

# NTMS4937N

## MOSFET – Power, N-Channel, SO-8 30 V, 13.6 A

### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

- DC-DC Converters
- Points of Loads
- Power Load Switch
- Motor Controls

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

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			$V_{DSS}$	30	V
Gate-to-Source Voltage			$V_{GS}$	$\pm 20$	V
Continuous Drain Current $R_{\theta JA}$ (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	11.2	A
		$T_A = 70^\circ\text{C}$		9.0	
Power Dissipation $R_{\theta JA}$ (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$	1.36	W
Continuous Drain Current $R_{\theta JA}$ (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	8.6	A
		$T_A = 70^\circ\text{C}$		6.9	
Power Dissipation $R_{\theta JA}$ (Note 2)		$T_A = 25^\circ\text{C}$	$P_D$	0.81	W
Continuous Drain Current $R_{\theta JA}$ , $t \leq 10\text{ s}$ (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	13.6	A
		$T_A = 70^\circ\text{C}$		11	
Power Dissipation $R_{\theta JA}$ , $t \leq 10\text{ s}$ (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$	2.0	W
Pulsed Drain Current	$T_A = 25^\circ\text{C}$ , $t_p = 10\ \mu\text{s}$		$I_{DM}$	112	A
Operating Junction and Storage Temperature			$T_J$ , $T_{stg}$	-55 to 150	$^\circ\text{C}$
Source Current (Body Diode)			$I_S$	2.1	A
Single Pulse Drain-to-Source Avalanche Energy ( $T_J = 25^\circ\text{C}$ , $V_{DD} = 30\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_L = 13\text{ A}_{pk}$ , $L = 1.0\text{ mH}$ , $R_G = 25\ \Omega$ )			$E_{AS}$	84.5	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			$T_L$	260	$^\circ\text{C}$

### THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Ambient – Steady State (Note 1)	$R_{\theta JA}$	91.9	$^\circ\text{C/W}$
Junction-to-Ambient – $t \leq 10\text{ s}$ (Note 1)	$R_{\theta JA}$	61.1	
Junction-to-Foot (Drain)	$R_{\theta JF}$	22.6	
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	154.7	

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

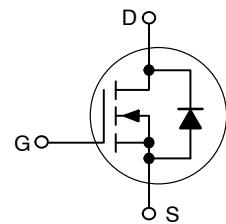


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$V_{(BR)DSS}$	$R_{DS(ON)}\text{ MAX}$	$I_D\text{ MAX}$
30 V	6.5 m $\Omega$ @ 10 V	13.6 A
	8.7 m $\Omega$ @ 4.5 V	

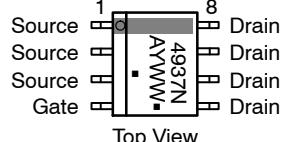
### N-Channel



### MARKING DIAGRAM/ PIN ASSIGNMENT



1  
SO-8  
CASE 751  
STYLE 12



Top View

4937N = 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 <sup>†</sup>
NTMS4937NR2G	SO-8 (Pb-Free)	2500/Tape & Reel

<sup>†</sup>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.

## **NTMS4937N**

1. Surfacemounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
2. Surfacemounted on FR4 board using the minimum recommended pad size.

# NTMS4937N

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	30			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS/T<sub>J</sub></sub>			13.1		mV/°C
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 24 V	T <sub>J</sub> = 25°C		1.0	μA
			T <sub>J</sub> = 125°C		10	
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V			±100	nA

### ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	1.0		2.5	V
Negative Threshold Temperature Coefficient	V <sub>GS(TH)/T<sub>J</sub></sub>			5.1		mV/°C
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 7.5 A		5.4	6.5	mΩ
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 6.5 A		7.1	8.7	
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = 1.5 V, I <sub>D</sub> = 7.5 A		27.3		S

### CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, f = 1.0 MHz, V <sub>DS</sub> = 25 V		2563		pF
Output Capacitance	C <sub>oss</sub>			715		
Reverse Transfer Capacitance	C <sub>rss</sub>			25		
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 15 V, I <sub>D</sub> = 7.5 A		17.4		nC
Threshold Gate Charge	Q <sub>G(TH)</sub>			4.1		
Gate-to-Source Charge	Q <sub>GS</sub>			6.6		
Gate-to-Drain Charge	Q <sub>GD</sub>			3.3		
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 15 V, I <sub>D</sub> = 7.5 A		38.5		nC

### SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 15 V, I <sub>D</sub> = 1.0 A, R <sub>G</sub> = 6.0 Ω		12.3		ns
Rise Time	t <sub>r</sub>			3.6		
Turn-Off Delay Time	t <sub>d(off)</sub>			33.8		
Fall Time	t <sub>f</sub>			38.9		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 2.0 A	T <sub>J</sub> = 25°C		0.72	1.0	V
			T <sub>J</sub> = 125°C		0.56		
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V, d <sub>I<sub>S</sub></sub> /d <sub>t</sub> = 100 A/μs, I <sub>S</sub> = 2.0 A			40		ns
					18.8		
					21.2		
					38		nC

### PACKAGE PARASITIC VALUES

Source Inductance	L <sub>S</sub>	T <sub>A</sub> = 25°C		0.66		nH
				0.2		
				1.5		
				0.4	1.0	Ω

3. Pulse Test: pulse width = 300 μs, duty cycle ≤ 2%.

4. Switching characteristics are independent of operating junction temperatures.

## TYPICAL PERFORMANCE CURVES

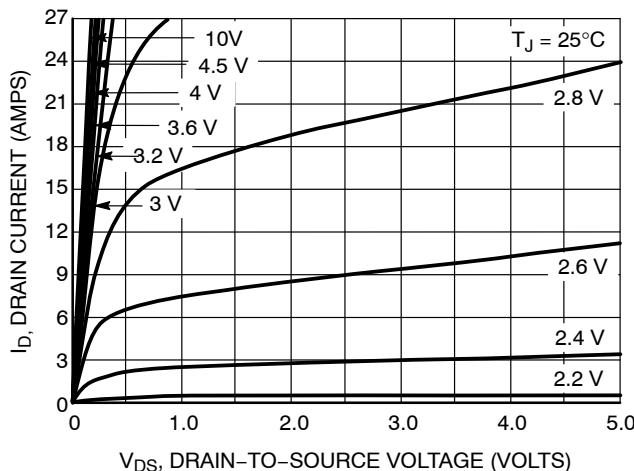


Figure 1. On-Region Characteristics

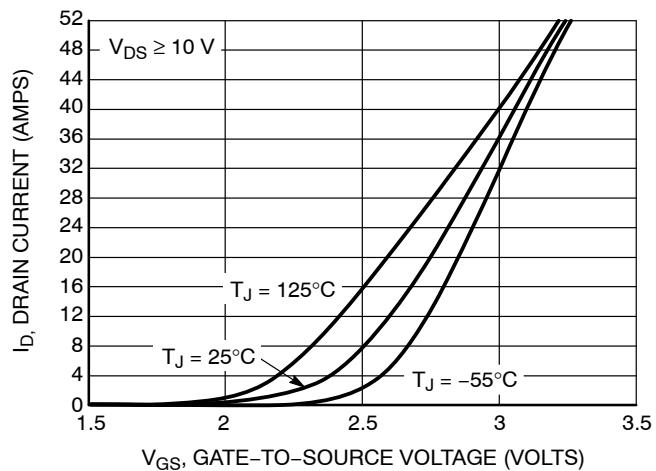


Figure 2. Transfer Characteristics

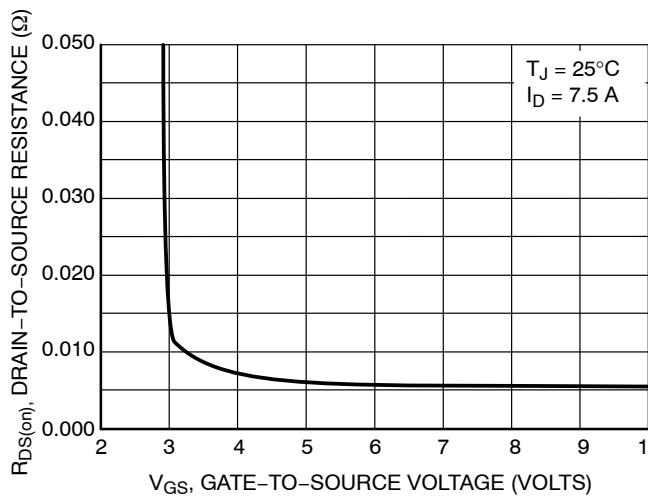


Figure 3. On-Resistance vs. Gate-to-Source Voltage

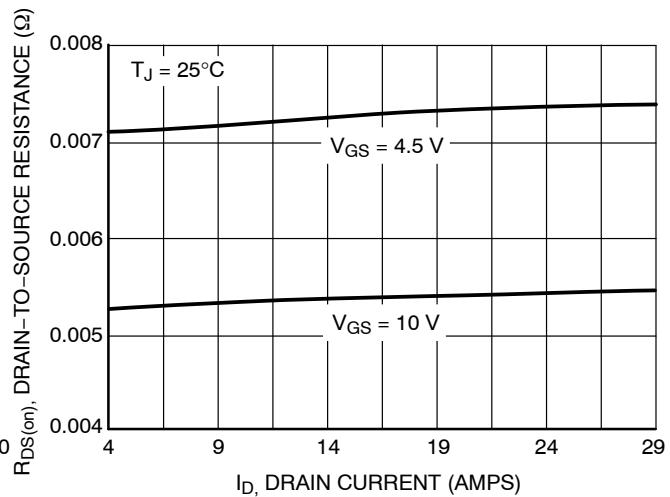


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

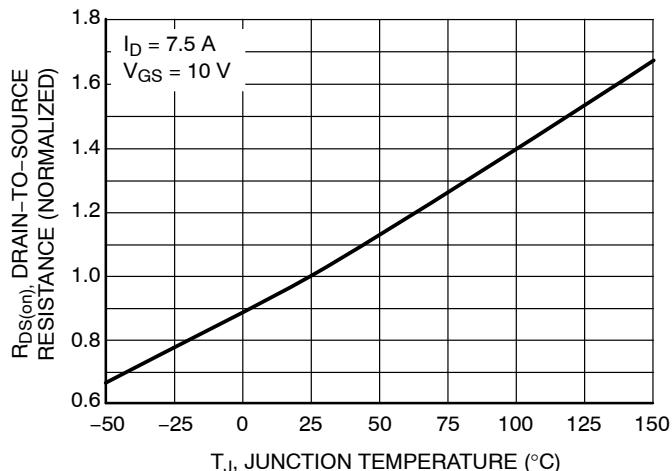


Figure 5. On-Resistance Variation with Temperature

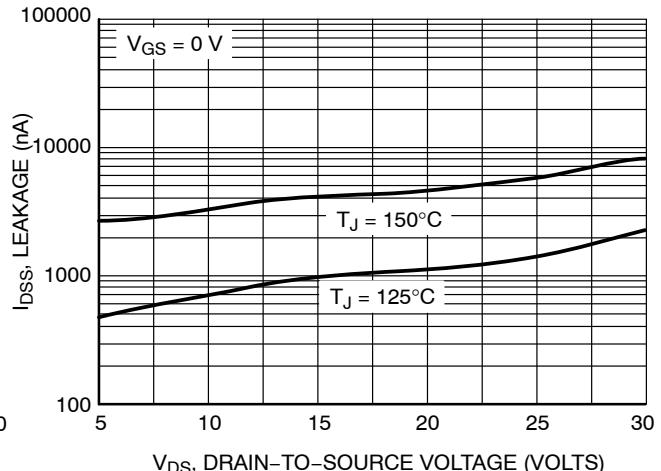


Figure 6. Drain-to-Source Leakage Current vs. Voltage

## TYPICAL PERFORMANCE CURVES

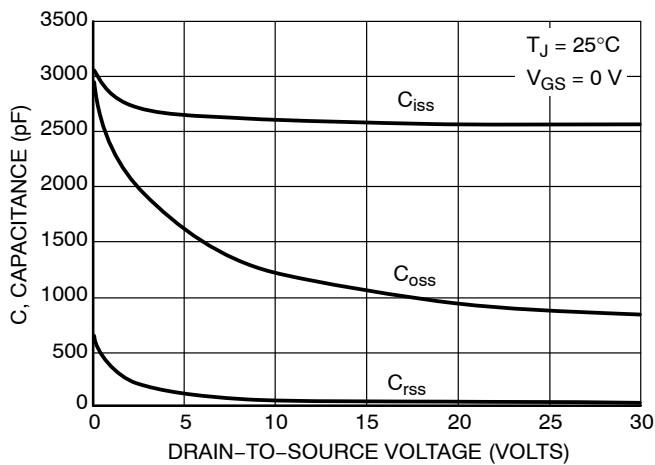


Figure 7. Capacitance Variation

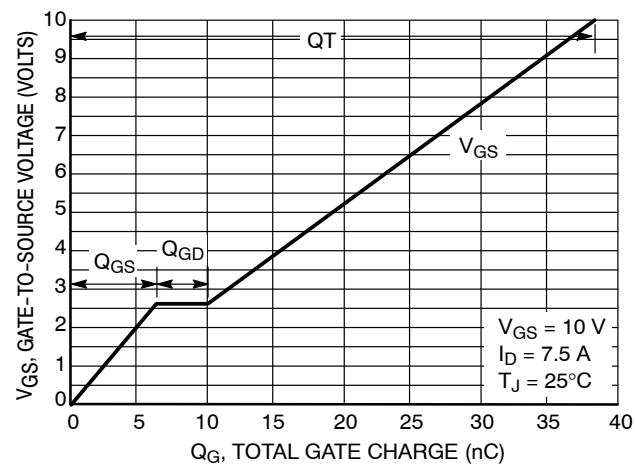


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

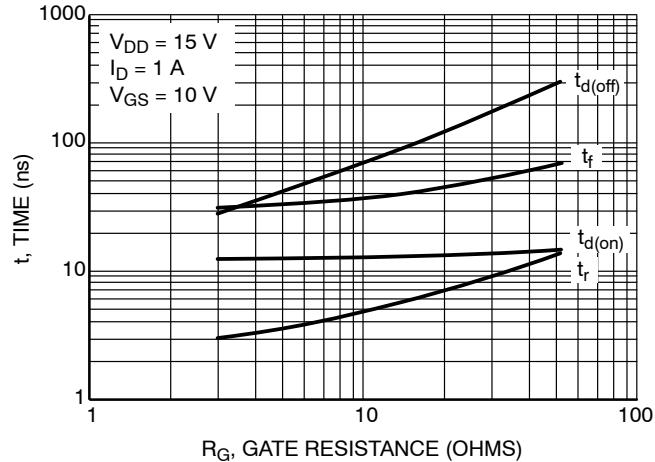


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

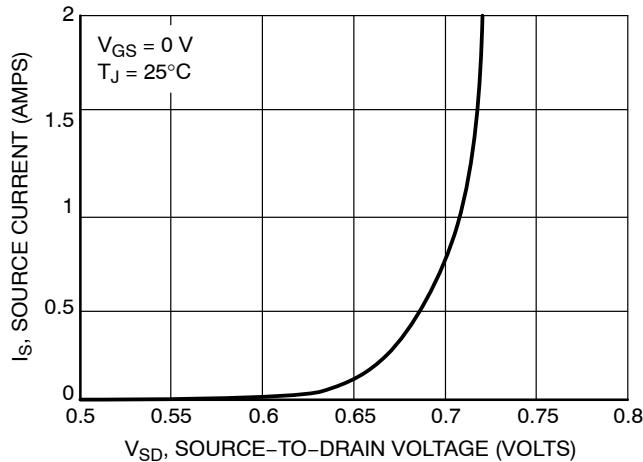


Figure 10. Diode Forward Voltage vs. Current

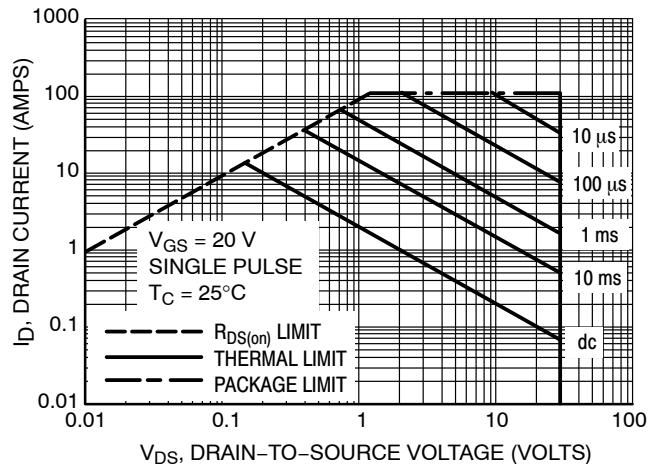


Figure 11. Maximum Rated Forward Biased Safe Operating Area

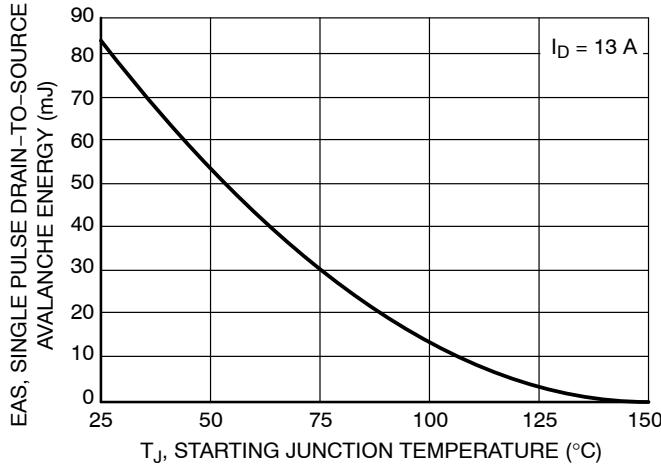


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

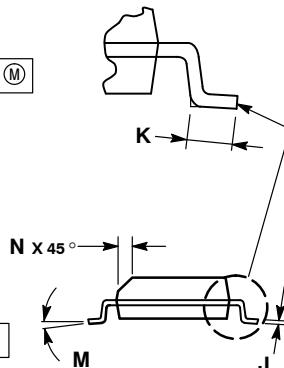
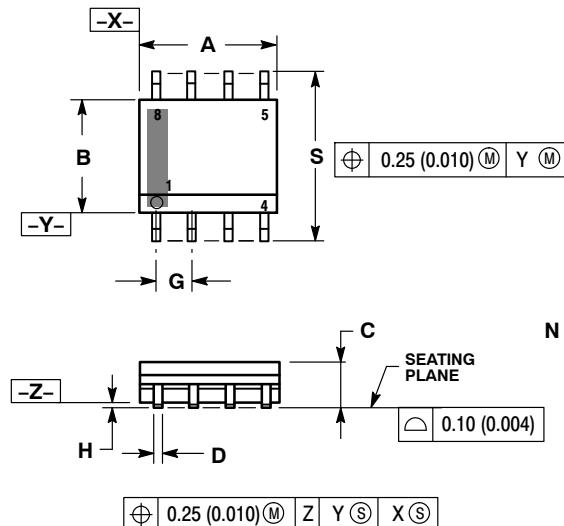
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SCALE 1:1

SOIC-8 NB  
CASE 751-07  
ISSUE AK

DATE 16 FEB 2011

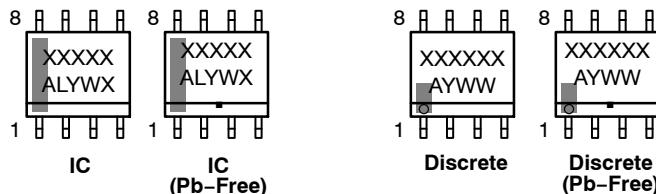


NOTES:

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.

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\*



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.

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

SCALE 6:1 (mm/inches)

STYLES ON PAGE 2

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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. VBUCK 7. VBUCK 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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