



November 2000

# FDD3570

## 80V N-Channel PowerTrench<sup>®</sup> MOSFET

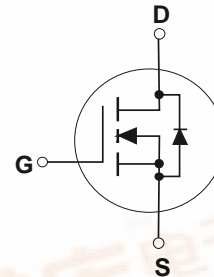
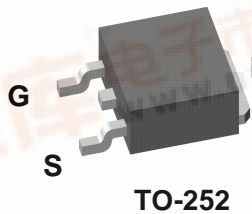
### General Description

This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers.

This MOSFET features faster switching and lower gate change than other MOSFETs with comparable  $R_{DS(ON)}$  specifications resulting in DC/DC power supply designs with higher overall efficiency.

### Features

- 10 A, 80 V.  $R_{DS(ON)} = 20\text{ m}\Omega @ V_{GS} = 10\text{ V}$   
 $R_{DS(ON)} = 23\text{ m}\Omega @ V_{GS} = 6\text{ V}$
- Fast switching speed
- High performance trench technology for extremely low  $R_{DS(ON)}$
- High power and current handling capability



### Absolute Maximum Ratings

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

Symbol	Parameter	Ratings	Units
$V_{DSS}$	Drain-Source Voltage	80	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Maximum Drain Current-Continuous (Note 1)	43	A
	Maximum Drain Current – Pulsed (Note 1a)	10	
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$ (Note 1)	69	W
	$T_A = 25^\circ\text{C}$ (Note 1a)	3.4	
	$T_A = 25^\circ\text{C}$ (Note 1b)	1.3	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to- Case (Note 1)	1.8	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to- Ambient (Note 1b)	96	$^\circ\text{C}/\text{W}$

### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDD3570	FDD3570	13"	16mm	2500



## Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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### Drain-Source Avalanche Ratings (Note 2)

$W_{DSS}$	Single Pulse Drain-Source Avalanche Energy	$V_{DD} = 40\text{ V}, I_D = 10\text{ A}$			360	mJ
$I_{AR}$	Maximum Drain-Source Avalanche Current				10	A

### Off Characteristics

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	80			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		78		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 64\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			100	nA
$I_{GSSR}$	Gate-Body Leakage, Reverse	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$			-100	nA

### On Characteristics (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2	2.4	4	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		-7		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 10\text{ A}$ $V_{GS} = 10\text{ V}, I_D = 10\text{ A}, T_J = 125^\circ\text{C}$ $V_{GS} = 6\text{ V}, I_D = 9\text{ A}$		15 27 16	20 40 23	m $\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$	25			A
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{ V}, I_D = 14\text{ A}$		40		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		2800		pF
$C_{oss}$	Output Capacitance			230		pF
$C_{riss}$	Reverse Transfer Capacitance			117		pF

### Switching Characteristics (Note 2)

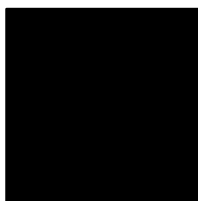
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 40\text{ V}, I_D = 1\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$		20	32	ns
$t_r$	Turn-On Rise Time			12	24	ns
$t_{d(off)}$	Turn-Off Delay Time			60	95	ns
$t_f$	Turn-Off Fall Time			24	38	ns
$Q_g$	Total Gate Charge	$V_{DS} = 40\text{ V}, I_D = 9\text{ A},$ $V_{GS} = 10\text{ V},$		54	76	nC
$Q_{gs}$	Gate-Source Charge			9.6		nC
$Q_{gd}$	Gate-Drain Charge			14		nC

### Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current				2.8	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 2.8\text{ A}$ (Note 2)		0.72	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)  $R_{\theta JA} = 40\ ^\circ\text{C/W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper.



b)  $R_{\theta JA} = 96\ ^\circ\text{C/W}$  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%

## Typical Characteristics

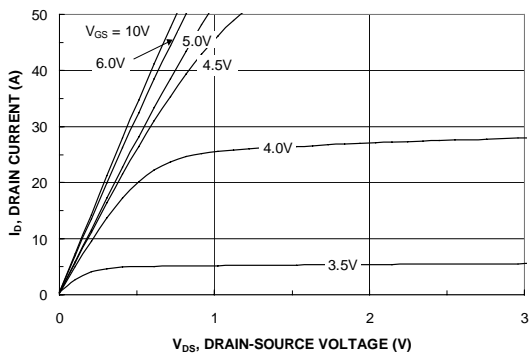


Figure 1. On-Region Characteristics.

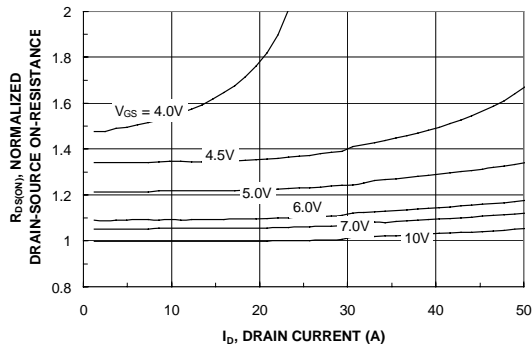


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

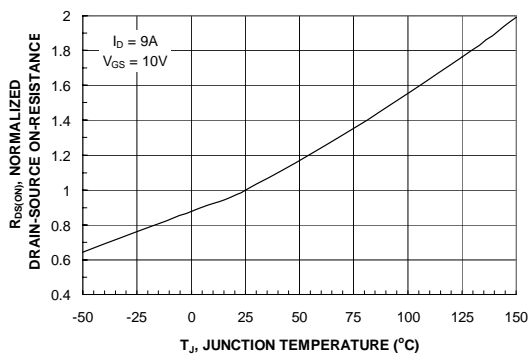


Figure 3. On-Resistance Variation with Temperature.

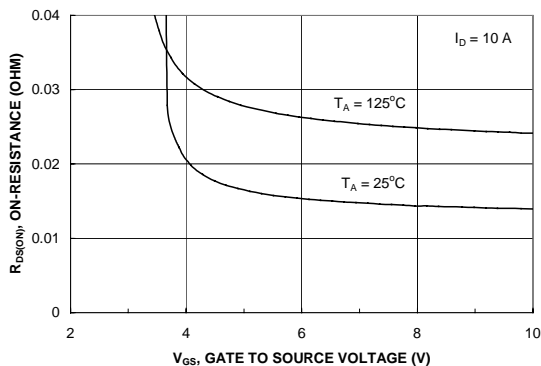


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

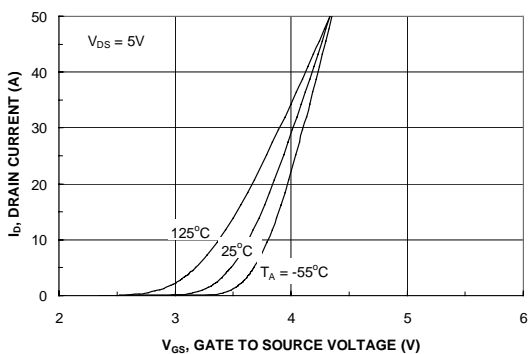


Figure 5. Transfer Characteristics.

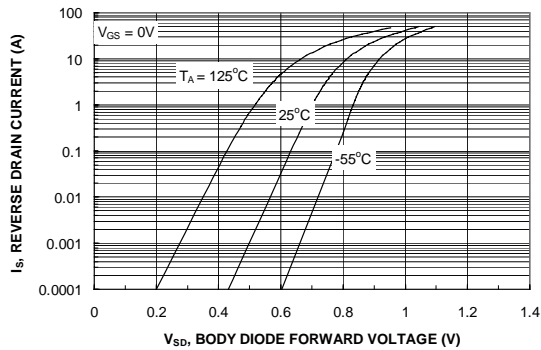


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

### Typical Characteristics

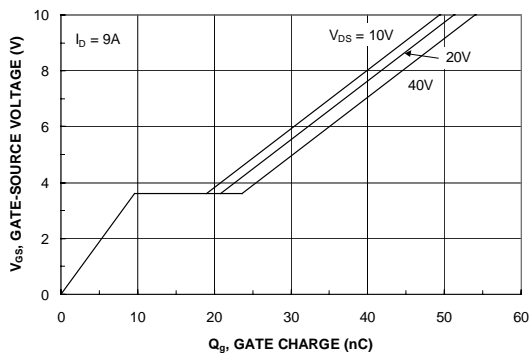


Figure 7. Gate Charge Characteristics.

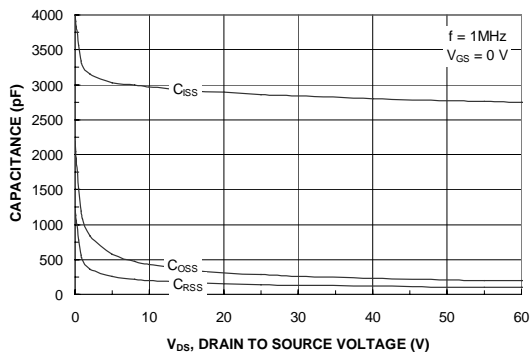


Figure 8. Capacitance Characteristics.

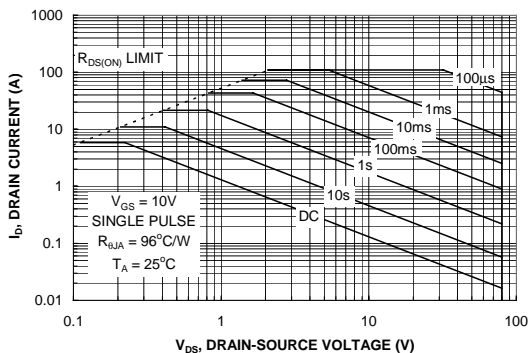


Figure 9. Maximum Safe Operating Area.

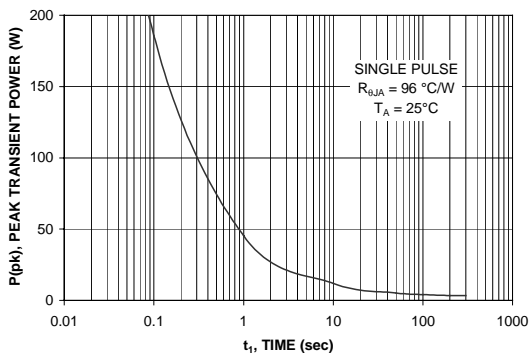


Figure 10. Single Pulse Maximum Power Dissipation.

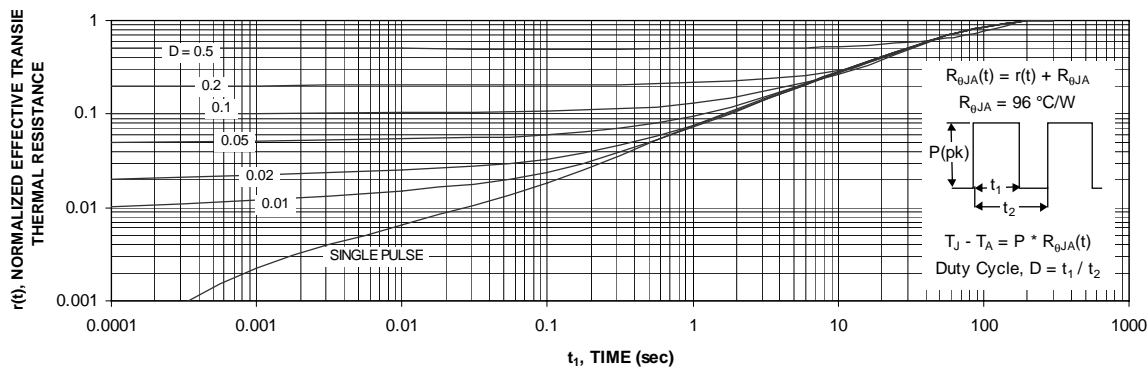


Figure 11. Transient Thermal Response Curve.

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

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