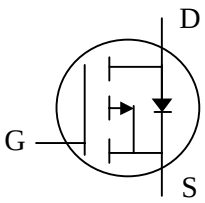
# P-channel Enhancement-mode Power MOSFET

**Simple Drive Requirement**

**Small Package Outline**

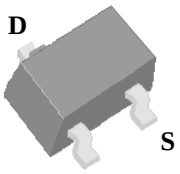
**Surface Mount Device**

**RoHS-compliant, Halogen-free**




| | |
|---|---|
| $BV_{DSS}$ | -60V |
| $R_{DS(ON)}$ | 250mΩ |
| $I_D$ | -1.8A |

## Description




SOT-23

Advanced Power MOSFETs from APEC provide the designer with the best combination of fast switching, low on-resistance and cost-effectiveness.

The AP2311GN-HF-3 is in the popular SOT-23 small surface-mount package which is widely used in commercial and industrial applications where a small board footprint is required.
This device is well suited for use in medium current applications such as load switches.

## Absolute Maximum Ratings

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | -60 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $I_D$ at $T_A$ =25°C | Continuous Drain Current [3] | -1.8 | A |
| $I_D$ at $T_A$= 70°C | Continuous Drain Current[3] | -1.4 | A |
| $I_{DM}$ | Pulsed Drain Current[1] | -10 | A |
| $P_D$ at $T_A$=25°C | Total Power Dissipation | 1.38 | W |
| | Linear Derating Factor | 0.01 | W/°C |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | °C |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | °C |

## Thermal Data

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| Rthj-a | Maximum Thermal Resistance, Junction-ambient | 90 | °C/W |

## Ordering Information

**AP2311GN-HF-3TR** **RoHS-compliant, halogen-free SOT-23, shipped on tape and reel, 3000pcs/reel**

## Electrical Specifications at $T_j$=25°C (unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V, $I_D$=-250uA | -60 | - | - | V |
| $\Delta BV_{DSS}/\Delta T_j$ | Breakdown Voltage Temperature Coefficient | Reference to 25°C, $I_D$=-1mA | - | -0.04 | - | V/°C |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance[2] | $V_{GS}$=-10V, $I_D$=-1.8A | - | 200 | 250 | mΩ |
| | | $V_{GS}$=-4.5V, $I_D$=-1.4A | - | 240 | 300 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_D$=-250uA | -1 | - | -3 | V |
| $g_{fs}$ | Forward Transconductance | $V_{DS}$=-10V, $I_D$=-1A | - | 2 | - | S |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=-60V, $V_{GS}$=0V | - | - | -10 | uA |
| | Drain-Source Leakage Current ($T_j$=70°C) | $V_{DS}$=-48V, $V_{GS}$=0V | - | - | -25 | uA |
| $I_{GSS}$ | Gate-Source Leakage | $V_{GS}$=±20V | - | - | ±100 | nA |
| $Q_g$ | Total Gate Charge[2] | $I_D$=-1A | - | 6 | 10 | nC |
| $Q_{gs}$ | Gate-Source Charge | $V_{DS}$=-48V | - | 1 | - | nC |
| $Q_{gd}$ | Gate-Drain ("Miller") Charge | $V_{GS}$=-4.5V | - | 3 | - | nC |
| $t_{d(on)}$ | Turn-on Delay Time[2] | $V_{DS}$=-30V | - | 8 | - | ns |
| $t_r$ | Rise Time | $I_D$=-1A | - | 5 | - | ns |
| $t_{d(off)}$ | Turn-off Delay Time | $R_G$=3.3Ω, $V_{GS}$=-10V | - | 22 | - | ns |
| $t_f$ | Fall Time | $R_D$=30Ω | - | 3 | - | ns |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V | - | 510 | 810 | pF |
| $C_{oss}$ | Output Capacitance | $V_{DS}$=-25V | - | 50 | - | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | f=1.0MHz | - | 40 | - | pF |
| $R_g$ | Gate Resistance | f=1.0MHz | - | 6.4 | 9.6 | Ω |

## Source-Drain Diode

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Forward On Voltage[2] | $I_S$=-1.2A, $V_{GS}$=0V | - | - | -1.2 | V |
| $t_{rr}$ | Reverse Recovery Time[2] | $I_S$=-1A, $V_{GS}$=0V, | - | 30 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | dI/dt=100A/μs | - | 38 | - | nC |

### Notes:

1. Pulse width limited by maximum junction temperature.
2. Pulse test - pulse width ≤ 300μs , duty cycle ≤ 2%
3. Surface mounted on 1 in$^2$copper pad of FR4 board, t ≤10sec; 270°C/W when mounted on minimum copper pad.

## Typical Electrical Characteristics

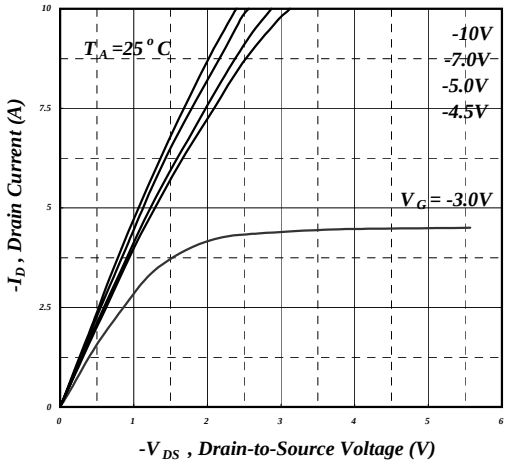



Fig 1. Typical Output Characteristics

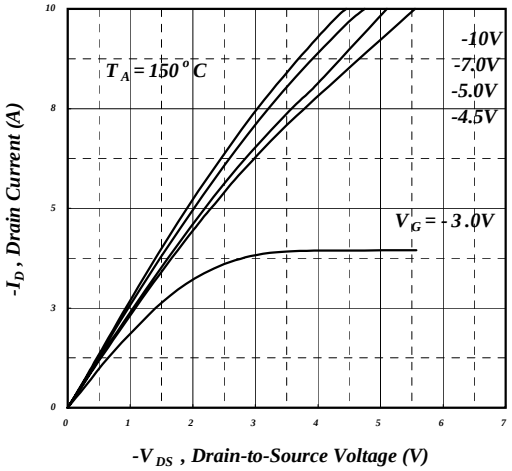



Fig 2. Typical Output Characteristics

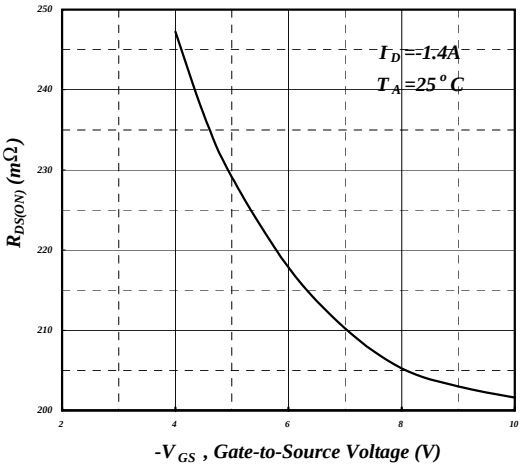



Fig 3. On-Resistance vs. Gate Voltage

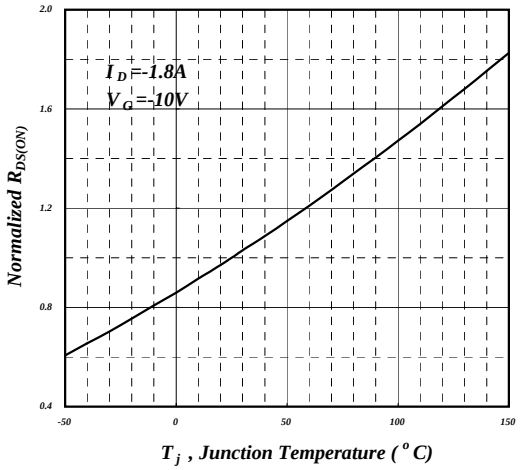



Fig 4. Normalized On-Resistance vs. Junction Temperature

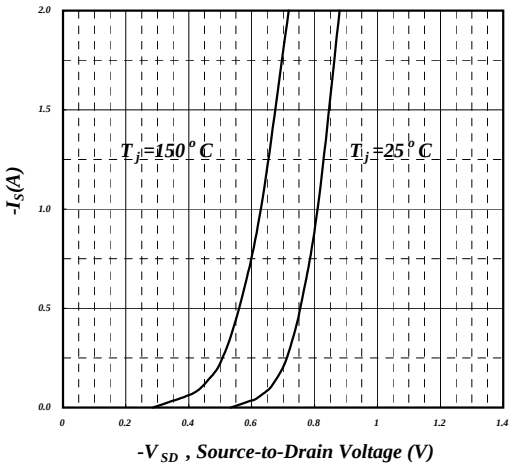



Fig 5. Forward Characteristic of Reverse Diode

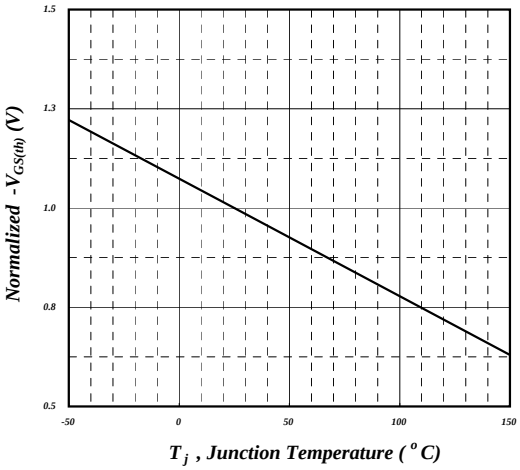



Fig 6. Gate Threshold Voltage vs. Junction Temperature

## Typical Electrical Characteristics (cont.)

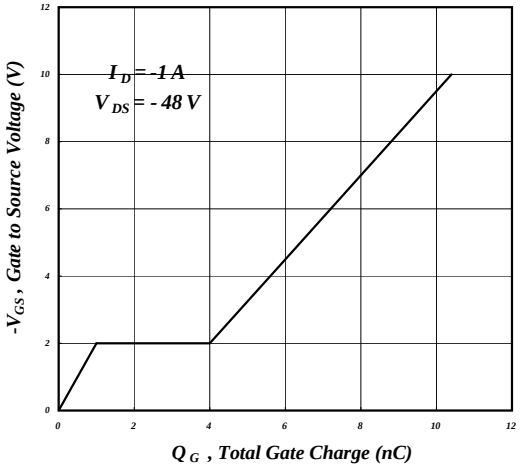



Fig 7. Gate Charge Characteristics

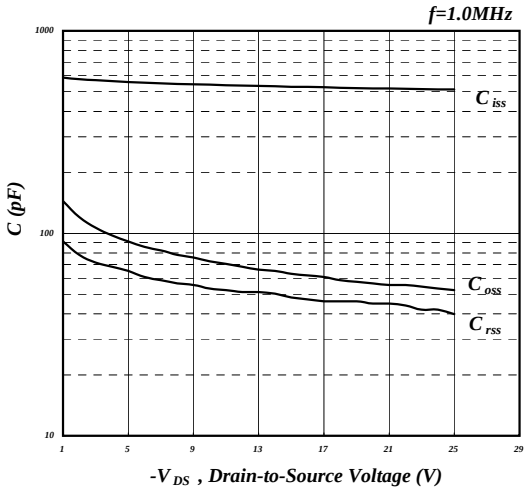



Fig 8. Typical Capacitance Characteristics

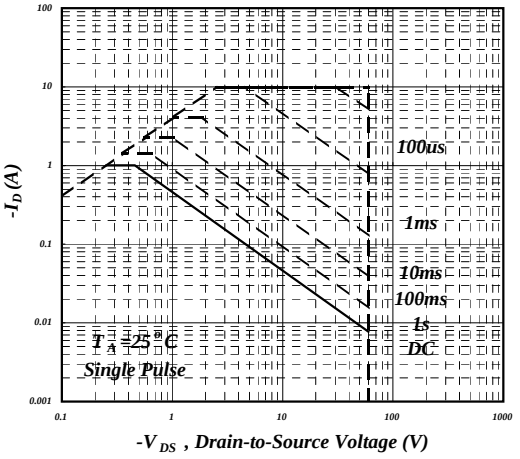



Fig 9. Maximum Safe Operating Area

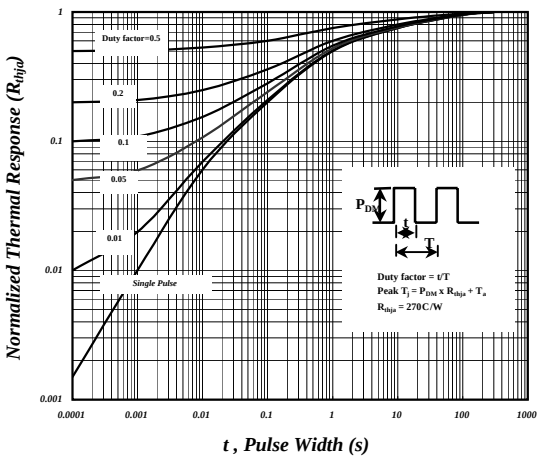



Fig 10. Effective Transient Thermal Impedance

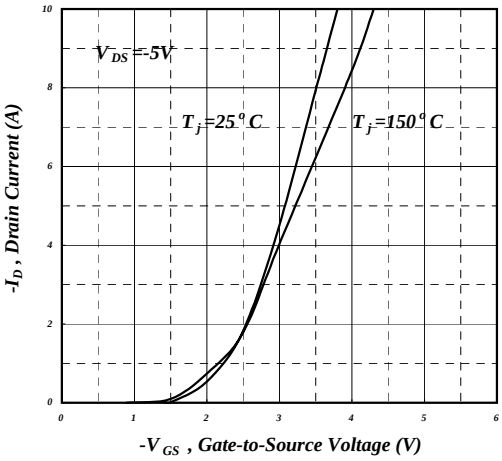



Fig 11. Transfer Characteristics

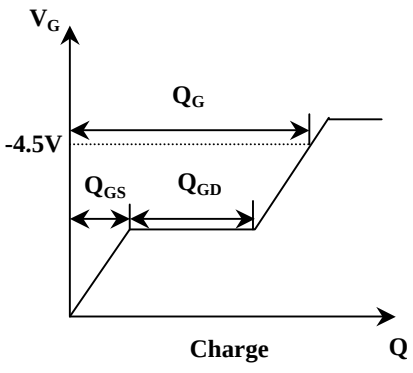
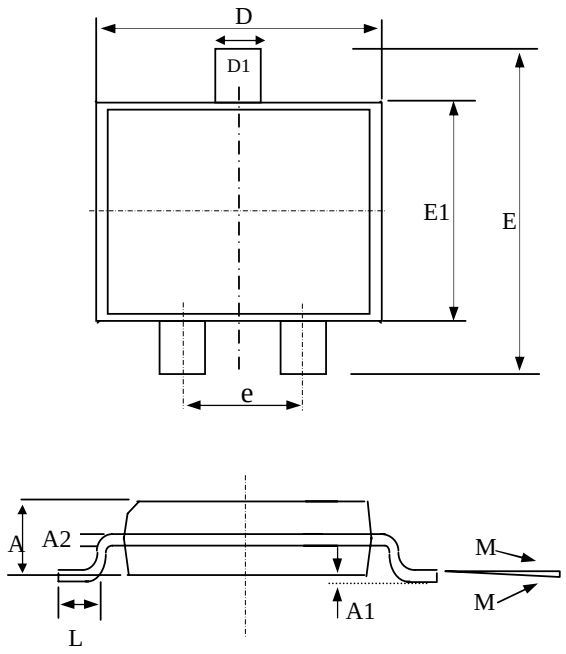



Fig 12. Gate Charge Waveform

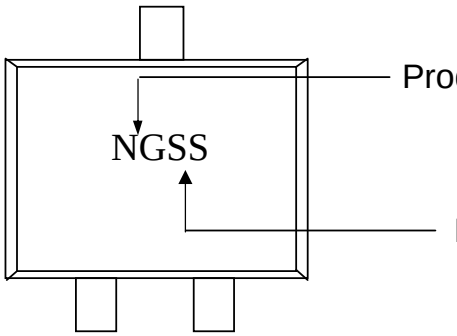
## Package Dimensions: SOT-23




| SYMBOLS | Millimeters | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 0.88 | -- | 1.30 |
| A1 | 0.00 | -- | 0.10 |
| A2 | 0.08 | -- | 0.25 |
| D1 | 0.30 | 0.40 | 0.50 |
| e | 1.70 | 2.00 | 2.30 |
| D | 2.70 | 2.90 | 3.10 |
| E | 2.20 | 2.60 | 3.00 |
| E1 | 1.20 | 1.50 | 1.80 |
| M | 0° | -- | 10° |
| L | 0.30 | -- | 0.60 |

1. All dimensions are in millimeters.
2. Dimensions do not include mold protrusions.

## Marking Information: SOT-23




Product: NG = AP2311GN-HF-3

Date/lot code

For details of how to convert this to standard YYWW date code format, please contact us directly.