

# MOSFET - Power, Single N-Channel, DUAL COOL® 80 V, 10 mΩ, 61 A

## NTMFSC011N08M7

### Features

- DUAL COOL Top Side Cooling PQFN Package
- Max  $r_{DS(on)} = 10 \text{ m}\Omega$  at  $V_{GS} = 10 \text{ V}$ ,  $I_D = 10 \text{ A}$
- High Performance Technology for Extremely Low  $r_{DS(on)}$
- 100% UIL Tested
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

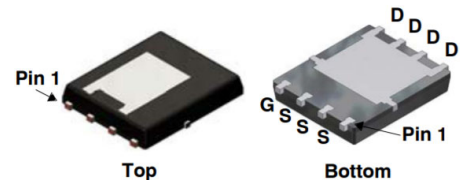
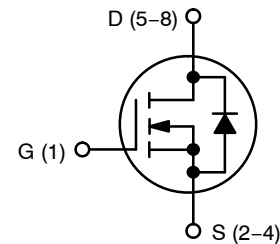
| Parameter                                                                  |                                               |                        | Symbol                            | Value       | Unit |
|----------------------------------------------------------------------------|-----------------------------------------------|------------------------|-----------------------------------|-------------|------|
| Drain-to-Source Voltage                                                    |                                               |                        | V <sub>DSS</sub>                  | 80          | V    |
| Gate-to-Source Voltage                                                     |                                               |                        | V <sub>GS</sub>                   | ±20         | V    |
| Continuous Drain Current R <sub>θJC</sub> (Notes 1, 3)                     | Steady State                                  | T <sub>C</sub> = 25°C  | I <sub>D</sub>                    | 61          | A    |
|                                                                            |                                               | T <sub>C</sub> = 100°C |                                   | 38.6        |      |
| Power Dissipation R <sub>θJC</sub> (Note 1)                                |                                               | T <sub>C</sub> = 25°C  | P <sub>D</sub>                    | 78.1        | W    |
|                                                                            |                                               | T <sub>C</sub> = 100°C |                                   | 31.2        |      |
| Continuous Drain Current R <sub>θJA</sub> (Notes 1, 2, 3)                  | Steady State                                  | T <sub>A</sub> = 25°C  | I <sub>D</sub>                    | 12.5        | A    |
|                                                                            |                                               | T <sub>A</sub> = 100°C |                                   | 7.9         |      |
| Power Dissipation R <sub>θJA</sub> (Notes 1, 2)                            |                                               | T <sub>A</sub> = 25°C  | P <sub>D</sub>                    | 3.3         | W    |
|                                                                            |                                               | T <sub>A</sub> = 100°C |                                   | 1.3         |      |
| Pulsed Drain Current                                                       | T <sub>A</sub> = 25°C, t <sub>p</sub> = 10 μs |                        | I <sub>DM</sub>                   | 180         | A    |
| Operating Junction and Storage Temperature Range                           |                                               |                        | T <sub>J</sub> , T <sub>stg</sub> | -55 to +150 | °C   |
| Source Current (Body Diode)                                                |                                               |                        | I <sub>S</sub>                    | 61          | A    |
| Single Pulse Drain-to-Source Avalanche Energy (I <sub>L(pk)</sub> = 3.9 A) |                                               |                        | E <sub>AS</sub>                   | 640         | mJ   |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s)          |                                               |                        | T <sub>L</sub>                    | 260         | °C   |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface-mounted on FR4 board using a 1 in<sup>2</sup> pad size, 1 oz Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

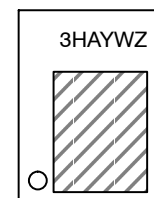
| $V_{(BR)DSS}$ | $R_{DS(ON)} \text{ MAX}$ | $I_D \text{ MAX}$ |
|---------------|--------------------------|-------------------|
| 80 V          | 10 mΩ @ 10 V             | 61 A              |

### N-Channel MOSFET



DFN8 5x6  
(Dual Cool 56)  
CASE 506EG

### MARKING DIAGRAM



- 3H = Specific Device Code  
A = Assembly Location  
Y = Year  
W = Work Week  
Z = Assembly Lot Code

### ORDERING INFORMATION

| Device         | Package        | Shipping           |
|----------------|----------------|--------------------|
| NTMFSC011N08M7 | DFN8 (Pb-Free) | 3000 / Tape & Reel |

# NTMFSC011N08M7

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|-----------|--------|----------------|-----|-----|-----|------|
|-----------|--------|----------------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|                                                           |                   |                                                     |                           |    |           |                      |
|-----------------------------------------------------------|-------------------|-----------------------------------------------------|---------------------------|----|-----------|----------------------|
| Drain to Source Breakdown Voltage                         | $V_{(BR)DSS}$     | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 80                        |    |           | V                    |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ |                                                     |                           | 49 |           | mV/ $^\circ\text{C}$ |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$         | $V_{GS} = 0\text{ V}, V_{DS} = 80\text{ V}$         | $T_J = 25^\circ\text{C}$  |    | 10        | $\mu\text{A}$        |
|                                                           |                   |                                                     | $T_J = 125^\circ\text{C}$ |    | 100       |                      |
| Zero Gate Voltage Drain Current                           | $I_{GSS}$         | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$     |                           |    | $\pm 100$ | nA                   |

### ON CHARACTERISTICS (Note 4)

|                                   |                  |                                                 |     |      |     |                      |
|-----------------------------------|------------------|-------------------------------------------------|-----|------|-----|----------------------|
| Gate Threshold Voltage            | $V_{GS(TH)}$     | $V_{GS} = V_{DS}, I_D = 120\text{ }\mu\text{A}$ | 2.5 | 3.3  | 4.5 | V                    |
| Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ |                                                 |     | -9   |     | mV/ $^\circ\text{C}$ |
| Drain-to-Source On Resistance     | $R_{DS(on)}$     | $V_{GS} = 10\text{ V}, I_D = 10\text{ A}$       |     | 7.6  | 10  | m $\Omega$           |
| Forward Transconductance          | gFS              | $V_{DS} = 5\text{ V}, I_D = 10\text{ A}$        |     | 21.5 | 40  | S                    |

### CHARGES, CAPACITANCES & GATE RESISTANCE

|                               |              |                                             |                                                                 |   |      |      |               |
|-------------------------------|--------------|---------------------------------------------|-----------------------------------------------------------------|---|------|------|---------------|
| Input Capacitance             | $C_{iss}$    | $V_{GS} = 0\text{ V}, f = 1\text{ MHz}$     | $V_{DS} = 0\text{ V}$                                           |   | 2373 |      | $\mu\text{F}$ |
|                               | $C_{iss}$    |                                             | $V_{DS} = 40\text{ V}$                                          |   | 2080 | 2700 |               |
| Output Capacitance            | $C_{oss}$    |                                             |                                                                 |   | 286  | 430  |               |
| Reverse Transfer Capacitance  | $C_{rss}$    |                                             |                                                                 |   | 11   | 17   |               |
| Gate Resistance               | $R_g$        | $V_{GS} = 0.5\text{ V}, f = 1\text{ MHz}$   |                                                                 | 1 | 2    |      | $\Omega$      |
| Threshold Gate Charge         | $Q_{g(th)}$  | $V_{GS} = 0\text{ to }2\text{ V}$           | $V_{GS} = 10\text{ V}, V_{DS} = 40\text{ V}; I_D = 10\text{ A}$ |   | 4.3  |      | nC            |
| Total Gate Charge             | $Q_{G(TOT)}$ | $V_{GS} = 0\text{ to }10\text{ V}$          |                                                                 |   | 29.3 | 38   |               |
| Gate to Source Gate Charge    | $Q_{gs}$     | $V_{GS} = 0\text{ to }10\text{ V}$          |                                                                 |   | 11.8 |      |               |
| Gate to Drain "Miller" Charge | $Q_{gd}$     |                                             |                                                                 |   | 4.3  |      |               |
| Plateau Voltage               | $V_{GP}$     |                                             |                                                                 |   | 5.5  |      | V             |
| Output Charge                 | $Q_{oss}$    | $V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$ |                                                                 |   | 26   |      | nC            |

### SWITCHING CHARACTERISTICS (Note 5)

|                     |              |                                                                                            |  |    |  |    |
|---------------------|--------------|--------------------------------------------------------------------------------------------|--|----|--|----|
| Turn-On Delay Time  | $t_{d(ON)}$  | $V_{DD} = 40\text{ V}, I_D = 10\text{ A}, V_{GS} = 10\text{ V}, R_{GEN} = 6\text{ }\Omega$ |  | 14 |  | ns |
| Turn-On Rise Time   | $t_r$        |                                                                                            |  | 6  |  | ns |
| Turn-Off Delay Time | $t_{d(OFF)}$ |                                                                                            |  | 27 |  | ns |
| Turn-Off Fall Time  | $t_f$        |                                                                                            |  | 6  |  | ns |

### DRAIN – SOURCE DIODE CHARACTERISTICS

|                               |          |                                                                                 |  |      |     |    |
|-------------------------------|----------|---------------------------------------------------------------------------------|--|------|-----|----|
| Source to Drain Diode Voltage | $V_{SD}$ | $I_{SD} = 10\text{ A}, V_{GS} = 0\text{ V}$                                     |  | 0.82 | 1.2 | V  |
| Reverse Recovery Time         | $T_{RR}$ | $V_{GS} = 0\text{ V}, dI_{SD}/dt = 100\text{ A}/\mu\text{s}, I_S = 10\text{ A}$ |  | 41   | 50  | ns |
| Charge Time                   | $t_a$    |                                                                                 |  | 24.6 |     |    |
| Discharge Time                | $t_b$    |                                                                                 |  | 16.1 |     |    |
| Reverse Recovery Charge       | $Q_{RR}$ |                                                                                 |  | 45   | 58  | nC |

4. Pulse Test: pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

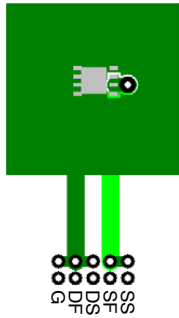
5. Switching characteristics are independent of operating junction temperatures.

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## THERMAL CHARACTERISTICS

| Symbol          | Parameter                                           | Value | Unit |
|-----------------|-----------------------------------------------------|-------|------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case (Top Source)   | 1.6   | °C/W |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case (Bottom Drain) | 3.0   |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a)   | 38    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1b)   | 81    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1c)   | 27    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1d)   | 34    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1e)   | 16    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1f)   | 19    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1g)   | 26    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1h)   | 61    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1i)   | 16    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1j)   | 23    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1k)   | 11    |      |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1l)   | 13    |      |

6.  $R_{\theta JA}$  is determined with the device mounted on a FR-4 board using a specified pad of 2 oz copper as shown below.  $R_{\theta JA}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a) 38°C/W when mounted on a 1 in2 pad of 2 oz copper.



b) 81°C/W when mounted on a minimum pad of 2 oz copper.

- c) Still air, 20.9-10.4-12.7 mm Aluminum Heat Sink, 1 in2 pad of 2 oz copper
- d) Still air, 20.9-10.4-12.7 mm Aluminum Heat Sink, minimum pad of 2 oz copper
- e) Still air, 45.2-41.4-11.7 mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in2 pad of 2 oz copper
- f) Still air, 45.2-41.4-11.7 mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper
- g) .200FPM Airflow, No Heat Sink, 1 in2 pad of 2 oz copper
- h) .200FPM Airflow, No Heat Sink, minimum pad of 2 oz copper
- i) .200FPM Airflow, 20.9-10.4-12.7 mm Aluminum Heat Sink, 1 in2 pad of 2 oz copper
- j) .200FPM Airflow, 20.9-10.4-12.7 mm Aluminum Heat Sink, minimum pad of 2 oz copper
- k) .200FPM Airflow, 45.2-41.4-11.7 mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in2 pad of 2 oz copper
- l) .200FPM Airflow, 45.2-41.4-11.7 mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper

7. Pulse Test: Pulse Width < 300  $\mu$ s, Duty cycle < 2.0%.

## TYPICAL CHARACTERISTICS

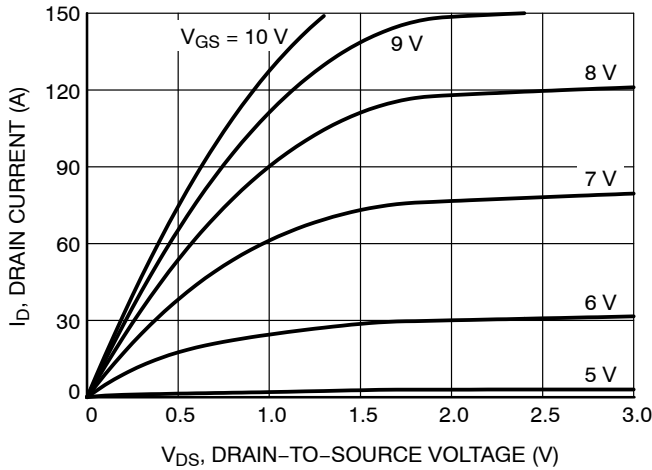


Figure 1. On-Region Characteristics

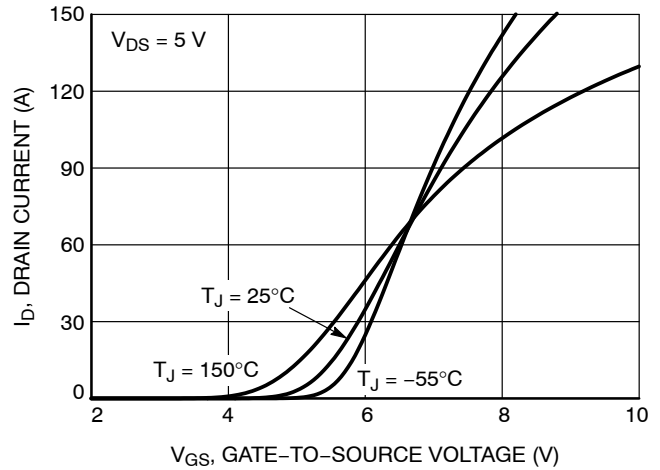


Figure 2. Transfer Characteristics

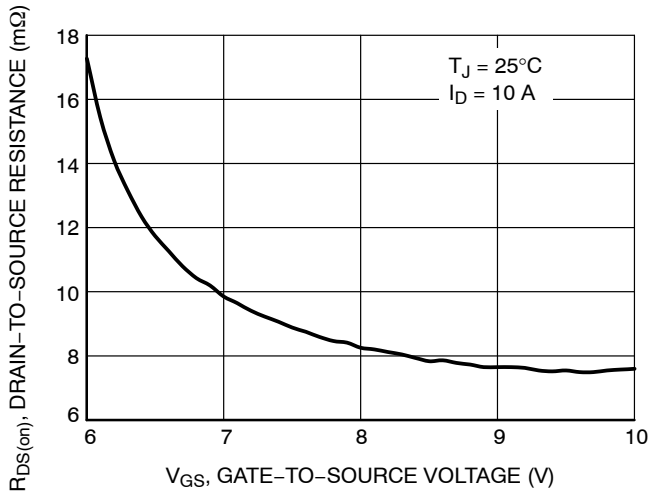


Figure 3. On-Resistance vs. Gate-to-Source Voltage

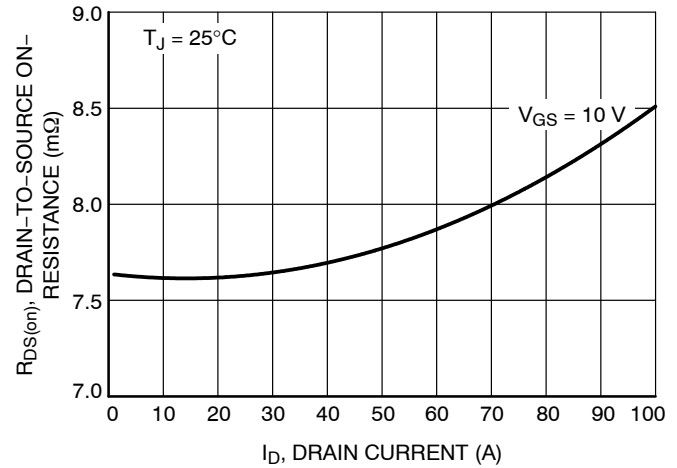


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

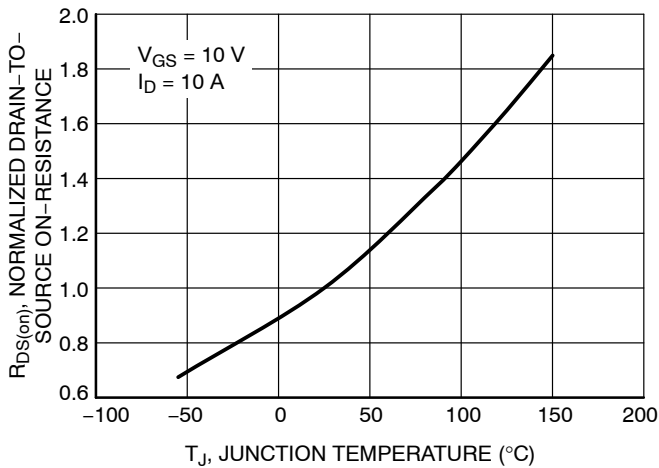


Figure 5. On-Resistance Variation with Temperature

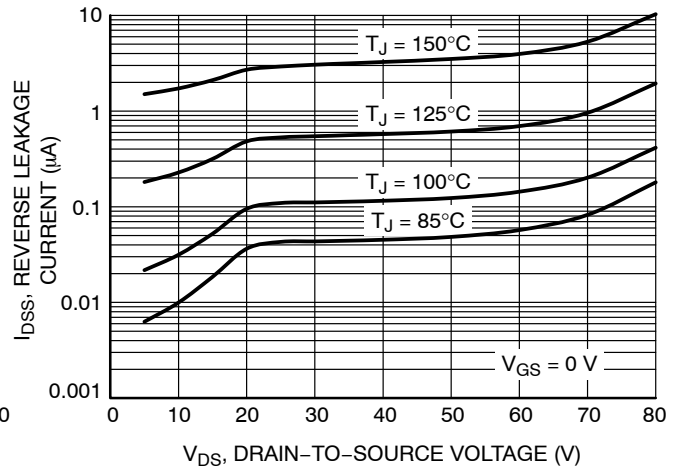


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

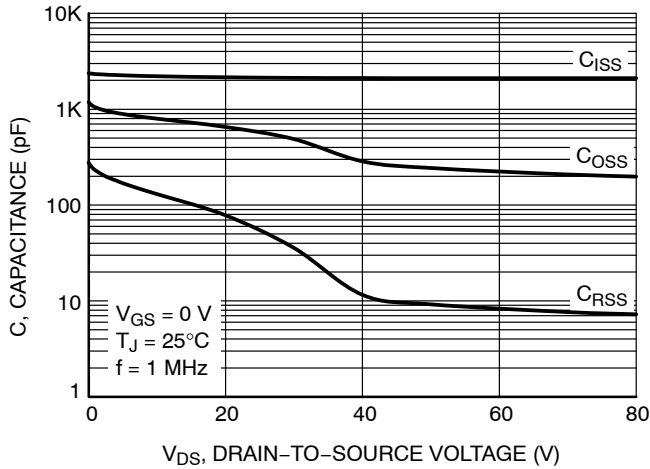


Figure 7. Capacitance Variation

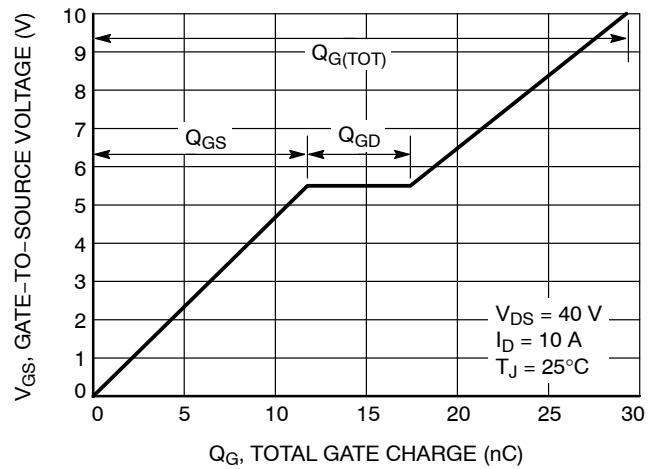


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

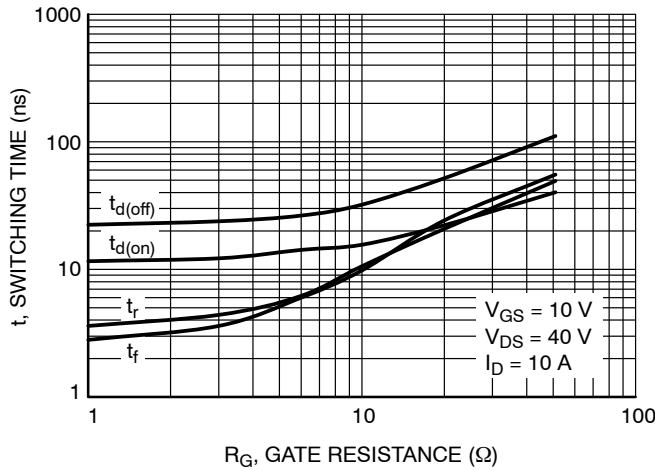


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

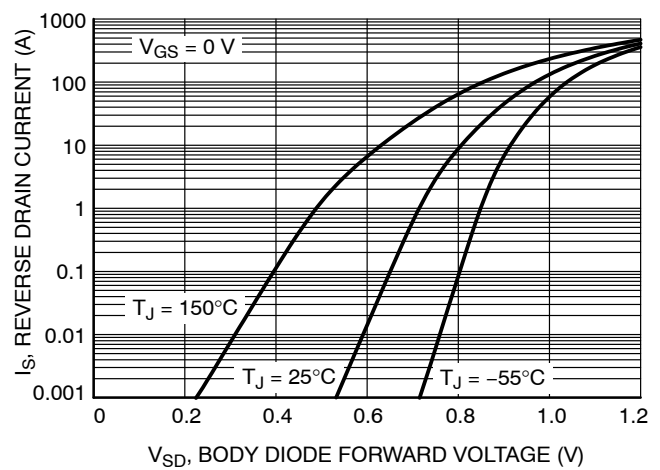


Figure 10. Diode Forward Voltage vs. Current

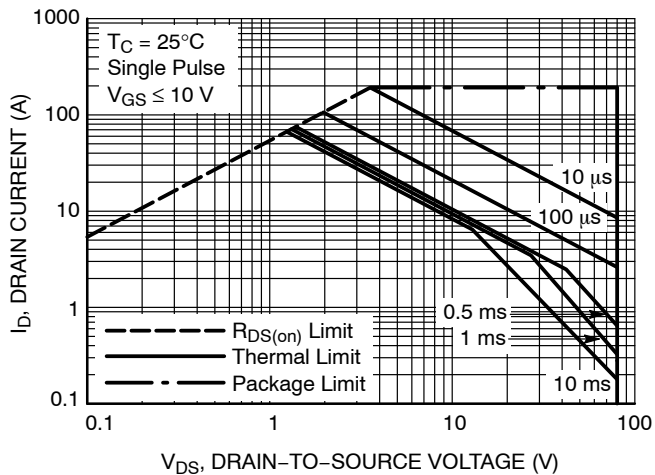


Figure 11. Safe Operating Area

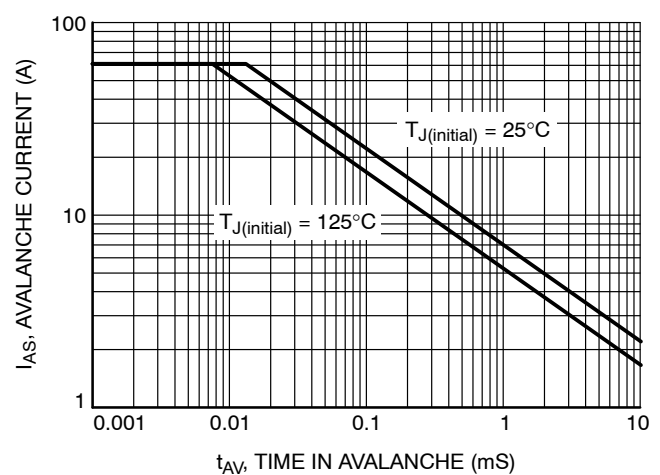


Figure 12.  $I_{PEAK}$  vs. Time in Avalanche

## TYPICAL CHARACTERISTICS

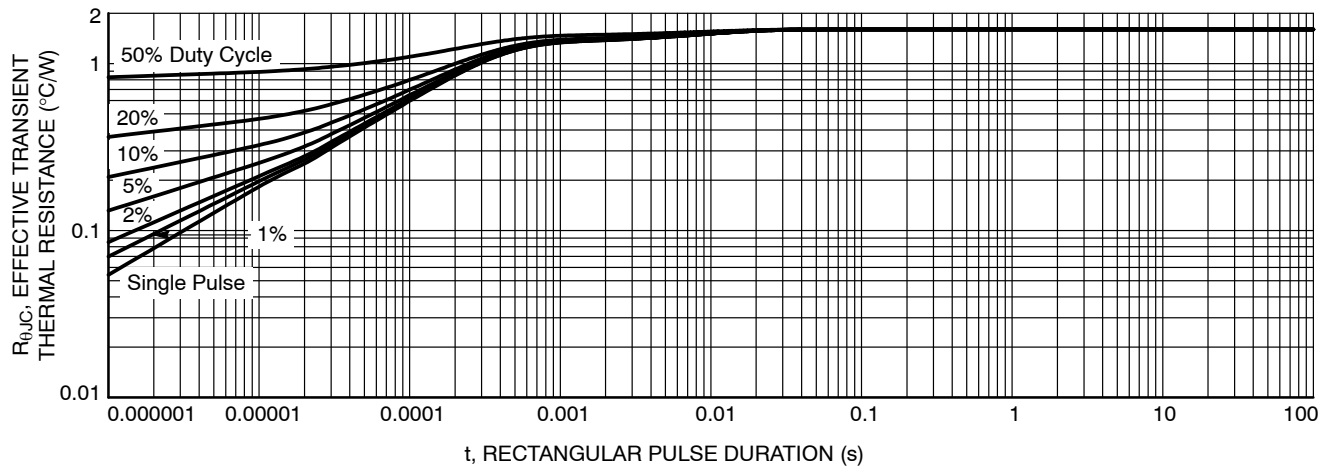
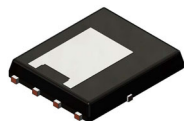


Figure 13. Thermal Response

# MECHANICAL CASE OUTLINE

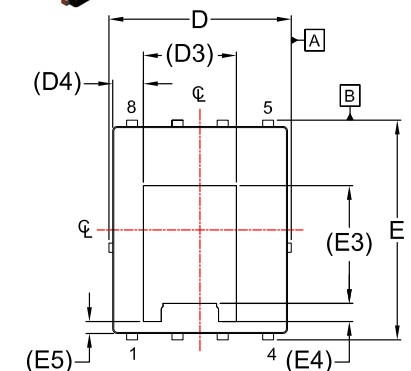
## PACKAGE DIMENSIONS

ON Semiconductor®

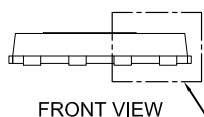


### DFN8 5x6.15, 1.27P, DUAL COOL CASE 506EG ISSUE D

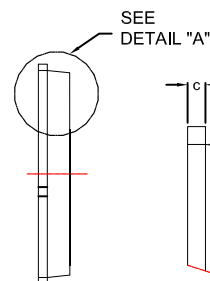
DATE 25 AUG 2020



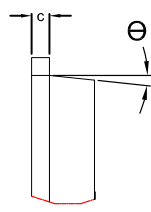
TOP VIEW



FRONT VIEW



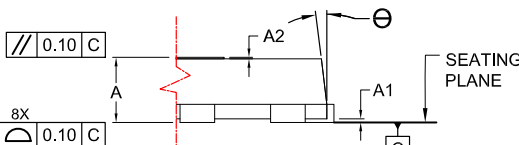
SIDE VIEW



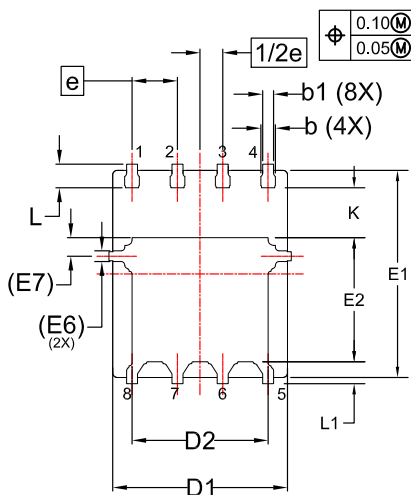
DETAIL "A"  
SCALE: 2:1

#### NOTES:

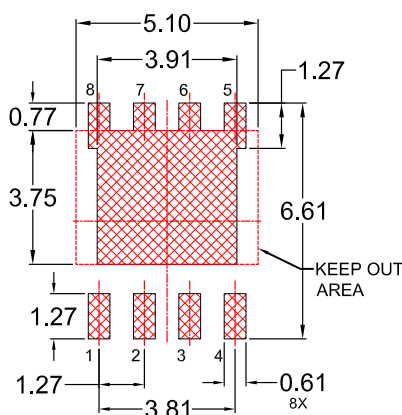
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.



DETAIL "B"  
SCALE: 2:1



BOTTOM VIEW

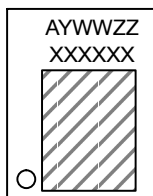


LAND PATTERN  
RECOMMENDATION

\*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

| DIM  | MILLIMETERS |      |      |
|------|-------------|------|------|
|      | MIN.        | NOM. | MAX. |
| A    | 0.85        | 0.90 | 0.95 |
| A1   | -           | -    | 0.05 |
| A2   | -           | -    | 0.05 |
| b    | 0.31        | 0.41 | 0.51 |
| b1   | 0.21        | 0.31 | 0.41 |
| c    | 0.20        | 0.25 | 0.30 |
| D    | 4.90        | 5.00 | 5.10 |
| D1   | 4.80        | 4.90 | 5.00 |
| D2   | 3.67        | 3.82 | 3.97 |
| D3   | 2.60 REF    |      |      |
| D4   | 0.86 REF    |      |      |
| E    | 6.05        | 6.15 | 6.25 |
| E1   | 5.70        | 5.80 | 5.90 |
| E2   | 3.38        | 3.48 | 3.58 |
| E3   | 3.30 REF    |      |      |
| E4   | 0.50 REF    |      |      |
| E5   | 0.34 REF    |      |      |
| E6   | 0.30 REF    |      |      |
| E7   | 0.52 REF    |      |      |
| e    | 1.27 BSC    |      |      |
| 1/2e | 0.635 BSC   |      |      |
| K    | 1.30        | 1.40 | 1.50 |
| L    | 0.56        | 0.66 | 0.76 |
| L1   | 0.52        | 0.62 | 0.72 |
| Θ    | 0°          | ---  | 12°  |

#### GENERIC MARKING DIAGRAM\*



XXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
ZZ = Assembly Lot Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

|                  |                               |                                                                                                                                                                                  |
|------------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| DESCRIPTION:     | DFN8 5x6.15, 1.27P, DUAL COOL | PAGE 1 OF 1                                                                                                                                                                      |

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