



# AAT3242

## 300mA/150mA Dual CMOS LDO Linear Regulator

**PowerLinear™**

### General Description

The AAT3242 is a Dual Low Dropout Linear Regulator with Power OK outputs. Two integrated regulators provide a high power 300mA output and a lower power 150mA output, making this device ideal for use with microprocessors and DSP cores in portable products. Two Power OK (POK) pins provide open drain output signals when their respective regulator output is within regulation. The AAT3242 has independent input voltage and enable pins for increased design flexibility. This device features a very low quiescent current (140µA typical), and low dropout voltages, typically 200mV and 400mV at the full output current level, making it ideal for portable applications where extended battery life is critical. The AAT3242 has complete over-current/short-circuit and over-temperature protection circuits to guard against extreme operating conditions.

The AAT3242 is available in a space saving 12 pin TSOPJW package. This device is capable of operation over a -40 to 85°C temperature range.

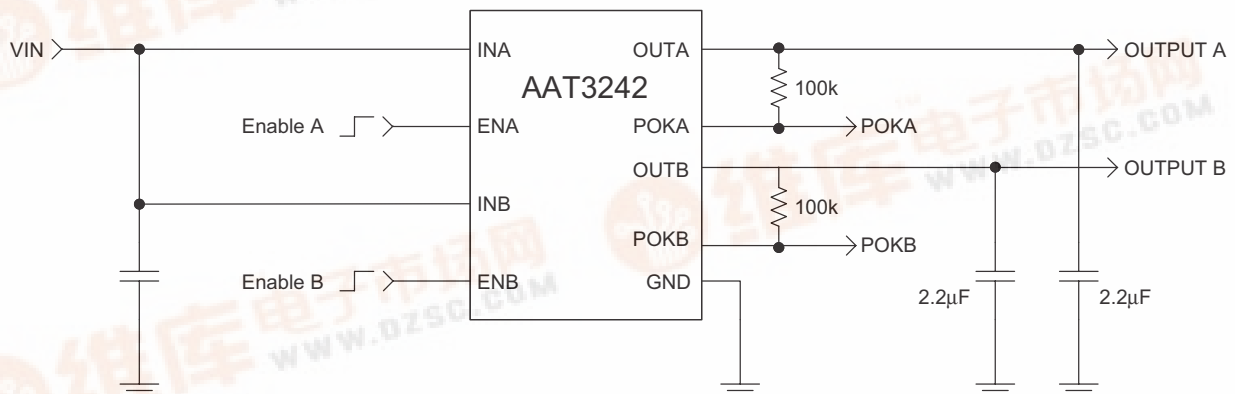
### Features

- High/Low Current Outputs, 300mA/150mA
- Low Dropout
  - LDO A: 400mV at 300mA
  - LDO B: 200mV at 150mA
- High output voltage accuracy,  $\pm 1.5\%$
- High PSRR: 65dB at 1KHz
- 70µA Quiescent Current for each LDO
- Over-current/short-circuit protection
- Over-Temperature protection
- 2 Power OK (POK) outputs
- Independent power and enable inputs
- Uses low ESR ceramic capacitors
- Available in 12 pin TSOPJW Package
- -40 to 85°C Temperature Range

### Applications

- Microprocessor/DSP Core/IO Power
- Cellular Phones
- Notebook Computers
- PDA's and Handheld Computers
- Digital Cameras
- Portable Communication Devices
- Handheld instruments

### Typical Application

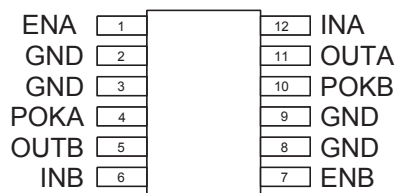


## Pin Descriptions

Pin #	Symbol	Function
1	ENA	Enable Regulator A pin - this pin should not be left floating. When pulled low the PMOS pass transistor turns off and the device enters shutdown mode, consuming less than 1 $\mu$ A.
2, 3, 8, 9	GND	Ground connection pins.
4	POKA	Power OK pin with Open drain output. It is pulled low when the OUTA pin is below the 10% regulation window.
5	OUTB	Low Current (150mA) Regulator Output pin - should be decoupled with a 2.2 $\mu$ F or greater output low ESR ceramic capacitor.
6	INB	Input voltage pin for regulator B - should be decoupled with 1 $\mu$ F or greater capacitor.
7	ENB	Enable Regulator B - this pin should not be left floating. When pulled low, the PMOS pass transistor turns off and the device enters shutdown mode, consuming less than 1 $\mu$ A.
10	POKB	Power OK pin with Open drain output. It is pulled low when the OUTB pin is below the 10% regulation window.
11	OUTA	High current (300mA) Regulator Output Pin - should be decoupled with a 2.2 $\mu$ F or greater output low ESR ceramic capacitor.
12	INA	Input voltage pin for regulator A - should be decoupled with 1 $\mu$ F or greater capacitor.

## Pin Configuration

**TSOPJW-12**  
(Top View)



## **Absolute Maximum Ratings<sup>1</sup>**

Symbol	Description	Value	Units
$V_{IN}$	Input Voltage	6.0	V
$V_{ENIN(MAX)}$	Maximum EN to Input Voltage	0.3	V
$I_{OUT}^{2}$	DC Output Current	$P_D/(V_{IN}-V_O)$	mA
$T_J$	Operating Junction Temperature Range	-40 to 150	°C
$T_{LEAD}$	Maximum Soldering Temperature (at leads, 10 sec)	300	°C

Notes:

1: Stresses above those listed in Absolute Maximum Ratings may cause permanent damage to the device. Functional operation at conditions other than the operating conditions specified is not implied. Only one Absolute Maximum rating should be applied at any one time.

2: Based on long-term current density limitation.

## **Thermal Information**

Symbol	Description	Value	Units
$\theta_{JA}$	Thermal Resistance <sup>1</sup>	110	°C/W
$P_D$	Maximum Power Dissipation ( $T_A = 25^{\circ}\text{C}$ ) <sup>2</sup>	909	mW

Note 1: Mounted on a FR4 board.

Note 2: Derate 9.1mW/°C above 25°C.

## Electrical Characteristics<sup>1</sup>

$V_{IN} = V_{OUT(NOM)} + 1.0\text{ V}$  for  $V_{OUT}$  options greater than 1.5V.  $V_{IN} = 2.5\text{ V}$  for  $V_{OUT} \leq 1.5\text{ V}$ .  $I_{OUT} = 1.0\text{ mA}$ ,  $C_{OUT} = 2.2\text{ }\mu\text{F}$ ,  $C_{IN} = 1.0\text{ }\mu\text{F}$ ,  $T_A = -40\text{ to }85^\circ\text{C}$  unless otherwise noted. Typical values are  $T_A = 25^\circ\text{C}$ .

Symbol	Description	Conditions	Min	Typ	Max	Units
<b>LDO A; <math>I_{OUT} = 300\text{ mA}</math></b>						
$V_{OUT}$	Output Voltage Tolerance	$I_{OUT} = 1\text{ mA}$ to $300\text{ mA}$	$T_A = 25^\circ\text{C}$	-1.5	1.5	%
			$T_A = -40\text{ to }85^\circ\text{C}$	-2.5	2.5	
$V_{IN}$	Input Voltage		$V_{OUT} + V_{DO}^5$		5.5	V
$V_{DO}$	Dropout Voltage <sup>2,3</sup>	$I_{OUT} = 300\text{ mA}$		400	600	mV
$\frac{\Delta V_{OUT}}{V_{OUT}} / \frac{\Delta V_{IN}}{V_{IN}}$	Line Regulation <sup>4</sup>	$V_{IN} = V_{OUT} + 1\text{ to }5.0\text{ V}$			0.09	%/V
$\Delta V_{OUT(Line)}$	Dynamic Line Regulation	$I_{OUT} = 300\text{ mA}$ , $V_{IN} = V_{OUT} + 1\text{ to }V_{OUT} + 2$ , $T_R/T_F = 2\text{ }\mu\text{S}$		5.0		mV
$\Delta V_{OUT(Load)}$	Dynamic Load Regulation	$I_{OUT} = 1\text{ mA to }300\text{ mA}$ , $T_R < 5\text{ }\mu\text{S}$		60		mV
$V_{EN(L)}$	Enable Threshold Low				0.6	V
$V_{EN(H)}$	Enable Threshold High		1.5			V
$V_{POK}$	Power OK Trip Threshold	$V_{OUT}$ rising, $T_A = 25^\circ\text{C}$	90	94	98	% of $V_{OUT}$
$V_{POKHYS}$	Power OK Hysteresis			1.0		% of $V_{OUT}$
$V_{POK(LO)}$	Power OK Output Voltage Low	$I_{SINK} = 1\text{ mA}$			0.4	V
$I_{POK}$	POK Output Leakage Current	$V_{POK} < 5.5\text{ V}$ , $V_{OUT}$ in regulation			1.0	$\mu\text{A}$
$I_{OUT}$	Output Current	$V_{OUT} > 1.2\text{ V}$	300			mA
$I_{SC}$	Short Circuit Current	$V_{OUT} < 0.4\text{ V}$		600		mA
$I_Q$	Ground Current	$V_{IN} = 5\text{ V}$ , no load; $EN A = V_{IN}$		70	125	$\mu\text{A}$
$I_{SD}$	Shutdown Current	$V_{IN} = 5\text{ V}$ , $EN A = 0\text{ V}$			1.0	$\mu\text{A}$
PSRR	Power Supply Rejection Ratio	$I_{OUT} = 10\text{ mA}$	1kHz	65		dB
			10kHz	45		
			1MHz	42		
$T_{SD}$	Over Temp Shutdown Threshold			145		$^\circ\text{C}$
$T_{HYS}$	Over Temp Shutdown Hysteresis			12		$^\circ\text{C}$
$e_N$	Output Noise	$e_{NBW} = 300\text{ Hz to }50\text{ kHz}$		250		$\mu\text{VRMS}/\sqrt{\text{Hz}}$
TC	Output Voltage Temp. Coeff.			22		ppm/ $^\circ\text{C}$

### Notes:

1: The AAT3242 is guaranteed to meet performance specification over the  $-40\text{ to }+85^\circ\text{C}$  operating temperature range, and are assured by design, characterization and correlation with statistical process controls.

2:  $V_{DO}$  is defined as  $V_{IN} - V_{OUT}$  when  $V_{OUT}$  is 98% of nominal.

3: For  $V_{OUT} < 2.1\text{ V}$ ,  $V_{DO} = 2.5 - V_{OUT}$

4:  $C_{IN} = 10\text{ }\mu\text{F}$

5: To calculate minimum input voltage, use the following equation:  $V_{IN(MIN)} = V_{OUT(MAX)} + V_{DO(MAX)}$  as long as  $V_{IN} \geq 2.5\text{ V}$ .

### Electrical Characteristics<sup>1</sup> (continued)

$V_{IN} = V_{OUT(NOM)} + 1.0\text{ V}$  for  $V_{OUT}$  options greater than 1.5V.  $V_{IN} = 2.5\text{ V}$  for  $V_{OUT} \leq 1.5\text{ V}$ .  $I_{OUT} = 1.0\text{ mA}$ ,  $C_{OUT} = 2.2\text{ }\mu\text{F}$ ,  $C_{IN} = 1.0\text{ }\mu\text{F}$ ,  $T_A = -40\text{ to }85^\circ\text{C}$  unless otherwise noted. Typical values are  $T_A = 25^\circ\text{C}$ .

Symbol	Description	Conditions	Min	Typ	Max	Units
<b>LDO B; <math>I_{OUT} = 150\text{ mA}</math></b>						
$V_{OUT}$	Output Voltage Tolerance	$I_{OUT} = 1\text{ mA}$ to $150\text{ mA}$ $T_A = 25^\circ\text{C}$ $T_A = -40\text{ to }85^\circ\text{C}$	-1.5 -2.5		1.5 2.5	%
$V_{IN}$	Input Voltage		$V_{OUT} + V_{DO}^5$		5.5	V
$V_{DO}$	Dropout Voltage <sup>2,3</sup>	$I_{OUT} = 150\text{ mA}$		200	300	mV
$\frac{\Delta V_{OUT}}{V_{OUT}} / \frac{\Delta V_{IN}}{V_{IN}}$	Line Regulation <sup>4</sup>	$V_{IN} = V_{OUT} + 1\text{ to }5.0\text{ V}$			0.09	%/V
$\Delta V_{OUT(Line)}$	Dynamic Line Regulation	$I_{OUT} = 150\text{ mA}$ , $V_{IN} = V_{OUT} + 1$ to $V_{OUT} + 2$ , $T_R/T_F = 2\text{ }\mu\text{S}$		5.0		mV
$\Delta V_{OUT(Load)}$	Dynamic Load Regulation	$I_{OUT} = 1\text{ mA to }150\text{ mA}$ , $T_R < 5\text{ }\mu\text{S}$		60		mV
$V_{EN(L)}$	Enable Threshold Low				0.6	V
$V_{EN(H)}$	Enable Threshold High		1.5			V
$V_{POK}$	Power OK Trip Threshold	$V_{OUT}$ rising, $T_A = 25^\circ\text{C}$	90	94	98	% of $V_{OUT}$
$V_{POKHYS}$	Power OK Hysteresis			1.0		% of $V_{OUT}$
$V_{POK(LO)}$	Power OK Output Voltage Low	$I_{SINK} = 1\text{ mA}$			0.4	V
$I_{POK}$	POK Output Leakage Current	$V_{POK} < 5.5\text{ V}$ , $V_{OUT}$ in regulation			1.0	$\mu\text{A}$
$I_{OUT}$	Output Current	$V_{OUT} > 1.2\text{ V}$	150			mA
$I_{SC}$	Short Circuit Current	$V_{OUT} < 0.4\text{ V}$		600		mA
$I_Q$	Ground Current	$V_{IN} = 5\text{ V}$ , no load; $EN\text{ B} = V_{IN}$		70	125	$\mu\text{A}$
PSRR	Power Supply Rejection Ratio	$I_{OUT} = 10\text{ mA}$ 1 kHz		65		dB
		10 kHz		45		
		1 MHz		42		
$T_{SD}$	Over Temp Shutdown Threshold			145		$^\circ\text{C}$
$T_{HYS}$	Over Temp Shutdown Hysteresis			12		$^\circ\text{C}$
$e_N$	Output Noise	$e_{NBW} = 300\text{ Hz to }50\text{ kHz}$		250		$\mu\text{VRMS}/\sqrt{\text{Hz}}$
$T_C$	Output Voltage Temp. Coeff.			22		ppm/ $^\circ\text{C}$

#### Notes:

1: The AAT3242 is guaranteed to meet performance specification over the  $-40\text{ to }+85^\circ\text{C}$  operating temperature range, and are assured by design, characterization and correlation with statistical process controls.

2:  $V_{DO}$  is defined as  $V_{IN} - V_{OUT}$  when  $V_{OUT}$  is 98% of nominal.

3: For  $V_{OUT} < 2.3\text{ V}$ ,  $V_{DO} = 2.5 - V_{OUT}$

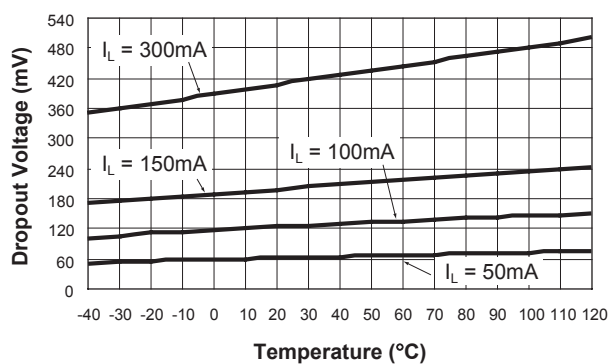
4:  $C_{IN} = 10\text{ }\mu\text{F}$

5: To calculate minimum input voltage, use the following equation:  $V_{IN(MIN)} = V_{OUT(MAX)} + V_{DO(MAX)}$  as long as  $V_{IN} \geq 2.5\text{ V}$ .

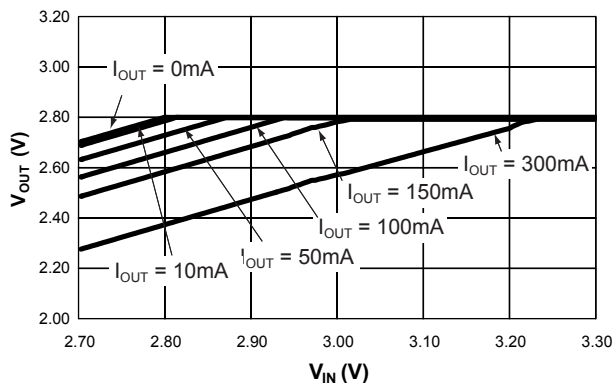
### Typical Characteristics

(Unless otherwise noted,  $V_{IN} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ )

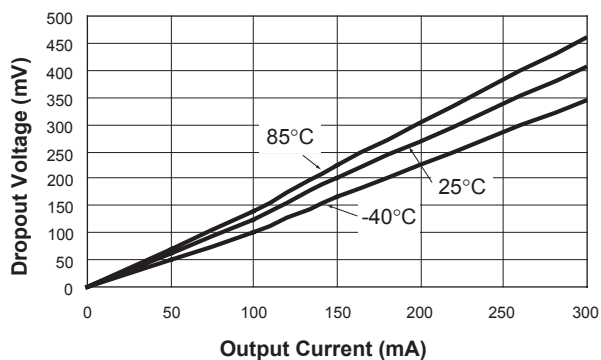
**Dropout Voltage vs. Temperature**



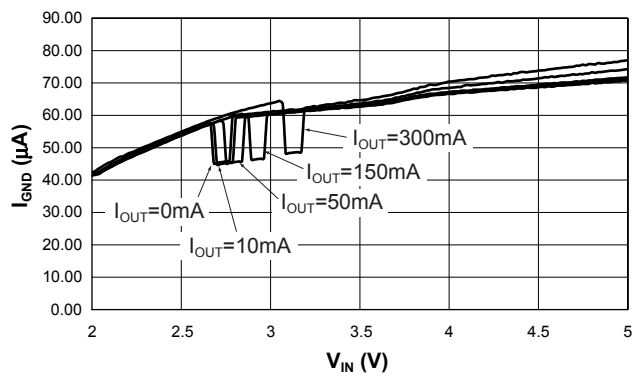
**Dropout Characteristics**



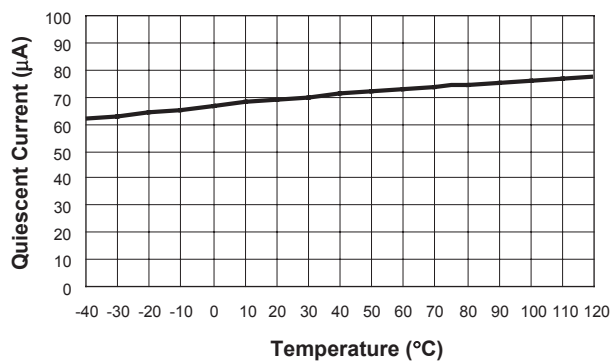
**Dropout Voltage vs. Output Current**



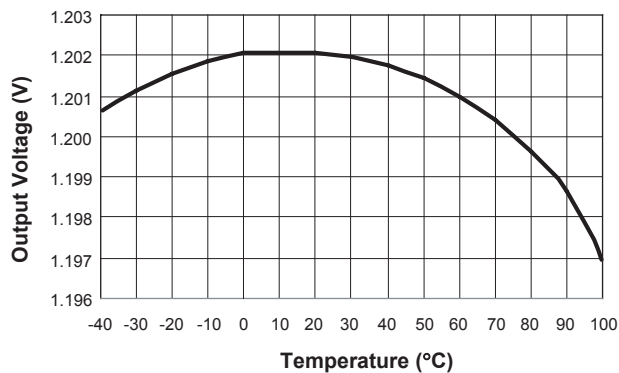
**Ground Current vs. Input Voltage**



**Quiescent Current vs. Temperature**



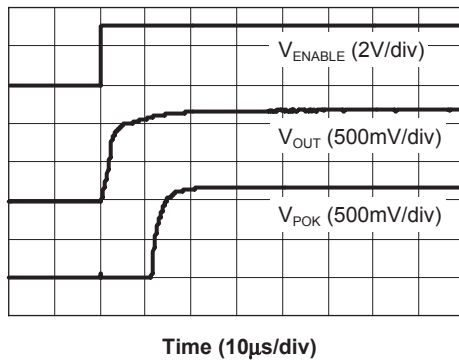
**Output Voltage vs. Temperature**



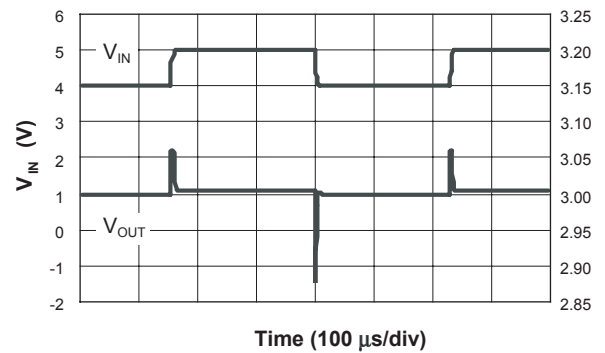
### Typical Characteristics

(Unless otherwise noted,  $V_{IN} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ )

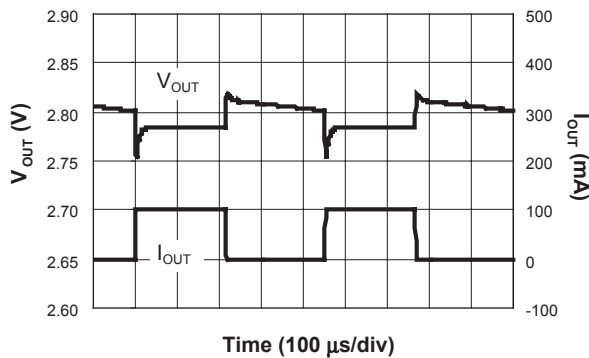
Turn On Time and POK Delay



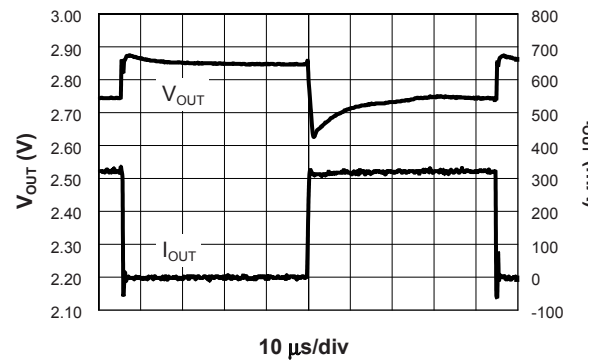
Line Transient Response



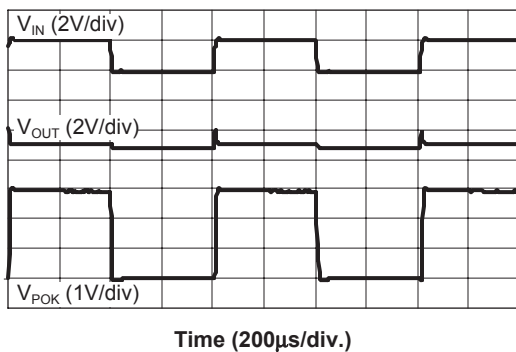
Load Transient Response



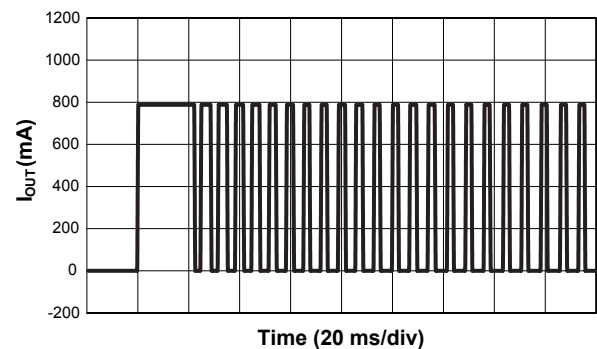
Load Transient Response 300mA



POK Output Response



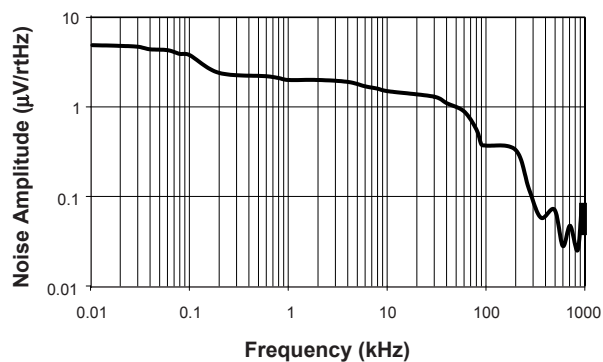
Over Current Protection



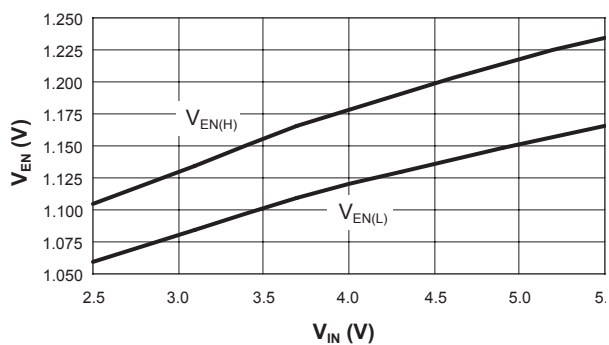
## Typical Characteristics

(Unless otherwise noted,  $V_{IN} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ )

**Self Noise**

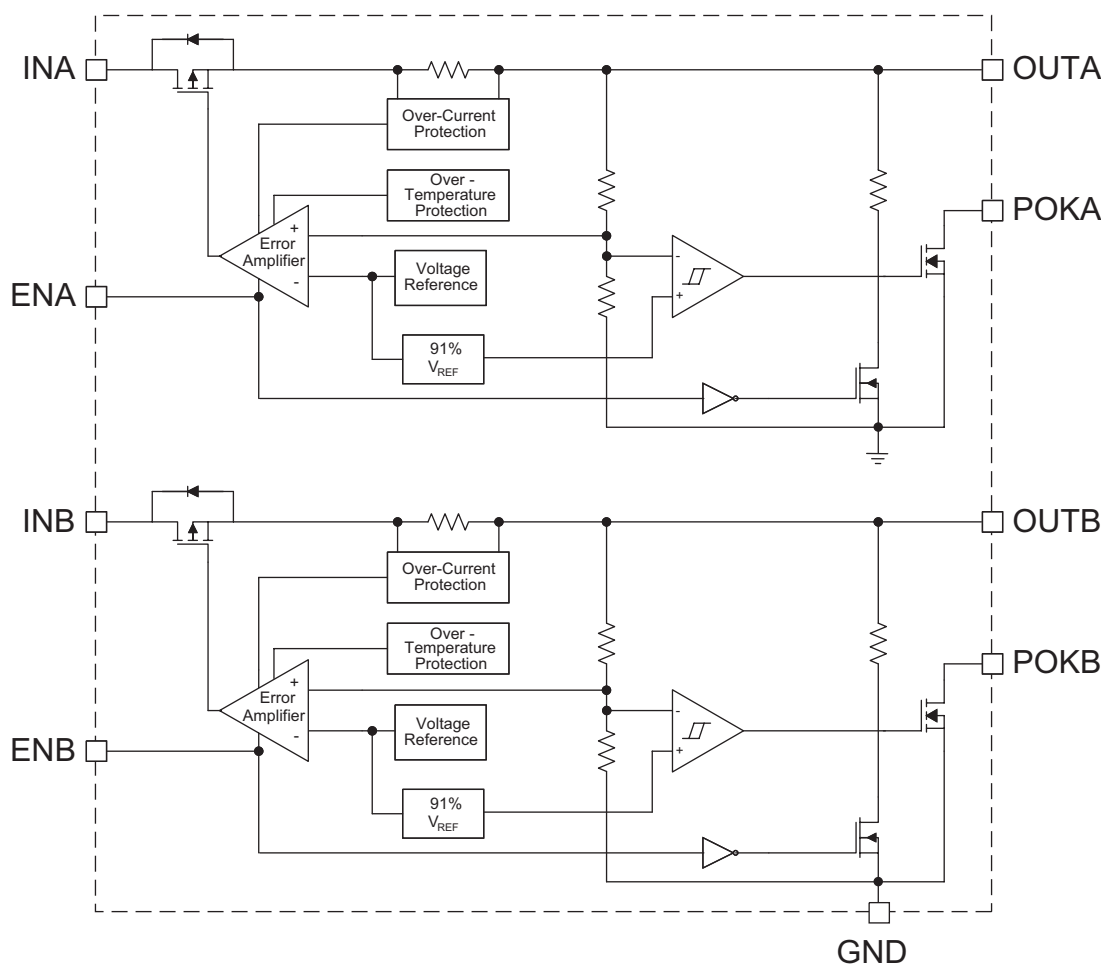


**$V_{EN(H)}$  and  $V_{EN(L)}$  vs.  $V_{IN}$**





## Functional Block Diagram



## Functional Description

The AAT3242 is a high performance dual LDO regulator with two power OK pins. The first regulator (A) sources 300mA of current while the second (B) regulator can deliver 150mA.. Each regulator has an integrated power OK comparator which indicates when the respective output is out of regulation. The POK pins are open drain outputs, and they are held low when the respective regulator is in shutdown mode.

The device has independent enable pins to shut-down each LDO regulator for power conservation in portable products. Forcing EN A/B low (<0.6V) powers down the regulators and draws a maximum of 1.0  $\mu$ A. The AAT3242 has short circuit and thermal protection in case of adverse operating conditions. Device power dissipation is limited to the package type and thermal dissipation properties. Refer to the thermal consideration section for details on device operation at maximum output current loads.

## Applications Information

To assure the maximum possible performance is obtained from the AAT3242, please refer to the following application recommendations.

### Input Capacitor

Typically a 1 $\mu$ F or larger capacitor is recommended for  $C_{IN}$  in most applications. A  $C_{IN}$  capacitor is not required for basic LDO regulator operation. However, if the AAT3242 is physically located more than 3 centimeters from an input power source, a  $C_{IN}$  capacitor will be needed for stable operation.  $C_{IN}$  should be located as close to the device  $V_{IN}$  pin as practically possible.  $C_{IN}$  values greater than 1 $\mu$ F will offer superior input line transient response and will assist in maximizing the highest possible power supply ripple rejection.

Ceramic, tantalum or aluminum electrolytic capacitors may be selected for  $C_{IN}$ . There is no specific capacitor ESR requirement for  $C_{IN}$ . However, for 300mA LDO regulator output operation, ceramic capacitors are recommended for  $C_{IN}$  due to their inherent capability over tantalum capacitors to withstand input current surges from low impedance sources such as batteries in portable devices.

### Output Capacitor

For proper load voltage regulation and operational stability, a capacitor is required between pins  $V_{OUT}$  and GND. The  $C_{OUT}$  capacitor connection to the LDO regulator ground pin should be made as direct as practically possible for maximum device performance. The AAT3242 has been specifically designed to function with very low ESR ceramic capacitors. For best performance, ceramic capacitors are recommended.

Typical output capacitor values for maximum output current conditions range from 1 $\mu$ F to 10 $\mu$ F.

Applications utilizing the exceptionally low output noise and optimum power supply ripple rejection

characteristics of the AAT3242 should use 2.2 $\mu$ F or greater for  $C_{OUT}$ . If desired,  $C_{OUT}$  may be increased without limit. In low output current applications where output load is less than 10mA, the minimum value for  $C_{OUT}$  can be as low as 0.47 $\mu$ F.

### Capacitor Characteristics

Ceramic composition capacitors are highly recommended over all other types of capacitors for use with the AAT3242. Ceramic capacitors offer many advantages over their tantalum and aluminum electrolytic counterparts. A ceramic capacitor typically has very low ESR, is lower cost, has a smaller PCB footprint and is non-polarized. Line and load transient response of the LDO regulator is improved by using low ESR ceramic capacitors. Since ceramic capacitors are non-polarized, they are not prone to incorrect connection damage.

### Equivalent Series Resistance (ESR)

ESR is a very important characteristic to consider when selecting a capacitor. ESR is the internal series resistance associated with a capacitor, which includes lead resistance, internal connections, size and area, material composition and ambient temperature. Typically capacitor ESR is measured in milliohms for ceramic capacitors and can range to more than several ohms for tantalum or aluminum electrolytic capacitors.

### Ceramic Capacitor Materials

Ceramic capacitors less than 0.1 $\mu$ F are typically made from NPO or COG materials. NPO and COG materials are typically tight tolerance very stable over temperature. Larger capacitor values are typically composed of X7R, X5R, Z5U and Y5V dielectric materials. Large ceramic capacitors, typically greater than 2.2 $\mu$ F are often available in the low cost Y5V and Z5U dielectrics. These two material types are not recommended for use with LDO regulators since the capacitor tolerance can vary more than  $\pm 50\%$  over the operating temperature range of the device. A

2.2μF Y5V capacitor could be reduced to 1μF over temperature; this could cause problems for circuit operation. X7R and X5R dielectrics are much more desirable. The temperature tolerance of X7R dielectric is better than ±15%. Capacitor area is another contributor to ESR. Capacitors which are physically large in size will have a lower ESR when compared to a smaller sized capacitor of an equivalent material and capacitance value. These larger devices can improve circuit transient response when compared to an equal value capacitor in a smaller package size. Consult capacitor vendor data sheets carefully when selecting capacitors for LDO regulators.

### POK Output

The AAT3242 features integrated Power-OK comparators which can be used as an error flag. The POK open-drain output goes low when output voltage is 6% (typ) below its nominal regulation voltage. Additionally, any time one of the regulators is in shutdown, the respective POK output is pulled low. Connect a pull-up resistor from POKA to OUTA, and POKB to OUTB.

### Enable Function

The AAT3242 features LDO regulator enable/disable function. Each LDO has its own dedicated enable pin. These pins (EN) are active high and are compatible with CMOS logic. To assure the LDO regulators will switch on, the ENA/B must be greater than 1.6 volts. The LDO regulators will shutdown when the voltage on the ENA/B pins falls below 0.6 volts. In shutdown, AAT3242 will consume less than 1.0μA of current. 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.

When the LDO regulators are in the shutdown mode, an internal 20Ω resistor is connected between  $V_{OUT}$  and GND. This is intended to discharge  $C_{OUT}$  when the LDO regulators are disabled. The internal 20Ω has no adverse effects on device turn on time.

### Short Circuit Protection

The AAT3242 contains an internal short circuit protection circuit that will trigger when the output load

current exceeds the internal threshold limit. Under short circuit conditions the output of the LDO regulator will be current limited until the short circuit condition is removed from the output or LDO regulator package power dissipation exceeds the device thermal limit.

### Thermal Protection

The AAT3242 has an internal thermal protection circuit which will turn on when the device die temperature exceeds 145°C. The LDO regulator output will remain in a shutdown state until the internal die temperature falls back below the 145°C trip point. The combination and interaction between the short circuit and thermal protection systems allows the LDO regulators to withstand indefinite short circuit conditions without sustaining permanent damage.

### No-Load Stability

The AAT3242 is designed to maintain output voltage regulation and stability under operational no load conditions. This is an important characteristic for applications where the output current may drop to zero.

### Reverse Output to Input Voltage Conditions and Protection

Under normal operating conditions a parasitic diode exists between the output and input of the LDO regulator. The input voltage should always remain greater than the output load voltage maintaining a reverse bias on the internal parasitic diode. Conditions where  $V_{OUT}$  might exceed  $V_{IN}$  should be avoided since this would forward bias the internal parasitic diode and allow excessive current flow into the  $V_{OUT}$  pin possibly damaging the LDO regulator. In applications where there is a possibility of  $V_{OUT}$  exceeding  $V_{IN}$  for brief amounts of time during normal operation, the use of a larger value  $C_{IN}$  capacitor is highly recommended. A larger value of  $C_{IN}$  with respect to  $C_{OUT}$  will effect a slower  $C_{IN}$  decay rate during shutdown, thus preventing  $V_{OUT}$  from exceeding  $V_{IN}$ . In applications where there is a greater danger of  $V_{OUT}$  exceeding  $V_{IN}$  for extended periods of time, it is recommended to place a Schottky diode across  $V_{IN}$  to  $V_{OUT}$  (connecting the

cathode to  $V_{IN}$  and anode to  $V_{OUT}$ ). The Schottky diode forward voltage should be less than 0.45 volts.

### Thermal Considerations and High Output Current Applications

The AAT3242 is designed to deliver continuous output load currents of 300 and 150mA under normal operations, and can supply up to 500mA during circuit start up conditions. This is desirable for circuit applications where there might be a brief high in-rush current during a power on event.

The limiting characteristic for the maximum output load current safe operating area is essentially package power dissipation and the internal preset thermal limit of the device. In order to obtain high operating currents, careful device layout and circuit operating conditions need to be taken into account.

The following discussions will assume the LDO regulator is mounted on a printed circuit board utilizing the minimum recommended footprint as stated in the layout considerations section of the document. At any given ambient temperature ( $T_A$ ) the

maximum package power dissipation can be determined by the following equation:

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

Constants for the AAT3242 are  $T_{J(MAX)}$ , the maximum junction temperature for the device which is 125°C and  $\theta_{JA} = 110^\circ\text{C/W}$ , the package thermal resistance. Typically, maximum conditions are calculated at the maximum operating temperature of  $T_A = 85^\circ\text{C}$  and under normal ambient conditions where  $T_A = 25^\circ\text{C}$ . Given  $T_A = 85^\circ$ , the maximum package power dissipation is 364mW. At  $T_A = 25^\circ\text{C}$ , the maximum package power dissipation is 909mW.

The maximum continuous output current for the AAT3242 is a function of the package power dissipation and the input to output voltage drop across the LDO regulator. To figure what the maximum output current would be for a given output voltage, refer to the following equation. This calculation accounts for the total power dissipation of the LDO Regulator, including that caused by ground current.

$$P_{D(MAX)} = [(V_{IN} - V_{OUTA})I_{OUTA} + (V_{IN} \times I_{GND})] + [(V_{IN} - V_{OUTB})I_{OUTB} + (V_{IN} \times I_{GND})]$$

This formula can be solved for  $I_{OUTA}$  to determine the maximum output current for LDOA:

$$I_{OUTA(MAX)} = \frac{P_{D(MAX)} - (2 \times V_{IN} \times I_{GND}) - (V_{IN} - V_{OUTB}) \times I_{OUTB}}{V_{IN} - V_{OUTA}}$$

The following is an example for a 2.5 volt output:

From the discussion above,  $P_{D(MAX)}$  was determined to equal 909mW at  $T_A = 25^\circ\text{C}$ .

$$V_{OUTA} = 2.5 \text{ volts}$$

$$V_{OUTB} = 1.5 \text{ volts}$$

$$I_{OUTB} = 150 \text{ mA}$$

$$V_{IN} = 4.2\text{V}$$

$$I_{GND} = 125\mu\text{A}$$

$$I_{OUTA(MAX)} = \frac{909\text{mW} - (2 \times 4.2\text{V} \times 125\mu\text{A}) - (4.2 - 1.5) \times 150\text{mA}}{4.2 - 2.5}$$

$$I_{OUTA(MAX)} = 296\text{mA}$$

Thus, with Regulator B delivering 150mA at 1.5V, Regulator A can sustain a constant 2.5V output at a 296mA load current at an ambient temperature of  $25^\circ\text{C}$ . Higher input to output voltage differentials can be obtained with the AAT3242, while maintaining device functions within the thermal safe operating area. To accomplish this, the device thermal resistance must be reduced by increasing the heat sink area or by operating the LDO regulator in a duty cycled mode.

For example, an application requires  $V_{IN} = 4.2\text{V}$  while  $V_{OUT} = 1.5\text{V}$  at a 500mA load and  $T_A = 25^\circ\text{C}$ . To maintain this high input voltage and output current level, the LDO regulator must be operated in a duty cycled mode. Refer to the following calculation for duty cycle operation:

$P_{D(MAX)}$  is assumed to be 909mW

$$I_{GND} = 125\mu\text{A}$$

$$I_{OUT} = 500\text{mA}$$

$$V_{IN} = 4.2\text{V}$$

$$V_{OUT} = 1.5\text{V}$$

$$\%DC = \frac{100(P_{D(MAX)})}{[(V_{IN} - V_{OUTA})I_{OUTA} + (V_{IN} \times I_{GND})] + [(V_{IN} - V_{OUTB})I_{OUTB} + (V_{IN} \times I_{GND})]}$$

$$\%DC = \frac{100(909\text{mW})}{[(4.2\text{V} - 1.5\text{V})500\text{mA} + (4.2\text{V} \times 125\mu\text{A})] + [(4.2\text{V} - 1.5\text{V})200\text{mA} + (4.2\text{V} \times 125\mu\text{A})]}$$

$$\%DC = 48.10\%$$

For a 500mA output current and a 2.7 volt drop across the AAT3242 at an ambient temperature of  $25^\circ\text{C}$ , the maximum on time duty cycle for the device would be 48.10%.

### Ordering Information

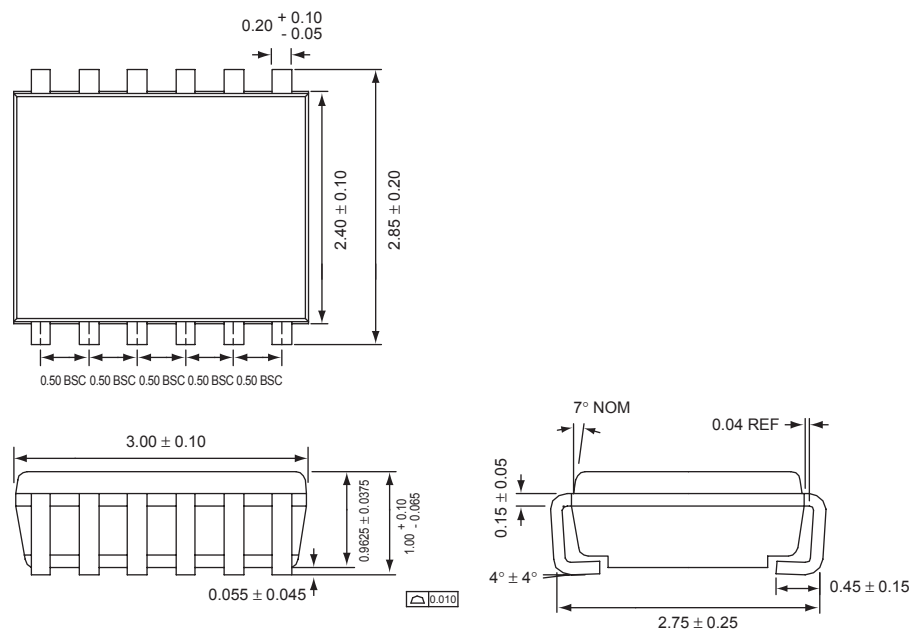
Package	Voltage		Marking <sup>1</sup>	Part Number (Tape and Reel)
	LDO A	LDO B		
TSOPJW-12	3.3V	2.5V	LSXYY	AAT3242ITP-WN-T1
TSOPJW-12	3.0V	2.85V	LPXYY	AAT3242ITP-TR-T1
TSOPJW-12	3.0V	2.5V	LJXYY	AAT3242ITP-TN-T1
TSOPJW-12	3.0V	1.8V	LHXYY	AAT3242ITP-TI-T1
TSOPJW-12	2.9V	1.5V	MOXYY	AAT3242ITP-SG-T1
TSOPJW-12	2.8V	3.0V	LVXYY	AAT3242ITP-QT-T1
TSOPJW-12	2.8V	2.8V	LDXYY	AAT3242ITP-QQ-T1
TSOPJW-12	2.8V	2.6V	LQXYY	AAT3242ITP-QO-T1
TSOPJW-12	2.8V	2.5V	LLXYY	AAT3242ITP-QN-T1
TSOPJW-12	2.8V	1.9V	LRXYY	AAT3242ITP-QY-T1
TSOPJW-12	2.8V	1.5V	MCXYY	AAT3242ITP-QG-T1
TSOPJW-12	2.7V	2.7V	LOXYY	AAT3242ITP-PP-T1
TSOPJW-12	2.6V	1.8V	MJXYY	AAT3242ITP-OI-T1
TSOPJW-12	1.8V	1.5V	MWXYY	AAT3242ITP-IG-T1

Note 1: XYY = assembly and date code.

Legend	
Voltage	Code
1.5	G
1.8	I
1.9	Y
2.5	N
2.6	O
2.7	P
2.8	Q
2.85	R
2.9	S
3.0	T
3.3	W

### Package Information

#### TSOPJW-12



All dimensions in millimeters.



# AAT3242

## 300mA/150mA Dual CMOS LDO Linear Regulator

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