

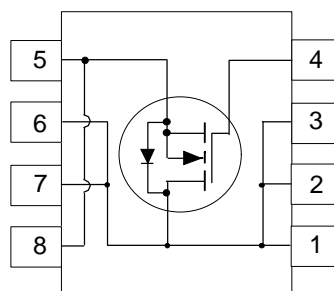
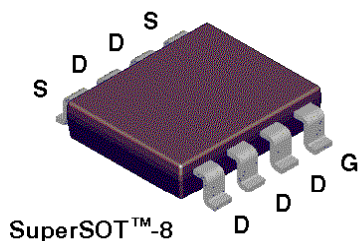
## NDH853N N-Channel Enhancement Mode Field Effect Transistor

### General Description

These 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 minimize on-state resistance and provide superior switching performance. These devices are particularly suited for low voltage applications such as battery powered circuits or portable electronics where fast switching, low in-line power loss, and resistance to transients are needed.

### Features

- 7.6 A, 30 V.  $R_{DS(ON)} = 0.017 \Omega @ V_{GS} = 10 \text{ V}$   
 $R_{DS(ON)} = 0.025 \Omega @ V_{GS} = 4.5 \text{ V}$ .
- High density cell design for extremely low  $R_{DS(ON)}$ .
- Proprietary SuperSOT™-8 small outline surface mount package with high power and current handling capability.



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

Symbol	Parameter	NDH853N	Units
$V_{DSS}$	Drain-Source Voltage	30	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Drain Current - Continuous (Note 1a)	7.6	A
	- Pulsed	23	
$P_D$	Maximum Power Dissipation (Note 1a)	1.8	W
	(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)	70	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	20	$^\circ\text{C/W}$

**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	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	30			V	
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$	
			$T_J = 55^\circ\text{C}$		10	$\mu\text{A}$	
$I_{GSSF}$	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	1.5	2	V	
			$T_J = 125^\circ\text{C}$	0.7	1		1.6
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 7.6\text{ A}$		0.014	0.017	$\Omega$	
			$T_J = 125^\circ\text{C}$		0.02		0.031
				$V_{GS} = 4.5\text{ V}, I_D = 6.7\text{ A}$			0.021
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$	23			A	
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{ V}, I_D = 7.6\text{ A}$		18		S	
<b>DYNAMIC CHARACTERISTICS</b>							
$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		1140		pF	
$C_{oss}$	Output Capacitance			630		pF	
$C_{rss}$	Reverse Transfer Capacitance			210		pF	
<b>SWITCHING CHARACTERISTICS</b> (Note 2)							
$t_{D(on)}$	Turn - On Delay Time	$V_{DD} = 10\text{ V}, I_D = 1\text{ A},$ $V_{GEN} = 10\text{ V}, R_{GEN} = 6\ \Omega$		14	30	ns	
$t_r$	Turn - On Rise Time			24	50	ns	
$t_{D(off)}$	Turn - Off Delay Time			73	120	ns	
$t_f$	Turn - Off Fall Time			48	80	ns	
$Q_g$	Total Gate Charge		$V_{DS} = 15\text{ V},$ $I_D = 7.6\text{ A}, V_{GS} = 10\text{ V}$		38	50	nC
$Q_{gs}$	Gate-Source Charge			2.8		nC	
$Q_{gd}$	Gate-Drain Charge			12.7		nC	

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
$I_S$	Maximum Continuous Drain-Source Diode Forward Current				1.5	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 1.5\text{ A}$ (Note 2)		0.72	1.2	V

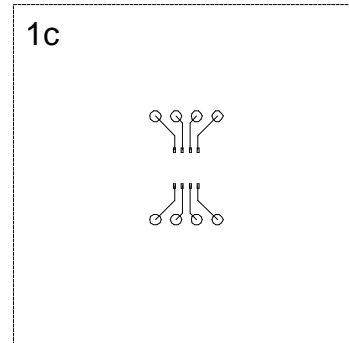
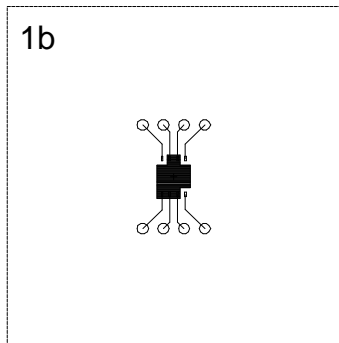
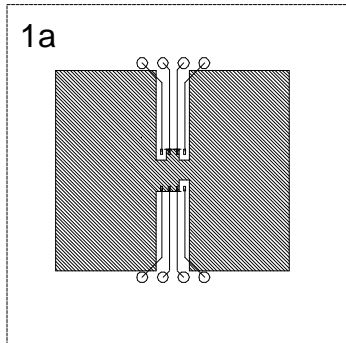
Notes:

- $R_{\theta JA}$  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.

$$P_D(t) = \frac{T_J - T_A}{R_{\theta JA}(t)} = \frac{T_J - T_A}{R_{\theta JC} + R_{\theta CA}(t)} = I_D^2(t) \times R_{DS(ON)}@T_J$$

Typical  $R_{\theta JA}$  using the board layouts shown below on 4.5"x5" FR-4 PCB in a still air environment:

- 70°C/W when mounted on a 1 in<sup>2</sup> pad of 2oz copper.
- 125°C/W when mounted on a 0.026 in<sup>2</sup> pad of 2oz copper.
- 135°C/W when mounted on a 0.005 in<sup>2</sup> 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

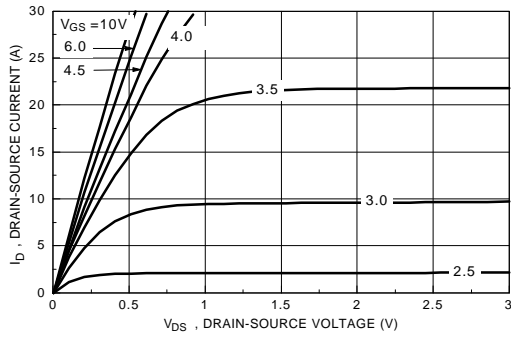


Figure 1. On-Region Characteristics.

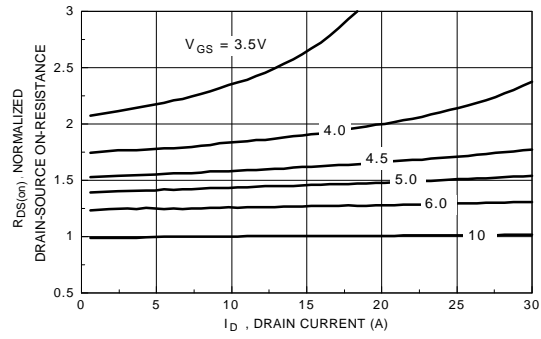


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

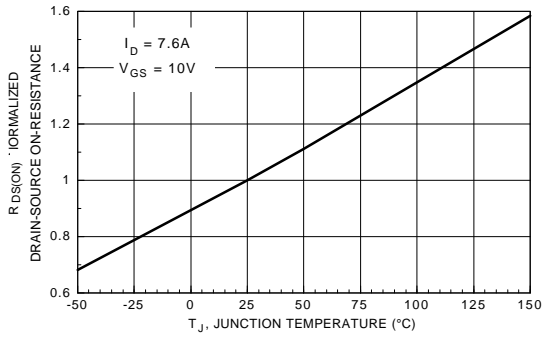


Figure 3. On-Resistance Variation with Temperature.

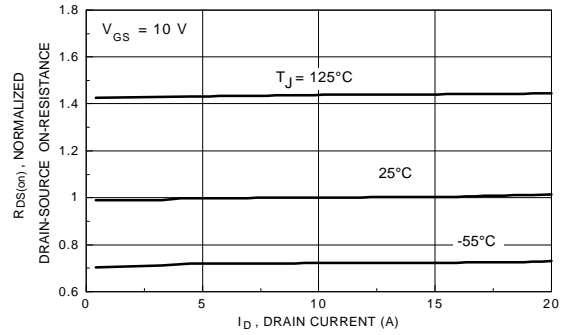


Figure 4. On-Resistance Variation with Drain Current and Temperature.

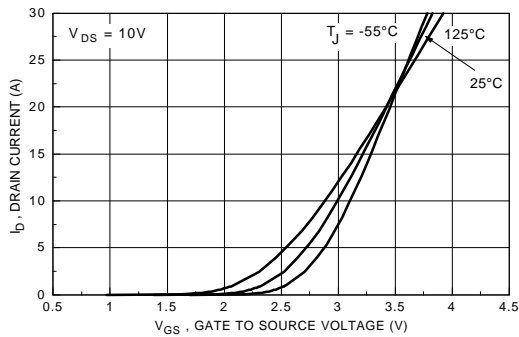


Figure 5. Transfer Characteristics.

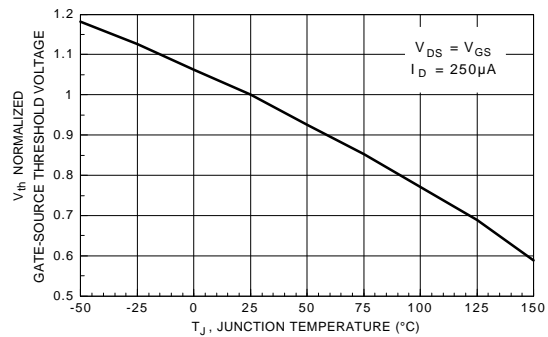
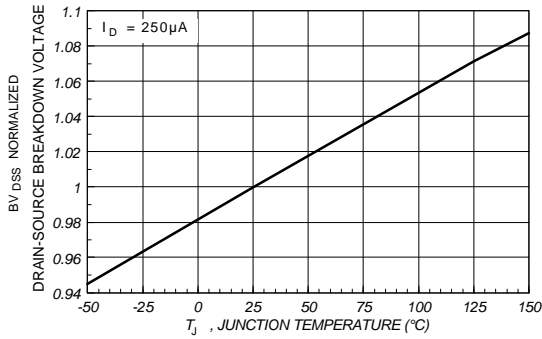
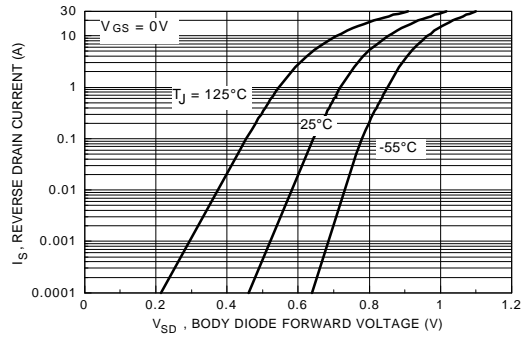


Figure 6. Gate Threshold Variation with Temperature.

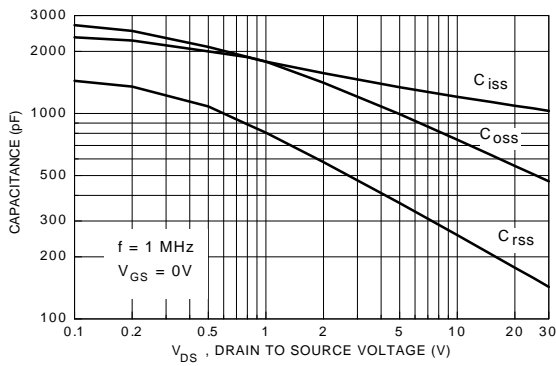
## Typical Electrical Characteristics (continued)



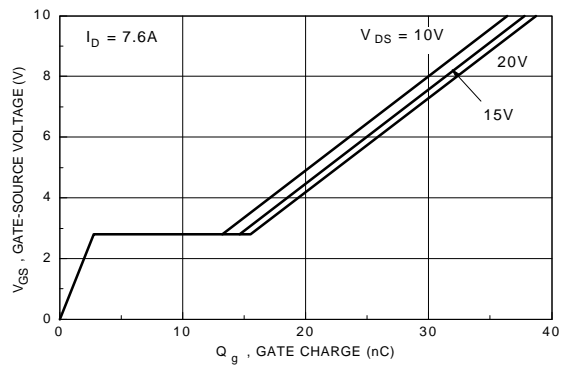
**Figure 7. Breakdown Voltage Variation with Temperature.**



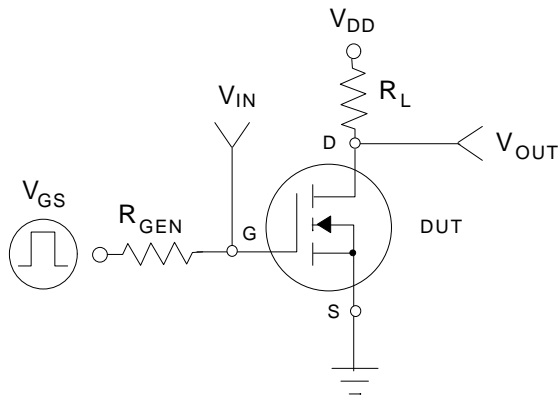
**Figure 8. Body Diode Forward Voltage Variation with Source Current and Temperature.**



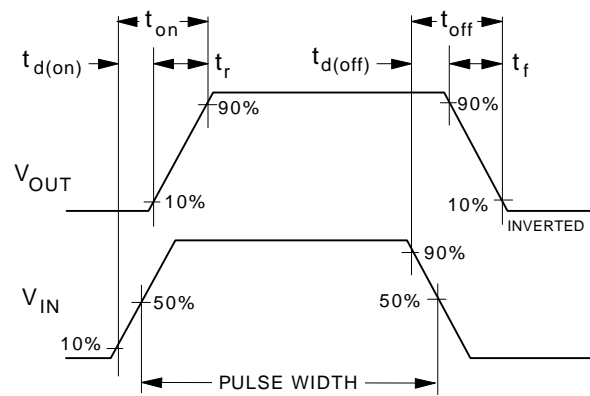
**Figure 9. Capacitance Characteristics.**



**Figure 10. Gate Charge Characteristics.**

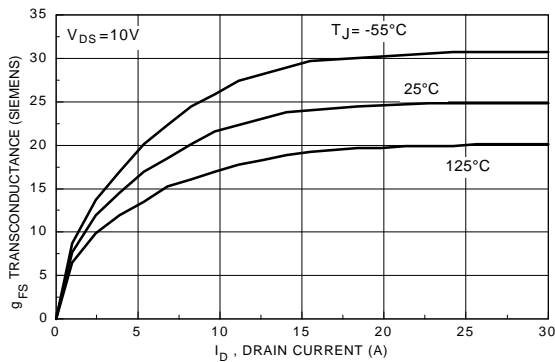


**Figure 11. Switching Test Circuit.**

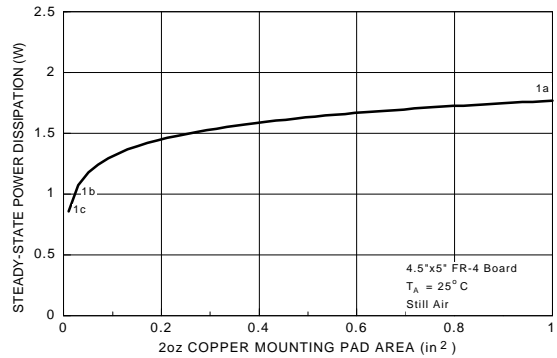


**Figure 12. Switching Waveforms.**

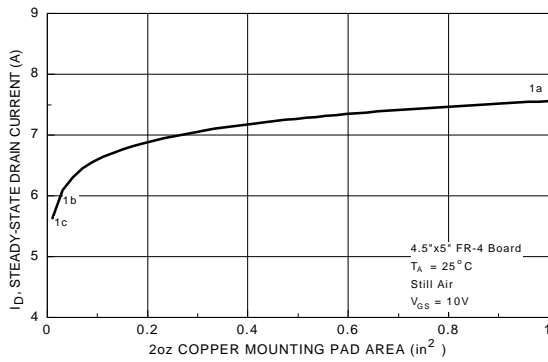
## Typical Electrical and Thermal Characteristics (continued)



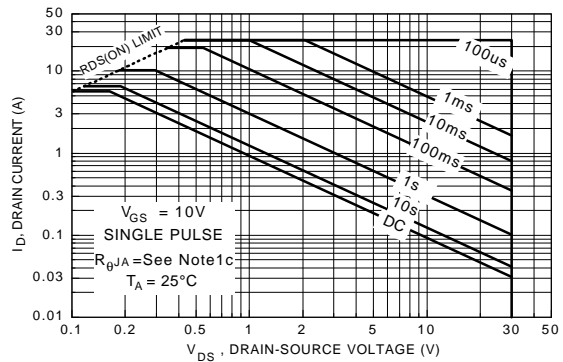
**Figure 13. Transconductance Variation with Drain Current and Temperature.**



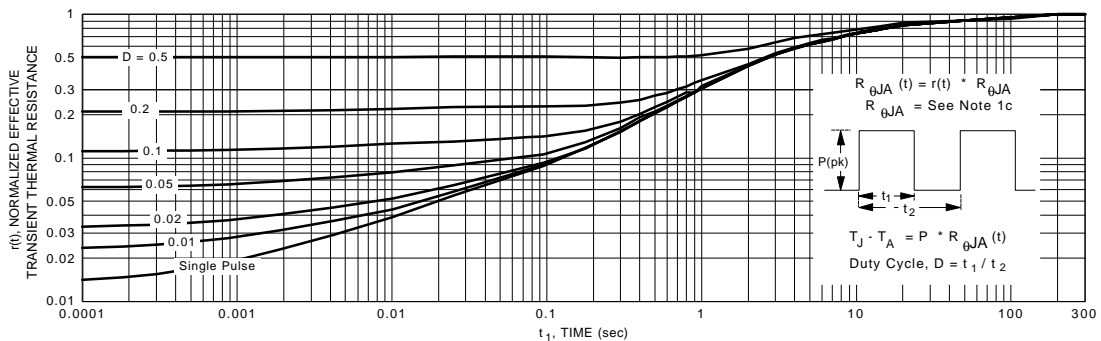
**Figure 14. SOT-8 Maximum Steady-State Power Dissipation versus Copper Mounting Pad Area.**



**Figure 15. Maximum Steady-State Drain Current versus Copper Mounting Pad Area.**



**Figure 16. Maximum Safe Operating Area.**



**Figure 17. Transient Thermal Response Curve.**

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