



## PRODUCT DATA SHEET



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**Resources**



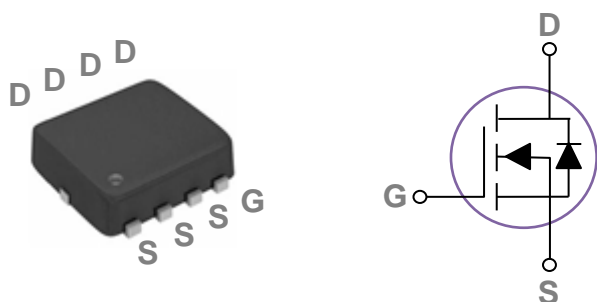
**Samples**

Please note: Please check the JINGAO Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at [www.jg-semi.cn](http://www.jg-semi.cn). Please email any questions regarding the system integration to [JINGAO\\_questions@jgsemi.com](mailto:JINGAO_questions@jgsemi.com).

## General Description

These N-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 Pin Configuration



| BVDSS | RDS(ON) | ID  |
|-------|---------|-----|
| 30V   | 6mΩ     | 60A |

## Features

- 30V, 60A,  $R_{DS(ON)} = 6m\Omega @ V_{GS} = 10V$
- Improved  $dv/dt$  capability
- Fast switching
- 100% EAS Guaranteed
- Green Device Available

## Applications

- MB / VGA / Vcore
- POL Applications
- SMPS 2<sup>nd</sup> SR

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

| Symbol    | Parameter  | Rating     | Units               |
|-----------|--|------------|---------------------|
| $V_{DS}$  | Drain-Source Voltage                                   | 30         | V                   |
| $V_{GS}$  | Gate-Source Voltage                                    | $\pm 20$   | V                   |
| $I_D$     | Drain Current – Continuous ( $T_c=25^\circ\text{C}$ )  | 60         | A                   |
|           | Drain Current – Continuous ( $T_c=100^\circ\text{C}$ ) | 38         | A                   |
| $I_{DM}$  | Drain Current – Pulsed <sup>1</sup>                    | 240        | A                   |
| EAS       | Single Pulse Avalanche Energy <sup>2</sup>             | 88         | mJ                  |
| IAS       | Single Pulse Avalanche Current <sup>2</sup>            | 42         | A                   |
| $P_D$     | Power Dissipation ( $T_c=25^\circ\text{C}$ )           | 45         | W                   |
|           | Power Dissipation – Derate above $25^\circ\text{C}$    | 0.36       | W/ $^\circ\text{C}$ |
| $T_{STG}$ | Storage Temperature Range                              | -55 to 150 | $^\circ\text{C}$    |
| $T_J$     | Operating Junction Temperature Range                   | -55 to 125 | $^\circ\text{C}$    |

## Thermal Characteristics

| Symbol          | Parameter                              | Typ. | Max. | Unit               |
|-----------------|--|------|------|--------------------|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | ---  | 62   | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case    | ---  | 2.8  | $^\circ\text{C/W}$ |

**Electrical Characteristics ( $T_J=25^\circ\text{C}$ , unless otherwise noted)**
**Static State 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 $25^\circ\text{C}$ , $I_D=1mA$          | ---  | 0.04 | ---       | $V/^\circ\text{C}$  |
| $I_{DSS}$                    | 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                  |
| $R_{DS(ON)}$                 | Static Drain-Source On-Resistance <sup>3</sup> | $V_{GS}=10V$ , $I_D=20A$                             | ---  | 4.8  | 6         | $m\Omega$           |
|                              |  | $V_{GS}=4.5V$ , $I_D=10A$                            | ---  | 6.7  | 9         | $m\Omega$           |
| $V_{GS(th)}$                 | 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   | ---       | $mV/^\circ\text{C}$ |
| $g_{fs}$                     | Forward Transconductance                       | $V_{DS}=10V$ , $I_D=10A$                             | ---  | 23   | ---       | S                   |

**Dynamic Characteristics**

|              |                                     |  |     |      |      |          |
|--------------|-------------------------------------|--|-----|------|------|----------|
| $Q_g$        | Total Gate Charge <sup>3, 4</sup>   | $V_{DS}=15V$ , $V_{GS}=4.5V$ , $I_D=20A$                   | --- | 11.1 | 18   | nC       |
| $Q_{gs}$     | Gate-Source Charge <sup>3, 4</sup>  |  | --- | 1.85 | 3.8  |          |
| $Q_{gd}$     | Gate-Drain Charge <sup>3, 4</sup>   |  | --- | 6.8  | 12   |          |
| $T_{d(on)}$  | Turn-On Delay Time <sup>3, 4</sup>  | $V_{DD}=15V$ , $V_{GS}=10V$ , $R_G=3.3\Omega$<br>$I_D=15A$ | --- | 7.5  | 14   | ns       |
| $T_r$        | Rise Time <sup>3, 4</sup>           |  | --- | 14.5 | 28   |          |
| $T_{d(off)}$ | Turn-Off Delay Time <sup>3, 4</sup> |  | --- | 35.2 | 67   |          |
| $T_f$        | Fall Time <sup>3, 4</sup>           |  | --- | 9.6  | 18   |          |
| $C_{iss}$    | Input Capacitance                   | $V_{DS}=25V$ , $V_{GS}=0V$ , $F=1MHz$                      | --- | 1210 | 1800 | pF       |
| $C_{oss}$    | Output Capacitance                  |  | --- | 190  | 280  |          |
| $C_{rss}$    | Reverse Transfer Capacitance        |  | --- | 100  | 150  |          |
| $R_g$        | Gate resistance                     | $V_{GS}=0V$ , $V_{DS}=0V$ , $F=1MHz$                       | --- | 2.5  | 5    | $\Omega$ |

**Guaranteed Avalanche Energy**

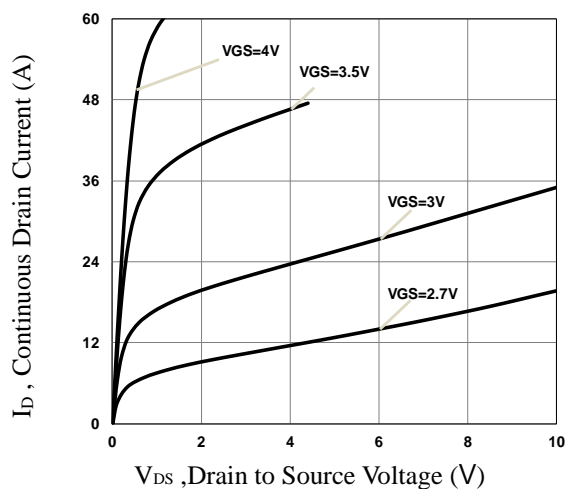
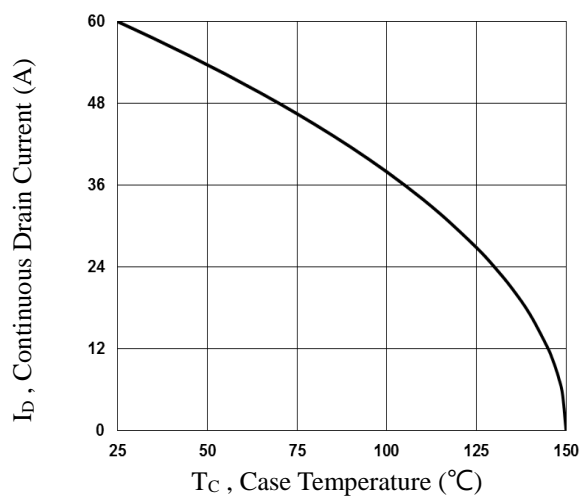
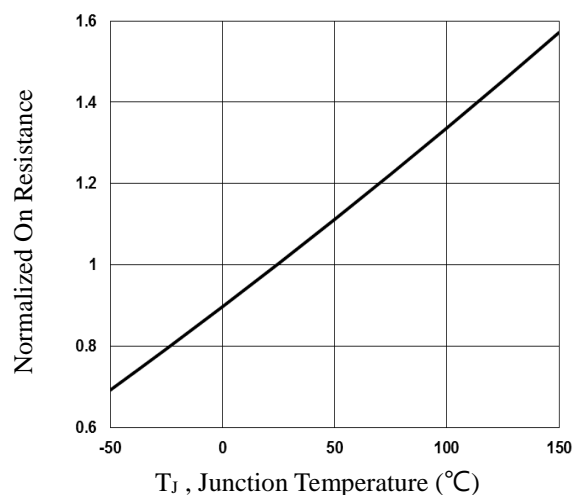
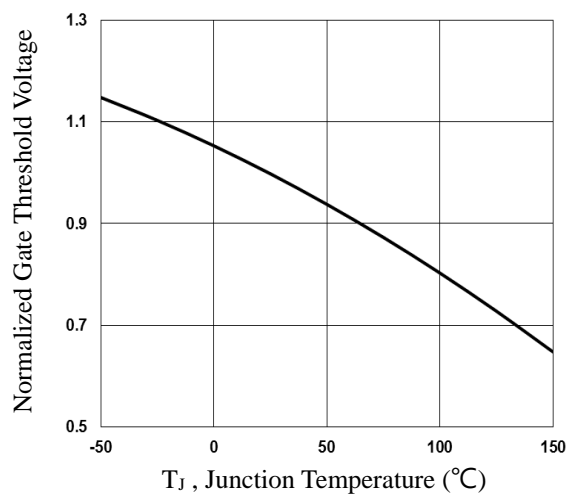
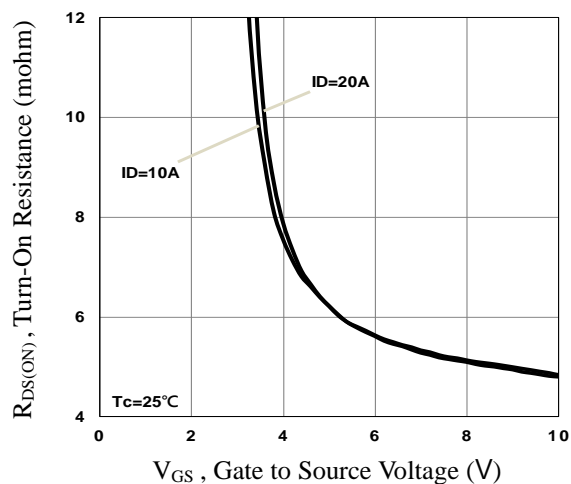
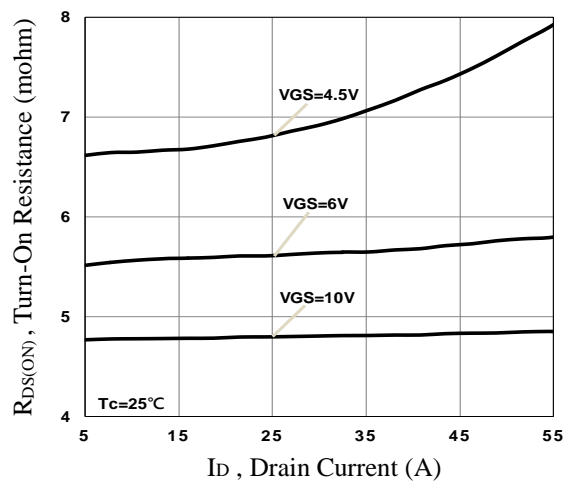
| Symbol | Parameter                     | Conditions                              | Min. | Typ. | Max. | Unit |
|--------|-------------------------------|---|------|------|------|------|
| EAS    | Single Pulse Avalanche Energy | $V_{DD}=25V$ , $L=0.1mH$ , $I_{AS}=20A$ | 20   | ---  | ---  | mJ   |

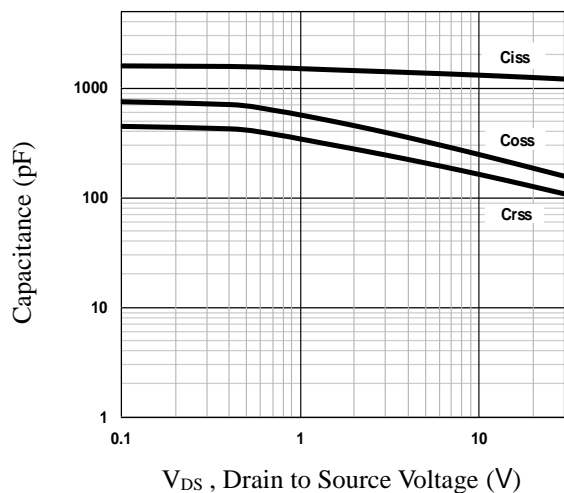
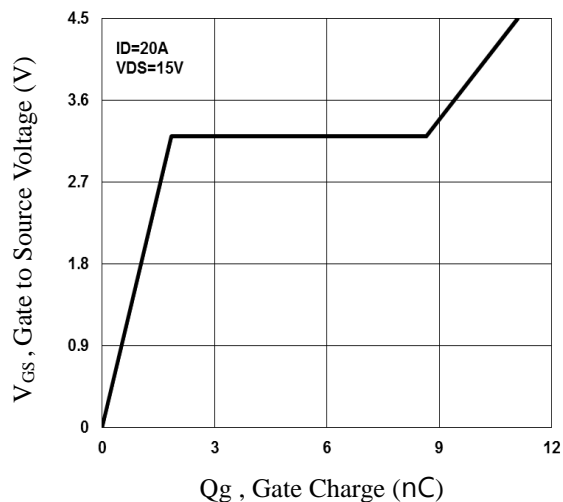
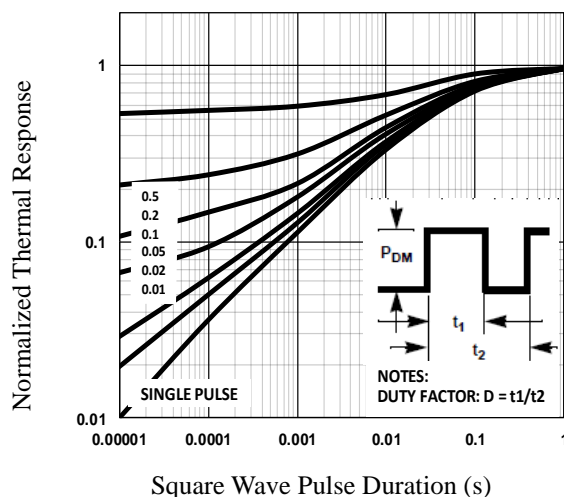
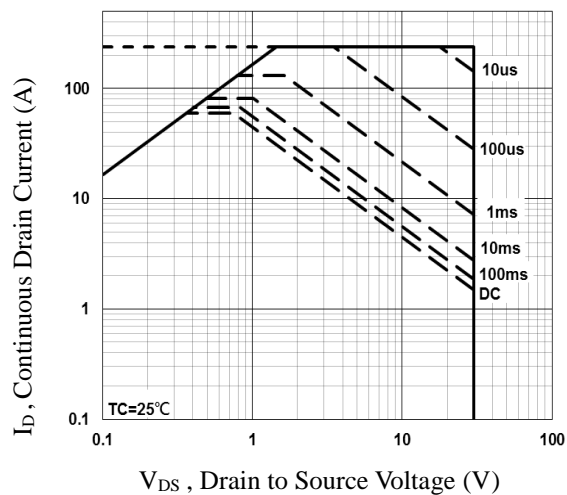
**Drain-Source Diode Characteristics**

| Symbol   | Parameter                          | Conditions                                      | Min. | Typ. | Max. | Unit |
|----------|------------------------------------|---|------|------|------|------|
| $I_S$    | Continuous Source Current          | $V_G=V_D=0V$ , Force Current                    | ---  | ---  | 60   | A    |
| $I_{SM}$ | Pulsed Source Current <sup>3</sup> |   | ---  | ---  | 240  | A    |
| $V_{SD}$ | Diode Forward Voltage <sup>3</sup> | $V_{GS}=0V$ , $I_S=1A$ , $T_J=25^\circ\text{C}$ | ---  | ---  | 1    | V    |
| $t_{rr}$ | Reverse Recovery Time              | $V_{GS}=0V$ , $I_S=1A$ , $di/dt=100A/\mu s$     | ---  | ---  | ---  | ns   |
| $Q_{rr}$ | Reverse Recovery Charge            | $T_J=25^\circ\text{C}$                          | ---  | ---  | ---  | nC   |

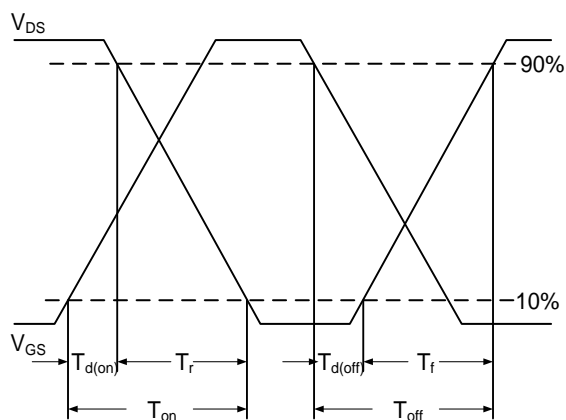
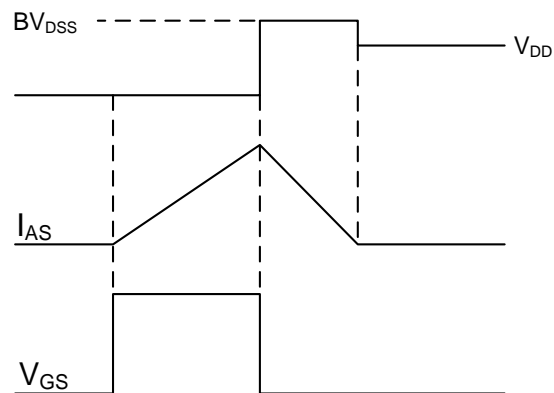
Note :

1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2.  $V_{DD}=25V$ ,  $V_{GS}=10V$ ,  $L=0.1mH$ ,  $I_{AS}=42A$ ,  $R_G=25\Omega$ , 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.

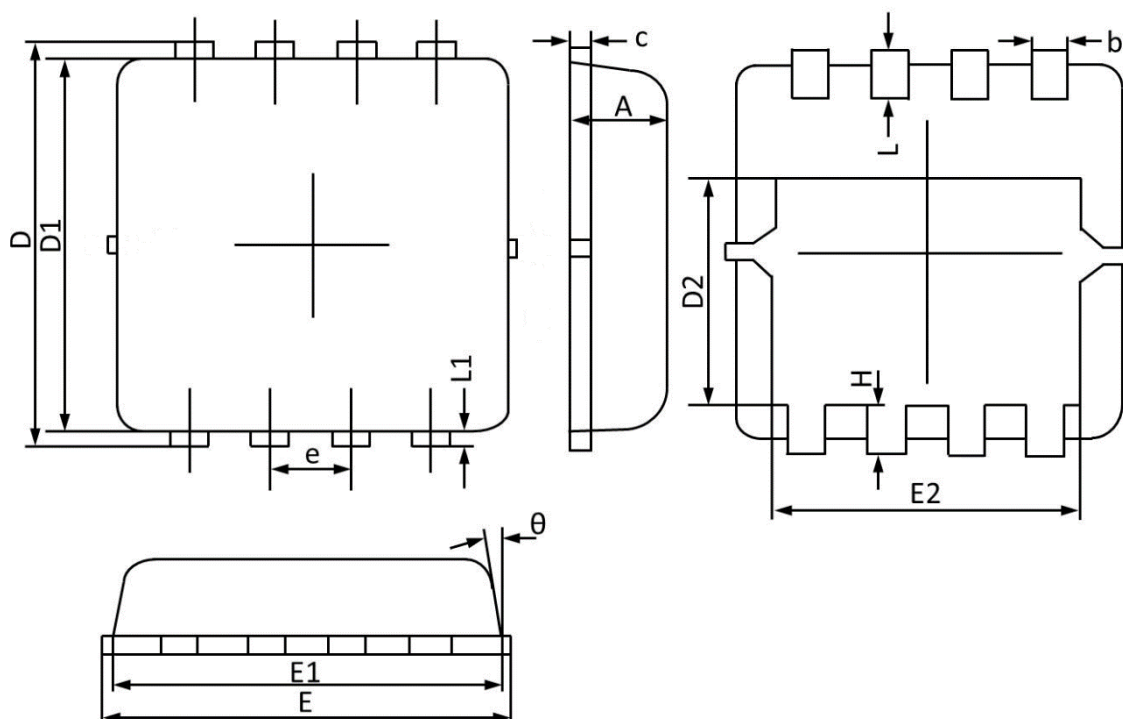

**Fig.1 Typical Output Characteristics**

**Fig.2 Continuous Drain Current vs.  $T_C$** 

**Fig.3 Normalized  $R_{DS(on)}$  vs.  $T_J$** 

**Fig.4 Normalized  $V_{th}$  vs.  $T_J$** 

**Fig.5 Turn-On Resistance vs.  $V_{GS}$** 

**Fig.6 Turn-On Resistance vs.  $I_D$**


**Fig.7 Capacitance Characteristics**

**Fig.8 Gate Charge Characteristics**

**Fig.9 Normalized Transient Impedance**

**Fig.10 Maximum Safe Operation Area**

$$EAS = \frac{1}{2} L \times I_{AS}^2 \times \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$


**Fig.11 Switching Time Waveform**

**Fig.12 EAS Waveform**

## PPAK3x3 PACKAGE INFORMATION



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | MAX                       | MIN   | MAX                  | MIN   |
| A      | 0.900                     | 0.700 | 0.035                | 0.028 |
| b      | 0.350                     | 0.250 | 0.014                | 0.010 |
| c      | 0.250                     | 0.100 | 0.010                | 0.004 |
| D      | 3.500                     | 3.050 | 0.138                | 0.120 |
| D1     | 3.200                     | 2.900 | 0.126                | 0.114 |
| D2     | 1.950                     | 1.350 | 0.077                | 0.053 |
| E      | 3.400                     | 3.000 | 0.134                | 0.118 |
| E1     | 3.300                     | 2.900 | 0.130                | 0.114 |
| E2     | 2.600                     | 2.350 | 0.102                | 0.093 |
| e      | 0.65BSC                   |       | 0.026BSC             |       |
| H      | 0.750                     | 0.300 | 0.030                | 0.012 |
| L      | 0.600                     | 0.300 | 0.024                | 0.012 |
| L1     | 0.200                     | 0.060 | 0.008                | 0.002 |
| θ      | 14°                       | 6°    | 14°                  | 6°    |

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