capacitance recommended (temperature characte-ristics of X7R, X5R, Z5U or Y5V) is within the 1μF to 10μF range with 5mΩ to 50mΩ ESR range ceramic capacitor between LDO output and GND for transient stability, but it may be increased without limit. Higher capacitance values help to improve transient response. The output capacitor's ESR is critical because it forms a zero to provide phase lead which is required for loop stability.

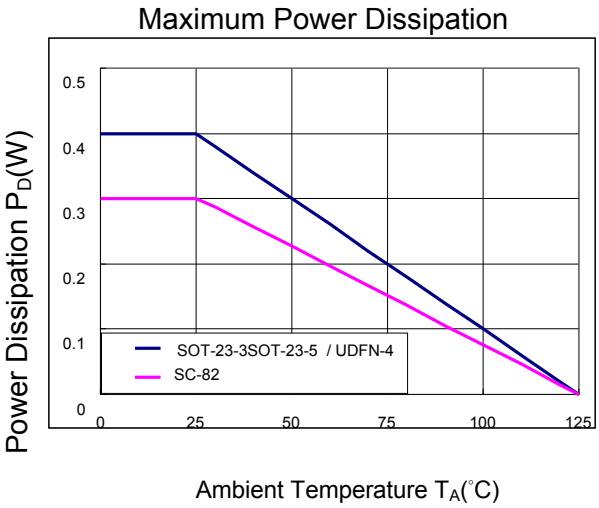
Enable Function

The iD9319 is shut down by pulling the EN pin low, and turned on by driving the input high. If the shutdown feature is not required, the EN pin should be tied to VIN to keep the regulator on at all times (the EN pin ***MUST NOT*** be left floating).To assure proper operation, the signal source used to drive the EN pin must be able to swing above and below the specified turn-on/off voltage thresholds listed in the “Electrical Characteristics” under VIH and VIL. The ON/OFF signal may come from either CMOS output, or an open-collector output with pull-up resistor to the device input voltage or another logic supply. The high-level voltage may exceed the device input voltage, but must remain within the absolute maximum ratings for the EN pin.

Operating Region and Power Dissipation

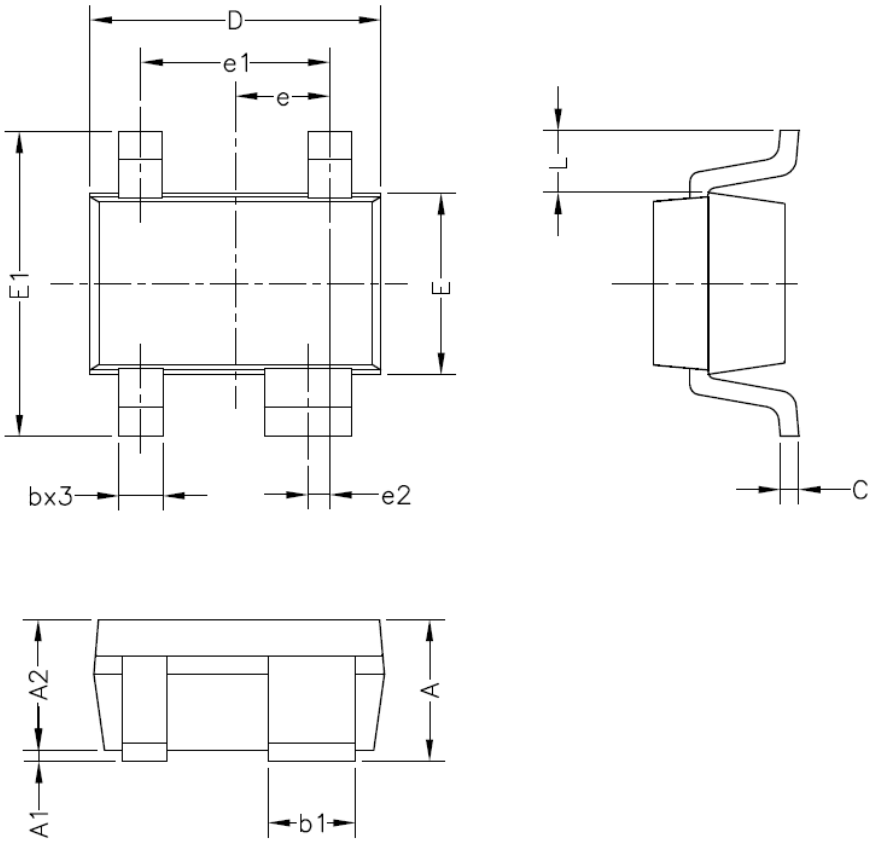
Since the iD9319 is a linear regulator, its power dissipation is always given by $P = I_{OUT} (V_{IN} – V_{OUT})$. The maximum power dissipation is given by: $P_{D(MAX)} = (T_J–T_A) /\theta_{JA}=(125°C -25°C)/333°C /W = 300mW$ Where $(T_J–T_A)$ is the temperature difference the iD9319 die and the ambient air, θ_{JA} is the thermal resistance of the chosen package to the ambient air. For surface mount device, heat sinking is accomplished by using the heat spreading capabilities of the PC board and its copper traces. In the case of a SC-82 package, the thermal resistance is typically 333°C /Watt. Refer to below figure for maximum power dissipation information of SC-82.

The die attachment area of the iD9319 lead frame is connected to pin 2, which is the GND pin. Therefore, the GND pin of iD9319 can dissipate the heat from the die very effectively. To improve the maximum power providing capability, connect the GND pin to ground using a large ground plane near the GND pin.



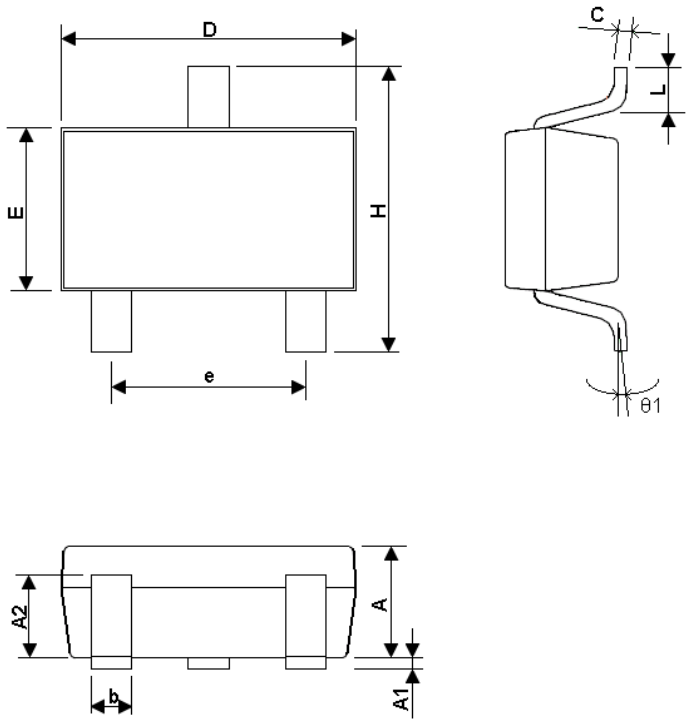
Packaging

SC-82



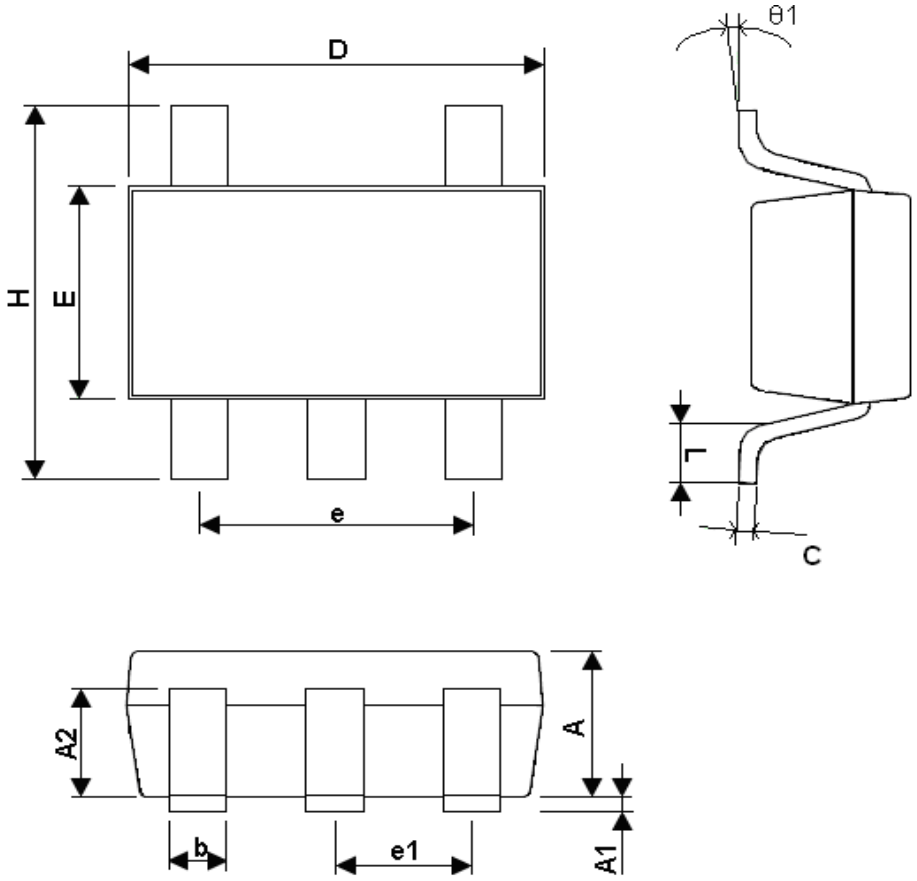
SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.85	---	1.05	0.033	---	0.041
A1	0.00	---	0.10	0.000	---	0.004
A2	0.85	---	0.95	0.033	---	0.037
b	0.20	---	0.40	0.008	---	0.016
b1	0.50		0.70	0.020		0.028
C	0.10	---	0.15	0.004	---	0.006
D	1.90	---	2.10	0.075	---	0.083
E	1.15	---	1.35	0.045	---	0.053
E1	2.00	---	2.30	0.080	---	0.091
e	0.65 BSC.			0.026 BSC.		
e1	1.30 BSC.			0.052 BSC.		
e2	0.15 BSC.			0.006 BSC.		
L	0.425 REF.			0.017 REF.		

SOT-23-3



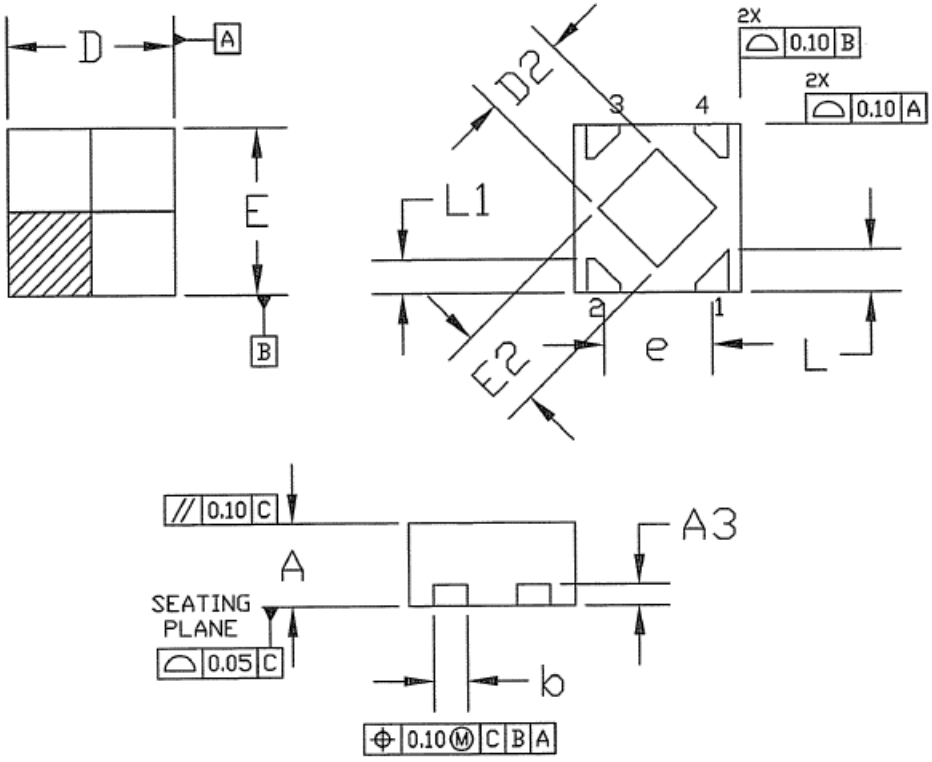
SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.00	1.10	1.30	0.039	0.043	0.051
A1	0.00	---	0.10	0.000	---	0.004
A2	0.70	0.80	0.90	0.027	0.031	0.035
b	0.35	0.40	0.50	0.013	0.016	0.020
C	0.10	0.15	0.25	0.004	0.006	0.001
D	2.70	2.90	3.10	0.106	0.114	0.122
E	1.40	1.60	1.80	0.055	0.063	0.071
e	---	1.90(TYP)	---	---	0.075	---
H	2.60	2.80	3.00	0.102	0.110	0.118
L	0.370	---	---	0.015	---	---
Θ1	1°	5°	9°	1°	5°	9°

SOT-23-5



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.00	1.10	1.30	0.039	0.043	0.051
A1	0.00	---	0.10	0.000	---	0.004
A2	0.70	0.80	0.90	0.027	0.031	0.035
b	0.35	0.40	0.50	0.013	0.016	0.020
C	0.10	0.15	0.25	0.004	0.006	0.001
D	2.70	2.90	3.10	0.106	0.114	0.122
E	1.50	1.60	1.80	0.059	0.063	0.071
e	---	1.90(TYP)	---	---	0.075	---
H	2.60	2.80	3.00	0.102	0.110	0.118
L	0.370	---	---	0.015	---	---
Θ1	1°	5°	9°	1°	5°	9°
e1	---	0.95(TYP)	---	---	0.037	---

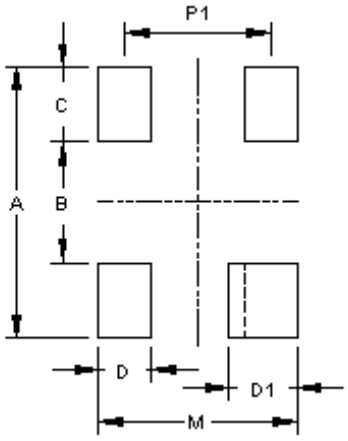
UDFN-4



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.55	0.60	0.65	0.022	0.024	0.026
A3		0.100 REF			0.004 REF	
b	0.15	0.20	0.25	0.006	0.008	0.010
D	0.90	1.00	1.10	0.035	0.039	0.043
D2	0.40	0.50	0.60	0.016	0.020	0.024
E	0.90	1.00	1.10	0.035	0.039	0.043
E2	0.40	0.50	0.60	0.016	0.020	0.024
e		0.65 BSC			0.026 BSC	
L	0.20	0.25	0.30	0.008	0.010	0.012
L1	0.15	0.20	0.25	0.006	0.008	0.010

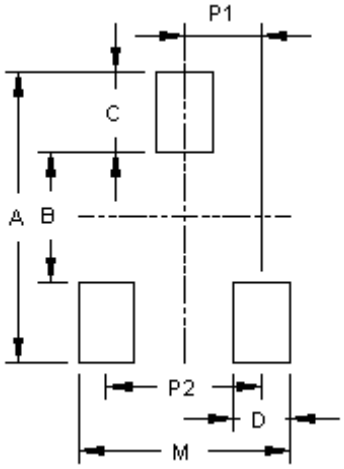
Footprints

SC-82



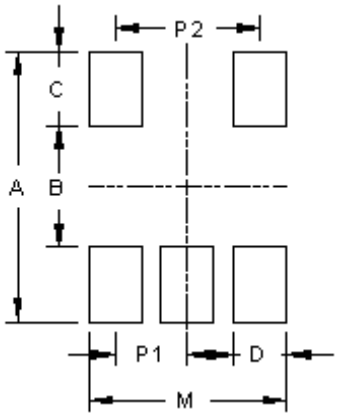
Package	Number of PIN	Footprint Dimension (mm)								Tolerance
		P1	P2	A	B	C	D	D1	M	
SC-82	4	1.30	-	2.70	1.10	0.80	0.60	0.80	1.90	±0.10

SOT-23-3



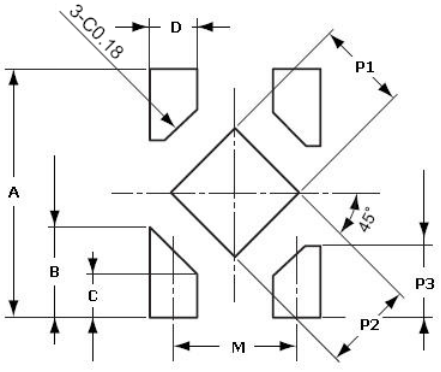
Package	Number of PIN	Footprint Dimension (mm)							Tolerance
		P1	P2	A	B	C	D	M	
SOT-23-3	3	0.95	1.90	3.60	1.60	1.00	0.80	2.70	±0.10

SOT-23-5



Package	Number of Pin	Footprint Dimension (mm)							Tolerance
		P1	P2	A	B	C	D	M	
SOT-23-5	5	0.95	1.90	3.60	1.60	1.00	0.70	2.60	±0.10

UDFN-4



Package	Number of	Footprint Dimension (mm)								Tolerance
	PIN	P1	P2	P3	A	B	C	D	M	
UDFN-4	4	0.48	0.48	0.4	1.3	0.47	0.22	0.25	0.65	±0.10