300mA Ultra-Fast Output Voltage LDO Regulator

General Description

The iD9305 is a 300mA with fixed output voltage options ranging from 1.05V to 1.4V, low dropout and low noise linear regulator with high ripple rejection ratio and fast turn-on time.

It 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 circuit protection.

The iD9305 works well with low ESR ceramic capacitors, suitable 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
- Wide 2.5V to 6V Operating Range
- Quick Start-Up
- Four Fixed Voltage Options Available
- Current Limiting Protection
- Thermal Shutdown Protection
- Standby Current Less Than 0.1μA
- Auto Discharge

Applications

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

Ordering Information

iD9305 - □□ □□□□ □

Packing
R: Tape and Reel

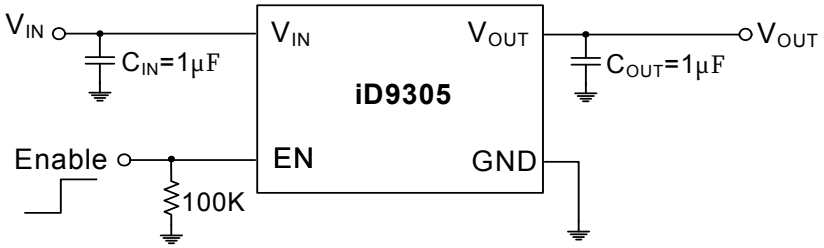
Package
A30:SOT23-3
A50:SOT23-5
C40:SC-82
C50:SC70-5

Output Voltage	Voltage Code
1.1	11
1.2	12
1.3	13
1.4	14

Marking Information

For marking information, contact our sales representative directly or through an iDESYN distributor located in your area, otherwise visit our website for detail.

Typical Application Circuit



Absolute Maximum Ratings

Supply Voltage V_{IN}	6V
Power Dissipation, P_D @ T_A=25°C	
SC70-5 / SC-82	300mW
SOT23-5 / SOT23-3	400mW
Thermal Resistance, θja	
SC70-5 / SC-82	333°C/W
SOT23-5 / SOT23-3	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 6V
EN Input Voltage	0V to 6V
Junction Temperature	-40°C to 125°C
Ambient Operating Temperature	-40°C to 85°C

Electrical Characteristics (Unless otherwise specified V_{IN} = 2.5V, T_A = 25°C)

Parameters		Symbol	Condition	Min	Typ	Max	Units
Output Voltage Accuracy		ΔV_{OUT}	I_{OUT} =1mA	-30		+30	mV
Standby Current		I_{SBY}	V_{EN} = GND, Shutdown		0.01	1	μA
Supply Current Limit		I_{Limit}	R_{LOAD} = 1Ω	400	800		mA
Quiescent Current		I_Q	$V_{EN} \geqq$ 1.2V, I_{OUT} = 0mA		80	120	μA
EN Input Bias Current		I_{IBSD}	V_{EN} = GND or V_{IN}		0	100	nA
Dropout Voltage (Note 2)		V_{DROP}	V_{OUT} = 1.2V, I_{OUT} = 150mA		700	900	mV
Operating Voltage Range		V_{IN}		2.5	--	6	V
Line Regulation		ΔV_{LINE}	V_{IN} = 2.5V to 6V I_{OUT} = 1mA			6	mV/V
Load Regulation		ΔV_{LOAD}	1mA < I_{OUT} < 300mA		10	35	mV
Output Noise Voltage		eNO	10Hz to 100KHz, I_{OUT} = 200mA, C_{OUT} = 1μF			100	μV_{RMS}
Fast Discharge N-MOSFET Turn On Resistance		$R_{DISCHARGE}$	V_{IN} = 4V, V_{EN} = 0V		35		Ω
Thermal Shutdown Temperature		T_{SD}			165		°C
Thermal Shutdown Temperature Hysteresis		ΔT_{SD}			30		°C
EN Threshold	Logic-Low V	V_{IL}	V_{IN} = 2.5V to 6V, Shutdown			0.4	V
	Logic-High V	V_{IH}	V_{IN} = 2.5V to 6V, Start-Up	1.6			
Power Supply Rejection Rate	f = 100Hz	PSRR	C_{OUT} = 1μF, I_{OUT} = 10mA		-55		dB

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

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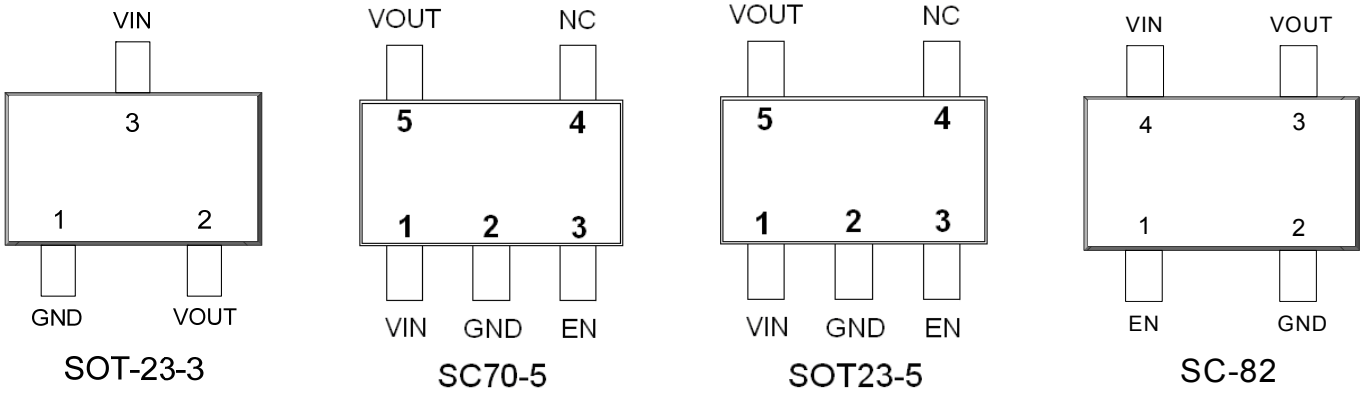
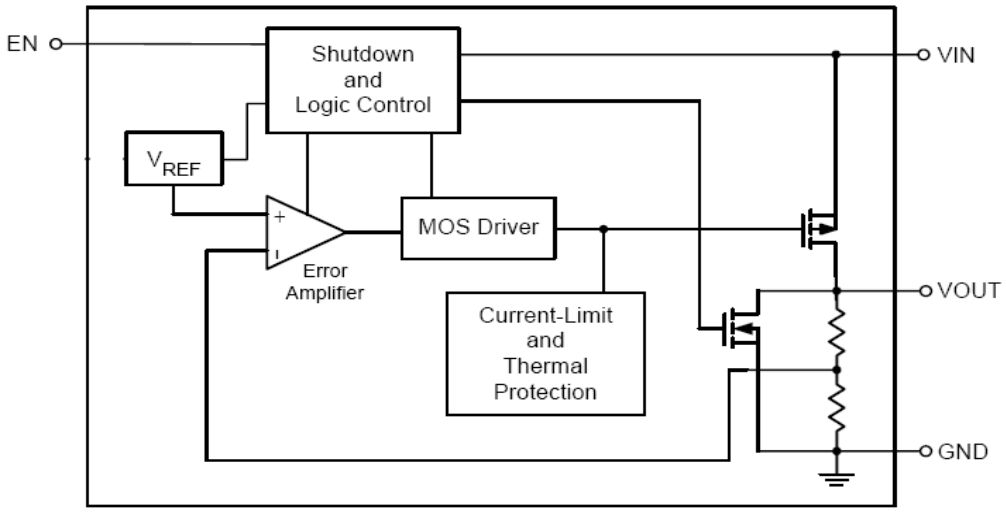
Pin Configurations (Top View)



Description

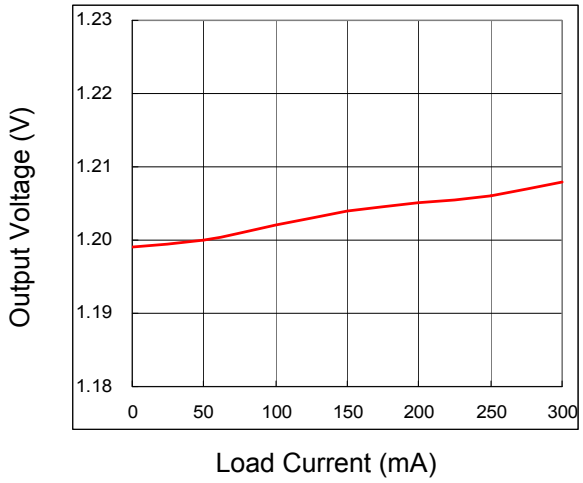
Pin Name	Pin Function
EN	Chip Enable (Active High). Note that this pin is high impedance. There should be a pull low 100kΩ resistor connected to GND when the control signal is floating.
GND	Ground
VOUT	Output Voltage
VIN	Input Voltage

Function Block Diagram

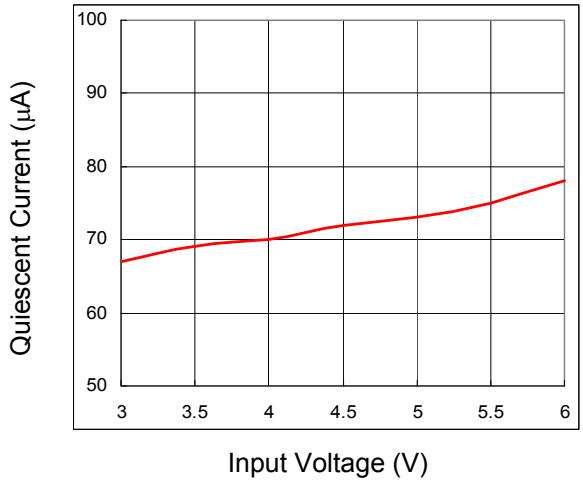


Typical Operating Characteristics

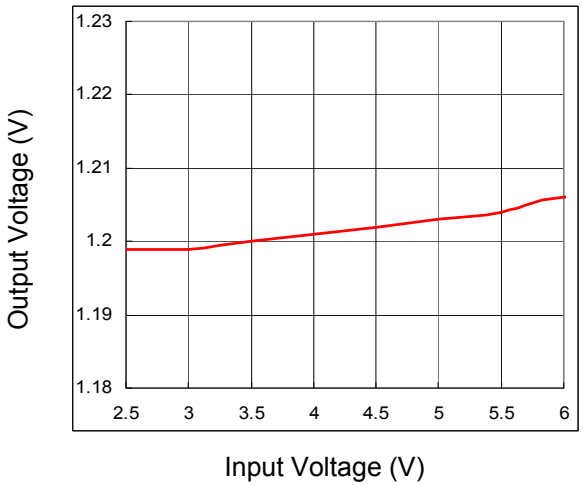
Load Regulation



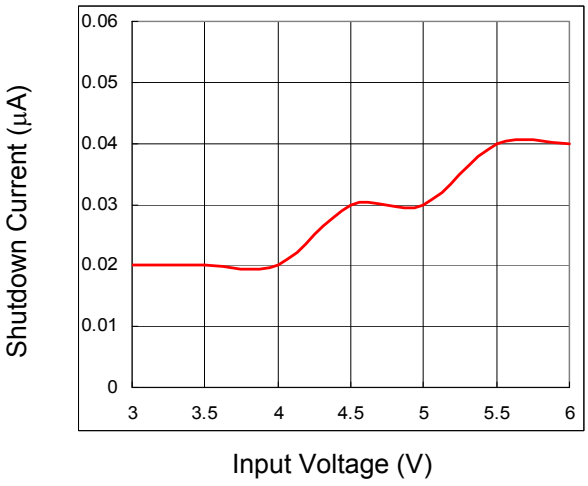
Quiescent Current vs. Input Voltage



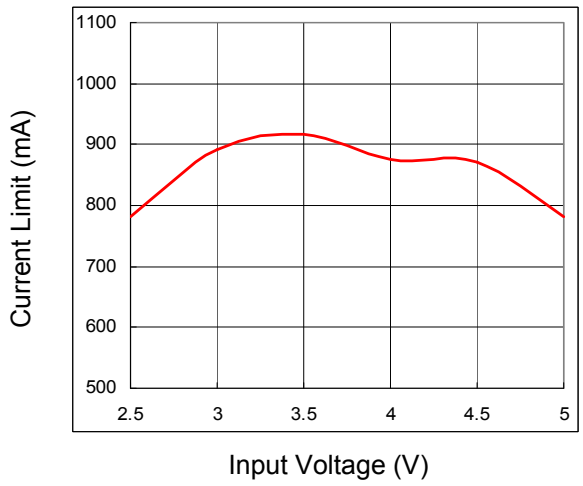
Line Regulation



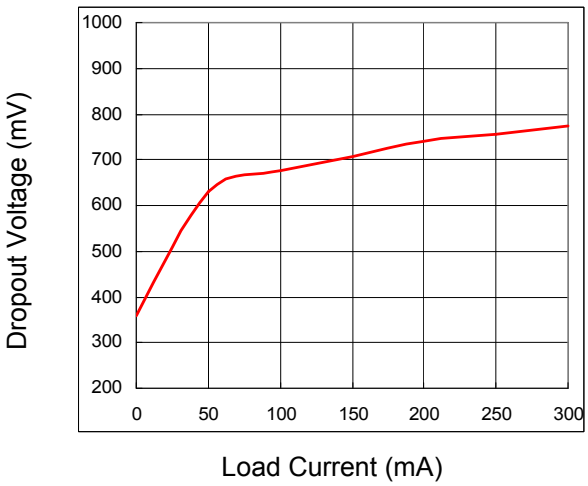
Shutdown Current vs. Input Voltage



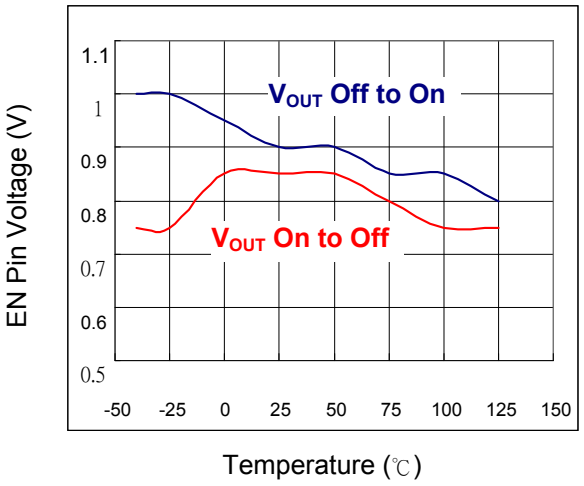
Current Limit vs. Input Voltage



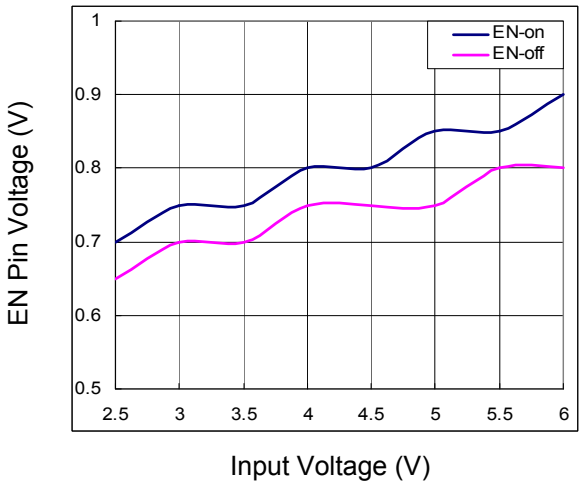
Dropout Voltage vs. Load Current



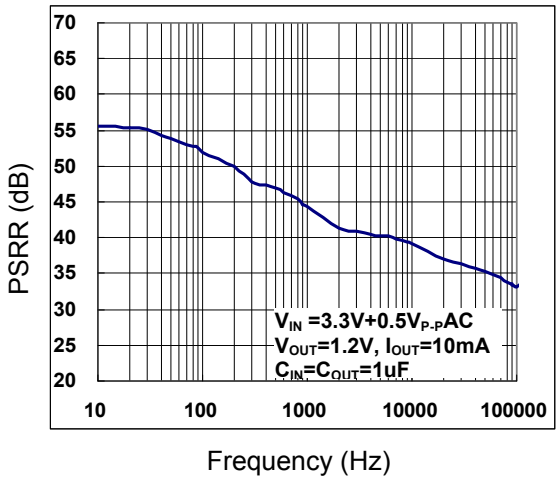
Enable Threshold vs. Temperature



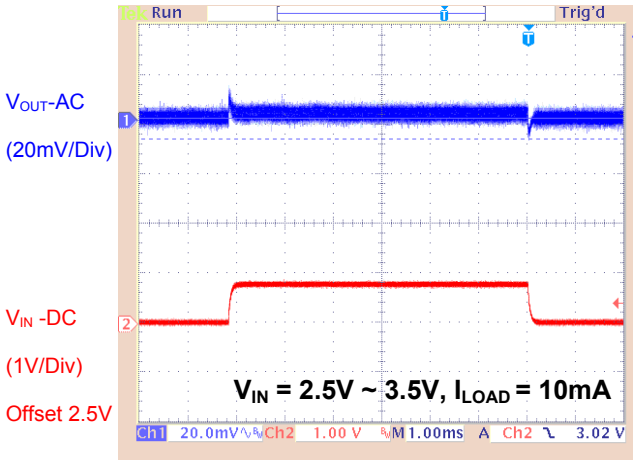
Enable Threshold vs. Input Voltage



PSRR

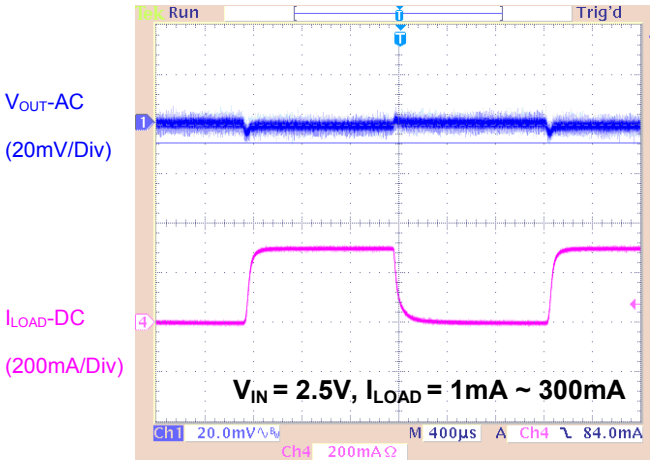


Line Transient Response



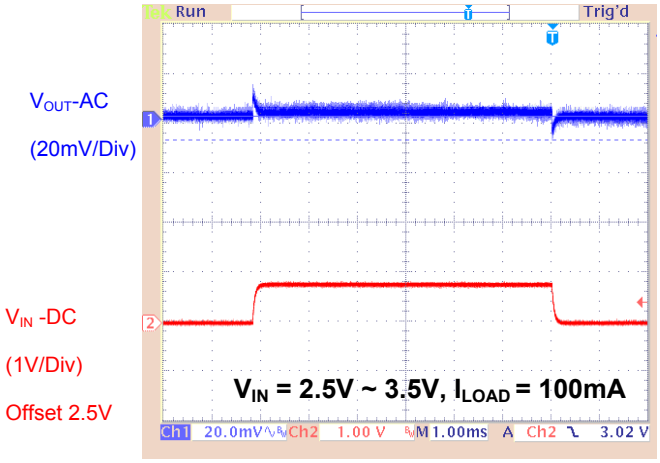
Time (1ms/Div)

Load Transient Response



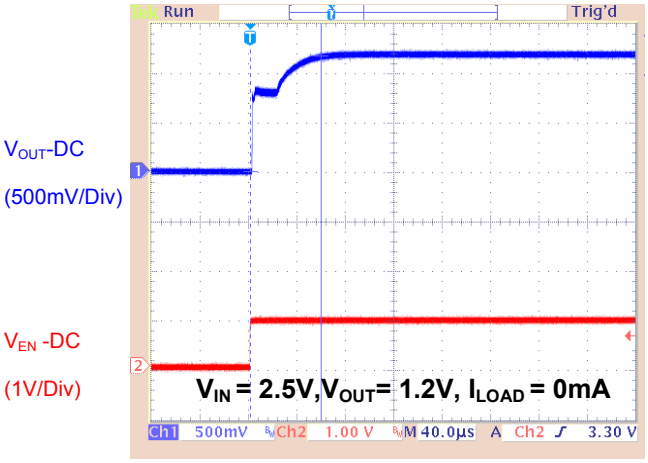
Time (400µs/Div)

Line Transient Response



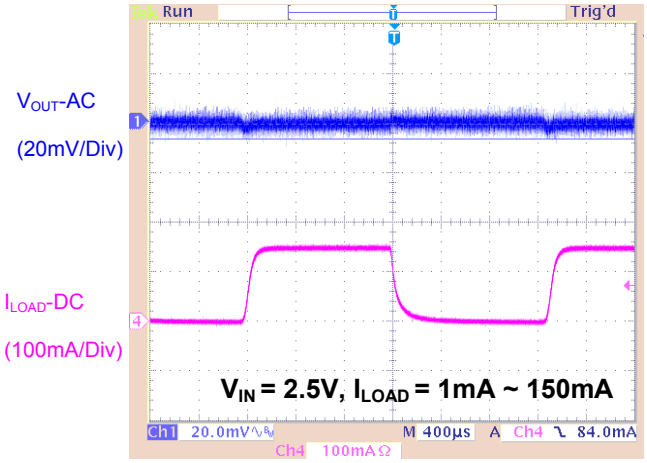
Time (1ms/Div)

Start Up Response



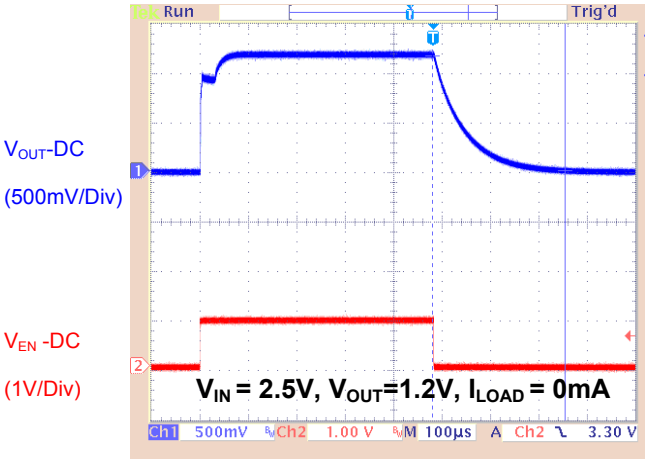
Time (40µs/Div)

Load Transient Response



Time (400µs/Div)

Shutdown Response



Time (100µs/Div)

Application Information

Capacitor Selection and Regulator Stability

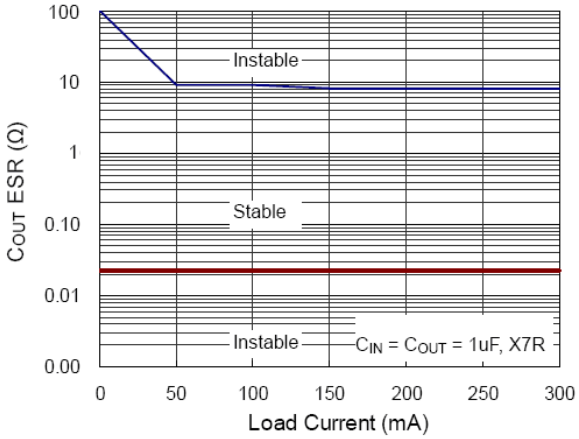
Input Capacitor

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 (see PCB Layout Section). 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

Like any low-dropout regulator, the external capacitors used with the iD9305 must be carefully selected for regulator stability and performance. Use a capacitor whose value is > 1μF on the iD9305 input, however the amount of capacitance can be increased without limit. The input capacitor must be located a distance of not more than 0.5 inch of from the input pin of the IC and returned to a clean analog ground. Any good quality ceramic or tantalum can be used for this capacitor. Capacitor with larger value and lower ESR (equivalent series resistance) provides better PSRR and line-transient response. The output capacitor must meet both requirements for minimum amount of capacitance and ESR in all LDOs application. The iD9305 is designed specifically to work with low ESR ceramic output capacitors in space-saving and performance consideration. Using a ceramic capacitor whose value is at least 1μF with ESR is > 25mΩ on the iD9305 output ensures stability. The iD9305 still works well with output capacitors of other types due to the wide stable ESR range. Figure 1 shows the curves of allowable ESR range as a function of load current for various output capacitor values. Output capacitors of larger capacitance can reduce noise and improve load transient response, stability and PSRR. The output capacitor should be located not more than 0.5 inches from the V_{OUT} pin of the iD9305 and returned to a clean analog ground.

Figure 1. Region of Stable C_{OUT} ESR vs. Load Current



Enable Function

The iD9305 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 V_{IH} and V_{IL}. 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 iD9305 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: $P_{D(MAX)} = (T_J – T_A) / \theta_{JA} = (125^{\circ}C - 25^{\circ}C)/250^{\circ}C/W = 400mW$ where $(T_J – T_A)$ is the temperature difference the iD9305 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 SOT23-5 package, the thermal resistance is typically 250°C/Watt. Refer to Figure 2 & 3 for the iD9305 valid operating region (Safe Operating Area) and refer to Figure 4 for maximum power dissipation information of SOT23-5.

The die attachment area of the iD9305 lead frame is connected to pin 2, which is the GND pin. Therefore, the GND pin of iD9305 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.

Safe Operation Area of I_{OUT}=300mA
[Power Dissipation Limit]

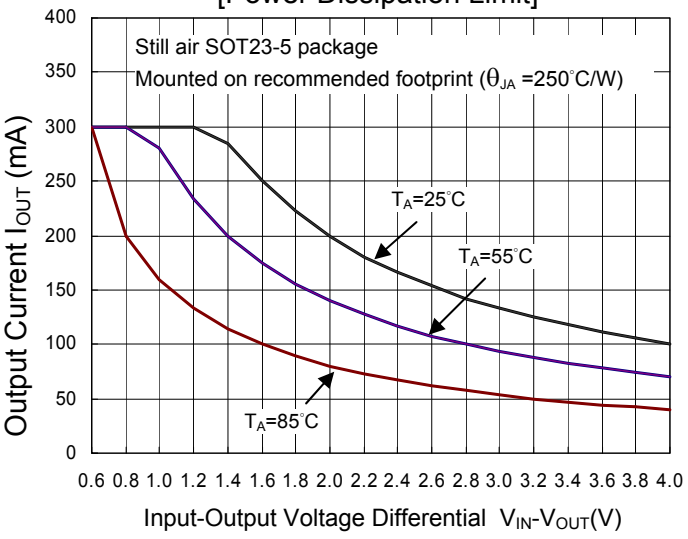


Fig 3

Safe Operation Area of I_{OUT}=150mA
[Power Dissipation Limit]

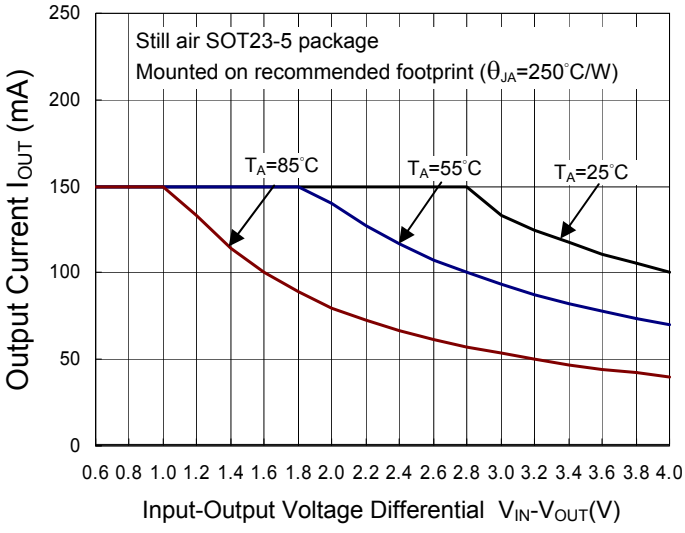


Fig 2

Maximum Power Dissipation

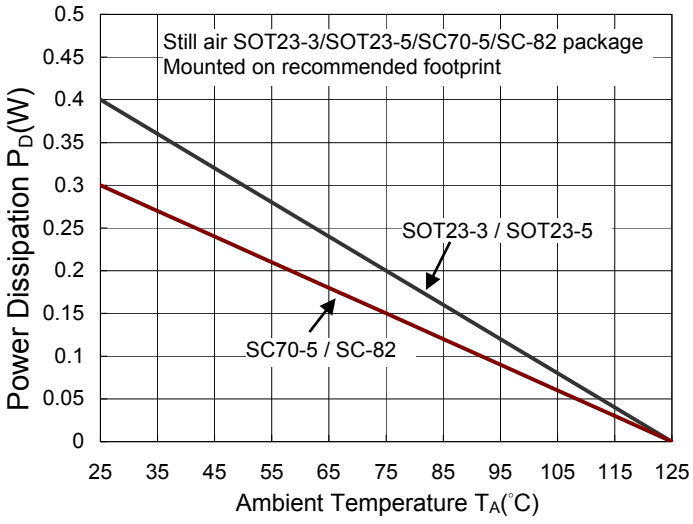
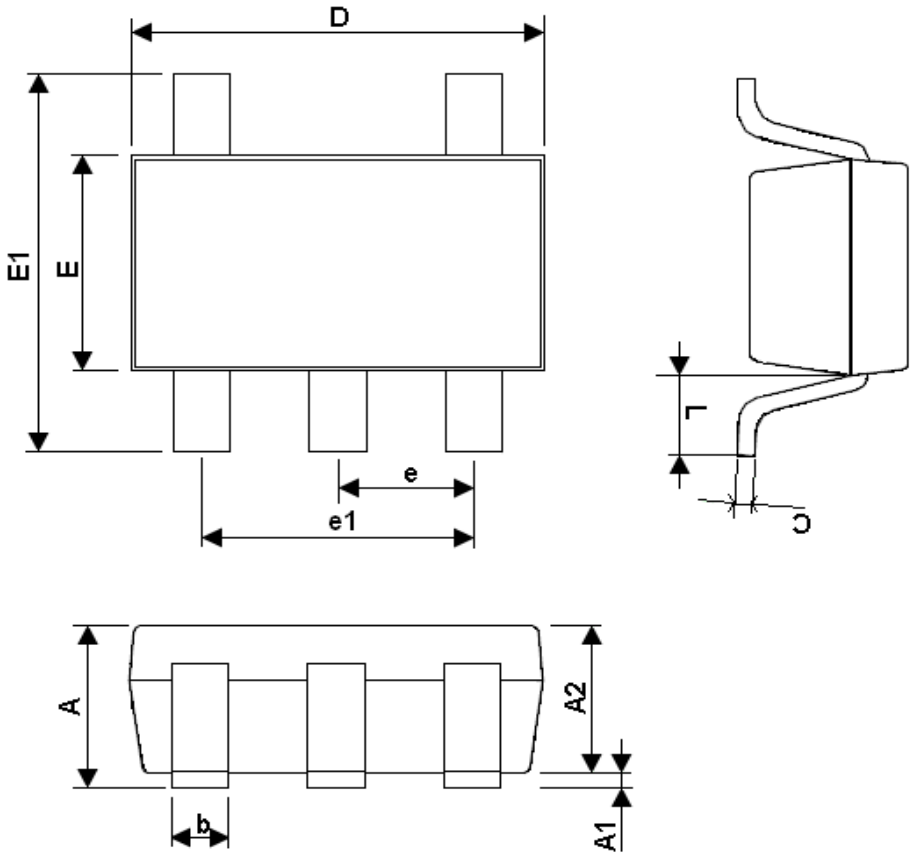


Fig 4

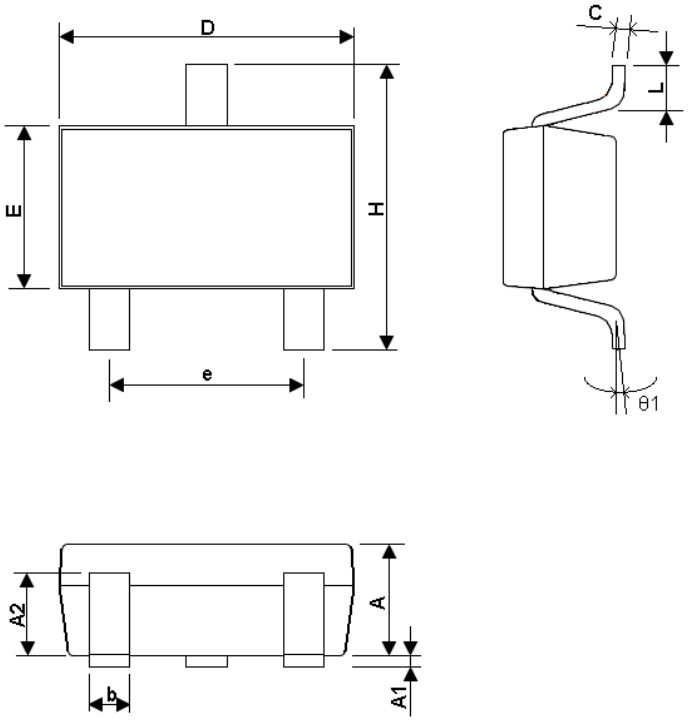
Packaging

SC70-5



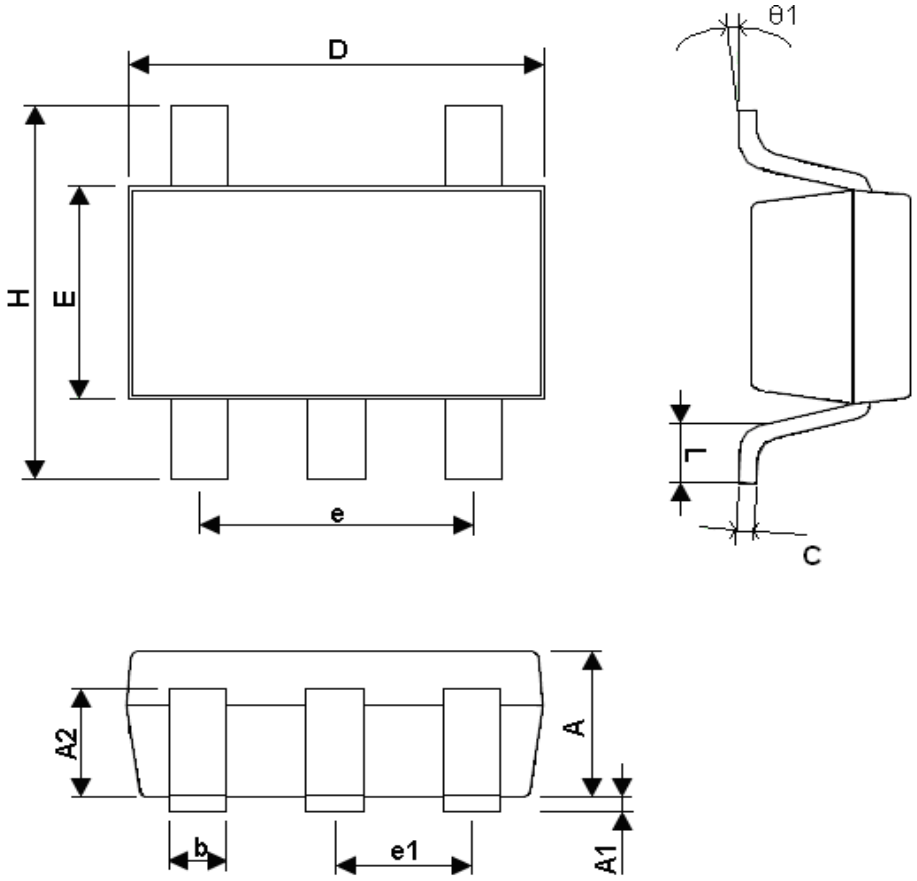
SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.90	---	1.10	0.036	---	0.044
A1	0.025	---	0.10	0.001	---	0.004
A2	0.875	---	1.00	0.035	---	0.040
b	0.20	---	0.40	0.008	---	0.016
C	0.10	---	0.15	0.004	---	0.006
D	1.90	---	2.10	0.076	---	0.084
E	1.15	---	1.35	0.046	---	0.054
E1	2.00	---	2.20	0.080	---	0.088
e	0.65 BSC.			0.026 BSC.		
e1	1.30 BSC.			0.052 BSC.		
L	0.425 REF.			0.017 REF.		

SOT23-3



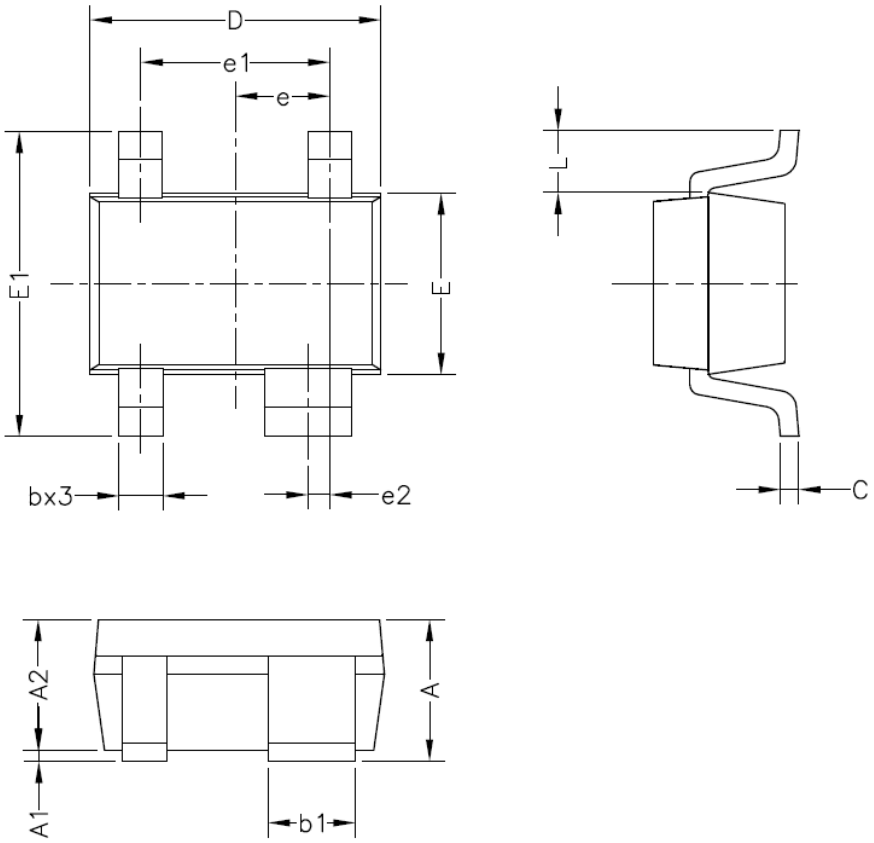
SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.00	1.10	1.30	0.039	0.043	0.051
A1	0.00	---	0.10	0.000	---	0.004
A2	0.70	0.80	0.90	0.027	0.031	0.035
b	0.35	0.40	0.50	0.013	0.016	0.020
C	0.10	0.15	0.25	0.004	0.006	0.001
D	2.70	2.90	3.10	0.106	0.114	0.122
E	1.40	1.60	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°

SOT23-5



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	---

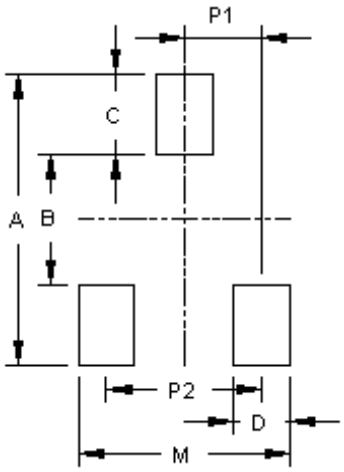
SC-82



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	0.5		0.7	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.		

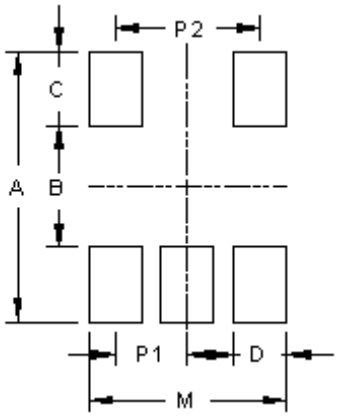
Footprints

SOT23-3



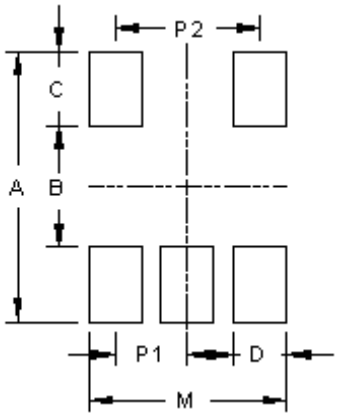
Package	Number of Pin	Footprint Dimension (mm)							Tolerance
		P1	P2	A	B	C	D	M	
SOT-23-3	3	0.95	1.90	3.60	1.60	1.00	0.80	2.70	±0.10

SOT23-5



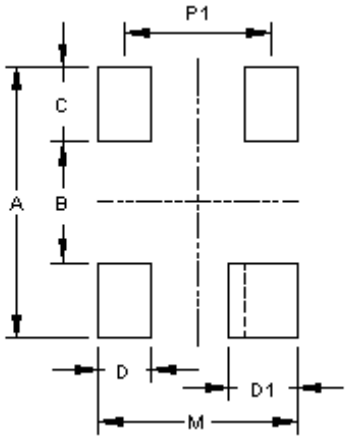
Package	Number of Pin	Footprint Dimension (mm)							Tolerance
		P1	P2	A	B	C	D	M	
SOT-23-5	5	0.95	1.90	3.60	1.60	1.00	0.70	2.60	±0.10

SC70-5



Package	Number of Pin	Footprint Dimension (mm)							Tolerance
		P1	P2	A	B	C	D	M	
SC-70-5	5	0.65	1.30	2.70	1.10	0.80	0.40	1.70	±0.10

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