**SEMICONDUCTOR**
**TECHNICAL DATA**

# FTK6710

## 60V N+P Dual Channel MOSFETs

### General Description

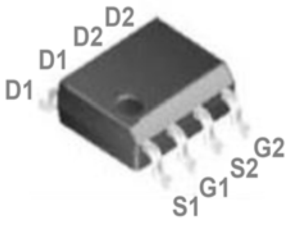
*These N+P dual Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency fast switching applications.*

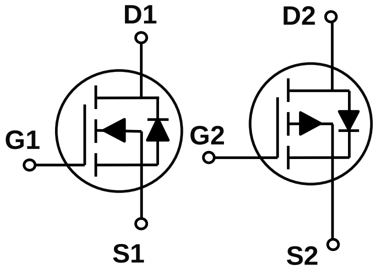
| BVDSS | RDSON | ID |
|---|---|---|
| 60V | 54mΩ | 4.5A |
| -60V | 105mΩ | -3.5A |

### Features

- *Fast switching*
- *Green Device Available*
- *Suit for 4.5V Gate Drive Applications*

### SOP-8 Pin Configuration





### Applications

- *DC Fan*
- *Motor Drive Applications*
- *Networking*
- *Half / Full Bridge Topology*

### Absolute Maximum Ratings **(Tc=25℃ unless otherwise noted)**

| Symbol | Parameter | Rating | | Units |
|---|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 60 | -60 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | ±20 | V |
| $I_D$ | Drain Current – Continuous ($T_C$=25℃) | 4.5 | -3.5 | A |
| | Drain Current – Continuous ($T_C$=100℃) | 2.85 | -2.21 | A |
| $I_{DM}$ | Drain Current – Pulsed$^1$ | 18 | -14 | A |
| $P_D$ | Power Dissipation ($T_C$=25℃) | 3.57 | | W |
| | Power Dissipation – Derate above 25℃ | 0.028 | | W/℃ |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | | ℃ |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | | ℃ |

### Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | --- | 75 | ℃/W |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case | --- | 35 | ℃/W |

# 60V N+P Dual Channel MOSFETs

## N-CH Electrical Characteristics **($T_J$=25 ℃, unless otherwise)**

### Off Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=250uA | 60 | --- | --- | V |
| $\triangle BV_{DSS}/\triangle T_J$ | $BV_{DSS}$ Temperature Coefficient | Reference to 25℃ , $I_D$=1mA | --- | 0.05 | --- | V/℃ |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=60V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
| | | $V_{DS}$=48V , $V_{GS}$=0V , $T_J$=125℃ | --- | --- | 10 | uA |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=± 20V , $V_{DS}$=0V | --- | --- | ± 100 | nA |

### On Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V , $I_D$=6A | --- | 45 | 54 | mΩ |
| | | $V_{GS}$=4.5V , $I_D$=3A | --- | 52 | 63 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 1.2 | 1.8 | 2.5 | V |
| $\triangle V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | -4.2 | --- | mV/℃ |
| gfs | Forward Transconductance | $V_{DS}$=10V , $I_D$=4A | --- | 4.2 | --- | S |

### Dynamic and switching Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge$^{2,3}$ | $V_{DS}$=30V , $V_{GS}$=10V , $I_D$=4A | --- | 14 | 21 | nC |
| $Q_{gs}$ | Gate-Source Charge$^{2,3}$ | | --- | 2.9 | 5 | |
| $Q_{gd}$ | Gate-Drain Charge$^{2,3}$ | | --- | 2.3 | 4 | |
| $T_{d(on)}$ | Turn-On Delay Time$^{2,3}$ | $V_{DD}$=30V , $V_{GS}$=10V , $R_G$=3.3Ω<br>$I_D$=1A | --- | 3.9 | 7 | ns |
| $T_r$ | Rise Time$^{2,3}$ | | --- | 12.6 | 24 | |
| $T_{d(off)}$ | Turn-Off Delay Time$^{2,3}$ | | --- | 23.1 | 44 | |
| $T_f$ | Fall Time$^{2,3}$ | | --- | 6.7 | 13 | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=15V , $V_{GS}$=0V , F=1MHz | --- | 800 | 1160 | pF |
| $C_{oss}$ | Output Capacitance | | --- | 380 | 550 | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 115 | 170 | |
| $R_g$ | Gate resistance | $V_{GS}$=0V, $V_{DS}$=0V, F=1MHz | --- | 1.7 | 3.4 | Ω |

### Drain-Source Diode Characteristics and Maximum Ratings

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current | $V_G$=$V_D$=0V , Force Current | --- | --- | 4.5 | A |
| $I_{SM}$ | Pulsed Source Current | | --- | --- | 9 | A |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$=0V , $I_S$=1A , $T_J$=25℃ | --- | --- | 1 | V |

Note :

1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. The data tested by pulsed , pulse width ≦300us , duty cycle ≦2%.
3. Essentially independent of operating temperature.

## 60V N+P Dual Channel MOSFETs

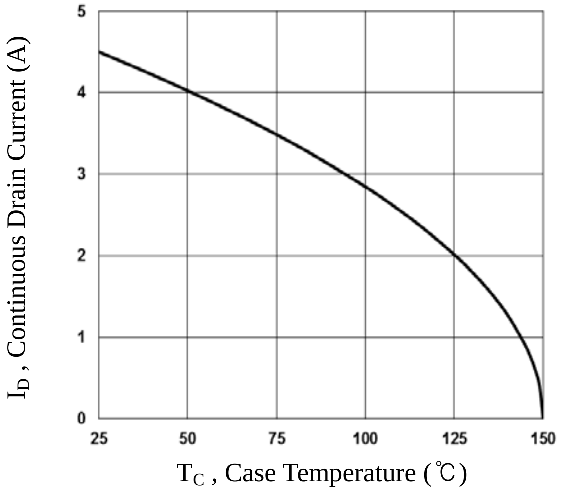


Fig.1 Continuous Drain Current vs. $T_C$

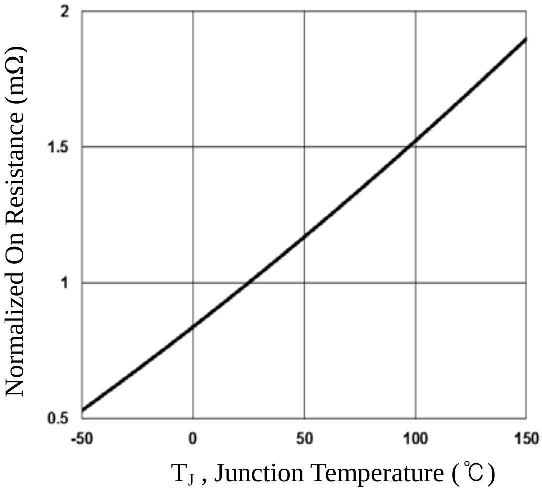


Fig.2 Normalized RDSON vs. $T_J$

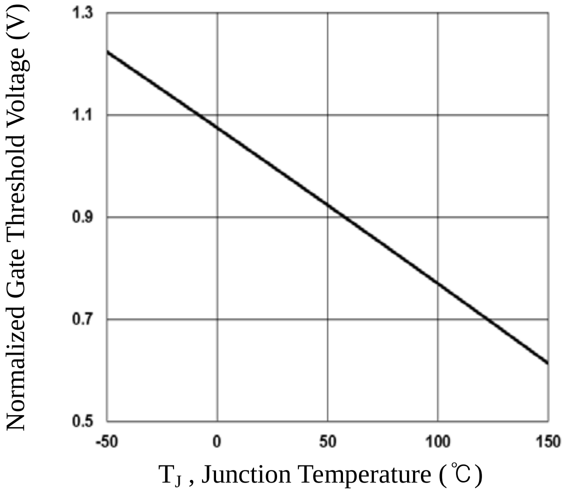


Fig.3 Normalized $V_{th}$ vs. $T_J$

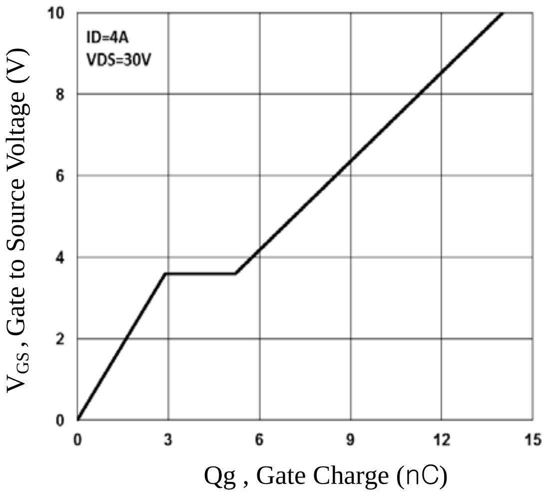


Fig.4 Gate Charge Waveform

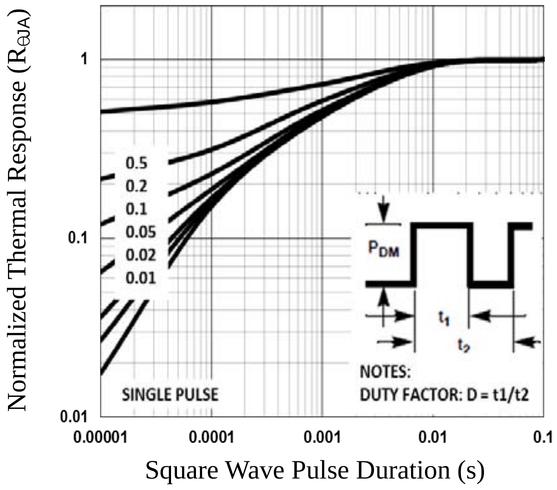


Fig.5 Normalized Transient Impedance

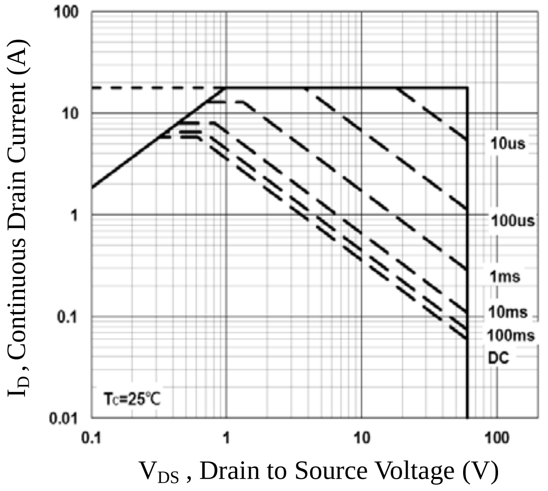


Fig.6 Maximum Safe Operation Area

# 60V N+P Dual Channel MOSFETs

## P-CH Electrical Characteristics **($T_J$=25 ℃, unless otherwise)**

### Off Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=-250uA | -60 | --- | --- | V |
| $\triangle BV_{DSS}/\triangle T_J$ | $BV_{DSS}$ Temperature Coefficient | Reference to 25℃ , $I_D$=-1mA | --- | -0.05 | --- | V/℃ |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=-60V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | -1 | uA |
|  |  | $V_{DS}$=-48V , $V_{GS}$=0V , $T_J$=125℃ | --- | --- | -10 | uA |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=± 20V , $V_{DS}$=0V | --- | --- | ± 100 | nA |

### On Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=-10V , $I_D$=-6A | --- | 87 | 105 | mΩ |
|  |  | $V_{GS}$=-4.5V , $I_D$=-3A | --- | 120 | 145 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$=-250uA | -1.0 | -1.6 | -2.5 | V |
| $\triangle V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient |  | --- | 3 | --- | mV/℃ |
| gfs | Forward Transconductance | $V_{DS}$=-10V , $I_D$=-6A | --- | 5.5 | --- | S |

### Dynamic and switching Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge[2,3] | $V_{DS}$=-30V , $V_{GS}$=-10V , $I_D$=-4A | --- | 10 | 15 | nC |
| $Q_{gs}$ | Gate-Source Charge[2,3] |  | --- | 1.6 | 3.2 |  |
| $Q_{gd}$ | Gate-Drain Charge[2,3] |  | --- | 3 | 6 |  |
| $T_{d(on)}$ | Turn-On Delay Time[2,3] | $V_{DD}$=-30V , $V_{GS}$=-10V , $R_G$=6Ω<br>$I_D$=-1A | --- | 8 | 16 | ns |
| $T_r$ | Rise Time[2,3] |  | --- | 15.4 | 30 |  |
| $T_{d(off)}$ | Turn-Off Delay Time[2,3] |  | --- | 42.8 | 80 |  |
| $T_f$ | Fall Time[2,3] |  | --- | 8.4 | 16 |  |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=-30V , $V_{GS}$=0V , F=1MHz | --- | 785 | 1300 | pF |
| $C_{oss}$ | Output Capacitance |  | --- | 175 | 300 |  |
| $C_{rss}$ | Reverse Transfer Capacitance |  | --- | 112 | 220 |  |

### Drain-Source Diode Characteristics and Maximum Ratings

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current | $V_G$=$V_D$=0V , Force Current | --- | --- | -3.5 | A |
| $I_{SM}$ | Pulsed Source Current |  | --- | --- | -7 | A |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$=0V , $I_S$=-1A , $T_J$=25℃ | --- | --- | -1 | V |

Note :

4. Repetitive Rating : Pulsed width limited by maximum junction temperature.
5. The data tested by pulsed , pulse width ≦300us , duty cycle ≦2%.
6. Essentially independent of operating temperature.

## 60V N+P Dual Channel MOSFETs

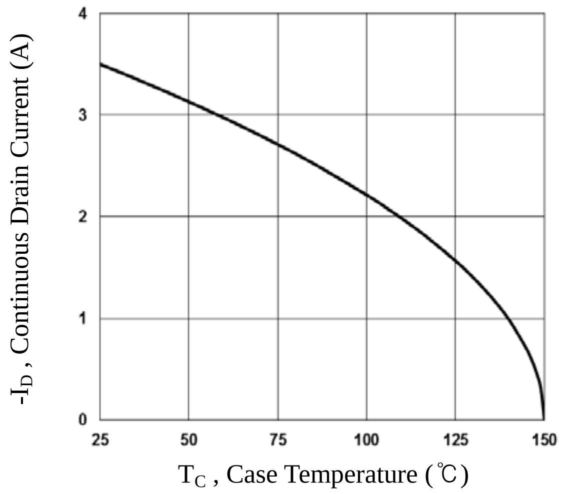


Fig.7 Continuous Drain Current vs. $T_C$

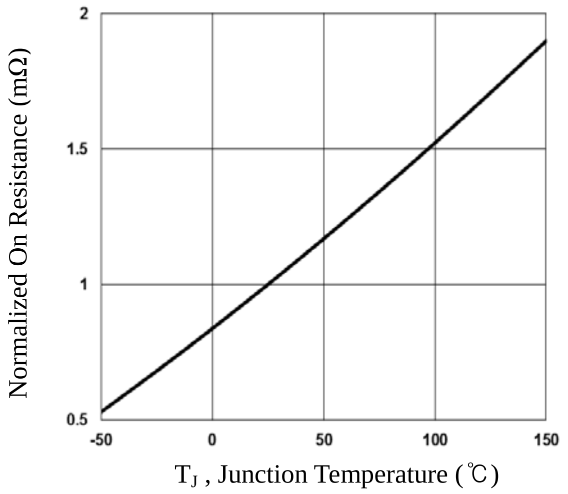


Fig.8 Normalized RDSON vs. $T_J$

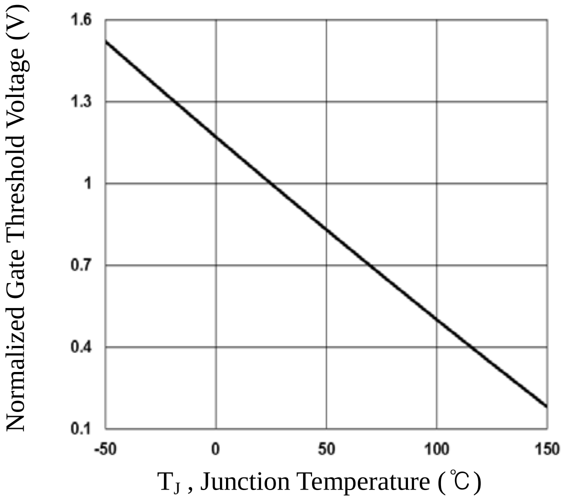


Fig.9 Normalized $V_{th}$ vs. $T_J$

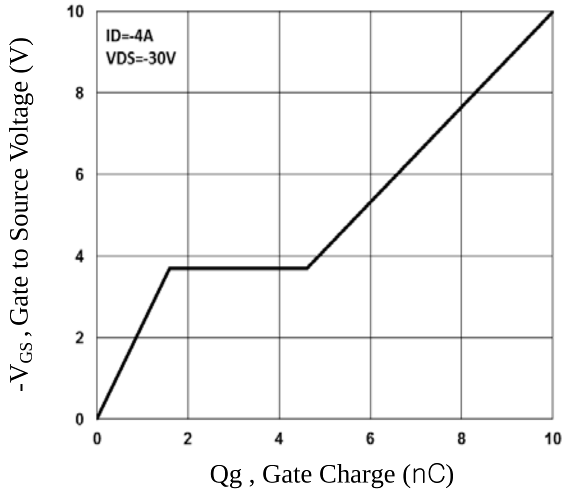


Fig.10 Gate Charge Waveform

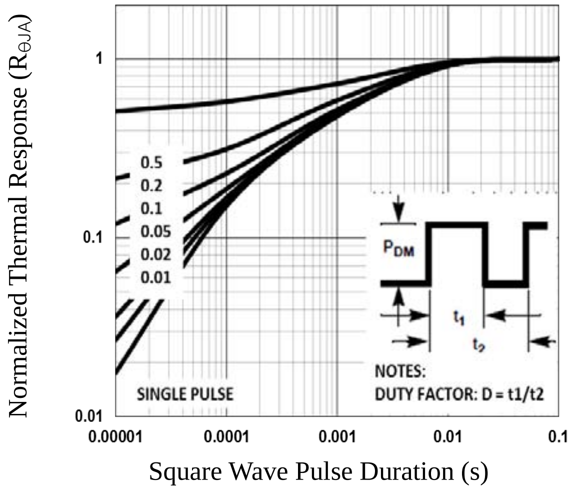


Fig.11 Normalized Transient Impedance

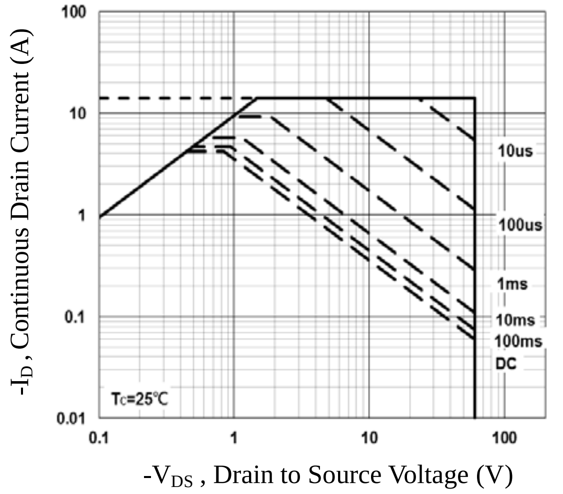
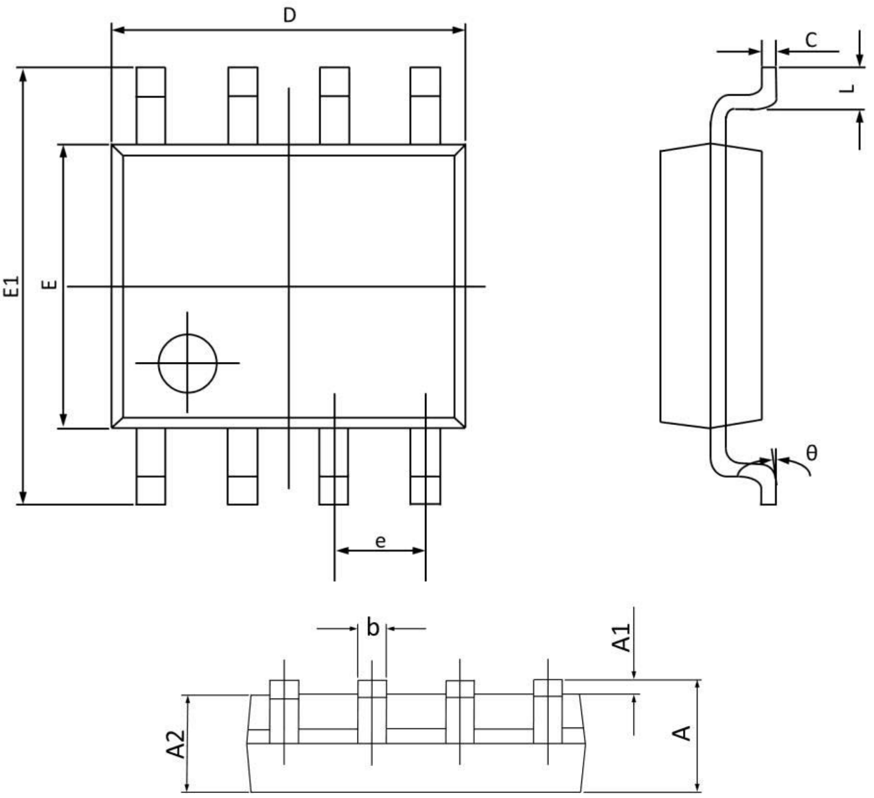


Fig.12 Maximum Safe Operation Area

# SOP-8 PACKAGE INFORMATION



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MAX | MIN | MAX | MIN |
| A | 1.750 | 1.350 | 0.069 | 0.053 |
| A1 | 0.250 | 0.100 | 0.010 | 0.004 |
| A2 | 1.500 | 1.300 | 0.059 | 0.051 |
| b | 0.490 | 0.350 | 0.019 | 0.014 |
| C | 0.260 | 0.190 | 0.010 | 0.007 |
| D | 5.100 | 4.700 | 0.201 | 0.185 |
| E | 4.100 | 3.700 | 0.161 | 0.146 |
| E1 | 6.200 | 5.800 | 0.244 | 0.228 |
| e | 1.27BSC | | 0.05BSC | |
| L | 0.900 | 0.400 | 0.035 | 0.016 |
| θ | 8° | 0° | 8° | 0° |