



## Constant current primary side control power switch

### Description

D80422 is the control power switch chip apply to off-line small power AC/DC switch power supply of high performance of the primary side feedback, to achieve high precision of constant current output in the full input voltage range, precision is less than  $\pm 5\%$ , no loop compensation, without the opt coupler, without TL431 and transformer auxiliary winding and other components, reduce the system costs.

The chip integrates cycle-by-cycle peak current limit, the FB over-voltage protection, open/short circuit protection and boot soft start protection and so on, in order to improve the reliability of the system.

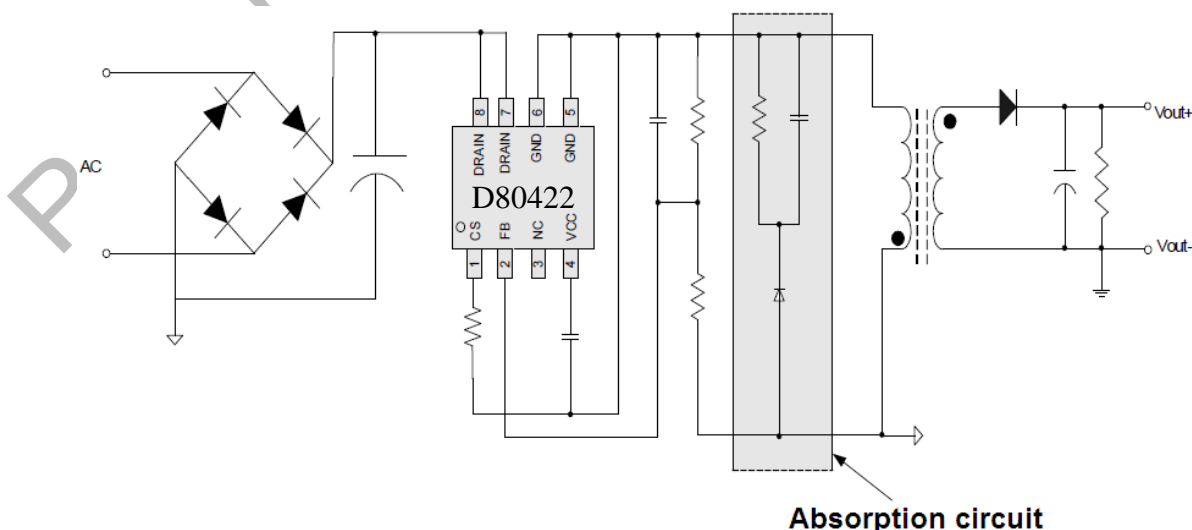
### Feature

- Topology structure: fly back and low cost BUCK-Boost
- Use 730V single chip integrated process
- The precision of constant current  $< \pm 5\%$  in the width input voltage 85Vac~265Vac range
- Compatible with 1-5W in universal input voltage
- Patent of primary side feedback control technology without primary of auxiliary winding, which leave out opt coupler and 431 components from the system.
- Without loop circuit compensate
- Built-in LEB
- Compare cycle-by-cycle peak current
- Output open/short circuit protection
- Built-in boot soft start
- Built-in FB over voltage protection and short circuit protection and so on
- Available in SOP-8 package

### Application

- LED lighting driver

### Typical Application

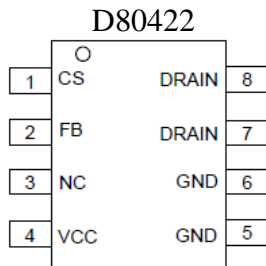




## Output Power List

|               |              |               |
|---------------|--------------|---------------|
| Input voltage | 85Vac~265Vac | 180Vac~265Vac |
| Output power  | 1~5W         | 5~7W          |

## Pin Configuration



## Pin Definition

| Pin No. | Pin Name | Pin Description                          |
|---------|----------|--|
| 1       | CS       | Primary side peak current detection port |
| 2       | FB       | Output voltage feeding port              |
| 3       | NC       | Empty pin                                |
| 4       | VCC      | Internal power supply voltage port       |
| 5, 6    | GND      | Ground of chip                           |
| 7, 8    | DRAIN    | Power switch tube leakage port input     |

## Absolute Maximum Ratings (TA=25°C)

| Symbol           | Description            | Range   | Unit |
|------------------|------------------------|---------|------|
| VCC              | Chip operating voltage | -0.3~6  | V    |
| V <sub>FB</sub>  | FB input voltage       | ~       | V    |
| V <sub>CS</sub>  | CS input voltage       | -0.3~7  | V    |
| T <sub>A</sub>   | Operating temperature  | -20~125 | °C   |
| T <sub>stg</sub> | Storage temperature    | -40~150 | °C   |



|                 |                           |            |               |
|-----------------|---------------------------|------------|---------------|
| $V_{ESD}$       | Human body model          | 4          | KV            |
| $R_{\theta ja}$ | Thermal resistance        | 65         | $^{\circ}C/W$ |
| $V_{DS}$        | $V_{DS}$ pressure voltage | -0.3 ~ 730 | V             |

## Electrical Characteristics ( $T_A=25^{\circ}C$ , $V_{CC}=6V$ , unless special notes)

| Symbol         | Description                                       | Range |      |     | Unit    |
|----------------|---|-------|------|-----|---------|
|                |   | Min   | Typ  | Max |         |
| $I_{CC}$       | Quietness current                                 |       | -250 |     | $\mu A$ |
| $V_{CC}$       | Internal voltage supply                           |       | 6    |     | V       |
| $V_{CS}$       | Current detection threshold value                 |       | 620  |     | mA      |
| $T_{LEB}$      | Lead edge blanking time                           |       | 450  |     | nS      |
| $V_{FBMIN}$    | FB Min. threshold value                           |       | 300  |     | mV      |
| $V_{FBMAX}$    | FB over voltage threshold value                   |       | 4    |     | V       |
| $T_{DEM\_MIN}$ | Min. degaussing time                              |       | 5    |     | $\mu S$ |
| $D_{MAX}$      | Max duty cycle                                    |       | 42   |     | %       |
| $R_{DSON}$     | On-resistance                                     |       | 15   |     | Ohm     |
| $B_{VD\_SS}$   | Against breakdown voltage                         |       | 730  |     | V       |
| $V_{CC\_UVLO}$ | $V_{CC}$ under-voltage protection threshold value |       | 4    |     | V       |

## Application information

D80422 is the control power switch chip apply to off-line small power AC/DC switch power supply of high performance of the primary side feedback, in the universal input voltage range, constant current output precision is less than  $\pm 5\%$ . D80422 control the system output through primary sampling mode, the internal integration of high voltage process, without the opt coupler and TL431 components. The chip integrates cycle-by-cycle peak current limit, the FB over-voltage protection, output open/short circuit protection and boot soft start protection and so on, in order to improve the reliability of the system.

## Start-up and Control

The internal of D80422 integration of high voltage power switch, leave out the external



start-up resistor and auxiliary winding of power supply circuit through high voltage start-up, greatly reduce the system cost.

## Operating principle

The IC realize to control the primary side high-precision constant current, application system of flyback power supply must to operating in DCM mode, the IC control the output voltage/current through detection the fly back voltage of primary auxiliary winding. The output current depends on turns ratio and peak current:

$$I_o = 2/7 \times N \times I_p \quad (1)$$

$I_o$  is output current

$N$  is turns ratio of transformer

## Operating frequently

D80422 control switch frequency by load size, no need the external frequently set components (the max switch frequency should less than 65K). In the discontinue flyback power mode, the max output power is:

$$P_o = \frac{1}{2} \times L_p \times F_{sw} \times I_p^2 \quad (3)$$

$L_p$  is primary winding inductance.  $I_p$  is primary winding peak current. By the formula 3, change the primary winding inductance will lead to the constant current change in the max output power and constant current mode. In order to compensate for the primary inductance variation, the internal loop circuit will lock the switch frequency, switch frequency locking can be expressed as below:

$$F_{sw} = \frac{4}{7 \times T_{DEMAG}} \quad (4)$$

Because the  $T_{DEMAG}$  and inductance is inversely, the product of  $L_p$  and  $F_{sw}$  remained unchanged though the frequency locked. The constant current will not change with the primary inductance in the max output power and constant current mode. D80422 chip max compensate for the range  $\pm 10\%$  of inductance value.

## Current detection and LEB

Chip through the CS port detection the voltage of sense resistor to control the power switch action, thus realizing to control the current of the transformer primary side, provide



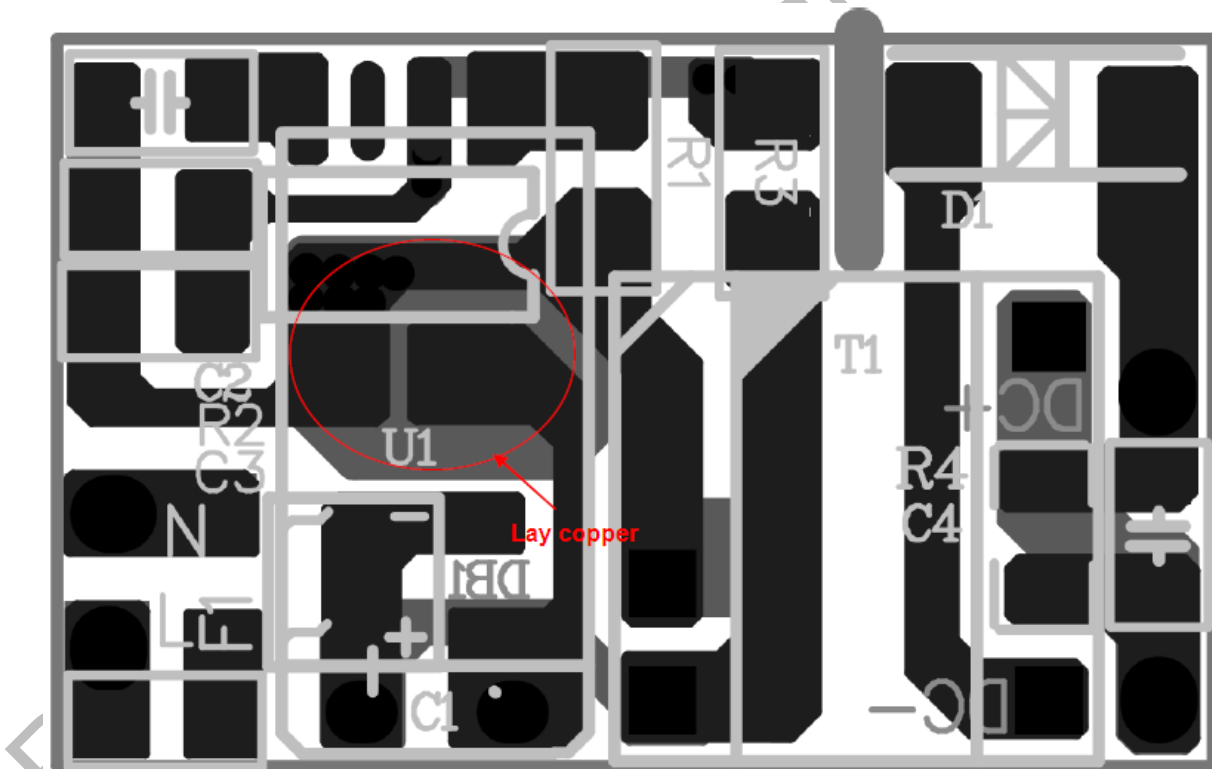
cycle-by-cycle peak current limit. Input the switch current to the CS pin through an external sense resistor.

In order to eliminate the peak interface caused by the high voltage power MOSFET in the turn on moments, built-in leading edge blanking, avoid the misoperation in the power MOSFET in the turn on moments, so that can leave out the external RC filter circuit and save system cost.

## Protection circuit

Improve the system reliability, the D80422 IC integrated various protection, include: cycle-by-cycle peak current limited, output short circuit protection, FB over voltage protection, soft start and so on.

## PCB Layout Notes:



The chip pin5, 6 need to laying copper for heat dissipation, as both the top and the bottom need to lay copper, in order to reduce the temperature of the chip and improve the performance of system.

As possible as short the loop circuit distance between the transformer and DRAIN pin, the loop area as small as possible, can't lay the large area of copper.

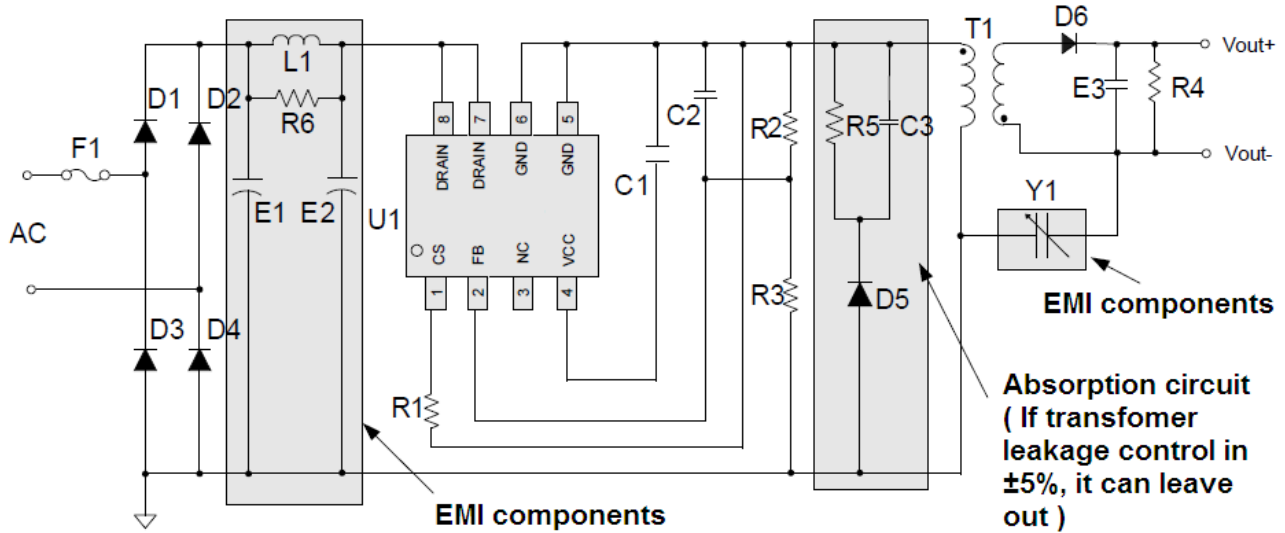
When lay the FB pin wire, must be far away from the high voltage loop circuit, the distance  $\geq 1\text{mm}$ , to avoid the influence.



## Typical Application Solution

D80422 18V/300mA LED advanced lighting solution

Schematic diagram:

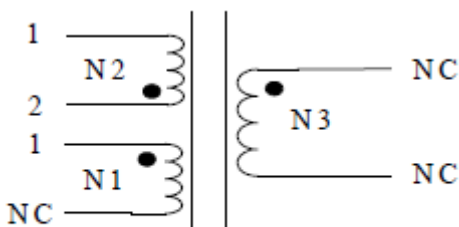


### BOM list:

| Place          | Parameter  | Place | Parameter |
|----------------|------------|-------|-----------|
| D1、D2、D3、D4、D5 | RS1M       | C1    | 1uF/16V   |
| D6             | ES1J       | C2    | 15pF/16V  |
| R1             | 1.8Ω/1206  | C3    | 102/1KV   |
| R2             | 39K        | U1    | D80422    |
| R3             | 1M/1206    | F1    | 0.5A/250V |
| R4、R6          | 20K/1206   | T1    | EE13      |
| R5             | 120K/1206  | L1    | 2.2mH/1W  |
| E1、E2          | 4.7uf/400V | Y1    | 102/250V  |
| E3             | 10uF/35V   |       |           |

### Transformer Parameter:

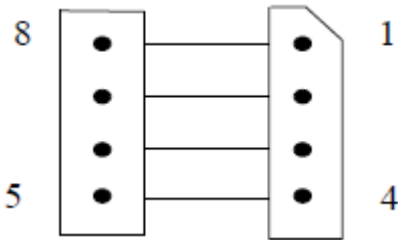
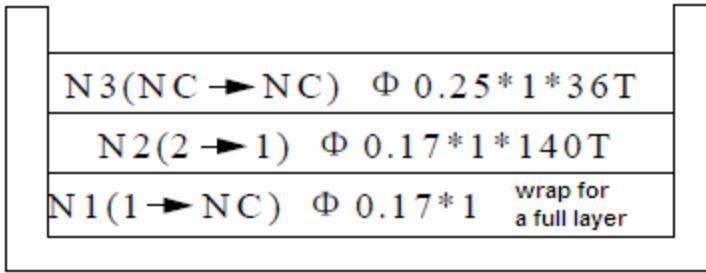
Use three insulated wires winding



- inlet wire



## Transformer winding method



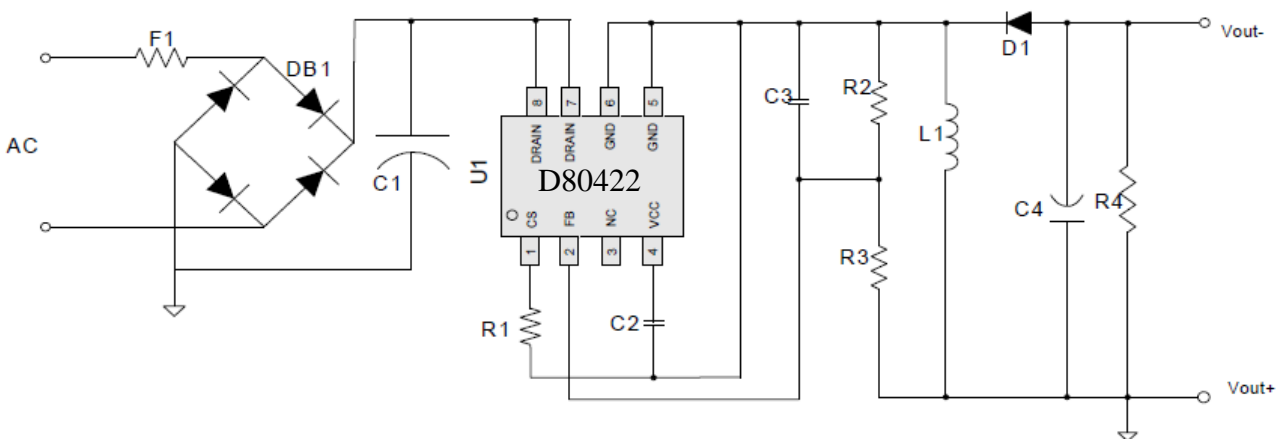
Bottom view

### Instruction:

1. Bobbin EE13 (4+4) horizontal, PC40 magnetic core.
2. Inductance  $L_P(2 \rightarrow 1) = 2.0\text{mH}$ , leakage inductance should lower than  $\pm 5\%$  of  $L_P$ .
3. Primary to secondary withstand voltage for 3000VAC, leakage current  $< 2\text{mA}/60\text{s}$ .
4. Primary to magnetic core withstand voltage for 1500VAC, leakage current  $< 2\text{mA}/60\text{s}$ .
5. Secondary to magnetic core withstand voltage for 1500VAC, leakage current  $< 2\text{mA}/60\text{s}$ .
6. Test 1min in DC500V condition, winding to mechanic core  $> 100\text{ m}\Omega$ .
7. Test 1min in DC500V condition, winding to winding  $> 100\text{ m}\Omega$ .

## D80422 60V/100mA BUSK-Boost power supply solution

### Schematic Diagram:





## BOM File:

| Place | Parameter  | Place | Parameter                        |
|-------|------------|-------|----------------------------------|
| DB1   | MB6S       | C2    | 1uF                              |
| D1    | ES1J       | C3    | 15pF                             |
| R1    | 1.6Ω/1206  | C4    | 10uF/1206                        |
| R2    | 75K        | F1    | 10R wound wire resistor          |
| R3    | 2M/1206    | L1    | 2.4mh/ saturation current >400mA |
| R4    | 120K       | U1    | D80422                           |
| C1    | 6.8uf/400V |       |                                  |

D80422 EMI conduction picture

L wire

## EMI TEST REPORT

----- parameter

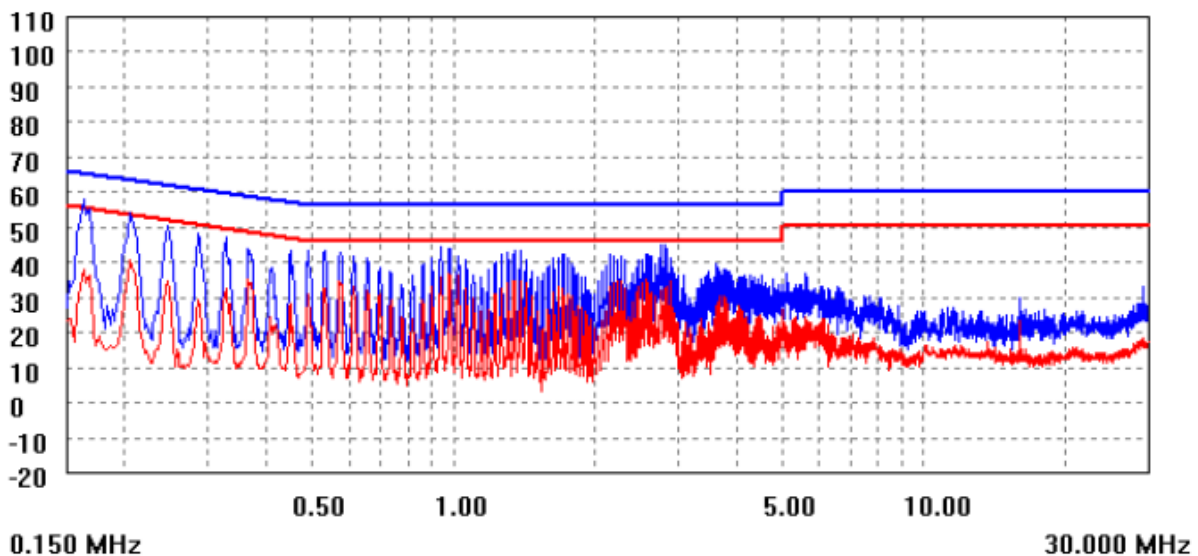
|                        |  |                               |
|------------------------|--|-------------------------------|
| <b>Organization:</b>   | <b>Operator:</b>                       | <b>EUT:</b>                   |
| <b>Place:</b>          | <b>Time:</b> 2012/12/5/17:35           | <b>Test equipment:</b> KH3935 |
| <b>Detector:</b> PK+AV | <b>Test-time(ms):</b> 20               | <b>SN:</b> 1135217            |
| <b>Limit:</b> EN55022B | <b>Transductor(PK/AV):</b> PK-1 / AV-1 |                               |
| <b>Remark:</b>         |  |                               |

----- freq, step

| Start(MHz) | End(MHz) | Step(MHz) |
|------------|----------|-----------|
| 0.150      | 2.000    | 0.002     |
| 2.000      | 10.000   | 0.010     |
| 10.000     | 30.000   | 0.025     |

----- scan result

dBuV







N wire

## EMI TEST REPORT

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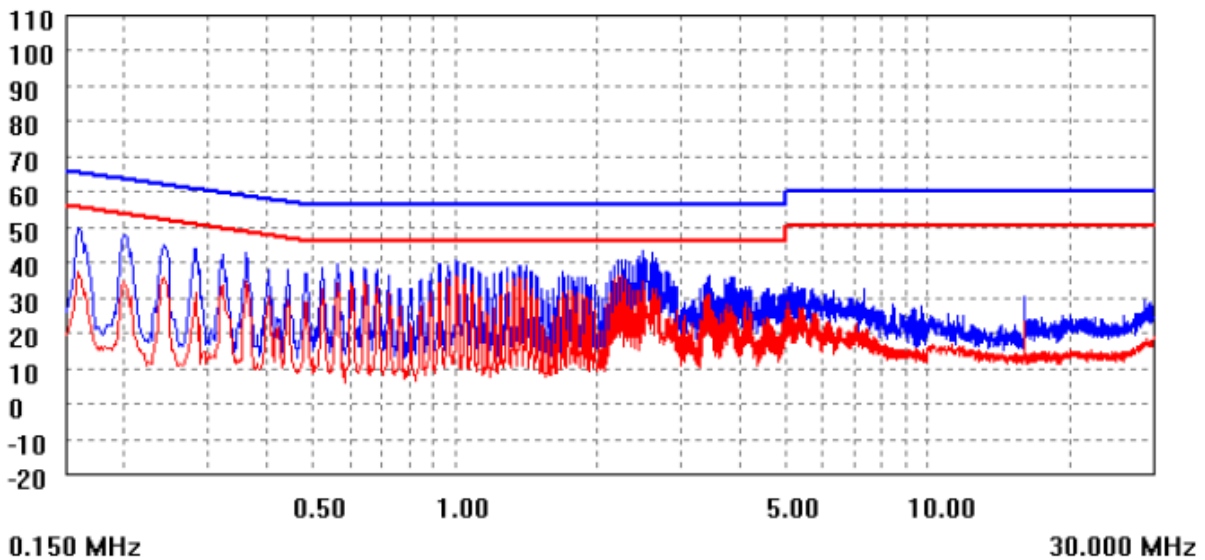
|                        |  |                               |
|------------------------|--|-------------------------------|
| <b>Organization:</b>   | <b>Operator:</b>                       | <b>EUT:</b>                   |
| <b>Place:</b>          | <b>Time:</b> 2012/12/5/17:41           | <b>Test equipment:</b> KH3935 |
| <b>Detector:</b> PK+AV | <b>Test-time(ms):</b> 20               | <b>SN:</b> 1135217            |
| <b>Limit:</b> EN55022B | <b>Transductor(PK/AV):</b> PK-1 / AV-1 |                               |
| <b>Remark:</b>         |  |                               |

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|                   |                 |                  |
|-------------------|-----------------|------------------|
| <b>Start(MHz)</b> | <b>End(MHz)</b> | <b>Step(MHz)</b> |
| 0.150             | 2.000           | 0.002            |
| 2.000             | 10.000          | 0.010            |
| 10.000            | 30.000          | 0.025            |

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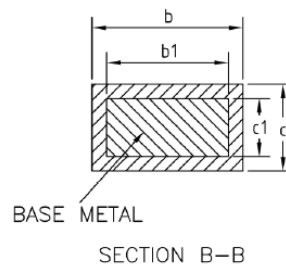
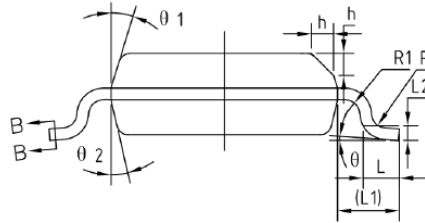
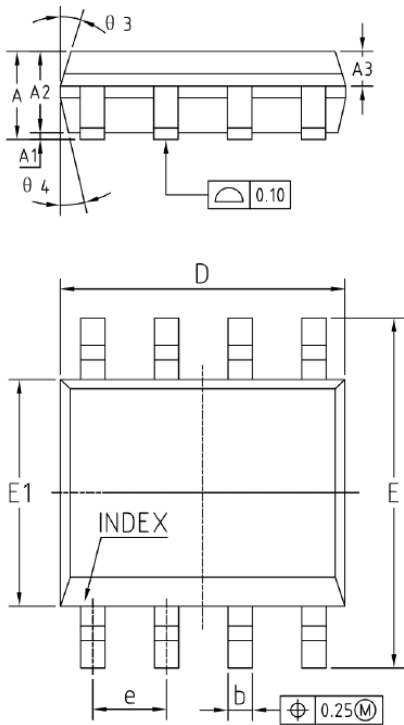
**dBuV** scan result





## Physical Dimensions

SOP-8



COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

| SYMBOL  | MIN     | NOM  | MAX  |
|---------|---------|------|------|
| A       | 1.35    | 1.55 | 1.75 |
| A1      | 0.10    | 0.15 | 0.25 |
| A2      | 1.25    | 1.40 | 1.65 |
| A3      | 0.50    | 0.60 | 0.70 |
| b       | 0.38    | —    | 0.51 |
| b1      | 0.37    | 0.42 | 0.47 |
| c       | 0.17    | —    | 0.25 |
| c1      | 0.17    | 0.20 | 0.23 |
| D       | 4.80    | 4.90 | 5.00 |
| E       | 5.80    | 6.00 | 6.20 |
| E1      | 3.80    | 3.90 | 4.00 |
| e       | 1.27BSC |      |      |
| L       | 0.45    | 0.60 | 0.80 |
| L1      | 1.04REF |      |      |
| L2      | 0.25BSC |      |      |
| R       | 0.07    | —    | —    |
| R1      | 0.07    | —    | —    |
| h       | 0.30    | 0.40 | 0.50 |
| theta   | 0°      | —    | 8°   |
| theta 1 | 15°     | 17°  | 19°  |
| theta 2 | 11°     | 13°  | 15°  |
| theta 3 | 15°     | 17°  | 19°  |
| theta 4 | 11°     | 13°  | 15°  |

NOTES:  
ALL DIMENSIONS MEET JEDEC STANDARD MS-012 AA  
DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.



| 日期<br>Date | 版本<br>Version | 说明<br>Description   | 排版<br>Typical<br>setting | 工程师<br>Engineer | 状态<br>Status |
|------------|---------------|---|--------------------------|-----------------|--------------|
| 2013-7-2   | A0            | /   | F                        | /               | Cancel       |
| 2014-4-12  | A1_E          | /   | E                        | 林剑波             | Cancel       |
| 2016-7-26  | A2_J          | Correct internal power MOSFET SPEC. and change the typical setting. | Jasper                   | /               | Active       |