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July 2015

FDMS7650DC

N-Channel Dual CoolTM 56 PowerTrench[®] MOSFET 30 V, 100 A, 0.99 m Ω

Features

- Dual CoolTM Top Side Cooling PQFN package
- Max $r_{DS(on)} = 0.99 \text{ m}\Omega$ at $V_{GS} = 10 \text{ V}$, $I_D = 36 \text{ A}$
- Max $r_{DS(on)} = 1.55 \text{ m}\Omega$ at $V_{GS} = 4.5 \text{ V}$, $I_D = 32 \text{ A}$
- High performance technology for extremely low r_{DS(on)}
- RoHS Compliant

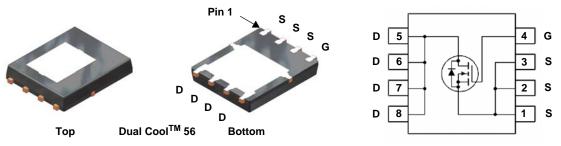
General Description

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.

Applications

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





MOSFET Maximum Ratings T_A= 25 °C unless otherwise noted

Symbol	Parameter			Ratings	Units
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		100	
	-Continuous (Silicon limited) T _C = 25 °C			289	A
'D	-Continuous	T _A = 25 °C	(Note 1a)	47	^
	-Pulsed			200	
E _{AS}	Single Pulse Avalanche Energy		(Note 3)	578	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 5)	0.5	V/ns
P _D	Power Dissipation	T _C = 25 °C		125	W
	Power Dissipation	T _A = 25 °C	(Note 1a)	3.3	VV
T _J , T _{STG}	Operating and Storage Junction Temperature R	ange		-55 to +150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	(Top Source)	2.3	
$R_{\theta JC}$	Thermal Resistance, Junction to Case	(Bottom Drain)	1	
$R_{\theta JA}$	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
7650	FDMS7650DC	Dual Cool TM 56	13 "	12 mm	3000 units

Electrical Characteristics $T_J = 25$ °C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Тур	Max	Units
Off Chara	acteristics					
BV _{DSS}	Drain to Source Breakdown Voltage	$I_D = 250 \mu A, V_{GS} = 0 V$	30			V
$\frac{\Delta BV_{DS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μ A, referenced to 25 °C		12		mV/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 24 V, V _{GS} = 0 V			1	μА
I _{GSS}	Gate to Source Leakage Current, Forward	V _{GS} = 20 V, V _{DS} = 0 V			100	nA

On Characteristics

V _{GS(th)}	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250 \mu A$	1.1	1.9	2.7	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = 250 μ A, referenced to 25 °C		-7		mV/°C
	Static Drain to Source On Resistance	V _{GS} = 10 V, I _D = 36 A		0.6	0.99	
r _{DS(on)}		$V_{GS} = 4.5 \text{ V}, I_D = 32 \text{ A}$		1	1.55	mΩ
		$V_{GS} = 10 \text{ V}, I_D = 36 \text{ A}, T_J = 125 ^{\circ}\text{C}$		0.9	1.5	
9 _{FS}	Forward Transconductance	$V_{DS} = 5 \text{ V}, I_{D} = 36 \text{ A}$		225		S

Dynamic Characteristics

C _{iss}	Input Capacitance	45.77.77	11100	14765	pF
C _{oss}	Output Capacitance	$V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V},$ $f = 1 \text{ MHz}$	3440	4575	pF
C _{rss}	Reverse Transfer Capacitance	1 = 1 IVIT12	205	310	pF
R_g	Gate Resistance		1.3		Ω

Switching Characteristics

t _{d(on)}	Turn-On Delay Time		29	46	ns
t _r	Rise Time	V _{DD} = 15 V, I _D = 36 A,	28	45	ns
t _{d(off)}	Turn-Off Delay Time	V_{GS} = 10 V, R_{GEN} = 6 Ω	81	130	ns
t _f	Fall Time		20	32	ns
Qg	Total Gate Charge	V _{GS} = 0 V to 10 V	147	206	nC
Qg	Total Gate Charge	$V_{GS} = 0 \text{ V to } 4.5 \text{ V}$ $V_{DD} = 15 \text{ V}$	62	87	nC
Q _{gs}	Gate to Source Charge	I _D = 36 A	38		nC
Q _{gd}	Gate to Drain "Miller" Charge		9.7		nC

Drain-Source Diode Characteristics

V _{SD} Source to Drain Diode Forward Volta	Source to Drain Diode Forward Voltage	$V_{GS} = 0 V, I_S = 2.1 A$ (Note 2)	0.7	1.2	\/
	Source to Drain Diode Forward voltage	$V_{GS} = 0 \text{ V}, I_S = 36 \text{ A}$ (Note 2)	0.8	1.3	V
t _{rr}	Reverse Recovery Time	I _F = 36 A, di/dt = 100 A/μs	75	120	ns
Q _{rr}	Reverse Recovery Charge	T _F = 36 A, α/αι = 100 A/μs	61	98	nC

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	(Top Source)	2.3	
$R_{\theta JC}$	Thermal Resistance, Junction to Case	(Bottom Drain)	1	
$R_{\theta JA}$	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,JA} is determined with the device mounted on a FR-4 board using a specified pad of 2 oz copper as shown below. R_{0,JC} is guaranteed by design while R_{0,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

- c. Still air, 20.9x10.4x12.7mm Aluminum Heat Sink, 1 in² 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 in 2 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. 200FPM 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 $\mu s,$ Duty cycle < 2.0%.
- 3. E_{AS} of 578 mJ is based on starting T_J = 25 ^{o}C ; N-ch: L = 1 mH, I_{AS} = 34 A, V_{DD} = 27 V, V_{GS} = 10 V.
- 4. As an N-ch device, the negative Vgs rating is for low duty cycle pulse ocurrence only. No continuous rating is implied.
- 5. $I_{SD} \leq$ 36 A, di/dt \leq 100 A/ μ s, $V_{DD} \leq$ BV $_{DSS}$, Starting T_J = 25 °C.

Typical Characteristics T_J = 25 °C unless otherwise noted

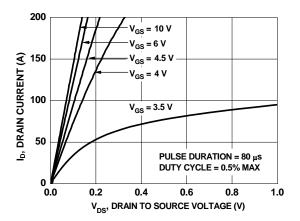


Figure 1. On Region Characteristics

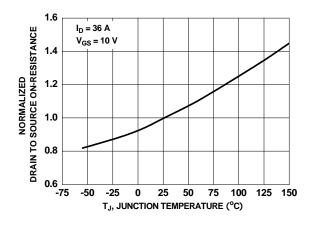


Figure 3. Normalized On Resistance vs Junction Temperature

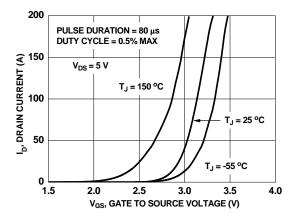


Figure 5. Transfer Characteristics

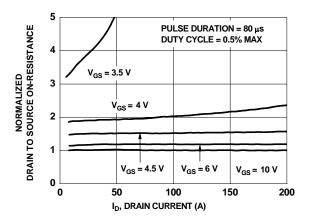


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

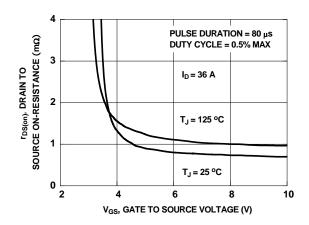


Figure 4. On-Resistance vs Gate to Source Voltage

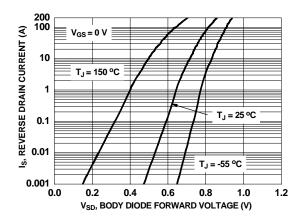


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics $T_J = 25$ °C unless otherwise noted

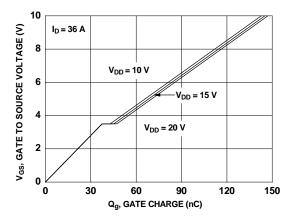


Figure 7. Gate Charge Characteristics

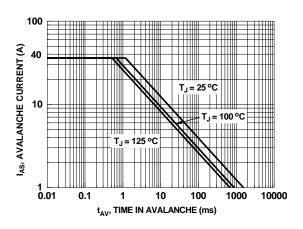


Figure 9. Unclamped Inductive Switching Capability

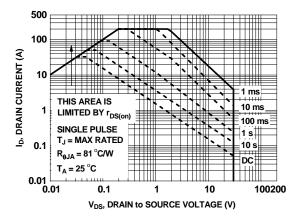


Figure 11. Forward Bias Safe Operating Area

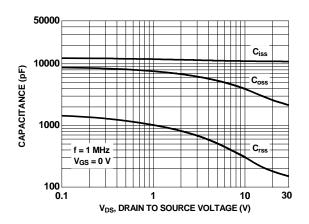


Figure 8. Capacitance vs Drain to Source Voltage

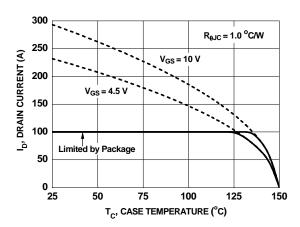


Figure 10. Maximum Continuous Drain Current vs Case Temperature

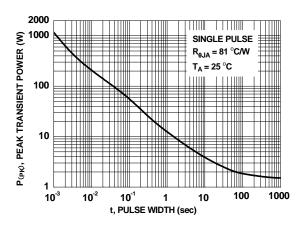


Figure 12. Single Pulse Maximum Power Dissipation

Typical Characteristics $T_J = 25$ °C unless otherwise noted

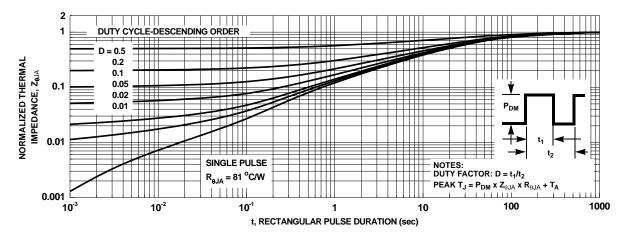
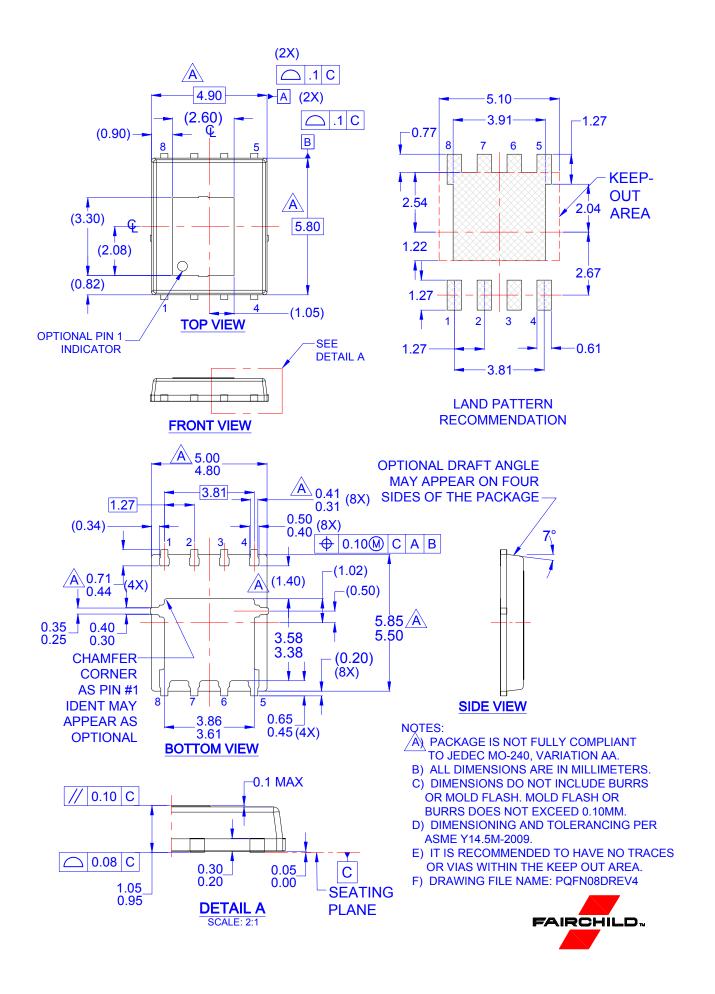


Figure 13. Junction-to-Ambient Transient Thermal Response Curve



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