

# NTGS3136P, NVGS3136P

## MOSFET – Power, Single, P-Channel, TSOP-6 -20 V, -5.8 A

### Features

- Low  $R_{DS(on)}$  in TSOP-6 Package
- 1.8 V Gate Rating
- Fast Switching
- NV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

- Optimized for Battery and Load Management Applications in Portable Equipment
- High Side Load Switch
- Switching Circuits for Game Consoles, Camera Phone, etc.

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

Parameter		Symbol	Value	Unit
Drain-to-Source Voltage		$V_{DSS}$	-20	V
Gate-to-Source Voltage		$V_{GS}$	$\pm 8.0$	V
Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	-5.1
		$T_A = 85^\circ\text{C}$		-3.6
	$t \leq 5 \text{ s}$	$T_A = 25^\circ\text{C}$		-5.8
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$	1.25
	$t \leq 5 \text{ s}$			1.6
Continuous Drain Current (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	-3.7
		$T_A = 85^\circ\text{C}$		-2.7
Power Dissipation (Note 2)	Steady State	$T_A = 25^\circ\text{C}$	$P_D$	0.7
Pulsed Drain Current	$t_p = 10 \mu\text{s}$	$I_{DM}$	-20	A
Operating Junction and Storage Temperature		$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260	$^\circ\text{C}$

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. Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces)
2. Surface-mounted on FR4 board using the minimum recommended pad size (Cu area = 0.0775 in sq).

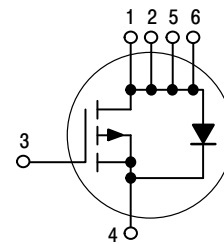


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$V_{(BR)DSS}$	$R_{DS(ON)}$ TYP	$I_D$ MAX
-20 V	25 m $\Omega$ @ -4.5 V	-5.1 A
	32 m $\Omega$ @ -2.5 V	-4.5 A
	41 m $\Omega$ @ -1.8 V	-2.5 A

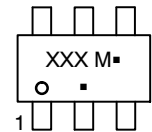
### P-Channel



### MARKING DIAGRAM



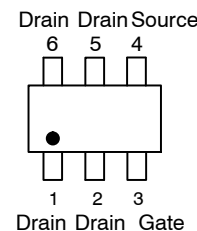
TSOP-6  
CASE 318G  
STYLE 1



XXX = Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### PIN ASSIGNMENT



### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

# NTGS3136P, NVGS3136P

## THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Ambient – Steady State (Note 3)	$R_{\theta JA}$	100	°C/W
Junction-to-Ambient – $t = 5$ s (Note 3)	$R_{\theta JA}$	77	
Junction-to-Ambient – Steady State (Note 4)	$R_{\theta JA}$	185	

3. Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces)  
 4. Surface-mounted on FR4 board using the minimum recommended pad size (Cu area = 0.0775 in sq).

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

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

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0$ V, $I_D = -250$ $\mu\text{A}$	-20			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = -250$ $\mu\text{A}$ , Reference $25^\circ\text{C}$		-13		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0$ V, $V_{DS} = -20$ V			-1.0	$\mu\text{A}$
		$T_J = 25^\circ\text{C}$				
		$T_J = 85^\circ\text{C}$			-5.0	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0$ V, $V_{GS} = \pm 8.0$ V			$\pm 0.1$	$\mu\text{A}$

### ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}$ , $I_D = -250$ $\mu\text{A}$	-0.4		-1.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			3		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = -4.5$ V, $I_D = -5.1$ A		25	33	m $\Omega$
		$V_{GS} = -2.5$ V, $I_D = -4.5$ A		32	40	
		$V_{GS} = -1.8$ V, $I_D = -2.5$ A		41	51	
Forward Transconductance	$g_{FS}$	$V_{DS} = -5.0$ V, $I_D = -5.1$ A		22		S

### CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0$ V, $f = 1$ MHz, $V_{DS} = -10$ V		1901		pF
Output Capacitance	$C_{OSS}$			274		
Reverse Transfer Capacitance	$C_{RSS}$			175		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -4.5$ V, $V_{DS} = -10$ V; $I_D = -5.1$ A		18	29	nC
Threshold Gate Charge	$Q_{G(TH)}$			0.7		
Gate-to-Source Charge	$Q_{GS}$			2.4		
Gate-to-Drain Charge	$Q_{GD}$			4.3		
Gate Resistance	$R_G$			7.6		

### SWITCHING CHARACTERISTICS (Note 6)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -4.5$ V, $V_{DD} = -10$ V, $I_D = -1.0$ A, $R_G = 6.0$ $\Omega$		9	19	ns
Rise Time	$T_r$			9	19	
Turn-Off Delay Time	$t_{d(OFF)}$			99	160	
Fall Time	$T_f$			48	79	

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0$ V, $I_S = -1.7$ A	$T_J = 25^\circ\text{C}$	-0.7	-1.2	V
			$T_J = 125^\circ\text{C}$	-0.6		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0$ V, $dI_S/dt = 100$ A/ $\mu\text{s}$ , $I_S = -1.7$ A		37	60	ns

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.

5. Pulse Test: pulse width  $\leq 300$   $\mu\text{s}$ , duty cycle  $\leq 2\%$   
 6. Switching characteristics are independent of operating junction temperatures

# NTGS3136P, NVGS3136P

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

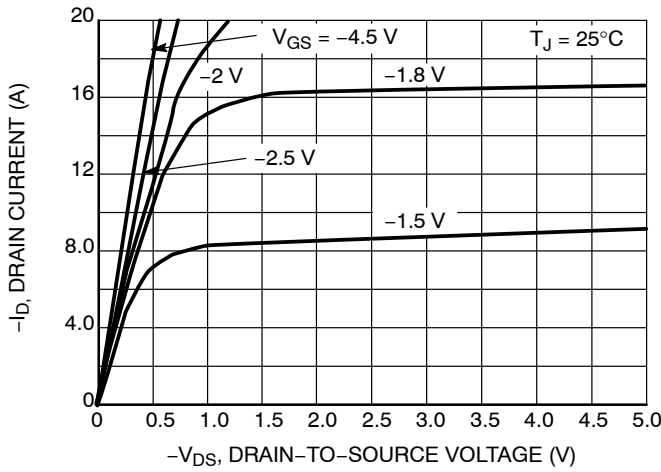


Figure 1. On-Region Characteristics

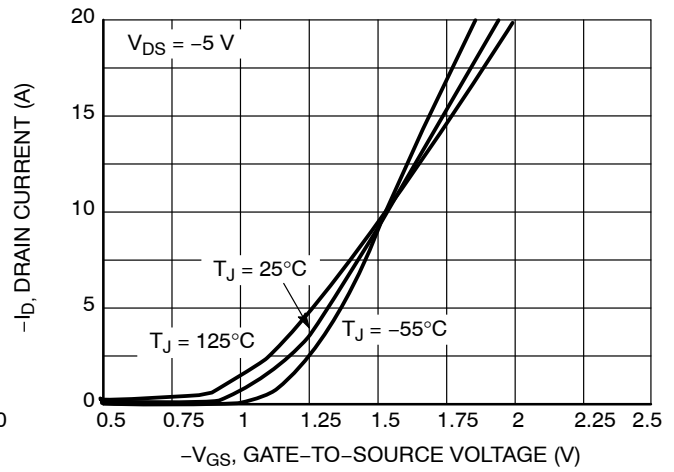


Figure 2. Transfer Characteristics

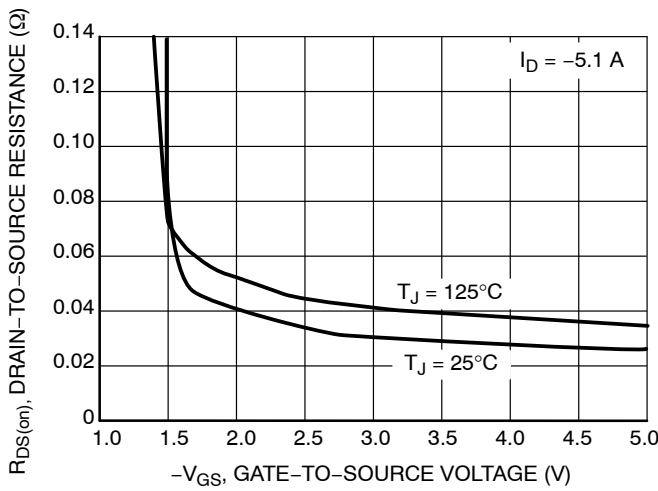


Figure 3. On-Resistance vs. Gate-to-Source Voltage

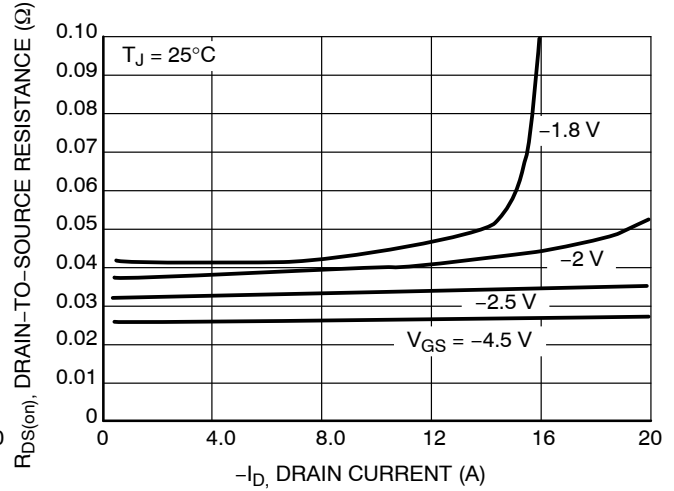


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

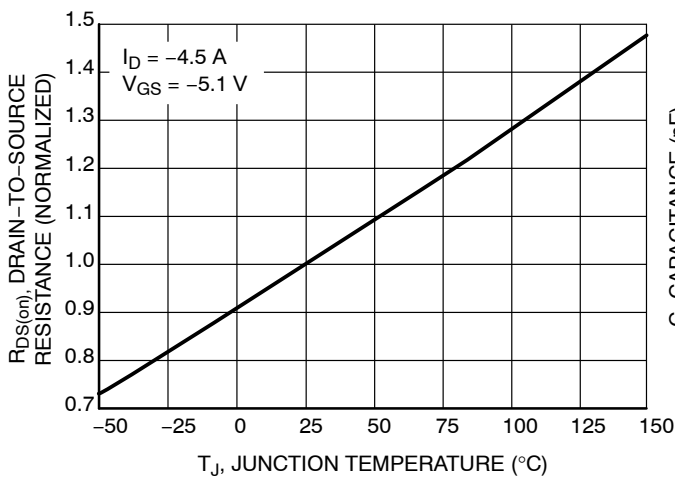


Figure 5. On-Resistance Variation with Temperature

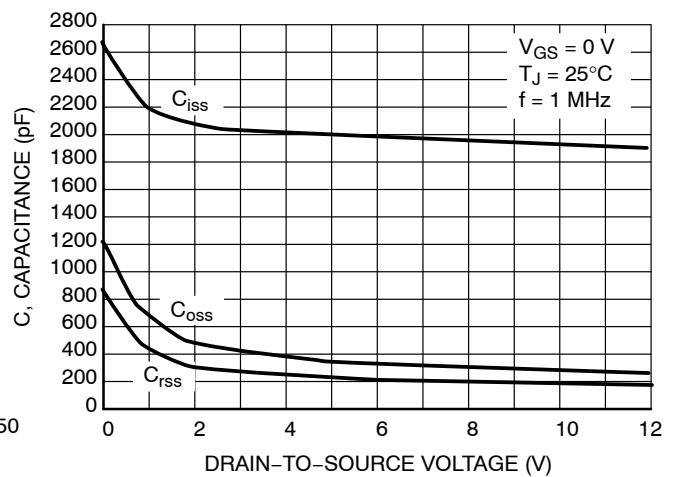
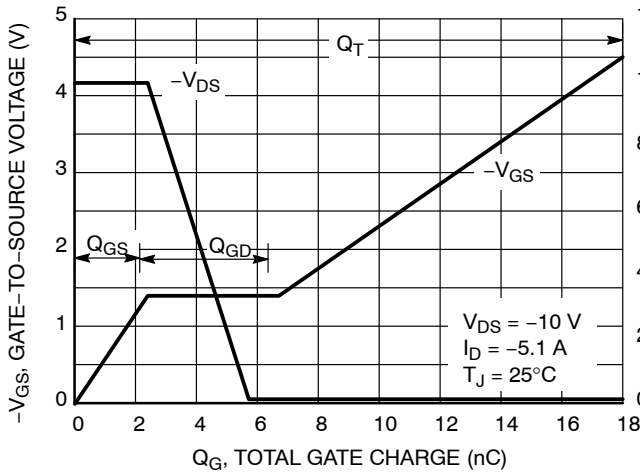


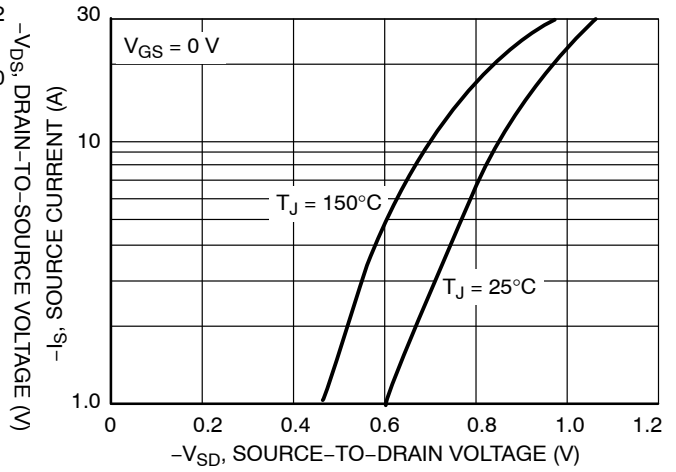
Figure 6. Capacitance Variation

# NTGS3136P, NVGS3136P

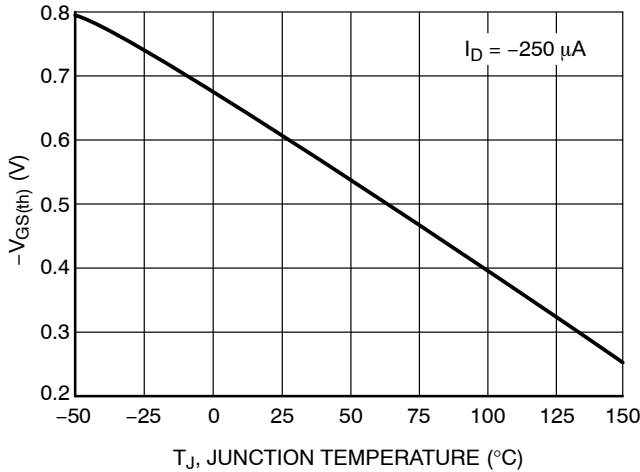
## TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$ unless otherwise noted)



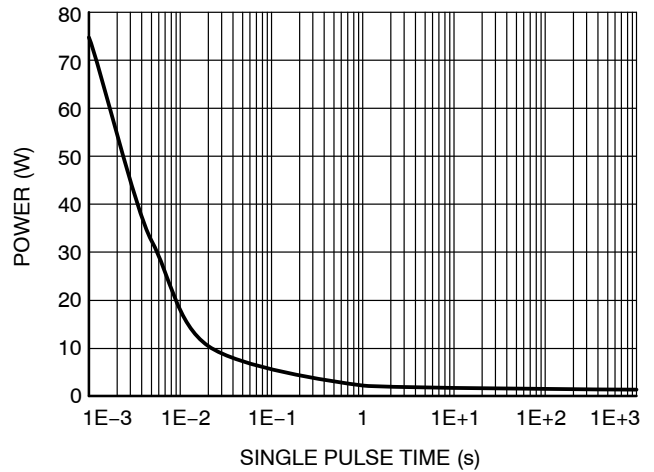
**Figure 7. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge**



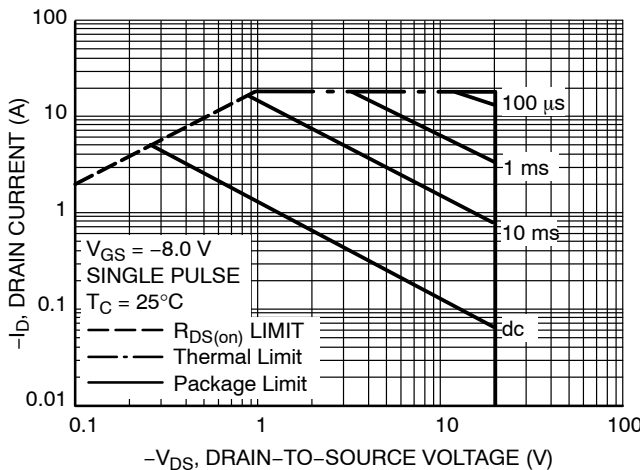
**Figure 8. Diode Forward Voltage vs. Current**



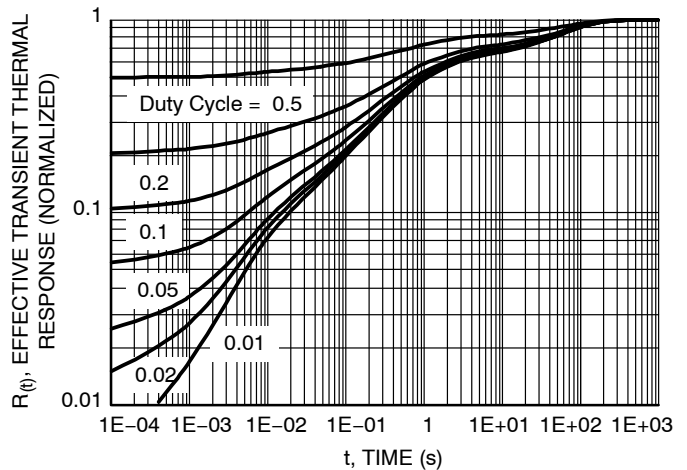
**Figure 9. Threshold Voltage**



**Figure 10. Single Pulse Maximum Power Dissipation**



**Figure 11. Maximum Rated Forward Biased Safe Operating Area**



**Figure 12. FET Thermal Response**

# NTGS3136P, NVGS3136P

## ORDERING INFORMATION

Device	Marking	Package	Shipping†
NTGS3136PT1G	SD	TSOP-6 (Pb-Free)	3000 / Tape & Reel
NVGS3136PT1G*	VSD		

†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.

\*NV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

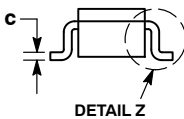
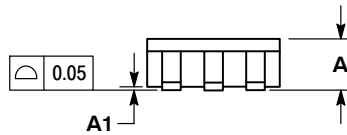
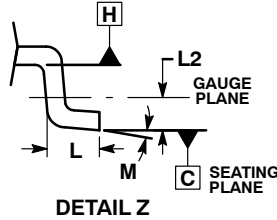
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SCALE 2:1

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

DATE 12 JUN 2012



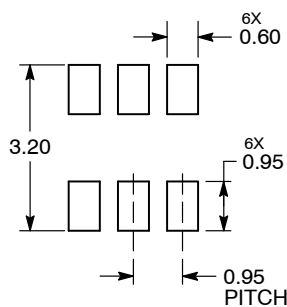
NOTES:

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.

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DESCRIPTION:	TSOP-6	PAGE 1 OF 1

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