GLF2331B

High Precision Current Limit Power Switch

Product Specification

DESCRIPTION

The GLF2331B is an advanced technology fully integrated power switch for applications required precision output current limiting. The GLF2331B features also various protection functions such as under voltage lockout, reverse current blocking (RCB), short circuit protection, and thermal shutdown.

The GLF2331B provides a built-in output voltage slew rate control to limit the inrush current and voltage surges. The FLGB output pin can be used to send a signal of fault events to the system controller. The integrated thermal shutdown (TSD) insures complete protection for the switch during output current limit and short circuit conditions. The GLF2331B is an ideal switch for USB power supply.

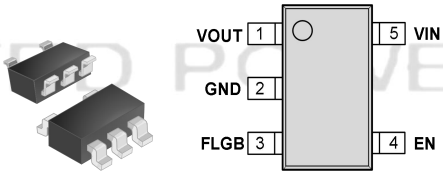
APPLICATIONS

- USB ports
- Notebooks
- Telecom Systems

FEATURES

- Fixed Constant Output Current Limit, 1.3 A Typ
- Input Range: 2.5 V to 5.5 V
- Low R_{ON}: 53 mΩ Typ. at 5 V_{IN}
- Ultra-Low I_Q: 18 μA Typ. at 5 V_{IN}
- Ultra-Low I_{SD}: 35 nA Typ. at 5 V_{IN}
- Under Voltage Lockout Protection
- Output Voltage Slew Rate Control
- Reverse Current Blocking Protection
- Short Circuit Protection
- Deglitched Fault Flag Indication
- Integrated Output Discharge Switch
- Thermal Shutdown Protection

PACKAGE



SOT23-5L

DEVICE ORDERING INFORMATION

Part Number	Top Mark	Current Limit I_{LIM}	Output Discharge	Fault Flag FLGB	EN Activity	Package
GLF2331B-T1G7	KE	1.3 A Typ Fixed	300 Ω	Yes	High	SOT23-5L

APPLICATION DIAGRAM

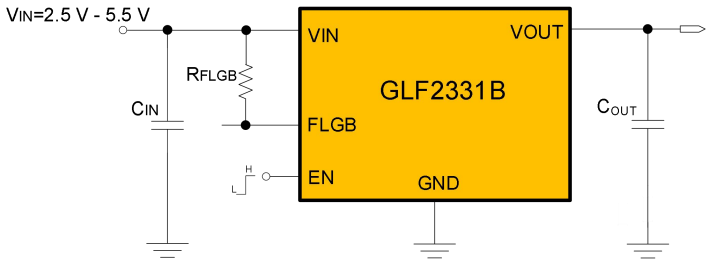


Figure 1. Typical Application

FUNCTIONAL BLOCK DIAGRAM

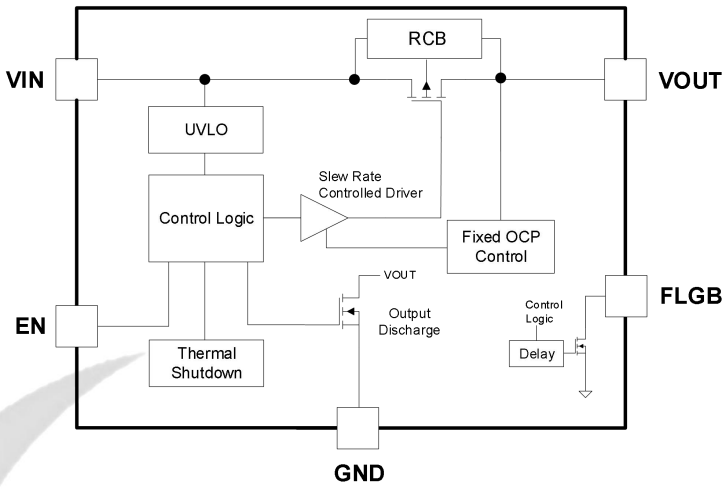


Figure 2. Functional Block Diagram

PIN CONFIGURATION

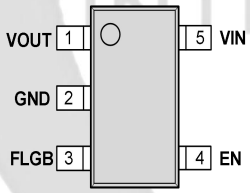


Figure 3. Package and Pin configuration

PIN DEFINITION

Pin #	Name	Description
1	VOUT	Switch Output
2	GND	Ground
3	FLGB	Flag pin goes low to indicate OCP, SCP, RCB, UVLO and TSD fault conditions
4	EN	Active high switch output enables to control the switch
5	VIN	Switch Input. Supply voltage for IC

ABSOLUTE MAXIMUM RATINGS

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter		Min.	Max.	Unit
V_{IN}, V_{OUT}, V_{EN}	V_{IN}, V_{OUT}, V_{EN} to GND		- 0.3	6	V
T_{STG}	Storage Junction Temperature		- 65	150	°C
T_A	Operating Temperature Range		- 40	85	°C
θ_{JA}	Thermal Resistance, Junction to Ambient			180	°C/W
ESD	Electrostatic Discharge Capability	Human Body Model, JESD22-A114	± 8		kV
		Charged Device Model, JESD22-C101	± 2		

ELECTRICAL CHARACTERISTICS

Values are at V_{IN} = 5.0 V and T_A = 25 °C. Unless otherwise noted

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Units
Basic Operation							
V_{IN}	Supply Voltage			2.5		5.5	V
I_Q	Quiescent Current	V_{EN}= High, I_{OUT}= 0 mA			18	25	µA
I_{SD}	Shutdown Current	V_{EN}= Low, I_{OUT}= 0 mA			35	80	nA
R_{ON}	On-Resistance	V_{IN}= 5.0 V, I_{OUT}= 500 mA	T_A= 25 °C		53	60	mΩ
			T_A= 85 °C (1)		63		
		V_{IN}= 3.3 V, I_{OUT}= 500 mA	T_A= 25°C		61	70	
			T_A= 85 °C (1)		73		
R_{DSC}	Output Discharge Resistance	V_{EN}= Low , I_{FORCE}= 10 mA			300		Ω
V_{IH}	EN Input Logic High Voltage	V_{IN}= 2.5 V to 5.5 V		1.2			V
V_{IL}	EN Input Logic Low Voltage	V_{IN}= 2.5 V to 5.5 V				0.6	V
R_{EN}	EN pull down resistance	Internal Resistance			10	12	MΩ
I_{EN}	EN Source or Sink Current	V_{EN}= 5.5 V			0.55	0.8	µA
V_{FLGB}	FLGB Output Low Voltage	I_{FLGB}= 0.5 mA				100	mV
I_{FLGB}	FLGB Output High Leakage	V_{FLGB}= 5.5 V				50	nA
t_{FLGB}	FLGB Output Delay Time (1)	Delay time for assertion at over current			8		ms
		Delay time for assertion at short circuit and thermal shutdown condition			120		µs
Protection							
V_{UVLO}	Under Voltage Lockout Voltage	Input Rising			2.3		V
		Input Falling			2.1		V
I_{LIM}	Over Current Limit			1.2	1.3	1.4	A
V_{RCB_TH}	Reverse Current Blocking Protection Trip Voltage	V_{OUT} - V_{IN}			40		mV
V_{RCB_RL}	Reverse Current Blocking Protection Release Voltage	V_{IN} - V_{OUT}			25		
I_{RCB}	Reverse Current Blocking Protection Leakage	V_{OUT} – V_{IN} > V_{RCB}				1	µA
TSD	Thermal Shutdown	20 °C Hysteresis (1)			140		°C
Switching Characteristics (2)							
t_{dON}	Turn-On Delay	R_{OUT}= 150 Ω, C_{OUT}= 1.0 µF			160		µs
t_R	V_{OUT} Rise Time				560		
t_{dOFF}	Turn-Off Delay				14		
t_F	V_{OUT} Fall Time				240		

Notes: 1. By design; characterized; not production tested.
2. Switching Timing Diagram

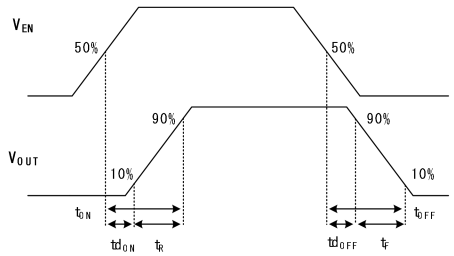


Figure 4. Switching Timing Diagram

TYPICAL PERFORMANCE CHARACTERISTICS

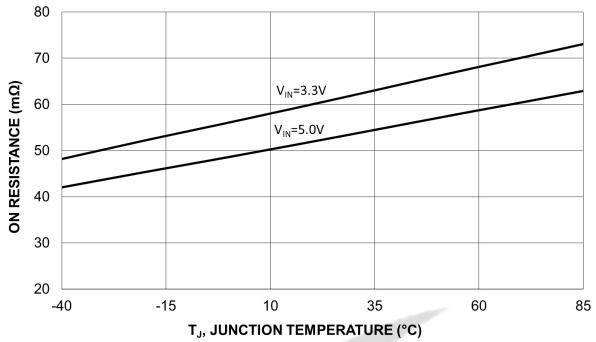


Figure 5. On-Resistance vs. Temperature

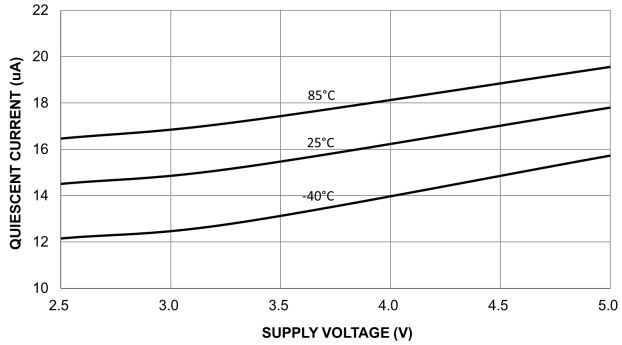


Figure 6. Quiescent Current vs. Supply Voltage

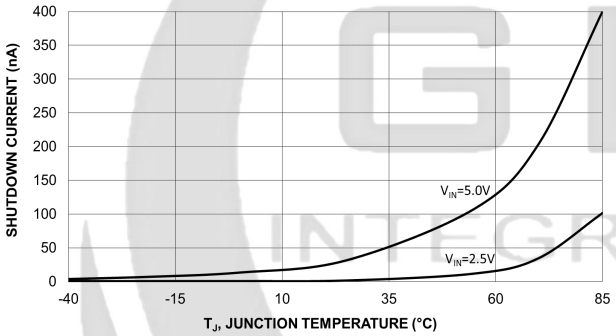


Figure 7. Shutdown Current vs. Temperature

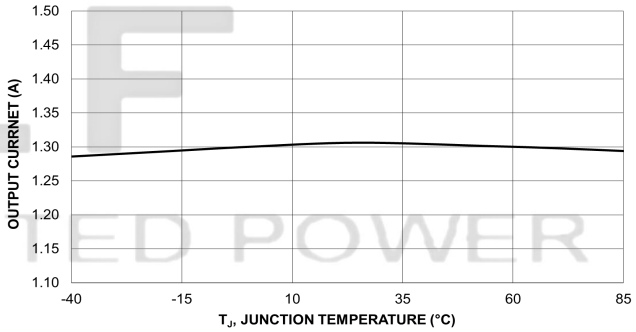


Figure 8. Over Current Limit vs. Temperature

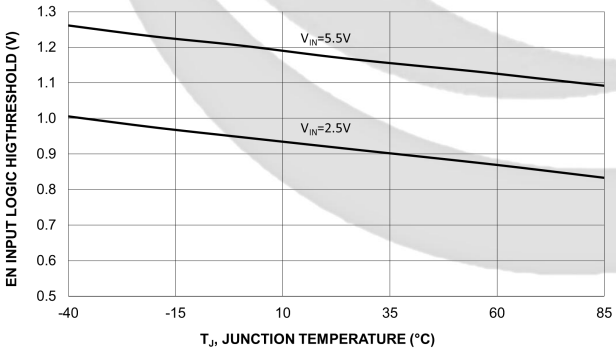


Figure 9. EN Input Logic High Threshold

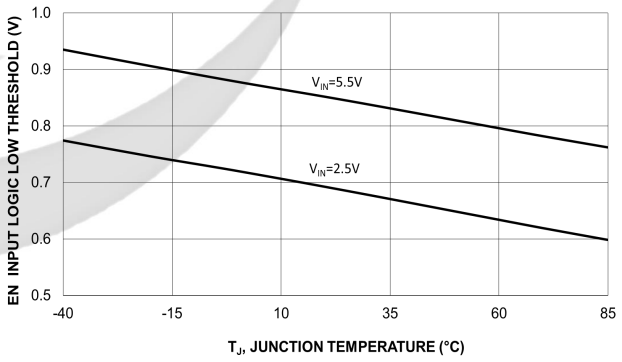


Figure 10. EN Input Logic Low Threshold

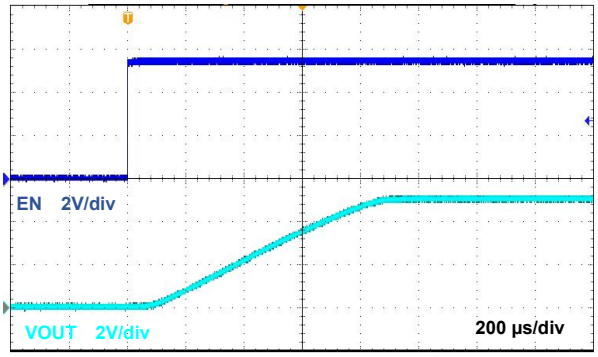


Figure 11. Turn-On Response
V_{IN}=5.0 V, C_{IN}=C_{OUT}=1.0 µF, R_L=150 Ω

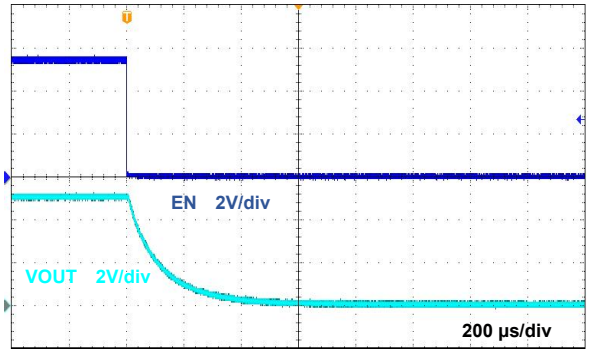


Figure 12. Turn-Off Response
V_{IN}=5.0 V, C_{IN}=C_{OUT}=1.0 µF, R_L=150 Ω

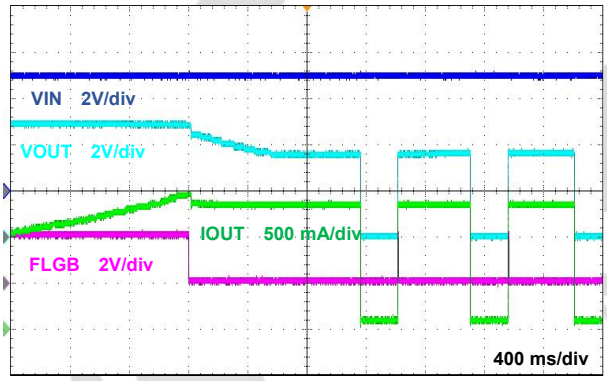


Figure 13. Current Limit Response
V_{IN}=5.0 V, C_{IN}=C_{OUT}=1.0 µF

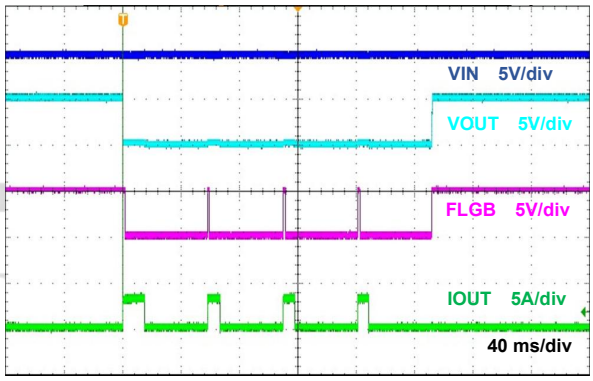


Figure 14. Short Circuit Response
V_{IN}=5.0 V, C_{IN}=C_{OUT}=1.0 µF, R_L=0 Ω

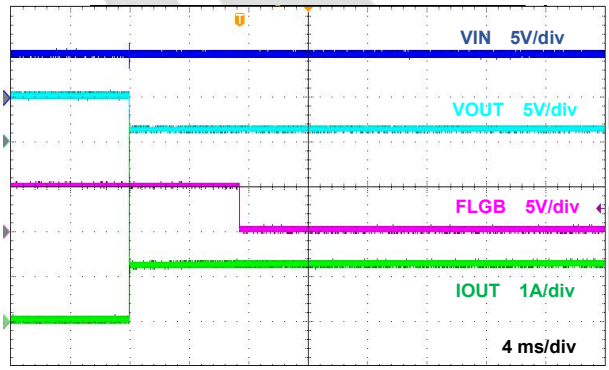


Figure 15. FLGB Response with OCP
V_{IN}=5.0 V, C_{IN}=C_{OUT}=1.0 µF

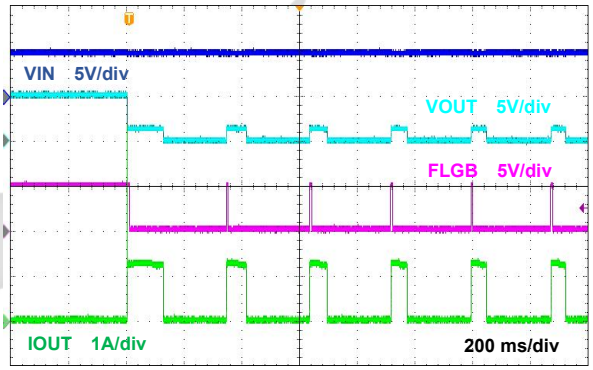


Figure 16. Thermal Shutdown Response
V_{IN}=5.0 V, C_{IN}=C_{OUT}=1.0 µF

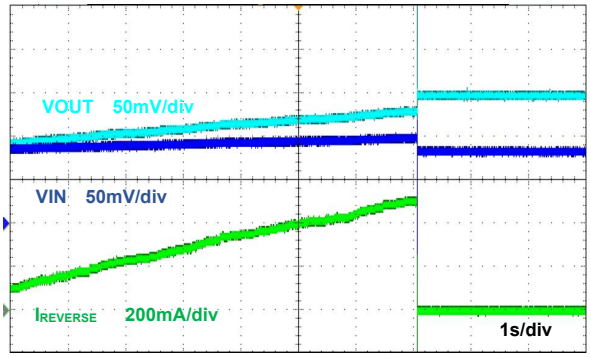


Figure 17. Reverse Current Blocking Threshold
V_{IN}=3.3 V, V_{OUT}=Up to 3.4 V, C_{IN}=C_{OUT}=1.0 μF

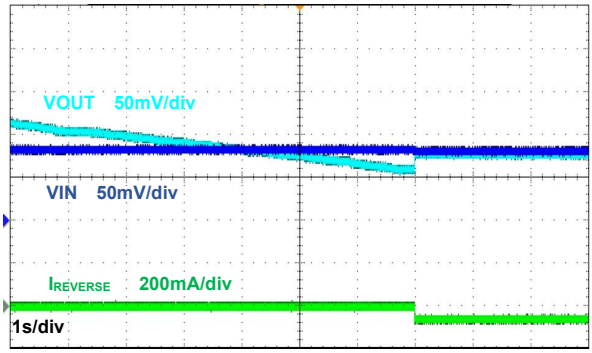


Figure 18. Reverse Current Blocking Release
V_{IN}=3.3 V, V_{OUT}=Down to 3.2 V, C_{IN}=C_{OUT}=1.0 μF

APPLICATION INFORMATION

The GLF2331B is an advanced technology fully integrated power switch for applications required for precision output current limiting. It features also various protection functions such as under voltage lockout, reverse current blocking (RCB), short circuit protection, and thermal shutdown.

Current Limiting and Short Circuit Protection

The GLF2331B limits the output current at 1.3 A typ at an output over current condition. During the constant current-limit condition, the junction temperature of the GLF2331B increases. The thermal shutdown protection (TSD) turns off the device when the junction temperature exceeds 140 °C. As the junction temperature cools down to 120 °C, the device is turned on again. The short circuit protection will take action immediately to shut down the device once a short circuit on the output node is detected. The GLF2331B retries to turn on and limits the output current until the short circuit condition is removed or the device is controlled by the thermal shutdown protection as the junction temp exceeds the temperature threshold.

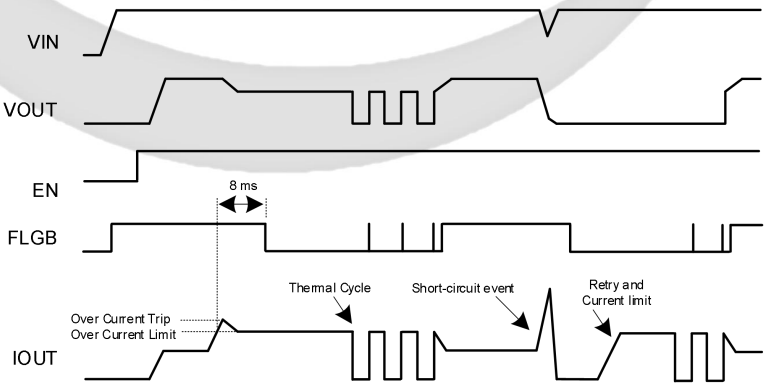


Figure 19. Over Current and Short Circuit Protection

Reverse Current Blocking

The GLF2331B has a built-in reverse current blocking protection which always monitors the output voltage level regardless of the status of EN pin to check if it is greater than the input voltage. When the output voltage goes above the input voltage by the reverse current blocking protection threshold (V_{RCB_TH}), the device turns off. Note that some reverse current can occur until the V_{RCB_TH} is triggered. The main switch will resume normal operation when the output voltage drops below the input source by the RCB protection release voltage (V_{RCB_RL}).

Fault Flag Response

The output of the open drain FLGB pin goes active low for any of following fault conditions: output current limit, output short-circuit, reverse current blocking, or thermal shutdown. The GLF2331B is designed to avoid false FLGB reporting by using an internal 8 ms deglitch delay for the current limit condition and 120 µs delay for the short circuit and over temperature conditions. The FLGB output remains low until over-current or over-temperature condition is removed. When short circuit fault conditions occur, the device is turned off immediately and will retry to start. The FLGB output is asserted and de-asserted following the short circuit protection. Once the output fault is resolved, the FLGB returns to normal.

EN Pin

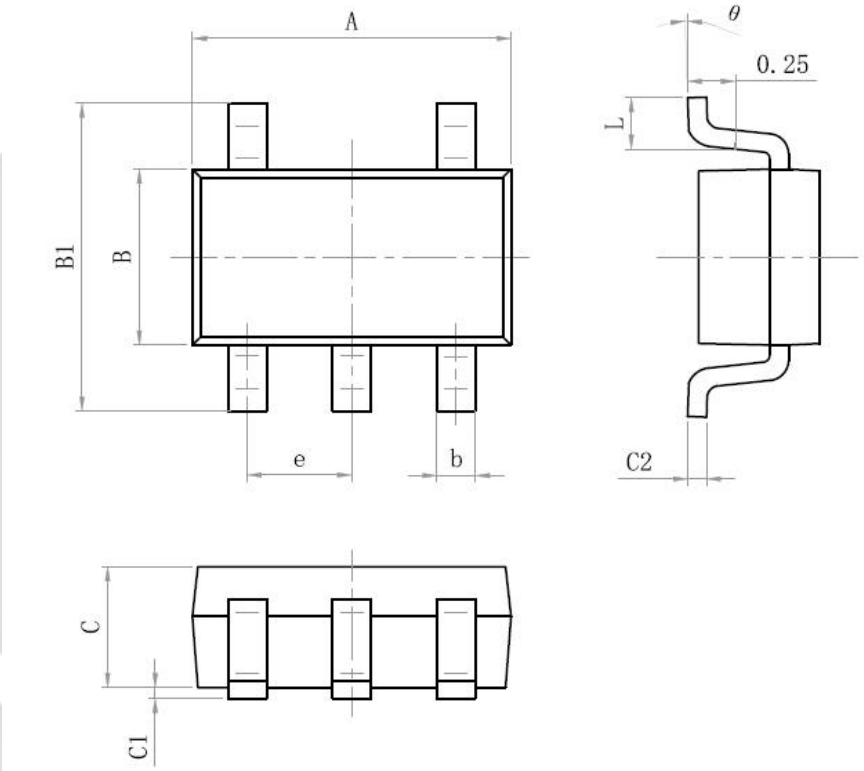
The GLF2331B can be activated by EN pin high. Note that the EN pin has an internal pull-down resistor to maintain a reliable status without EN signal applied from an external controller.

Input and Output Capacitor

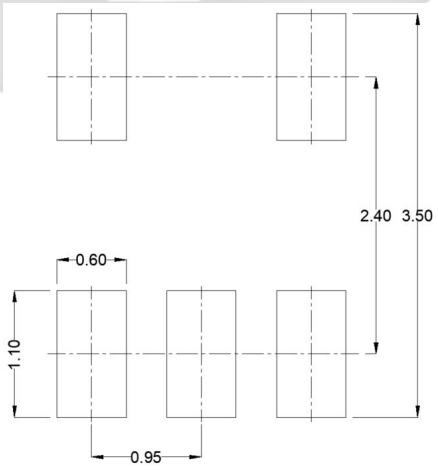
A minimum 1 µF input capacitor is recommended to be placed close to the V_{IN} pin to reduce the voltage drop on the input power rail caused by transient inrush current at start-up. A higher input capacitor value can be used to further attenuate the input voltage drop. Also, a minimum 1 µF output capacitor is recommended to minimize voltage undershoot on the output pin during the transition when the switch is turned off. Undershoot can be caused by parasitic inductance from board traces or intentional load inductances. If load inductances do exist, use of an output capacitor can improve output voltage stability and system reliability. The C_{OUT} capacitor should be placed close to the VOUT and GND pins.

PACKAGE OUTLINE

Size / Mark	Min(mm)	Max(mm)	Size / Mark	Min(mm)	Max(mm)
A	2.82	3.02	C	1.05	1.15
e	0.95 (BSC)		C1	0.03	0.15
b	0.28	0.45	C2	0.12	0.23
B	1.50	1.70	L	0.35	0.55
B1	2.60	3.00	θ	0°	8°

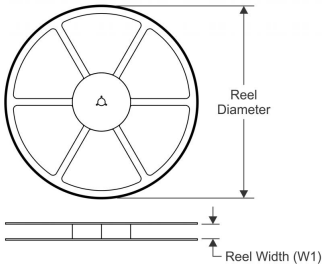


Recommended Footprint

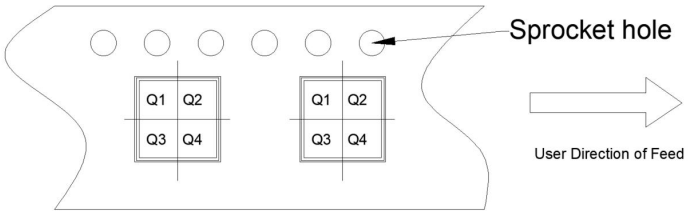


TAPE AND REEL INFORMATION

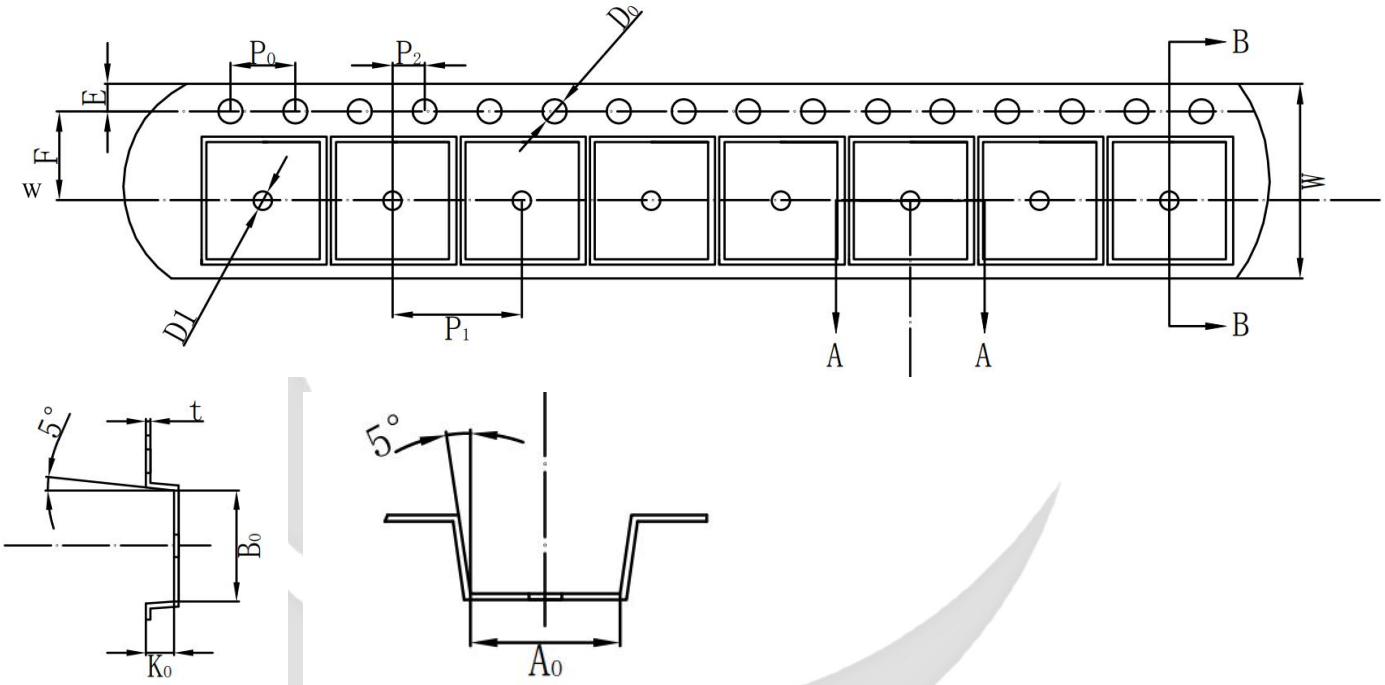
REEL DIMENSIONS



QUADRANT ASSIGNMENTS PIN 1 ORIENTATION TAPE



TAPE DIMENSIONS



Device	Package	Pins	SPQ	Reel Diameter (mm)	Reel Width W1	A0	B0	K0	P1	W	Pin1
GLF2331B-T1G7	SOT23-5	5	3000	178	9	3.25	3.30	1.38	4	8	Q3

Remark:

A0: Dimension designed to accommodate the component width

B0: Dimension designed to accommodate the component length

C0: Dimension designed to accommodate the component thickness

W: Overall width of the carrier tape

P1: Pitch between successive cavity centers

SPECIFICATION DEFINITIONS

Document Type	Meaning	Product Status
Target Specification	This is a target specification intended to support exploration and discussion of critical needs for a proposed or target device. Parameters including the typical, minimum, and maximum values are desired, or target. GLF reserves the right to change contents at any time without warning or notification. A target specification will not guarantee the future production of the device.	Design / Development
Preliminary Specification	This is a draft version of a product specification which is under internal review and subject to change. GLF reserves the right to change the specification at any time without warning or notification. A preliminary specification will not guarantee the future production of the device.	Qualification
Product Specification	This document represents the characteristics of the device.	Production

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