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Product Specification

XBL29302ADTR

3A Fast Response LDO Regulator

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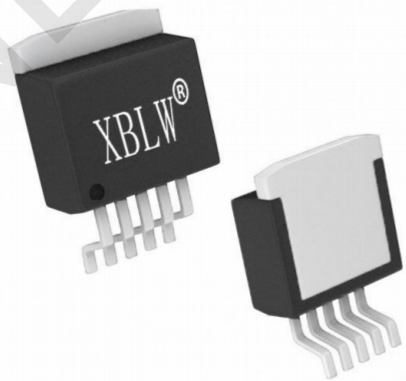
RoHS

Description

The XBL29302A is a high-current, low-dropout voltage regulator that uses XBLW's proprietary Superβ eta 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 XBL29302A has an adjustable output that can beset by two external resistors to a voltage between1.24V and 15V. 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 XBL29302A to shutdown the regulator.When not used, the device can be set to continuous operation by connecting EN to the input (IN). The XBL29302A is available in the standard TO263-5L package with an operating junction temperature range of –40°C to +125°C.

Features

- High-Current Capability
- Operating Input Voltage Range: 3V to 16V
- Low Dropout Voltage
- Low Ground Current
- Accurate 1% Tolerance
- Fast Transient Response
- 1.24V to 15V Adjustable Output Voltage
- Packages: TO-263-5L



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

Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
XBL29302ADTR	TO-263-5L	XBL29302A	Tape	800Pcs/Reel

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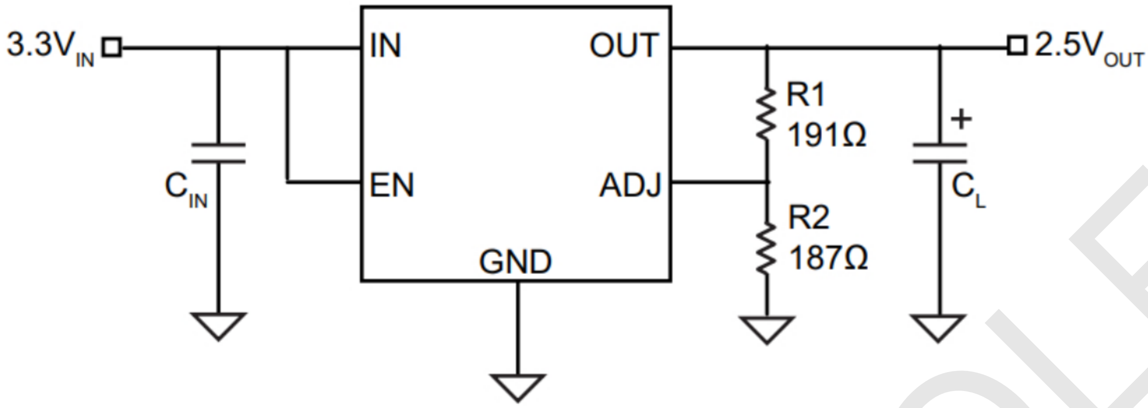
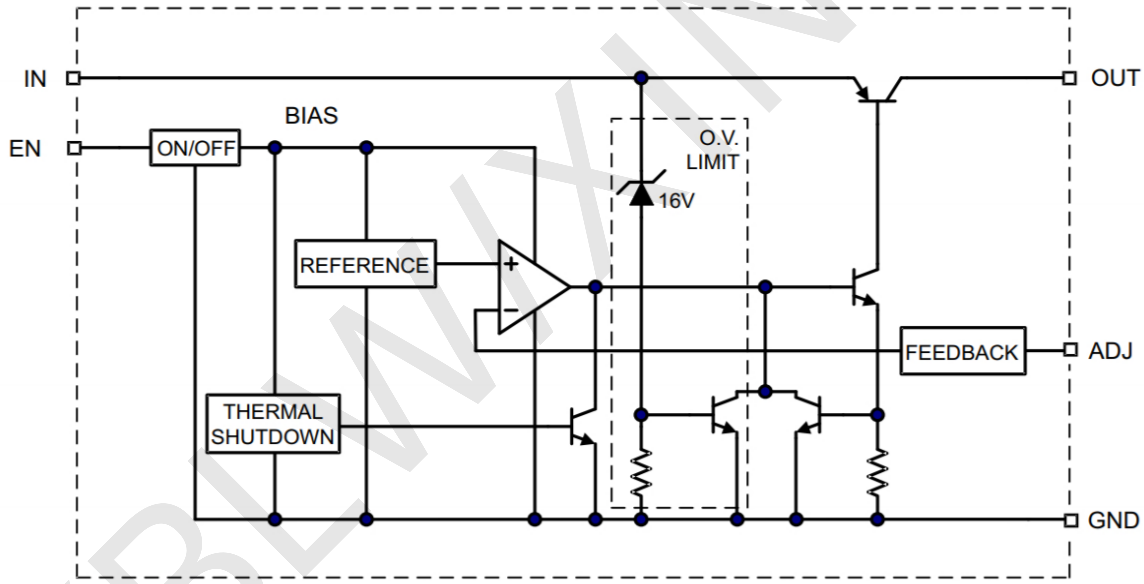
Typical Application Circuit



Functional Block Diagram



Absolute Maximum Ratings (Ta=25℃)

Rating	Symbol	Value	Unit
Input Supply Voltage	VIN	20	V
Enable Input Voltage	VEN	VIN	V
Operating Junction Temperature Range	T_J	-40 to +125	℃
Storage Temperature Range	T_{stg}	-65 to +150	℃
Operating Input Voltage	VOP	3~18	V
Package Thermal Resistances TO263-5L	θJC	3	℃/W
Package Thermal Resistances TO263-5L	θJA	28	℃/W

Electrical Characteristics

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
Output Voltage						
Output Voltage Accuracy	ΔV_{OUT}	−2	—	2	%	100 mA ≤ I_{OUT} ≤ 3A, (V_{OUT} + 1V) ≤ V_{IN} ≤ 16V
Line Regulation	$\Delta V_{OUT}/ \Delta V_{IN}$	—	0.1	0.5	%	I_{OUT} = 100 mA, (V_{OUT} + 1V) ≤ V_{IN} ≤ 16V
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} = 16V
Reference						
Reference Voltage	V_{REF}	1.215		1.267	V	Note 4
Adjust Pin Bias Current	I_{ADJ}	—	40	—	nA	
		—	—	120		

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 VIN.
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: $V_{REF} \le V_{OUT} \le V_{IN} - 1$, 3V ≤ V_{OUT} ≤ 16V, 10 mA ≤ I_L ≤ I_{FL}, $T_J \le T_{J(MAX)}$.
5: V_{EN} ≤ 0.8V, V_{IN} ≤ 16V and VOUT = 0V.

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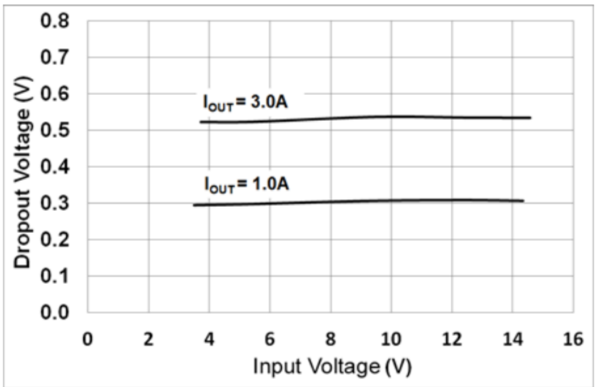
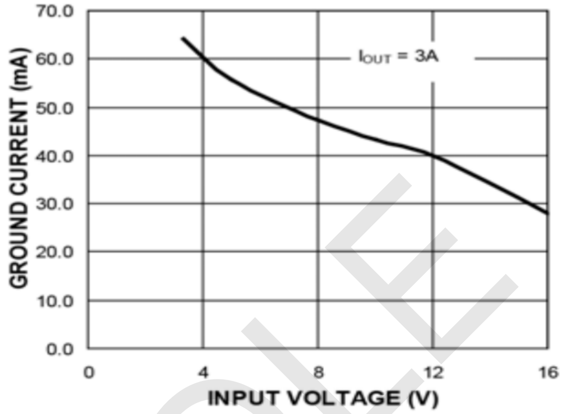
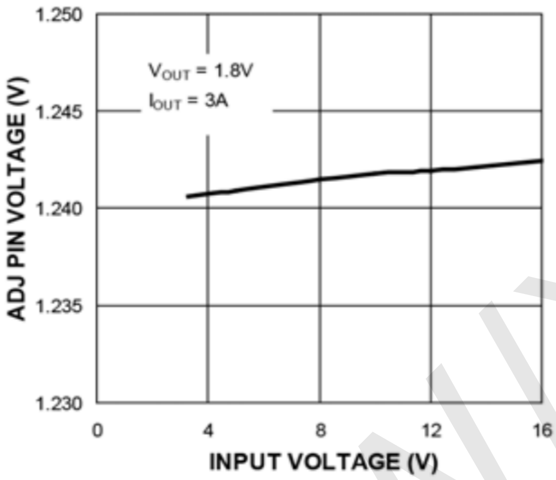
Typical Characteristics



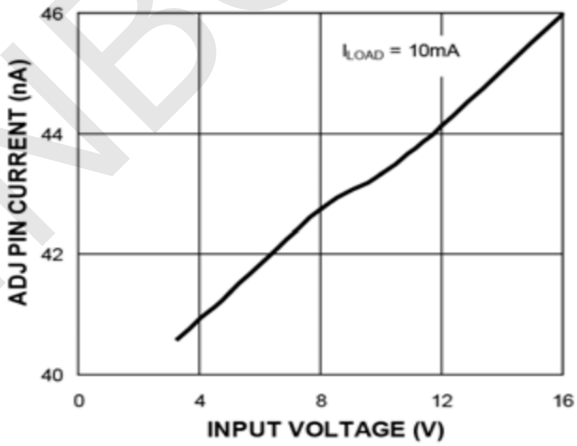
Dropout Voltage vs. Input Voltage.



GND Pin Current vs. Input Voltage.



Adjust Pin Voltage vs. Input Voltage.



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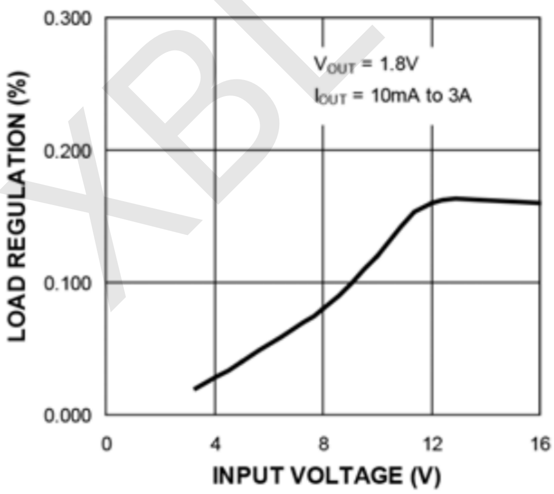
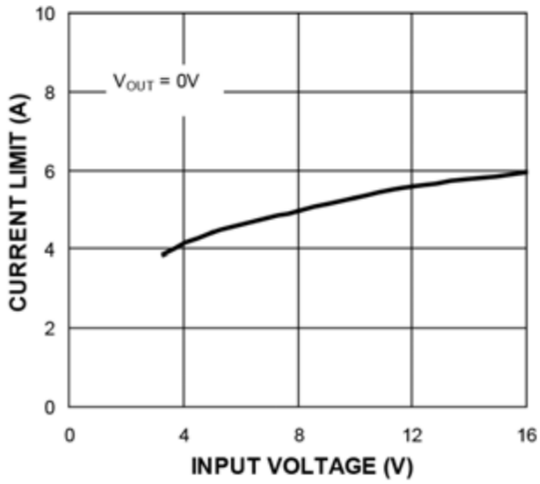
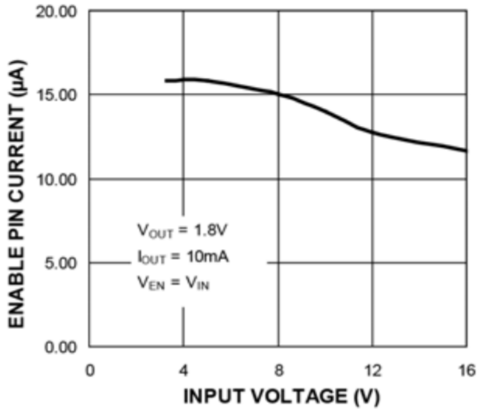


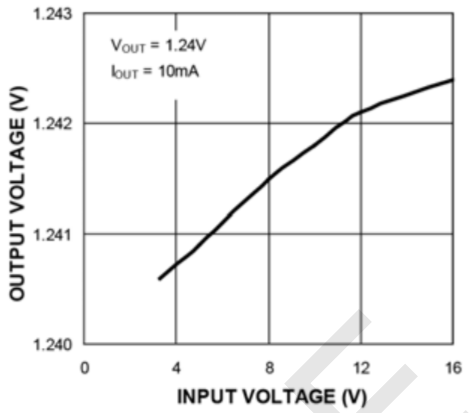
Load Regulation vs. Input Voltage.



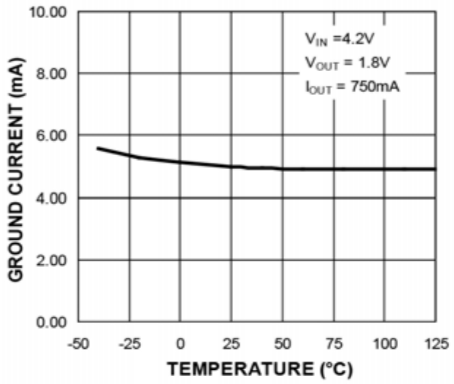
Short-Circuit Current vs.Input Voltage.



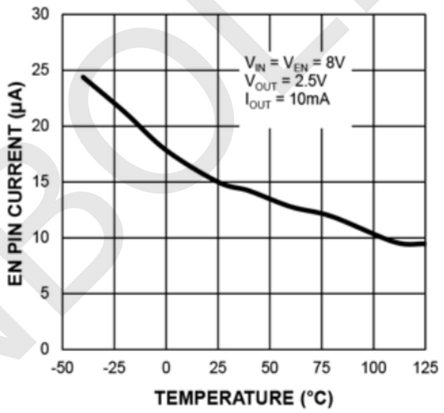
Enable Pin Current vs. Input Voltage.



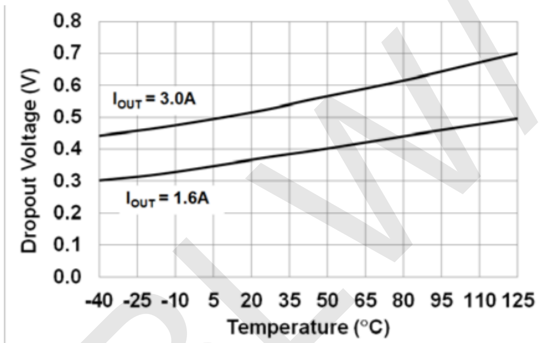
Output Voltage vs. Input Voltage.



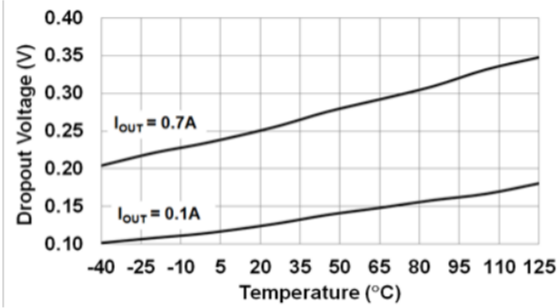
GND Pin Current vs. Temperature.



Enable Bias Current vs. Temperature.



Dropout Voltage vs. Temperature.



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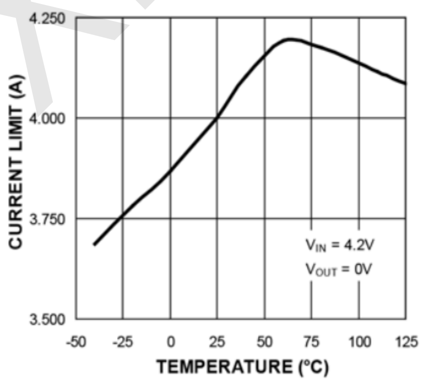

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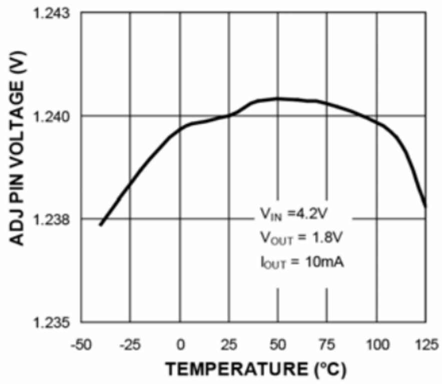

Adjust Pin Current vs. Temperature.

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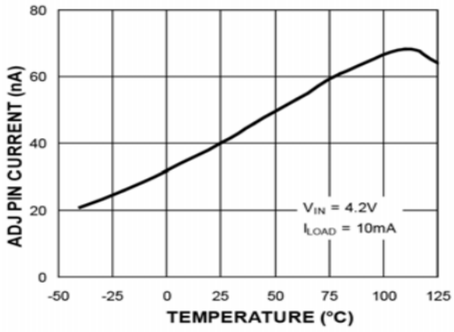
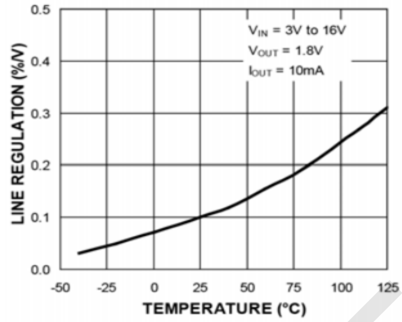
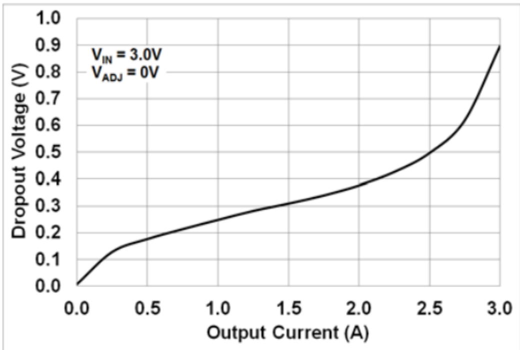


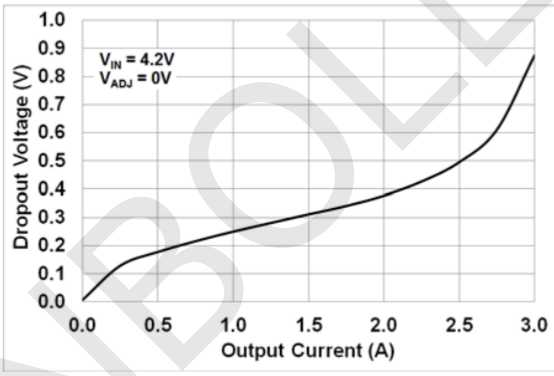
Adjust Pin Voltage vs. Temperature.



Line Regulation vs. Temperature.



Dropout Voltage vs. Output Current.



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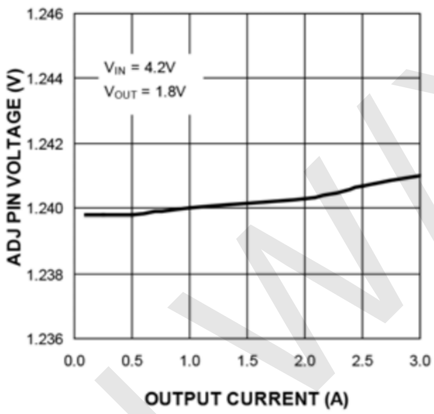
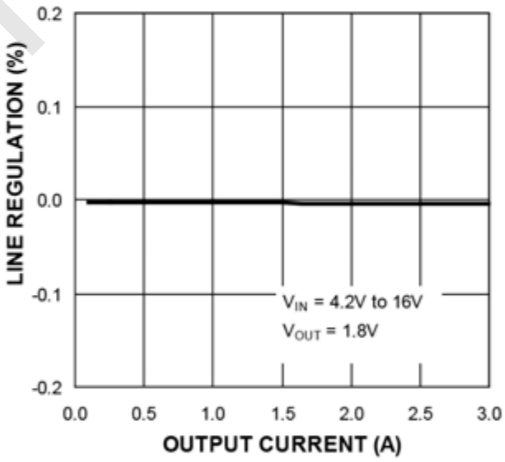
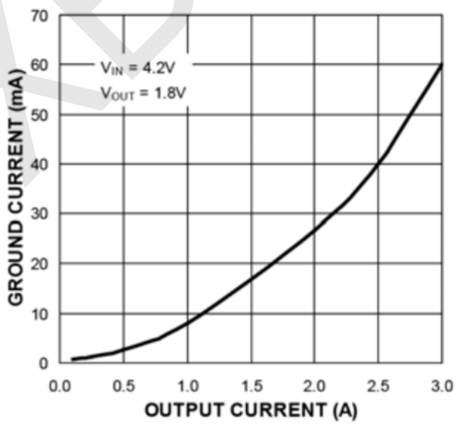


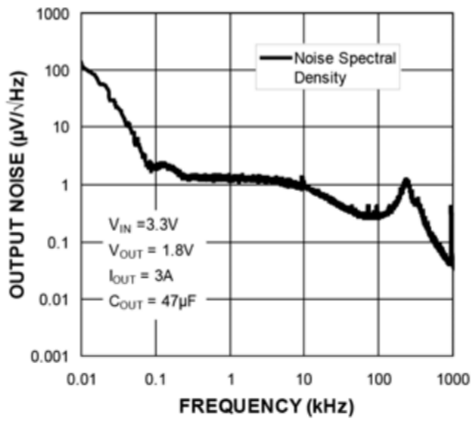
Adjust Pin Voltage vs.Output Current.



Line Regulation vs. Output Current.



GND Pin Current vs. Output Current.



Output Noise vs. Frequency.

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APPLICATION INFORMATION

The XBL29302A 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 VCE 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 XBL29302A regulator is fully protected from damage 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 XBL29302A offers a logic-level ON/OFF control. When disabled, the device draws 32 μA at maximum 16V 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 XBL29302A is stable 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.

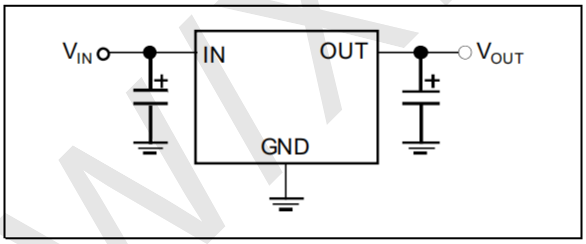

FIGURE 1: Linear Regulators Require O nly Two Capacitors for Operation.

2.Transient Response and 5V to3.3V Conversion

The XBL29302A 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 XBLW 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. XBLW'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 XBL29302A 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 15V. 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)

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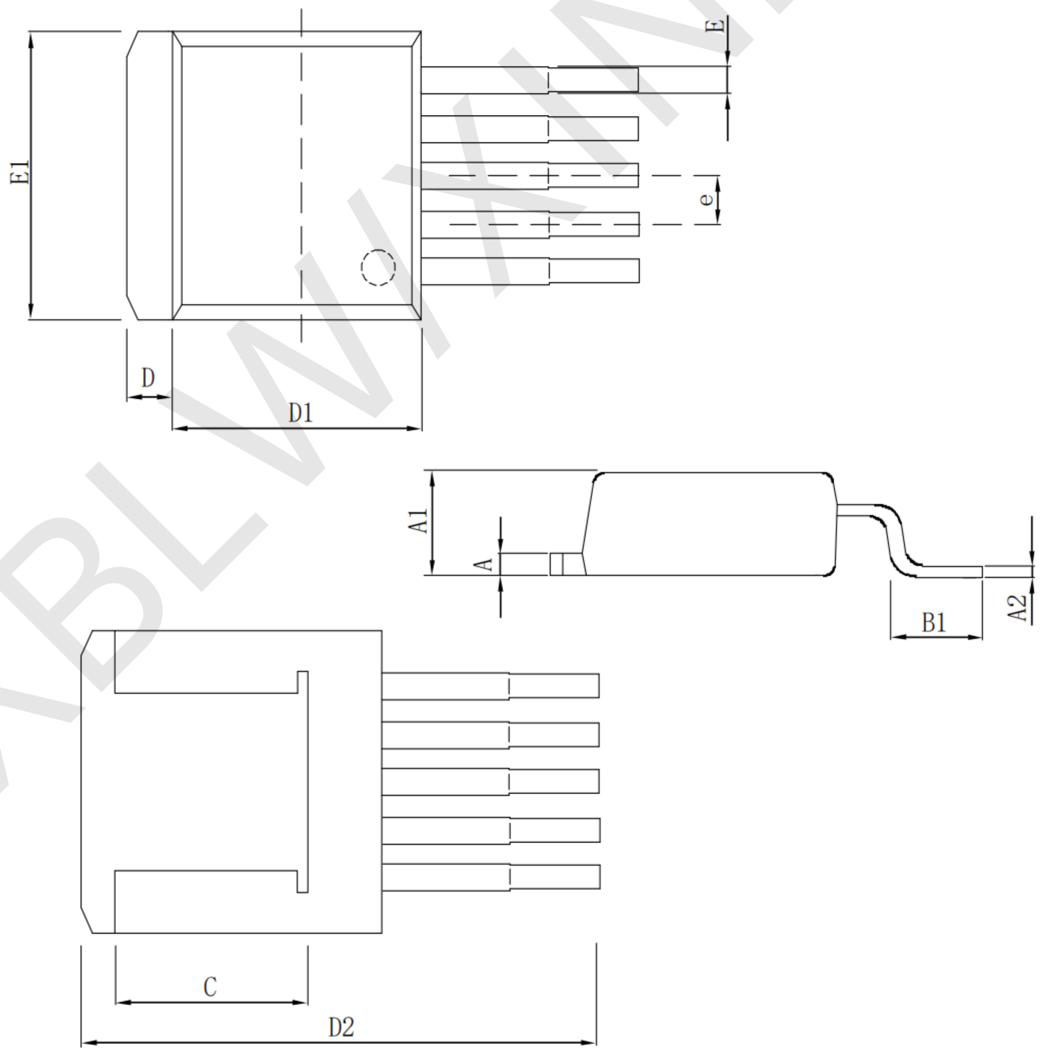
Package Information

· TO-263-5L

Symbol \ Size	Dimensions In Millimeters		Symbol \ Size	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)	



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