# GPT15N65 / GPT15N65D

POWER FIELD EFFECT TRANSISTOR

## GENERAL DESCRIPTION

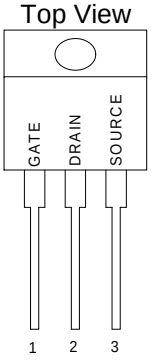
This high voltage MOSFET uses an advanced termination scheme to provide enhanced voltage-blocking capability without degrading performance over time. In addition, this advanced MOSFET is designed to withstand high energy in avalanche and commutation modes. The new energy efficient design also offers a drain-to-source diode with a fast recovery time. Designed for high voltage, high speed switching applications in power supplies, converters and PWM motor controls, these devices are particularly well suited for bridge circuits where diode speed and commutating safe operating areas are critical and offer additional and safety margin against unexpected voltage transients.

## FEATURES

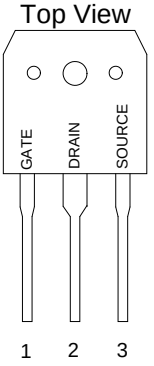
- Robust High Voltage Termination
- Avalanche Energy Specified
- Source-to-Drain Diode Recovery Time Comparable to a Discrete Fast Recovery Diode
- Diode is Characterized for Use in Bridge Circuits
- $I_{DSS}$ and $V_{DS}$(on) Specified at Elevated Temperature
- Isolated Mounting Hole Reduces Mounting Hardware

## PIN CONFIGURATION

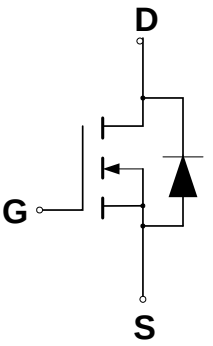
TO-220F
Top View




TO-3P/T-O247
Top View




## SYMBOL




N-Channel MOSFET

## ABSOLUTE MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Drain to Current — Continuous | $I_D$ | 15 | A |
| — Pulsed | $I_{DM}$ | 45 | |
| Gate-to-Source Voltage — Continue | $V_{GS}$ | ±30 | V |
| Total Power Dissipation – TO220FP | $P_D$ | 57 | W |
| – TO3P | | 255 | W/℃ |
| – TO247 | | 235 | |
| Derate above 25℃ – TO220FP | | 0.38 | |
| – TO3P | | 2.3 | |
| – TO247 | | 1.95 | |
| Operating and Storage Temperature Range | $T_J$, $T_{STG}$ | -55 to 150 | ℃ |
| Single Pulse Drain-to-Source Avalanche Energy — $T_J$ = 25℃ ($V_{DD}$ = 100V, $V_{GS}$ = 10V, $I_L$ = 13A, L = 10mH, $R_G$ = 25Ω) | $E_{AS}$ | 845 | mJ |
| Thermal Resistance — Junction to Case -TO220FP | $\theta_{JC}$ | 3.12 | ℃/W |
| — Junction to Case -TO3P | | 0.45 | |
| — Junction to Case -TO247 | | 0.59 | |
| — Junction to Ambient -TO220FP | $\theta_{JA}$ | 62.5 | |
| — Junction to Ambient -TO3P, TO247 | | 40 | |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds | $T_L$ | 260 | ℃ |
| ESD SENSITIVITY — HBM, C=100pF, R=1.5kΩ | Vesd | 2000 | V |

## ORDERING INFORMATION

| Part Number | Package |
|---|---|
| GPT15N65GN3P* | TO-3P |
| GPT15N65GN247* | TO-247 |
| GPT15N65DGN220FP* | TO-220F |

***Note:** G : Suffix for PB Free Product

## ELECTRICAL CHARACTERISTICS

Unless otherwise specified, $T_J$ = 25℃.

| | | | GPT15N65 | | | |
|---|---|---|---|---|---|---|
| **Characteristic** | | **Symbol** | **Min** | **Typ** | **Max** | **Units** |
| Drain-Source Breakdown Voltage ($V_{GS}$ = 0 V, $I_D$ = 250 μA) | | $V_{(BR)DSS}$ | 650 | | | V |
| Drain-Source Leakage Current ($V_{DS}$ = 650 V, $V_{GS}$ = 0 V) | | $I_{DSS}$ | | | 1 | uA |
| Gate-Source Leakage Current-Forward ($V_{gsf}$ = 30 V, $V_{DS}$ = 0 V) | | $I_{GSSF}$ | | | 100 | nA |
| Gate-Source Leakage Current-Reverse ($V_{gsr}$ = 30 V, $V_{DS}$ = 0 V) | | $I_{GSSR}$ | | | 100 | nA |
| Gate Threshold Voltage ($V_{DS}$ = $V_{GS}$, $I_D$ = 250 μA) | | $V_{GS(th)}$ | 3 | | 5 | V |
| Static Drain-Source On-Resistance ($V_{GS}$ = 10 V, $I_D$ = 7.5A) * | | $R_{DS(on)}$ | | | 0.44 | Ω |
| Forward Transconductance ($V_{DS}$ = 50 V, $I_D$ = 7.5A) * | | $g_{FS}$ | | 16 | | S |
| Input Capacitance | ($V_{DS}$ = 25 V, $V_{GS}$ = 0 V, f = 1.0 MHz) | $C_{iss}$ | | 3349 | | pF |
| Output Capacitance | | $C_{oss}$ | | 299.5 | | pF |
| Reverse Transfer Capacitance | | $C_{rss}$ | | 11 | | pF |
| Turn-On Delay Time | ($V_{DD}$ = 325 V, $I_D$ = 15 A, $R_G$ = 25Ω) * | $t_{d(on)}$ | | 42.13 | | ns |
| Rise Time | | $t_r$ | | 94.93 | | ns |
| Turn-Off Delay Time | | $t_{d(off)}$ | | 69.3 | | ns |
| Fall Time | | $t_f$ | | 56.5 | | ns |
| Total Gate Charge | ($V_{DS}$ = 520 V, $I_D$ = 15 A, $V_{GS}$ = 10 V)* | $Q_g$ | | 64.5 | | nC |
| Gate-Source Charge | | $Q_{gs}$ | | 19.1 | | nC |
| Gate-Drain Charge | | $Q_{gd}$ | | 26.1 | | nC |
| SOURCE-DRAIN DIODE CHARACTERISTICS | | | | | | |
| Forward On-Voltage(1) | ($I_S$ = 15 A, $d_{IS}/d_t$ = 100A/μs) | $V_{SD}$ | | | 1.5 | V |
| Forward Turn-On Time | | $t_{on}$ | | ** | | ns |
| Reverse Recovery Time | | $t_{rr}$ | | 556 | | ns |

* Pulse Test: Pulse Width ≦300μs, Duty Cycle ≦2%

** Negligible, Dominated by circuit inductance

## TYPICAL ELECTRICAL CHARACTERISTICS

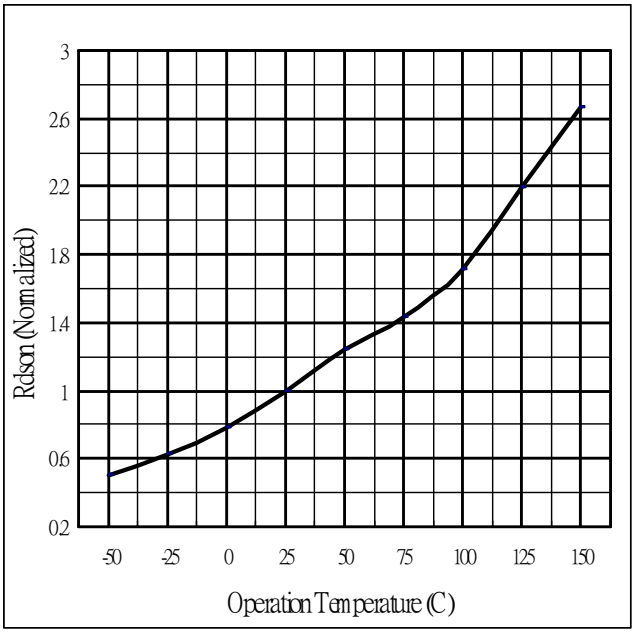



**Fig 1. On-Resistance Variation with vs. Temperature**

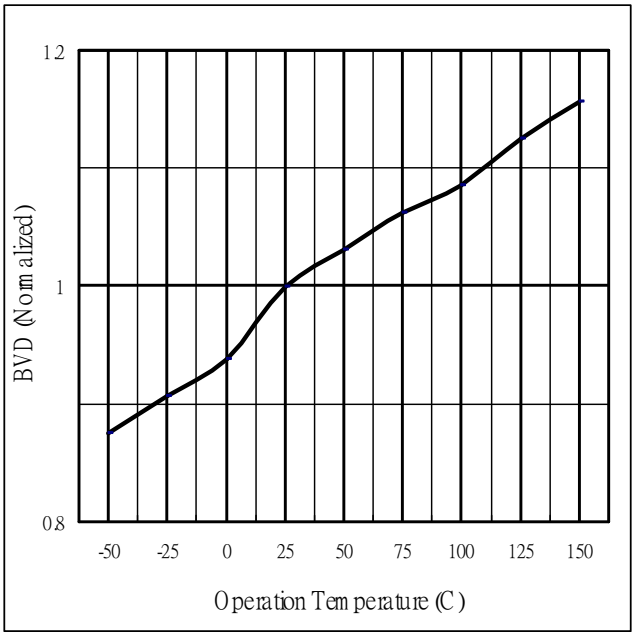



**Fig.2 Breakdown Voltage Variation vs. Temperature**

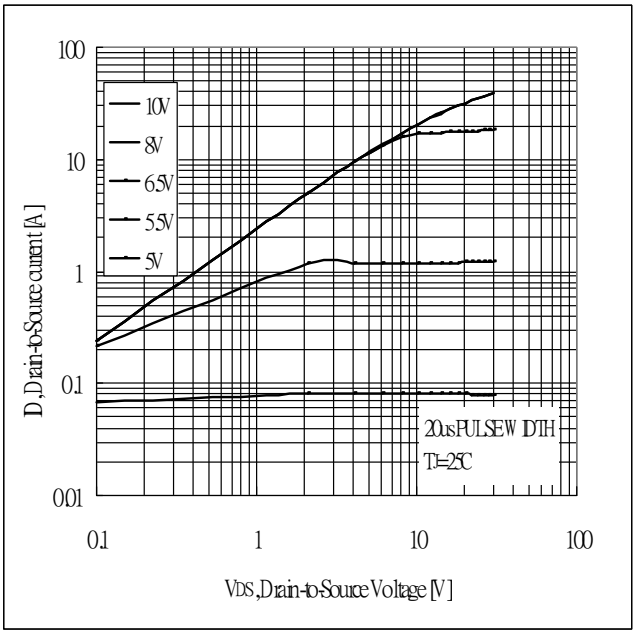



**Fig 3. Typical Output Characteristics**

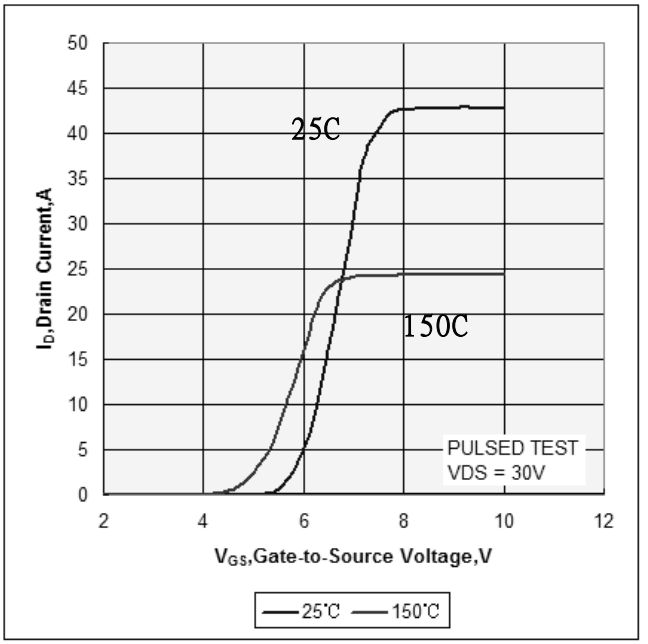



**Fig 4. Typical Transfer Characteristics**

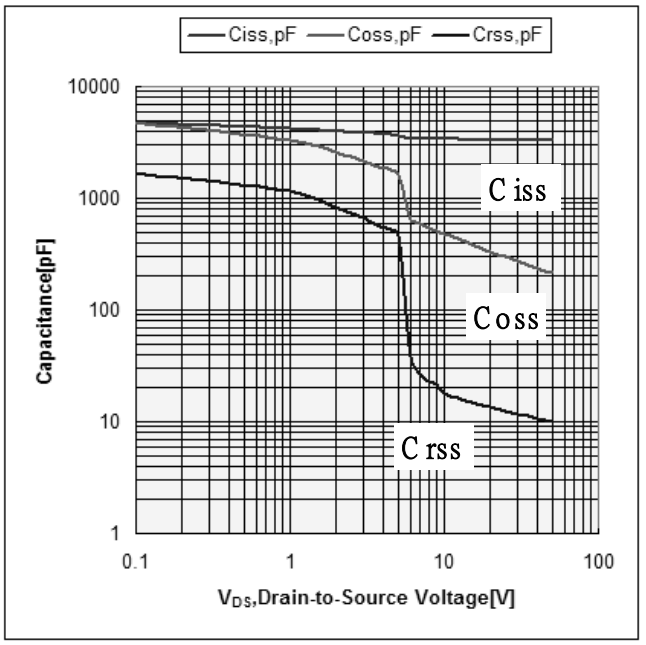



**Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage**

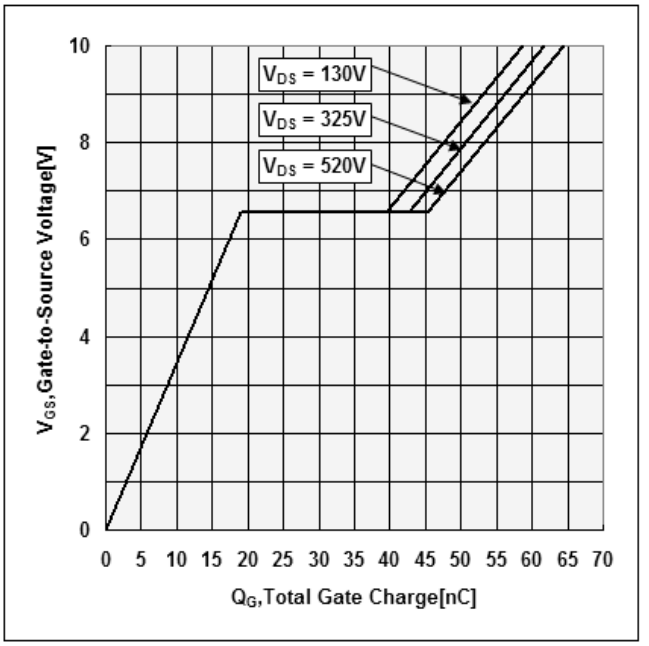
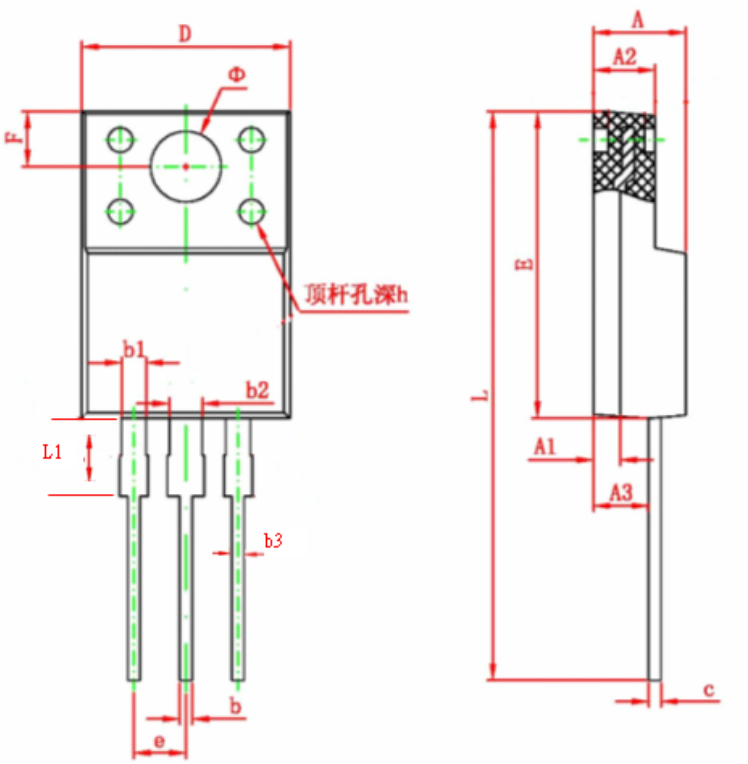



**Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage**

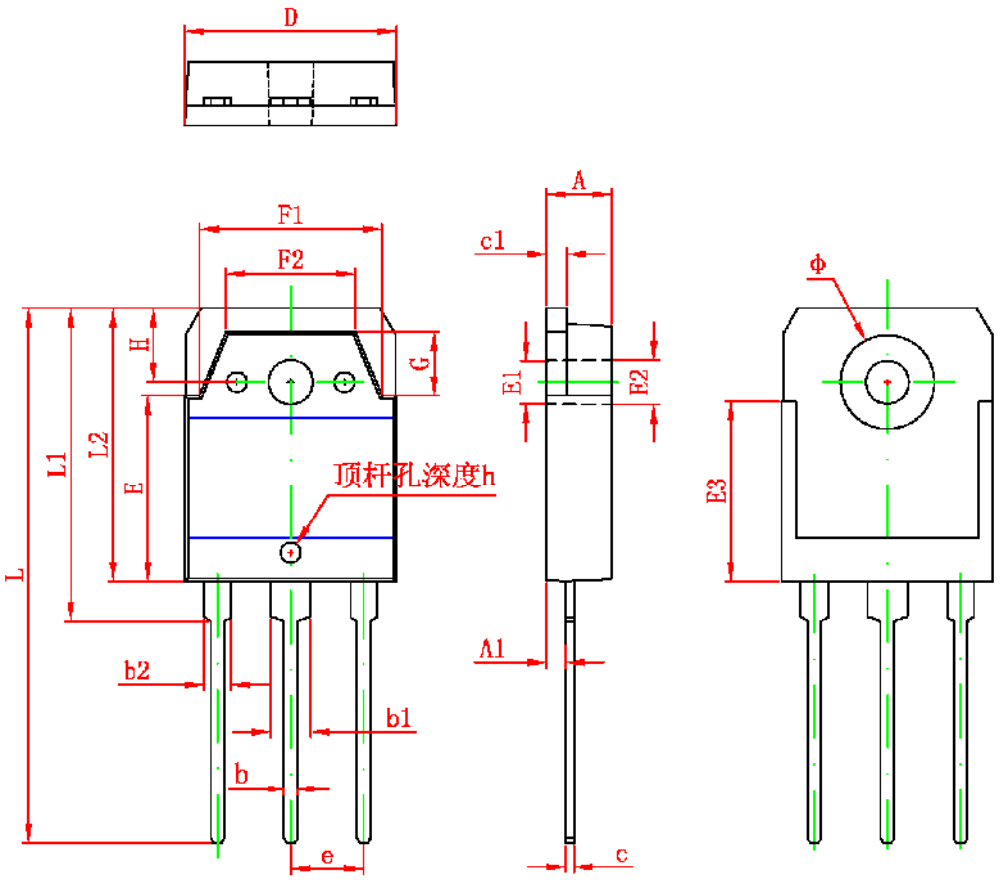
## PACKAGE DIMENSION

**TO-220F**



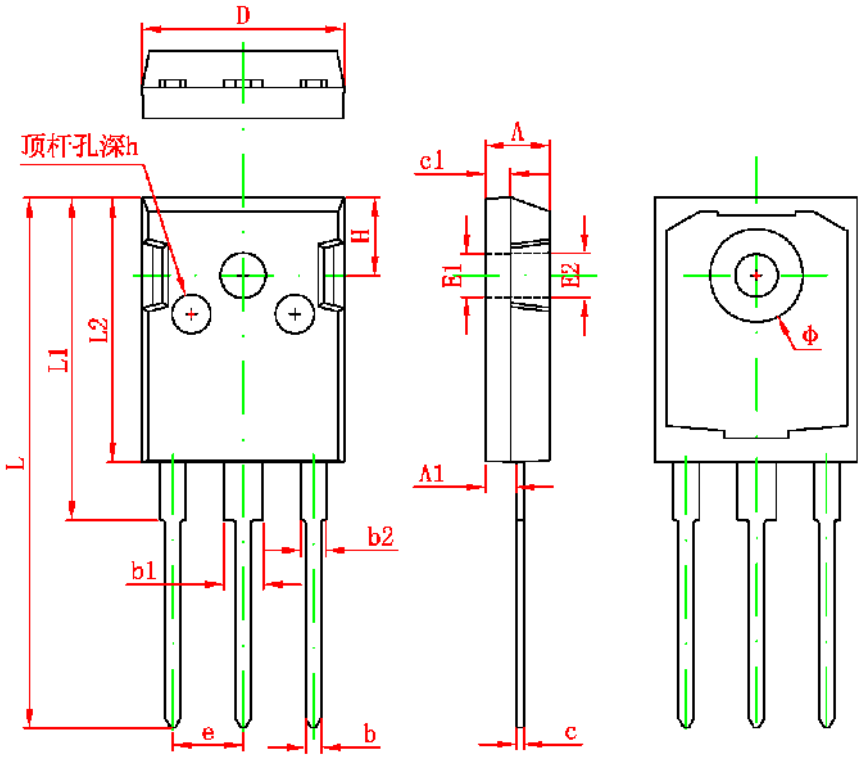

| Symbol | Dimensions In Millimeters | |
|---|---|---|
| | Min. | Max |
| A | 3.80 | 4.70 |
| A1 | 1.3 REF. | |
| A2 | 2.20 | 3.20 |
| A3 | 2.10 | 3.20 |
| b | 0.30 | 0.95 |
| b1 | 1.00 | 1.75 |
| b2 | 1.00 | 1.75 |
| b3 | 0.50 | 0.80 |
| c | 0.30 | 0.90 |
| D | 9.90 | 10.40 |
| E | 14.60 | 16.20 |
| e | 2.54 TYP. | |
| F | 3.00 REF. | |
| Φ | 3.50 REF. | |
| h | 0.00 | 0.30 |
| L | 28.00 | 30.00 |
| L1 | 3.20 | 3.55 |

## TO-3P




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 4.600 | 5.000 | 0.181 | 0.197 |
| A1 | 1.200 | 1.600 | 0.047 | 0.063 |
| b | 0.800 | 1.200 | 0.031 | 0.047 |
| 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 | 1.450 | 1.650 | 0.057 | 0.065 |
| D | 15.450 | 15.850 | 0.606 | 0.622 |
| E | 13.700 | 14.100 | 0.539 | 0.555 |
| E1 | 3.200 REF | | 0.126 REF | |
| E2 | 3.300 REF | | 0.130 REF | |
| E3 | 13.450 REF | | 0.530 REF | |
| F1 | 13.400 | 13.800 | 0.528 | 0.543 |
| F2 | 9.400 | 9.800 | 0.370 | 0.386 |
| L | 39.900 | 40.300 | 1.571 | 1.587 |
| L1 | 23.200 | 23.600 | 0.913 | 0.929 |
| L2 | 20.300 | 20.600 | 0.799 | 0.811 |
| Φ | 6.900 | 7.100 | 0.272 | 0.280 |
| G | 5.150 | 5.550 | 0.203 | 0.219 |
| e | 5.450 TYP | | 0.215 TYP | |
| H | 5.000 REF | | 0.197 REF | |
| h | 0.000 | 0.300 | 0.000 | 0.012 |

**TO-247**




| 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 | |
| h | 0.000 | 0.300 | 0.000 | 0.012 |

# IMPORTANT NOTICE

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