

X2-Class Power MOSFET

IXTY4N65X2
IXTA4N65X2
IXTP4N65X2

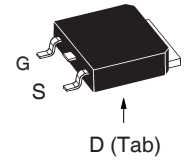
$V_{DSS} = 650V$
 $I_{D25} = 4A$
 $R_{DS(on)} \leq 850m\Omega$

N-Channel Enhancement Mode

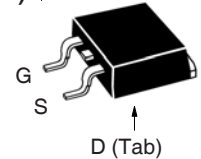


| Symbol | Test Conditions | Maximum Ratings | |
|---------------|--|--------------------|------------|
| V_{DSS} | $T_J = 25^\circ C$ to $150^\circ C$ | 650 | V |
| V_{DGR} | $T_J = 25^\circ C$ to $150^\circ C$, $R_{GS} = 1M\Omega$ | 650 | V |
| V_{GSS} | Continuous | ± 30 | V |
| V_{GSM} | Transient | ± 40 | V |
| I_{D25} | $T_C = 25^\circ C$ | 4 | A |
| I_{DM} | $T_C = 25^\circ C$, Pulse Width Limited by T_{JM} | 8 | A |
| I_A | $T_C = 25^\circ C$ | 2 | A |
| E_{AS} | $T_C = 25^\circ C$ | 150 | mJ |
| dv/dt | $I_S \leq I_{DM}$, $V_{DD} \leq V_{DSS}$, $T_J \leq 150^\circ C$ | 15 | V/ns |
| P_D | $T_C = 25^\circ C$ | 80 | W |
| T_J | | -55 ... +150 | $^\circ C$ |
| T_{JM} | | 150 | $^\circ C$ |
| T_{stg} | | -55 ... +150 | $^\circ C$ |
| T_L | Maximum Lead Temperature for Soldering | 300 | $^\circ C$ |
| T_{SOLD} | 1.6 mm (0.062in.) from Case for 10s | 260 | $^\circ C$ |
| F_C | Mounting Force (TO-263) | 10..65 / 2.2..14.6 | N/lb |
| M_d | Mounting Torque (TO-220) | 1.13 / 10 | Nm/lb.in |
| Weight | TO-252 | 0.35 | g |
| | TO-263 | 2.50 | g |
| | TO-220 | 3.00 | g |

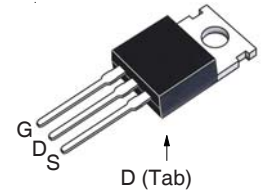
TO-252 (IXTY)



TO-263 (IXTA)



TO-220 (IXTP)



G = Gate D = Drain
S = Source Tab = Drain

Features

- International Standard Packages
- Low $R_{DS(ON)}$ and Q_G
- Avalanche Rated
- Low Package Inductance

Advantages

- High Power Density
- Easy to Mount
- Space Savings

Applications

- Switch-Mode and Resonant-Mode Power Supplies
- DC-DC Converters
- PFC Circuits
- AC and DC Motor Drives
- Robotics and Servo Controls

| Symbol | Test Conditions ($T_J = 25^\circ C$, Unless Otherwise Specified) | Characteristic Values | | |
|--------------|---|-----------------------|------|--------------------------|
| | | Min. | Typ. | Max. |
| BV_{DSS} | $V_{GS} = 0V$, $I_D = 250\mu A$ | 650 | | V |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$, $I_D = 250\mu A$ | 3.0 | | 5.0 V |
| I_{GSS} | $V_{GS} = \pm 30V$, $V_{DS} = 0V$ | | | ± 100 nA |
| I_{DSS} | $V_{DS} = V_{DSS}$, $V_{GS} = 0V$ $T_J = 125^\circ C$ | | | 5 μA 100 μA |
| $R_{DS(on)}$ | $V_{GS} = 10V$, $I_D = 0.5 \cdot I_{D25}$, Note 1 | | | 850 m Ω |

| Symbol | Test Conditions ($T_J = 25^\circ\text{C}$, Unless Otherwise Specified) | Characteristic Values | | |
|-------------------------------------|---|--|------|-------------------------|
| | | Min. | Typ. | Max |
| g_{fs} | $V_{DS} = 10\text{V}$, $I_D = 0.5 \cdot I_{D25}$, Note 1 | 2.5 | 4.2 | S |
| R_{Gi} | Gate Input Resistance | | 13 | Ω |
| C_{iss} | } $V_{GS} = 0\text{V}$, $V_{DS} = 25\text{V}$, $f = 1\text{MHz}$ | | 455 | pF |
| C_{oss} | | | 294 | pF |
| C_{rss} | | | 0.8 | pF |
| Effective Output Capacitance | | | | |
| $C_{o(er)}$ | Energy related | } $V_{GS} = 0\text{V}$ $V_{DS} = 0.8 \cdot V_{DSS}$ | 32 | pF |
| $C_{o(tr)}$ | Time related | | 82 | pF |
| Resistive Switching Times | | | | |
| $t_{d(on)}$ | } $V_{GS} = 10\text{V}$, $V_{DS} = 0.5 \cdot V_{DSS}$, $I_D = 0.5 \cdot I_{D25}$ $R_G = 50\Omega$ (External) | | 22 | ns |
| t_r | | | 28 | ns |
| $t_{d(off)}$ | | | 57 | ns |
| t_f | | | 25 | ns |
| $Q_{g(on)}$ | } $V_{GS} = 10\text{V}$, $V_{DS} = 0.5 \cdot V_{DSS}$, $I_D = 0.5 \cdot I_{D25}$ | | 8.3 | nC |
| Q_{gs} | | | 2.0 | nC |
| Q_{gd} | | | 3.0 | nC |
| R_{thJC} | TO-220 | | | 1.56 $^\circ\text{C/W}$ |
| R_{thCS} | | | 0.50 | $^\circ\text{C/W}$ |

Source-Drain Diode

| Symbol | Test Conditions ($T_J = 25^\circ\text{C}$, Unless Otherwise Specified) | Characteristic Values | | |
|----------|---|-----------------------|------|-------|
| | | Min. | Typ. | Max |
| I_S | $V_{GS} = 0\text{V}$ | | | 4 A |
| I_{SM} | Repetitive, pulse Width Limited by T_{JM} | | | 16 A |
| V_{SD} | $I_F = I_S$, $V_{GS} = 0\text{V}$, Note 1 | | | 1.4 V |
| t_{rr} | } $I_F = 2\text{A}$, $-di/dt = 100\text{A}/\mu\text{s}$ $V_R = 100\text{V}$ | | 160 | ns |
| Q_{RM} | | | 890 | nC |
| I_{RM} | | | 11.4 | A |

Note 1. Pulse test, $t \leq 300\mu\text{s}$, duty cycle, $d \leq 2\%$.

IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

| | | | | | | | | | | |
|--|-----------|-----------|-----------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|
| IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents: | 4,835,592 | 4,931,844 | 5,049,961 | 5,237,481 | 6,162,665 | 6,404,065B1 | 6,683,344 | 6,727,585 | 7,005,734B2 | 7,157,338B2 |
| | 4,860,072 | 5,017,508 | 5,063,307 | 5,381,025 | 6,259,123B1 | 6,534,343 | 6,710,405B2 | 6,759,692 | 7,063,975B2 | |
| | 4,881,106 | 5,034,796 | 5,187,117 | 5,486,715 | 6,306,728B1 | 6,583,505 | 6,710,463 | 6,771,478B2 | 7,071,537 | |

Fig. 1. Output Characteristics @ $T_J = 25^\circ\text{C}$

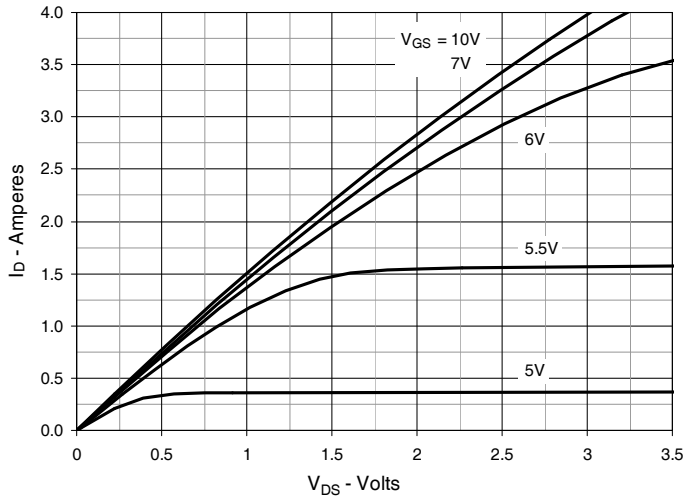


Fig. 2. Extended Output Characteristics @ $T_J = 25^\circ\text{C}$

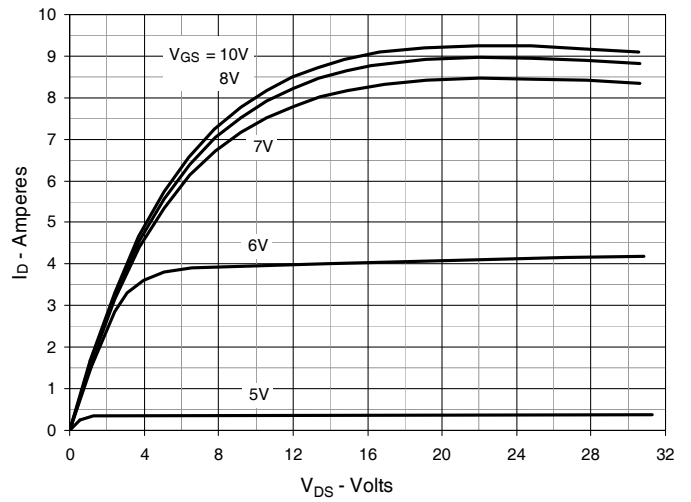


Fig. 3. Output Characteristics @ $T_J = 125^\circ\text{C}$

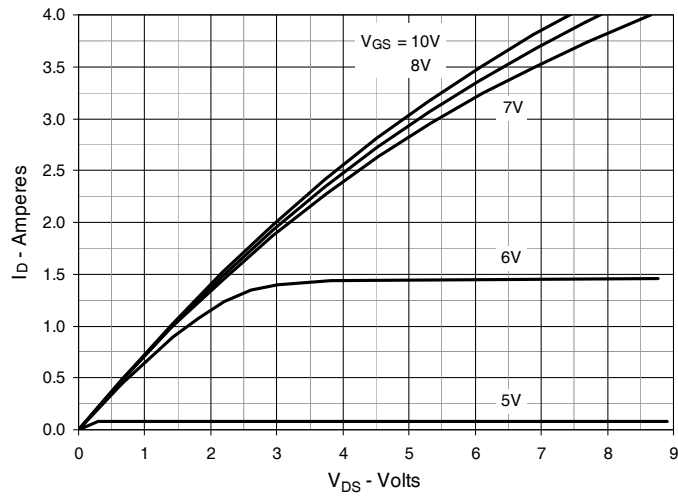


Fig. 4. $R_{DS(on)}$ Normalized to $I_D = 2\text{A}$ Value vs. Junction Temperature

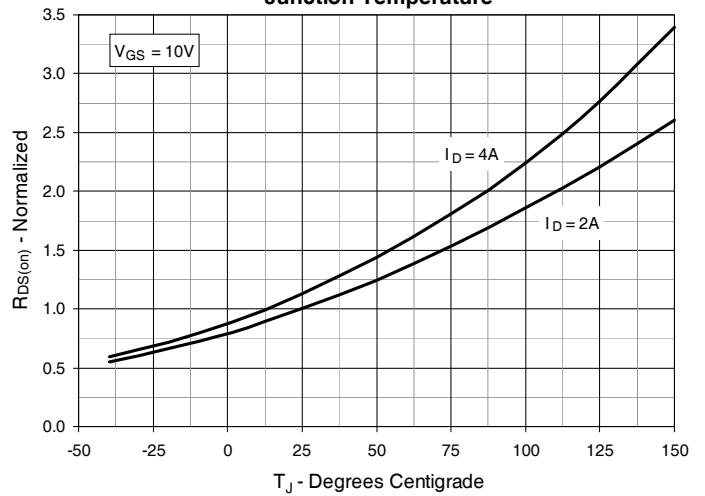


Fig. 5. $R_{DS(on)}$ Normalized to $I_D = 2\text{A}$ Value vs. Drain Current

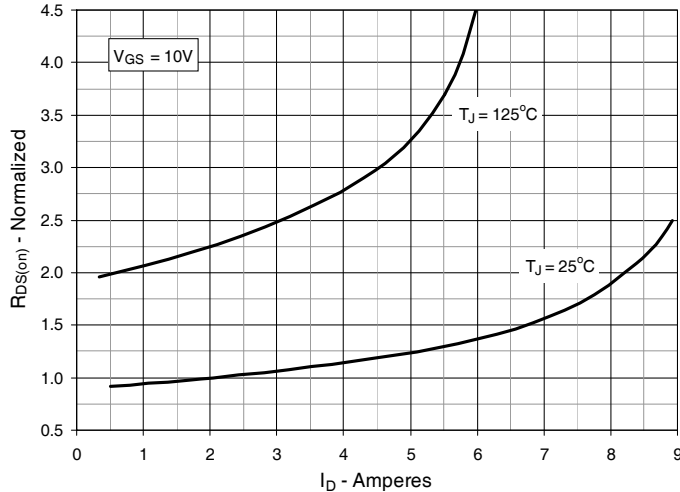


Fig. 6. Maximum Drain Current vs. Case Temperature

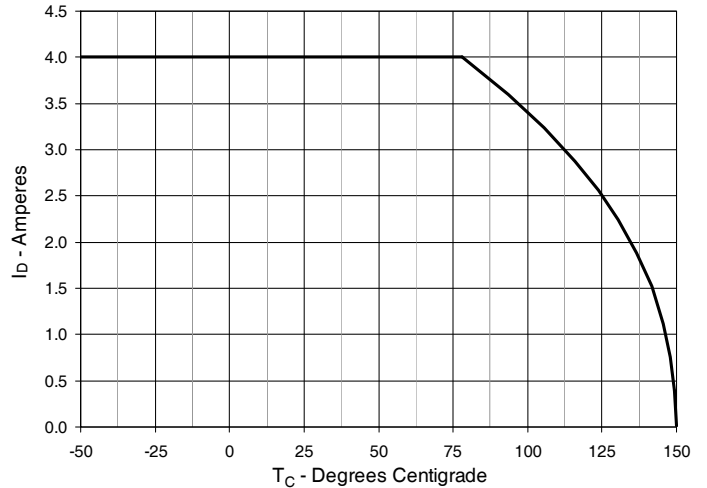


Fig. 7. Input Admittance

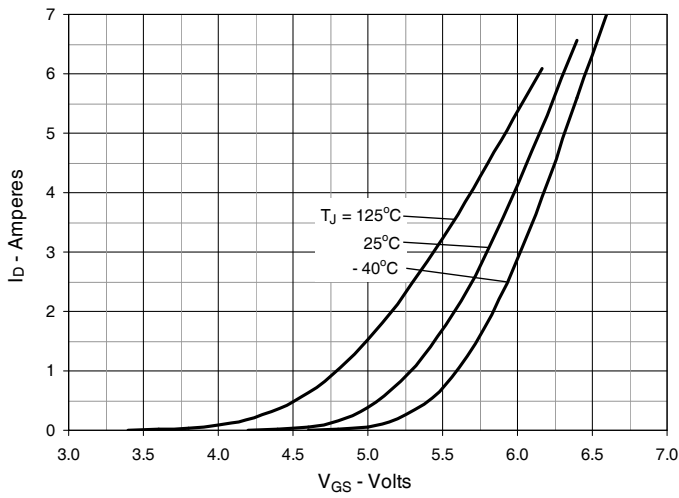


Fig. 8. Transconductance

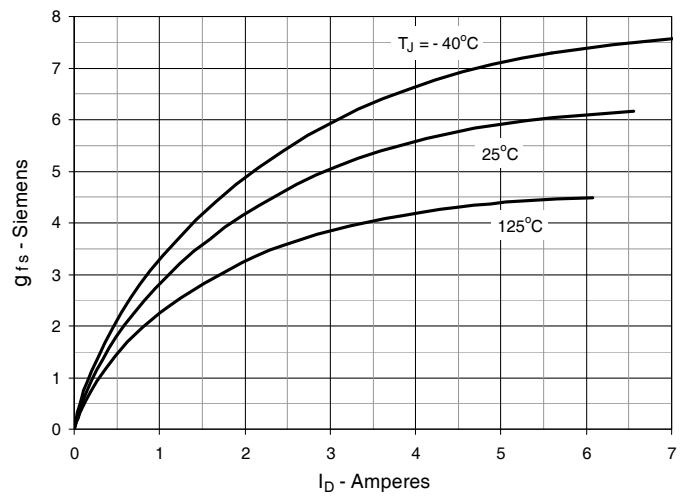


Fig. 9. Forward Voltage Drop of Intrinsic Diode

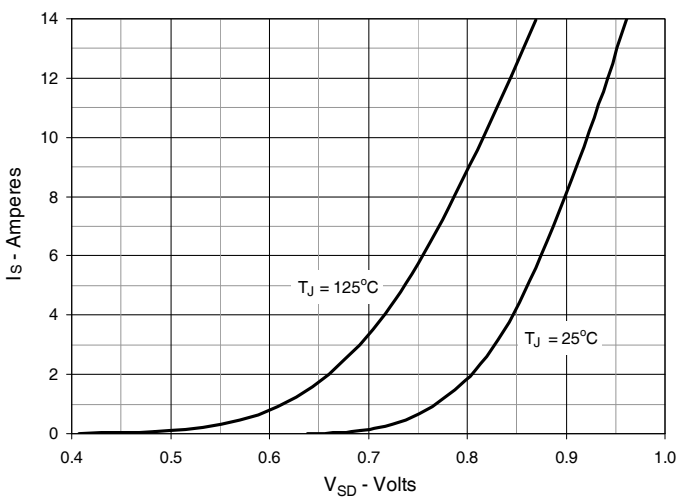


Fig. 10. Gate Charge

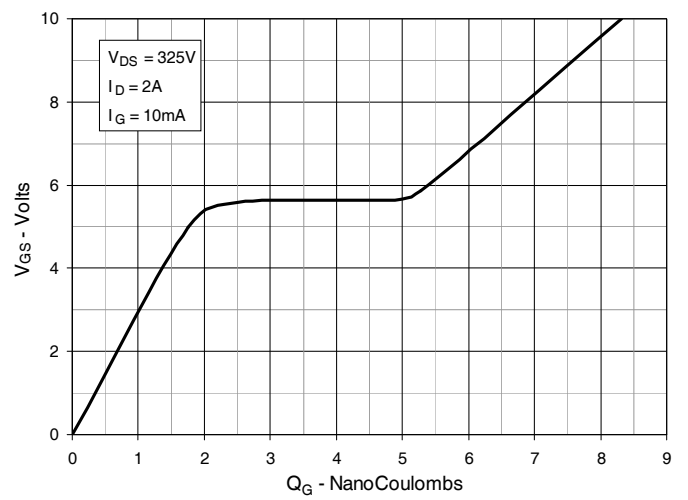


Fig. 11. Capacitance

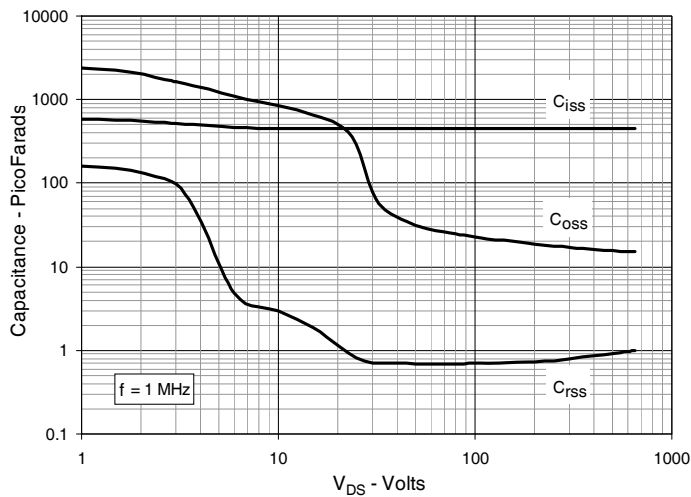


Fig. 12. Output Capacitance Stored Energy

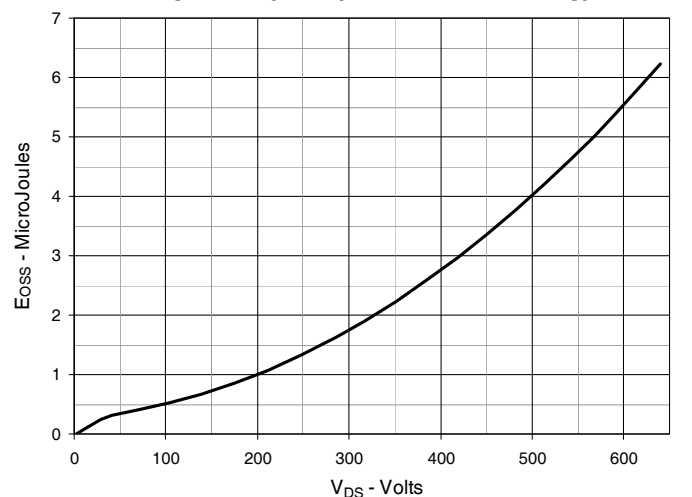


Fig. 13. Forward-Bias Safe Operating Area

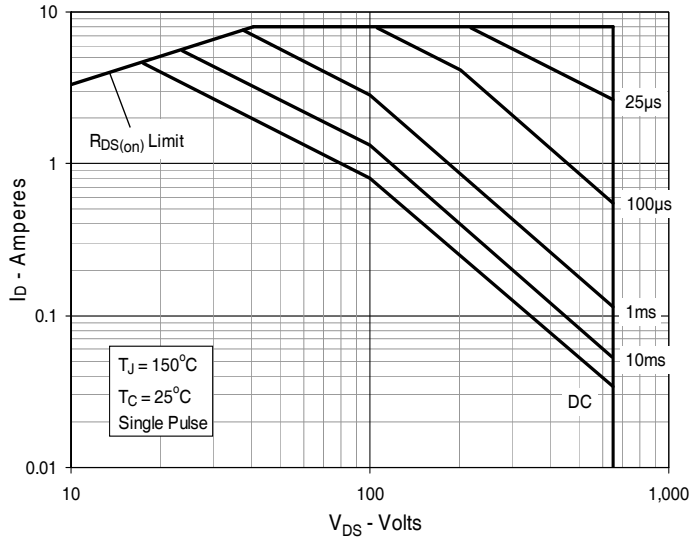
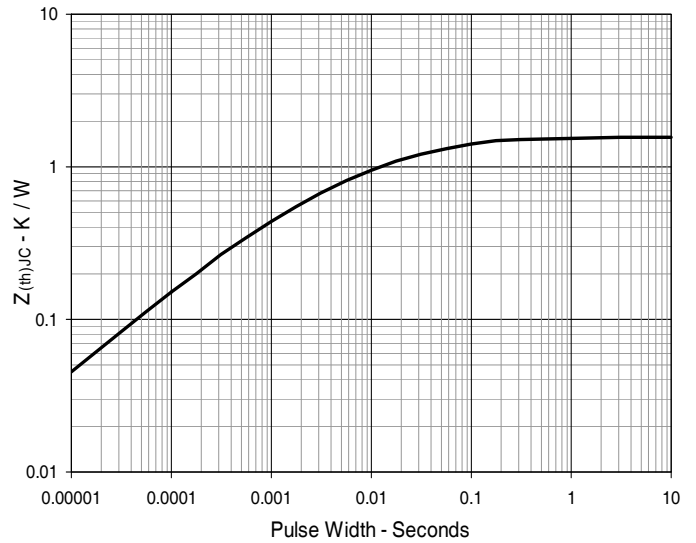
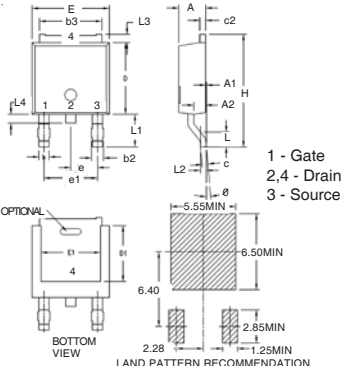


Fig. 14. Maximum Transient Thermal Impedance

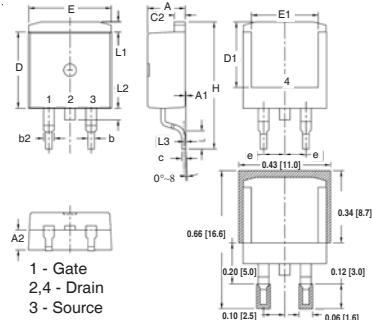


TO-252 AA Outline



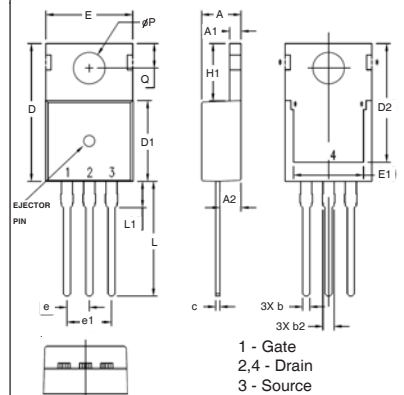
| SYM | INCHES | | MILLIMETERS | |
|-----|----------|------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | .086 | .094 | 2.19 | 2.38 |
| A1 | 0 | .005 | 0 | 0.12 |
| A2 | .038 | .046 | 0.97 | 1.17 |
| b | .025 | .035 | 0.64 | 0.89 |
| b2 | .030 | .045 | 0.76 | 1.14 |
| b3 | .200 | .215 | 5.08 | 5.46 |
| c | .018 | .024 | 0.46 | 0.61 |
| c2 | .018 | .023 | 0.46 | 0.58 |
| D | .235 | .245 | 5.97 | 6.22 |
| D1 | .180 | .205 | 4.57 | 5.21 |
| E | .250 | .265 | 6.35 | 6.73 |
| E1 | .170 | .205 | 4.32 | 5.21 |
| e | .090 BSC | | 2.28 BSC | |
| e1 | .180 BSC | | 4.57 BSC | |
| H | .370 | .410 | 9.40 | 10.42 |
| L | .055 | .070 | 1.40 | 1.78 |
| L1 | .100 | .115 | 2.54 | 2.92 |
| L2 | .020 BSC | | 0.50 BSC | |
| L3 | .025 | .040 | 0.64 | 1.02 |
| L4 | .025 | .040 | 0.64 | 1.02 |
| θ | 0° | 10° | 0° | 10° |

TO-263 Outline



| SYM | INCHES | | MILLIMETER | |
|-----|----------|------|------------|-------|
| | MIN | MAX | MIN | MAX |
| A | .170 | .185 | 4.30 | 4.70 |
| A1 | .000 | .008 | 0.00 | 0.20 |
| A2 | .091 | .098 | 2.30 | 2.50 |
| b | .028 | .035 | 0.70 | 0.90 |
| b2 | .046 | .060 | 1.18 | 1.52 |
| C | .018 | .024 | 0.45 | 0.60 |
| C2 | .049 | .060 | 1.25 | 1.52 |
| D | .340 | .370 | 8.63 | 9.40 |
| D1 | .300 | .327 | 7.62 | 8.30 |
| E | .380 | .410 | 9.65 | 10.41 |
| E1 | .270 | .330 | 6.86 | 8.38 |
| e | .100 BSC | | 2.54 BSC | |
| H | .580 | .620 | 14.73 | 15.75 |
| L | .075 | .105 | 1.91 | 2.67 |
| L1 | .039 | .060 | 1.00 | 1.52 |
| L2 | — .070 | | — 1.77 | |
| L3 | .010 BSC | | 0.254 BSC | |

TO-220 Outline



| SYM | INCHES | | MILLIMETERS | |
|------|----------|------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | .169 | .185 | 4.30 | 4.70 |
| A1 | .047 | .055 | 1.20 | 1.40 |
| A2 | .079 | .106 | 2.00 | 2.70 |
| b | .024 | .039 | 0.60 | 1.00 |
| b2 | .045 | .057 | 1.15 | 1.45 |
| c | .014 | .026 | 0.35 | 0.65 |
| D | .587 | .626 | 14.90 | 15.90 |
| D1 | .335 | .370 | 8.50 | 9.40 |
| (D2) | .500 | .531 | 12.70 | 13.50 |
| E | .382 | .406 | 9.70 | 10.30 |
| (E1) | .283 | .323 | 7.20 | 8.20 |
| e | .100 BSC | | 2.54 BSC | |
| e1 | .200 BSC | | 5.08 BSC | |
| H1 | .244 | .268 | 6.20 | 6.80 |
| L | .492 | .547 | 12.50 | 13.90 |
| L1 | .110 | .154 | 2.80 | 3.90 |
| ∅P | .134 | .150 | 3.40 | 3.80 |
| Q | .106 | .126 | 2.70 | 3.20 |



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