

## Description:

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

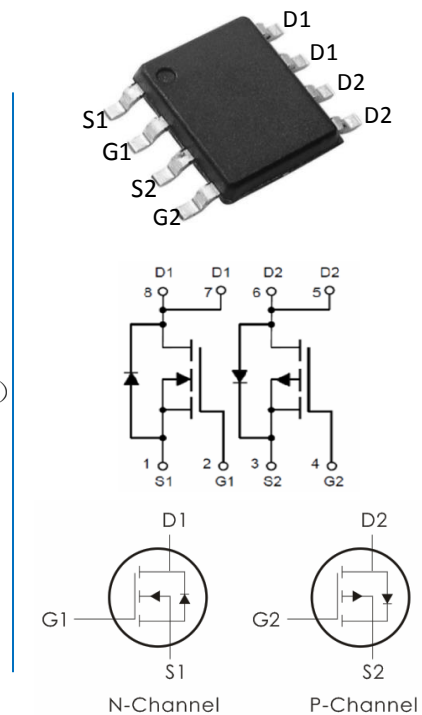
It can be used in a wide variety of applications.

## Features:

N-Channel:  $V_{DS}=60V, I_D=5A, R_{DS(on)} < 33m\Omega @ V_{GS}=10V$  (Typ:  $25m\Omega$ )

P-Channel:  $V_{DS}=-60V, I_D=-4A, R_{DS(on)} < 90m\Omega @ V_{GS}=-10V$  (Typ:  $75m\Omega$ )

- 1) Low gate charge.
- 2) Green device available.
- 3) Advanced high cell density SGT 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       |
|----------|---------|---------|---------------|
| DOS4612E | S4612E  | SOP-8D  | 3000 pcs/Reel |

## Absolute Maximum Ratings: ( $T_A=25^\circ\text{C}$ 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                |
| $I_D$          | Drain Current-Continuous @ $T_A=25^\circ\text{C}$ <sup>1</sup> | 5           | -4          | A                |
|                | Drain Current-Continuous @ $T_A=70^\circ\text{C}$ <sup>1</sup> | 3.5         | -2.8        |                  |
| $I_{DM}$       | Pulsed Drain Current <sup>2</sup>                              | 20          | -16         |                  |
| $E_{AS}$       | Single Pulsed Avalanche Energy <sup>3</sup>                    | 22          | 29.7        | mJ               |
| $P_D$          | Power Dissipation                                              | 1.5         | 1.5         | W                |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range               | -55 to +150 | -55 to +150 | $^\circ\text{C}$ |

## Thermal Characteristics:

| Symbol           | Parameter                               | N-Channel Max | P-Channel Max | Units                     |
|------------------|-----------------------------------------|---------------|---------------|---------------------------|
| $R_{\theta JA}$  | Thermal Resistance, Junction to Ambient | 85            | 85            | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JAC}$ | Thermal Resistance, Junction Case       | 25            | 25            |                           |

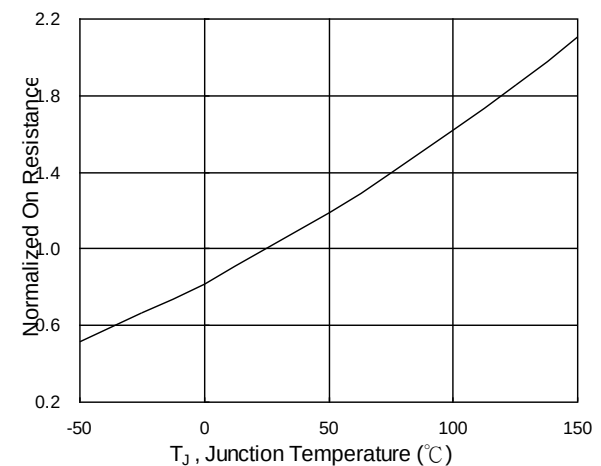
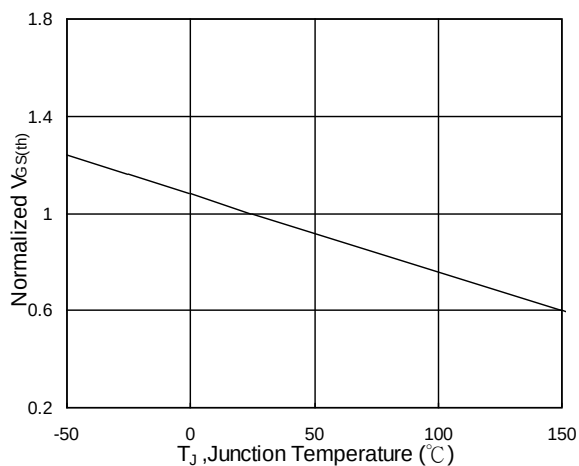
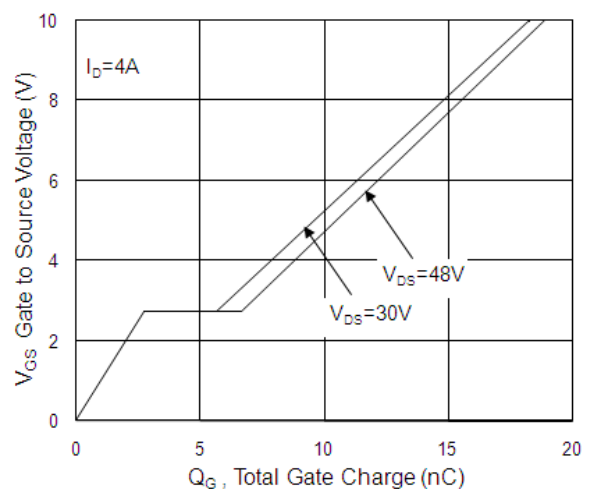
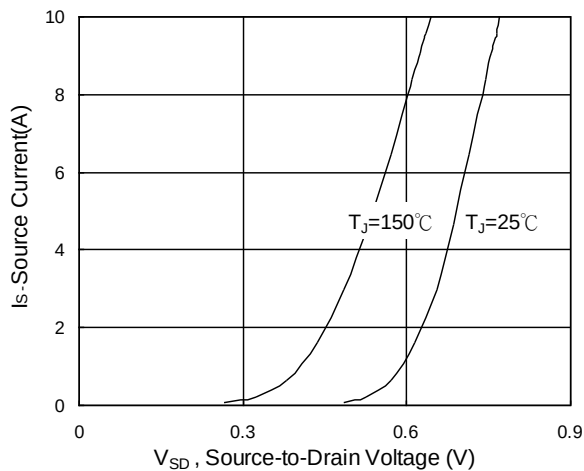
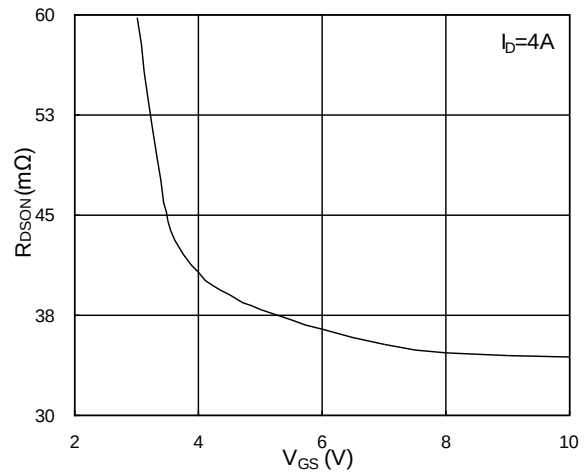
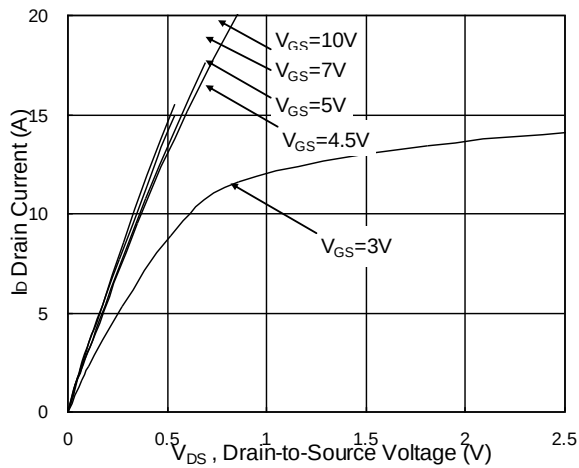
## N-Channel Electrical Characteristics: ( $T_A=25^{\circ}\text{C}$ unless otherwise noted)

| Symbol                             | Parameter                               | Conditions                                                                               | Min | Typ  | Max   | Units |
|------------------------------------|-----------------------------------------|------------------------------------------------------------------------------------------|-----|------|-------|-------|
| ON/Off Characteristics             |                                         |                                                                                          |     |      |       |       |
| BV <sub>DSS</sub>                  | Drain-Source Breakdown Voltage          | V <sub>GS</sub> =0V, I <sub>D</sub> =250 μ A                                             | 60  | ---  | ---   | V     |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current         | V <sub>GS</sub> =0V, V <sub>DS</sub> =48V                                                | --- | ---  | 1     | μ A   |
| I <sub>GSS</sub>                   | Gate-Source Leakage Current             | V <sub>GS</sub> =± 20V, V <sub>DS</sub> =0A                                              | --- | ---  | ± 100 | nA    |
| On Characteristics                 |                                         |                                                                                          |     |      |       |       |
| V <sub>GS(th)</sub>                | Gate -Source Threshold Voltage          | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250 μ A                               | 1   | ---  | 2.5   | V     |
| R <sub>DS(ON)</sub>                | Drain-Source On Resistance <sup>4</sup> | V <sub>GS</sub> =10V, I <sub>D</sub> =4A                                                 | --- | 25   | 33    | m Ω   |
|                                    |                                         | V <sub>GS</sub> =4.5V, I <sub>D</sub> =3A                                                | --- | 31   | 40    |       |
| G <sub>FS</sub>                    | Forward Transconductance                | V <sub>DS</sub> =5V, I <sub>D</sub> =4A                                                  | --- | 28.3 | ---   | S     |
| R <sub>g</sub>                     | Gate Resistance                         | V <sub>DS</sub> =0V , V <sub>GS</sub> =0V, f=1MHz                                        | --- | 2.5  | ---   | Ω     |
| Dynamic Characteristics            |                                         |                                                                                          |     |      |       |       |
| C <sub>iss</sub>                   | Input Capacitance                       | V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, f=1MHz                                        | --- | 950  | ---   | pF    |
| C <sub>oss</sub>                   | Output Capacitance                      |                                                                                          | --- | 65   | ---   |       |
| C <sub>rss</sub>                   | Reverse Transfer Capacitance            |                                                                                          | --- | 46   | ---   |       |
| Switching Characteristics          |                                         |                                                                                          |     |      |       |       |
| t <sub>d(on)</sub>                 | Turn-On Delay Time                      | V <sub>DD</sub> =30V, I <sub>D</sub> =4A<br>V <sub>GS</sub> =10V , R <sub>G</sub> =3.3 Ω | --- | 3    | ---   | ns    |
| t <sub>r</sub>                     | Rise Time                               |                                                                                          | --- | 34   | ---   | ns    |
| t <sub>d(off)</sub>                | Turn-Off Delay Time                     |                                                                                          | --- | 23   | ---   | ns    |
| t <sub>f</sub>                     | Fall Time                               |                                                                                          | --- | 6    | ---   | ns    |
| Q <sub>g</sub>                     | Total Gate Charge (4.5V)                | V <sub>GS</sub> =10V, V <sub>DS</sub> =48V,<br>I <sub>D</sub> =4A                        | --- | 20   | ---   | nC    |
| Q <sub>gs</sub>                    | Gate-Source Charge                      |                                                                                          | --- | 2.6  | ---   | nC    |
| Q <sub>gd</sub>                    | Gate-Drain “Miller” Charge              |                                                                                          | --- | 4.1  | ---   | nC    |
| Drain-Source Diode Characteristics |                                         |                                                                                          |     |      |       |       |
| V <sub>SD</sub>                    | Source-Drain Diode Forward Voltage      | V <sub>GS</sub> =0V, I <sub>S</sub> =1A , T <sub>J</sub> =25°C                           | --- | ---  | 1.2   | V     |
| I <sub>S</sub>                     | Continuous Drain to Source Diode        | V <sub>D</sub> =V <sub>G</sub> =0V                                                       | --- | ---  | 4.2   | A     |
| I <sub>SM</sub>                    | Pulsed Drain to Source Diode            |                                                                                          | --- | ---  | 16.6  |       |
| t <sub>rr</sub>                    | Body Diode Reverse Recovery Time        | I <sub>F</sub> =4A , dI/dt=100A/μs ,                                                     | --- | 12.1 | ---   | nS    |
| Q <sub>rr</sub>                    | Body Diode Reverse Recovery             | T <sub>J</sub> =25°C                                                                     | --- | 6.7  | ---   | 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 :  $T_J=25^{\circ}C, V_{DD}=30V, V_G=10V, L=0.5mH$
4. Pulse Test: Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 0.5\%$

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



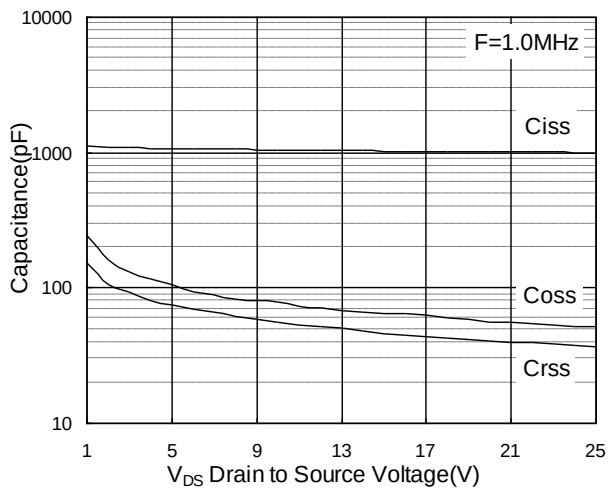


**Fig.7 Capacitance**

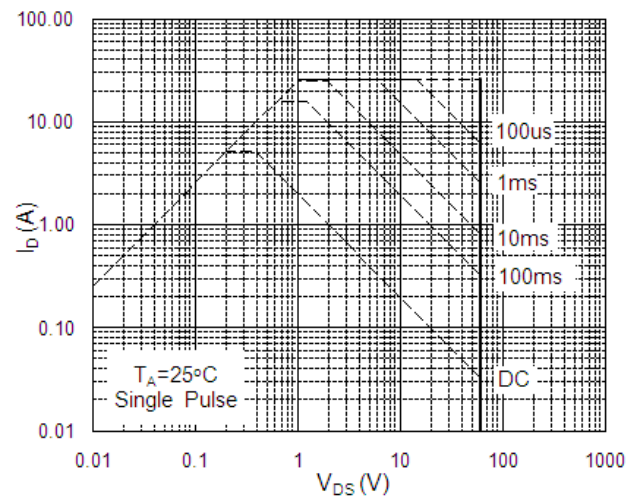


**Fig.8 Safe Operating Area**

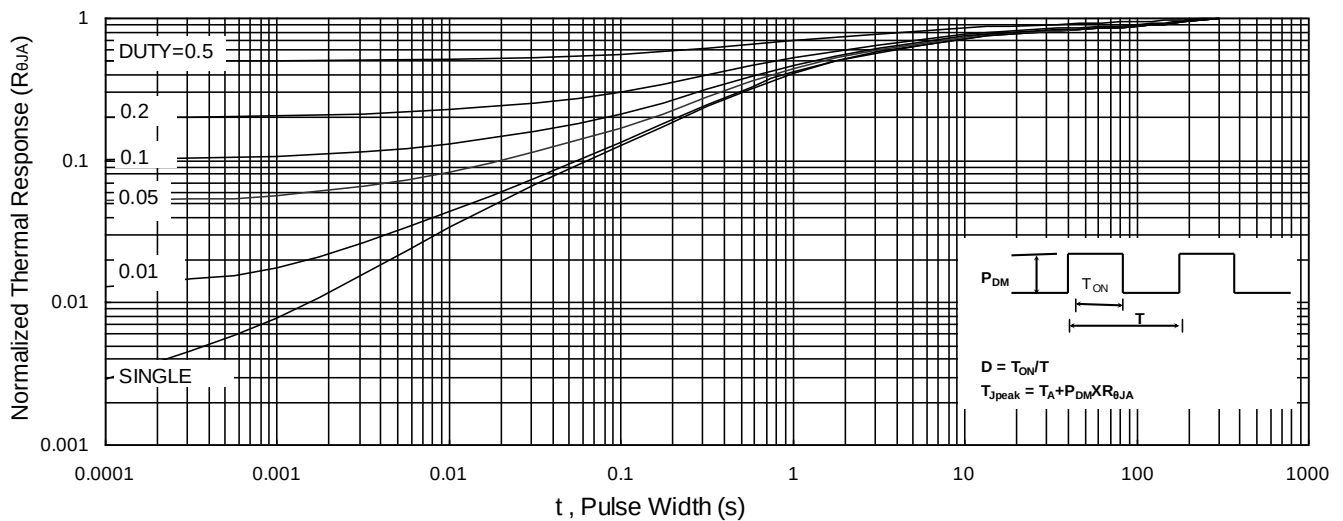


**Fig.9 Normalized Maximum Transient Thermal Impedance**

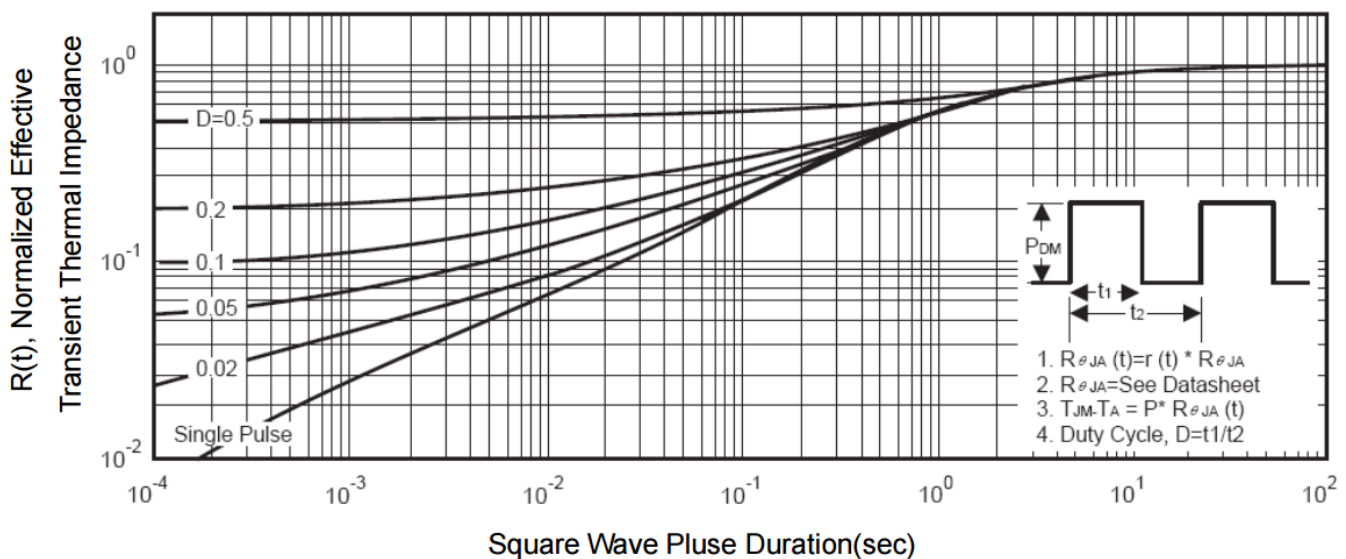


**Figure11. Normalized Maximum Transient Thermal Impedance**

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

| Symbol                             | Parameter                               | Conditions                                                                                  | Min  | Typ  | Max   | Units |
|------------------------------------|-----------------------------------------|---------------------------------------------------------------------------------------------|------|------|-------|-------|
| ON/Off States                      |                                         |                                                                                             |      |      |       |       |
| BV <sub>DSS</sub>                  | Drain-Sourctce Breakdown Voltage        | V <sub>GS</sub> =0V,I <sub>D</sub> =-250 μ A                                                | -60  | ---  | ---   | V     |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current         | V <sub>GS</sub> =0V, V <sub>DS</sub> =-60V                                                  | ---  | ---  | 1     | μ A   |
| I <sub>GSS</sub>                   | Gate-Source Leakage Current             | V <sub>GS</sub> =± 20V, V <sub>DS</sub> =0A                                                 | ---  | ---  | ± 100 | nA    |
| On Characteristics                 |                                         |                                                                                             |      |      |       |       |
| V <sub>GS(th)</sub>                | Gate -Source Threshold Voltage          | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250 μ A                                 | -1.2 | ---  | -2.5  | V     |
| R <sub>DS(ON)</sub>                | Drain-Source On Resistance <sup>4</sup> | V <sub>GS</sub> =-10V,I <sub>D</sub> =-3A                                                   | ---  | 75   | 90    | m Ω   |
|                                    |                                         | V <sub>GS</sub> =-4.5V,I <sub>D</sub> =-2A                                                  | ---  | 90   | 115   |       |
| G <sub>FS</sub>                    | Forward Transconductance                | V <sub>DS</sub> =-5V, I <sub>D</sub> =-3A                                                   | ---  | 8.7  | ---   | S     |
| R <sub>g</sub>                     | Gate Resistance                         | V <sub>DS</sub> = 0 V , V <sub>GS</sub> =0V f=1MHz                                          | ---  | 15   | ---   | Ω     |
| Dynamic Characteristics            |                                         |                                                                                             |      |      |       |       |
| C <sub>iss</sub>                   | Input Capacitance                       | V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V, f=1MHz                                          | ---  | 900  | ---   | pF    |
| C <sub>oss</sub>                   | Output Capacitance                      |                                                                                             | ---  | 65   | ---   |       |
| C <sub>rss</sub>                   | Reverse Transfer Capacitance            |                                                                                             | ---  | 47   | ---   |       |
| Switching Characteristics          |                                         |                                                                                             |      |      |       |       |
| t <sub>d(on)</sub>                 | Turn-On Delay Time                      | V <sub>DD</sub> =-15V, V <sub>GS</sub> =-10<br>R <sub>GEN</sub> =3.3 Ω ,I <sub>D</sub> =-1A | ---  | 8.8  | ---   | ns    |
| t <sub>r</sub>                     | Rise Time                               |                                                                                             | ---  | 19.6 | ---   | ns    |
| t <sub>d(off)</sub>                | Turn-Off Delay Time                     |                                                                                             | ---  | 47.2 | ---   | ns    |
| t <sub>f</sub>                     | Fall Time                               |                                                                                             | ---  | 9.6  | ---   | ns    |
| Q <sub>g</sub>                     | Total Gate Charge                       | V <sub>GS</sub> =-4.5V, V <sub>DS</sub> =-48V,<br>I <sub>D</sub> =-3A                       | ---  | 10   | ---   | nC    |
| Q <sub>gs</sub>                    | Gate-Source Charge                      |                                                                                             | ---  | 1.9  | ---   | nC    |
| Q <sub>gd</sub>                    | Gate-Drain “Miller” Charge              |                                                                                             | ---  | 6.5  | ---   | nC    |
| Drain-Source Diode Characteristics |                                         |                                                                                             |      |      |       |       |
| V <sub>SD</sub>                    | Source-Drain Diode Forward Voltage      | V <sub>GS</sub> =0V,I <sub>S</sub> =-6.5A                                                   | ---  | ---  | -1.2  | V     |
| I <sub>S</sub>                     | Continuous Source Current               | V <sub>D</sub> =V <sub>G</sub> =0V                                                          | ---  | ---  | -3.3  | A     |
| I <sub>SM</sub>                    | Diode Forward Voltage                   |                                                                                             | ---  | ---  | -13.3 |       |

## Notes:

1. omputed 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 :  $T_J=25^{\circ}C$ ,  $V_{DD}=-30V$ ,  $V_G=-10V$ ,  $L=0.5mH$
4. Pulse Test: Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 0.5\%$

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

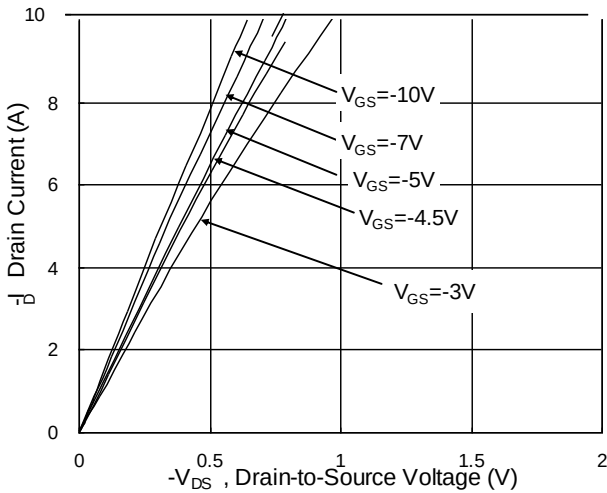


**Fig.1 Typical Output Characteristics**

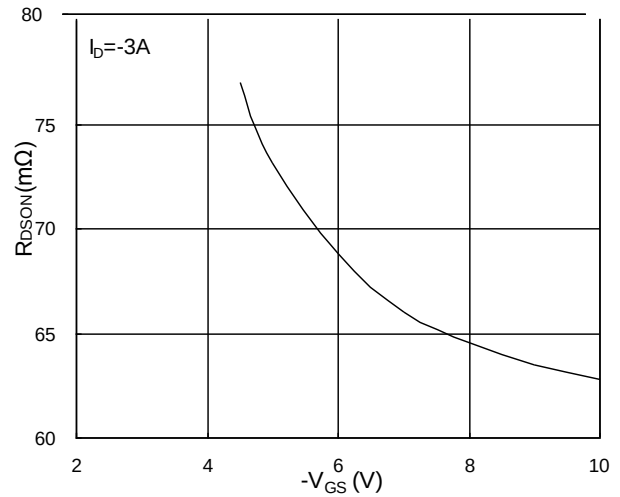


**Fig.2 On-Resistance v.s Gate-Source**

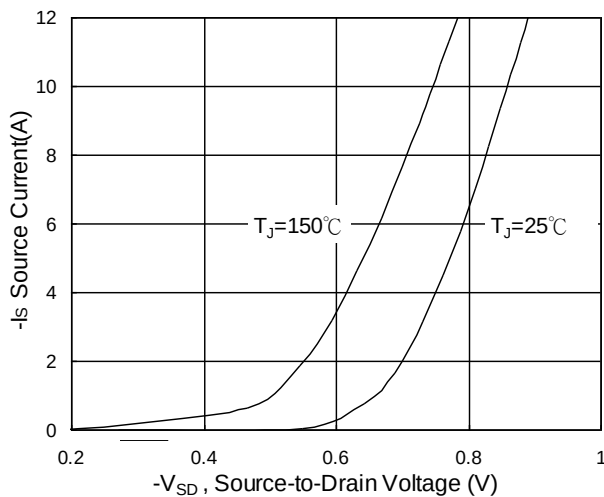


**Fig.3 Forward Characteristics of Reverse**

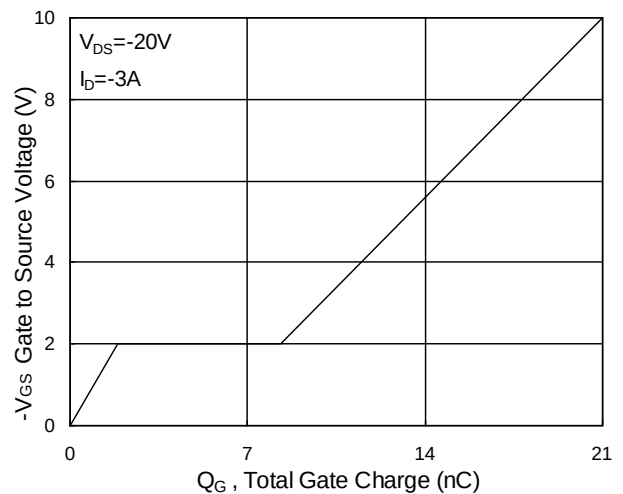


**Fig.4 Gate-Charge Characteristics**

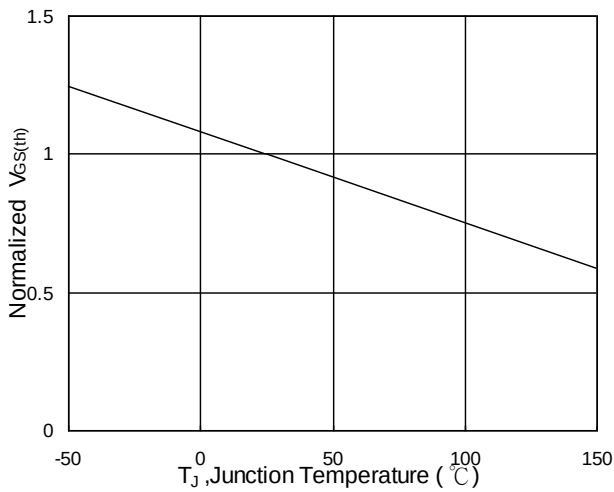


**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**

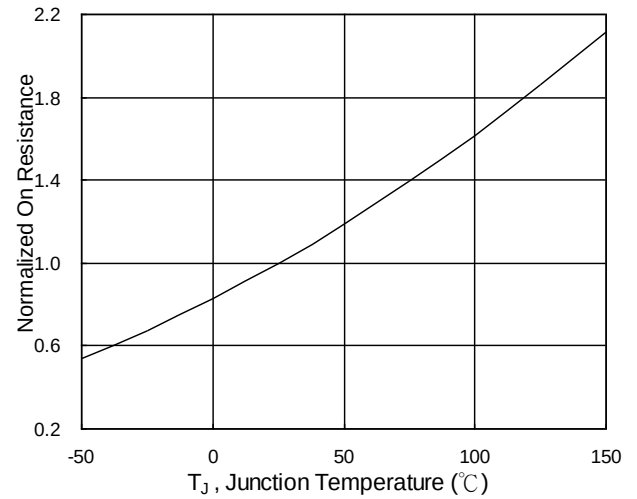


**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**

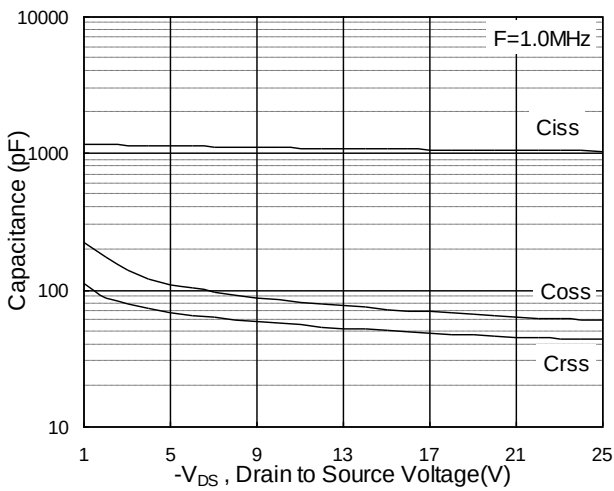


**Fig.7 Capacitance**

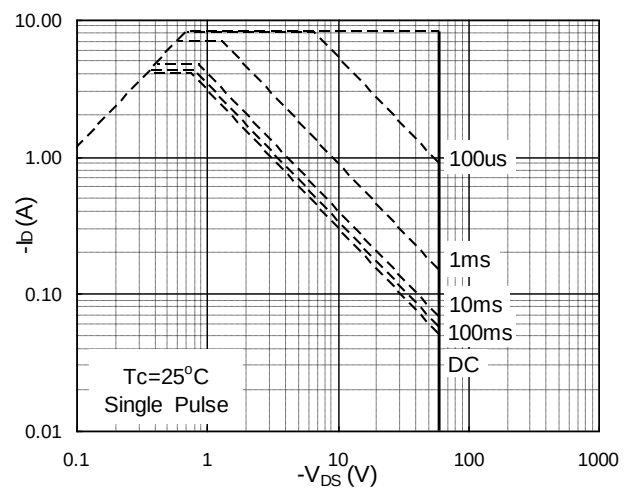


**Fig.8 Safe Operating Area**

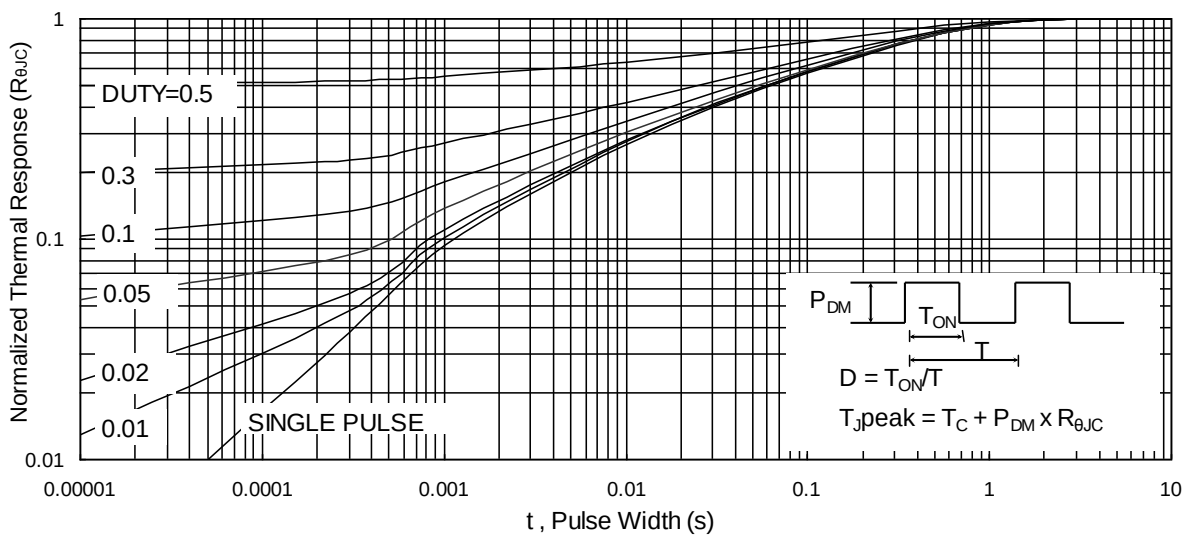
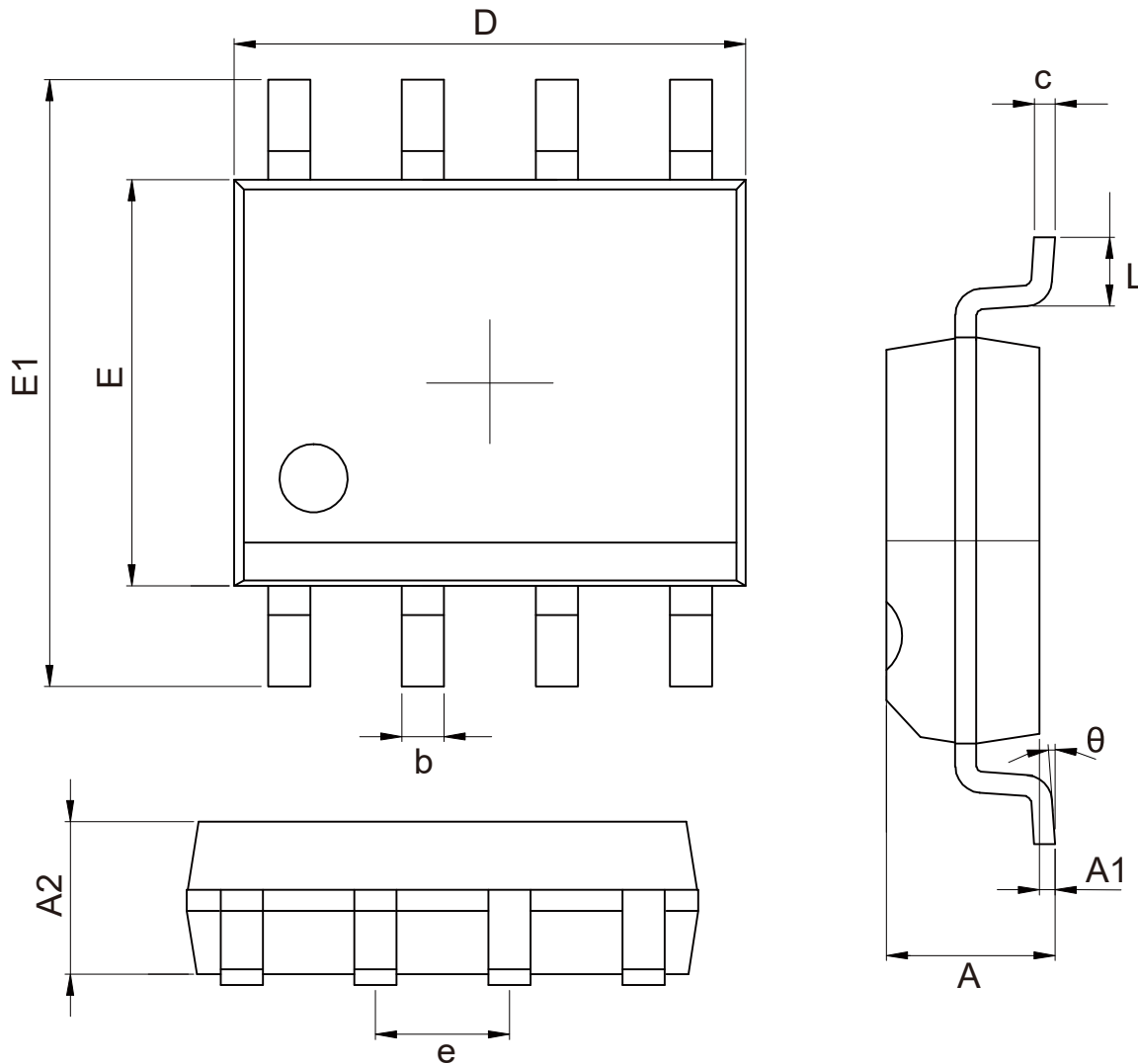


**Fig.9 Normalized Maximum Transient Thermal Impedance**

## SOP-8DPackage Information:

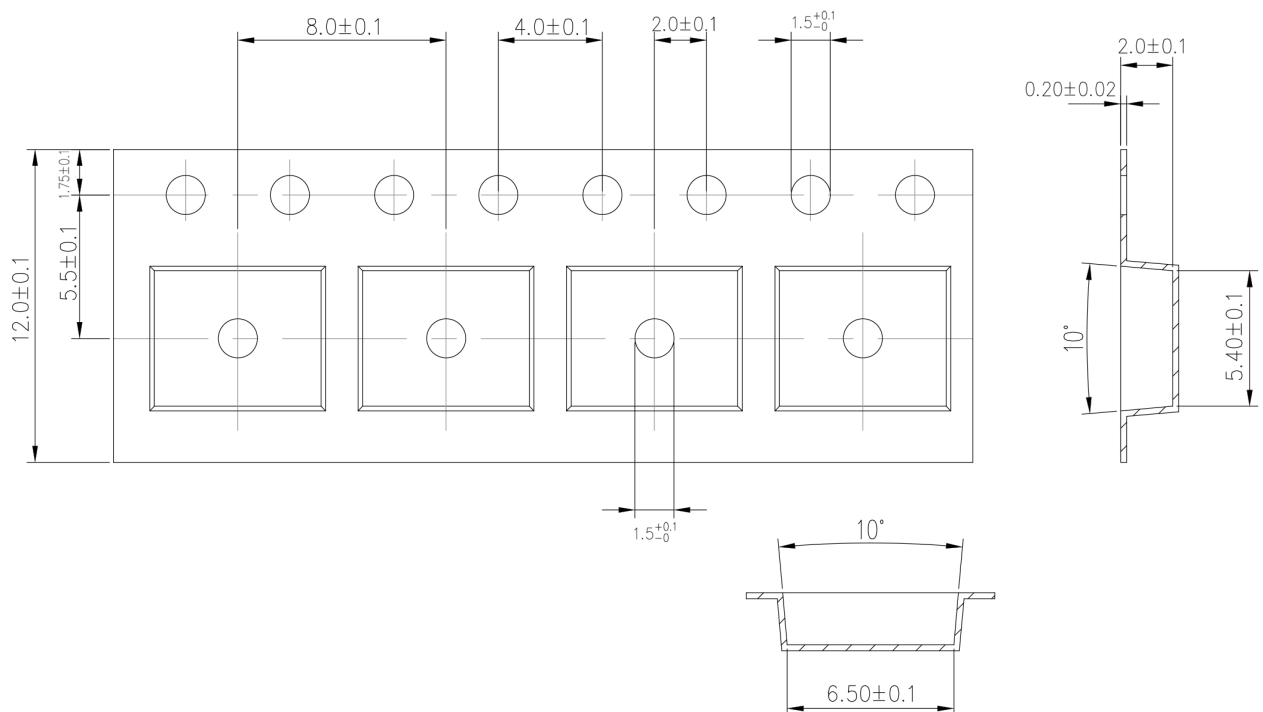
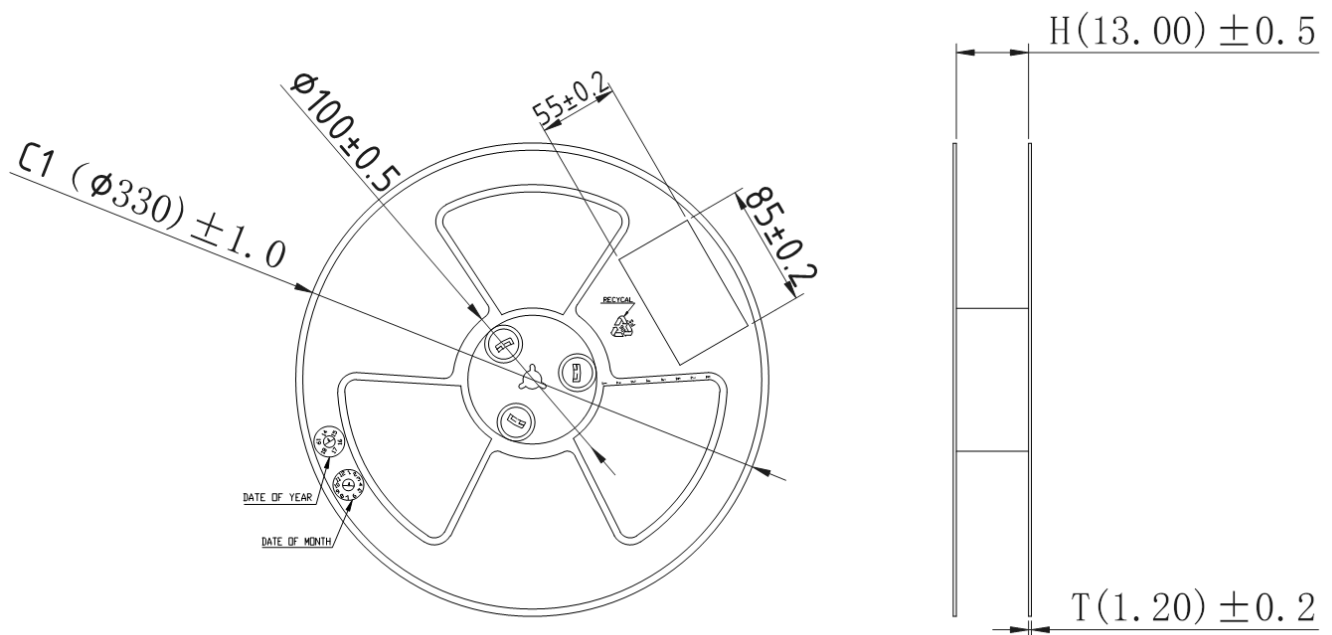


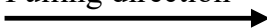
| COMMON DIMENSIONS<br>CUNITS MEASURE=MILLIMETER |          |       |       |
|------------------------------------------------|----------|-------|-------|
| SYMBOL                                         | MIN      | NOM   | MAX   |
| A                                              | 1.350    | —     | 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 |
| $\theta$                                       | 0°       | —     | 8°    |

Unit:mm

## Tape & Reel Information

Dimensions in mm



Pulling direction 

## Marking Information:

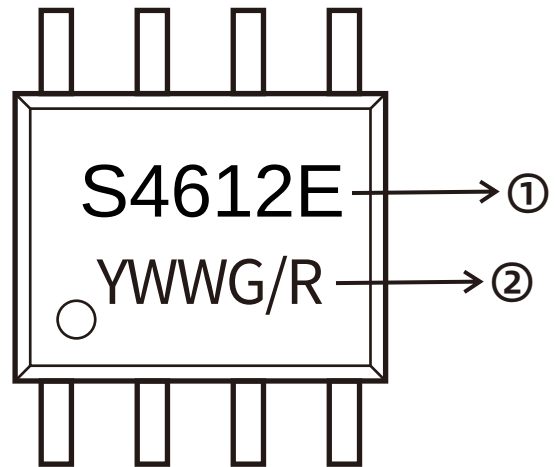
①. Part NO.

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) |
|---------|------------|----------------------------------------------|
| 2.1     | 2026-01-09 | Release of final version                     |

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