



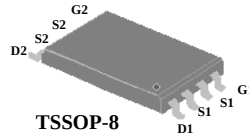
**Advanced Power  
Electronics Corp.**

**AP9938GEO-HF**

**Halogen-Free Product**

*DUAL N-CHANNEL ENHANCEMENT  
MODE POWER MOSFET*

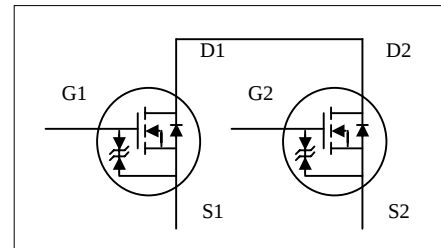
- ▼ Low on-resistance
- ▼ Capable of 1.8V Gate Drive
- ▼ Optimal DC/DC Battery Application
- ▼ Halogen Free & RoHS Compliant Product



|              |              |
|--------------|--------------|
| $BV_{DSS}$   | 20V          |
| $R_{DS(ON)}$ | 18m $\Omega$ |
| $I_D^3$      | 6A           |

## Description

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



## Absolute Maximum Ratings

| Symbol                     | Parameter                                    | Rating     | Units            |
|----------------------------|----------------------------------------------|------------|------------------|
| $V_{DS}$                   | Drain-Source Voltage                         | 20         | V                |
| $V_{GS}$                   | Gate-Source Voltage                          | $\pm 8$    | V                |
| $I_D@T_A=25^\circ\text{C}$ | Drain Current <sup>3</sup> , $V_{GS}$ @ 4.5V | 6          | A                |
| $I_D@T_A=70^\circ\text{C}$ | Drain Current <sup>3</sup> , $V_{GS}$ @ 4.5V | 4.8        | A                |
| $I_{DM}$                   | Pulsed Drain Current <sup>1</sup>            | 20         | A                |
| $P_D@T_A=25^\circ\text{C}$ | Total Power Dissipation                      | 1          | W                |
| $T_{STG}$                  | Storage Temperature Range                    | -55 to 150 | $^\circ\text{C}$ |
| $T_J$                      | Operating Junction Temperature Range         | -55 to 150 | $^\circ\text{C}$ |

## Thermal Data

| Symbol | Parameter                                                 | Value | Unit                      |
|--------|-----------------------------------------------------------|-------|---------------------------|
| Rthj-a | Maximum Thermal Resistance, Junction-ambient <sup>3</sup> | 125   | $^\circ\text{C}/\text{W}$ |


**Electrical Characteristics@T<sub>J</sub>=25°C(unless otherwise specified)**

| Symbol              | Parameter                                      | Test Conditions                                          | Min. | Typ. | Max. | Units |
|---------------------|------------------------------------------------|----------------------------------------------------------|------|------|------|-------|
| BV <sub>DSS</sub>   | Drain-Source Breakdown Voltage                 | V <sub>GS</sub> =0V, I <sub>D</sub> =250uA               | 20   | -    | -    | V     |
| R <sub>DS(ON)</sub> | Static Drain-Source On-Resistance <sup>2</sup> | V <sub>GS</sub> =4.5V, I <sub>D</sub> =6A                | -    | 14.9 | 18   | mΩ    |
|                     |                                                | V <sub>GS</sub> =2.5V, I <sub>D</sub> =4A                | -    | 17.2 | 24   | mΩ    |
|                     |                                                | V <sub>GS</sub> =1.8V, I <sub>D</sub> =2A                | -    | 19.9 | 28   | mΩ    |
| V <sub>GS(th)</sub> | Gate Threshold Voltage                         | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA | 0.3  | -    | 1    | V     |
| g <sub>fs</sub>     | Forward Transconductance                       | V <sub>DS</sub> =5V, I <sub>D</sub> =6A                  | -    | 28   | -    | S     |
| I <sub>DSS</sub>    | Drain-Source Leakage Current                   | V <sub>DS</sub> =16V, V <sub>GS</sub> =0V                | -    | -    | 10   | uA    |
| I <sub>GSS</sub>    | Gate-Source Leakage                            | V <sub>GS</sub> =±8V, V <sub>DS</sub> =0V                | -    | -    | ±30  | uA    |
| Q <sub>g</sub>      | Total Gate Charge                              | I <sub>D</sub> =6A                                       | -    | 16   | 26   | nC    |
| Q <sub>gs</sub>     | Gate-Source Charge                             | V <sub>DS</sub> =10V                                     | -    | 1.6  | -    | nC    |
| Q <sub>gd</sub>     | Gate-Drain ("Miller") Charge                   | V <sub>GS</sub> =4.5V                                    | -    | 4.3  | -    | nC    |
| t <sub>d(on)</sub>  | Turn-on Delay Time                             | V <sub>DS</sub> =10V                                     | -    | 7    | -    | ns    |
| t <sub>r</sub>      | Rise Time                                      | I <sub>D</sub> =1A                                       | -    | 11   | -    | ns    |
| t <sub>d(off)</sub> | Turn-off Delay Time                            | R <sub>G</sub> =3.3Ω                                     | -    | 31   | -    | ns    |
| t <sub>f</sub>      | Fall Time                                      | V <sub>GS</sub> =5V                                      | -    | 6    | -    | ns    |
| C <sub>iss</sub>    | Input Capacitance                              | V <sub>GS</sub> =0V                                      | -    | 1070 | 1710 | pF    |
| C <sub>oss</sub>    | Output Capacitance                             | V <sub>DS</sub> =10V                                     | -    | 130  | -    | pF    |
| C <sub>rss</sub>    | Reverse Transfer Capacitance                   | f=1.0MHz                                                 | -    | 115  | -    | pF    |
| R <sub>g</sub>      | Gate Resistance                                | f=1.0MHz                                                 | -    | 1.4  | 2.8  | Ω     |

**Source-Drain Diode**

| Symbol          | Parameter                       | Test Conditions                           | Min. | Typ. | Max. | Units |
|-----------------|---------------------------------|-------------------------------------------|------|------|------|-------|
| V <sub>SD</sub> | Forward On Voltage <sup>2</sup> | I <sub>S</sub> =1.2A, V <sub>GS</sub> =0V | -    | -    | 1.2  | V     |
| t <sub>rr</sub> | Reverse Recovery Time           | I <sub>S</sub> =6A, V <sub>GS</sub> =0V,  | -    | 14   | -    | ns    |
| Q <sub>rr</sub> | Reverse Recovery Charge         | dI/dt=100A/μs                             | -    | 4    | -    | nC    |

**Notes:**

- 1.Pulse width limited by Max. junction temperature.
- 2.Pulse test
- 3.Surface mounted on 1 in<sup>2</sup> copper pad of FR4 board ; 208°C/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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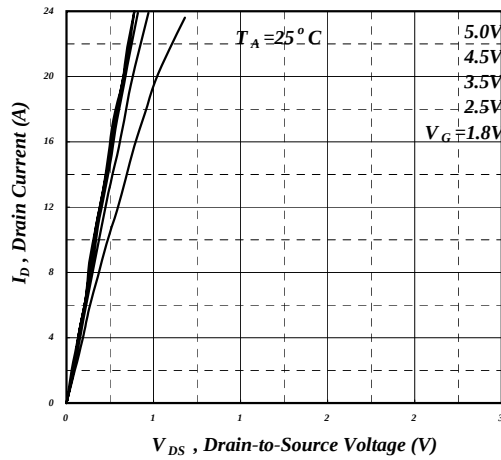


Fig 1. Typical Output Characteristics

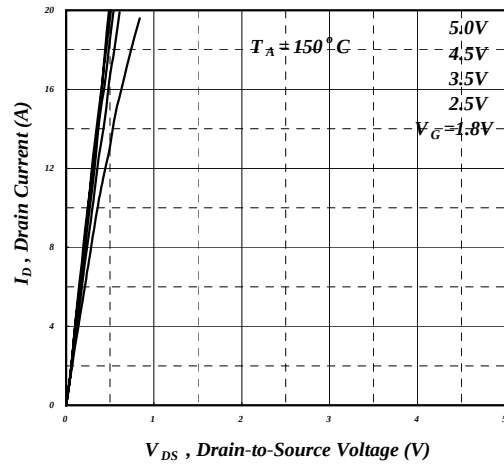


Fig 2. Typical Output Characteristics

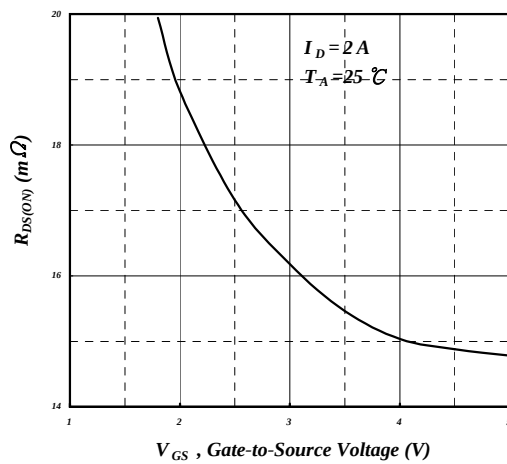


Fig 3. On-Resistance v.s. Gate Voltage

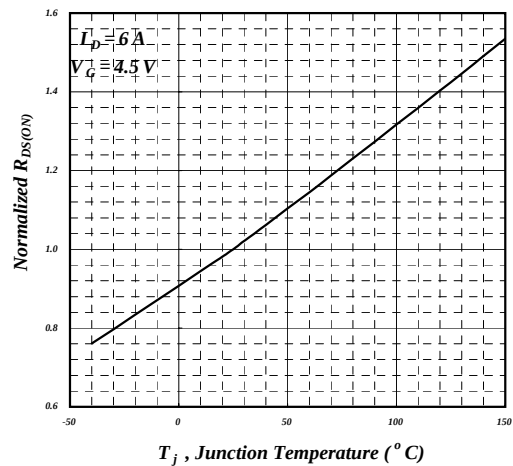


Fig 4. Normalized On-Resistance v.s. Junction Temperature

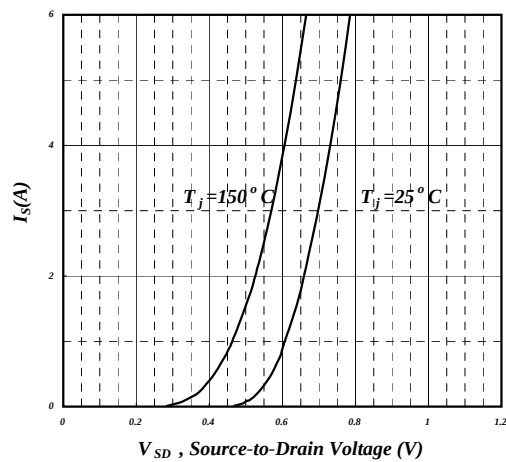


Fig 5. Forward Characteristic of Reverse Diode

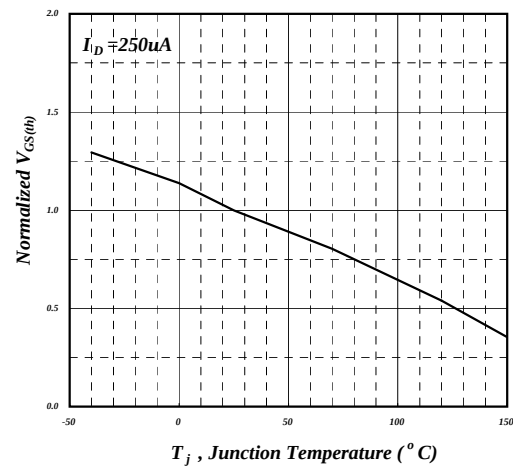


Fig 6. Gate Threshold Voltage v.s. Junction Temperature

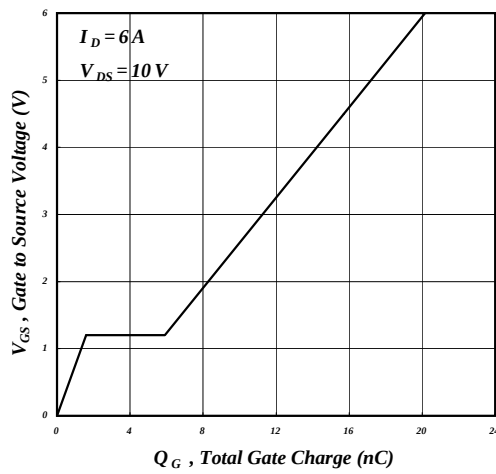


Fig 7. Gate Charge Characteristics

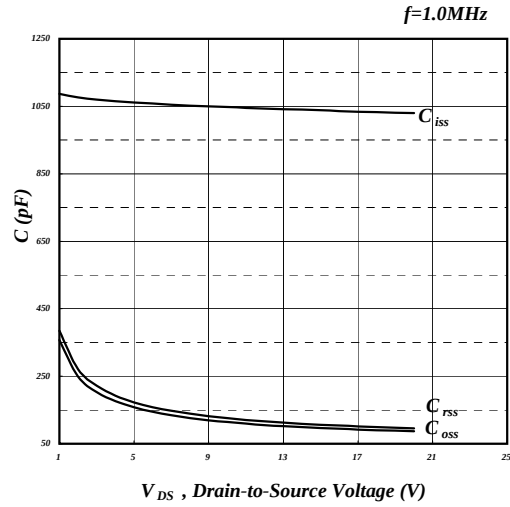


Fig 8. Typical Capacitance Characteristics

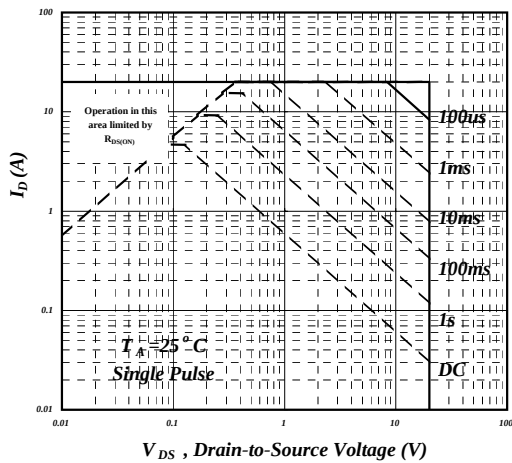


Fig 9. Maximum Safe Operating Area

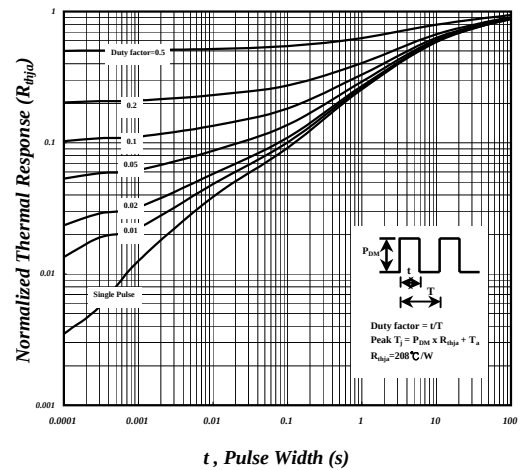


Fig 10. Effective Transient Thermal Impedance

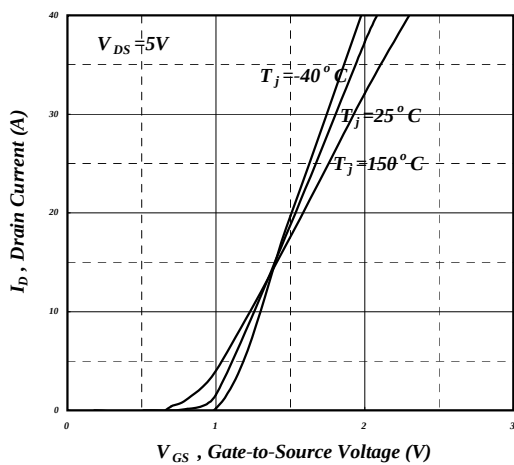


Fig 11. Transfer Characteristics

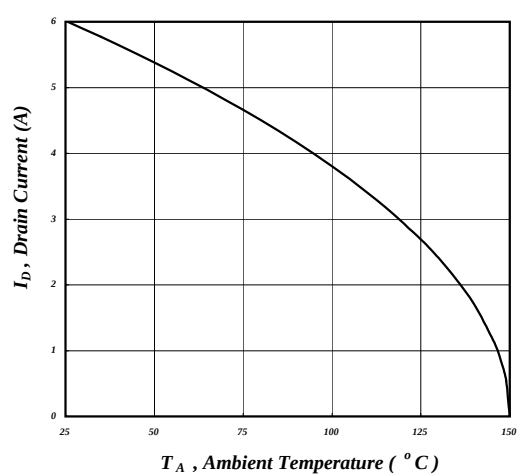


Fig 12. Drain Current v.s. Ambient Temperature



## MARKING INFORMATION

