# **ON Semiconductor**

# Is Now



To learn more about onsemi<sup>™</sup>, please visit our website at www.onsemi.com

onsemi and ONSEMI. and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "onsemi" or its affiliates and/or subsidiaries in the United States and/or other countries. onsemi owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of onsemi product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. onsemi reserves the right to make changes at any time to any products or information herein is provided "as-is" and onsemi makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using onsemi products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by onsemi. "Typical" parameters which may be provided in onsemi data sheets and/ or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. onsemi does not convey any license under any of its intellectual property rights nor the rights of others. onsemi products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use onsemi products for any such unintended or unauthorized application,



ON Semiconductor®

# FDB14AN06LA0-F085

# N-Channel PowerTrench<sup>®</sup> MOSFET 60V, 60A, 14.6m $\Omega$

#### **Features**

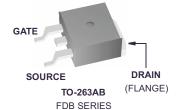
- $r_{DS(ON)} = 12.8 \text{m}\Omega \text{ (Typ.)}, V_{GS} = 5 \text{V}, I_D = 60 \text{A}$
- $Q_q(tot) = 24nC (Typ.), V_{GS} = 5V$
- · Low Miller Charge
- Low Q<sub>RR</sub> Body Diode
- UIS Capability (Single Pulse and Repetitive Pulse)
- Qualified to AEC Q101
- RoHS Compliant



#### **Applications**

- · Motor / Body Load Control
- · ABS Systems
- Powertrain Management
- Injection Systems
- DC-DC converters and Off-line UPS
- Distributed Power Architectures and VRMs
- Primary Switch for 12V and 24V systems

Formerly developmental type 83557





# MOSFET Maximum Ratings T<sub>C</sub> = 25°C unless otherwise noted

| Symbol                            | Parameter  | Ratings    | Units |
|-----------------------------------|--|------------|-------|
| V <sub>DSS</sub>                  | Drain to Source Voltage  | 60         | V     |
| V <sub>GS</sub>                   | Gate to Source Voltage   | ±20        | V     |
|                                   | Drain Current  |            |       |
|                                   | Continuous (T <sub>C</sub> = 25°C, V <sub>GS</sub> = 10V)              | 67         | A     |
| $I_D$                             | Continuous (T <sub>C</sub> = 25°C, V <sub>GS</sub> = 5V)               | 60         | А     |
|                                   | Continuous ( $T_A = 25$ °C, $V_{GS} = 5V$ , $R_{\theta JA} = 43$ °C/W) | 10         | А     |
|                                   | Pulsed   | Figure 4   | А     |
| E <sub>AS</sub>                   | Single Pulse Avalanche Energy (Note 1)                                 | 46         | mJ    |
| D                                 | Power dissipation  | 125        | W     |
| $P_{D}$                           | Derate above 25°C  | 0.83       | W/°C  |
| T <sub>J</sub> , T <sub>STG</sub> | Operating and Storage Temperature                                      | -55 to 175 | °C    |

## **Thermal Characteristics**

| $R_{\theta JC}$ | Maximum Thermal Resistance Junction to Case TO-263                                      | 1.2 | °C/W |
|-----------------|---|-----|------|
| $R_{\theta JA}$ | Maximum Thermal Resistance Junction to Ambient TO-263, 1in <sup>2</sup> copper pad area | 43  | °C/W |

Units

nC

nC

nC

nC

3.9

-

# **Package Marking and Ordering Information**

| Device Marking | Device            | Package  | Reel Size | Tape Width | Quantity  |  |
|----------------|-------------------|----------|-----------|------------|-----------|--|
| FDB14AN06LA0   | FDB14AN06LA0-F085 | TO-263AB | 330mm     | 24mm       | 800 units |  |

**Test Conditions** 

Min

Тур

3.0

12

9.1

7.9

Max

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

**Parameter** 

| B <sub>VDSS</sub>   | Drain to Source Breakdown Voltage | $I_D = 250 \mu A, V_{GS} = 0 V$                          |                                  | 60 | -      | -      | V  |
|---------------------|-----------------------------------|--|----------------------------------|----|--------|--------|----|
| I <sub>DSS</sub>    | Zero Gate Voltage Drain Current   | V <sub>DS</sub> = 50V                                    |                                  | -  | -      | 1      | ^  |
|                     |                                   | $V_{GS} = 0V$  | $T_{\rm C} = 150^{\rm o}{\rm C}$ | -  | -      | 250    | μΑ |
| I <sub>GSS</sub>    | Gate to Source Leakage Current    | V <sub>GS</sub> = ±20V                                   | •                                | -  | -      | ±100   | nA |
|                     | racteristics                      | \\ -\\ 1 -   | 2504                             |    | ı      |        | V  |
| V <sub>GS(TH)</sub> | Gate to Source Threshold Voltage  | $V_{GS} = V_{DS}, I_{D} =$                               |                                  | 1  | -      | 3      | V  |
| r <sub>DS(ON)</sub> | Drain to Source On Resistance     |  | 67A, V <sub>GS</sub> = 10V       |    | 0.0102 | 0.0116 | Ω  |
|                     |                                   | $I_D = 60A, V_{GS} = 5V$                                 |                                  | -  | 0.0128 | 0.0146 |    |
|                     |                                   | $I_D = 60A, V_{GS} = T_J = 175^{\circ}C$                 | 5V,                              | -  | 0.028  | 0.033  | 32 |
| Dynamic             | Characteristics                   | •  |                                  |    | •      |        |    |
| C <sub>ISS</sub>    | Input Capacitance                 | V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V,<br>f = 1MHz |                                  | -  | 2900   | -      | pF |
| Coss                | Output Capacitance                |  |                                  | -  | 270    | -      | pF |
| C <sub>RSS</sub>    | Reverse Transfer Capacitance      |  |                                  | -  | 115    | -      | pF |
| Q <sub>g(TOT)</sub> | Total Gate Charge at 5V           | $V_{GS} = 0V \text{ to } 5V$                             |                                  |    | 24     | 31     | nC |
|                     |                                   |  | <b>⊣</b>                         |    | 1      |        |    |

#### **Switching Characteristics** $(V_{GS} = 5V)$

Threshold Gate Charge

Gate to Source Gate Charge

Gate to Drain "Miller" Charge

Gate Charge Threshold to Plateau

| t <sub>ON</sub>     | Turn-On Time        | $V_{DD} = 30V, I_{D} = 60A$<br>$V_{GS} = 5V, R_{GS} = 5.1\Omega$ | - | -   | 276 | ns |
|---------------------|---------------------|--|---|-----|-----|----|
| t <sub>d(ON)</sub>  | Turn-On Delay Time  |  | - | 15  | -   | ns |
| t <sub>r</sub>      | Rise Time           |  | - | 169 | -   | ns |
| t <sub>d(OFF)</sub> | Turn-Off Delay Time |  | - | 24  | -   | ns |
| t <sub>f</sub>      | Fall Time           |  | - | 50  | -   | ns |
| t <sub>OFF</sub>    | Turn-Off Time       |  | - | -   | 109 | ns |

 $V_{GS} = \overline{0V \text{ to } 1V}$ 

 $V_{DD} = 30V$ 

 $I_{g}^{-} = 1.0 \text{mA}$ 

 $I_{D} = 60A$ 

#### **Drain-Source Diode Characteristics**

| $V_{SD}$        | Source to Drain Diode Voltage | I <sub>SD</sub> = 60A                      | - | - | 1.25 | V  |
|-----------------|-------------------------------|--|---|---|------|----|
|                 |                               | I <sub>SD</sub> = 30A                      | - | - | 1.0  | V  |
| t <sub>rr</sub> | Reverse Recovery Time         | $I_{SD} = 60A$ , $dI_{SD}/dt = 100A/\mu s$ | - | - | 33   | ns |
| $Q_{RR}$        | Reverse Recovered Charge      | $I_{SD} = 60A$ , $dI_{SD}/dt = 100A/\mu s$ | - | - | 29   | nC |

#### Notes:

 $Q_{g(TH)}$ 

 $\mathsf{Q}_{\mathsf{gs}}$ 

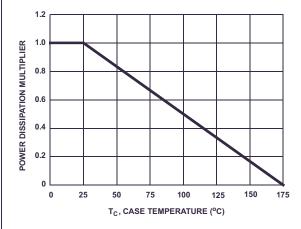
 $Q_{gs2}$ 

 $Q_{gd}$ 

Symbol

1: Starting  $T_J = 25^{\circ}C$ ,  $L = 40\mu H$ ,  $I_{AS} = 48A$ .

# **Typical Characteristics** T<sub>C</sub> = 25°C unless otherwise noted



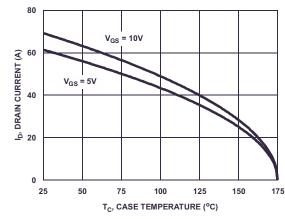


Figure 1. Normalized Power Dissipation vs
Ambient Temperature

Figure 2. Maximum Continuous Drain Current vs Case Temperature

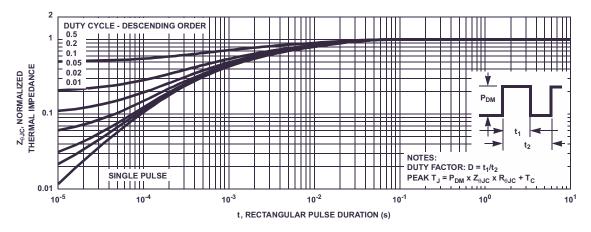


Figure 3. Normalized Maximum Transient Thermal Impedance

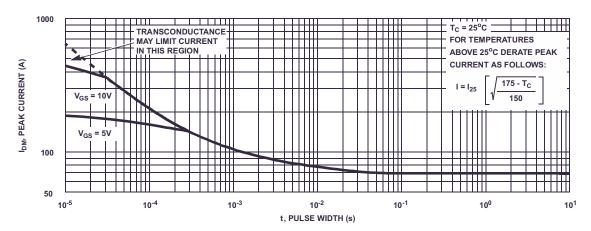
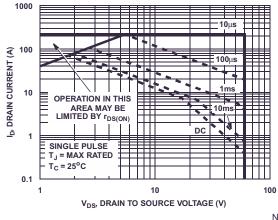


Figure 4. Peak Current Capability

# Typical Characteristics T<sub>C</sub> = 25°C unless otherwise noted



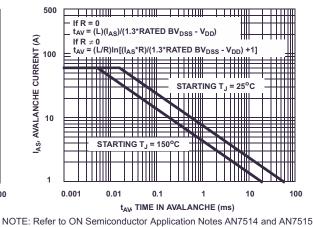
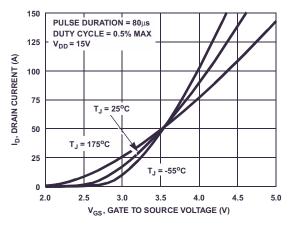


Figure 5. Forward Bias Safe Operating Area

OTE: Refer to ON Semiconductor Application Notes AN7514 and AN7515

Figure 6. Unclamped Inductive Switching Capability



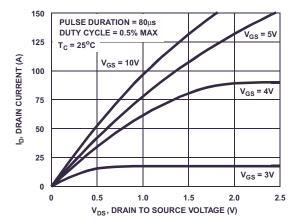
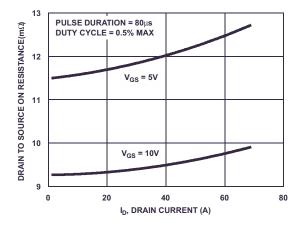


Figure 7. Transfer Characteristics

Figure 8. Saturation Characteristics



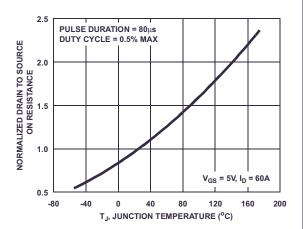


Figure 9. Drain to Source On Resistance vs Drain Current

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

## Typical Characteristics T<sub>C</sub> = 25°C unless otherwise noted

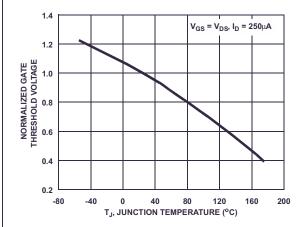


Figure 11. Normalized Gate Threshold Voltage vs Junction Temperature

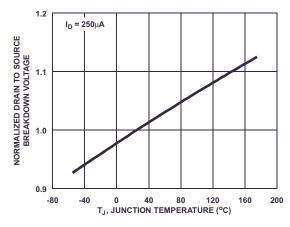


Figure 12. Normalized Drain to Source Breakdown Voltage vs Junction Temperature

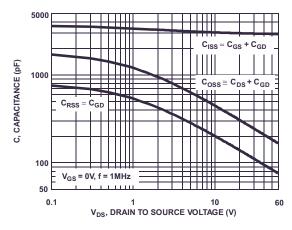


Figure 13. Capacitance vs Drain to Source Voltage

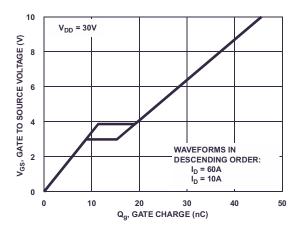


Figure 14. Gate Charge Waveforms for Constant Gate Currents

# **Test Circuits and Waveforms**

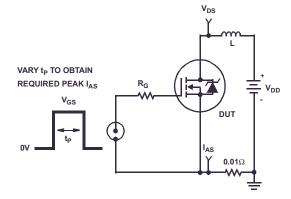


Figure 15. Unclamped Energy Test Circuit

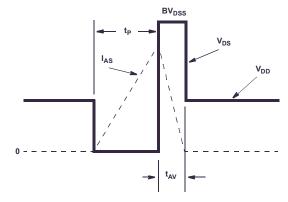


Figure 16. Unclamped Energy Waveforms

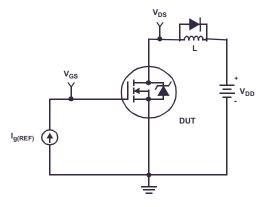


Figure 17. Gate Charge Test Circuit

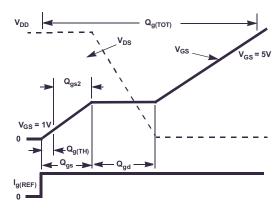


Figure 18. Gate Charge Waveforms

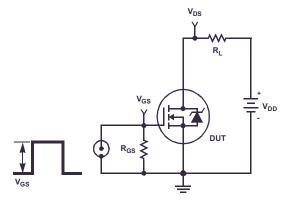


Figure 19. Switching Time Test Circuit

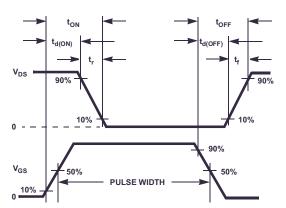


Figure 20. Switching Time Waveforms

### Thermal Resistance vs. Mounting Pad Area

The maximum rated junction temperature,  $T_{JM}$ , and the thermal resistance of the heat dissipating path determines the maximum allowable device power dissipation,  $P_{DM}$ , in an application. Therefore the application's ambient temperature,  $T_A$  (°C), and thermal resistance  $R_{\theta JA}$  (°C/W) must be reviewed to ensure that  $T_{JM}$  is never exceeded. Equation 1 mathematically represents the relationship and serves as the basis for establishing the rating of the part.

$$P_{DM} = \frac{(T_{JM} - T_A)}{R_{\theta, JA}} \tag{EQ. 1}$$

In using surface mount devices such as the TO-263 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  $P_{\mbox{\scriptsize DM}}$  is complex and influenced by many factors:

- Mounting pad area onto which the device is attached and whether there is copper on one side or both sides of the board.
- 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.
- 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.

ON Semiconductor provides thermal information to assist the designer's preliminary application evaluation. Figure 21 defines the  $R_{\theta JA}$  for the device as a function of the top copper (component side) area. This is for a horizontally positioned FR-4 board with 1oz 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 ON Semiconductor 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.

$$R_{\Theta JA} = 26.51 + \frac{19.84}{(0.262 + Area)}$$
 (EQ. 2)

Area in Inches Squared

$$R_{\theta JA} = 26.51 + \frac{128}{(1.69 + Area)}$$
 (EQ. 3)

Area in Centimeters Squared

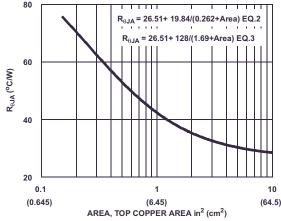


Figure 21. Thermal Resistance vs Mounting
Pad Area

#### **PSPICE Electrical Model** .SUBCKT FDP14AN06LA0 2 1 3; rev January 2004 Ca 12 8 1.8e-9 Cb 15 14 1.8e-9 LDRAIN Cin 6 8 3e-9 **DPLCAP** DRAIN 10 Dbody 7 5 DbodyMOD **RLDRAIN** ₹RSLC1 Dbreak 5 11 DbreakMOD **DBREAK** Dplcap 10 5 DplcapMOD RSI C2 **ESLC** Ebreak 11 7 17 18 64.8 50 Eds 14 8 5 8 1 Egs 13 8 6 8 1 DBODY **≷**RDRAIN ESG $\left(\frac{6}{8}\right)$ **EBREAK** Esg 6 10 6 8 1 **EVTHRES** Evthres 6 21 19 8 1 MWEAK Evtemp 20 6 18 22 1 LGATE EVTEME **RGATE ★**MMED 18 22 It 8 17 1 J<sub>9</sub> 20 **←**MSTR RLGATE Lgate 1 9 7.4e-9 LSOURCE CIN SOURCE Ldrain 2 5 1.00e-9 Lsource 3 7 3e-9 RSOURCE RLSOURCE RLgate 1 9 74 RBREAK RLdrain 2 5 10 <u>13</u> 8 14 13 17 18 RLsource 3 7 30 **≸**RVTEMP S1B o SZB Mmed 16 6 8 8 MmedMOD CB 19 CA: Mstro 16 6 8 8 MstroMOD IT (♠ Mweak 16 21 8 8 MweakMOD **VBAT** EGS **EDS** Rbreak 17 18 RbreakMOD 1 Rdrain 50 16 RdrainMOD 4.1e-3 **RVTHRES** Rgate 9 20 2 7 RSLC1 5 51 RSLCMOD 1e-6 RSLC2 5 50 1e3 Rsource 8 7 RsourceMOD 4e-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\*200),3))} .MODEL DbodyMOD D (IS=1.7e-11 RS=2.8e-3 N=1.05 TRS1=1.5e-3 TRS2=1e-6 + CJO=1e-9 TT=1.9e-8 M=0.58 IKF=15.00 XTI=3) .model dbreakmod d (RS=1e-1 TRS1=1.12e-3 TRS2=1.25e-6) .MODEL DplcapMOD D (CJO=8e-10 IS=1e-30 N=10 M=0.57) .MODEL MmedMOD NMOS (VTO=1.96 KP=8 IS=1e-30 N=10 TOX=1 L=1u W=1u RG=2.7) .MODEL MstroMOD NMOS (VTO=2.42 KP=105 IS=1e-30 N=10 TOX=1 L=1u W=1u) .MODEL MweakMOD NMOS (VTO=1.6 KP=0.04 IS=1e-30 N=10 TOX=1 L=1u W=1u RG=27 RS=0.1) .MODEL RbreakMOD RES (TC1=9.2e-4 TC2=-3.55e-7) .MODEL RdrainMOD RES (TC1=1e-2 TC2=3e-5) .MODEL RSLCMOD RES (TC1=2.8e-3 TC2=1e-7) .MODEL RsourceMOD RES (TC1=4.0e-3 TC2=1e-6) .MODEL RvthresMOD RES (TC1=-2.7e-3 TC2=-9.5e-6)

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.

.MODEL RvtempMOD RES (TC1=-2.3e-3 TC2=1.5e-6)

**FNDS** 

.MODEL S1AMOD VSWITCH (RON=1e-5 ROFF=0.1 VON=-4 VOFF=-3)
.MODEL S1BMOD VSWITCH (RON=1e-5 ROFF=0.1 VON=-3 VOFF=-4)
.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)

#### SABER Electrical Model REV January 2004 template FDP14AN06LA0 n2,n1,n3 electrical n2,n1,n3 var i iscl dp..model dbodymod = (isl=1.7e-11,rs=2.8e-3,nl=1.05,trs1=1.5e-3,trs2=1e-6,cjo=1e-9,tt=1.9e-8,m=0.58,ikf=15.00,xti=3) dp..model dbreakmod = (rs=1e-1,trs1=1.12e-3,trs2=1.25e-6) dp..model dplcapmod = (cjo=8e-10,isl=10e-30,nl=10,m=0.57) m..model mmedmod = (type=\_n,vto=1.96,kp=8,is=1e-30, tox=1) m..model mstrongmod = (type=\_n,vto=2.42,kp=105,is=1e-30, tox=1) m..model mweakmod = (type=\_n,vto=1.6,kp=0.04,is=1e-30, tox=1,rs=0.1) LDRAIN sw\_vcsp..model s1amod = (ron=1e-5,roff=0.1,von=-4,voff=-3) DPLCAP DRAIN sw vcsp..model s1bmod = (ron=1e-5,roff=0.1,von=-3,voff=-4) 10 sw\_vcsp..model s2amod = (ron=1e-5,roff=0.1,von=-2.5,voff=-0.5) RI DRAIN sw\_vcsp..model s2bmod = (ron=1e-5,roff=0.1,von=-0.5,voff=-2.5) RSLC1 c.ca n12 n8 = 1.8e-9 RSLC2 ₹ c.cb n15 n14 = 1.8e-9ISCL c.cin n6 n8 = 3e-9 DBREAK dp.dbody n7 n5 = model=dbodymod **≷**RDRAIN dp.dbreak n5 n11 = model=dbreakmod <u> 6</u> 8 ESG ( ■ DBODY dp.dplcap n10 n5 = model=dplcapmod **EVTHRES** 19 8 MWEAK **LGATE** EVTEM spe.ebreak n11 n7 n17 n18 = 64.8 GATE 18 22 **EBREAK** spe.eds n14 n8 n5 n8 = 1 20 spe.egs n13 n8 n6 n8 = 1 MSTRO RLGATE spe.esg n6 n10 n6 n8 = 1 **LSOURCE** spe.evthres n6 n21 n19 n8 = 1 CIN SOURCE spe.evtemp n20 n6 n18 n22 = 1 RSOURCE RLSOURCE i.it n8 n17 = 1 RBREAK 17 18 I.lgate n1 n9 = 7.4e-9I.ldrain n2 n5 = 1.00e-9**≷** RVTEMP I.Isource n3 n7 = 3e-9СВ 19 CA ΙT res.rlgate n1 n9 = 74 VBAT res.rldrain n2 n5 = 10 res.rlsource n3 n7 = 30 RVTHRES m.mmed n16 n6 n8 n8 = model=mmedmod, l=1u, w=1u m.mstrong n16 n6 n8 n8 = model=mstrongmod, l=1u, w=1u m.mweak n16 n21 n8 n8 = model=mweakmod, I=1u, w=1u res.rbreak n17 n18 = 1, tc1=9.2e-4,tc2=-3.5e-7 res.rdrain n50 n16 = 4.1e-3, tc1=1e-2,tc2=3e-5 res.rgate n9 n20 = 2.7 res.rslc1 n5 n51 = 1e-6, tc1=2.8e-3,tc2=1e-7 res.rslc2 n5 n50 = 1e3 res.rsource n8 n7 = 4e-3, tc1=4.0e-3,tc2=1e-6 res.rvthres n22 n8 = 1, tc1=-2.7e-3,tc2=-9.5e-6 res.rvtemp n18 n19 = 1, tc1=-2.3e-3,tc2=1.5e-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 sw\_vcsp.s2b n13 n15 n14 n13 = model=s2bmod v.vbat n22 n19 = dc=1 equations { i (n51->n50) +=iscl iscl: v(n51,n50) = ((v(n5,n51)/(1e-9+abs(v(n5,n51))))\*((abs(v(n5,n51)\*1e6/200))\*\*3))

#### SPICE Thermal Model

REV January 2004 FDP14AN06LA0T

CTHERM1 TH 6 2.5e-3 CTHERM2 6 5 3e-3 CTHERM3 5 4 4e-3 CTHERM4 4 3 7e-3 CTHERM5 3 2 8.2e-3 CTHERM6 2 TL 5e-2

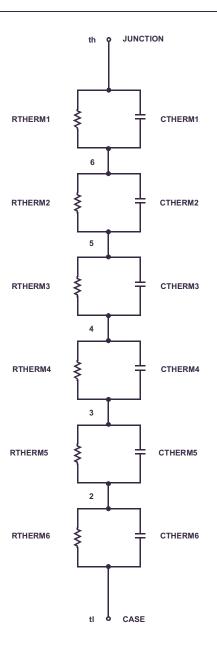
RTHERM1 TH 6 4.2e-2 RTHERM2 6 5 8.4e-2 RTHERM3 5 4 1.04e-1 RTHERM4 4 3 1.14e-1 RTHERM5 3 2 2.74e-1 RTHERM6 2 TL 3.44e-1

#### SABER Thermal Model

SABER thermal model FDP14AN06LA0T template thermal\_model th tl thermal\_c th, tl

ctherm.ctherm1 th 6 = 2.5e-3 ctherm.ctherm2 6 5 = 3e-3 ctherm.ctherm3 5 4 = 4e-3 ctherm.ctherm4 4 3 = 7e-3 ctherm.ctherm5 3 2 = 8.2e-3 ctherm.ctherm6 2 tl = 5e-2

rtherm.rtherm1 th 6 =4.2e-2 rtherm.rtherm2 6 5 =8.4e-2 rtherm.rtherm3 5 4 =1.04e-1 rtherm.rtherm4 4 3 =1.14e-1 rtherm.rtherm5 3 2 =2.74e-1 rtherm.rtherm6 2 tl =3.44e-1 }



ON Semiconductor and III) are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at <a href="www.onsemi.com/site/pdf/Patent-Marking.pdf">www.onsemi.com/site/pdf/Patent-Marking.pdf</a>. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages.

Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

#### **PUBLICATION ORDERING INFORMATION**

#### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor 19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free USA/Canada Europe, Middle East and Africa Technical Support:

Phone: 421 33 790 2910 Japan Customer Focus Center Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative

# **X-ON Electronics**

Largest Supplier of Electrical and Electronic Components

Click to view similar products for MOSFET category:

Click to view products by ON Semiconductor manufacturer:

Other Similar products are found below:

614233C 648584F IRFD120 JANTX2N5237 FCA20N60\_F109 FDZ595PZ 2SK2545(Q,T) 405094E 423220D TPCC8103,L1Q(CM MIC4420CM-TR VN1206L SBVS138LT1G 614234A 715780A NTNS3166NZT5G SSM6J414TU,LF(T 751625C BUK954R8-60E NTE6400 SQJ402EP-T1-GE3 2SK2614(TE16L1,Q) 2N7002KW-FAI DMN1017UCP3-7 EFC2J004NUZTDG ECH8691-TL-W FCAB21350L1 P85W28HP2F-7071 DMN1053UCP4-7 NTE221 NTE222 NTE2384 NTE2903 NTE2941 NTE2945 NTE2946 NTE2960 NTE2967 NTE2969 NTE2976 NTE455 NTE6400A NTE2910 NTE2916 NTE2956 NTE2911 DMN2080UCB4-7 TK10A80W,S4X(S SSM6P69NU,LF DMP22D4UFO-7B