

## General Description

The WSP4964 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 WSP4964 meet the RoHS and Green Product requirement , 100% EAS guaranteed with full function reliability approved.

## Features

- Advanced high cell density Trench technology
- Super Low Gate Charge
- Excellent  $CdV/dt$  effect decline
- 100% EAS Guaranteed
- Green Device Available

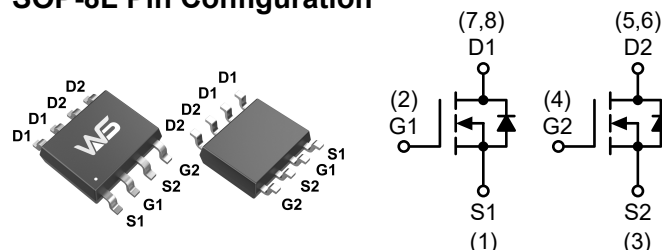
## Product Summary

| $BV_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|------------|--------------|-------|
| 40V        | 18m $\Omega$ | 9A    |

## Applications

- High Frequency Point-of-Load Synchronous Buck Converter for MB/NB/UMPC/VGA
- Networking DC-DC Power System
- Load Switch

## SOP-8L Pin Configuration



## Absolute Maximum Ratings

| Symbol                | Parameter                                  | Rating     | Units       |
|-----------------------|--------------------------------------------|------------|-------------|
| $V_{DS}$              | Drain-Source Voltage                       | 40         | V           |
| $V_{GS}$              | Gate-Source Voltage                        | $\pm 20$   | V           |
| $I_D@T_C=25^{\circ}C$ | Continuous Drain Current, $V_{GS} @ 10V^1$ | 9          | A           |
| $I_D@T_C=70^{\circ}C$ | Continuous Drain Current, $V_{GS} @ 10V^1$ | 4.6        | A           |
| $I_{DM}$              | Pulsed Drain Current <sup>2</sup>          | 30         | A           |
| EAS                   | Single Pulse Avalanche Energy <sup>3</sup> | 15         | mJ          |
| $I_{AS}$              | Avalanche Current                          | 10.5       | A           |
| $P_D@T_A=25^{\circ}C$ | Total Power Dissipation <sup>4</sup>       | 2.5        | W           |
| $T_{STG}$             | Storage Temperature Range                  | -55 to 150 | $^{\circ}C$ |
| $T_J$                 | Operating Junction Temperature Range       | -55 to 150 | $^{\circ}C$ |

## Thermal Data

| Symbol          | Parameter                                        | Typ. | Max. | Unit          |
|-----------------|--------------------------------------------------|------|------|---------------|
| $R_{\theta JA}$ | Thermal Resistance Junction-ambient <sup>1</sup> | ---  | 65.2 | $^{\circ}C/W$ |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case <sup>1</sup>    | ---  | 50   | $^{\circ}C/W$ |

**Electrical Characteristics ( $T_J=25^\circ\text{C}$ , unless otherwise noted)**

| Symbol                       | Parameter                                      | Conditions                                                                | Min. | Typ.  | Max.      | Unit                 |
|------------------------------|------------------------------------------------|---------------------------------------------------------------------------|------|-------|-----------|----------------------|
| $BV_{DSS}$                   | Drain-Source Breakdown Voltage                 | $V_{GS}=0V$ , $I_D=250\mu A$                                              | 40   | ---   | ---       | V                    |
| $\Delta BV_{DSS}/\Delta T_J$ | BVDSS Temperature Coefficient                  | Reference to $25^\circ\text{C}$ , $I_D=1mA$                               | ---  | 0.044 | ---       | V/ $^\circ\text{C}$  |
| $R_{DS(ON)}$                 | Static Drain-Source On-Resistance <sup>2</sup> | $V_{GS}=10V$ , $I_D=2A$                                                   | ---  | 18    | 23        | $m\Omega$            |
|                              |                                                | $V_{GS}=4.5V$ , $I_D=2A$                                                  | ---  | 25    | 35        |                      |
| $V_{GS(th)}$                 | Gate Threshold Voltage                         | $V_{GS}=V_{DS}$ , $I_D=250\mu A$                                          | 1.0  | 1.4   | 2.5       | V                    |
| $\Delta V_{GS(th)}$          | $V_{GS(th)}$ Temperature Coefficient           |                                                                           | ---  | -3.8  | ---       | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                    | Drain-Source Leakage Current                   | $V_{DS}=24V$ , $V_{GS}=0V$ , $T_J=25^\circ\text{C}$                       | ---  | ---   | 1         | $\mu A$              |
|                              |                                                | $V_{DS}=24V$ , $V_{GS}=0V$ , $T_J=55^\circ\text{C}$                       | ---  | ---   | 5         |                      |
| $I_{GSS}$                    | Gate-Source Leakage Current                    | $V_{GS}=\pm 20V$ , $V_{DS}=0V$                                            | ---  | ---   | $\pm 100$ | nA                   |
| $g_{fs}$                     | Forward Transconductance                       | $V_{DS}=5V$ , $I_D=4A$                                                    | ---  | 16    | ---       | S                    |
| $R_g$                        | Gate Resistance                                | $V_{DS}=0V$ , $V_{GS}=0V$ , $f=1MHz$                                      | ---  | 2.5   | 5         | $\Omega$             |
| $Q_g$                        | Total Gate Charge (10V)                        | $V_{DS}=20V$ , $V_{GS}=10V$ , $I_D=6.3A$                                  | ---  | 5     | ---       | nC                   |
| $Q_{gs}$                     | Gate-Source Charge                             |                                                                           | ---  | 1.9   | ---       |                      |
| $Q_{gd}$                     | Gate-Drain Charge                              |                                                                           | ---  | 3.6   | ---       |                      |
| $T_{d(on)}$                  | Turn-On Delay Time                             | $V_{DD}=20V$ , $V_{GEN}=10V$ , $R_G=6\Omega$<br>$I_D=4A$ , $R_L=30\Omega$ | ---  | 8.2   | ---       | ns                   |
| $T_r$                        | Rise Time                                      |                                                                           | ---  | 3     | ---       |                      |
| $T_{d(off)}$                 | Turn-Off Delay Time                            |                                                                           | ---  | 23    | ---       |                      |
| $T_f$                        | Fall Time                                      |                                                                           | ---  | 3.1   | ---       |                      |
| $C_{iss}$                    | Input Capacitance                              | $V_{DS}=20V$ , $V_{GS}=0V$ , $f=1MHz$                                     | ---  | 610   | ---       | pF                   |
| $C_{oss}$                    | Output Capacitance                             |                                                                           | ---  | 102   | ---       |                      |
| $C_{rss}$                    | Reverse Transfer Capacitance                   |                                                                           | ---  | 60    | ---       |                      |

**Guaranteed Avalanche Characteristics**

| Symbol | Parameter                                  | Conditions                                | Min. | Typ. | Max. | Unit |
|--------|--------------------------------------------|-------------------------------------------|------|------|------|------|
| EAS    | Single Pulse Avalanche Energy <sup>5</sup> | $V_{DD}=20V$ , $L=0.1mH$ , $I_{AS}=10.5A$ | 15   | ---  | ---  | mJ   |

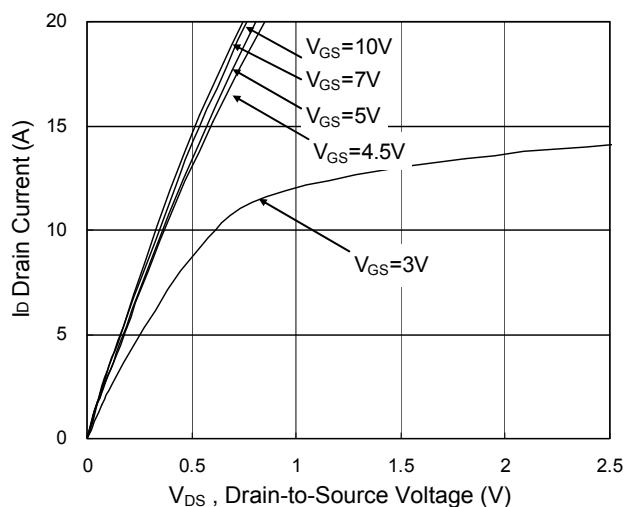
**Diode Characteristics**

| Symbol   | Parameter                                | Conditions                                               | Min. | Typ. | Max. | Unit |
|----------|------------------------------------------|----------------------------------------------------------|------|------|------|------|
| $I_S$    | Continuous Source Current <sup>1,6</sup> | $V_G=V_D=0V$ , Force Current                             | ---  | ---  | 5.0  | A    |
| $I_{SM}$ | Pulsed Source Current <sup>2,6</sup>     |                                                          | ---  | ---  | 10.5 | A    |
| $V_{SD}$ | Diode Forward Voltage <sup>2</sup>       | $V_{GS}=0V$ , $I_S=1A$ , $T_J=25^\circ\text{C}$          | ---  | ---  | 1.1  | V    |
| $t_{rr}$ | Reverse Recovery Time                    | $I_F=6.3A$ , $dI/dt=100A/\mu s$ , $T_J=25^\circ\text{C}$ | ---  | 18   | ---  | nS   |
| $Q_{rr}$ | Reverse Recovery Charge                  |                                                          | ---  | 16   | ---  | nC   |

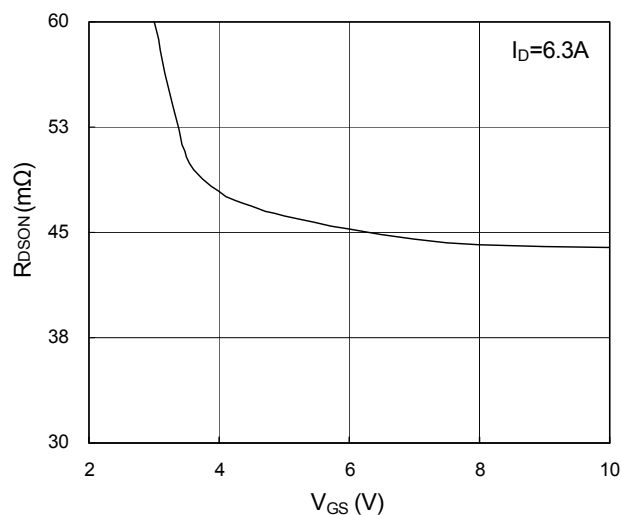
Note :

- 1.The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper,  $t<10sec$ .
- 2.The data tested by pulsed , pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
- 3.The EAS data shows Max. rating . The test condition is  $V_{DD}=25V$ ,  $V_{GS}=10V$ ,  $L=0.1mH$ ,  $I_{AS}=12A$
- 4.The power dissipation is limited by  $150^\circ\text{C}$  junction temperature
- 5.The Min. value is 100% EAS tested guarantee.
- 6.The data is theoretically the same as  $I_D$  and  $I_{DM}$ , in real applications , should be limited by total power dissipation.

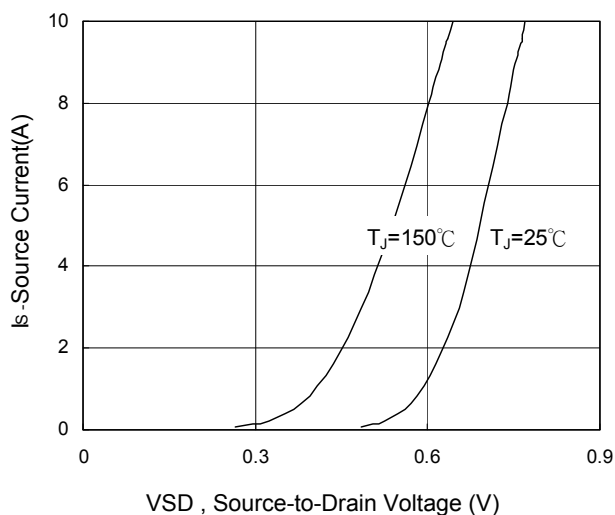
### Typical Characteristics



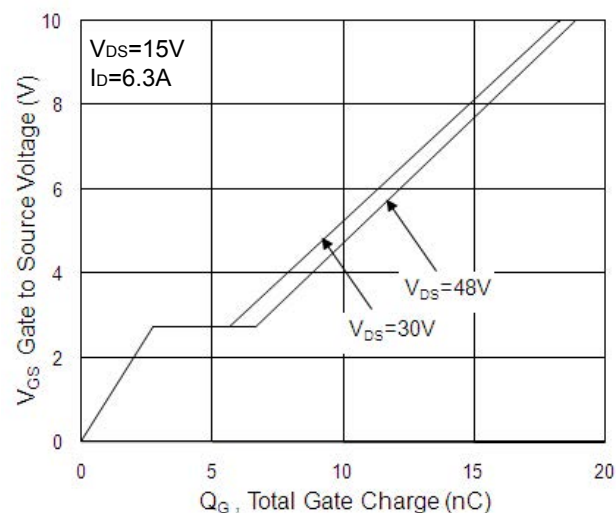
**Fig.1 Typical Output Characteristics**



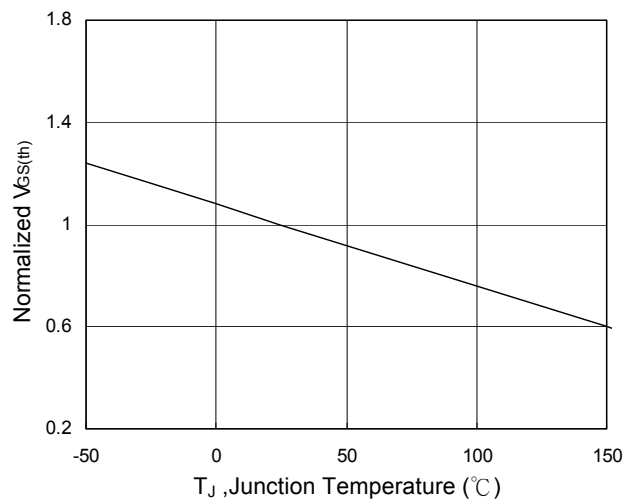
**Fig.2 On-Resistance vs. Gate-Source**



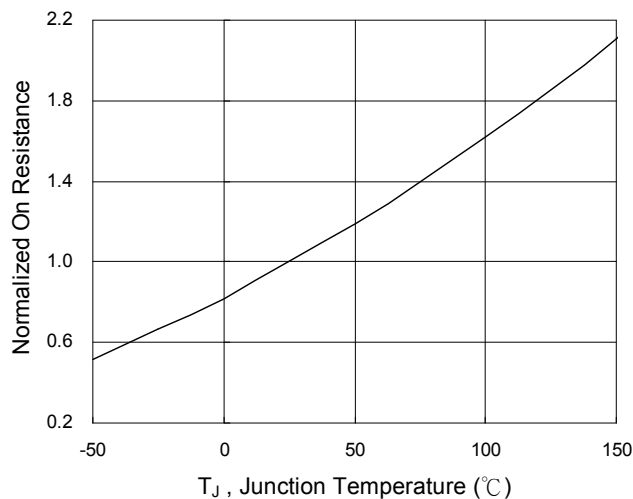
**Fig.3 Forward Characteristics Of Reverse**



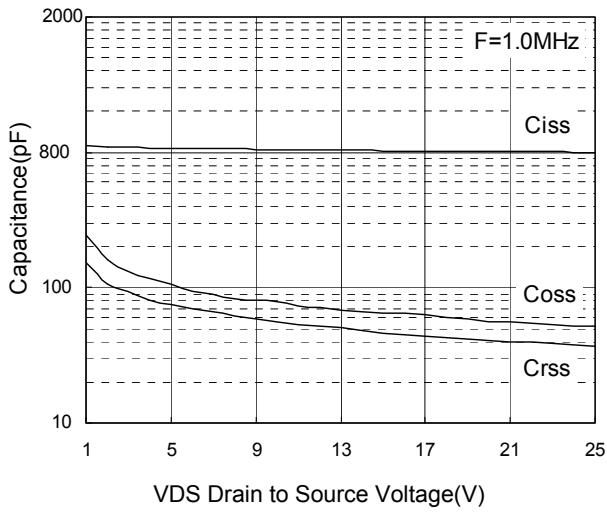
**Fig.4 Gate-Charge Characteristics**



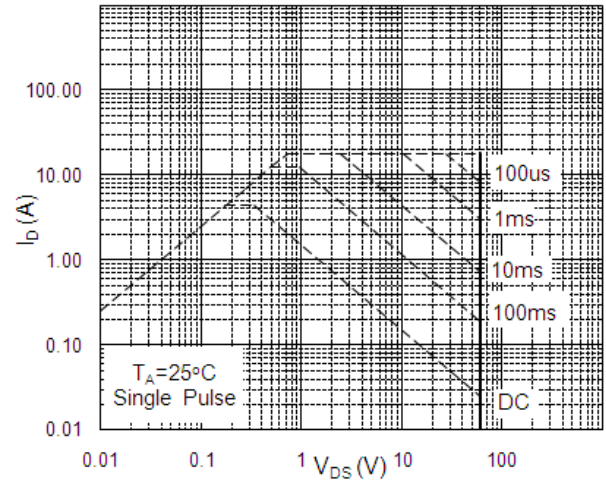
**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**



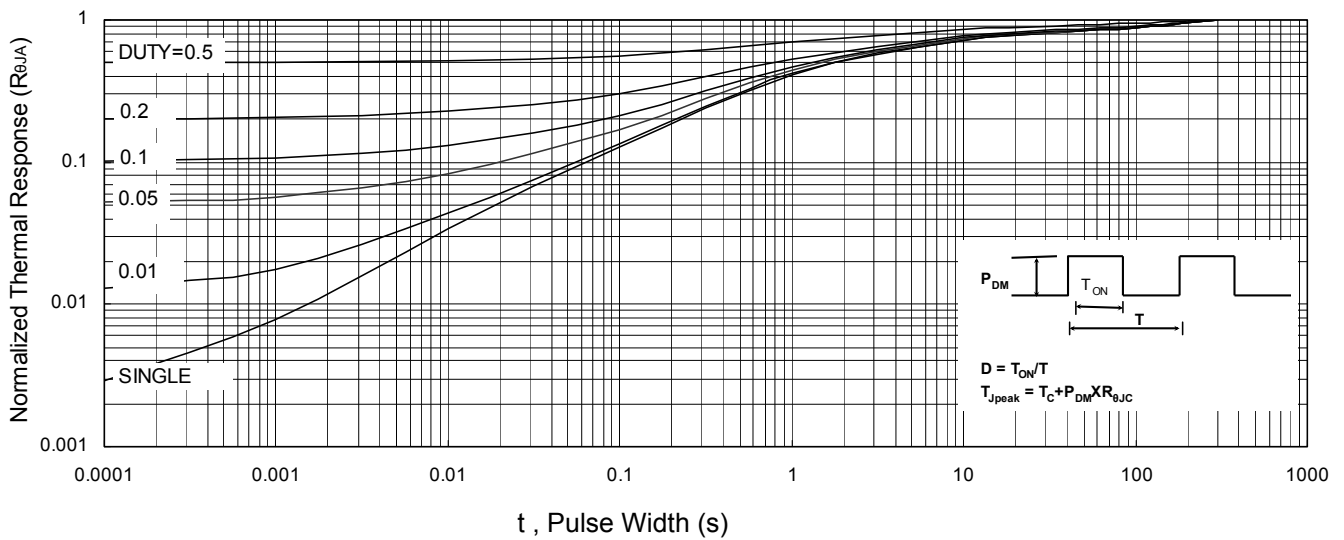
**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**



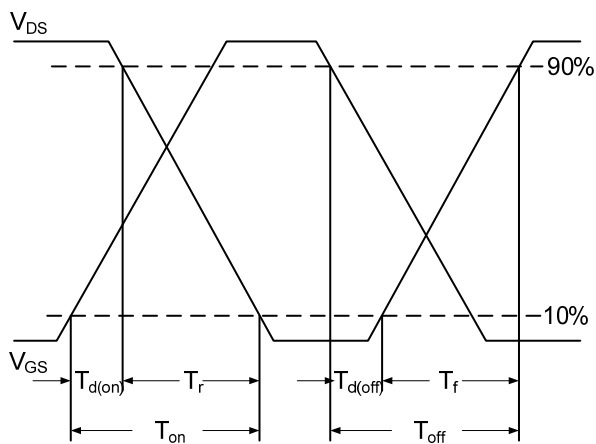
**Fig.7 Capacitance**



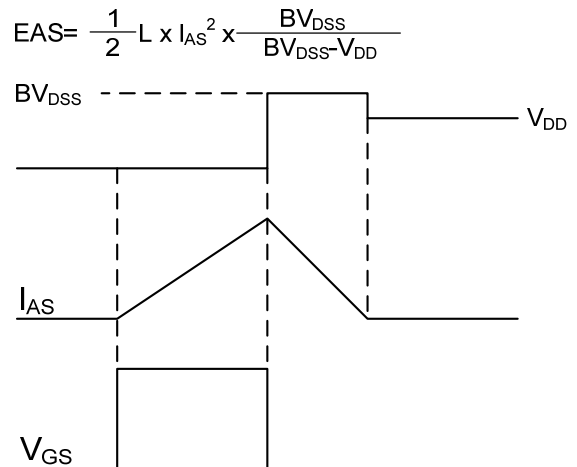
**Fig.8 Safe Operating Area**



**Fig.9 Normalized Maximum Transient Thermal Impedance**

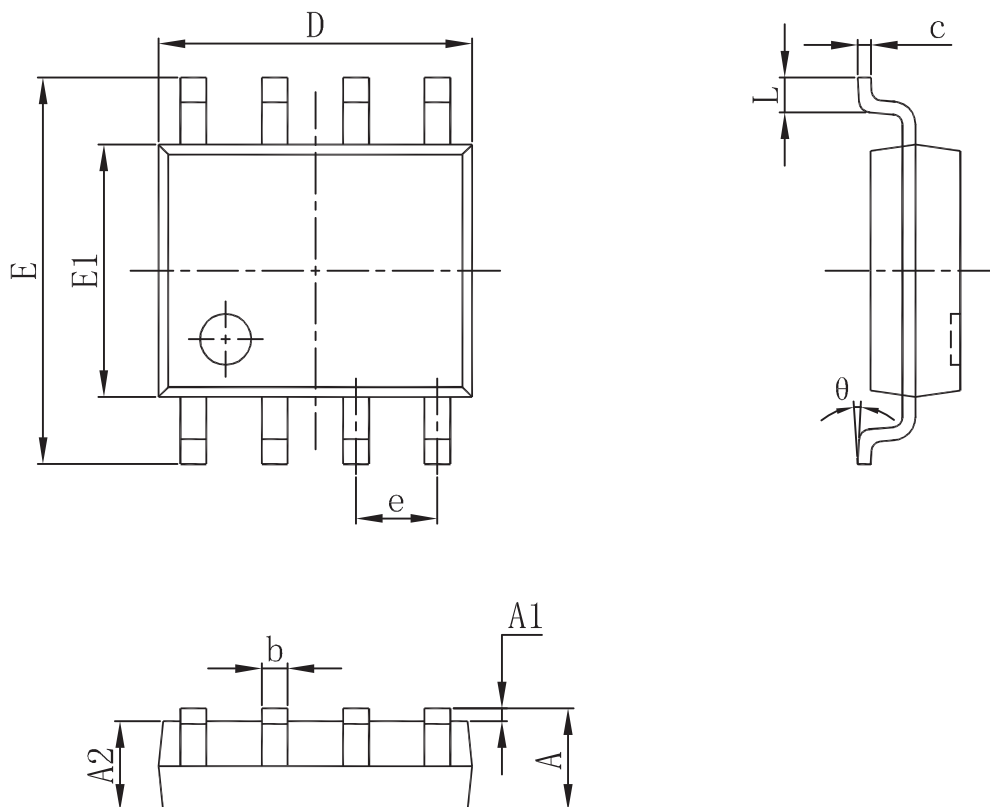


**Fig.10 Switching Time Waveform**



**Fig.11 Unclamped Inductive Switching Waveform**

## Packaging information



| 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 | 0.007                | 0.010 |
| D      | 4.800                     | 5.000 | 0.189                | 0.197 |
| e      | 1.270 (BSC)               |       | 0.050 (BSC)          |       |
| E      | 5.800                     | 6.200 | 0.228                | 0.244 |
| E1     | 3.800                     | 4.000 | 0.150                | 0.157 |
| L      | 0.400                     | 1.270 | 0.016                | 0.050 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |

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