

## Description:

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

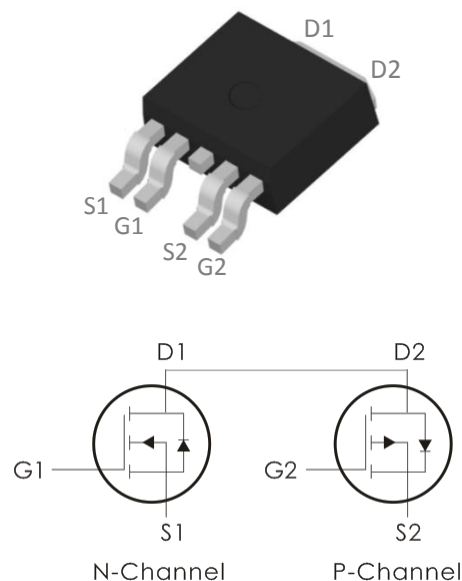
It can be used in a wide variety of applications.

## Features:

N-Channel:  $V_{DS}=40V, I_D=28A, R_{DS(on)} < 13m\Omega @ V_{GS}=10V$  (Typ:  $10m\Omega$ )

P-Channel:  $V_{DS}=-40V, I_D=-35A, R_{DS(on)} < 18m\Omega @ V_{GS}=-10V$  (Typ:  $14m\Omega$ )

- 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       |
|----------|---------|-----------|---------------|
| DOD629C  | D629C   | TO- 252-4 | 2500 pcs/Reel |

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

| Symbol         | Parameter                                        | N-Channel   | P-Channel | Units      |
|----------------|--------------------------------------------------|-------------|-----------|------------|
| $V_{DS}$       | Drain-Source Voltage                             | 40          | -40       | V          |
| $V_{GS}$       | Gate-Source Voltage                              | $\pm 20$    | $\pm 20$  | V          |
| $I_D$          | Continuous Drain Current- $T_C=25^\circ C^1$     | 28          | -35       | A          |
|                | Continuous Drain Current- $T_C=100^\circ C^1$    | 19.6        | -24.5     |            |
| $I_{DM}$       | Pulsed Drain Current <sup>2</sup>                | 112         | -140      | A          |
| $E_{AS}$       | Single pulse avalanche energy <sup>3</sup>       | 28          | 70        | mJ         |
| $P_D$          | Power Dissipation - $T_C=25^\circ C$             | 40          | 45        | 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        |
|-----------------|--------------------------------------|------|------|--------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Cast | 3.1  | 2.78 | $^\circ C/W$ |

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

| Symbol                             | Parameter                                  | Conditions                                                                                 | Min | Typ  | Max   | Units |
|------------------------------------|--------------------------------------------|--------------------------------------------------------------------------------------------|-----|------|-------|-------|
| Off Characteristics                |                                            |                                                                                            |     |      |       |       |
| BV <sub>DSS</sub>                  | Drain-Sourtce Breakdown Voltage            | V <sub>GS</sub> =0V,I <sub>D</sub> =250 μ A                                                | 40  | ---  | ---   | V     |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current            | V <sub>GS</sub> =0V, V <sub>DS</sub> =40V                                                  | --- | ---  | 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   | 1.5  | 2.5   | V     |
| R <sub>DS(ON)</sub>                | Drain-Source On Resistance <sup>4</sup>    | V <sub>GS</sub> =10V,I <sub>D</sub> =10A                                                   | --- | 10   | 13    | m Ω   |
|                                    |                                            | V <sub>GS</sub> =4.5V,I <sub>D</sub> =5A                                                   | --- | 13   | 20    | m Ω   |
| Dynamic Characteristics            |                                            |                                                                                            |     |      |       |       |
| C <sub>iss</sub>                   | Input Capacitance                          | V <sub>DS</sub> =20V, V <sub>GS</sub> =0V, f=1MHz                                          | --- | 1100 | ---   | pF    |
| C <sub>oss</sub>                   | Output Capacitance                         |                                                                                            | --- | 210  | --    |       |
| C <sub>rss</sub>                   | Reverse Transfer Capacitance <sup>63</sup> |                                                                                            | --- | 131  | ---   |       |
| Switching Characteristics          |                                            |                                                                                            |     |      |       |       |
| t <sub>d(on)</sub>                 | Turn-On Delay Time                         | V <sub>DD</sub> =20V, R <sub>L</sub> =2 Ω ,<br>R <sub>ENG</sub> =3 Ω ,V <sub>GS</sub> =10V | --- | 4.2  | ---   | ns    |
| t <sub>r</sub>                     | Rise T8e                                   |                                                                                            | --- | 12   | ---   | ns    |
| t <sub>d(off)</sub>                | Turn-Off Delay T39e                        |                                                                                            | --- | 18.9 | ---   | ns    |
| t <sub>f</sub>                     | Fall T16ime                                |                                                                                            | --- | 5.8  | ---   | ns    |
| Q <sub>g</sub>                     | Total Gate Charge                          | V <sub>GS</sub> =10V, V <sub>DS</sub> =20V,<br>I <sub>D</sub> =10A                         | --- | 20   | ---   | nC    |
| Q <sub>gs</sub>                    | Gate-Source Charge                         |                                                                                            | --- | 4.2  | ---   | nC    |
| Q <sub>gd</sub>                    | Gate-Drain “Miller” Charge                 |                                                                                            | --- | 3.6  | ---   | nC    |
| Drain-Source Diode Characteristics |                                            |                                                                                            |     |      |       |       |
| V <sub>SD</sub>                    | Diode Forward Voltage                      | V <sub>GS</sub> =0V, I <sub>SD</sub> =10A                                                  | --- | ---  | 1.2   | V     |
| I <sub>S</sub>                     | Continuous Drain Curren                    | V <sub>D</sub> =V <sub>G</sub> =0V                                                         | --- | ---  | 28    | A     |
| I <sub>SM</sub>                    | Pulsed Drain Current                       |                                                                                            | --- | ---  | 112   | A     |

### 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 :  $T_J=25^{\circ}C, V_{DD}=20V, V_G=10V, L=0.5mH$
4. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 0.5\%$

### Test Circuit

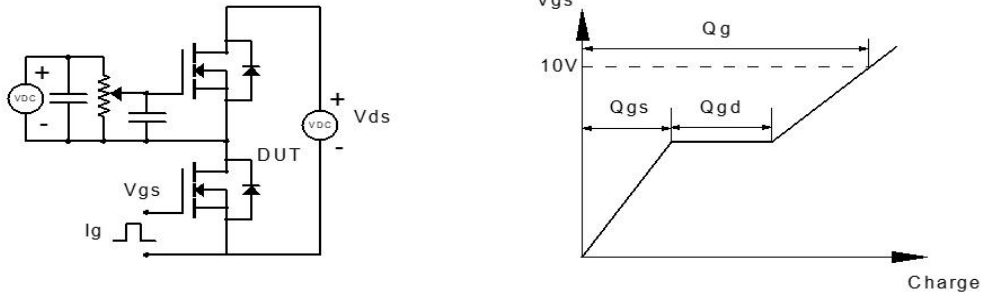


**Figure 1: Gate Charge Test Circuit & Waveform**

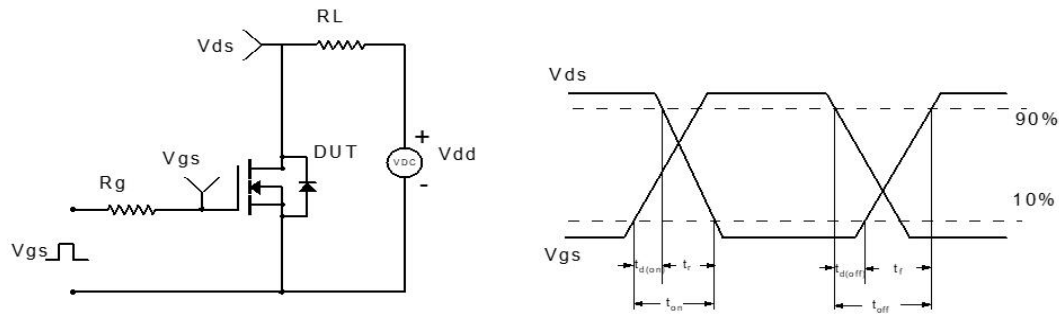


**Figure 2: Resistive Switching Test Circuit & Waveform**

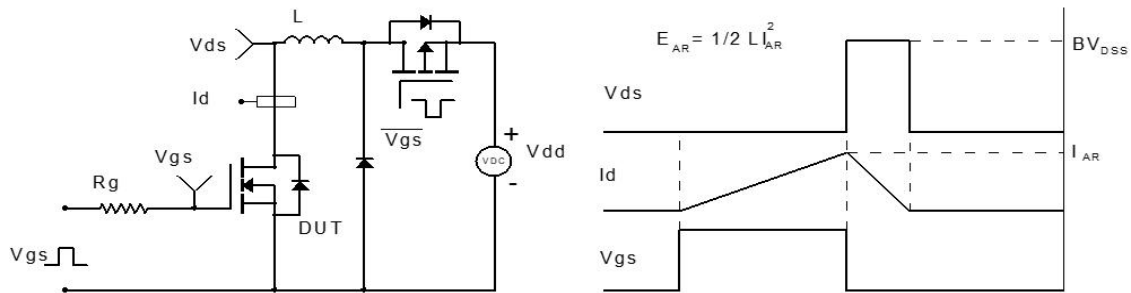


**Figure 3: Unclamped Inductive Switching Test Circuit & Waveform**

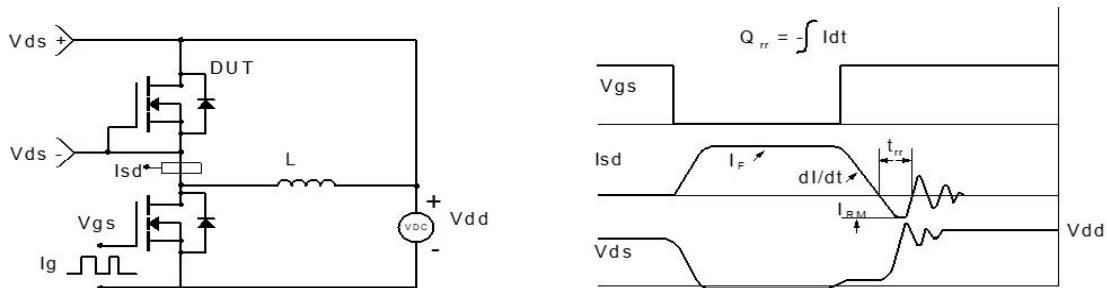


**Figure 4: Diode Recovery Test Circuit & Waveform**

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

| Symbol                             | Parameter                               | Conditions                                                                                       | Min | Typ  | Max   | Units |
|------------------------------------|-----------------------------------------|--------------------------------------------------------------------------------------------------|-----|------|-------|-------|
| Off Characteristics                |                                         |                                                                                                  |     |      |       |       |
| BV <sub>DSS</sub>                  | Drain-Sourctce Breakdown Voltage        | V <sub>GS</sub> =0V, I <sub>D</sub> =250 μ A                                                     | -40 | ---  | ---   | V     |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current         | V <sub>GS</sub> =0V, V <sub>DS</sub> =-32V                                                       | --- | ---  | -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  | -1.6 | -2.5  | V     |
| R <sub>DS(ON)</sub>                | Drain-Source On Resistance <sup>4</sup> | V <sub>GS</sub> =-10V, I <sub>D</sub> =-10A                                                      | --- | 14   | 18    | m Ω   |
|                                    |                                         | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-5A                                                      | --- | 20   | 24    |       |
| Dynamic Characteristics            |                                         |                                                                                                  |     |      |       |       |
| C <sub>iss</sub>                   | Input Capacitance                       | V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V, f=1MHz                                               | --- | 1400 | ---   | pF    |
| C <sub>oss</sub>                   | Output Capacitance                      |                                                                                                  | --- | 150  | ---   |       |
| C <sub>rss</sub>                   | Reverse Transfer Capacitance            |                                                                                                  | --- | 135  | ---   |       |
| Switching Characteristics          |                                         |                                                                                                  |     |      |       |       |
| t <sub>d(on)</sub>                 | Turn-On Delay Time                      | V <sub>DD</sub> = -20V, I <sub>D</sub> =-1A<br><br>V <sub>GS</sub> = -10V, R <sub>GEN</sub> =6 Ω | --- | 13.6 | ---   | ns    |
| t <sub>r</sub>                     | Rise Time                               |                                                                                                  | --- | 25.2 | ---   | ns    |
| t <sub>d(off)</sub>                | Turn-Off Delay Time                     |                                                                                                  | --- | 29.4 | ---   | ns    |
| t <sub>f</sub>                     | Fall Time                               |                                                                                                  | --- | 24.1 | ---   | ns    |
| Q <sub>g</sub>                     | Total Gate Charge                       | V <sub>GS</sub> =-4.5V, V <sub>DS</sub> =-20V,<br><br>I <sub>D</sub> =-8A                        | --- | 40   | ---   | nC    |
| Q <sub>gs</sub>                    | Gate-Source Charge                      |                                                                                                  | --- | 6.4  | ---   | nC    |
| Q <sub>gd</sub>                    | Gate-Drain “Miller” Charge              |                                                                                                  | --- | 6.9  | ---   | nC    |
| Drain-Source Diode Characteristics |                                         |                                                                                                  |     |      |       |       |
| I <sub>S</sub>                     | Continuous Drain to Source Diode        | V <sub>D</sub> =V <sub>G</sub> =0V                                                               | --- | ---  | -35   | A     |
| I <sub>SM</sub>                    | Pulsed Drain to Source Diode            |                                                                                                  | --- | ---  | -140  | A     |
| V <sub>SD</sub>                    | Source-Drain Diode Forward Voltage      | V <sub>GS</sub> =0V, I <sub>S</sub> =-1A                                                         | --- | ---  | -1.2  | V     |

## 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 :  $T_J=25^{\circ}C, V_{DD}=-20V, V_G=-10V, L=0.5mH$
4. Pulse Test: Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 0.5\%$

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

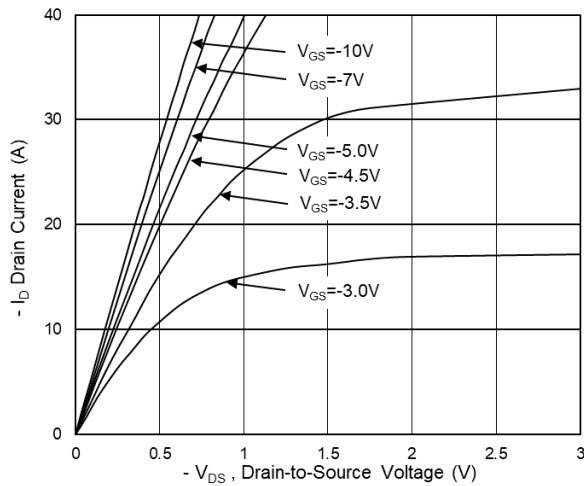


**Fig.1 Typical Output Characteristics**

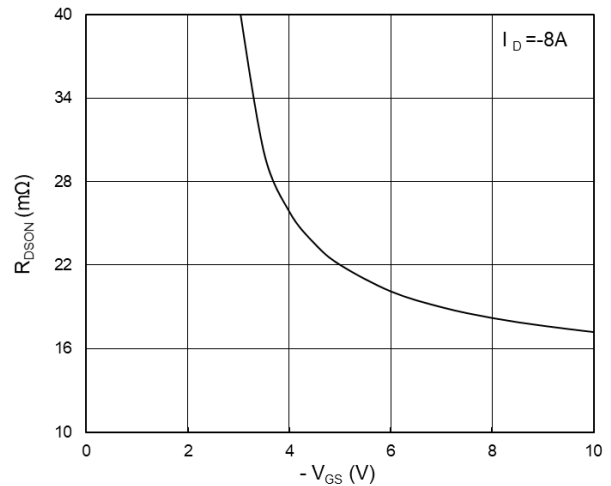


**Fig.2 On-Resistance vs G-S Voltage**

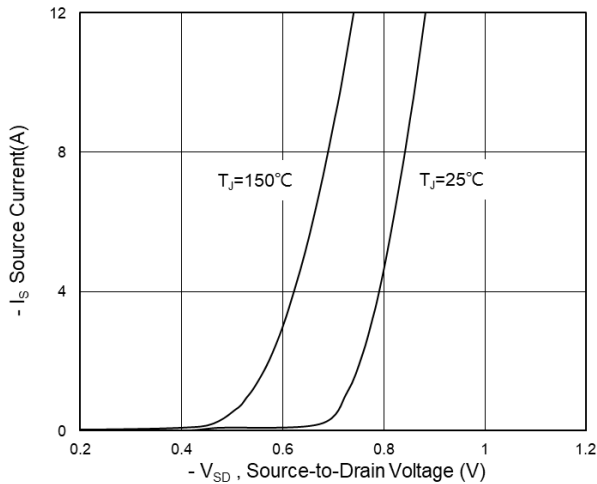


**Fig.3 Source Drain Forward Characteristics**

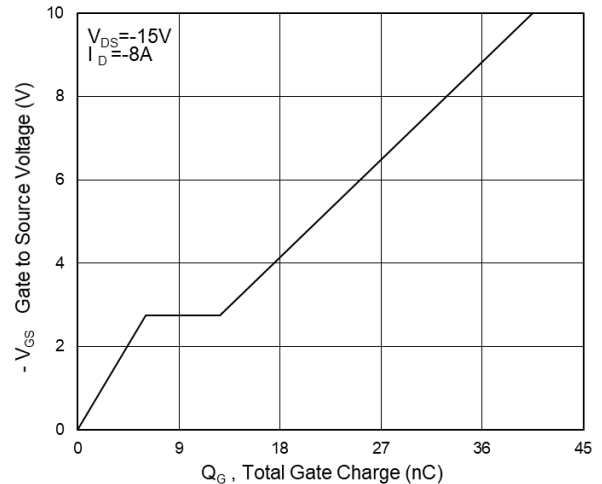


**Fig.4 Gate-Charge Characteristics**

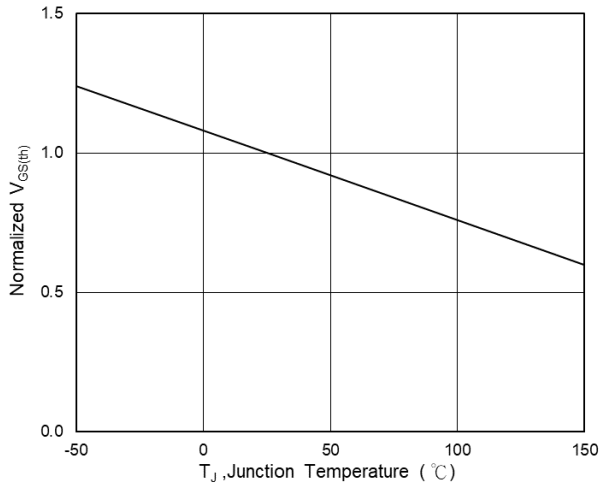


**Fig.5 Normalized  $V_{GS(th)}$  vs  $T_J$**

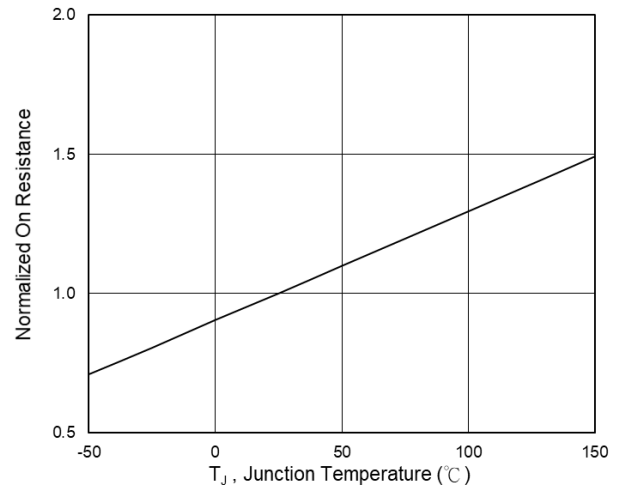


**Fig.6 Normalized  $R_{DS(on)}$  vs  $T_J$**

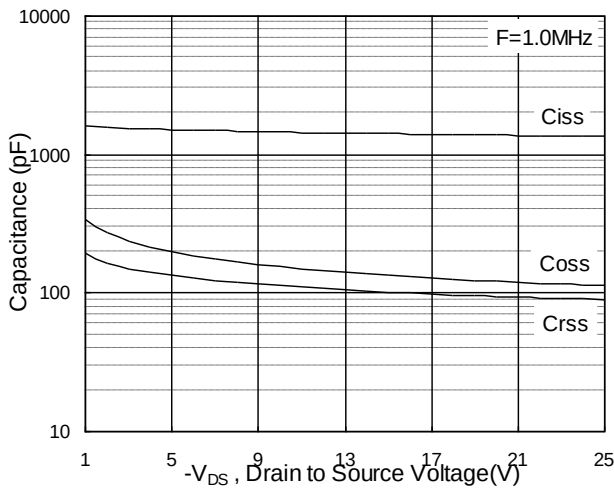


**Fig.7 Capacitance**

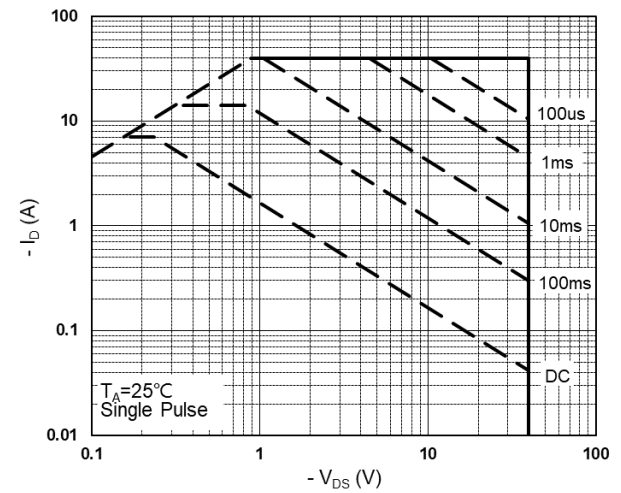


**Fig.8 Safe Operating Area**

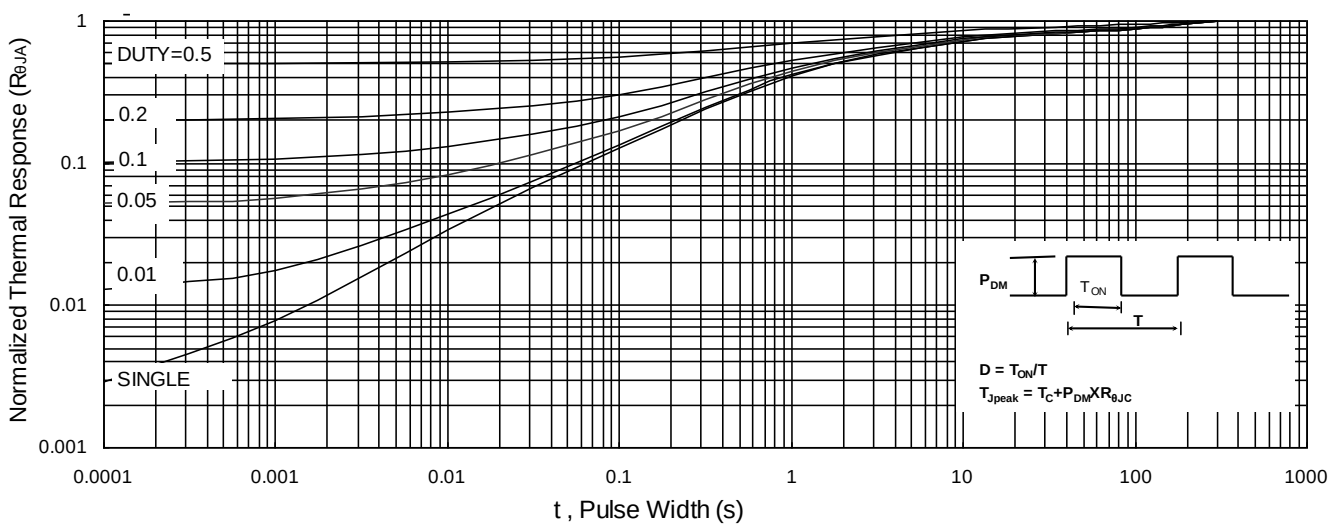


**Fig.9 Normalized Maximum Transient Thermal Impedance**

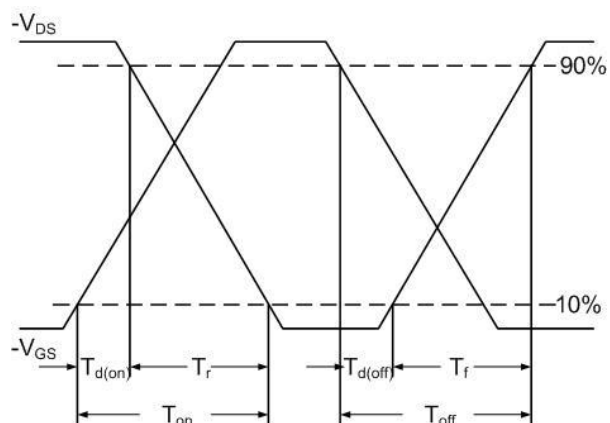


**Fig.10 Switching Time Waveform**

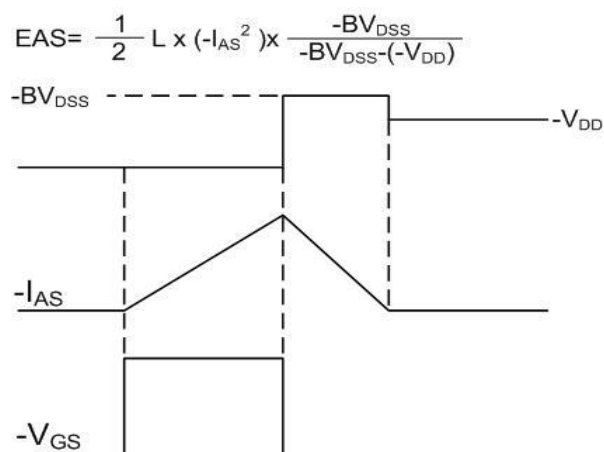
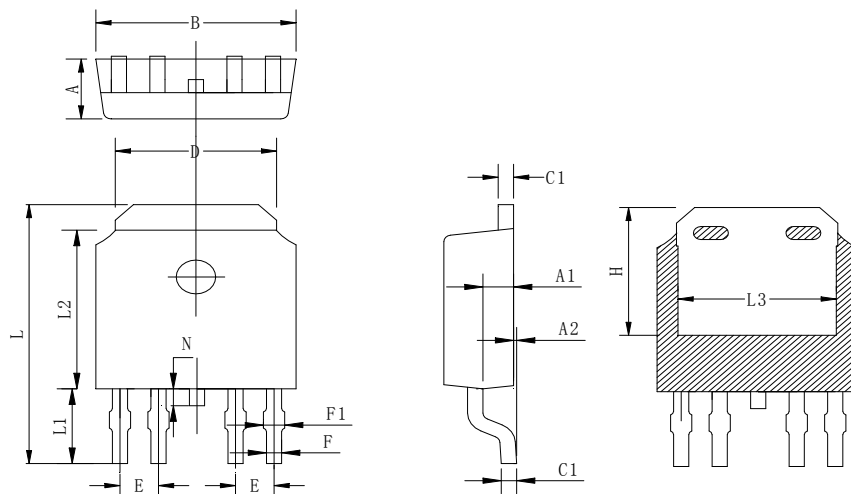


**Fig.11 Unclamped Inductive Switching Waveform**

$$EAS = \frac{1}{2} L \times (-I_{AS}^2) \times \frac{-BV_{DSS}}{-BV_{DSS} - (-V_{DD})}$$

## TO-252-4 Package Outline Data

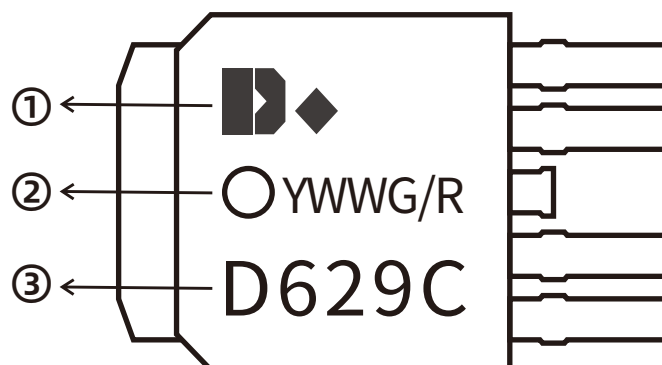
UNIT: mm



| Symbol | Min      | Typ   | Max   |
|--------|----------|-------|-------|
| A      | 2.20     | 2.30  | 2.40  |
| A1     | 0.91     | 1.01  | 1.11  |
| A2     | 0.05     | 0.15  | 0.25  |
| B      | 6.45     | 6.60  | 6.75  |
| C      | 0.45     | 0.50  | 0.58  |
| C1     | 0.45     | 0.50  | 0.58  |
| D      | 5.12     | 5.32  | 5.52  |
| E      | 1.27 TYP |       |       |
| F1     | 0.45     | 0.60  | 0.75  |
| F      | 0.40     | 0.50  | 0.60  |
| H      | 4.70     | 4.90  | 5.10  |
| L      | 9.70     | 10.00 | 10.20 |
| L1     | 2.6      | 2.8   | 3.0   |
| L2     | 5.95     | 6.10  | 6.25  |
| L3     | 5.00     | 5.20  | 5.40` |
| N      | 0.45     | 0.65  | 0.85  |

## Marking Information:

- ①: Doingter LOGO
- 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)
- ③: Part NO.



## Previous Version

| Version | Date       | Subjects (major changes since last revision) |
|---------|------------|----------------------------------------------|
| 1.1     | 2025-07-08 | Release of final version                     |

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