

Complementary Plastic Power Transistors

NPN/PNP Silicon DPAK For Surface Mount Applications



ON Semiconductor®

www.onsemi.com

MJD200 (NPN), MJD210 (PNP)

Designed for low voltage, low-power, high-gain audio amplifier applications.

Features

- High DC Current Gain
- Lead Formed for Surface Mount Applications in Plastic Sleeves (No Suffix)
- Low Collector–Emitter Saturation Voltage
- High Current–Gain – Bandwidth Product
- Annular Construction for Low Leakage
- Epoxy Meets UL 94 V–0 @ 0.125 in
- NJV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC–Q101 Qualified and PPAP Capable
- These Devices are Pb–Free and are RoHS Compliant

MAXIMUM RATINGS

| Rating | Symbol | Max | Unit |
|---------------------------------------------------------------------------------------------------|----------------|--------------|--------------------------|
| Collector–Base Voltage | V_{CB} | 40 | Vdc |
| Collector–Emitter Voltage | V_{CEO} | 25 | Vdc |
| Emitter–Base Voltage | V_{EB} | 8.0 | Vdc |
| Collector Current – Continuous | I_C | 5.0 | Adc |
| Collector Current – Peak | I_{CM} | 10 | Adc |
| Base Current | I_B | 1.0 | Adc |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C | P_D | 12.5 0.1 | W W/ $^\circ\text{C}$ |
| Total Power Dissipation (Note 1) @ $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 1.4 0.011 | W W/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range | T_J, T_{stg} | –65 to +150 | $^\circ\text{C}$ |
| ESD – Human Body Model | HBM | 3B | V |
| ESD – Machine Model | MM | C | V |

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.

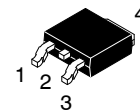
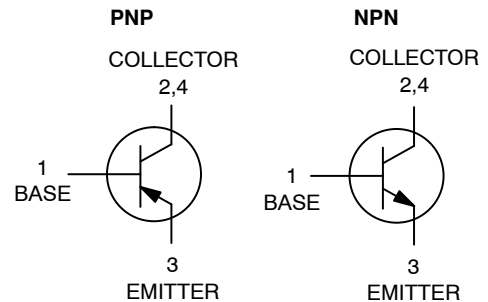
1. These ratings are applicable when surface mounted on the minimum pad sizes recommended.

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|--------------------------------------------------|-----------------|------|---------------------------|
| Thermal Resistance, Junction–to–Case | $R_{\theta JC}$ | 10 | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction–to–Ambient (Note 2) | $R_{\theta JA}$ | 89.3 | $^\circ\text{C}/\text{W}$ |

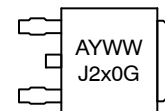
2. These ratings are applicable when surface mounted on the minimum pad sizes recommended.

SILICON POWER TRANSISTORS 5 AMPERES 25 VOLTS, 12.5 WATTS



**DPAK
CASE 369C
STYLE 1**

MARKING DIAGRAM



- A = Assembly Location
- Y = Year
- WW = Work Week
x = 1 or 0
- G = Pb–Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

MJD200 (NPN), MJD210 (PNP)

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

| Characteristic | Symbol | Min | Max | Unit |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------|--------------------|-------------------------|
| OFF CHARACTERISTICS | | | | |
| Collector-Emitter Sustaining Voltage (Note 3) ($I_C = 10\text{ mAdc}$, $I_B = 0$) | $V_{CE(sus)}$ | 25 | - | Vdc |
| Collector Cutoff Current ($V_{CB} = 40\text{ Vdc}$, $I_E = 0$) ($V_{CB} = 40\text{ Vdc}$, $I_E = 0$, $T_J = 125^\circ\text{C}$) | I_{CBO} | - | 100 | nAdc μAdc |
| Emitter Cutoff Current ($V_{BE} = 8\text{ Vdc}$, $I_C = 0$) | I_{EBO} | - | 100 | nAdc |
| ON CHARACTERISTICS | | | | |
| C Current Gain (Note 3), ($I_C = 500\text{ mAdc}$, $V_{CE} = 1\text{ Vdc}$) ($I_C = 2\text{ Adc}$, $V_{CE} = 1\text{ Vdc}$) ($I_C = 5\text{ Adc}$, $V_{CE} = 2\text{ Vdc}$) | h_{FE} | 70 45 10 | - 180 - | - |
| Collector-Emitter Saturation Voltage (Note 3) ($I_C = 500\text{ mAdc}$, $I_B = 50\text{ mAdc}$) ($I_C = 2\text{ Adc}$, $I_B = 200\text{ mAdc}$) ($I_C = 5\text{ Adc}$, $I_B = 1\text{ Adc}$) | $V_{CE(sat)}$ | - - - | 0.3 0.75 1.8 | Vdc |
| Base-Emitter Saturation Voltage (Note 3) ($I_C = 5\text{ Adc}$, $I_B = 1\text{ Adc}$) | $V_{BE(sat)}$ | - | 2.5 | Vdc |
| Base-Emitter On Voltage (Note 3) ($I_C = 2\text{ Adc}$, $V_{CE} = 1\text{ Vdc}$) | $V_{BE(on)}$ | - | 1.6 | Vdc |
| DYNAMIC CHARACTERISTICS | | | | |
| Current-Gain - Bandwidth Product (Note 4) ($I_C = 100\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f_{test} = 10\text{ MHz}$) | f_T | 65 | - | MHz |
| Output Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f = 0.1\text{ MHz}$) MJD200 MJD210, NJVMJD210T4G | C_{ob} | - - | 80 120 | pF |

3. Pulse Test: Pulse Width = 300 μs , Duty Cycle $\approx 2\%$.

4. $f_T = |h_{fe}| \cdot f_{test}$.

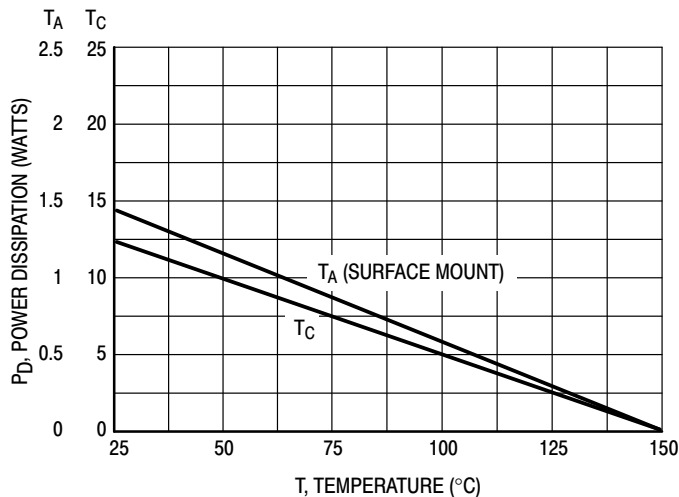


Figure 1. Power Derating

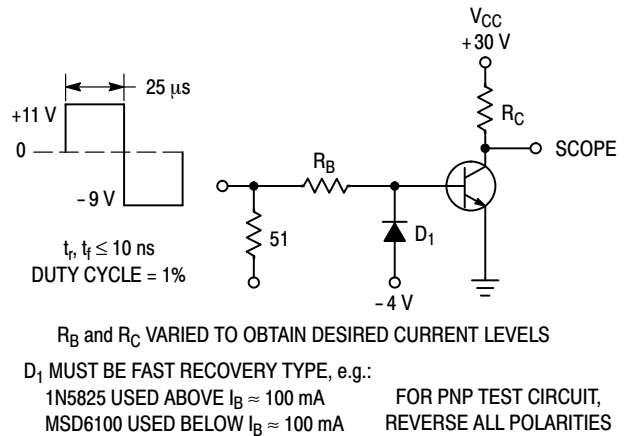


Figure 2. Switching Time Test Circuit

MJD200 (NPN), MJD210 (PNP)

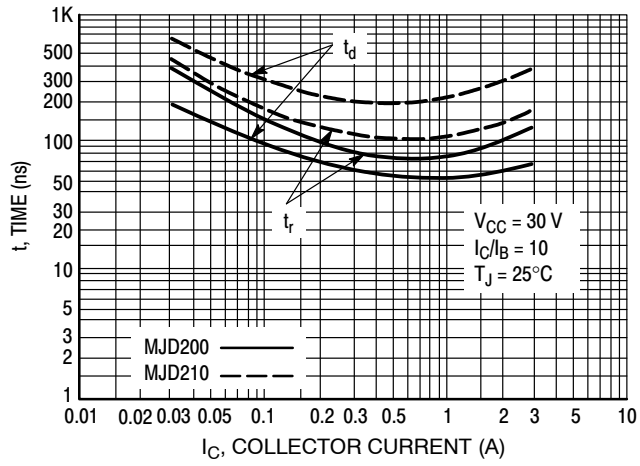


Figure 3. Turn-On Time

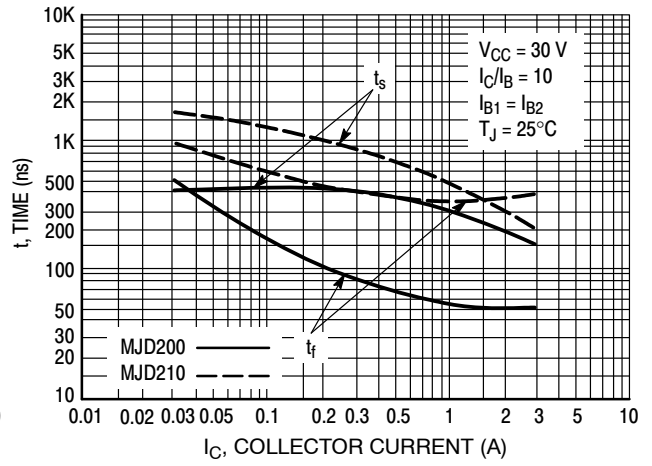


Figure 4. Turn-Off Time

MJD200 (NPN), MJD210 (PNP)

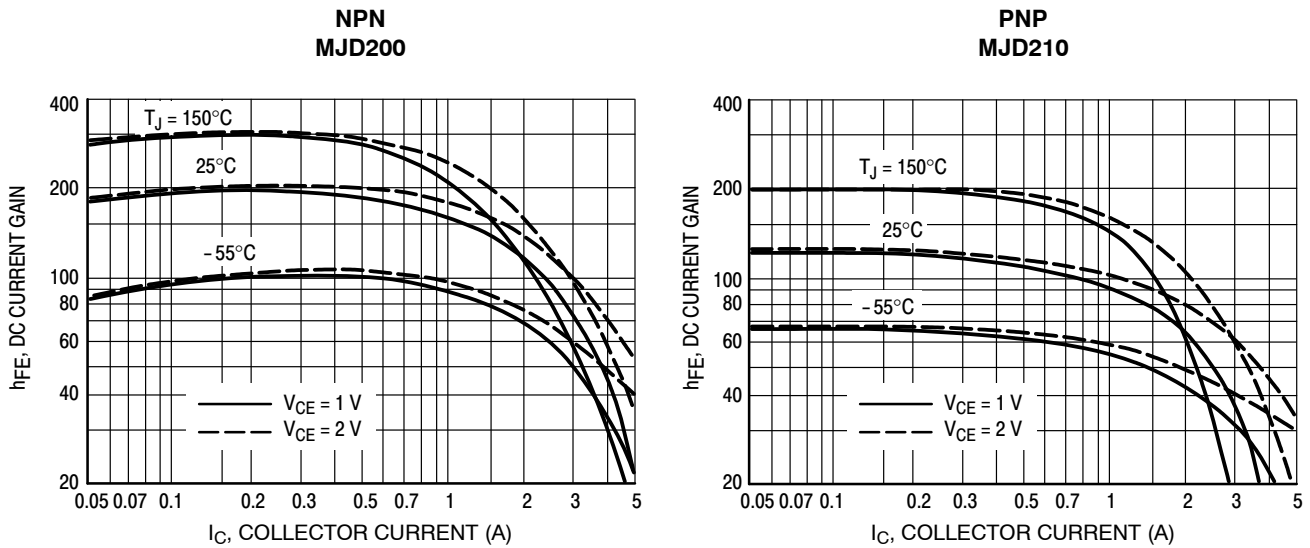


Figure 5. DC Current Gain

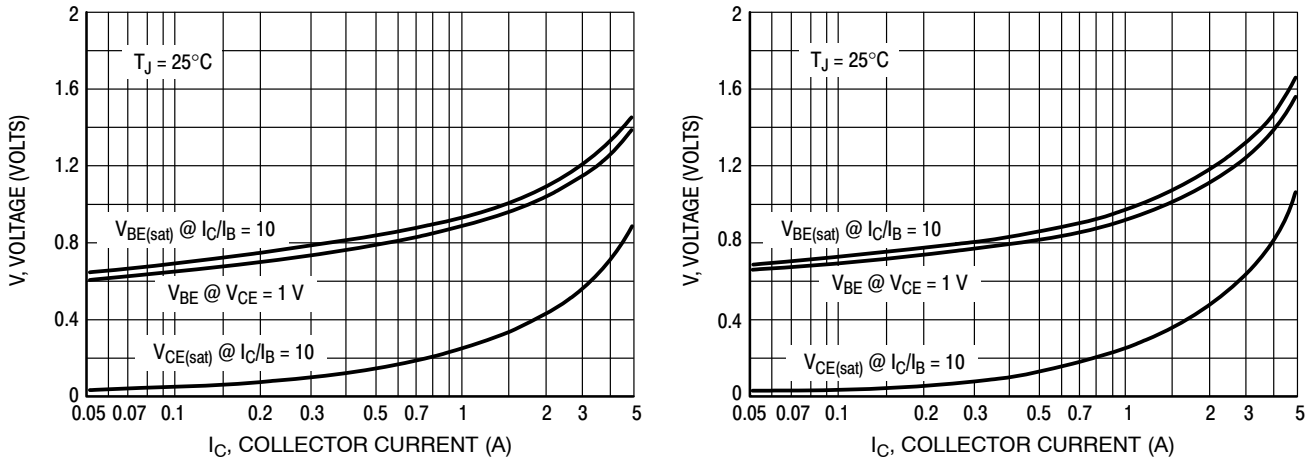


Figure 6. "On" Voltage

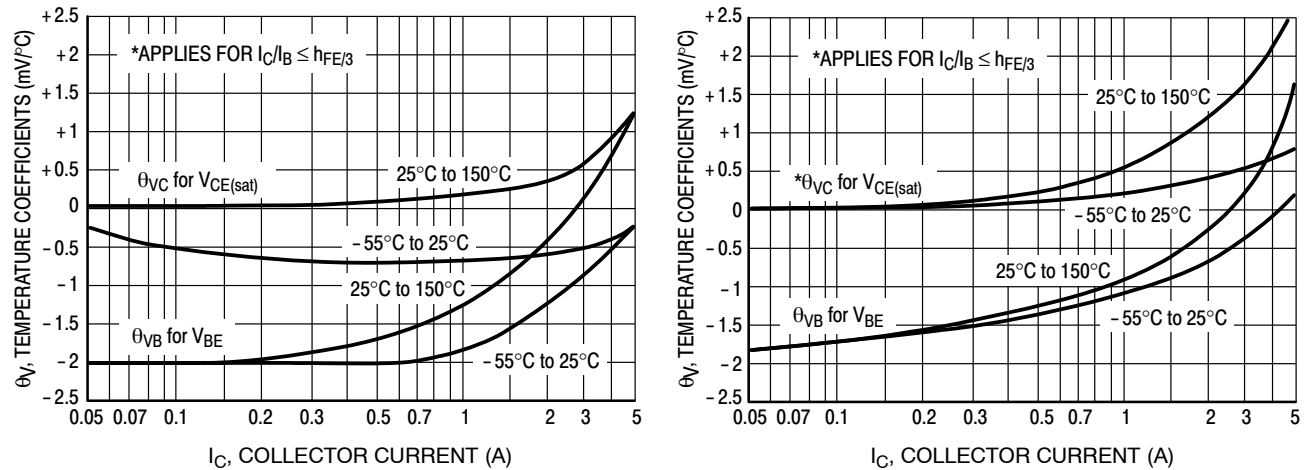


Figure 7. Temperature Coefficients

MJD200 (NPN), MJD210 (PNP)

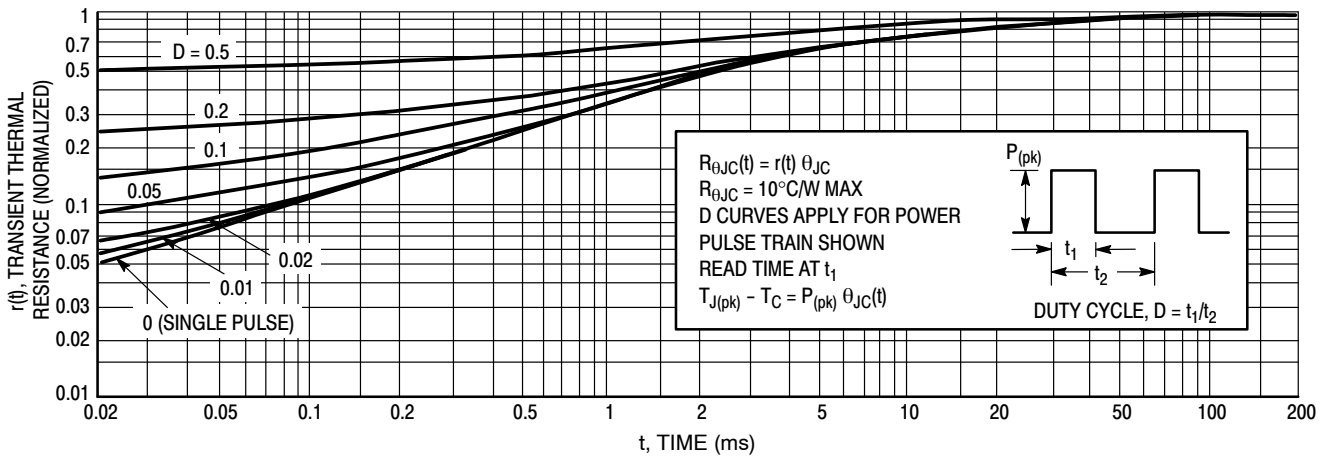


Figure 8. Thermal Response

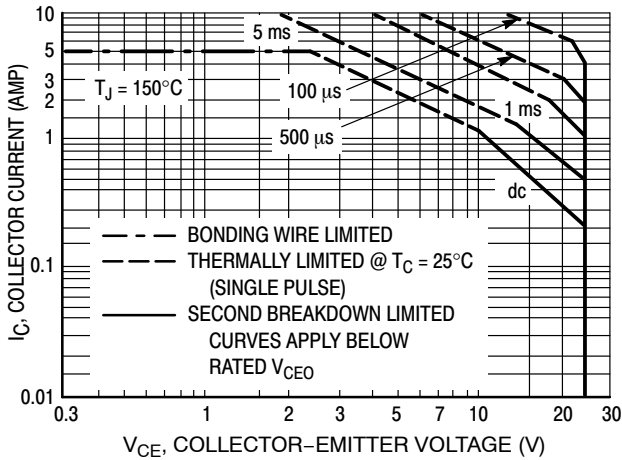


Figure 9. Active Region Safe Operating Area

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate $I_C - V_{CE}$ limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 9 is based on $T_{J(pk)} = 150^{\circ}\text{C}$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 150^{\circ}\text{C}$. $T_{J(pk)}$ may be calculated from the data in Figure 8. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

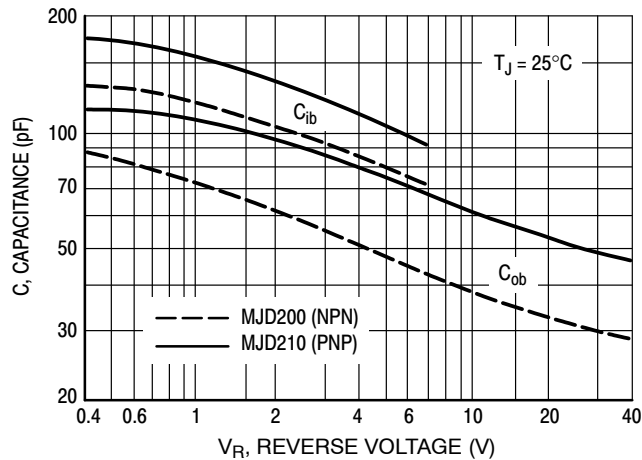


Figure 10. Capacitance

MJD200 (NPN), MJD210 (PNP)

ORDERING INFORMATION

| Device | Package Type | Shipping† |
|---------------|-------------------|---------------------|
| MJD200G | DPAK (Pb-Free) | 75 Units / Rail |
| MJD200RLG | DPAK (Pb-Free) | 1,800 / Tape & Reel |
| MJD200T4G | DPAK (Pb-Free) | 2,500 / Tape & Reel |
| MJD210G | DPAK (Pb-Free) | 75 Units / Rail |
| MJD210RLG | DPAK (Pb-Free) | 1,800 / Tape & Reel |
| MJD210T4G | DPAK (Pb-Free) | 2,500 / Tape & Reel |
| NJVMJD210T4G* | DPAK (Pb-Free) | 2,500 / 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.

*NJV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales