

## 1.5A Low Dropout Positive Fixed-Mode Regulator

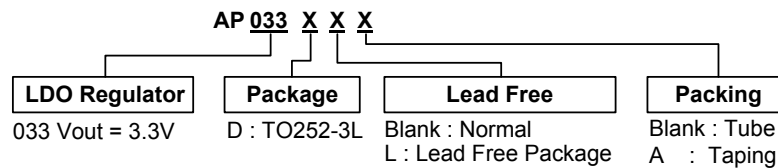
### ■ Features

- 3-Terminal and Fixed 3.3V
- 1.4V Maximum Dropout at Full Load Current.
- Fast Transient Response.
- Built-in Thermal Shutdown.
- Output Current Limiting.

### ■ Applications

- PC peripheral
- Communication

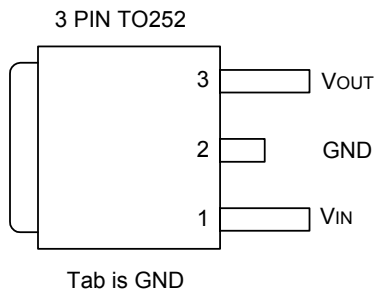
### ■ Ordering Information



### ■ General Description

AP033 is a low dropout positive fixed-mode regulator with minimum of 1.5A output current capability. The product is specifically designed to provide well-regulated supply for low voltage IC applications such as high-speed bus termination and low current 3.3V logic supply. AP033 is guaranteed to have <1.4V dropout at full load current making it ideal to provide well regulated outputs of 3.3V with 4.7V to 12V input supply by different output voltage.

### ■ Pin Assignments

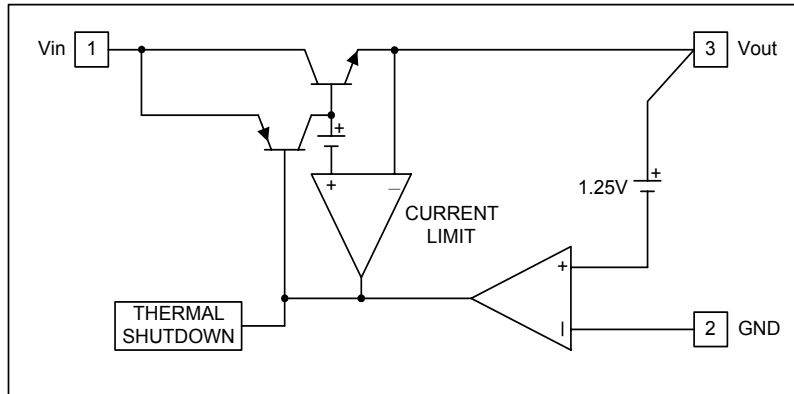


### ■ Pin Descriptions

Name	Pin #	Function
VIN	1	The input pin of regulator. Typically a large storage capacitor is connected from this pin to ground to insure that the input voltage does not sag below the minimum dropout voltage during the load transient response. This pin must always be 1.4V higher than VOUT in order for the device to regulate properly.
GND	2	Ground
VOUT	3	The output of the regulator. A minimum of 10μF capacitor must be connected from this pin to ground to insure stability. Ground

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### ■ Block Diagram



### ■ Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
V <sub>IN</sub>	DC Supply Voltage	-0.3 to 14	V
P <sub>D</sub>	Power Dissipation	Internally Limited	
T <sub>ST</sub>	Storage Temperature	-65 to +150	°C
T <sub>OP</sub>	Operating Junction Temperature Range	0 to +150	°C

### ■ Electrical Characteristics (Under Operating Conditions)

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage	V <sub>IN</sub> = 5V, I <sub>OUT</sub> = 0mA, T <sub>J</sub> = 25°C	3.267	3.300	3.333	V
	4.7V < V <sub>IN</sub> < 12V, 0 < I <sub>OUT</sub> < 1.5A	3.235	3.300	3.365	V
Line Regulation	4.7V < V <sub>IN</sub> < 12V, I <sub>OUT</sub> = 0mA, T <sub>J</sub> = 25°C		0.5	10	mV
			1.0	10	mV
Load Regulation	V <sub>IN</sub> = 5V, 0 < I <sub>OUT</sub> < 1.5A, T <sub>J</sub> = 25°C (Notes 1,2)		3	15	mV
			8	33	mV
Dropout Voltage (V <sub>IN</sub> -V <sub>OUT</sub> )	ΔV <sub>OUT</sub> , ΔV <sub>REF</sub> = 1%, I <sub>OUT</sub> = 1.5A (Note 3)		1.3	1.4	V
Current Limit	(V <sub>IN</sub> -V <sub>OUT</sub> ) ≥ 1.4V, ΔV <sub>OUT</sub> = 100mV (Note 4)	1.6			A
Quiescent Current	V <sub>IN</sub> < 12V		5	10	mA
Thermal Regulation	T <sub>A</sub> = 25°C, 30ms pulse		0.008	0.04	%/W
Ripple Rejection	F = 120Hz, C <sub>OUT</sub> = 25uF Tantalum, I <sub>OUT</sub> = 1.5A				
	AP033   V <sub>IN</sub> = 6.3V		60	72	dB
Temperature Stability			0.5		%
Thermal Resistance Junction-to-Ambient (No heat sink ;No air flow)	TO-252		101		°C/W
Thermal Resistance Junction-to-Case	TO-252: Control Circuitry/Power Transistor		10		°C/W

Note 1: See thermal regulation specifications for changes in output voltage due to heating effects. Line and load regulation are measured at a constant junction temperature by low duty cycle pulse testing.

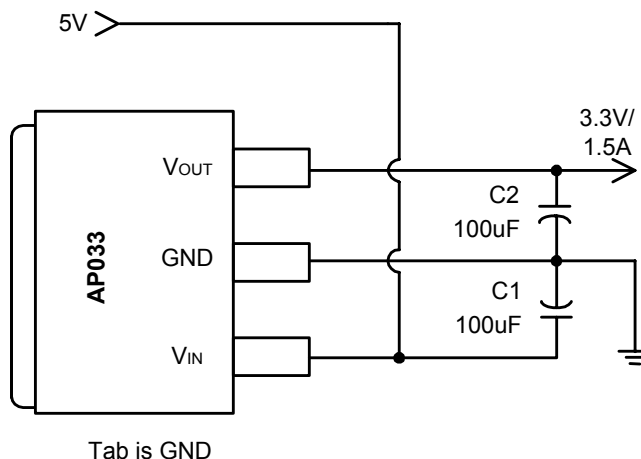
Note 2: Line and load regulation are guaranteed up to the maximum power dissipation of 2W. Power dissipation is determined by the input/output differential and the output current.

Note 3: Dropout voltage is specified over the full output current range of the device.

Note 4: AP033 is guaranteed to operate at higher peak current than 1.6 Amp. See the thermal regulation specifications for changes in output voltage due the heating effects.

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### ■ Typical Application



5V to 3.3V Fixed Mode Regulator

### ■ Function Description

#### Introduction

The AP033 fixed-mode Low Dropout (LDO) regulator is a 3 terminal device. The AP033 only needs 1.4V differential between  $V_{IN}$  and  $V_{OUT}$  to maintain output regulation. In addition, the output voltage tolerances are also extremely tight and they include the transient response as part of the specification. For example, Intel VRE specification calls for a total of +/- 100mV including initial tolerance, load regulation and 0 to 1.5A load step. The AP033 is specifically designed to meet the fast current transient needs as well as providing an accurate initial voltage, reducing the overall system cost with the need for fewer output capacitors.

#### Load Regulation

Since the AP033 is only a 3 terminal device, it is not possible to provide true remote sensing of the output voltage at the load. But it can supply good load regulation by internal feedback bypass the external loss such as adjustable mode.

#### Stability

The AP033 requires the use of an output capacitor as part of the frequency compensation in order to make the regulator stable. For most applications a minimum of 10uF aluminum electrolytic capacitor insures both stability and good transient response.

#### Thermal Design

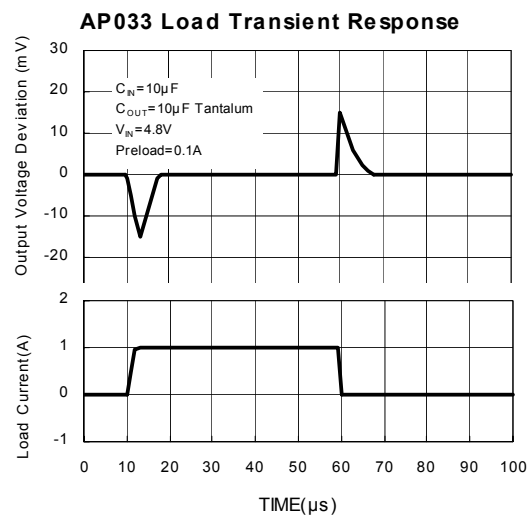
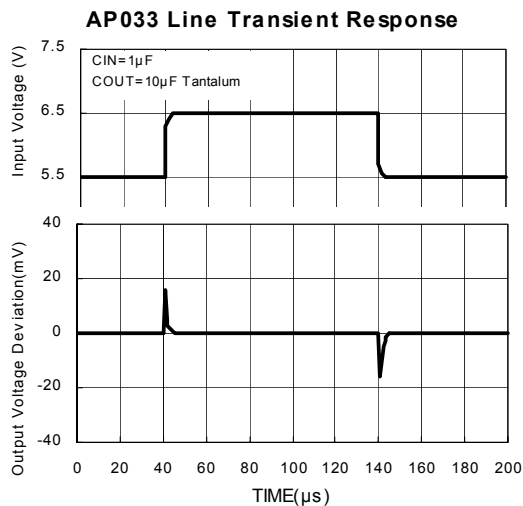
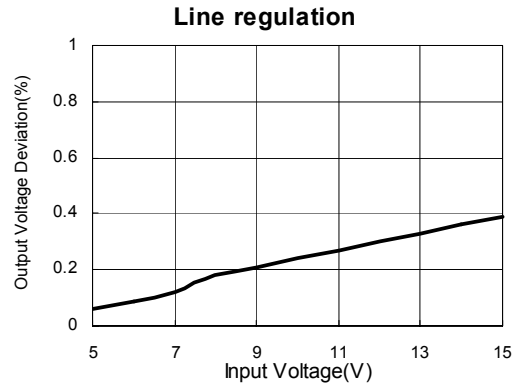
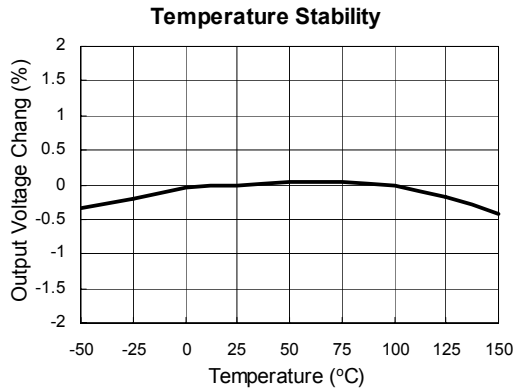
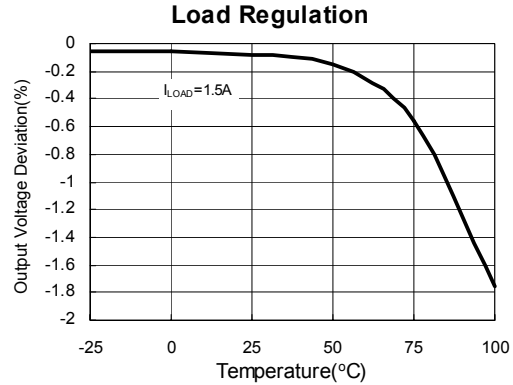
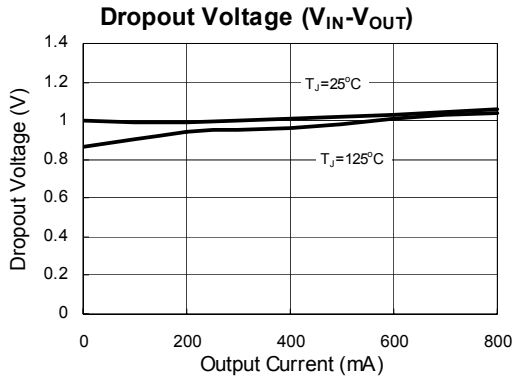
The AP033 incorporates an internal thermal shutdown that protects the device when the junction temperature exceeds the maximum allowable junction temperature. Although this device can operate with junction temperatures in the range of 150°C, it is recommended that the selected heat sink be chosen such that during maximum continuous load operation the junction temperature is kept below the temperature.

#### Layout Consideration

The output capacitors must be located as close to the  $V_{OUT}$  terminal of the device as possible. It is recommended to use a section of a layer of the PC board as a plane to connect the  $V_{OUT}$  pin to the output capacitors to prevent any high frequency oscillation that may result due to excessive trace inductance.

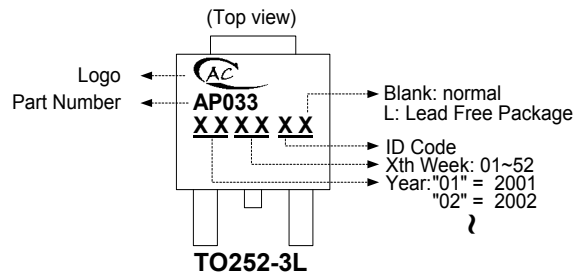
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### ■ Typical Performance Characteristics



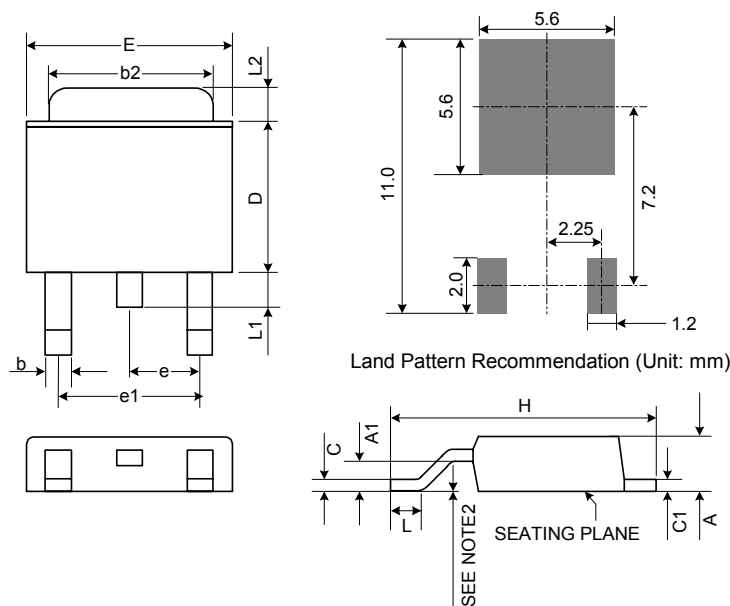
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### ■ Marking Information



### ■ Package Dimension

TO252-3L



Notes:

1. JEDEC Outline: TO-252 AB
2. Mils suggested for positive contact at mounting.

Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	2.18	2.29	2.39	0.086	0.090	0.094
A1	1.02	1.15	1.27	0.040	0.045	0.050
b	0.61 TYP.			0.024 TYP.		
b2	5.20	5.35	5.50	0.205	0.211	0.217
C	0.46	0.52	0.58	0.018	0.020	0.023
C1	0.46	0.52	0.58	0.018	0.020	0.023
D	5.33	5.57	5.80	0.210	0.219	0.228
E	6.35	6.58	6.80	0.250	0.259	0.268
e	2.25 BSC.			0.089 BSC.		
e1	4.50 BSC.			0.177 BSC.		
H	9.00	9.70	10.40	0.354	0.382	0.409
L	0.51	-	-	0.020	-	-
L1	0.64	0.83	1.02	0.025	0.033	0.040
L2	1.52	1.78	2.03	0.060	0.070	0.080