

## Features

- Very Low On-resistance  $R_{DS(ON)}$
- Low  $C_{rss}$
- Fast switching
- Improved  $dv/dt$  capability

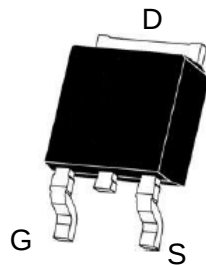
## Applications

- PWM Application
- Load Switch
- Power Management

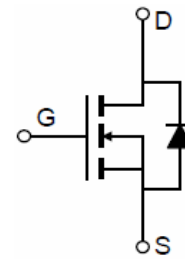


## Product Summary

|                                  |    |    |
|----------------------------------|----|----|
| $V_{DS}$                         | 20 | V  |
| $R_{DS(on), Typ @ V_{GS}=4.5 V}$ | 20 | mΩ |
| $I_D$                            | 24 | A  |



TO-252 top view



Schematic diagram

## Absolute Maximum Ratings

$T_C = 25^\circ\text{C}$  unless otherwise noted

| Symbol          | Parameter                                               | Value       | Units              |
|-----------------|---------------------------------------------------------|-------------|--------------------|
| $V_{DSS}$       | Drain-Source Voltage                                    | 20          | V                  |
| $I_D$           | Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ ) | 20          | A                  |
|                 | - Continuous ( $T_C = 70^\circ\text{C}$ )               | 16          | A                  |
| $I_{DM}$        | Drain Current - Pulsed (Note 1)                         | 60          | A                  |
| $V_{GSS}$       | Gate-Source Voltage                                     | $\pm 10$    | V                  |
| $P_D$           | Power Dissipation ( $T_C = 25^\circ\text{C}$ )          | 27          | W                  |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case                    | 4.6         | $^\circ\text{C/W}$ |
| $T_J, T_{STG}$  | Operating and Storage Temperature Range                 | -55 to +150 | $^\circ\text{C}$   |

## Electrical Characteristics

 $T_C = 25^\circ\text{C}$  unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

### Off Characteristics

|            |                                    |                                                     |    |    |      |               |
|------------|------------------------------------|-----------------------------------------------------|----|----|------|---------------|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage     | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 20 | -- | --   | V             |
| $I_{DSS}$  | Zero Gate Voltage Drain Current    | $V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$         | -- | -- | 1    | $\mu\text{A}$ |
|            |                                    | $V_{DS} = 1\text{ V}, T_C = 125^\circ\text{C}$      | -- | -- | 10   | $\mu\text{A}$ |
| $I_{GSSF}$ | Gate-Body Leakage Current, Forward | $V_{GS} = 10\text{ V}, V_{DS} = 0\text{ V}$         | -- | -- | 100  | nA            |
| $I_{GSSR}$ | Gate-Body Leakage Current, Reverse | $V_{GS} = -10\text{ V}, V_{DS} = 0\text{ V}$        | -- | -- | -100 | nA            |

### On Characteristics

|              |                                   |                                                 |     |    |     |                  |
|--------------|-----------------------------------|-------------------------------------------------|-----|----|-----|------------------|
| $V_{GS(th)}$ | Gate Threshold Voltage            | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | 0.4 | -  | 1.0 | V                |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = 4.5\text{ V}, I_D = 8\text{ A}$       | --  | 20 | 28  | $\text{m}\Omega$ |
|              |                                   | $V_{GS} = 2.5\text{ V}, I_D = 6.6\text{ A}$     | -   | 29 | 35  |                  |

### Dynamic Characteristics

|           |                              |                                                                      |    |     |   |    |
|-----------|------------------------------|----------------------------------------------------------------------|----|-----|---|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$ | -- | 259 | - | pF |
| $C_{oss}$ | Output Capacitance           |                                                                      | -- | 51  | - | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                      | -- | 47  | - | pF |

### Switching Characteristics

|              |                     |                                                                                                                     |    |      |    |    |
|--------------|---------------------|---------------------------------------------------------------------------------------------------------------------|----|------|----|----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{GS} = 5\text{ V}, V_{DS} = 10\text{ V}, I_D = 20\text{ A},$<br>$R_G = 6\text{ }\Omega, R_L = 2.7\text{ }\Omega$ | -- | 5.0  | -- | ns |
| $t_r$        | Turn-On Rise Time   |                                                                                                                     | -- | 36   | -- | ns |
| $t_{d(off)}$ | Turn-Off Delay Time |                                                                                                                     | -- | 15   | -- | ns |
| $t_f$        | Turn-Off Fall Time  |                                                                                                                     | -- | 5.4  | -- | ns |
| $Q_g$        | Total Gate Charge   | $V_{DS} = 10\text{ V}, I_D = 20\text{ A},$<br>$V_{GS} = 5\text{ V}$                                                 | -- | 4.2  | -- | nC |
| $Q_{gs}$     | Gate-Source Charge  |                                                                                                                     | -- | 0.62 | -- | nC |
| $Q_{gd}$     | Gate-Drain Charge   |                                                                                                                     | -- | 1.9  | -- | nC |

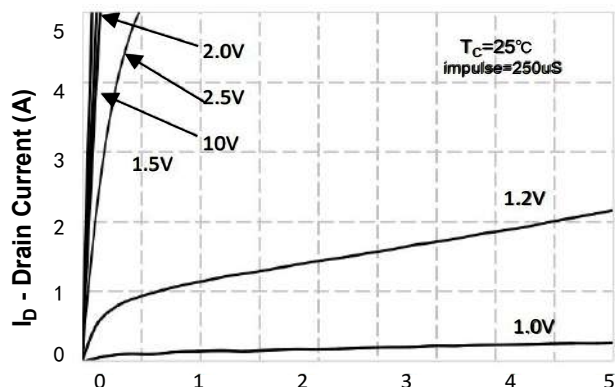
### Drain-Source Diode Characteristics and Maximum Ratings

|          |                                                                                                           |    |    |     |   |
|----------|-----------------------------------------------------------------------------------------------------------|----|----|-----|---|
| $I_S$    | Maximum Continuous Drain-Source Diode Forward Current                                                     | -- | -- | 24  | A |
| $I_{SM}$ | Maximum Pulsed Drain-Source Diode Forward Current                                                         | -- | -- | 60  | A |
| $V_{SD}$ | Drain to Source Diode Forward Voltage, $V_{GS} = 0\text{ V}, I_{SD} = 4\text{ A}, T_J = 25^\circ\text{C}$ | -- | -- | 1.2 | V |

#### Notes:

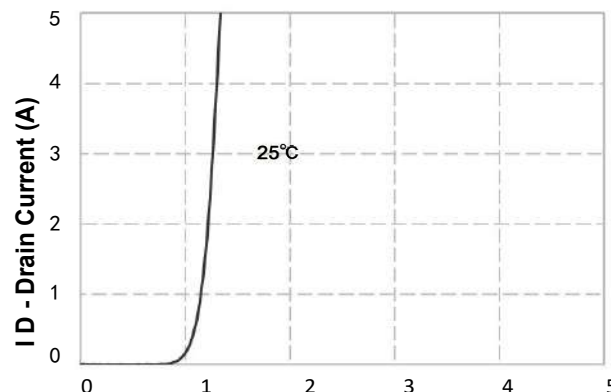
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
2. Device mounted on FR-4 PCB, 1inch x 0.85inch x 0.062 inch
3. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 0.5\%$

### N- Channel Typical Characteristics



$V_{DS}$  Drain-Source Voltage (V)

Figure 1. On-Region Characteristics



$V_{GS}$  Gate-Source Voltage (V)

Figure 2. Transfer Characteristics

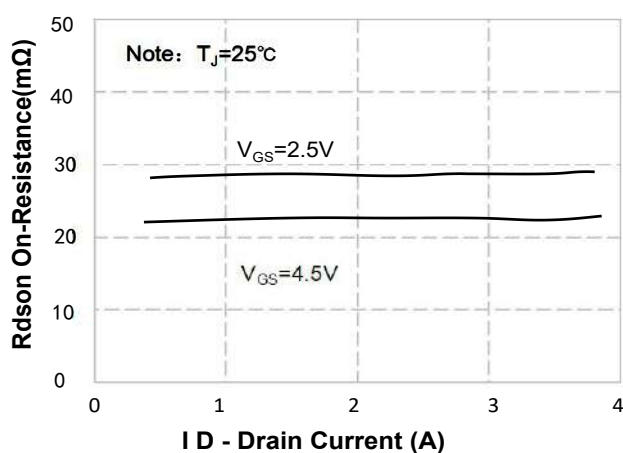


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

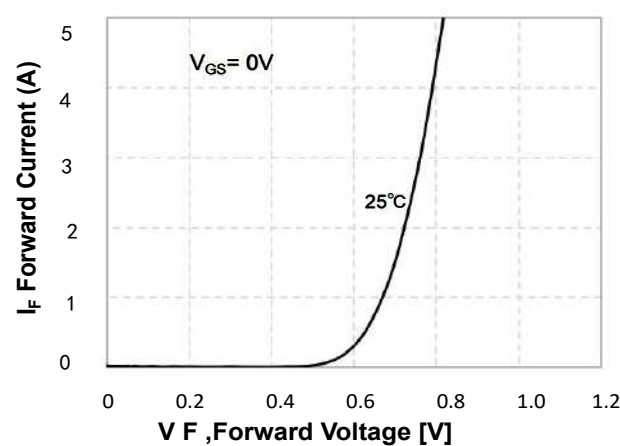


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

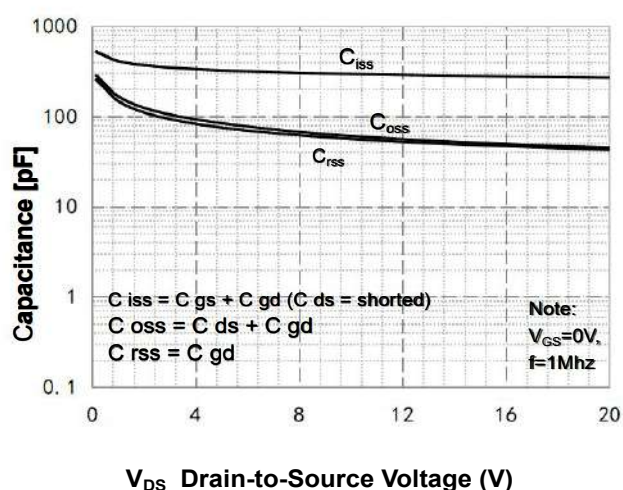


Figure 5. Capacitance Characteristics

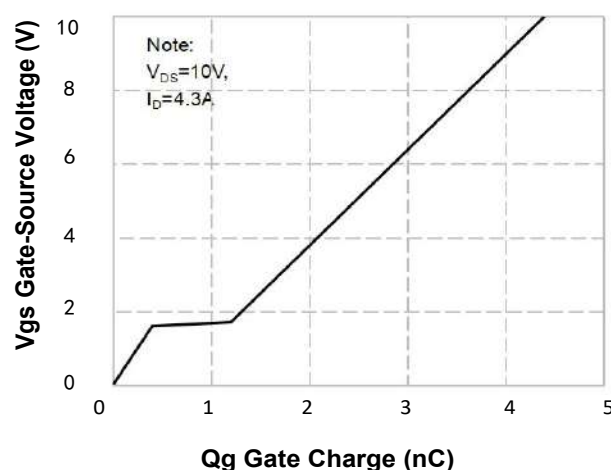
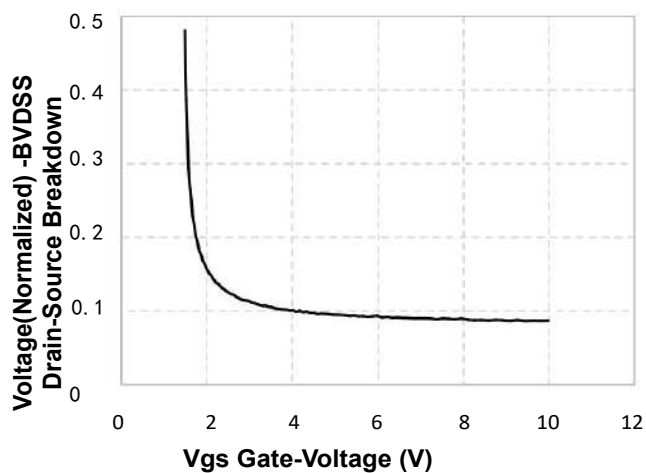
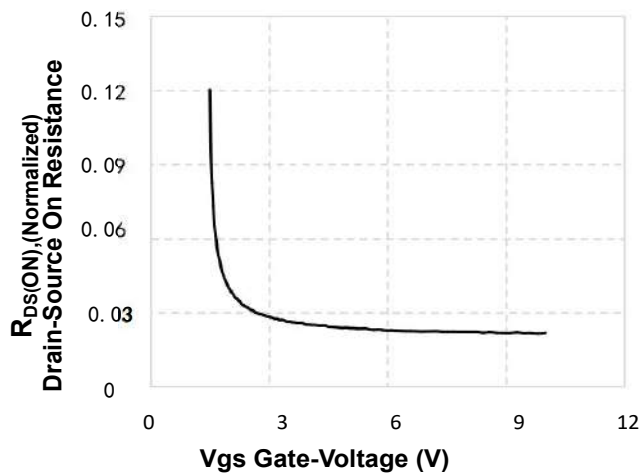


Figure 6. Gate Charge Characteristics

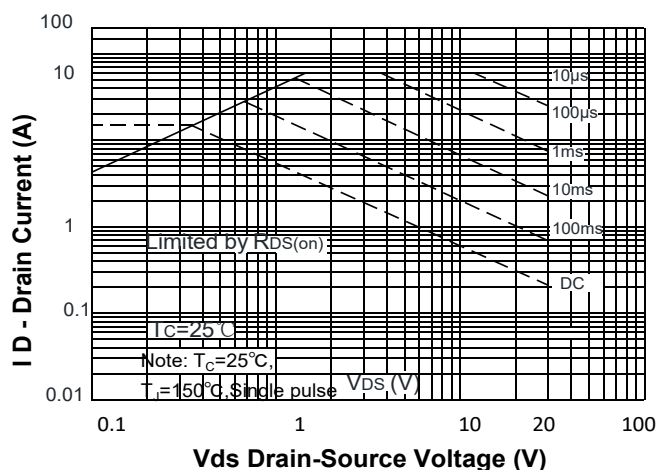
## N- Channel Typical Characteristics (Continued)



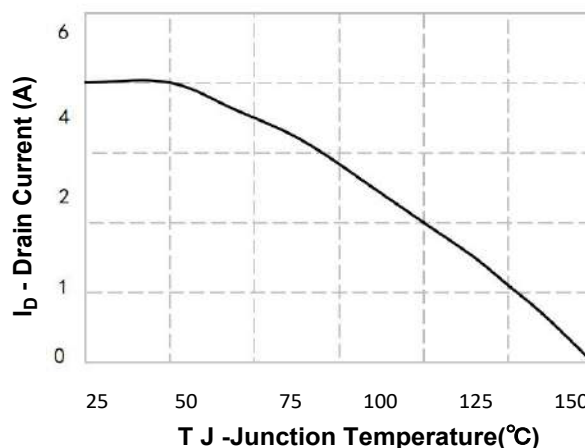
**Figure 7. Breakdown Voltage Variation vs Gate-Voltage**



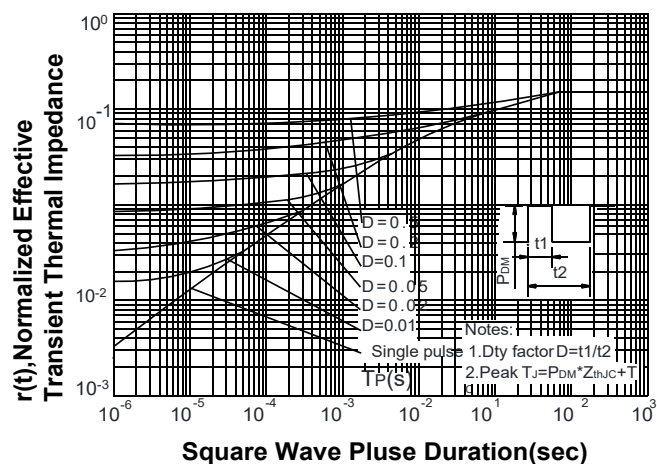
**Figure 8. On-Resistance Variation vs Gate Voltage**



**Figure 9. Maximum Safe Operating Area**

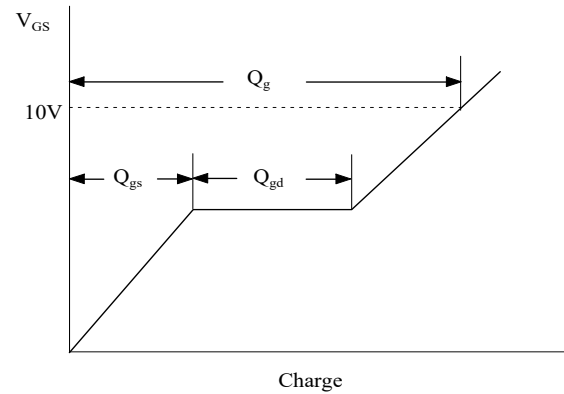
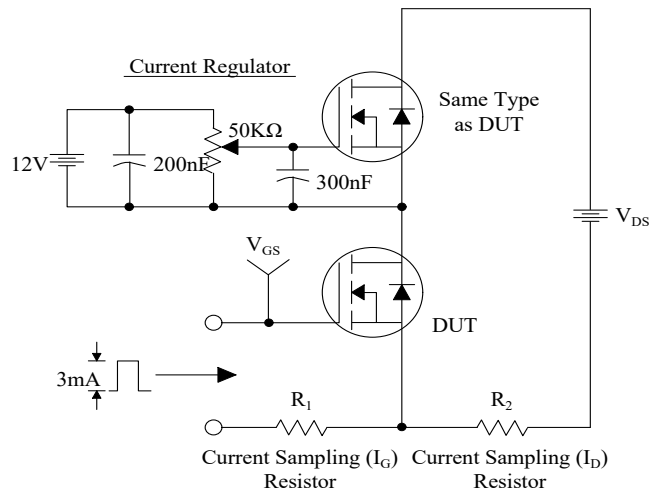


**Figure 10. Maximum PContinuous Drain Current vs Case Temperature**

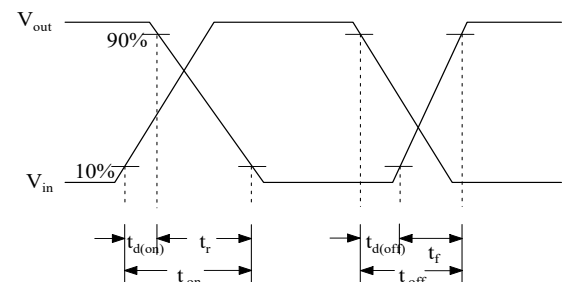
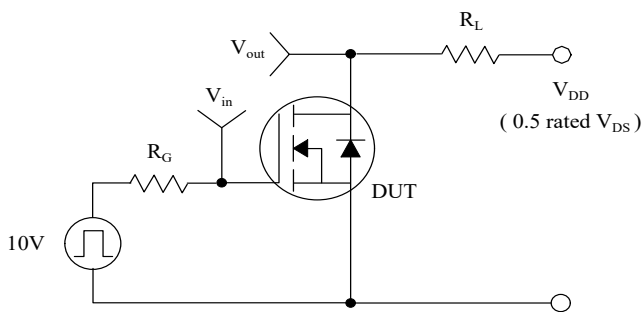


**Figure 11. Transient Thermal Response Curve**

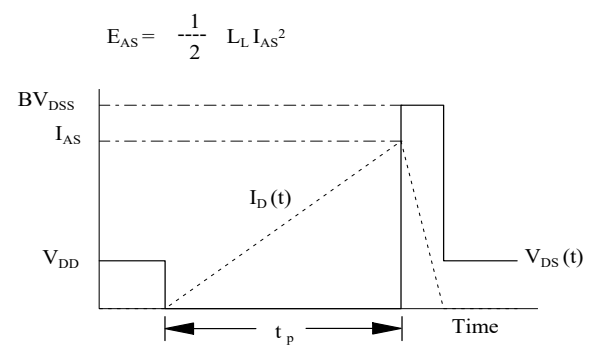
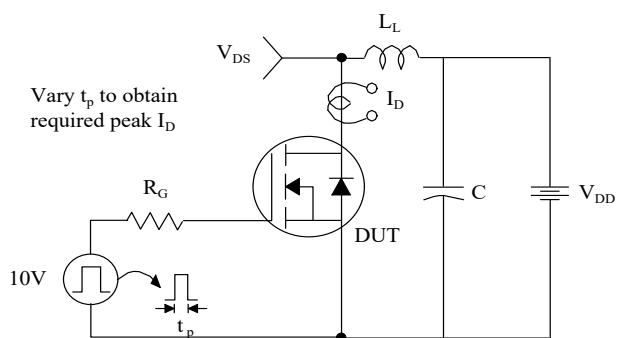
### Gate Charge Test Circuit & Waveform



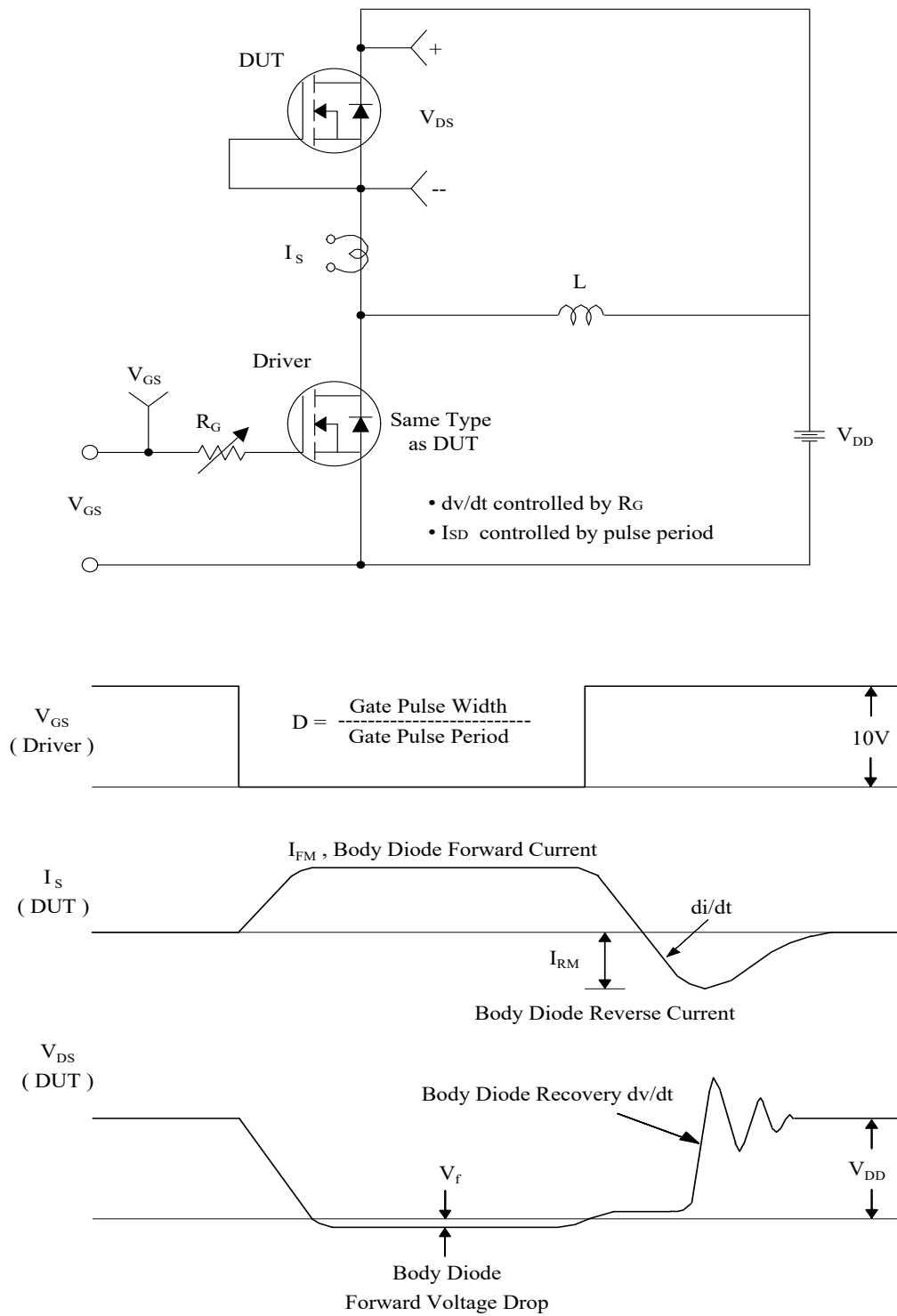
### Resistive Switching Test Circuit & Waveforms



### Unclamped Inductive Switching Test Circuit & Waveforms

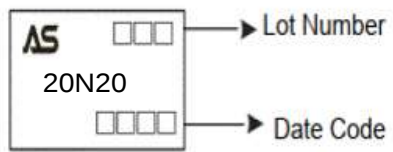


## Peak Diode Recovery dv/dt Test Circuit & Waveforms

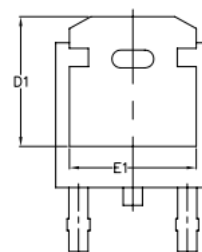
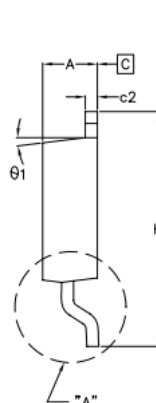
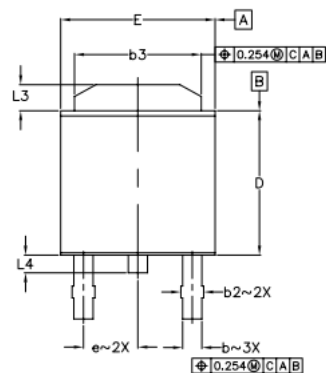


## Ordering and Marking Information

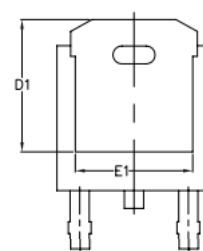
| Ordering Device No. | Marking | Package | Packing   | Quantity   |
|---------------------|---------|---------|-----------|------------|
| ASDM20N20KQ-R       | 20N20   | TO-252  | Tape&Reel | 2500/ Reel |

| PACKAGE | MARKING                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TO-252  |  <p>The diagram shows a TO-252 package with the following markings:         <ul style="list-style-type: none"> <li>Top left: <b>AS</b> logo</li> <li>Top right: <b>□□□</b> (three squares) with an arrow pointing to <b>Lot Number</b></li> <li>Middle: <b>20N20</b></li> <li>Bottom: <b>□□□□</b> (four squares) with an arrow pointing to <b>Date Code</b></li> </ul> </p> |

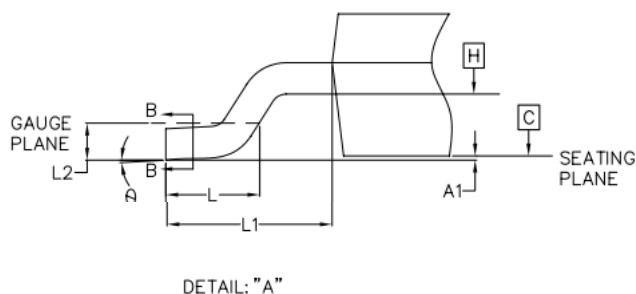
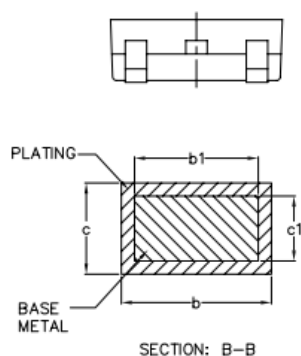
## TO-252



Option A



Option B



|    | COMMON    |        |           |       |
|----|-----------|--------|-----------|-------|
|    | MM        |        | INCH      |       |
|    | MIN.      | MAX.   | MIN.      | MAX.  |
| A  | 2.184     | 2.387  | 0.086     | 0.094 |
| A1 | —         | 0.127  | —         | 0.005 |
| b  | 0.750     | 0.890  | 0.029     | 0.035 |
| b1 | 0.750     | 0.860  | 0.029     | 0.034 |
| b2 | 0.762     | 1.143  | 0.030     | 0.045 |
| b3 | 4.953     | 5.461  | 0.195     | 0.215 |
| c  | 0.460     | 0.610  | 0.018     | 0.024 |
| c1 | 0.410     | 0.559  | 0.016     | 0.022 |
| c2 | 0.460     | 0.889  | 0.018     | 0.035 |
| D  | 5.969     | 6.223  | 0.235     | 0.245 |
| D1 | 5.207     | —      | 0.205     | —     |
| E  | 6.350     | 6.731  | 0.250     | 0.265 |
| E1 | 4.318     | —      | 0.170     | —     |
| e  | 2.290 BSC |        | 0.090 BSC |       |
| H  | 9.398     | 10.414 | 0.370     | 0.410 |
| L  | 1.397     | 1.778  | 0.055     | 0.070 |
| L1 | 2.743 BSC |        | 0.108 BSC |       |
| L2 | 0.508 BSC |        | 0.020 BSC |       |
| L3 | 0.889     | 1.270  | 0.035     | 0.050 |
| L4 | —         | 1.016  | —         | 0.040 |
| θ  | 0°        | 10°    | 0°        | 10°   |
| θ1 | 0°        | 15°    | 0°        | 15°   |

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