

## NCE N-Channel Enhancement Mode Power MOSFET

### Description

The NCE0130A 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

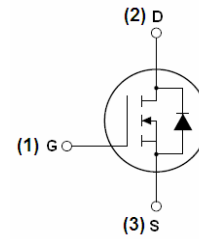
- $V_{DS} = 100V, I_D = 30A$   
 $R_{DS(ON)} < 32m\Omega @ V_{GS}=10V$  (Typ:25m $\Omega$ )
- Special process technology for high ESD capability
- High density cell design for ultra low Rdson
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation

### Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply

**100% UIS TESTED!**

**100%  $\Delta V_{ds}$  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 |
|----------------|----------|----------------|-----------|------------|----------|
| NCE0130A       | NCE0130A | TO-220-3L      | -         | -          | -        |

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

| Parameter   | Symbol             | Limit      | Unit          |
|---|--------------------|------------|---------------|
| Drain-Source Voltage                              | $V_{DS}$           | 100        | V             |
| Gate-Source Voltage                               | $V_{GS}$           | $\pm 20$   | V             |
| Drain Current-Continuous                          | $I_D$              | 30         | A             |
| Drain Current-Continuous( $T_C=100^\circ C$ )     | $I_D(100^\circ C)$ | 21         | A             |
| Pulsed Drain Current <sup>(Note 1)</sup>          | $I_{DM}$           | 120        | A             |
| Maximum Power Dissipation                         | $P_D$              | 85         | W             |
| Derating factor                                   |                    | 0.57       | W/ $^\circ C$ |
| Single pulse avalanche energy <sup>(Note 5)</sup> | $E_{AS}$           | 200        | mJ            |
| $V_{DS}$ Spike <sup>(Note 6)</sup>                | 10 $\mu s$         | 120        | V             |
| Operating Junction and Storage Temperature Range  | $T_J, T_{STG}$     | -55 To 175 | $^\circ C$    |

### Thermal Characteristic

|  |                 |     |              |
|--|-----------------|-----|--------------|
| Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup> | $R_{\theta JC}$ | 1.8 | $^\circ C/W$ |
|--|-----------------|-----|--------------|

## Electrical Characteristics ( $T_C=25^\circ\text{C}$ unless otherwise noted)

| Symbol                                    | Parameter                        | Condition  | Min | Typ  | Max       | Unit       |
|---|----------------------------------|--|-----|------|-----------|------------|
| <b>Off Characteristics</b>                |                                  |  |     |      |           |            |
| $BV_{DSS}$                                | Drain-Source Breakdown Voltage   | $V_{GS}=0V, I_D=250\mu A$  | 100 | 115  | -         | V          |
| $I_{DSS}$                                 | Zero Gate Voltage Drain Current  | $V_{DS}=100V, V_{GS}=0V$   | -   | -    | 1         | $\mu A$    |
| $I_{GSS}$                                 | Gate-Body Leakage Current        | $V_{GS}=\pm 20V, V_{DS}=0V$  | -   | -    | $\pm 100$ | nA         |
| <b>On Characteristics (Note 3)</b>        |                                  |  |     |      |           |            |
| $V_{GS(th)}$                              | Gate Threshold Voltage           | $V_{DS}=V_{GS}, I_D=250\mu A$  | 1.3 | 1.9  | 2.5       | V          |
| $R_{DS(ON)}$                              | Drain-Source On-State Resistance | $V_{GS}=10V, I_D=10A$  | -   | 25   | 32        | m $\Omega$ |
| $g_{FS}$                                  | Forward Transconductance         | $V_{DS}=5V, I_D=10A$   | -   | 15   | -         | S          |
| <b>Dynamic Characteristics (Note 4)</b>   |                                  |  |     |      |           |            |
| $C_{iss}$                                 | Input Capacitance                | $V_{DS}=50V, V_{GS}=0V,$<br>$F=1.0\text{MHz}$                              | -   | 2479 | -         | PF         |
| $C_{oss}$                                 | Output Capacitance               |  | -   | 96   | -         | PF         |
| $C_{rSS}$                                 | Reverse Transfer Capacitance     |  | -   | 79   | -         | PF         |
| <b>Switching Characteristics (Note 4)</b> |                                  |  |     |      |           |            |
| $t_{d(on)}$                               | Turn-on Delay Time               | $V_{DD}=50V, R_L=5\Omega$<br>$V_{GS}=10V, R_{GEN}=3\Omega$                 | -   | 9    | -         | nS         |
| $t_r$                                     | Turn-on Rise Time                |  | -   | 9    | -         | nS         |
| $t_{d(off)}$                              | Turn-Off Delay Time              |  | -   | 32   | -         | nS         |
| $t_f$                                     | Turn-Off Fall Time               |  | -   | 8    | -         | nS         |
| $Q_g$                                     | Total Gate Charge                | $V_{DS}=50V, I_D=10A,$<br>$V_{GS}=10V$                                     | -   | 67.2 | -         | nC         |
| $Q_{gs}$                                  | Gate-Source Charge               |  | -   | 9.4  | -         | nC         |
| $Q_{gd}$                                  | Gate-Drain Charge                |  | -   | 15.5 | -         | nC         |
| <b>Drain-Source Diode Characteristics</b> |                                  |  |     |      |           |            |
| $V_{SD}$                                  | Diode Forward Voltage (Note 3)   | $V_{GS}=0V, I_S=10A$   | -   | -    | 1.2       | V          |
| $I_S$                                     | Diode Forward Current (Note 2)   | -  | -   | -    | 30        | A          |
| $t_{rr}$                                  | Reverse Recovery Time            | $T_J = 25^\circ\text{C}, I_F = 10A$<br>$di/dt = 100A/\mu\text{s}$ (Note 3) | -   | 32   | -         | nS         |
| $Q_{rr}$                                  | Reverse Recovery Charge          |  | -   | 53   | -         | nC         |
| $t_{on}$                                  | Forward Turn-On Time             | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)       |     |      |           |            |

### Notes:

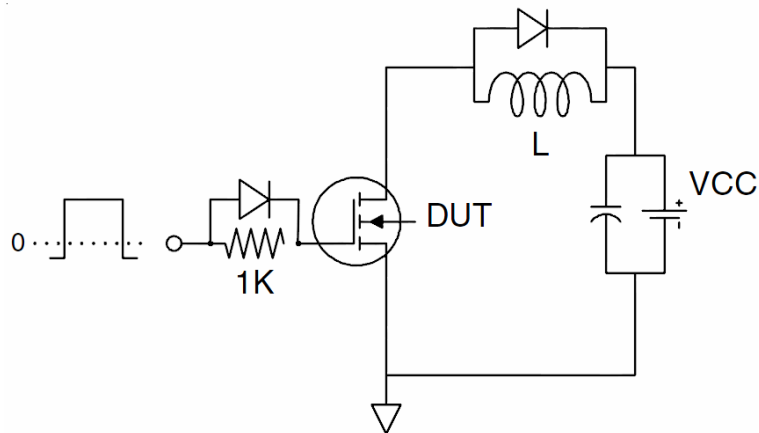
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS Condition :  $T_J=25^\circ\text{C}, V_{DD}=50V, V_G=10V, L=0.5\text{mH}, R_g=25\Omega$
6. The spike duty cycle 5% max, limited by junction temperature  $T_J(\text{MAX})=125^\circ\text{C}$

## Test Circuit

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



### 2) Gate Charge Test Circuit



### 3) Switch Time Test Circuit



Typical Electrical and Thermal Characteristics (Curves)

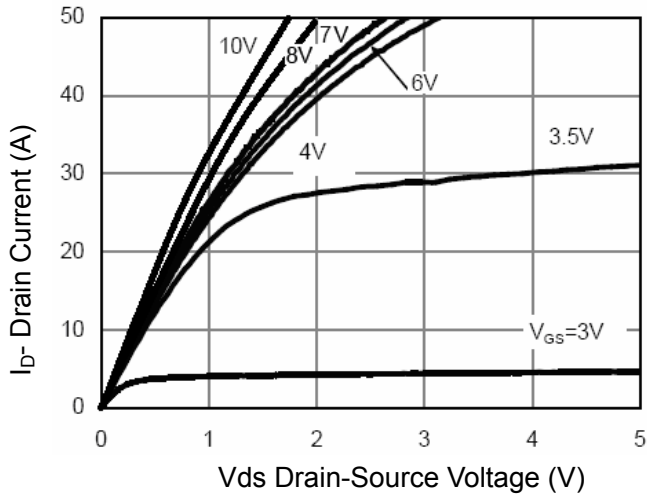


Figure 1 Output Characteristics

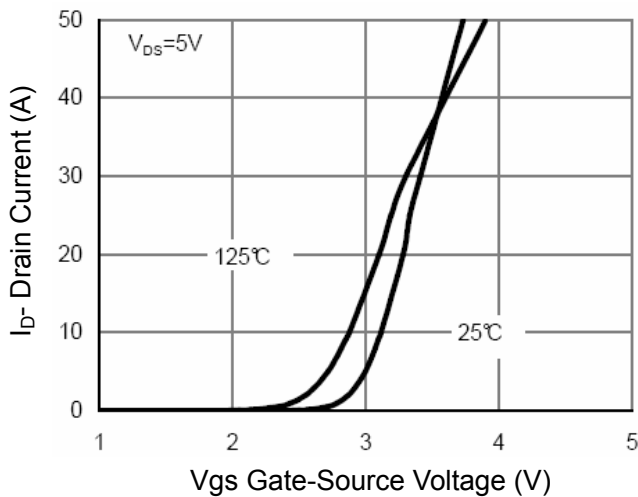


Figure 2 Transfer Characteristics

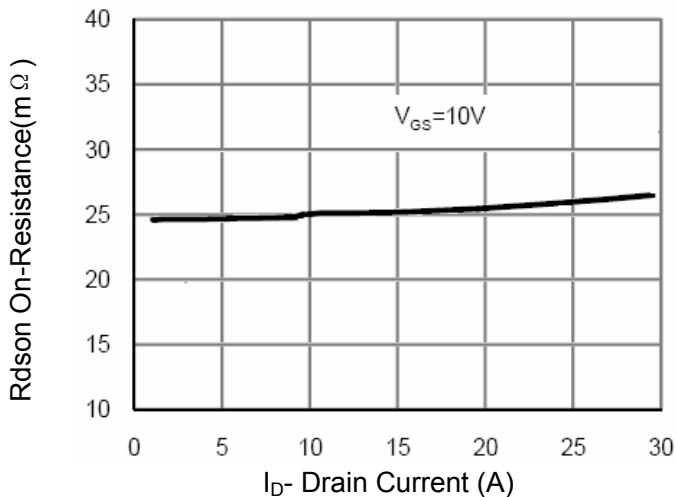


Figure 3 Rdson- Drain Current

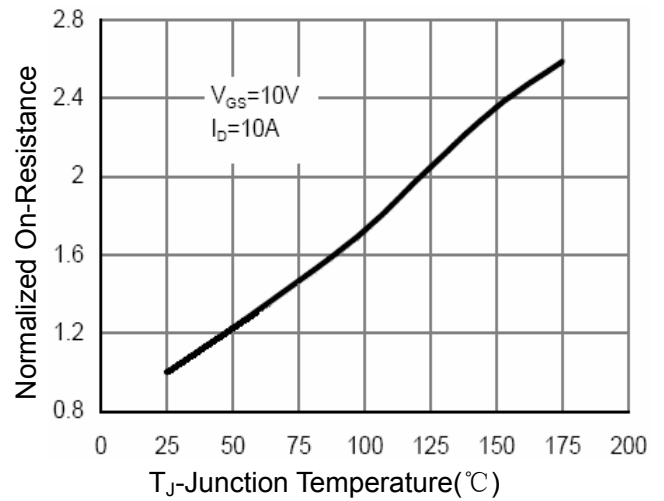


Figure 4 Rdson-Junction Temperature

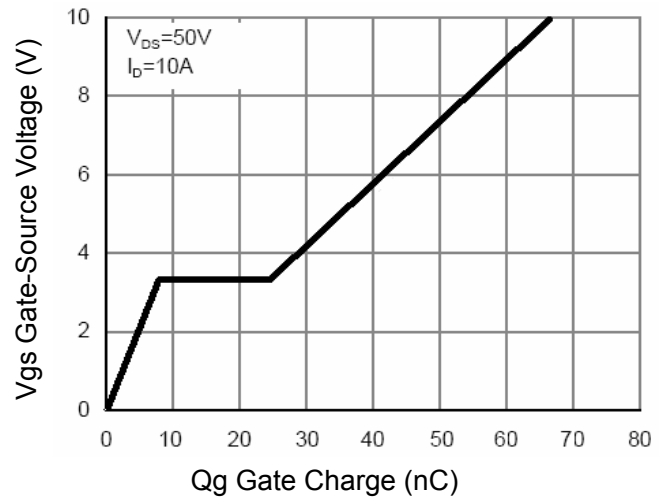


Figure 5 Gate Charge

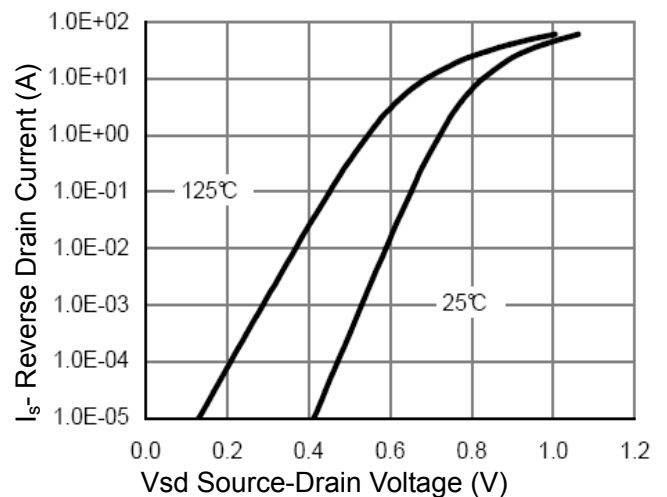


Figure 6 Source- Drain Diode Forward

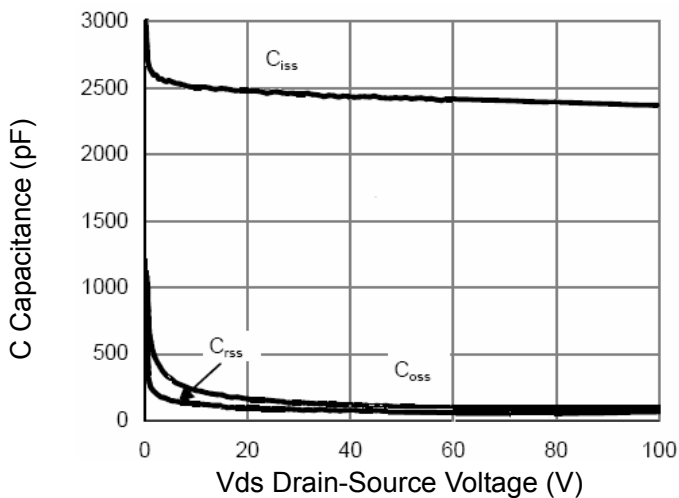


Figure 7 Capacitance vs Vds

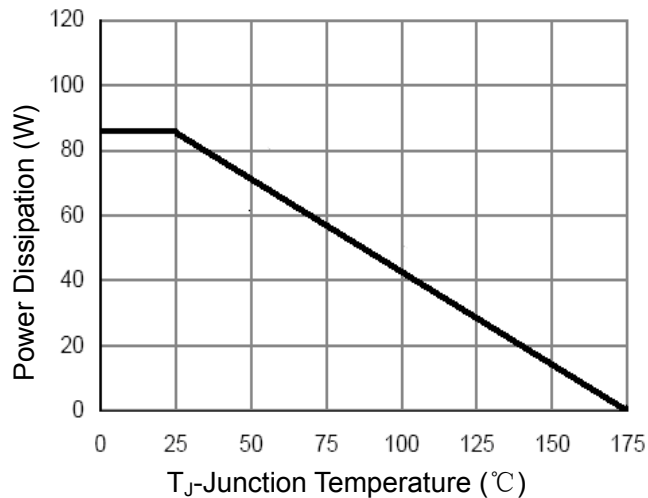


Figure 9 Power De-rating

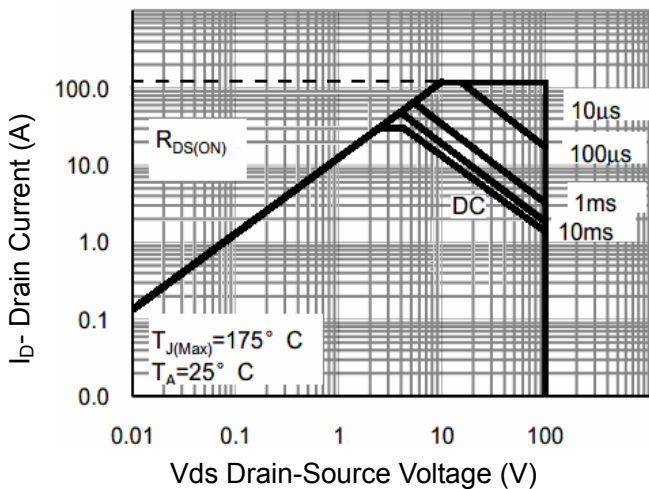


Figure 8 Safe Operation Area

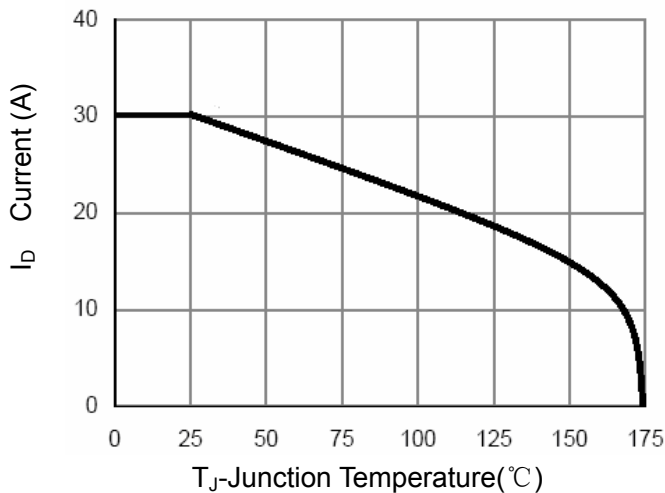


Figure 10 ID Current- Junction Temperature

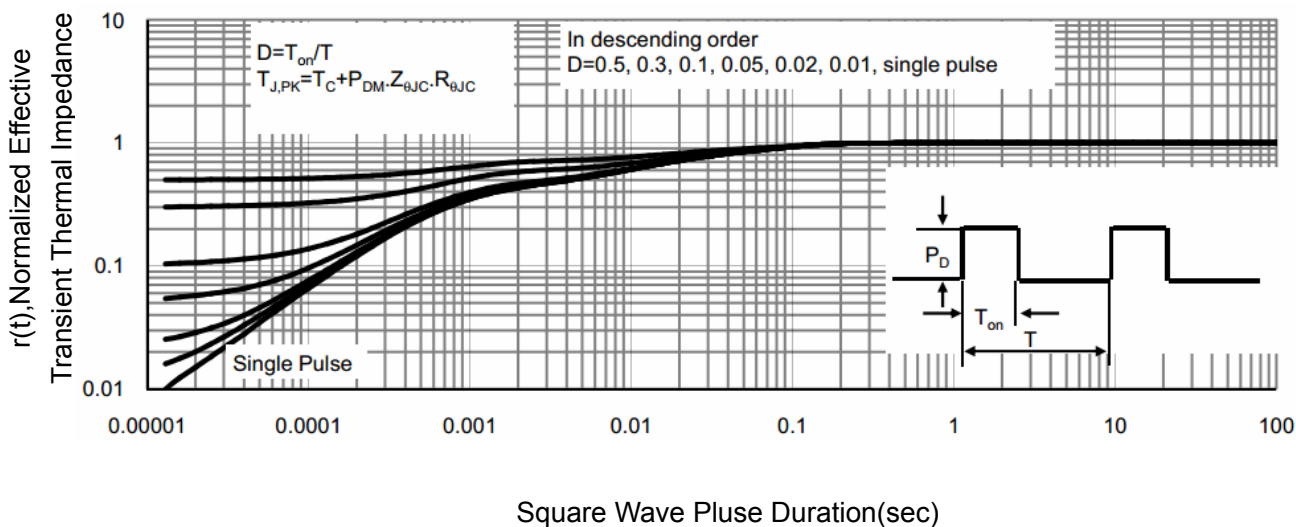
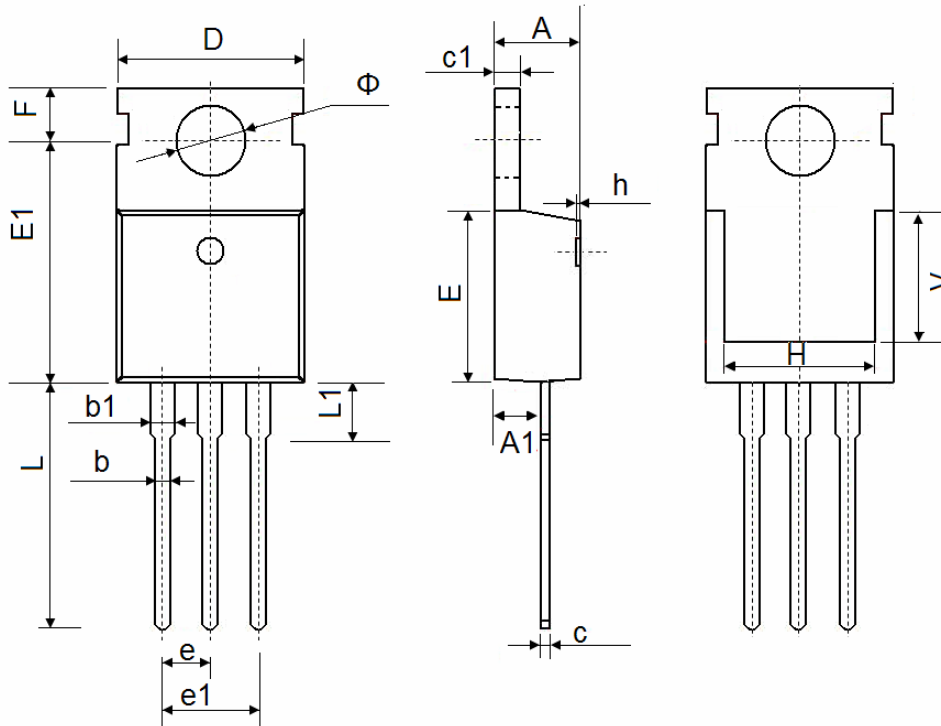


Figure 11 Normalized Maximum Transient Thermal Impedance

**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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