

NTGD4169F

Power MOSFET and Schottky Diode

30 V, 2.9 A, N-Channel with Schottky Barrier Diode, TSOP-6

Features

- Fast Switching
- Low Gate Charge
- Low $R_{DS(on)}$
- Low V_F Schottky Diode
- Independently Connected Devices to Provide Design Flexibility
- This is a Pb-Free Device

Applications

- DC-DC Converters
- Portable Devices like PDA's, Cellular Phones, and Hard Drives

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

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			V_{DS}	30	V
Gate-to-Source Voltage			V_{GS}	± 12	V
N-Channel Continuous Drain Current (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	I_D	2.6	A
		$T_A = 85^\circ\text{C}$		1.9	
	$t \leq 5 \text{ s}$	$T_A = 25^\circ\text{C}$		2.9	
Power Dissipation (Note 1)	Steady State	$T_A = 25^\circ\text{C}$	P_D	0.9	W
	$t \leq 5 \text{ s}$			1.1	
Pulsed Drain Current		$t_p = 10 \mu\text{s}$	I_{DM}	8.6	A
Operating Junction and Storage Temperature			T_J, T_{STG}	-25 to 150	$^\circ\text{C}$
Source Current (Body Diode)			I_S	0.9	A
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T_L	260	$^\circ\text{C}$

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

Parameter	Symbol	Value	Unit
Peak Repetitive Reverse Voltage	V_{RRM}	30	V
DC Blocking Voltage	V_R	30	V
Average Rectified Forward Current	I_F	1	A

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Ambient - Steady State (Note 1)	$R_{\theta JA}$	140	$^\circ\text{C/W}$
Junction-to-Ambient - $t \leq 5 \text{ s}$ (Note 1)	$R_{\theta JA}$	110	$^\circ\text{C/W}$

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 [1 oz] including traces).



ON Semiconductor®

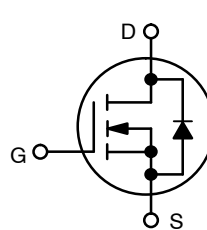
<http://onsemi.com>

N-CHANNEL MOSFET

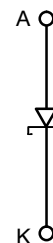
$V_{(BR)DSS}$	$R_{DS(on)}$ Max	I_D Max
30 V	90 m Ω @ 4.5 V	2.6 A
	125 m Ω @ 2.5 V	2.2 A

SCHOTTKY DIODE

V_R Max	V_F Max	I_F Max
30 V	0.53 V	1.0 A



N-Channel MOSFET

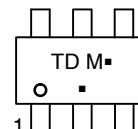


Schottky Diode



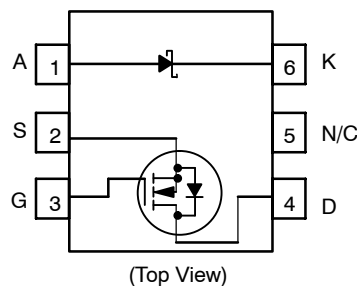
TSOP-6
CASE 318G
STYLE 15

MARKING DIAGRAM



TD = Specific Device Code
M = Date Code
■ = Pb-Free Package
(Note: Microdot may be in either location)

PIN CONNECTION



(Top View)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

NTGD4169F

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

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	30			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			21.4		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$	$T_J = 25^\circ\text{C}$		1.0	μA
			$T_J = 85^\circ\text{C}$		10	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 12\text{ V}$			100	nA

ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	0.5	0.9	1.5	V
Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			-3.4		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 4.5\text{ V}, I_D = 2.6\text{ A}$		52	90	m Ω
		$V_{GS} = 2.5\text{ V}, I_D = 2.2\text{ A}$		67	125	
Forward Transconductance	g_{FS}	$V_{DS} = 15\text{ V}, I_D = 2.6\text{ A}$		2.6		S

CHARGES, CAPACITANCES AND GATE RESISTANCE

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 15\text{ V}$		295		pF
Output Capacitance	C_{OSS}			48		
Reverse Transfer Capacitance	C_{RSS}			27		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 2.0\text{ A}$		3.7	5.5	nC
Threshold Gate Charge	$Q_{G(TH)}$			0.6		
Gate-to-Source Charge	Q_{GS}			0.9		
Gate-to-Drain Charge	Q_{GD}			0.8		

SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 1.0\text{ A}, R_G = 6.0\text{ }\Omega$		7.0		ns
Rise Time	t_r			4.0		
Turn-Off Delay Time	$t_{d(OFF)}$			14		
Fall Time	t_f			2.0		

DRAIN-TO-SOURCE CHARACTERISTICS

Forward Diode Voltage	V_{SD}	$V_{GS} = 0\text{ V}, I_S = 0.9\text{ A}$	$T_J = 25^\circ\text{C}$		0.7	1.2	V
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s}, I_S = 0.9\text{ A}$			8.0		ns
Charge Time	T_a				5.0		
Discharge Time	T_b				3.0		
Reverse Recovery Time	Q_{RR}				3.0		nC

2. Pulse Test: pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

3. Switching characteristics are independent of operating junction temperatures.

NTGD4169F

SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Maximum Instantaneous Forward Voltage	V_F	$I_F = 0.5\text{ A}$		0.41	0.45	V
		$I_F = 1.0\text{ A}$		0.46	0.53	
Maximum Instantaneous Reverse Current	I_R	$V_R = 30\text{ V}$		7.3	20	μA
		$V_R = 20\text{ V}$		2.5	8.0	

SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS ($T_J = 85^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Maximum Instantaneous Forward Voltage	V_F	$I_F = 0.5\text{ A}$		0.35		V
		$I_F = 1.0\text{ A}$		0.41		
Maximum Instantaneous Reverse Current	I_R	$V_R = 30\text{ V}$		0.4		mA
		$V_R = 20\text{ V}$		0.17		

SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS ($T_J = 125^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Maximum Instantaneous Forward Voltage	V_F	$I_F = 0.5\text{ A}$		0.31		V
		$I_F = 1.0\text{ A}$		0.39		
Maximum Instantaneous Reverse Current	I_R	$V_R = 30\text{ V}$		4.4		mA
		$V_R = 20\text{ V}$		1.6		

SCHOTTKY DIODE ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Capacitance	C	$V_R = 10\text{ V}$, $f = 1.0\text{ MHz}$		28		pF

ORDERING INFORMATION

Device	Package	Shipping [†]
NTGD4169FT1G	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.

TYPICAL CHARACTERISTICS N-CHANNEL

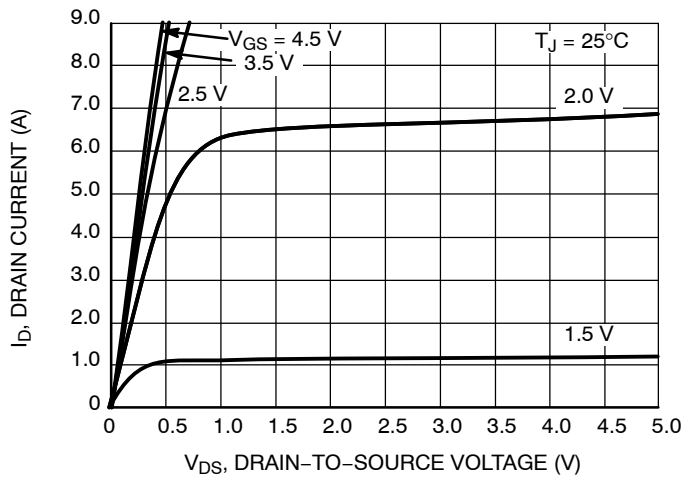


Figure 1. On-Region Characteristics

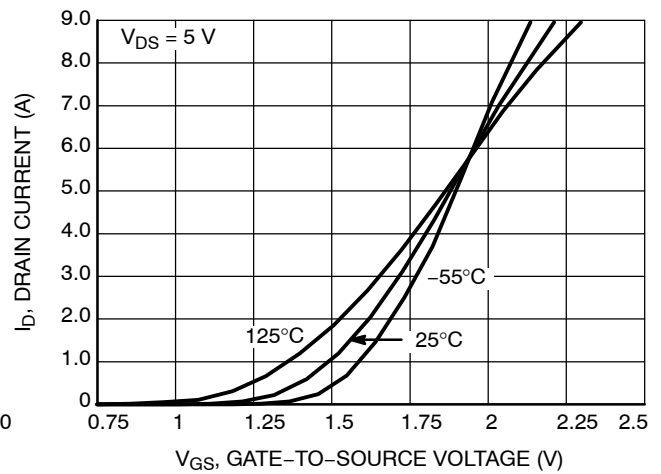


Figure 2. Transfer Characteristics

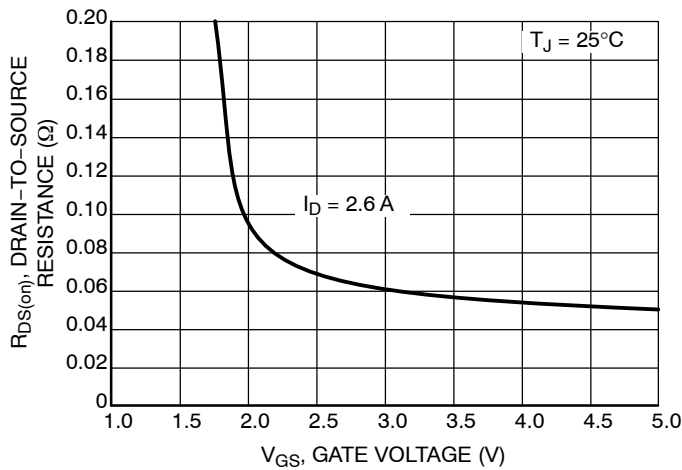


Figure 3. On-Region vs. Gate-To-Source Voltage

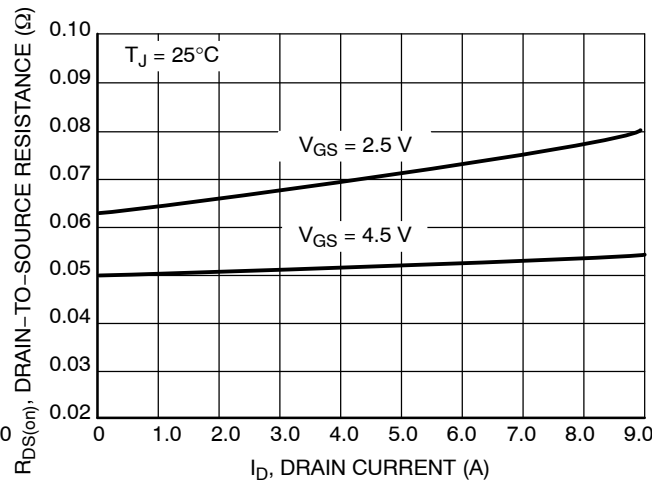


Figure 4. On-Resistance vs. Drain Current and Temperature

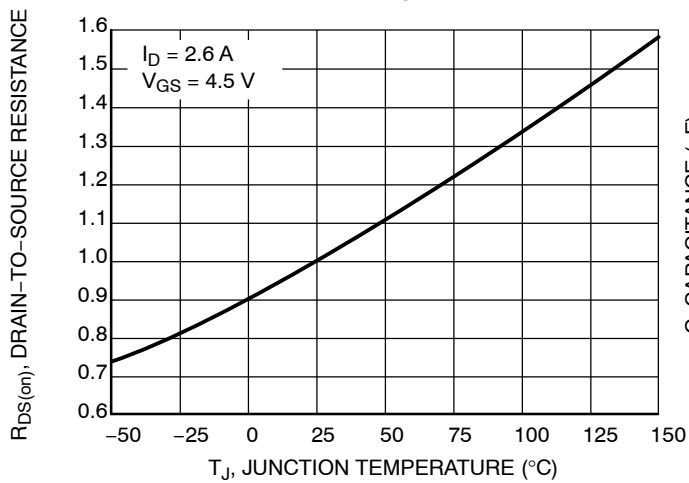


Figure 5. On-Resistance Variation with Temperature

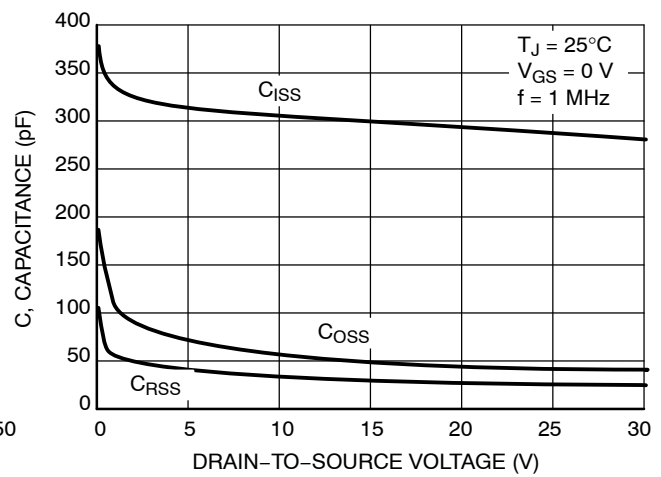


Figure 6. Capacitance Variation

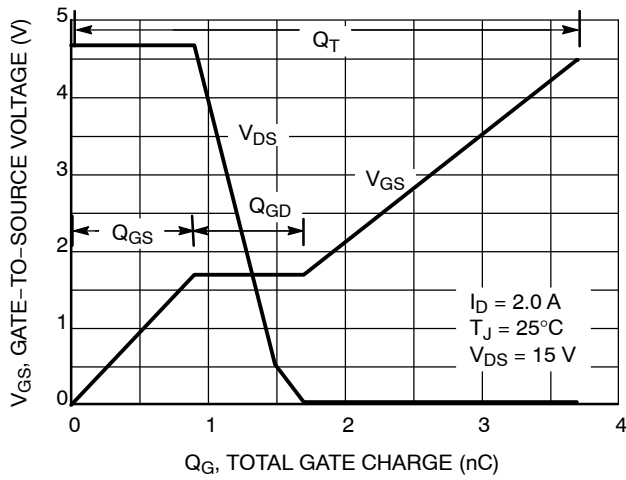


Figure 7. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

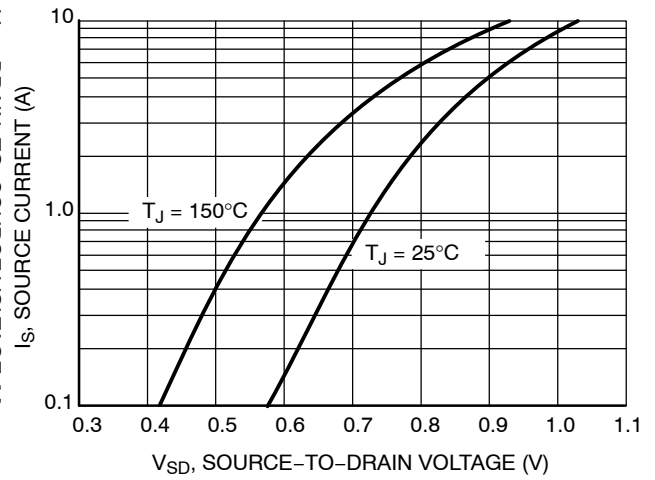


Figure 8. Diode Forward Voltage versus Current

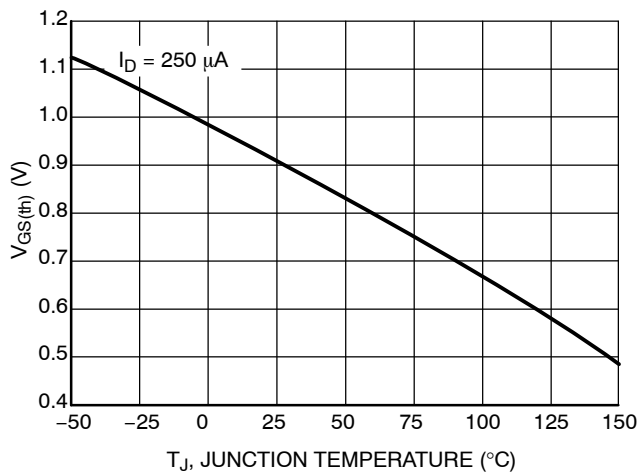


Figure 9. Threshold Voltage

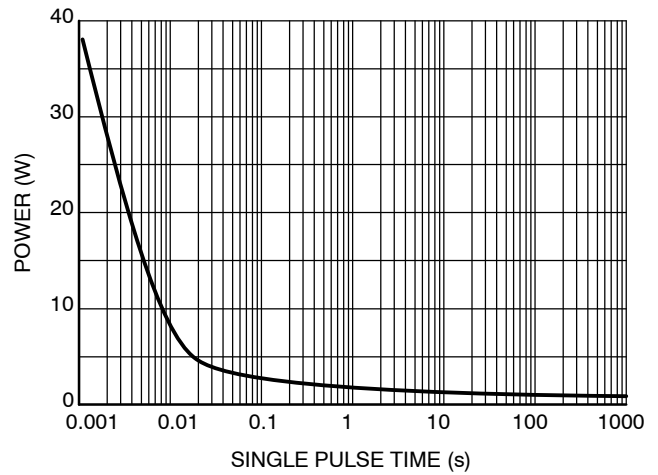


Figure 10. Single Pulse Maximum Power Dissipation

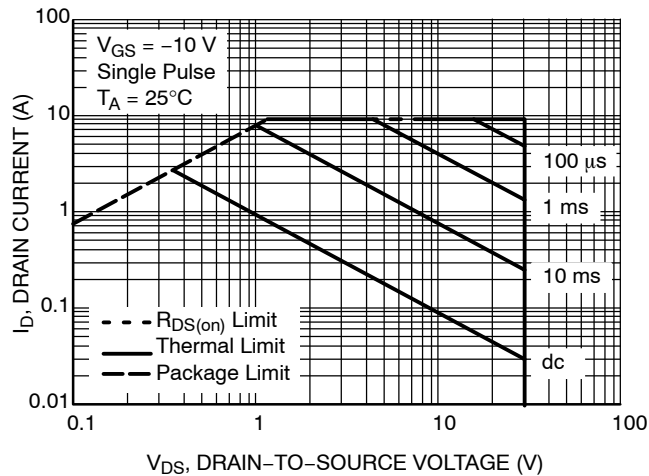


Figure 11. Maximum Rated Forward Biased Safe Operating Area

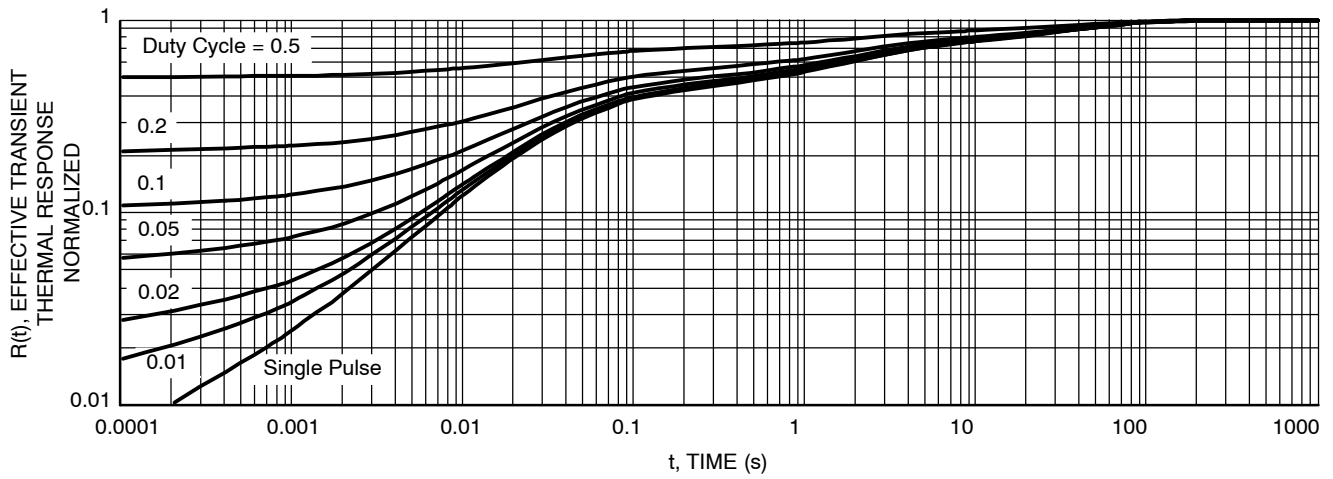


Figure 12. FET Thermal Response

TYPICAL CHARACTERISTICS SCHOTTKY

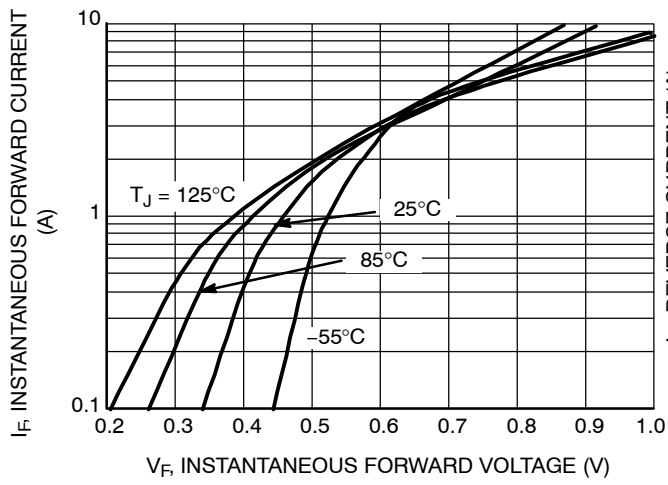


Figure 13. Typical Forward Voltage

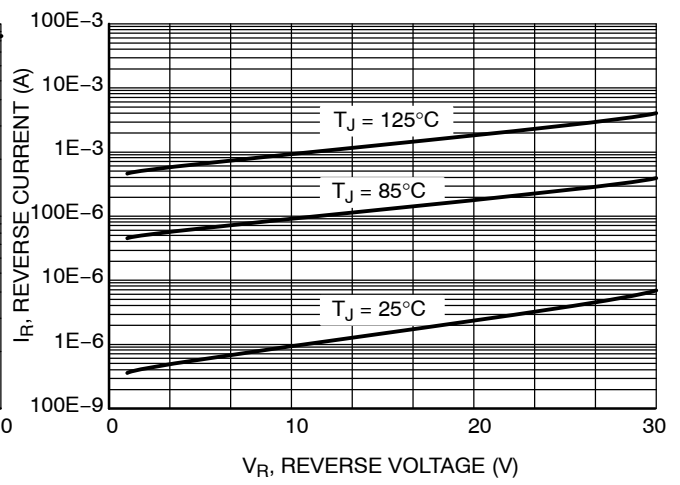
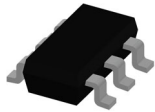
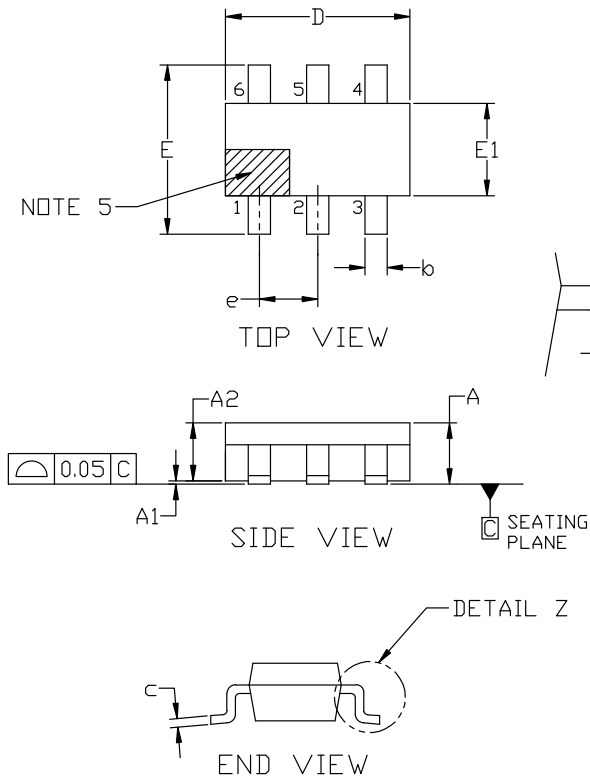


Figure 14. Typical Reverse Current



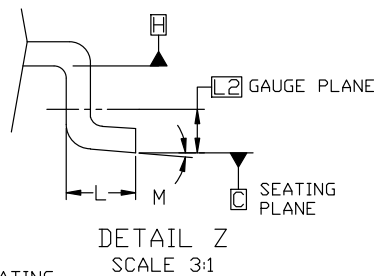
TSOP-6 3.00x1.50x0.90, 0.95P
CASE 318G
ISSUE W

DATE 26 FEB 2024

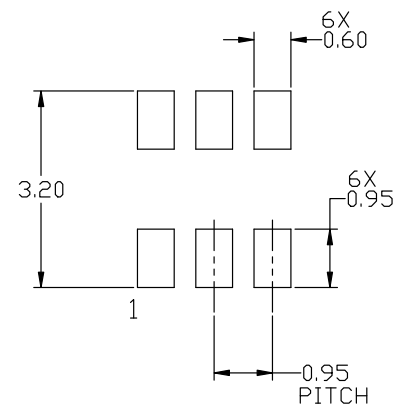


NOTES:

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 the ON Semiconductor Soldering and Mounting Techniques Reference manual, SOLDERRM/D.

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MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS



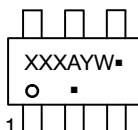
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CASE 318G

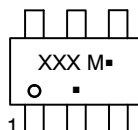
ISSUE W

DATE 26 FEB 2024

GENERIC MARKING DIAGRAM*



IC



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. 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

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