RoHS COMPLIANT | H F BFRsICFRsIPVC-Free

DW8528

Power Factor Correction IC
for LED Lighting

Ver. 1.7

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1. General Description

The DW8528 is an active boundary-mode power factor correction controller for AC-DC SMPS applications. The DW8528 provides the optimization method of Isolation LED Lighting. The DW8528 is available in a thermally enhanced 8 SOIC package.

■ **Features**
- Boundary Mode Power Factor Correction Control
- Improved Power Factor and THD
- Wide Range Supply Voltage
- Under Voltage Lock Out
- Extremely Low Startup Current
- Low Quiescent Current
- Precise Internal Reference Voltage
- Leading Edge Blanking Circuit
- On Chip R/C Filter on CS pin
- Zero Current Switching
- System Power Limit at Feedback Open
- Supply Voltage Over Voltage Protection
- Thermal Shutdown Protection
- Disable Function on ZCD pin
- -600mA/+800mA Totem Pole Gate Driver
- 8 SOIC Package

■ **Applications**
- Single Stage High PF flyback AC/DC SMPS
- LED Lighting Power

2. Block Diagram
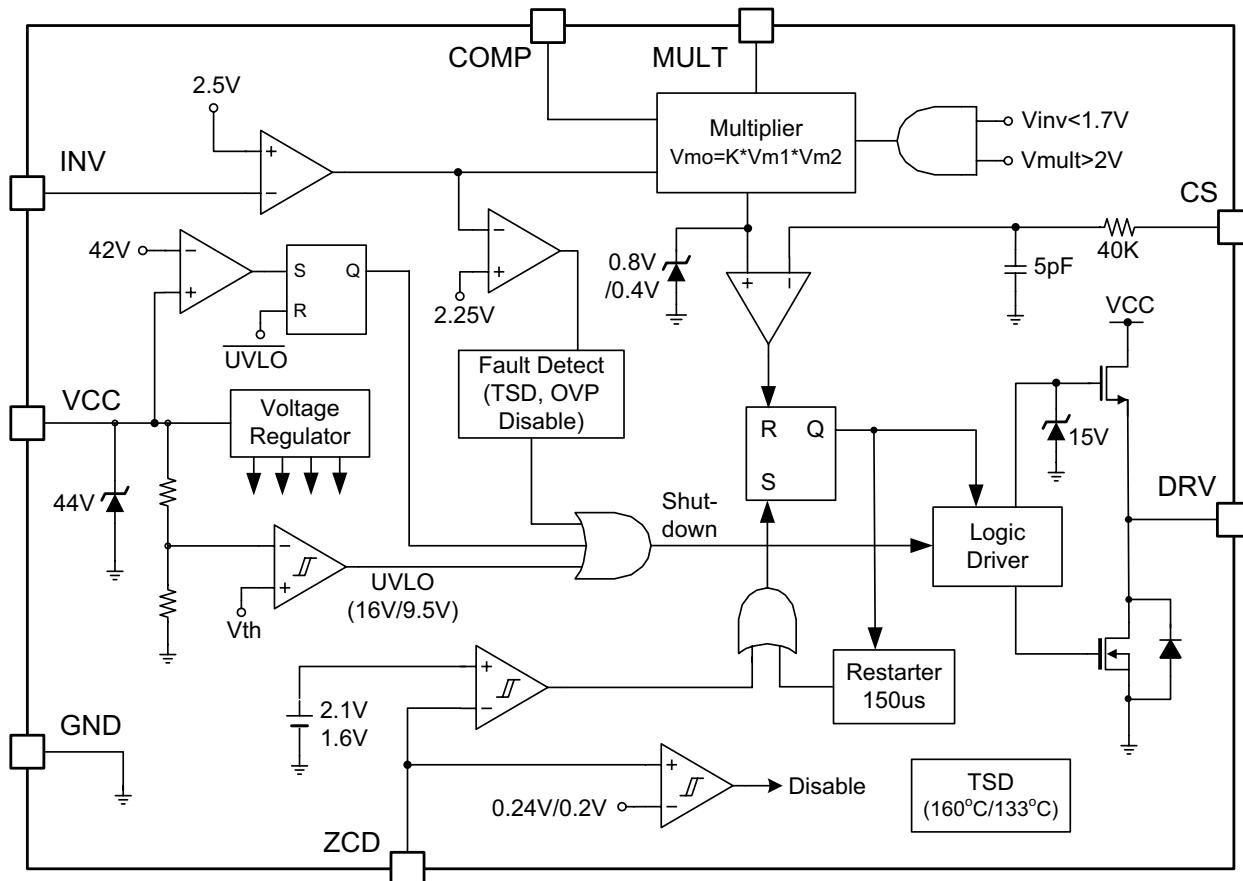
3. Pin Information

■ Pin Placement
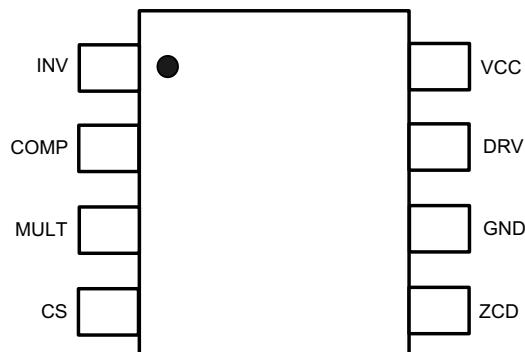
8SOIC

■ Pin Description

No.	Pin Name	Description	Note
1	INV	Inverting input of the error amplifier	
2	COMP	Output of the error amplifier.	
3	MULT	Input of the multiplier stage. A resistive divider connects to this pin the rectified mains. A voltage signal, proportional to the rectified mains, appears on this pin.	
4	CS	Input to the comparator of the control loop. The current is sensed by a resistor and the resulting voltage is applied to this pin.	
5	ZCD	Zero current detection input. If it is connected to GND, the device is disabled.	
6	GND	Current return for driver and control circuits.	
7	DRV	Gate driver output. A push pull output stage is able to drive the Power NOMS with peak current of +800mA/-600mA.	
8	VCC	Supply voltage of driver and control circuits.	

4. Absolute Maximum Ratings[1]

Symbol	Parameter	Ratings
V_{CC}	Maximum Supply Voltage	40 V
I_{CC}	Maximum Supply Current	30 mA
I_{OMAX}	Output Maximum Current (2us)	± 700 mA
V_{IN}	Input Voltage (SS, MULT, CS)	-0.3 ~ 7 V
V_{COMP}	Erramp Output Voltage (COMP)	-0.3 ~ 7 V
I_{ZCD}	ZCD Pin Current	-10/20 mA
θ_{JA}[2]	Package Thermal Resistance	150 ℃/W
T_{OPR}	Operating Junction Temperature	-40 ~ 125 ℃
T_{STG}	Storage Temperature	-55 ~ 150 ℃

Note (1) Stresses above the max. Values listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the integrated circuit.

(2) θ_{JA} is measured in the convection at Ta=30℃ on a high effective thermal conductivity test board(4 Layers, 2S2P) of JEDEC 51-7 thermal measurement standard. PCB dimension is 100mmx100mmx1.6mm and 4 layers.

5. Recommended Operating Condition

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage	10.3		36	V

6. Electrical Specification

(Vcc = 14V, typical values are at TA=+25℃, unless otherwise specified.)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
SUPPLY VOLTAGE SECTION						
Operating Voltage Range	V_{OP}	After Turn On	10.3	-	36	V
VCC Turn-on Threshold	V_{CCON}	V_{CC}=8~18V	15	16	17	V
VCC Turn-off Threshold	V_{CCOFF}	V_{CC}=18~8V	8.7	9.5	10.3	V
UVLO Hysteresis	V_{CCHYS}	V_{CCON}-V_{CCOFF}	6	6.5	7	V
VCC OVP Threshold Voltage	V_{OVP}	Positive-going	-	42	-	V
VCC Zener Clamp Voltage	V_Z	I_{CC}=25mA	-	44	-	V
SUPPLY VOLTAGE SECTION						
Start-up Current	I_{ST}	V_{CC}=11V	10	30	50	uA
Quiescent Current	I_Q	V_{CC}=14V	1.2	2.5	3.8	mA
	I_{QMAX}	V_{CC}=20V	1.2	3	4.5	mA
Quiescent Current at Disable	I_{QDH}	V_{CC}=14V	0.5	1.2	2	mA
	I_{QDL}	V_{CC}=8V	5	15	30	uA
Quiescent Current at OVP	I_{QOVP}	V_{INV}=2.7V	0.5	1.2	2	mA
Operation Supply Current	I_{CC}	F_{SW}=70KHz	2	3	5	mA
MULTIPLIER SECTION (Note1)						
MULT Input Bias Current	I_{MULT1}	V_{MULT}=0V	-1	-0.1	1	uA
	I_{MULT2}	V_{MULT}=3V	-1	-0.1	1	uA
Multiplier Input Voltage Range	V_{MULT}		0	-	3	V
Multiplier Output Max. Slope	V_{CS}/dV_{MULT}	V_{MULT}=0V, 0.5V	0.7	0.85	1	-
Multiplier Gain	K	V_{MULT}=1V	0.34	0.4	0.46	1/V
ERROR AMPLIFIER SECTION						
Erramp Inverting Voltage	V_{INV}	INV=COMP	2.46	2.5	2.54	V
INV Input Bias Current	I_{INV}	V_{INV}=2.5V	-0.5	-0.1	0.5	uA
INV Line Regulation	R_{LINE}	V_{CC}=12~24V	-	0.1	5	mV
COMP Source Current	I_{COMP}	V_{COMP}=4V	-3	-5	-10	mA
COMP Sink Current	I_{SINK}	V_{COMP}=4V	3	5	-	mA
COMP Upper Clamp Voltage	$V_{COMP}H$	I_{COMP}=-0.5mA	5.2	5.7	6.2	V
COMP Lower Clamp Voltage	$V_{COMP}L$	I_{COMP}=0.5mA	2.1	2.25	2.4	V
Static OVP Threshold Voltage	V_{SOVP}		2.1	2.25	2.4	V

6.1. Electrical Specification

(Vcc = 14V, typical values are at TA=+25℃, unless otherwise specified.)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
CURRENT SENSE SECTION (Note2)						
CS Input Bias Current	I_{CS}	V_{CS}=0V	-1	-0.05	1	uA
Leading Edge Blanking Time	T_{LEB}	(Note3)	-	240	-	ns
CS Propagation Delay	T_D	(Note4)	-	180	-	ns
CS Reference Clamp Voltage	V_{CS}		0.7	0.8	0.9	V
CS Offset Voltage	V_{OS}	V_{MULT}=0V	-	10	-	mV
CS Power Limitation Voltage	V_{CSLIM}	V_{INV}=1.4V, V_{MULT}=1.5V	-	0.6	-	V
		V_{INV}=1.4V, V_{MULT}=2V	-	0.4	-	V
ZERO CURRENT DETECTOR SECTION						
ZCD Upper Clamp Voltage	V_{UPPER}	I_{ZCD}=3mA	6	6.7	7.4	V
ZCD Lower Clamp Voltage	V_{LOWER}	I_{ZCD}=-3mA	0.4	0.7	1	V
ZCD Input Threshold Voltage	V_{ZCD}	Positive-going	1.9	2.1	2.3	V
		Negative-going	1.4	1.6	1.8	V
ZCD Input Hysteresis	H_{ZCD}	V_{ZCD}=2.5~1.2V	0.3	0.5	0.7	V
ZCD Input Bias Current	I_{ZCD}	V_{ZCD}=1~4.5V	-4	2	4	uA
ZCD Source Current Capability	I_{ZCDSC}		-3	-	-	mA
ZCD Sink Current Capability	I_{ZCDSI}		3	-	-	mA
Disable Triggering Current	I_{DIS}	V_{ZCD}=0.3V	-12	-6	-3	mA
Disable Threshold Voltage	V_{DIS}	Negative-going	150	200	250	mV
		Positive-going	150	250	350	mV
Holding Current after Disable	I_{HOLD}	V_{ZCD}=0.15V	-120	-75	-30	uA
RESTART TIMER SECTION						
Restart Time Delay	T_{RST}		70	150	300	us
GATE DRIVER SECTION						
DRV Output Low Voltage	V_{OL}	I_{DRV}=100mA	-	0.3	0.6	V
DRV Dropout Voltage	V_{DROP}	V_{CC}=12V,Idrv=-100mA	1	1.7	2.5	V
DRV Peak Source Current	V_{DRVSC}	(Note5)	-0.6	-	-	A
DRV Peak Sink Current	V_{DRVSI}	(Note6)	0.8	-	-	A
DRV Rising Time	T_R	Co=1nF (Note7)	-	60	110	ns
DRV Falling Time	T_F	Co=1nF (Note8)	-	30	70	ns
DRV Maximum Clamp Voltage	V_{OMAX}	V_{CC}=20V, Io=-5mA	11	12.7	14	V
DRV Sink Current at UV	I_{DRV_OFF}	V_{CC}=5V, V_{DRV}=1V	5	10	30	mA

6.2. Electrical Specification

(V_{CC} = 14V, typical values are at T_A=+25℃, unless otherwise specified.)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
THERMAL SHUTDOWN SECTION						
Thermal Shutdown Temp.	TSD	Positive-going (Note9)	-	160	-	℃
		Negative-going (Note10)	-	133	-	℃
TSD Hysteresis Temp.	HY_{TSD}	(Note11)	-	27	-	℃

Note 1, 2 : $V_{CS}=K*V_{MULT}*(V_{COMP}-2.5)$

Note 3, 4, 5, 6, 7, 8, 9, 10, 11 : Parameters are guaranteed by design, but not tested in production.

7. Typical Operating Characteristics

(Vcc = 14V, typical values are at T_A=+25℃, unless otherwise specified.)

VCC Operating Current

Start-up Current (I_{ST})
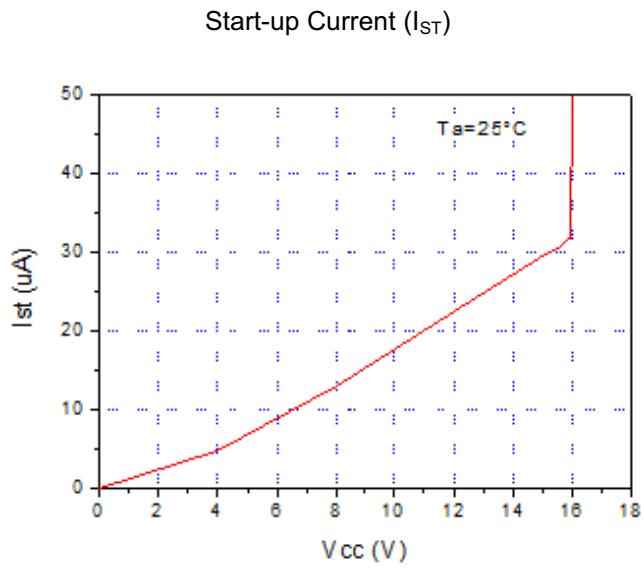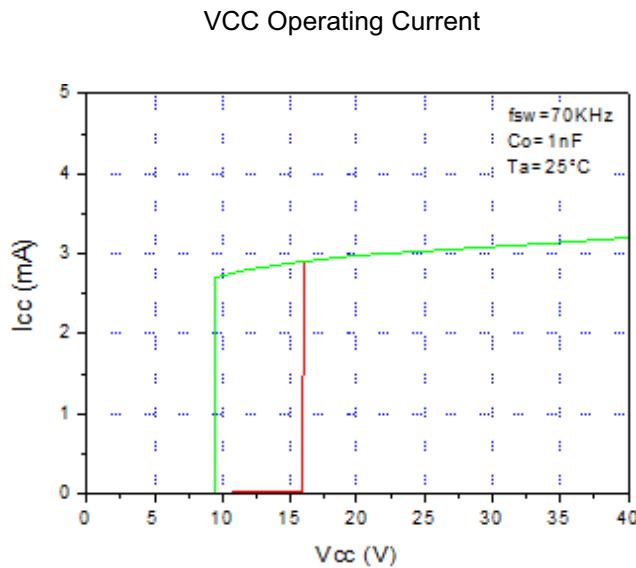
ZCD Input Threshold Voltage
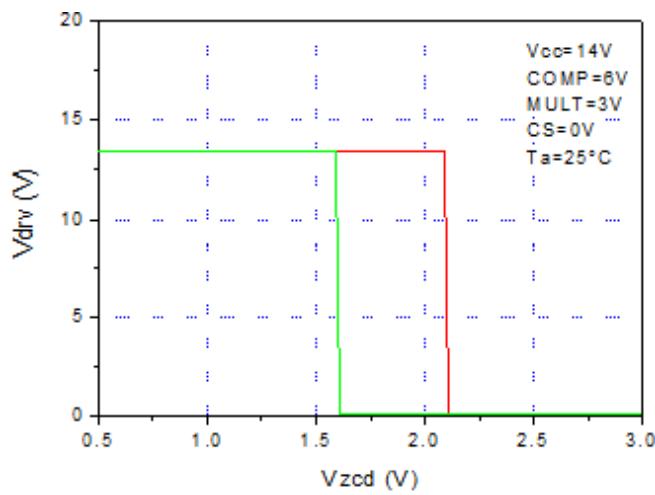
Disable Threshold Voltage
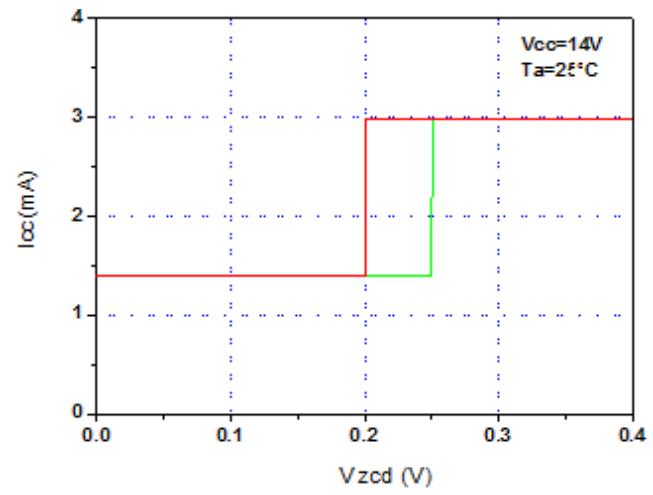
7.1. Typical Operating Characteristics

(Vcc = 14V, typical values are at T_A=+25℃, unless otherwise specified.)

Reference Voltage vs. Temp
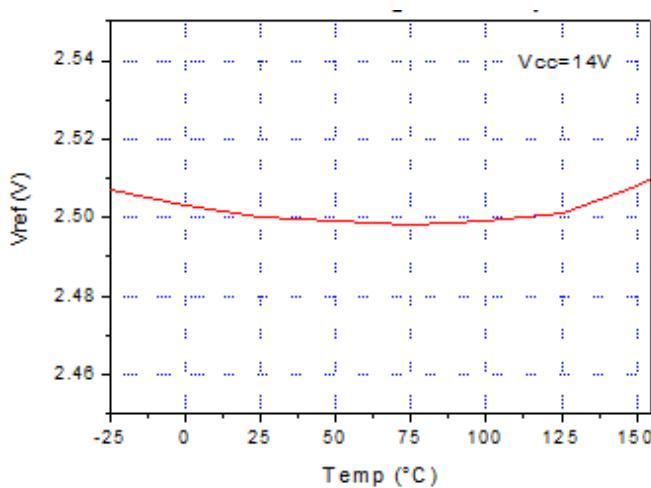
VCC Zener Clamp Voltage
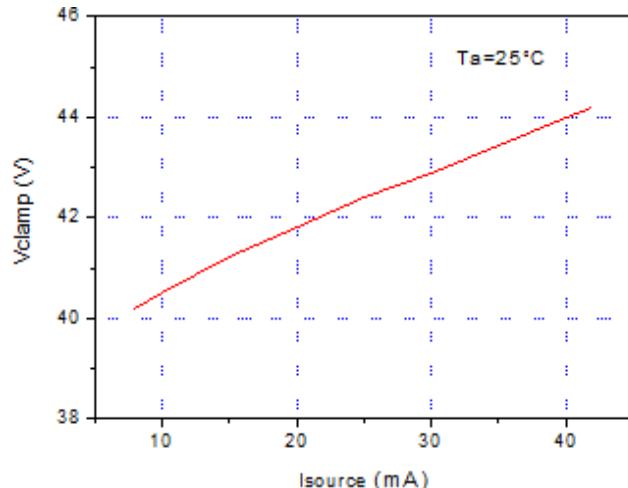

Multiplier Input vs. Output
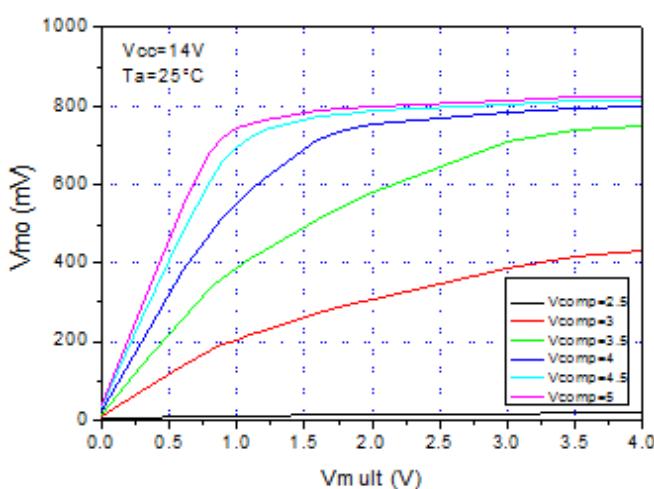

Multiplier Input vs. Gain
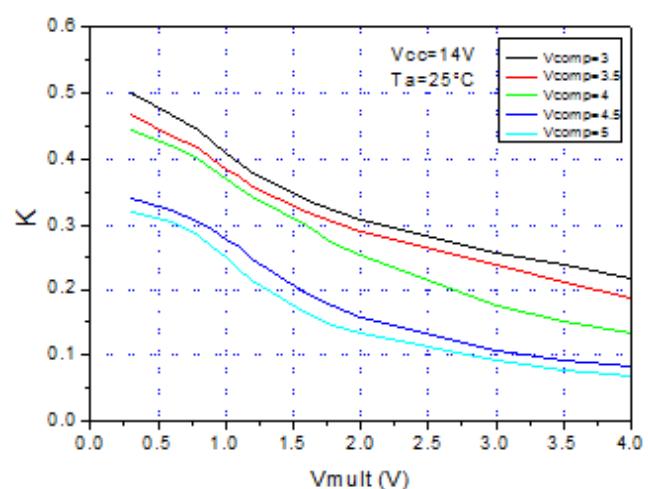
8. Typical Application Circuit
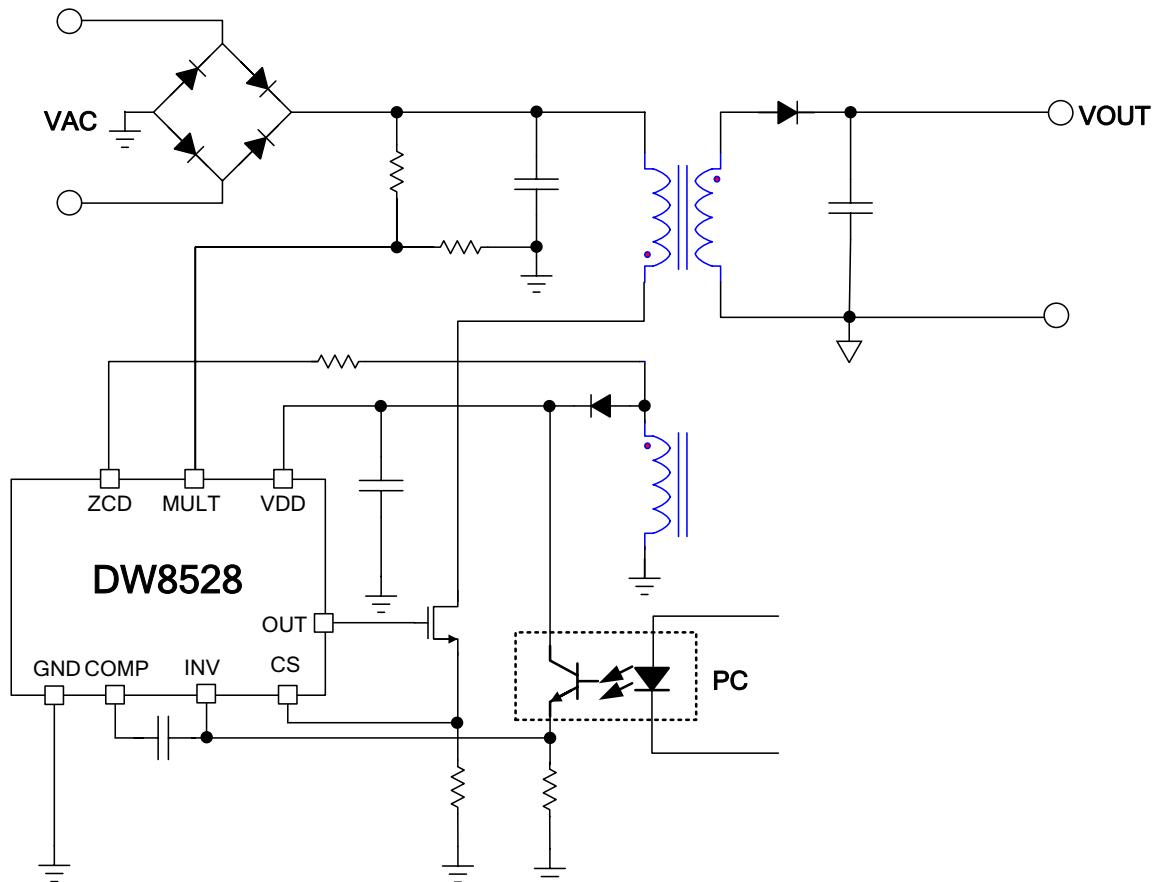
9. Package Dimension

Package Name : 8 SOIC
Package Size : 6.2mm * 5.1mm, Thickness : 1.75mm
Pin Pitch   : 1.27mm
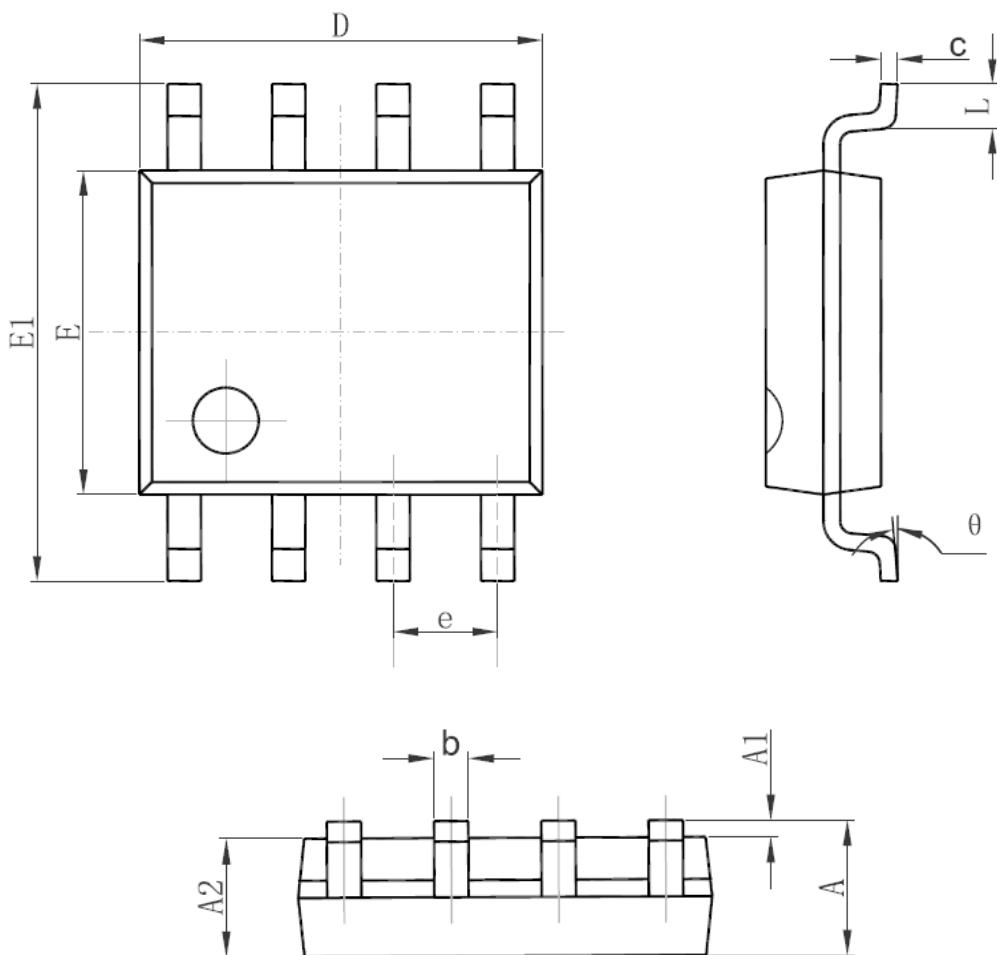
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°