

# Thermal Measurement Report

DATE: 5/8/96  
revised 11/18/96

Package Description:    Package: 240 32 x 32 mm QFP  
                                  Die Down  
                                  Flag: 10.6 mm Square  
                                  Leadframe: SIDN 1234625  
                                  Die Attach: JMI 2500AN  
                                  Mold Compound: Sumitomo 7304LC  
                                  Assembled: ANAM  
                                  Die: PST6 - 10.16 mm Square

Junction to Ambient Thermal Resistance or Theta JA ( $R_{\theta JA}$ ) was measured per SEMI Test Method G38-87 at 1.5 watts in a horizontal configuration. The test board conforms to EIA/JESD 51-3; it is a single layer 115x102 mm board designed to test 0.5 mm pitch QFP packages from 208 to 304 leads. The trace width is 0.24 mm, trace thickness is 0.076 mm. Sample size was 5.

| Convection | Theta JA<br>Average<br>°C/watt | Standard<br>Deviation<br>°C/watt | Theta JA<br>Ave + 3 Std. Dev.<br>°C/watt |
|------------|--------------------------------|----------------------------------|------------------------------------------|
| Natural    | 31.0                           | 0.08                             | 31.3                                     |
| 100 ft/min | 27.7                           | 0.18                             | 28.3                                     |
| 200        | 26.1                           | 0.1                              | 26.4                                     |
| 400        | 23.7                           | 0.34                             | 24.7                                     |
| 800        | 19.9                           | 0.11                             | 20.2                                     |

"Thermal resistance" from junction to a thermocouple on top center of case, previously titled Theta J-Ref ( $R_{\theta JR}$ ), was been renamed by the industry standard committee JEDEC JC15.1 as  $\Psi_{JT}$  and defined in EIA/JESD51-2. It is a useful value to use to estimate junction temperature in steady state customer environments.

| Convection | $\Psi_{JT}$<br>Average<br>°C/watt | Standard<br>Deviation<br>°C/watt |
|------------|-----------------------------------|----------------------------------|
| Natural    | 1.9                               | 0.09                             |
| 100 ft/min | 2.3                               | 0.06                             |
| 200        | 2.5                               | 0.04                             |
| 400        | 3.1                               | 0.08                             |
| 800        | 3.9                               | 0.1                              |

Junction to case thermal resistance, Theta JC ( $R_{\theta JC}$ ), was measured using the cold plate technique with the cold plate temperature used as the "case" temperature. The reference specifications are MIL-STD 883D, Method 1012.1 and SEMI G30-88. Sample size was 5.

| Theta JC<br>Average<br>°C/watt | Standard<br>Deviation<br>°C/watt | Theta JC<br>Ave + 3 Std. Dev.<br>°C/watt |
|--------------------------------|----------------------------------|------------------------------------------|
| 8.9                            | 0.07                             | 9.1                                      |

Junction to board thermal resistance Theta JB ( $R_{\theta JB}$ ) was measured using a cold plate technique with the cold plate in thermal contact with the bottom of the printed circuit board. The board temperature was measured with a thermocouple soldered to a center lead along one side of the package where the lead was soldered to the board. The measurement was taken using the 4 conductor layer printed circuit board described below. Sample size is 5.

| Theta JB<br>Average<br>°C/watt | Standard<br>Deviation<br>°C/watt | Theta JB<br>Ave + 3 Std. Dev.<br>°C/watt |
|--------------------------------|----------------------------------|------------------------------------------|
| 18.8                           | 0.19                             | 19.4                                     |

Junction to Ambient Thermal Resistance (Theta JA) was also measured on a four layer test board. The test board was a 115x102 mm board designed to test 0.5 mm pitch QFP packages from 208 to 304 leads with two solid internal plane of 1 oz nominal thickness (0.033 mm thick). The trace pattern on the component side had a trace width of 0.231 mm, trace thickness of 0.0715 mm. Sample size was 5.

**Do Not Use this data without special footnote indicating that the results were measured on a board with two solid internal planes.**

| Convection | Theta JA<br>Average<br>°C/watt | Standard<br>Deviation<br>°C/watt | Theta JA<br>Ave + 3 Std. Dev.<br>°C/watt |
|------------|--------------------------------|----------------------------------|------------------------------------------|
| Natural    | 26.1                           | 0.11                             | 26.4                                     |
| 100 ft/min | 23.8                           | 0.13                             | 24.2                                     |
| 200        | 22.8                           | 0.13                             | 23.2                                     |
| 400        | 21.3                           | 0.19                             | 21.9                                     |
| 800        | 18.6                           | 0.16                             | 19.1                                     |

SEMI specifications are available from Semiconductor Equipment and Materials International at (415) 964-5111.

MIL-SPEC and EIA/JESD (JEDEC) specifications are available from Global Engineering Documents at 800-854-7179 or 303-397-7956.

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Freescal Semiconductor Japan Ltd.  
Headquarters  
ARCO Tower 15F  
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Technical Information Center  
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Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

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Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А