# N-Channel Enhancement Mode Power MOSFET

## Description

The HM20N15A uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in a wide variety of applications.

## General Features

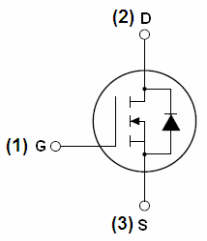
- $V_{DS}$ = 150V,$I_D$ =20A
  $R_{DS(ON)}$ <75mΩ @ $V_{GS}$=10V (Typ:62mΩ)
  $R_{DS(ON)}$ <80mΩ @ $V_{GS}$=4.5V (Typ:68mΩ)
- High density cell design for ultra low Rdson
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high $E_{AS}$
- Excellent package for good heat dissipation

## Application

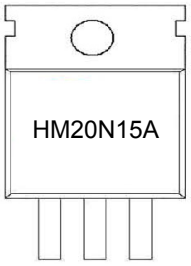
- Boost converters
- LED backlighting
- Uninterruptible power supply

***100% UIS TESTED!***

***100% ΔVds TESTED!***




**Schematic diagram**




**Marking and pin assignment**


**TO-220-3L top view**

## Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|---|---|---|---|---|---|
| HM20N15A | HM20N15A | TO-220-3L | - | - | - |

## Absolute Maximum Ratings ($T_C$=25℃unless otherwise noted)

| Symbol | Parameter | Limit | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 150 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $I_D$ | Drain Current-Continuous | 20 | A |
| $I_D$ (100℃) | Drain Current-Continuous(TC=100℃) | 14 | A |
| $I_{DM}$ | Pulsed Drain Current | 40 | A |
| $P_D$ | Maximum Power Dissipation | 90 | W |
| | Derating factor | 0.6 | W/℃ |
| $E_{AS}$ | Single pulse avalanche energy (Note 5) | 80 | mJ |
| $T_J$,$T_{STG}$ | Operating Junction and Storage Temperature Range | -55 To 175 | ℃ |

## Thermal Characteristic

| | | | |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case (Note 2) | 1.7 | ℃/W |

## Electrical Characteristics ($T_C$=25℃unless otherwise noted)

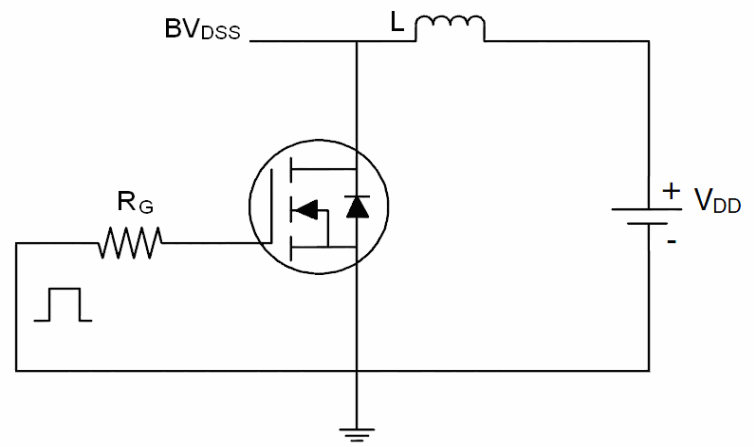
| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V $I_D$=250μA | 150 | 165 | - | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=150V,$V_{GS}$=0V | - | - | 1 | μA |
| $I_{GSS}$ | Gate-Body Leakage Current | $V_{GS}$=±20V,$V_{DS}$=0V | - | - | ±100 | nA |
| **On Characteristics (Note 3)** | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$,$I_D$=250μA | 1.2 | 1.6 | 2.5 | V |
| $R_{DS(ON)}$ | Drain-Source On-State Resistance | $V_{GS}$=10V, $I_D$=10A | - | 62 | 75 | mΩ |
| | | $V_{GS}$=4.5V, $I_D$=10A | - | 68 | 80 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=5V,$I_D$=10A | - | 20 | - | S |
| **Dynamic Characteristics (Note4)** | | | | | | |
| $C_{lss}$ | Input Capacitance | $V_{DS}$=75V,$V_{GS}$=0V, F=1.0MHz | - | 2500 | - | PF |
| $C_{oss}$ | Output Capacitance | | - | 68 | - | PF |
| $C_{rss}$ | Reverse Transfer Capacitance | | - | 54 | - | PF |
| **Switching Characteristics (Note 4)** | | | | | | |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD}$=75V,$R_L$=5Ω $V_{GS}$=10V,$R_{GEN}$=3Ω | - | 18.5 | - | nS |
| $t_r$ | Turn-on Rise Time | | - | 10 | - | nS |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 22 | - | nS |
| $t_f$ | Turn-Off Fall Time | | - | 8 | - | nS |
| $Q_g$ | Total Gate Charge | $V_{DS}$=75V,$I_D$=10A, $V_{GS}$=10V | - | 60 | - | nC |
| $Q_{gs}$ | Gate-Source Charge | | - | 7.1 | - | nC |
| $Q_{gd}$ | Gate-Drain Charge | | - | 17 | - | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| $V_{SD}$ | Diode Forward Voltage (Note 3) | $V_{GS}$=0V,$I_S$=20A | - | - | 1.2 | V |
| $I_S$ | Diode Forward Current (Note 2) | - | - | - | 20 | A |
| $t_{rr}$ | Reverse Recovery Time | TJ = 25°C, IF = 10A di/dt = 100A/μs (Note3) | - | 34 | - | nS |
| Qrr | Reverse Recovery Charge | | - | 55 | - | nC |
| $t_{on}$ | Forward Turn-On Time | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD) | | | | |

Notes:

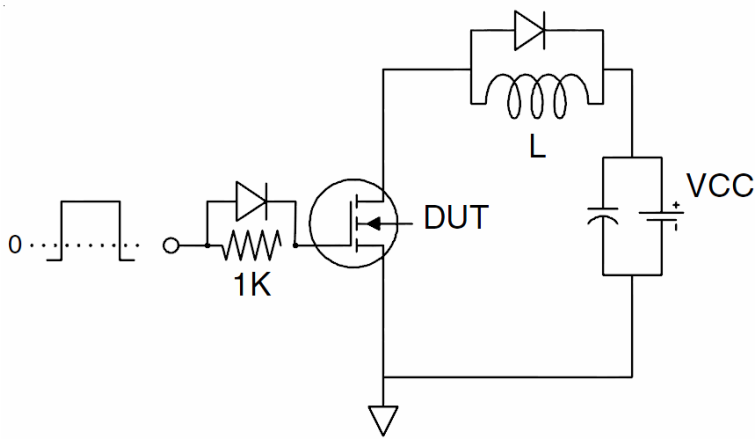
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production
5. EAS condition:Tj=25℃,$V_{DD}$=50V,$V_G$=10V,L=0.5mH,Rg=25Ω

## Test Circuit

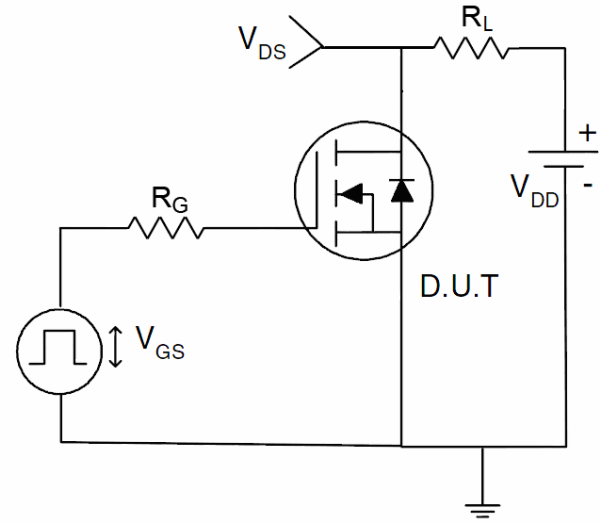
### 1) $E_{AS}$ Test Circuit




### 2) Gate Charge Test Circuit




### 3) Switch Time Test Circuit



## Typical Electrical and Thermal Characteristics (Curves)

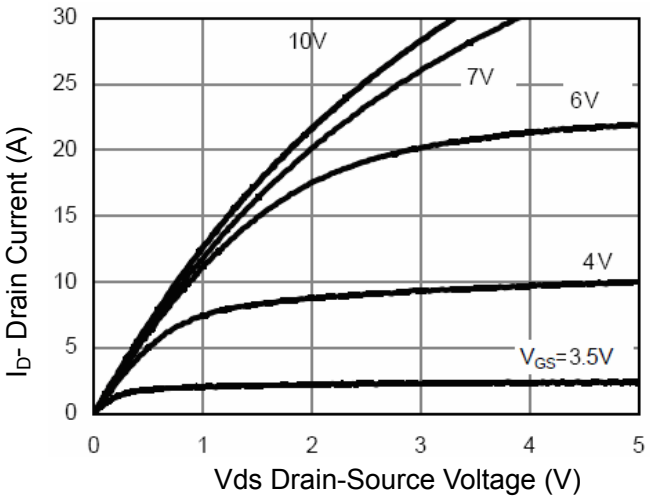



**Figure 1 Output Characteristics**

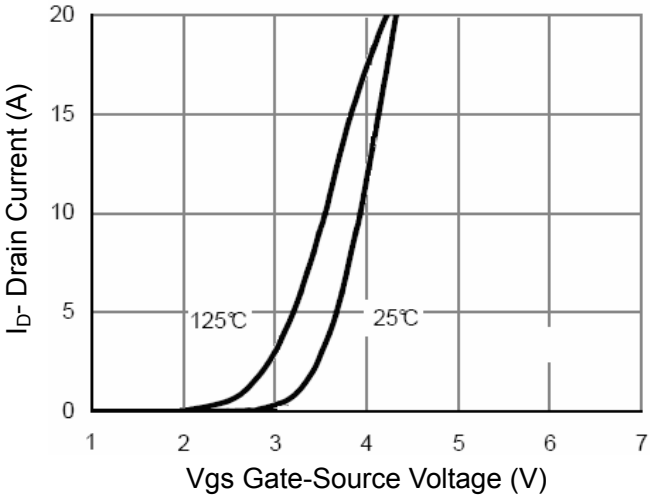



**Figure 2 Transfer Characteristics**

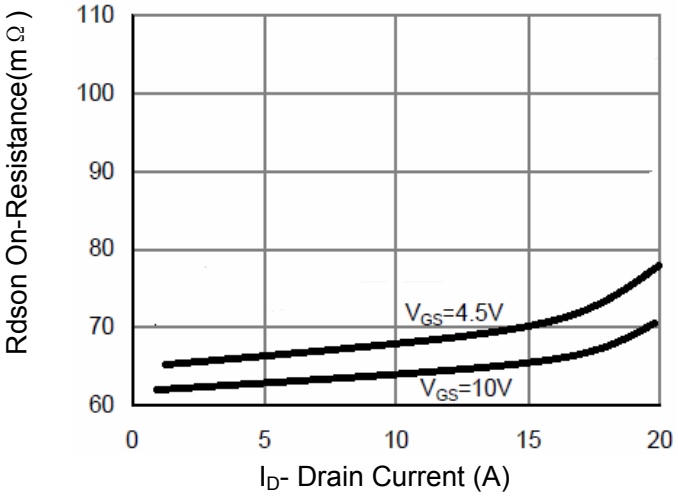



**Figure 3 Rdson- Drain Current**

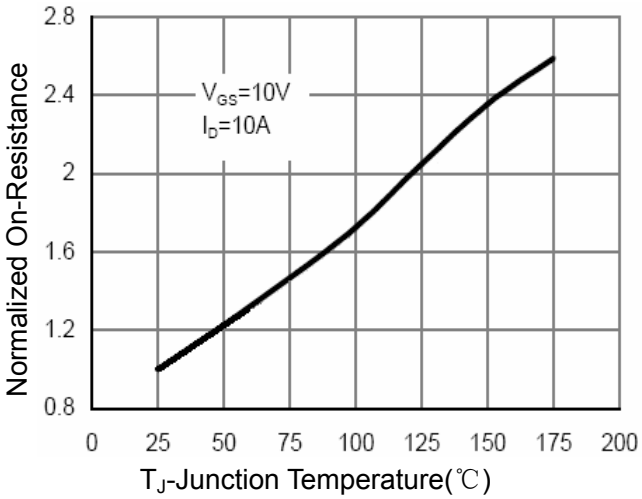



**Figure 4 Rdson-JunctionTemperature**

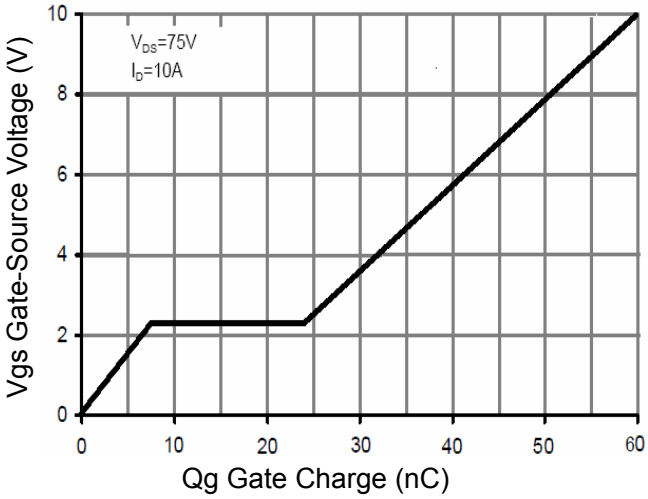



**Figure 5 Gate Charge**

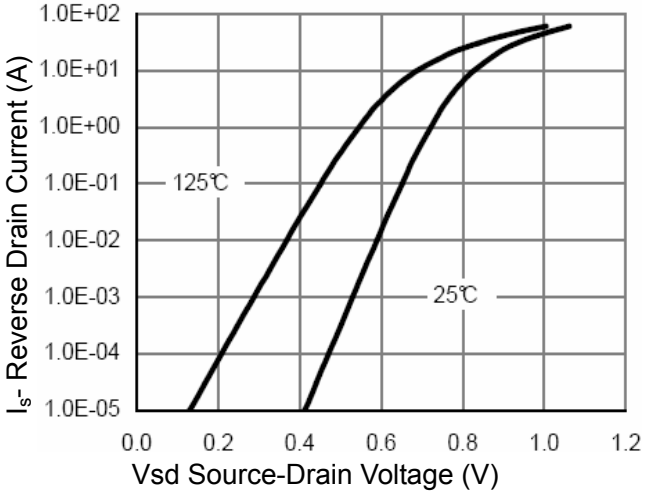



**Figure 6 Source- Drain Diode Forward**

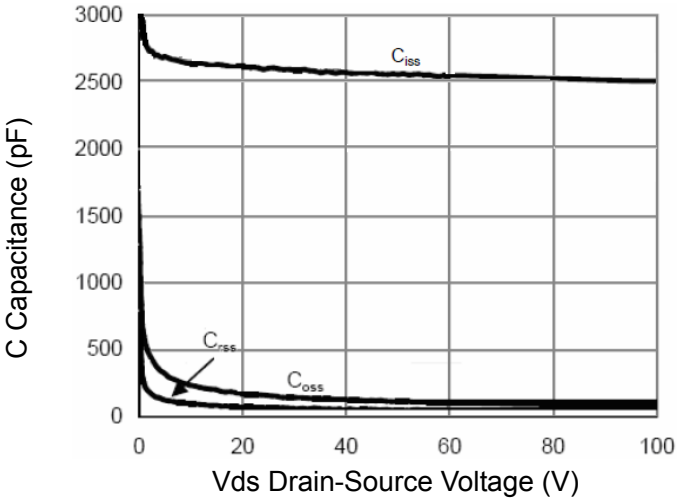



**Figure 7 Capacitance vs Vds**

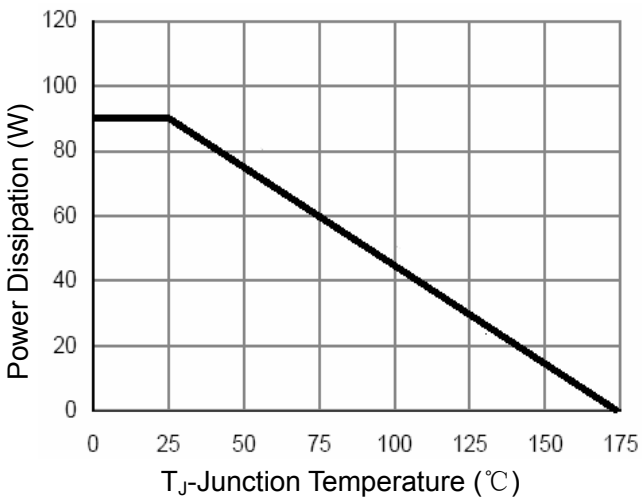



**Figure 9 Power De-rating**

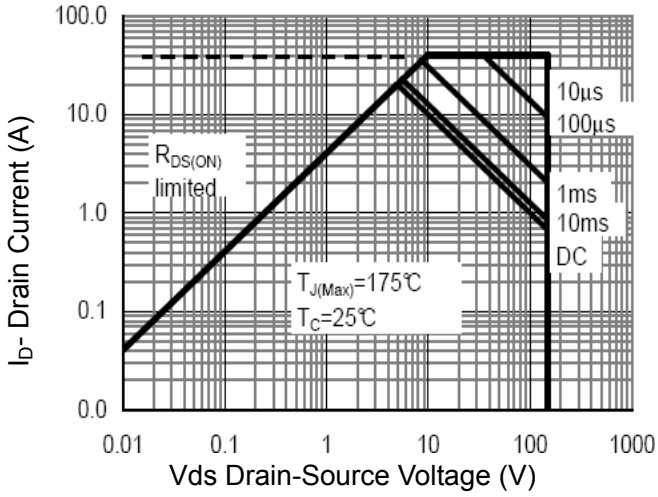



**Figure 8 Safe Operation Area**

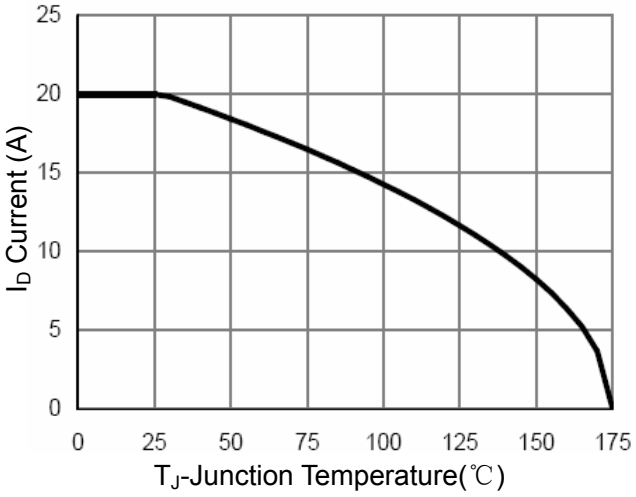



**Figure 10ID Current- Junction Temperature**

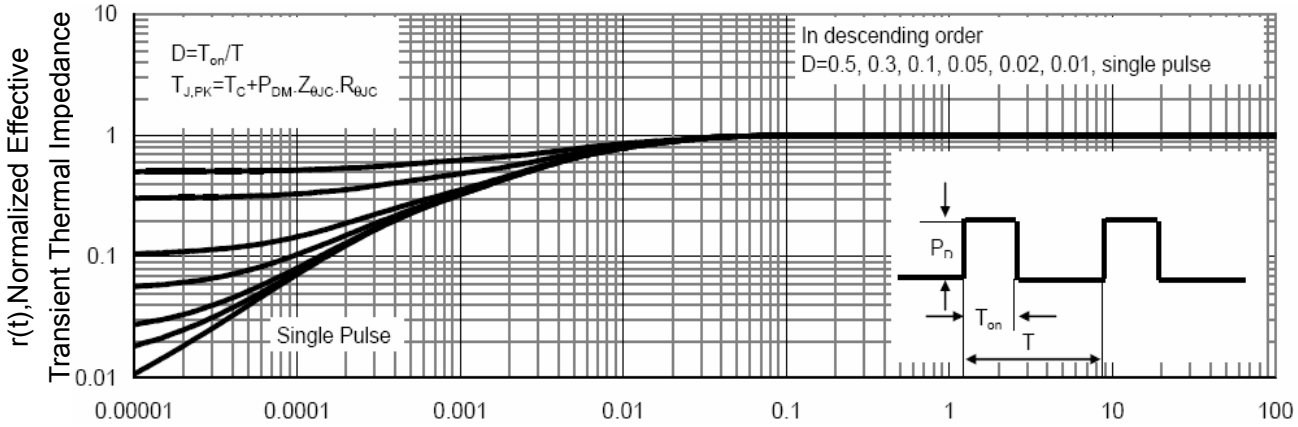
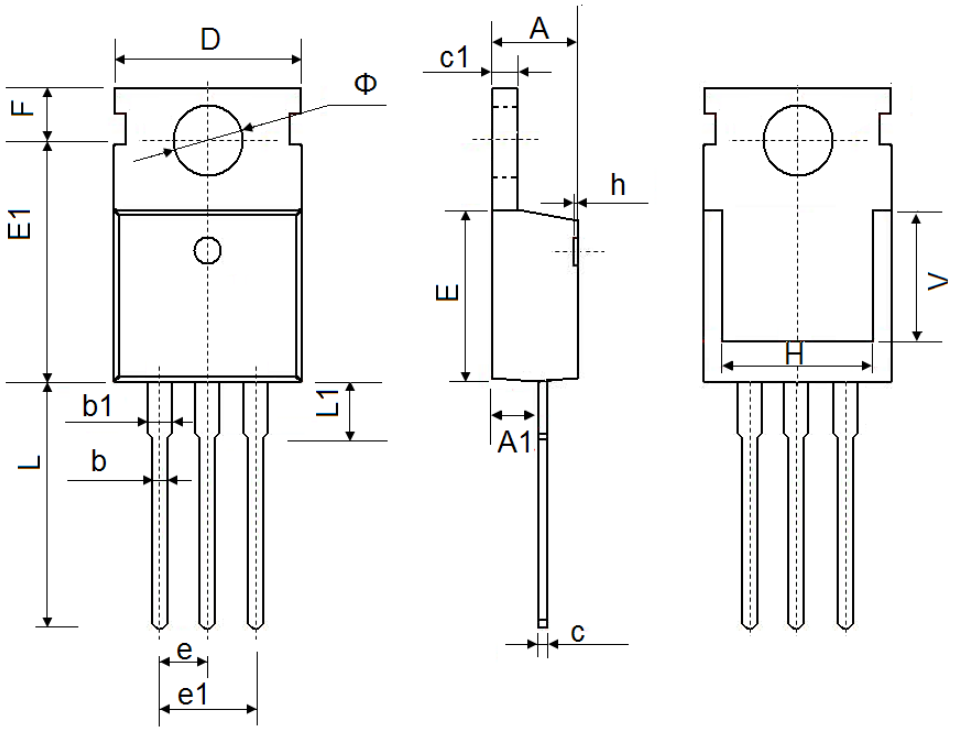



**Figure 11 Normalized Maximum Transient Thermal Impedance**

## TO-220-3L Package Information




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 4.400 | 4.600 | 0.173 | 0.181 |
| A1 | 2.250 | 2.550 | 0.089 | 0.100 |
| b | 0.710 | 0.910 | 0.028 | 0.036 |
| b1 | 1.170 | 1.370 | 0.046 | 0.054 |
| c | 0.330 | 0.650 | 0.013 | 0.026 |
| c1 | 1.200 | 1.400 | 0.047 | 0.055 |
| D | 9.910 | 10.250 | 0.390 | 0.404 |
| E | 8.9500 | 9.750 | 0.352 | 0.384 |
| E1 | 12.650 | 12.950 | 0.498 | 0.510 |
| e | 2.540 TYP. | | 0.100 TYP. | |
| e1 | 4.980 | 5.180 | 0.196 | 0.204 |
| F | 2.650 | 2.950 | 0.104 | 0.116 |
| H | 7.900 | 8.100 | 0.311 | 0.319 |
| h | 0.000 | 0.300 | 0.000 | 0.012 |
| L | 12.900 | 13.400 | 0.508 | 0.528 |
| L1 | 2.850 | 3.250 | 0.112 | 0.128 |
| V | 7.500 REF. | | 0.295 REF. | |
| Φ | 3.400 | 3.800 | 0.134 | 0.150 |

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