

NTMS4N01R2

Power MOSFET

4.2 Amps, 20 Volts

N-Channel Enhancement-Mode Single SO-8 Package

Features

- High Density Power MOSFET with Ultra Low $R_{DS(on)}$ Providing Higher Efficiency
- Miniature SO-8 Surface Mount Package Saving Board Space; Mounting Information for the SO-8 Package is Provided
- I_{DSS} Specified at Elevated Temperature
- Drain-to-Source Avalanche Energy Specified
- Diode Exhibits High Speed, Soft Recovery
- Pb-Free Package is Available

Applications

- Power Management in Portable and Battery-Powered Products, i.e.: Computers, Printers, PCMCIA Cards, Cellular & Cordless Telephones

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

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DSS}	20	V
Drain-to-Gate Voltage ($R_{GS} = 1.0\text{ m}\Omega$)	V_{DGR}	20	V
Gate-to-Source Voltage - Continuous	V_{GS}	± 10	V
Thermal Resistance, Junction-to-Ambient (Note 1)	$R_{\theta JA}$	50	$^\circ\text{C/W}$
Total Power Dissipation @ $T_A = 25^\circ\text{C}$	P_D	2.5	W
Continuous Drain Current @ 25°C	I_D	5.9	A
Continuous Drain Current @ 70°C	I_D	4.7	A
Pulsed Drain Current (Note 4)	I_{DM}	25	A
Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	100	$^\circ\text{C/W}$
Total Power Dissipation @ $T_A = 25^\circ\text{C}$	P_D	1.25	W
Continuous Drain Current @ 25°C	I_D	4.2	A
Continuous Drain Current @ 70°C	I_D	3.3	A
Pulsed Drain Current (Note 4)	I_{DM}	20	A
Thermal Resistance, Junction-to-Ambient (Note 3)	$R_{\theta JA}$	162	$^\circ\text{C/W}$
Total Power Dissipation @ $T_A = 25^\circ\text{C}$	P_D	0.77	W
Continuous Drain Current @ 25°C	I_D	3.3	A
Continuous Drain Current @ 70°C	I_D	2.6	A
Pulsed Drain Current (Note 4)	I_{DM}	15	A
Operating and Storage Temperature Range	T_J, T_{stg}	-55 to $+150$	$^\circ\text{C}$
Single Pulse Drain-to-Source Avalanche Energy - Starting $T_J = 25^\circ\text{C}$ ($V_{DD} = 20\text{ Vdc}$, $V_{GS} = 5.0\text{ Vdc}$, Peak $I_L = 7.5\text{ Apk}$, $L = 6\text{ mH}$, $R_G = 25\text{ }\Omega$)	E_{AS}	169	mJ
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	T_L	260	$^\circ\text{C}$

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. Mounted onto a 2" square FR-4 Board (1" sq. 2 oz Cu 0.06" thick single sided), $t \leq 10$ seconds.
2. Mounted onto a 2" square FR-4 Board (1" sq. 2 oz Cu 0.06" thick single sided), $t = \text{steady state}$.
3. Minimum FR-4 or G-10 PCB, $t = \text{Steady State}$.
4. Pulse Test: Pulse Width = 300 μs , Duty Cycle = 2%.



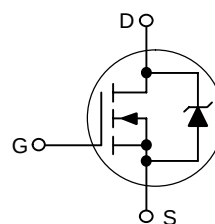
ON Semiconductor®

<http://onsemi.com>

4.2 AMPERES, 20 VOLTS

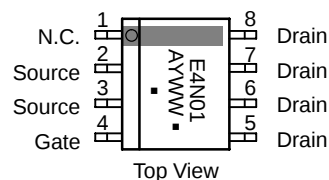
$0.045\text{ }\Omega @ V_{GS} = 4.5\text{ V}$

Single N-Channel



SO-8
CASE 751
STYLE 13

MARKING DIAGRAM AND PIN ASSIGNMENT



E4N01 = Device Code
A = Assembly Location
Y = Year
WW = Work Week
■ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping [†]
NTMS4N01R2	SO-8	2500 / Tape & Reel
NTMS4N01R2G	SO-8 (Pb-Free)	2500 / Tape & Reel

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

NTMS4N01R2

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted) (Note 5)

Characteristic	Symbol	Min	Typ	Max	Unit	
OFF CHARACTERISTICS						
Drain-to-Source Breakdown Voltage (V _{GS} = 0 Vdc, I _D = 250 μAdc) Temperature Coefficient (Positive)	V _{(BR)DSS}	20 –	– 20	– –	Vdc mV/°C	
Zero Gate Voltage Drain Current (V _{DS} = 12 Vdc, V _{GS} = 0 Vdc, T _J = 25°C) (V _{DS} = 12 Vdc, V _{GS} = 0 Vdc, T _J = 125°C) (V _{DS} = 20 Vdc, V _{GS} = 0 Vdc, T _J = 25°C)	I _{DSS}	– – –	– – 0.2	1.0 10 –	μAdc	
Gate-Body Leakage Current (V _{GS} = +10 Vdc, V _{DS} = 0 Vdc)	I _{GSS}	–	–	100	nAdc	
Gate-Body Leakage Current (V _{GS} = –10 Vdc, V _{DS} = 0 Vdc)	I _{GSS}	–	–	–100	nAdc	
ON CHARACTERISTICS						
Gate Threshold Voltage (V _{DS} = V _{GS} , I _D = 250 μAdc) Temperature Coefficient (Negative)	V _{GS(th)}	0.6 –	0.95 –3.0	1.2 –	Vdc mV/°C	
Static Drain-to-Source On-State Resistance (V _{GS} = 4.5 Vdc, I _D = 4.2 Adc) (V _{GS} = 2.7 Vdc, I _D = 2.1 Adc) (V _{GS} = 2.5 Vdc, I _D = 2.0 Adc)	R _{DS(on)}	– – –	0.030 0.035 0.037	0.04 0.05 –	Ω	
Forward Transconductance (V _{DS} = 2.5 Vdc, I _D = 2.0 Adc)	g _{FS}	–	10	–	Mhos	
DYNAMIC CHARACTERISTICS						
Input Capacitance	(V _{DS} = 10 Vdc, V _{GS} = 0 Vdc, f = 1.0 MHz)	C _{iSS}	–	870	1200	pF
Output Capacitance		C _{oSS}	–	260	400	
Reverse Transfer Capacitance		C _{rSS}	–	60	100	
SWITCHING CHARACTERISTICS (Notes 6 & 7)						
Turn-On Delay Time	(V _{DD} = 12 Vdc, I _D = 4.2 Adc, V _{GS} = 4.5 Vdc, R _G = 2.3 Ω)	t _{d(on)}	–	13	25	ns
Rise Time		t _r	–	35	65	
Turn-Off Delay Time		t _{d(off)}	–	45	75	
Fall Time		t _f	–	50	90	
Total Gate Charge	(V _{DS} = 12 Vdc, V _{GS} = 4.5 Vdc, I _D = 4.2 Adc)	Q _{tot}	–	11	16	nC
Gate-Source Charge		Q _{gs}	–	2.0	–	
Gate-Drain Charge		Q _{gd}	–	3.0	–	
BODY-DRAIN DIODE RATINGS (Note 6)						
Diode Forward On-Voltage	(I _S = 4.2 Adc, V _{GS} = 0 Vdc) (I _S = 4.2 Adc, V _{GS} = 0 Vdc, T _J = 125°C)	V _{SD}	– –	0.85 0.70	1.1 –	Vdc
Reverse Recovery Time	(I _S = 4.2 Adc, V _{GS} = 0 Vdc, di _S /dt = 100 A/μs)	t _{rr}	–	20	–	ns
		t _a	–	12	–	
		t _b	–	8.0	–	
Reverse Recovery Stored Charge		Q _{RR}	–	0.01	–	μC

5. Handling precautions to protect against electrostatic discharge is mandatory.
6. Indicates Pulse Test: Pulse Width = 300 μ s max, Duty Cycle = 2%.
7. Switching characteristics are independent of operating junction temperature.

NTMS4N01R2

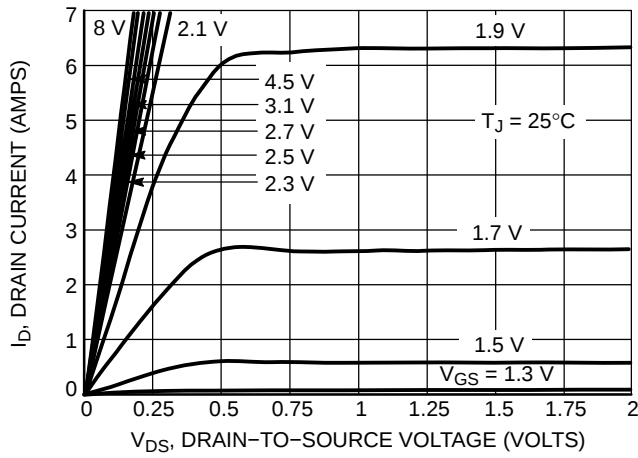


Figure 1. On-Region Characteristics

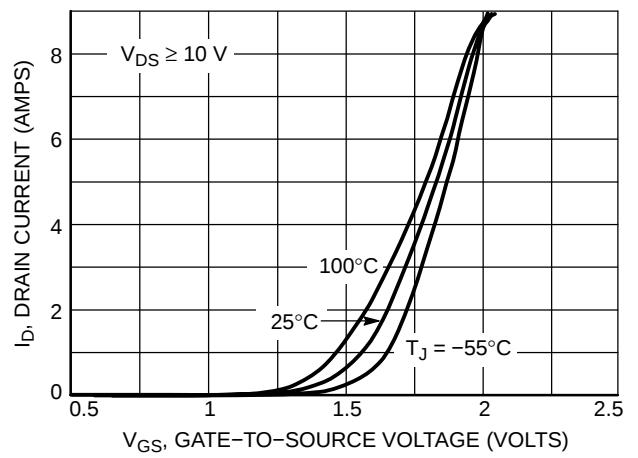


Figure 2. Transfer Characteristics

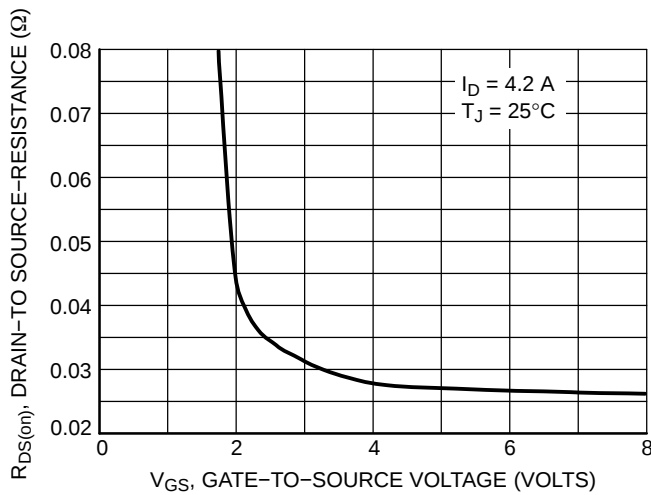


Figure 3. On-Resistance versus Gate-to-Source Voltage

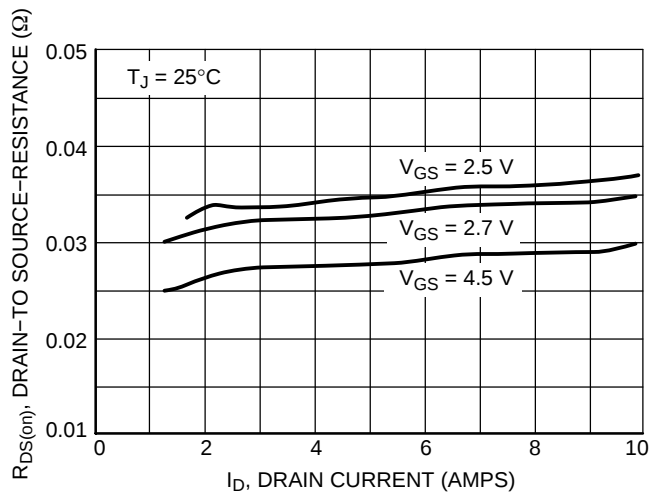


Figure 4. On-Resistance versus Drain Current and Gate Voltage

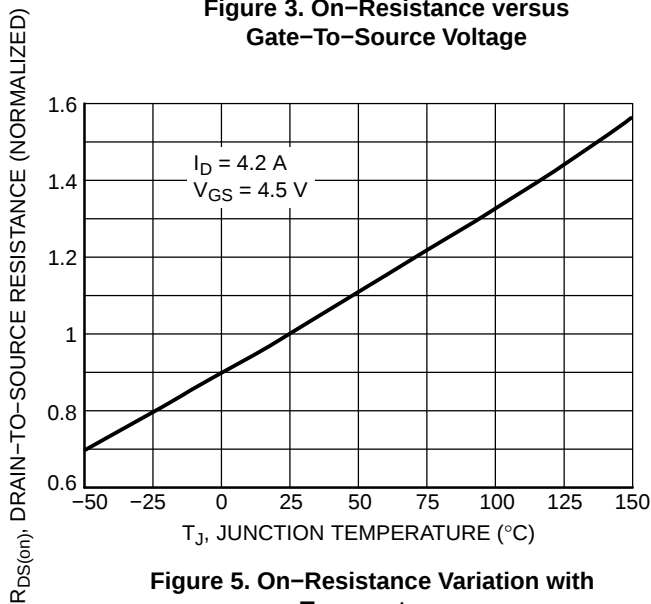


Figure 5. On-Resistance Variation with Temperature

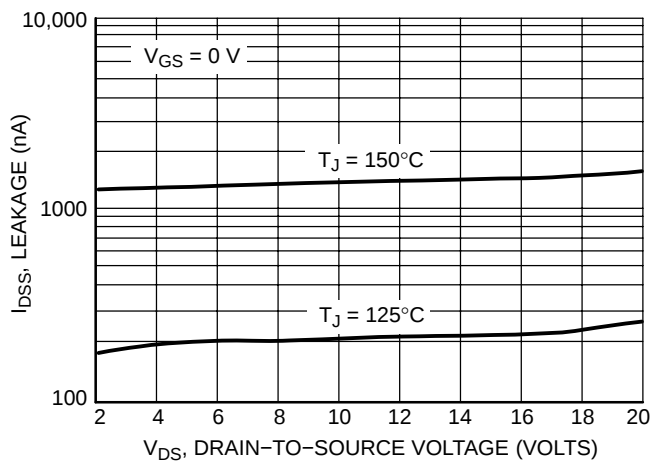


Figure 6. Drain-To-Source Leakage Current versus Voltage

NTMS4N01R2

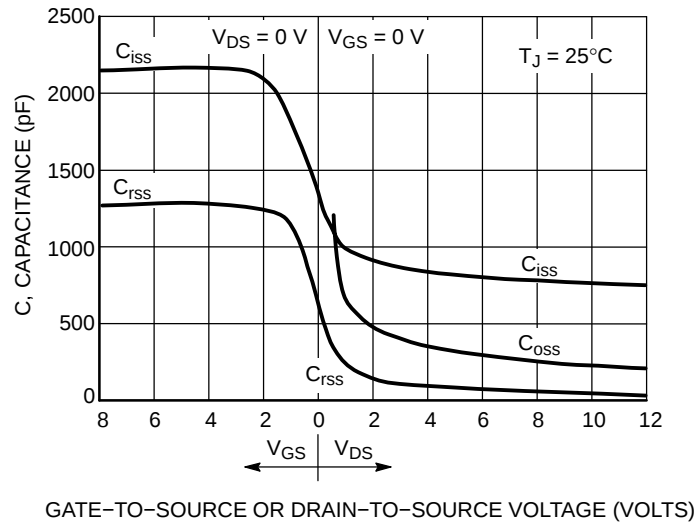


Figure 7. Capacitance Variation

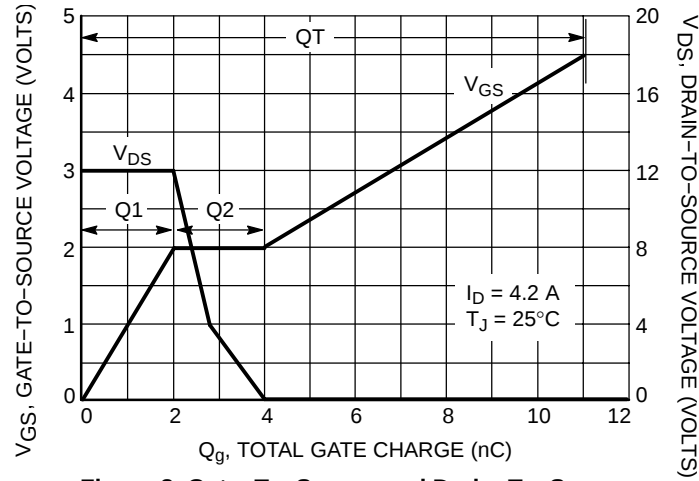


Figure 8. Gate-To-Source and Drain-To-Source Voltage versus Total Charge

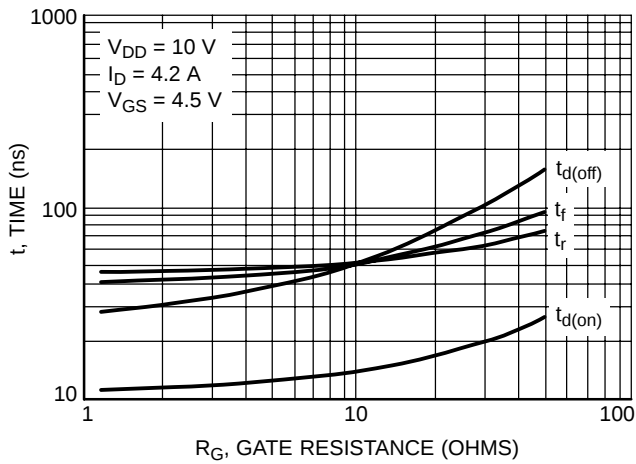


Figure 9. Resistive Switching Time Variation versus Gate Resistance

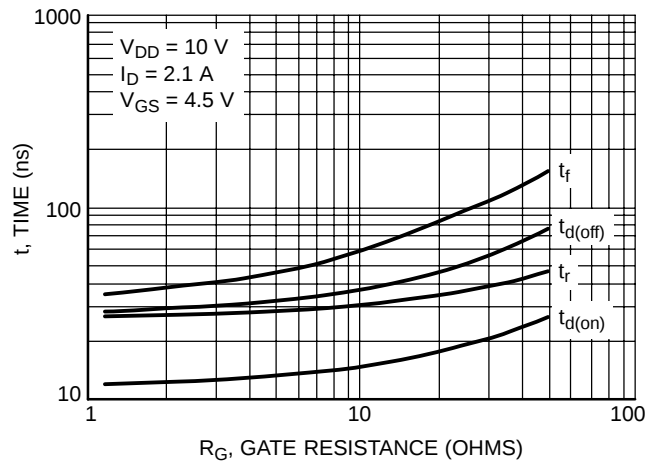


Figure 10. Resistive Switching Time Variation versus Gate Resistance

NTMS4N01R2

DRAIN-TO-SOURCE DIODE CHARACTERISTICS

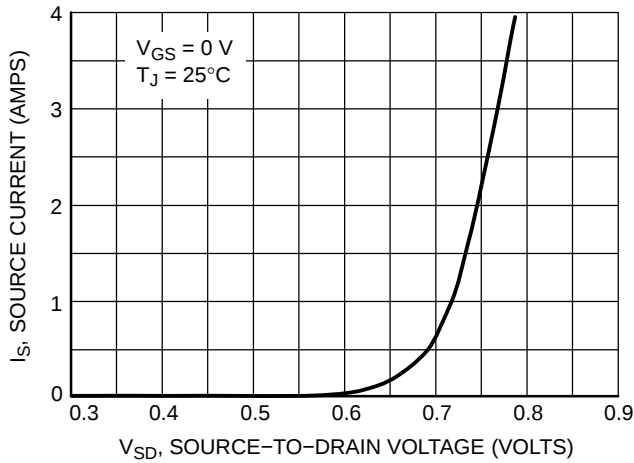


Figure 11. Diode Forward Voltage versus Current

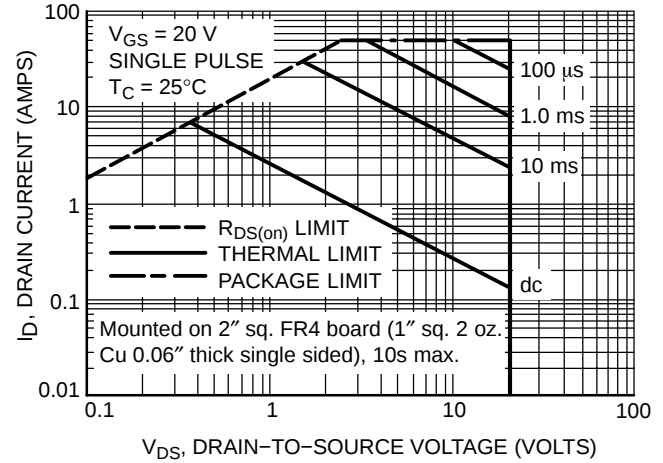


Figure 12. Maximum Rated Forward Biased Safe Operating Area

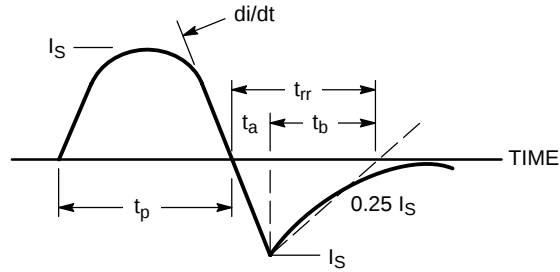


Figure 13. Diode Reverse Recovery Waveform

TYPICAL ELECTRICAL CHARACTERISTICS

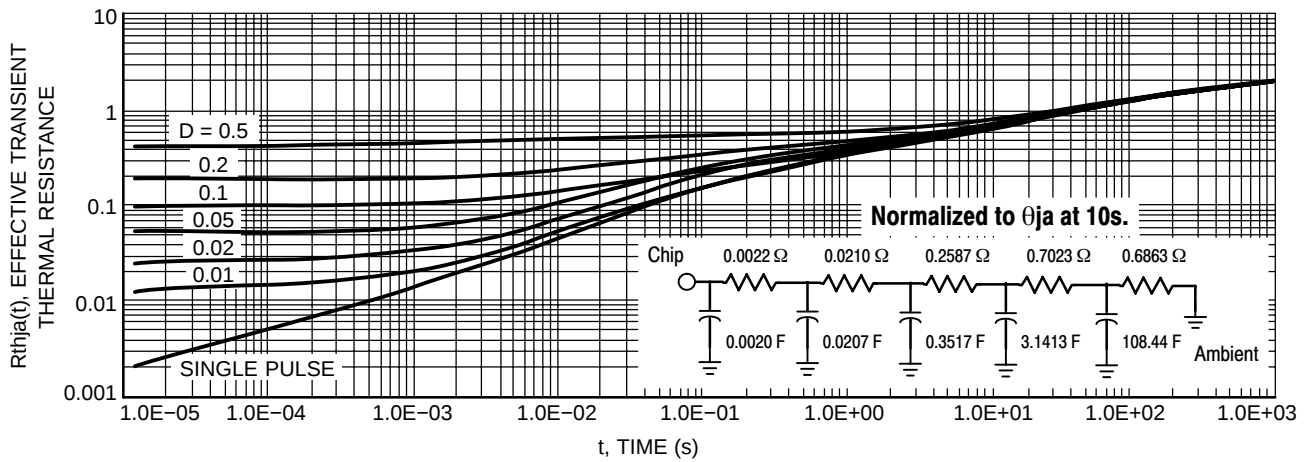


Figure 14. Thermal Response



SCALE 1:1

SOIC-8 NB
CASE 751-07
ISSUE AK

DATE 16 FEB 2011

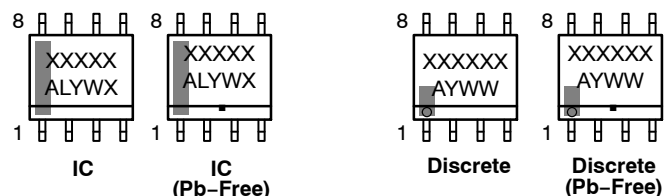


NOTES:

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.

DIM	MILLIMETERS		INCHES	
	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

GENERIC
MARKING DIAGRAM*



XXXXXX = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb-Free Package

XXXXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb-Free Package

*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.

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

STYLES ON PAGE 2

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SOIC-8 NB
CASE 751-07
ISSUE AK

DATE 16 FEB 2011

STYLE 1: PIN 1. EMITTER 2. COLLECTOR 3. COLLECTOR 4. EMITTER 5. EMITTER 6. BASE 7. BASE 8. EMITTER	STYLE 2: PIN 1. COLLECTOR, DIE, #1 2. COLLECTOR, #1 3. COLLECTOR, #2 4. COLLECTOR, #2 5. BASE, #2 6. EMITTER, #2 7. BASE, #1 8. EMITTER, #1	STYLE 3: PIN 1. DRAIN, DIE #1 2. DRAIN, #1 3. DRAIN, #2 4. DRAIN, #2 5. GATE, #2 6. SOURCE, #2 7. GATE, #1 8. SOURCE, #1	STYLE 4: PIN 1. ANODE 2. ANODE 3. ANODE 4. ANODE 5. ANODE 6. ANODE 7. ANODE 8. COMMON CATHODE
STYLE 5: PIN 1. DRAIN 2. DRAIN 3. DRAIN 4. DRAIN 5. GATE 6. GATE 7. SOURCE 8. SOURCE	STYLE 6: PIN 1. SOURCE 2. DRAIN 3. DRAIN 4. SOURCE 5. SOURCE 6. GATE 7. GATE 8. SOURCE	STYLE 7: PIN 1. INPUT 2. EXTERNAL BYPASS 3. THIRD STAGE SOURCE 4. GROUND 5. DRAIN 6. GATE 3 7. SECOND STAGE Vd 8. FIRST STAGE Vd	STYLE 8: PIN 1. COLLECTOR, DIE #1 2. BASE, #1 3. BASE, #2 4. COLLECTOR, #2 5. COLLECTOR, #2 6. EMITTER, #2 7. EMITTER, #1 8. COLLECTOR, #1
STYLE 9: PIN 1. EMITTER, COMMON 2. COLLECTOR, DIE #1 3. COLLECTOR, DIE #2 4. EMITTER, COMMON 5. EMITTER, COMMON 6. BASE, DIE #2 7. BASE, DIE #1 8. EMITTER, COMMON	STYLE 10: PIN 1. GROUND 2. BIAS 1 3. OUTPUT 4. GROUND 5. GROUND 6. BIAS 2 7. INPUT 8. GROUND	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	STYLE 12: PIN 1. SOURCE 2. SOURCE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN
STYLE 13: PIN 1. N.C. 2. SOURCE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN	STYLE 14: PIN 1. N-SOURCE 2. N-GATE 3. P-SOURCE 4. P-GATE 5. P-DRAIN 6. P-DRAIN 7. N-DRAIN 8. N-DRAIN	STYLE 15: PIN 1. ANODE 1 2. ANODE 1 3. ANODE 1 4. ANODE 1 5. CATHODE, COMMON 6. CATHODE, COMMON 7. CATHODE, COMMON 8. CATHODE, COMMON	STYLE 16: PIN 1. EMITTER, DIE #1 2. BASE, DIE #1 3. EMITTER, DIE #2 4. BASE, DIE #2 5. COLLECTOR, DIE #2 6. COLLECTOR, DIE #2 7. COLLECTOR, DIE #1 8. COLLECTOR, DIE #1
STYLE 17: PIN 1. VCC 2. V2OUT 3. V1OUT 4. TXE 5. RXE 6. VEE 7. GND 8. ACC	STYLE 18: PIN 1. ANODE 2. ANODE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. CATHODE 8. CATHODE	STYLE 19: PIN 1. SOURCE 1 2. GATE 1 3. SOURCE 2 4. GATE 2 5. DRAIN 2 6. MIRROR 2 7. DRAIN 1 8. MIRROR 1	STYLE 20: PIN 1. SOURCE (N) 2. GATE (N) 3. SOURCE (P) 4. GATE (P) 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN
STYLE 21: PIN 1. CATHODE 1 2. CATHODE 2 3. CATHODE 3 4. CATHODE 4 5. CATHODE 5 6. COMMON ANODE 7. COMMON ANODE 8. CATHODE 6	STYLE 22: PIN 1. I/O LINE 1 2. COMMON CATHODE/VCC 3. COMMON CATHODE/VCC 4. I/O LINE 3 5. COMMON ANODE/GND 6. I/O LINE 4 7. I/O LINE 5 8. COMMON ANODE/GND	STYLE 23: PIN 1. LINE 1 IN 2. COMMON ANODE/GND 3. COMMON ANODE/GND 4. LINE 2 IN 5. LINE 2 OUT 6. COMMON ANODE/GND 7. COMMON ANODE/GND 8. LINE 1 OUT	STYLE 24: PIN 1. BASE 2. EMITTER 3. COLLECTOR/ANODE 4. COLLECTOR/ANODE 5. CATHODE 6. CATHODE 7. COLLECTOR/ANODE 8. COLLECTOR/ANODE
STYLE 25: PIN 1. VIN 2. N/C 3. REXT 4. GND 5. IOUT 6. IOUT 7. IOUT 8. IOUT	STYLE 26: PIN 1. GND 2. dv/dt 3. ENABLE 4. ILIMIT 5. SOURCE 6. SOURCE 7. SOURCE 8. VCC	STYLE 27: PIN 1. ILIMIT 2. OVLO 3. UVLO 4. INPUT+ 5. SOURCE 6. SOURCE 7. SOURCE 8. DRAIN	STYLE 28: PIN 1. SW_TO_GND 2. DASIC_OFF 3. DASIC_SW_DET 4. GND 5. V_MON 6. VBULK 7. VBULK 8. VIN
STYLE 29: PIN 1. BASE, DIE #1 2. EMITTER, #1 3. BASE, #2 4. EMITTER, #2 5. COLLECTOR, #2 6. COLLECTOR, #2 7. COLLECTOR, #1 8. COLLECTOR, #1	STYLE 30: PIN 1. DRAIN 1 2. DRAIN 1 3. GATE 2 4. SOURCE 2 5. SOURCE 1/DRAIN 2 6. SOURCE 1/DRAIN 2 7. SOURCE 1/DRAIN 2 8. GATE 1		

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