# R-C Thermal Model Parameters

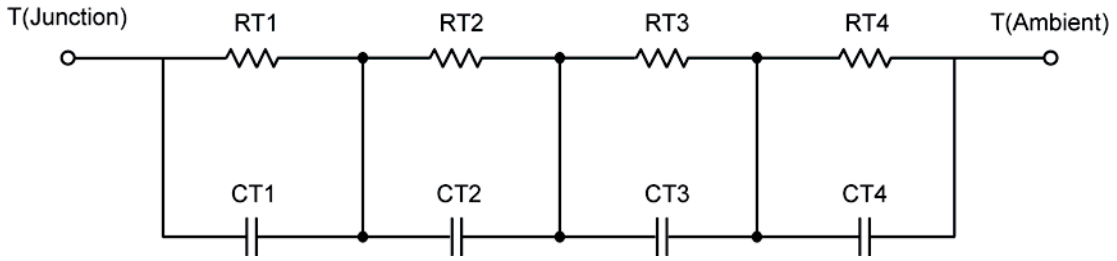
## DESCRIPTION

The parametric values in the R-C thermal model have been derived using curve-fitting techniques. These techniques are described in "A Simple Method of Generating Thermal Models for a Power MOSFET"[1]. When implemented in P-Spice, these values have matching characteristic curves to the Single Pulse Transient Thermal Impedance curves for the MOSFET.

R-C values for the electrical circuit in the Foster/Tank and Cauer/Filter configurations are included.

*Note:*
*For a detailed explanation of implementing these values in P-SPICE, refer to Application Note AN609 Thermal Simulations Of Power MOSFETs on P-SPICE Platform.*

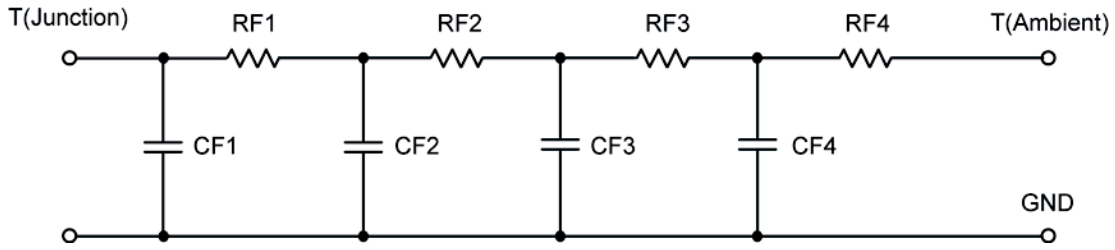
## R-C THERMAL MODEL FOR TANK CONFIGURATION




| R-C VALUES FOR TANK CONFIGURATION | | | | | |
|---|---|---|---|---|---|
| **Thermal Resistance (°C/W)** | | | | | |
| **Junction to** | **Ambient Nch** | **Ambient Pch** | **Case** | **Foot Nch** | **Foot Pch** |
| RT1 | 48.0374 | 48.0374 | N/A | 32.0266 | 32.0266 |
| RT2 | 8.6873 | 8.6873 | N/A | 19.4793 | 19.4793 |
| RT3 | 45.0184 | 45.0184 | N/A | 24.9093 | 24.9093 |
| RT4 | 48.2569 | 48.2569 | N/A | 3.5122 | 3.5122 |
| **Thermal Capacitance (Joules/°C)** | | | | | |
| **Junction to** | **Ambient Nch** | **Ambient Pch** | **Case** | **Foot Nch** | **Foot Pch** |
| CT1 | 27.4375 m | 27.4375 m | N/A | 36.5693 m | 36.5693 m |
| CT2 | 2.1458 m | 2.1458 m | N/A | 4.7455 m | 4.7455 m |
| CT3 | 6.5026 m | 6.5026 m | N/A | 14.7293 m | 14.7293 m |
| CT4 | 1.4630 | 1.4630 | N/A | 627.8455 u | 627.8455 u |

*This document is intended as a SPICE modeling guideline and does not constitute a commercial product data sheet. Designers should refer to the appropriate data sheet of the same number for guaranteed specification limits.*

## R-C THERMAL MODEL FOR FILTER CONFIGURATION

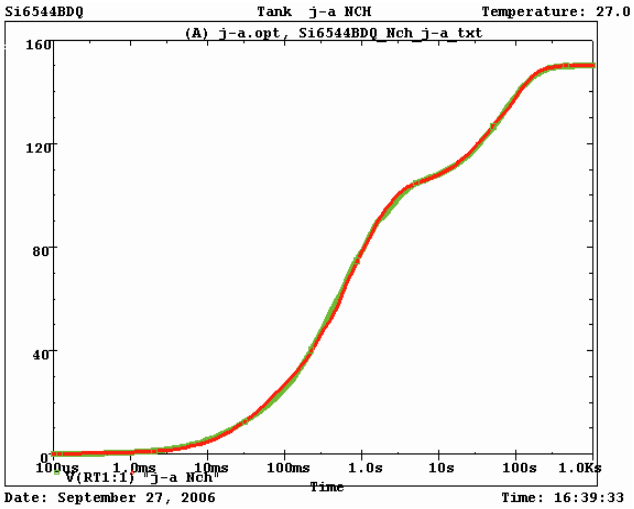


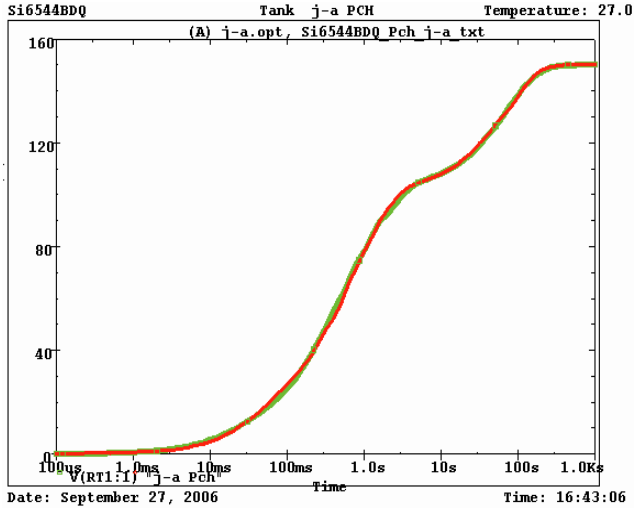

| R-C VALUES FOR FILTER CONFIGURATION | | | | | |
|---|---|---|---|---|---|
| **Thermal Resistance (°C/W)** | | | | | |
| **Junction to** | **Ambient Nch** | **Ambient Pch** | **Case** | **Foot Nch** | **Foot Pch** |
| RF1 | 29.4283 | 29.4283 | N/A | 4.5385 | 4.5385 |
| RF2 | 57.9672 | 57.9672 | N/A | 21.8045 | 21.8045 |
| RF3 | 14.9632 | 14.9632 | N/A | 33.2166 | 33.2166 |
| RF4 | 47.6413 | 47.6413 | N/A | 20.4404 | 20.4404 |
| **Thermal Capacitance (Joules/°C)** | | | | | |
| **Junction to** | **Ambient Nch** | **Ambient Pch** | **Case** | **Foot Nch** | **Foot Pch** |
| CF1 | 1.8196 m | 1.8196 m | N/A | 394.4165 u | 394.4165 u |
| CF2 | 9.1194 m | 9.1194 m | N/A | 2.6911 m | 2.6911 m |
| CF3 | 1.9156 m | 1.9156 m | N/A | 3.7818 m | 3.7818 m |
| CF4 | 1.4004 | 1.4004 | N/A | 49.0134 m | 49.0134 m |

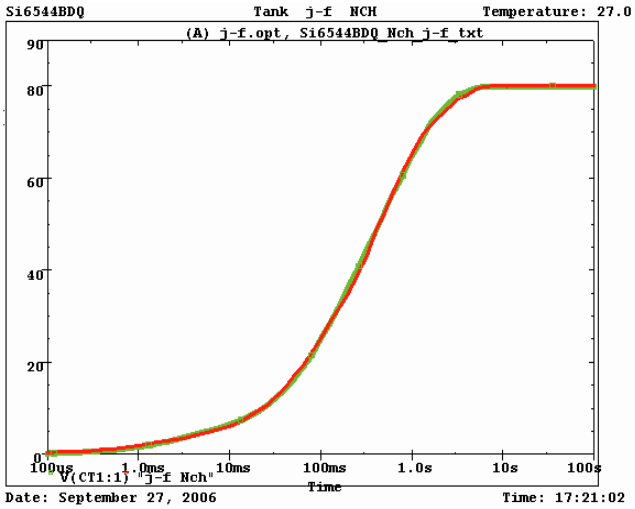
*Note: NA indicates not applicable*

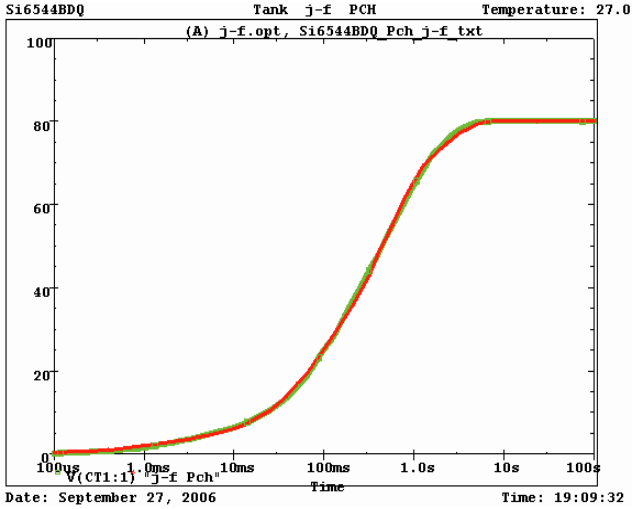
*Reference:*

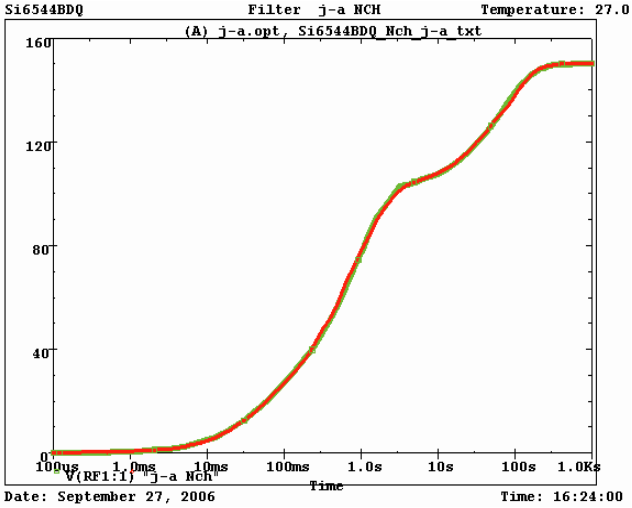
*[1] "A Simple Method of Generating Thermal Models for a Power MOSFET" by Wharton McDaniel and Kandarp Pandya, IEEE / SEMITHERM 2002*

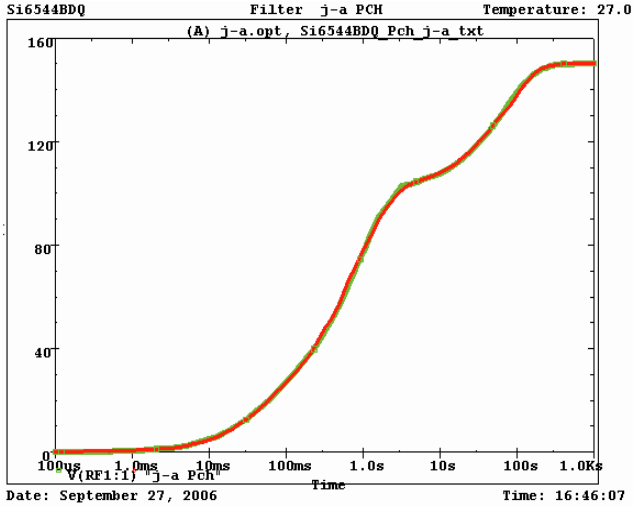

Si6544BDQ
Tank j-a NCH
Temperature: 27.0
(A) j-a.opt, Si6544BDQ_Nch_j-a_txt
160
120
80
40
0
100us 1.0ms 10ms 100ms 1.0s 10s 100s 1.0Ks
V(RT1:1) "j-a Nch"
Time
Date: September 27, 2006
Time: 16:39:33

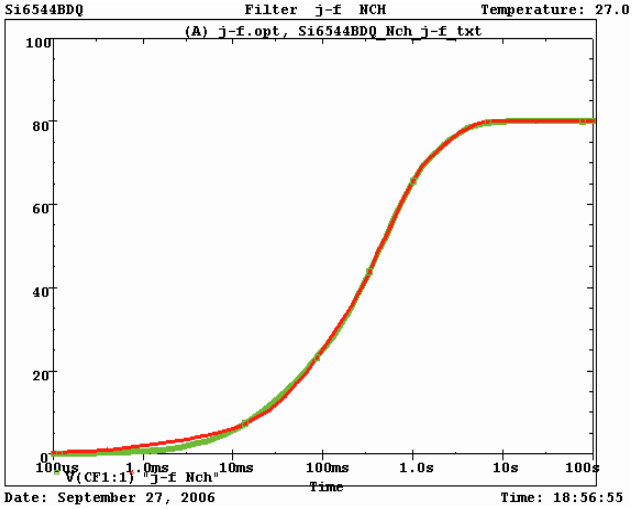

Si6544BDQ
Tank j-a PCH
Temperature: 27.0
(A) j-a.opt, Si6544BDQ_Pch_j-a_txt
160
120
80
40
0
100us 1.0ms 10ms 100ms 1.0s 10s 100s 1.0Ks
V(RT1:1) "j-a Pch"
Time
Date: September 27, 2006
Time: 16:43:06

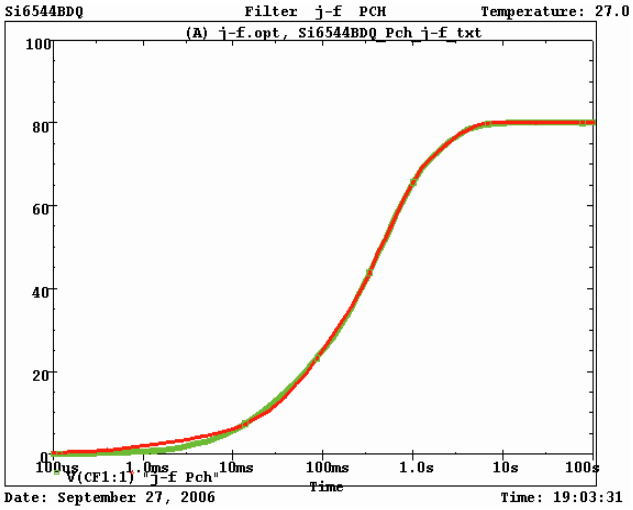

Si6544BDQ
Tank j-f NCH
Temperature: 27.0
(A) j-f.opt, Si6544BDQ_Nch_j-f_txt
90
80
60
40
20
0
100us 1.0ms 10ms 100ms 1.0s 10s 100s
V(CT1:1) "j-f Nch"
Time
Date: September 27, 2006
Time: 17:21:02


Si6544BDQ
Tank j-f PCH
Temperature: 27.0
(A) j-f.opt, Si6544BDQ_Pch_j-f_txt
100
80
60
40
20
0
100us 1.0ms 10ms 100ms 1.0s 10s 100s
V(CT1:1) "j-f Pch"
Time
Date: September 27, 2006
Time: 19:09:32


Si6544BDQ
Filter j-a NCH
Temperature: 27.0
(A) j-a.opt, Si6544BDQ_Nch_j-a_txt
160
120
80
40
0
100us 1.0ms 10ms 100ms 1.0s 10s 100s 1.0Ks
V(RF1:1) "j-a Nch"
Time
Date: September 27, 2006
Time: 16:24:00


Si6544BDQ
Filter j-a PCH
Temperature: 27.0
(A) j-a.opt, Si6544BDQ_Pch_j-a_txt
160
120
80
40
0
100us 1.0ms 10ms 100ms 1.0s 10s 100s 1.0Ks
V(RF1:1) "j-a Pch"
Time
Date: September 27, 2006
Time: 16:46:07


Si6544BDQ
Filter j-f NCH
Temperature: 27.0
(A) j-f.opt, Si6544BDQ_Nch_j-f_txt
100
80
60
40
20
0
100us 1.0ms 10ms 100ms 1.0s 10s 100s
V(CF1:1) "j-f Nch"
Time
Date: September 27, 2006
Time: 18:56:55


Si6544BDQ
Filter j-f PCH
Temperature: 27.0
(A) j-f.opt, Si6544BDQ_Pch_j-f_txt
100
80
60
40
20
0
100us 1.0ms 10ms 100ms 1.0s 10s 100s
V(CF1:1) "j-f Pch"
Time
Date: September 27, 2006
Time: 19:03:31