

NTMFD4C87N

PowerPhase, Dual N-Channel SO8FL 30 V, High Side 20 A / Low Side 26 A

Features

- Co-Packaged Power Stage Solution to Minimize Board Space
- Minimized Parasitic Inductances
- Optimized Devices to Reduce Power Losses
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

- DC-DC Converters
- System Voltage Rails
- Point of Load

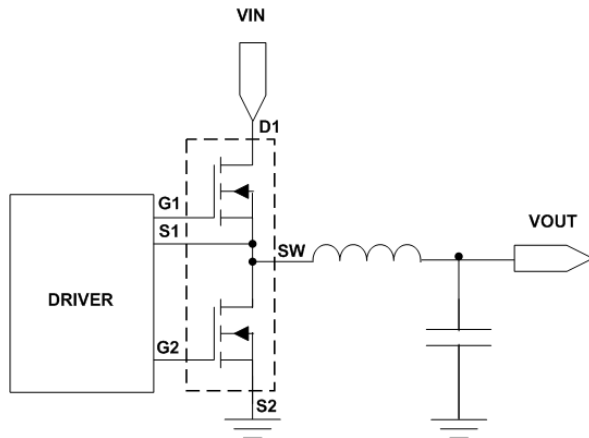


Figure 1. Typical Application Circuit

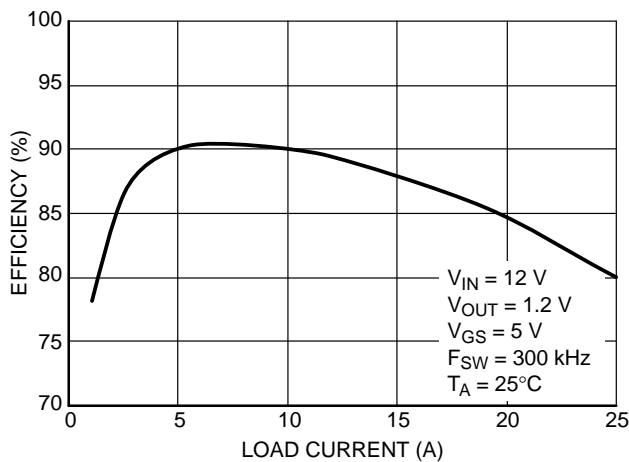


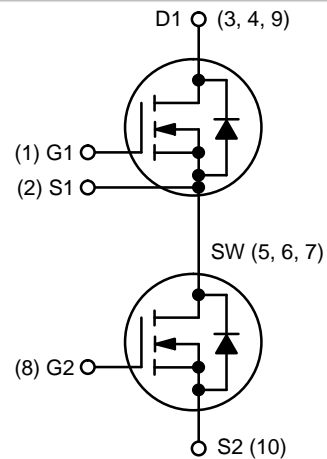
Figure 2. Typical Efficiency Performance
POWERPHASEGEVB Evaluation Board



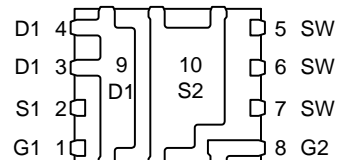
ON Semiconductor®

www.onsemi.com

| $V_{(BR)DSS}$ | $R_{DS(ON) MAX}$ | $I_D MAX$ |
|-----------------------|------------------|-----------|
| Q1 Top FET 30 V | 5.4 mΩ @ 10 V | 20 A |
| | 8.1 mΩ @ 4.5 V | |
| Q2 Bottom FET 30 V | 3.1 mΩ @ 10 V | 26 A |
| | 4.3 mΩ @ 4.5 V | |

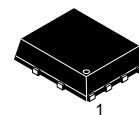


PIN CONNECTIONS



(Bottom View)

MARKING DIAGRAM



DFN8
CASE 506CR



- 4C87N = Specific Device Code
- A = Assembly Location
- Y = Year
- W = Work Week
- ZZ = Lot Traceability

ORDERING INFORMATION

See detailed ordering and shipping information on page 10 of this data sheet.

NTMFD4C87N

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

| Parameter | | | Symbol | Value | Unit | |
|--|-------------------|--------------|----------------|--|------------------|----|
| Drain-to-Source Voltage | Q1 | | V_{DSS} | 30 | V | |
| Drain-to-Source Voltage | Q2 | | | | | |
| Gate-to-Source Voltage | Q1 | | V_{GS} | ± 20 | V | |
| Gate-to-Source Voltage | Q2 | | | | | |
| Continuous Drain Current $R_{\theta JA}$ (Note 1) | | Steady State | I_D | $T_A = 25^\circ\text{C}$ | 15.4 | A |
| | | | | $T_A = 85^\circ\text{C}$ | 11.1 | |
| | | | | $T_A = 25^\circ\text{C}$ | 19.5 | |
| | | | | $T_A = 85^\circ\text{C}$ | 14.1 | |
| Power Dissipation $R_{\theta JA}$ (Note 1) | | | P_D | $T_A = 25^\circ\text{C}$ | 1.89 | W |
| | | | | | | |
| Continuous Drain Current $R_{\theta JA} \leq 10$ s (Note 1) | | Steady State | I_D | $T_A = 25^\circ\text{C}$ | 21.0 | A |
| | | | | $T_A = 85^\circ\text{C}$ | 15.1 | |
| | | | | $T_A = 25^\circ\text{C}$ | 26.6 | |
| | | | | $T_A = 85^\circ\text{C}$ | 19.2 | |
| Power Dissipation $R_{\theta JA} \leq 10$ s (Note 1) | | | P_D | $T_A = 25^\circ\text{C}$ | 3.51 | W |
| | | | | | | |
| Continuous Drain Current $R_{\theta JA}$ (Note 2) | | Steady State | I_D | $T_A = 25^\circ\text{C}$ | 11.7 | A |
| | | | | $T_A = 85^\circ\text{C}$ | 8.5 | |
| | | | | $T_A = 25^\circ\text{C}$ | 14.9 | |
| | | | | $T_A = 85^\circ\text{C}$ | 10.7 | |
| Power Dissipation $R_{\theta JA}$ (Note 2) | | | P_D | $T_A = 25^\circ\text{C}$ | 1.10 | W |
| | | | | | | |
| Pulsed Drain Current | | | I_{DM} | $T_A = 25^\circ\text{C}$ $t_p = 10 \mu\text{s}$ | 160 | A |
| | | | | | 260 | |
| Operating Junction and Storage Temperature | Q1 | | T_J, T_{STG} | -55 to +150 | $^\circ\text{C}$ | |
| | Q2 | | | | | |
| Source Current (Body Diode) | Q1 | | I_S | 10 | A | |
| | Q2 | | | | | 10 |
| Drain to Source DV/DT | | | dV/dt | 6 | V/ns | |
| Single Pulse Drain-to-Source Avalanche Energy ($T_J = 25^\circ\text{C}$, $V_{DD} = 50$ V, $V_{GS} = 10$ V, $L = 0.1$ mH, $R_G = 25 \Omega$) | $I_L = 20 A_{pk}$ | Q1 | EAS | 20 | mJ | |
| | $I_L = 30 A_{pk}$ | Q2 | EAS | 45 | | |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | | | T_L | 260 | $^\circ\text{C}$ | |

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.

- Surface-mounted on FR4 board using 1 sq-in pad, 2 oz Cu.
- Surface-mounted on FR4 board using the minimum recommended pad size of 100 mm².

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THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter | Symbol | Value | Unit |
|---|-----------------|-------|------|
| Junction-to-Ambient – Steady State (Note 3) | $R_{\theta JA}$ | 66.0 | °C/W |
| Junction-to-Ambient – Steady State (Note 4) | $R_{\theta JA}$ | 113.7 | |
| Junction-to-Ambient – ($t \leq 10$ s) (Note 3) | $R_{\theta JA}$ | 35.6 | |

3. Surface-mounted on FR4 board using 1 sq-in pad, 2 oz Cu.

4. Surface-mounted on FR4 board using the minimum recommended pad size of 100 mm².

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

| Parameter | FET | Symbol | Test Condition | Min | Typ | Max | Unit |
|--|-----|---------------------|-------------------------------------|---------------------------|------|-----|---------|
| OFF CHARACTERISTICS | | | | | | | |
| Drain-to-Source Break-down Voltage | Q1 | $V_{(BR)DSS}$ | $V_{GS} = 0$ V, $I_D = 250$ μ A | 30 | | | V |
| | Q2 | | | 30 | | | |
| Drain-to-Source Break-down Voltage Temperature Coefficient | Q1 | $V_{(BR)DSS} / T_J$ | | | 15.8 | | mV / °C |
| | Q2 | | | | 15.3 | | |
| Zero Gate Voltage Drain Current | Q1 | I_{DSS} | $V_{GS} = 0$ V, $V_{DS} = 24$ V | $T_J = 25^\circ\text{C}$ | | 1 | μ A |
| | | | | $T_J = 125^\circ\text{C}$ | | 10 | |
| | Q2 | | $V_{GS} = 0$ V, $V_{DS} = 24$ V | $T_J = 25^\circ\text{C}$ | | 1 | |
| | | | | | | | |
| Gate-to-Source Leakage Current | Q1 | I_{GSS} | $V_{GS} = 0$ V, $V_{DS} = \pm 20$ V | | | 100 | nA |
| | Q2 | | | | | 100 | |

ON CHARACTERISTICS (Note 5)

| | | | | | | | |
|--|----|--------------------|---|--------------|-----|-----|------------|
| Gate Threshold Voltage | Q1 | $V_{GS(TH)}$ | $V_{GS} = V_{DS}$, $I_D = 250$ μ A | 1.3 | | 2.2 | V |
| | Q2 | | | 1.3 | | 2.2 | |
| Negative Threshold Temperature Coefficient | Q1 | $V_{GS(TH)} / T_J$ | | | 5.0 | | mV / °C |
| | Q2 | | | | 5.1 | | |
| Drain-to-Source On Resistance | Q1 | $R_{DS(on)}$ | $V_{GS} = 10$ V | $I_D = 30$ A | 4.3 | 5.4 | m Ω |
| | | | $V_{GS} = 4.5$ V | $I_D = 18$ A | 6.5 | 8.1 | |
| | Q2 | | $V_{GS} = 10$ V | $I_D = 30$ A | 2.5 | 3.1 | |
| | | | $V_{GS} = 4.5$ V | $I_D = 30$ A | 3.4 | 4.3 | |

CAPACITANCES

| | | | | | | | |
|---------------------|----|-----------|--|--|------|--|----|
| Input Capacitance | Q1 | C_{ISS} | $V_{GS} = 0$ V, $f = 1$ MHz, $V_{DS} = 15$ V | | 1252 | | pF |
| | Q2 | | | | 1939 | | |
| Output Capacitance | Q1 | C_{OSS} | | | 610 | | pF |
| | Q2 | | | | 1055 | | |
| Reverse Capacitance | Q1 | C_{RSS} | | | 129 | | pF |
| | Q2 | | | | 49 | | |

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.

5. Pulse Test: pulse width ≤ 300 μ s, duty cycle $\leq 2\%$.

6. Switching characteristics are independent of operating junction temperatures.

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

| Parameter | FET | Symbol | Test Condition | Min | Typ | Max | Unit | | |
|--|-----|--------------|--|---|------|------|----------|--|----|
| CHARGES, CAPACITANCES & GATE RESISTANCE | | | | | | | | | |
| Total Gate Charge | Q1 | $Q_{G(TOT)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$ | | 10.9 | | nC | | |
| | Q2 | | | | 13.8 | | | | |
| Threshold Gate Charge | Q1 | $Q_{G(TH)}$ | | | 1.2 | | | | |
| | Q2 | | | | 2.0 | | | | |
| Gate-to-Source Charge | Q1 | Q_{GS} | | | 3.4 | | | | |
| | Q2 | | | | 5.5 | | | | |
| Gate-to-Drain Charge | Q1 | Q_{GD} | | | 5.4 | | | | |
| | Q2 | | | | 3.6 | | | | |
| Total Gate Charge | Q1 | $Q_{G(TOT)}$ | | $V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$ | | 22.2 | | | nC |
| | Q2 | | | | | 30.3 | | | |
| Gate Resistance | Q1 | R_G | $T_A = 25^\circ\text{C}$ | | 1.0 | | Ω | | |
| | Q2 | | | | 1.0 | | | | |

SWITCHING CHARACTERISTICS (Note 6)

| | | | | | | | |
|---------------------|----|--------------|---|--|------|--|----|
| Turn-On Delay Time | Q1 | $t_{d(ON)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\ \Omega$ | | 8.9 | | ns |
| | Q2 | | | | 10.6 | | |
| Rise Time | Q1 | t_r | | | 21.2 | | |
| | Q2 | | | | 4.6 | | |
| Turn-Off Delay Time | Q1 | $t_{d(OFF)}$ | | | 15.3 | | |
| | Q2 | | | | 21 | | |
| Fall Time | Q1 | t_f | | | 4.4 | | |
| | Q2 | | | | 4.9 | | |

SWITCHING CHARACTERISTICS (Note 6)

| | | | | | | | |
|---------------------|----|--------------|--|--|------|--|----|
| Turn-On Delay Time | Q1 | $t_{d(ON)}$ | $V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\ \Omega$ | | 6.7 | | ns |
| | Q2 | | | | 8.1 | | |
| Rise Time | Q1 | t_r | | | 19.5 | | |
| | Q2 | | | | 15 | | |
| Turn-Off Delay Time | Q1 | $t_{d(OFF)}$ | | | 20.1 | | |
| | Q2 | | | | 26.2 | | |
| Fall Time | Q1 | t_f | | | 2.8 | | |
| | Q2 | | | | 3.1 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|-----------------|----|----------|--|---------------------------|--|------|---|
| Forward Voltage | Q1 | V_{SD} | $V_{GS} = 0\text{ V}, I_S = 10\text{ A}$ | $T_J = 25^\circ\text{C}$ | | 0.82 | V |
| | | | | $T_J = 125^\circ\text{C}$ | | 1.15 | |
| | Q2 | | $V_{GS} = 0\text{ V}, I_S = 10\text{ A}$ | $T_J = 25^\circ\text{C}$ | | 0.8 | |
| | | | | $T_J = 125^\circ\text{C}$ | | 1.10 | |

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.

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

6. Switching characteristics are independent of operating junction temperatures.

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ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise specified)

| Parameter | FET | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|-----|-----------------|--|-----|------|-----|------|
| DRAIN-SOURCE DIODE CHARACTERISTICS | | | | | | | |
| Reverse Recovery Time | Q1 | t _{RR} | V _{GS} = 0 V, d _{IS} /d _t = 100 A/μs, I _S = 30 A | | 29.1 | | ns |
| | Q2 | | | | 40.2 | | |
| Charge Time | Q1 | t _a | | | 14.2 | | |
| | Q2 | | | | 19.5 | | |
| Discharge Time | Q1 | t _b | | | 14.6 | | |
| | Q2 | | | | 20.6 | | |
| Reverse Recovery Charge | Q1 | Q _{RR} | | | 21 | | nC |
| | Q2 | | | | 39 | | |

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.

5. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

6. Switching characteristics are independent of operating junction temperatures.

NTMFD4C87N

TYPICAL CHARACTERISTICS – Q1

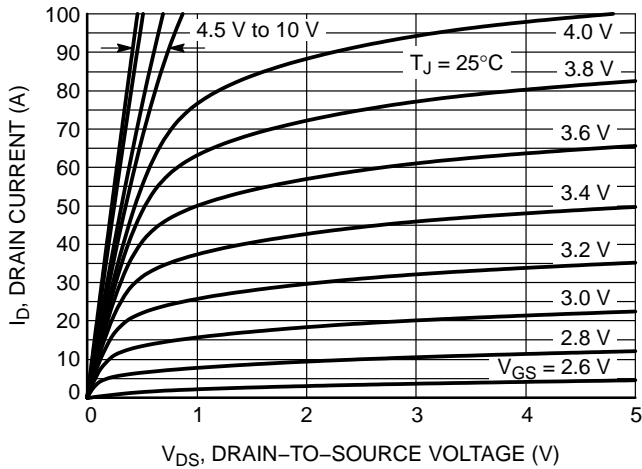


Figure 3. On-Region Characteristics

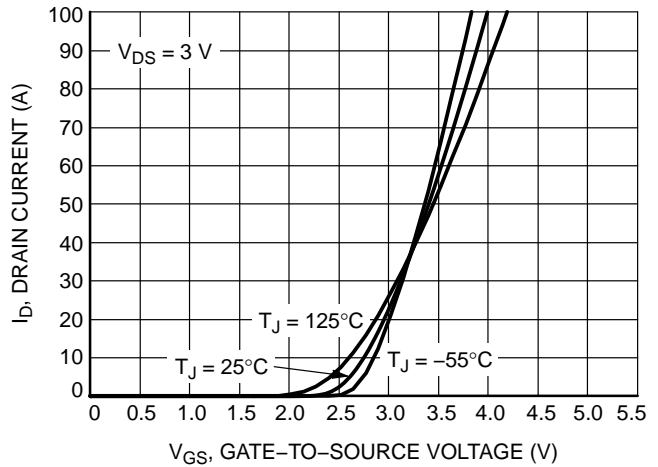


Figure 4. Transfer Characteristics

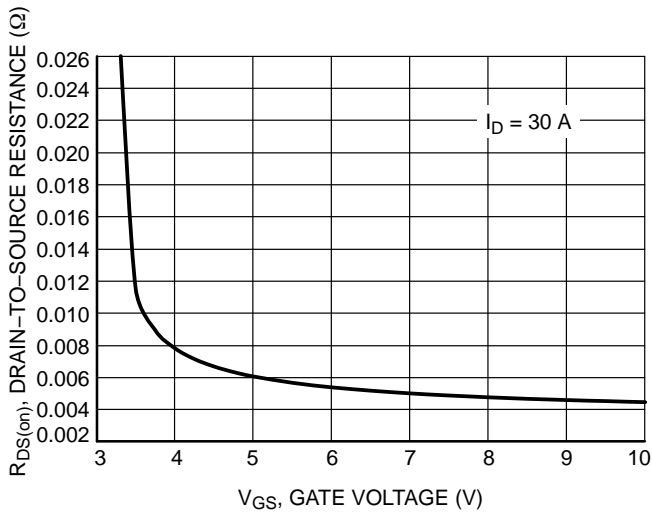


Figure 5. On-Resistance vs. Gate-to-Source Voltage

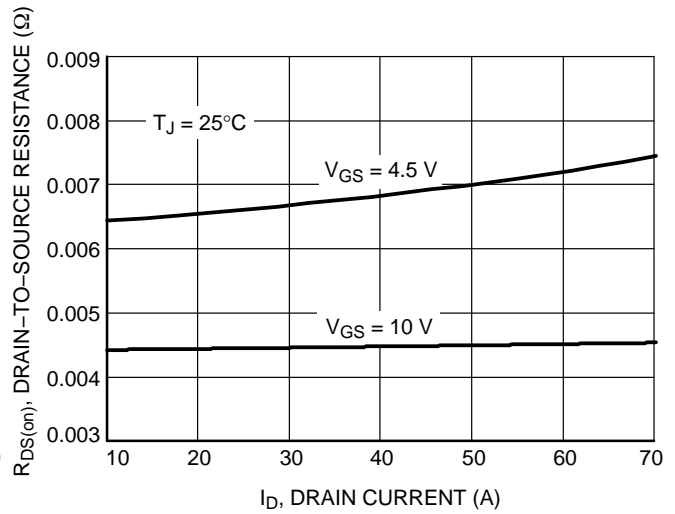


Figure 6. On-Resistance vs. Drain Current and Gate Voltage

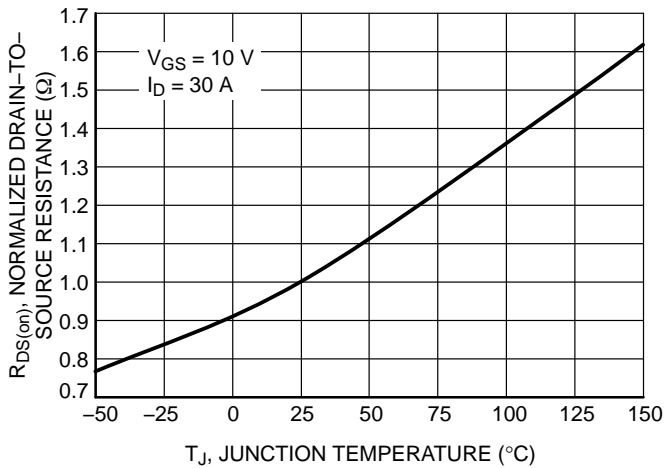


Figure 7. On-Resistance Variation with Temperature

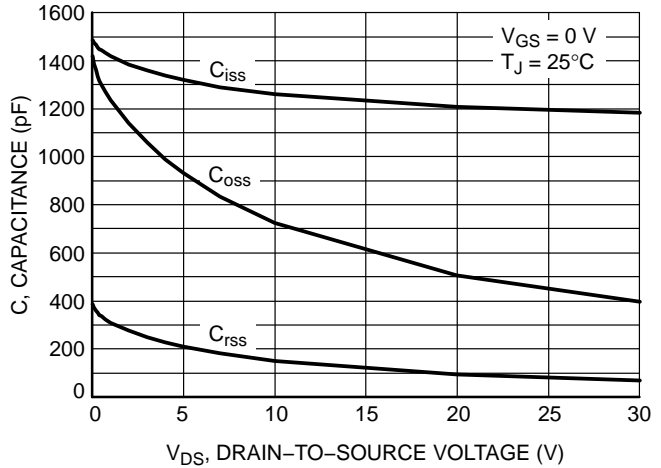


Figure 8. Capacitance Variation

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TYPICAL CHARACTERISTICS – Q1

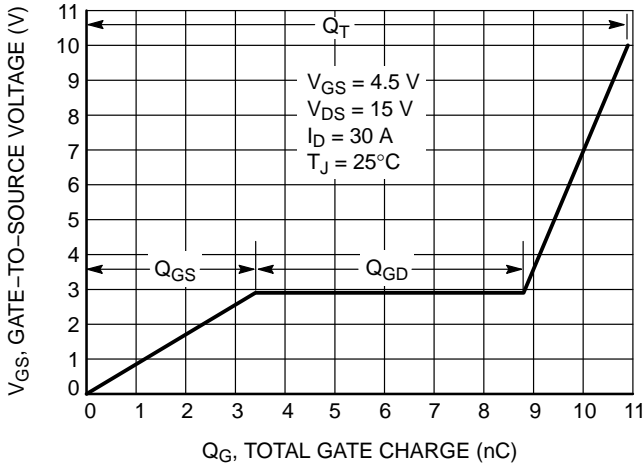


Figure 9. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

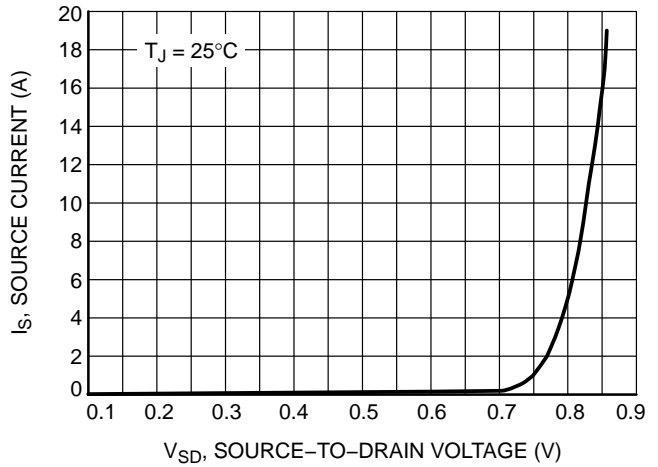


Figure 10. Diode Forward Voltage vs. Current

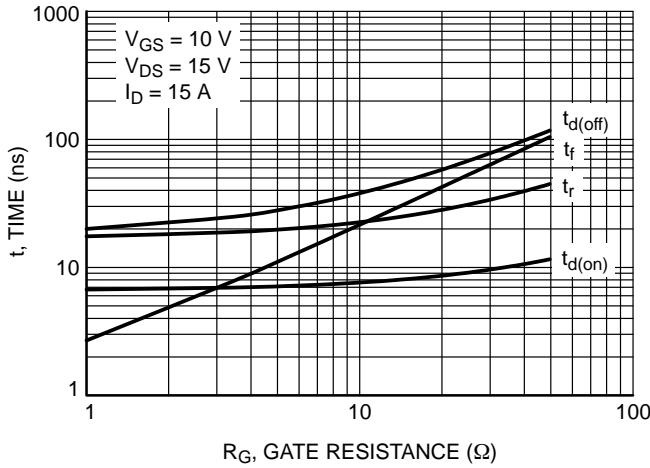


Figure 11. Resistive Switching Time Variation vs. Gate Resistance

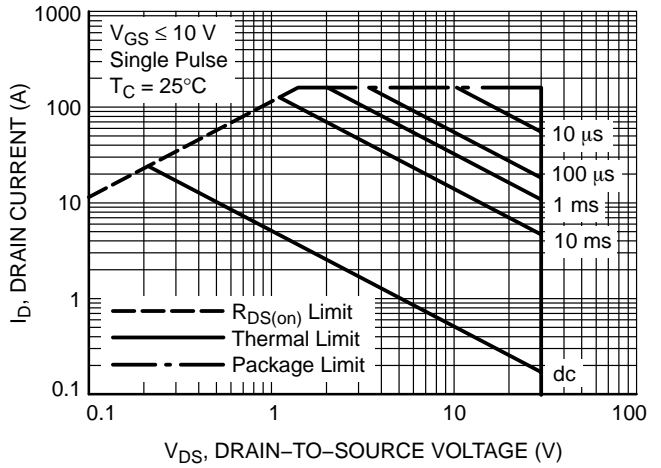


Figure 12. Maximum Rated Forward Biased Safe Operating Area

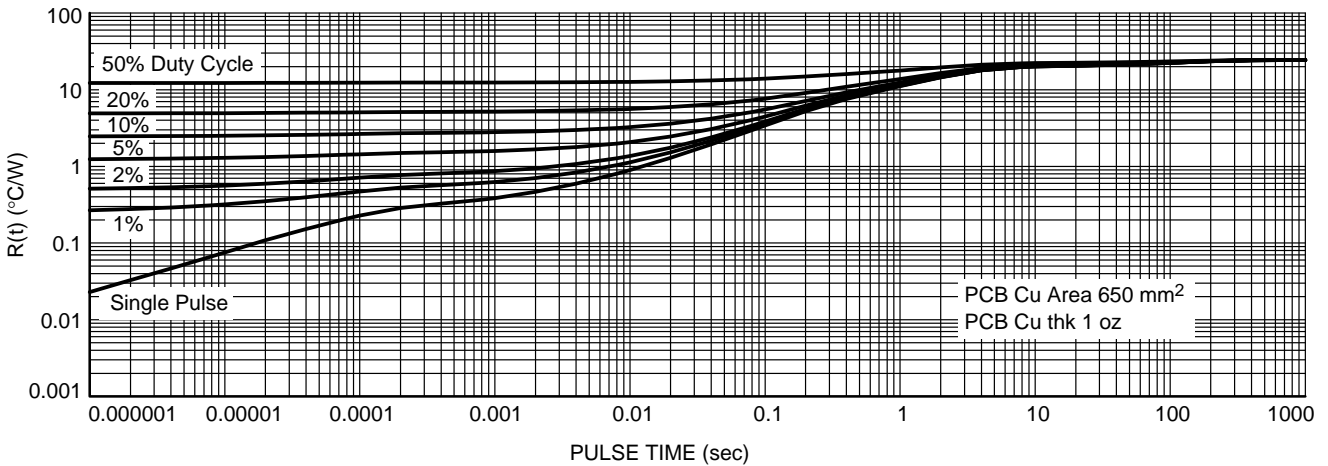


Figure 13. Thermal Characteristics

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TYPICAL CHARACTERISTICS – Q2

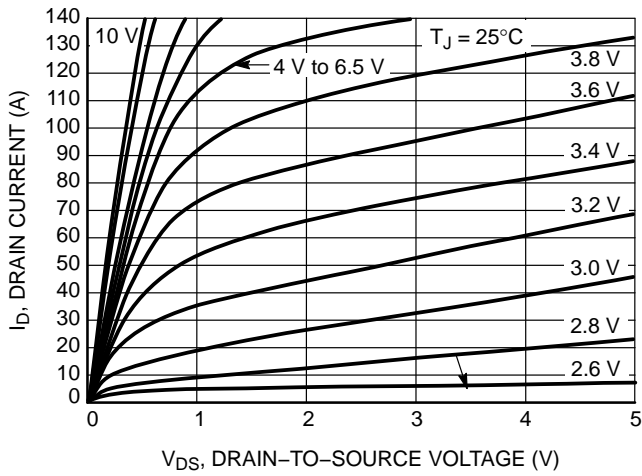


Figure 14. On-Region Characteristics

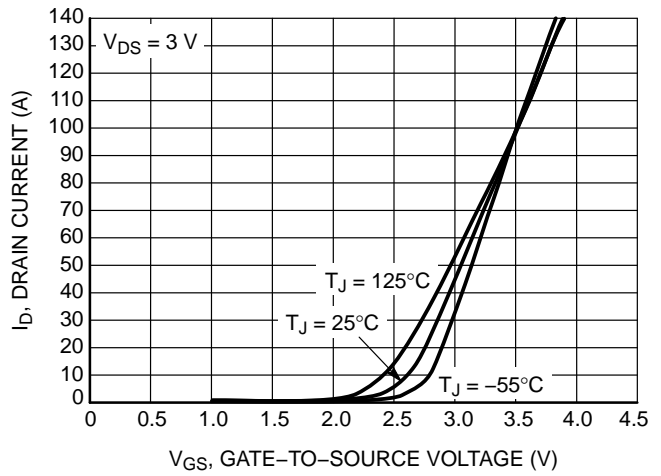


Figure 15. Transfer Characteristics

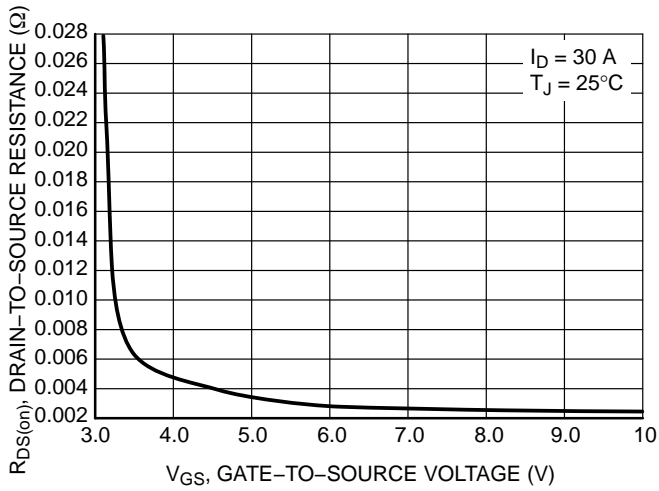


Figure 16. On-Resistance vs. V_{GS}

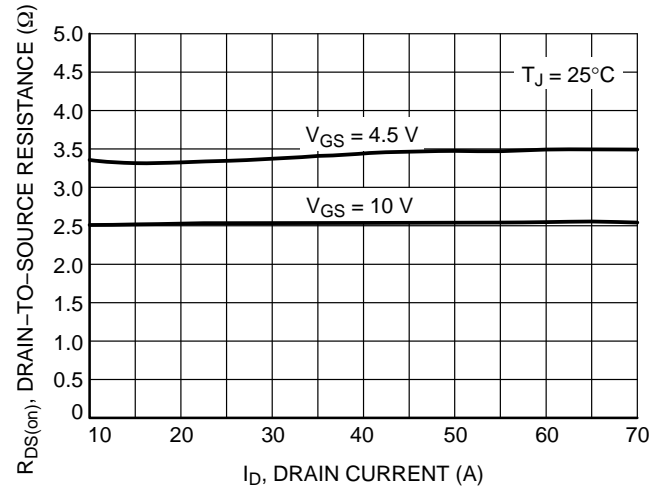


Figure 17. On-Resistance vs. Drain Current and Gate Voltage

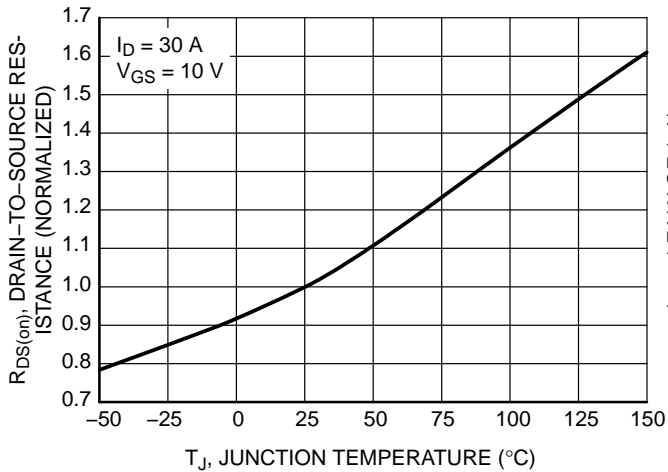


Figure 18. On-Resistance Variation with Temperature

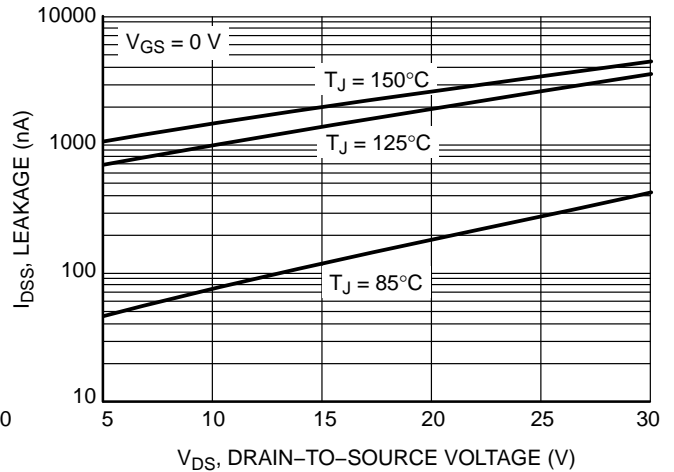


Figure 19. Drain-to-Source Leakage Current vs. Voltage

NTMFD4C87N

TYPICAL CHARACTERISTICS – Q2

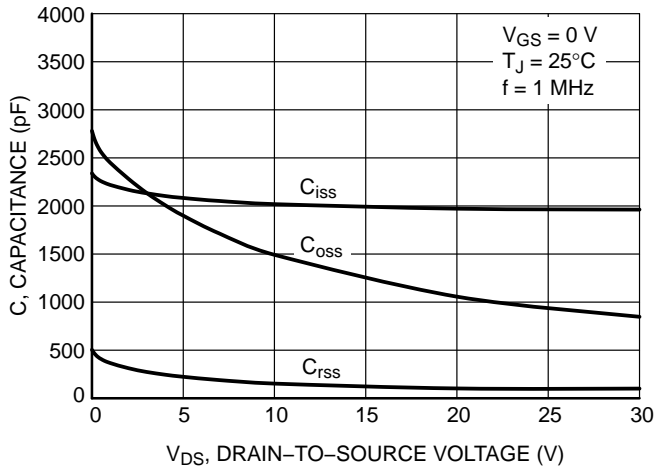


Figure 20. Capacitance Variation

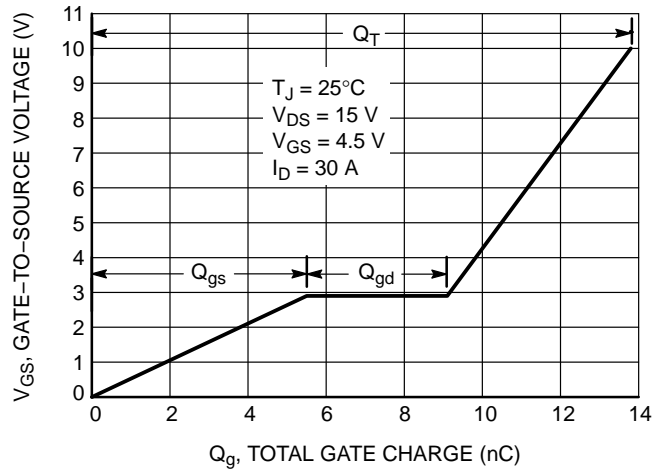


Figure 21. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

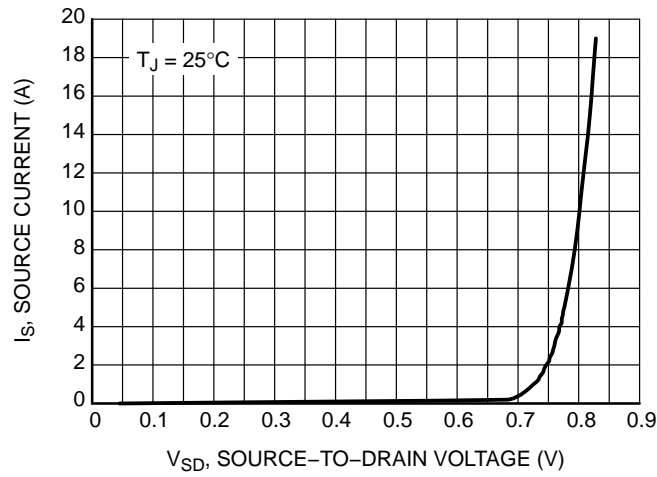


Figure 22. Diode Forward Voltage vs. Current

NTMFD4C87N

TYPICAL CHARACTERISTICS – Q2

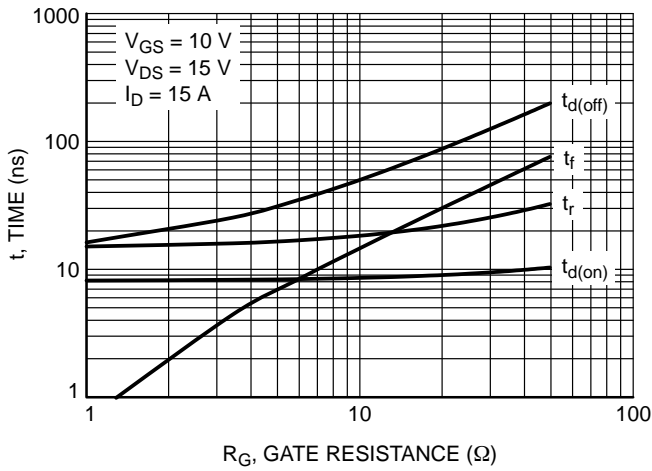


Figure 23. Resistive Switching Time Variation vs. Gate Resistance

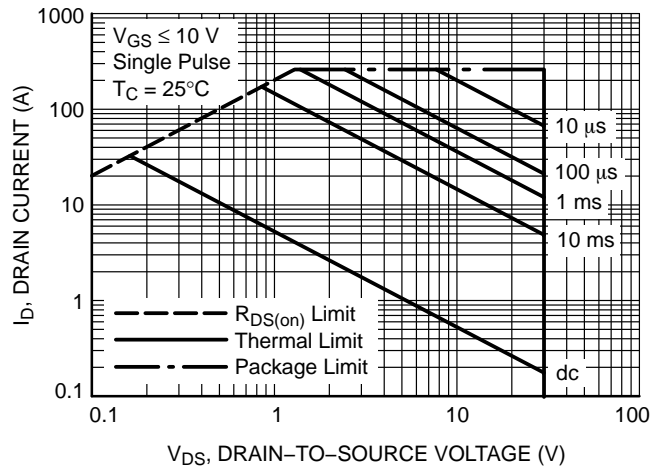


Figure 24. Maximum Rated Forward Biased Safe Operating Area

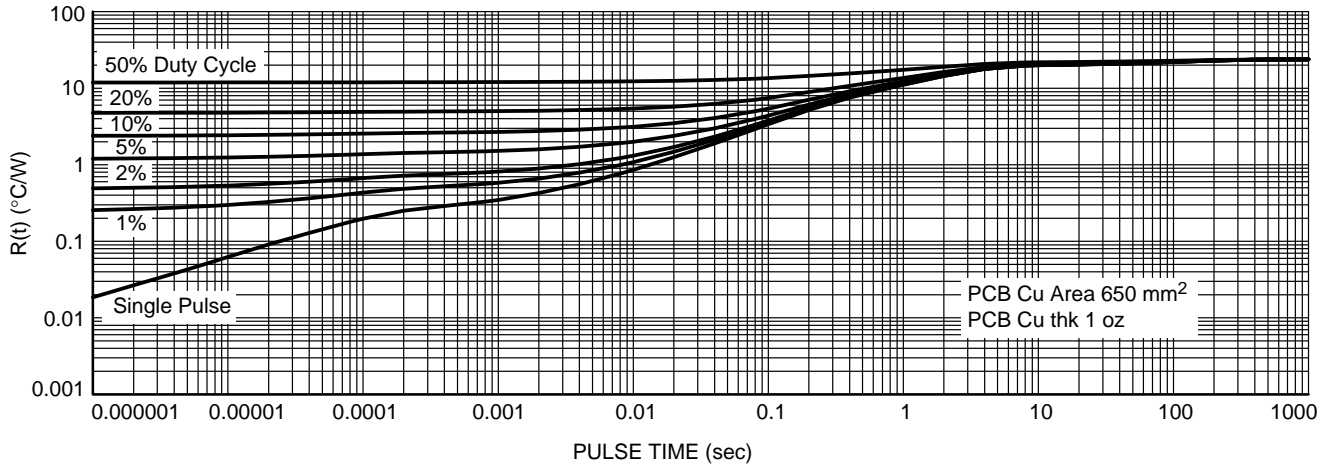


Figure 25. Thermal Characteristics

ORDERING INFORMATION

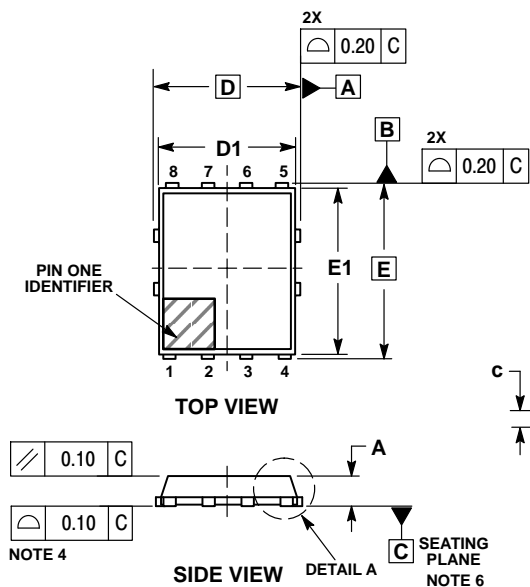
| Device | Package | Shipping [†] |
|---------------|-------------------|-----------------------|
| NTMFD4C87NT1G | DFN8 (Pb-Free) | 1500 / Tape & Reel |
| NTMFD4C87NT3G | DFN8 (Pb-Free) | 5000 / Tape & Reel |

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

NTMFD4C87N

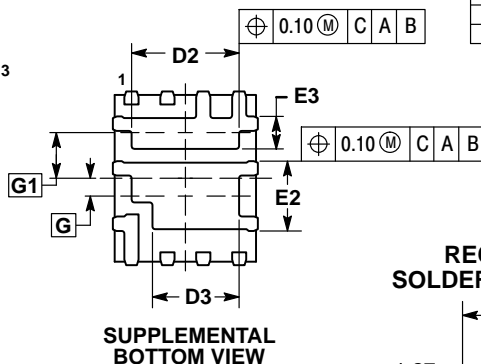
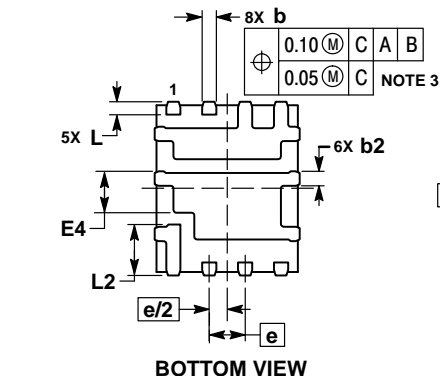
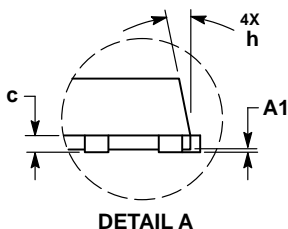
PACKAGE DIMENSIONS

DFN8 5x6, 1.27P PowerPhase FET
CASE 506CR
ISSUE B

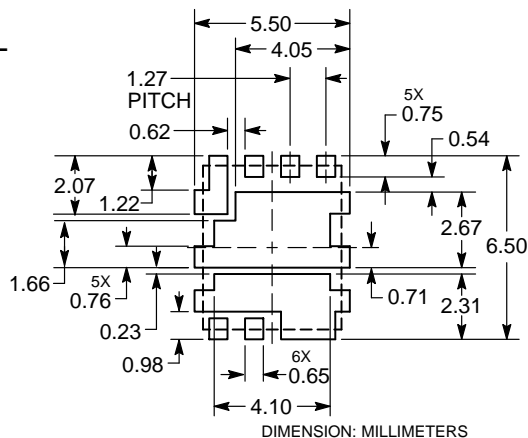


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
 2. CONTROLLING DIMENSION: MILLIMETERS.
 3. DIMENSIONS b AND b1 APPLY TO PLATED TERMINAL AND ARE MEASURED BETWEEN 0.15 AND 0.25 MM FROM THE TIPS.
 4. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
 5. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
 6. 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.

| MILLIMETERS | | |
|-------------|-----------|------|
| DIM | MIN | MAX |
| A | 0.90 | 1.10 |
| A1 | 0.00 | 0.05 |
| b | 0.40 | 0.60 |
| b2 | 0.40 | 0.60 |
| c | 0.20 | 0.30 |
| D | 5.15 BSC | |
| D1 | 4.90 | 5.10 |
| D2 | 3.70 | 3.90 |
| D3 | 2.96 | 3.16 |
| E | 6.15 BSC | |
| E1 | 5.80 | 6.00 |
| E2 | 2.37 | 2.57 |
| E3 | 1.05 | 1.25 |
| E4 | 1.36 | 1.56 |
| e | 1.27 BSC | |
| G | 0.625 BSC | |
| G1 | 1.615 BSC | |
| h | — 12° | |
| L | 0.34 | 0.59 |
| L2 | 1.68 | 1.93 |




RECOMMENDED SOLDERING FOOTPRINT*



*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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