



SPN166T06

N-Channel Enhancement Mode MOSFET

DESCRIPTION

The SPN166T06 is the N-Channel logic enhancement mode power field effect transistor which is produced using super high cell density DMOS trench technology. This high density process is especially tailored to minimize on-state resistance. These devices are particularly suitable for synchronous rectifier application, Motor control power management and other Power Tool circuits. It has been optimized for low gate charge, low $R_{DS(ON)}$ and fast switching speed.

APPLICATIONS

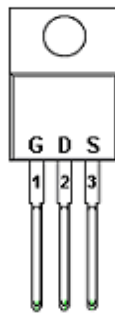
- DC/DC Converter
- Load Switch
- SMPS Secondary Side Synchronous Rectifier
- Motor Control
- Power Tool

FEATURES

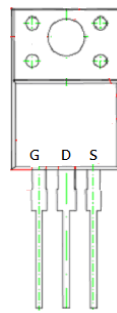
- ◆ 60V/166A, $R_{DS(ON)}=3.0m\Omega@V_{GS}=10V$
 $R_{DS(ON)}=4.5m\Omega@V_{GS}=4.5V$
- ◆ Super high density cell design for extremely low $R_{DS(ON)}$
- ◆ Exceptional on-resistance and maximum DC current capability
- ◆ TO-220-3L/TO-220F-3L/PPAK5x6-8L package design

PIN CONFIGURATION

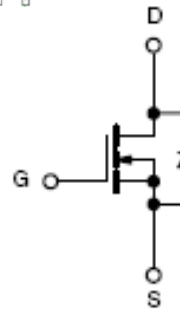
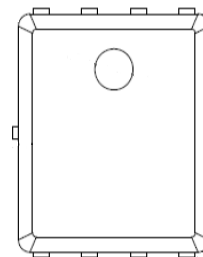
TO-220



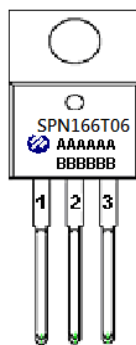
TO-220F



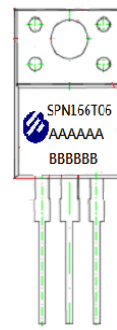
PPAK 5x6



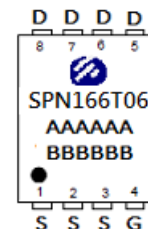
PART MARKING



A : Lot Code
B : Date Code
(YY/MM/DD)



A: Lot Code
B: Date Code
(YYMMDD)



A : Lot Code
B : Date Code
(YY/MM/DD)



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N-Channel Enhancement Mode MOSFET

PIN DESCRIPTION

| Pin | Symbol | Description |
|-----|--------|-------------|
| 1 | G | Gate |
| 2 | D | Drain |
| 3 | S | Source |

PPAK5x6 PIN DESCRIPTION

| Pin | Symbol | Description |
|-----|--------|-------------|
| 1 | S | Source |
| 2 | S | Source |
| 3 | S | Source |
| 4 | G | Gate |
| 5 | D | Drain |
| 6 | D | Drain |
| 7 | D | Drain |
| 8 | D | Drain |

ORDERING INFORMATION

| Part Number | Package | Part Marking |
|-------------------|------------|--------------|
| SPN166T06T220TGB | TO-220-3L | SPN166T06 |
| SPN166T06T220FTGB | TO-220F-3L | SPN166T06 |
| SPN166T06DN8RGB | PPAK5x6-8L | SPN166T06 |

- ※ SPN166T06T220TGB : Tube ; Pb – Free ; Halogen – Free
- ※ SPN166T06T220FTGB : Tube ; Pb – Free ; Halogen – Free
- ※ SPN166T06DN82RGB : Tape&Reel ; Pb – Free ; Halogen - Free



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ABSOLUTE MAXIMUM RATINGS

(TA=25°C Unless otherwise noted)

| Parameter | Symbol | Typical | Unit | |
|---------------------------------------------------------------|------------------|---------|------|---|
| Drain-Source Voltage | V _{DSS} | 60 | V | |
| Gate –Source Voltage | V _{GSS} | ±20 | V | |
| Continuous Drain Current (Silicon Limited)(TO-220/TO-220F) | I _D | Tc=25°C | 166 | A |
| | | Tc=70°C | 118 | |
| Continuous Drain Current (Silicon Limited)(PPAK5x6) | I _D | Tc=25°C | 161 | A |
| | | Tc=70°C | 102 | |
| Pulsed Drain Current | I _{DM} | 400 | A | |
| Power Dissipation @ Tc=25°C | P _D | TO-220 | 104 | W |
| Power Dissipation @ Tc=25°C | | TO-220F | 93 | |
| Power Dissipation @ Tc=25°C | | PPAK5x6 | 83 | |
| Avalanche Energy with Single Pulse (Tc=25°C , L=0.1mH.) | EAS | 171 | mJ | |
| Operating Junction Temperature | T _J | -55/150 | °C | |
| Storage Temperature Range | T _{STG} | -55/150 | °C | |
| Thermal Resistance-Junction to Case (TO-220/TO-220F) | R _{θJC} | 1.2 | °C/W | |
| Thermal Resistance-Junction to Case (PPAK5x6) | R _{θJC} | 1.5 | °C/W | |

Note :

The maximum current rating is package limited at 78A for TO-220F-3L

The maximum current rating is package limited at 80A for PPAK5x6-8L



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ELECTRICAL CHARACTERISTICS

(TA=25°C Unless otherwise noted)

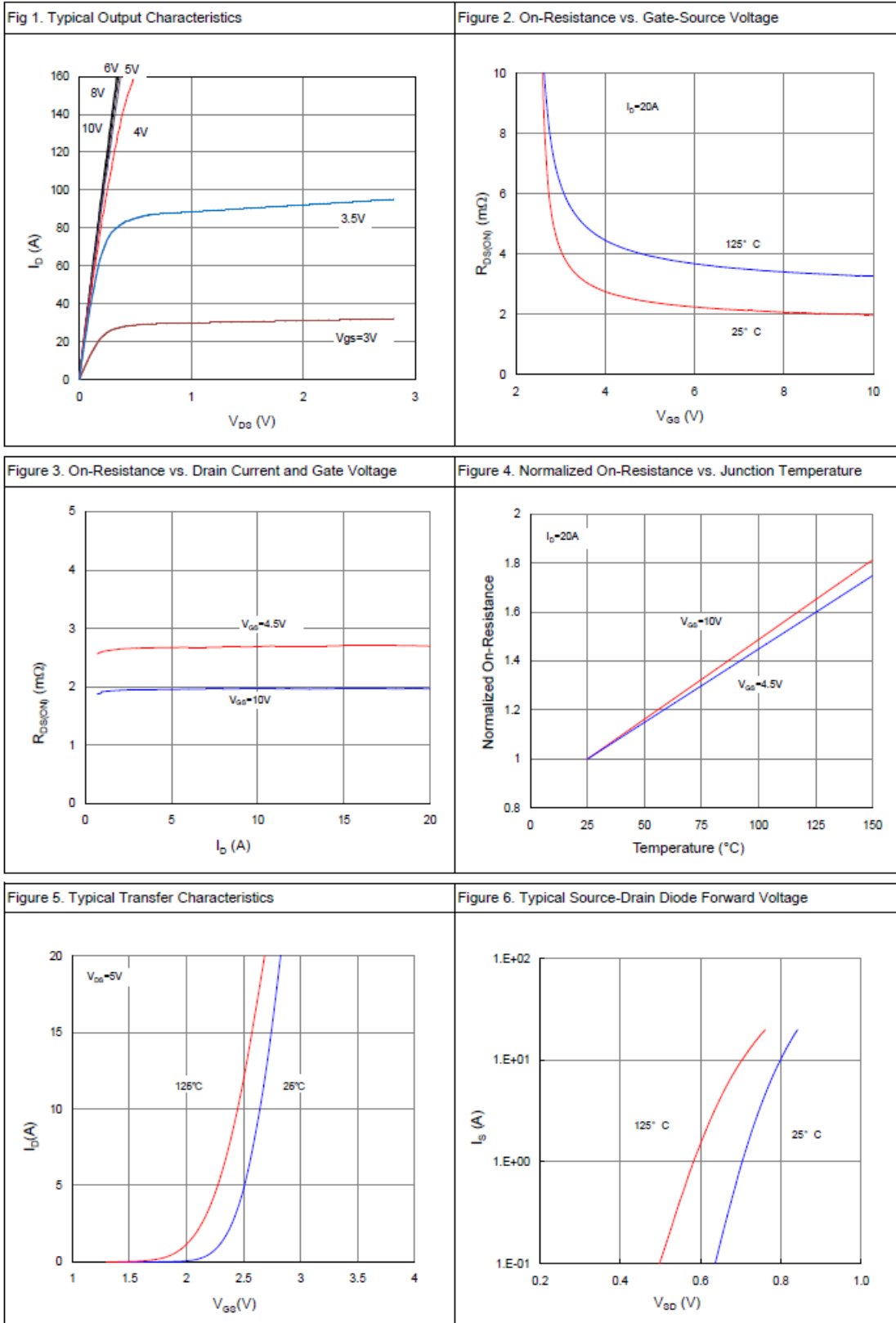
| Parameter | Symbol | Conditions | Min. | Typ | Max. | Unit |
|---------------------------------|---------------|------------------------------------------------------|------|------|-----------|------|
| Static | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=250\mu A$ | 60 | | | V |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 1.0 | 1.6 | 2.4 | |
| Gate Leakage Current | I_{GSS} | $V_{DS}=0V, V_{GS}=\pm 20V$ | | | ± 100 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=48V, V_{GS}=0V$ $T_J=25^\circ C$ | | | 1 | uA |
| | | $V_{DS}=48V, V_{GS}=0V$ $T_J=100^\circ C$ | | | 100 | |
| Drain-Source On-Resistance | $R_{DS(on)}$ | $V_{GS}=10V, I_D=20A$ | | 2.5 | 3.0 | mΩ |
| | | $V_{GS}=4.5V, I_D=20A$ | | 3.5 | 4.5 | |
| Forward Transconductance | g_{fs} | $V_{DS}=5V, I_D=20A$ | | 80 | | S |
| Diode Forward Voltage | V_{SD} | $I_S=20A, V_{GS}=0V$ | | 0.9 | 1.2 | V |
| Gate Resistance | R_G | $V_{GS}=0V, V_{DS}$ open, $f=1MHz$ | | 1.6 | | Ω |
| Dynamic | | | | | | |
| Total Gate Charge (10V) | Q_g | $V_{DS}=30V, V_{GS}=10V$ $I_D=20A$ | | 64 | | nC |
| Total Gate Charge (4.5V) | Q_g | | | 31 | | |
| Gate-Source Charge | Q_{gs} | | | 18 | | |
| Gate-Drain Charge | Q_{gd} | | | 12 | | |
| Input Capacitance | C_{iss} | $V_{DS}=30V, V_{GS}=0V$ $f=1MHz$ | | 4424 | | pF |
| Output Capacitance | C_{oss} | | | 1670 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 73 | | |
| Turn-On Time | $t_d(on)$ | $V_{DD}=30V, I_D=20A$ $V_{GEN}=10V, R_G=10\Omega$ | | 14 | | nS |
| | t_r | | | 11 | | |
| Turn-Off Time | $t_d(off)$ | | | 58 | | |
| | t_f | | | 17 | | |



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TYPICAL CHARACTERISTICS





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TYPICAL CHARACTERISTICS

Figure 7. Typical Gate-Charge vs. Gate-to-Source Voltage

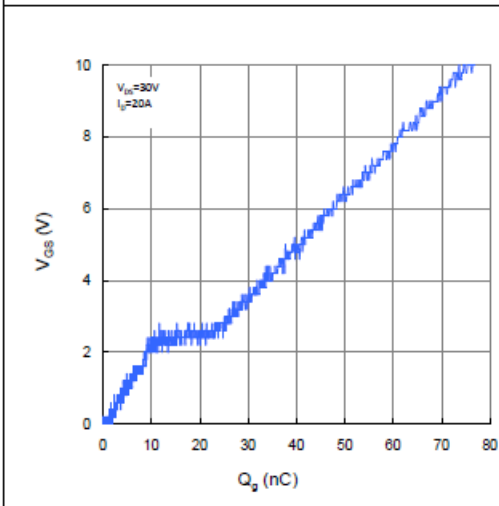


Figure 8. Typical Capacitance vs. Drain-to-Source Voltage

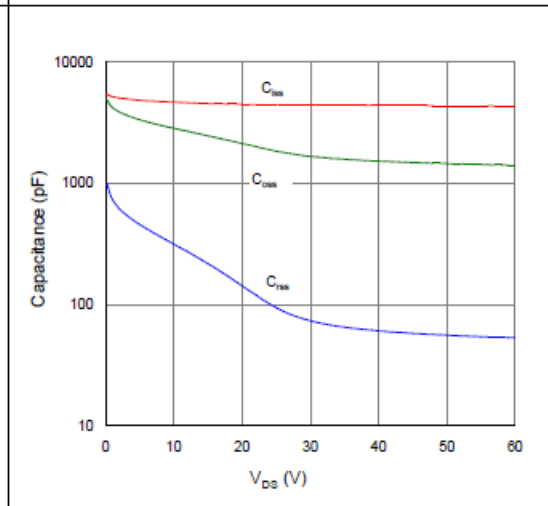


Figure 9. Maximum Safe Operating Area

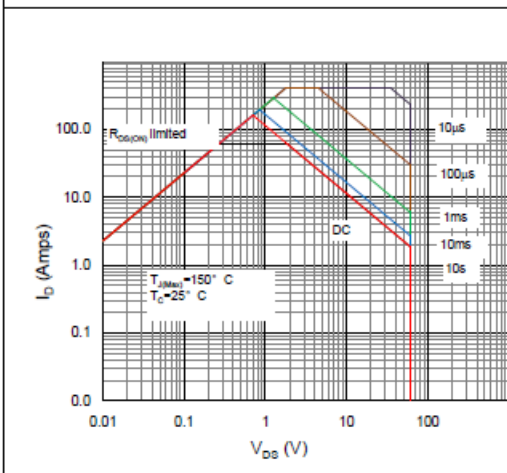


Figure 10. Maximum Drain Current vs. Case Temperature

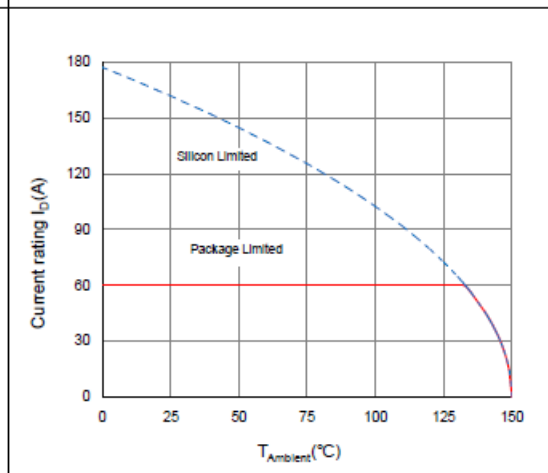
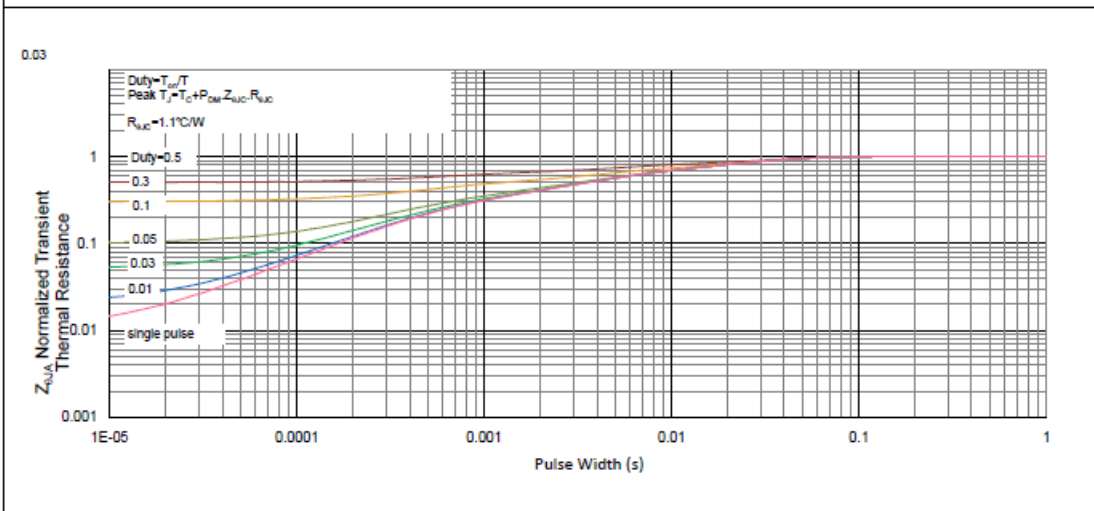


Figure 11. Normalized Maximum Transient Thermal Impedance, Junction-to-Ambient

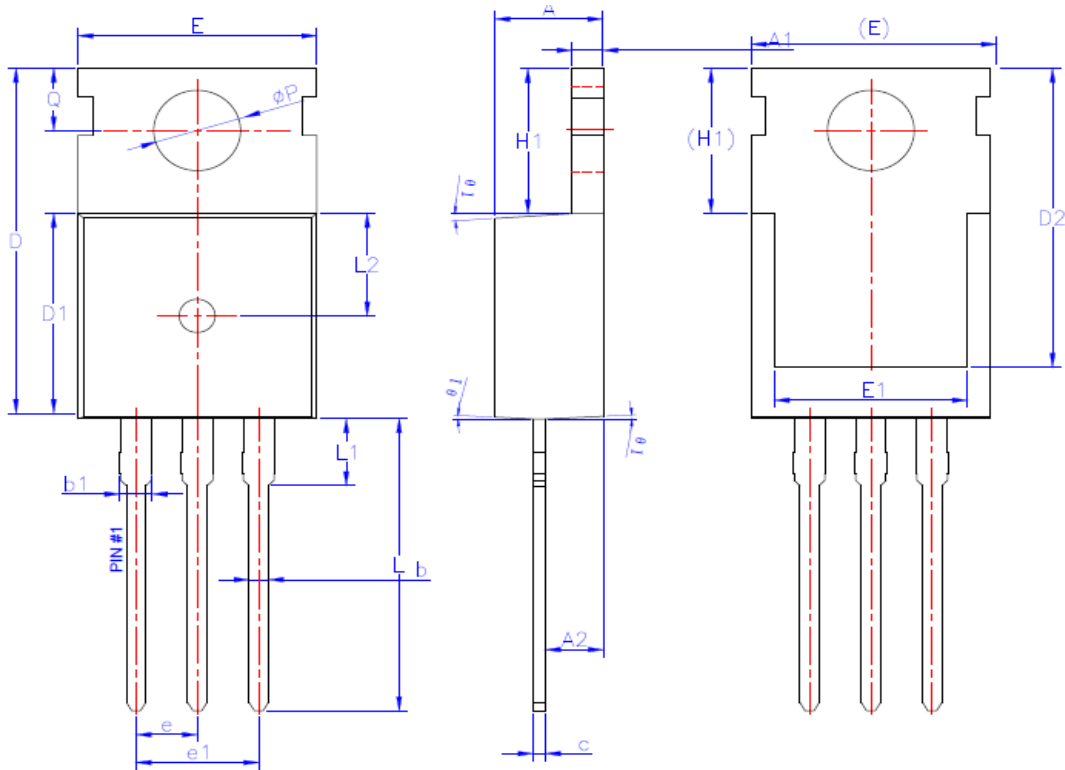




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TO-220-3L PACKAGE OUTLINE



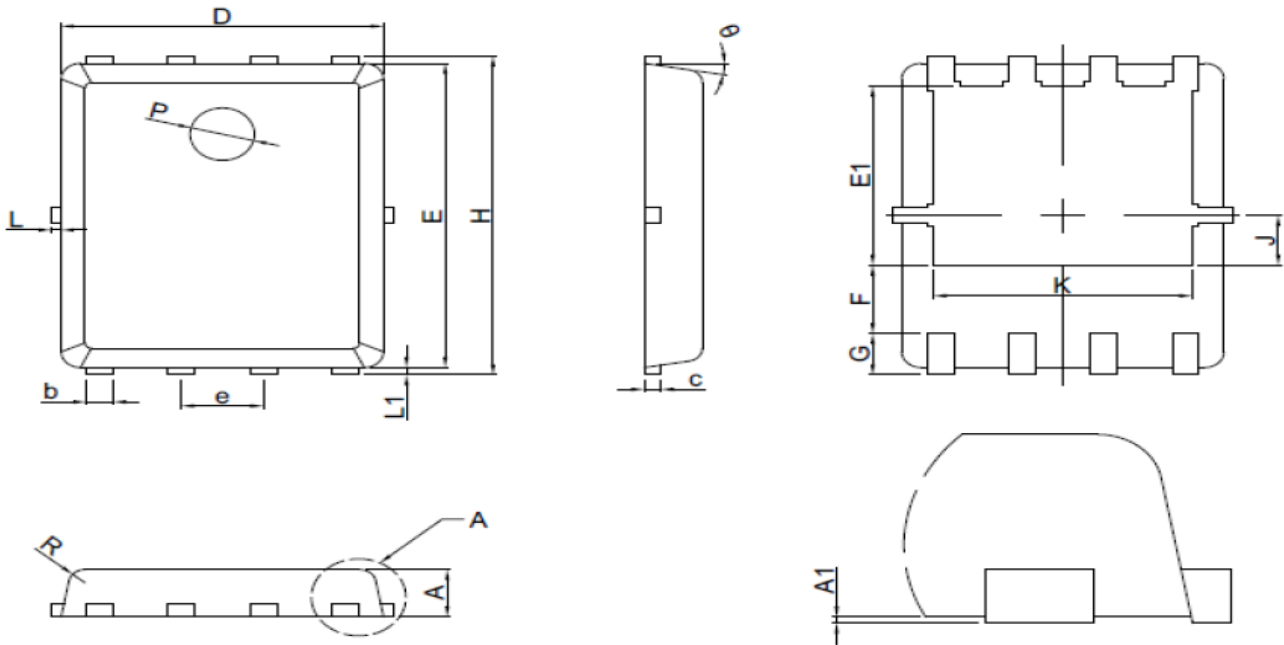
| SYMBOL | MIN | NOM | MAX |
|--------|---------|-------|-------|
| A | 4.40 | 4.50 | 4.60 |
| A1 | 1.27 | 1.30 | 1.33 |
| A2 | 2.30 | 2.40 | 2.50 |
| b | 0.70 | 0.60 | 0.90 |
| b1 | - | - | 1.40 |
| c | 0.45 | 0.50 | 0.60 |
| D | 15.30 | 15.70 | 16.10 |
| D1 | 9.10 | 9.20 | 9.30 |
| D2 | 13.10 | - | 13.70 |
| E | 9.70 | 9.90 | 10.20 |
| E1 | 7.80 | 8.00 | 8.20 |
| e | 2.54BSC | | |
| e1 | 5.08BSC | | |
| H1 | 6.30 | 6.50 | 6.70 |
| L | 12.78 | 13.08 | 13.38 |
| L1 | - | - | 3.50 |
| L2 | 4.6REF | | |
| φ P | 3.55 | 3.60 | 3.65 |
| Q | 2.73 | - | 2.87 |
| θ 1 | 1° | 3° | 5° |



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PPAK5x6-8L PACKAGE OUTLINE



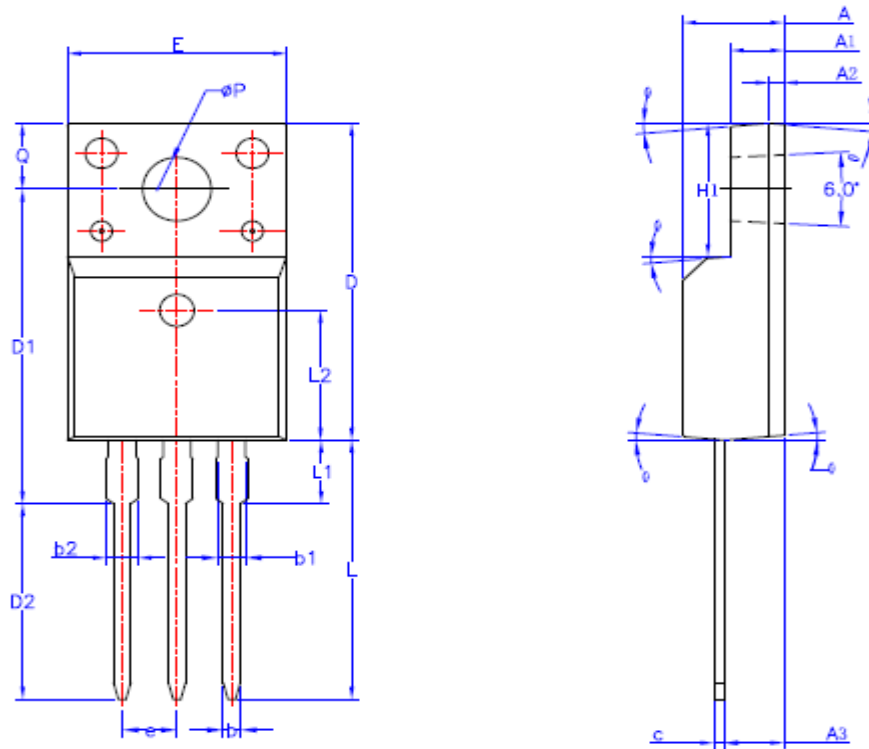
| SYMBOL | MILLIMETERS | | |
|----------|-------------|------|------|
| | MIN | NOM | MAX |
| A | 0.8 | 0.95 | 1.1 |
| A1 | 0.00 | 0.03 | 0.05 |
| b | 0.33 | 0.41 | 0.51 |
| c | 0.254 REF | | |
| D | 4.80 | 4.95 | 5.10 |
| F | 1.40 REF | | |
| E | 5.70 | 5.80 | 5.90 |
| e | 1.27 BSC | | |
| H | 5.90 | 6.05 | 6.20 |
| L1 | 0.06 | 0.13 | 0.20 |
| G | 0.60 REF | | |
| J | 0.95 BSC | | |
| K | 4.00 REF | | |
| L | --- | ---- | 0.20 |
| P | 1.00 REF | | |
| E1 | 3.40REF | | |
| E2 | 0.95 REF | | |
| θ | 6° | 10° | 14° |
| R | 0.25REF | | |



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TO-220F-3L PACKAGE OUTLINE



| SYMBOL | MIN | NOM | MAX |
|--------|---------|-------|-------|
| A | 4.50 | 4.70 | 4.83 |
| A1 | 2.34 | 2.54 | 2.74 |
| A2 | 0.7REF | | |
| A3 | 2.56 | 2.76 | 2.93 |
| b | 0.70 | -- | 0.90 |
| b1 | 1.18 | -- | 1.40 |
| b2 | -- | -- | 1.47 |
| c | 0.45 | 0.50 | 0.60 |
| D | 15.67 | 15.87 | 16.07 |
| D1 | 15.55 | 15.75 | 15.95 |
| D2 | 9.60 | 9.80 | 10.00 |
| E | 9.96 | 10.16 | 10.36 |
| e | 2.54BSC | | |
| H1 | 6.48 | 6.68 | 6.88 |
| L | 12.68 | 12.98 | 13.28 |
| L1 | - | - | 3.50 |
| L2 | 6.50REF | | |
| φ P | 3.08 | 3.18 | 3.28 |
| Q | 3.20 | - | 3.40 |
| θ 1 | 1° | 3° | 5° |



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