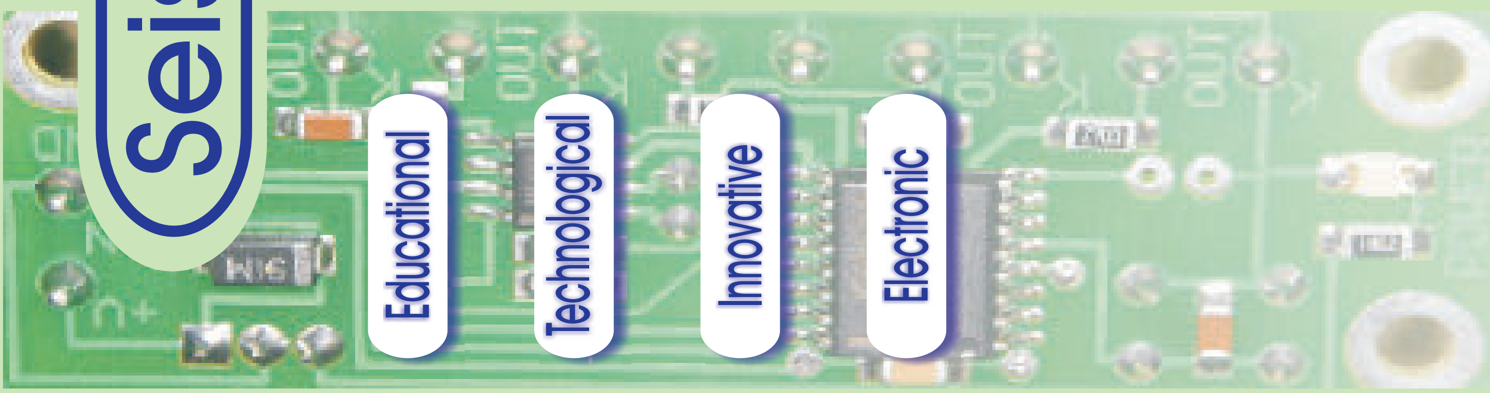
Heatsink Thermal Resistance Calculation

Design

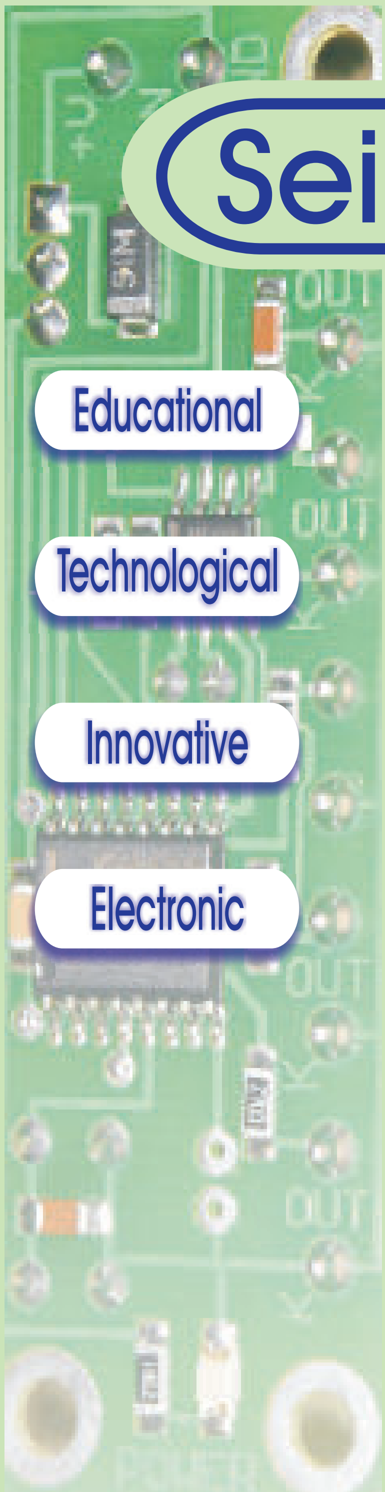
LET IT SHAKE !

Seismo-Quake™

HEATSINK



Heatsink Thermal Resistance Calculation

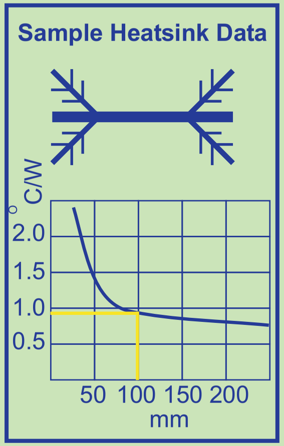


Seismo-Quake™

LET IT SHAKE !

Design

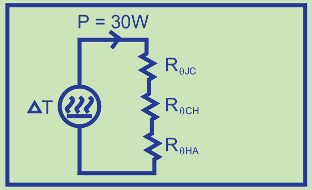
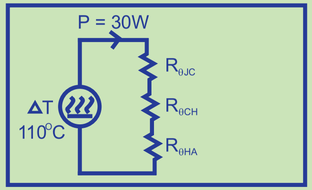
HEATSINK



Information Given:

Package	TO220
$R_{\theta JA}$	70
$R_{\theta JC}$	2
V_{CE}	10V
I_C	3A
T_{JMax}	150°C

Calculate the heatsink dissipation rate required by the transistor.

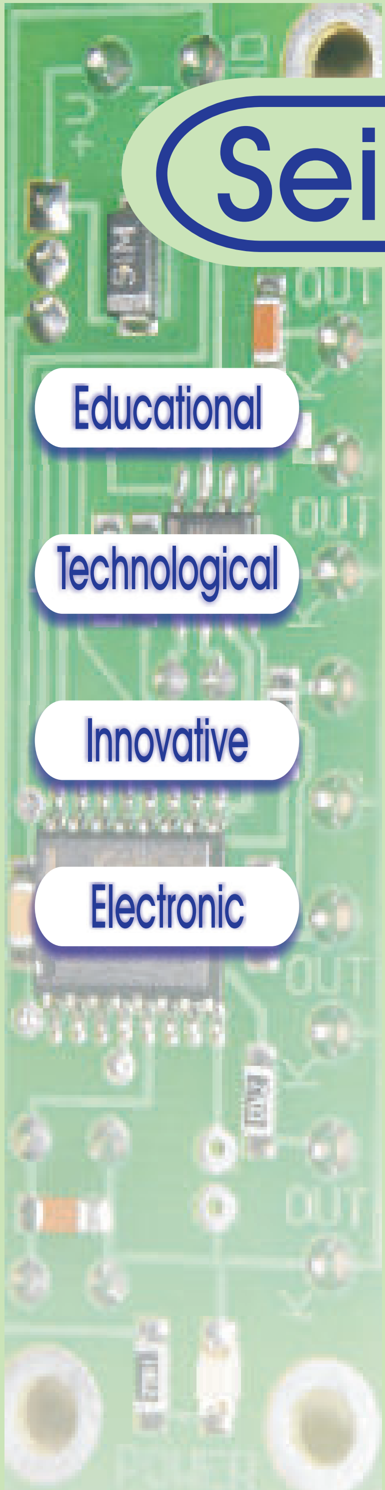
Description	Formula	Diagram
Determine the device power dissipation by multiplying the collector current by the collector-emitter voltage.	$P = I_C \times V_{CE}$ $= 3 \times 10$ $= 30W$	
Assuming an ambient temperature of $T_A = 40^{\circ}C$ (worst case scenario).	$\Delta T = T_J - T_A$ $= 150^{\circ}C - 40^{\circ}C$ $= 110^{\circ}C$	
The sum of the series thermal resistances (R_θ) may not be higher than the value calculated in $R_{\theta TOTAL}$.	$R_{\theta TOTAL} = \frac{\Delta T}{\Delta P}$ $= \frac{110^{\circ}C}{30W}$ $= 3.66^{\circ}C/W$	Intentionally Left Blank

www.seismoquake.com

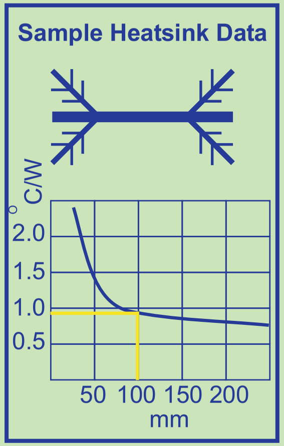
Heatsink Thermal Resistance Calculation

Design

Seismo-Quake™ **LET IT SHAKE !**



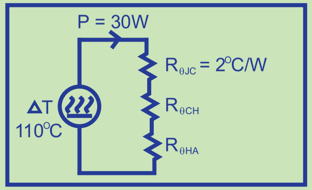
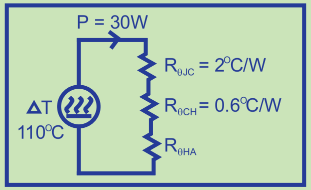
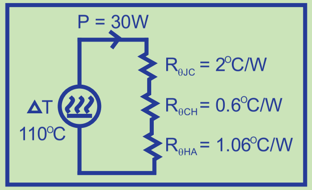
HEATSINK



Information Given:

Package	TO220
$R_{\theta JA}$	70
$R_{\theta JC}$	2
V_{CE}	10V
I_C	3A
T_{JMax}	150°C

Calculate the heatsink dissipation rate required by the transistor.

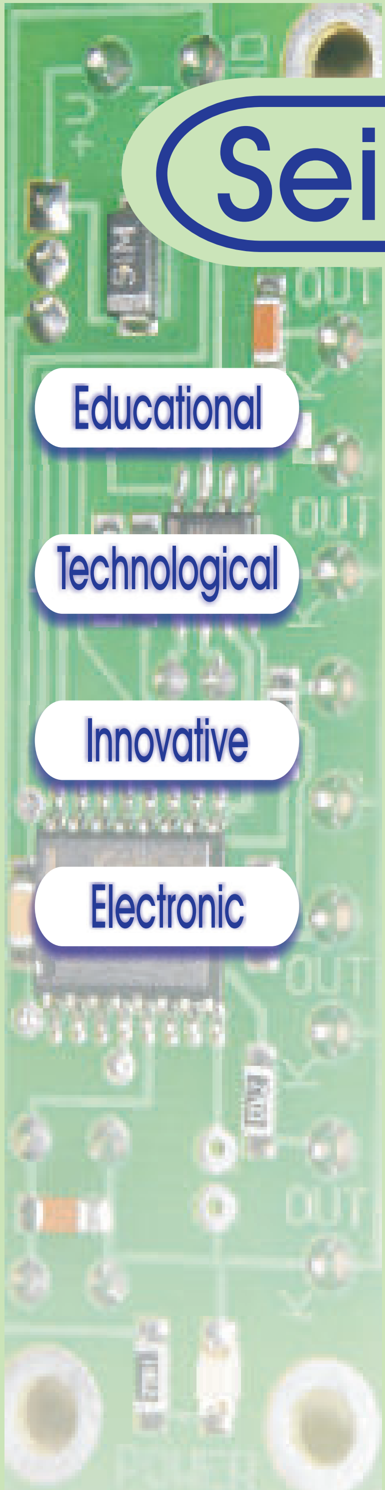
Description	Formula	Diagram
The TO220 package value for $R_{\theta JC}$ is given as 2°C/W. Enter this value into the thermal resistance diagram.	Intentionally Left Blank	
A good isolation material between the casing and heatsink is an aluminium oxide spacer combined with heat conducting paste with a value of 0.2 - 0.6°C/W. Take the worst case scenario.	Intentionally Left Blank	
Use the information obtained from a heatsink datasheet.	$R_{\theta HA} = R_{\theta TOTAL} - (R_{\theta JC} + R_{\theta CH})$ $= 3.66 - (2 + 0.6)$ $= 1.06°C/W$ →	

www.seismoquake.com

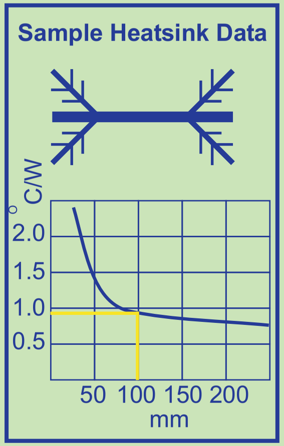
Heatsink Thermal Resistance Calculation

Design

Seismo-Quake™ LET IT SHAKE !



HEATSINK



Information Given:

Package	TO220
$R_{\theta JA}$	70
$R_{\theta JC}$	2
V_{CE}	10V
I_C	3A
T_{JMax}	150°C

Calculate the heatsink dissipation rate required by the transistor.

Conclusion

This specific transistor requires a heatsink that is manufactured to dissipate heat at a rate of 1.06°C/W.

These calculations are for a black iodized heatsink with fins mounted upwards.

According to the heatsink dissipation graph a heatsink cut to a length of 100mm will provide a heat dissipation rate of 0.9°C/W.

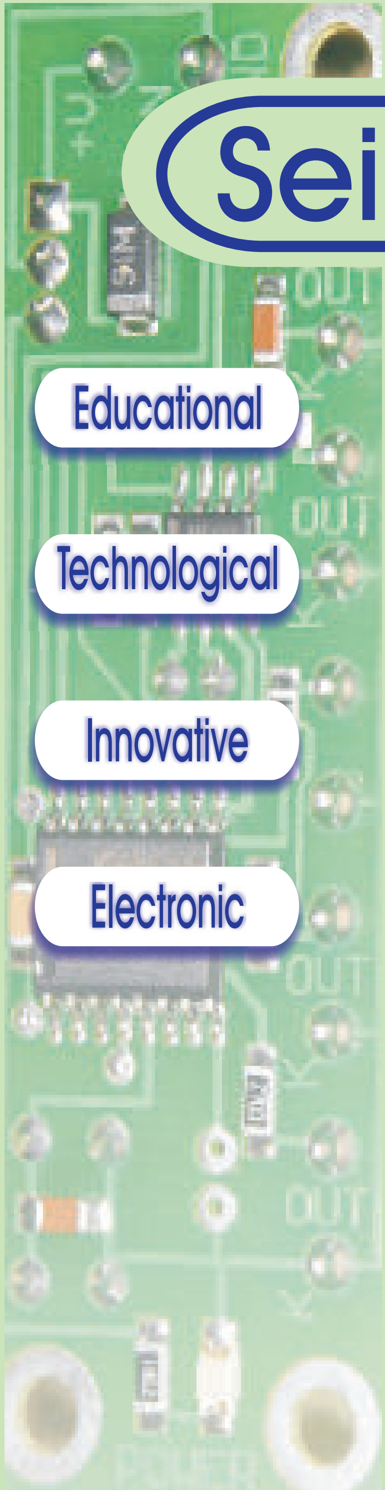
The thermal resistance symbols mean the following:

$R_{\theta JC}$ = Thermal Resistance, Junction to Casing
$R_{\theta CH}$ = Thermal Resistance, Casing to Heatsink
$R_{\theta HA}$ = Thermal Resistance, Heatsink to Ambiet

www.seismoquake.com

Design

Seismo-Quake™ LET IT SHAKE !



Contact Details for Seismo-Quake™

Information	
Website	www.seismoquake.com
Postal	P.O. Box 773 Silverton 0127 South Africa