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FDP8880 / FDB8880

N-Channel PowerTrench® MOSFET

30V, 54A, 11.6mΩ

Features

- $r_{DS(ON)} = 14.5m\Omega$, $V_{GS} = 4.5V$, $I_D = 40A$
- $r_{DS(ON)} = 11.6m\Omega$, $V_{GS} = 10V$, $I_D = 40A$
- High performance trench technology for extremely low $r_{DS(ON)}$
- Low gate charge
- High power and current handling capability
- RoHS Compliant

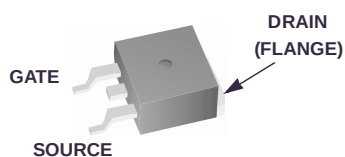


General Description

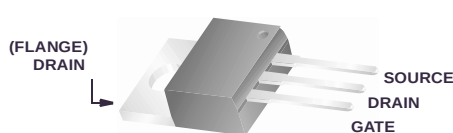
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $r_{DS(ON)}$ and fast switching speed.

Application

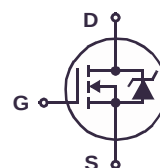
- DC / DC Converters



TO-263AB
FDB SERIES



TO-220AB
FDP SERIES



MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain to Source Voltage	30	V
V_{GS}	Gate to Source Voltage	± 20	V
I_D	Drain Current		
	Continuous ($T_C = 25^\circ\text{C}$, $V_{GS} = 10\text{V}$)	54	A
	Continuous ($T_C = 25^\circ\text{C}$, $V_{GS} = 4.5\text{V}$)	48	A
	Continuous ($T_{amb} = 25^\circ\text{C}$, $V_{GS} = 10\text{V}$, with $R_{\theta JA} = 43^\circ\text{C/W}$)	11	A
	Pulsed	Figure 4	A
E_{AS}	Single Pulse Avalanche Energy (Note 1)	31	mJ
P_D	Power dissipation	55	W
	Derate above 25°C	0.37	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature	-55 to 175	$^\circ\text{C}$

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance Junction to Case TO-220, TO-263	2.73	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient TO-220, TO-262 (Note 2)	62	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient TO-263, 1in ² copper pad area	43	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP8880	FDP8880	TO-220AB	Tube	N/A	50 units
FDB8880	FDB8880	TO-263AB	330mm	24mm	800 units

Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

B_{VDSS}	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}$, $V_{GS} = 0\text{V}$	30	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{V}$	-	-	1	μA
		$V_{GS} = 0\text{V}$, $T_C = 150^\circ\text{C}$	-	-	250	
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{V}$	-	-	± 100	nA

On Characteristics

$V_{GS(TH)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\mu\text{A}$	1.2	-	2.5	V
$r_{DS(ON)}$	Drain to Source On Resistance	$I_D = 40\text{A}$, $V_{GS} = 10\text{V}$	-	0.0095	0.0116	Ω
		$I_D = 40\text{A}$, $V_{GS} = 4.5\text{V}$	-	0.012	0.0145	
		$I_D = 40\text{A}$, $V_{GS} = 10\text{V}$, $T_J = 175^\circ\text{C}$	-	0.015	0.019	

Dynamic Characteristics

C _{ISS}	Input Capacitance	V _{DS} = 15V, V _{GS} = 0V, f = 1MHz	-	1240	-	pF	
C _{OSS}	Output Capacitance		-	255	-	pF	
C _{RSS}	Reverse Transfer Capacitance		-	147	-	pF	
R _G	Gate Resistance	V _{GS} = 0.5V, f = 1MHz	-	2.7	-	Ω	
Q _{g(TOT)}	Total Gate Charge at 10V	V _{GS} = 0V to 10V	V _{DD} = 15V I _D = 40A I _g = 1.0mA	-	22	29	nC
Q _{g(5)}	Total Gate Charge at 5V	V _{GS} = 0V to 5V		-	12	16	nC
Q _{g(TH)}	Threshold Gate Charge	V _{GS} = 0V to 1V		-	1.6	2.1	nC
Q _{gs}	Gate to Source Gate Charge			-	3.2	-	nC
Q _{gs2}	Gate Charge Threshold to Plateau			-	2.0	-	nC
Q _{gd}	Gate to Drain “Miller” Charge			-	4.8	-	nC

Switching Characteristics ($V_{GS} = 10V$)

t_{ON}	Turn-On Time	$V_{DD} = 15V, I_D = 40A$ $V_{GS} = 10V, R_{GS} = 13.6\Omega$	-	-	171	ns
$t_{d(ON)}$	Turn-On Delay Time		-	8	-	ns
t_r	Rise Time		-	107	-	ns
$t_{d(OFF)}$	Turn-Off Delay Time		-	47	-	ns
t_f	Fall Time		-	51	-	ns
t_{OFF}	Turn-Off Time		-	-	147	ns

Drain-Source Diode Characteristics

V_{SD}	Source to Drain Diode Voltage	$I_{SD} = 40A$	-	-	1.25	V
		$I_{SD} = 3.5A$	-	-	1.0	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 40A, dI_{SD}/dt = 100A/\mu s$	-	-	27	ns
Q_{RR}	Reverse Recovered Charge	$I_{SD} = 40A, dI_{SD}/dt = 100A/\mu s$	-	-	18	nC

Notes:

- 1: Starting $T_J = 25^\circ C$, $L = 34\mu H$, $I_{AS} = 43A$, $V_{dd} = 27V$, $V_{gs} = 10V$.
2: Pulse width = 100s.

Typical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

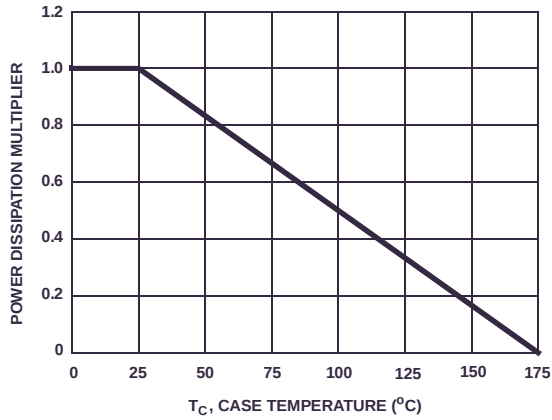


Figure 1. Normalized Power Dissipation vs Case Temperature

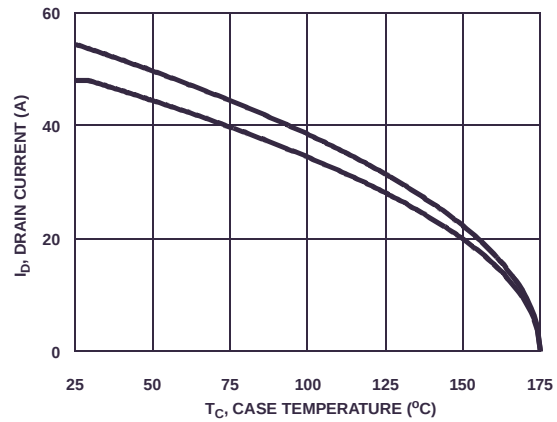


Figure 2. Maximum Continuous Drain Current vs Case Temperature

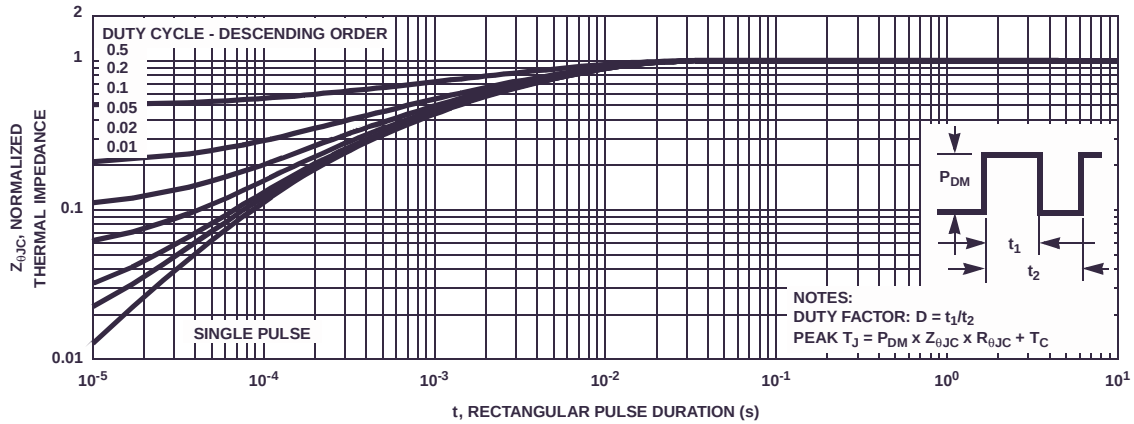


Figure 3. Normalized Maximum Transient Thermal Impedance

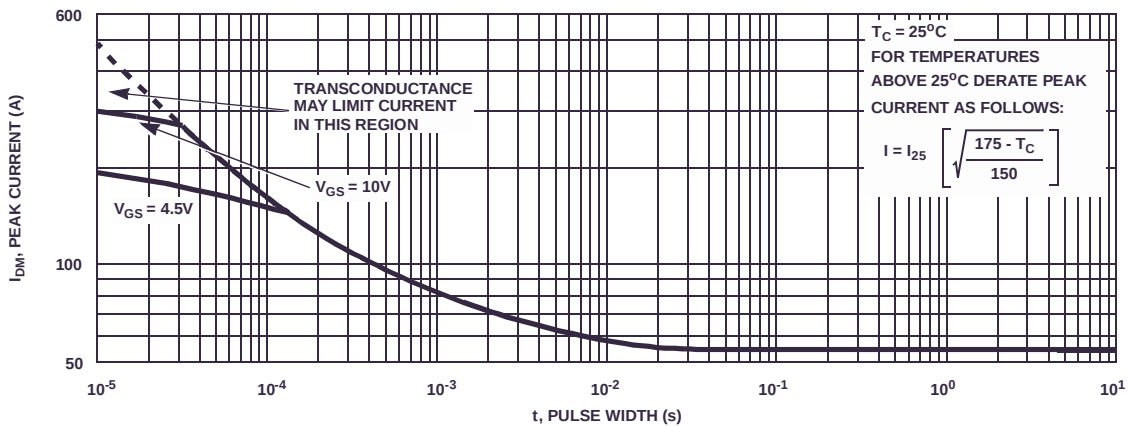


Figure 4. Peak Current Capability

Typical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

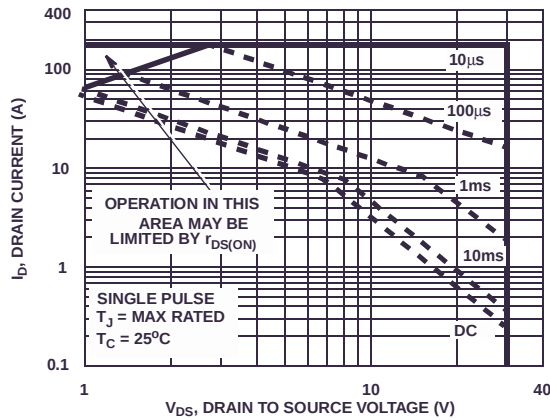
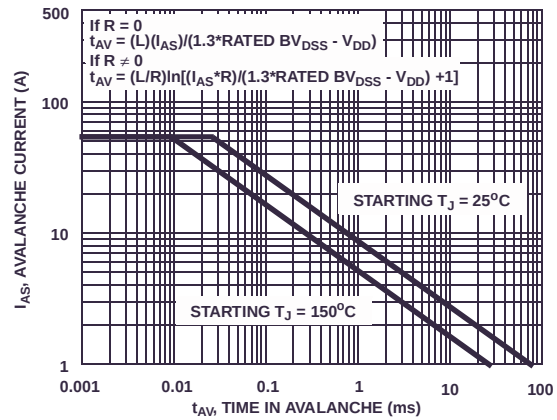


Figure 5. Forward Bias Safe Operating Area



NOTE: Refer to Fairchild Application Notes AN7514 and AN7515
Figure 6. Unclamped Inductive Switching Capability

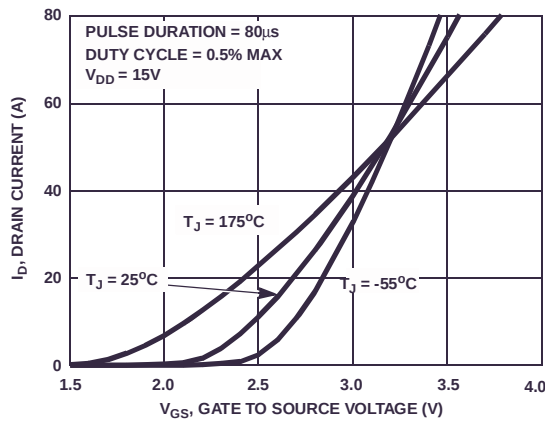


Figure 7. Transfer Characteristics

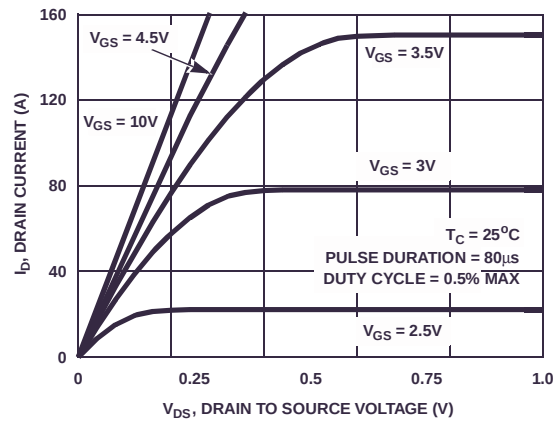


Figure 8. Saturation Characteristics

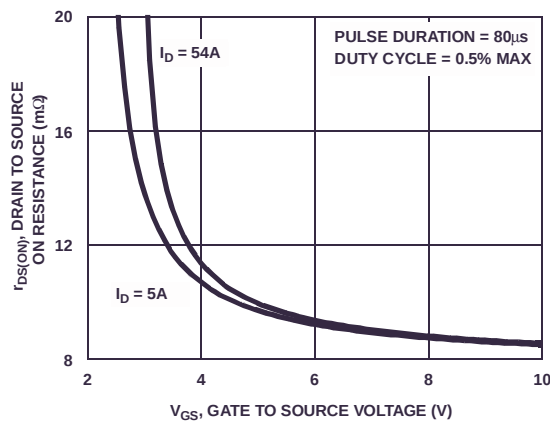


Figure 9. Drain to Source On Resistance vs Gate Voltage and Drain Current

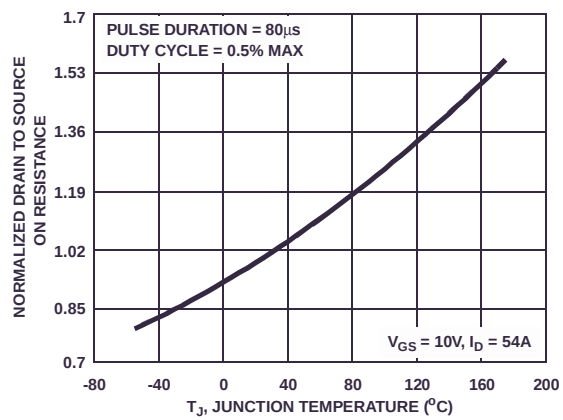


Figure 10. Normalized Drain to Source On Resistance vs Junction Temperature

Typical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

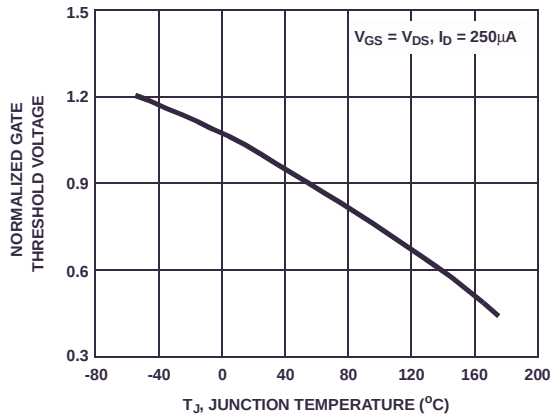


Figure 11. Normalized Gate Threshold Voltage vs Junction Temperature

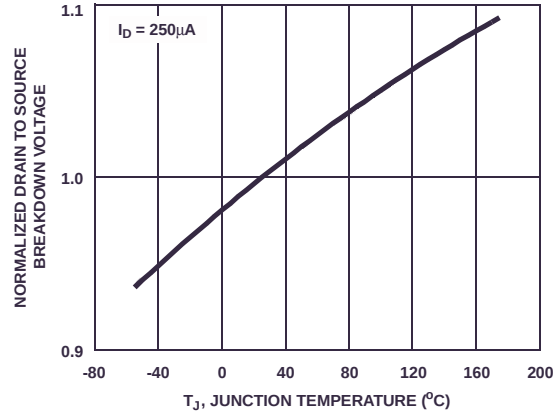


Figure 12. Normalized Drain to Source Breakdown Voltage vs Junction Temperature

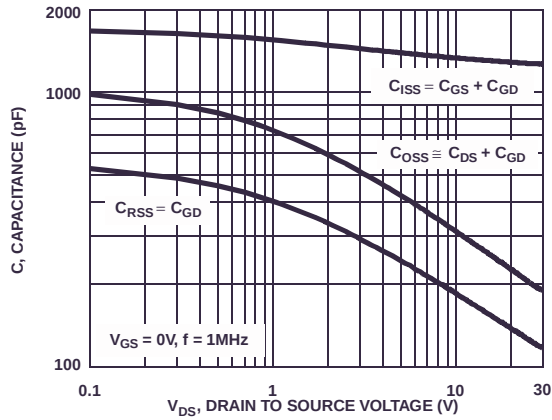


Figure 13. Capacitance vs Drain to Source Voltage

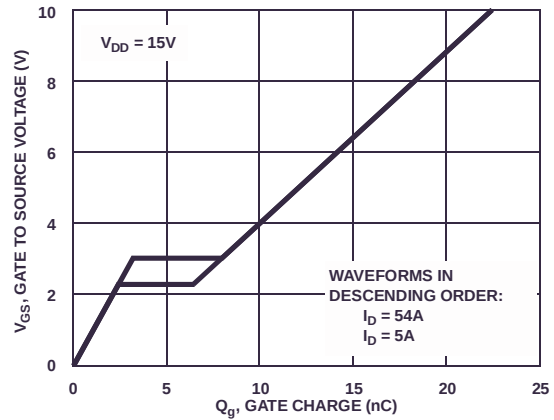


Figure 14. Gate Charge Waveforms for Constant Gate Current

Test Circuits and Waveforms

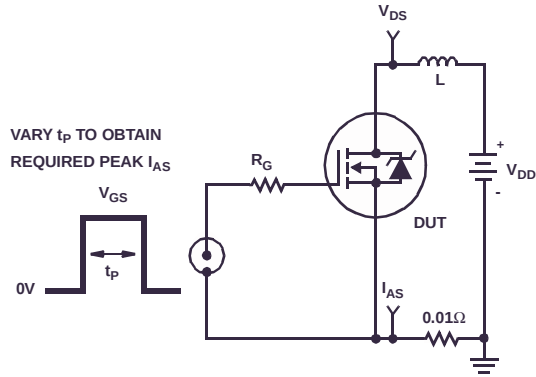


Figure 15. Unclamped Energy Test Circuit

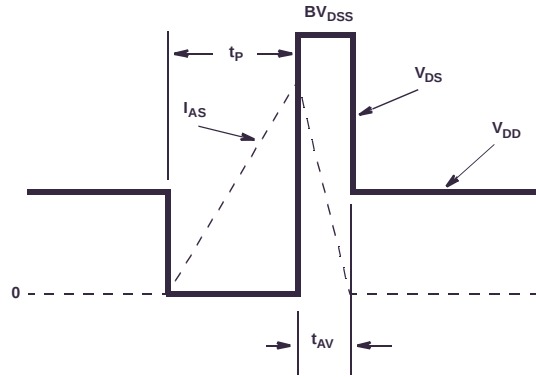


Figure 16. Unclamped Energy Waveforms

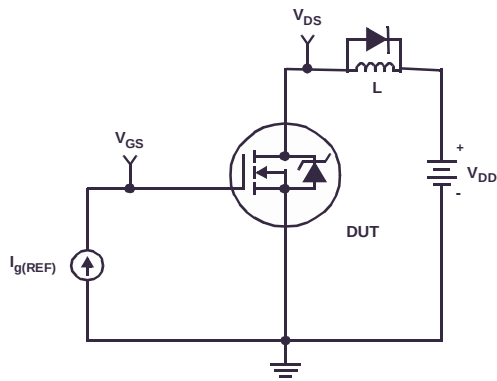


Figure 17. Gate Charge Test Circuit

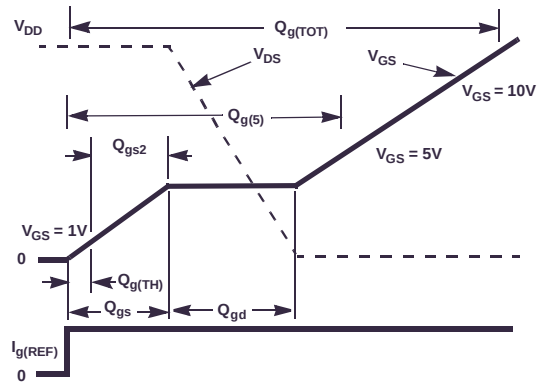


Figure 18. Gate Charge Waveforms

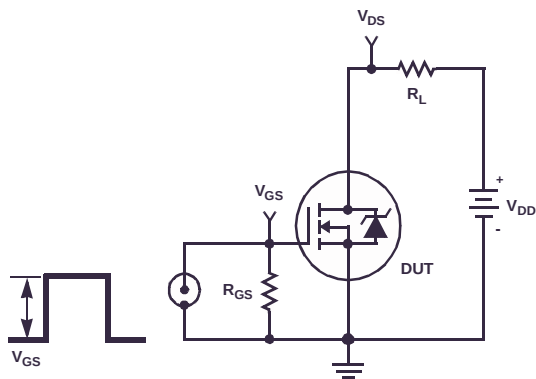


Figure 19. Switching Time Test Circuit

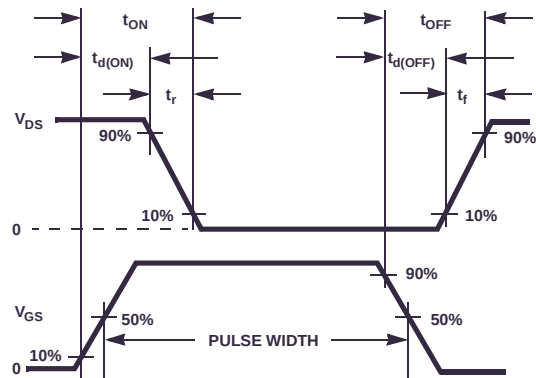


Figure 20. Switching Time Waveforms

PSPICE Thermal Model

REV 23 December 2003

FDP8880T

CTHERM1 TH 6 8e-4
 CTHERM2 6 5 1e-3
 CTHERM3 5 4 2.5e-3
 CTHERM4 4 3 2.6e-3
 CTHERM5 3 2 8e-3
 CTHERM6 2 TL 1.5e-2

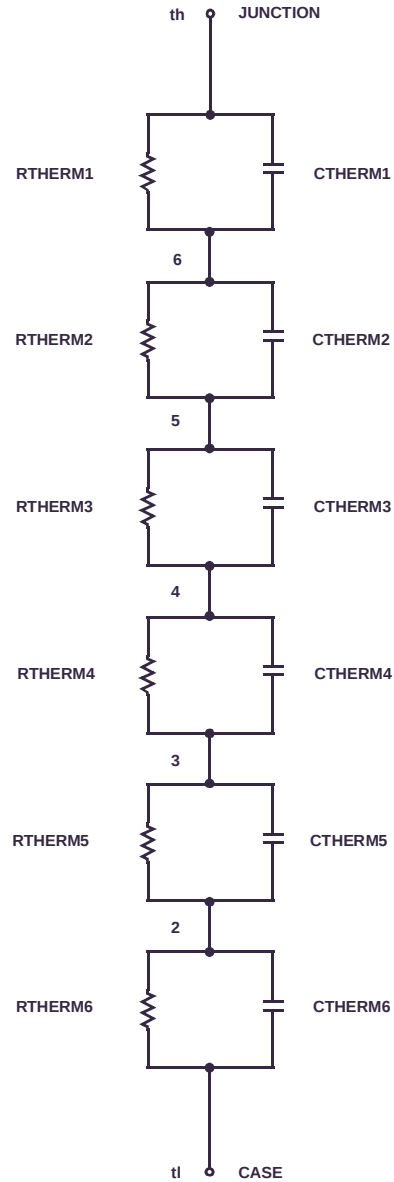
RTHERM1 TH 6 1.44e-1
 RTHERM2 6 5 1.9e-1
 RTHERM3 5 4 3.0e-1
 RTHERM4 4 3 4.0e-1
 RTHERM5 3 2 5.7e-1
 RTHERM6 2 TL 5.8e-1

SABER Thermal Model

SABER thermal model FDP8880T
 template thermal_model th tl
 thermal_c th, tl

```
{
  ctherm.ctherm1 th 6 =8e-4
  ctherm.ctherm2 6 5 =1e-3
  ctherm.ctherm3 5 4 =2.5e-3
  ctherm.ctherm4 4 3 =2.6e-3
  ctherm.ctherm5 3 2 =8e-3
  ctherm.ctherm6 2 tl =1.5e-2
```

```
  rtherm.rtherm1 th 6 =1.44e-1
  rtherm.rtherm2 6 5 =1.9e-1
  rtherm.rtherm3 5 4 =3.0e-1
  rtherm.rtherm4 4 3 =4.0e-1
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  rtherm.rtherm6 2 tl =5.8e-1
}
```





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