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ON Semiconductor®

# FDG312P

## P-Channel 2.5V Specified PowerTrench™ MOSFET

### General Description

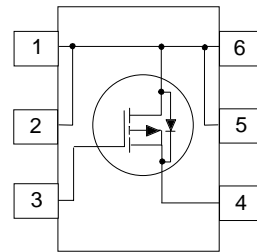
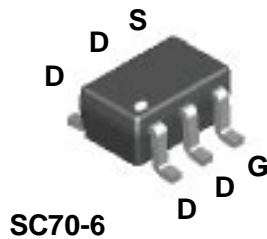
This P-Channel MOSFET is produced using ON Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain low gate charge for superior switching performance. These devices are well suited for portable electronics applications.

### Applications

- Load switch
- Battery protection
- Power management

### Features

- -1.2 A, -20 V.  $R_{DS(on)} = 0.18 \Omega @ V_{GS} = -4.5 V$   
 $R_{DS(on)} = 0.25 \Omega @ V_{GS} = -2.5 V$ .
- Low gate charge (3.3 nC typical).
- High performance trench technology for extremely low  $R_{DS(on)}$ .
- Compact industry standard SC70-6 surface mount package.



### 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 1) - Pulsed	-1.2	A
		-6	
P <sub>D</sub>	Power Dissipation for Single Operation (Note 1a)	0.75	W
	(Note 1b)	0.55	
	(Note 1c)	0.48	
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 1)	260	°C/W
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### Package Outlines and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
.12	FDG312P	7"	8mm	3000 units

## DMOS 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 $25^\circ\text{C}$		-19		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 $25^\circ\text{C}$		2.5		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = -4.5\text{ V}, I_D = -1.2\text{ A}$ $V_{GS} = -4.5\text{ V}, I_D = -1.2\text{ A}$ @ $125^\circ\text{C}$ $V_{GS} = -2.5\text{ V}, I_D = -1\text{ A}$		0.135 0.200 0.187	0.18 0.29 0.25	$\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = -4.5\text{ V}, V_{DS} = -5\text{ V}$	-3			A
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{ V}, I_D = -1.2\text{ A}$		3.8		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		330		pF
$C_{oss}$	Output Capacitance			80		pF
$C_{rss}$	Reverse Transfer Capacitance			35		pF

### Switching Characteristics (Note 2)

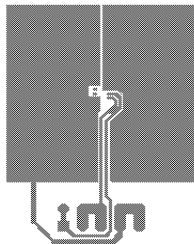
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -5\text{ V}, I_D = -0.5\text{ A},$ $V_{GS} = -4.5\text{ V}, R_{GEN} = 6\ \Omega$		7	15	ns
$t_r$	Turn-On Rise Time			12	22	ns
$t_{d(off)}$	Turn-Off Delay Time			16	26	ns
$t_f$	Turn-Off Fall Time			5	12	ns
$Q_g$	Total Gate Charge	$V_{DS} = -10\text{ V}, I_D = -1.2\text{ A},$ $V_{GS} = -4.5\text{ V}$		3.3	5	nC
$Q_{gs}$	Gate-Source Charge			0.8		nC
$Q_{gd}$	Gate-Drain Charge			0.7		nC

### Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current			-0.6	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = -0.6\text{ A}$ (Note 2)		-0.83	-1.2	V

#### Notes:

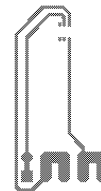
- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta JA}$  is determined by the user's board design.



a)  $170^\circ\text{C/W}$  when mounted on a  $1\text{ in}^2$  pad of 2oz copper.



b)  $225^\circ\text{C/W}$  when mounted on a half of package sized 2oz copper.



c)  $260^\circ\text{C/W}$  when mounted on a minimum pad of 2oz copper.

Scale 1 : 1 on letter size paper

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

### Typical Characteristics

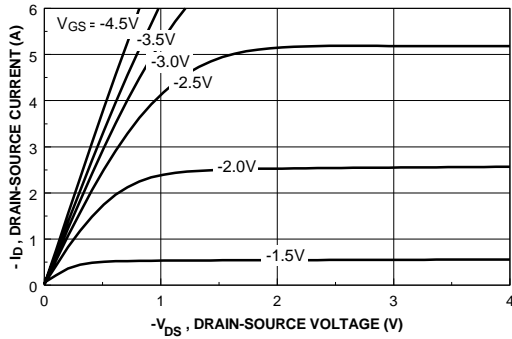


Figure 1. On-Region Characteristics.

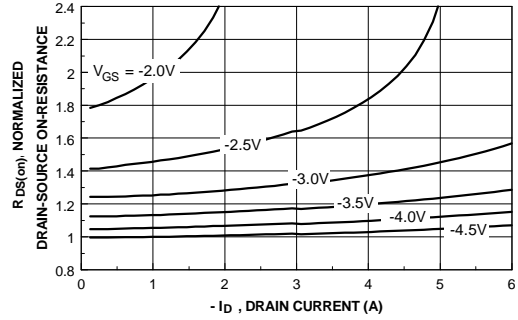


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

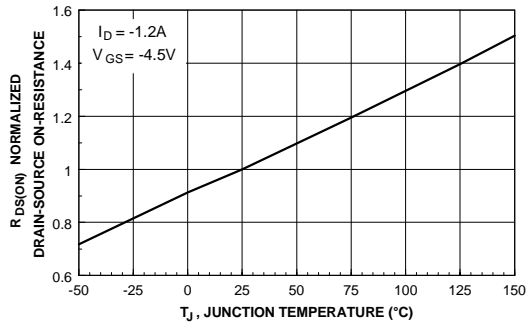


Figure 3. On-Resistance Variation with Temperature.

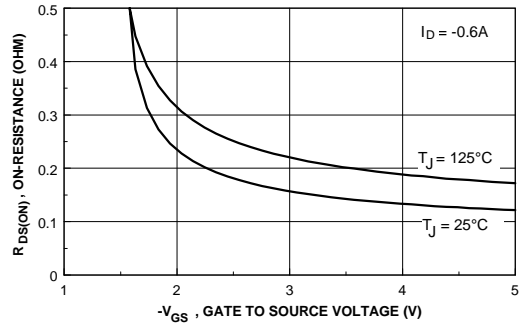


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

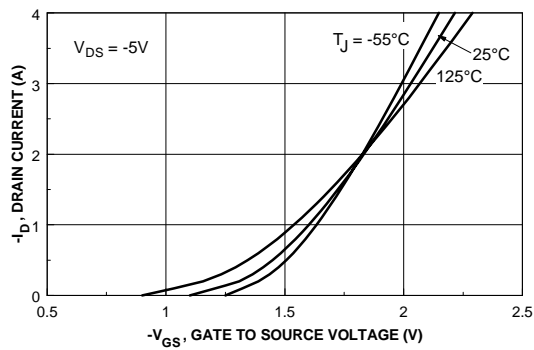


Figure 5. Transfer Characteristics.

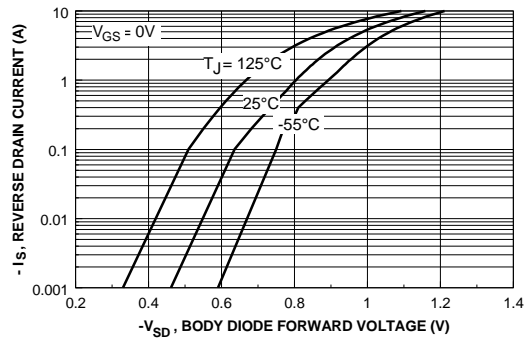


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics (continued)

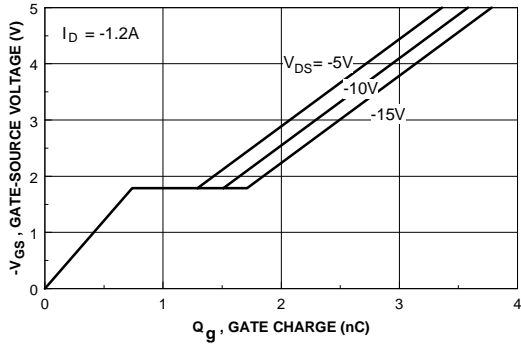


Figure 7. Gate-Charge Characteristics.

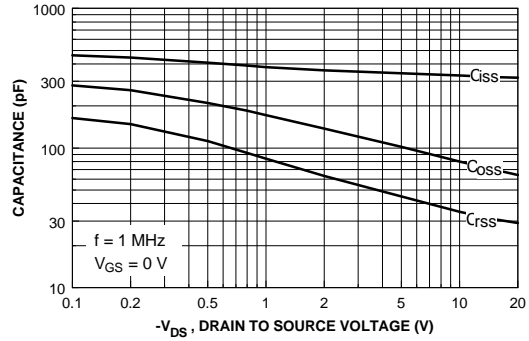


Figure 8. Capacitance Characteristics.

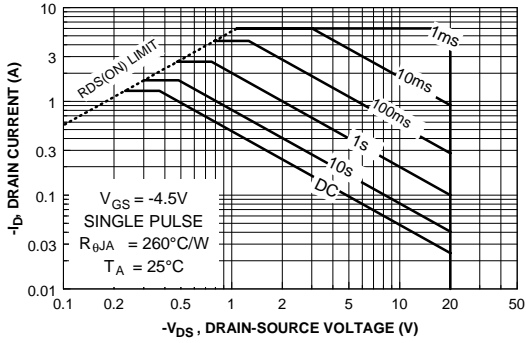


Figure 9. Maximum Safe Operating Area.

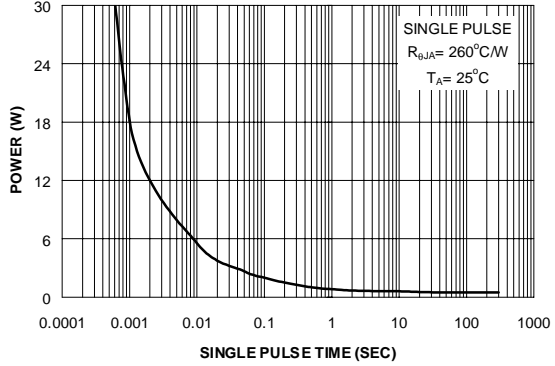


Figure 10. Single Pulse Maximum Power Dissipation.

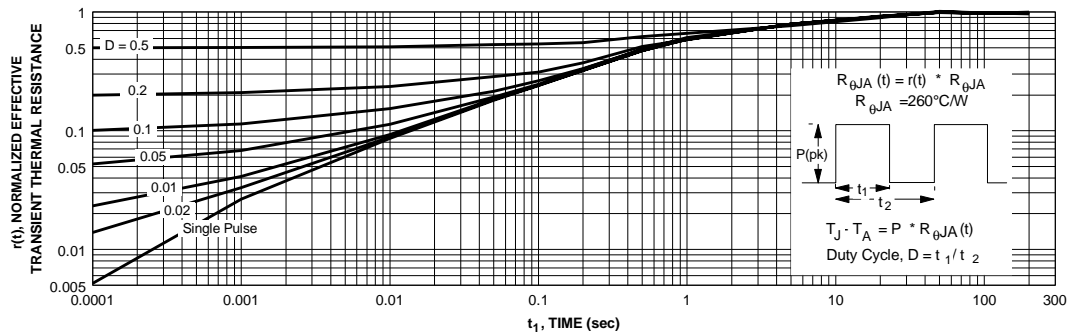


Figure 11. Transient Thermal Response Curve.

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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