

FDS4501H

Complementary PowerTrench Half-Bridge MOSFET

General Description

This complementary MOSFET half-bridge 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
- · Load switch
- · Battery protection

Features

Q1: N-Channel

9.3A, 30V
$${\rm R_{DS(on)}=18~m\Omega}~@~{\rm V_{GS}=10V}$$

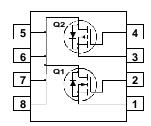
$$R_{DS(on)} = 23 \text{ m}\Omega @ V_{GS} = 4.5V$$

Q2: P-Channel

$$-5.6A, -20V$$
 $R_{DS(on)} = 46 \text{ m}\Omega @ V_{GS} = -4.5V$

$$R_{DS(on)} = 63 \text{ m}\Omega @ V_{GS} = -2.5V$$





Absolute Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter		Q1	Q2	Units
V_{DSS}	Drain-Source Voltage		30	-20	V
V_{GSS}	Gate-Source Voltage		±20	±8	V
I _D	Drain Current - Continuous	(Note 1a)	9.3	-5.6	Α
	- Pulsed		20	-20	
P_D	Power Dissipation for Single Operation	(Note 1a)	2.	5	W
		(Note 1b)	1.	2	
		(Note 1c)	1		
T _J , T _{STG}	Operating and Storage Junction Temperature Range		–55 to	+150	°C

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	50	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	(Note 1)	25	°C/W

Package Marking and Ordering Information

Device Marking Device		Reel Size	Tape width	Quantity
FDS4501H	FDS4501H	13"	12mm	2500 units

Symbol	Parameter	Test Conditions	Туре	Min	Тур	Max	Units
Off Chai	acteristics		•		•		•
BV _{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$ $V_{GS} = 0 \text{ V}, I_D = -250 \mu\text{A}$	Q1 Q2	30 –20			V
<u>ΔBV_{DSS}</u> ΔT _J	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$, Referenced to 25°C $I_D = -250 \mu\text{A}$, Referenced to 25°C	Q1 Q2		24 -13		mV/°C
l _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 24 V, V _{GS} = 0 V V _{DS} = -16 V, V _{GS} = 0 V	Q1 Q2			1 –1	μΑ
l _{GSS}	Gate-Body Leakage	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$ $V_{GS} = \pm 8 \text{ V}, V_{DS} = 0 \text{ V}$	Q1 Q2			<u>+</u> 100 <u>+</u> 100	nA
On Char	acteristics (Note 2)	•					
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250 \mu A$ $V_{DS} = V_{GS}, I_D = -250 \mu A$	Q1 Q2	1 -0.4	1.6 -0.7	3 –1.5	V
$\Delta V_{GS(th)} \over \Delta T_J$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250 \mu A$, Referenced to 25°C $I_D = -250 \mu A$, Referenced to 25°C	Q1 Q2		-4 3		mV/°C
R _{DS(on)}	Static Drain-Source On-Resistance	$V_{GS} = 10 \text{ V}, I_D = 9.3 \text{ A}$ $V_{GS} = 10 \text{ V}, I_D = 9.3 \text{ A}, T_J = 125^{\circ}\text{C}$ $V_{GS} = 4.5 \text{ V}, I_D = 7.6 \text{ A}$	Q1		14 21 17	18 29 23	mΩ
		$V_{\text{CS}} = -4.5 \text{ V}, I_{\text{D}} = -5.6 \text{ A}$ $V_{\text{CS}} = -4.5 \text{ V}, I_{\text{D}} = -5.6 \text{ A}, T_{\text{J}} = 125^{\circ}\text{C}$ $V_{\text{CS}} = -2.5 \text{ V}, I_{\text{D}} = -5.0 \text{ A}$	Q2		36 49 47	46 80 63	
I _{D(on)}	On-State Drain Current	$V_{GS} = 10 \text{ V}, V_{DS} = 5 \text{ V}$ $V_{GS} = -4.5 \text{ V}, V_{DS} = -5 \text{ V}$	Q1 Q2	20 –20			Α
g FS	Forward Transconductance	$V_{DS} = 5 \text{ V}, I_{D} = 9.3 \text{ A}$ $V_{DS} = 5 \text{ V}, I_{D} = -5.6 \text{ A}$	Q1 Q2		28 16		S
Dynamic	Characteristics						
C _{iss}	Input Capacitance	$V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V},$ f = 1.0 MHz	Q1 Q2		1958 1312		pF
Coss	Output Capacitance		Q1 Q2		424 240		pF
C _{rss}	Reverse Transfer Capacitance		Q1 Q2		182 106		pF

Electrical Characteristics (continued)

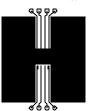
 $T_A = 25$ °C unless otherwise noted

Symbol	Parameter	Test Conditions	Туре	Min	Тур	Max	Units
Switchin	ig Characteristics (Note 2)					
t _{d(on)}	Turn-On Delay Time	Q1 $V_{DD} = 15 \text{ V}, I_{D} = 1 \text{ A},$	Q1 Q2		15 15	27 27	ns
t _r	Turn-On Rise Time	V_{GS} = 10V, R_{GEN} = 6 Ω	Q1 Q2		5 15	10 27	ns
$t_{\text{d(off)}}$	Turn-Off Delay Time	$V_{DD} = -10 \text{ V}, I_{D} = -1 \text{ A},$ $V_{GS} = -4.5 \text{ V}, R_{GEN} = 6 \Omega$	Q1 Q2		38 40	61 64	ns
t _f	Turn-Off Fall Time		Q1 Q2		10 25	20 40	ns
Q_g	Total Gate Charge	Q1 $V_{DS} = 15 \text{ V}, I_D = 9.3 \text{ A}, V_{GS} = 4.5 \text{ V}$	Q1 Q2		17 13	27 21	nC
Q_{gs}	Gate-Source Charge	Q2	Q1 Q2		4 2.5		nC
Q_{gd}	Gate-Drain Charge	$V_{DS} = 15 \text{ V}, I_{D} = -2.4 \text{ A}, V_{GS} = -4.5 \text{ V}$	Q1 Q2		5 2.0		nC
Drain-Sc	ource Diode Charact	eristics and Maximum Ratings				•	
	a. cc b.cao onaraot	onone and maximum realingo					

ls	Maximum Continuous Drain-Source Diode Forward Current		2.1 –2.1	Α
V _{SD}	Drain-Source Diode Forward $V_{\text{CS}} = 0 \text{ V}$, $I_{\text{S}} = 2.1 \text{ A}$ (Note 2) Voltage $V_{\text{CS}} = 0 \text{ V}$, $I_{\text{S}} = -2.1 \text{ A}$ (Note 2)	Q1 Q2	1.2 –1.2	V

Notes:

1. R_{BJA} 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. $\rm R_{\theta JC}$ is guaranteed by design while $\rm R_{\theta CA}$ is determined by the user's board design.



a) 50°C/W when mounted on a 1 in² pad of 2 oz mounted on a 1 in² pad of 2 oz copper



b) 105°C/W when mounted on a 0.04 in² pad of 2 oz copper



c) 125°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%

Typical Characteristics: Q2

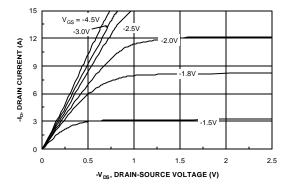


Figure 1. On-Region Characteristics.

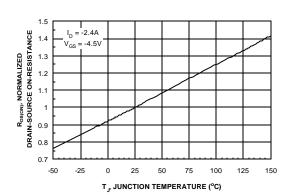


Figure 3. On-Resistance Variation with Temperature.

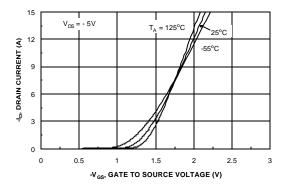


Figure 5. Transfer Characteristics.

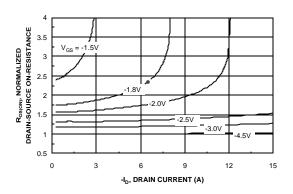


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

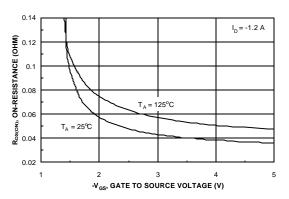


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

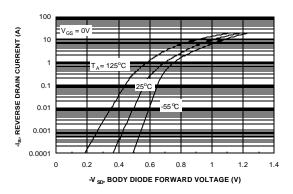
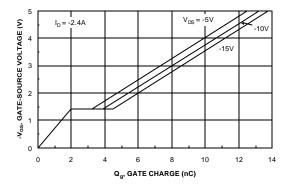


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics: Q2



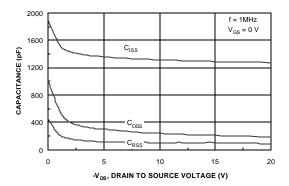
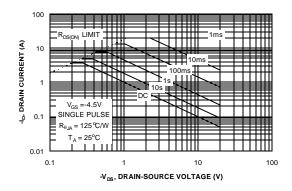


Figure 7. Gate Charge Characteristics.

Figure 8. Capacitance Characteristics.



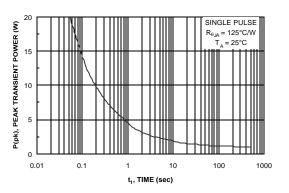


Figure 9. Maximum Safe Operating Area.

Figure 10. Single Pulse Maximum Power Dissipation.

Typical Characteristics: Q1

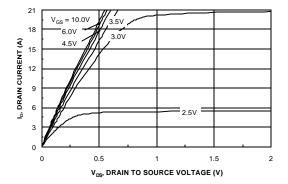


Figure 11. On-Region Characteristics.

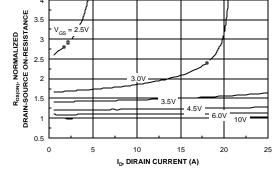


Figure 12. On-Resistance Variation with Drain Current and Gate Voltage.

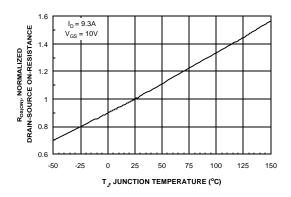


Figure 13. On-Resistance Variation with Temperature.

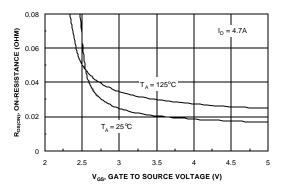


Figure 14. On-Resistance Variation with Gate-to-Source Voltage.

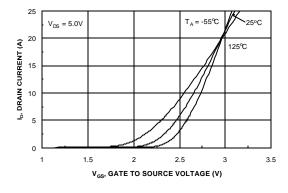


Figure 15. Transfer Characteristics.

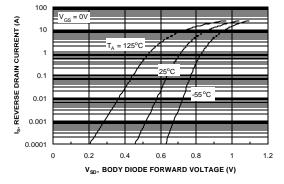
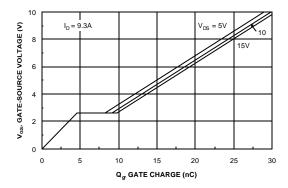


Figure 16. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics Q1



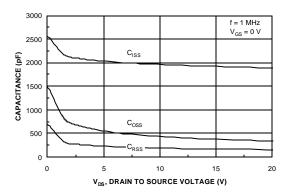
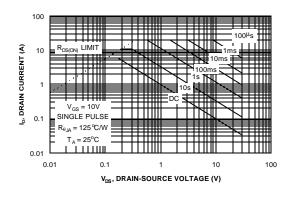


Figure 17. Gate Charge Characteristics.





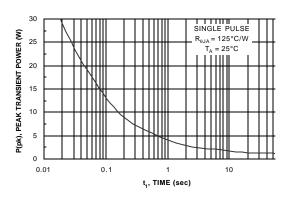


Figure 19. Maximum Safe Operating Area.

Figure 20. Single Pulse Maximum Power Dissipation.

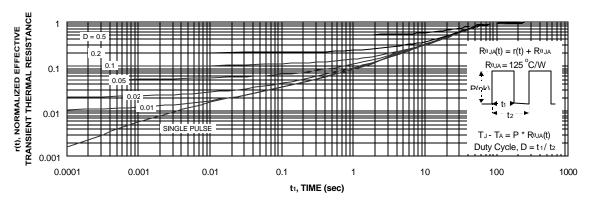


Figure 21. Transient Thermal Response Curve.

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

TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

FAST® ACEx™ OPTOPLANAR™ SuperSOT™-3 FASTr™ PACMAN™ SuperSOT™-6 Bottomless™ POPTM CoolFET™ FRFET™ SuperSOT™-8 CROSSVOLT™ SyncFET™ GlobalOptoisolator™ PowerTrench ® GTO^TM TinyLogic™ DenseTrench™ QFET™ UHC™ $HiSeC^{TM}$ QS^{TM} DOME™ EcoSPARK™ ISOPLANAR™ QT Optoelectronics™ UltraFET® VCX^{TM} E²CMOSTM LittleFET™ Quiet Series™

EnSigna™ MicroFET™ SILENT SWITCHER® FACT™ MICROWIRE™ SMART START™

FACT Quiet Series™ OPTOLOGIC™ Stealth™

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

- 1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.
- A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.