# AP2309GN-HF

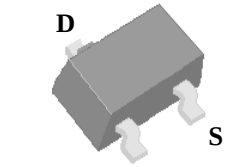
**Halogen-Free Product**

## Advanced Power Electronics Corp.

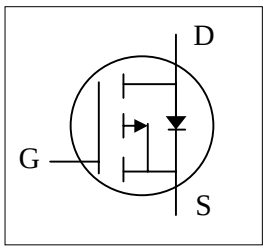
*P-CHANNEL ENHANCEMENT MODE POWER MOSFET*

- ▼ **Simple Drive Requirement**
- ▼ **Small Package Outline**
- ▼ **Surface Mount Device**
- ▼ **RoHS Compliant**

| | |
|---|---|
| $BV_{DSS}$ | -30V |
| $R_{DS(ON)}$ | 75mΩ |
| $I_D$ | - 3.7A |




SOT-23




## Description

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

The SOT-23 package is widely preferred for commercial-industrial surface mount applications and suited for low voltage applications such as DC/DC converters.

## Absolute Maximum Ratings

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | - 30 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $I_D$@$T_A$=25℃ | Continuous Drain Current[3] | - 3.7 | A |
| $I_D$@$T_A$=70℃ | Continuous Drain Current[3] | - 3 | A |
| $I_{DM}$ | Pulsed Drain Current[1] | -12 | A |
| $P_D$@$T_A$=25℃ | Total Power Dissipation | 1.38 | W |
| | Linear Derating Factor | 0.01 | W/℃ |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | ℃ |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | ℃ |

## Thermal Data

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| Rthj-a | Maximum Thermal Resistance, Junction-ambient[3] | 90 | ℃/W |

## Electrical Characteristics@$T_j$=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 | -30 | - | - | V |
| $\Delta BV_{DSS}/\Delta T_j$ | Breakdown Voltage Temperature Coefficient | Reference to 25℃, $I_D$=-1mA | - | -0.02 | - | V/℃ |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance[2] | $V_{GS}$=-10V, $I_D$=-3A | - | - | 75 | mΩ |
| | | $V_{GS}$=-4.5V, $I_D$=-2.6A | - | - | 120 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_D$=-250uA | -1 | - | -3 | V |
| $g_{fs}$ | Forward Transconductance | $V_{DS}$=-10V, $I_D$=-3A | - | 5 | - | S |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=-30V, $V_{GS}$=0V | - | - | -1 | uA |
| | Drain-Source Leakage Current ($T_j$=55°C) | $V_{DS}$=-24V, $V_{GS}$=0V | - | - | -25 | uA |
| $I_{GSS}$ | Gate-Source Leakage | $V_{GS}$=±20V | - | - | ±100 | nA |
| $Q_g$ | Total Gate Charge[2] | $I_D$=-3A | - | 5 | 8 | nC |
| $Q_{gs}$ | Gate-Source Charge | $V_{DS}$=-24V | - | 1 | - | nC |
| $Q_{gd}$ | Gate-Drain ("Miller") Charge | $V_{GS}$=-4.5V | - | 3 | - | nC |
| $t_{d(on)}$ | Turn-on Delay Time[2] | $V_{DS}$=-15V | - | 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 | - | 20 | - | ns |
| $t_f$ | Fall Time | $R_D$=15Ω | - | 7 | - | ns |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V | - | 412 | 660 | pF |
| $C_{oss}$ | Output Capacitance | $V_{DS}$=-25V | - | 91 | - | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | f=1.0MHz | - | 62 | - | pF |

## 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] | $I_S$=-3A, $V_{GS}$=0V, | - | 20 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | dI/dt=100A/μs | - | 15 | - | nC |

### Notes:

1.Pulse width limited by Max. junction temperature.

2.Pulse test

3.Surface mounted on 1 $in^2$ copper pad of FR4 board ; 270℃/W when mounted on min. copper pad.

THIS PRODUCT IS SENSITIVE TO ELECTROSTATIC DISCHARGE, PLEASE HANDLE WITH CAUTION.

USE OF THIS PRODUCT AS A CRITICAL COMPONENT IN LIFE SUPPORT OR OTHER SIMILAR SYSTEMS IS NOT AUTHORIZED.

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APEC RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN.

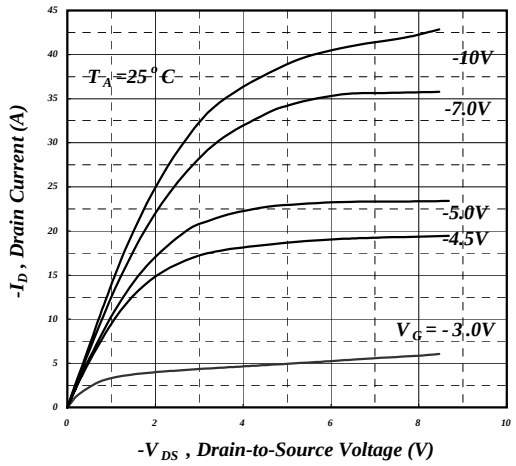



**Fig 1. Typical Output Characteristics**

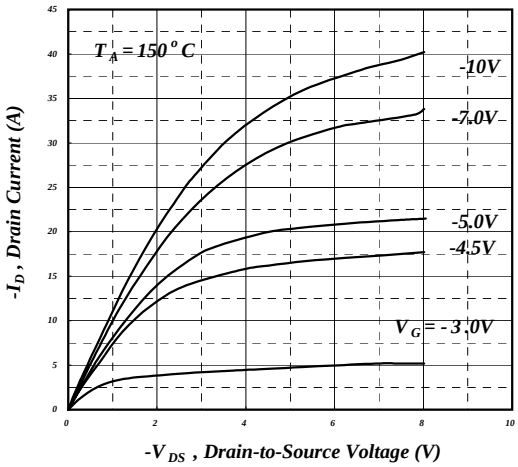



**Fig 2. Typical Output Characteristics**

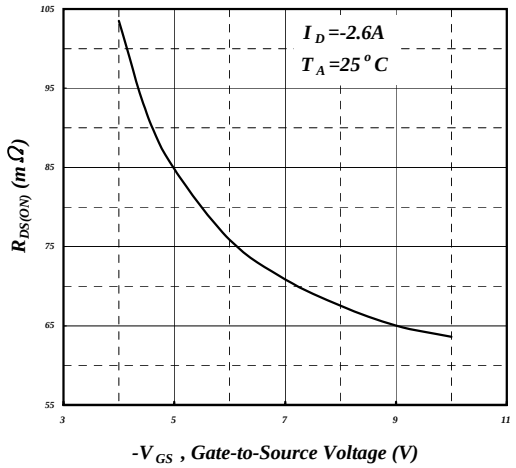



**Fig 3. On-Resistance v.s. Gate Voltage**

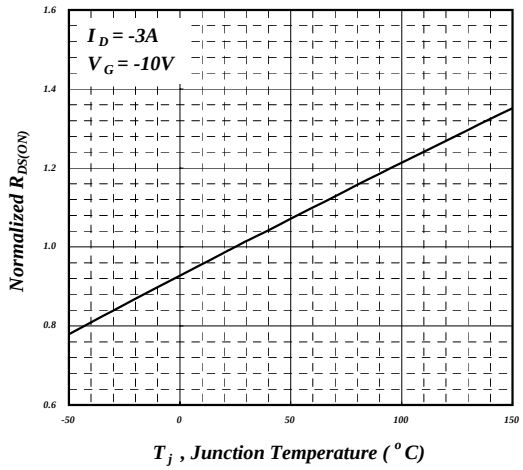



**Fig 4. Normalized On-Resistance v.s. Junction Temperature**

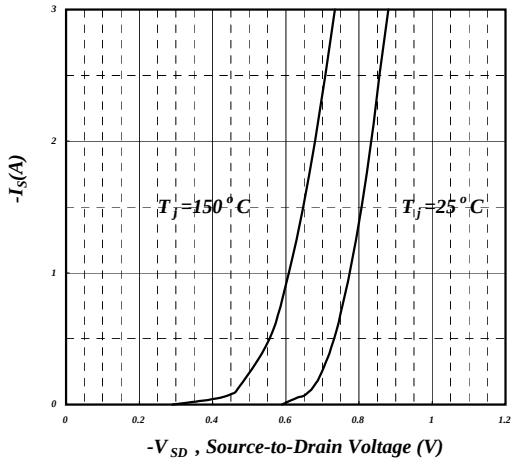



**Fig 5. Forward Characteristic of Reverse Diode**

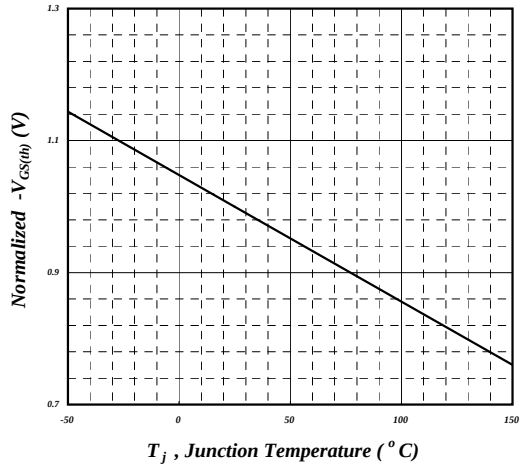



**Fig 6. Gate Threshold Voltage v.s. Junction Temperature**

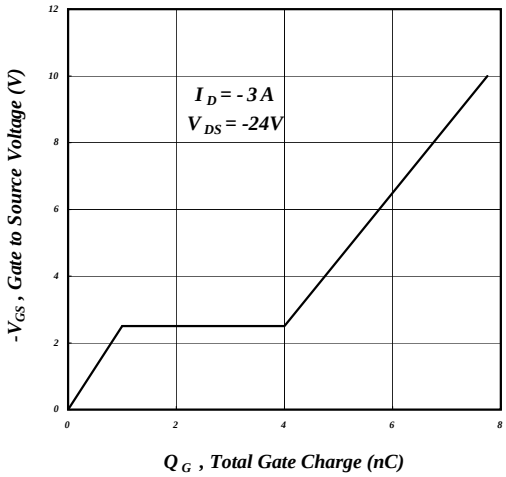



Fig 7. Gate Charge Characteristics

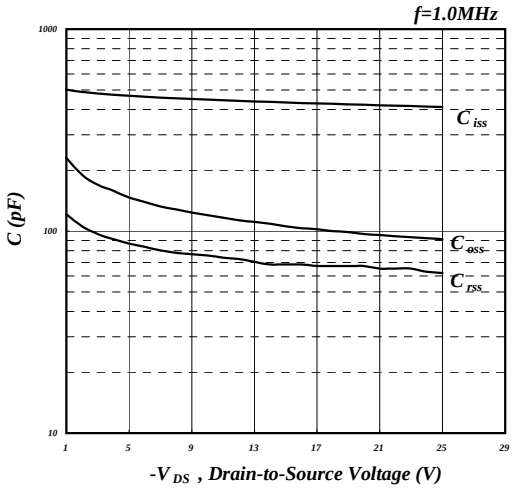



Fig 8. Typical Capacitance Characteristics

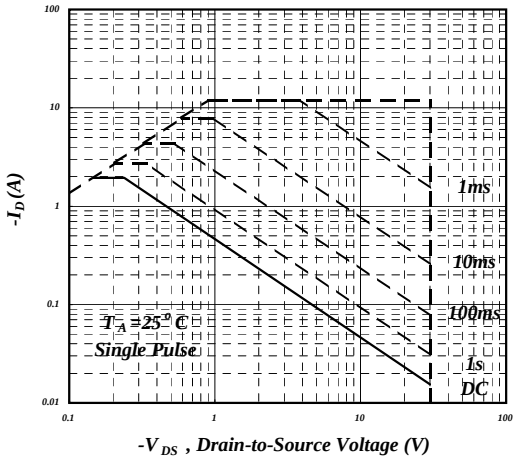



Fig 9. Maximum Safe Operating Area

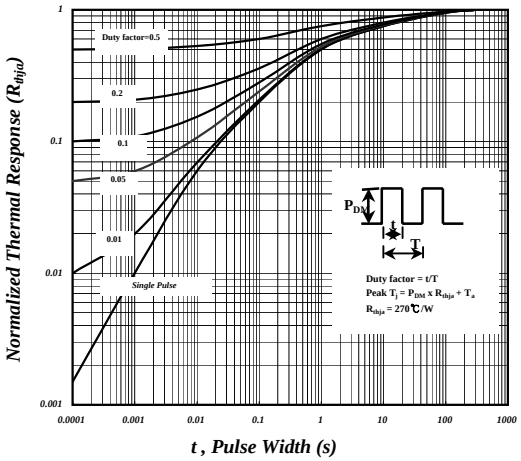



Fig 10. Effective Transient Thermal Impedance

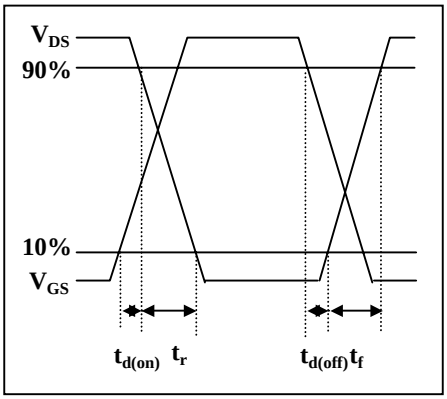



Fig 11. Switching Time Circuit

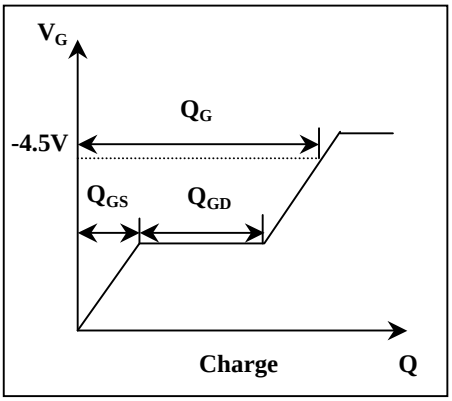
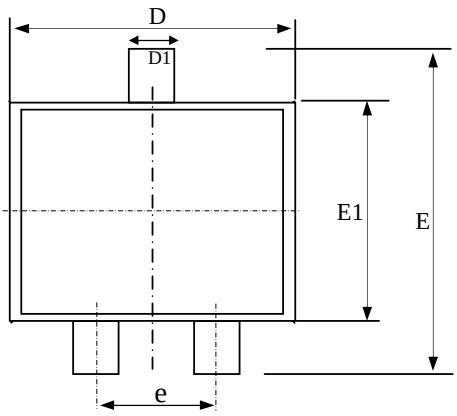
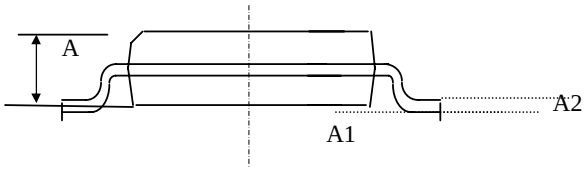



Fig 12. Gate Charge Circuit

## Package Outline : SOT-23



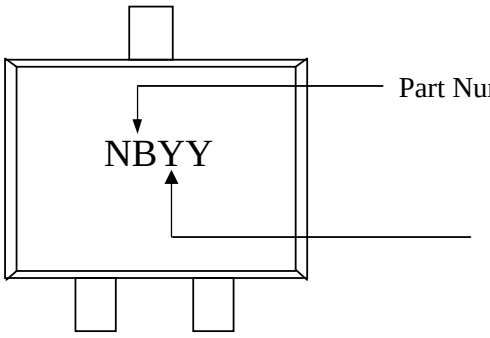

| SYMBOLS | Millimeters | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 1.00 | 1.15 | 1.30 |
| A1 | 0.00 | -- | 0.10 |
| A2 | 0.10 | 0.15 | 0.25 |
| D1 | 0.30 | 0.40 | 0.50 |
| e | 1.70 | 2.00 | 2.30 |
| D | 2.70 | 2.90 | 3.10 |
| E | 2.40 | 2.65 | 3.00 |
| E1 | 1.40 | 1.50 | 1.60 |




1.All Dimension Are In Millimeters.

2.Dimension Does Not Include Mold Protrusions.

## Part Marking Information & Packing : SOT-23




Part Number : NB

Date Code : YY

YY:2004,2008,2012…

YY:2003,2007,2011…

YY:2002,2006,2010…

YY:2001,2005,2009…