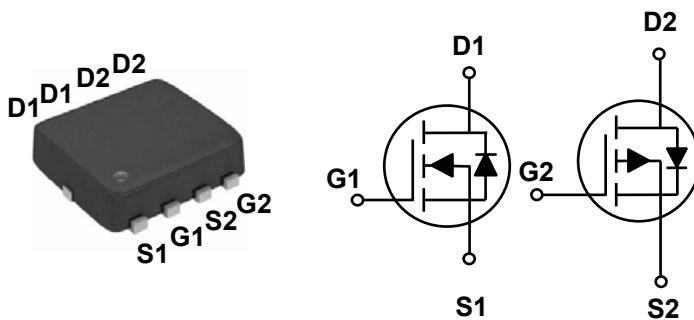


### General Description

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.

### PPAK3X3 Dual 2EP Pin Configuration



| BVDSS | RDSON | ID  |
|-------|-------|-----|
| 30V   | 20mΩ  | 12A |
| -30V  | 50mΩ  | -8A |

### Features

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

### Applications

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



### Absolute Maximum Ratings $T_c=25^\circ\text{C}$ unless otherwise noted

| Symbol    | Parameter  | Rating     |          | Units               |
|-----------|--|------------|----------|---------------------|
|           |  |            |          |                     |
| $V_{DS}$  | Drain-Source Voltage                                   | 30         | -30      | V                   |
| $V_{GS}$  | Gate-Source Voltage                                    | $\pm 20$   | $\pm 20$ | V                   |
| $I_D$     | Drain Current – Continuous ( $T_c=25^\circ\text{C}$ )  | 12         | -8       | A                   |
|           | Drain Current – Continuous ( $T_c=100^\circ\text{C}$ ) | 7.2        | -4.8     | A                   |
| $I_{DM}$  | Drain Current – Pulsed <sup>1</sup>                    | 48         | -32      | A                   |
| EAS       | Single Pulse Avalanche Energy <sup>2,6</sup>           | 14         | 5        | mJ                  |
| IAS       | Single Pulse Avalanche Current <sup>2</sup>            | 17         | 10       | A                   |
| $P_D$     | Power Dissipation ( $T_c=25^\circ\text{C}$ )           | 20         |          | W                   |
|           | Power Dissipation – Derate above $25^\circ\text{C}$    | 0.16       |          | W/ $^\circ\text{C}$ |
| $T_{STG}$ | Storage Temperature Range                              | -55 to 150 |          | $^\circ\text{C}$    |
| $T_J$     | Operating Junction Temperature Range                   | -55 to 150 |          | $^\circ\text{C}$    |

### Thermal Characteristics

| Symbol          | Parameter                              | Typ. | Max. | Unit                      |
|-----------------|--|------|------|---------------------------|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | ---  | 62.5 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case    | ---  | 6.4  | $^\circ\text{C}/\text{W}$ |

**N-CH Electrical Characteristics ( $T_J=25^\circ\text{C}$ , unless otherwise)**
**Off Characteristics**

| Symbol     | Parameter                      | Conditions                                     | Min. | Typ. | Max.      | Unit    |
|------------|--------------------------------|--|------|------|-----------|---------|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}=0V, I_D=250\mu A$                      | 30   | ---  | ---       | V       |
| $I_{DSS}$  | Drain-Source Leakage Current   | $V_{DS}=30V, V_{GS}=0V, T_J=25^\circ\text{C}$  | ---  | ---  | 1         | $\mu A$ |
|            |                                | $V_{DS}=24V, V_{GS}=0V, T_J=125^\circ\text{C}$ | ---  | ---  | 10        | $\mu A$ |
| $I_{GSS}$  | Gate-Source Leakage Current    | $V_{GS}=\pm 20V, V_{DS}=0V$                    | ---  | ---  | $\pm 100$ | nA      |

**On Characteristics**

|                     |                                      |                               |     |     |     |                     |
|---------------------|--------------------------------------|-------------------------------|-----|-----|-----|---------------------|
| $R_{DS(ON)}$        | Static Drain-Source On-Resistance    | $V_{GS}=10V, I_D=10A$         | --- | 15  | 20  | $m\Omega$           |
|                     |                                      | $V_{GS}=4.5V, I_D=6A$         | --- | 21  | 30  | $m\Omega$           |
| $V_{GS(th)}$        | Gate Threshold Voltage               | $V_{GS}=V_{DS}, I_D=250\mu A$ | 1.2 | 1.5 | 2.5 | V                   |
| $\Delta V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient |                               | --- | -4  | --- | $mV/^\circ\text{C}$ |
| $g_{fs}$            | Forward Transconductance             | $V_{DS}=5V, I_D=6A$           | --- | 13  | --- | S                   |

**Dynamic and switching Characteristics**

|              |                                    |   |     |      |     |          |
|--------------|------------------------------------|---|-----|------|-----|----------|
| $Q_g$        | Total Gate Charge <sup>3,4</sup>   | $V_{DS}=15V, V_{GS}=4.5V, I_D=8A$                 | --- | 4.1  | 6   | nC       |
| $Q_{gs}$     | Gate-Source Charge <sup>3,4</sup>  |   | --- | 1    | 1.4 |          |
| $Q_{gd}$     | Gate-Drain Charge <sup>3,4</sup>   |   | --- | 2.1  | 4   |          |
| $T_{d(on)}$  | Turn-On Delay Time <sup>3,4</sup>  | $V_{DD}=15V, V_{GS}=10V, R_G=6\Omega$<br>$I_D=1A$ | --- | 2.8  | 5   | ns       |
| $T_r$        | Rise Time <sup>3,4</sup>           |   | --- | 7.2  | 14  |          |
| $T_{d(off)}$ | Turn-Off Delay Time <sup>3,4</sup> |   | --- | 15.8 | 30  |          |
| $T_f$        | Fall Time <sup>3,4</sup>           |   | --- | 4.6  | 9   |          |
| $C_{iss}$    | Input Capacitance                  | $V_{DS}=25V, V_{GS}=0V, F=1\text{MHz}$            | --- | 345  | 500 | pF       |
| $C_{oss}$    | Output Capacitance                 |   | --- | 55   | 80  |          |
| $C_{rss}$    | Reverse Transfer Capacitance       |   | --- | 32   | 55  |          |
| $R_g$        | Gate resistance                    | $V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$             | --- | 3.2  | 6.4 | $\Omega$ |

**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              | ---  | ---  | 12   | A    |
| $I_{SM}$ | Pulsed Source Current     |   | ---  | ---  | 24   | A    |
| $V_{SD}$ | Diode Forward Voltage     | $V_{GS}=0V, I_S=1A, T_J=25^\circ\text{C}$ | ---  | ---  | 1    | V    |

**Note :**

1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2.  $V_{DD}=25V, V_{GS}=10V, L=0.1mH, I_{AS}=17A, R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$ .
3. The data tested by pulsed , pulse width  $\leq 300\mu s$  , duty cycle  $\leq 2\%$ .
4. Essentially independent of operating temperature.

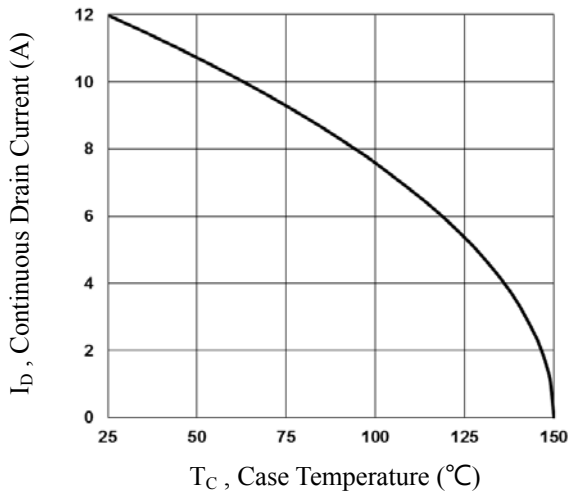


Fig.1 Continuous Drain Current vs.  $T_C$

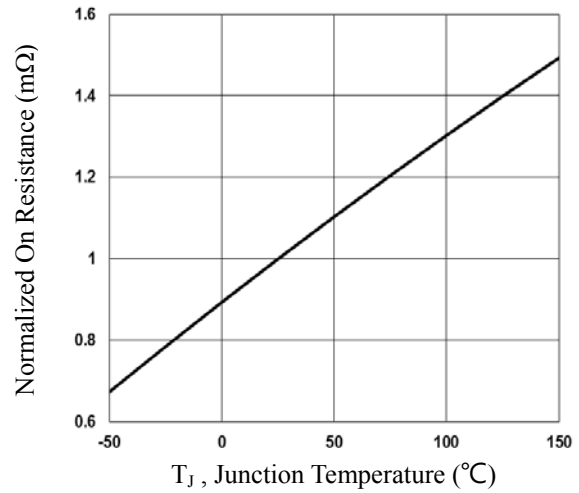


Fig.2 Normalized  $R_{DS(on)}$  vs.  $T_J$

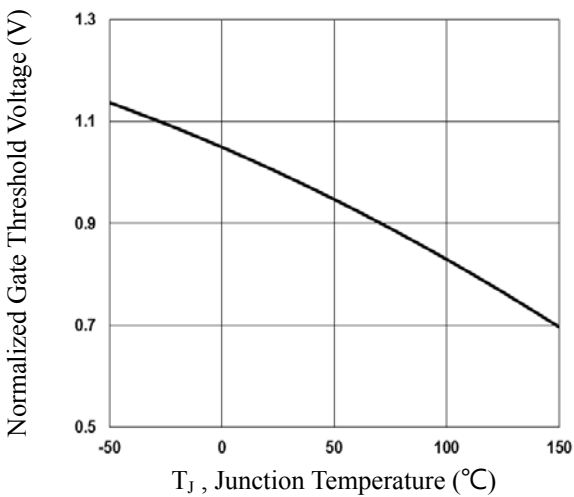


Fig.3 Normalized  $V_{th}$  vs.  $T_J$

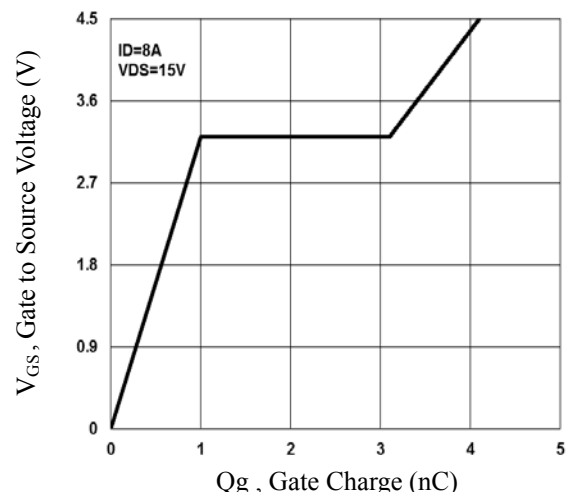


Fig.4 Gate Charge Waveform

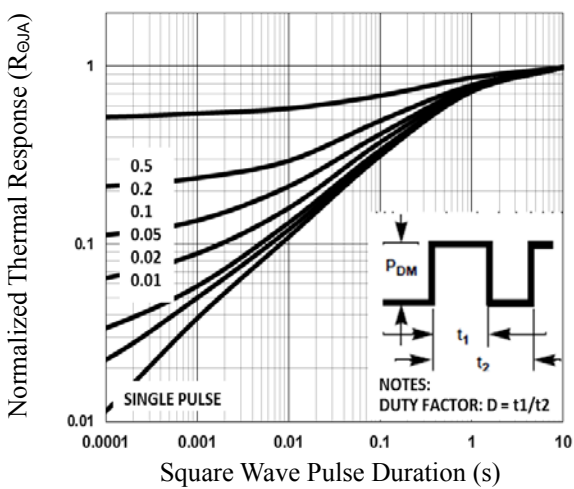


Fig.5 Normalized Transient Response

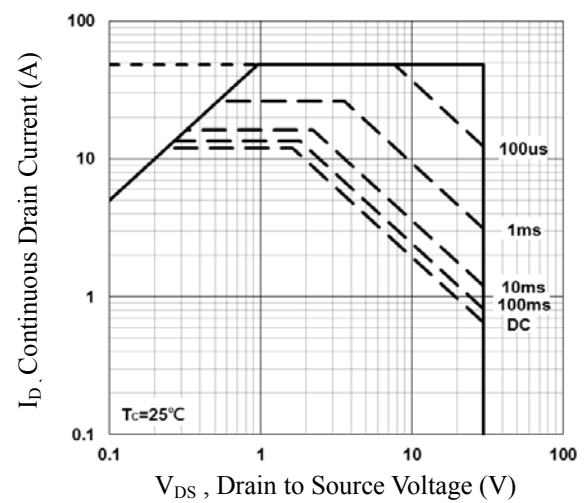


Fig.6 Maximum Safe Operation Area

**P-CH Electrical Characteristics ( $T_J=25^\circ\text{C}$ , unless otherwise)**
**Off Characteristics**

| Symbol                       | Parameter                          | Conditions  | Min. | Typ.  | Max.      | Unit               |
|------------------------------|------------------------------------|---|------|-------|-----------|--------------------|
| $BV_{DSS}$                   | Drain-Source Breakdown Voltage     | $V_{GS}=0V, I_D=-250\mu A$                          | -30  | ---   | ---       | V                  |
| $\Delta BV_{DSS}/\Delta T_J$ | $BV_{DSS}$ Temperature Coefficient | Reference to $25^\circ\text{C}$ , $I_D=-1\text{mA}$ | ---  | -0.03 | ---       | $V/^\circ\text{C}$ |
| $I_{DSS}$                    | Drain-Source Leakage Current       | $V_{DS}=-30V, V_{GS}=0V, T_J=25^\circ\text{C}$      | ---  | ---   | -1        | $\mu A$            |
|                              |                                    | $V_{DS}=-24V, V_{GS}=0V, T_J=125^\circ\text{C}$     | ---  | ---   | -10       | $\mu A$            |
| $I_{GSS}$                    | Gate-Source Leakage Current        | $V_{GS}=\pm 20V, V_{DS}=0V$                         | ---  | ---   | $\pm 100$ | nA                 |

**On Characteristics**

|                     |                                      |                                |      |      |      |                            |
|---------------------|--------------------------------------|--------------------------------|------|------|------|----------------------------|
| $R_{DS(ON)}$        | Static Drain-Source On-Resistance    | $V_{GS}=-10V, I_D=-5A$         | ---  | 40   | 50   | m $\Omega$                 |
|                     |                                      | $V_{GS}=-4.5V, I_D=-3A$        | ---  | 60   | 75   | m $\Omega$                 |
| $V_{GS(th)}$        | Gate Threshold Voltage               | $V_{GS}=V_{DS}, I_D=-250\mu A$ | -1.2 | -1.6 | -2.5 | V                          |
| $\Delta V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient |                                | ---  | 4    | ---  | $\text{mV}/^\circ\text{C}$ |
| gfs                 | Forward Transconductance             | $V_{DS}=-10V, I_D=-3A$         | ---  | 3.5  | ---  | S                          |

**Dynamic and switching Characteristics**

|              |                                    |  |     |      |     |    |
|--------------|------------------------------------|--|-----|------|-----|----|
| $Q_g$        | Total Gate Charge <sup>7,8</sup>   | $V_{DS}=-15V, V_{GS}=-4.5V, I_D=-3A$                 | --- | 5.1  | 7   | nC |
| $Q_{gs}$     | Gate-Source Charge <sup>7,8</sup>  |  | --- | 2    | 3   |    |
| $Q_{gd}$     | Gate-Drain Charge <sup>7,8</sup>   |  | --- | 2.2  | 4   |    |
| $T_{d(on)}$  | Turn-On Delay Time <sup>7,8</sup>  | $V_{DD}=-15V, V_{GS}=-10V, R_G=6\Omega$<br>$I_D=-1A$ | --- | 3.4  | 6   | ns |
| $T_r$        | Rise Time <sup>7,8</sup>           |  | --- | 10.8 | 21  |    |
| $T_{d(off)}$ | Turn-Off Delay Time <sup>7,8</sup> |  | --- | 26.9 | 51  |    |
| $T_f$        | Fall Time <sup>7,8</sup>           |  | --- | 6.9  | 13  |    |
| $C_{iss}$    | Input Capacitance                  | $V_{DS}=-15V, V_{GS}=0V, F=1\text{MHz}$              | --- | 560  | 810 | pF |
| $C_{oss}$    | Output Capacitance                 |  | --- | 55   | 80  |    |
| $C_{rss}$    | Reverse Transfer Capacitance       |  | --- | 40   | 60  |    |

**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               | ---  | ---  | -8   | A    |
| $I_{SM}$ | Pulsed Source Current     |  | ---  | ---  | -16  | A    |
| $V_{SD}$ | Diode Forward Voltage     | $V_{GS}=0V, I_S=-1A, T_J=25^\circ\text{C}$ | ---  | ---  | -1   | V    |

Note :

5. Repetitive Rating : Pulsed width limited by maximum junction temperature.
6.  $V_{DD}=-25V, V_{GS}=-10V, L=0.1\text{mH}, I_{AS}=-10A, R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$
7. The data tested by pulsed, pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .
8. Essentially independent of operating temperature.

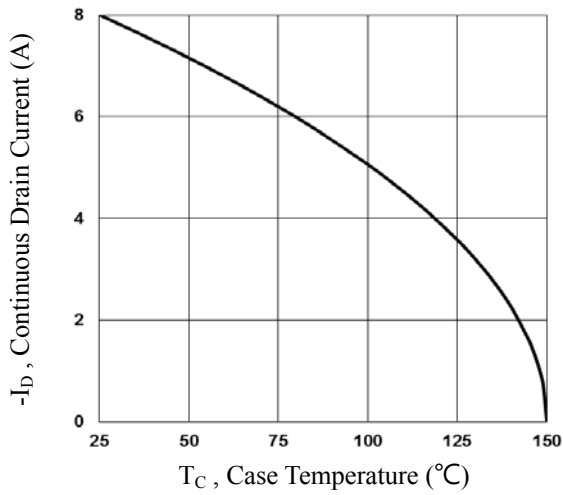


Fig.1 Continuous Drain Current vs.  $T_C$

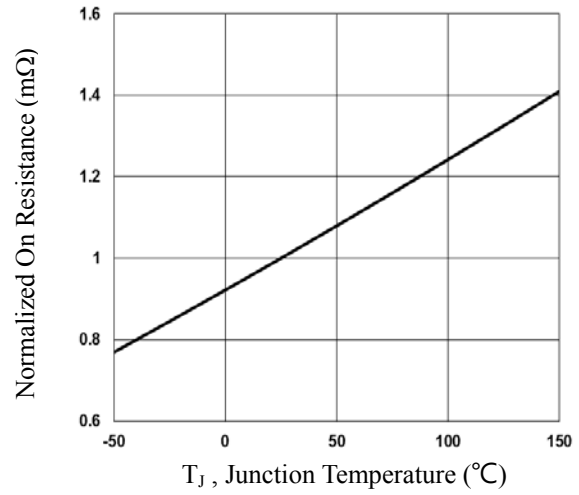


Fig.2 Normalized  $R_{DS(on)}$  vs.  $T_J$

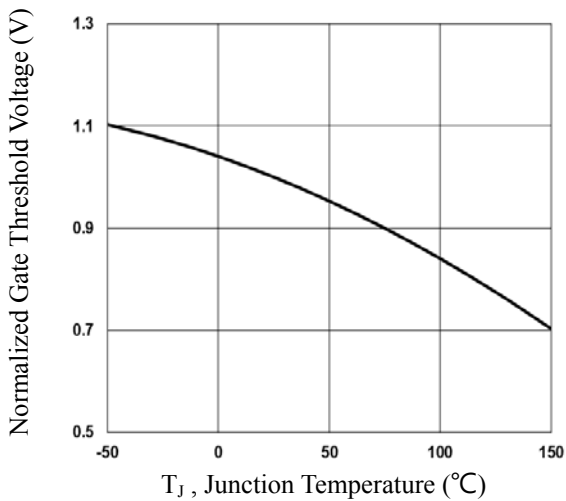


Fig.3 Normalized  $V_{th}$  vs.  $T_J$

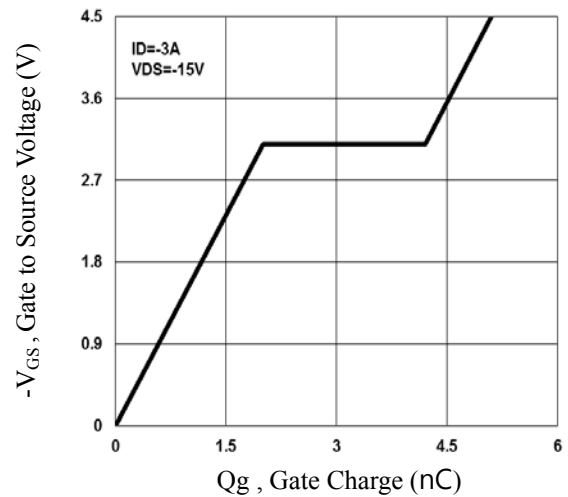


Fig.4 Gate Charge Waveform

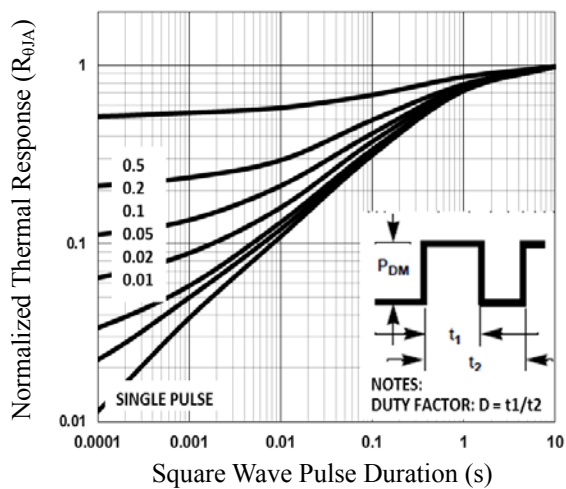


Fig.5 Normalized Transient Impedance

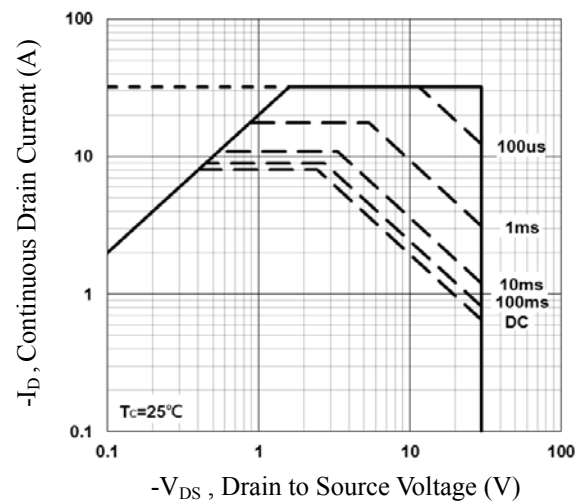
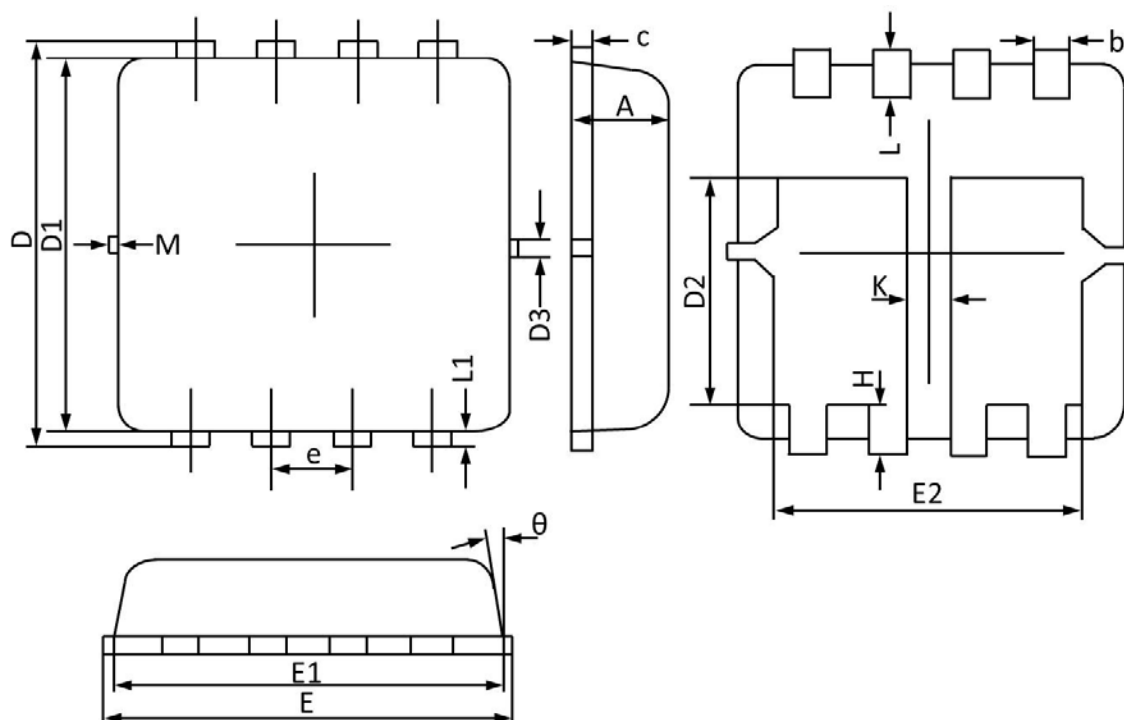


Fig.6 Maximum Safe Operation Area

**PPAK3x3 Dual PACKAGE INFORMATION**


| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Min                       | Max   | Min                  | Max   |
| A        | 0.700                     | 0.800 | 0.028                | 0.031 |
| b        | 0.250                     | 0.350 | 0.010                | 0.013 |
| c        | 0.100                     | 0.250 | 0.004                | 0.009 |
| D        | 3.250                     | 3.450 | 0.128                | 0.135 |
| D1       | 3.000                     | 3.200 | 0.119                | 0.125 |
| D2       | 1.780                     | 1.980 | 0.070                | 0.077 |
| D3       | 0.130 REF                 |       | 0.005 REF            |       |
| E        | 3.200                     | 3.400 | 0.126                | 0.133 |
| E1       | 3.000                     | 3.200 | 0.119                | 0.125 |
| E2       | 2.390                     | 2.590 | 0.094                | 0.102 |
| e        | 0.650 BSC                 |       | 0.026 BSC            |       |
| H        | 0.300                     | 0.500 | 0.011                | 0.019 |
| L        | 0.300                     | 0.500 | 0.011                | 0.019 |
| L1       | 0.130 REF                 |       | 0.005 REF            |       |
| K        | 0.300 REF                 |       | 0.012 REF            |       |
| $\theta$ | 0°                        | 12°   | 0°                   | 12°   |
| M        | 0.150 REF                 |       | 0.006 REF            |       |