2N6764, JANTX2N6764, JANTXV2N6764
2N6766, JANTX2N6766, JANTXV2N6766

2N6768, JANTX2N6768, JANTXV2N6768
2N6770, JANTX2N6770, JANTXV2N6770

# JANTX, JANTXV POWER MOSFET IN TO-204 PACKAGE, QUALIFIED TO MIL-PRF-19500/543

100V Thru 500V, Up to 38A, N-Channel,
Enhancement Mode MOSFET Power Transistor


## FEATURES

- Low $R_{DS(on)}$
- Ease of Paralleling
- Qualified to MIL-PRF-19500/543

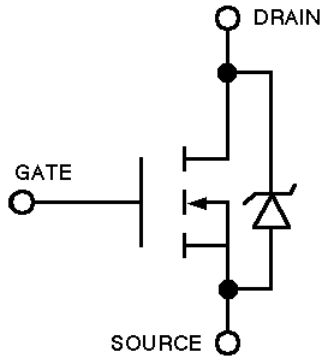
## DESCRIPTION

This hermetically packaged QPL product features the latest advanced MOSFET technology. It is ideally suited for Military requirements where small size, high performance and high reliability are required, and in applications such as switching power supplies, motor controls, inverters, choppers, audio amplifiers and high energy pulse circuits.

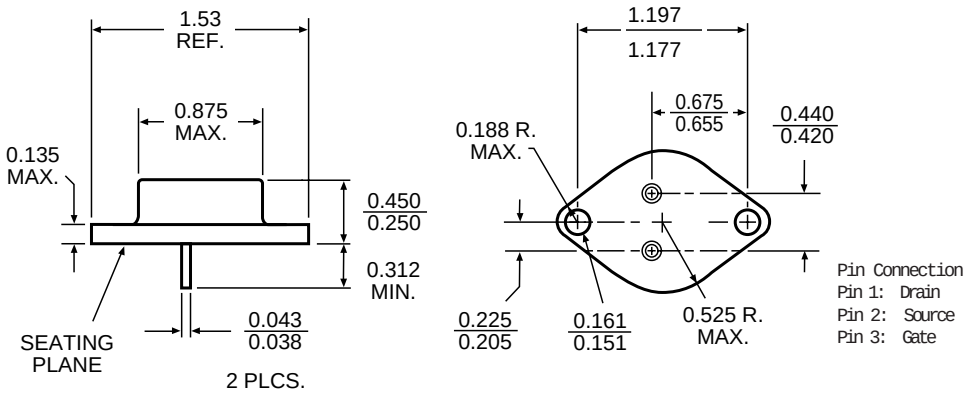
## PRIMARY ELECTRICAL CHARACTERISTICS @ $T_C$ = 25 C

| PART NUMBER | $V_{DS}$, Volts | $R_{DS(on)}$ | $I_D$, Amps |
|---|---|---|---|
| 2N6764 | 100 | .055 | 38 |
| 2N6766 | 200 | .085 | 30 |
| 2N6768 | 400 | .30 | 14 |
| 2N6770 | 500 | .40 | 12 |

## SCHEMATIC




## MECHANICAL OUTLINE




Note: For part number 2N6764 and 2N6766 the mechanical dimensions are the same as above except the lead diameter is 0.058 min to 0.063 max.



Omnirel

## ABSOLUTE MAXIMUM RATINGS ($T_C$ = 25°C unless otherwise noted

| Parameter | | JANTXV, JANTX, 2N6764 | Units |
|---|---|---|---|
| $I_D$ @ $V_{GS}$ = 10V, $T_C$ = 25°C | Continuous Drain Current | 38 | A |
| $I_D$ @ $V_{GS}$ = 10V, $T_C$ = 100°C | Continuous Drain Current | 24 | A |
| $I_{DM}$ | Pulsed Drain Current[1] | 152 | A |
| $P_D$ @ $T_C$ = 25°C | Maximum Power Dissipation | 150 | W |
| | Linear Derating Factor | 1.2 | W/°C |
| $V_{GS}$ | Gate-Source Voltage | ± 20 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy [2] | 150 [4] | mJ |
| $I_{AR}$ | Avalanche Current[1] | 38 [4] | A |
| $T_J$<br>$T_{STG}$ | Operating Junction<br>Storage Temperature Range | -55 to 150 | °C |
| | Lead Temperature | 300(.06 from case for 10 sec) | °C |

## ELECTRICAL CHARACTERISTICS @ $T_J$ = 25°C (Unless Otherwise Specified)

| | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | 100 | | | V | $V_{GS}$ = 0V, $I_D$ = 1.0 mA, |
| $R_{DS(on)}$ | Static Drain-to-Source On-State Resistance | – | – | 0.055 | | $V_{GS}$ = 10 V, $I_D$ = 24 A [3] |
| | | – | – | 0.065 | | $V_{GS}$ = 10 V, $I_D$ = 38 A [3] |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | – | 4.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | – | – | 25 | µA | $V_{DS}$ = 80 V, $V_{GS}$ = 0V |
| | | – | – | 250 | | $V_{DS}$ = 80 V, $V_{GS}$ = 0V, $T_J$ = 125 °C |
| $I_{GSS}$ | Gate -to-Source Leakage Forward | – | – | 100 | nA | $V_{GS}$ = 20 V |
| $I_{GSS}$ | Gate -to-Source Leakage Reverse | – | – | -100 | nA | $V_{GS}$ = -20 V |
| $Q_{G(on)}$ | On-state Gate Charge | 50 | – | 125 | nC | $V_{GS}$ = 10 V, $I_D$ = 38A |
| $Q_{GS}$ | Gate-to-Source Charge | 8 | – | 22 | nC | $V_{DS}$ = 50 V |
| $Q_{Gd}$ | Gate-to-Drain ("Miller") Charge | 25 | – | 65 | nC | See note 4 |
| $t_{d(on)}$ | Turn-On Delay Time | – | – | 35 | ns | $V_{DD}$ = 50 V, $I_D$ = 38A, $R_G$ = 2.35 |
| $t_r$ | Rise Time | – | – | 190 | ns | See note 4 |
| $t_{d(off)}$ | Turn-Off Delay Time | – | – | 170 | ns | |
| $t_f$ | Fall Time | – | – | 130 | ns | |

### Source-Drain Diode Ratings and Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Diode Forward Voltage | – | – | 1.9 | V | $T_J$ = 25°C, $I_S$ = 38A [3], $V_{GS}$ = 0 V |
| $t_{rr}$ | Reverse Recovery Time | – | – | 500 | ns | $T_J$ = 25°C, $I_F$ = 38A, di/dt ≤ 100A/µs [3] |

### Thermal Resistance

| | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $R_{thJC}$ | Junction-to-Case | – | – | 0.83 | °C/W | Mounting surface flat, smooth, and greased |
| $R_{thCS}$ | Case-to-sink | – | 0.21 | – | | |
| $R_{thJA}$ | Junction-to-Ambient | – | – | 48 | | Typical socket mount |

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. @$V_{DD}$ = 50V, Starting $T_J$ = 25°C, L = 100 µH ± 10%, $R_G$ = 25 , Peak $I_L$ = 38A
3. Pulse width ≤ 300 µs; Duty Cycle ≤ 2 %
4. See MIL-S-19500/543

## ABSOLUTE MAXIMUM RATINGS ($T_C$ = 25°C unless otherwise noted

| Parameter | | JANTXV, JANTX, 2N6766 | Units |
|---|---|---|---|
| $I_D$ @ $V_{GS}$ = 10V, $T_C$ = 25°C | Continuous Drain Current | 30 | A |
| $I_D$ @ $V_{GS}$ = 10V, $T_C$ = 100°C | Continuous Drain Current | 19 | A |
| $I_{DM}$ | Pulsed Drain Current[1] | 120 | A |
| $P_D$ @ $T_C$ = 25°C | Maximum Power Dissipation | 150 | W |
| | Linear Derating Factor | 1.2 | W/°C |
| $V_{GS}$ | Gate-Source Voltage | ± 20 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy [2] | 60 [4] | mJ |
| $I_{AR}$ | Avalanche Current[1] | 30 [4] | A |
| $T_J$<br>$T_{STG}$ | Operating Junction<br>Storage Temperature Range | -55 to 150 | °C |
| | Lead Temperature | 300(.06 from case for 10 sec) | °C |

## ELECTRICAL CHARACTERISTICS @ $T_J$ = 25°C (Unless Otherwise Specified)

| Parameter | | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | 200 | | | V | $V_{GS}$ = 0V, $I_D$ = 1.0 mA, |
| $R_{DS(on)}$ | Static Drain-to-Source On-State Resistance | – | – | .085 | | $V_{GS}$ = 10 V, $I_D$ = 19 A [3] |
| | | – | – | .090 | | $V_{GS}$ = 10 V, $I_D$ = 30 A [3] |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | – | 4.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | – | – | 25 | µA | $V_{DS}$ = 160 V, $V_{GS}$ = 0V |
| | | – | – | 250 | | $V_{DS}$ = 160 V, $V_{GS}$ = 0V, $T_J$ = 125°C |
| $I_{GSS}$ | Gate -to-Source Leakage Forward | – | – | 100 | nA | $V_{GS}$ = 20 V |
| $I_{GSS}$ | Gate -to-Source Leakage Reverse | – | – | -100 | nA | $V_{GS}$ = -20 V |
| $Q_{g(on)}$ | On-state Gate Charge | 55 | – | 115 | nC | $V_{GS}$ = 10 V, $I_D$ = 30A |
| $Q_{gs}$ | Gate-to-Source Charge | 8 | – | 22 | nC | $V_{DS}$ = 100V |
| $Q_{gd}$ | Gate-to-Drain ("Miller") Charge | 30 | – | 60 | nC | See note 4 |
| $t_{d(on)}$ | Turn-On Delay Time | – | – | 35 | ns | $V_{DD}$ = 100 V, $I_D$ = 30A, $R_G$ = 2.35 |
| $t_r$ | Rise Time | – | – | 190 | ns | See note 4 |
| $t_{d(off)}$ | Turn-Off Delay Time | – | – | 170 | ns | |
| $t_f$ | Fall Time | – | – | 130 | ns | |

### Source-Drain Diode Ratings and Characteristics

| Parameter | | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Diode Forward Voltage | – | – | 1.9 | V | $T_J$ = 25°C, $I_S$ = 30 A [3], $V_{GS}$ = 0 V |
| $t_{rr}$ | Reverse Recovery Time | – | – | 950 | ns | $T_J$ = 25°C, $I_F$ = 30 A, di/dt≤100A/µs [3] |

### Thermal Resistance

| Parameter | | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $R_{thJC}$ | Junction-to-Case | – | – | 0.83 | °C/W | Mounting surface flat, smooth, and greased |
| $R_{thCS}$ | Case-to-sink | – | 0.21 | – | | |
| $R_{thJA}$ | Junction-to-Ambient | – | – | 48 | | Typical socket mount |

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. @$V_{DD}$ = 50 V, Starting $T_J$ = 25°C, L = 100 µH ± 10%, $R_G$ = 25 , Peak $I_L$ = 30 A
3. Pulse width ≤ 300 µs; Duty Cycle ≤ 2 %
4. See MIL-S-19500/543

## ABSOLUTE MAXIMUM RATINGS ($T_C$ = 25°C unless otherwise noted

| Parameter | | JANTXV, JANTX, 2N6768 | Units |
|---|---|---|---|
| $I_D$ @ $V_{GS}$ = 10V, $T_C$ = 25°C | Continuous Drain Current | 14 | A |
| $I_D$ @ $V_{GS}$ = 10V, $T_C$ = 100°C | Continuous Drain Current | 9.0 | A |
| $I_{DM}$ | Pulsed Drain Current[1] | 56 | A |
| $P_D$ @ $T_C$ = 25°C | Maximum Power Dissipation | 150 | W |
| | Linear Derating Factor | 1.2 | W/°C |
| $V_{GS}$ | Gate-Source Voltage | ± 20 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy [2] | 11.3 [4] | mJ |
| $I_{AR}$ | Avalanche Current[1] | 14 [4] | A |
| $T_J$<br>$T_{STG}$ | Operating Junction<br>Storage Temperature Range | -55 to 150 | °C |
| | Lead Temperature | 300(.06 from case for 10 sec) | °C |

## ELECTRICAL CHARACTERISTICS @ $T_J$ = 25°C (Unless Otherwise Specified)

| | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | 400 | | | V | $V_{GS}$ = 0V, $I_D$ = 1.0 mA, |
| $R_{DS(on)}$ | Static Drain-to-Source On-State Resistance | – | – | .300 | | $V_{GS}$ = 10 V, $I_D$ = 9.0 A [3] |
| | | – | – | .400 | | $V_{GS}$ = 10 V, $I_D$ = 14 A [3] |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | – | 4.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | – | – | 25 | µA | $V_{DS}$ = 320 V, $V_{GS}$ = 0V |
| | | – | – | 250 | | $V_{DS}$ = 320 V, $V_{GS}$ = 0V, $T_J$ = 125°C |
| $I_{GSS}$ | Gate -to-Source Leakage Forward | – | – | 100 | nA | $V_{GS}$ = 20 V |
| $I_{GSS}$ | Gate -to-Source Leakage Reverse | – | – | -100 | nA | $V_{GS}$ = -20 V |
| $Q_{G(on)}$ | On-state Gate Charge | 52 | – | 110 | nC | $V_{GS}$ = 10 V, $I_D$ = 14A |
| $Q_{GS}$ | Gate-to-Source Charge | 5.0 | – | 18 | nC | $V_{DS}$ = 200 V |
| $Q_{Gd}$ | Gate-to-Drain ("Miller") Charge | 25 | – | 65 | nC | See note 4 |
| $t_{d(on)}$ | Turn-On Delay Time | – | – | 35 | ns | $V_{DD}$ = 200 V, $I_D$ = 14 A, $R_G$ = 2.35 |
| $t_r$ | Rise Time | – | – | 190 | ns | See note 4 |
| $t_{d(off)}$ | Turn-Off Delay Time | – | – | 170 | ns | |
| $t_f$ | Fall Time | – | – | 130 | ns | |

### Source-Drain Diode Ratings and Characteristics

| | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Diode Forward Voltage | – | – | 1.7 | V | $T_J$ = 25°C, $I_S$ = 14 A [3], $V_{GS}$ = 0 V |
| $t_{rr}$ | Reverse Recovery Time | – | – | 1200 | ns | $T_J$ = 25°C, $I_F$ = 14 A, di/dt≤100A/µs [3] |

### Thermal Resistance

| | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $R_{thJC}$ | Junction-to-Case | – | – | 0.83 | °C/W | Mounting surface flat, smooth, and greased |
| $R_{thCS}$ | Case-to-sink | – | 0.21 | – | | |
| $R_{thJA}$ | Junction-to-Ambient | – | – | 48 | | Typical socket mount |

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. @$V_{DD}$ = 50 V, Starting $T_J$ = 25°C, L = 100 µH ± 10%, $R_G$ = 25 , Peak $I_L$ = 14 A
3. Pulse width ≤ 300 µs; Duty Cycle ≤ 2 %
4. See MIL-S-19500/543

## ABSOLUTE MAXIMUM RATINGS ($T_C$ = 25°C unless otherwise noted

| Parameter | | JANTXV, JANTX, 2N6770 | Units |
|---|---|---|---|
| $I_D$ @ $V_{GS}$ = 10V, $T_C$ = 25°C | Continuous Drain Current | 12 | A |
| $I_D$ @ $V_{GS}$ = 10V, $T_C$ = 100°C | Continuous Drain Current | 7.75 | A |
| $I_{DM}$ | Pulsed Drain Current[1] | 48 | A |
| $P_D$ @ $T_C$ = 25°C | Maximum Power Dissipation | 150 | W |
| | Linear Derating Factor | 1.2 | W/°C |
| $V_{GS}$ | Gate-Source Voltage | ± 20 | V |
| $E_{AS}$ | Single Pulse Avalanche Energy [2] | 8.0 [4] | mJ |
| $I_{AR}$ | Avalanche Current[1] | 12 [4] | A |
| $T_J$<br>$T_{STG}$ | Operating Junction<br>Storage Temperature Range | -55 to 150 | °C |
| | Lead Temperature | 300(.06 from case for 10 sec) | °C |

## ELECTRICAL CHARACTERISTICS @ $T_J$ = 25°C (Unless Otherwise Specified)

| Parameter | | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | 500 | | | V | $V_{GS}$ = 0V, $I_D$ = 1.0 mA, |
| $R_{DS(on)}$ | Static Drain-to-Source On-State Resistance | – | – | .400 | | $V_{GS}$ = 10 V, $I_D$ = 7.75 A [3] |
| | | – | – | .500 | | $V_{GS}$ = 10 V, $I_D$ = 12 A [3] |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | – | 4.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | – | – | 25 | µA | $V_{DS}$ = 400 V, $V_{GS}$ = 0V |
| | | – | – | 250 | | $V_{DS}$ = 400V, $V_{GS}$ = 0V, $T_J$ = 125°C |
| $I_{GSS}$ | Gate -to-Source Leakage Forward | – | – | 100 | nA | $V_{GS}$ = 20 V |
| $I_{GSS}$ | Gate -to-Source Leakage Reverse | – | – | -100 | nA | $V_{GS}$ = -20 V |
| $Q_{G(on)}$ | On-state Gate Charge | 55 | – | 120 | nC | $V_{GS}$ = 10 V, $I_D$ = 12 A |
| $Q_{GS}$ | Gate-to-Source Charge | 5.0 | – | 19 | nC | $V_{DS}$ = 250 V |
| $Q_{Gd}$ | Gate-to-Drain ("Miller") Charge | 27 | – | 70 | nC | See note 4 |
| $t_{d(on)}$ | Turn-On Delay Time | – | – | 35 | ns | $V_{DD}$ = 250 V, $I_D$ = 12 A, $R_G$ = 2.35 |
| $t_r$ | Rise Time | – | – | 190 | ns | See note 4 |
| $t_{d(off)}$ | Turn-Off Delay Time | – | – | 170 | ns | |
| $t_f$ | Fall Time | – | – | 130 | ns | |

### Source-Drain Diode Ratings and Characteristics

| Parameter | | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Diode Forward Voltage | – | – | 1.7 | V | $T_J$ = 25°C, $I_S$ = 12A [3], $V_{GS}$ = 0 V |
| $t_{rr}$ | Reverse Recovery Time | – | – | 1600 | ns | $T_J$ = 25°C, $I_F$ = 12A, di/dt ≤ 100A/µs [3] |

### Thermal Resistance

| Parameter | | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $R_{thJC}$ | Junction-to-Case | – | – | 0.83 | °C/W | Mounting surface flat, smooth, and greased |
| $R_{thCS}$ | Case-to-sink | – | 0.21 | – | | |
| $R_{thJA}$ | Junction-to-Ambient | – | – | 48 | | Typical socket mount |

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. @$V_{DD}$ = 50 V, Starting $T_J$ = 25°C, L = 100 µH ± 10%, $R_G$ = 25 , Peak $I_L$ = 12A
3. Pulse width ≤ 300 µs; Duty Cycle ≤ 2 %
4. See MIL-S-19500/543