JW77156D

60V, 13mΩ Synchronous Rectifier

Preliminary Specifications Subject to Change without Notice

DESCRIPTION

JW77156D is a synchronous rectifier, used for the secondary side rectification of Flyback. By driving an internal MOSFET, JW77156D is able to significantly improve the efficiency comparing with the conventional Diode rectifier.

When JW77156D senses V_{DS} of internal MOSFET less than -300mV, it turns on the internal MOSFET. Once the V_{SW} is greater than -10mV, JW77156D turns off the internal MOSFET.

JW77156D supports multiple operation modes, such as DCM, CrCM, CCM and Quasi-Resonant. By implementing the Joulwatt proprietary technology, JW77156D is able to handle CCM operation.

JW77156D is available in ESOP-8 package.

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FEATURES

- Supports DCM, Quasi-Resonant, CrCM and CCM operation
- Support the Flyback topology
- Output voltage directly supply VCC
- Low quiescent current
- Under-voltage protection
- Fast driver capability for CCM operation
- ESOP-8 package

APPLICATIONS

- Flyback converter
- 18W/20W quick charge adaptor

TYPICAL APPLICATION

ORDER INFORMATION

DEVICE[1]	PACKAGE	TOP MARKING[2]	ENVIRONMENTAL[3]
JW77156DESOP#TR	ESOP8	J77156D YW☐☐☐☐☐	Green

Notes：

1)
JW☐☐ ☐☐ #TR
— Tape and Reel (If TR is not shown, it means Tube)
— Package Code
— Part No.

2) Line1:
J ☐☐☐☐☐☐
— Product code
— JoulWatt LOGO

Line2:
YW ☐☐☐☐☐
— Lot number
— Week code
— Year code
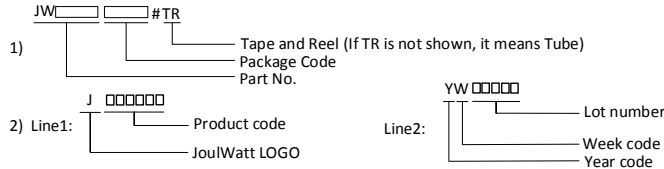
3) All JoulWatt products are packaged with Pb-free and Halogen-free materials and compliant to RoHS standards.

PIN CONFIGURATION

TOP VIEW

GND	1	8 NC
GND	2	7 NC
VCC	3	6 NC
VO	4	5 SWC

0
SW

ESOP-8
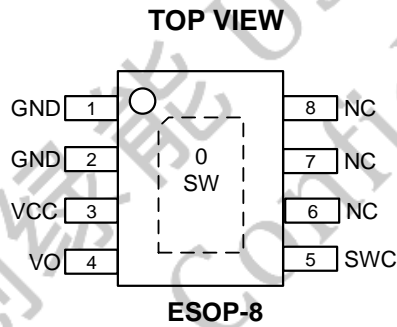
ABSOLUTE MAXIMUM RATING[1]

SW Pin 60V

SWC Pin 60V

VO Pin 28V

VCC Pin...6.5V

Junction Temperature[2] [3] 150ºC

Storage Temperature .... -65ºC to 150ºC

Lead Temperature (Soldering, 10sec.) 260ºC

Continuous Power Dissipation (TA = +25 ºC) [4] ESOP-8……….………….……………….……… 2.5W

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RECOMMENDED OPERATING CONDITIONS

SW Pin..4.7V to 48V

SWC Pin...4.7V to 48V

VO Pin..2.5V to 20V

VCC Pin..4.5V to 6.4V

Operation Junction Temperature .... -40ºC to 125ºC

THERMAL PERFORMANCE[5)]
θ_{JA} $\quad \theta_{Jc}$

ESOP8...50....10ºC/W

Note：

1) Exceeding these ratings may damage the device. These stress rating do not imply function operation of the device at any other conditions beyond those indicated under RECOMMENDED OPERATING CONDITIONS.
2) Continuous operation over the specified absolute maximum operating junction temperature may damage the device.
3) The device is not guaranteed to function outside of its operating conditions.
4) The maximum allowable continuous power dissipation at any ambient temperature is calculated by $P_D(MAX)=(T_J(MAX)-T_A)/\theta_{JA}$.
5) Measured on JESD51-7, 4-layer PCB.

ELECTRICAL CHARACTERISTICS

*T*_A *= 25ºC, unless otherwise stated*

Advance Information, not production data, subject to change without notice.

Item	Symbol	Condition	Min.	Typ.	Max.	Units
VCC Section						
VCC Voltage	VCC	SW=40V, VCC=2.2uF		5.8		V
VCC Startup Voltage	$V_{CC\_Startup}$			4.05		V
VCC UVLO	V_{CC_UVLO}			3.95		V
Quiescent Current	I_q	VCC=4.5V, VCC=2.2uF		24		uA
Internal Driver Section						
Internal Gate Pull up Current [6]	I_{GU}	GT=1V		0.65		A
Internal Gate Pull down Current [6]	I_{GD}	GT=5V		4.7		A
Internal Gate Minimum on Time [6]	T_{MIN_ON}			1.3		uS
Internal Gate Minimum off Time[6]	T_{MIN_OFF}			700		nS
Turn-on Total Delay[6]	T_{DON}			84		nS
Turn-off Total Delay [6]	T_{DOF}			22.4		nS
SWC and VO Section						
Internal MOSFET Turn on Threshold[6]	V_{SW_ON}			-300		mV
Internal MOSFET Turn off Threshold[6]	V_{SW_OFF}			-10		mV
Internal MOSFET Turn off Threshold in MOT[6]	$V_{SW\_OFF\_MOT}$			+150		mV
SW Control Voltage[6]	V_{SW_REG}			-40		mV
SW Control Voltage MAX[6]	$V_{SW\_REG\_MAX}$			-170		mV
VO Enable Charge Voltage	V_{O_EN}	VCC=4V, SW=0V		4.55		V
VO Disable Charge Voltage	V_{O_DIS}	VCC=4V, SW=0V		4.35		V
VCC Charge Current	I_{CV}	SW=40V, VCC=4V		44		mA
VO Charge Current	I_{VO_CHG}	SW=0V, VCC=4V，VO=5V		20		mA
Vo Short-circuit Detection Voltage	V_{O_SHORT}		1.8	2.1	2.3	V
Internal MOSFET Section						
Internal MOSFET Rdson[6]	Rdson			13		mΩ
Breakdown Voltage	$B_{(BR)DSS}$		60			V

6) Guaranteed by design.Not tested in production.

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PIN DESCRIPTION

Pin No.	Name	Description
1,2	GND	Power Ground.
3	VCC	Power supply. Bypass a Capacitor Between VCC and GND.
4	VO	Output Voltage Sensing and Charging to VCC.
5	SWC	Internal Power MOSFET Drain Voltage Sensing. Charging to VCC.
6,7,8	NC	NC
0	SW	Internal Power MOSFET Drain.

BLOCK DIAGRAM

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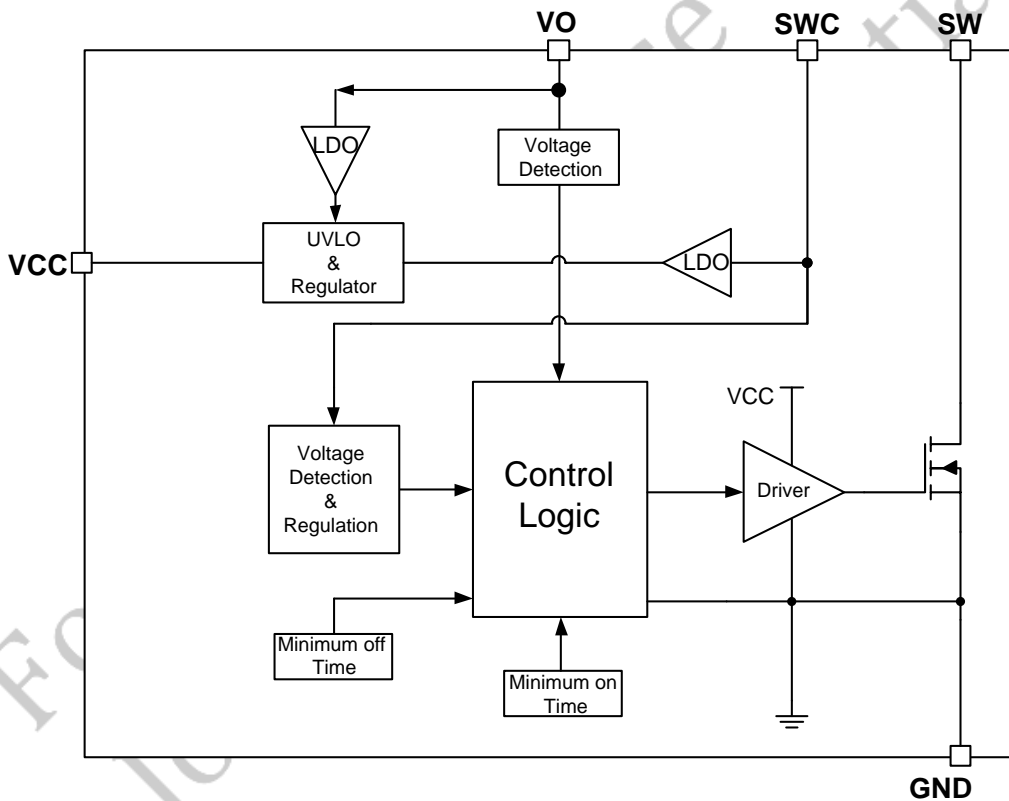
FUNCTIONAL DESCRIPTION

Operation

JW77156D is a synchronous rectifier which combined with internal MOSFET can replace the Schottky Barrier Diode. It supports all operations, such as DCM, CrCM, (Quasi-Resonant) and CCM when adopted in flyback converter.

Startup

During the startup period, when the VCC is lower than startup voltage, the external MOSFET is turned off. The current flows though body diode before the VCC reaches to the startup voltage Vcc_startup.

Under-Voltage Lockout (UVLO)

When the VCC is below UVLO threshold, the external MOSFET is turned off and pulled low internally. Once the VCC exceeds the startup voltage Vcc_startup, the parts is activated again.

LDO Charging Logic

JW77156D have two internal LDO to charge the VCC pin. When VO is lower than 4.35V, JW77156D can power itself through the internal LDO connected to SWC pin during the SR turn-off period, which means primary the primary side MOSFET is turned on and SWC presents a positive voltage. A capacitor between VCC and GND is required to store the energy and supply to IC during the SR turn-on period.

The other internal LDO is connected from VO to

VCC, it charges VCC pin when VO is higher than 4.55V.

Turn On Phase

When the synchronous MOEFET is conducting, current flows through the body diode of MOSFET, which generates a negative voltage V_{SW} across it. When V_{SW} is lower than V_{MOS_ON}, the part will pull the internal gate high to turn on the synchronous MOSFET after turn on delay time T_{DON}.
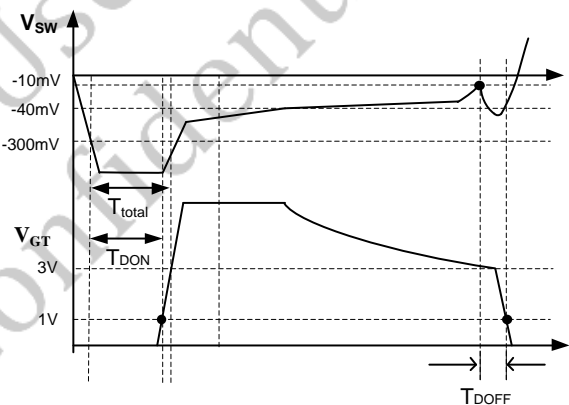

Figure-1 Turn on delay and turn off delay

Conducting Phase

When the synchronous MOSFET is turn on, the drain source voltage V_{SW} it is determined by its on resistance and the current through it. The part adjusts the gate voltage and regulates the Vsw to a internal threshold (typical -40mV) after the synchronous MOSFET turn on. When the V_{SW} is lower than -40mV, the gate keep its maximum voltage. And the synchronous MOSFET is fully on.

The control circuit contains a minimum on time function. The V_{SW} voltage may have a parasitic ring when the synchronous MOSFET turns on. So a minimum on time (MOT) is very important

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to avoid the MOSFET turn off threshold is false triggered. During the minimum time, the gate can still be turned off if V_{SW} touches a positive threshold value, +150mV.

Turn Off Phase

After synchronous MOSFET conducting, once the voltage V_{SW} touches the MOSFET turn off threshold (-10mV), the internal gate is pulled to low after a turn off delay time T_{DOFF}. A 700nS blanking time is necessary to avoid error trigger.

Minimum On-time (MOT)

MOT stands for the minimum on time of synchronous MOSFET. For JW77156D, MOT is about 1.3uS.

Output Voltage Detection

The JW77156D has output voltage detection function via VO pin. To avoid the gate error turn on during starting-up period, the whole SR control logic is disabled when the VO voltage is lower than 2.1V. VCC is charged from VO pin when VO is higher than 4.55V to save power loss caused by the LDO when charging from SWC pin to VCC pin.

TAPE AND REEL INFORMATION

Reel			UNIT: mm

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	1.05	1.15	1.25
A1	0	0.05	0.15
A2	0.95	1.10	1.20
b	0.20	0.40	0.60
c	0.05	—	0.21
D	2.72	2.92	3.12
E	2.60	2.80	3.00
E1	1.40	1.60	1.80
e	0.95（BSC)		
L	0.30	0.45	0.60
θ	0°	—	8°

Package	Diameter Φ	Thickness W1	Width W2	W4
ESOP8	330±2	17.6±2	12.4±2	100±2

Carrier Tape   UNIT: mm

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPAE

Sprocket Holes

Procket Quadrants
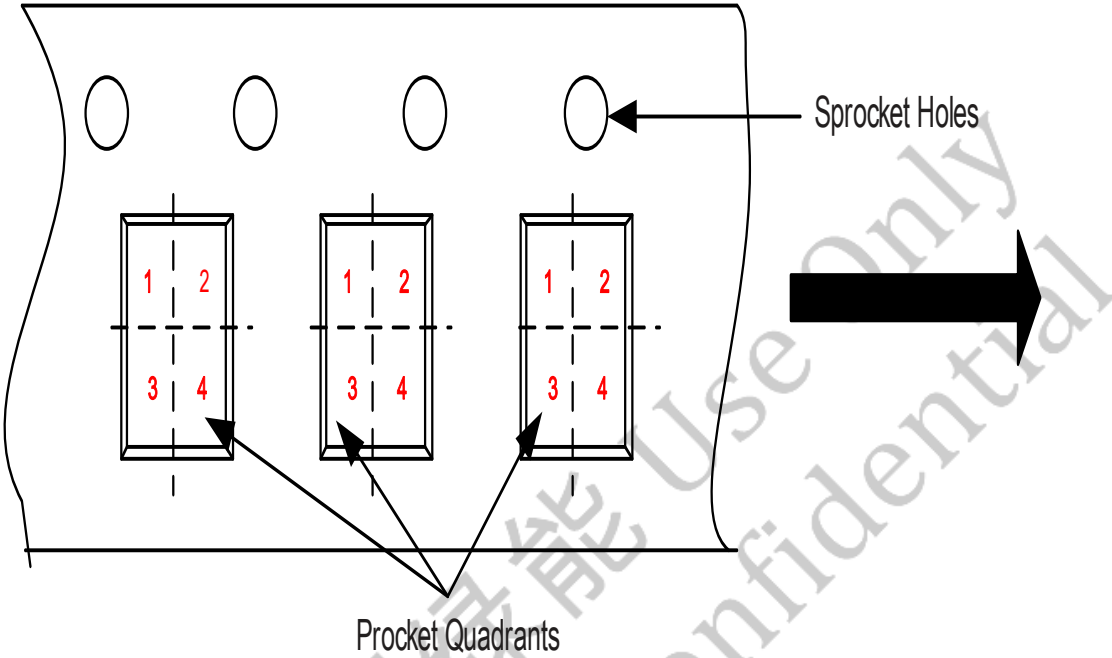
Package	Tape dimensions (mm)											
	P0	P2	P1	A0	B0	W	T	K0	Φ1	Φ2	E	F
ESOP8	4.0±0.1	2.0±0.1	8.0±0.1	6.40±0.3	5.35±0.3	12.0±0.3	0.25±0.2	2.00±0.2	1.50min	1.50min	1.75±0.1	5.50±0.10

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PACKAGE OUTLINE

ESOP8			UNIT: mm

Symbol	MILLIMETER		
	MIN	NOM	MAX
A	1.30	1.50	1.70
A1	0.10	0.15	0.20
A2	1.35	1.42	1.55
A3	0.66	0.67	0.68
c	0.170	0.203	0.250
E	3.80	3.90	4.00
E1	5.80	6.00	6.20
L	0.45	0.60	0.75
b	0.33	0.40	0.51
D	4.80	4.90	5.00
e	1.27BSC		
θ	1°	3°	5°

L/F Szie (mil)	Symbol	MILLIMETER		
		MIN	NOM	MAX
90*90	D1	2.034	2.184	2.334
	E2	2.034	2.184	2.334
95*130	D1	2.953	3.103	3.253
	E2	2.063	2.213	2.363

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPAE

Sprocket Holes

Procket Quadrants

Package Type	Pin1 Quadrant
ESOP8	1

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