

# FDMS86300DC

## POWERTRENCH<sup>®</sup> MOSFET, N-Channel, DUAL COOL<sup>®</sup> 56

80 V, 110 A, 3.1 mΩ

### General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced POWERTRENCH<sup>®</sup> process that incorporates Shielded Gate technology. Advancements in both silicon and DUAL COOL<sup>®</sup> 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.

### Features

- DUAL COOL Top Side Cooling PQFN package
- Max  $r_{DS(on)}$  = 3.1 mΩ at  $V_{GS} = 10\text{ V}$ ,  $I_D = 24\text{ A}$
- Max  $r_{DS(on)}$  = 4.0 mΩ at  $V_{GS} = 8\text{ V}$ ,  $I_D = 21\text{ A}$
- High performance technology for extremely low  $r_{DS(on)}$
- 100% UIL Tested
- RoHS Compliant

### Typical Applications

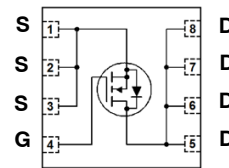
- Synchronous Rectifier for DC/DC Converters
- Telecom Secondary Side Rectification
- High End Server/Workstation Vcore Low Side



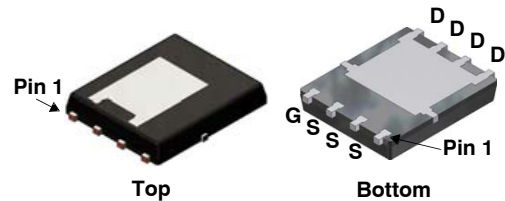
ON Semiconductor<sup>®</sup>

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### ELECTRICAL CONNECTION

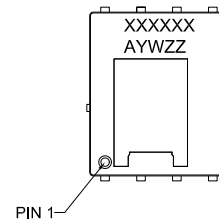


N-Channel MOSFET



DFN8 5.1x6.15  
(Dual Cool 56)  
CASE 506EG

### MARKING DIAGRAM



XXXXXX	= Device Code
A	= Assy Location
Y	= Year Code
WW	= Work Week Code
ZZ	= Assy Lot Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

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## PACKAGE MARKING AND ORDERING INFORMATION

Device Marking	Device	Package	Reel Size	Tape Width	Shipping <sup>†</sup>
86300	FDMS86300DC	UDFN8	13"	12 mm	3000 Units/ Tape & Reel

<sup>†</sup>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.

## MOSFET MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	80	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current – Continuous $T_C = 25^\circ\text{C}$	110	A
	– Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	24	
	– Pulsed (Note 2)	260	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	240	mJ
$P_D$	Power Dissipation $T_C = 25^\circ\text{C}$	125	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	3.2	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	$-55$ to $+150$	$^\circ\text{C}$

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.

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
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### OFF CHARACTERISTICS

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{ V}$	80			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , referenced to $25^\circ\text{C}$		45		$\text{mV}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 64 \text{ V}, V_{GS} = 0 \text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$			$\pm 100$	nA

### ON CHARACTERISTICS

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	2.5	3.3	4.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , referenced to $25^\circ\text{C}$		-11		$\text{mV}/^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 24 \text{ A}$		2.6	3.1	m $\Omega$
		$V_{GS} = 8 \text{ V}, I_D = 21 \text{ A}$		3.1	4.0	
		$V_{GS} = 10 \text{ V}, I_D = 24 \text{ A}, T_J = 125^\circ\text{C}$		4.1	5.0	
$g_{FS}$	Forward Transconductance	$V_{DD} = 10 \text{ V}, I_D = 24 \text{ A}$		79		S

### DYNAMIC CHARACTERISTICS

$C_{ISS}$	Input Capacitance	$V_{DS} = 40 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$		5265	7005	pF
$C_{OSS}$	Output Capacitance			929	1235	pF
$C_{RSS}$	Reverse Transfer Capacitance			21	50	pF
$R_G$	Gate Resistance			0.1	1.2	2.6

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## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
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### SWITCHING CHARACTERISTICS

$t_{d(ON)}$	Turn – On Delay Time	$V_{DD} = 40\text{ V}, I_D = 24\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$		29	47	ns
$t_r$	Rise Time			25	44	ns
$t_{D(OFF)}$	Turn – Off Delay Time			35	57	ns
$t_f$	Fall Time			9	18	ns
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\text{ V to }10\text{ V}$ $V_{GS} = 0\text{ V to }8\text{ V}$		72	101	nC
	Total Gate Charge			59	84	nC
$Q_{gs}$	Gate to Source Gate Charge	$V_{DD} = 40\text{ V},$ $I_D = 24\text{ A}$		26		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			14		nC

### DRAIN-SOURCE DIODE CHARACTERISTICS

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 2.7\text{ A}$ (Note 2)		0.72	1.2	V
		$V_{GS} = 0\text{ V}, I_S = 24\text{ A}$ (Note 2)		0.80	1.3	
$I_S$	Source to Drain Diode Forward Voltage	$T_C = 25^\circ\text{C}$			75	V
					150	
$t_{rr}$	Reverse Recovery Time	$I_F = 24\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		56	88	ns
$Q_{rr}$	Reverse Recovery Charge			42	67	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.

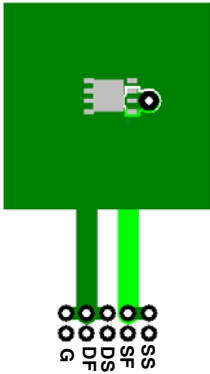
### THERMAL CHARACTERISTICS

Symbol	Parameter	Ratings	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case (Top Source)	2.3	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction to Case (Bottom Drain)	1.0	
$R_{\theta JA}$	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	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1f)	19	
$R_{\theta JA}$	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 1l)	13	

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**NOTES:**

1.  $R_{\theta JA}$  is determined with the device mounted on a FR-4 board using a specified pad of 2 oz copper as shown below.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a) 38°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



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

- c) Still air, 20.9×10.4×12.7 mm Aluminum Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- d) Still air, 20.9×10.4×12.7 mm Aluminum Heat Sink, minimum pad of 2 oz copper
- e) Still air, 45.2×41.4×11.7 mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- f) Still air, 45.2×41.4×11.7 mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper
- g) .200FPM Airflow, No Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- h) .200FPM Airflow, No Heat Sink, minimum pad of 2 oz copper
- i) .200FPM Airflow, 20.9×10.4×12.7 mm Aluminum Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- j) .200FPM Airflow, 20.9×10.4×12.7 mm Aluminum Heat Sink, minimum pad of 2 oz copper
- k) .200FPM Airflow, 45.2×41.4×11.7 mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- l) .200FPM Airflow, 45.2×41.4×11.7 mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper

2. Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.
3. Starting  $T_J = 25^\circ\text{C}$ ; N-ch:  $L = 0.3\text{ mH}$ ,  $I_{AS} = 40\text{ A}$ ,  $V_{DD} = 72\text{ V}$ ,  $V_{GS} = 10\text{ V}$ .

## TYPICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

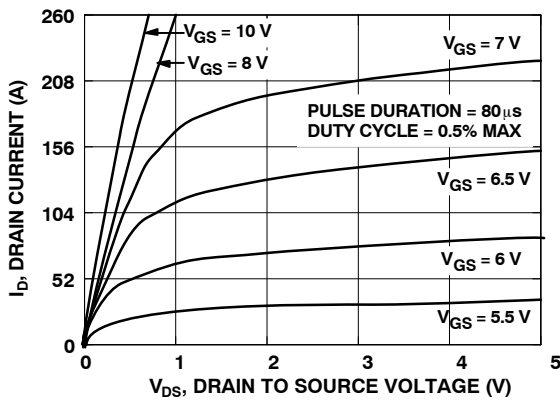


Figure 1. On Region Characteristics

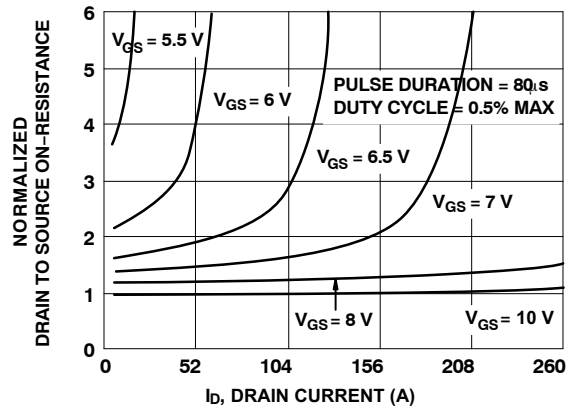


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

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## TYPICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

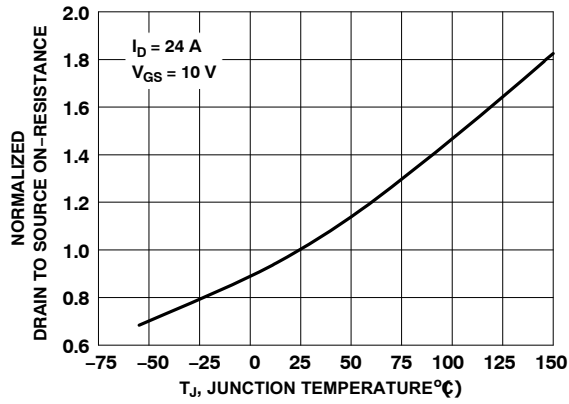


Figure 3. Normalized On Resistance vs. Junction Temperature

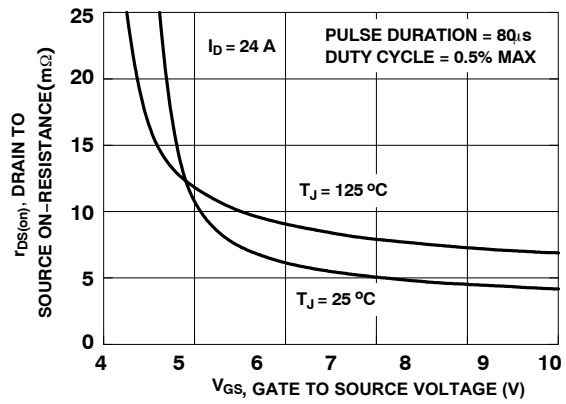


Figure 4. On-Resistance vs. Gate to Source Voltage

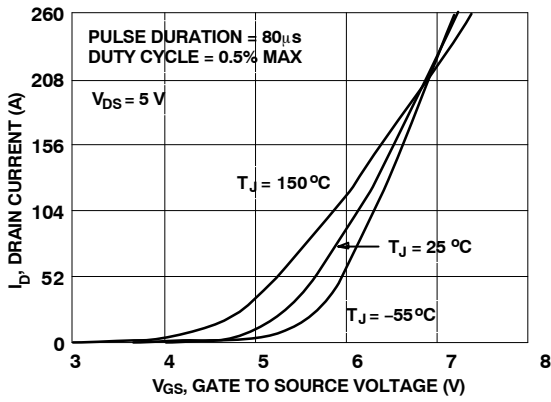


Figure 5. Transfer Characteristics

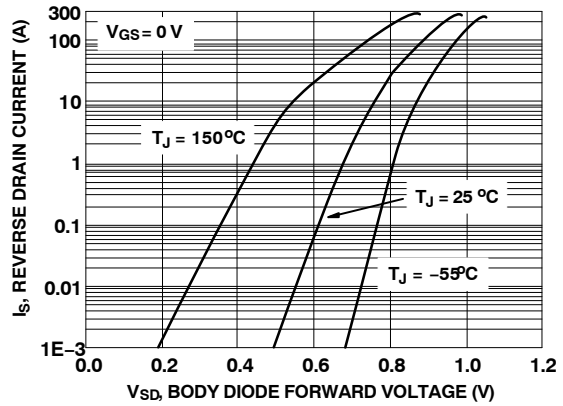


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

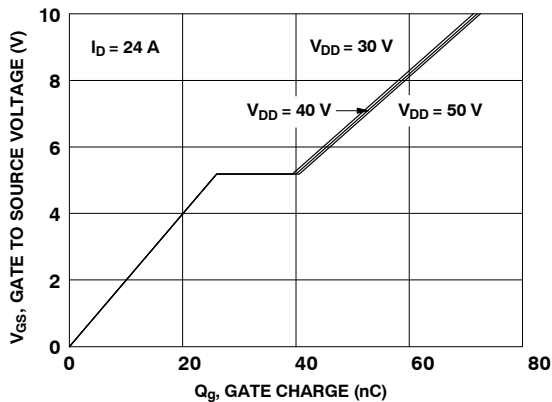


Figure 7. Gate Charge Characteristics

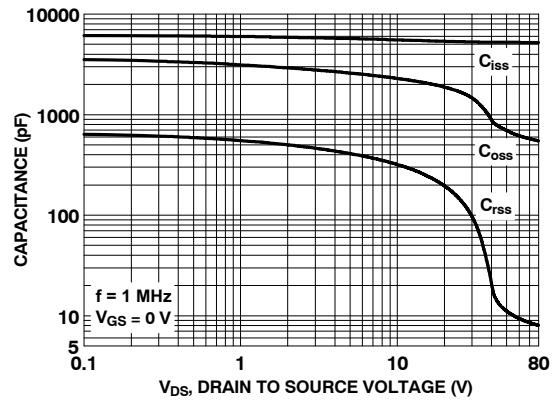


Figure 8. Capacitance vs. Drain to Source Voltage

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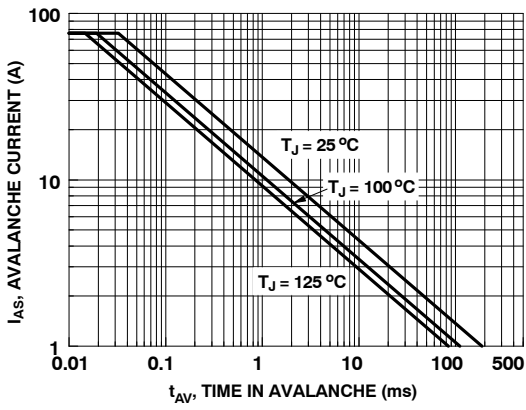


Figure 9. Unclamped Inductive Switching Capability

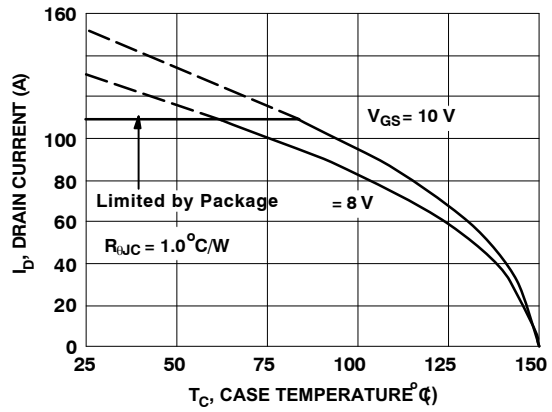


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

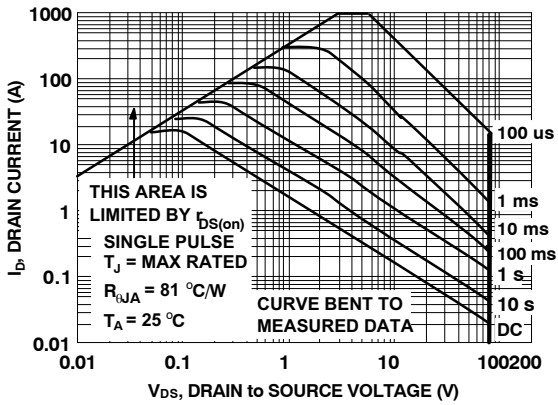


Figure 11. Forward Bias Safe Operating Area

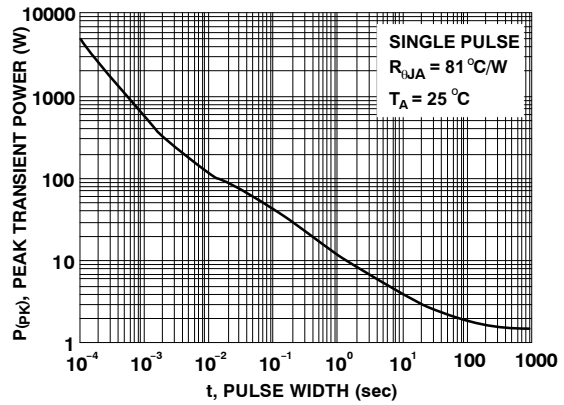


Figure 12. Single Pulse Maximum Power Dissipation

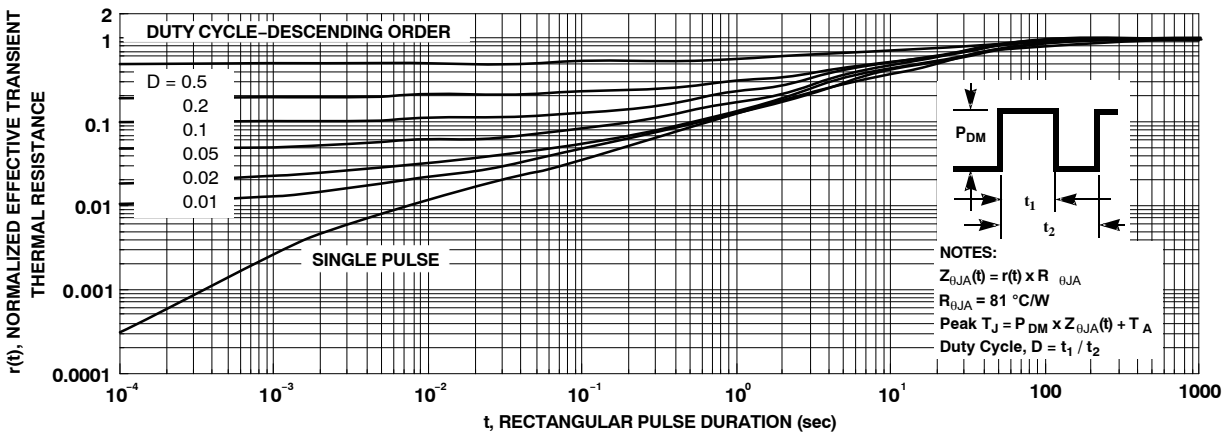


Figure 13. Junction-to-Case Transient Thermal Response Curve

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