

# NTGS4111P, NVGS4111P

## MOSFET – Power, Single, P-Channel, TSOP-6

**-30 V, -4.7 A**

### Features

- Leading -30 V Trench Process for Low  $R_{DS(on)}$
- Low Profile Package Suitable for Portable Applications
- Surface Mount TSOP-6 Package Saves Board Space
- Improved Efficiency for Battery Applications
- NV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- Pb-Free Package is Available

### Applications

- Battery Management and Switching
- Load Switching
- Battery Protection

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

Rating		Symbol	Value	Unit	
Drain-to-Source Voltage		$V_{DS}$	-30	V	
Gate-to-Source Voltage		$V_{GS}$	$\pm 20$	V	
Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	-3.7	A
			$T_A = 85^\circ\text{C}$	-2.7	
	$t \leq 5\text{ s}$	$T_A = 25^\circ\text{C}$		-4.7	
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$	1.25	W
			$t \leq 5\text{ s}$	2.0	
Continuous Drain Current (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	-2.6	A
				$T_A = 85^\circ\text{C}$	
		$T_A = 25^\circ\text{C}$	$P_D$	0.63	W
Pulsed Drain Current	$t_p = 10\ \mu\text{s}$	$I_{DM}$	-15	A	
Operating Junction and Storage Temperature		$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$	
Source Current (Body Diode)		$I_S$	-1.7	A	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260	$^\circ\text{C}$	

### THERMAL RESISTANCE RATINGS

Rating	Symbol	Max	Unit
Junction-to-Ambient – Steady State (Note 1)	$R_{\theta JA}$	100	$^\circ\text{C}/\text{W}$
Junction-to-Ambient – $t \leq 5\text{ s}$ (Note 1)	$R_{\theta JA}$	62.5	
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	200	

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. Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).

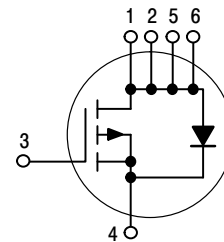


**ON Semiconductor®**

<http://onsemi.com>

$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	$I_D$ MAX
-30 V	38 m $\Omega$ @ -10 V	-4.7 A
	68 m $\Omega$ @ -4.5 V	

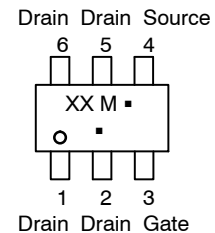
### P-Channel



### MARKING DIAGRAM & PIN ASSIGNMENT



**TSOP-6  
CASE 318G  
STYLE 1**



- XX = Specific Device Code
- M = Date Code\*
- = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation may vary depending upon manufacturing location.

### ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

## NTGS4111P, NVGS4111P

2. Surface-mounted on FR4 board using the minimum recommended pad size (Cu area = 0.006 in sq).

# NTGS4111P, NVGS4111P

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

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
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</sub> /T <sub>J</sub>			-17		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		-100	
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		-3.0	V
Negative Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>			5.0		mV/°C
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = -10 V, I <sub>D</sub> = -3.7 A		38	60	mΩ
		V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -2.7 A		68	110	
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = -10 V, I <sub>D</sub> = -3.7 A		6.0		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> = -15 V		750		pF
Output Capacitance	C <sub>OSS</sub>			140		
Reverse Transfer Capacitance	C <sub>RSS</sub>			105		
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = -10 V, V <sub>DD</sub> = -15 V, I <sub>D</sub> = -3.7 A		15.25	32	nC
Threshold Gate Charge	Q <sub>G(TH)</sub>			0.8		
Gate-to-Source Charge	Q <sub>GS</sub>			2.6		
Gate-to-Drain Charge	Q <sub>GD</sub>			3.4		

## SWITCHING CHARACTERISTICS, V<sub>GS</sub> = -10 V (Note 4)

Turn-On Delay Time	t <sub>d(ON)</sub>	V <sub>GS</sub> = -10 V, V <sub>DD</sub> = -15 V, I <sub>D</sub> = -1.0 A, R <sub>G</sub> = 6.0 Ω		9.0	17	ns
Rise Time	t <sub>r</sub>			9.0	18	
Turn-Off Delay Time	t <sub>d(OFF)</sub>			38	85	
Fall Time	t <sub>f</sub>			22	45	

## SWITCHING CHARACTERISTICS, V<sub>GS</sub> = -4.5 V (Note 4)

Turn-On Delay Time	t <sub>d(ON)</sub>	V <sub>GS</sub> = -4.5 V, V <sub>DD</sub> = -15 V, I <sub>D</sub> = -1.0 A, R <sub>G</sub> = 6.0 Ω		11	20	ns
Rise Time	t <sub>r</sub>			15	28	
Turn-Off Delay Time	t <sub>d(OFF)</sub>			28	56	
Fall Time	t <sub>f</sub>			22	50	

## DRAIN - SOURCE DIODE CHARACTERISTICS

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Forward Diode Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = -1.0 A	T <sub>J</sub> = 25°C	-0.76	-1.2	V
			T <sub>J</sub> = 125°C	-0.60		
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V dI <sub>S</sub> /dt = 100 A/μs, I <sub>S</sub> = -1.0 A		17	40	ns
Charge Time	t <sub>a</sub>			9.0		
Discharge Time	t <sub>b</sub>			8.0		
Reverse Recovery Charge	Q <sub>RR</sub>			8.0		nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

4. Switching characteristics are independent of operating junction temperatures.

# NTGS4111P, NVGS4111P

## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

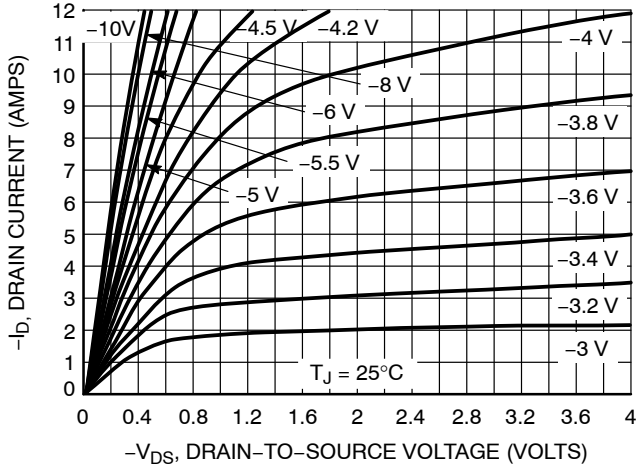


Figure 1. On-Region Characteristics

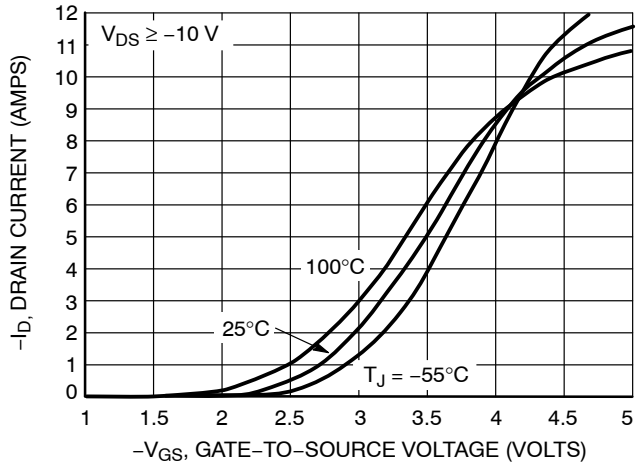


Figure 2. Transfer Characteristics

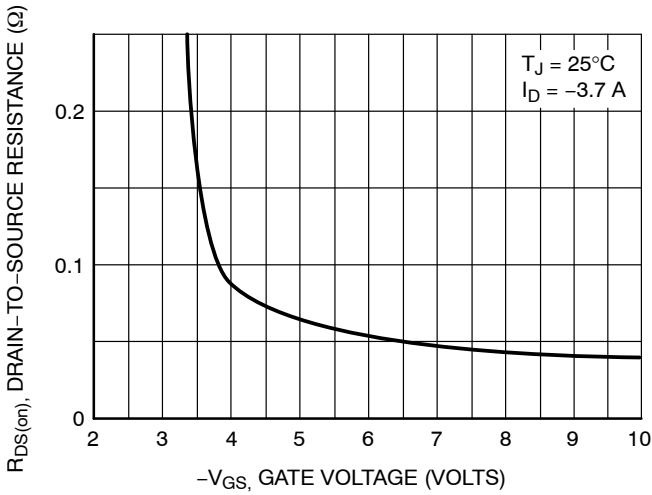


Figure 3. On-Resistance vs. Gate-to-Source Voltage

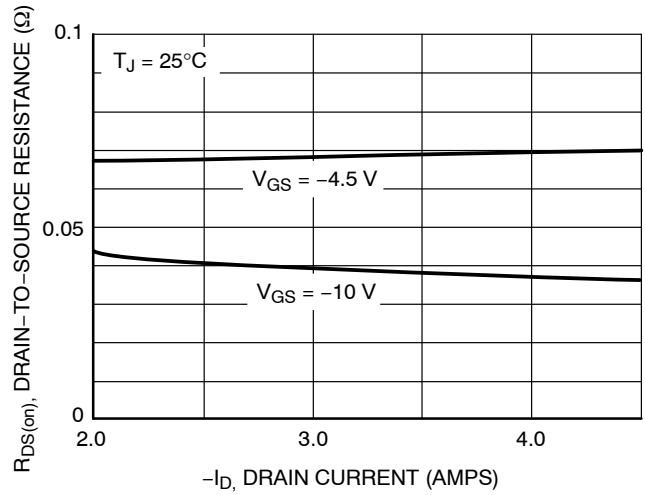


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

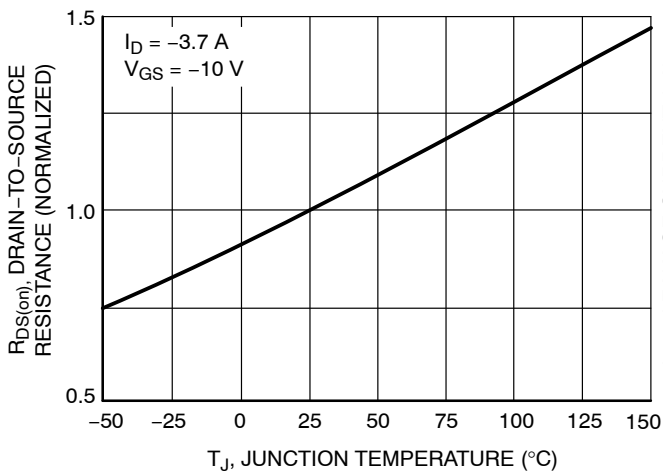


Figure 5. On-Resistance Variation with Temperature

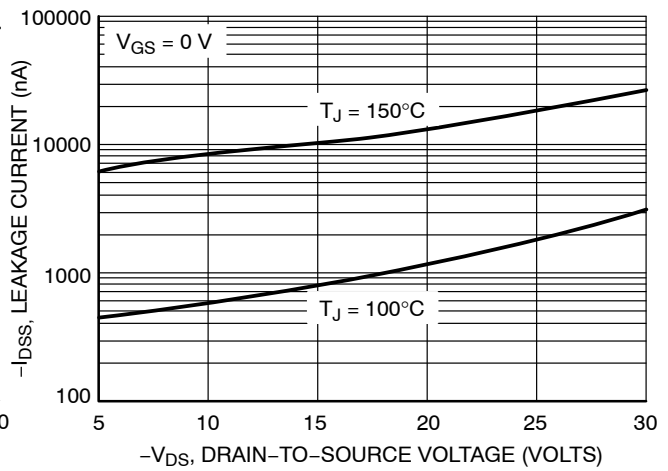


Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NTGS4111P, NVGS4111P

## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

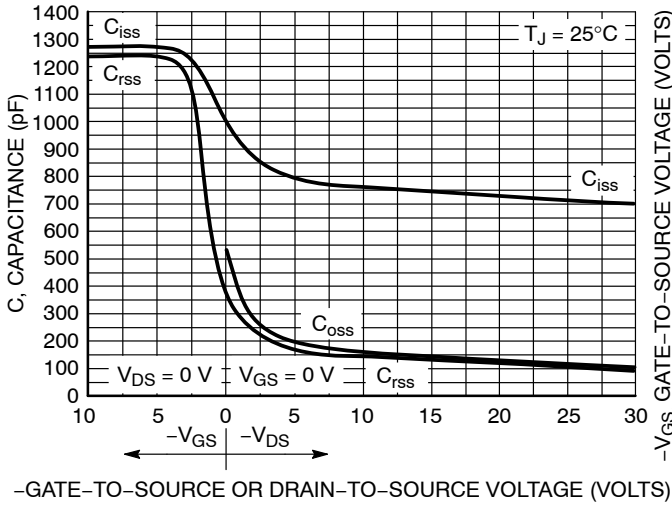


Figure 7. Capacitance Variation

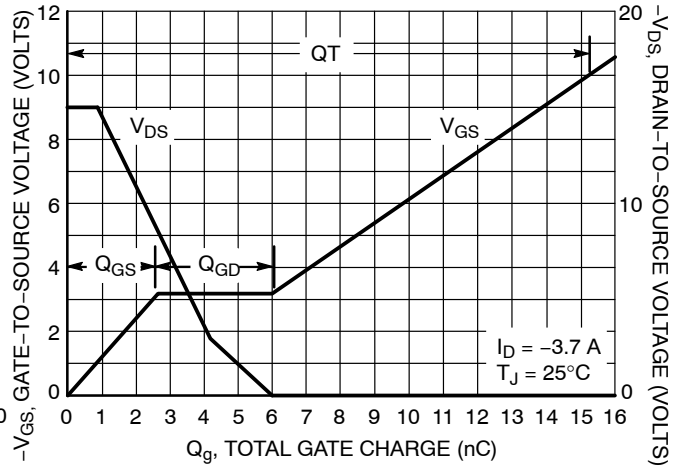


Figure 8. Gate-to-Source Voltage vs. Total Gate Charge

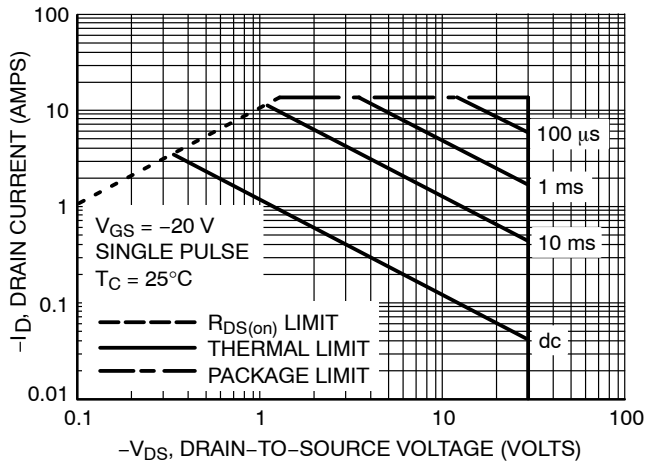


Figure 9. Maximum Rated Forward Biased Safe Operating Area

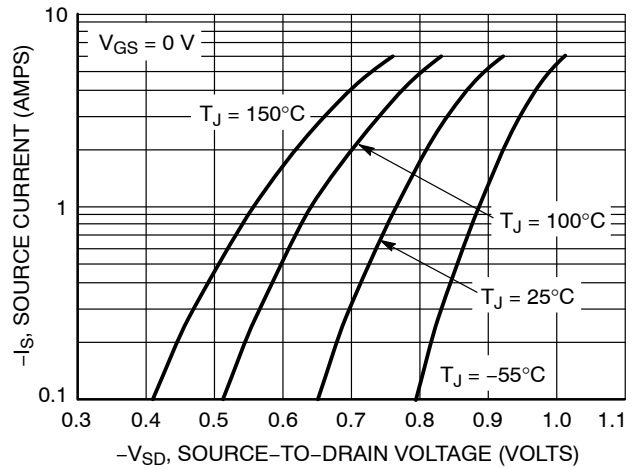


Figure 10. Diode Forward Voltage vs. Current

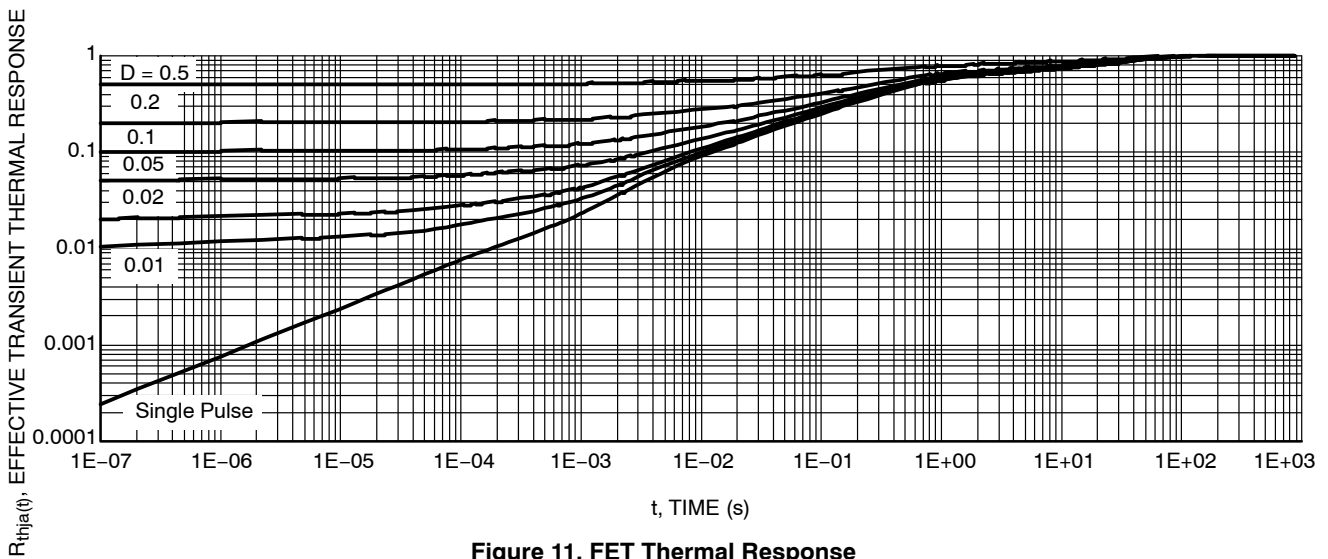


Figure 11. FET Thermal Response

# NTGS4111P, NVGS4111P

**Table 1. ORDERING INFORMATION**

<b>Part Number</b>	<b>Marking (XX)</b>	<b>Package</b>	<b>Shipping<sup>†</sup></b>
NTGS4111PT1	TG	SC-88	3000 / Tape & Reel
NTGS4111PT1G	TG	SC-88 (Pb-Free)	3000 / Tape & Reel
NVGS4111PT1G	VTG	SC-88 (Pb-Free)	3000 / 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 Specifications Brochure, BRD8011/D.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

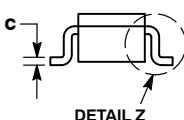
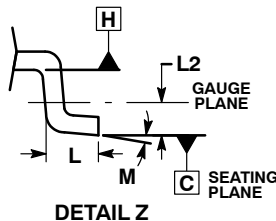
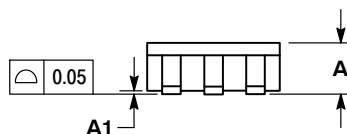
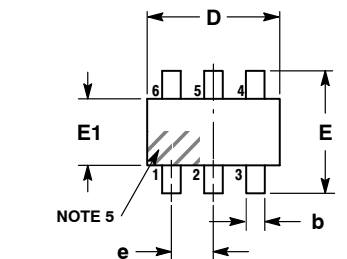
ON Semiconductor®



SCALE 2:1

### TSOP-6 CASE 318G-02 ISSUE V

DATE 12 JUN 2012

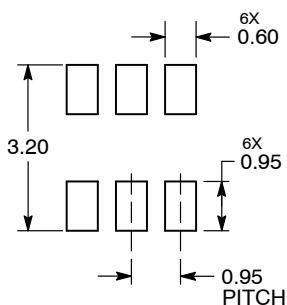


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
  4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSIONS D AND E1 ARE DETERMINED AT DATUM H.
  5. PIN ONE INDICATOR MUST BE LOCATED IN THE INDICATED ZONE.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.01	0.06	0.10
b	0.25	0.38	0.50
c	0.10	0.18	0.26
D	2.90	3.00	3.10
E	2.50	2.75	3.00
E1	1.30	1.50	1.70
e	0.85	0.95	1.05
L	0.20	0.40	0.60
L2	0.25 BSC		
M	0°	-	10°

- |  |  |   |   |   |  |
|--|--|---|---|---|--|
| <p>STYLE 1:<br/>PIN 1. DRAIN<br/>2. DRAIN<br/>3. GATE<br/>4. SOURCE<br/>5. DRAIN<br/>6. DRAIN</p>              | <p>STYLE 2:<br/>PIN 1. EMITTER 2<br/>2. BASE 1<br/>3. COLLECTOR 1<br/>4. EMITTER 1<br/>5. BASE 2<br/>6. COLLECTOR 2</p>    | <p>STYLE 3:<br/>PIN 1. ENABLE<br/>2. N/C<br/>3. R BOOST<br/>4. Vz<br/>5. V in<br/>6. V out</p>                            | <p>STYLE 4:<br/>PIN 1. N/C<br/>2. V in<br/>3. NOT USED<br/>4. GROUND<br/>5. ENABLE<br/>6. LOAD</p>                | <p>STYLE 5:<br/>PIN 1. EMITTER 2<br/>2. BASE 2<br/>3. COLLECTOR 1<br/>4. EMITTER 1<br/>5. BASE 1<br/>6. COLLECTOR 2</p> | <p>STYLE 6:<br/>PIN 1. COLLECTOR<br/>2. COLLECTOR<br/>3. BASE<br/>4. EMITTER<br/>5. COLLECTOR<br/>6. COLLECTOR</p> |
| <p>STYLE 7:<br/>PIN 1. COLLECTOR<br/>2. COLLECTOR<br/>3. BASE<br/>4. N/C<br/>5. COLLECTOR<br/>6. EMITTER</p>   | <p>STYLE 8:<br/>PIN 1. Vbus<br/>2. D(in)<br/>3. D(in)+<br/>4. D(out)+<br/>5. D(out)<br/>6. GND</p>                         | <p>STYLE 9:<br/>PIN 1. LOW VOLTAGE GATE<br/>2. DRAIN<br/>3. SOURCE<br/>4. DRAIN<br/>5. DRAIN<br/>6. HIGH VOLTAGE GATE</p> | <p>STYLE 10:<br/>PIN 1. D(OUT)+<br/>2. GND<br/>3. D(OUT)-<br/>4. D(IN)-<br/>5. VBUS<br/>6. D(IN)+</p>             | <p>STYLE 11:<br/>PIN 1. SOURCE 1<br/>2. DRAIN 2<br/>3. DRAIN 2<br/>4. SOURCE 2<br/>5. GATE 1<br/>6. DRAIN 1/GATE 2</p>  | <p>STYLE 12:<br/>PIN 1. I/O<br/>2. GROUND<br/>3. I/O<br/>4. I/O<br/>5. VCC<br/>6. I/O</p>                          |
| <p>STYLE 13:<br/>PIN 1. GATE 1<br/>2. SOURCE 2<br/>3. GATE 2<br/>4. DRAIN 2<br/>5. SOURCE 1<br/>6. DRAIN 1</p> | <p>STYLE 14:<br/>PIN 1. ANODE<br/>2. SOURCE<br/>3. GATE<br/>4. CATHODE/DRAIN<br/>5. CATHODE/DRAIN<br/>6. CATHODE/DRAIN</p> | <p>STYLE 15:<br/>PIN 1. ANODE<br/>2. SOURCE<br/>3. GATE<br/>4. DRAIN<br/>5. N/C<br/>6. CATHODE</p>                        | <p>STYLE 16:<br/>PIN 1. ANODE/CATHODE<br/>2. BASE<br/>3. EMITTER<br/>4. COLLECTOR<br/>5. ANODE<br/>6. CATHODE</p> | <p>STYLE 17:<br/>PIN 1. EMITTER<br/>2. BASE<br/>3. ANODE/CATHODE<br/>4. ANODE<br/>5. CATHODE<br/>6. COLLECTOR</p>       |  |

### RECOMMENDED SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

### GENERIC MARKING DIAGRAM\*



- |  |   |
|--|---|
| <p>XXX = Specific Device Code<br/>A = Assembly Location<br/>Y = Year<br/>W = Work Week<br/>▪ = Pb-Free Package</p> | <p>XXX = Specific Device Code<br/>M = Date Code<br/>▪ = Pb-Free Package</p> |
|--|---|

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

\*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.

DOCUMENT NUMBER:	98ASB14888C	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	TSOP-6	PAGE 1 OF 1

ON Semiconductor and ON are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Email Requests to: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

ON Semiconductor Website: [www.onsemi.com](http://www.onsemi.com)

### TECHNICAL SUPPORT

North American Technical Support:  
Voice Mail: 1 800-282-9855 Toll Free USA/Canada  
Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative