



**THE DATASHEET OF  
FDS5170N7**



# FDS5170N7

## 60V N-Channel PowerTrench® MOSFET

### General Description

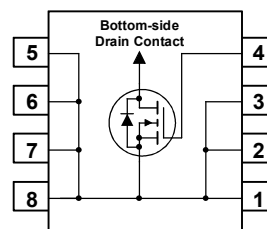
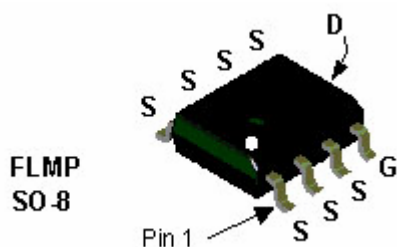
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for "low side" synchronous rectifier operation, providing an extremely low  $R_{DS(ON)}$  in a small package.

### Applications

- Synchronous rectifier
- DC/DC converter

### Features

- 10.6 A, 60 V.  $R_{DS(ON)} = 12\text{ m}\Omega @ V_{GS} = 10\text{ V}$   
 $R_{DS(ON)} = 15\text{ m}\Omega @ V_{GS} = 6.0\text{ V}$
- High performance trench technology for extremely low  $R_{DS(ON)}$
- High power and current handling capability
- Fast switching, low gate charge (51nC typical)
- FLMP SO-8 package: Enhanced thermal performance in industry-standard package size



### Absolute Maximum Ratings T<sub>A</sub>=25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DSS}$	Drain-Source Voltage	60	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Drain Current – Continuous (Note 1a)	10.6	A
	– Pulsed	50	
$P_D$	Power Dissipation for Single Operation (Note 1a)	3.0	W
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	40	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	0.5	

### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDS5170N7	FDS5170N7	13"	12mm	2500 units

## 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)

$W_{DSS}$	Drain-Source Avalanche Energy	Single Pulse, $V_{DD} = 30\text{ V}$ , $I_D = 10.6\text{ A}$			300	mJ
$I_{AR}$	Drain-Source Avalanche Current				10.6	A

### Off Characteristics

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}$ , $I_D = 250\ \mu\text{A}$	60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		60		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 48\text{ V}$ , $V_{GS} = 0\text{ V}$			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	$V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$	2	2.3	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	$V_{GS} = 10\text{ V}$ , $I_D = 10.6\text{ A}$ $V_{GS} = 6.0\text{ V}$ , $I_D = 10.1\text{ A}$ $V_{GS} = 10\text{ V}$ , $I_D = 10.6\text{ A}$ , $T_J = 125^\circ\text{C}$		9 11 16	12 15 23	m $\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}$ , $V_{DS} = 10\text{ V}$	25			A
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{ V}$ , $I_D = 10.6\text{ A}$		43		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 30\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1.0\text{ MHz}$		2889		pF
$C_{oss}$	Output Capacitance			329		pF
$C_{rss}$	Reverse Transfer Capacitance			134		pF
$R_G$	Gate Resistance	$V_{GS} = 15\text{ mV}$ , $f = 1.0\text{ MHz}$		1.1		$\Omega$

### Switching Characteristics (Note 2)

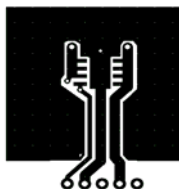
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\text{ V}$ , $I_D = 1\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\ \Omega$		12	22	ns
$t_r$	Turn-On Rise Time			10	20	ns
$t_{d(off)}$	Turn-Off Delay Time			43	69	ns
$t_f$	Turn-Off Fall Time			25	40	ns
$Q_g$	Total Gate Charge	$V_{DS} = 30\text{ V}$ , $I_D = 10.6\text{ A}$ , $V_{GS} = 10\text{ V}$		51	71	nC
$Q_{gs}$	Gate-Source Charge			10		nC
$Q_{gd}$	Gate-Drain Charge			11		nC

### Drain-Source Diode Characteristics and Maximum Ratings

$I_S$	Maximum Continuous Drain-Source Diode Forward Current				2.5	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 2.5\text{ A}$ (Note 2)		0.7	1.2	V
$t_{rr}$	Diode Reverse Recovery Time	$I_F = 10.6\text{ A}$		39		nS
$Q_{rr}$	Diode Reverse Recovery Charge	$dI_F/dt = 100\text{ A}/\mu\text{s}$ (Note 2)		83		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)  $40^\circ\text{C/W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper

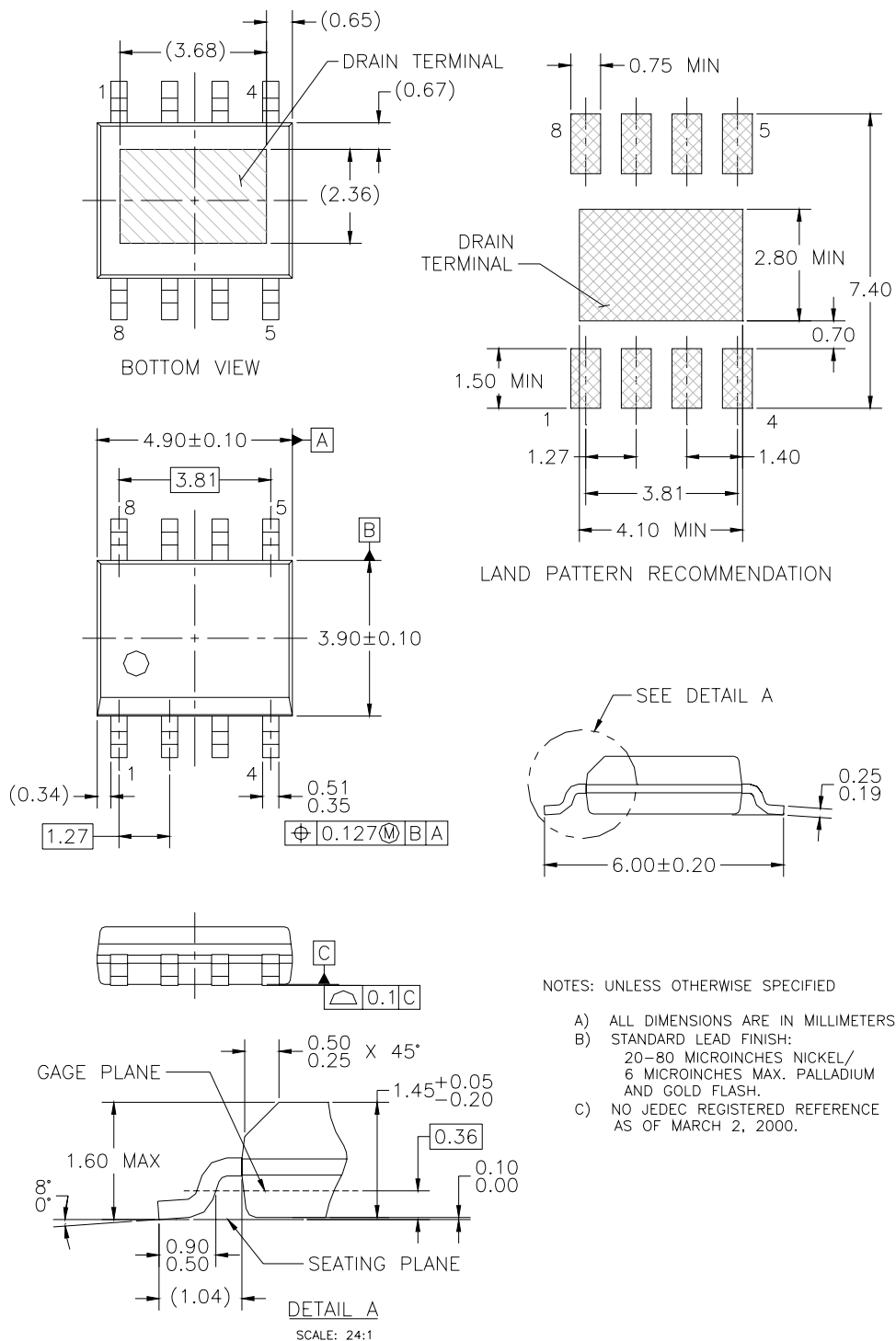


- b)  $85^\circ\text{C/W}$  when mounted on a minimum pad of 2 oz copper

Scale 1 : 1 on letter size paper

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

### Dimensional Outline and Pad Layout



NOTES: UNLESS OTHERWISE SPECIFIED

- A) ALL DIMENSIONS ARE IN MILLIMETERS.
- B) STANDARD LEAD FINISH:  
20-80 MICROINCHES NICKEL/  
6 MICROINCHES MAX. PALLADIUM  
AND GOLD FLASH.
- C) NO JEDEC REGISTERED REFERENCE  
AS OF MARCH 2, 2000.

## Typical Characteristics

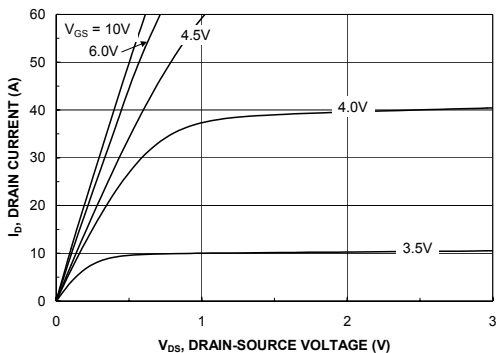


Figure 1. On-Region Characteristics.

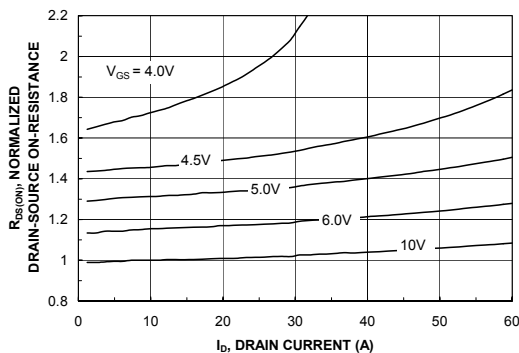


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

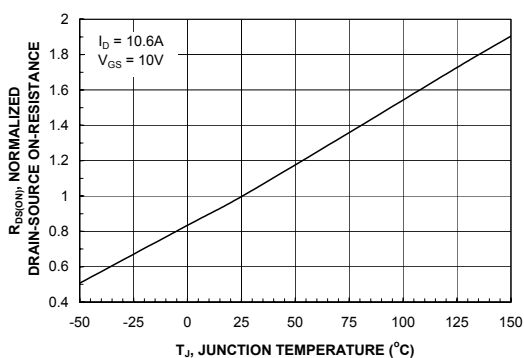


Figure 3. On-Resistance Variation with Temperature.

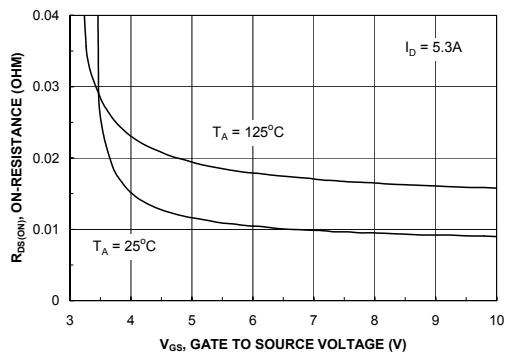


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

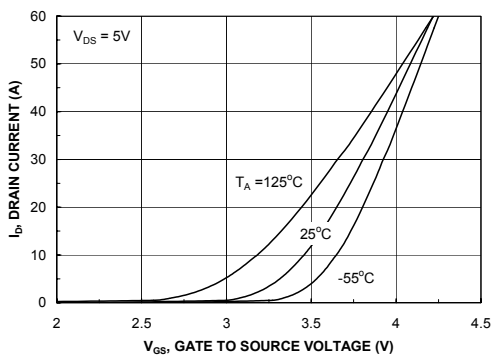


Figure 5. Transfer Characteristics.

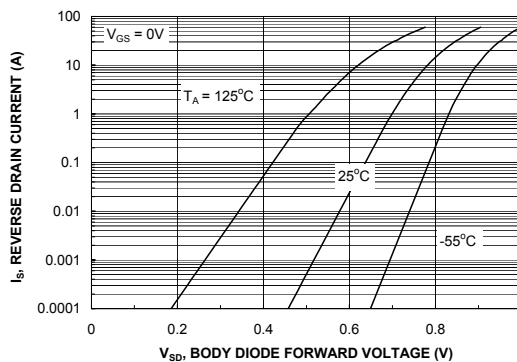


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Characteristics

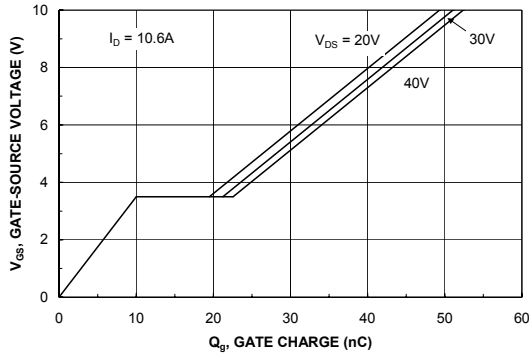


Figure 7. Gate Charge Characteristics.

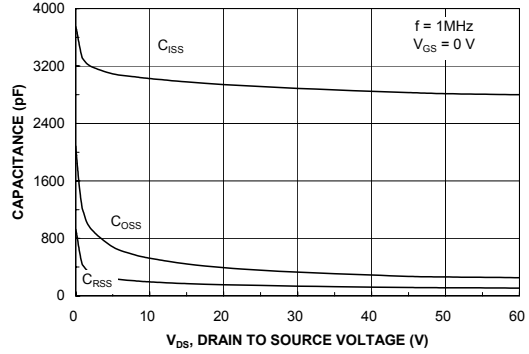


Figure 8. Capacitance Characteristics.

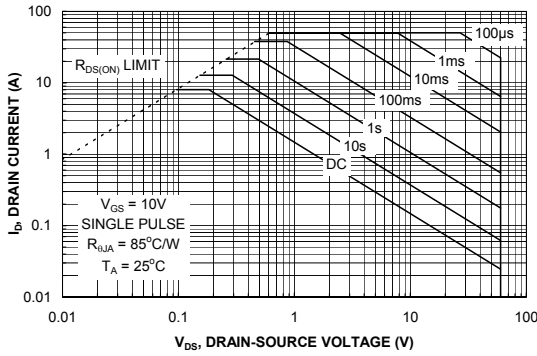


Figure 9. Maximum Safe Operating Area.

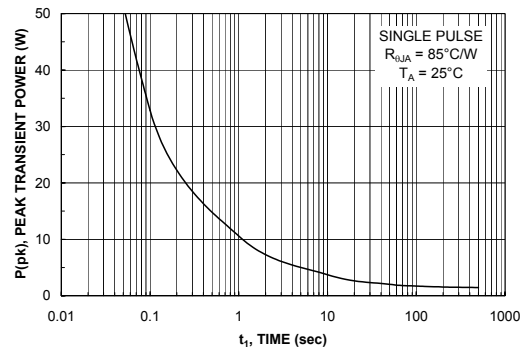


Figure 10. Single Pulse Maximum Power Dissipation.

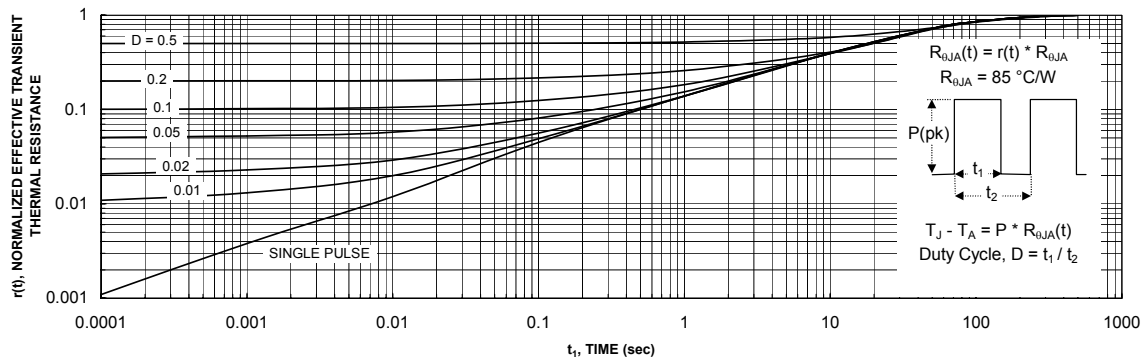


Figure 11. Transient Thermal Response Curve.

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

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