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July 2016

FDMT80040DC

N-Channel Dual Cool™ 88 PowerTrench® MOSFET

40 V, 420 A, 0.56 mΩ

Features

- Max $r_{DS(on)}$ = 0.56 mΩ at $V_{GS} = 10$ V, $I_D = 64$ A
- Max $r_{DS(on)}$ = 0.9 mΩ at $V_{GS} = 6$ V, $I_D = 47$ A
- Advanced Package and Silicon Combination for Low $r_{DS(on)}$ and High Efficiency
- Next Generation Enhanced Body Diode Technology, Engineered for Soft Recovery
- Low Profile 8x8mm MLP Package
- MSL1 Robust Package Design
- 100% UIL Tested
- RoHS Compliant

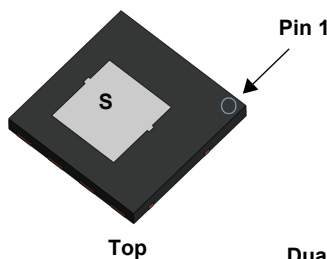


General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process. Advancements in both silicon and Dual Cool™ 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.

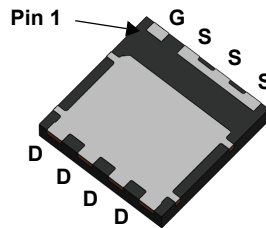
Applications

- OringFET / Load Switching
- Synchronous Rectification
- DC-DC Conversion

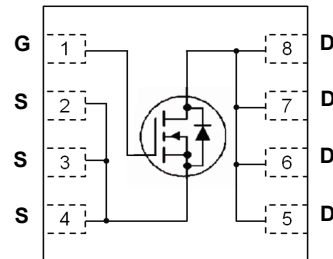


Top

Dual Cool™ 88



Bottom



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

Symbol	Parameter	Ratings	Units
V_{DS}	Drain to Source Voltage	40	V
V_{GS}	Gate to Source Voltage	± 20	V
I_D	Drain Current -Continuous $T_C = 25^\circ\text{C}$ (Note 5)	420	A
	-Continuous $T_C = 100^\circ\text{C}$ (Note 5)	265	
	-Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	64	
	-Pulsed (Note 4)	2644	
E_{AS}	Single Pulse Avalanche Energy (Note 3)	2773	mJ
P_D	Power Dissipation $T_C = 25^\circ\text{C}$	156	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	$^\circ\text{C}$

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Top Source)	1.6	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Bottom Drain)	0.8	
$R_{\theta JA}$	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 1i)	15	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1j)	21	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1k)	9	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
80040DC	FDMT80040DC	Dual Cool™ 88	13"	13.3 mm	3000 units

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	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0\ \text{V}$	40			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, referenced to 25°C		21		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 32\ \text{V}$, $V_{GS} = 0\ \text{V}$			10	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 20\ \text{V}$, $V_{DS} = 0\ \text{V}$			± 100	nA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\ \mu\text{A}$	2.0	2.7	4.0	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°C		-9		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\ \text{V}$, $I_D = 64\ \text{A}$		0.44	0.56	m Ω
		$V_{GS} = 6\ \text{V}$, $I_D = 47\ \text{A}$		0.63	0.9	
		$V_{GS} = 10\ \text{V}$, $I_D = 64\ \text{A}$, $T_J = 125^\circ\text{C}$		0.66	0.84	
g_{FS}	Forward Transconductance	$V_{DS} = 5\ \text{V}$, $I_D = 64\ \text{A}$		278		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 20\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$		18650	26110	pF
C_{oss}	Output Capacitance			5540	7760	pF
C_{rss}	Reverse Transfer Capacitance			304	1210	pF
R_g	Gate Resistance		0.1	1.8	3.6	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 20\ \text{V}$, $I_D = 64\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_{GEN} = 6\ \Omega$		63	101	ns
t_r	Rise Time			62	100	ns
$t_{d(off)}$	Turn-Off Delay Time			101	162	ns
t_f	Fall Time			43	69	ns
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $10\ \text{V}$	$V_{DD} = 20\ \text{V}$, $I_D = 64\ \text{A}$	241	338	nC
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $6\ \text{V}$		149	209	nC
Q_{gs}	Gate to Source Charge			76		nC
Q_{gd}	Gate to Drain "Miller" Charge			35		nC

Drain-Source Diode Characteristics

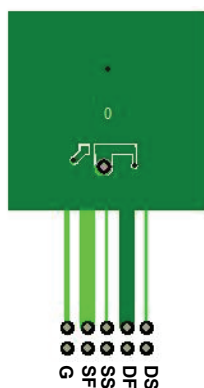
V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\ \text{V}$, $I_S = 2.6\ \text{A}$ (Note 2)		0.67	1.1	V
		$V_{GS} = 0\ \text{V}$, $I_S = 64\ \text{A}$ (Note 2)		0.77	1.2	
t_{rr}	Reverse Recovery Time	$I_F = 64\ \text{A}$, $di/dt = 100\ \text{A}/\mu\text{s}$		94	151	ns
Q_{rr}	Reverse Recovery Charge			219	351	nC

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Top Source)	1.6	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Bottom Drain)	0.8	
$R_{\theta JA}$	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)	26	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1d)	34	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1e)	14	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1f)	16	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1g)	26	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1h)	60	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1i)	15	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1j)	21	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1k)	9	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1l)	11	

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. $R_{\theta CA}$ 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

- Still air, 20.9x10.4x12.7mm Aluminum Heat Sink, 1 in² pad of 2 oz copper
 - Still air, 20.9x10.4x12.7mm Aluminum Heat Sink, minimum pad of 2 oz copper
 - Still air, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in² pad of 2 oz copper
 - Still air, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper
 - 200FPM Airflow, No Heat Sink, 1 in² pad of 2 oz copper
 - 200FPM Airflow, No Heat Sink, minimum pad of 2 oz copper
 - 200FPM Airflow, 20.9x10.4x12.7mm Aluminum Heat Sink, 1 in² pad of 2 oz copper
 - 200FPM Airflow, 20.9x10.4x12.7mm Aluminum Heat Sink, minimum pad of 2 oz copper
 - 200FPM Airflow, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in² pad of 2 oz copper
 - 200FPM Airflow, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper
- Pulse Test: Pulse Width < 300 μ s, Duty cycle < 2.0%.
 - E_{AS} of 2773mJ is based on starting $T_J = 25^\circ\text{C}$; N-ch: $L = 3\text{ mH}$, $I_{AS} = 43\text{ A}$, $V_{DD} = 40\text{ V}$, $V_{GS} = 10\text{ V}$. 100% test at $L = 0.3\text{ mH}$, $I_{AS} = 93\text{ A}$.
 - Pulsed I_d please refer to Fig 11 SOA graph for more details.
 - Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design.

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

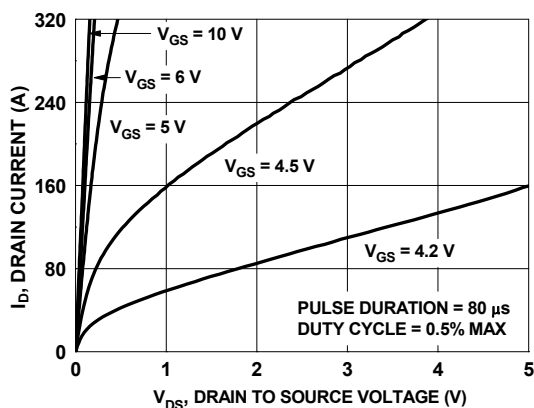


Figure 1. On Region Characteristics

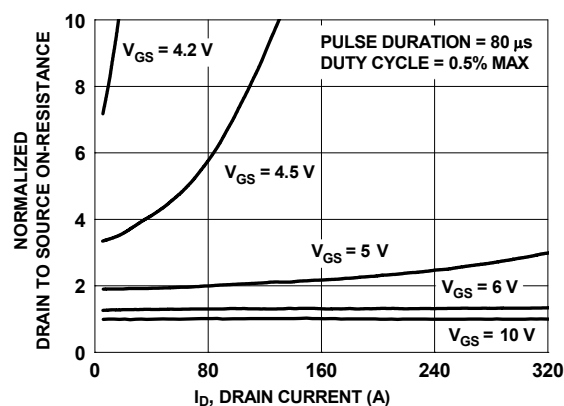


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

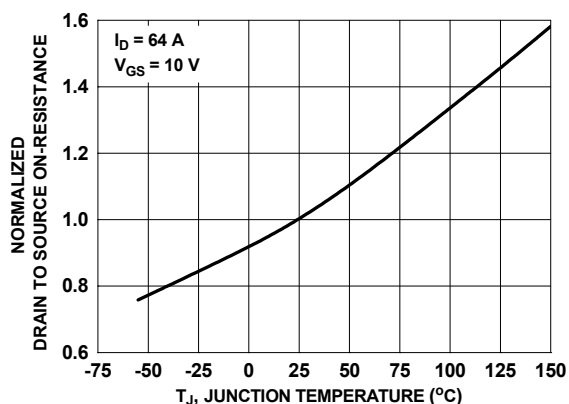


Figure 3. Normalized On Resistance vs. Junction Temperature

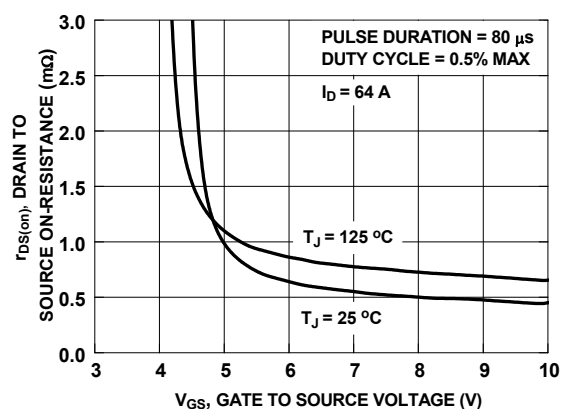


Figure 4. On-Resistance vs. Gate to Source Voltage

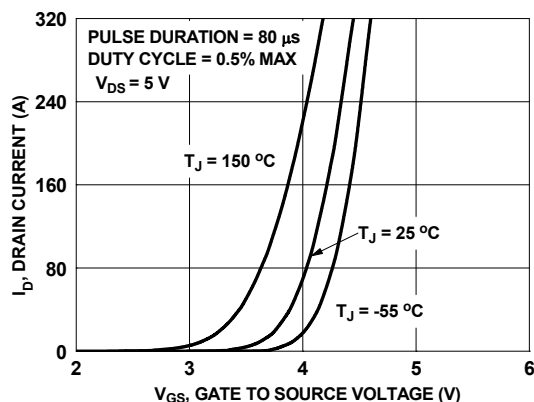


Figure 5. Transfer Characteristics

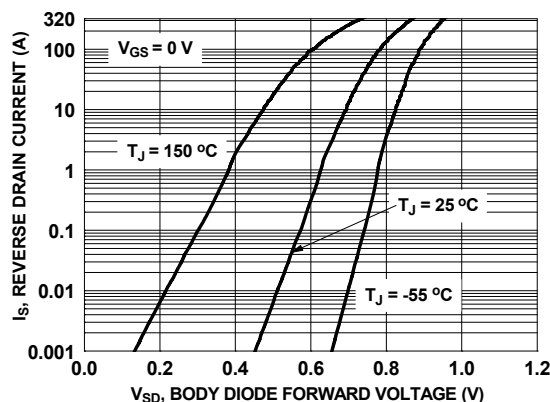


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

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

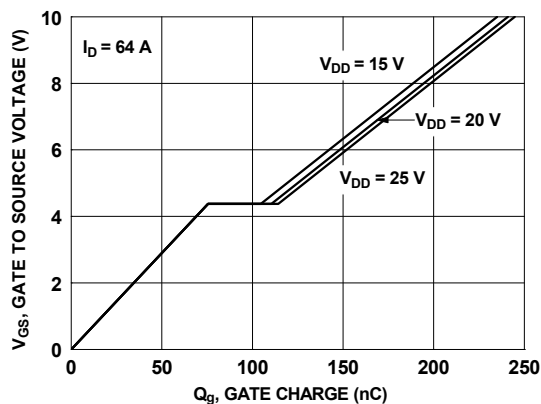


Figure 7. Gate Charge Characteristics

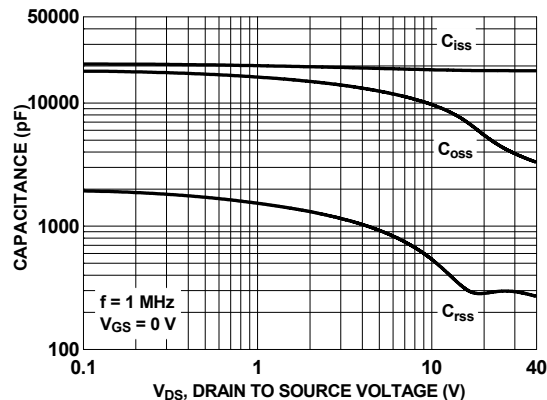


Figure 8. Capacitance vs Drain to Source Voltage

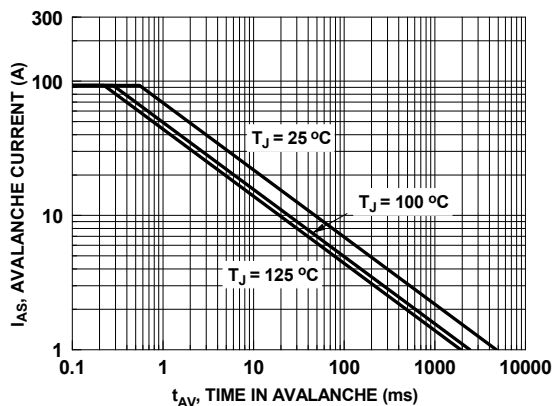


Figure 9. Unclamped Inductive Switching Capability

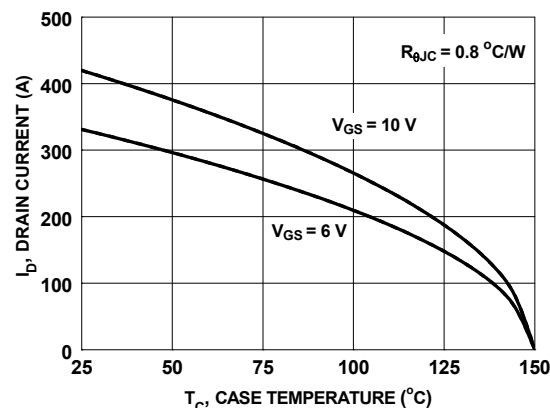


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

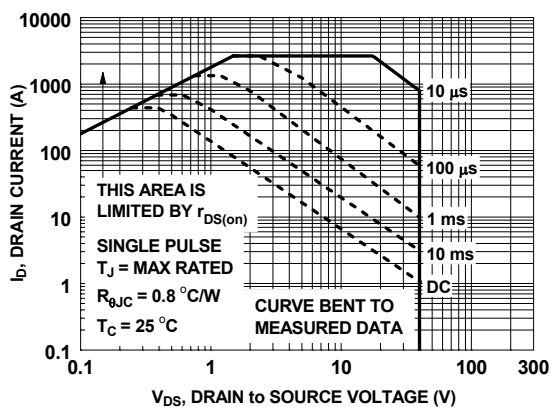


Figure 11. Forward Bias Safe Operating Area

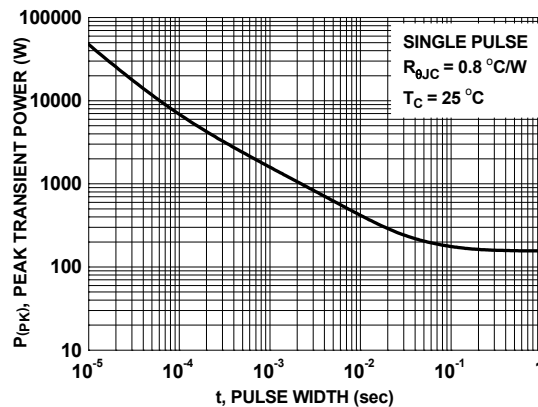


Figure 12. Single Pulse Maximum Power Dissipation

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

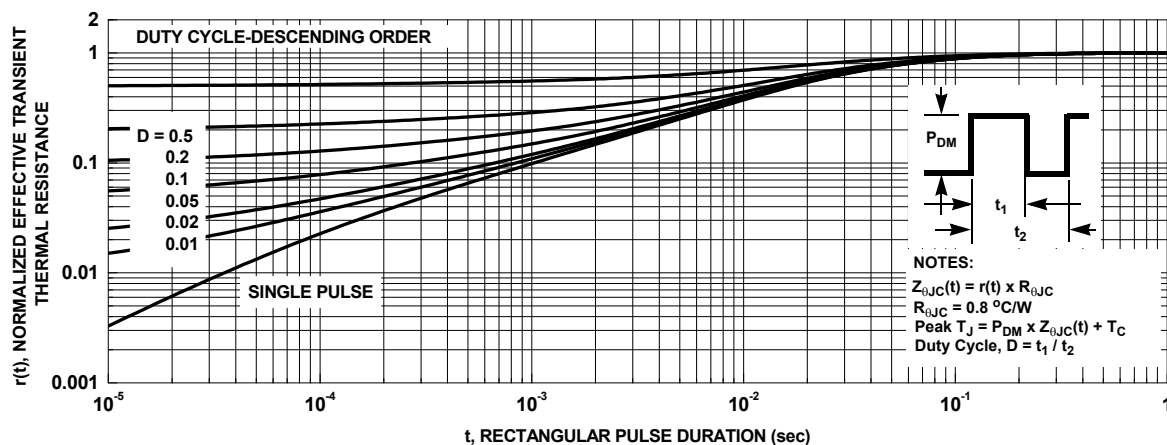


Figure 13. Junction-to-Case Transient Thermal Response Curve

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