# 优尚

YOUSHANG SEMICONDUCTOR

## 设计研发新型功率器件

## 各类小信号开关

## 中低压及高压大电流等场效应管

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## Product Summary

| **BV$_{DSS}$** | **R$_{DS(ON)}$ Max** | **I$_D$**<br>**T$_C$ = +25°C**<br>(Note 7) |
|---|---|---|
| 40V | 3.7mΩ @ V$_{GS}$ = 10V | 100A |

## Features

- Rated to +175°C – Ideal For High Ambient Temperature Environments
- 100% Unclamped Inductive Switching – Ensures More Reliable And Robust End Application
- Low R$_{DS(ON)}$ – Minimizes Power Losses
- Low Q$_g$ – Minimizes Switching Losses

## Description and Applications

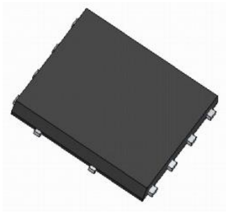
This MOSFET is designed to meet the stringent requirements of automotive applications. It is qualified to AEC-Q101, supported by a PPAP and is ideal for use in:

- Engine management systems
- Body control electronics
- DC-DC converters

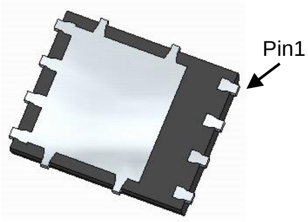
## Mechanical Data

- Package: PowerDI®5060-8
- Package Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Finish - Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 ⓔ3
- Weight: 0.097 grams (Approximate)

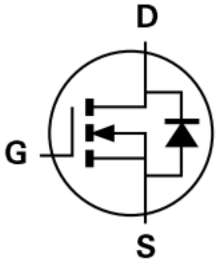
PowerDI5060-8



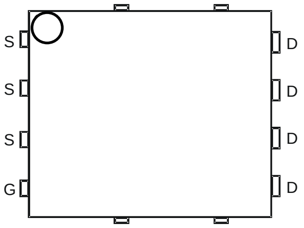
Top View



Bottom View



Internal Schematic



Top View
Pin Configuration

## Maximum Ratings (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | 40 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±20 | V |
| Continuous Drain Current (Note 5) | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | 20.9<br>17.5 | A |
| Continuous Drain Current (Notes 6 & 7) | $T_C$ = +25°C<br>$T_C$ = +100°C | $I_D$ | 100<br>100 | A |
| Maximum Continuous Body Diode Forward Current (Note 6) | | $I_S$ | 100 | A |
| Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%) | | $I_{DM}$ | 150 | A |
| Avalanche Current, L=0.6mH | | $I_{AS}$ | 21 | A |
| Avalanche Energy, L=0.6mH | | $E_{AS}$ | 132.3 | mJ |

## Thermal Characteristics

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Total Power Dissipation (Note 5) | $T_A$= +25°C | $P_D$ | 2.6 | W |
| Thermal Resistance, Junction to Ambient (Note 5) | | $R_{\theta JA}$ | 57 | °C/W |
| Total Power Dissipation (Note 6) | $T_C$ = +25°C | $P_D$ | 150 | W |
| Thermal Resistance, Junction to Case (Note 6) | | $R_{\theta JC}$ | 1 | °C/W |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +175 | °C |

## Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS (Note 8)** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | 40 | — | — | V | $V_{GS}$ = 0V, $I_D$ = 1mA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | — | — | 1 | µA | $V_{DS}$ = 32V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±100 | nA | $V_{GS}$ = ±20V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 8)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | 2 | — | 4 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | — | 2.9 | 3.7 | mΩ | $V_{GS}$ = 10V, $I_D$ = 50A |
| Diode Forward Voltage | $V_{SD}$ | — | 0.88 | — | V | $V_{GS}$ = 0V, $I_S$ = 50A |
| **DYNAMIC CHARACTERISTICS (Note 9)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 3,062 | — | pF | $V_{DS}$ = 20V, $V_{GS}$ = 0V, f = 1MHz |
| Output Capacitance | $C_{oss}$ | — | 902.2 | — | | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 179.2 | — | | |
| Gate Resistance | $R_g$ | — | 0.67 | — | Ω | $V_{DS}$ = 0V, $V_{GS}$ = 0V, f = 1MHz |
| Total Gate Charge | $Q_g$ | — | 49.1 | — | nC | $V_{DD}$ = 20V, $I_D$ = 50A, $V_{GS}$ = 10V |
| Gate-Source Charge | $Q_{gs}$ | — | 10.3 | — | | |
| Gate-Drain Charge | $Q_{gd}$ | — | 13 | — | | |
| Turn-On Delay Time | $t_{D(ON)}$ | — | 8.7 | — | ns | $V_{DD}$ = 20V, $V_{GS}$ = 10V, $I_D$ = 50A, $R_G$ = 3Ω |
| Turn-On Rise Time | $t_R$ | — | 6.8 | — | | |
| Turn-Off Delay Time | $t_{D(OFF)}$ | — | 18.6 | — | | |
| Turn-Off Fall Time | $t_F$ | — | 7.3 | — | | |
| Body Diode Reverse Recovery Time | $t_{RR}$ | — | 31.8 | — | ns | $I_F$ = 50A, di/dt = 100A/µs |
| Body Diode Reverse Recovery Charge | $Q_{RR}$ | — | 26.5 | — | nC | |

Notes:
5. Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1-inch square copper plate.
6. Thermal resistance from junction to soldering point (on the exposed drain pad).
7. Package limited.
8. Short duration pulse test used to minimize self-heating effect.
9. Guaranteed by design. Not subject to product testing.

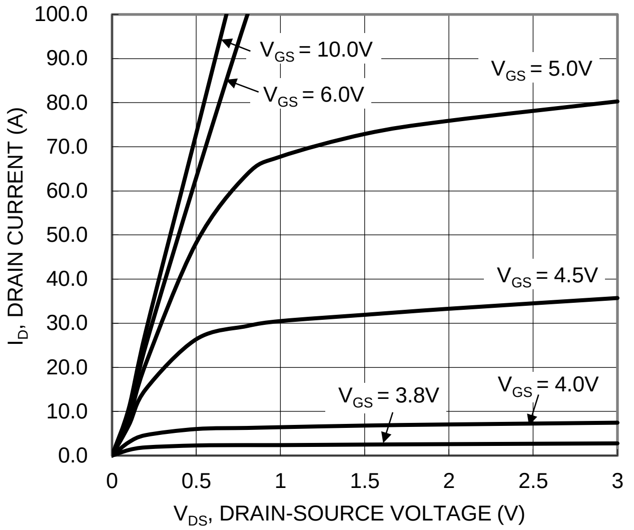


Figure 1 Typical Output Characteristic

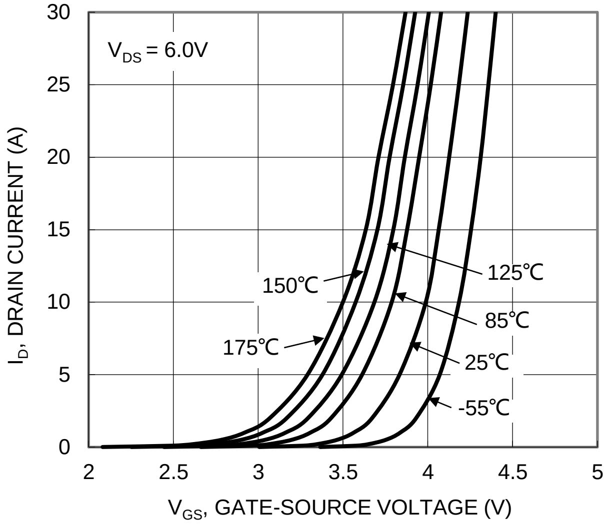


Figure 2 Typical Transfer Characteristic

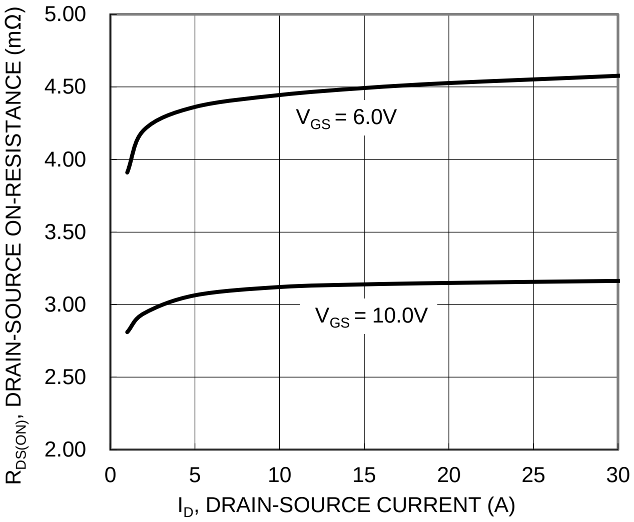


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

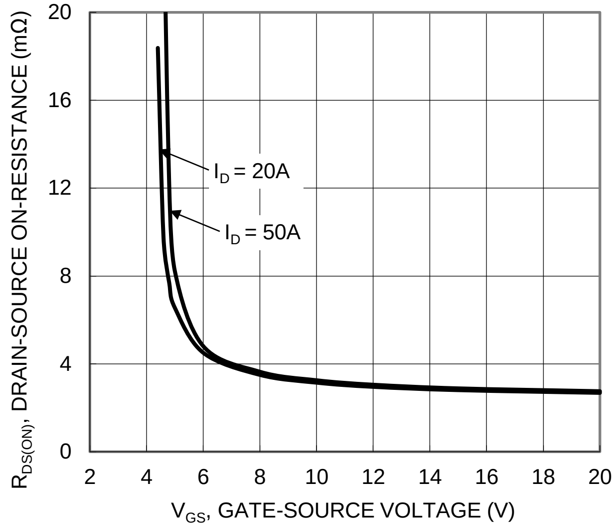


Figure 4 Typical Transfer Characteristic

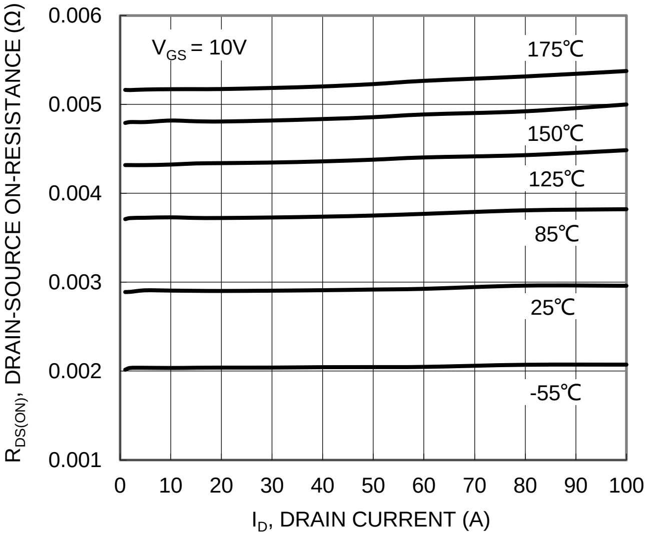


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

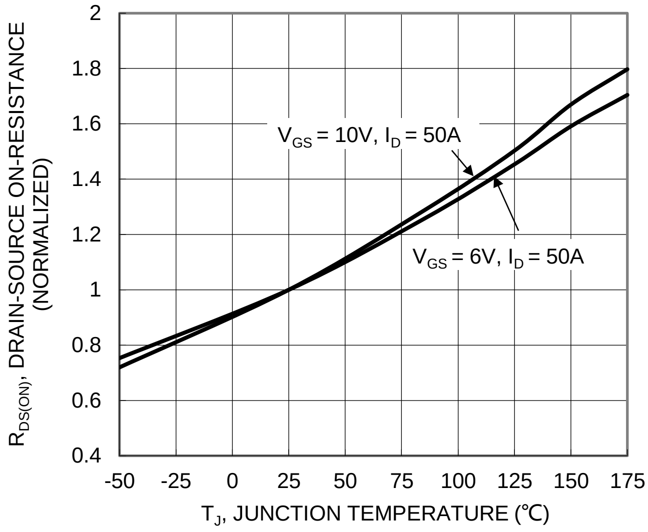


Figure 6 On-Resistance Variation with Temperature

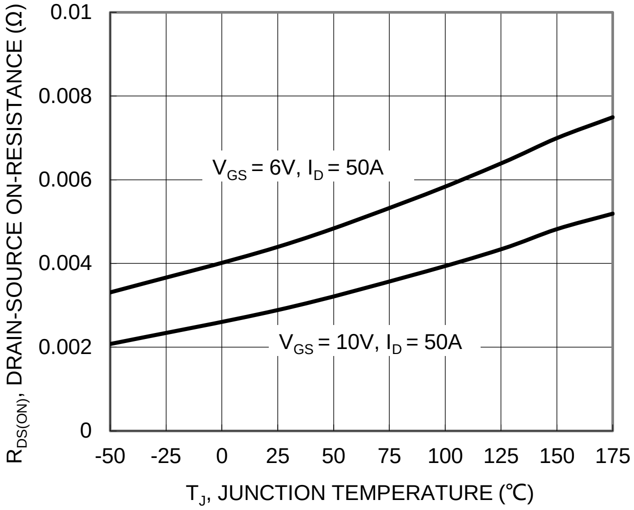


Figure 7 On-Resistance Variation with Temperature

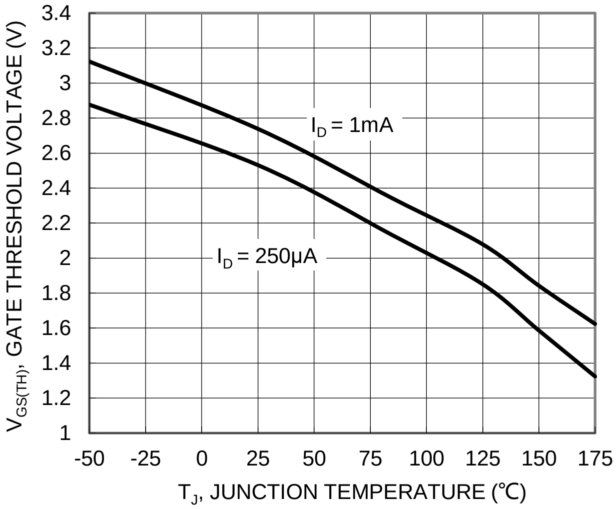


Figure 8 Gate Threshold Variation vs. Temperature

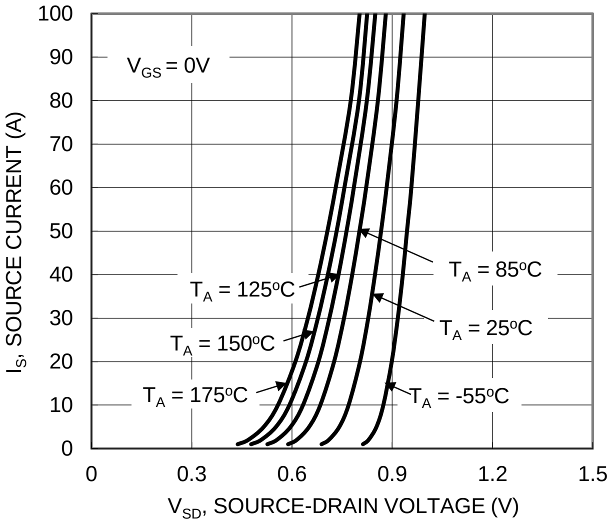


Figure 9 Diode Forward Voltage vs. Current

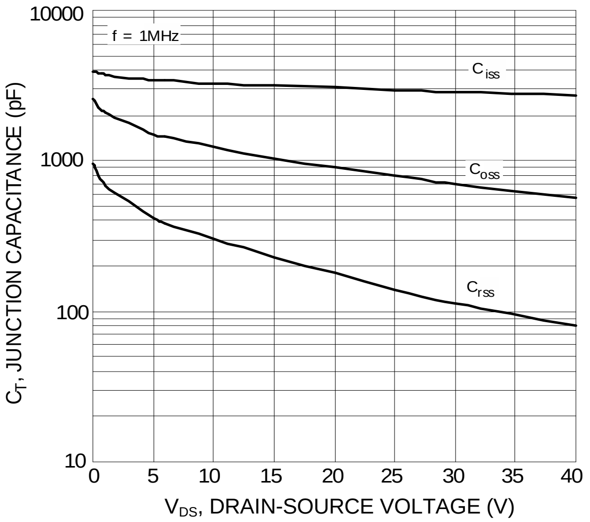


Figure 10 Typical Junction Capacitance

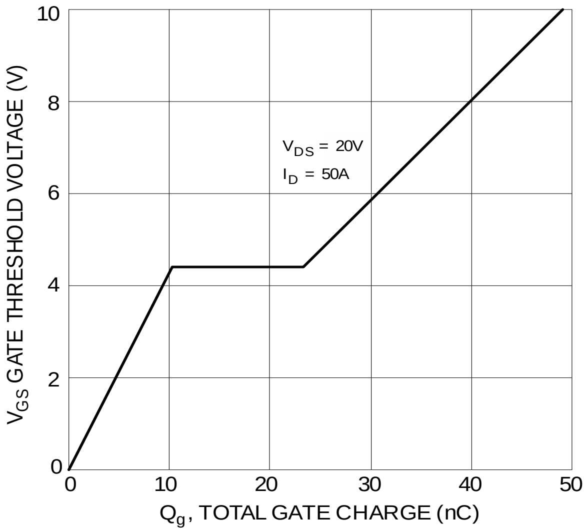


Figure 11 Gate Charge

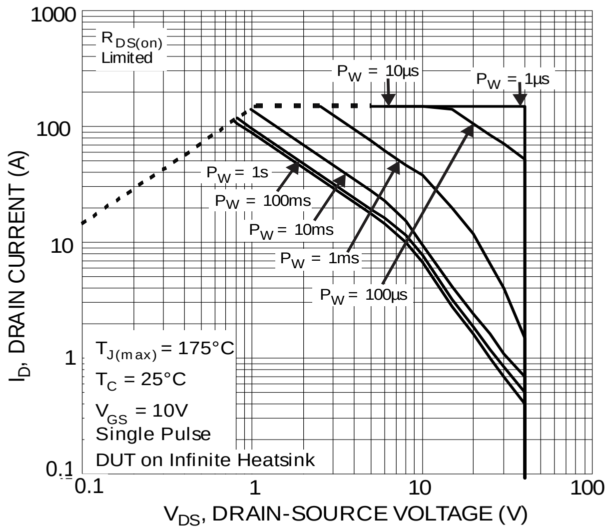


Figure 12 SOA, Safe Operation Area

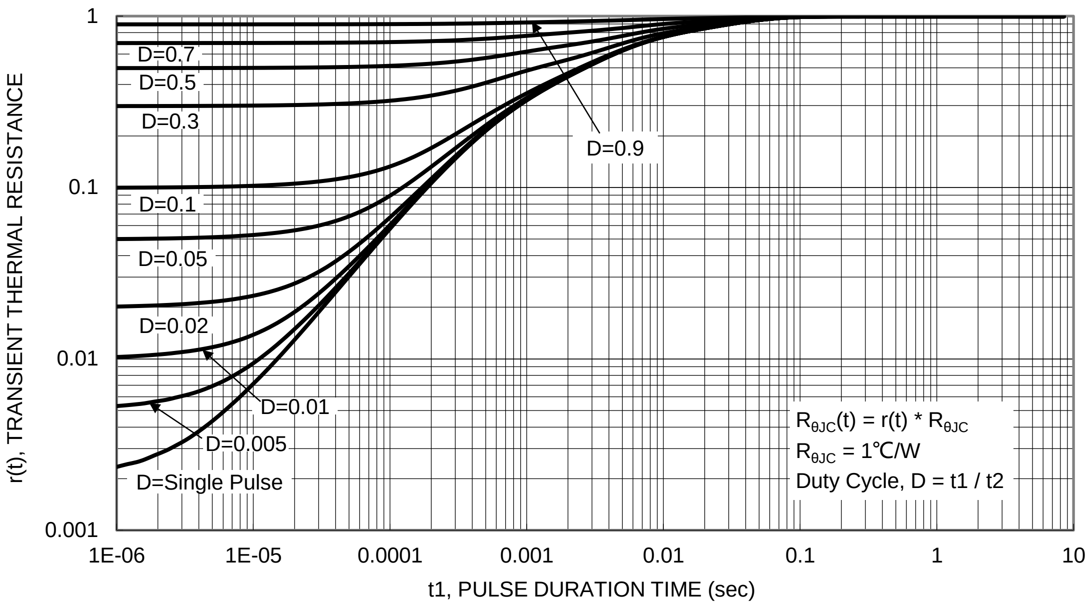
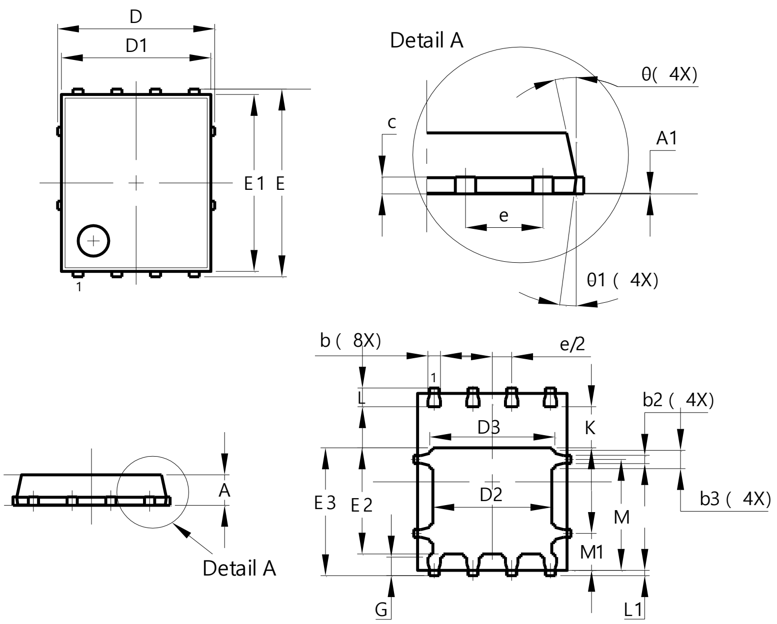


Figure 13 Transient Thermal Resistance

## Package Outline Dimensions

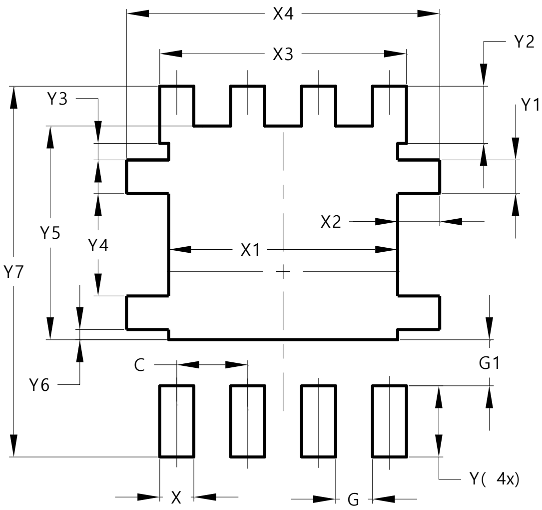
**PowerDI5060-8**



| PowerDI5060-8 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.90 | 1.10 | 1.00 |
| **A1** | 0.00 | 0.05 | – |
| **b** | 0.33 | 0.51 | 0.41 |
| **b2** | 0.200 | 0.350 | 0.273 |
| **b3** | 0.40 | 0.80 | 0.60 |
| **c** | 0.230 | 0.330 | 0.277 |
| **D** | 5.15 BSC | | |
| **D1** | 4.70 | 5.10 | 4.90 |
| **D2** | 3.70 | 4.10 | 3.90 |
| **D3** | 3.90 | 4.30 | 4.10 |
| **E** | 6.15 BSC | | |
| **E1** | 5.60 | 6.00 | 5.80 |
| **E2** | 3.28 | 3.68 | 3.48 |
| **E3** | 3.99 | 4.39 | 4.19 |
| **e** | 1.27 BSC | | |
| **G** | 0.51 | 0.71 | 0.61 |
| **K** | 0.51 | – | – |
| **L** | 0.51 | 0.71 | 0.61 |
| **L1** | 0.100 | 0.200 | 0.175 |
| **M** | 3.235 | 4.035 | 3.635 |
| **M1** | 1.00 | 1.40 | 1.21 |
| **Θ** | 10° | 12° | 11° |
| **Θ1** | 6° | 8° | 7° |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

**PowerDI5060-8**



| Dimensions | Value (in mm) |
|---|---|
| **C** | 1.270 |
| **G** | 0.660 |
| **G1** | 0.820 |
| **X** | 0.610 |
| **X1** | 4.100 |
| **X2** | 0.755 |
| **X3** | 4.420 |
| **X4** | 5.610 |
| **Y** | 1.270 |
| **Y1** | 0.600 |
| **Y2** | 1.020 |
| **Y3** | 0.295 |
| **Y4** | 1.825 |
| **Y5** | 3.810 |
| **Y6** | 0.180 |
| **Y7** | 6.610 |