

## NDT2955

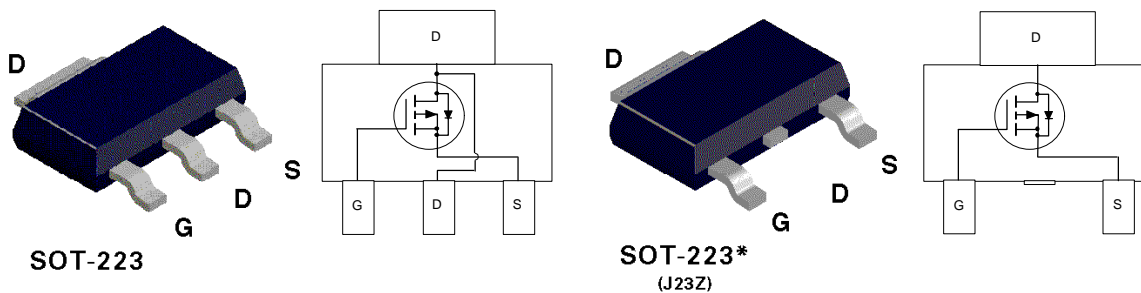
### P-Channel Enhancement Mode Field Effect Transistor

#### 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

- -2.5A, -60V.  $R_{DS(ON)} = 0.3\Omega @ V_{GS} = -10V$ .
- 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		NDT2955	Units
$V_{DSS}$	Drain-Source Voltage		-60	V
$V_{GSS}$	Gate-Source Voltage		$\pm 20$	V
$I_D$	Drain Current	- Continuous (Note 1a)	-2.5	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	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-60			V	
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}$			-10	$\mu\text{A}$	
			$T_J = 125^\circ\text{C}$		-100	$\mu\text{A}$	
$I_{GSSF}$	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	$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	-2	-2.4	-4	V	
			$T_J = 125^\circ\text{C}$	-0.8	-2		-2.6
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = -10\text{ V}, I_D = -2.5\text{ A}$		0.21	0.3	$\Omega$	
			$T_J = 125^\circ\text{C}$		0.3		0.45
			$V_{GS} = -4.5\text{ V}, I_D = -2\text{ A}$		0.36		0.5
$I_{D(on)}$	On-State Drain Current	$V_{GS} = -10\text{ V}, V_{DS} = -5\text{ V}$	-12			A	
$g_{FS}$	Forward Transconductance	$V_{DS} = -10\text{ V}, I_D = -2.5\text{ A}$		3.5		S	
<b>DYNAMIC CHARACTERISTICS</b>							
$C_{iss}$	Input Capacitance	$V_{DS} = -25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		570		pF	
$C_{oss}$	Output Capacitance			140		pF	
$C_{rss}$	Reverse Transfer Capacitance			40		pF	
<b>SWITCHING CHARACTERISTICS</b> (Note 2)							
$t_{D(on)}$	Turn - On Delay Time	$V_{DD} = -30\text{ V}, I_D = -1\text{ A},$ $V_{GEN} = -10\text{ V}, R_{GEN} = 6\ \Omega$		8	15	ns	
$t_r$	Turn - On Rise Time			20	40	ns	
$t_{D(off)}$	Turn - Off Delay Time			20	40	ns	
$t_f$	Turn - Off Fall Time			5	20	ns	
$Q_g$	Total Gate Charge	$V_{DS} = -30\text{ V},$ $I_D = -2.5\text{ A}, V_{GS} = -10\text{ V}$		16	25	nC	
$Q_{gs}$	Gate-Source Charge			2	5	nC	
$Q_{gd}$	Gate-Drain Charge			4	8	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				-2.3	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = -2.5 A (Note2)			-1.3	V

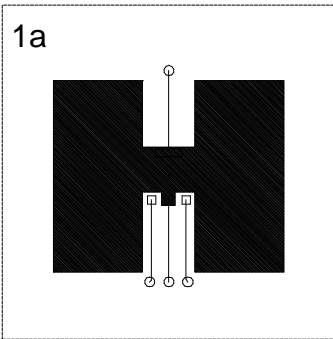
**Notes:**

- 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 determined by the user's board design.

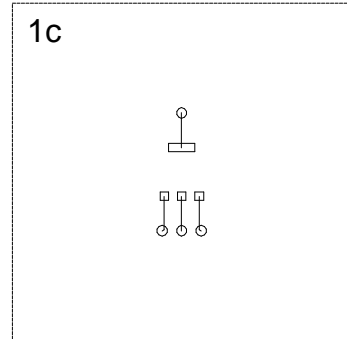
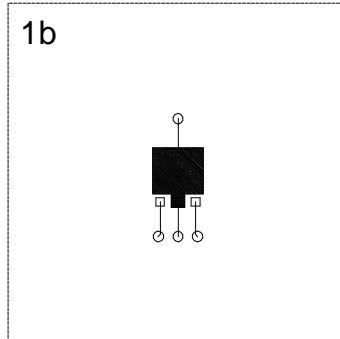
$$P_D(t) = \frac{T_J - T_A}{R_{\theta J A}(t)} = \frac{T_J - T_A}{R_{\theta J C} + R_{\theta C A}(t)} = I_D^2(t) \times R_{DS(on)} \theta_{TJ}$$

Typical R<sub>θJA</sub> 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 ≤ 300μs, Duty Cycle ≤ 2.0%.

## Typical Electrical Characteristics

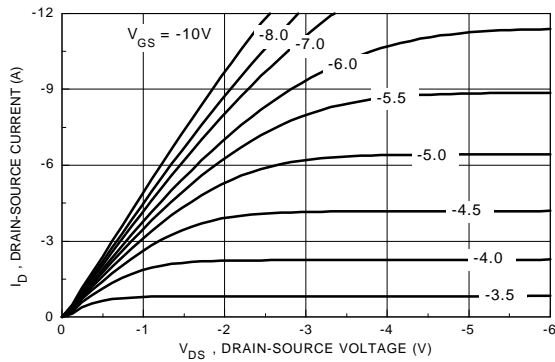


Figure 1. On-Region Characteristics.

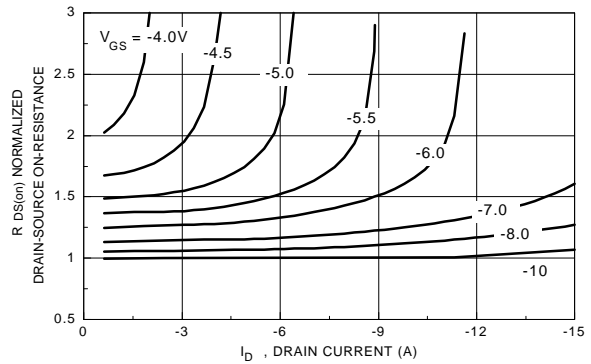


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current.

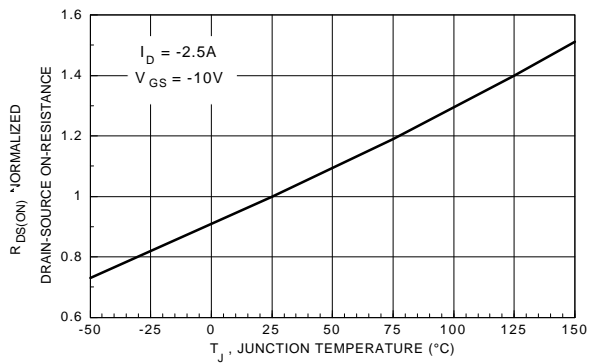


Figure 3. On-Resistance Variation with Temperature.

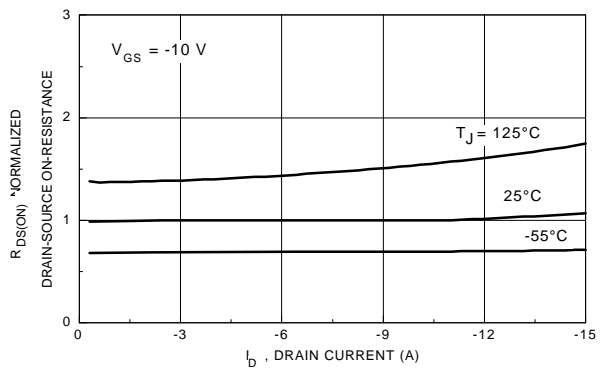


Figure 4. On-Resistance Variation with Drain Current and Temperature.

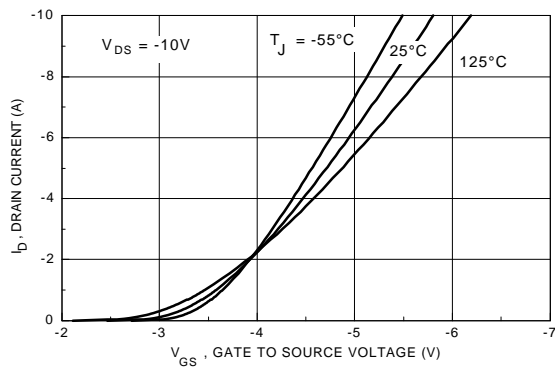


Figure 5. Drain Current Variation with Gate Voltage and Temperature.

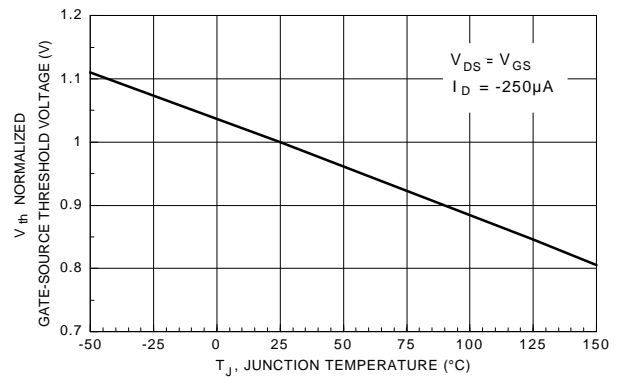
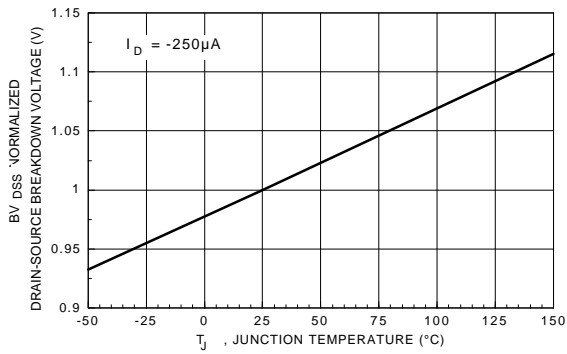
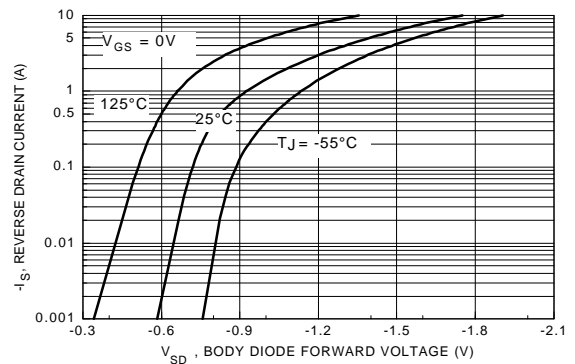


Figure 6. Gate Threshold Variation with Temperature.

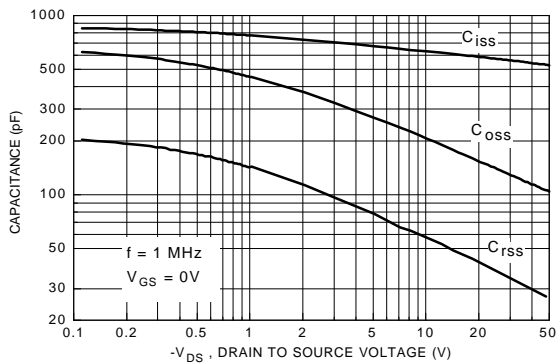
## Typical Electrical Characteristics (continued)



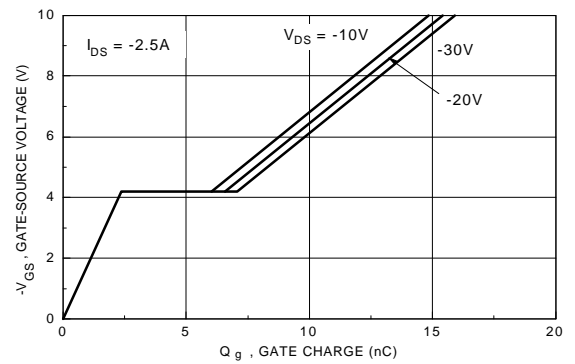
**Figure 7. Breakdown Voltage Variation with Temperature.**



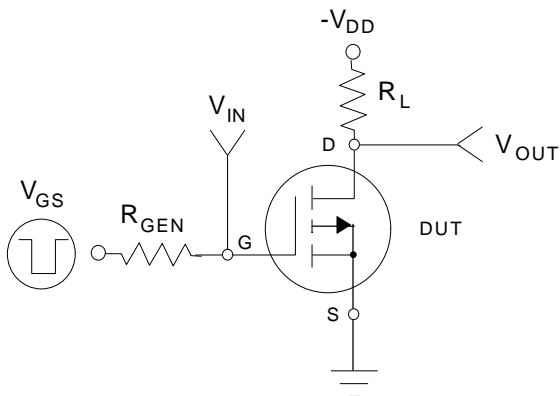
**Figure 8. Body Diode Forward Voltage Variation with Current and Temperature**



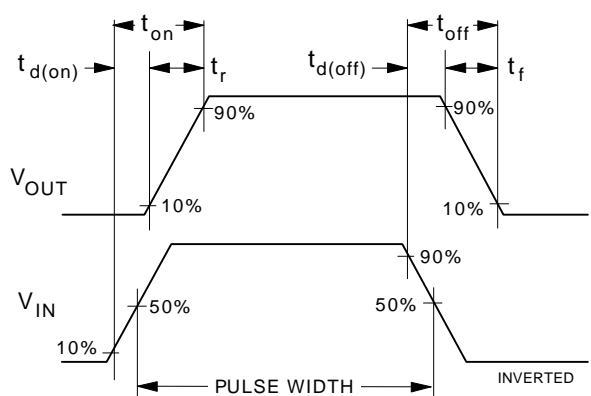
**Figure 9. Capacitance Characteristics.**



**Figure 10. Gate Charge Characteristics.**

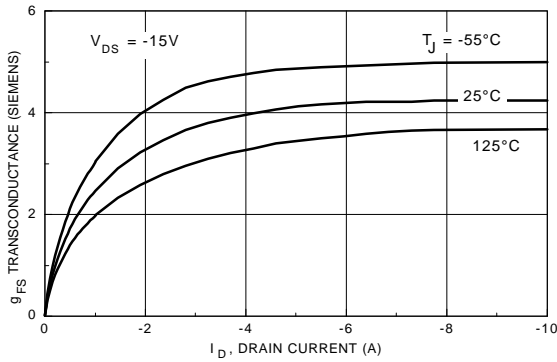


**Figure 11. Switching Test Circuit.**

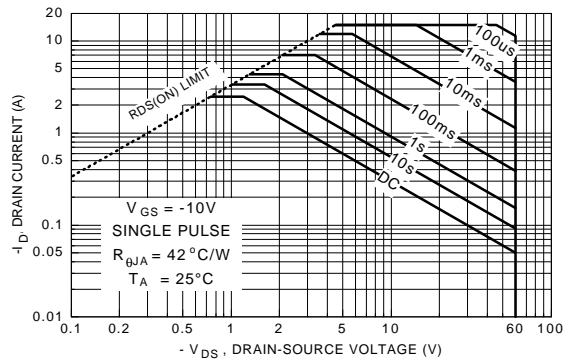


**Figure 12. Switching Waveforms.**

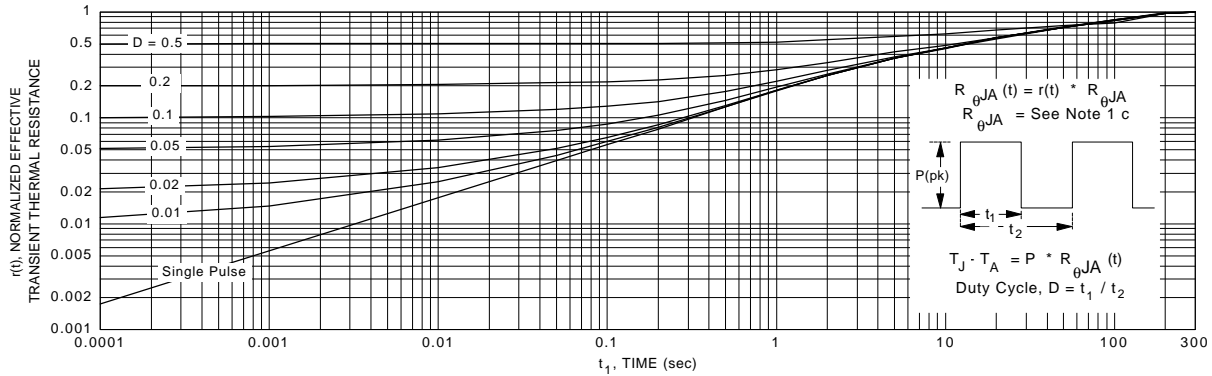
**Typical Electrical Characteristics (continued)**



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



**Figure 14. Maximum Safe Operating Area.**



**Figure 15. 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.