

## Description:

This N+P Channel MOSFET uses advanced trench technology and design to provide excellent  $R_{DS(on)}$  with low gate charge.

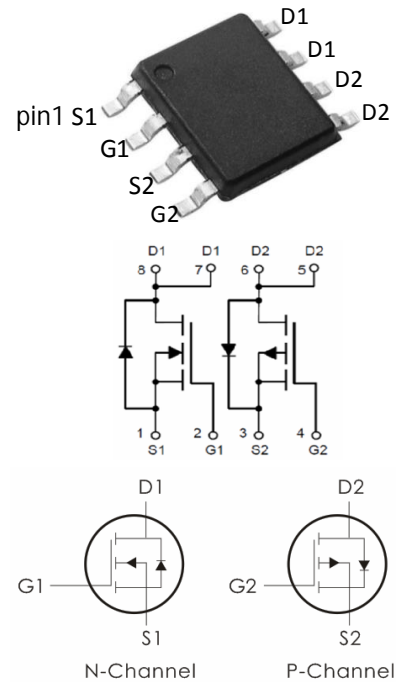
It can be used in a wide variety of applications.

## Features:

N-Channel:  $V_{DS}=60V, I_D=6A, R_{DS(on)} < 26m\Omega @ V_{GS}=10V$  (Typ:  $20m\Omega$ )

P-Channel:  $V_{DS}=-60V, I_D=-9A, R_{DS(on)} < 35m\Omega @ V_{GS}=-10V$  (Typ:  $28.5m\Omega$ )

- 1) Low gate charge.
- 2) Green device available.
- 3) Advanced high cell density Trench technology for ultra low  $R_{DS(on)}$ .
- 4) Excellent package for good heat dissipation.
- 5) MSL3



## Package Marking and Ordering Information:

| Part NO. | Marking | Package | Packing       |
|----------|---------|---------|---------------|
| DOS4610B | S4610B  | SOP-8   | 3000 pcs/Reel |

## Absolute Maximum Ratings: ( $T_A=25^\circ C$ unless otherwise noted)

| Symbol         | Parameter  | N-Channel   | P-Channel | Units      |
|----------------|--|-------------|-----------|------------|
| $V_{DS}$       | Drain-Source Voltage                                     | 60          | -60       | V          |
| $V_{GS}$       | Gate-Source Voltage                                      | $\pm 20$    | $\pm 20$  | V          |
| $I_D$          | Continuous Drain Current- $T_A=25^\circ C$ <sup>1</sup>  | 6           | -9        | A          |
|                | Continuous Drain Current- $T_A=100^\circ C$ <sup>1</sup> | 3           | -4.5      |            |
| $I_{DM}$       | Pulsed Drain Current <sup>2</sup>                        | 24          | -36       | A          |
| $E_{AS}$       | Single pulse avalanche energy <sup>3</sup>               | 35          | 80        | mJ         |
| $P_D$          | Power Dissipation - $T_A=25^\circ C$                     | 1.4         | 1.4       | W          |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range         | -55 to +150 |           | $^\circ C$ |

## Thermal Characteristics:

| Symbol          | Parameter                               | N-CH | P-CH | Units        |
|-----------------|---|------|------|--------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | 90   | 90   | $^\circ C/W$ |

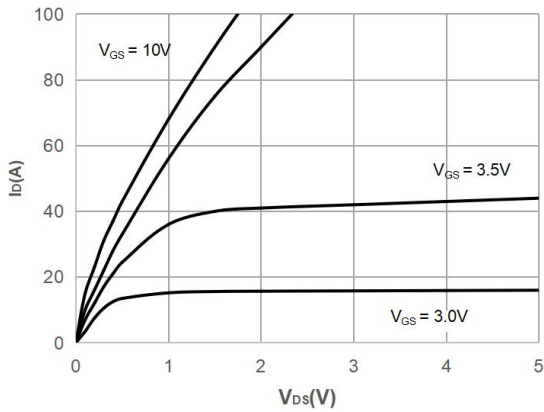
## N-Channel Electrical Characteristics: ( $T_A=25^{\circ}\text{C}$ unless otherwise noted)

| Symbol                                    | Parameter                               | Conditions  | Min                                    | Typ  | Max       | Units            |
|---|---|---|--|------|-----------|------------------|
| <b>Off Characteristics</b>                |   |   |  |      |           |                  |
| $BV_{DSS}$                                | Drain-Source Breakdown Voltage          | $V_{GS}=0V, I_D=250\ \mu\text{A}$                         | 40                                     | ---  | ---       | V                |
| $I_{DSS}$                                 | Zero Gate Voltage Drain Current         | $V_{GS}=0V, V_{DS}=60V$                                   | ---                                    | ---  | 1         | $\mu\text{A}$    |
| $I_{GSS}$                                 | Gate-Source Leakage Current             | $V_{GS}=\pm 20V, V_{DS}=0A$                               | ---                                    | ---  | $\pm 100$ | nA               |
| <b>On Characteristics</b>                 |   |   |  |      |           |                  |
| $V_{GS(th)}$                              | Gate-Source Threshold Voltage           | $V_{GS}=V_{DS}, I_D=250\ \mu\text{A}$                     | 1.2                                    | 1.7  | 2.5       | V                |
| $R_{DS(on)}$                              | Drain-Source On Resistance <sup>4</sup> | $V_{GS}=10V, I_D=10A$                                     | ---                                    | 20   | 26        | $\text{m}\Omega$ |
|   |   | $V_{GS}=4.5V, I_D=5A$                                     | ---                                    | 27   | 34        | $\text{m}\Omega$ |
| <b>Dynamic Characteristics</b>            |   |   |  |      |           |                  |
| $C_{iss}$                                 | Input Capacitance                       | $V_{DS}=25V, V_{GS}=0V, f=1\text{MHz}$                    | ---                                    | 1030 | ---       | pF               |
| $C_{oss}$                                 | Output Capacitance                      |   | ---                                    | 68.2 | ---       |                  |
| $C_{rss}$                                 | Reverse Transfer Capacitance            |   | ---                                    | 63   | ---       |                  |
| <b>Switching Characteristics</b>          |   |   |  |      |           |                  |
| $t_{d(on)}$                               | Turn-On Delay Time                      | $V_{DS}=30V, I_D=20A,$<br>$R_{ENG}=3\ \Omega, V_{GS}=10V$ | ---                                    | 7    | ---       | ns               |
| $t_r$                                     | Rise Time                               |   | ---                                    | 21   | ---       | ns               |
| $t_{d(off)}$                              | Turn-Off Delay Time                     |   | ---                                    | 16   | ---       | ns               |
| $t_f$                                     | Fall Time                               |   | ---                                    | 24   | ---       | ns               |
| $Q_g$                                     | Total Gate Charge                       |   | $V_{GS}=10V, V_{DS}=30V,$<br>$I_D=10A$ | ---  | 25        | ---              |
| $Q_{gs}$                                  | Gate-Source Charge                      | ---   |  | 4.5  | ---       | nC               |
| $Q_{gd}$                                  | Gate-Drain "Miller" Charge              | ---   |  | 6.5  | ---       | nC               |
| <b>Drain-Source Diode Characteristics</b> |   |   |  |      |           |                  |
| $V_{SD}$                                  | Diode Forward Voltage                   | $V_{GS}=0V, I_{SD}=20A$                                   | ---                                    | ---  | 1.2       | V                |
| $I_S$                                     | Continuous Drain Current                | $V_D=V_G=0V$  | ---                                    | ---  | 5         | A                |
| $I_{SM}$                                  | Pulsed Drain Current                    |   | ---                                    | ---  | 20        | A                |
| $T_{rr}$                                  | Reverse Recovery Time                   | $I_F=10A, T_J=25^{\circ}\text{C}$                         | ---                                    | 29   | ---       | ns               |
| $Q_{rr}$                                  | Reverse Recovery Charge                 | $di/dt=100A/\mu\text{s}$                                  | ---                                    | 49   | ---       | nC               |

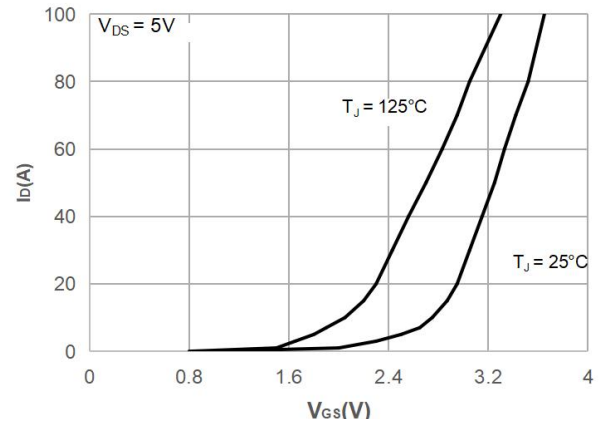
## Notes:

1. Computed continuous current assumes the condition of  $T_{j,Max}$  while the actual continuous current depends on the thermal & electro-mechanical application board design
2. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
3. EAS condition :  $T_J=25^{\circ}C, V_{DD}=30V, V_G=10V, L=0.1mH$
4. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 0.5\%$

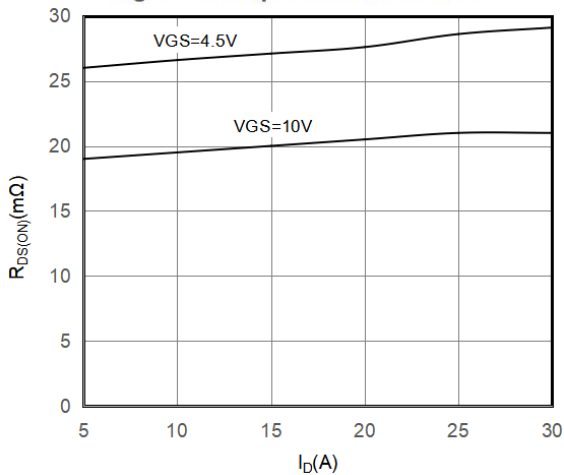
## N-Typical Characteristics: ( $T_A=25^{\circ}C$ unless otherwise noted)



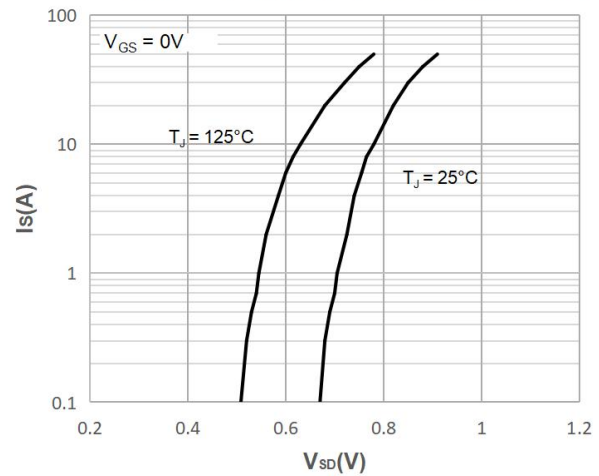
**Figure 1: Output Characteristics**



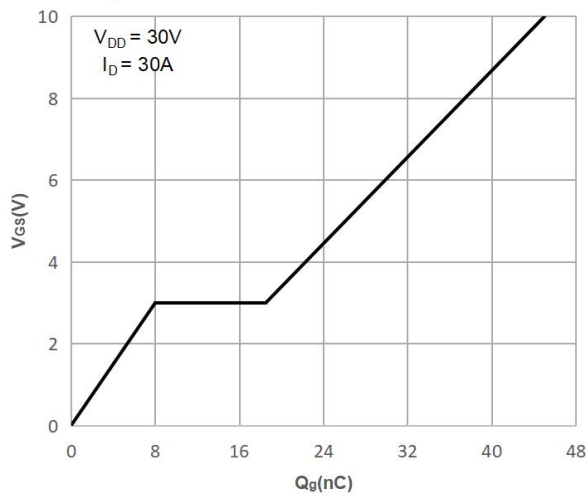
**Figure 2: Typical Transfer Characteristics**



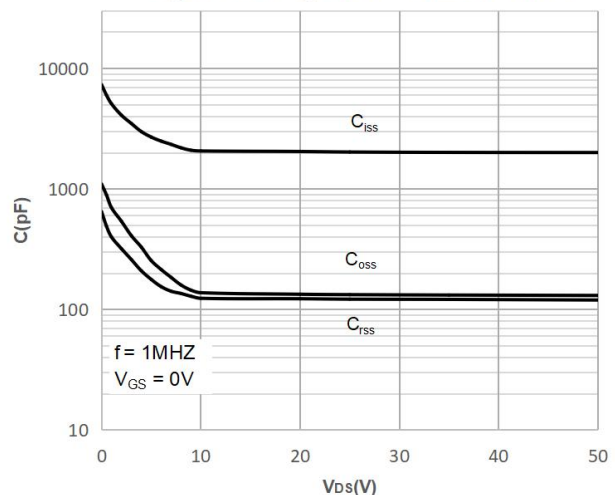
**Figure 3: On-resistance vs. Drain Current**



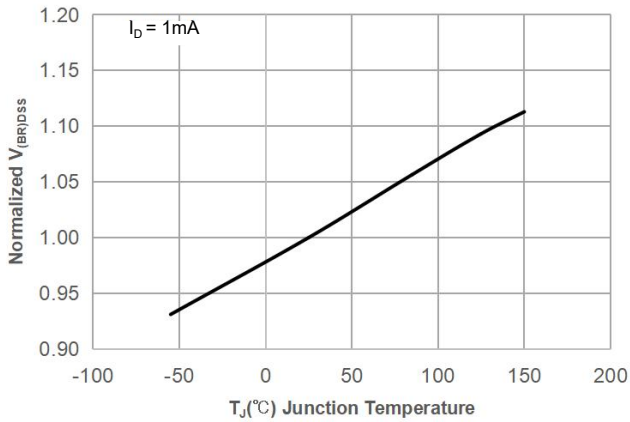
**Figure 4: Body Diode Characteristics**



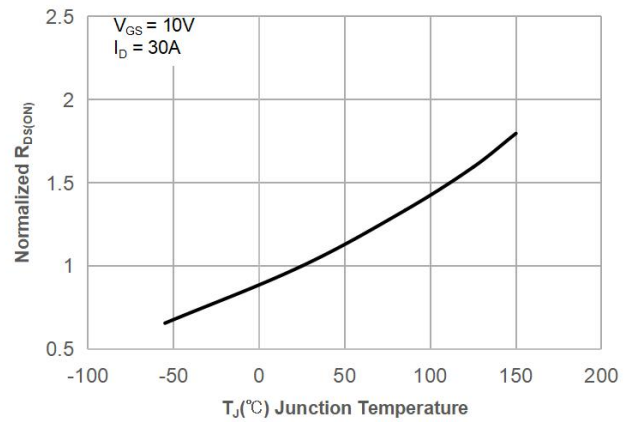
**Figure 5: Gate Charge Characteristics**



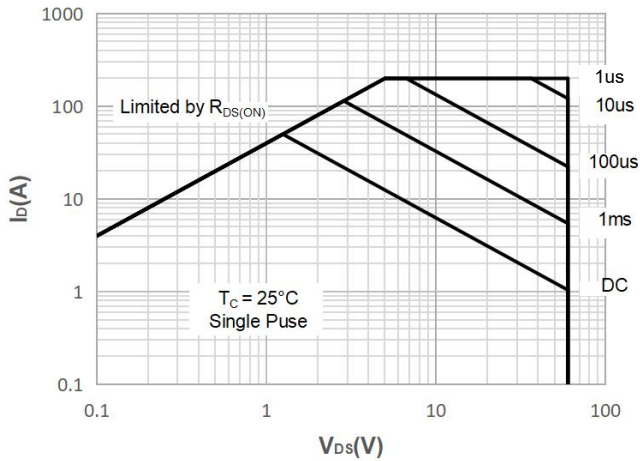
**Figure 6: Capacitance Characteristics**



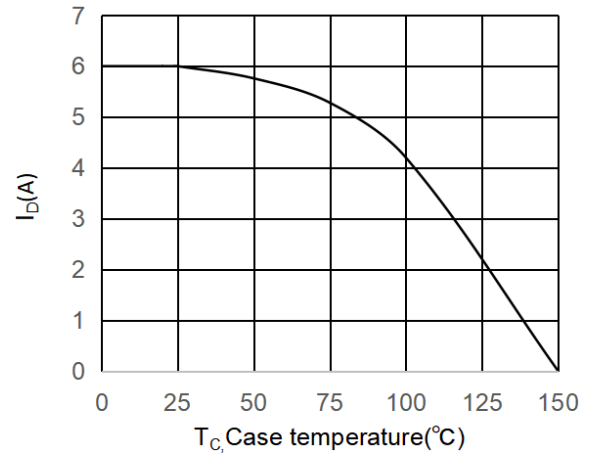
**Figure 7: Normalized Breakdown voltage vs. Junction Temperature**



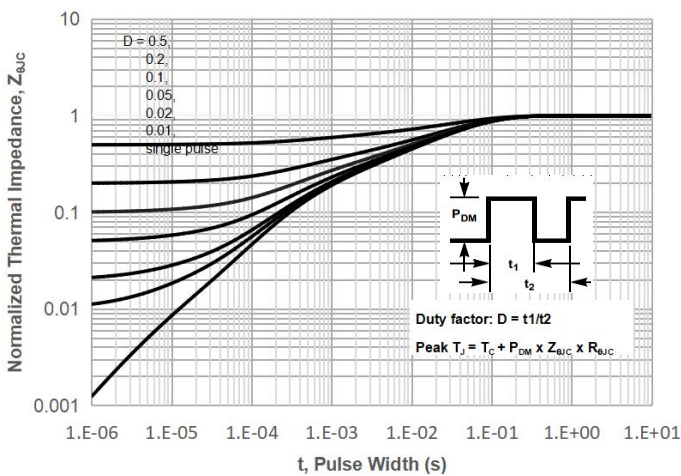
**Figure 8: Normalized on Resistance vs. Junction Temperature**



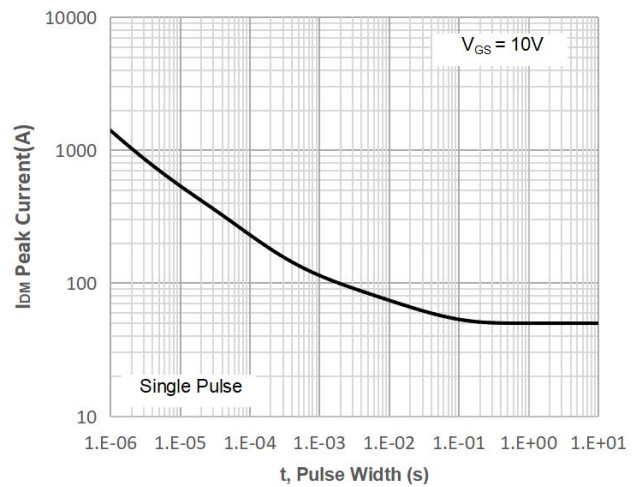
**Figure 9: Maximum Safe Operating Area**



**Figure 10: Maximum Continuous Driant Current vs. Case Temperature**



**Figure 11: Normalized Maximum Transient Thermal Impedance**



**Figure 12: Peak Current Capacity**

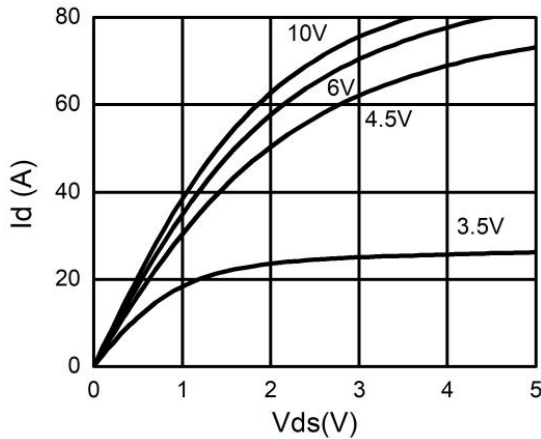
## P-Channel Electrical Characteristics: ( $T_A=25^\circ\text{C}$ unless otherwise noted)

| Symbol                                       | Parameter                               | Conditions  | Min | Typ   | Max       | Units            |
|--|---|---|-----|-------|-----------|------------------|
| <b>Off Characteristics</b>                   |   |   |     |       |           |                  |
| $BV_{DSS}$                                   | Drain-Source Breakdown Voltage          | $V_{GS}=0V, I_D=250\ \mu\text{A}$                           | -60 | ---   | ---       | V                |
| $I_{DSS}$                                    | Zero Gate Voltage Drain Current         | $V_{GS}=0V, V_{DS}=-60V$                                    | --- | ---   | -1        | $\mu\text{A}$    |
| $I_{GSS}$                                    | Gate-Source Leakage Current             | $V_{GS}=\pm 20V, V_{DS}=0A$                                 | --- | ---   | $\pm 100$ | nA               |
| <b>On Characteristics</b>                    |   |   |     |       |           |                  |
| $V_{GS(th)}$                                 | Gate-Source Threshold Voltage           | $V_{GS}=V_{DS}, I_D=250\ \mu\text{A}$                       | -1  | -1.69 | -2.5      | V                |
| $R_{DS(on)}$                                 | Drain-Source On Resistance <sup>4</sup> | $V_{GS}=-10V, I_D=-15A$                                     | --- | 28.5  | 35        | $\text{m}\Omega$ |
|  |   | $V_{GS}=-4.5V, I_D=-10A$                                    | --- | 32.5  | 40        |                  |
| <b>Dynamic Characteristics</b>               |   |   |     |       |           |                  |
| $C_{iss}$                                    | Input Capacitance                       | $V_{DS}=-25V, V_{GS}=0V, f=1\text{MHz}$                     | --- | 3500  | ---       | pF               |
| $C_{oss}$                                    | Output Capacitance                      |   | --- | 133   | ---       |                  |
| $C_{rss}$                                    | Reverse Transfer Capacitance            |   | --- | 97    | ---       |                  |
| <b>Switching Characteristics<sup>4</sup></b> |   |   |     |       |           |                  |
| $t_{d(on)}$                                  | Turn-On Delay Time                      | $V_{DD}=-30V, I_D=-20A$<br>$V_{GS}=-10V, R_{GEN}=3\ \Omega$ | --- | 12    | ---       | ns               |
| $t_r$  | Rise Time                               |   | --- | 9     | ---       | ns               |
| $t_{d(off)}$                                 | Turn-Off Delay Time                     |   | --- | 63    | ---       | ns               |
| $t_f$  | Fall Time                               |   | --- | 13    | ---       | ns               |
| $Q_g$  | Total Gate Charge                       |   | --- | 46    | ---       | nC               |
| $Q_{gs}$                                     | Gate-Source Charge                      | $V_{GS}=-10V, V_{DS}=-30V,$<br>$I_D=-20A$                   | --- | 10    | ---       | nC               |
| $Q_{gd}$                                     | Gate-Drain "Miller" Charge              |   | --- | 12    | ---       | nC               |
| <b>Drain-Source Diode Characteristics</b>    |   |   |     |       |           |                  |
| $I_S$  | Continuous Drain to Source Diode        | $V_D=V_G=0V$  | --- | ---   | -7.5      | A                |
| $I_{SM}$                                     | Pulsed Drain to Source Diode            |   | --- | ---   | -30       | ---              |
| $V_{SD}$                                     | Source-Drain Diode Forward Voltage      | $V_{GS}=0V, I_S=-15A$                                       | --- | ---   | -1.2      | V                |
| $T_{rr}$                                     | Reverse Recovery Time                   | $I_F=-20A, T_J=25^\circ\text{C}$                            | --- | 26    | ---       | ns               |
| $Q_{rr}$                                     | Reverse Recovery Charge                 | $di/dt=100A/\mu\text{s}$                                    | --- | 29    | ---       | nC               |

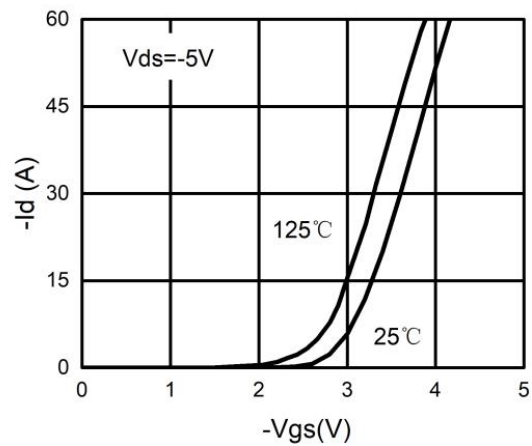
## Notes:

1. Computed continuous current assumes the condition of  $T_{j,Max}$  while the actual continuous current depends on the thermal & electro-mechanical application board design
2. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
3. EAS condition :  $T_J=25^{\circ}C, V_{DD}=-30V, V_G=-10V, L=0.1mH$
4. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 0.5\%$

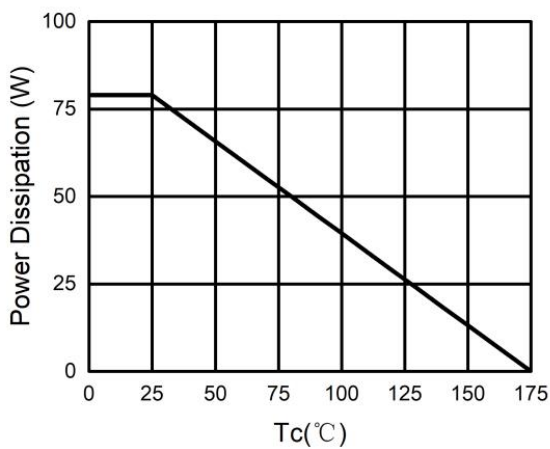
## P-Typical Characteristics: ( $T_A=25^{\circ}C$ unless otherwise noted)



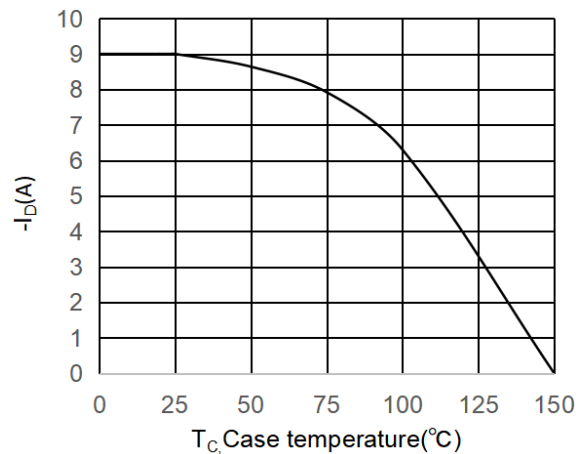
**Figure 1. Output Characteristics**



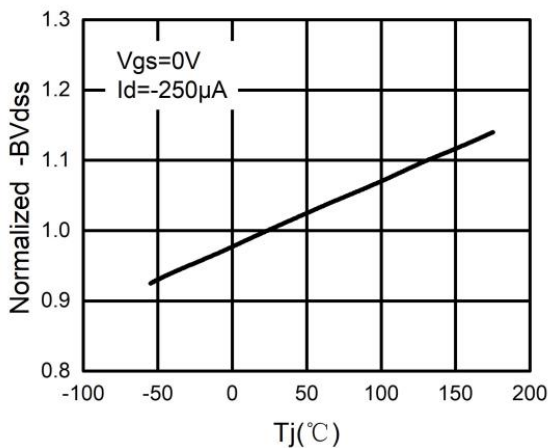
**Figure 2. Transfer Characteristics**



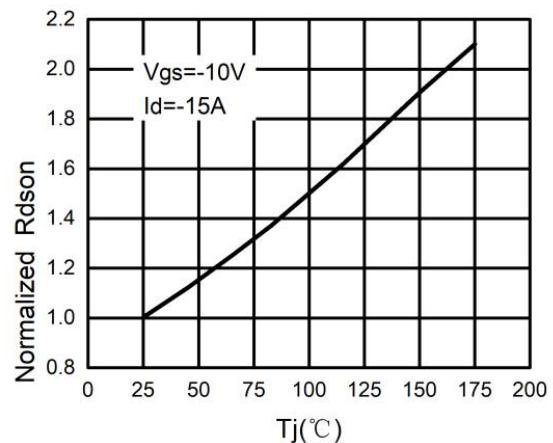
**Figure 3. Power Dissipation**



**Figure 4. Drain Current**



**Figure 5.  $BV_{DSS}$  vs Junction Temperature**



**Figure 6.  $R_{DS(ON)}$  vs Junction Temperature**

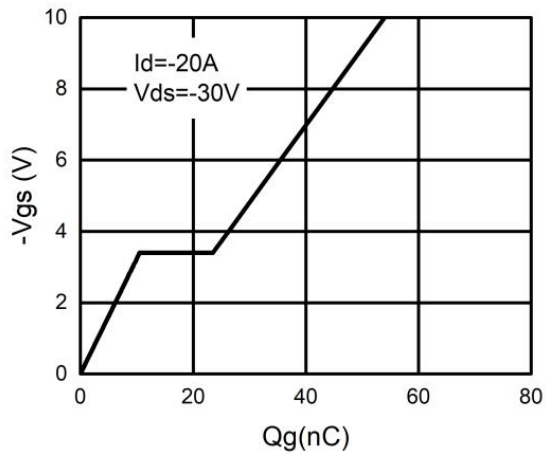


Figure 7. Gate Charge Waveforms

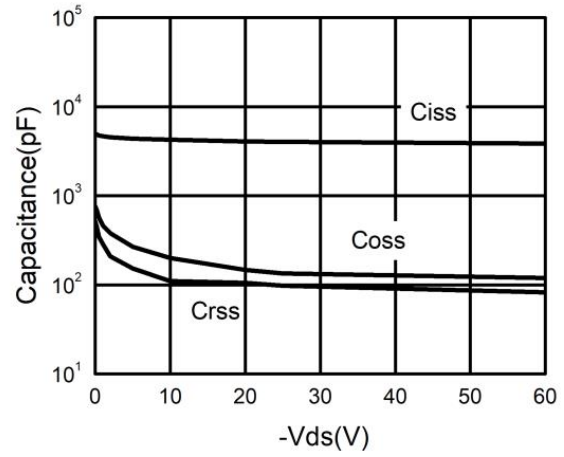


Figure 8. Capacitance

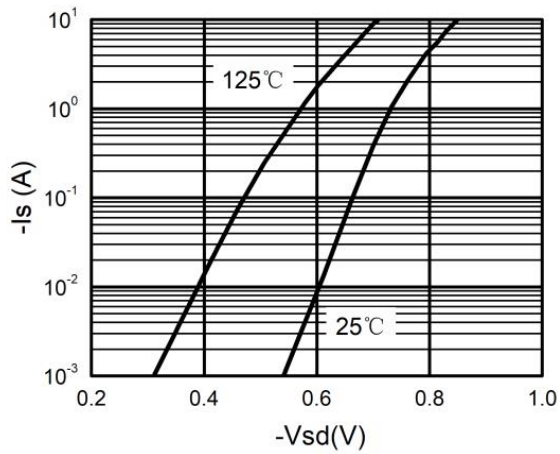


Figure 9. Body-Diode Characteristics

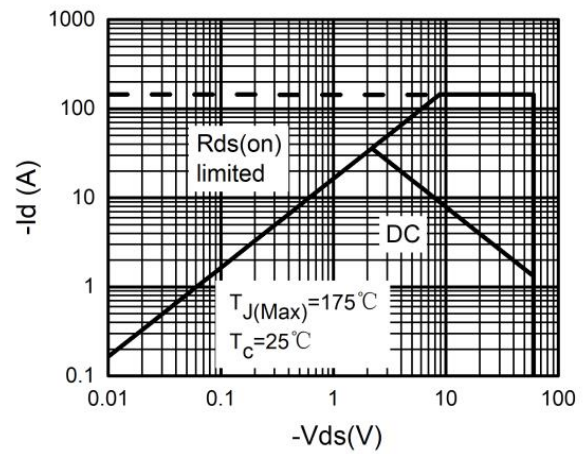
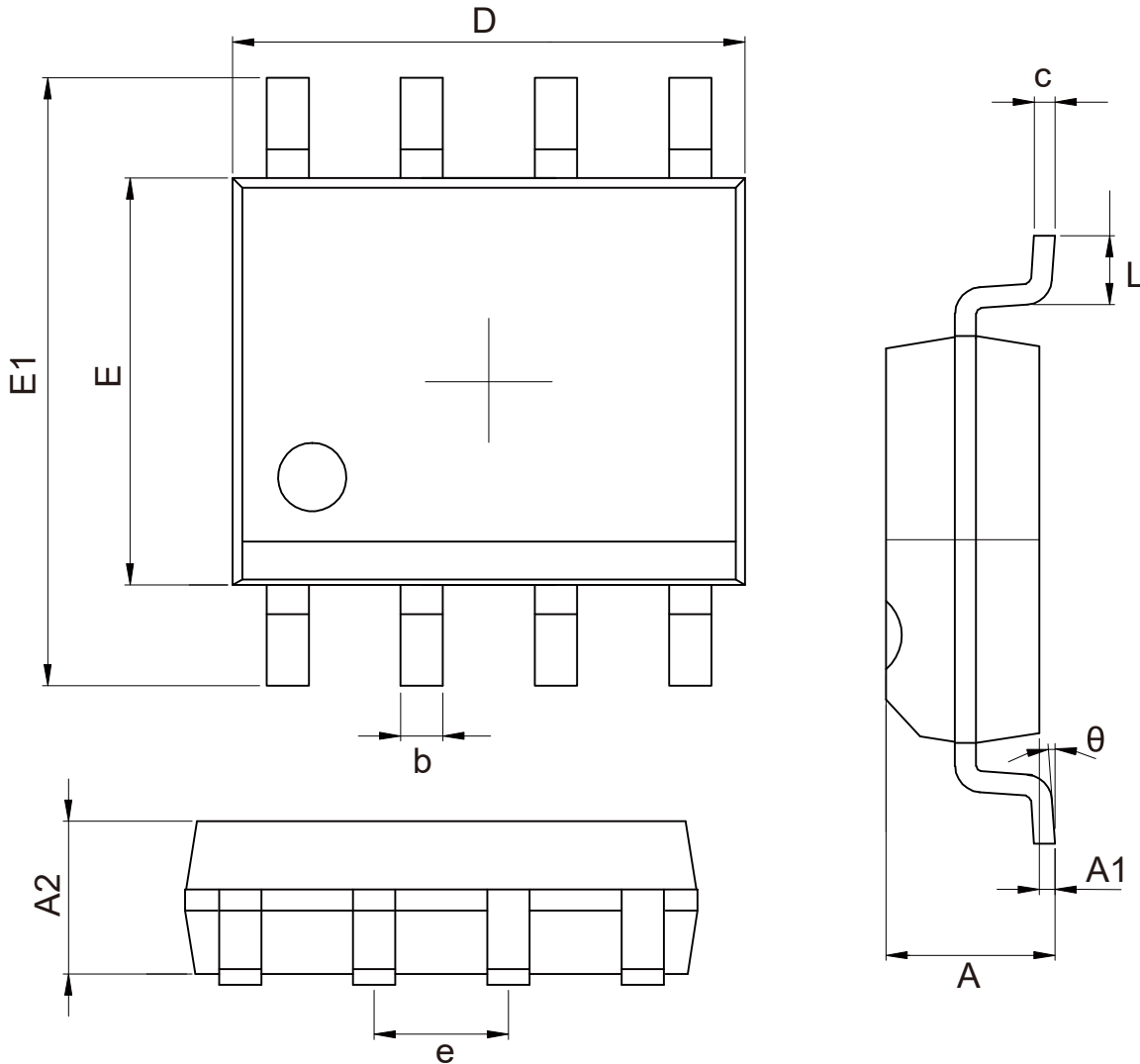


Figure 10. Maximum Safe Operating Area

## SOP-8D Package Information:

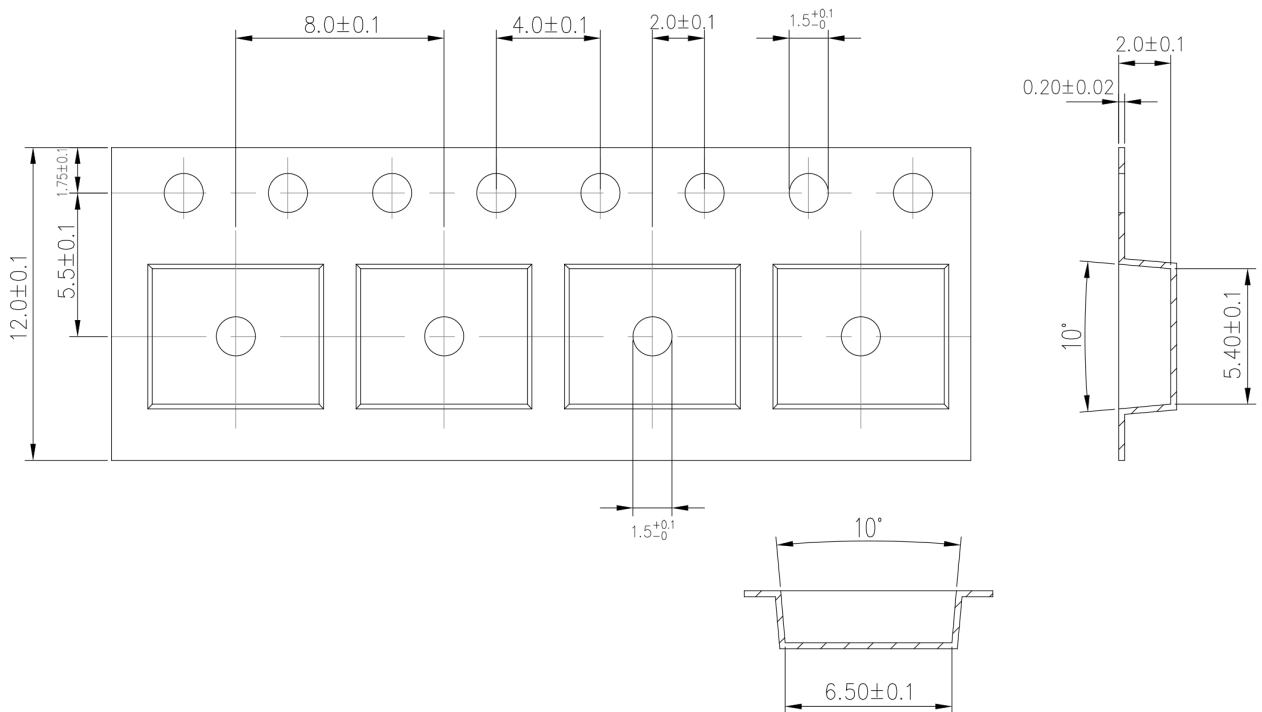
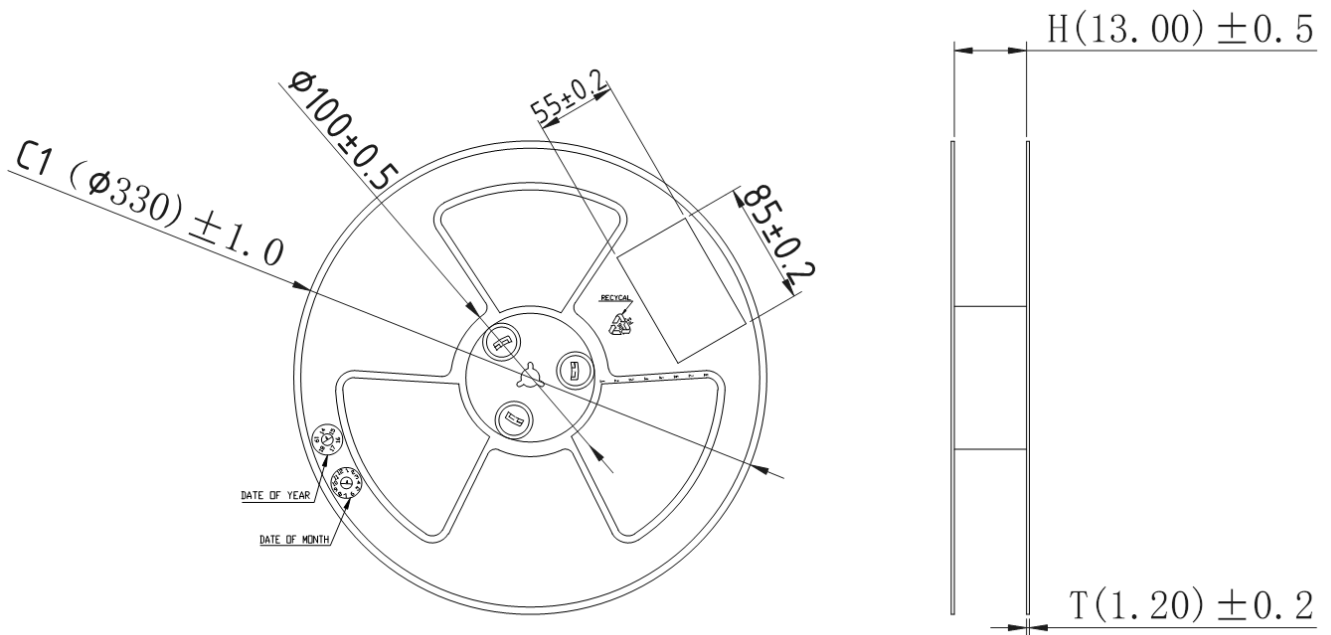


| COMMON DIMENSIONS        |          |       |       |
|--------------------------|----------|-------|-------|
| UNITS MEASURE=MILLIMETER |          |       |       |
| SYMBOL                   | MIN      | NOM   | MAX   |
| A                        | 1.350    | ---   | 1.750 |
| A1                       | 0.100    | ---   | 0.250 |
| A2                       | 1.350    | ---   | 1.550 |
| b                        | 0.330    | ---   | 0.510 |
| c                        | 0.170    | ---   | 0.250 |
| D                        | 4.700    | ---   | 5.100 |
| E                        | 3.800    | 3.900 | 4.000 |
| E1                       | 5.800    | ---   | 6.200 |
| e                        | 1.270BSC |       |       |
| L                        | 0.400    | ---   | 1.270 |
| θ                        | 0°       | --    | 8°    |

Unit:mm

## Tape & Reel Information

Dimensions in mm



Pulling direction →

## Marking Information:

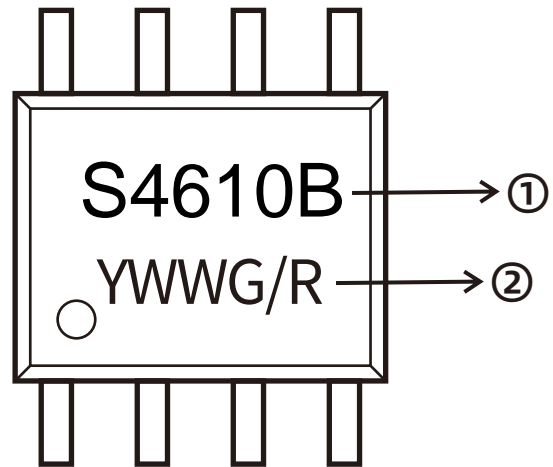
①. Part NO.

②. Date Code(YWWG / R)

Y : Year Code , last digit of the year

WW : Week Code(01-53)

G/R : G(Green) /R(Lead Free)



## Previous Version

| Version | Date       | Subjects (major changes since last revision) |
|---------|------------|--|
| 1.1     | 2026-01-20 | Release of final version                     |

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