## MOSFET - N-Channel, POWERTRENCH ${ }^{\text {® }}$

## 150 V, 14 A, 120 m $\Omega$

## FDD120AN15AO

## Features

- $\mathrm{R}_{\mathrm{DS}(\text { on })}=101 \mathrm{~m} \Omega$ (Typ.) $@ \mathrm{~V}_{\mathrm{GS}}=10 \mathrm{~V}, \mathrm{I}_{\mathrm{D}}=4 \mathrm{~A}$
- $\mathrm{Q}_{\mathrm{G}(\mathrm{tot})}=11.2 \mathrm{nC}($ Typ. $) @ \mathrm{~V}_{\mathrm{GS}}=10 \mathrm{~V}$
- Low Miller Charge
- Low Qrr Body Diode
- UIS Capability (Single Pulse and Repetitive Pulse)
- This Device is $\mathrm{Pb}-$ Free, Halide Free and is RoHS Compliant


## Applications

- Consumer Appliances
- LED TV
- Synchronous Rectification
- Uninterruptible Power Supply
- Micro Solar Inverter

MOSFET MAXIMUM RATINGS $\left(T_{C}=25^{\circ} \mathrm{C}\right.$, unless otherwise noted)

| Symbol | Parameter | Ratings | Unit |
| :---: | :--- | :---: | :---: |
| $\mathrm{V}_{\mathrm{DSS}}$ | Drain to Source Voltage | 150 | V |
| $\mathrm{~V}_{\mathrm{GS}}$ | Gate to Source Voltage | $\pm 20$ | V |
| $\mathrm{I}_{\mathrm{D}}$ | Drain Current |  | A |
|  | Continuous $\left(\mathrm{T}_{\mathrm{C}}=25^{\circ} \mathrm{C}, \mathrm{V}_{\mathrm{GS}}=10 \mathrm{~V}\right)$ | 14 |  |
|  | Continuous $\left(\mathrm{T}_{\mathrm{C}}=100^{\circ} \mathrm{C}, \mathrm{V}_{\mathrm{GS}}=10 \mathrm{~V}\right)$ | 9.7 |  |
|  | Continuous $\left(\mathrm{T}_{\text {amb }}=25^{\circ} \mathrm{C}, \mathrm{V}_{\mathrm{GS}}=10 \mathrm{~V}\right)$ | 2.8 |  |
|  | wulsed $\quad$ with $\mathrm{R}_{\theta J \mathrm{AJ}}=52^{\circ} \mathrm{C} / \mathrm{W}$ | Figure 4 |  |
| $\mathrm{E}_{\mathrm{AS}}$ | Single Pulse Avalanche Energy (Note 1) | 122 | mJ |
| $\mathrm{P}_{\mathrm{D}}$ | Power Dissipation | 65 | W |
|  | Derate above $25^{\circ} \mathrm{C}$ | 0.43 | $\mathrm{~W} /{ }^{\circ} \mathrm{C}$ |
| $\mathrm{T}_{\mathrm{J}}, \mathrm{T}_{\mathrm{STG}}$ | Operating and Storage Temperature | -55 to 175 | ${ }^{\circ} \mathrm{C}$ |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL CHARACTERISTICS ( $\mathrm{T}_{\mathrm{C}}=25^{\circ} \mathrm{C}$, unless otherwise noted)

| Symbol | Parameter | Ratings | Unit |
| :---: | :--- | :---: | :---: |
| $R_{\theta J C}$ | Thermal Resistance, Junction to Case, Max. | 2.31 | ${ }^{\circ} \mathrm{C} / \mathrm{W}$ |
| $\mathrm{R}_{\theta J A}$ | Thermal Resistance, Junction to Ambient, <br> Max. | 100 |  |
| $\mathrm{R}_{\theta J A}$ | Thermal Resistance, Junction to Ambient, <br> 1 in $^{2}$ Copper Pad Area, Max. | 52 | ${ }^{\circ} \mathrm{C} / \mathrm{W}$ |


| $\mathbf{V}_{\text {DSS }}$ | $\mathbf{R}_{\text {DS(on) }}$ MAX | $\mathbf{I}_{\mathrm{D}}$ MAX |
| :---: | :---: | :---: |
| 150 V | $120 \mathrm{~m} \Omega @ 10 \mathrm{~V}$ | 14 A |



DPAK3 (TO-252 3 LD)
CASE 369AS

## MARKING DIAGRAM


\&Z $\quad=$ Assembly Plant Code
\&3 $=3$-Digit Date Code
\&K $\quad=2$-Digits Lot Run Traceability Code
FDD120AN15A0 = Device Code


N-Channel

ORDERING INFORMATION
See detailed ordering and shipping information on page 12 of this data sheet.

ELECTRICAL CHARACTERISTICS $\left(\mathrm{T}_{\mathrm{C}}=25^{\circ} \mathrm{C}\right.$ unless otherwise noted)

| Symbol | Parameter | Test Condition | Min | Typ | Max | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| OFF CHARACTERISTICS |  |  |  |  |  |  |
| BvDss | Drain to Source Breakdown Voltage | $\mathrm{I}_{\mathrm{D}}=250 \mu \mathrm{~A}, \mathrm{~V}_{\mathrm{GS}}=0 \mathrm{~V}$ | 150 | - | - | V |
| ${ }^{\text {dSS }}$ | Zero Gate Voltage Drain Current | $\mathrm{V}_{\mathrm{DS}}=120 \mathrm{~V}, \mathrm{~V}_{\mathrm{GS}}=0 \mathrm{~V}$ | - | - | 1 | $\mu \mathrm{A}$ |
|  |  | $\mathrm{V}_{\mathrm{DS}}=120 \mathrm{~V}, \mathrm{~V}_{\mathrm{GS}}=0 \mathrm{~V}, \mathrm{~T}_{\mathrm{C}}=150^{\circ} \mathrm{C}$ | - | - | 250 |  |
| IGSS | Gate to Source Leakage Current | $\mathrm{V}_{\mathrm{GS}}= \pm 20 \mathrm{~V}$ | - | - | $\pm 100$ | nA |

ON CHARACTERISTICS

| $\mathrm{V}_{\mathrm{GS} \text { (TH) }}$ | Gate to Source Threshold Voltage | $\mathrm{V}_{\mathrm{GS}}=\mathrm{V}_{\mathrm{DS}}, \mathrm{I}_{\mathrm{D}}=250 \mu \mathrm{~A}$ | 2 | - | 4 | V |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{R}_{\mathrm{DS} \text { (on) }}$ | Drain to Source On Resistance | $\mathrm{I}_{\mathrm{D}}=4 \mathrm{~A}, \mathrm{~V}_{\mathrm{GS}}=10 \mathrm{~V}$ | - | 0.101 | 0.120 | $\Omega$ |
|  |  | $\mathrm{I}_{\mathrm{D}}=2 \mathrm{~A}, \mathrm{~V}_{\mathrm{GS}}=6 \mathrm{~V}$ | - | 0.113 | 0.170 |  |
|  |  | $\mathrm{I}_{\mathrm{D}}=4 \mathrm{~A}, \mathrm{~V}_{\mathrm{GS}}=10 \mathrm{~V}, \mathrm{~T}_{\mathrm{J}}=175^{\circ} \mathrm{C}$ | - | 0.235 | 0.282 |  |

DYNAMIC CHARACTERISTICS

| $\mathrm{C}_{\text {ISS }}$ | Input Capacitance | $\mathrm{V}_{\mathrm{DS}}=25 \mathrm{~V}, \mathrm{~V}_{\mathrm{GS}}=0 \mathrm{~V}, \mathrm{f}=1 \mathrm{MHz}$ | - | 770 | - | pF |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Coss | Output Capacitance |  | - | 85 | - | pF |
| $\mathrm{C}_{\text {RSS }}$ | Reverse Transfer Capacitance |  | - | 17 | - | pF |
| $\mathrm{Q}_{\mathrm{g} \text { (TOT) }}$ | Total Gate Charge at 10 V | $\begin{aligned} & \mathrm{V}_{\mathrm{GS}}=0 \mathrm{~V} \text { to } 10 \mathrm{~V}, \mathrm{~V}_{\mathrm{DD}}=75 \mathrm{~V}, \mathrm{I}_{\mathrm{D}}=4 \mathrm{~A}, \\ & \mathrm{I}_{\mathrm{g}}=1.0 \mathrm{~mA} \end{aligned}$ | - | 11.2 | 14.5 | nC |
| $\mathrm{Q}_{\mathrm{g}(\mathrm{TH})}$ | Threshold Gate Charge | $\begin{aligned} & \mathrm{V}_{\mathrm{GS}}=0 \mathrm{~V} \text { to } 2 \mathrm{~V}, \mathrm{~V}_{\mathrm{DD}}=75 \mathrm{~V}, \mathrm{I}_{\mathrm{D}}=4 \mathrm{~A}, \\ & \mathrm{I}_{\mathrm{g}}=1.0 \mathrm{~mA} \end{aligned}$ | - | 1.4 | 1.8 | nC |
| $\mathrm{Q}_{\mathrm{gs}}$ | Gate to Source Gate Charge | $\mathrm{V}_{\mathrm{DD}}=75 \mathrm{~V}, \mathrm{I}_{\mathrm{D}}=4 \mathrm{~A}, \mathrm{I}_{\mathrm{g}}=1.0 \mathrm{~mA}$ | - | 3.5 | - | nC |
| $Q_{\text {gs2 }}$ | Gate Charge Threshold to Plateau |  | - | 2.1 | - | nC |
| $\mathrm{Q}_{\mathrm{gd}}$ | Gate to Drain "Miller" Charge |  | - | 2.6 | - | nC |

SWITCHING CHARACTERISTICS $\left(\mathrm{V}_{\mathrm{GS}}=10 \mathrm{~V}\right)$

| ton | Turn-On Time | $\begin{aligned} & \mathrm{V}_{\mathrm{DD}}=75 \mathrm{~V}, \mathrm{I}_{\mathrm{D}}=4 \mathrm{~A} \\ & \mathrm{~V}_{\mathrm{GS}}=10 \mathrm{~V}, \mathrm{R}_{\mathrm{GS}}=24 \Omega \end{aligned}$ | - | - | 33 | ns |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{t}_{\mathrm{d}(\mathrm{ON})}$ | Turn-On Delay Time |  | - | 6 | - | ns |
| $\mathrm{t}_{\mathrm{r}}$ | Rise Time |  | - | 16 | - | ns |
| $\mathrm{t}_{\mathrm{d} \text { (OFF) }}$ | Turn-Off Delay Time |  | - | 30 | - | ns |
| $\mathrm{t}_{\mathrm{f}}$ | Fall Time |  | - | 19 | - | ns |
| toff | Turn-Off Time |  | - | - | 74 | ns |

DRAIN-SOURCE DIODE CHARACTERISTICS

| $\mathrm{V}_{\mathrm{SD}}$ | Source to Drain Diode Voltage | $\mathrm{I}_{\mathrm{SD}}=4 \mathrm{~A}$ | - | - | 1.25 | V |
| :---: | :--- | :--- | :---: | :---: | :---: | :---: |
|  |  | $\mathrm{I}_{\mathrm{SD}}=2 \mathrm{~A}$ | - | - | 1.0 | V |
| $\mathrm{t}_{\mathrm{rr}}$ | Reverse Recovery Time | $\mathrm{I}_{\mathrm{SD}}=4 \mathrm{~A}, \mathrm{~d} \mathrm{I}_{\mathrm{SD}} / \mathrm{dt}=100 \mathrm{~A} / \mu \mathrm{s}$ | - | - | 61 | ns |
| $\mathrm{Q}_{\mathrm{RR}}$ | Reverse Recovered Charge | $\mathrm{I}_{\mathrm{SD}}=4 \mathrm{~A}, \mathrm{~d} \mathrm{I}_{\mathrm{SD}} / \mathrm{dt}=100 \mathrm{~A} / \mu \mathrm{s}$ | - | - | 109 | nC |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. Starting $\mathrm{T}_{\mathrm{J}}=25^{\circ} \mathrm{C}, \mathrm{L}=27 \mathrm{mH}, \mathrm{I}_{\mathrm{AS}}=3 \mathrm{~A}$.
2. Pulse width $=100 \mathrm{~s}$.

TYPICAL CHARACTERISTICS $\left(\mathrm{T}_{\mathrm{C}}=25^{\circ} \mathrm{C}\right.$, unless otherwise noted)


Figure 1. Normalized Power Dissipation vs. Ambient Temperature


Figure 3. Normalized Maximum Transient Thermal Impedance


Figure 4. Peak Current Capability

TYPICAL CHARACTERISTICS $\left(\mathrm{T}_{\mathrm{C}}=25^{\circ} \mathrm{C}\right.$, unless otherwise noted) (continued)


Figure 6. Unclamped Inductive Switching Capability


Figure 8. Saturation Characteristics


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

TYPICAL CHARACTERISTICS $\left(\mathrm{T}_{\mathrm{C}}=25^{\circ} \mathrm{C}\right.$, unless otherwise noted) (continued)


Figure 11. Normalized Gate Threshold Voltage vs. Junction Temperature

$V_{\text {DS }}$, DRAIN TO SOURCE VOLTAGE (V)
Figure 13. Capacitance vs. Drain to Source Voltage


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


Figure 14. Gate Charge Waveforms for Constant Gate Currents

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TEST CIRCUITS AND WAVEFORMS


Figure 15. Unclamped Energy Test Circuit


Figure 17. Gate Charge Test Circuit


Figure 19. Switching Time Test Circuit


Figure 16. Unclamped Energy Waveforms


Figure 18. Gate Charge Waveforms


Figure 20. Switching Time Waveforms

## THERMAL RESISTANCE VS. MOUNTING PAD AREA

The maximum rated junction temperature, $\mathrm{T}_{\mathrm{JM}}$, and the thermal resistance of the heat dissipating path determines the maximum allowable device power dissipation, $\mathrm{P}_{\mathrm{DM}}$, in an application. Therefore the application's ambient temperature, $\mathrm{T}_{\mathrm{A}}\left({ }^{\circ} \mathrm{C}\right)$, and thermal resistance $\mathrm{R}_{\theta \mathrm{JA}}\left({ }^{\circ} \mathrm{C} / \mathrm{W}\right)$ must be reviewed to ensure that $\mathrm{T}_{\mathrm{JM}}$ is never exceeded. Equation 1 mathematically represents the relationship and serves as the basis for establishing the rating of the part.

$$
\begin{equation*}
P_{D M}=\frac{\left(T_{J M}-T_{A}\right)}{R_{\theta J A}} \tag{eq.1}
\end{equation*}
$$

In using surface mount devices such as the TO-252 package, the environment in which it is applied will have a significant influence on the part's current and maximum power dissipation ratings. Precise determination of $\mathrm{P}_{\mathrm{DM}}$ is complex and influenced by many factors:

1. Mounting pad area onto which the device is attached and whether there is copper on one side or both sides of the board.
2. The number of copper layers and the thickness of the board.
3. The use of external heat sinks.
4. The use of thermal vias.
5. Air flow and board orientation.
6. For non steady state applications, the pulse width, the duty cycle and the transient thermal response of the part, the board and the environment they are in.
onsemi provides thermal information to assist the designer's preliminary application evaluation. Figure 21 defines the $\mathrm{R}_{\theta \mathrm{JA}}$ for the device as a function of the top copper (component side) area. This is for a horizontally positioned FR-4 board with 1 oz copper after 1000 seconds of steady state power with no air flow. This graph provides the necessary information for calculation of the steady state junction temperature or power dissipation. Pulse applications
can be evaluated using the onsemi device Spice thermal model or manually utilizing the normalized maximum transient thermal impedance curve.
Thermal resistances corresponding to other copper areas can be obtained from Figure 21 or by calculation using Equation 2 or 3 . Equation 2 is used for copper area defined in inches square and Equation 3 is for area in centimeters square. The area, in square inches or square centimeters is the top copper area including the gate and source pads.

$$
\begin{equation*}
R_{\text {日JA }}=33.32+\frac{23.84}{(0.268+\text { Area })} \tag{eq.2}
\end{equation*}
$$

Area in Inches Squared

$$
\begin{equation*}
\mathrm{R}_{\text {өJA }}=33.32+\frac{154}{(1.73+\text { Area })} \tag{eq.3}
\end{equation*}
$$

Area in Centimeters Squared


Figure 21. Thermal Resistance vs. Mounting Pad Area

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## PSPICE ELECTRICAL MODEL

.SUBCKT FDD120AN15A0 213 ; rev July 2002
Ca $1282.5 \mathrm{e}-10$
Cb $15142.5 \mathrm{e}-10$
Cin 68 7.5e-10
Dbody 75 DbodyMOD
Dbreak 511 DbreakMOD
Dplcap 105 DplcapMOD

Ebreak 1171718162
Eds 148581
Egs 138681
Esg 610681
Evthres 6211981
Evtemp 20618221
It 8171

Lgate 19 3e-9
Ldrain 25 1.0e-9
Lsource 37 2e-9
RLgate 1930
RLdrain 2510
RLsource 3720
Mmed 16688 MmedMOD
Mstro 16688 MstroMOD
Mweak 162188 MweakMOD
Rbreak 1718 RbreakMOD 1
Rdrain 5016 RdrainMOD 6.55e-2
Rgate 9203.6
RSLC1 551 RSLCMOD 1.0e-6
RSLC2 550 1.0e3
Rsource 87 RsourceMOD 2.8e-2
Rvthres 228 RvthresMOD 1
Rvtemp 1819 RvtempMOD 1
S1a 612138 S1AMOD
S1b 1312138 S1BMOD
S2a 6151413 S2AMOD
S2b 13151413 S2BMOD

Vbat 2219 DC 1
$\operatorname{ESLC} 5150$ VALUE $=\{(\mathrm{V}(5,51) / \operatorname{ABS}(\mathrm{V}(5,51))) *(\operatorname{PWR}(\mathrm{~V}(5,51) /(1 \mathrm{e}-6 * 25), 3))\}$
.MODEL DbodyMOD D (IS=4E-12 N=1.07 RS=6.5e-3 TRS1=3.0e-3 TRS2=1.5e-6
$+\mathrm{CJO}=5.5 \mathrm{e}-10 \mathrm{M}=0.65 \mathrm{TT}=5 \mathrm{e}-8 \mathrm{XTI}=4.2$ )
.MODEL DbreakMOD D (RS=0.5 TRS1=1e-3 TRS2=-1e-6)
.MODEL DplcapMOD D (CJO=1.56e-10 IS=1.0e-30 N=10 M=0.62)
.MODEL MmedMOD NMOS (VTO=3.6 KP=1.8 IS=1e-30 N=10 TOX=1 L=1u W=1u RG=3.6)
.MODEL MstroMOD NMOS (VTO=4.4 KP=30 IS=1e-30 N=10 TOX=1 L=1u W=1u)
.MODEL MweakMOD NMOS (VTO=3.14 KP=0.02 IS=1e-30 N=10 TOX=1 L=1u W=1u RG=36 RS=0.1)
.MODEL RbreakMOD RES (TC1=1.1e-3 TC2=-1e-6)
.MODEL RdrainMOD RES (TC1=8.5e-3 TC2=2.5e-5)
.MODEL RSLCMOD RES (TC1=3.4e-3 TC2=1.5e-6)
.MODEL RsourceMOD RES (TC1=4.1e-3 TC2=1e-6)
.MODEL RvthresMOD RES (TC1 $=-3.6 \mathrm{e}-3 \mathrm{TC} 2=-1.4 \mathrm{e}-5$ )
.MODEL RvtempMOD RES (TC1=-4.1e-3 TC2=1.5e-6)
.MODEL S1AMOD VSWITCH (RON=1e-5 ROFF=0.1 VON=-6.0 VOFF=-4.0)
.MODEL S1BMOD VSWITCH (RON=1e-5 ROFF=0.1 VON=-4.0 VOFF=-6.0)
.MODEL S2AMOD VSWITCH (RON=1e-5 ROFF=0.1 VON=-2.5 VOFF=-0.5)
.MODEL S2BMOD VSWITCH (RON=1e-5 ROFF=0.1 VON=-0.5 VOFF=-2.5)
.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.


Figure 22.

## FDD120AN15A0

## SABER ELECTRICAL MODEL

REV July 2002
template FDD120AN15A0 n2,n1,n3
electrical n2,n1,n3
\{
var i iscl
dp..model dbodymod $=($ isl $=4 \mathrm{e}-12, \mathrm{nl}=1.07, \mathrm{rs}=6.5 \mathrm{e}-3, \operatorname{trs} 1=3.0 \mathrm{e}-3, \operatorname{trs} 2=1.5 \mathrm{e}-6, \mathrm{cjo}=5.5 \mathrm{e}-10, \mathrm{~m}=0.65, \mathrm{tt}=5 \mathrm{e}-8, \mathrm{xti}=4.2)$
dp.. model dbreakmod $=(r s=0.5, \operatorname{trs} 1=1 \mathrm{e}-3, \operatorname{trs} 2=-1 \mathrm{e}-6)$
dp..model dplcapmod $=(\mathrm{cjo}=1.56 \mathrm{e}-10, \mathrm{isl}=10.0 \mathrm{e}-30, \mathrm{nl}=10, \mathrm{~m}=0.62)$
$\mathrm{m} .$. model mmedmod $=\left(\right.$ type $=\_\mathrm{n}, \mathrm{vto}=3.6, \mathrm{kp}=1.8$, is $=1 \mathrm{e}-30$, tox $\left.=1\right)$
$\mathrm{m} .$. model mstrongmod $=\left(\right.$ type $=\_\mathrm{n}, \mathrm{vto}=4.4, \mathrm{kp}=30$, is $=1 \mathrm{e}-30$, tox $\left.=1\right)$
$\mathrm{m} .$. model mweakmod $=\left(\right.$ type $=\_\mathrm{n}, \mathrm{vto}=3.14, \mathrm{kp}=0.02, \mathrm{is}=1 \mathrm{e}-30$, tox $\left.=1, \mathrm{rs}=0.1\right)$
sw_vcsp..model s1amod $=($ ron $=1 \mathrm{e}-5$, roff $=0.1$, von $=-6.0$, voff $=-4.0)$
sw_vcsp..model s1bmod $=($ ron=1e-5,roff=0.1,von=-4.0,voff=-6.0)
sw_vcsp..model s2amod $=($ ron=1e-5,roff=0.1,von=-2.5,voff=-0.5)
sw_vcsp..model s2bmod $=($ ron=1e -5, roff $=0.1$, von $=-0.5$, voff $=-2.5)$
c.ca n12 n8 $=2.5 \mathrm{e}-10$
c.cb n15 n $14=2.5 \mathrm{e}-10$
c.cin $\mathrm{n} 6 \mathrm{n} 8=7.5 \mathrm{e}-10$
dp.dbody n7 n5 = model=dbodymod
dp.dbreak n5 n11 = model=dbreakmod
dp.dplcap n10 n5 = model=dplcapmod
spe.ebreak n11 n7 n17n18 $=162$
spe.eds n14 n8 n5 n8 = 1
spe.egs n13 n8 n6 n8 $=1$
spe.esg n6 n10 n6 n8 = 1
spe.evthres n6n21n19n8 = 1
spe.evtemp n20 n6n18n22 $=1$
i.it $\mathrm{n} 8 \mathrm{n} 17=1$
1.lgate n1 n9 $=3 \mathrm{e}-9$
1.ldrain $\mathrm{n} 2 \mathrm{n} 5=1.0 \mathrm{e}-9$
1.lsource n3 n7 = 2e-9
res.rlgate $\mathrm{n} 1 \mathrm{n} 9=30$
res.rldrain n2 n5 $=10$
res.rlsource $\mathrm{n} 3 \mathrm{n} 7=20$
m.mmed n16n6n8n8 = model=mmedmod, $\mathrm{l}=\mathrm{lu}, \mathrm{w}=1 \mathrm{u}$
m.mstrong n16n6n8n8 = model=mstrongmod, $\mathrm{l}=1 \mathrm{u}, \mathrm{w}=1 \mathrm{u}$
m.mweak n16n21n8n8= model=mweakmod, $\mathrm{l}=1 \mathrm{u}, \mathrm{w}=1 \mathrm{u}$
res.rbreak n17 n18 $=1$, tc $1=1.1 \mathrm{e}-3$,tc $2=-1 \mathrm{e}-6$
res.rdrain n50 n16 $=6.55 \mathrm{e}-2$, tc $1=8.5 \mathrm{e}-3$, tc $2=2.5 \mathrm{e}-5$
res.rgate $\mathrm{n} 9 \mathrm{n} 20=3.6$
res.rslc1 n5 n51 $=1.0 \mathrm{e}-6$, tc $1=3.4 \mathrm{e}-3$, tc $2=1.5 \mathrm{e}-6$
res.rslc $2 \mathrm{n} 5 \mathrm{n} 50=1.0 \mathrm{e} 3$
res.rsource $\mathrm{n} 8 \mathrm{n} 7=2.8 \mathrm{e}-2$, tc $1=4.1 \mathrm{e}-3$, tc $2=1 \mathrm{e}-6$
res.rvthres $\mathrm{n} 22 \mathrm{n} 8=1$, tc1 $=-3.6 \mathrm{e}-3$,tc2 $=-1.4 \mathrm{e}-5$
res.rvtemp n18 n19 $=1$, tc $1=-4.1 \mathrm{e}-3$, tc $2=1.5 \mathrm{e}-6$
sw_vcsp.s1a n6 n12 n13 n8 = model=s1amod
sw_vcsp.s1b n13 n12 n13 n8 = model=s1bmod
sw_vcsp.s2a n6 n15 n14 n13 $=$ model=s2amod

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sw_vcsp.s2b n13 n15 n14 n13 = model=s2bmod
v.vbat n22 n19 = dc=1
equations \{
i (n51->n50) +=iscl
iscl: $\mathrm{v}(\mathrm{n} 51, \mathrm{n} 50)=\left((\mathrm{v}(\mathrm{n} 5, \mathrm{n} 51) /(1 \mathrm{e}-9+\operatorname{abs}(\mathrm{v}(\mathrm{n} 5, \mathrm{n} 51))))^{*}\left((\operatorname{abs}(\mathrm{v}(\mathrm{n} 5, \mathrm{n} 51) * 1 \mathrm{e} 6 / 25))^{* *} 3\right)\right)$
\}


Figure 23.

## PSPICE ELECTRICAL MODEL

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FDD120AN15A0T

CTHERM1 TH 6 1.2e-3
CTHERM2 $652 \mathrm{e}-3$
CTHERM3 $542.5 \mathrm{e}-3$
CTHERM4 43 3.15e-3
CTHERM5 32 3.3e-3
CTHERM6 2 TL $1.35 \mathrm{e}-2$

RTHERM1 TH 6 6.8e-2
RTHERM2 65 1.18e-1
RTHERM3 $542.28 \mathrm{e}-1$
RTHERM4 43 3.28e-1
RTHERM5 32 5.28e-1
RTHERM6 2 TL 5.78e-1

## SABER ELECTRICAL MODEL

SABER thermal model FDD120AN15A0T
template thermal_model th tl
thermal_c th, tl
\{
ctherm.ctherm1 th $6=1.2 \mathrm{e}-3$
ctherm.ctherm2 $65=2 \mathrm{e}-3$
ctherm.ctherm3 $54=2.5 \mathrm{e}-3$
ctherm.ctherm4 $43=3.15 \mathrm{e}-3$
ctherm.ctherm5 $32=3.3 \mathrm{e}-3$
ctherm.ctherm6 $2 \mathrm{tl}=1.35 \mathrm{e}-2$
rtherm.rtherm1 th $6=6.8 \mathrm{e}-2$
rtherm.rtherm2 $65=1.18 \mathrm{e}-1$
rtherm.rtherm3 $54=2.28 \mathrm{e}-1$
rtherm.rtherm4 $43=3.28 \mathrm{e}-1$
rtherm.rtherm5 $32=5.28 \mathrm{e}-1$
rtherm.rtherm6 $2 \mathrm{tl}=5.78 \mathrm{e}-1$ \}


Figure 24.

PACKAGE MARKING AND ORDERING INFORMATION

| Device | Device Marking | Package | Reel Size | Tape Width | Shipping $^{\dagger}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| FDD120AN15A0 | FDD120AN15A0 | DPAK3 (TO-252 3 LD) <br> (Pb-Free, Halide Free) | 330 mm | 16 mm | $2500 /$ Tape \& Reel |

$\dagger$ For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot " r ", may or may not be present. Some products may not follow the Generic Marking.


XXXX = Specific Device Code A = Assembly Location Y = Year
WW = Work Week
ZZ = Assembly Lot Code

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