

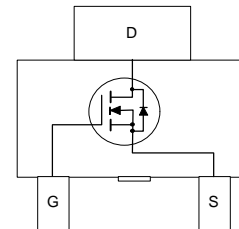
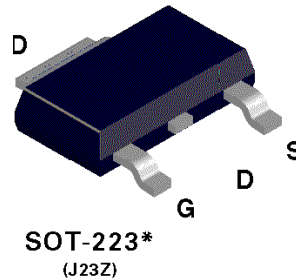
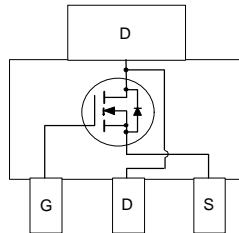
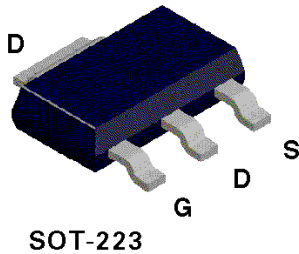
**NDT455N**  
**N-Channel Enhancement Mode Field Effect Transistor**

**General Description**

These N-Channel logic level 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, provide superior switching performance, and withstand high energy pulses in the avalanche and commutation modes. These devices are particularly suited for low voltage applications such as DC motor control and DC/DC conversion where fast switching, low in-line power loss, and resistance to transients are needed.

**Features**

- 11.5 A, 30 V.  $R_{DS(ON)} = 0.015 \Omega @ V_{GS} = 10 \text{ V}$   
 $R_{DS(ON)} = 0.02 \Omega @ V_{GS} = 4.5 \text{ V}$ .
- High density cell design for extremely low  $R_{DS(ON)}$ .
- High power and current handling capability in a widely used surface mount package.



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

Symbol	Parameter	NDT455N	Units
$V_{DSS}$	Drain-Source Voltage	30	V
$V_{GSS}$	Gate-Source Voltage	20	V
$I_D$	Drain Current - Continuous (Note 1a)	$\pm 11.5$	A
	- Pulsed	$\pm 40$	
$P_D$	Maximum Power Dissipation (Note 1a)	3	W
	(Note 1b)	1.3	
	(Note 1c)	1.1	
$T_J, T_{STG}$	Operating and Storage Temperature Range	-65 to 150	$^\circ\text{C}$

**THERMAL CHARACTERISTICS**

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	42	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	12	$^\circ\text{C/W}$

**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	3	V
			$T_J = 125^\circ\text{C}$	0.7	0.9	
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 11.5\text{ A}$		0.013	0.015	$\Omega$
			$T_J = 125^\circ\text{C}$		0.019	
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 4.5\text{ V}, I_D = 10\text{ A}$		0.018	0.02	A
$g_{FS}$	Forward Transconductance	$V_{GS} = 10\text{ V}, I_D = 11.5\text{ A}$		26		S
<b>DYNAMIC CHARACTERISTICS</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		1220		pF
$C_{oss}$	Output Capacitance			715		pF
$C_{rss}$	Reverse Transfer Capacitance			280		pF
<b>SWITCHING CHARACTERISTICS</b> (Note 2)						
$t_{D(on)}$	Turn - On Delay Time	$V_{DD} = 15\text{ V}, I_D = 1\text{ A},$ $V_{GEN} = 10\text{ V}, R_{GEN} = 6\ \Omega$		11	20	ns
$t_r$	Turn - On Rise Time			16	30	ns
$t_{D(off)}$	Turn - Off Delay Time			48	80	ns
$t_f$	Turn - Off Fall Time			40	70	ns
$Q_g$	Total Gate Charge		$V_{DS} = 10\text{ V},$ $I_D = 11.5\text{ A}, V_{GS} = 10\text{ V}$		43	61
$Q_{gs}$	Gate-Source Charge			4		nC
$Q_{gd}$	Gate-Drain Charge			11		nC

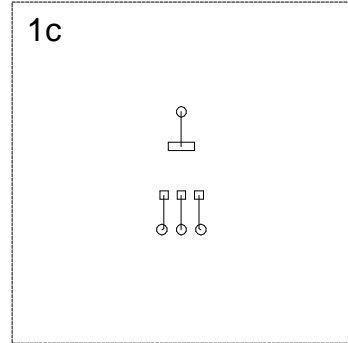
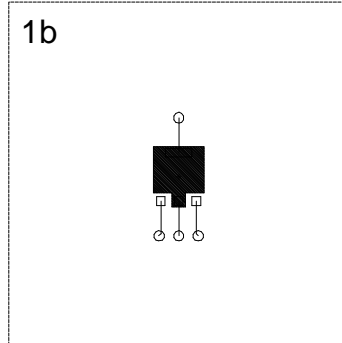
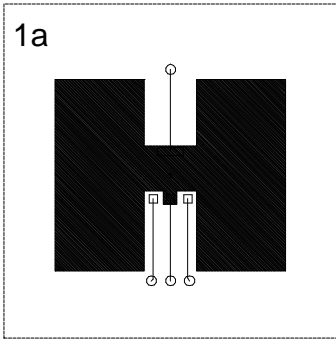
## Electrical Characteristics (T<sub>A</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current				2.5	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 2.5 A (Note 2)		0.845	1.2	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>F</sub> = 2.5 A dI <sub>F</sub> /dt = 100 A/μs			140	ns

Notes:

1.  $P_D(t) = \frac{T_J - T_A}{R_{\theta JA}(t)} = \frac{T_J - T_A}{R_{\theta JC} + R_{\theta CA}(t)} = I_D^2(t) \times R_{DS(ON)@T_J}$  R<sub>θJA</sub> 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<sub>θJC</sub> is guaranteed by design while R<sub>θCA</sub> is defined by users. For general reference: Applications on 4.5"x5" FR-4 PCB under still air environment, typical R<sub>θJA</sub> is found to be:

- 42°C/W with 1 in<sup>2</sup> of 2 oz copper mounting pad.
- 95°C/W with 0.066 in<sup>2</sup> of 2 oz copper mounting pad.
- 110°C/W with 0.0123 in<sup>2</sup> of 2 oz copper mounting pad.



Scale 1 : 1 on letter size paper

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

## Typical Electrical Characteristics

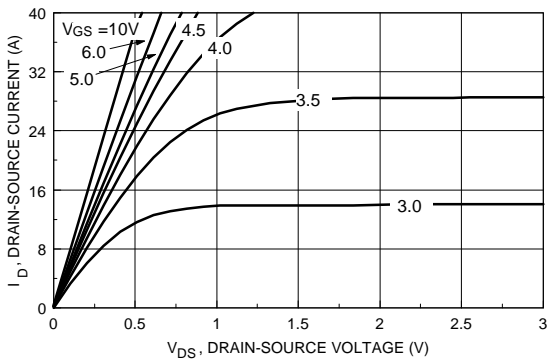


Figure 1. On-Region Characteristics.

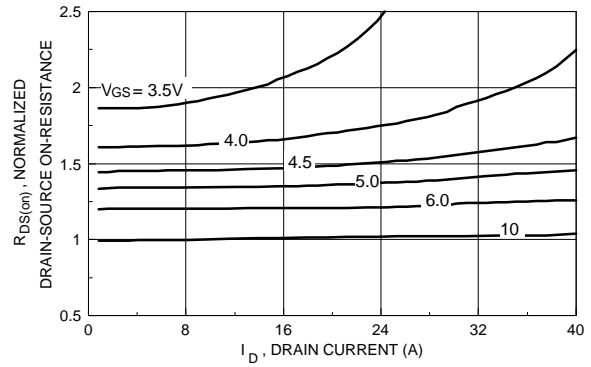


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current.

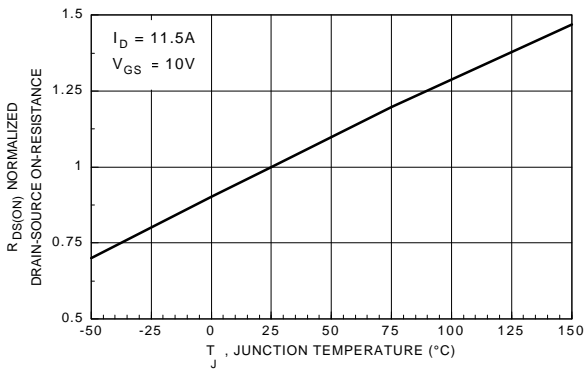


Figure 3. On-Resistance Variation with Temperature.

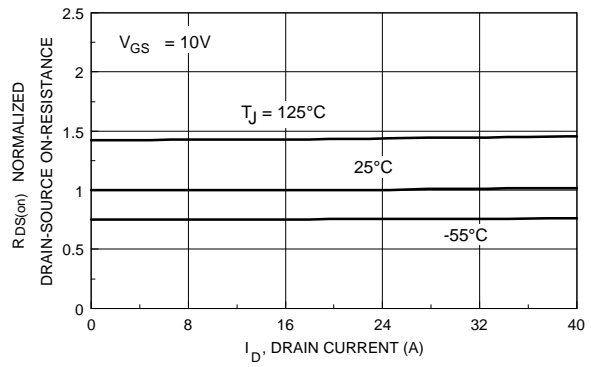


Figure 4. On-Resistance Variation with Drain Current and Temperature.

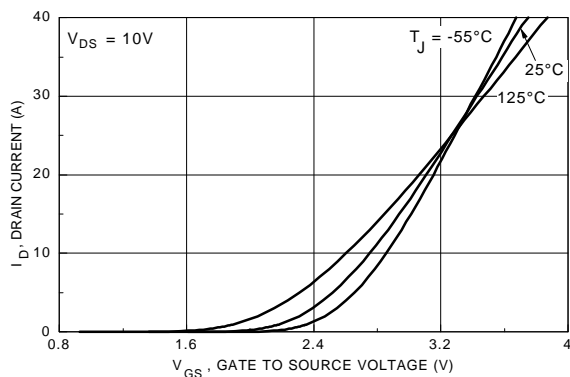


Figure 5. Transfer Characteristics.

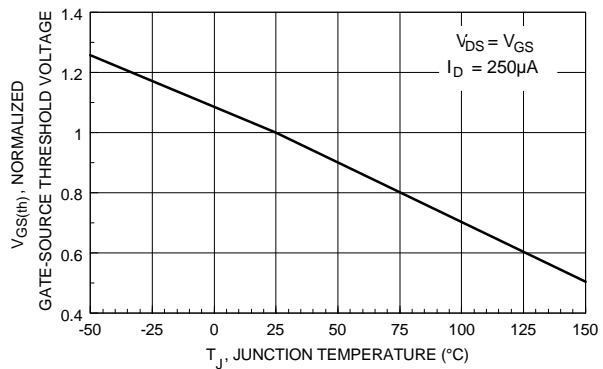


Figure 6. Gate Threshold Variation with Temperature.

## Typical Electrical Characteristics

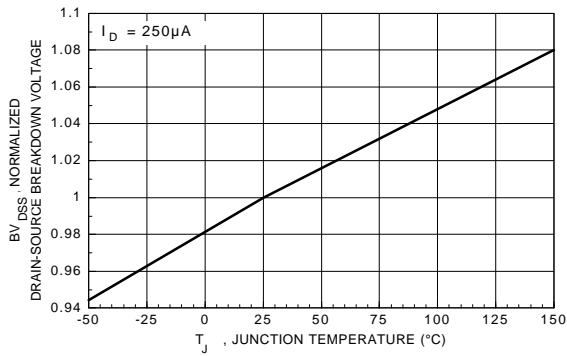


Figure 7. Breakdown Voltage Variation with Temperature.

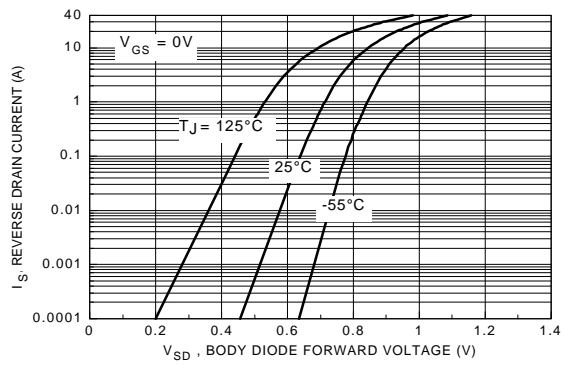


Figure 8. Body Diode Forward Voltage Variation with Current and Temperature.

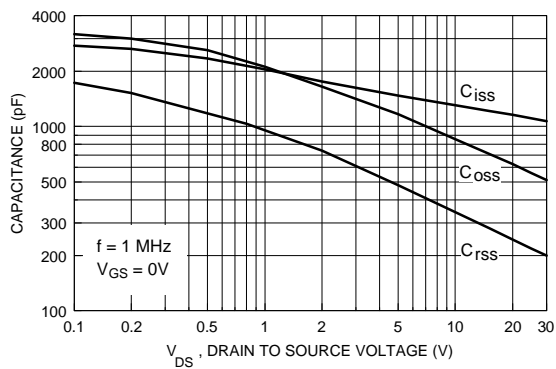


Figure 9. Capacitance Characteristics.

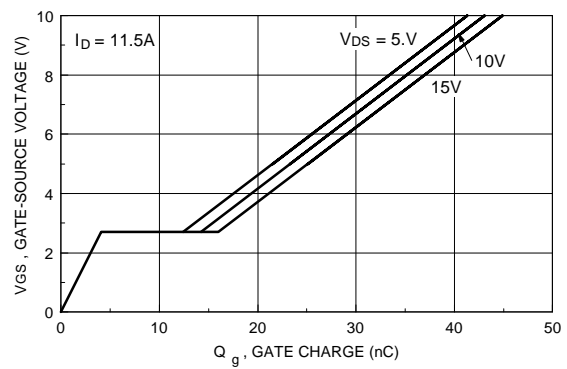


Figure 10. Gate Charge Characteristics.

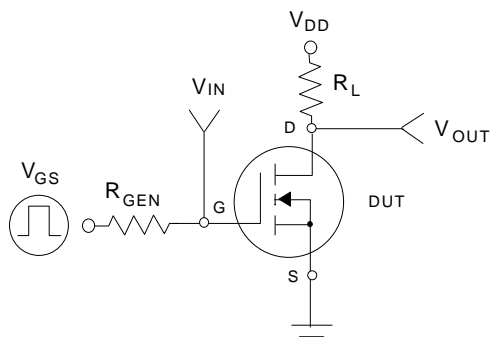


Figure 11. Switching Test Circuit.

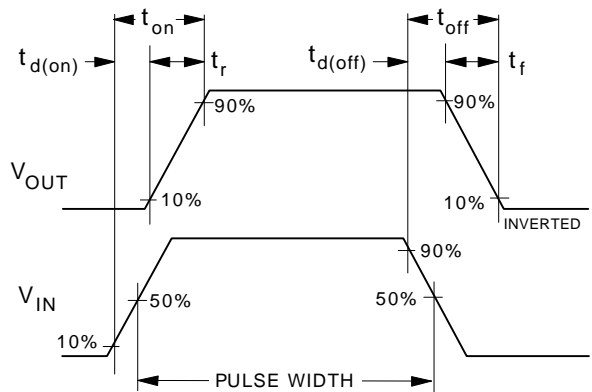
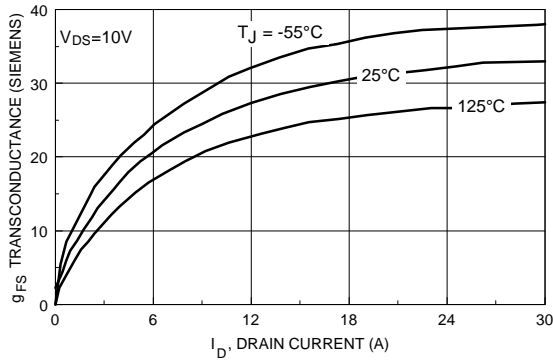
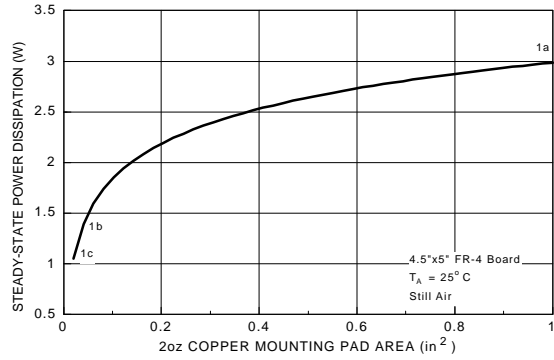


Figure 12. Switching Waveforms.

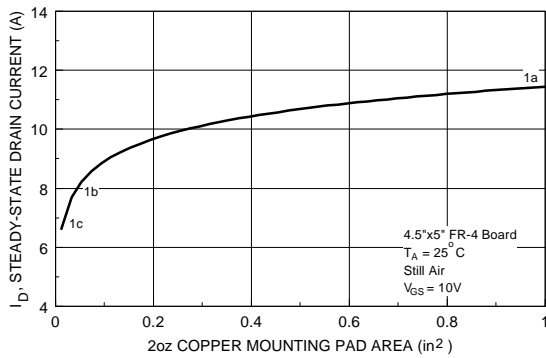
## Typical Thermal Characteristics



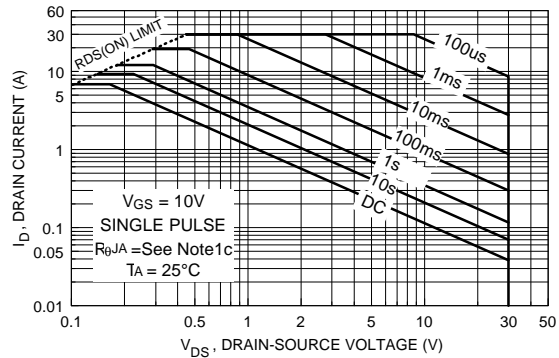
**Figure 13. Transconductance Variation with Drain Current and Temperature.**



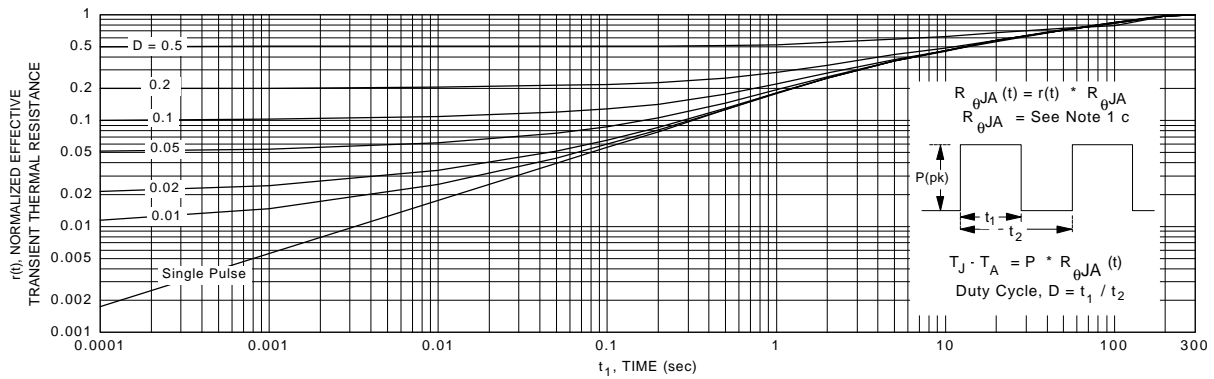
**Figure 14. SOT-223 Maximum Steady-State Power Dissipation versus Copper Mounting Pad Area.**



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



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



**Figure 17. Typical Transient Thermal Impedance Curve.**

Remark: Thermal characterization performed under the conditions of Note 1c. Should better thermal design employs,  $R_{\theta JA}$  will be lower and reach thermal equivalent sooner.

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