

# FDC610PZ

## P-Channel PowerTrench® MOSFET

-30V, -4.9A, 42mΩ

### Features

- Max  $r_{DS(on)}$  = 42mΩ at  $V_{GS} = -10V$ ,  $I_D = -4.9A$
- Max  $r_{DS(on)}$  = 75mΩ at  $V_{GS} = -4.5V$ ,  $I_D = -3.7A$
- Low gate charge (17nC typical).
- 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).
- RoHS Compliant

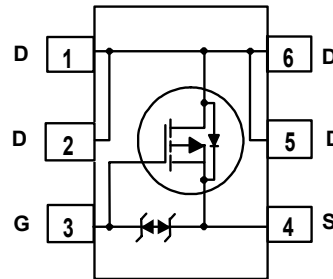
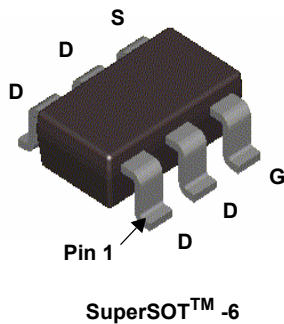


### General Description

This P-Channel MOSFET is produced using Fairchild 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 battery power applications: load switching and power management, battery charging circuits, and DC/DC conversion.

### Application

- DC - DC Conversion



### MOSFET Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Rated	Units
$V_{DS}$	Drain to Source Voltage	-30	V
$V_{GS}$	Gate to Source Voltage	±25	V
$I_D$	Drain Current -Continuous (Note 1a)	-4.9	A
	-Pulsed	-20	
$P_D$	Power Dissipation (Note 1a)	1.6	W
	Power Dissipation (Note 1b)	0.8	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	78	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	156	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
.610Z	FDC610PZ	SSOT6	7"	8mm	3000units

## Electrical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
--------	-----------	-----------------	-----	-----	-----	-------

### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = -250\mu\text{A}, V_{GS} = 0\text{V}$	-30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$		-22		mV/°C
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -24\text{V}, V_{GS} = 0\text{V}$			-1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 25\text{V}, V_{DS} = 0\text{V}$			$\pm 10$	$\mu\text{A}$

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = -250\mu\text{A}$	-1	-2.2	-3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$		6		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -10\text{V}, I_D = -4.9\text{A}$		36	42	m $\Omega$
		$V_{GS} = -4.5\text{V}, I_D = -3.7\text{A}$		58	75	
		$V_{GS} = -10\text{V}, I_D = -4.9\text{A}, T_J = 125^\circ\text{C}$		50	60	
$g_{FS}$	Forward Transconductance	$V_{DD} = -10\text{V}, I_D = -4.9\text{A}$		15		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -15\text{V}, V_{GS} = 0\text{V},$ $f = 1\text{MHz}$		755	1005	pF
$C_{oss}$	Output Capacitance			145	195	pF
$C_{rss}$	Reverse Transfer Capacitance			125	190	pF
$R_g$	Gate Resistance		$f = 1\text{MHz}$		13	

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -15\text{V}, I_D = -4.9\text{A}$ $V_{GS} = -10\text{V}, R_{GEN} = 6\Omega$		7	14	ns
$t_r$	Rise Time			4	10	ns
$t_{d(off)}$	Turn-Off Delay Time			33	53	ns
$t_f$	Fall Time			23	37	ns
$Q_g$	Total Gate Charge		$V_{GS} = 0\text{V to } -10\text{V}$	$V_{DD} = -15\text{V},$ $I_D = -4.9\text{A}$	17	24
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{V to } -4.5\text{V}$	9		13	nC
$Q_{gs}$	Gate to Source Gate Charge		2.9			nC
$Q_{gd}$	Gate to Drain "Miller" Charge		4.3			nC

### Drain-Source Diode Characteristics

$I_S$	Maximum Continuous Drain-Source Diode Forward Current			-1.3	A	
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = -1.3\text{A}$ (Note 2)		-0.8	-1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = -4.9\text{A}, di/dt = 100\text{A}/\mu\text{s}$		19	35	ns
$Q_{rr}$	Reverse Recovery Charge			9	18	nC

#### Notes:

1.  $R_{\theta JA}$  is determined with the device mounted on a  $1\text{in}^2$  pad 2 oz copper pad on a  $1.5 \times 1.5\text{in.}$  board of FR-4 material.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



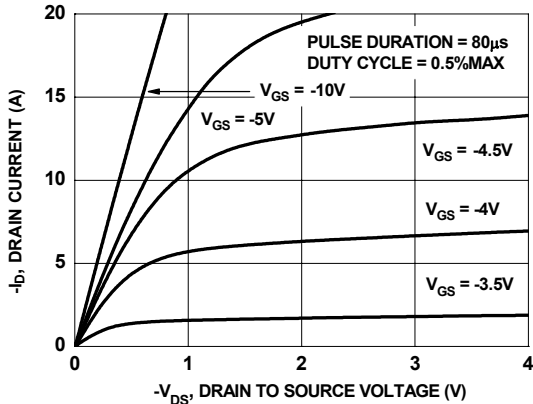
a.  $78^\circ\text{C/W}$  when mounted on a  $1\text{in}^2$  pad of 2 oz copper.



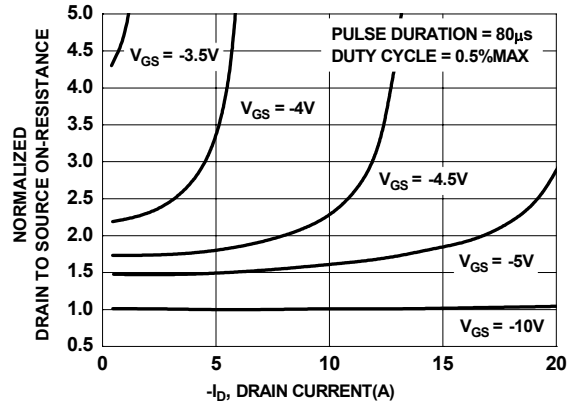
b.  $156^\circ\text{C/W}$  when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width <  $300\mu\text{s}$ , Duty cycle < 2.0%.

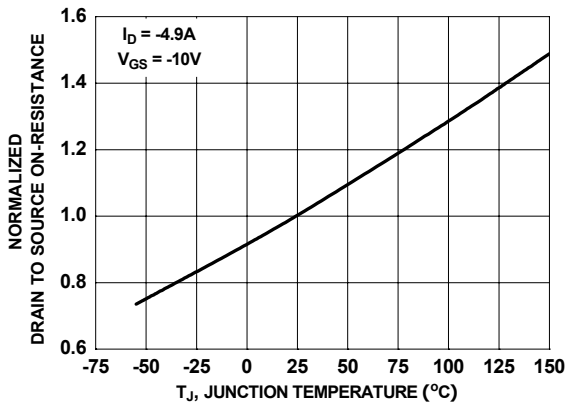
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



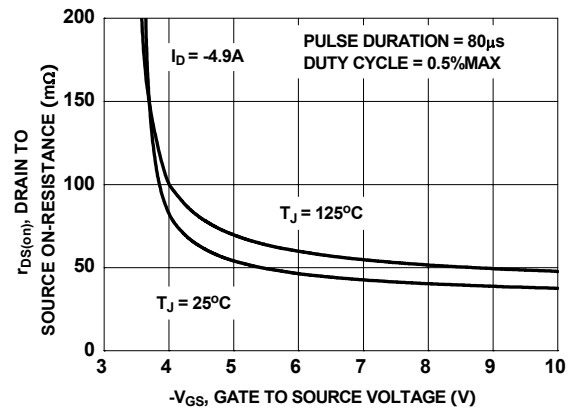
**Figure 1. On-Region Characteristics**



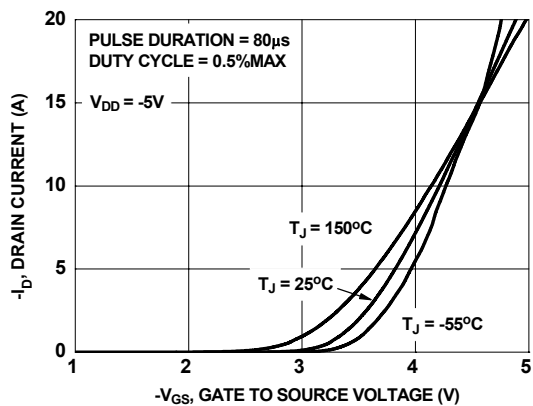
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



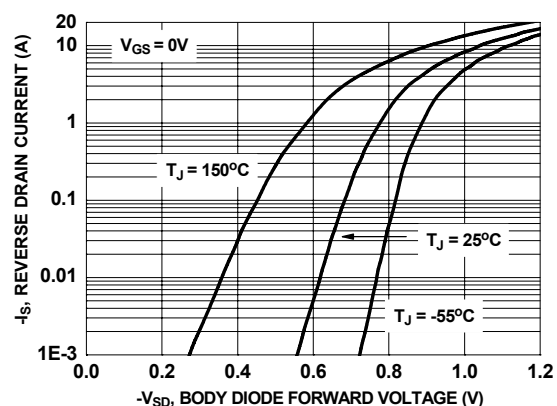
**Figure 3. Normalized On-Resistance vs Junction Temperature**



**Figure 4. On-Resistance vs Gate to Source Voltage**

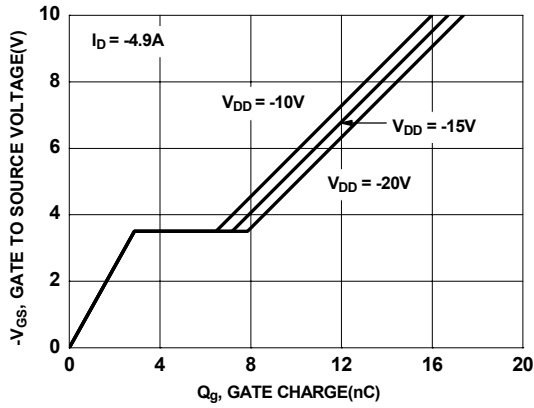


**Figure 5. Transfer Characteristics**

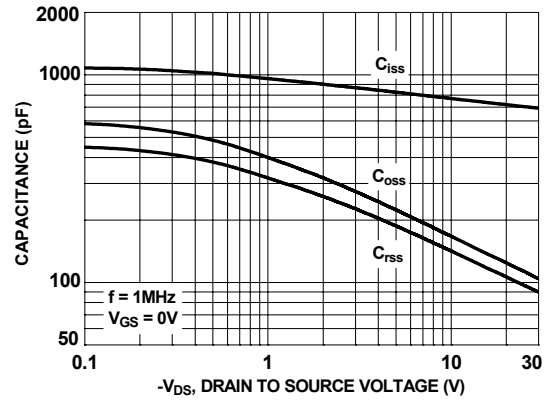


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

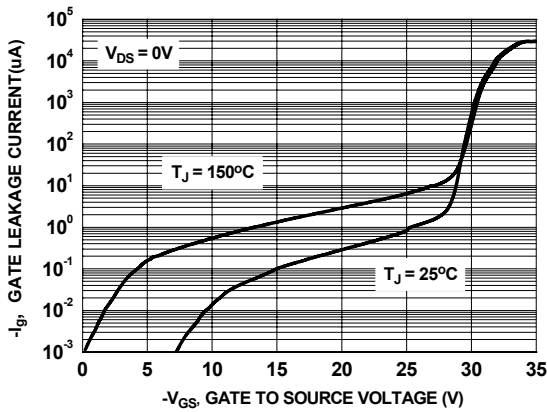
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



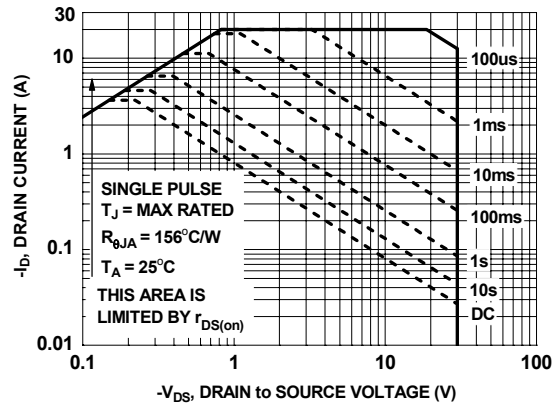
**Figure 7. Gate Charge Characteristics**



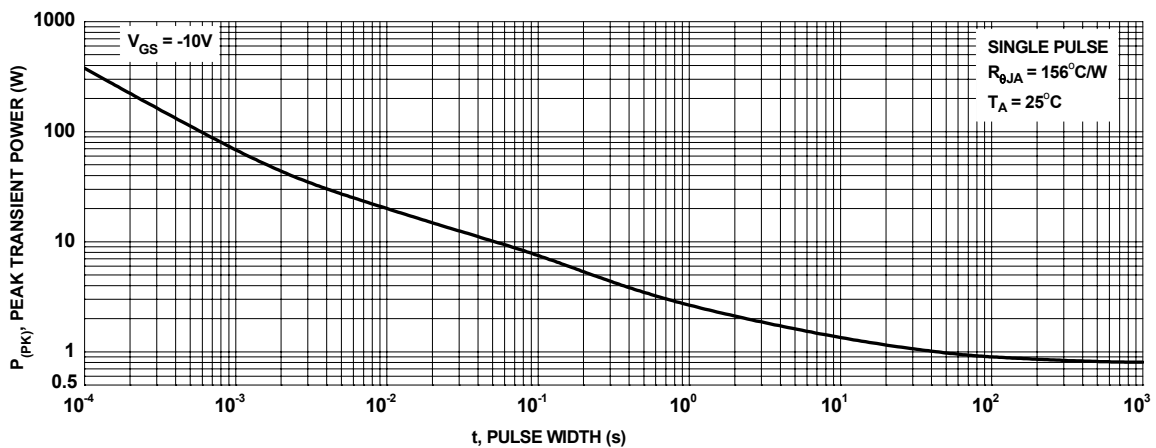
**Figure 8. Capacitance vs Drain to Source Voltage**



**Figure 9. Gate Leakage Current vs Gate to Source Voltage**

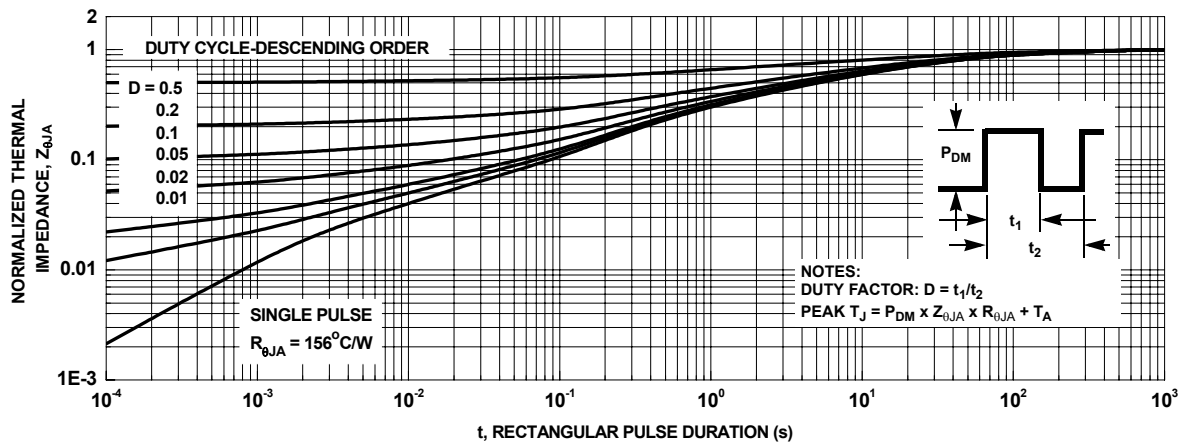


**Figure 10. Forward Bias Safe Operating Area**



**Figure 11. Single Pulse Maximum Power Dissipation**

**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



**Figure 12. Transient Thermal Response Curve**



**TRADEMARKS**

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

- |                                     |                      |                            |                      |
|-------------------------------------|----------------------|----------------------------|----------------------|
| ACEx®                               | Green FPS™           | Power247®                  | SuperSOT™-8          |
| Build it Now™                       | Green FPS™ e-Series™ | POWEREDGE®                 | SyncFET™             |
| CorePLUS™                           | GTO™                 | Power-SPM™                 | The Power Franchise® |
| CROSSVOLT™                          | i-Lo™                | PowerTrench®               | the power franchise  |
| CTL™                                | IntelliMAX™          | Programmable Active Droop™ | TinyBoost™           |
| Current Transfer Logic™             | ISOPLANAR™           | QFET®                      | TinyBuck™            |
| EcoSPARK®                           | MegaBuck™            | QS™                        | TinyLogic®           |
| <b>F</b> ®                          | MICROCOUPLER™        | QT Optoelectronics™        | TINYOPTO™            |
| Fairchild®                          | MicroFET™            | Quiet Series™              | TinyPower™           |
| Fairchild Semiconductor®            | MicroPak™            | RapidConfigure™            | TinyPWM™             |
| FACT Quiet Series™                  | MillerDrive™         | SMART START™               | TinyWire™            |
| FACT®                               | Motion-SPM™          | SPM®                       | μSerDes™             |
| FAST®                               | OPTOLOGIC®           | STEALTH™                   | UHC®                 |
| FastvCore™                          | OPTOPLANAR®          | SuperFET™                  | UniFET™              |
| FPS™                                | ®                    | SuperSOT™-3                | VCX™                 |
| FRFET®                              | PDP-SPM™             | SuperSOT™-6                |                      |
| Global Power Resource <sup>SM</sup> | Power220®            |                            |                      |

**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. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

**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, and (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 a significant injury of the user.
2. A critical component in 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; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice 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 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.