NTMD6601NR2G

Power MOSFET

80 V, 2.2 A, Dual N−Channel, SO−8

Features

- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- Dual SO−8 Surface Mount Package Saves Board Space
- This is a Pb−Free Device

Applications

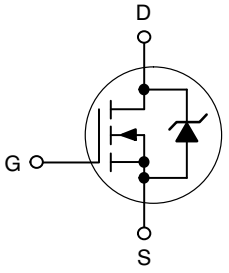
- LCD Displays

ON Semiconductor®

http://onsemi.com

$V_{(BR)DSS}$	$R_{DS(on)}$ Max	I_D Max
80 V	215 mΩ @ 10 V	2.2 A
	245 mΩ @ 4.5 V	

N−Channel



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

Rating			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	80	V
Gate−to−Source Voltage − Continuous			V_{GS}	±15	V
Continuous Drain Current $R_{\theta JA}$ (Note 1)	Steady State	T_A = 25°C	I_D	1.4	A
		T_A = 70°C		1.2	
Power Dissipation $R_{\theta JA}$ (Note 1)		T_A = 25°C	P_D	1.0	W
Continuous Drain Current $R_{\theta JA}$ (Note 2)		T_A = 25°C	I_D	1.1	A
		T_A = 70°C		0.9	
Power Dissipation $R_{\theta JA}$ (Note 2)		T_A = 25°C	P_D	0.6	W
Continuous Drain Current $R_{\theta JA}$ t < 5 s (Note 1)		T_A = 25°C	I_D	2.2	A
		T_A = 70°C		1.7	
Pulsed Drain Current	T_A = 25°C, t_p = 10 μs		I_{DM}	9.0	A
Operating Junction and Storage Temperature			T_J, T_{STG}	−55 to +150	°C
Source Current (Body Diode)			I_S	1.3	A
Single Pulse Drain−to−Source Avalanche Energy T_J = 25C, V_{DD} = 50 V, V_{GS} = 10 V, I_L = 7.0 A_{pk}, L = 1.0 mH, R_G = 25 Ω			EAS	2 5	mJ
Lead Temperature for Soldering Purposes (1/8″ from case for 10 s)			T_L	260	°C

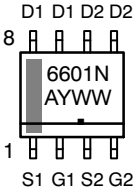
THERMAL RESISTANCE RATINGS

Rating	Symbol	Max	Unit
Junction−to−Ambient – Steady State (Note 1)	$R_{\theta JA}$	120	°C/W
Junction−to−Ambient – t≤ 5 s (Note 1)	$R_{\theta JA}$	48	
Junction−to−FOOT (Drain)	$R_{\theta JF}$	40	
Junction−to−Ambient – Steady State (Note 2)	$R_{\theta JA}$	200	

1. Surface−mounted on 2 inch sq FR4 board using 1 inch sq pad size, 1 oz Cu.
2. Surface−mounted on FR4 board using the minimum recommended pad size.

MARKING DIAGRAM & PIN ASSIGNMENT

SO−8
CASE 751
STYLE 11



6601N = Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package

ORDERING INFORMATION

Device	Package	Shipping†
NTMD6601NR2G	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.

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

Characteristic	Symbol	Test Condition		Min	Typ	Max	Unit
OFF CHARACTERISTICS							
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 250 μA		80			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$				99.8		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 80 V	T_J = 25°C			1.0	μA
			T_J = 125°C			25	
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±15 V				±100	nA
ON CHARACTERISTICS (Note 3)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 250 μA		1.0	1.9	3.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				4.6		mV/°C
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = 10 V	I_D = 2.2 A		190	215	mΩ
		V_{GS} = 5.0 V	I_D = 1.0 A		215	245	
CHARGES, CAPACITANCES AND GATE RESISTANCE							
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1.0 MHz, V_{DS} = 25 V			220	400	pF
Output Capacitance	C_{OSS}				55	100	
Reverse Transfer Capacitance	C_{RSS}				16	30	
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 5.0 V, V_{DS} = 40 V, I_D = 1.0 A			5.0	9.0	nC
Threshold Gate Charge	$Q_{G(TH)}$				0.4		
Gate−to−Source Charge	Q_{GS}				1.0		
Gate−to−Drain Charge	Q_{GD}				2.75		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 10 V, V_{DS} = 40 V, I_D = 1.0 A			9.0	15	nC
SWITCHING CHARACTERISTICS (Note 4)							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = 4.5 V, V_{DD} = 40 V, I_D = 1.0 A, R_G = 27 Ω			21	35	ns
Rise Time	t_r				62	105	
Turn−Off Delay Time	$t_{d(OFF)}$				52	85	
Fall Time	t_f				50	85	
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = 10 V, V_{DD} = 40 V, I_D = 2.5 A, R_G = 47 Ω			15		ns
Rise Time	t_r				95		
Turn−Off Delay Time	$t_{d(OFF)}$				50		
Fall Time	t_f				105		
BODY − DRAIN DIODE RATINGS (Note 3)							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_D = 1.0 A	T_J = 25°C		0.8	1.0	V
			T_J = 150°C		0.6		
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, d_{IS}/d_t = 100 A/μs, I_S = 1.0 A			44		ns
Charge Time	T_a				21		
Discharge Time	T_b				23		
Reverse Recovery Time	Q_{RR}				43	86	nC

3. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
4. Switching characteristics are independent of operating junction temperatures.

TYPICAL ELECTRICAL CHARACTERISTICS

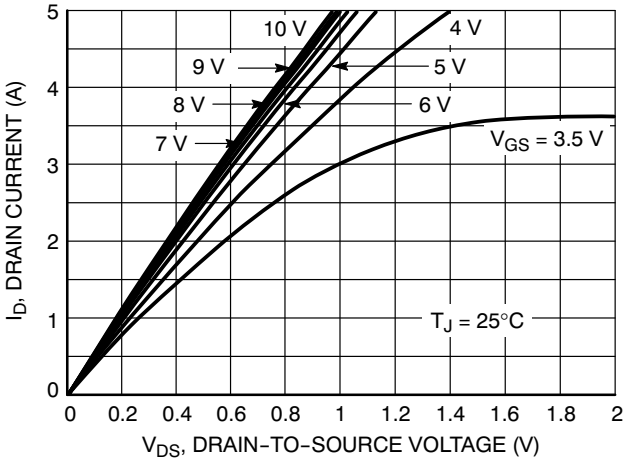


Figure 1. On−Region Characteristics

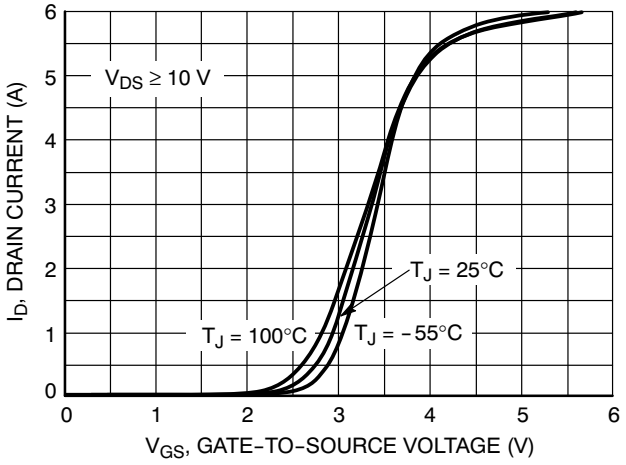


Figure 2. Transfer Characteristics

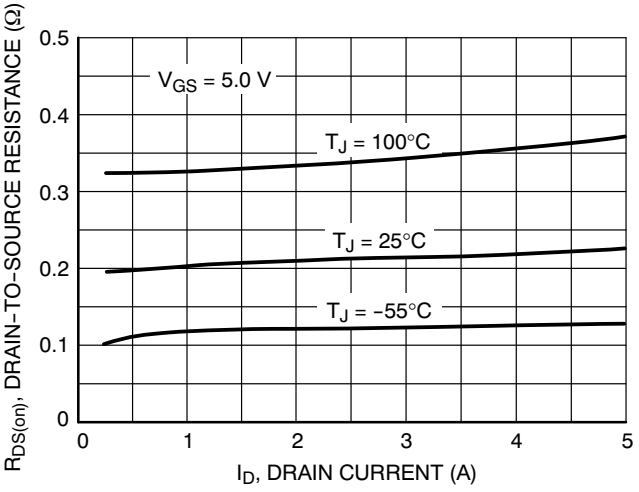


Figure 3. On−Resistance versus Drain Current and Temperature

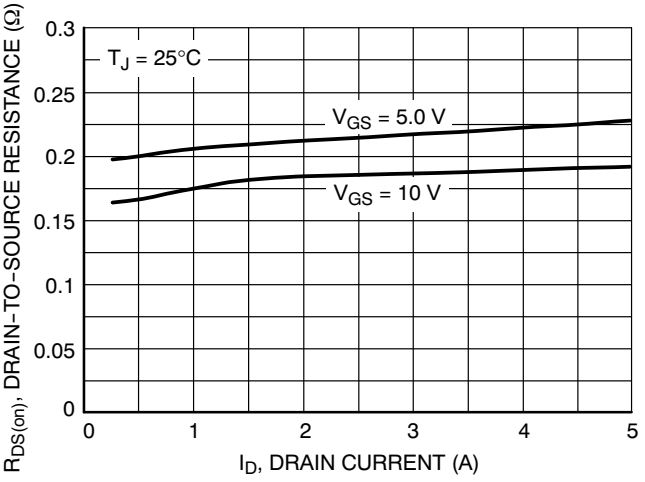


Figure 4. On−Resistance versus Drain Current and Gate Voltage

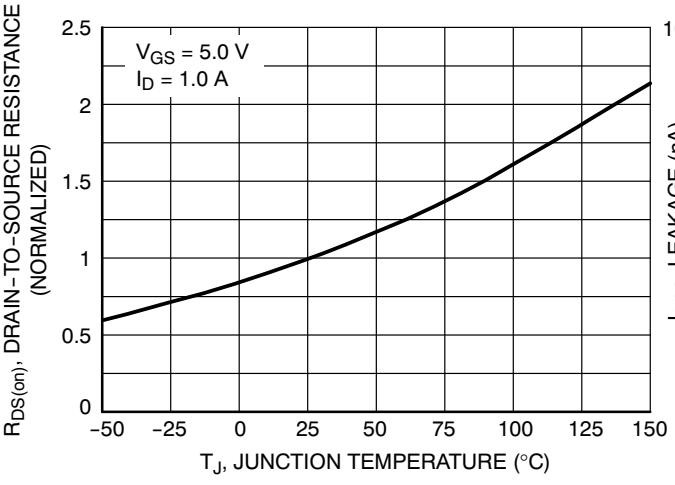


Figure 5. On−Resistance Variation with Temperature

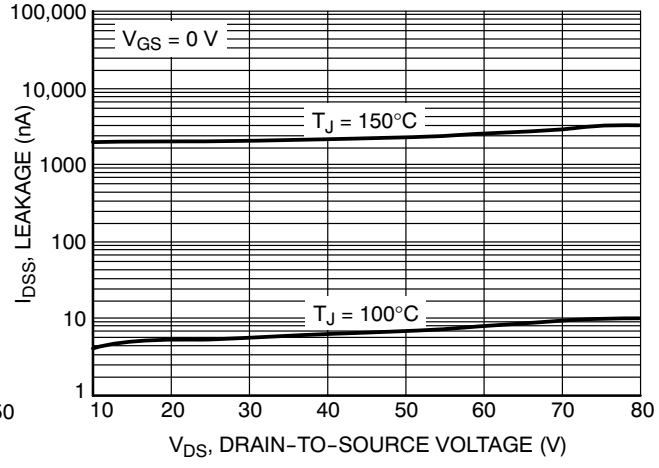


Figure 6. Drain−To−Source Leakage Current versus Voltage

TYPICAL ELECTRICAL CHARACTERISTICS

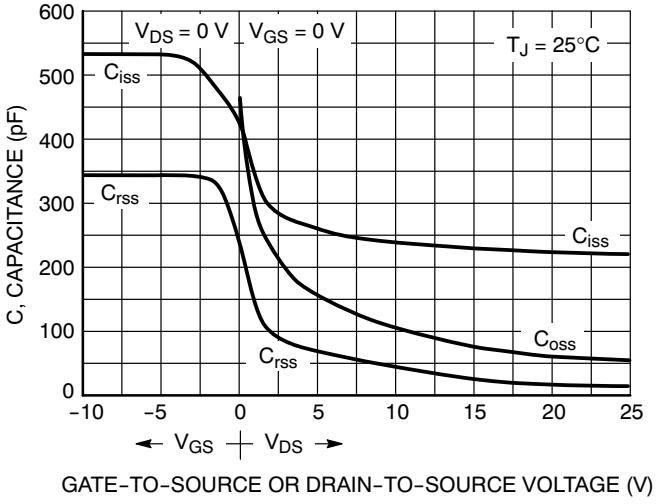


Figure 7. Capacitance Variation

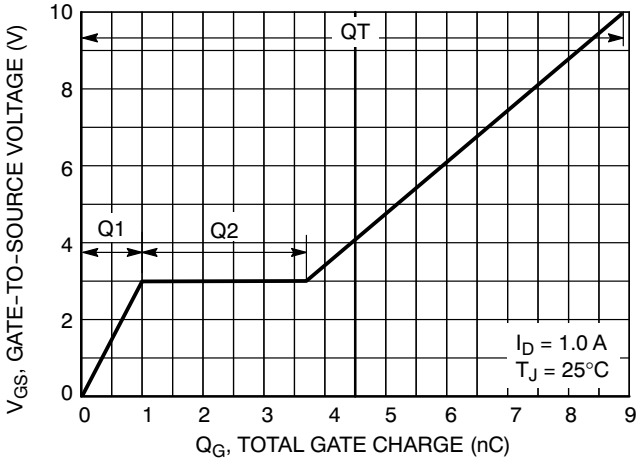


Figure 8. Gate−To−Source and Drain−To−Source Voltage versus Total Charge

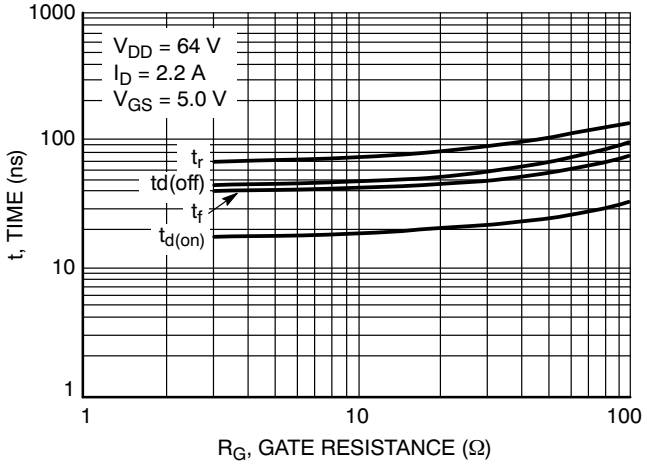


Figure 9. Resistive Switching Time Variation versus Gate Resistance

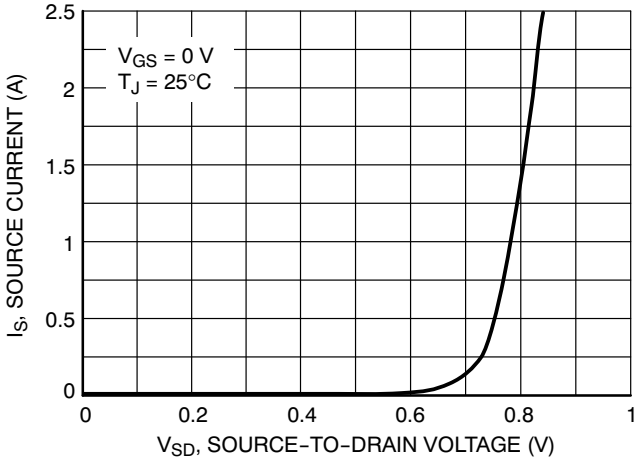


Figure 10. Diode Forward Voltage versus Current

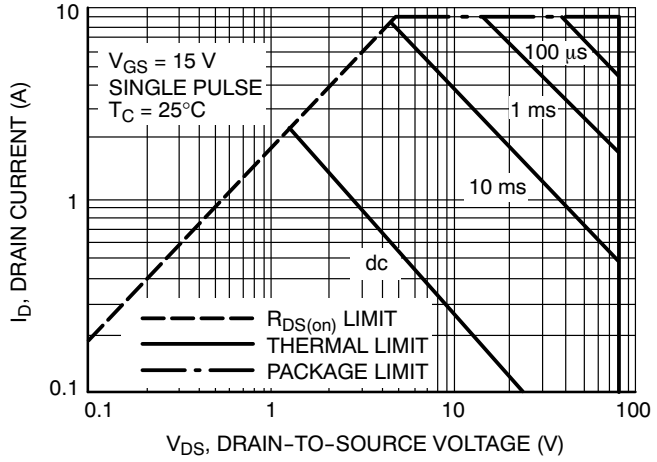


Figure 11. Maximum Rated Forward Biased Safe Operating Area

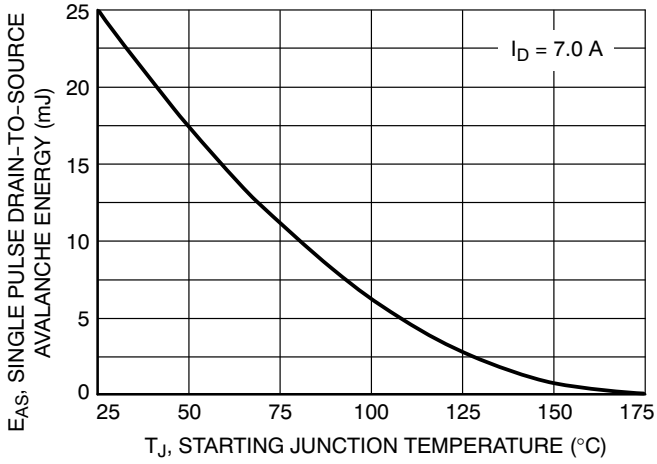


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

TYPICAL ELECTRICAL CHARACTERISTICS

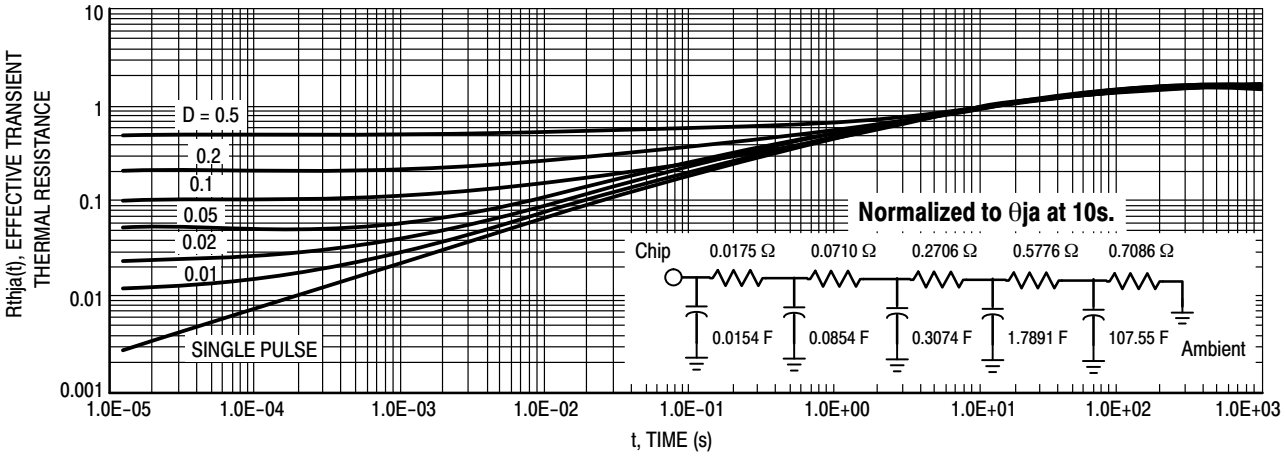


Figure 13. Thermal Response

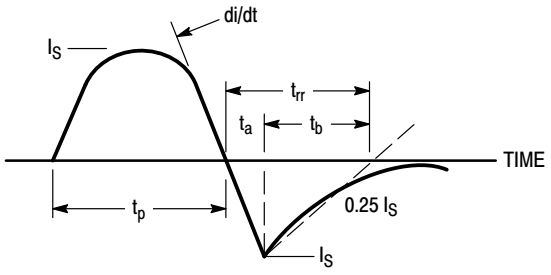


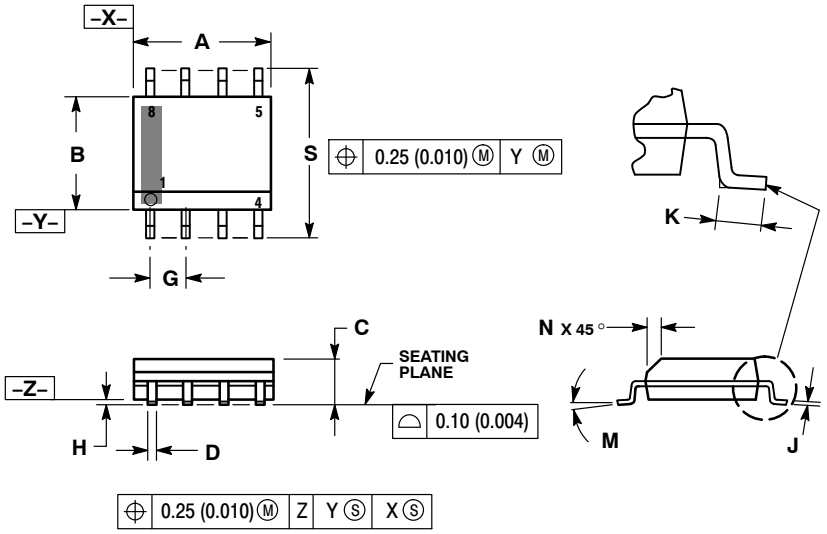
Figure 14. Diode Reverse Recovery Waveform

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

SCALE 1:1

SOIC−8 NB
CASE 751−07
ISSUE AK

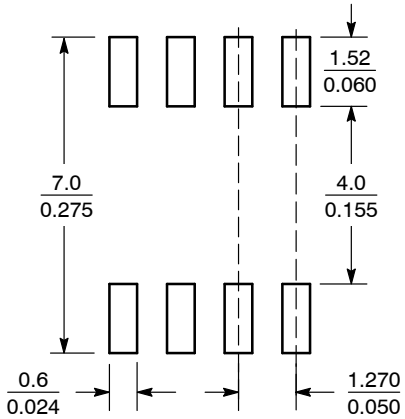
DATE 16 FEB 2011



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.

	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

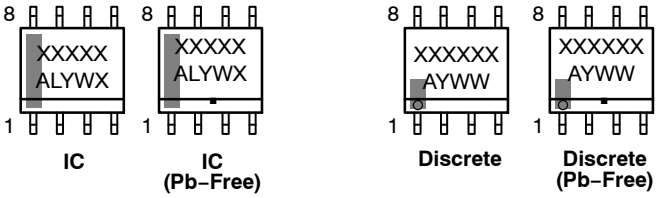
SOLDERING FOOTPRINT*



SCALE 6:1 (mm / inches)

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

GENERIC MARKING DIAGRAM*



IC | IC (Pb−Free) | Discrete | Discrete (Pb−Free)

XXXXX = 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.

STYLES ON PAGE 2

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DESCRIPTION:	**SOIC−8 NB**	**PAGE 1 OF 2**

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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