

July 2013

FDMS3008SDC

N-Channel Dual CoolTM PowerTrench[®] SyncFETTM 30 V, 65 A, 2.6 m Ω

Features

- Dual CoolTM Top Side Cooling PQFN package
- Max $r_{DS(on)} = 2.6 \text{ m}\Omega$ at $V_{GS} = 10 \text{ V}$, $I_D = 28 \text{ A}$
- Max $r_{DS(on)} = 3.3 \text{ m}\Omega$ at $V_{GS} = 4.5 \text{ V}$, $I_D = 22 \text{ A}$
- High performance technology for extremely low r_{DS(on)}
- SyncFET Schottky Body Diode
- RoHS Compliant

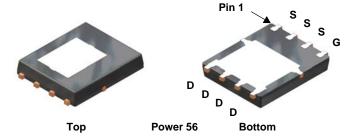


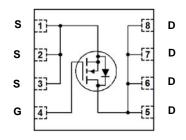
General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process. Advancements in both silicon and Dual CoolTM package technologies have been combined to offer the lowest r_{DS(on)} while maintaining excellent switching performance by extremely low Junction-to-Ambient thermal resistance. This device has the added benefit of an efficient monolithic Schottky body diode.

Applications

- Synchronous Rectifier for DC/DC Converters
- Telecom Secondary Side Rectification
- High End Server/Workstation Vcore Low Side





MOSFET Maximum Ratings $T_A = 25$ °C unless otherwise noted

| Symbol | Parameter | Parameter | | | |
|-----------------------------------|---|------------------------|-----------|-------------|------|
| V_{DS} | Drain to Source Voltage | | | 30 | V |
| V_{GS} | Gate to Source Voltage | | (Note 4) | ±20 | V |
| | Drain Current -Continuous (Package limited) | T _C = 25 °C | | 65 | |
| | -Continuous (Silicon limited) | T _C = 25 °C | | 140 | _ |
| I _D | -Continuous | T _A = 25 °C | (Note 1a) | 29 | A |
| | -Pulsed | | | 200 | |
| E _{AS} | Single Pulse Avalanche Energy | | (Note 3) | 112 | mJ |
| dv/dt | Peak Diode Recovery dv/dt | | (Note 5) | 2.3 | V/ns |
| Ъ | Power Dissipation | T _C = 25 °C | | 78 | W |
| P_{D} | Power Dissipation | T _A = 25 °C | (Note 1a) | 3.3 | VV |
| T _J , T _{STG} | Operating and Storage Junction Temperature Ra | ange | | -55 to +150 | °C |

Thermal Characteristics

| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | (Top Source) | 3.5 | |
|-----------------|---|----------------|-----|------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | (Bottom Drain) | 1.6 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1a) | 38 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1b) | 81 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1i) | 16 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1j) | 23 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1k) | 11 | |

Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|----------------|-------------|----------------------------------|-----------|------------|------------|
| 3008S | FDMS3008SDC | Dual Cool TM Power 56 | 13" | 12 mm | 3000 units |

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

| Parameter | Test Conditions | Min | Тур | Max | Units |
|--|---|---|--|--|-----------------------------------|
| acteristics | | | | | |
| Drain to Source Breakdown Voltage | $I_D = 1$ mA, $V_{GS} = 0$ V | 30 | | | V |
| Breakdown Voltage Temperature Coefficient | I _D = 10 mA, referenced to 25°C | | 13 | | mV/°C |
| Zero Gate Voltage Drain Current | V _{DS} = 24 V, V _{GS} = 0 V | | | 500 | μΑ |
| Gate to Source Leakage Current, Forward | V _{GS} = 20 V, V _{DS} = 0 V | | | 100 | nA |
| | Drain to Source Breakdown Voltage Breakdown Voltage Temperature Coefficient Zero Gate Voltage Drain Current | acteristicsDrain to Source Breakdown Voltage $I_D = 1 \text{ mA}, V_{GS} = 0 \text{ V}$ Breakdown Voltage Temperature Coefficient $I_D = 10 \text{ mA}, \text{ referenced to } 25^{\circ}\text{C}$ Zero Gate Voltage Drain Current $V_{DS} = 24 \text{ V}, V_{GS} = 0 \text{ V}$ | acteristics Drain to Source Breakdown Voltage $I_D = 1 \text{ mA}, V_{GS} = 0 \text{ V}$ 30 Breakdown Voltage Temperature Coefficient $I_D = 10 \text{ mA}, \text{ referenced to } 25^{\circ}\text{C}$ Zero Gate Voltage Drain Current $V_{DS} = 24 \text{ V}, V_{GS} = 0 \text{ V}$ | Drain to Source Breakdown Voltage Breakdown Voltage Temperature Coefficient Zero Gate Voltage Drain Current ID = 1 mA, VGS = 0 V ID = 10 mA, referenced to 25°C 13 VDS = 24 V, VGS = 0 V | Drain to Source Breakdown Voltage |

On Characteristics

| V _{GS(th)} | Gate to Source Threshold Voltage | $V_{GS} = V_{DS}$, $I_D = 1 \text{ mA}$ | 1.2 | 1.9 | 3.0 | V |
|--|---|--|-----|-----|-----|-------|
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | I _D = 10 mA, referenced to 25°C | | -5 | | mV/°C |
| | | V _{GS} = 10 V, I _D = 28 A | | 1.8 | 2.6 | |
| r _{DS(on)} | r _{DS(on)} Static Drain to Source On Resistance | $V_{GS} = 4.5 \text{ V}, I_D = 22 \text{ A}$ | | 2.7 | 3.3 | mΩ |
| | | $V_{GS} = 10 \text{ V}, I_D = 28 \text{ A}, T_J = 125^{\circ}\text{C}$ | | 2.4 | 3.6 | |
| 9 _{FS} | Forward Transconductance | V _{DS} = 5 V, I _D = 28 A | | 144 | | S |

Dynamic Characteristics

| C _{iss} | Input Capacitance | V 45 V V 0 V | 3400 | 4520 | pF |
|------------------|------------------------------|---|------|------|----|
| C _{oss} | Output Capacitance | $V_{DS} = 15 \text{ V, } V_{GS} = 0 \text{ V,}$ f = 1MHz | 1115 | 1485 | pF |
| C _{rss} | Reverse Transfer Capacitance | 1 - 1101112 | 80 | 120 | pF |
| R_g | Gate Resistance | | 0.7 | | Ω |

Switching Characteristics

| t _{d(on)} | Turn-On Delay Time | | 15 | 27 | ns |
|---------------------|-------------------------------|--|-----|----|----|
| t _r | Rise Time | V _{DD} = 15 V, I _D = 28 A, | 4.7 | 10 | ns |
| t _{d(off)} | Turn-Off Delay Time | $V_{GS} = 10 \text{ V}, R_{GEN} = 6 \Omega$ | 33 | 53 | ns |
| t _f | Fall Time | | 3 | 10 | ns |
| Q_g | Total Gate Charge | V _{GS} = 0 V to 10 V | 46 | 64 | nC |
| Qg | Total Gate Charge | $V_{GS} = 0 \text{ V to } 4.5 \text{ V}$ $V_{DD} = 15 \text{ V}$ | 21 | 29 | nC |
| Q _{gs} | Gate to Source Charge | I _D = 28 A | 9.6 | | nC |
| Q_{gd} | Gate to Drain "Miller" Charge | | 4.3 | | nC |

Drain-Source Diode Characteristics

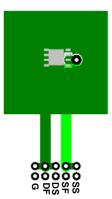
| | $V_{GS} = 0 \text{ V, } I_S = 2 \text{ A}$ (Note 2) | 0.4 | 0.8 | V | |
|-----------------|---|---|-----|-----|-----|
| V _{SD} | Source-Drain Diode Forward Voltage | $V_{GS} = 0 V, I_S = 28 A$ (Note 2) | 0.8 | 1.2 | · • |
| t _{rr} | Reverse Recovery Time | I _F = 28 A, di/dt = 300 A/μs | 32 | 51 | ns |
| Q _{rr} | Reverse Recovery Charge | I _F = 26 A, α/αι = 300 A/μs | 39 | 62 | nC |

Thermal Characteristics

| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | (Top Source) | 3.5 | |
|-----------------|---|----------------|-----|-------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | (Bottom Drain) | 1.6 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1a) | 38 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1b) | 81 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1c) | 27 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1d) | 34 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1e) | 16 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1f) | 19 | 10/00 |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1g) | 26 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1h) | 61 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1i) | 16 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1j) | 23 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1k) | 11 | |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | (Note 1I) | 13 | |

NOTES

1. R_{0,1A} is determined with the device mounted on a FR-4 board using a specified pad of 2 oz copper as shown below. R_{0,1C} is guaranteed by design while R_{0,1C} is determined by the user's board design.



a. 38 °C/W when mounted on a 1 in² pad of 2 oz copper



b. 81 °C/W when mounted on a minimum pad of 2 oz copper

- c. Still air, 20.9x10.4x12.7mm Aluminum Heat Sink, 1 in 2 pad of 2 oz copper
- d. Still air, 20.9x10.4x12.7mm Aluminum Heat Sink, minimum pad of 2 oz copper
- e. Still air, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in 2 pad of 2 oz copper
- f. Still air, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper
- g. 200FPM Airflow, No Heat Sink,1 in² pad of 2 oz copper
- h. 200FPM Airflow, No Heat Sink, minimum pad of 2 oz copper
- i. 200FPM Airflow, 20.9x10.4x12.7mm Aluminum Heat Sink, 1 in² pad of 2 oz copper
- j. 200FPM Airflow, 20.9x10.4x12.7mm Aluminum Heat Sink, minimum pad of 2 oz copper
- k. 200FPM Airflow, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in² pad of 2 oz copper
- $I.\ 200 FPM\ Airflow,\ 45.2x41.4x11.7mm\ Aavid\ Thermalloy\ Part\ \#\ 10-L41B-11\ Heat\ Sink,\ minimum\ pad\ of\ 2\ oz\ copper$
- 2. Pulse Test: Pulse Width < 300 $\mu\text{s},$ Duty cycle < 2.0%.
- 3. E_{AS} of 112 mJ is based on starting T_J = 25 °C, L = 1 mH, I_{AS} = 15 A, V_{DD} = 27 V, V_{GS} = 10 V. 100% test at L = 0.1 mH, I_{AS} = 33.4 A.

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

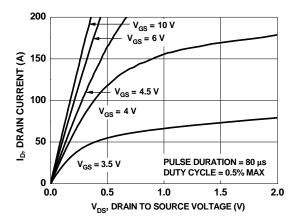


Figure 1. On Region Characteristics

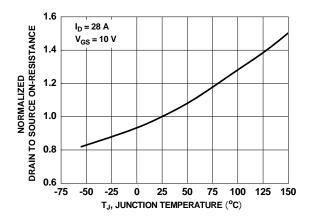


Figure 3. Normalized On Resistance vs Junction Temperature

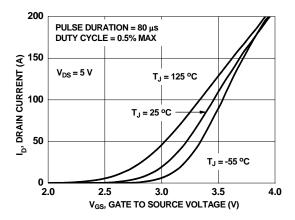


Figure 5. Transfer Characteristics

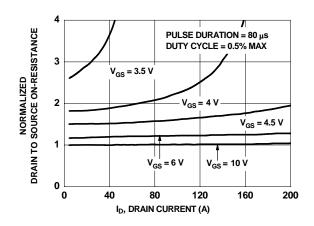


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

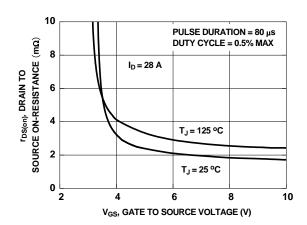


Figure 4. On-Resistance vs Gate to Source Voltage

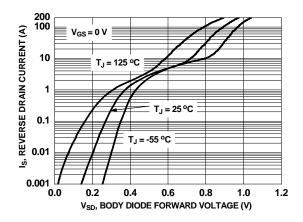


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

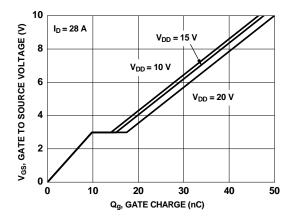


Figure 7. Gate Charge Characteristics

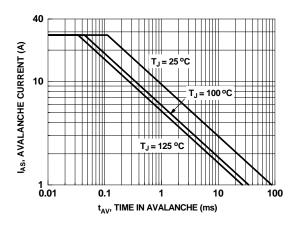


Figure 9. Unclamped Inductive Switching Capability

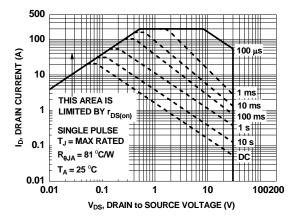


Figure 11. Forward Bias Safe Operating Area

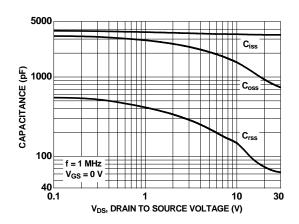


Figure 8. Capacitance vs Drain to Source Voltage

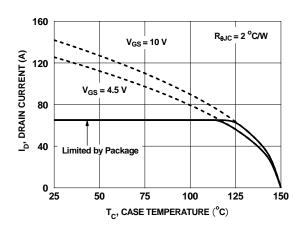


Figure 10. Maximum Continuous Drain Current vs Case Temperature

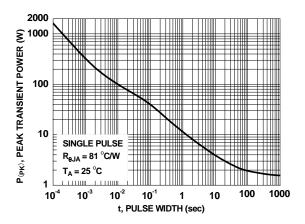


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25°C unless otherwise noted

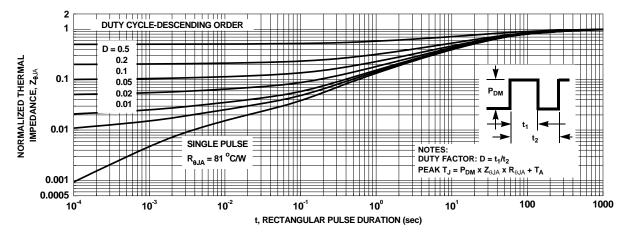


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

Typical Characteristics (continued)

SyncFET Schottky body diode Characteristics

Fairchild's SyncFET process embeds a Schottky diode in parallel with PowerTrench MOSFET. This diode exhibits similar characteristics to a discrete external Schottky diode in parallel with a MOSFET. Figure 14 shows the reverse recovery characteristic of the FDMS3008SDC.

Schottky barrier diodes exhibit significant leakage at high temperature and high reverse voltage. This will increase the power in the device.

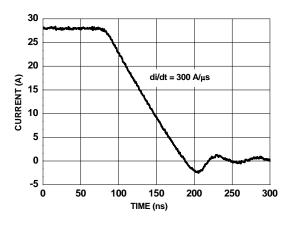


Figure 14. FDMS3008SDC SyncFET body diode reverse recovery characteristic

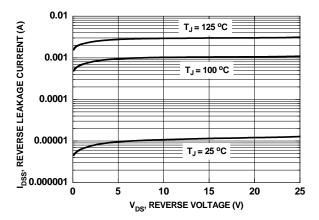


Figure 15. SyncFET body diode reverses leakage versus drain-source voltage

Dimensional Outline and Pad Layout 5.10 4.90 A 5.10 (2.60)3.91 PKG (0.90)1.27 0.77 В KEEP-OUT 4.52 3.75 PKG Q **AREA** 6.25 5.90 (3.30)6.61 1.27 (0.82)PIN #1 IDENT MAY **TOP VIEW** SEE 0.61 APPEAR AS OPTIONAL 1.27 DETAIL A 3.81 LAND PATTERN RECOMMENDATION FRONT VIEW OPTIONAL DRAFT ANGLE 3.81 MAY APPEAR ON FOUR 1.27 SIDES OF THE PACKAGE 0.50 0.40 (8X) (0.34)0.71 0.44 → 0.10M C A B CHAMFER 5.85 CORNER 5.65 (3.44)AS PIN #1 **IDENT MAY** 4.01±0.30 APPEAR AS **OPTIONAL** SIDE VIEW 3.86 3.61 0.65 NOTES: UNLESS OTHERWISE SPECIFIED A) PACKAGE STANDARD REFERENCE: 0.45 JEDEC MO-240, ISSUE A, VAR. AA, **BOTTOM VIEW** DATED OCTOBER 2002 B) ALL DIMENSIONS ARE IN MILLIMETERS. C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH, MOLD FLASH OR -0.1 MAX // 0.10 C BURRS DOES NOT EXCEED 0.10MM. D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994 E) IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA. ○ 0.08 C 0.30_ 0.20 0.05_ С 1.05 SEATING 0.95 DETAIL A SCALE: 2:1 PLANE





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