

## P-Channel Enhancement Mode MOSFET

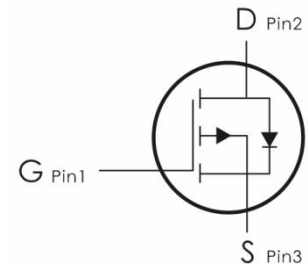
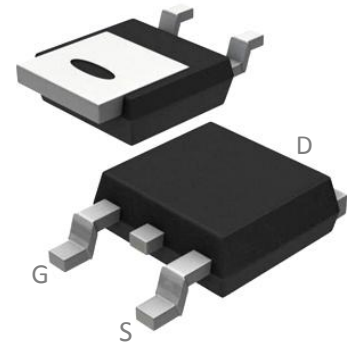
### Description:

This P-Channel MOSFET 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.

### Features:

- 1)  $V_{DS}=-40V, I_D=-65A, R_{DS(on)}<11m\Omega @V_{GS}=-10V$
- 2) Low gate charge.
- 3) Green device available.
- 4) Advanced high cell density trench technology for ultra low  $R_{DS(on)}$ .
- 5) Excellent package for good heat dissipation.



### Package Marking and Ordering Information:

| Part NO.  | Marking | Package | Packing       |
|-----------|---------|---------|---------------|
| NCE40P70K | 40P70K  | TO- 252 | 2500 pcs/Reel |

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

| Symbol         | Parameter                                        | Ratings  | Units       |
|----------------|--------------------------------------------------|----------|-------------|
| $V_{DS}$       | Drain-Source Voltage                             | -40      | V           |
| $V_{GS}$       | Gate-Source Voltage                              | $\pm 20$ | V           |
| $I_D$          | Continuous Drain Current                         | -65      | A           |
|                | Continuous Drain Current- $T_C=100^{\circ}C$     | -44.8    |             |
| $I_{DM}$       | Pulsed Drain Current <sup>1</sup>                | -252     |             |
| $P_D$          | Power Dissipation                                | 79       | W           |
| $E_{AS}$       | Single pulse avalanche energy <sup>2</sup>       | 272      | mJ          |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range | -55-+175 | $^{\circ}C$ |

### Thermal Characteristics:

| Symbol          | Parameter                            | Max | Units         |
|-----------------|--------------------------------------|-----|---------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 1.9 | $^{\circ}C/W$ |

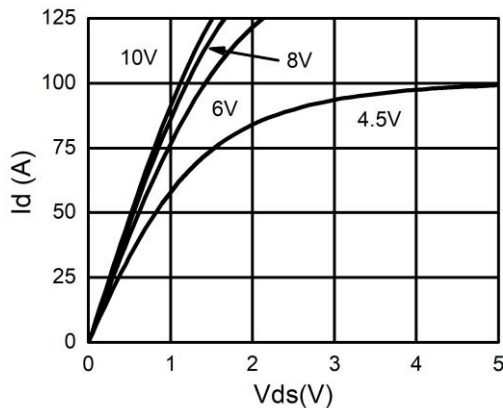
# Electrical Characteristics: (T<sub>C</sub>=25 °C unless otherwise noted)

| Symbol                             | Parameter                          | Conditions                                                             | Min | Typ  | Max   | Units |
|------------------------------------|------------------------------------|------------------------------------------------------------------------|-----|------|-------|-------|
| Off Characteristics                |                                    |                                                                        |     |      |       |       |
| BV <sub>DSS</sub>                  | Drain-Sourctce Breakdown Voltage   | V <sub>GS</sub> =0V,I <sub>D</sub> =250 μ A                            | -40 | ---  | ---   | V     |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current    | V <sub>GS</sub> =0V, V <sub>DS</sub> =-40V                             | --- | ---  | -1    | μ A   |
| I <sub>GSS</sub>                   | Gate-Source Leakage Current        | V <sub>GS</sub> =± 20V, V <sub>DS</sub> =0A                            | --- | ---  | ± 100 | nA    |
| On Characteristics                 |                                    |                                                                        |     |      |       |       |
| V <sub>GS(th)</sub>                | GATE-Source Threshold Voltage      | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250 μ A             | -1  | -1.7 | -2.5  | V     |
| R <sub>DS(ON)</sub>                | Drain-Source On Resistance         | V <sub>GS</sub> =-10V,I <sub>D</sub> =-15A                             | --- | 9    | 11    | m Ω   |
|                                    |                                    | V <sub>GS</sub> =-4.5V,I <sub>D</sub> =-10A                            | --- | 13.5 | 17.5  | m Ω   |
| Dynamic Characteristics            |                                    |                                                                        |     |      |       |       |
| C <sub>iss</sub>                   | Input Capacitance                  | V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V, f=1MHz                     | --- | 3403 | ---   | pF    |
| C <sub>OSS</sub>                   | Output Capacitance                 |                                                                        | --- | 229  | --    |       |
| C <sub>rss</sub>                   | Reverse Transfer Capacitance       |                                                                        | --- | 169  | ---   |       |
| Switching Characteristics          |                                    |                                                                        |     |      |       |       |
| t <sub>d(on)</sub>                 | Turn-On Delay Time                 | V <sub>DS</sub> =-20V,<br>R <sub>ENG</sub> =3 Ω ,V <sub>GS</sub> =-10V | --- | 11.4 | ---   | ns    |
| t <sub>r</sub>                     | Rise Time                          |                                                                        | --- | 13.4 | ---   | ns    |
| t <sub>d(off)</sub>                | Turn-Off Delay Time                |                                                                        | --- | 38   | ---   | ns    |
| t <sub>f</sub>                     | Fall Time                          |                                                                        | --- | 12   | ---   | ns    |
| Q <sub>g</sub>                     | Total Gate Charge                  | V <sub>GS</sub> =-10V, V <sub>DS</sub> =-20V,<br>I <sub>D</sub> =-20A  | --- | 60   | ---   | nc    |
| Q <sub>gs</sub>                    | Gate-Source Charge                 |                                                                        | --- | 8.6  | ---   | nc    |
| Q <sub>gd</sub>                    | Gate-Drain “Miller” Charge         |                                                                        | --- | 15.2 | ---   | nc    |
| Drain-Source Diode Characteristics |                                    |                                                                        |     |      |       |       |
| V <sub>SD</sub>                    | Diode Forward Voltage <sup>3</sup> | V <sub>GS</sub> =0V, I <sub>SD</sub> =-15A                             | --- | ---  | -1.2  | V     |
| I <sub>S</sub>                     | Continuous Drain Curren            | VD=VG=0V                                                               | --- | ---  | -65   | A     |
| I <sub>SM</sub>                    | Pulsed Drain Current               |                                                                        | --- | ---  | -252  | A     |
| Trr                                | Reverse Recovery Time              | I <sub>F</sub> =-20A,T <sub>J</sub> =25℃                               | --- | 43   | ---   | ns    |
| Qrr                                | Reverse Recovery Charge            | dI/dt=100A/us                                                          | --- | 48   | ---   | nc    |

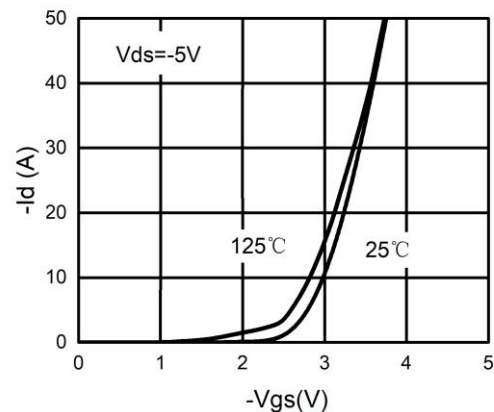
### Notes:

- 1.Repetitive Rating: Pulse width limited by maximum junction temperature.
- 2.EAS condition:  $T_J=25^{\circ}\text{C}$ ,  $V_{DD}=40\text{V}$ ,  $V_G=-10\text{V}$ ,  $R_g=25\Omega$ ,  $L=0.5\text{mH}$ .
- 3.Repetitive Rating: Pulse width limited by maximum junction temperature.

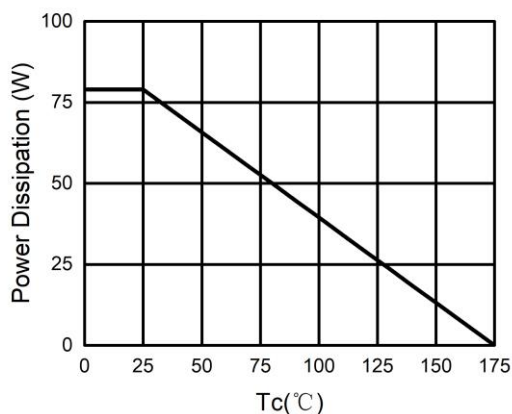
**Typical Characteristics:** ( $T_C=25^{\circ}\text{C}$  unless otherwise noted)



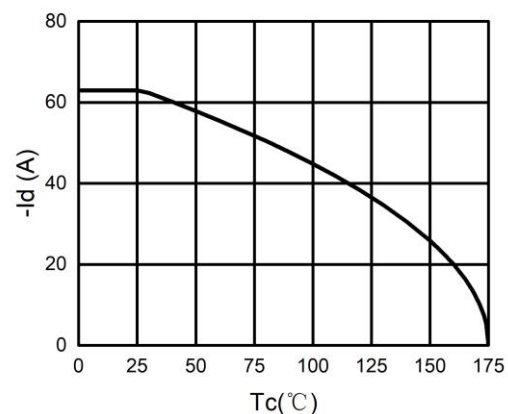
**Figure 1. Output Characteristics**



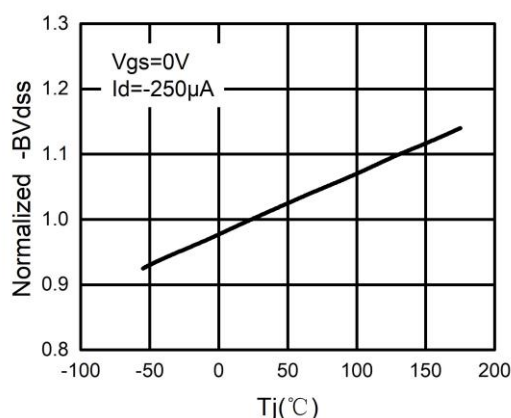
**Figure 2. Transfer Characteristics**



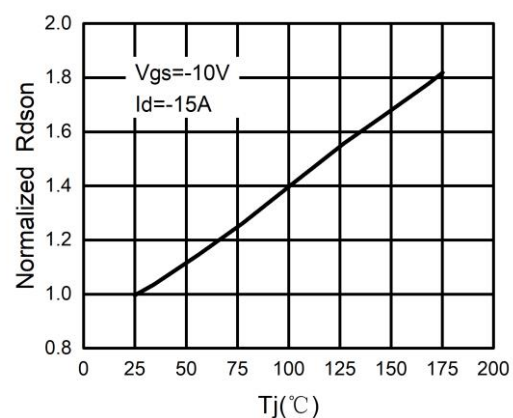
**Figure 3. Power Dissipation**



**Figure 4. Drain Current**



**Figure 5.  $BV_{DSS}$  vs Junction Temperature**



**Figure 6.  $R_{DS(ON)}$  vs Junction Temperature**

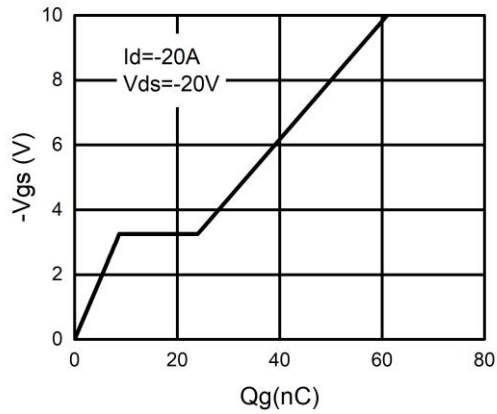


Figure 7. Gate Charge Waveforms

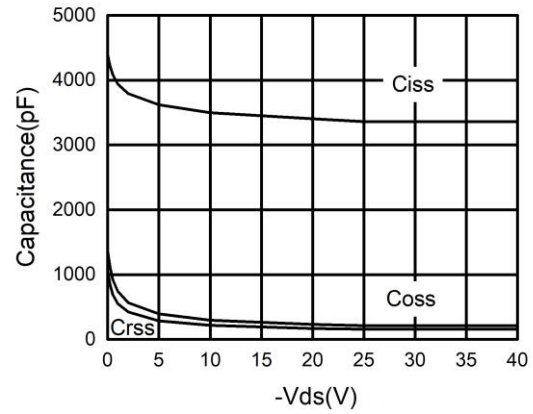


Figure 8. Capacitance

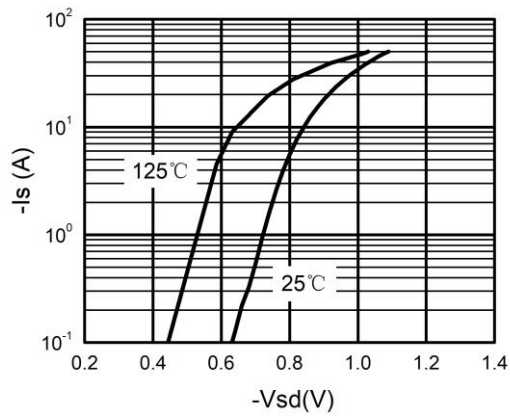


Figure 9. Body-Diode Characteristics

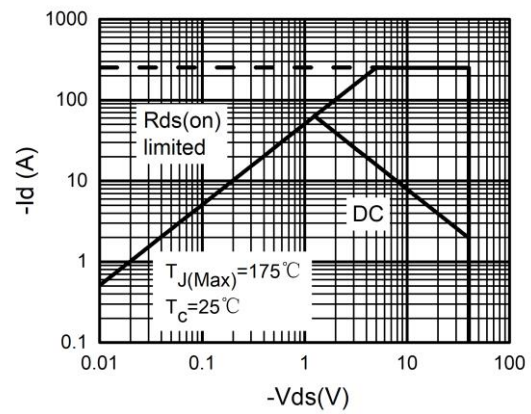
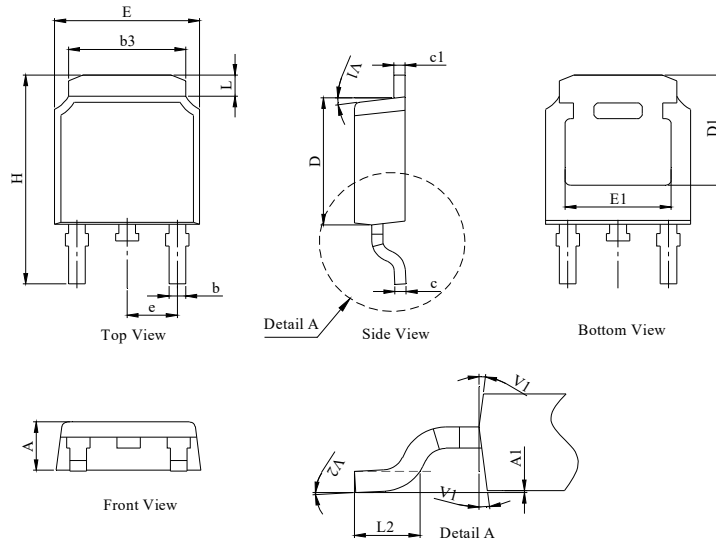


Figure 10. Maximum Safe Operating Area

## TO-252 Package Information

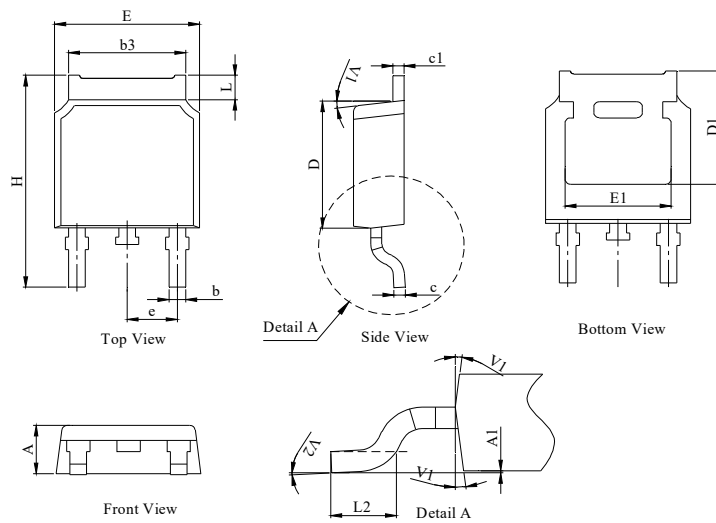
### Package Outline Type-A

UNIT: mm



| DIM. | MILLIMETER |       |       |
|------|------------|-------|-------|
|      | MIN.       | NOM.  | MAX.  |
| A    | 2.18       | 2.30  | 2.39  |
| A1   | 0          | --    | 0.13  |
| b    | 0.64       | 0.76  | 0.89  |
| c    | 0.40       | 0.50  | 0.61  |
| c1   | 0.46       | 0.50  | 0.58  |
| D    | 5.97       | 6.10  | 6.23  |
| D1   | 5.05       | --    | --    |
| E    | 6.35       | 6.60  | 6.73  |
| E1   | 4.32       | --    | --    |
| b3   | 5.21       | 5.38  | 5.55  |
| e    | 2.29 BSC   |       |       |
| H    | 9.40       | 10.00 | 10.40 |
| L    | 0.89       | --    | 1.27  |
| L2   | 1.40       | --    | 1.78  |
| V1   | 7° REF     |       |       |
| V2   | 0°         | --    | 6°    |

### Package Outline Type-B



| DIM. | MILLIMETER |       |       |
|------|------------|-------|-------|
|      | MIN.       | NOM.  | MAX.  |
| A    | 2.10       | 2.30  | 2.40  |
| A1   | 0          | --    | 0.13  |
| b    | 0.66       | 0.76  | 0.86  |
| b3   | 5.21       | 5.38  | 5.55  |
| c    | 0.40       | 0.50  | 0.60  |
| c1   | 0.44       | 0.50  | 0.58  |
| D    | 5.90       | 6.10  | 6.30  |
| D1   | 5.30REF    |       |       |
| E    | 6.40       | 6.60  | 6.80  |
| E1   | 4.63       | -     | -     |
| e    | 2.29 BSC   |       |       |
| H    | 9.50       | 10.00 | 10.70 |
| L    | 1.09       | --    | 1.21  |
| L2   | 1.35       | --    | 1.65  |
| V1   | 7° REF     |       |       |
| V2   | 0°         | --    | 6°    |

### Recommended Soldering Footprint

