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Product Specification

XBLW XBL1507

150KHz 3A PWM Buck DC/DC Converter

WEB | www.xinboleic.com

RoHS

Descriptions

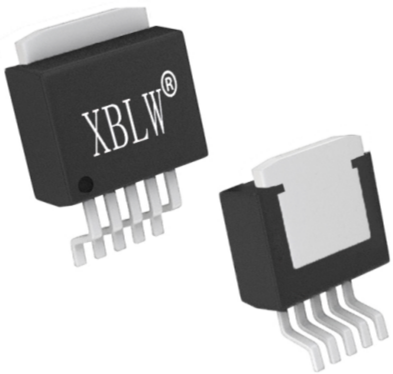
The XBL1507 is a monolithic IC designed for a step-down DC/DC converter and is capable of driving a 3A load without an external transistor. Due to reducing the number of external components, the board space can be saved easily. The external shutdown function can be controlled by logic level and then come into standby mode. The internal compensation makes the feedback control have good line and load regulation without an external design. Regarding the protected function, the thermal shutdown is to prevent over temperature operating from damaging the device, and current limit is against over current operating of the output switch. If the current limit function occurred and VFB is down to 0.5V below, the switching frequency will be reduced. The XBL1507 series operates at a switching frequency of 150KHz thus allowing smaller sized filter components than what would be needed with lower frequency switching regulators. Other features include a guaranteed ± 4% tolerance on output voltage under specified input voltage and output load conditions, and ± 15% on the oscillator frequency. The output version included a fixed 3.3V, 5V, 12V, and an adjustable type.
XBL1507 is available in a TO252-5 package.

Features

- Output Voltage: 3.3V, 5V, 12V and Adjustable Output Version
- Adjustable Version Output Voltage Range, 1.23V to 37V± 4%
- 150KHz± 15% Fixed Switching Frequency
- Voltage Mode Non-Synchronous PWM Control
- Thermal-Shutdown and Current-Limit Protection
- ON/OFF Shutdown Control Input
- Operating Voltage can be up to 40V
- Output Load Current: 3A
- Low Power Standby Mode
- Built-in Switching Transistor On Chip
- Lead Free Finish/RoHS Compliant

Applications

- Simple High-efficiency step-down regulator
- On-card switching regulators
- Positive to negative converter

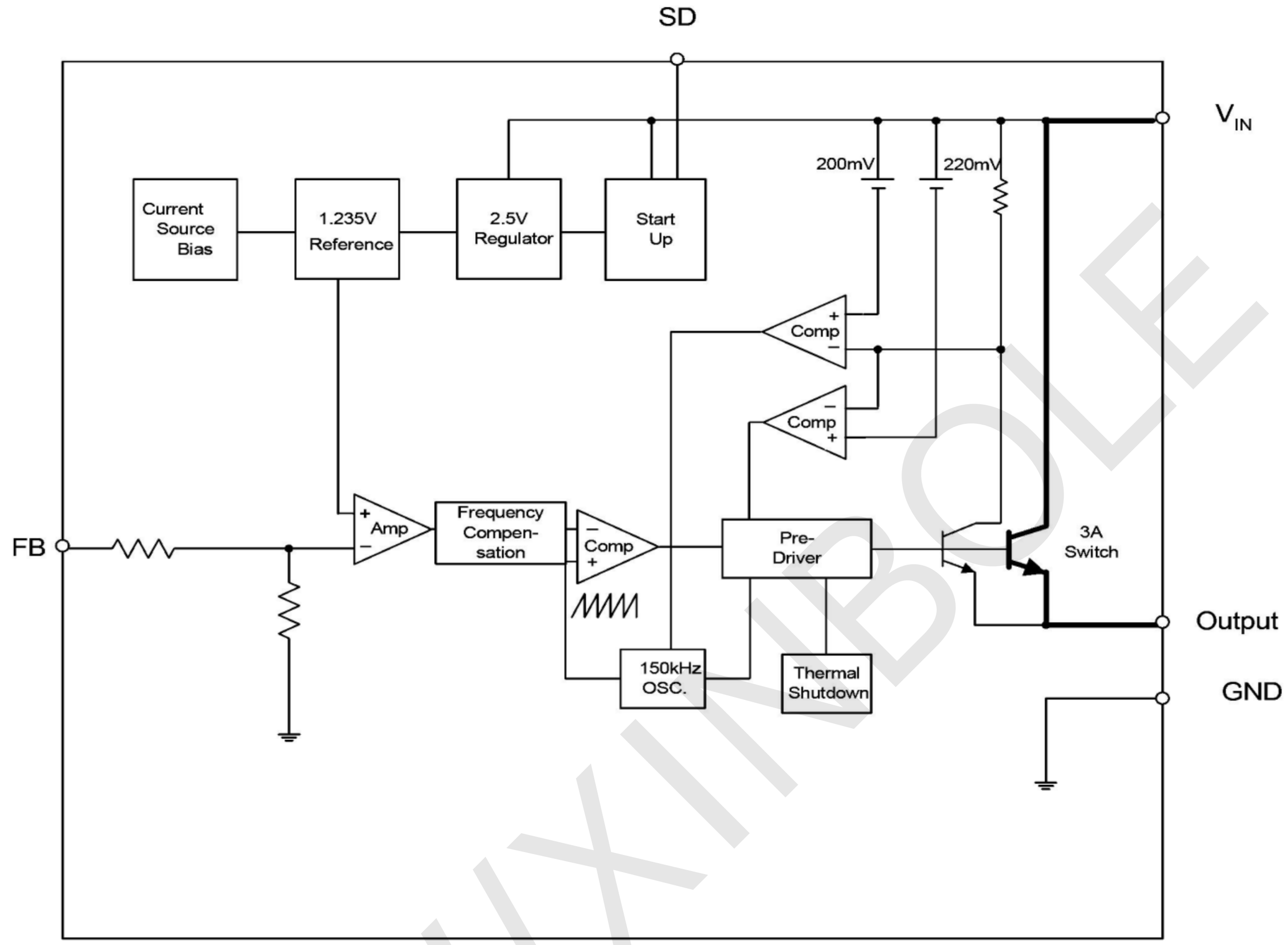


TO-252-5L

Ordering Information

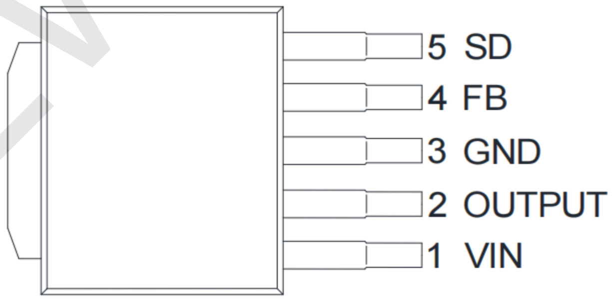
Product Model	Package Type	Marking	Packing	Packing Qty
XBL1507-ADJ	TO-252-5L	XBL1507-ADJ	Tape	2500Pcs/Reel
XBL1507-3.3	TO-252-5L	XBL1507-3.3	Tape	2500Pcs/Reel
XBL1507-5.0	TO-252-5L	XBL1507-5.0	Tape	2500Pcs/Reel
XBL1507-12	TO-252-5L	XBL1507-12	Tape	2500Pcs/Reel

Block Diagram



Pin Configuration

TOP VIEW



XBL1507(TO252-5)

Pin Descriptions

Name	Description
V_{IN}	Operating voltage input
Output	Switching output
GND	Ground
FB	Output voltage feedback control
SD	ON/OFF Shutdown

Absolute Maximum Ratings

Characteristics	Symbol	Value	Unit
Supply Voltage	V_{CC}	6 ~ 40	V
ON/OFF pin input voltage	V_{SD}	-0.3 ~ +40	V
Feedback pin voltage	V_{FB}	-0.3 ~ +40	V
Output voltage to ground	V_{OUT}	-1	V
Power dissipation	P_D	Internally limited	W
Storage temperature	Tstg	-65 ~ +150	℃
Operating temperature	Topr	-40 ~ +125	℃
Operating voltage	V_{OP}	+4.5 ~ +22	V

Electrical Characteristics

(Refer to the test circuit, VIN =12V for 3.3V,5V,adjustable version and VIN =18V for the 12V version,ILOA D =0.5A)

Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unint
Feedback bias current	I_{FB}	V_{FB}=1.3V (Adjustable version only)		-10	-50	nA
					-100	
Oscillator frequency	Fosc		127	150	173	KHz
			110		173	
Oscillator frequency of short circuit protect	Fscp	When current limit occurred and $V_{FB}<0.5V$,Ta=25℃	10	30	50	KHz
Saturation voltage	V_{SAT}	IOUT =3A No outside circuit V_{FB}=0V force driver on		1.4	1.6	V
					1.7	
Max.duty cycle(ON)	DC	V_{FB}=0V force driver on		100		%
Min. duty cycle(OFF)		V_{FB}=12V force driver off		0		
Current limit	I_{CL}	Peak current No outside circuit V_{FB}=0V force driver on	3.6	4.5	5.5	A
					6.5	
Output leakage current (output=0V)	I_L	No outside circuit V_{FB}=12V force driver off			-200	μA
Output leakage current (output=-1V)		V_{IN} =40V		-5		mA
Quiescent current	I_Q	V_{FB}=12V force driver off		5	10	mA
Standby quiescent current	I_{STBY}	ON/OFF pin=5V V_{IN} =40V		70	150	μA
					200	
ON/OFF pin logic input threshold voltage	V_{IL}	Low(regulator ON)		1.3	0.6	V
	V_{IH}	High(regulator OFF)	2.0			
ON/OFF pin logic input current	I_H	$V_{LOG\ IC}$ =2.5V(OFF)			-0.01	μA
ON/OFF pin input current	I_L	$V_{LOG\ IC}$ =0.5V(ON)		-0.1	-1	
Thermal resistance	θ_{JC}	Junction to case		10		℃/W
Thermal resistance with copper area of approximately 2cm2	θ_{JA}	Junction to ambient		50		℃/W

Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unint
XBL1507-ADJ						
Output feedback	V_{FB}	$5V \le V_{IN} \le 40V$ $0.2A \le I_{LOAD} \le 3A$ V_{OUT} programmed for 3V	1.193 1.18	1.23	1.267 1.28	V
Efficiency	η	V_{IN} =12V,I_{LOAD} =3A		74		%
XBL1507-3.3						
Output Voltage	V_{OUT}	$5.5V \le V_{IN} \le 40V$ $0.2A \le I_{LOAD} \le 3A$	3.168 3.135	3.3	3.432 3.465	V
Efficiency	η	V_{IN} =12V,I_{LOAD} =3A		75		%
XBL1507-5.0						
Output Voltage	V_{OUT}	$8V \le V_{IN} \le 40V$ $0.2A \le I_{LOAD} \le 3A$	4.8 4.75	5	5.2 5.25	V
Efficiency	η	V_{IN} =12V,I_{LOAD} =3A		80		%
XBL1507-12						
Output Voltage	V_{OUT}	$15V \le V_{IN} \le 40V$ $0.2A \le I_{LOAD} \le 3A$	11.52 11.4	12	12.48 12.6	V
Efficiency	η	V_{IN} =16V,I_{LOAD} =3A		89		%

Function Description

Pin Function: +V_{IN}

This is the positive input supply for the IC switching regulator. A suitable input bypass capacitor must be present at this pin to minimize voltage transients and to supply the switching currents needed by the regulator.

Ground

Circuit ground.

Output

Internal switch. The voltage at this pin switches between (+V_{IN} – V_{SAT}) and approximately – 0.5V, with a duty cycle of approximately V_{OUT} / V_{IN} . To minimize coupling to sensitive circuitry, the PC board copper area connected to this pin should be kept at minimum.

Feedback

Senses the regulated output voltage to complete the feedback loop.

SD

Allows the switching regulator circuit to be shutdown using logic level signals thus dropping the total input supply current to approximately 150uA. Pulling this pin below a threshold voltage of approximately 1.3V turns the regulator on, and pulling this pin above 1.3V (up to a maximum of 40V) shuts the regulator down. If this shutdown feature is not needed, the SD pin can be wired to the ground pin.

Thermal Considerations

The TO252-5 surface mount package tab is designed to be soldered to the copper on a printed circuit board. The copper and the board are the heat sink for this package and the other heat producing components, such as the catch diode and inductor. The PC board copper area that the package is soldered to should be at least 0.8 in 2 , and ideally should have 2 or more square inches of 2 oz. additional copper area which improves the thermal characteristics. With copper areas greater than approximately 6 in 2 , only small improvements in heat dissipation are realized. If further thermal improvements are needed, double sided, multi-layer PC board with large copper areas and/or airflow will be recommended.

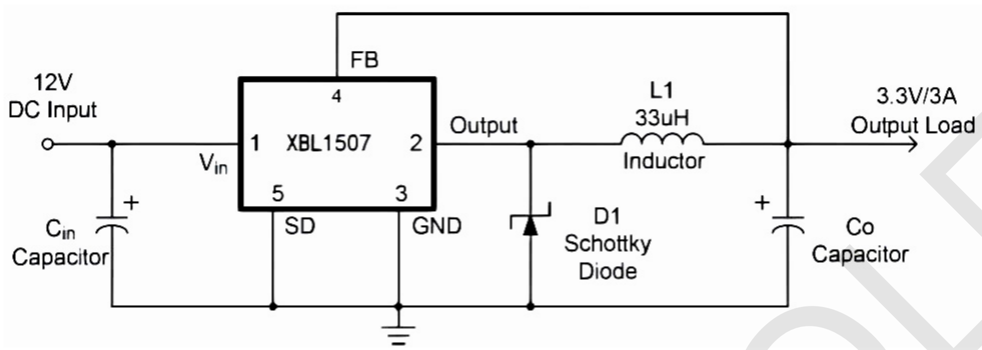
The XBL1507 (TO252-5 package) junction temperature rises above ambient temperature with a 3A load for various input and output voltages. This data was taken with the circuit operating as a buck-switching regulator with all components mounted on a PC board to simulate the junction temperature under actual operating conditions. This curve can be used for a quick check for the approximate junction temperature for various conditions, but there are many factors that can affect the junction temperature. When load currents higher than 3A are used, double sided or multi-layer PC boards with large copper areas and/or airflow might be needed, especially for high ambient temperatures and high output voltages.

For the best thermal performance, wide copper traces and generous amounts of printed circuit board copper should be used in the board layout. (One exception to this is the output (switch) pin, which should not have large areas of copper.) Large areas of copper provide the best transfer of heat (lower thermal resistance) to the surrounding air, and moving air lowers the thermal resistance even further.

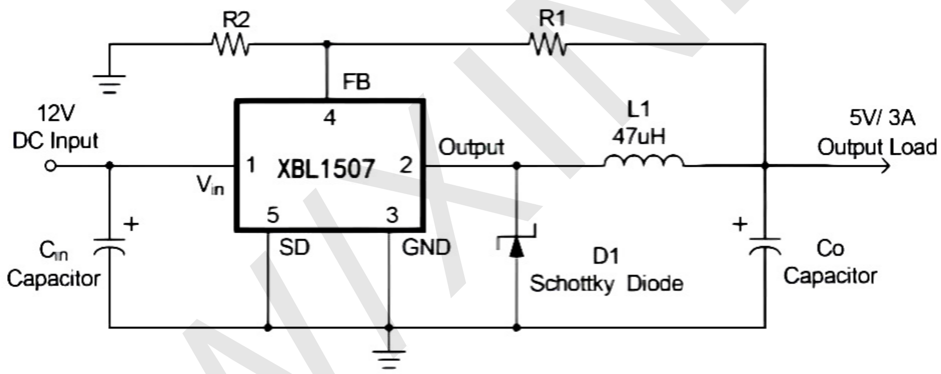
Package thermal resistance and junction temperature rise numbers are all approximate, and there are many factors that will affect these numbers. Some of these factors include board size, shape, thickness, position, location, and even board temperature. Other factors are trace width, total printed circuit copper area, copper thickness, single or double-sided, multi-layer board and the amount of solder on the board. The effectiveness of the PC board to dissipate heat also depends on the size, quantity and spacing of other components on the board, as well as whether the surrounding air is still or moving. Furthermore, some of these components such as the catch diode will add heat to the PC board and the heat can vary as the input voltage changes. For the inductor, depending on the physical size, type of core material and the DC resistance, it could either act as a heat sink taking heat away from the board, or it could add heat to the board.

Application Circuit

Fixed Type Circuit



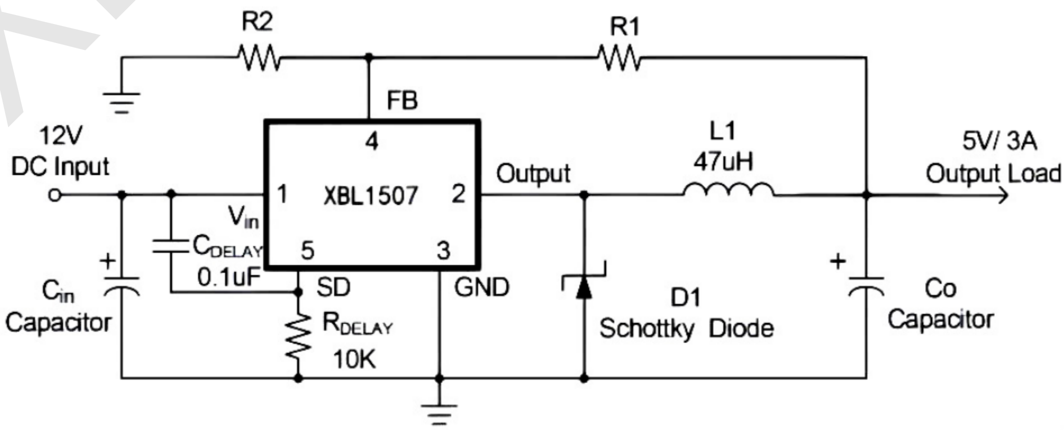
Adjustable Type Circuit



$$V_{out} = V_{FB} \times \left(1 + \frac{R1}{R2}\right)$$

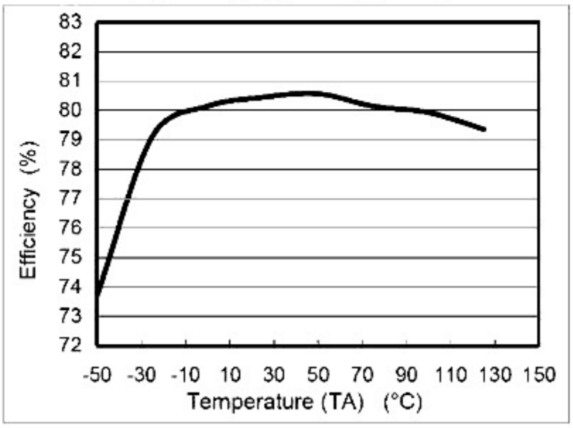
V_{FB} = 1.23V
R2 = 1K ~ 3K

Delay Start Circuit

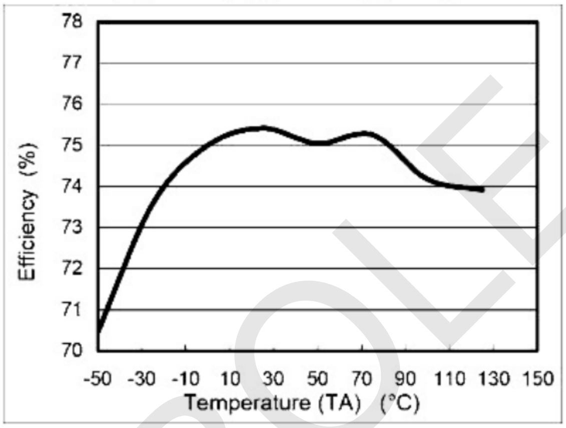


Characteristics Curves

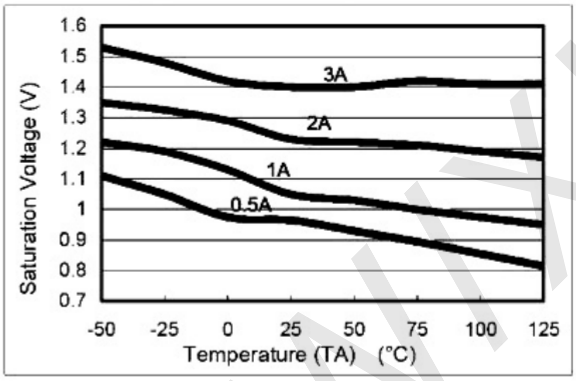
XBL1507 Efficiency vs. Temperature
(V_{in} = 12V, V_{out} = 5V, I_o = 3A)



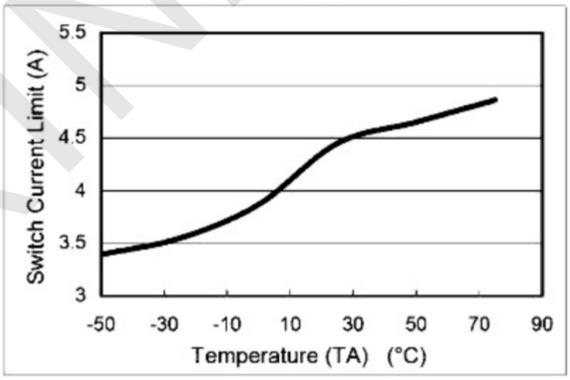
XBL1507 Efficiency vs. Temperature
(V_{in} = 12V, V_{out} = 3.3V, I_o = 3A)



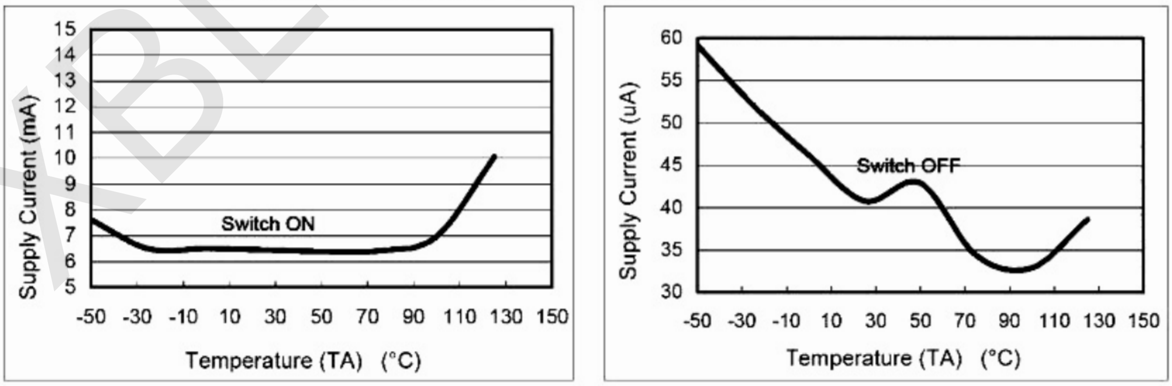
XBL1507 Saturation Voltage vs. Temperature
(V_{cc} = 12V, V_{fb} = 0V, VSD = 0)



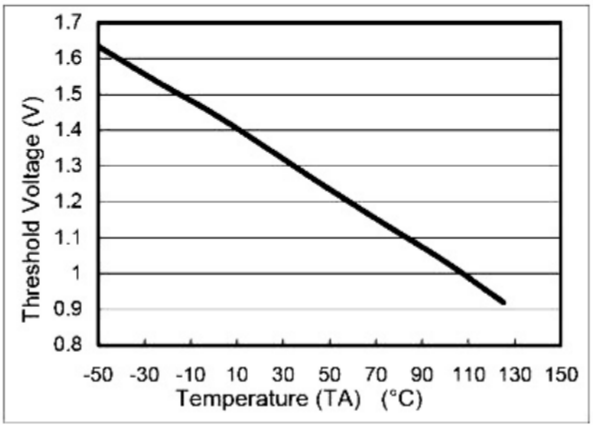
XBL1507 Switch Current Limit vs. Temperature
(V_{cc} = 12V, V_{fb} = 0V)



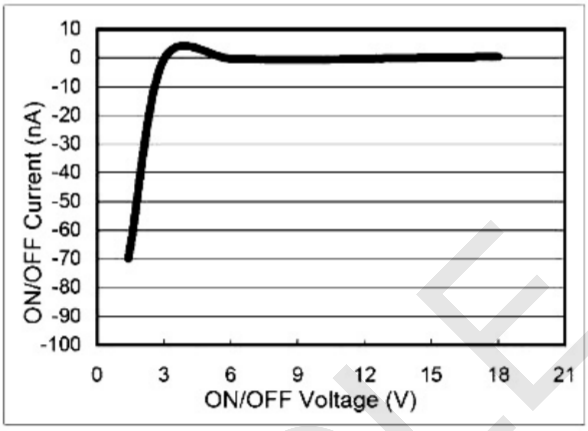
XBL1507 Supply Current vs. Temperature
(V_{cc} = 12V, No Load, $V_{on/off}$ = 0V (Switch ON), $V_{on/off}$ = 5V (Switch OFF))



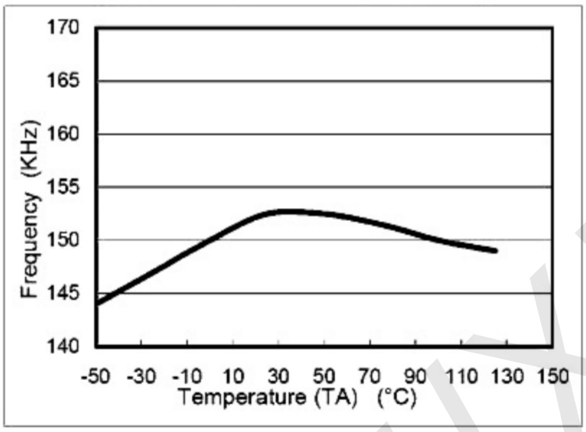
XBL1507 Threshold Voltage vs. Temperature
(V_{cc} = 12V, I_o = 100mA)



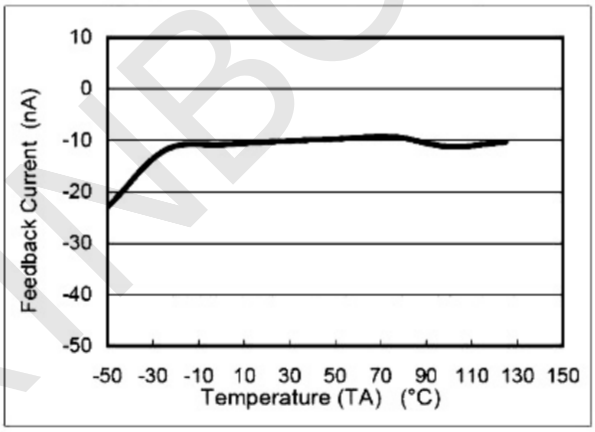
XBL1507 ON/OFF Current vs. ON/OFF Voltage
(V_{in}= 12V)



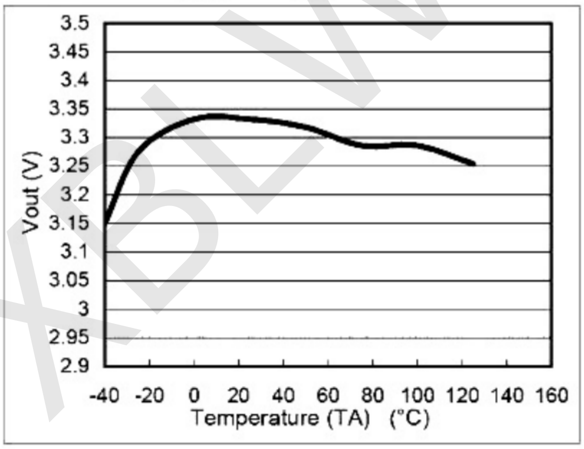
XBL1507 Frequency vs. Temperature
(V_{cc} = 12V, I_o = 500mA, V_{out} = 5V)



XBL1507 Feedback Current vs. Temperature
(V_{cc} = 12V, V_{out} = 5V, V_{fb} = 1.3V)



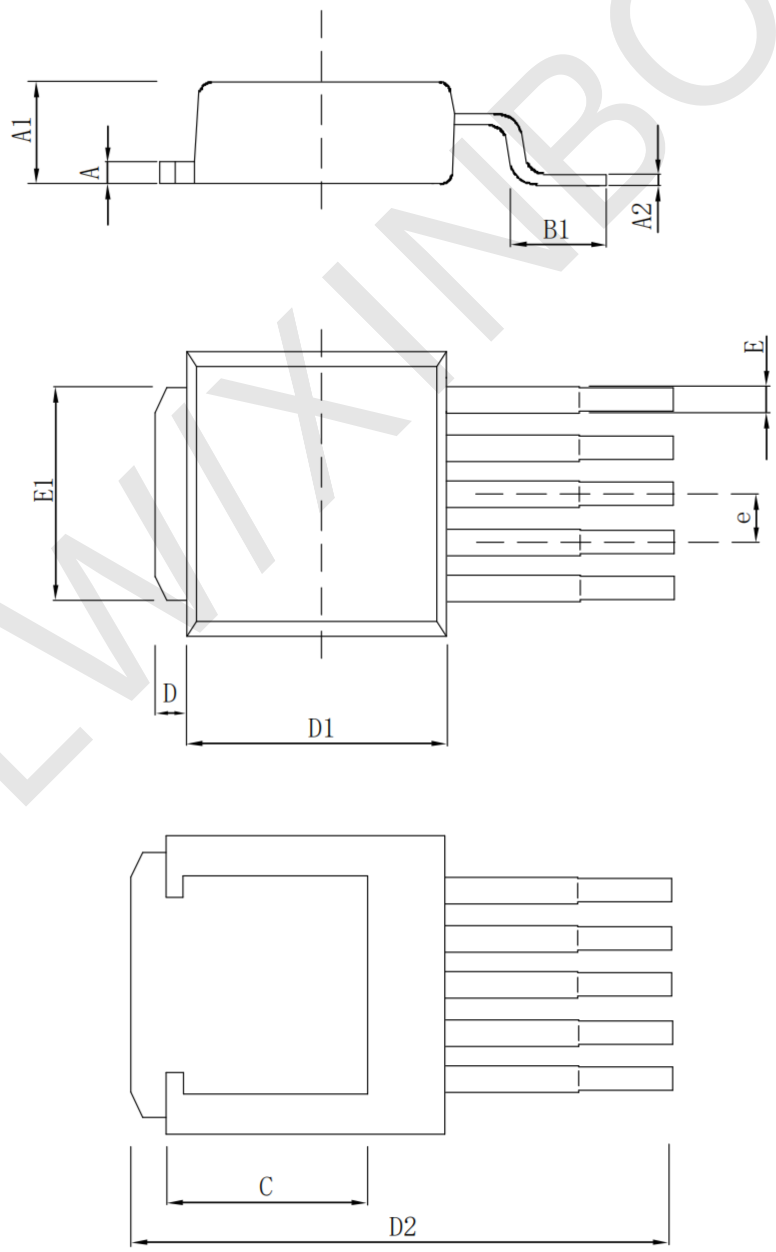
XBL1507 Output Voltage vs. Temperature
(V_{in} = 12V, I_o = 3A)



Package Information

· TO-252-5L

Size / Symbol	Dimensions In Millimeters		Size / Symbol	Dimensions In Inches	
	Min(mm)	Max(mm)		Min(in)	Max(in)
A	0.470	0.530	A	0.018	0.021
A1	2.180	2.400	A1	0.085	0.094
A2	0.250	0.350	A2	0.009	0.013
B1	1.100	1.300	B1	0.043	0.051
C	5.200	5.600	C	0.204	0.220
D	1.000	1.200	D	0.039	0.047
D1	6.000	6.200	D1	0.236	0.245
D2	9.800	10.10	D2	0.385	0.397
E	0.630	0.770	E	0.024	0.031
E1	6.450	6.750	E1	0.253	0.266
e	1.270(BSC)		e	0.050(BSC)	



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