

N-Channel Super Junction Power MOSFET III

General Description

The series of devices use advanced trench gate super junction technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

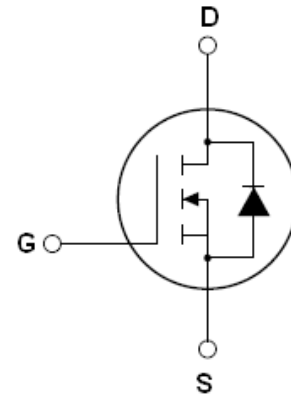
Features

- New technology for high voltage device
- Low on-resistance and low conduction losses
- Small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested
- ROHS compliant

Application

- Power factor correction (PFC)
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply (UPS)

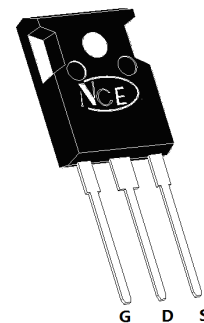
| | | |
|------------------|-----|------------|
| V_{DS} | 650 | V |
| $R_{DS(ON) MAX}$ | 180 | m Ω |
| I_D | 21 | A |



Schematic diagram

Package Marking And Ordering Information

| Device | Device Package | Marking |
|------------|----------------|------------|
| NCE65T180T | TO-247 | NCE65T180T |



TO-247

Table 1. Absolute Maximum Ratings ($T_C=25^\circ\text{C}$)

| Parameter | Symbol | Value | | Unit |
|---|-----------------|----------|-------|---------------------|
| Drain-Source Voltage ($V_{GS}=0V$) | V_{DS} | 650 | | V |
| Gate-Source Voltage ($V_{DS}=0V$), AC ($f>1\text{ Hz}$) | V_{GS} | ± 30 | | V |
| Continuous Drain Current at $T_C=25^\circ\text{C}$ | $I_{D(DC)}$ | 21 | 21* | A |
| Continuous Drain Current at $T_C=100^\circ\text{C}$ | $I_{D(DC)}$ | 13.2 | 13.2* | A |
| Pulsed drain current (Note 1) | $I_{DM(pluse)}$ | 84 | 84* | A |
| Maximum Power Dissipation($T_C=25^\circ\text{C}$) | P_D | 188 | 33.8 | W |
| Derate above 25°C | | 1.5 | 0.27 | W/ $^\circ\text{C}$ |
| Single pulse avalanche energy (Note 2) | E_{AS} | 441 | | mJ |
| Avalanche current (Note 1) | I_{AR} | 10.5 | | A |
| Repetitive Avalanche energy , t_{AR} limited by T_{Jmax} (Note 1) | E_{AR} | 0.7 | | mJ |

| Parameter | Symbol | Value | Unit |
|---|----------------|------------|------|
| Drain Source voltage slope, $V_{DS} \leq 480V$, | dv/dt | 50 | V/ns |
| Reverse diode dv/dt, $V_{DS} \leq 480V, I_{SD} < I_D$ | dv/dt | 15 | V/ns |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55...+150 | °C |

* limited by maximum junction temperature

Table 2. Thermal Characteristic

| Parameter | Symbol | Value | Unit |
|---|------------|-------|------|
| Thermal Resistance, Junction-to-Case (Maximum) | R_{thJC} | 0.66 | °C/W |
| Thermal Resistance, Junction-to-Ambient (Maximum) | R_{thJA} | 62.5 | °C/W |

Table 3. Electrical Characteristics (TA=25°C unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|--|--------------|--|-----|------|-----------|------------|
| On/off states | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 650 | | | V |
| Zero Gate Voltage Drain Current($T_C=25^\circ C$) | I_{DSS} | $V_{DS}=650V, V_{GS}=0V$ | | 0.05 | 1 | μA |
| Zero Gate Voltage Drain Current($T_C=125^\circ C$) | I_{DSS} | $V_{DS}=650V, V_{GS}=0V$ | | | 100 | μA |
| Gate-Body Leakage Current | I_{GSS} | $V_{GS}=\pm 20V, V_{DS}=0V$ | | | ± 100 | nA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 3 | 3.5 | 4 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=10.5A$ | | 150 | 180 | m Ω |
| Dynamic Characteristics | | | | | | |
| Forward Transconductance | g_{FS} | $V_{DS} = 20V, I_D = 10.5A$ | | 16 | | S |
| Input Capacitance | C_{ISS} | $V_{DS}=50V, V_{GS}=0V,$ $F=1.0MHz$ | | 2250 | | PF |
| Output Capacitance | C_{OSS} | | | 83 | | PF |
| Reverse Transfer Capacitance | C_{RSS} | | | 1.6 | | PF |
| Total Gate Charge | Q_g | $V_{DS}=480V, I_D=21A,$ $V_{GS}=10V$ | | 36 | | nC |
| Gate-Source Charge | Q_{gs} | | | 14 | | nC |
| Gate-Drain Charge | Q_{gd} | | | 8.5 | | nC |
| Switching times | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}=380V, I_D=11A,$ $R_G=4\Omega, V_{GS}=10V$ | | 11 | | nS |
| Turn-on Rise Time | t_r | | | 6 | | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 61 | | nS |
| Turn-Off Fall Time | t_f | | | 4.5 | | nS |
| Source- Drain Diode Characteristics | | | | | | |
| Source-drain current(Body Diode) | I_{SD} | $T_C=25^\circ C$ | | | 21 | A |
| Pulsed Source-drain current(Body Diode) | I_{SDM} | | | | 84 | A |
| Forward on voltage | V_{SD} | $T_J=25^\circ C, I_{SD}=21A, V_{GS}=0V$ | | 0.9 | 1.3 | V |
| Reverse Recovery Time | t_{rr} | $T_J=25^\circ C, I_F=21A, di/dt=100A/\mu s$ | | 310 | | nS |
| Reverse Recovery Charge | Q_{rr} | | | 5 | | μC |
| Peak Reverse Recovery Current | I_{rrm} | | | 28 | | A |

Notes 1. Repetitive Rating: Pulse width limited by maximum junction temperature

2. $T_J=25^\circ C, V_{DD}=50V, V_G=10V, R_G=25\Omega$

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure1. Safe operating area

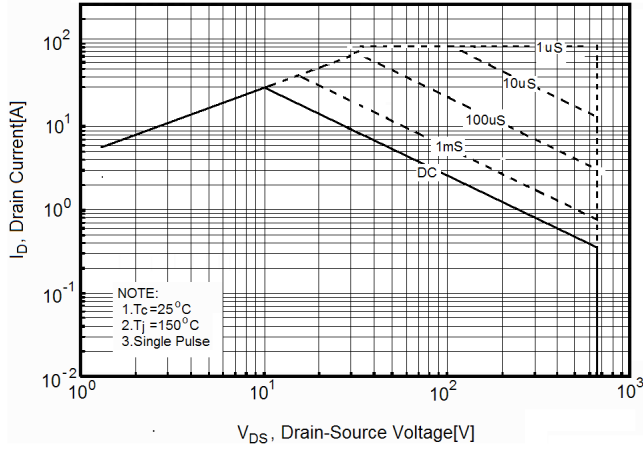


Figure2. Transient Thermal Impedance

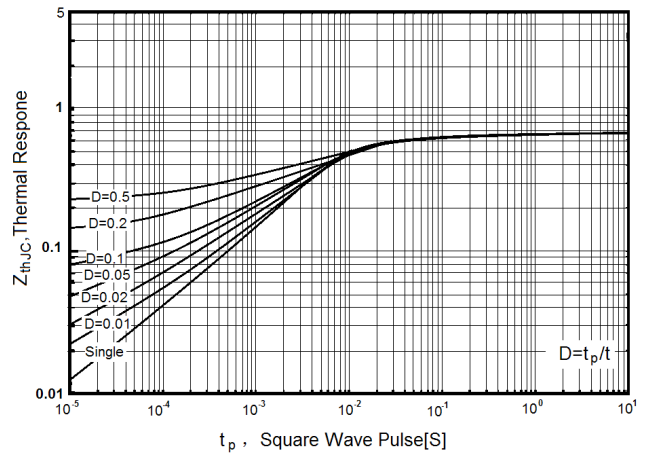


Figure3. Source-Drain Diode Forward Voltage

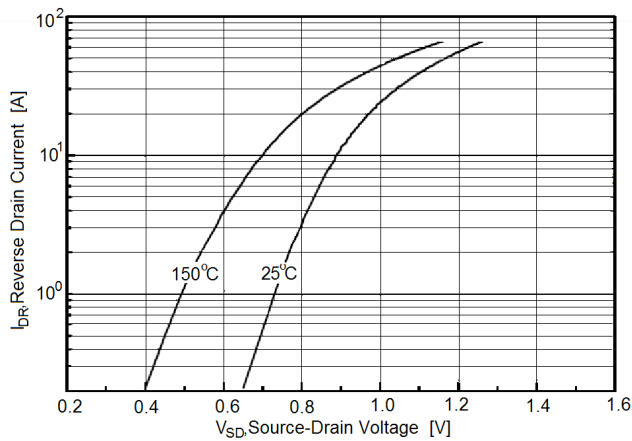


Figure4. Output characteristics

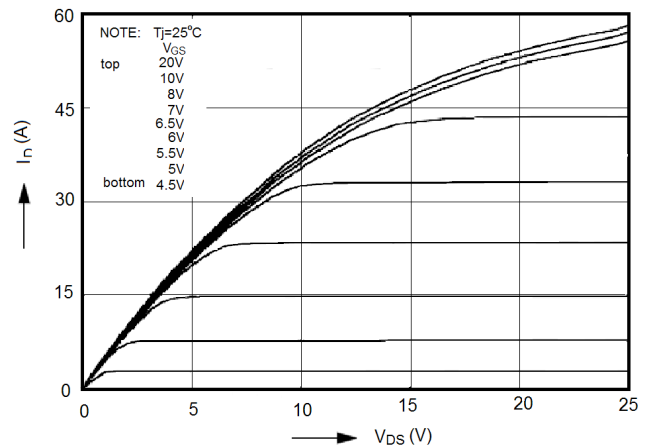


Figure5. Transfer characteristics

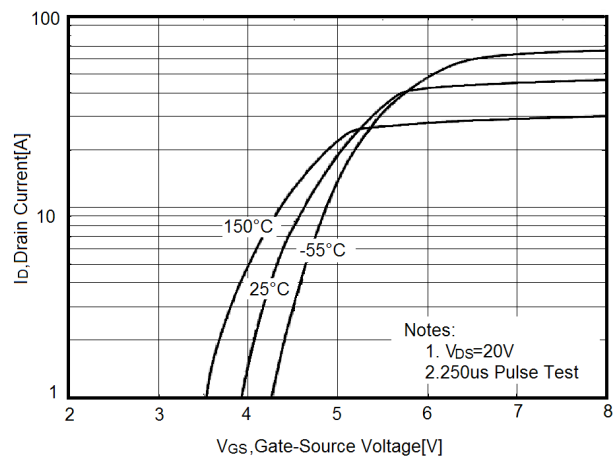


Figure6. Static drain-source on resistance

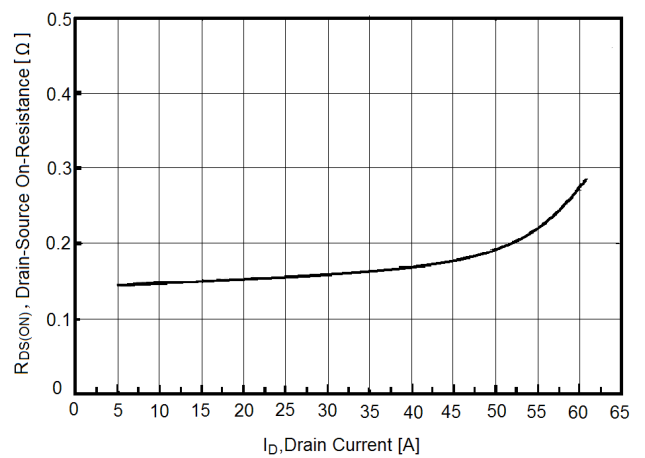


Figure7. $R_{DS(ON)}$ vs Junction Temperature

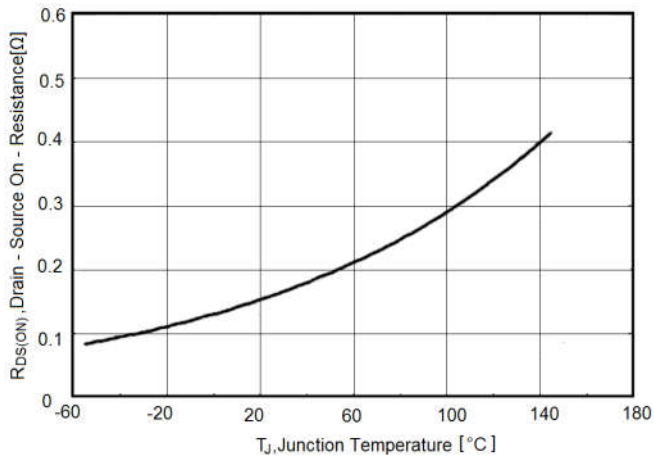


Figure8. BV_{DSS} vs Junction Temperature

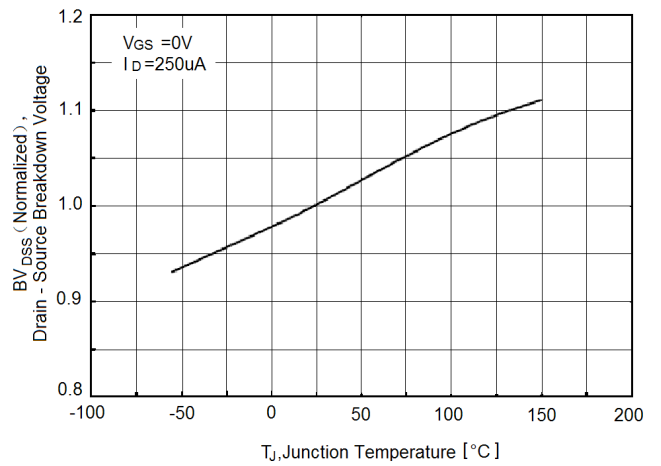


Figure9. Maximum I_D vs Junction Temperature

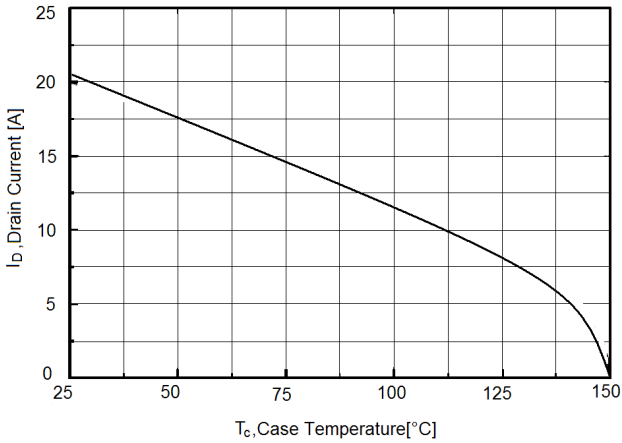


Figure10. Gate charge waveforms

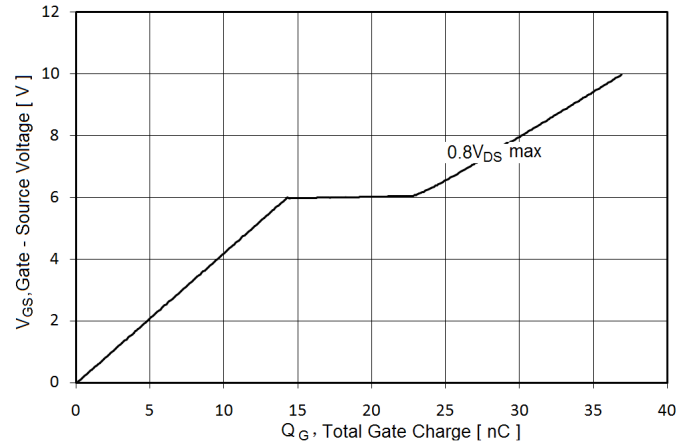
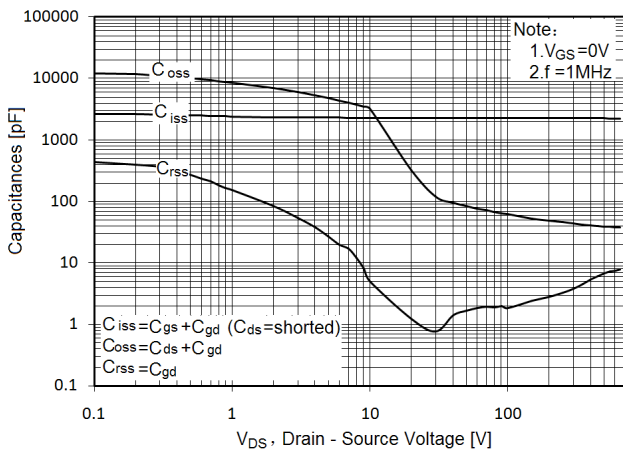
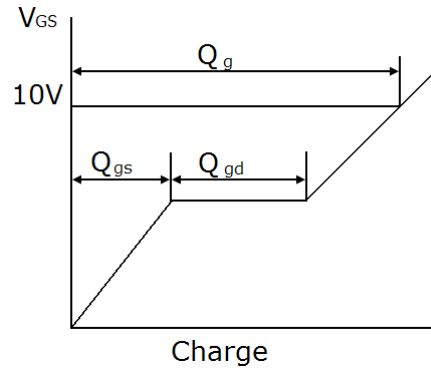
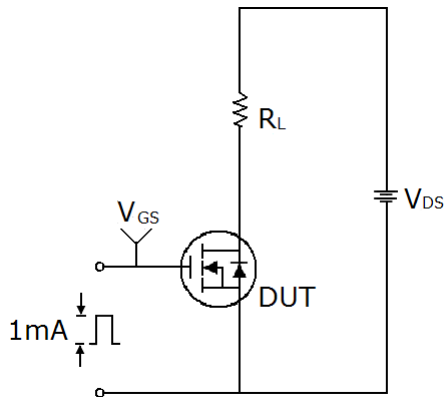


Figure11. Capacitance

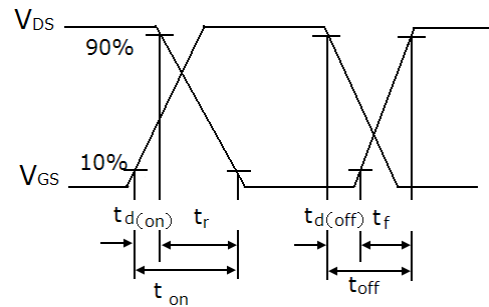
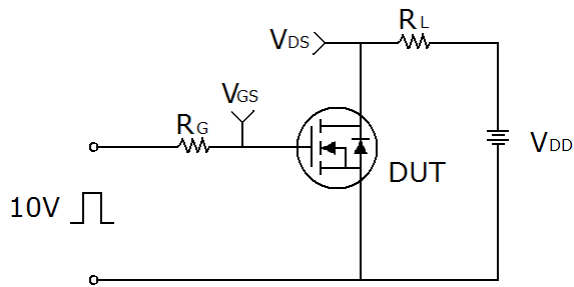


Test circuit

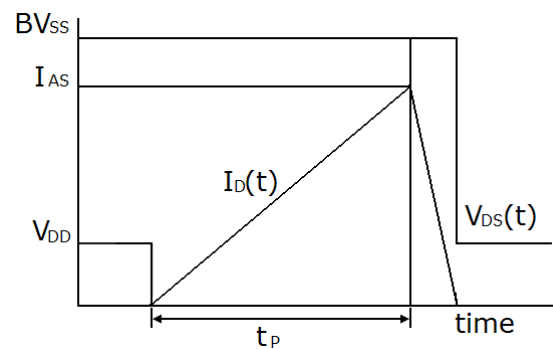
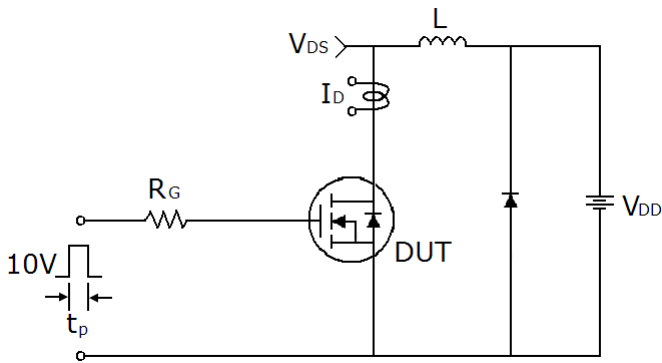
1) Gate charge test circuit & Waveform



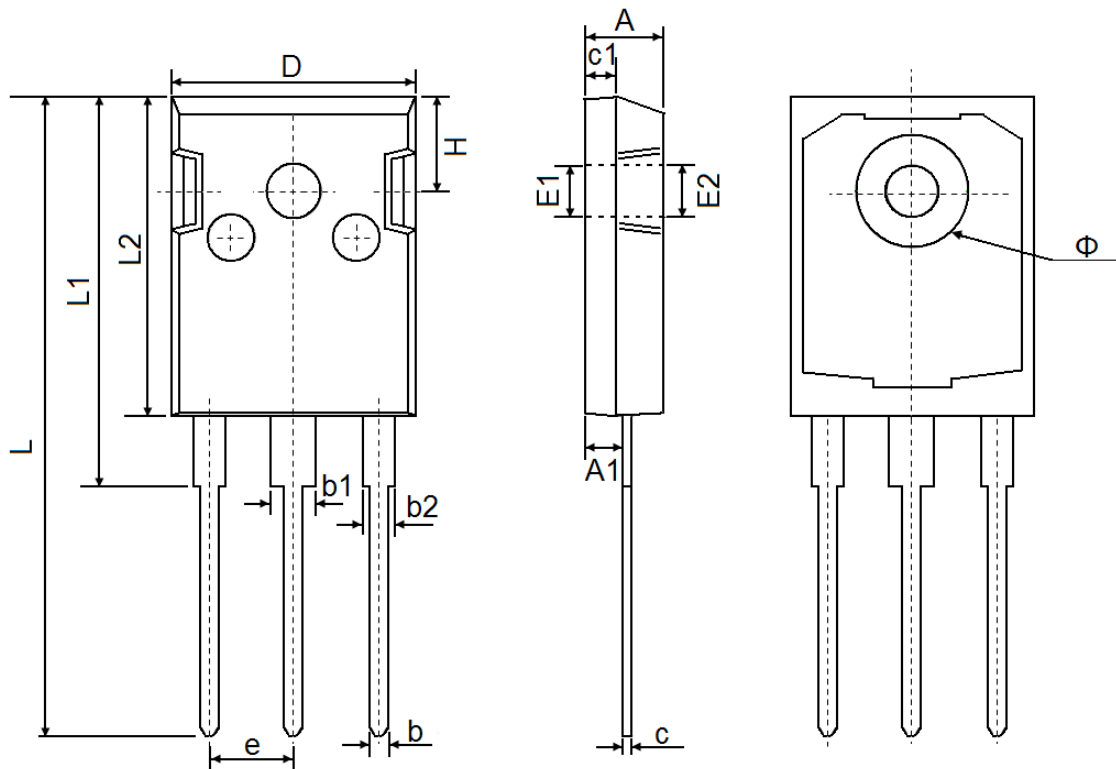
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms



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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