DESCRIPTION

The A6303D series are highly precise, low noise positive voltage LDO regulators manufactured using CMOS processes. The A6303D achieves high ripple rejection and low dropout and consists of a voltage reference, an error amplifier, a current limiter and a phase compensation circuit plus a driver transistor.

The A603D is also compatible with low ESR ceramic capacitors which give added output stability. This stability can be maintained even during load fluctuations due to the excellent transient response of the series. The current limiter's foldback circuit also operates as a short protect for the output current limiter and the output pin. The EN function enables the output to be turned off, resulting in greatly reduced power consumption.

The A6303D is available in SOT-25, SC-70-5 and DFN4 (1x1) packages.

ORDERING INFORMATION

Package Type		Part Number
SOT-25 SPQ: 3,000pcs/Reel	E5	A6303DE5R-XX
		A6303DE5VR-XX
SC70-5 SPQ: 3,000pcs/Reel	C5	A6303DC5R-XX
		A6303DC5VR-XX
DFN4(1x1) SPQ: 5,000pcs/Reel	J4	A6303DJ4R-XX
		A6303DJ4VR-XX
Note	XX: Output Voltage 10=1.0V, 33=3.3V V: Halogen free Package R: Tape & Reel	
AiT provides all RoHS products		

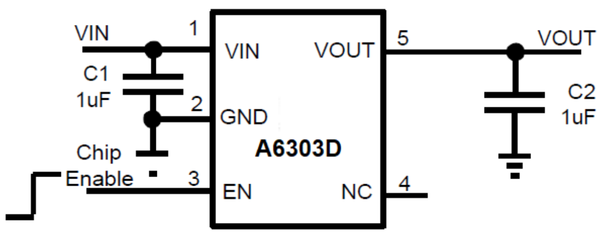
FEATURES

- Maximum Output Current: 300mA
- Low Dropout: 140mV@300mA (V_{OUT}=2.8V)
- Wide Operating Voltage Ranges: 1.8V to 5.5V
- Ultra-low Noise
- Ultra-Fast Transient Response
- High PSRR: -87dB @ 217Hz
  -83dB @ 1kHz
  -54dB @ 1MHz
- 0.1μA Standby Current When Shutdown
- Current Limiting and Short Circuit Current Protection
- Thermal Shutdown Protection
- Only 1μF Output Capacitor Required for Stability
- Fast output discharge
- Available in SOT-25, SC70-5 and DFN4(1x1) packages

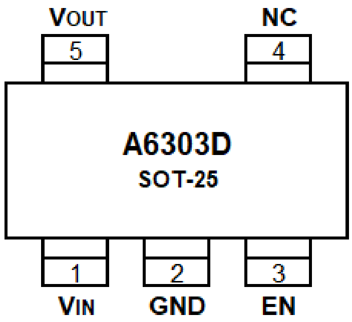
APPLICATION

- Smart Phones, Mobile Phones, Cordless Phones
- Wireless communication equipment
- Portable games, Portable AV equipment
- Camera and Machine Vision Modules
- Battery-Powered Equipment
- Laptop, Palmtops, Notebook Computers
- Reference Voltage

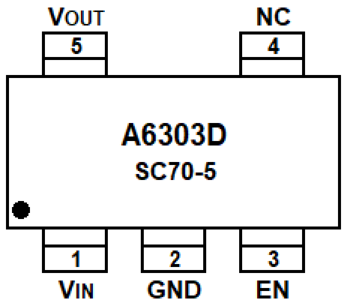
TYPICAL APPLICATION



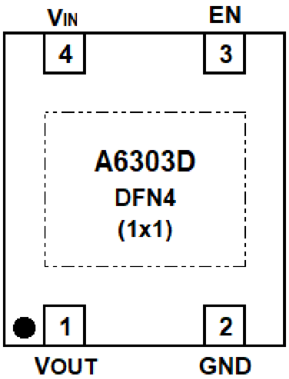
PIN DESCRIPTION



Top View



Top View



Top View

Pin #		Symbol	Function
SOT-25, SC70-5	DFN4(1x1)		
1	4	V_{IN}	Power Input Voltage
2	2	GND	Ground
3	3	EN	Chip Enable Pin, This pin has an internal pull-down resistor
4	-	NC	No Connection
5	1	V_{OUT}	Output Voltage
-	Exposed Pad	-	The exposed pad should be connected to a large ground plane to maximize thermal performance.

ABSOLUTE MAXIMUM RATING

V_{IN}, Input Supply Voltage	-0.3V ~ +6V
EN Pin Input Voltage	-0.3V ~ +V_{IN}
Output Voltages	-0.3V ~ V_{IN}+0.3V
Output Current	300mA
Maximum Junction Temperature	150°C
Operating Temperature Range[NOTE1]	-40°C ~ 85°C
Storage Temperature Range	-65°C ~ 125°C
Lead Temperature (Soldering, 10s)	300°C

Stresses beyond may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

NOTE1: The A6303D is guaranteed to meet performance specifications from 0°C to 70°C. Specifications over the –40°C to 85°C operating temperature range are assured by design, characterization and correlation with statistical process controls.

THERMAL RESISTANCE[NOTE2]

Package	θ_{JA}	θ_{JC}
SOT-25	250°C/W	130°C/W
SC70-5	333°C/W	170°C/W

NOTE2: Thermal Resistance is specified with approximately 1 square of 1 oz copper.

ELECTRICAL CHARACTERISTICS[NOTE3]

V_{IN}=V_{OUT} +1V, EN=V_{IN}, C_{IN}=C_{OUT}=1μF, T_A=25℃,unless otherwise noted.

Parameter		Symbol	Conditions	Min	Typ.	Max	Unit
Input Voltage		V_{IN}		1.8	-	5.5	V
Output Voltage Accuracy		ΔV_{OUT}	V_{IN}=V_{OUT}+1V, I_{OUT}=1mA	-2	-	+2	%
Current Limit		I_{LIM}	R_{LOAD}=1Ω	350	-	-	mA
Short Circuit Current		I_{SHORT}	V_{OUT}=0V	-	180	-	mA
Quiescent Current		I_Q	V_{EN}>1.2V, I_{OUT}=0mA	-	45	70	μA
Dropout Voltage		V_{DROP}	I_{OUT}=300mA, V_{OUT}=3.3V	-	130	200	mV
			I_{OUT}=300mA, V_{OUT}=2.8V	-	140	210	
			I_{OUT}=300mA, V_{OUT}=1.8V	-	210	300	
			I_{OUT}=300mA, V_{OUT}=1.0V	-	450	650	
Line Regulation[NOTE4]		ΔV_{LINE}	V_{IN}=V_{OUT}+1V to 5.5V I_{OUT}=1mA	-	0.03	0.17	%/V
Load Regulation[NOTE5]		ΔV_{LOAD}	1mA<I_{OUT}<300mA V_{IN}=V_{OUT}+1V	-	0.002	-	%mA
Output Voltage Temperature Coefficient[NOTE6]		TC_{VOUT}	I_{OUT}=1mA	-	±60	-	ppm/℃
Standby Current		I_{STBY}	V_{EN}=GND, Shutdown	-	0.1	1	μA
EN Input Bias Current		I_{IBSD}	V_{EN}=GND or V_{IN}	-	0.1	1	μA
EN Input Threshold	Logic Low	V_{IL}	V_{IN}=3V to 5.5V, Shutdown	-	-	0.4	V
	Logic High	V_{IH}	V_{IN}=3V to 5.5V, Start up	1.2	-	-	
Output Noise Voltage		e_{NO}	10 to100kHz; C_{OUT}=1uF I_{OUT}=100mA; V_{OUT}=2.8V	-	50	-	μV_{RMS}
			10 to100kHz; C_{OUT}=1uF I_{OUT}=100mA; V_{OUT}=1.8V	-	38	-	
Power Supply Rejection Ratio	f=217Hz	PSRR	I_{OUT}=10mA V_{OUT}=1.8V V_{IN}=2.8V	-	-87	-	dB
	f=1kHz			-	-83	-	
	f=10kHz			-	-72	-	
	f=1MHz			-	-54	-	
Thermal Shutdown Temperature		T_{SD}	Shutdown, Temp increasing	-	170	-	℃
Thermal Shutdown Hysteresis		T_{SDHY}		-	25	-	℃

NOTE3: Production test at +25°C. Specifications over the temperature range are guaranteed by design and characterization.

NOTE4: Line regulation is calculated by ΔV_{LINE}= [(V_{OUT1}-V_{OUT2})/(ΔV_{IN}x$V_{OUT(normal)}$)]x100

Where V_{OUT1} is the output voltage when V_{IN}=5.5V, and V_{OUT2} is the output voltage when V_{IN}=4.3V, ΔV_{IN}=1.2V. $V_{OUT(normal)}$=3.3V

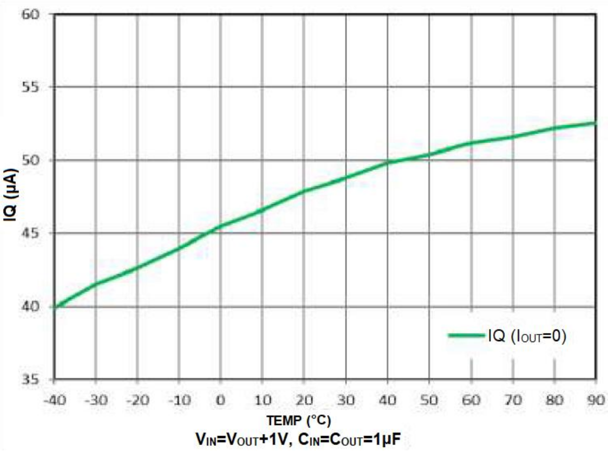
NOTE5: Load regulation is calculated by ΔV_{LOAD}= [(V_{OUT1}-V_{OUT2})/(ΔI_{OUT}x$V_{OUT(normal)}$)]x100

Where V_{OUT1} is the output voltage when I_{OUT}=1mA, and V_{OUT2} is the output voltage when I_{OUT}=300mA. ΔI_{OUT}=299mA, $V_{OUT(normal)}$=2.8V.

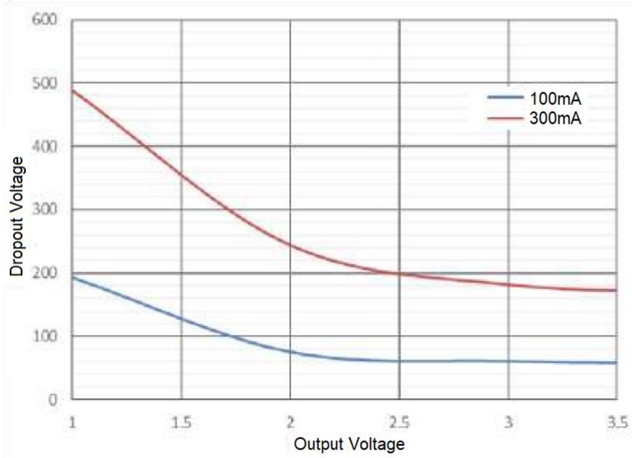
NOTE6: The temperature coefficient is calculated by TC_{VOUT}=ΔV_{OUT} /(ΔTxV_{OUT})

TYPICAL PERFORMANCE CHARACTERISTICS

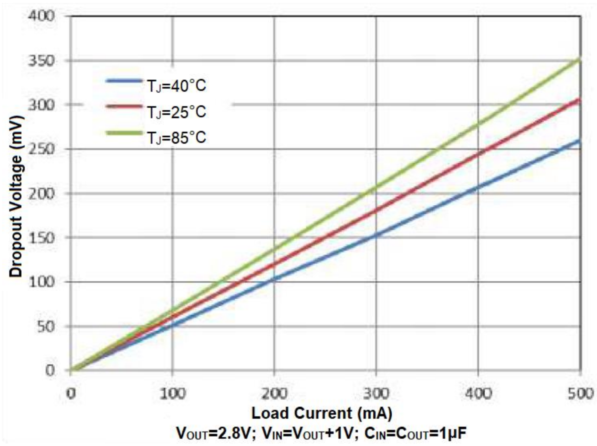
1. Quiescent Current vs. Temperature



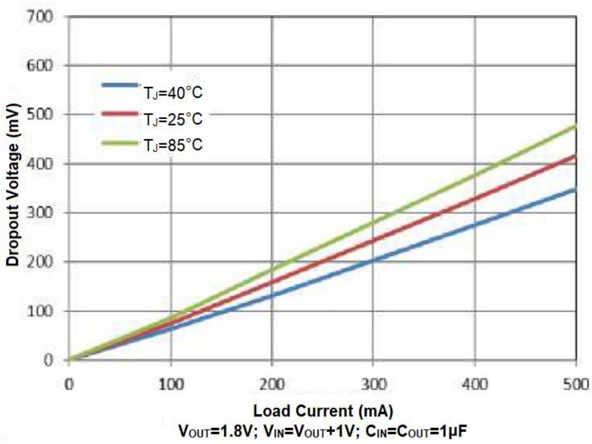
2. Dropout Voltage vs. Output Voltage



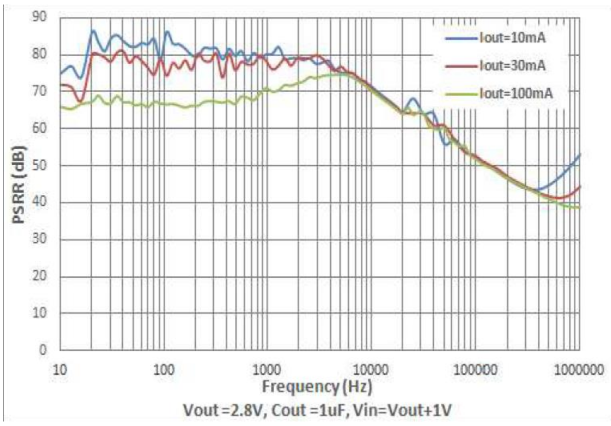
3. Dropout Voltage vs. Load Current (V_{OUT}=2.8V)



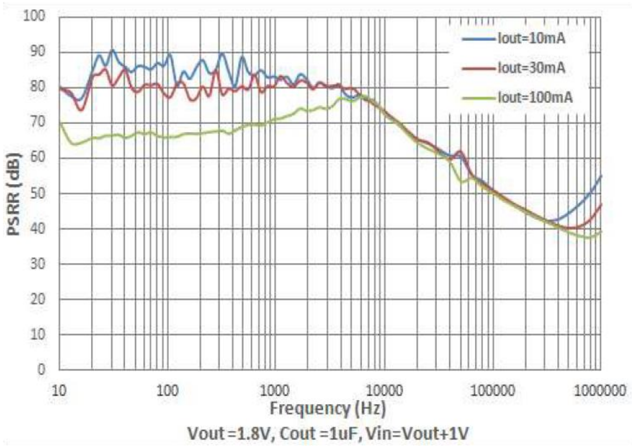
4. Dropout Voltage vs. Load Current (V_{OUT}=1.8V)



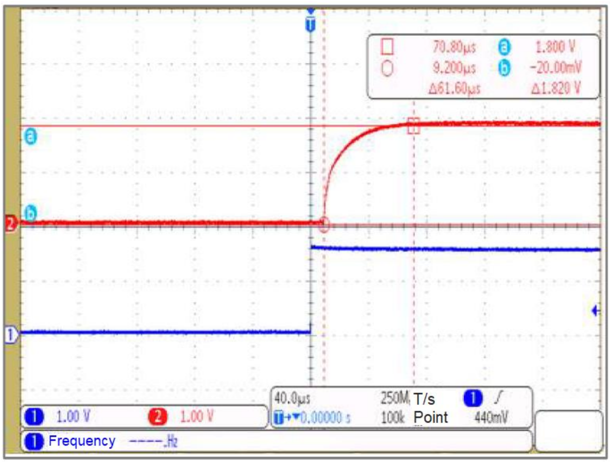
5. Power-Supply Ripple Rejection vs. Frequency (V_{OUT}=2.8V)



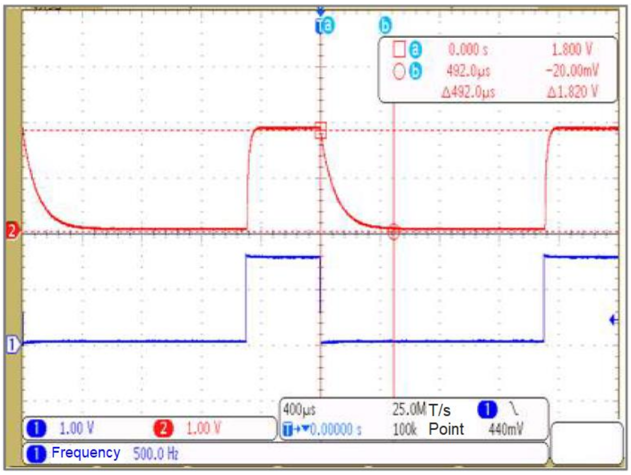
6. Power-Supply Ripple Rejection vs. Frequency (V_{OUT}=1.8V)



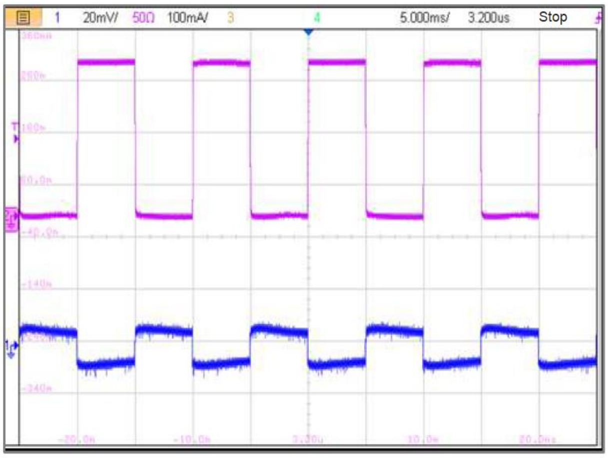
7. EN Start (V_{OUT}=1.8V)



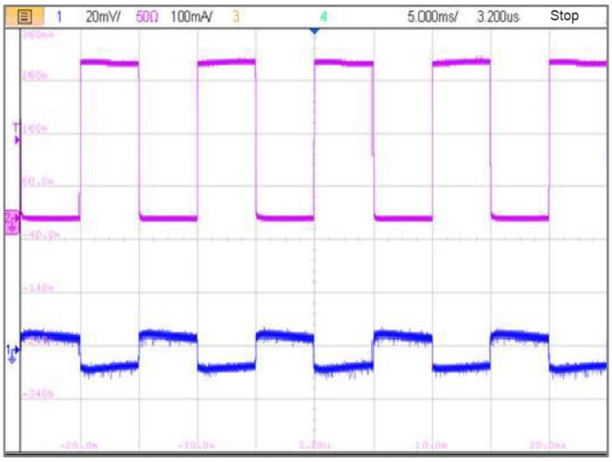
8. EN Shutdown (V_{OUT}=1.8V)



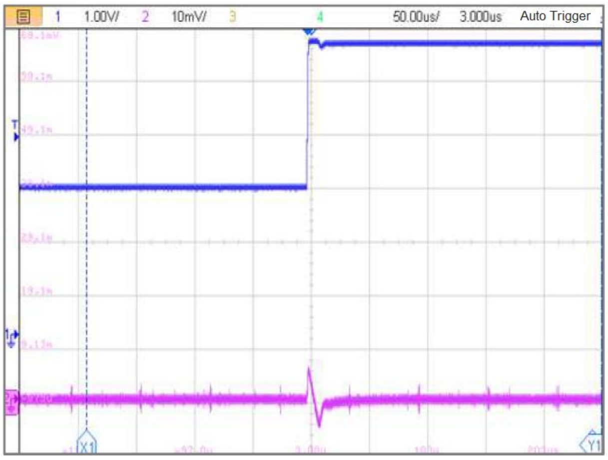
9. Load Trans 1mA~300mA (V_{OUT}= 1.8V)



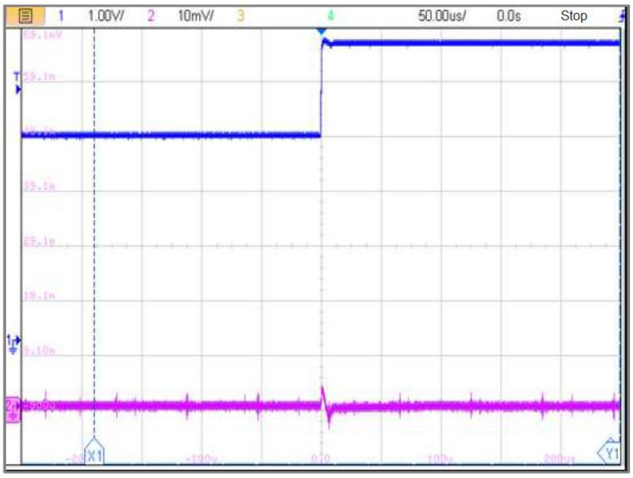
10. Load Trans 1mA~300mA (V_{OUT}= 2.8V)



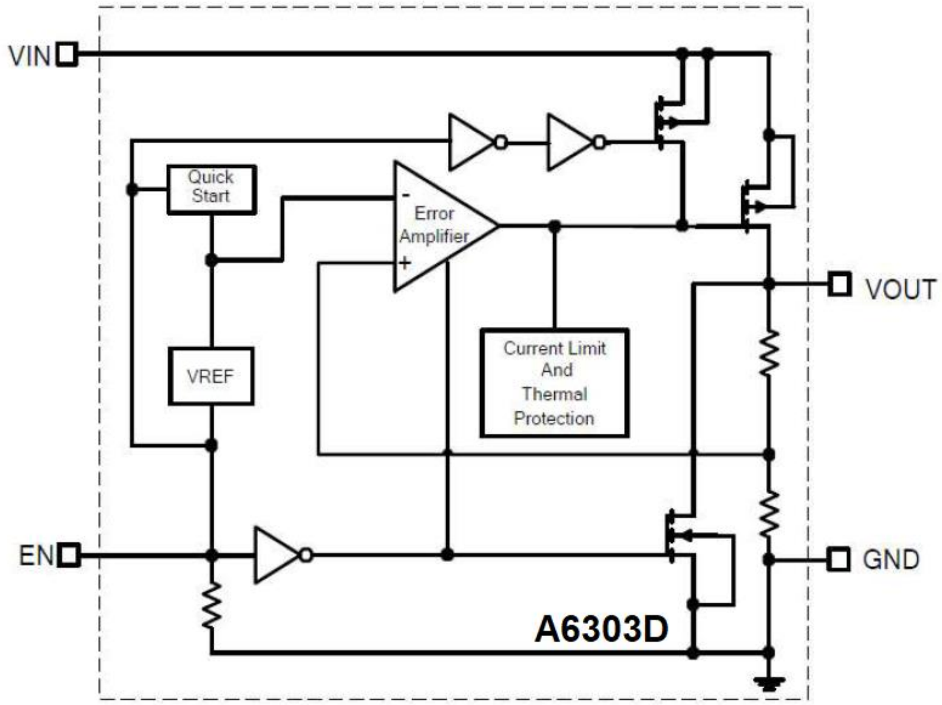
11. Line Trans 2.8V~5.5V (V_{OUT}=1.8V,I_{OUT}=1mA)



12. Line Trans 3.8V~5.5V (V_{OUT}=2.8V,I_{OUT}=1mA)



BLOCK DIAGRAM



APPLICATIONS INFORMATION

Like any low-dropout regulator, the external capacitors used with the A6303D must be carefully selected for regulator stability and performance. Using a capacitor whose value is > 1μF on the A6303D input and the amount of capacitance can be increased without limit. The input capacitor must be located a distance of not more than 0.5 inch 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. The 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. Generally, 1.0-μF X7R-type ceramic capacitors are recommended because these capacitors have minimal variation in value and equivalent series resistance (ESR) over temperature. Output capacitor 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 inch from the V_{OUT} pin of the A6303D and returned to a clean analog ground.

Enable Function

The A6303D features an LDO regulator enable/disable function. To assure the LDO regulator will switch on; the EN turn on control level must be greater than 1.2 volts. The LDO regulator will go into the shutdown mode when the voltage on the EN pin falls below 0.4 volts. For to protect the system, the A6303D have a quick discharge function. If the enable function is not needed in a specific application, it may be tied to V_{IN} to keep the LDO regulator in a continuously on state.

Thermal Considerations

Thermal protection limits power dissipation in A6303D. When the operation junction temperature exceeds 170°C, the OTP circuit starts the thermal shutdown function turn the pass element off. The pass element turns on again after the junction temperature cools by 25°C. For continue operation, do not exceed absolute maximum operation junction temperature 125°C. The power dissipation definition in device is:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

Where $T_{J(MAX)}$ is the maximum operation junction temperature 125°C, T_A is the ambient temperature and the θ_{JA} is the junction to ambient thermal resistance. For recommended operating conditions specification of A6303D, where $T_{J(MAX)}$ is the maximum junction temperature of the die (125°C) and T_A is the maximum ambient temperature. The junction to ambient thermal resistance (θ_{JA} is layout dependent) for SOT-25 package is 250°C/W, on standard JEDEC 51-3 thermal test board. The maximum power dissipation at

T_A=25°C can be calculated by following formula:

$$P_{D(MAX)} = (125°C-25°C)/250 = 400mW \text{ (SOT-25)}$$

The maximum power dissipation depends on operating ambient temperature for fixed $T_{J(MAX)}$ and thermal resistance θ_{JA}. It is also useful to calculate the junction of temperature of the A6303D under a set of specific conditions. In this example let the Input voltage V_{IN}=3.3V, the output current I_O=300mA and the case temperature T_A=40°C measured by a thermal couple during operation. The power dissipation for the V_{OUT}=2.8V version of the A6303D can be calculated as:

$$P_D = (3.3V-2.8V) \times 300mA + 3.6V \times 100\mu A = 150mW$$

And the junction temperature, T_J, can be calculated as follows:

$$T_J = T_A + P_D \times \theta_{JA} = 40°C + 0.15W \times 250°C/W$$
$$= 40°C + 37.5°C = 77.5°C < T_{J(MAX)} = 125°C$$

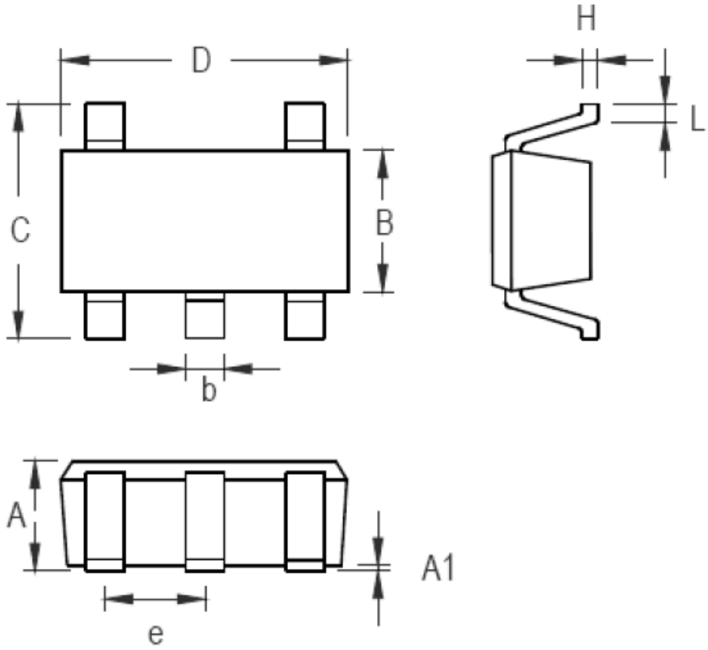
For this operating condition, T_J is lower than the absolute maximum operating junction temperature,125°C, so it is safe to use the A6303D in this configuration.

Layout considerations

To improve ac performance such as PSRR, output noise, and transient response, it is recommended that the PCB be designed with separate ground planes for V_{IN} and V_{OUT}, with each ground plane connected only at the GND pin of the device.

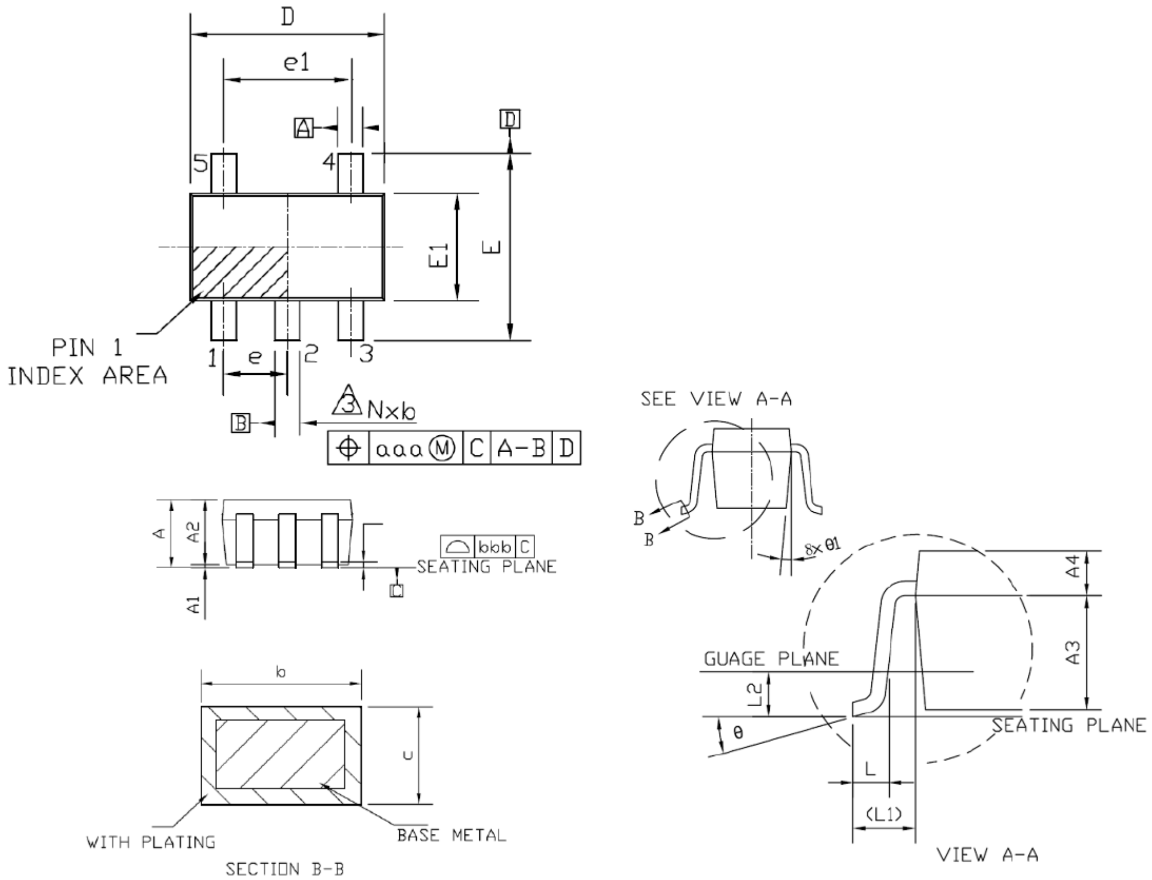
PACKAGE INFORMATION

Dimension in SOT-25 (Unit: mm)



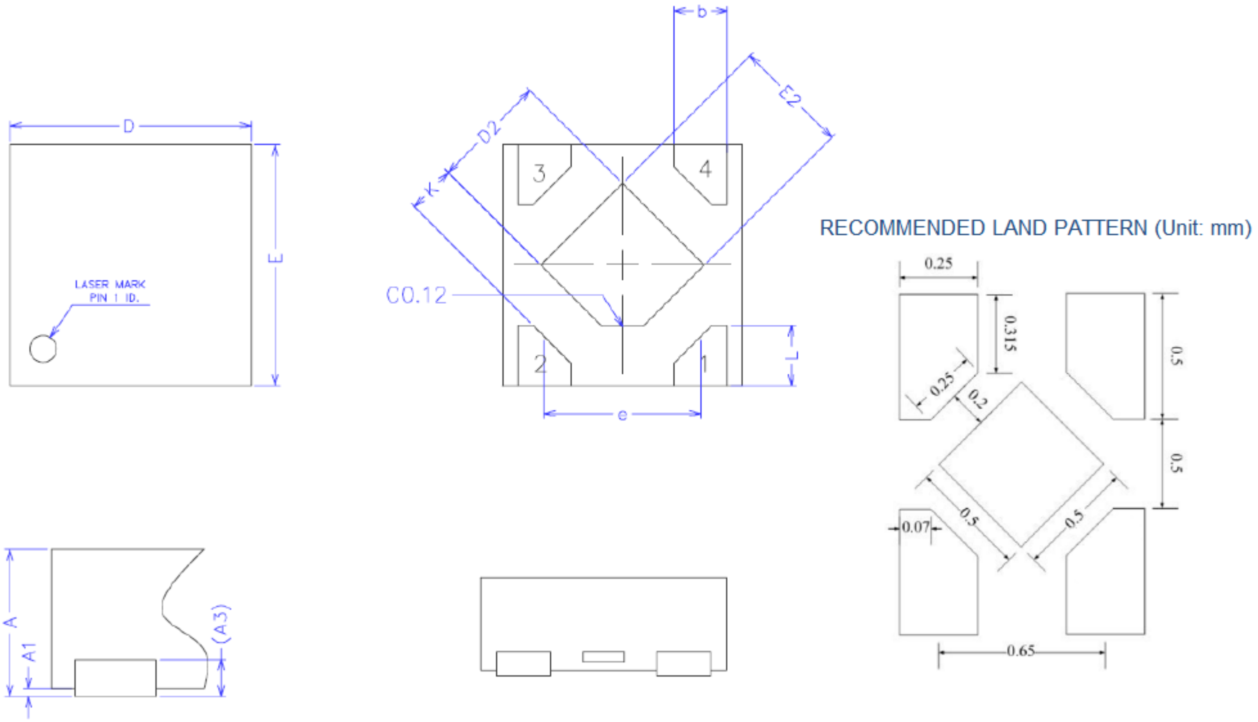
Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.035	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.356	0.559	0.014	0.022
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

Dimension in SC70-5 (Unit: mm)



Symbol	Min	Max	Symbol	Min	Max
A	0.80	1.10	E	1.80	2.40
A1	0	0.10	E1	1.15	1.35
A2	0.80	1.00	L	0.10	0.45
A3	0.47	0.57	L1	0.42 REF.	
A4	0.33	0.43	L2	0.20 BSC	
b	0.15	0.30	θ	0°	30°
c	0.10	0.25	θ1	4°	12°
D	1.85	2.20	aaa	0.10	
e	0.65 BSC		bbb	0.10	
e1	1.30 BSC				

Dimension in DFN4(1x1) (Unit: mm)



Symbol	Min	Max
A	0.34	0.40
A1	0.00	0.05
A3	0.100 REF	
b	0.17	0.27
D	0.95	1.05
E	0.95	1.05
D2	0.43	0.53
E2	0.43	0.53
L	0.20	0.30
e	0.65	
K	0.15	-

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