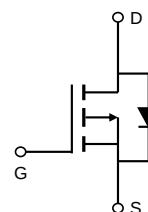
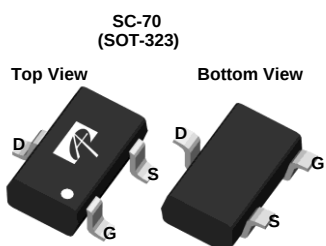


### General Description

The AO7401 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge, and operation with gate voltages as low as 2.5V, in the small SOT363 footprint. It can be used for a wide variety of applications, including load switching, low current inverters and low current DC-DC converters.

### Product Summary

|                                   |         |
|-----------------------------------|---------|
| $V_{DS}$                          | -30V    |
| $I_D$ (at $V_{GS}=-10V$ )         | -1.4A   |
| $R_{DS(ON)}$ (at $V_{GS}=-10V$ )  | < 115mΩ |
| $R_{DS(ON)}$ (at $V_{GS}=-4.5V$ ) | < 140mΩ |
| $R_{DS(ON)}$ (at $V_{GS}=-2.5V$ ) | < 200mΩ |



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

| Parameter                              | Symbol         | Maximum    | Units            |
|----------------------------------------|----------------|------------|------------------|
| Drain-Source Voltage                   | $V_{DS}$       | -30        | V                |
| Gate-Source Voltage                    | $V_{GS}$       | $\pm 12$   | V                |
| Continuous Drain Current               | $I_D$          | -1.4       | A                |
| $T_A=25^\circ\text{C}$                 |                | -1.0       |                  |
| Pulsed Drain Current <sup>C</sup>      | $I_{DM}$       | -10        |                  |
| Power Dissipation <sup>B</sup>         | $P_D$          | 0.35       | W                |
| $T_A=25^\circ\text{C}$                 |                | 0.22       |                  |
| Junction and Storage Temperature Range | $T_J, T_{STG}$ | -55 to 150 | $^\circ\text{C}$ |

### Thermal Characteristics

| Parameter                                  | Symbol          | Typ | Max | Units              |
|--------------------------------------------|-----------------|-----|-----|--------------------|
| Maximum Junction-to-Ambient <sup>A</sup>   | $R_{\theta JA}$ | 300 | 360 | $^\circ\text{C/W}$ |
| $t \leq 10s$                               |                 |     |     |                    |
| Maximum Junction-to-Ambient <sup>A,D</sup> | $R_{\theta JL}$ | 340 | 425 | $^\circ\text{C/W}$ |
| Steady-State                               |                 |     |     |                    |
| Maximum Junction-to-Lead                   | $R_{\theta JL}$ | 280 | 320 | $^\circ\text{C/W}$ |
| Steady-State                               |                 |     |     |                    |

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

| Symbol                      | Parameter                             | Conditions                                                                                 | Min  | Typ         | Max        | Units |
|-----------------------------|---------------------------------------|--------------------------------------------------------------------------------------------|------|-------------|------------|-------|
| <b>STATIC PARAMETERS</b>    |                                       |                                                                                            |      |             |            |       |
| BV <sub>DSS</sub>           | Drain-Source Breakdown Voltage        | I <sub>D</sub> =-250μA, V <sub>GS</sub> =0V                                                | -30  |             |            | V     |
| I <sub>DSS</sub>            | Zero Gate Voltage Drain Current       | V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V<br>T <sub>J</sub> =55°C                         |      |             | -1<br>-5   | μA    |
| I <sub>GSS</sub>            | Gate-Body leakage current             | V <sub>DS</sub> =0V, V <sub>GS</sub> = ±12V                                                |      |             | ±100       | nA    |
| V <sub>GS(th)</sub>         | Gate Threshold Voltage                | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA                                  | -0.6 | -1          | -1.4       | V     |
| I <sub>D(ON)</sub>          | On state drain current                | V <sub>GS</sub> =-10V, V <sub>DS</sub> =-5V                                                | -10  |             |            | A     |
| R <sub>DS(ON)</sub>         | Static Drain-Source On-Resistance     | V <sub>GS</sub> =-10V, I <sub>D</sub> =-1.4A<br>T <sub>J</sub> =125°C                      |      | 92.5<br>130 | 115<br>160 | mΩ    |
|                             |                                       | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-1.2A                                              |      | 110         | 140        | mΩ    |
|                             |                                       | V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-1A                                                |      | 150         | 200        | mΩ    |
| g <sub>FS</sub>             | Forward Transconductance              | V <sub>DS</sub> =-5V, I <sub>D</sub> =-1.4A                                                |      | 6           |            | S     |
| V <sub>SD</sub>             | Diode Forward Voltage                 | I <sub>S</sub> =-1A, V <sub>GS</sub> =0V                                                   |      | -0.78       | -1         | V     |
| I <sub>S</sub>              | Maximum Body-Diode Continuous Current |                                                                                            |      |             | -0.5       | A     |
| <b>DYNAMIC PARAMETERS</b>   |                                       |                                                                                            |      |             |            |       |
| C <sub>iss</sub>            | Input Capacitance                     | V <sub>GS</sub> =0V, V <sub>DS</sub> =-15V, f=1MHz                                         |      | 260         | 315        | pF    |
| C <sub>oss</sub>            | Output Capacitance                    |                                                                                            |      | 37          |            | pF    |
| C <sub>rss</sub>            | Reverse Transfer Capacitance          |                                                                                            |      | 20          |            | pF    |
| R <sub>g</sub>              | Gate resistance                       | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz                                           | 4    | 8           | 12         | Ω     |
| <b>SWITCHING PARAMETERS</b> |                                       |                                                                                            |      |             |            |       |
| Q <sub>g(10V)</sub>         | Total Gate Charge                     | V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, I <sub>D</sub> =-1.4A                        |      | 5.9         | 7.2        | nC    |
| Q <sub>g(4.5V)</sub>        | Total Gate Charge                     |                                                                                            |      | 2.8         | 3.5        | nC    |
| Q <sub>gs</sub>             | Gate Source Charge                    |                                                                                            |      | 0.7         |            | nC    |
| Q <sub>gd</sub>             | Gate Drain Charge                     |                                                                                            |      | 1           |            | nC    |
| t <sub>D(on)</sub>          | Turn-On DelayTime                     | V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, R <sub>L</sub> =10Ω,<br>R <sub>GEN</sub> =3Ω |      | 6           |            | ns    |
| t <sub>r</sub>              | Turn-On Rise Time                     |                                                                                            |      | 3.5         |            | ns    |
| t <sub>D(off)</sub>         | Turn-Off DelayTime                    |                                                                                            |      | 20          |            | ns    |
| t <sub>f</sub>              | Turn-Off Fall Time                    |                                                                                            |      | 5           |            | ns    |
| t <sub>rr</sub>             | Body Diode Reverse Recovery Time      | I <sub>F</sub> =-1.4A, dI/dt=100A/μs                                                       |      | 11.5        | 15         | ns    |
| Q <sub>rr</sub>             | Body Diode Reverse Recovery Charge    | I <sub>F</sub> =-1.4A, dI/dt=100A/μs                                                       |      | 4.5         |            | nC    |

A. The value of R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25° C. The value in any given application depends on the user's specific board design.

B. The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub>=150° C, using ≤ 10s junction-to-ambient thermal resistance.

C. Repetitive rating, pulse width limited by junction temperature T<sub>J(MAX)</sub>=150° C. Ratings are based on low frequency and duty cycles to keep initial T<sub>J</sub>=25° C.

D. The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

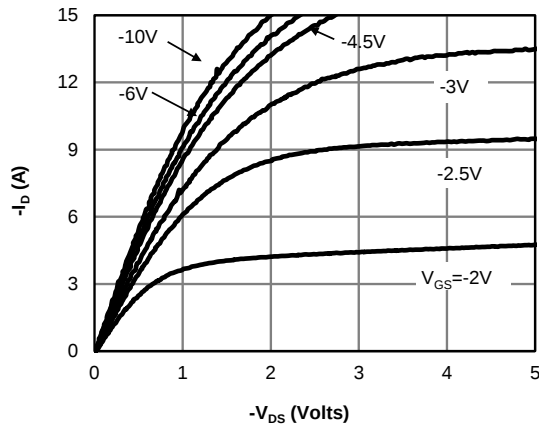
F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=150° C. The SOA curve provides a single pulse rating.

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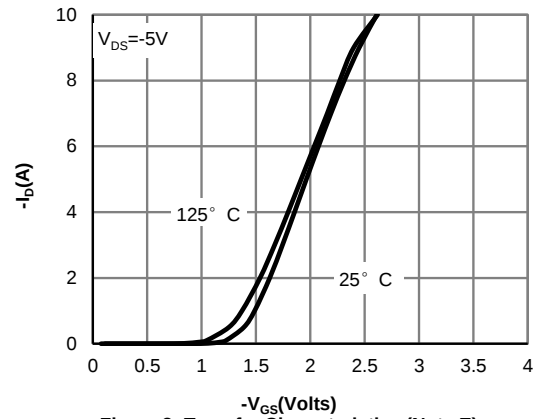
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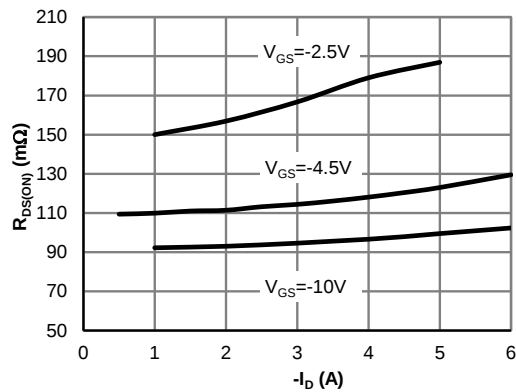
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



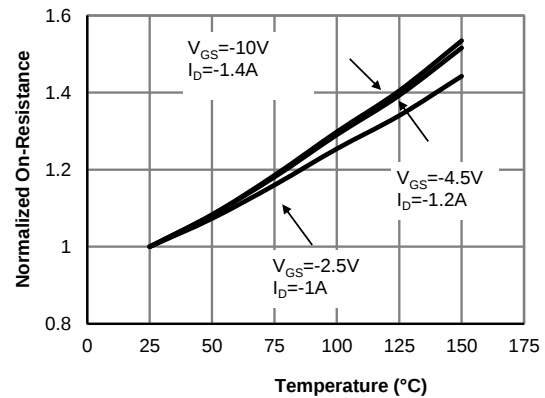
**Fig 1: On-Region Characteristics (Note E)**



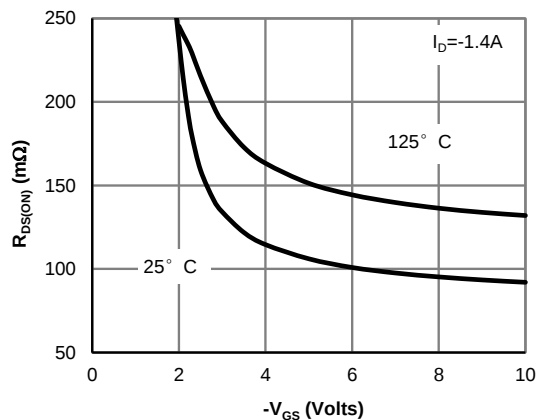
**Figure 2: Transfer Characteristics (Note E)**



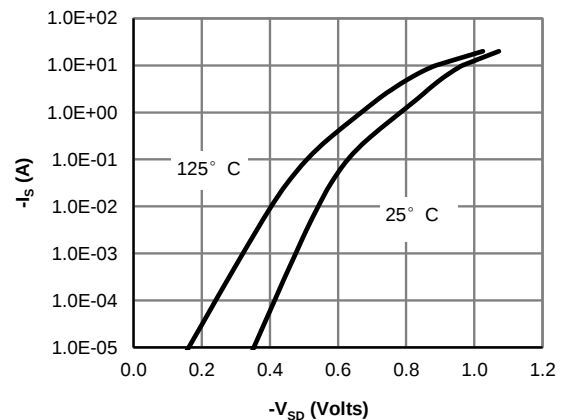
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)**



**Figure 4: On-Resistance vs. Junction Temperature (Note E)**

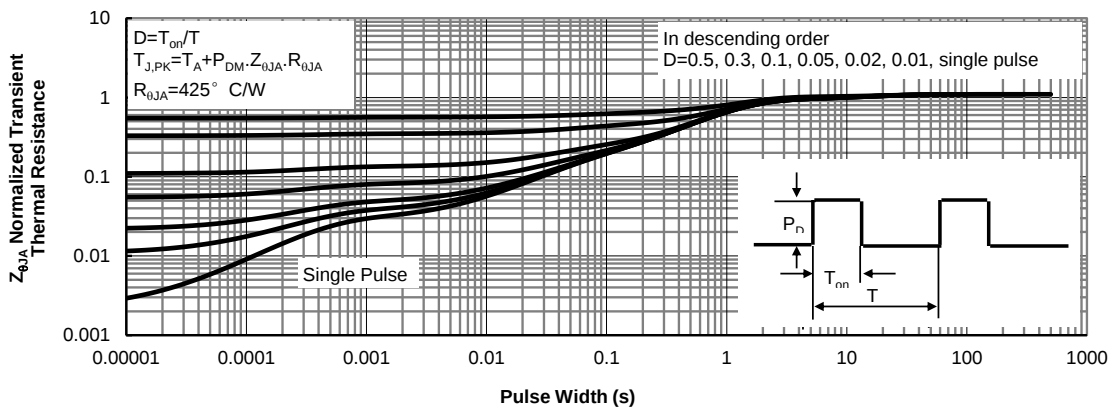
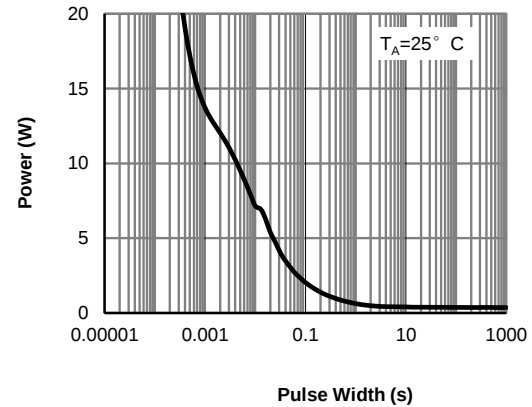
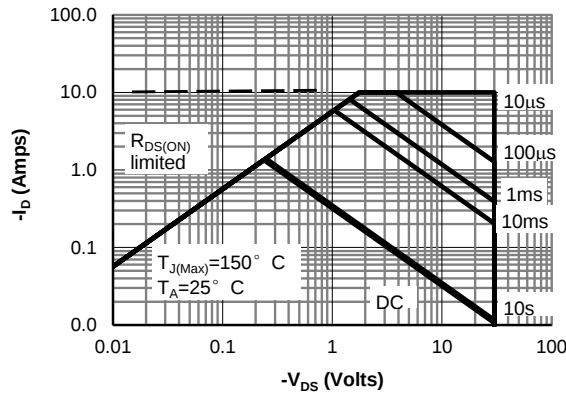
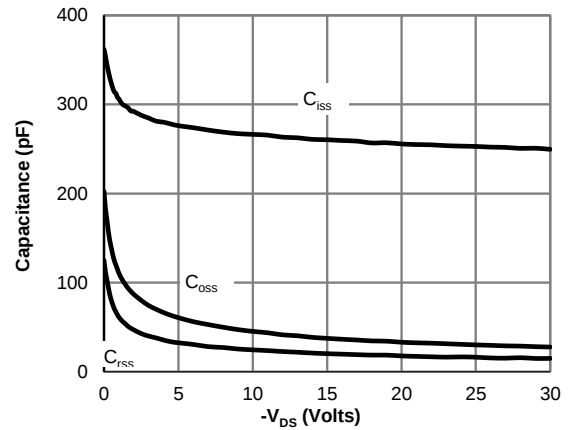
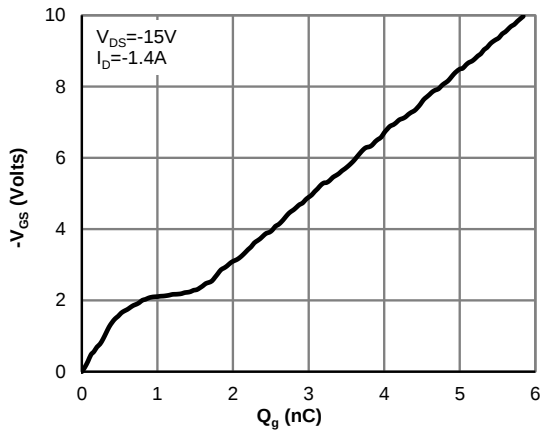


**Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)**

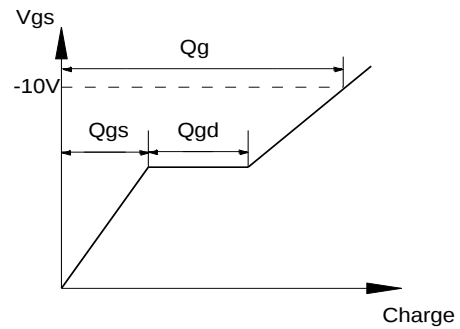
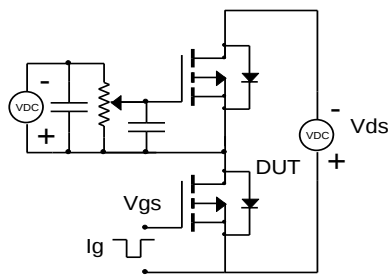


**Figure 6: Body-Diode Characteristics (Note E)**

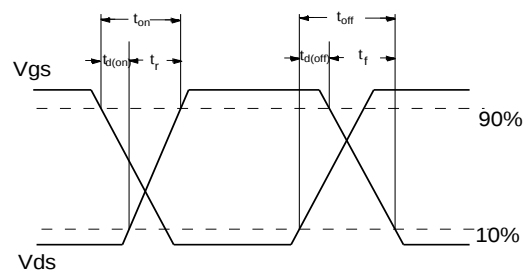
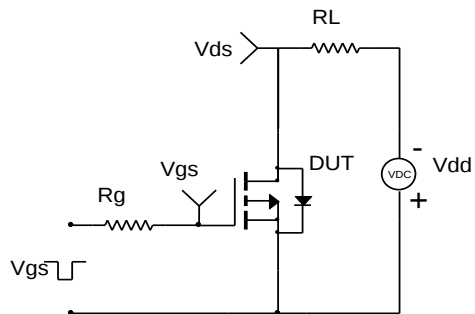
## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



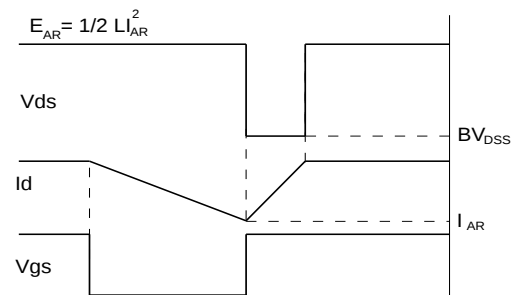
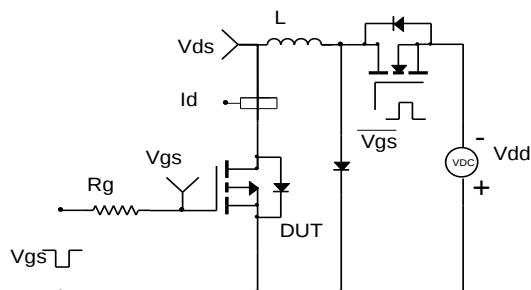
### Gate Charge Test Circuit & Waveform



### Resistive Switching Test Circuit & Waveforms



### Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



### Diode Recovery Test Circuit & Waveforms

