

## NCE P-Channel Enhancement Mode Power MOSFET

### Description

The NCE55P15 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

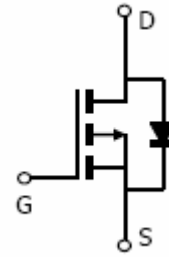
- $V_{DS} = -55V, I_D = -15A$   
 $R_{DS(ON)} < 75m\Omega @ V_{GS} = -10V$
- High density cell design for ultra low  $R_{DS(on)}$
- Fully characterized avalanche voltage and current
- Excellent package for good heat dissipation

### Application

- Power switching application
- Hard switched and high frequency circuits
- DC-DC converter

**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 |
|----------------|----------|----------------|-----------|------------|----------|
| NCE55P15       | NCE55P15 | TO-220-3L      | -         | -          | -        |

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

| Parameter                                        | Symbol             | Limit      | Unit       |
|--------------------------------------------------|--------------------|------------|------------|
| Drain-Source Voltage                             | $V_{DS}$           | -55        | V          |
| Gate-Source Voltage                              | $V_{GS}$           | $\pm 20$   | V          |
| Drain Current-Continuous                         | $I_D$              | -15        | A          |
| Drain Current-Continuous( $T_C = 100^\circ C$ )  | $I_D(100^\circ C)$ | -10        | A          |
| Pulsed Drain Current                             | $I_{DM}$           | -50        | A          |
| Maximum Power Dissipation                        | $P_D$              | 45         | W          |
| 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> | $R_{\theta JC}$ | 3.3 | $^{\circ}\text{C/W}$ |
|----------------------------------------------------------|-----------------|-----|----------------------|

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

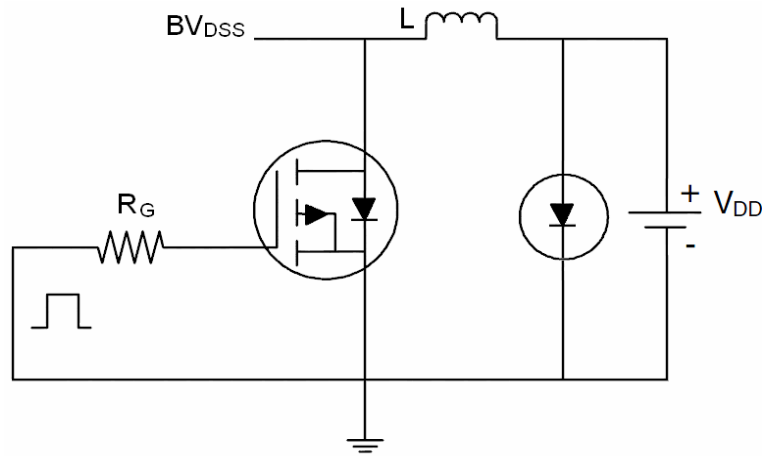
| Parameter                          | Symbol       | Condition                                                       | Min  | Typ  | Max       | Unit       |
|------------------------------------|--------------|-----------------------------------------------------------------|------|------|-----------|------------|
| Off Characteristics                |              |                                                                 |      |      |           |            |
| Drain-Source Breakdown Voltage     | $BV_{DSS}$   | $V_{GS}=0V, I_D=-250\mu A$                                      | -60  | -    | -         | V          |
| Zero Gate Voltage Drain Current    | $I_{DSS}$    | $V_{DS}=-55V, V_{GS}=0V$                                        | -    | -    | 1         | $\mu A$    |
| Gate-Body Leakage Current          | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$                                     | -    | -    | $\pm 100$ | nA         |
| On Characteristics (Note 3)        |              |                                                                 |      |      |           |            |
| Gate Threshold Voltage             | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=-250\mu A$                                  | -1.5 | -2.6 | -3.5      | V          |
| Drain-Source On-State Resistance   | $R_{DS(ON)}$ | $V_{GS}=-10V, I_D=-5A$                                          | -    | 60   | 75        | m $\Omega$ |
| Forward Transconductance           | $g_{FS}$     | $V_{DS}=-15V, I_D=-5A$                                          | 16   | -    | -         | S          |
| Dynamic Characteristics (Note4)    |              |                                                                 |      |      |           |            |
| Input Capacitance                  | $C_{ISS}$    | $V_{DS}=-20V, V_{GS}=0V,$<br>$F=1.0MHz$                         | -    | 1450 | -         | PF         |
| Output Capacitance                 | $C_{OSS}$    |                                                                 | -    | 145  | -         | PF         |
| Reverse Transfer Capacitance       | $C_{RSS}$    |                                                                 | -    | 110  | -         | PF         |
| Switching Characteristics (Note 4) |              |                                                                 |      |      |           |            |
| Turn-on Delay Time                 | $t_{d(on)}$  | $V_{DD}=-30V, , R_L=30\Omega$<br>$V_{GS}=-10V, R_{GEN}=6\Omega$ | -    | 8    | -         | nS         |
| Turn-on Rise Time                  | $t_r$        |                                                                 | -    | 9    | -         | nS         |
| Turn-Off Delay Time                | $t_{d(off)}$ |                                                                 | -    | 65   | -         | nS         |
| Turn-Off Fall Time                 | $t_f$        |                                                                 | -    | 30   | -         | nS         |
| Total Gate Charge                  | $Q_g$        | $V_{DS}=-30V, I_D=-5A,$<br>$V_{GS}=-10V$                        | -    | 26   | -         | nC         |
| Gate-Source Charge                 | $Q_{gs}$     |                                                                 | -    | 4.5  | -         | nC         |
| Gate-Drain Charge                  | $Q_{gd}$     |                                                                 | -    | 7    | -         | nC         |
| Drain-Source Diode Characteristics |              |                                                                 |      |      |           |            |
| Diode Forward Voltage (Note 3)     | $V_{SD}$     | $V_{GS}=0V, I_S=-5A$                                            | -    | -    | 1.2       | V          |
| Diode Forward Current (Note 2)     | $I_S$        |                                                                 | -    | -    | -15       | A          |

## Notes:

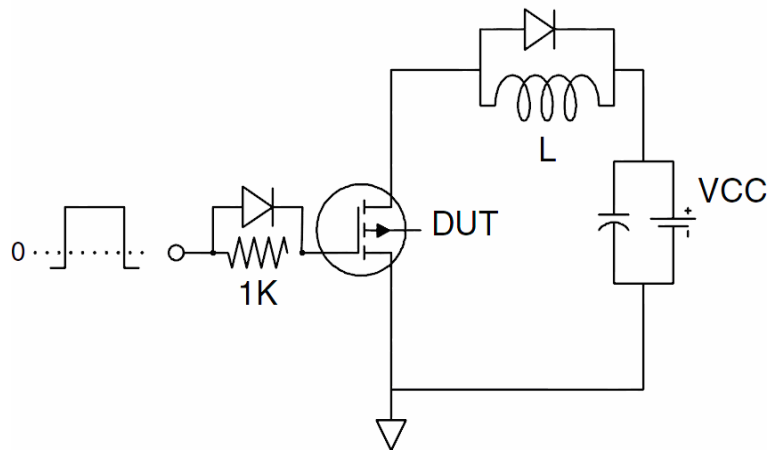
1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production

## Test Circuit

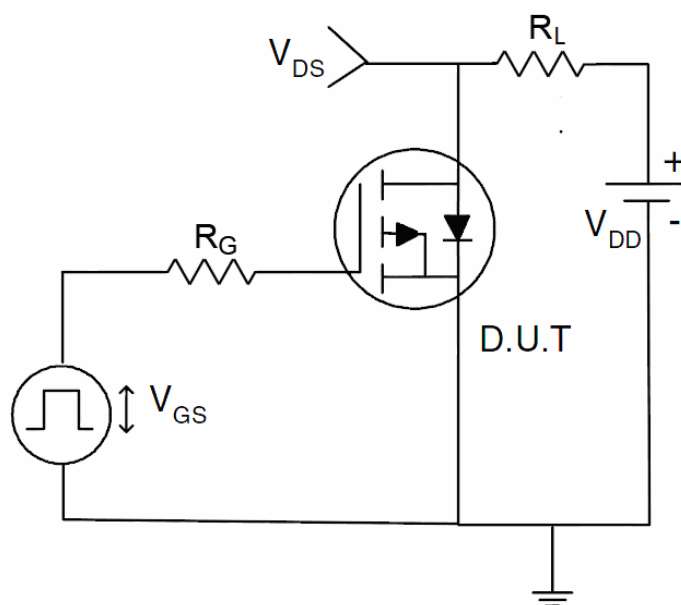
### 1) $E_{AS}$ Test Circuit



### 2) Gate Charge Test Circuit



### 3) Switch Time Test Circuit



## Typical Electrical and Thermal Characteristics (Curves)

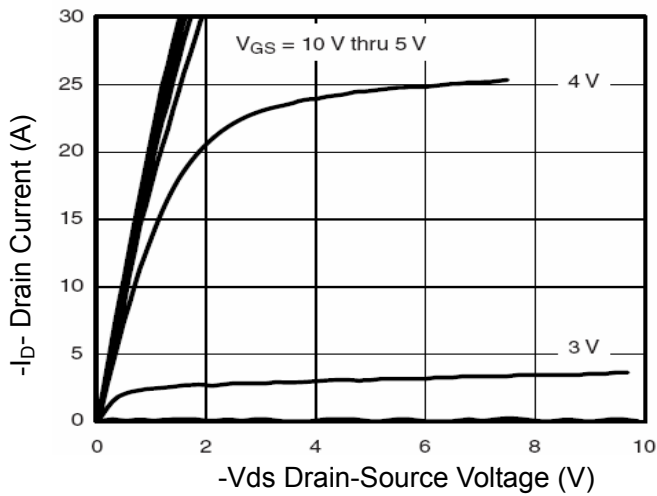


Figure 1 Output Characteristics

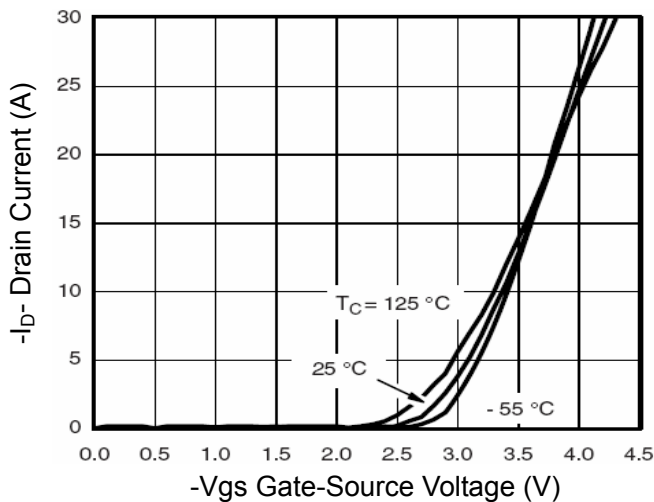


Figure 2 Transfer Characteristics

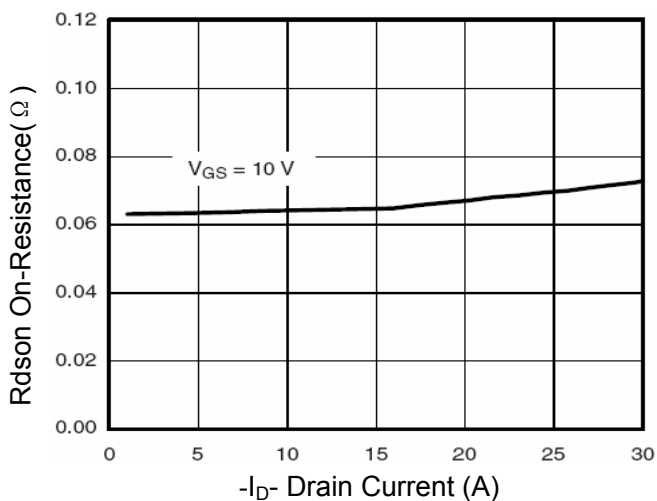


Figure 3 Rdson- Drain Current

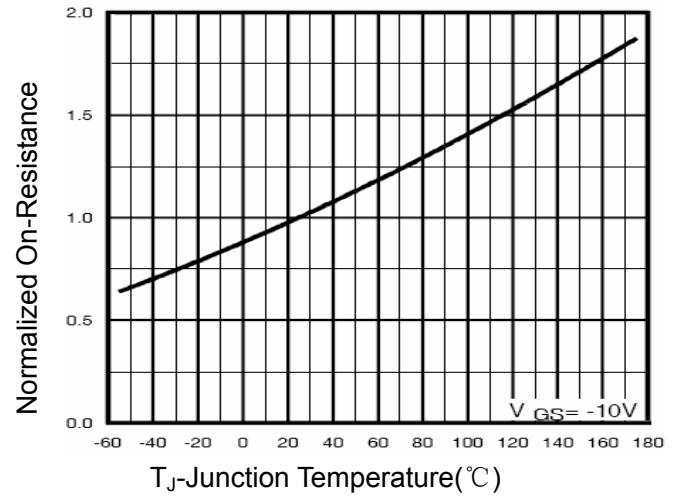


Figure 4 Rdson-Junction Temperature

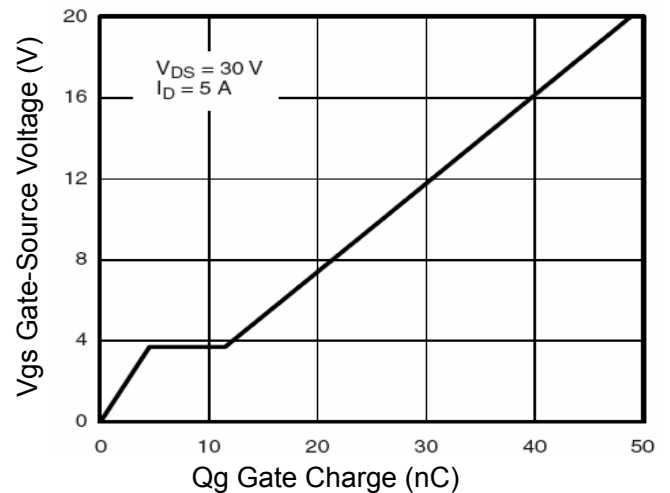


Figure 5 Gate Charge

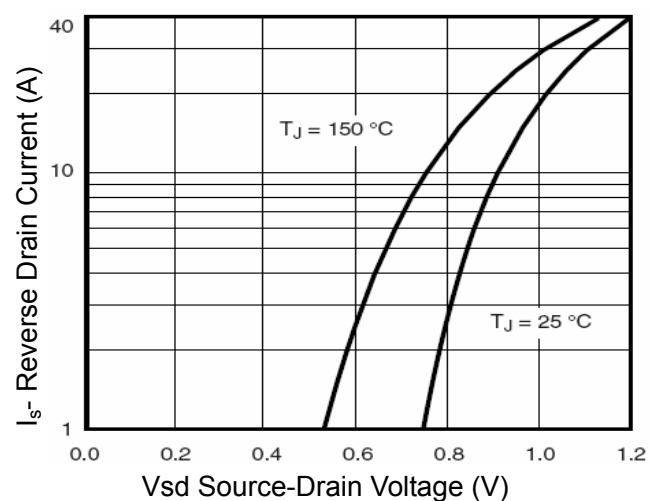


Figure 6 Source- Drain Diode Forward

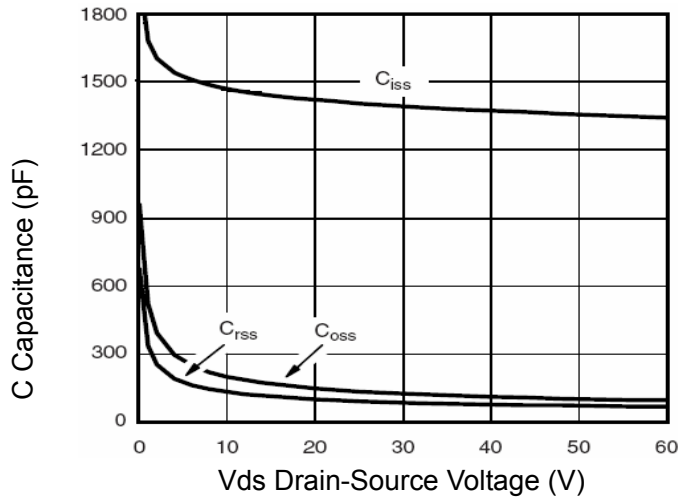


Figure 7 Capacitance vs Vds

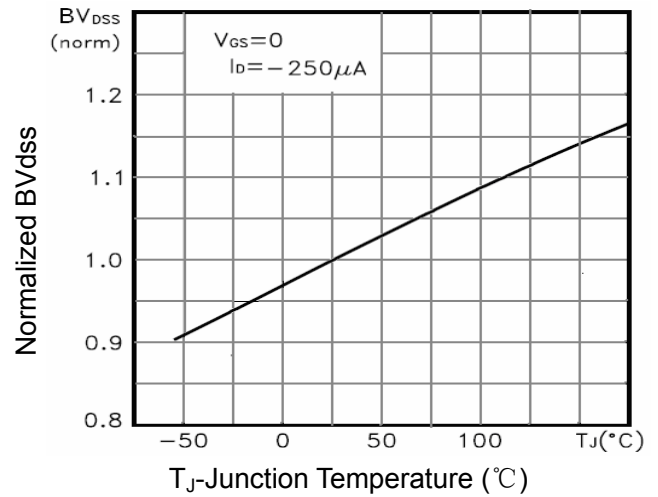
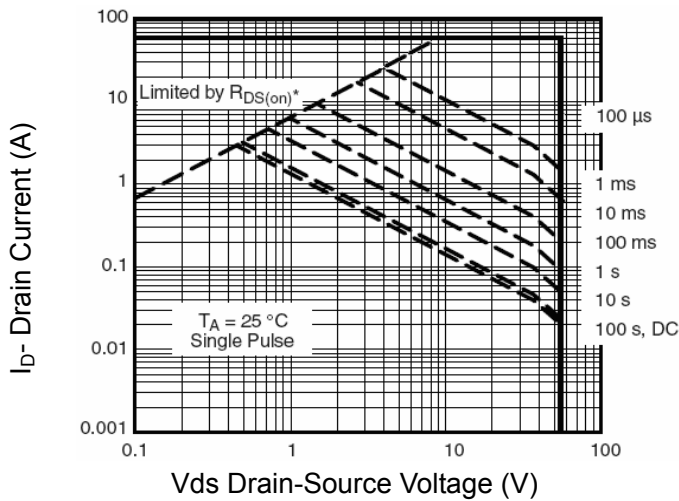

Figure 9  $BV_{DSS}$  vs Junction Temperature


Figure 8 Safe Operation Area

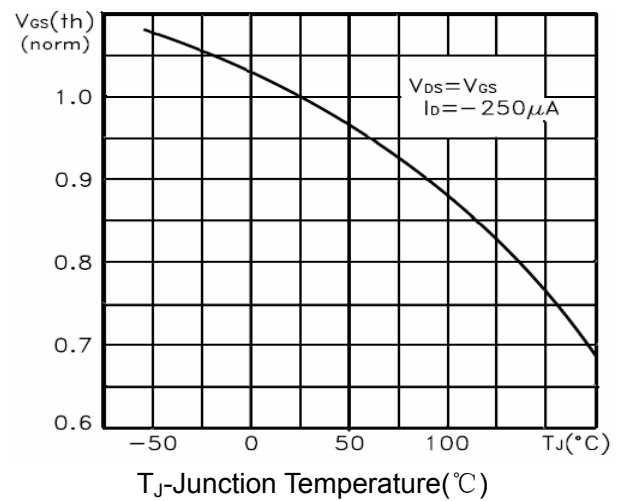
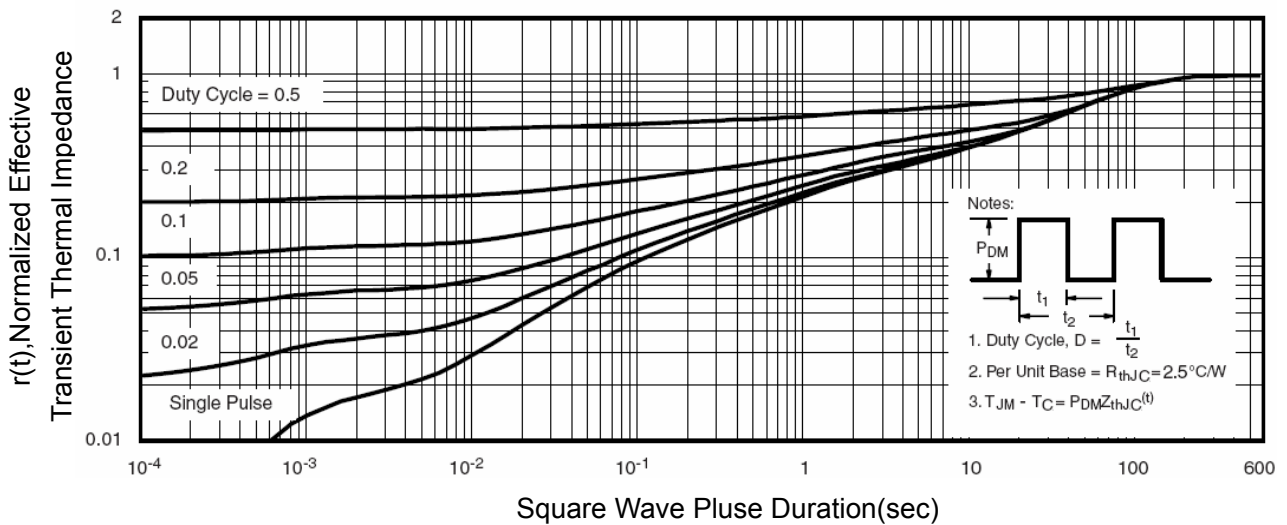
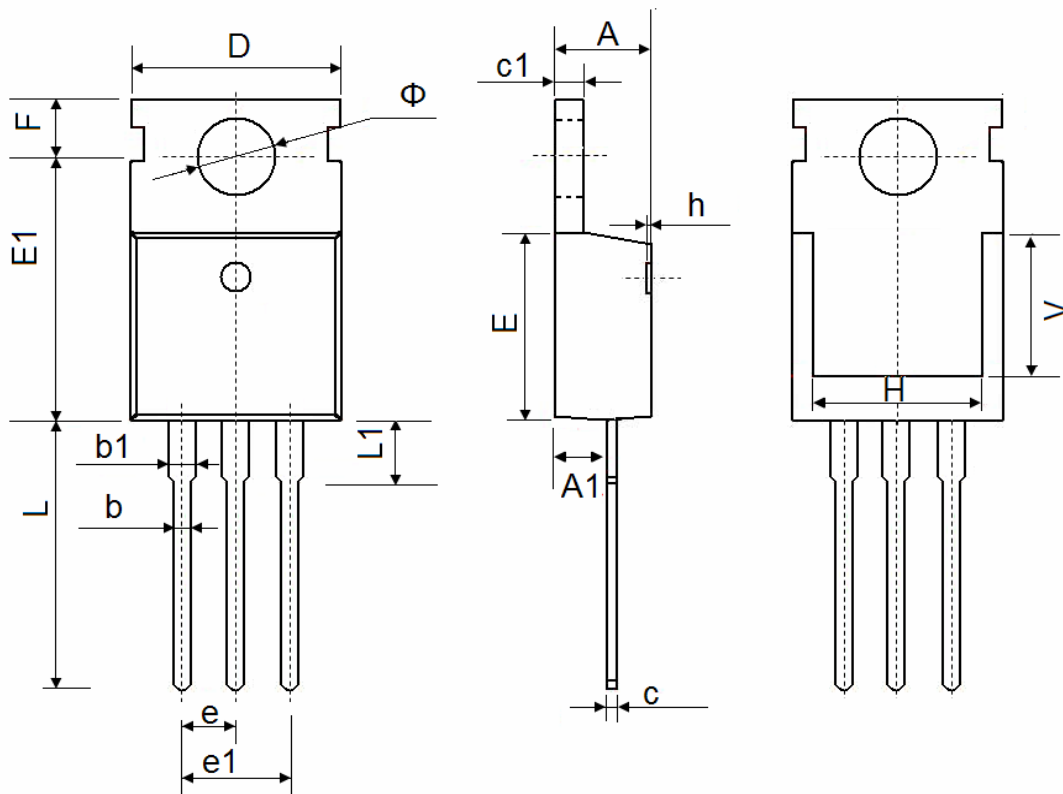

Figure 10  $V_{GS(th)}$  vs Junction Temperature


Figure 11 Normalized Maximum Transient Thermal Impedance

## TO-220-3L Package Information



| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min.                      | Max.   | Min.                 | Max.  |
| A      | 4.400                     | 4.600  | 0.173                | 0.181 |
| A1     | 2.250                     | 2.550  | 0.089                | 0.100 |
| b      | 0.710                     | 0.910  | 0.028                | 0.036 |
| b1     | 1.170                     | 1.370  | 0.046                | 0.054 |
| c      | 0.330                     | 0.650  | 0.013                | 0.026 |
| c1     | 1.200                     | 1.400  | 0.047                | 0.055 |
| D      | 9.910                     | 10.250 | 0.390                | 0.404 |
| E      | 8.9500                    | 9.750  | 0.352                | 0.384 |
| E1     | 12.650                    | 12.950 | 0.498                | 0.510 |
| e      | 2.540 TYP.                |        | 0.100 TYP.           |       |
| e1     | 4.980                     | 5.180  | 0.196                | 0.204 |
| F      | 2.650                     | 2.950  | 0.104                | 0.116 |
| H      | 7.900                     | 8.100  | 0.311                | 0.319 |
| h      | 0.000                     | 0.300  | 0.000                | 0.012 |
| L      | 12.900                    | 13.400 | 0.508                | 0.528 |
| L1     | 2.850                     | 3.250  | 0.112                | 0.128 |
| V      | 7.500 REF.                |        | 0.295 REF.           |       |
| Φ      | 3.400                     | 3.800  | 0.134                | 0.150 |

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