GLF2204

Over Voltage and Over Current Protection IC

Preliminary Specification

DESCRIPTION

The GLF2204 is an integrated Over voltage protection (OVP) power switch. There are external and internal OVP thresholds. The device provides more protection features which are under voltage lockout, programmable current and thermal shutdown.

The external OVP threshold is adjusted by an external resistor divider from 4.5 V to 9 V. The device has an internal fixed OVP threshold voltage when the OVLO pin voltage is lower than an external OVP set threshold voltage (V_{OVP_TH}). When an input voltage of VIN exceeds the over voltage threshold, the GLF2204 will be turned off immediately to isolate the system from the input source.

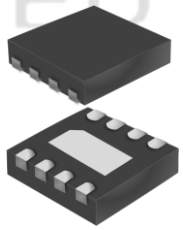
FEATURES

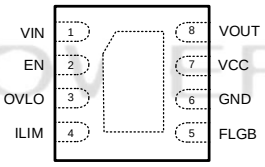
- Supply Voltage Range: 3.5 V to 9 V
- Integrated Over Voltage Protection Threshold
  - Internal Fixed 6.85 V Typ.
  - Programmable OVP from 4.5 V to 9 V
- Low R_{ON}: 188 mΩ Typ at 5 V_{IN}
- Low I_Q: 80 μA at 5 V_{IN}
- Under Voltage Lockout
- Programmable Over Current Protection
  - From 300 mA to 2 A
- Active Low FLGB Indication
- Thermal Shutdown Protection
- Internal 19 ms Recovery Delay after Protection

APPLICATIONS

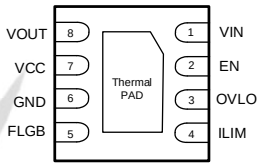
- Smart Portable Devices
- Low Power Sub-systems
- Smartphones and Tablets
- USB Power System
- IP Camera

PACKAGE





TOP VIEW



BOTTOM VIEW

2 mm x2 mm DFN-8L

APPLICATION DIAGRAM

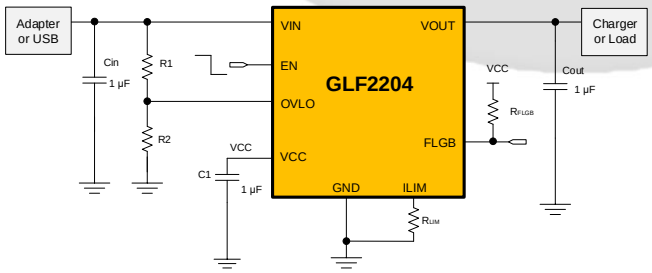


Figure 1. Programmable Over Voltage Protection

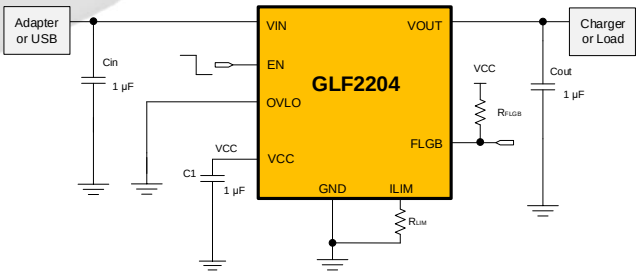


Figure 2. Fixed Over Voltage Protection

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ORDERING INFORMATION

Part Number	Top Mark	R_{ON} (Typ) at 5 V_{IN}	Over Current Protection Behavior	EN Activity	Package
GLF2204-D2G7	FN	188 mΩ	Latch off	Low	DFN 2x2-8L

FUNCTIONAL BLOCK DIAGRAMS

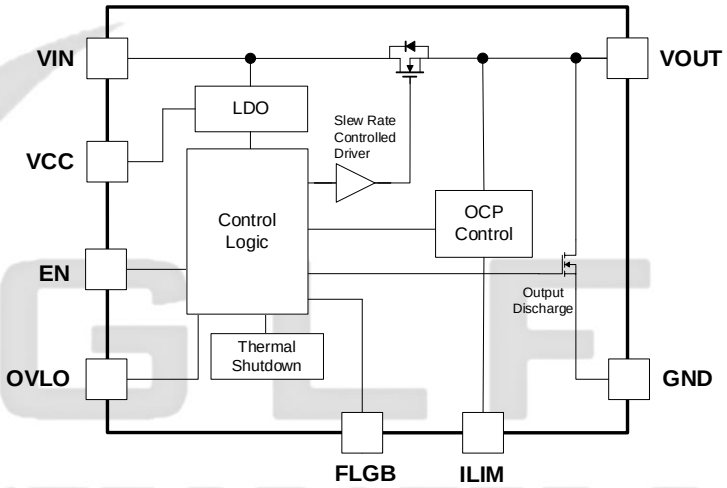
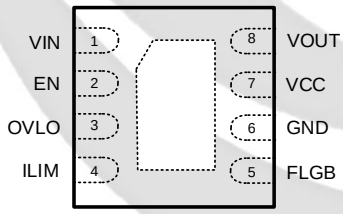
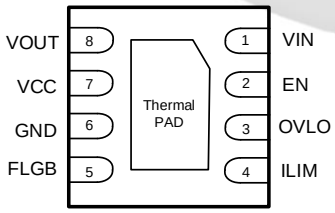


Figure 3. Functional Block Diagram

PIN CONFIGURATION



TOP VIEW



BOTTOM VIEW

Figure 4. 2 mm x2 mm DFN-8L

PIN DEFINITION

Pin #	Name	Description
1	VIN	Switch Input. Supply Voltage for IC
2	EN	Active low switch output enables to control the switch, internal pull up
3	OVLO	External OVP programmable pin by the resistor divider. Tie the OVLO pin to GND to use the internal fixed OVP threshold.
4	ILIM	Programmable current limit Do not leave this pin floating.
5	FLGB	Open-drain output. Power good and fault flag pin.
6	GND	Ground
7	VCC	3.3 V LDO output
8	VOUT	Output of main power switch
Thermal Pad		Connect this pad to GND

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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}	Reference to GND		-0.3	12	V
V_{OUT}	When the device is disabled		-0.3	7	
V_{OVLO}, V_{FLGB}, V_{CC} V_{EN}, V_{ILIM}	Each Pin to GND		-0.3	6	
I_{OUT}	Maximum Continuous Switch Current		Internal Limited		A
T_{STG}	Storage Junction Temperature		-65	150	°C
T_J	Operating Junction Temperature Range		-40	150	°C
θ_{JA}	Thermal Resistance, Junction to Ambient			80	°C/W
ESD	Electrostatic Discharge Capability	Human Body Model, JESD22-A114	±2		kV
		Charged Device Model, JESD22-C101	±1		

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min.	Max.	Unit
V_{IN}	Supply Voltage	3.5	9	V
T_A	Ambient Operating Temperature	-40	+85	°C

ELECTRICAL CHARACTERISTICS

V_{IN} = 5.0 V, T_A = 25°C, unless otherwise noted

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Units
Basic Operation							
V_{UVLO}	Under Voltage Lockout	Turn-on, V_{IN} increasing		2.6	2.8	3	V
		Hysteresis			0.4		V
I_Q	Input Quiescent Current	V_{IN} = 5 V, I_{OUT} = 0 mA, V_{EN} = 0 V			80	150	µA
		V_{IN} = 9 V, I_{OUT} = 0 mA, V_{EN} = 0 V	T_A = 25 °C		93	160	
			T_A = 85 °C (1)		99		
I_{SD}	Input Shutdown Current	V_{IN} = 5 V, I_{OUT} = 0 mA, V_{EN} = 5 V			23	33	µA
		V_{IN} = 9 V, I_{OUT} = 0 mA, V_{EN} = 5 V	T_A = 25 °C		27	36	
			T_A = 85 °C (1)		32		
V_{OVP}	Internal OVP Trip Voltage	V_{IN} rising, V_{OVLO} = 0 V, Switch Off		6.7	6.85	7.0	V
		Hysteresis			0.25		V
V_{OVP_SEL}	External OVP Selection	OVLO pin voltage rising		0.3			V
V_{OVP_TH}	External OVP Set Threshold	OVLO pin voltage rising, Device turns off		1.1	1.25	1.4	V
	External OVP Hysteresis				0.05		V
t_{OVP}	OVP Response Time (1)	V_{OVLO} to 90 % of V_{OUT}			1		µs
R_{ON}	On-Resistance	V_{IN} = 3.5 V, I_{OUT} = 1 A	T_A = 25 °C		193	205	mΩ
			T_A = 85 °C (1)		230		
		V_{IN} = 5 V, I_{OUT} = 1 A	T_A = 25 °C		188	200	
			T_A = 85 °C (1)		225		
		V_{IN} = 9 V, I_{OUT} = 1 A	T_A = 25 °C		182	195	
			T_A = 85 °C (1)		218		

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Vcc	LDO Output Voltage	V_{IN} = 5 V, I_{VCC} = 1 mA	3.1	3.3	3.5	V
V_{IH}	EN Input Logic High Voltage	V_{IN} = 3.5 V to 9 V	1.2			V
V_{IL}	EN Input Logic Low Voltage	V_{IN} = 3.5 V to 9 V			0.6	V
R_{EN}	EN Pull Up Resistance	Internal Resistance		12	14	MΩ
I_{EN}	EN Source or Sink Current	V_{EN} = 5.5 V		0.2	0.6	μA
R_{DSC}	Output Discharge Resistance	V_{EN} = 5 V, I_{FORCE}= 10 mA		127		Ω
V_{FLGB}	FLGB Output Low Voltage	I_{FLGB} = 0.5 mA		80	180	mV
I_{FLGB}	FLGB Output High Leakage	V_{FLGB} = 5.5 V		3		nA
t_{FLGBF}	FLGB assertion delay (1)	When OVP, Short Circuit and Thermal Shutdown is triggered		27		μs
t_{FLGBR}	FLGB de-assertion delay (1)	Recovery from OVP, OCP and Thermal Shutdown Protection		4.6		ms
T_{SD}	Thermal Shutdown Protection (1)	Shutdown Temperature		150		°C
		Thermal Hysteresis		25		°C
I_{LIM}	Over Current Limit	Load Current Rising, R_{ILIM}= 150 kΩ	0.8	1.2	1.6	A
Switching Characteristics (2)						
t_{dON}	Turn-On Delay	R_{OUT} = 150 Ω, C_{OUT} = 1.0 μF		19		ms
t_R	V_{OUT} Rise Time			51		μs
t_{dOFF}	Turn-Off Delay	R_{OUT} = 150 Ω, C_{OUT} = 1.0 μF		7		μs
t_F	V_{OUT} Fall Time			130		μs

Notes: 1. By design; characterized, not production tested.
2. $t_{ON} = t_{dON} + t_R$, $t_{OFF} = t_{dOFF} + t_F$

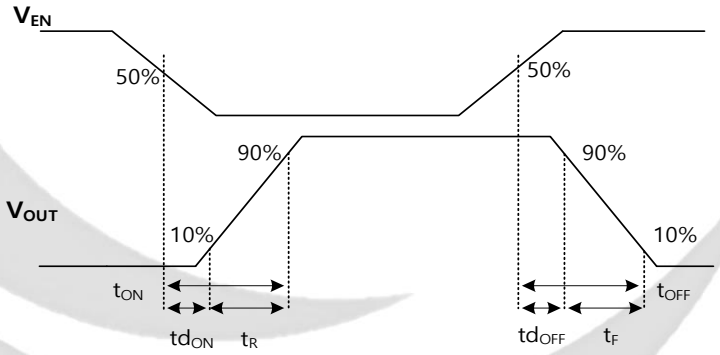

Figure 5. Switching Timing Diagram

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TYPICAL PERFORMANCE CHARACTERISTICS

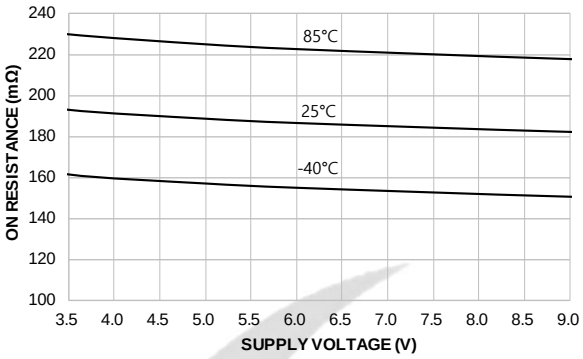

Figure 6. R_{ON} vs. Input Voltage

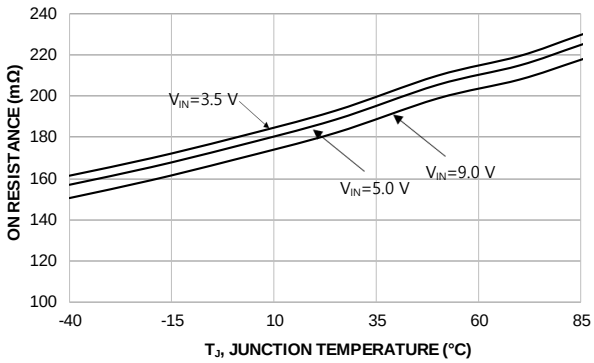

Figure 7. R_{ON} vs. Temperature

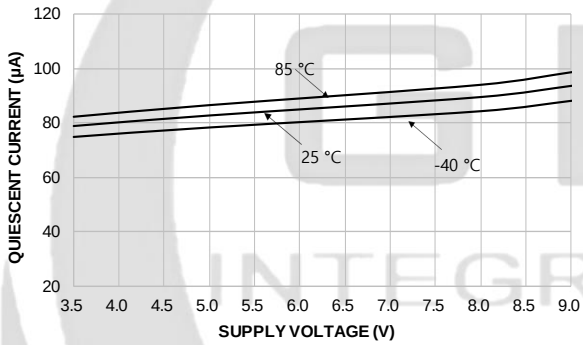

Figure 8. Quiescent Current vs. Input Voltage

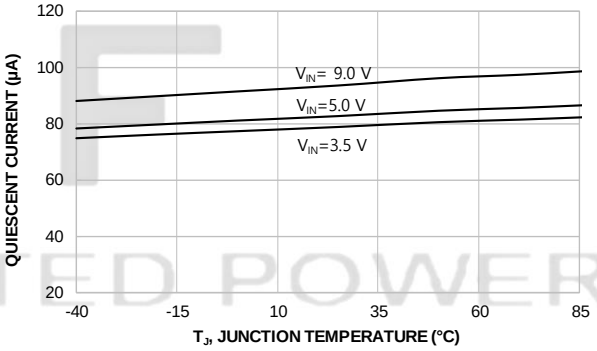

Figure 9. Quiescent Current vs. Temperature

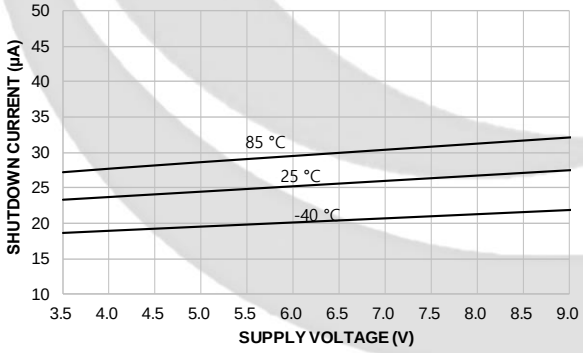

Figure 10. Shutdown Current vs. Input Voltage

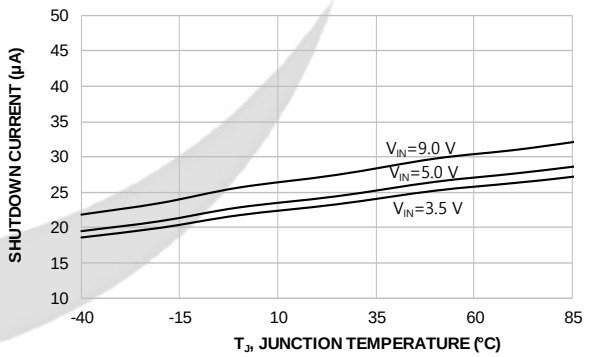

Figure 11. Shutdown Current vs. Temperature

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TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

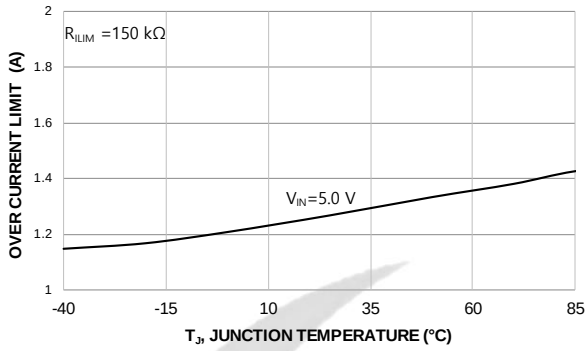

Figure 12. Over Current Limit vs. Temperature

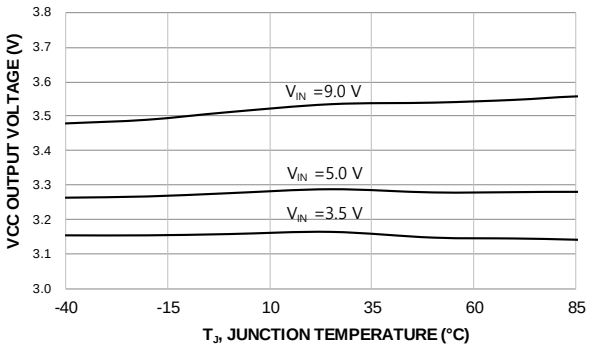

Figure 13. VCC output vs. Temperature

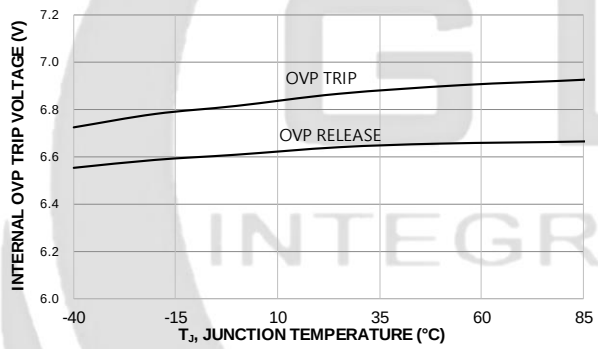

Figure 14. Internal OVP Trip Voltage vs. Temperature

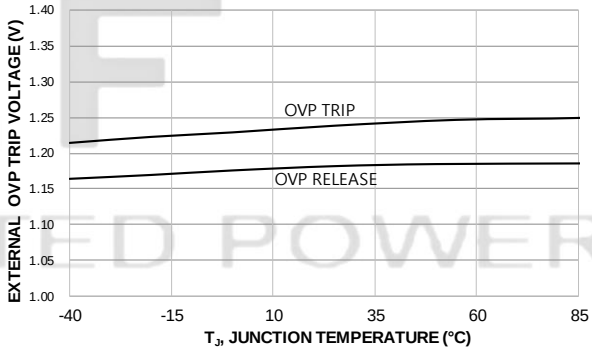

Figure 15. External OVP Set Threshold vs. Temperature

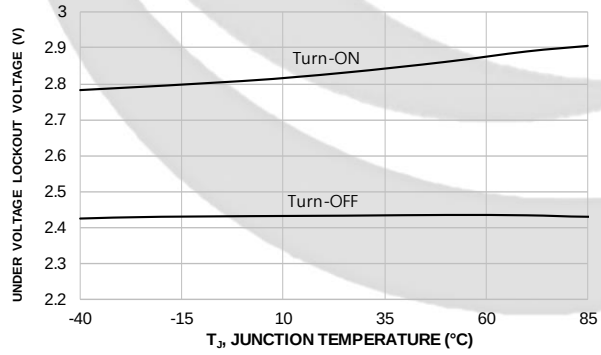

Figure 16. UVLO vs. Temperature

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TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

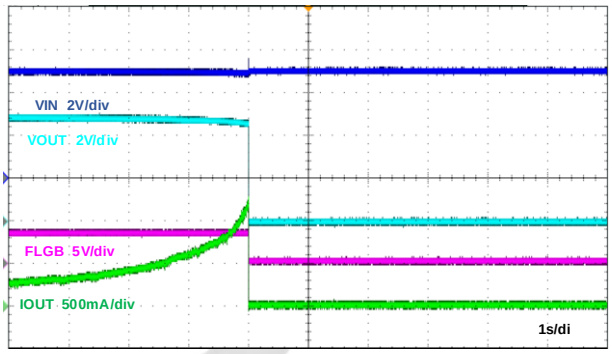

Figure 17. Current Limit Response
V_{IN}=5.0 V, C_{IN}=C_{OUT}=1.0 µF, R_{LIM}=150 kΩ

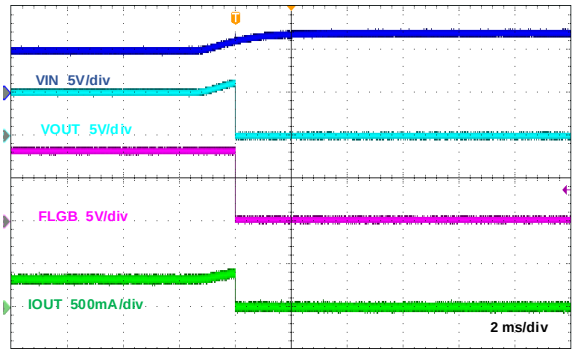

Figure 18. Internal OVP response V_{IN}=5 V to 7 V,
C_{IN}=C_{OUT}=1.0 µF, R_L=150 Ω

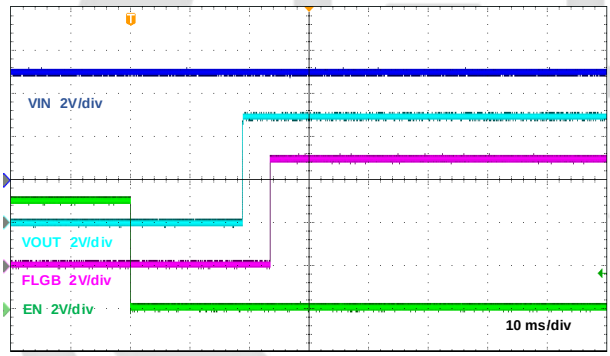

Figure 19. Turn-On Response, V_{IN}=5 V,
C_{IN}=C_{OUT}=1.0 µF, R_L=150 Ω

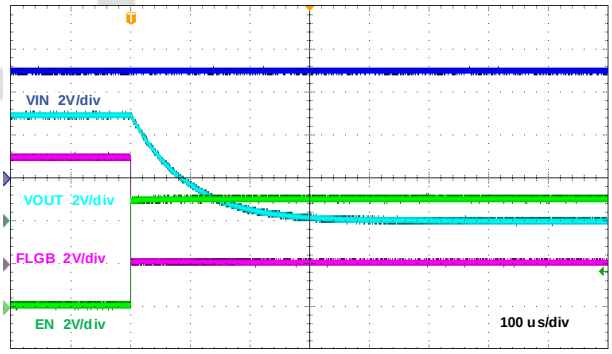

Figure 20. Turn-Off Response, V_{IN}=5 V,
C_{IN}=C_{OUT}=1.0 µF, R_L=150 Ω

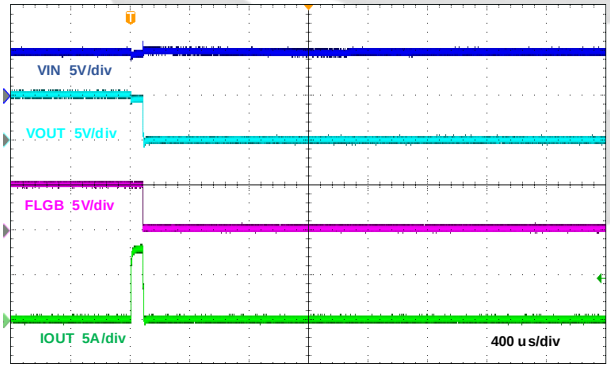

Figure 21. FLGB Response with OCP,
V_{IN}=5 V, C_{IN}=C_{OUT}=1.0 µF, R_{LIM}=150 kΩ

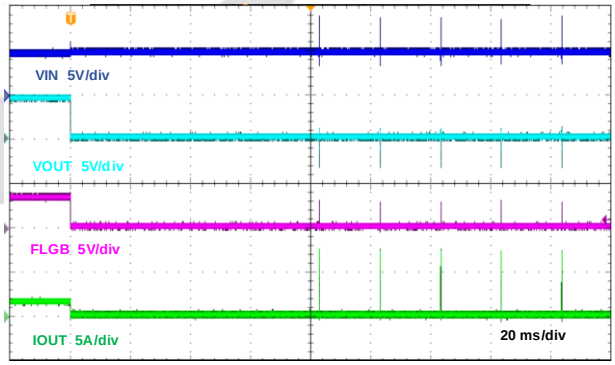

Figure 22. Thermal Shutdown Response,
V_{IN}=5 V, C_{IN}=C_{OUT}=1.0 µF, R_{LIM}=150 kΩ

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Application Information

The GLF2204 is an integrated power switch with UVLO, OVP, OCP and thermal shutdown protection. When EN is low and VOUT is turned on, the device continuously monitors the load current and input voltage and ensures the safety of the load. The device operates at the input voltage range from 3.5 V to 9 V with very low on-resistance to reduce conduction loss.

Under Voltage Lockout (UVLO)

The power switch will keep off until the input voltage reaches the UVLO turn on threshold. Built-in hysteresis prevents unwanted on and off cycling because of input voltage droop during turn on.

Over Voltage Lockout Protection

The GLF2204 provides an internal fixed OVP threshold (6.85 V Typ.) and a programmable OVP threshold that can be programmed by an external resistor divider. To select the internal fixed OVP, the OVLO pin must be tied to GND to ensure its voltage is lower than 300 mV which is the external OVP selection threshold (V_{OVP_SEL}). When the voltage at the OVLO pin is higher than the V_{OVP_SEL}, the device automatically selects the external OVP threshold voltage set by the external resistor divider. Fig. 23 shows the timing graph of OVP.

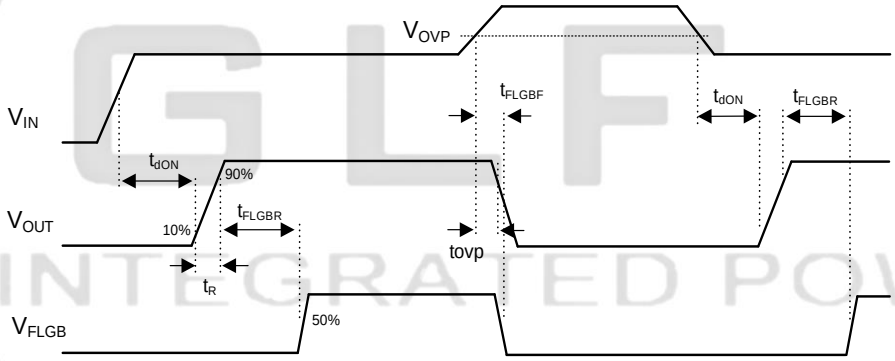

Figure 23. Timing for OVP Trip

The external OVP threshold is calculate by the following equation: $\mathbf{V_{OVP} = 1.2\ V \times (1 + R1/R2\ )}$

Where R1 and R2 are the voltage divider in the application diagram. Recommend R2 is lower than 1 MΩ.

Current Limiting and Short Circuit Protection

The output current limit level of GLF2204 can be programmed by an external resistor (R_{LIM}) between I_{LIM} and GND. 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 table 1 and Figure 24 to find the resistor values corresponding to different current limit levels.

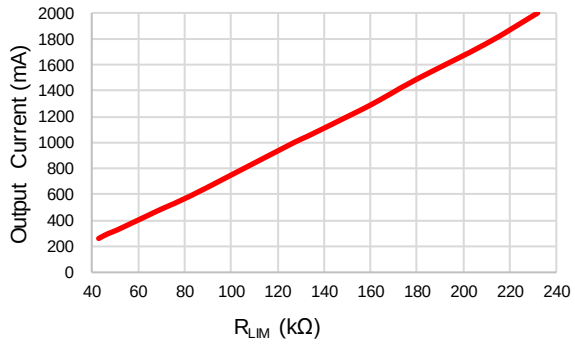

Figure 24. Current Trip and Limit vs. R_{LIM}

R_{LIM} (kΩ)	OCP Trip (mA) Typ 5 V_{IN}, T_A=25 °C
232	2000
210	1765
180	1500
150	1200
127	1000
100	750

Table 1. Current Limit Trip Level by R_{LIM}

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When output current exceeds a preset current limit level, the GLF2204 is turned off and remain off states until the power is cycled or the EN pin is toggled.

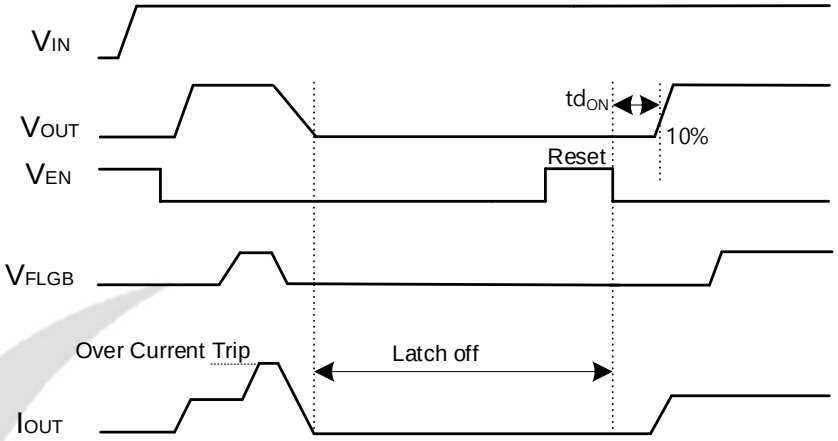

Figure 25. OCP Protection Diagram

FLGB Fault Flag

The output of the open drain FLGB pin goes active low for any of following fault conditions: output over current, UVLO, over voltage or thermal shutdown. The FLGB output remains low until fault condition is removed. The FLGB signal is de-asserted once device power is cycled or the enable is toggled and the device resumes normal operation. The delay for FLGB assertion and de-assertion are 4.6 ms and 27 µs respectively. In a typical application, the FLGB is recommended to connect with the internal 3.3 V LDO output pin (VCC) by a pull-up resistor, and of course, the FLGB can also be connected to other power supplies below 6V.

Internal LDO Output

VCC is an integrated 3.3 V LDO output port in the GLF2204. When the VIN is connected to a 3.5 V to 9 V power supply, the 3.3 V output is automatically turned on, regardless of the EN status. VCC can only be used for FLGB pull-up power supplies or loads with a load current less than 20 mA.

Thermal Shutdown Protection

The thermal-sensing circuits protect the GLF2204 device if the temperature exceeds recommended operating conditions. The thermal sensor turns off the power switch when the die temperature exceeds 150 °C, and the switch turns on after the device has cooled by approximately 25 °C. The FLGB is asserted (low) during an over temperature shutdown condition.

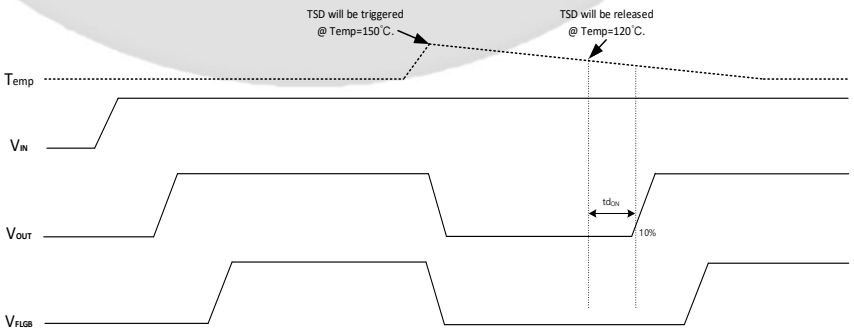

Figure 26. Thermal Shutdown Diagram

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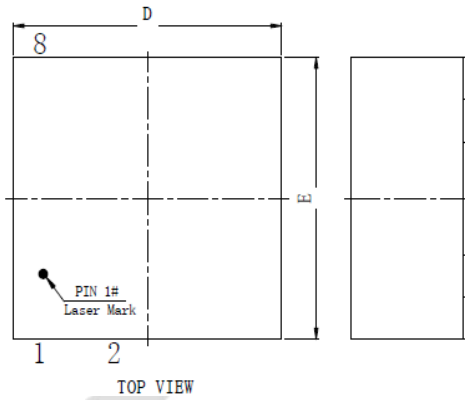
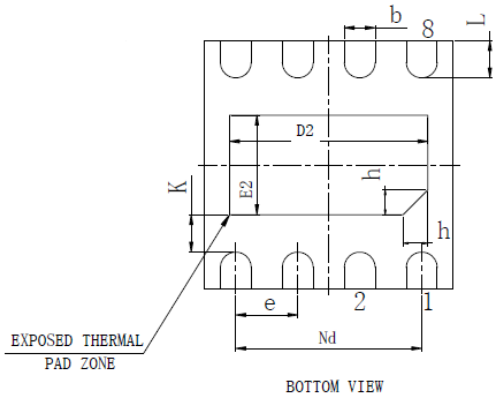
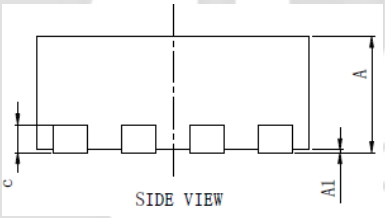
PACKAGE OUTLINE.





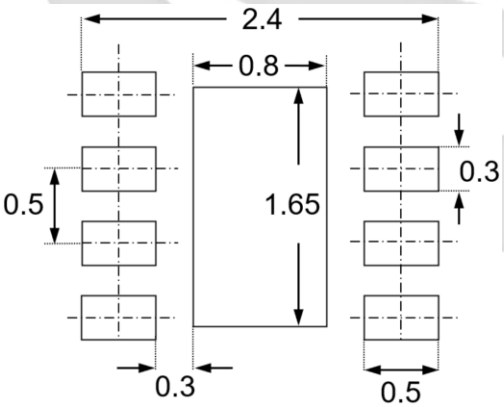


SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.80	0.85	0.90
A1	0	0.02	0.05
b	0.20	0.25	0.30
c		0.203REF	
D	1.95	2.00	2.05
D2	1.55	1.60	1.65
Nd		1.50BSC	
e		0.50BSC	
E	1.95	2.00	2.05
E2	0.75	0.80	0.85
L	0.25	0.30	0.35
K	0.25	0.30	0.35
h		0.20REF	

Notes

1. All DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.

Recommended Footprint



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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

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