GENERAL DESCRIPTION

OB5682x is a primary side regulation off-line LED lighting power switch which can achieve accurate LED current. It significantly simplifies LED lighting system design by eliminating the secondary side feedback circuitry, HV startup resistor and power supply capacitor.

LED current (CC control) can be adjusted by the external sense resistor connected between CS pin and ground.

OB5682x offers comprehensive protection coverage with auto-recovery features including LED open circuit protection, LED short circuit protection, Cycle-by-Cycle current limiting, and thermal foldback, etc.

OB5682x is offered in SOT33-5(A)/SOP7/DIP7/ CDFN8-7 package.

FEATURES

- HV startup without power supply capacitor
- Low System Cost and High Efficiency
- Low operation current
- Primary-side Sensing and Regulation Without TL431 and Opto-coupler
- Cycle-by-Cycle Current Limiting
- Built-in Leading Edge Blanking (LEB)
- LED Short Circuit Protection
- LED Open Circuit Protection
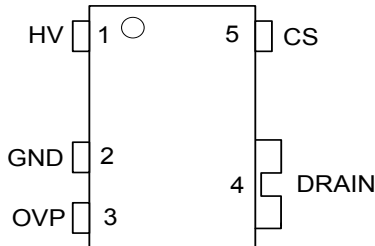- Thermal foldback

APPLICATIONS

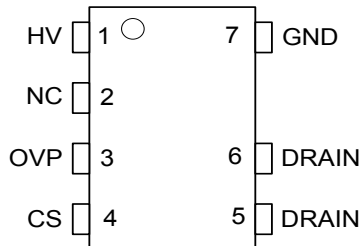- LED lighting

TYPICAL APPLICATION
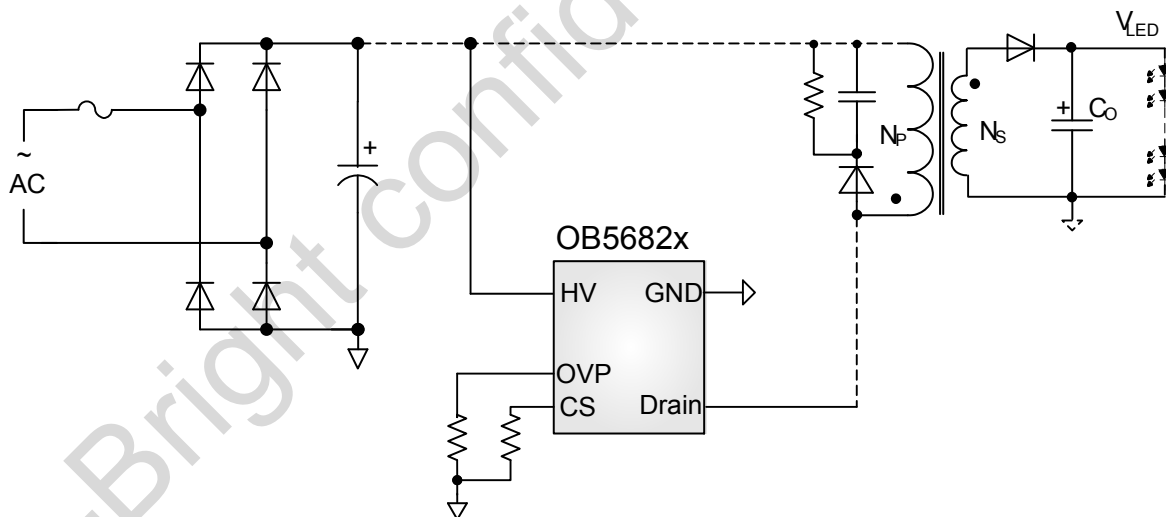
GENERAL INFORMATION
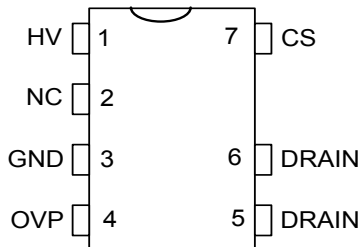
Pin Configuration

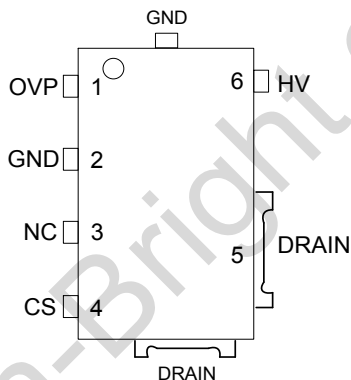The pin map is shown as below for SOT33-5(A).

The pin map is shown as below for SOP7.

The pin map is shown as below for DIP7.

The pin map is shown as below for CDFN8-7.

Package Dissipation Rating

Package	RθJA (℃/W)
SOT33-5(A)	145
SOP7	95
DIP7	77
CDFN8-7	125

Ordering Information

Part Number	Description
OB5682MMKP-H	SOT33-5(A), Halogen-free in T&R
OB5682NJP-H	SOP7, Halogen-free in Tube
OB5682NJPA-H	SOP7, Halogen-free in T&R
OB5682NJP	SOP7, Halogen-free in Tube
OB5682NJPA	SOP7, Halogen-free in T&R
OB5682PJP	SOP7, Halogen-free in Tube
OB5682PJPA	SOP7, Halogen-free in T&R
OB5682PASP	DIP7, Halogen-free in Tube
OB5682TASP	DIP7, Halogen-free in Tube
OB5682MWUP-H	CDFN8-7,Halogen-free in Tube
OB5682MWUPA-H	CDFN8-7,Halogen-free in T&R
OB5682NWUP-H	CDFN8-7,Halogen-free in Tube
OB5682NWUPA-H	CDFN8-7,Halogen-free in T&R
OB5682SWUP-H	CDFN8-7,Halogen-free in Tube
OB5682SWUPA-H	CDFN8-7,Halogen-free in T&R

Absolute Maximum Ratings

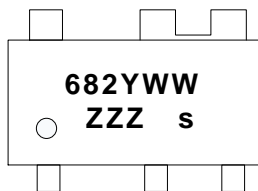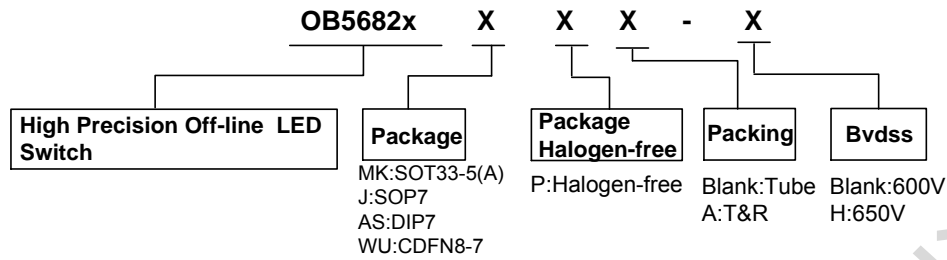| Parameter	Value
Drain Voltage	-0.3 to BVdss
HV Voltage	-0.3 to 650V
CS Input Voltage	-0.3 to 8V
OVP Input Voltage	-0.3 to 8V
Min/Max Operating Junction Temperature T_J	-40 to 150 ℃
Operating Ambient Temperature T_A	-40 to 85 ℃
Min/Max Storage Temperature T_{stg}	-55 to 150 ℃
Lead Temperature (Soldering, 10secs)	260 ℃

Note: Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute maximum-rated conditions for extended periods may affect device reliability.

Output Power Table

Product	90~264Vac Input	220Vac±20% Input
OB5682MMKP-H	6W	10W
OB5682NJP-H	9W	12W
OB5682NJP	9W	12W
OB5682PJP	12W	15W
OB5682PASP	14W	20W
OB5682TASP	16W	24W
OB5682SWUP-H	5W	7W
OB5682MWUP-H	6.3W	10.5W
OB5682NWUP-H	8.6W	11.7W

Note: Maximum practical continuous power in an open frame design with sufficient drain pattern as a heat sink, at 50℃ ambient and 60℃ temperature rise. Higher output power is possible with extra added heat sink, air circulation and decrease output current to reduce thermal resistance.

Marking Information

OB5682x X X X - X

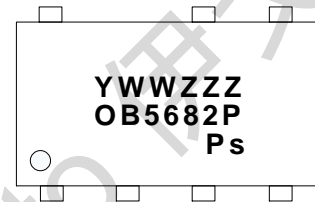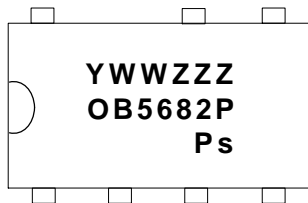| High Precision Off-line LED Switch	Package	Package Halogen-free	Packing	Bvdss
	MK:SOT33-5(A) J:SOP7 AS:DIP7 WU:CDFN8-7	P:Halogen-free	Blank:Tube A:T&R	Blank:600V H:650V

682YWW ZZZ s

Y: Year Code
WW: Week Code (01-52)
ZZZ:Lot Code
S: Internal Code(Optional)

YWWZZZ OB5682N Ps

Y: Year Code
WW: Week Code (01-52)
ZZZ:Lot Code
P:Halogen-free Package
S: Internal Code(Optional)

YWWZZZ OB5682P Ps

Y: Year Code
WW: Week Code (01-52)
ZZZ:Lot Code
P:Halogen-free Package
S: Internal Code(Optional)

YWWZZZ OB5682P Ps

Y: Year Code
WW: Week Code (01-52)
ZZZ:Lot Code
P:Halogen-free Package
s: Internal Code(Optional)

YWWZZZ OB5682T Ps

Y: Year Code
WW: Week Code (01-52)
ZZZ:Lot Code
P:Halogen-free Package
s: Internal Code(Optional)
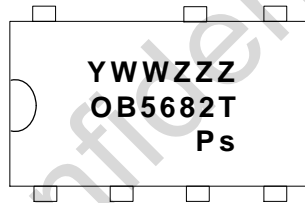
YWWZZZ OB5682M Ps

Y: Year Code
WW: Week Code (01-52)
ZZZ:Lot Code
P:Halogen-free Package
S: Internal Code(Optional)

YWWZZZ OB5682N Ps

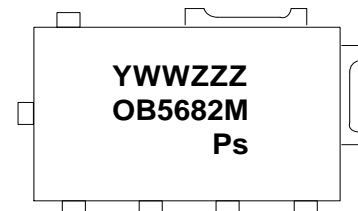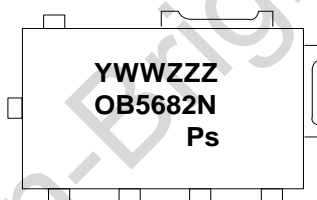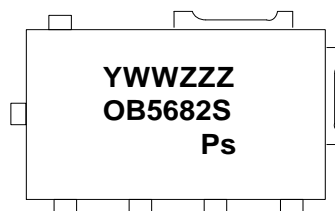Y: Year Code
WW: Week Code (01-52)
ZZZ:Lot Code
P:Halogen-free Package
S: Internal Code(Optional)

YWWZZZ OB5682S Ps

Y: Year Code
WW: Week Code (01-52)
ZZZ:Lot Code
P:Halogen-free Package
S: Internal Code(Optional)

TERMINAL ASSIGNMENTS for OB5682MMKP-H

Pin Num	Pin Name	I/O	Description
1	HV	P	High Voltage power supply
2	GND	P	Ground
3	OVP	I	Over Voltage Protection configuration pin
4	Drain	I	Drain of internal MOSFET
5	CS	I	Current sense pin

TERMINAL ASSIGNMENTS for OB5682NJP-H/ PJP/NJP

Pin Num	Pin Name	I/O	Description
1	HV	P	High Voltage power supply
2	NC		No connection
3	OVP	I	Over Voltage Protection configuration pin
4	CS	I	Current sense pin
5,6	Drain	I	Drain of internal MOSFET
7	GND	P	Ground

TERMINAL ASSIGNMENTS for OB5682PASP/ TASP

Pin Num	Pin Name	I/O	Description
1	HV	P	High Voltage power supply
2	NC		No connection
3	GND	P	Ground
4	OVP	I	Over Voltage Protection configuration pin
5,6	Drain	I	Drain of internal MOSFET
7	CS	I	Current sense pin

TERMINAL ASSIGNMENTS for OB5682MWUP-H/ NWUP-H/ SWUP-H

Pin Num	Pin Name	I/O	Description
1	OVP	I	Over Voltage Protection configuration pin
2	GND	P	Ground
3	NC		No connection
4	CS	I	Current sense pin
5	Drain	I	Drain of internal MOSFET
6	HV	P	High Voltage power supply

BLOCK DIAGRAM
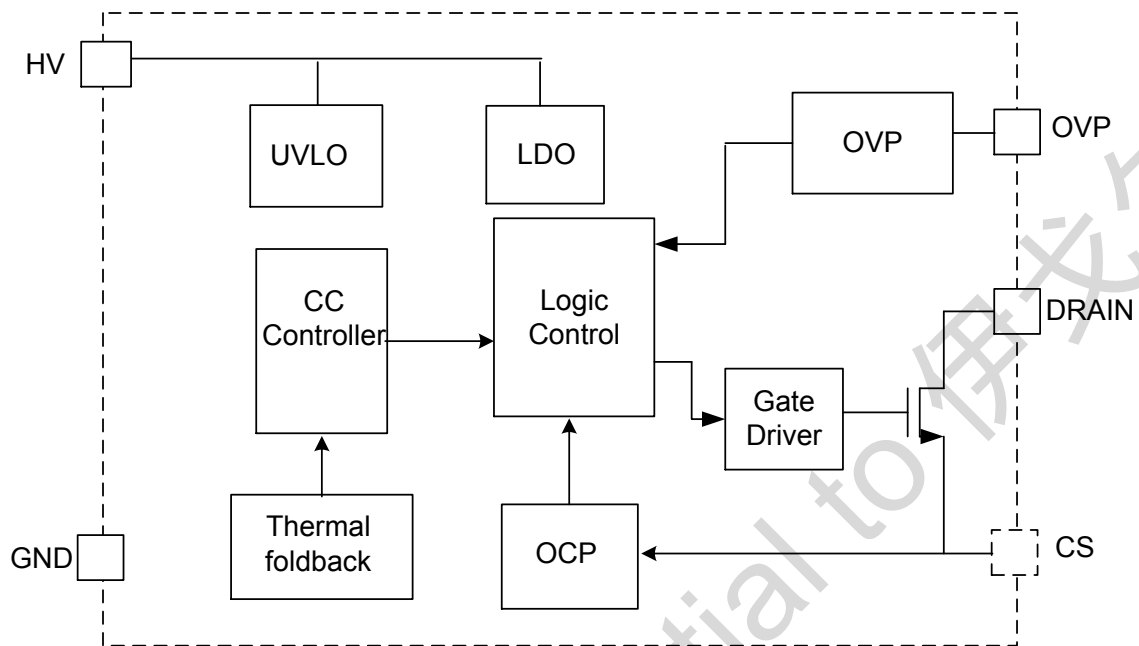
ELECTRICAL CHARACTERISTICS

(TA = 25℃if not otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Unit
Supply Voltage (HV) Section						
I_static	Static Current	HV=45V		200		uA
Current Sense Input Section						
TLEB	Leading Edge Blanking time			0.4		us
Vth_ocp	Over current threshold			500		mV
Toff_max	Maximum off time			600		us
Ton_max	Maximum on time			50		us
Tdem_blk	Demag blanking time			2		us
OVP Section						
Toff_min	Minimum off time	Rovp=10Kohm		5		us
		Rovp=floating		4.7		us
Thermal Section						
Thermal	Thermal regulation threshold			150		℃

Product \ Parameter	BVdss(V) MOSFET Drain-Source Breakdown Voltage		
	Min	Typ.	Max
OB5682MMKP-H	650		
OB5682NJP-H	650		
OB5682NJP	630		
OB5682PJP	600		
OB5682PASP	600		
OB5682TASP	600		
OB5682MWUP-H	650		
OB5682NWUP-H	650		
OB5682SWUP-H	650		

OPERATION DESCRIPTION

OB5682x is a cost effective PWM power switch optimized for off-line LED lighting applications. Based on flyback converter topology working in DCM mode, it operates in primary side sensing and regulation, It significantly simplifies the LED lighting system design by eliminating the secondary side feedback circuitry, HV startup resistor and power supply capacitor. Proprietary built-in CC control can achieve high precision LED current meeting LED lighting application requirements.

Start up Control

At work state, OB5682x gets power supply directly from HV pin and regulates the supply voltage by internal startup circuits.

Principle of CC Operation

To support OB5682x proprietary CC control, system needs to be designed in DCM mode for flyback system (Refer to Typical Application Diagram on page1) ,and the minimum reflected voltage V_{RO_MIN} should be more than 50V.
The minimum reflected voltage V_{RO_MIN} is given by

$$V_{RO\_MIN} = N \cdot V_{O\_MIN} \qquad (1)$$

Where N is the ratio of transformer between primary winding and secondary winding, V_{O_MIN} is the minimum output voltage.
The LED output current I_{LED} is given by

$$I_{LED} = \frac{1}{2} L_P . F_{SW} . I_{PK}{}^2 / V_O \qquad (2)$$

Where Lp indicates the inductance of primary winding, Ipk is the peak current of primary winding.
Refer to the equation 2, the change of the primary winding inductance results in the change of the constant output current. To compensate the change from variations of primary winding inductance, the switching frequency is locked by an internal loop such that the switching frequency is
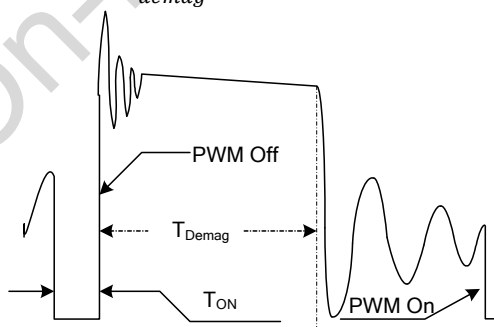
$$F_{SW} = \frac{1}{2T_{demag}} \qquad (3)$$

Figure.1 Primary voltage waveform

Since Tdemag is direct proportional to the inductance, as a result, the product of *Lp* and *Fsw* is constant, thus output current will not change as primary winding inductance changes. The output LED current is

$$I_{LED} = \frac{1}{4} N \frac{V_{th\_ocp}}{R_{CS}} \qquad (4)$$

Where Vth_ocp is over current threshold.

Adjustable CC point and Output Power

In OB5682x, the CC point and maximum output power can be externally adjusted by external current sense resistor Rcs at CS pin as illustrated in Typical Application Diagram.   The output power is adjusted through CC point change.   The larger Rcs, the smaller CC point is, and the smaller output power becomes.

Operation switching frequency

The switching frequency of OB5682x is adaptively controlled according to the load conditions and the operation modes. No external frequency setting components are required.
For flyback operating in DCM, The operation frequency is given by

$$F_{SW} = \frac{V_O . N^2}{8 . L_P . I_{LED}} \qquad (5)$$

The switching frequency at maximum output power is recommended 65kHz~75kHz, and the minimum switching frequency at normal operation should not below 30kHz.

Current Sensing and Leading Edge Blanking

Cycle-by-Cycle current limiting is offered in OB5682x. The switch current is detected by a sense resistor into the CS pin. An internal leading edge blanking circuit chops off the sensed voltage spike at initial power MOSFET on state so that the external RC filtering on sense input is no longer needed.

LED Short Circuit Protection

OB5682x detects the states of LED. When LED string short circuit occurs, the switching frequency is reduced to the minimum switching frequency with maximum Toff time. OB5682x resumes normal operation after the fault condition is removed.

Programmable LED Open Circuit Protection / OVP

The OB5682x provide programmable output over voltage protection when LED string are open. The threshold voltage of OVP is set by the minimum off time (Toff_min), when the off time of OB5682x is less then the Toff_min OB5682x stops switching and re-detect the LED string status after 150ms (typical). If the fault condition is removed, OB5682x resumes normal operation. Otherwise,

the above operation is repeated. The minimum off time (Toff_min) is given by

$$T_{off\_min} = \frac{L_P.V_{th\_ocp}}{N.R_{CS}.V_{OVP}} \qquad (6)$$

Where Vovp is threshold voltage of OVP.
A resistor Rovp is connected between the OVP pin and ground. The minimum off time (Toff_min) can be adjusting the resistance of Rovp, the resistance is given by

$$R_{OVP} = \frac{0.05}{T_{off\_min}} \qquad (7)$$

And the resistance range of Rovp should be 5K~16K for Toff_min setting.

When OVP pin floating, Toff_min is set to 4.7us internally.

Thermal foldback
OB5682x provides thermal foldback function to control LED output current. The LED current will reduce with the temperature rise up. When the temperature is over 150℃ (typical), the output current follows the thermal foldback function scheme. When the temperature is below 150℃ (typical), the output current returns to the full level.

PACKAGE MECHANICAL DATA

SOP7
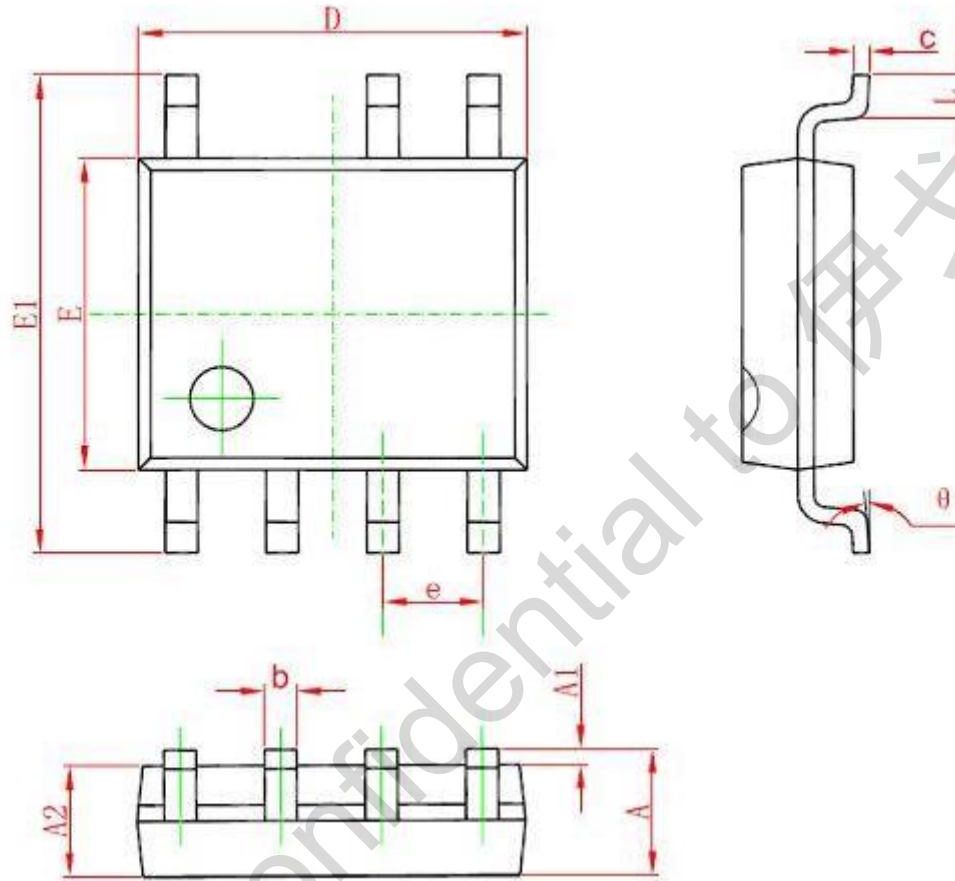
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	**Max**	**Min**	**Max**
A	1.350	1.750	0.053	0.069
A1	0.050	0.250	0.002	0.010
A2	1.250	1.650	0.049	0.065
b	0.310	0.510	0.012	0.020
c	0.100	0.250	0.004	0.010
D	4.700	5.150	0.185	0.203
E	3.700	4.100	0.146	0.161
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0º	8º	0º	8º

SOT33-5(A)
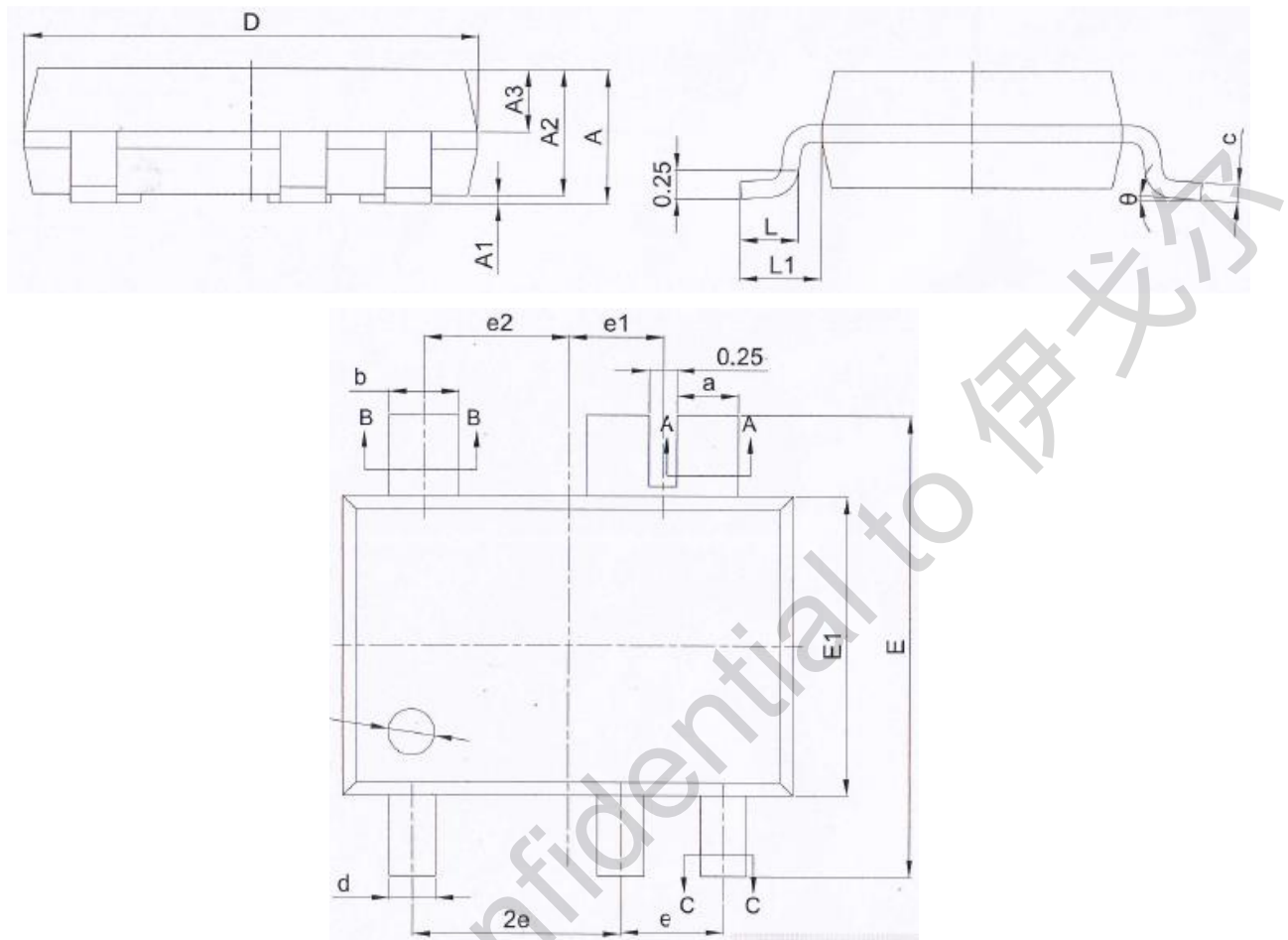
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	**Max**	**Min**	**Max**
A	-	1.30	-	0.051
A1	0.05	0.15	0.002	0.006
A2	1.05	1.15	0.041	0.045
a	0.52	0.60	0.020	0.024
b	0.58	0.66	0.023	0.026
c	0.15	0.19	0.006	0.007
D	3.80	4.00	0.150	0.157
E1	2.50	2.70	0.098	0.106
E	3.80	4.20	0.150	0.165
e	0.90(BSC)		0.035(BSC)	
e1	0.81(BSC)		0.032(BSC)	
e2	1.25(BSC)		0.049(BSC)	
L	0.40	0.60	0.016	0.024
θ	0º	8º	0º	8º

DIP7
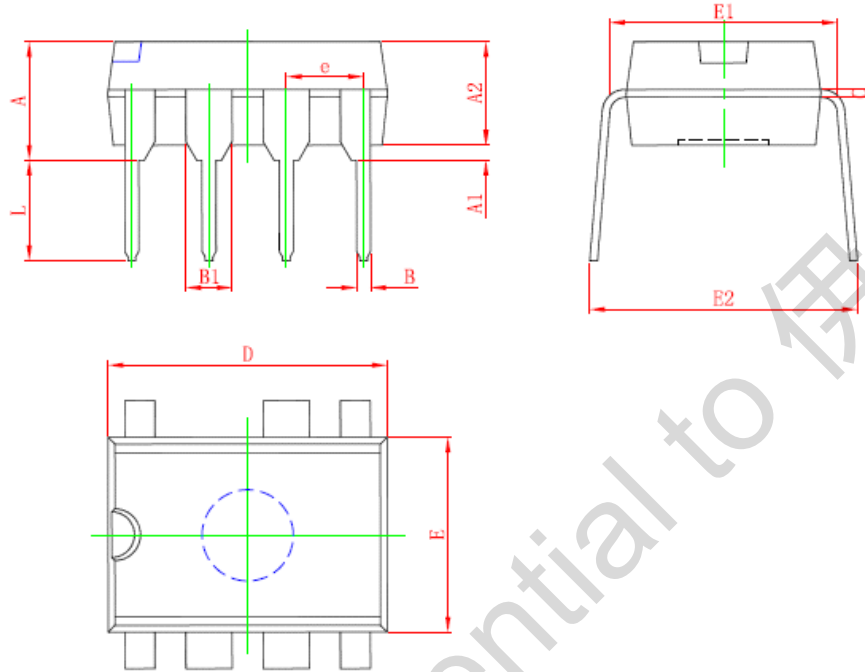
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.710	5.334	0.146	0.210
A1	0.381		0.015	
A2	2.921	4.953	0.115	0.195
B	0.350	0.650	0.014	0.026
B1	1.524 (BSC)		0.06 (BSC)	
C	0.200	0.360	0.008	0.014
D	9.000	10.160	0.354	0.400
E	6.096	7.112	0.240	0.280
E1	7.320	8.255	0.288	0.325
e	2.540 (BSC)		0.1 (BSC)	
L	2.921	3.810	0.115	0.150
E2	7.620	10.920	0.300	0.430

CDFN8-7
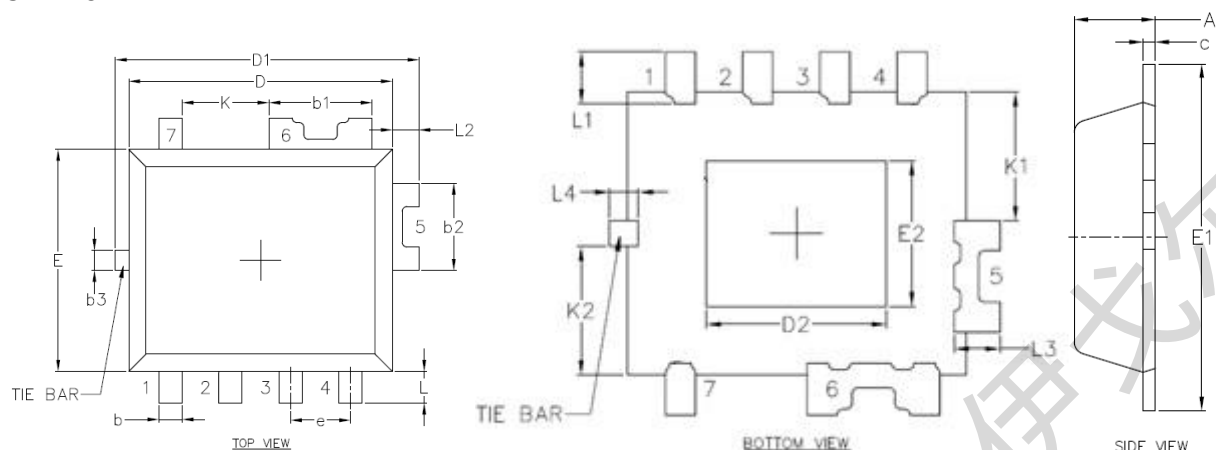
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	**Max**	**Min**	**Max**
A	0.95	1.05	0.037	0.041
b	0.30	0.40	0.012	0.016
b1	1.50	1.60	0.059	0.063
b2	1.25	1.35	0.049	0.053
b3*Note	0.20	0.35	0.008	0.014
c	0.10	0.20	0.004	0.008
D	3.90	4.00	0.154	0.157
D1	4.40	4.70	0.173	0.185
D2	2.00	2.20	0.079	0.087
E	2.95	3.35	0.116	0.132
E1	3.84	4.34	0.151	0.171
E2	1.60	1.80	0.063	0.071
e	0.85	0.95	0.033	0.037
L	0.42	0.52	0.017	0.020
L1	0.63 Max.		0.025 Max.	
L2	0.30	0.45	0.012	0.018
L3	0.56 Max.		0.022 Max.	
L4	0.36 Max.		0.014 Max.	
K	1.25	1.35	0.049	0.053
K1	1.28	1.63	0.050	0.064
K2	1.28	1.63	0.050	0.064

*Note: Not recommended to connect this pin with PCB by soldering or any other conductive material.

IMPORTANT NOTICE

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On-Bright Electronics Corp. reserves the right to make corrections, modifications, enhancements, improvements and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

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