

## N-Channel Enhancement Mode MOSFET

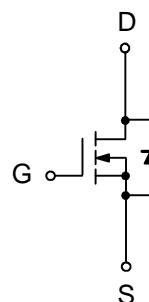
### Features

- 25V/50A ,  
 $R_{DS(ON)}=7.5m\Omega$  (typ.) @  $V_{GS}=10V$   
 $R_{DS(ON)}=13m\Omega$  (typ.) @  $V_{GS}=4.5V$
- Super High Dense Cell Design
- Avalanche Rated
- Reliable and Rugged
- Lead Free Available (RoHS Compliant)

### Pin Description



Top View of TO-220




N-Channel MOSFET

### Applications

- Power Management in Computer or SPS Systems

### Ordering and Marking Information

|   |  |
|---|--|
| <p>APM2509N □□-□□ □</p> <div style="margin-left: 20px;"> <p>└─ Lead Free Code</p> <p>└─ Handling Code</p> <p>└─ Temp. Range</p> <p>└─ Package Code</p> </div> | <p>Package Code<br/>F : TO-220</p> <p>Operating Junction Temp. Range<br/>C : -55 to 150° C</p> <p>Handling Code<br/>TU : Tube</p> <p>Lead Free Code<br/>L : Lead Free Device</p> |
| <p>APM2509N F : </p>   | <p>XXXXX - Date Code</p>   |

Note: ANPEC lead-free products contain molding compounds and 100% matte tin plate termination finish; which are fully compliant with RoHS and compatible with both SnPb and lead-free soldering operations. ANPEC lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J STD-020C for MSL classification at lead-free peak reflow temperature.

ANPEC reserves the right to make changes to improve reliability or manufacturability without notice, and advise customers to obtain the latest version of relevant information to verify before placing orders.

## Absolute Maximum Ratings

| Symbol   | Parameter                                    | Rating                         | Unit               |
|--|--|--------------------------------|--------------------|
| <b>Common Ratings</b> ( $T_A=25^\circ\text{C}$ Unless Otherwise Noted) |  |                                |                    |
| $V_{DSS}$  | Drain-Source Voltage                         | 25                             | V                  |
| $V_{GSS}$  | Gate-Source Voltage                          | $\pm 20$                       |                    |
| $T_J$  | Maximum Junction Temperature                 | 150                            | $^\circ\text{C}$   |
| $T_{STG}$  | Storage Temperature Range                    | -55 to 150                     | $^\circ\text{C}$   |
| $I_S$  | Diode Continuous Forward Current             | $T_C=25^\circ\text{C}$<br>30   | A                  |
| <b>Mounted on Large Heat Sink</b>                                      |  |                                |                    |
| $I_{DP}$   | 300 $\mu\text{s}$ Pulse Drain Current Tested | $T_C=25^\circ\text{C}$<br>200  | A                  |
|  |  | $T_C=100^\circ\text{C}$<br>170 |                    |
| $I_D$  | Continuous Drain Current                     | $T_C=25^\circ\text{C}$<br>50*  | A                  |
|  |  | $T_C=100^\circ\text{C}$<br>43  |                    |
| $P_D$  | Maximum Power Dissipation                    | $T_C=25^\circ\text{C}$<br>62.5 | W                  |
|  |  | $T_C=100^\circ\text{C}$<br>25  |                    |
| $R_{\theta JC}$  | Thermal Resistance-Junction to Case          | 2                              | $^\circ\text{C/W}$ |
| <b>Mounted on PCB of Minimum Footprint</b>                             |  |                                |                    |
| $I_{DP}$   | 300 $\mu\text{s}$ Pulse Drain Current Tested | $T_A=25^\circ\text{C}$<br>48   | A                  |
|  |  | $T_A=100^\circ\text{C}$<br>30  |                    |
| $I_D$  | Continuous Drain Current                     | $T_A=25^\circ\text{C}$<br>12   | A                  |
|  |  | $T_A=100^\circ\text{C}$<br>7.5 |                    |
| $P_D$  | Maximum Power Dissipation                    | $T_A=25^\circ\text{C}$<br>2    | W                  |
|  |  | $T_A=100^\circ\text{C}$<br>0.8 |                    |
| $R_{\theta JA}$  | Thermal Resistance-Junction to Ambient       | 62.5                           | $^\circ\text{C/W}$ |

Notes :

\* Current limited by bond wire.

## Electrical Characteristics (T<sub>A</sub> = 25°C unless otherwise noted)

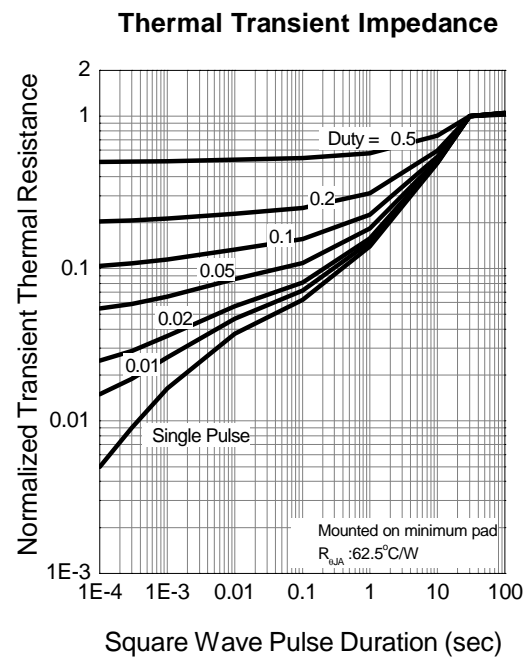
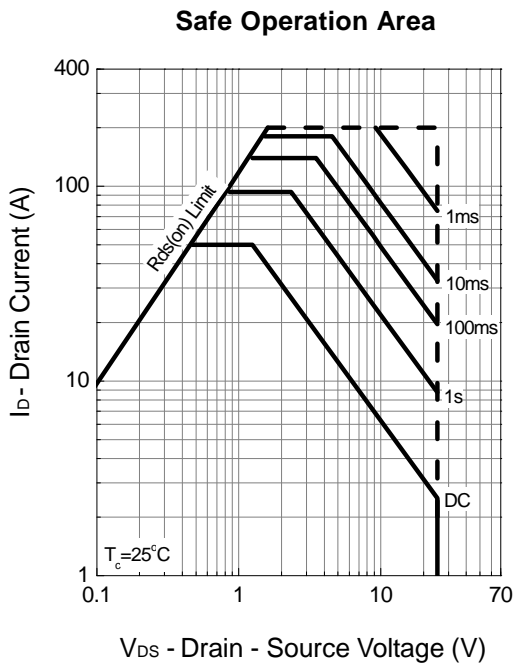
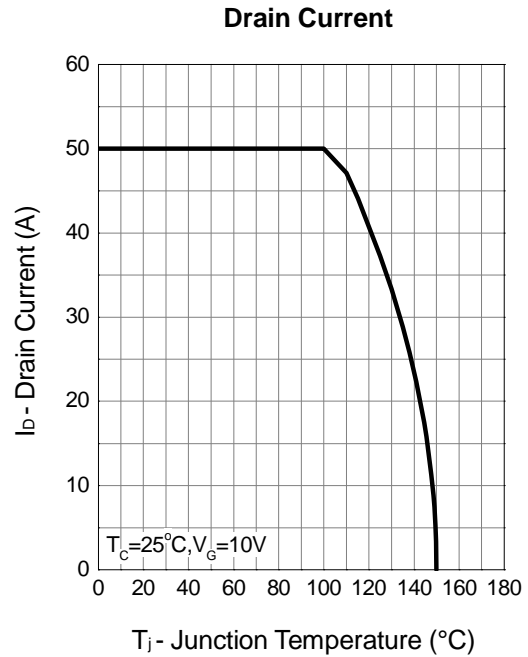
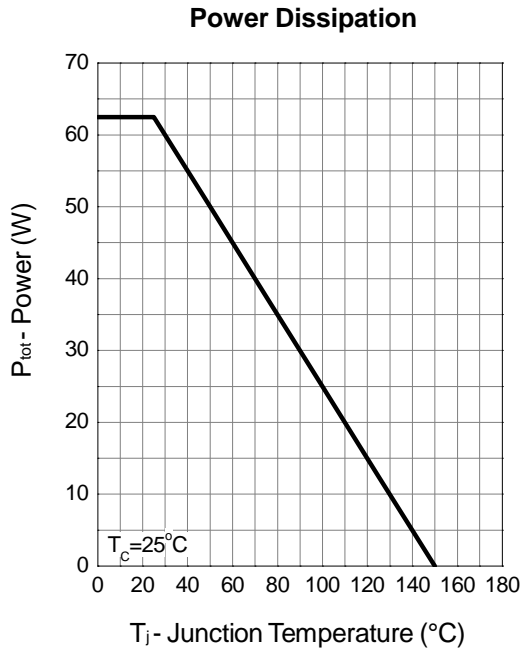
| Symbol   | Parameter                        | Test Condition  | APM2509NF |      |      | Unit |
|--|----------------------------------|---|-----------|------|------|------|
|  |                                  |   | Min.      | Typ. | Max. |      |
| <b>Drain-Source Avalanche Ratings</b>          |                                  |   |           |      |      |      |
| E <sub>AS</sub>                                | Avalanche Energy, Single Pulsed  | I <sub>D</sub> =15A, V <sub>DD</sub> =20V   |           |      | 50   | mJ   |
| <b>Static Characteristics</b>                  |                                  |   |           |      |      |      |
| BV <sub>DSS</sub>                              | Drain-Source Breakdown Voltage   | V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA   | 25        |      |      | V    |
| I <sub>DSS</sub>                               | Zero Gate Voltage Drain Current  | V <sub>DS</sub> =20V, V <sub>GS</sub> =0V<br>T <sub>J</sub> =85°C   |           |      | 1    | μA   |
|  |                                  |   |           |      |      |      |
| V <sub>GS(th)</sub>                            | Gate Threshold Voltage           | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA   | 1.3       | 1.8  | 2.5  | V    |
| I <sub>GSS</sub>                               | Gate Leakage Current             | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V  |           |      | ±100 | nA   |
| R <sub>DS(ON)</sub> <sup>a</sup>               | Drain-Source On-state Resistance | V <sub>GS</sub> =10V, I <sub>DS</sub> =30A  |           | 7.5  | 9    | mΩ   |
|  |                                  | V <sub>GS</sub> =4.5V, I <sub>DS</sub> =15A   |           | 13   | 18   |      |
| <b>Diode Characteristics</b>                   |                                  |   |           |      |      |      |
| V <sub>SD</sub> <sup>a</sup>                   | Diode Forward Voltage            | I <sub>SD</sub> =10A, V <sub>GS</sub> =0V   |           | 0.9  | 1.1  | V    |
| t <sub>rr</sub>                                | Reverse Recovery Time            | I <sub>DS</sub> =10A, dI <sub>SD</sub> /dt=100A/μs  |           | 17   |      | ns   |
| Q <sub>rr</sub>                                | Reverse Recovery Charge          |   |           | 6    |      | nC   |
| <b>Dynamic Characteristics<sup>b</sup></b>     |                                  |   |           |      |      |      |
| R <sub>G</sub>                                 | Gate Resistance                  | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz  |           | 1.8  |      | Ω    |
| C <sub>iss</sub>                               | Input Capacitance                | V <sub>GS</sub> =0V,<br>V <sub>DS</sub> =15V,<br>Frequency=1.0MHz   |           | 1560 |      | pF   |
| C <sub>oss</sub>                               | Output Capacitance               |   |           | 345  |      |      |
| C <sub>rss</sub>                               | Reverse Transfer Capacitance     |   |           | 245  |      |      |
| t <sub>d(ON)</sub>                             | Turn-on Delay Time               | V <sub>DD</sub> =15V, R <sub>L</sub> =15Ω,<br>I <sub>DS</sub> =1A, V <sub>GEN</sub> =10V,<br>R <sub>G</sub> =6Ω |           | 17   |      | ns   |
| T <sub>r</sub>                                 | Turn-on Rise Time                |   |           | 18   |      |      |
| t <sub>d(OFF)</sub>                            | Turn-off Delay Time              |   |           | 41   |      |      |
| T <sub>f</sub>                                 | Turn-off Fall Time               |   |           | 16   |      |      |
| <b>Gate Charge Characteristics<sup>b</sup></b> |                                  |   |           |      |      |      |
| Q <sub>g</sub>                                 | Total Gate Charge                | V <sub>DS</sub> =15V, V <sub>GS</sub> =4.5V,<br>I <sub>DS</sub> =30A  |           | 17.5 | 26   | nC   |
| Q <sub>gs</sub>                                | Gate-Source Charge               |   |           | 5    |      |      |
| Q <sub>gd</sub>                                | Gate-Drain Charge                |   |           | 11   |      |      |

Notes :

a : Pulse test ; pulse width ≤ 300μs, duty cycle ≤ 2%.

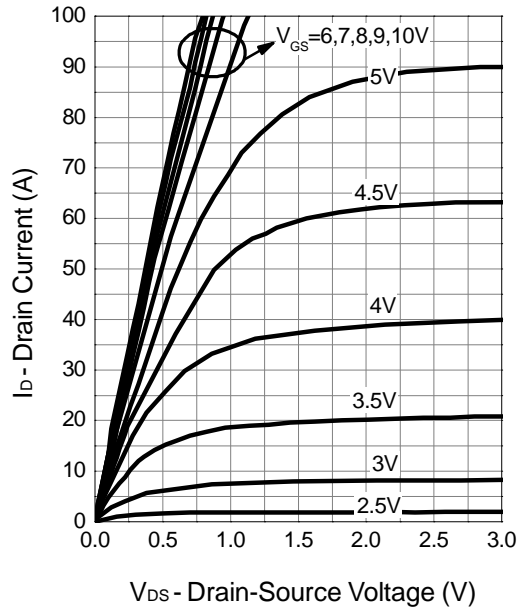
b : Guaranteed by design, not subject to production testing.

## Typical Characteristics

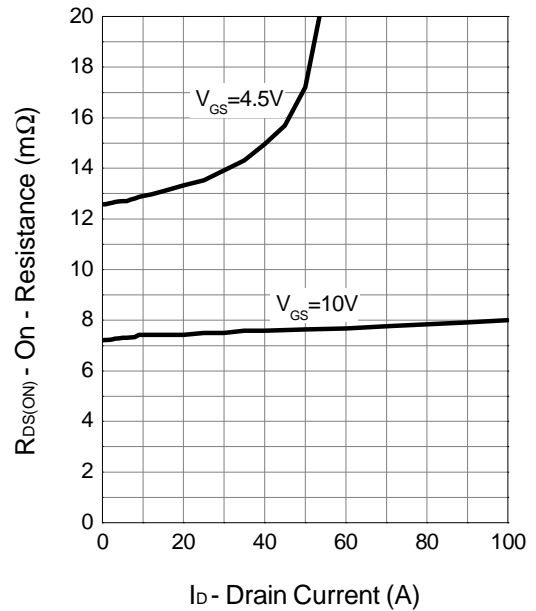


Typical Characteristics (Cont.)

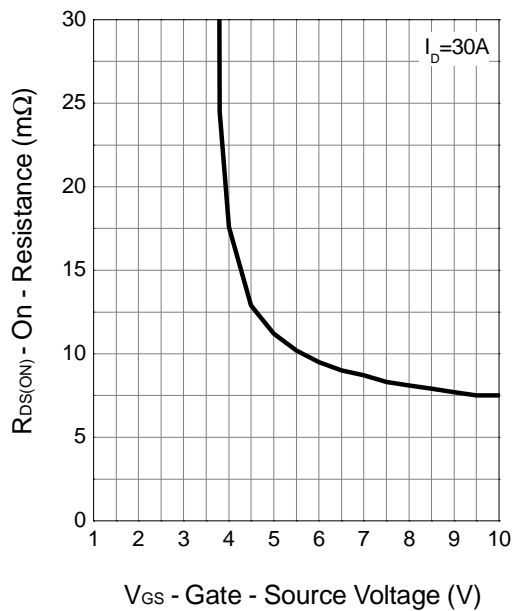
Output Characteristics



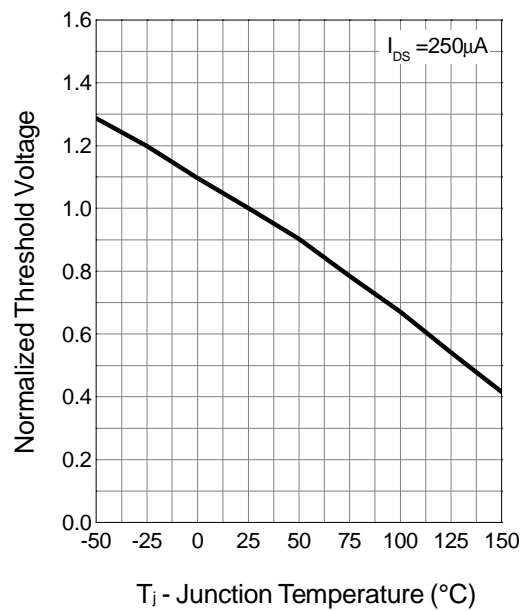
Drain-Source On Resistance



Gate-Source On Resistance

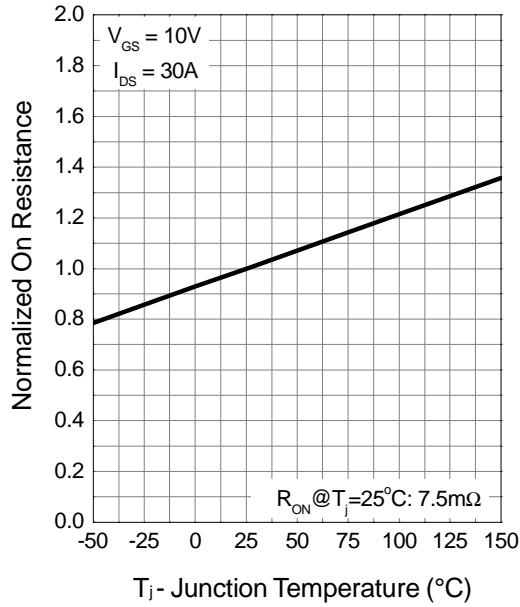


Gate Threshold Voltage

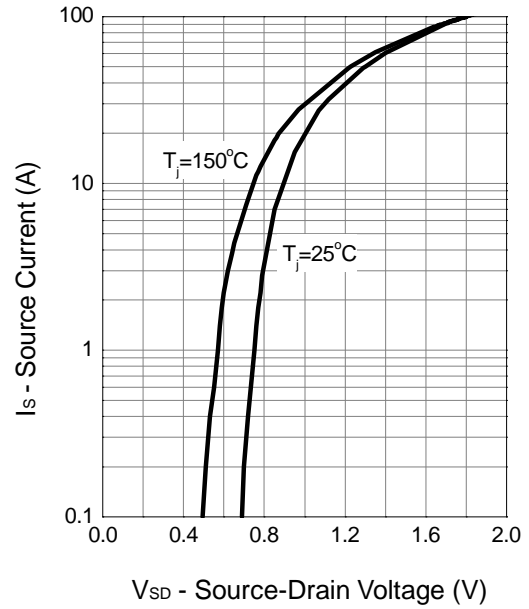


Typical Characteristics (Cont.)

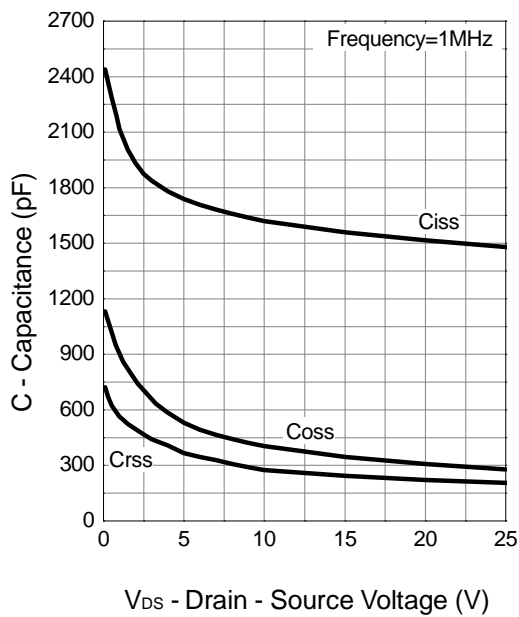
Drain-Source On Resistance



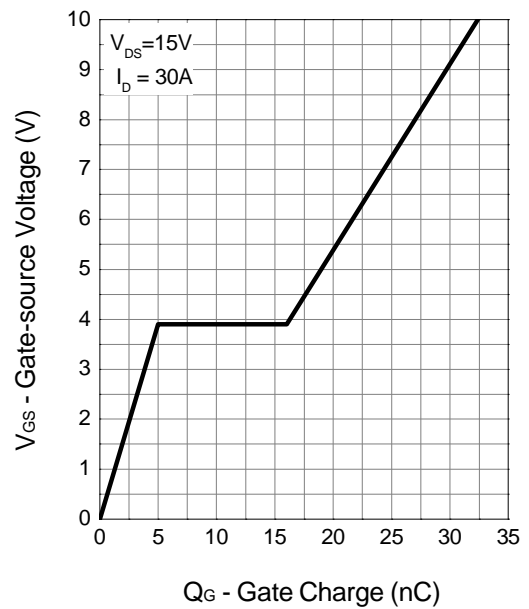
Source-Drain Diode Forward



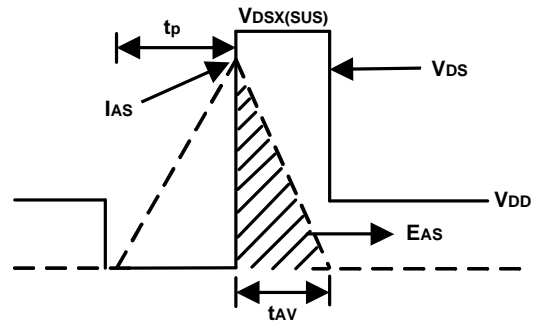
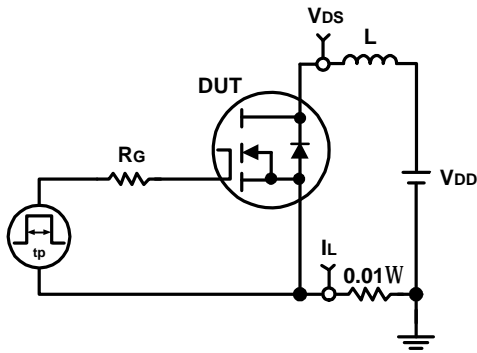
Capacitance



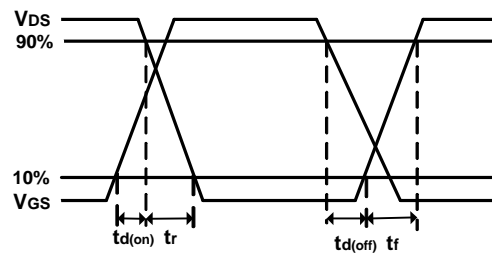
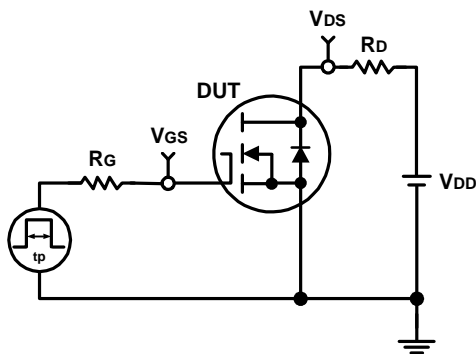
Gate Charge



## Avalanche Test Circuit and Waveforms

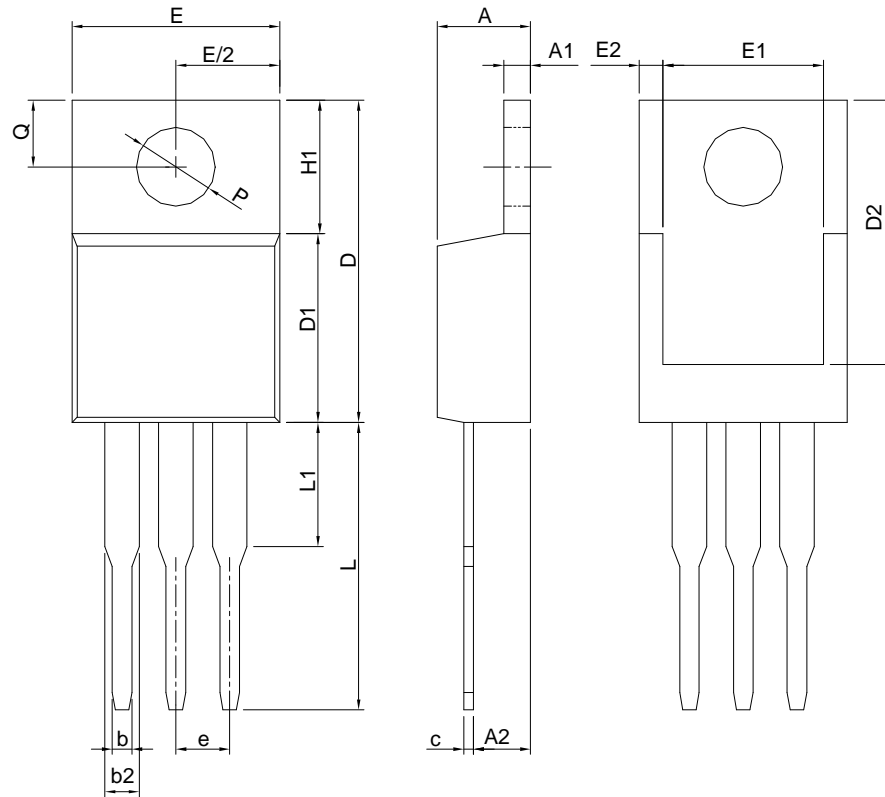


## Switching Time Test Circuit and Waveforms



Package Information

TO-220



| Dim | Millimeters |       | Inches    |       |
|-----|-------------|-------|-----------|-------|
|     | Min.        | Max.  | Min.      | Max.  |
| A   | 3.56        | 4.83  | 0.140     | 0.190 |
| A1  | 0.51        | 1.40  | 0.020     | 0.055 |
| A2  | 2.03        | 2.92  | 0.080     | 0.115 |
| b   | 0.38        | 1.02  | 0.015     | 0.040 |
| b2  | 1.14        | 1.78  | 0.045     | 0.070 |
| c   | 0.36        | 0.61  | 0.014     | 0.024 |
| D   | 14.22       | 16.51 | 0.560     | 0.650 |
| D1  | 8.38        | 9.02  | 0.330     | 0.355 |
| D2  | 12.19       | 12.88 | 0.480     | 0.507 |
| E   | 9.65        | 10.67 | 0.380     | 0.420 |
| E1  | 6.86        | 8.89  | 0.270     | 0.350 |
| E2  | -           | 0.76  | -         | 0.030 |
| e   | 2.54 BSC    |       | 0.100 BSC |       |
| H1  | 5.84        | 6.86  | 0.230     | 0.270 |
| L   | 12.70       | 14.73 | 0.500     | 0.580 |
| L1  | -           | 6.35  | -         | 0.250 |
| P   | 3.53        | 4.09  | 0.139     | 0.161 |
| Q   | 2.54        | 3.43  | 0.100     | 0.135 |



## Physical Specifications

|                    |  |
|--------------------|--|
| Terminal Material  | Solder-Plated Copper (Solder Material : Sn)                  |
| Lead Solderability | Meets EIA Specification RSI86-91, ANSI/J-STD-002 Category 3. |

## Reliability test program

| Test item     | Method              | Description               |
|---------------|---------------------|---------------------------|
| SOLDERABILITY | MIL-STD-883D-2003   | 245°C,5 SEC               |
| HOLT          | MIL-STD 883D-1005.7 | 1000 Hrs Bias @125°C      |
| PCT           | JESD-22-B, A102     | 168 Hrs, 100% RH, 121°C   |
| TST           | MIL-STD 883D-1011.9 | -65°C ~ 150°C, 200 Cycles |

## Customer Service

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