HEATSINK SELECTION FOR LOW DROPOUT REGULATORS

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Introduction

A crucial part of the overall design in a system incorporating a linear regulator is dissipating the heat that is generated in the regulator. This application note gives advice on choosing a heatsink and suitable part numbers from leading manufacturers.

Selecting a Heatsink(1)

1. On the chart for the device that you are planning to use, cross reference the maximum current required and the system's maximum ambient temperature.(2)

2. Read the required heatsink thermal impedance (sink-to-ambient) off the chart. If your plotted point is between two lines, use the **lower** thermal impedance value.

3. Look up your required thermal impedance value in Table 1: Suggested Heatsink Selection, ensuring that you use the column relevant to the air flow in your application. If the air flow in your application is between two of the values, then the **lower** flow rate column must be used. From this table you can obtain suggested part numbers for three different manufacturers.

Notes

1. These charts apply to heatsinking TO-220 regulators converting from 5V to 3.3V only. Please refer to the next column for information on how to calculate the heatsink requirements for other applications.

2. Note that if the device is mounted with no insulation, the heatsink will be smaller, less hardware will be used, and therefore the cost will be lower! Remember that in this case, the heatsink will be at the same potential as the output of the regulator. In cases with very high power dissipation, using insulation may not be an option. In extreme cases, consider using one of Semtech's switching solutions, or the EZ1900 Load Balance Controller to enable the use of two smaller heatsinks.

Detailed Calculations For θ_{s-a}

The required thermal impedance (sink-to-ambient) for any application is defined by the following equation:-

$$\theta_{s-a} = \frac{T_j - T_a}{P} - \theta_{j-c} - \theta_{c-s}$$

Where:

θ_{s-a} = thermal impedance sink-to-ambient (°C/W)

T_j = maximum junction temperature (°C) (obtained from the device data sheet)

T_a = maximum ambient temperature (°C)

θ_{j-c} = thermal impedance junction-to-case (°C/W) (obtained from the device data sheet)

θ_{c-s} = thermal impedance case-to-sink (°C/W) (look up in your thermal management hardware supplier's data - for the TO-220 package, typically 1.25°C/W using silicone pads, and 0.5°C/W using thermal grease with no insulation)

P = power dissipated in the device (W) (where $P = I_{OUT(max)}(V_{IN(max)}-V_{OUT(min)})$ for worst case calculation)

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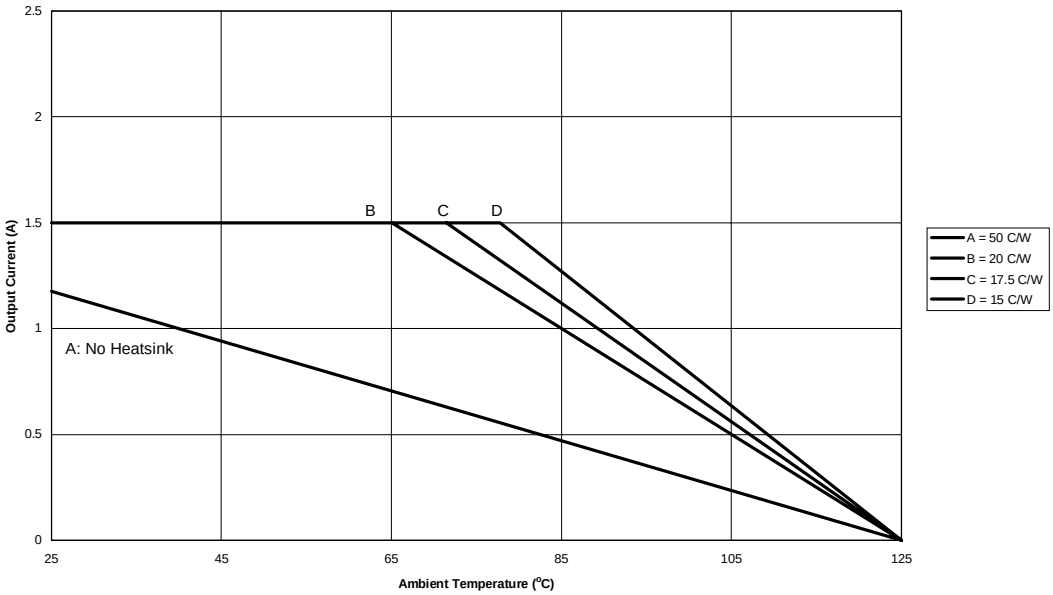
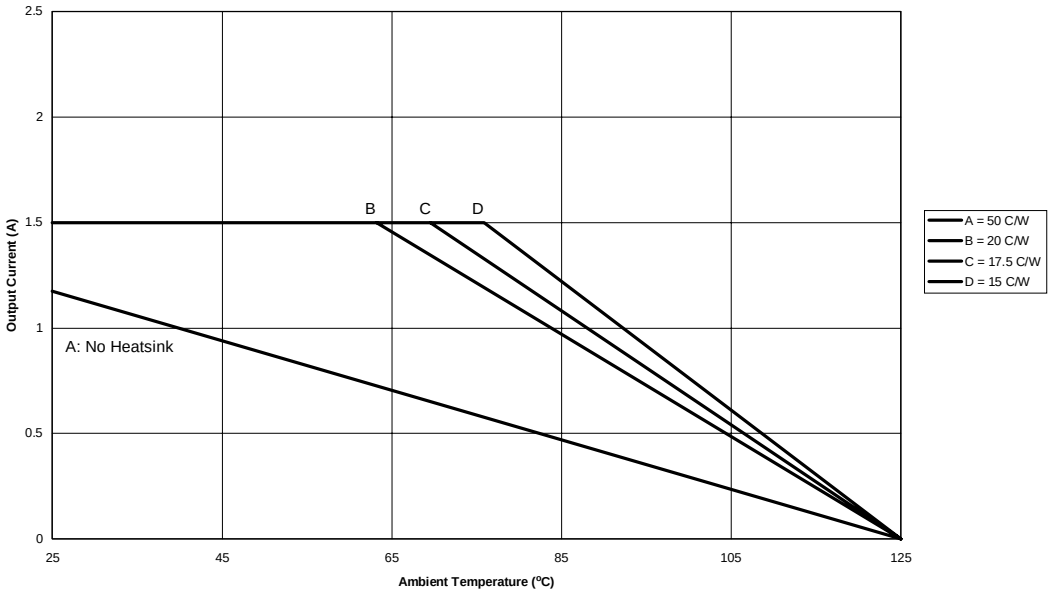
Heatsink for EZ1086CT

Heatsink Thermal Impedance (Sink-to-Ambient) vs. Ambient Temperature and Output Current
Device mounted using thermal grease with no insulation on unfinished aluminum (θ_{c-s} = 0.5 °C/W)



Heatsink Thermal Impedance (Sink-to-Ambient) vs. Ambient Temperature and Output Current
Device mounted using a silicone pad (θ_{c-s} = 1.25 °C/W)



Note: these charts valid for 5V to 3.3V conversion only

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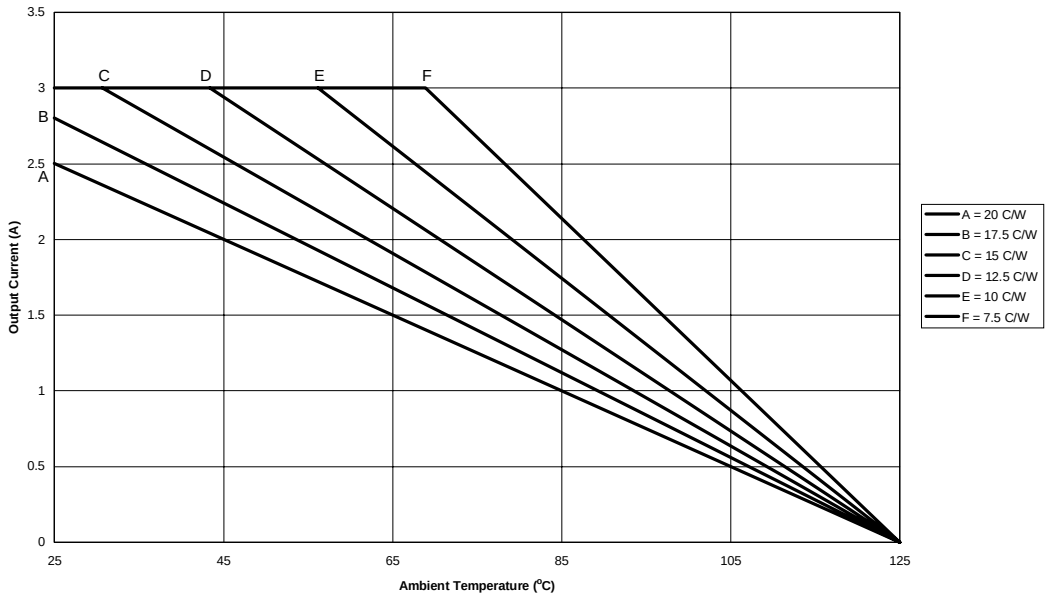
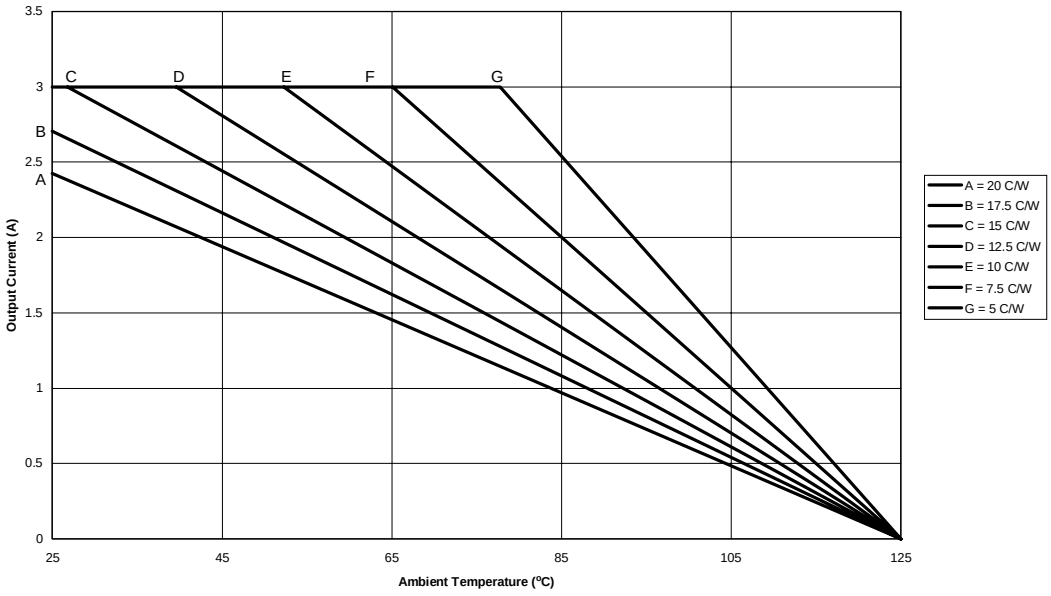
Heatsink for EZ1085CT and EZ1587CT

Heatsink Thermal Impedance (Sink-to-Ambient) vs. Ambient Temperature and Output Current
Device mounted using thermal grease with no insulation on unfinished aluminum (θ_{c-s} = 0.5 °C/W)



Heatsink Thermal Impedance (Sink-to-Ambient) vs. Ambient Temperature and Output Current
Device mounted using a silicone pad (θ_{c-s} = 1.25 °C/W)



Note: these charts valid for 5V to 3.3V conversion only

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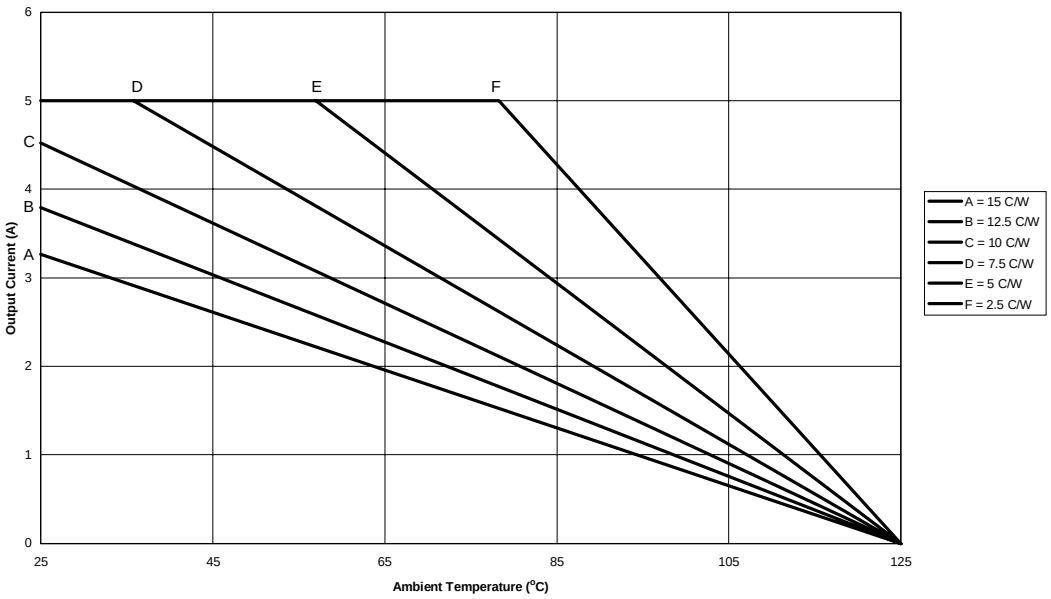
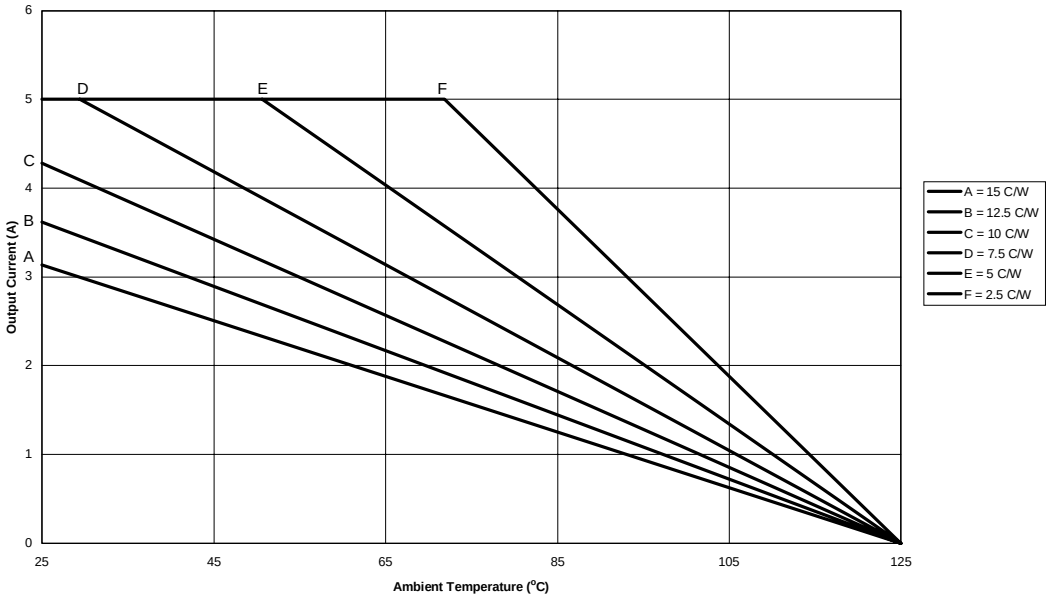
Heatsink for EZ1084CT and EZ1087CT

Heatsink Thermal Impedance (Sink-to-Ambient) vs. Ambient Temperature and Output Current
Device mounted using thermal grease with no insulation on unfinished aluminum (θ_{c-s} = 0.5 °C/W)



Heatsink Thermal Impedance (Sink-to-Ambient) vs. Ambient Temperature and Output Current
Device mounted using a silicone pad (θ_{c-s} = 1.25 °C/W)



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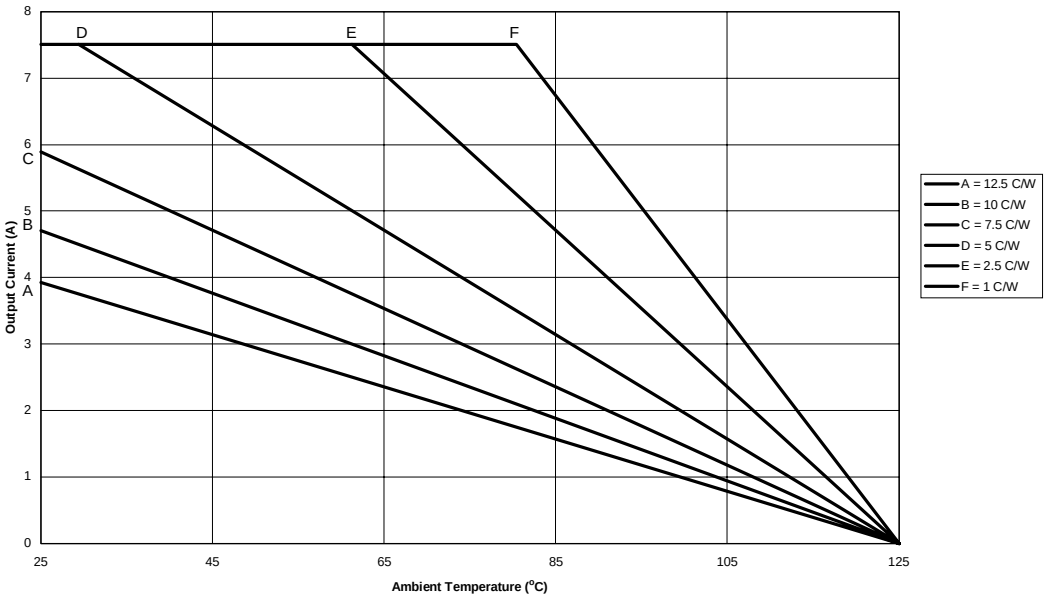
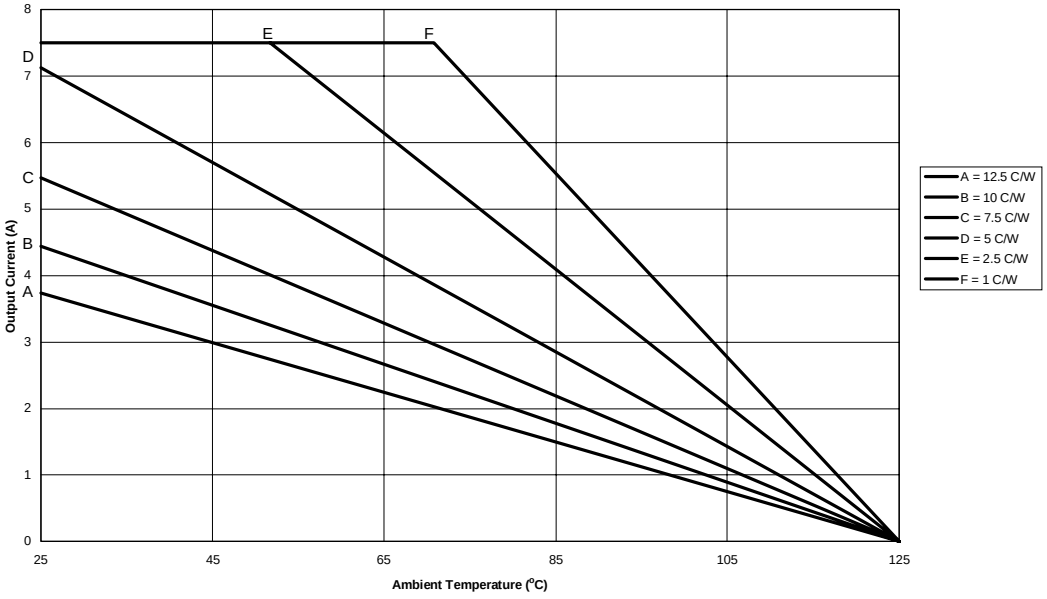
Heatsink for EZ1083CT

Heatsink Thermal Impedance (Sink-to-Ambient) vs. Ambient Temperature and Output Current
Device mounted using thermal grease with no insulation on unfinished aluminum (θ_{c-s} = 0.5 °C/W)



Heatsink Thermal Impedance (Sink-to-Ambient) vs. Ambient Temperature and Output Current
Device mounted using a silicone pad (θ_{c-s} = 1.25 °C/W)



Note: these charts valid for 5V to 3.3V conversion only

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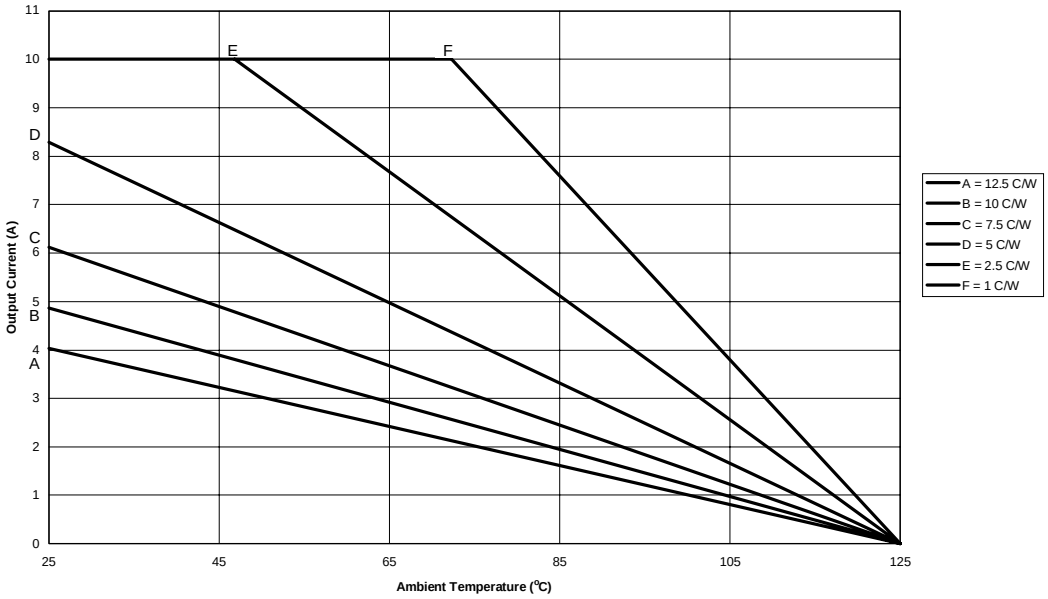
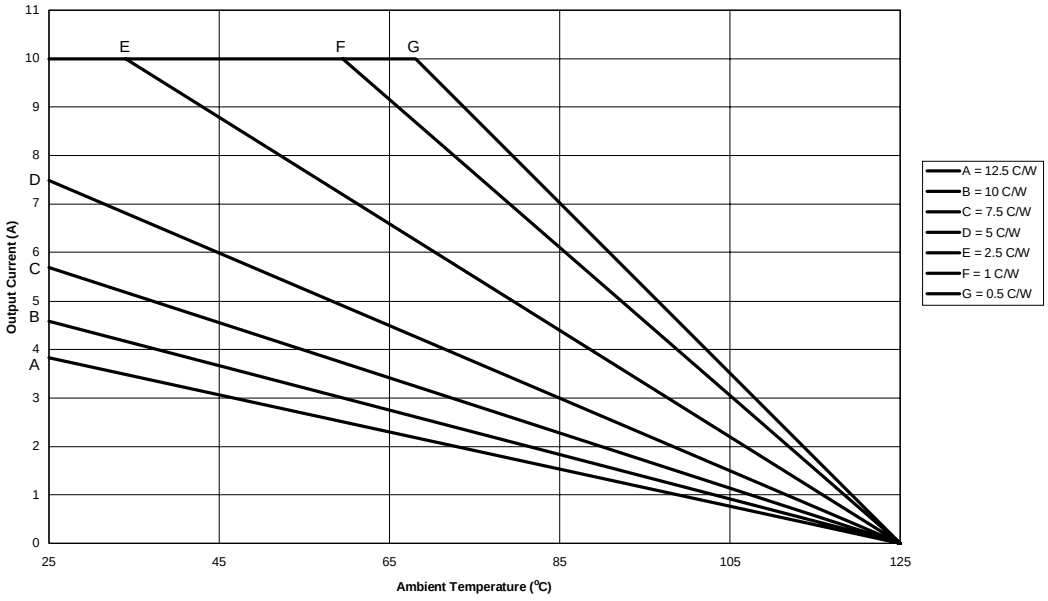
Heatsink for EZ1082CT

Heatsink Thermal Impedance (Sink-to-Ambient) vs. Ambient Temperature and Output Current
Device mounted using thermal grease with no insulation on unfinished aluminum (θ_{c-s} = 0.5 °C/W)



Heatsink Thermal Impedance (Sink-to-Ambient) vs. Ambient Temperature and Output Current
Device mounted using a silicone pad (θ_{c-s} = 1.25 °C/W)



Note: these charts valid for 5V to 3.3V conversion only

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Table 1: Suggested Heatsink Selection

Heatsink θ_{s-a} (°C/W)		Forced Air Cooling		
	Mfr.[1]	None (Convection Only)	100 Linear Feet Per Minute	800 Linear Feet Per Minute
20	A	574802[2]	574802[2]	574802[2]
	T	6038B[2]	6038B[2]	6038B[2]
	W	297-V2-80B[2]	297-V2-80B[2]	297-V2-80B[2]
17.5	A	575002	574802[2]	574802[2]
	T	6021PB	6038B[2]	6038B[2]
	W	286-AB	297-V2-80B[2]	297-V2-80B[2]
15	A	575002	574802[2]	574802[2]
	T	6021PB	6021PB	6038B[2]
	W	286-AB	297-V2-80B[2]	297-V2-80B[2]
12.5	A	513102	575002	574802[2]
	T	6099B	6021PB	6038B[2]
	W	627-15ABP	286-AB	297-V2-80B[2]
10	A	513202	575002	574802[2]
	T	6100B	6021PB	6038B[2]
	W	627-20ABP	286-AB	297-V2-80B[2]
7.5	A	532602	513302	574802[2]
	T	6298B	6101B	6038B[2]
	W	657-15ABP	627-25ABP	297-V2-80B[2]
5	A	532702	513302	574802[2]
	T	6299B	6101B	6021PB
	W	657-20ABP	627-25ABP	286-AB
2.5	A	Not Applicable	532802	513002
	T		6400B	6098B
	W		677-25ABP	627-10ABP
1	A		Not Applicable	532802
	T			6300B
	W			657-25ABP
0.5				Specialized Solutions Only

Notes:

1. Manufacturer: A = Aavid Engineering, Inc.
   T = Thermalloy, Inc.
   W = Wakefield Engineering
2. No additional hardware required for these heatsinks (other than insulators/thermal grease as needed)