

Low BOM Cost Power Switch

Features

- Internal 600V Power MOSFET
- Current Mode Control
- Green Mode Control
- 45KHz Switching Frequency
- Frequency Jittering
- Standby Power<0.15W
- Over Load Protection
- VCC Over Voltage Protection
- Internal Over Temperature Protection
- 9V Output voltage
- SOP-7 Package

Description

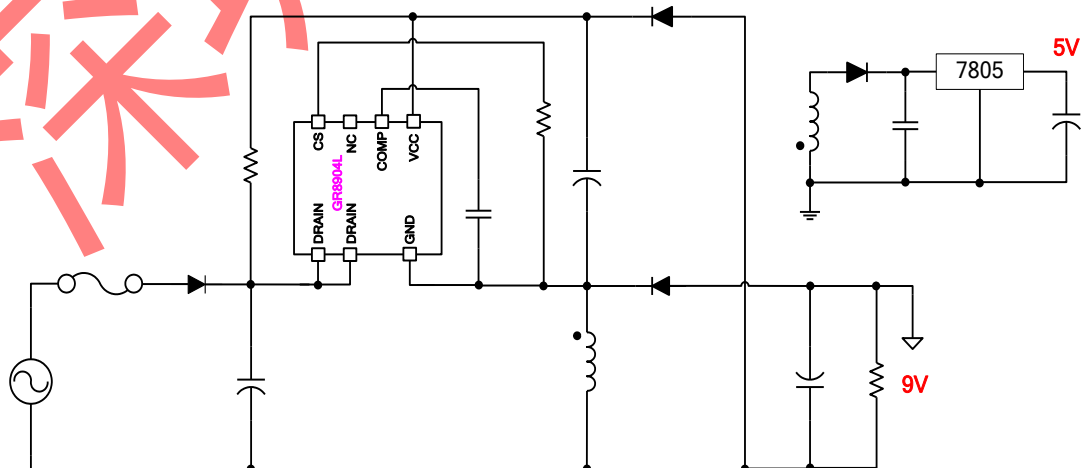
The GR8904L is a highly integrated, current mode power switch with green mode control for low BOM cost buck-boost application. It provides functions of low standby power consumption (<0.15W), green-mode power-saving operation for green design. The specific adjustable output voltage function provides the feasibility for wider output application. The integrated functions of VCC OVP, OLP, and internal OTP prevent the circuit being damaged from the abnormal conditions.

It minimizes the components counts and is available in SOP-7 package. Those make it an ideal design for low cost application.

Application

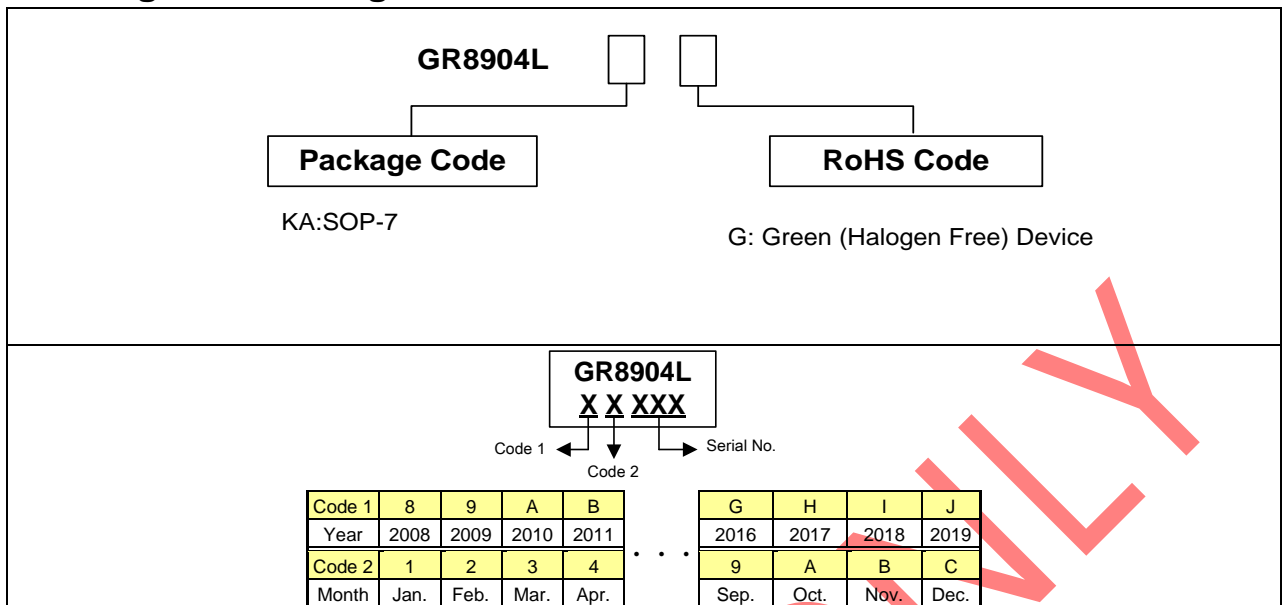
- Home Appliance

Application Information



Buck-Boost Converter

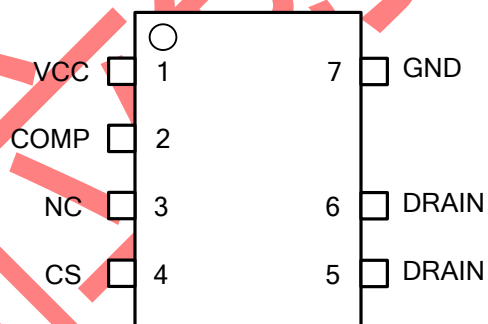
Ordering and Marking Information



Greenergy OPTO Inc. reserves the right to make changes to improve reliability or manufacture ability without notice, and advise customers to obtain the latest version of relevant information to verify before placing orders.

Pin Configuration

TOP VIEW



Pin Description

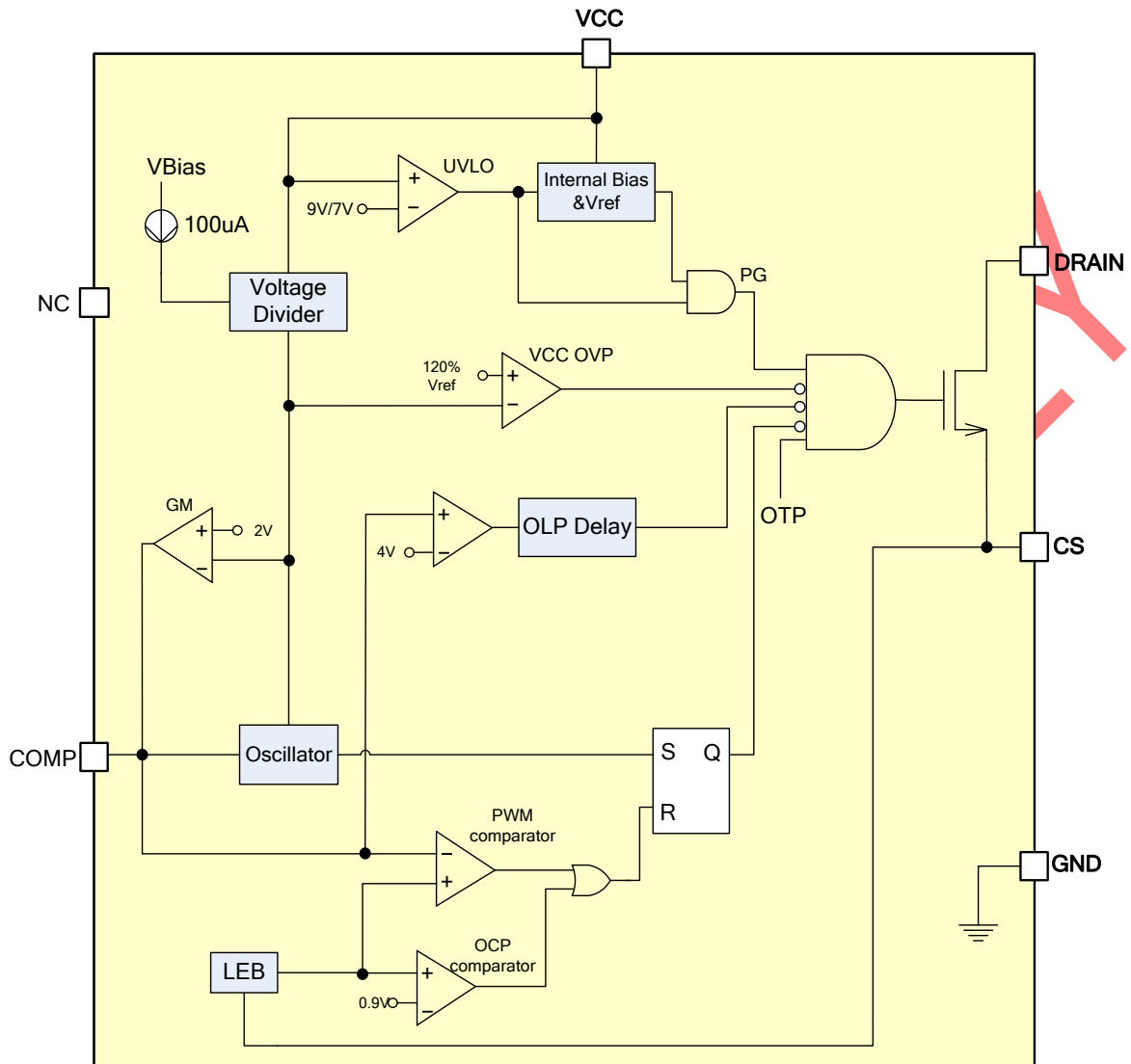
Pin No.	Name	Function
1	VCC	Power supply pin
2	COMP	Voltage Feedback pin
3	NC	No connect.
4	CS	Current sense pin, connect to sense the power MOS current
5,6	DRAIN	Drain of internal HV MOSFET
7	GND	Ground

Absolute Maximum Ratings

Supply Voltage VCC	-----	30V
COMP, CS	-----	-0.3 ~ 7V
DRAIN Voltage	-----	-0.3~600V
Junction Temperature	-----	150°C
Operating Ambient Temperature	-----	-20°C to 85°C
Storage Temperature Range	-----	-65°C to 150°C
Lead Temperature (Soldering,10sec)	-----	260°C
ESD Voltage Protection, Human Body Model (Exclude Drain pin)	-----	2.0 kV
ESD Voltage Protection, Machine Model	-----	200 V

Recommended Operating Conditions

Item	Min	Max	Unit
Supply voltage VCC	7	25	V
VCC capacitor	10	22	uF
COMP pin capacitor	0.022	0.1	uF

Block Diagram


Electrical Characteristics (VCC = 9V & TA = 25°C, unless otherwise specified.)

Parameter	Test Conditions	Min	Typ	Max	Unit
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VCC SECTION

Start-Up Current	VCC<UVLO on		8	15	μA
Operating Current	Vcomp=0V		0.6		mA
	Vcomp=2.5V		1		mA
	Protection tripped (OVP, OLP, OCP)		0.7		mA
On Threshold Voltage			9.0		V
Off Threshold Voltage			7.0		V
VCC OVP	120% VCC Level	115	120	125	%
	De-bounce Time		100		μs

OSCILLATOR SECTION

Switching Frequency	VCC=9V	40	45	50	KHz
Frequency Jittering			±6		%
Minimum Frequency	VCC=10V		500		Hz
Voltage stability (VCC=9~25V) (*)				3	%

CURRENT-SENSE SECTION

Input Impedance		1			MΩ
Peak Current Limitation		0.85	0.9	0.95	V
Leading Edge Blanking			350		ns
Delay to Output			100		ns
Max On time			20		μs

ERROR AMPLIFIER (COMP pin)

Reference Voltage			2		V
Trans-conductance			150		μmho
Output Sink Current			15.0		μA
Output Source Current			-15.0		μA
Output Clamp Voltage			5.5		V
OLP triple level			4		V
OLP delay time			60		ms

MOSFET SECTION

BVdss		600			V
Rds(on)			4.7		Ω



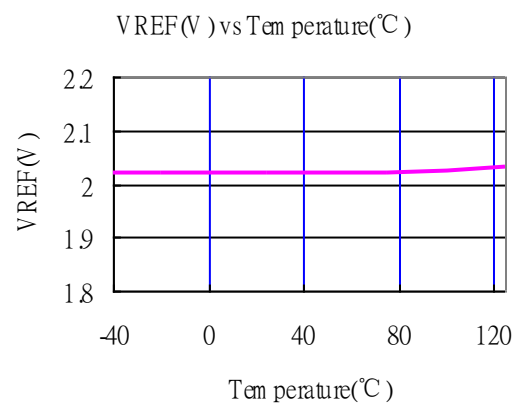
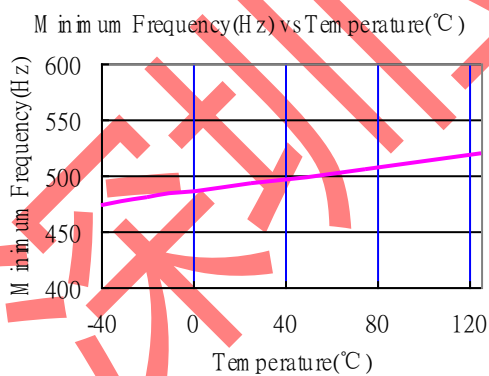
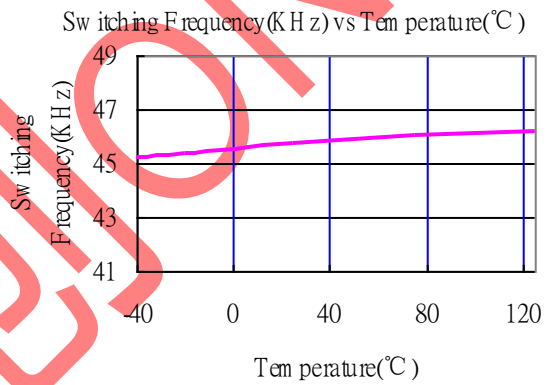
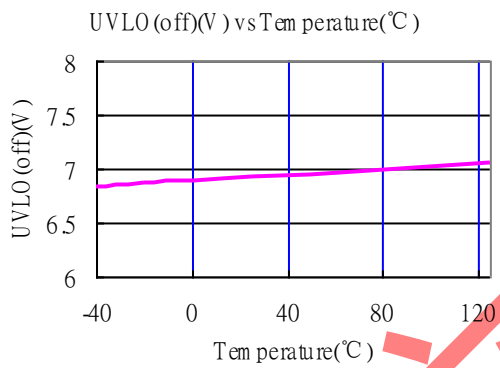
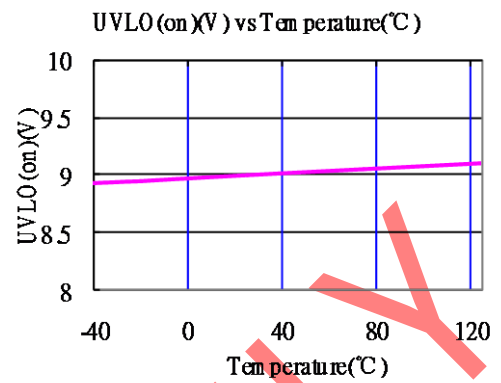
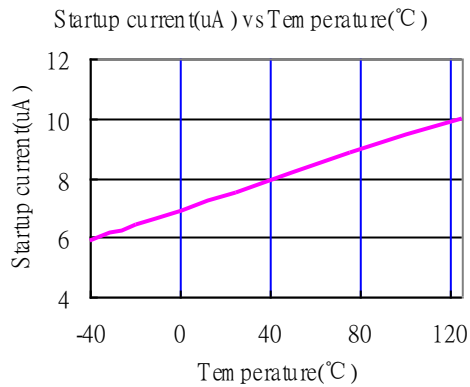
ON-CHIP OVER TEMPERATURE PROTECTION

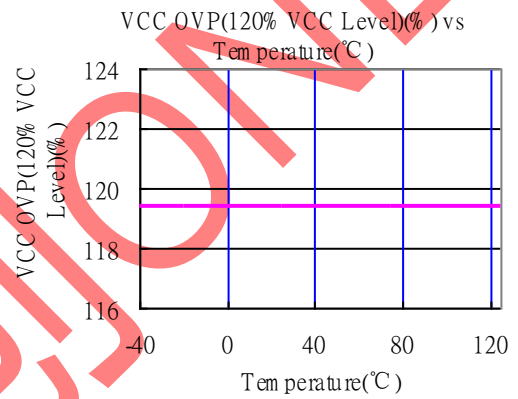
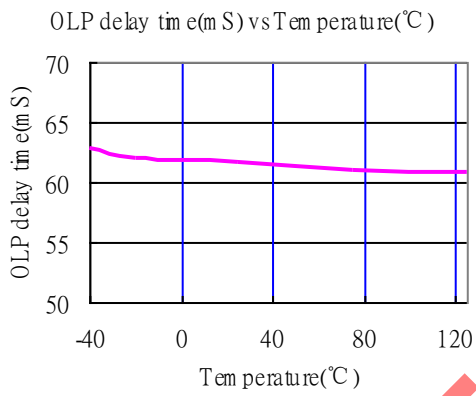
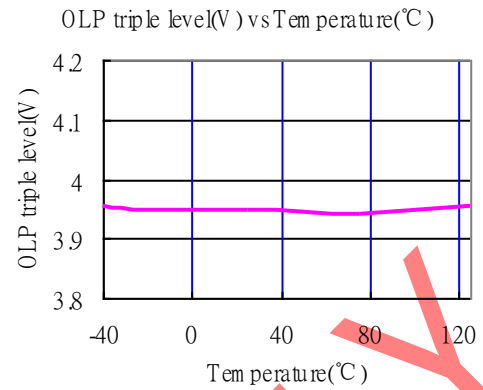
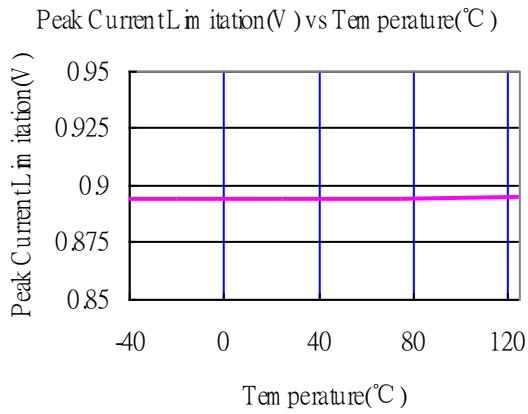
OTP Triple level(*)			150		°C
	Hysteresis		30		°C

* : Design guarantee

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Typical Performance Characteristic





Application Information

Overview

The GR8904L provides a cost effective PWM control solution for buck and flyback application, especially in home appliance market. With highly integrated functions, a low cost and component count design can be achieved easily.

Start-up Current

The typical start-up current is about 8uA. It provides the energy for internal circuits and charging the capacitor on VCC pin before UVLO on.

Generally, we desire to use a lower start-up resistor to get a faster start-up. But there is always trade-off between the value of start-up resistor and the power dissipation. With this low start-up current, a larger start-up resistor is available not only for reducing the power dissipation on it but matching the start-up requirement.

UVLO (Under Voltage Lockout)

A UVLO comparator with hysteresis is implemented in GR8904L. The turn-on and turn-off threshold level are set as 9.0V and 7.0V respectively.

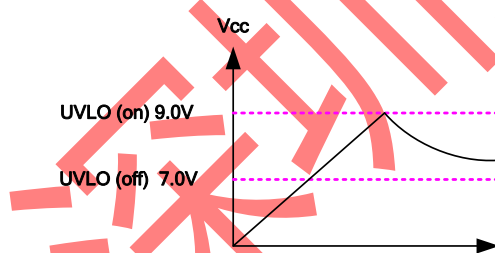


Fig.1

Oscillator and Switching Frequency

The maximum switching frequency of GR8904L is 45kHz. The switching frequency is controlled by VCC and COMP level as shown in Fig.2 and Fig. 3. The switching frequency will be the fixed 45kHz if the VCC level is lower than V_{th1} . And the switching frequency starts to decrease for a better response

as VCC level is higher than V_{th1} . And the switching frequency will be the minimum value of 500Hz if VCC level is higher than V_{th2} as shown in Fig.2. In order to have a better power saving and regulation, the oscillator is also controlled by COMP level as shown in Fig.3.

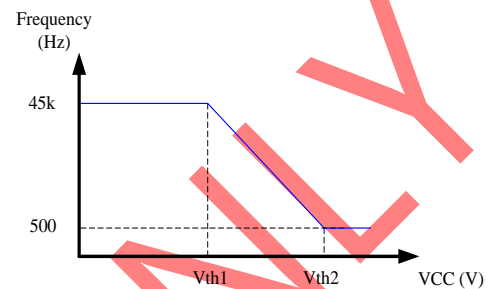


Fig.2

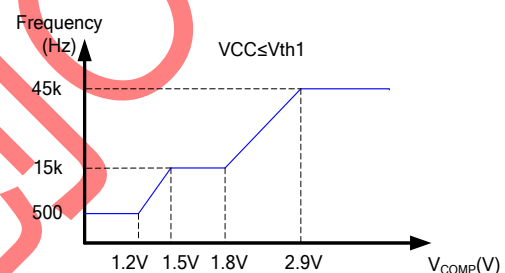


Fig.3

Output Regulation (Built-in error amplifier)

In GR8904L, the output regulation is implemented by an error amplifier inside. The output voltage is feedback thru a resistor divider to the inverted input of the error amplifier. After comparing with the 2V voltage reference on non-inverted input, the output of the error amplifier will modulate the COMP pin level for output regulation.

Current Sense & Leading-Edge Blanking (LEB)

The operation mode of GR8904L is current mode control with cycle by cycle current detection. The current is detected thru a sense resistor on CS pin. leading-edge blanking (LEB) time is built-in to avoid the false triggering of turn-on current spike caused by the switching-on of the power MOSFET.

During this blanking period, the gate driver will be turned-on continually but can't be turned-off.

Frequency Jittering for EMI Improvement

The built-in frequency jittering function is implemented for EMI improvement in GR8904L. The switching frequency is modulated by the oscillator control mechanism inside and the spectrum energy is spread out to a wide range. It will reduce the conduction emission and suppression solution on system for a cost effective design.

OVP (Over Voltage Protection)

To prevent system from damaged, the OVP function is implemented in GR8904L. As the VCC rises up to a higher level than the OVP threshold, the output of gate driver will be turned off immediately to shutdown the switching of the power MOSFET. The operation mode of OVP is auto recovery mode. That is, the protection will be reset at UVLO(off) and the output of gate driver will be turned on again at next UVLO(on) as shown in Fig.4

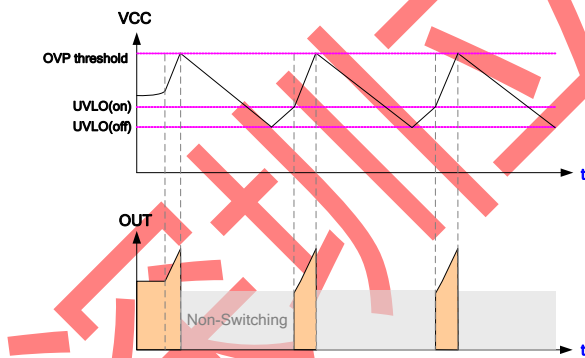


Fig.4

OLP (Over Load Protection)

The Over Load Protection function in GR8904L can prevent the system from being damaged during the over load condition. At the over load occurs, the feedback mechanism will pull the level of COMP pin

up to reach the balance. As the level of COMP pin being raised over 4.0V, the internal circuits start to count the duration. After a 60ms OLP delay time with exceeding COMP level is accomplished, the output driver will be turned-off immediately. The VCC starts to decrease until UVLO off and then restarts again. Fig.5 shows the waveform of the OLP operation.

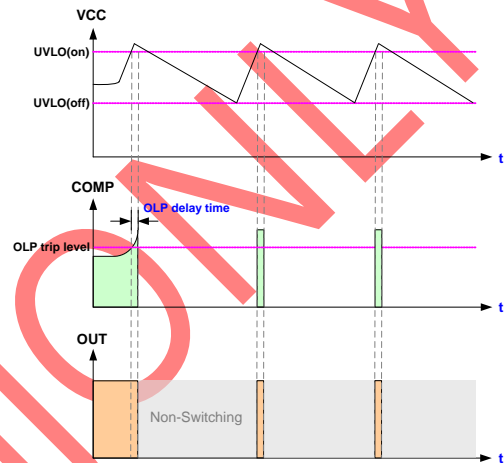
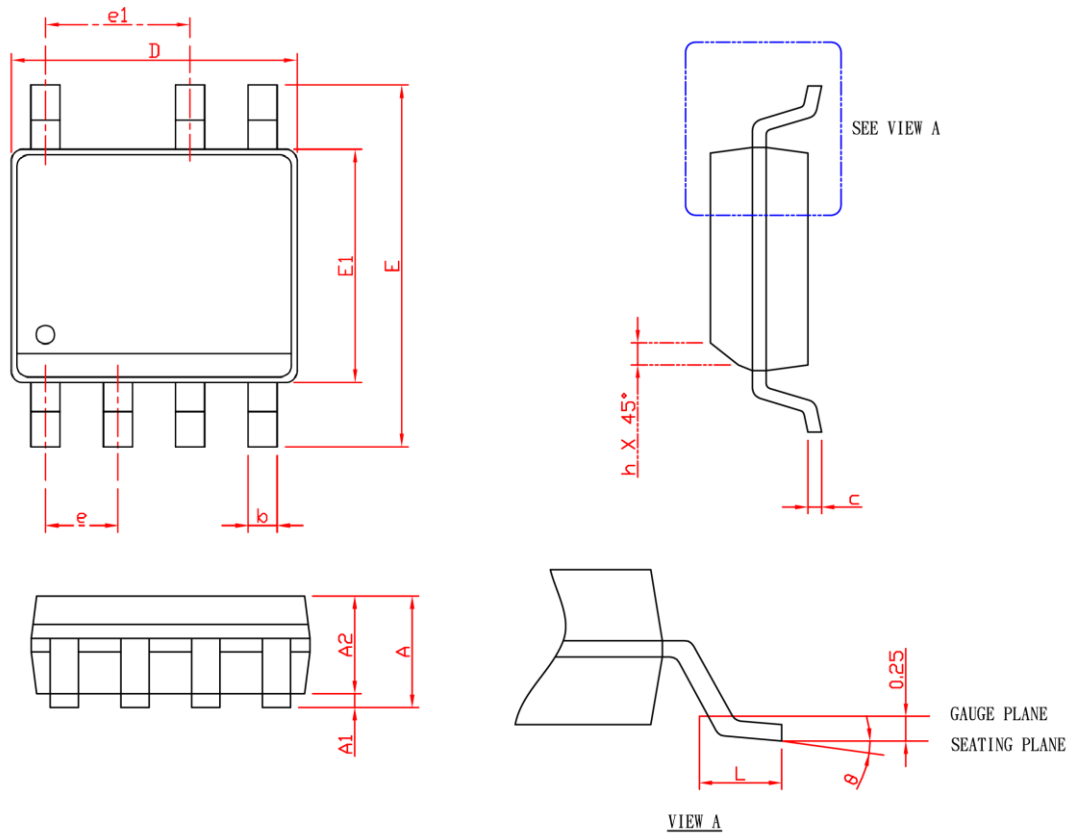


Fig.5

Maximum On Time

In order to prevent the system from being damaged in abnormal conditions, there is a fixed 20μs maximum on time limitation in GR8904L.

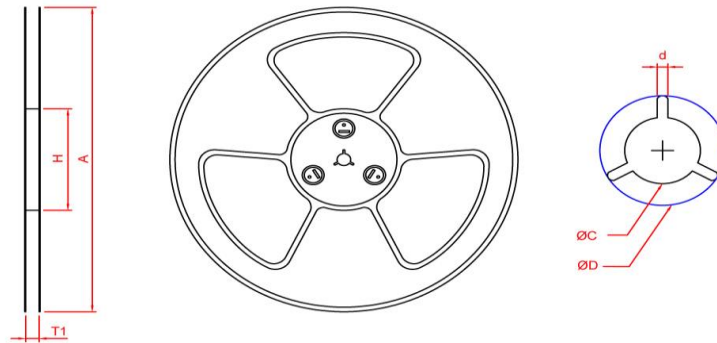
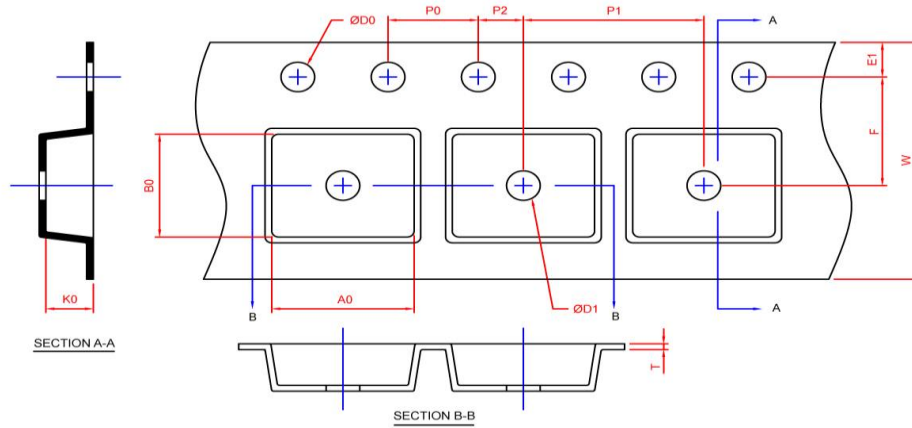
Package Information
SOP-7


SYMBOL	SOP-7			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.75		0.069
A1	0.10	0.25	0.004	0.010
A2	1.25		0.049	
b	0.31	0.51	0.012	0.020
c	0.17	0.25	0.007	0.010
D	4.80	5.00	0.189	0.197
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
e1	2.54 BSC		0.101 BSC	
h	0.25	0.50	0.010	0.020
L	0.40	1.27	0.016	0.050
θ	0°	8°	0°	8°

Note: 1. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side.

2. Dimension "E" does not include inter-lead flash or protrusions. Inter-lead flash and protrusions shall not exceed 10 mil per side.

Carrier Tape & Reel Dimensions

SOP-7


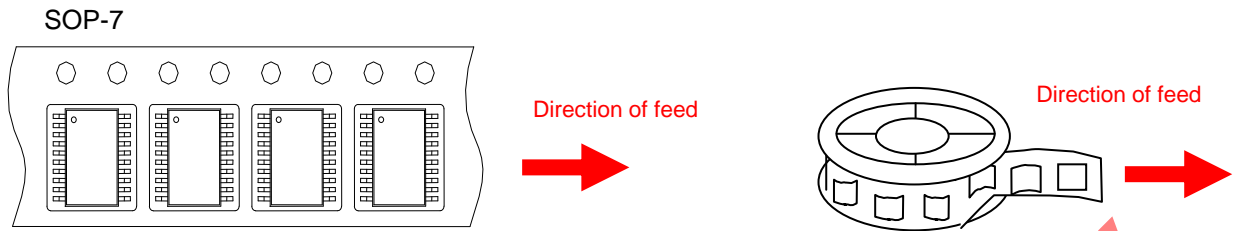
Application	A	H	T1	C	d	D	W	E1	F
SOP-7	330.0±2.0	50 MIN.	12.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	12.0±0.30	1.75±0.10	5.5±0.05
	P0	P1	P2	D0	D1	T	A0	B0	K0
	4.0±0.10	8.0±0.10	2.0±0.05	1.5+0.10 -0.00	1.5 MIN.	0.6+0.00 -0.40	6.40±0.20	5.20±0.20	2.10±0.20

(mm)

Devices Per Unit

Application	Carrier Width	Cover Tape Width	Devices Per Reel
SOP-7	12	-	2500

Tape and Specification Reel



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