NTGS3130N, NVGS3130N

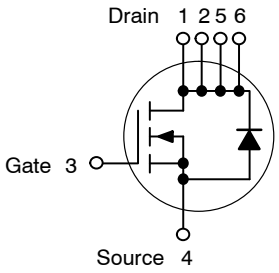
MOSFET – Single, N-Channel, TSOP-6
20 V, 5.6 A, 24 mΩ

ON Semiconductor®

http://onsemi.com

$V_{(BR)DSS}$	$R_{DS(on)}$ mAX	I_D Max
20 V	24 mΩ @ 4.5 V	5.6 A
	32 mΩ @ 2.5 V	4.9 A

N–Channel



Features
- Leading Edge Trench Technology for Low On Resistance
- Low Gate Charge for Fast Switching
- Small Size (3 x 2.75 mm) TSOP−6 Package
- 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
- DC−DC Converters
- Lithium Ion Battery Applications
- Load/Power Switching

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

Rating			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	20	V
Gate−to−Source Voltage			V_{GS}	±8	V
Continuous Drain Current (Note 1)	Steady State	T_A = 25°C	I_D	5.6	A
		T_A = 85°C		4.1	
	t ≤ 10 s	T_A = 25°C		6.2	
Power Dissipation (Note 1)	Steady State	T_A = 25°C	P_D	1.1	W
	t ≤ 10 s			1.4	
Continuous Drain Current (Note 2)	Steady State	T_A = 25°C	I_D	4.2	A
		T_A = 85°C		3.0	
Power Dissipation (Note 2)		T_A = 25°C	P_D	0.6	W
Pulsed Drain Current	t_P ≤ 10 s		I_{DM}	19	A
Operating and Storage Temperature Range			T_J, T_{stg}	−55 to 150	°C
Source Current (Body Diode)			I_S	1.0	A
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T_L	260	°C

THERMAL RESISTANCE RATINGS

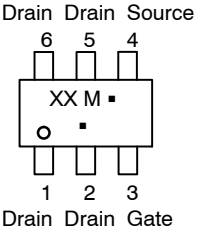
Parameter	Symbol	Max	Unit
Junction−to−Ambient − Steady State (Note 1)	$R_{\theta JA}$	110	°C/W
Junction−to−Ambient − t ≤ 10 s (Note 1)		90	
Junction−to−Ambient − Steady State (Note 2)		200	

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)
2. Surface−mounted on FR4 board using the minimum recommended pad size

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 ion page 5 of this data sheet.

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	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	20			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			9.8		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V; V_{DS} = 16 V, T_J = 25°C			1.0	μA
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0, V_{GS} = ±8 V			100	nA
ON CHARACTERISTICS (Note 3)						
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 250 μA	0.4	0.6	1.4	V
Negative Temperature Coefficient	$V_{GS(TH)}/T_J$			3.4		mV/°C
Drain−to−Source On−Resistance	$R_{DS(on)}$	V_{GS} = 4.5 V, I_D = 5.6 A		19	24	mΩ
		V_{GS} = 2.5 V, I_D = 4.9 A		25	32	
Forward Transconductance	g_{FS}	V_{DS} = 10 V, I_D = 5.6 A		8.2		S
CHARGES, CAPACITANCE, & GATE RESISTANCE						
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1 MHz, V_{DS} = 16 V		935		pF
Output Capacitance	C_{OSS}			169		
Reverse Transfer Capacitance	C_{RSS}			104		
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1 MHz, V_{DS} = 10 V		965		
Output Capacitance	C_{OSS}			198		
Reverse Transfer Capacitance	C_{RSS}			110		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 4.5 V, V_{DS} = 16 V, I_D = 5.6 A		13.2	20.3	nC
Threshold Gate Charge	$Q_{G(TH)}$			0.60		
Gate−to−Source Charge	Q_{GS}			1.5		
Gate−to−Drain Charge	Q_{GD}			4.2		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 4.5 V, V_{DS} = 5.0 V, I_D = 6.2 A		11.8	18.0	
Threshold Gate Charge	$Q_{G(TH)}$			0.6		
Gate−to−Source Charge	Q_{GS}			1.4		
Gate−to−Drain Charge	Q_{GD}			2.7		
SWITCHING CHARACTERISTICS, V_{GS} = 4.5 V (Note 4)						
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = 4.5 V, V_{DD} = 16 V, I_D = 1 A, R_G = 3 Ω		6.3	12.6	ns
Rise Time	t_r			7.3	13.5	
Turn−Off Delay Time	$t_{d(OFF)}$			21.7	35.1	
Fall Time	t_f			9.7	17.6	
DRAIN−SOURCE DIODE CHARACTERISTICS						
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = 1.0 A, T_J = 25°C		0.7	1.2	V
Reverse Recovery Time	t_{RR}	V_{GS} = 0 Vdc, dI_{SD}/dt = 100 A/μs, I_S = 1.0 A		20.4		ns
Charge Time	t_a			8.1		
Discharge Time	t_b			11.6		
Reverse Recovery Charge	Q_{RR}			8.8		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 temperature.

TYPICAL CHARACTERISTICS

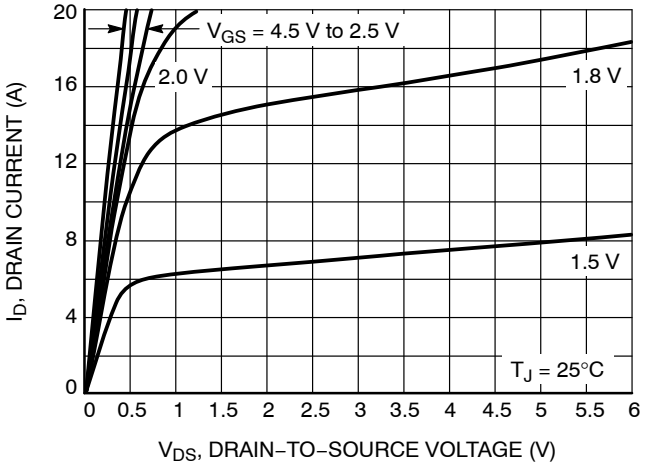


Figure 1. On−Region Characteristics

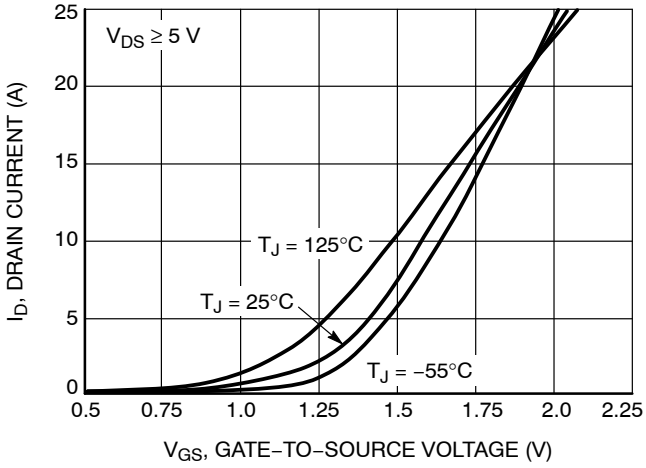


Figure 2. Transfer Characteristics

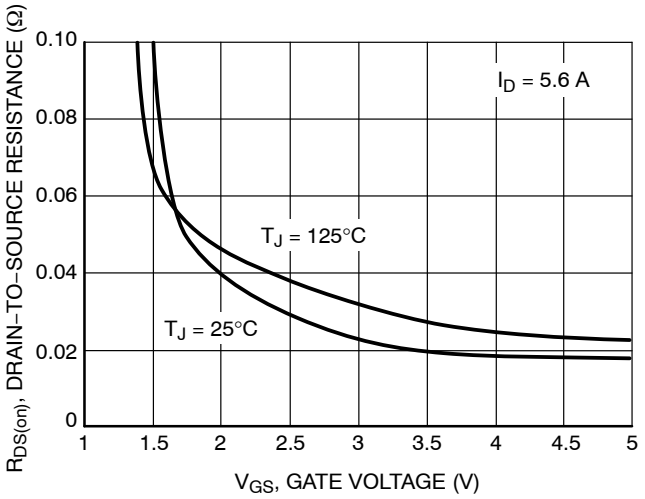


Figure 3. On−Resistance vs. Gate−to−Source Voltage

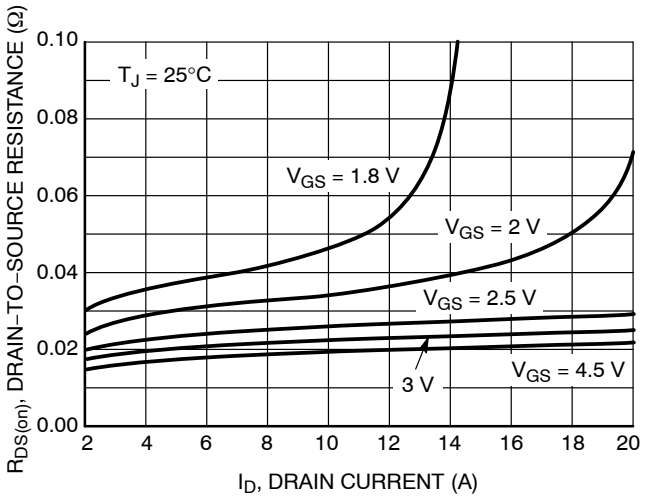


Figure 4. On−Resistance vs. Drain Current and Gate Voltage

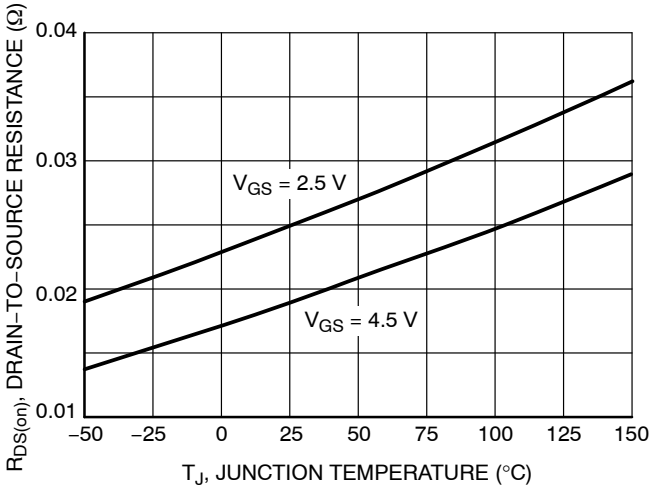


Figure 5. On−Resistance Variation with Temperature

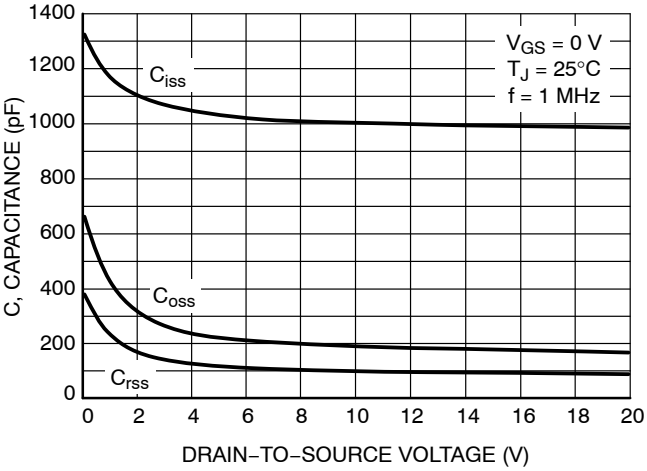


Figure 6. Capacitance Variation

TYPICAL CHARACTERISTICS

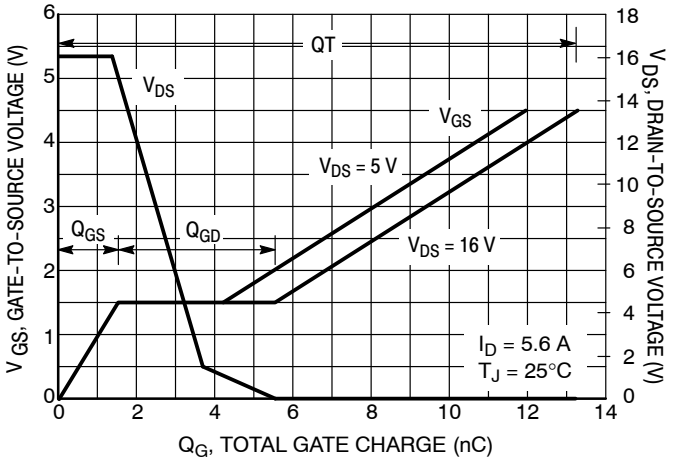


Figure 7. Gate−To−Source and Drain−To−Source Voltage vs. Total Charge

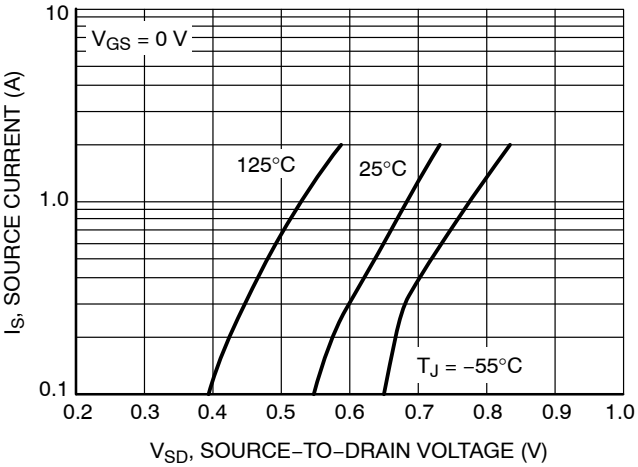


Figure 8. Diode Forward Voltage vs. Current

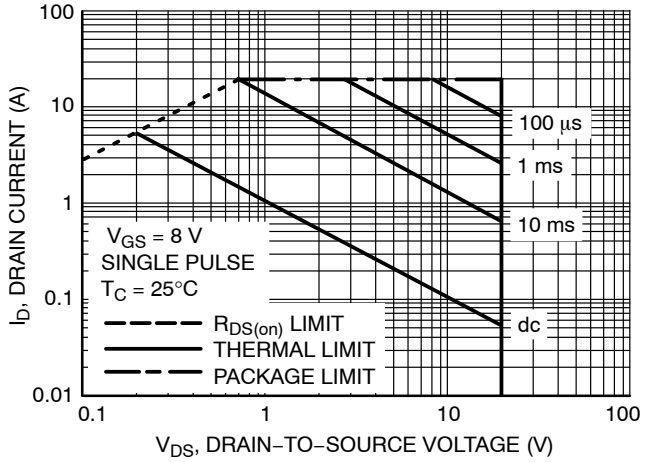


Figure 9. Maximum Rated Forward Biased Safe Operating Area

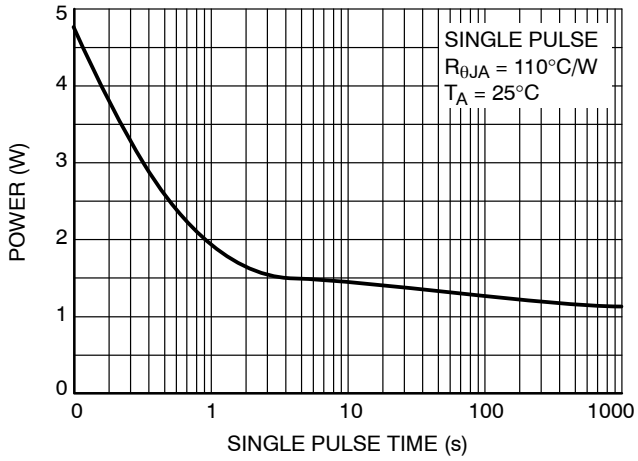


Figure 10. Single Pulse Maximum Power Dissipation

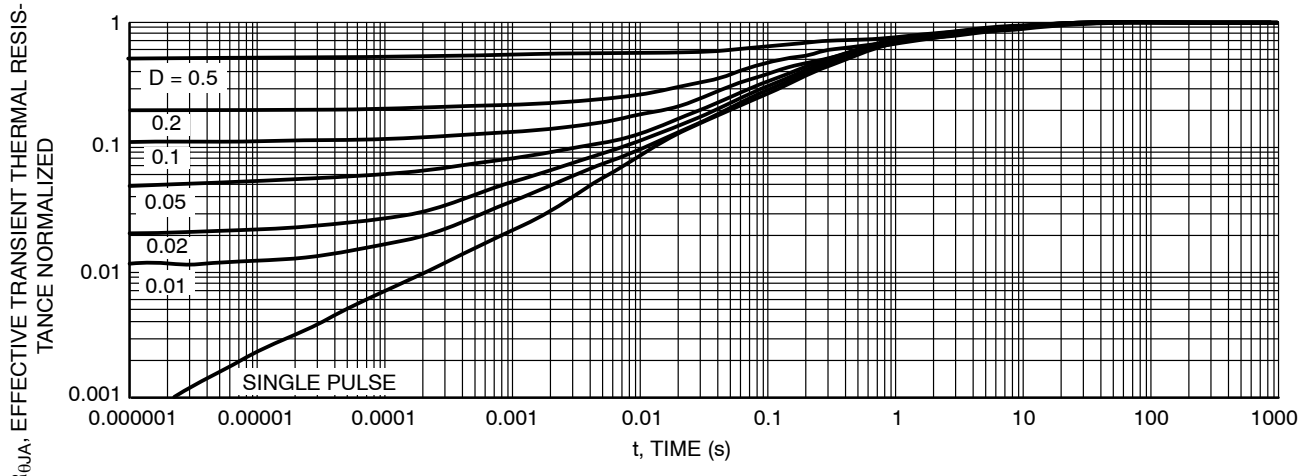


Figure 11. Thermal Response

Table 1. ORDERING INFORMATION

Part Number	Marking (XX)	Package	Shipping†
NTGS3130NT1G	S9	TSOP−6 (Pb−Free)	3000 / Tape & Reel
NVGS3130NT1G	VS9	TSOP−6 (Pb−Free)	3000 / Tape & Reel

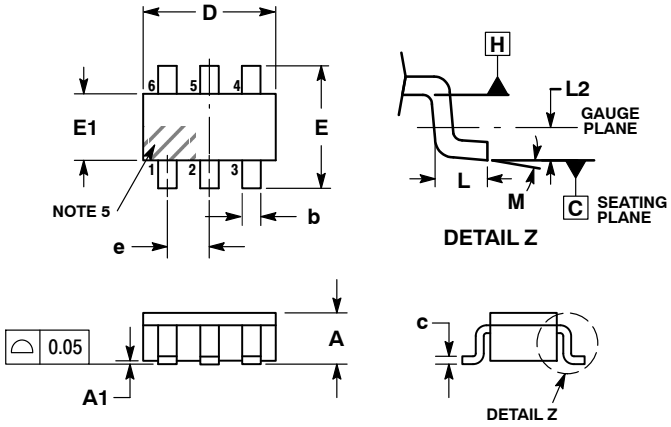
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

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

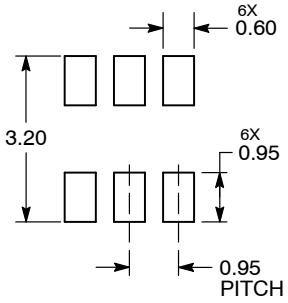
STYLE 14:
PIN 1. ANODE
2. SOURCE
3. GATE
4. CATHODE/DRAIN
5. CATHODE/DRAIN
6. CATHODE/DRAIN

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

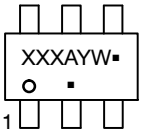
RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

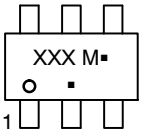
*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

GENERIC MARKING DIAGRAM*



IC

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



STANDARD

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. Some products may not follow the Generic Marking.

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

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical−documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support
For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales