

## Product Summary

|               |                 |       |
|---------------|-----------------|-------|
| $V_{(BR)DSS}$ | $R_{DS(on)TYP}$ | $I_D$ |
| 80V           | 9.0mΩ@10V       | 60A   |



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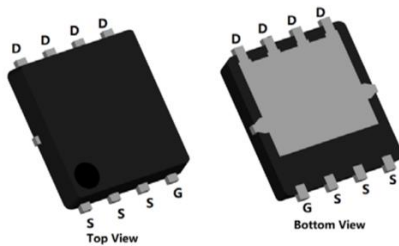
## Feature

- Fast Switching
- Low Gate Charge and Rdson
- Advanced Split Gate Trench Technology
- 100% Single Pulse avalanche energy Test

## Applications

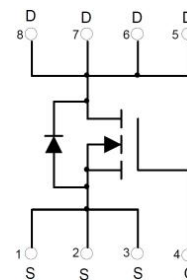
- Power switching application
- DC-DC Converter
- Uninterruptible power supply

## Package



PDFN5X6-8L

## Circuit diagram



## Marking



**SP80N09GHNK**  
\*\*

:Device Code  
:Week Code

## Order Information

| Device      | Package    | Unit/Tape |
|-------------|------------|-----------|
| SP80N09GHNK | PDFN5X6-8L | 5000      |

**Absolute maximum ratings (Ta=25°C, unless otherwise noted)**

| Parameter                                  | Symbol          | Rating     | Unit |
|--------------------------------------------|-----------------|------------|------|
| Drain-Source Voltage                       | $V_{DSS}$       | 80         | V    |
| Gate-Source Voltage                        | $V_{GSS}$       | $\pm 20$   | V    |
| Continuous Drain Current (Tc=25°C)         | $I_D$           | 60         | A    |
| Continuous Drain Current (Tc=100°C)        | $I_D$           | 40         | A    |
| Pulse Drain Current Tested                 | $I_{DM}$        | 240        | A    |
| Single Pulse Avalanche Energy <sup>1</sup> | $E_{AS}$        | 78         | mJ   |
| Power Dissipation (Tc=25°C)                | $P_D$           | 71.4       | W    |
| Power Dissipation (Tc=100°C)               | $P_D$           | 23.8       | W    |
| Thermal Resistance Junction-to-Case        | $R_{\theta JC}$ | 1.75       | °C/W |
| Maximum Junction Temperature               | $T_J$           | -55 to 150 | °C   |
| Storage Temperature Range                  | $T_{STG}$       | -55 to 150 | °C   |

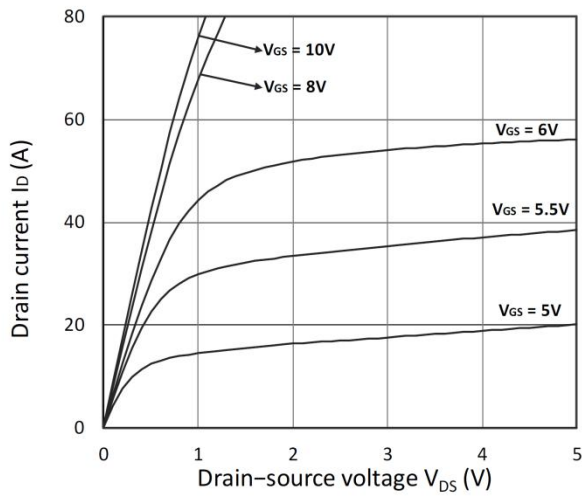
**Electrical characteristics (Ta=25°C, unless otherwise noted)**

| Characteristics                         | Symbol            | Test Condition                     | Min | Typ  | Max  | Unit |
|-----------------------------------------|-------------------|------------------------------------|-----|------|------|------|
| Static Characteristics                  |                   |                                    |     |      |      |      |
| Drain-Source Breakdown Voltage          | BV <sub>DSS</sub> | ID=250μA , VGS=0V                  | 80  | -    | -    | V    |
| Zero Gate Voltage Drain Current         | IDSS              | VDS=64V , VGS=0V                   | -   | -    | 1    | uA   |
| Gate Leakage Current                    | IGSS              | VGS=±20V , VDS=0V                  | -   | -    | ±100 | nA   |
| Gate Threshold Voltage                  | VGS(th)           | VDS=VGS , ID=250μA                 | 2.6 | 3.0  | 3.4  | V    |
| Drain-Source On-state Resistance        | RDS(ON)           | VGS=10V , ID=20A                   | -   | 9.0  | 12.5 | mΩ   |
| Gate Resistance                         | RG                | f=1MHz                             | -   | 1.9  | -    | Ω    |
| Dynamic Characteristics                 |                   |                                    |     |      |      |      |
| Input Capacitance                       | Ciss              | VGS=0V , VDS=40V , f=1MHz          | -   | 1001 | -    | pF   |
| Output Capacitance                      | Coss              |                                    | -   | 244  | -    |      |
| Reverse Transfer Capacitance            | Crss              |                                    | -   | 16   | -    |      |
| Total Gate Charge                       | Qg                | VDS=40V , VGS=10V , ID=20A         | -   | 16   | -    | nC   |
| Gate-Source Charge                      | Qgs               |                                    | -   | 4.8  | -    |      |
| Gate-Drain Charge                       | Qgd               |                                    | -   | 4.4  | -    |      |
| Gate Plateau Voltage                    | Vplateau          |                                    | -   | 4.5  | -    | V    |
| Switching Characteristics               |                   |                                    |     |      |      |      |
| Turn-On Delay Time                      | td(on)            | VDD=40V , ID=20A , VGS=10V , RG=3Ω | -   | 8.0  | -    | nS   |
| Rise Time                               | tr                |                                    | -   | 5.6  | -    |      |
| Turn-Off Delay Time                     | td(off)           |                                    | -   | 14   | -    |      |
| Fall Time                               | tf                |                                    | -   | 4.8  | -    |      |
| Drain-Source Body Diode Characteristics |                   |                                    |     |      |      |      |
| Source-Drain Diode Forward Voltage      | VSD               | VGS=0V , IS=1A , TJ=25℃            | -   | -    | 1.2  | V    |
| Maximum Body-Diode Continuous Current   | IS                |                                    | -   | -    | 60   | A    |
| Reverse Recovery Time                   | Trr               | IS=20A , di/dt=100A/μs , TJ=25℃    | -   | 35   | -    | nS   |
| Reverse Recovery Charge                 | Qrr               |                                    | -   | 27.8 | -    | nC   |

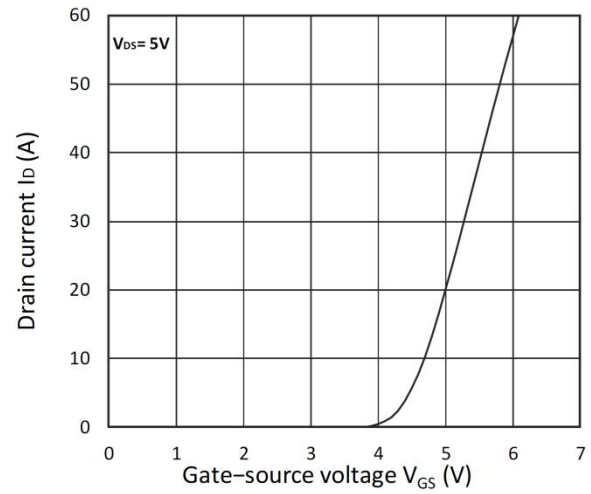
**Note :**

1. The test condition is  $V_{DD}=40V$ ,  $V_{GS}=10V$ ,  $L=0.5mH$ ,  $R_G=25\Omega$ ;

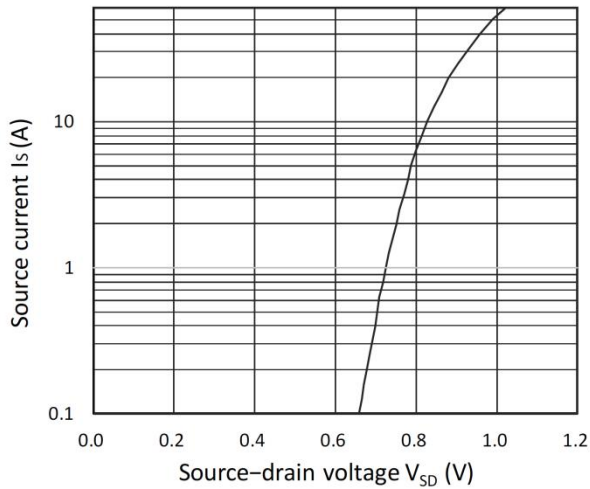
## Typical Characteristics



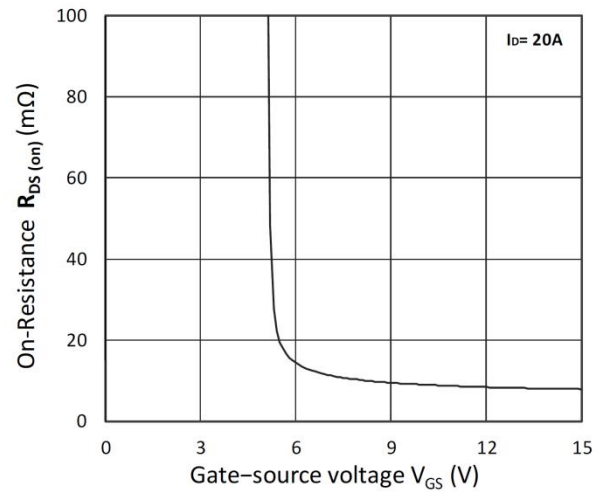
Output Characteristics



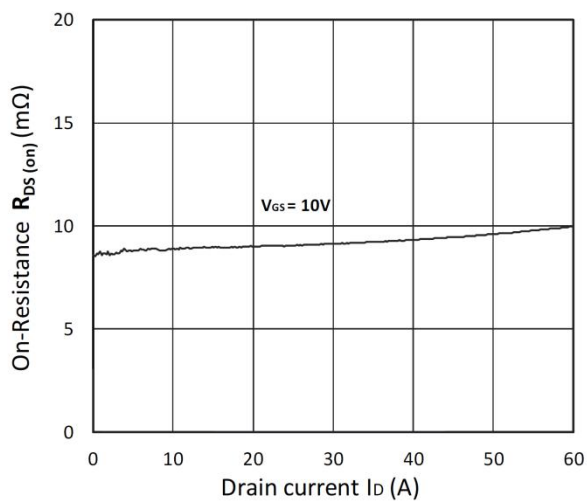
Transfer Characteristics



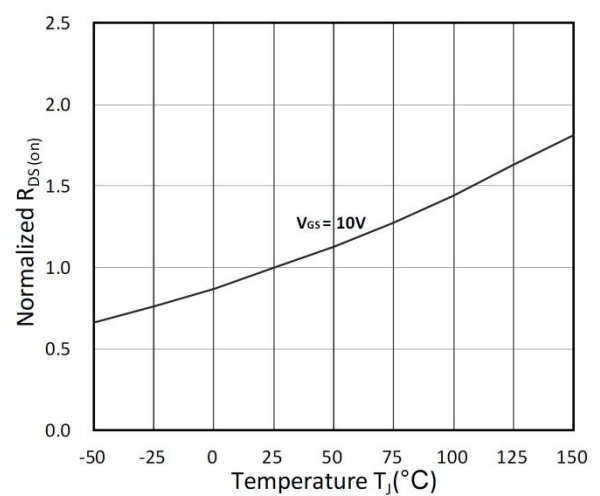
Forward Characteristics of Reverse



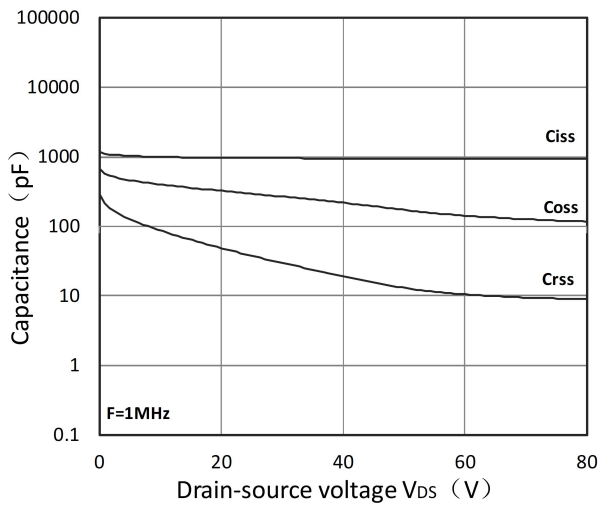
$R_{DS(on)}$  vs.  $V_{GS}$



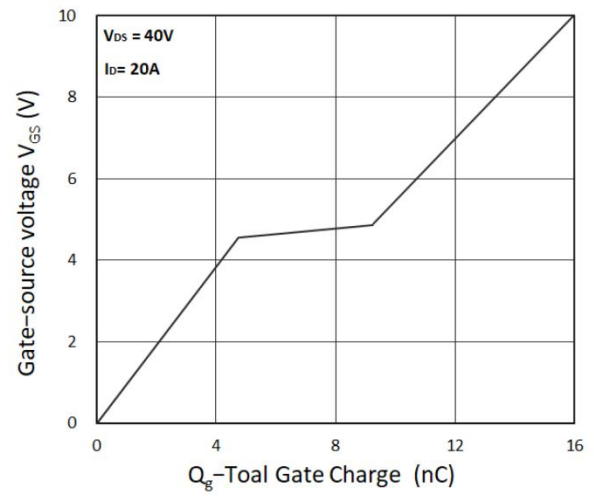
$R_{DS(on)}$  vs.  $I_D$



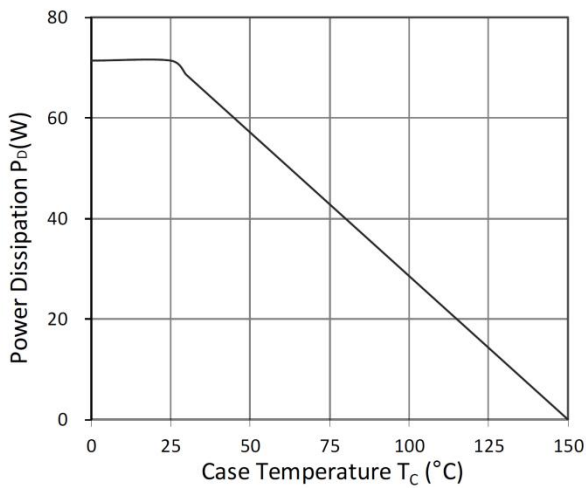
Normalized  $R_{DS(on)}$  vs. Temperature



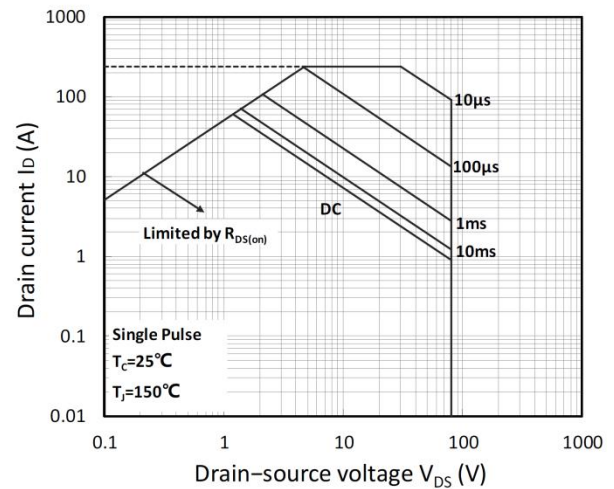
Capacitance Characteristics



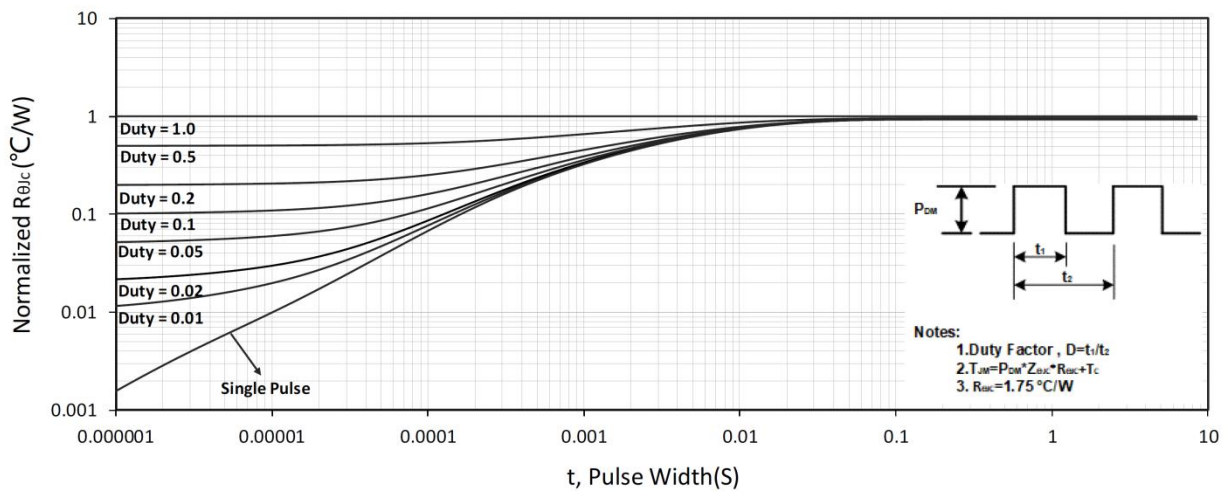
Gate Charge Characteristics



Power Dissipation



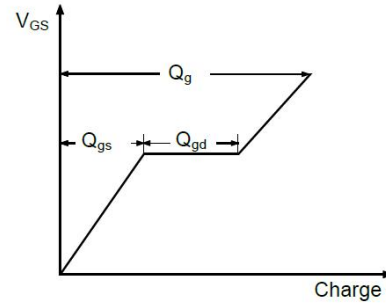
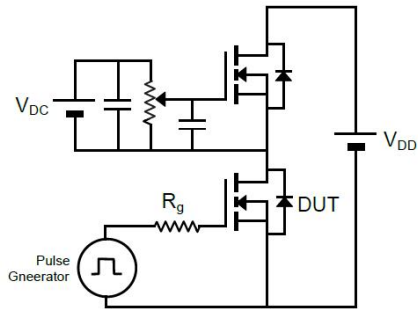
Safe Operating Area



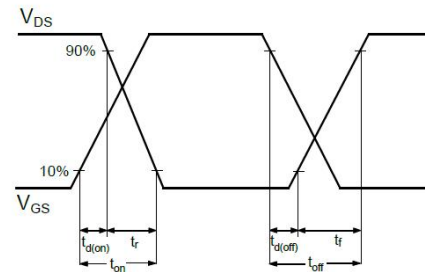
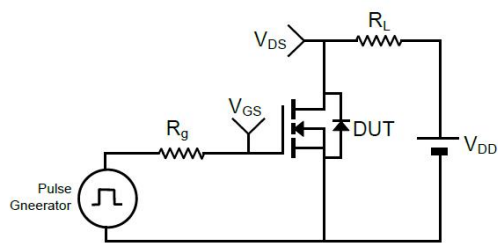
Normalized Maximum Transient Thermal Impedance

## Test Circuit

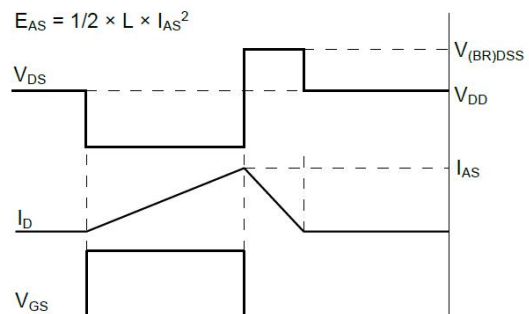
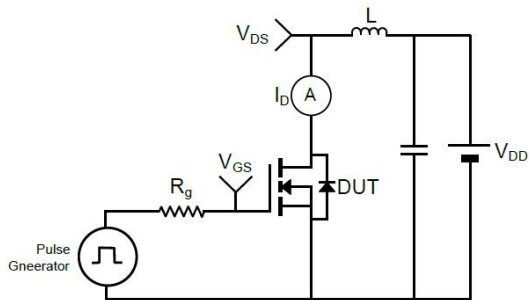
### Gate Charge



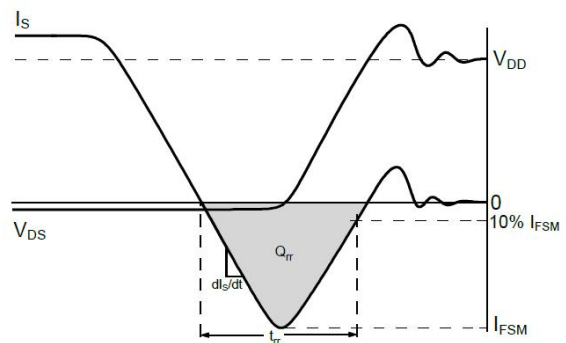
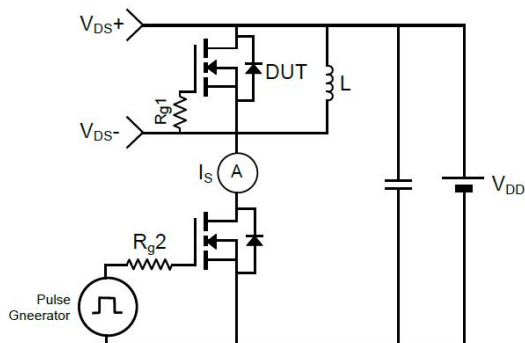
### Resistive Load Switching Time



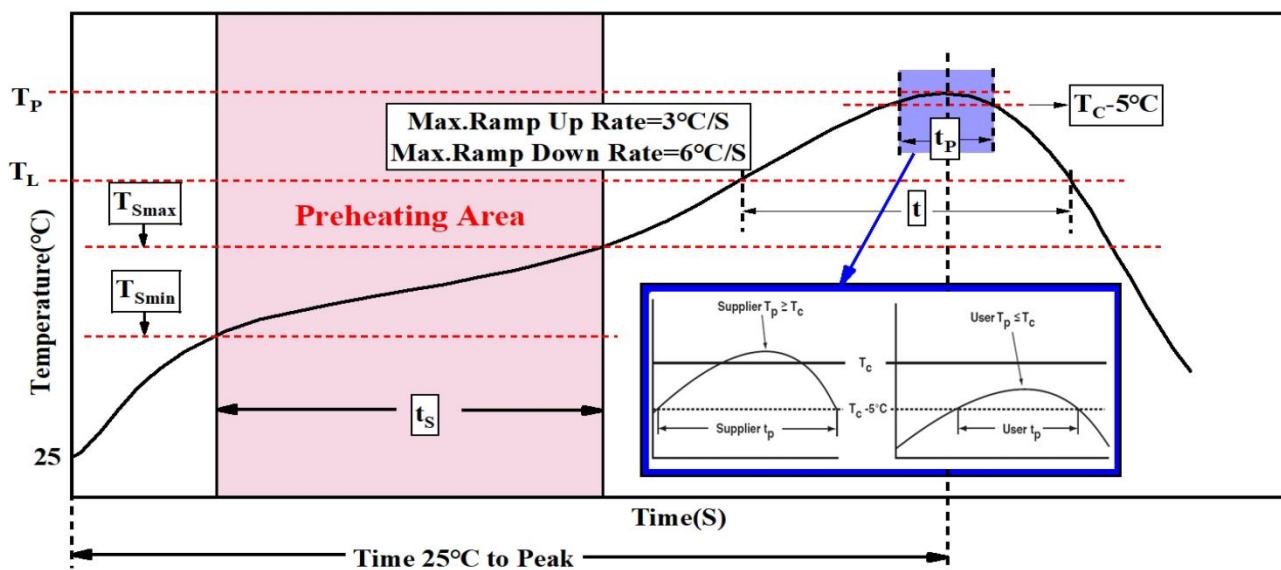
### Un-clamped Inductive Load Switching



### Drain-Source Body Diode Reverse Recovery



## Temperature Profile for IR Reflow Soldering



| Profile Feature                                                                                                                                                                                                            | Sn-Pb Eutectic Assembly            | Pb-Free Assembly                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------|
| <b>Preheat &amp; Soak</b>                                                                                                                                                                                                  |                                    |                                    |
| Temperature min ( $T_{Smin}$ )                                                                                                                                                                                             | 100°C                              | 150°C                              |
| Temperature max ( $T_{Smax}$ )                                                                                                                                                                                             | 150°C                              | 200°C                              |
| Time ( $T_{Smin}$ to $T_{Smax}$ ) ( $t_s$ )                                                                                                                                                                                | 60-120 seconds                     | 60-120 seconds                     |
| Average ramp-up rate ( $T_{Smax}$ to $T_P$ )                                                                                                                                                                               | 3 °C/second max.                   | 3°C/second max.                    |
| Liquidous temperature ( $T_L$ )                                                                                                                                                                                            | 183 °C                             | 217°C                              |
| Time at liquidous ( $t_L$ )                                                                                                                                                                                                | 60-150 seconds                     | 60-150 seconds                     |
| Peak package body Temperature e ( $T_P$ )*                                                                                                                                                                                 | See Classification Temp in table 1 | See Classification Temp in table 2 |
| Time ( $t_P$ )** within 5°C of the specified classification temperature ( $T_c$ )                                                                                                                                          | 20** seconds                       | 30** seconds                       |
| Average ramp-down rate ( $T_P$ to $T_{Smax}$ )                                                                                                                                                                             | 6 °C/second max.                   | 6 °C/second max.                   |
| Time 25°C to peak temperature                                                                                                                                                                                              | 6 minutes max.                     | 8 minutes max.                     |
| * Tolerance for peak profile Temperature ( $T_P$ ) is defined as a supplier minimum and a user maximum.<br>** Tolerance for time at peak profile temperature ( $t_P$ ) is defined as a supplier minimum and a user maximum |                                    |                                    |

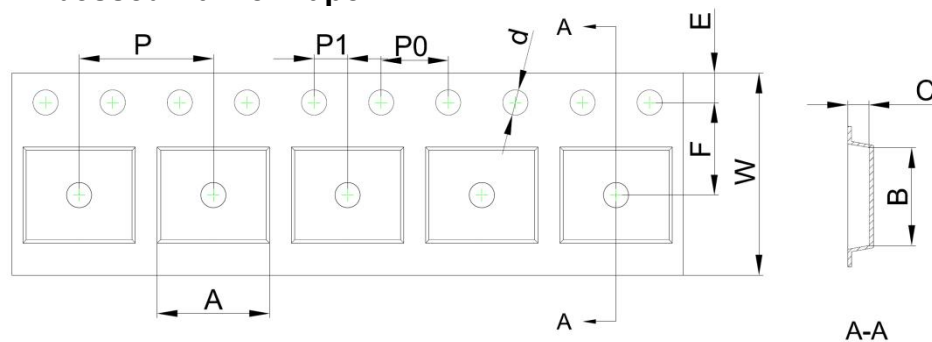
Table 1. SnPb Eutectic Process – Classification Temperatures ( $T_c$ )

| Package Thickness | Volume mm <sup>3</sup><br><350 | Volume mm <sup>3</sup><br>≥350 |
|-------------------|--------------------------------|--------------------------------|
| <2.5 mm           | 235 °C                         | 220 °C                         |
| ≥2.5 mm           | 220 °C                         | 220 °C                         |

Table 2. Pb-free Process – Classification Temperatures ( $T_c$ )

| Package Thickness | Volume mm <sup>3</sup><br><350 | Volume mm <sup>3</sup><br>350-2000 | Volume mm <sup>3</sup><br>>2000 |
|-------------------|--------------------------------|------------------------------------|---------------------------------|
| <1.6 mm           | 260 °C                         | 260 °C                             | 260 °C                          |
| 1.6 mm – 2.5 mm   | 260 °C                         | 250 °C                             | 245 °C                          |
| ≥2.5 mm           | 250 °C                         | 245 °C                             | 245 °C                          |

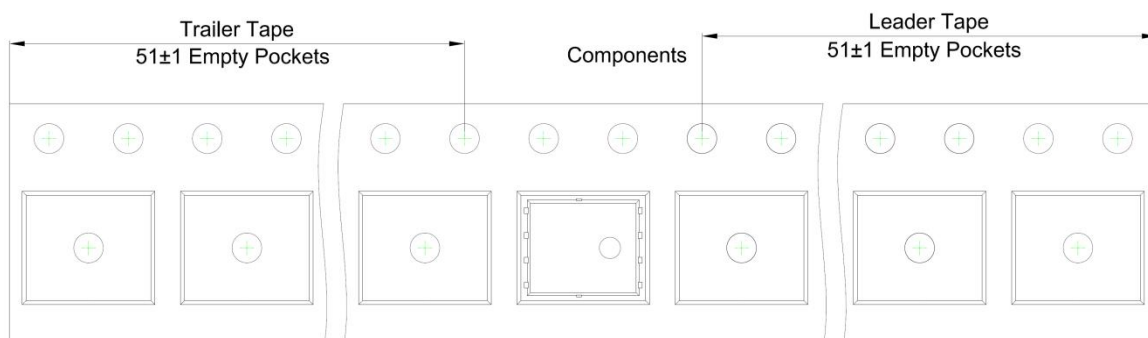
## PDFN5X6-8L Embossed Carrier Tape



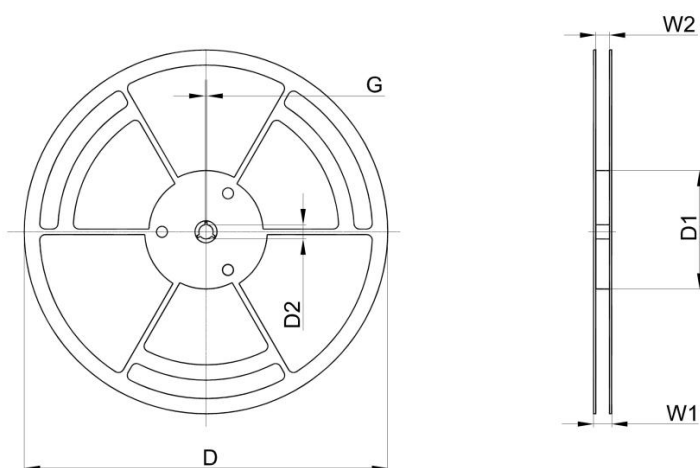
Dimensions are in millimeter

| Pkg type   | A    | B    | C    | d     | E    | F    | P0   | P    | P1   | W     |
|------------|------|------|------|-------|------|------|------|------|------|-------|
| PDFN5X6-8L | 6.30 | 5.30 | 1.10 | Φ1.50 | 1.75 | 5.50 | 4.00 | 8.00 | 2.00 | 12.00 |

## PDFN5X6-8L Tape Leader and Trailer



## PDFN5X6-8L Reel

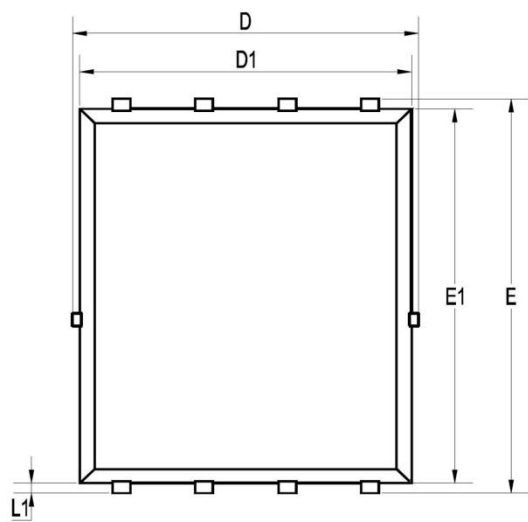


Dimensions are in millimeter

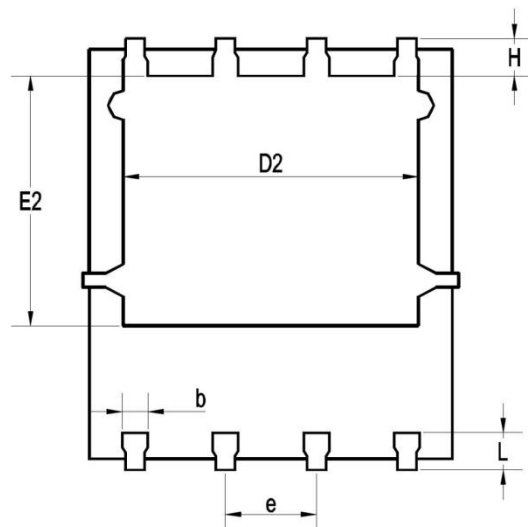
| Reel Option | D       | D1     | D2    | G    | W1    | W2    |
|-------------|---------|--------|-------|------|-------|-------|
| 13"Dia      | Ø330.00 | 100.00 | 13.00 | 1.90 | 17.60 | 12.40 |

| REEL      | Reel Size | Box       | Box Size(mm) | Carton     | Carton Size(mm) |
|-----------|-----------|-----------|--------------|------------|-----------------|
| 5,000 pcs | 13 inch   | 5,000 pcs | 340×336×29   | 50,000 pcs | 353×346×365     |

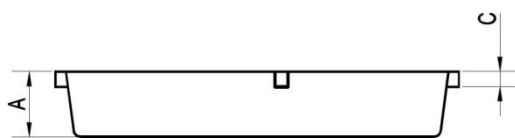
**PDFN5X6-8L Package Information**



Top View  
[顶视图]



Bottom View  
[背视图]



Side View  
[侧视图]

| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min.                      | Max.  | Min.                 | Max.  |
| A      | 0.900                     | 1.200 | 0.035                | 0.047 |
| b      | 0.330                     | 0.510 | 0.013                | 0.020 |
| C      | 0.110                     | 0.340 | 0.004                | 0.013 |
| D      | 4.700                     | 5.260 | 0.185                | 0.207 |
| D1     | 4.700                     | 5.100 | 0.185                | 0.201 |
| D2     | 3.560                     | 4.500 | 0.140                | 0.177 |
| E      | 5.750                     | 6.250 | 0.226                | 0.246 |
| E1     | 5.600                     | 6.000 | 0.220                | 0.236 |
| E2     | 3.180                     | 3.660 | 0.125                | 0.144 |
| e      | 1.170                     | 1.370 | 0.046                | 0.054 |
| L      | 0.350                     | 0.750 | 0.014                | 0.030 |
| L1     | 0.000                     | 0.200 | 0.000                | 0.008 |
| H      | 0.350                     | 0.710 | 0.014                | 0.028 |