

N-Channel 20 V (D-S) MOSFET

| PRODUCT SUMMARY | | | | | | |
|---------------------|----------------------------------|---------------------------------|-----------------------|--|--|--|
| V _{DS} (V) | $R_{DS(on)}\left(\Omega\right)$ | I _D (A) ^e | Q _g (Typ.) | | | |
| | 0.028 at V _{GS} = 4.5 V | 6 ^a | | | | |
| 20 | 0.042 at V _{GS} = 2.5 V | 6 ^a | 8.8 nC | | | |
| | 0.050 at V _{GS} = 1.8 V | 5.6 | | | | |



FEATURES

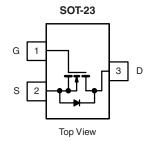
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFET
- 100 % R_g Tested
- Compliant to RoHS Directive 2002/95/EC



HALOGEN FREE

APPLICATIONS

- DC/DC Converters
- Load Switch for Portable Applications



| ABSOLUTE MAXIMUM RATINGS T _A = 25 °C, unless otherwise noted | | | | | |
|--|------------------------|-----------------------------------|----------------------|------|--|
| Parameter | | Symbol | Limit | Unit | |
| Drain-Source Voltage | | V_{DS} | 20 | V | |
| Gate-Source Voltage | | V_{GS} | ± 12 | | |
| | T _C = 25 °C | | 6 ^a | | |
| Continuous Prain Current /T - 150 °C) | T _C = 70 °C | - I _D | 5.1 | | |
| Continuous Drain Current (T _J = 150 °C) | T _A = 25 °C | | 5 ^{b, c} | | |
| | T _A = 70 °C | | 4 ^{b, c} | Α | |
| Pulsed Drain Current | | I _{DM} | 20 | | |
| Continuous Source-Drain Diode Current | T _C = 25 °C | | 1.75 | | |
| Continuous Source-Drain Diode Current | T _A = 25 °C | l _S | 1.04 ^{b, c} | | |
| | T _C = 25 °C | | 2.1 | | |
| Maximum Power Dissipation | T _C = 70 °C | i | 1.3 | w | |
| Maximum Power Dissipation | T _A = 25 °C | P _D | 1.25 ^{b, c} | VV | |
| | T _A = 70 °C |] | 0.8 ^{b, c} | | |
| Operating Junction and Storage Temperature Range | | T _J , T _{stg} | - 55 to 150 | °C | |
| Soldering Recommendations (Peak Tempera | ature) | | 260 | | |

| THERMAL RESISTANCE RATINGS | | | | | | |
|---|--------------|-------------------|---------|------|--------|--|
| Parameter | Symbol | Typical | Maximum | Unit | | |
| Maximum Junction-to-Ambient ^{b, d} | t ≤ 5 s | R _{thJA} | 80 | 100 | °C/W | |
| Maximum Junction-to-Foot (Drain) | Steady State | R_{thJF} | 40 | 60 | O/ V V | |

Notes:

- a. Package limited
- b. Surface Mounted on 1" x 1" FR4 board.
- d. Maximum under steady state conditions is 125 $^{\circ}\text{C/W}.$
- e. Based on T_C = 25 °C.



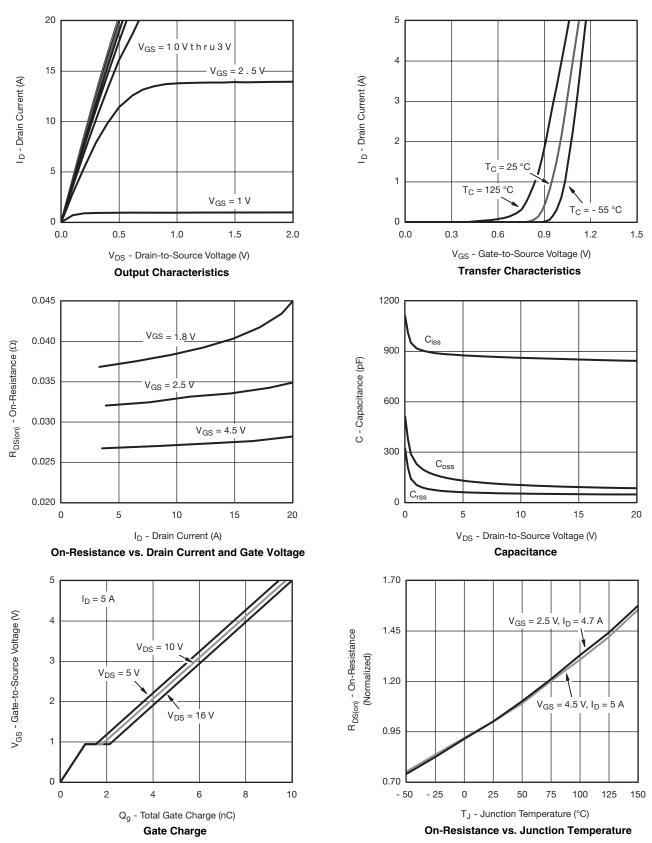
| Parameter | Symbol | Test Conditions | Min. | Тур. | Max. | Unit |
|---|-------------------------|---|----------|-------|-------|----------|
| Static | | | 1 | | | |
| Drain-Source Breakdown Voltage | V _{DS} | $V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$ | 20 | | | V |
| V _{DS} Temperature Coefficient | $\Delta V_{DS}/T_{J}$ | _S /T _J I _D = 250 μA | | 25 | | mV/°C |
| V _{GS(th)} Temperature Coefficient | $\Delta V_{GS(th)}/T_J$ | I _D = 250 μA | | - 2.6 | | mv/°C |
| Gate-Source Threshold Voltage | V _{GS(th)} | $V_{DS} = V_{GS}$, $I_D = 250 \mu A$ | 0.45 | | 1.0 | V |
| Gate-Source Leakage | I _{GSS} | $V_{DS} = 0 \text{ V}, V_{GS} = \pm 8 \text{ V}$ | | | ± 100 | nA |
| | | $V_{DS} = 20 \text{ V}, V_{GS} = 0 \text{ V}$ | | | 1 | μΑ |
| Zero Gate Voltage Drain Current | IDSS | $V_{DS} = 20 \text{ V}, V_{GS} = 0 \text{ V}, T_{J} = 70 \text{ °C}$ | | | 10 | |
| On-State Drain Current ^a | I _{D(on)} | $V_{DS} \le 5 \text{ V}, V_{GS} = 4.5 \text{ V}$ | 20 | | | Α |
| | , , | $V_{GS} = 4.5 \text{ V}, I_D = 5.0 \text{ A}$ | | 0.028 | | Ω |
| Drain-Source On-State Resistance ^a | R _{DS(on)} | $V_{GS} = 2.5 \text{ V}, I_D = 4.7 \text{ A}$ | | 0.042 | | |
| | ` ′ | $V_{GS} = 1.8 \text{ V}, I_D = 4.3 \text{ A}$ | | 0.050 | | |
| Forward Transconductance ^a | 9 _{fs} | V _{DS} = 10 V, I _D = 5.0 A | | 24 | | S |
| Dynamic ^b | | | | l | | |
| Input Capacitance | C _{iss} | tion | | 865 | | |
| Output Capacitance | C _{oss} | $V_{DS} = 10 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$ | | 105 | | pF |
| Reverse Transfer Capacitance | C _{rss} | | | 55 | | |
| · | | $V_{DS} = 10 \text{ V}, V_{GS} = 5 \text{ V}, I_D = 5.0 \text{ A}$ | | 12 | 18 | |
| Total Gate Charge | Q_g | 20 | | 8.8 | 14 | nC |
| Gate-Source Charge | Q _{gs} | $V_{DS} = 10 \text{ V}, V_{GS} = 4.5 \text{ V}, I_D = 5.0 \text{ A}$ | | 1.1 | | |
| Gate-Drain Charge | Q _{gd} | 20 / GO / D | | 0.7 | | |
| Gate Resistance | R _g | f = 1 MHz | 0.5 | 2.4 | 4.8 | Ω |
| Turn-On Delay Time | t _{d(on)} | | | 8 | 16 | |
| Rise Time | t _r | V_{DD} = 10 V, R_L = 2.2 Ω | | 17 | 26 | |
| Turn-Off Delay Time | t _{d(off)} | $I_D\cong 4$ A, V_{GEN} = 4.5 V, R_g = 1 Ω | | 31 | 47 | - |
| Fall Time | t _f | | | 8 | 16 | - |
| Turn-On Delay Time | t _{d(on)} | | | 5 | 10 | ns |
| Rise Time | t _r | V_{DD} = 10 V, R_L = 2.2 Ω | | 13 | 20 | |
| Turn-Off Delay Time | t _{d(off)} | $I_D\cong 4$ A, $V_{GEN}=5$ V, $R_g=1$ Ω | | 21 | 32 | |
| Fall Time | t _f | | | 6 | 12 | - |
| Drain-Source Body Diode Characteristic | <u> </u> | | <u> </u> | | | |
| Continuous Source-Drain Diode Current | Is | T _C = 25 °C | | | 1.75 | |
| Pulse Diode Forward Current | I _{SM} | - | | | 20 | A |
| Body Diode Voltage | V _{SD} | I _S = 4 A, V _{GS} = 0 V | | 0.75 | 1.2 | V |
| Body Diode Reverse Recovery Time | t _{rr} | | | 12 | 20 | ns |
| Body Diode Reverse Recovery Charge | Q _{rr} | | | 5 | 10 | nC |
| Reverse Recovery Fall Time | t _a | $I_F = 4 \text{ A}, \text{ dI/dt} = 100 \text{ A/}\mu\text{s}, T_J = 25 ^{\circ}\text{C}$ | | 7 | | † |
| Reverse Recovery Rise Time | t _b | | | 5 | | ns |

Notes:

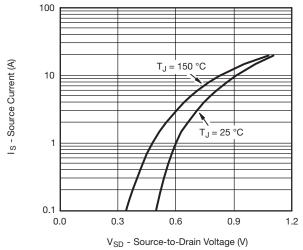
- a. Pulse test; pulse width \leq 300 $\mu s,$ duty cycle \leq 2 % b. Guaranteed by design, not subject to production testing.

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.

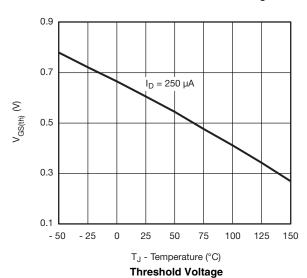








Source-Drain Diode Forward Voltage

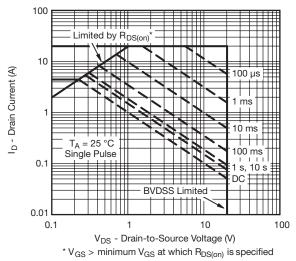


 $I_{D} = 5 \text{ A}$ $I_{D} = 5 \text$

On-Resistance vs. Gate-to-Source Voltage

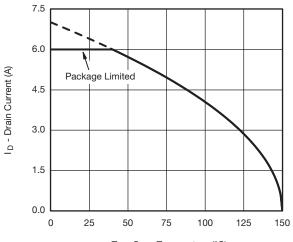


Single Pulse Power (Junction-to-Ambient)



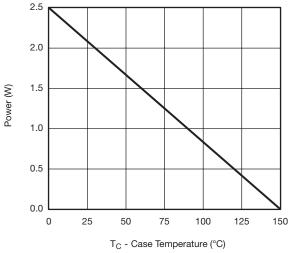
Safe Operating Area, Junction-to-Ambient

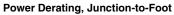


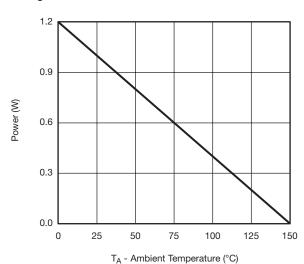


T_C - Case Temperature (°C)

Current Derating*



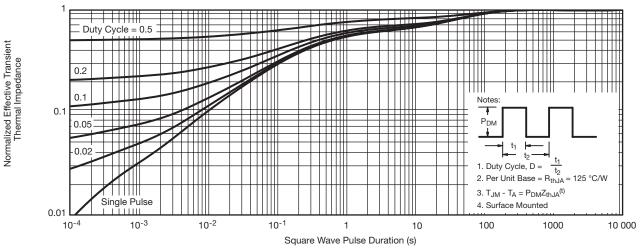




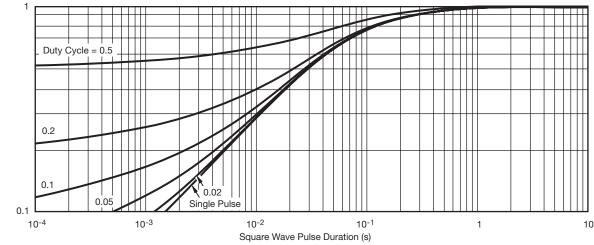
Power Derating, Junction-to-Ambient

^{*} 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

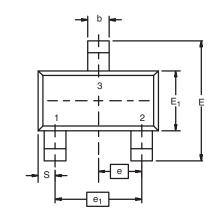


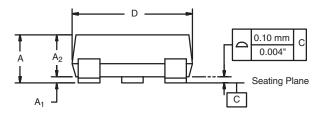
Normalized Thermal Transient Impedance, Junction-to-Foot

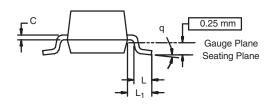
Normalized Effective Transient Thermal Impedance



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







| Dim | MILLIM | IETERS | 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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TK16J60W,S1VQ(O 2SK2614(TE16L1,Q) DMN1017UCP3-7 DMN1053UCP4-7 SQJ469EP-T1-GE3 NTE2384 DMC2700UDMQ-7
DMN2080UCB4-7 DMN61D9UWQ-13 US6M2GTR DMN31D5UDJ-7 DMP22D4UFO-7B DMN1006UCA6-7 DMN16M9UCA6-7
STF5N65M6 IRF40H233XTMA1 STU5N65M6 DMN6022SSD-13 DMN13M9UCA6-7 DMTH10H4M6SPS-13 DMN2990UFB-7B
IPB80P04P405ATMA2 2N7002W-G MCAC30N06Y-TP MCQ7328-TP BXP7N65D BXP4N65F AOL1454G WMJ80N60C4 BXP2N20L
BXP2N65D BXT1150N10J BXT1700P06M TSM60NB380CP ROG RQ7L055BGTCR DMNH15H110SK3-13 SLF10N65ABV2
BSO203SP BSO211P IPA60R230P6 IPA60R460CE