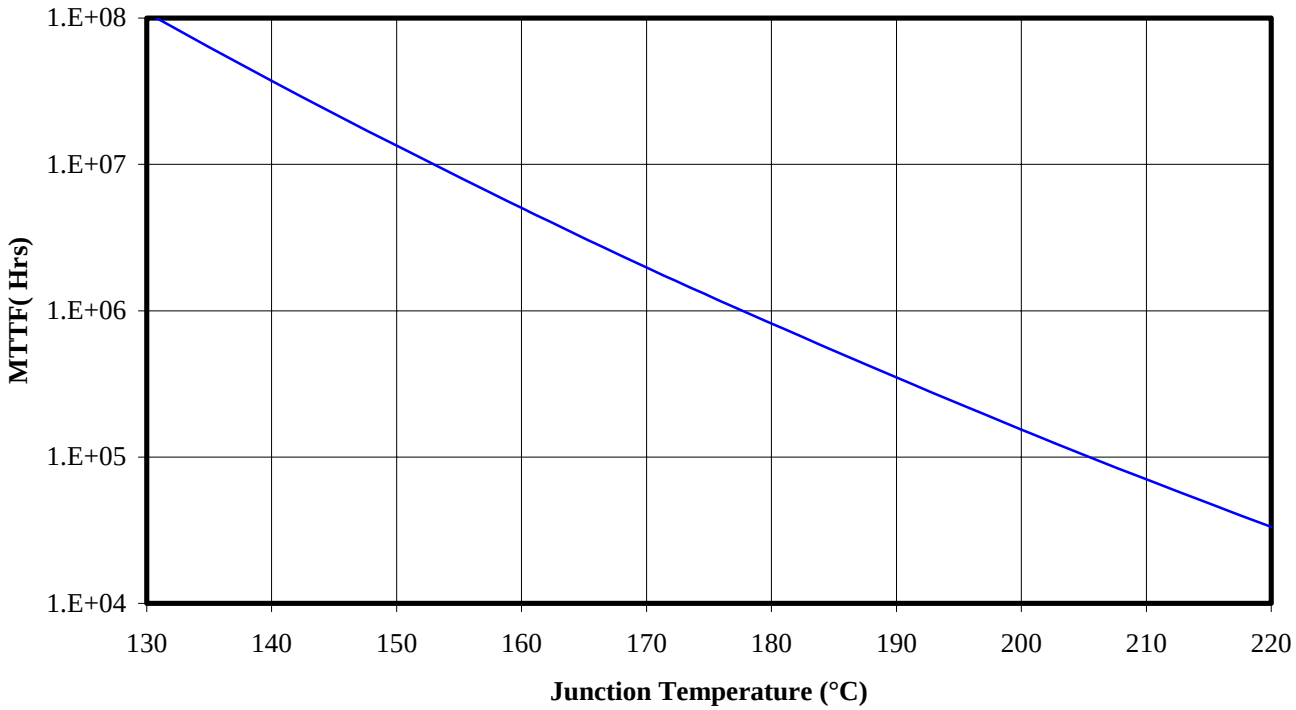

Based on three temperature tests performed by our foundry, WJ arrived at an activation energy of 1.54 eV for the InGaP HBT process consisting of our AGxxx-xx Product Family. To determine the proper pre-exponential factor for of our gain blocks, two sets of 10 devices each were eutectically attached to copper pedestals and heated at a constant base plate temperature until failure. The junction temperatures for the devices were elevated with a DC bias to a device current density of 25 kA/cm^2. Failure is defined as a 10% drop in device current or gain, or a 20% in beta. Using our derived thermal resistance values and bias settings, we could then infer what the junction temperatures were at a given base plate temperature. The results of those measurements showed that a junction temperature of 291 ºC gave a MTTF of 350 hours, while 282 ºC gave a MTTF of 620 hours. This data supports the following Arrhenius equation to derive the MTTF for our InGaP gain blocks:

$$\mathbf{MTTF = A^* e^{(Ea/k/Tj)}}$$

Where: $A = 6.0 \times 10^{-12}$ (hrs) (Pre-exponential Factor)
$Ea = 1.54$ (eV) (Activation Energy)
$k = 8.617 \times 10^{-5}$ (eV/ºK) (Boltzmann's Constant)
Tj = Junction Temperature (ºK)

Assuming continuous operation at a certain case temperature, MTTF and junction temperature can be related to curve shown above with the following equation:

$$\mathbf{T_j = T_c + R_{th} * V_d * I_d + 273}$$

Where: T_j = Junction Temperature (ºK)
V_d = Device Voltage
I_d = Device Current
R_{th} = Worst-case published thermal resistance (shown on datasheets)
T_c = Case Temperature (ºC)
273 is the factor to convert from ºC to ºK

Based on the MTTF curve shown above, the WJ Communications AG Series InGaP HBT Gain Blocks can achieve a minimum MTTF of 1 million hours at a continuous junction temperature of 177 ºC.