

### Features

- 40V/40A,
- $R_{DS(ON)} = 6m\Omega(Typ.)@V_{GS}=10V$
- $R_{DS(ON)} = 8m\Omega(Typ.)@V_{GS}=4.5V$
- Uses Ruichips Advanced RUISGT™ Technology
- Low Gate Charge Minimizing Switching Loss
- Ultra Low On-Resistance
- Excellent  $Q_{gx}R_{DS(on)}$  product(FOM)
- 100% Avalanche Tested
- Lead Free and Green Devices (RoHS Compliant)

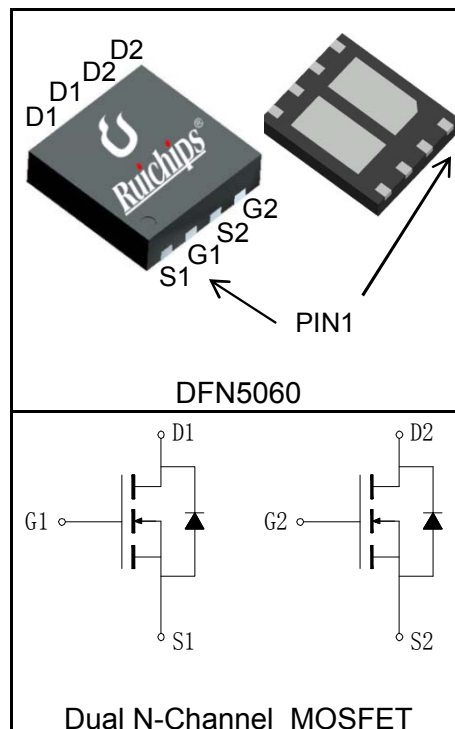
### Applications

- DC/DC Converters
- On Board Power for Server
- Synchronous Rectification



Halogen-Free

### Pin Description



### Absolute Maximum Ratings

| Symbol                                                       | Parameter                                                                   |                       | Rating     | Unit |
|--------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------|------------|------|
| Common Ratings (T <sub>C</sub> =25°C Unless Otherwise Noted) |                                                                             |                       |            |      |
| V <sub>DSS</sub>                                             | Drain-Source Voltage                                                        |                       | 40         | V    |
| V <sub>GSS</sub>                                             | Gate-Source Voltage                                                         |                       | ±20        |      |
| T <sub>J</sub>                                               | Maximum Junction Temperature                                                |                       | 150        | °C   |
| T <sub>STG</sub>                                             | Storage Temperature Range                                                   |                       | -55 to 150 | °C   |
| I <sub>S</sub>                                               | Diode Continuous Forward Current                                            | T <sub>C</sub> =25°C  | 40         | A    |
| Mounted on Large Heat Sink                                   |                                                                             |                       |            |      |
| I <sub>DP</sub> <sup>①</sup>                                 | 300μs Pulse Drain Current Tested                                            | T <sub>C</sub> =25°C  | 160        | A    |
| I <sub>D</sub> <sup>②</sup>                                  | Continuous Drain Current@T <sub>C</sub> (V <sub>GS</sub> =10V)              | T <sub>C</sub> =25°C  | 40         | A    |
|                                                              |                                                                             | T <sub>C</sub> =100°C | 25         |      |
|                                                              | Continuous Drain Current@T <sub>A</sub> (V <sub>GS</sub> =10V) <sup>③</sup> | T <sub>A</sub> =25°C  | 18         |      |
|                                                              |                                                                             | T <sub>A</sub> =70°C  | 14         |      |
| P <sub>D</sub>                                               | Maximum Power Dissipation@T <sub>C</sub>                                    | T <sub>C</sub> =25°C  | 39         | W    |
|                                                              |                                                                             | T <sub>C</sub> =100°C | 16         |      |
|                                                              | Maximum Power Dissipation@T <sub>A</sub> <sup>③</sup>                       | T <sub>A</sub> =25°C  | 4.2        |      |
|                                                              |                                                                             | T <sub>A</sub> =70°C  | 2.7        |      |

| Symbol                                | Parameter                              | Rating | Unit |
|---------------------------------------|----------------------------------------|--------|------|
| $R_{\theta JC}$                       | Thermal Resistance-Junction to Case    | 3.2    | °C/W |
| $R_{\theta JA}^{③}$                   | Thermal Resistance-Junction to Ambient | 30     | °C/W |
| <b>Drain-Source Avalanche Ratings</b> |                                        |        |      |
| $E_{AS}^{④}$                          | Avalanche Energy, Single Pulsed        | 169    | mJ   |

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

| Symbol                       | Parameter                        | Test Condition                                                                             | RUH40D40M |      |      | 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         |      | 2.5  | 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> =4.5V, I <sub>DS</sub> =20A                                                |           | 8    | 10   | mΩ   |
|                              |                                  | V <sub>GS</sub> =10V, I <sub>DS</sub> =20A                                                 |           | 6    | 8    | mΩ   |
|                              |                                  | T <sub>J</sub> =150°C                                                                      |           | 9.4  | 13   | mΩ   |
| Diode Characteristics        |                                  |                                                                                            |           |      |      |      |
| V <sub>SD</sub> ⑤            | Diode Forward Voltage            | I <sub>SD</sub> =40A, V <sub>GS</sub> =0V                                                  |           | 0.9  | 1.2  | V    |
| g <sub>fs</sub>              | Transconductance                 | V <sub>DS</sub> =5V, I <sub>DS</sub> =40A                                                  |           | 30   | 50   | S    |
| t <sub>rr</sub>              | Reverse Recovery Time            | I <sub>SD</sub> =40A, dI <sub>SD</sub> /dt=100A/μs                                         |           | 16   | 30   | ns   |
| Q <sub>rr</sub>              | Reverse Recovery Charge          |                                                                                            |           | 7    | 15   | nC   |
| Dynamic Characteristics⑥     |                                  |                                                                                            |           |      |      |      |
| R <sub>G</sub>               | Gate Resistance                  | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz                                           |           | 1    | 1.5  | Ω    |
| C <sub>iss</sub>             | Input Capacitance                | V <sub>GS</sub> =0V,<br>V <sub>DS</sub> =20V,<br>Frequency=1.0MHz                          |           | 1560 | 2000 | pF   |
| C <sub>oss</sub>             | Output Capacitance               |                                                                                            |           | 355  | 500  |      |
| C <sub>rss</sub>             | Reverse Transfer Capacitance     |                                                                                            |           | 35   | 60   |      |
| t <sub>d(ON)</sub>           | Turn-on Delay Time               | V <sub>DD</sub> =20V, I <sub>DS</sub> =40A,<br>V <sub>GEN</sub> =10V, R <sub>G</sub> =4.7Ω |           | 11   | 20   | ns   |
| t <sub>r</sub>               | Turn-on Rise Time                |                                                                                            |           | 85   | 130  |      |
| t <sub>d(OFF)</sub>          | Turn-off Delay Time              |                                                                                            |           | 21   | 40   |      |
| t <sub>f</sub>               | Turn-off Fall Time               |                                                                                            |           | 4    | 10   |      |
| Gate Charge Characteristics⑧ |                                  |                                                                                            |           |      |      |      |
| Q <sub>g</sub>               | Total Gate Charge                | V <sub>DS</sub> =32V, V <sub>GS</sub> =10V,<br>I <sub>DS</sub> =40A                        |           | 26   | 40   | nC   |
| Q <sub>gs</sub>              | Gate-Source Charge               |                                                                                            |           | 8    | 15   |      |
| Q <sub>gd</sub>              | Gate-Drain Charge                |                                                                                            |           | 3    | 10   |      |

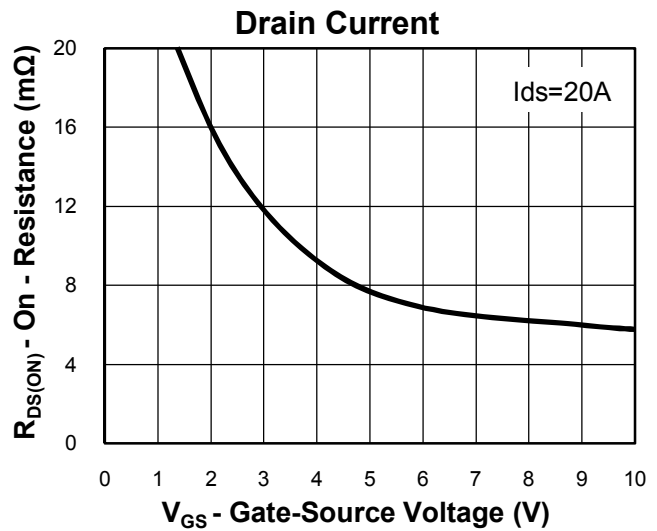
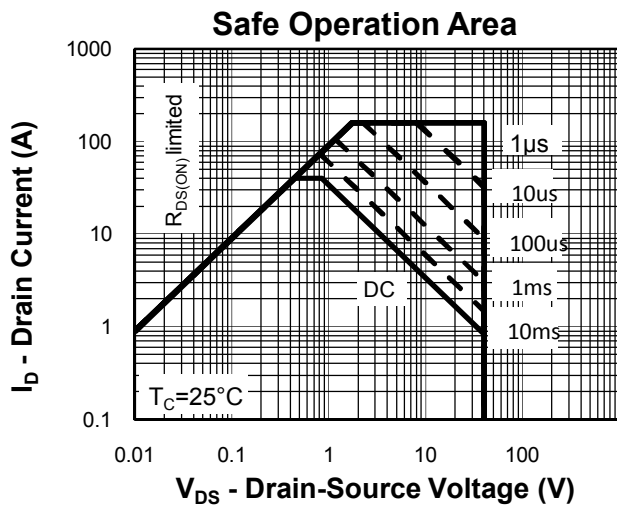
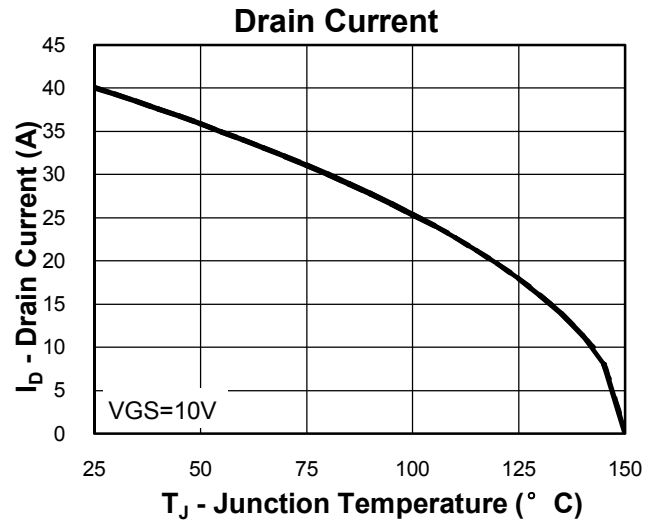
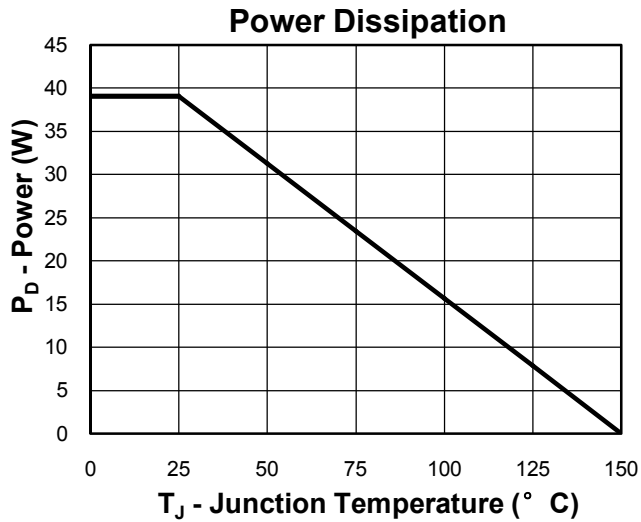
**Notes:**

- ① Max current is limited by the source bonding.
- ② Pulse width limited by safe operating area.
- ③ When mounted on 1 inch square copper board, t 10sec.
- ④ This value is based on starting TJ=25° C, L =0.5mH, RG = 50Ω, IAS = 26A, VDD =32V; 100% FT tested at L = 0.5mH, IAS = 13A.
- ⑤ Pulse test ; Pulse width300s, duty cycle2%.
- ⑥ Guaranteed by design, not subject to production testing.

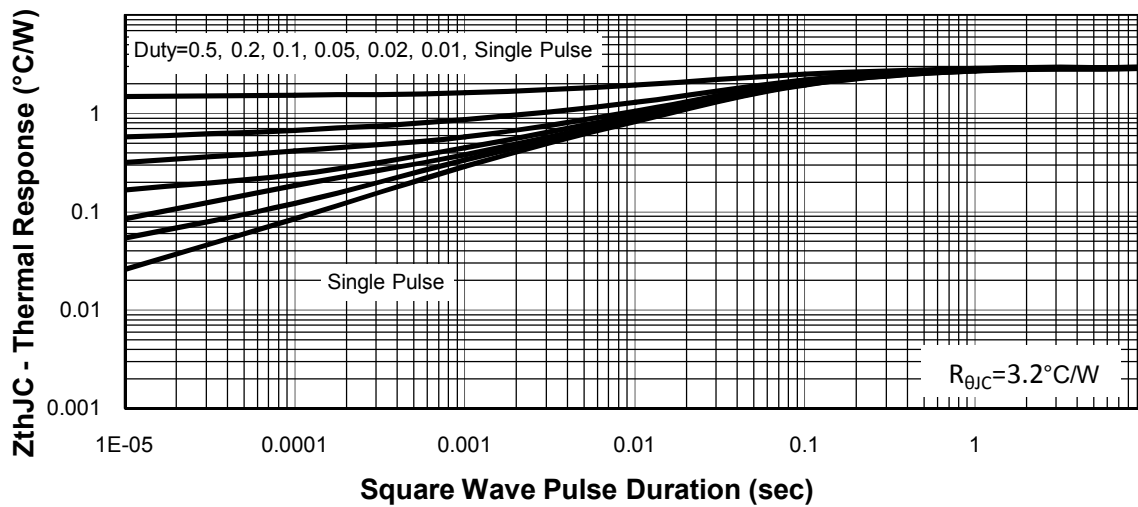
**Ordering and Marking Information**

| Device    | Marking   | Package | Packaging | Quantity | Reel Size | Tape width |
|-----------|-----------|---------|-----------|----------|-----------|------------|
| RUH40D40M | RUH40D40M | DFN5060 | Tape&Reel | 5000     | 13"       | 12mm       |

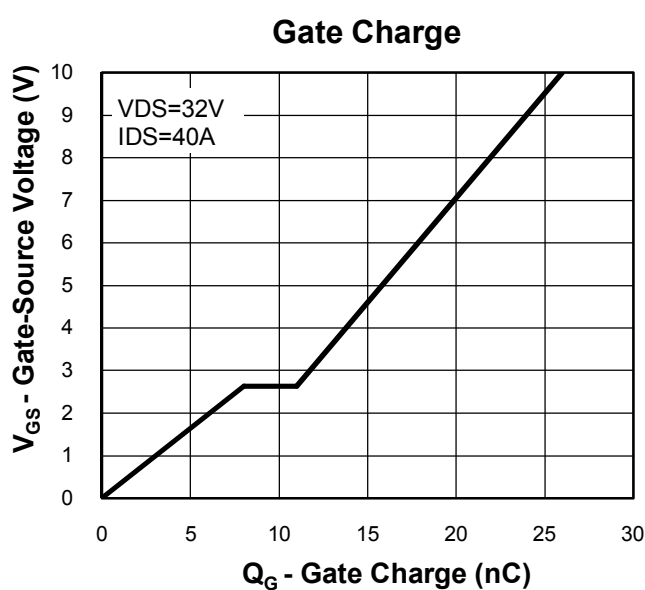
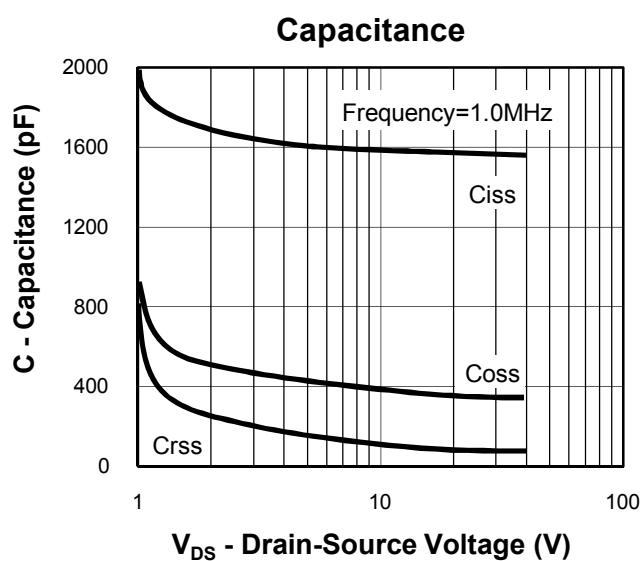
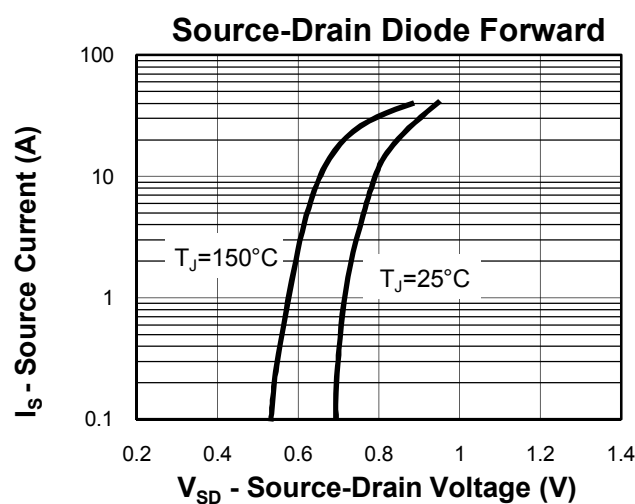
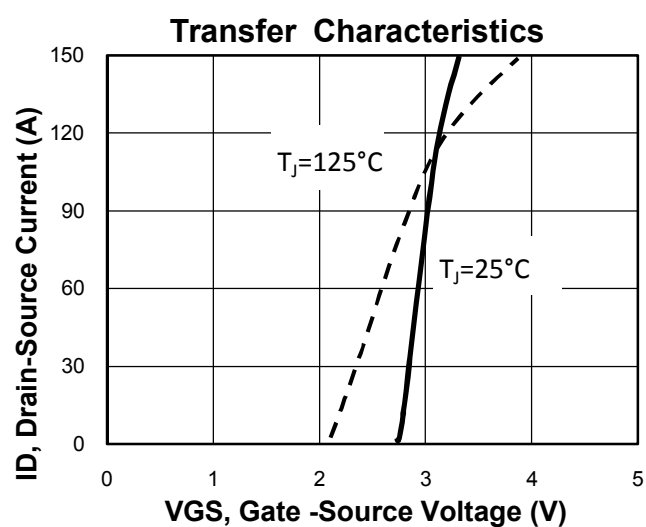
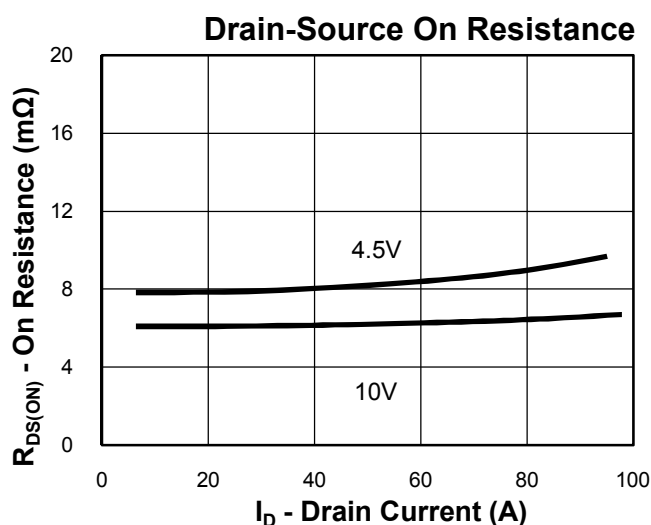
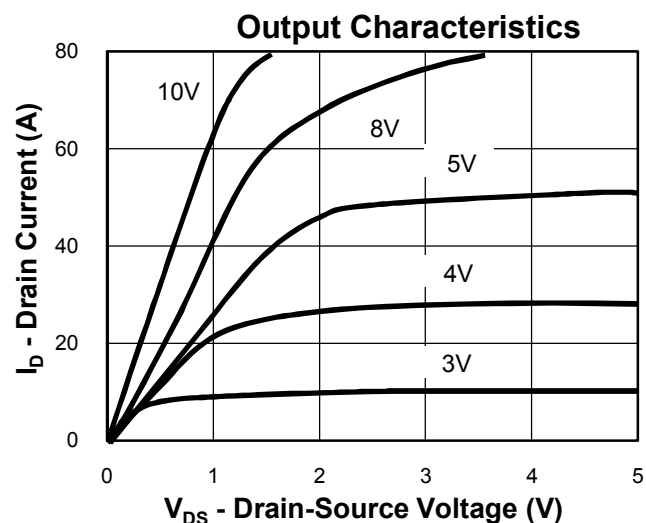
## Typical Characteristics



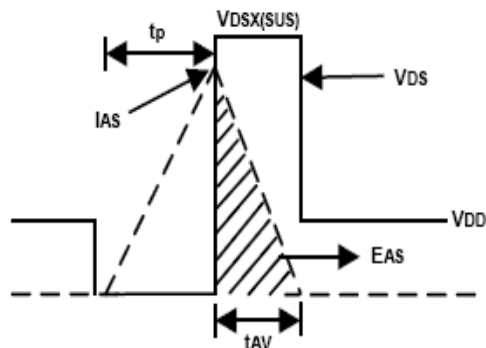
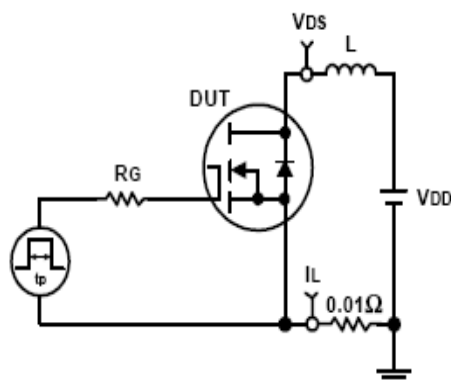
## Thermal Transient Impedance



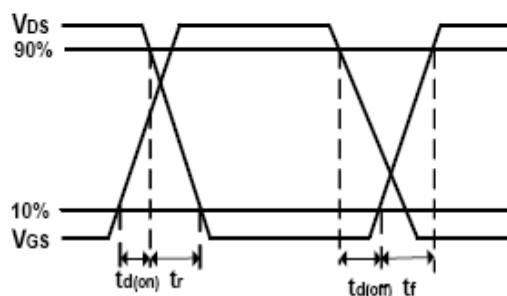
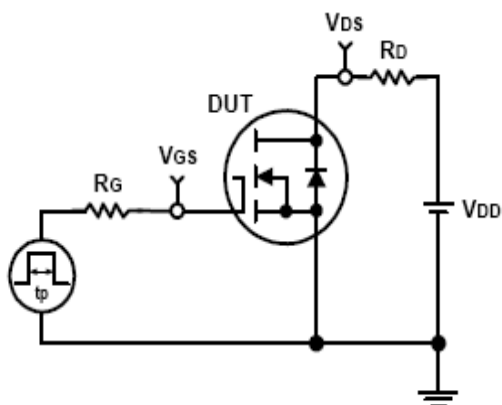
## Typical Characteristics



## Avalanche Test Circuit and Waveforms

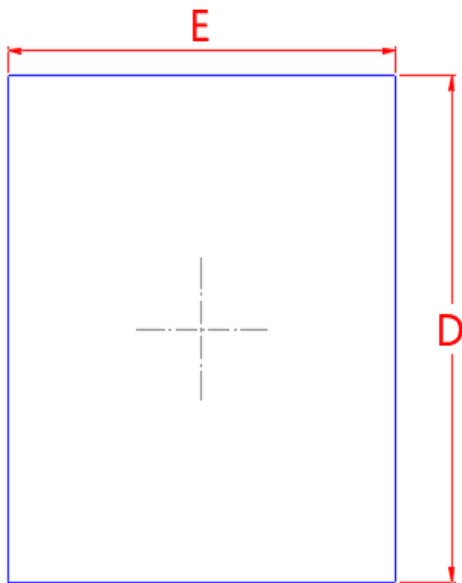


## Switching Time Test Circuit and Waveforms

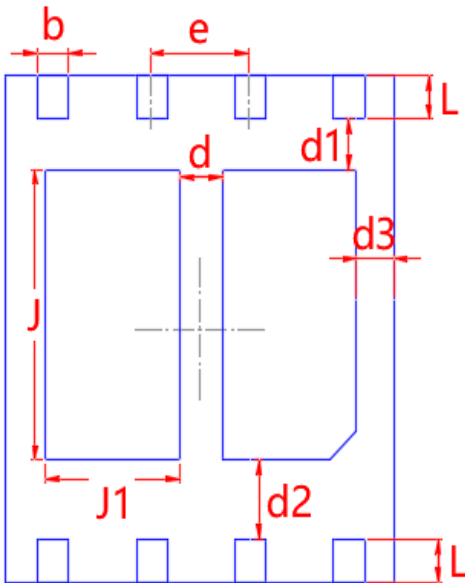


Package Information

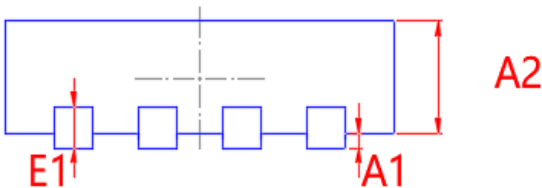
DFN5060



TOP VIEW



BOTTOM VIEW



SIDE VIEW

| SYMBOL | MM    |       |       | INCH  |       |       |
|--------|-------|-------|-------|-------|-------|-------|
|        | MIN   | NOM   | MAX   | MIN   | NOM   | MAX   |
| A1     |       |       | 0.015 | -     | -     | 0.001 |
| A2     | 0.700 | 0.750 | 0.800 | 0.028 | 0.030 | 0.031 |
| E1     | 0.185 | 0.235 | 0.285 | 0.007 | 0.009 | 0.011 |
| b      | 0.360 | 0.410 | 0.460 | 0.014 | 0.016 | 0.018 |
| e      | 1.220 | 1.270 | 1.320 | 0.048 | 0.050 | 0.052 |
| D      | 5.900 | 6.000 | 6.100 | 0.232 | 0.236 | 0.240 |
| E      | 4.900 | 5.000 | 5.100 | 0.193 | 0.197 | 0.201 |
| J      | 3.415 | 3.445 | 3.475 | 0.134 | 0.136 | 0.137 |
| J1     | 1.695 | 1.725 | 1.755 | 0.067 | 0.068 | 0.069 |
| d      | 0.510 | 0.530 | 0.550 | 0.020 | 0.021 | 0.022 |
| d1     | 0.530 | 0.560 | 0.590 | 0.021 | 0.022 | 0.023 |
| d2     | 0.910 | 0.930 | 0.950 | 0.036 | 0.037 | 0.037 |
| d3     | 0.480 | 0.510 | 0.540 | 0.019 | 0.020 | 0.021 |
| L      | 0.460 | 0.510 | 0.560 | 0.018 | 0.020 | 0.022 |