



JMP(C.F.H.I.K.N.Y)2N60A

Description

JMP N-channel MOSFET

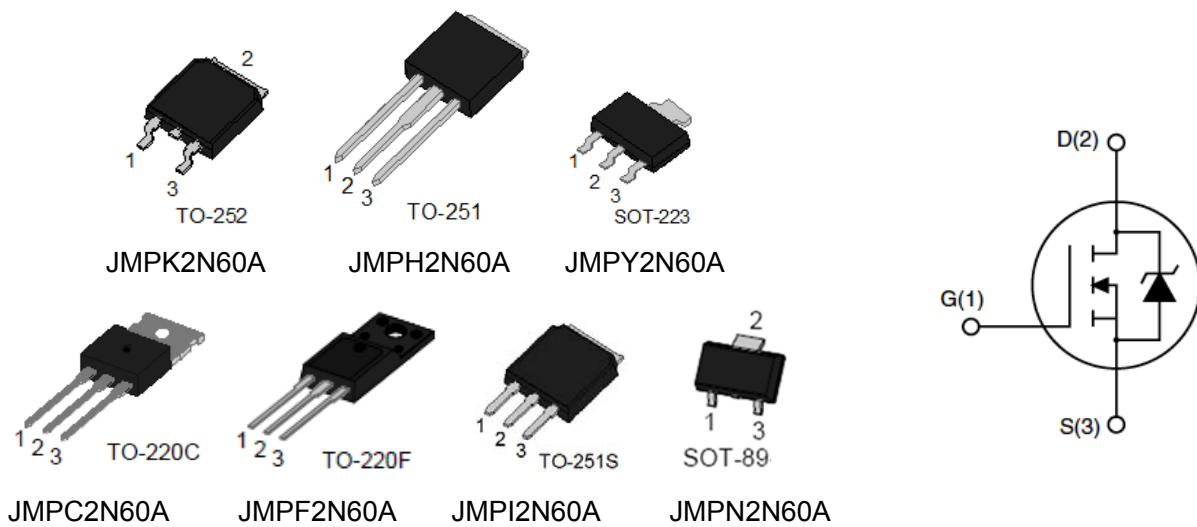
Features

- 600V, 2A
- $R_{DS(ON)} = 4.3\Omega$ (Typ.) @ $V_{GS} = 10V, I_D = 1A$
- Fast Switching
- Improved dv/dt Capability
- 100% Avalanche Tested

Application

- Switch Mode Power Supply(SMPS)
- Charger, LED
- Power Factor Correction (PFC)

Package



Absolute Maximum Ratings (T_C=25°C unless otherwise specified)

| Symbol | Parameter | Max. | | | | Units | |
|-----------------------------------|-------------------------------------------------|-------------------------------|---------|---------|--------------------|-------|------|
| | | TO-251/ TO-252/ TO-251S | TO-220F | TO-220C | SOT-89/ SOT-223 | | |
| V _{DSS} | Drain-Source Voltage | 600 | | | | V | |
| V _{GSS} | Gate-Source Voltage | ±30 | | | | V | |
| I _D | Continuous Drain Current | T _C = 25°C | 2 | | | A | |
| | | T _C = 100°C | 1.2 | | | A | |
| I _{DM} | Pulsed Drain Current ^{note1} | 8 | | | | A | |
| E _{AS} | Single Pulsed Avalanche Energy ^{note2} | 6.4 | | | | mJ | |
| P _D | Power Dissipation | T _C = 25°C | 25 | 20 | 32.5 | 9.6 | W |
| R _{θJC} | Thermal Resistance, Junction to Case | | 5 | 6.25 | 3.85 | 13 | °C/W |
| R _{θJA} | Thermal Resistance, Junction to Ambient | | 60 | 62.5 | 60 | 65 | °C/W |
| T _J , T _{STG} | Operating and Storage Temperature Range | -55 to +150 | | | | °C | |



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Electrical Characteristics ($T_C=25^\circ\text{C}$ unless otherwise specified)

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Units |
|---------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------|------|------|-----------|----------|
| Off Characteristic | | | | | | |
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}=0V, I_D=250\mu A$ | 600 | - | - | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 600V, V_{GS} = 0V,$ $T_J = 25^\circ\text{C}$ | - | - | 1 | μA |
| I_{GSS} | Gate to Body Leakage Current | $V_{DS} = 0V, V_{GS} = \pm 30V$ | - | - | ± 100 | nA |
| On Characteristics | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}, I_D = 250\mu A$ | 2.0 | 3.0 | 4.0 | V |
| $R_{DS(on)}$ <small>note3</small> | Static Drain-Source on-Resistance | $V_{GS} = 10V, I_D = 1.0A$ | - | 4.3 | 5 | Ω |
| Dynamic Characteristics | | | | | | |
| C_{iss} | Input Capacitance | $V_{DS} = 25V, V_{GS} = 0V,$ $f = 1.0\text{MHz}$ | - | 310 | - | pF |
| C_{oss} | Output Capacitance | | - | 39 | - | pF |
| C_{riss} | Reverse Transfer Capacitance | | - | 6 | - | pF |
| Q_g | Total Gate Charge | $V_{DD} = 480V, I_D = 2.0A,$ $V_{GS} = 10V$ | - | 8 | - | nC |
| Q_{gs} | Gate-Source Charge | | - | 1.2 | - | nC |
| Q_{gd} | Gate-Drain("Miller") Charge | | - | 5.0 | - | nC |
| Switching Characteristics | | | | | | |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD} = 250V, I_D = 2.0A,$ $R_G = 25\Omega$ | - | 7.8 | - | ns |
| t_r | Turn-on Rise Time | | - | 33 | - | ns |
| $t_{d(off)}$ | Turn-off Delay Time | | - | 23 | - | ns |
| t_f | Turn-off Fall Time | | - | 59 | - | ns |
| Drain-Source Diode Characteristics and Maximum Ratings | | | | | | |
| I_S | Maximum Continuous Drain to Source Diode Forward Current | | - | - | 2 | A |
| I_{SM} | Maximum Pulsed Drain to Source Diode Forward Current | | - | - | 8 | A |
| V_{SD} | Drain to Source Diode Forward Voltage | $V_{GS} = 0V, I_{SD} = 2.0A$ | - | - | 1.4 | V |
| t_{rr} | Reverse Recovery Time | $V_{GS} = 0V, I_S = 2.0A,$ $di/dt = 100A/\mu s$ | - | 80 | - | ns |
| Q_{rr} | Reverse Recovery Charge | | - | 1.8 | - | μC |

Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. $I_{AS} = 2.0A, V_{DD} = 50V, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}$

3. Pulse Test: Pulse Width $\leq 300\mu s, \text{Duty Cycle} \leq 1\%$



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Typical Performance Characteristics

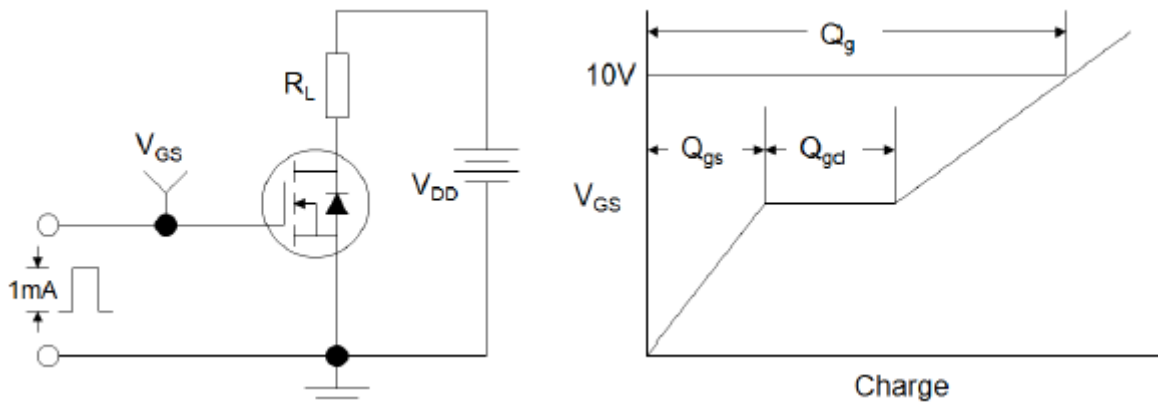


Figure1:Gate Charge Test Circuit & Waveform

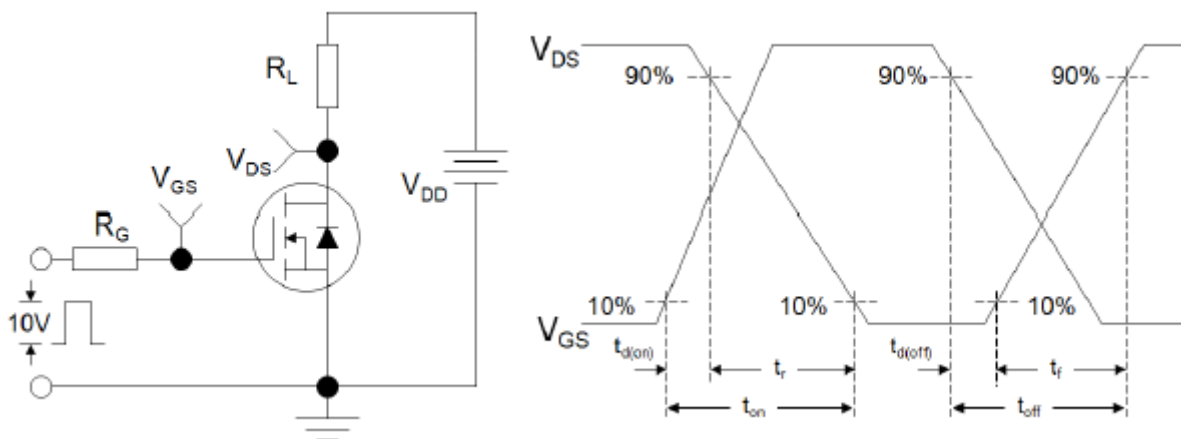


Figure 2: Resistive Switching Test Circuit & Waveforms

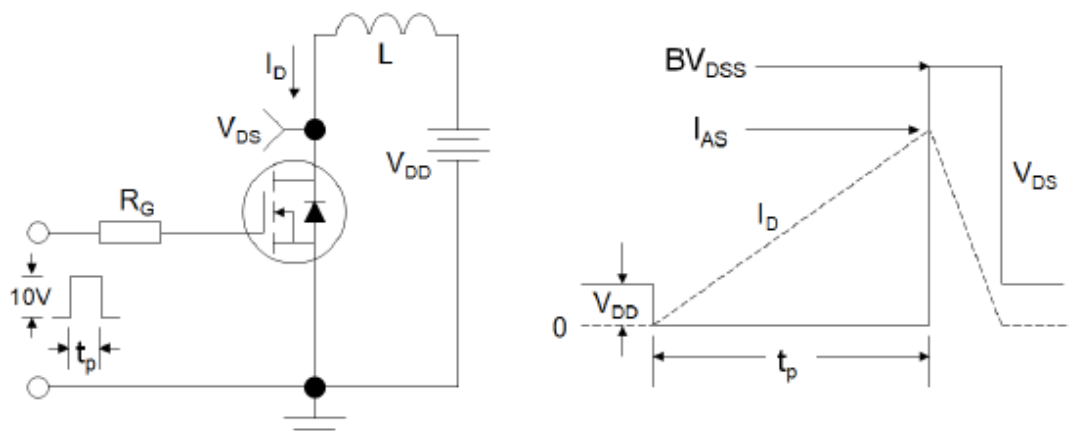


Figure 3:Unclamped Inductive Switching Test Circuit & Waveforms



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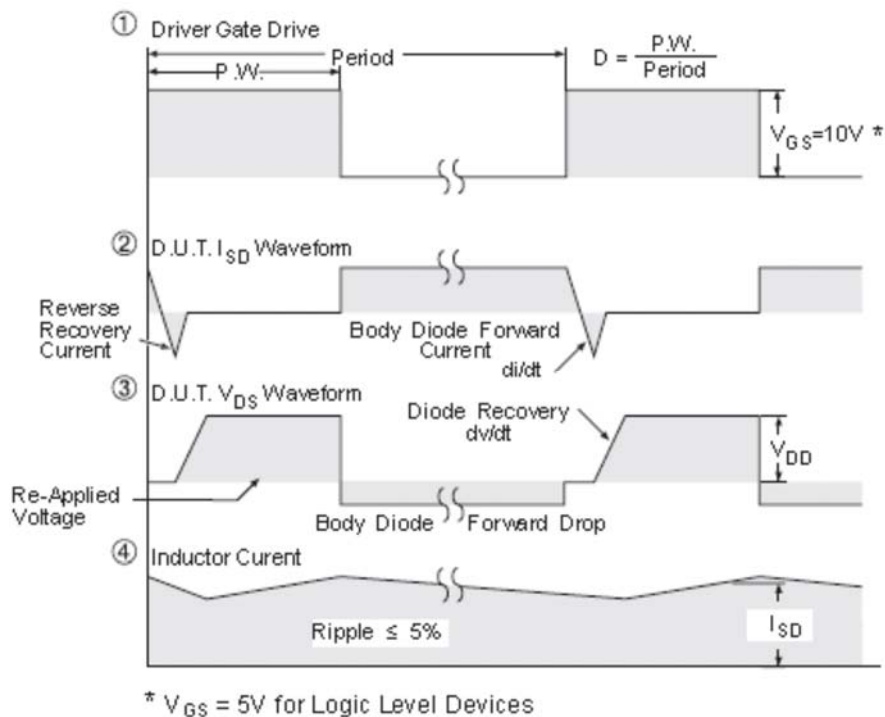
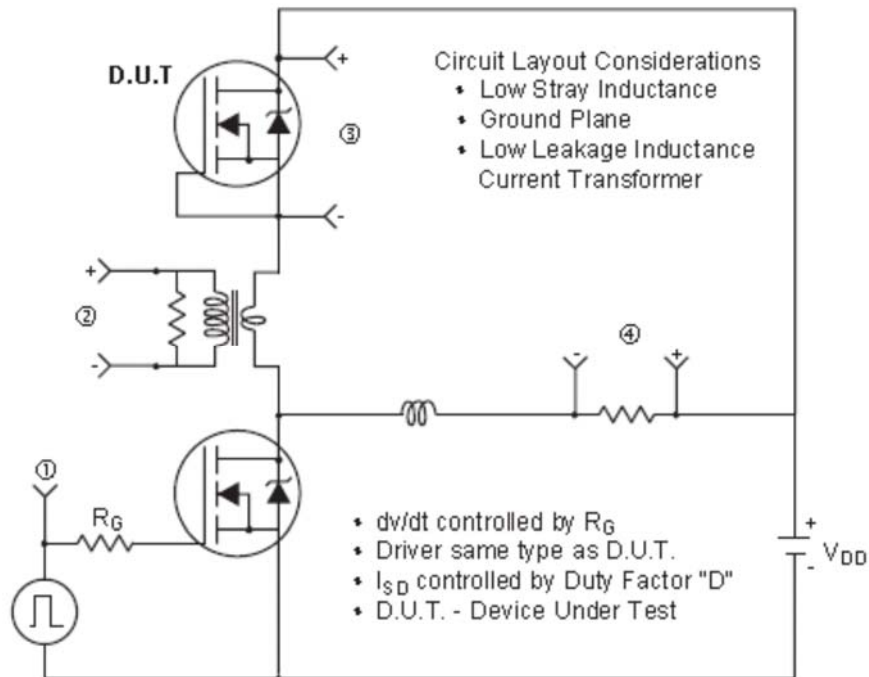
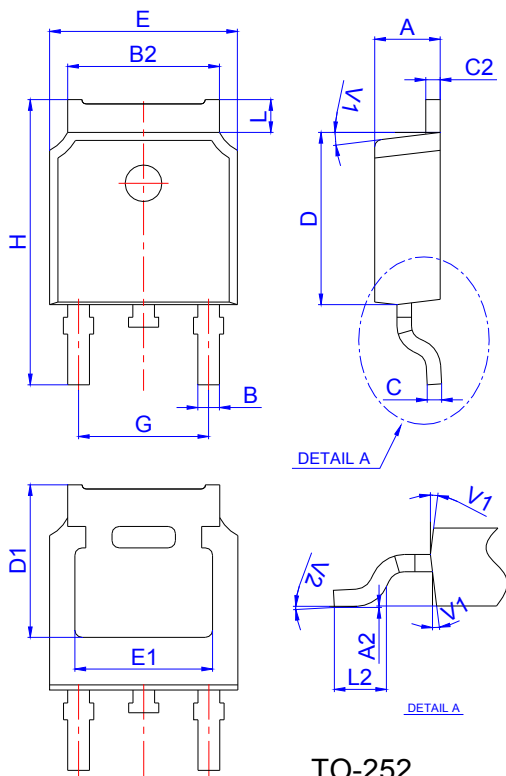


Figure 4: Peak Diode Recovery dv/dt Test Circuit & Waveforms (For N-channel)



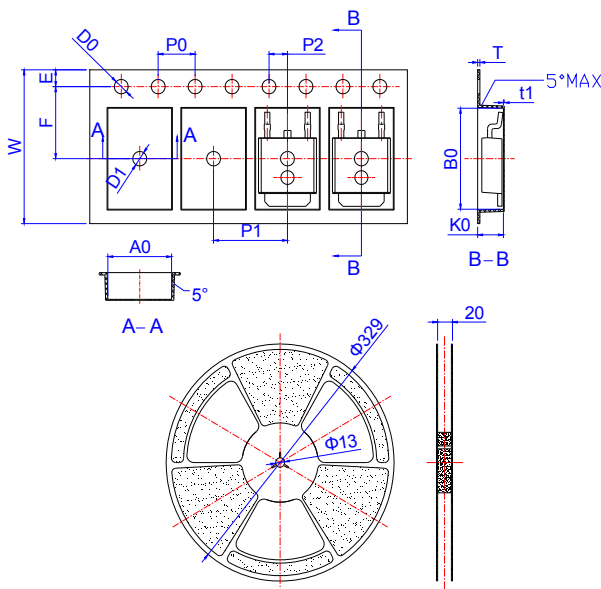
JMP(C.F.H.I.K.N.Y)2N60A

Package Mechanical Data



| Ref. | Dimensions | | | | | |
|------|-------------|------|-------|----------|------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 2.10 | | 2.50 | 0.083 | | 0.098 |
| A2 | 0 | | 0.10 | 0 | | 0.004 |
| B | 0.66 | | 0.86 | 0.026 | | 0.034 |
| B2 | 5.18 | | 5.48 | 0.202 | | 0.216 |
| C | 0.40 | | 0.60 | 0.016 | | 0.024 |
| C2 | 0.44 | | 0.58 | 0.017 | | 0.023 |
| D | 5.90 | | 6.30 | 0.232 | | 0.248 |
| D1 | 5.30REF | | | 0.209REF | | |
| E | 6.40 | | 6.80 | 0.252 | | 0.268 |
| E1 | 4.63 | | | 0.182 | | |
| G | 4.47 | | 4.67 | 0.176 | | 0.184 |
| H | 9.50 | | 10.70 | 0.374 | | 0.421 |
| L | 1.09 | | 1.21 | 0.043 | | 0.048 |
| L2 | 1.35 | | 1.65 | 0.053 | | 0.065 |
| V1 | | 7° | | | 7° | |
| V2 | 0° | | 6° | 0° | | 6° |

Reel Specification-TO-252



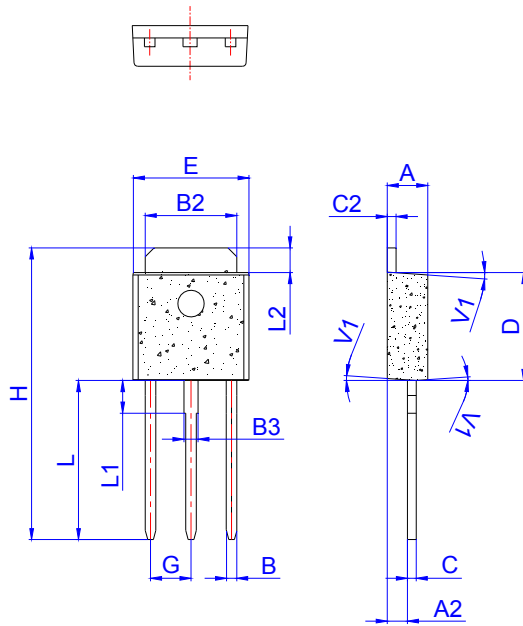
| Ref. | Dimensions | | | | | |
|------|-------------|-------|-------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| W | 15.90 | 16.00 | 16.10 | 0.626 | 0.630 | 0.634 |
| E | 1.65 | 1.75 | 1.85 | 0.065 | 0.069 | 0.073 |
| F | 7.40 | 7.50 | 7.60 | 0.291 | 0.295 | 0.299 |
| D0 | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 |
| D1 | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 |
| P0 | 3.90 | 4.00 | 4.10 | 0.154 | 0.157 | 0.161 |
| P1 | 7.90 | 8.00 | 8.10 | 0.311 | 0.315 | 0.319 |
| P2 | 1.90 | 2.00 | 2.10 | 0.075 | 0.079 | 0.083 |
| A0 | 6.85 | 6.90 | 7.00 | 0.270 | 0.271 | 0.276 |
| B0 | 10.45 | 10.50 | 10.60 | 0.411 | 0.413 | 0.417 |
| K0 | 2.68 | 2.78 | 2.88 | 0.105 | 0.109 | 0.113 |
| T | 0.24 | | 0.27 | 0.009 | | 0.011 |
| t1 | 0.10 | | | 0.004 | | |
| 10P0 | 39.80 | 40.00 | 40.20 | 1.567 | 1.575 | 1.583 |

| OUTLINE | REEL (PCS) | PER CARTON (PCS) | TAPE & REEL |
|---------|------------|------------------|-------------|
| TAPING | 2,500 | 25,000 | 13inch |



JMP(C.F.H.I.K.N.Y)2N60A

Package Mechanical Data



TO-251

| Ref. | Dimensions | | | | | |
|------|-------------|------|------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 2.20 | | 2.40 | 0.086 | | 0.095 |
| A2 | 0.90 | | 1.20 | 0.035 | | 0.047 |
| B | 0.55 | | 0.65 | 0.022 | | 0.026 |
| B2 | 5.10 | | 5.40 | 0.200 | | 0.213 |
| B3 | 0.76 | | 0.85 | 0.030 | | 0.033 |
| C | 0.45 | | 0.62 | 0.018 | | 0.024 |
| C2 | 0.48 | | 0.62 | 0.019 | | 0.024 |
| D | 6.00 | | 6.20 | 0.236 | | 0.244 |
| E | 6.40 | | 6.70 | 0.252 | | 0.264 |
| G | | 2.30 | | | 0.091 | |
| H | 16.0 | | 17.0 | 0.630 | | 0.669 |
| L | 8.90 | | 9.40 | 0.350 | | 0.370 |
| L1 | 1.80 | | 1.90 | 0.071 | | 0.075 |
| L2 | 1.37 | | 1.50 | 0.054 | | 0.059 |
| V1 | | 4° | | | 4° | |

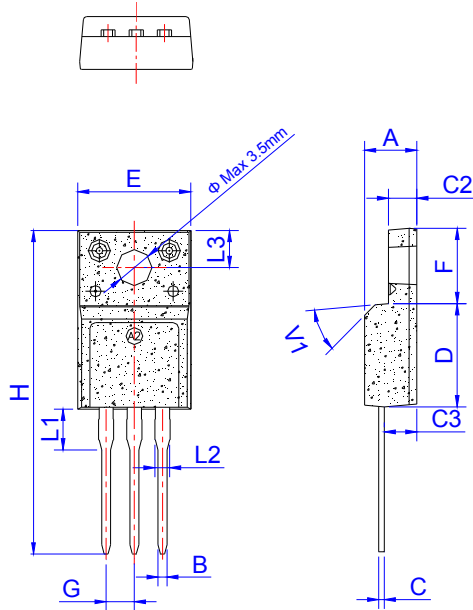
Package Information -TO-251

| OUTLINE | TUBE (PCS) | INNER BOX (PCS) | PER CARTON (PCS) |
|---------|------------|-----------------|------------------|
| TUBE | 80 | 4,000 | 32,000 |



JMP(C.F.H.I.K.N.Y)2N60A

Package Mechanical Data



TO-220F

| Ref. | Dimensions | | | | | |
|------|-------------|------|------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 4.50 | | 4.90 | 0.177 | | 0.193 |
| B | 0.74 | 0.80 | 0.83 | 0.029 | 0.031 | 0.033 |
| C | 0.47 | | 0.65 | 0.019 | | 0.026 |
| C2 | 2.45 | | 2.75 | 0.096 | | 0.108 |
| C3 | 2.60 | | 3.00 | 0.102 | | 0.118 |
| D | 8.80 | | 9.30 | 0.346 | | 0.366 |
| E | 9.80 | | 10.4 | 0.386 | | 0.410 |
| F | 6.40 | | 6.80 | 0.252 | | 0.268 |
| G | | 2.54 | | | 0.1 | |
| H | 28.0 | | 29.8 | 1.102 | | 1.173 |
| L1 | | 3.63 | | | 0.143 | |
| L2 | 1.14 | | 1.70 | 0.045 | | 0.067 |
| L3 | | 3.30 | | | 0.130 | |
| V1 | | 45° | | | 45° | |

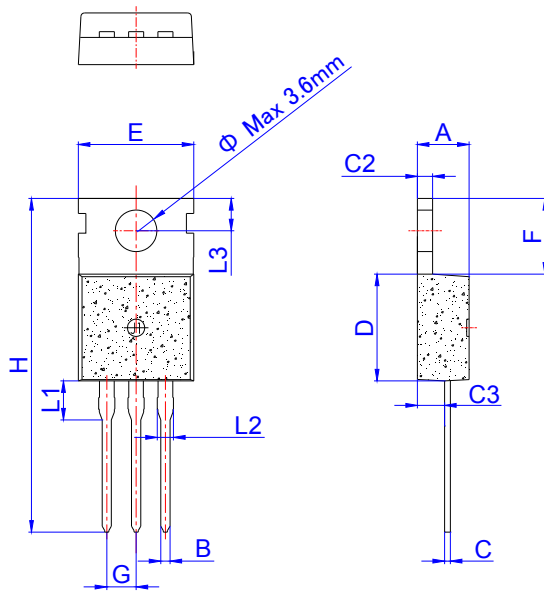
Package Information -TO-220F

| OUTLINE | TUBE (PCS) | INNER BOX (PCS) | PER CARTON (PCS) |
|---------|------------|-----------------|------------------|
| TUBE | 50 | 1,000 | 8,000 |



JMP(C.F.H.I.K.N.Y)2N60A

Package Mechanical Data



TO-220C

| Ref. | Dimensions | | | | | |
|------|-------------|------|------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 4.40 | | 4.60 | 0.173 | | 1.181 |
| B | 0.70 | | 0.90 | 0.027 | | 0.035 |
| C | 0.45 | | 0.60 | 0.018 | | 0.024 |
| C2 | 1.23 | | 1.32 | 0.048 | | 0.052 |
| C3 | 2.20 | | 2.60 | 0.086 | | 0.102 |
| D | 8.90 | | 9.90 | 0.350 | | 0.390 |
| E | 9.90 | | 10.3 | 0.390 | | 0.406 |
| F | 6.30 | | 6.90 | 0.248 | | 0.272 |
| G | | 2.54 | | | 0.1 | |
| H | 28.0 | | 29.8 | 11.0 | | 11.7 |
| L1 | | 3.39 | | | 0.133 | |
| L2 | 1.14 | | 1.70 | 0.045 | | 0.067 |
| L3 | 2.65 | | 2.95 | 0.104 | | 0.116 |
| Φ | | 3.6 | | | 0.142 | |

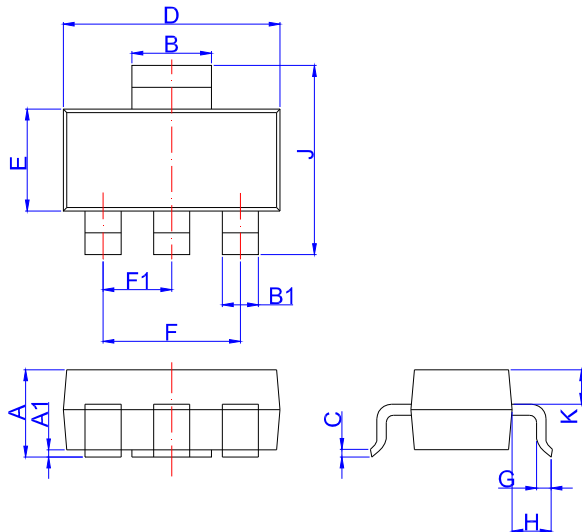
Package Information -TO-220C

| OUTLINE | TUBE (PCS) | INNER BOX (PCS) | PER CARTON (PCS) |
|---------|------------|-----------------|------------------|
| TUBE | 50 | 1,000 | 8,000 |



JMP(C.F.H.I.K.N.Y)2N60A

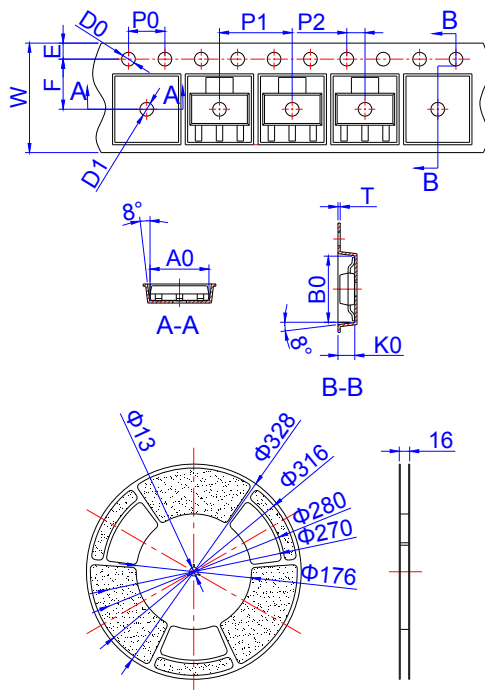
Package Mechanical Data



SOT-223

| Ref. | Dimensions | | | | | |
|------|-------------|------|------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 1.5 | 1.6 | 1.8 | 0.059 | 0.063 | 0.071 |
| A1 | 0.01 | 0.06 | 0.10 | 0.001 | 0.002 | 0.004 |
| B | 2.9 | 3.0 | 3.1 | 0.114 | 0.118 | 0.122 |
| B1 | 0.6 | 0.7 | 0.8 | 0.024 | 0.028 | 0.031 |
| C | 0.22 | 0.26 | 0.32 | 0.009 | 0.010 | 0.013 |
| D | 6.3 | 6.5 | 6.7 | 0.248 | 0.256 | 0.264 |
| E | 3.3 | 3.5 | 3.7 | 0.130 | 0.138 | 0.146 |
| F | | 4.6 | | | 0.181 | |
| F1 | | 2.3 | | | 0.091 | |
| G | 0.7 | 0.9 | 1.1 | 0.028 | 0.035 | 0.043 |
| H | 1.5 | 1.75 | 2.0 | 0.059 | 0.069 | 0.079 |
| J | 6.7 | 7.0 | 7.3 | 0.264 | 0.276 | 0.287 |
| K | 0.8 | 0.9 | 1.0 | 0.031 | 0.035 | 0.039 |

Reel Specification-SOT-223



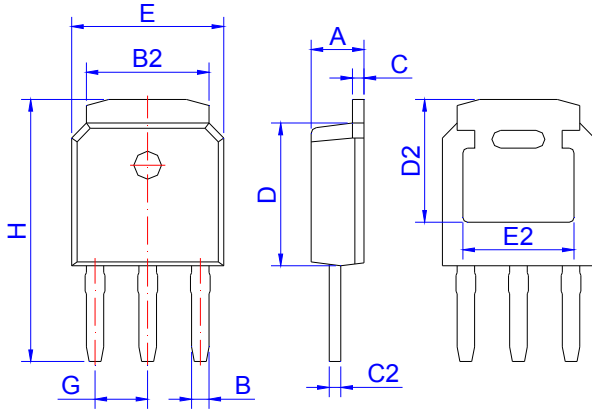
| Ref. | Dimensions | | | | | |
|------|-------------|-------|-------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| W | 12.00 | | 12.20 | 0.472 | | 0.483 |
| E | 1.65 | 1.75 | 1.85 | 0.065 | 0.069 | 0.073 |
| F | 5.45 | 5.50 | 5.55 | 0.214 | 0.217 | 0.219 |
| D0 | 1.50 | | 1.60 | 0.059 | | 0.063 |
| D1 | 1.55 | | 1.80 | 0.061 | | 0.071 |
| P0 | 3.90 | 4.00 | 4.10 | 0.154 | 0.157 | 0.161 |
| P1 | 7.90 | 8.00 | 8.10 | 0.311 | 0.315 | 0.319 |
| P2 | 1.95 | 2.00 | 2.05 | 0.077 | 0.079 | 0.081 |
| 10P0 | 39.80 | 40.00 | 40.20 | 1.567 | 1.575 | 1.583 |
| A0 | 6.73 | 6.83 | 6.93 | 0.265 | 0.269 | 0.273 |
| B0 | 7.30 | 7.40 | 7.50 | 0.287 | 0.291 | 0.295 |
| K0 | 1.78 | 1.88 | 1.98 | 0.070 | 0.074 | 0.078 |
| T | 0.25 | 0.30 | 0.35 | 0.010 | 0.012 | 0.014 |

| OUTLINE | REEL (PCS) | PER CARTON (PCS) | TAPE & REEL |
|---------|------------|------------------|-------------|
| TAPING | 4,000 | 40,000 | 13inch |



JMP(C.F.H.I.K.N.Y)2N60A

Package Mechanical Data



TO-251S

| Ref. | Dimensions | | | | | |
|------|-------------|-------|-------|-----------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 2.10 | 2.30 | 2.50 | 0.083 | 0.091 | 0.098 |
| B | 0.66 | 0.76 | 0.86 | 0.026 | 0.030 | 0.034 |
| B2 | 5.15 | 5.33 | 5.48 | 0.203 | 0.210 | 0.216 |
| C | 0.44 | 0.51 | 0.58 | 0.017 | 0.020 | 0.023 |
| C2 | 0.44 | 0.51 | 0.58 | 0.017 | 0.020 | 0.023 |
| D | 5.90 | 6.10 | 6.30 | 0.232 | 0.240 | 0.248 |
| D2 | 5.30 REF | | | 0.209 REF | | |
| E | 6.40 | 6.60 | 6.80 | 0.252 | 0.260 | 0.268 |
| E2 | 4.83 REF | | | 0.190 REF | | |
| G | 2.19 | 2.29 | 2.39 | 0.086 | 0.090 | 0.094 |
| H | 10.60 | 11.20 | 11.80 | 0.417 | 0.441 | 0.465 |

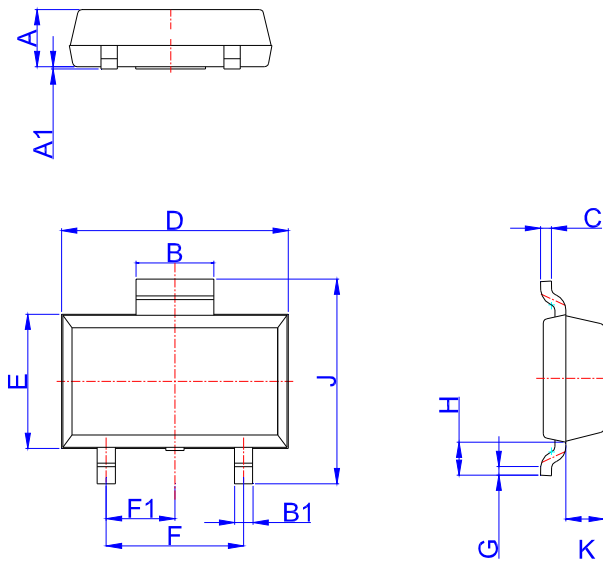
Package Information-TO-251S

| OUTLINE | TUBE (PCS) | INNER BOX (PCS) | PER CARTON (PCS) |
|---------|------------|-----------------|------------------|
| TUBE | 80 | 4,000 | 32,000 |



JMP(C.F.H.I.K.N.Y)2N60A

Package Mechanical Data



SOT-89

| Ref. | Dimensions | | | | | |
|------|-------------|-------|------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 1.3 | 1.4 | 1.5 | 0.051 | 0.055 | 0.059 |
| A1 | 0.01 | 0.06 | 0.10 | 0.001 | 0.002 | 0.004 |
| B | 1.6 | 1.7 | 1.8 | 0.063 | 0.067 | 0.071 |
| B1 | 0.3 | 0.4 | 0.5 | 0.012 | 0.016 | 0.020 |
| C | 0.22 | 0.254 | 0.32 | 0.009 | 0.010 | 0.013 |
| D | 4.75 | 4.95 | 5.15 | 0.187 | 0.195 | 0.203 |
| E | 2.75 | 2.95 | 3.15 | 0.108 | 0.116 | 0.124 |
| F | | 3.0 | | | 0.118 | |
| F1 | | 1.5 | | | 0.059 | |
| G | 0.2 | 0.3 | 0.4 | 0.008 | 0.012 | 0.016 |
| H | 0.58 | 0.78 | 0.98 | 0.023 | 0.031 | 0.039 |
| J | 4.3 | 4.5 | 4.7 | 0.169 | 0.177 | 0.185 |
| K | | 0.88 | | | 0.035 | |

Package Information-SOT-89

| OUTLINE | REEL (PCS) | PER CARTON (PCS) | TAPE & REEL |
|---------|------------|------------------|-------------|
| TAPING | 4,000 | 40,000 | 13inch |

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