

## NCE N-Channel Enhancement Mode Power MOSFET

### Description

The NCE30H28 uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

### General Features

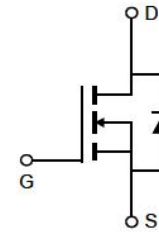
- $V_{DS} = 30V$ ,  $I_D = 280A$   
 $R_{DS(ON)} < 1.5m\Omega$  @  $V_{GS}=10V$   
 $R_{DS(ON)} < 2.0m\Omega$  @  $V_{GS}=4.5V$
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high  $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

### Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply

**100% UIS TESTED!**

**100%  $\Delta V_{ds}$  TESTED!**



Schematic diagram



Marking and pin assignment



TO-220-3L top view

### Package Marking and Ordering Information

| Device Marking | Device   | Device Package | Reel Size | Tape width | Quantity |
|----------------|----------|----------------|-----------|------------|----------|
| NCE30H28       | NCE30H28 | TO-220-3L      | -         | -          | -        |

### Absolute Maximum Ratings ( $T_A=25^\circ C$ unless otherwise noted)

| Parameter  | Symbol             | Limit      | Unit          |
|--|--------------------|------------|---------------|
| Drain-Source Voltage                             | $V_{DS}$           | 30         | V             |
| Gate-Source Voltage                              | $V_{GS}$           | $\pm 20$   | V             |
| Drain Current-Continuous                         | $I_D$              | 280        | A             |
| Drain Current-Continuous( $T_C=100^\circ C$ )    | $I_D(100^\circ C)$ | 198        | A             |
| Pulsed Drain Current                             | $I_{DM}$           | 1120       | A             |
| Maximum Power Dissipation                        | $P_D$              | 235        | W             |
| Derating factor                                  |                    | 1.57       | W/ $^\circ C$ |
| Single pulse avalanche energy (Note 5)           | $E_{AS}$           | 2381       | mJ            |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$     | -55 To 175 | $^\circ C$    |

## Thermal Characteristic

|  |                 |      |                      |
|--|-----------------|------|----------------------|
| Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup> | $R_{\theta JC}$ | 0.64 | $^{\circ}\text{C/W}$ |
|--|-----------------|------|----------------------|

## Electrical Characteristics ( $T_A=25^{\circ}\text{C}$ unless otherwise noted)

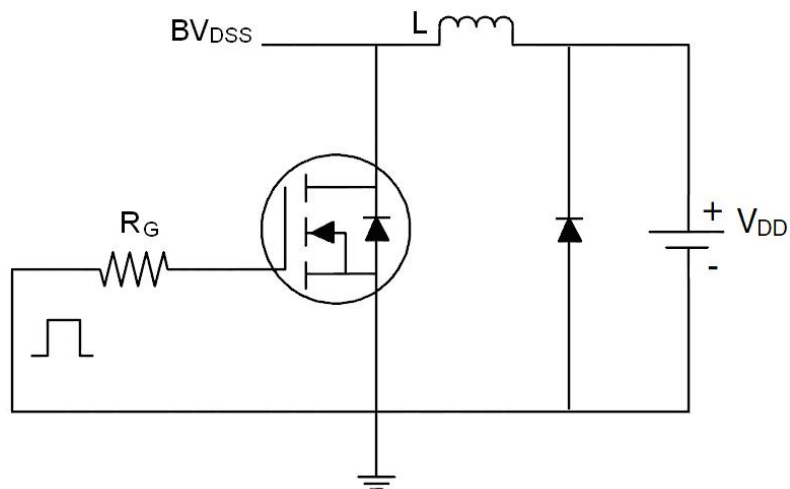
| Parameter   | Symbol              | Condition  | Min | Typ   | Max  | Unit |
|---|---------------------|--|-----|-------|------|------|
| Off Characteristics                               |                     |  |     |       |      |      |
| Drain-Source Breakdown Voltage                    | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =250μA  | 30  | -     | -    | V    |
| Zero Gate Voltage Drain Current                   | I <sub>DSS</sub>    | V <sub>DS</sub> =30V, V <sub>GS</sub> =0V  | -   | -     | 1    | μA   |
| Gate-Body Leakage Current                         | I <sub>GSS</sub>    | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V   | -   | -     | ±100 | nA   |
| On Characteristics <small>(Note 3)</small>        |                     |  |     |       |      |      |
| Gate Threshold Voltage                            | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                 | 1.2 | 1.8   | 2.5  | V    |
| Drain-Source On-State Resistance                  | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =20A  | -   | 1.1   | 1.5  | mΩ   |
|   |                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A   | -   | 1.55  | 2.0  | mΩ   |
| Forward Transconductance                          | g <sub>FS</sub>     | V <sub>DS</sub> =10V, I <sub>D</sub> =40A  | -   | 90    | -    | S    |
| Dynamic Characteristics <small>(Note4)</small>    |                     |  |     |       |      |      |
| Input Capacitance                                 | C <sub>iss</sub>    | V <sub>DS</sub> =15V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                   | -   | 10100 | -    | pF   |
| Output Capacitance                                | C <sub>oss</sub>    |  | -   | 1590  | -    | pF   |
| Reverse Transfer Capacitance                      | C <sub>rss</sub>    |  | -   | 1060  | -    | pF   |
| Switching Characteristics <small>(Note 4)</small> |                     |  |     |       |      |      |
| Turn-on Delay Time                                | t <sub>d(on)</sub>  | V <sub>DD</sub> =15V, R <sub>L</sub> =15Ω,<br>R <sub>G</sub> =2.5Ω, V <sub>GS</sub> =10V | -   | 30    | -    | nS   |
| Turn-on Rise Time                                 | t <sub>r</sub>      |  | -   | 140   | -    | nS   |
| Turn-Off Delay Time                               | t <sub>d(off)</sub> |  | -   | 70    | -    | nS   |
| Turn-Off Fall Time                                | t <sub>f</sub>      |  | -   | 90    | -    | nS   |
| Total Gate Charge                                 | Q <sub>g</sub>      | I <sub>D</sub> =20A, V <sub>DD</sub> =15V, V <sub>GS</sub> =10V                          | -   | 228   | -    | nC   |
| Gate-Source Charge                                | Q <sub>gs</sub>     |  | -   | 40.5  | -    | nC   |
| Gate-Drain Charge                                 | Q <sub>gd</sub>     |  | -   | 61.9  | -    | nC   |
| Drain-Source Diode Characteristics                |                     |  |     |       |      |      |
| Diode Forward Voltage <small>(Note 3)</small>     | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =20A   | -   | -     | 1.2  | V    |
| Diode Forward Current <small>(Note 2)</small>     | I <sub>S</sub>      |  | -   | -     | 280  | A    |
| Reverse Recovery Time                             | t <sub>rr</sub>     | T <sub>J</sub> = 25°C, I <sub>F</sub> = 40A<br>di/dt = 100A/μs <small>(Note3)</small>    | -   | 45    | -    | nS   |
| Reverse Recovery Charge                           | Q <sub>rr</sub>     |  | -   | 160   | -    | nC   |
| Forward Turn-On Time                              | t <sub>on</sub>     | Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)                     |     |       |      |      |

## Notes:

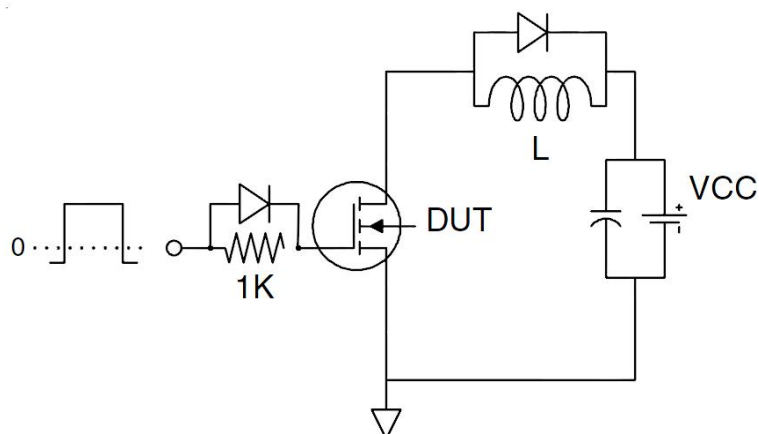
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5. EAS condition:  $T_J=25^{\circ}\text{C}, V_{DD}=15V, V_G=10V, L=0.5mH, R_G=25\Omega$

## Test circuit

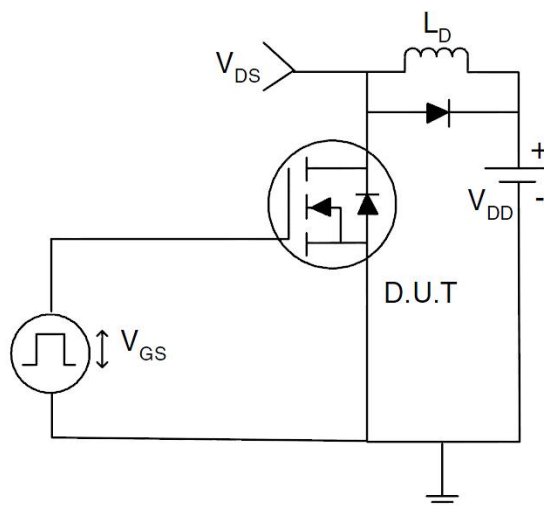
### 1) $E_{AS}$ test Circuits



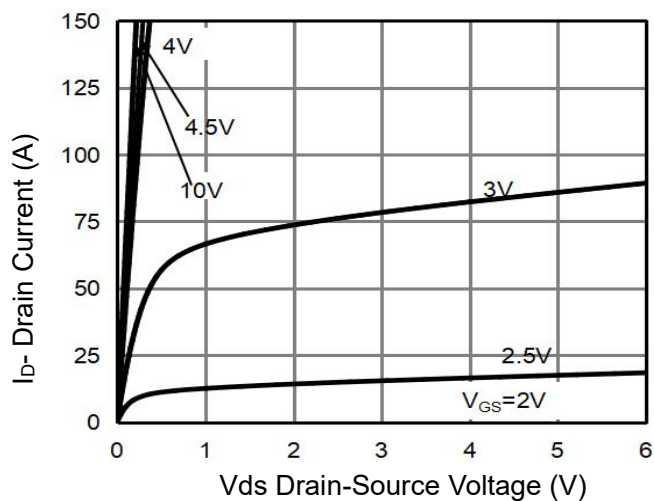
### 2) Gate charge test Circuit:



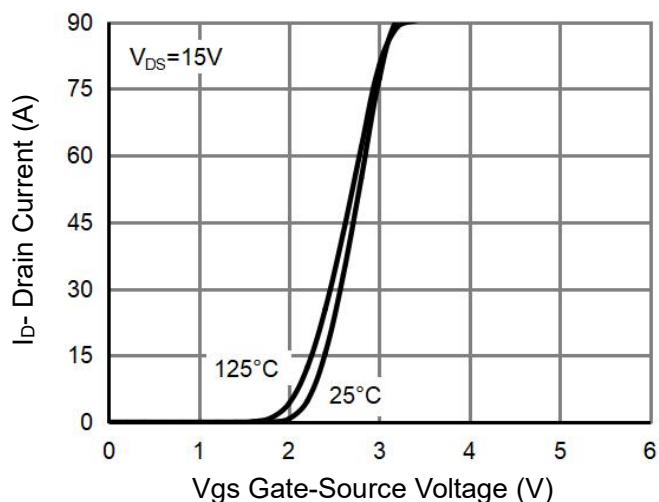
### 3) Switch Time Test Circuit:



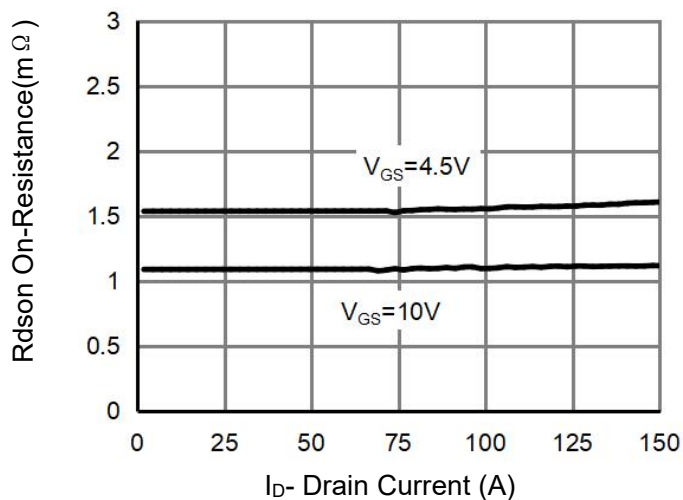
## Typical Electrical and Thermal Characteristics (Curves)



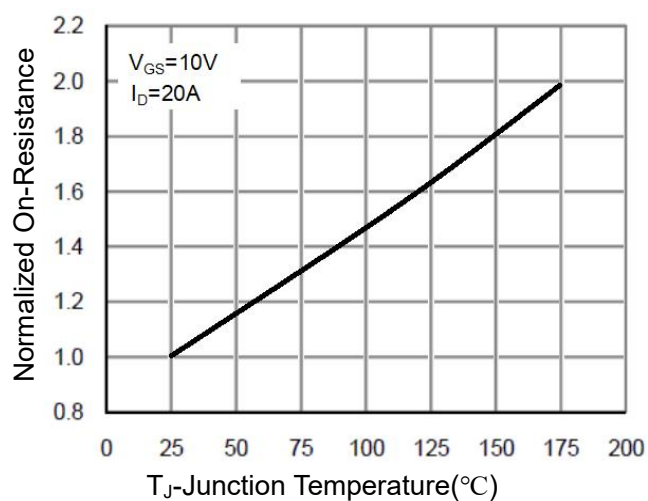
**Figure 1 Output Characteristics**



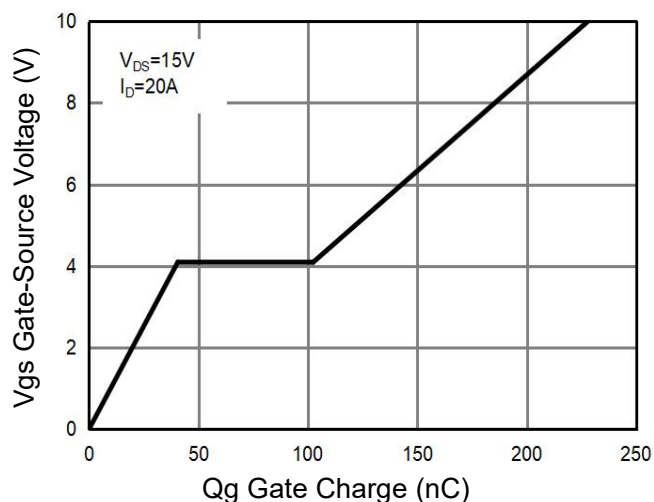
**Figure 2 Transfer Characteristics**



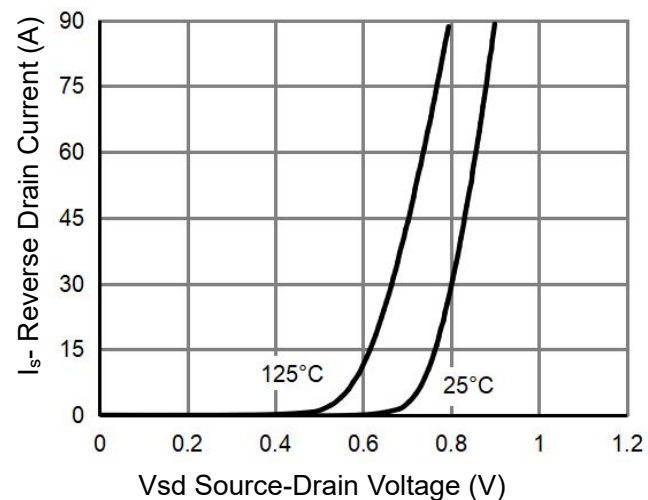
**Figure 3 Rdson- Drain Current**



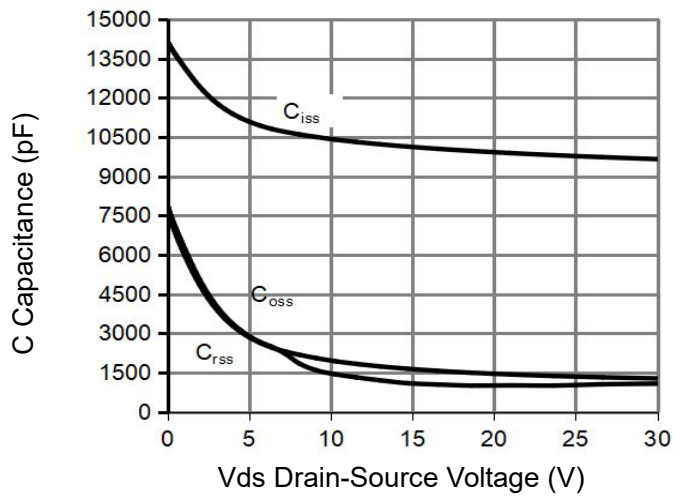
**Figure 4 Rdson-Junction Temperature**



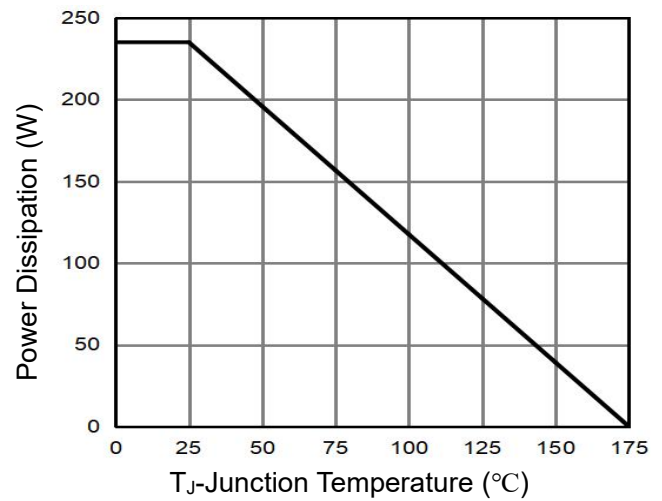
**Figure 5 Gate Charge**



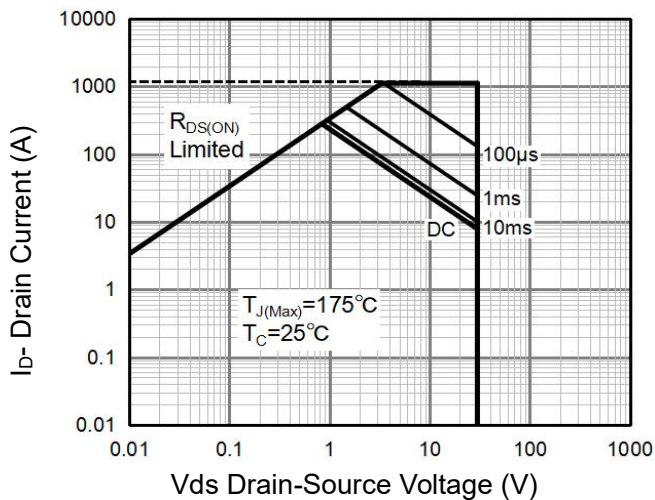
**Figure 6 Source- Drain Diode Forward**



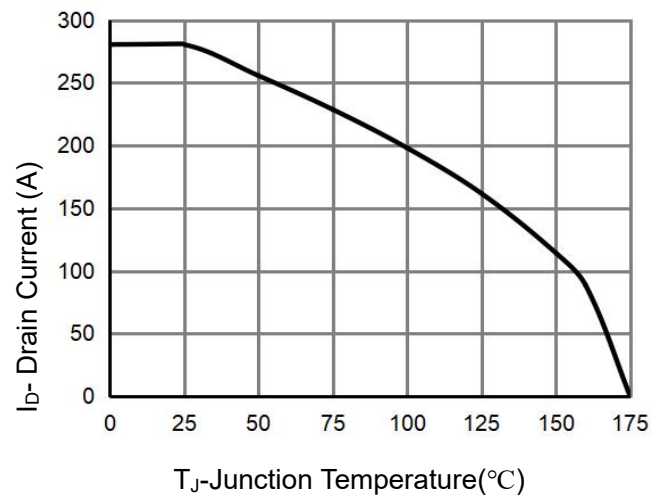
**Figure 7 Capacitance vs Vds**



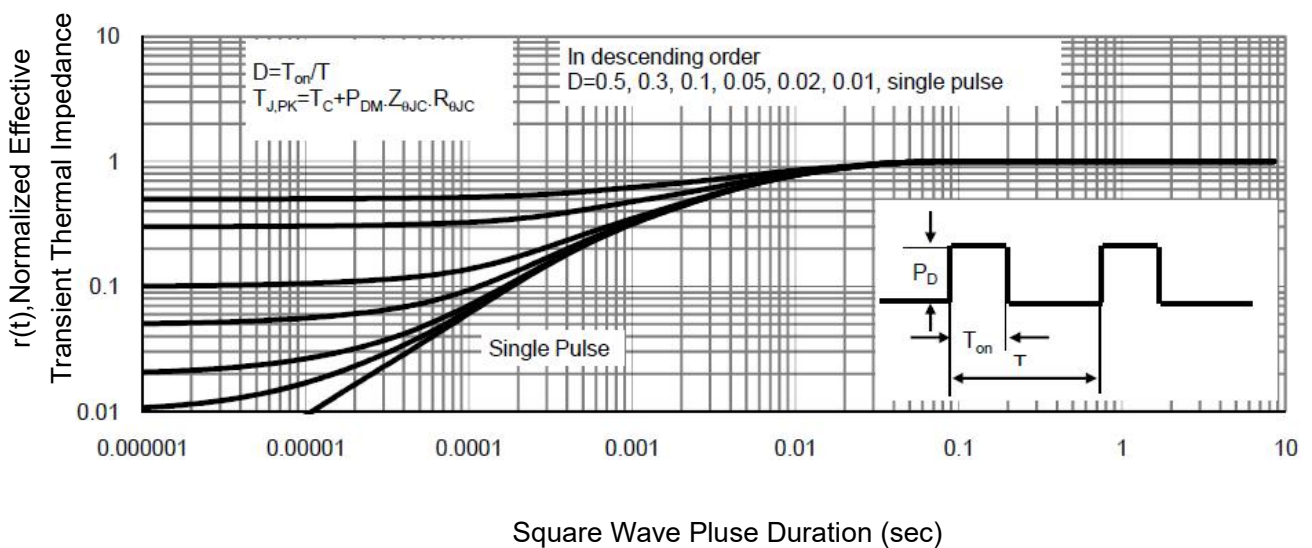
**Figure 9 Power De-rating**



**Figure 8 Safe Operation Area**

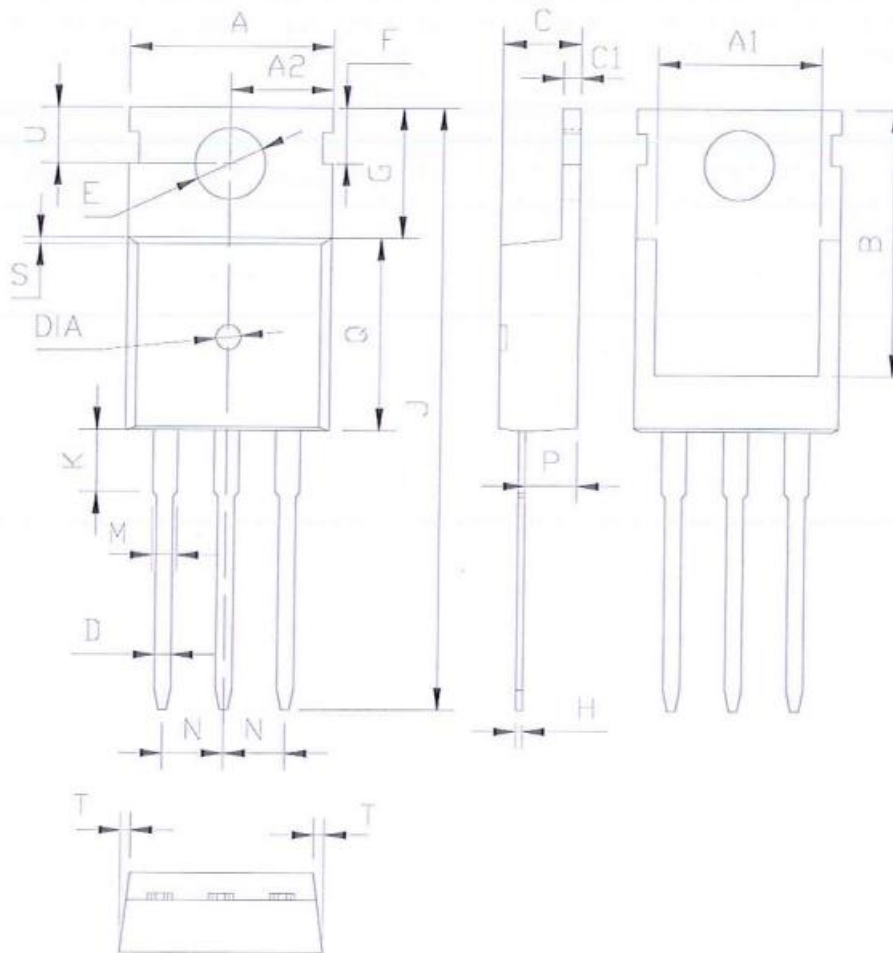


**Figure 10 Current vs Junction Temperature**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

## TO-220-3L Package Information



| DIM | MILLIMETERS               |
|-----|---------------------------|
| A   | 10.00±0.30                |
| A1  | 8.00±0.30                 |
| A2  | 5.00±0.30                 |
| B   | 13.20±0.40                |
| C   | 4.50±0.20                 |
| C1  | 1.30±0.20                 |
| D   | 0.80±0.20                 |
| E   | 3.60±0.20                 |
| F   | 3.00±0.30                 |
| G   | 6.60±0.40                 |
| H   | 0.50±0.20                 |
| J   | 28.88±0.50                |
| K   | 3.00±0.30                 |
| M   | 1.30±0.30                 |
| N   | Typical 2.54              |
| P   | 2.40±0.40                 |
| Q   | 9.20±0.40                 |
| S   | 0.25±0.15                 |
| T   | 0.25±0.15                 |
| U   | 2.80±0.30                 |
| DIA | 宽 1.50±0.10<br>深 0.50 MAX |

(单位: mm)



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