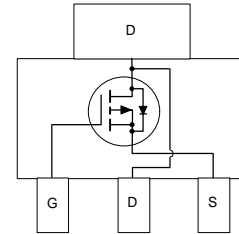


General Description

Power SOT-223 P-Channel enhancement mode power field effect transistors 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

- $V_{DS}(V) = -30V$
- $I_D = -7.5A$ ($V_{GS} = -10V$)
- $R_{DS(ON)} < 30m\Omega$ ($V_{GS} = -10V$)
- $R_{DS(ON)} < 45m\Omega$ ($V_{GS} = -4.5V$)
- 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 $T = 25^\circ C$ unless otherwise noted

| Symbol | Parameter | NDT456P | Units |
|----------------|---|------------|------------|
| V_{DSS} | Drain-Source Voltage | -30 | V |
| V_{GSS} | Gate-Source Voltage | ± 20 | V |
| I_D | Drain Current - Continuous (Note 1a) | ± 7.5 | A |
| | - Pulsed | ± 20 | |
| 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 | $^\circ C$ |

THERMAL CHARACTERISTICS

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

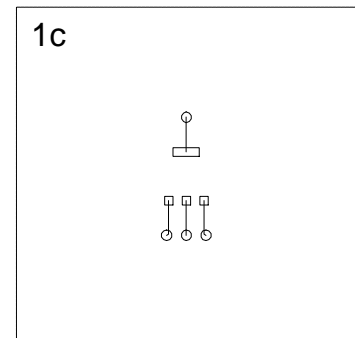
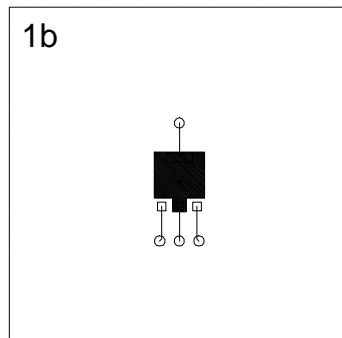
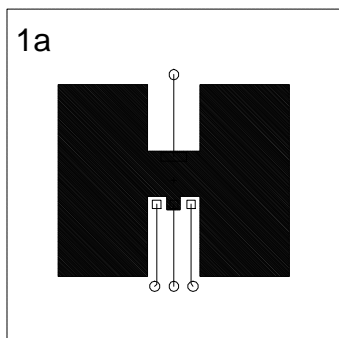
Electrical Characteristics (T_A = 25°C unless otherwise noted)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---------------------|---|---|--|-------|------|-------|
| BV _{DSS} | Drain-Source Breakdown Voltage | V _{GS} = 0 V, I _D = 250 μA | -30 | | | V |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} = -24 V, V _{GS} = 0 V | | | -1 | μA |
| | | T _J = 55°C | | | -10 | μA |
| I _{GSSF} | Gate - Body Leakage, Forward | V _{GS} = 20 V, V _{DS} = 0 V | | | 100 | nA |
| I _{GSSR} | Gate - Body Leakage, Reverse | V _{GS} = -20 V, V _{DS} = 0 V | | | -100 | nA |
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} = V _{GS} , I _D = -250 μA | -1 | -1.5 | -3 | V |
| R _{DS(ON)} | Static Drain-Source On-Resistance | V _{GS} = -10 V, I _D = -7.5 A | | 26 | 30 | mΩ |
| | | V _{GS} = -4.5 V, I _D = -6 A | | 41 | 45 | |
| I _{D(on)} | On-State Drain Current | V _{GS} = -10 V, V _{DS} = -5 V | -20 | | | A |
| | | V _{GS} = -4.5 V, V _{DS} = -5 V | -10 | | | |
| G _{fs} | Forward Transconductance | V _{GS} = -10 V, I _D = -7.5 A | | 13 | | S |
| C _{iss} | Input Capacitance | V _{DS} = -15 V, V _{GS} = 0 V, f = 1.0 MHz | | 1440 | | pF |
| C _{oss} | Output Capacitance | | | 905 | | pF |
| C _{rss} | Reverse Transfer Capacitance | | | 355 | | pF |
| t _{D(on)} | Turn - On Delay Time | | V _{DD} = -15 V, I _D = -7 A, V _{GEN} = -10 V, R _{GEN} = 12 Ω | | 10 | 20 |
| t _r | Turn - On Rise Time | | | 65 | 120 | ns |
| t _{D(off)} | Turn - Off Delay Time | | | 70 | 130 | ns |
| t _f | Turn - Off Fall Time | | | 70 | 130 | ns |
| Q _g | Total Gate Charge | V _{DS} = -10 V, I _D = -7.5 A, V _{GS} = -10 V | | | 47 | 67 |
| Q _{gs} | Gate-Source Charge | | | 5 | | nC |
| Q _{gd} | Gate-Drain Charge | | | 12 | | nC |
| I _S | Maximum Continuous Drain-Source Diode Forward Current | | | | -2.5 | A |
| V _{SD} | Drain-Source Diode Forward Voltage | V _{GS} = 0 V, I _S = -2.5 A (Note 2) | | -0.85 | -1.2 | V |
| t _{rr} | Reverse Recovery Time | V _{GS} = 0 V, I _F = -2.5 A dI _F /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_{θJA} 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_{θJC} is guaranteed by design while R_{θCA} is defined by users. For general reference: Applications on 4.5"x5" FR-4 PCB under still air environment, typical R_{θJA} is found to be:

- a. 42°C when mounted on a 1 in² pad of 2oz copper.
- b. 95°C when mounted on a 0.066in² pad of 2oz copper.
- c. 110°C/W when mounted on a 0.00123in² pad of 2oz copper.



Scale 1 : 1 on letter size paper

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

Typical Electrical Characteristics

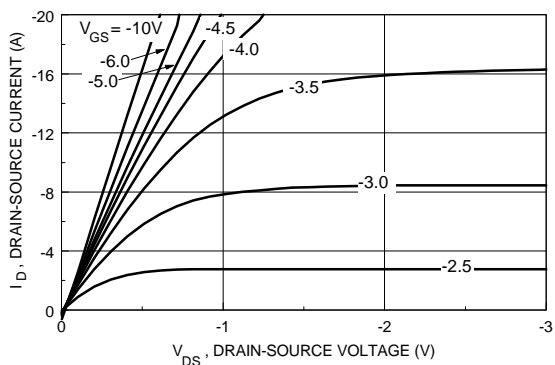


Figure 1. On-Region Characteristics.

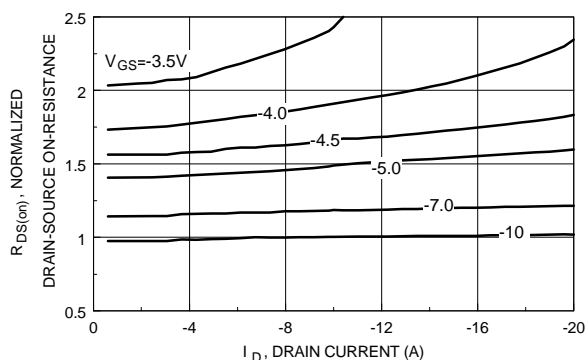


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current.

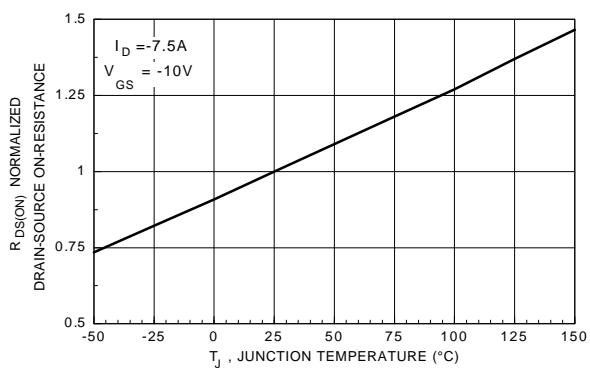


Figure 3. On-Resistance Variation with Temperature.

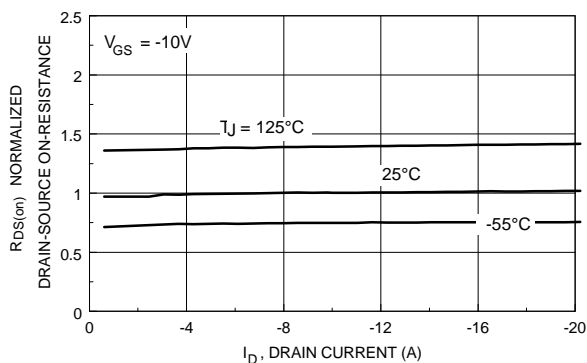


Figure 4. On-Resistance Variation with Drain Current and Temperature.

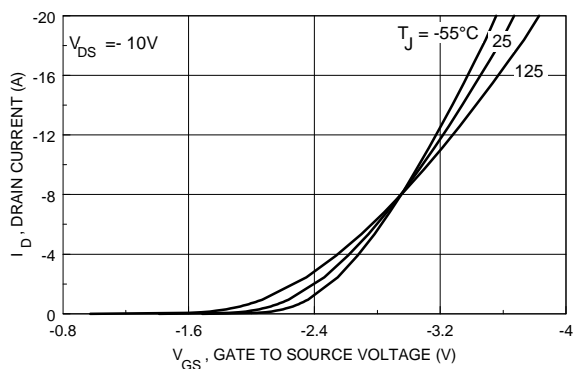


Figure 5. Transfer Characteristics.

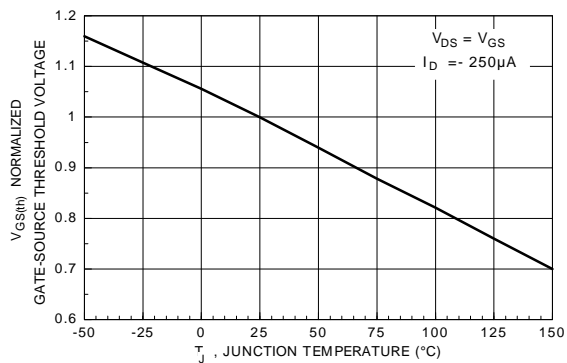


Figure 6. Gate Threshold Variation with Temperature.

Typical Electrical Characteristics

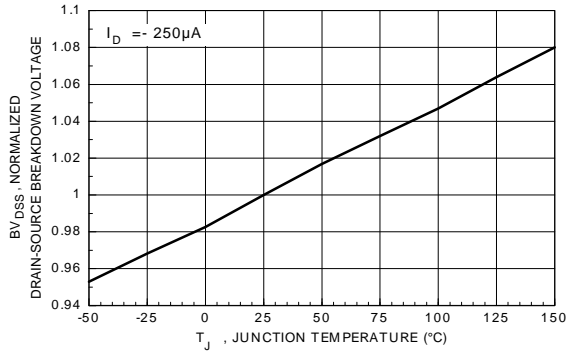


Figure 7. Breakdown Voltage Variation with Temperature.

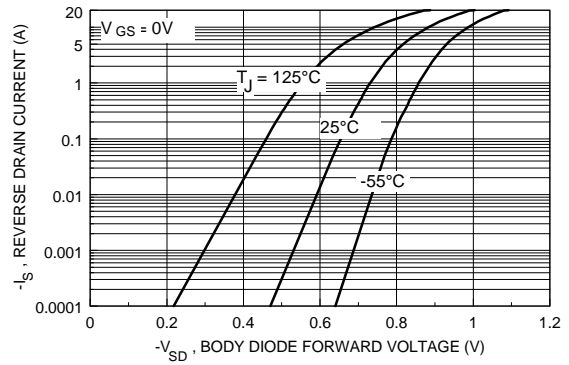


Figure 8. Body Diode Forward Voltage Variation with Current and Temperature.

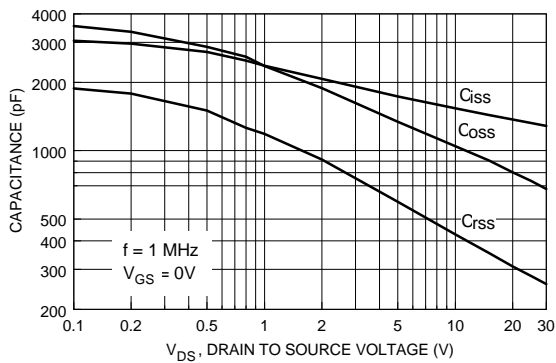


Figure 9. Capacitance Characteristics.

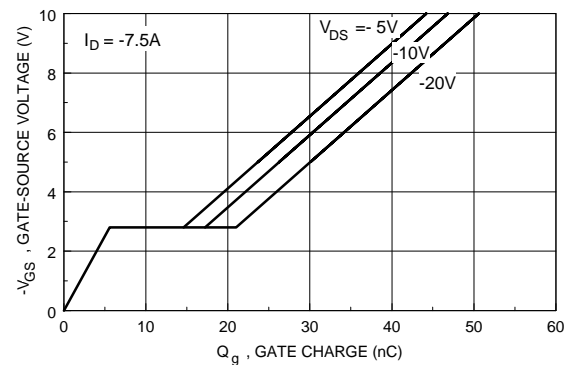


Figure 10. Gate Charge Characteristics.

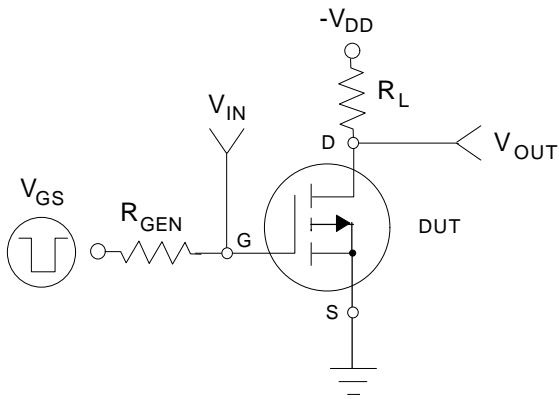


Figure 11. Switching Test Circuit.

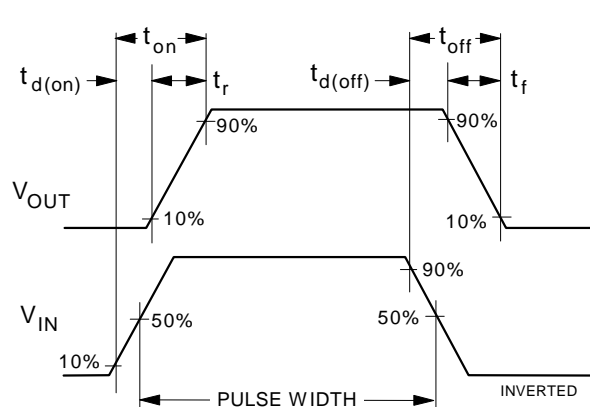


Figure 12. Switching Waveforms.

Typical Thermal Characteristics

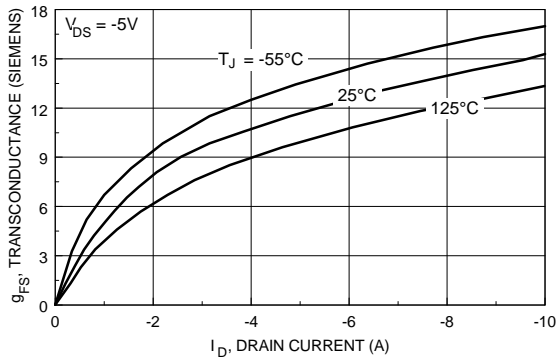


Figure 13. Transconductance Variation with Drain Current and Temperature.

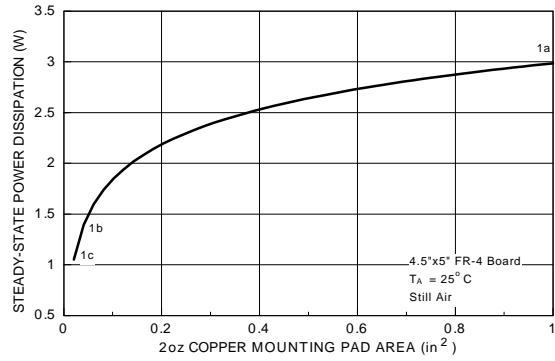


Figure 14. SOT-223 Maximum Steady-State Power Dissipation versus Copper Mounting Pad Area.

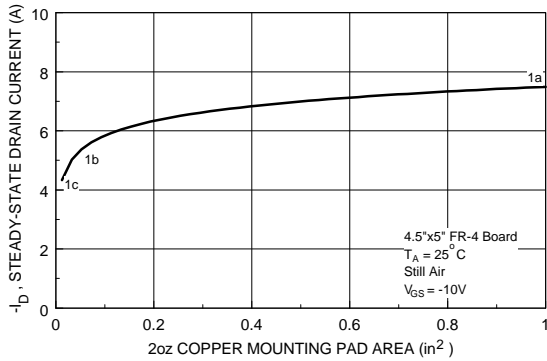


Figure 15. Maximum Steady-State Drain Current versus Copper Mounting Pad Area.

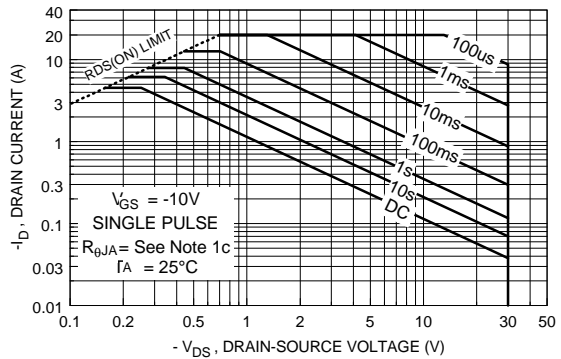


Figure 16. Maximum Safe Operating Area.

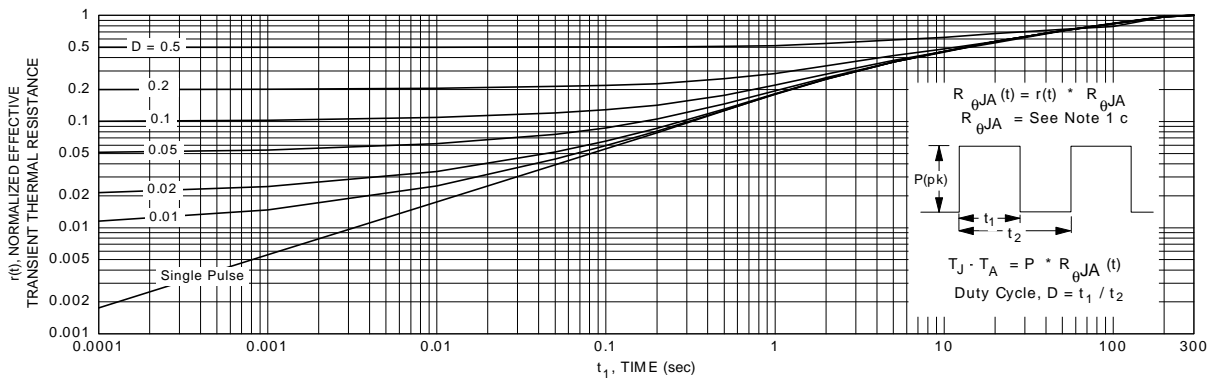
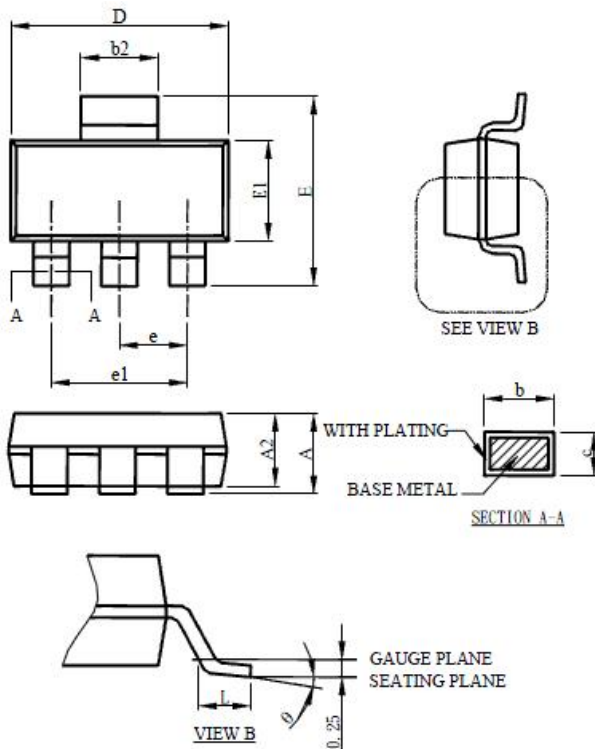


Figure 17. Transient Thermal Response Curve.

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

Package Dimensions

SOT-223



| SYMBOL | SOT-223 | |
|--------|-------------|------|
| | MILLIMETERS | |
| | MIN. | MAX. |
| A | | 1.80 |
| A1 | 0.02 | 0.10 |
| A2 | 1.55 | 1.65 |
| b | 0.68 | 0.84 |
| b2 | 2.90 | 3.10 |
| c | 0.23 | 0.33 |
| D | 6.30 | 6.70 |
| E | 6.70 | 7.30 |
| E1 | 3.30 | 3.70 |
| e | 2.30 BSC | |
| e1 | 4.60 BSC | |
| L | 0.90 | |
| θ | 0° | 8° |

- Note:
1. Refer to JEDEC TO-261AA.
 2. Dimension D and E1 are determined at the outermost extremes of the plastic body exclusive of mold flash, tie bar burrs, gate burrs, and interlead flash, but including any mismatch between the top and bottom of the plastic body.
 3. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

Marking



Ordering information

| Order code | Package | Baseqty | Deliverymode |
|-------------|---------|---------|---------------|
| UMW NDT456P | SOT-223 | 2500 | Tape and reel |