

**COMPLEMENTARY PAIR ENHANCEMENT MODE MOSFET**

**Product Summary**

Device	V <sub>(BR)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 & 4)**
- **Qualified to AEC-Q101 standards for High Reliability**

**Description**

This MOSFET has been designed to minimize the on-state resistance (R<sub>DS(on)</sub>) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

**Applications**

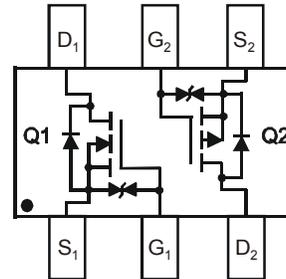
- General Purpose Interfacing Switch
- Power Management Functions
- Analog Switch

**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
- Weight: 0.027 grams (approximate)



Top View



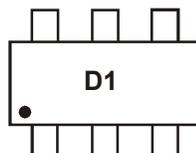
Top View Schematic and Transistor Diagram

**Ordering Information** (Note 5 & 6)

Part Number	Case	Packaging
DMC2990UDJ-7	SOT963	10K/Tape & Reel
DMC2990UDJ-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. Product manufactured with Date Code UO (week 40, 2007) and newer are built with Green Molding Compound. Product manufactured prior to Date Code UO are built with Non-Green Molding Compound and may contain Halogens or Sb<sub>2</sub>O<sub>3</sub> Fire Retardants.
  5. The options -7 and -7B stand for different taping orientations. Please refer to Diodes website at <http://www.diodes.com> for further details.
  6. 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** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic			Symbol	Value	Units
Drain-Source Voltage			$V_{DSS}$	20	V
Gate-Source Voltage			$V_{GSS}$	$\pm 8$	V
Continuous Drain Current (Note 7) $V_{GS} = 4.5\text{V}$	Steady State	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	450 350	mA
	t<5s	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	520 410	mA
Continuous Drain Current (Note 7) $V_{GS} = 1.8\text{V}$	Steady State	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	330 260	mA
	t<5s	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	390 310	mA
Maximum Continuous Body Diode Forward Current (Note 7)			$I_S$	440	mA
Pulsed Drain Current (Note 8)			$I_{DM}$	800	mA

**Maximum Ratings Q2 P-CHANNEL** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic			Symbol	Value	Units
Drain-Source Voltage			$V_{DSS}$	-20	V
Gate-Source Voltage			$V_{GSS}$	$\pm 8$	V
Continuous Drain Current (Note 5) $V_{GS} = -4.5\text{V}$	Steady State	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	-310 -240	mA
	t<5s	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	-360 -280	mA
Continuous Drain Current (Note 5) $V_{GS} = -1.8\text{V}$	Steady State	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	-240 -190	mA
	t<5s	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	-280 -220	mA
Maximum Continuous Body Diode Forward Current (Note 7)			$I_S$	-440	mA
Pulsed Drain Current (Note 8)			$I_{DM}$	-800	mA

**Thermal Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic		Symbol	Value	Units
Total Power Dissipation (Note 7)		$P_D$	350	mW
Thermal Resistance, Junction to Ambient (Note 7)	Steady State	$R_{\theta JA}$	360	$^\circ\text{C/W}$
	t<5s		270	$^\circ\text{C/W}$
Operating and Storage Temperature Range		$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$

- Notes: 7. Device mounted on FR-4 PCB, with minimum recommended pad layout.  
8. Device mounted on minimum recommended pad layout test board, 10 $\mu\text{s}$  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 9)</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>	@T <sub>C</sub> = +25°C	-	-	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 9)</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 10)</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 9)</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>	@T <sub>C</sub> = +25°C	-	-	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 9)</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 10)</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: 9. Short duration pulse test used to minimize self-heating effect.  
10. Guaranteed by design. Not subject to product testing.

**Q1 N-CHANNEL**

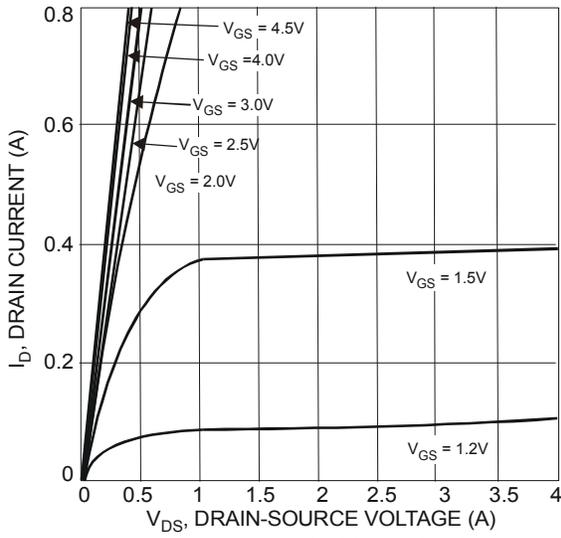


Fig. 1 Typical Output Characteristics

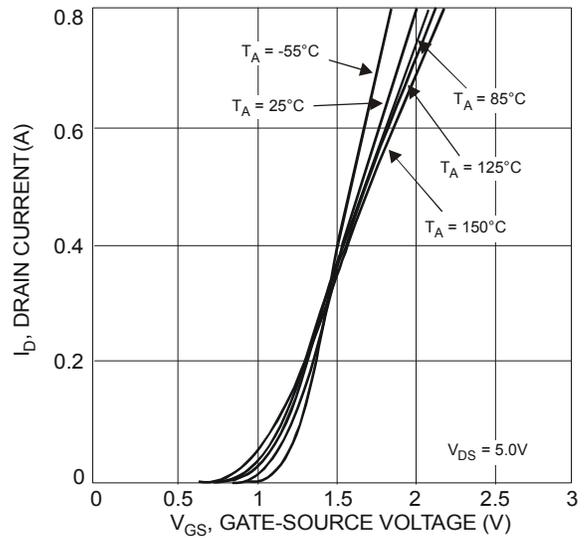


Fig. 2 Typical Transfer Characteristics

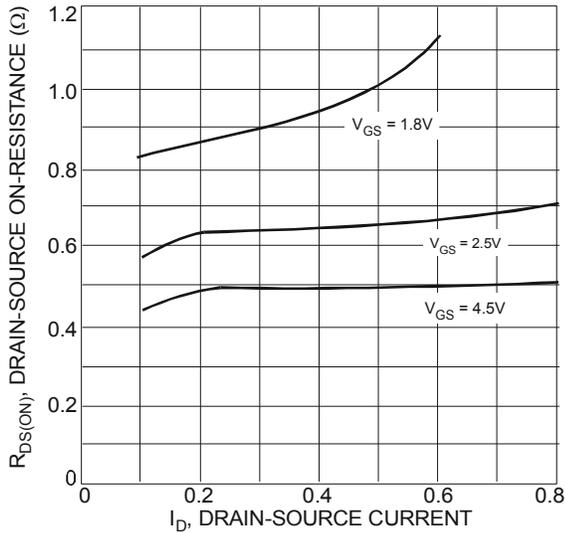


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

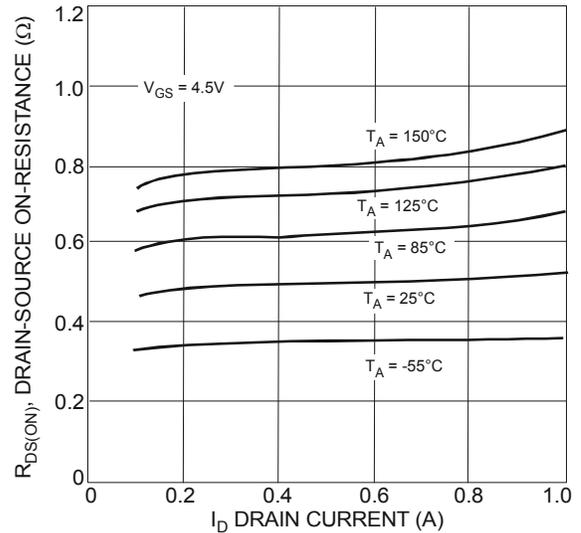


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

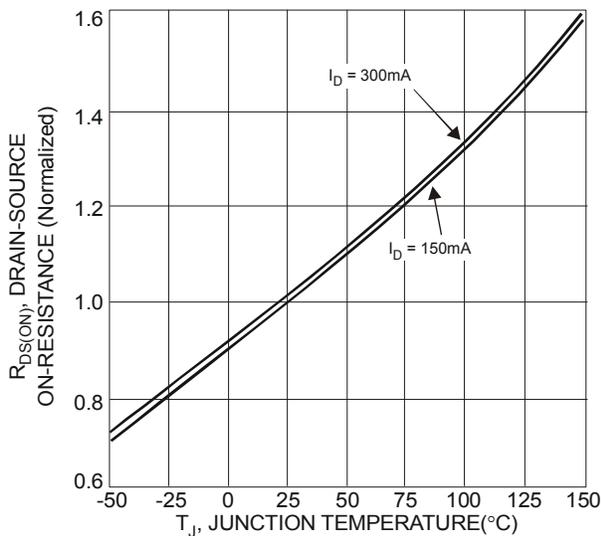


Fig. 5 On-Resistance Variation with Temperature

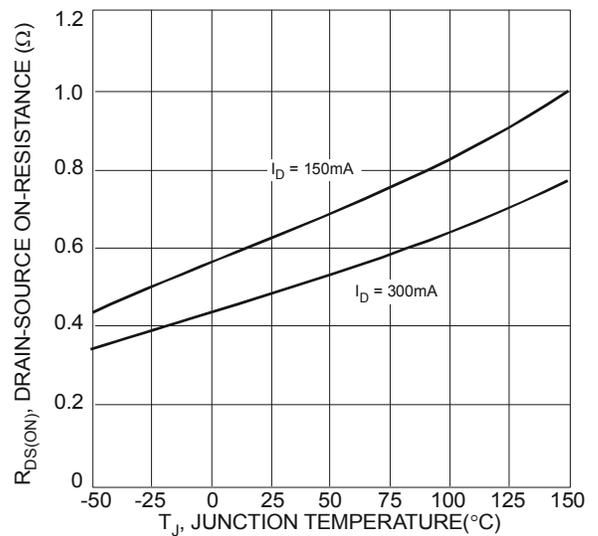


Fig. 6 On-Resistance Variation with Temperature

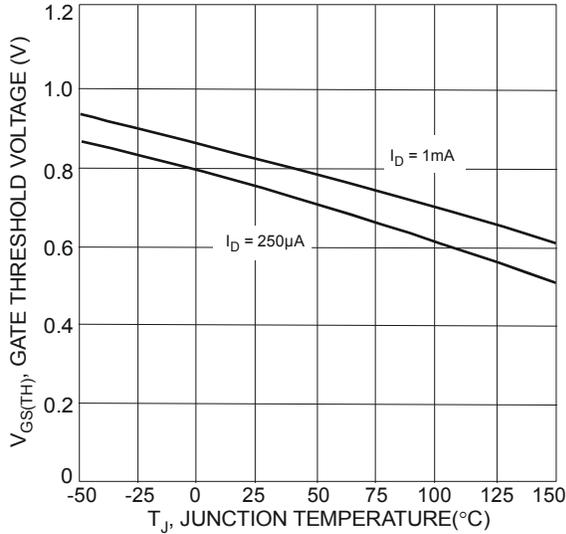


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

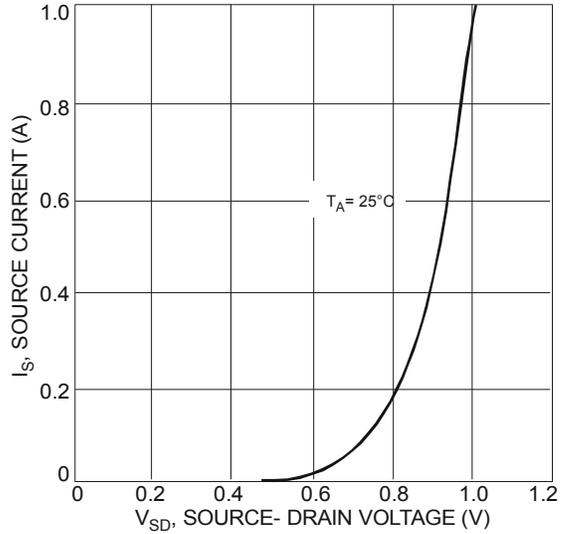


Fig. 8 Diodes Forward Voltage vs. Current

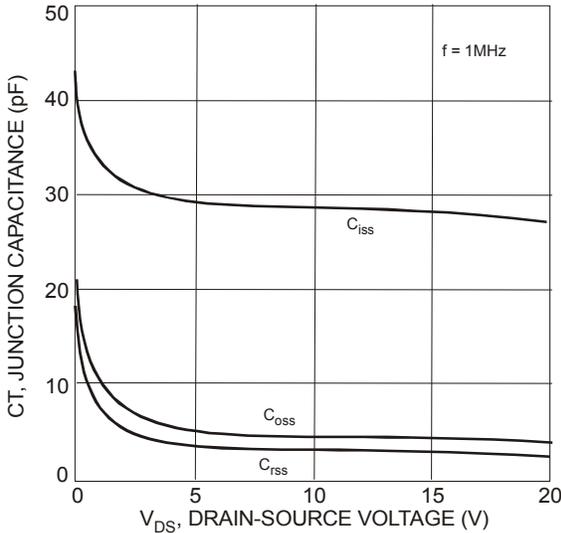


Fig. 9 Typical Junction Capacitance

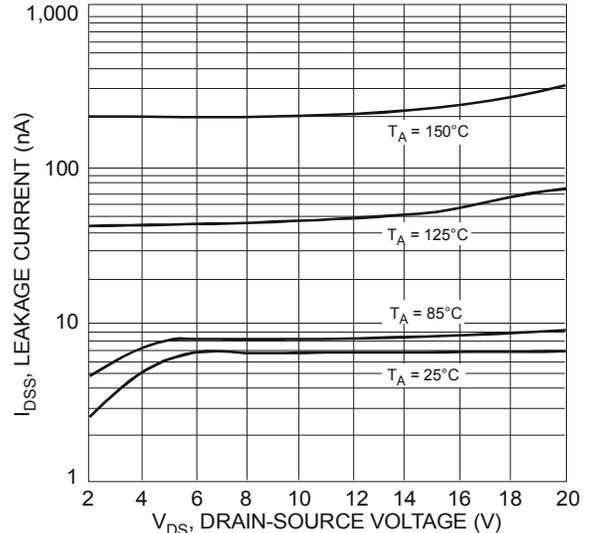


Fig. 10 Typical Drain-Source Leakage Current vs. Voltage

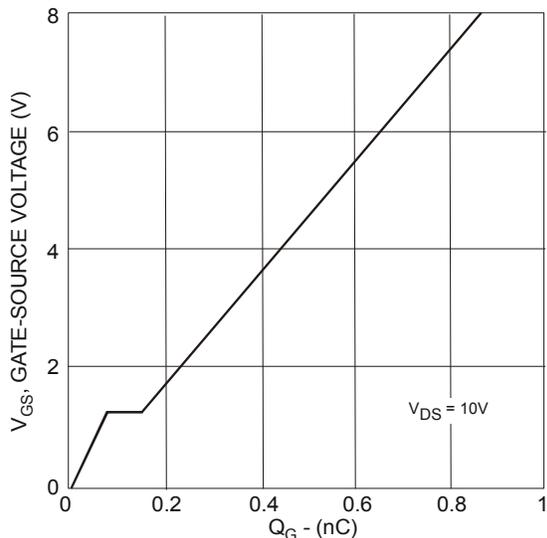


Fig. 11 Gate Charge Characteristics

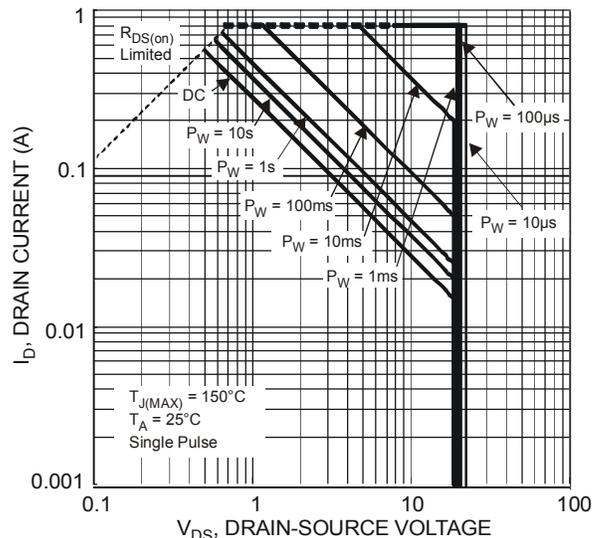


Fig. 12 SOA, Safe Operation Area

**Q2 P-CHANNEL**

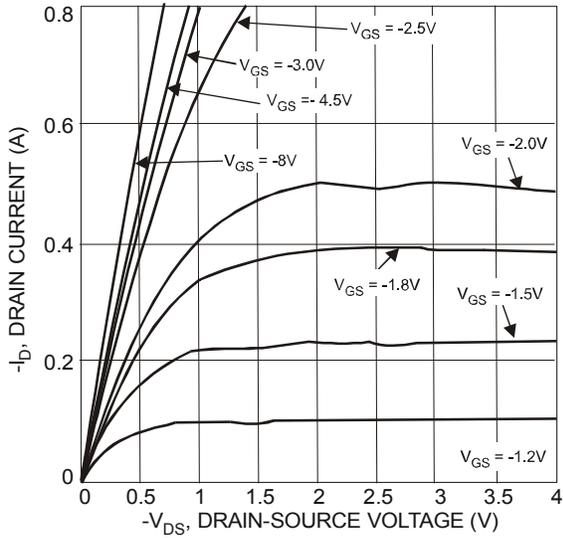


Fig. 13 Typical Output Characteristics

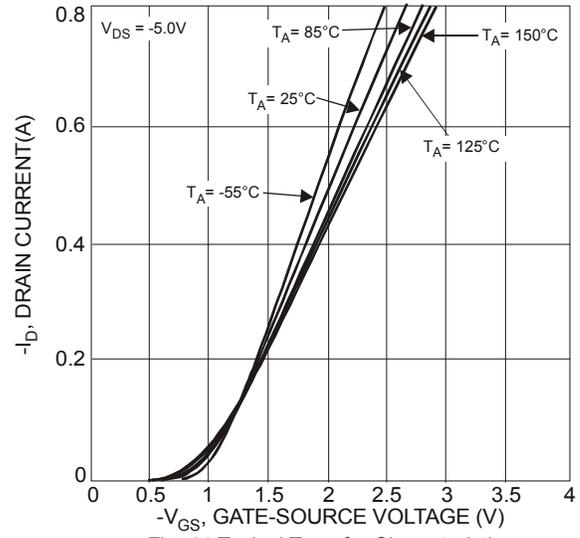


Fig. 14 Typical Transfer Characteristics

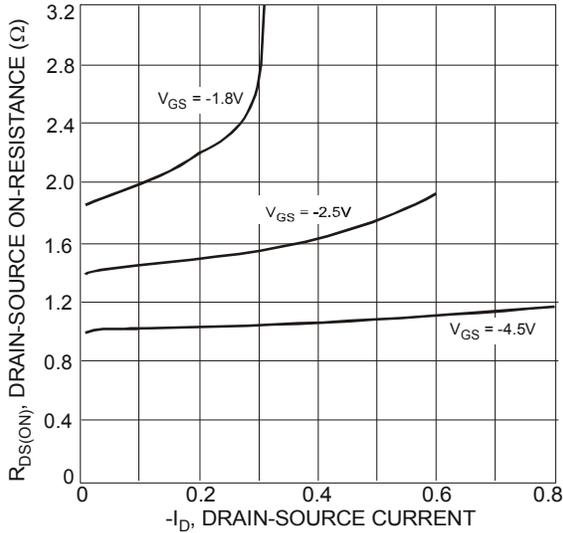


Fig. 15 Typical On-Resistance vs. Drain Current and Gate Voltage

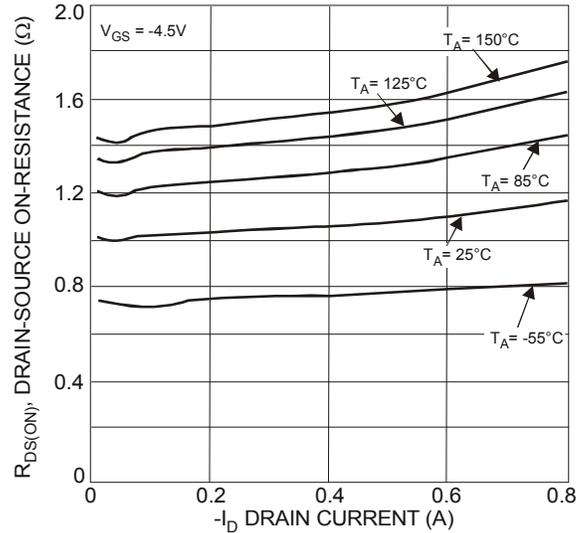


Fig. 16 Typical On-Resistance vs. Drain Current and Temperature

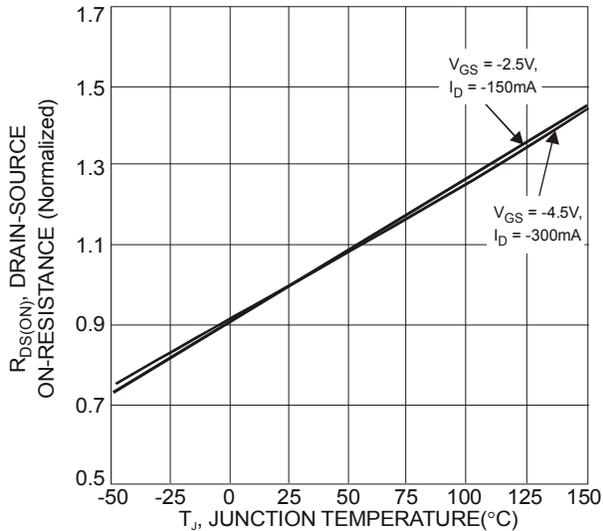


Fig. 17 On-Resistance Variation with Temperature

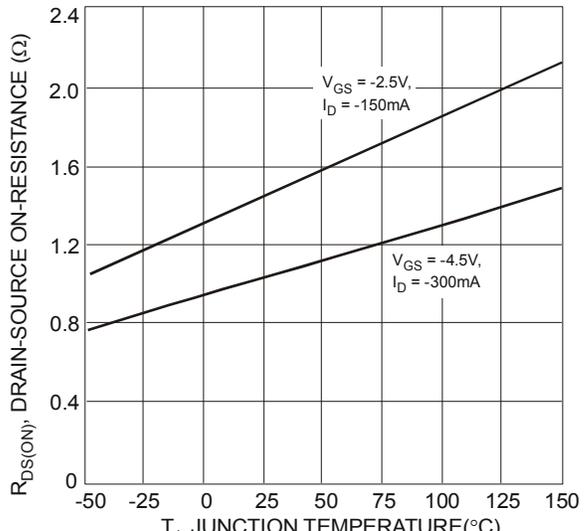


Fig. 18 On-Resistance Variation with Temperature

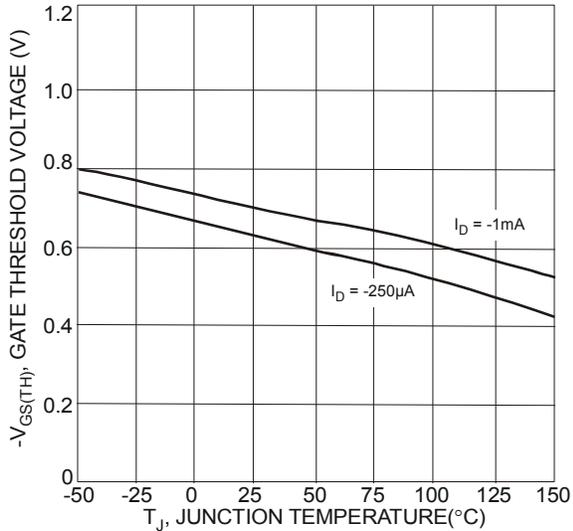


Fig. 19 Gate Threshold Variation vs. Ambient Temperature

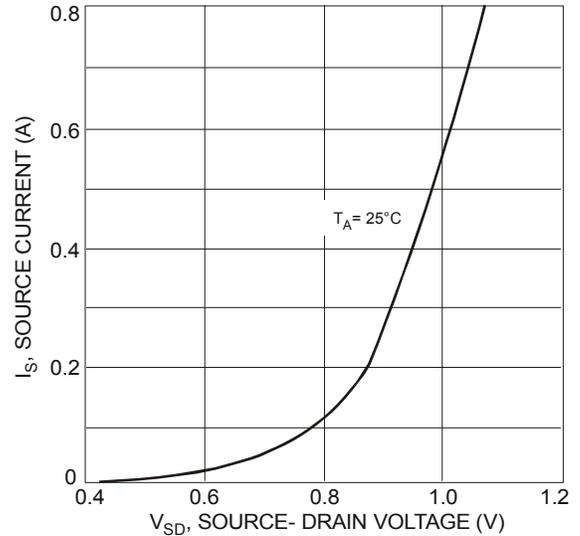


Fig. 20 Diodes Forward Voltage vs. Current

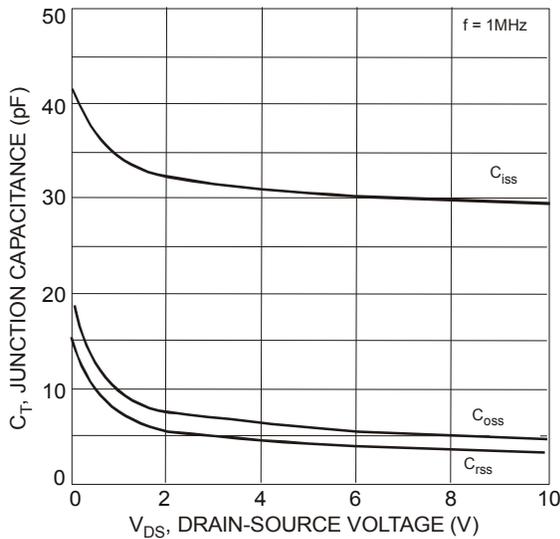


Fig. 21 Typical Junction Capacitance

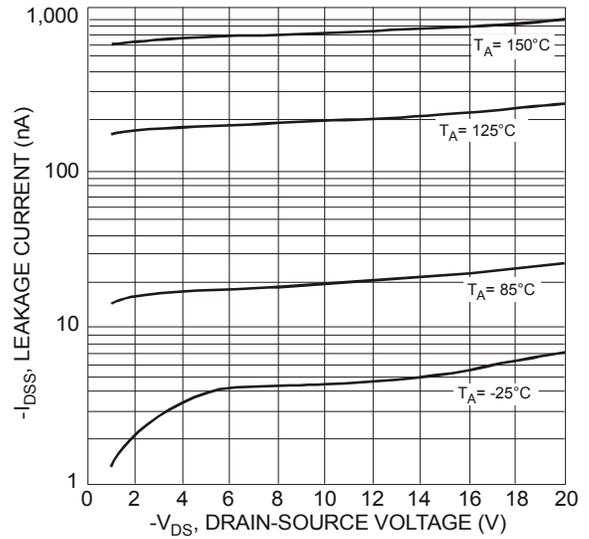


Fig. 22 Typical Leakage Current vs. Drain-Source Voltage

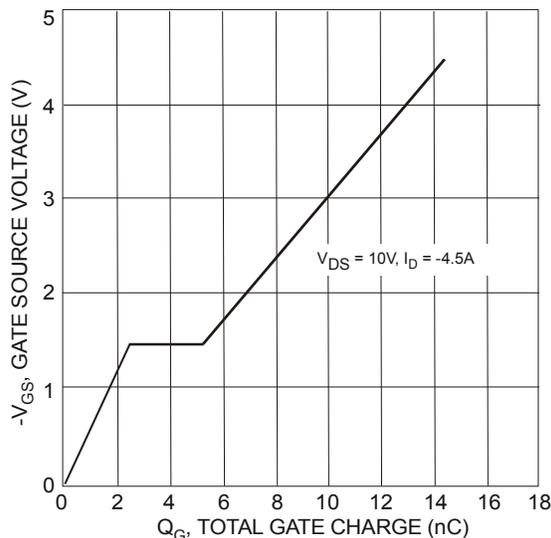


Fig. 23 Gate Charge Characteristics

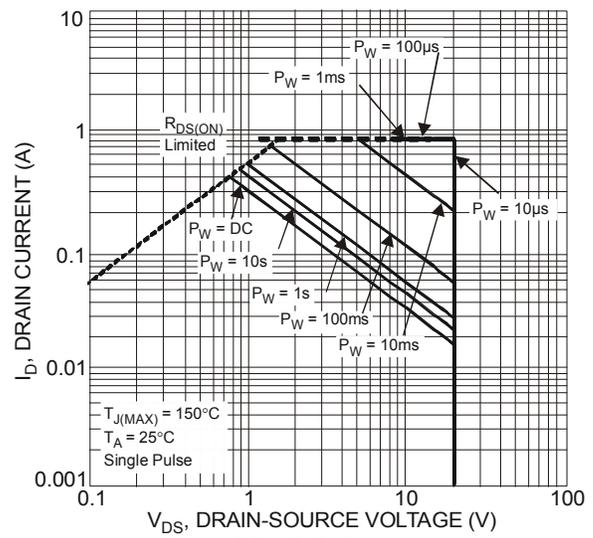
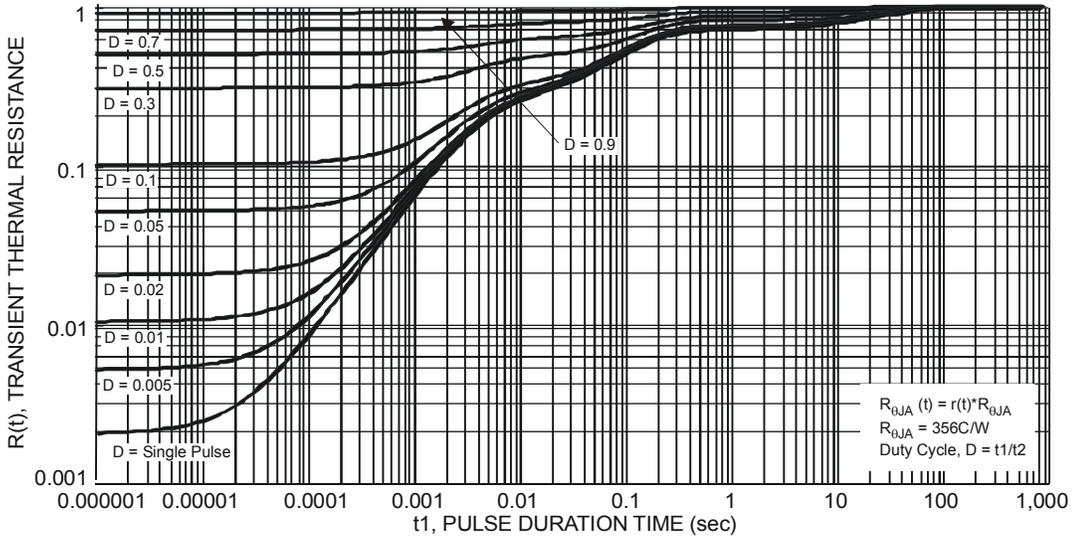
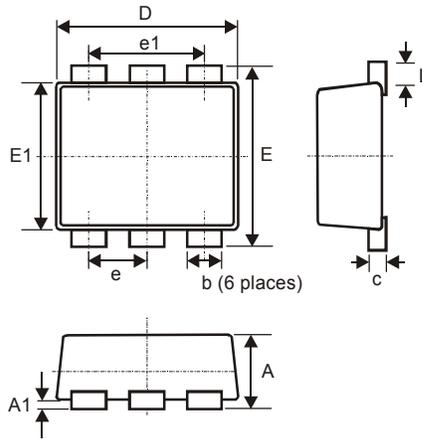


Fig. 24 SOA, Safe Operation Area

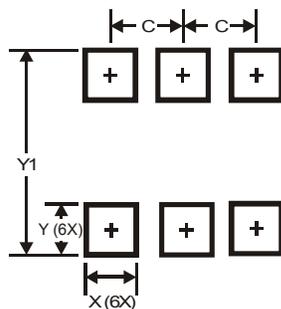


**Package Outline Dimensions**



SOT963			
Dim	Min	Max	Typ
A	0.40	0.50	0.45
A1	0	0.05	-
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
L	0.05	0.15	0.10
b	0.10	0.20	0.15
e	0.35 Typ		
e1	0.70 Typ		
All Dimensions in mm			

**Suggested Pad Layout**



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

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A. Life support devices or systems are devices or systems which:

1. are intended to implant into the body, or
2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

Customers represent that they have all necessary expertise in the safety and regulatory ramifications of their life support devices or systems, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of Diodes Incorporated products in such safety-critical, life support devices or systems, notwithstanding any devices- or systems-related information or support that may be provided by Diodes Incorporated. Further, Customers must fully indemnify Diodes Incorporated and its representatives against any damages arising out of the use of Diodes Incorporated products in such safety-critical, life support devices or systems.

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