

## Product Summary

| $V_{(BR)DSS}$ | $R_{DS(on)TYP}$    | $I_D$ |
|---------------|--------------------|-------|
| 100V          | 15m $\Omega$ @10V  | 48A   |
|               | 18m $\Omega$ @4.5V |       |



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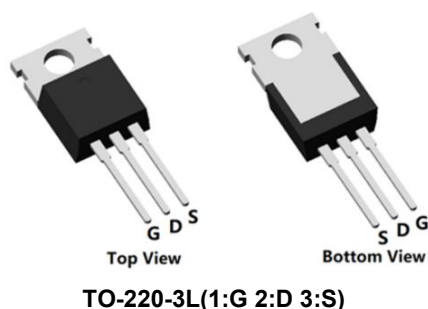
## Feature

- Fast Switching
- Low Gate Charge and Rdson
- Advanced Split Gate Trench Technology
- 100% Single Pulse avalanche energy Test

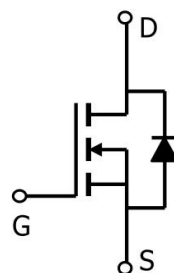
## Applications

- Power switching application
- Battery management
- Uninterruptible power supply

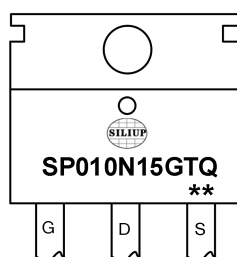
## Package



## Circuit diagram



## Marking



SP010N15GTQ : Product code  
\*\* : Week code

## Order Information

| Device      | Package   | Unit/Tube |
|-------------|-----------|-----------|
| SP010N15GTQ | TO-220-3L | 50        |

**Absolute maximum ratings (Ta=25°C unless otherwise noted)**

| Parameter                                  | Symbol          | Rating    | Unit |
|--------------------------------------------|-----------------|-----------|------|
| Drain-Source Voltage                       | $V_{DS}$        | 100       | V    |
| Gate-Source Voltage                        | $V_{GS}$        | $\pm 20$  | V    |
| Continuous Drain Current (Tc=25°C)         | $I_D$           | 48        | A    |
| Continuous Drain Current (Tc=100°C)        | $I_D$           | 32        | A    |
| Pulsed Drain Current                       | $I_{DM}$        | 192       | A    |
| Single Pulse Avalanche Energy <sup>1</sup> | $E_{AS}$        | 126       | mJ   |
| Power Dissipation (Tc=25°C)                | $P_D$           | 76        | W    |
| Power Dissipation (Tc=100°C)               | $P_D$           | 30        | W    |
| Thermal Resistance Junction-to-Case        | $R_{\theta JC}$ | 1.64      | °C/W |
| Storage Temperature Range                  | $T_{STG}$       | 55 to 150 | °C   |
| Operating Junction Temperature Range       | $T_J$           | 55 to 150 | °C   |

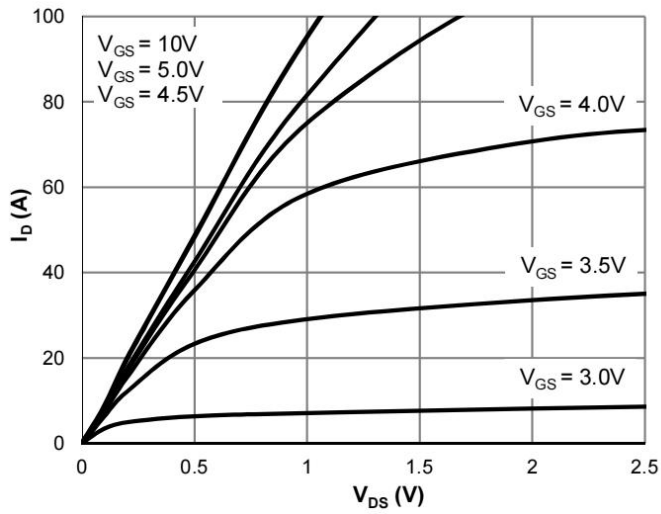
**Electrical characteristics (Ta=25°C, unless otherwise noted)**

| Characteristics                         | Symbol            | Test Condition                      | Min | Typ  | Max  | Unit |
|-----------------------------------------|-------------------|-------------------------------------|-----|------|------|------|
| Static Characteristics                  |                   |                                     |     |      |      |      |
| Drain-Source Breakdown Voltage          | BV <sub>DSS</sub> | VGS=0V , ID=250uA                   | 100 | -    | -    | V    |
| Drain Cut-Off Current                   | IDSS              | VDS=80V , VGS=0V , TJ=25℃           | -   | -    | 1    | μA   |
| Gate Leakage Current                    | IGSS              | VGS=±20V , VDS=0V                   | -   | -    | ±100 | nA   |
| Gate Threshold Voltage                  | VGS(th)           | VGS=VDS , ID=250uA                  | 1.5 | 1.9  | 2.5  | V    |
| Drain-Source ON Resistance              | RDS(ON)           | VGS=10V , ID=20A                    | -   | 15   | 19   | mΩ   |
|                                         |                   | VGS=4.5V , ID=10A                   | -   | 18   | 24   |      |
| Gate Resistance                         | RG                | VDS=50V , VGS=0V , f=1MHz           | -   | 2.16 | -    | Ω    |
| Dynamic Characteristics                 |                   |                                     |     |      |      |      |
| Input Capacitance                       | Ciss              | VDS=50V , VGS=0V , f=1MHz           | -   | 925  | -    | pF   |
| Output Capacitance                      | Coss              |                                     | -   | 258  | -    |      |
| Reverse Transfer Capacitance            | Crss              |                                     | -   | 14   | -    |      |
| Total Gate Charge                       | Qg                | VDS=50V , VGS=10V , ID=20A          | -   | 16   | -    | nC   |
| Gate-Source Charge                      | Qgs               |                                     | -   | 5    | -    |      |
| Gate-Drain Charge                       | Qgd               |                                     | -   | 2.7  | -    |      |
| Gate Plateau Voltage                    | Vplateau          |                                     | -   | 3.6  | -    | V    |
| Switching Characteristics               |                   |                                     |     |      |      |      |
| Turn-On Delay Time                      | td(on)            | VDD=50V, VGS=10V , RG=2.2Ω , ID=20A | -   | 38   | -    | nS   |
| Rise Time                               | tr                |                                     | -   | 12   | -    |      |
| Turn-Off Delay Time                     | td(off)           |                                     | -   | 51   | -    |      |
| Fall Time                               | tf                |                                     | -   | 17   | -    |      |
| Drain-Source Body Diode Characteristics |                   |                                     |     |      |      |      |
| Source-Drain Diode Forward Voltage      | VSD               | IS=1A , VGS=0V , TJ=25℃             | -   | -    | 1.2  | V    |
| Maximum Body-Diode Continuous Current   | IS                |                                     | -   | -    | 48   | A    |
| Reverse Recovery Time                   | Trr               | IS=20A , di/dt=100A/us , TJ=25℃     | -   | 40   | -    | nS   |
| Reverse Recovery Charge                 | Qrr               |                                     | -   | 42   | -    | nC   |

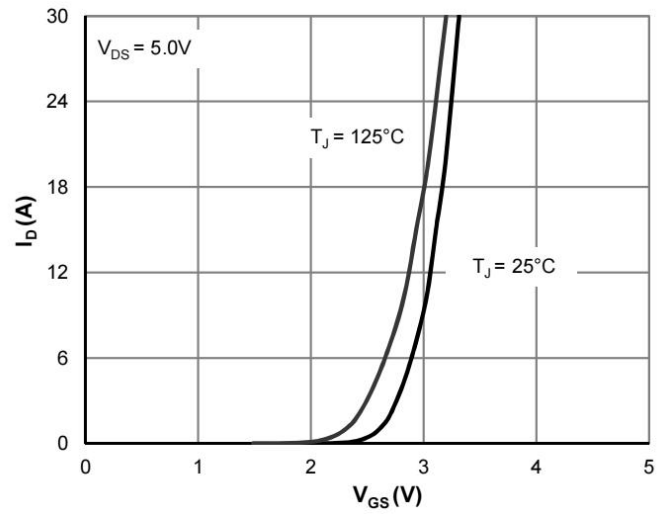
**Note:**

- The EAS test condition is  $V_{DD}=50V, V_{GS}=10V, L=0.5mH, R_G=25\Omega$

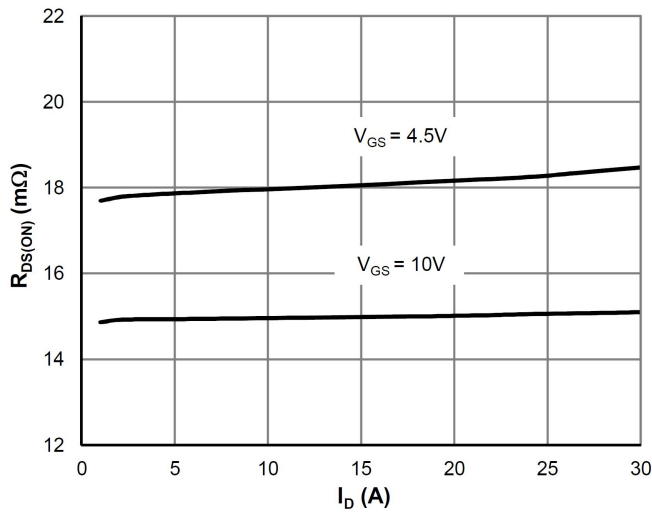
## Typical Characteristics



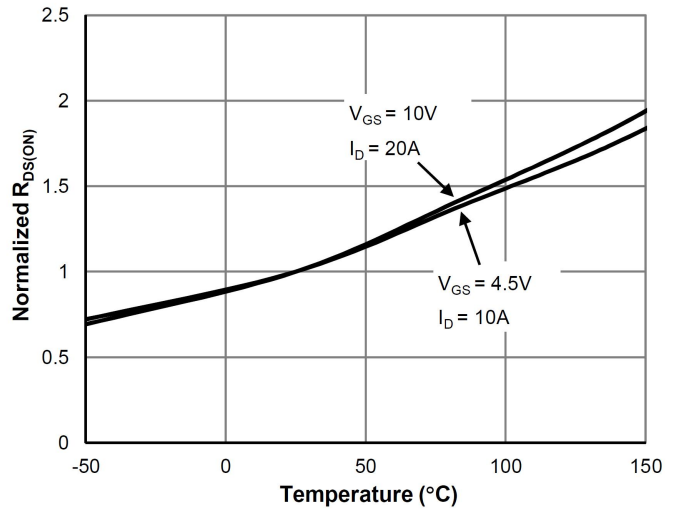
Typical Output Characteristics



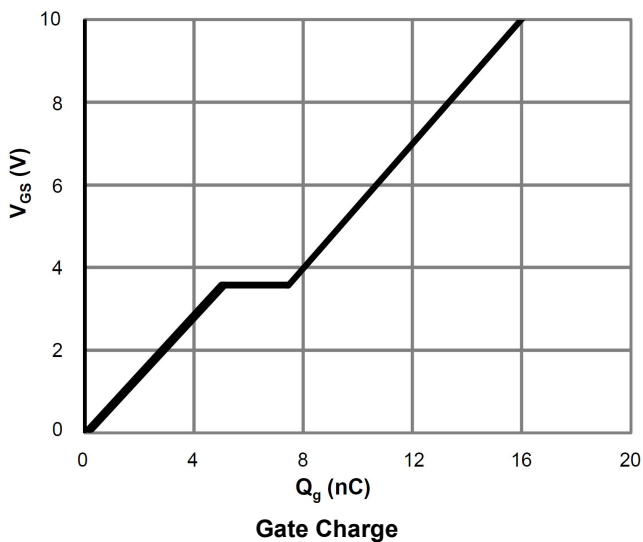
Transfer Characteristics



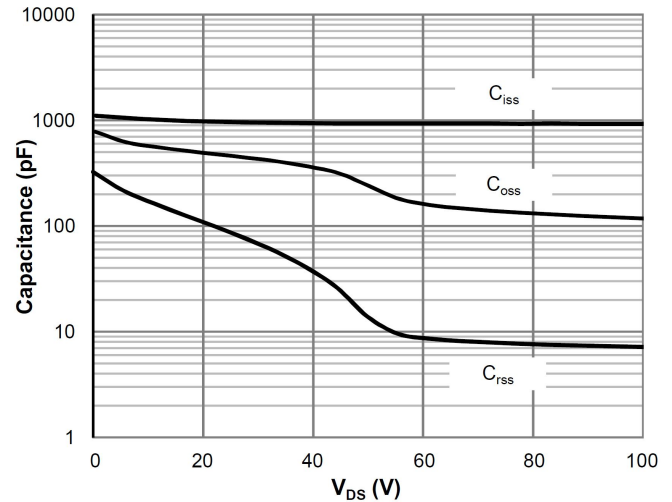
On-Resistance vs. Drain Current



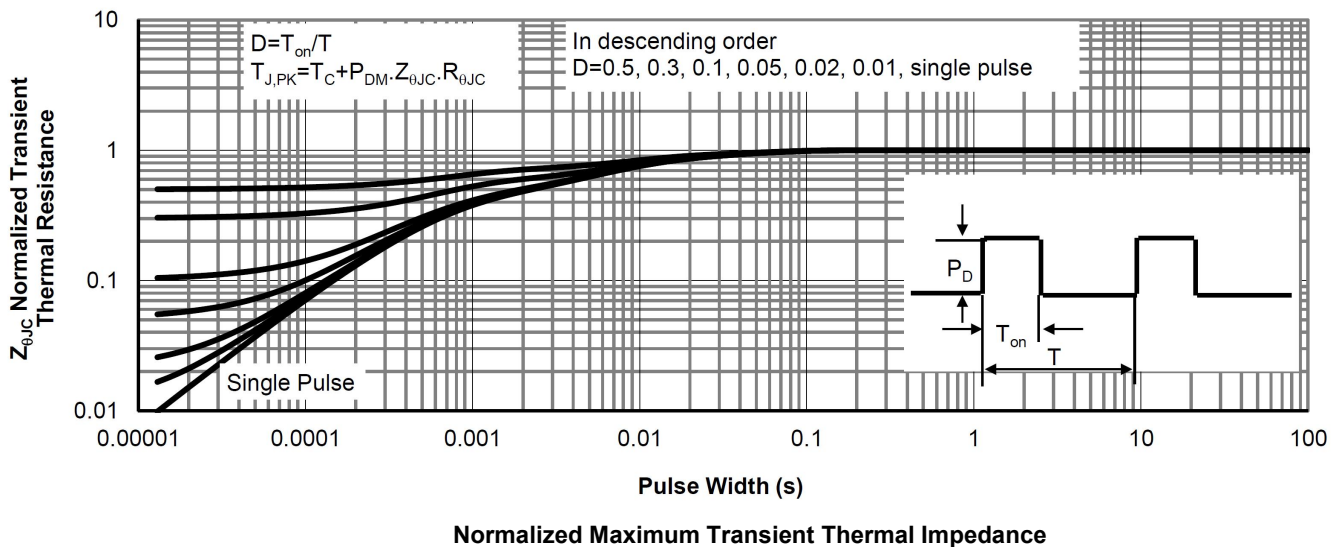
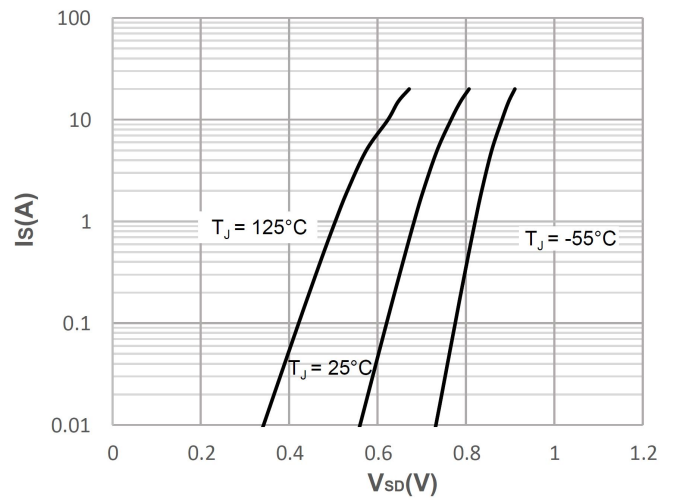
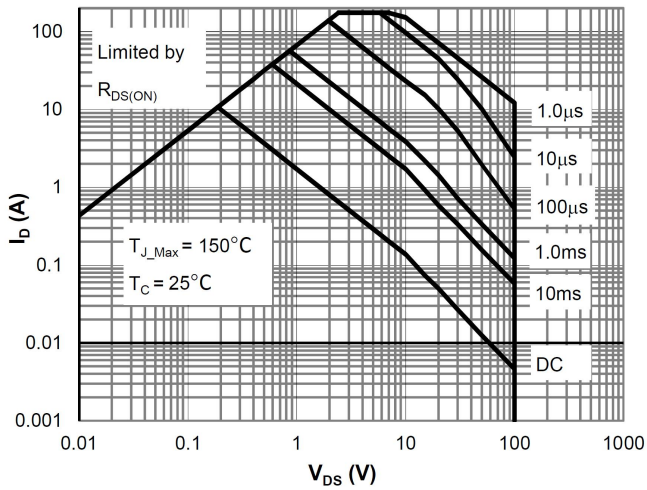
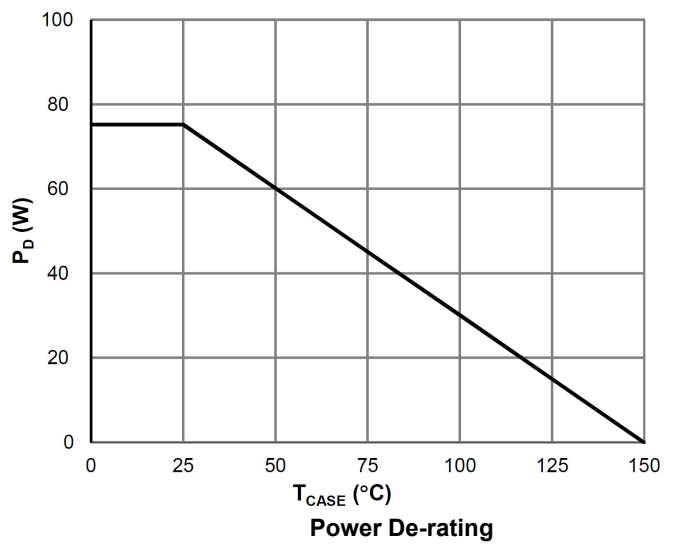
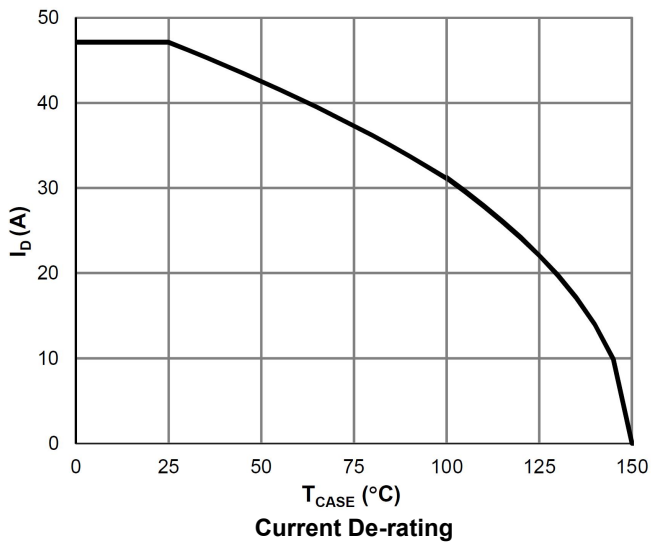
On-Resistance vs. Junction Temperature



Gate Charge

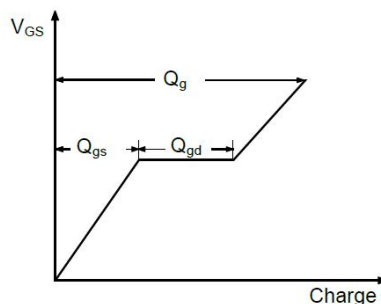
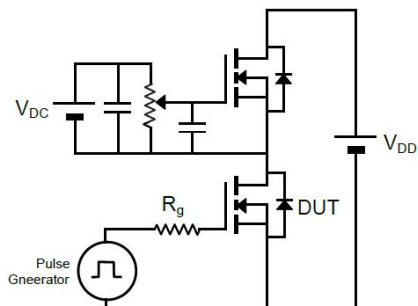


Capacitance Characteristics

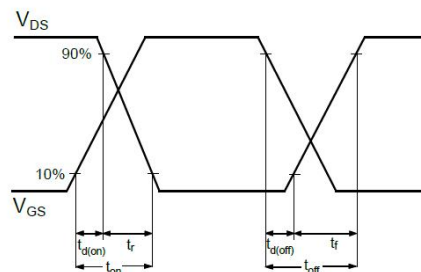
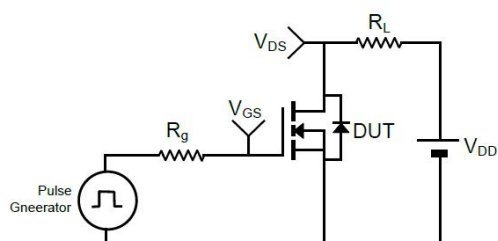


## Test Circuit

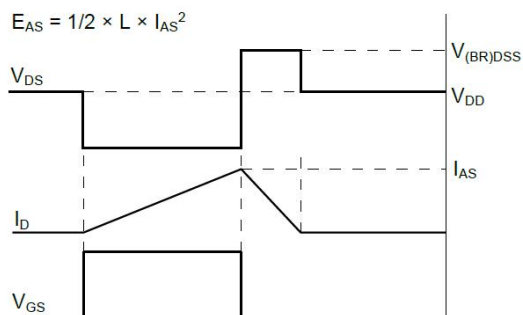
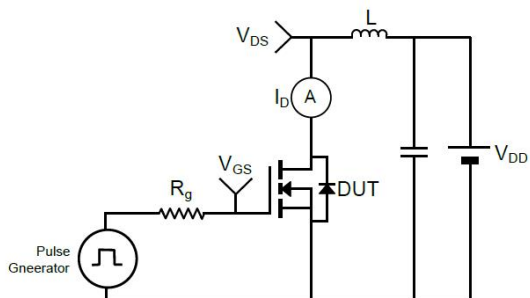
### Gate Charge



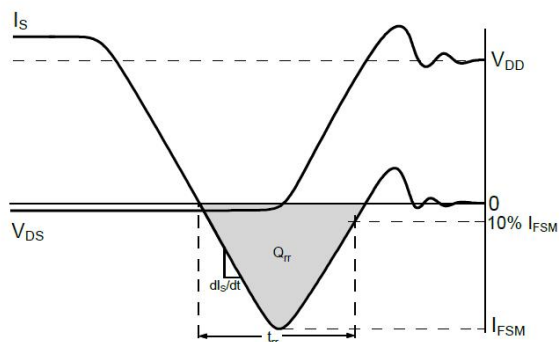
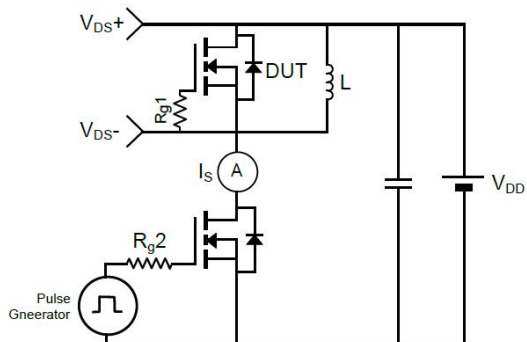
### Resistive Load Switching Time



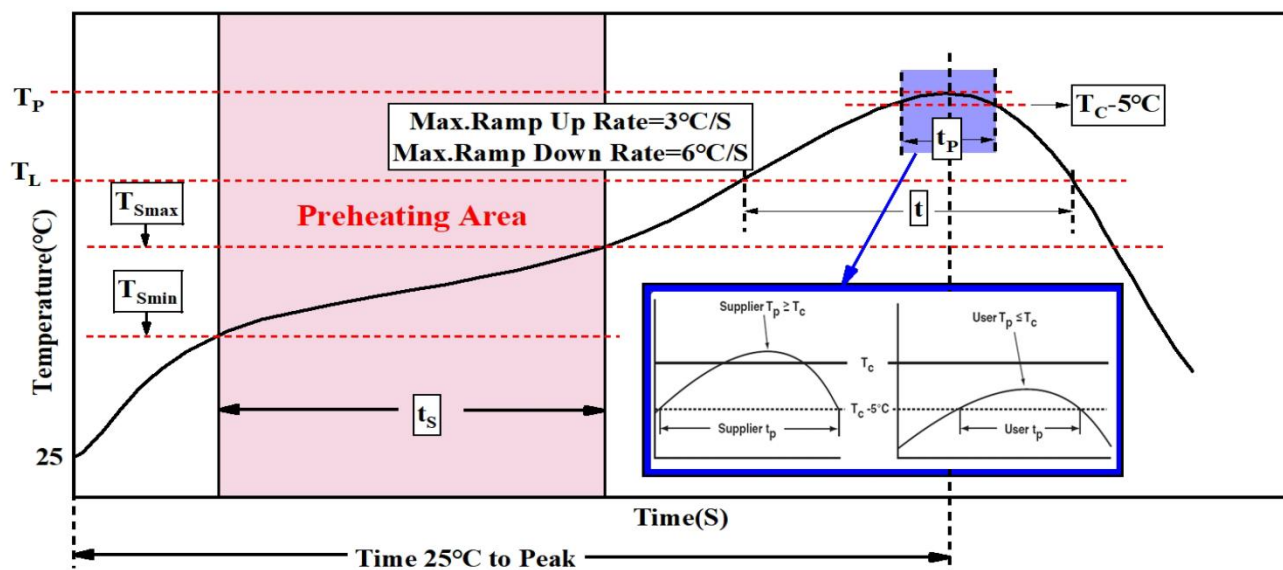
### Un-clamped Inductive Load Switching



### Drain-Source Body Diode Reverse Recovery



## Temperature Profile for IR Reflow Soldering



| Profile Feature                                                                                                                                                                                                            | Sn-Pb Eutectic Assembly            | Pb-Free Assembly                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------|
| <b>Preheat &amp; Soak</b>                                                                                                                                                                                                  |                                    |                                    |
| Temperature min ( $T_{Smin}$ )                                                                                                                                                                                             | 100°C                              | 150°C                              |
| Temperature max ( $T_{Smax}$ )                                                                                                                                                                                             | 150°C                              | 200°C                              |
| Time ( $T_{Smin}$ to $T_{Smax}$ ) ( $t_s$ )                                                                                                                                                                                | 60-120 seconds                     | 60-120 seconds                     |
| Average ramp-up rate ( $T_{Smax}$ to $T_P$ )                                                                                                                                                                               | 3 °C/second max.                   | 3°C/second max.                    |
| Liquidous temperature ( $T_L$ )                                                                                                                                                                                            | 183 °C                             | 217°C                              |
| Time at liquidous ( $t_L$ )                                                                                                                                                                                                | 60-150 seconds                     | 60-150 seconds                     |
| Peak package body Temperature e ( $T_P$ )*                                                                                                                                                                                 | See Classification Temp in table 1 | See Classification Temp in table 2 |
| Time ( $t_P$ )** within 5°C of the specified classification temperature ( $T_C$ )                                                                                                                                          | 20** seconds                       | 30** seconds                       |
| Average ramp-down rate ( $T_P$ to $T_{Smax}$ )                                                                                                                                                                             | 6 °C/second max.                   | 6 °C/second max.                   |
| Time 25°C to peak temperature                                                                                                                                                                                              | 6 minutes max.                     | 8 minutes max.                     |
| * Tolerance for peak profile Temperature ( $T_P$ ) is defined as a supplier minimum and a user maximum.<br>** Tolerance for time at peak profile temperature ( $t_P$ ) is defined as a supplier minimum and a user maximum |                                    |                                    |

Table 1. SnPb Eutectic Process – Classification Temperatures ( $T_C$ )

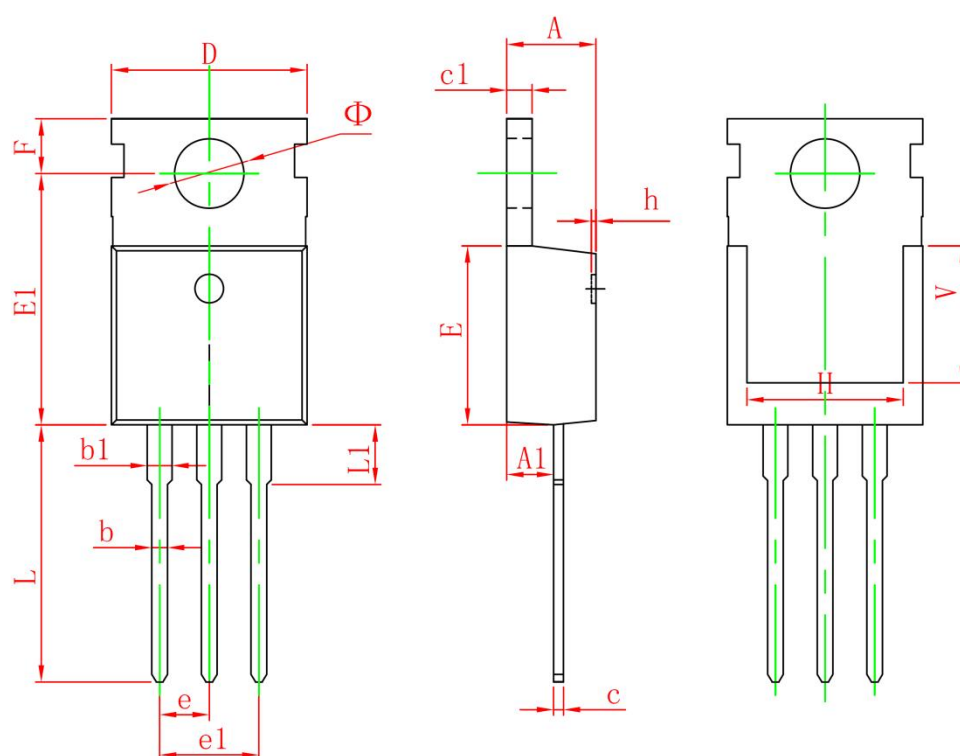
| Package Thickness | Volume mm <sup>3</sup> <350 | Volume mm <sup>3</sup> ≥350 |
|-------------------|-----------------------------|-----------------------------|
| <2.5 mm           | 235 °C                      | 220 °C                      |
| ≥2.5 mm           | 220 °C                      | 220 °C                      |

Table 2. Pb-free Process – Classification Temperatures ( $T_C$ )

| Package Thickness | Volume mm <sup>3</sup> <350 | Volume mm <sup>3</sup> 350-2000 | Volume mm <sup>3</sup> >2000 |
|-------------------|-----------------------------|---------------------------------|------------------------------|
| <1.6 mm           | 260 °C                      | 260 °C                          | 260 °C                       |
| 1.6 mm – 2.5 mm   | 260 °C                      | 250 °C                          | 245 °C                       |
| ≥2.5 mm           | 250 °C                      | 245 °C                          | 245 °C                       |



## TO-220-3L Package Information



| Symbol | Dimensions In Millimeters |        |
|--------|---------------------------|--------|
|        | Min.                      | Max.   |
| A      | 4.300                     | 4.700  |
| A1     | 2.200                     | 2.500  |
| b      | 0.700                     | 0.900  |
| b1     | 1.100                     | 1.400  |
| c      | 0.300                     | 0.700  |
| c1     | 1.200                     | 1.400  |
| D      | 9.800                     | 10.200 |
| E      | 9.000                     | 9.400  |
| E1     | 12.700                    | 13.500 |
| e      | 2.490                     | 2.590  |
| e1     | 4.980                     | 5.180  |
| F      | 2.650                     | 2.950  |
| H      | 7.600                     | 8.400  |
| h      | 0.000                     | 0.300  |
| L      | 12.700                    | 13.500 |
| L1     | 2.850                     | 3.250  |
| V      | 6.900 REF.                |        |
| Φ      | 3.400                     | 3.800  |