

## Description

The AP3419 is a 2A step-down DC-DC converter. At heavy load, the constant frequency PWM control performs excellent stability and transient response. No external compensation components are required.

The AP3419 supports a range of input voltages from 2.7V to 5.5V, allowing the use of a single Li+/Li- polymer cell, multiple Alkaline/NiMH cell, and other standard power sources. The output voltage is adjustable from 0.6V to the input voltage. The AP3419 employs internal power switch and synchronous rectifier to minimize external part count and realize high efficiency. During shutdown, the input is disconnected from the output and the shutdown current is less than 1 $\mu$ A. Other key features include over-temperature and short circuit protection, and under-voltage lockout to prevent deep battery discharge.

The AP3419 delivers 2A maximum output current while consuming only 90 $\mu$ A of no-load quiescent current. Ultra-low R<sub>DS(ON)</sub> integrated MOSFETs and 100% duty cycle operation make the AP3419 an ideal choice for high output voltage, high current applications which require a low dropout threshold.

The AP3419 is available in TSOT26 package.

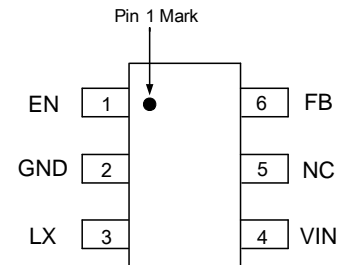
## Features

- Output Current: Up to 2A
- Output Voltage: 0.6V to V<sub>IN</sub>
- Input Voltage: 2.7V to 5.5V
- Peak Efficiency Up to 95%
- 90 $\mu$ A (Typ) No Load Quiescent Current
- Shutdown Current: <1 $\mu$ A
- 100% Duty Cycle Operation
- 1MHz Switching Frequency
- Internal Soft Start
- No External Compensation Required
- Current Limit Protection
- Thermal Shutdown
- TSOT26 package
- **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) compliant.
  2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) 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

(Top View)

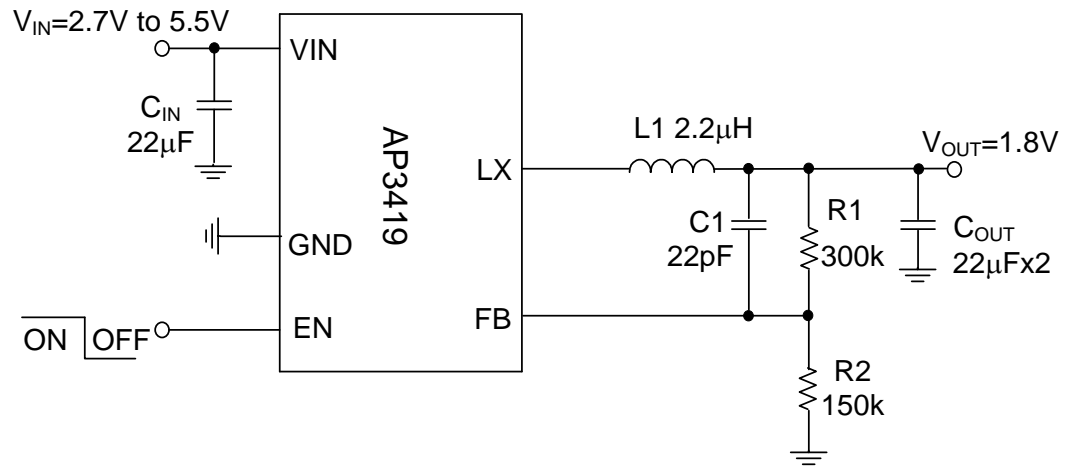


TSOT26

## Applications

- 5V or 3.3V Point of Load Conversion
- Telecom/Networking Equipment
- Set Top Boxes
- Storage Equipment
- Video Cards
- DDR Power Supply

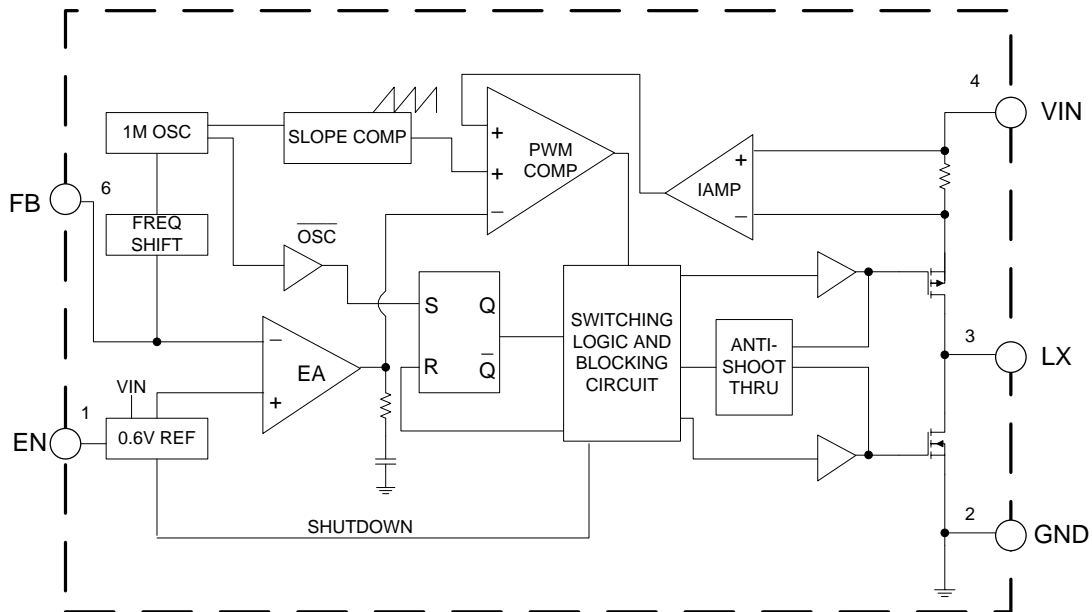
Typical Applications Circuit



Pin Descriptions

| Pin Number | Pin Name | Function   |
|------------|----------|--|
| 1          | EN       | Enable control input. Force this pin voltage above 1.5V enables the chip, and below 0.4V shuts down the device |
| 2          | GND      | Ground pin   |
| 3          | LX       | The drains of the internal main and synchronous power MOSFETs  |
| 4          | VIN      | Bias supply. Chip main power supply pin  |
| 5          | NC       | No connected   |
| 6          | FB       | Feedback voltage to internal error amplifier. The threshold voltage is 0.6V                                    |

**Functional Block Diagram**



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**Absolute Maximum Ratings** (Note 4)

| Symbol        | Parameter                                | Rating               | Unit          |
|---------------|--|----------------------|---------------|
| $V_{IN}$      | Input Voltage                            | -0.3 to 6            | V             |
| $V_{EN}$      | EN Pin Voltage                           | -0.3 to $V_{IN}+0.3$ | V             |
| $V_{LX}$      | LX Pin Voltage                           | -0.3 to $V_{IN}+0.3$ | V             |
| $V_{FB}$      | Feedback Pin Voltage                     | -0.3 to $V_{IN}+0.3$ | V             |
| $\theta_{JA}$ | Thermal Resistance (Junction to Ambient) | 220                  | $^{\circ}C/W$ |
| $T_J$         | Operating Junction Temperature           | +150                 | $^{\circ}C$   |
| $T_{STG}$     | Storage Temperature                      | -65 to +150          | $^{\circ}C$   |
| $T_{LEAD}$    | Lead Temperature (Soldering, 5 sec)      | +300                 | $^{\circ}C$   |
| $V_{MM}$      | ESD (Machine Model)                      | 200                  | V             |
| $V_{HBM}$     | ESD (Human Body Model)                   | 2000                 | V             |

Note 4: 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

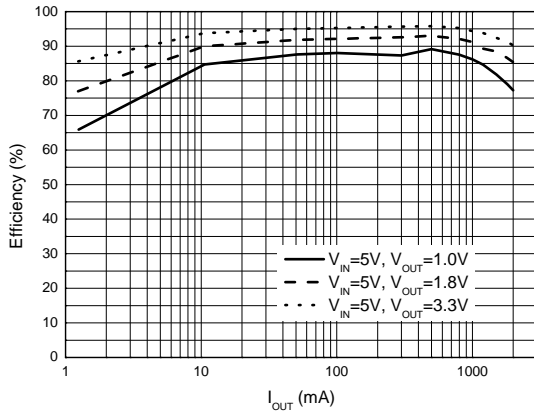
| Symbol          | Parameter                     | Min | Max  | Unit |
|-----------------|-------------------------------|-----|------|------|
| V <sub>IN</sub> | Input Voltage Range           | 2.7 | 5.5  | V    |
| T <sub>A</sub>  | Operating Ambient Temperature | -40 | +85  | °C   |
| T <sub>J</sub>  | Junction Temperature Range    | -40 | +125 | °C   |

## Electrical Characteristics (@V<sub>IN</sub> = 5V, V<sub>OUT</sub> = 1.8V, L = 2.2μH, C<sub>OUT</sub> = 22μF×2, T<sub>A</sub> = +25°C, unless otherwise specified.)

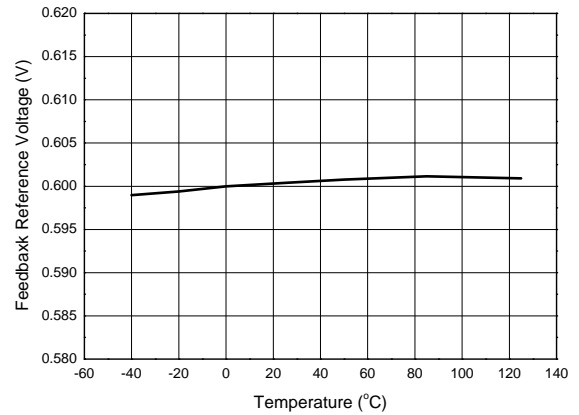
| Symbol              | Parameters                              | Conditions                             | Min   | Typ  | Max             | Unit |
|---------------------|---|--|-------|------|-----------------|------|
| V <sub>IN</sub>     | Input Voltage Range                     | –                                      | 2.7   | –    | 5.5             | V    |
| V <sub>OUT</sub>    | Output Voltage Range                    | –                                      | 0.6   | –    | V <sub>IN</sub> | V    |
| V <sub>FB</sub>     | Regulated Feedback Voltage              | –                                      | 0.588 | 0.6  | 0.612           | V    |
| I <sub>FB</sub>     | FB Leakage Current                      | V <sub>FB</sub> = 1V                   | –     | –    | 0.2             | μA   |
| I <sub>Q</sub>      | Quiescent Current                       | V <sub>FB</sub> = 0.65V                | –     | 90   | –               | μA   |
| I <sub>SD</sub>     | Shutdown Current                        | V <sub>EN</sub> = 0V                   | –     | –    | 1               | μA   |
| I <sub>LIM</sub>    | Peak Inductor Current                   | –                                      | 3     | –    | –               | A    |
| f <sub>OSC</sub>    | Oscillator Frequency                    | –                                      | –     | 1    | –               | MHz  |
| R <sub>DS(ON)</sub> | Drain to Source On-state Resistance     | I <sub>LX</sub> = 100mA, high side     | –     | 110  | –               | mΩ   |
|                     |   | I <sub>LX</sub> = 100mA, low side      | –     | 80   | –               |      |
| V <sub>ENH</sub>    | EN High Threshold                       | –                                      | 1.5   | –    | –               | V    |
| V <sub>ENL</sub>    | EN Low Threshold                        | –                                      | –     | –    | 0.4             | V    |
| I <sub>EN</sub>     | EN Leakage Current                      | V <sub>IN</sub> = V <sub>EN</sub> = 5V | -1.0  | –    | 1.0             | μA   |
| V <sub>UVLO</sub>   | Input UVLO Threshold                    | –                                      | –     | 2.4  | 2.7             | V    |
| V <sub>HYS</sub>    | UVLO Hysteresis                         | –                                      | –     | 0.2  | –               | V    |
| T <sub>OTP</sub>    | Over Temperature Protection             | –                                      | –     | +160 | –               | °C   |
| T <sub>OTH</sub>    | OTP Hysteresis                          | –                                      | –     | +30  | –               | °C   |
| V <sub>IOVP</sub>   | V <sub>IN</sub> Over Voltage Protection | —                                      | —     | 6.25 | —               | V    |
| V <sub>IHSY</sub>   | IOVP Hysteresis                         | —                                      | —     | 0.25 | —               | V    |
| t <sub>SS</sub>     | Soft-start Time                         | –                                      | –     | 1.8  | –               | ms   |

**Performance Characteristics** (@ $T_A = +25^\circ\text{C}$ ,  $V_{IN} = 5\text{V}$ ,  $V_{OUT} = 1.8\text{V}$ , unless otherwise specified.)

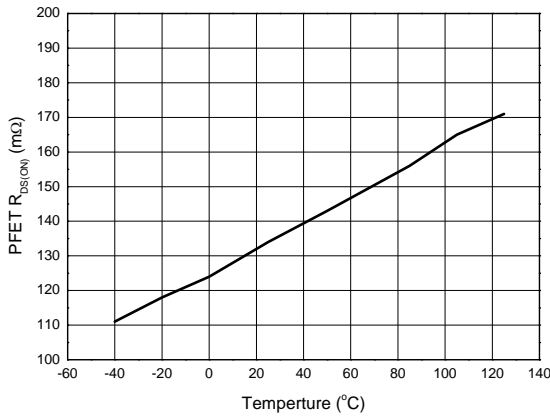
**Efficiency vs. Load Current**



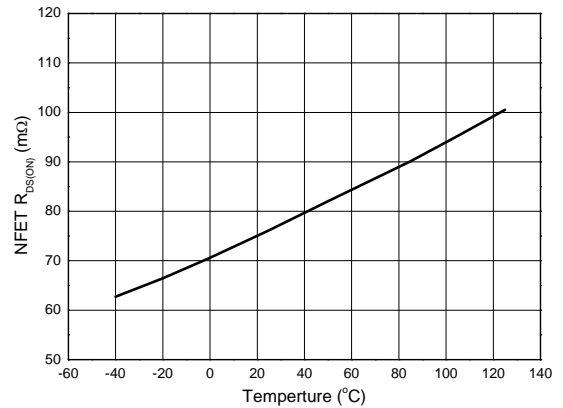
**Feedback Reference Voltage vs. Temperature**



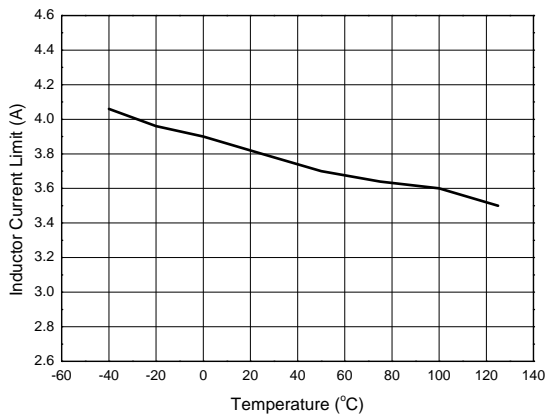
**PFET Drain-Source On-State Resistance vs. Temperature**



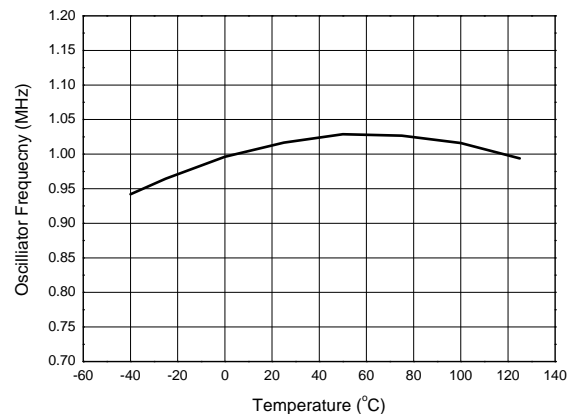
**NFET Drain-Source On-State Resistance vs. Temperature**



**Inductor Current Limit vs. Temperature**

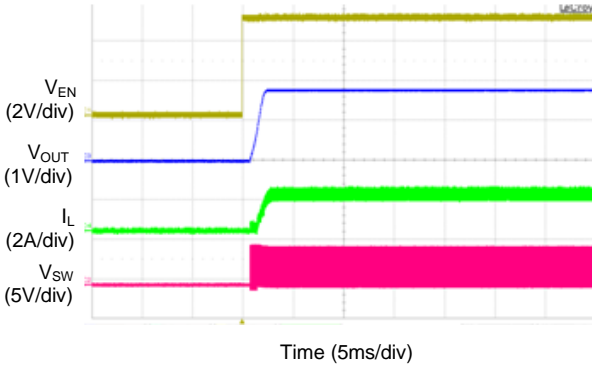


**Oscillation Frequency vs. Temperature**

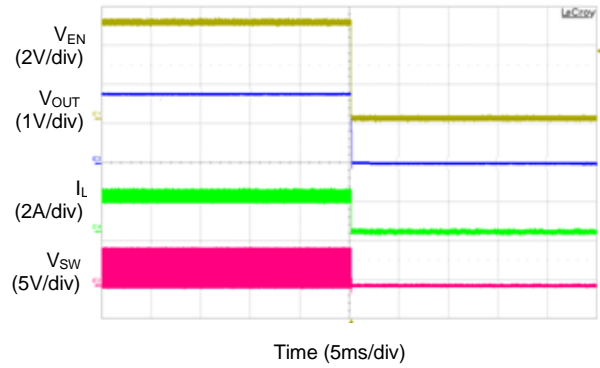


**Performance Characteristics** (Cont. @ $T_A = +25^\circ\text{C}$ ,  $V_{IN} = 5\text{V}$ ,  $V_{OUT} = 1.8\text{V}$ , unless otherwise specified.)

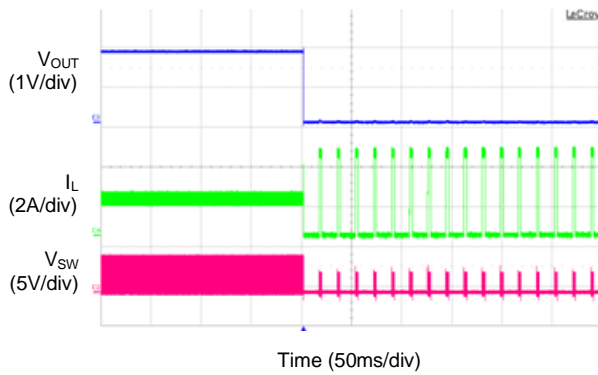
**Enable Turn on Characteristic ( $I_{OUT}=2\text{A}$ )**



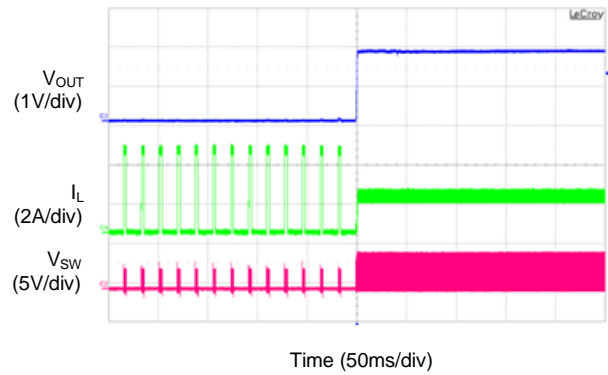
**Enable Turn off Characteristic ( $I_{OUT}=2\text{A}$ )**



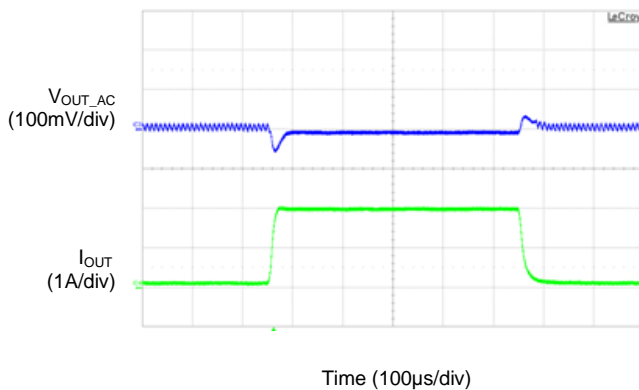
**Short Current Protection ( $I_{OUT}=2\text{A}$ )**



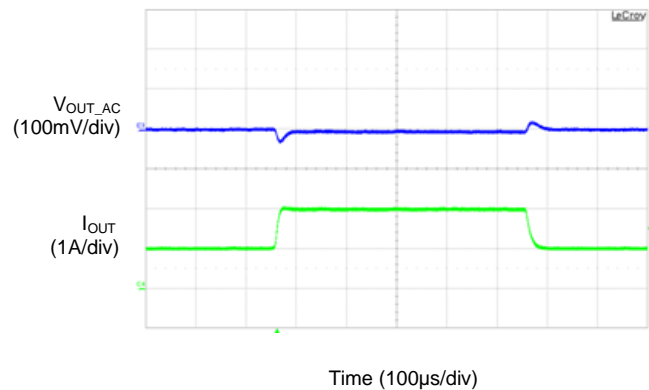
**SCP Recovery ( $I_{OUT}=2\text{A}$ )**



**Load Transient ( $I_{OUT}=0.1\text{A}$  to  $2\text{A}$ )**



**Load Transient ( $I_{OUT}=1\text{A}$  to  $2\text{A}$ )**



NEW PRODUCT

## Application Information

Typical application circuit is shown in the application circuit and for the circuit parameters setting please refers to the following descriptions.

### Under Voltage Lockout (UVLO) Circuit

When the  $V_{IN}$  drops lower than the UVLO detector threshold, the UVLO circuit starts to operate,  $V_{REF}$  stops, and high-side switch and low-side switch built-in switch transistors turn "OFF". As a result,  $V_{OUT}$  drops according to the  $C_{OUT}$  capacitance value and the load. When the  $V_{IN}$  is rising higher than UVLO released voltage, the IC will restart the operation.

### Short Circuit Protection and Recovery

When the AP3419 output node is shorted to GND that  $V_{FB}$  drops under 0.3V, AP3419 will enter hiccup mode to protect itself. If short circuit is removed, and  $V_{FB}$  rises over 0.3V, the AP3419 recovers to normal operation again. If the AP3419 reaches OCP threshold while short circuit, the AP3419 will enter cycle by cycle current limit mode until the current under OCP threshold.

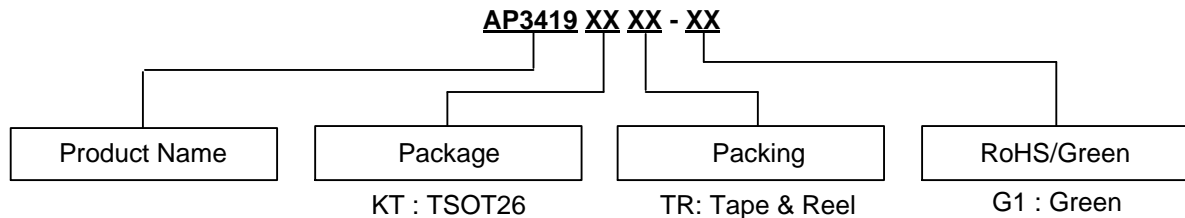
### Over Temperature Protection

The internal thermal temperature protection circuitry is provided to protect the integrated circuit in the event that the maximum junction temperature is exceeded. When the junction temperature exceeds +160°C, it shuts down the internal control circuit and switching power MOSFET. The AP3419 will restart automatically under the control of soft start circuit when the junction temperature decreases to +130°C.

### Input Over Voltage Protection

When input voltage of AP3419 is near 6.25V, the IC will enter Input-Over-Voltage-Protection. It would be shut down and there will be no output voltage in this state. As the input voltage goes down below 6V, it will leave input OVP and recover the output voltage.

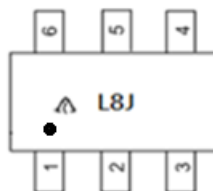
## Ordering Information



| Package | Temperature Range | Part Number   | Marking ID | Packing          |
|---------|-------------------|---------------|------------|------------------|
| TSOT26  | -40 to +85°C      | AP3419KTTR-G1 | L8J        | 3000/Tape & Reel |

## Marking Information

(Top View)

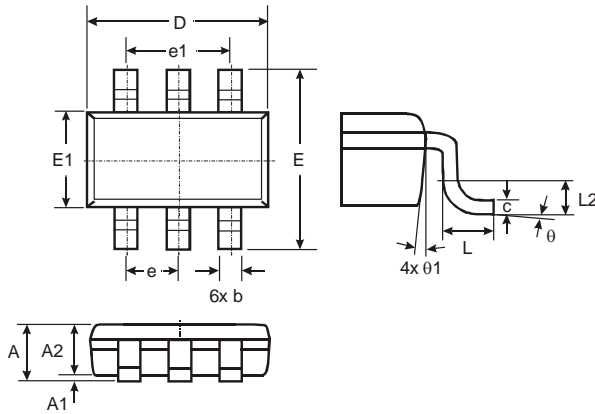


First Line: Logo and Marking ID

## Package Outline Dimensions

Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.

### (1) Package Type: TSOT26

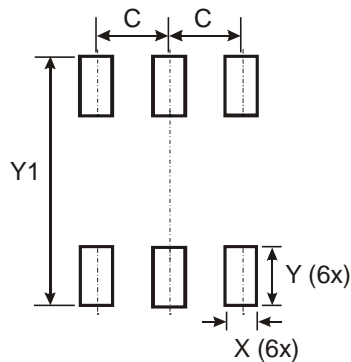


| TSOT26                      |      |      |      |
|-----------------------------|------|------|------|
| Dim                         | Min  | Max  | Typ  |
| A                           | -    | 1.00 | -    |
| A1                          | 0.01 | 0.10 | -    |
| A2                          | 0.84 | 0.90 | -    |
| D                           | -    | -    | 2.90 |
| E                           | -    | -    | 2.80 |
| E1                          | -    | -    | 1.60 |
| b                           | 0.30 | 0.45 | -    |
| c                           | 0.12 | 0.20 | -    |
| e                           | -    | -    | 0.95 |
| e1                          | -    | -    | 1.90 |
| L                           | 0.30 | 0.50 | -    |
| L2                          | -    | -    | 0.25 |
| θ                           | 0°   | 8°   | 4°   |
| θ1                          | 4°   | 12°  | -    |
| <b>All Dimensions in mm</b> |      |      |      |

## Suggested Pad Layout

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.

### (1) Package Type: TSOT26



| Dimensions | Value (in mm) |
|------------|---------------|
| C          | 0.950         |
| X          | 0.700         |
| Y          | 1.000         |
| Y1         | 3.199         |



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