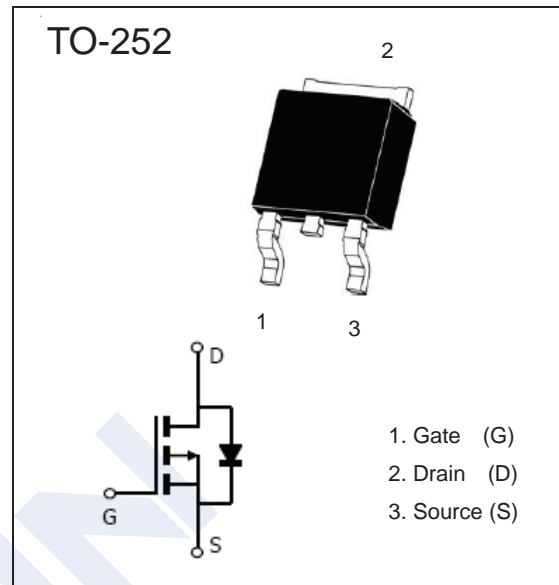


## P-Channel MOSFET

## NDT20P04

## ■ Features

- $V_{DS} (V) = -40V$
- $I_D = -20A$
- $R_{DS(ON)} < 33.5m\Omega @ V_{GS} = -10V$
- $R_{DS(ON)} < 43m\Omega @ V_{GS} = -4.5V$
- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high EAS

■ Absolute Maximum Ratings ( $T_c = 25^\circ C$  Unless otherwise noted)

| Parameter                                        | Symbol          | Rating     | Unit         |
|--------------------------------------------------|-----------------|------------|--------------|
| Drain-Source Voltage                             | $V_{DS}$        | -40        | V            |
| Gate-Source Voltage                              | $V_{GS}$        | $\pm 20$   |              |
| Continuous Drain Current                         | $I_D$           | -20        | A            |
| Continuous Drain Current ( $T_c = 100^\circ C$ ) |                 | -12.5      |              |
| Pulsed Drain Current                             |                 | $I_{DM}$   |              |
| Single pulse avalanche energy (Note 1)           | EAS             | 272        | mJ           |
| Power Dissipation                                | $P_D$           | 80         | W            |
| Thermal Resistance, Junction- to-Case (Note 2)   | $R_{\theta JC}$ | 1.88       | $^\circ C/W$ |
| Junction Temperature                             | $T_J$           | 175        | $^\circ C$   |
| Junction Storage Temperature Range               | $T_{stg}$       | -55 to 175 |              |

Notes:

1. EAS condition:  $T_j = 25^\circ C, V_{DD} = -20V, V_G = -10V, L = 1mH, R_g = 25\Omega, I_{AS} = 16.5A$
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.

## NDT20P04

■ Electrical Characteristics (T<sub>c</sub> = 25°C Unless otherwise noted)

| Parameter                             | Symbol              | Test Conditions                                                                               | Min  | Typ  | Max  | Unit |
|---------------------------------------|---------------------|-----------------------------------------------------------------------------------------------|------|------|------|------|
| Off Characteristics                   |                     |                                                                                               |      |      |      |      |
| Drain-Source Breakdown Voltage        | BV <sub>DSS</sub>   | I <sub>D</sub> =-250μA, V <sub>GS</sub> =0V                                                   | -40  |      |      | V    |
| Zero Gate Voltage Drain Current       | I <sub>DSS</sub>    | V <sub>DS</sub> =-40V, V <sub>GS</sub> =0V                                                    |      |      | -1   | μA   |
| Gate-Body Leakage Current             | I <sub>GSS</sub>    | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V                                                    |      |      | ±100 | nA   |
| On Characteristics (Note 3)           |                     |                                                                                               |      |      |      |      |
| Gate Threshold Voltage                | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA                                     | -1.1 |      | -2.2 | V    |
| Static Drain-Source On-Resistance     | R <sub>DS(on)</sub> | V <sub>GS</sub> =-10V, I <sub>D</sub> =-14A                                                   |      |      | 33.5 | mΩ   |
|                                       |                     | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-10A                                                  |      |      | 43   |      |
| Forward Transconductance              | g <sub>FS</sub>     | V <sub>DS</sub> =-5V, I <sub>D</sub> =-12A                                                    | 17   |      |      | S    |
| Dynamic Characteristics (Note 4)      |                     |                                                                                               |      |      |      |      |
| Input Capacitance                     | C <sub>iss</sub>    | V <sub>GS</sub> =0V, V <sub>DS</sub> =-20V, f=1MHz                                            |      | 1960 |      | pF   |
| Output Capacitance                    | C <sub>oss</sub>    |                                                                                               |      | 270  |      |      |
| Reverse Transfer Capacitance          | C <sub>rss</sub>    |                                                                                               |      | 210  |      |      |
| Switching Characteristics (Note 4)    |                     |                                                                                               |      |      |      |      |
| Total Gate Charge                     | Q <sub>g</sub>      | V <sub>DS</sub> =-20V, I <sub>D</sub> =-14A, V <sub>GS</sub> = -10V                           |      | 52   |      | nC   |
| Gate Source Charge                    | Q <sub>gs</sub>     |                                                                                               |      | 12   |      |      |
| Gate Drain Charge                     | Q <sub>gd</sub>     |                                                                                               |      | 11   |      |      |
| Turn-On Delay Time                    | t <sub>d(on)</sub>  | V <sub>DD</sub> =-20V, I <sub>D</sub> =-10A,<br>V <sub>GS</sub> = -10 V, R <sub>G</sub> = 3 Ω |      | 10   |      | ns   |
| Turn-On Rise Time                     | t <sub>r</sub>      |                                                                                               |      | 18   |      |      |
| Turn-Off Delay Time                   | t <sub>d(off)</sub> |                                                                                               |      | 38   |      |      |
| Turn-Off Fall Time                    | t <sub>f</sub>      |                                                                                               |      | 24   |      |      |
| Drain-Source Diode Characteristics    |                     |                                                                                               |      |      |      |      |
| Maximum Body-Diode Continuous Current | I <sub>S</sub>      |                                                                                               |      |      | -20  | A    |
| Diode Forward Voltage (Note 3)        | V <sub>SD</sub>     | I <sub>SD</sub> =-10 A, V <sub>GS</sub> =0V                                                   |      |      | -1.2 | V    |
| Reverse Recovery Time                 | t <sub>rr</sub>     | T <sub>J</sub> = 25°C, I <sub>F</sub> =-10A,<br>di/dt = 100A/μs (Note 3)                      |      | 25   |      | nS   |
| Reverse Recovery Charge               | Q <sub>rr</sub>     |                                                                                               |      | 21   |      | nC   |

Notes:

- Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
- Guaranteed by design, not subject to production

## ■ Marking

|         |               |
|---------|---------------|
| Marking | 20P04<br>K*** |
|---------|---------------|

# NDT20P04

## Typical Electrical and Thermal Characteristics

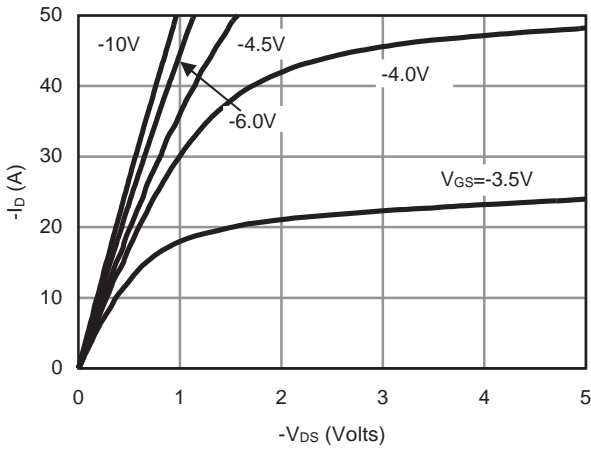


Figure 1: On-Region Characteristics

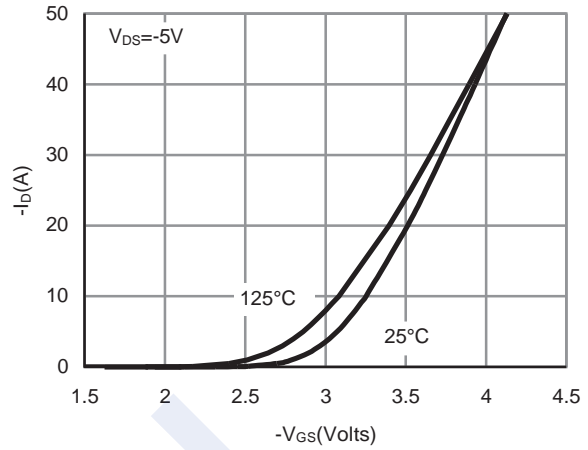


Figure 2: Transfer Characteristics

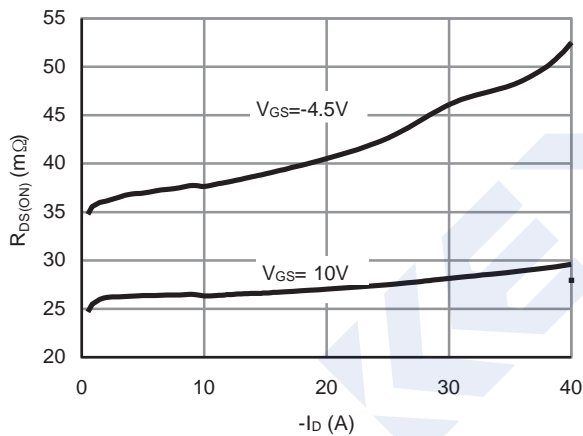


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

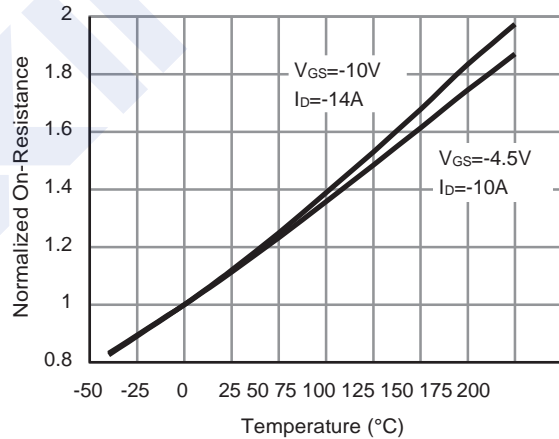


Figure 4: On-Resistance vs. Junction Temperature

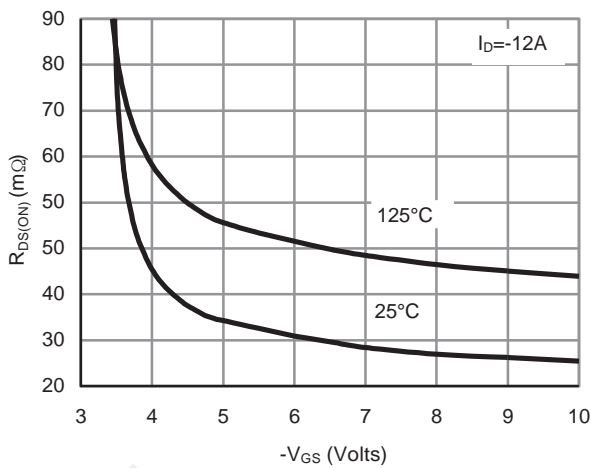


Figure 5: On-Resistance vs. Gate-Source Voltage

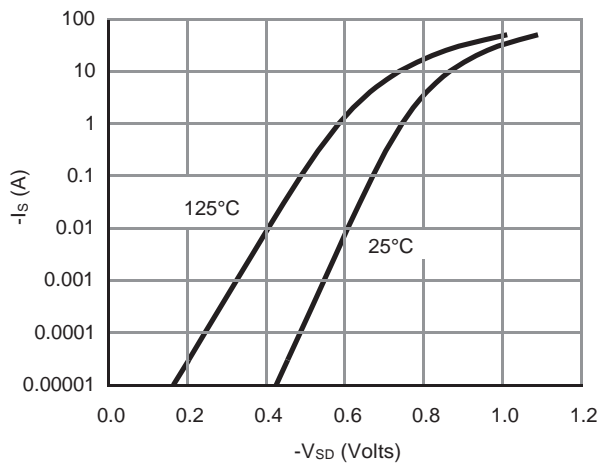


Figure 6: Body-Diode Characteristics

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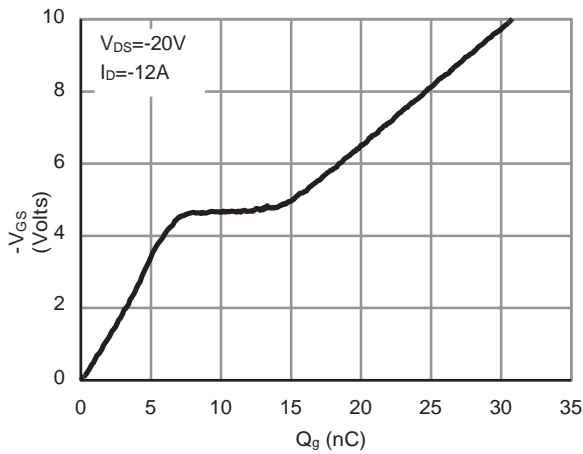


Figure 7: Gate-Charge Characteristics

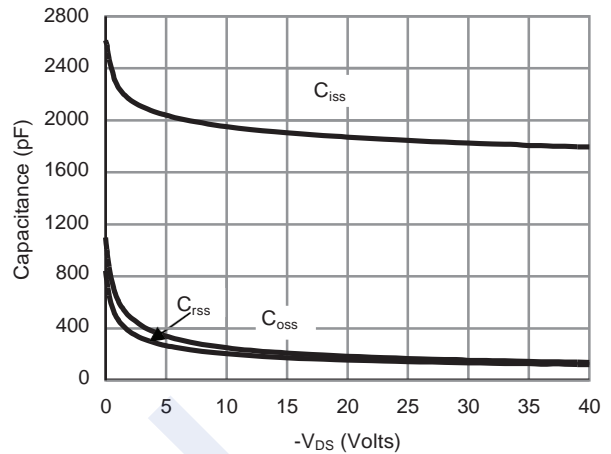


Figure 8: Capacitance Characteristics

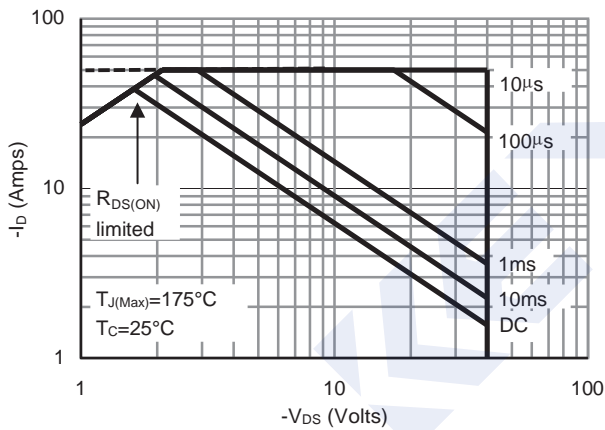


Figure 9: Maximum Forward Biased Safe Operating Area

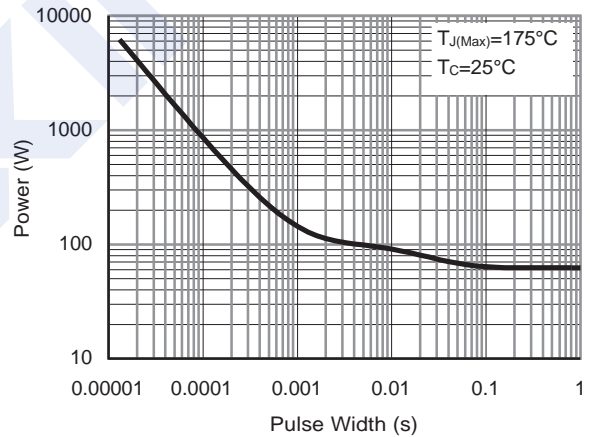


Figure 10: Single Pulse Power Rating Junction-to-Case

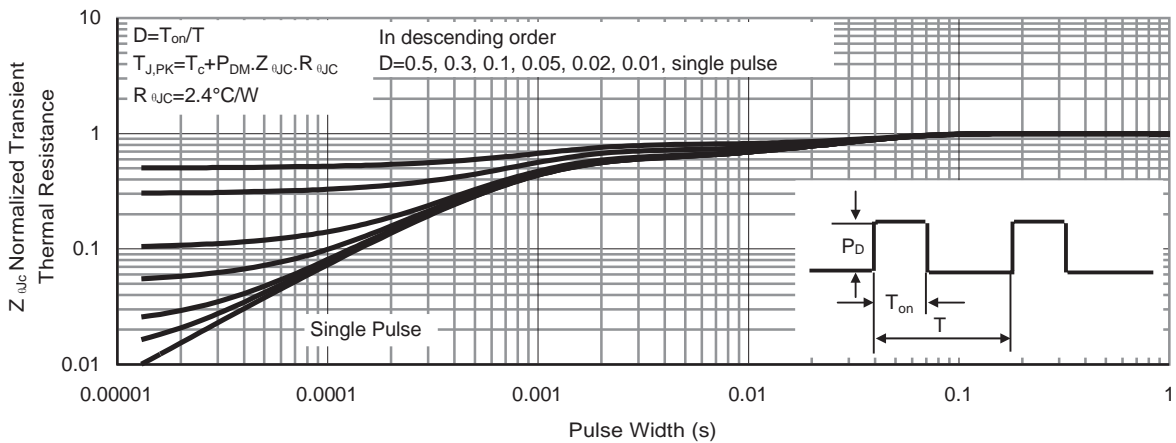
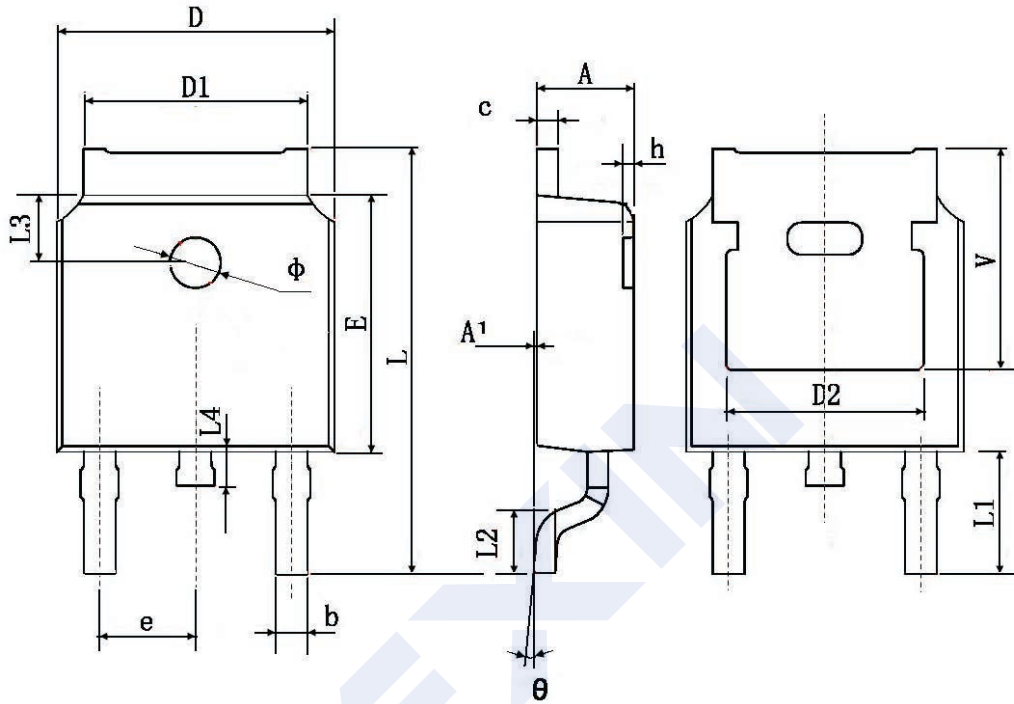


Figure 11: Normalized Maximum Transient Thermal Impedance

## NDT20P04

## ■ Package Dimension

## TO-252



| Symbol | Dimensions In Millimeters |        | Dimensions In Inches |       |
|--------|---------------------------|--------|----------------------|-------|
|        | Min.                      | Max.   | Min.                 | Max.  |
| A      | 2.200                     | 2.400  | 0.087                | 0.094 |
| A1     | 0.000                     | 0.127  | 0.000                | 0.005 |
| b      | 0.660                     | 0.860  | 0.026                | 0.034 |
| c      | 0.460                     | 0.580  | 0.018                | 0.023 |
| D      | 6.500                     | 6.700  | 0.256                | 0.264 |
| D1     | 5.100                     | 5.460  | 0.201                | 0.215 |
| D2     | 4.830 TYP.                |        | 0.190 TYP.           |       |
| E      | 6.000                     | 6.200  | 0.236                | 0.244 |
| e      | 2.186                     | 2.386  | 0.086                | 0.094 |
| L      | 9.800                     | 10.400 | 0.386                | 0.409 |
| L1     | 2.900 TYP.                |        | 0.114 TYP.           |       |
| L2     | 1.400                     | 1.700  | 0.055                | 0.067 |
| L3     | 1.600 TYP.                |        | 0.063 TYP.           |       |
| L4     | 0.600                     | 1.000  | 0.024                | 0.039 |
| φ      | 1.100                     | 1.300  | 0.043                | 0.051 |
| θ      | 0°                        | 8°     | 0°                   | 8°    |
| h      | 0.000                     | 0.300  | 0.000                | 0.012 |
| V      | 5.350 TYP.                |        | 0.211 TYP.           |       |