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# FDS4559

# 60V Complementary PowerTrench®MOSFET

#### **General Description**

This complementary MOSFET device is produced using Fairchild's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain low gate charge for superior switching performance.

### **Applications**

- DC/DC converter
- Power management
- LCD backlight inverter

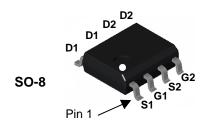
#### **Features**

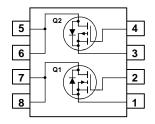
Q1: N-Channel

4.5 A, 60 V 
$$R_{DS(on)} = 55 \text{ m}\Omega @ V_{GS} = 10V$$
 
$$R_{DS(on)} = 75 \text{ m}\Omega @ V_{GS} = 4.5V$$

Q2: P-Channel

$$-3.5$$
 A,  $-60$  V  $~R_{DS(on)}=105$   $m\Omega$  @  $V_{GS}=-10$  V 
$$~R_{DS(on)}=135$$
  $m\Omega$  @  $V_{GS}=-4.5$  V





# Absolute Maximum Ratings T<sub>A</sub> = 25°C unless otherwise noted

Symbol	Parameter		Q1	Q2	Units
V <sub>DSS</sub>	Drain-Source Voltage		60	-60	V
V <sub>GSS</sub>	Gate-Source Voltage		±20	±20	V
I <sub>D</sub>	Drain Current - Continuous	(Note 1a)	4.5	-3.5	А
	- Pulsed		20	-20	
P <sub>D</sub>	Power Dissipation for Dual Operation		2	2	W
	Power Dissipation for Single Operation	(Note 1a)	1.	.6	
		(Note 1b)	1.	.2	
		(Note 1c)	,	1	
$T_J$ , $T_{STG}$	Operating and Storage Junction Temperature Range		-55 to	+175	°C

#### **Thermal Characteristics**

R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient	(Note 1a)	78	°C/W
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case	(Note 1)	40	°C/W

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDS4559	FDS4559	13"	12mm	2500 units

Symbol	Parameter	Test Conditions	Туре	Min	Тур	Max	Units
Drain-S	ource Avalanche Rating	<b>]S</b> (Note 1)					
W <sub>DSS</sub>	Single Pulse Drain-Source Avalanche Energy	$V_{DD} = 30 \text{ V}, \qquad I_{D} = 4.5 \text{ A}$	Q1			90	mJ
I <sub>AR</sub>	Maximum Drain-Source Avalanche Current		Q1			4.5	Α
Off Cha	racteristics						
BV <sub>DSS</sub>	Drain-Source Breakdown	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	Q1	60			V
. 5) (	Voltage	$V_{GS} = 0 \text{ V}, I_D = -250 \mu\text{A}$	Q2	-60			1400
∆BV <sub>DSS</sub>	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^{\circ}\text{C}$	Q1 Q2		58 –49		mV/°C
ΔT <sub>J</sub>	-	$I_D = -250 \mu\text{A}$ , Referenced to 25°C	Q2 Q1		-49	1	
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	$V_{DS} = 48 \text{ V}, V_{GS} = 0 \text{ V}$ $V_{DS} = -48 \text{ V}, V_{GS} = 0 \text{ V}$	Q1 Q2			1 –1	μΑ
I <sub>GSS</sub>	Gate-Body Leakage	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$	Q1			+100	nA
1055	Cate Body Loanage	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$	Q2			+100	1.5
On Cha	racteristics (Note 2)					. —	
V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_{D} = 250 \ \mu A$	Q1	1	2.2	3	V
V GS(III)	Cate Thromolog Voltage	$V_{DS} = V_{GS}, I_D = 250 \mu A$	Q2	-1	-1.6	-3	•
$\Delta V_{GS(th)}$	Gate Threshold Voltage	I <sub>D</sub> = 250 μA, Referenced to 25°C	Q1		-5.5		mV/°C
$\Delta T_{J}$	Temperature Coefficient	$I_D = -250 \mu\text{A}$ , Referenced to 25°C	Q2		4		
R <sub>DS(on)</sub>	Static Drain-Source	$V_{GS} = 10 \text{ V}, I_D = 4.5 \text{ A}$	Q1		42	55	$m\Omega$
	On-Resistance	$V_{GS} = 10 \text{ V}, I_D = 4.5 \text{ A}, T_J = 125^{\circ}\text{C}$			72	94	
		$V_{GS} = 4.5 \text{ V}, I_D = 4 \text{ A}$ $V_{GS} = -10 \text{ V}, I_D = -3.5 \text{ A}$			55	75	
			Q2		82	105	
		$V_{GS} = -10 \text{ V}, I_D = -3.5 \text{ A}, T_J = 125^{\circ}\text{C}$			130	190	
	On State Drain Current	$V_{GS} = -4.5 \text{ V}, I_D = -3.1 \text{ A}$	01	20	105	135	^
I <sub>D(on)</sub>	On-State Drain Current	$V_{GS} = 10 \text{ V}, V_{DS} = 5 \text{ V}$ $V_{GS} = -10 \text{ V}, V_{DS} = -5 \text{ V}$	Q1 Q2	20 –20			Α
g <sub>FS</sub>	Forward Transconductance	$V_{DS} = 10 \text{ V}, V_{DS} = -3 \text{ V}$ $V_{DS} = 10 \text{ V}, I_{D} = 4.5 \text{ A}$	Q1	-20	14		S
913		$V_{DS} = -5 \text{ V}, I_D = -3 \text{ 5 A}$	Q2		9		
Dvnami	c Characteristics						
C <sub>iss</sub>	Input Capacitance	Q1	Q1		650		pF
Oiss	mput Supusitarios	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$	Q2		759		Pi
Coss	Output Capacitance	f = 1.0 MHz	Q1		80		pF
		Q2	Q2		90		·
Crss	Reverse Transfer	$V_{DS} = -30 \text{ V}, V_{GS} = 0 \text{ V},$	Q1		35		pF
	Capacitance	f = 1.0 MHz	Q2		39		
Switchin	g Characteristics (Note 2	)					
	Turn-On Delay Time	Q1	Q1		11	20	ns
(011)	,	$V_{DD} = 30 \text{ V}, I_D = 1 \text{ A},$	Q2		7	14	
	Turn-On Rise Time	$V_{GS} = 10V$ , $R_{GEN} = 6 \Omega$	Q1		8	18	ns
			Q2		10	20	
d(off)	Turn-Off Delay Time	Q2	Q1		19	35	ns
	Turn Off Fall Time	$V_{DD} = -30 \text{ V}, I_{D} = -1 \text{ A},$ $V_{GS} = -10 \text{ V}, R_{GEN} = 6 \Omega$	Q2		19	34	
	Turn-Off Fall Time	V <sub>GS</sub> = -10 V, N <sub>GEN</sub> = 0 22	Q1 Q2		6 12	15 22	ns
$Q_{g}$	Total Gate Charge	Q1	Q1		12.5	18	nC
·9	3	$V_{DS} = 30 \text{ V}, I_D = 4.5 \text{ A}, V_{GS} = 10 \text{ V}$	Q2		15	21	
) <sub>gs</sub>	Gate-Source Charge		Q1		2.4		nC
		Q2	Q2		2.5		1
) <sub>gd</sub>	Gate-Drain Charge	$V_{DS} = -30 \text{ V}, I_{D} = -3.5 \text{ A}, V_{GS} = -10 \text{V}$	Q1		2.6		nC
			Q2		3.0		

## Electrical Characteristics (continued) T<sub>A</sub> = 25°C unless otherwise noted

Drain-Source Diode Characteristics and Maximum Ratings							
Is	Maximum Continuous Drain-Source Diode Forward Current	Q1			1.3	Α	
		Ω2			_1 3		

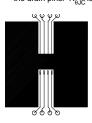
**Test Conditions** 

# $V_{SD}$

Symbol

 R<sub>8JA</sub> 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<sub>8JC</sub> is guaranteed by design while R<sub>8CA</sub> is determined by the user's board design.

 $V_{GS} = 0 \text{ V}, I_S = 1.3 \text{ A} \text{ (Note 2)}$  $V_{GS} = 0 \text{ V}, I_S = -1.3 \text{ A} \text{ (Note 2)}$ 



Voltage

a) 78°C/W when mounted on a 0.5 in² pad of 2 oz copper

**Parameter** 

Drain-Source Diode Forward



b) 125°C/W when mounted on a .02 in<sup>2</sup> pad of 2 oz copper



Q1

Q2

c) 135°C/W when mounted on a minimum pad.

Type | Min | Typ | Max | Units

0.8

-0.8

1.2

Scale 1:1 on letter size paper

2. Pulse Test: Pulse Width <  $300\mu s$ , Duty Cycle < 2.0%

# **Typical Characteristics: Q2**

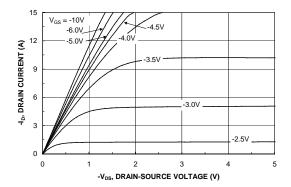


Figure 1. On-Region Characteristics.

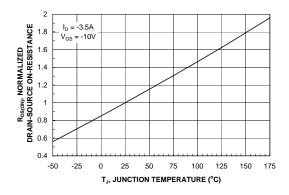


Figure 3. On-Resistance Variation with Temperature.

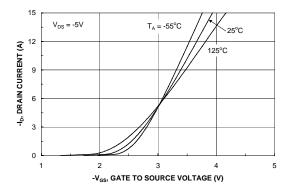


Figure 5. Transfer Characteristics.

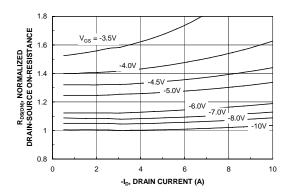


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

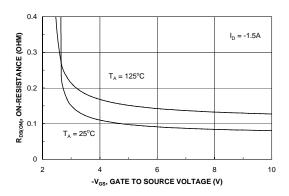


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

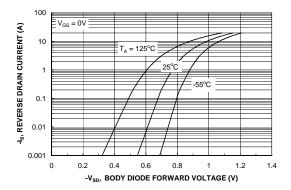
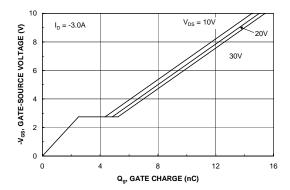


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

f = 1 MHz V<sub>GS</sub> = 0 V

# **Typical Characteristics: Q2**



-V<sub>DS</sub>, DRAIN TO SOURCE VOLTAGE (V)

1200

1000

800 600 400

CAPACITANCE (pF)

Figure 7. Gate Charge Characteristics.

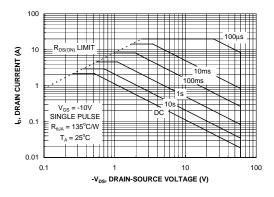


Figure 8. Capacitance Characteristics.

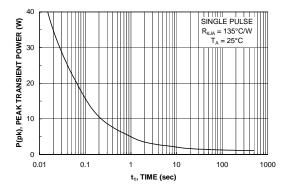


Figure 9. Maximum Safe Operating Area.

Figure 10. Single Pulse Maximum Power Dissipation.

# **Typical Characteristics: Q1**

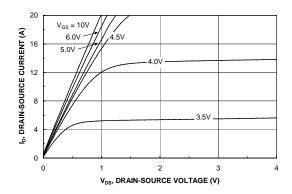


Figure 11. On-Region Characteristics.

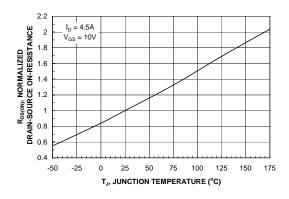


Figure 13. On-Resistance Variation with Temperature.

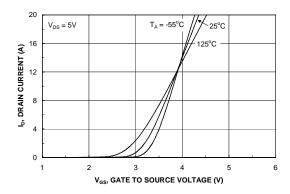


Figure 15. Transfer Characteristics.

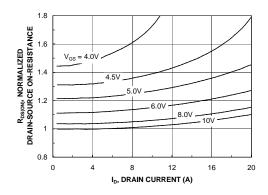


Figure 12. On-Resistance Variation with Drain Current and Gate Voltage.

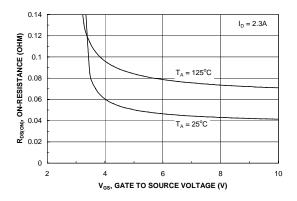


Figure 14. On-Resistance Variation with Gate-to-Source Voltage.

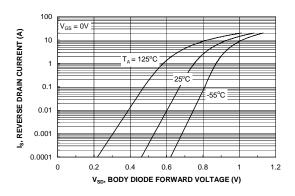
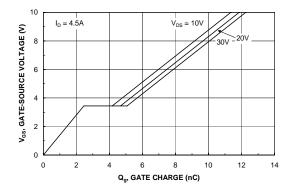


Figure 16. Body Diode Forward Voltage Variation with Source Current and Temperature.

# **Typical Characteristics: Q1**



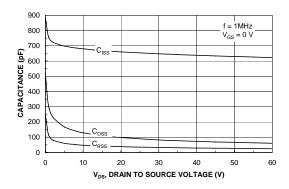
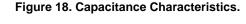
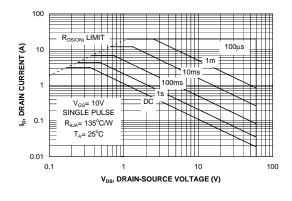


Figure 17. Gate Charge Characteristics.





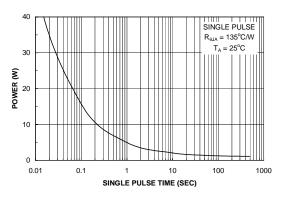


Figure 19. Maximum Safe Operating Area.

Figure 20. Single Pulse Maximum Power Dissipation.

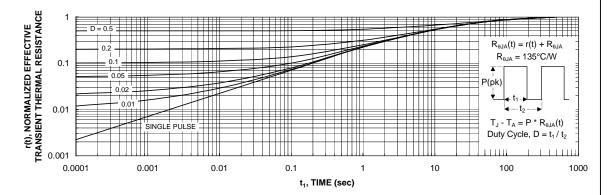


Figure 21. Transient Thermal Response Curve.

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





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Definition of Terms							
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Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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