

# USB10H

## Dual P-Channel 2.5V Specified PowerTrench™ MOSFET

### General Description

These P-Channel 2.5V specified MOSFETs are produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize on-state resistance and yet maintain low gate charge for superior switching performance.

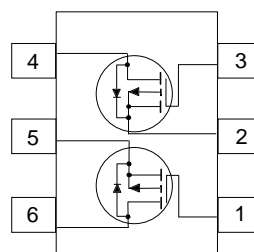
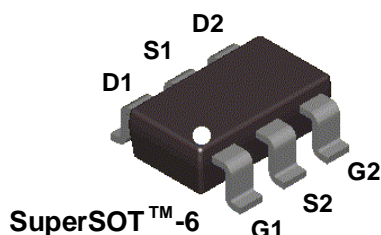
These devices have been designed to offer exceptional power dissipation in a very small footprint for applications where the bigger more expensive SO-8 and TSSOP-8 packages are impractical.

### Applications

- Load switch
- Battery protection
- Power management

### Features

- -1.9 A, -20 V.  $R_{DS(on)} = 0.170 \Omega @ V_{GS} = -4.5 V$   
 $R_{DS(on)} = 0.250 \Omega @ V_{GS} = -2.5 V$
- Low gate charge (3 nC typical).
- Fast switching speed.
- High performance trench technology for extremely low  $R_{DS(on)}$ .
- SuperSOT™-6 package: small footprint (72% smaller than standard SO-8); low profile (1mm thick).



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

Symbol	Parameter	Ratings	Units
V <sub>DSS</sub>	Drain-Source Voltage	-20	V
V <sub>GSS</sub>	Gate-Source Voltage	±8	V
I <sub>D</sub>	Drain Current - Continuous (Note 1a)	-1.9	A
		-5	
P <sub>D</sub>	Power Dissipation for Single Operation (Note 1a)	0.96	W
		0.9 (Note 1b)	
		0.7 (Note 1c)	
T <sub>J</sub> , T <sub>stg</sub>	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient (Note 1a)	130	°C/W
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case (Note 1)	60	°C/W

### Package Outlines and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
.306	USB10H	7"	8mm	3000 units

## Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		-18		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 8\text{ V}, V_{DS} = 0\text{ V}$			100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -8\text{ V}, V_{DS} = 0\text{ V}$			-100	nA

## On Characteristics (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	-0.4	-0.9	-1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		3		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = -4.5\text{ V}, I_D = -1.9\text{ A}$ $V_{GS} = -4.5\text{ V}, I_D = -1.9\text{ A}$ @ $125^\circ\text{C}$ $V_{GS} = -2.5\text{ V}, I_D = -1.7\text{ A}$		0.127 0.182 0.194	0.170 0.270 0.250	$\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = -4.5\text{ V}, V_{DS} = -5\text{ V}$	-5			A
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{ V}, I_D = -1.9\text{ A}$		4		S

## Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		441		pF
$C_{oss}$	Output Capacitance			127		pF
$C_{rss}$	Reverse Transfer Capacitance			67		pF

## Switching Characteristics (Note 2)

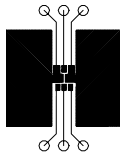
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -10\text{ V}, I_D = -1\text{ A},$ $V_{GS} = -4.5\text{ V}, R_{GEN} = 6\ \Omega$		6	12	ns
$t_r$	Turn-On Rise Time			9	18	ns
$t_{d(off)}$	Turn-Off Delay Time			14	25	ns
$t_f$	Turn-Off Fall Time			3	9	ns
$Q_g$	Total Gate Charge	$V_{DS} = -10\text{ V}, I_D = -1.9\text{ A},$ $V_{GS} = -4.5\text{ V}$		3	4.2	nC
$Q_{gs}$	Gate-Source Charge			0.7		nC
$Q_{gd}$	Gate-Drain Charge			0.8		nC

## Drain-Source Diode Characteristics and Maximum Ratings

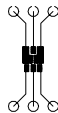
$I_S$	Maximum Continuous Drain-Source Diode Forward Current			-0.8	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = -0.8\text{ A}$ (Note 2)		-0.8	-1.2	V

### Notes:

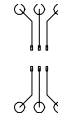
- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta JA}$  is determined by the user's board design. Both devices are assumed to be operating and sharing the dissipated heat energy equally.



a)  $130\ ^\circ\text{C/W}$  when mounted on a  $0.125\text{ in}^2$  pad of 2 oz. copper.



b)  $140\ ^\circ\text{C/W}$  when mounted on a  $0.005\text{ in}^2$  pad of 2 oz. copper.



c)  $180\ ^\circ\text{C/W}$  when mounted on a  $0.0015\text{ in}^2$  pad of 2 oz. copper.

Scale 1 : 1 on letter size paper

- Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$

### Typical Characteristics

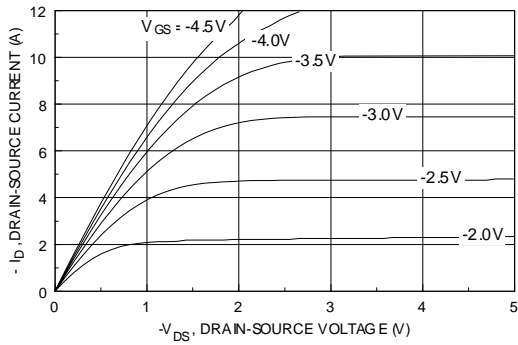


Figure 1. On-Region Characteristics.

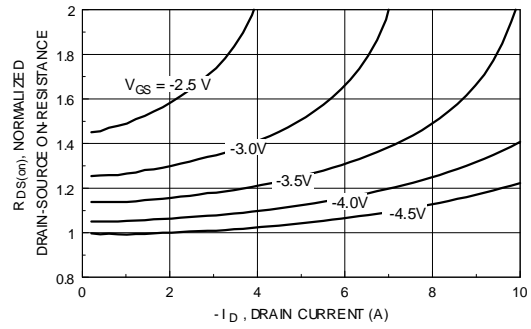


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

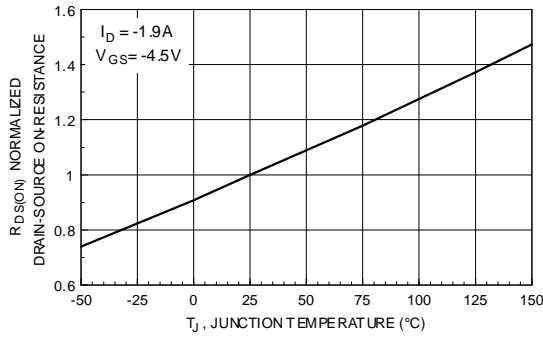


Figure 3. On-Resistance Variation with Temperature.

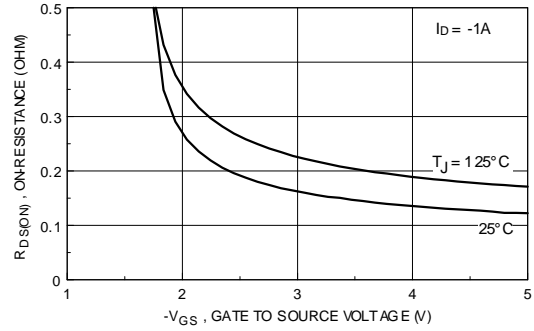


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

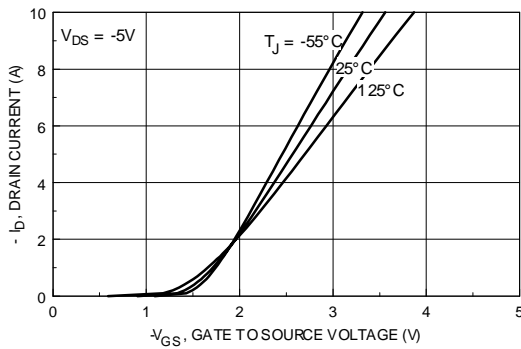


Figure 5. Transfer Characteristics.

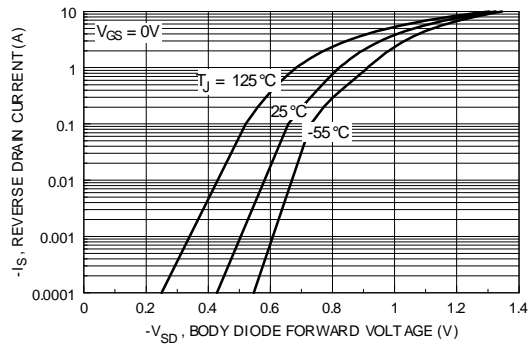


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics (continued)

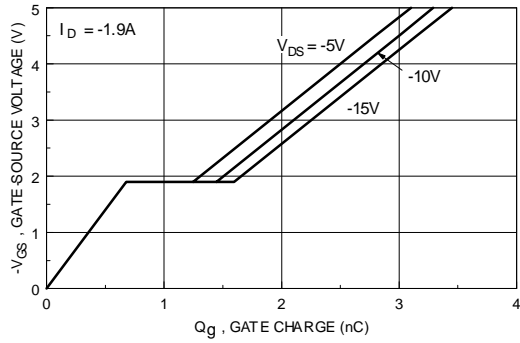


Figure 7. Gate-Charge Characteristics.

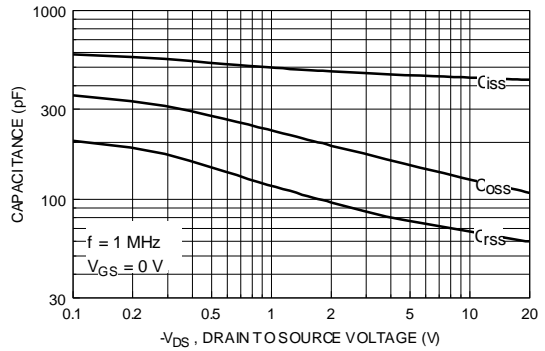


Figure 8. Capacitance Characteristics.

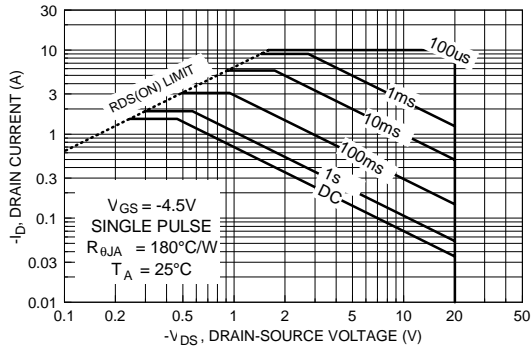


Figure 9. Maximum Safe Operating Area.

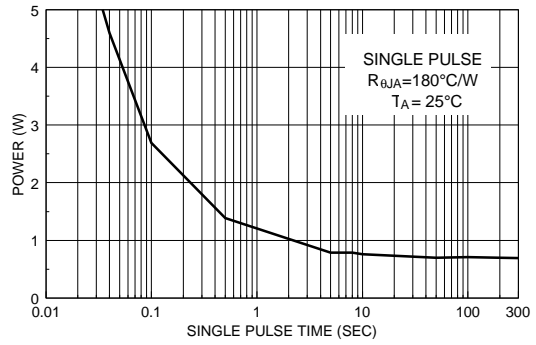


Figure 10. Single Pulse Maximum Power Dissipation.

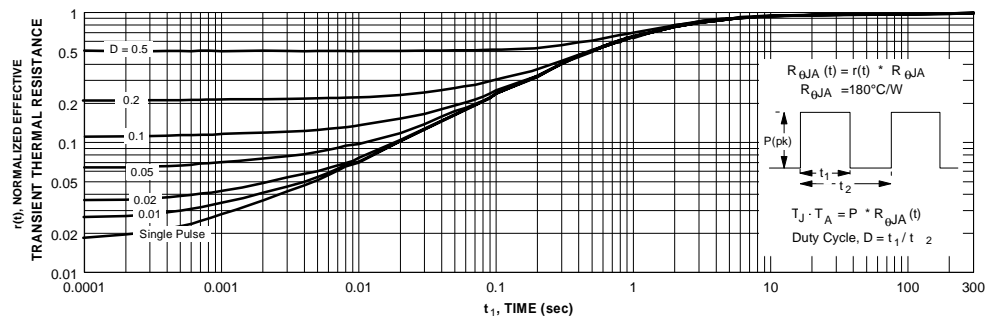


Figure 11. Transient Thermal Response Curve.

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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