

## TM06G02S

## N+P-Channel Enhancement Mode Mosfet

### General Description

- Low  $R_{DS(ON)}$
- RoHS and Halogen-Free Compliant

### Applications

- Load switch
- PWM

### Product Summary

#### N Channel

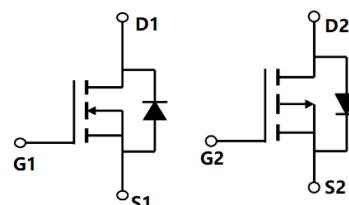
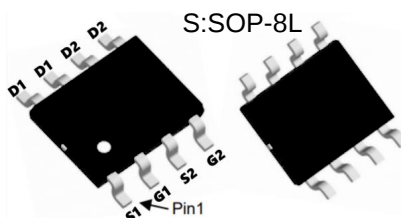
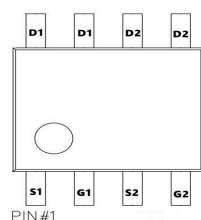
$V_{DS} = 20V, I_D = 6.0A$   
 $R_{DS(ON)} = 21m\Omega (typ.) @ V_{GS} = 4.5V$

#### P Channel

$V_{DS} = -20V, I_D = -5.0A$   
 $R_{DS(ON)} = 52m\Omega (typ.) @ V_{GS} = 4.5V$

100% UIS Tested

100%  $R_g$  Tested



Marking: 06G02 OR 4606B

### Absolute Maximum Ratings ( $T_C = 25^\circ C$ unless otherwise noted)

| Symbol                    | Parameter                                  | Rating     |            | Units      |
|---------------------------|--------------------------------------------|------------|------------|------------|
|                           |                                            | N-Channel  | P-Channel  |            |
| $V_{DS}$                  | Drain-Source Voltage                       | 20         | -20        | V          |
| $V_{GS}$                  | Gate-Source Voltage                        | $\pm 12$   | $\pm 12$   | V          |
| $I_D @ T_C = 25^\circ C$  | Continuous Drain Current, $V_{GS} @ 10V^1$ | 6          | -5         | A          |
| $I_D @ T_C = 100^\circ C$ | Continuous Drain Current, $V_{GS} @ 10V^1$ | 5          | -4         | A          |
| $I_{DM}$                  | Pulsed Drain Current <sup>2</sup>          | 20         | -12        | A          |
| EAS                       | Single Pulse Avalanche Energy <sup>3</sup> | 72         | 59         | mJ         |
| $I_{AS}$                  | Avalanche Current                          | 21         | -19        | A          |
| $P_D @ T_C = 25^\circ C$  | Total Power Dissipation <sup>4</sup>       | 2.5        | 2.08       | W          |
| $T_{STG}$                 | Storage Temperature Range                  | -55 to 150 | -55 to 150 | $^\circ C$ |
| $T_J$                     | Operating Junction Temperature Range       | -55 to 150 | -55 to 150 | $^\circ C$ |

### Thermal Data

| Symbol          | Parameter                                        | Typ. | Max. | Unit         |
|-----------------|--------------------------------------------------|------|------|--------------|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient <sup>1</sup> | ---  | 85   | $^\circ C/W$ |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case <sup>1</sup>    | ---  | 50   | $^\circ C/W$ |

**TM06G02S****N+P-Channel Enhancement Mode Mosfet****N-Channel Electrical Characteristics ( $T_J=25^\circ\text{C}$ , unless otherwise noted)**

| Symbol                                                 | Parameter                                                 | Test Condition                                                                              | Min. | Typ. | Max. | Units |
|--------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------------------------------------------|------|------|------|-------|
| Off Characteristic                                     |                                                           |                                                                                             |      |      |      |       |
| V <sub>(BR)DSS</sub>                                   | Drain-Source Breakdown Voltage                            | V <sub>GS</sub> =0V, I <sub>D</sub> =250μA                                                  | 20   | -    | -    | V     |
| I <sub>DSS</sub>                                       | Zero Gate Voltage Drain Current                           | V <sub>DS</sub> =20V, V <sub>GS</sub> =0V,                                                  | -    | -    | 1.0  | μA    |
| I <sub>GSS</sub>                                       | Gate to Body Leakage Current                              | V <sub>DS</sub> =0V, V <sub>GS</sub> =±12V                                                  | -    | -    | ±100 | nA    |
| On Characteristics                                     |                                                           |                                                                                             |      |      |      |       |
| V <sub>GS(th)</sub>                                    | Gate Threshold Voltage                                    | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                    | 0.4  | 0.7  | 1    | V     |
| R <sub>DS(on)</sub>                                    | Static Drain-Source on-Resistance<br><small>note2</small> | V <sub>GS</sub> =4.5V, I <sub>D</sub> =4A                                                   | -    | 21   | 27   | mΩ    |
|                                                        |                                                           | V <sub>GS</sub> =2.5V, I <sub>D</sub> =3A                                                   | -    | 29   | 44   |       |
| Dynamic Characteristics                                |                                                           |                                                                                             |      |      |      |       |
| C <sub>iss</sub>                                       | Input Capacitance                                         | V <sub>DS</sub> =10V, V <sub>GS</sub> =0V,<br>f=1.0MHz                                      | -    | 358  | -    | pF    |
| C <sub>oss</sub>                                       | Output Capacitance                                        |                                                                                             | -    | 69.3 | -    | pF    |
| C <sub>rss</sub>                                       | Reverse Transfer Capacitance                              |                                                                                             | -    | 58.5 | -    | pF    |
| Q <sub>g</sub>                                         | Total Gate Charge                                         | V <sub>DS</sub> =10V, I <sub>D</sub> =2A,<br>V <sub>GS</sub> =4.5V                          | -    | 5.6  | -    | nC    |
| Q <sub>gs</sub>                                        | Gate-Source Charge                                        |                                                                                             | -    | 0.8  | -    | nC    |
| Q <sub>gd</sub>                                        | Gate-Drain(“Miller”) Charge                               |                                                                                             | -    | 1    | -    | nC    |
| Switching Characteristics                              |                                                           |                                                                                             |      |      |      |       |
| t <sub>d(on)</sub>                                     | Turn-on Delay Time                                        | V <sub>DS</sub> =10V,<br>I <sub>D</sub> =4A, R <sub>GEN</sub> =3Ω,<br>V <sub>GS</sub> =4.5V | -    | 5    | -    | ns    |
| t <sub>r</sub>                                         | Turn-on Rise Time                                         |                                                                                             | -    | 30   | -    | ns    |
| t <sub>d(off)</sub>                                    | Turn-off Delay Time                                       |                                                                                             | -    | 48   | -    | ns    |
| t <sub>f</sub>                                         | Turn-off Fall Time                                        |                                                                                             | -    | 36   | -    | ns    |
| Drain-Source Diode Characteristics and Maximum Ratings |                                                           |                                                                                             |      |      |      |       |
| I <sub>S</sub>                                         | Maximum Continuous Drain to Source Diode Forward Current  |                                                                                             | -    | -    | 6    | A     |
| I <sub>SM</sub>                                        | Maximum Pulsed Drain to Source Diode Forward Current      |                                                                                             | -    | -    | 16   | A     |
| V <sub>SD</sub>                                        | Drain to Source Diode Forward Voltage                     | V <sub>GS</sub> =0V, I <sub>S</sub> =4A                                                     | -    | -    | 1.2  | V     |

Notes: 1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. Pulse Test: Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 0.5\%$

**TM06G02S****N+P-Channel Enhancement Mode Mosfet****P-Channel Electrical Characteristics ( $T_J=25^\circ\text{C}$ , unless otherwise noted)**

| Symbol                                                 | Parameter                                                 | Test Condition                                                                                                         | Min. | Typ. | Max. | Units |
|--------------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|------|------|------|-------|
| Off Characteristic                                     |                                                           |                                                                                                                        |      |      |      |       |
| V <sub>(BR)DSS</sub>                                   | Drain-Source Breakdown Voltage                            | V <sub>GS</sub> =0V, I <sub>D</sub> = -250μA                                                                           | -20  | -    | -    | V     |
| I <sub>DSS</sub>                                       | Zero Gate Voltage Drain Current                           | V <sub>DS</sub> = -20V, V <sub>GS</sub> =0V,                                                                           | -    | -    | -1   | μA    |
| I <sub>GSS</sub>                                       | Gate to Body Leakage Current                              | V <sub>DS</sub> =0V, V <sub>GS</sub> = ±12V                                                                            | -    | -    | ±100 | nA    |
| On Characteristics                                     |                                                           |                                                                                                                        |      |      |      |       |
| V <sub>GS(th)</sub>                                    | Gate Threshold Voltage                                    | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> = -250μA                                                             | -0.5 | -0.7 | -1.0 | V     |
| R <sub>DS(on)</sub>                                    | Static Drain-Source on-Resistance<br><small>note2</small> | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3A                                                                          | -    | 52   | 70   | mΩ    |
|                                                        |                                                           | V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -2A                                                                          | -    | 70   | 100  |       |
| Dynamic Characteristics                                |                                                           |                                                                                                                        |      |      |      |       |
| C <sub>iss</sub>                                       | Input Capacitance                                         | V <sub>DS</sub> = -10V, V <sub>GS</sub> =0V,<br>f=1.0MHz                                                               | -    | 503  | -    | pF    |
| C <sub>oss</sub>                                       | Output Capacitance                                        |                                                                                                                        | -    | 67   | -    | pF    |
| C <sub>rss</sub>                                       | Reverse Transfer Capacitance                              |                                                                                                                        | -    | 58   | -    | pF    |
| Q <sub>g</sub>                                         | Total Gate Charge                                         | V <sub>DS</sub> = -10V, I <sub>D</sub> = -2A,<br>V <sub>GS</sub> = -4.5V                                               | -    | 4.1  | -    | nC    |
| Q <sub>gs</sub>                                        | Gate-Source Charge                                        |                                                                                                                        | -    | 0.8  | -    | nC    |
| Q <sub>gd</sub>                                        | Gate-Drain(“Miller”) Charge                               |                                                                                                                        | -    | 1.1  | -    | nC    |
| Switching Characteristics                              |                                                           |                                                                                                                        |      |      |      |       |
| t <sub>d(on)</sub>                                     | Turn-on Delay Time                                        | V <sub>DD</sub> = -10V, I <sub>D</sub> = -3A,<br>R <sub>G</sub> =1Ω, V <sub>GEN</sub> = -4.5V,<br>R <sub>L</sub> =1.2Ω | -    | 11   | -    | ns    |
| t <sub>r</sub>                                         | Turn-on Rise Time                                         |                                                                                                                        | -    | 52   | -    | ns    |
| t <sub>d(off)</sub>                                    | Turn-off Delay Time                                       |                                                                                                                        | -    | 16   | -    | ns    |
| t <sub>f</sub>                                         | Turn-off Fall Time                                        |                                                                                                                        | -    | 10   | -    | ns    |
| Drain-Source Diode Characteristics and Maximum Ratings |                                                           |                                                                                                                        |      |      |      |       |
| I <sub>S</sub>                                         | Maximum Continuous Drain to Source Diode Forward Current  |                                                                                                                        | -    | -    | -5   | A     |
| I <sub>SM</sub>                                        | Maximum Pulsed Drain to Source Diode Forward Current      |                                                                                                                        | -    | -    | -12  | A     |
| V <sub>SD</sub>                                        | Drain to Source Diode Forward Voltage                     | V <sub>GS</sub> =0V, I <sub>S</sub> = -3A                                                                              | -    | -    | -1.2 | V     |

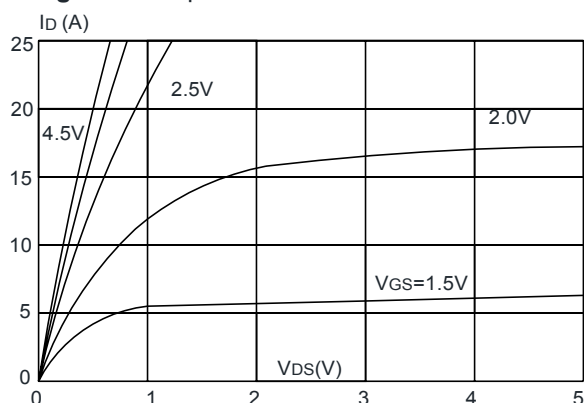
Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. Pulse Test: Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 2\%$

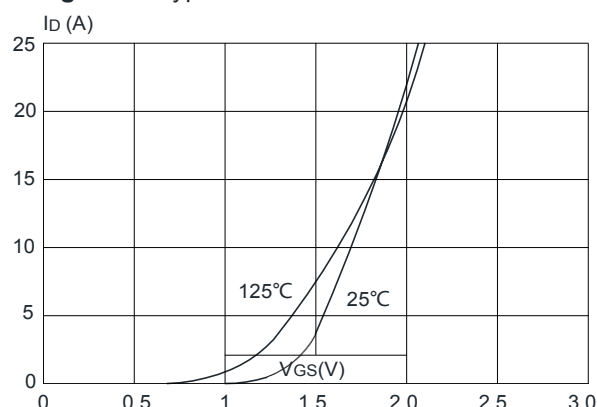
## Typical Performance Characteristics

### N-Channel Typical Characteristics

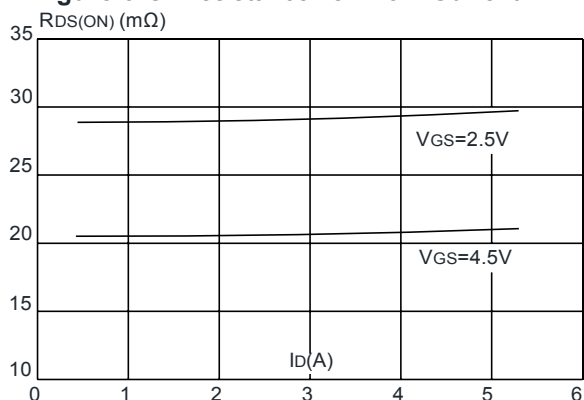
**Figure 1:** Output Characteristics



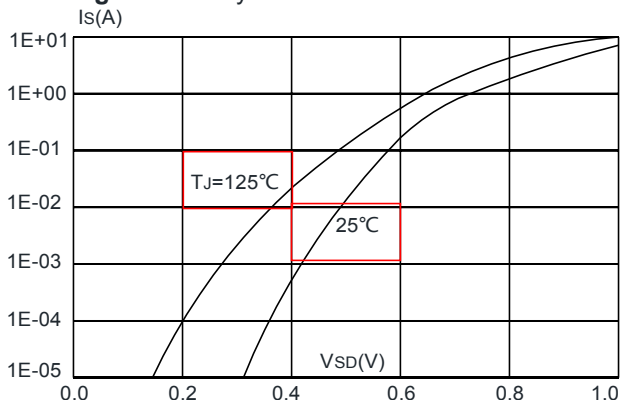
**Figure 2:** Typical Transfer Characteristics



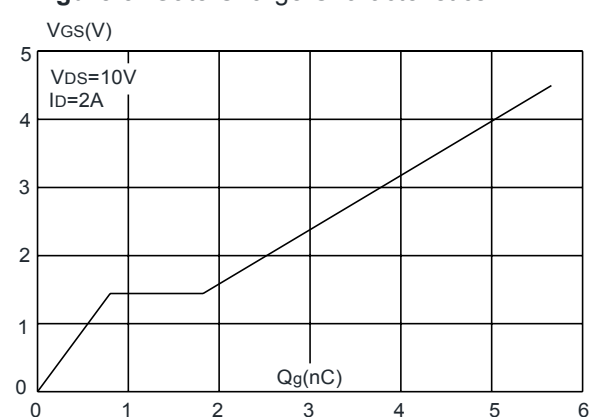
**Figure 3:** On-resistance vs. Drain Current



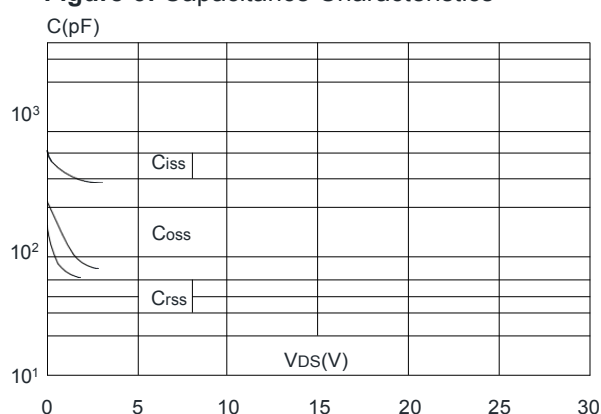
**Figure 4:** Body Diode Characteristics



**Figure 5:** Gate Charge Characteristics



**Figure 6:** Capacitance Characteristics



## Typical Performance Characteristics

### P-Channel Typical Characteristics

Figure 1: Output Characteristics

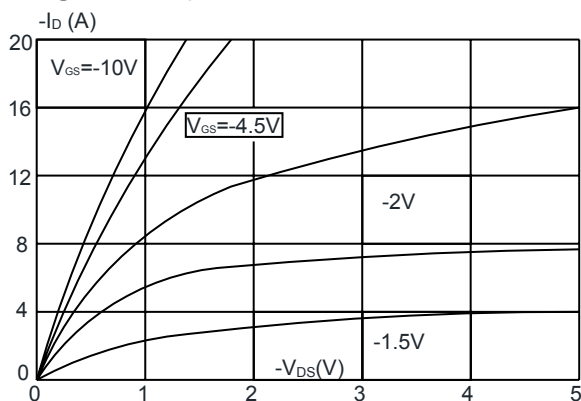


Figure 2: Typical Transfer Characteristics

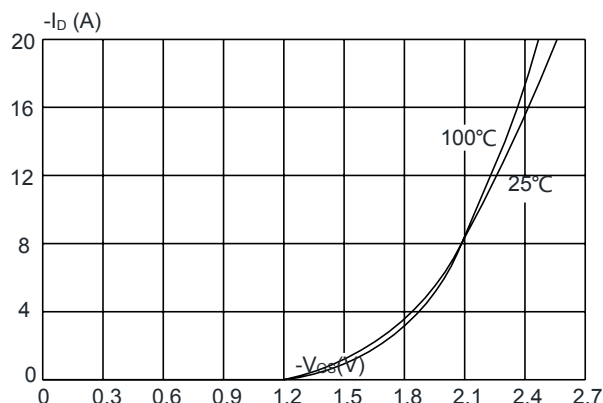


Figure 3: On-resistance vs. Drain Current

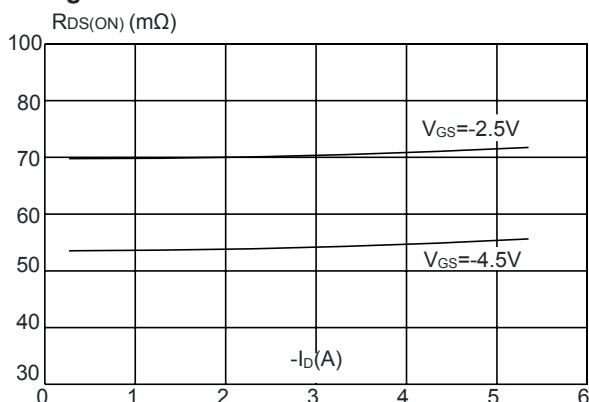


Figure 4: Body Diode Characteristics

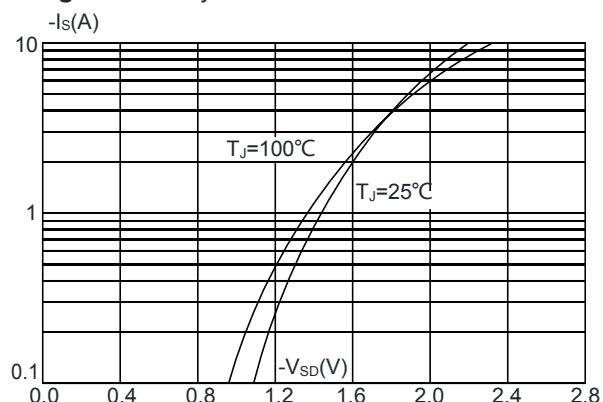


Figure 5: Gate Charge Characteristics

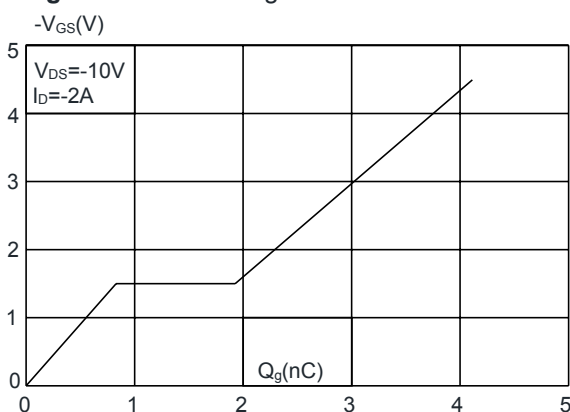
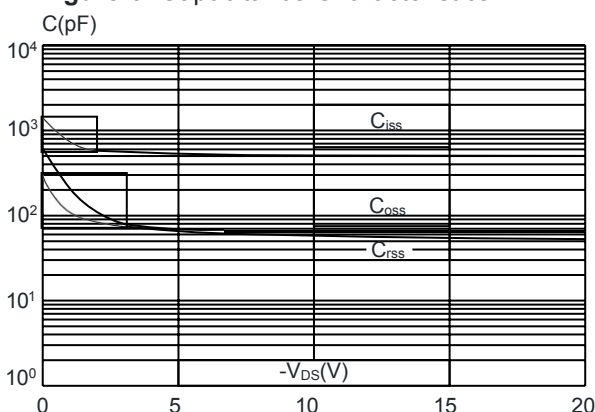
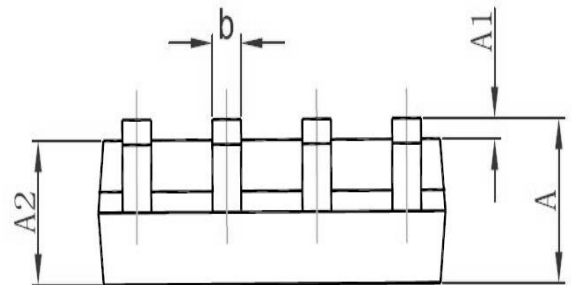
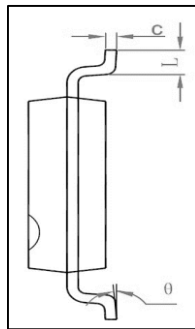
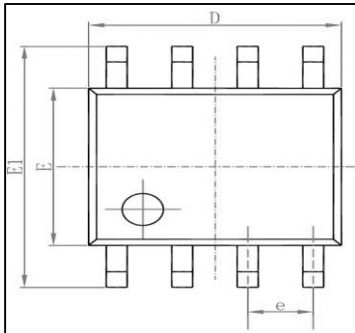


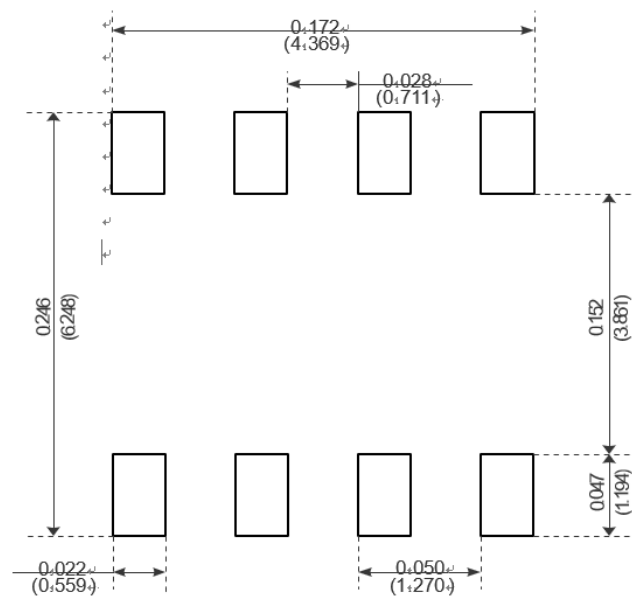
Figure 6: Capacitance Characteristics



## Package Mechanical Data:SOP-8L



| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Min                       | Max   | Min                  | Max   |
| A        | 1.350                     | 1.750 | 0.053                | 0.069 |
| A1       | 0.100                     | 0.250 | 0.004                | 0.010 |
| A2       | 1.350                     | 1.550 | 0.053                | 0.061 |
| b        | 0.330                     | 0.510 | 0.013                | 0.020 |
| c        | 0.170                     | 0.250 | 0.006                | 0.010 |
| D        | 4.700                     | 5.100 | 0.185                | 0.200 |
| E        | 3.800                     | 4.000 | 0.150                | 0.157 |
| E1       | 5.800                     | 6.200 | 0.228                | 0.244 |
| e        | 1.270 (BSC)               |       | 0.050 (BSC)          |       |
| L        | 0.400                     | 1.270 | 0.016                | 0.050 |
| $\theta$ | 0°                        | 8°    | 0°                   | 8°    |



Recommended Minimum Pads