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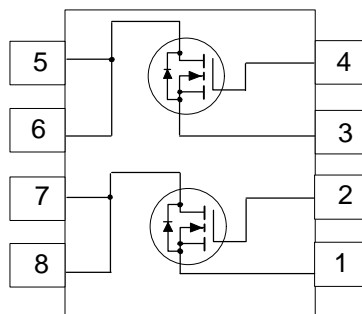
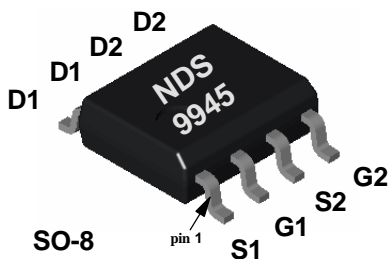
## NDS9945 Dual N-Channel Enhancement Mode Field Effect Transistor

### General Description

SO-8 N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process is especially tailored to provide superior switching performance and minimize on-state resistance. These devices are particularly suited for low voltage applications such as disk drive motor control, battery powered circuits where fast switching, low in-line power loss, and resistance to transients are needed.

### Features

- 3.5 A, 60 V.  $R_{DS(ON)} = 0.100 \Omega @ V_{GS} = 10 \text{ V}$ ,  
 $R_{DS(ON)} = 0.200 \Omega @ V_{GS} = 4.5 \text{ V}$ .
- High density cell design for extremely low  $R_{DS(ON)}$ .
- High power and current handling capability in a widely used surface mount package.
- Dual MOSFET in surface mount package.



### Absolute Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	NDS9945	Units
$V_{DSS}$	Drain-Source Voltage	60	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Drain Current - Continuous (Note 1a)	3.5	A
	- Pulsed	10	
$P_D$	Power Dissipation for Dual Operation	2	W
	Power Dissipation for Single Operation (Note 1a)	1.6	
	(Note 1b)	1	
	(Note 1c)	0.9	
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to 150	$^\circ\text{C}$

### THERMAL CHARACTERISTICS

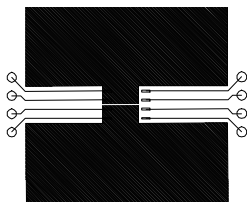
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	78	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	40	$^\circ\text{C/W}$

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

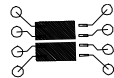
Symbol	Parameter	Conditions	Min	Typ	Max	Units	
<b>OFF CHARACTERISTICS</b>							
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	60			V	
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		60		mV/ $^\circ\text{C}$	
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$	
$I_{GSSF}$	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	
<b>ON CHARACTERISTICS</b> (Note 2)							
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$		1	1.7	3	V
			$T_J = 125^\circ\text{C}$	0.7		2.2	
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 3.5\text{ A}$		0.076	0.1	$\Omega$	
			$T_J = 125^\circ\text{C}$		0.124		0.18
			$V_{GS} = 4.5\text{ V}, I_D = 2.5\text{ A}$		0.103		0.2
			$T_J = 125^\circ\text{C}$		0.166	0.3	
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 10\text{ V}$	10			A	
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 3.5\text{ A}$		5.3		S	
<b>DYNAMIC CHARACTERISTICS</b>							
$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		345		pF	
$C_{oss}$	Output Capacitance			110		pF	
$C_{rss}$	Reverse Transfer Capacitance			25		pF	
<b>SWITCHING CHARACTERISTICS</b> (Note 2)							
$t_{D(on)}$	Turn - On Delay Time	$V_{DS} = 30\text{ V}, I_D = 1\text{ A}$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$		5	25	ns	
$t_r$	Turn - On Rise Time			7.5	30		
$t_{D(off)}$	Turn - Off Delay Time			20	50		
$t_f$	Turn - Off Fall Time			7	40		
$Q_g$	Total Gate Charge		$V_{DS} = 30\text{ V}, I_D = 3.5\text{ A},$ $V_{GS} = 10\text{ V}$		12.9		30
$Q_{gs}$	Gate-Source Charge			1.7			
$Q_{gd}$	Gate-Drain Charge			3.2			
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>							
$I_S$	Maximum Continuous Drain-Source Diode Forward Current				1.3	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 1.3\text{ A}$ (Note 2)		0.8	1.2	V	
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_F = 1.3\text{ A},$ $di_F/dt = 100\text{ A}/\mu\text{s}$		40		ns	
$I_{rr}$	Reverse Recovery Current			1.5		A	

Notes:

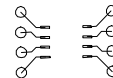
- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a.  $78^\circ\text{C}/\text{W}$  on a  $0.5\text{ in}^2$  pad of 2oz copper.



b.  $125^\circ\text{C}/\text{W}$  on a  $0.02\text{ in}^2$  pad of 2oz copper.



c.  $135^\circ\text{C}/\text{W}$  on a  $0.003\text{ in}^2$  pad of 2oz copper.

Scale 1 : 1 on letter size paper

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

## Typical Electrical Characteristics

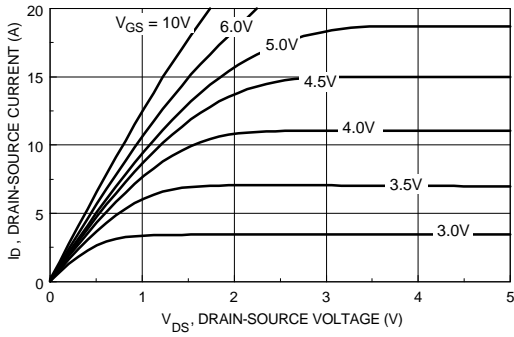


Figure 1. On-Region Characteristics.

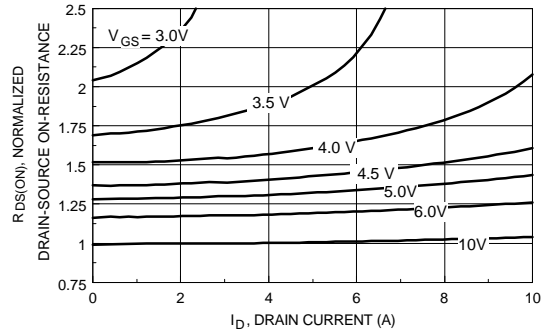


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

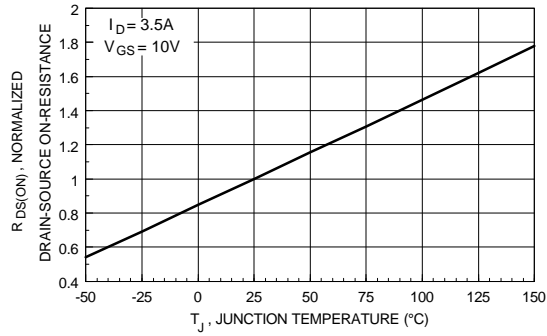


Figure 3. On-Resistance Variation With Temperature.

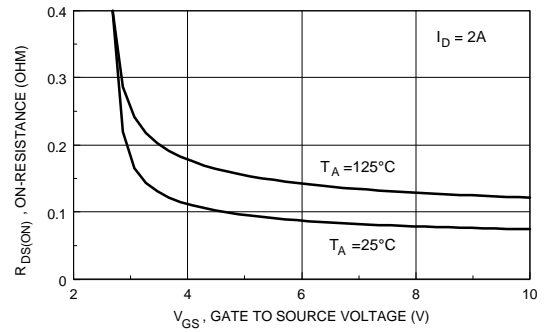


Figure 4. On Resistance Variation with Gate-to-Source Voltage.

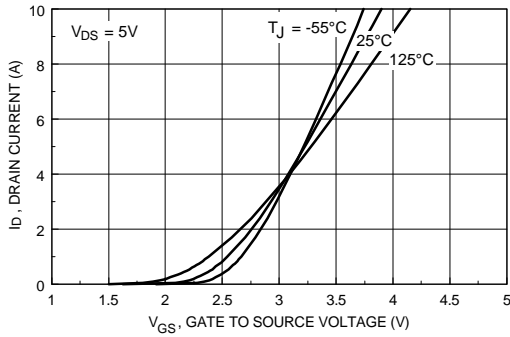


Figure 5 . Transfer Characteristics.

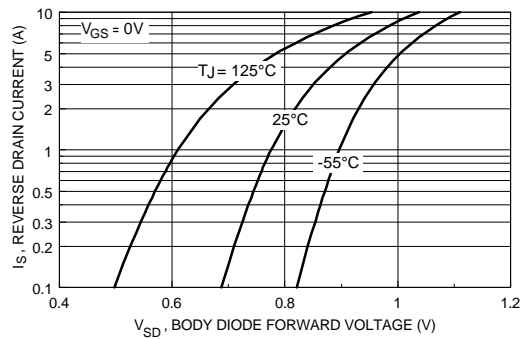


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Electrical Characteristics (continued)

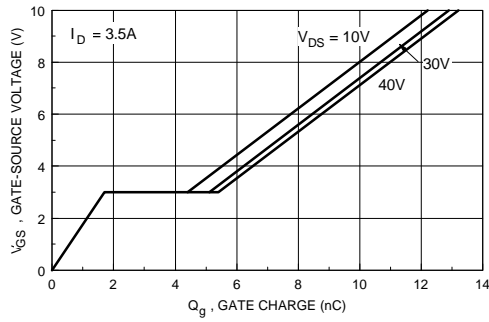


Figure 7. Gate Charge Characteristics.

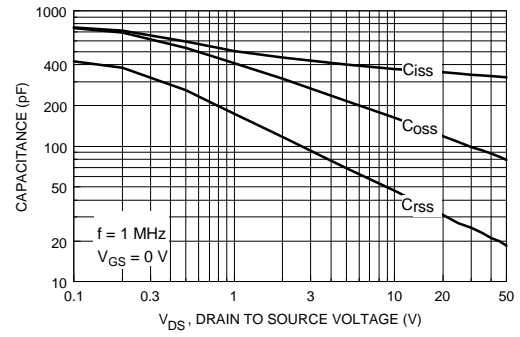


Figure 8. Capacitance Characteristics.

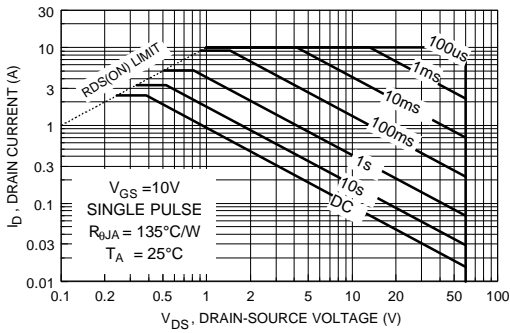


Figure 9. Maximum Safe Operating Area.

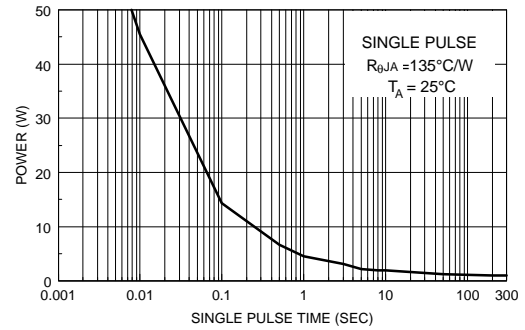


Figure 10. Single Pulse Maximum Power Dissipation.

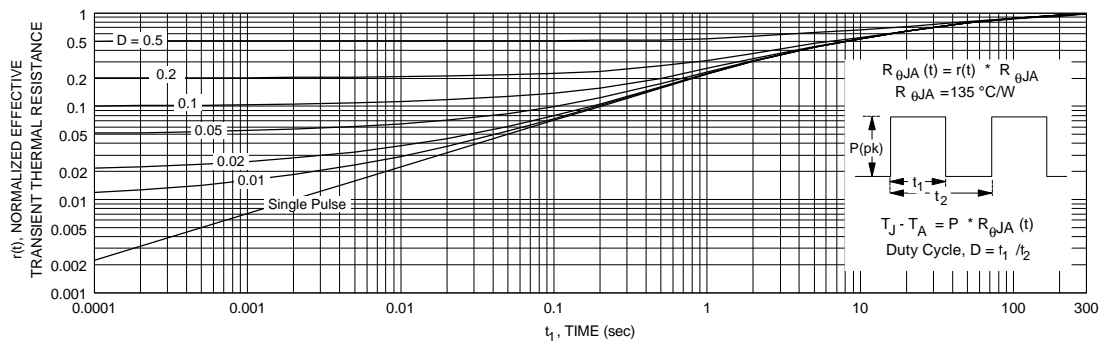


Figure 11. Transient Thermal Response Curve.

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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