

### General Description

The WSD6040DN56 is the highest performance trench N-Ch MOSFET with extreme high cell density, which provide excellent  $R_{DS(on)}$  and gate charge for most of the synchronous buck converter applications.

The WSD6040DN56 meet the RoHS and Green Product requirement 100% EAS guaranteed with full function reliability approved.

### Features

- Lead Free and Green Devices Available (RoHS Compliant)
- 100% UIS + Rg Tested
- Reliable and Rugged
- Moisture Sensitivity Level MSL1

(per JED EC J-STD-020D)

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

| Symbol            | Parameter                              |                    | Rating     | Units         |
|-------------------|--|--------------------|------------|---------------|
| $V_{DS}$          | Drain-Source Voltage                   |                    | 60         | V             |
| $V_{GS}$          | Gate-Source Voltage                    |                    | $\pm 20$   | V             |
| $I_D$             | Continuous Drain Current               | $T_C=25^{\circ}C$  | 36         | A             |
|                   |  | $T_C=100^{\circ}C$ | 22         |               |
| $I_D$             | Continuous Drain Current               | $T_A=25^{\circ}C$  | 8.4        | A             |
|                   |  | $T_A=100^{\circ}C$ | 6.8        |               |
| $I_{DM}^a$        | Pulsed Drain Current                   | $T_C=25^{\circ}C$  | 140        | A             |
| $P_D$             | Maximum Power Dissipation              | $T_C=25^{\circ}C$  | 37.8       | W             |
|                   |  | $T_C=100^{\circ}C$ | 15.1       |               |
| $P_D$             | Maximum Power Dissipation              | $T_A=25^{\circ}C$  | 2.08       | W             |
|                   |  | $T_A=70^{\circ}C$  | 1.33       |               |
| $I_{AS}^c$        | Avalanche Current, Single pulse        | $L=0.5mH$          | 16         | A             |
| $E_{AS}^c$        | Single Pulse Avalanche Energy          | $L=0.5mH$          | 64         | mJ            |
| $I_S$             | Diode Continuous Forward Current       | $T_C=25^{\circ}C$  | 18         | A             |
| $T_J$             | Maximum Junction Temperature           |                    | 150        | $^{\circ}C$   |
| $T_{STG}$         | Storage Temperature Range              |                    | -55 to 150 | $^{\circ}C$   |
| $R_{\theta JA}^b$ | Thermal Resistance Junction to ambient | Steady State       | 60         | $^{\circ}C/W$ |
| $R_{\theta JC}$   | Thermal Resistance-Junction to Case    | Steady State       | 3.3        | $^{\circ}C/W$ |

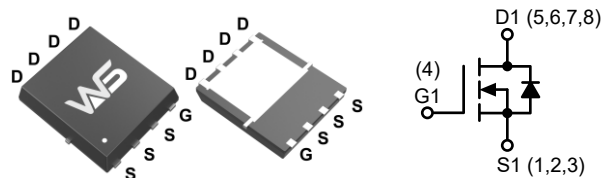
### Product Summary

| $BV_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|------------|--------------|-------|
| 60V        | 14m $\Omega$ | 36A   |

### Applications

- Secondary Side Synchronous Rectification
- DC-DC Converter
- Motor Control
- Load Switching

### DFN5X6-8L Pin Configuration



Note a: Pulse width limited by max. junction temperature.

Note b: Surface Mounted on 1in<sup>2</sup> pad area.

Note c: UIS tested and pulse width limited by maximum junction temperature 150°C (initial temperature T<sub>j</sub>=25°C).

**Electrical Characteristics @T<sub>A</sub>=25°C unless otherwise noted**

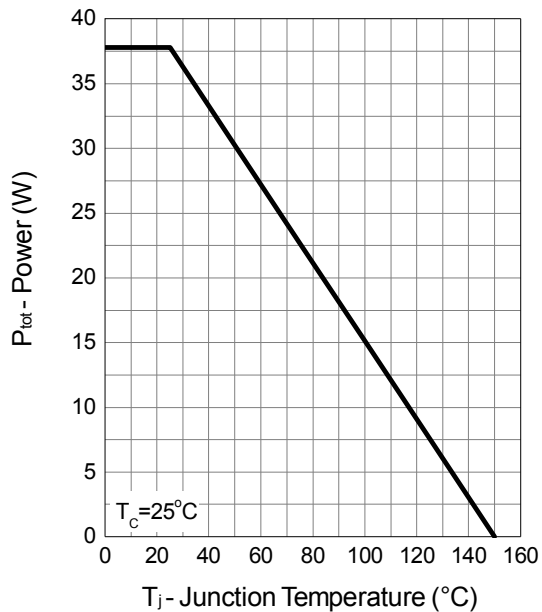
| Symbol  | Parameter                          | Conditions   | Min. | Typ. | Max. | Unit |
|---|------------------------------------|--|------|------|------|------|
| <b>Static</b>   |                                    |  |      |      |      |      |
| V <sub>(BR)DSS</sub>  | Drain-Source Breakdown Voltage     | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA   | 60   |      |      | V    |
| I <sub>DSS</sub>  | Zero Gate Voltage Drain Current    | V <sub>DS</sub> = 48 V, V <sub>GS</sub> = 0V   |      |      | 1    | μA   |
|   |                                    | T <sub>J</sub> =85°C   |      |      | 30   |      |
| I <sub>GSS</sub>  | Gate Leakage Current               | V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V   |      |      | ±100 | nA   |
| <b>On Characteristics</b>                                     |                                    |  |      |      |      |      |
| V <sub>GS(TH)</sub>   | Gate Threshold Voltage             | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250μA   | 1    | 1.6  | 2.5  | V    |
| R <sub>DS(on)</sub> <sup>d</sup>                              | Drain-Source On-state Resistance   | V <sub>GS</sub> = 10V, I <sub>D</sub> = 25A  |      | 14   | 17.5 | mΩ   |
|   |                                    | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 20A   |      | 19   | 22   | mΩ   |
| <b>Switching</b>  |                                    |  |      |      |      |      |
| Q <sub>g</sub>  | Total Gate Charge                  | V <sub>DS</sub> =30V<br>V <sub>GS</sub> =10V<br>I <sub>D</sub> =25A  |      | 42   |      | nC   |
| Q <sub>gs</sub>   | Gate-Source Charge                 |  |      | 6.4  |      | nC   |
| Q <sub>gd</sub>   | Gate-Drain Charge                  |  |      | 9.6  |      | nC   |
| t <sub>d(on)</sub>  | Turn-on Delay Time                 | V <sub>GEN</sub> =10V<br>V <sub>DD</sub> =30V<br>I <sub>D</sub> =1A<br>R <sub>G</sub> =6Ω<br>R <sub>L</sub> =30Ω |      | 9    |      | ns   |
| t <sub>r</sub>  | Turn-on Rise Time                  |  |      | 17   |      | ns   |
| t <sub>d(off)</sub>   | Turn-off Delay Time                |  |      | 14   |      | ns   |
| t <sub>f</sub>  | Turn-off Fall Time                 |  |      | 58   |      | ns   |
| R <sub>g</sub>  | Gate resistance                    | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz   |      | 1.5  |      | Ω    |
| <b>Dynamic</b>  |                                    |  |      |      |      |      |
| C <sub>iss</sub>  | In Capacitance                     | V <sub>GS</sub> =0V<br>V <sub>DS</sub> =30V<br>f=1MHz  |      | 2100 |      | pF   |
| C <sub>oss</sub>  | Out Capacitance                    |  |      | 140  |      | pF   |
| C <sub>rss</sub>  | Reverse Transfer Capacitance       |  |      | 100  |      | pF   |
| <b>Drain-Source Diode Characteristics and Maximum Ratings</b> |                                    |  |      |      |      |      |
| I <sub>S</sub>  | Continuous Source Current          | V <sub>G</sub> =V <sub>D</sub> =0V, Force Current  |      |      | 18   | A    |
| I <sub>SM</sub>   | Pulsed Source Current <sup>3</sup> |  |      |      | 35   | A    |
| V <sub>SD</sub> <sup>d</sup>                                  | Diode Forward Voltage              | I <sub>SD</sub> = 20A, V <sub>GS</sub> =0V   |      | 0.8  | 1.3  | V    |
| t <sub>rr</sub>   | Reverse Recovery Time              | I <sub>SD</sub> =25A, dI <sub>SD</sub> /dt=100A/μs   |      | 27   |      | ns   |
| Q <sub>rr</sub>   | Reverse Recovery Charge            |  |      |      | 33   |      |

Note d: Pulse test ; pulse width ≤ 300μs, duty cycle ≤ 2%.

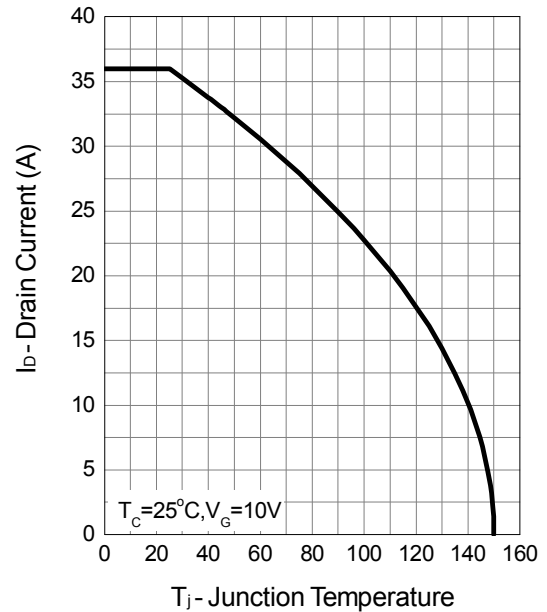
Note e: Guaranteed by design, not subject to production testing.

## Typical Operating Characteristics

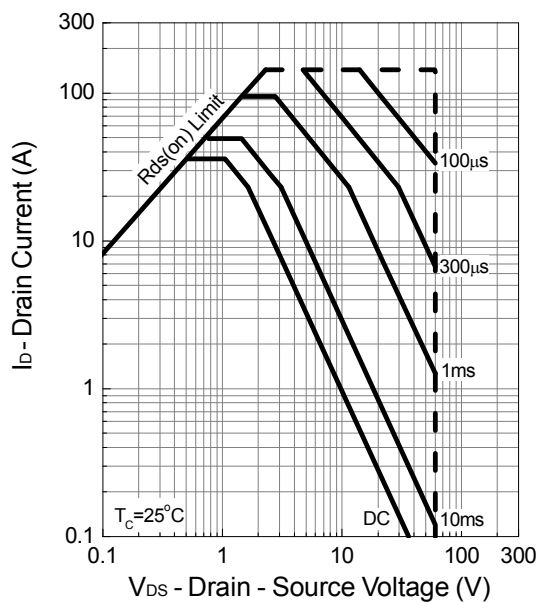
**Power Dissipation**



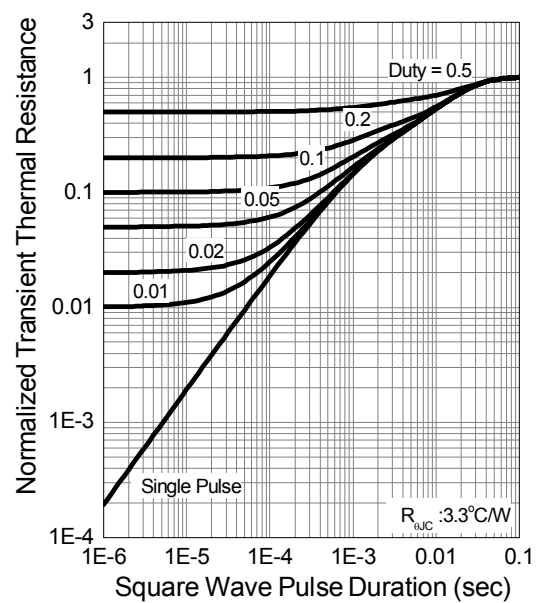
**Drain Current**



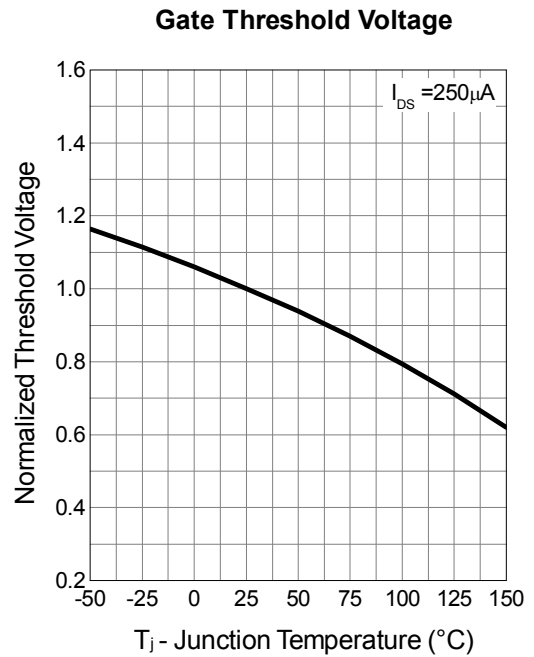
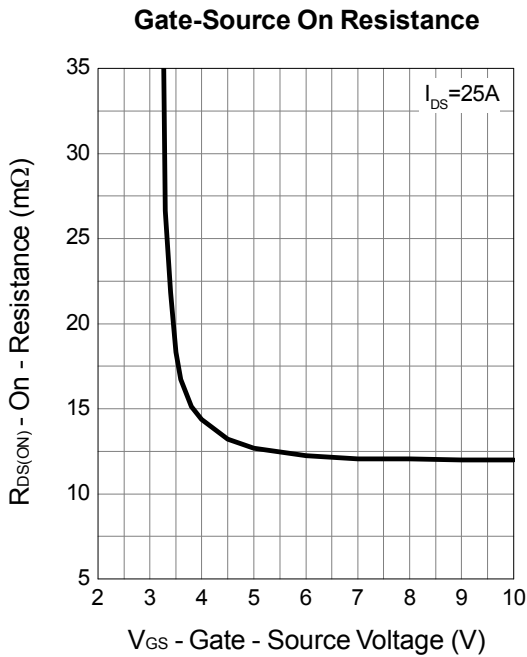
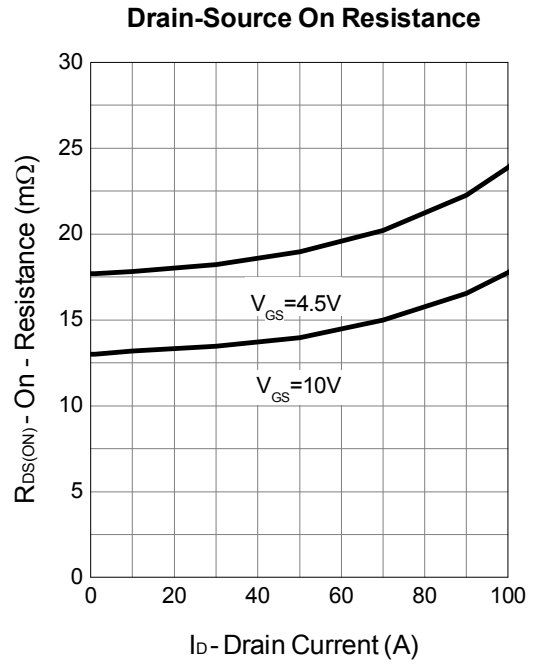
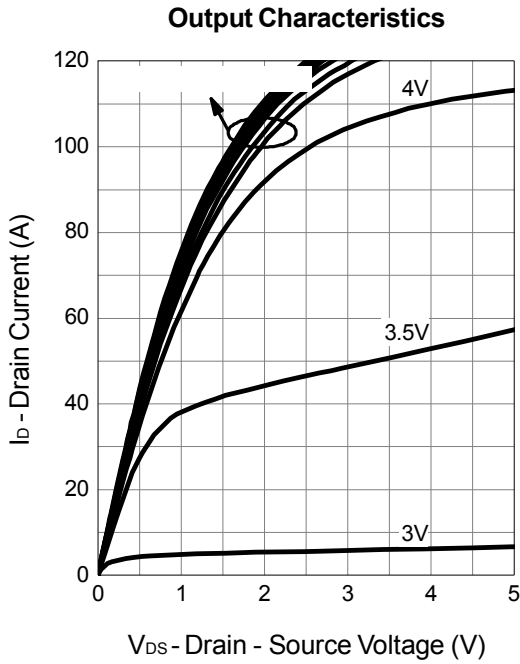
**Safe Operation Area**



**Thermal Transient Impedance**

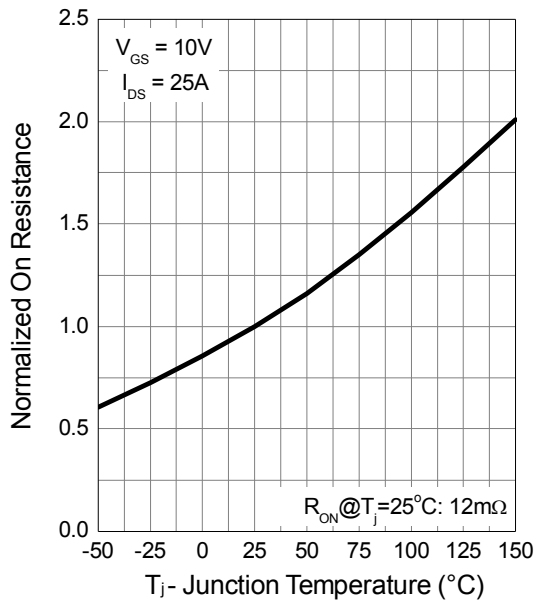


**Typical Operating Characteristics (Cont.)**

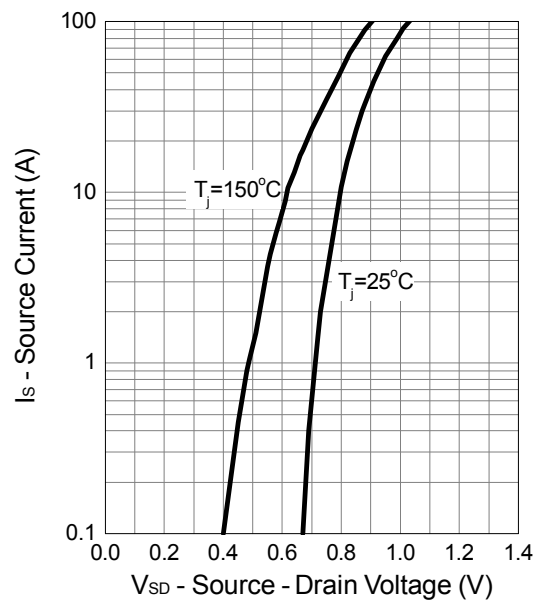


### Typical Operating Characteristics (Cont.)

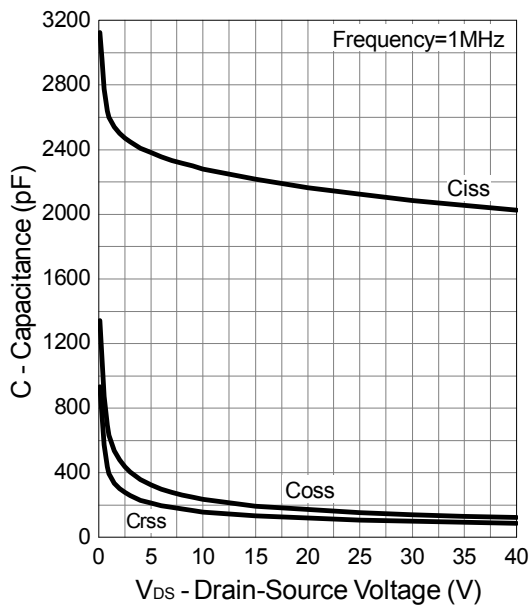
**Drain-Source On Resistance**



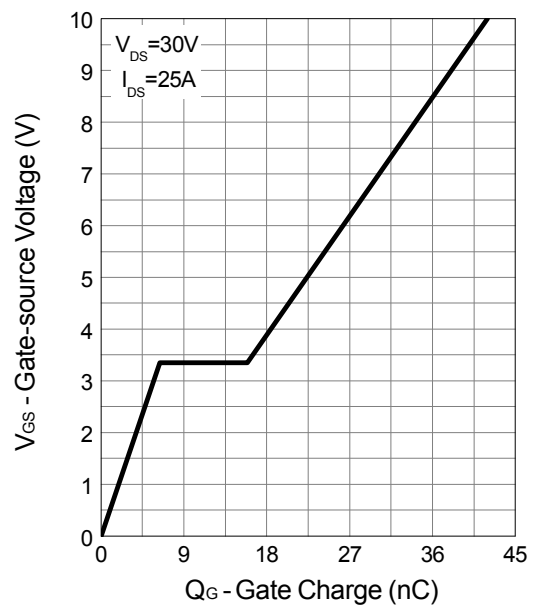
**Source-Drain Diode Forward**

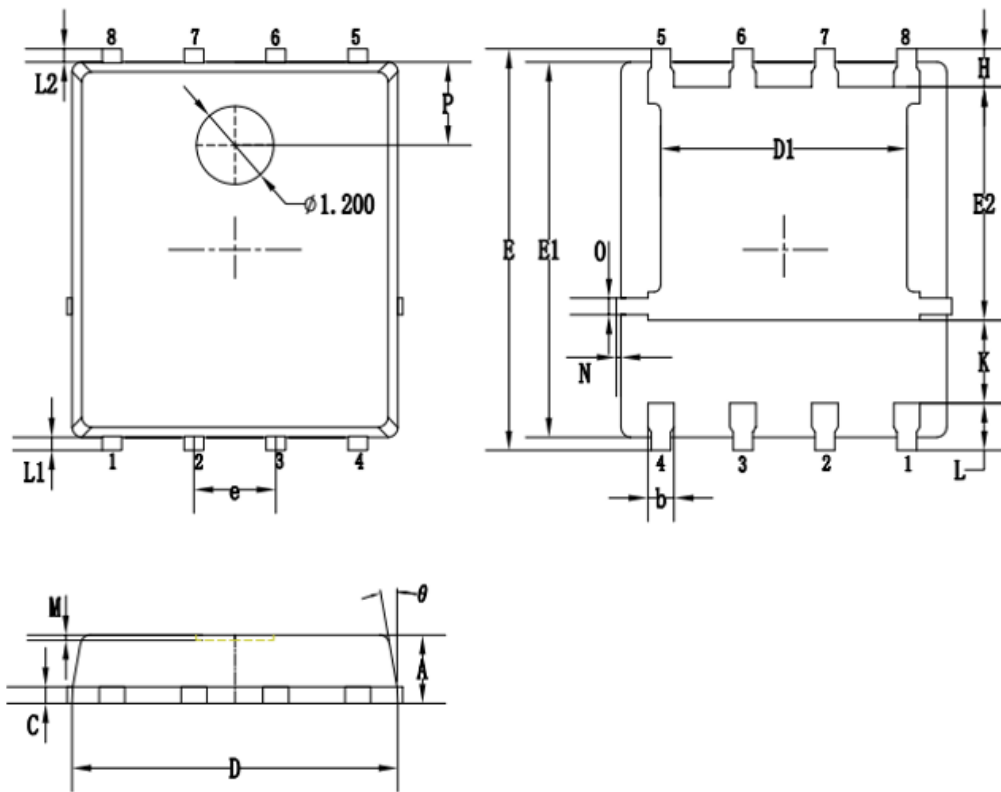


**Capacitance**



**Gate Charge**



**Packaging information**


| SYMBOLS  | MILLIMETERS |      |      |
|----------|-------------|------|------|
|          | MIN.        | NOM. | MAX. |
| A        | 0.90        | 1.05 | 1.20 |
| b        | 0.35        | 0.40 | 0.50 |
| C        | 0.20        | 0.25 | 0.35 |
| D        | 4.90        | 5.05 | 5.20 |
| D1       | 3.72        | 3.82 | 3.92 |
| E        | 6.00        | 6.15 | 6.30 |
| E1       | 5.60        | 5.75 | 5.90 |
| E2       | 3.47        | 3.57 | 3.67 |
| e        | 1.27 BSC.   |      |      |
| H        | 0.48        | 0.58 | 0.68 |
| K        | 1.17        | 1.27 | 1.37 |
| L        | 0.64        | 0.74 | 0.84 |
| L1/L2    | 0.20 REF.   |      |      |
| $\theta$ | 8°          | 10°  | 12°  |
| M        | 0.08 REF.   |      |      |
| N        | 0           | -    | 0.15 |
| O        | 0.25 REF.   |      |      |
| P        | 1.28 REF.   |      |      |



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