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# FDP070AN06A0

## N-Channel PowerTrench® MOSFET 60 V, 80 A, 7 mΩ

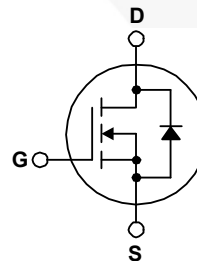
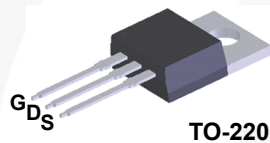
### Features

- $R_{DS(on)} = 6.1 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 80 \text{ A}$
- $Q_{g(tot)} = 51 \text{ nC}$  (Typ.) @  $V_{GS} = 10 \text{ V}$
- Low Miller Charge
- Low  $Q_{rr}$  Body Diode
- UIS Capability (Single Pulse and Repetitive Pulse)

### Applications

- Synchronous Rectification for ATX / Server / Telecom PSU
- Battery Protection Circuit
- Motor Drives and Uninterruptible Power Supplies

Formerly developmental type 82567



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

Symbol	Parameter	FDP070AN06A0	Unit
$V_{DSS}$	Drain to Source Voltage	60	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current		
	Continuous ( $T_C < 97^\circ\text{C}$ , $V_{GS} = 10\text{V}$ )	80	A
	Pulsed	Figure 4	A
$E_{AS}$	Single Pulse Avalanche Energy (Note 1)	190	mJ
$P_D$	Power dissipation	175	W
	Derate above $25^\circ\text{C}$	1.17	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, Max.	0.86	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient, Max. (Note 2)	62	$^\circ\text{C/W}$



## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP070AN06A0	FDP070AN06A0	TO-220	N/A	N/A	50 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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### Off Characteristics

$B_{VDSS}$	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}$ , $V_{GS} = 0\text{V}$	60	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 50\text{V}$ $V_{GS} = 0\text{V}$	-	-	1	$\mu\text{A}$
		$T_C = 150^\circ\text{C}$	-	-	250	
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{V}$	-	-	$\pm 100$	nA

### On Characteristics

$V_{GS(TH)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250\mu\text{A}$	2	-	4	V
$r_{DS(ON)}$	Drain to Source On Resistance	$I_D = 80\text{A}$ , $V_{GS} = 10\text{V}$	-	0.0061	0.007	$\Omega$
		$I_D = 80\text{A}$ , $V_{GS} = 10\text{V}$ , $T_J = 175^\circ\text{C}$	-	0.0127	0.015	

### Dynamic Characteristics

$C_{ISS}$	Input Capacitance	$V_{DS} = 25\text{V}$ , $V_{GS} = 0\text{V}$ , $f = 1\text{MHz}$	-	3000	-	pF
$C_{OSS}$	Output Capacitance		-	510	-	pF
$C_{RSS}$	Reverse Transfer Capacitance		-	230	-	pF
$Q_{g(TOT)}$	Total Gate Charge at 10V	$V_{GS} = 0\text{V}$ to 10V	$V_{DD} = 30\text{V}$ $I_D = 80\text{A}$ $I_g = 1.0\text{mA}$	51	66	nC
$Q_{g(TH)}$	Threshold Gate Charge	$V_{GS} = 0\text{V}$ to 2V		5.4	7	nC
$Q_{gs}$	Gate to Source Gate Charge			17	-	nC
$Q_{gs2}$	Gate Charge Threshold to Plateau			11.6	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge			16	-	nC

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

$t_{ON}$	Turn-On Time	$V_{DD} = 30\text{V}$ , $I_D = 80\text{A}$ $V_{GS} = 10\text{V}$ , $R_{GS} = 5.6\Omega$	-	-	256	ns
$t_{d(ON)}$	Turn-On Delay Time		-	12	-	ns
$t_r$	Rise Time		-	159	-	ns
$t_{d(OFF)}$	Turn-Off Delay Time		-	27	-	ns
$t_f$	Fall Time		-	35	-	ns
$t_{OFF}$	Turn-Off Time		-	-	93	ns

### Drain-Source Diode Characteristics

$V_{SD}$	Source to Drain Diode Voltage	$I_{SD} = 80\text{A}$	-	-	1.25	V
		$I_{SD} = 40\text{A}$	-	-	1.0	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 75\text{A}$ , $dI_{SD}/dt = 100\text{A}/\mu\text{s}$	-	-	34	ns
$Q_{RR}$	Reverse Recovered Charge	$I_{SD} = 75\text{A}$ , $dI_{SD}/dt = 100\text{A}/\mu\text{s}$	-	-	35	nC

#### Notes:

1: Starting  $T_J = 25^\circ\text{C}$ ,  $L = 93\mu\text{H}$ ,  $I_{AS} = 64\text{A}$ .

2: Pulse width = 100s.

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

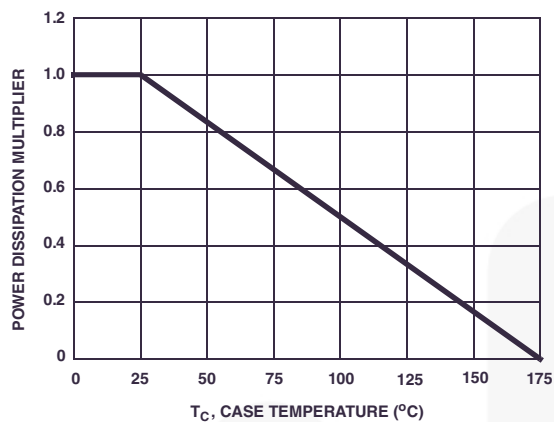


Figure 1. Normalized Power Dissipation vs Ambient Temperature

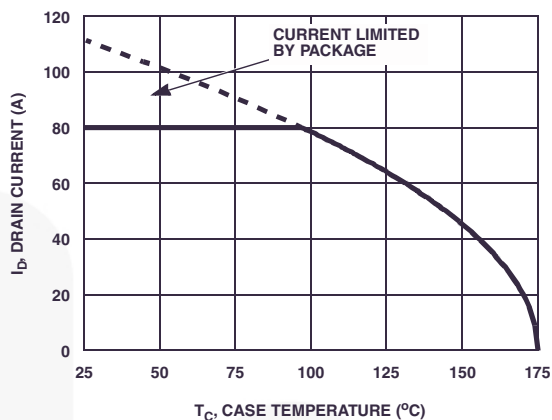


Figure 2. Maximum Continuous Drain Current vs Case Temperature

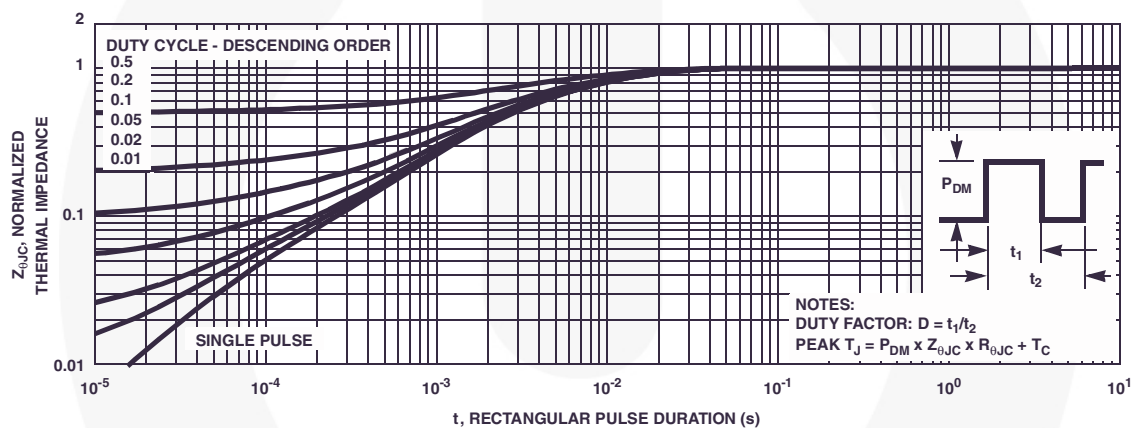


Figure 3. Normalized Maximum Transient Thermal Impedance

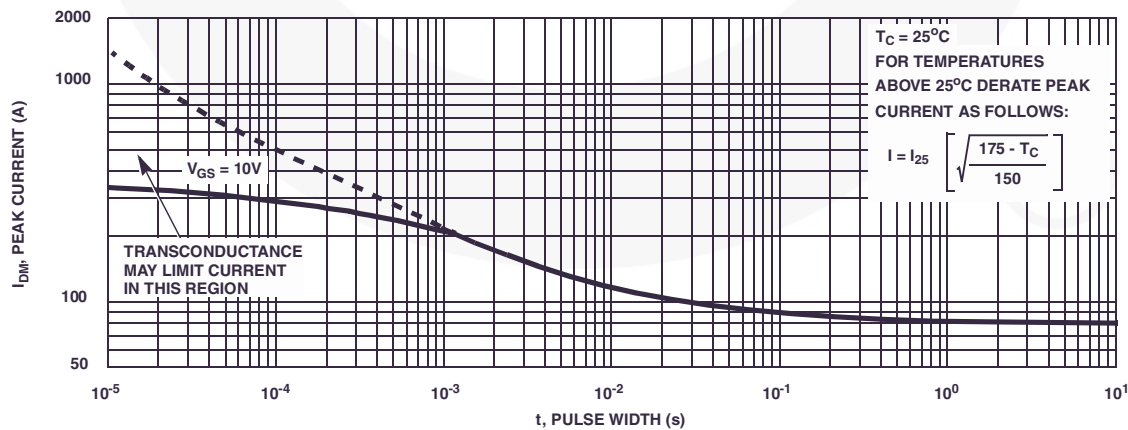


Figure 4. Peak Current Capability

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

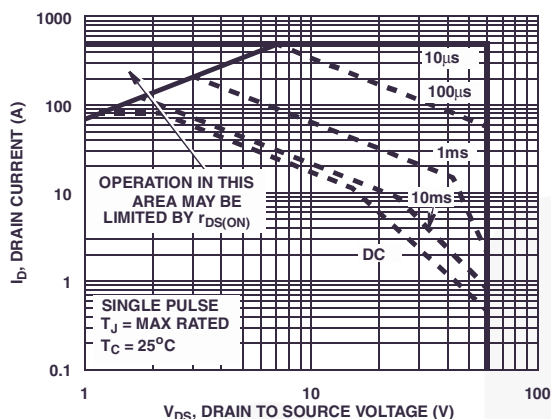
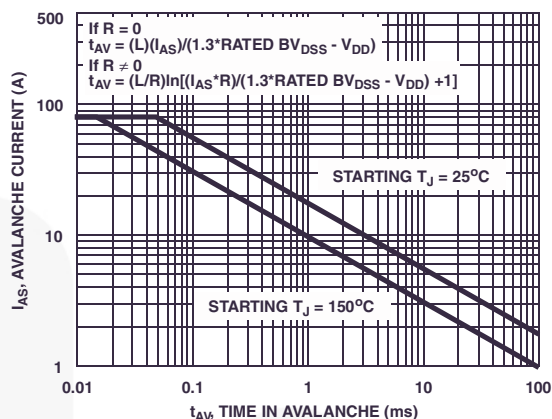


Figure 5. Forward Bias Safe Operating Area



NOTE: Refer to Fairchild Application Notes AN7514 and AN7515

Figure 6. Unclamped Inductive Switching Capability

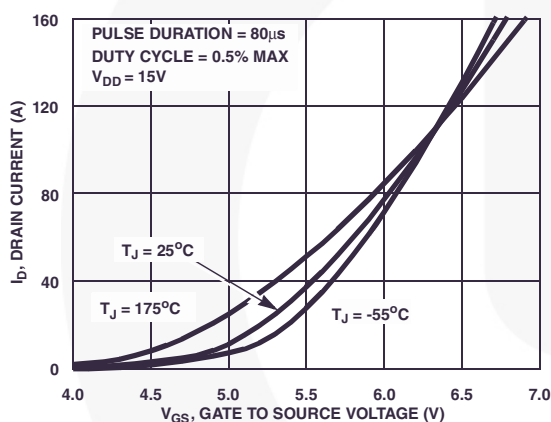


Figure 7. Transfer Characteristics

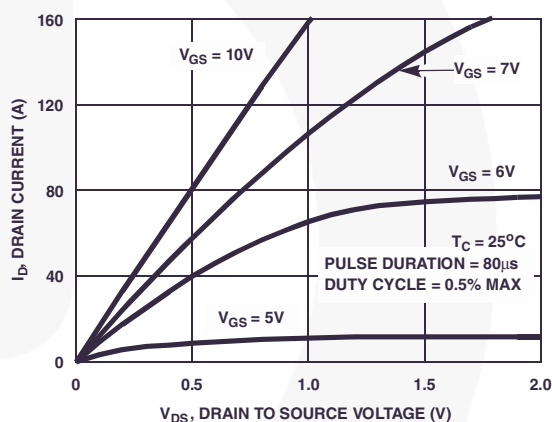


Figure 8. Saturation Characteristics

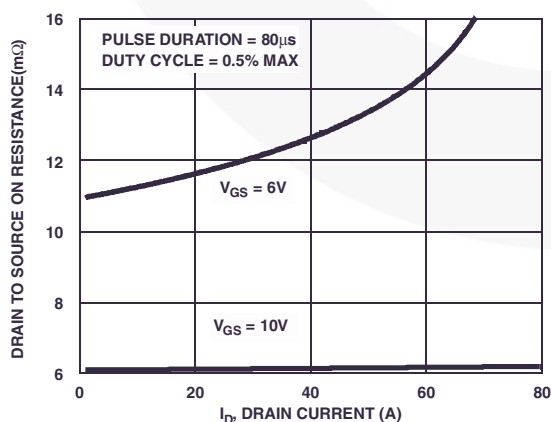


Figure 9. Drain to Source On Resistance vs Drain Current

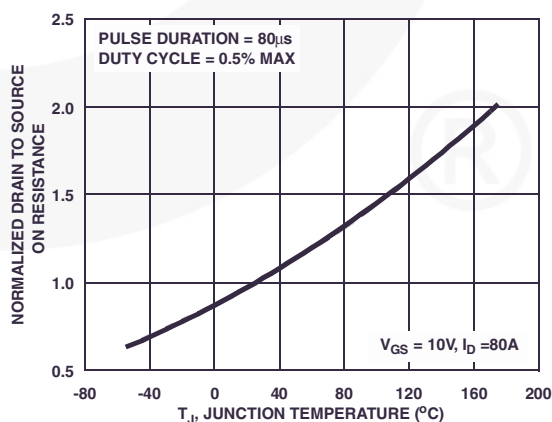
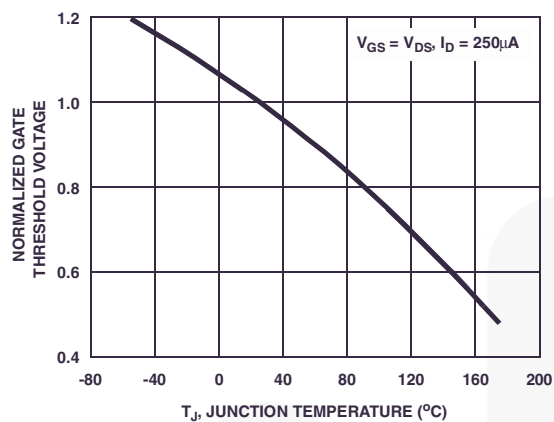
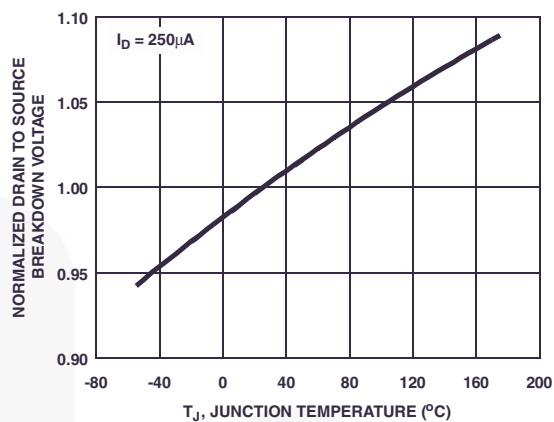


Figure 10. Normalized Drain to Source On Resistance vs Junction Temperature

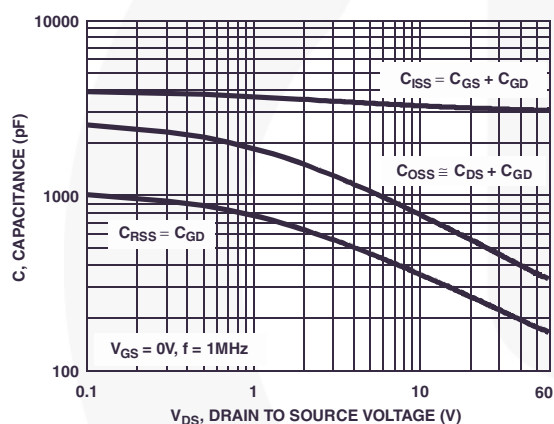
**Typical Characteristics**  $T_C = 25^\circ\text{C}$  unless otherwise noted



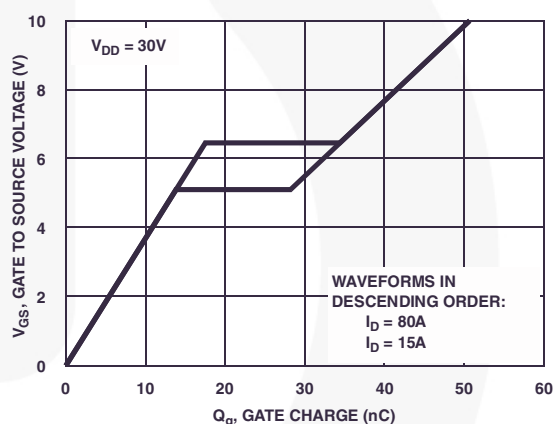
**Figure 11. Normalized Gate Threshold Voltage vs Junction Temperature**



**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

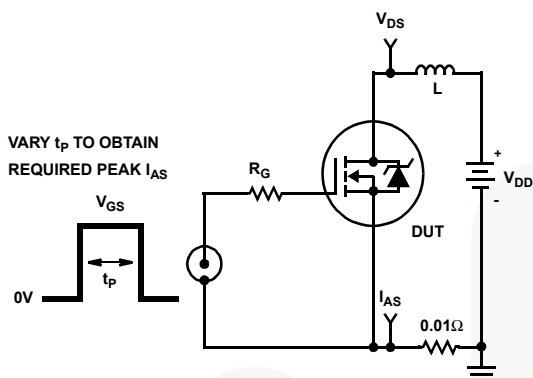


Figure 15. Unclamped Energy Test Circuit

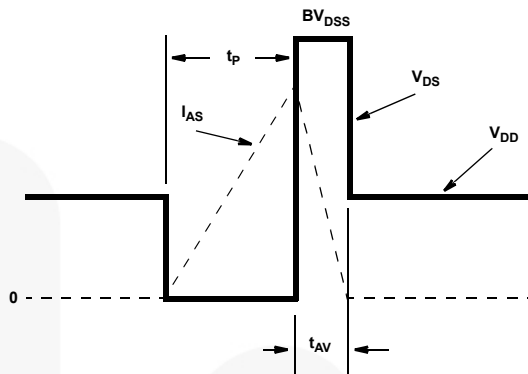


Figure 16. Unclamped Energy Waveforms

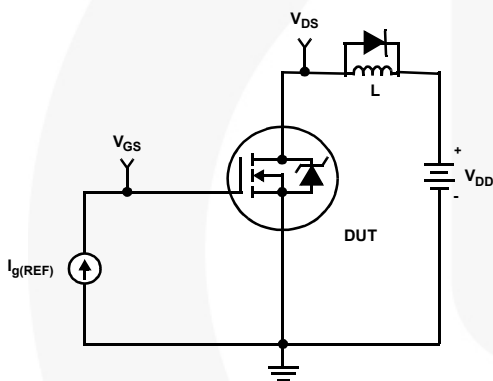


Figure 17. Gate Charge Test Circuit

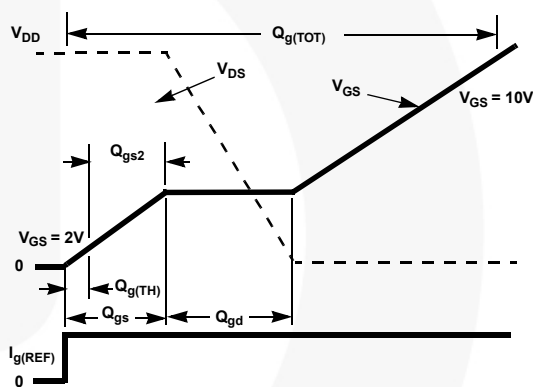


Figure 18. Gate Charge Waveforms

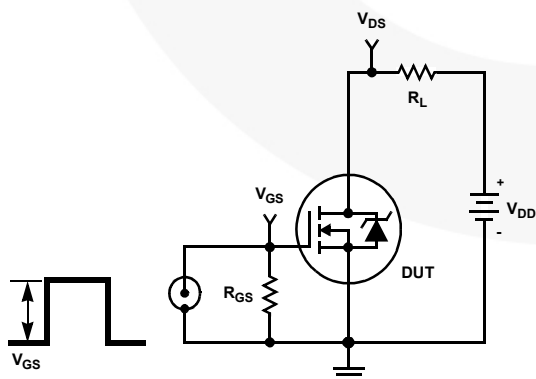


Figure 19. Switching Time Test Circuit

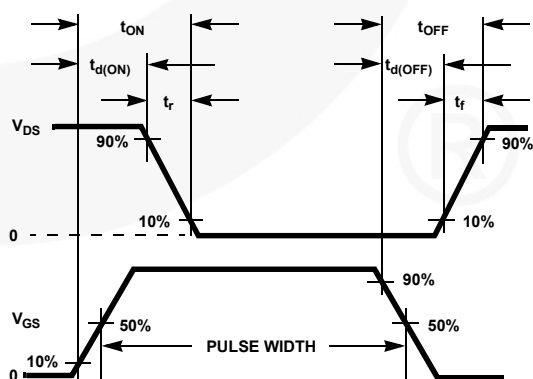


Figure 20. Switching Time Waveforms



**PSPICE Electrical Model**

.SUBCKT FDP070AN06A0 2 1 3 ; rev March 2003

Ca 12 8 1.5e-9

Cb 15 14 1.5e-9

Cin 6 8 2.9e-9

Dbody 7 5 DbodyMOD

Dbreak 5 11 DbreakMOD

Dplcap 10 5 DplcapMOD

Ebreak 11 7 17 18 62

Eds 14 8 5 8 1

Egs 13 8 6 8 1

Esg 6 10 6 8 1

Evthres 6 21 19 8 1

Evtemp 20 6 18 22 1

It 8 17 1

Lgate 1 9 4.8e-9

Ldrain 2 5 1.0e-9

Lsource 3 7 3e-9

RLgate 1 9 48

RLdrain 2 5 10

RLsource 3 7 3

Mmed 16 6 8 8 MmedMOD

Mstro 16 6 8 8 MstroMOD

Mweak 16 21 8 8 MweakMOD

Rbreak 17 18 RbreakMOD 1

Rdrain 50 16 RdrainMOD 1.3e-3

Rgate 9 20 2.7

RSLC1 5 51 RSLCMOD 1e-6

RSLC2 5 50 1e3

Rsource 8 7 RsourceMOD 3.1e-3

Rvthres 22 8 RvthresMOD 1

Rvtemp 18 19 RvtempMOD 1

S1a 6 12 13 8 S1AMOD

S1b 13 12 13 8 S1BMOD

S2a 6 15 14 13 S2AMOD

S2b 13 15 14 13 S2BMOD

Vbat 22 19 DC 1

ESLC 51 50 VALUE={ (V(5,51)/ABS(V(5,51))) \* (PWR(V(5,51)/(1e-6\*250),10)) }

.MODEL DbodyMOD D (IS=7.6E-12 N=1.04 RS=2.2e-3 TRS1=2.7e-3 TRS2=2e-7

+ CJO=1.6e-9 M=0.55 TT=5e-12 XTI=3.9)

.MODEL DbreakMOD D (RS=8e-1 TRS1=5e-4 TRS2=-8.9e-6)

.MODEL DplcapMOD D (CJO=1.05e-9 IS=1e-30 N=10 M=0.45)

.MODEL MmedMOD NMOS (VTO=3.7 KP=10 IS=1e-30 N=10 TOX=1 L=1u W=1u RG=2.7)

.MODEL MstroMOD NMOS (VTO=4.7 KP=100 IS=1e-30 N=10 TOX=1 L=1u W=1u)

.MODEL MweakMOD NMOS (VTO=3.01 KP=0.03 IS=1e-30 N=10 TOX=1 L=1u W=1u RG=27 RS=0.1)

.MODEL RbreakMOD RES (TC1=7.1e-4 TC2=-5.5e-7)

.MODEL RdrainMOD RES (TC1=1.7e-2 TC2=4e-5)

.MODEL RSLCMOD RES (TC1=3e-3 TC2=1e-5)

.MODEL RsourceMOD RES (TC1=1e-3 TC2=1e-6)

.MODEL RvthresMOD RES (TC1=-5.2e-3 TC2=-1.5e-5)

.MODEL RvtempMOD RES (TC1=-3e-3 TC2=1.3e-6)

.MODEL S1AMOD VSWITCH (RON=1e-5 ROFF=0.1 VON=-4 VOFF=-2)

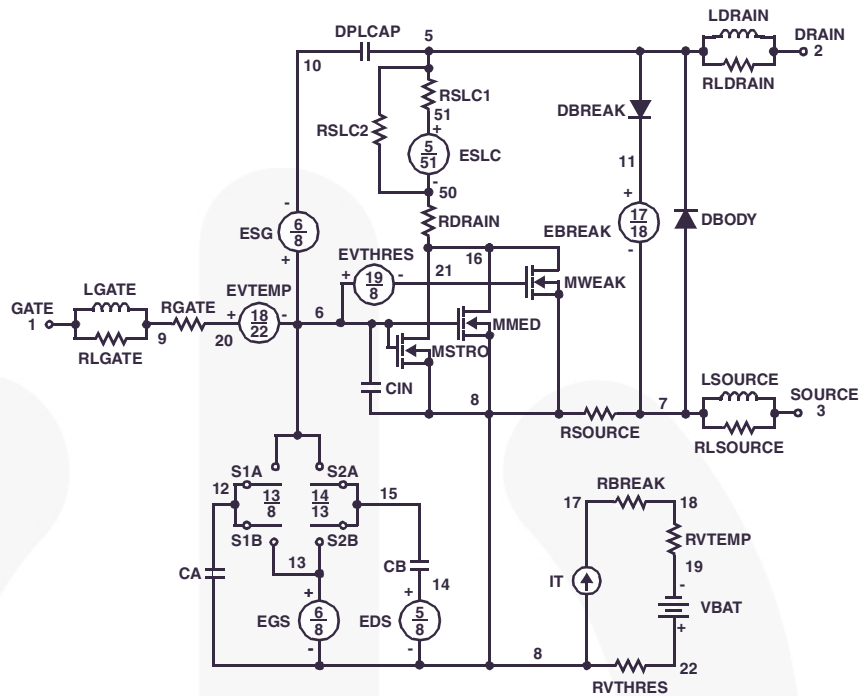
.MODEL S1BMOD VSWITCH (RON=1e-5 ROFF=0.1 VON=-2 VOFF=-4)

.MODEL S2AMOD VSWITCH (RON=1e-5 ROFF=0.1 VON=-1.5 VOFF=0.5)

.MODEL S2BMOD VSWITCH (RON=1e-5 ROFF=0.1 VON=0.5 VOFF=-1.5)

.ENDS

Note: For further discussion of the PSPICE model, consult **A New PSPICE Sub-Circuit for the Power MOSFET Featuring Global Temperature Options**; IEEE Power Electronics Specialist Conference Records, 1991, written by William J. Hepp and C. Frank Wheatley.





## SPICE Thermal Model

REV 23 March 2003

FDB070AN06A0T

CTHERM1 TH 6 3.5e-3  
CTHERM2 6 5 1.7e-2  
CTHERM3 5 4 1.8e-2  
CTHERM4 4 3 1.9e-2  
CTHERM5 3 2 4.7e-2  
CTHERM6 2 TL 7e-2

RTHERM1 TH 6 2e-2  
RTHERM2 6 5 7e-2  
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RTHERM5 3 2 1.6e-1  
RTHERM6 2 TL 1.85e-1

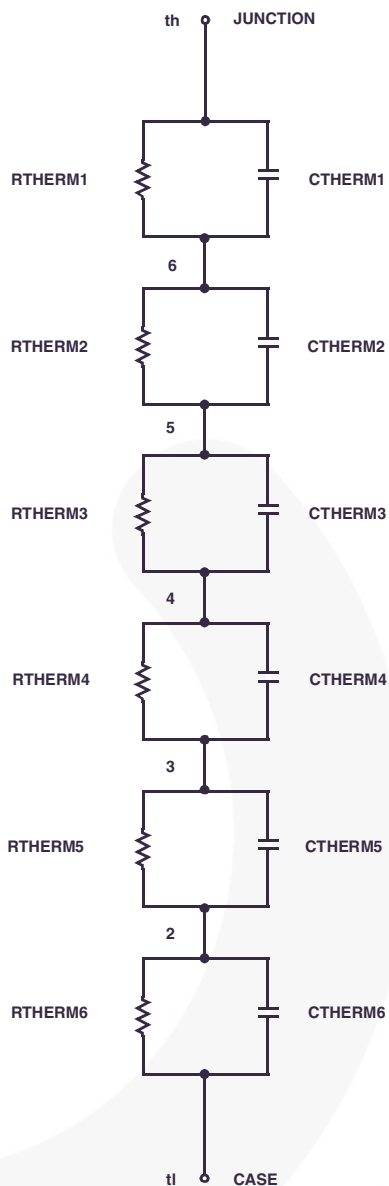
## SABER Thermal Model

SABER thermal model FDB070AN06A0T

template thermal\_model th tl  
thermal\_c th, tl

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  ctherm.ctherm3 5 4 =1.8e-2
  ctherm.ctherm4 4 3 =1.9e-2
  ctherm.ctherm5 3 2 =4.7e-2
  ctherm.ctherm6 2 tl =7e-2
```

```
rtherm.rtherm1 th 6 =2e-2
rtherm.rtherm2 6 5 =7e-2
rtherm.rtherm3 5 4 =1e-1
rtherm.rtherm4 4 3 =1.5e-1
rtherm.rtherm5 3 2 =1.6e-1
rtherm.rtherm6 2 tl =1.85e-1
}
```



## Mechanical Dimensions

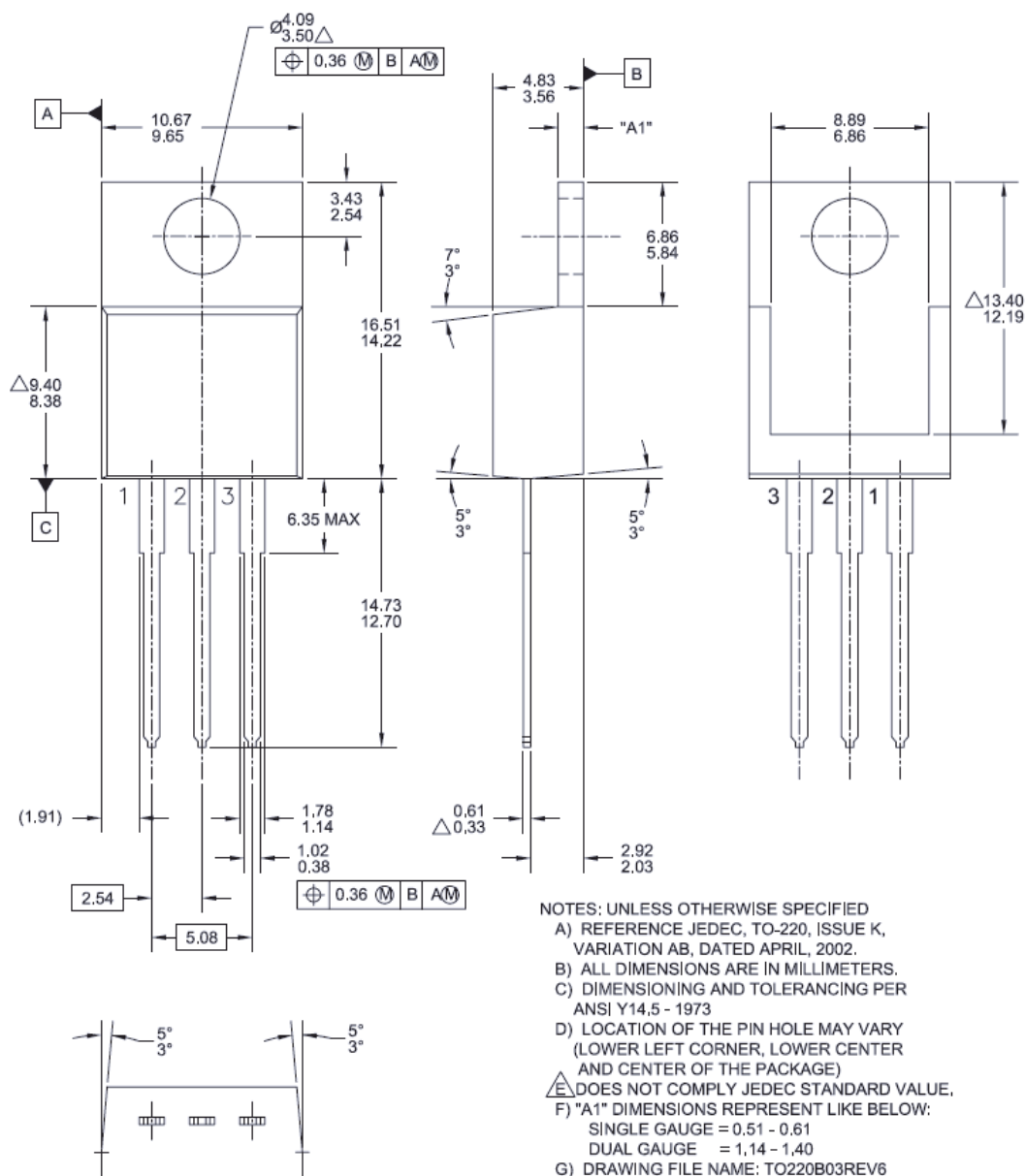


Figure 21. TO-220, Molded, 3-Lead, Jedec Variation AB

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

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	MicroPak™		
Fairchild®	MicroPak2™		UHC®
Fairchild Semiconductor®	MillerDrive™		Ultra FRFET™
FACT Quiet Series™	MotionMax™		UniFET™
FACT®	mWSaver®		VCX™
FAST®	OptoHiT™		VisualMax™
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FETBench™	OPTOPLANAR®		XS™
FPS™			

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