

FDC699P

P-Channel 2.5V PowerTrench® MOSFET

General Description

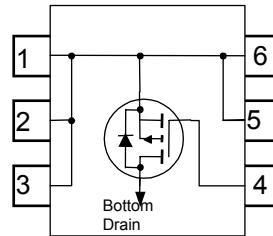
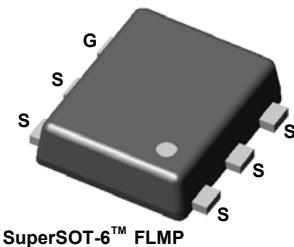
This P-Channel 2.5V specified MOSFET is a rugged gate version of Fairchild Semiconductor's advanced PowerTrench process. It has been optimized for power management applications with a wide range of gate drive voltage (2.5V – 12V).

Applications

- Battery management
- Load Switch
- Battery protection

Features

- -7 A, -20 V $R_{DS(ON)} = 22 \text{ m}\Omega$ @ $V_{GS} = -4.5 \text{ V}$
 $R_{DS(ON)} = 30 \text{ m}\Omega$ @ $V_{GS} = -2.5 \text{ V}$
- High performance trench technology for extremely low $R_{DS(ON)}$
- Fast switching speed
- FLMP SuperSOT-6 package: Enhanced thermal performance in industry-standard package size



Absolute Maximum Ratings

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

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain-Source Voltage	-20	V
V_{GSS}	Gate-Source Voltage	± 12	V
I_D	Drain Current – Continuous (Note 1a)	-7	A
	– Pulsed	-40	
P_D	Power Dissipation (Note 1a)	1.9	W
	(Note 1b)	1.5	
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)	68	°C/W
		111	

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
.699	FDC699P	7"	8mm	3000 units

Electrical Characteristics

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

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

Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$\text{V}_{\text{GS}} = 0 \text{ V}$, $\text{I}_D = -250 \mu\text{A}$	-20			V
$\Delta \text{BV}_{\text{DSS}}$ ΔT_J	Breakdown Voltage Temperature Coefficient	$\text{I}_D = -250 \mu\text{A}$, Referenced to 25°C		-12		$\text{mV/}^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$\text{V}_{\text{DS}} = -16 \text{ V}$, $\text{V}_{\text{GS}} = 0 \text{ V}$			-1	μA
I_{GSS}	Gate-Body Leakage	$\text{V}_{\text{GS}} = \pm 12 \text{ V}$, $\text{V}_{\text{DS}} = 0 \text{ V}$			± 100	nA

On Characteristics (Note 2)

$\text{V}_{\text{GS}(\text{th})}$	Gate Threshold Voltage	$\text{V}_{\text{DS}} = \text{V}_{\text{GS}}$, $\text{I}_D = -250 \mu\text{A}$	-0.6	-0.9	-1.5	V
$\Delta \text{V}_{\text{GS}(\text{th})}$ ΔT_J	Gate Threshold Voltage Temperature Coefficient	$\text{I}_D = -250 \mu\text{A}$, Referenced to 25°C		3		$\text{mV/}^\circ\text{C}$
$\text{R}_{\text{DS}(\text{on})}$	Static Drain-Source On-Resistance	$\text{V}_{\text{GS}} = -4.5 \text{ V}$, $\text{I}_D = -7 \text{ A}$ $\text{V}_{\text{GS}} = -2.5 \text{ V}$, $\text{I}_D = -6 \text{ A}$ $\text{V}_{\text{GS}} = -4.5 \text{ V}$, $\text{I}_D = -7 \text{ A}$, $T_J = 125^\circ\text{C}$		14 21 17	22 30 31	$\text{m}\Omega$
$\text{I}_{\text{D}(\text{on})}$	On-State Drain Current	$\text{V}_{\text{GS}} = -4.5 \text{ V}$, $\text{V}_{\text{DS}} = -5 \text{ V}$	-40			A
g_{FS}	Forward Transconductance	$\text{V}_{\text{DS}} = -5 \text{ V}$, $\text{I}_D = -7 \text{ A}$		30		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$\text{V}_{\text{DS}} = -10 \text{ V}$, $\text{V}_{\text{GS}} = 0 \text{ V}$		2640		pF
C_{oss}	Output Capacitance	$\text{f} = 1.0 \text{ MHz}$		560		pF
C_{rss}	Reverse Transfer Capacitance			280		pF
R_G	Gate Resistance	$\text{V}_{\text{GS}} = 15 \text{ mV}$, $\text{f} = 1.0 \text{ MHz}$		3.6		Ω

Switching Characteristics (Note 2)

$t_{\text{d}(\text{on})}$	Turn-On Delay Time	$\text{V}_{\text{DD}} = -10 \text{ V}$, $\text{I}_D = -1 \text{ A}$, $\text{V}_{\text{GS}} = -4.5 \text{ V}$, $\text{R}_{\text{GEN}} = 6 \Omega$		16	28	ns
t_r	Turn-On Rise Time			11	19	ns
$t_{\text{d}(\text{off})}$	Turn-Off Delay Time			75	120	ns
t_f	Turn-Off Fall Time			41	65	ns
Q_g	Total Gate Charge	$\text{V}_{\text{DS}} = -10 \text{ V}$, $\text{I}_D = -7 \text{ A}$, $\text{V}_{\text{GS}} = -5 \text{ V}$		27	38	nC
Q_{gs}	Gate-Source Charge			5		nC
Q_{gd}	Gate-Drain Charge			7		nC

Drain-Source Diode Characteristics and Maximum Ratings

I_S	Maximum Continuous Drain-Source Diode Forward Current			-1.6		A
V_{SD}	Drain-Source Diode Forward Voltage	$\text{V}_{\text{GS}} = 0 \text{ V}$, $\text{I}_S = -1.6 \text{ A}$ (Note 2)		-0.7	-1.2	V
t_r	Reverse Recovery Time	$\text{I}_F = -7 \text{ A}$,		28		ns
Q_{rr}	Reverse Recovery Charge	$\text{d}_F/\text{d}_t = 100 \text{ A}/\mu\text{s}$		14		nC

Notes: 1. R_{DJA} 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_{IJC} is guaranteed by design while R_{UCA} is determined by the user's board design.



a) 68°C/W when mounted on a 1in² pad of 2 oz copper

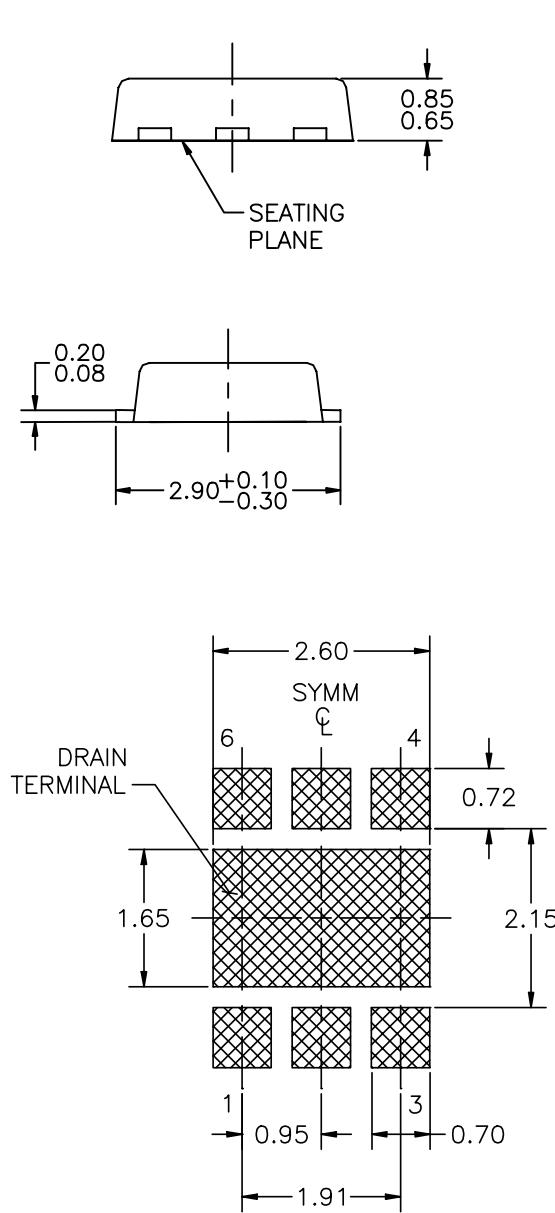
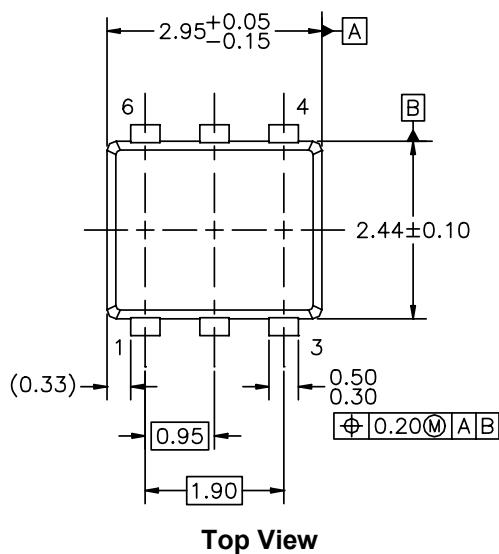
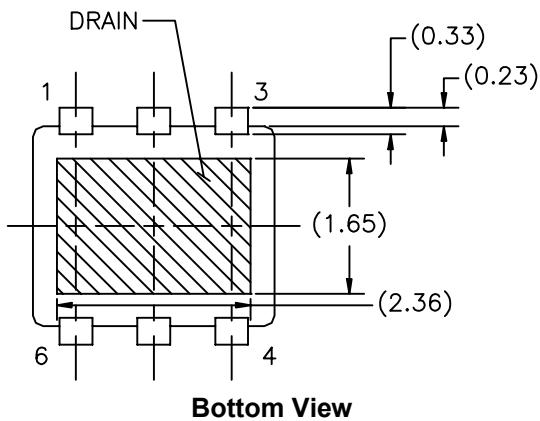


b) 111°C/W when mounted on a minimum pad of 2 oz copper

Scale 1 : 1 on letter size paper

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

Dimensional Outline and Pad Layout



Typical Characteristics

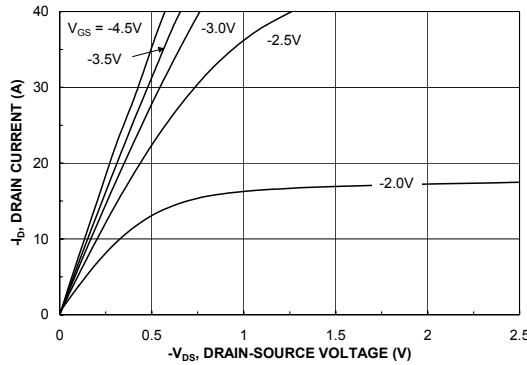


Figure 1. On-Region Characteristics.

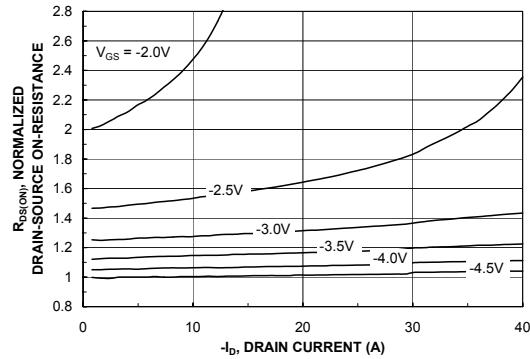


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

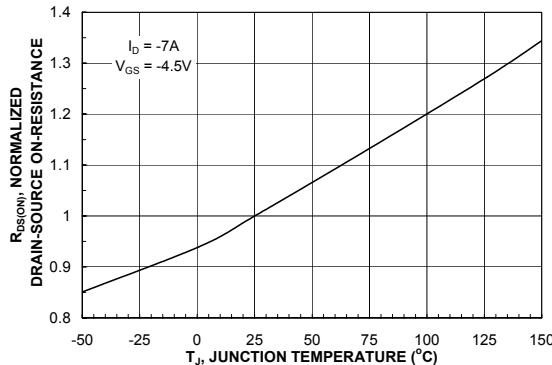


Figure 3. On-Resistance Variation with Temperature.

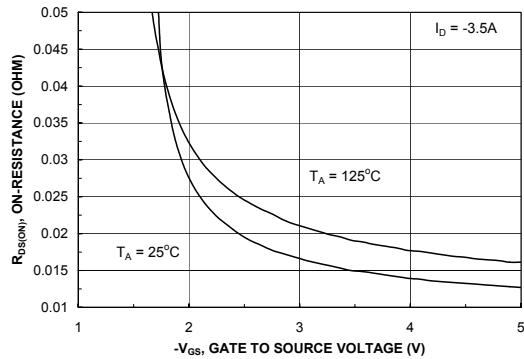


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

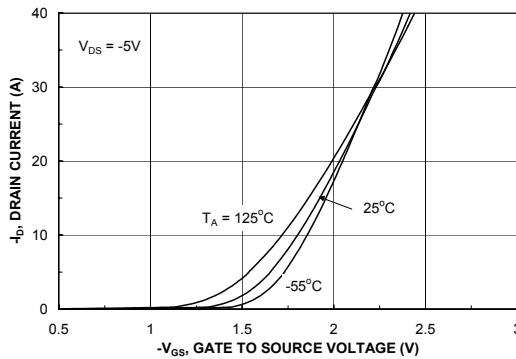


Figure 5. Transfer Characteristics.

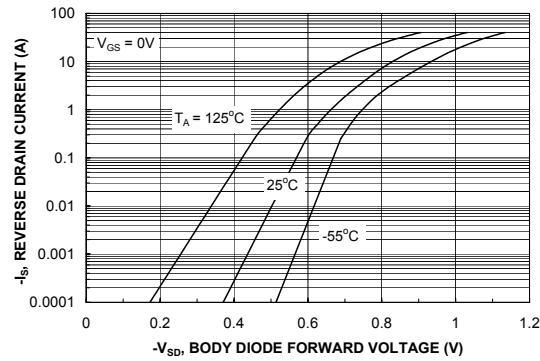


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

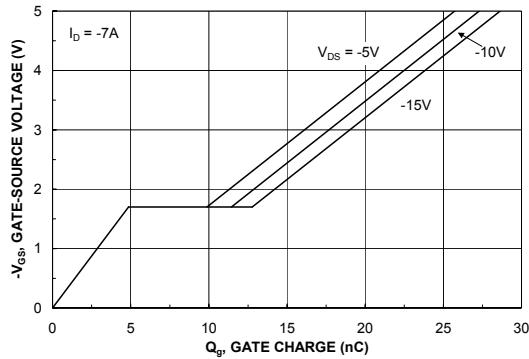


Figure 7. Gate Charge Characteristics.

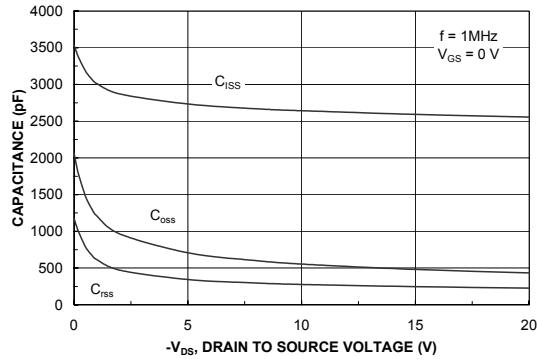


Figure 8. Capacitance Characteristics.

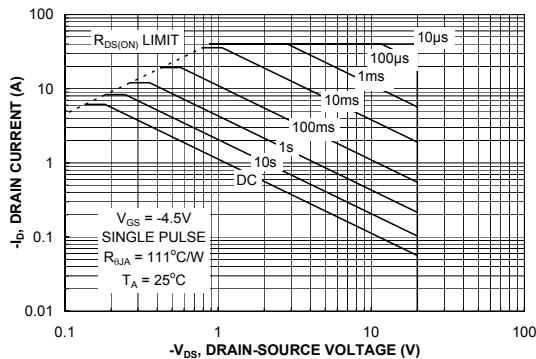


Figure 9. Maximum Safe Operating Area.

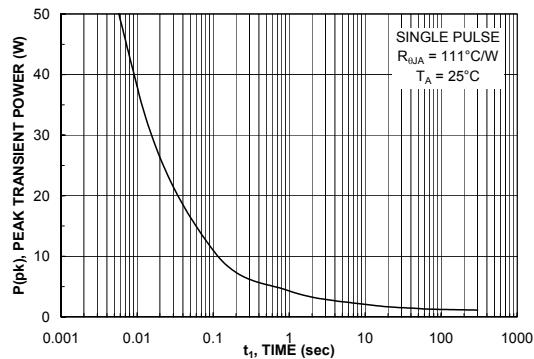


Figure 10. Single Pulse Maximum Power Dissipation.

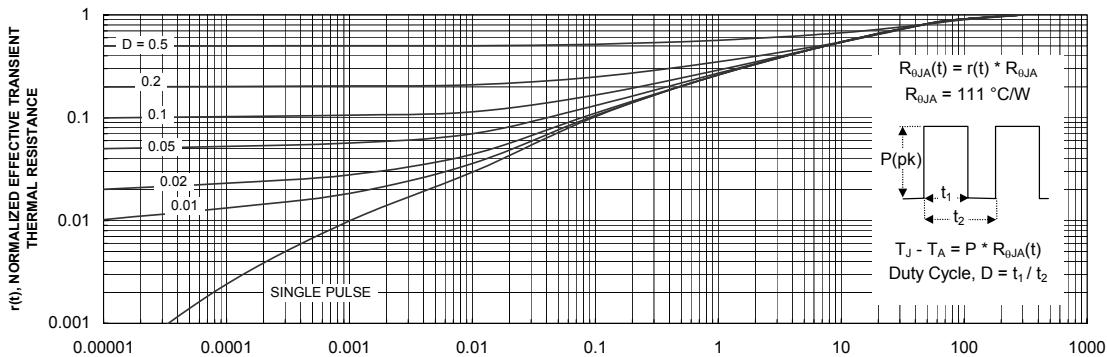


Figure 11. Transient Thermal Response Curve.

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

TRADEMARKS

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

ACE TM	FACT TM	ImpliedDisconnect TM	PACMAN TM	SPM TM
ActiveArray TM	FACT Quiet Series TM	ISOPLANAR TM	POP TM	Stealth TM
Bottomless TM	FAST [®]	LittleFET TM	Power247 TM	SuperSOT ^{TM-3}
CoolFET TM	FASTr TM	MicroFET TM	PowerTrench [®]	SuperSOT ^{TM-6}
CROSSVOLT TM	FRFET TM	MicroPak TM	QFET TM	SuperSOT ^{TM-8}
DOME TM	GlobalOptoisolator TM	MICROWIRE TM	QS TM	SyncFET TM
EcoSPARK TM	GTO TM	MSX TM	QT Optoelectronics TM	TinyLogic [®]
E ² CMOS TM	HiSeC TM	MSXPro TM	Quiet Series TM	TruTranslation TM
EnSigna TM	I ² C TM	OCX TM	RapidConfigure TM	UHC TM
Across the board. Around the world. TM		OCXPro TM	RapidConnect TM	UltraFET [®]
The Power Franchise TM		OPTOLOGIC [®]	SILENT SWITCHER [®]	VCX TM
Programmable Active Droop TM		OPTOPLANAR TM	SMART START TM	

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.

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