

# 40V 2.4mohm N-channel SGT MOSFET

## AKG4N024DM

### Description:

This N channel SGT MOSFET has been designed to low on-state resistance, low switching loss with good  $E_{AS}$  performance, especially for DC-DC and Motor driving applications.

### Features:

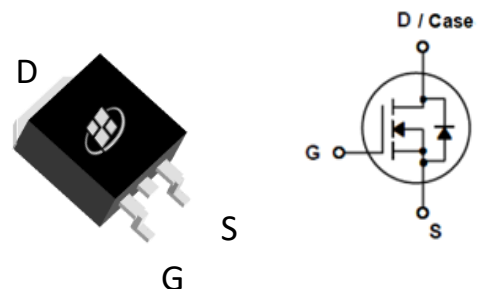
- Low FOM  $R_{DS(ON)} \times Q_G$
- Ultra-low on-resistance
- RoHS compliant (Note 1)
- Halogen-free (Note 1)
- 100% UIS Tested

### Applications:

- Battery Management System
- Motor Drivers
- DC-DC Converter

### Key Performance Parameters:

| Parameter                         | Value | Unit       |
|-----------------------------------|-------|------------|
| $V_{DS}$                          | 40    | V          |
| $R_{DS(ON)}, \max @ V_{GS} = 10V$ | 2.4   | m $\Omega$ |
| $I_D$                             | 120   | A          |



### Ordering Information:

| Ordering Code | Package Type | Marking Code | Form | Packing |
|---------------|--------------|--------------|------|---------|
| AKG4N024DM    | TO-263       | G4N024DM     | Tube | 1000PCS |

### Notes:

1. Contact ALKAIDSEMI sales for detail information

## Maximum Ratings ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

| Symbol         | Parameter                                                                   | Value       | Units            |
|----------------|-----------------------------------------------------------------------------|-------------|------------------|
| $V_{DS}$       | Drain-Source Voltage                                                        | 40          | V                |
| $I_D$          | Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ ) <sup>(Note 1)</sup> | 120         | A                |
|                | Drain Current - Continuous ( $T_C = 100^\circ\text{C}$ )                    | 120         | A                |
| $I_{DM}$       | Drain Current - Pulsed <sup>(Note 2)</sup>                                  | 440         | A                |
| $V_{GS}$       | Gate-Source Voltage                                                         | $\pm 20$    | V                |
| $E_{AS}$       | Single Pulsed Avalanche Energy <sup>(Note 3)</sup>                          | 361         | mJ               |
| $P_D$          | Power Dissipation ( $T_C = 25^\circ\text{C}$ )                              | 192         | W                |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range                                     | -55 to +150 | $^\circ\text{C}$ |

## Thermal Characteristics

| Symbol          | Parameter                                                                 | Value | Units              |
|-----------------|---------------------------------------------------------------------------|-------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case, Steady-State                        | 0.7   | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient, Steady State <sup>(Note 4)</sup> | 50    | $^\circ\text{C/W}$ |

### Notes:

1. The max drain current rating is package limited
2. Repetitive Rating: Pulse width limited by maximum junction temperature
3.  $L = 0.5\text{ mH}$ ,  $V_{DD} = 20\text{V}$ ,  $I_{AS} = 38\text{ A}$ ,  $R_G = 25\ \Omega$ , Starting  $T_J = 25\ ^\circ\text{C}$
4. Mount on minimum PCB layout

**Electrical Characteristics** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

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

**Static Characteristics**

|              |                                  |                                                     |    |     |           |               |
|--------------|----------------------------------|-----------------------------------------------------|----|-----|-----------|---------------|
| $BV_{DSS}$   | Drain-Source Breakdown Voltage   | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 40 |     |           | V             |
| $I_{DSS}$    | Zero Gate Voltage Drain Current  | $V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$         |    |     | 1         | $\mu\text{A}$ |
| $I_{GSS}$    | Gate Leakage Current             | $V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$     |    |     | $\pm 100$ | nA            |
| $V_{GS(TH)}$ | Gate Threshold voltage           | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$     | 2  | 3.2 | 4         | V             |
| $R_{DS(ON)}$ | Drain-Source on-state resistance | $V_{GS} = 10\text{ V}, I_D = 20\text{ A}$           |    | 2   | 2.4       | m $\Omega$    |

**Dynamic Characteristics**

|           |                              |                                                                    |  |      |  |          |
|-----------|------------------------------|--------------------------------------------------------------------|--|------|--|----------|
| $C_{ISS}$ | Input Capacitance            | $V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V},$<br>$F = 1\text{ MHz}$ |  | 3244 |  | pF       |
| $C_{OSS}$ | Output Capacitance           |                                                                    |  | 1077 |  | pF       |
| $C_{RSS}$ | Reverse Transfer Capacitance |                                                                    |  | 52   |  | pF       |
| $R_G$     | Gate Resistance              | $F = 1\text{ MHz}$                                                 |  | 6    |  | $\Omega$ |

**Switching Characteristics**

|              |                     |                                                                                                 |  |      |  |    |
|--------------|---------------------|-------------------------------------------------------------------------------------------------|--|------|--|----|
| $T_{D(ON)}$  | Turn On Delay Time  | $V_{DD} = 20\text{ V}, R_L = 1\text{ }\Omega,$<br>$V_{GS} = 10\text{ V}, R_G = 6\text{ }\Omega$ |  | 21.5 |  | nS |
| $T_R$        | Rise Time           |                                                                                                 |  | 44.5 |  | nS |
| $T_{D(OFF)}$ | Turn Off Delay Time |                                                                                                 |  | 67.5 |  | nS |
| $T_F$        | Fall Time           |                                                                                                 |  | 24.5 |  | nS |
| $Q_G$        | Total Gate Charge   | $V_{DD} = 20\text{ V}, I_D = 20\text{ A},$<br>$V_{GS} = 10\text{ V}$                            |  | 56.5 |  | nC |
| $Q_{GS}$     | Gate-Source Charge  |                                                                                                 |  | 19.5 |  | nC |
| $Q_{GD}$     | Gate-Drain Charge   |                                                                                                 |  | 7.9  |  | nC |

**Drain-Source Diode Characteristics and Maximum Ratings**

|                  |                                                               |                                                                    |  |      |     |    |
|------------------|---------------------------------------------------------------|--------------------------------------------------------------------|--|------|-----|----|
| I <sub>S</sub>   | Maximum Continuous Body-Diode Forward Current                 |                                                                    |  |      | 120 | A  |
| I <sub>SM</sub>  | Maximum Pulsed Body-Diode Forward Current <sup>(NOTE 1)</sup> |                                                                    |  |      | 440 | A  |
| V <sub>SD</sub>  | Diode Forward Voltage                                         | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 1 A                        |  | 0.7  | 1   | V  |
| T <sub>RR</sub>  | Reverse recovery time                                         | V <sub>DD</sub> = 20 V, I <sub>D</sub> = 15 A,<br>di/dt = 100 A/μS |  | 54.3 |     | ns |
| Q <sub>RR</sub>  | Reverse recovery charge                                       |                                                                    |  | 59.5 |     | nC |
| I <sub>RRM</sub> | Peak Reverse Recovery Current                                 |                                                                    |  | 1.8  |     | A  |

## Electrical Characteristics Diagrams

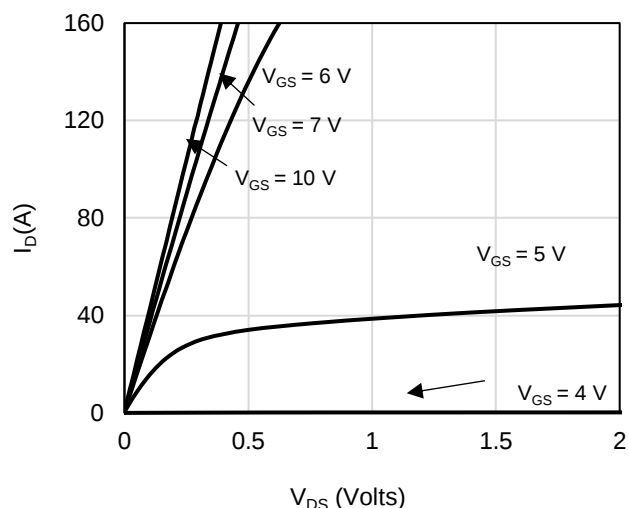


Figure 1: On-Region Characteristics

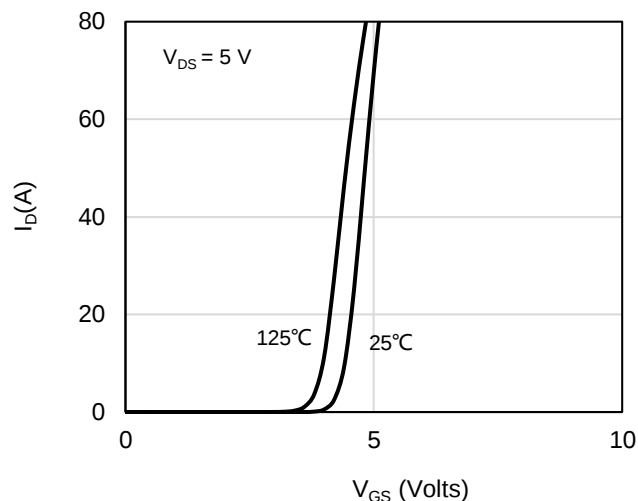


Figure 2: Transfer Characteristics

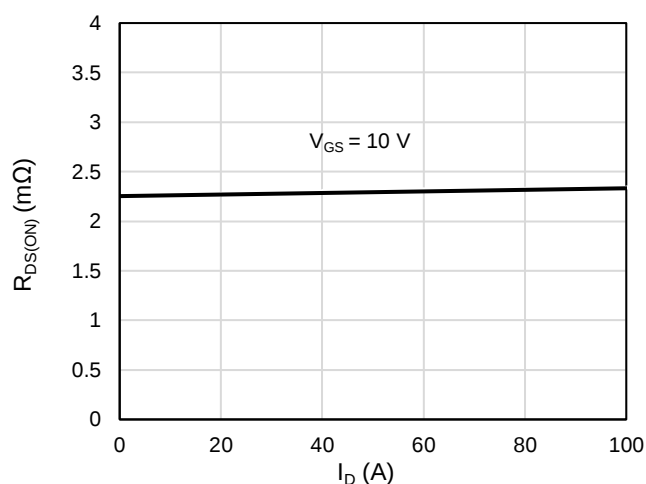


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

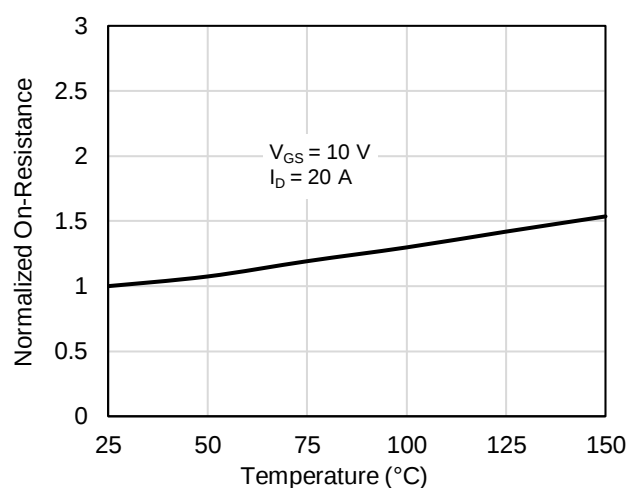


Figure 4: On-Resistance vs. Junction Temperature

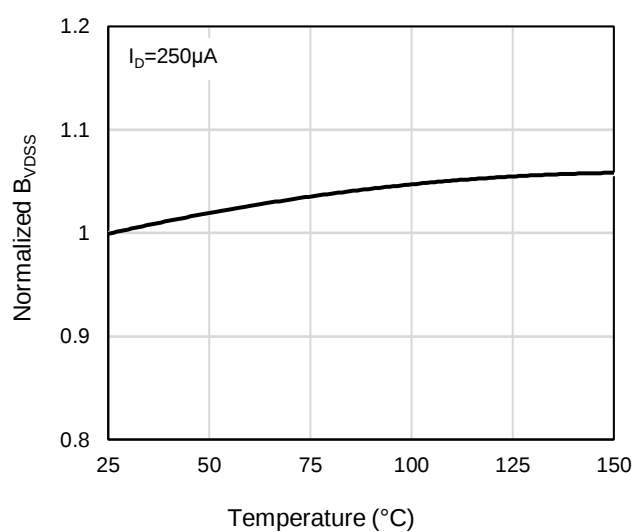


Figure 5: Breakdown Voltage vs. Junction Temperature

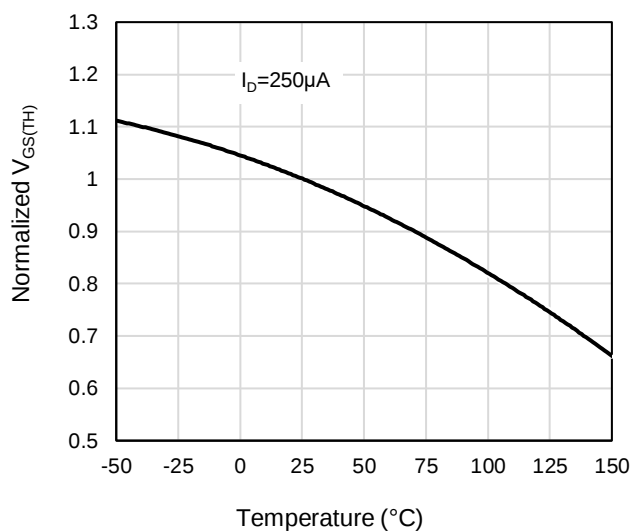


Figure 6: Threshold Voltage vs. Junction Temperature

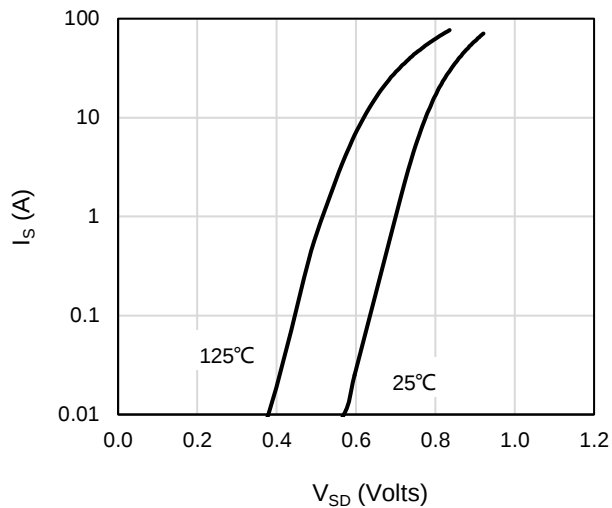


Figure 7: Body-Diode Characteristics

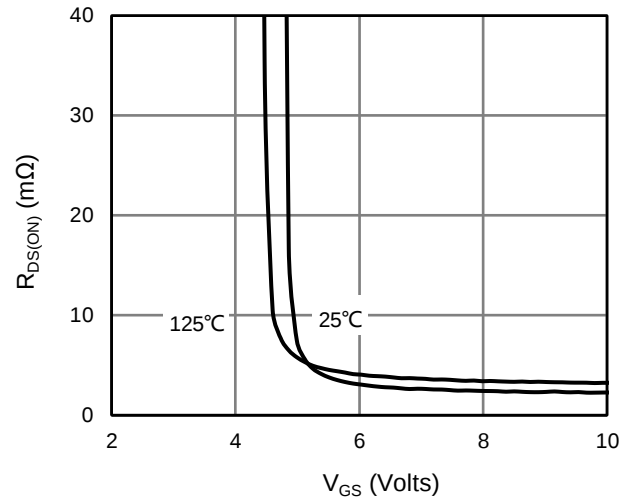


Figure 8: On-Resistance vs. Gate-Source Voltage

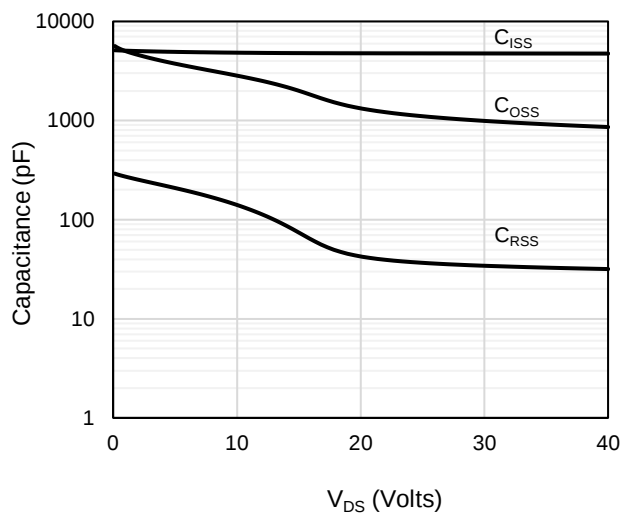


Figure 9: Capacitance Characteristics

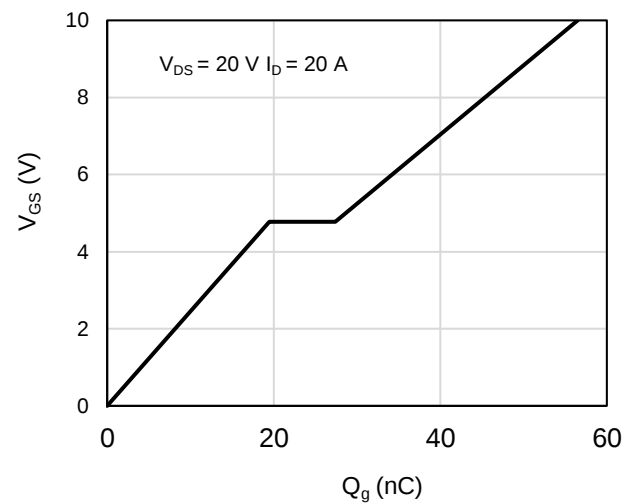


Figure 10: Gate-Charge Characteristics

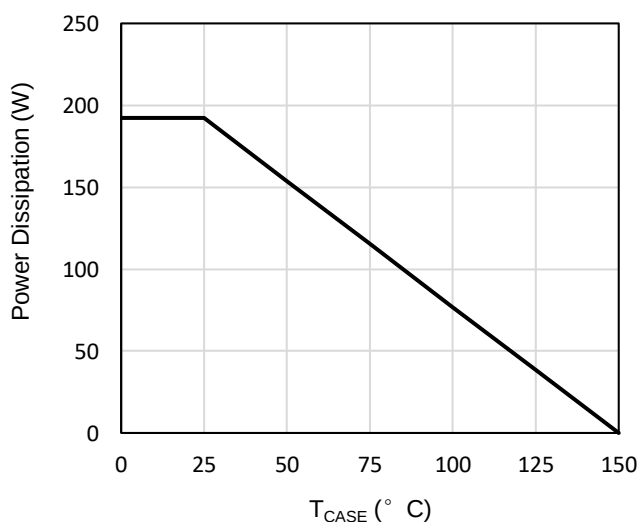


Figure 11: Power De-rating

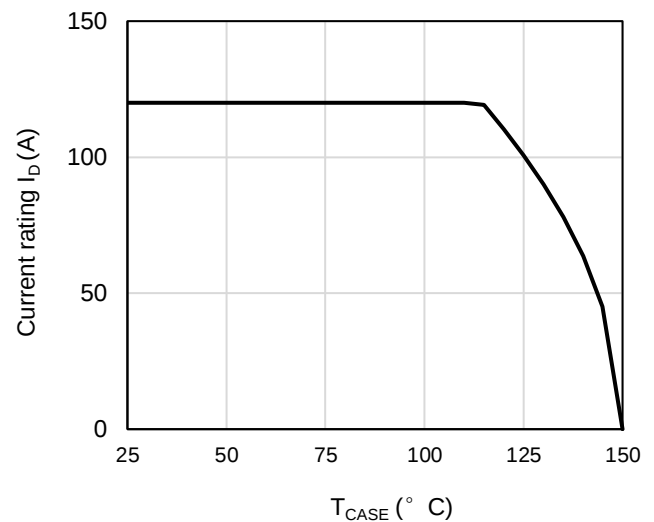
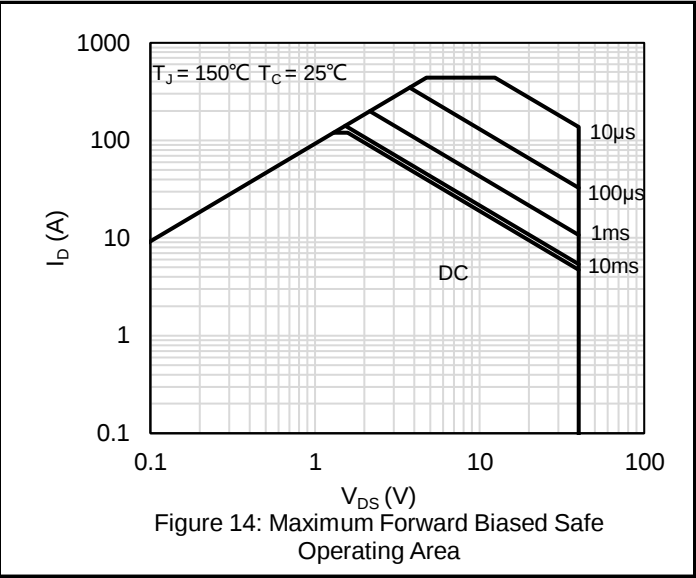
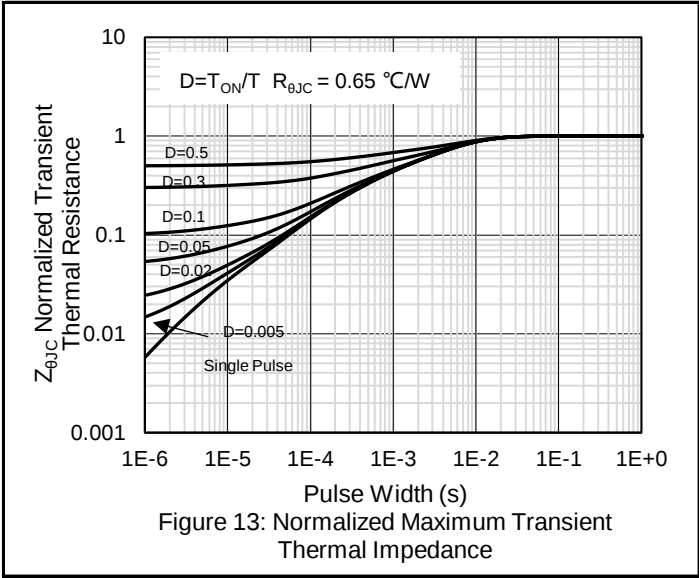
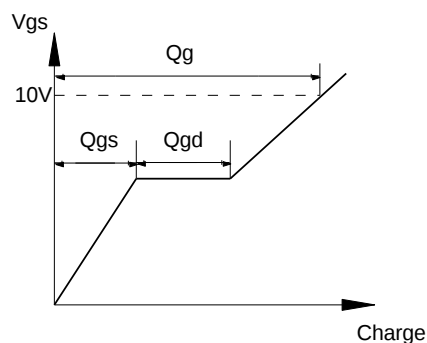
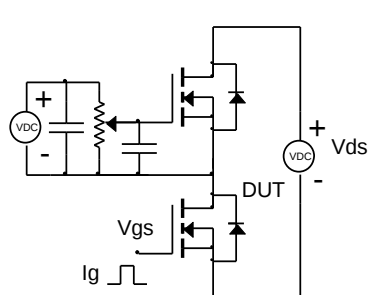


Figure 12: Current De-rating

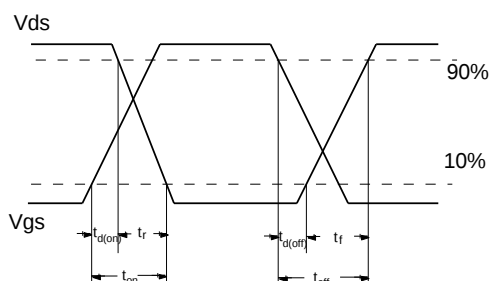
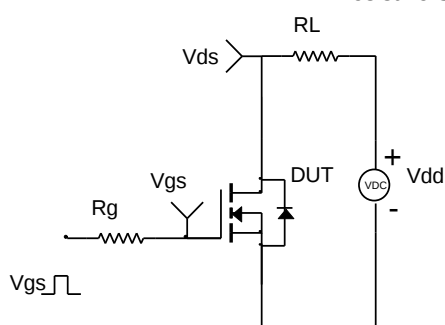


## Test Circuit and Waveform

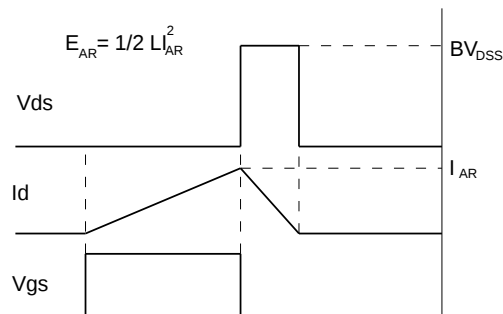
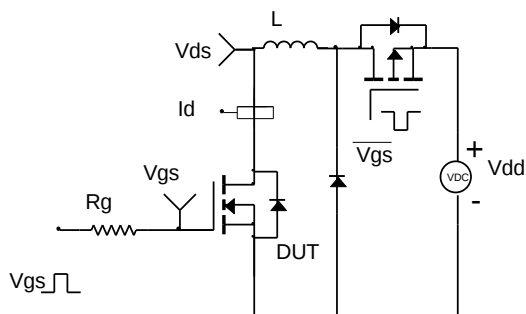
Gate Charge Test Circuit &amp; Waveform



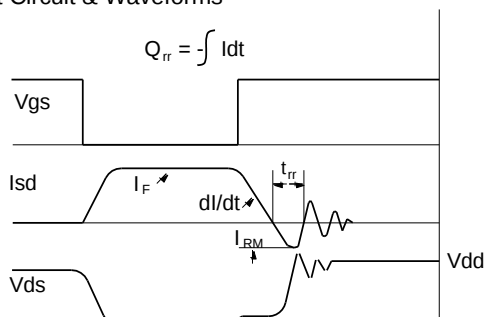
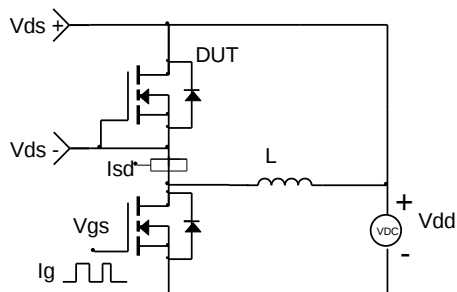
Resistive Switching Test Circuit &amp; Waveforms



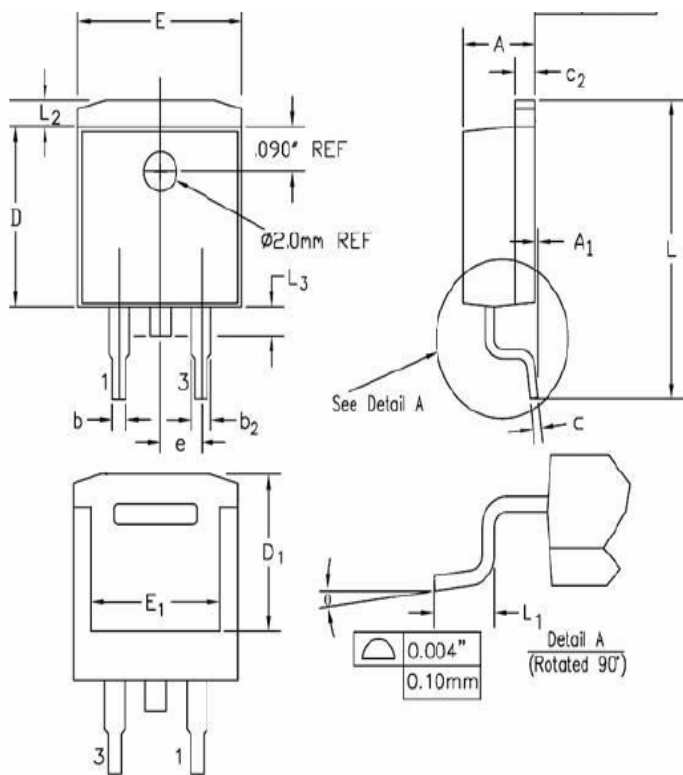
Unclamped Inductive Switching (UIS) Test Circuit &amp; Waveforms



Diode Recovery Test Circuit &amp; Waveforms



Package Outlines



| SYMBOL | INCHES     |       | MILLIMETERS |       | NOTES |
|--------|------------|-------|-------------|-------|-------|
|        | MIN        | MAX   | MIN         | MAX   |       |
| A      | 0.170      | 0.180 | 4.32        | 4.57  |       |
| A1     | -          | 0.010 | -           | 0.25  |       |
| b      | 0.028      | 0.037 | 0.71        | 0.94  |       |
| b2     | 0.045      | 0.055 | 1.15        | 1.40  |       |
| c      | 0.018      | 0.024 | 0.46        | 0.61  |       |
| c2     | 0.048      | 0.055 | 1.22        | 1.40  |       |
| D      | 0.350      | 0.370 | 8.89        | 9.40  |       |
| D1     | 0.315      | 0.324 | 8.01        | 8.23  |       |
| E      | 0.395      | 0.405 | 10.04       | 10.28 |       |
| E1     | 0.310      | 0.318 | 7.88        | 8.08  |       |
| e      | 0.100 BSC. |       | 2.54 BSC.   |       |       |
| L      | 0.580      | 0.620 | 14.73       | 15.75 |       |
| L1     | 0.090      | 0.110 | 2.29        | 2.79  |       |
| L2     | 0.045      | 0.055 | 1.15        | 1.39  |       |
| L3     | 0.050      | 0.070 | 1.27        | 1.77  |       |
| θ      | 0°         | 8°    | 0°          | 8°    |       |

## Marking Information



G4N024DM  
XXXXXXX

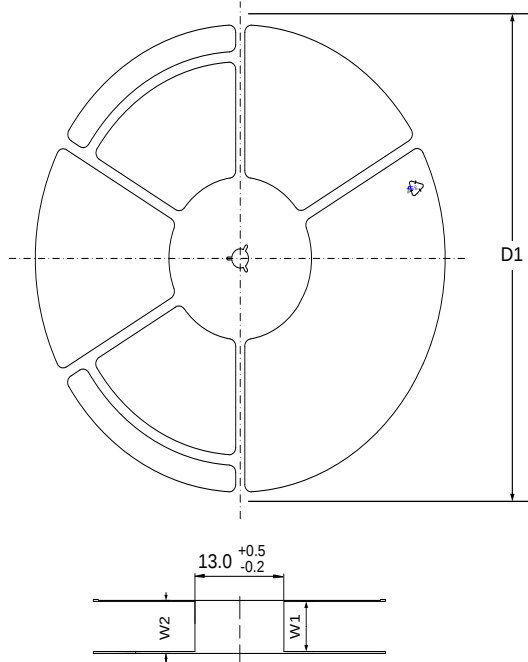
Note:

G4N024DM = Product Name Code

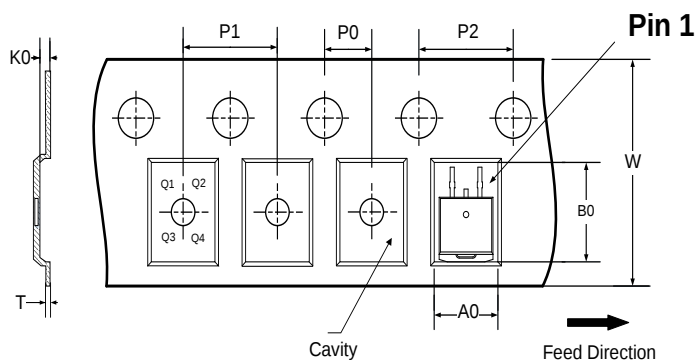
XXXXXXX = Date code

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REEL DIMENSIONS



TAPE DIMENSIONS



- A0: Dimension designed to accommodate the component width
- B0: Dimension designed to accommodate the component length
- K0: Dimension designed to accommodate the component thickness
- W: Overall width of the carrier tape
- P0: Pitch between sprocket hole
- P1: Pitch between successive cavity centers
- P2: Pitch between successive cavity centers and sprocket hole
- T: Tape material thickness
- D1: Reel Diameter
- W1: Reel Width

DIMENSIONS

(Unit: mm)

|                            | D1  | W1    | W2 |    |      |      |     |     |                | Material |
|----------------------------|-----|-------|----|----|------|------|-----|-----|----------------|----------|
| Reel                       | 330 | 25.65 | 31 |    |      |      |     |     |                | Hips     |
|                            | P0  | P1    | P2 | W  | A0   | B0   | K0  | T   | Pin 1 Quadrant | Material |
| Tape                       | 4   | 12    | 2  | 24 | 10.5 | 16.1 | 5.1 | 0.4 | Q2             | PC       |
| All dimensions are nominal |     |       |    |    |      |      |     |     |                |          |

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## Revision History

| Revision | Release Date | Remark          |
|----------|--------------|-----------------|
| Rev.1.0  | 2022/6/22    | Initial Release |

## Disclaimer

The information given in this document describes the independent performance of the product, but similar performance is not guaranteed under other working conditions, and cannot be guaranteed when installed with other products or equipment. To achieve the required performance of the product in actual scenarios, the customer should conduct a complete application test to assess the functionality of the product.

Alkaidsemi assumes no responsibility for equipment failures result from using products at values that exceed the ratings, operating conditions, or other parameters listed in the product specifications.

The product described in this specification is not applicable for aerospace or other applications which requires high reliability. Customers using or selling these products for use in medical, life-saving, or life-sustaining applications do so at their own risk and agree to fully indemnify.

Due to product or technical improvements, the information described or contained herein may be changed without prior notice.