

## Product Summary

Device	BV <sub>DSS</sub>	R <sub>DS(ON)</sub> Max	I <sub>D</sub> Max T <sub>A</sub> = +25°C
Q1	20V	0.99Ω @ V <sub>GS</sub> = 4.5V	450mA
		1.2Ω @ V <sub>GS</sub> = 2.5V	400mA
		1.8Ω @ V <sub>GS</sub> = 1.8V	330mA
		2.4Ω @ V <sub>GS</sub> = 1.5V	300mA
Q2	-20V	1.9Ω @ V <sub>GS</sub> = -4.5V	-310mA
		2.4Ω @ V <sub>GS</sub> = -2.5V	-280mA
		3.4Ω @ V <sub>GS</sub> = -1.8V	-240mA
		5Ω @ V <sub>GS</sub> = -1.5V	-180mA

## Features and Benefits

- Low On-Resistance
- Very Low Gate Threshold Voltage, 1.0V Max
- Low Input Capacitance
- Fast Switching Speed
- Ultra-Small Surface Mount Package 1mm x 1mm
- Low Package Profile, 0.45mm Maximum Package Height
- ESD Protected Gate
- **Totally Lead-Free & Fully RoHS Compliant (Note 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP Capable (Note 4)**

## Description and Applications

This MOSFET is designed to meet the stringent requirements of Automotive applications. It is qualified to AEC-Q101, supported by a PPAP and is ideal for use in:

- General Purpose Interfacing Switch
- Power Management Functions
- Analog Switch

## Mechanical Data

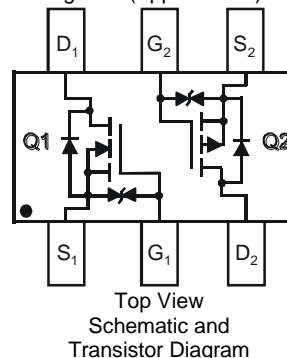
- Case: SOT963
- Case Material: Molded Plastic, "Green" Molding Compound.  
UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections Indicator: See Diagram
- Terminals: Finish — Matte Tin Annealed over Copper Leadframe.  
Solderable per MIL-STD-202, Method 208 **e3**
- Weight: 0.027 grams (Approximate)



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Top View

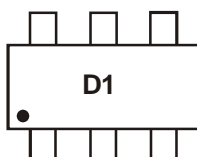


## Ordering Information (Note 5)

Part Number	Case	Packaging
DMC2990UDJQ-7	SOT963	10K/Tape & Reel
DMC2990UDJQ-7B	SOT963	10K/Tape & Reel

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
  4. Automotive products are AEC-Q101 qualified and are PPAP capable. Refer to [http://www.diodes.com/product\\_compliance\\_definitions.html](http://www.diodes.com/product_compliance_definitions.html).
  5. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information



D1 = Product Type Marking Code

**Maximum Ratings Q1 N-CHANNEL** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			V <sub>DSS</sub>	20	V
Gate-Source Voltage			V <sub>GSS</sub>	±8	V
Continuous Drain Current (Note 6) V <sub>GS</sub> = 4.5V	Steady State	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	450 350	mA
	t<5s	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	520 410	mA
Continuous Drain Current (Note 6) V <sub>GS</sub> = 1.8V	Steady State	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	330 260	mA
	t<5s	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	390 310	mA
Maximum Continuous Body Diode Forward Current (Note 6)			I <sub>S</sub>	440	mA
Pulsed Drain Current (Note 7)			I <sub>DM</sub>	800	mA

**Maximum Ratings Q2 P-CHANNEL** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			V <sub>DSS</sub>	-20	V
Gate-Source Voltage			V <sub>GSS</sub>	±8	V
Continuous Drain Current (Note 6) V <sub>GS</sub> = -4.5V	Steady State	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	-310 -240	mA
	t<5s	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	-360 -280	mA
Continuous Drain Current (Note 6) V <sub>GS</sub> = -1.8V	Steady State	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	-240 -190	mA
	t<5s	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	-280 -220	mA
Maximum Continuous Body Diode Forward Current (Note 6)			I <sub>S</sub>	-440	mA
Pulsed Drain Current (Note 7)			I <sub>DM</sub>	-800	mA

**Thermal Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic		Symbol	Value	Unit
Total Power Dissipation (Note 6)		P <sub>D</sub>	350	mW
Thermal Resistance, Junction to Ambient (Note 6)	Steady State	R <sub>θJA</sub>	360	°C/W
	t<5s		270	°C/W
Operating and Storage Temperature Range		T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

- Notes: 6. Device mounted on FR-4 PCB, with minimum recommended pad layout.  
7. Device mounted on minimum recommended pad layout test board, 10µs pulse duty cycle = 1%.

**Electrical Characteristics Q1 N-CHANNEL** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 8)</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	20	-	-	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	-	-	100	nA	V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V
		-	-	50		V <sub>DS</sub> = 5V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	-	-	±100	nA	V <sub>GS</sub> = ±5V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 8)</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	0.4	-	1.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	-	0.60	0.99	Ω	V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 100mA
		-	0.75	1.2		V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 50mA
		-	0.90	1.8		V <sub>GS</sub> = 1.8V, I <sub>D</sub> = 20mA
		-	1.2	2.4		V <sub>GS</sub> = 1.5V, I <sub>D</sub> = 10mA
		-	2.0	-		V <sub>GS</sub> = 1.2V, I <sub>D</sub> = 1mA
Forward Transfer Admittance	Y <sub>fs</sub>	180	850	-	ms	V <sub>DS</sub> = 5V, I <sub>D</sub> = 125mA
Diode Forward Voltage	V <sub>SD</sub>	-	0.6	1.0	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 10mA
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	C <sub>iSS</sub>	-	27.6	-	pF	V <sub>DS</sub> = 15V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oSS</sub>	-	4.0	-	pF	
Reverse Transfer Capacitance	C <sub>rSS</sub>	-	2.8	-	pF	
Gate Resistance	R <sub>g</sub>	-	113	-	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1.0MHz
Total Gate Charge	Q <sub>g</sub>	-	0.5	-	nC	V <sub>GS</sub> = 4.5V, V <sub>DS</sub> = 10V, I <sub>D</sub> = 250mA
Gate-Source Charge	Q <sub>gs</sub>	-	0.07	-	nC	
Gate-Drain Charge	Q <sub>gd</sub>	-	0.07	-	nC	
Turn-On Delay Time	t <sub>D(ON)</sub>	-	4.0	-	ns	V <sub>DD</sub> = 15V, V <sub>GS</sub> = 4.5V, R <sub>L</sub> = 47Ω, R <sub>g</sub> = 2Ω, I <sub>D</sub> = 200mA
Turn-On Rise Time	t <sub>R</sub>	-	3.3	-	ns	
Turn-Off Delay Time	t <sub>D(OFF)</sub>	-	19.0	-	ns	
Turn-Off Fall Time	t <sub>F</sub>	-	6.4	-	ns	

**Electrical Characteristics Q2 P-CHANNEL** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 8)</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	-20	-	-	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	-	-	100	nA	V <sub>DS</sub> = -16V, V <sub>GS</sub> = 0V
		-	-	50		V <sub>DS</sub> = -5V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	-	-	±100	nA	V <sub>GS</sub> = ±5V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 8)</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	-0.4	-	-1.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	-	1.2	1.9	Ω	V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -100mA
		-	1.5	2.4		V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -50mA
		-	2.1	3.4		V <sub>GS</sub> = -1.8V, I <sub>D</sub> = -20mA
		-	2.5	5		V <sub>GS</sub> = -1.5V, I <sub>D</sub> = -10mA
		-	4.0	-		V <sub>GS</sub> = -1.2V, I <sub>D</sub> = -1mA
Forward Transfer Admittance	Y <sub>fs</sub>	100	450	-	ms	V <sub>DS</sub> = -5V, I <sub>D</sub> = -125mA
Diode Forward Voltage	V <sub>SD</sub>	-	-0.6	-1.0	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = -10mA
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	C <sub>iSS</sub>	-	28.7	-	pF	V <sub>DS</sub> = -15V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oSS</sub>	-	4.2	-	pF	
Reverse Transfer Capacitance	C <sub>rSS</sub>	-	2.9	-	pF	
Gate Resistance	R <sub>g</sub>	-	399	-	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1.0MHz
Total Gate Charge	Q <sub>g</sub>	-	0.4	-	nC	V <sub>GS</sub> = -4.5V, V <sub>DS</sub> = -10V, I <sub>D</sub> = -250mA
Gate-Source Charge	Q <sub>gs</sub>	-	0.08	-	nC	
Gate-Drain Charge	Q <sub>gd</sub>	-	0.06	-	nC	
Turn-On Delay Time	t <sub>D(ON)</sub>	-	5.8	-	ns	V <sub>DD</sub> = -15V, V <sub>GS</sub> = -4.5V, R <sub>g</sub> = 2Ω, I <sub>D</sub> = -200mA
Turn-On Rise Time	t <sub>R</sub>	-	5.7	-	ns	
Turn-Off Delay Time	t <sub>D(OFF)</sub>	-	31.1	-	ns	
Turn-Off Fall Time	t <sub>F</sub>	-	16.4	-	ns	

Notes: 8. Short duration pulse test used to minimize self-heating effect.  
9. Guaranteed by design. Not subject to product testing.

**Typical Characteristics - N-CHANNEL**

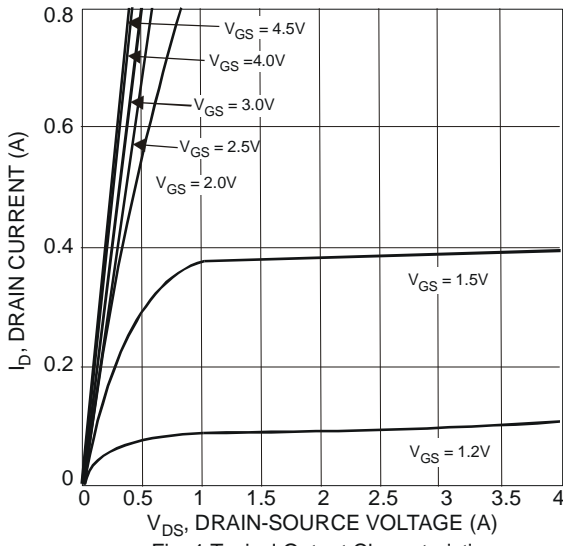


Fig. 1 Typical Output Characteristics

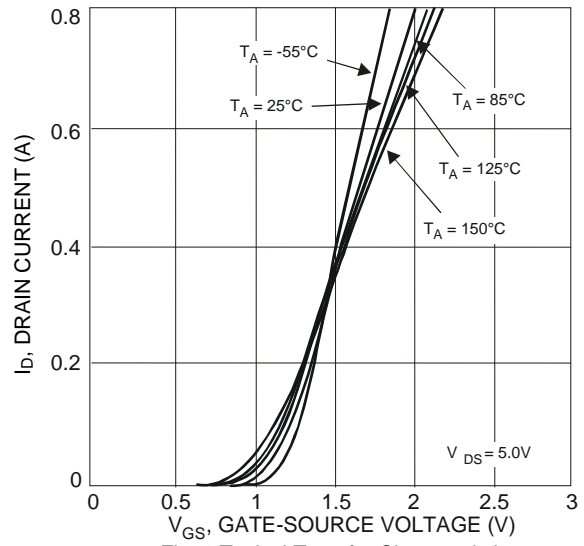


Fig. 2 Typical Transfer Characteristics

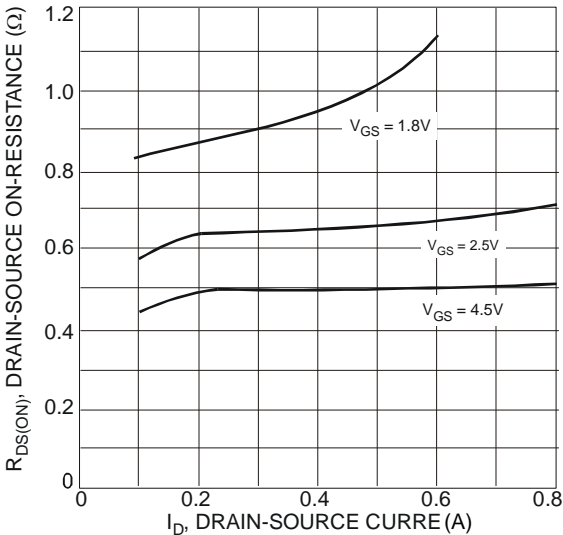


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

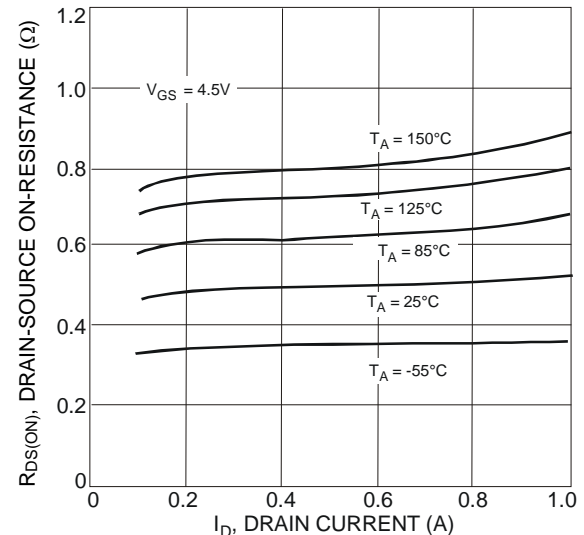


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

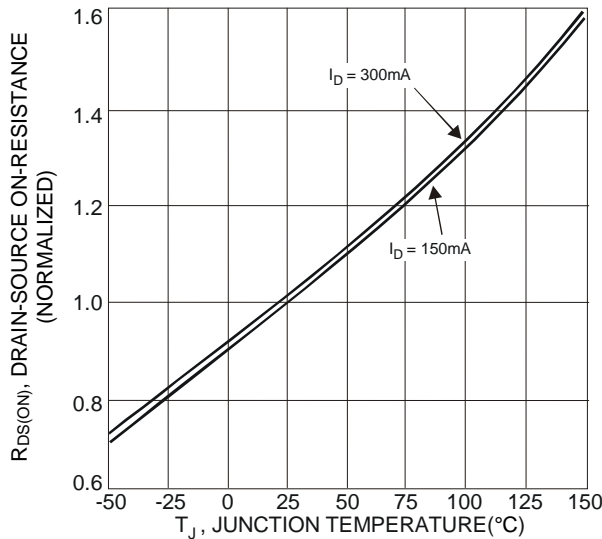


Fig. 5 On-Resistance Variation with Temperature

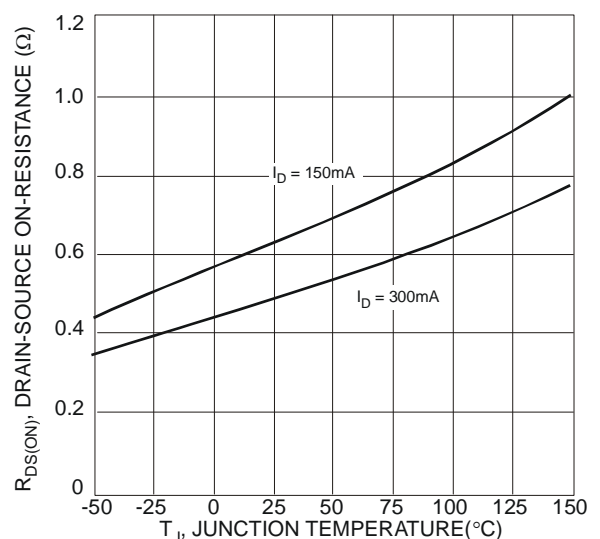


Fig. 6 On-Resistance Variation with Temperature

**Typical Characteristics - N-CHANNEL (Cont.)**

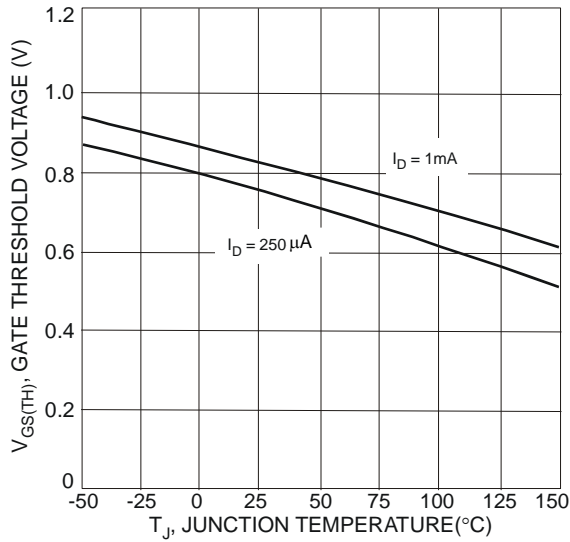


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

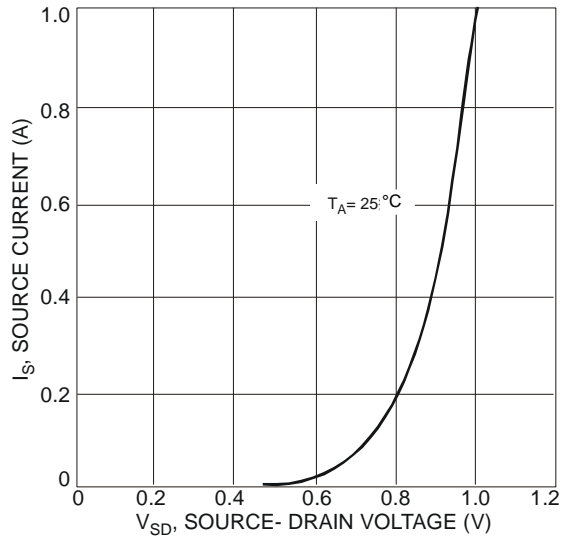


Fig. 8 Diodes Forward Voltage vs. Current

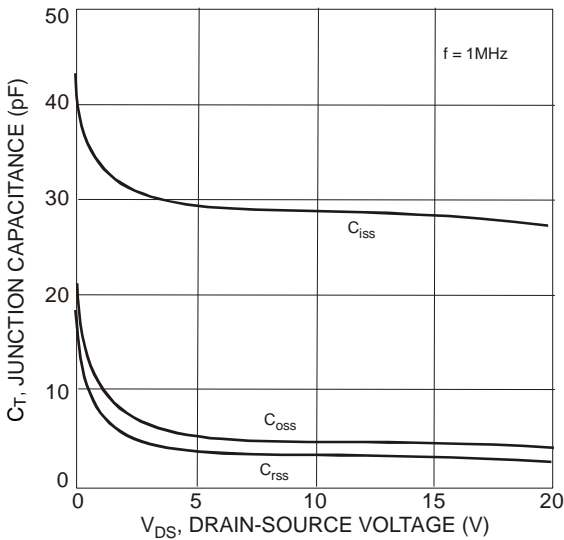


Fig. 9 Typical Junction Capacitance

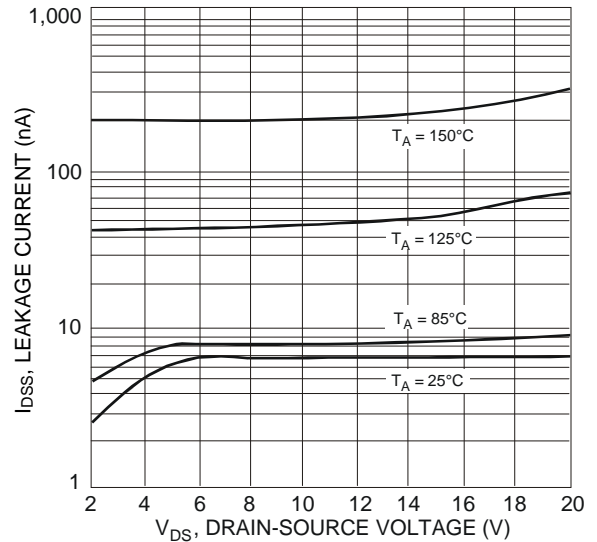


Fig. 10 Typical Drain-Source Leakage Current vs. Voltage

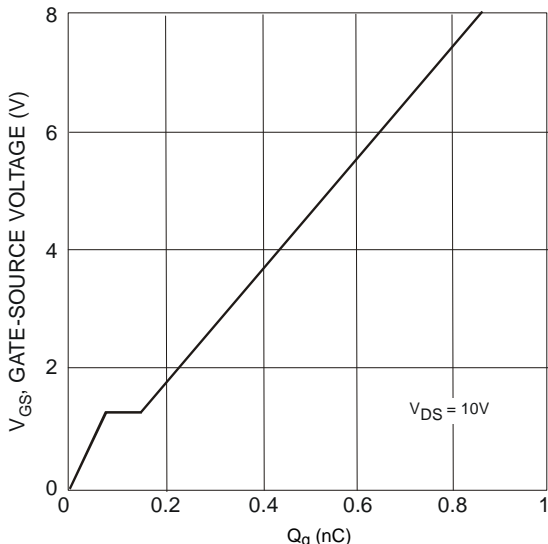


Fig. 11 Gate Charge Characteristics

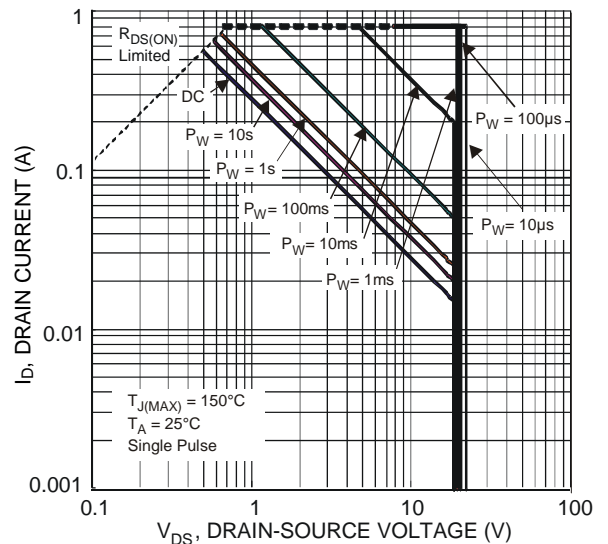


Fig. 12 SOA, Safe Operation Area

**Typical Characteristics - P-CHANNEL**

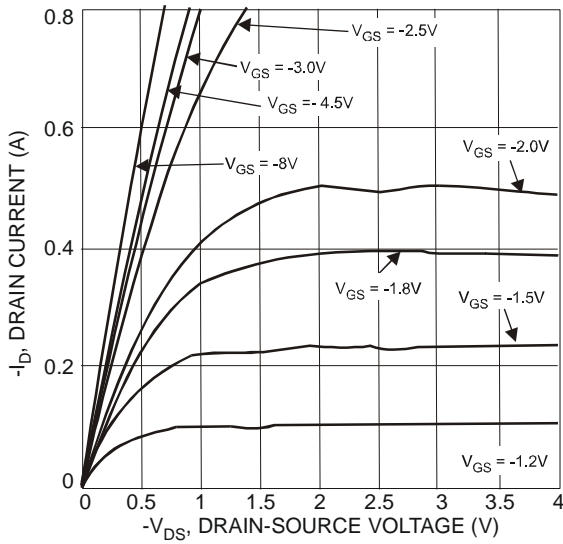


Fig. 13 Typical Output Characteristics

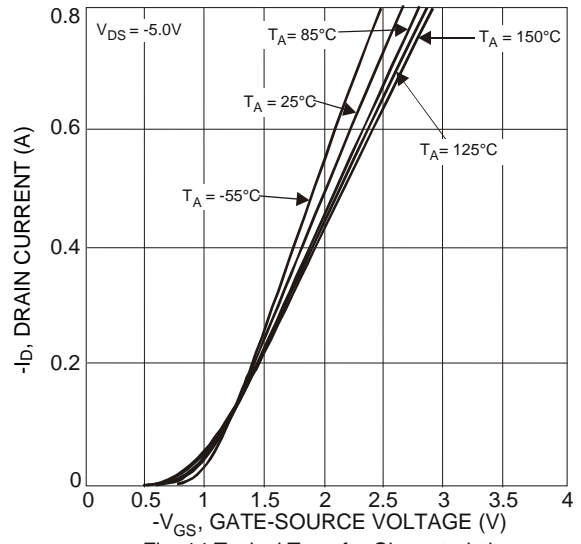


Fig. 14 Typical Transfer Characteristics

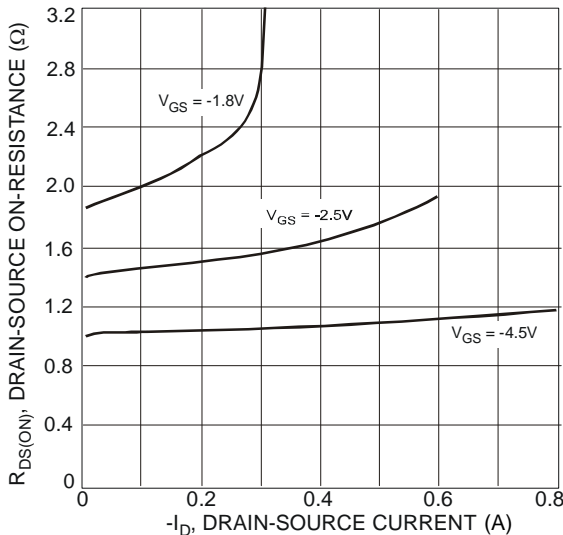


Fig. 15 Typical On-Resistance vs. Drain Current and Gate Voltage

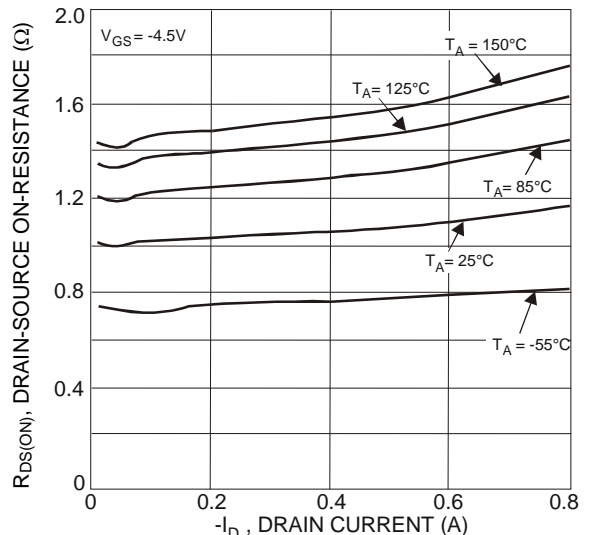


Fig. 16 Typical On-Resistance vs. Drain Current and Temperature

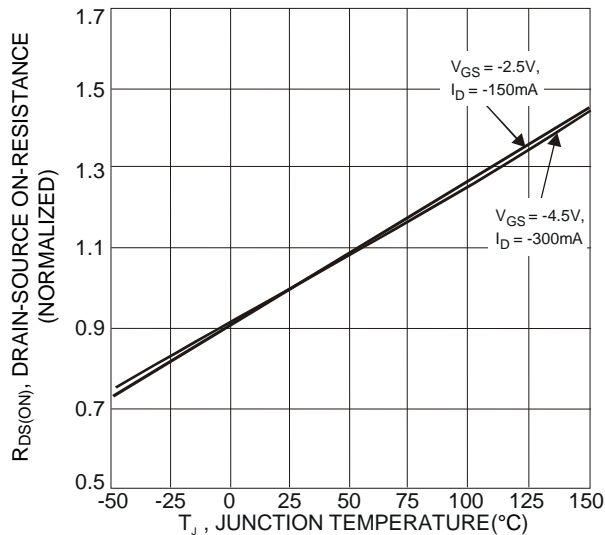


Fig. 17 On-Resistance Variation with Temperature

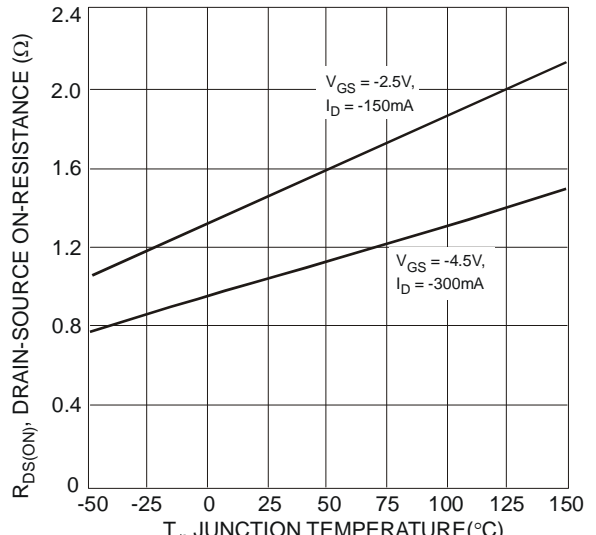


Fig. 18 On-Resistance Variation with Temperature

**Typical Characteristics - P-CHANNEL (Cont.)**

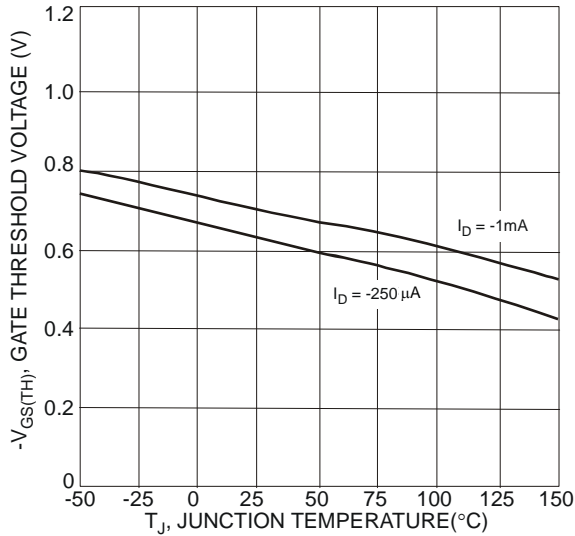


Fig. 19 Gate Threshold Variation vs. Ambient Temperature

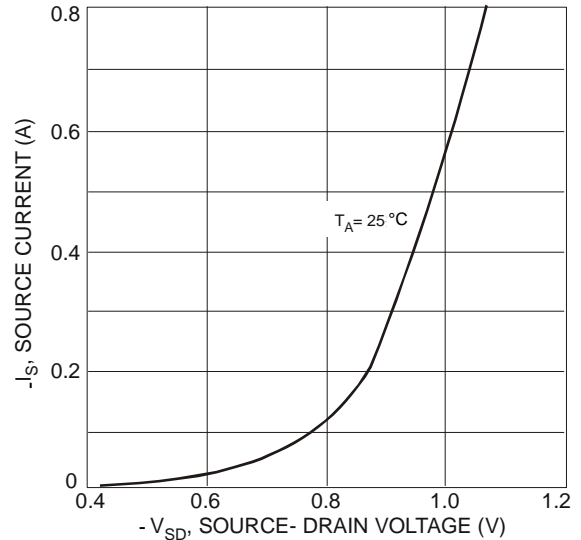


Fig. 20 Diodes Forward Voltage vs. Current

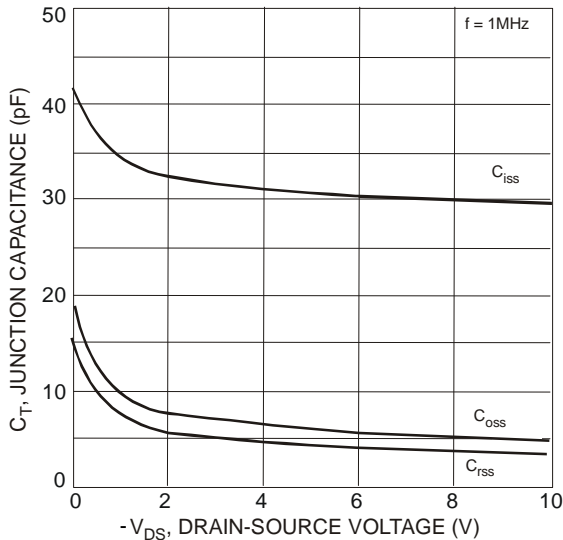


Fig. 21 Typical Junction Capacitance

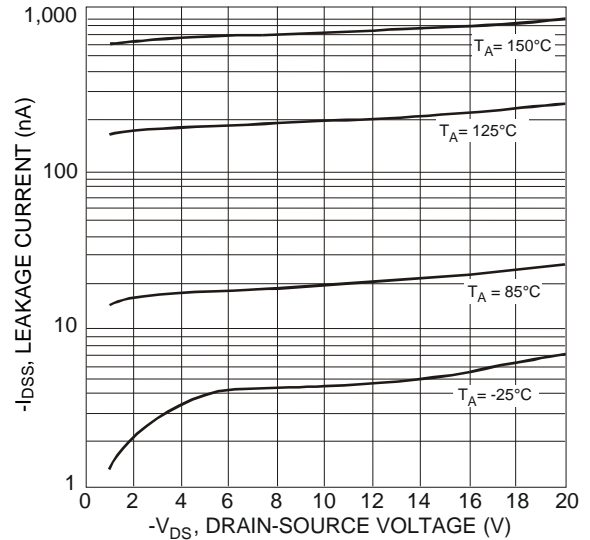


Fig. 22 Typical Leakage Current vs. Drain-Source Voltage

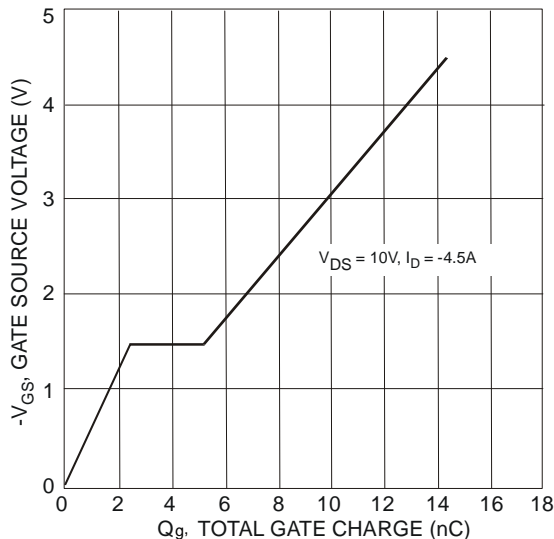


Fig. 23 Gate Charge Characteristics

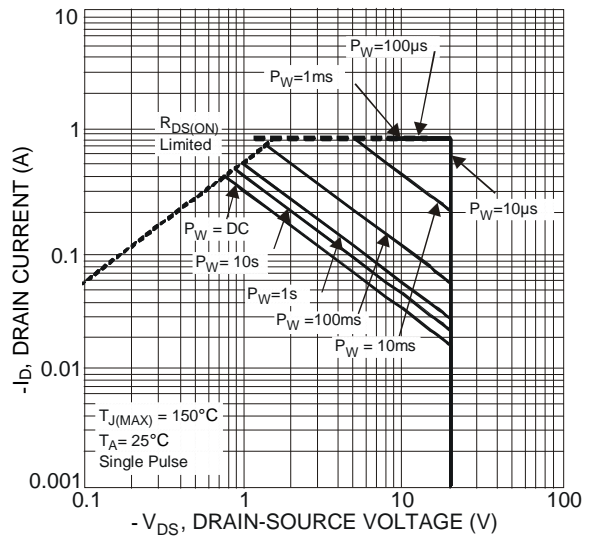
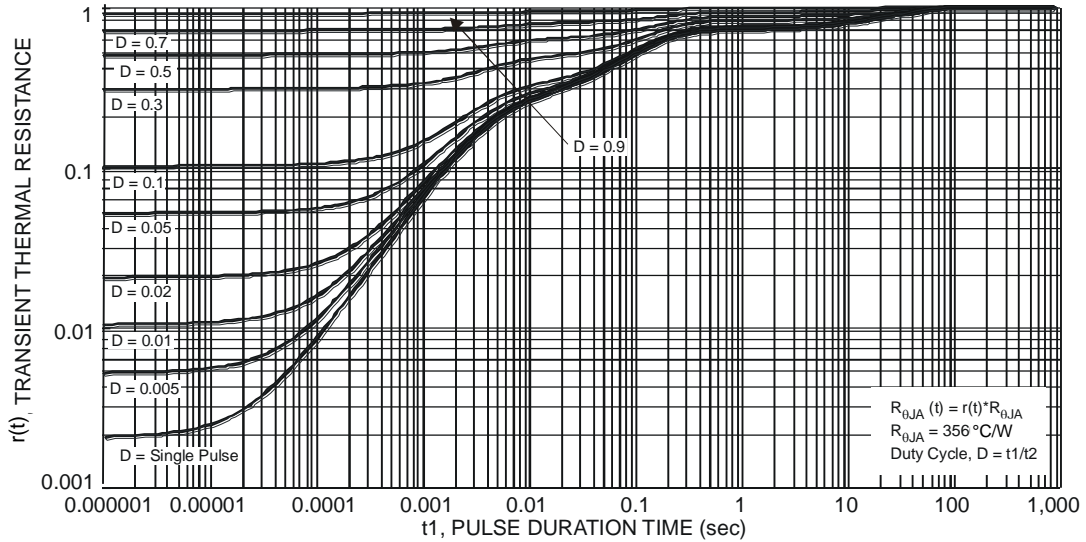


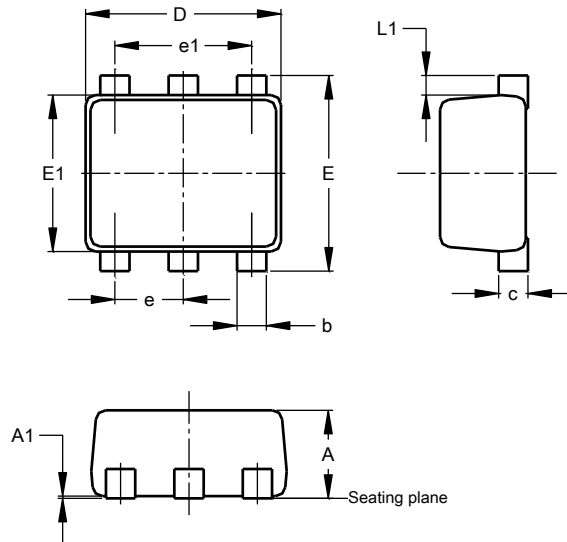
Fig. 24 SOA, Safe Operation Area



### Package Outline Dimensions

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

#### SOT963

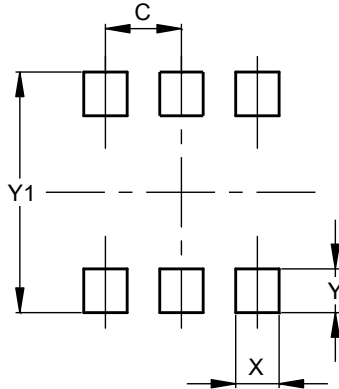


SOT963			
Dim	Min	Max	Typ
A	0.40	0.50	0.45
A1	0.00	0.05	--
b	0.10	0.20	0.15
c	0.120	0.180	0.150
D	0.95	1.05	1.00
E	0.95	1.05	1.00
E1	0.75	0.85	0.80
e	--	--	0.35
e1	--	--	0.70
L1	0.05	0.15	0.10
All Dimensions in mm			



## Suggested Pad Layout

Please see <http://www.diodes.com/package-outlines.html> for the latest version.  
**SOT963**



Dimensions	Value (in mm)
C	0.350
X	0.200
Y	0.200
Y1	1.100

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