

M21X-VB Datasheet

P-Channel 20-V (D-S) MOSFET

| MOSFET PRODUCT SUMMARY | | | | | | |
|------------------------|------------------------------------|---------------------------------|-----------------------|--|--|--|
| V _{DS} (V) | $R_{DS(on)}(\Omega)$ | I _D (A) ^a | Q _g (Typ.) | | | |
| | 0.060 at V _{GS} = - 10 V | - 4.0 | | | | |
| - 20 | 0.065 at V _{GS} = - 4.5 V | - 3.5 | 10 nC | | | |
| | 0.080 at V _{GS} = - 2.5 V | - 2.0 | | | | |

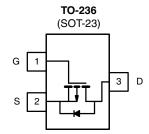
FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- 100 % R_g Tested
- Compliant to RoHS Directive 2002/95/EC



APPLICATIONS

- · Load Switch
- PA Switch
- DC/DC Converters



| ABSOLUTE MAXIMUM RATINGS (TA = | = 25 °C, unless otl | herwise noted) | | | |
|---|-----------------------------------|----------------|------------------------|---|--|
| Parameter | Symbol | Limit | Unit | | |
| Drain-Source Voltage | V_{DS} | - 20 | V | | |
| Gate-Source Voltage | V_{GS} | ± 12 | V | | |
| | T _C = 25 °C | | - 4 ^e | | |
| Continuous Drain Current (T _{.I} = 150 °C) | T _C = 70 °C | I _D | -3.2 | Α | |
| Continuous Brain Current (1) = 100 °C) | T _A = 25 °C | טי | - 3 .5 ^{b, c} | | |
| | T _A = 70 °C | | - 2 .5 ^{b, c} | | |
| Pulsed Drain Current | I _{DM} | - 10 | | | |
| Continuous Source-Drain Diode Current | T _C = 25 °C | I _S | - 2.1 | | |
| Continuous Source-Diam Diode Current | T _A = 25 °C | 'S | - 1.0 ^{b, c} | | |
| | T _C = 25 °C | | 2.5 | | |
| Maximum Power Dissipation | T _C = 70 °C | P_{D} | 1.6 | w | |
| Maximum Fower Dissipation | T _A = 25 °C | l LD | 1.25 ^{b, c} | | |
| | T _A = 70 °C | | 0.8 ^{b, c} | | |
| Operating Junction and Storage Temperature Range | T _J , T _{stg} | - 55 to 150 | °C | | |

| THERMAL RESISTANCE RATINGS | | | | | | | |
|---|--------------|-------------------|---------|---------|--------------|--|--|
| Parameter | | Symbol | Typical | Maximum | Unit | | |
| Maximum Junction-to-Ambient ^{b, d} | ≤5 s | R _{thJA} | 75 | 100 | °C/W | | |
| Maximum Junction-to-Foot (Drain) | Steady State | R_{thJF} | 40 | 50 | O/ VV | | |

Notes:

- a. Based on T_C = 25 °C.
- b. Surface mounted on 1" x 1" FR4 board.
- c. t = 5 s.
- d. Maximum under steady state conditions is 166 $^{\circ}\text{C/W}.$
- e. Package limited.



| Parameter | Symbol | Test Conditions | Min. | Тур. | Max. | Unit | |
|---|-------------------------|--|-------|--------|-------|-------|--|
| Static | | | | | | 1 | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{DS} = 0 \text{ V}, I_D = -250 \mu\text{A}$ | - 20 | | | V | |
| V _{DS} Temperature Coefficient | $\Delta V_{DS}/T_{J}$ | | | - 13.4 | | mV/°C | |
| V _{GS(th)} Temperature Coefficient | $\Delta V_{GS(th)}/T_J$ | I _D = - 250 μA | | 2.9 | | | |
| Gate-Source Threshold Voltage | V _{GS(th)} | $V_{DS} = V_{GS}, I_{D} = -250 \mu A$ | - 0.5 | | - 1.5 | V | |
| Gate-Source Leakage | I _{GSS} | $V_{DS} = 0 \text{ V}, V_{GS} = \pm 12 \text{ V}$ | | | ± 100 | nA | |
| 7 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | | $V_{DS} = -20 \text{ V}, V_{GS} = 0 \text{ V}$ | | | - 1 | | |
| Zero Gate Voltage Drain Current | I _{DSS} | $V_{DS} = -20 \text{ V}, V_{GS} = 0 \text{ V}, T_{J} = 55 ^{\circ}\text{C}$ | | | - 10 | μΑ | |
| On-State Drain Current ^a | I _{D(on)} | $V_{DS} \le -5 \text{ V}, V_{GS} = -4.5 \text{ V}$ | - 10 | | | Α | |
| | | V _{GS} = - 10 V, I _D = - 3 A | | 0.060 | | | |
| Drain-Source On-State Resistance ^a | R _{DS(on)} | V _{GS} = - 4.5 V, I _D = - 2.5 A | | 0.065 | | Ω | |
| | | V _{GS} = - 2.5 V, I _D = - 2 A | | 0.080 | | | |
| Forward Transconductance ^a | 9 _{fs} | V _{DS} = - 5 V, I _D = - 3 A | | 15 | | S | |
| Dynamic ^b | | | | | | | |
| Input Capacitance | C _{iss} | | | 835 | | | |
| Output Capacitance | C _{oss} | V _{DS} = - 10 V, V _{GS} = 0 V, f = 1 MHz | | 180 | | pF | |
| Reverse Transfer Capacitance | C _{rss} | | | 155 | | | |
| Total Oats Observe | 0 | V _{DS} = - 10 V, V _{GS} = - 4.5 V, I _D = - 3.1 A | | 10 | | nC | |
| Total Gate Charge | Q_g | 20 20 | | 6.4 | | | |
| Gate-Source Charge | Q_{gs} | V _{DS} = - 10 V, V _{GS} = - 2.5 V, I _D = - 3.1 A | | 1.7 | | | |
| Gate-Drain Charge | Q_{gd} | | | 3.4 | | | |
| Gate Resistance | R_g | f = 1 MHz | 0.9 | 4.4 | 8.8 | Ω | |
| Turn-On Delay Time | t _{d(on)} | | | 22 | 33 | | |
| Rise Time | t _r | $V_{DD} = -10 \text{ V}, R_{L} = 2.4 \Omega$ | | 20 | 30 | ns | |
| Turn-Off Delay Time | t _{d(off)} | $I_D = -3.1 \text{ A}, V_{GEN} = -4.5 \text{ V}, R_g = 1 \Omega$ | | 28 | 42 | | |
| Fall Time | t _f | | | 9 | 18 | 1 | |
| Drain-Source Body Diode Characteristi | cs | | | | | • | |
| Continuous Source-Drain Diode Current | I _S | T _C = 25 °C | | | - 2.1 | Α | |
| Pulse Diode Forward Current ^a | I _{SM} | | | | - 1 0 | 1 ^ | |
| Body Diode Voltage | V_{SD} | I _S = - 3.1 A | | - 0.8 | - 1.2 | ٧ | |
| Body Diode Reverse Recovery Time | t _{rr} | | | 23 | 35 | ns | |
| Body Diode Reverse Recovery Charge | Q _{rr} | 1 04 A 41/44 400 A / - T 05 00 | | 12 | 20 | nC | |
| Reverse Recovery Fall Time | t _a | $I_F = -3.1 \text{ A, dI/dt} = 100 \text{ A/}\mu\text{s, T}_J = 25 ^{\circ}\text{C}$ | | 15 | | | |
| verse Recovery Rise Time t _b | | | 8 | | ns | | |

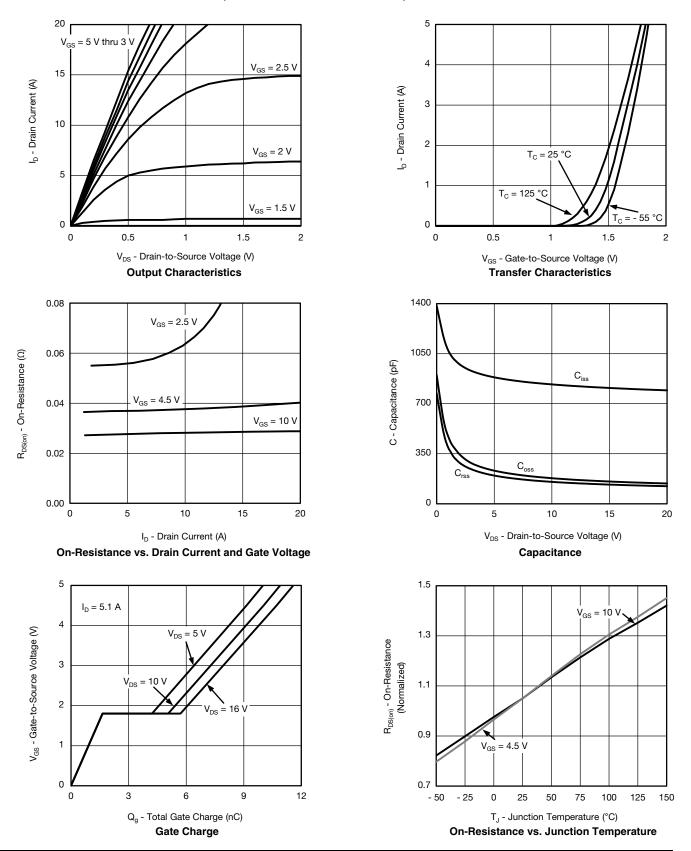
Notes:

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

a. Pulse test; pulse width \leq 300 $\mu s,$ duty cycle \leq 2 %.

b. Guaranteed by design, not subject to production testing.



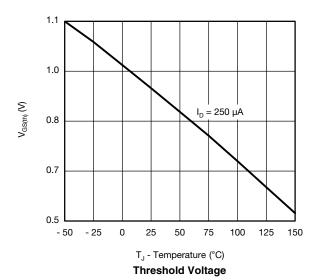


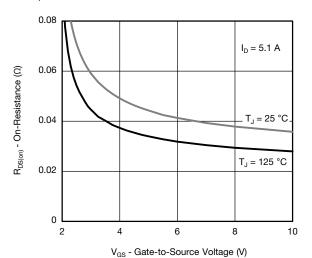
服务热线:400-655-8788 3



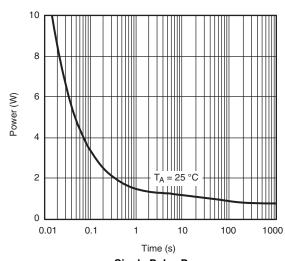


Source-Drain Diode Forward Voltage

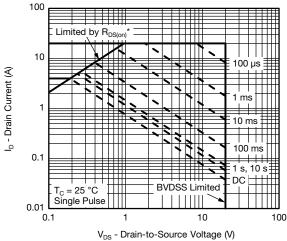




On-Resistance vs. Gate-to-Source Voltage



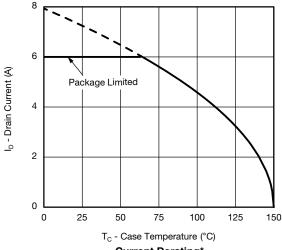
Single Pulse Power



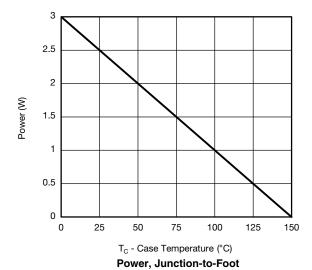
* V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified

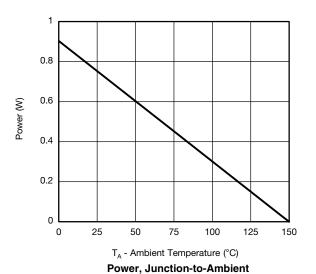
Safe Operating Area





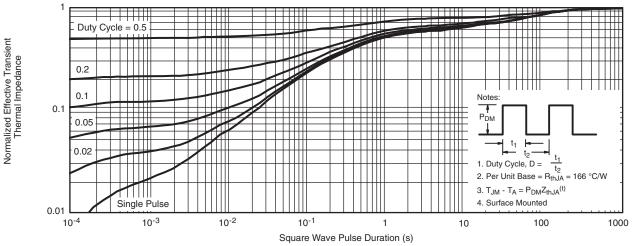




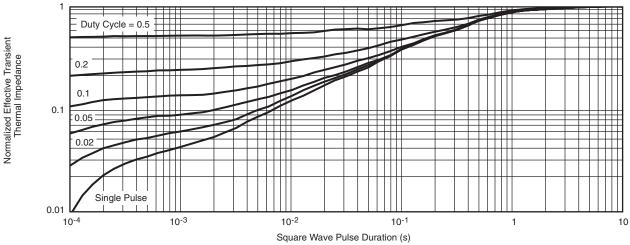


^{*} The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.





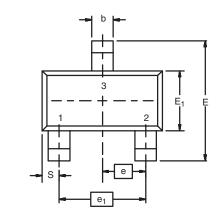
Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot



SOT-23 (TO-236): 3-LEAD





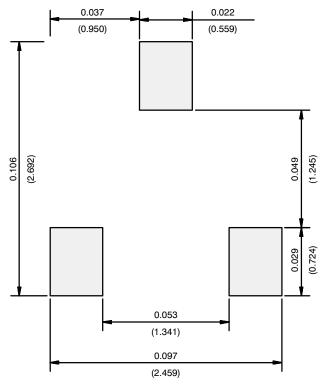


| Dim | MILLIMETERS | | INCHES | | |
|--------------------------|-------------|------|------------|-------|--|
| | Min | Max | Min | Max | |
| Α | 0.89 | 1.12 | 0.035 | 0.044 | |
| A ₁ | 0.01 | 0.10 | 0.0004 | 0.004 | |
| A ₂ | 0.88 | 1.02 | 0.0346 | 0.040 | |
| b | 0.35 | 0.50 | 0.014 | 0.020 | |
| С | 0.085 | 0.18 | 0.003 | 0.007 | |
| D | 2.80 | 3.04 | 0.110 | 0.120 | |
| E | 2.10 | 2.64 | 0.083 | 0.104 | |
| E ₁ | 1.20 | 1.40 | 0.047 | 0.055 | |
| е | 0.95 BSC | | 0.0374 Ref | | |
| e ₁ | 1.90 | BSC | 0.0748 Ref | | |
| L | 0.40 | 0.60 | 0.016 | 0.024 | |
| L ₁ | 0.64 Ref | | 0.025 Ref | | |
| S | 0.50 Ref | | 0.020 Ref | | |
| q | 3° | 8° | 3° | 8° | |
| ECN: S-03946-Rev. K. 09- | Jul-01 | | | | |

DWG: 5479



RECOMMENDED MINIMUM PADS FOR SOT-23



Recommended Minimum Pads Dimensions in Inches/(mm)

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