

12A, 650V N-CHANNEL MOSFET

GENERAL DESCRIPTION

These N-Channel enhancement mode power field effect transistors are produced using Hi-semicon's proprietary, planar stripe, DMOS technology.

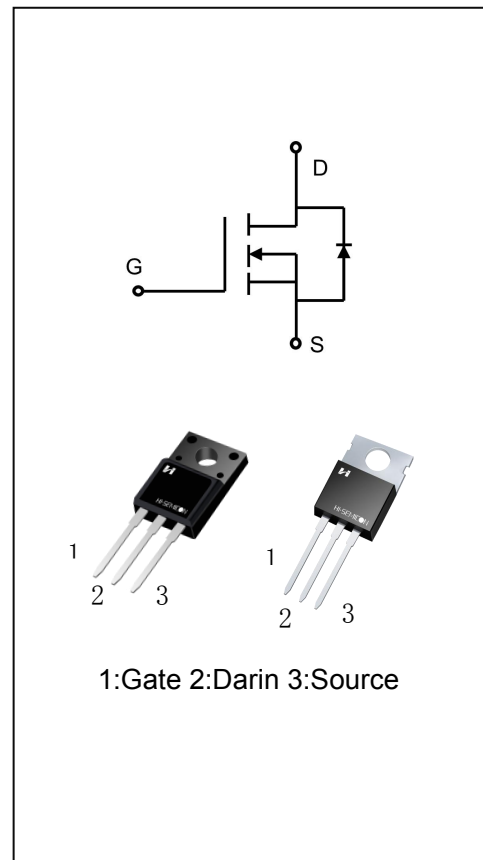
This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switched mode power supplies, active power factor correction, electronic lamp ballasts based on half bridge topology.

Features

- ◆ $V_{DS}(V)=650V, I_D=12A$
- ◆ $R_{DS(ON)}$
 TYP: $605m\Omega @ V_{GS}=10V, I_D=6A$
 MAX: $800m\Omega$

Applications

- ◆ Power factor correction (PFC)
- ◆ Switched mode power supplies (SMPS)
- ◆ Uninterruptible power supply (UPS)
- ◆ LED lighting power



ORDERING INFORMATION

| Part No. | Package | Marking | Material | Packing |
|----------|------------|----------|----------|---------|
| SFF12N65 | TO-220F-3L | SFF12N65 | Pb Free | Tube |
| SFP12N65 | TO-220-3L | SFP12N65 | Pb Free | Tube |

ABSOLUTE MAXIMUM RATINGS (T_J=25°C unless otherwise noted)

| Characteristics | Symbol | Ratings | | Unit |
|---|------------------|------------------------|----------|------|
| | | SFF12N65 | SFP12N65 | |
| Drain-Source Voltage | V _{DS} | 650 | | V |
| Gate-Source Voltage | V _{GS} | ±30 | | V |
| Drain Current | I _D | T _C = 25°C | | A |
| | | T _C = 100°C | | |
| Drain Current Pulsed (Note 1) | I _{DM} | 48 | | A |
| Power Dissipation(T _C =25°C) -Derate above 25°C | P _D | 53 | 225 | W |
| | | 0.41 | 1.8 | W/°C |
| Single Pulsed Avalanche Energy (Note 2) | E _{AS} | 311 | | mJ |
| Operation Junction Temperature Range | T _J | -55~+150 | | °C |
| Storage Temperature Range | T _{stg} | -55~+150 | | °C |
| Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds | TL | 300 | | °C |

THERMAL CHARACTERISTICS

| Characteristics | Symbol | MAX | | Unit |
|---|------------------|----------|----------|------|
| | | SFF12N65 | SFP12N65 | |
| Thermal Resistance, Junction-to-Case | R _{θJC} | 2.44 | 0.56 | °C/W |
| Thermal Resistance, Junction-to-Ambient | R _{θJA} | 62.5 | 62.5 | °C/W |

ELECTRICAL CHARACTERISTICS

| Characteristics | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
|--|---------------------|---|------|-------|------|------|
| Off Characteristics | | | | | | |
| Drain -Source Breakdown Voltage | B _{VDS} | V _{GS} =0V, I _D =250μA | 650 | 690 | -- | V |
| Drain-Source Leakage Current | I _{DSS} | V _{DS} =650V, V _{GS} =0V | -- | 6.0 | 100 | nA |
| Gate-Source Leakage Current | I _{GSS} | V _{GS} =30V, V _{DS} =0V | -- | 0.7 | 100 | nA |
| Gate-Source Leakage Current | I _{GSS} | V _{GS} =-30V, V _{DS} =0V | -- | -0.4 | -100 | nA |
| On Characteristics | | | | | | |
| Gate Threshold Voltage | V _{GS(th)} | V _{GS} = V _{DS} , I _D =250μA | 2 | 3.0 | 4.0 | V |
| Static Drain- Source On State Resistance | R _{DS(on)} | V _{GS} =10V, I _D =3A | -- | 573 | 790 | mΩ |
| | | V _{GS} =10V, I _D =6A | -- | 605 | 800 | mΩ |
| Dynamic Characteristics | | | | | | |
| Gate Resistance | R _g | V _{GS} =0V; f=1.0MHZ | 1 | 2.7 | 10 | Ω |
| Input Capacitance | C _{iss} | V _{DS} =25V V _{GS} =0V f=1.0MHZ | -- | 2100 | -- | pF |
| Output Capacitance | C _{oss} | | -- | 162.6 | -- | |
| Reverse Transfer Capacitance | C _{rss} | | -- | 7.0 | -- | pF |
| Switching Characteristics | | | | | | |
| Turn-on Delay Time | t _{d(on)} | V _{DD} =325V; V _{GS} =10V R _G =10Ω; I _D =10A (Note 3.4) | -- | 27.6 | -- | ns |
| Turn-on Rise Time | t _r | | -- | 52.6 | -- | |
| Turn-off Delay Time | t _{d(off)} | | -- | 75.2 | -- | |

| | | | | | | |
|--------------------|----------|--|----|------|----|----|
| Turn-off Fall Time | t_f | $V_{DD}=225V; V_{GS}=10V$ $R_G=10\Omega; I_D=10A$ (Note 3.4) | -- | 42.5 | -- | ns |
| Total Gate Charge | Q_g | $V_{DS}=520V, I_D=12A$ $V_{GS}=10V$ (Note 3.4) | -- | 37 | -- | nc |
| Gate-Source Charge | Q_{gs} | | -- | 7.4 | -- | |
| Gate-Drain Charge | Q_{gd} | | -- | 18 | -- | |

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

| Characteristics | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
|---------------------------|----------|---|------|------|------|---------|
| Continuous Source Current | I_S | Integral Reverse P-N Junction Diode in the MOSFET | -- | -- | 12 | A |
| Pulsed Source Current | I_{SM} | | -- | -- | 48 | |
| Diode Forward Voltage | V_{SD} | $I_S=12A, V_{GS}=0V$ | -- | 0.75 | 1.2 | V |
| Reverse Recovery Time | T_{rr} | $I_F=12A, V_R=520V,$ $dI_F/dt=100A/\mu S$ | -- | 566 | -- | ns |
| Reverse Recovery Charge | Q_{rr} | | -- | 5.8 | -- | μC |

1. Pulse width limited by maximum junction temperature
2. $L=20mH, I_{AS}=5.5A, V_{DD}=100V, V_G=10V, R_G=25\Omega$, starting $T_J=25^\circ C$
3. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$
4. Essentially independent of operating temperature

Typical Performance Characteristics

Figure 1. On-Region Characteristics

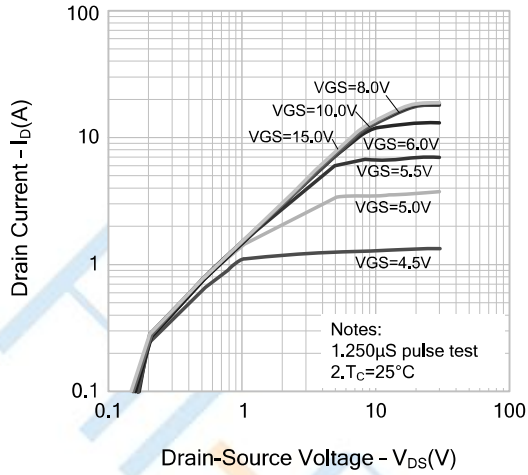


Figure 2. Transfer Characteristics

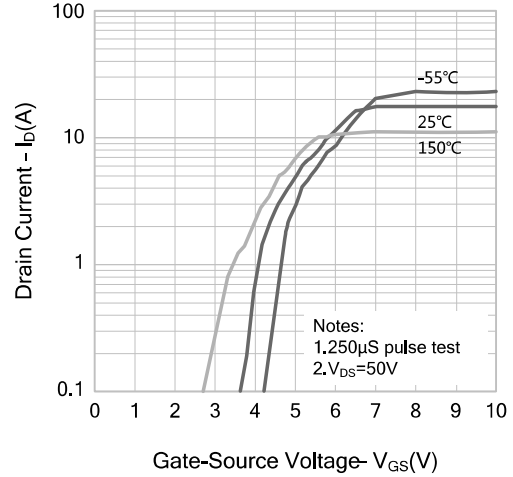


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

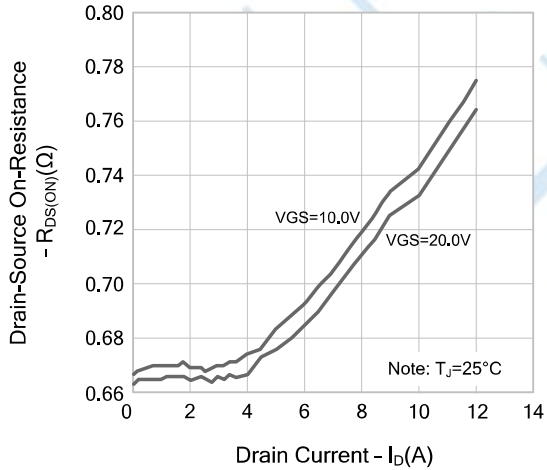


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

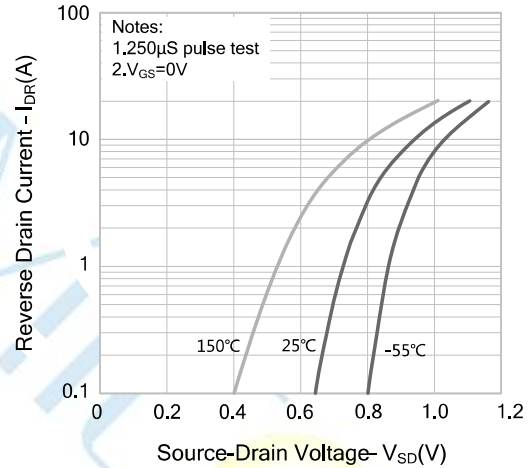


Figure 5. Capacitance Characteristics

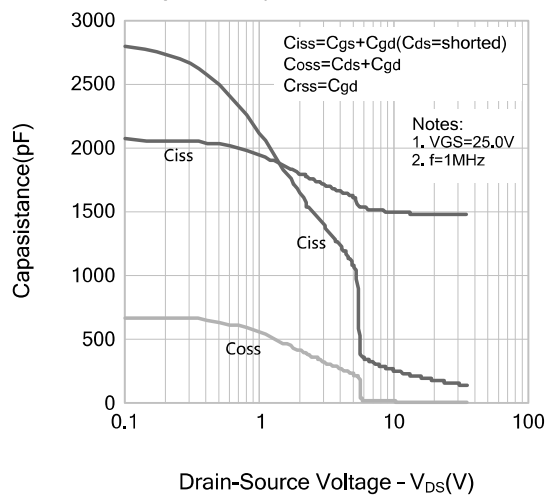
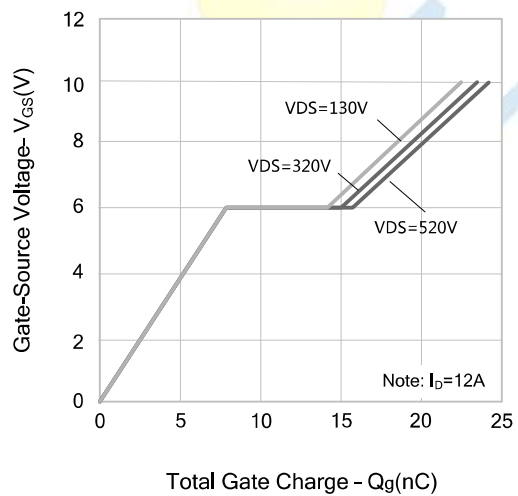


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics

Figure 7. Breakdown Voltage Variation vs. Temperature

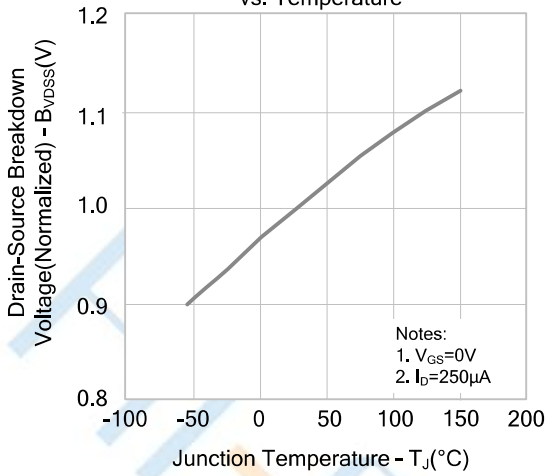


Figure 8. On-resistance Variation vs. Temperature

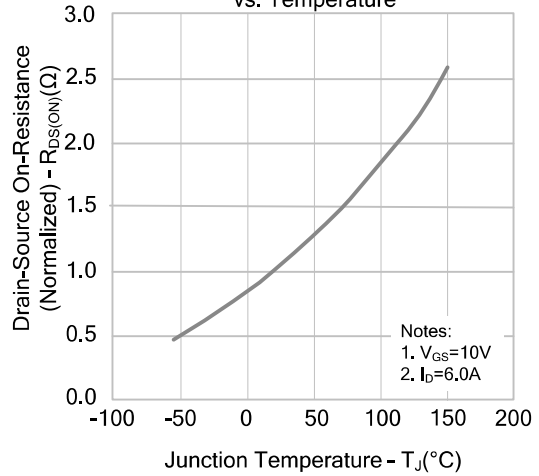


Figure 9-1. Max. Safe Operating Area(SFP12N65)

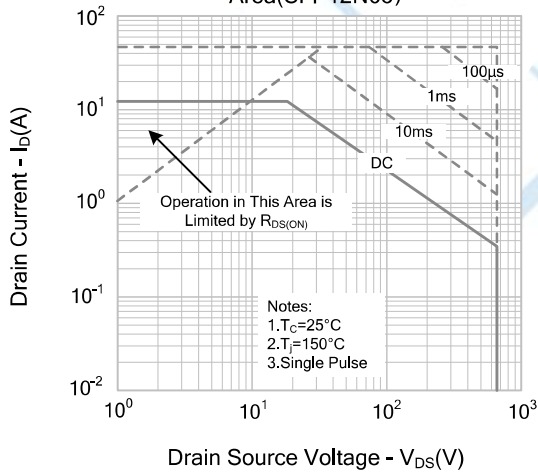


Figure 9-2. Max. Safe Operating Area(SFF12N65)

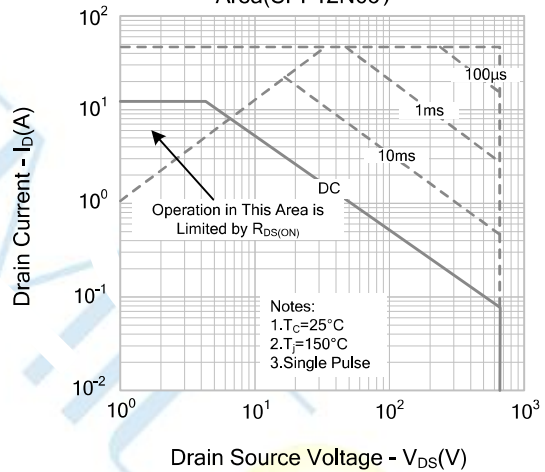
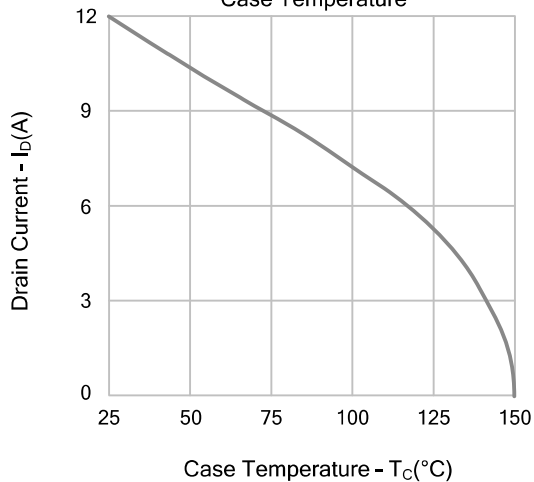
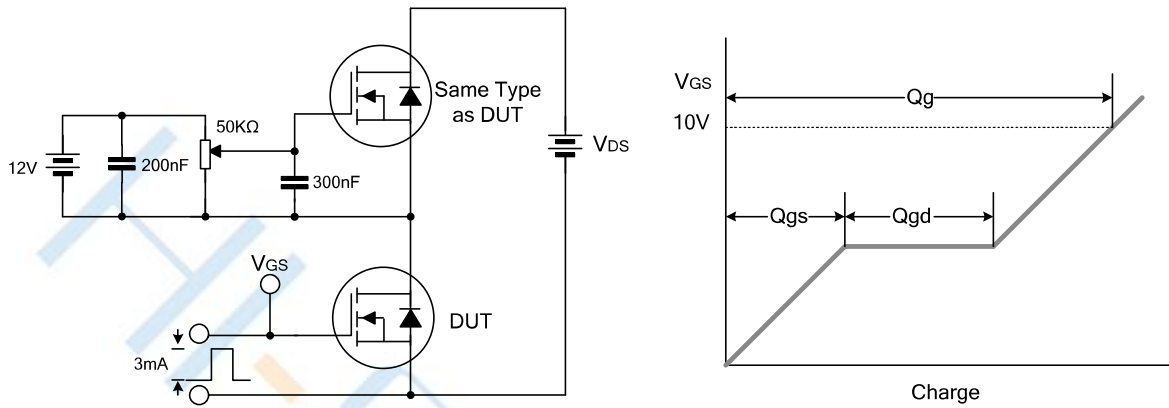


Figure 10. Maximum Drain Current vs. Case Temperature

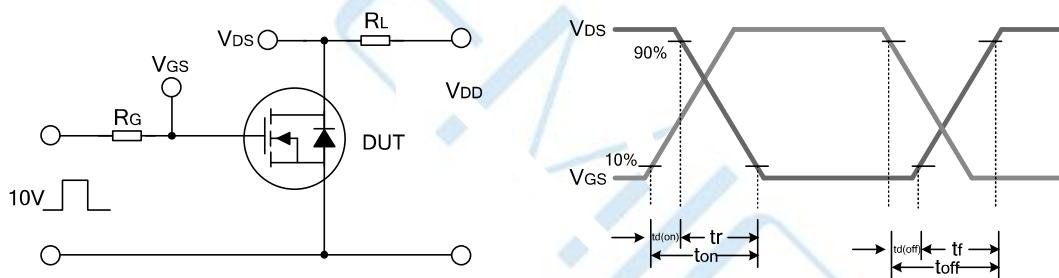


Test Circuit

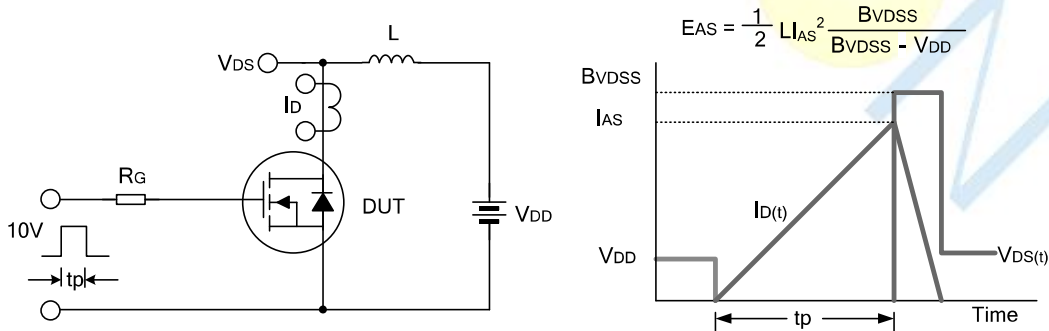
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform

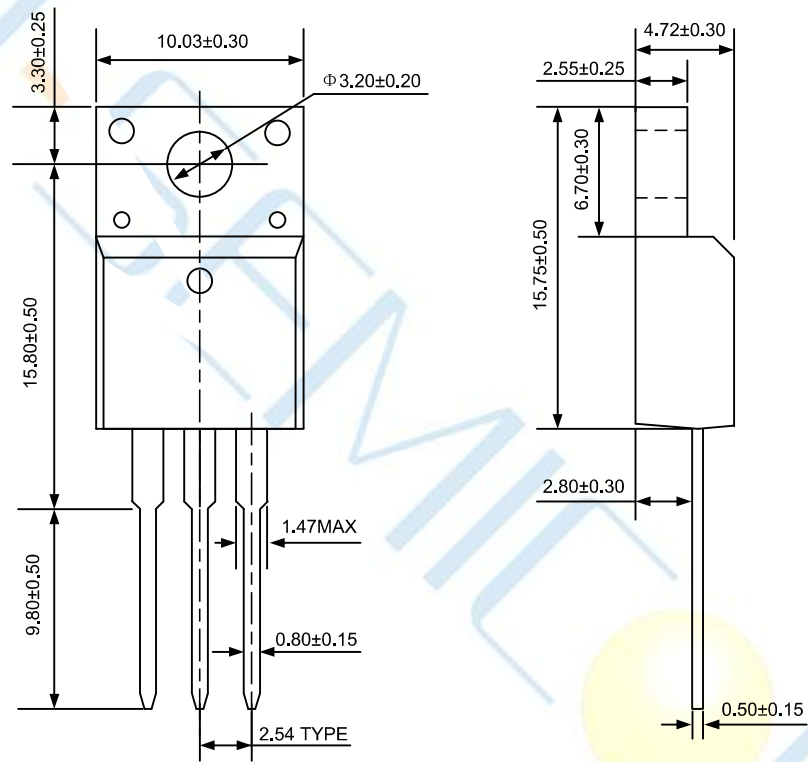


Undamped Inductive Switching Test Circuit & Waveform



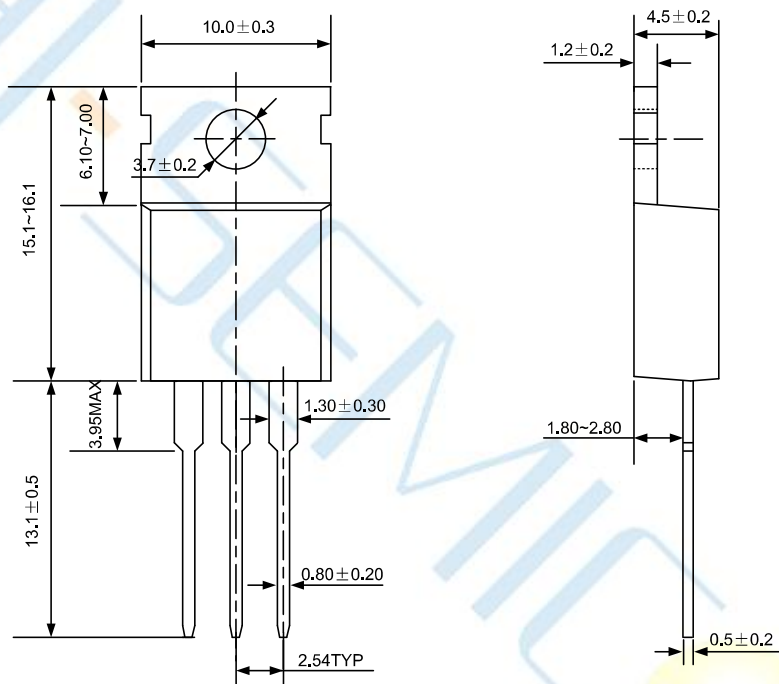
Package Dimensions of TO-220F-3L

Unit:mm



Package Dimensions of TO-220-3L

Unit:mm



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