

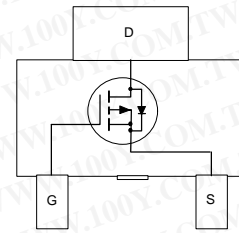
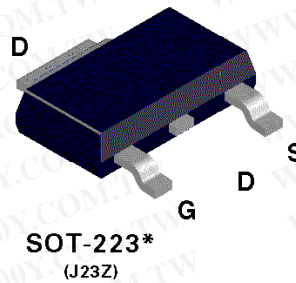
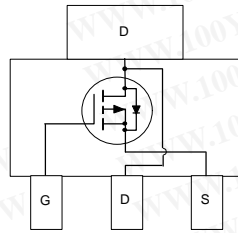
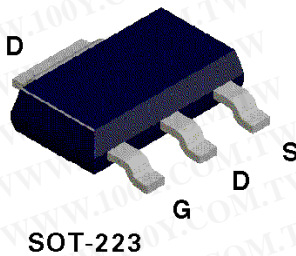
## NDT452AP P-Channel Enhancement Mode Field Effect Transistor

### General Description

Power SOT P-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 notebook computer power management and DC motor control.

### Features

- -5A, -30V.  $R_{DS(ON)} = 0.065\Omega @ V_{GS} = -10V$   
 $R_{DS(ON)} = 0.1\Omega @ V_{GS} = -4.5V.$
- 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	NDT452AP	Units
$V_{DSS}$	Drain-Source Voltage	-30	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Drain Current - Continuous (Note 1a)	-5	A
	- Pulsed	- 15	
$P_D$	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	$^\circ\text{C/W}$

\* Order option J23Z for cropped center drain lead.

**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	-1.6	-2.8	V
			$T_J = 125^\circ\text{C}$	-0.7	-1.2	-2.2	
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = -10\text{ V}, I_D = -5.0\text{ A}$			0.052	0.065	$\Omega$
			$T_J = 125^\circ\text{C}$			0.075	
$I_{D(on)}$	On-State Drain Current	$V_{GS} = -4.5\text{ V}, I_D = -4.3\text{ A}$			0.085	0.1	
			$V_{GS} = -4.5\text{ V}, V_{DS} = -5\text{ V}$				
$I_{D(on)}$	On-State Drain Current	$V_{GS} = -10\text{ V}, V_{DS} = -5\text{ V}$	-15			A	
$I_{D(on)}$	On-State Drain Current	$V_{GS} = -4.5\text{ V}, V_{DS} = -5\text{ V}$	-5			A	
$g_{FS}$	Forward Transconductance	$V_{DS} = -10\text{ V}, I_D = -5.0\text{ A}$		7		S	
<b>DYNAMIC CHARACTERISTICS</b>							
$C_{iss}$	Input Capacitance	$V_{DS} = -15\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		690		pF	
$C_{oss}$	Output Capacitance			430		pF	
$C_{rss}$	Reverse Transfer Capacitance			160		pF	
<b>SWITCHING CHARACTERISTICS</b> (Note 2)							
$t_{D(on)}$	Turn - On Delay Time	$V_{DD} = -10\text{ V}, I_D = -1\text{ A},$ $V_{GEN} = -10\text{ V}, R_{GEN} = 6\ \Omega$		9	20	ns	
$t_r$	Turn - On Rise Time			20	30	ns	
$t_{D(off)}$	Turn - Off Delay Time			40	50	ns	
$t_f$	Turn - Off Fall Time			19	40	ns	
$Q_g$	Total Gate Charge		$V_{DS} = -10\text{ V},$ $I_D = -5.0\text{ A}, V_{GS} = -10\text{ V}$		22	30	nC
$Q_{gs}$	Gate-Source Charge			3.2		nC	
$Q_{gd}$	Gate-Drain Charge			5.2		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				-2.5	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = -2.5\text{ A}$ (Note 2)		-0.85	-1.2	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}$ , $I_F = -2.5\text{ A}$ , $dI_F/dt = 100\text{ A}/\mu\text{s}$			100	ns

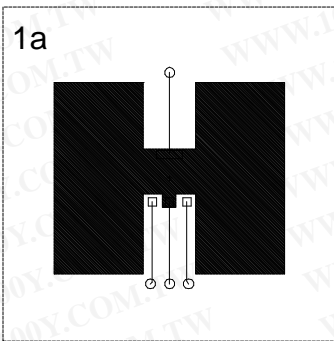
Notes:

- $R_{\theta_{JA}}$  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.

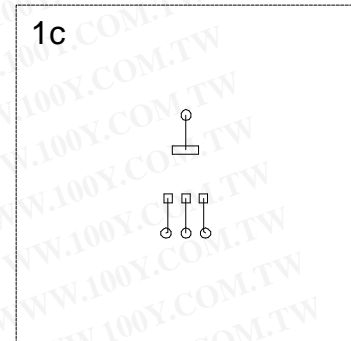
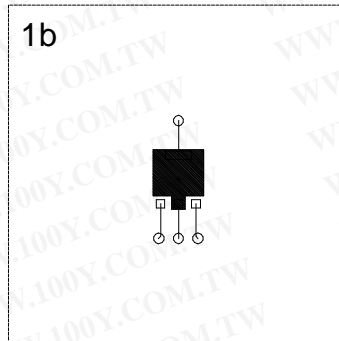
$$P_D(t) = \frac{I_F I_A}{R_{\theta_{JA}}(t)} = \frac{I_F I_A}{R_{\theta_{JC}} + R_{\theta_{CA}}(t)} = I_D^2(t) \times R_{DS(on)} \theta_{TJ}$$

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

- 42°C/W when mounted on a 1 in<sup>2</sup> pad of 2oz copper.
- 95°C/W when mounted on a 0.066 in<sup>2</sup> pad of 2oz copper.
- 110°C/W when mounted on a 0.0123 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

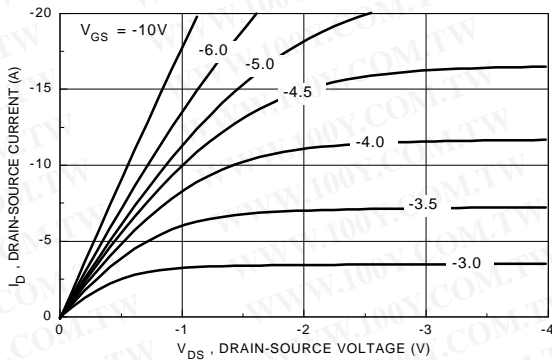


Figure 1. On-Region Characteristics.

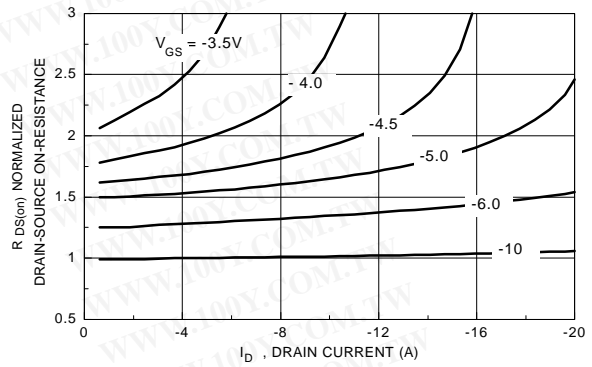


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current.

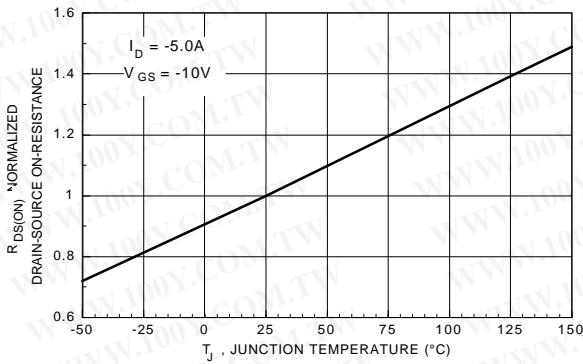


Figure 3. On-Resistance Variation with Temperature.

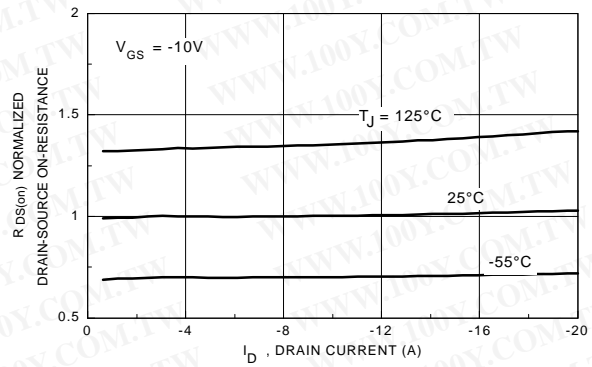


Figure 4. On-Resistance Variation with Drain Current and Temperature.

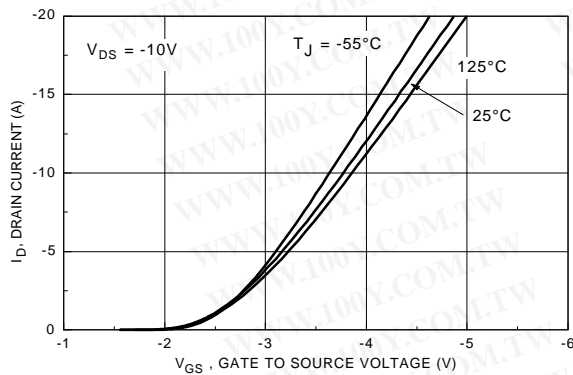


Figure 5. Transfer Characteristics.

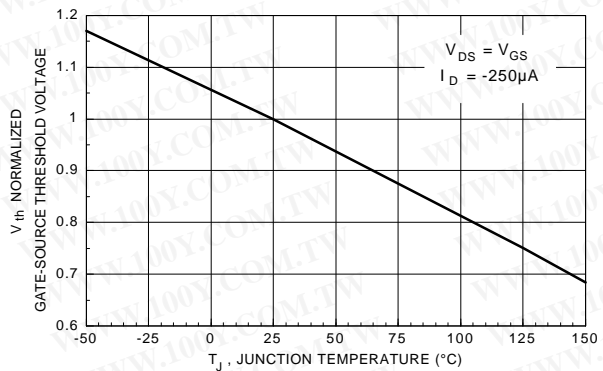


Figure 6. Gate Threshold Variation with Temperature.

## Typical Electrical Characteristics

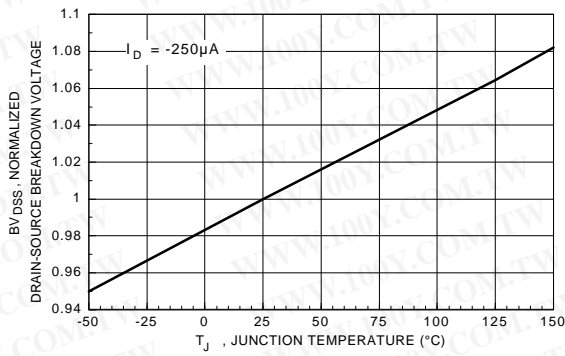


Figure 7. Breakdown Voltage Variation with Temperature.

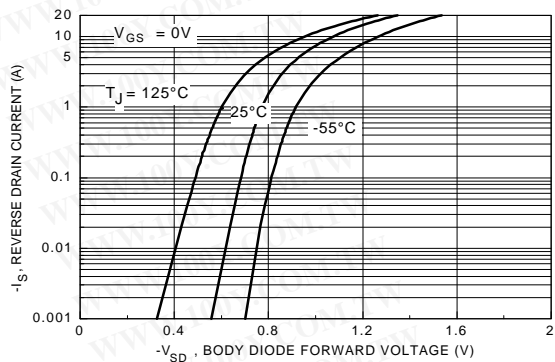


Figure 8. Body Diode Forward Voltage Variation with Current and Temperature.

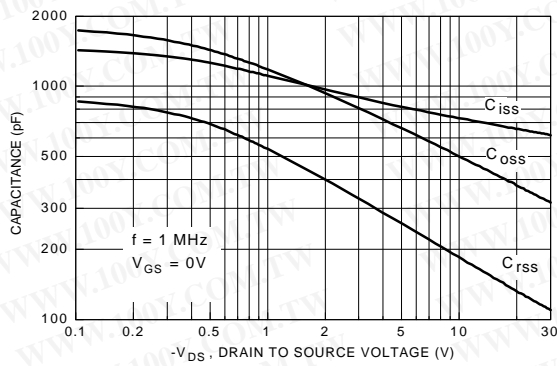


Figure 9. Capacitance Characteristics.

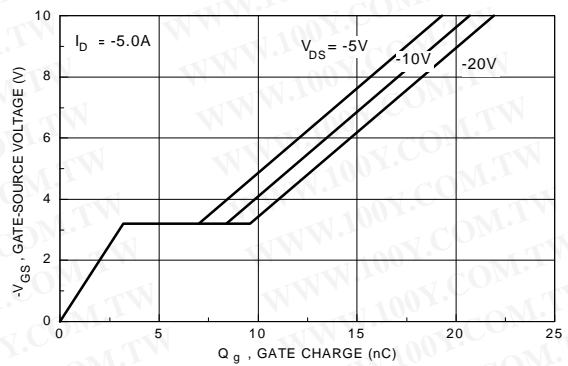


Figure 10. Gate Charge Characteristics.

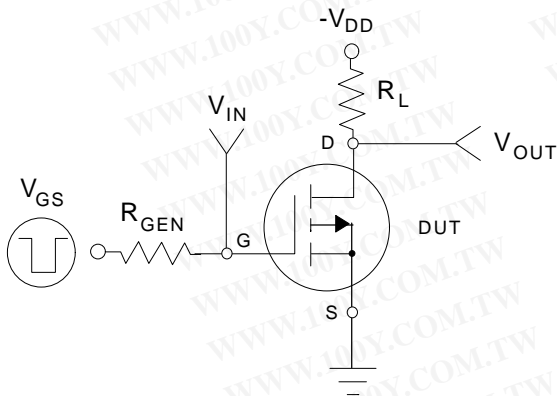


Figure 11. Switching Test Circuit.

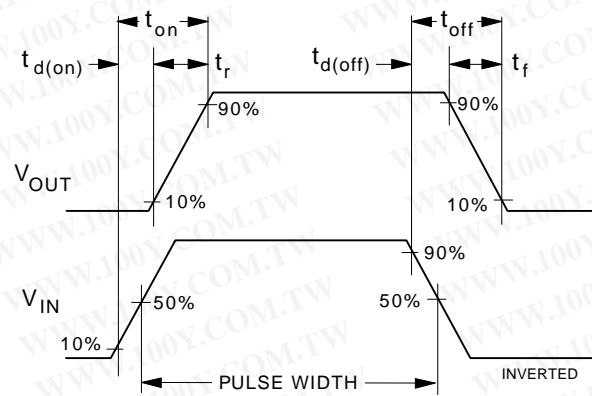


Figure 12. Switching Waveforms.

## Typical Thermal Characteristics

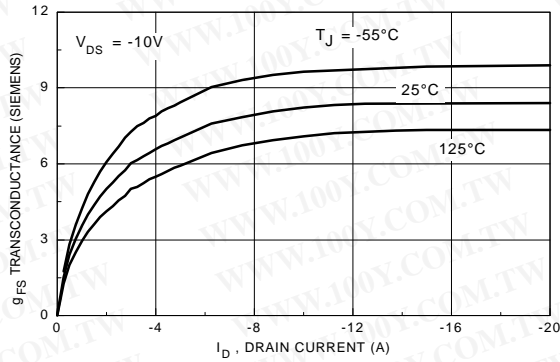


Figure 13. Transconductance Variation with Drain Current and Temperature.

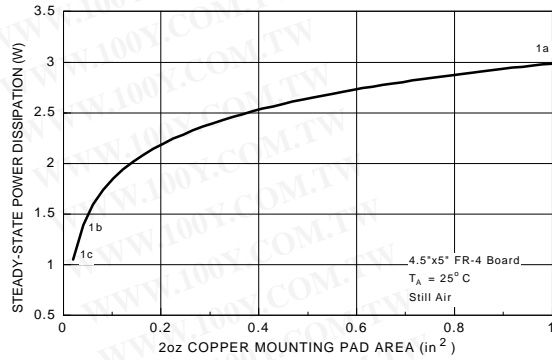


Figure 14. SOT-223 Maximum Steady-state Power Dissipation versus Copper Mounting Pad Area.

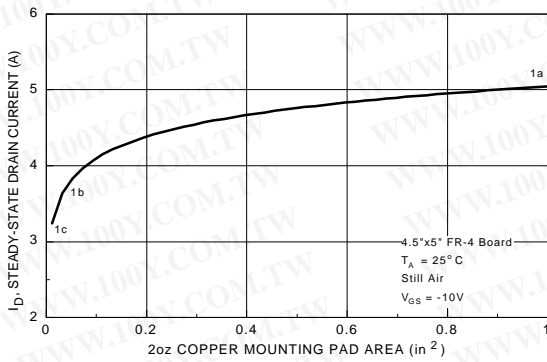


Figure 15. Maximum Steady-State Drain Current versus Copper Mounting Pad Area.

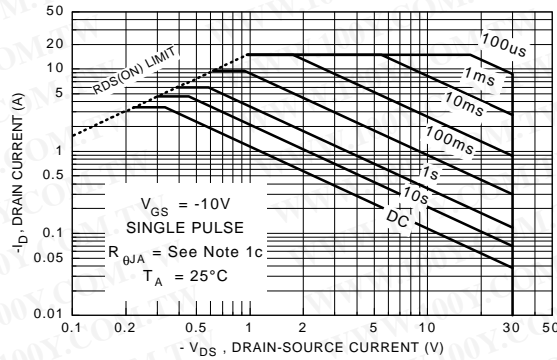


Figure 16. Maximum Safe Operating Area.

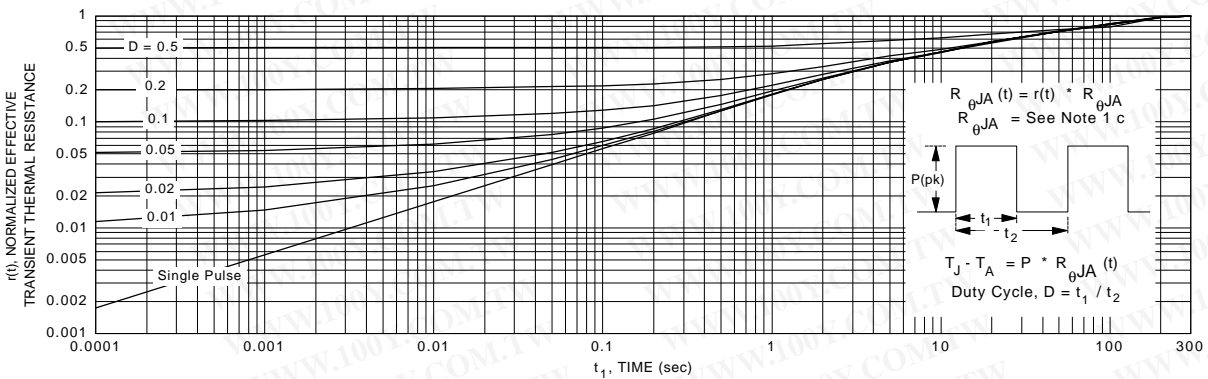


Figure 17. Transient Thermal Response Curve.

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

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