

# NTJD4105C

## MOSFET – Small Signal, Complementary, SC-88 20 V / -8.0 V, +0.63 A / -0.775 A

### Features

- Complementary N and P Channel Device
- Leading -8.0 V Trench for Low  $R_{DS(on)}$  Performance
- ESD Protected Gate – ESD Rating: Class 1
- SC-88 Package for Small Footprint (2 x 2 mm)
- Pb-Free Packages are Available

### Applications

- DC-DC Conversion
- Load/Power Switching
- Single or Dual Cell Li-Ion Battery Supplied Devices
- Cell Phones, MP3s, Digital Cameras, PDAs

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

Parameter		Symbol	Value	Unit
Drain-to-Source Voltage	N-Ch	$V_{DS}$	20	V
	P-Ch		-8.0	
Gate-to-Source Voltage	N-Ch	$V_{GS}$	$\pm 12$	V
	P-Ch		$\pm 8.0$	
Continuous Drain Current – Steady State (Based on $R_{\theta JA}$ )	N-Ch	$T_A = 25^\circ\text{C}$	0.63	A
		$T_A = 85^\circ\text{C}$	0.46	
	P-Ch	$T_A = 25^\circ\text{C}$	-0.775	
		$T_A = 85^\circ\text{C}$	-0.558	
Continuous Drain Current – Steady State (Based on $R_{\theta JL}$ )	N-Ch	$T_A = 25^\circ\text{C}$	0.91	
		$T_A = 85^\circ\text{C}$	0.65	
	P-Ch	$T_A = 25^\circ\text{C}$	-1.1	
		$T_A = 85^\circ\text{C}$	-0.8	
Pulsed Drain Current	$tp \leq 10 \mu\text{s}$	$I_{DM}$	$\pm 1.2$	A
Power Dissipation – Steady State (Based on $R_{\theta JA}$ )	$T_A = 25^\circ\text{C}$	$P_D$	0.27	W
	$T_A = 85^\circ\text{C}$		0.14	
Power Dissipation – Steady State (Based on $R_{\theta JL}$ )	$T_A = 25^\circ\text{C}$		0.55	
	$T_A = 85^\circ\text{C}$		0.29	
Operating Junction and Storage Temperature		$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$
Source Current (Body Diode)	N-Ch	$I_S$	0.63	A
	P-Ch		-0.775	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		$T_L$	260	$^\circ\text{C}$

### THERMAL RESISTANCE RATINGS (Note 1)

Junction-to-Ambient – Steady State	Typ	$R_{\theta JA}$	400	$^\circ\text{C/W}$
	Max		460	
Junction-to-Lead (Drain) – Steady State	Typ	$R_{\theta JL}$	194	
	Max		226	

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 oz Cu area = 0.9523 in sq.

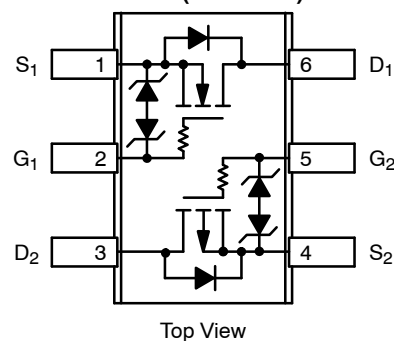


ON Semiconductor®

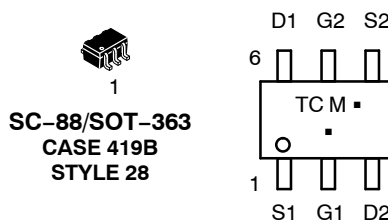
<http://onsemi.com>

$V_{(BR)DS}$	$R_{DS(on)}$ TYP	$I_D$ Max
N-Ch 20 V	0.29 $\Omega$ @ 4.5 V	0.63 A
	0.36 $\Omega$ @ 2.5 V	
P-Ch -8.0 V	0.22 $\Omega$ @ -4.5 V	-0.775 A
	0.32 $\Omega$ @ -2.5 V	
	0.51 $\Omega$ @ -1.8 V	

SOT-363  
SC-88 (6-LEADS)



### MARKING DIAGRAM & PIN ASSIGNMENT



TC = Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

# NTJD4105C

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

Parameter	Symbol	N/P	Test Condition	Min	Typ	Max	Units
<b>OFF CHARACTERISTICS</b>							
Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	N	V <sub>GS</sub> = 0 V	I <sub>D</sub> = 250 μA	20	27	V
		P		I <sub>D</sub> = -250 μA	-8.0	-10.5	
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> / T <sub>J</sub>	N			22		mV/°C
		P			-6.0		
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	N	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 16 V	T <sub>J</sub> = 25 °C		1.0	μA
		P	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = -6.4 V			1.0	
Gate-to-Source Leakage Current	I <sub>GSS</sub>	N	V <sub>DS</sub> = 0 V	V <sub>GS</sub> = ±12 V		10	μA
		P		V <sub>GS</sub> = ±8.0		10	

## ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	N	V <sub>GS</sub> = V <sub>DS</sub>	I <sub>D</sub> = 250 μA	0.6	0.92	1.5	V
		P		I <sub>D</sub> = -250 μA	-0.45	-0.83	-1.0	
Gate Threshold Temperature Coefficient	V <sub>GS(TH)</sub> / T <sub>J</sub>	N				-2.1		-mV/°C
		P				2.2		
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	N	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 0.63 A			0.29	0.375	Ω
		P	V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -0.57 A			0.22	0.30	
		N	V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 0.40 A			0.36	0.445	
		P	V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -0.48 A			0.32	0.46	
		P	V <sub>GS</sub> = -1.8 V, I <sub>D</sub> = -0.20 A			0.51	0.90	
Forward Transconductance	g <sub>FS</sub>	N	V <sub>DS</sub> = 4.0 V, I <sub>D</sub> = 0.63 A			2.0		S
		P	V <sub>DS</sub> = -4.0 V, I <sub>D</sub> = -0.57 A			2.0		

## CHARGES AND CAPACITANCES

Input Capacitance	C <sub>ISS</sub>	N	f = 1 MHz, V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 20 V		33	46	pF
		P		V <sub>DS</sub> = -8.0 V		160	225	
Output Capacitance	C <sub>OSS</sub>	N		V <sub>DS</sub> = 20 V		13	22	
		P		V <sub>DS</sub> = -8.0 V		38	55	
Reverse Transfer Capacitance	C <sub>RSS</sub>	N		V <sub>DS</sub> = 20 V		2.8	5.0	
		P		V <sub>DS</sub> = -8.0 V		28	40	
Total Gate Charge	Q <sub>G(TOT)</sub>	N		V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 10 V, I <sub>D</sub> = 0.7 A		1.3	3.0	nC
		P		V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -5.0 V, I <sub>D</sub> = -0.6 A		2.2	4.0	
Threshold Gate Charge	Q <sub>G(TH)</sub>	N		V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 10 V, I <sub>D</sub> = 0.7 A		0.1		
		P		V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -5.0 V, I <sub>D</sub> = -0.6 A		0.1		
Gate-to-Source Charge	Q <sub>GS</sub>	N		V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 10 V, I <sub>D</sub> = 0.7 A		0.2		
		P		V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -5.0 V, I <sub>D</sub> = -0.6 A		0.5		
Gate-to-Drain Charge	Q <sub>GD</sub>	N		V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 10 V, I <sub>D</sub> = 0.7 A		0.4		
		P		V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -5.0 V, I <sub>D</sub> = -0.6 A		0.5		

## SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	t <sub>d(ON)</sub>	N	V <sub>GS</sub> = 4.5 V, V <sub>DD</sub> = 10 V, I <sub>D</sub> = 0.5 A, R <sub>G</sub> = 20 Ω		0.083		μs
Rise Time	t <sub>r</sub>				0.227		
Turn-Off Delay Time	t <sub>d(OFF)</sub>				0.786		
Fall Time	t <sub>f</sub>				0.506		
Turn-On Delay Time	t <sub>d(ON)</sub>	P	V <sub>GS</sub> = -4.5 V, V <sub>DD</sub> = -4.0 V, I <sub>D</sub> = -0.5 A, R <sub>G</sub> = 8.0 Ω		0.013		
Rise Time	t <sub>r</sub>				0.023		
Turn-Off Delay Time	t <sub>d(OFF)</sub>				0.050		
Fall Time	t <sub>f</sub>				0.036		

## DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V <sub>SD</sub>	N	V <sub>GS</sub> = 0 V, T <sub>J</sub> = 25°C	I <sub>S</sub> = 0.23 A		0.76	1.1	V
		P		I <sub>S</sub> = -0.23 A		0.76	1.1	
		N	V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125°C	I <sub>S</sub> = 0.23 A		0.63		
		P		I <sub>S</sub> = -0.23 A		0.63		
Reverse Recovery Time	t <sub>RR</sub>	N	V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 90 A/μs	I <sub>S</sub> = 0.23 A		0.410		μs
		P		I <sub>S</sub> = -0.23 A		0.078		

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

3. Switching characteristics are independent of operating junction temperatures.

TYPICAL N-CHANNEL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

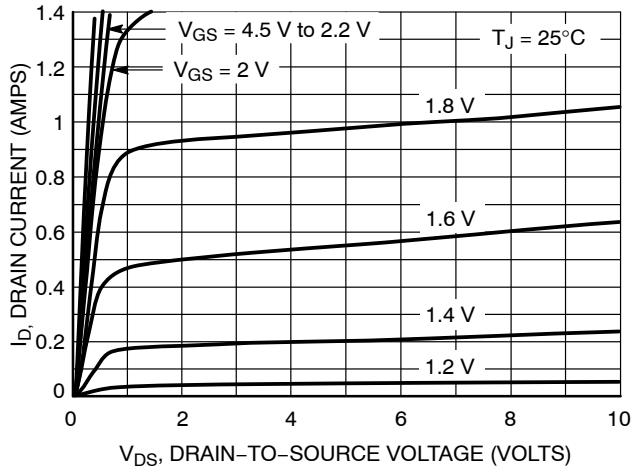


Figure 1. On-Region Characteristics

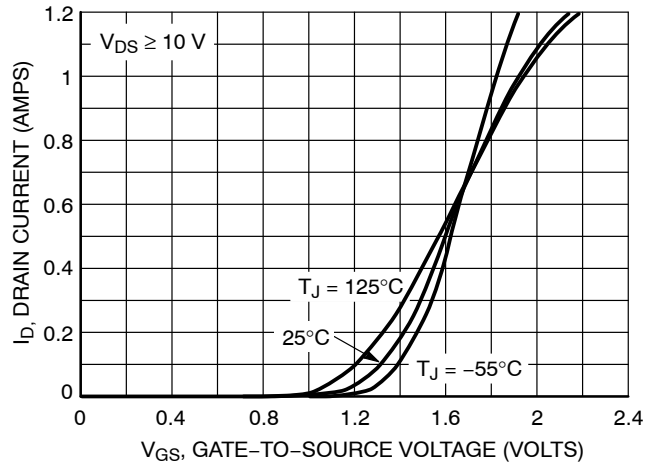


Figure 2. Transfer Characteristics

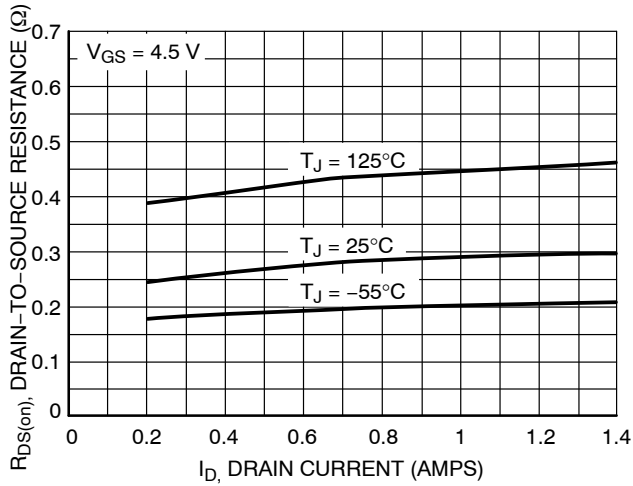


Figure 3. On-Resistance vs. Drain Current and Temperature

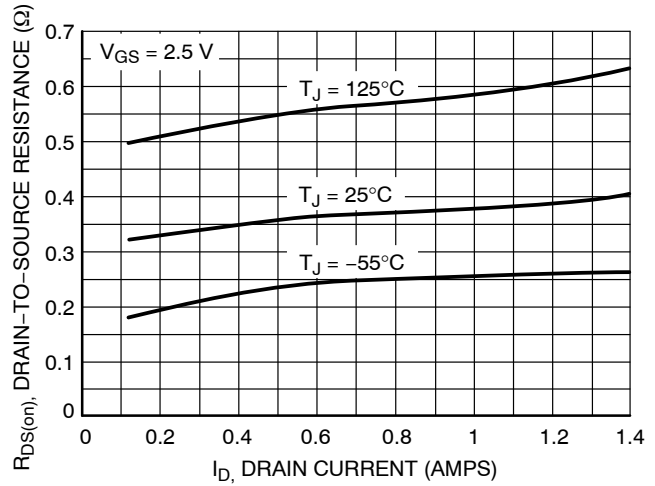


Figure 4. On-Resistance vs. Drain Current and Temperature

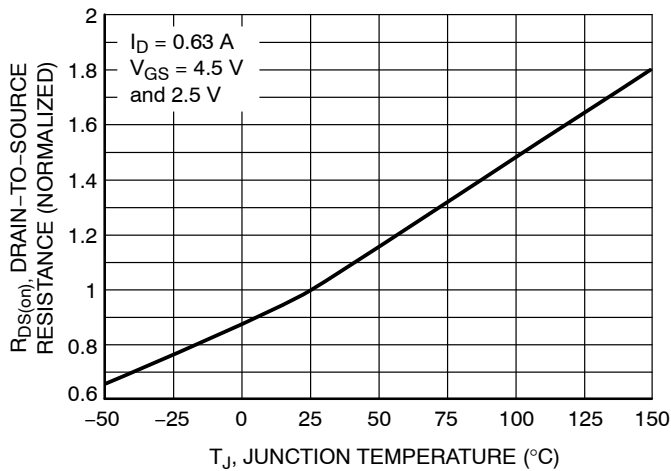


Figure 5. On-Resistance Variation with Temperature

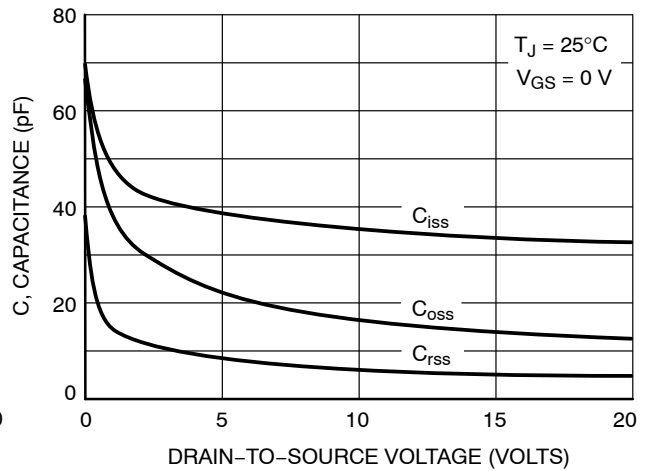
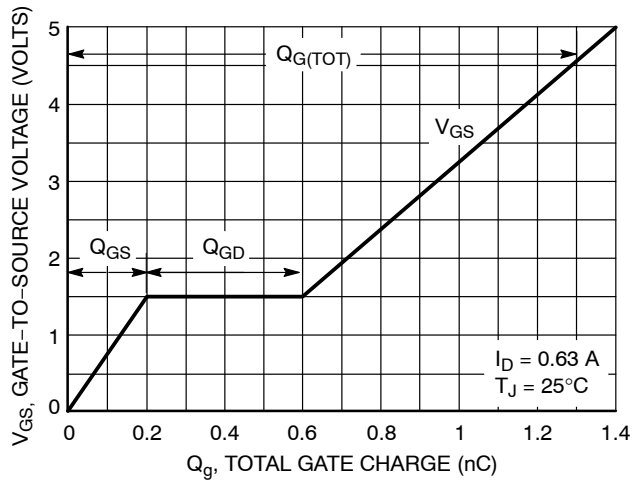
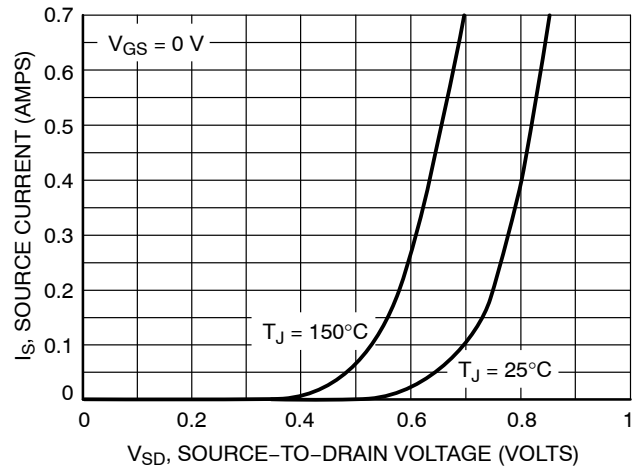


Figure 6. Capacitance Variation

TYPICAL N-CHANNEL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$  unless otherwise noted)



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



**Figure 8. Diode Forward Voltage vs. Current**

TYPICAL P-CHANNEL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

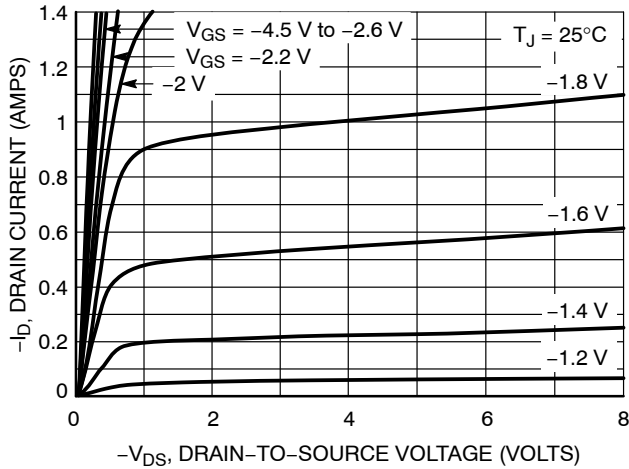


Figure 9. On-Region Characteristics

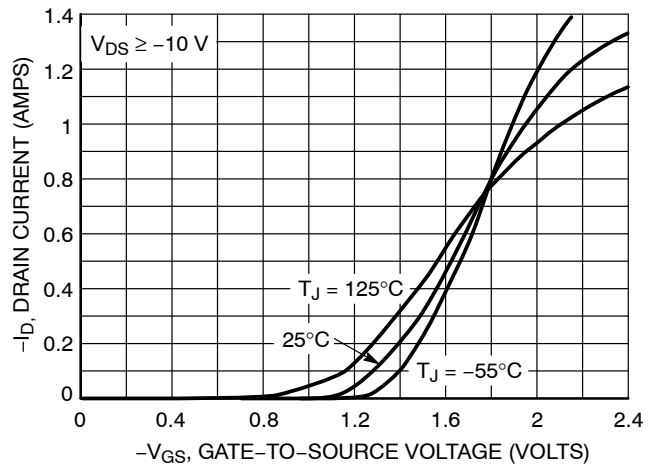


Figure 10. Transfer Characteristics

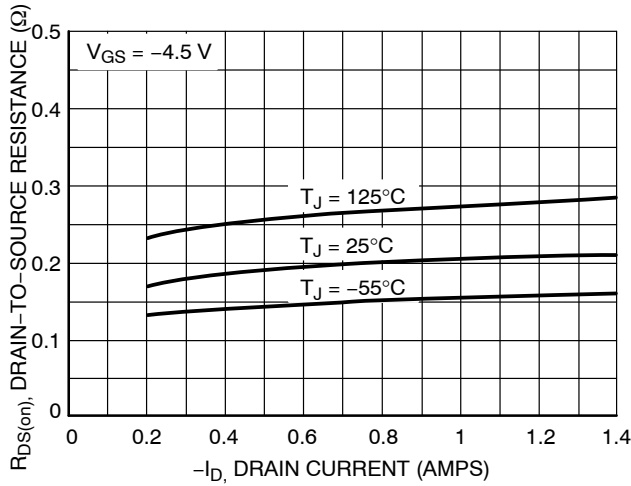


Figure 11. On-Resistance vs. Drain Current and Temperature

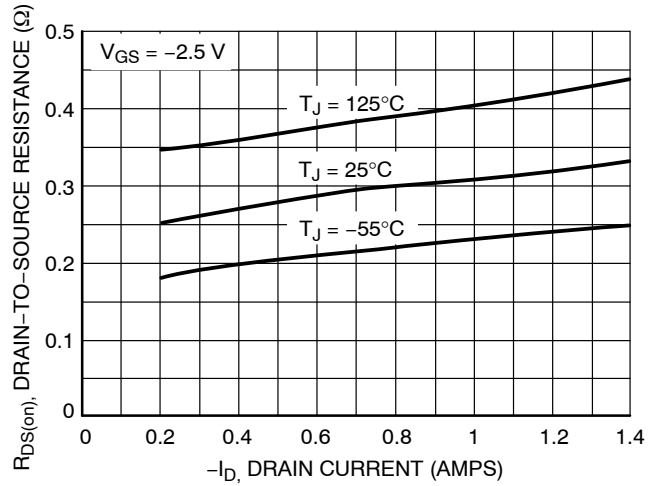


Figure 12. On-Resistance vs. Drain Current and Temperature

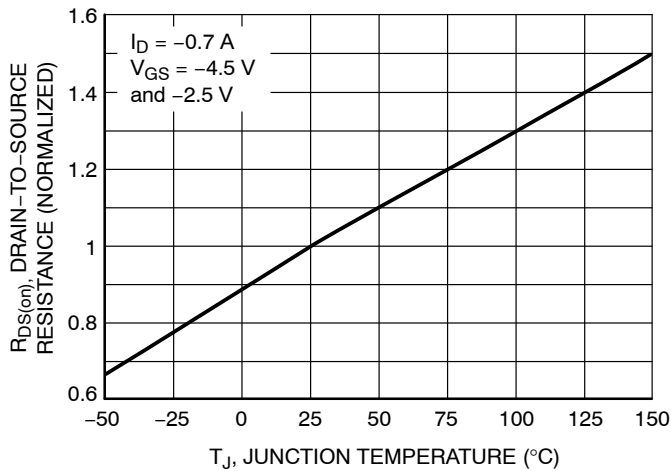


Figure 13. On-Resistance Variation with Temperature

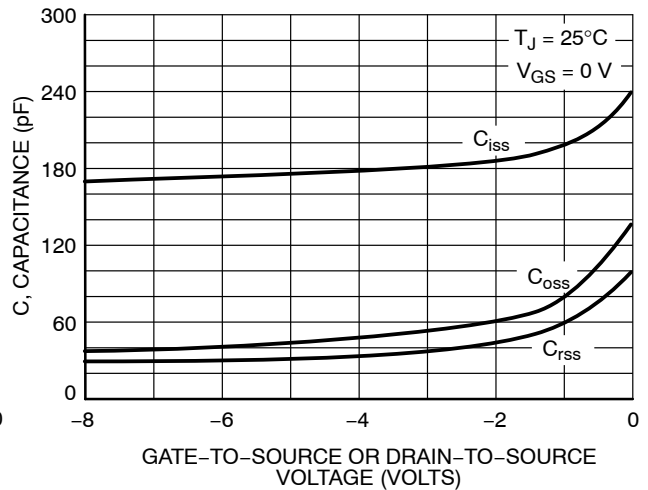
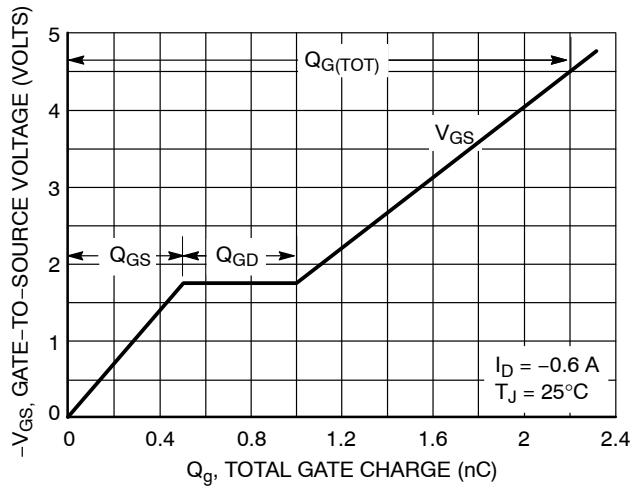
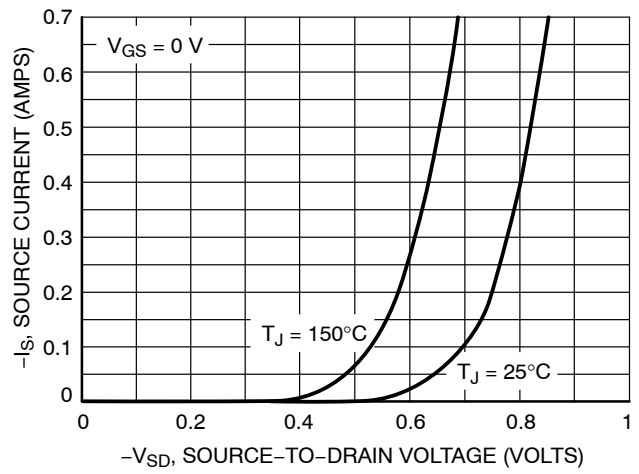


Figure 14. Capacitance Variation

TYPICAL P-CHANNEL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$  unless otherwise noted)



**Figure 15. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge**



**Figure 16. Diode Forward Voltage vs. Current**

## NTJD4105C

### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
NTJD4105CT1	SOT-363	3000 / Tape & Reel
NTJD4105CT1G	SOT-363 (Pb-Free)	3000 / Tape & Reel
NTJD4105CT2	SOT-363	3000 / Tape & Reel
NTJD4105CT2G	SOT-363 (Pb-Free)	3000 / Tape & Reel
NTJD4105CT4	SOT-363	10,000 / Tape & Reel
NTJD4105CT4G	SOT-363 (Pb-Free)	10,000 / Tape & Reel

<sup>†</sup>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.

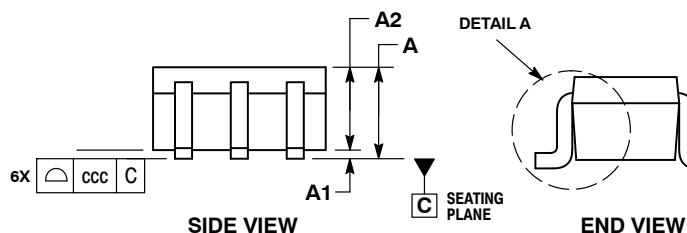
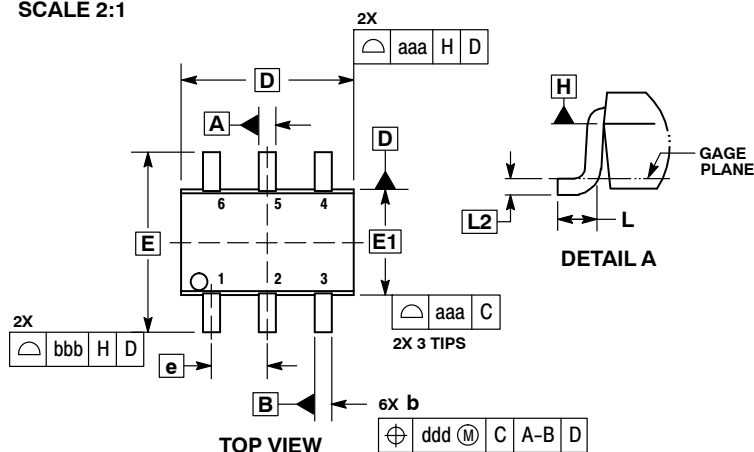
# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 2:1

SC-88/SC70-6/SOT-363  
CASE 419B-02  
ISSUE Y

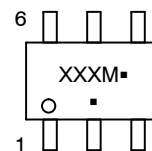
DATE 11 DEC 2012



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
  4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H.
  5. DATUMS A AND B ARE DETERMINED AT DATUM H.
  6. DIMENSIONS b AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP.
  7. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION b AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	---	---	1.10	---	---	0.043
A1	0.00	---	0.10	0.000	---	0.004
A2	0.70	0.90	1.00	0.027	0.035	0.039
b	0.15	0.20	0.25	0.006	0.008	0.010
C	0.08	0.15	0.22	0.003	0.006	0.009
D	1.80	2.00	2.20	0.070	0.078	0.086
E	2.00	2.10	2.20	0.078	0.082	0.086
E1	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65 BSC			0.026 BSC		
L	0.26	0.36	0.46	0.010	0.014	0.018
L2	0.15 BSC			0.006 BSC		
aaa	0.15			0.006		
bbb	0.30			0.012		
ccc	0.10			0.004		
ddd	0.10			0.004		

## GENERIC MARKING DIAGRAM\*



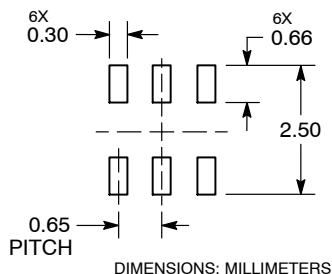
XXX = Specific Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing location.

\*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.

## RECOMMENDED SOLDERING 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.

STYLES ON PAGE 2

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DESCRIPTION:	SC-88/SC70-6/SOT-363	PAGE 1 OF 2

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**SC-88/SC70-6/SOT-363**  
**CASE 419B-02**  
**ISSUE Y**

DATE 11 DEC 2012

<b>STYLE 1:</b> PIN 1. EMITTER 2 2. BASE 2 3. COLLECTOR 1 4. EMITTER 1 5. BASE 1 6. COLLECTOR 2	<b>STYLE 2:</b> CANCELLED	<b>STYLE 3:</b> CANCELLED	<b>STYLE 4:</b> PIN 1. CATHODE 2. CATHODE 3. COLLECTOR 4. EMITTER 5. BASE 6. ANODE	<b>STYLE 5:</b> PIN 1. ANODE 2. ANODE 3. COLLECTOR 4. EMITTER 5. BASE 6. CATHODE	<b>STYLE 6:</b> PIN 1. ANODE 2 2. N/C 3. CATHODE 1 4. ANODE 1 5. N/C 6. CATHODE 2
<b>STYLE 7:</b> PIN 1. SOURCE 2 2. DRAIN 2 3. GATE 1 4. SOURCE 1 5. DRAIN 1 6. GATE 2	<b>STYLE 8:</b> CANCELLED	<b>STYLE 9:</b> PIN 1. EMITTER 2 2. EMITTER 1 3. COLLECTOR 1 4. BASE 1 5. BASE 2 6. COLLECTOR 2	<b>STYLE 10:</b> PIN 1. SOURCE 2 2. SOURCE 1 3. GATE 1 4. DRAIN 1 5. DRAIN 2 6. GATE 2	<b>STYLE 11:</b> PIN 1. CATHODE 2 2. CATHODE 2 3. ANODE 1 4. CATHODE 1 5. CATHODE 1 6. ANODE 2	<b>STYLE 12:</b> PIN 1. ANODE 2 2. ANODE 2 3. CATHODE 1 4. ANODE 1 5. ANODE 1 6. CATHODE 2
<b>STYLE 13:</b> PIN 1. ANODE 2. N/C 3. COLLECTOR 4. EMITTER 5. BASE 6. CATHODE	<b>STYLE 14:</b> PIN 1. VREF 2. GND 3. GND 4. IOUT 5. VEN 6. VCC	<b>STYLE 15:</b> PIN 1. ANODE 1 2. ANODE 2 3. ANODE 3 4. CATHODE 3 5. CATHODE 2 6. CATHODE 1	<b>STYLE 16:</b> PIN 1. BASE 1 2. EMITTER 2 3. COLLECTOR 2 4. BASE 2 5. EMITTER 1 6. COLLECTOR 1	<b>STYLE 17:</b> PIN 1. BASE 1 2. EMITTER 1 3. COLLECTOR 2 4. BASE 2 5. EMITTER 2 6. COLLECTOR 1	<b>STYLE 18:</b> PIN 1. VIN1 2. VCC 3. VOUT2 4. VIN2 5. GND 6. VOUT1
<b>STYLE 19:</b> PIN 1. I OUT 2. GND 3. GND 4. V CC 5. V EN 6. V REF	<b>STYLE 20:</b> PIN 1. COLLECTOR 2. COLLECTOR 3. BASE 4. EMITTER 5. COLLECTOR 6. COLLECTOR	<b>STYLE 21:</b> PIN 1. ANODE 1 2. N/C 3. ANODE 2 4. CATHODE 2 5. N/C 6. CATHODE 1	<b>STYLE 22:</b> PIN 1. D1 (i) 2. GND 3. D2 (i) 4. D2 (c) 5. VBUS 6. D1 (c)	<b>STYLE 23:</b> PIN 1. Vn 2. CH1 3. Vp 4. N/C 5. CH2 6. N/C	<b>STYLE 24:</b> PIN 1. CATHODE 2. ANODE 3. CATHODE 4. CATHODE 5. CATHODE 6. CATHODE
<b>STYLE 25:</b> PIN 1. BASE 1 2. CATHODE 3. COLLECTOR 2 4. BASE 2 5. EMITTER 6. COLLECTOR 1	<b>STYLE 26:</b> PIN 1. SOURCE 1 2. GATE 1 3. DRAIN 2 4. SOURCE 2 5. GATE 2 6. DRAIN 1	<b>STYLE 27:</b> PIN 1. BASE 2 2. BASE 1 3. COLLECTOR 1 4. EMITTER 1 5. EMITTER 2 6. COLLECTOR 2	<b>STYLE 28:</b> PIN 1. DRAIN 2. DRAIN 3. GATE 4. SOURCE 5. DRAIN 6. DRAIN	<b>STYLE 29:</b> PIN 1. ANODE 2. ANODE 3. COLLECTOR 4. EMITTER 5. BASE/ANODE 6. CATHODE	<b>STYLE 30:</b> PIN 1. SOURCE 1 2. DRAIN 2 3. DRAIN 2 4. SOURCE 2 5. GATE 1 6. DRAIN 1

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

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