

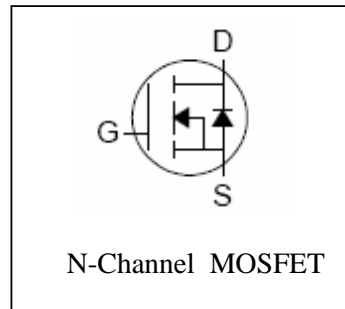
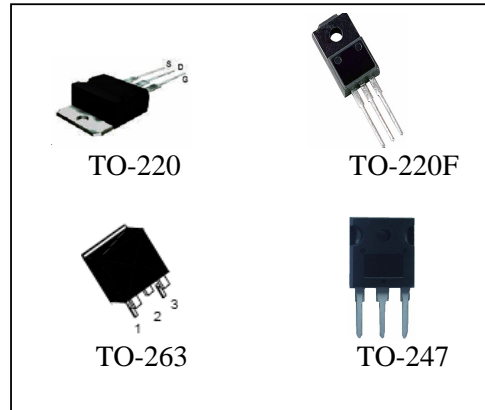
Features

- 60V/100A,
- $R_{DS(ON)} = 7.5m$ (max.) @ $V_{GS} = 10V$ $I_{DS} = 40A$
- Ultra Low On-Resistance
- Exceptional dv/dt capability
- Fast Switching and Fully Avalanche Rated
- 175°C Operating Temperature
- Lead Free and Green Devices Available (RoHS Compliant)

Applications

- Switching Application Systems

Pin Description



Absolute Maximum Ratings

| Symbol | Parameter | Rating | Unit |
|--|--|--|--------------|
| Common Ratings ($T_A = 25^\circ C$ Unless Otherwise Noted) | | | |
| V_{DSS} | Drain-Source Voltage | 60 | V |
| V_{GSS} | Gate-Source Voltage | ± 25 | |
| T_J | Maximum Junction Temperature | 175 | $^\circ C$ |
| T_{STG} | Storage Temperature Range | -55 to 175 | $^\circ C$ |
| I_S | Diode Continuous Forward Current | $T_C = 25^\circ C$ 100 | A |
| Mounted on Large Heat Sink | | | |
| I_{DP} | 300 μs Pulse Drain Current Tested | $T_C = 25^\circ C$ 400 ^① | A |
| I_D | Continuous Drain Current | $T_C = 25^\circ C$ 90 | A |
| | | $T_C = 100^\circ C$ 82 | |
| P_D | Maximum Power Dissipation | $T_C = 25^\circ C$ 275 | W |
| | | $T_C = 100^\circ C$ 200 | |
| $R_{\theta JC}$ | Thermal Resistance-Junction to Case | 0.55 | $^\circ C/W$ |
| Drain-Source Avalanche Ratings | | | |
| E_{AS} | Avalanche Energy, Single Pulsed | 1.2 | J |

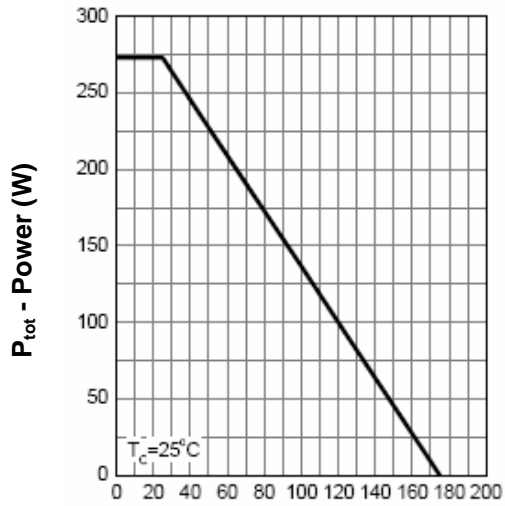
Electrical Characteristics ($T_A=25^\circ\text{C}$ Unless Otherwise Noted)

| Symbol | Parameter | Test Condition | RU3205 | | | Unit |
|---|----------------------------------|---|--------|------|-----------|------------|
| | | | Min. | Typ. | Max. | |
| Static Characteristics | | | | | | |
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS}=0V, I_{DS}=250\mu A$ | 60 | | | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS}=60V, V_{GS}=0V$ $T_J=85^\circ\text{C}$ | | | 1 | μA |
| | | | | | 30 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}=V_{GS}, I_{DS}=250\mu A$ | 2 | 3 | 4 | V |
| I_{GSS} | Gate Leakage Current | $V_{GS}=\pm 25V, V_{DS}=0V$ | | | ± 100 | nA |
| $R_{DS(ON)}^{(2)}$ | Drain-Source On-state Resistance | $V_{GS}=10V, I_{DS}=40A$ | | | 7.5 | m Ω |
| Diode Characteristics | | | | | | |
| $V_{SD}^{(2)}$ | Diode Forward Voltage | $I_{SD}=20A, V_{GS}=0V$ | | 0.83 | 1.2 | V |
| t_{rr} | Reverse Recovery Time | $I_{SD}=40A, di_{SD}/dt=100A/\mu s$ | | 50 | | ns |
| q_{rr} | Reverse Recovery Charge | | | 110 | | nC |
| Dynamic Characteristics ⁽³⁾ | | | | | | |
| R_G | Gate Resistance | $V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$ | | 1.4 | | Ω |
| C_{iss} | Input Capacitance | $V_{GS}=0V,$ $V_{DS}=30V,$ Frequency=1.0MHz | | 3300 | | pF |
| C_{oss} | Output Capacitance | | | 440 | | |
| C_{rss} | Reverse Transfer Capacitance | | | 150 | | |
| $t_{d(ON)}$ | Turn-on Delay Time | $V_{DD}=35V, R_L=35\Omega,$ $I_{DS}=1A, V_{GEN}=10V,$ $R_G=6\Omega$ | | 21 | 40 | ns |
| t_r | Turn-on Rise Time | | | 12 | 20 | |
| $t_{d(OFF)}$ | Turn-off Delay Time | | | 67 | 125 | |
| t_f | Turn-off Fall Time | | | 60 | 115 | |
| Gate Charge Characteristics ⁽³⁾ | | | | | | |
| Q_g | Total Gate Charge | $V_{DS}=60V, V_{GS}=10V,$ $I_{DS}=80A$ | | 75 | 105 | nC |
| Q_{gs} | Gate-Source Charge | | | 18 | | |
| Q_{gd} | Gate-Drain Charge | | | 25 | | |

- Notes: ① Current limited by Safe operating area.
 ② Pulse test ; Pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$.
 ③ Guaranteed by design, not subject to production testing.

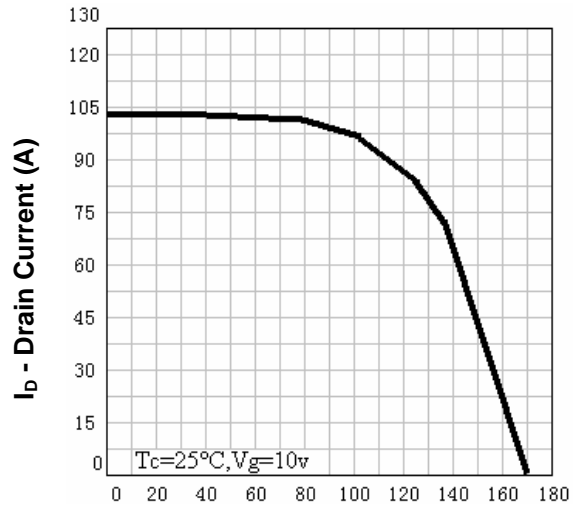
Typical Characteristics

Power Dissipation



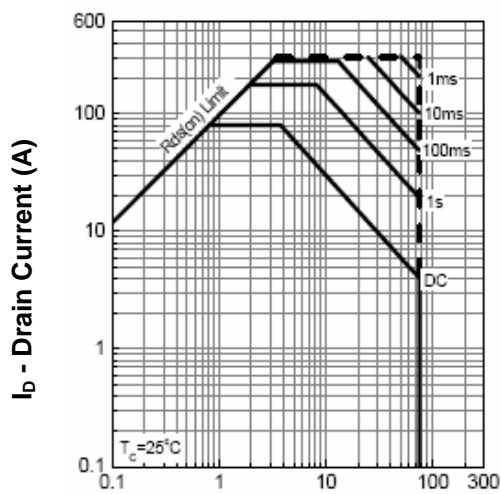
T_j - Junction Temperature (°C)

Drain Current



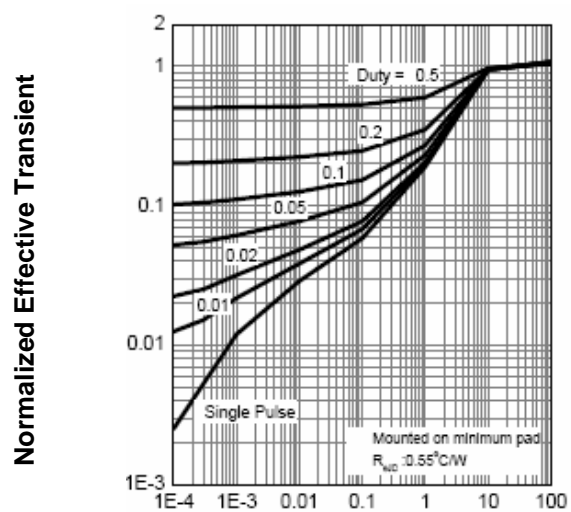
T_j - Junction Temperature (°C)

Safe Operation Area



V_{DS} - Drain-Source Voltage (V)

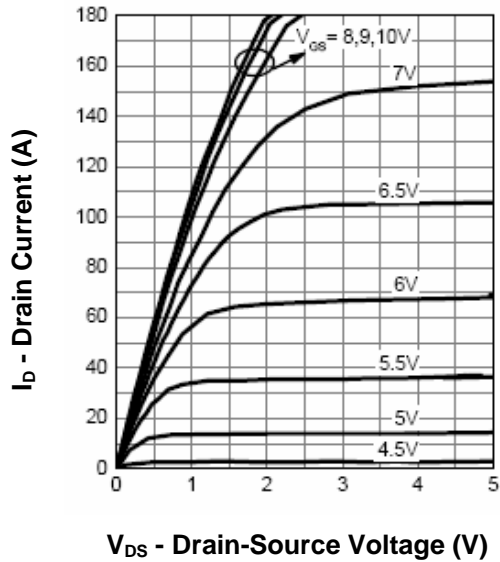
Thermal Transient Impedance



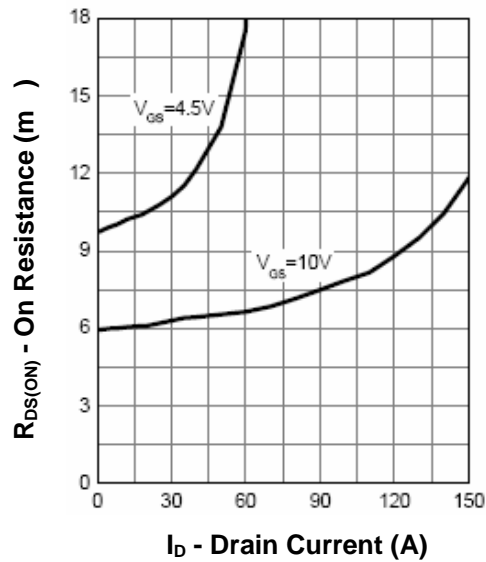
Square Wave Pulse Duration (sec)

Typical Characteristics

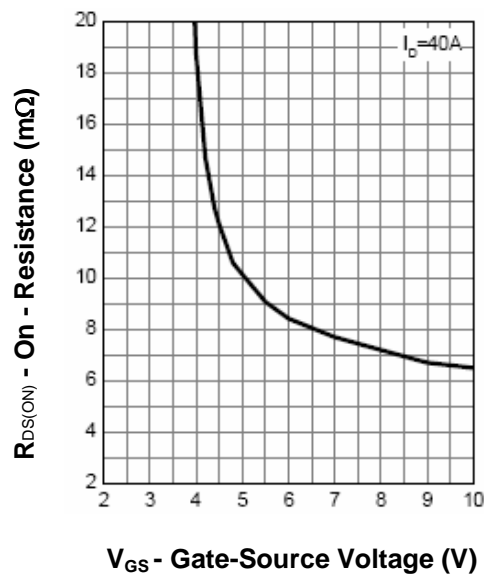
Output Characteristics



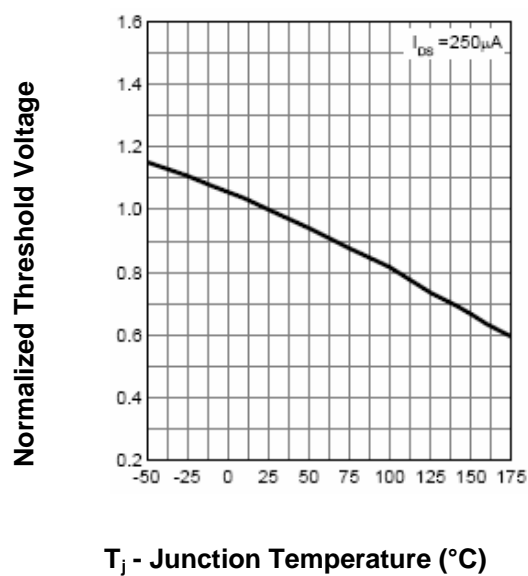
Drain-Source On Resistance



Drain-Source On Resistance

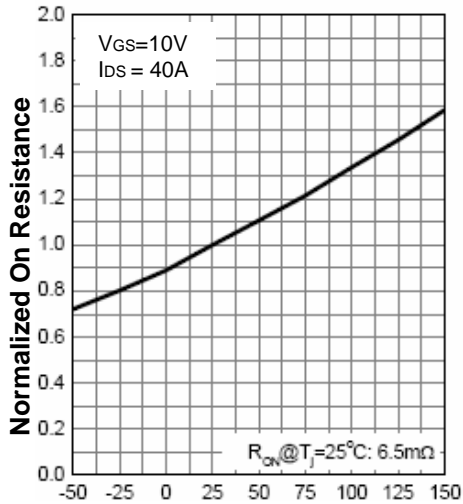


Gate Threshold Voltage



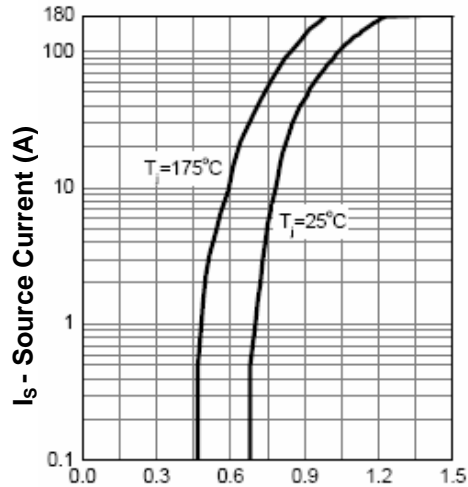
Typical Characteristics

Drain-Source On Resistance



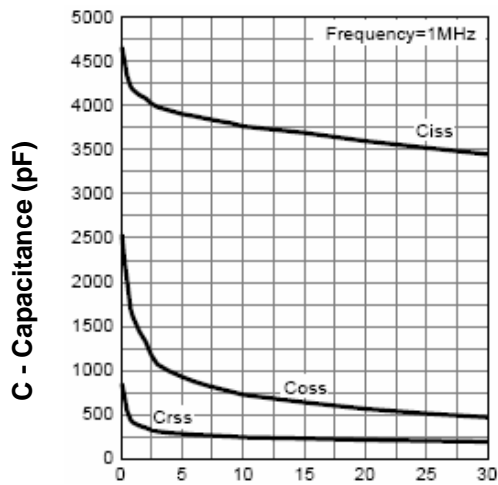
T_j - Junction Temperature (°C)

Source-Drain Diode Forward



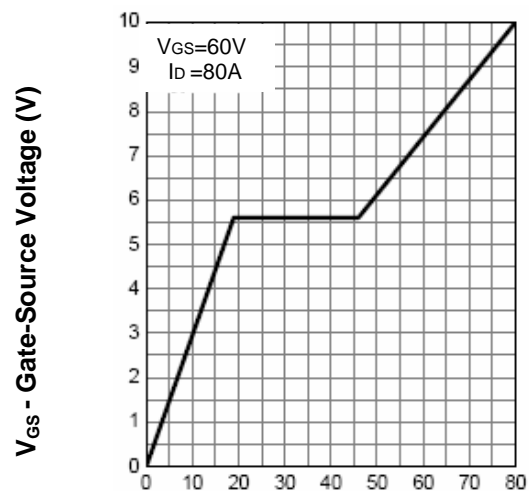
V_{SD} - Source-Drain Voltage (V)

Capacitance



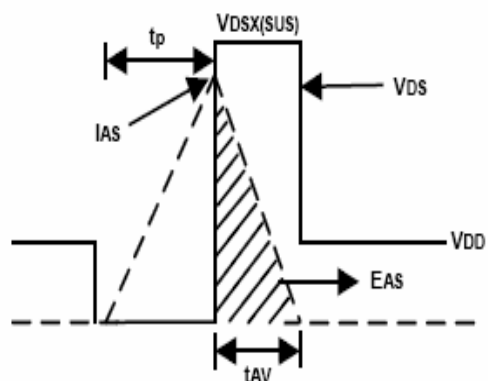
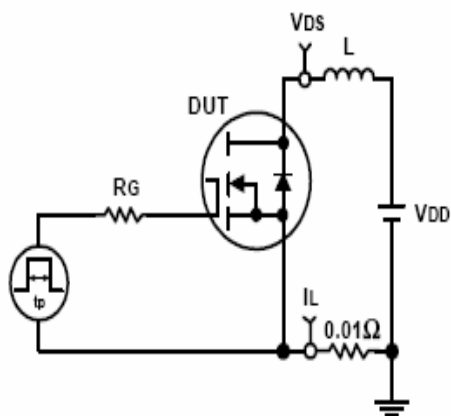
V_{DS} - Drain-Source Voltage (V)

Gate Charge

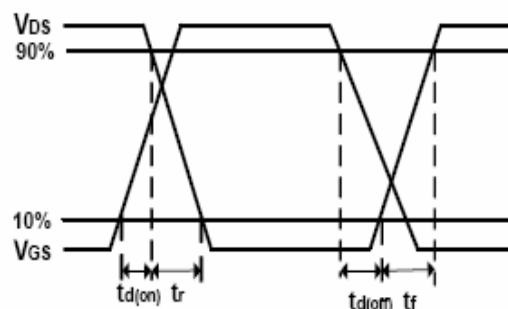
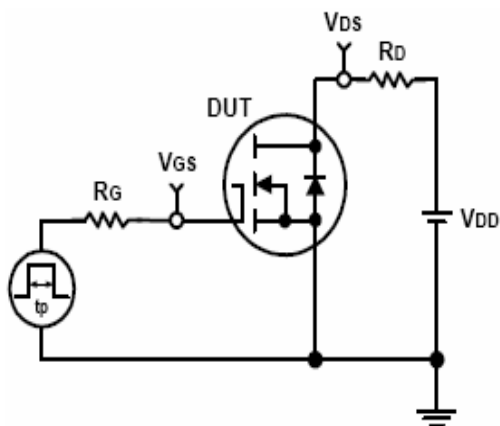


Q_G - Gate Charge (nC)

Avalanche Test Circuit and Waveforms



Switching Time Test Circuit and Waveforms



Ordering and Marking Information**RU3205****Package (Available)**

R : TO-220; S: TO-263; P: TO-220F; Q:TO-247

Operating Temperature Range

C : -55 to 175 °C

Assembly Material

G : Green & Lead Free Device

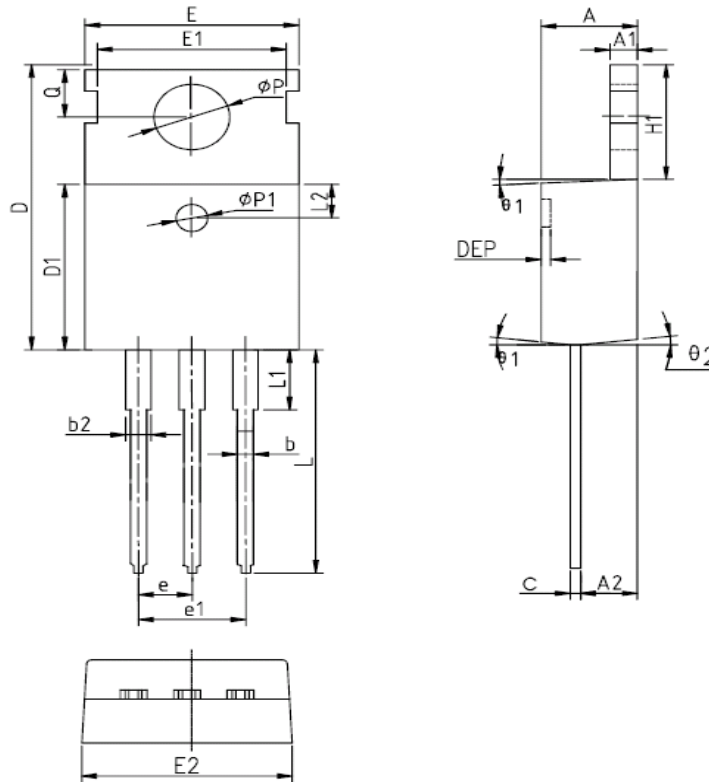
Packaging

T : TUBE

TR : Tape & Reel

Package Information

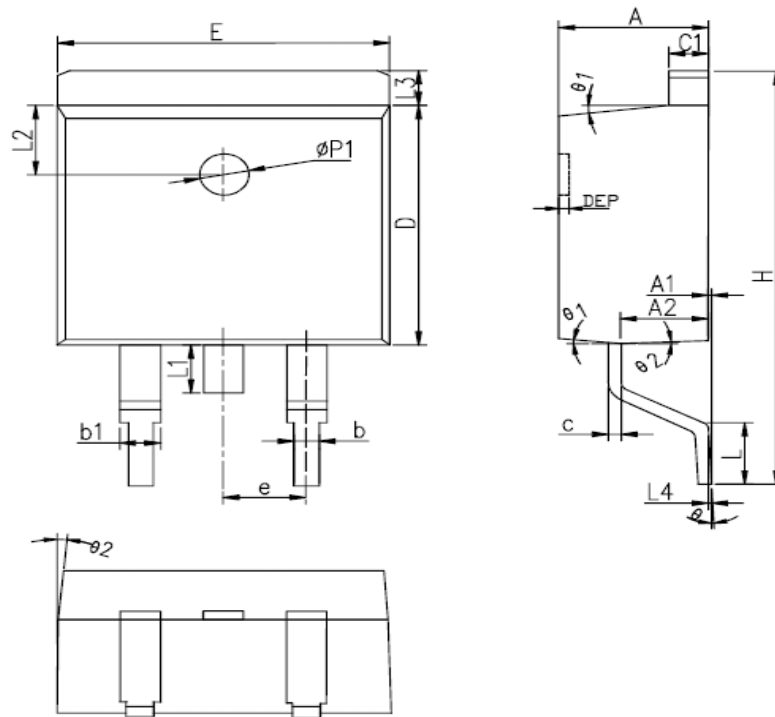
TO-220FB-3L



| SYMBOL | MM | | | INCH | | | SYMBOL | MM | | | INCH | | |
|--------|-------|-------|-------|-------|-------|-------|------------|----------|------|-------|-----------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX | | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 4.40 | 4.57 | 4.70 | 0.173 | 0.180 | 0.185 | $\phi p1$ | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 |
| A1 | 1.27 | 1.30 | 1.33 | 0.050 | 0.051 | 0.052 | e | 2.54BSC | | | 0.1BSC | | |
| A2 | 2.35 | 2.40 | 2.50 | 0.093 | 0.094 | 0.098 | e1 | 5.08BSC | | | 0.2BSC | | |
| b | 0.77 | - | 0.90 | 0.030 | - | 0.035 | H1 | 6.40 | 6.50 | 6.60 | 0.252 | 0.256 | 0.260 |
| b2 | 1.23 | - | 1.36 | 0.048 | - | 0.054 | L | 12.75 | - | 13.17 | 0.502 | - | 0.519 |
| C | 0.48 | 0.50 | 0.52 | 0.019 | 0.020 | 0.021 | L1 | - | - | 3.95 | - | - | 0.156 |
| D | 15.40 | 15.60 | 15.80 | 0.606 | 0.614 | 0.622 | L2 | 2.50REF. | | | 0.098REF. | | |
| D1 | 9.00 | 9.10 | 9.20 | 0.354 | 0.358 | 0.362 | ϕp | 3.57 | 3.60 | 3.63 | 0.141 | 0.142 | 0.143 |
| DEP | 0.05 | 0.10 | 0.20 | 0.002 | 0.004 | 0.008 | Q | 2.73 | 2.80 | 2.87 | 0.107 | 0.110 | 0.113 |
| E | 9.70 | 9.90 | 10.10 | 0.382 | 0.389 | 0.398 | $\theta 1$ | 5° | 7° | 9° | 5° | 7° | 9° |
| E1 | - | 8.70 | - | - | 0.343 | - | $\theta 2$ | 1° | 3° | 5° | 1° | 3° | 5° |
| E2 | 9.80 | 10.00 | 10.20 | 0.386 | 0.394 | 0.401 | | | | | | | |

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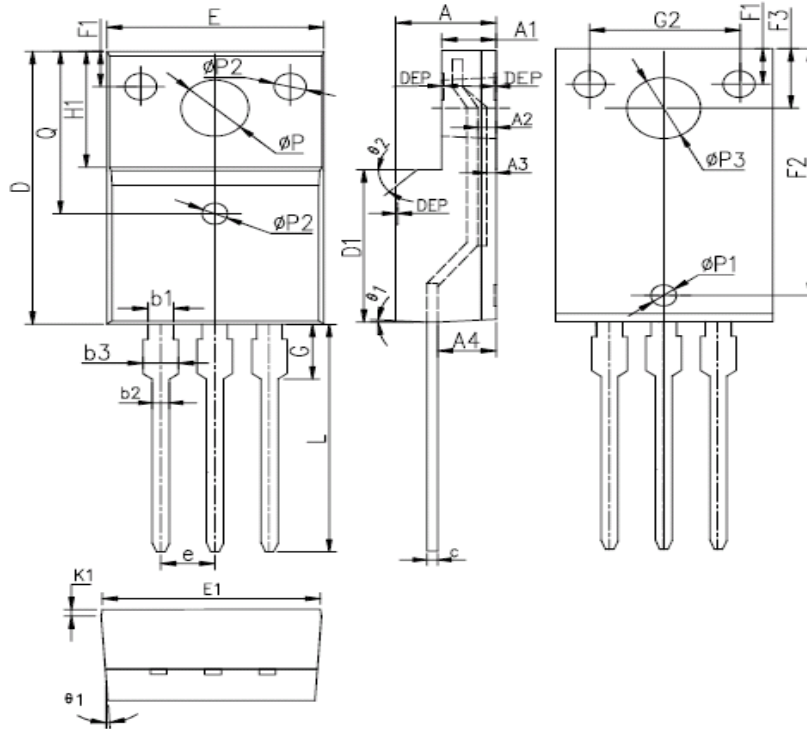
TO-263-2L



| SYMBOL | MM | | | INCH | | | SYMBOL | MM | | | INCH | | |
|--------|---------|-------|-------|--------|-------|-------|------------|----------|------|------|-----------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX | | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 4.40 | 4.57 | 4.70 | 0.173 | 0.180 | 0.185 | L | 2.00 | 2.30 | 2.60 | 0.079 | 0.090 | 0.102 |
| A1 | 0 | 0.10 | 0.25 | 0 | 0.004 | 0.010 | L3 | 1.17 | 1.27 | 1.40 | 0.046 | 0.050 | 0.055 |
| A2 | 2.59 | 2.69 | 2.79 | 0.102 | 0.106 | 0.110 | L1 | - | - | 1.70 | - | - | 0.067 |
| b | 0.77 | - | 0.90 | 0.030 | - | 0.035 | L4 | 0.25BSC | | | 0.01BSC | | |
| b1 | 1.23 | - | 1.36 | 0.048 | - | 0.052 | L2 | 2.50REF. | | | 0.098REF. | | |
| c | 0.34 | - | 0.47 | 0.013 | - | 0.019 | θ | 0° | - | 8° | 0° | - | 8° |
| C1 | 1.22 | - | 1.32 | 0.048 | - | 0.052 | $\theta 1$ | 5° | 7° | 9° | 5° | 7° | 9° |
| D | 8.60 | 8.70 | 8.80 | 0.338 | 0.343 | 0.346 | $\theta 2$ | 1° | 3° | 5° | 1° | 3° | 5° |
| E | 10.00 | 10.16 | 10.26 | 0.394 | 0.4 | 0.404 | DEP | 0.05 | 0.10 | 0.20 | 0.002 | 0.004 | 0.008 |
| e | 2.54BSC | | | 0.1BSC | | | $\phi p1$ | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 |
| H | 14.70 | 15.10 | 15.50 | 0.579 | 0.594 | 0.610 | | | | | | | |

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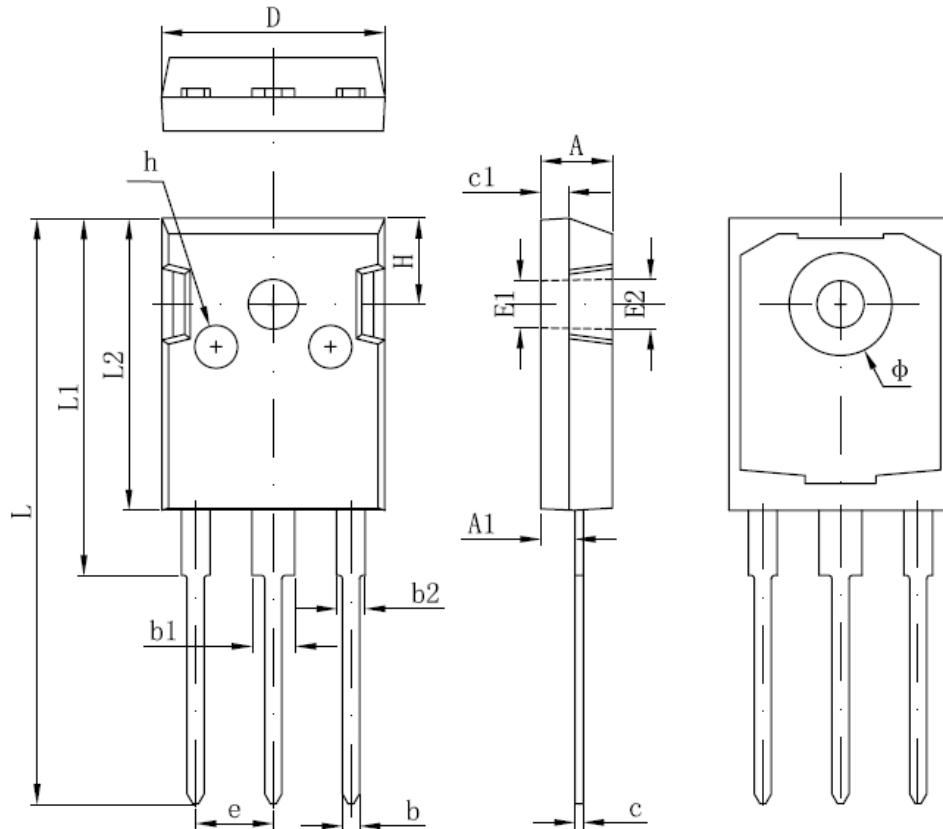
TO-220F-3L



| SYMBOL | MM | | | INCH | | | SYMBOL | MM | | | INCH | | |
|--------|---------|-------|-------|--------|-------|-------|--------|-------|-------|-------|-------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX | | MIN | NOM | MAX | MIN | NOM | MAX |
| E | 9.96 | 10.16 | 10.36 | 0.392 | 0.400 | 0.408 | ∅p3 | - | 3.450 | - | - | 0.136 | - |
| A | 4.50 | 4.70 | 4.90 | 0.177 | 0.185 | 0.193 | θ 1 | 5° | 7° | 9° | 5° | 7° | 9° |
| A1 | 2.34 | 2.54 | 2.74 | 0.092 | 0.100 | 0.108 | θ 2 | - | 45° | - | - | 45° | - |
| A2 | 0.95 | 1.05 | 1.15 | 0.037 | 0.041 | 0.045 | DEP | 0.05 | 0.10 | 0.15 | 0.002 | 0.004 | 0.006 |
| A3 | 0.42 | 0.52 | 0.62 | 0.017 | 0.020 | 0.024 | F1 | 1.90 | 2.00 | 2.10 | 0.075 | 0.079 | 0.083 |
| A4 | 2.65 | 2.75 | 2.85 | 0.104 | 0.108 | 0.112 | F2 | 13.61 | 13.81 | 14.01 | 0.536 | 0.544 | 0.552 |
| c | - | 0.50 | - | - | 0.020 | - | F3 | 3.20 | 3.30 | 3.40 | 0.126 | 0.130 | 0.134 |
| D | 15.67 | 15.87 | 16.07 | 0.617 | 0.625 | 0.633 | G | 3.25 | 3.45 | 3.65 | 0.128 | 0.136 | 0.144 |
| Q | 8.80 | 9.00 | 9.20 | 0.346 | 0.354 | 0.362 | G1 | 5.90 | 6.00 | 6.10 | 0.232 | 0.236 | 0.240 |
| H1 | 6.48 | 6.68 | 6.88 | 0.255 | 0.263 | 0.271 | G2 | 6.90 | 7.00 | 7.10 | 0.272 | 0.276 | 0.280 |
| e | 2.54BSC | | | 0.1BSC | | | b1 | 1.17 | 1.20 | 1.24 | 0.046 | 0.047 | 0.048 |
| ∅p | - | 3.183 | - | - | 0.125 | - | b2 | 0.77 | 0.8 | 0.85 | 0.030 | 0.031 | 0.033 |
| L | 12.78 | 12.98 | 13.18 | 0.503 | 0.511 | 0.519 | b3 | 1.10 | 1.30 | 1.50 | 0.043 | 0.051 | 0.059 |
| D1 | 8.99 | 9.19 | 9.39 | 0.354 | 0.362 | 0.370 | E1 | 9.8 | 10.00 | 10.20 | 0.386 | 0.394 | 0.412 |
| ∅p1 | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 | K1 | 0.75 | 0.8 | 0.85 | 0.030 | 0.031 | 0.033 |
| ∅p2 | 1.15 | 1.20 | 1.25 | 0.045 | 0.047 | 0.049 | | | | | | | |

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TO-247



| SYMBOL | MM | | INCH | | SYMBOL | MM | | INCH | |
|--------|------------|--------|------------|-------|--------|------------|--------|------------|-------|
| | MIN | MAX | MIN | MAX | | MIN | MAX | MIN | MAX |
| A | 4.850 | 5.150 | 0,191 | 0.200 | E2 | 3.600 REF | | 0.142 REF | |
| A1 | 2.200 | 2.600 | 0.087 | 0.102 | L | 40.900 | 41.300 | 1.610 | 1.626 |
| B | 1.000 | 1.400 | 0.039 | 0.055 | L1 | 24.800 | 25.100 | 0.976 | 0.988 |
| b1 | 2.800 | 3.200 | 0.110 | 0.126 | L2 | 20.300 | 20.600 | 0.799 | 0.811 |
| b2 | 1.800 | 2.200 | 0.071 | 0.087 | Φ | 7.100 | 7.300 | 0.280 | 0.287 |
| c | 0.500 | 0.700 | 0.020 | 0.028 | e | 5.450 TYP | | 0.215 TYP | |
| c1 | 1.900 | 2.100 | 0.075 | 0.083 | H | 5.980 REF. | | 0.235 REF. | |
| D | 15.450 | 15.750 | 0.608 | 0.620 | h | 0.000 | 0.300 | 0.000 | 0.012 |
| E1 | 3.500 REF. | | 0.138 REF. | | | | | | |

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