Smart Discharge Controller for Pump Express Plus™ Solution

REV: 00

General Description

The LD8107 is an active discharge controller compatible with MediaTek Pump Express Plus™ portable devices charger solution. It can be used in Leadtrend primary-side regulation controller, ex: LD5516 and LD5516C.

The device intelligent switching frequency detection for USB cable unplug condition, the maximum discharge current is around 200mA and can meet fast discharge time less than 0.5sec from 12V to 5V. The LD8107 is available in the tiny SOT-25 package.

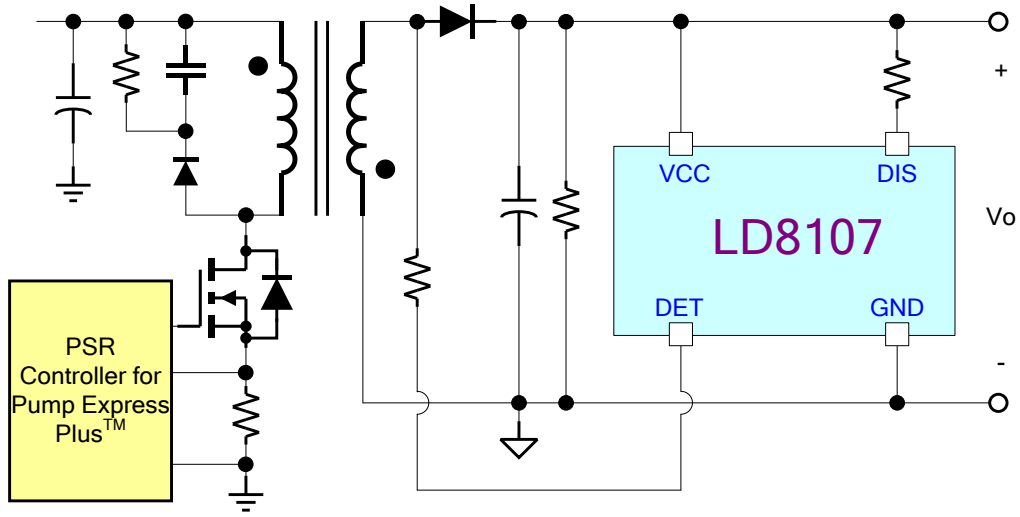
Features

- Fast discharge from 12V/9V/7V to 5V.
- Primary side switching frequency detection.
- 200mA maximum discharge current.
- Compatible with MediaTek Pump Express Plus™ portable devices charger solution.
- SOT-25 package.

Applications

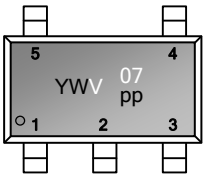
- Pump Express Plus™ based Charger
- AC/DC Adaptor for Phone and Tablet
- USB power delivery discharging

Typical Application



Pin Configuration

SOT-25 (TOP VIEW)



YY, Y : Year code (D: 2004, E: 2005.....)
WW, W : Week code
PP : Production code
V07 : LD8107

Ordering Information

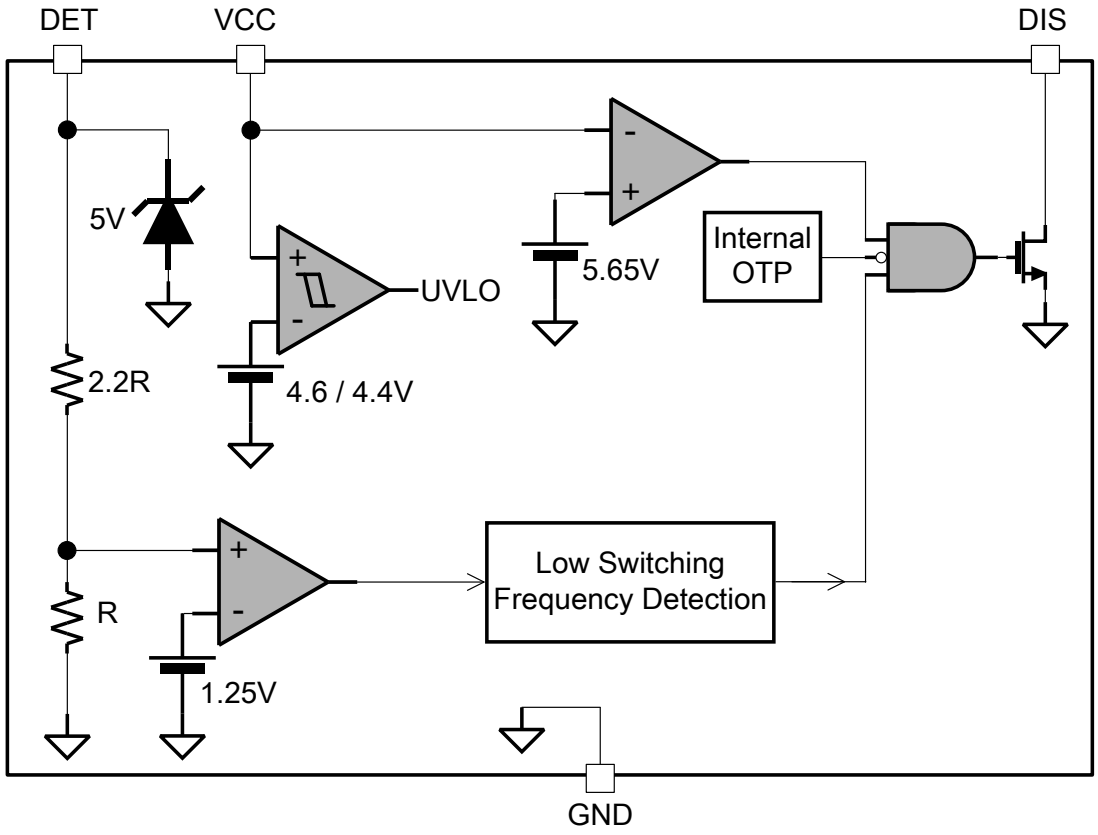
Part number	Package	Top Mark	Shipping
LD8107 GL	SOT-25	YWV/07	3000 / tape & reel

The LD8107 is green packaged.

Pin Descriptions

PIN	NAME	FUNCTION
1	DET	Primary side switching frequency detection.
2	GND	Ground.
3	NC	NC.
4	DIS	Output capacitor discharge.
5	VCC	Supply voltage pin & output voltage detection.

Block Diagram



Absolute Maximum Ratings

VCC, DIS	-0.3V ~ 30V
VDET	-0.8V ~ 6V
IDET	-1mA ~+1mA
Package Thermal Resistance (SOT-25, θ_{JA})	200 °C/W
Power Dissipation (SOT-25, at Ambient Temperature = 85°C)	200mW
Storage Temperature Range	-65°C ~ 150°C
Maximum Junction Temperature	150°C
Lead Temperature (Soldering, 10sec)	260°C
ESD Voltage Protection, Human Body Model	2.5KV
ESD Voltage Protection, Machine Model	250V

Recommended Operating Conditions

Item	Min.	Max.	Unit
Operating Junction Temperature	-40	125	°C
R_{DET}	-	100	KΩ
R_{DIS}	50	100	Ω

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

(V_{CC}=12V, T_A=25°C, unless otherwise noted.)

PARAMETER	CONDITIONS	Symbol	MIN.	TYP.	MAX.	UNITS
Supply Voltage (VCC Pin)						
UVLO(ON)		UVLO_ON		4.5		V
UVLO(OFF)		UVLO_OFF		4.25		V
UVLO(OFF) - UVLO(ON)		UVLO_HYS		0.25		V
Operating Current		IOP		0.23		mA
Discharge Turn-off Trip Level		VDIS_STP	4.9	5.4	5.9	V
Switching Frequency Detection for DIS Turn-on (DET Pin)						
Upper Clamp Voltage	IDET=0.8mA	VDET_HCI			6	V
Input Impendence		ZDET	2.6	3.5	4.4	MΩ
Low Clamp Voltage	IDET=0.8mA	VDET_LCI	-0.6			V
Switching Frequency Detection Trip Level		VDET_TR	3.	4	4.4	V
Timeout for Low Frequency Detection		TIMEOUT	670	850	1030	µs
Dummy Load Enable Debounce time	DET period > TIMEOUT	TD_DMY	7	10	13	ms
Vo Discharge Enable De-bounce Time	DET period >TIMEOUT	TD_DIS	55	75	100	ms
Output Discharge (DIS Pin)						
Off-State Leakage Current		IDIS_OFF		30	50	µA
Dummy Load Current		I_DMY	4	5	6	mA
Discharge Current	DIS voltage=6~12V	IDIS_ON	200	300	400	mA

Typical Characteristics

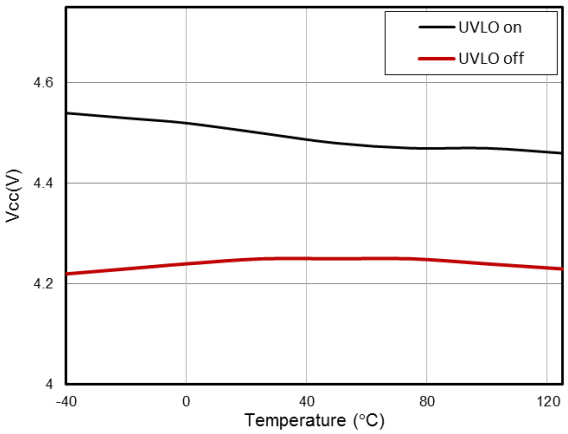


Fig. 1 UVLO level vs.Temperature

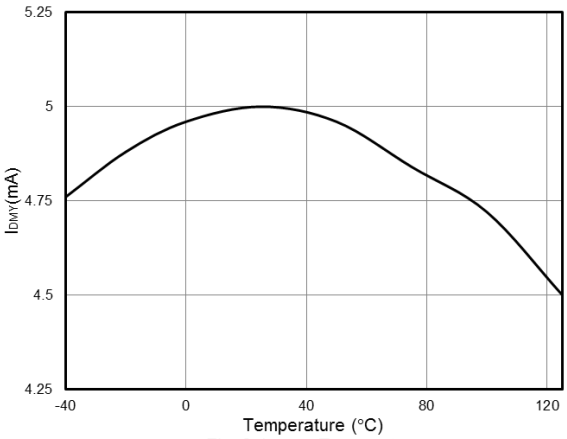


Fig. 2 I_{DMY} vs.Temperature

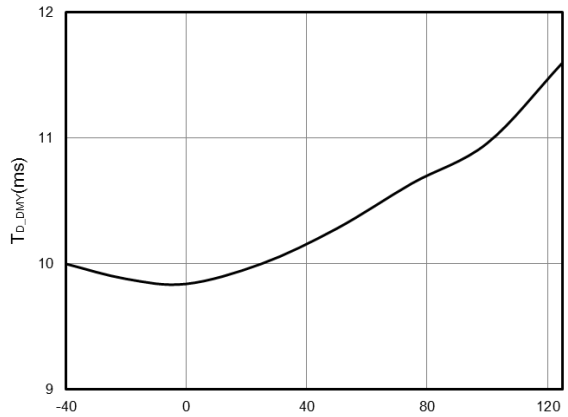


Fig. 3 T_{D_DMY} vs.Temperature

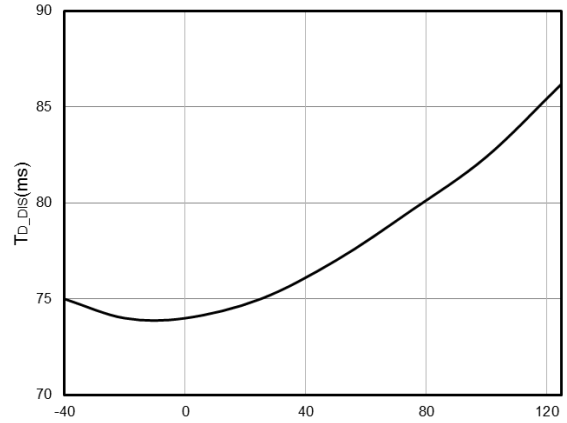


Fig. 4 T_{D_DIS} vs.Temperature

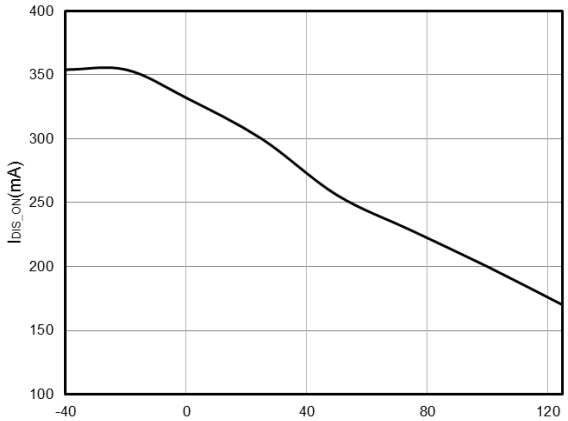


Fig. 5 I_{DIS_ON} vs.Temperature

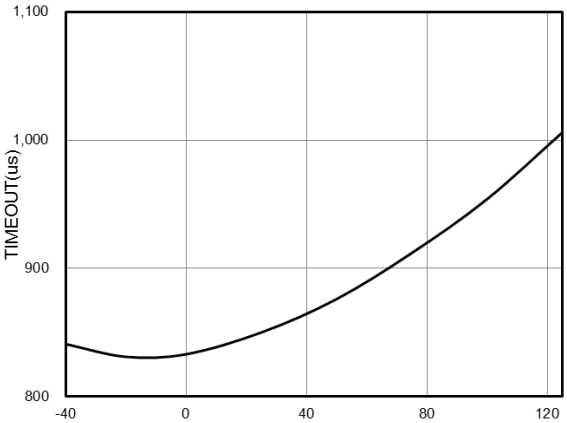


Fig. 6 TIMEOUT vs.Temperature

Application Information

Operation Overview

The smart phone consumes more and more power. Charging becomes an important issue for smart phones. To solve this problem, the smart phone chip makers, Qualcomm and MediaTek, boost the charger's output-voltage to accelerate charging and design their own protocol. When the smart phone using fast charging technology is charged, the charger will boost its output-voltage to 12V so that it can achieve the goal of fast charging. However, when the smart phone is unplugged, the charger must recover its output-voltage to 5V quickly for the sake of safety. The LD8107 is designed for the portable charger equipped with the technology, MediaTek Pump Express Plus™, to achieve the status that the charger unplugged USB discharges quickly.

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 maximum rating of VCC would be 30V which is easily and suitable for speedy charger design.

USB Unplug Fast Discharging

For the MediaTek Pump Express Plus™, when the charging current is small enough, the smart phone is regarded as well charged or unplugged, the output voltage will go back to 5V form 7V, 9V, or 12V. For the Leadtrend primary-side regulation controller designed for MediaTek Pump Express Plus™ charger, ex: LD5516 and LD5516C, when the charging current is small enough for 200ms, the LD5516(C) will switch the feedback reference voltage for 7Vo, 9Vo, 12Vo to 5Vo. When there is still a small charging current exist, it won't take too much time for the output voltage back to 5V. But when the USB cable is unplugged, there is no charging current to discharge the charger output capacitors and thus it will take a long time for the charger output voltage back to 5V. LD8107 will fast discharge the charger output capacitor when the USB cable is unplugged to ensure the charger output voltage back to 5V within 0.5 sec.

Active Dummy Load

LD8107 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. 7. The function which is according to DET pulse frequency is determined in cable plug-out condition. The dummy load will be turned-on if PSR controller switching cycle time is more than 900μs for more than 75ms. That is, when the cable is plug-out and the LD5516(C) switches the feedback reference voltage form 7V, 9V, 12V back to 5V, the switching cycle time will be more than 900μs for more than 75ms and thus LD8107 turns-on the dummy load to discharge the output capacitors as shown in Fig. 8.

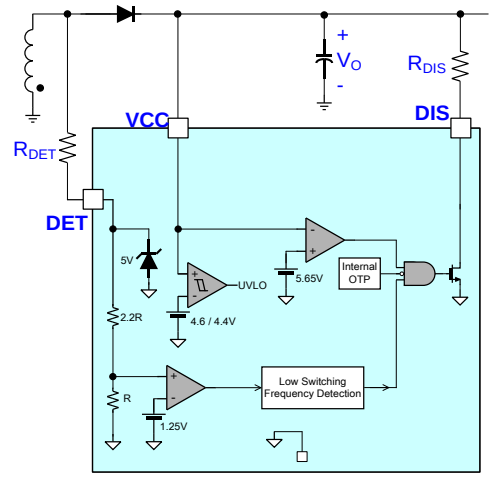

+
VO
-
RDIS
VCC
DIS
RDET
DET
5V
UVLO
5.65V
Internal OTP
2.2R
4.6 / 4.4V
R
Low Switching Frequency Detection
1.25V

Fig. 7

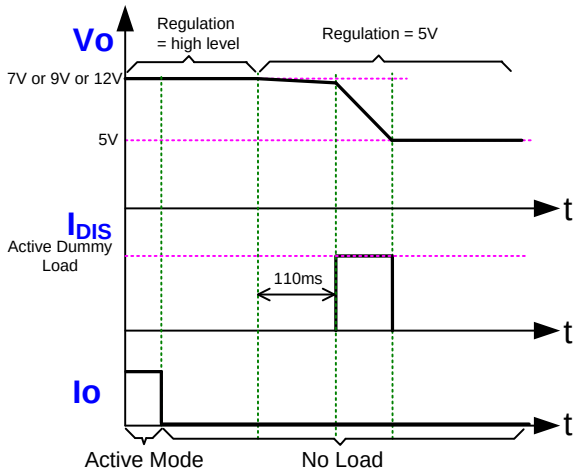
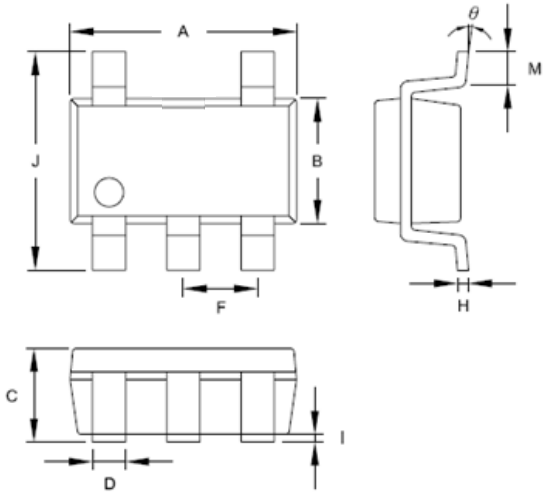

Vo
Regulation = high level
Regulation = 5V
7V or 9V or 12V
5V
t
IDIS
Active Dummy Load
110ms
t
Io
t
Active Mode
No Load

Fig. 8

Package Information

SOT-25



Symbol	Dimension in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	2.692	3.099	0.106	0.122
B	1.397	1.803	0.055	0.071
C	-------	1.450	-------	0.057
D	0.300	0.500	0.012	0.020
F	0.95 TYP.		0.037 TYP	
H	0.080	0.254	0.003	0.010
I	0.050	0.150	0.002	0.006
J	2.600	3.000	0.102	0.118
M	0.300	0.600	0.012	0.024
θ	0°	10°	0°	10°

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	2016/05/02	Original Specification.