# **Power MOSFET**

60 V, 295 mA, Dual N–Channel with ESD Protection, SC–88

## Features

- Low R<sub>DS(on)</sub>
- Low Gate Threshold
- Low Input Capacitance
- ESD Protected Gate
- This is a Pb–Free Device

## Applications

- Low Side Load Switch
- DC-DC Converters (Buck and Boost Circuits)

#### **MAXIMUM RATINGS** (T<sub>J</sub> = $25^{\circ}C$ unless otherwise stated)

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			V <sub>DSS</sub>	60	V
Gate-to-Source Voltage			V <sub>GS</sub>	±20	V
Continuous Drain	Steady	$T_A = 25^{\circ}C$	Ι <sub>D</sub>	295	mA
Current (Note 1)	State	$T_A = 85^{\circ}C$		212	
	t ≤ 5 s	$T_A = 25^{\circ}C$		304	
		$T_A = 85^{\circ}C$	1	219	
Power Dissipation (Note 1)	Steady State	$T_A = 25^{\circ}C$	P <sub>D</sub>	250	mW
	t ≤ 5 s			266	
Pulsed Drain Current	t <sub>p</sub> =	= 10 μs	I <sub>DM</sub>	900	mA
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>	210	mA	
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			ΤL	260	°C
Gate-Source ESD Rating (HBM)			ESD <sub>HBM</sub>	2000	V
Gate-Source ESD Rating (MM)			ESD <sub>MM</sub>	200	V

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.

#### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Ambient - Steady State	$R_{\theta JA}$	500	°C/W
Junction-to-Ambient – t $\leq$ 5 s	$R_{\theta JA}$	470	

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

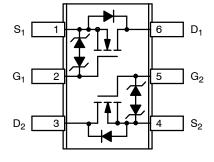


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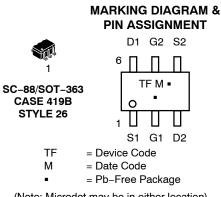
### http://onsemi.com

V <sub>(BR)DSS</sub>	R <sub>DS(on)</sub> MAX	I <sub>D</sub> Max
60 V	1.6 Ω @ 10 V	295 mA
	2.5 Ω @ 4.5 V	295 IIIA





Top View



(Note: Microdot may be in either location)

## **ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>
NTJD5121NT1G	SC-88 (Pb-Free)	3000 / Tape & Reel
NTJD5121NT2G	SC-88 (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.

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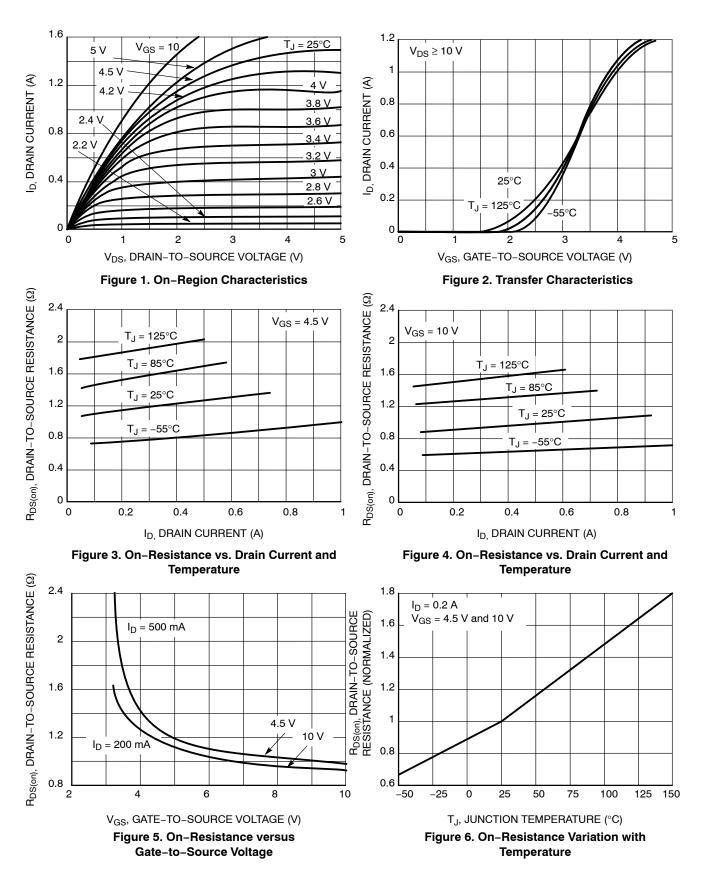
# **ELECTRICAL CHARACTERISTICS** (T<sub>J</sub> = $25^{\circ}$ C unless otherwise stated)

Parameter	Symbol	Test Condition		Min	Тур	Max	Unit	
OFF CHARACTERISTICS					•			
Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	$V_{GS}$ = 0 V, I <sub>D</sub> = 250 $\mu$ A		60			V	
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA, r	ef to 25°C		92		mV/°C	
Zero Gate Voltage Drain Current	I <sub>DSS</sub> V <sub>GS</sub> = V <sub>DS</sub> =	V <sub>GS</sub> = 0 V,	$T_J = 25^{\circ}C$	= 25°C		1.0	μΑ	
		$V_{\rm DS} = 60 \text{ V}$	T <sub>J</sub> = 125°C			500	1	
Gate-to-Source Leakage Current	I <sub>GSS</sub>	$V_{DS} = 0 V, V_{G}$	<sub>iS</sub> = ±20 V			±10	μA	
ON CHARACTERISTICS (Note 2)						-		
Gate Threshold Voltage	V <sub>GS(TH)</sub>	$V_{GS} = V_{DS}, I_{D}$	e = 250 μA	1.0	1.7	2.5	V	
Negative Threshold Temperature Coefficient	V <sub>GS(TH)</sub> /T <sub>J</sub>				4.0		mV/°C	
Drain-to-Source On Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 500 mA			1.0	1.6	Ω	
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 200 mA			1.2	2.5		
Forward Transconductance	9FS	V <sub>DS</sub> = 5 V, I <sub>D</sub> = 200 mA			80		S	
Gate Resistance	R <sub>G</sub>				536		Ω	
CHARGES AND CAPACITANCES								
Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1.0 MHz, V <sub>DS</sub> = 20 V			26		pF	
Output Capacitance	C <sub>OSS</sub>				4.4		1	
Reverse Transfer Capacitance	C <sub>RSS</sub>	• 05 = -			2.5			
Total Gate Charge	Q <sub>G(TOT)</sub>				0.9		nC	
Threshold Gate Charge	Q <sub>G(TH)</sub>	V <sub>GS</sub> = 4.5 V, V	ns = 25 V.		0.2			
Gate-to-Source Charge	Q <sub>GS</sub>	$I_{\rm D} = 200$			0.3			
Gate-to-Drain Charge	Q <sub>GD</sub>		Ē		0.28			
SWITCHING CHARACTERISTICS (No	ote 3)		•		•			
Turn-On Delay Time	t <sub>d(on)</sub>				22		ns	
Rise Time	tr	$V_{GS}$ = 4.5 V, $V_{DD}$ = 25 V, I <sub>D</sub> = 200 mA, R <sub>G</sub> = 25 $\Omega$			34			
Turn-Off Delay Time	t <sub>d(off)</sub>				34			
Fall Time	t <sub>f</sub>				32		7	
DRAIN-SOURCE DIODE CHARACTE	RISTICS				•			
Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V,	$T_J = 25^{\circ}C$		0.8	1.2	V	
		I <sub>S</sub> = 200 mA			0.7			

2. Pulse Test: pulse width  $\leq$  300  $\mu$ s, duty cycle  $\leq$  2%. 3. Switching characteristics are independent of operating junction temperatures.

## **TYPICAL PERFORMANCE CURVES**

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



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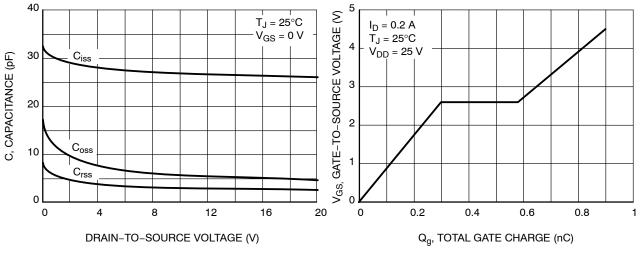
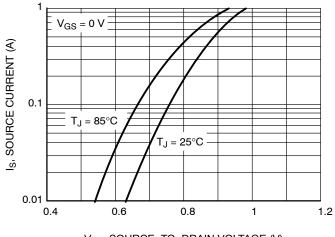


Figure 7. Capacitance Variation

Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge



V<sub>SD</sub>, SOURCE-TO-DRAIN VOLTAGE (V)

Figure 9. Diode Forward Voltage vs. Current

#### PACKAGE DIMENSIONS

SC-88/SC70-6/SOT-363 CASE 419B-02 ISSUE Y D H A 3 D GAGE 4 4 L2 6. Ε E1 **DETAIL A** 2X 3 TIPS е 6X b В  $\oplus$  ddd  $\bigcirc$  C A-B D TOP VIEW Α2 DETAIL A 6х 🗀 ссс С A1 SEATING PLANE Ċ С STYLE 26: SIDE VIEW **END VIEW** З. RECOMMENDED 4. SOLDERING FOOTPRINT\* 0.30 0.66 2 50 0.65 PITCH DIMENSIONS: MILLIMETERS

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

	MILLIMETERS			INCHES			
DIM	MIN	NOM	MAX	MIN	NOM	MAX	
Α			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	
С	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	
Е	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			
Г	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			

PIN 1. SOURCE 1 2. GATE 1 DRAIN 2 SOURCE 2

5. GATE 2 6. DRAIN 1

\*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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