芯伯乐®
XINBOLE

Product Specification

XBL29302

3A Fast Response LDO Regulator

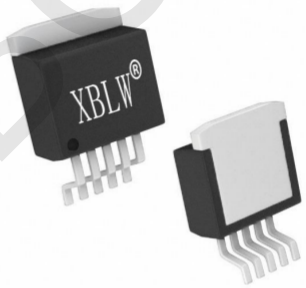
WEB | www.xinboleic.com

Descriptions

The XBL29302 is a high-current, low-dropout voltage regulator that uses XBLW's proprietary Super βeta PNP process with a PNP pass element. The 3A LDO regulator features 300mV to 370mV (full load) dropout voltageand very low ground current. Designed for high-currentloads, these devices also find applications in lowercurrent, low-dropout critical systems, where theirdropout voltages and ground current values ar eimportant attributes.
Along with a total accuracy of ±2% (over temperature,line, and load regulation) the regulator features very fast transient recovery from input voltage surges and output load current changes.
The XBL29302 has an adjustable output that can beset by two external resistors to a voltage between1.24V and 25V. In addition, the device is fully protected against overcurrent faults, reversed input polarity,reversed lead insertion, and over temperature operation. A TTL/CMOS logic enable (EN) pin isavailable in the XBL29302 A to shutdown the regulator.When not used, the device can be set to continuous operation by connecting EN to the input (IN).

Features

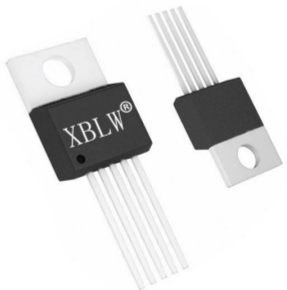
- High-Current Capability
- Operating Input Voltage Range: 3V to 26V
- Low Dropout Voltage
- Low Ground Current
- Accurate 1% Tolerance
- Fast Transient Response
- 1.24V to 25V Adjustable Output Voltage
- Packages: TO-263-5L and TO-220-5L



TO-263-5L

Applications

- Battery-Powered Equipment
- High-Efficiency Computer Systems
- High-Efficiency Linear Power Supplies
- High-Efficiency Post-Regulator for Switching Supply
- Automotive Electronics



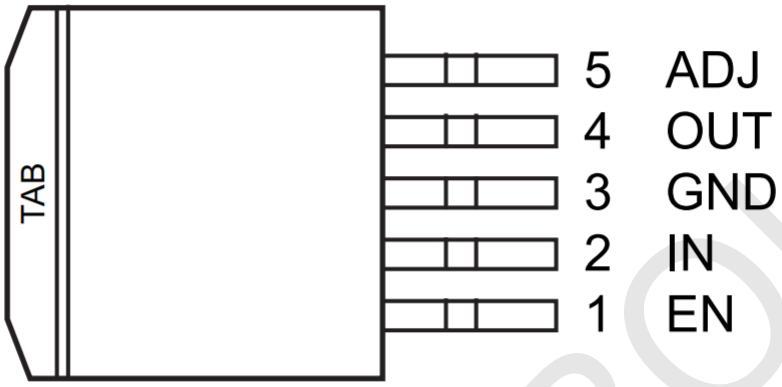
TO-220-5L

Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
XBL29302N	TO-220-5L	XBL29302N	Tube	1000Pcs/Box
XBL29302DTR	TO-263-5L	XBL29302	Tape	800Pcs/Reel

XBLW/XINBOLE

Pins Configuration



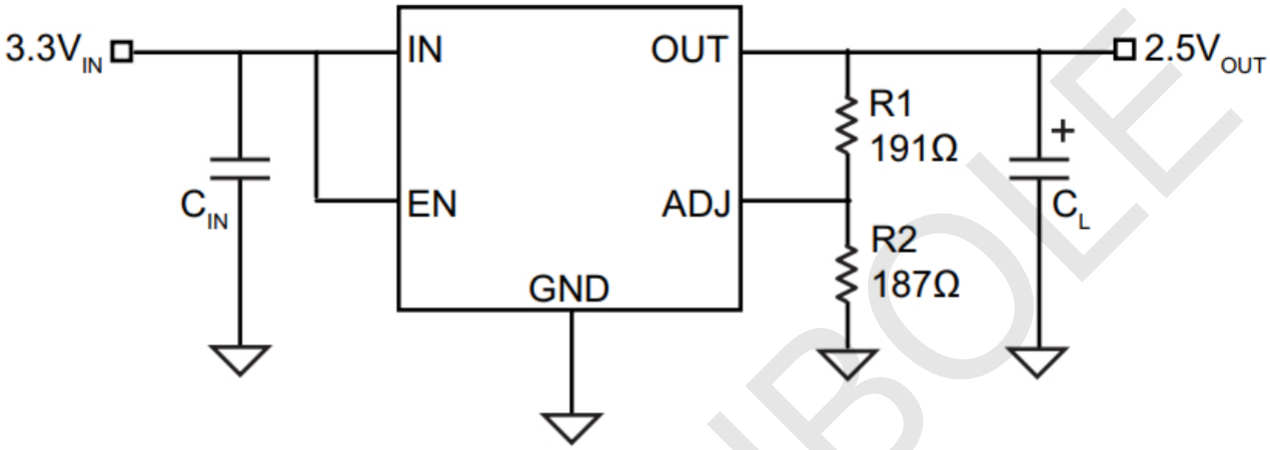
(TOP VIEW)

Pin Description

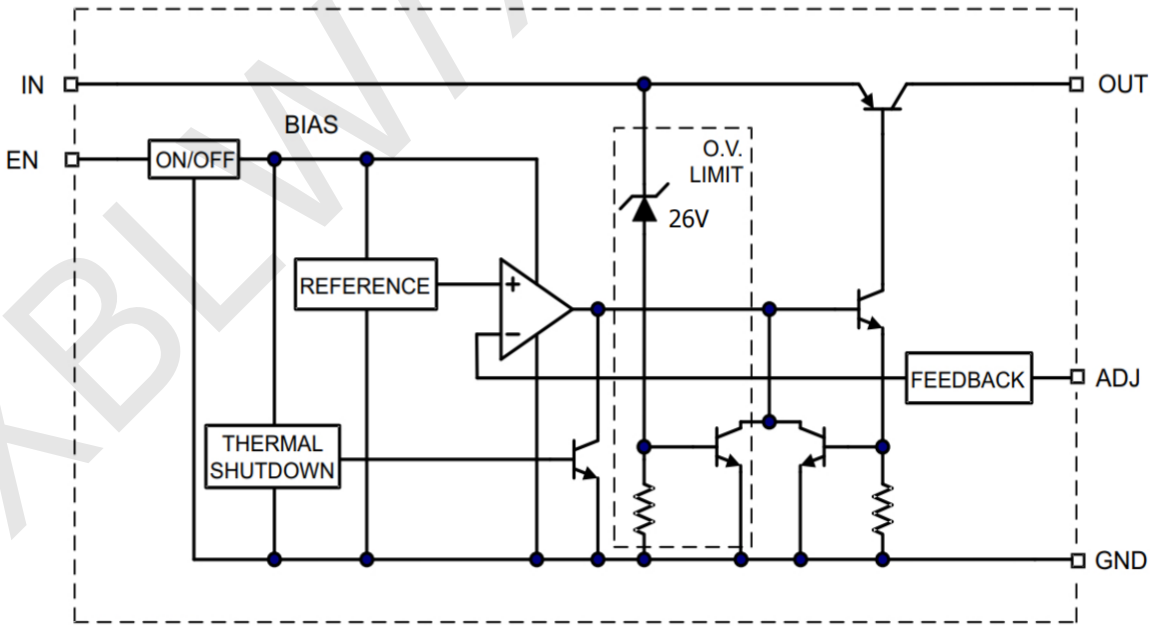
No.	Name	Description
1	EN	Enabling end, compatible with CMOS logic level. When EN=H, the device works; When EN=L, the device flags.
2	IN	Input voltage
3	GND	Ground
4	OUT	Output
5	ADJ	Adjust the feedback terminal, connected tothe output terminal and the ground terminal resistance voltage divider network, to set the output voltage value

XBLW/XINBOLE

Typical Application Circuit



Functional Block Diagram



XBLW/XINBOLE

Absolute Maximum Ratings (Ta=25°C)

Rating	Symbol	Value	Unit
Input Supply Voltage	VIN	40	V
Enable Input Voltage	VEN	VIN	V
Operating Junction Temperature Range	T_J	-40 to +125	°C
Storage Temperature Range	T_{stg}	-65 to +150	°C
Operating Input Voltage	VOP	3~26	V
Package Thermal Resistances TO263-5L	θJ_C	3	°C/W
Package Thermal Resistances TO263-5L	θ_{JA}	28	°C/W

Recommended Operation Conditions

Symbol	Parameter	Range	Unit
V_{IN}	Maximum Operating Input Voltage	26	V
T_{amb}	Operation Junction Temperature	-40 to +125	°C

Electrical Characteristics

V_{IN} = 4.184 V; I_{OUT} = 100 mA; TA = +25°C, **bold** values indicate 40°C ≤ T_J ≤ +125°C, unless noted. Note 1

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Output Voltage						
Output Voltage Accuracy	ΔV_{OUT}	−2	—	2	%	100 mA ≤ I_{OUT} ≤ 3A, (V_{OUT} + 1V) ≤V_{IN} ≤ 26V
Line Regulation	$\Delta V_{OUT}/\Delta V_{IN}$	—	0.1	0.5	%	I_{OUT} = 100 mA, (V_{OUT} + 1V) ≤ V_{IN} ≤ 26V
Load Regulation	$\Delta V_{OUT}/\Delta I_{OUT}$	—	0.2	1	%	V_{IN} = V_{OUT} + 1V, 100 mA ≤ I_{OUT} ≤ 3A
Dropout Voltage (Note 2)	V_{DO}	—	100	200	mV	I_{OUT} = 100 mA, V_{IN} ≥ 3.184V
		—	300	—		I_{OUT} = 1.5A, V_{IN} ≥ 3.184V
		—	500	—		I_{OUT} = 2.75A, V_{IN} ≥ 3.184V
		—	560	800		I_{OUT} = 3A, V_{IN} ≥ 3.4V
Ground Current						
Ground Current	I_{GND}	—	5	20	mA	I_{OUT} = 750 mA, V_{IN} = V_{OUT} + 1V
		—	15	—		I_{OUT} = 1.5A
		—	60	150		I_{OUT} = 3A
Ground Pin Current at Dropout	I_{GNDDO}	—	2	—	mA	V_{IN} = 0.5V less than specified V_{OUT}; I_{OUT} = 10 mA
Current Limit	I_{LIMIT}	3	4	—	A	V_{OUT} = 0V, Note 3
Output Noise Voltage (10 Hz to 100 kHz)	e_N	—	400	—	μV_{RMS}	C_L = 10 µF
		—	260	—		C_L = 33 µF
Ground Pin Current in Shutdown	I_{SHDN}	—	32	—	µA	Input Voltage V_{IN} = 26V
Reference						
Reference Voltage	V_{REF}	1.215		1.267	V	Note 4
Adjust Pin Bias Current	I_{ADJ}	—	40	—	nA	
		—	—	120		

XBLW XINBOLE

ELECTRICAL CHARACTERISTICS (CONTINUED)

V_{IN}= 4.184V; I_{OUT}= 100 mA; T_A= +25°C, **bold** values indicate –40°C ≤ T_J ≤ +125°C, unless noted. Note 1

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
ENABLE Input						
Input Logic Voltage	V_{ENABLE}	—	—	0.8	V	Low (OFF)
		2.4	—	—		High (ON)
Enable Pin Input Current	I_{ENABLE}	—	15	30	µA	V_{EN} = 4.2V
		—	—	75		
				2		V_{EN} = 0.8V
		—	—	4		
Regulator Output Current in Shutdown	$I_{OUT-SHDN}$	—	10	—	µA	Note 5
		—	—	20		

Note :

1: Specification for packaged product only

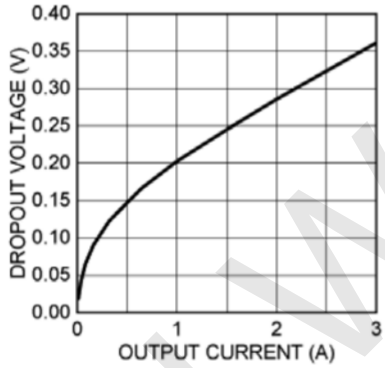
2: Dropout voltage is defined as the input-to-output differential when output voltage drops to 99% of its nor- mal value with V_{OUT} + 1V applied to V_{IN}.

3: V_{IN}= V_{OUT} (nominal) + 1V. For example, use V_{IN} = 4.3V for a 3.3V regulator or use 6V for a 5V regulator. Employ pulse testing procedure for current-limit.

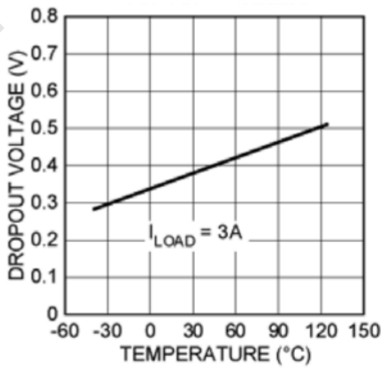
4: V_{REF}≤ V_{OUT}≤ V_{IN} – 1, 3V ≤ V_{OUT} ≤ 26V, 10 mA ≤ I_L ≤ IFL, T_J ≤ $T_{J(MAX)}$.

5: V_{EN} ≤ 0.8V, V_{IN} ≤ 26V and V_{OUT} = 0V.

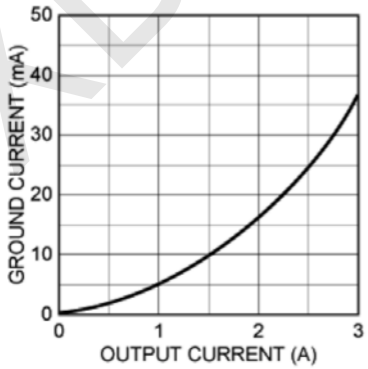
Typical Characteristics



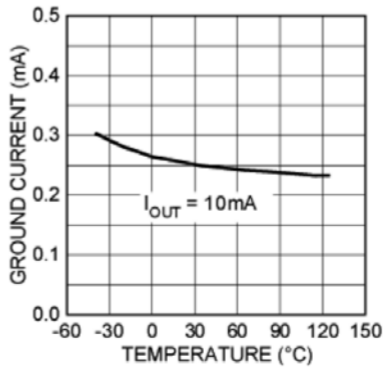
Dropout Voltage vs. Output Current.



Dropout Voltage vs. Temperature.



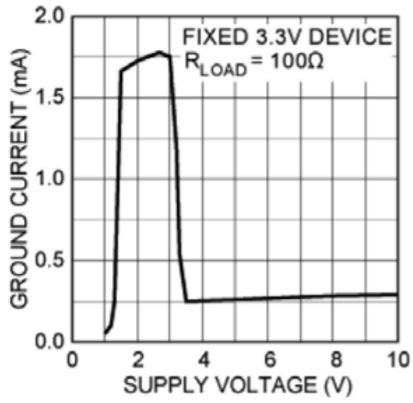
Ground Current vs. Output Current.



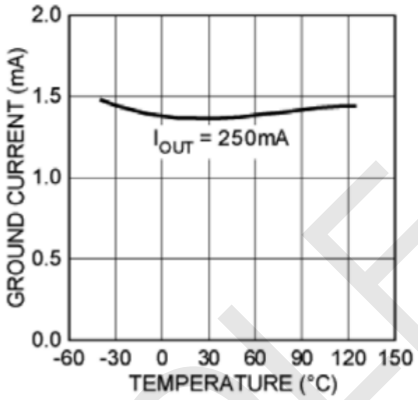
Ground Current vs. Temperature.

XBLW/XINBOLE

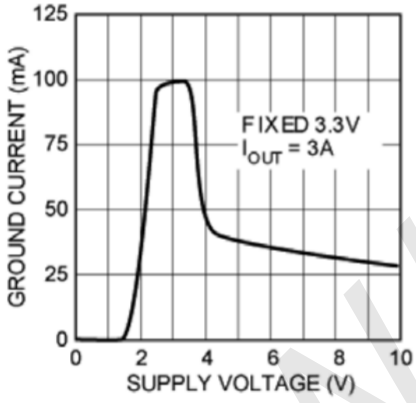
Typical Characteristics



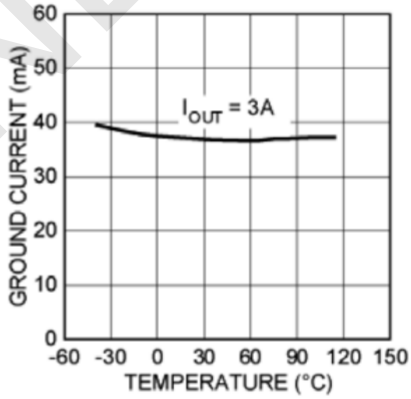
Ground Current vs. Supply Voltage.



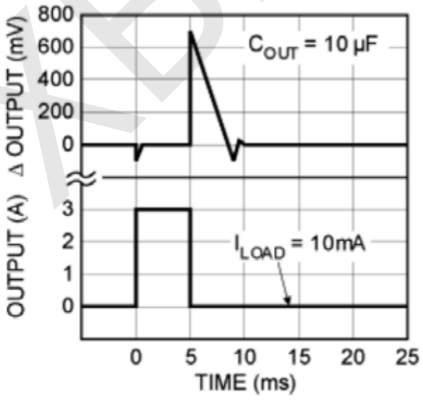
Ground Current vs. Temperature.



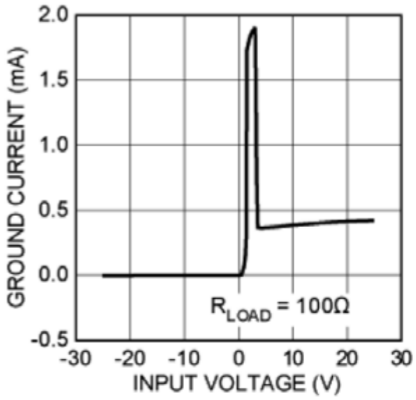
Ground Current vs. Supply Voltage.



Ground Current vs. Temperature.



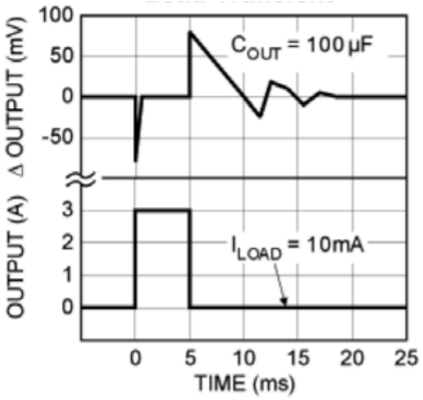
Load Transient.



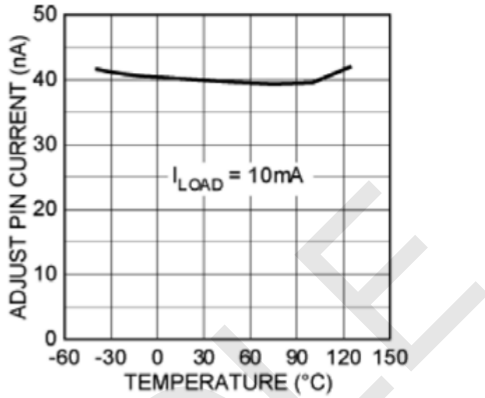
Ground Current vs. Input Voltage.

XBLW/XINBOLE

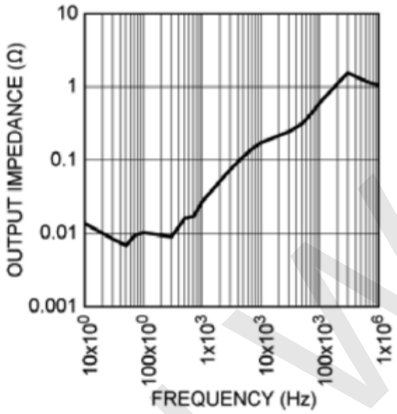
Typical Characteristics



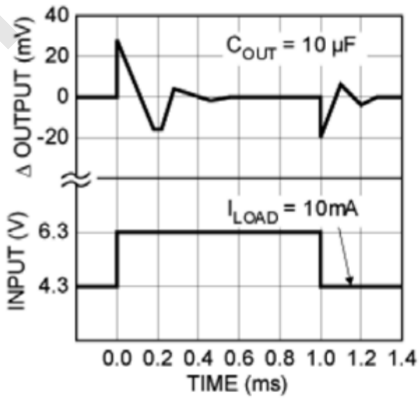
Load Transient.



Adjust Pin Current vs. Temperature.



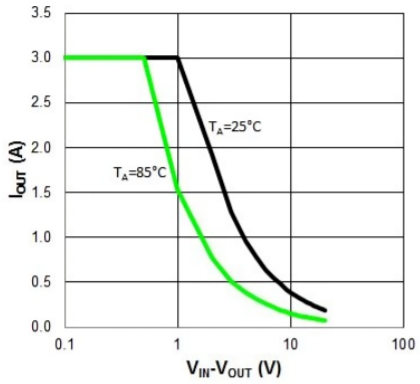
Output Impedance vs. Frequency.



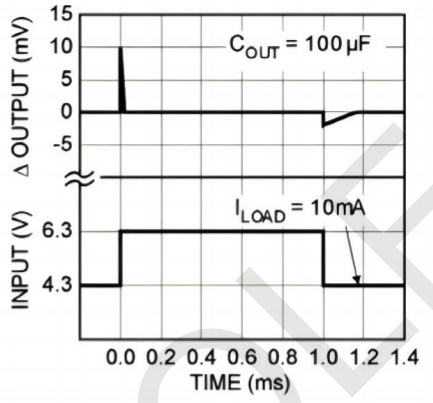
Line Transient.

XBLW/XINBOLE

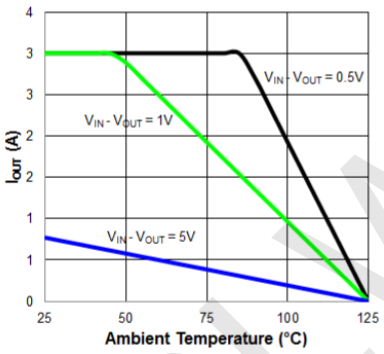
Typical Characteristics



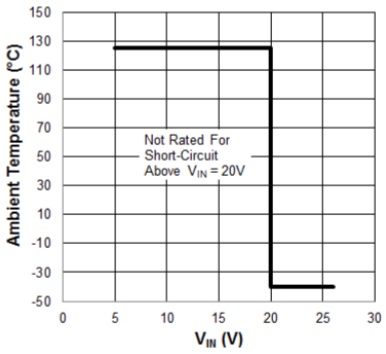
I_{OUT} vs. V_{IN} – V_{OUT} SOA (TO-263).



Line Transient.



I_{OUT} vs. T_A SOA(TO-263).



Short-Circuit SOA vs. Temperature (TO-263).

XBLW/XINBOLE

APPLICATION INFORMATION

The XBL29302 is a high-performance, low-dropout voltage regulator suitable for all moderate to high-current voltage regulation applications. Its 560 mV typical dropout voltage at full load makes it especially valuable in battery-powered systems and as high efficiency noise filters in post-regulator applications.Unlike older NPN-pass transistor designs, where the minimum dropout voltage is limited by the base-emitter voltage drop and collector-emitter saturation voltage, dropout performance of the PNP output is limited merely by the low V_{CE} saturation voltage.

A trade-off for the low dropout voltage is a varying base driver requirement. But the Super ßeta PNP process reduces this drive requirement to merely 1% of the load current.

The XBL29302 regulator is fully protected fromdam age due to fault conditions. Current limiting is linear; output current under overload conditions is constant. Thermal shutdown disables the device when the die temperature exceeds the +125°C maximum safe operating temperature. The output structure of the regulators allows voltages in excess of the desired output voltage to be applied without reverse current flow. The XBL29302 offers a logic-level ON/OFF control. When disabled, the device draws 32 µA at maximum 26V input.

1 Capacitor Requirements

For stability and minimum output noise, a capacitor on the regulator output is necessary. The value of this capacitor is dependent upon the output current; lower currents allow smaller capacitors. The XBL29302 issta ble with a 10 µF capacitor at full load.

This capacitor need not be an expensive low-ESR type; aluminum electrolytics are adequate. In fact, extremely low-ESR capacitors may contribute to instability. Tantalum capacitors are recommended for systems where fast load transient response is important.

When the regulator is powered from a source with high AC impedance, a 0.1 µF capacitor connected between input and GND is recommended.

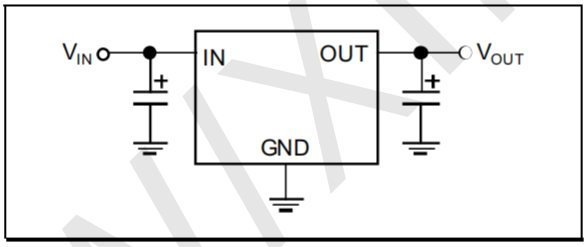


FIGURE 1: Linear Regulators Require Only Two Capacitors for Operation.

2. Transient Response and 5V to 3.3V Conversio

The XBL29302 has excellent response to variations in input voltage and load current. By virtue of its low dropout voltage, the device does not saturate into dropout as readily as similar NPN-based designs. A 3.3V output Microchip LDO will maintain full speed and performance with an input supply as low as 4.2V, and will still provide some regulation with supplies down to 3.8V, unlike NPN devices that require 5.1V or more for good performance and become nothing more than a resistor under 4.6V of input. Microchip's PNP regulators provide superior performance in "5V to 3.3V" conversion applications than NPN regulators, especially when all tolerances are considered.

3. Minimum Load Current

The XBL29302 regulator operates within a specified load range. If the output current is too small, leakage currents dominate and the output voltage rises.

A minimum load current of 10 mA is necessary for proper regulation and to swamp any expected leakage current across the operating temperature range.

For best performance the total resistance (R1+R2) should be small enough to pass the minimum regulator load current of 10 mA.

4. Adjustable Regulator Design

The output voltage can be programmed anywhere between 1.25V and the 25V. Two resistors are used. The resistor values are calculated by:

EQUATION 4-1:

$$R1 = R2 \times \left(\frac{V_{OUT}}{1.240} - 1\right)$$

Where:

V_{OUT} = Desired output voltage.

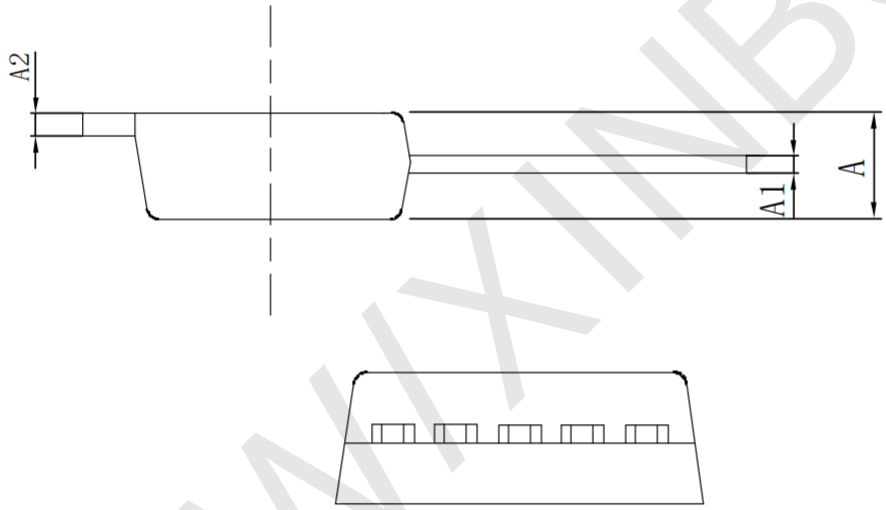
shows component definition. Applicationswith widely varying load currents may scale theresistors to draw the minimum load current required forproper operation (see the Minimum Load Currentsection).

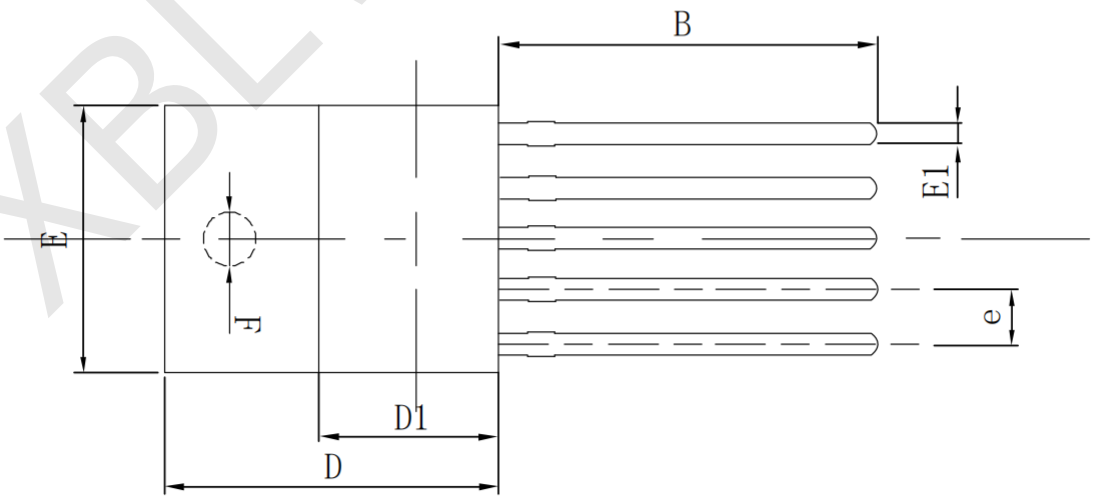
XBLW/XINBOLE

Package Information

· TO-220-5L

Size / Symbol	Dimensions In Millimeters		Size / Symbol	Dimensions In Inches	
	Min(mm)	Max(mm)		Min(in)	Max(in)
A	4.300	4.700	A	0.169	0.185
A1	0.450	0.600	A1	0.017	0.023
A2	1.250	1.400	A2	0.049	0.055
B	12.88	13.38	B	0.507	0.527
D	15.50	15.90	D	0.610	0.626
D1	9.000	9.400	D1	0.354	0.370
E	9.700	10.10	E	0.381	0.398
E1	0.660	0.914	E1	0.025	0.036
e	1.702(BSC)		e	0.670(BSC)	
F	Φ3.500	Φ3.700	F	Φ0.137	Φ0.146

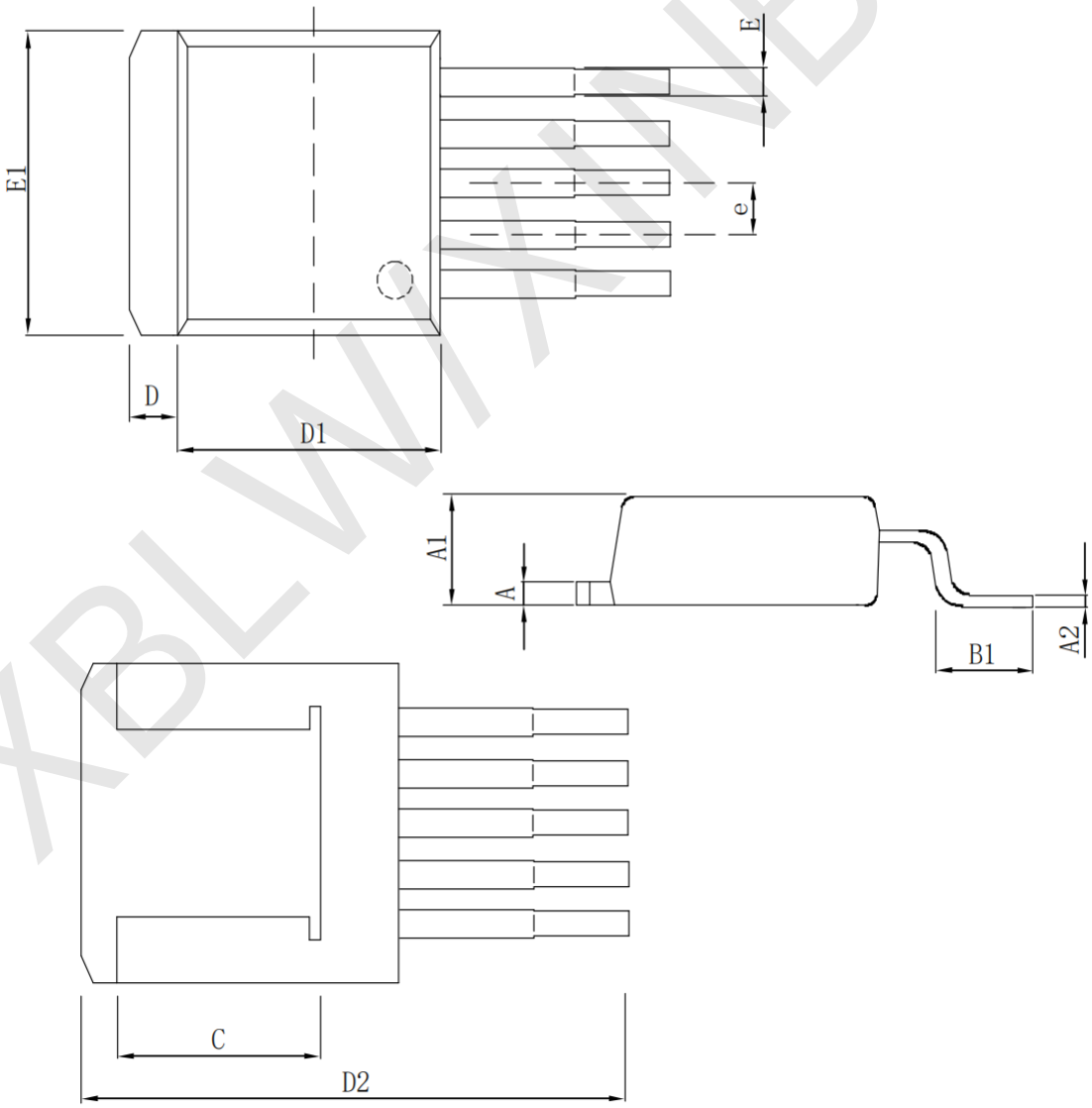




XBLW/XINBOLE

· TO-263-5L

Size / Symbol	Dimensions In Millimeters		Size / Symbol	Dimensions In Inches	
	Min(mm)	Max(mm)		Min(in)	Max(in)
A	1.170	1.370	A	0.046	0.054
A1	4.470	4.670	A1	0.176	0.184
A2	0.310	0.530	A2	0.012	0.021
B1	2.340	2.740	B1	0.092	0.108
C	5.080(REF)		C	0.200(REF)	
D	1.170	1.370	D	0.046	0.054
D1	8.500	8.900	D1	0.335	0.350
D2	14.55	15.55	D2	0.572	0.612
E	0.660	0.860	E	0.025	0.034
E1	10.01	10.31	E1	0.394	0.406
e	1.700(BSC)		e	0.067(BSC)	



XBLW XINBOLE

Statement:

- XBLW reserves the right to modify the product manual without prior notice! Before placing an order, customers need to confirm whether the obtained information is the latest version and verify the completeness of the relevant information.
- Any semiconductor product may malfunction under specified conditions. When using XBLW products for system design and overall manufacturing, the buyer is responsible for complying with safety standards and taking appropriate safety measures to avoid risks that may cause personal injury or property damage.
- XBLW products have not been licensed for life support, military, and aerospace applications, and therefore XBLW is not responsible for any consequences arising from the use of this product in these areas.
- If any or all XBLW products (including technical data, services) described or contained in this document are subject to any applicable local export control laws and regulations, they may not be exported without an export license from the relevant authorities in accordance with such laws.
- The specifications of any and all XBLW products described or contained in this document specify the performance, characteristics, and functionality of said products in their standalone state, but do not guarantee the performance, characteristics, and functionality of said products installed in Customer's products or equipment. In order to verify symptoms and conditions that cannot be evaluated in a standalone device, the Customer should ultimately evaluate and test the device installed in the Customer's product device.
- XBLW documentation is only allowed to be copied without any alteration of the content and with the relevant authorization. XBLW assumes no responsibility or liability for altered documents.
- XBLW is committed to becoming the preferred semiconductor brand for customers, and XBLW will strive to provide customers with better performance and better quality products.

XBLW XINBOLE