



Is Now Part of



ON Semiconductor®

To learn more about ON Semiconductor, please visit our website at
www.onsemi.com

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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 ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor 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 ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor 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 ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

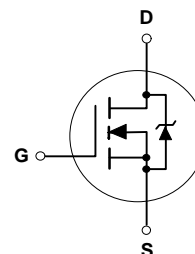
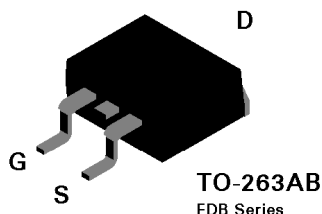
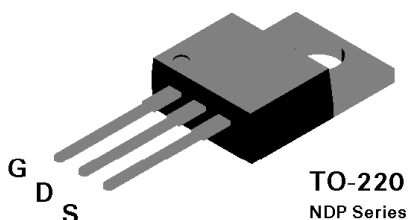
NDP7060 / NDB7060 N-Channel Enhancement Mode Field Effect Transistor

General Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process is especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulses in the avalanche and commutation modes. These devices are particularly suited for low voltage applications such as automotive, DC/DC converters, PWM motor controls, and other battery powered circuits where fast switching, low in-line power loss, and resistance to transients are needed.

Features

- 75A, 60V. $R_{DS(ON)} = 0.013\Omega @ V_{GS}=10V$.
- Critical DC electrical parameters specified at elevated temperature.
- Rugged internal source-drain diode can eliminate the need for an external Zener diode transient suppressor.
- 175°C maximum junction temperature rating.
- High density cell design for extremely low $R_{DS(ON)}$.
- TO-220 and TO-263 (D²PAK) package for both through hole and surface mount applications.



Absolute Maximum Ratings $T_c = 25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | NDP7060 | NDB7060 | Units |
|----------------|---|------------|---------|------------------|
| V_{DSS} | Drain-Source Voltage | 60 | | V |
| V_{DGR} | Drain-Gate Voltage ($R_{GS} \leq 1\text{ M}\Omega$) | 60 | | V |
| V_{GSS} | Gate-Source Voltage - Continuous | ± 20 | | V |
| | - Nonrepetitive ($t_p < 50\ \mu\text{s}$) | ± 40 | | |
| I_D | Drain Current - Continuous | 75 | | A |
| | - Pulsed | 225 | | |
| P_D | Maximum Power Dissipation @ $T_c = 25^\circ\text{C}$ | 150 | | W |
| | Derate above 25°C | 1 | | |
| T_J, T_{STG} | Operating and Storage Temperature Range | -65 to 175 | | $^\circ\text{C}$ |
| T_L | Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds | 275 | | $^\circ\text{C}$ |

Electrical Characteristics ($T_c = 25^\circ\text{C}$ unless otherwise noted)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|--|--|--|---------------------------|------|-------|---------------|
| DRAIN-SOURCE AVALANCHE RATINGS (Note 1) | | | | | | |
| W_{DSS} | Single Pulse Drain-Source Avalanche Energy | $V_{DD} = 25\text{ V}$, $I_D = 75\text{ A}$ | | | 550 | mJ |
| I_{AR} | Maximum Drain-Source Avalanche Current | | | | 75 | A |
| OFF CHARACTERISTICS | | | | | | |
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$ | 60 | | | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 60\text{ V}$, $V_{GS} = 0\text{ V}$ | | | 250 | μA |
| | | | $T_J = 125^\circ\text{C}$ | | 1 | mA |
| I_{GSSF} | Gate - Body Leakage, Forward | $V_{GS} = 20\text{ V}$, $V_{DS} = 0\text{ V}$ | | | 100 | nA |
| I_{GSSR} | Gate - Body Leakage, Reverse | $V_{GS} = -20\text{ V}$, $V_{DS} = 0\text{ V}$ | | | -100 | nA |
| ON CHARACTERISTICS (Note 1) | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$ | 2 | 2.8 | 4 | V |
| | | | $T_J = 125^\circ\text{C}$ | 1.4 | 2.1 | |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = 10\text{ V}$, $I_D = 40\text{ A}$ | | 0.01 | 0.013 | Ω |
| | | | $T_J = 125^\circ\text{C}$ | | 0.015 | |
| $I_{D(on)}$ | On-State Drain Current | $V_{GS} = 10\text{ V}$, $V_{DS} = 10\text{ V}$ | 75 | | | A |
| g_{FS} | Forward Transconductance | $V_{DS} = 10\text{ V}$, $I_D = 37.5\text{ A}$ | 15 | 39 | | S |
| DYNAMIC CHARACTERISTICS | | | | | | |
| C_{ISS} | Input Capacitance | $V_{DS} = 25\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1.0\text{ MHz}$ | | 2960 | 3600 | pF |
| C_{OSS} | Output Capacitance | | | 1130 | 1600 | pF |
| C_{RSS} | Reverse Transfer Capacitance | | | 380 | 800 | pF |
| SWITCHING CHARACTERISTICS (Note 1) | | | | | | |
| $t_{D(on)}$ | Turn - On Delay Time | $V_{DD} = 30\text{ V}$, $I_D = 75\text{ A}$, $V_{GS} = 10\text{ V}$, $R_{GEN} = 5\text{ }\Omega$ | | 17 | 30 | nS |
| t_r | Turn - On Rise Time | | | 128 | 400 | nS |
| $t_{D(off)}$ | Turn - Off Delay Time | | | 54 | 80 | nS |
| t_f | Turn - Off Fall Time | | | 90 | 200 | nS |
| Q_g | Total Gate Charge | $V_{DS} = 48\text{ V}$, $I_D = 75\text{ A}$, $V_{GS} = 10\text{ V}$ | | 100 | 115 | nC |
| Q_{gs} | Gate-Source Charge | | | 14.5 | | nC |
| Q_{gd} | Gate-Drain Charge | | | 51 | | nC |

Electrical Characteristics ($T_c = 25^\circ\text{C}$ unless otherwise noted)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|--|---------------------------|------|------|---------------------------|
| DRAIN-SOURCE DIODE CHARACTERISTICS | | | | | | |
| I_S | Maximum Continuous Drain-Source Diode Forward Current | | | | 75 | A |
| I_{SM} | Maximum Pulsed Drain-Source Diode Forward Current | | | | 225 | A |
| V_{SD} | Drain-Source Diode Forward Voltage | $V_{GS} = 0\text{ V}$, $I_S = 37.5\text{ A}$ (Note 1) | | 0.9 | 1.3 | V |
| | | | $T_J = 125^\circ\text{C}$ | 0.84 | 1.2 | |
| t_{rr} | Reverse Recovery Time | $V_{GS} = 0\text{ V}$, $I_F = 75\text{ A}$, $di_F/dt = 100\text{ A}/\mu\text{s}$ | 40 | 76 | 150 | ns |
| I_{rr} | Reverse Recovery Current | | 2 | 4.7 | 10 | A |
| THERMAL CHARACTERISTICS | | | | | | |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case | | | | 1 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | | | | 62.5 | $^\circ\text{C}/\text{W}$ |

Note:

1. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2.0\%$.

Typical Electrical Characteristics

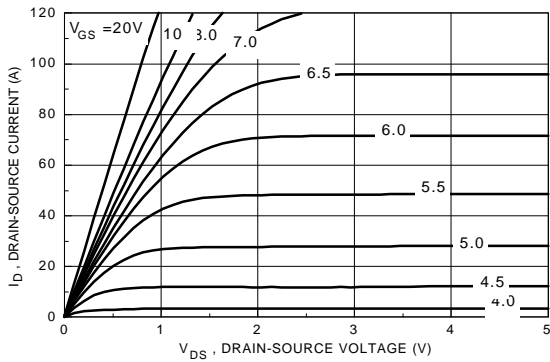


Figure 1. On-Region Characteristics

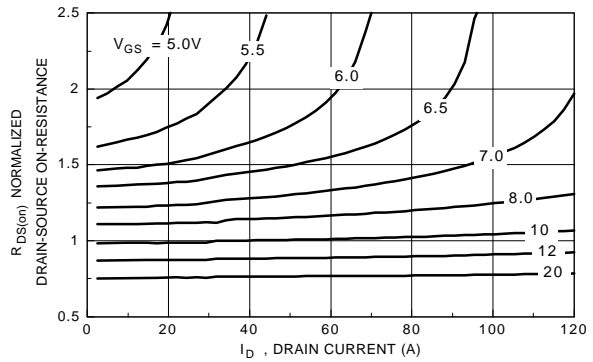


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current

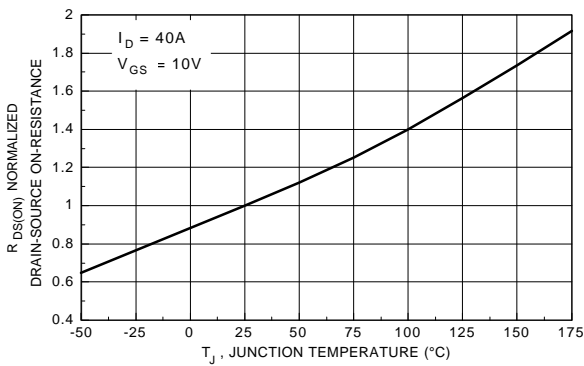


Figure 3. On-Resistance Variation with Temperature

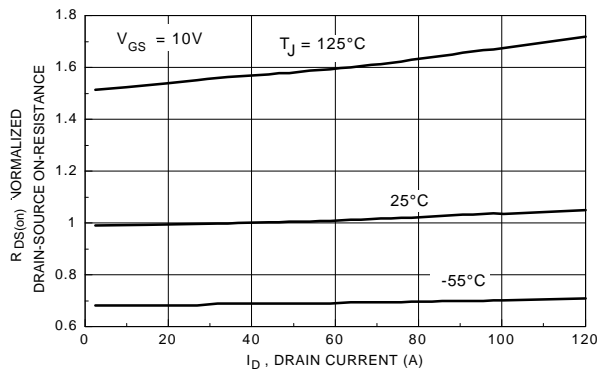


Figure 4. On-Resistance Variation with Drain Current and Temperature

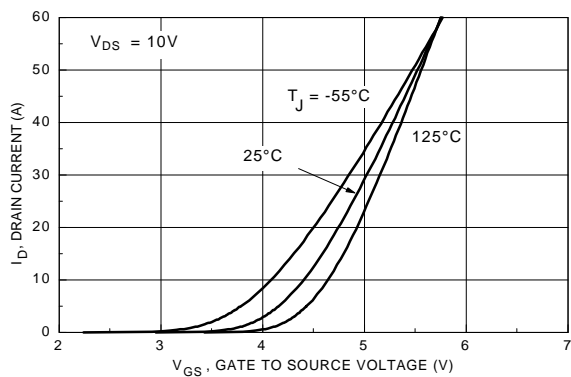


Figure 5. Transfer Characteristics

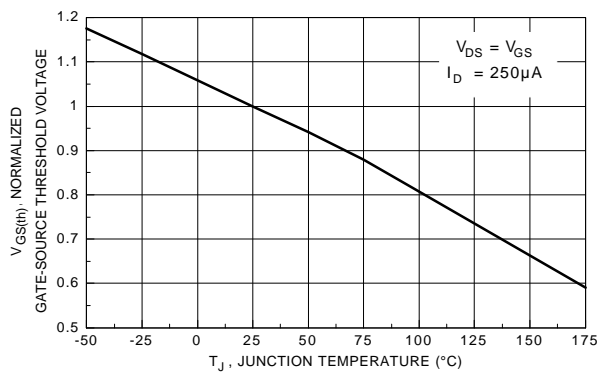


Figure 6. Gate Threshold Variation with Temperature

Typical Electrical Characteristics (continued)

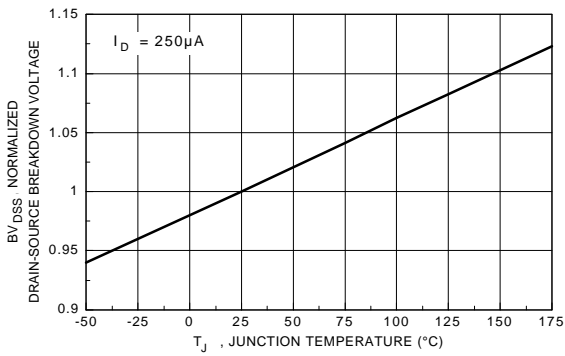


Figure 7. Breakdown Voltage Variation with Temperature

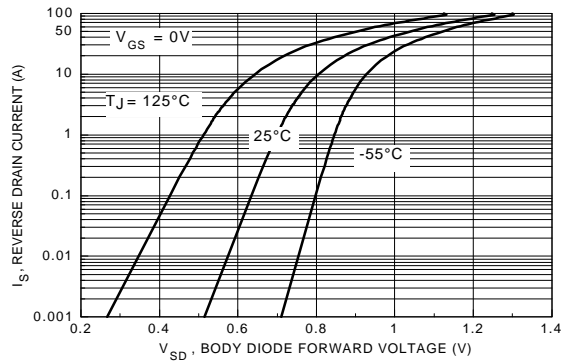


Figure 8. Body Diode Forward Voltage Variation with Current and Temperature

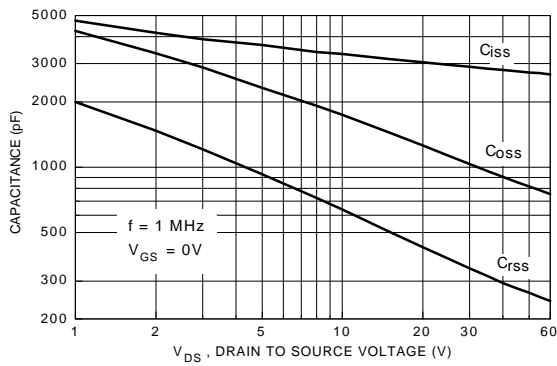


Figure 9. Capacitance Characteristics

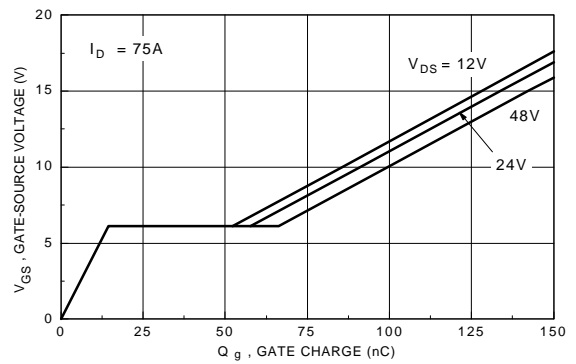


Figure 10. Gate Charge Characteristics

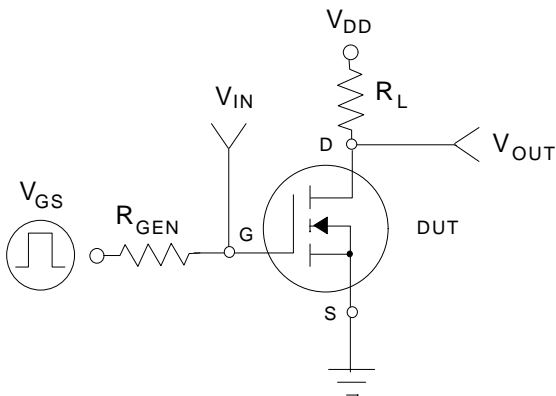


Figure 11. Switching Test Circuit

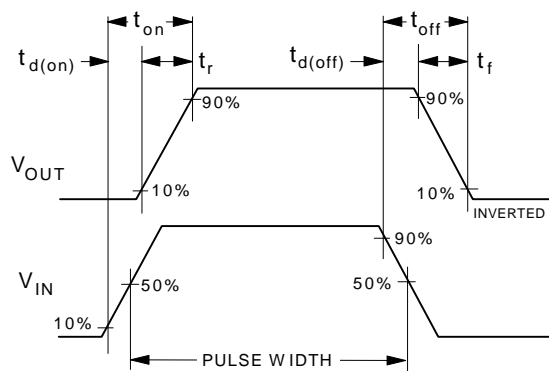


Figure 12. Switching Waveforms

Typical Electrical Characteristics (continued)

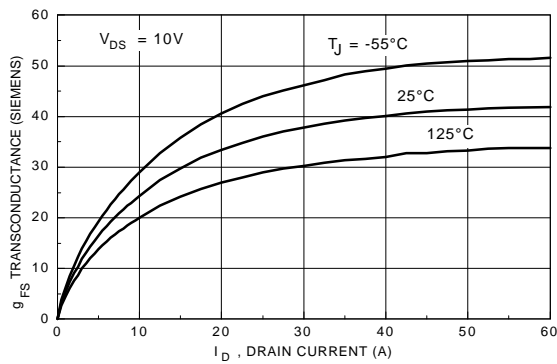


Figure 13. Transconductance Variation with Drain Current and Temperature

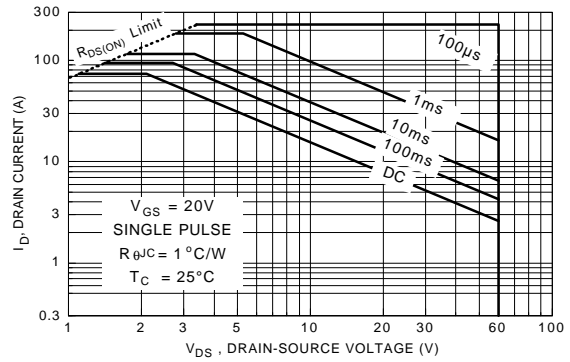


Figure 14. Maximum Safe Operating Area

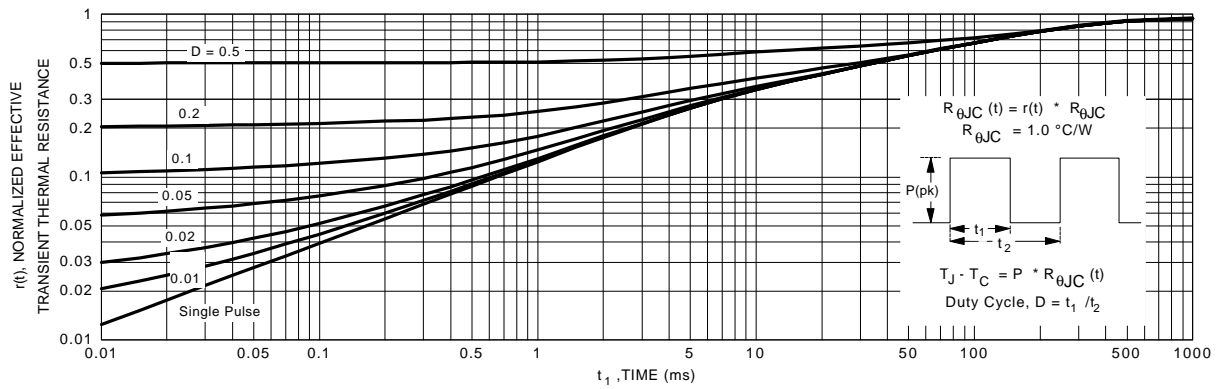


Figure 15. Transient Thermal Response Curve

TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

| | | |
|----------------------|---------------|------------|
| ACEx™ | ISOPLANAR™ | SyncFET™ |
| CoolFET™ | MICROWIRE™ | TinyLogic™ |
| CROSSVOLT™ | POP™ | UHC™ |
| E ² CMOS™ | PowerTrench® | VCX™ |
| FACT™ | QFET™ | |
| FACT Quiet Series™ | QS™ | |
| FAST® | Quiet Series™ | |
| FASTr™ | SuperSOT™-3 | |
| GTO™ | SuperSOT™-6 | |
| HiSeC™ | SuperSOT™-8 | |

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

| Datasheet Identification | Product Status | Definition |
|--------------------------|------------------------|---|
| Advance Information | Formative or In Design | This datasheet contains the design specifications for product development. Specifications may change in any manner without notice. |
| Preliminary | First Production | This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design. |
| No Identification Needed | Full Production | This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design. |
| Obsolete | Not In Production | This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only. |