COMPLEMENTARY PAIR ENHANCEMENT MODE MOSFET

Product Summary

Device	$V_{(BR)DSS}$	$R_{DS(ON)}$ max	I_D max T_A = 25°C
Q1	20V	0.99Ω @ V_{GS} = 4.5V	450mA
		1.2Ω @ V_{GS} = 2.5V	400mA
		1.8Ω @ V_{GS} = 1.8V	330mA
		2.4Ω @ V_{GS} = 1.5V	300mA
Q2	-20V	1.9Ω @ V_{GS} = -4.5V	-310mA
		2.4Ω @ V_{GS} = -2.5V	-280mA
		3.4Ω @ V_{GS} = -1.8V	-240mA
		5Ω @ V_{GS} = -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
- **Lead Free By Design/RoHS Compliant (Note 1)**
- **"Green" Device, Halogan and Antimony Free (Note 2)**
- **Qualified to AEC-Q101 standards for High Reliability**

Description and Applications

This MOSFET has been designed to minimize the on-state resistance ($R_{DS(on)}$) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

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

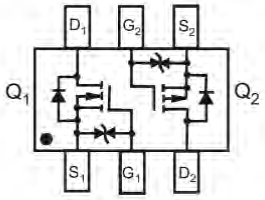
Mechanical Data

- 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)

ESD PROTECTED

SOT963

Top View



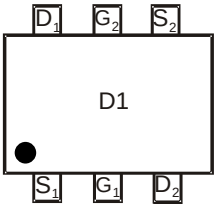
Top View
Schematic and Transistor Diagram

Ordering Information (Note 3)

Part Number	Case	Packaging
DMC2990UDJ-7	SOT963	10K/Tape & Reel

Notes: 1. No purposefully added lead.
2. Diodes Inc.'s "Green" policy can be found on our website at http://www.diodes.com.
3. For packaging details, go to our website at http://www.diodes.com.

Marking Information



D1 = Product Type Marking Code

Thermal Characteristics @T_A = 25°C unless otherwise specified

Characteristic		Symbol	Value	Units
Total Power Dissipation (Note 4)		P_D	350	mW
Thermal Resistance, Junction to Ambient (Note 4)	Steady State	$R_{\theta JA}$	360	°C/W
	t<5s		270	°C/W
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to +150	°C

Maximum Ratings Q1 N-CHANNEL @T_A = 25°C unless otherwise specified

Characteristic			Symbol	Value	Units
Drain-Source Voltage			V_{DSS}	20	V
Gate-Source Voltage			V_{GSS}	±8	V
Continuous Drain Current (Note 4) V_{GS} = 4.5V	Steady State	T_A = 25°C T_A = 70°C	I_D	450 350	mA
Continuous Drain Current (Note 4) V_{GS} = 1.8V	Steady State	T_A = 25°C T_A = 70°C	I_D	330 260	mA
Continuous Drain Current (Note 4) V_{GS} = 4.5V	t<5s	T_A = 25°C T_A = 70°C	I_D	520 410	mA
Continuous Drain Current (Note 4) V_{GS} = 1.8V	t<5s	T_A = 25°C T_A = 70°C	I_D	390 310	mA
Maximum Continuous Body Diode Forward Current (Note 4)			I_S	440	mA
Pulsed Drain Current (Note 5)			I_{DM}	800	mA

Maximum Ratings Q2 P-CHANNEL @T_A = 25°C unless otherwise specified

Characteristic			Symbol	Value	Units
Drain-Source Voltage			V_{DSS}	-20	V
Gate-Source Voltage			V_{GSS}	±8	V
Continuous Drain Current (Note 4) V_{GS} = -4.5V	Steady State	T_A = 25°C T_A = 70°C	I_D	-310 -240	mA
Continuous Drain Current (Note 4) V_{GS} = -1.8V	Steady State	T_A = 25°C T_A = 70°C	I_D	-240 -190	mA
Continuous Drain Current (Note 4) V_{GS} = -4.5V	t<5s	T_A = 25°C T_A = 70°C	I_D	-360 -280	mA
Continuous Drain Current (Note 4) V_{GS} = -1.8V	t<5s	T_A = 25°C T_A = 70°C	I_D	-280 -220	mA
Maximum Continuous Body Diode Forward Current (Note 4)			I_S	-440	mA
Pulsed Drain Current (Note 5)			I_{DM}	-800	mA

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

Electrical Characteristics Q1 N-CHANNEL @T_A = 25°C unless otherwise specified

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 6)						
Drain-Source Breakdown Voltage	BV_{DSS}	20	-	-	V	V_{GS} = 0V, I_D = 250µA
Zero Gate Voltage Drain Current @T_c = 25°C	I_{DSS}	-	-	100	nA	V_{DS} = 16V, V_{GS} = 0V
		-	-	50		V_{DS} = 5V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	-	-	±100	nA	V_{GS} = ±5V, V_{DS} = 0V
ON CHARACTERISTICS (Note 6)						
Gate Threshold Voltage	$V_{GS(th)}$	0.4	-	1.0	V	V_{DS} = V_{GS}, I_D = 250µA
Static Drain-Source On-Resistance	$R_{DS\ (ON)}$	-	0.60	0.99	Ω	V_{GS} = 4.5V, I_D = 100mA
		-	0.75	1.2		V_{GS} = 2.5V, I_D = 50mA
		-	0.90	1.8		V_{GS} = 1.8V, I_D = 20mA
		-	1.2	2.4		V_{GS} = 1.5V, I_D = 10mA
		-	2.0	-		V_{GS} = 1.2V, I_D = 1mA
Forward Transfer Admittance	$\|Y_{fs}\|$	180	850	-	mS	V_{DS} = 5V, I_D = 125mA
Diode Forward Voltage (Note 6)	V_{SD}	-	0.6	1.0	V	V_{GS} = 0V, I_S = 10mA
DYNAMIC CHARACTERISTICS (Note 7)						
Input Capacitance	C_{iss}	-	27.6	-	pF	V_{DS} = 15V, V_{GS} = 0V, f = 1.0MHz
Output Capacitance	C_{oss}	-	4.0	-	pF	
Reverse Transfer Capacitance	C_{rss}	-	2.8	-	pF	
Gate Resistance	R_G	-	0.11	-	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1.0MHz
Total Gate Charge	Q_g	-	0.5	-	nC	V_{GS} = 4.5V, V_{DS} = 10V, I_D = 250mA
Gate-Source Charge	Q_{gs}	-	0.07	-	nC	
Gate-Drain Charge	Q_{gd}	-	0.07	-	nC	
Turn-On Delay Time	$t_{D(on)}$	-	4.0	-	ns	V_{DD} = 15V, V_{GS} = 4.5V, R_L = 47Ω, R_G = 2Ω, I_D = 200mA
Turn-On Rise Time	t_r	-	3.3	-	ns	
Turn-Off Delay Time	$t_{D(off)}$	-	19.0	-	ns	
Turn-Off Fall Time	t_f	-	6.4	-	ns	

Electrical Characteristics Q2 P-CHANNEL @T_A = 25°C unless otherwise specified

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 6)						
Drain-Source Breakdown Voltage	BV_{DSS}	-20	-	-	V	V_{GS} = 0V, I_D = -250µA
Zero Gate Voltage Drain Current @T_c = 25°C	I_{DSS}	-	-	100	nA	V_{DS} = -16V, V_{GS} = 0V
		-	-	50		V_{DS} = -5V, V_{GS} = 0V
Gate-Source Leakage	I_{GSS}	-	-	±100	nA	V_{GS} = ±5V, V_{DS} = 0V
ON CHARACTERISTICS (Note 6)						
Gate Threshold Voltage	$V_{GS(th)}$	-0.4	-	-1.0	V	V_{DS} = V_{GS}, I_D = -250µA
Static Drain-Source On-Resistance	$R_{DS\ (ON)}$	-	1.2	1.9	Ω	V_{GS} = -4.5V, I_D = -100mA
		-	1.5	2.4		V_{GS} = -2.5V, I_D = -50mA
		-	2.1	3.4		V_{GS} = -1.8V, I_D = -20mA
		-	2.5	5		V_{GS} = -1.5V, I_D = -10mA
		-	4.0	-		V_{GS} = -1.2V, I_D = -1mA
Forward Transfer Admittance	$\|Y_{fs}\|$	100	450	-	mS	V_{DS} = -5V, I_D = -125mA
Diode Forward Voltage (Note 6)	V_{SD}	-	-0.6	-1.0	V	V_{GS} = 0V, I_S = -10mA
DYNAMIC CHARACTERISTICS (Note 7)						
Input Capacitance	C_{iss}	-	28.7	-	pF	V_{DS} = -15V, V_{GS} = 0V, f = 1.0MHz
Output Capacitance	C_{oss}	-	4.2	-	pF	
Reverse Transfer Capacitance	C_{rss}	-	2.9	-	pF	
Gate Resistance	R_G	-	0.4	-	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1.0MHz
Total Gate Charge	Q_g	-	0.4	-	nC	V_{GS} = -4.5V, V_{DS} =- 10V, I_D = -250mA
Gate-Source Charge	Q_{gs}	-	0.08	-	nC	
Gate-Drain Charge	Q_{gd}	-	0.06	-	nC	
Turn-On Delay Time	$t_{D(on)}$	-	5.8	-	ns	V_{DD} = -15V, V_{GS} = -4.5V, R_G = 2Ω, I_D = -200mA
Turn-On Rise Time	t_r	-	5.7	-	ns	
Turn-Off Delay Time	$t_{D(off)}$	-	31.1	-	ns	
Turn-Off Fall Time	t_f	-	16.4	-	ns	

Notes: 6. Short duration pulse test used to minimize self-heating effect.
7. Guaranteed by design. Not subject to product testing.

Q1 N-CHANNEL

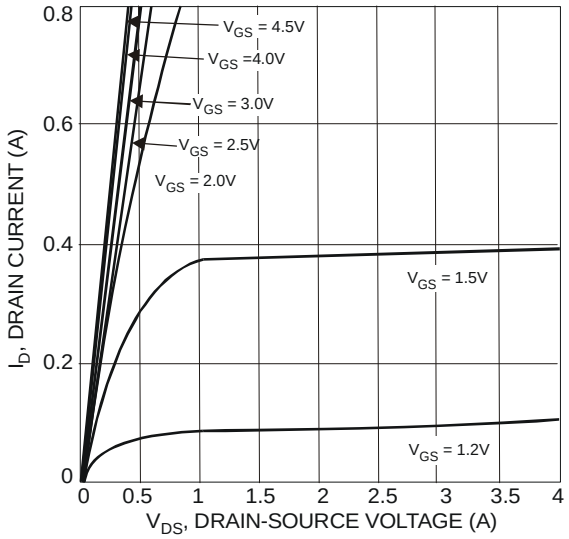


Fig. 1 Typical Output Characteristics

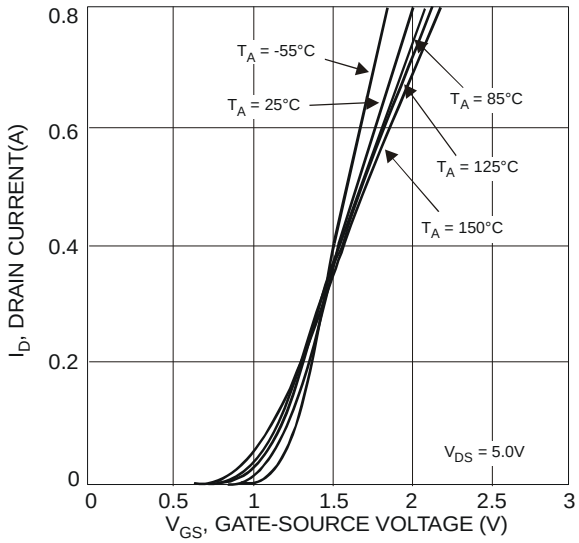


Fig. 2 Typical Transfer Characteristics

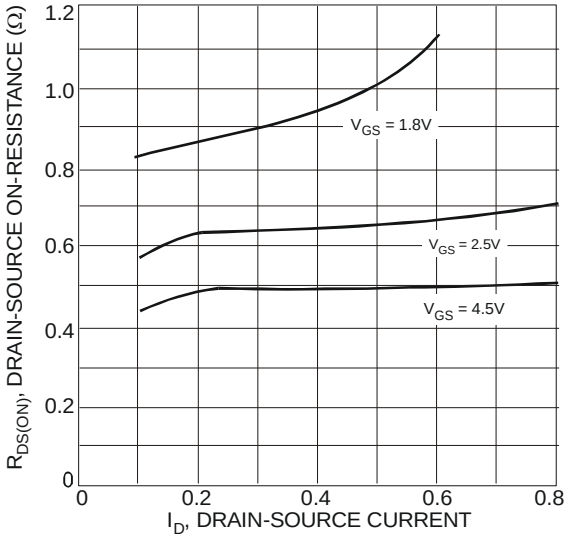


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

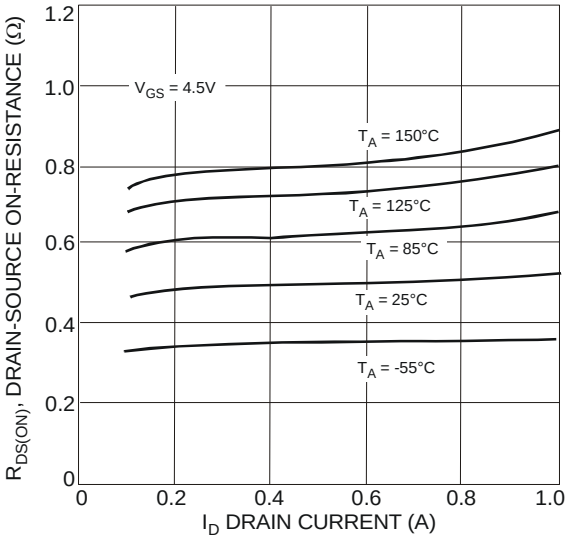


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

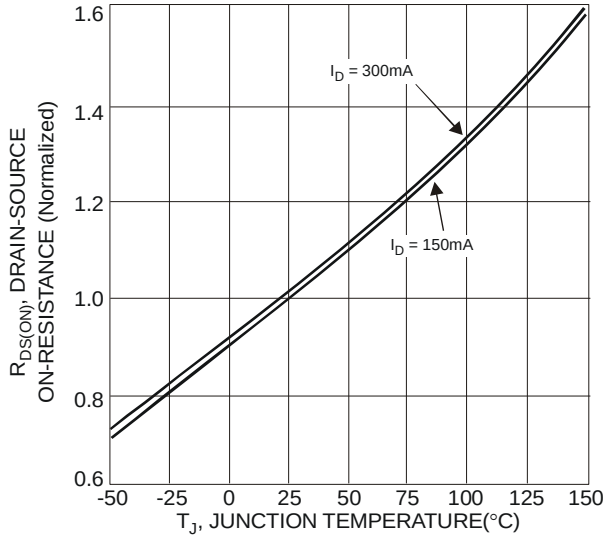


Fig. 5 On-Resistance Variation with Temperature

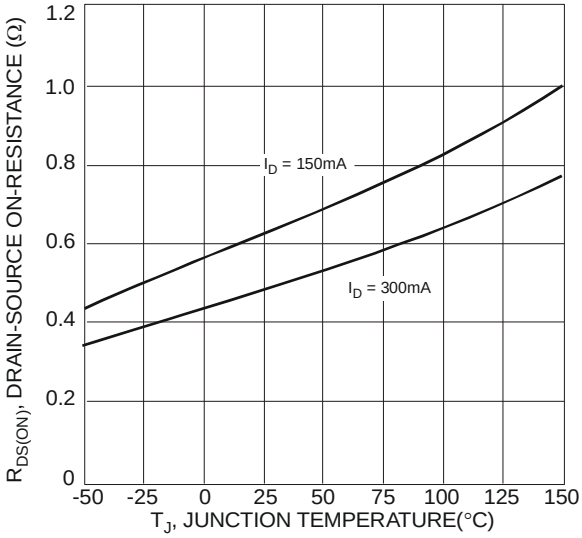


Fig. 6 On-Resistance Variation with Temperature

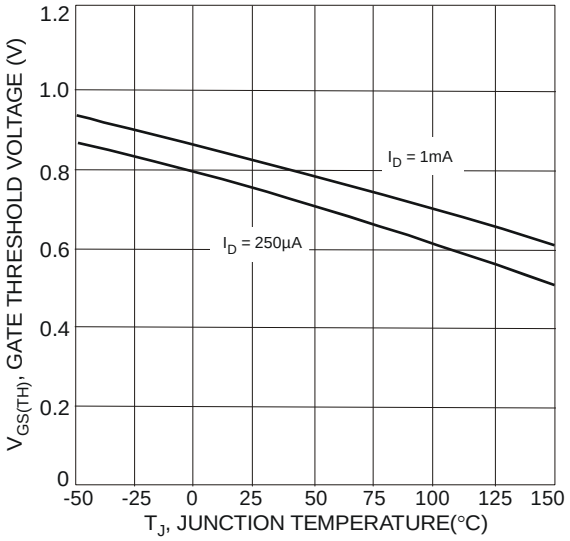


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

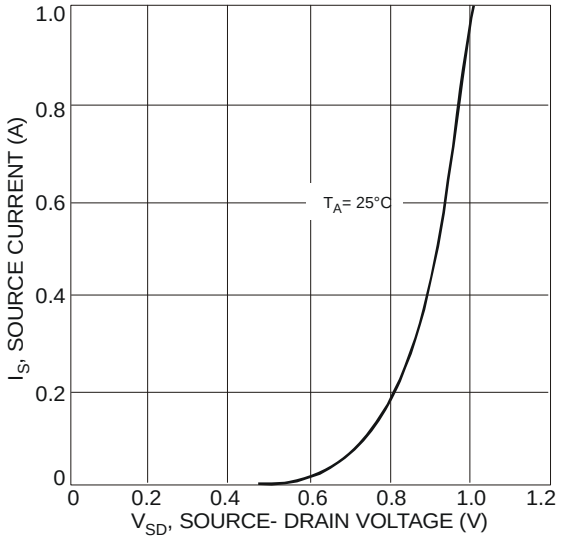


Fig. 8 Diodes Forward Voltage vs. Current

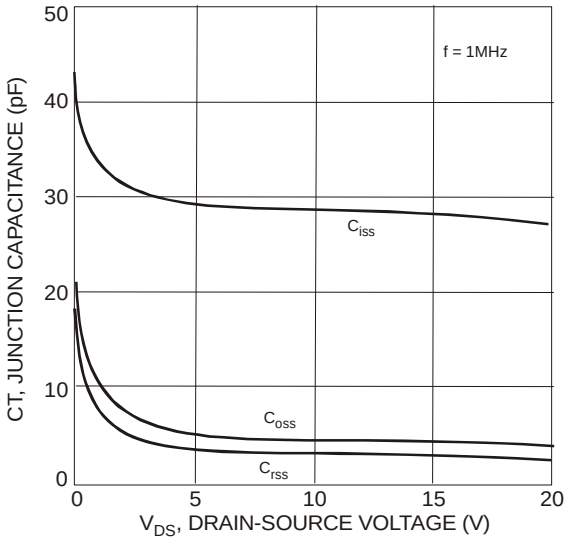


Fig. 9 Typical Junction Capacitance

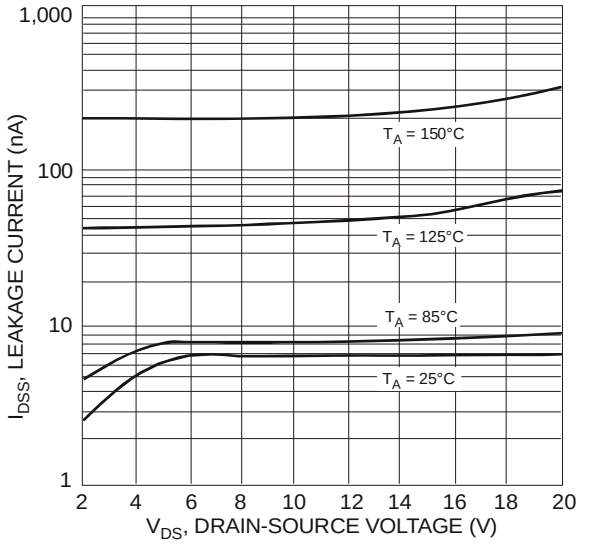


Fig. 10 Typical Drain-Source Leakage Current vs. Voltage

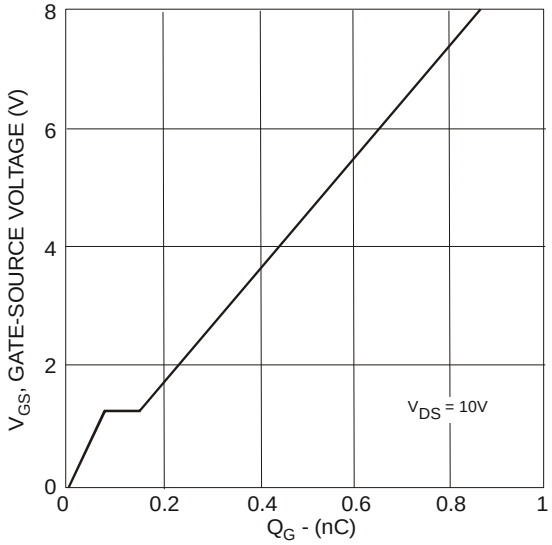


Fig. 11 Gate Charge Characteristics

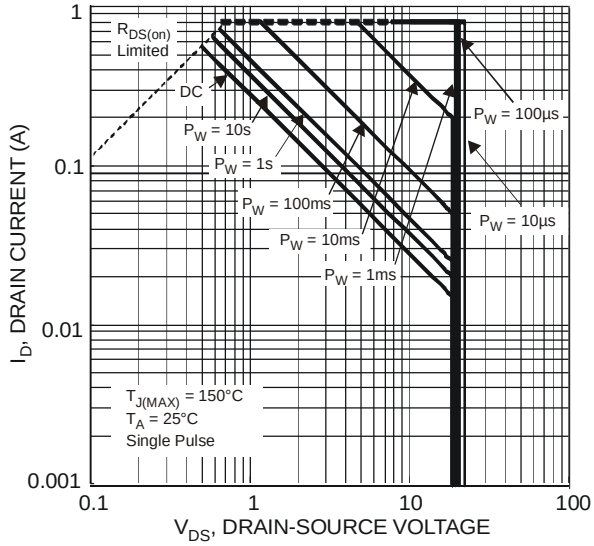


Fig. 12 SOA, Safe Operation Area

Q2 P-CHANNEL

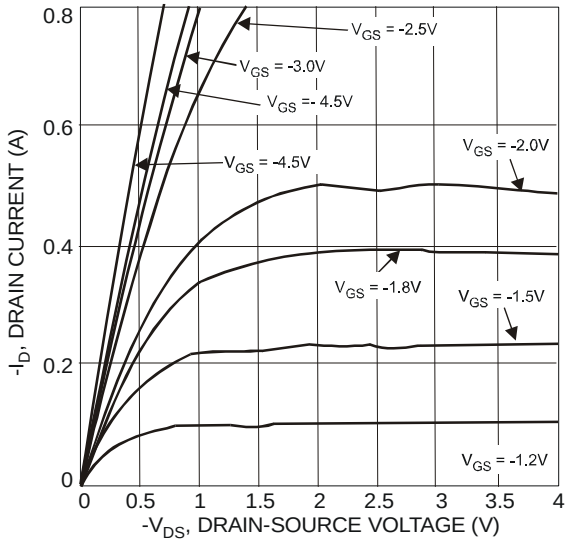


Fig. 13 Typical Output Characteristics

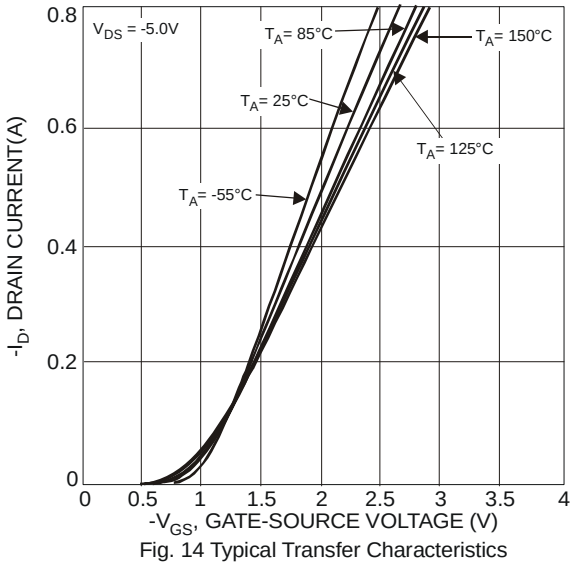


Fig. 14 Typical Transfer Characteristics

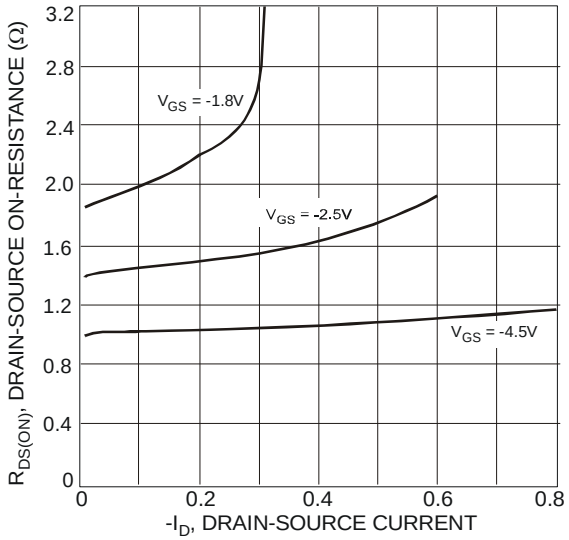


Fig. 15 Typical On-Resistance vs. Drain Current and Gate Voltage

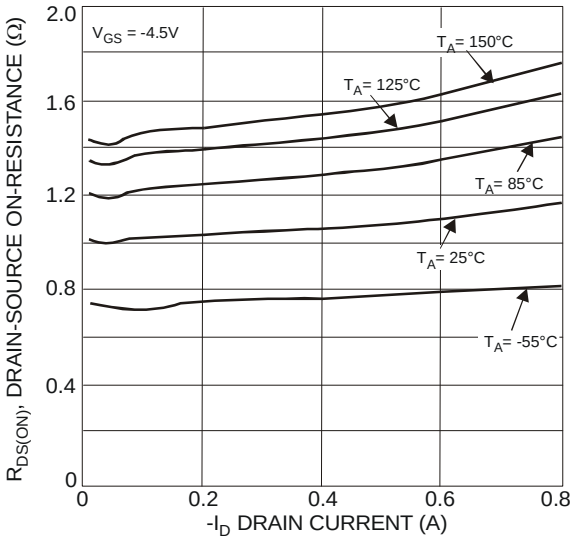


Fig. 16 Typical On-Resistance vs. Drain Current and Temperature

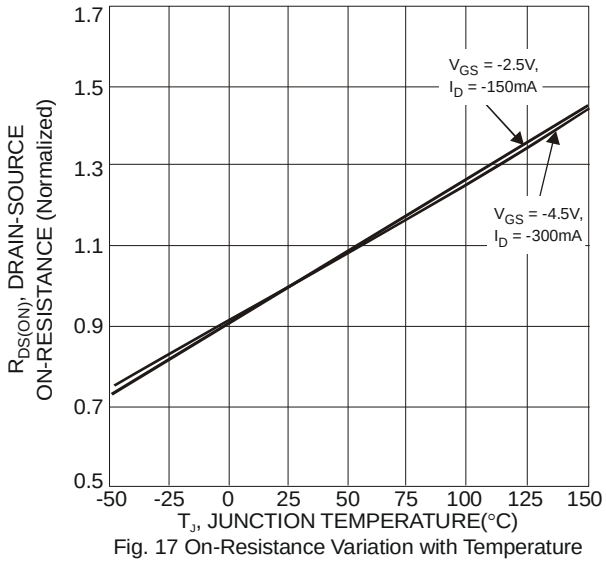


Fig. 17 On-Resistance Variation with Temperature

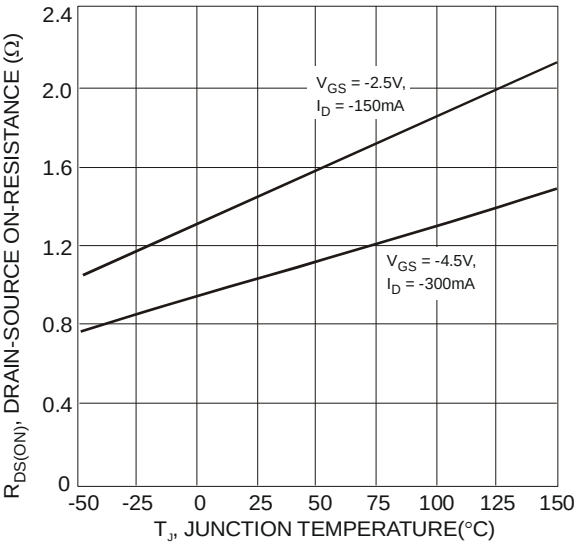


Fig. 18 On-Resistance Variation with Temperature

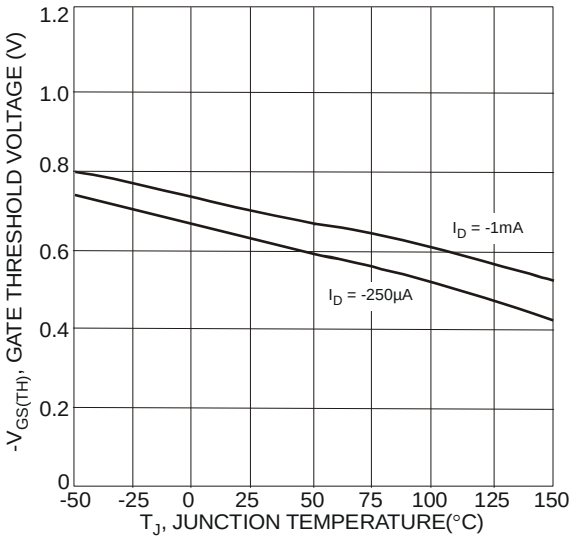


Fig. 19 Gate Threshold Variation vs. Ambient Temperature

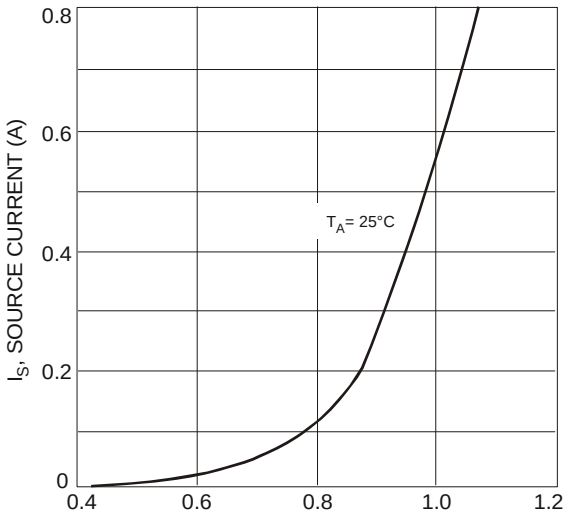


Fig. 20 Diodes Forward Voltage vs. Current

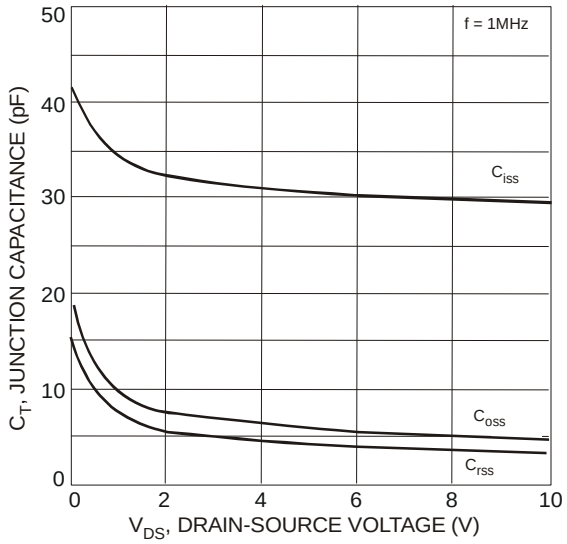


Fig. 21 Typical Junction Capacitance

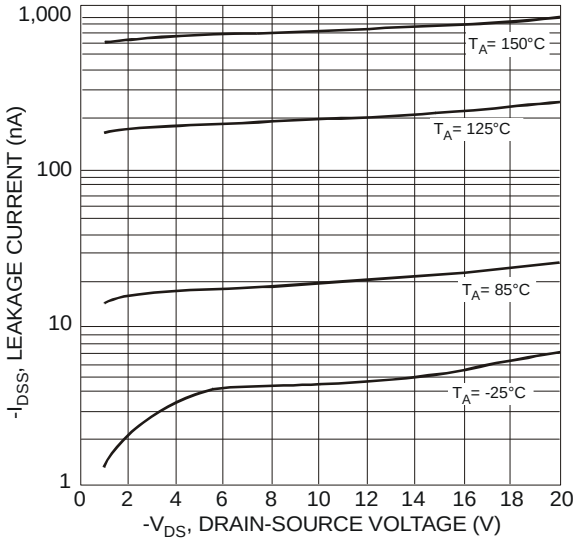


Fig. 22 Typical Leakage Current vs. Drain-Source Voltage

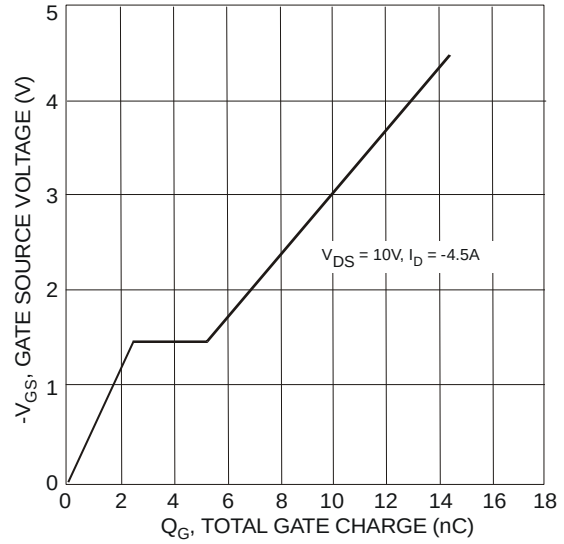


Fig. 23 Gate Charge Characteristics

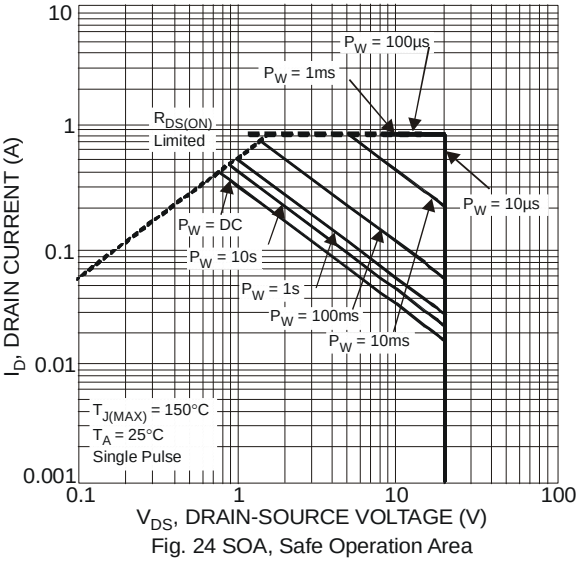


Fig. 24 SOA, Safe Operation Area

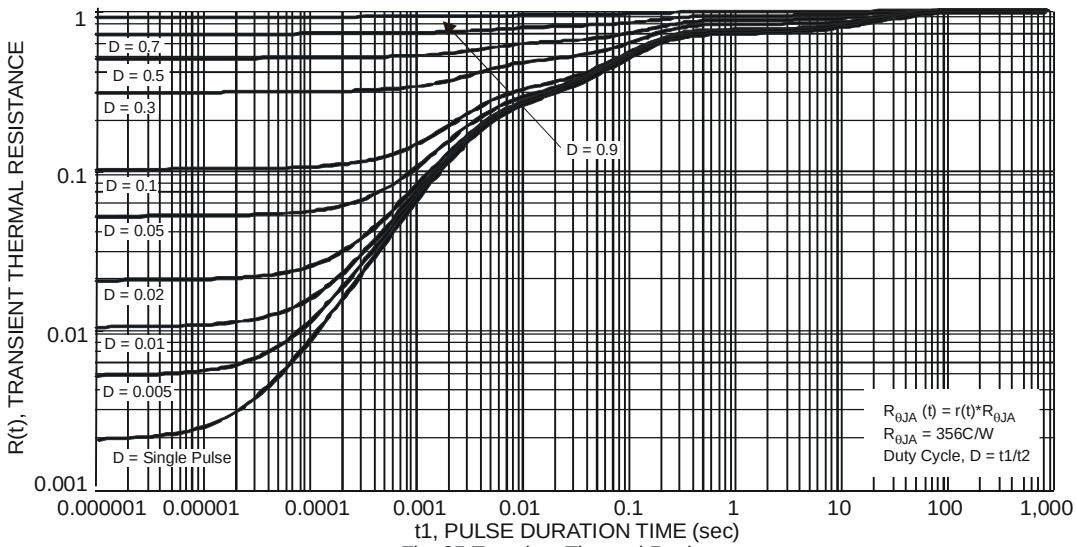
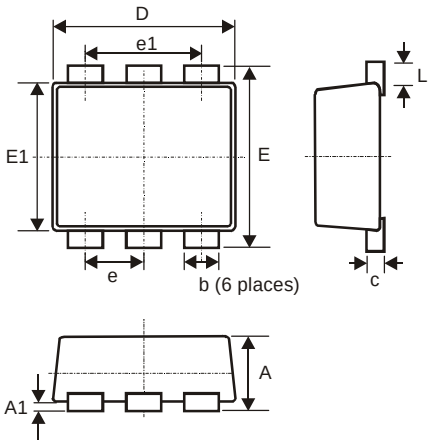


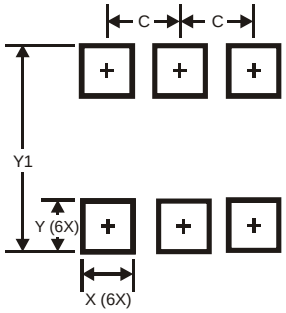
Fig. 25 Transient Thermal Resistance

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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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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