

## DESCRIPTION

The GLF2351B is an advanced technology fully integrated power switch for applications required precision output current limiting. The GLF2351B features also various protection functions such as under voltage lockout, true reverse current blocking (TRCB), short circuit protection, and thermal shutdown.

The GLF2351B 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 GLF2351B is an ideal switch for USB power supply.

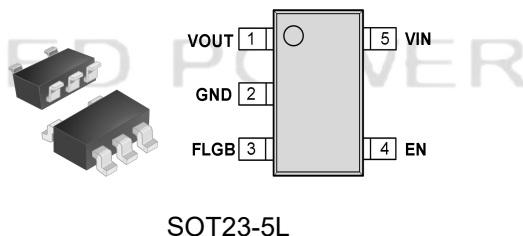
## APPLICATIONS

- USB ports
- Notebooks
- Telecom Systems

## FEATURES

- Input Range: 2.5 V to 5.5 V
- Fixed Constant Output Current Limit, 2.5 A Typ
- Low  $R_{ON}$ : 40 m $\Omega$  Typ. at 5 V<sub>IN</sub>
- Ultra-Low  $I_Q$ : 17  $\mu$ A Typ. at 5 V<sub>IN</sub>
- Ultra-Low  $I_{SD}$ : 60 nA Typ. at 5 V<sub>IN</sub>
- Under Voltage Lockout Protection
- Output Voltage Slew Rate Control
- True Reverse Current Blocking Protection
- Short Circuit Protection
- Deglitched Fault Flag Indication
- Integrated Output Discharge Switch
- Thermal Shutdown Protection

## PACKAGE



## DEVICE ORDERING INFORMATION

Part Number	Top Mark	Current Limit ILIM	Output Discharge	Fault Flag FLGB	EN Activity	Package
GLF2351B-T1G7	JF	2.55 A Fixed	300 $\Omega$	Yes	High	SOT23-5L

## APPLICATION DIAGRAM

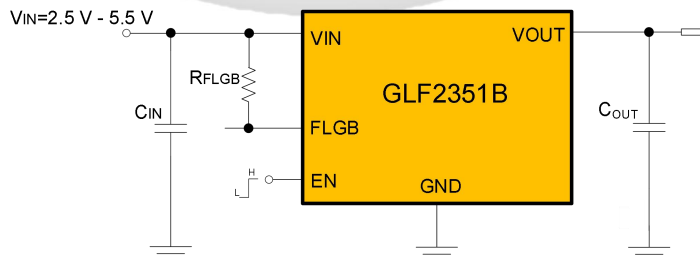


Figure 1. Typical Application

## FUNCTIONAL BLOCK DIAGRAM

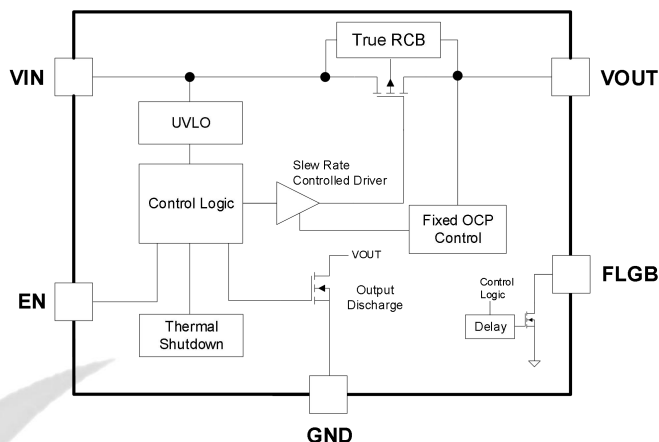


Figure 2. Functional Block Diagram

## PIN CONFIGURATION

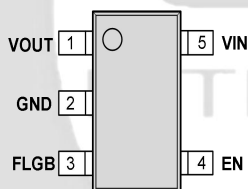


Figure 3. Package and Pin configuration

## PIN DEFINITION

Pin #	Name	Description
1	VOUT	Switch Output
2	GND	Ground
3	FLGB	Flag pin goes low to indicate OCP, SC, TRCB, 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
$V_{IN}$	$V_{IN}$ , $V_{OUT}$ , $V_{EN}$ to GND	- 0.3	6	V
$I_{OUT}$	DC Continuous Current at $T_A = 25^\circ\text{C}$		2.8	A
$T_{STG}$	Storage Junction Temperature	- 65	150	$^\circ\text{C}$
$T_A$	Operating Temperature Range	- 40	85	$^\circ\text{C}$
$\theta_{JA}$	Thermal Resistance, Junction to Ambient		180	$^\circ\text{C/W}$
ESD	Electrostatic Discharge Capability	Human Body Model, JESD22-A114	8	kV
		Charged Device Model, JESD22-C101	2	

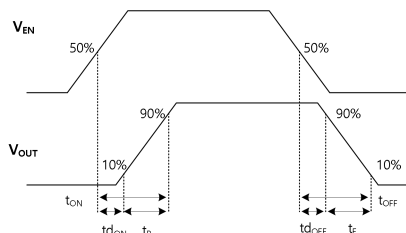
## ELECTRICAL CHARACTERISTICS

 Values are at  $V_{IN} = 5.0\text{ V}$  and  $T_A = 25^\circ\text{C}$ . Unless otherwise noted

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Units
Basic Operation							
V <sub>IN</sub>	Supply Voltage			2.5		5.5	V
I <sub>Q</sub>	Quiescent Current	V <sub>EN</sub> = High, I <sub>OUT</sub> = 0 mA			17	25	μA
I <sub>SD</sub>	Shutdown Current	V <sub>EN</sub> = Low, I <sub>OUT</sub> = 0 mA			60	100	nA
R <sub>ON</sub>	On-Resistance	V <sub>IN</sub> = 5.0 V, I <sub>OUT</sub> = 500 mA	T <sub>A</sub> = 25 °C		40	50	mΩ
			T <sub>A</sub> = 85 °C <sup>(1)</sup>		48		
		V <sub>IN</sub> = 3.3 V, I <sub>OUT</sub> = 500 mA	T <sub>A</sub> = 25°C		46	56	
			T <sub>A</sub> = 85 °C <sup>(1)</sup>		55		
R <sub>DSC</sub>	Output Discharge Resistance	V <sub>EN</sub> = Low , I <sub>FORCE</sub> = 10 mA			300		Ω
V <sub>IH</sub>	EN Input Logic High Voltage	V <sub>IN</sub> = 2.5 V to 5.5 V		1.2			V
V <sub>IL</sub>	EN Input Logic Low Voltage	V <sub>IN</sub> = 2.5 V to 5.5 V				0.6	V
R <sub>EN</sub>	EN pull down resistance	Internal Resistance			10	13	MΩ
I <sub>EN</sub>	EN Source or Sink Current	V <sub>EN</sub> = 5.5 V			0.5	0.8	μA
V <sub>FLGB</sub>	FLGB Output Low Voltage	I <sub>FLGB</sub> = 0.5 mA				100	mV
I <sub>FLGB</sub>	FLGB Output High Leakage	V <sub>FLGB</sub> = 5.5 V				50	nA
t <sub>FLGB</sub>	FLGB Output Delay Time <sup>(1)</sup>	Delay time for assertion at over current			8		ms
		Delay time for assertion at short circuit and thermal shutdown conditions			120		μs
Protection							
V <sub>UVLO</sub>	Under Voltage Lockout Voltage	Input Rising			2.3		V
		Input Falling			2.1		V
I <sub>LIM</sub>	Over Current Limit			2.35	2.55	2.75	A
I <sub>SC</sub>	Short Circuit <sup>(1)</sup>				4.6		A
V <sub>RCB_TH</sub>	Reverse Current Blocking Protection Trip Voltage	V <sub>OUT</sub> - V <sub>IN</sub>			35		mV
V <sub>RCB_RL</sub>	Reverse Current Blocking Protection Release Voltage	V <sub>IN</sub> - V <sub>OUT</sub>			22		mV
I <sub>RCB</sub>	Reverse Current Blocking Protection Leakage	V <sub>OUT</sub> – V <sub>IN</sub> > V <sub>RCB</sub>				1	μA
TSD	Thermal Shutdown	20 °C Hysteresis <sup>(1)</sup>			140		°C
Switching Characteristics <sup>(2)</sup>							
t <sub>dON</sub>	Turn-On Delay	R <sub>OUT</sub> = 150 Ω, C <sub>OUT</sub> =1.0 μF			160		μs
t <sub>R</sub>	V <sub>OUT</sub> Rise Time				590		
t <sub>dOFF</sub>	Turn-Off Delay				16		
t <sub>F</sub>	V <sub>OUT</sub> Fall Time				200		

Notes: 1. By design; characterized; not production tested.

2. Switching Timing Diagram


**Figure 4. Switching Timing Diagram**

## TYPICAL PERFORMANCE CHARACTERISTICS

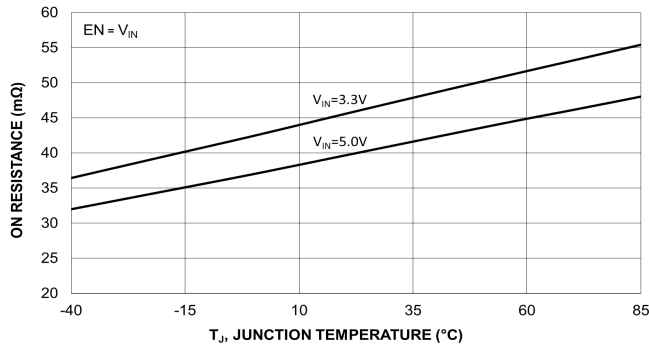


Figure 5. On-Resistance vs. Temperature

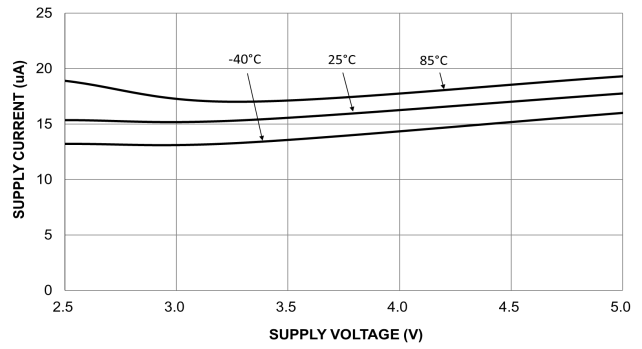


Figure 6. Quiescent Current vs. Supply Voltage

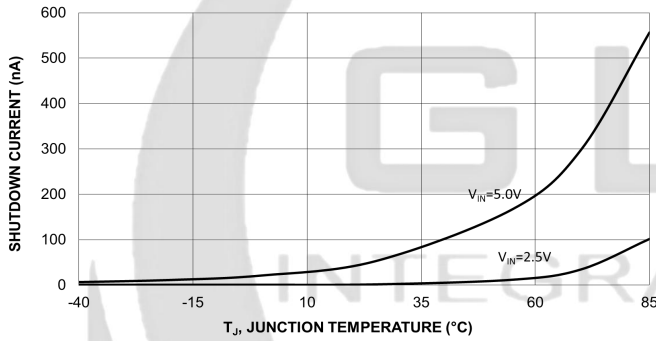


Figure 7. Shutdown Current vs. Temperature

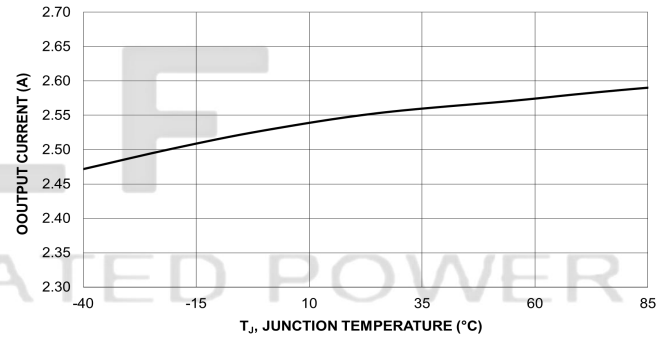


Figure 8. Over Current Limit vs. Temperature

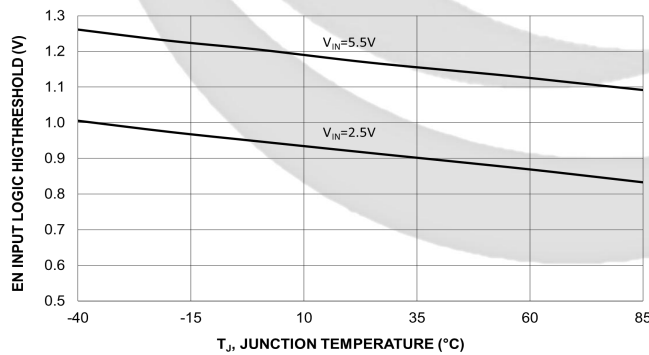


Figure 9. EN Input Logic High Threshold

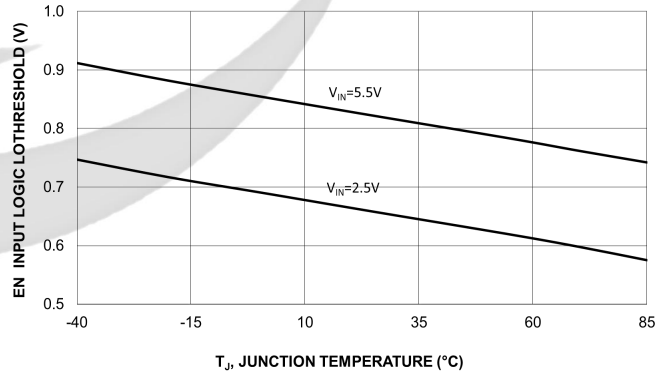
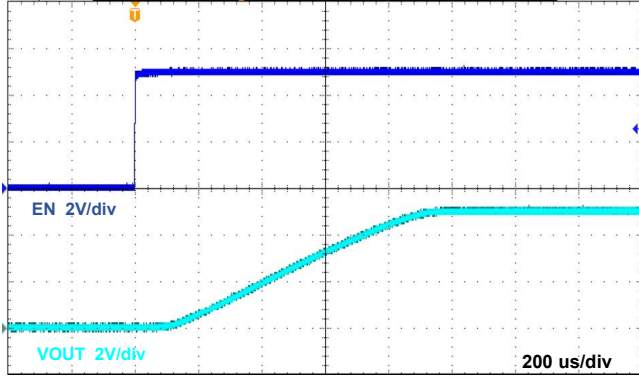
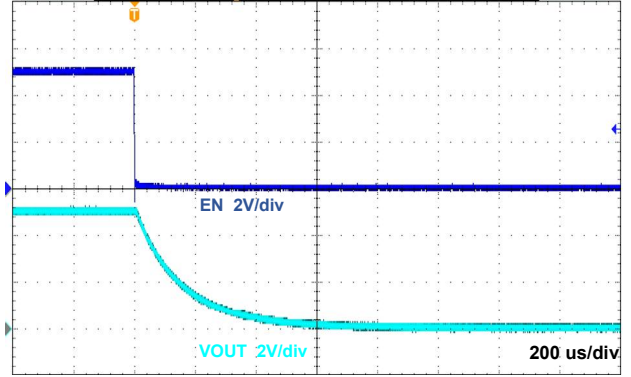


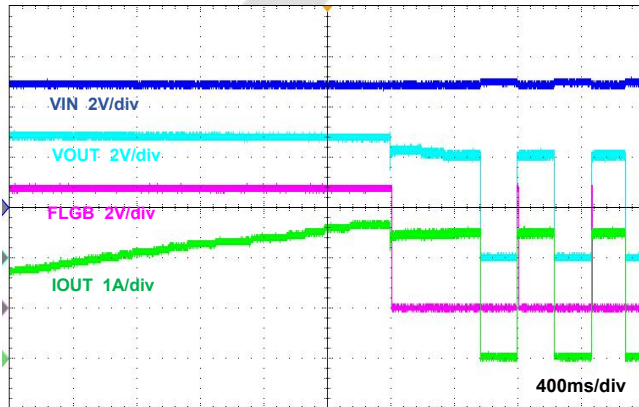
Figure 10. EN Input Logic Low Threshold



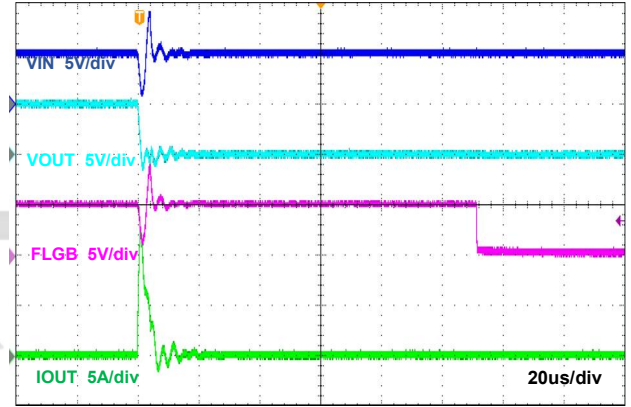
**Figure 11. Turn-On Response**  
 $V_{IN}=5.0\text{ V}$ ,  $C_{IN}=C_{OUT}=1.0\text{ }\mu\text{F}$ ,  $R_L=150\text{ }\Omega$



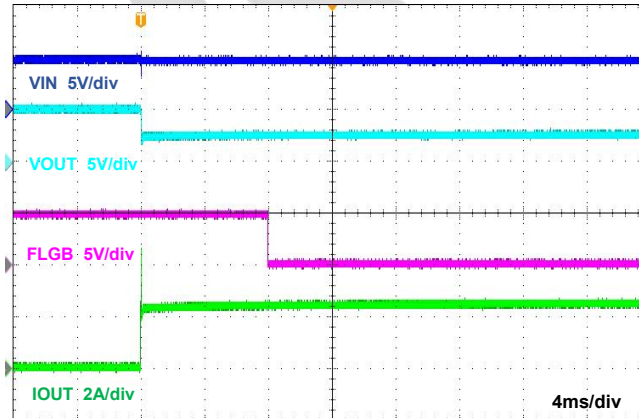
**Figure 12. Turn-Off Response**  
 $V_{IN}=5.0\text{ V}$ ,  $C_{IN}=C_{OUT}=1.0\text{ }\mu\text{F}$ ,  $R_L=150\text{ }\Omega$



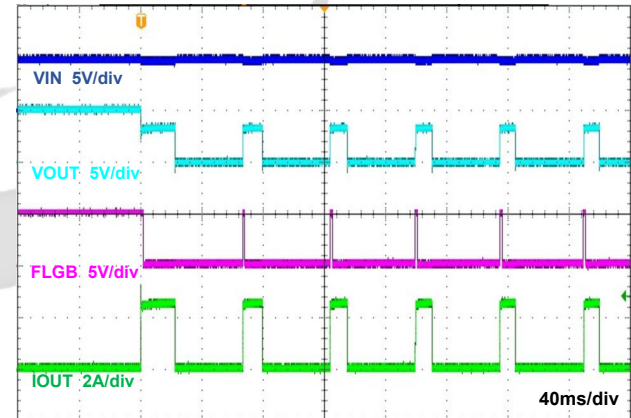
**Figure 13. Current Limit Response**  
 $V_{IN}=5.0\text{ V}$ ,  $C_{IN}=C_{OUT}=1.0\text{ }\mu\text{F}$



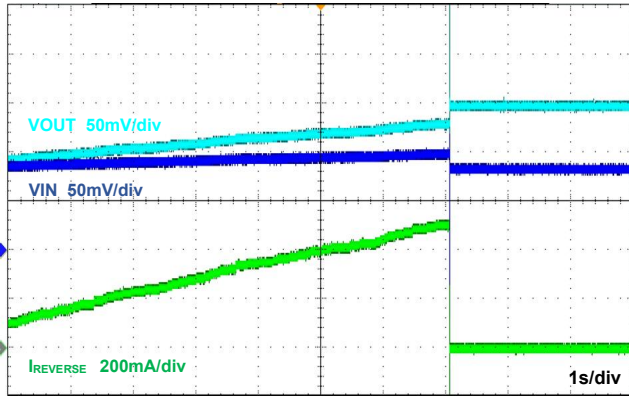
**Figure 14. Short Circuit Response**  
 $V_{IN}=5.0\text{ V}$ ,  $C_{IN}=C_{OUT}=1.0\text{ }\mu\text{F}$ ,  $R_L=0\text{ }\Omega$



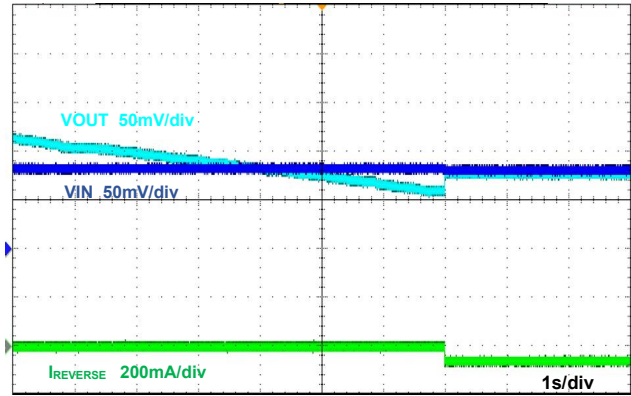
**Figure 15. FLGB Response**  
 $V_{IN}=5.0\text{ V}$ ,  $C_{IN}=C_{OUT}=1.0\text{ }\mu\text{F}$



**Figure 16. OTP Response**  
 $V_{IN}=5.0\text{ V}$ ,  $C_{IN}=C_{OUT}=1.0\text{ }\mu\text{F}$



**Figure 17. Reverse Current Blocking Threshold**  
 $V_{IN}=3.3\text{ V}$ ,  $V_{OUT}=\text{Up to } 3.4\text{ V}$ ,  $C_{IN}=C_{OUT}=1.0\text{ }\mu\text{F}$



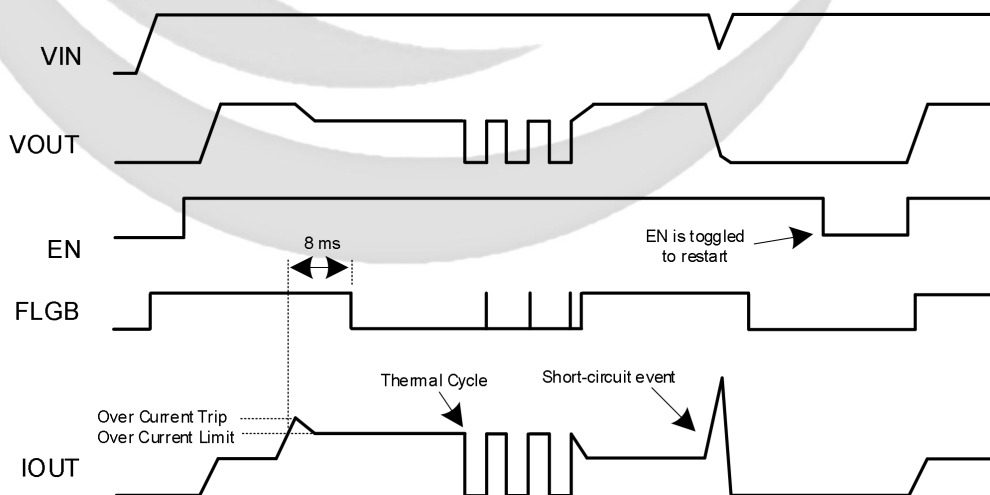
**Figure 18. Reverse Current Blocking Release**  
 $V_{IN}=3.3\text{ V}$ ,  $V_{OUT}=\text{Down to } 3.3\text{ V}$ ,  $C_{IN}=C_{OUT}=1.0\text{ }\mu\text{F}$

## APPLICATION INFORMATION

The GLF2351B 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, true reverse current blocking (TRCB), short circuit protection, and thermal shutdown.

### Current Limiting and Short Circuit Protection

The GLF2351B limits the output current at 2.55 A at an output over current condition. During the constant current-limit condition, the junction temperature of the GLF2351B increases. The over temperature protection (OTP) 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 device remains off until power is cycled or the EN pin is toggled.



**Figure 19. Over Current and Short Circuit Protection**



## True Reverse Current Blocking

The GLF2351B 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  $V_{RCB}$  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 GLF2351B is designed to avoid false FLGB reporting by using an internal 8 ms deglitch delay for the current limit condition and 120  $\mu$ s 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 latched-off and the FLGB output remains low. The FLGB signal is de-asserted once device power is cycled or the EN pin is toggled and the device resumes normal operation.

## EN pin

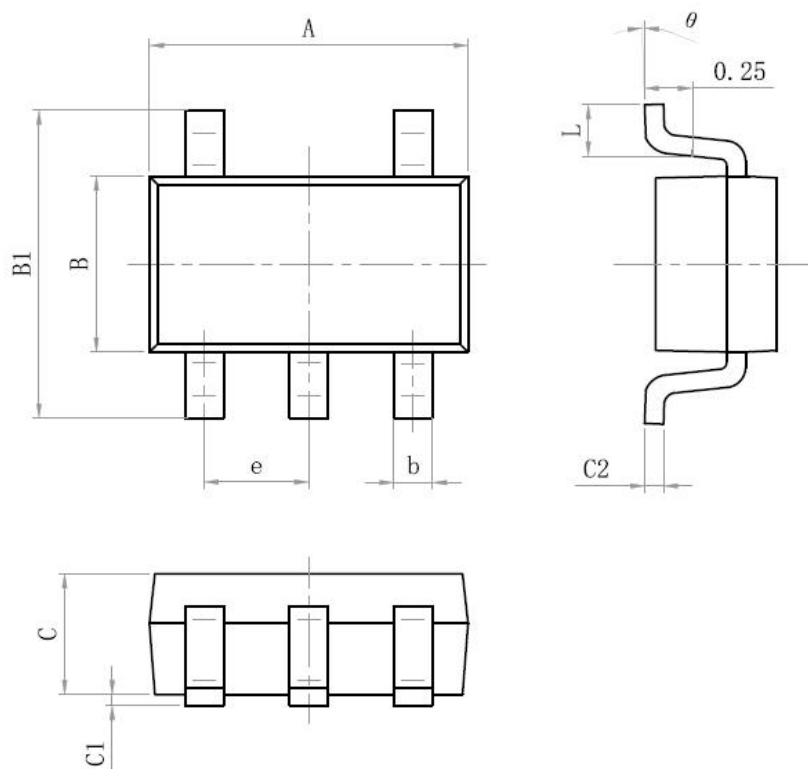
The GLF2351B can be activated by EN pin high. Note that the EN pin has an internal pull-down resistor to maintain a reliable status without EN signal applied from an external controller.

## Input and Output Capacitor

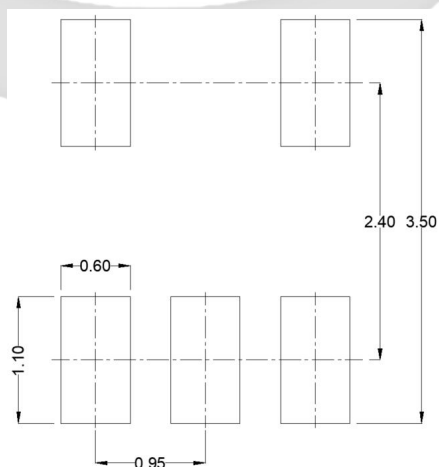
A minimum 1  $\mu$ F input capacitor is recommended to be placed close to the  $V_{IN}$  pin to reduce the voltage drop on the input power rail caused by transient inrush current at start-up. A higher input capacitor value can be used to further attenuate the input voltage drop. Also, a minimum 1  $\mu$ F 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°



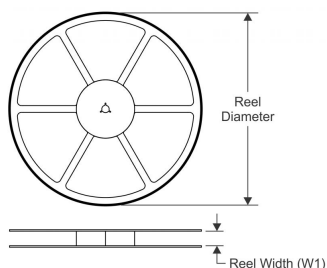
**Recommended Footprint**



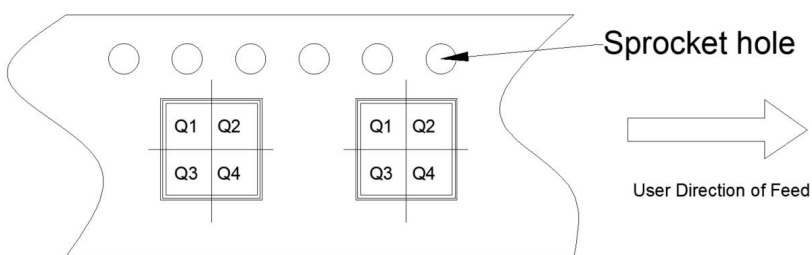


## TAPE AND REEL INFORMATION

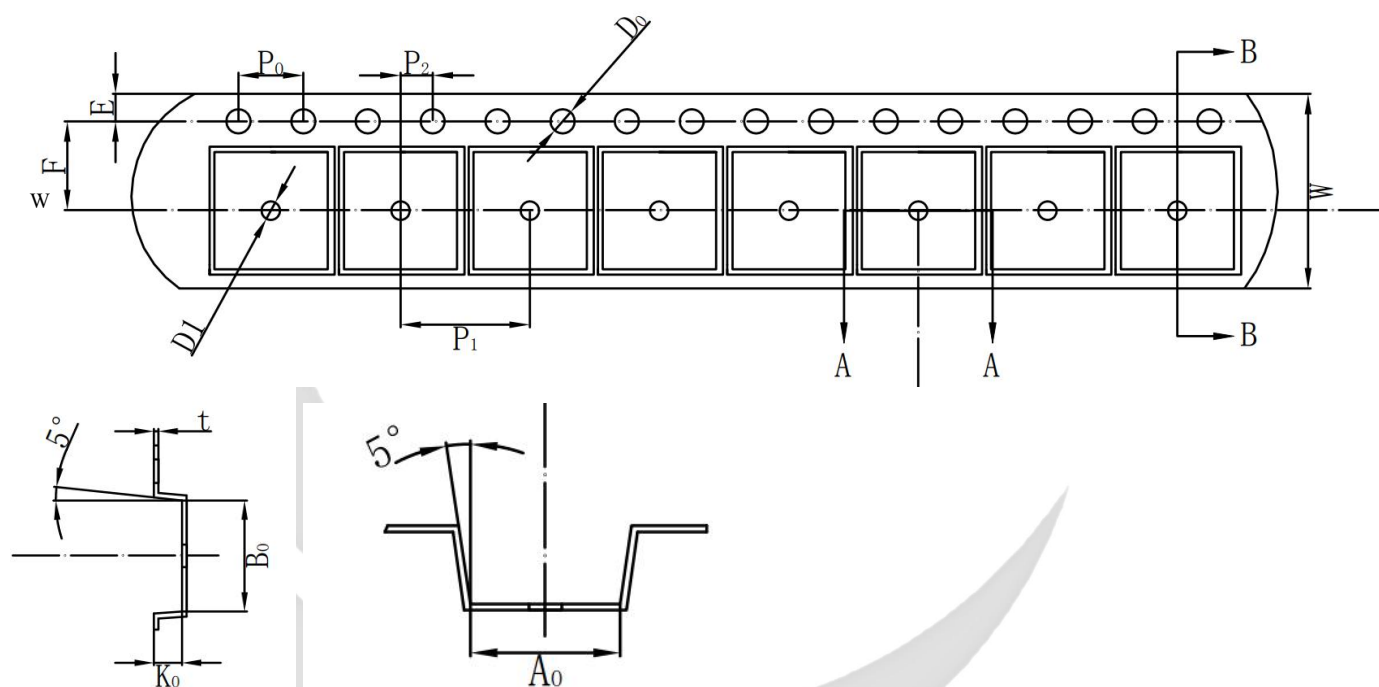
### REEL DIMENSIONS



### QUADRANT ASSIGNMENTS PIN 1 ORIENTATION TAPE



### TAPE DIMENSIONS



Device	Package	Pins	SPQ	Reel Diameter (mm)	Reel Width W1	A0	B0	K0	P1	W	Pin1
GLF2351B-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. Spec limits including typical, minimum, and maximum values are desired, or target, limits. GLF reserves the right to change limits at any time without warning or notification. A target specification in no way guarantees future production of the device in question.	Design / Development
Preliminary Specification	This is a draft version of a product specification. The specification is still 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 in no way guarantees future production of the device in question.	Qualification
Product Specification	This document represents the anticipated production performance characteristics of the device.	Production

## DISCLAIMERS

Information in this document is believed to be accurate and reliable, however GLF assumes no liability for errors or omissions. Device performance may be impacted by testing methods and application use cases. Users are responsible to independently evaluate the applicability, usability, and suitability of GLF devices in their application. In no case will GLF be liable for incidental, indirect, or consequential damages associated with the use, mis-use, or sale of its product. Customers are wholly responsible to assure GLF devices meet their system level and end product requirements. GLF retains the right to change the information provided in this data sheet without notice.