# SI7850DP-VB Datasheet

## N-Channel 60-V (D-S) MOSFET

| PRODUCT SUMMARY | |
|---|---|
| $V_{DS}$ (V) | 60 |
| $R_{DS(on)}$ (Ω) at $V_{GS}$ = 10 V | 0.024 |
| $R_{DS(on)}$ (Ω) at $V_{GS}$ = 4.5 V | 0.028 |
| $Q_g$ typ. (nC) | 5.2 |
| $I_D$ (A) | 15[a, g] |
| Configuration | Single |

### FEATURES

- **Halogen-free According to IEC 61249-2-21 Available**
- Trench Power MOSFET
- 100 % $R_g$ Tested
- 100 % UIS Tested

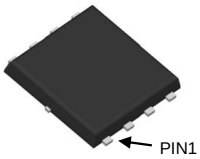
Pb-free
RoHS COMPLIANT

### APPLICATIONS

- Battery Switch
- DC/DC Converter

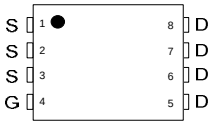
DFN5X6

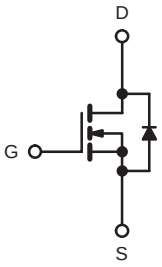
Top View




Bottom View

Top View




N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25 °C, unless otherwise noted) | | | | |
|---|---|---|---|---|
| **PARAMETER** | | **SYMBOL** | **LIMIT** | **UNIT** |
| Drain-source voltage | | $V_{DS}$ | 60 | V |
| Gate-source voltage | | $V_{GS}$ | ± 20 | |
| Continuous drain current ($T_J$ = 150 °C) | $T_C$ = 25 °C | $I_D$ | 15 [a] | A |
| | $T_C$ = 70 °C | | 9[a] | |
| | $T_A$ = 25 °C | | 10.3 [b, c] | |
| | $T_A$ = 70 °C | | 8.1 [b, c] | |
| Pulsed drain current (t = 100 µs) | | $I_{DM}$ | 40 | |
| Continuous source-drain diode current | $T_C$ = 25 °C | $I_S$ | 12 [a] | |
| | $T_A$ = 25 °C | | 3 [b, c] | |
| Single pulse avalanche current | L = 0.1 mH | $I_{AS}$ | 15 | |
| Single pulse avalanche energy | | $E_{AS}$ | 11.3 | mJ |
| Maximum power dissipation | $T_C$ = 25 °C | $P_D$ | 35.7 | W |
| | $T_C$ = 70 °C | | 22.9 | |
| | $T_A$ = 25 °C | | 3.6 [b, c] | |
| | $T_A$ = 70 °C | | 2.3 [b, c] | |
| Operating junction and storage temperature range | | $T_J$, $T_{stg}$ | -55 to +150 | °C |
| Soldering recommendations (peak temperature) [c] | | | 260 | |

| THERMAL RESISTANCE RATINGS | | | | | |
|---|---|---|---|---|---|
| **PARAMETER** | | **SYMBOL** | **TYPICAL** | **MAXIMUM** | **UNIT** |
| Maximum junction-to-ambient [b] | t ≤ 10 s | $R_{thJA}$ | 25 | 35 | °C/W |
| Maximum junction-to-case (drain) | Steady state | $R_{thJC}$ | 2.7 | 3.5 | |

**Notes**
a. Package limited
b. Surface mounted on 1" x 1" FR4 board
c. t = 10 s

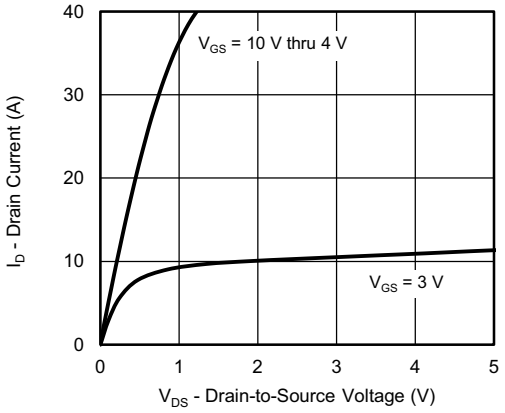
| **SPECIFICATIONS** ($T_J$ = 25 °C, unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **TEST CONDITIONS** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| **Static** | | | | | | |
| Drain-source breakdown voltage | $V_{DS}$ | $V_{GS}$ = 0 V, $I_D$ = 250 µA | 60 | - | - | V |
| $V_{DS}$ temperature coefficient | $\Delta V_{DS}/T_J$ | $I_D$ = 250 µA | - | 33 | - | mV/°C |
| $V_{GS(th)}$ temperature coefficient | $\Delta V_{GS(th)}/T_J$ | | - | -4.8 | - | |
| Gate-source threshold voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 1 | - | 2.8 | V |
| Gate-source leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 20 V | - | - | 100 | nA |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$ = 60 V, $V_{GS}$ = 0 V | - | - | 1 | µA |
| | | $V_{DS}$ = 60 V, $V_{GS}$ = 0 V, $T_J$ = 70 °C | - | - | 10 | |
| On-state drain current [a] | $I_{D(on)}$ | $V_{DS}$ ≥ 5 V, $V_{GS}$ =10 V | 10 | - | - | A |
| Drain-source on-state resistance [a] | $R_{DS(on)}$ | $V_{GS}$ =10 V, $I_D$ = 10 A | - | 0.024 | - | Ω |
| | | $V_{GS}$ = 4.5 V, $I_D$ = 5 A | - | 0.028 | - | |
| Forward transconductance [a] | $g_{fs}$ | $V_{DS}$ = 10 V, $I_D$ = 10 A | - | 39 | - | S |
| **Dynamic [b]** | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{DS}$ = 30 V, $V_{GS}$ = 0 V, f = 1 MHz | - | 790 | - | pF |
| Output capacitance | $C_{oss}$ | | - | 330 | - | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 14 | - | |
| Total gate charge | $Q_g$ | $V_{DS}$ = 30 V, $V_{GS}$ = 10 V, $I_D$ = 5 A | - | 11.1 | 17 | nC |
| | | $V_{DS}$ = 30 V, $V_{GS}$ = 4.5 V, $I_D$ = 5 A | - | 5.2 | 8 | |
| Gate-source charge | $Q_{gs}$ | | - | 2.2 | - | |
| Gate-drain charge | $Q_{gd}$ | | - | 1.1 | - | |
| Gate resistance | $R_g$ | f = 1 MHz | 0.1 | 0.6 | 1.2 | Ω |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$ = 30 V, $R_L$ = 6 Ω, $I_D$ ≅ 5 A, $V_{GEN}$ = 10 V, $R_g$ = 1 Ω | - | 7 | 15 | ns |
| Rise time | $t_r$ | | - | 21 | 40 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 10 | 20 | |
| Fall time | $t_f$ | | - | 10 | 20 | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$ = 30 V, $R_L$ = 6 Ω, $I_D$ ≅ 5 A, $V_{GEN}$ = 4.5 V, $R_g$ = 1 Ω | - | 13 | 25 | |
| Rise time | $t_r$ | | - | 25 | 50 | |
| Turn-off delay time | $t_{d(off)}$ | | - | 10 | 20 | |
| Fall time | $t_f$ | | - | 22 | 45 | |
| **Drain-Source Body Diode Characteristics** | | | | | | |
| Continuous source-drain diode current | $I_S$ | $T_C$ = 25 °C | - | 15 | - | A |
| Pulse diode forward current | $I_{SM}$ | | - | - | 40 | |
| Body diode voltage | $V_{SD}$ | $I_S$ = 5 A, $V_{GS}$ = 0 V | - | 0.79 | 1.2 | V |
| Body diode reverse recovery time | $t_{rr}$ | $I_F$ = 5 A, di/dt = 100 A/µs, $T_J$ = 25 °C | - | 30 | 60 | ns |
| Body diode reverse recovery charge | $Q_{rr}$ | | - | 60 | 120 | nC |
| Reverse recovery fall time | $t_a$ | | - | 15 | - | ns |
| Reverse recovery rise time | $t_b$ | | - | 15 | - | |

**Notes**

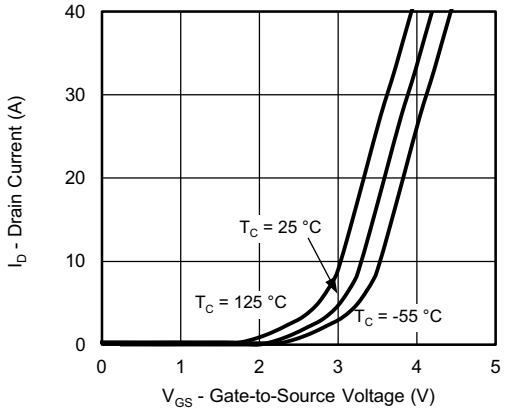
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %

b. Guaranteed by design, not subject to production testing

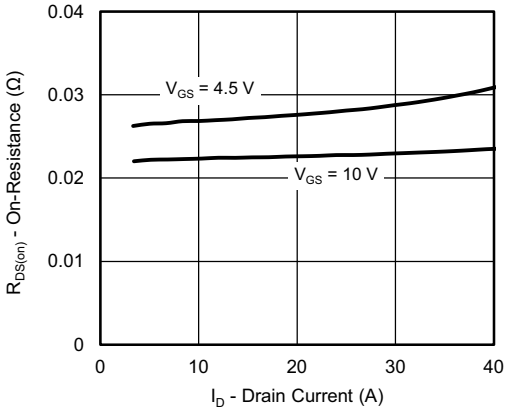
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



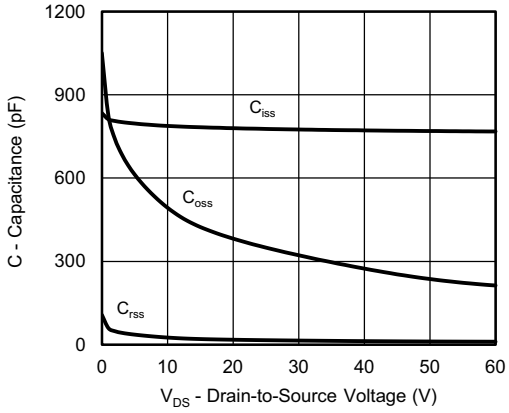

**Output Characteristics**



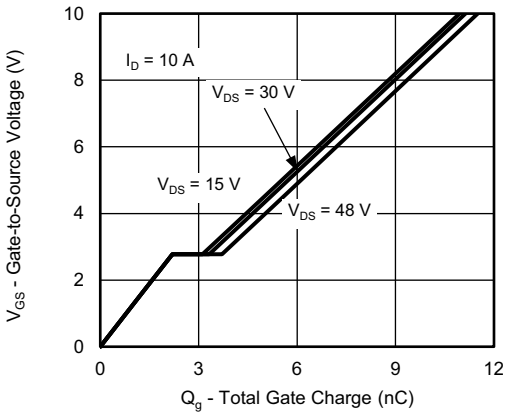

**Transfer Characteristics**



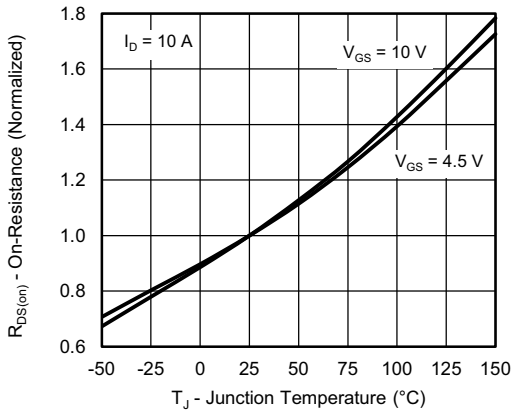

**On-Resistance vs. Drain Current and Gate Voltage**




**Capacitance**

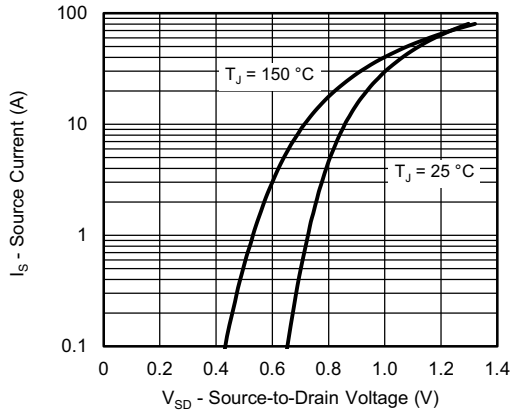



**Gate Charge**

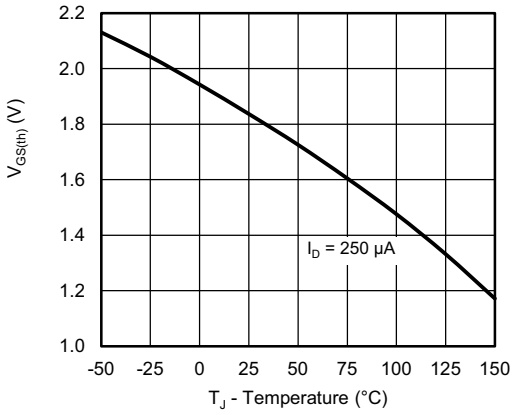



**On-Resistance vs. Junction Temperature**

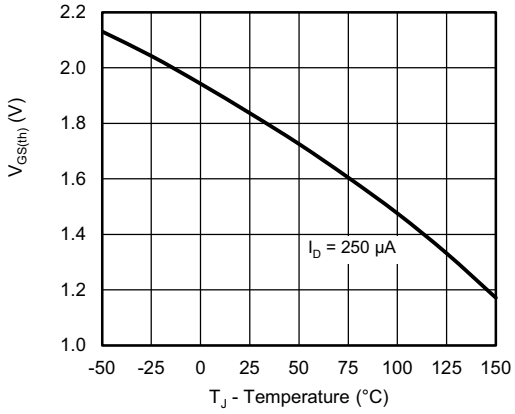
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



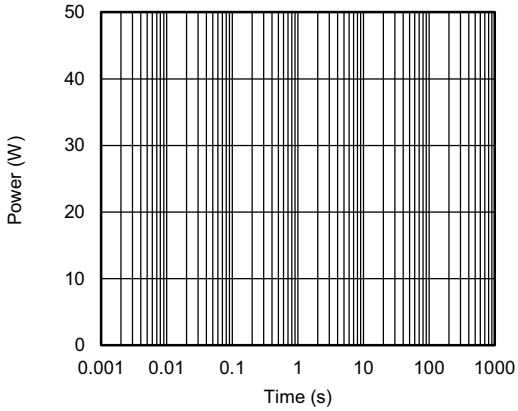

**Source-Drain Diode Forward Voltage**



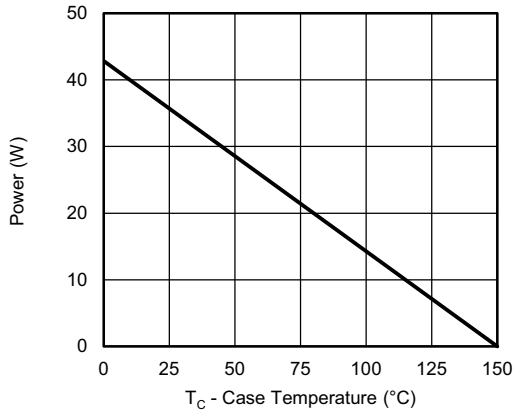

**Threshold Voltage**



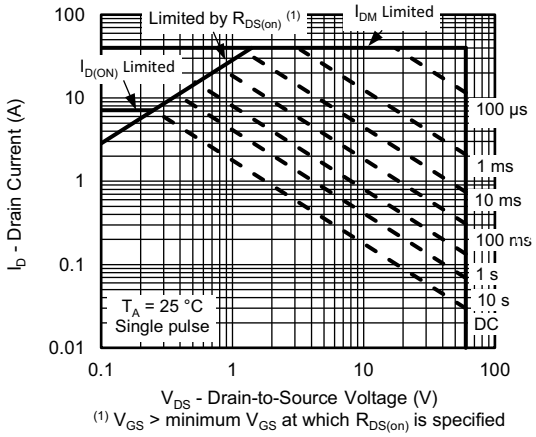

**Threshold Voltage**




**Single Pulse Power, Junction-to-Ambient**

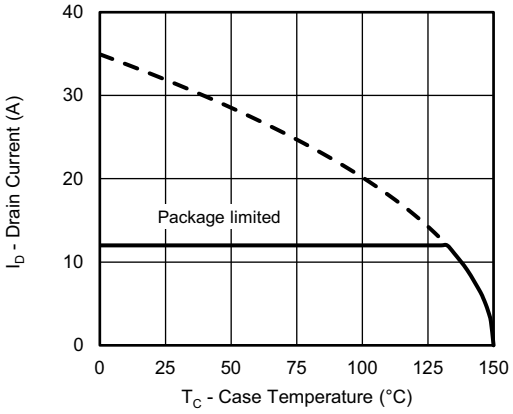



**Power, Junction-to-Case**




**Safe Operating Area, Junction-to-Ambient**

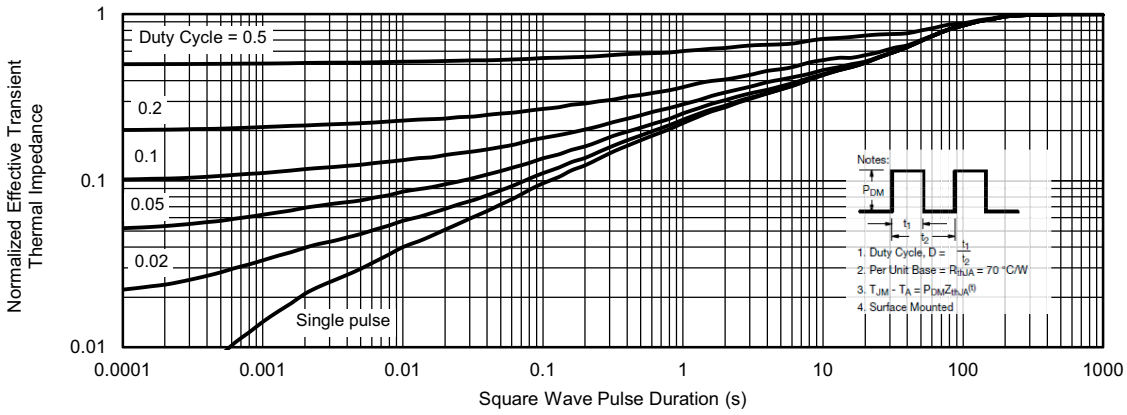
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



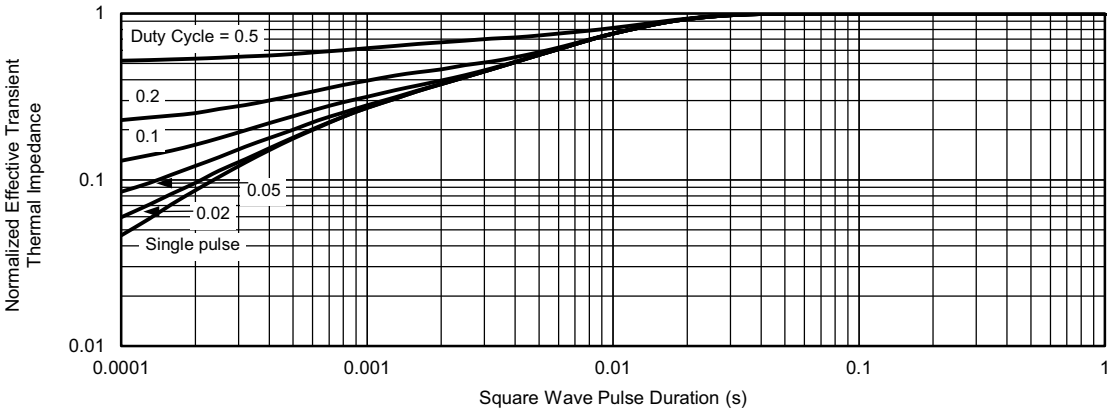

**Current Derating** [a]

**Note**

a. The power dissipation $P_D$ is based on $T_J$ max. = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit




**Normalized Thermal Transient Impedance, Junction-to-Ambient**




**Normalized Thermal Transient Impedance, Junction-to-Foot**

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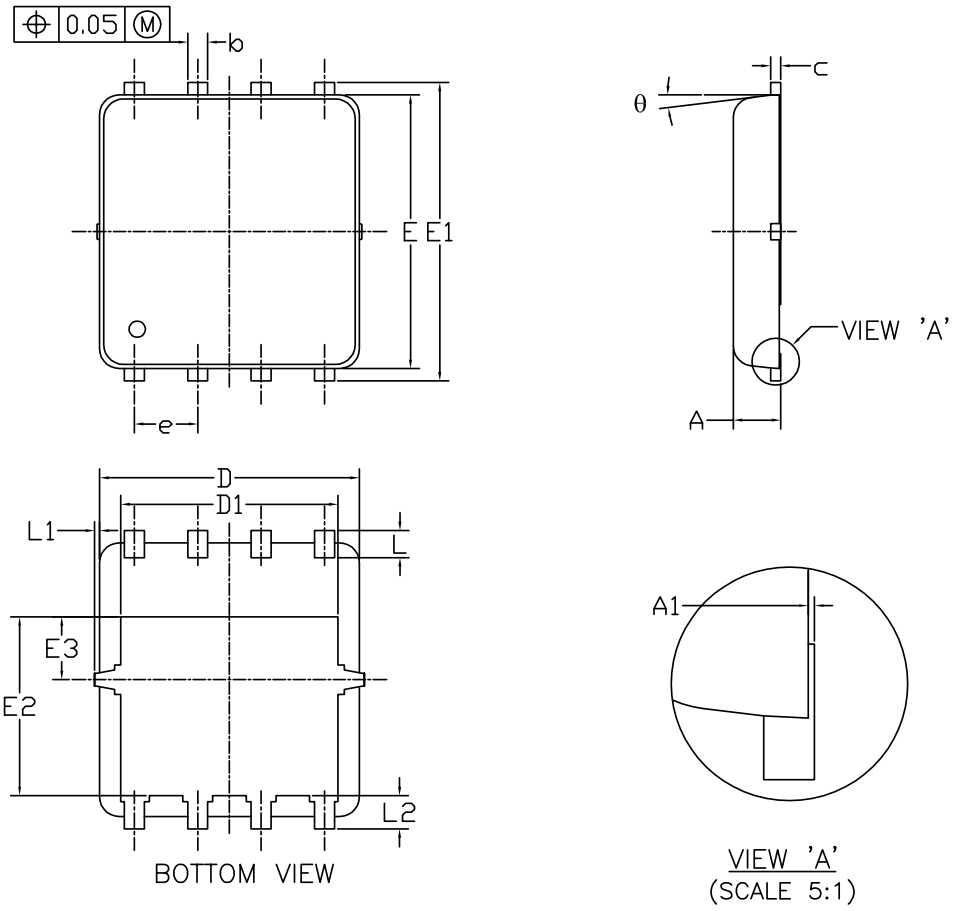
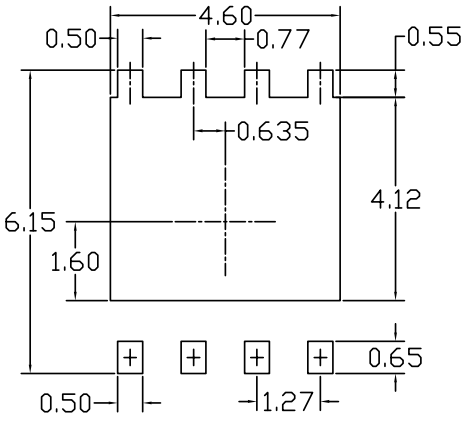
## DFN5x6_8L_EP1_P PACKAGE OUTLIN




RECOMMENDED LAND PATTERN




| SYMBOLS | DIMENSIONS IN MILLIMETERS | | | DIMENSIONS IN INCHES | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.85 | 0.95 | 1.00 | 0.033 | 0.037 | 0.039 |
| A1 | 0.00 | --- | 0.05 | 0.000 | --- | 0.002 |
| b | 0.30 | 0.40 | 0.50 | 0.012 | 0.016 | 0.020 |
| c | 0.15 | 0.20 | 0.25 | 0.006 | 0.008 | 0.010 |
| D | 5.10 | 5.20 | 5.30 | 0.201 | 0.205 | 0.209 |
| D1 | 4.25 | 4.35 | 4.45 | 0.167 | 0.171 | 0.175 |
| E | 5.45 | 5.55 | 5.65 | 0.215 | 0.219 | 0.222 |
| E1 | 5.95 | 6.05 | 6.15 | 0.234 | 0.238 | 0.242 |
| E2 | 3.525 | 3.625 | 3.725 | 0.139 | 0.143 | 0.147 |
| E3 | 1.175 | 1.275 | 1.375 | 0.046 | 0.050 | 0.054 |
| e | 1.27 BSC | | | 0.050 BSC | | |
| L | 0.45 | 0.55 | 0.65 | 0.018 | 0.022 | 0.026 |
| L1 | 0 | --- | 0.15 | 0 | --- | 0.006 |
| L2 | 0.68 REF | | | 0.027 REF | | |
| θ | 0° | --- | 10° | 0° | --- | 10° |

UNIT: mm

NOTE

1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS.
   MOLD FLASH AT THE NON-LEAD SIDES SHOULD BE LESS THAN 6 MILS EACH.
2. CONTROLLING DIMENSION IS MILLIMETER.
   CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT

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