FAIRCHILD
SEMICONDUCTOR TM

November 1997

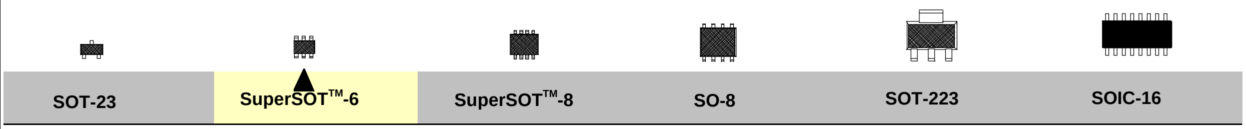
FDC653N
N-Channel Enhancement Mode Field Effect Transistor

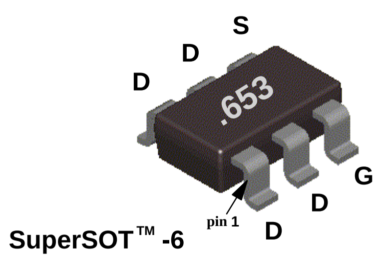
General Description

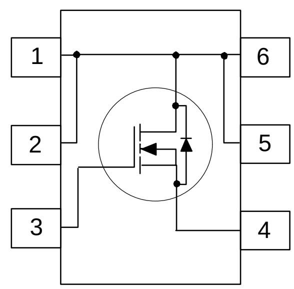
This N-Channel enhancement mode power field effect transistors is produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process is tailored to minimize on-state resistance. These devices are particularly suited for low voltage applications in notebook computers, portable phones, PCMICA cards, and other battery powered circuits where fast switching, and low in-line power loss are needed in a very small outline surface mount package.

Features

- 5 A, 30 V. $R_{DS(ON)}$ = 0.035 Ω @ V_{GS} = 10 V
  $R_{DS(ON)}$ = 0.055 Ω @ V_{GS} = 4.5 V.
- Proprietary SuperSOT™-6 package design using copper lead frame for superior thermal and electrical capabilities.
- High density cell design for extremely low $R_{DS(ON)}$.
- Exceptional on-resistance and maximum DC current capability.







Absolute Maximum Ratings T_A = 25°C unless otherwise note

Symbol	Parameter		FDC653N	Units
V_{DSS}	Drain-Source Voltage		30	V
V_{GSS}	Gate-Source Voltage - Continuous		±20	V
I_D	Drain Current - Continuous	(Note 1a)	5	A
	- Pulsed		15	
P_D	Maximum Power Dissipation	(Note 1a)	1.6	W
		(Note 1b)	0.8	
T_J,T_{STG}	Operating and Storage Temperature Range		-55 to 150	°C
THERMAL CHARACTERISTICS				
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	78	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	(Note 1)	30	°C/W

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
OFF CHARACTERISTICS						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 µA	30			V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	I_D = 250 µA, Referenced to 25 °C		31		mV /°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V			1	µA
		T_J = 55°C			10	µA
I_{GSSF}	Gate - Body Leakage, Forward	V_{GS} = 20 V, V_{DS} = 0 V			100	nA
I_{GSSR}	Gate - Body Leakage, Reverse	V_{GS} = -20 V, V_{DS} = 0 V			-100	nA
ON CHARACTERISTICS (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 µA	1	1.7	2	V
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold VoltageTemp.Coefficient	I_D = 250 µA, Referenced to 25 °C		-4.2		mV /°C
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 5 A		0.027	0.035	Ω
		T_J = 125°C		0.042	0.056	
		V_{GS} = 4.5 V, I_D = 4.2 A		0.046	0.055	
$I_{D(on)}$	On-State Drain Current	V_{GS} = 10 V, V_{DS} = 5 V	8			A
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 5 A		6.2		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V,		350		pF
C_{oss}	Output Capacitance	f = 1.0 MHz		220		pF
C_{rss}	Reverse Transfer Capacitance			80		pF
SWITCHING CHARACTERISTICS (Note 2)						
$t_{D(on)}$	Turn - On Delay Time	V_{DD} = 10 V, I_D = 1 A,		7.5	15	ns
t_r	Turn - On Rise Time	V_{GS} = 4.5 V, R_{GEN} = 6 Ω		12	25	ns
$t_{D(off)}$	Turn - Off Delay Time			13	25	ns
t_f	Turn - Off Fall Time			6	15	ns
Q_g	Total Gate Charge	V_{DS} = 15 V, I_D = 5 A,		12	17	nC
Q_{gs}	Gate-Source Charge	V_{GS} = 10 V		2.1		nC
Q_{gd}	Gate-Drain Charge			2.6		nC
DRAIN-SOURCE DIODE CHARACTERISTICS						
I_S	Continuous Source Diode Current				1.3	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 1.3 A (Note 2)		0.75	1.2	V
		T_J = 125°C		0.6	1	

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 minimum on a 1 in^2 pad of 2oz Cu in FR-4 board.

   b. 156°C/W when mounted on a minimum pad of 2oz Cu in FR-4 board.

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

Typical Electrical Characteristics

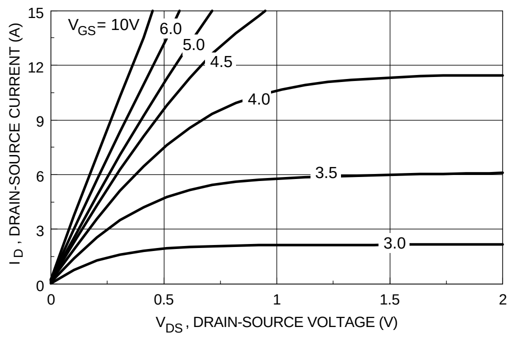


Figure 1. On-Region Characteristics.

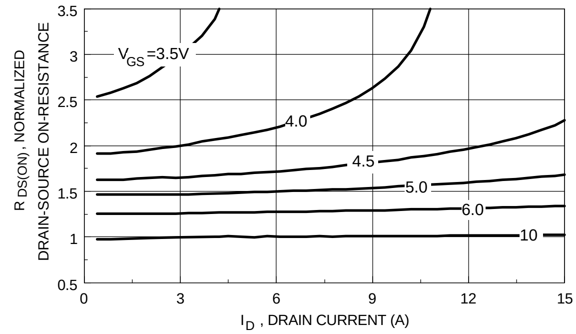


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

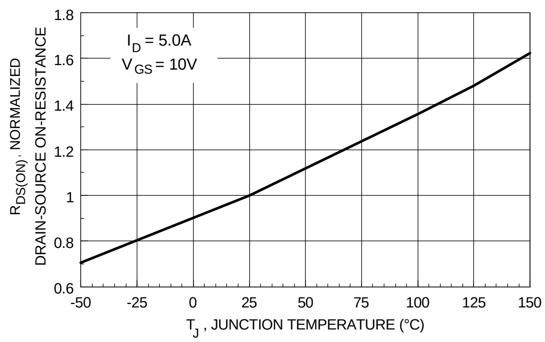


Figure 3. On-Resistance Variation with Temperature.

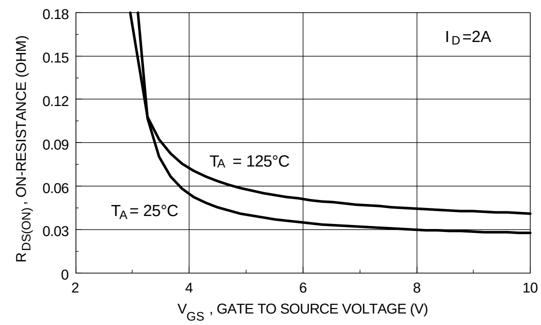


Figure 4. On Resistance Variation with Gate-To- Source Voltage.

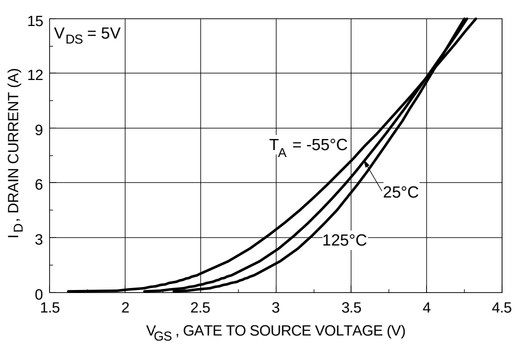


Figure 5. Transfer Characteristics.

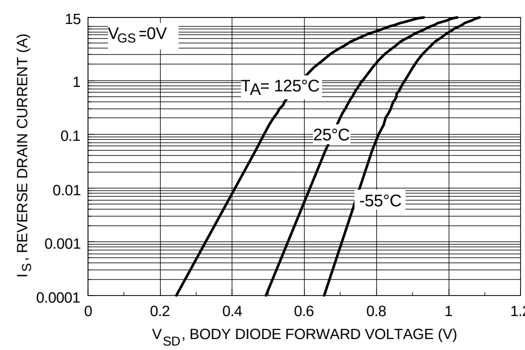


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Electrical And Thermal Characteristics

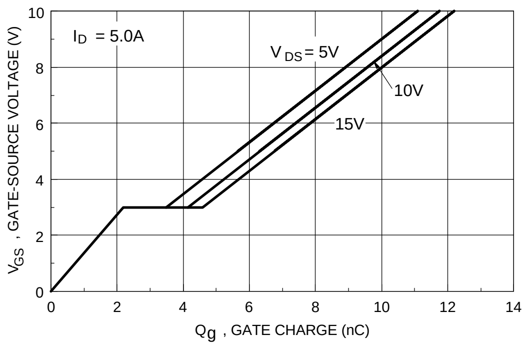


Figure 7. Gate Charge Characteristics.

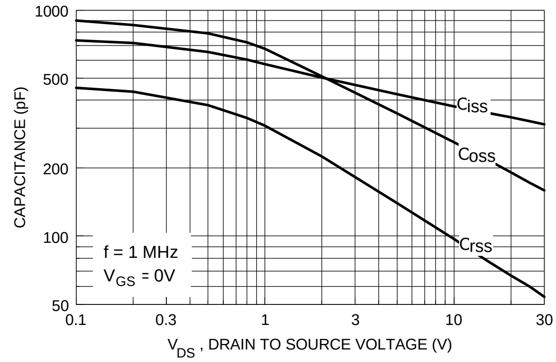


Figure 8. Capacitance Characteristics.

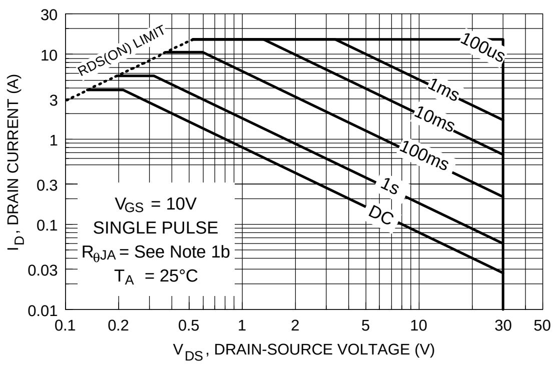


Figure 9. Maximum Safe Operating Area.

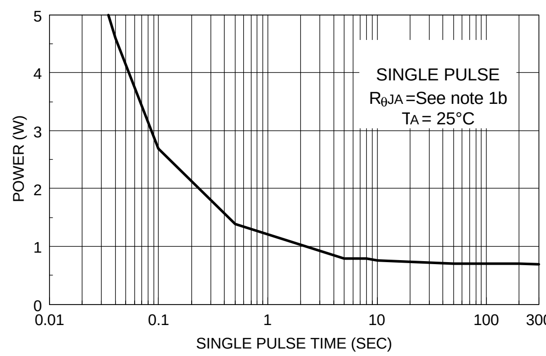


Figure 10. Single Pulse Maximum Power Dissipation.

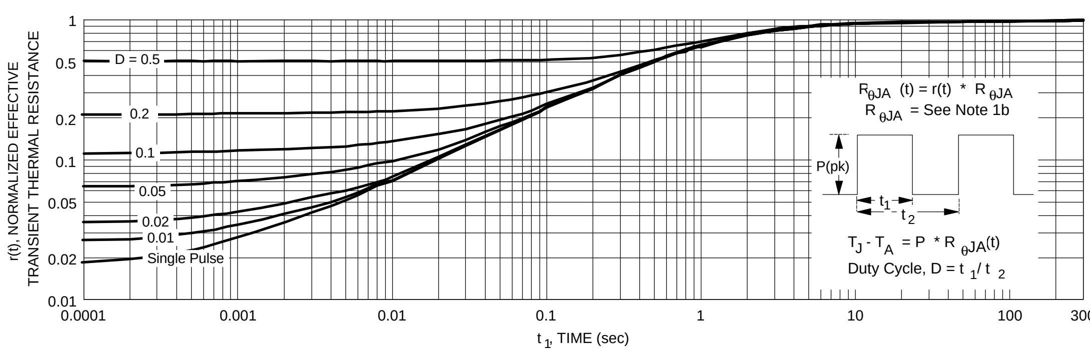


Figure 11. Transient Thermal Response Curve.

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

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.