NTZD3156C

Small Signal MOSFET

20 V, 540 mA / −20 V, −430 mA Complementary N− and P−Channel MOSFETs with Integrated Pull Up/Down Resistor and ESD Protection

ON Semiconductor®

http://onsemi.com

Features

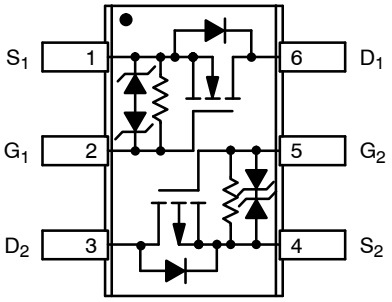
- Leading Trench Technology for Low $R_{DS(on)}$ Performance
- High Efficiency System Performance
- Low Threshold Voltage
- Integrated G−S Resistor on Both Devices
- ESD Protected Gate
- Small Footprint 1.6 x 1.6 mm
- These are Pb−Free Devices

Applications

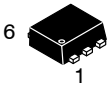
- Load/Power Switching with Level Shift
- Portable Electronic Products such as GPS, Cell Phones, DSC, PMP, Bluetooth Accessories

$V_{(BR)DSS}$	$R_{DS(on)}$ Max	I_D Max (Note 1)
N−Channel 20 V	0.55 Ω @ 4.5 V	540 mA
	0.7 Ω @ 2.5 V	
	0.9 Ω @ 1.8 V	
P−Channel −20 V	0.9 Ω @ −4.5 V	−430 mA
	1.2 Ω @ −2.5 V	
	2.0 Ω @ −1.8 V	

PINOUT: SOT−563



Top View



SOT−563−6
CASE 463A
STYLE 9

MARKING DIAGRAM

ZC = Specific Device Code
M = Date Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

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

Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	20	V
Gate−to−Source Voltage			V_{GS}	±6	V
N−Channel Continuous Drain Current (Note 1)	Steady State	T_A = 25°C	I_D	540	mA
		T_A = 85°C		390	
	t ≤ 5 s	T_A = 25°C		570	
P−Channel Continuous Drain Current (Note 1)	Steady State	T_A = 25°C		−430	
		T_A = 85°C		−310	
	t ≤ 5 s	T_A = 25°C		−455	
Power Dissipation (Note 1)	Steady State	T_A = 25°C	P_D	250	mW
	t ≤ 5 s			280	
Pulsed Drain Current	N−Channel	t_p = 10 μs	I_{DM}	1500	mA
	P−Channel			−750	
Operating Junction and Storage Temperature			T_J, T_{STG}	−55 to 150	°C
Source Current (Body Diode)			I_S	350	mA
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 [1 oz] including traces).

ORDERING INFORMATION

Device	Package	Shipping†
NTZD3156CT1G	SOT−563	4000 / Tape & Reel
NTZD3156CT2G	SOT−563	4000 / Tape & Reel
NTZD3156CT5G	SOT−563	8000 / 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.

Thermal Resistance Ratings

Parameter	Symbol	Max	Unit
Junction−to−Ambient − Steady State (Note 2)	$R_{\theta JA}$	116	°C/W
Junction−to−Ambient − t = 5 s (Note 2)		304	

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

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

Parameter	Symbol	N/P	Test Condition		Min	Typ	Max	Unit
OFF CHARACTERISTICS								
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	N	V_{GS} = 0 V	I_D = 250 μA	20			V
		P		I_D = −250 μA	−20			
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$					20		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	N	V_{GS} = 0 V, V_{DS} = 16 V	T_J = 25°C			1.0	μA
		P	V_{GS} = 0 V, V_{DS}= −16 V				−1.0	
		N	V_{GS} = 0 V, V_{DS} = 16 V	T_J = 125°C			2.0	μA
		P	V_{GS} = 0 V, V_{DS}= − 16V				−5.0	
Gate−to−Source Leakage Current	I_{GSS}	N	V_{DS} = 0 V, V_{GS} = ±4.5 V				±50	μA
		P					±50	
ON CHARACTERISTICS (Note 3)								
Gate Threshold Voltage	$V_{GS(TH)}$	N	V_{GS} = V_{DS}	I_D = 250 μA	0.45		1.0	V
		P		I_D = −250 μA	−0.45		−1.0	
Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$					2.0		−mV/°C
Drain−to−Source On Resistance	$R_{DS(on)}$	N	V_{GS} = 4.5 V, I_D = 540 mA			0.19	0.55	Ω
		P	V_{GS} = −4.5V, I_D = −430 mA			0.39	0.9	
		N	V_{GS} = 2.5 V, I_D = 500 mA			0.26	0.7	
		P	V_{GS} = −2.5V, I_D = −300 mA			0.53	1.2	
		N	V_{GS} = 1.8 V, I_D = 350 mA			0.36	0.9	
		P	V_{GS} = −1.8V, I_D = −150 mA			0.72	2.0	
Forward Transconductance	g_{FS}	N	V_{DS} = 10 V, I_D = 540 mA			1.46		S
		P	V_{DS} = −10 V, I_D = −430 mA			1.18		
CHARGES, CAPACITANCES AND GATE RESISTANCE								
Input Capacitance	C_{ISS}	N	f = 1 MHz, V_{GS} = 0 V V_{DS} = 16 V			72		pF
Output Capacitance	C_{OSS}					13		
Reverse Transfer Capacitance	C_{RSS}					10		
Input Capacitance	C_{ISS}	P	f = 1 MHz, V_{GS} = 0 V V_{DS} = −16 V			93		
Output Capacitance	C_{OSS}					15		
Reverse Transfer Capacitance	C_{RSS}					11		

3. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%

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

Parameter	Symbol	N/P	Test Condition	Min	Typ	Max	Unit
CHARGES, CAPACITANCES AND GATE RESISTANCE							
Total Gate Charge	$Q_{G(TOT)}$	N	V_{GS} = 4.5 V, V_{DS} = 10 V; I_D = 540 mA		1.39	2.5	nC
Threshold Gate Charge	$Q_{G(TH)}$				0.1		
Gate−to−Source Charge	Q_{GS}				0.26		
Gate−to−Drain Charge	Q_{GD}				0.39		
Total Gate Charge	$Q_{G(TOT)}$	P	V_{GS} = −4.5 V, V_{DS} = −10 V; I_D = −430 mA		1.49	2.5	
Threshold Gate Charge	$Q_{G(TH)}$				0.1		
Gate−to−Source Charge	Q_{GS}				0.3		
Gate−to−Drain Charge	Q_{GD}				0.37		
SWITCHING CHARACTERISTICS (V_{GS} = V) (Note 4)							
Turn−On Delay Time	$t_{d(ON)}$	N	V_{GS} = 4.5 V, V_{DD} = 10 V, I_D = 540 mA, R_G = 10 Ω		7.7		ns
Rise Time	t_r				5.3		
Turn−Off Delay Time	$t_{d(OFF)}$				21		
Fall Time	t_f				10		
Turn−On Delay Time	$t_{d(ON)}$	P	V_{GS} = −4.5 V, V_{DD} = −10 V, I_D = −430 mA, R_G = 10 Ω		9.2		
Rise Time	t_r				6.5		
Turn−Off Delay Time	$t_{d(OFF)}$				29		
Fall Time	t_f				19.5		
Drain−Source Diode Characteristics							
Forward Diode Voltage	V_{SD}	N	V_{GS} = 0 V, T_J = 25°C	I_S = 350 mA	0.77	1.2	V
		P		I_S = −350 mA	−0.77	−1.2	
		N	V_{GS} = 0 V, T_J = 125°C	I_S = 350 mA	0.65		
		P		I_S = −350 mA	0.63		
Reverse Recovery Time	t_{RR}	N	V_{GS} = 0 V, dIS/dt = 100 A/μs	I_S = 350 mA	9.4		ns
		P		I_S = −350 mA	14.6		

4. Switching characteristics are independent of operating junction temperatures

N−CHANNEL TYPICAL PERFORMANCE CURVES (T_J = 25°C unless otherwise noted)

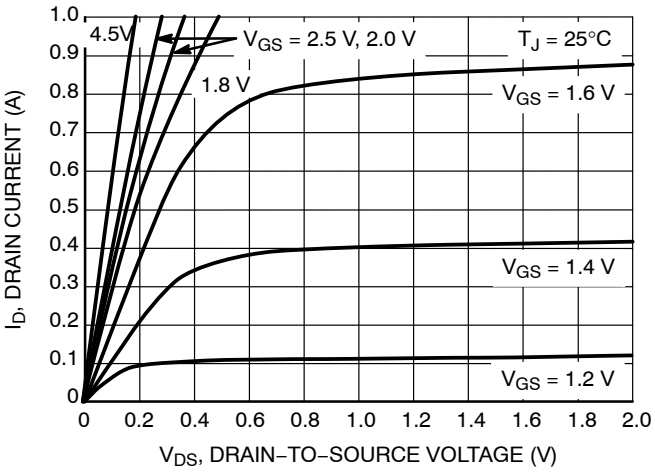


Figure 1. On−Region Characteristics

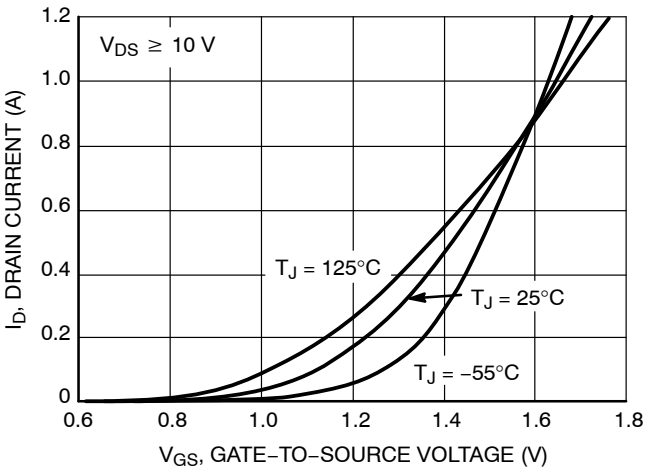


Figure 2. Transfer Characteristics

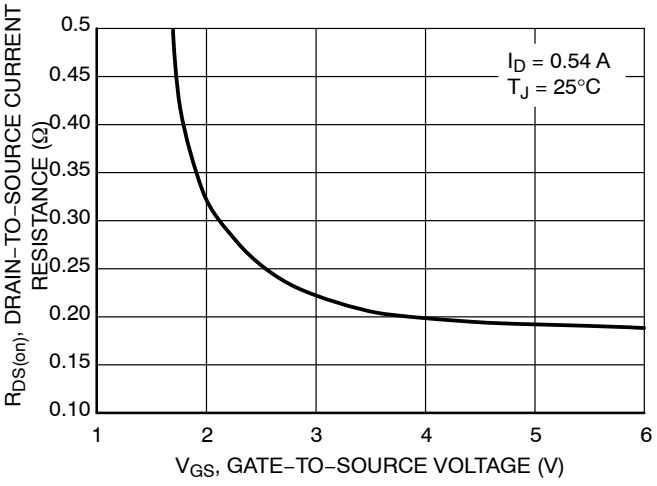


Figure 3. On−Resistance versus Gate−to−Source Voltage

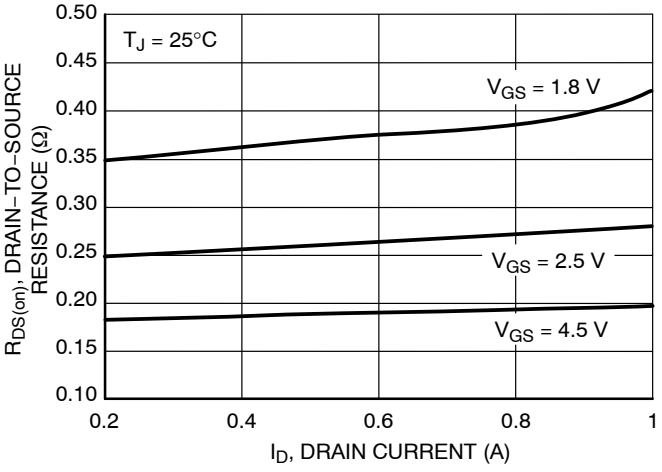


Figure 4. On−Resistance versus Drain Current and Gate Voltage

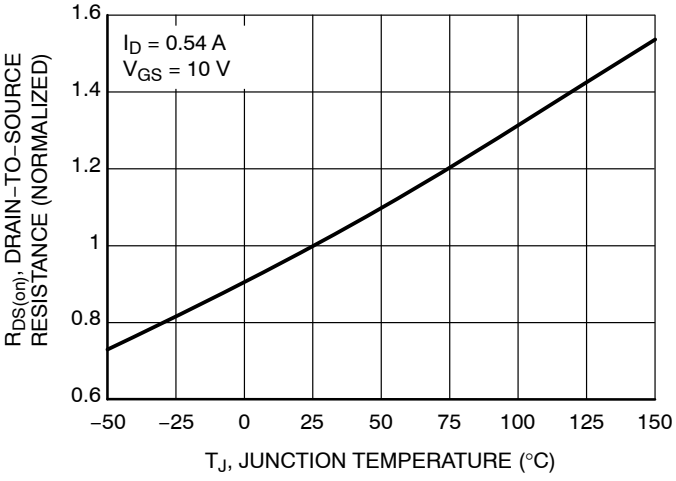


Figure 5. On−Resistance Variation with Temperature

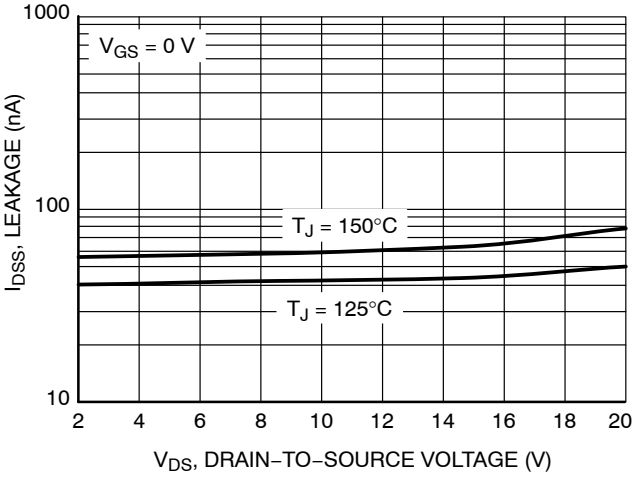


Figure 6. Drain−to−Source Leakage Current versus Voltage

N−CHANNEL TYPICAL PERFORMANCE CURVES (T_J = 25°C unless otherwise noted)

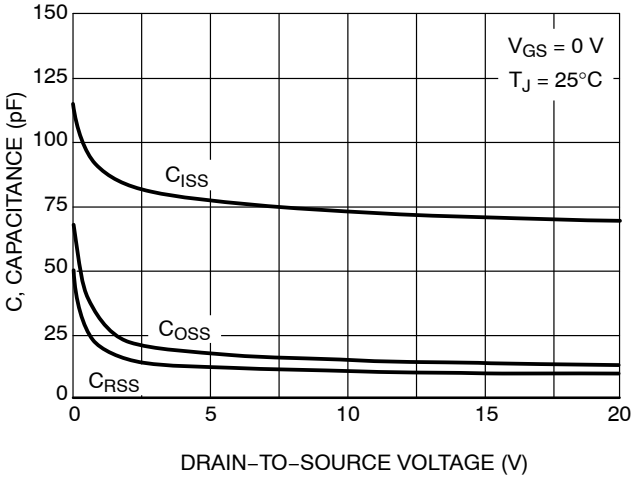


Figure 7. Capacitance Variation

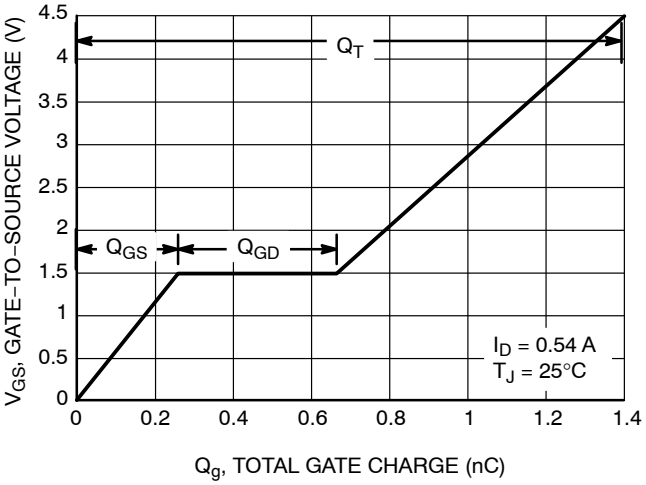


Figure 8. Gate−to−Source and Drain−to−Source Voltage versus Total Charge

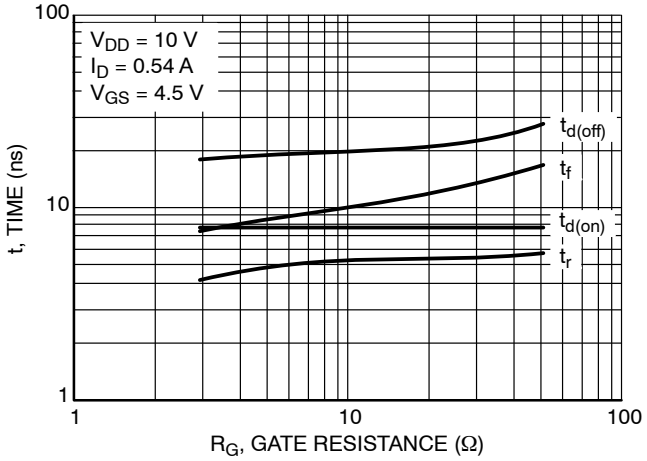


Figure 9. Resistive Switching Time Variation versus Gate Resistance

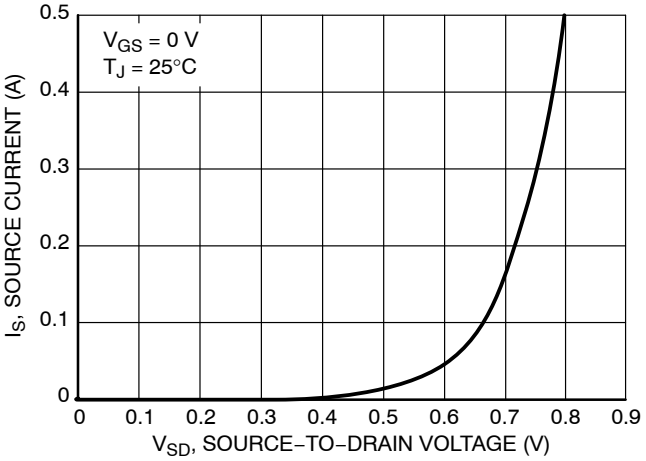


Figure 10. Diode Forward Voltage versus Current

P−CHANNEL TYPICAL PERFORMANCE CURVES (T_J = 25°C unless otherwise noted)

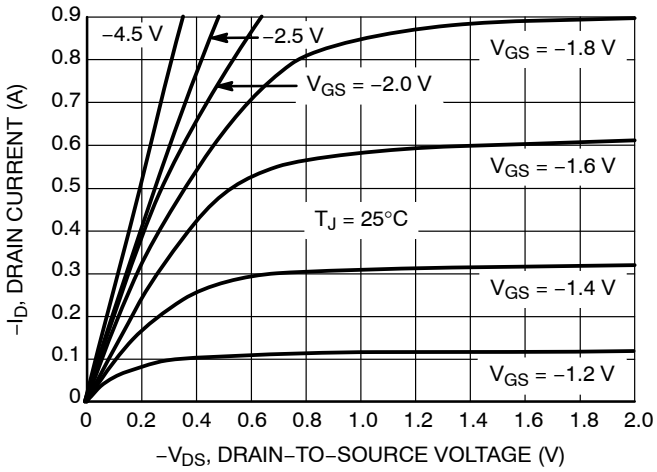


Figure 11. On−Region Characteristics

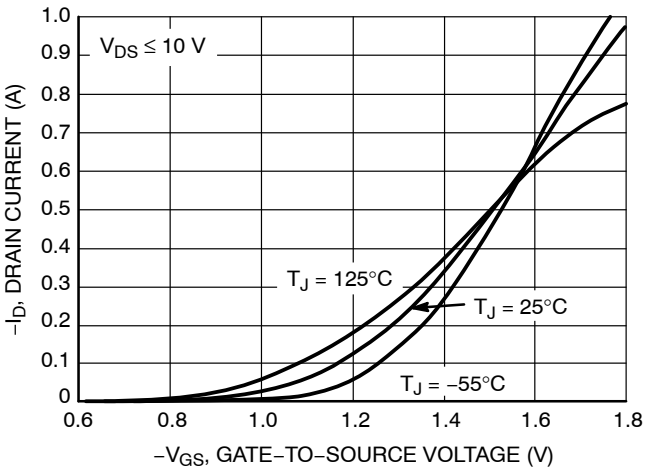


Figure 12. Transfer Characteristics

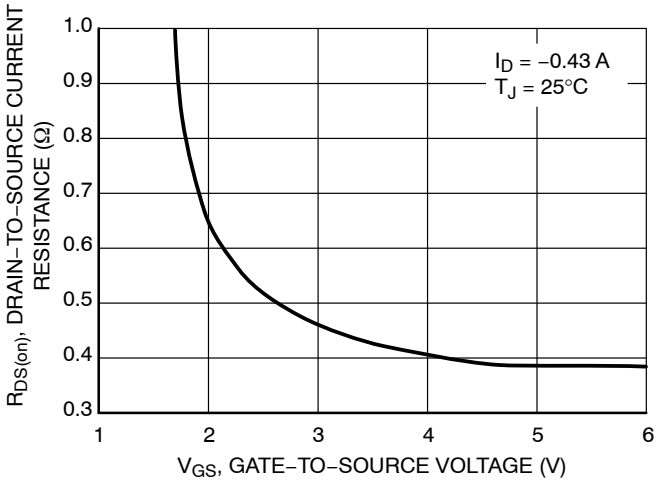


Figure 13. On−Resistance versus Gate−to−Source Voltage

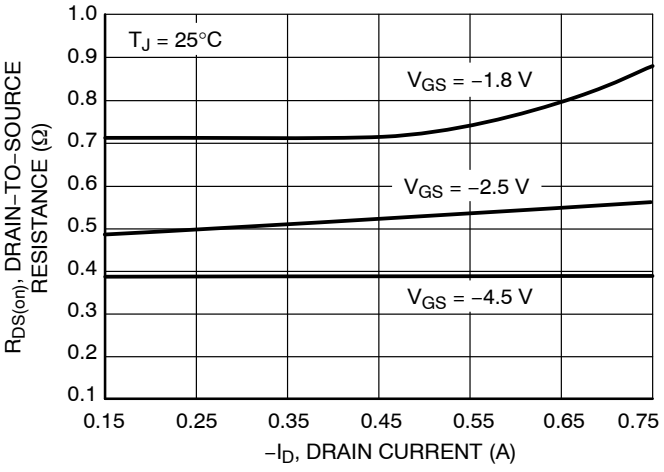


Figure 14. On−Resistance versus Drain Current and Gate Voltage

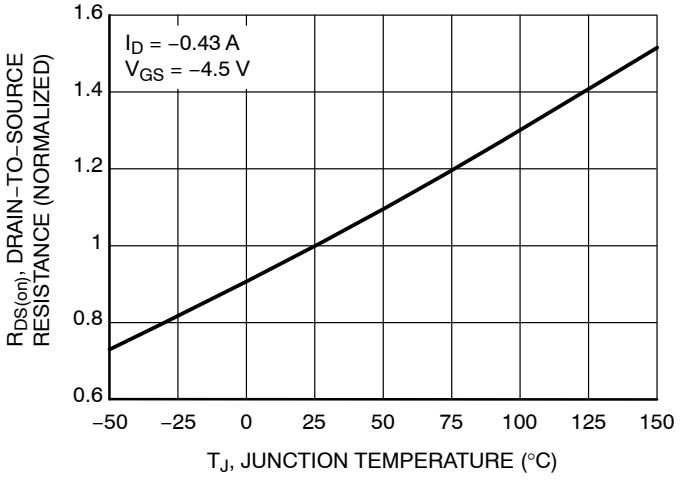


Figure 15. On−Resistance Variation with Temperature

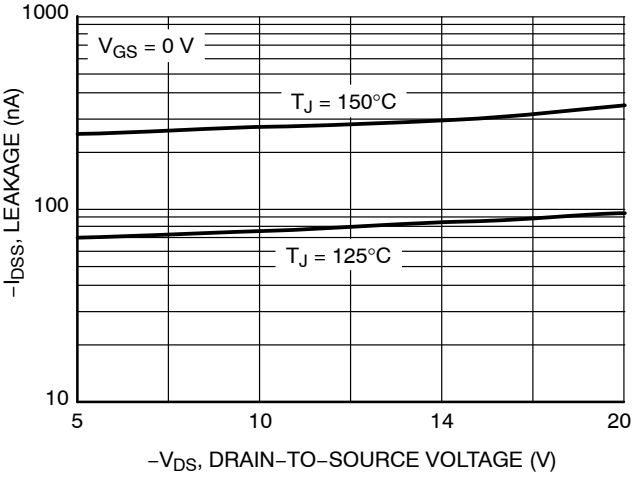


Figure 16. Drain−to−Source Leakage Current versus Voltage

P−CHANNEL TYPICAL PERFORMANCE CURVES (T_J = 25°C unless otherwise noted)

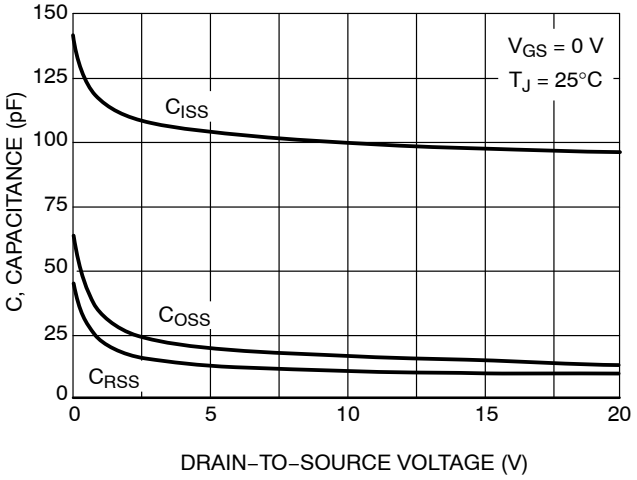


Figure 17. Capacitance Variation

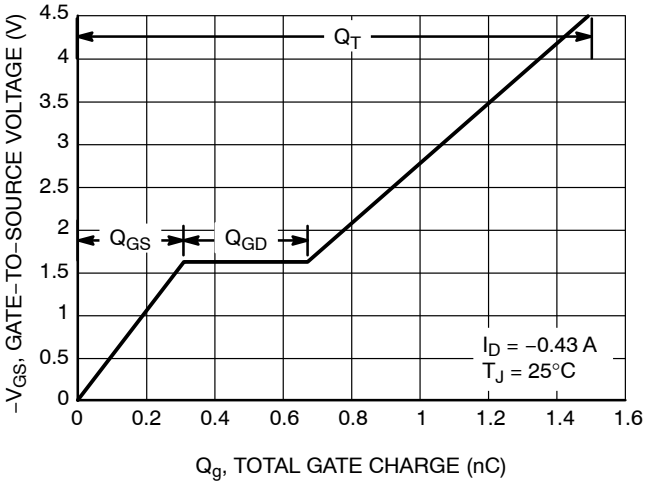


Figure 18. Gate−to−Source and Drain−to−Source Voltage versus Total Charge

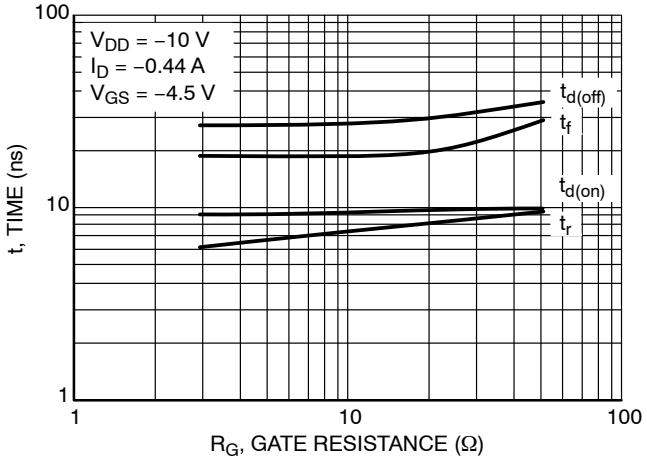


Figure 19. Resistive Switching Time Variation versus Gate Resistance

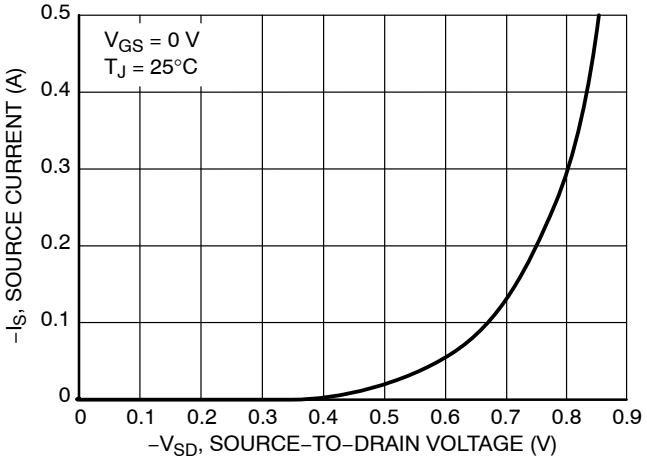
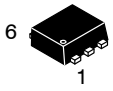


Figure 20. Diode Forward Voltage versus Current

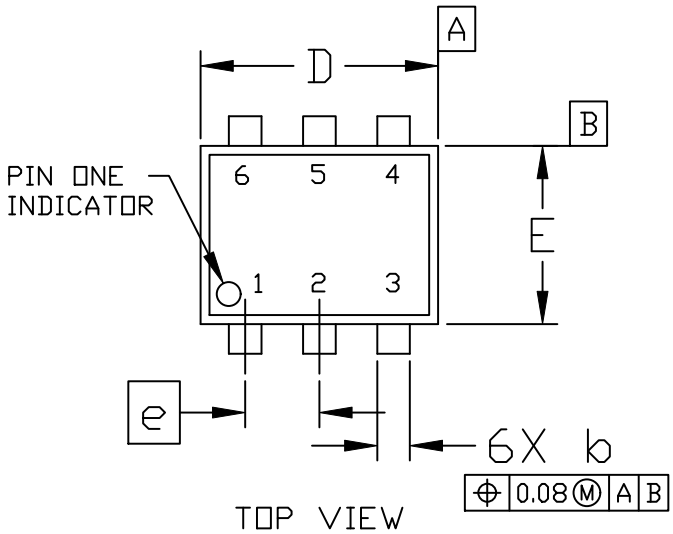


SCALE 4:1

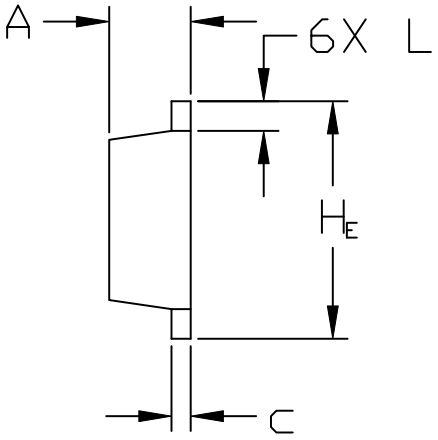
SOT−563, 6 LEAD
CASE 463A
ISSUE H

DATE 26 JAN 2021

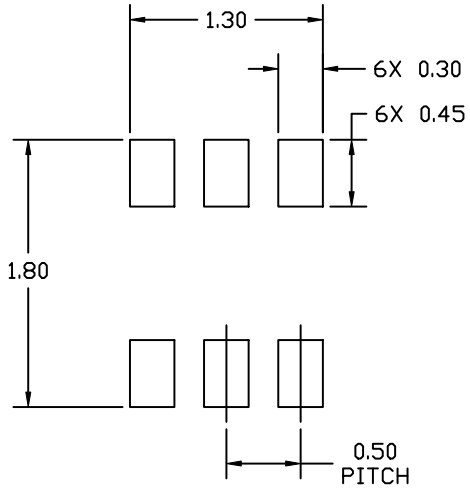
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.



TOP VIEW



SIDE VIEW



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.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.50	0.55	0.60
b	0.17	0.22	0.27
c	0.08	0.13	0.18
D	1.50	1.60	1.70
E	1.10	1.20	1.30
e	0.50 BSC		
L	0.10	0.20	0.30
H_E	1.50	1.60	1.70

SOT−563, 6 LEAD
CASE 463A
ISSUE H

DATE 26 JAN 2021

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

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

STYLE 3:
PIN 1. CATHODE 1
2. CATHODE 1
3. ANODE/ANODE 2
4. CATHODE 2
5. CATHODE 2
6. ANODE/ANODE 1

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

STYLE 5:
PIN 1. CATHODE
2. CATHODE
3. ANODE
4. ANODE
5. CATHODE
6. CATHODE

STYLE 6:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. CATHODE
5. CATHODE
6. CATHODE

STYLE 7:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. CATHODE
5. ANODE
6. CATHODE

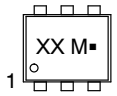
STYLE 8:
PIN 1. DRAIN
2. DRAIN
3. GATE
4. SOURCE
5. DRAIN
6. DRAIN

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

STYLE 10:
PIN 1. CATHODE 1
2. N/C
3. CATHODE 2
4. ANODE 2
5. N/C
6. ANODE 1

STYLE 11:
PIN 1. EMITTER 2
2. BASE 2
3. COLLECTOR 1
4. EMITTER 1
5. BASE 1
6. COLLECTOR 2

GENERIC MARKING DIAGRAM*



XX = Specific Device Code
M = Month 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:	SOT−563, 6 LEAD	PAGE 2 OF 2

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Email Requests to: orderlit@onsemi.com

onsemi Website: www.onsemi.com

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Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:
Phone: 00421 33 790 2910
For additional information, please contact your local Sales Representative

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