FAIRCHILD SEMICONDUCTOR®

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FDD8447L

N-Channel PowerTrench® MOSFET

40V, 54A, 8.5mO

General Description

This N-Channel MOSFET has been produced using Fairchild Semiconductor's proprietary PowerTrench technology to deliver low $r_{DS(on)}$ and optimized Bvdss capability to offer superior performance benefit in the applications.

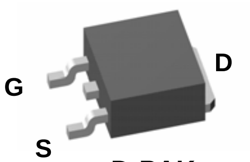
Applications

- Inverter
- Power Supplies

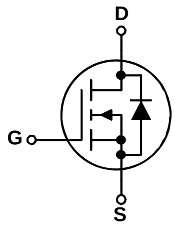
LEAD-FREE IMPLEMENTATION

Features

- Max $r_{DS(on)}$ = 8.5 mΩ at V_{GS} = 10V, I_D = 14A
- Max $r_{DS(on)}$ = 11 mΩ at V_{GS} = 4.5V, I_D = 11A
- Fast Switching
- RoHS compliant



D-PAK
(TO-252)



Absolute Maximum Ratings T_A=25°C unless otherwise noted

Symbol	Parameter			Ratings	Units
V_{DS}	Drain-Source Voltage			40	V
V_{GS}	Gate-Source Voltage			±20	V
I_D	Continuous Drain Current	@T_C=25°C	(Note 3)	54	A
		@T_A=25°C	(Note 1a)	21	
		Pulsed	(Note 1a)	100	
P_D	Power Dissipation	@T_C=25°C	(Note 3)	45	W
		@T_A=25°C	(Note 1a)	3.8	
		@T_A=25°C	(Note 1b)	1.6	
T_J, T_{STG}	Operating and Storage Junction Temperature Range			–55 to +150	°C

Thermal Characteristics

Symbol	Parameter	Note	Ratings	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	(Note 1)	2.8	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	40	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1b)	96	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape width	Quantity
FDD8447L	FDD8447L	D-PAK (TO-252)	13''	12mm	2500 units

Electrical Characteristics

T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Drain-Source Avalanche Ratings						
E_{AS}	Drain-Source Avalanche Energy (Single Pulse)	V_{DD} = 40 V, I_D= 16 A, L=1mH		153		mJ
I_{AS}	Drain-Source Avalanche Current				16	A
Off Characteristics (Note 2)						
BV_{DSS}	Drain–Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	40			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C		35		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 32 V, V_{GS} = 0 V			1	μA
I_{GSS}	Gate–Body Leakage	V_{GS} = ±20 V, V_{DS} = 0 V			±100	nA
On Characteristics (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	1	1.9	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C		–5		mV/°C
$r_{DS(on)}$	Static Drain–Source On–Resistance	V_{GS} = 10 V, I_D = 14 A V_{GS} = 4.5 V, I_D = 11 A V_{GS} = 10 V, I_D = 14 A, T_J=125°C		7 8.5 10.4	8.5 11 14	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 5 V, I_D = 14 A		58		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 20 V, V_{GS} = 0 V, f = 1.0 MHz		1970		pF
C_{oss}	Output Capacitance			250		pF
C_{rss}	Reverse Transfer Capacitance			150		pF
R_G	Gate Resistance	f = 1.0 MHz, V_{GS} = 0V		1.27		Ω
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = 20 V, I_D = 1 A, V_{GS} = 10 V, R_{GEN} = 6 Ω		12	21	ns
t_r	Turn–On Rise Time			12	21	ns
$t_{d(off)}$	Turn–Off Delay Time			38	61	ns
t_f	Turn–Off Fall Time			9	18	ns
$Q_{g\ (TOT)}$	Total Gate Charge, V_{GS} = 10V	V_{DS} = 20 V, I_D = 14 A		37	52	nC
$Q_{g\ (TOT)}$	Total Gate Charge, V_{GS} = 5V			20	28	nC
Q_{gs}	Gate–Source Charge			6		nC
Q_{gd}	Gate–Drain Charge			7		nC

Electrical Characteristics

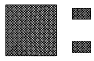
T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Drain–Source Diode Characteristics						
V_{SD}	Drain–Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 14 A (Note 2)		0.8	1.2	V
trr	Diode Reverse Recovery Time	IF = 14 A, diF/dt = 100 A/µs		22		ns
Qrr	Diode Reverse Recovery Charge			11		nC

Notes:

1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.

a) $R_{\theta JA}$ = 40°C/W when mounted on a 1in^2 pad of 2 oz copper



b) $R_{\theta JA}$ = 96°C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < 300µs, Duty Cycle < 2.0%

3. Maximum current is calculated as: $\sqrt{\frac{P_D}{R_{DS(ON)}}}$

where P_D is maximum power dissipation at T_C = 25°C and $R_{DS(on)}$ is at $T_{J(max)}$ and V_{GS} = 10V. Package current limitation is 21A

4. BV(avalanche) rating is guaranteed if device is operated within the UIS SOA boundary of the device.

Typical Characteristics

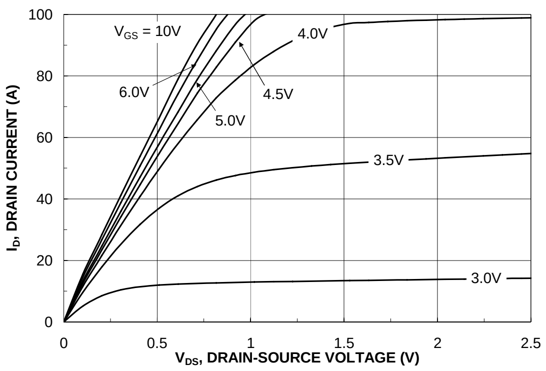


Figure 1. On-Region Characteristics

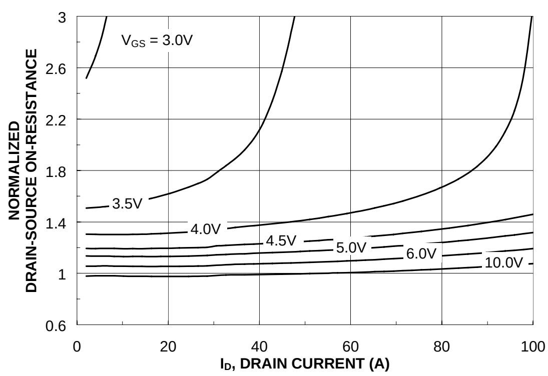


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

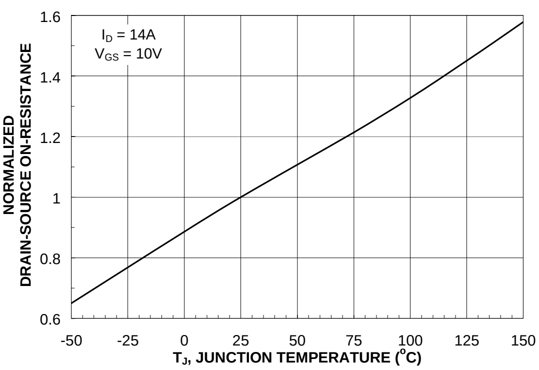


Figure 3. On-Resistance Variation with Temperature

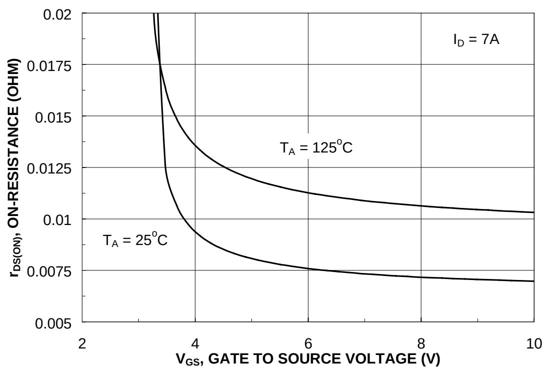


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

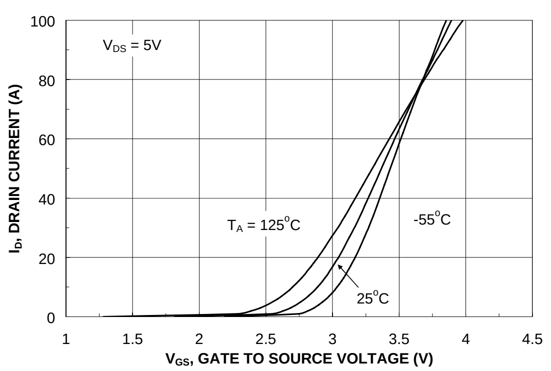


Figure 5. Transfer Characteristics

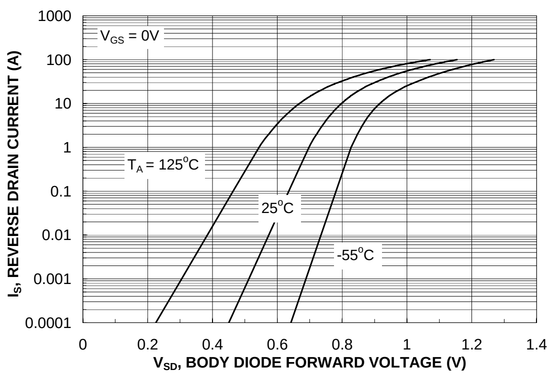


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

Typical Characteristics

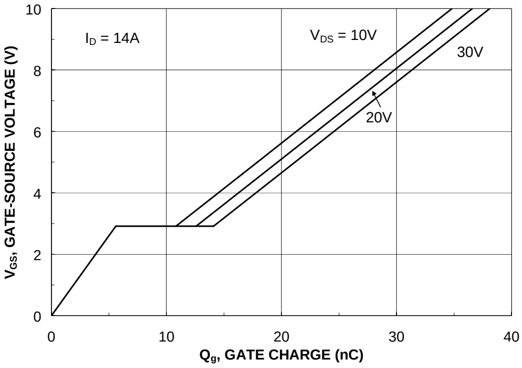


Figure 7. Gate Charge Characteristics

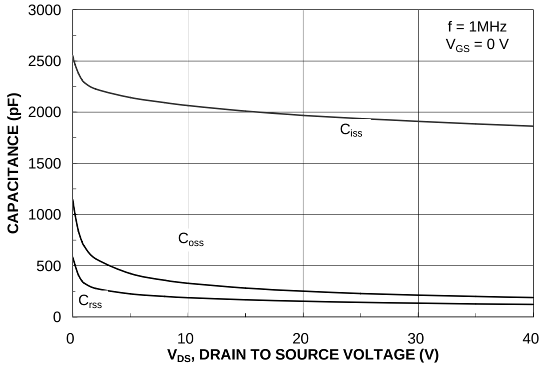


Figure 8. Capacitance Characteristics

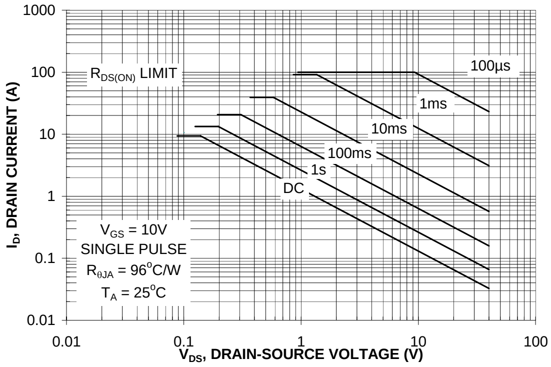


Figure 9. Maximum Safe Operating Area

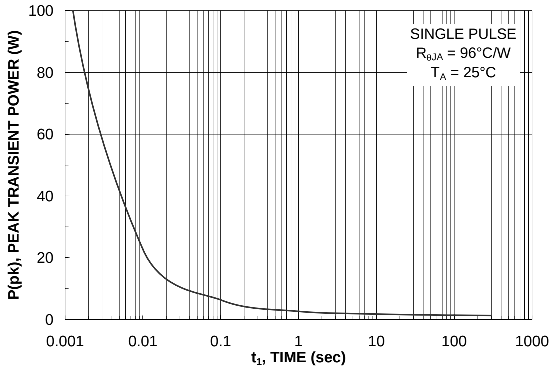


Figure 10. Single Pulse Maximum Power Dissipation

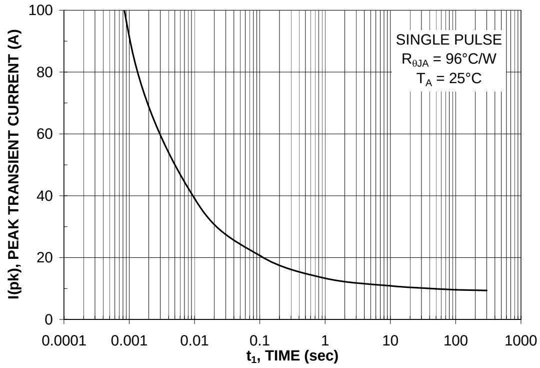


Figure 11. Single Pulse Maximum Peak Current

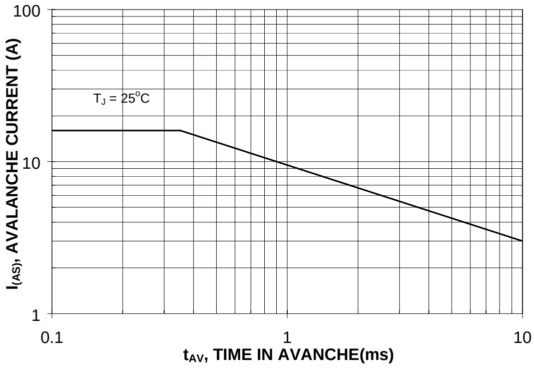


Figure 12. Unclamped Inductive Switching Capability

Typical Characteristics

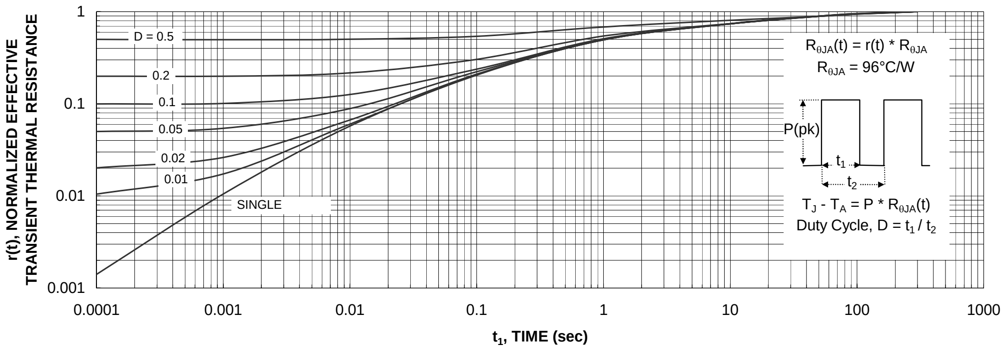


Figure 13. Transient Thermal Response Curve

Thermal characterization performed using the conditions described in Note 1b.
Transient thermal response will change depending on the circuit board design.

Test Circuits and Waveforms

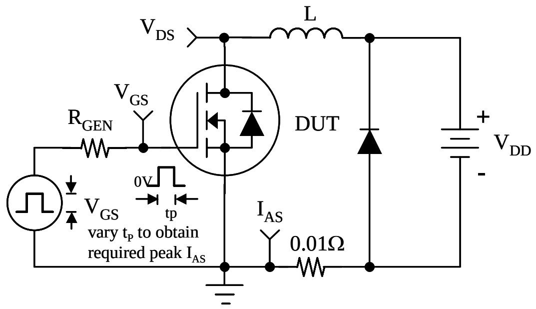


Figure 14. Unclamped Inductive Load Test Circuit

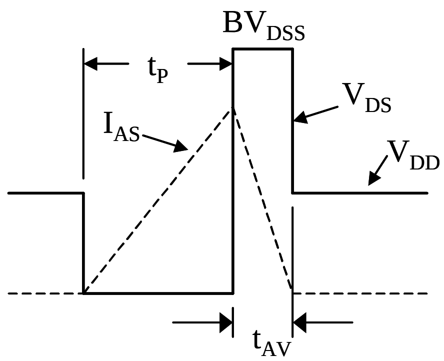


Figure 15. Unclamped Inductive Waveforms

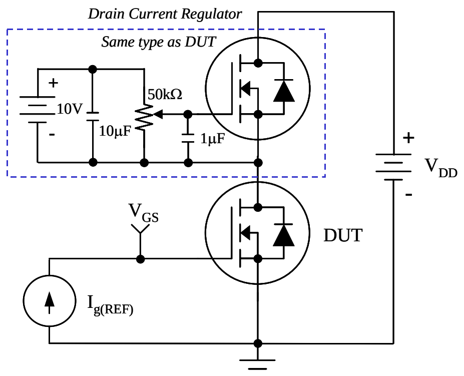


Figure 16. Gate Charge Test Circuit

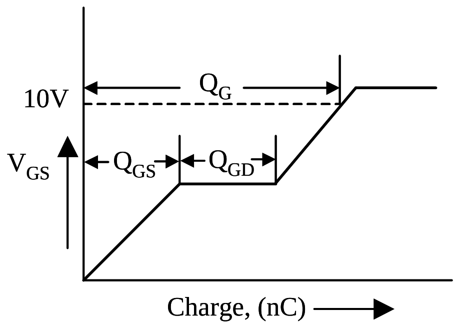


Figure 17. Gate Charge Waveform

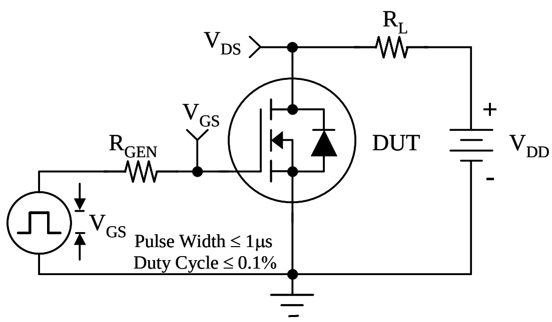


Figure 18. Switching Time Test Circuit

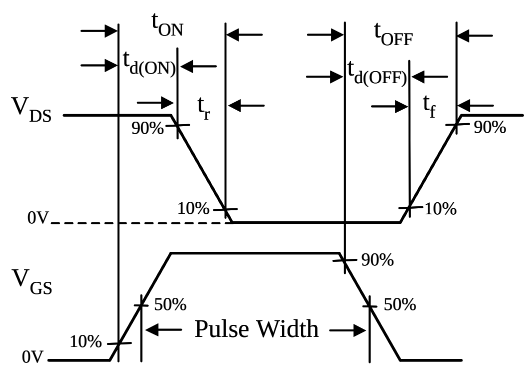


Figure 19. Switching Time Waveforms

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