

## ■ DESCRIPTION

The 4419 is the P-Channel logic enhancement mode power field effect transistor is produced using high cell density advanced trench technology..

This high density process is especially tailored to minimize on-state resistance. These devices are particularly suited for low voltage application, notebook computer power management and other battery powered circuits where high-side switching

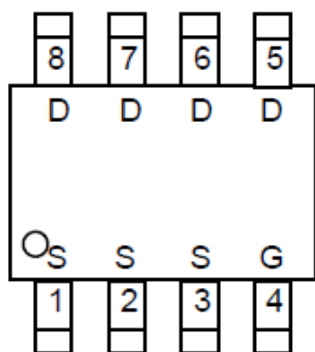
## ■ FEATURE

- ◆ -30V/-9.7A,  $R_{DS(ON)}=19.5m\Omega$  (typ.)@ $V_{GS}=-10V$
- ◆ -30V/-7.0A,  $R_{DS(ON)}=23.5m\Omega$  (typ.)@ $V_{GS}=-4.5V$
- ◆ Super high design for extremely low  $R_{DS(ON)}$
- ◆ Exceptional on-resistance and Maximum DC current capability
- ◆ Full RoHS compliance
- ◆ SOP8 package design

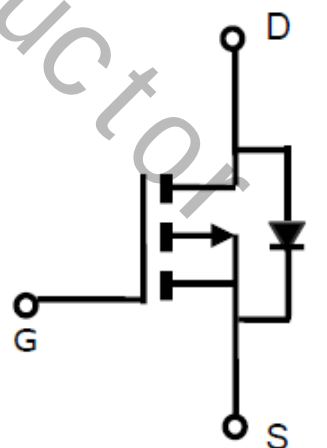
## ■ APPLICATIONS

- ◆ High Frequency Point-of-Load Synchronous
- ◆ Newworking DC-DC Power System
- ◆ Load Switch

## ■ PIN CONFIGURATION



TOP VIEW  
SOP-8



P-Channel

■ **ABSOLUTE MAXIMUM RATINGS** ( $T_A = 25^\circ\text{C}$  Unless otherwise noted)

| Symbol          | Parameter                                           |                        | Typical  | Unit               |
|-----------------|-----------------------------------------------------|------------------------|----------|--------------------|
| $V_{DSS}$       | Drain-Source Voltage                                |                        | -30      | V                  |
| $V_{GSS}$       | Gate-Source Voltage                                 |                        | $\pm 20$ | V                  |
| $I_D$           | Continuous Drain Current ( $T_A=25^\circ\text{C}$ ) | $V_{GS}=10\text{V}$    | -9.7     | A                  |
| $I_{DM}$        | Pulsed Drain Current                                |                        | -40      | A                  |
| $I_S$           | Continuous Source Current (Diode Conduction)        |                        | -2.1     | A                  |
| $P_D$           | Power Dissipation                                   | $T_A=25^\circ\text{C}$ | 3.0      | W                  |
|                 |                                                     | $T_A=70^\circ\text{C}$ | 2.1      |                    |
| $T_J$           | Operation Junction Temperature                      |                        | 150      | $^\circ\text{C}$   |
| $T_{STG}$       | Storage Temperature Range                           |                        | -55~+150 | $^\circ\text{C}$   |
| $R_{\theta JA}$ | Thermal Resistance Junction to Ambient              |                        | 85       | $^\circ\text{C/W}$ |

**Note:** Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress rating only and functional device operation is not implied

■ **ELECTRICAL CHARACTERISTICS**( $T_A=25^\circ\text{C}$  Unless otherwise noted)

| Symbol               | Parameter                       | Condition                                                                                     | Min  | Typ   | Max    | Unit |
|----------------------|---------------------------------|-----------------------------------------------------------------------------------------------|------|-------|--------|------|
| Static Parameters    |                                 |                                                                                               |      |       |        |      |
| V <sub>(BR)DSS</sub> | Drain-Source Breakdown Voltage  | V <sub>GS</sub> =0V, I <sub>D</sub> =-250uA                                                   | -30  |       |        | V    |
| V <sub>GS(th)</sub>  | Gate Threshold Voltage          | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250uA                                     | -1.2 | -1.4  | -2.7   | V    |
| I <sub>GSS</sub>     | Gate Leakage Current            | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V                                                    |      |       | ±100   | nA   |
| I <sub>DSS</sub>     | Zero Gate Voltage Drain Current | V <sub>DS</sub> =-24V, V <sub>GS</sub> =0                                                     |      |       | -1     | uA   |
|                      |                                 | V <sub>DS</sub> =-24V, V <sub>GS</sub> =0<br>T <sub>J</sub> =55℃                              |      |       | -5     |      |
| R <sub>DS(ON)</sub>  | Drain-Source On-Resistance      | V <sub>GS</sub> =-10V, I <sub>D</sub> =-9.7A                                                  |      | 19.5  | 28     | mΩ   |
|                      |                                 | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-7A                                                   |      | 23    | 35     |      |
| Source-Drain Diode   |                                 |                                                                                               |      |       |        |      |
| V <sub>SD</sub>      | Diode Forward Voltage           | I <sub>S</sub> =-1.0A, V <sub>GS</sub> =0V                                                    |      | -0.7  | -1.0   | V    |
| Dynamic Parameters   |                                 |                                                                                               |      |       |        |      |
| Q <sub>g</sub>       | Total Gate Charge               | V <sub>DS</sub> =-15V<br>15V<br>V <sub>GS</sub> =-10V<br>10V                                  |      | 33.82 | 43.97  | nC   |
| Q <sub>gs</sub>      | Gate-Source Charge              |                                                                                               |      | 4.93  | 6.41   |      |
| Q <sub>gd</sub>      | Gate-Drain Charge               |                                                                                               |      | 5.2   | 6.76   |      |
| C <sub>iss</sub>     | Input Capacitance               | V <sub>DS</sub> =-15V<br>V <sub>GS</sub> =0V<br>f=1MHz                                        |      | 1573  | 1900   | pF   |
| C <sub>oss</sub>     | Output Capacitance              |                                                                                               |      | 319   |        |      |
| C <sub>rss</sub>     | Reverse Transfer Capacitance    |                                                                                               |      | 211   | 295    |      |
| T <sub>d(on)</sub>   | Turn-On Time                    | V <sub>DS</sub> =-15V<br>I <sub>D</sub> =-10A<br>V <sub>GEN</sub> =-10V<br>R <sub>G</sub> =6Ω |      | 15.44 | 30.88  | nS   |
| T <sub>r</sub>       |                                 |                                                                                               |      | 5.04  | 10.08  |      |
| T <sub>d(off)</sub>  | Turn-Off Time                   |                                                                                               |      | 71.04 | 142.08 |      |
| T <sub>f</sub>       |                                 |                                                                                               |      | 16.8  | 33.6   |      |

Note: 1. Pulse test: pulse width $\leq 300\mu\text{s}$ , duty cycle $\leq 2\%$

2.Static parameters are based on package level with recommended wire bonding

# ■ **TYPICAL CHARACTERISTICS** (25°C Unless Note)

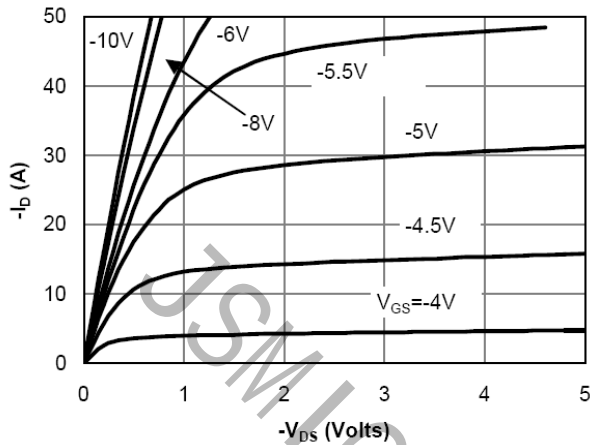


Fig 1: On-Region Characteristics

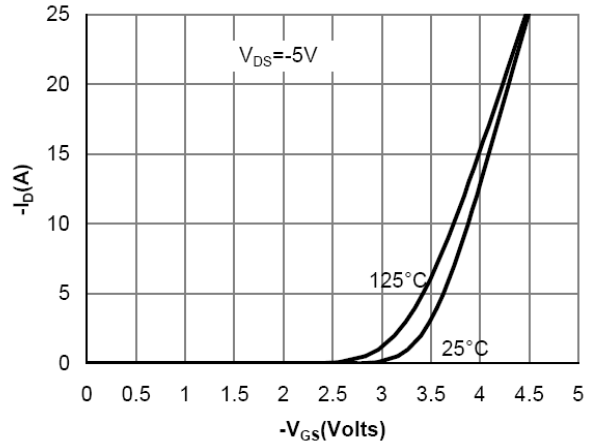


Figure 2: Transfer Characteristics

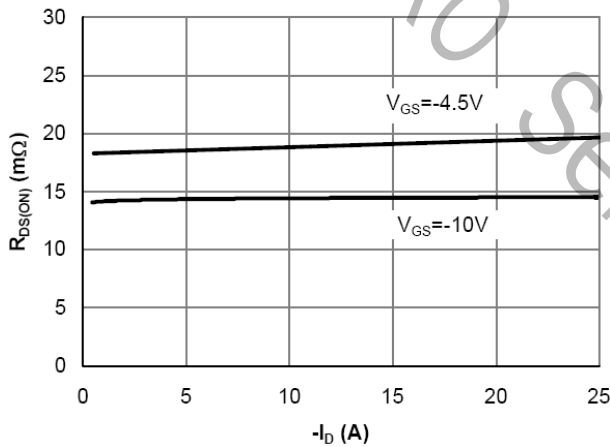


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

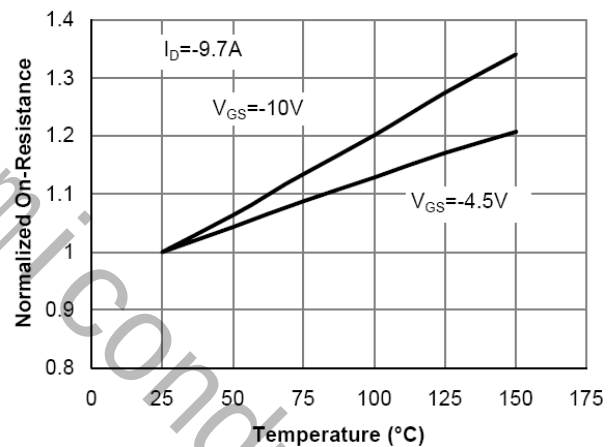


Figure 4: On-Resistance vs. Junction Temperature

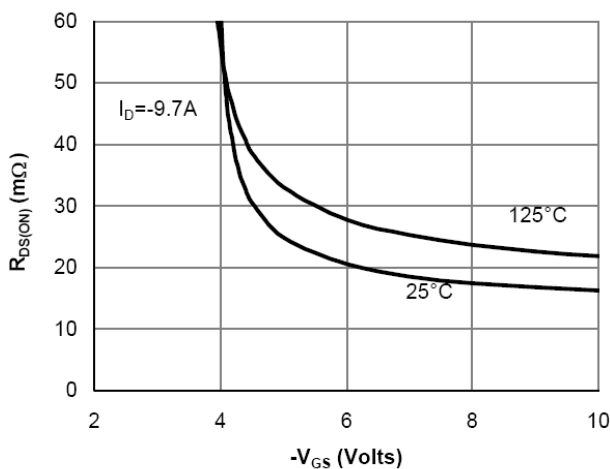


Figure 5: On-Resistance vs. Gate-Source Voltage

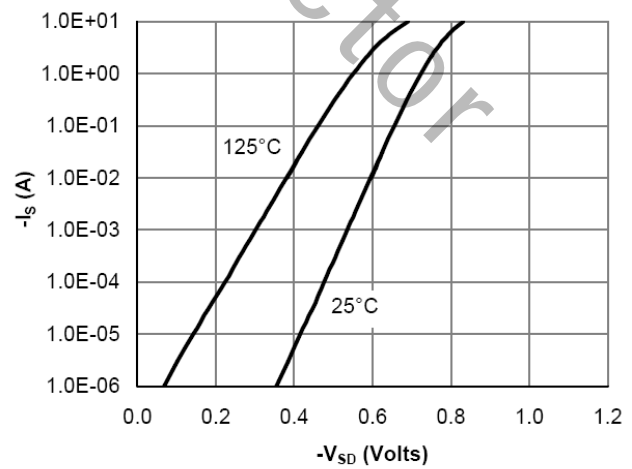


Figure 6: Body-Diode Characteristics

## ■ TYPICAL CHARACTERISTICS (continuous)

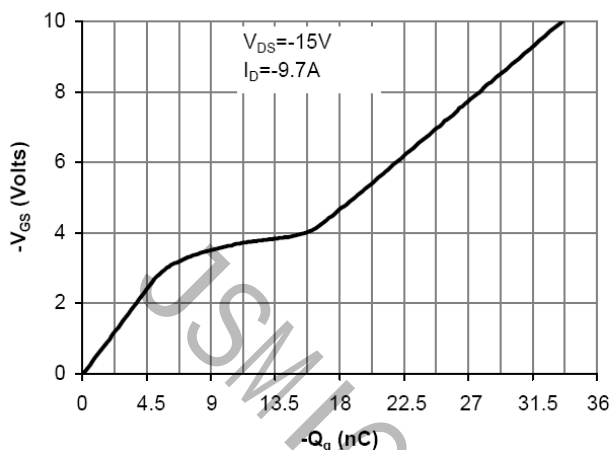


Figure 7: Gate-Charge Characteristics

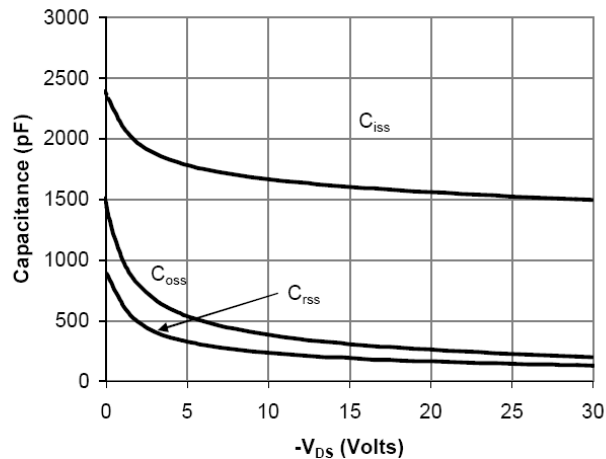


Figure 8: Capacitance Characteristics

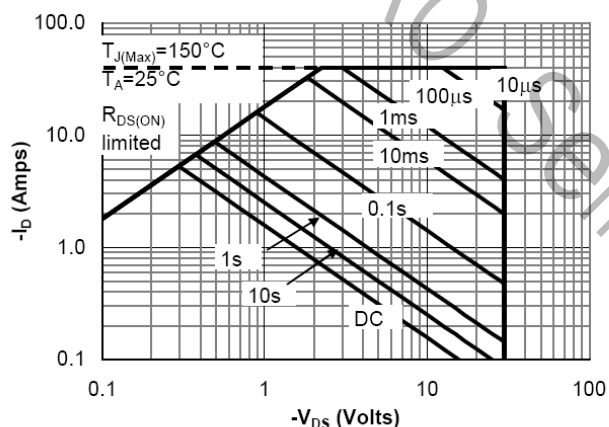


Figure 9: Maximum Forward Biased Safe Operating Area

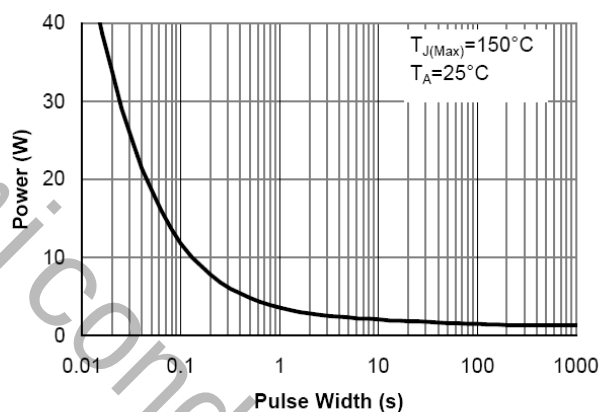


Figure 10: Single Pulse Power Rating Junction-to-Ambient

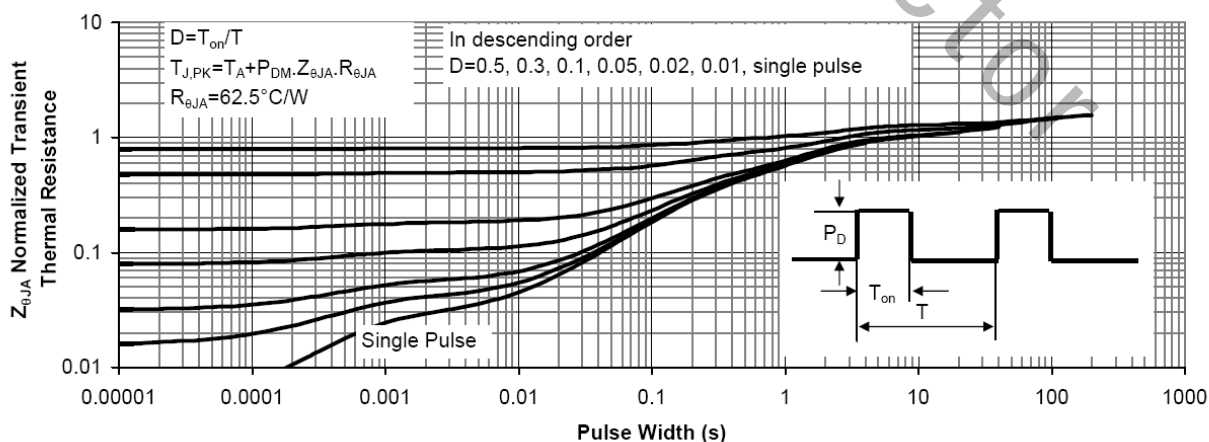
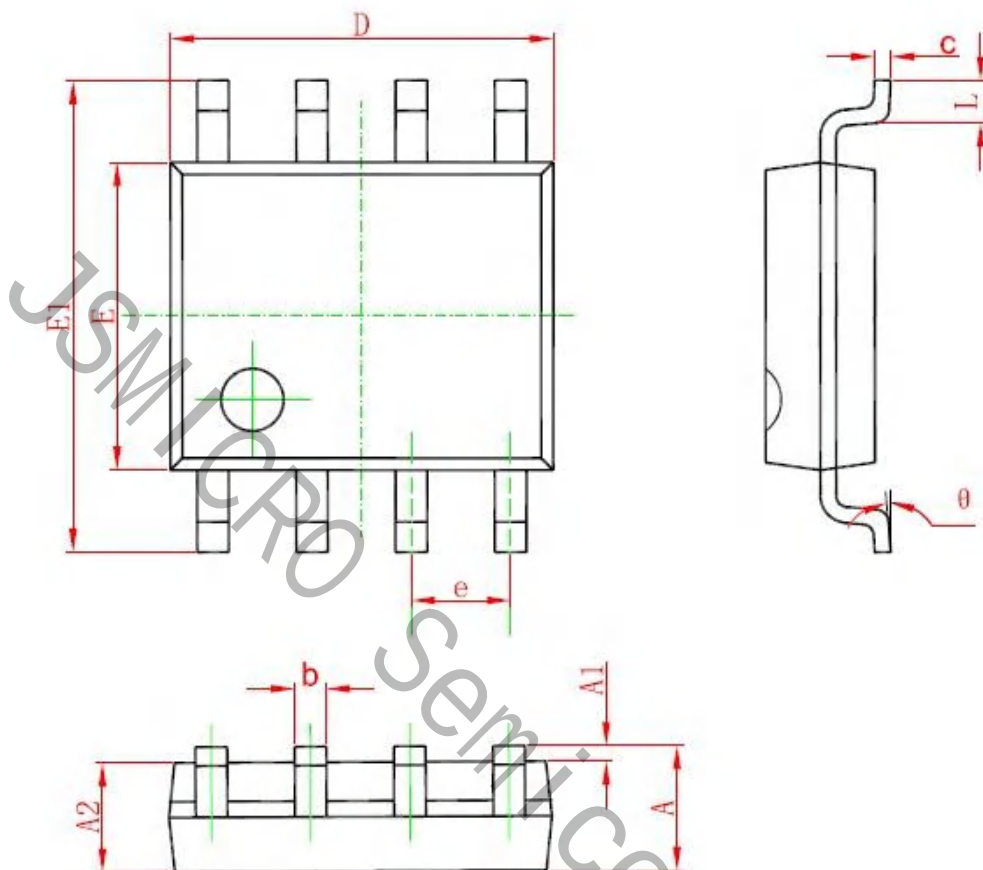


Figure 11: Normalized Maximum Transient Thermal Impedance

■ SOP8 PACKAGE OUTLINE DIMENSIONS

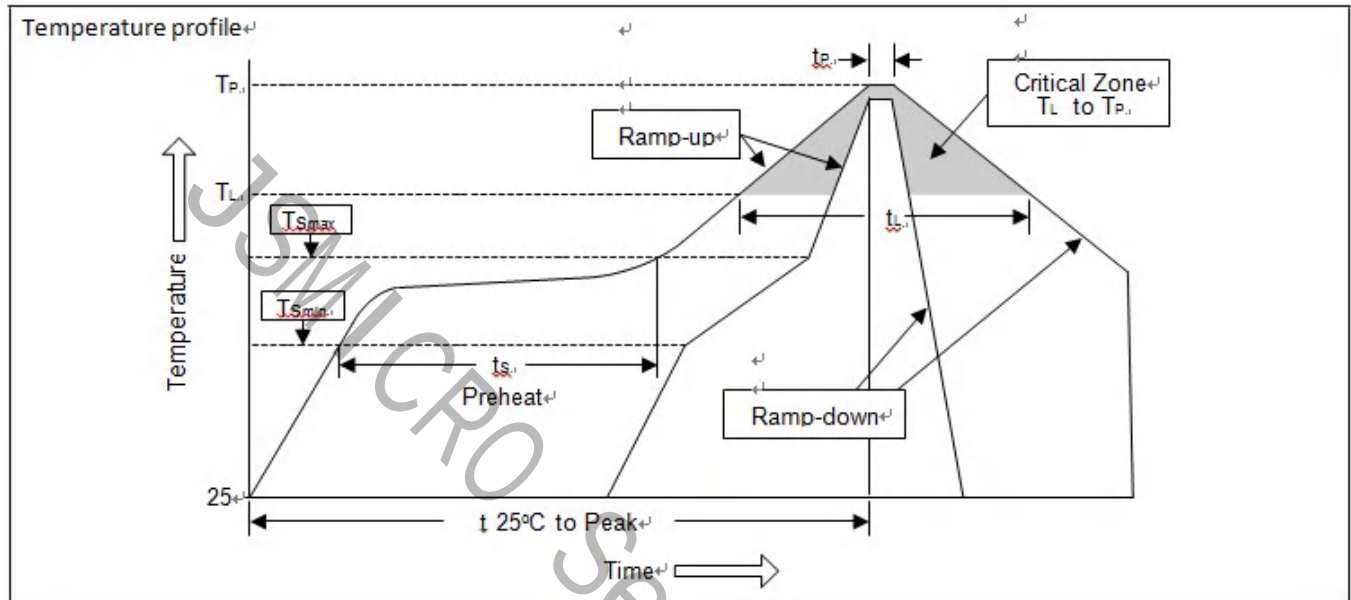


| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 1.350                     | 1.750 | 0.053                | 0.069 |
| A1     | 0.100                     | 0.250 | 0.004                | 0.010 |
| A2     | 1.350                     | 1.550 | 0.053                | 0.061 |
| b      | 0.330                     | 0.510 | 0.013                | 0.020 |
| c      | 0.170                     | 0.250 | 0.006                | 0.010 |
| D      | 4.700                     | 5.100 | 0.185                | 0.200 |
| E      | 3.800                     | 4.000 | 0.150                | 0.157 |
| E1     | 5.800                     | 6.200 | 0.228                | 0.244 |
| e      | 1.270 (BSC)               |       | 0.050 (BSC)          |       |
| L      | 0.400                     | 1.270 | 0.016                | 0.050 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |

## ■ SOLDERING METHODS FOR UNIVERCHIP

Storage environment Temperature=10°C~35°C Humidity=65%±15%

Reflow soldering of surface mount device



| Profile Feature                                      | Sn-Pb Eutectic Assembly | Pb free Assembly |
|------------------------------------------------------|-------------------------|------------------|
| Average ramp-up rate ( $T_L$ to $T_P$ )              | <3°C/sec                | <3°C/sec         |
| Preheat                                              |                         |                  |
| -Temperature Min ( $T_{S_{min}}$ )                   | 100°C                   | 150°C            |
| -Temperature Max ( $T_{S_{max}}$ )                   | 150°C                   | 200°C            |
| -Time (min to max) ( $t_s$ )                         | 60~120 sec              | 60~180 sec       |
| $T_{S_{max}}$ to $T_L$                               |                         |                  |
| -Ramp-up Rate                                        | <3°C/sec                | <3°C/sec         |
| Time maintained above                                |                         |                  |
| -Temperature ( $T_L$ )                               | 183°C                   | 217°C            |
| -Time ( $t_L$ )                                      | 60~150 sec              | 60~150 sec       |
| Peak Temperature ( $T_P$ )                           | 240°C+0/-5°C            | 260°C+0/-5°C     |
| Time within 5°C of actual Peak Temperature ( $t_p$ ) | 10~30 sec               | 20~40 sec        |
| Ramp-down Rate                                       | <6°C/sec                | <6°C/sec         |
| Time 25°C to Peak Temperature                        | <6 minutes              | <6 minutes       |