High Performance Fast Shutdown Synchronous Rectifier Controller with CCM Support

FEATURES

- supports CCM, DCM and QR modes
- placed on the positive side of the output, no auxiliary winding supply required
- has an extremely short turn-on delay of ~25ns.
- Short turn-off delay ~10ns
- False turn-on prevention technology
- Intelligent over-zero detection technology
- support output as low as 3.3V synchronous rectification reliable operation
- supports switching power supply frequency up to 200kHz.
- Minimal peripheral circuitry

GENERAL DESCRIPTION

The DP601 is a high performance synchronous rectifier control IC that works with synchronous MOS to replace Schottky rectifier diodes to improve system efficiency and supports CCM, DCM and QR modes.

The DP601 supports both positive and negative output applications, and integrates a 100V high voltage power supply circuit, eliminating the need for an additional auxiliary winding power supply and reducing system cost.

The DP601 utilizes a unique false turn-on prevention technology that effectively prevents SR false turn-on due to VDS oscillation.

The DP601 has a very short turn-on delay as well as a turn-off delay to achieve the highest possible efficiency. The very short turn-off delay allows the chip to operate stably in CCM mode.

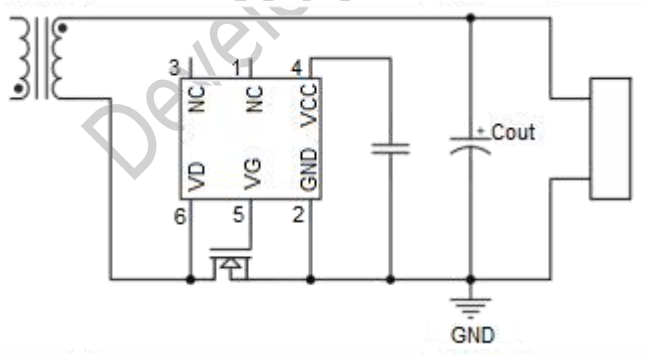
APPLICATIONS

- USB-PD,PPS,Fast Charger/Adapter
- AC to DC Power Supply
- Multi-Port Plug, Charger

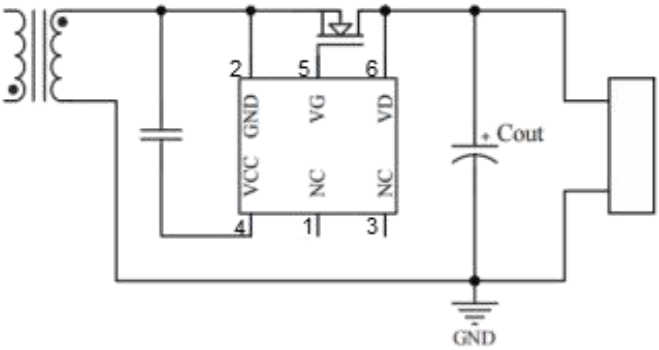
PACKAGE

Model number	Description
DP601	SOT23-6，halogen-free, braided disc pack, 3000 PCS/plate

TYPICAL APPLICATIONI CIRCUIT



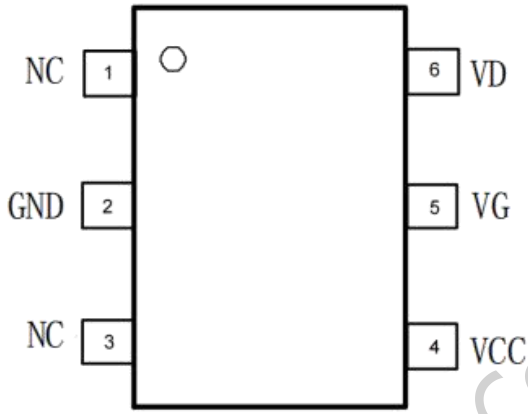
SR Negative end rectification applications



SR Positive Rectification Applications

PRODUCTS DESCRIPTION

➢ PIN CONFIGURATION



➢ PIN DISCRIPTION

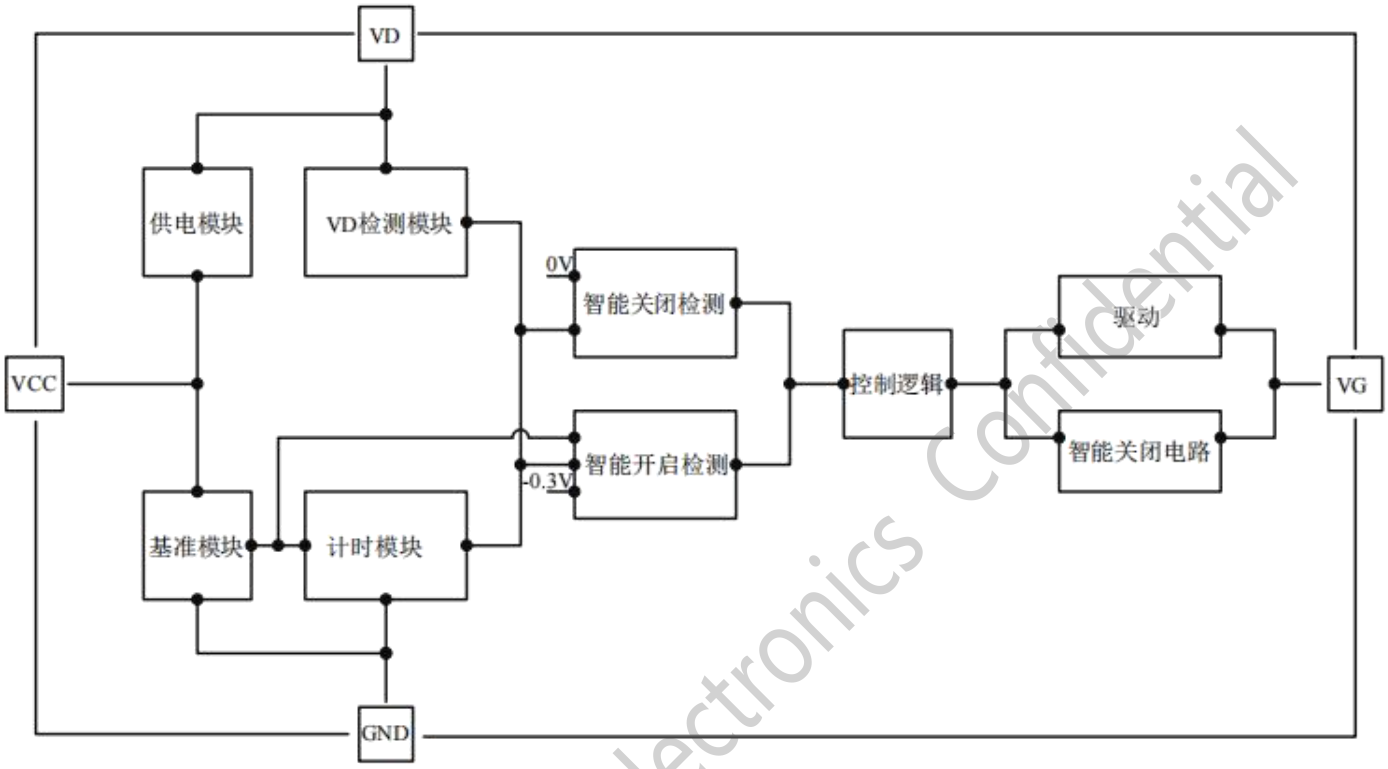
Pin symbol	Pin name	Description
1,3	NC	unassisted foot
2	GND	Chip ground, connected to the MOS source, also used as the source reference point for MOS VD detection
4	VCC	Chip power supply, internal self-powered output
5	VG	drive output
6	VD	Synchronous rectifier drain detection, internal integrated self-powered inputs

➢ MARKING INFORMATION

DP601is the product name:

XXXX The first and second X represents the last year,2020 is 20;The third and fourth X on behalf of the week code, 01-52 said.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Parameters	Numerical values	Units
VCC to GND	-0.3 to+7	V
VDD to GND	0.5 to 100	V
VG to GND	-0.3 to+7	V
Maximum junction temperature	150	℃

RECOMMENDED OPERATION CONDITIONS

Parameters	Numerical value	Units
VCC to S	5 to 6	V
D to S	10 to 90	V
Junction temperature range (TJ)	-40 to +125	℃
Encapsulated thermal resistance Rja-- Junction to environment (SOT23-6)	220	℃/W

(1) Out of range chip may be damaged

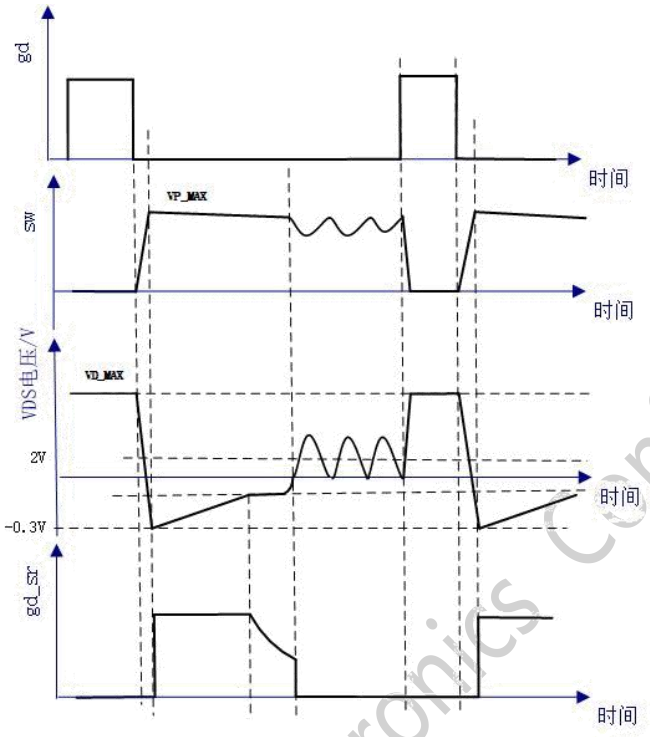
(2) The maximum power to be tolerated is composed of the maximum ambient temperature TJ (MAX), the ambient thermal resistance θJA and the ambient temperature TA. The maximum power in any environment is calculated from PD (MAX) = (TJ (MAX) - TA)/θJA. Exceeding the maximum tolerable power will result in extremely high chip temperatures, causing the internal circuitry of the chip to shut down due to overheating protection.

(3) Measurement on a JESDSD51-7, 4 layers PCB

ELECTRICAL CHARACTERISTICS (TA= 25℃,If not otherwise noted)

Symbols	Parameters	Test conditions	Min	Typ	Max	Units
power supply VCC						
V_{CC_ON}	Turn-On Voltage			4.6		V
V_{CC_OFF}	Turn-Off Voltage			4		V
V_{CC_STB}	Stabilized voltage	V_D=14V		6		V
I_{VCC}	Operating Current	V_{CC}=6V F_{SW}=100KHz		3.5		mA
$I_{q(VCC)}$	quiescent current	V_{CC}=6.4V F_{SW}=0KHz		350		mA
Synchronous rectifier on-off control						
V_{DS_REG}	Adjustment of the voltage target value			-40		mV
V_{ON_th}	Open Voltage Threshold			-300		mV
V_{OFF_th}	Off Voltage Threshold			0		mV
T_{D_ON}	Turn-On delay			25		nS
T_{D_OFF}	Turn-off delay			10		nS
LEB	Frontier fade time			1.2		uS
T_{OFF_min}	Minimum shutdown time			500		nS

PRODUCT APPLICATION INFORMATION



Function Waveform

DDP601 is a high performance synchronous rectifier IC used to drive synchronous MOS alternative flyback (flyack) vice side Schottky diode rectifier, with suitable synchronous MOS alternative diode rectifier to improve system efficiency.

- **Synchronous Rectifier IC Drive On Judgment**

In order to turn on the synchronous rectifier IC drive, the following two conditions must be met at the same time:

(1) Set the time for VDS>2V as t1, and the internal setting time of the chip as Toff_min. The first condition of turning on the synchronous rectifier is satisfied when t1>Toff_min.

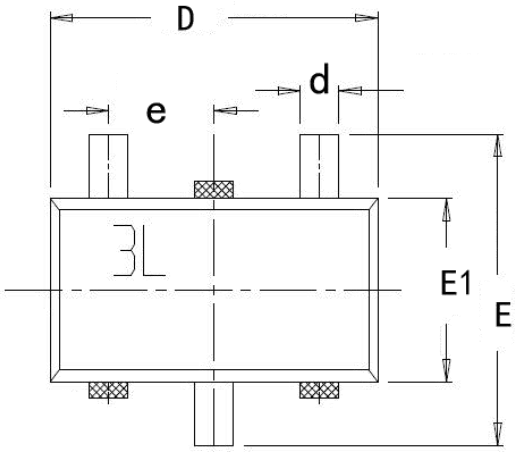
(2) Let the time for VDS to go from 2V to -0.3V be t2, and the fixed time set internally by the chip be t3, and the second condition of turning on the synchronous rectifier tube is satisfied when t2<t3.

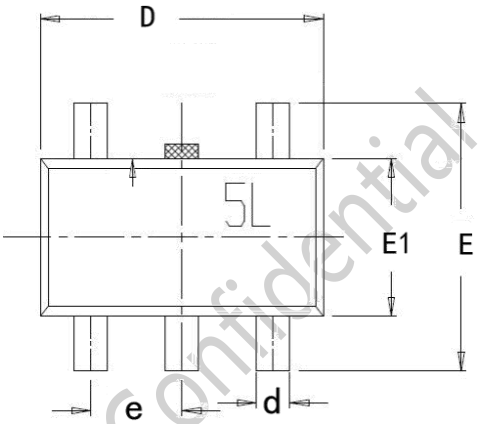
- **Synchronous rectifier IC driver turn on and off process**

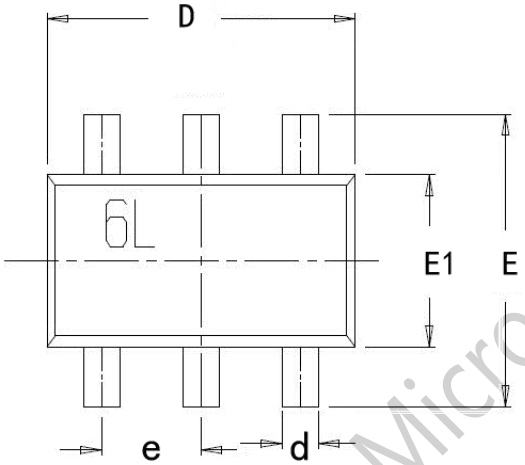
After the synchronous rectifier is turned on, the chip internally sets a period of Leading Edge Blanking Time (LEB), during which its shutdown threshold will be raised. LEB is to prevent the ringing of VDS after the synchronous rectifier is turned on from causing the chip to be mistakenly shut down after detection. After the leading-edge fading time is over, the shutdown threshold is then set to zero, and the smart shutdown detection is turned on to control the gate end of the synchronous rectifier to realize the adjustment of the VDS voltage to stabilize it at the adjusted voltage value. The purpose of the smart turn-off detection is to reduce the turn-off delay and avoid the "crossover" phenomenon (simultaneous conduction of the primary and secondary switching tubes) during CCM. This phenomenon will generate additional energy loss, and in serious cases, the chip will be burned。

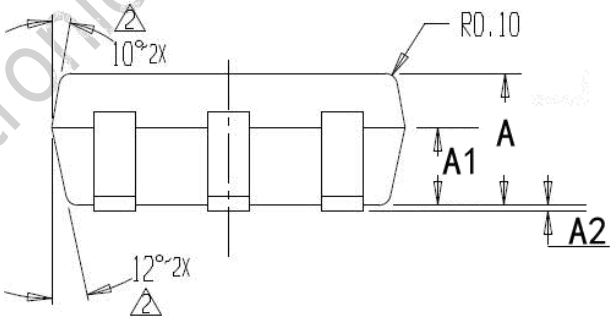
PACKAGE SIZE

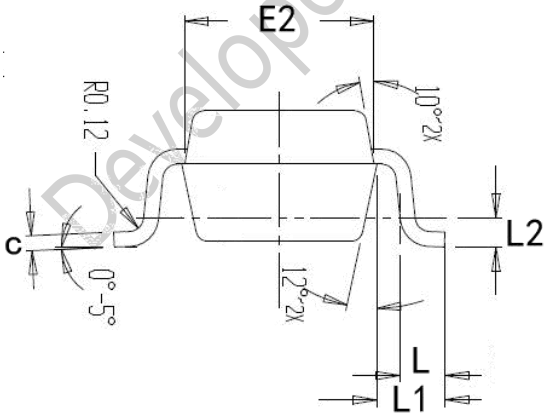
SOT23-6











Symbol	Min	Nom	Max
A	1.050	1.100	1.150
A1	0.625	0.650	0.675
A2	0.010	0.050	0.090
c	0.047	0.127	0.207
D	2.900	2.950	3.000
d	0.325	0.350	0.375
E	2.720	2.800	2.880
E1	1.600	1.650	1.700
E2	1.550	1.600	1.650
e	0.925	0.950	0.975
L	0.300	0.380	0.460
L1	0.599REF		
L2	0.250BSC		

REVISED HISTORY

Editions	Revised Date	Redaction person	Revision content
REV1.0	2022/12/28	AE	First edition
REV1.1	2024/5/17	AE	Correction of silkscreen

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