LD8108A

08/02/2016

AC/DC Speedy Charge™ Controller for Qualcomm® Quick Charge 2.0 USB Interface

REV. 00

General Description

The LD8108A is an AC/DC Speedy Charge™ controller for Qualcomm® Quick Charge™ 2.0 (QC2.0) USB interface receiver for High Voltage Dedicated Charging Port (HVDCP) charger solution.

The device can receive QC2.0 signal from D+ and D- of USB interface for HVDCP control. Paired with LD5718A series primary-side regulation (PSR) controllers, LD8108A will send the digital data by a single photocouplier to PSR controller and change output regulation.

LD8108A provides typical 300mA discharging current for output from HVDCP voltage to 5V in order to meet a short discharge time. Active dummy load function is built in LD8108A to keep output regulation while in no load condition. LD8108A implements temperature detection function which will send digital data to shutdown PSR controller during over temperature condition.

The LD8108A is available in both SOP-8 package.

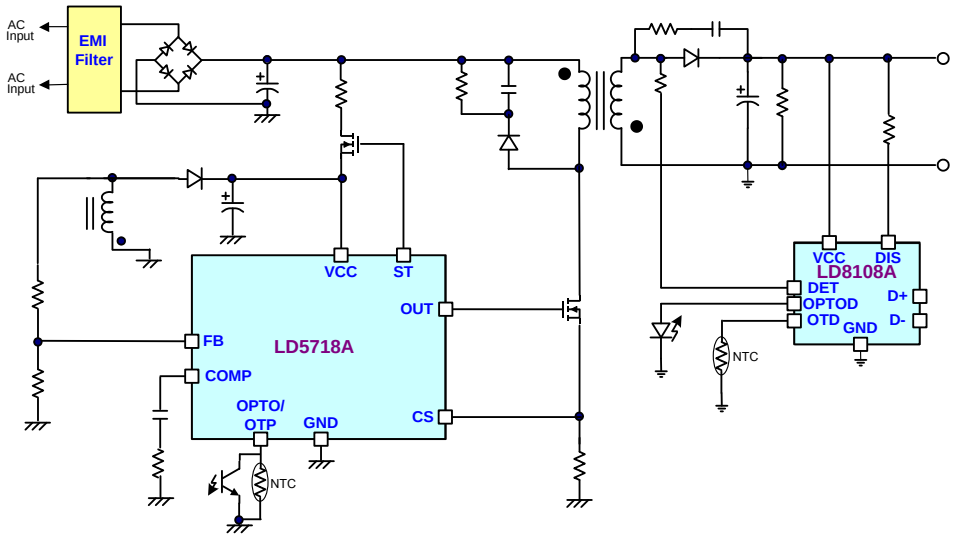
Features

- Speedy Charge™ technology
- Compatible with Qualcomm® Quick Charge™ 2.0 class-A portable devices charger solution
- Fast discharging from HVDCP voltage to 5V
- Active dummy load for PSR controller
- Secondary side over temperature detection
- Low operating current
- VCC max. rating up to 30V

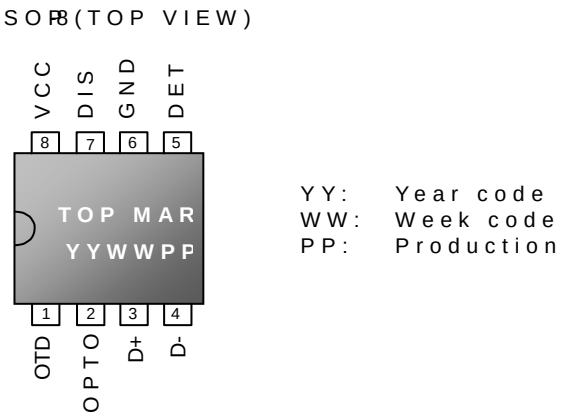
Applications

- Quick Charge™ 2.0 based HVDCP charger
- AC/DC Speedy Charger for Smart phone and Tablet

Typical Application



Pin Configuration



Ordering Information

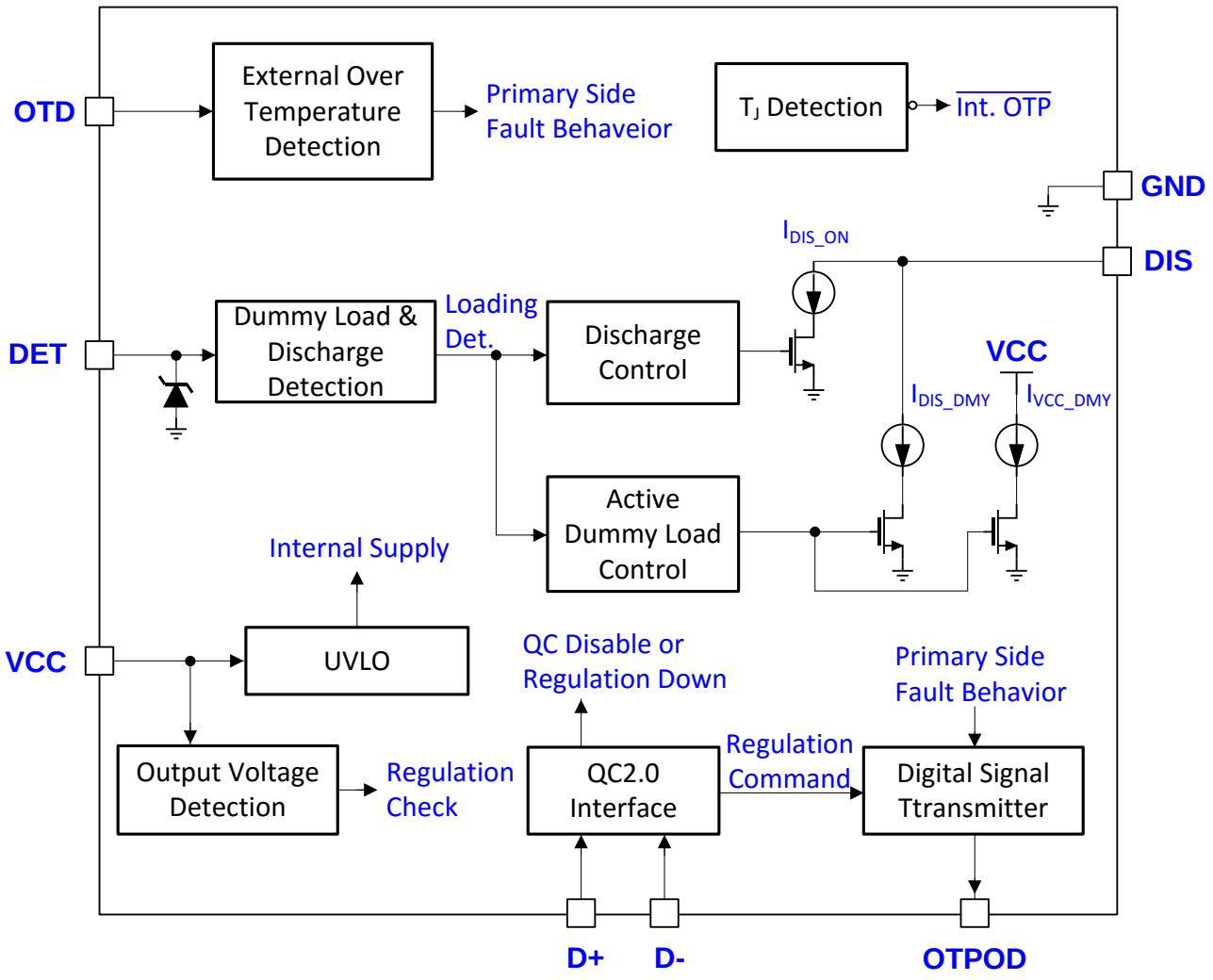
Part number	$T_{Timeout}$	V_{DET_T}	Package	Top Mark	Shipping
LD8108A GS	900µs	4.0V	SOP-8	LD8108AGS	2500 /tape & reel

The LD8108A is ROHS compliant/ Green Packaged.

Pin Descriptions

Pin	NAME	FUNCTION
1	OTD	Typical 100uA sourcing current to a thermistor for over temperature detection function
2	OPTOD	A typical 5mA driving current for a photocoupler to transmit the voltage regulation setting and fault signal
3	D+	USB D+ signal.
4	D-	USB D- signal.
5	DET	Primary side switching frequency detection for Vo discharge detection and active dummy load control.
6	GND	Ground.
7	DIS	Discharging for fast change output regulation or active dummy load.
8	VCC	Supply voltage pin.

Block Diagram



Absolute Maximum Ratings

Supply Voltage VCC, DIS	-0.3V ~ 30V
DET (IDET = -1mA ~ +1mA)	-0.8V ~ 6V
D+, D-, OPTO, OTD	-0.3V ~ 6V
IDET	-3mA ~ 3mA
Maximum Junction Temperature	150°C
Storage Temperature Range	-65°C ~ 125°C
Package Thermal Resistance, SOP-8, θ_{JA}	160 °C/W
Power Dissipation (SOP-8, at Ambient Temperature = 85°C)	250mW
Lead Temperature (Soldering, 10sec)	260°C
ESD Level (Human Body Model)	2.5KV
ESD Level (Machine Model)	250V

Recommended Operating Conditions

R_{DET}	75kΩ ~ 120kΩ
Junction Temperature Range	-40°C ~ 125°C

Caution:

Stress exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stress above Recommended Operating Conditions may affect device reliability.

Electrical Characteristics

(T_A = +25°C unless otherwise stated, VCC=5.0V)

PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNITS
UVLO & Operating Current (VCC Pin)						
UVLO(ON)		V_{UVLO_ON}	3.9	4.1	4.3	V
UVLO(OFF)		V_{UVLO_OFF}	3.7	3.9	4.1	V
UVLO(ON) - UVLO(OFF)		V_{UVLO_HYS}	0.1	0.2	0.3	V
Fast Response Threshold Level	*	V_{VCC_FAST}		4.4		V
Operating Current		I_{OP}	0.35	0.5	0.6	mA
1st Active Dummy Load of VCC		I_{VCC_DMY}	4	5	6.3	mA
Switching Pulse Detetion (DET Pin)						
Upper Clamp Voltage	IDET = +1mA	V_{DET_UP2}	5		6	V
Input Impendence		Z_{DET}	2.4	3	3.6	MΩ
Low Clamp Voltage	IDET = -1mA	V_{DET_L2}	-0.8		0.5	V
Switching Pulse Trip Level		V_{DET_TH}	3.7	4.0	4.1	V
Switching Pulse Trip Debounce	*	T_{DET_T}		100		ns
Switching Puse Timeout for Active Dummy Load Turn-on		$T_{TIMEOUTA}$	700	900	1000	µs
1st Active Dummy Load Turn-on Debounce		T_{DMY_ONA}	7	8	9	ms
2nd Active Dummy Load Turn-on Debounce		T_{DIS_ON}	70	75	92	ms
Output Discharge (DIS Pin)						
Turn-off state leakage current	VCC = 4V, VDIS = 12V	I_{DIS_OFF}	3		20	µA
Maximum Turn-on Current (2nd Active Dummy Load)	VDIS > 5V	I_{DIS_ON}	150		300	mA
1st Active Dummy Load of DIS	VDIS > 5V	I_{DISDMY}	3.5	5	5.5	mA
Output Regulation Check (VCC Pin)						
VCC Trip Level for Stop Discharge	D+ = 3.3V, D- = 0.6V	VCC_{D9}	8.1	9.00	9.9	V
	D+ =0.6V, D- = 0V	VCC_{D5}	4.75	5.00	5.25	
VCC Trip Level for Enable 2nd Active Load	D+ = 0V, D- = 0V	VCC_{DISEN}	5.3	5.6	6.4	V

PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNITS
Over Temperature Detection (OTD Pin)						
OTD Pin Source Current		I_{OTD}	90	100	110	µA
OTD Pin Open Loop Voltage	*	V_{OTD_OL}			5.5	V
Over Temperature Threshold		V_{OTP}	0.9	1.00	1.1	V
Over Temperature Release Threshold	*	V_{OTP_R}		1.10		V
Over Temperature Threshold Debounce		T_{OTD}	150	250	350	µs
Photocoupler Driver (OPTOD Pin)						
Photocoupler Driving Current		I_{OPTOD}	4	5	5.5	mA
QC 2.0 Interface (D+ & D- Pin)						
D+ & D- Data detect voltage		V_{DAT_REF}	0.25	0.325	0.40	V
Output Voltage Selection Reference		V_{SEL_REF}	1.8	2.0	2.2	V
D+ high glitch filter time		T_{BC_DONE}	1000	1250	1500	ms
D+ Pull Down Resistance		R_{DAT_LKG}	400	500	600	kΩ
D- Pull Down Resistance		R_{DM_DWM}	14.25	19	24.5	kΩ

*: Guaranteed by design.

Typical Performance Characteristics

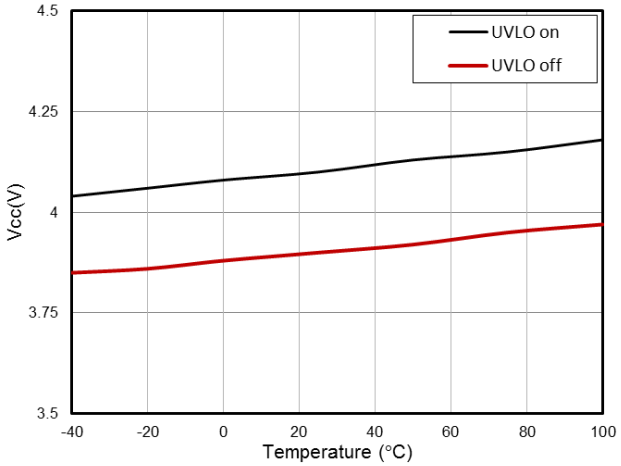


Fig. 1 UVLO level vs.Temperature

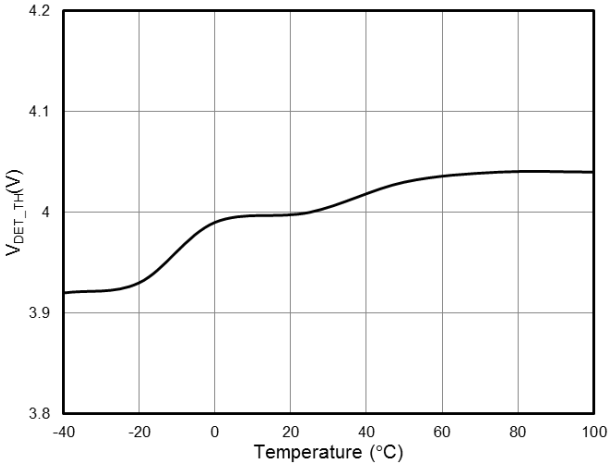


Fig. 2 V_{DET_TH} vs.Temperature

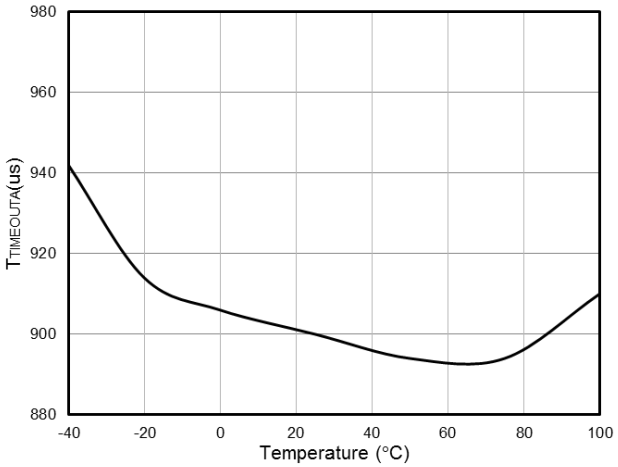


Fig. 3 $T_{TIMEOUTA}$ vs.Temperature

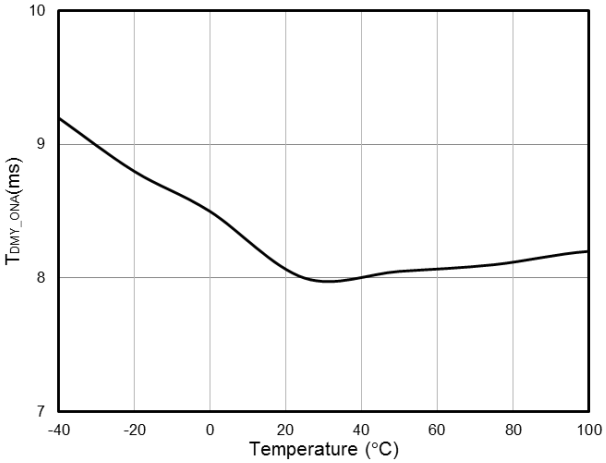


Fig. 4 T_{DMY_ONA} vs.Temperature

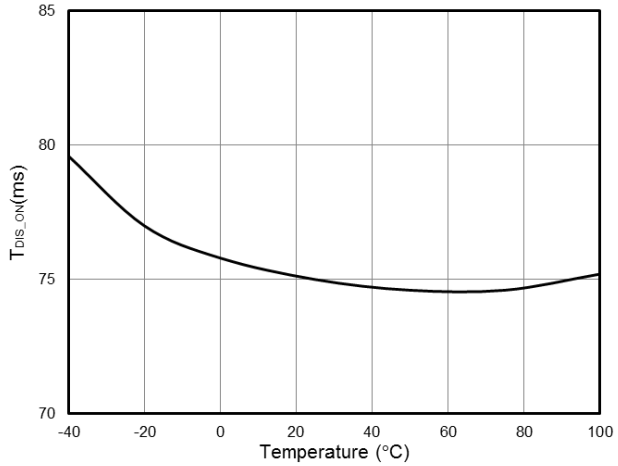


Fig. 5 T_{DIS_ON} vs.Temperature

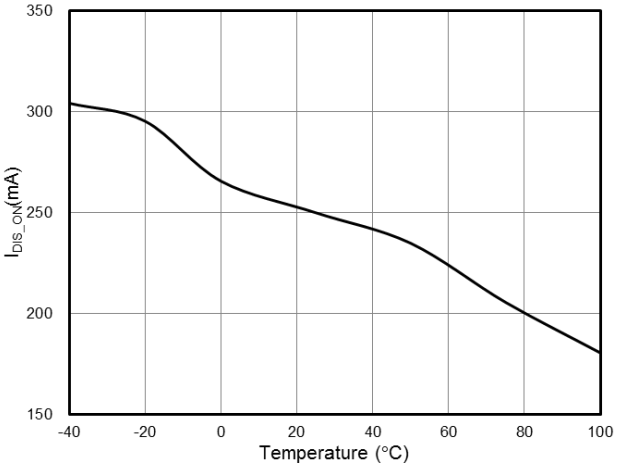


Fig. 6 I_{DIS_ON} vs.Temperature

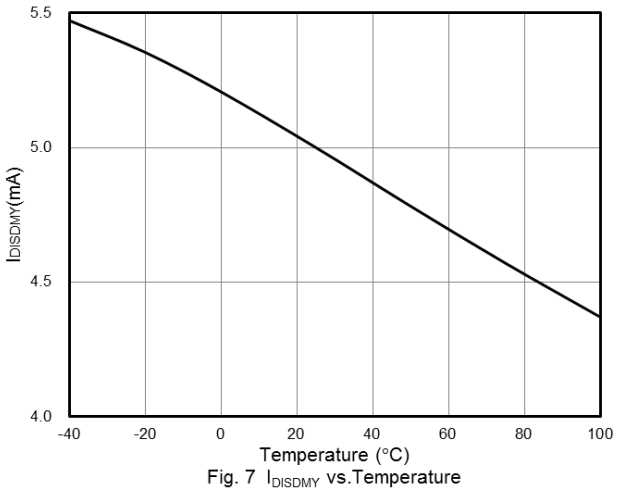


Fig. 7 I_{DISDMY} vs.Temperature

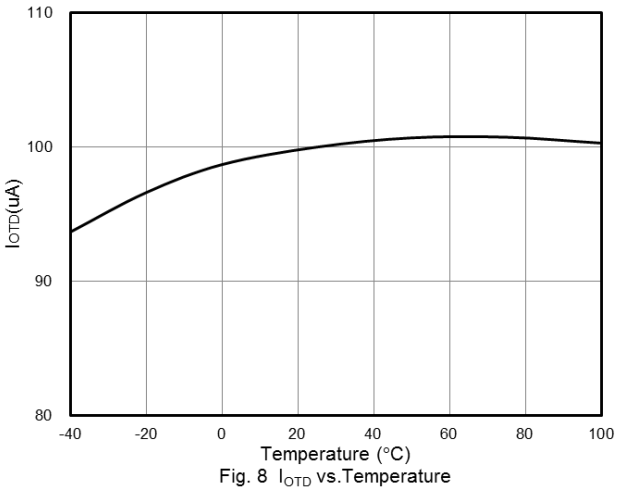


Fig. 8 I_{OTD} vs.Temperature

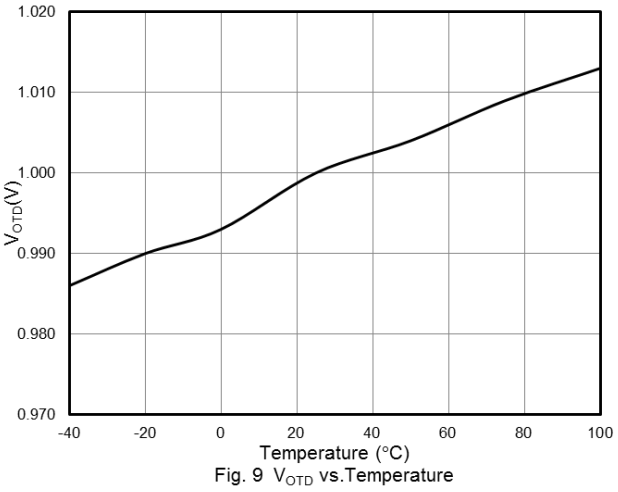


Fig. 9 V_{OTD} vs.Temperature

Application Information

Operation Overview

The LD8108A is Qualcomm® Quick Charge™ 2.0 (QC2.0) USB interface receiver for AC/DC Speedy Charge™ High Voltage Dedicated Charging Port (HVDCP) charger solution. Paired with AC/DC primary-side regulation (PSR) controllers like LD5718A series IC, the output voltage can be programmed from 5V, 9V to 12V in order to boost more output power.

LD8108A supports fast discharge function with maximum 300mA discharging current while in a higher voltage level to a default 5V within 0.5 second. So that it is easily suitable and safe for general USB devices. LD8108A is built-in active dummy load which improves system efficiency and keeps quite low power consumption in no load condition. LD8108A implements temperature detection over OTD pin and will issue over temperature protection(OTP) signal to primary-side controller only by a single photocoupler.

Under Voltage Lockout (UVLO)

An UVLO comparator is implemented in the chip that can detect the voltage across VCC pin and shutdown the IC while in low VCC condition. It can be assure the supply voltage is enough for controller operating. The maxium rating of VCC would be 30V which is easily and suitable for speedy charger design.

QC2.0 Interface

LD8108A is compatible with Qualcomm® Quick Charge™ 2.0 (QC2.0) protocol for High Voltage Dedicated Charging Port (HVDCP) class-A system design. Please refer to Table 1 for the voltage setting configulation. When LD8108A receives the command from D+ and D- signal from USB port, LD8108A will decode the command and transmit it to primary side controller via a photocoupler to set the output voltage, the function block diagram is shown as Fig 10. For QC2.0 class-A, the output voltage could be regulated from 5V, 9V to 12V. LD8108A had passed UL verification to ensure whole system working well.

D+	D-	Output	Class-A	Class-B
0.6V	0.6V	12V	V	V
3.3V	0.6V	9V	V	V
3.3V	3.3V	20V		V
0.6V	GND	5V (default)	V	V

Table 1

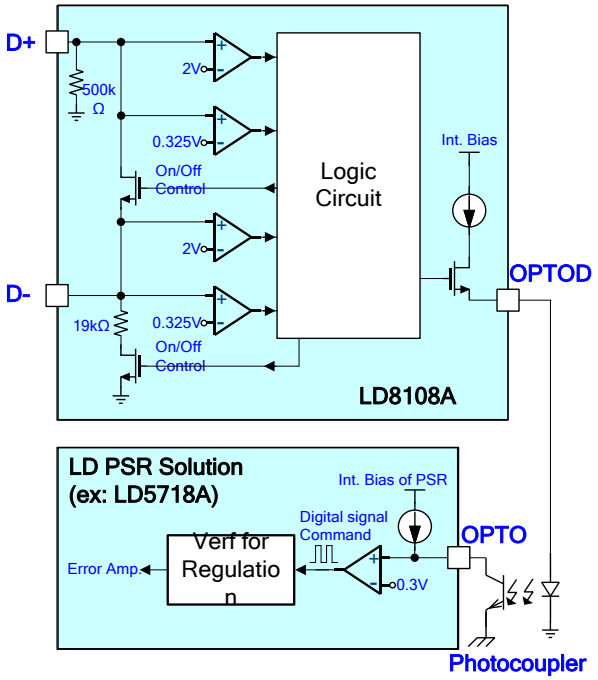


Fig. 10

Speedy Charge™

As to the demand of larger battery usage in many protable devides (PDs) now, Leadttrend Tech. develops a total solution for fast charging technology and interface that can provide safer and more flexiable topology for speedy charger power design.

LD8108A is built-in such a technology that secondary side transmits signals to primary side via a single

photocoupler. By such technology, the system can easily be designed with more cost effective and better performance.

Photocoupler driver (OPTOD)

LD8108A integrates Speedy Charge™ technology that secondary-side IC transmits commands to primary-side controller, like LD5718A series. For example, the commands include the output voltage setting and also the over temperature protection (OVP).

Fast Discharging

LD8108A supports fast discharging function, the block diagram shown as Fig. 11 which regulates the output voltage to 5V within a short time when the output voltage is set low or the output cable is unplugged. Especially for speedy charge device unpluging condition from USB cable, it's necessary for a standard 5V USB device within 0.5 sec discharging.

The command of discharging function is applied from D+/D- signal. The output will be discharged from DIS pin while the discharge current can be fine-tuned by external resistor R_{DIS} and to avoid lots of power dissipation and heat through IC package. The maximum discharging current of LD8108A is around 300mA.

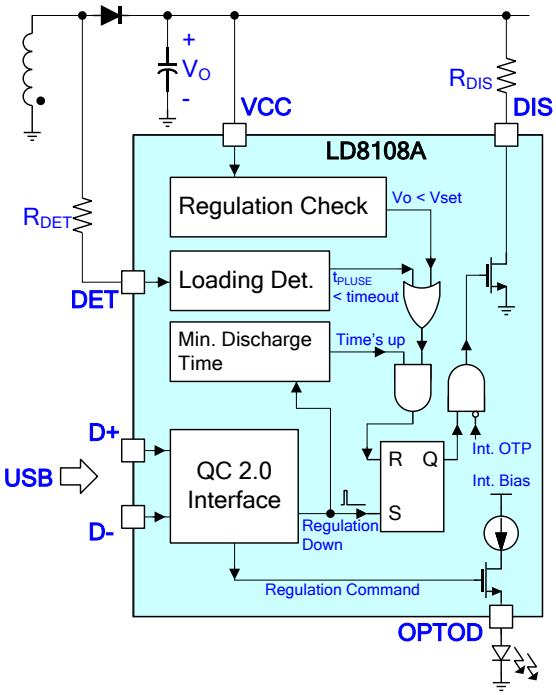


Fig. 11

Active Dummy Load

As well known, Primary-Side Regulation (PSR) controller must keep power MOSFET switching to sense the output voltage which will generate extra engery to the output at light load. However, in order to consume these unnecessary energy to ouput, designers have to add a dymmy load at output to keep the regulation. But the dummy load will cause additional efficiency loss, especially in higher output voltage levels like 9V, 12V.

LD8108A is built-in active dummy load function, it will turn-off dummy load during free running condition for efficiency improvement. Please refer to the block diagram shown as Fig. 12. The function which is according to DET pulse frequency is determined in no load condition. The dummy load will be turned-on if PSR controller switching cycle time is more than 900µs for LD8108A and lasts for more than debounce time. Once the dummy load causes PSR switching cycle time less than 900µs for LD8108A, the dummy load will be turned-off, please refer to the waveforms as Fig 13.

LD8108A will also provide 2nd active dummy load for fast dischange function which is suitable for another HVDCP solution, MediaTek Pump Express Plus™. The 2nd dummy load will be turned-on if the 1st dummy load keeps turn on and last for 75ms during a higher level output regulation condition without QC 2.0 mode, please refer to the waveforms as shown in Fig. 14.

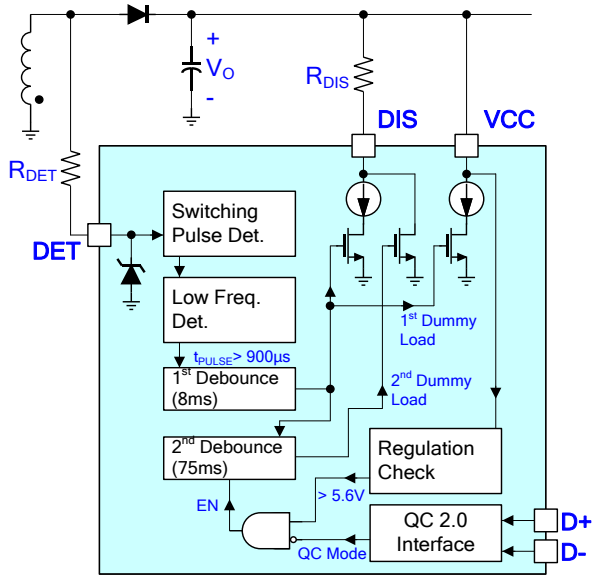


Fig. 12

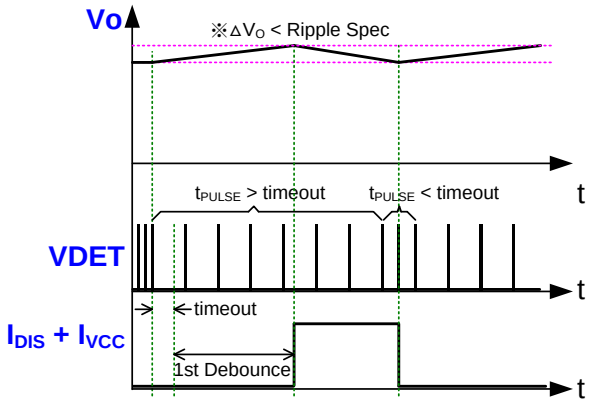


Fig. 13

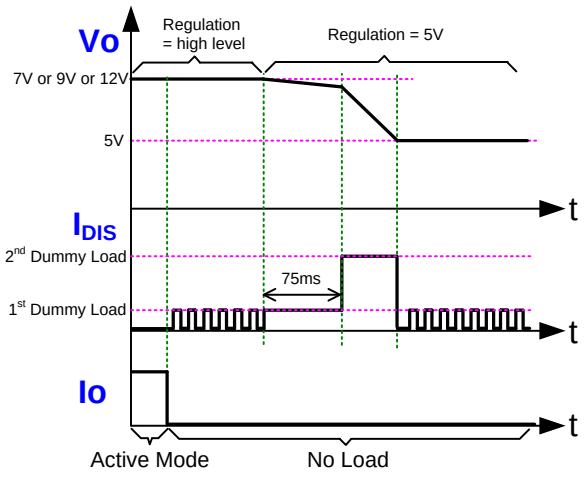
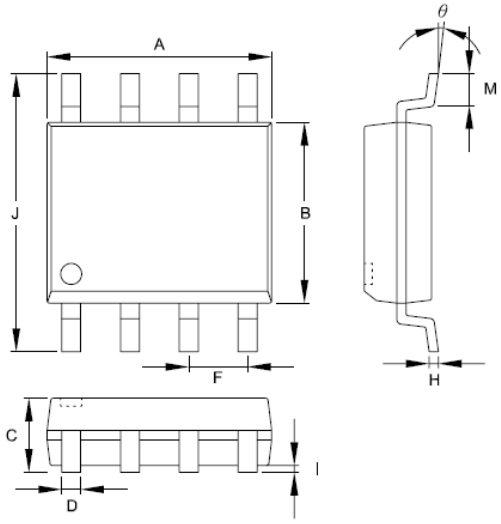


Fig. 14

Package Information

SOP-8



Symbols	Dimensions in Millimeters		Dimensions in Inch	
	MIN	MAX	MIN	MAX
A	4.801	5.004	0.189	0.197
B	3.810	3.988	0.150	0.157
C	1.346	1.753	0.053	0.069
D	0.330	0.508	0.013	0.020
F	1.194	1.346	0.047	0.053
H	0.178	0.254	0.007	0.010
I	0.102	0.254	0.004	0.010
J	5.791	6.198	0.228	0.244
M	0.406	1.270	0.016	0.050
θ	0°	8°	0°	8°

Important Notice

Leadtrend Technology Corp. reserves the right to make changes or corrections to its products at any time without notice. Customers should verify the datasheets are current and complete before placing order.

Revision History

REV.	Date	Change Notice
00	08/02/2016	Original Specification