

MOSFET – P-Channel 1.8 V Specified POWERTRENCH®

FDN304P

General Description

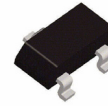
This P-Channel 1.8 V specified MOSFET uses **onsemi**'s advanced low voltage POWERTRENCH process. It has been optimized for battery power management applications.

Features

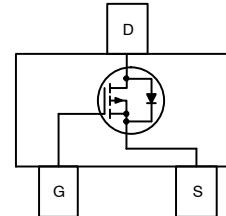
- -2.4 A, -20 V
 - ◆ $R_{DS(ON)} = 52 \text{ m}\Omega @ V_{GS} = -4.5 \text{ V}$
 - ◆ $R_{DS(ON)} = 70 \text{ m}\Omega @ V_{GS} = -2.5 \text{ V}$
 - ◆ $R_{DS(ON)} = 100 \text{ m}\Omega @ V_{GS} = -1.8 \text{ V}$
- Fast Switching Speed
- High Performance Trench Technology for Extremely Low $R_{DS(ON)}$
- SUPERSOT™ -23 provides Low $R_{DS(ON)}$ and 30% Higher Power Handling Capability than SOT23 in the same Footprint
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

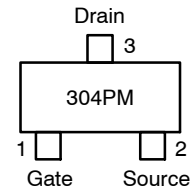
- Battery Management
- Load Switch
- Battery Protection



SOT-23/SUPERSOT-23, 3 LEAD, 1.4x2.9
 CASE 527AG



MARKING DIAGRAM



304P = Specific Device Code
 M = Date Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

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ABSOLUTE MAXIMUM RATINGS

T_A = 25°C unless otherwise noted

| Symbol | Parameter | Ratings | Unit |
|-----------------------------------|-----------------------------------------------------|-------------|------|
| V _{DSS} | Drain–Source Voltage | –20 | V |
| V _{GSS} | Gate–Source Voltage | ±8 | V |
| I _D | Drain Current Continuous (Note 1a) Pulsed | –2.4 –10 | A |
| P _D | Maximum Power Dissipation (Note 1a) (Note 1b) | 0.5 0.46 | W |
| T _J , T _{STG} | Operating and Storage Junction Temperature Range | –55 to +150 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL CHARACTERISTICS

| Symbol | Parameter | Ratings | Unit |
|------------------|---------------------------------------------------|---------|------|
| R _{θJA} | Thermal Resistance, Junction–to–Ambient (Note 1a) | 250 | °C/W |
| R _{θJC} | Thermal Resistance, Junction–to–Case (Note 1) | 75 | °C/W |

ELECTRICAL CHARACTERISTICS

T_A = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|--------|-----------|-----------------|-----|-----|-----|------|
|--------|-----------|-----------------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | | |
|--------------------------------------|-------------------------------------------|-------------------------------------------------|-----|-----|------|-------|
| BV _{DSS} | Drain–Source Breakdown Voltage | V _{GS} = 0 V, I _D = –250 μA | –20 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | I _D = –250 μA, Referenced to 25°C | | –13 | | mV/°C |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} = –16 V, V _{GS} = 0 V | | | –1 | μA |
| I _{GSSF} | Gate–Body Leakage, Forward | V _{GS} = 8 V, V _{DS} = 0 V | | | 100 | nA |
| I _{GSSR} | Gate–Body Leakage, Reverse | V _{GS} = –8 V, V _{DS} = 0 V | | | –100 | nA |

ON CHARACTERISTICS (Note 2)

| | | | | | | |
|----------------------------------------|------------------------------------------------|--------------------------------------------------------------|------|------|------|-------|
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} = V _{GS} , I _D = –250 μA | –0.4 | –0.8 | –1.5 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | I _D = –250 μA, Referenced to 25°C | | 3 | | mV/°C |
| R _{DS(on)} | Static Drain–Source On–Resistance | V _{GS} = –4.5 V, I _D = –2.4 A | | 36 | 52 | mΩ |
| | | V _{GS} = –2.5 V, I _D = –2 A | | 47 | 70 | |
| | | V _{GS} = –1.8 V, I _D = –1.8 A | | 65 | 100 | |
| I _{D(on)} | On–State Drain Current | V _{GS} = –4.5 V, V _{DS} = –5 V | –10 | | | A |
| g _{FS} | Forward Transconductance | V _{DS} = –5 V, I _D = –1.25 A | | 12 | | S |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|------------------|------------------------------|-------------------------------------------------------------|--|------|--|----|
| C _{iss} | Input Capacitance | V _{DS} = –10 V, V _{GS} = 0 V, f = 1.0 MHz | | 1312 | | pF |
| C _{oss} | Output Capacitance | | | 240 | | pF |
| C _{rss} | Reverse Transfer Capacitance | | | 106 | | pF |

SWITCHING CHARACTERISTICS (Note 2)

| | | | | | | |
|---------------------|---------------------|-----------------------------------------------------------------------------------------------------|--|----|----|----|
| t _{d(on)} | Turn–On Delay Time | V _{DD} = –10 V, I _D = –1 A, V _{GS} = –4.5 V, R _{GEN} = 6 Ω | | 15 | 27 | ns |
| t _r | Turn–On Rise Time | | | 15 | 27 | ns |
| t _{d(off)} | Turn–Off Delay Time | | | 40 | 64 | ns |
| t _f | Turn–Off Fall Time | | | 25 | 40 | ns |

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ELECTRICAL CHARACTERISTICS (continued)

T_A = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|-------------------------------------------|--------------------|----------------------------------------------------------------------------|-----|-----|-----|------|
| SWITCHING CHARACTERISTICS (Note 2) | | | | | | |
| Q _g | Total Gate Charge | V _{DS} = -10 V, I _D = -2.4 A, V _{GS} = -4.5 V | | 12 | 20 | nC |
| Q _{gs} | Gate-Source Charge | | | 2 | | nC |
| Q _{gd} | Gate-Drain Charge | | | 2 | | nC |

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

| | | | | | | |
|-----------------|-------------------------------------------------------|----------------------------------------------------------|--|-------|------|---|
| I _S | Maximum Continuous Drain-Source Diode Forward Current | | | -0.42 | A | |
| V _{SD} | Drain-Source Diode Forward Voltage | V _{GS} = 0 V, I _S = -0.42 A (Note 2) | | -0.6 | -1.2 | V |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

NOTES:

- 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 determined by the user's board design.



a) 250°C/W when mounted on a 0.02 in² pad of 2 oz copper.



b) 270°C/W when mounted on a minimum pad.

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

PACKAGE MARKING AND ORDERING INFORMATION

| Device | Device Marking | Package | Shipping† |
|---------|----------------|------------------|--------------------------|
| FDN304P | 304P | SOT-23 (Pb-Free) | 3000 units / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

TYPICAL CHARACTERISTICS

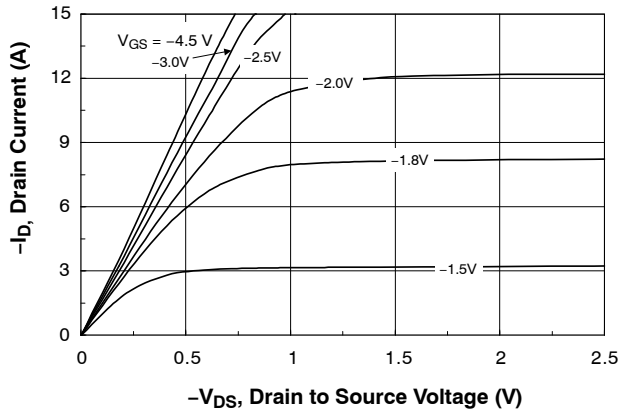


Figure 1. On-Region Characteristics

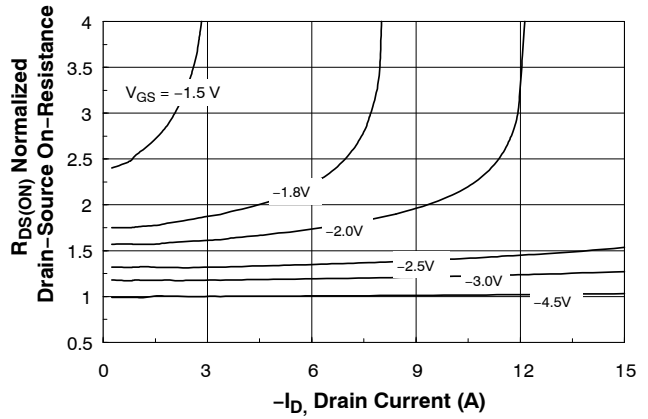


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

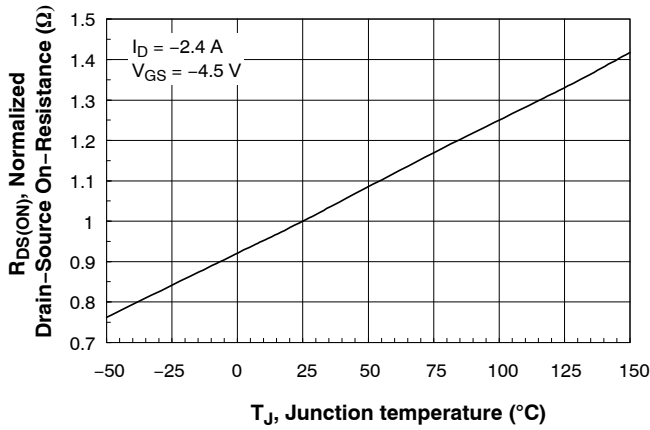


Figure 3. On-Resistance Variation with Temperature

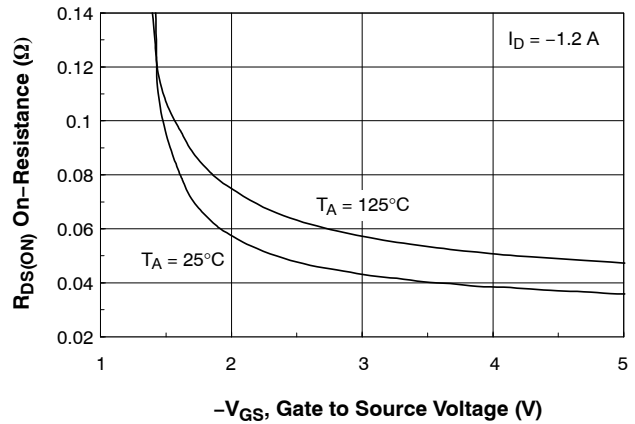


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

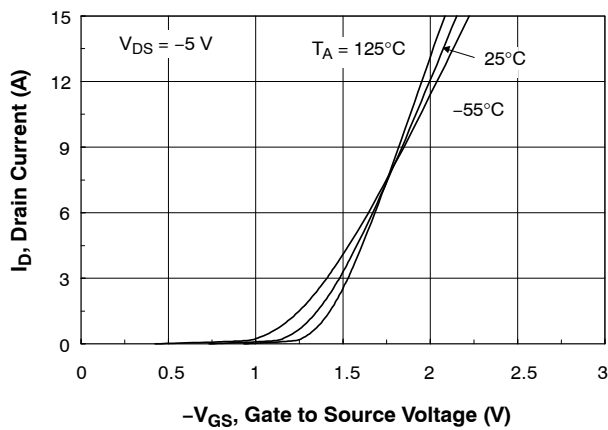


Figure 5. Transfer Characteristics

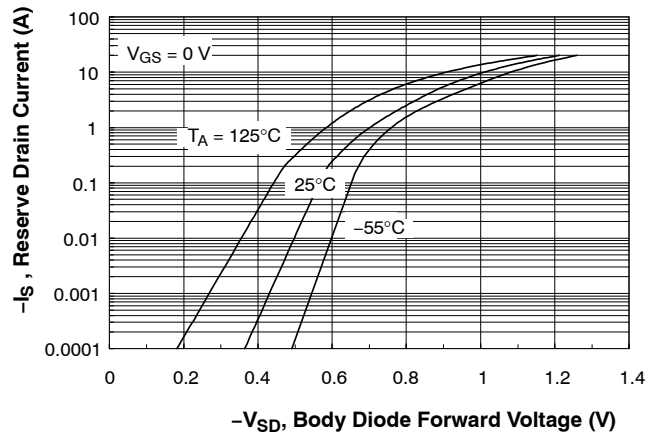


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

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TYPICAL CHARACTERISTICS (Continued)

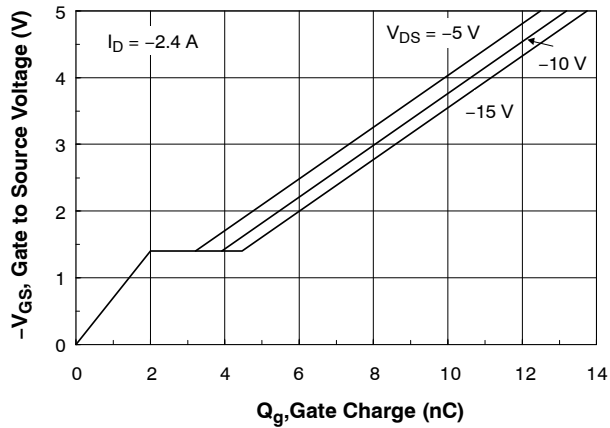


Figure 7. Gate Charge Characteristics

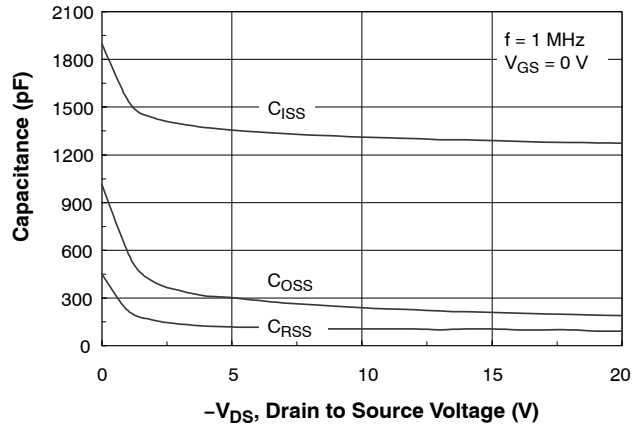


Figure 8. Capacitance Characteristics

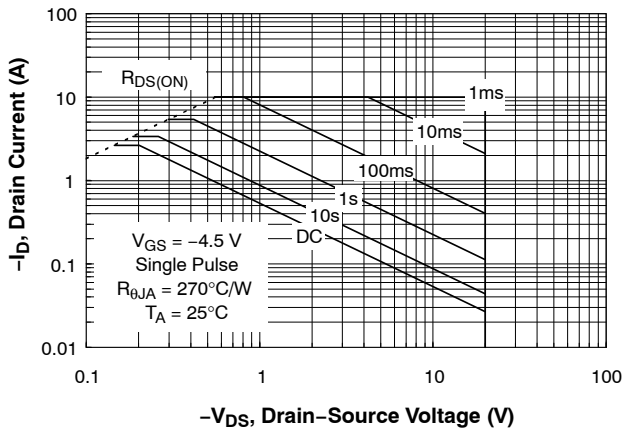


Figure 9. Maximum Safe Operating Area

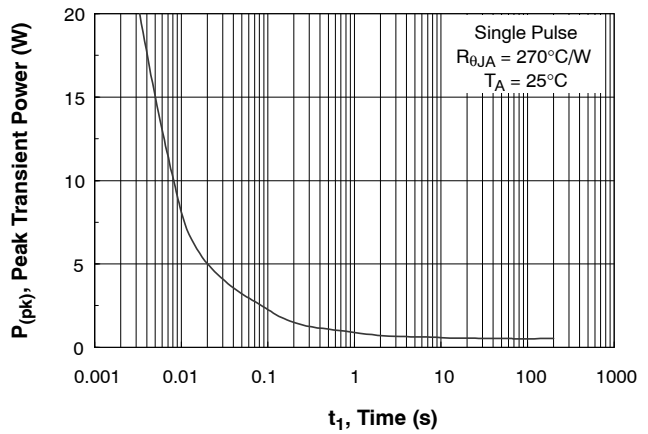


Figure 10. Single Pulse Maximum Power Dissipation

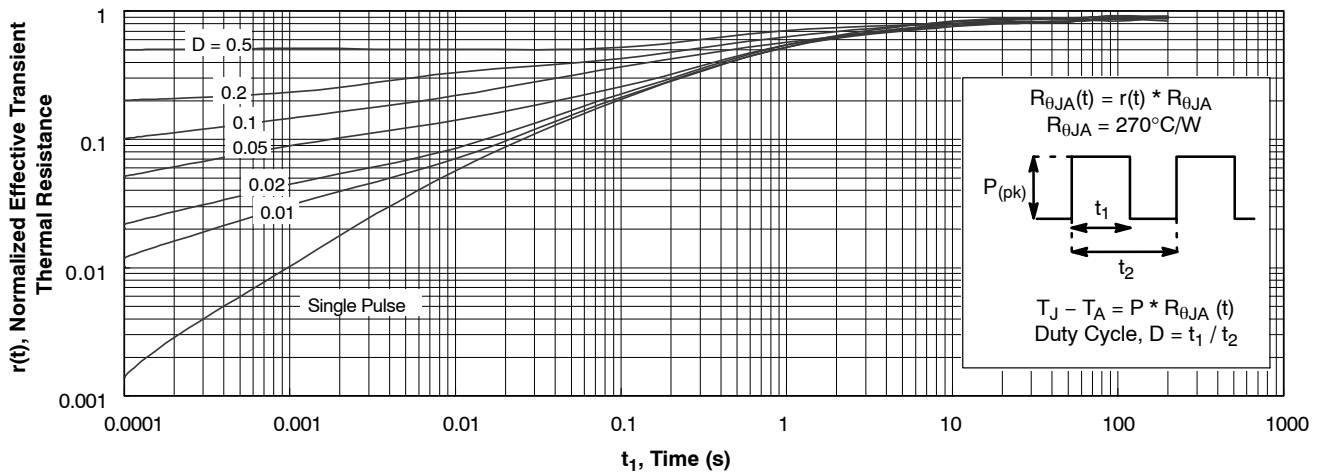
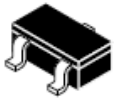


Figure 11. Transient Thermal Response Curve

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

MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SOT-23/SUPERSOT™ -23, 3 LEAD, 1.4x2.9
CASE 527AG
ISSUE A

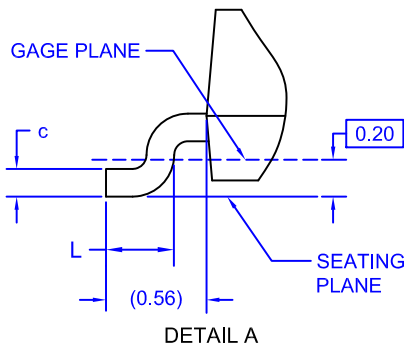
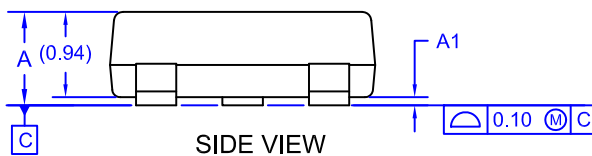
DATE 09 DEC 2019



NOTES: UNLESS OTHERWISE SPECIFIED

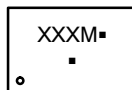
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.

| DIM | MIN. | NOM. | MAX. |
|-----|----------|-------|-------|
| A | 0.85 | 0.95 | 1.12 |
| A1 | 0.00 | 0.05 | 0.10 |
| b | 0.370 | 0.435 | 0.508 |
| c | 0.085 | 0.150 | 0.180 |
| D | 2.80 | 2.92 | 3.04 |
| E | 2.31 | 2.51 | 2.71 |
| E1 | 1.20 | 1.40 | 1.52 |
| e | 0.95 BSC | | |
| e1 | 1.90 BSC | | |
| L | 0.33 | 0.38 | 0.43 |



*FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

GENERIC MARKING DIAGRAM*



- XXX = Specific Device Code
- M = Month Code
- = Pb-Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

| | | |
|------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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