

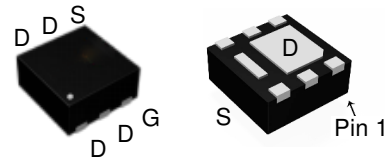
### Features

- 12V/-16A,  
 $R_{DS(ON)} = 11m\Omega(\text{typ.}) @ V_{GS} = -4.5V$   
 $R_{DS(ON)} = 17m\Omega(\text{typ.}) @ V_{GS} = -2.5V$
- Reliable and Rugged
- Lead Free and Green Devices Available  
(RoHS Compliant)

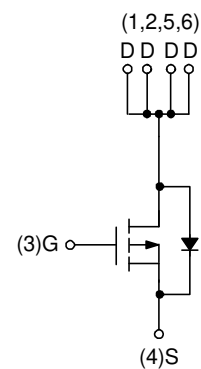
### Applications

- Power Management in Notebook Computer, Portable Equipment and Battery Powered Systems.

### Pin Description



DFN2x2-6



P-Channel MOSFET

## Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$ Unless Otherwise Noted)

| Symbol                | Parameter                                            | Rating                   | Unit               |
|-----------------------|------------------------------------------------------|--------------------------|--------------------|
| $V_{DSS}$             | Drain-Source Voltage                                 | -12                      | V                  |
| $V_{GSS}$             | Gate-Source Voltage                                  | $\pm 12$                 |                    |
| $I_D^a$               | Continuous Drain Current ( $V_{GS} = -4.5\text{V}$ ) | $T_A = 25^\circ\text{C}$ | A                  |
|                       |                                                      | $T_A = 70^\circ\text{C}$ |                    |
| $I_{DM}^a$            | Pulsed Drain Current ( $V_{GS} = -4.5\text{V}$ )     | -48                      |                    |
| $I_S^a$               | Diode Continuous Forward Current                     | -16                      |                    |
| $I_{AS}^c$            | Avalanche Current, Single pulse                      | $L = 0.1\text{mH}$       | A                  |
|                       |                                                      | $L = 0.5\text{mH}$       |                    |
| $E_{AS}^c$            | Avalanche Energy, Single pulse                       | $L = 0.1\text{mH}$       | mJ                 |
|                       |                                                      | $L = 0.5\text{mH}$       |                    |
| $T_J$                 | Maximum Junction Temperature                         | 150                      | $^\circ\text{C}$   |
| $T_{STG}$             | Storage Temperature Range                            | -55 to 150               |                    |
| $P_D^a$               | Maximum Power Dissipation                            | $T_A = 25^\circ\text{C}$ | W                  |
|                       |                                                      | $T_A = 70^\circ\text{C}$ |                    |
| $R_{\theta JA}^{a,b}$ | Thermal Resistance-Junction to Ambient               | $t \leq 10\text{s}$      | $^\circ\text{C/W}$ |
|                       |                                                      | Steady State             |                    |

Note \* : Current limited by bond wire.

Note a : Surface Mounted on  $1\text{in}^2$  pad area,  $t \leq 10\text{sec}$ .

Note b : Maximum under Steady State conditions is  $75^\circ\text{C/W}$ .

Note c : UIS tested and pulse width limited by maximum junction temperature  $150^\circ\text{C}$  (initial temperature  $T_J = 25^\circ\text{C}$ ).

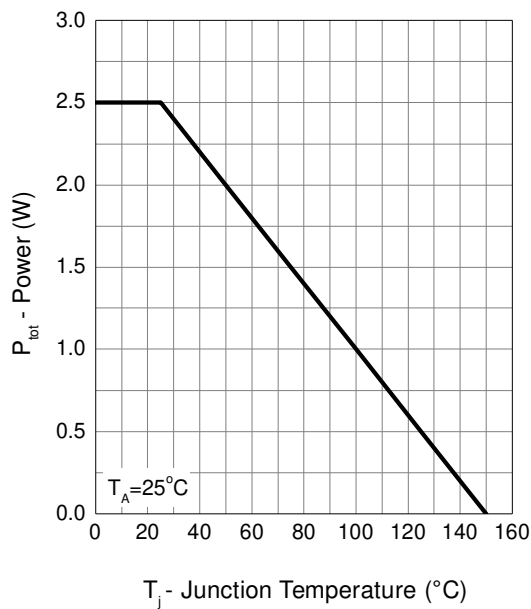
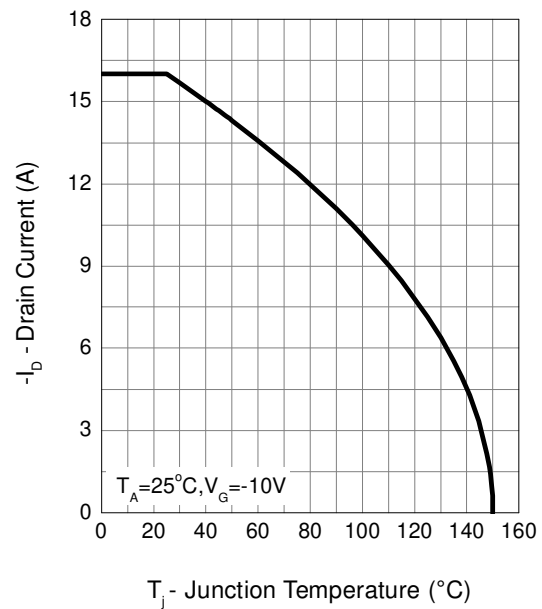
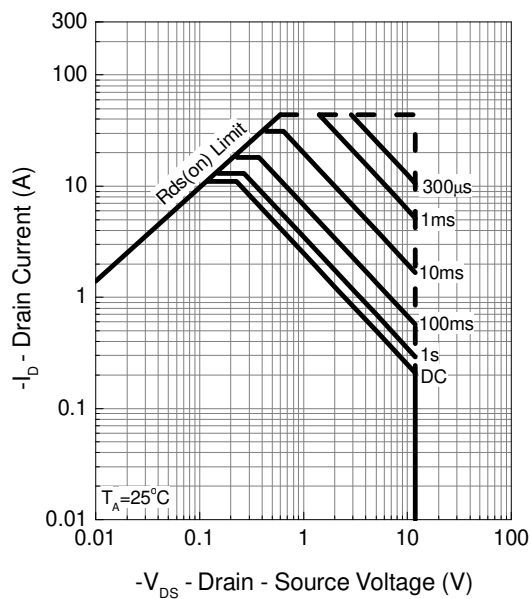
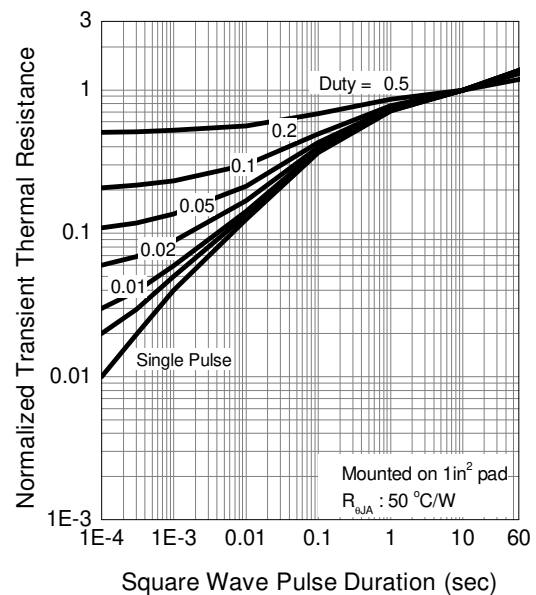
**Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  Unless Otherwise Noted)

| Symbol                                   | Parameter                        | Test Conditions                                                                                                     | Min. | Typ.  | Max. | Unit |
|------------------------------------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------|------|-------|------|------|
| Static Characteristics                   |                                  |                                                                                                                     |      |       |      |      |
| BV <sub>DSS</sub>                        | Drain-Source Breakdown Voltage   | V <sub>GS</sub> =0V, I <sub>DS</sub> =-250μA                                                                        | -12  | -     | -    | V    |
| I <sub>DSS</sub>                         | Zero Gate Voltage Drain Current  | V <sub>DS</sub> =-9.6V, V <sub>GS</sub> =0V                                                                         | -    | -     | -1   | μA   |
|                                          |                                  | T <sub>J</sub> =85°C                                                                                                | -    | -     | -30  |      |
| V <sub>GS(th)</sub>                      | Gate Threshold Voltage           | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =-250μA                                                          | -0.4 | -0.75 | -0.9 | V    |
| I <sub>GSS</sub>                         | Gate Leakage Current             | V <sub>GS</sub> =±8V, V <sub>DS</sub> =0V                                                                           | -    | -     | ±100 | nA   |
| R <sub>DS(ON)</sub> <sup>d</sup>         | Drain-Source On-state Resistance | V <sub>GS</sub> =-4.5V, I <sub>DS</sub> =-11A                                                                       | -    | 11    | 15   | mΩ   |
|                                          |                                  | V <sub>GS</sub> =-2.5V, I <sub>DS</sub> =-7A                                                                        | -    | 17    | 23   |      |
| Diode Characteristics                    |                                  |                                                                                                                     |      |       |      |      |
| V <sub>SD</sub> <sup>d</sup>             | Diode Forward Voltage            | I <sub>SD</sub> =-1A, V <sub>GS</sub> =0V                                                                           | -    | -0.7  | -1   | V    |
| t <sub>rr</sub> <sup>e</sup>             | Reverse Recovery Time            | I <sub>F</sub> =-11A, dI <sub>SD</sub> /dt=100A/μs                                                                  | -    | 35    | -    | ns   |
| Q <sub>rr</sub> <sup>e</sup>             | Reverse Recovery Charge          |                                                                                                                     | -    | 19    | -    | nC   |
| Dynamic Characteristics <sup>e</sup>     |                                  |                                                                                                                     |      |       |      |      |
| 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,<br>V <sub>DS</sub> =-6V,<br>Frequency=1.0MHz                                                   | -    | 2100  | -    | pF   |
| C <sub>oss</sub>                         | Output Capacitance               |                                                                                                                     | -    | 612   | -    |      |
| C <sub>rss</sub>                         | Reverse Transfer Capacitance     |                                                                                                                     | -    | 500   | -    |      |
| t <sub>d(ON)</sub>                       | Turn-on Delay Time               | V <sub>DD</sub> =-10V, R <sub>L</sub> =10Ω,<br>I <sub>DS</sub> =-1A, V <sub>GEN</sub> =-4.5V,<br>R <sub>G</sub> =6Ω | -    | 12    | -    | ns   |
| t <sub>r</sub>                           | Turn-on Rise Time                |                                                                                                                     | -    | 14    | -    |      |
| t <sub>d(OFF)</sub>                      | Turn-off Delay Time              |                                                                                                                     | -    | 80    | -    |      |
| t <sub>f</sub>                           | Turn-off Fall Time               |                                                                                                                     | -    | 50    | -    |      |
| Gate Charge Characteristics <sup>e</sup> |                                  |                                                                                                                     |      |       |      |      |
| Q <sub>g</sub>                           | Total Gate Charge                | V <sub>DS</sub> =-6V, V <sub>GS</sub> =-4.5V,<br>I <sub>DS</sub> =-11A                                              | -    | 25    | -    | nC   |
| Q <sub>gs</sub>                          | Gate-Source Charge               |                                                                                                                     | -    | 2.8   | -    |      |
| Q <sub>gd</sub>                          | Gate-Drain Charge                |                                                                                                                     | -    | 8     | -    |      |

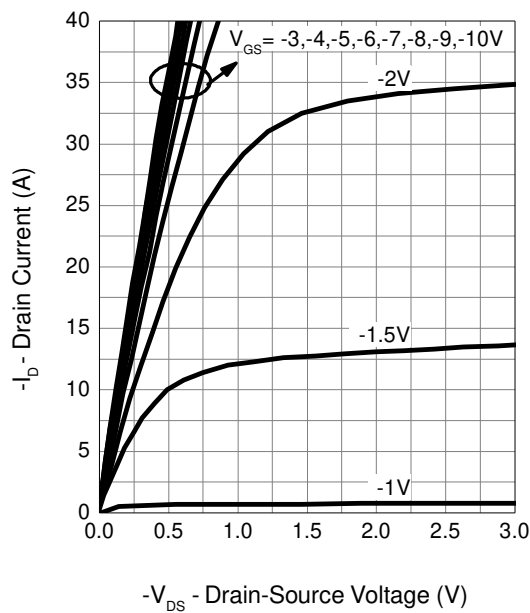
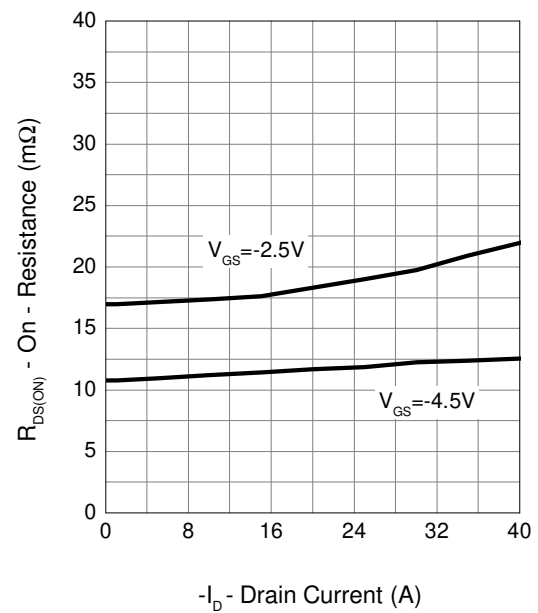
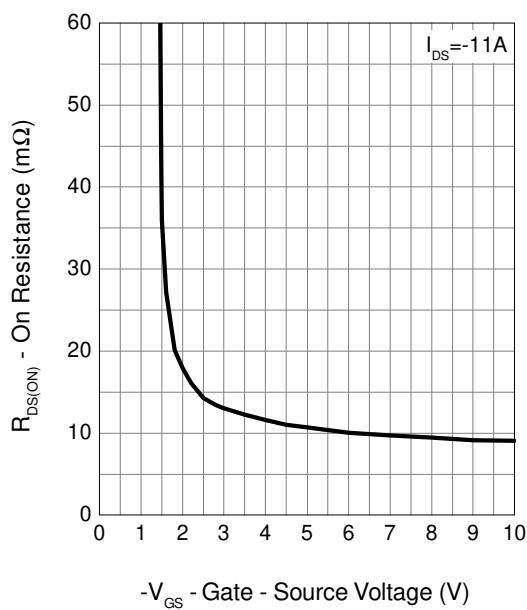
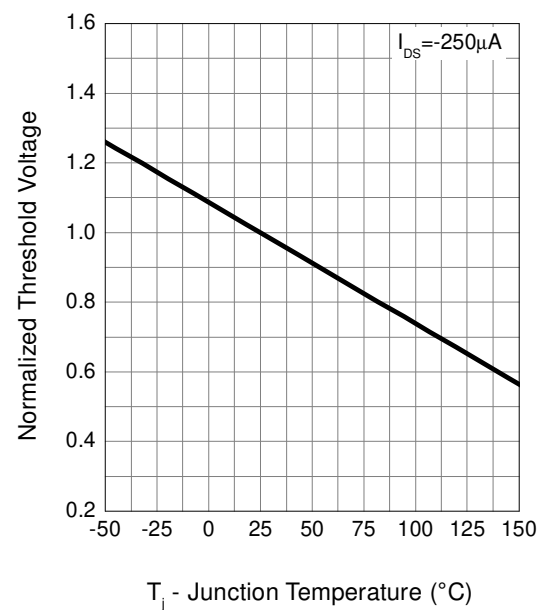
Note d : Pulse test ; pulse width $\leq 300\mu s$ , duty cycle $\leq 2\%$ .

Note e : Guaranteed by design, not subject to production testing.

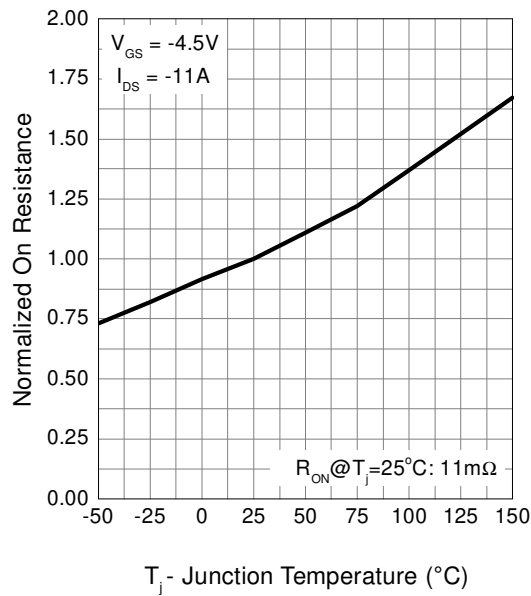
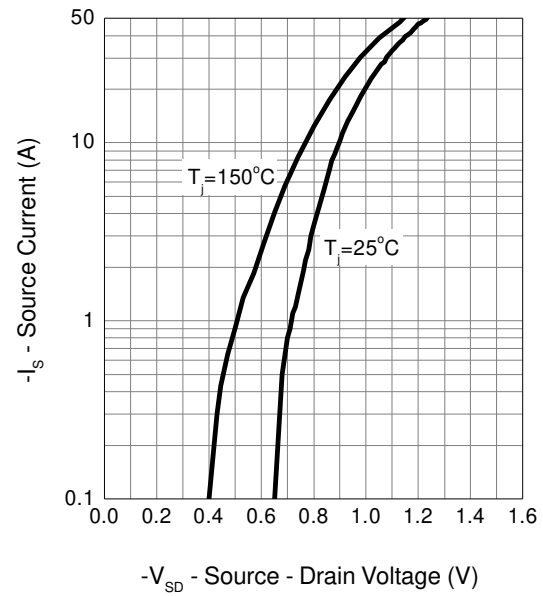
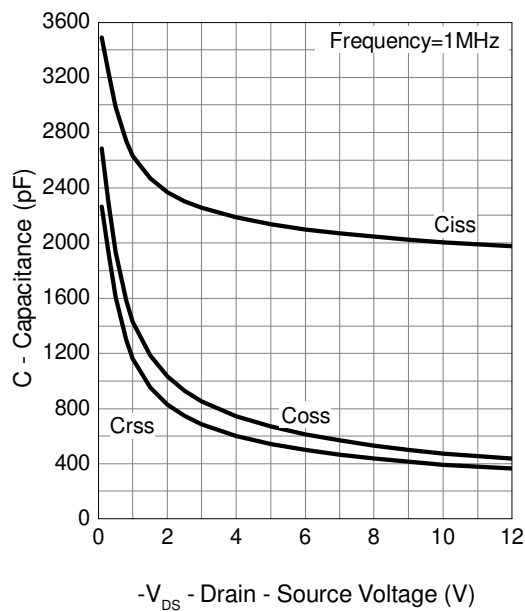
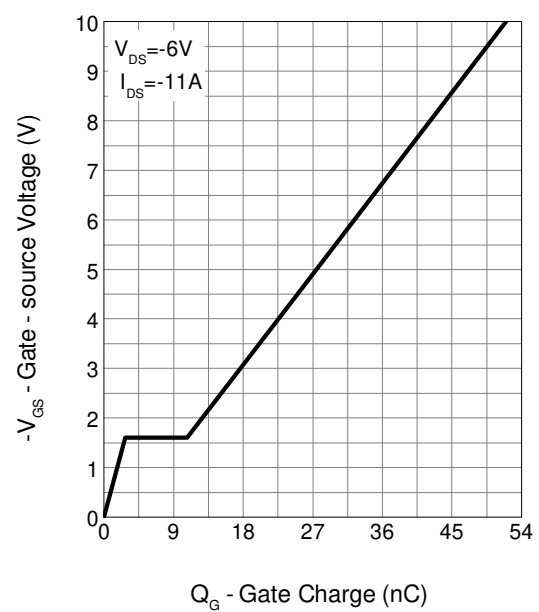
## Typical Operating Characteristics

**Power Dissipation**

**Drain Current**

**Safe Operation Area**

**Thermal Transient Impedance**


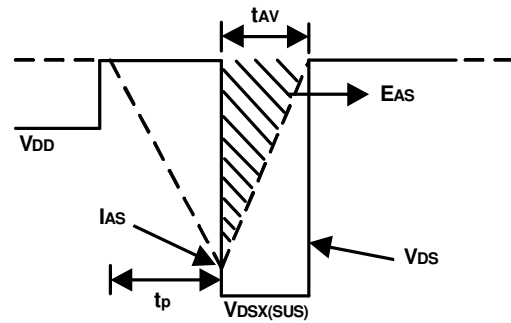
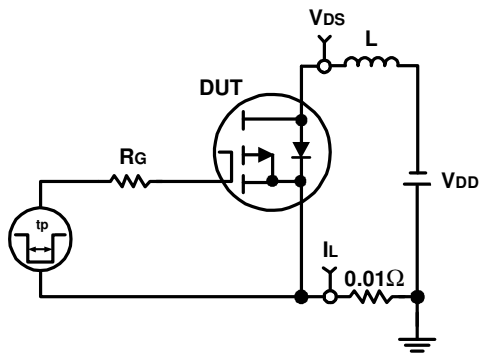
## Typical Operating Characteristics (Cont.)

**Output Characteristics**

**Drain-Source On Resistance**

**Gate-Source On Resistance**

**Gate Threshold Voltage**


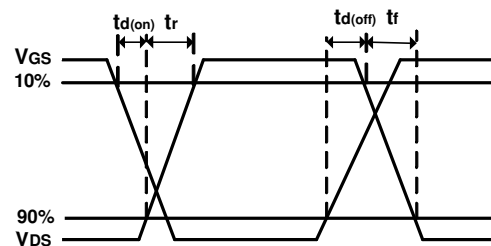
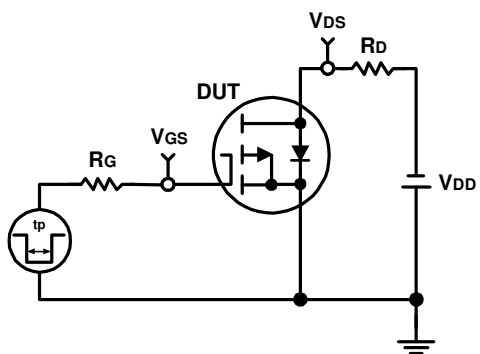
## Typical Operating Characteristics (Cont.)

**Drain-Source On Resistance**

**Source-Drain Diode Forward**

**Capacitance**

**Gate Charge**


## Avalanche Test Circuit and Waveforms

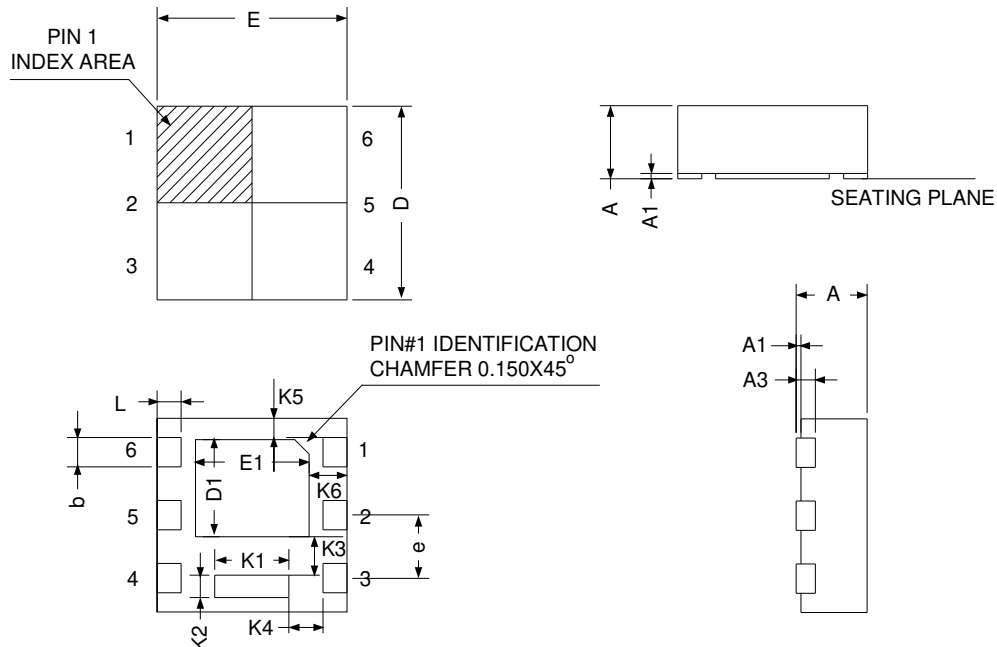


## Switching Time Test Circuit and Waveforms



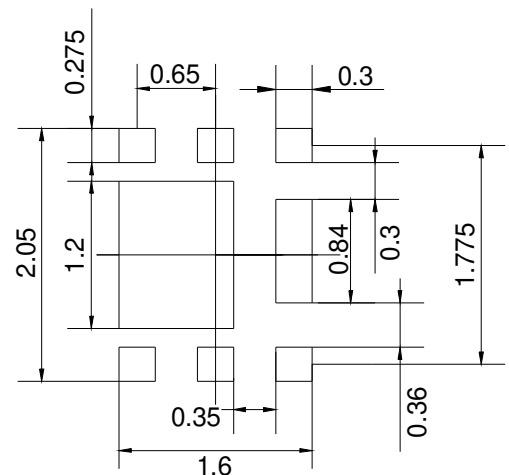
## Package Information

### DFN2x2-6



| SYMBOL | DFN2x2-6    |      |           |       |
|--------|-------------|------|-----------|-------|
|        | MILLIMETERS |      | INCHES    |       |
|        | MIN.        | MAX. | MIN.      | MAX.  |
| A      | 0.70        | 0.80 | 0.028     | 0.031 |
| A1     | 0.00        | 0.05 | 0.000     | 0.002 |
| A3     | 0.200 REF   |      | 0.008 REF |       |
| b      | 0.25        | 0.35 | 0.010     | 0.014 |
| D      | 1.90        | 2.10 | 0.075     | 0.083 |
| E      | 1.90        | 2.10 | 0.075     | 0.083 |
| D1     | 0.90        | 1.10 | 0.035     | 0.043 |
| E1     | 0.90        | 1.10 | 0.035     | 0.043 |
| e      | 0.65 BSC    |      | 0.026 BSC |       |
| L      | 0.20        | 0.30 | 0.008     | 0.012 |
| K1     | 0.65        | 0.85 | 0.026     | 0.033 |
| K2     | 0.20        | -    | 0.008     | -     |
| K3     | 0.20        | -    | 0.008     | -     |
| K4     | 0.32        | -    | 0.013     | -     |
| K5     | 0.20        | 0.26 | 0.008     | 0.010 |
| K6     | 0.45        | 0.55 | 0.018     | 0.022 |

### RECOMMENDED LAND PATTERN



UNIT: mm