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User Guidelines for IR Thermal Imaging Determination of Die Temperature

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USER GUIDELINES FOR IR THERMAL IMAGING DETERMINATION OF DIE TEMPERATURE

(From JEDEC Board Ballot JCB-95-69, formulated under the cognizance of the JC-25 Committee on Transistors.)

1 Purpose

The purpose of these user guidelines is to provide background and an example for the use of an infrared (IR) microscope to determine die temperature of electronic devices for calculations such as thermal resistance.

2 Terms and definitions

The following definitions and symbols are used throughout this document:

$T_{J(M)}$ **peak junction temperature** (in degrees Celsius)

$T_{J(AV)}$ **average junction temperature** (in degrees Celsius)

T_C **case temperature** (in degrees Celsius)

NOTE — Measured with a thermocouple that is attached as close as possible to the major heat flow path, usually on the bottom center of the device package or case for packaged parts. For wafers, this temperature is the die temperature. For surface-mount devices, this is the lead frame.

T_M **mounting surface temperature** (in degrees Celsius)

NOTE — Measured with a thermocouple inserted in an access hole terminated near the device/stage interface.

P_D **power dissipation** (in watts) of a single junction under test or of the entire package.

$R_{\theta JR}$ **thermal resistance between junction and a reference** (such as ambient ($R_{\theta JA}$) or case ($R_{\theta JC}$), measured in °C/W)

emissivity: A dimensionless factor that is a property of the material and its surface texture.

NOTE — Emissivity (ε) is represented by a number between 0 and 1 where $\varepsilon = 0$ represents a perfect infrared reflector and $\varepsilon = 1$ represents a perfect infrared absorber or "blackbody". A blackbody is also a perfect radiator or emitter of infrared radiation.

spatial resolution: The diameter of a spot, in micrometers, whose size is determined from the half-power points resulting from a point infrared source.