GLF2351A

High Precision Programmable Current Limit Power Switch

Product Specification

DESCRIPTION

The GLF2351A is an advanced technology fully integrated power switch for applications required for precision output current limiting. The GLF2351A also features various protection functions such as under voltage lockout, true reverse current blocking (TRCB), short circuit protection, and thermal shutdown.

The GLF2351A 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 GLF2351A is an ideal switch for USB power supply.

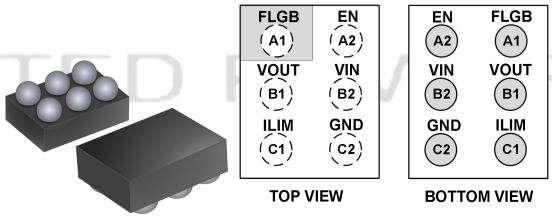
FEATURES

- Input Range: 2.5 V to 5.5 V
- Programmable Output Constant Current Limit Range: 40 mA to 2.8 A
- Low R_{ON}: 32 mΩ Typ. at 5.0 V_{IN}
- Ultra-Low I_Q: 19 μA Typ. at 5.0 V_{IN}
- Ultra-Low I_{SD}: 63 nA Typ. at 5.0 V_{IN}
- Under Voltage Lockout Protection
- Output Voltage Slew Rate Controlled
- True Reverse Current Blocking Protection
- Short Circuit Protection
- Deglitched Fault Flag Indication
- Integrated Output Discharge Switch
- Thermal Shutdown Protection

APPLICATIONS

- Notebooks and Tablets
- Wireless LAN and Broadband Access Devices
- Storage and Peripherals
- Smart Mobile Devices

PACKAGE



0.97 mm x 1.47 mm x 0.55 mm WL-CSP 0.5 mm Pitch

DEVICE ORDERING INFORMATION

Part Number	Top Mark	Current Limit ILIM	Output Discharge	Fault Flag FLGB	EN Activity	Package
GLF2351A-S3G7	JG	Programmable 40 mA to 2.8 A	300 Ω	Yes	High	0.97 mm x 1.47 mm CSP

APPLICATION DIAGRAM

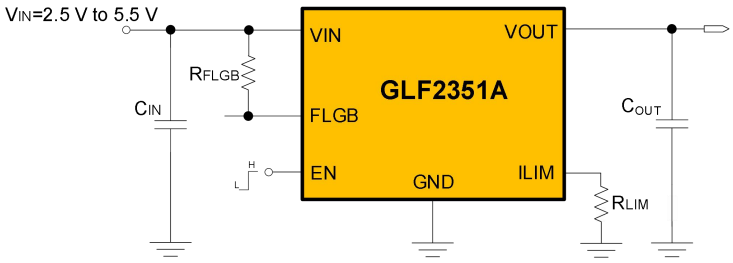


Figure 1. Typical Application

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FUNCTIONAL BLOCK DIAGRAM

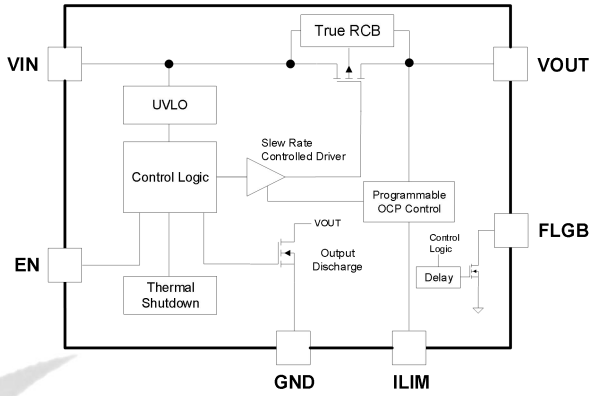

Figure 2. Functional Block Diagram

PIN CONFIGURATION

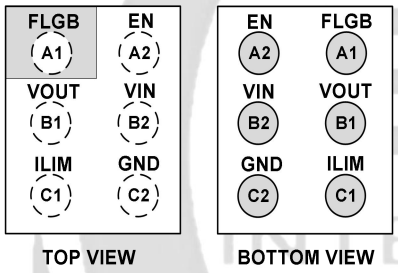

Figure 3. Package and Pin configuration

PIN DEFINITION

Pin #	Name	Description
A1	FLGB	Flag pin goes low to indicate OCP, SC, TRCB, UVLO and TSD fault conditions
A2	EN	Active high switch output enables the device
B1	VOUT	Switch output
B2	VIN	Switch Input. Supply voltage for IC
C1	ILIM	Programmable current limit Do not leave this pin floating.
C2	GND	Ground

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°C			3	A
T_J	Junction Temperature			150	°C
T_{STG}	Storage Junction Temperature		- 65	150	°C
θ_{JA}	Thermal Resistance, Junction to Ambient			120	°C/W
ESD	Electrostatic Discharge Capability	Human Body Model, JESD22-A114	8		kV
		Charged Device Model, JESD22-C101	2		

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min.	Max.	Unit
V_{IN}	Supply Voltage	2.5	5.5	V
T_A	Ambient Operating Temperature	-40	+85	°C

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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							
I_Q	Quiescent Current	V_{EN}= High, I_{OUT}=0 mA, V_{IN} = V_{EN} =5.0V			19	25	µA
		V_{EN}= High, I_{OUT}=0 mA, V_{IN} = V_{EN} =5.0V, T_A=85 °C			26		
I_{SD}	Shutdown Current	V_{EN}= Low, V_{IN} =5.0 V			63	100	nA
		V_{EN}= Low, V_{IN} =5.0 V, T_A=85 °C			660		
R_{ON}	On-Resistance	V_{IN}=5.0 V, I_{OUT}= 500 mA	T_A=25 °C		32	42	mΩ
			T_A=85 °C (1)		40		
		V_{IN}=2.5 V, I_{OUT}= 500 mA	T_A=25 °C		46	56	
			T_A=85 °C (1)		56		
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		MΩ
I_{EN}	EN Source or Sink Current	V_{EN}= 5.5 V				0.6	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_{FLAG}	FLGB Output Delay Time (1)	Delay time for assertion at over-current			8		ms
		Delay time for assertion at short circuit and thermal shutdown conditions			120		µs
Protection							
V_{UVLO}	Under Voltage Lockout Voltage	Input Rising			2.4		V
		Input Falling			2.1		
I_{LIM}	Over Current Limit (1)	R_{LIM}= 1 kΩ		2.5	2.8	3.1	A
V_{RCB_TH}	Reverse Current Blocking Protection Trip Voltage	V_{OUT} - V_{IN}			25		mV
V_{RCB_RL}	Reverse Current Blocking Protection Release Voltage	V_{IN} - V_{OUT}			23		
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			106		µs
t_R	V_{OUT} Rise Time				486		
t_{dOFF}	Turn-Off Delay	R_{OUT}= 150 Ω, C_{OUT}= 1.0 µF			17		
t_F	V_{OUT} Fall Time				220		

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

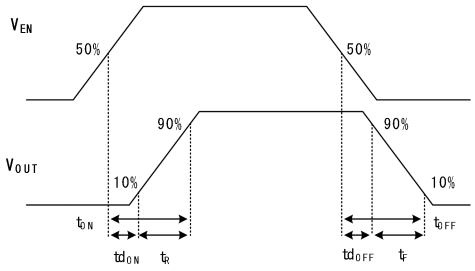

Figure 4. Switching Timing Diagram

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TYPICAL PERFORMANCE CHARACTERISTICS

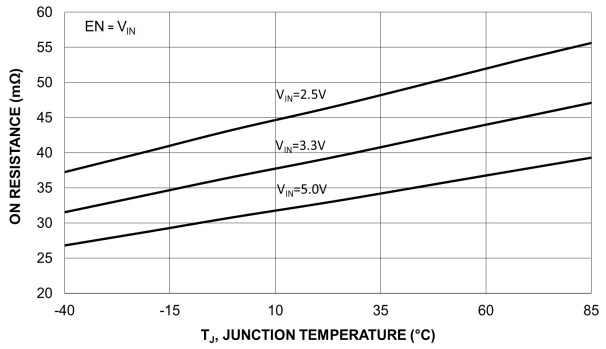

Figure 5. On-Resistance vs. Temperature

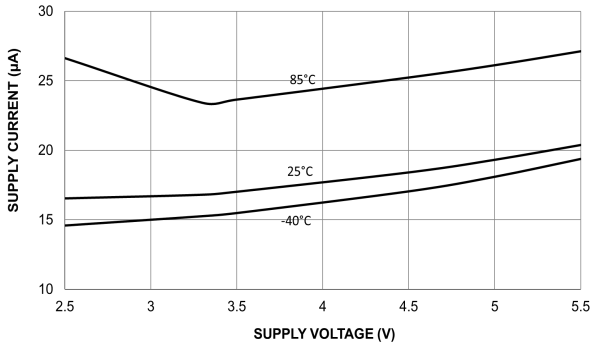

Figure 6. Quiescent Current vs. Supply Voltage

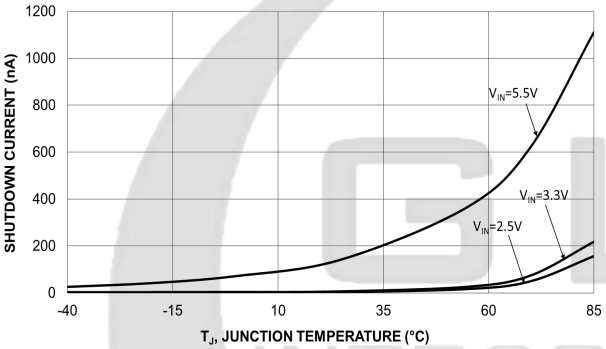

Figure 7. Shutdown Current vs. Temperature

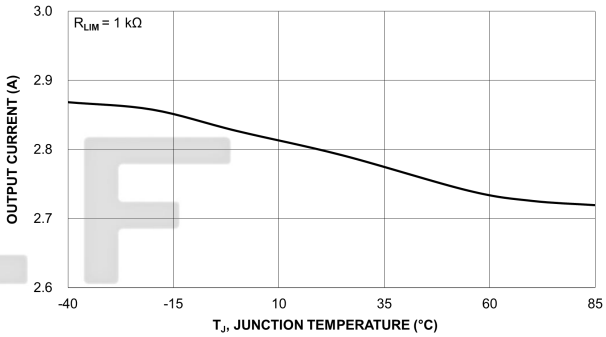

Figure 8. Over Current Limit vs. Temperature

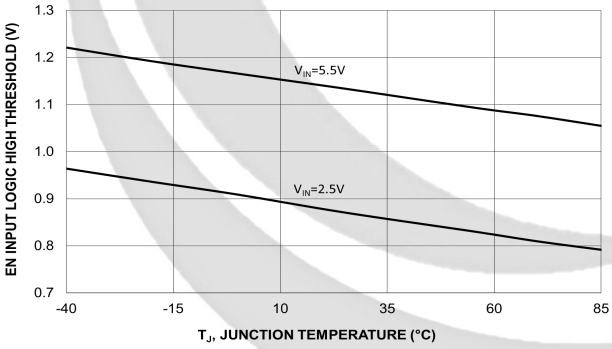

Figure 9. EN Input Logic High Threshold

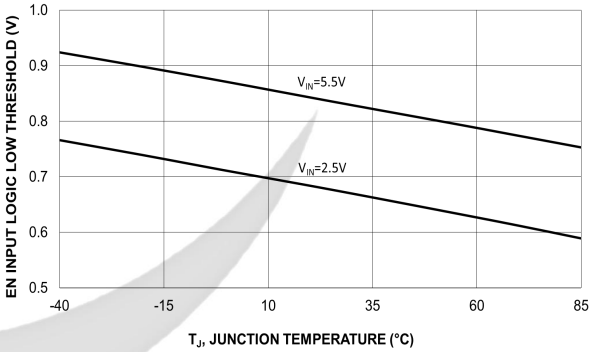

Figure 10. EN Input Logic Low Threshold

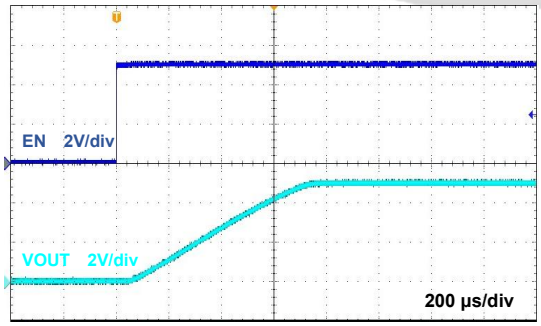

Figure 11. Turn-On Response
V_{IN}=5.0 V, C_{IN}=C_{OUT}=1.0 μF, R_L=150 Ω

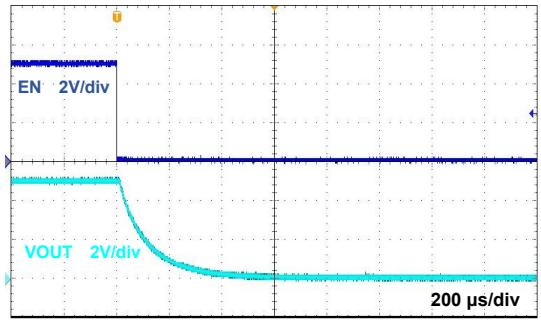

Figure 12. Turn-Off Response
V_{IN}=5.0 V, C_{IN}=C_{OUT}=1.0 μF, R_L=150 Ω

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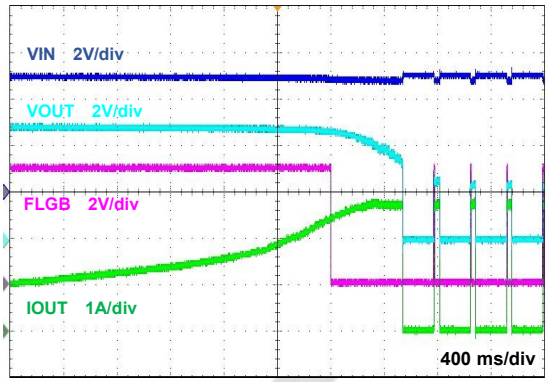

Figure 13. Current Limit Response
V_{IN}=5.0 V, C_{IN}=C_{OUT}=1.0 μF

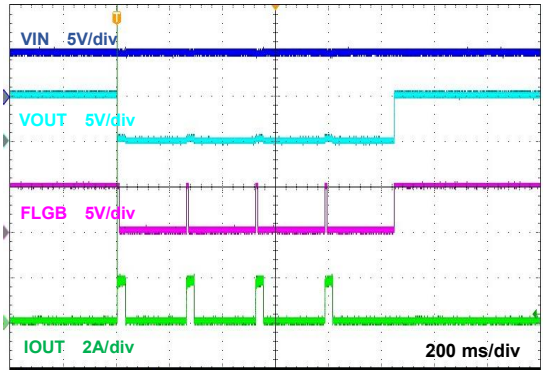

Figure 14. Short Circuit Response
V_{IN}=5.0 V, C_{IN}=C_{OUT}=1.0 μF, R_L=0 Ω

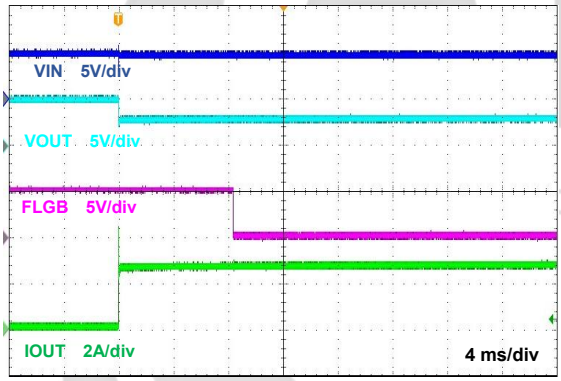

Figure 15. FLGB Response
V_{IN}=5.0 V, C_{IN}=C_{OUT}=1.0 μF

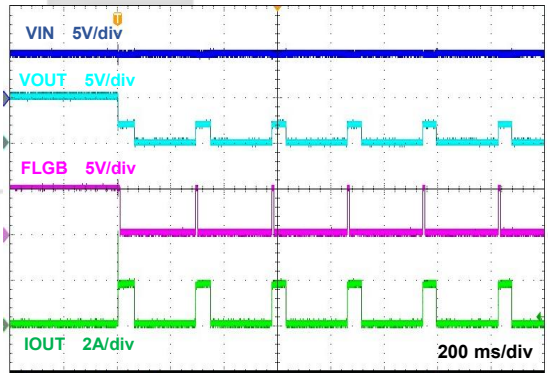

Figure 16. OTP Response
V_{IN}=5.0 V, C_{IN}=C_{OUT}=1.0 μF

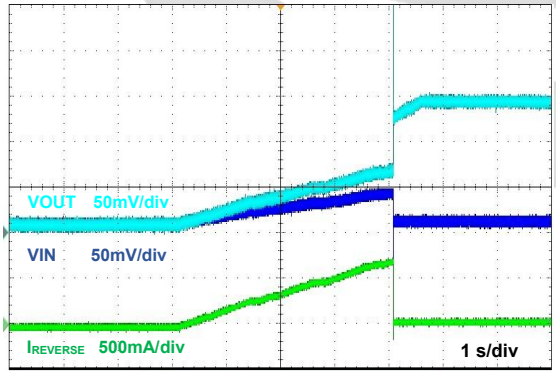

Figure 17. Reverse Current Blocking Threshold
V_{IN}=3.3 V, V_{OUT}=Up to 3.4 V, C_{IN}=C_{OUT}=1.0 μF

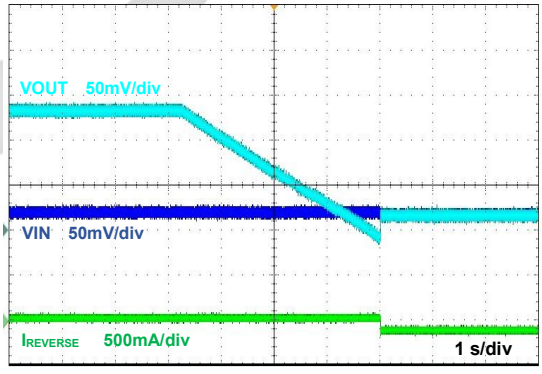

Figure 18. Reverse Current Blocking Release
V_{IN}=3.3 V, V_{OUT}=Down to 3.3 V, C_{IN}=C_{OUT}=1.0 μF

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APPLICATION INFORMATION

The GLF2351A is an advanced technology fully integrated power switch for applications required for precision output current limiting. It also features various protection functions such as under voltage lockout, true reverse current blocking (TRCB), short circuit protection, and thermal shutdown protection.

Current Limiting and Over Temperature Protection

When the GLF2351A is enabled, the current-limit circuitry starts monitoring the output current. When the load current reaches up to the over current protection threshold or short circuit occurs, the device clamps the output current to a preset constant current limit level by an external resistor (R_{LIM}) between ILIM and GND pins. The 1% precision resistors are recommended. The R_{LIM} resistor traces should be as short as possible to reduce parasitic effects on the current-limit accuracy. Refer to the Figure 19 and table 1 to find the resistor values corresponding to different current limit levels. When the load current back to normal and the short circuit condition is removed, the device releases the clamped output current.

When the current limit condition continues and the junction temperature exceeds the exceeds the OTP (Over Temperature Protection) threshold, 140 °C, the GLF2351A is turned off immediately. As the junction temperature cools down below the OPT hysteresis, the GLF2351A resumes normal operation.

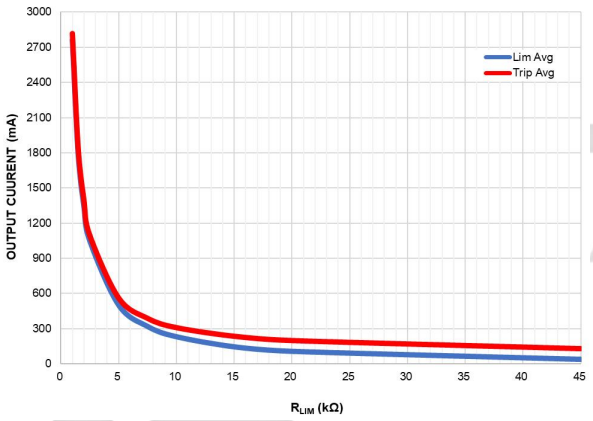

Figure 19. Current Trip and Limit vs. R_{LIM}

R_{LIM} (kΩ)	Current Limit Trip Typ (mA)			Current Limit Typ (mA)		
	Min	Typ	Max	Min	Typ	Max
1.0	2625	2940	3255	2500	2800	3100
1.5	1701	1890	2079	1620	1800	1980
2.0	1260	1418	1565	1200	1350	1490
2.5	998	1103	1208	950	1050	1150
5.0	495	560	605	450	500	550
7.5	348	384	420	290	320	350
10	240	310	380	205	230	255
15	155	234	315	130	145	160
20	120	198	280	100	110	120
45	60	130	200	20	40	60

Table 1. Current Limit Level by R_{LIM}

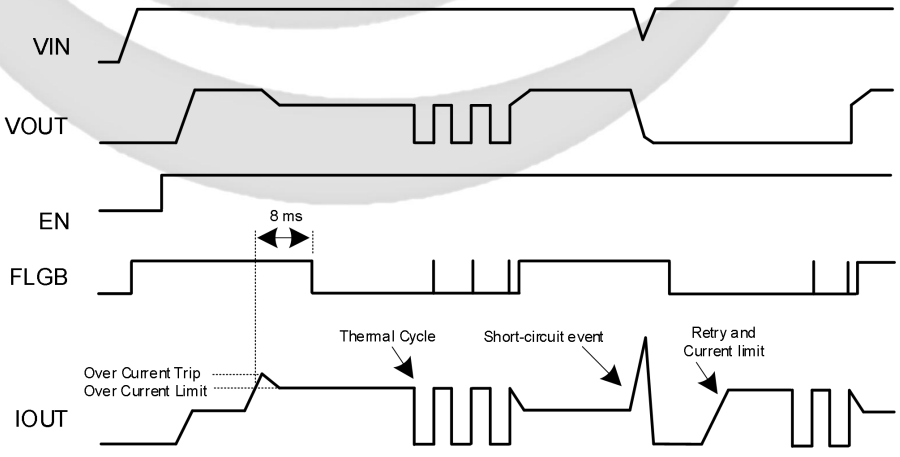

Figure 20. Over Current and Short Circuit Protection

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True Reverse Current Blocking

The GLF2351A 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 (V_{RCB_TH}). When the output voltage goes beyond the input voltage by the reverse current blocking protection trip voltage (V_{RCB_RL}), the GLF2351A is turned 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.

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 GLF2351A 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 limits the output current and the FLGB output remains low. The FLGB signal is de-asserted once device power is cycled or the enable is toggled and the device resumes normal operation.

EN pin

The GLF2351A 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.

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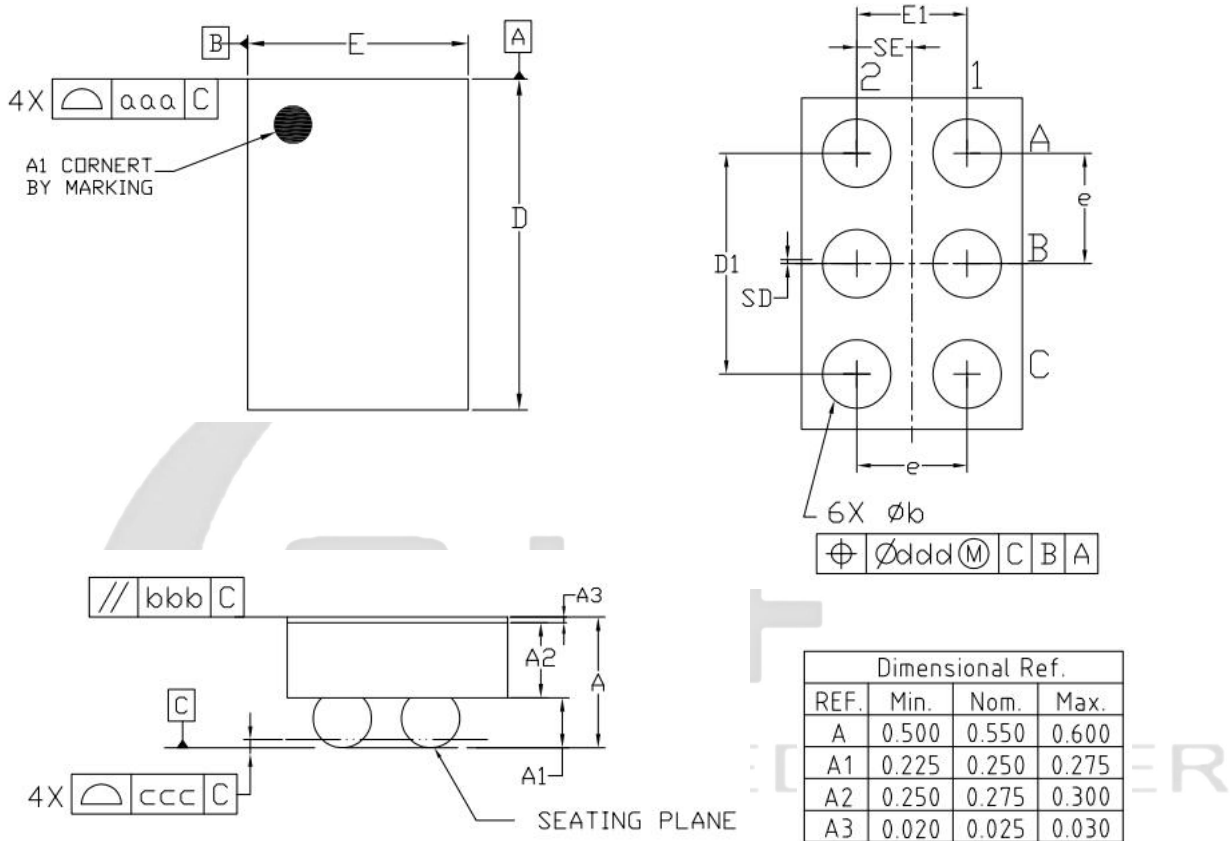
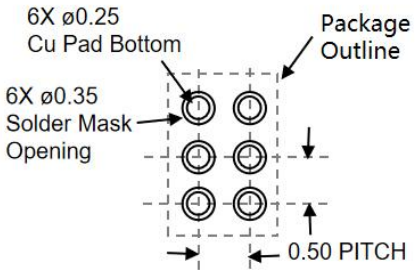
PACKAGE OUTLINE



Dimensional Ref.			
REF.	Min.	Nom.	Max.
A	0.500	0.550	0.600
A1	0.225	0.250	0.275
A2	0.250	0.275	0.300
A3	0.020	0.025	0.030
D	1.460	1.470	1.485
E	0.960	0.970	0.985
D1	0.950	1.000	1.050
E1	0.450	0.500	0.550
b	0.260	0.310	0.360
e	0.500 BSC		
SD	0.000 BSC		
SE	0.250 BSC		
Tol. of Form&Position			
aaa	0.10		
bbb	0.10		
ccc	0.05		
ddd	0.05		

Recommended Footprint



Notes

1. ALL DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGRESS)
2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
3. A3: BACKSIDE LAMINATION

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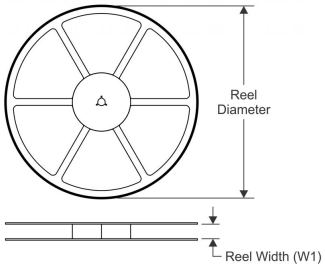
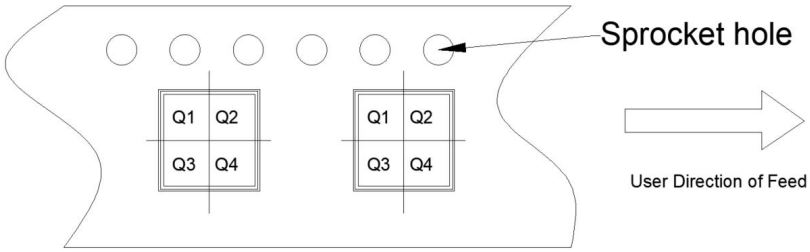
TAPE AND REEL INFORMATION

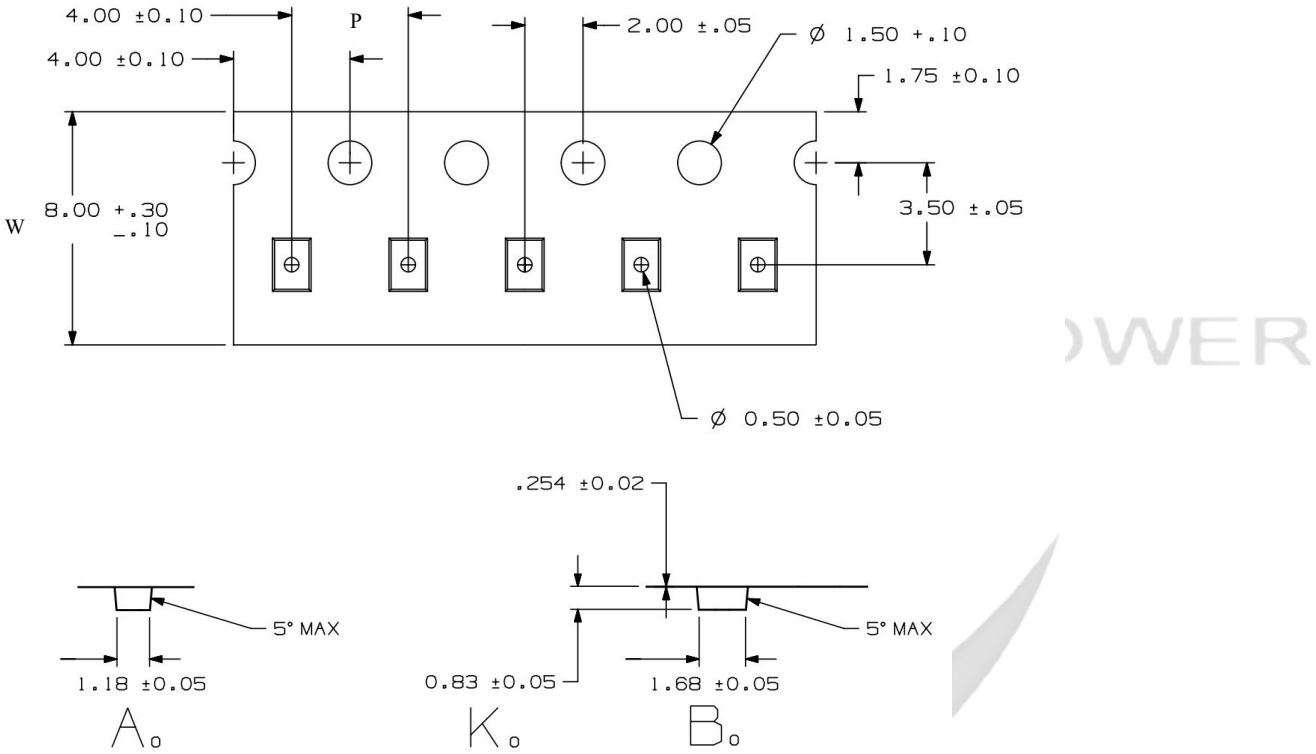
REEL DIMENSIONS



QUADRANT ASSIGNMENTS PIN 1 ORIENTATION TAPE



TAPE DIMENSIONS



Device	Package	Pins	SPQ	Reel Diameter (mm)	Reel Width W1	A0	B0	K0	P	W	Pin1
GLF2351A-S3G7	WLCSP	6	3000	180	9	1.18	1.68	0.83	4	8	Q1

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

P: Pitch between successive cavity centers

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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

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