

## NCE N-Channel Super Trench Power MOSFET

### Description

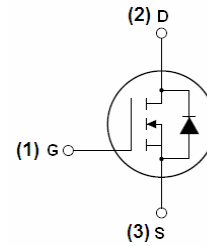
The NCEP85T35T uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

### General Features

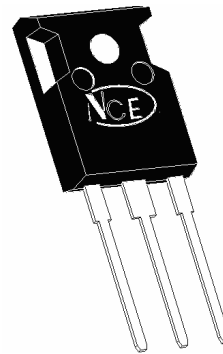
- $V_{DS} = 85V, I_D = 350A$   
 $R_{DS(ON)} < 1.85m\Omega @ V_{GS} = 10V$
- Excellent gate charge x  $R_{DS(on)}$  product
- Very low on-resistance  $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating
- 100% UIS tested

### Application

- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification



Schematic diagram



TO-247 top view

**100% UIS TESTED!**

**100% ΔVds TESTED!**

### Package Marking and Ordering Information

| Device Marking | Device     | Device Package | Reel Size | Tape width | Quantity |
|----------------|------------|----------------|-----------|------------|----------|
| NCEP85T35T     | NCEP85T35T | TO-247         | -         | -          | -        |

### Absolute Maximum Ratings ( $T_C = 25^\circ C$ unless otherwise noted)

| Parameter   | Symbol             | Limit      | Unit |
|---|--------------------|------------|------|
| Drain-Source Voltage                              | $V_{DS}$           | 85         | V    |
| Gate-Source Voltage                               | $V_{GS}$           | $\pm 20$   | V    |
| Drain Current-Continuous                          | $I_D$              | 350        | A    |
| Drain Current-Continuous( $T_C = 100^\circ C$ )   | $I_D(100^\circ C)$ | 280        | A    |
| Pulsed Drain Current                              | $I_{DM}$           | 1400       | A    |
| Maximum Power Dissipation                         | $P_D$              | 520        | W    |
| Derating factor                                   |                    | 3.47       | W/°C |
| Single pulse avalanche energy <sup>(Note 5)</sup> | $E_{AS}$           | 3800       | mJ   |
| Operating Junction and Storage Temperature Range  | $T_J, T_{STG}$     | -55 To 175 | °C   |

### Thermal Characteristic

|  |                 |      |      |
|--|-----------------|------|------|
| Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup> | $R_{\theta JC}$ | 0.29 | °C/W |
|--|-----------------|------|------|

**Electrical Characteristics (T<sub>C</sub>=25°C unless otherwise noted)**

| Parameter                                 | Symbol              | Condition  | Min | Typ   | Max  | Unit |
|---|---------------------|--|-----|-------|------|------|
| <b>Off Characteristics</b>                |                     |  |     |       |      |      |
| Drain-Source Breakdown Voltage            | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA  | 85  | 90    | -    | V    |
| Zero Gate Voltage Drain Current           | I <sub>DSS</sub>    | V <sub>DS</sub> =85V, V <sub>GS</sub> =0V  | -   | -     | 1    | μA   |
| Gate-Body Leakage Current                 | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V   | -   | -     | ±100 | nA   |
| <b>On Characteristics</b> (Note 3)        |                     |  |     |       |      |      |
| Gate Threshold Voltage                    | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                 | 3   | 3.8   | 5    | V    |
| Drain-Source On-State Resistance          | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =175A   | -   | 1.4   | 1.85 | mΩ   |
| Forward Transconductance                  | g <sub>FS</sub>     | V <sub>DS</sub> =10V, I <sub>D</sub> =175A   | -   | 150   | -    | S    |
| <b>Dynamic Characteristics</b> (Note 4)   |                     |  |     |       |      |      |
| Input Capacitance                         | C <sub>iss</sub>    | V <sub>DS</sub> =40V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                   | -   | 19500 | -    | PF   |
| Output Capacitance                        | C <sub>oss</sub>    |  | -   | 2990  | -    | PF   |
| Reverse Transfer Capacitance              | C <sub>rss</sub>    |  | -   | 200   | -    | PF   |
| <b>Switching Characteristics</b> (Note 4) |                     |  |     |       |      |      |
| Turn-on Delay Time                        | t <sub>d(on)</sub>  | V <sub>DD</sub> =40V, I <sub>D</sub> =100A<br>V <sub>GS</sub> =10V, R <sub>G</sub> =1.8Ω | -   | 35    | -    | nS   |
| Turn-on Rise Time                         | t <sub>r</sub>      |  | -   | 98    | -    | nS   |
| Turn-Off Delay Time                       | t <sub>d(off)</sub> |  | -   | 110   | -    | nS   |
| Turn-Off Fall Time                        | t <sub>f</sub>      |  | -   | 45    | -    | nS   |
| Total Gate Charge                         | Q <sub>g</sub>      | V <sub>DS</sub> =40V, I <sub>D</sub> =100A,<br>V <sub>GS</sub> =10V                      | -   | 324   | -    | nC   |
| Gate-Source Charge                        | Q <sub>gs</sub>     |  | -   | 123   | -    | nC   |
| Gate-Drain Charge                         | Q <sub>gd</sub>     |  | -   | 88    | -    | nC   |
| <b>Drain-Source Diode Characteristics</b> |                     |  |     |       |      |      |
| Diode Forward Voltage (Note 3)            | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>F</sub> =175A  | -   | -     | 1.2  | V    |
| Diode Forward Current (Note 2)            | I <sub>S</sub>      |  | -   | -     | 350  | A    |
| Reverse Recovery Time                     | t <sub>rr</sub>     | T <sub>J</sub> = 25°C, I <sub>F</sub> = I <sub>S</sub><br>di/dt = 100A/μs (Note 3)       | -   | 155   | -    | nS   |
| Reverse Recovery Charge                   | Q <sub>rr</sub>     |  | -   | 436   | -    | nC   |

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. EAS condition : T<sub>J</sub>=25°C, V<sub>DD</sub>=42.5V, V<sub>G</sub>=10V, L=1mH, R<sub>G</sub>=25Ω

**Test Circuit**

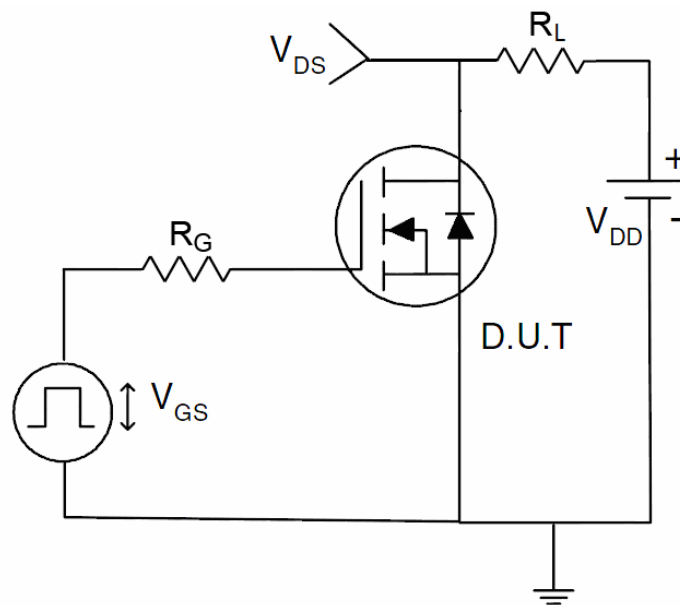
**1) E<sub>AS</sub> test Circuit**



**2) Gate charge test Circuit**



**3) Switch Time Test Circuit**



Typical Electrical and Thermal Characteristics

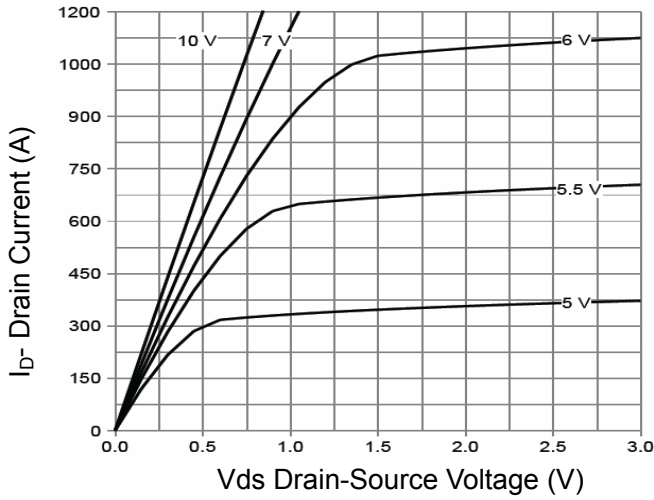


Figure 1 Output Characteristics

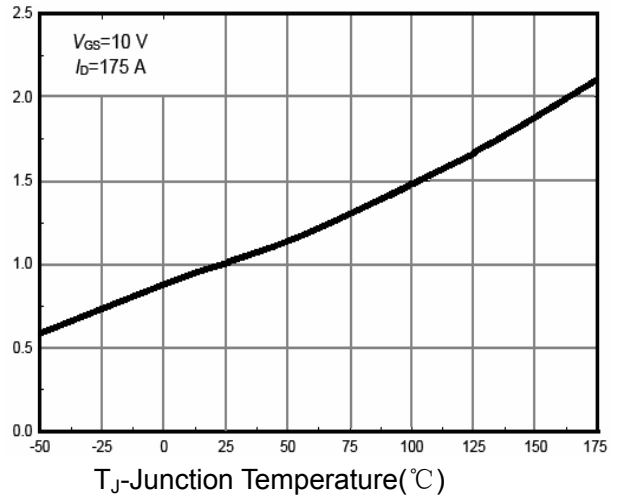


Figure 4 Rds(on)-Junction Temperature

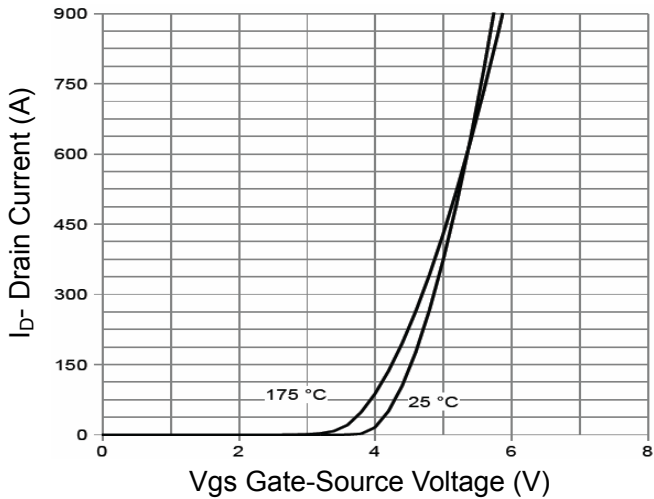


Figure 2 Transfer Characteristics

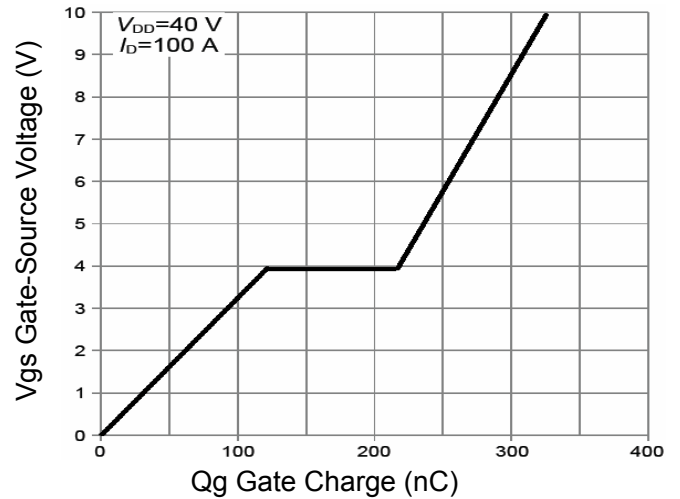


Figure 5 Gate Charge

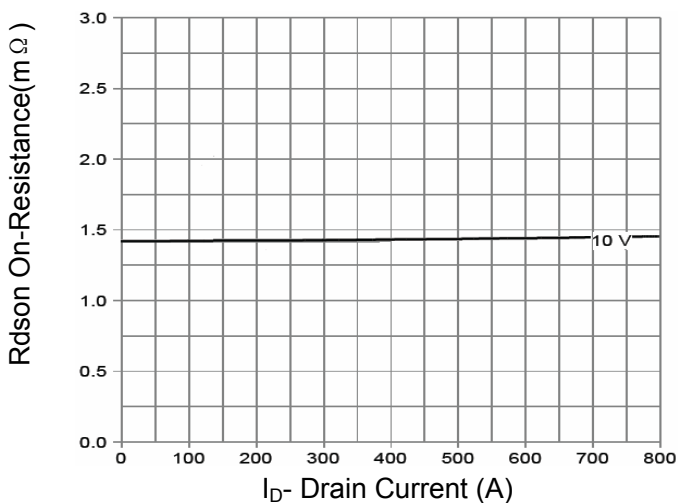


Figure 3 Rds(on)- Drain Current

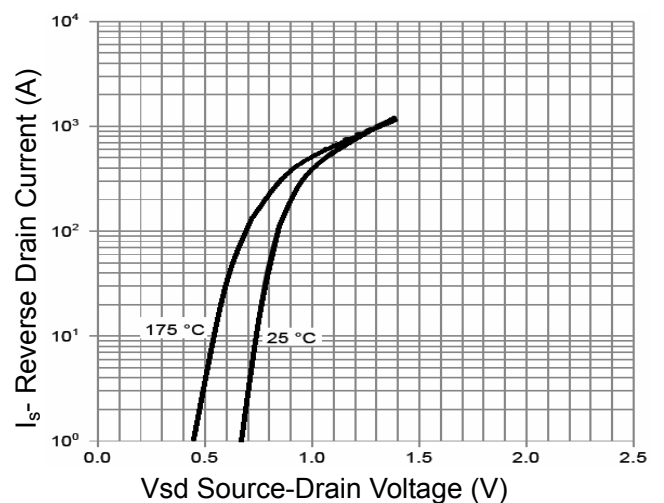
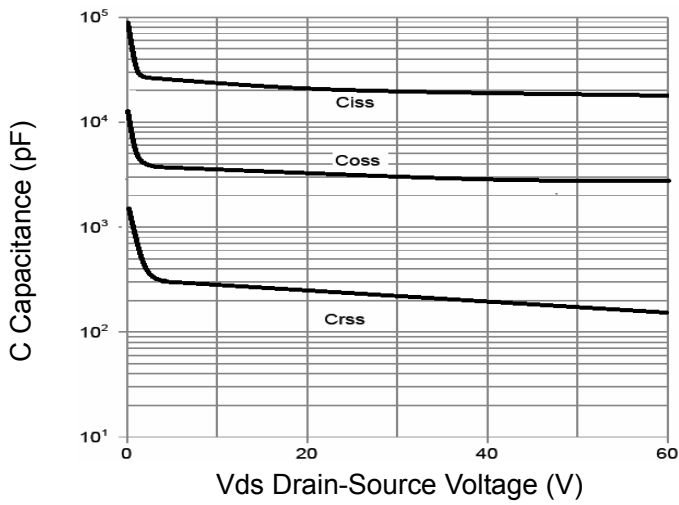
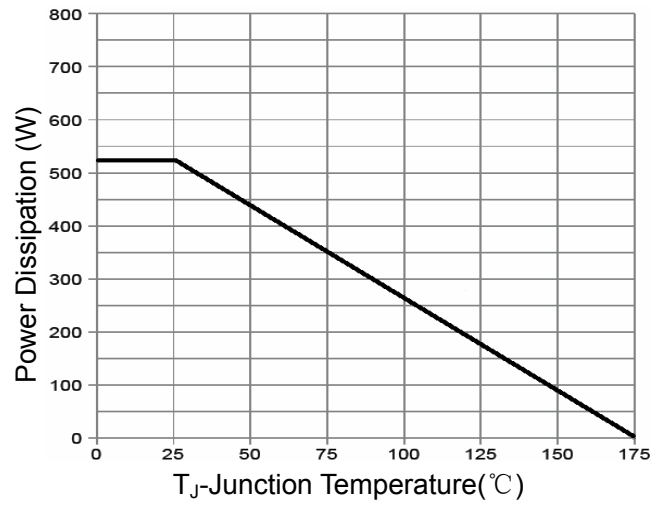


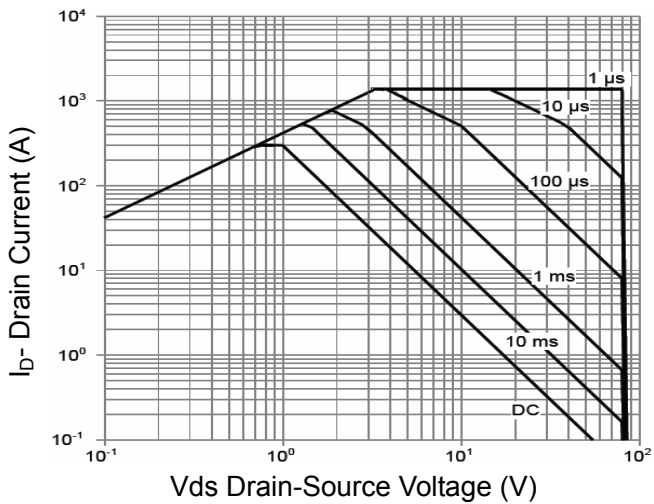
Figure 6 Source- Drain Diode Forward



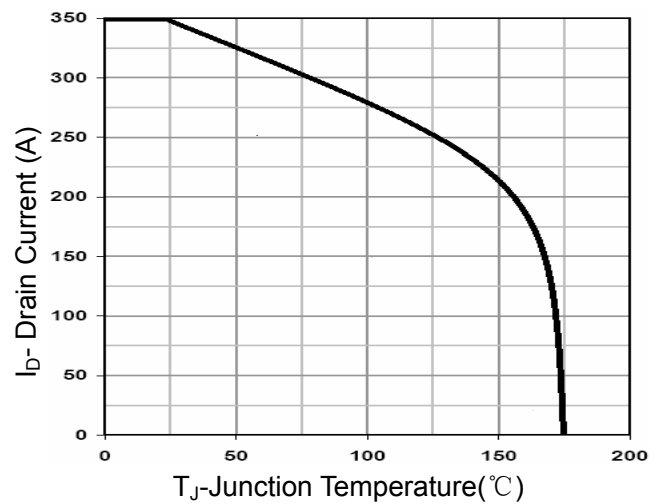
**Figure 7 Capacitance vs Vds**



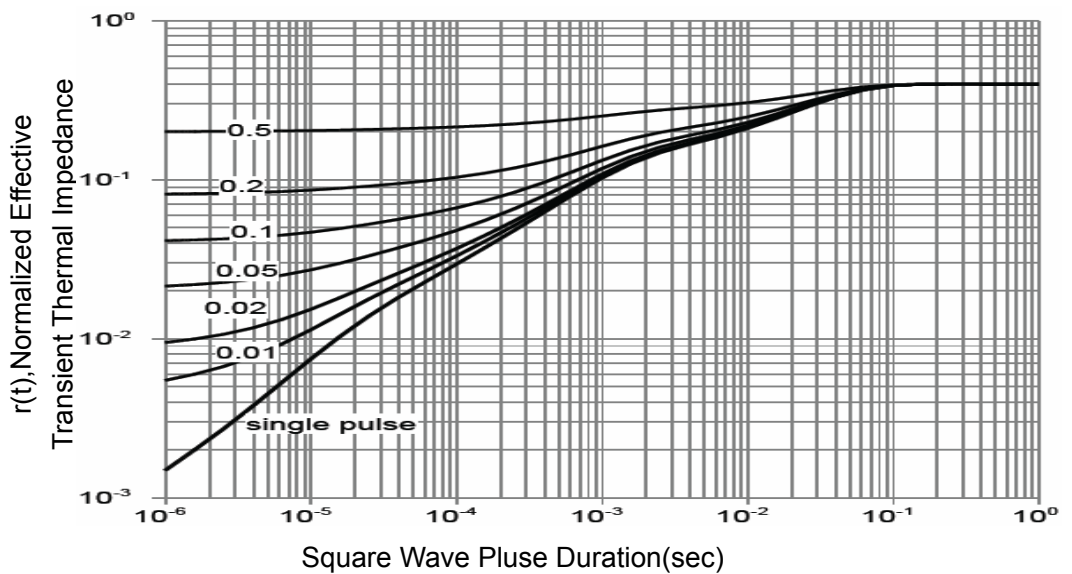
**Figure 9 Power De-rating**



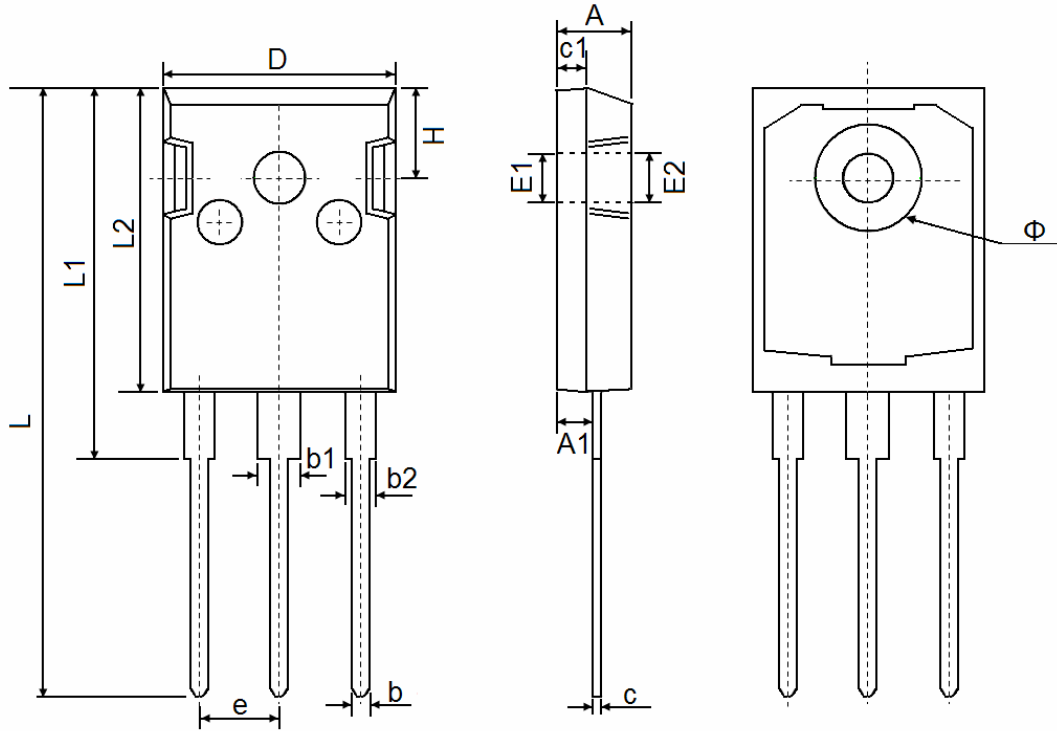
**Figure 8 Safe Operation Area**



**Figure 10 Current De-rating**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

**TO-247 Package Information**


| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min.                      | Max.   | Min.                 | Max.  |
| A      | 4.850                     | 5.150  | 0.191                | 0.200 |
| A1     | 2.200                     | 2.600  | 0.087                | 0.102 |
| b      | 1.000                     | 1.400  | 0.039                | 0.055 |
| b1     | 2.800                     | 3.200  | 0.110                | 0.126 |
| b2     | 1.800                     | 2.200  | 0.071                | 0.087 |
| c      | 0.500                     | 0.700  | 0.020                | 0.028 |
| c1     | 1.900                     | 2.100  | 0.075                | 0.083 |
| D      | 15.450                    | 15.750 | 0.608                | 0.620 |
| E1     | 3.500 REF                 |        | 0.138 REF            |       |
| E2     | 3.600 REF                 |        | 0.142 REF            |       |
| L      | 40.900                    | 41.300 | 1.610                | 1.626 |
| L1     | 24.800                    | 25.100 | 0.976                | 0.988 |
| L2     | 20.300                    | 20.600 | 0.799                | 0.811 |
| Φ      | 7.100                     | 7.300  | 0.280                | 0.287 |
| e      | 5.450 TYP                 |        | 0.215 TYP            |       |
| H      | 5.980 REF                 |        | 0.235 REF            |       |

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