



**THE DATASHEET OF
AP2822EKETR-G1**



Description

The AP2822 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 $R_{DS(ON)}$, 85m Ω is designed to meet USB voltage drop requirements. The IC 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 AP2822 is available in the standard package of SOT-23-5.

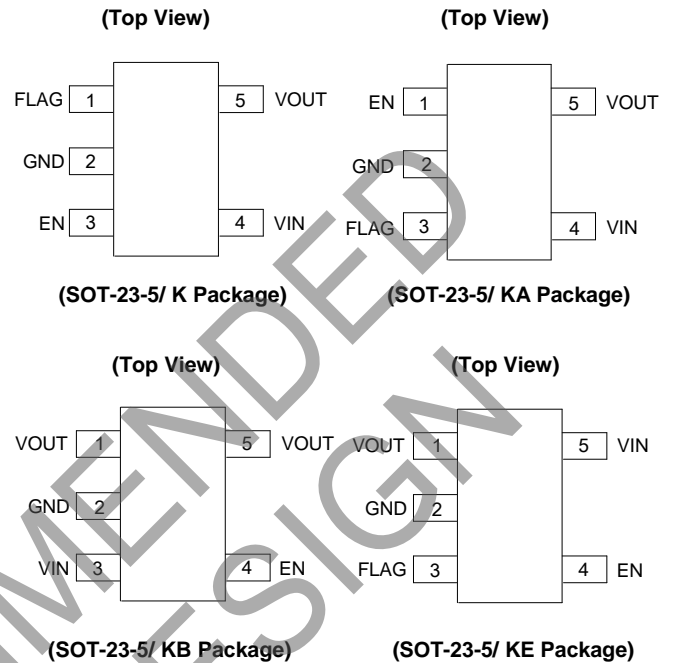
Features

- Low MOSFET On Resistance: 85m Ω
- Compliant to USB Specifications
- Available 4 Versions of Continuous Load: 0.5A/1.0A/1.5A/2.0A
- Logic Level Enable Pin: Available with Active-high or Active-low Version
- Operating Voltage Range: 2.7V to 5.5V
- Low Supply Current: 68 μ A (Typ.)
- Low Shutdown Current: 1.0 μ A (Max)
- Under-voltage Lockout
- Soft Start-up
- Over-current Protection
- Over Temperature Protection
- Load Short Protection with Fold-back
- No Reverse Current When Power Off
- Deglitched FLAG Output with Open Drain
- With Output Shutdown Pull-low Resistor (For Auto-discharge)
(AP2822A/AP2822B/AP2822C/AP2822D/AP2822E/AP2822F/AP2822G/AP2822H)
- Without Output Shutdown Pull-low Resistor (For No Auto-discharge)
(AP2822AN/AP2822BN/AP2822CN/AP2822DN/AP2822EN/AP2822FN/AP2822GN/AP2822HN)
- **Totally Lead-free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

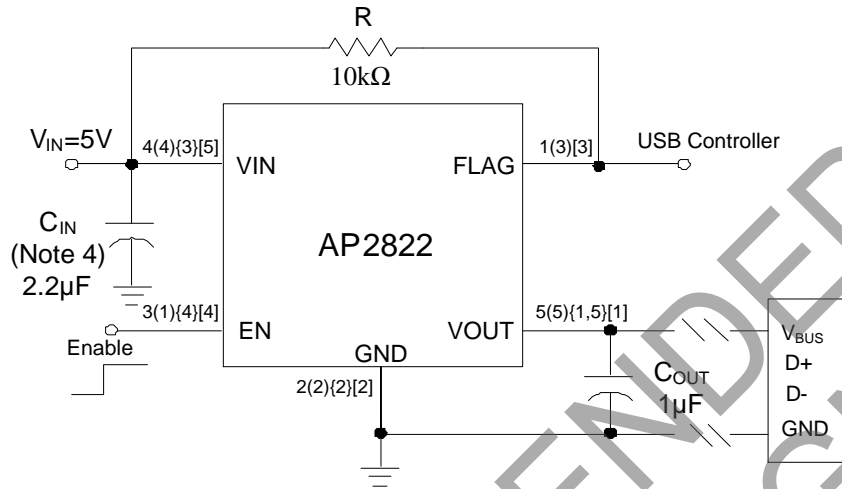
Pin Assignments



Applications

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

Typical Applications Circuit



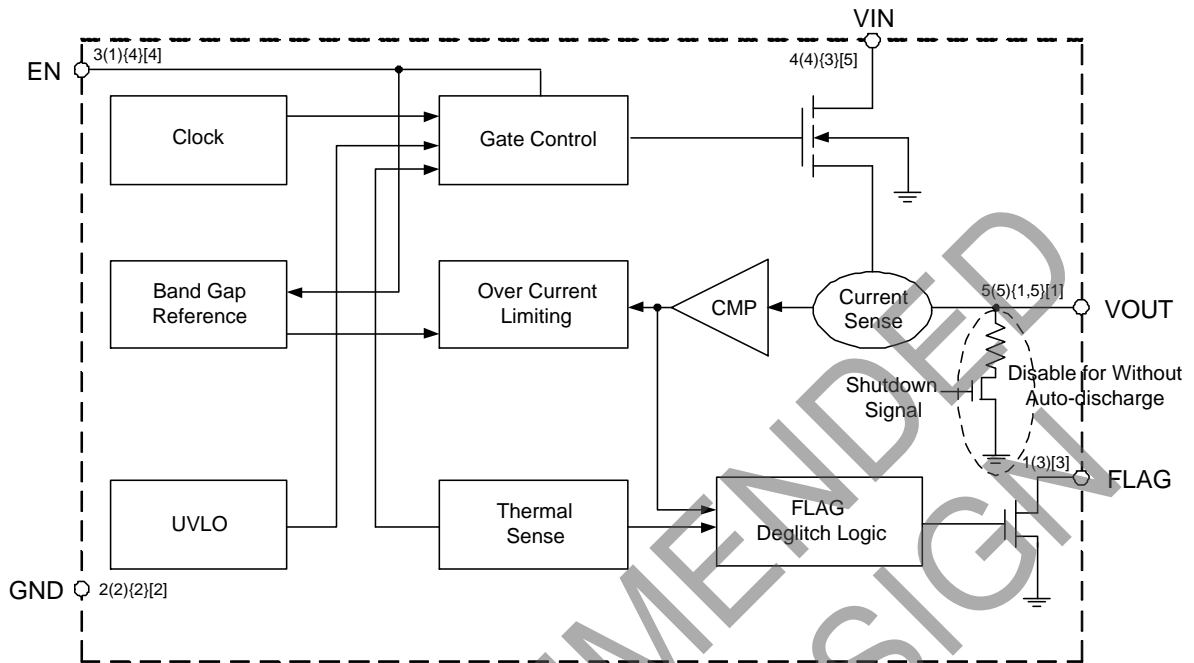
- A(B){C}[D]
 A: SOT-23-5(K Package)
 B: SOT-23-5(KA Package)
 C: SOT-23-5(KB Package)
 D: SOT-23-5(KE Package)

Note 4: 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.

Pin Descriptions

| Pin Number | Pin Name | Function |
|------------|----------|---|
| 1(K) | FLAG | Fault flag pin, output with open drain, need a pull-up resistor in application, active low to indicate OCP or OTP |
| 3(KA/KE) | | |
| 2 | GND | Ground |
| 3(K) | EN | Chip enable control input, active low or high |
| 1(KA) | | |
| 4(KB/KE) | | |
| 4(K/KA) | VIN | Supply input pin |
| 3(KB) | | |
| 5(KE) | | |
| 5(K/KA) | VOUT | Switch output voltage |
| 1,5(KB) | | |
| 1(KE) | | |

Functional Block Diagram



- A(B){C}[D]
 A: SOT-23-5(K Package)
 B: SOT-23-5(KA Package)
 C: SOT-23-5(KB Package)
 D: SOT-23-5(KE Package)

NOT RECOMMENDED FOR NEW DESIGN

Absolute Maximum Ratings (Note 5)

| Symbol | Parameter | Rating | Unit |
|-------------------|--|-------------|------|
| V _{IN} | Power Supply Voltage | 6.0 | V |
| T _J | Operating Junction Temperature Range | +150 | °C |
| T _{STG} | Storage Temperature Range | -65 to +150 | °C |
| T _{LEAD} | Lead Temperature (Soldering, 10sec) | +260 | °C |
| θ _{JA} | Thermal Resistance (Junction to Ambient) | 200 | °C/W |
| — | ESD (Machine Model) | 200 | V |
| — | ESD (Human Body Model) | 2000 | V |

Note 5: 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

| Symbol | Parameter | Min | Max | Unit |
|-----------------|-------------------------------------|-----|-----|------|
| V _{IN} | Supply Voltage | 2.7 | 5.5 | V |
| T _A | Operating Ambient Temperature Range | -40 | +85 | °C |

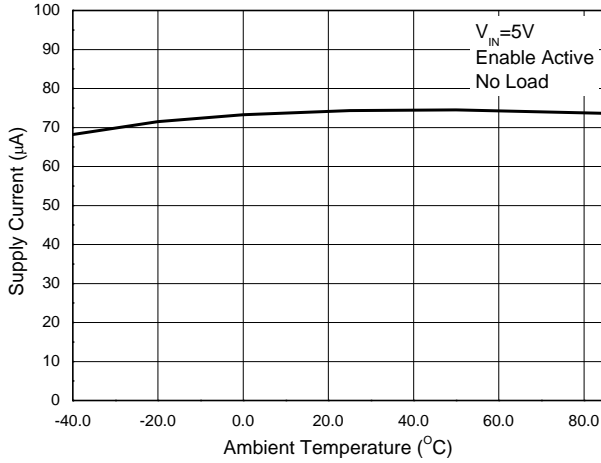
NOT RECOMMENDED FOR NEW DESIGN

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)

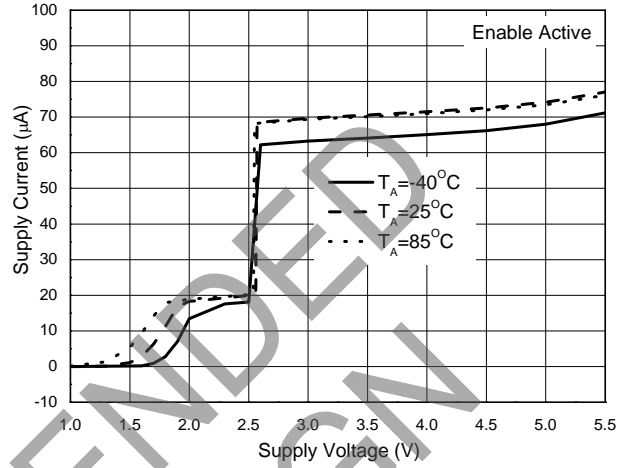
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------|---|--|------|------|-----|--------------|
| V_{IN} | Supply Voltage | — | 2.7 | — | 5.5 | V |
| $R_{DS(ON)}$ | Switch On Resistance | $V_{IN} = 5.0V$, $I_{OUT} = 2.0A$ | — | 85 | 110 | m Ω |
| I_{LIMIT} | Current Limit | AP2822A/B(0.5A), $V_{OUT} = 4.0V$ | 0.7 | 1.0 | 1.4 | A |
| | | AP2822C/D(1.0A), $V_{OUT} = 4.0V$ | 1.1 | 1.5 | 2.1 | |
| | | AP2822E/F(1.5A), $V_{OUT} = 4.0V$ | 1.65 | 2.2 | 2.8 | |
| | | AP2822G/H(2.0A), $V_{OUT} = 4.0V$ | 2.2 | 2.7 | 3.2 | |
| I_{SUPPLY} | Supply Current | $V_{IN} = 5.0V$, No Load | — | 68 | 95 | μA |
| I_{SHORT} | Fold-back Short Current | AP2822 A/B/C/D, $V_{OUT} = 0V$ | — | 0.7 | — | A |
| | | AP2822 E/F/G/H, $V_{OUT} = 0V$ | — | 1.1 | — | |
| $I_{SHUTDOWN}$ | Shutdown Supply Current | Chip Disable, Shutdown Mode | — | 0.1 | 1.0 | μA |
| V_{ENH} | Enable High Input Threshold | — | 1.6 | — | 5.5 | V |
| V_{ENL} | Enable Low Input Threshold | — | 0 | — | 1.0 | V |
| I_{EN} | Enable Pin Input Current | Force 0V to 5.0V at EN Pin | -1.0 | — | 1.0 | μA |
| V_{UVLO} | Under Voltage Lockout Threshold Voltage | V_{IN} Increasing from 0V | 2.2 | 2.5 | 3.0 | V |
| V_{UVLOHY} | Under Voltage Hysteresis | — | — | 0.2 | — | V |
| $I_{REVERSE}$ | Reverse Current | Chip Disable, $V_{OUT} > V_{IN}$ | — | 0.1 | 1.0 | μA |
| $R_{DISCHARGE}$ | Output Pull Low Resistance after Shutdown | With Auto-discharge | — | 100 | 200 | Ω |
| $I_{SHDN_LEAKAGE}$ | Output Leakage Current after Shutdown | Without Auto-discharge | — | — | 1.0 | μA |
| t_{ON} | Output Turn-on Time | From Enable Active to 90% of Output | — | 500 | — | μs |
| t_{DFLG} | FLAG Pin Delay Time | From Over Current Fault Condition to Flag Active | 5 | 10 | 15 | ms |
| V_{FLG} | FLAG Pin Low Voltage | $I_{SINK} = 5.0mA$ | — | 35 | 70 | mV |
| $I_{LEAKAGE}$ | FLAG Pin Leakage Current | FLAG Disable, Force 5.0V | — | — | 1.0 | μA |
| T_{OTSD} | Thermal Shutdown Temperature | — | — | +150 | — | $^\circ C$ |
| T_{HYOTSD} | Thermal Shutdown Hysteresis | — | — | +30 | — | |
| θ_{JC} | Thermal Resistance (Junction to Case) | — | — | 93 | — | $^\circ C/W$ |

Performance Characteristics

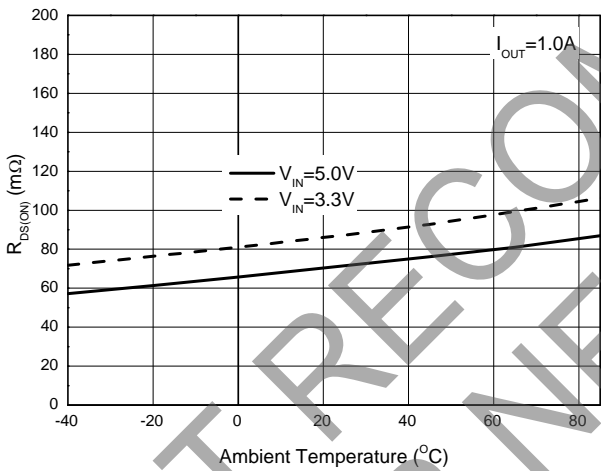
Supply Current vs. Ambient Temperature



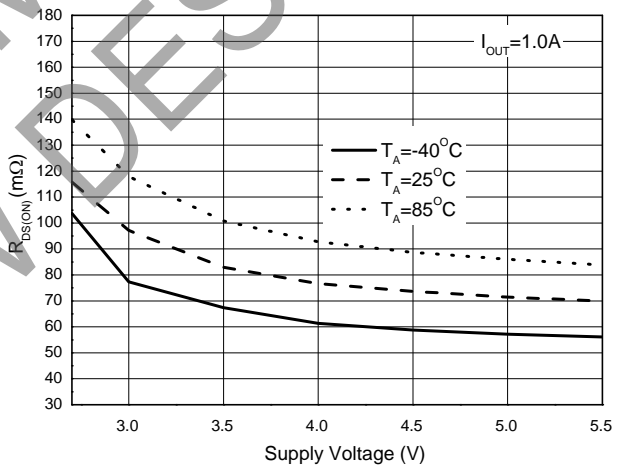
Supply Current vs. Supply Voltage



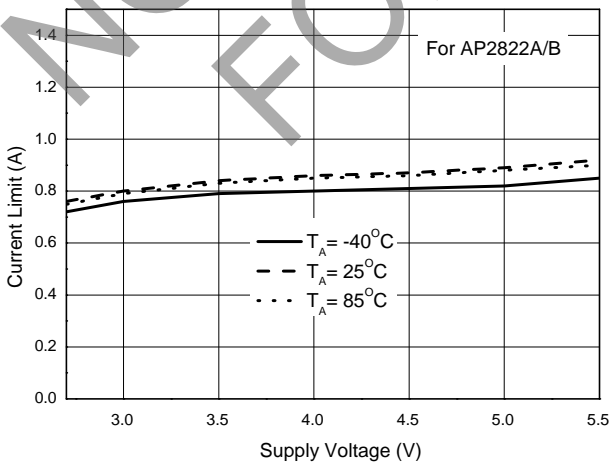
$R_{DS(ON)}$ vs. Ambient Temperature



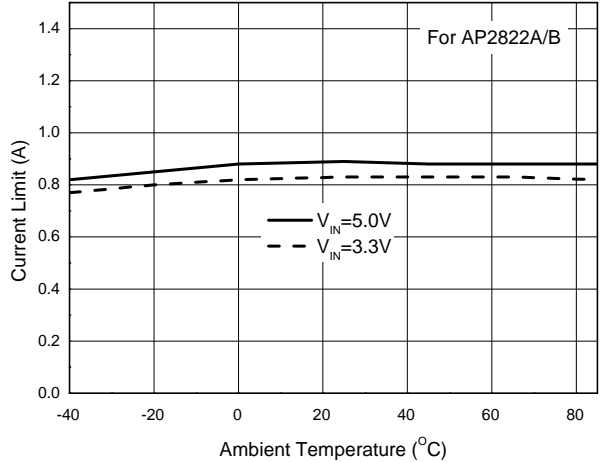
$R_{DS(ON)}$ vs. Supply Voltage



Current Limit vs. Supply Voltage

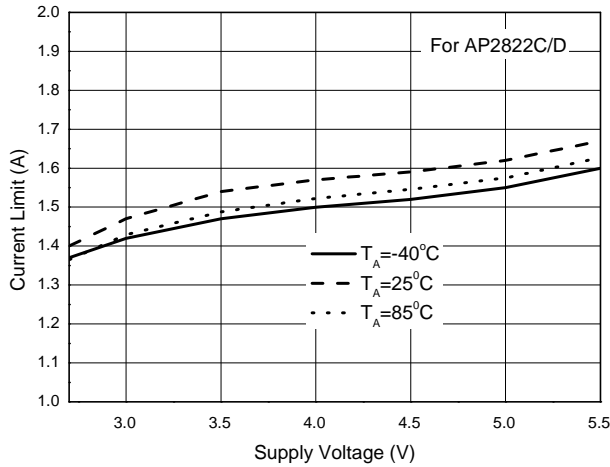


Current Limit vs. Ambient Temperature

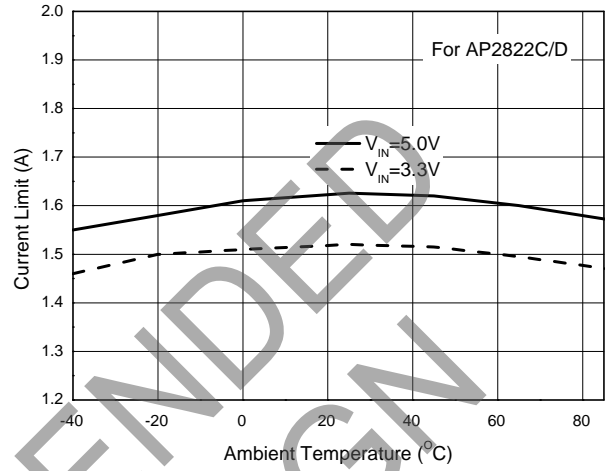


Performance Characteristics (Cont.)

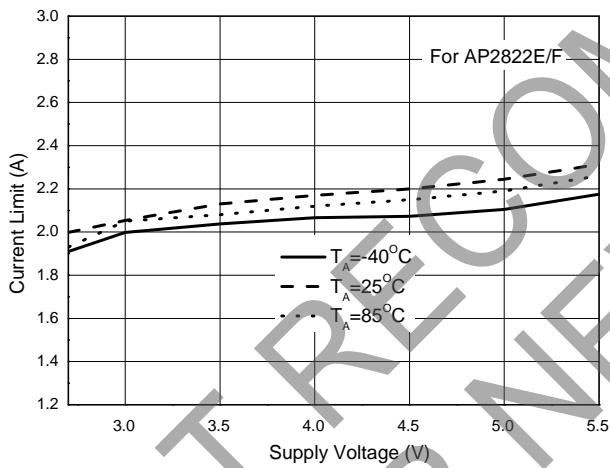
Current Limit vs. Supply Voltage



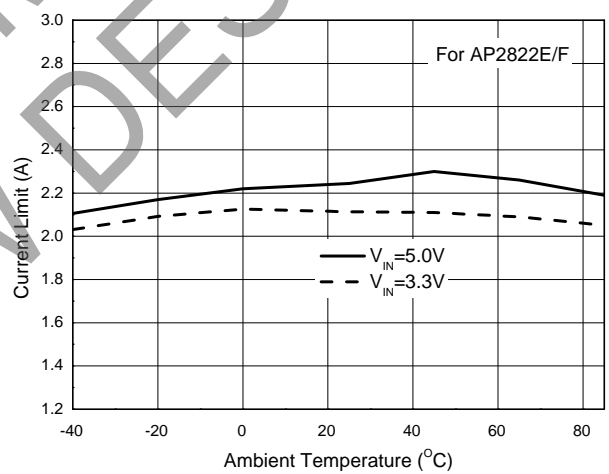
Current Limit vs. Ambient Temperature



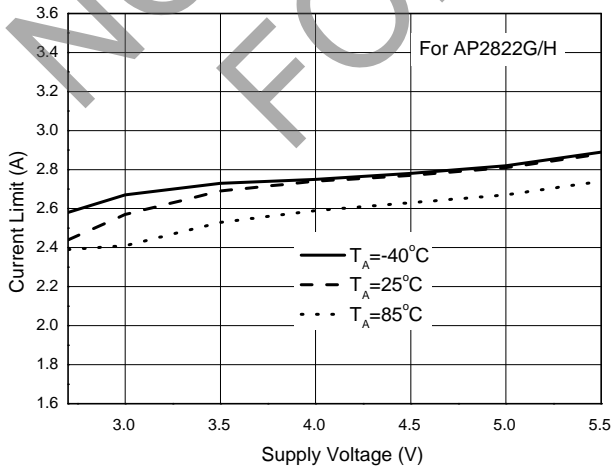
Current Limit vs. Supply Voltage



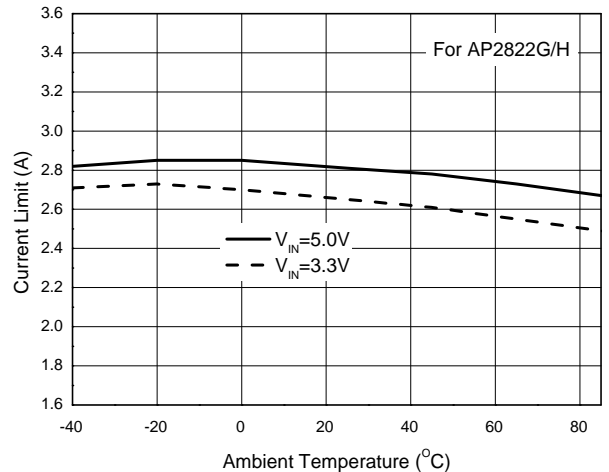
Current Limit vs. Ambient Temperature



Current Limit vs. Supply Voltage

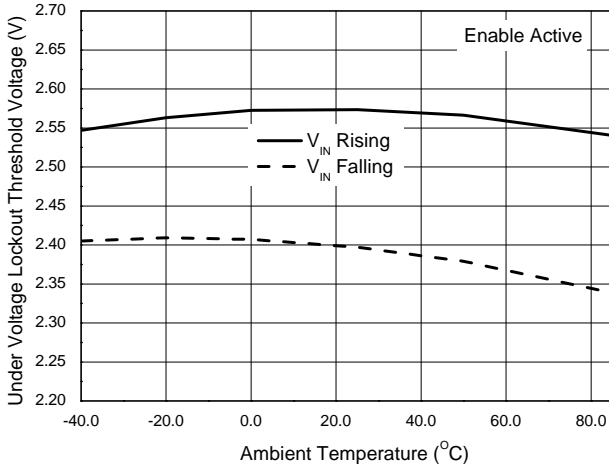


Current Limit vs. Ambient Temperature

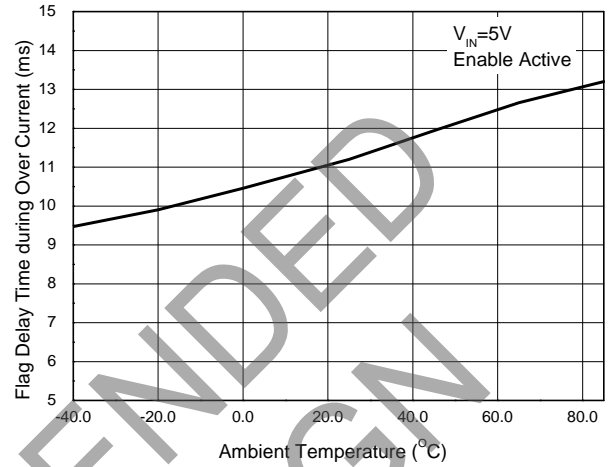


Performance Characteristics (Cont.)

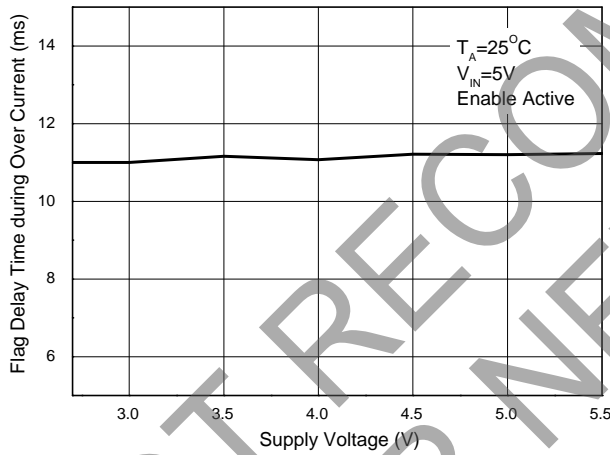
UVLO Voltage vs. Ambient Temperature



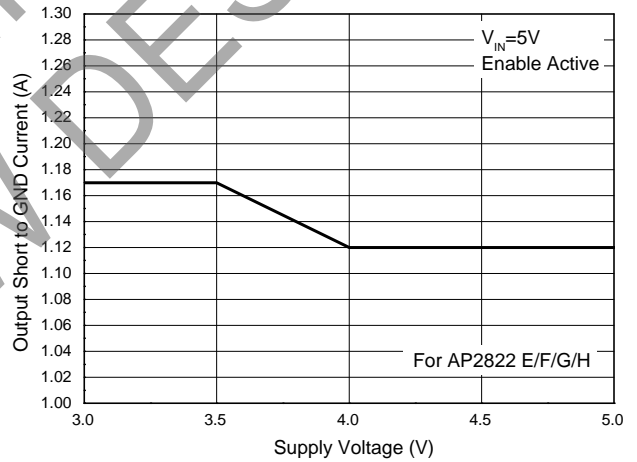
Flag Delay Time during Over Current vs. Ambient Temperature



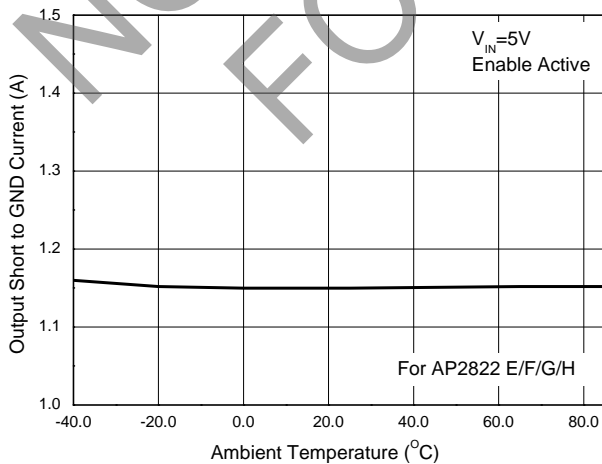
Flag Delay Time during Over Current vs. Supply Voltage



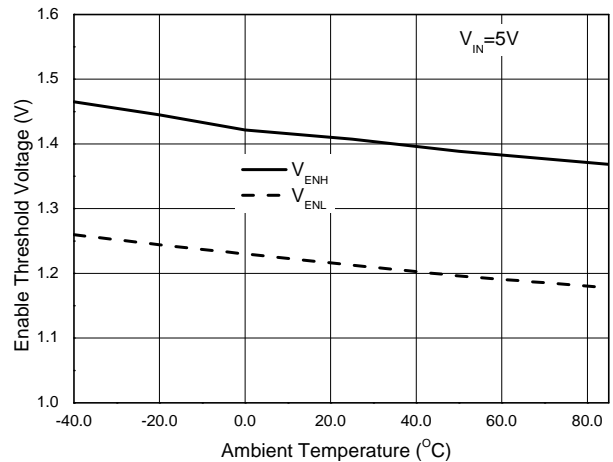
Output Short to GND Current vs. Supply Voltage



Output Short to GND Current vs. Ambient Temperature

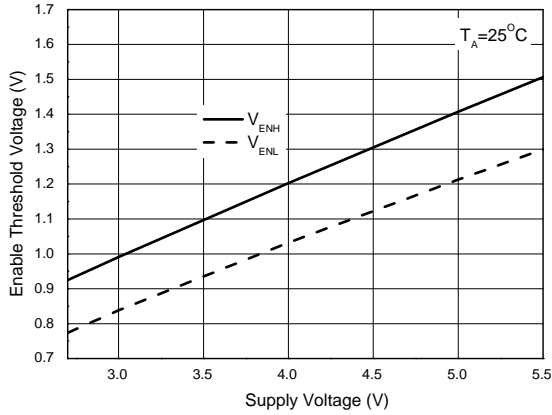


Enable Threshold Voltage vs. Ambient Temperature

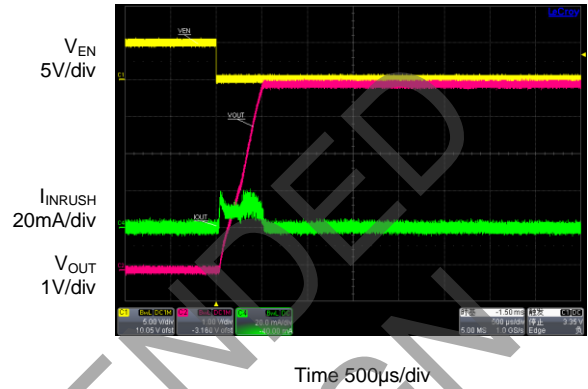


Performance Characteristics (Cont.)

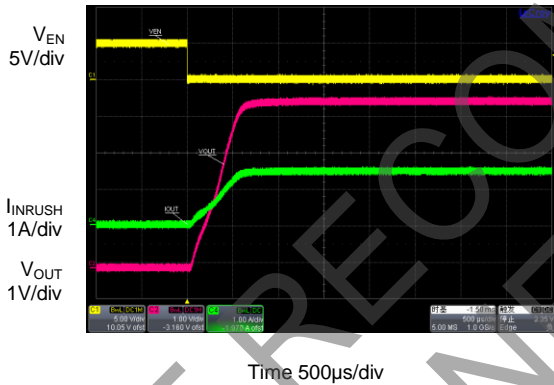
Enable Threshold Voltage vs. Supply Voltage



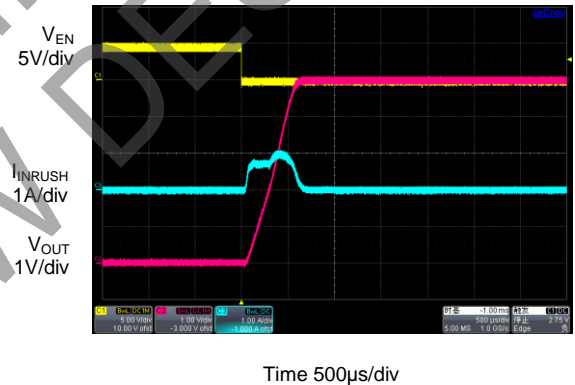
Output Turn On and Rise Time
($C_{IN} = 1.0\mu\text{F}$, $C_{OUT} = 1.0\mu\text{F}$, No Load)



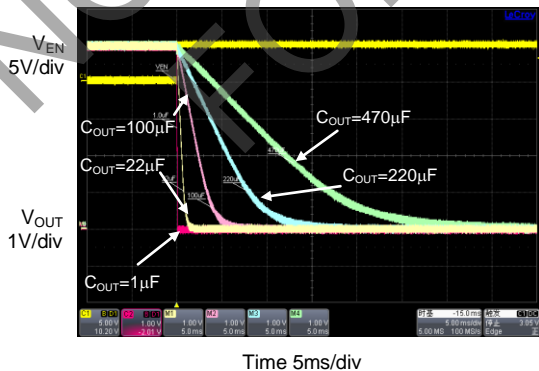
Output Turn On and Rise Time
($C_{IN} = 1.0\mu\text{F}$, $C_{OUT} = 1.0\mu\text{F}$, $R_L = 3.3\Omega$)



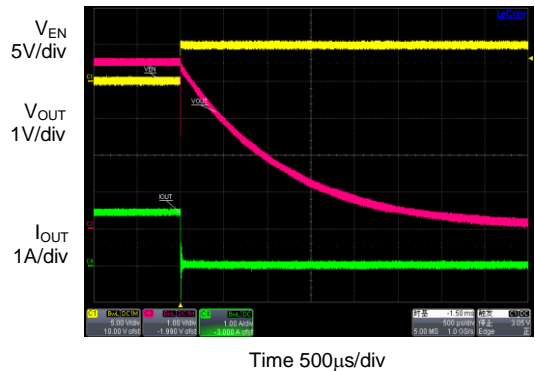
Output Turn On and Rise Time
($C_{IN} = 1.0\mu\text{F}$, $C_{OUT} = 100\mu\text{F}$, No Load)



Output Turn Off and Fall Time
($V_{IN} = 5\text{V}$, $C_{IN} = 1.0\mu\text{F}$, No Load)



Output Turn Off and Fall Time
($V_{IN} = 5\text{V}$, $C_{IN} = 1.0\mu\text{F}$, $C_{OUT} = 470\mu\text{F}$, $R_L = 3.3\Omega$)



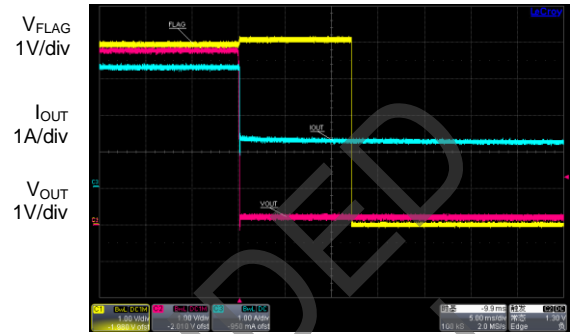
Performance Characteristics (Cont.)

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



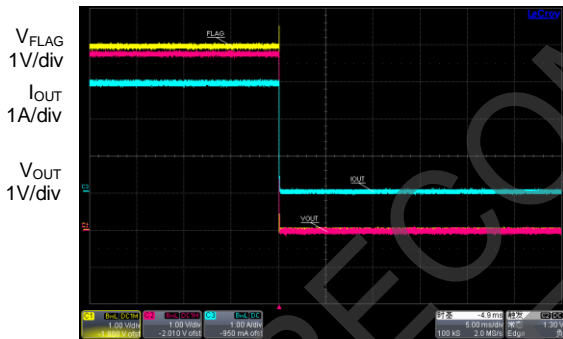
Time 20ms/div

FLAG Response during Over Current



Time 5ms/div

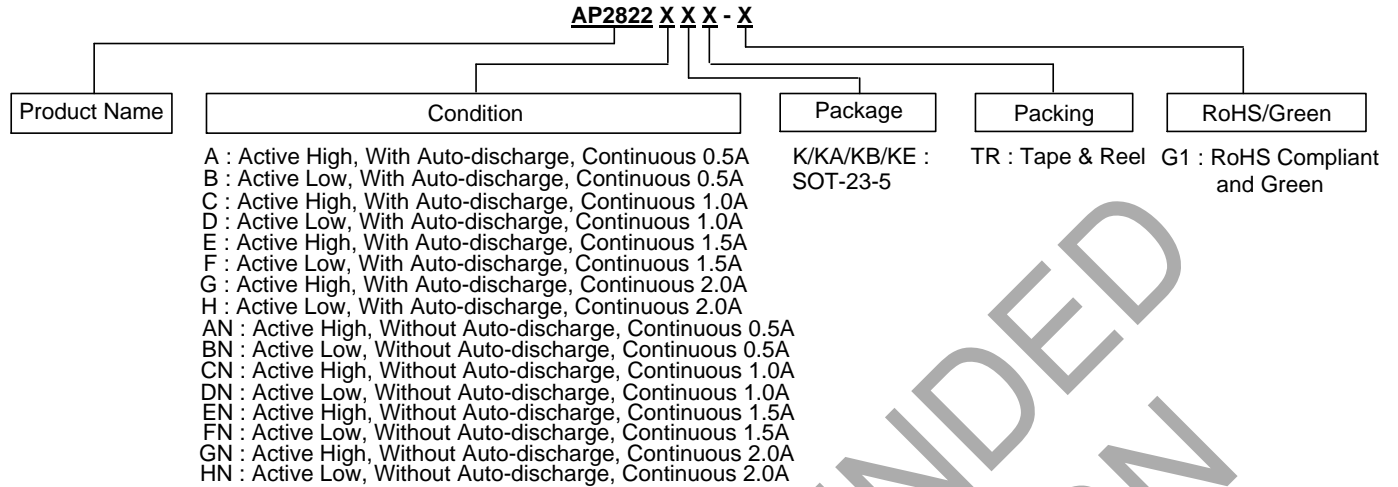
FLAG Response during Over Temperature ($T_A = +125^\circ C$)



Time 5ms/div

NOT RECOMMENDED FOR NEW DESIGN

Ordering Information



| Package | Temperature Range | Condition | Part Number | Marking ID | Packing |
|----------|-------------------|---|----------------|------------|------------------|
| SOT-23-5 | -40 to +85°C | Active High, With Auto-discharge (Continuous 0.5A) | AP2822AKTR-G1 | GCO | 3000/Tape & Reel |
| | | Active Low, With Auto-discharge (Continuous 0.5A) | AP2822BKTR-G1 | GCR | 3000/Tape & Reel |
| | | Active High, With Auto-discharge (Continuous 1.0A) | AP2822CKTR-G1 | GCS | 3000/Tape & Reel |
| | | Active Low, With Auto-discharge (Continuous 1.0A) | AP2822DKTR-G1 | GCT | 3000/Tape & Reel |
| | | Active High, With Auto-discharge (Continuous 1.5A) | AP2822EKTR-G1 | GCU | 3000/Tape & Reel |
| | | Active Low, With Auto-discharge (Continuous 1.5A) | AP2822FKTR-G1 | GCV | 3000/Tape & Reel |
| | | Active High, With Auto-discharge (Continuous 2.0A) | AP2822GKTR-G1 | GCW | 3000/Tape & Reel |
| | | Active Low, With Auto-discharge (Continuous 2.0A) | AP2822HKTR-G1 | GCZ | 3000/Tape & Reel |
| SOT-23-5 | -40 to +85°C | Active High, Without Auto-discharge (Continuous 0.5A) | AP2822ANKTR-G1 | GMQ | 3000/Tape & Reel |
| | | Active Low, Without Auto-discharge (Continuous 0.5A) | AP2822BNKTR-G1 | GMR | 3000/Tape & Reel |
| | | Active High, Without Auto-discharge (Continuous 1.0A) | AP2822CNKTR-G1 | GMS | 3000/Tape & Reel |
| | | Active Low, Without Auto-discharge (Continuous 1.0A) | AP2822DNKTR-G1 | GMT | 3000/Tape & Reel |
| | | Active High, Without Auto-discharge (Continuous 1.5A) | AP2822ENKTR-G1 | GMU | 3000/Tape & Reel |
| | | Active Low, Without Auto-discharge (Continuous 1.5A) | AP2822FNKTR-G1 | GMV | 3000/Tape & Reel |
| | | Active High, Without Auto-discharge (Continuous 2.0A) | AP2822GNKTR-G1 | GMW | 3000/Tape & Reel |
| | | Active Low, Without Auto-discharge (Continuous 2.0A) | AP2822HNKTR-G1 | GMZ | 3000/Tape & Reel |

Ordering Information (Cont.)

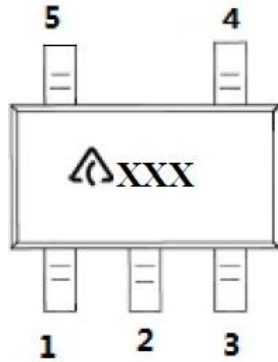
| Package | Temperature Range | Condition | Part Number | Marking ID | Packing |
|----------|-------------------|---|-----------------|------------|------------------|
| SOT-23-5 | -40 to +85°C | Active High, With Auto-discharge (Continuous 0.5A) | AP2822AKATR-G1 | GDQ | 3000/Tape & Reel |
| | | Active Low, With Auto-discharge (Continuous 0.5A) | AP2822BKATR-G1 | GDR | 3000/Tape & Reel |
| | | Active High, With Auto-discharge (Continuous 1.0A) | AP2822CKATR-G1 | GDS | 3000/Tape & Reel |
| | | Active Low, With Auto-discharge (Continuous 1.0A) | AP2822DKATR-G1 | GDT | 3000/Tape & Reel |
| | | Active High, With Auto-discharge (Continuous 1.5A) | AP2822EKATR-G1 | GDU | 3000/Tape & Reel |
| | | Active Low, With Auto-discharge (Continuous 1.5A) | AP2822FKATR-G1 | GDV | 3000/Tape & Reel |
| | | Active High, With Auto-discharge (Continuous 2.0A) | AP2822GKATR-G1 | GDW | 3000/Tape & Reel |
| | | Active Low, With Auto-discharge (Continuous 2.0A) | AP2822HKATR-G1 | GDZ | 3000/Tape & Reel |
| SOT-23-5 | -40 to +85°C | Active High, Without Auto-discharge (Continuous 0.5A) | AP2822ANKATR-G1 | G5Q | 3000/Tape & Reel |
| | | Active Low, Without Auto-discharge (Continuous 0.5A) | AP2822BNKATR-G1 | G5R | 3000/Tape & Reel |
| | | Active High, Without Auto-discharge (Continuous 1.0A) | AP2822CNKATR-G1 | G5S | 3000/Tape & Reel |
| | | Active Low, Without Auto-discharge (Continuous 1.0A) | AP2822DNKATR-G1 | G5T | 3000/Tape & Reel |
| | | Active High, Without Auto-discharge (Continuous 1.5A) | AP2822ENKATR-G1 | G5U | 3000/Tape & Reel |
| | | Active Low, Without Auto-discharge (Continuous 1.5A) | AP2822FNKATR-G1 | G5V | 3000/Tape & Reel |
| | | Active High, Without Auto-discharge (Continuous 2.0A) | AP2822GNKATR-G1 | G5W | 3000/Tape & Reel |
| | | Active Low, Without Auto-discharge (Continuous 2.0A) | AP2822HNKATR-G1 | G5Z | 3000/Tape & Reel |
| SOT-23-5 | -40 to +85°C | Active High, With Auto-discharge (Continuous 0.5A) | AP2822AKBTR-G1 | GLA | 3000/Tape & Reel |
| | | Active Low, With Auto-discharge (Continuous 0.5A) | AP2822BKBTR-G1 | GLB | 3000/Tape & Reel |
| | | Active High, With Auto-discharge (Continuous 1.0A) | AP2822CKBTR-G1 | GLC | 3000/Tape & Reel |
| | | Active Low, With Auto-discharge (Continuous 1.0A) | AP2822DKBTR-G1 | GLD | 3000/Tape & Reel |
| | | Active High, With Auto-discharge (Continuous 1.5A) | AP2822EKBTR-G1 | GLE | 3000/Tape & Reel |
| | | Active Low, With Auto-discharge (Continuous 1.5A) | AP2822FKBTR-G1 | GLF | 3000/Tape & Reel |
| | | Active High, With Auto-discharge (Continuous 2.0A) | AP2822GKBTR-G1 | GLG | 3000/Tape & Reel |
| | | Active Low, With Auto-discharge (Continuous 2.0A) | AP2822HKBTR-G1 | GLH | 3000/Tape & Reel |

Ordering Information (Cont.)

| Package | Temperature Range | Condition | Part Number | Marking ID | Packing |
|----------|-------------------|---|-----------------|------------|------------------|
| SOT-23-5 | -40 to +85°C | Active High, Without Auto-discharge (Continuous 0.5A) | AP2822ANKBTR-G1 | GMA | 3000/Tape & Reel |
| | | Active Low, Without Auto-discharge (Continuous 0.5A) | AP2822BNKBTR-G1 | GMB | 3000/Tape & Reel |
| | | Active High, Without Auto-discharge (Continuous 1.0A) | AP2822CNKBTR-G1 | GMC | 3000/Tape & Reel |
| | | Active Low, Without Auto-discharge (Continuous 1.0A) | AP2822DNKBTR-G1 | GMD | 3000/Tape & Reel |
| | | Active High, Without Auto-discharge (Continuous 1.5A) | AP2822ENKBTR-G1 | GME | 3000/Tape & Reel |
| | | Active Low, Without Auto-discharge (Continuous 1.5A) | AP2822FNKBTR-G1 | GMF | 3000/Tape & Reel |
| | | Active High, Without Auto-discharge (Continuous 2.0A) | AP2822GNKBTR-G1 | GMG | 3000/Tape & Reel |
| | | Active Low, Without Auto-discharge (Continuous 2.0A) | AP2822HNKBTR-G1 | GMH | 3000/Tape & Reel |
| SOT-23-5 | -40 to +85°C | Active High, With Auto-discharge (Continuous 0.5A) | AP2822AKETR-G1 | GLI | 3000/Tape & Reel |
| | | Active Low, With Auto-discharge (Continuous 0.5A) | AP2822BKETR-G1 | GLJ | 3000/Tape & Reel |
| | | Active High, With Auto-discharge (Continuous 1.0A) | AP2822CKETR-G1 | GLK | 3000/Tape & Reel |
| | | Active Low, With Auto-discharge (Continuous 1.0A) | AP2822DKETR-G1 | GLL | 3000/Tape & Reel |
| | | Active High, With Auto-discharge (Continuous 1.5A) | AP2822EKETR-G1 | GLM | 3000/Tape & Reel |
| | | Active Low, With Auto-discharge (Continuous 1.5A) | AP2822FKETR-G1 | GLN | 3000/Tape & Reel |
| | | Active High, With Auto-discharge (Continuous 2.0A) | AP2822GKETR-G1 | GLO | 3000/Tape & Reel |
| | | Active Low, With Auto-discharge (Continuous 2.0A) | AP2822HKETR-G1 | GLP | 3000/Tape & Reel |
| SOT-23-5 | -40 to +85°C | Active High, Without Auto-discharge (Continuous 0.5A) | AP2822ANKETR-G1 | GMI | 3000/Tape & Reel |
| | | Active Low, Without Auto-discharge (Continuous 0.5A) | AP2822BNKETR-G1 | GMJ | 3000/Tape & Reel |
| | | Active High, Without Auto-discharge (Continuous 1.0A) | AP2822CNKETR-G1 | GMK | 3000/Tape & Reel |
| | | Active Low, Without Auto-discharge (Continuous 1.0A) | AP2822DNKETR-G1 | GML | 3000/Tape & Reel |
| | | Active High, Without Auto-discharge (Continuous 1.5A) | AP2822ENKETR-G1 | GMM | 3000/Tape & Reel |
| | | Active Low, Without Auto-discharge (Continuous 1.5A) | AP2822FNKETR-G1 | GMN | 3000/Tape & Reel |
| | | Active High, Without Auto-discharge (Continuous 2.0A) | AP2822GNKETR-G1 | GMO | 3000/Tape & Reel |
| | | Active Low, Without Auto-discharge (Continuous 2.0A) | AP2822HNKETR-G1 | GMP | 3000/Tape & Reel |

Marking Information

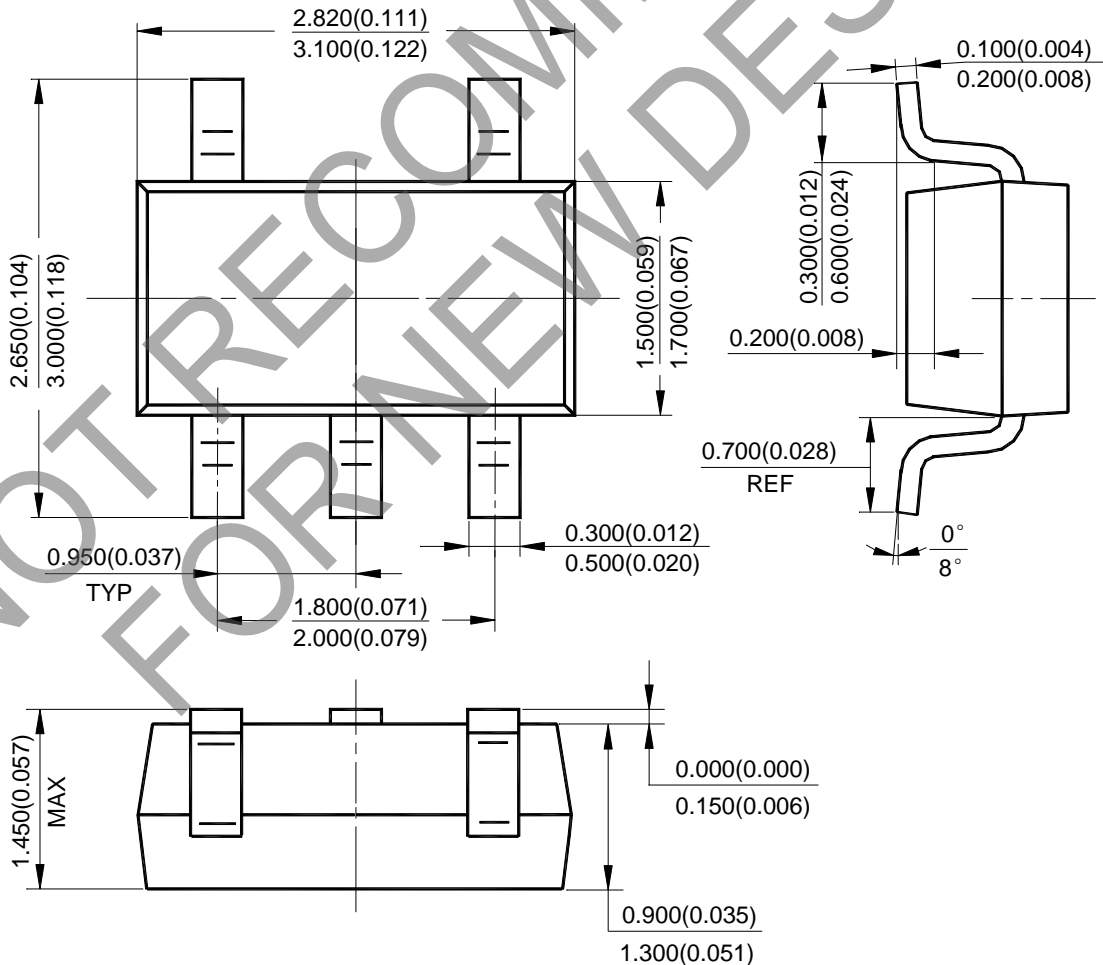
(1) SOT-23-5



: Logo
XXX: Marking ID (See Ordering Information)

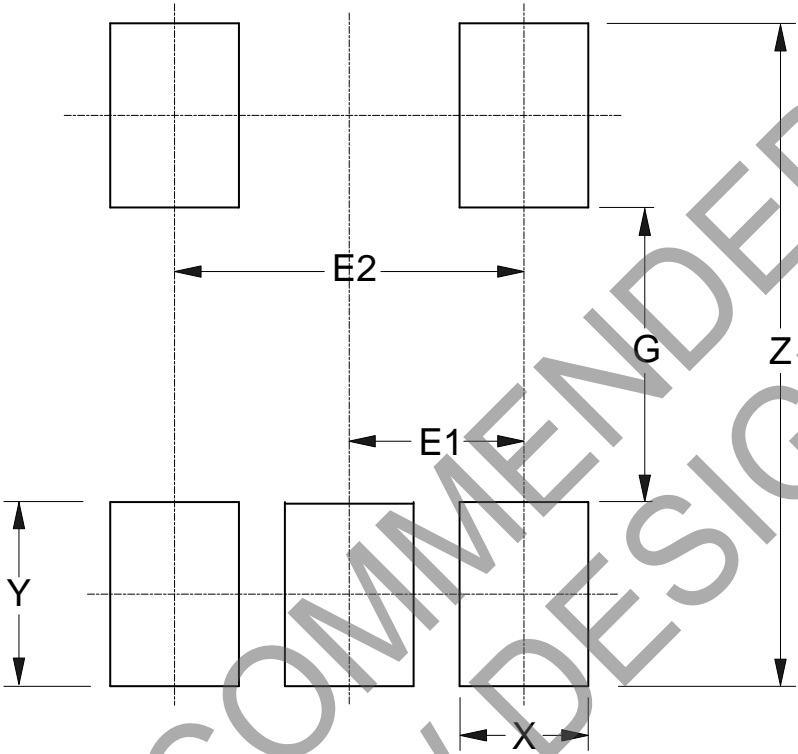
Package Outline Dimensions (All dimensions in mm(inch).)

(1) Package Type: SOT-23-5



Suggested Pad Layout

(1) Package Type: SOT-23-5



| Dimensions | Z (mm)/(inch) | G (mm)/(inch) | X (mm)/(inch) | Y (mm)/(inch) | E1 (mm)/(inch) | E2 (mm)/(inch) |
|------------|------------------|------------------|------------------|------------------|-------------------|-------------------|
| Value | 3.600/0.142 | 1.600/0.063 | 0.700/0.028 | 1.000/0.039 | 0.950/0.037 | 1.900/0.075 |

NOT RECOMMENDED FOR NEW DESIGN

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