

APM1402ASC-TRL-VB Datasheet

N-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY

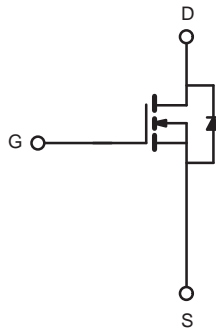
| V_{DS} (V) | $R_{DS(on)}$ (Ω) | I_D (A) ^a | Q_g (Typ.) |
|--------------|---------------------------|------------------------|--------------|
| 20 | 0.036 at $V_{GS} = 10$ V | 4 | 4 nC |
| | 0.040 at $V_{GS} = 4.5$ V | 3.8 | |
| | 0.048 at $V_{GS} = 2.5$ V | 3.6 | |

FEATURES

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



RoHS
COMPLIANT
HALOGEN
FREE



APPLICATIONS

- Portable Devices
 - Load Switch
 - Battery Switch
- Load Switch for Motors, Relays and Solenoids

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 | |
| Continuous Drain Current ($T_J = 150$ °C) | I_D | $T_C = 25$ °C | 4 ^a |
| | | $T_C = 70$ °C | 3.6 ^a |
| | | $T_A = 25$ °C | 4 ^{a, b, c} |
| | | $T_A = 70$ °C | 3.7 ^{b, c} |
| Pulsed Drain Current ($t = 300$ μ s) | I_{DM} | 20 | |
| Continuous Source-Drain Diode Current | I_S | $T_C = 25$ °C | 2.3 ^a |
| | | $T_A = 25$ °C | 1.3 ^{b, c} |
| Maximum Power Dissipation | P_D | $T_C = 25$ °C | 2.8 |
| | | $T_C = 70$ °C | 1.8 |
| | | $T_A = 25$ °C | 1.56 ^{b, c} |
| | | $T_A = 70$ °C | 1.0 ^{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} | R_{thJA} | 60 | 80 | °C/W |
| Maximum Junction-to-Foot (Drain) | R_{thJF} | 34 | 45 | |

Notes:

- Package limited, $T_C = 25$ °C.
- Surface mounted on 1" x 1" FR4 board.
- $t = 5$ s.
- Maximum under steady state conditions is 125 °C/W.

| SPECIFICATIONS (T _J = 25 °C, unless otherwise noted) | | | | | | |
|---|--------------------------------------|--|------|-------|-------|-------|
| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | V _{DS} | V _{GS} = 0 V, I _D = 250 μA | 20 | | | V |
| V _{DS} Temperature Coefficient | ΔV _{DS} /T _J | I _D = 250 μA | | 23 | | mV/°C |
| V _{GS(th)} Temperature Coefficient | ΔV _{GS(th)} /T _J | | | - 3.2 | | |
| Gate-Source Threshold Voltage | V _{GS(th)} | V _{DS} = V _{GS} , I _D = 250 μA | 0.6 | | 1.3 | V |
| Gate-Source Leakage | I _{GSS} | V _{DS} = 0 V, V _{GS} = ± 4.5 V | | | ± 0.5 | μA |
| | | V _{DS} = 0 V, V _{GS} = ± 12 V | | | ± 25 | |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} = 20 V, V _{GS} = 0 V | | | 1 | |
| | | V _{DS} = 20 V, V _{GS} = 0 V, T _J = 55 °C | | | 10 | |
| On-State Drain Current ^a | I _{D(on)} | V _{DS} ≥ 5 V, V _{GS} = 4.5 V | 15 | | | A |
| Drain-Source On-State Resistance ^a | R _{DS(on)} | V _{GS} = 10 V, I _D = 3.7 A | | 0.036 | | Ω |
| | | V _{GS} = 4.5 V, I _D = 3.6 A | | 0.040 | | |
| | | V _{GS} = 2.5 V, I _D = 1.5 A | | 0.048 | | |
| Forward Transconductance ^a | g _{fs} | V _{DS} = 15 V, I _D = 3.7 A | | 17 | | S |
| Dynamic ^b | | | | | | |
| Total Gate Charge | Q _g | V _{DS} = 15 V, V _{GS} = 10 V, I _D = 3.7 A | | 8.8 | 13.5 | nC |
| | | V _{DS} = 15 V, V _{GS} = 4.5 V, I _D = 3.7 A | | 4 | 6 | |
| Gate-Source Charge | Q _{gs} | | | 0.9 | | |
| Gate-Drain Charge | Q _{gd} | | | 1.1 | | |
| Gate Resistance | R _g | f = 1 MHz | 0.4 | 2 | 4 | kΩ |
| Turn-On Delay Time | t _{d(on)} | V _{DD} = 15 V, R _L = 4.1 Ω I _D ≅ 3.7 A, V _{GEN} = 4.5 V, R _g = 1 Ω | | 0.29 | 0.58 | μs |
| Rise Time | t _r | | | 0.4 | 0.8 | |
| Turn-Off DelayTime | t _{d(off)} | | | 1.9 | 3.8 | |
| Fall Time | t _f | | | 0.75 | 1.5 | |
| Turn-On Delay Time | t _{d(on)} | V _{DD} = 15 V, R _L = 4.1 Ω I _D ≅ 3.7 A, V _{GEN} = 10 V, R _g = 1 Ω | | 0.1 | 0.2 | |
| Rise Time | t _r | | | 0.15 | 0.3 | |
| Turn-Off DelayTime | t _{d(off)} | | | 3 | 6 | |
| Fall Time | t _f | | | 0.75 | 1.5 | |
| Drain-Source Body Diode Characteristics | | | | | | |
| Continuous Source-Drain Diode Current | I _S | T _C = 25 °C | | | 2.3 | A |
| Pulse Diode Forward Current | I _{SM} | | | | 20 | |
| Body Diode Voltage | V _{SD} | I _S = 3.7 A, V _{GS} = 0 V | | 0.85 | 1.2 | V |
| Body Diode Reverse Recovery Time | t _{rr} | I _F = 3.7 A, dI/dt = 100 A/μs, T _J = 25 °C | | 12 | 25 | ns |
| Body Diode Reverse Recovery Charge | Q _{rr} | | | 5 | 10 | nC |
| Reverse Recovery Fall Time | t _a | | | 6.5 | | ns |
| Reverse Recovery Rise Time | t _b | | | 5.5 | | |

Notes:

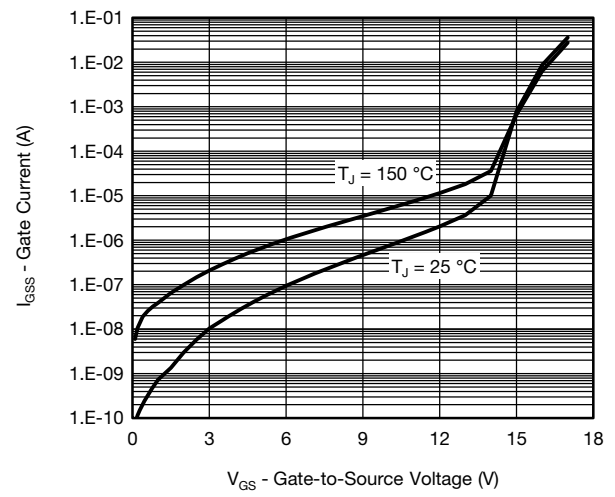
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
 b. Guaranteed by design, not subject to production testing.

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.

TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise noted)



Gate Current vs. Gate-to-Source Voltage



Gate Current vs. Gate-to-Source Voltage



Output Characteristics



Transfer Characteristics



On-Resistance vs. Drain Current

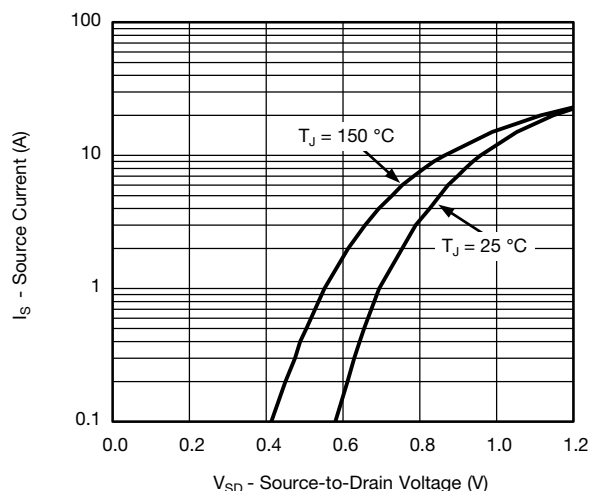


Gate Charge

TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)



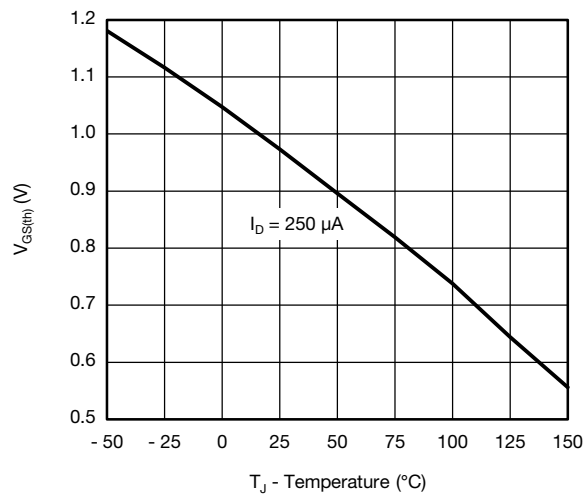
Normalized On-Resistance vs. Junction Temperature



Source-Drain Diode Forward Voltage



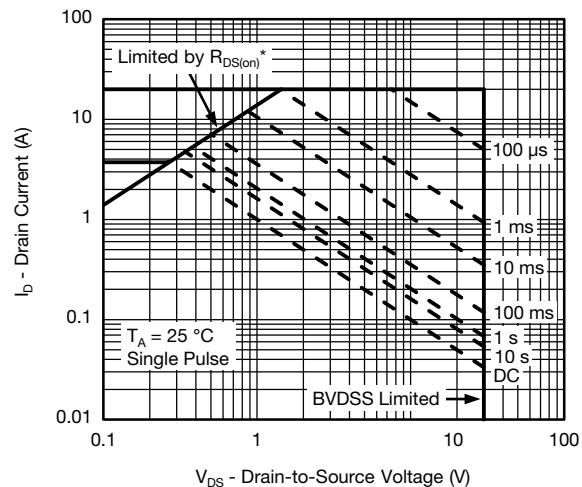
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power, Junction-to-Ambient



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

TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)



* The power dissipation P_D is based on $T_{J(\max)} = 150\text{ }^{\circ}\text{C}$, 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.

TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

Normalized Thermal Transient Impedance, Junction-to-Ambient

Normalized Thermal Transient Impedance, Junction-to-Foot

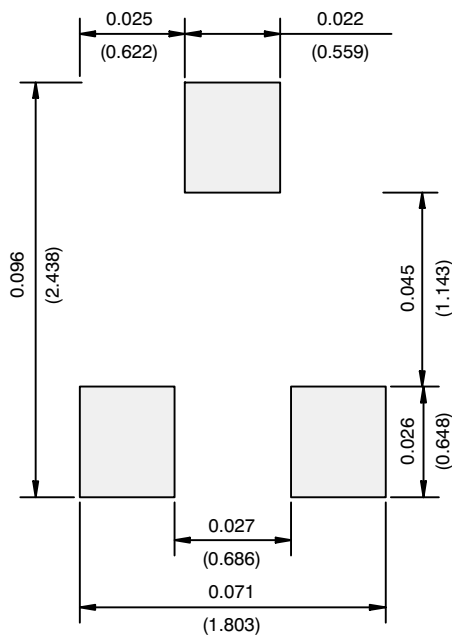
SC-70: 3-LEADS



| Dim | MILLIMETERS | | | INCHES | | |
|----------------|-------------|------|------|----------|-------|-------|
| | Min | Nom | Max | Min | Nom | Max |
| A | 0.90 | — | 1.10 | 0.035 | — | 0.043 |
| A ₁ | — | — | 0.10 | — | — | 0.004 |
| A ₂ | 0.80 | — | 1.00 | 0.031 | — | 0.039 |
| b | 0.25 | — | 0.40 | 0.010 | — | 0.016 |
| c | 0.10 | — | 0.25 | 0.004 | — | 0.010 |
| D | 1.80 | 2.00 | 2.20 | 0.071 | 0.079 | 0.087 |
| E | 1.80 | 2.10 | 2.40 | 0.071 | 0.083 | 0.094 |
| E ₁ | 1.15 | 1.25 | 1.35 | 0.045 | 0.049 | 0.053 |
| e | 0.65BSC | | | 0.026BSC | | |
| e ₁ | 1.20 | 1.30 | 1.40 | 0.047 | 0.051 | 0.055 |
| L | 0.10 | 0.20 | 0.30 | 0.004 | 0.008 | 0.012 |
| α | 7°Nom | | | 7°Nom | | |

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DWG: 5549

RECOMMENDED MINIMUM PADS FOR SC-70: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

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