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**1.0A High-side Power Distribution Switch with Enable and Flag**

**AP2810**

**General Description**

The AP2810 is an integrated high-side power switch that consists of N-Channel MOSFET, charge pump, over current & temperature and other related protection circuits. The switch's low RDS (ON), 60mΩ, design easily to meet USB voltage drop requirements. It includes soft-start to limit inrush current, over-current protection, load short protection with fold-back, and thermal shutdown to avoid switch failure during hot plug-in. Under voltage lockout (UVLO) function is used to ensure the device remain off unless there is a valid input voltage present. A Flag output is available to indicate fault conditions to the local USB controller.

The AP2810 is available in standard packages of SOIC-8 and MSOP-8.

**Features**

- Low MOSFET on Resistance: 60mΩ @V<sub>IN</sub>=5.0V
- Compliant to USB Specifications
- Operating Voltage Range: 2.7V to 5.5V
- Low Supply Current: 65μA (Typ)
- Low Shutdown Current: 1.0μA (Max)
- Guarantee 1.0A Continuous Load
- Current Limit: 1.1A (Min), 2.1A (Max)
- Under-voltage Lockout
- Logic Level Enable Pin: Available in Active-high or Active-low Version
- Over-current Protection
- Over Temperature Protection
- Load Short Protection with Fold-back
- No Reverse Current When Power off
- With Output Shutdown Pull-low Resistor for A/C Versions

**Applications**

- USB Power Management
- USB Bus/Self Powered Hubs
- Hot-plug Power Supplies
- Battery-charger Circuits
- Notebooks, Motherboard PCs

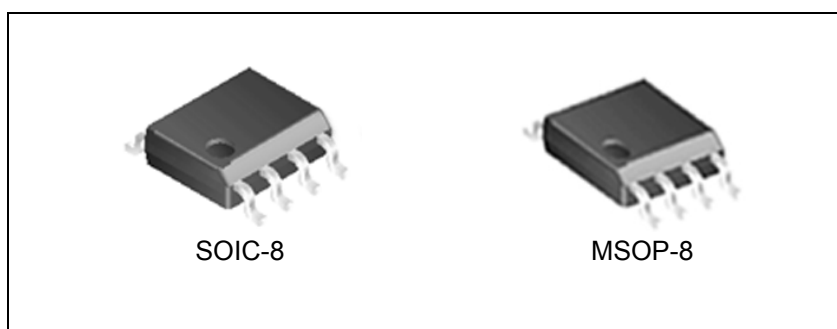


Figure 1. Package Types of AP2810



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**AP2810**

**Pin Configuration**

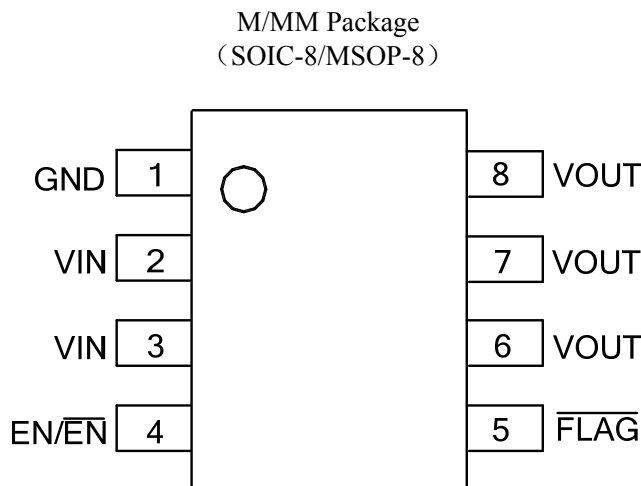


Figure 2. Pin Configuration of AP2810 (Top View)

**Pin Descriptions**

| Pin Number | Pin Name                   | Function  |
|------------|----------------------------|---|
| 1          | GND                        | Ground  |
| 2, 3       | VIN                        | Supply input pin  |
| 4          | EN/ $\overline{\text{EN}}$ | Chip enable control input, active low or high   |
| 5          | $\overline{\text{FLAG}}$   | Fault flag pin, output with open drain, need a pull-up resistor in application, active low to indicate OCP or OTP |
| 6, 7, 8    | VOUT                       | Switch output voltage   |



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**Functional Block Diagram**

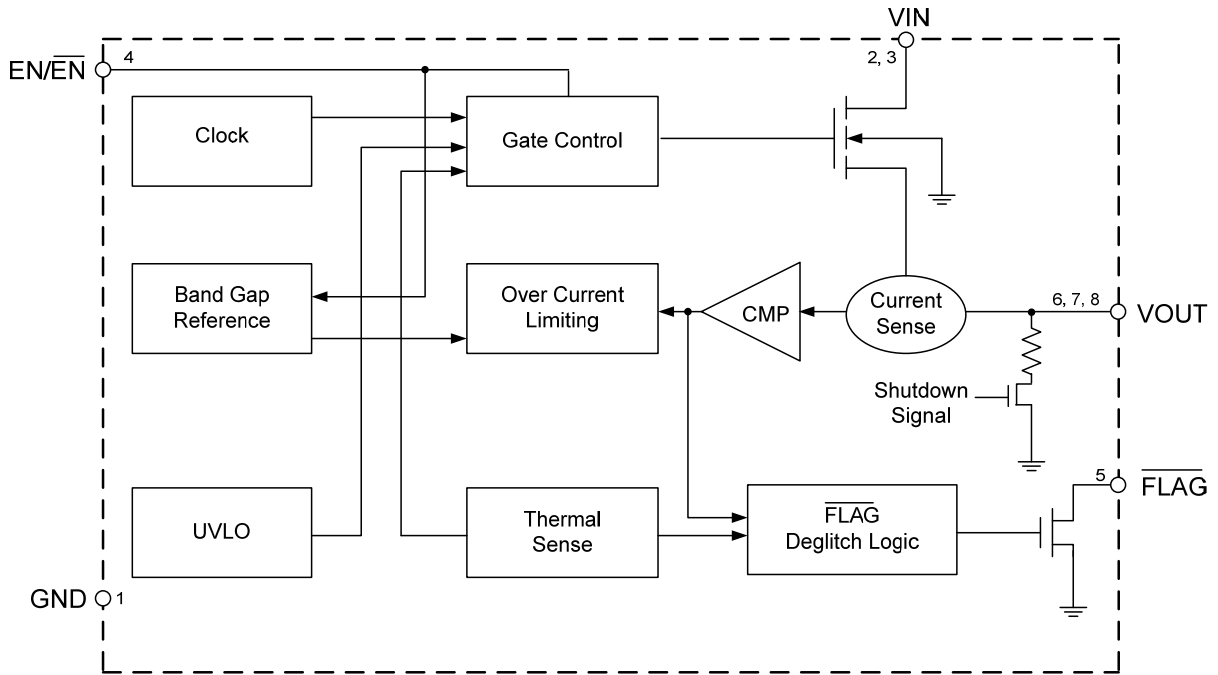


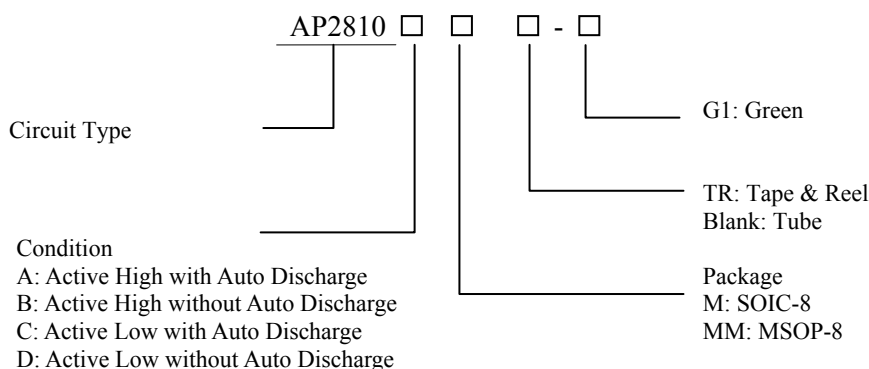
Figure 3. Functional Block Diagram of AP2810



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**Ordering Information**



| Product | Package | Condition                          | Temperature Range | Part Number    | Marking ID | Packing Type |
|---------|---------|------------------------------------|-------------------|----------------|------------|--------------|
|         |         |                                    |                   | Green          | Green      |              |
| AP2810A | SOIC-8  | Active High with Auto Discharge    | -40 to 85°C       | AP2810AM-G1    | 2810AM-G1  | Tube         |
|         |         |                                    |                   | AP2810AMTR-G1  | 2810AM-G1  | Tape & Reel  |
|         | MSOP-8  |                                    |                   | AP2810AMM-G1   | 2810AMM-G1 | Tube         |
|         |         |                                    |                   | AP2810AMMTR-G1 | 2810AMM-G1 | Tape & Reel  |
| AP2810B | SOIC-8  | Active High without Auto Discharge | -40 to 85°C       | AP2810BM-G1    | 2810BM-G1  | Tube         |
|         |         |                                    |                   | AP2810BMTR-G1  | 2810BM-G1  | Tape & Reel  |
|         | MSOP-8  |                                    |                   | AP2810BMM-G1   | 2810BMM-G1 | Tube         |
|         |         |                                    |                   | AP2810BMMTR-G1 | 2810BMM-G1 | Tape & Reel  |
| AP2810C | SOIC-8  | Active Low with Auto Discharge     | -40 to 85°C       | AP2810CM-G1    | 2810CM-G1  | Tube         |
|         |         |                                    |                   | AP2810CMTR-G1  | 2810CM-G1  | Tape & Reel  |
|         | MSOP-8  |                                    |                   | AP2810CMM-G1   | 2810CMM-G1 | Tube         |
|         |         |                                    |                   | AP2810CMMTR-G1 | 2810CMM-G1 | Tape & Reel  |
| AP2810D | SOIC-8  | Active Low without Auto Discharge  | -40 to 85°C       | AP2810DM-G1    | 2810DM-G1  | Tube         |
|         |         |                                    |                   | AP2810DMTR-G1  | 2810DM-G1  | Tape & Reel  |
|         | MSOP-8  |                                    |                   | AP2810DMM-G1   | 2810DMM-G1 | Tube         |
|         |         |                                    |                   | AP2810DMMTR-G1 | 2810DMM-G1 | Tape & Reel  |

BCD Semiconductor's Pb-free products, as designated with "G1" suffix in the part number, are RoHS compliant and Green.



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**Absolute Maximum Ratings (Note 1)**

| Parameter                                | Symbol        | Value      | Unit |      |
|--|---------------|------------|------|------|
| Power Supply Voltage                     | $V_{IN}$      | 6.0        | V    |      |
| Operating Junction Temperature Range     | $T_J$         | 150        | °C   |      |
| Storage Temperature Range                | $T_{STG}$     | -65 to 150 | °C   |      |
| Lead Temperature (Soldering, 10 Seconds) | $T_{LEAD}$    | 260        | °C   |      |
| Thermal Resistance Junction to Ambient   | $\theta_{JA}$ | SOIC-8     | 135  | °C/W |
|  |               | MSOP-8     | 150  |      |
| ESD (Machine Model)                      |               | 200        | V    |      |
| ESD (Human Body Model)                   |               | 2000       | V    |      |

Note 1: Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and 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 Ratings” for extended periods may affect device reliability.

**Recommended Operating Conditions**

| Parameter                           | Symbol   | Min | Max | Unit |
|-------------------------------------|----------|-----|-----|------|
| Supply Voltage                      | $V_{IN}$ | 2.7 | 5.5 | V    |
| Operating Ambient Temperature Range | $T_A$    | -40 | 85  | °C   |



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**Electrical Characteristics**

( $V_{IN}=5.0V$ ,  $C_{IN}=2.2\mu F$ ,  $C_{OUT}=1.0\mu F$ , Typical  $T_A=25^\circ C$ , unless otherwise specified)

| Parameter                                 | Symbol          | Conditions                          | Min  | Typ | Max | Unit       |
|---|-----------------|-------------------------------------|------|-----|-----|------------|
| Input Voltage Range                       | $V_{IN}$        |                                     | 2.7  |     | 5.5 | V          |
| Switch On Resistance                      | $R_{DS(ON)}$    | $V_{IN}=5V$ , $I_{OUT}=1.0A$        |      | 60  | 80  | m $\Omega$ |
| Current Limit                             | $I_{LIMIT}$     | $V_{OUT}=4.0V$                      | 1.1  | 1.5 | 2.1 | A          |
| Supply Current                            | $I_{SUPPLY}$    | $V_{IN}=5V$ , No Load               |      | 65  | 85  | $\mu A$    |
| Fold-back Short Current                   | $I_{SHORT}$     | $V_{OUT}=0$                         |      | 0.6 |     | A          |
| Shutdown Supply Current                   | $I_{SHUTDOWN}$  | Chip Disable, Shutdown Mode         |      | 0.1 | 1   | $\mu A$    |
| Enable High Input Threshold               | $V_{ENH}$       |                                     | 1.6  |     | 5.5 | V          |
| Enable Low Input Threshold                | $V_{ENL}$       |                                     | 0    |     | 1.0 | V          |
| Enable Pin Input Current                  | $I_{EN}$        | Force 0V to 5.0V at EN Pin          | -1.0 |     | 1.0 | $\mu A$    |
| Under Voltage Lockout Threshold Voltage   | $V_{UVLO}$      | $V_{IN}$ Increasing from 0V         | 2.2  | 2.5 | 2.7 | V          |
| Under Voltage Hysteresis                  | $V_{UVLOHY}$    |                                     |      | 0.2 |     | V          |
| Reverse Current                           | $I_{REVERSE}$   | Chip Disable, $V_{OUT}>V_{IN}$      |      | 0.1 | 1.0 | $\mu A$    |
| Output Pull Low Resistance after Shutdown | $R_{DISCHARGE}$ | AP2810A, AP2810C only               |      | 100 | 200 | $\Omega$   |
| Output Turn-on Time                       | $t_{ON}$        | From Enable Active to 90% of Output |      | 500 |     | $\mu s$    |
| Flag Delay Time                           | $t_{DFLG}$      | From Fault Condition to Flag Active | 5    | 10  | 15  | ms         |
| Flag Low Voltage                          | $V_{FLG}$       | $I_{SINK}=5mA$                      |      | 35  | 70  | mV         |
| Flag Leakage                              | $I_{LEAKAGE}$   | Flag Disable, Force 5.0V            |      |     | 1.0 | $\mu A$    |
| Thermal Shutdown Temperature              | $T_{OTS}$       |                                     |      | 150 |     | $^\circ C$ |
| Thermal Shutdown Hysteresis               | $T_{HYOTS}$     |                                     |      | 30  |     | $^\circ C$ |



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**Typical Performance Characteristics**

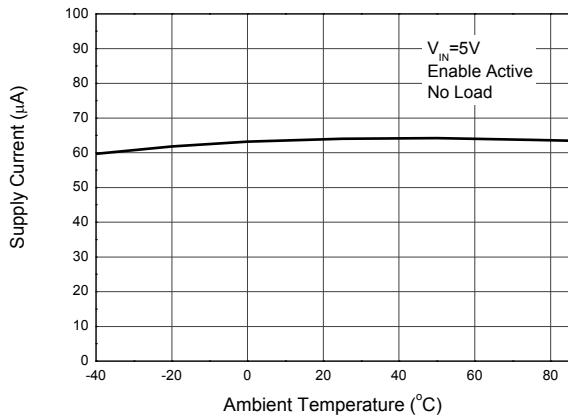


Figure 4. Supply Current vs. Ambient Temperature

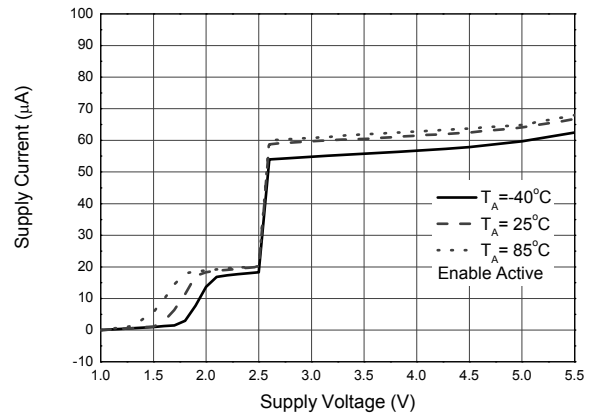


Figure 5. Supply Current vs. Supply Voltage

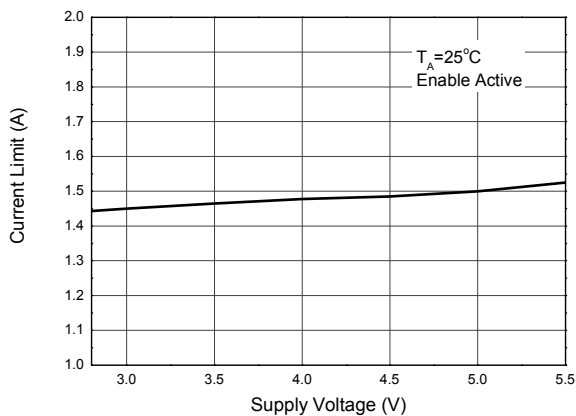


Figure 6. Current Limit vs. Supply Voltage

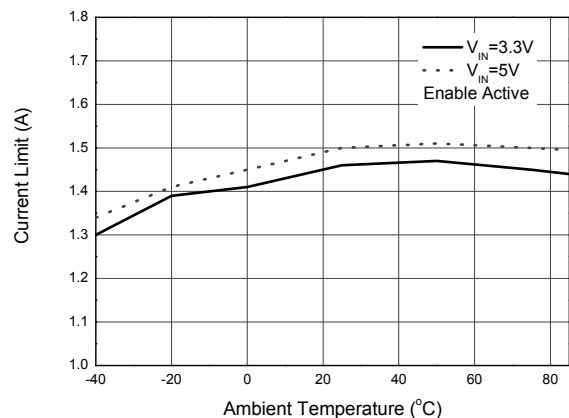


Figure 7. Current Limit vs. Ambient Temperature





**1.0A High-side Power Distribution Switch with Enable and Flag**

**AP2810**

**Typical Performance Characteristics (Continued)**

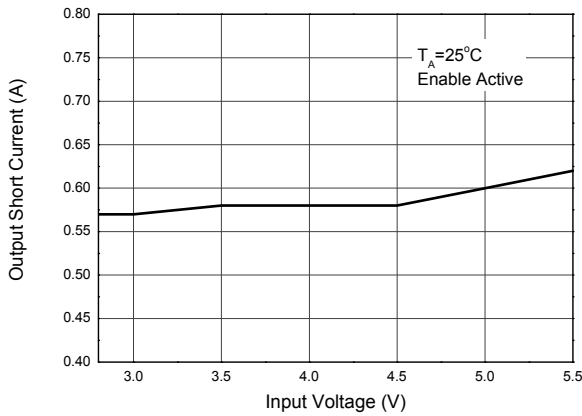


Figure 8. Output Short Current vs. Input Voltage

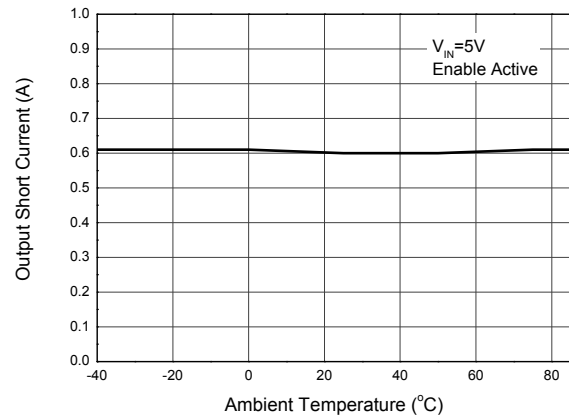


Figure 9. Output Short Current vs. Ambient Temperature

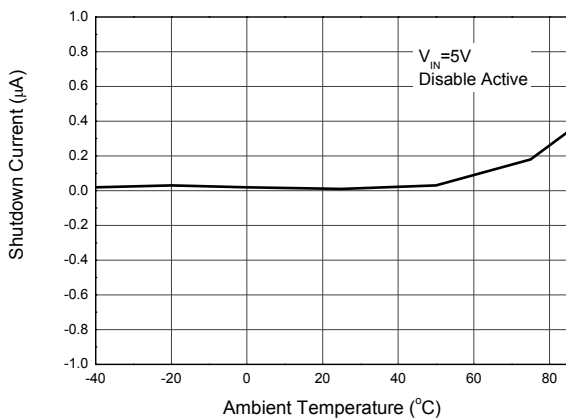


Figure 10. Shutdown Current vs. Ambient Temperature

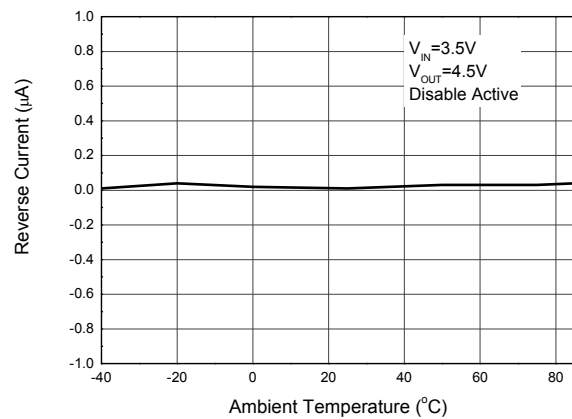


Figure 11. Reverse Current vs. Ambient Temperature



Advance Datasheet

**1.0A High-side Power Distribution Switch with Enable and Flag**

**AP2810**

**Typical Performance Characteristics (Continued)**

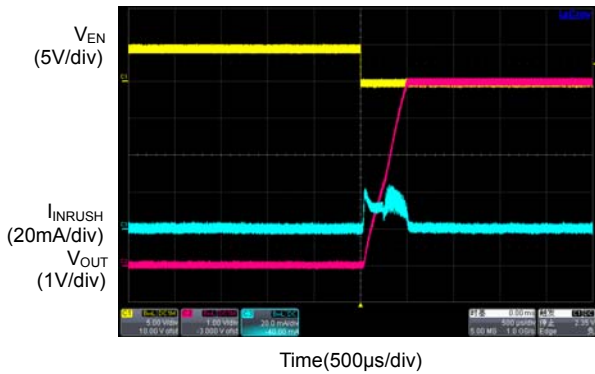


Figure 12. Output Turn ON and Rise Time  
( $C_{IN}=1.0\mu F$ ,  $C_{OUT}=1.0\mu F$ , No Load)

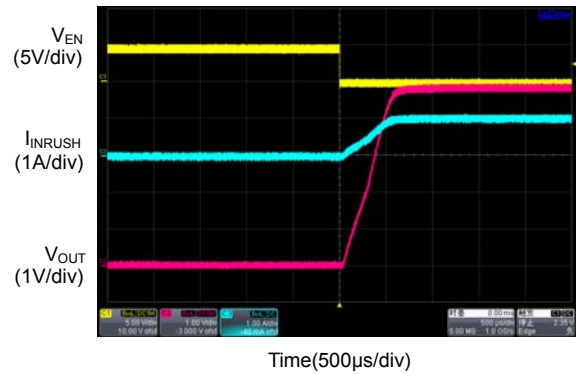


Figure 13. Output Turn ON and Rise Time  
( $C_{IN}=1.0\mu F$ ,  $C_{OUT}=1.0\mu F$ ,  $R_L=5.0\Omega$ )

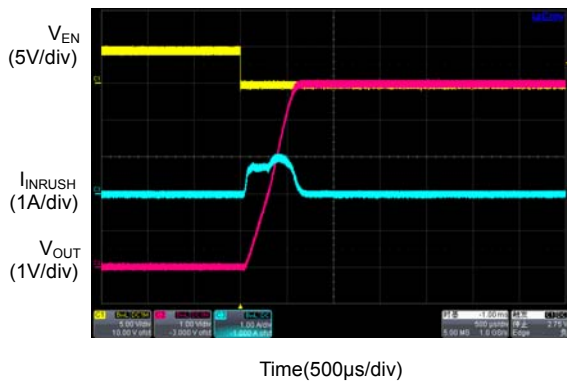


Figure 14. Output Turn ON and Rise Time  
( $C_{IN}=1.0\mu F$ ,  $C_{OUT}=100\mu F$ , No Load)

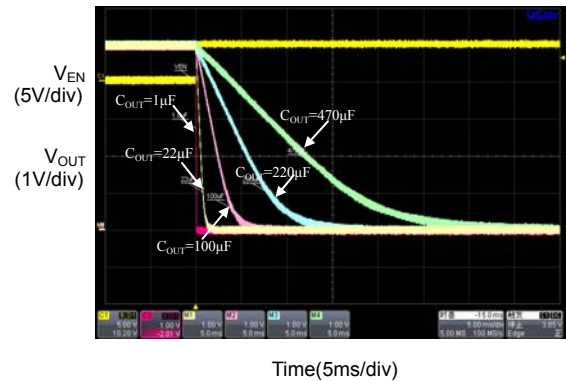


Figure 15. Output Turn OFF and Falling Time  
( $V_{IN}=5V$ ,  $C_{IN}=1.0\mu F$ , No Load)



**1.0A High-side Power Distribution Switch with Enable and Flag**

**AP2810**

**Typical Performance Characteristics (Continued)**

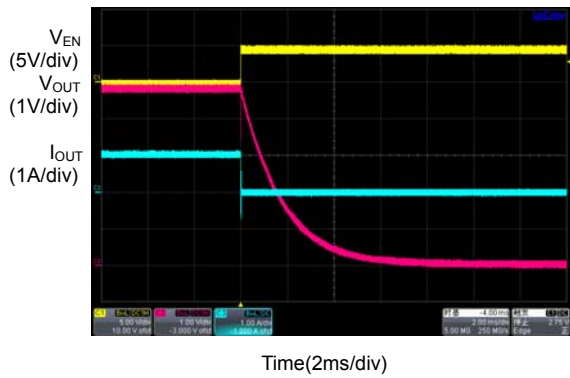


Figure 16. Output Turn OFF and Falling Time  
 $(V_{IN}=5V, C_{IN}=1.0\mu F, C_{OUT}=470\mu F, R_L=5.0\Omega)$

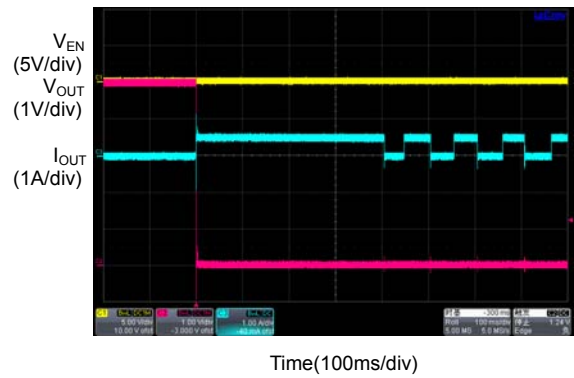


Figure 17. Output Short to GND Current  
 $(V_{IN}=5V, C_{IN}=1.0\mu F)$

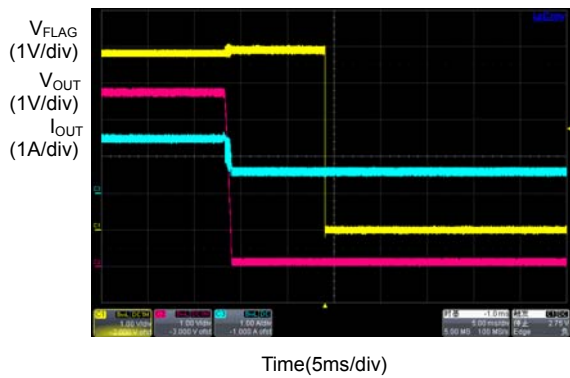


Figure 18. FLAG Response During Over Current  
 $(V_{IN}=5V, C_{IN}=1.0\mu F, C_{OUT}=470\mu F)$

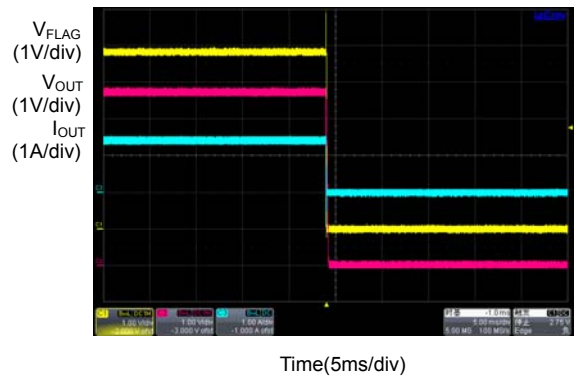


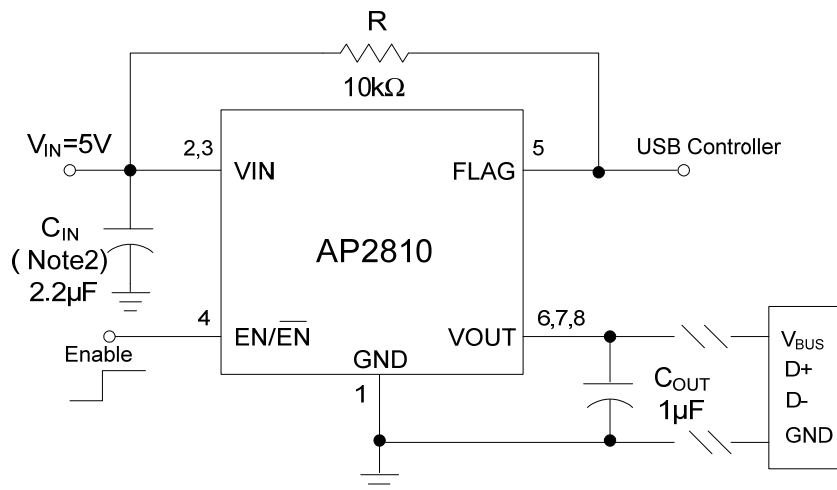
Figure 19. FLAG Response During Over Temperature  
 $(V_{IN}=5V, C_{IN}=1.0\mu F, C_{OUT}=220\mu F, R_L=5.0\Omega)$



**1.0A High-side Power Distribution Switch with Enable and Flag**

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**Typical Application**



Note 2: 2.2µF input capacitor is enough in most application cases.  
 If the VOUT is short to ground frequently during usage, large size input capacitor is necessary, recommend 22µF.

Figure 20. Typical Application of AP2810



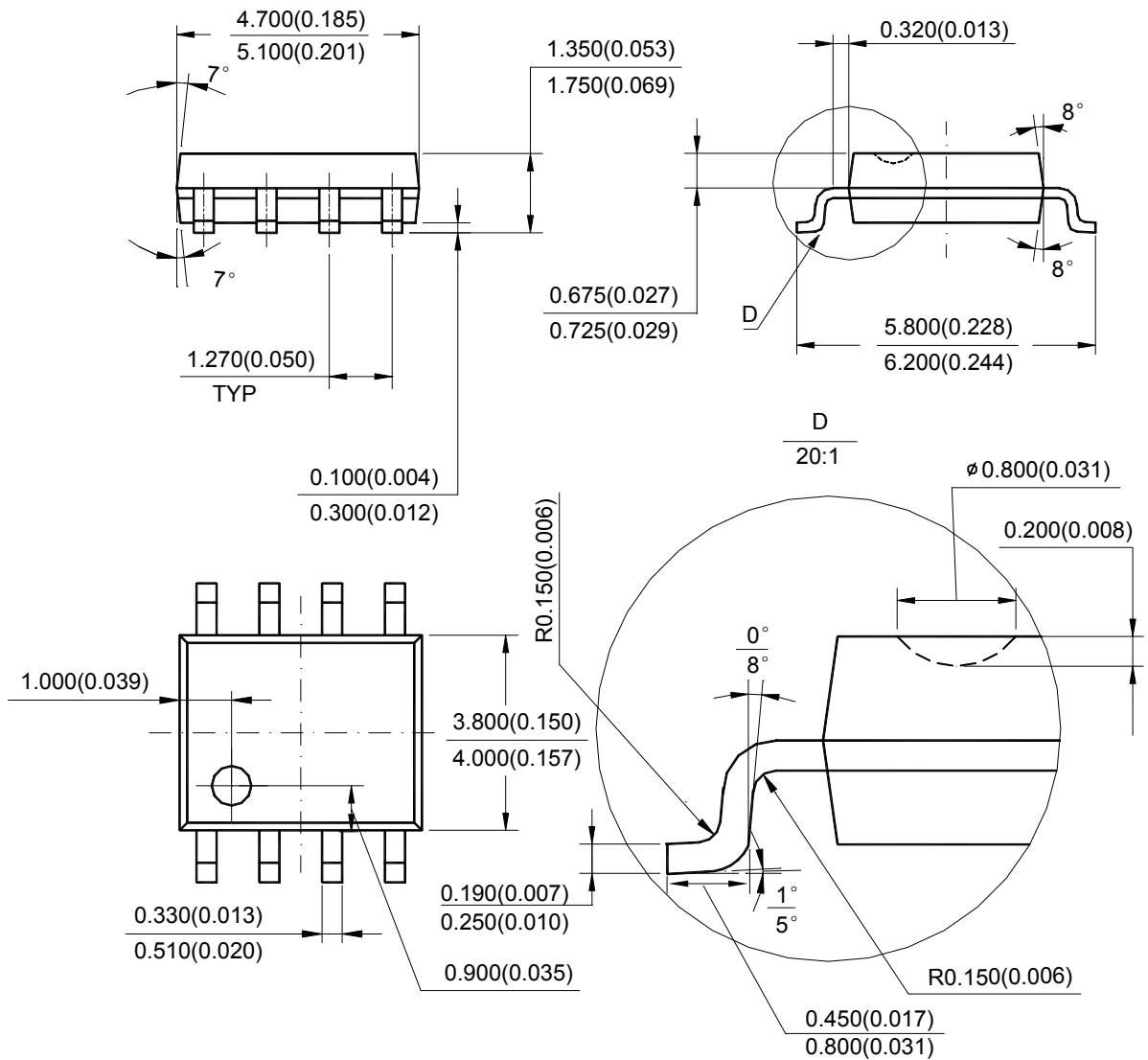
**1.0A High-side Power Distribution Switch with Enable and Flag**

**AP2810**

**Mechanical Dimensions**

**SOIC-8**

**Unit: mm(inch)**



Note: Eject hole, oriented hole and mold mark is optional.



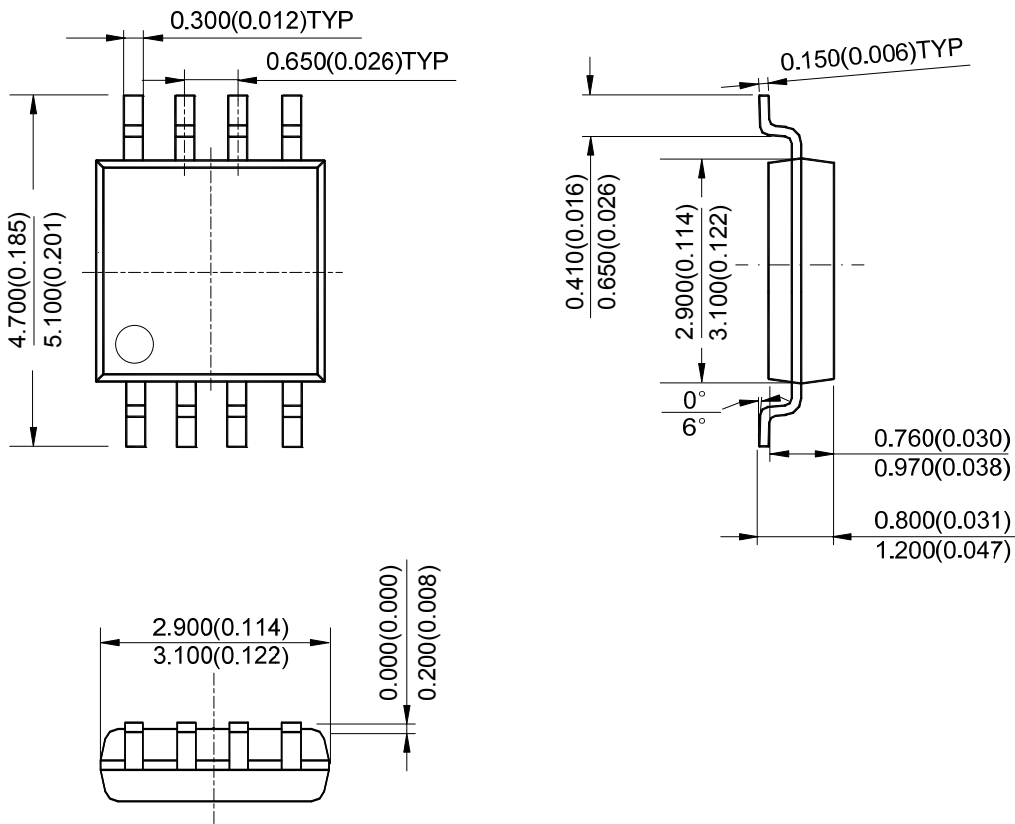
**1.0A High-side Power Distribution Switch with Enable and Flag**

**AP2810**

**Mechanical Dimensions (Continued)**

**MSOP-8**

**Unit: mm(inch)**



Note: Eject hole, oriented hole and mold mark is optional.



## **BCD Semiconductor Manufacturing Limited**

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