

芯伯乐®  
X I N B O L E

# Product Specification

XBL29301

3A Fast Response LDO Regulator

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## Descriptions

The XBL29301 is a high-current. The 3A LDO regulator features 300mV to 370mV (full load) dropout voltage and very low ground current. Designed for high-current loads, these devices also find applications in lower current, low-dropout critical systems, where their dropout voltages and ground current values are important attributes.

Along with a total accuracy of  $\pm 2\%$  (over temperature, line, and load regulation) the regulator features very fast transient recovery from input voltage surges and output load current changes.

The XBL29301 has a Fixed output that have voltage of 3.3V, 5.0V, 12V. In addition, the device is fully protected against overcurrent faults, reversed input polarity, reversed lead insertion, and over temperature operation.

The XBL29301 is available in the standard TO263-5L and TO220-5 package with an operating junction temperature range of  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ .

## Features

- High-Current Capability
- Operating Input Voltage Range: 3V to 26V
- Low Dropout Voltage
- Low Ground Current
- Accurate 1% Tolerance
- Fast Transient Response
- Fixed Output Voltage: 3.3V, 5V, 12V
- Packages: TO-263-5L and TO220-5L package



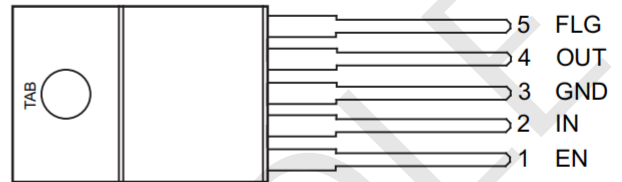
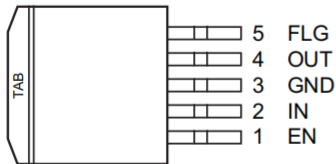
TO-263-5L

TO-220-5L

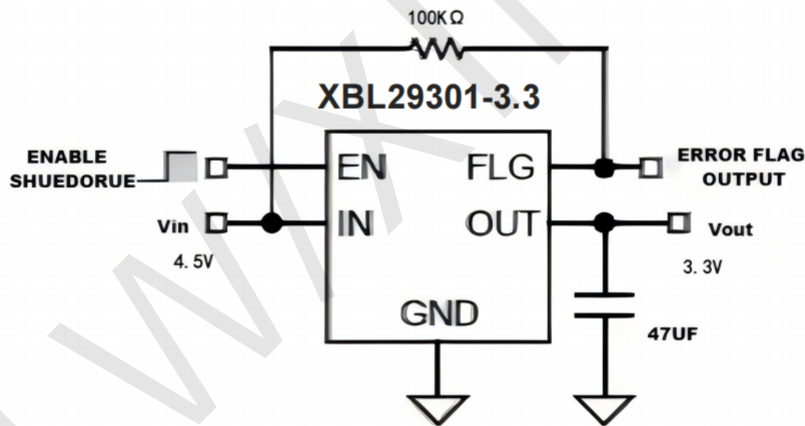
## Ordering Information

Product Model	Package Type	Marking	Packing	Packing Qty
XBL29301T-3.3	TO-220-5L	XBL29301T-3.3	Tube	1000Pcs/Box
XBL29301T-5.0	TO-220-5L	XBL29301T-5.0	Tube	1000Pcs/Box
XBL29301T-12	TO-220-5L	XBL29301T-12	Tube	1000Pcs/Box
XBL29301S-3.3DTR	TO-263-5L	XBL29301S-3.3	Tape	800Pcs/Reel
XBL29301S-5.0DTR	TO-263-5L	XBL29301S-5.0	Tape	800Pcs/Reel
XBL29301S-12DTR	TO-263-5L	XBL29301S-12	Tape	800Pcs/Reel

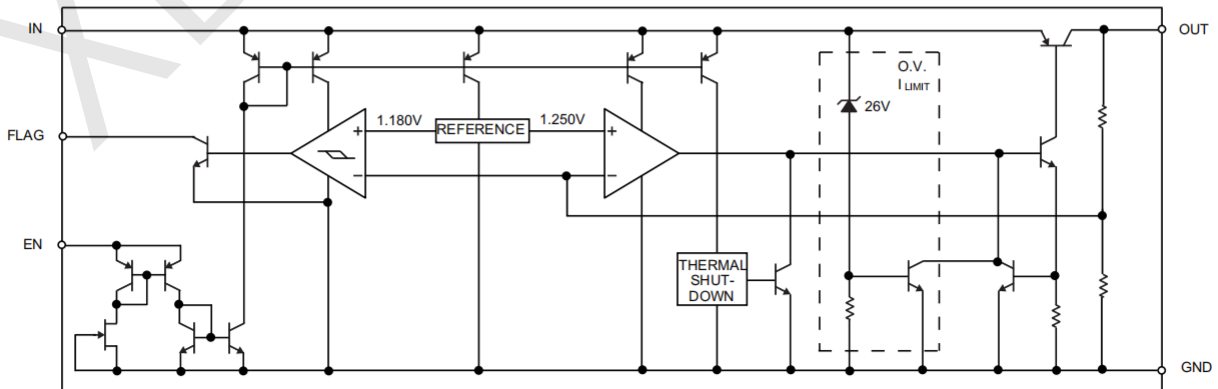
### Pin Description



### Typical Application Circuit



### Functional Block Diagram



## Absolute Maximum Ratings (T<sub>a</sub>=25 °C)

Rating	Symbol	Value	Unit
Input Supply Voltage	V <sub>IN</sub>	30	V
Enable Input Voltage	V <sub>EN</sub>	V <sub>IN</sub>	V
Operating Junction Temperature Range	T <sub>J</sub>	-40 to +125	°C
Storage Temperature Range	T <sub>stg</sub>	-65 to +150	°C
Operating Input Voltage	V <sub>OP</sub>	3~26	V
Package Thermal Resistances TO263-5L/TO220-5L	θ <sub>JC</sub>	3	°C/W
Package Thermal Resistances TO263-5L/TO220-5L	θ <sub>JA</sub>	28	°C/W

† **Notice:** Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability.

‡ **Notice:** The device is not guaranteed to function outside its operating ratings.

**Note 1:** Maximum positive supply voltage of 60V must be of limited duration (<100 ms) and duty cycle (≤1%). The maximum continuous supply voltage is 26V. Exceeding the absolute maximum rating may damage the device.

**2:** Devices are ESD sensitive. Handling precautions recommended.

## Electrical Characteristics

V<sub>IN</sub> = 4.184V; I<sub>OUT</sub> = 100 mA; T<sub>A</sub> = +25°C, bold values indicate -40°C ≤ T<sub>J</sub> ≤ +125°C, unless noted. Note 1

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Output Voltage						
Output Voltage Accuracy	ΔV <sub>OUT</sub>	-2	—	2	%	100 mA ≤ I <sub>OUT</sub> ≤ 3A, (V <sub>OUT</sub> + 1V) ≤ V <sub>IN</sub> ≤ 26V
Line Regulation	ΔV <sub>OUT</sub> /ΔV <sub>IN</sub>	—	0.1	0.5	%	I <sub>OUT</sub> = 100 mA, (V <sub>OUT</sub> + 1V) ≤ V <sub>IN</sub> ≤ 26V
Load Regulation	ΔV <sub>OUT</sub> /ΔI <sub>OUT</sub>	—	0.2	1	%	V <sub>IN</sub> = V <sub>OUT</sub> + 1V, 100 mA ≤ I <sub>OUT</sub> ≤ 3A
Dropout Voltage (Note 2)	V <sub>DO</sub>	—	100	200	mV	I <sub>OUT</sub> = 100 mA, V <sub>IN</sub> ≥ 3.184V
		—	300	—		I <sub>OUT</sub> = 1.5A, V <sub>IN</sub> ≥ 3.184V
		—	500	—		I <sub>OUT</sub> = 2.75A, V <sub>IN</sub> ≥ 3.184V
		—	560	800		I <sub>OUT</sub> = 3A, V <sub>IN</sub> ≥ 3.4V

## ELECTRICAL CHARACTERISTICS (CONTINUED)

V<sub>IN</sub> = 4.184V; I<sub>OUT</sub> = 100 mA; T<sub>A</sub> = +25°C, bold values indicate -40°C ≤ T<sub>J</sub> ≤ +125°C, unless noted. Note 1

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

**Note 1:** Specification for packaged product only

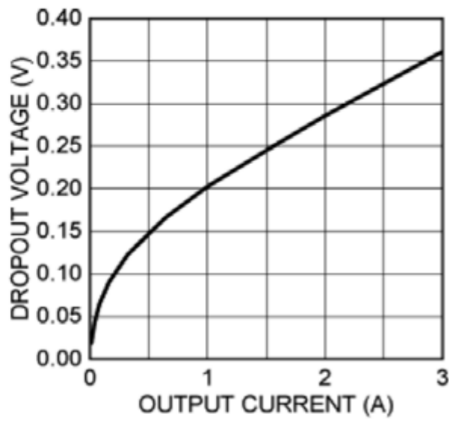
**2:** Dropout voltage is defined as the input-to-output differential when output voltage drops to 99% of its normal value with V<sub>OUT</sub> + 1V applied to V<sub>IN</sub>.

**3:** V<sub>IN</sub> = V<sub>OUT</sub> (nominal) + 1V. For example, use V<sub>IN</sub> = 4.3V for a 3.3V regulator or use 6V for a 5V regulator. Employ pulse testing procedure for current-limit.

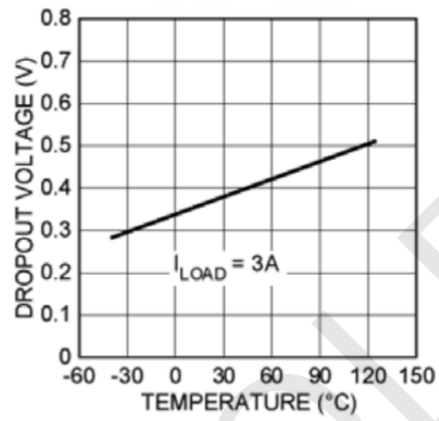
**4:** V<sub>REF</sub> ≤ V<sub>OUT</sub> ≤ V<sub>IN</sub> - 1, 3V ≤ V<sub>OUT</sub> ≤ 26V, 10 mA ≤ I<sub>L</sub> ≤ I<sub>FL</sub>, T<sub>J</sub> ≤ T<sub>J(MAX)</sub>.

**5:** V<sub>EN</sub> ≤ 0.8V, V<sub>IN</sub> ≤ 26V and V<sub>OUT</sub> = 0V.

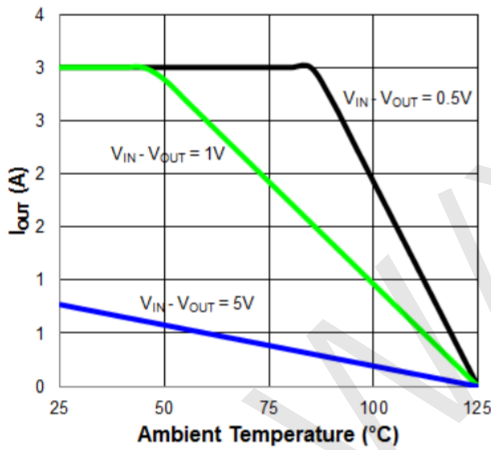
## Typical Characteristics



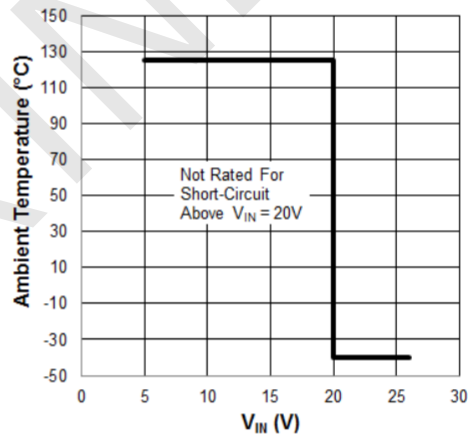
Dropout Voltage vs. Output Current



Dropout Voltage vs. Temperature.

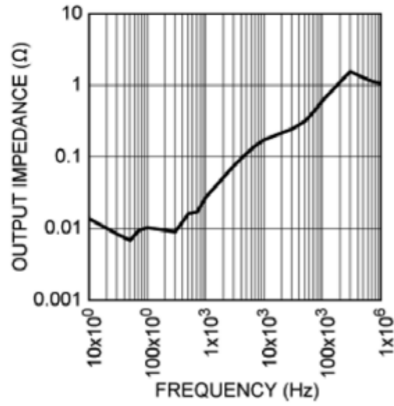


$I_{OUT}$  vs.  $T_A$  SOA(TO-263).

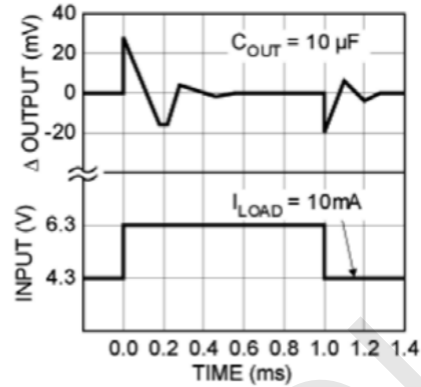


Short-Circuit SOA vs. Temperature (TO-263).

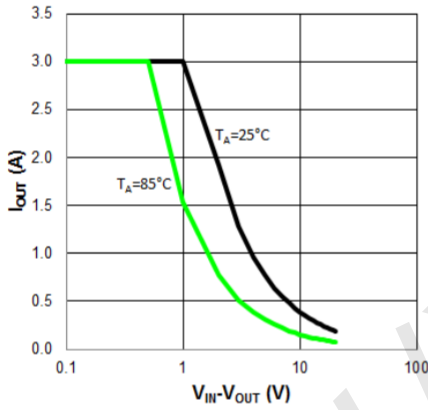
### Typical Characteristics



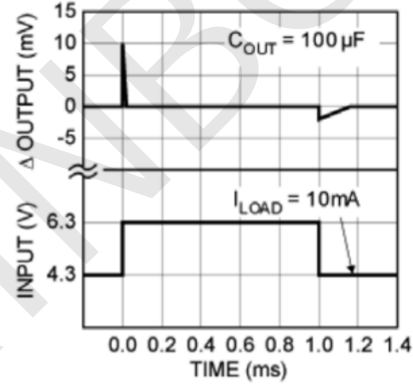
Output Impedance vs. Frequency



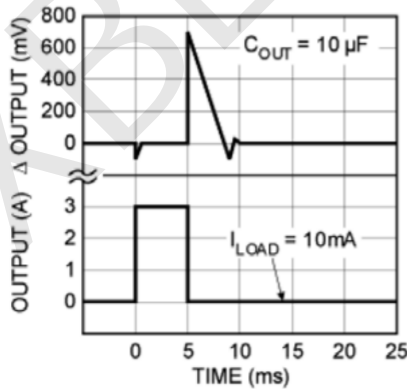
Line Transient.



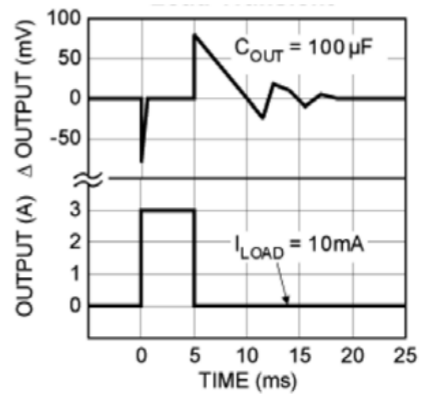
$I_{OUT}$  vs.  $V_{IN} - V_{OUT}$  SOA(TO-263).



Line Transient.



Line Transient.



Line Transient.

## APPLICATION INFORMATION

The XBL29301 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  $\beta$  PNP process reduces this drive requirement to merely 1% of the load current.

The XBL29301 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 XBL29301 offers a logic-level ON/OFF control. When disabled, the device draws 32  $\mu$ A 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 XBL29301 is stable with a 10  $\mu$ F 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  $\mu$ F capacitor connected between input and GND is recommended.

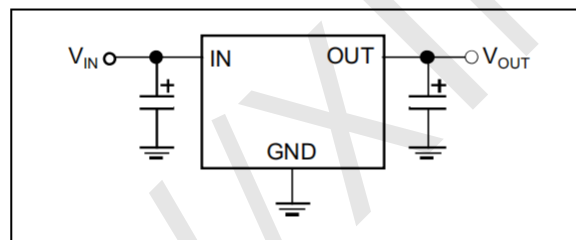


FIGURE 1: Linear Regulators Require Only Two Capacitors for Operation.

### 2. Transient Response and 5V to 3.3V Conversion.

The XBL29301 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 XBL 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. XBL'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

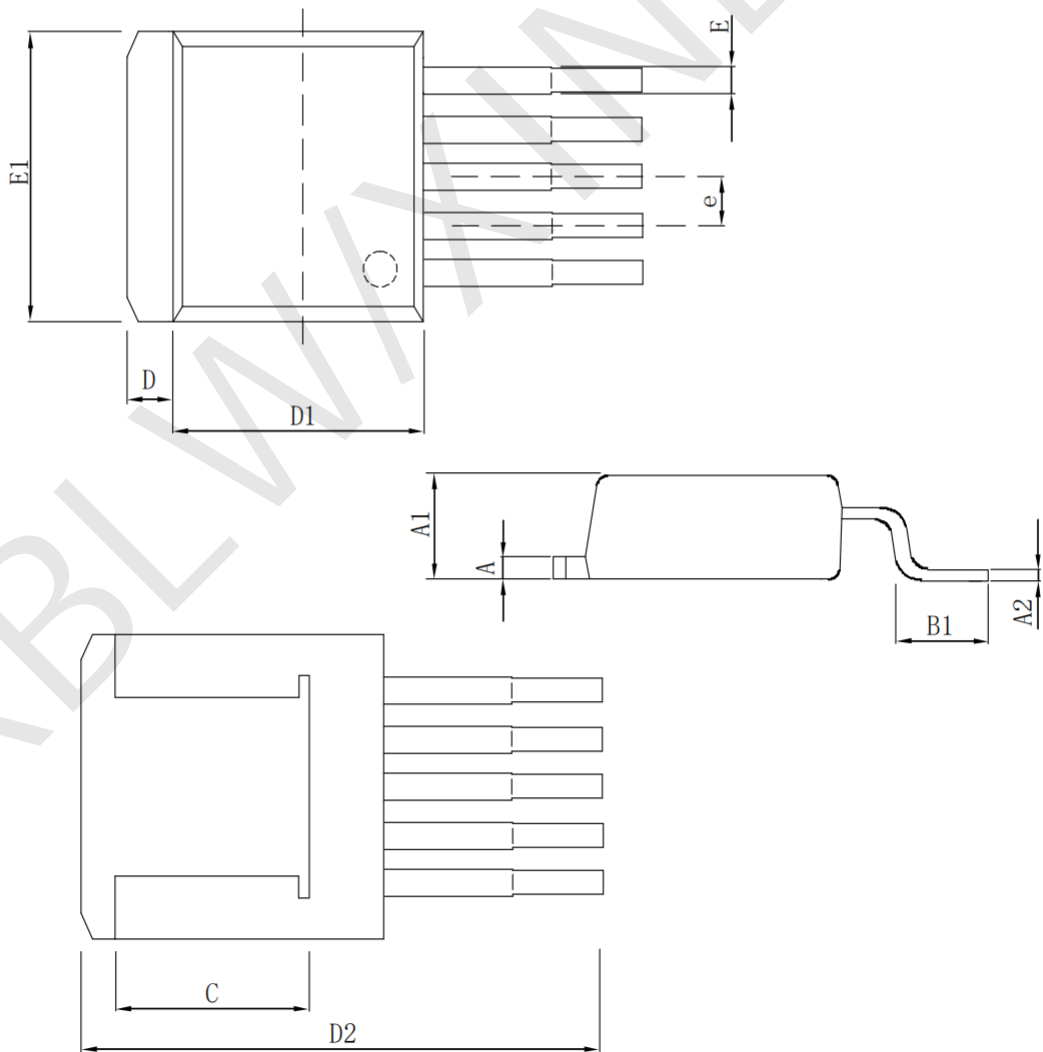
The XBL29301 regulator operates within a specified load range. If the output current is too small, leakage currents dominate and the output voltage rises.

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

Package Information

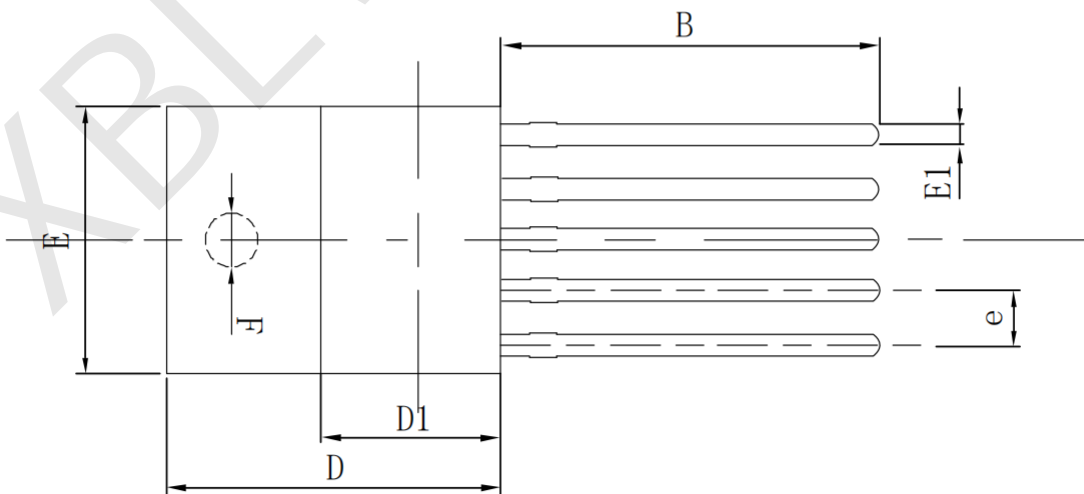
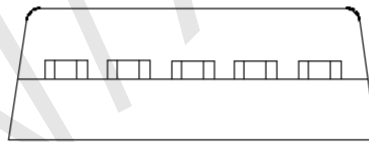
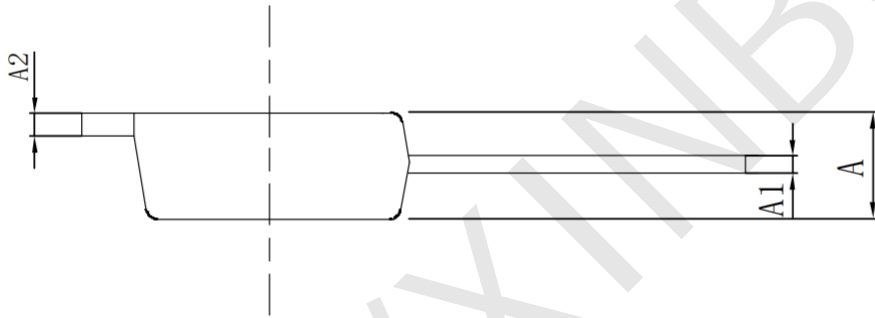
· T0-263-5L

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)	



· T0-220-5L

Symbol	Size	Dimensions In Millimeters		Symbol	Size	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



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