NTGS5120P, NVGS5120P

MOSFET – Power, Single, P-Channel, TSOP-6
-60 V, -2.9 A

ON Semiconductor®

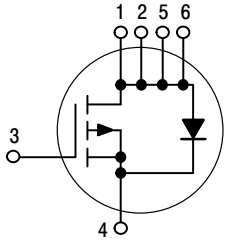
http://onsemi.com

Features
- 60 V BVds, Low $R_{DS(on)}$ in TSOP−6 Package
- 4.5 V Gate Rating
- NV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable
- This is a Pb−Free Device

Applications
- High Side Load Switch
- Power Switch for Printers, Communication Equipment

$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	I_D MAX
−60 V	111 mΩ @ −10 V	−2.9 A
	142 mΩ @ −4.5 V	

P−Channel



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

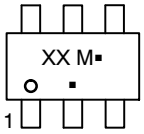
Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	−60	V
Gate−to−Source Voltage			V_{GS}	±20	V
Continuous Drain Current (Note 1)	Steady State	T_A = 25°C	I_D	−2.5	A
		T_A = 85°C		−2.0	
	t ≤ 5 s	T_A = 25°C		−2.9	
Power Dissipation (Note 1)	Steady State	T_A = 25°C	P_D	1.1	W
	t ≤ 5 s			1.4	
Continuous Drain Current (Note 2)	Steady State	T_A = 25°C	I_D	−1.8	A
		T_A = 85°C		−1.3	
Power Dissipation (Note 2)		T_A = 25°C	P_D	0.6	W
Pulsed Drain Current	t_p = 10 μs		I_{DM}	−20	A
Operating Junction and Storage Temperature			T_J, T_{STG}	−55 to 150	°C
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			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. 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.

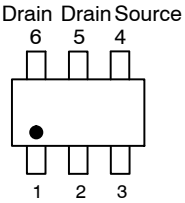
MARKING DIAGRAM

TSOP−6
CASE 318G
STYLE 1



XX = 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 ion page 5 of this data sheet.

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction−to−Ambient − Steady State (Note 3)	$R_{\theta JA}$	102	°C/W
Junction−to−Ambient − t = 5 s (Note 3)	$R_{\theta JA}$	77.6	
Junction−to−Ambient − Steady State (Note 4)	$R_{\theta JA}$	200	

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.

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

Parameter	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		−60			V
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = −48 V	T_J = 25°C			−1.0	μA
			T_J = 125°C			−5.0	
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±12 V				±100	nA
		V_{DS} = 0 V, V_{GS} = ±20 V				±200	nA
ON CHARACTERISTICS (Note 5)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = −250 μA		−1.0		−3.0	V
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = −10 V, I_D = −2.9 A			72	111	mΩ
		V_{GS} = −4.5 V, I_D = −2.5 A			88	142	
Forward Transconductance	g_{FS}	V_{DS} = −5.0 V, I_D = −6.0 A			10.1		S
CHARGES, CAPACITANCES AND GATE RESISTANCE							
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1 MHz, V_{DS} = −30 V			942		pF
Output Capacitance	C_{OSS}				72		
Reverse Transfer Capacitance	C_{RSS}				48		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = −10 V, V_{DS} = −30 V; I_D = −2.9 A			18.1		nC
Threshold Gate Charge	$Q_{G(TH)}$				1.2		
Gate−to−Source Charge	Q_{GS}				2.7		
Gate−to−Drain Charge	Q_{GD}				3.6		
SWITCHING CHARACTERISTICS (Note 6)							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = −10 V, V_{DS} = −30 V, I_D = −1.0 A, R_G = 6.0 Ω			8.7		ns
Rise Time	t_r				4.9		
Turn−Off Delay Time	$t_{d(OFF)}$				38		
Fall Time	t_f				12.8		
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = −0.9 A	T_J = 25°C		−0.75	−1.0	V
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, d_{IS}/d_t = 100 A/μs, I_S = −0.9 A			18.3		ns
Charge Time	t_a				15.5		ns
Reverse Recovery Charge	Q_{RR}				15.1		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.

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

TYPICAL CHARACTERISTICS

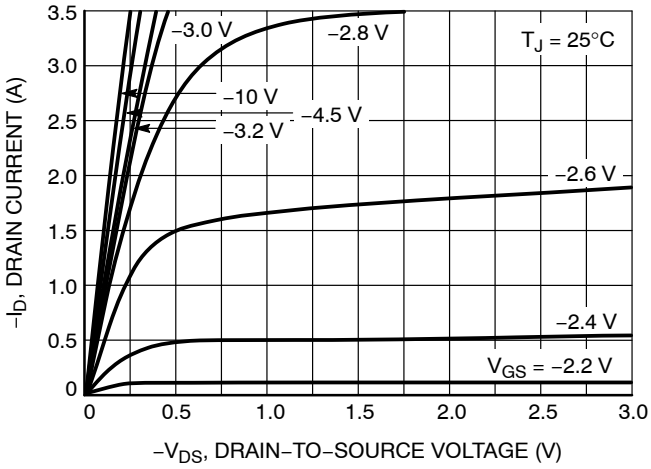


Figure 1. On−Region Characteristics

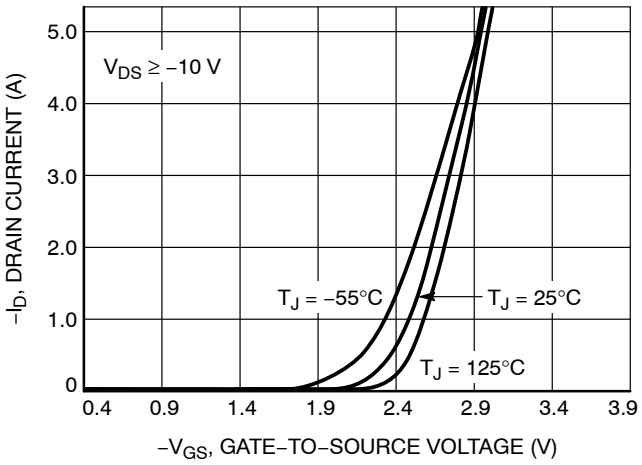


Figure 2. Transfer Characteristics

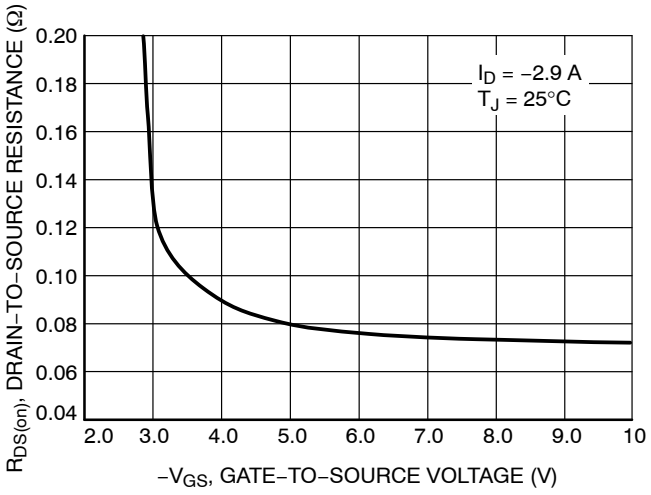


Figure 3. On−Resistance vs. Gate Voltage

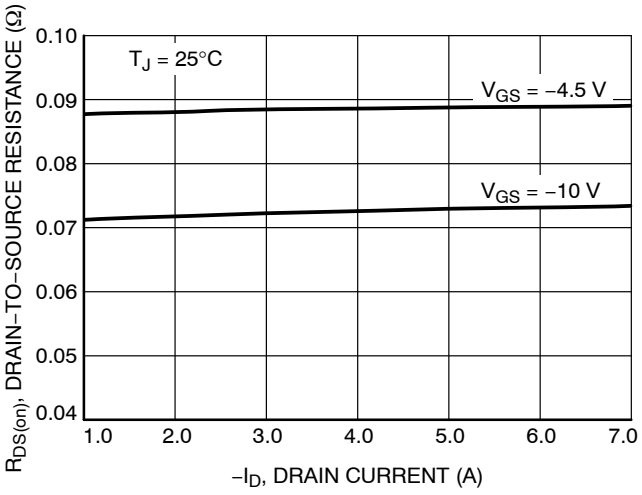


Figure 4. On−Resistance vs. Drain Current and Gate Voltage

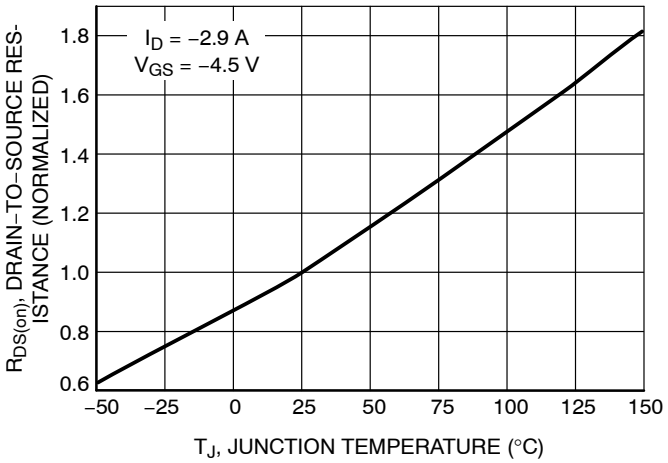


Figure 5. On−Resistance Variation with Temperature

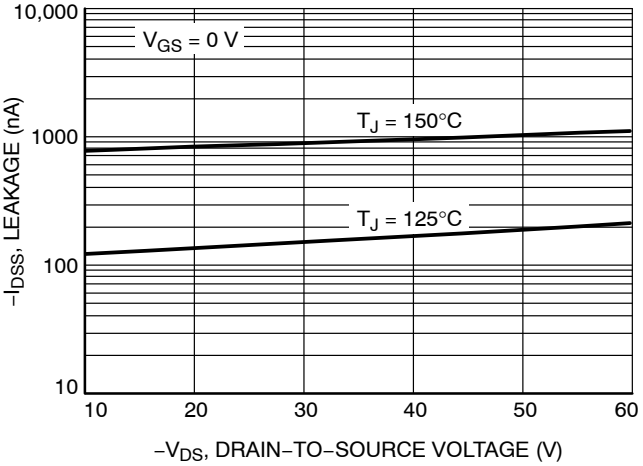


Figure 6. Drain−to−Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

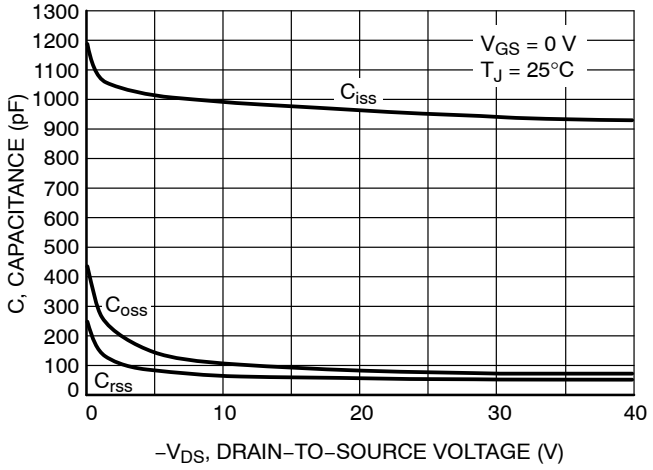


Figure 7. Capacitance Variation

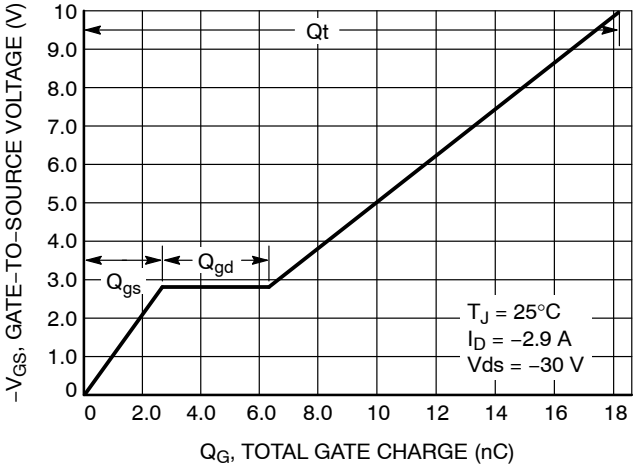


Figure 8. Gate−to−Source Voltage vs. Total Charge

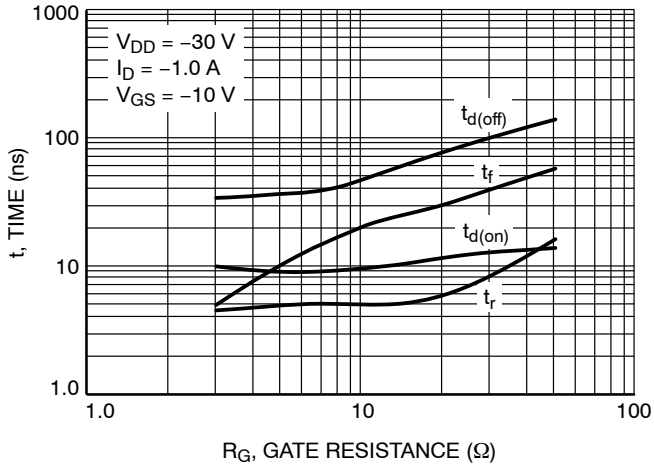


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

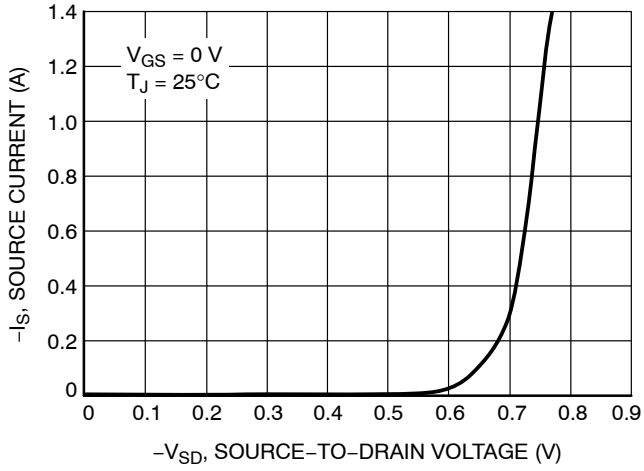


Figure 10. Diode Forward Voltage vs. Current

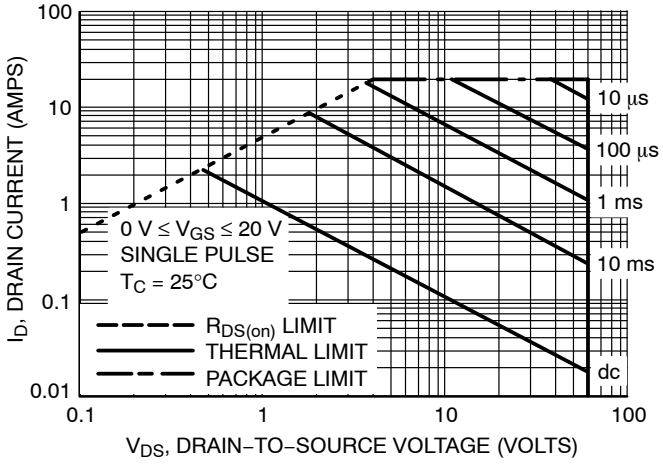


Figure 11. Maximum Rated Forward Biased Safe Operating Area

TYPICAL CHARACTERISTICS

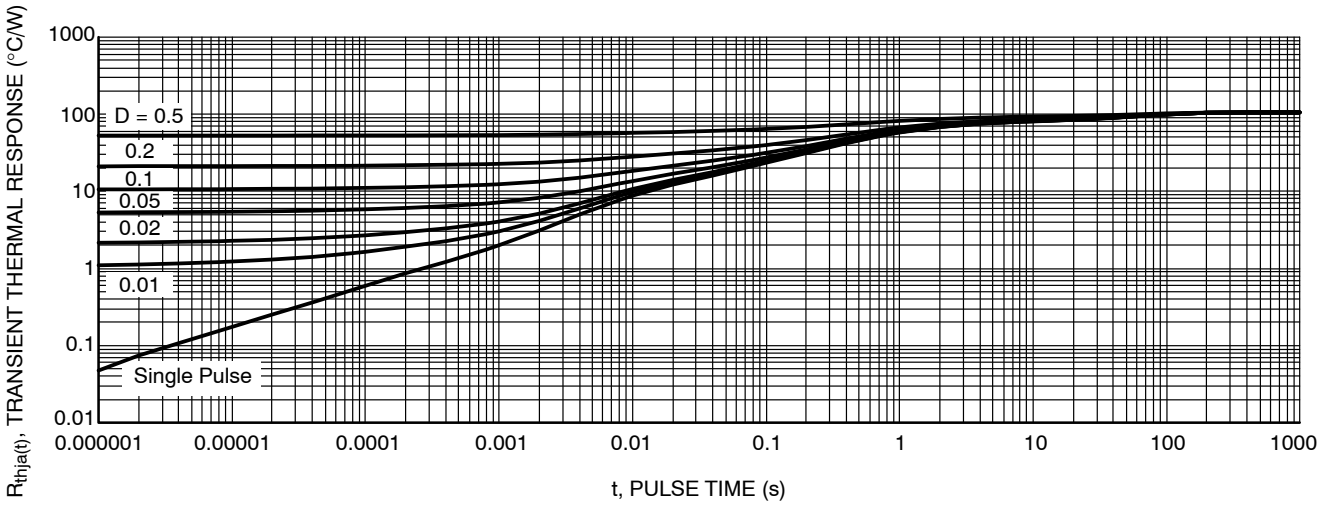


Figure 12. Thermal Response

Table 1. ORDERING INFORMATION

Part Number	Marking (XX)	Package	Shipping†
NTGS5120PT1G	P6	TSOP−6 (Pb−Free)	3000 / Tape & Reel
NVGS5120PT1G	VP6	TSOP−6 (Pb−Free)	3000 / 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.

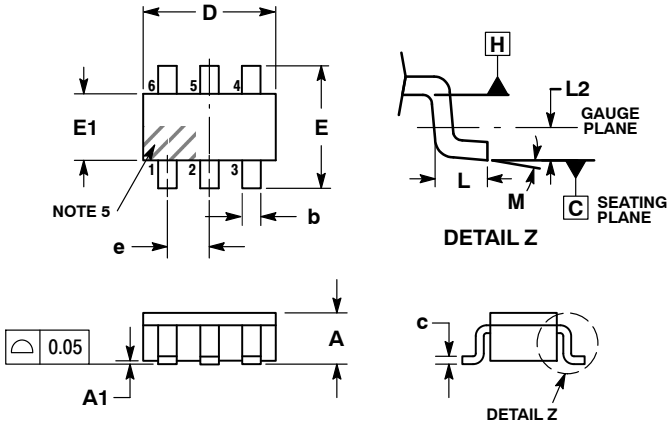
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

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.

	MILLIMETERS		
DIM	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°

STYLE 1:
PIN 1. DRAIN
2. DRAIN
3. GATE
4. SOURCE
5. DRAIN
6. DRAIN

STYLE 2:
PIN 1. EMITTER 2
2. BASE 1
3. COLLECTOR 1
4. EMITTER 1
5. BASE 2
6. COLLECTOR 2

STYLE 3:
PIN 1. ENABLE
2. N/C
3. R BOOST
4. Vz
5. V in
6. V out

STYLE 4:
PIN 1. N/C
2. V in
3. NOT USED
4. GROUND
5. ENABLE
6. LOAD

STYLE 5:
PIN 1. EMITTER 2
2. BASE 2
3. COLLECTOR 1
4. EMITTER 1
5. BASE 1
6. COLLECTOR 2

STYLE 6:
PIN 1. COLLECTOR
2. COLLECTOR
3. BASE
4. EMITTER
5. COLLECTOR
6. COLLECTOR

STYLE 7:
PIN 1. COLLECTOR
2. COLLECTOR
3. BASE
4. N/C
5. COLLECTOR
6. EMITTER

STYLE 8:
PIN 1. Vbus
2. D(in)
3. D(in)+
4. D(out)+
5. D(out)
6. GND

STYLE 9:
PIN 1. LOW VOLTAGE GATE
2. DRAIN
3. SOURCE
4. DRAIN
5. DRAIN
6. HIGH VOLTAGE GATE

STYLE 10:
PIN 1. D(OUT)+
2. GND
3. D(OUT)−
4. D(IN)−
5. VBUS
6. D(IN)+

STYLE 11:
PIN 1. SOURCE 1
2. DRAIN 2
3. DRAIN 2
4. SOURCE 2
5. GATE 1
6. DRAIN 1/GATE 2

STYLE 12:
PIN 1. I/O
2. GROUND
3. I/O
4. I/O
5. VCC
6. I/O

STYLE 13:
PIN 1. GATE 1
2. SOURCE 2
3. GATE 2
4. DRAIN 2
5. SOURCE 1
6. DRAIN 1

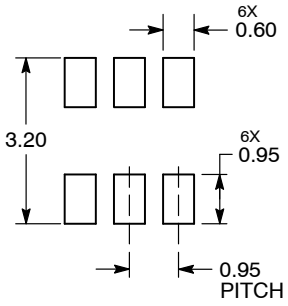
STYLE 14:
PIN 1. ANODE
2. SOURCE
3. GATE
4. CATHODE/DRAIN
5. CATHODE/DRAIN
6. CATHODE/DRAIN

STYLE 15:
PIN 1. ANODE
2. SOURCE
3. GATE
4. DRAIN
5. N/C
6. CATHODE

STYLE 16:
PIN 1. ANODE/CATHODE
2. BASE
3. EMITTER
4. COLLECTOR
5. ANODE
6. CATHODE

STYLE 17:
PIN 1. EMITTER
2. BASE
3. ANODE/CATHODE
4. ANODE
5. CATHODE
6. COLLECTOR

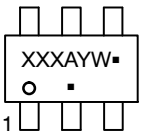
RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

*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*



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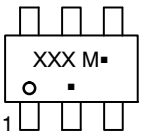

STANDARD

XXX = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
▪ = Pb−Free Package

XXX = Specific Device Code
M = Date Code
▪ = 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.

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DESCRIPTION:	**TSOP−6**	**PAGE 1 OF 1**

PUBLICATION ORDERING INFORMATION

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