Leiditech

# LMAK50N03

## N-Channel Enhancement Mode Power MOSFET

## Description

The LMAK50N03 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.

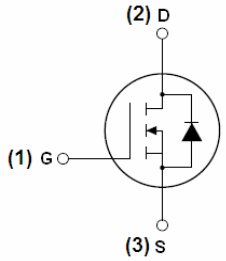
## General Features

- $V_{DS}$ =30V,$I_D$ =50A
  $R_{DS(ON)}$ < 11mΩ @ $V_{GS}$=10V
  $R_{DS(ON)}$ < 16mΩ @ $V_{GS}$=5V
- 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
- Special process technology for high ESD capability

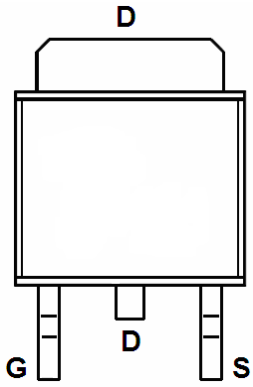
## Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible Power Supply

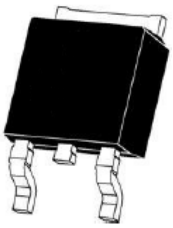
***100% UIS TESTED!***




**Schematic diagram**




**Marking and pin assignment**



**TO-252-2L top view**

## Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|---|---|---|---|---|---|
| NCE3050K | LMAK50N03 | TO-252-2L | - | - | - |

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

| Parameter | Symbol | Limit | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | 30 | V |
| Gate-Source Voltage | $V_{GS}$ | ±20 | V |
| Drain Current-Continuous | $I_D$ | 50 | A |
| Drain Current-Continuous($T_C$=100℃) | $I_D$ (100℃) | 35 | A |
| Pulsed Drain Current | $I_{DM}$ | 140 | A |
| Maximum Power Dissipation | $P_D$ | 60 | W |
| Derating factor | | 0.4 | W/℃ |
| Single pulse avalanche energy (Note 5) | $E_{AS}$ | 70 | mJ |
| Operating Junction and Storage Temperature Range | $T_J$,$T_{STG}$ | -55 To 175 | ℃ |



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## Thermal Characteristic

| | | | |
|---|---|---|---|
| Thermal Resistance,Junction-to-Case (Note 2) | $R_{\theta JC}$ | 2.5 | ℃/W |

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

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=250μA | 30 | 33 | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=30V,$V_{GS}$=0V | - | - | 1 | μA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V,$V_{DS}$=0V | - | - | ±100 | nA |
| **On Characteristics** (Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=250μA | 1 | 1.6 | 3 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=25A | - | 8 | 11 | mΩ |
| | | $V_{GS}$=5V, $I_D$=20A | - | 10 | 16 | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=5V,$I_D$=20A | 15 | - | - | S |
| **Dynamic Characteristics** (Note4) | | | | | | |
| Input Capacitance | $C_{lss}$ | $V_{DS}$=15V,$V_{GS}$=0V, F=1.0MHz | - | 2000 | - | PF |
| Output Capacitance | $C_{oss}$ | | - | 280 | - | PF |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 160 | - | PF |
| **Switching Characteristics** (Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=15V,$I_D$=20A $V_{GS}$=10V,$R_{GEN}$=1.8Ω | - | 10 | - | nS |
| Turn-on Rise Time | $t_r$ | | - | 8 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 30 | - | nS |
| Turn-Off Fall Time | $t_f$ | | - | 5 | - | nS |
| Total Gate Charge | $Q_g$ | $V_{DS}$=10V,$I_D$=25A, $V_{GS}$=10V | - | 23 | - | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | 7 | - | nC |
| Gate-Drain Charge | $Q_{gd}$ | | - | 4.5 | - | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| Diode Forward Voltage (Note 3) | $V_{SD}$ | $V_{GS}$=0V,$I_S$=25A | - | 0.85 | 1.2 | V |
| Diode Forward Current (Note 2) | $I_S$ | | - | - | 50 | A |
| Reverse Recovery Time | $t_{rr}$ | TJ = 25°C, IF = 50A di/dt = 100A/μs (Note3) | - | 22 | 35 | nS |
| Reverse Recovery Charge | Qrr | | - | 11 | 18 | nC |
| Forward Turn-On Time | $t_{on}$ | 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℃, $V_{DD}$=15V,$V_G$=10V,L=1mH, Rg=25Ω



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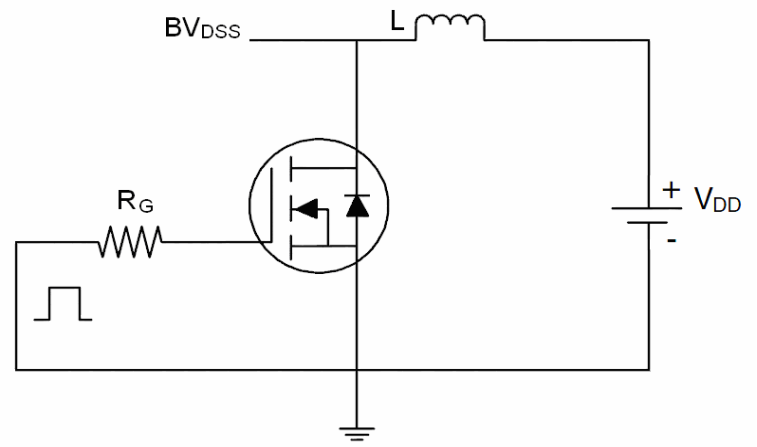
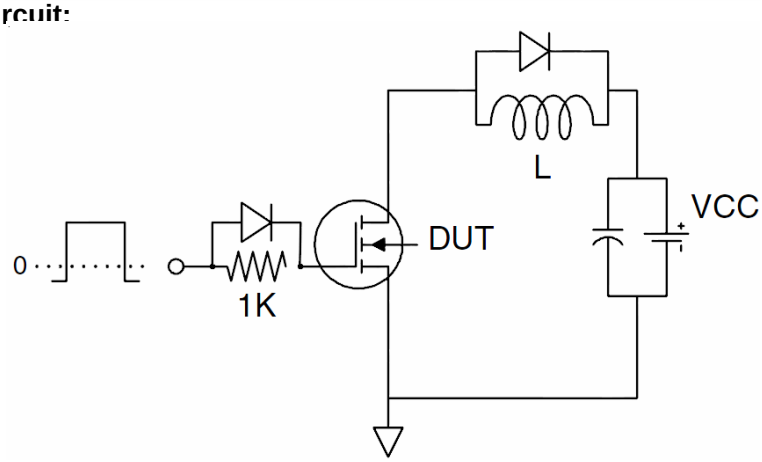
# Test circuit

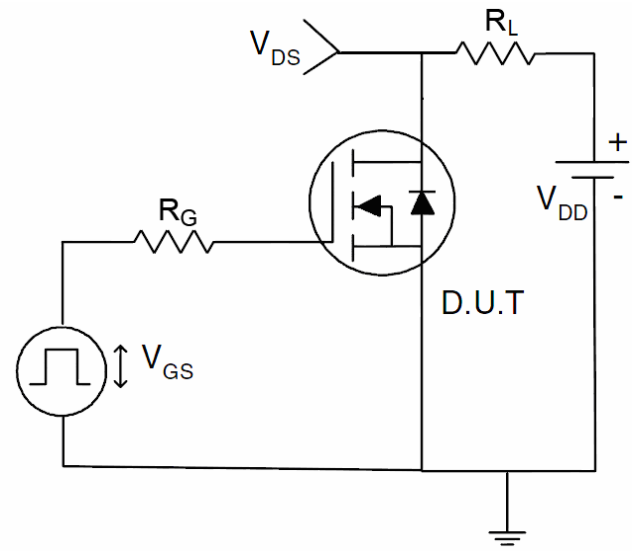
**1）$E_{AS}$ test Circuits**




**2）Gate charge test Circuit:**




**3）Switch Time Test Circuit:**



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## Typical Electrical and Thermal Characteristics (Curves)

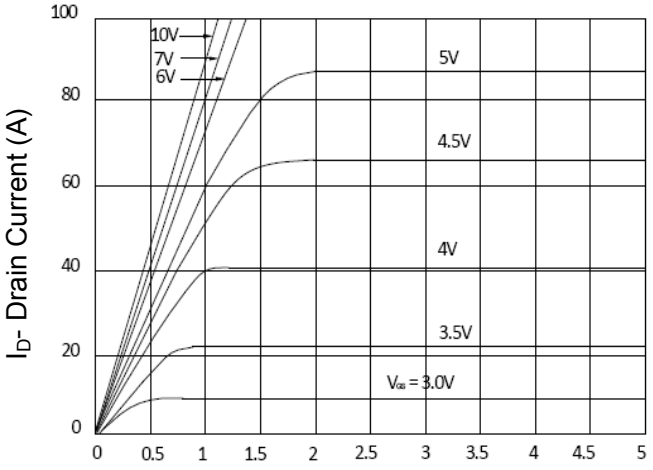


**Figure 1 Output Characteristics**

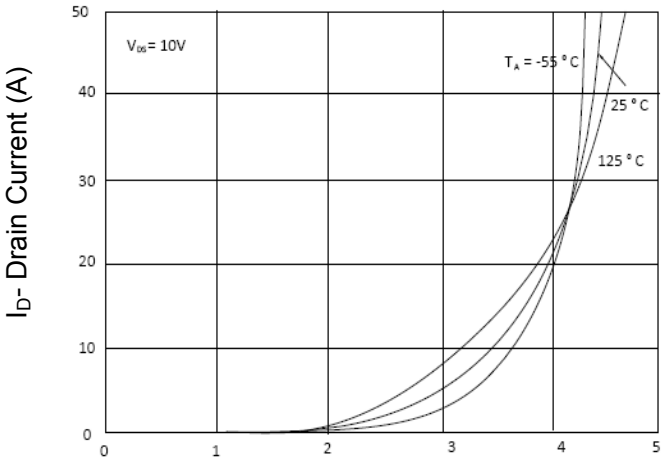


**Figure 2 Transfer Characteristics**

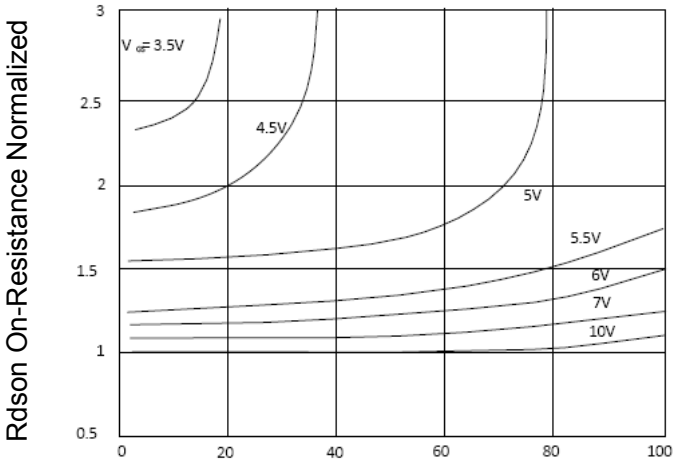


**Figure 3 Rdson- Drain Current**

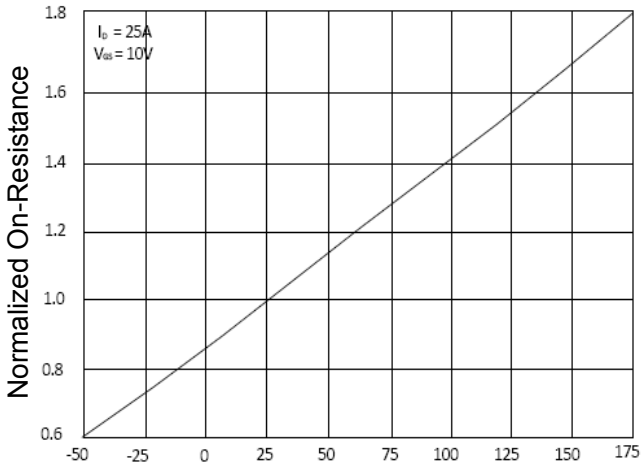


**Figure 4 Rdson-JunctionTemperature**

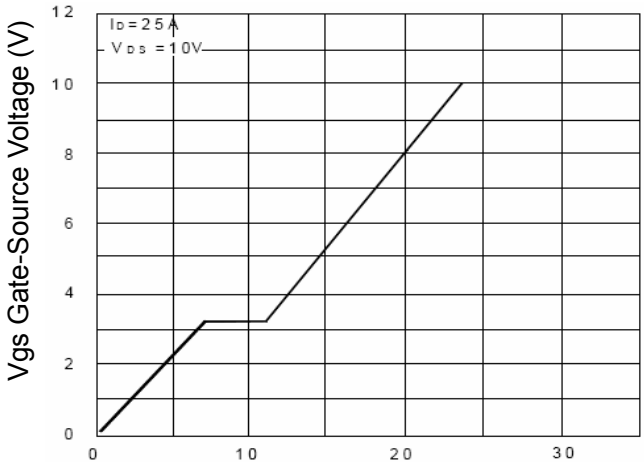


**Figure 5 Gate Charge**

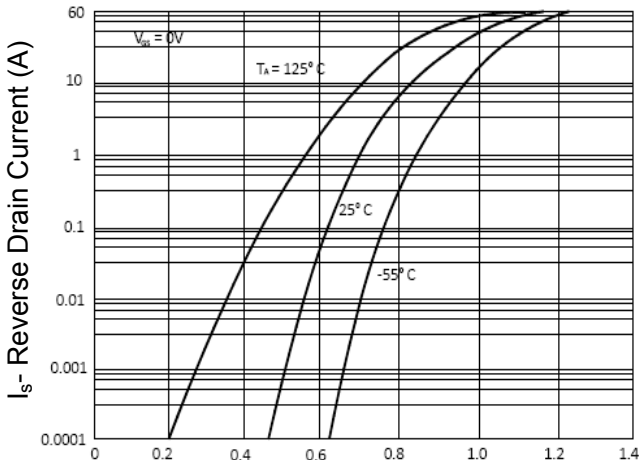


**Figure 6 Source- Drain Diode Forward**



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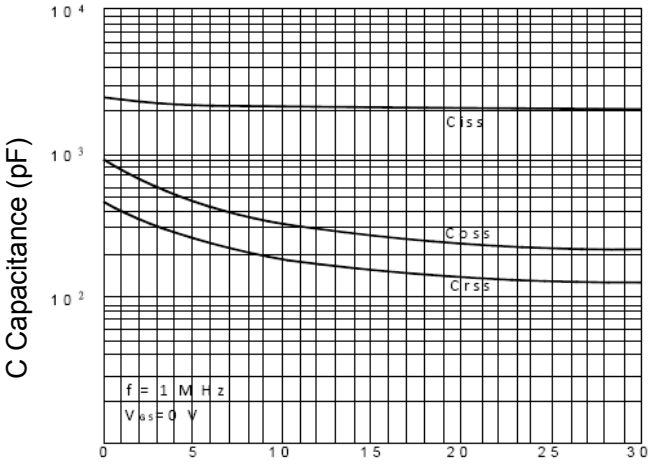


**Figure 7 Capacitance vs Vds**

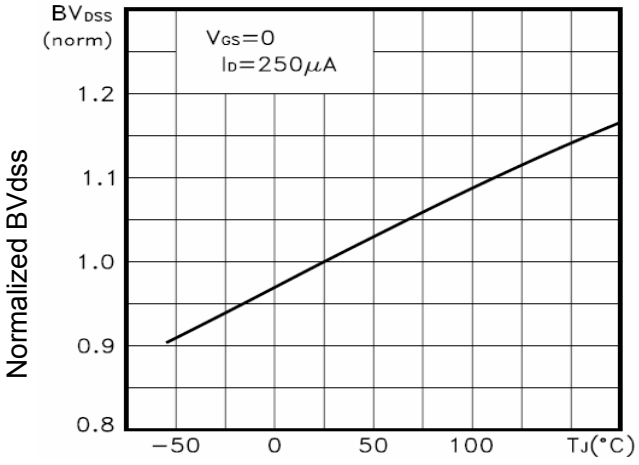


**Figure 9 $BV_{DSS}$ vs Junction Temperature**

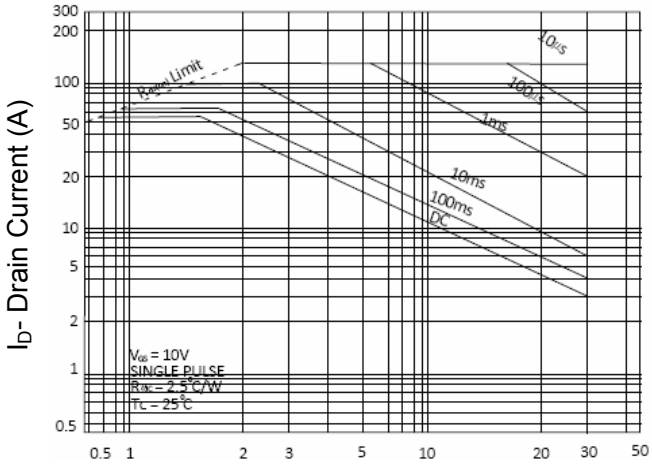


**Figure 8 Safe Operation Area**

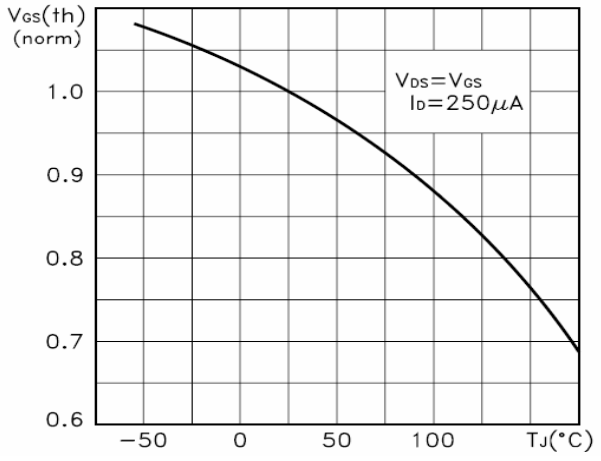


**Figure 10 $V_{GS(th)}$ vs Junction Temperature**

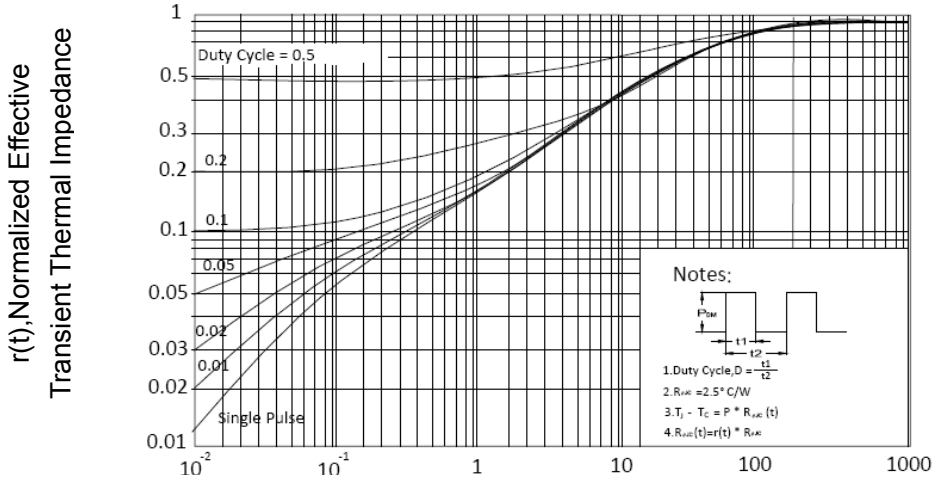


**Figure 11 Normalized Maximum Transient Thermal Impedance**



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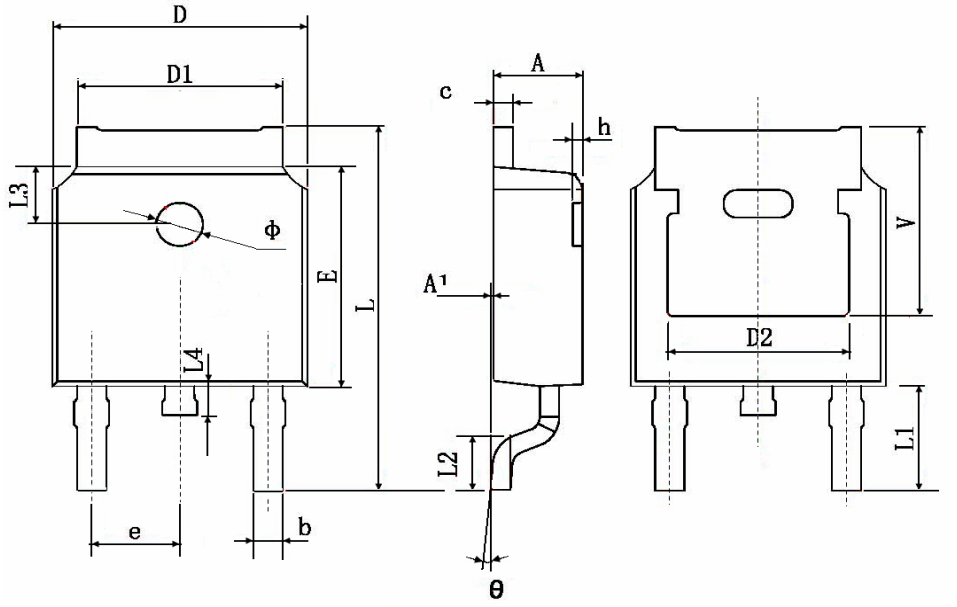
## TO-252 Package Information




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 2.200 | 2.400 | 0.087 | 0.094 |
| A1 | 0.000 | 0.127 | 0.000 | 0.005 |
| b | 0.660 | 0.860 | 0.026 | 0.034 |
| c | 0.460 | 0.580 | 0.018 | 0.023 |
| D | 6.500 | 6.700 | 0.256 | 0.264 |
| D1 | 5.100 | 5.460 | 0.201 | 0.215 |
| D2 | 4.830 TYP. | | 0.190 TYP. | |
| E | 6.000 | 6.200 | 0.236 | 0.244 |
| e | 2.186 | 2.386 | 0.086 | 0.094 |
| L | 9.800 | 10.400 | 0.386 | 0.409 |
| L1 | 2.900 TYP. | | 0.114 TYP. | |
| L2 | 1.400 | 1.700 | 0.055 | 0.067 |
| L3 | 1.600 TYP. | | 0.063 TYP. | |
| L4 | 0.600 | 1.000 | 0.024 | 0.039 |
| Φ | 1.100 | 1.300 | 0.043 | 0.051 |
| θ | 0° | 8° | 0° | 8° |
| h | 0.000 | 0.300 | 0.000 | 0.012 |
| V | 5.350 TYP. | | 0.211 TYP. | |

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