

# FDD6690A

## 30V N-Channel PowerTrench<sup>®</sup> MOSFET

### General Description

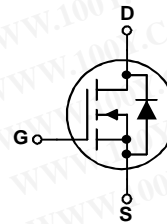
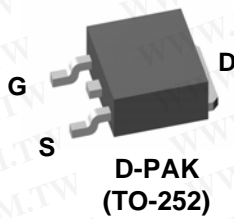
This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on state resistance and yet maintain low gate charge for superior switching performance.

### Applications

- DC/DC converter
- Motor Drives

### Features

- 46 A, 30 V  $R_{DS(ON)} = 12\text{ m}\Omega @ V_{GS} = 10\text{ V}$   
 $R_{DS(ON)} = 14\text{ m}\Omega @ V_{GS} = 4.5\text{ V}$
- Low gate charge
- Fast Switching Speed
- High performance trench technology for extremely low  $R_{DS(ON)}$



### 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>	Continuous Drain Current @ T <sub>C</sub> =25°C (Note 3)	46	A	
		@ T <sub>A</sub> =25°C (Note 1a)		12
		Pulsed (Note 1a)		100
P <sub>D</sub>	Power Dissipation @ T <sub>C</sub> =25°C (Note 3)	56	W	
		@ T <sub>A</sub> =25°C (Note 1a)		3.3
		@ T <sub>A</sub> =25°C (Note 1b)		1.5
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Junction Temperature Range	-55 to +175	°C	

### Thermal Characteristics

R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case (Note 1)	2.7	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient (Note 1a)	45	
R <sub>θJA</sub>	(Note 1b)	96	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape width	Quantity
FDD6690A	FDD6690A	D-PAK (TO-252)	13"	12mm	2500 units

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

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

**Drain-Source Avalanche Ratings** (Note 2)

$E_{AS}$	Drain-Source Avalanche Energy	Single Pulse, $V_{DD} = 15\text{ V}$ , $I_D = 12\text{ A}$			180	mJ
$I_{AS}$	Drain-Source Avalanche Current				12	A

**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 $25^\circ\text{C}$		24		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}$ , $V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate-Body Leakage	$V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$			$\pm 100$	nA

**On Characteristics** (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$	1	1.9	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		-5		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}$ , $I_D = 12\text{ A}$ $V_{GS} = 4.5\text{ V}$ , $I_D = 10\text{ A}$ $V_{GS} = 10\text{ V}$ , $I_D = 12\text{ A}$ , $T_J = 125^\circ\text{C}$		7.7 9.9 11.4	12 14 19	m $\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}$ , $V_{DS} = 5\text{ V}$	50			A
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{ V}$ , $I_D = 12\text{ A}$		47		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1.0\text{ MHz}$		1230		pF
$C_{oss}$	Output Capacitance			325		pF
$C_{rss}$	Reverse Transfer Capacitance			150		pF
$R_G$	Gate Resistance	$V_{GS} = 15\text{ mV}$ , $f = 1.0\text{ MHz}$		1.5		pF

**Switching Characteristics** (Note 2)

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{ V}$ , $I_D = 1\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\ \Omega$		10	19	ns
$t_r$	Turn-On Rise Time			7	13	ns
$t_{d(off)}$	Turn-Off Delay Time			29	46	ns
$t_f$	Turn-Off Fall Time			12	21	ns
$Q_g$	Total Gate Charge	$V_{DS} = 15\text{ V}$ , $I_D = 12\text{ A}$ , $V_{GS} = 5\text{ V}$		13	18	nC
$Q_{gs}$	Gate-Source Charge			3.5		nC
$Q_{gd}$	Gate-Drain Charge			5.1		nC

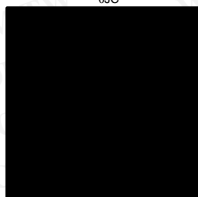
## Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain-Source Diode Forward Current				2.3	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 2.3\text{ A}$ (Note 2)		0.76	1.2	V
$t_{rr}$	Diode Reverse Recovery Time	$I_F = 12\text{ A}, dI_F/dt = 100\text{ A}/\mu\text{s}$		24		nS
$Q_{rr}$	Diode Reverse Recovery Charge			13		nC

**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)  $R_{\theta JA} = 45^\circ\text{C}/\text{W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper



b)  $R_{\theta JA} = 96^\circ\text{C}/\text{W}$  when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

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

3. Maximum current is calculated as: 
$$\sqrt{\frac{P_D}{R_{DS(ON)}}}$$

where  $P_D$  is maximum power dissipation at  $T_C = 25^\circ\text{C}$  and  $R_{DS(on)}$  is at  $T_{J(max)}$  and  $V_{GS} = 10\text{V}$ . Package current limitation is 21A

### Typical Characteristics

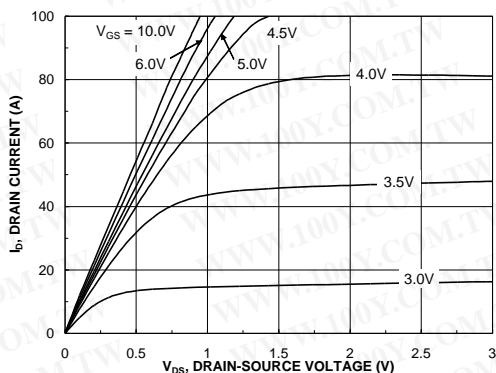


Figure 1. On-Region Characteristics

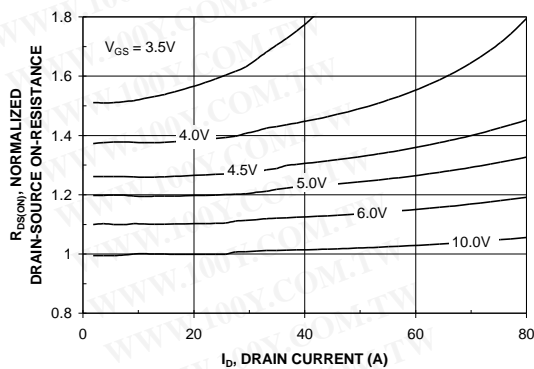


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

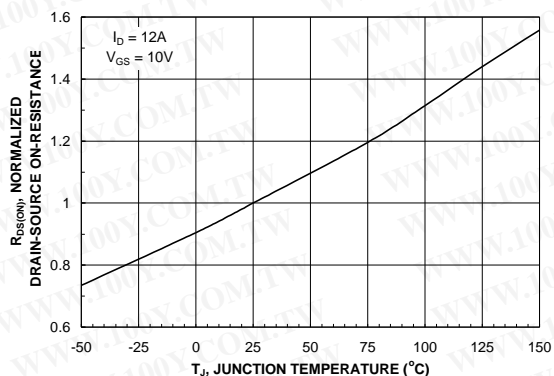


Figure 3. On-Resistance Variation with Temperature

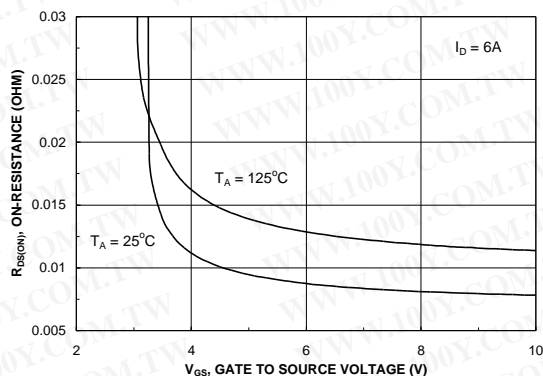


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

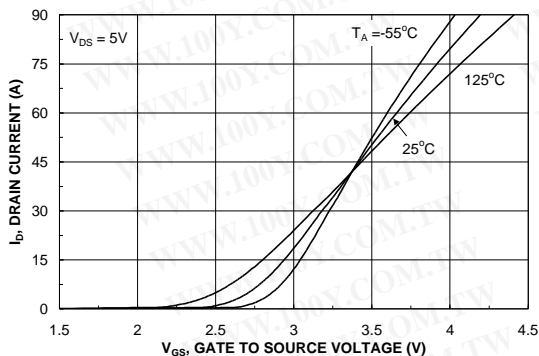


Figure 5. Transfer Characteristics

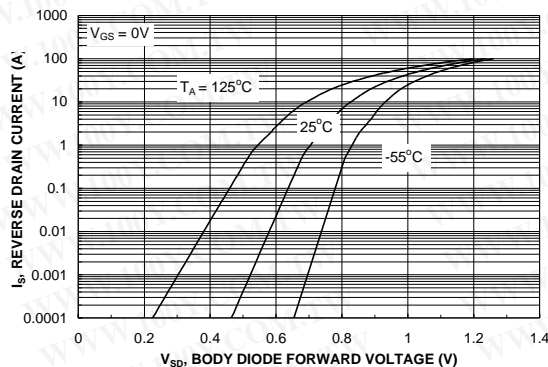


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

### Typical Characteristics

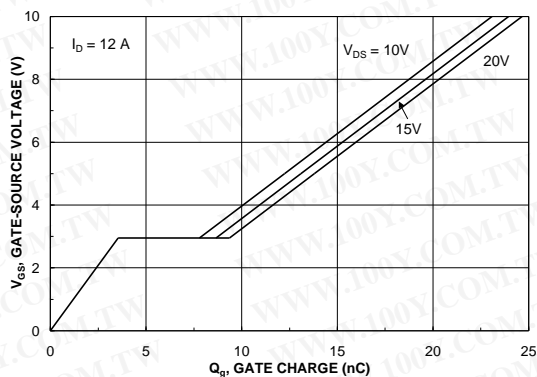


Figure 7. Gate Charge Characteristics

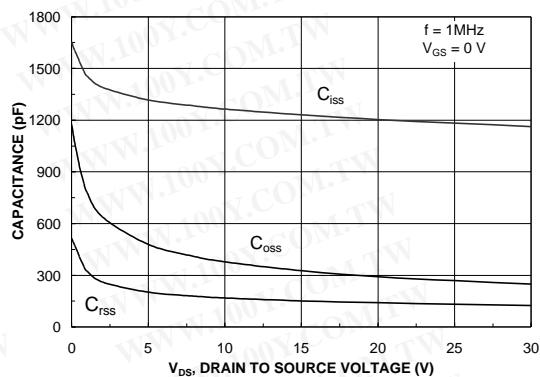


Figure 8. Capacitance Characteristics

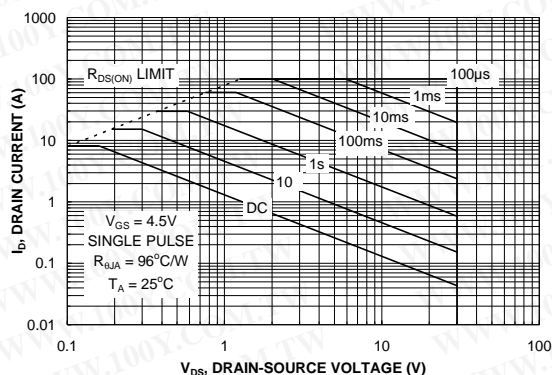


Figure 9. Maximum Safe Operating Area

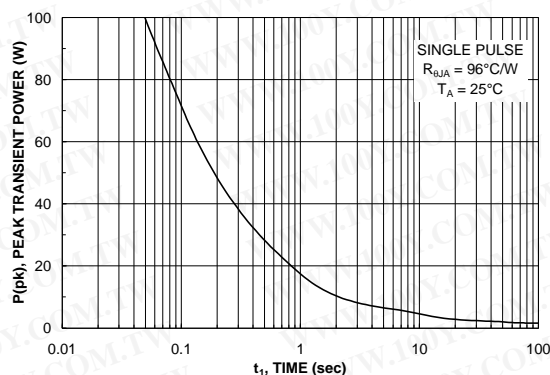


Figure 10. Single Pulse Maximum Power Dissipation

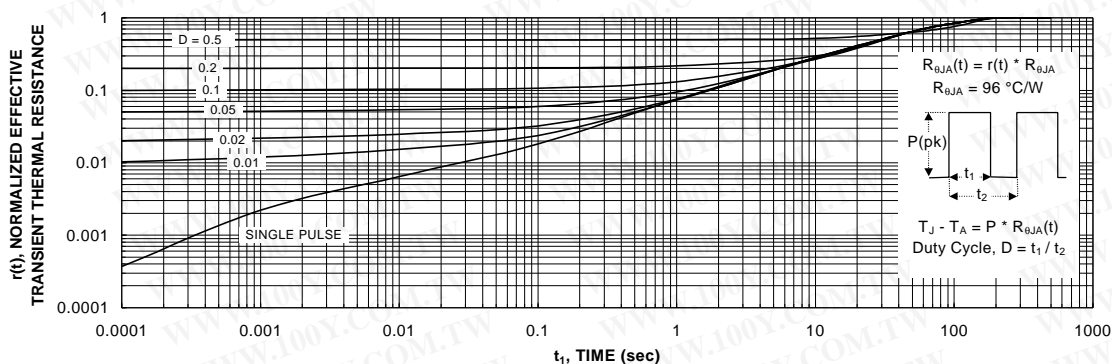


Figure 11. Transient Thermal Response Curve

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.

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

## 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.