

# NTJD3158C

## Power MOSFET

20 V, +0.63/-0.82 A,  
SC-88 Complementary, ESD Protected

### Features

- Complementary N- and P-Channel MOSFET
- Small Size Dual SC-88 Package
- Reduced Gate Charge to Improve Switching Response
- Independently Connected Devices to Provide Design Flexibility
- This is a Pb-Free Device

### Applications

- DC-DC Conversion Circuits
- Load/Power Switching with Level Shift

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

| Parameter                                                            |              |                       | Symbol                            | Value      | Unit |
|----------------------------------------------------------------------|--------------|-----------------------|-----------------------------------|------------|------|
| Drain-to-Source Voltage                                              |              |                       | V <sub>DSS</sub>                  | 20         | V    |
| Gate-to-Source Voltage                                               |              |                       | V <sub>GS</sub>                   | ±12        | V    |
| N-Channel<br>Continuous Drain<br>Current (Note 1)                    | Steady State | T <sub>A</sub> = 25°C | I <sub>D</sub>                    | 0.63       | A    |
|                                                                      |              | T <sub>A</sub> = 85°C |                                   | 0.46       |      |
|                                                                      | t ≤ 5 s      | T <sub>A</sub> = 25°C |                                   | 0.72       |      |
| P-Channel<br>Continuous Drain<br>Current (Note 1)                    | Steady State | T <sub>A</sub> = 25°C | I <sub>D</sub>                    | -0.82      | A    |
|                                                                      |              | T <sub>A</sub> = 85°C |                                   | -0.59      |      |
|                                                                      | t ≤ 5 s      | T <sub>A</sub> = 25°C |                                   | -0.93      |      |
| Power Dissipation<br>(Note 1)                                        | Steady State | T <sub>A</sub> = 25°C | P <sub>D</sub>                    | 0.27       | W    |
|                                                                      | t ≤ 5 s      |                       |                                   | 0.35       |      |
| Pulsed Drain<br>Current                                              | N-Ch         | tp = 10 μs            | I <sub>DM</sub>                   | 1.3        | A    |
|                                                                      | P-Ch         |                       |                                   | -1.6       |      |
| Operating Junction and Storage Temperature                           |              |                       | T <sub>J</sub> , T <sub>stg</sub> | -55 to 150 | °C   |
| Source Current (Body Diode)                                          |              |                       | I <sub>S</sub>                    | 0.46       | A    |
| Lead Temperature for Soldering Purposes<br>(1/8" from case for 10 s) |              |                       | T <sub>L</sub>                    | 260        | °C   |

### THERMAL RESISTANCE RATINGS

| Parameter                                          | Symbol          | Max | Unit               |
|----------------------------------------------------|-----------------|-----|--------------------|
| Junction-to-Ambient – Steady State (Note 1)        | $R_{\theta JA}$ | 460 | $^\circ\text{C/W}$ |
| Junction-to-Ambient – $t \leq 5\text{ s}$ (Note 1) | $R_{\theta JA}$ | 357 |                    |
| Junction-to-Lead (Drain) – Steady State (Note 1)   | $R_{\theta JL}$ | 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 in sq pad size  
(Cu area = 1.127 in sq [1 oz] including traces).

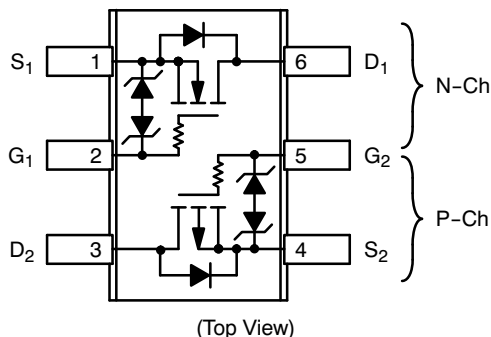


ON Semiconductor®

<http://onsemi.com>

| $V_{(BR)DSS}$ | $R_{DS(on)} \text{ Max}$ | $I_D \text{ Max}$ |
|---------------|--------------------------|-------------------|
| N-Ch<br>20 V  | 375 m $\Omega$ @ 4.5 V   | 0.63 A            |
|               | 445 m $\Omega$ @ 2.5 V   |                   |
| P-Ch<br>-20 V | 300 m $\Omega$ @ -4.5 V  | -0.82 A           |
|               | 500 m $\Omega$ @ -2.5 V  |                   |

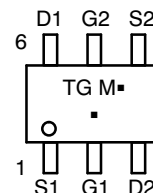
SC-88 (SOT-363)  
(6-Leads)



### MARKING DIAGRAM & PIN ASSIGNMENT



SC-88 (SOT-363)  
CASE 419B  
STYLE 26



TG = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

| Device       | Package            | Shipping†         |
|--------------|--------------------|-------------------|
| NTJD3158CT1G | SC-88<br>(Pb-Free) | 3000/Tape & Reel  |
| NTJD3158CT4G | SC-88<br>(Pb-Free) | 10000/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.

# NTJD3158C

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

| Parameter | Symbol | N/P | Test Condition | Min | Typ | Max | Unit |
|-----------|--------|-----|----------------|-----|-----|-----|------|
|-----------|--------|-----|----------------|-----|-----|-----|------|

### OFF CHARACTERISTICS (Note 3)

|                                                           |                                      |   |                                                 |                          |     |      |       |
|-----------------------------------------------------------|--------------------------------------|---|-------------------------------------------------|--------------------------|-----|------|-------|
| Drain-to-Source Breakdown Voltage                         | V <sub>(BR)DSS</sub>                 | N | V <sub>GS</sub> = 0 V                           | I <sub>D</sub> = 250 μA  | 20  |      | V     |
|                                                           |                                      | P |                                                 | I <sub>D</sub> = -250 μA | -20 |      |       |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V <sub>(BR)DSS</sub> /T <sub>J</sub> |   |                                                 |                          | 22  |      | mV/°C |
| Zero Gate Voltage Drain Current                           | I <sub>DSS</sub>                     | N | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 16 V   |                          |     | 1.0  | μA    |
|                                                           |                                      | P | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = -16 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>DS</sub> = 0 V, V <sub>GS</sub> = ±4.5 V |                          |     | ±1.0 |       |
|                                                           |                                      | P | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±12 V  |                          | 6.0 |      |       |

### ON CHARACTERISTICS (Note 2)

|                               |                     |   |                                                    |       |     |     |    |
|-------------------------------|---------------------|---|----------------------------------------------------|-------|-----|-----|----|
| Gate Threshold Voltage        | V <sub>GS(TH)</sub> | N | I <sub>D</sub> = 250 μA                            | 0.6   |     | 1.5 | V  |
|                               |                     | P | I <sub>D</sub> = -250 μA                           | -0.45 |     |     |    |
| 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   |       | 290 | 375 | mΩ |
|                               |                     | P | V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -0.88 A |       | 255 | 300 |    |
|                               |                     | N | V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 0.40 A   |       | 360 | 445 |    |
|                               |                     | P | V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -0.71 A |       | 345 | 500 |    |
| 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> = -10 V, I <sub>D</sub> = -0.88 A  |       | 3.0 |     |    |

### CHARGES, CAPACITANCES AND GATE RESISTANCE

|                              |                     |   |                                  |                                                                             |  |      |     |    |
|------------------------------|---------------------|---|----------------------------------|-----------------------------------------------------------------------------|--|------|-----|----|
| 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> = -20 V                                                     |  | 155  |     |    |
| Output Capacitance           | C <sub>OSS</sub>    | N |                                  | V <sub>DS</sub> = 20 V                                                      |  | 13   | 22  |    |
|                              |                     | P |                                  | V <sub>DS</sub> = -20 V                                                     |  | 25   |     |    |
| Reverse Transfer Capacitance | C <sub>RSS</sub>    | N |                                  | V <sub>DS</sub> = 20 V                                                      |  | 2.8  | 5.0 |    |
|                              |                     | P |                                  | V <sub>DS</sub> = -20 V                                                     |  | 18   |     |    |
| 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> = 0.63 A    |  | 1.3  | 3.0 | nC |
|                              |                     | P |                                  | V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -15 V, I <sub>D</sub> = -0.88 A |  | 2.2  |     |    |
| 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> = 0.63 A    |  | 0.2  |     |    |
|                              |                     | P |                                  | V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -15 V, I <sub>D</sub> = -0.88 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> = 0.63 A    |  | 0.4  |     |    |
|                              |                     | P |                                  | V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -10 V, I <sub>D</sub> = -0.88 A |  | 0.65 |     |    |

### 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,<br>I <sub>D</sub> = 0.5 A, R <sub>G</sub> = 20 Ω    |  | 83   |  | ns |
| Rise Time           | t <sub>r</sub>      |   |                                                                                                      |  | 227  |  |    |
| Turn-Off Delay Time | t <sub>d(OFF)</sub> |   |                                                                                                      |  | 786  |  |    |
| Fall Time           | t <sub>f</sub>      |   |                                                                                                      |  | 506  |  |    |
| Turn-On Delay Time  | t <sub>d(ON)</sub>  | P | V <sub>GS</sub> = -4.5 V, V <sub>DD</sub> = -10 V,<br>I <sub>D</sub> = -0.5 A, R <sub>G</sub> = 20 Ω |  | 5.8  |  |    |
| Rise Time           | t <sub>r</sub>      |   |                                                                                                      |  | 6.5  |  |    |
| Turn-Off Delay Time | t <sub>d(OFF)</sub> |   |                                                                                                      |  | 13.5 |  |    |
| Fall Time           | t <sub>f</sub>      |   |                                                                                                      |  | 3.5  |  |    |

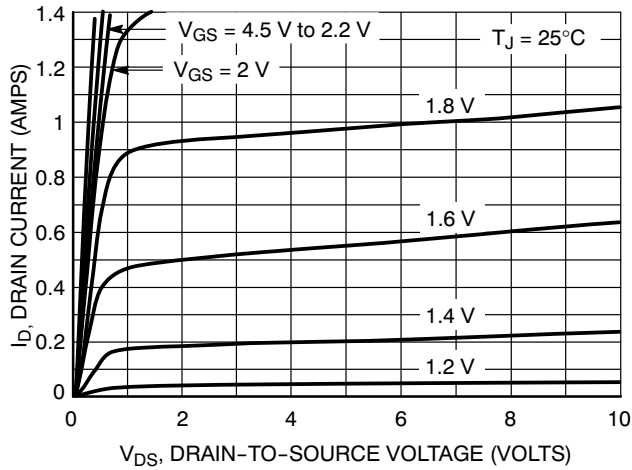
### DRAIN-SOURCE DIODE CHARACTERISTICS

|                       |                 |   |                                               |                          |  |       |      |   |
|-----------------------|-----------------|---|-----------------------------------------------|--------------------------|--|-------|------|---|
| 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> = -0.48 A |  | -0.8  | -1.2 |   |
|                       |                 | 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> = -0.48 A |  | -0.66 |      |   |

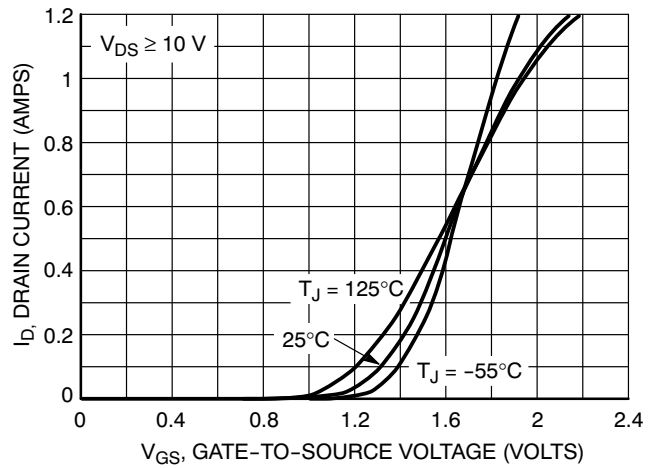
2. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

3. Switching characteristics are independent of operating junction temperatures.

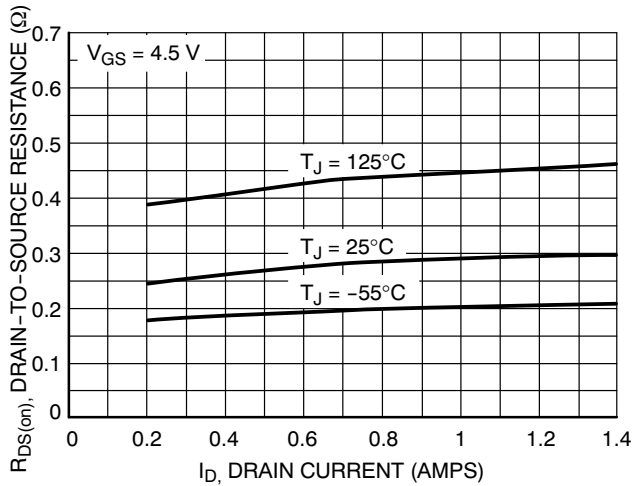
**TYPICAL PERFORMANCE CURVES (N-Ch)** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)



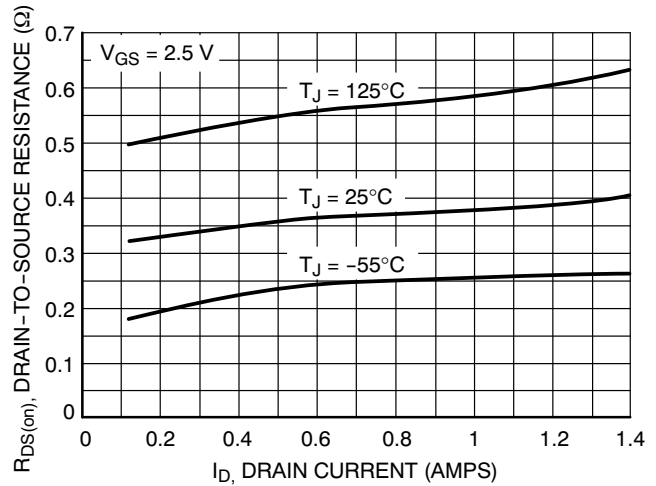
**Figure 1. On-Region Characteristics**



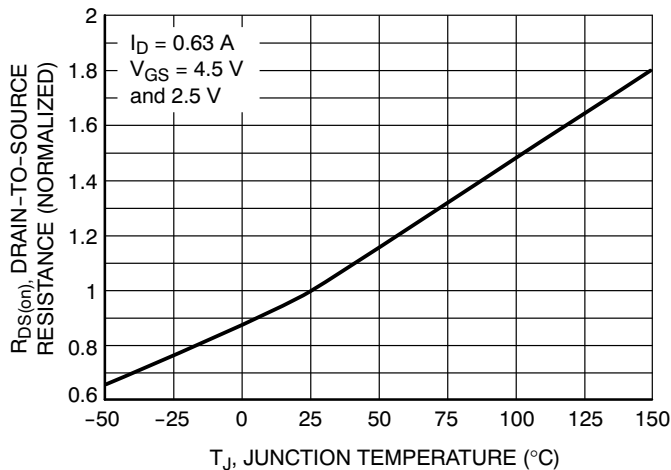
**Figure 2. Transfer Characteristics**



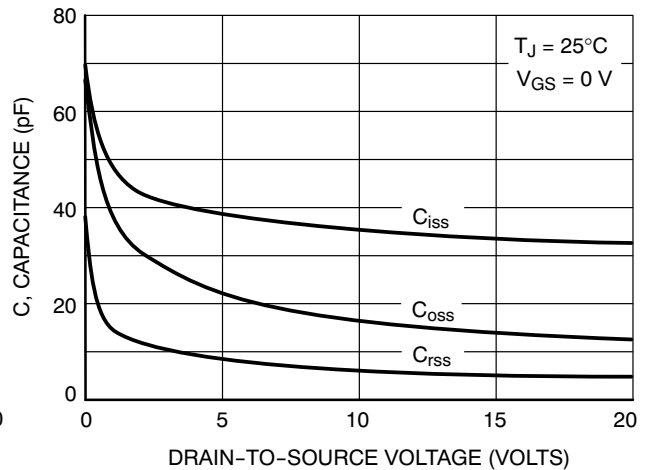
**Figure 3. On-Resistance vs. Drain Current and Temperature**



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



**Figure 5. On-Resistance Variation with Temperature**



**Figure 6. Capacitance Variation**

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

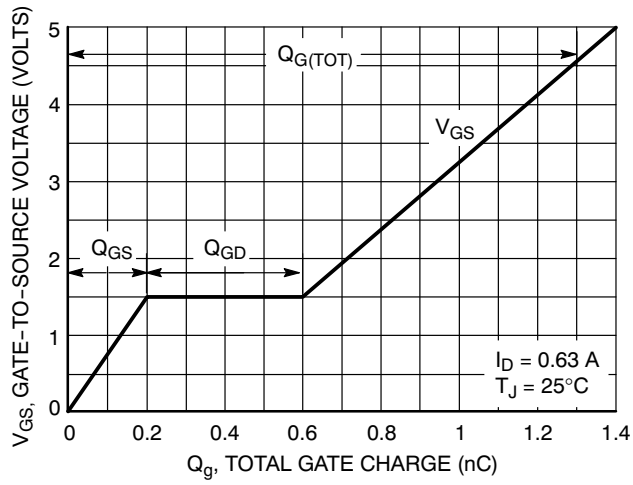


Figure 7. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

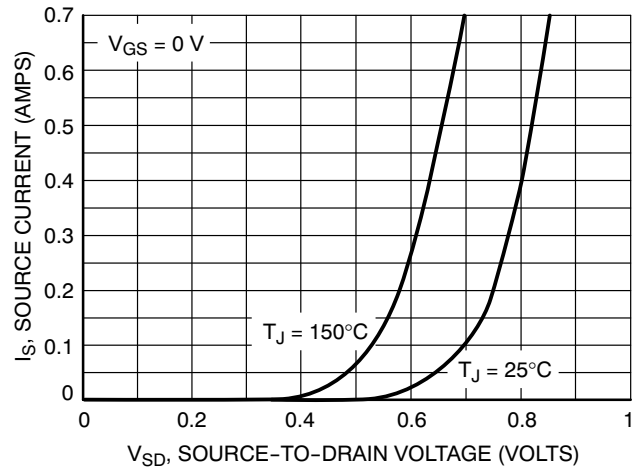


Figure 8. Diode Forward Voltage vs. Current

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

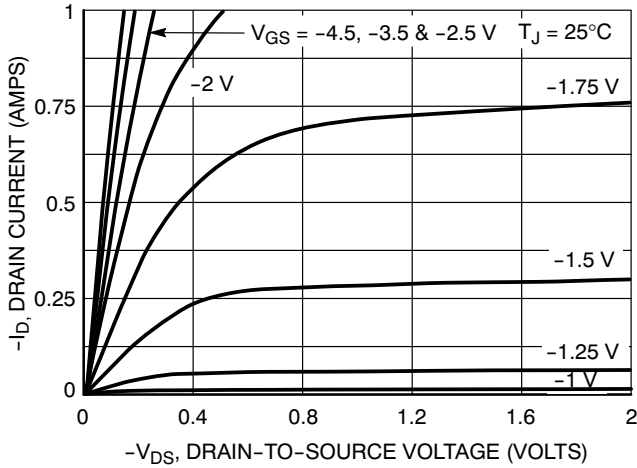


Figure 9. On-Region Characteristics

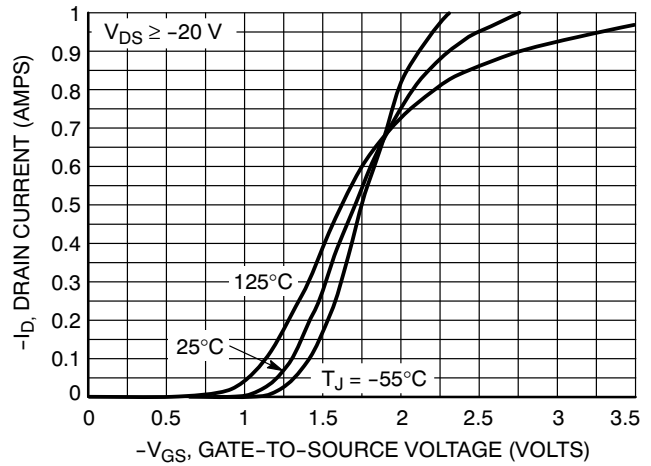


Figure 10. Transfer Characteristics

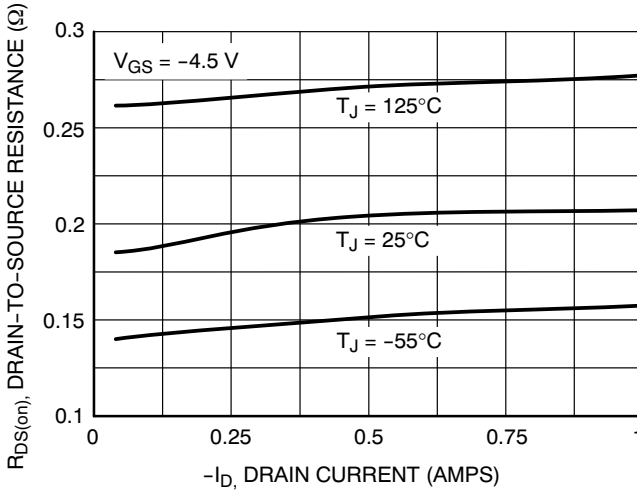


Figure 11. On-Resistance vs. Drain Current and Temperature

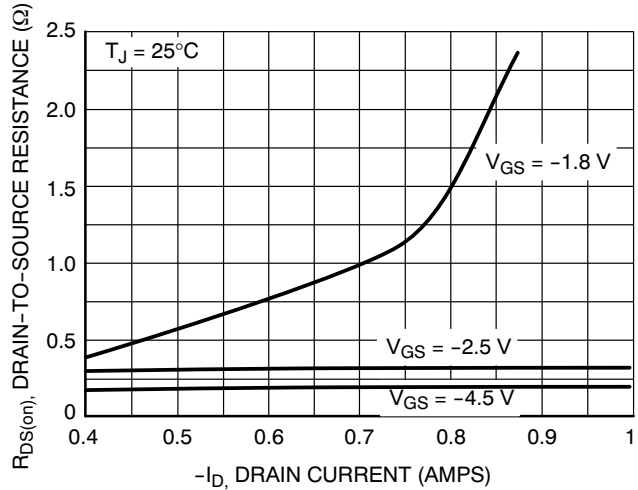


Figure 12. On-Resistance vs. Drain Current and Gate Voltage

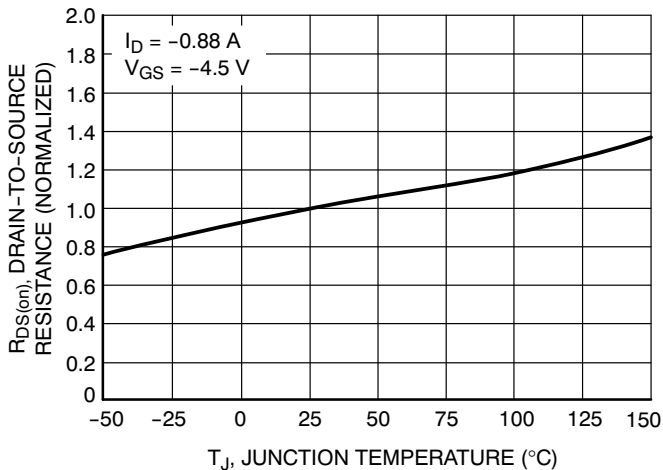


Figure 13. On-Resistance Variation with Temperature

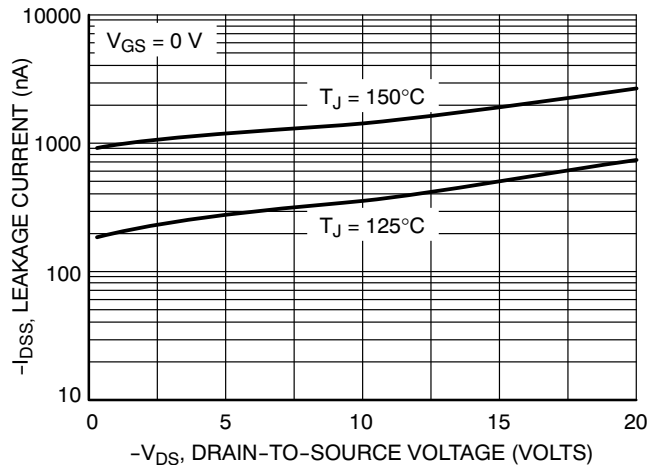
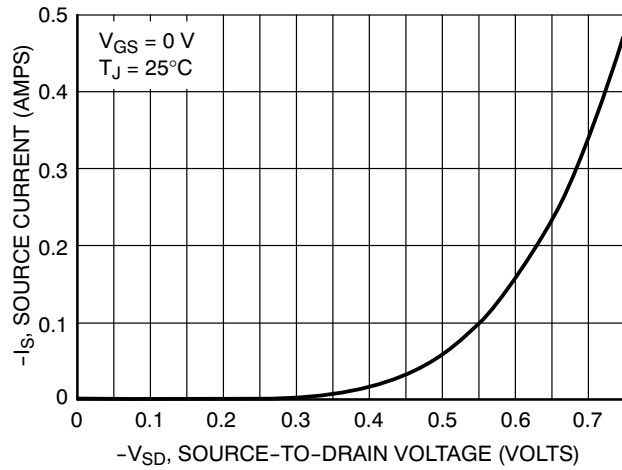
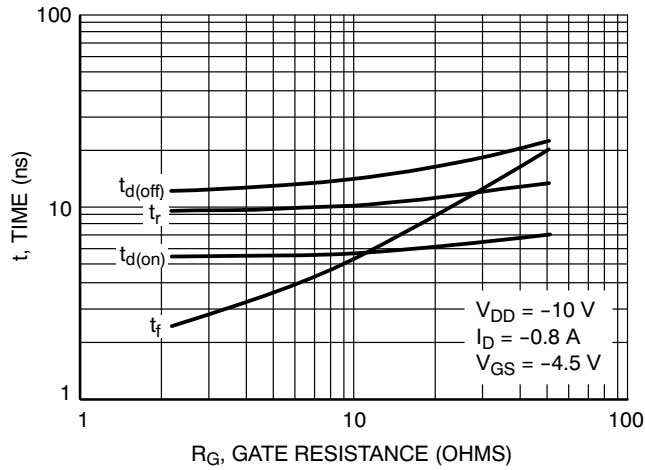
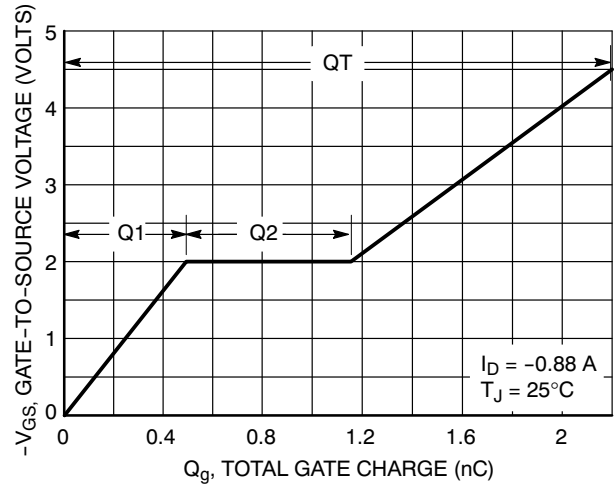
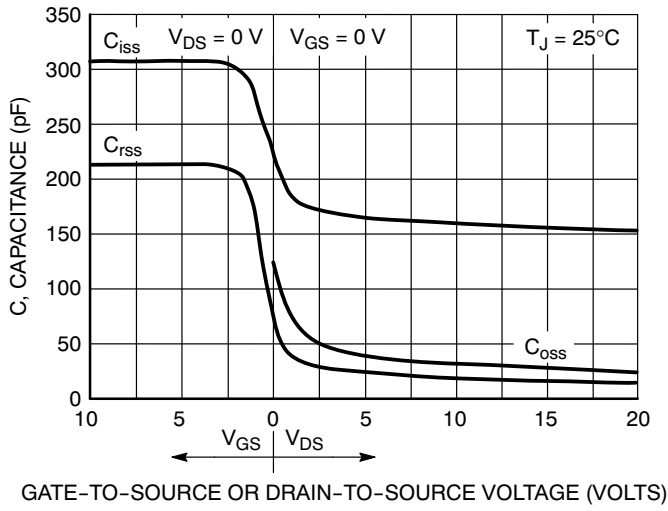


Figure 14. Drain-to-Source Leakage Current vs. Voltage

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



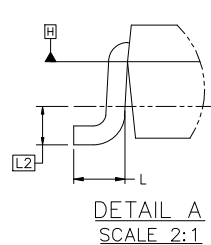
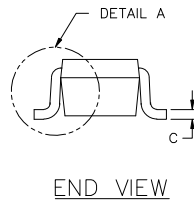
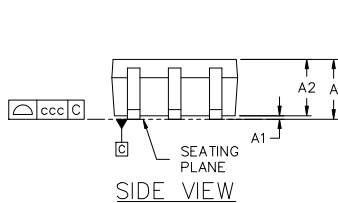
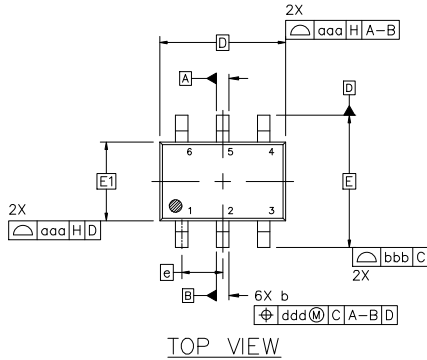


SC-88 2.00x1.25x0.90, 0.65P  
CASE 419B-02  
ISSUE Z

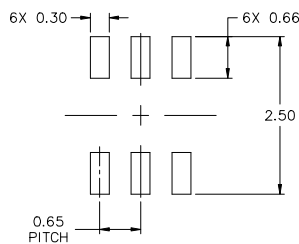
DATE 18 APR 2024

NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSION ARE IN 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.



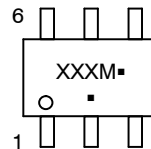
| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN.        | NOM. | MAX. |
| A   | ---         | ---  | 1.10 |
| A1  | 0.00        | ---  | 0.10 |
| A2  | 0.70        | 0.90 | 1.00 |
| b   | 0.15        | 0.20 | 0.25 |
| c   | 0.08        | 0.15 | 0.22 |
| D   | 2.00 BSC    |      |      |
| E   | 2.10 BSC    |      |      |
| E1  | 1.25 BSC    |      |      |
| e   | 0.65 BSC    |      |      |
| L   | 0.26        | 0.36 | 0.46 |
| L2  | 0.15 BSC    |      |      |
| aaa | 0.15        |      |      |
| bbb | 0.30        |      |      |
| ccc | 0.10        |      |      |
| ddd | 0.10        |      |      |



RECOMMENDED MOUNTING FOOTPRINT\*

\* FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

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.

STYLES ON PAGE 2

|                  |                             |                                                                                                                                                                                  |
|------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DOCUMENT NUMBER: | 98ASB42985B                 | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION:     | SC-88 2.00x1.25x0.90, 0.65P | PAGE 1 OF 2                                                                                                                                                                      |

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SC-88 2.00x1.25x0.90, 0.65P  
CASE 419B-02  
ISSUE Z

DATE 18 APR 2024

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