

FDC658AP

Single P-Channel Logic Level PowerTrench® MOSFET

-30V, -4A, 50mΩ

General Description

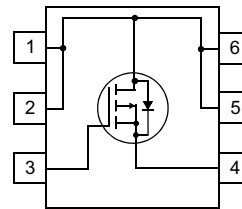
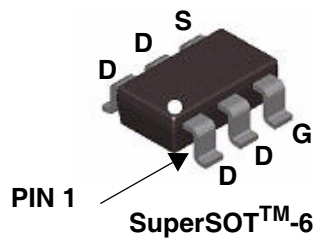
This P-Channel Logic Level MOSFET is produced using Fairchild's advanced PowerTrench process. It has been optimized for battery power management applications.

Applications

- Battery management
- Load switch
- Battery protection
- DC/DC conversion

Features

- Max $r_{DS(on)}$ = 50 mΩ @ $V_{GS} = -10$ V, $I_D = -4$ A
- Max $r_{DS(on)}$ = 75 mΩ @ $V_{GS} = -4.5$ V, $I_D = -3.4$ A
- Low Gate Charge
- High performance trench technology for extremely low $r_{DS(on)}$
- RoHS Compliant



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

Symbol	Parameter	Rated Value	Units
V_{DS}	Drain-Source Voltage	-30	V
V_{GS}	Gate-Source Voltage	± 25	V
I_D	Drain Current - Continuous (Note 1a)	-4	A
	- Pulsed	-20	
P_D	Maximum Power dissipation (Note 1a)	1.6	W
	(Note 1b)	0.8	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	78	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	30	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
.58A	FDC658AP	7inch	8mm	3000 units

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

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

Off Characteristics

BV_{DSS}	Drain-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°C		-22		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{GS} = 0\text{V}, V_{DS} = -24\text{V}$			-1	μA
I_{GSS}	Gate-Body Leakage	$V_{GS} = \pm 25\text{V}, V_{DS} = 0\text{V}$			± 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°C		4		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain-Source On-Resistance	$I_D = -4\text{A}, V_{GS} = -10\text{V}$		44	50	m Ω
		$I_D = -3.4\text{A}, V_{GS} = -4.5\text{V}$		67	75	
		$I_D = -4\text{A}, V_{GS} = -10\text{V}$, $T_J = 125^\circ\text{C}$		60	70	
$I_{D(ON)}$	On-State Drain Current	$V_{GS} = -10\text{V}, V_{DS} = -5\text{V}$	-20			A
g_{FS}	Forward Transconductance	$I_D = -4\text{A}, V_{DS} = -5\text{V}$		8.4		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = -15\text{V}, V_{GS} = 0\text{V}$, $f = 1\text{MHz}$		470		pF
C_{oss}	Output Capacitance			126		pF
C_{rss}	Reverse Transfer Capacitance			61		pF

Switching Characteristics (Note 2)

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -15\text{V}, I_D = -1\text{A}$, $V_{GS} = -10\text{V}, R_{GEN} = 6\Omega$		7	14	ns
t_r	Turn-On Rise Time			12	22	ns
$t_{d(off)}$	Turn-Off Delay Time			16	29	ns
t_f	Turn-Off Fall Time			6	12	ns
Q_g	Total Gate Charge			6	8.1	nC
Q_{gs}	Gate-Source Charge	$V_{DS} = -15\text{V}, I_D = -4\text{A}$, $V_{GS} = -5\text{V}$		2.1		nC
Q_{gd}	Gate-Drain Charge			2		nC

Drain-Source Diode Characteristics and Maximum Ratings

I_S	Maximum Continuous Drain-Source Diode Forward Current			-1.3	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = -1.3\text{A}$ (Note 2)	-0.77	-1.2	V

Notes:

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



a) 78°C/W when mounted on a 1 in^2 pad of 2 oz copper



b) 156°C/W when mounted on a minimum pad of 2 oz copper

Scale 1: 1 on letter size paper

2: Pulse Test: Pulse Width < 300 μs , Duty Cycle < 2.0%

Typical Characteristics

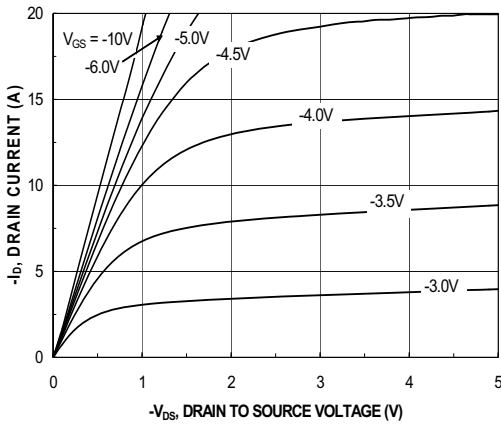


Figure 1. On-Region Characteristics

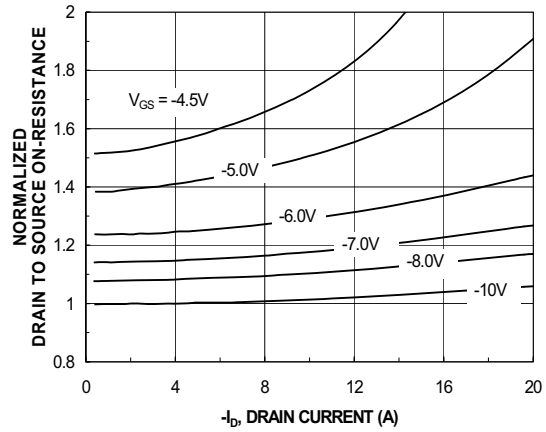


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

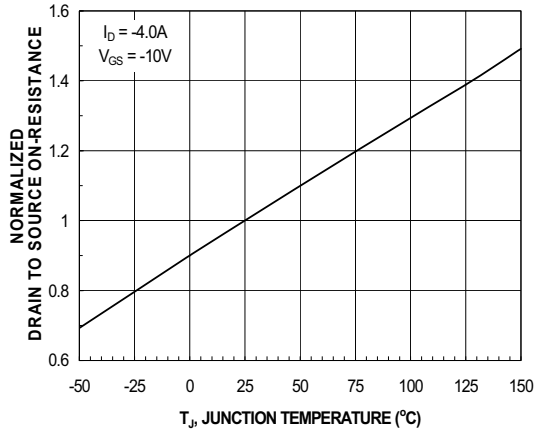


Figure 3. Normalized On-Resistance vs Junction Temperature

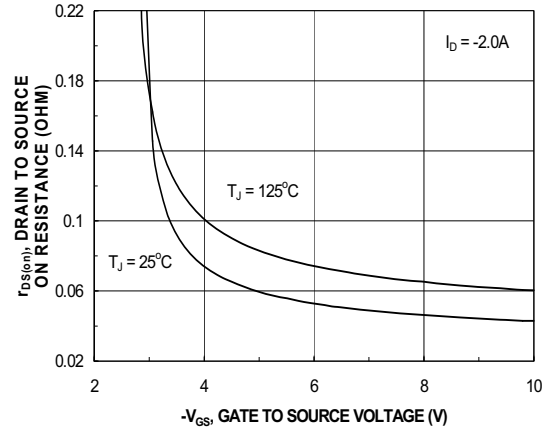


Figure 4. On-Resistance vs Gate to Source Voltage

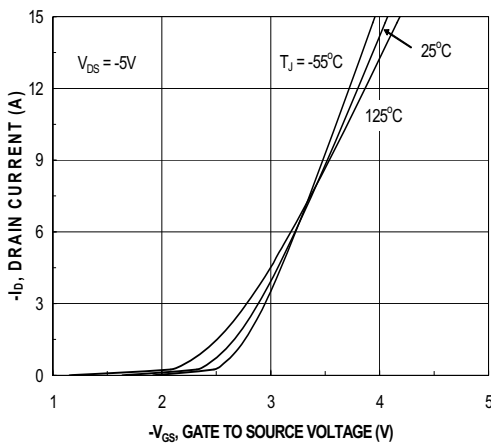


Figure 5. Transfer Characteristics

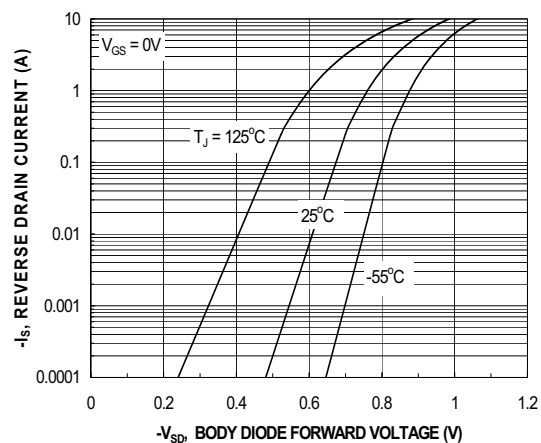


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics

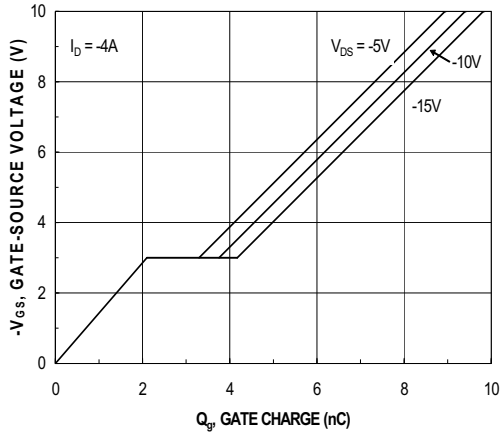


Figure 7. Gate Charge Characteristics

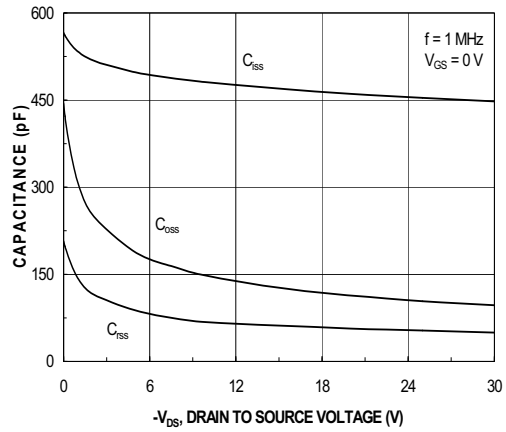


Figure 8. Capacitance vs Drain to Source Voltage

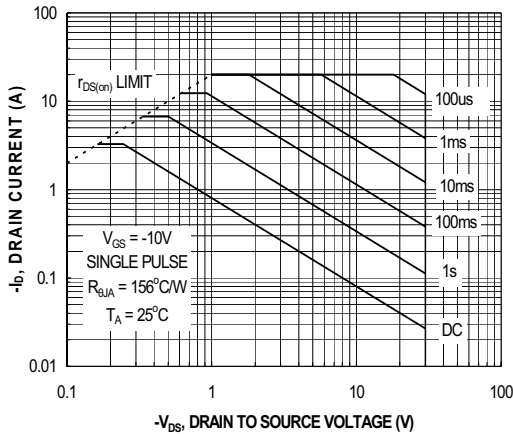


Figure 9. Forward Bias Safe Operating Area

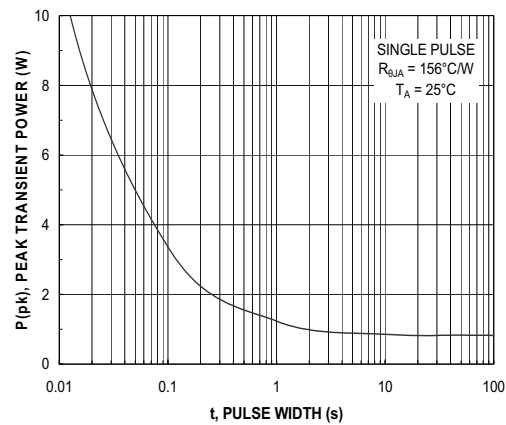


Figure 10. Single Pulse Maximum Power Dissipation

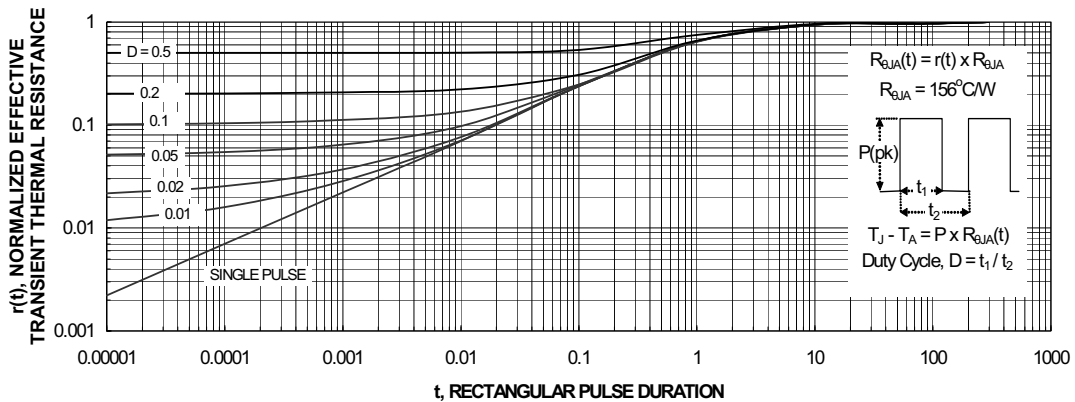







Figure 11. Transient Thermal Response Curve

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



TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

- | | | | |
|---|---|---|---|
| 2Cool™ | FPS™ | PDP SPM™ | The Power Franchise® |
| AccuPower™ | F-PFS™ | Power-SPM™ | the power® |
| Auto-SPM™ | FRFET® | PowerTrench® | franchise® |
| AX-CAP™* | Global Power Resource SM | PowerXS™ | TinyBoost™ |
| BitSiC® | Green FPS™ | Programmable Active Droop™ | TinyBuck™ |
| Build it Now™ | Green FPS™ e-Series™ | QFET® | TinyCalc™ |
| CorePLUS™ | Gmax™ | QS™ | TinyLogic® |
| CorePOWER™ | GTO™ | Quiet Series™ | TINYOPTO™ |
| CROSSVOLT™ | IntelliMAX™ | RapidConfigure™ | TinyPower™ |
| CTL™ | ISOPLANAR™ | TM | TinyPWM™ |
| Current Transfer Logic™ | Marking Small Speakers Sound Louder and Better™ |  Saving our world, 1mW/W/kW at a time™ | TinyWire™ |
| DEUXPEED® | MegaBuck™ | SignalWise™ | TranSiC® |
| Dual Cool™ | MICROCOUPLER™ | SmartMax™ | TriFault Detect™* |
| EcoSPARK® | MicroFET™ | SMART START™ | TRUECURRENT®* |
| EfficientMax™ | MicroPak™ | Solutions for Your Success™ | µSerDes™ |
| ESBC™ | MicroPak2™ | SPM® |  SerDes™ |
|  | MillerDrive™ | STEALTH™ | UHC® |
| Fairchild® | MotionMax™ | SuperFET® | Ultra FRFET™ |
| Fairchild Semiconductor® | Motion-SPM™ | SuperFET™-3 | UniFET™ |
| FACT Quiet Series™ | mWSaver™ | SuperSOT™-6 | VCX™ |
| FACT® | OptoHiT™ | SuperSOT™-8 | VisualMax™ |
| FAST® | OPTOLOGIC® | SupreMOS® | VoltagePlus™ |
| FastvCore™ | OPTOPLANAR® | SyncFET™ | XS™ |
| FETBench™ | ® | Sync-Lock™ | |
| FlashWriter®* |  |  SYSTEM GENERAL®* | |

*Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

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 here in:

- 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.
- 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.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.Fairchildsemi.com, under Sales Support. Counterfeiting of semiconductor parts is a growing problem in the industry. All manufactures of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed application, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address and warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	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	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.