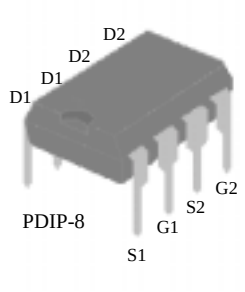
# AP4523GD

**Pb Free Plating Product**

## Advanced Power Electronics Corp.

*N AND P-CHANNEL ENHANCEMENT MODE POWER MOSFET*

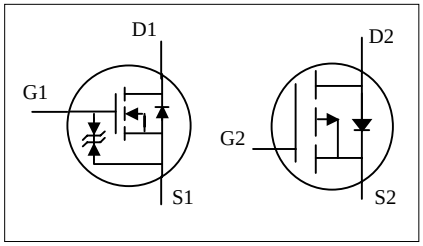
- ▼ **Low Gate Charge**
- ▼ **Fast Switching Speed**
- ▼ **PDIP-8 Package**
- ▼ **RoHS Compliant**




| | | |
|---|---|---|
| N-CH | $BV_{DSS}$ | 40V |
| | $R_{DS(ON)}$ | 40mΩ |
| | $I_D$ | 5.6A |
| P-CH | $BV_{DSS}$ | -40V |
| | $R_{DS(ON)}$ | 52mΩ |
| | $I_D$ | -5.1A |

## Description

The 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 |
|---|---|---|---|---|
| | | N-channel | P-channel | |
| $V_{DS}$ | Drain-Source Voltage | 40 | -40 | V |
| $V_{GS}$ | Gate-Source Voltage | ±10 | ±20 | V |
| $I_D$@$T_A$=25℃ | Continuous Drain Current[3] | 5.6 | -5.1 | A |
| $I_D$@$T_A$=70℃ | Continuous Drain Current[3] | 4.5 | -4 | A |
| $I_{DM}$ | Pulsed Drain Current[1] | 30 | -30 | A |
| $P_D$@$T_A$=25℃ | Total Power Dissipation | 2.0 | | W |
| | Linear Derating Factor | 0.016 | | 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 | Thermal Resistance Junction-ambient[3] | Max. | 62.5 | ℃/W |

## N-CH 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 | 40 | - | - | V |
| $\Delta BV_{DSS}/\Delta T_j$ | Breakdown Voltage Temperature Coefficient | Reference to 25℃, $I_D$=1mA | - | 0.03 | - | V/℃ |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance[2] | $V_{GS}$=10V, $I_D$=5A | - | - | 40 | mΩ |
| | | $V_{GS}$=4.5V, $I_D$=3A | - | - | 50 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_D$=250uA | 1 | - | 3 | V |
| $g_{fs}$ | Forward Transconductance | $V_{DS}$=10V, $I_D$=5A | - | 5 | - | S |
| $I_{DSS}$ | Drain-Source Leakage Current ($T_j$=25°C) | $V_{DS}$=40V, $V_{GS}$=0V | - | - | 1 | uA |
| | Drain-Source Leakage Current ($T_j$=70°C) | $V_{DS}$=32V, $V_{GS}$=0V | - | - | 25 | uA |
| $I_{GSS}$ | Gate-Source Leakage | $V_{GS}$=±10V | - | - | ±30 | uA |
| $Q_g$ | Total Gate Charge[2] | $I_D$=5A | - | 7 | 11 | nC |
| $Q_{gs}$ | Gate-Source Charge | $V_{DS}$=30V | - | 2 | - | nC |
| $Q_{gd}$ | Gate-Drain ("Miller") Charge | $V_{GS}$=4.5V | - | 3 | - | nC |
| $t_{d(on)}$ | Turn-on Delay Time[2] | $V_{DS}$=20V | - | 6 | - | ns |
| $t_r$ | Rise Time | $I_D$=1A | - | 5 | - | ns |
| $t_{d(off)}$ | Turn-off Delay Time | $R_G$=3.3Ω,$V_{GS}$=10V | - | 19 | - | ns |
| $t_f$ | Fall Time | $R_D$=20Ω | - | 4 | - | ns |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V | - | 580 | 930 | pF |
| $C_{oss}$ | Output Capacitance | $V_{DS}$=25V | - | 80 | - | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | f=1.0MHz | - | 48 | - | pF |
| $R_g$ | Gate Resistance | f=1.0MHz | - | 2 | 3 | Ω |

## Source-Drain Diode

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Forward On Voltage[2] | $I_S$=1.5A, $V_{GS}$=0V | - | - | 1.3 | V |
| $t_{rr}$ | Reverse Recovery Time[2] | $I_S$=5A, $V_{GS}$=0V | - | 18 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | dI/dt=100A/μs | - | 13 | - | nC |

## P-CH 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 | -40 | - | - | V |
| $\Delta BV_{DSS}/\Delta T_j$ | Breakdown Voltage Temperature Coefficient | Reference to 25℃,$I_D$=-1mA | - | -0.03 | - | V/℃ |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance[2] | $V_{GS}$=-10V, $I_D$=-5A | - | - | 52 | mΩ |
| | | $V_{GS}$=-4.5V, $I_D$=-3A | - | - | 80 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_D$=-250uA | -1 | - | -3 | V |
| $g_{fs}$ | Forward Transconductance | $V_{DS}$=-10V, $I_D$=-5A | - | 5 | - | S |
| $I_{DSS}$ | Drain-Source Leakage Current (Tj=25°C) | $V_{DS}$=-40V, $V_{GS}$=0V | - | - | -1 | uA |
| | Drain-Source Leakage Current (Tj=70°C) | $V_{DS}$=-32V, $V_{GS}$=0V | - | - | -25 | uA |
| $I_{GSS}$ | Gate-Source Leakage | $V_{GS}$=±20V | - | - | ±100 | nA |
| $Q_g$ | Total Gate Charge[2] | $I_D$=-5A | - | 11 | 18 | nC |
| $Q_{gs}$ | Gate-Source Charge | $V_{DS}$=-30V | - | 3 | - | nC |
| $Q_{gd}$ | Gate-Drain ("Miller") Charge | $V_{GS}$=-4.5V | - | 6 | - | nC |
| $t_{d(on)}$ | Turn-on Delay Time[2] | $V_{DS}$=-20V | - | 10 | - | ns |
| $t_r$ | Rise Time | $I_D$=-1A | - | 5 | - | ns |
| $t_{d(off)}$ | Turn-off Delay Time | $R_G$=3.3Ω,$V_{GS}$=-10V | - | 28 | - | ns |
| $t_f$ | Fall Time | $R_D$=20Ω | - | 7 | - | ns |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V | - | 960 | 1540 | pF |
| $C_{oss}$ | Output Capacitance | $V_{DS}$=-25V | - | 136 | - | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | f=1.0MHz | - | 102 | - | pF |
| $R_g$ | Gate Resistance | f=1.0MHz | - | 5 | 7.5 | Ω |

## Source-Drain Diode

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Forward On Voltage[2] | $I_S$=-1.5A, $V_{GS}$=0V | - | - | -1.3 | V |
| $t_{rr}$ | Reverse Recovery Time[2] | $I_S$=-5A, $V_{GS}$=0V | - | 25 | - | ns |
| $Q_{rr}$ | Reverse Recovery Charge | dI/dt=-100A/μs | - | 23 | - | nC |

### Notes:

1.Pulse width limited by Max. junction temperature.

2.Pulse width ≤300us , duty cycle ≤2%.

3.Surface mounted on 1 in$^2$ copper pad of FR4 board , t ≤10sec ; 90℃/W when mounted on min. copper pad.

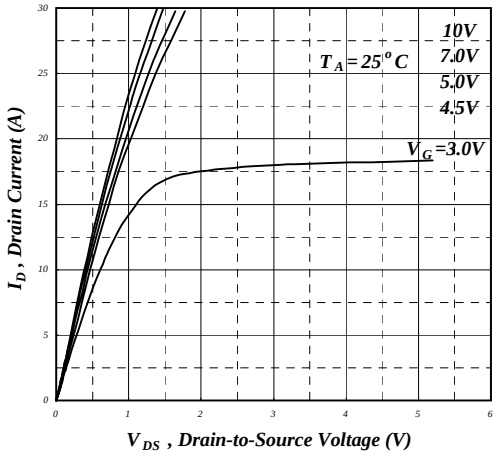



**Fig 1. Typical Output Characteristics**

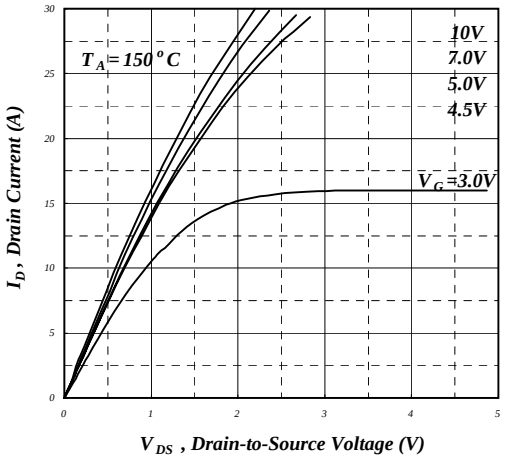



**Fig 2. Typical Output Characteristics**

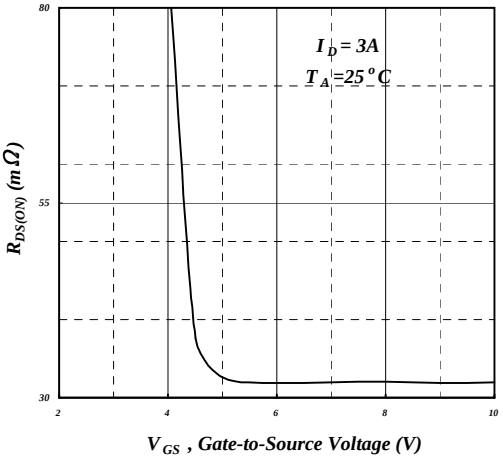



**Fig 3. On-Resistance v.s. Gate Voltage**

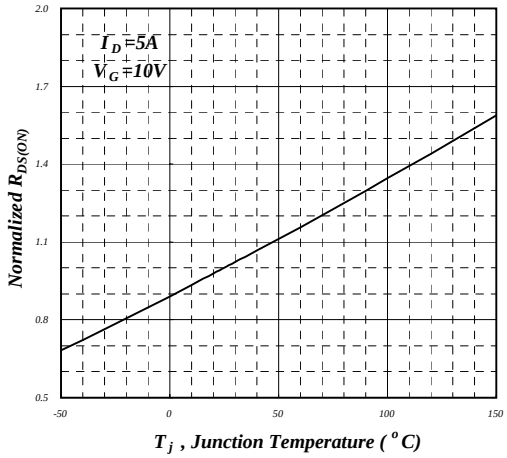



**Fig 4. Normalized On-Resistance v.s. Junction Temperature**

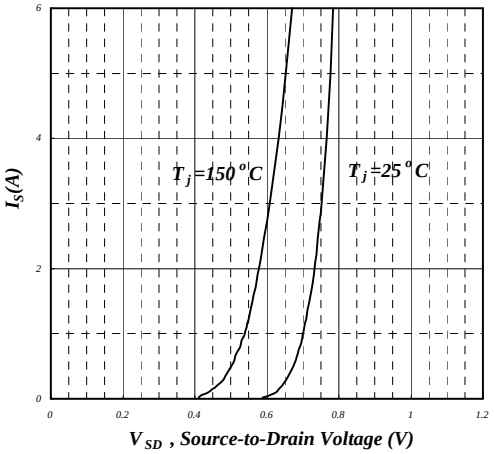



**Fig 5. Forward Characteristic of Reverse Diode**

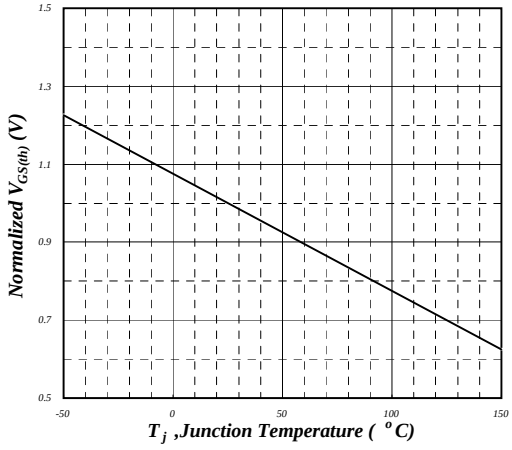



**Fig 6. Gate Threshold Voltage v.s. Junction Temperature**

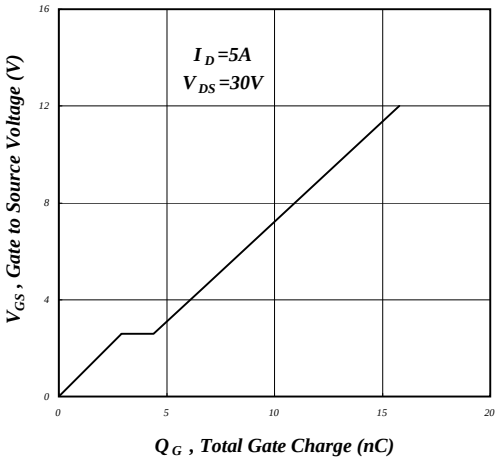



Fig 7. Gate Charge Characteristics

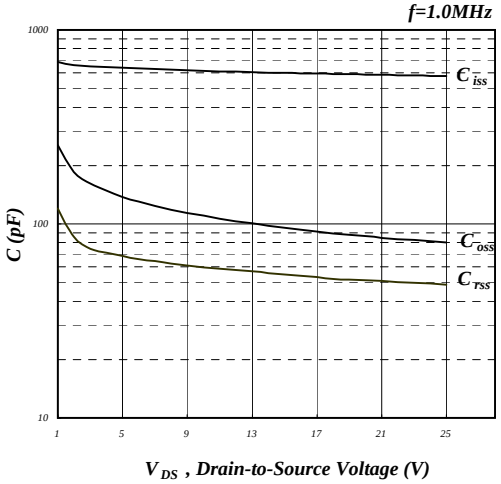



Fig 8. Typical Capacitance Characteristics

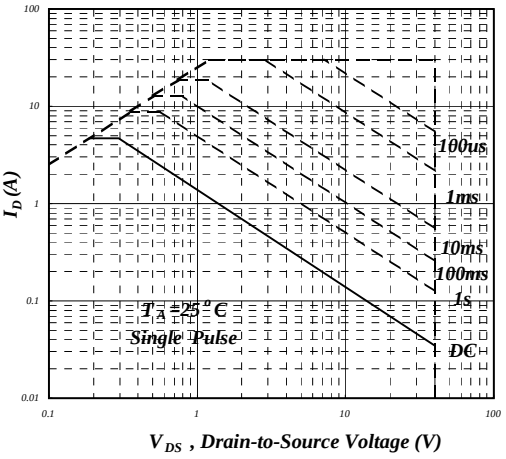



Fig 9. Maximum Safe Operating Area

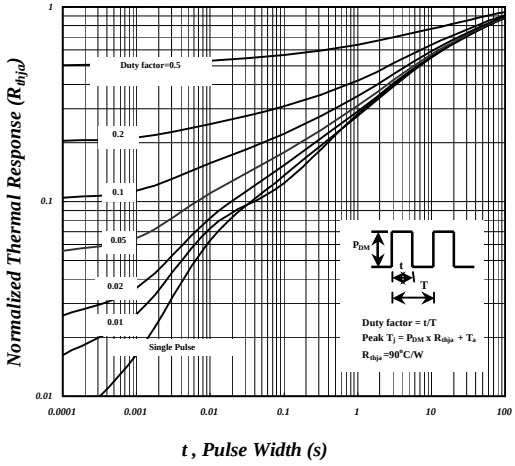



Fig 10. Effective Transient Thermal Impedance

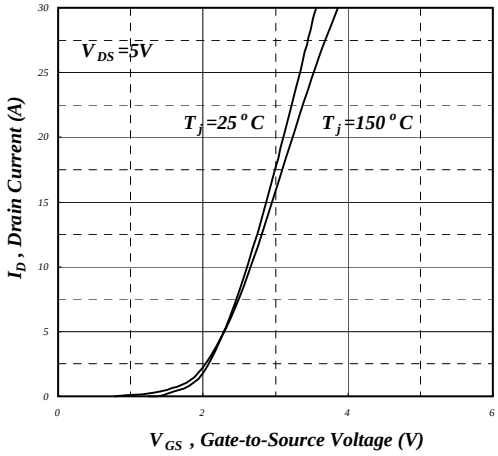



Fig 11. Transfer Characteristics

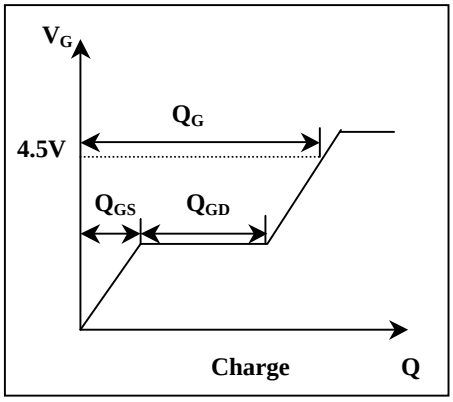



Fig 12. Gate Charge Waveform

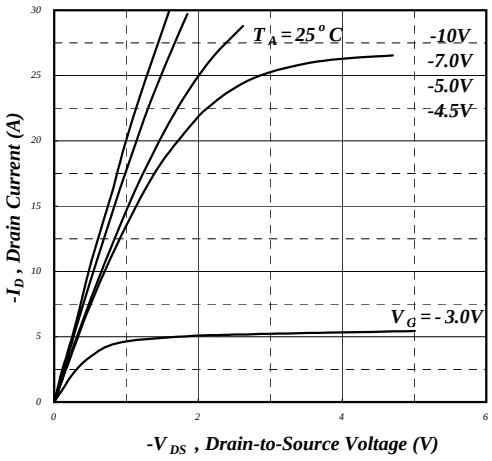



**Fig 1. Typical Output Characteristics**

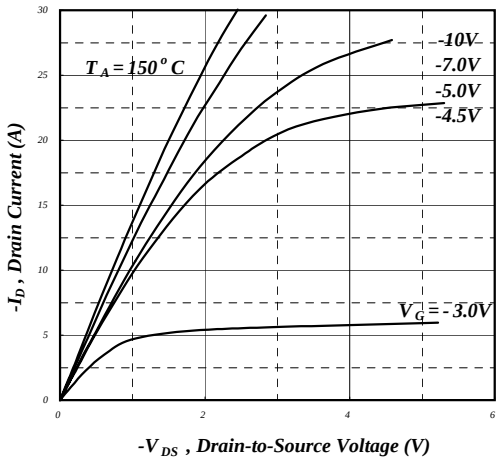



**Fig 2. Typical Output Characteristics**

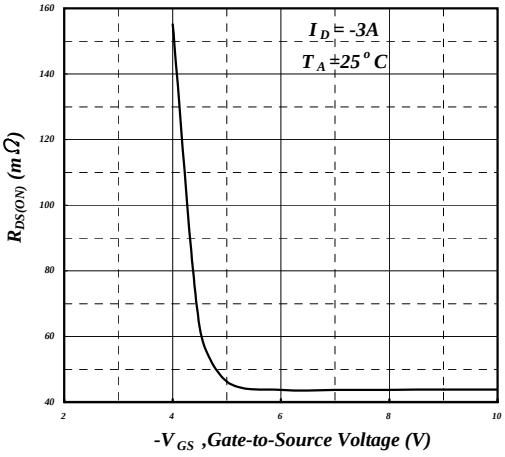



**Fig 3. On-Resistance v.s. Gate Voltage**

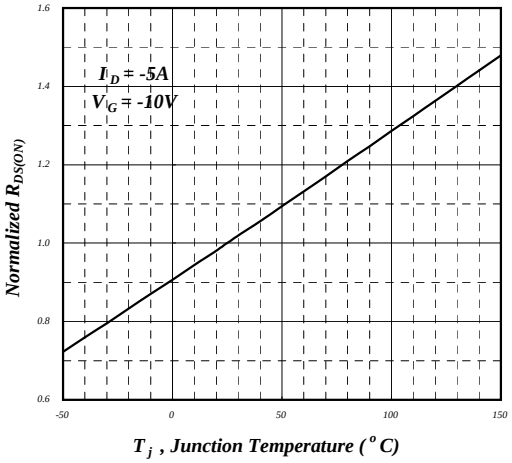



**Fig 4. Normalized On-Resistance v.s. Junction Temperature**

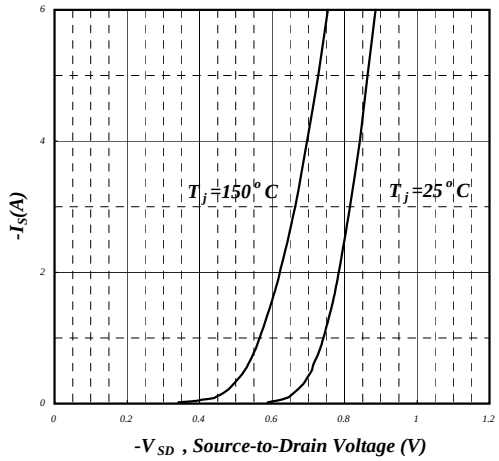



**Fig 5. Forward Characteristic of Reverse Diode**

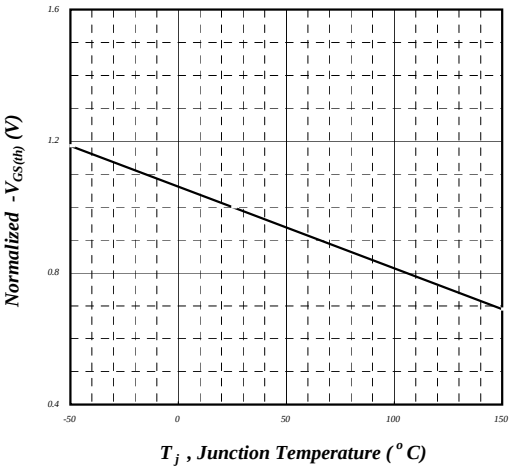



**Fig 6. Gate Threshold Voltage v.s. Junction Temperature**

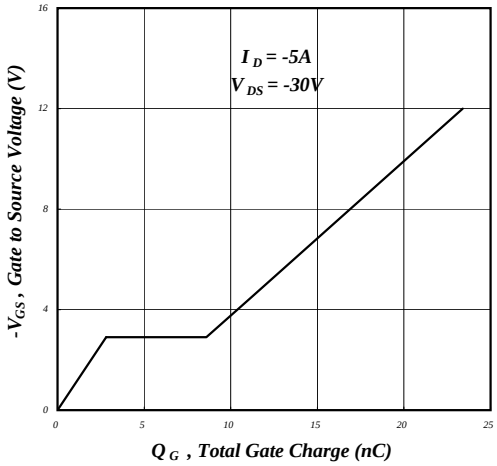



Fig 7. Gate Charge Characteristics

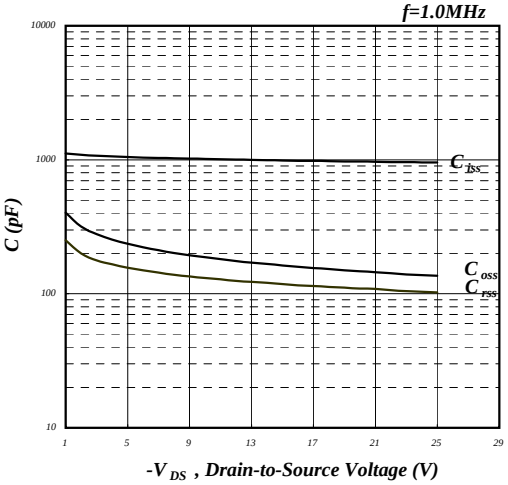



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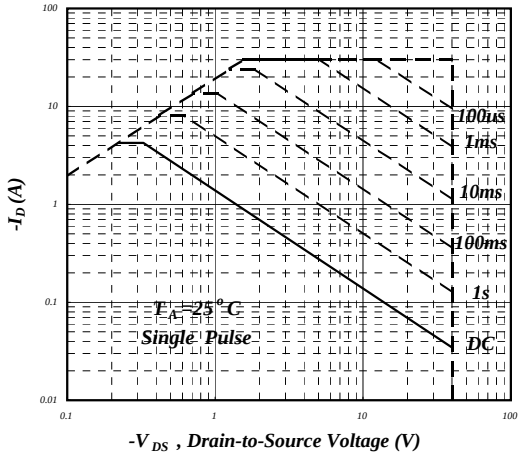



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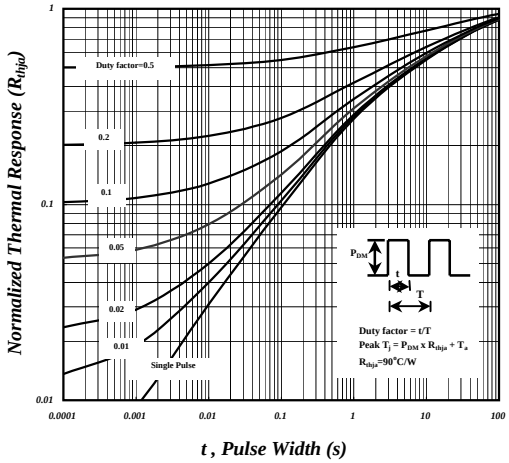



Fig 10. Effective Transient Thermal Impedance

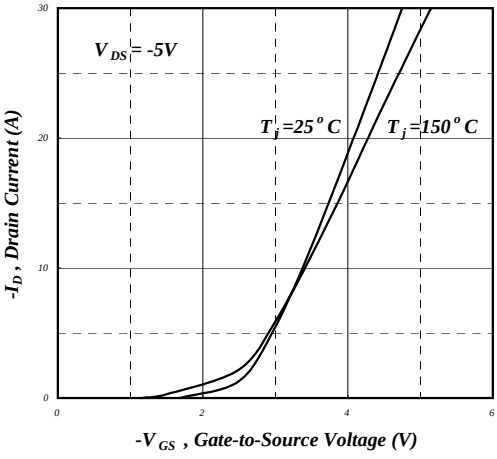



Fig 11. Transfer Characteristics

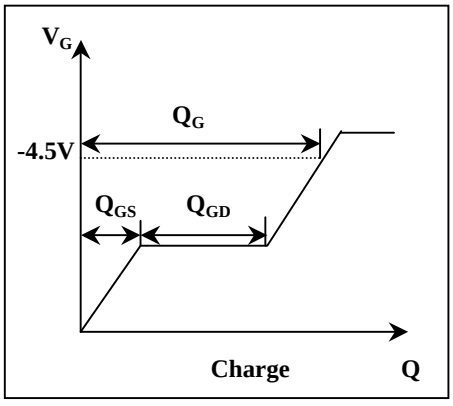



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