

2SK3590-01-VB Datasheet

N-Channel 150-V (D-S) 175 °C MOSFET

| PRODUCT SUMMARY | | |
|---------------------|---------------------------------|--------------------|
| V _{DS} (V) | R _{DS(on)} (Ω) | I _D (A) |
| 150 | 0.030 at V _{GS} = 10 V | 50 |
| | 0.033 at V _{GS} = 6 V | 45 |

FEATURES

- TrenchFET[®] Power MOSFETs
- 175 °C Junction Temperature
- New Low Thermal Resistance Package
- PWM Optimized
- Compliant to RoHS Directive 2002/95/EC



RoHS
COMPLIANT

APPLICATIONS

- Primary Side Switch

TO-220AB



Top View



N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS T _C = 25 °C, unless otherwise noted | | | |
|---|-----------------------------------|-------------------------------------|------------------|
| Parameter | Symbol | Limit | Unit |
| Drain-Source Voltage | V _{DS} | 150 | V |
| Gate-Source Voltage | V _{GS} | ± 20 | |
| Continuous Drain Current (T _J = 175 °C) | I _D | T _C = 25 °C | 50 |
| | | T _C = 125 °C | 35 |
| Pulsed Drain Current | I _{DM} | 150 | A |
| Avalanche Current | I _{AR} | 50 | |
| Repetitive Avalanche Energy ^a | E _{AR} | 80 | mJ |
| Maximum Power Dissipation ^a | P _D | T _C = 25 °C | 166 ^b |
| | | T _A = 25 °C ^c | 3.75 |
| Operating Junction and Storage Temperature Range | T _J , T _{stg} | - 55 to 175 | °C |

| THERMAL RESISTANCE RATINGS | | | |
|----------------------------------|-------------------|-------|------|
| Parameter | Symbol | Limit | Unit |
| Junction-to-Ambient ^c | R _{thJA} | 40 | °C/W |
| Junction-to-Case (Drain) | R _{thJC} | 0.9 | |

Notes:

- Duty cycle ≤ 1 %.
- See SOA curve for voltage derating.
- When Mounted on 1" square PCB (FR-4 material).

| SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted | | | | | | |
|---|---------------|--|------|-------|-----------|---------------|
| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{DS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 150 | | | V |
| Gate-Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | 2 | | 4 | |
| Gate-Body Leakage | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$ | | | ± 100 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 120\text{ V}, V_{GS} = 0\text{ V}$ | | | 1 | μA |
| | | $V_{DS} = 120\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$ | | | 50 | |
| | | $V_{DS} = 120\text{ V}, V_{GS} = 0\text{ V}, T_J = 175\text{ }^\circ\text{C}$ | | | 250 | |
| On-State Drain Current ^a | $I_{D(on)}$ | $V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$ | 80 | | | A |
| Drain-Source On-State Resistance ^a | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 15\text{ A}$ | | 0.030 | | Ω |
| | | $V_{GS} = 6\text{ V}, I_D = 10\text{ A}$ | | 0.033 | | |
| | | $V_{GS} = 10\text{ V}, I_D = 15\text{ A}, T_J = 125\text{ }^\circ\text{C}$ | | 0.076 | | |
| | | $V_{GS} = 10\text{ V}, I_D = 15\text{ A}, T_J = 175\text{ }^\circ\text{C}$ | | 0.100 | | |
| Forward Transconductance ^a | g_{fs} | $V_{DS} = 15\text{ V}, I_D = 15\text{ A}$ | 10 | | | S |
| Dynamic^b | | | | | | |
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$ | | 2500 | | pF |
| Output Capacitance | C_{oss} | | | 290 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 190 | | |
| Gate Resistance | R_g | | | 2 | | Ω |
| Total Gate Charge ^c | Q_g | $V_{DS} = 75\text{ V}, V_{GS} = 10\text{ V}, I_D = 40\text{ A}$ | | 38 | 60 | nC |
| Gate-Source Charge ^c | Q_{gs} | | | 13 | | |
| Gate-Drain Charge ^c | Q_{gd} | | | 13 | | |
| Turn-On Delay Time ^c | $t_{d(on)}$ | $V_{DD} = 75\text{ V}, R_L = 1.80\text{ }\Omega$ $I_D \equiv 40\text{ A}, V_{GEN} = 10\text{ V}, R_g = 2.5\text{ }\Omega$ | | 15 | 25 | ns |
| Rise Time ^c | t_r | | | 130 | 200 | |
| Turn-Off Delay Time ^c | $t_{d(off)}$ | | | 30 | 45 | |
| Fall Time ^c | t_f | | | 90 | 140 | |
| | | | | | | |
| Source-Drain Diode Ratings and Characteristics $T_C = 25\text{ }^\circ\text{C}$ ^b | | | | | | |
| Continuous Current | I_S | | | | 40 | A |
| Pulsed Current | I_{SM} | | | | 80 | |
| Forward Voltage ^a | V_{SD} | $I_F = 40\text{ A}, V_{GS} = 0\text{ V}$ | | 1.0 | 1.5 | V |
| Reverse Recovery Time | t_{rr} | $I_F = 40\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$ | | 100 | 150 | ns |
| Peak Reverse Recovery Current | $I_{RM(REC)}$ | | | 5 | 8 | A |
| Reverse Recovery Charge | Q_{rr} | | | 0.25 | 0.6 | μC |

Notes:

- Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$
- Guaranteed by design, not subject to production testing.
- Independent of operating temperature.

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.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



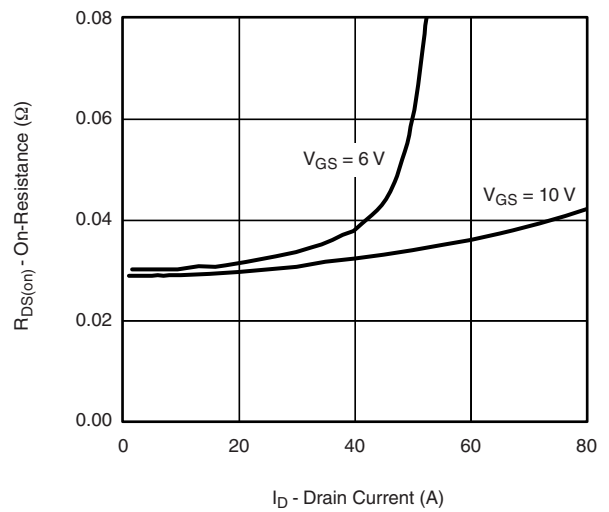
Output Characteristics



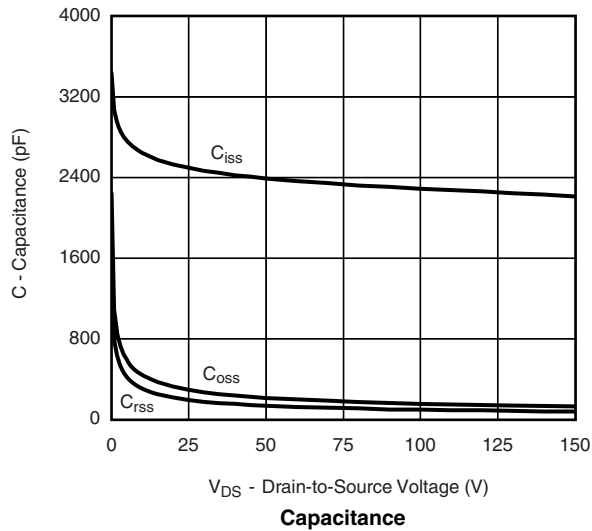
Transfer Characteristics



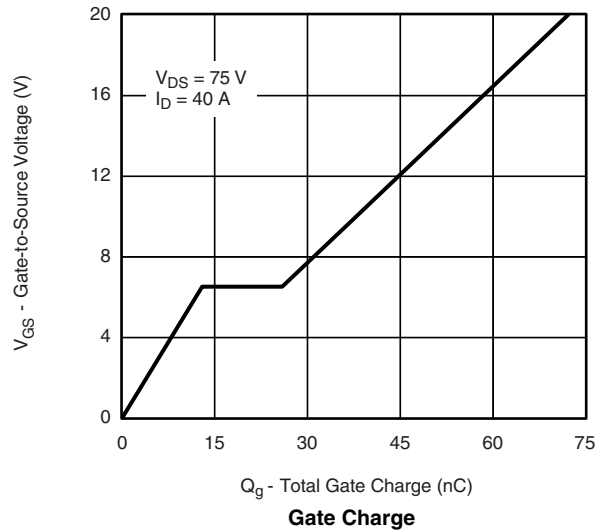
Transconductance



On-Resistance vs. Drain Current



Capacitance



Gate Charge

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



On-Resistance vs. Junction Temperature



Source-Drain Diode Forward Voltage

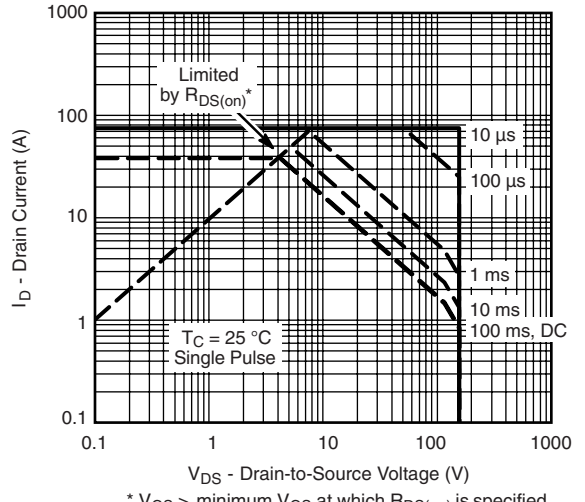


Drain Source Breakdown vs. Junction Temperature

THERMAL RATINGS



Maximum Avalanche and Drain Current vs. Case Temperature

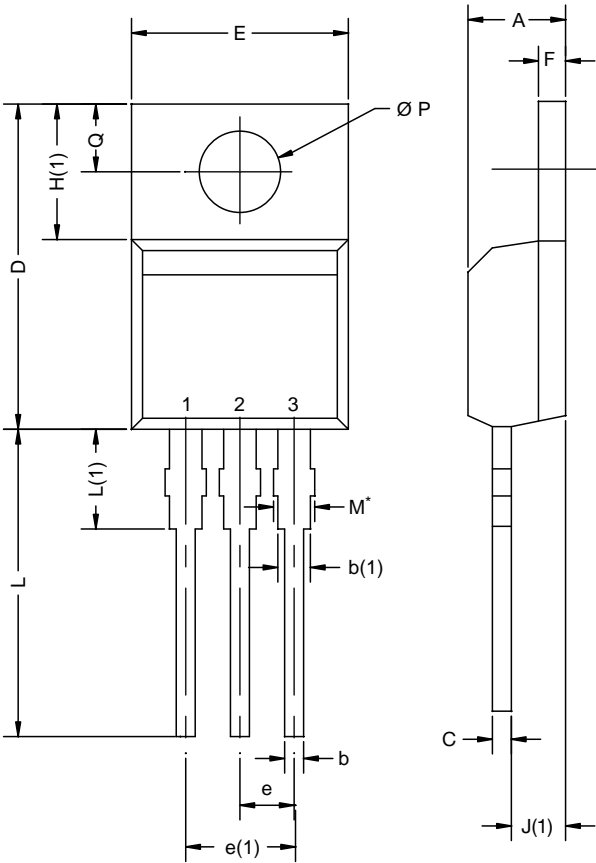


Safe Operating Area
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified



Normalized Thermal Transient Impedance, Junction-to-Case

TO-220AB



| DIM. | MILLIMETERS | | INCHES | |
|------|-------------|-------|--------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 4.25 | 4.65 | 0.167 | 0.183 |
| b | 0.69 | 1.01 | 0.027 | 0.040 |
| b(1) | 1.20 | 1.73 | 0.047 | 0.068 |
| c | 0.36 | 0.61 | 0.014 | 0.024 |
| D | 14.85 | 15.49 | 0.585 | 0.610 |
| E | 10.04 | 10.51 | 0.395 | 0.414 |
| e | 2.41 | 2.67 | 0.095 | 0.105 |
| e(1) | 4.88 | 5.28 | 0.192 | 0.208 |
| F | 1.14 | 1.40 | 0.045 | 0.055 |
| H(1) | 6.09 | 6.48 | 0.240 | 0.255 |
| J(1) | 2.41 | 2.92 | 0.095 | 0.115 |
| L | 13.35 | 14.02 | 0.526 | 0.552 |
| L(1) | 3.32 | 3.82 | 0.131 | 0.150 |
| Ø P | 3.54 | 3.94 | 0.139 | 0.155 |
| Q | 2.60 | 3.00 | 0.102 | 0.118 |

ECN: X12-0208-Rev. N, 08-Oct-12
DWG: 5471

Notes
 * M = 1.32 mm to 1.62 mm (dimension including protrusion)
 Heatsink hole for HVM

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