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April 2016

HUFA76413DK8T_F085

N-Channel Logic Level UltraFET® Power MOSFET

60V, 4.8A, 56mΩ

General Description

These N-Channel power MOSFETs are manufactured using the innovative UltraFET® process. This advanced process technology achieves the lowest possible onresistance per silicon area, resulting in outstanding performance. This device is capable of withstanding high energy

in the avalanche mode and the diode exhibits very low reverse recovery time and stored charge. It was designed for use in applications where power efficiency is important, such as switching regulators, switching converters, motor drivers, relay drivers, low-voltage bus switches, and power management in portable and battery-operated products.

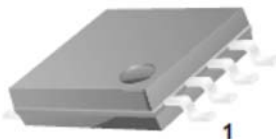


Features

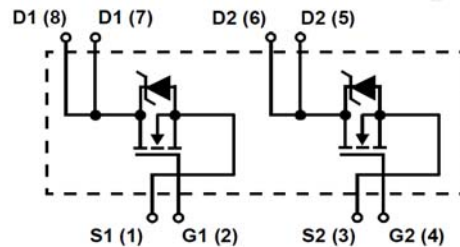
- 150°C Maximum Junction Temperature
- UIS Capability (Single Pulse and Repetitive Pulse)
- Ultra-Low On-Resistance $r_{DS(ON)} = 0.049\Omega$, $V_{GS} = 10V$
- Ultra-Low On-Resistance $r_{DS(ON)} = 0.056\Omega$, $V_{GS} = 5V$
- Qualified to AEC Q101
- RoHS Compliant

Applications

- Motor and Load Control
- Powertrain Management



SO-8



MOSFET Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain to Source Voltage	60	V
V_{GS}	Gate to Source Voltage	± 16	V
I_D	Drain Current -Continuous ($T_C = 25^\circ\text{C}$, $V_{GS} = 10V$)	5.1	A
	-Continuous ($T_C = 25^\circ\text{C}$, $V_{GS} = 5V$)	4.8	
	-Continuous ($T_C = 125^\circ\text{C}$, $V_{GS} = 5V$, $R_{\theta JA} = 228^\circ\text{C/W}$)	1	
	-Pulsed	Figure 4	
E_{AS}	Single Pulse Avalanche Energy (Note 1)	260	mJ
P_D	Power Dissipation	2.5	W
	Derate Above 25°C	0.02	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature	-55 to +150	$^\circ\text{C}$

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance Junction to Ambient SO-8 (Note 2)	50	$^\circ\text{C/W}$
	Thermal Resistance Junction to Ambient SO-8 (Note 3)	191	
	Thermal Resistance Junction to Ambient SO-8 (Note 4)	228	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
76413DK8	HUFA76413DK8T_F085	SO-8	330mm	12mm	2500 units

Notes:

- 1: Starting $T_J = 25^\circ\text{C}$, $L = 20\text{mH}$, $I_{AS} = 5.1\text{A}$
- 2: $R_{\theta JA}$ is 50°C/W when mounted on a 0.5 in^2 copper pad on FR-4 at 1 second.
- 3: $R_{\theta JA}$ is 191°C/W when mounted on a 0.027 in^2 copper pad on FR-4 at 1000 seconds.
- 4: $R_{\theta JA}$ is 228°C/W when mounted on a 0.006 in^2 copper pad on FR-4 at 1000 seconds.
- 5: A suffix as "...F085P" has been temporarily introduced in order to manage a double source strategy as Fairchild has officially announced in Aug 2014.

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	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0\ \text{V}$	60	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 55\ \text{V}$, $V_{GS} = 0\ \text{V}$	-	-	1	μA
		$T_A = 150^\circ\text{C}$	-	-	250	
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 16\ \text{V}$	-	-	± 100	nA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\ \mu\text{A}$	1	-	3	V
$r_{DS(on)}$	Static Drain to Source On Resistance	$I_D = 5.1\ \text{A}$, $V_{GS} = 10\ \text{V}$	-	0.041	0.049	Ω
		$I_D = 4.8\ \text{A}$, $V_{GS} = 5\ \text{V}$	-	0.048	0.056	
		$I_D = 4.8\ \text{A}$, $V_{GS} = 5\ \text{V}$, $T_A = 150^\circ\text{C}$	-	0.091	0.106	

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	-	620	-	pF
C_{oss}	Output Capacitance		-	180	-	pF
C_{rss}	Reverse Transfer Capacitance		-	30	-	pF
$Q_{g(TOT)}$	Total Gate Charge at 10V	$V_{GS} = 0$ to $10\ \text{V}$	-	18	23	nC
$Q_{g(5)}$	Total Gate Charge at 5V	$V_{GS} = 0$ to $5\ \text{V}$	-	10	13	nC
$Q_{g(TH)}$	Threshold Gate Charge	$V_{GS} = 0$ to $1\ \text{V}$	-	0.6	0.8	nC
Q_{gs}	Gate to Source Charge	$V_{DD} = 30\ \text{V}$, $I_D = 4.8\ \text{A}$, $I_g = 1.0\ \text{mA}$	-	1.8	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	5	-	nC

Switching Characteristics ($V_{GS}=5\text{V}$)

t_{on}	Turn-On Time	$V_{DD} = 30\ \text{V}$, $I_D = 1.0\ \text{A}$, $V_{GS} = 5\ \text{V}$, $R_{GS} = 16\ \Omega$	-	-	44	ns
$t_{d(on)}$	Turn-On Delay Time		-	10	-	ns
t_r	Rise Time		-	19	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	45	-	ns
t_f	Fall Time		-	27	-	ns
t_{off}	Turn-Off Time		-	-	108	ns

Drain-Source Diode Characteristics

V_{SD}	Source to Drain Diode Forward Voltage	$I_{SD} = 4.8\ \text{A}$	-	-	1.25	V
		$I_{SD} = 2.4\ \text{A}$	-	-	1.0	
t_{rr}	Reverse Recovery Time	$I_{SD} = 4.8\ \text{A}$, $dI_{SD}/dt = 100\ \text{A}/\mu\text{s}$	-	-	43	ns
Q_{rr}	Reverse Recovery Charge		-	-	55	nC

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

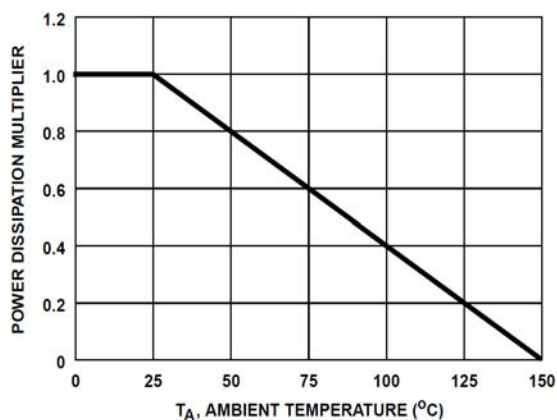


Figure 1. Normalized Power Dissipation vs. Ambient Temperature

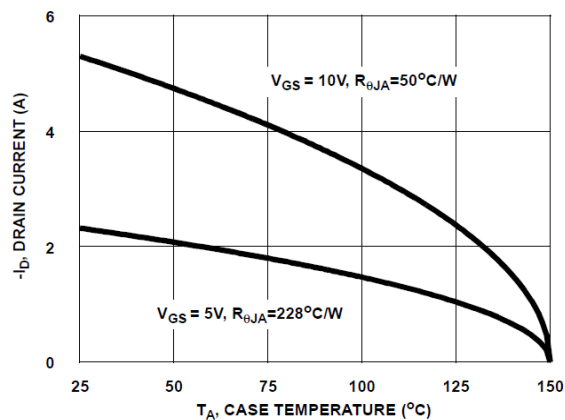


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

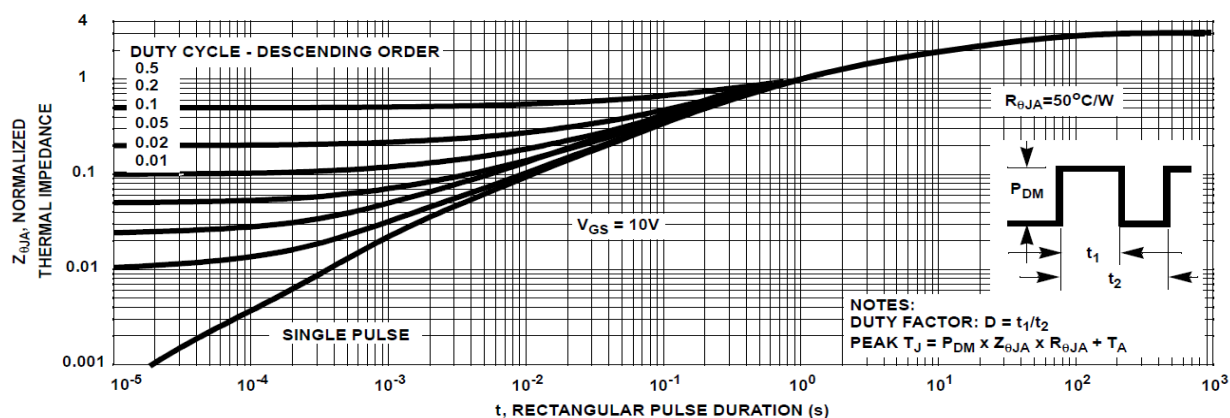


Figure 3. Normalized Maximum Transient Thermal Impedance

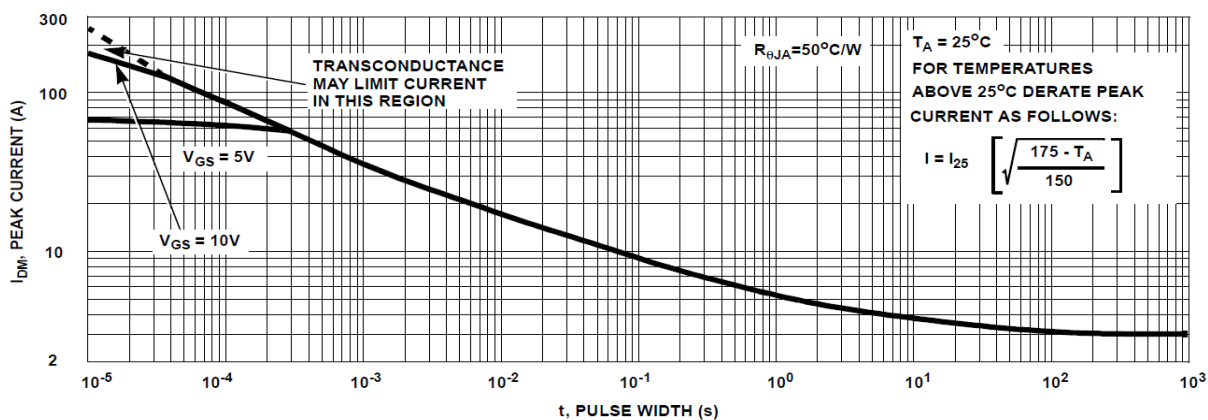


Figure 4. Peak Current Capability

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

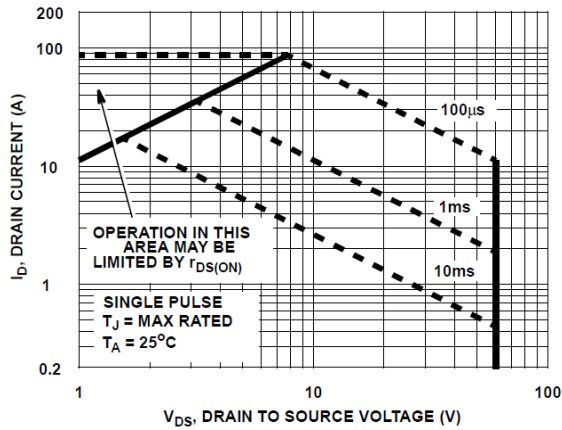


Figure 5. Forward Bias Safe Operating Area

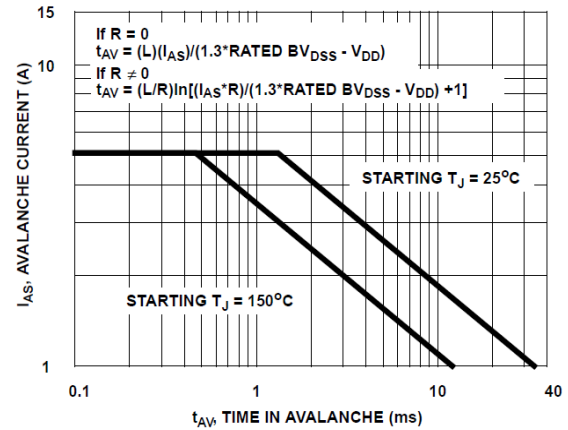


Figure 6. Unclamped Inductive Switching Capability

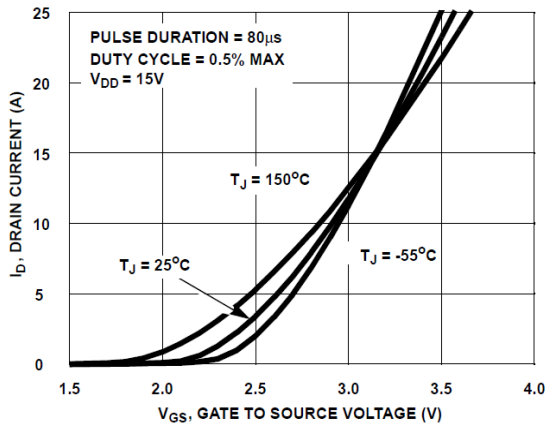


Figure 7. Transfer Characteristics

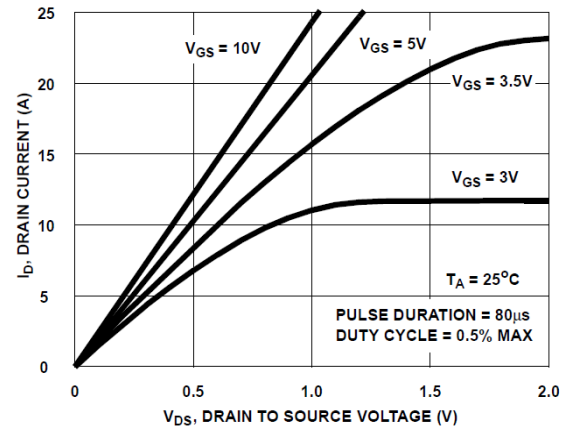


Figure 8. Saturation Characteristics

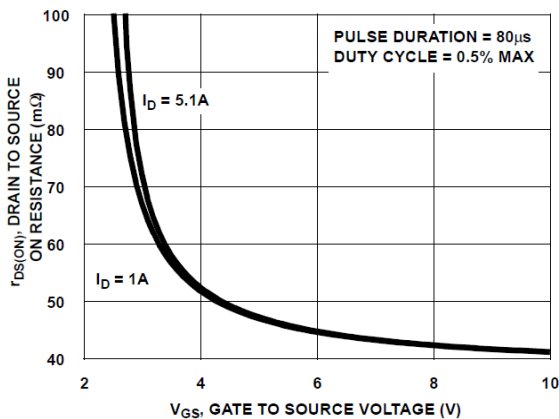


Figure 9. Drain to Source On Resistance vs. Gate Voltage and Drain Current

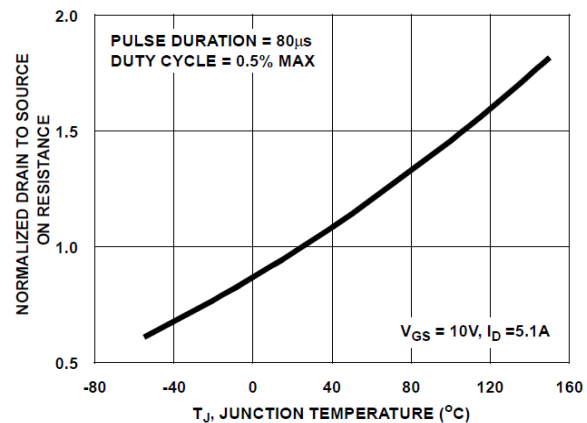


Figure 10. Normalized Drain to Source On Resistance vs. Junction Temperature

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

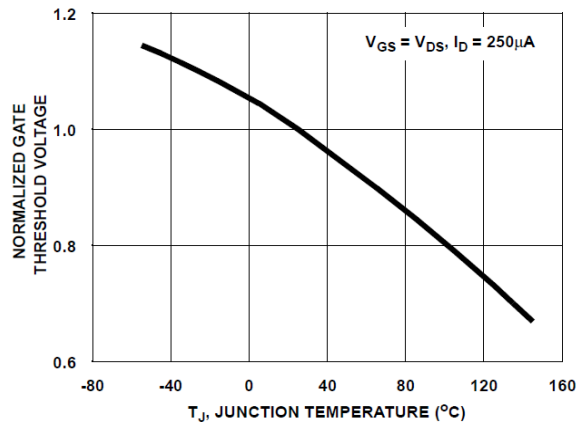


Figure 11. Normalized Gate Threshold Voltage vs. Junction Temperature

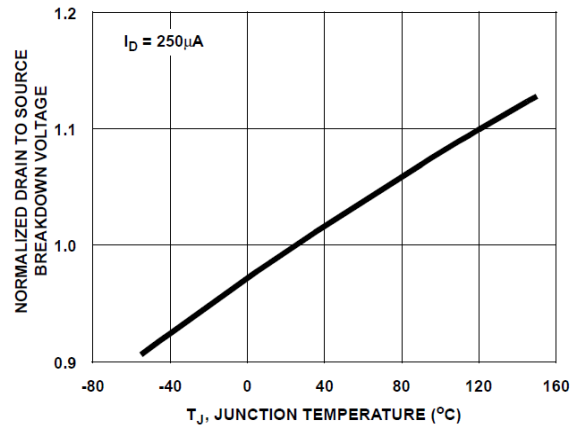


Figure 12. Normalized Drain to Source Breakdown Voltage vs. Junction Temperature

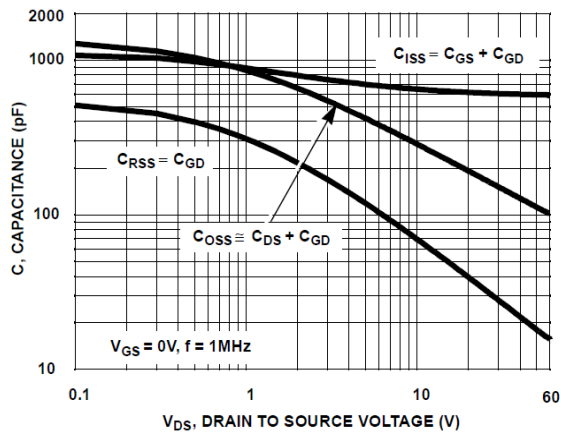


Figure 13. Capacitance vs. Drain to Source Voltage

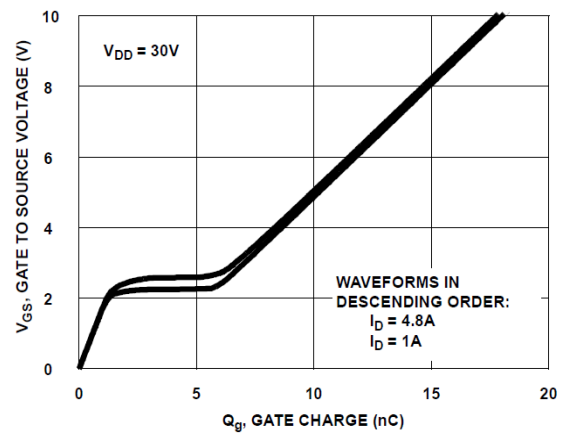


Figure 14. Gate Charge Waveforms for Constant Gate Currents

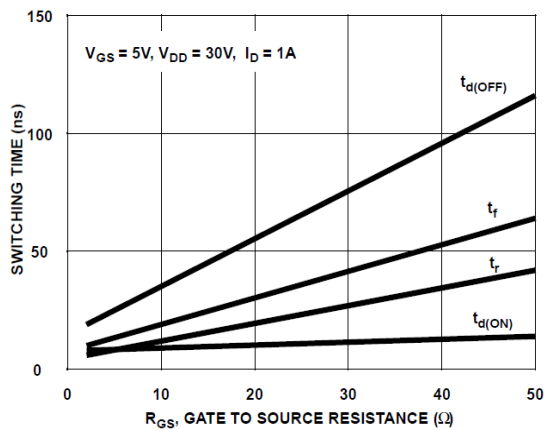


Figure 15. Switching Time vs Gate Resistance

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