One-Page Thermal Reference Sheet, Revised Sept 2013  
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**Thermal Calculations**

Measuring parts on a PCB:
Using Case temperature \( T_J = T_C + Power \times \Psi_{JT} \)

Estimating \( T_J \) for a new design (options):
Using PCB temperature \( T_J = T_B + Power \times \Psi_{JB} \)

System thermal modeling
PCB calculator
2R or Delphi model
Approximations based on existing device/system

*Where:*
\( T_J = \) Junction Temp: max for performance, reliability, etc.
\( T_C = \) Case Temperature (measured)
Power: estimated or measured power
\( \Psi_{JT} \): Thermal delta, device to case/top, in system
\( \Psi_{JB} \): Thermal delta, device to PCB, in system, near device

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**Description and Use of Common Terms:**

**Theta-JA:** \( (T_J - T_a) / Power \). Defined by JEDEC 51-2A. Unique for each device. For comparison of devices and/or packages in a standardized environment. Not for calculation of \( T_J \).

**Theta-JA,effective:** Non-JEDEC custom environment, such as EVM or specific end application.

**Theta-JC,top:** \( (T_J - T_c) / Power \). True thermal resistance to top of part. Only used with a heat sink.

**Psi-JT:** \( (T_J - T_C) / Power \). Measurement parameter. Used to calculate \( T_J \) based on a measured \( T_C \).

**Psi-JB/Psi-JB:** \( (T_J - T_B) / Power \). Resistance or measurement parameter based on board temperature. Useful for early estimates of a new part in a known end application.

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**Useful Links:**
- [www.ti.com/thermal](http://www.ti.com/thermal)
- TI Apps note: SPRA953A
- PCB Apps note: SLMA002
- TI E2E Community
- JEDEC JESD51 Specs

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**System Thermal Enhancements**
- Spread out hot devices on PCB
- Maximize GND layer in PCB
- No breaks in heat flow through planes
- Increase PCB layers or thickness
- Widen PCB traces near device
- PCB vias under or near device
- System air vents near to device
- Airflow (global and local)
- Heat sink (individual, group, chassis)
- Gap filler material up to chassis

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