NTGD3133P

Power MOSFET
−20 V, −2.5 A, P−Channel, TSOP−6 Dual

Features

- Reduced Gate Charge for Fast Switching
- −2.5 V Gate Rating
- Leading Edge Trench Technology for Low On Resistance
- Independent Devices to Provide Design Flexibility
- This is a Pb−Free Device

Applications

- Li−Ion Battery Charging
- Load Switch / Power Switching
- DC to DC Conversion
- Portable Devices like PDA's, Cellular Phones, and Hard Drives

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

Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	−20	V
Gate−to−Source Voltage			V_{GS}	±12	V
Continuous Drain Current (Note 1)	Steady State	T_A = 25°C	I_D	−2.2	A
		T_A = 85°C		−1.6	
	t ≤ 5 s	T_A = 25°C		−2.5	
Power Dissipation (Note 1)	Steady State	T_A = 25°C	P_D	1.0	W
	t ≤ 5 s			1.3	
Continuous Drain Current (Note 2)	Steady State	T_A = 25°C	I_D	−1.6	A
		T_A = 85°C		−1.2	
Power Dissipation (Note 2)		T_A = 25°C	P_D	0.56	W
Pulsed Drain Current		t_p = 10 μs	I_{DM}	−7.5	A
Operating Junction and Storage Temperature			T_J, T_{STG}	−55 to 150	°C
Source Current (Body Diode)			I_S	−0.8	A
Lead Temperature for Soldering Purposes (1/8″ from case for 10 s)			T_L	260	°C

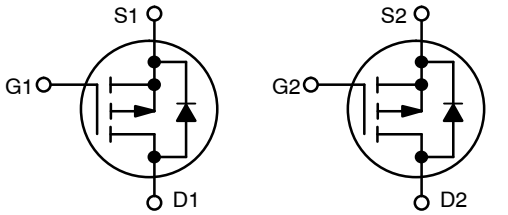
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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 = 30 mm^2 [2 oz] including traces).

ON Semiconductor®

http://onsemi.com

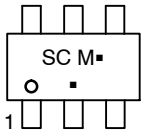
$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	I_D MAX
−20 V	145 mΩ @ −4.5 V	−2.2 A
	200 mΩ @ −2.5 V	−1.6 A



P−CHANNEL MOSFET **P−CHANNEL MOSFET**

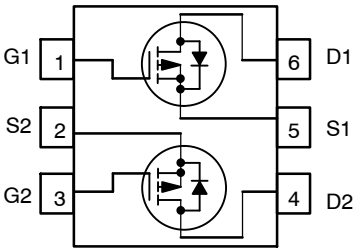
TSOP6
CASE 318G
STYLE 13

MARKING DIAGRAM



SC = Specific Device Code
M = Date Code
▪ = Pb−Free Package
(Note: Microdot may be in either location)

PIN CONNECTION



(Top View)

ORDERING INFORMATION

Device	Package	Shipping†
NTGD3133PT1G	TSOP6 (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 Specification Brochure, BRD8011/D.

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction−to−Ambient − Steady State (Note 3)	$R_{\theta JA}$	115	°C/W
Junction−to−Ambient − t ≤ 5 s (Note 3)	$R_{\theta JA}$	95	
Junction−to−Ambient − Steady State Min Pad (Note 4)	$R_{\theta JA}$	225	

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 = 30 mm^2 [2 oz] including traces).

MOSFET ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions		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	$V_{(BR)DSS}/T_J$			−	14.2	−	mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = −16 V	T_J = 25°C	−	−	−1.0	μA
			T_J = 85°C	−	−	−10	
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±12 V		−	−	±100	nA
ON CHARACTERISTICS (Note 5)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}	I_D = −250 μA	−0.6	−0.95	−1.4	V
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = −4.5 V, I_D = −2.2 A		−	90	145	mΩ
		V_{GS} = −2.5 V, I_D = −1.6 A		−	140	200	
Forward Transconductance	g_{FS}	V_{DS} = −5.0 V, I_D = −2.2 A		−	4.5	−	S
CHARGES, CAPACITANCES & GATE RESISTANCE							
Input Capacitance	C_{ISS}	V_{GS} = 0 V, V_{DS} = −10 V, f = 1.0 MHz		−	400	−	pF
Output Capacitance	C_{OSS}			−	75	−	
Reverse Transfer Capacitance	C_{RSS}			−	40	−	
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = −4.5 V, V_{DS} = −10 V, I_D = −2.2 A		−	3.8	5.5	nC
Threshold Gate Charge	$Q_{G(TH)}$			−	0.5	−	
Gate−to−Source Charge	Q_{GS}			−	0.9	−	
Gate−to−Drain Charge	Q_{GD}			−	1.0	−	
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 Ω		−	6.7	−	ns
Rise Time	t_r			−	12.7	−	
Turn−Off Delay Time	$t_{d(OFF)}$			−	13.2	−	
Fall Time	t_f			−	11	−	
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, T_J = 25°C	I_S = −0.8 A	−	−0.8	−1.2	V
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, dI_{SD} / dt = 100 A/μs, I_S = −0.8 A		−	12	−	ns
Charge Time	t_a			−	8.0	−	
Discharge Time	t_b			−	4.0	−	
Reverse Recovery Charge	Q_{RR}			−	4.0	−	nC

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

TYPICAL PERFORMANCE CHARACTERISTICS

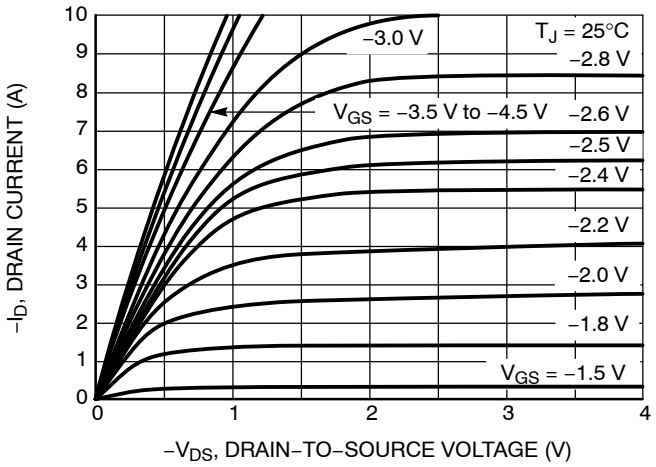


Figure 1. On−Region Characteristics

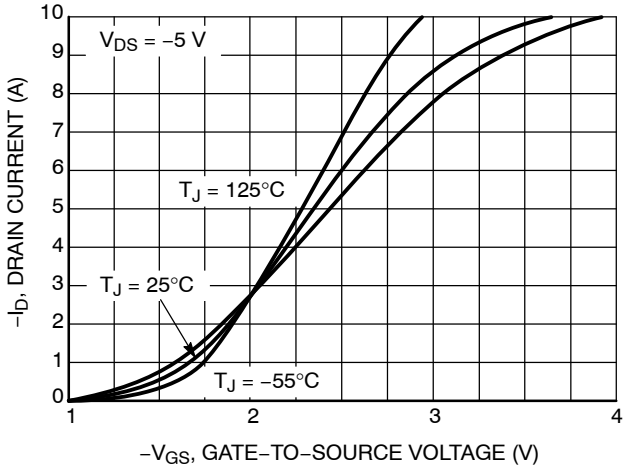


Figure 2. Transfer Characteristics

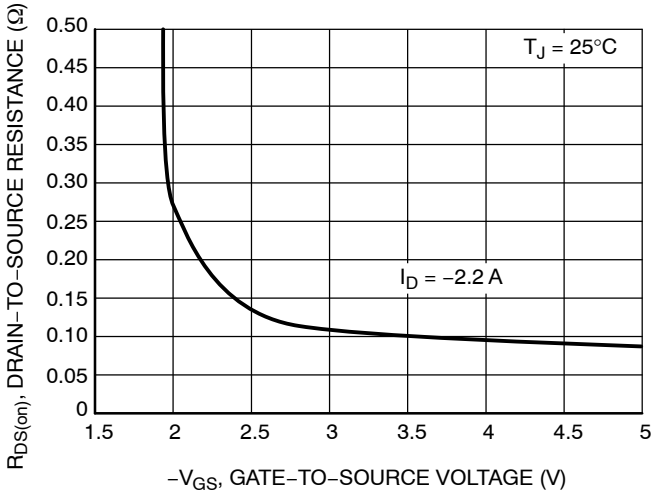


Figure 3. On−Resistance versus Gate−to−Source Voltage

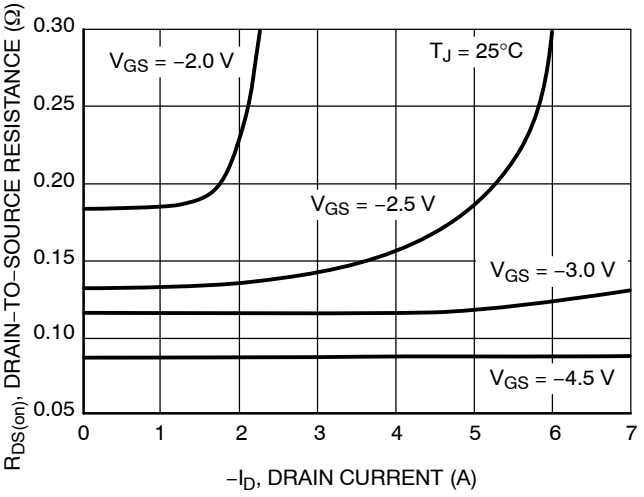


Figure 4. On−Resistance versus Drain Current and Gate Voltage

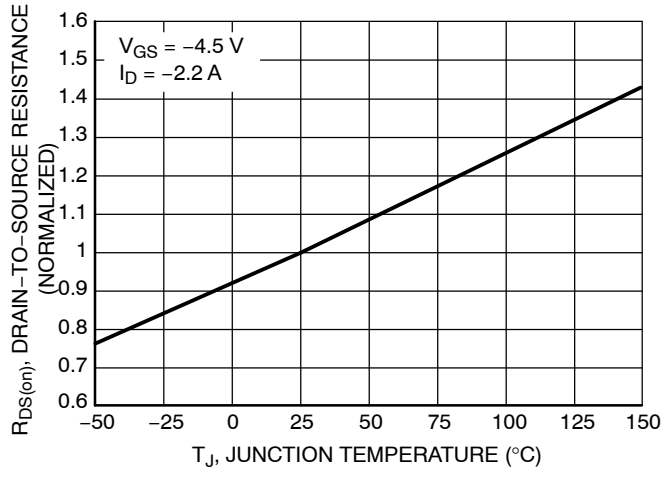


Figure 5. On−Resistance Variation with Temperature

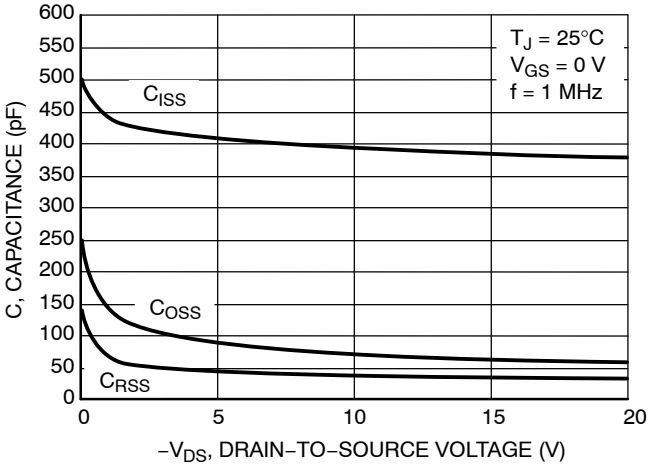


Figure 6. Capacitance Variation

TYPICAL PERFORMANCE CHARACTERISTICS

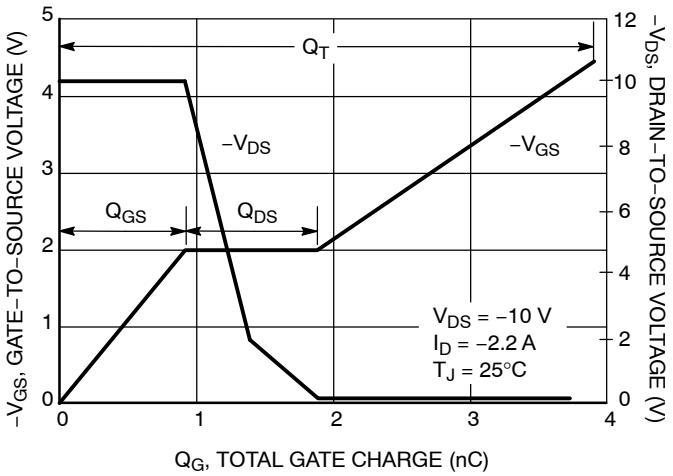


Figure 7. Gate−to−Source and Drain−to−Source Voltage versus Total Charge

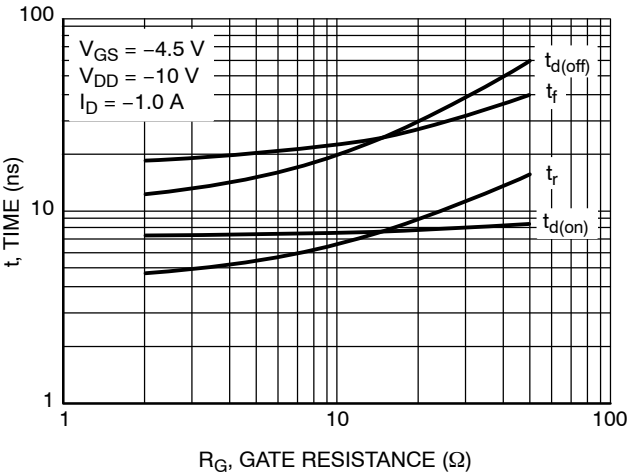


Figure 8. Resistive Switching Time Variation versus Gate Resistance

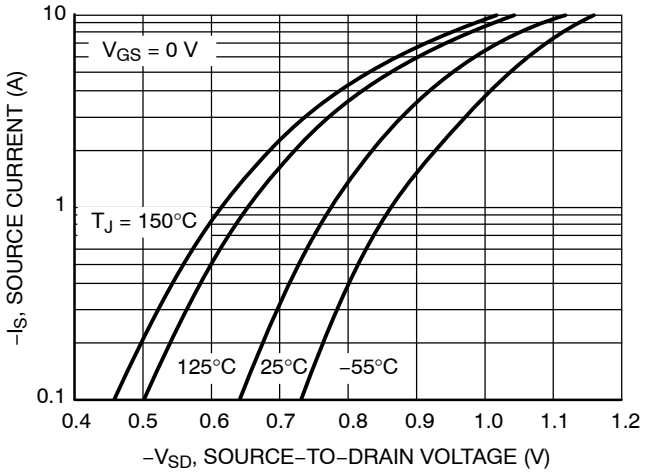


Figure 9. Diode Forward Voltage versus Current

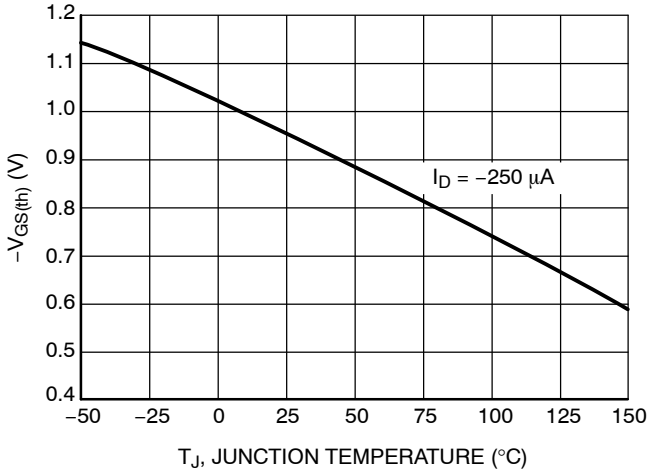


Figure 10. Threshold Voltage

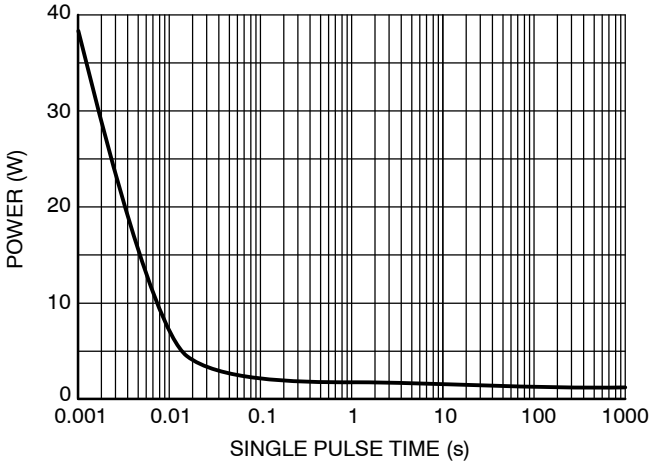


Figure 11. Single Pulse Maximum Power Dissipation

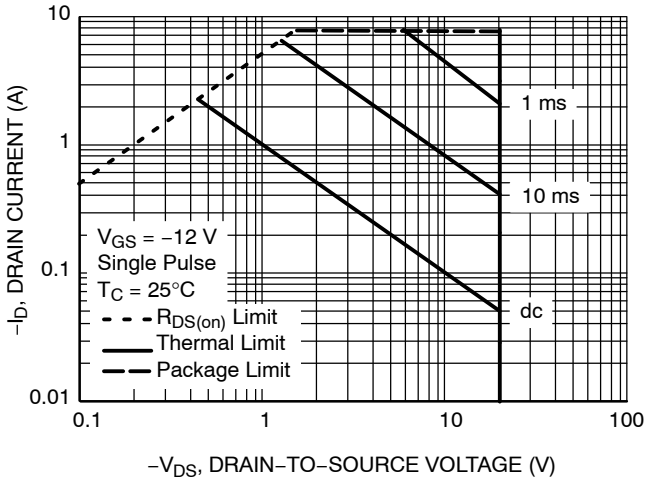


Figure 12. Maximum Rated Forward Biased Safe Operating Area

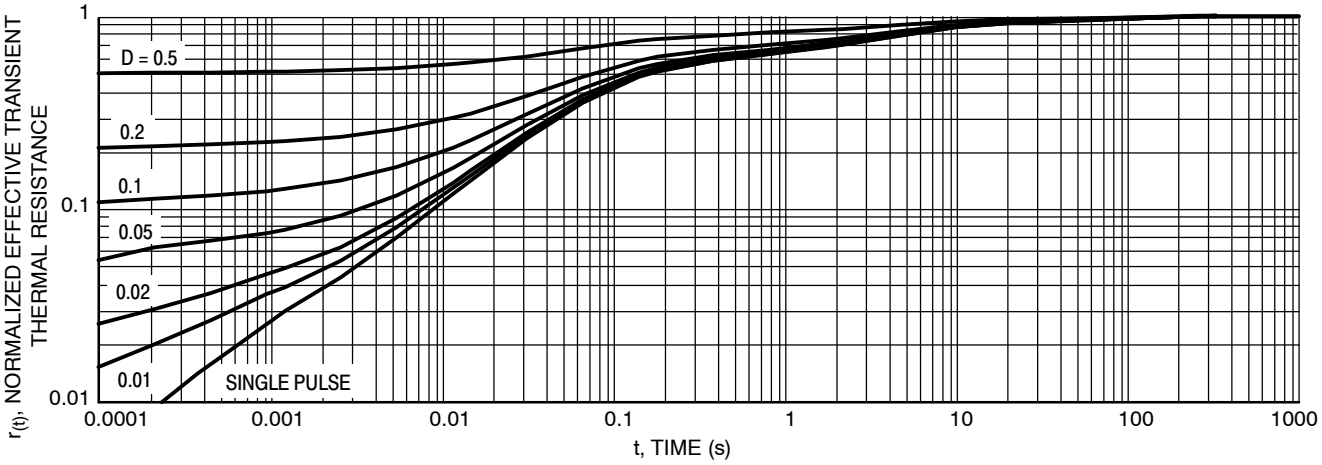
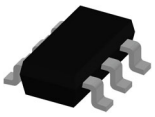


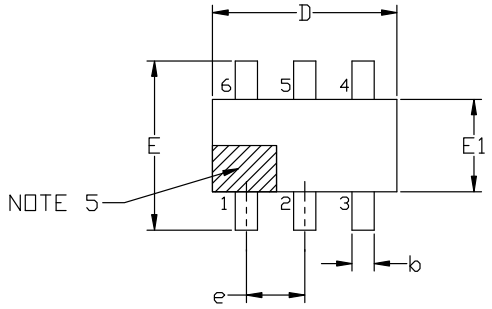
Figure 13. Thermal Response

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

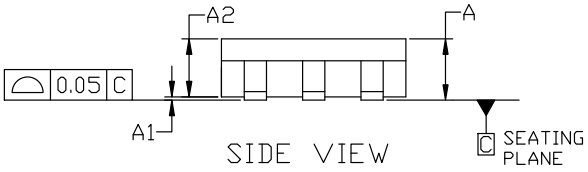


TSOP−6 3.00x1.50x0.90, 0.95P
CASE 318G
ISSUE W

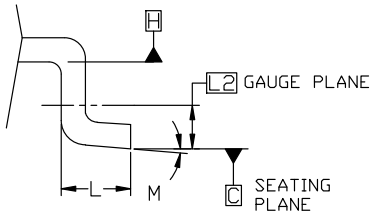
DATE 26 FEB 2024



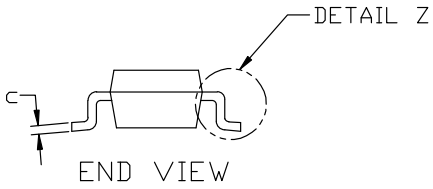
TOP VIEW



SIDE VIEW



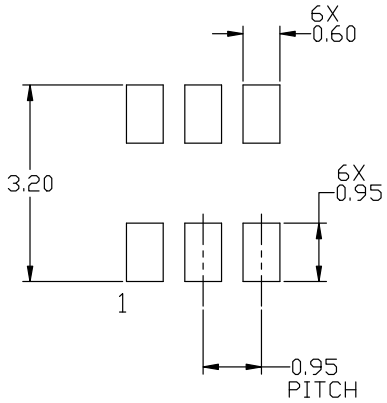
DETAIL Z
SCALE 3:1



END VIEW

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
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 1 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
A2	0.80	0.90	1.00
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°



RECOMMENDED MOUNTING FOOTPRINT

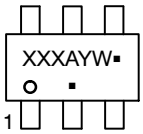
*For additional information on our Pb-Free strategy and soldering details, please download th e ON Semiconductor Soldering and Mounting Techniques Reference manual, SOLDERRM/D.

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 3.00x1.50x0.90, 0.95P**		**PAGE 1 OF 2**

TSOP−6 3.00x1.50x0.90, 0.95P
CASE 318G
ISSUE W

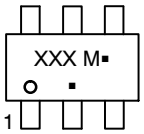
DATE 26 FEB 2024

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.

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

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