

### Description

The YB1220 family is a dual-channel LDO product consisting of 2 independent low noise, low dropout (LDO), linear regulators especially designed for battery-powered equipment and portable device. The regulator achieves a low 300 mV dropout at 200mA 3.3V output and good PSRR of near 50dB at 1K~10KHz frequency.

The YB1220 consumes only 80uA supply current with both regulators enabled and supports different output voltages of full range from 1.2 to 3.6V (pre-set).

The YB1220 is smartly designed to fit in three different pin allocations of SOT23-6 package which offers higher flexibility to users' PCB layout.

Other features of YB1220 include a thermal shutdown circuit and an output short-circuit protection.

### Features

- High Accuracy Output Voltage :  $\pm 2\%$
- Wide Output Voltage Range : 1.2~3.6V
- Each Channel Typical Current : 200mA
- Max. Allowable 300mA Each Channel
- Low Quiescent Current : ~80uA
- Dual Enable Pins Control
- 300mV Dropout at 200mA 3.3V Output
- Stable with 1.0uF Ceramic Capacitor
- Thermal Protection Shutdown
- Output Short-Circuit Current Limit
- Built-In Internal Soft-Start
- Green Package (RoHS) Available

### Applications

- Cellular Phone
- White LED Backlighting
- PDA, Notebook, PC
- Digital Camera
- Portable Application
- Wireless LAN
- Battery-Powered Equipment

### Typical Application Circuitry

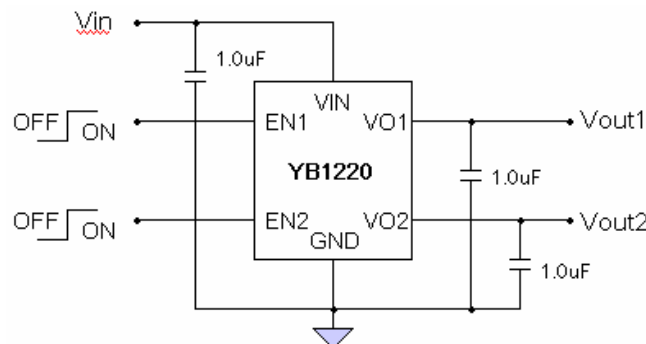


Figure 1 : Typical Application Circuit

### Pin Configuration

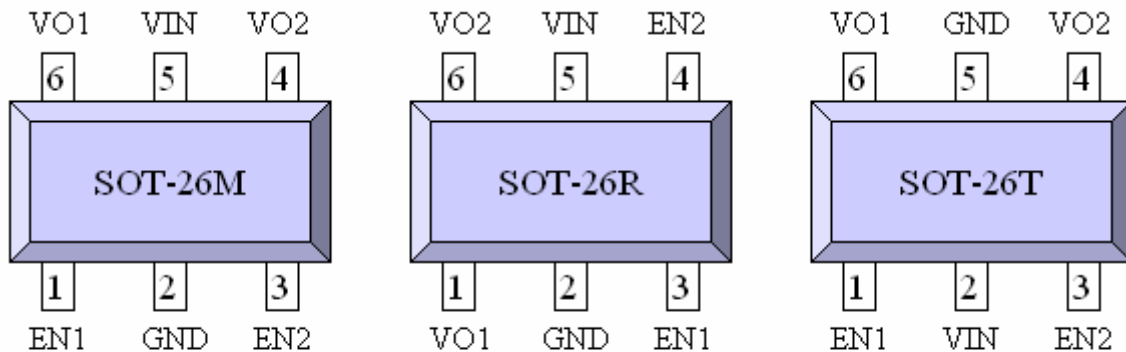


Figure 2 : Pin Configuration

### Pin Description

Table 1

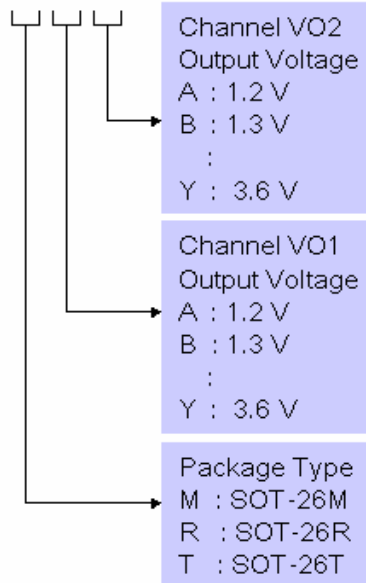
Pin	Name	SOT-26M Description
1	EN1	Pull High to Enable Output VO1
2	GND	Ground Pin
3	EN2	Pull High to Enable Output VO2
4	VO2	Regulated Output Voltage 2
5	VIN	Unregulated Input Supply
6	VO1	Regulated Output Voltage 1

Pin	Name	SOT-26R Description
1	VO1	Regulated Output Voltage 1
2	GND	Ground Pin
3	EN1	Pull High to Enable Output VO1
4	EN2	Pull High to Enable Output VO2
5	VIN	Unregulated Input Supply
6	VO2	Regulated Output Voltage 2

Pin	Name	SOT-26T Description
1	EN1	Pull High to Enable Output VO1
2	VIN	Unregulated Input Supply
3	EN2	Pull High to Enable Output VO2
4	VO2	Regulated Output Voltage 2
5	GND	Ground Pin
6	VO1	Regulated Output Voltage 1

### Ordering Information

Y B 1 2 2 0 S T 2 6      



- Order example :  
YB1220ST26MGS for YB1220 of VO1 1.8V output, VO2 3.0V output and SOT-26M package  
YB1220ST26RVQ for YB1220 of VO1 3.3V output, VO2 2.8V output and SOT-26R package  
YB1220ST26TSN for YB1220 of VO1 3.0V output, VO2 2.5V output and SOT-26T package
- Shipping Quantity :  
SOT-26 : 3000 units tape & reel

### Marking Information

X      

Code	A	B	C	D	E	F	G	H	I	J	K	L	M
Voltage	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4
Code	N	O	P	Q	R	S	T	U	V	W	X	Y	
Voltage	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	

- **A~Y** : VO2 Output Voltage, Refer to Above Table for Voltage Value
- **A~Y** : VO1 Output Voltage, Refer to Above Table for Voltage Value
- **M** : SOT-26M Package, **R** : SOT-26R Package, **T** : SOT-26T Package

### Absolute Maximum Ratings

Supply Voltage ..... -0.3V to 7.0V  
 Output Voltage ..... -0.3V to (V<sub>IN</sub>+0.3V)  
 Output Short-Circuit Duration ..... Infinite  
 Junction Temperature Range ..... +150°C  
 Storage Temperature Range ..... -65°C to +150°C  
 Lead Temperature ..... +250°C

### Recommended Operating Conditions

Input Supply Voltage ..... 2V to 6.0V  
 Operating Temperature ..... -40°C to +85°C  
 ESD Susceptibility (HBM)..... 2KV  
 ESD Susceptibility (MM)..... 200V  
 Thermal Resistance (SOT-26, θ<sub>Jc</sub>) ..... 140°C/W  
 Thermal Resistance (SOT-26, θ<sub>JA</sub>) ..... 250°C/W  
 Internal Power Dissipation (SOT-26, P<sub>D</sub>)..... 0.4W

### Electrical Characteristics

Table 2  $T_A = 25^\circ\text{C}$ ,  $V_{IN} = \text{Max}(V_{O1}, V_{O2}) + 1\text{V}$ ,  $C_{IN} = C_{O1} = C_{O2} = 1.0\mu\text{F}$ ,  $EN = V_{IN}$ , unless otherwise noted

Function Parameter	Conditions	Min	Typ	Max	Units
Input Voltage Range		2.0		6.0	V
Output Voltage	Predefined	1.2		3.6	V
Output Voltage Accuracy	$I_{OUT} = 10\text{mA}$ , $V_O \geq 1.3\text{V}$	-2.0		+2.0	%
	$I_{OUT} = 10\text{mA}$ , $V_O = 1.2\text{V}$	0		+4.0	%
Output Current Limit	Short-Circuit Output Limit		80		mA
Dropout Voltage (Note 1)	$V_{OUT} = 3.3\text{V}$ , $I_{OUT} = 200\text{mA}$		300		mV
	$V_{OUT} = 2.8\text{V}$ , $I_{OUT} = 200\text{mA}$		380		
	$V_{OUT} = 2.5\text{V}$ , $I_{OUT} = 200\text{mA}$		420		
	$V_{OUT} = 1.8\text{V}$ , $I_{OUT} = 200\text{mA}$		550		
	$V_{OUT} = 1.2\text{V}$ , $I_{OUT} = 200\text{mA}$		800		
Ground Current	$I_{out} = 0\text{mA}$		80		$\mu\text{A}$
Line Regulation	$V_{IN} = \text{Max}(V_{O1}, V_{O2}) + 1\text{V}$ to 6V, $I_{out} = 10\text{mA}$		0.4		%/V
Load Regulation	$I_{out} = 1\text{mA}$ to 200mA		1.0		%
Shutdown Supply Current	$EN1 = EN2 = 0\text{V}$		~0.01		$\mu\text{A}$
Ripple Rejection (PSRR)	$F = 1\text{KHz}$ , $I_{out} = 1\text{mA}$		62		dB
	$F = 10\text{KHz}$ , $I_{out} = 1\text{mA}$		50		dB
	$F = 100\text{KHz}$ , $I_{out} = 1\text{mA}$		34		dB
EN Logic Low Level	$V_{IN} = 2.0\text{V}$ to 6V			0.4	V
EN Logic High Level	$V_{IN} = 2.0\text{V}$ to 6V	1.5			V
EN Input Bias Current	$V_{IN} = EN = 6\text{V}$		0.01		$\mu\text{A}$
Thermal Shutdown	Shutdown Temperature		160		$^\circ\text{C}$
Thermal Hysteresis			20		$^\circ\text{C}$

**Note 1 :** The drop out voltage varies depending on output voltage selection

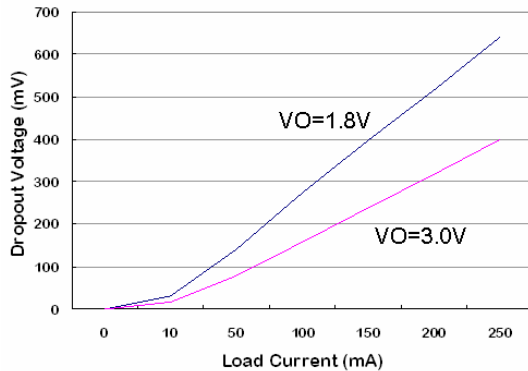
Dropout is defined as  $V_{IN} - V_O$  when  $V_O$  is 100mV below  $V_O$  where  $V_{IN} = \text{Max}(V_{O1}, V_{O2})$  for nominal  $V_O$ .

**Note 2:** Time needed for  $V_{OUT}$  to reach 90% of final value.

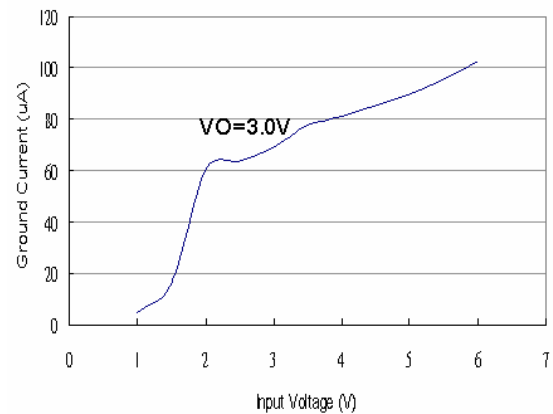
## Typical Characteristics

At  $T_A=25^{\circ}\text{C}$ ,  $V_{IN}=\text{Max}(V_{O1},V_{O2}) + 1\text{V}$ ,  $C_{IN}=C_{OUT}=1.0\mu\text{F}$ ,  $EN=V_{IN}$ , unless otherwise noted.

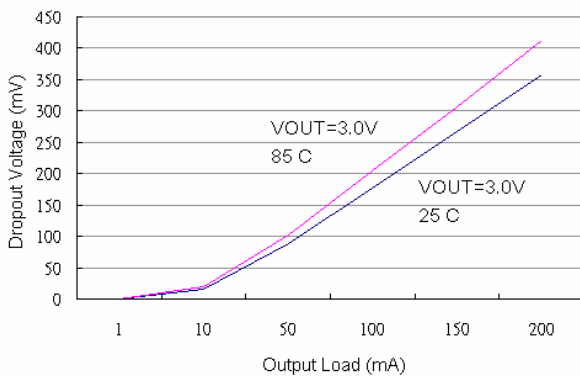
Dropout Voltage vs Load Current



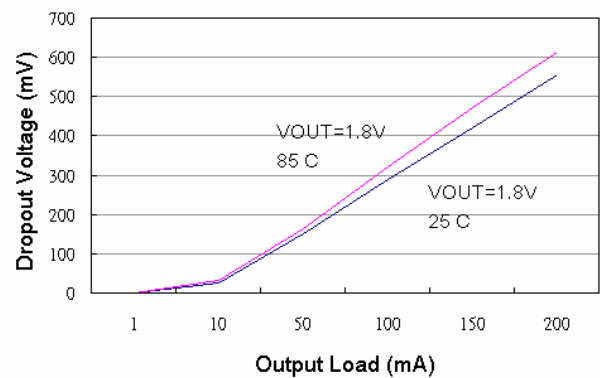
Ground Current vs Input Voltage (no load)



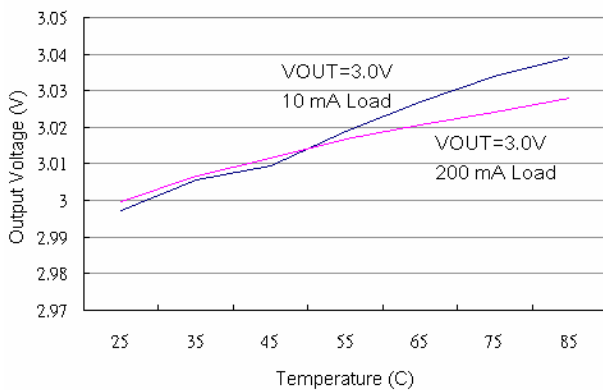
Dropout Voltage vs Temperature



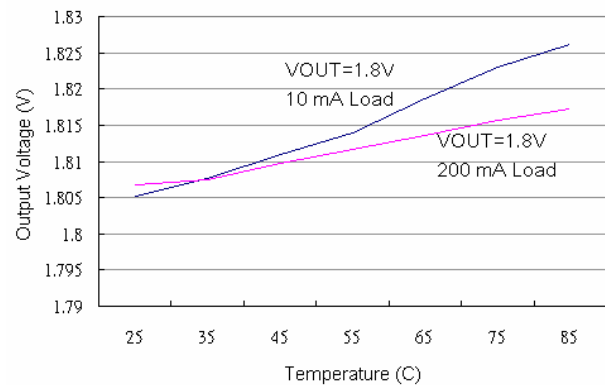
Dropout Voltage vs Temperature



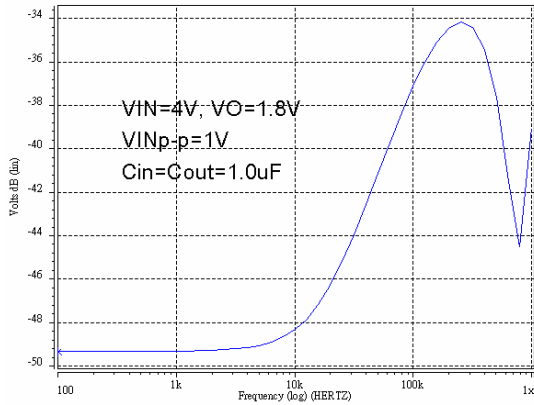
Output Voltage vs Temperature



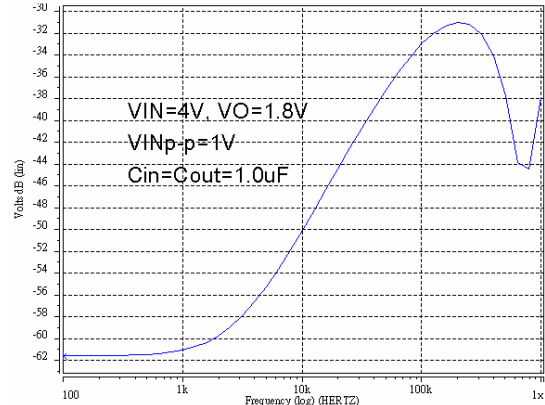
Output Voltage vs Temperature



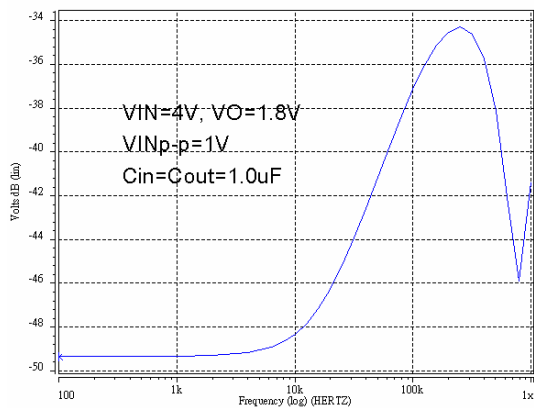
PSRR vs Frequency (10 mA load)



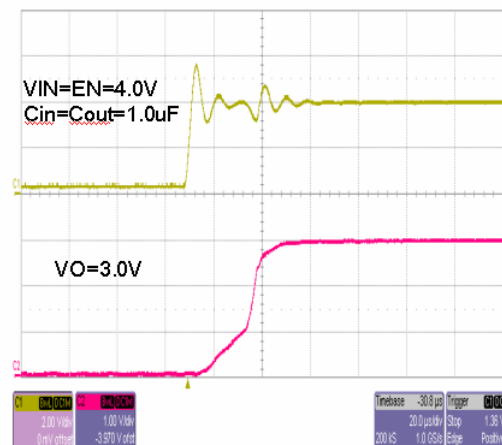
PSRR vs Frequency (1 mA load)



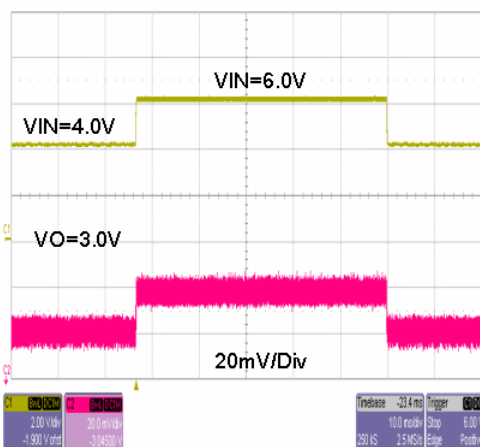
PSRR vs Frequency (100 mA load)



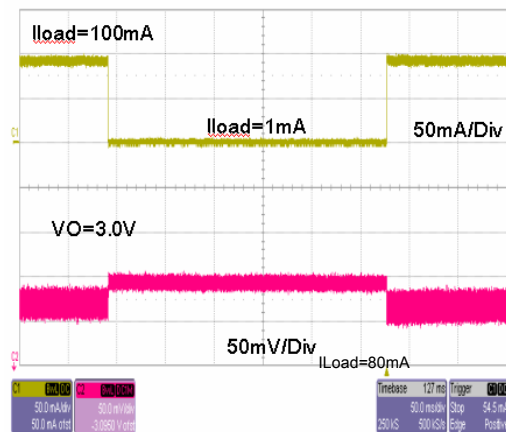
Start Up Delay (No load)



Line Transient Response



Load Transient Response



### Functional Block Diagram

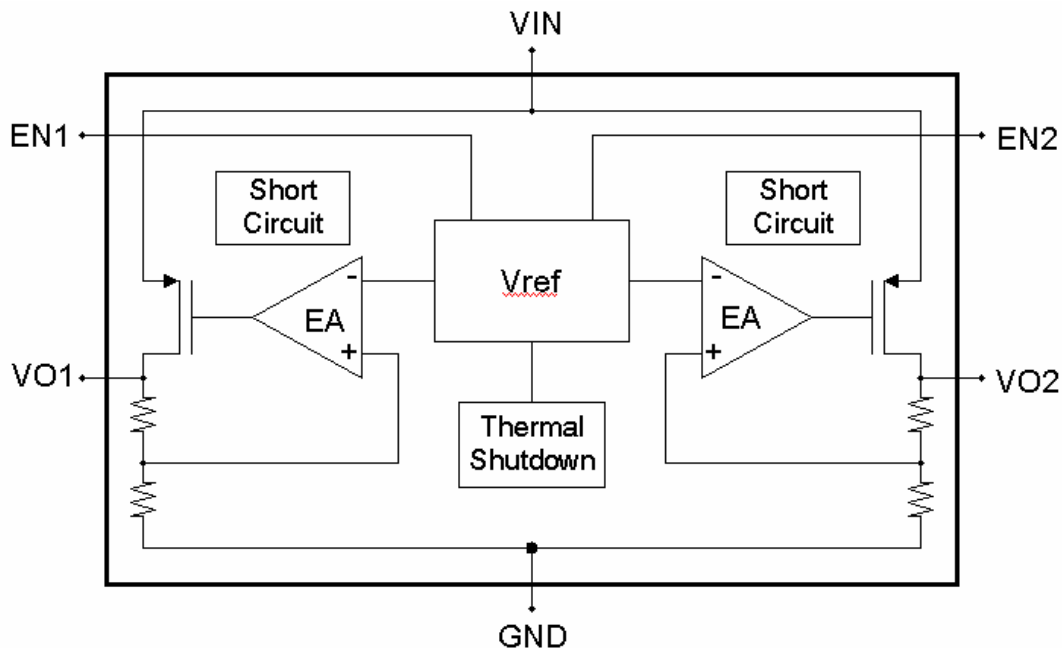


Figure 3 : Function Diagram

### Functional Description

The YB1220 consists of two low-noise, low-quiescent current, low-dropout linear regulators and is supplied in a small SOT-26 package suitable for portable and battery-powered applications. Each channel can independently supply loads up to 200mA (typical operation, not maximum) and output voltages are preset and ranging from 1.2V to 3.6V.

As shown in the *Functional Block Diagram*, the YB1220 consists of a single reference generating circuit, two error amplifiers, two P-channel pass transistors, independent internal feedback voltage dividers, two short circuit current limiters and one thermal shutdown protection circuit.

The internal reference is connected to the error amplifier's inverting input. The error amplifier compares this reference with the feedback voltage and amplifies the

difference. If the feedback voltage is lower than the reference voltage, the gate of pass-transistor is pulled low, allowing more current to pass to the output and increasing the output voltage. If the feedback voltage is too high, the gate of pass transistor is pulled high, resulting in less current to the output.

#### Stability

The YB1220 is a high performance LDO emphasizing stability with low output capacitance. It is able to maintain stability with an output capacitor as low as 1.0uF. The output capacitor can also be increased to optimize performance. The YB1220 will remain stable and in regulation with no load, unlike many other voltage regulators.

#### Internal P-Channel Pass Transistor

The YB1220 features a low impedance

P-channel MOSFET pass transistor. This provides several advantages over similar designs using a PNP pass transistor, including low operating power and longer battery life. The YB1220 consumes only 90 $\mu$ A around of quiescent current under most conditions.

### **Output Short-Circuit Current Limit**

The YB1220 includes two current limiters, which monitor and control the pass transistor's gate voltage, limiting the output current to about 80mA, for example, in a short-circuit output situation.

### **Shutdown**

The YB1220 also features a low-power shutdown mode. It consists of independent switches to turn off different channel. The two LDOs are allowed to work in both active, only one active or both disabled to keep the lowest current consumption. In the both shutdown mode, the internal functional blocks, such as voltage reference and the error amplifiers, are turned off completely, and the quiescent current is less than 1 $\mu$ A. In the single shutdown mode, the reference circuit and the active side error amplifier remain functional whereas the disabled error amplifier gets into shutdown mode.

### **Thermal Protection Shutdown**

The thermal protection shutdown function protects the device from operating in over temperature condition. When the junction temperature exceeds +160 $^{\circ}$ C, the thermal sensor signals the shutdown logic, turning off the pass transistor and allowing the IC to cool down. The thermal sensor turns the pass transistor on again after the IC's

junction temperature drops to +140 $^{\circ}$ C.

### **Soft-Start Circuitry**

The YB1220 includes a soft-start circuitry to limit inrush current at turn-on. During power up, the output capacitor and output load are charged with a reduced output current. Shortly after the initial power up, the soft-start feature is terminated and normal operation is resumed.

## **Application Information**

### **Enable/Shutdown**

The YB1220 comes with an active-high enable pin that allows the regulator to be enabled. Forcing the enable pin low disables the regulator and puts it into the shutdown mode. This pin cannot be left floating as it may cause an undetermined state.

### **Input/Output Capacitor**

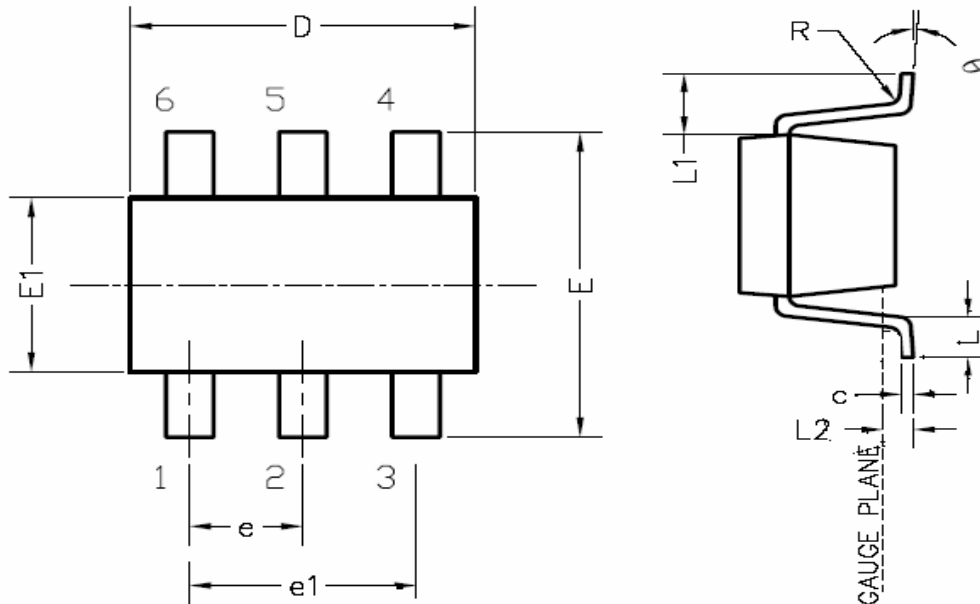
It is recommended to use a 1.0 $\mu$ F capacitor on the YB1220 input and a 1.0 $\mu$ F capacitor on the output. For high regulation performance, larger input capacitor values and lower ESRs provide better noise rejection and line-transient response. The output noise, load-transient response, stability, and power-supply rejection can be improved by using large output capacitors. Low ESR ceramic capacitors provide optimal performance and save space.

### **Transient Response**

The transient response can be improved by increasing the values of the input and output bypass capacitors, and through passive filtering techniques.



**SOT-26 Package Information**



Symbol	inch			mm		
	Min	Nom	Max	Min	Nom	Max
A	0.041	-	0.053	1.05	-	1.35
A1	0.002	-	0.006	0.05	-	0.15
A2	0.039	0.043	0.047	1.00	1.10	1.20
b	0.012	-	0.020	0.30	-	0.50
c	0.003	-	0.008	0.08	-	0.20
D	0.110	0.114	0.118	2.80	2.90	3.00
E	0.102	0.110	0.118	2.60	2.80	3.00
E1	0.059	0.063	0.067	1.50	1.60	1.70
e	0.0374 BSC			0.95 BSC		
e1	0.0748 BSC			1.90 BSC		
L	0.014	0.018	0.022	0.35	0.45	0.55
L1	0.0236 REF			0.60 REF		
L2	0.0098 BSC			0.25 BSC		
y	-	-	0.004	-	-	0.10
R	0.004	-	-	0.10	-	-
theta	0°	-	8°	0°	-	8°
theta1	7° NOM			7° NOM		
theta2	5° NOM			5° NOM		

