

## 1. 产品概述

ULN2402 是单片集成高耐压、大电流达林顿管阵列，电路内部包含四个独立的达林顿管驱动电路。电路内部设计有续流二极管，可用于驱动继电器、步进电机等感性负载。单个达林顿管集电极可输出 500mA 电流。将达林顿管并联可实现更高的输出电流能力。该电路可广泛应用于继电器驱动、照明驱动、显示屏驱动(LED)、步进电机驱动和逻辑缓冲器。

逻辑接口兼容 5V TTL 和 CMOS 电平。

## 2. 应用

- 继电器驱动
- 指示灯驱动
- 显示屏驱动

## 3. 特征

- 集成 4 个达林顿管
- 每个达林顿管驱动器输出电流 500 mA（峰值 600 mA）
- 输出电压 50 V
- 内部集成反向续流二极管
- TTL/CMOS 电平输入兼容
- 与输出引脚相对放置的输入引脚，以简化布局

## 4. 产品信息

| 产品型号          | 封装形式   | 备注        |
|---------------|--------|-----------|
| ULN2402-SO-TP | SOP10  | 卷盘，4000/包 |
| ULN2402-MS-TP | MSOP10 | 卷盘，4000/包 |

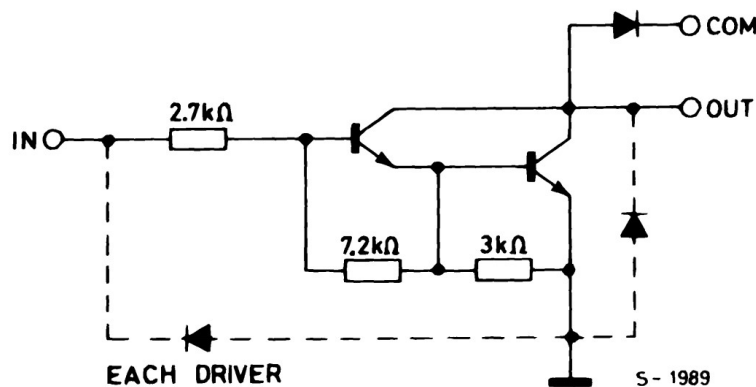


图 1 芯片内部简图（每个通道）

## 5. 引脚配置和功能

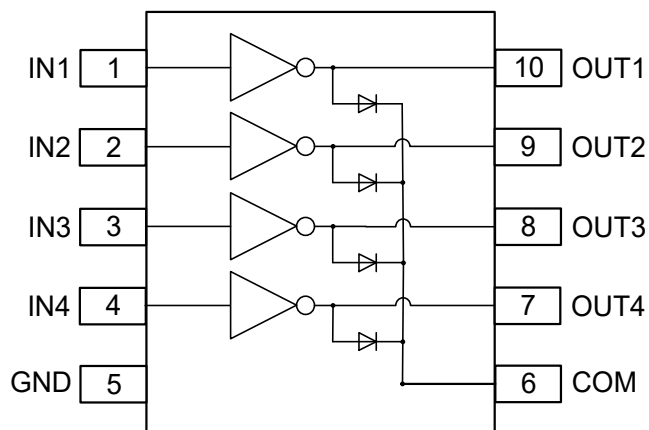


图 2 引脚图（顶视图）

## 6. 规格

### 6.1 绝对最大额定值

最大工作温度范围（除非另有说明）<sup>（1）（2）</sup>

| 符号               | 参数        | 最大值        | 单位 |
|------------------|-----------|------------|----|
| V <sub>ce</sub>  | 输出电压      | 50         | V  |
| V <sub>i</sub>   | 输入电压      | 30         | V  |
| I <sub>c</sub>   | 集电极连续电流   | 500        | mA |
| I <sub>B</sub>   | 基极连续电流    | 25         | mA |
| I <sub>F</sub>   | 钳位二极管持续电流 | 500        | mA |
| V <sub>R</sub>   | 钳位二极管反向电压 | 50         | V  |
| T <sub>J</sub>   | 可工作结温     | 150        | °C |
| T <sub>A</sub>   | 可工作环境温度   | -40 to 85  | °C |
| T <sub>stg</sub> | 存储温度      | -55 to 150 | °C |

（1）超出绝对最大额定值的范围可能对设备造成永久性损坏。这些只是等级强调。在那些任何其他超过建议条件下的芯片功能未说明。长时间工作在绝对最大额定值的条件下可能影响芯片的可靠性。

### 6.2 电气特性

T<sub>A</sub>=25°C （除非另有说明）

| 符号                   | 参数                   | 条件                                          | 最小值  | 典型值  | 最大值  | 单位 |
|----------------------|----------------------|---------------------------------------------|------|------|------|----|
| I <sub>CEX</sub>     | 输出漏电流                | V <sub>CE</sub> =50V, (图 3)                 |      |      | 50   | uA |
| V <sub>CE(SAT)</sub> | 集电极-发射极饱和电压<br>(图 4) | I <sub>C</sub> =30mA, V <sub>I</sub> =2.4V  |      |      | 1.0  | V  |
|                      |                      | I <sub>C</sub> =120mA, V <sub>I</sub> =2.4V |      |      | 1.2  |    |
|                      |                      | I <sub>C</sub> =350mA, V <sub>I</sub> =2.4V |      |      | 1.6  |    |
| I <sub>I(ON)</sub>   | 输入电流 (图 5)           | V <sub>I</sub> =3.85V                       |      | 0.93 | 1.30 | mA |
| I <sub>I(OFF)</sub>  | 输入电流 (图 6)           | I <sub>C</sub> =500uA, V <sub>CE</sub> =5V  | 50   |      |      | uA |
| V <sub>I(ON)</sub>   | 输入电压 (图 7)           | V <sub>CE</sub> =2V, I <sub>C</sub> =200mA  |      | 1.9  | 2.4  | V  |
|                      |                      | V <sub>CE</sub> =2V, I <sub>C</sub> =250mA  |      | 2.0  | 2.7  |    |
|                      |                      | V <sub>CE</sub> =2V, I <sub>C</sub> =300mA  |      | 2.1  | 3.0  |    |
| h <sub>FE</sub>      | 直流正向电流增益<br>(图 4)    | V <sub>CE</sub> =2V, I <sub>C</sub> =350mA  | 1000 |      |      |    |
| C <sub>I</sub>       | 输入电容                 |                                             |      | 15   | 25   | pF |
| t <sub>PLH</sub>     | 开启延迟时间               | 0.5V <sub>I</sub> to 0.5V <sub>O</sub>      |      | 0.15 | 1    | us |
| t <sub>PHL</sub>     | 关断延迟时间               | 0.5V <sub>I</sub> to 0.5V <sub>O</sub>      |      | 0.15 | 1    | us |
| I <sub>R</sub>       | 钳位二极管泄漏电流<br>(图 8)   | V <sub>R</sub> =50V                         |      |      | 100  | uA |
| V <sub>F</sub>       | 钳位二极管正向电压<br>(图 9)   | I <sub>F</sub> =500mA                       |      | 1.6  | 2.0  | V  |

## 6.3 测试电路

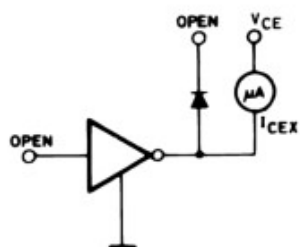


图3 输出漏电流

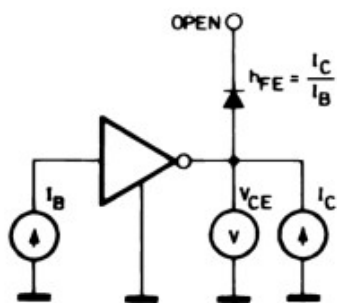


图4 集电极-发射极饱和电压

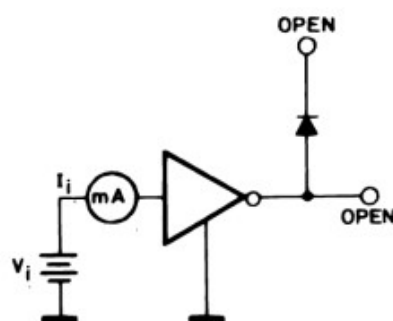


图5 输入电流 (ON)

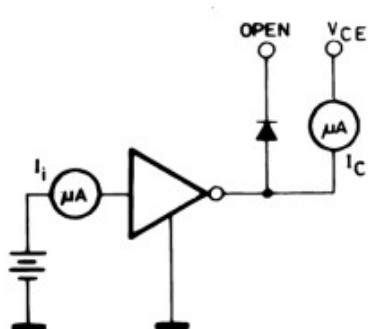


图6 输入电流 (OFF)

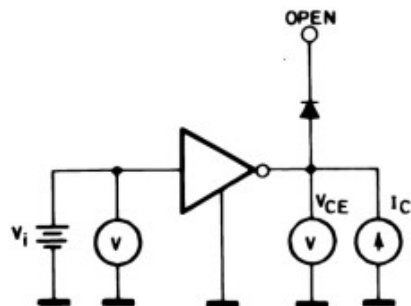


图7 输入电压

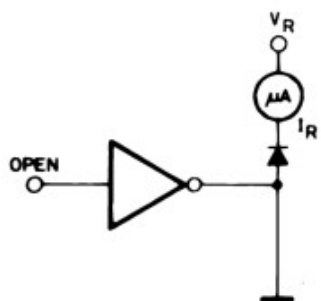


图8 钳位二极管漏电流

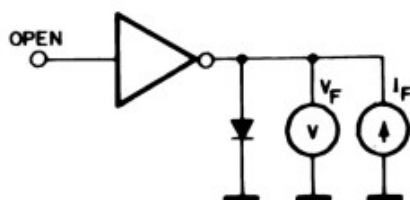
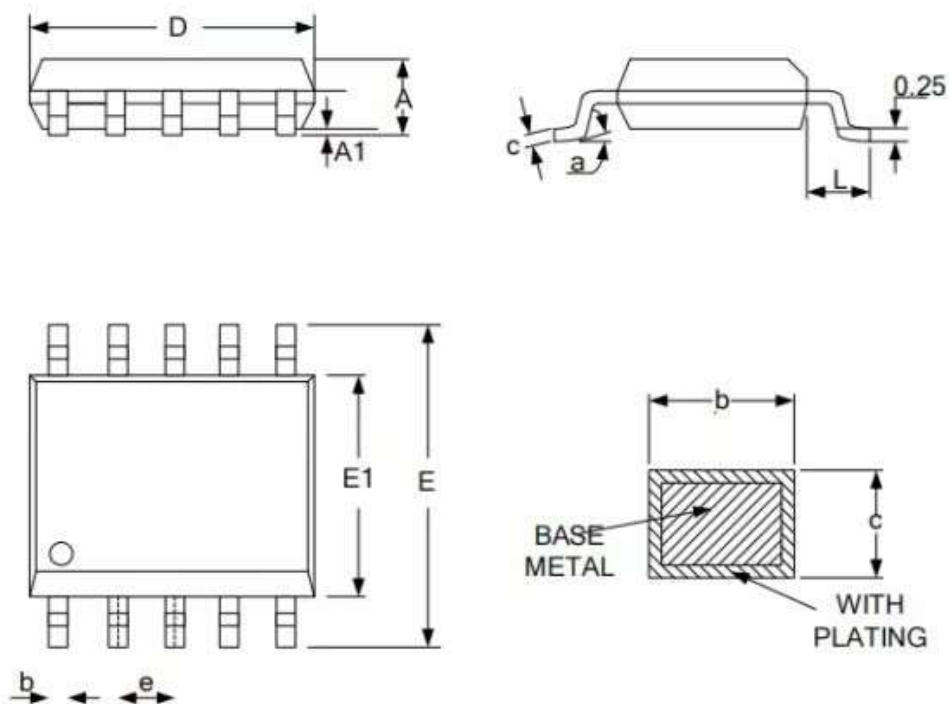


图9 钳位二极管正向电压

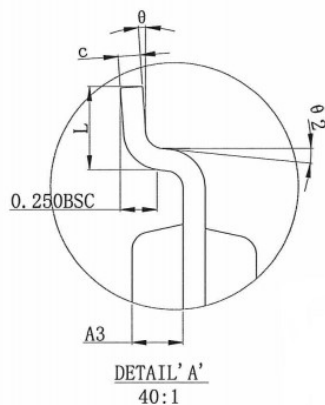
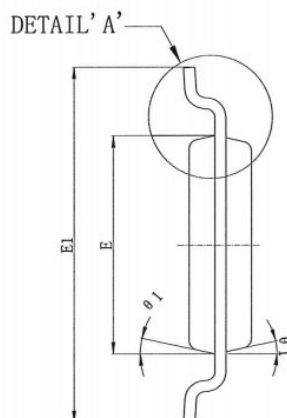
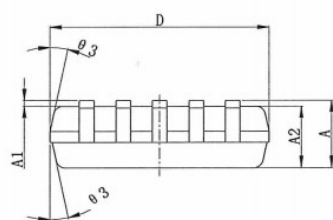
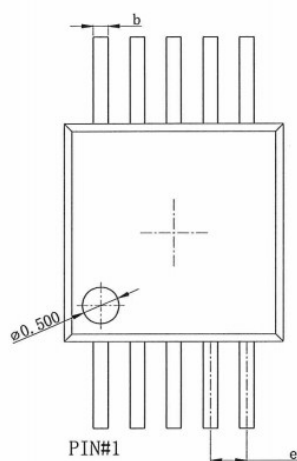
## 7. 封装信息

SOP10:



| SYMBOL | MILLIMETER |      |      |
|--------|------------|------|------|
|        | MIN        | NOM  | MAX  |
| A      | -          | -    | 1.75 |
| A1     | 0.10       | -    | 0.23 |
| b      | 0.30       | -    | 0.40 |
| c      | 0.19       | -    | 0.25 |
| D      | 4.70       | 4.90 | 5.10 |
| E      | 5.80       | 6.00 | 6.20 |
| E1     | 3.70       | 3.90 | 4.10 |
| e      | 1.00BSC    |      |      |
| L      | 0.40       | -    | 0.80 |
| a      | 0°         | -    | 8°   |

## MSOP10:



| SYMBOL     | MILLIMETER |       |       |
|------------|------------|-------|-------|
|            | MIN        | NOM   | MAX   |
| A          | 0.820      | 0.930 | 1.100 |
| A1         | 0.020      | 0.080 | 0.150 |
| A2         | 0.750      | 0.850 | 0.950 |
| A3         | 0.249      | 0.349 | 0.449 |
| c          | 0.090      | 0.152 | 0.230 |
| E          | 2.900      | 3.000 | 3.100 |
| E1         | 4.750      | 4.900 | 5.050 |
| L          | 0.400      | 0.600 | 0.800 |
| b          | 0.180      | 0.200 | 0.280 |
| D          | 2.900      | 3.000 | 3.100 |
| e          | 0.500BSC   |       |       |
| $\theta$   | 0°         | 3°    | 6°    |
| $\theta_1$ | 12° REF.   |       |       |
| $\theta_2$ | 4° REF.    |       |       |
| $\theta_3$ | 12° REF.   |       |       |

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