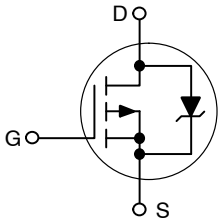
MOSFET – Power, Single, P-Channel, Enhancement Mode, SOIC-8
-5.4 A, -20 V

NTMS5P02, NVMS5P02

V_{DSS}	$R_{DS(ON)}$ TYP	I_D MAX
−20 V	26 mΩ @ −4.5 V	−5.4 A

Single P−Channel



Features

- High Density Power MOSFET with Ultra Low $R_{DS(on)}$ Providing Higher Efficiency
- Miniature SOIC-8 Surface Mount Package − Saves Board Space
- Diode Exhibits High Speed with Soft Recovery
- I_{DSS} Specified at Elevated Temperature
- Drain−to−Source Avalanche Energy Specified
- Mounting Information for the SOIC-8 Package is Provided
- These Devices are Pb−Free and are RoHS Compliant
- NVMS Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable

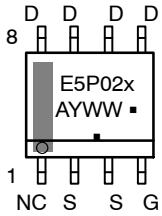
Applications

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

MARKING DIAGRAM & PIN ASSIGNMENT



SOIC-8
CASE 751
STYLE 13



E5P02 = Specific Device Code
x = Blank or S
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
NTMS5P02R2G	SOIC-8 (Pb−Free)	2500 / Tape & Reel
NVMS5P02R2G	SOIC-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 Specifications Brochure, BRD8011/D

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

Rating	Symbol	Value	Unit
Drain−to−Source Voltage	V_{DSS}	−20	V
Drain−to−Gate Voltage (R_{GS} = 1.0 mΩ)	V_{DGR}	−20	V
Gate−to−Source Voltage − Continuous	V_{GS}	±10	V
Thermal Resistance −			
Junction−to−Ambient (Note 1)	$R_{\theta JA}$	50	°C/W
Total Power Dissipation @ T_A = 25 °C	P_D	2.5	W
Continuous Drain Current @ 25 °C	I_D	−7.05	A
Continuous Drain Current @ 70 °C	I_D	−5.62	A
Maximum Operating Power Dissipation	P_D	1.2	W
Maximum Operating Drain Current	I_D	−4.85	A
Pulsed Drain Current (Note 4)	I_{DM}	−28	A
Thermal Resistance −			
Junction−to−Ambient (Note 2)	$R_{\theta JA}$	85	°C/W
Total Power Dissipation @ T_A = 25 °C	P_D	1.47	W
Continuous Drain Current @ 25 °C	I_D	−5.40	A
Continuous Drain Current @ 70 °C	I_D	−4.30	A
Maximum Operating Power Dissipation	P_D	0.7	W
Maximum Operating Drain Current	I_D	−3.72	A
Pulsed Drain Current (Note 4)	I_{DM}	−20	A
Thermal Resistance −			
Junction−to−Ambient (Note 3)	$R_{\theta JA}$	159	°C/W
Total Power Dissipation @ T_A = 25 °C	P_D	0.79	W
Continuous Drain Current @ 25 °C	I_D	−3.95	A
Continuous Drain Current @ 70 °C	I_D	−3.15	A
Maximum Operating Power Dissipation	P_D	0.38	W
Maximum Operating Drain Current	I_D	−2.75	A
Pulsed Drain Current (Note 4)	I_{DM}	−12	A
Operating and Storage Temperature Range	T_J, T_{stg}	−55 to +150	°C
Single Pulse Drain−to−Source Avalanche Energy − Starting T_J = 25 °C (V_{DD} = −20 Vdc, V_{GS} = −5.0 Vdc, Peak I_L = −8.5 Apk, L = 10 mH, R_G = 25 Ω)	E_{AS}	360	mJ
Maximum Lead Temperature for Soldering Purposes, 1/8″ from case for 10 seconds	T_L	260	°C

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. Mounted onto a 2″ square FR−4 Board (1″ sq. 2 oz Cu 0.06″ thick single sided), t ≤ 10 seconds.
2. Mounted onto a 2″ square FR−4 Board (1″ sq. 2 oz Cu 0.06″ thick single sided), t = steady state.
3. Minimum FR−4 or G−10 PCB, t = Steady State.
4. Pulse Test: Pulse Width = 300 μs, Duty Cycle = 2%.

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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 −	 − −15	 − −	Vdc mV/°C
Zero Gate Voltage Drain Current (V_{DS} = −16 Vdc, V_{GS} = 0 Vdc, T_J = 25 °C) (V_{DS} = −16 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)	$V_{GS(th)}$	 −0.65 −	 −0.9 2.9	 −1.25 −	Vdc mV/°C
Static Drain−to−Source On−State Resistance (V_{GS} = −4.5 Vdc, I_D = −5.4 Adc) (V_{GS} = −2.5 Vdc, I_D = −2.7 Adc)	$R_{DS(on)}$	 − −	 0.026 0.037	 0.033 0.048	Ω
Forward Transconductance (V_{DS} = −9.0 Vdc, I_D = −5.4 Adc)	g_{FS}	−	15	−	Mhos
DYNAMIC CHARACTERISTICS					
Input Capacitance	(V_{DS} = −16 Vdc, V_{GS} = 0 Vdc, f = 1.0 MHz)	C_{iss}	−	1375	1900	pF
Output Capacitance		C_{oss}	−	510	900	
Reverse Transfer Capacitance		C_{rss}	−	200	380	
SWITCHING CHARACTERISTICS (Notes 6 & 7)						
Turn−On Delay Time	(V_{DD} = −16 Vdc, I_D = −1.0 Adc, V_{GS} = −4.5 Vdc, R_G = 6.0 Ω)	$t_{d(on)}$	−	18	35	ns
Rise Time		t_r	−	25	50	
Turn−Off Delay Time		$t_{d(off)}$	−	70	125	
Fall Time		t_f	−	55	100	
Turn−On Delay Time	(V_{DD} = −16 Vdc, I_D = −5.4 Adc, V_{GS} = −4.5 Vdc, R_G = 6.0 Ω)	$t_{d(on)}$	−	22	−	ns
Rise Time		t_r	−	70	−	
Turn−Off Delay Time		$t_{d(off)}$	−	65	−	
Fall Time		t_f	−	90	−	
Total Gate Charge	(V_{DS} = −16 Vdc, V_{GS} = −4.5 Vdc, I_D = −5.4 Adc)	Q_{tot}	−	20	35	nC
Gate−Source Charge		Q_{gs}	−	4.0	−	
Gate−Drain Charge		Q_{gd}	−	7.0	−	
BODY−DRAIN DIODE RATINGS (Note 6)						
Diode Forward On−Voltage	(I_S = −5.4 Adc, V_{GS} = 0 V) (I_S = −5.4 Adc, V_{GS} = 0 Vdc, T_J = 125°C)	V_{SD}	 −	 −0.95 −0.72	 −1.25 −	Vdc
Reverse Recovery Time	(I_S = −5.4 Adc, V_{GS} = 0 Vdc, dI_S/dt = 100 A/μs)	t_{rr}	−	40	75	ns
		t_a	−	20	−	
		t_b	−	20	−	
Reverse Recovery Stored Charge		Q_{RR}	−	0.03	−	μC

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

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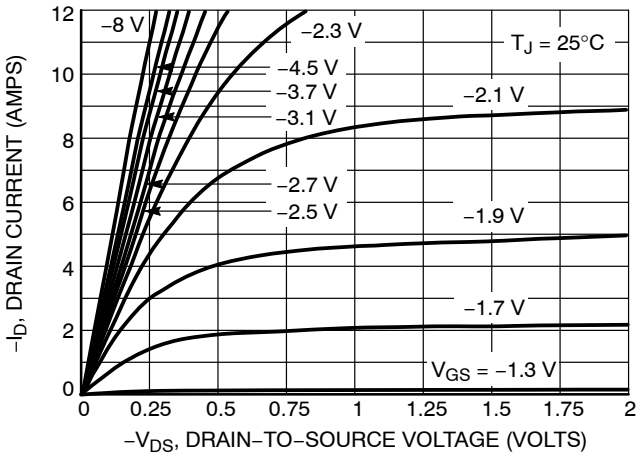


Figure 1. On−Region Characteristics

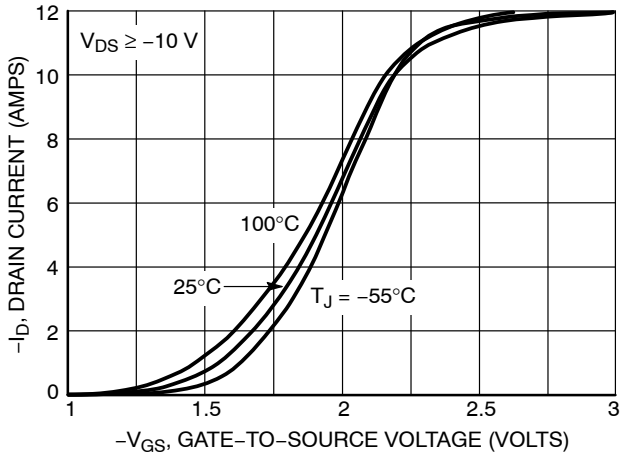


Figure 2. Transfer Characteristics

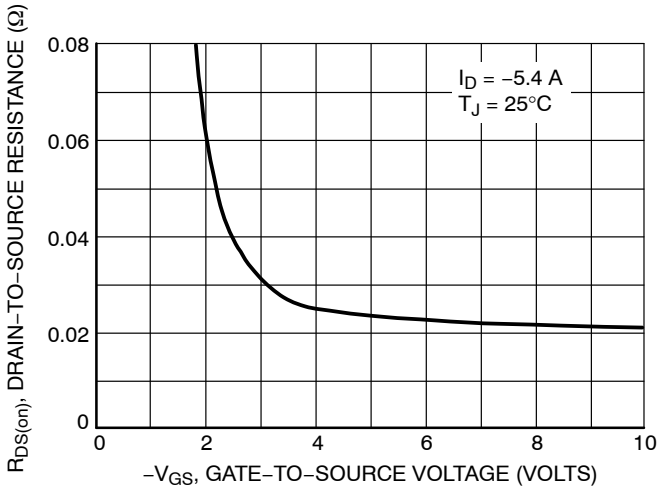


Figure 3. On−Resistance versus Gate−To−Source Voltage

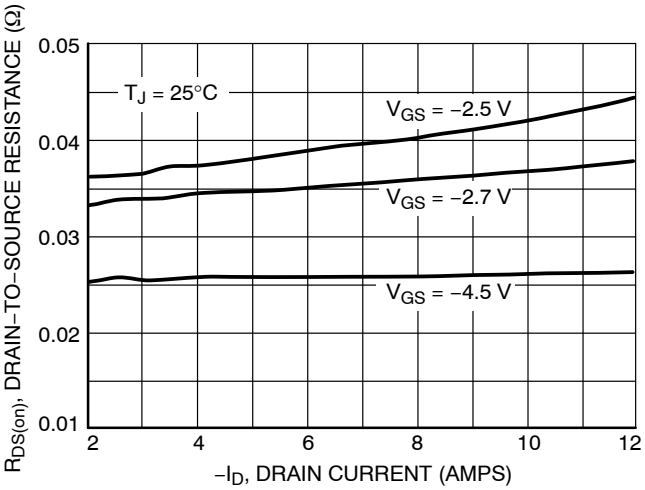


Figure 4. On-Resistance versus Drain Current and Gate Voltage

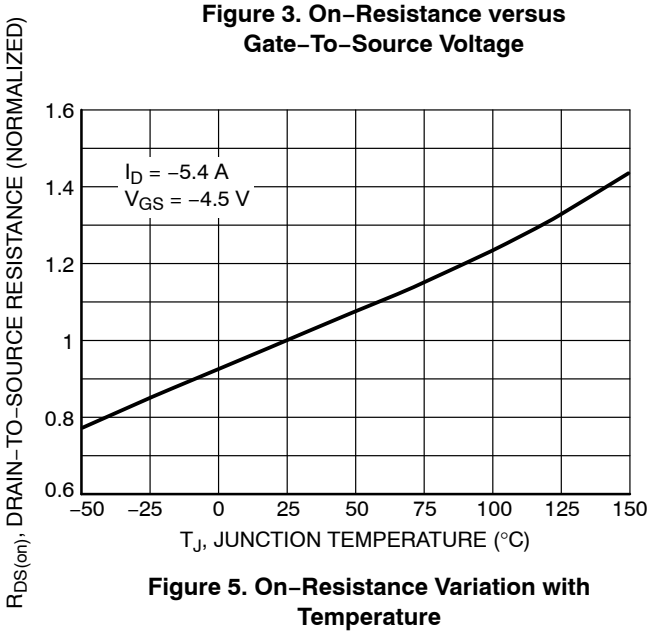


Figure 5. On−Resistance Variation with Temperature

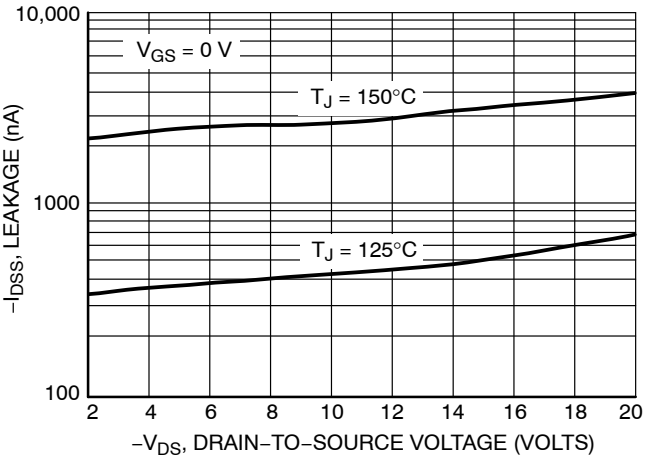


Figure 6. Drain−To−Source Leakage Current versus Voltage

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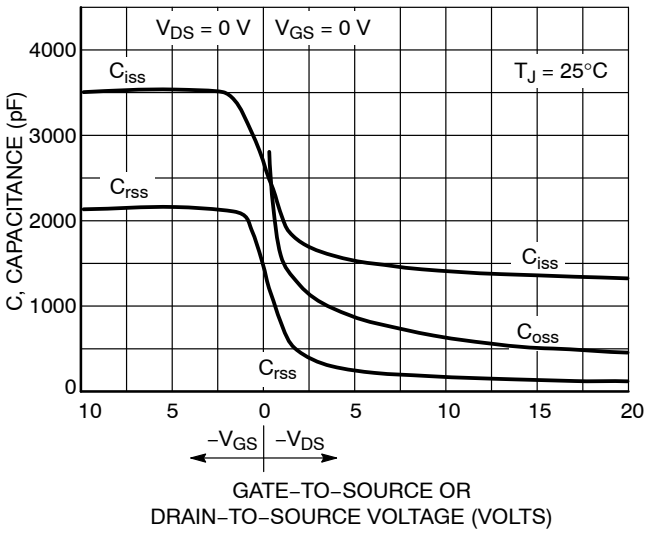


Figure 7. Capacitance Variation

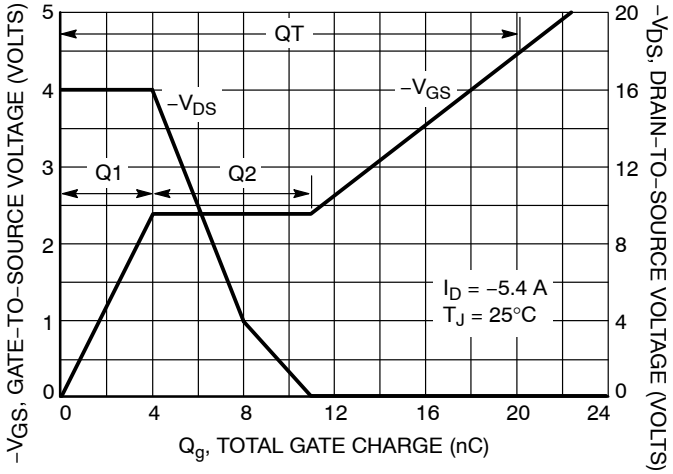


Figure 8. Gate−To−Source and Drain−To−Source Voltage versus Total Charge

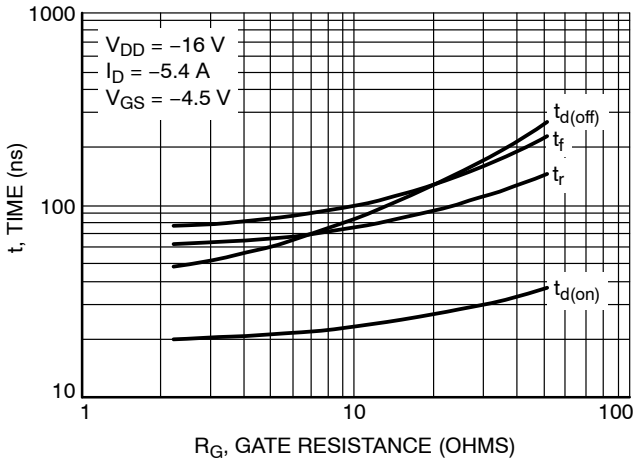


Figure 9. Resistive Switching Time Variation versus Gate Resistance

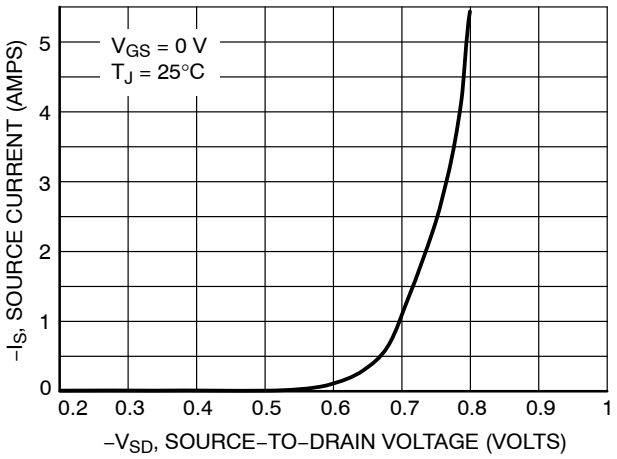


Figure 10. Diode Forward Voltage versus Current

DRAIN−TO−SOURCE DIODE CHARACTERISTICS

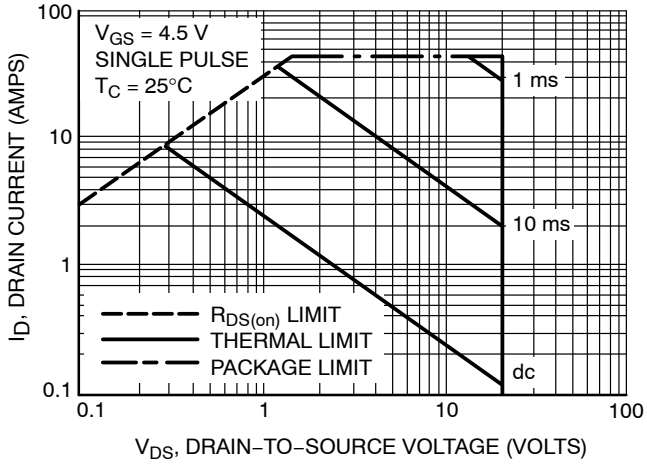


Figure 11. Maximum Rated Forward Biased Safe Operating Area

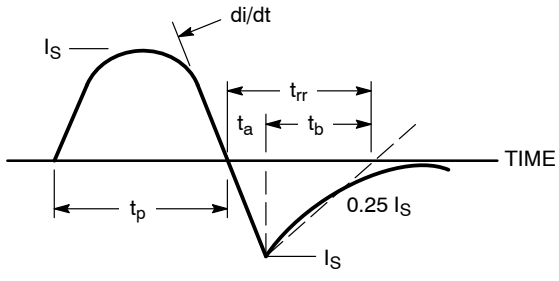


Figure 12. Diode Reverse Recovery Waveform

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TYPICAL ELECTRICAL CHARACTERISTICS

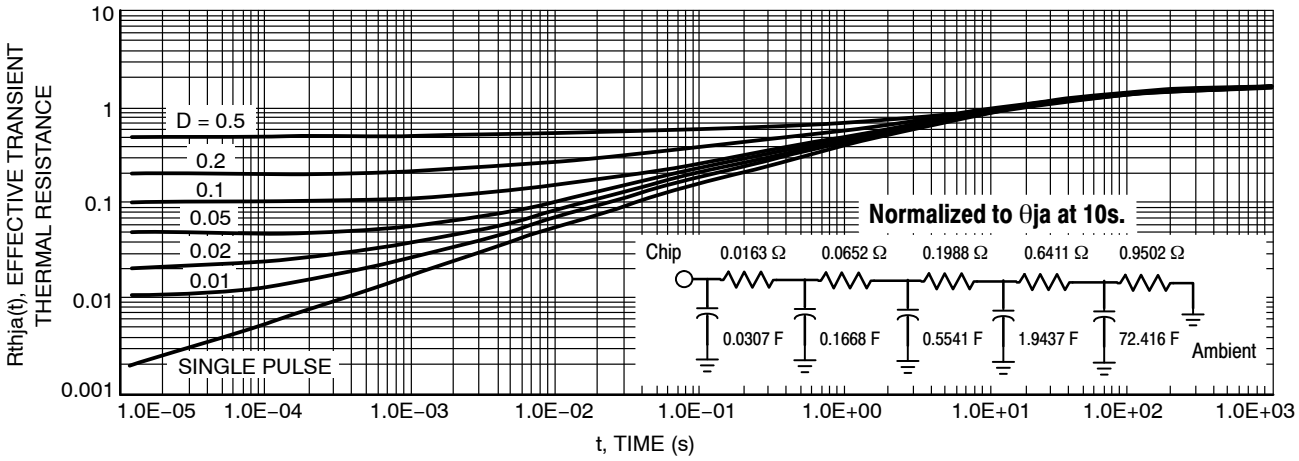


Figure 13. Thermal Response

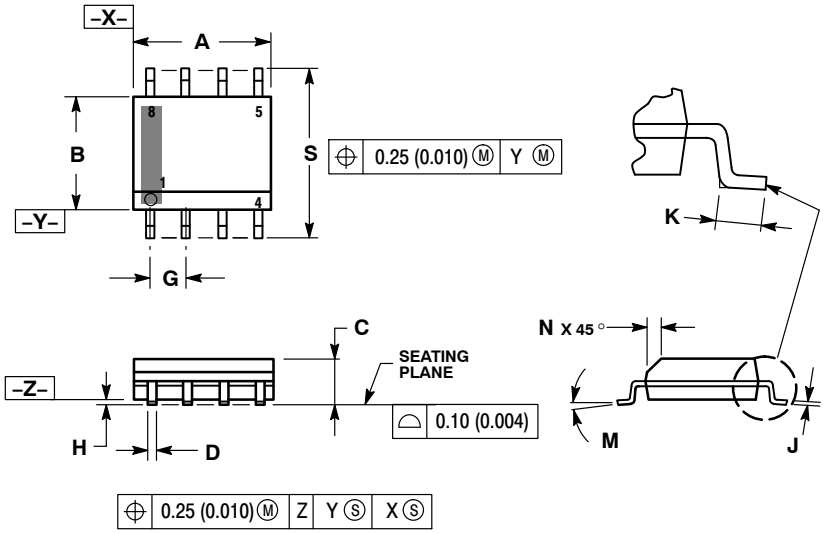
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SCALE 1:1

SOIC−8 NB
CASE 751−07
ISSUE AK

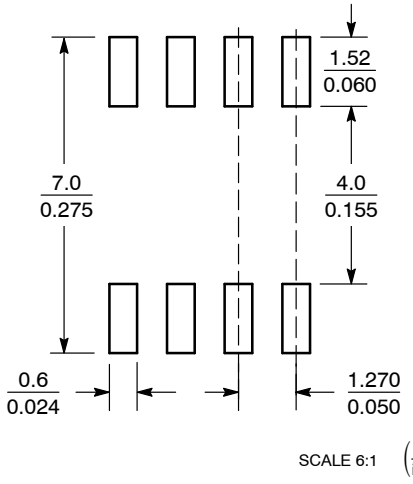
DATE 16 FEB 2011



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

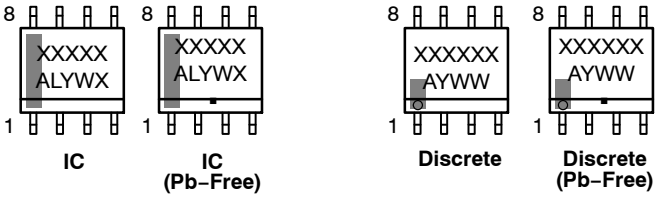
SOLDERING FOOTPRINT*



SCALE 6:1 (mm / inches)

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

GENERIC MARKING DIAGRAM*



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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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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