NTMC1300R2

Power MOSFET
3 Amps, 30 Volts

Complementary SO−8 Dual

Features

- Ultra Low $R_{DS(on)}$
- Higher Efficiency Extending Battery Life
- Miniature SO−8 Surface Mount Package

Applications

- DC−DC Converters
- Power Management in Portable and Battery Powered Products, i.e.: Computers, Printers, Cellular and Cordless Phones
- Low Voltage Motor Controls in Mass Storage Products, i.e.: Disk Drives, Tape Drives

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

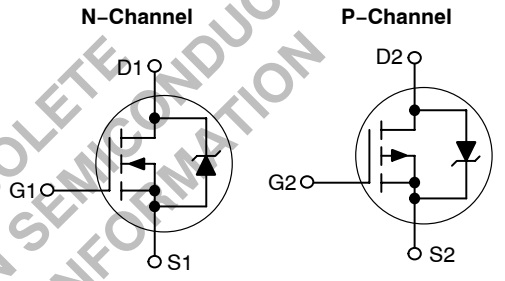
Rating	Symbol	Value	Unit
Drain−to−Source Voltage	V_{DSS}	30	V
Gate−to−Source Voltage − Continuous	V_{GS}	±20	V
Drain Current − Continuous (Note 1) N−Channel P−Channel	I_D	 2.2 1.8	Adc
Drain Current − Continuous (Note 2) N−Channel P−Channel	I_D	 2.8 2.3	Adc
Drain Current − Continuous (Note 3) N−Channel P−Channel	I_D	 3.6 3.0	Adc
Drain Current − Pulsed N−Channel P−Channel	I_{DM}	 8.5 7.0	Apk
Total Power Dissipation @ T_A = 25°C (Note 3)	P_D	2.0	W
Operating and Storage Temperature Range	T_J, T_{stg}	−65 to 150	°C
Single Pulse Drain−to−Source Avalanche Energy − Starting T_J = 25°C (V_{DD} = 20 Vdc, V_{GS} = 10 Vdc, I_L = 2.45 Apk, L = 25 mH, RG = 25 Ω)	E_{AS}	75	mJ
Thermal Resistance Junction−to−Ambient (Note 1) Junction−to−Ambient (Note 2) Junction−to−Ambient (Note 3)	$R_{\theta JA}$	 178.5 106 62.5	°C/W
Maximum Lead Temperature for Soldering Purposes for 10 Seconds	T_L	260	°C

1. When surface mounted to an FR−4 board using minimum recommended pad size, (Cu Area 0.412 in^2), Steady State.
2. When surface mounted to an FR−4 board using 1″ pad size, (Cu Area 0.412 in^2), Steady State.
3. When surface mounted to an FR−4 board using 1″ pad size, (Cu Area 0.412 in^2), T ≤ 10 Seconds.

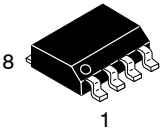
ON Semiconductor®

http://onsemi.com

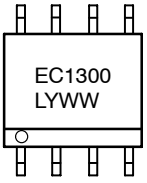
3 AMPERES, 30 VOLTS
73 mΩ @ V_{GS} = 10 V (Typ)
(N−Channel)
100 mΩ @ V_{GS} = 10 V (Typ)
(P−Channel)



MARKING DIAGRAM

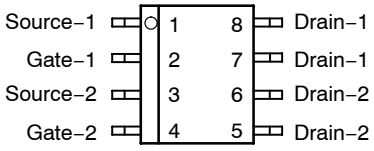


SO−8, Dual
CASE 751
STYLE 11



EC1300	= Device Code
L	= Location Code
Y	= Year
WW	= Work Week

PIN ASSIGNMENT



(Top View)

ORDERING INFORMATION

Device	Package	Shipping
NTMC1300R2	SO−8	2500/Tape & Reel

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic		Symbol	Polarity	Min	Typ	Max	Unit
OFF CHARACTERISTICS							
Drain−Source Breakdown Voltage (V_{GS} = 0 Vdc, I_D = 250 μA)		$V_{(BR)DSS}$	–	30	–	–	Vdc
Zero Gate Voltage Drain Current (V_{GS} = 0 Vdc, V_{DS} = 30 Vdc, T_J = 25°C)		I_{DSS}	(N) (P)	– –	– –	1.0 1.0	μAdc
Gate−Body Leakage Current (V_{GS} = ±20 Vdc, V_{DS} = 0 Vdc)		I_{GSS}	–	–	–	100	nAdc
ON CHARACTERISTICS (Notes 4 & 6)							
Gate Threshold Voltage (V_{DS} = V_{GS}, I_D = 250 μAdc)		$V_{GS(th)}$	(N) (P)	1.0 1.0	1.8 1.6	2.2 2.2	Vdc
Static Drain−to−Source On−State Resistance (V_{GS} = 10 Vdc, I_D = 3.0 Adc)		$R_{DS(on)}$	(N) (P)	– –	0.073 0.100	0.090 0.140	Ω
Static Drain−to−Source On−State Resistance (V_{GS} = 4.5 Vdc, I_D = 1.5 Adc)		$R_{DS(on)}$	(N) (P)	– –	0.093 0.150	0.130 0.200	Ω
Forward Transconductance (V_{DS} = 3.0 Vdc, I_D = 1.5 Adc)		gFS	(N) (P)	– –	4.0 4.0	– –	mhos
DYNAMIC CHARACTERISTICS							
Input Capacitance	(V_{DS} = 20 Vdc, V_{GS} = 0 Vdc, f = 1.0 MHz)	C_{iss}	(N) (P)	– –	190 325	300 550	pF
Output Capacitance		C_{oss}	(N) (P)	– –	75 110	150 175	
Reverse Transfer Capacitance		C_{rss}	(N) (P)	– –	30 40	60 75	
SWITCHING CHARACTERISTICS (Note 5)							
Turn−On Delay Time	(V_{DD} = 24 Vdc, I_D = 2.0 Adc, V_{GS} = 10 Vdc, R_G = 6.0 Ω)	$t_{d(on)}$	(N) (P)	– –	10 9.0	20 20	ns
Rise Time		t_r	(N) (P)	– –	7.0 11	15 20	
Turn−Off Delay Time		$t_{d(off)}$	(N) (P)	– –	20 25	35 40	
Fall Time		t_f	(N) (P)	– –	5.0 13	15 25	
Gate Charge	(V_{DS} = 16 Vdc, I_D = 2.0 Adc, V_{GS} = 4.5 Vdc)	Q_T	(N) (P)	– –	3.0 10	5.0 15	nC
		Q_{gs}	(N) (P)	– –	1.0 1.5	– –	
		Q_{gd}	(N) (P)	– –	1.5 4.0	– –	
BODY−DRAIN DIODE RATINGS (Note 6)							
Diode Forward On−Voltage	(I_S = 1.7 Adc, V_{GS} = 0 Vdc)	V_{SD}	(N) (P)	– –	0.85 0.81	1.1 1.1	Vdc
Reverse Recovery Time	(I_S = 2.0 Adc, V_{GS} = 0 Vdc, dI_S/dt = 100 A/μs)	t_{rr}	(N) (P)	– –	11 20	– –	ns
		t_a	(N) (P)	– –	8.0 16	– –	
		t_b	(N) (P)	– –	3.0 4.0	– –	
Reverse Recovery Stored Charge		Q_{rr}	(N) (P)	– –	0.005 0.020	– –	μC

4. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
5. Switching characteristics are independent of operating junction temperature.
6. Negative signs for P−Channel device omitted for clarity.

TYPICAL ELECTRICAL CHARACTERISTICS

N−Channel

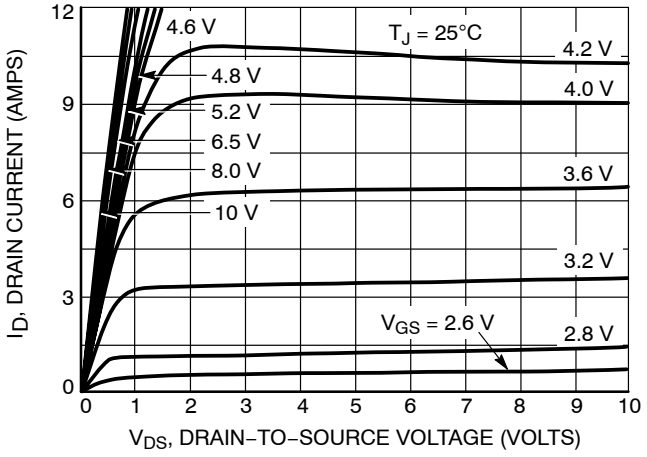


Figure 1. On−Region Characteristics

P−Channel

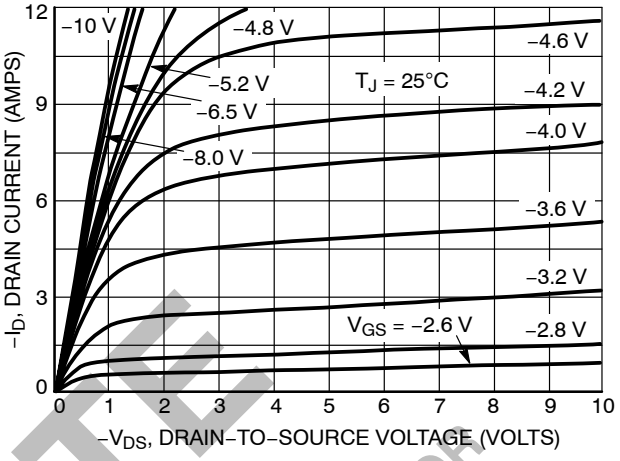


Figure 2. On−Region Characteristics

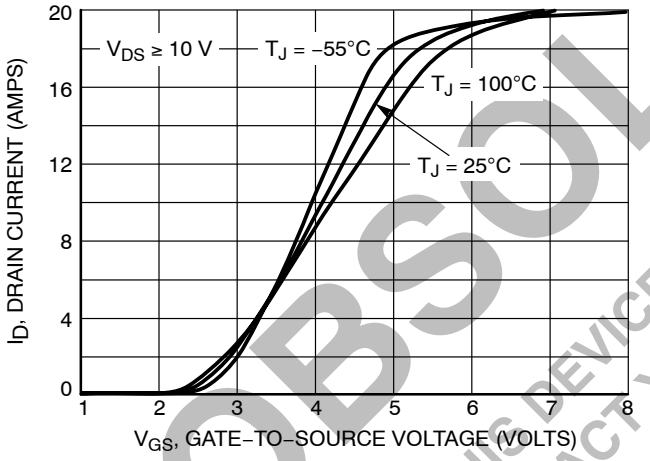


Figure 3. Transfer Characteristics

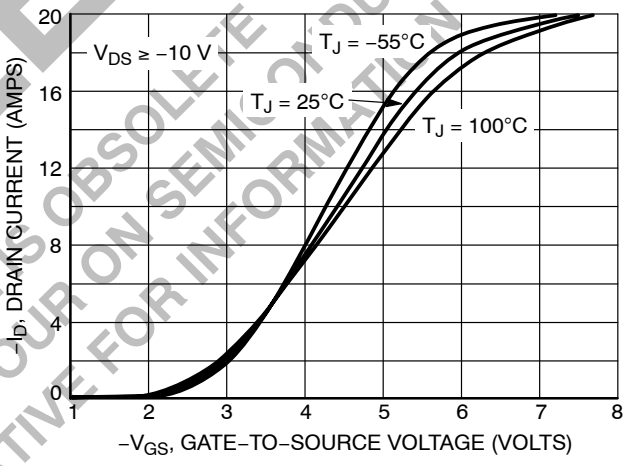


Figure 4. Transfer Characteristics

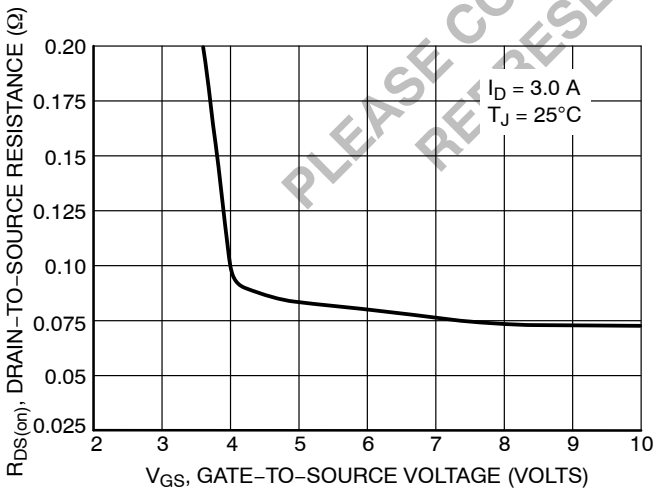


Figure 5. On−Resistance versus Gate−To−Source Voltage

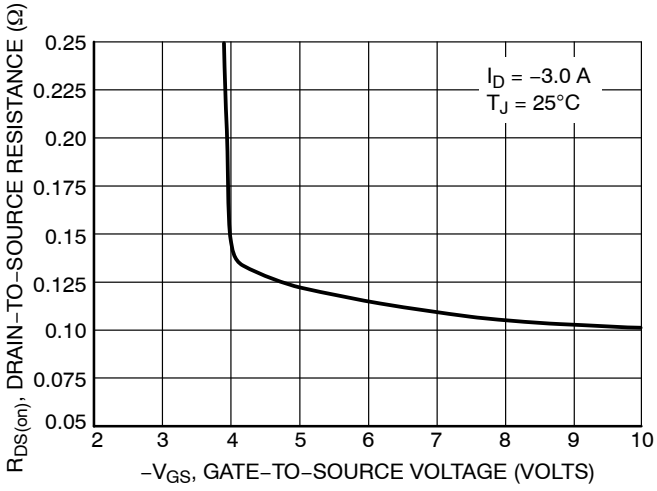


Figure 6. On−Resistance versus Gate−To−Source Voltage

TYPICAL ELECTRICAL CHARACTERISTICS

N−Channel

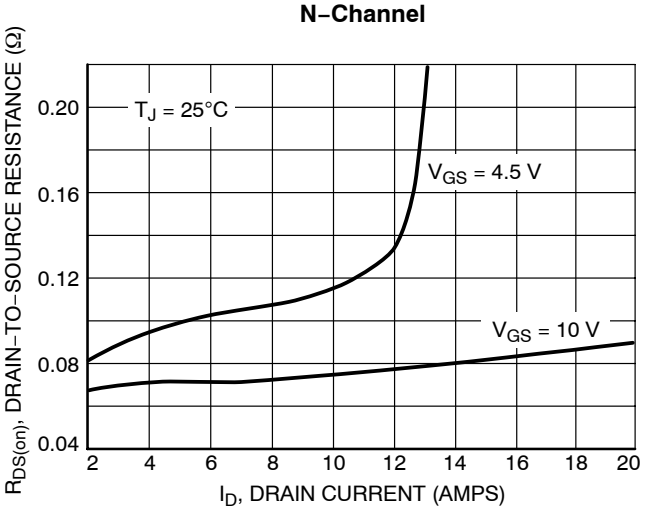


Figure 7. On−Resistance versus Drain Current and Gate Voltage

P−Channel

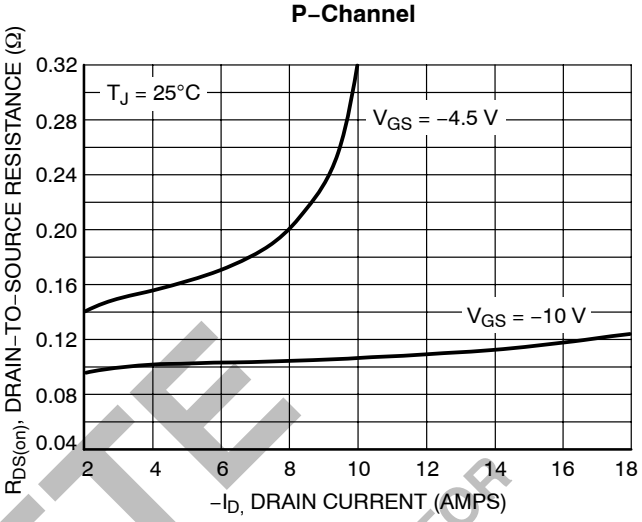


Figure 8. On−Resistance versus Drain Current and Gate Voltage

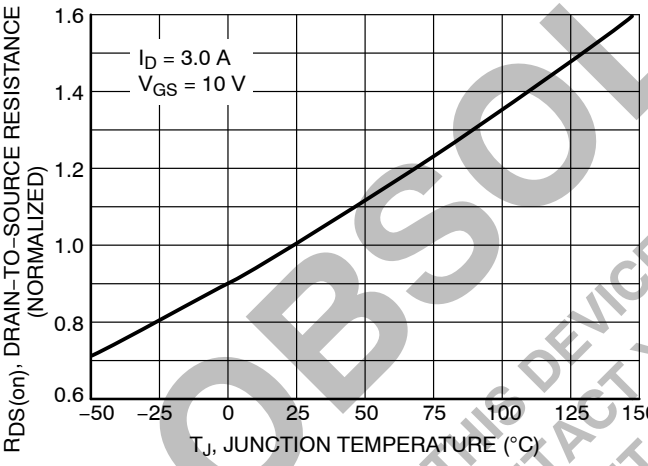


Figure 9. On−Resistance Variation with Temperature

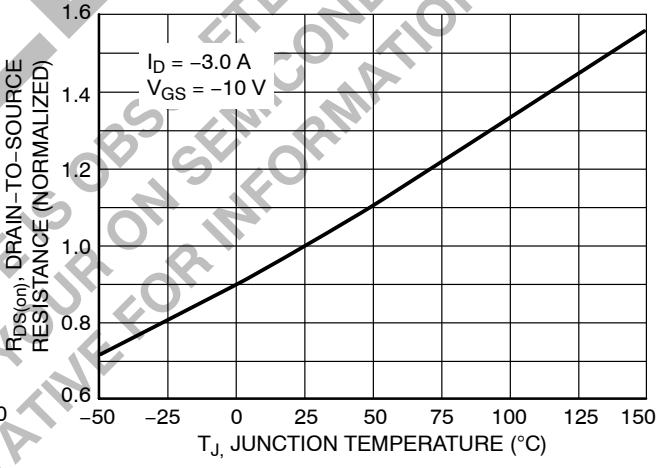


Figure 10. On−Resistance Variation with Temperature

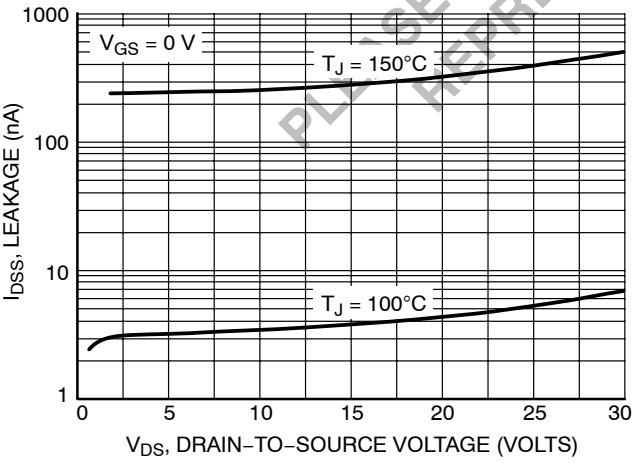


Figure 11. Drain−To−Source Leakage Current versus Voltage

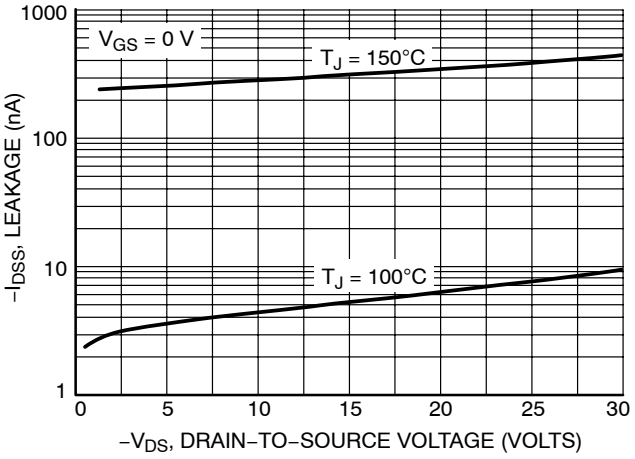


Figure 12. Drain−To−Source Leakage Current versus Voltage

N−Channel

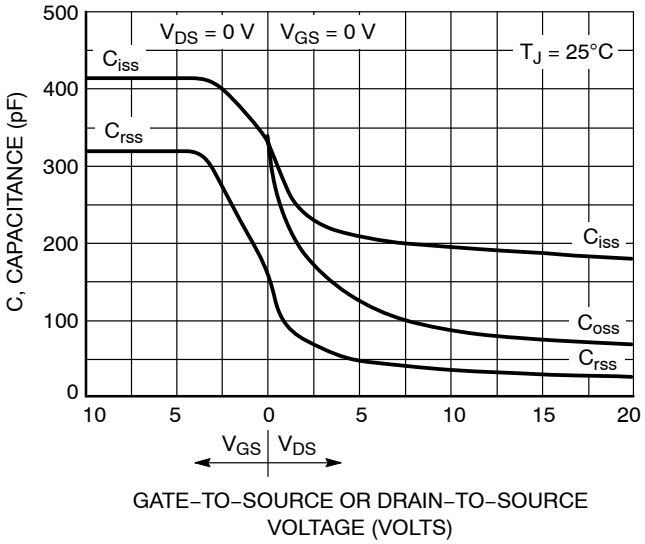


Figure 13. Capacitance Variation

P−Channel

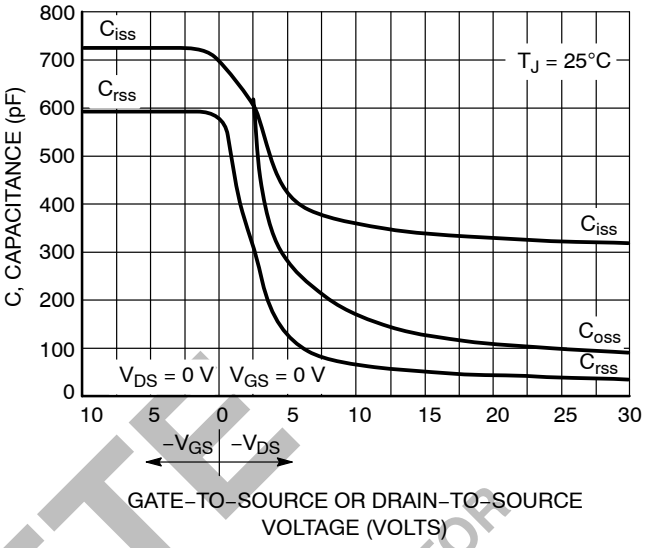


Figure 14. Capacitance Variation

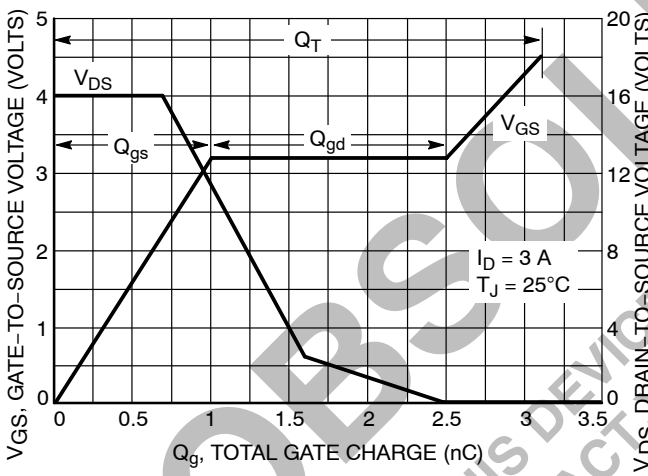


Figure 15. Gate−To−Source and Drain−To−Source Voltage versus Total Charge

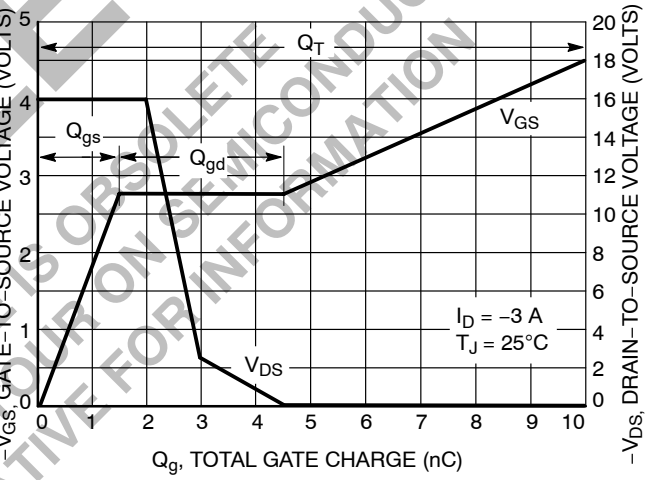


Figure 16. Gate−To−Source and Drain−To−Source Voltage versus Total Charge

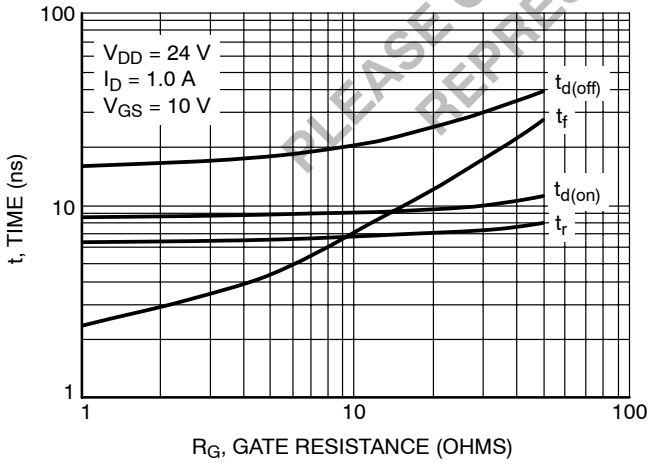


Figure 17. Resistive Switching Time Variation versus Gate Resistance

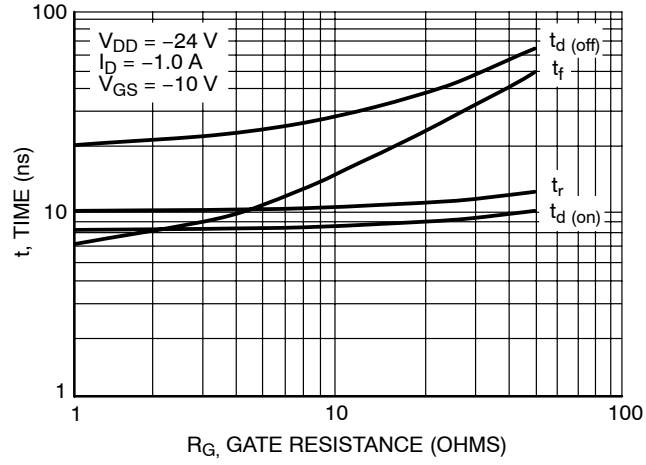


Figure 18. Resistive Switching Time Variation versus Gate Resistance

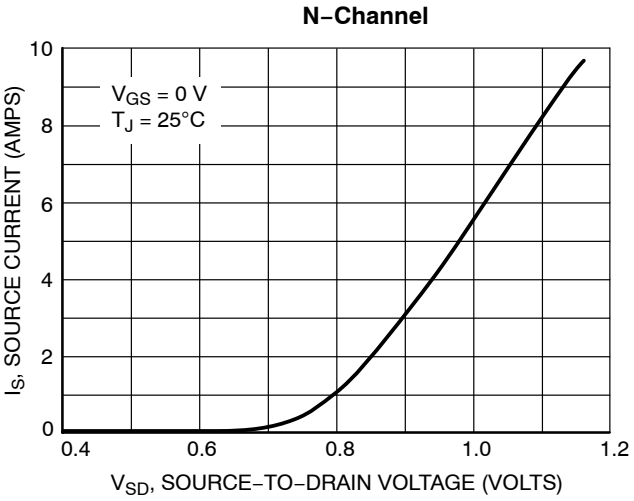


Figure 19. Diode Forward Voltage versus Current

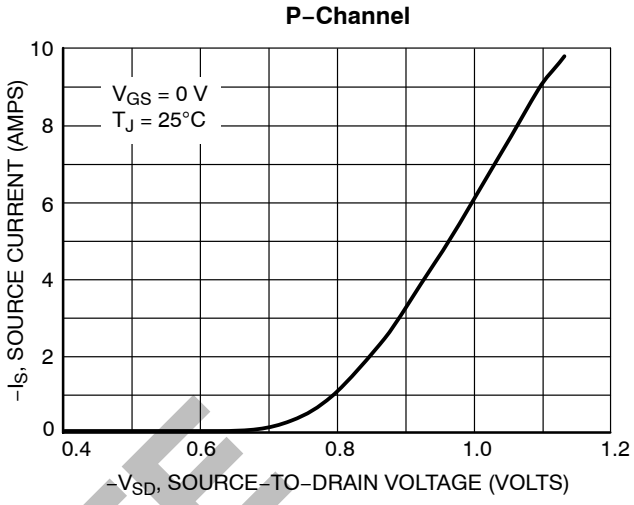


Figure 20. Diode Forward Voltage versus Current

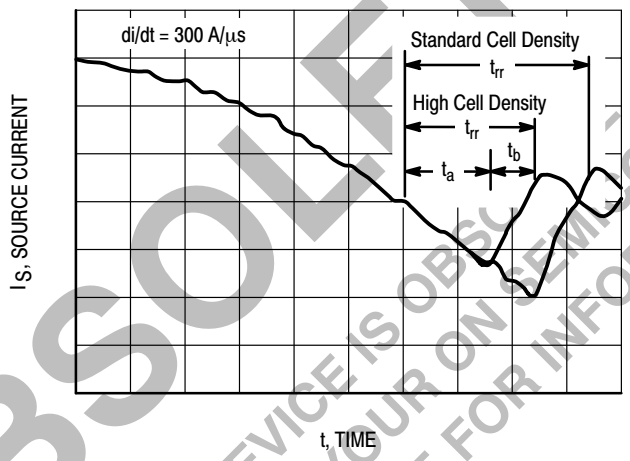
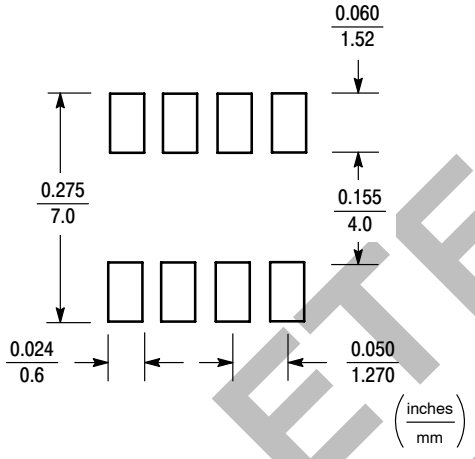


Figure 21. Reverse Recovery Time (t_{rr})

INFORMATION FOR USING THE SO−8 SURFACE MOUNT PACKAGE

MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE MOUNTED APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor packages must be the correct size to ensure proper solder connection interface between the board and the package. With the correct pad geometry, the packages will self−align when subjected to a solder reflow process.



SOLDERING PRECAUTIONS

The melting temperature of solder is higher than the rated temperature of the device. When the entire device is heated to a high temperature, failure to complete soldering within a short time could result in device failure. Therefore, the following items should always be observed in order to minimize the thermal stress to which the devices are subjected.

- Always preheat the device.
- The delta temperature between the preheat and soldering should be 100°C or less.*
- When preheating and soldering, the temperature of the leads and the case must not exceed the maximum temperature ratings as shown on the data sheet. When using infrared heating with the reflow soldering method, the difference shall be a maximum of 10°C.
- The soldering temperature and time shall not exceed 260°C for more than 10 seconds.
- When shifting from preheating to soldering, the maximum temperature gradient shall be 5°C or less.
- After soldering has been completed, the device should be allowed to cool naturally for at least three minutes. Gradual cooling should be used as the use of forced cooling will increase the temperature gradient and result in latent failure due to mechanical stress.
- Mechanical stress or shock should not be applied during cooling.

* Soldering a device without preheating can cause excessive thermal shock and stress which can result in damage to the device.

TYPICAL SOLDER HEATING PROFILE

For any given circuit board, there will be a group of control settings that will give the desired heat pattern. The operator must set temperatures for several heating zones and a figure for belt speed. Taken together, these control settings make up a heating “profile” for that particular circuit board. On machines controlled by a computer, the computer remembers these profiles from one operating session to the next. Figure 22 shows a typical heating profile for use when soldering a surface mount device to a printed circuit board. This profile will vary among soldering systems, but it is a good starting point. Factors that can affect the profile include the type of soldering system in use, density and types of components on the board, type of solder used, and the type of board or substrate material being used. This profile shows temperature versus time. The line on the graph shows the actual temperature that might be experienced on the surface of a test board at or near a central solder joint. The two profiles are based on a high density and a low density board. The Vitronics SMD310 convection/infrared reflow soldering system was used to generate this profile. The type of solder used was 62/36/2 Tin Lead Silver with a melting point between 177−189°C. When this type of furnace is used for solder reflow work, the circuit boards and solder joints tend to heat first. The components on the board are then heated by conduction. The circuit board, because it has a large surface area, absorbs the thermal energy more efficiently, then distributes this energy to the components. Because of this effect, the main body of a component may be up to 30 degrees cooler than the adjacent solder joints.

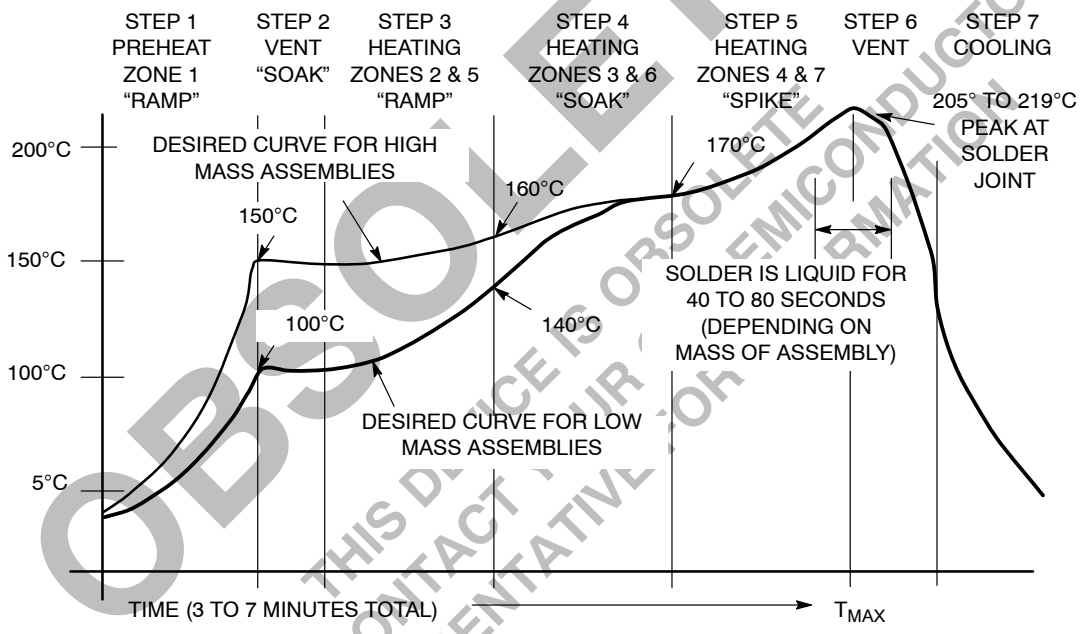
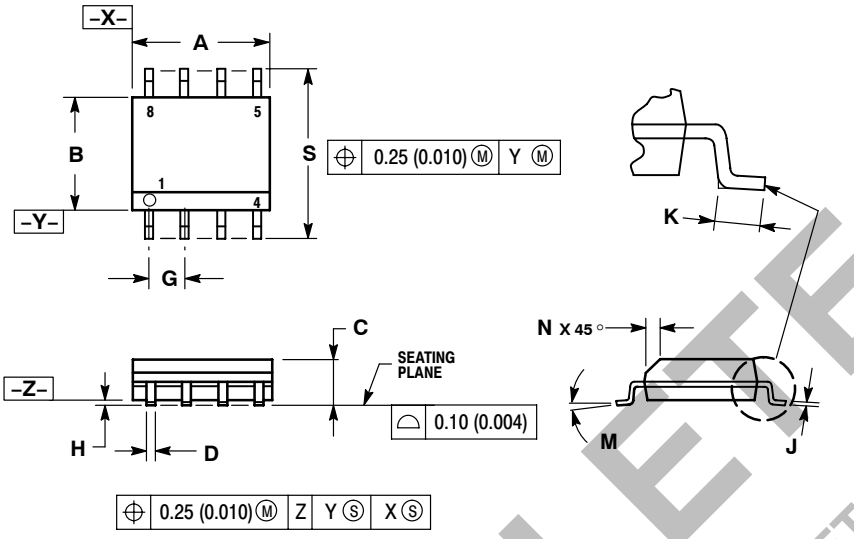


Figure 22. Typical Solder Heating Profile

PACKAGE DIMENSIONS

SO−8
CASE 751−07
ISSUE AA



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751−01 THRU 751−06 ARE OBSOLETE. NEW STANDARD IS 751−07.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0 °	8 °	0 °	8 °
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

STYLE 11:
PIN 1. SOURCE 1
2. GATE 1
3. SOURCE 2
4. GATE 2
5. DRAIN 2
6. DRAIN 2
7. DRAIN 1
8. DRAIN 1

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5773−3850

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative

NTMC1300R2/D