



ON Semiconductor®

# FDC6506P

## Dual P-Channel Logic Level PowerTrench™ MOSFET

### General Description

These P-Channel logic level MOSFETs are produced using ON 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.

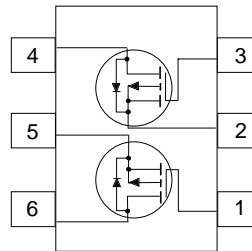
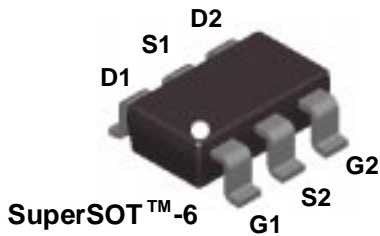
These devices have been designed to offer exceptional power dissipation in a very small footprint for applications where the bigger more expensive SO-8 and TSSOP-8 packages are impractical.

### Applications

- Load switch
- Battery protection
- Power management

### Features

- -1.8 A, -30 V.  $R_{DS(on)} = 0.170 \Omega @ V_{GS} = -10 \text{ V}$   
 $R_{DS(on)} = 0.280 \Omega @ V_{GS} = -4.5 \text{ V}$
- Low gate charge (2.3nC 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	-30	V
V <sub>GSS</sub>	Gate-Source Voltage	±20	V
I <sub>D</sub>	Drain Current - Continuous (Note 1a) - Pulsed	-1.8	A
		-10	
P <sub>D</sub>	Power Dissipation for Single Operation (Note 1a) (Note 1b) (Note 1c)	0.96	W
		0.9	
		0.7	
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
.506	FDC6506P	7"	8mm	3000 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Off Characteristics**

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		-20		$\text{mV}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -24\text{ V}, V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$			-100	nA

**On Characteristics** (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	-1	-1.8	-3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		4		$\text{mV}/^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = -10\text{ V}, I_D = -1.8\text{ A}$ $V_{GS} = -10\text{ V}, I_D = -1.8\text{ A}$ @ $125^\circ\text{C}$ $V_{GS} = -4.5\text{ V}, I_D = -1.4\text{ A}$		0.14 0.20 0.22	0.17 0.27 0.28	$\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = -10\text{ V}, V_{DS} = -5\text{ V}$	-10			A
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{ V}, I_D = -1.8\text{ A}$		3		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = -15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		190		pF
$C_{oss}$	Output Capacitance			70		pF
$C_{rss}$	Reverse Transfer Capacitance			30		pF

**Switching Characteristics** (Note 2)

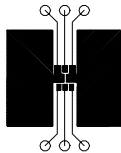
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -15\text{ V}, I_D = -1\text{ A},$ $V_{GS} = -4.5\text{ V}, R_{GEN} = 6\ \Omega$		7	14	ns
$t_r$	Turn-On Rise Time			8	16	ns
$t_{d(off)}$	Turn-Off Delay Time			14	25	ns
$t_f$	Turn-Off Fall Time			2	6	ns
$Q_g$	Total Gate Charge	$V_{DS} = -5\text{ V}, I_D = -1.8\text{ A},$ $V_{GS} = -10\text{ V}$		2.3	3.5	nC
$Q_{gs}$	Gate-Source Charge			1		nC
$Q_{gd}$	Gate-Drain Charge			0.8		nC

**Drain-Source Diode Characteristics and Maximum Ratings**

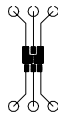
$I_S$	Maximum Continuous Drain-Source Diode Forward Current			-0.8	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = -0.8\text{ A}$ (Note 2)		-0.8	-1.2	V

**Notes:**

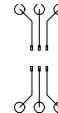
- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta JA}$  is determined by the user's board design. Both devices are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



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



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



c)  $180\ ^\circ\text{C}/\text{W}$  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

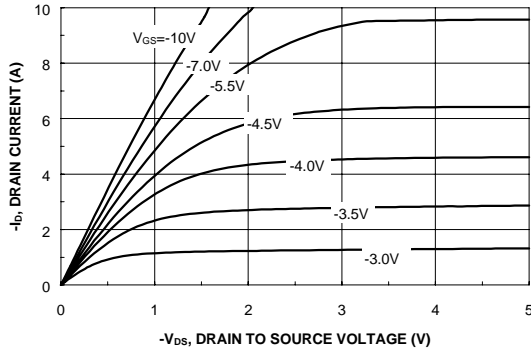


Figure 1. On-Region Characteristics.

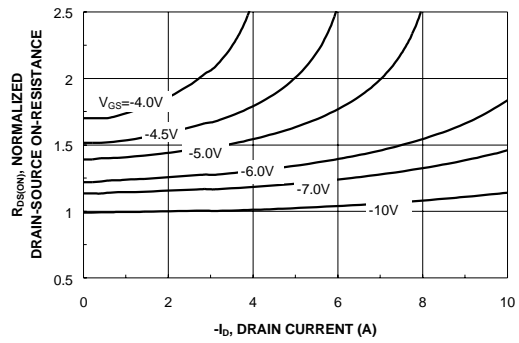


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

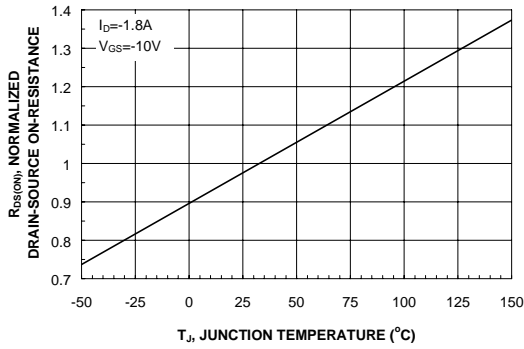


Figure 3. On-Resistance Variation with Temperature.

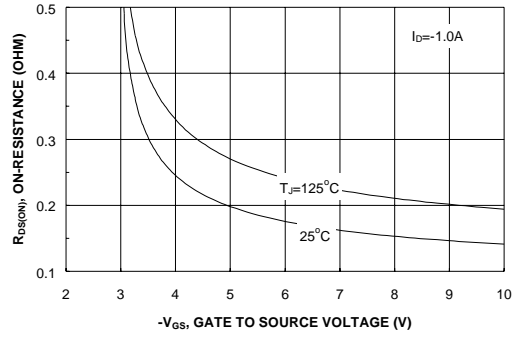


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

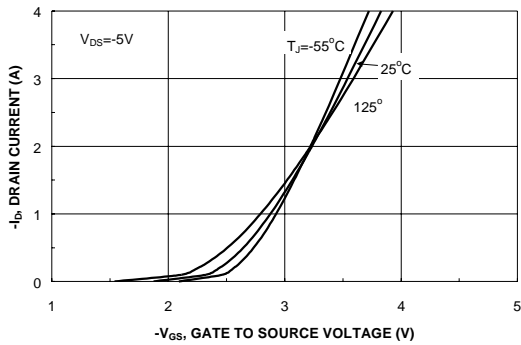


Figure 5. Transfer Characteristics.

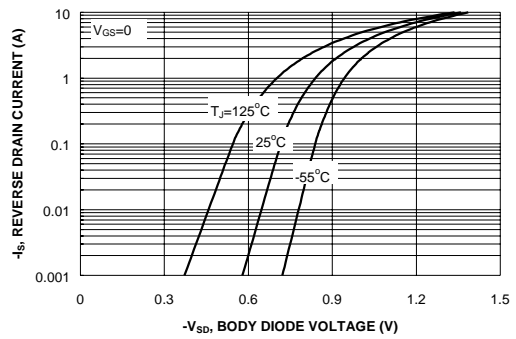
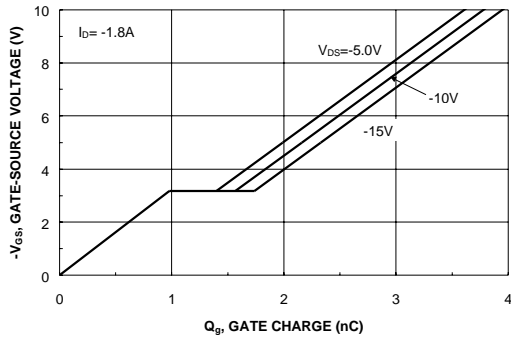
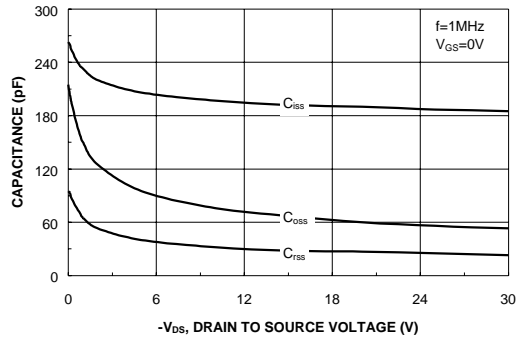


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

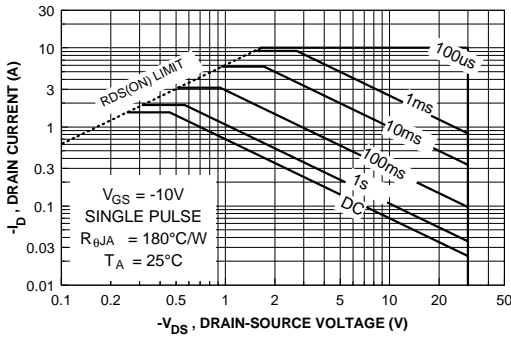
**Typical Characteristics** (continued)



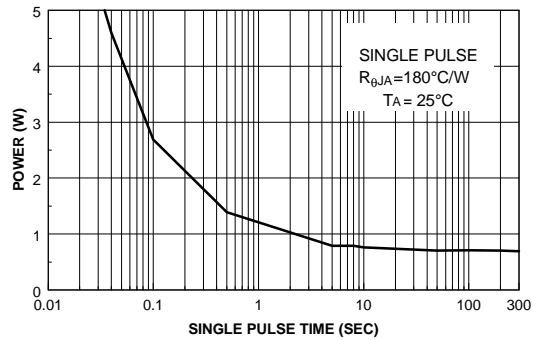
**Figure 7. Gate-Charge Characteristics.**



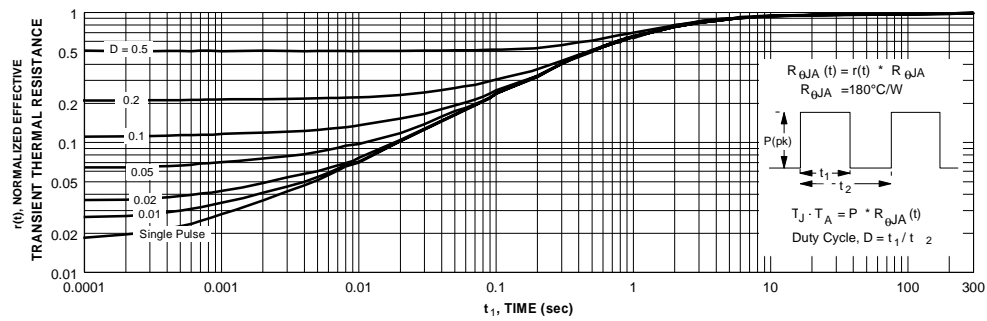
**Figure 8. Capacitance Characteristics.**



**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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