

Product Summary

| | | |
|---------------|-----------------|-------|
| $V_{(BR)DSS}$ | $R_{DS(on)TYP}$ | I_D |
| 40V | 1mΩ@10V | 120A |



合肥矽普半导体

Siliup Semiconductor Technology Co., Ltd

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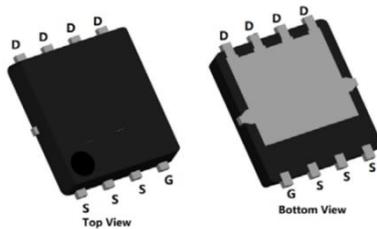
Feature

- Fast Switching
- Low Gate Charge and Rdson
- **AEC-Q101** qualified
- Advanced Split Gate Trench Technology
- 100% Single Pulse avalanche energy Test

Applications

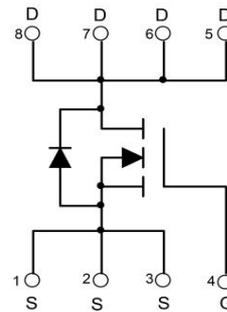
- DC-DC Converters
- Power management functions
- Synchronous-rectification applications

Package



PDFN5X6-8L

Circuit diagram



Marking



40N01GHKA
**

=Device Code
=Week Code

Order Information

| Device | Package | Unit/Tape |
|--------------|------------|-----------|
| SP40N01GHNKA | PDFN5X6-8L | 5000 |

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

| Parameter | Symbol | Rating | Unit |
|---|-----------------|------------|------|
| Drain-Source Voltage | V_{DSS} | 40 | V |
| Gate-Source Voltage | V_{GSS} | ± 20 | V |
| Continuous Drain Current (Tc=25°C) | Package Limit | I_D | 120 |
| Continuous Drain Current (Tc=25°C) | Silicon Llimit | I_D | 320 |
| Continuous Drain Current (Tc=100°C) | | I_D | 83 |
| Pulse Drain Current Tested | I_{DM} | 480 | A |
| Single pulsed avalanche energy ¹ | E_{AS} | 280 | mJ |
| Power Dissipation (Tc=25°C) | P_D | 160 | W |
| Power Dissipation (Tc=100°C) | P_D | 80 | W |
| Thermal Resistance Junction-to-Case | $R_{\theta JC}$ | 0.93 | °C/W |
| Thermal Resistance Junction-to-Ambient | $R_{\theta JA}$ | 57 | °C/W |
| Storage Temperature Range | T_{STG} | -55 to 175 | °C |
| Operating Junction Temperature Range | T_J | -55 to 175 | °C |

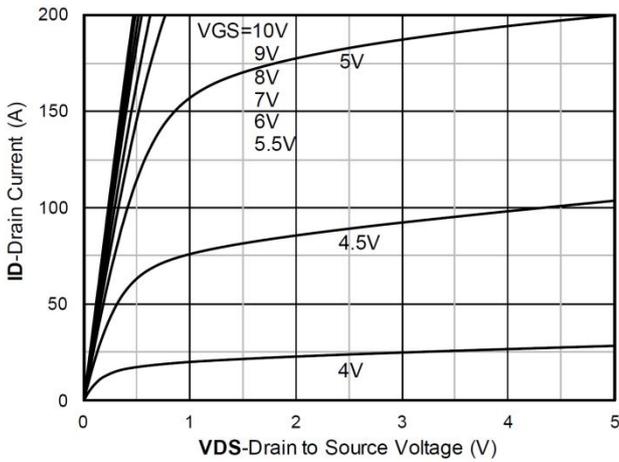
Electrical characteristics (Ta=25°C, unless otherwise noted)

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|-----------------------------------|---------------|--|------|------|-----------|------------|
| Static Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 40 | - | - | V |
| Drain-Source Leakage Current | I_{DSS} | $V_{DS}=40V, V_{GS}=0V, T_J=25^\circ C$ | - | - | 1 | μA |
| Gate-Source Leakage Current | I_{GSS} | $V_{GS}=\pm 20V, V_{DS}=0V$ | - | - | ± 100 | nA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{GS}=V_{DS}, I_D=250\mu A$ | 2.0 | 2.5 | 3.0 | V |
| Static Drain-Source On-Resistance | $R_{DS(on)}$ | $V_{GS}=10V, I_D=50A$ | - | 1.0 | 1.25 | m Ω |
| Gate Resistance | R_G | $V_{DS}=20V, V_{GS}=0V, f=1MHz$ | - | 1.3 | - | Ω |
| Dynamic characteristics | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS}=20V, V_{GS}=0V, f=1MHz$ | - | 6500 | - | pF |
| Output Capacitance | C_{oss} | | - | 1950 | - | |
| Reverse Transfer Capacitance | C_{rss} | | - | 98 | - | |
| Total Gate Charge | Q_g | $V_{DS}=20V, V_{GS}=10V, I_D=50A$ | - | 120 | - | nC |
| Gate-Source Charge | Q_{gs} | | - | 39 | - | |
| Gate-Drain Charge | Q_{gd} | | - | 26 | - | |
| Gate Plateau Voltage | $V_{plateau}$ | | - | 4.9 | - | |
| Switching Characteristics | | | | | | |
| Turn-On Delay Time | $T_{d(on)}$ | $V_{DD}=50V, V_{GS}=10V, R_G=1.3\Omega, I_D=50A$ | - | 19 | - | nS |
| Rise Time | T_r | | - | 26 | - | |
| Turn-Off Delay Time | $T_{d(off)}$ | | - | 85 | - | |
| Fall Time | T_f | | - | 45 | - | |
| Diode Characteristics | | | | | | |
| Diode Forward Voltage | V_{SD} | $V_{GS}=0V, I_S=1A, T_J=25^\circ C$ | - | - | 1.2 | V |
| Diode Continuous Current | I_S | | - | - | 120 | A |
| Reverse recover time | T_{rr} | $I_S=50A, di/dt=100A/\mu s, T_J=25^\circ C$ | - | 141 | - | nS |
| Reverse recovery charge | Q_{rr} | | - | 333 | - | nC |

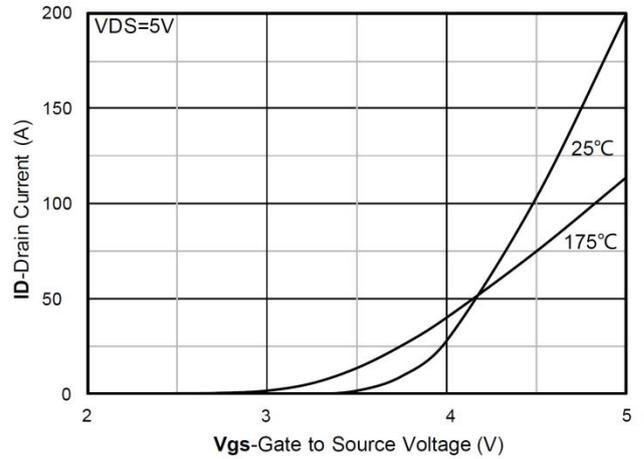
Note :

1. The test condition is $V_{DD}=20V, V_{GS}=10V, L=0.5mH, R_G=25\Omega$

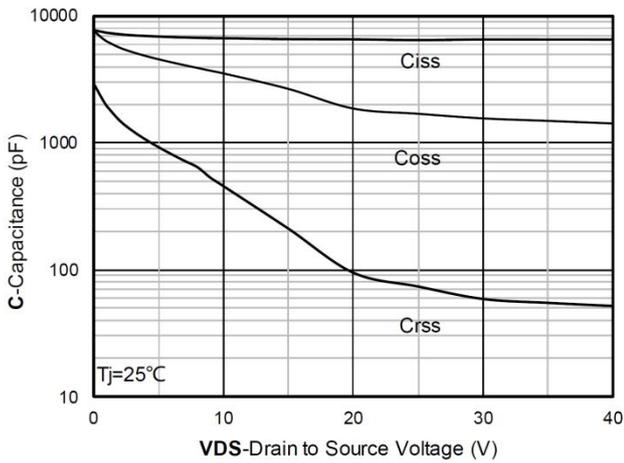
Typical Characteristics



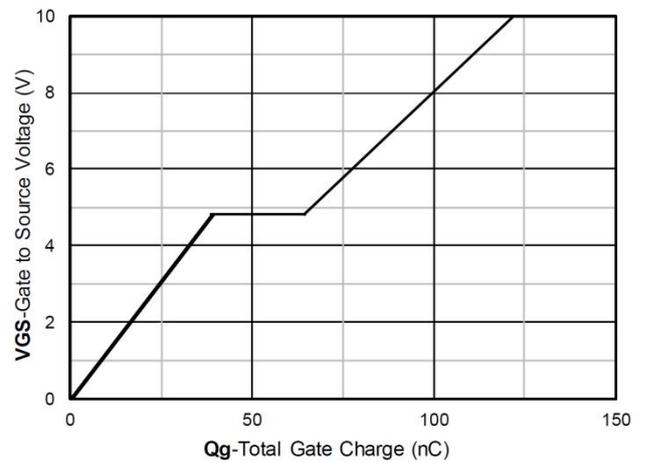
Output Characteristics



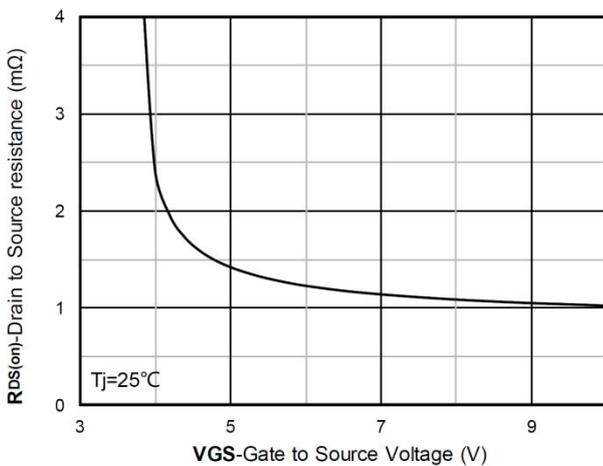
Transfer Characteristics



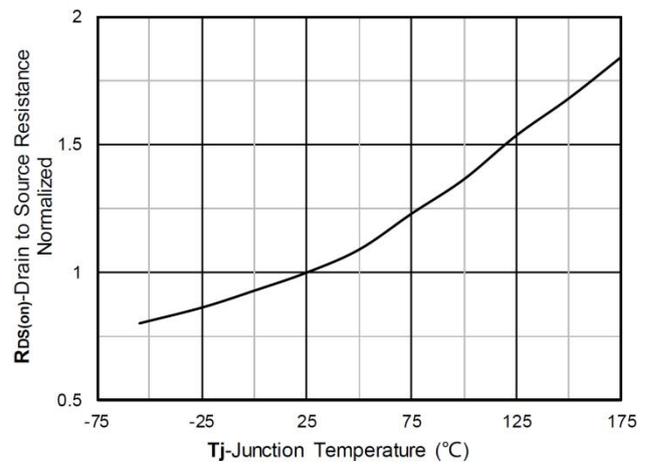
Capacitance Characteristics



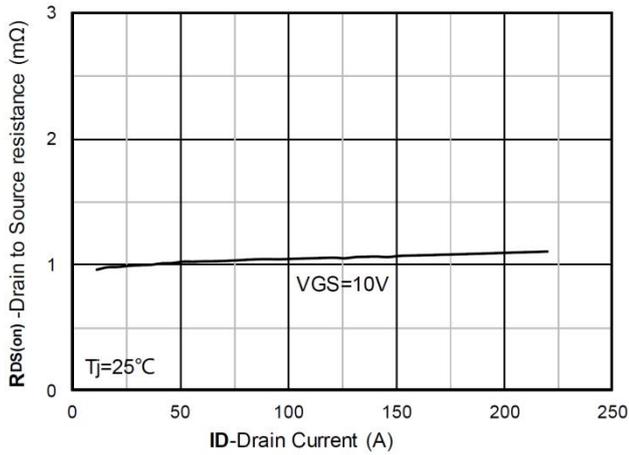
Gate Charge



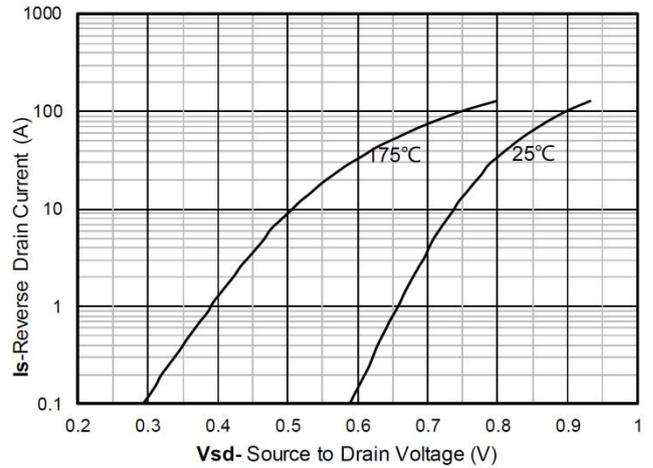
On-Resistance vs Gate to Source Voltage



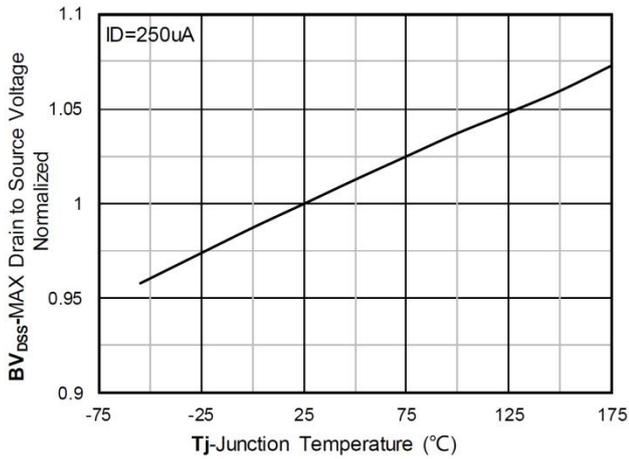
Normalized On-Resistance



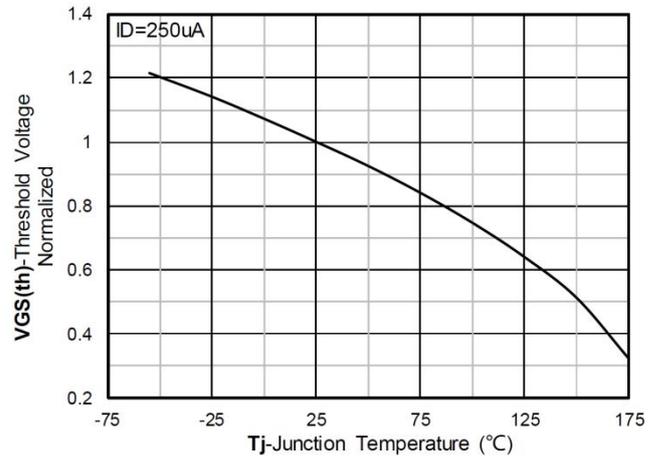
RDS(on) VS Drain Current



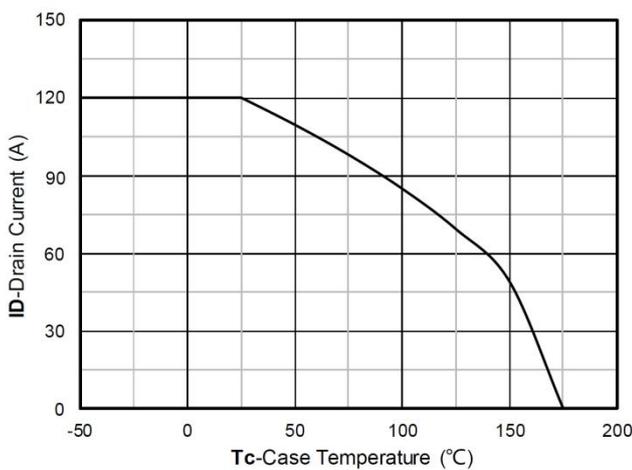
Forward characteristics of reverse diode



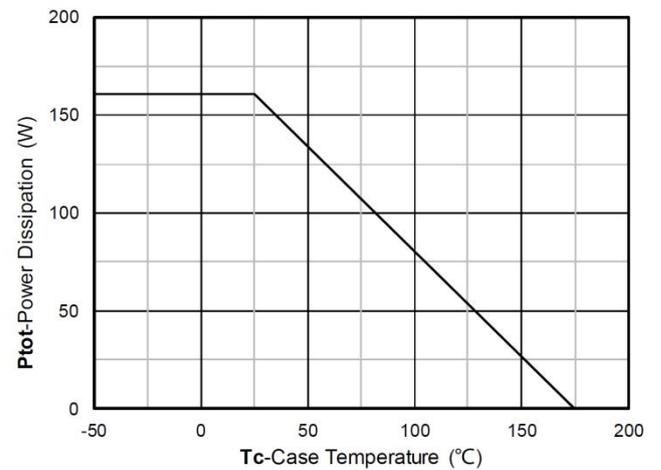
Normalized breakdown voltage



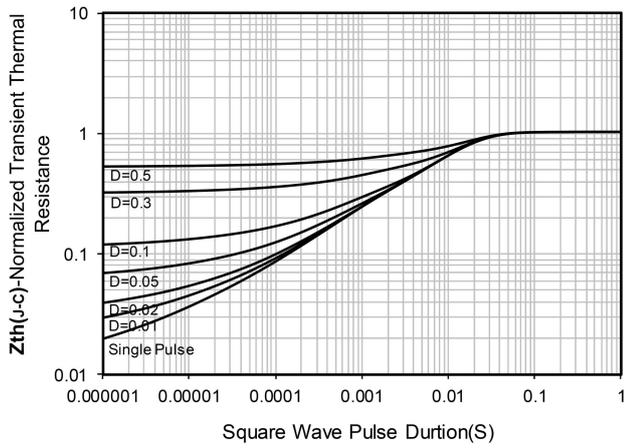
Normalized Threshold voltage



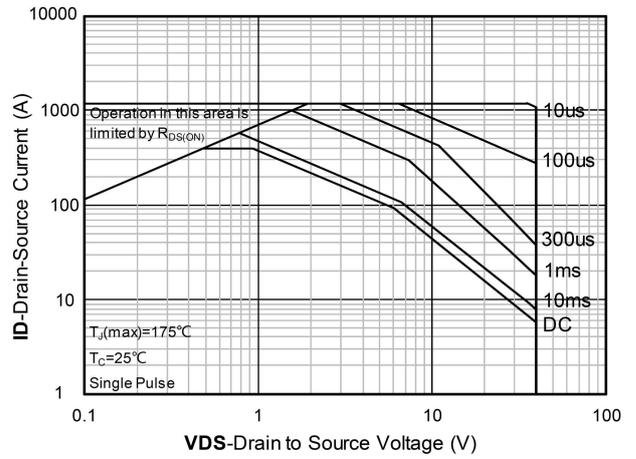
Current dissipation



Power dissipation



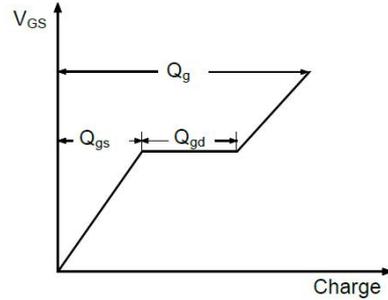
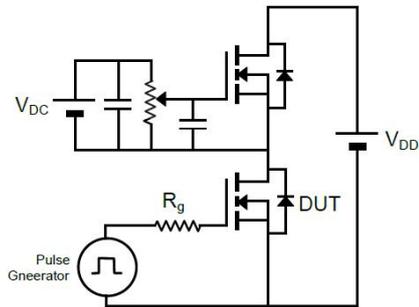
Maximum Transient Thermal Impedance



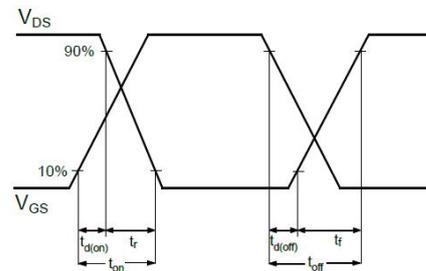
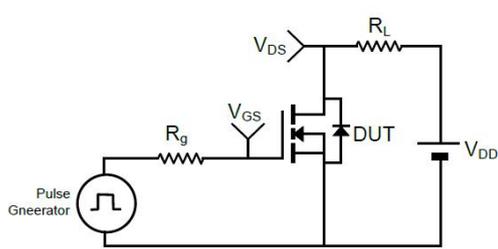
Safe Operation Area

Test Circuit

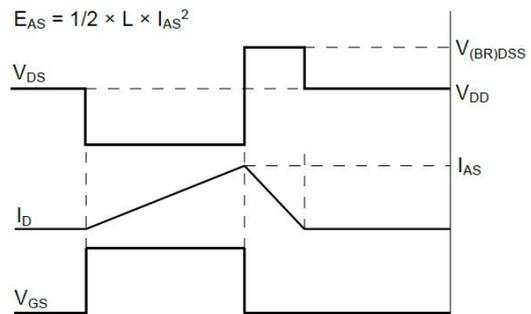
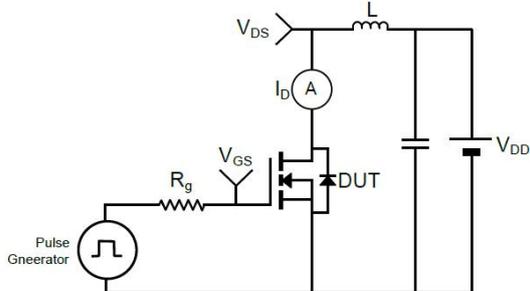
Gate Charge



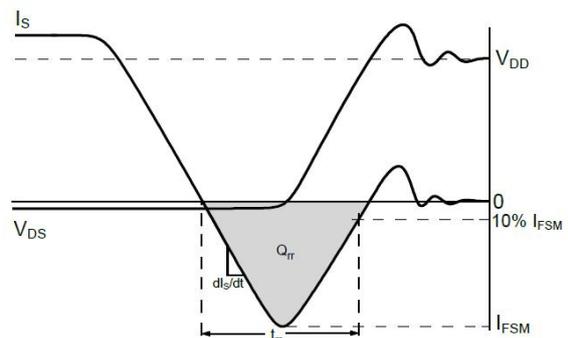
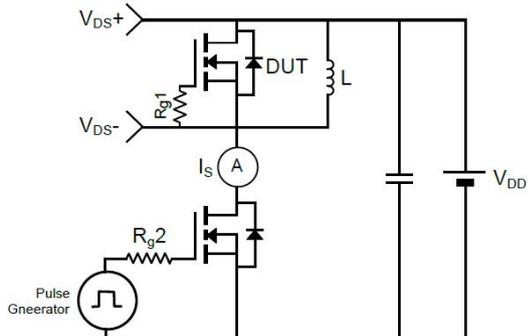
Resistive Load Switching Time

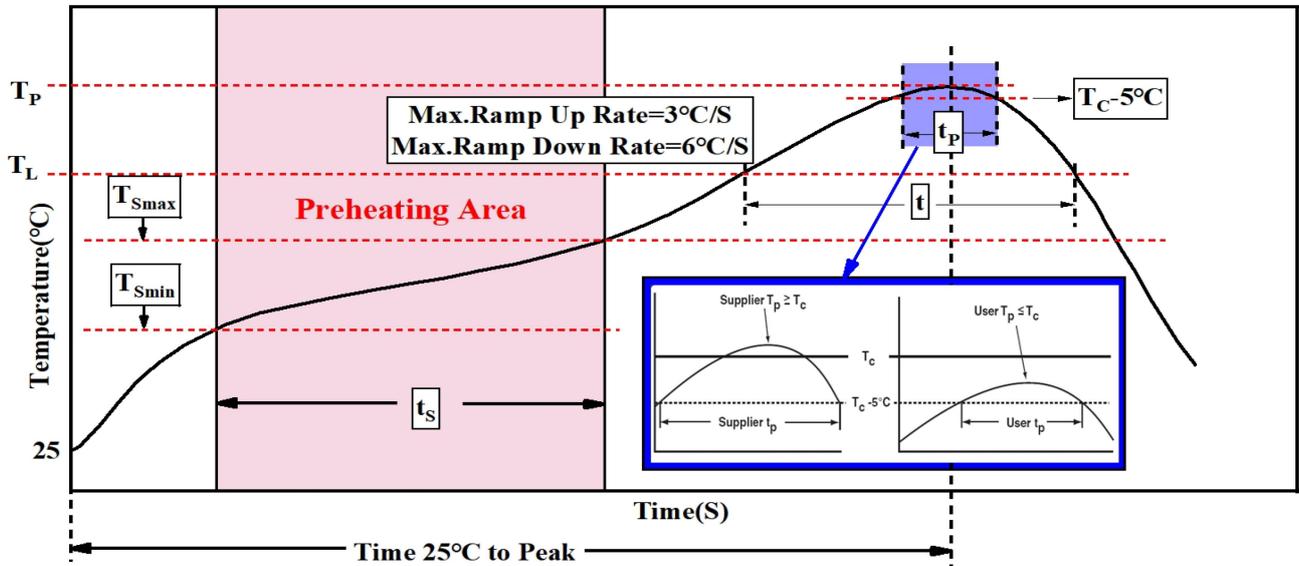


Un-clamped Inductive Load Switching



Drain-Source Body Diode Reverse Recovery



Temperature Profile for IR Reflow Soldering(Pb-Free)


| Profile Feature | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|--|------------------------------------|------------------------------------|
| Preheat & Soak | | |
| 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. ** Tolerance for time at peak profile temperature (t _p) is defined as a supplier minimum and a user maximum | | |

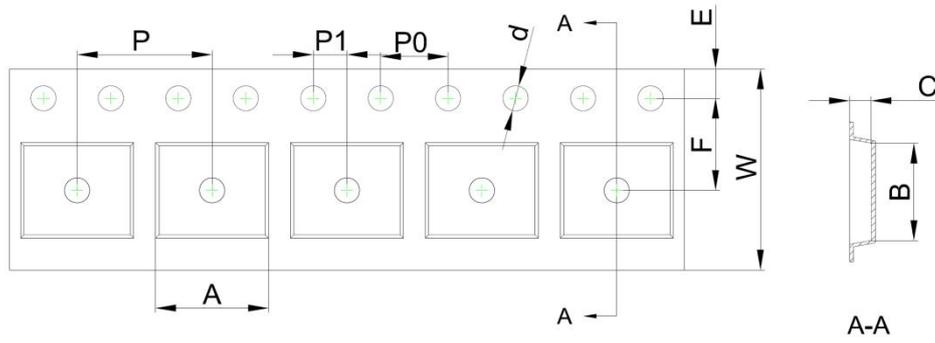
 Table 1. SnPb Eutectic Process – Classification Temperatures (T_c)

| Package Thickness | Volume mm ³ <350 | Volume mm ³ ≥350 |
|-------------------|-----------------------------|-----------------------------|
| <2.5 mm | 235 °C | 220 °C |
| ≥2.5 mm | 220 °C | 220 °C |

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

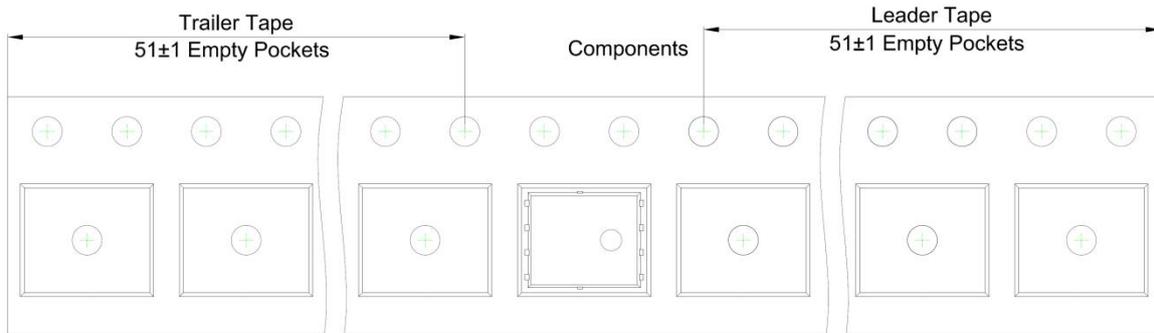
| Package Thickness | Volume mm ³ <350 | Volume mm ³ 350-2000 | Volume mm ³ >2000 |
|-------------------|-----------------------------|---------------------------------|------------------------------|
| <1.6 mm | 260 °C | 260 °C | 260 °C |
| 1.6 mm – 2.5 mm | 260 °C | 250 °C | 245 °C |
| ≥2.5 mm | 250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

PDFN5X6-8L Embossed Carrier Tape

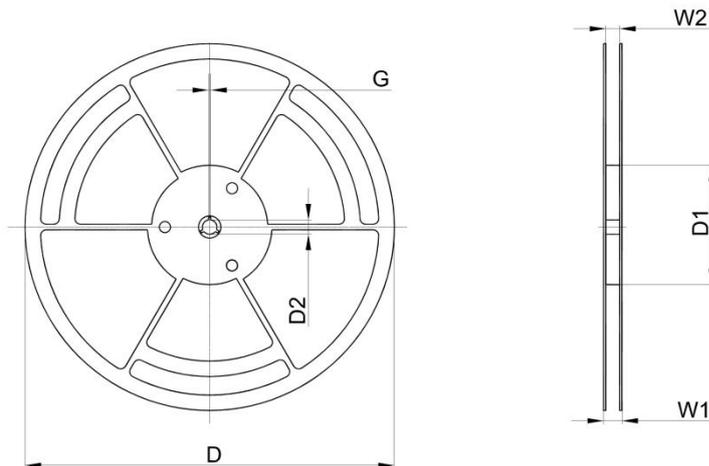


| Dimensions are in millimeter | | | | | | | | | | |
|------------------------------|------|------|------|-------|------|------|------|------|------|-------|
| Pkg type | A | B | C | d | E | F | P0 | P | P1 | W |
| PDFN5X6-8L | 6.30 | 5.30 | 1.10 | Φ1.50 | 1.75 | 5.50 | 4.00 | 8.00 | 2.00 | 12.00 |

PDFN5X6-8L Tape Leader and Trailer



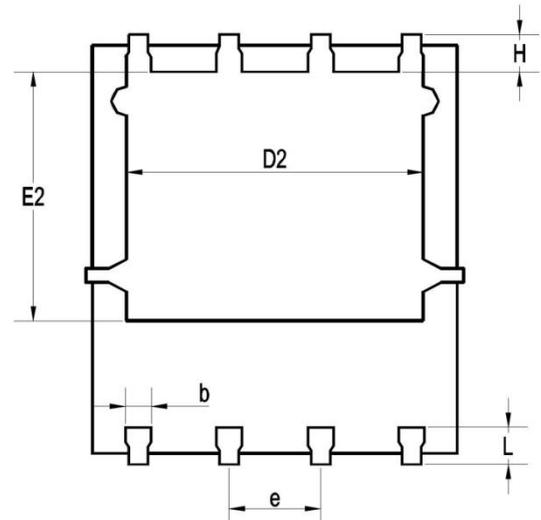
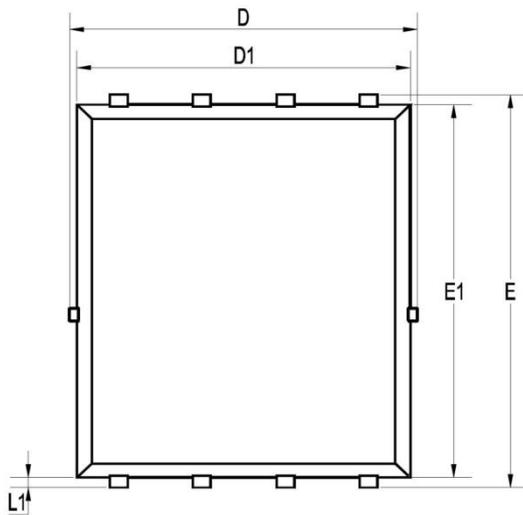
PDFN5X6-8L Reel



| 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



Side View [侧视图]

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 0.900 | 1.120 | 0.035 | 0.044 |
| 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 | 0.710 | 0.014 | 0.028 |
| L1 | 0.060 | 0.200 | 0.002 | 0.008 |
| H | 0.350 | 0.710 | 0.014 | 0.028 |