

## -0.66A, -20V P-CHANNEL MOSFET

### DESCRIPTION:



The ALPME3139K is an -0.66A, -20V P-Channel MOSFET and it has Excellent  $R_{DS(ON)}$ , low gate charge and low gate voltages. That the material of product compliance with RoHS requirement.

### FEATURES:

- $V_{(BR)DSS} = -20V$ ,  $I_D = -0.66A$
- $R_{DS(ON) TYP} = 600m\Omega @V_{GS} = -4.5V$ ,  $I_D = -0.66A$
- $R_{DS(ON) TYP} = 850m\Omega @V_{GS} = -2.5V$ ,  $I_D = -0.66A$ 
  - $R_{DS(ON)} = < 850m\Omega @V_{GS} = -4.5V$ ,  $I_D = -0.66A$
  - $R_{DS(ON)} = < 1200m\Omega @V_{GS} = -2.5V$ ,  $I_D = -0.66A$
  - $R_{DS(ON)} = < 2000m\Omega @V_{GS} = -1.8V$ ,  $I_D = -0.66A$
- ESD Protected Up to 2.0KV (HBM)
- Lead-free parts meet RoHS requirements

### APPLICATIONS:

- Load switch
- Interfacing, Load switch
- Power management

### MECHANICAL CHARACTERISTICS

- Epoxy: UL94-V0 rated flame retardant.
- Case: Molded plastic, SOT-523
- Terminals: Solder plated, solderable per MIL-STD-750, Method 2026
- Mounting Position: Any.

**MAXIMUM RATINGS**
**MAXIMUM RATINGS @  $T_A = 25^\circ\text{C}$  unless otherwise specified**

| PARAMETER                                                  |                          | SYMBOL          | VALUE       | UNIT                      |
|------------------------------------------------------------|--------------------------|-----------------|-------------|---------------------------|
| Drain-Source Voltage                                       |                          | $V_{DS}$        | -20         | V                         |
| Gate-Source Voltage                                        |                          | $V_{GS}$        | $\pm 12$    | V                         |
| Continuous Drain Current <sup>(1)</sup>                    | $T_C = 25^\circ\text{C}$ | $I_D$           | -0.66       | A                         |
| Continuous Drain Current <sup>(2)</sup>                    | $T_A = 75^\circ\text{C}$ |                 | -0.52       |                           |
| Pulsed Drain Current <sup>(3)</sup>                        |                          | $I_{DM}$        | -2          | A                         |
| Power Dissipation                                          |                          | $P_D$           | 150         | W                         |
| Thermal Resistance from Junction to Ambient <sup>(2)</sup> |                          | $R_{\theta JA}$ | 833         | $^\circ\text{C}/\text{W}$ |
| Junction Temperature                                       |                          | $T_J$           | +150        | $^\circ\text{C}$          |
| Storage Temperature Range                                  |                          | $T_{STG}$       | -55 to +150 | $^\circ\text{C}$          |

**Note:**

1. The maximum current rating is limited by package and device mounted on a large heat sink
2. Device mounted on 1in2 FR-4 board with 2oz. Copper, in a still air environment with  $T_A = 25^\circ\text{C}$
3. Pulse Test: Pulse Width  $\leq 10\mu\text{s}$ , duty cycle  $\leq 1\%$

**ELECTRICAL CHARACTERISTICS @ TA = 25 °C unless otherwise specified**

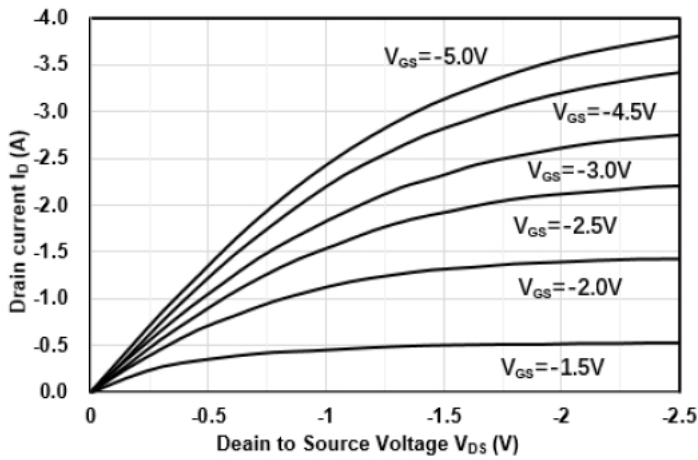
| PARAMETER                       | CONDITIONS                          | SYMBOL        | MIN   | TYP.  | MAX      | UNIT       |
|---------------------------------|-------------------------------------|---------------|-------|-------|----------|------------|
| <b>OFF CHARACTERISTICS</b>      |                                     |               |       |       |          |            |
| Drain-Source Breakdown Voltage  | $V_{GS} = 0V, I_D = -250 \mu A$     | $V_{(BR)DSS}$ | -20   |       |          | V          |
| Zero gate voltage drain current | $V_{DS} = -20V, V_{GS} = 0V$        | $I_{DSS}$     |       |       | 1        | $\mu A$    |
| Gate-body leakage current       | $V_{GS} = \pm 12V, V_{DS} = 0V$     | $I_{GSS}$     |       |       | $\pm 10$ | $\mu A$    |
| <b>ON CHARACTERISTICS</b>       |                                     |               |       |       |          |            |
| Gate-Threshold Voltage          | $V_{DS} = V_{GS}, I_D = -250 \mu A$ | $V_{GS(th)}$  | -0.35 | -0.65 | -1.00    | V          |
| Drain-Source On-Resistance      | $V_{GS} = -4.5V, I_D = -0.5A$       | $R_{DS(ON)}$  |       | 600   | 800      | m $\Omega$ |
|                                 | $V_{GS} = -2.5V, I_D = -0.3A$       |               |       | 850   | 1200     |            |
|                                 | $V_{GS} = -1.8V, I_D = -0.2A$       |               |       | 1300  | 2000     |            |

| <b>DYNAMIC CHARACTERISTICS</b> |                                                   |           |     |      |     |          |
|--------------------------------|---------------------------------------------------|-----------|-----|------|-----|----------|
| PARAMETER                      | CONDITIONS                                        | SYMBOL    | MIN | TYP. | MAX | UNIT     |
| Input Capacitance              | $V_{DS} = -10V, V_{GS} = 0V, f = 1.0 \text{ MHz}$ | $C_{iss}$ |     | 71   |     | pF       |
| Output Capacitance             | $V_{DS} = -10V, V_{GS} = 0V, f = 1.0 \text{ MHz}$ | $C_{oss}$ |     | 20   |     | pF       |
| Reverse Transfer Capacitance   | $V_{DS} = -10V, V_{GS} = 0V, f = 1.0 \text{ MHz}$ | $C_{rss}$ |     | 15   |     | pF       |
| Gate Resistance                | $f = 1.0 \text{ MHz}, \text{Open Drain}$          | $R_g$     |     | 85   |     | $\Omega$ |

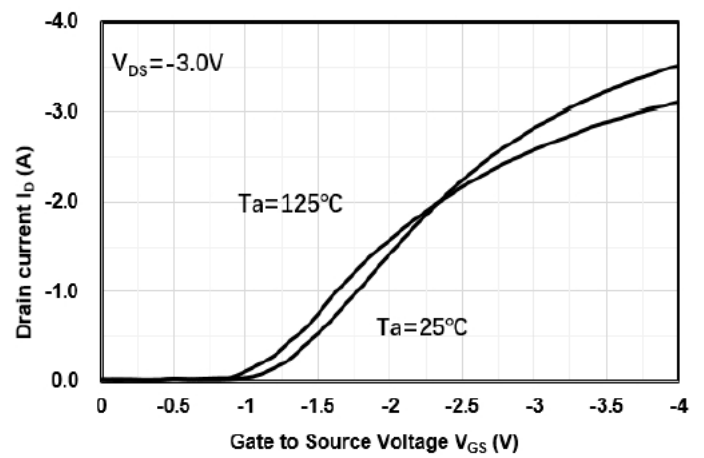
| <b>SWITCHING CHARACTERISTICS</b> |                                                                     |              |     |      |     |      |
|----------------------------------|---------------------------------------------------------------------|--------------|-----|------|-----|------|
| PARAMETER                        | CONDITIONS                                                          | SYMBOL       | MIN | TYP. | MAX | UNIT |
| Turn-On Delay Time               | $V_{DD} = -10V, V_{GS} = -4.5V, R_{GEN} = 3\Omega, R_L = 2.5\Omega$ | $t_{d(on)}$  |     | 4    |     | ns   |
| Turn-On Rise time                | $V_{DD} = -10V, V_{GS} = -4.5V, R_{GEN} = 3\Omega, R_L = 2.5\Omega$ | $t_r$        |     | 19   |     | ns   |
| Turn-Off Delay Time              | $V_{DD} = -10V, V_{GS} = -4.5V, R_{GEN} = 3\Omega, R_L = 2.5\Omega$ | $t_{d(off)}$ |     | 16   |     | ns   |
| Turn-Off Fall time               | $V_{DD} = -10V, V_{GS} = -4.5V, R_{GEN} = 3\Omega, R_L = 2.5\Omega$ | $t_f$        |     | 25   |     | ns   |
| Total Gate Charge                | $V_{DD} = -10V, V_{GS} = -4.5V, I_D = -0.5A$                        | $Q_g$        |     | 1.24 |     | nC   |
| Gate to Source Charge            | $V_{DD} = -10V, V_{GS} = -4.5V, I_D = -0.5A$                        | $Q_{gs}$     |     | 0.37 |     | nC   |
| Gate to Drain Charge             | $V_{DD} = -10V, V_{GS} = -4.5V, I_D = -0.5A$                        | $Q_{gd}$     |     | 0.27 |     | nC   |

| <b>SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS</b> |                             |          |     |      |      |      |
|-------------------------------------------------------|-----------------------------|----------|-----|------|------|------|
| PARAMETER                                             | CONDITIONS                  | SYMBOL   | MIN | TYP. | MAX  | UNIT |
| Drain Forward Voltage                                 | $I_S = -0.65A, V_{GS} = 0V$ | $V_{SD}$ |     |      | -1.2 | V    |

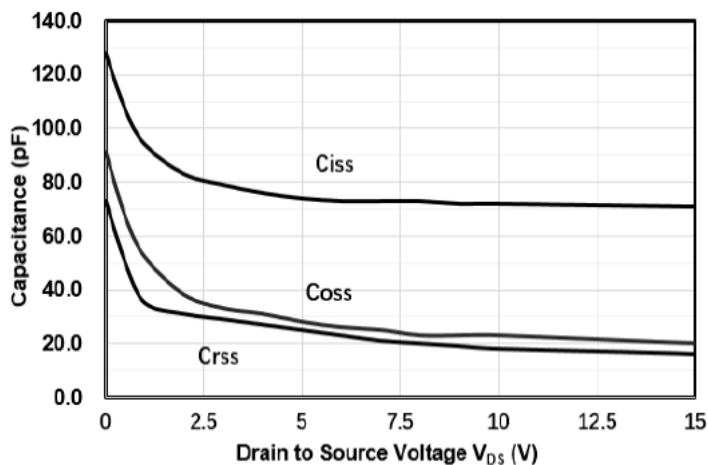
**TYPICAL DEVICE RATING AND CHARACTERISTICS CURVES ( $T_A = 25^\circ\text{C}$  unless otherwise noted)**



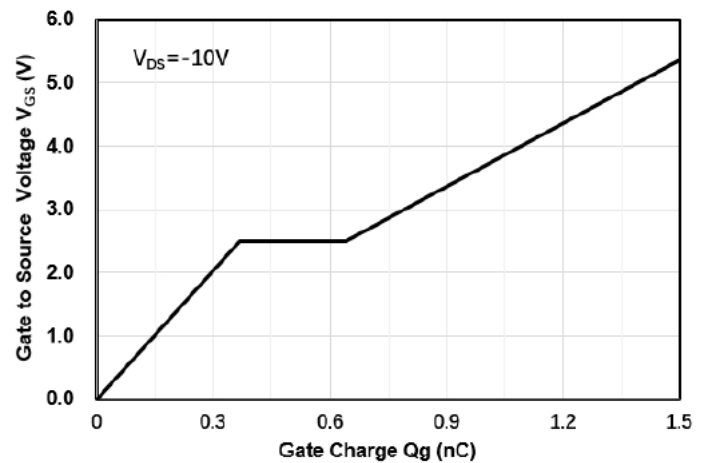
**Fig.1 OUTPUT CHARACTERISTICS**



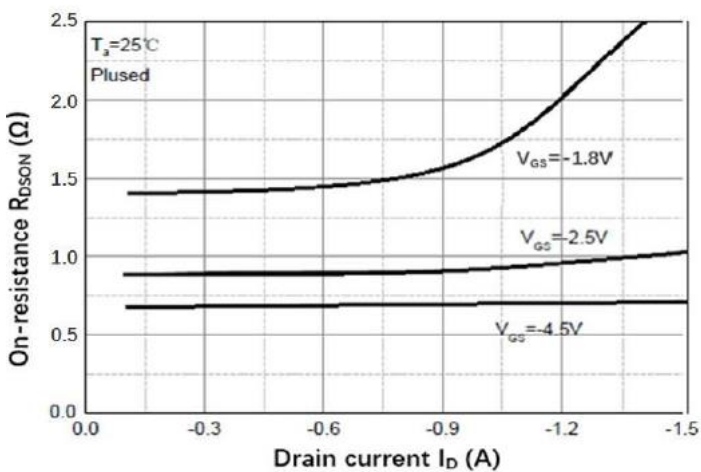
**Fig.2 TRANSFER CHARACTERISTICS**



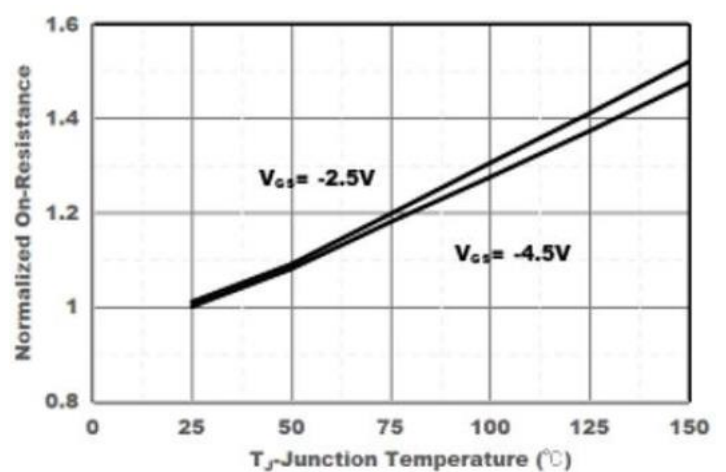
**Fig.3 CAPACITANCE CHARACTERISTICS**



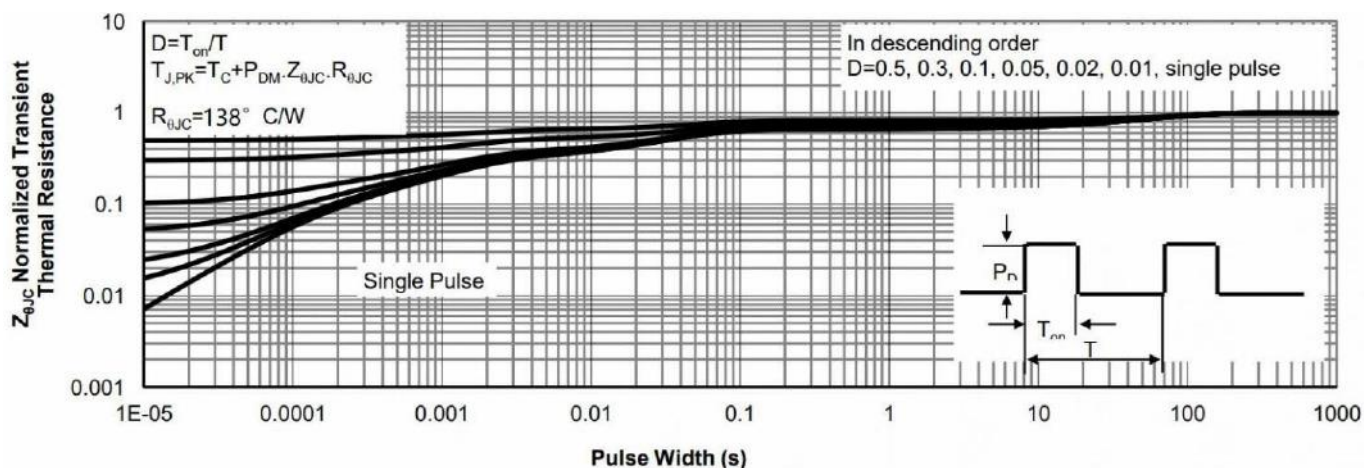
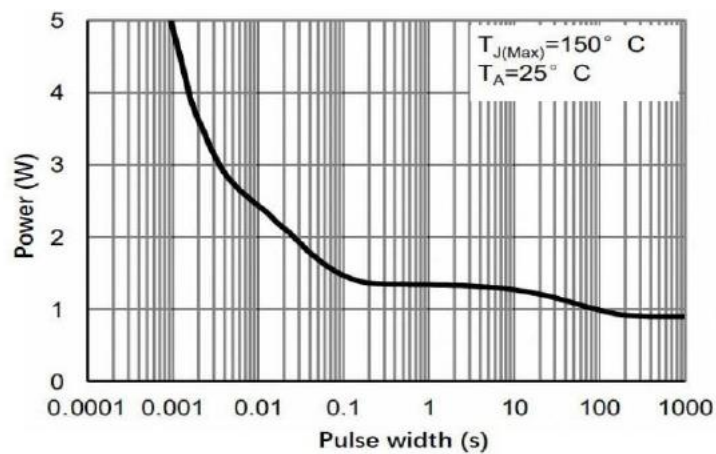
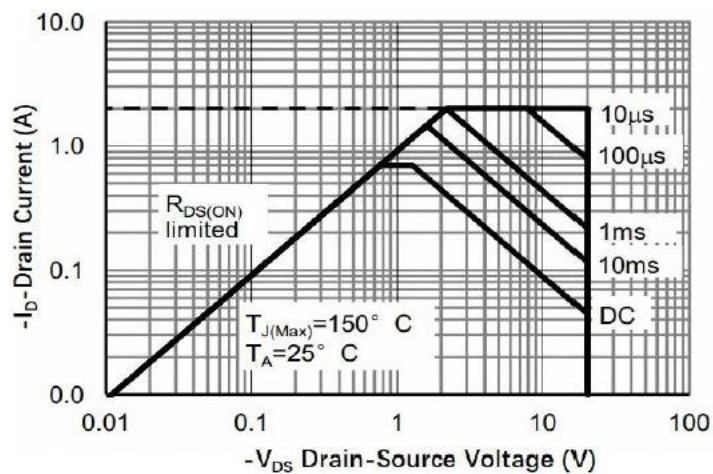
**Fig.4 GATE CHARGE**



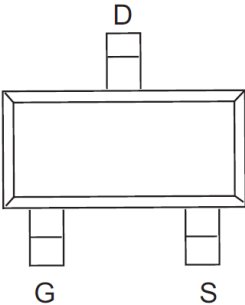
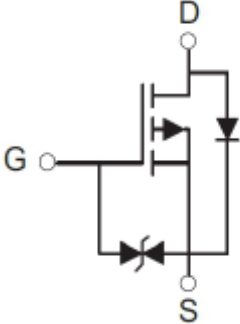
**Fig.5 DRAIN-SOURCE ON RESISTANCE**



**Fig.6 DRAIN-SOURCE ON RESISTANCE**

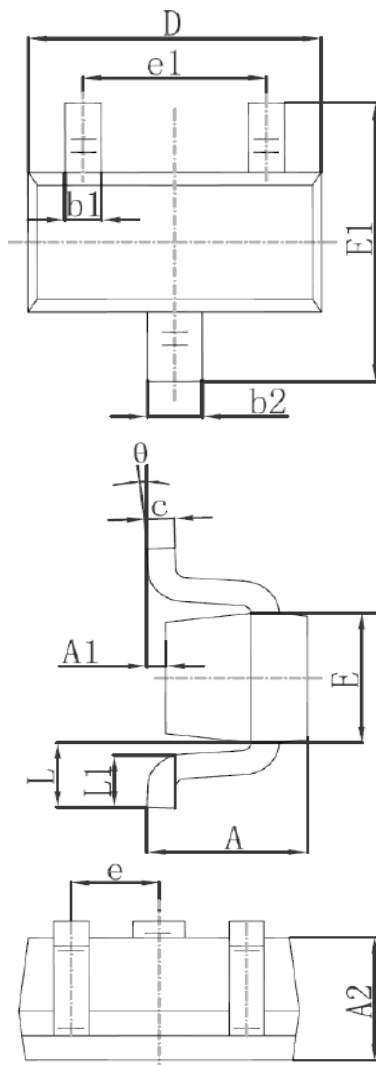


PINNING INFORMATION

| PIN                                       | SIMPLIFIED OUTLINE                                                                | SCHEMATIC DIAGRAM                                                                   |
|-------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Pin D Drain<br>Pin G Gate<br>Pin S Source |  |  |

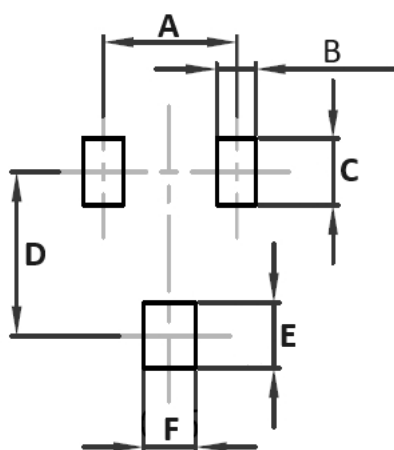
## PACKAGE INFORMATION

### SOT-523



| OUTLINE DIMENSIONS |             |      |            |       |
|--------------------|-------------|------|------------|-------|
| SYMBOL             | MILLIMETERS |      | INCHES     |       |
|                    | MIN         | MAX  | MIN        | MAX   |
| A                  | 0.70        | 0.90 | 0.028      | 0.035 |
| A1                 | 0.00        | 0.10 | 0.000      | 0.004 |
| A2                 | 0.70        | 0.80 | 0.028      | 0.031 |
| b1                 | 0.15        | 0.25 | 0.006      | 0.010 |
| b2                 | 0.25        | 0.35 | 0.010      | 0.014 |
| C                  | 0.10        | 0.20 | 0.004      | 0.008 |
| D                  | 1.50        | 1.70 | 0.059      | 0.067 |
| E                  | 0.70        | 0.90 | 0.028      | 0.035 |
| E1                 | 1.45        | 1.75 | 0.057      | 0.069 |
| E                  | 0.50 TYP.   |      | 0.020 TYP. |       |
| e1                 | 0.90        | 1.10 | 0.035      | 0.043 |
| L                  | 0.40 REF.   |      | 0.016 REF. |       |
| L1                 | 0.26        | 0.46 | 0.010      | 0.018 |
| θ                  | 0°          | 8°   | 0°         | 8°    |

### SUGGESTED SOLDER PAD LAYOUT

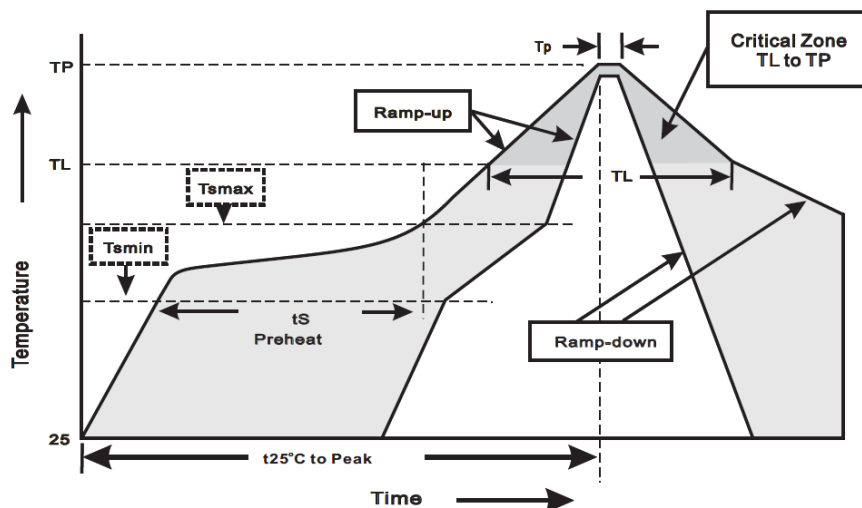


| OUTLINE DIMENSIONS                                                                                                                              |             |        |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------|
| SYMBOL                                                                                                                                          | MILLIMETERS | INCHES |
| A                                                                                                                                               | 1.00        | 0.039  |
| B                                                                                                                                               | 0.40        | 0.016  |
| C                                                                                                                                               | 0.60        | 0.024  |
| D                                                                                                                                               | 1.24        | 0.049  |
| E                                                                                                                                               | 0.60        | 0.024  |
| F                                                                                                                                               | 0.50        | 0.020  |
| <b>Note:</b><br>1. Controlling dimension: in millimeters.<br>2. General tolerance: ±0.05mm<br>3. The pad layout is for reference purposes only. |             |        |

## SOLDERING PARAMETERS

### SUGGESTED THERMAL PROFILES FOR SOLDERING PROCESSES

1. Storage environment: Temperature=5 °C~40 °C Humidity=55% ±25%
2. Reflow soldering of surface-mount devices



3. Reflow soldering

| PROFILE FEATURE                                      | SOLDERING CONDITION |
|------------------------------------------------------|---------------------|
| Average ramp-up rate ( $T_L$ to $T_P$ )              | <3 °C/sec           |
| Preheat                                              |                     |
| - Temperature Min ( $T_{smin}$ )                     | 150 °C              |
| - Temperature Max ( $T_{smax}$ )                     | 200 °C              |
| - Time (min to max) ( $t_s$ )                        | 60 ~ 120 sec        |
| $T_{smax}$ to $T_L$                                  |                     |
| - Ramp-upRate                                        | <3 °C/sec           |
| Time maintained above:                               |                     |
| - Temperature ( $T_L$ )                              | 217 °C              |
| - Time( $t_L$ )                                      | 60 ~ 260 sec        |
| Peak Temperature ( $T_P$ )                           | 255 °C-0/+5 °C      |
| Time within 5 °C of actual Peak Temperature( $t_P$ ) | 10 ~ 30 sec         |
| Ramp-down Rate                                       | <6 °C/sec           |
| Time 25 °C to Peak Temperature                       | <6 minutes          |



*beyond boundaries...*

**ALPME3139K**

**SOT-523**

## CUSTOMER NOTE:

### DISCLAIMER

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2. In Europe, please dispose as per EU Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE).



[sales@alpinesemi.com](mailto:sales@alpinesemi.com)  
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