

### Features

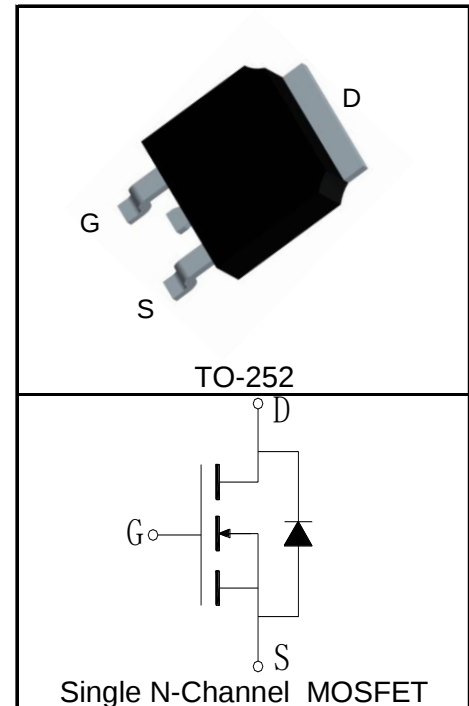
- 40V/45A,  
 $R_{DS(ON)} = 10m\Omega(Typ.)@V_{GS}=10V$   
 $R_{DS(ON)} = 15m\Omega(Typ.)@V_{GS}=4.5V$
- Low  $R_{DS(ON)}$
- Super High Dense Cell Design
- Fast Switching Speed
- Low Capacitance to Minimize Driver Losses

### Applications

- Power Switching Application
- Load Switching



### Pin Description



### Absolute Maximum Ratings

| Symbol                                                                 | Parameter                                    | Rating                        | Unit               |
|------------------------------------------------------------------------|----------------------------------------------|-------------------------------|--------------------|
| <b>Common Ratings</b> ( $T_C=25^\circ\text{C}$ Unless Otherwise Noted) |                                              |                               |                    |
| $V_{DSS}$                                                              | Drain-Source Voltage                         | 40                            | V                  |
| $V_{GSS}$                                                              | Gate-Source Voltage                          | $\pm 20$                      |                    |
| $T_J$                                                                  | Maximum Junction Temperature                 | 175                           | $^\circ\text{C}$   |
| $T_{STG}$                                                              | Storage Temperature Range                    | -55 to 175                    | $^\circ\text{C}$   |
| $I_S$                                                                  | Diode Continuous Forward Current             | $T_C=25^\circ\text{C}$<br>45  | A                  |
| <b>Mounted on Large Heat Sink</b>                                      |                                              |                               |                    |
| $I_{DP}^{①}$                                                           | 300 $\mu\text{s}$ Pulse Drain Current Tested | $T_C=25^\circ\text{C}$<br>180 | A                  |
| $I_D^{②}$                                                              | Continuous Drain Current( $V_{GS}=10V$ )     | $T_C=25^\circ\text{C}$<br>45  | A                  |
|                                                                        |                                              | $T_C=100^\circ\text{C}$<br>32 |                    |
| $P_D$                                                                  | Maximum Power Dissipation                    | $T_C=25^\circ\text{C}$<br>45  | W                  |
|                                                                        |                                              | $T_C=100^\circ\text{C}$<br>23 |                    |
| $R_{\theta JC}$                                                        | Thermal Resistance-Junction to Case          | 3.3                           | $^\circ\text{C/W}$ |
| $R_{\theta JA}^{③}$                                                    | Thermal Resistance-Junction to Ambient       | 100                           | $^\circ\text{C/W}$ |
| <b>Drain-Source Avalanche Ratings</b>                                  |                                              |                               |                    |
| $E_{AS}^{④}$                                                           | Avalanche Energy, Single Pulsed              | 36                            | mJ                 |

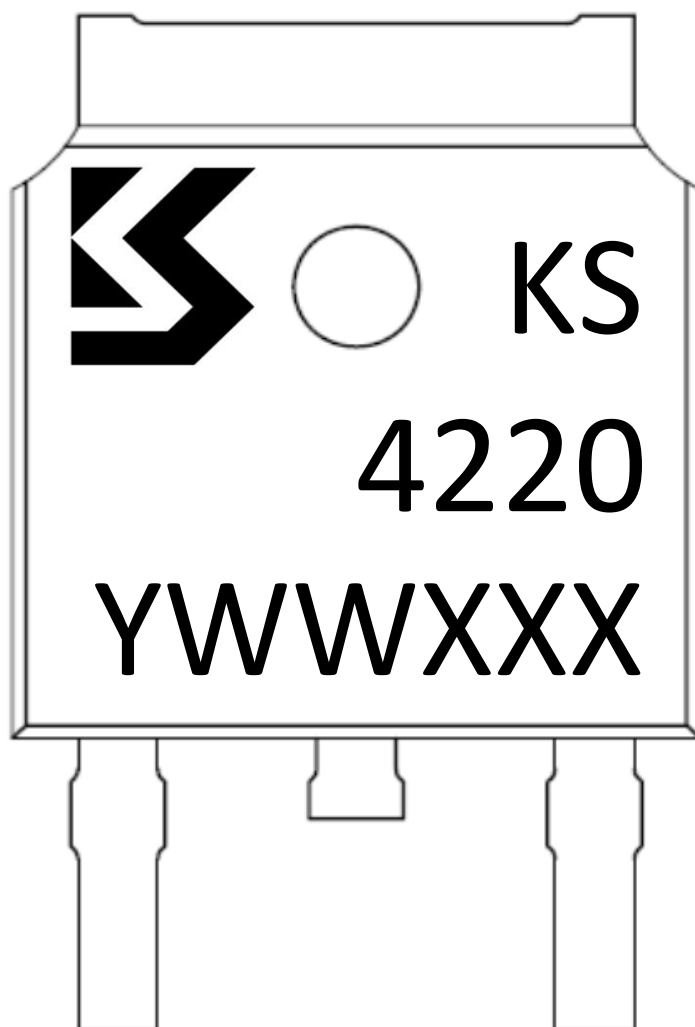
**Electrical Characteristics** ( $T_C=25^{\circ}\text{C}$  Unless Otherwise Noted)

| Symbol                        | Parameter                        | Test Condition                                                                        | KS4220DA |      |      | Unit |
|-------------------------------|----------------------------------|---------------------------------------------------------------------------------------|----------|------|------|------|
|                               |                                  |                                                                                       | Min.     | Typ. | Max. |      |
| Static Characteristics        |                                  |                                                                                       |          |      |      |      |
| BV <sub>DSS</sub>             | Drain-Source Breakdown Voltage   | V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA                                           | 40       |      |      | V    |
| I <sub>DSS</sub>              | Zero Gate Voltage Drain Current  | V <sub>DS</sub> =40V, V <sub>GS</sub> =0V                                             |          |      | 1    | μA   |
|                               |                                  | T <sub>J</sub> =125°C                                                                 |          |      | 30   |      |
| V <sub>GS(th)</sub>           | Gate Threshold Voltage           | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA                             | 1.1      | 1.7  | 2.3  | V    |
| I <sub>GSS</sub>              | Gate Leakage Current             | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                            |          |      | ±100 | nA   |
| R <sub>DS(ON)</sub> ⑤         | Drain-Source On-state Resistance | V <sub>GS</sub> =10V, I <sub>DS</sub> =20A                                            |          | 10   | 14   | mΩ   |
|                               |                                  | V <sub>GS</sub> =4.5V, I <sub>DS</sub> =15A                                           |          | 15   | 21   | mΩ   |
| Diode Characteristics         |                                  |                                                                                       |          |      |      |      |
| V <sub>SD</sub> ⑤             | Diode Forward Voltage            | I <sub>SD</sub> =20A, V <sub>GS</sub> =0V                                             |          | 0.89 | 1.2  | V    |
| t <sub>rr</sub>               | Reverse Recovery Time            | I <sub>SD</sub> =20A, dI <sub>SD</sub> /dt=100A/μs                                    |          | 11   |      | ns   |
| Q <sub>rr</sub>               | Reverse Recovery Charge          |                                                                                       |          | 8    |      | nC   |
| Dynamic Characteristics ⑥     |                                  |                                                                                       |          |      |      |      |
| R <sub>G</sub>                | Gate Resistance                  | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz                                      |          | 1.7  |      | Ω    |
| C <sub>iss</sub>              | Input Capacitance                | V <sub>GS</sub> =0V, V <sub>DS</sub> =20V, Frequency=1.0MHz                           |          | 1315 |      | pF   |
| C <sub>oss</sub>              | Output Capacitance               |                                                                                       |          | 100  |      |      |
| C <sub>rss</sub>              | Reverse Transfer Capacitance     |                                                                                       |          | 80   |      |      |
| t <sub>d(ON)</sub>            | Turn-on Delay Time               | V <sub>DD</sub> =20V, I <sub>DS</sub> =20A, V <sub>GEN</sub> =10V, R <sub>G</sub> =3Ω |          | 8    |      | ns   |
| t <sub>r</sub>                | Turn-on Rise Time                |                                                                                       |          | 12   |      |      |
| t <sub>d(OFF)</sub>           | Turn-off Delay Time              |                                                                                       |          | 28   |      |      |
| t <sub>f</sub>                | Turn-off Fall Time               |                                                                                       |          | 7    |      |      |
| Gate Charge Characteristics ⑥ |                                  |                                                                                       |          |      |      |      |
| Q <sub>g</sub>                | Total Gate Charge                | V <sub>DS</sub> =20V, V <sub>GS</sub> =10V, I <sub>DS</sub> =20A                      |          | 24   |      | nC   |
| Q <sub>gs</sub>               | Gate-Source Charge               |                                                                                       |          | 4.5  |      |      |
| Q <sub>gd</sub>               | Gate-Drain Charge                |                                                                                       |          | 4.8  |      |      |

- Notes:
- ① Pulse width limited by safe operating area.
  - ② Calculated continuous current based on maximum allowable junction temperature.
  - ③ When mounted on 1 inch square copper board,  $t \leq 10\text{sec}$ . The value in any given application depends on the user's specific board design.
  - ④ Limited by  $T_{Jmax}$ ,  $I_{AS}=12A$ ,  $L=0.5\text{mH}$ ,  $V_{DD}=32V$ ,  $R_G=25\Omega$ , Starting  $T_J=25^{\circ}\text{C}$ .
  - ⑤ Pulse test; Pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .
  - ⑥ Guaranteed by design, not subject to production testing.

## Ordering and Marking Information

| Device   | Package | Packaging | Quantity | Reel Size | Tape width |
|----------|---------|-----------|----------|-----------|------------|
| KS4220DA | TO-252  | Tape&Reel | 2500     | 13"       | 16mm       |

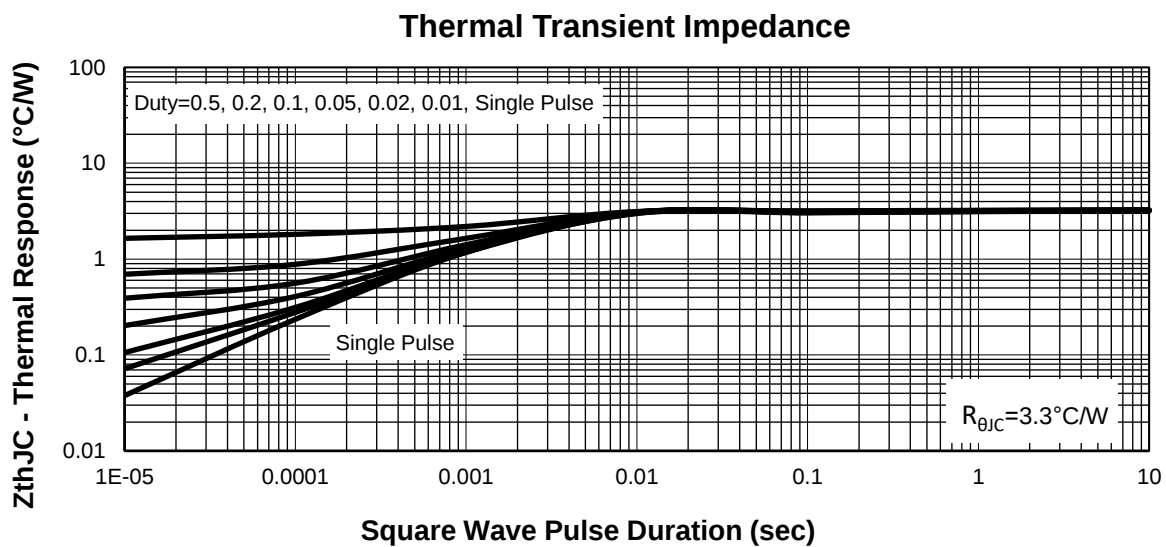
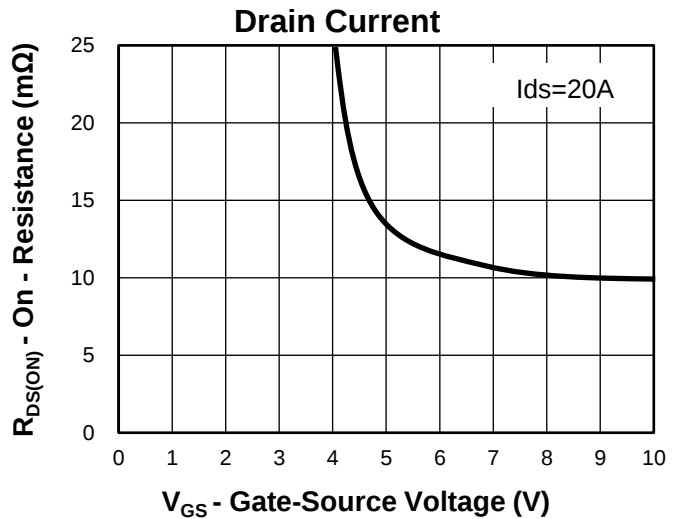
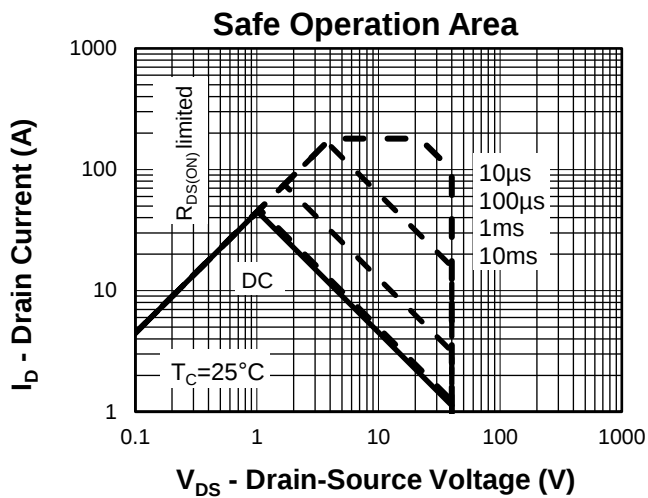
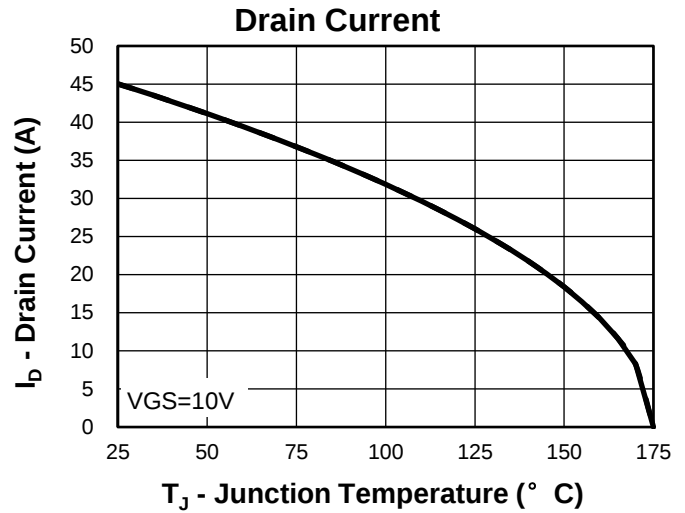
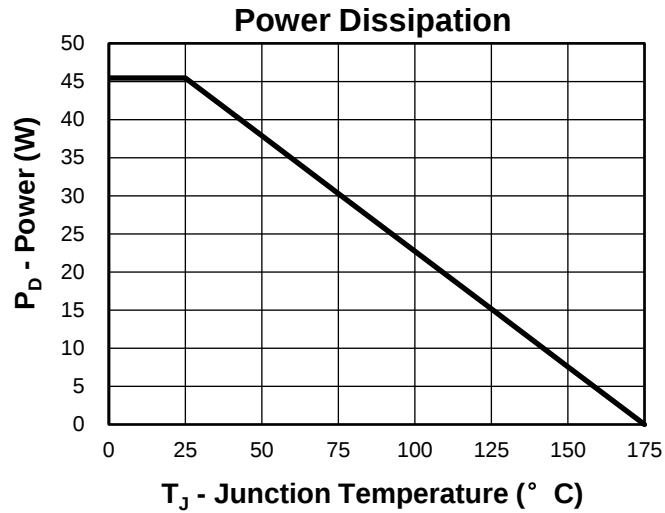


Y       =Year,2017-A,2018-B,etc.

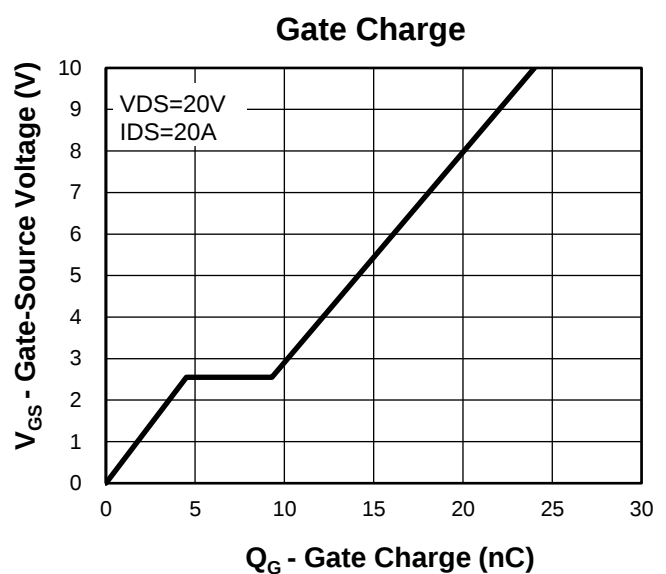
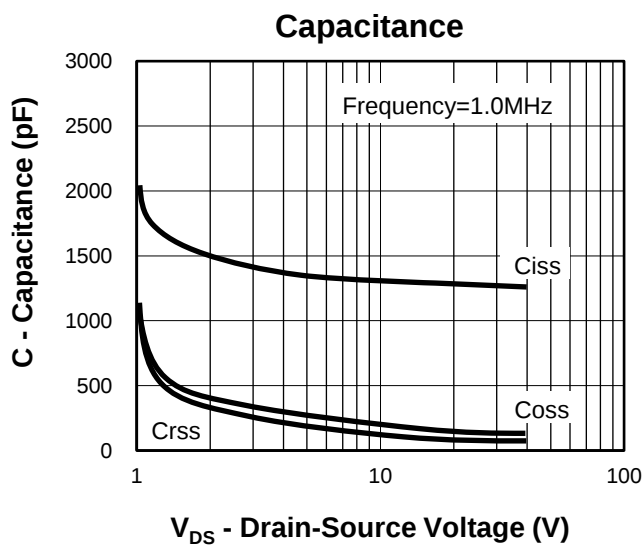
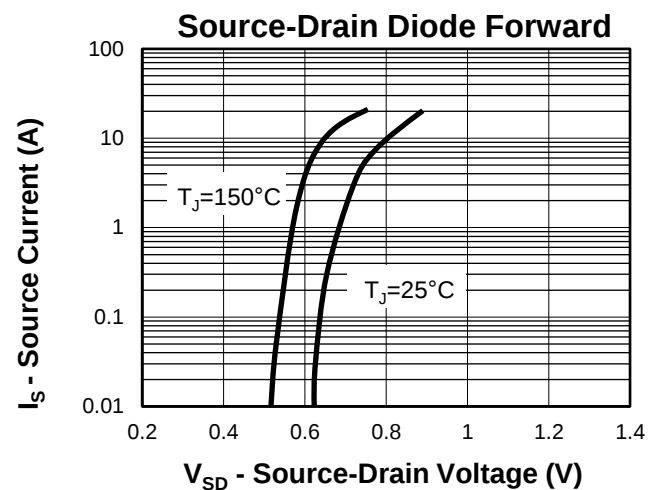
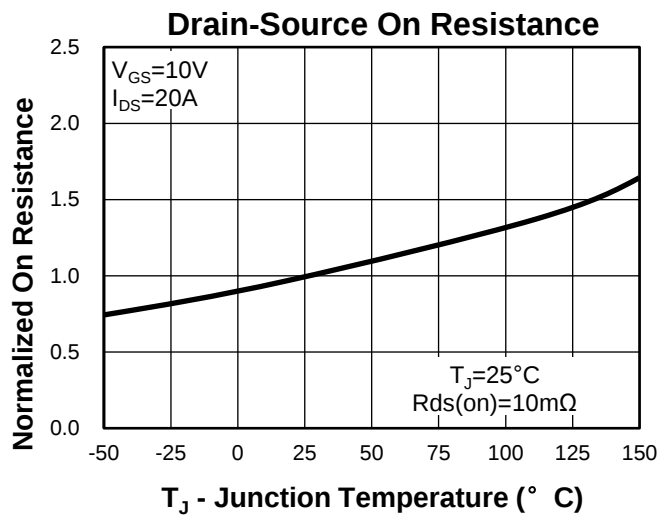
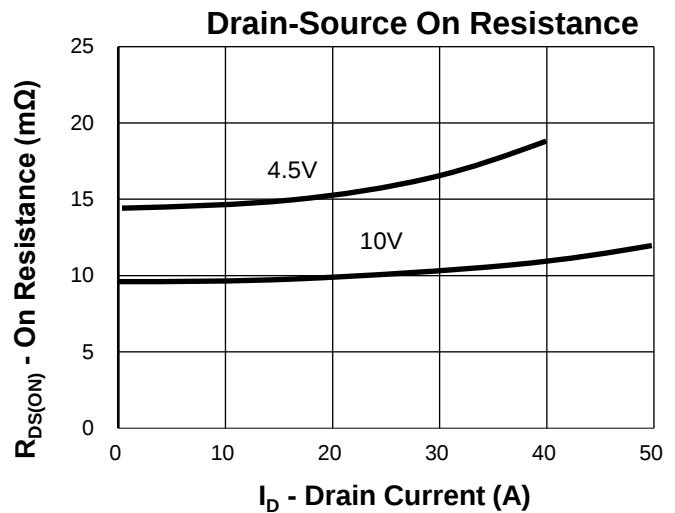
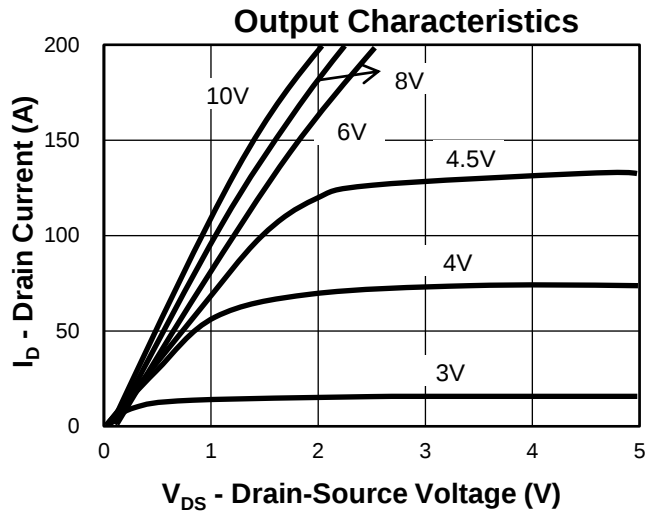
WW     =Week.

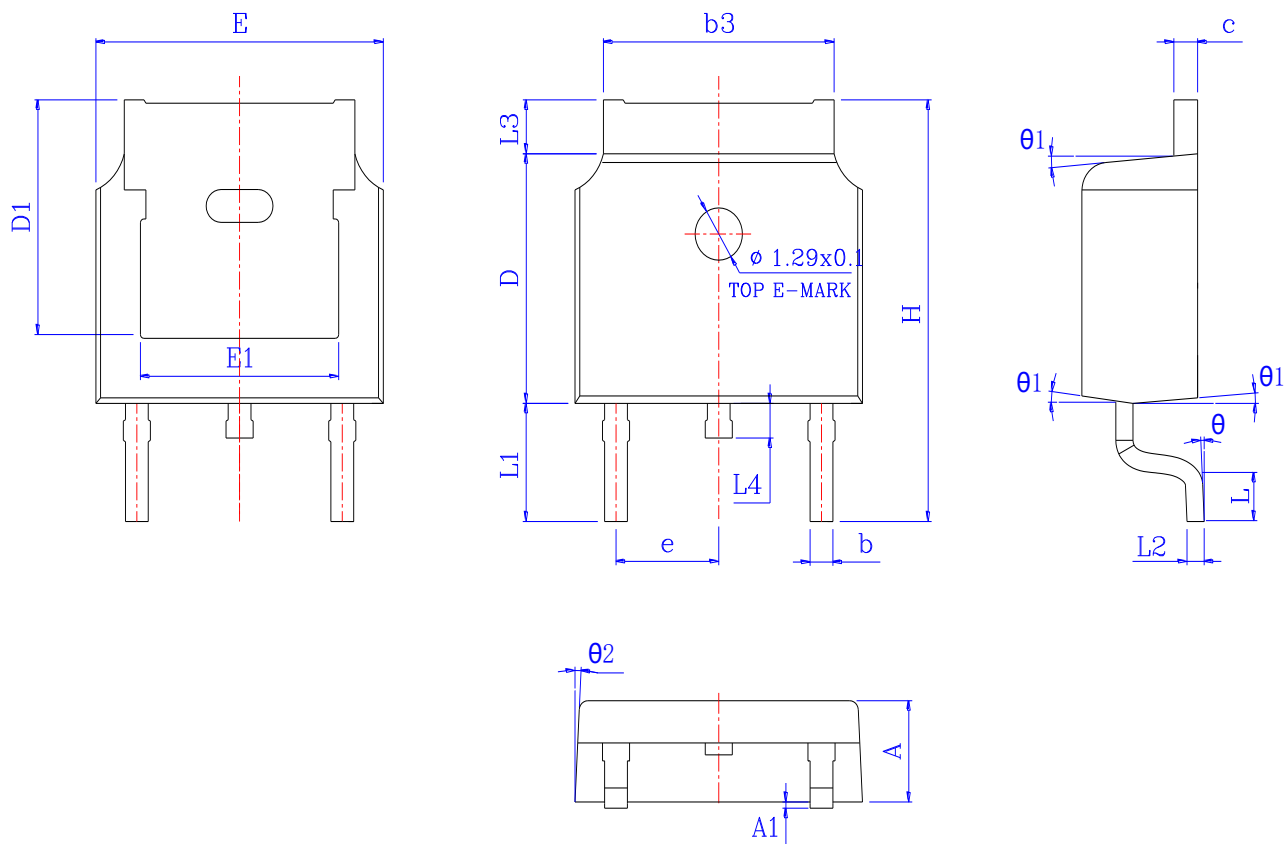
XXX    =Lot number.

## Typical Characteristics



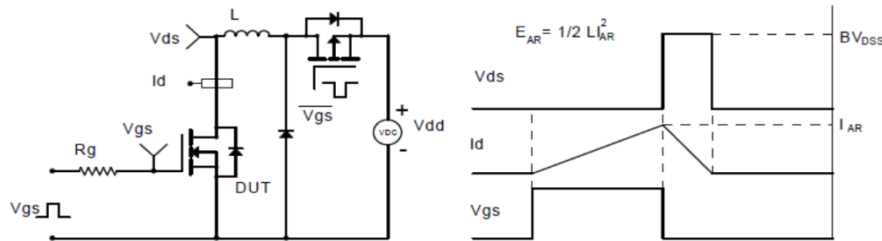
## Typical Characteristics



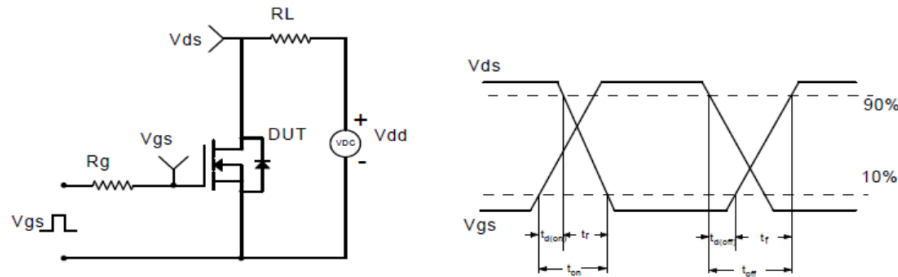
**Package Information**
**TO-252**


| SYMBOL     | MM        |        |        | INCH      |       |       |
|------------|-----------|--------|--------|-----------|-------|-------|
|            | MIN       | NOM    | MAX    | MIN       | NOM   | MAX   |
| A          | 2.200     | 2.300  | 2.400  | 0.087     | 0.091 | 0.094 |
| A1         | *         | *      | 0.100  | *         | *     | 0.004 |
| b          | 0.660     | 0.760  | 0.860  | 0.026     | 0.030 | 0.034 |
| b3         | 5.130     | 5.295  | 5.460  | 0.202     | 0.208 | 0.215 |
| c          | 0.470     | 0.535  | 0.600  | 0.019     | 0.021 | 0.024 |
| D          | 6.000     | 6.100  | 6.200  | 0.236     | 0.240 | 0.244 |
| D1         | 5.30 REF  |        |        | 0.20 REF  |       |       |
| E          | 6.500     | 6.600  | 6.700  | 0.256     | 0.260 | 0.264 |
| E1         | 4.700     | 4.810  | 4.920  | 0.185     | 0.189 | 0.194 |
| e          | 2.28 REF  |        |        | 0.09 REF  |       |       |
| H          | 9.800     | 10.100 | 10.400 | 0.386     | 0.398 | 0.409 |
| L          | 1.400     | 1.550  | 1.700  | 0.055     | 0.061 | 0.067 |
| L1         | 2.743 REF |        |        | 0.108 REF |       |       |
| L2         | 0.510 BSC |        |        | 0.020 BSC |       |       |
| L3         | 0.900     | 1.075  | 1.250  | 0.035     | 0.042 | 0.049 |
| L4         | 0.600     | 0.800  | 1.000  | 0.024     | 0.031 | 0.039 |
| $\theta$   | 0°        | *      | 8°     | 0°        | *     | 8°    |
| $\theta 1$ | 5°        | 7°     | 9°     | 5°        | 7°    | 9°    |
| $\theta 2$ | 5°        | 7°     | 9°     | 5°        | 7°    | 9°    |

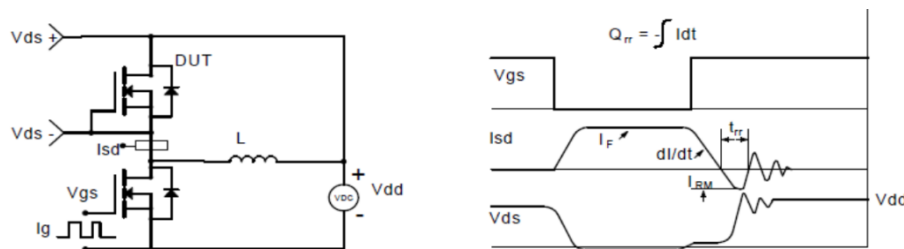
### Avalanche Test Circuit and Waveforms



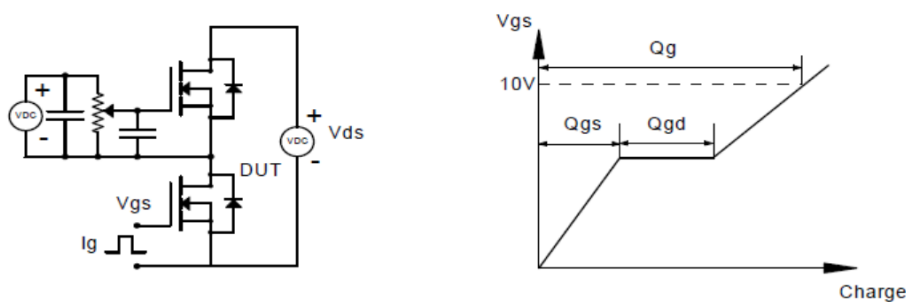
### Switching Time Test Circuit and Waveforms



### Diode Recovery Test Circuit and Waveforms



### Gate Charge Test Circuit and Waveform



### Customer Service

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