

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
- **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

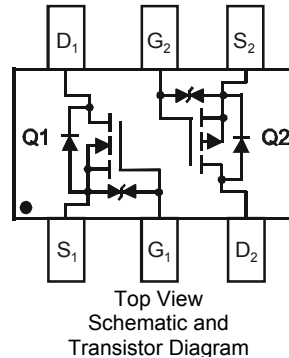
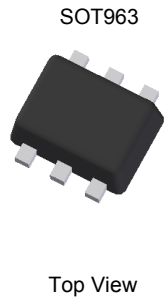
This MOSFET has been designed to minimize the on-state resistance (R_{DS(on)}) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

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)

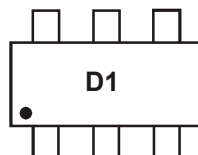


Ordering Information (Note 5 & 6)

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 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 Sb₂O₃ 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}	± 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}	± 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 μs pulse duty cycle = 1%.

Electrical Characteristics Q1 N-CHANNEL (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 9)						
Drain-Source Breakdown Voltage	BV_{DSS}	20	-	-	V	$V_{GS} = 0V, I_D = 250\mu A$
Zero Gate Voltage Drain Current	I_{DSS}	-	-	100	nA	$V_{DS} = 16V, V_{GS} = 0V$
		-	-	50		$V_{DS} = 5V, V_{GS} = 0V$
Gate-Source Leakage	I_{GSS}	-	-	± 100	nA	$V_{GS} = \pm 5V, V_{DS} = 0V$
ON CHARACTERISTICS (Note 9)						
Gate Threshold Voltage	$V_{GS(th)}$	0.4	-	1.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
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	V_{SD}	-	0.6	1.0	V	$V_{GS} = 0V, I_S = 10mA$
DYNAMIC CHARACTERISTICS (Note 10)						
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	-	113	-	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	$V_{DD} = 15V, V_{GS} = 4.5V, R_L = 47\Omega, R_G = 2\Omega, I_D = 200mA$
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 (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 9)						
Drain-Source Breakdown Voltage	BV_{DSS}	-20	-	-	V	$V_{GS} = 0V, I_D = -250\mu A$
Zero Gate Voltage Drain Current	I_{DSS}	-	-	100	nA	$V_{DS} = -16V, V_{GS} = 0V$
		-	-	50		$V_{DS} = -5V, V_{GS} = 0V$
Gate-Source Leakage	I_{GSS}	-	-	± 100	nA	$V_{GS} = \pm 5V, V_{DS} = 0V$
ON CHARACTERISTICS (Note 9)						
Gate Threshold Voltage	$V_{GS(th)}$	-0.4	-	-1.0	V	$V_{DS} = V_{GS}, I_D = -250\mu A$
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	V_{SD}	-	-0.6	-1.0	V	$V_{GS} = 0V, I_S = -10mA$
DYNAMIC CHARACTERISTICS (Note 10)						
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	-	399	-	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	$V_{DD} = -15V, V_{GS} = -4.5V, R_G = 2\Omega, I_D = -200mA$
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: 9. Short duration pulse test used to minimize self-heating effect.
 10. Guaranteed by design. Not subject to product testing.

Q1 N-CHANNEL

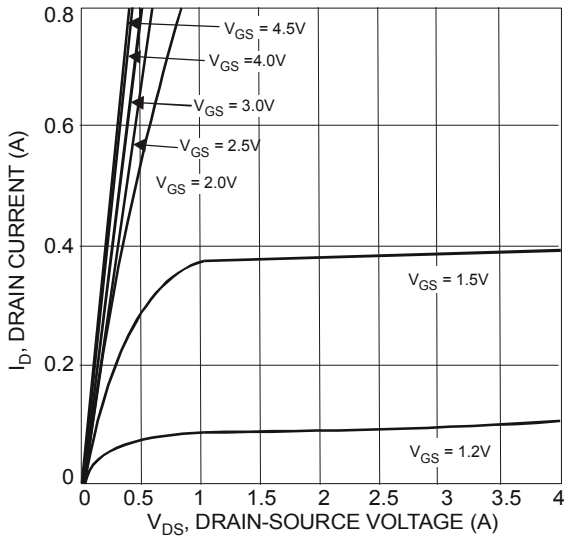


Fig. 1 Typical Output Characteristics

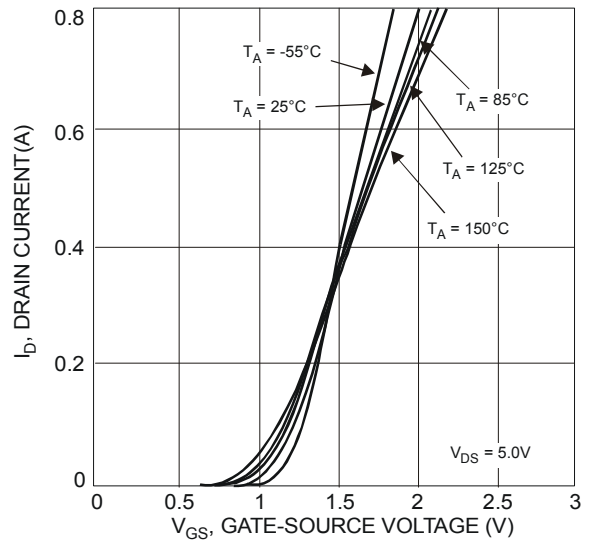


Fig. 2 Typical Transfer Characteristics

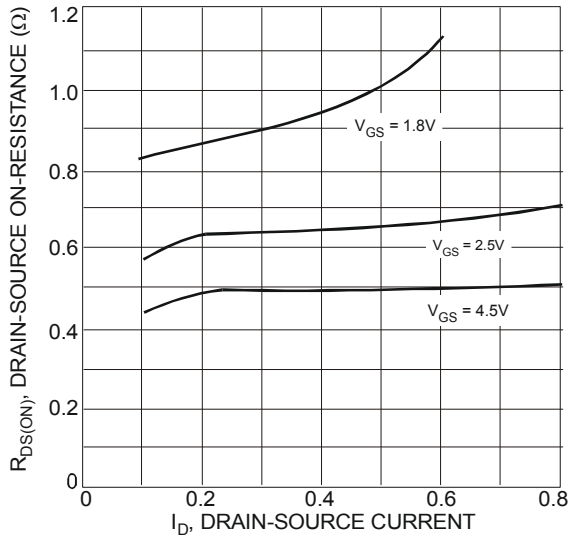


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

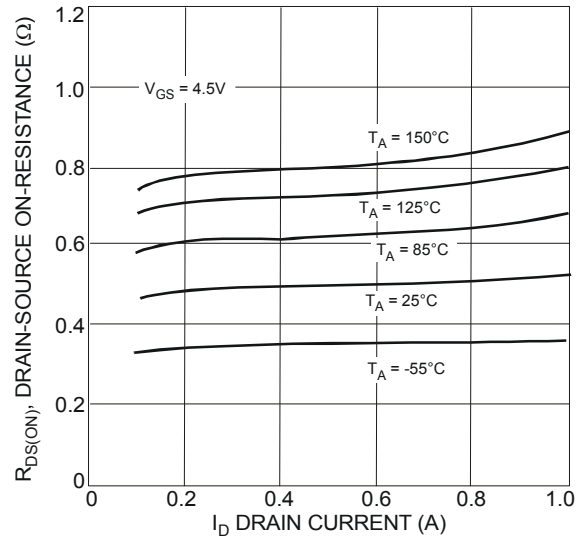


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

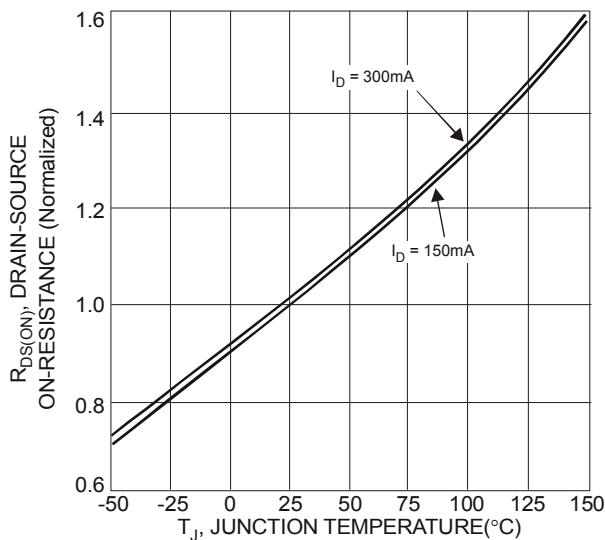


Fig. 5 On-Resistance Variation with Temperature

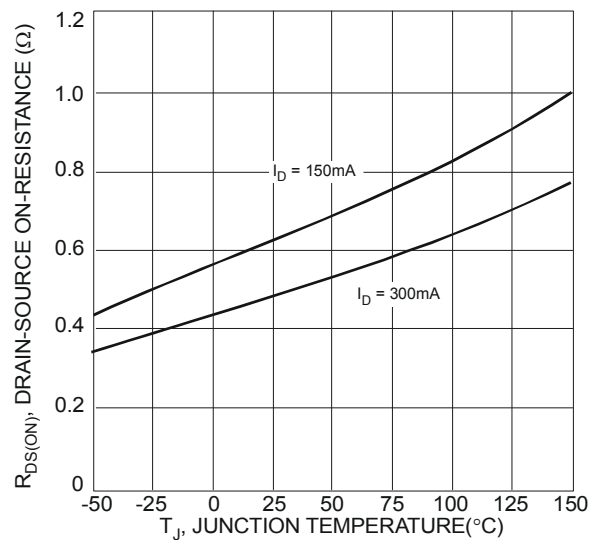


Fig. 6 On-Resistance Variation with Temperature

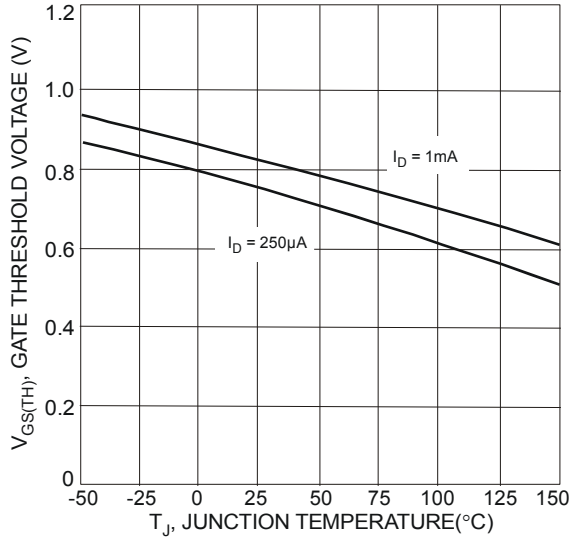


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

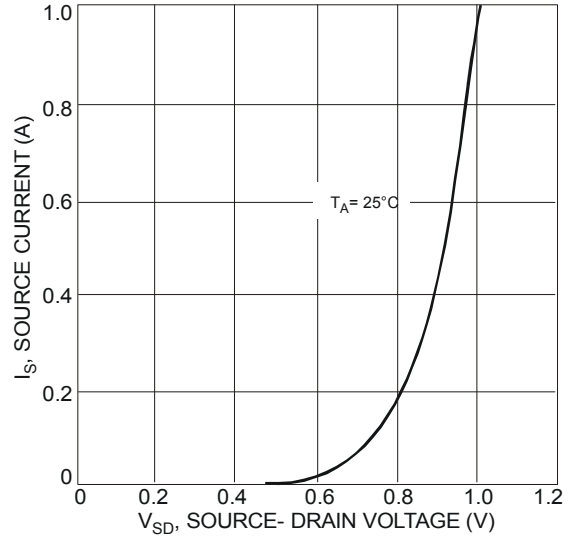


Fig. 8 Diodes Forward Voltage vs. Current

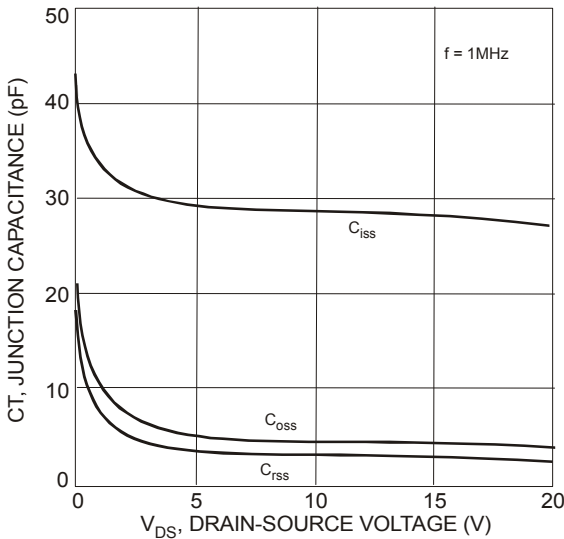


Fig. 9 Typical Junction Capacitance

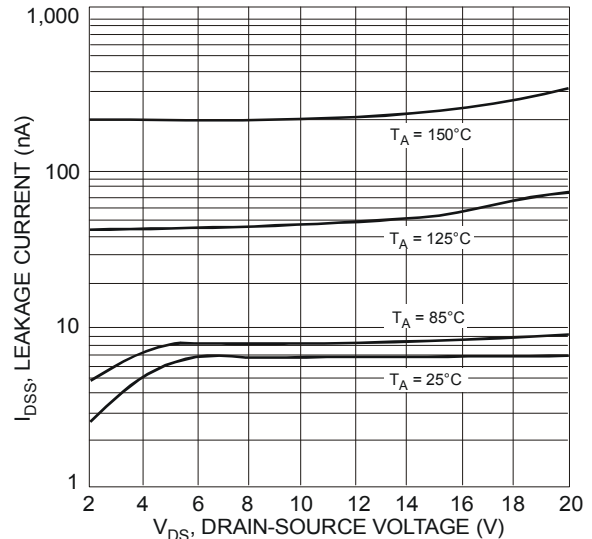


Fig. 10 Typical Drain-Source Leakage Current vs. Voltage

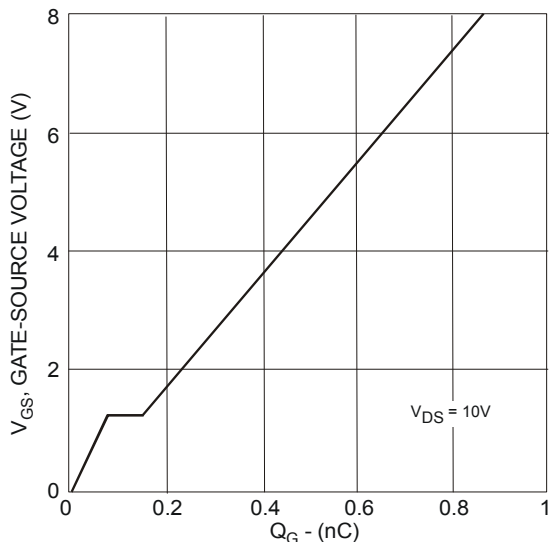


Fig. 11 Gate Charge Characteristics

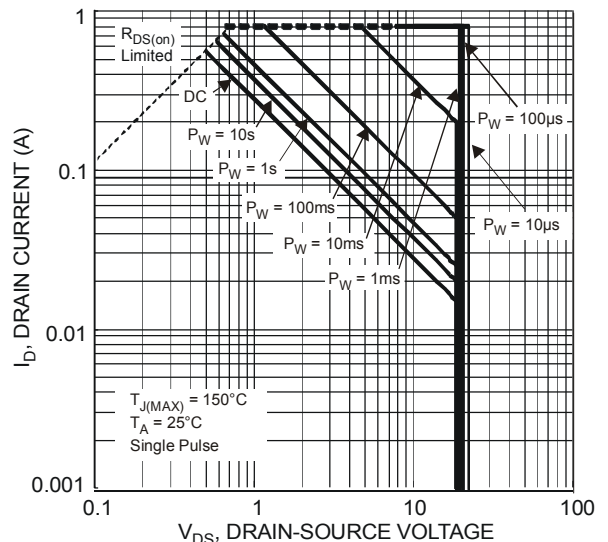


Fig. 12 SOA, Safe Operation Area

Q2 P-CHANNEL

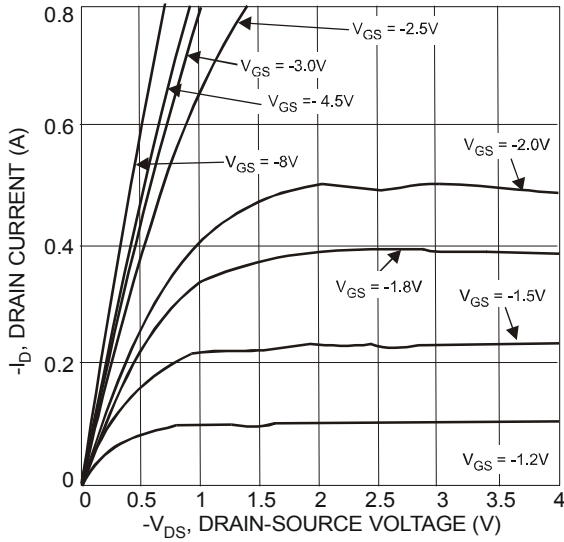


Fig. 13 Typical Output Characteristics

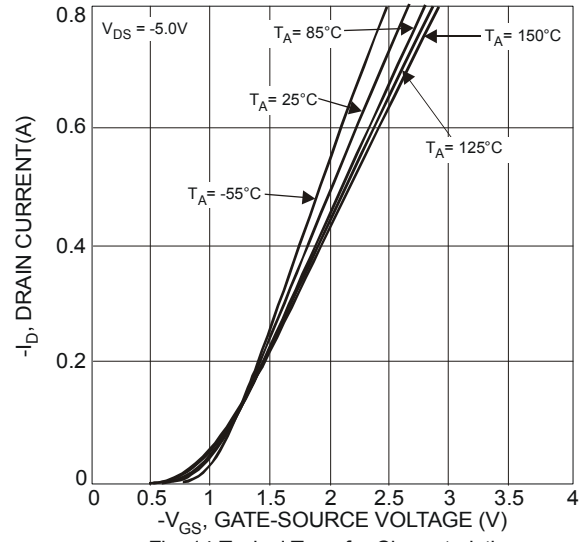


Fig. 14 Typical Transfer Characteristics

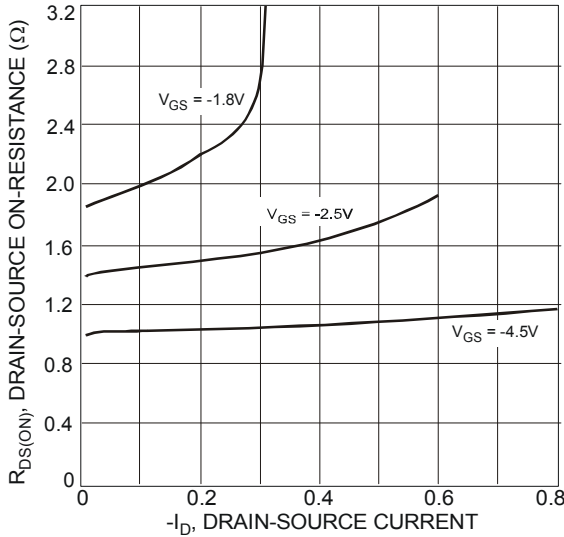


Fig. 15 Typical On-Resistance vs. Drain Current and Gate Voltage

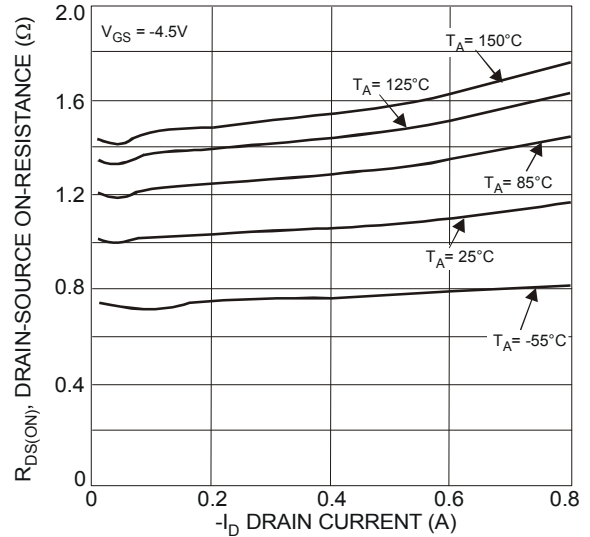


Fig. 16 Typical On-Resistance vs. Drain Current and Temperature

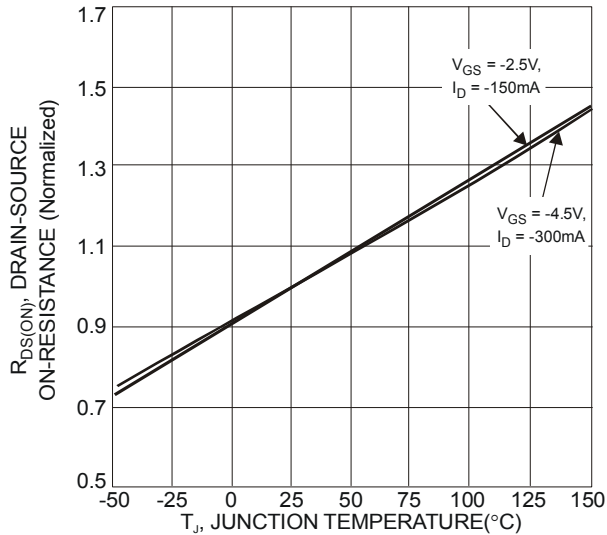


Fig. 17 On-Resistance Variation with Temperature

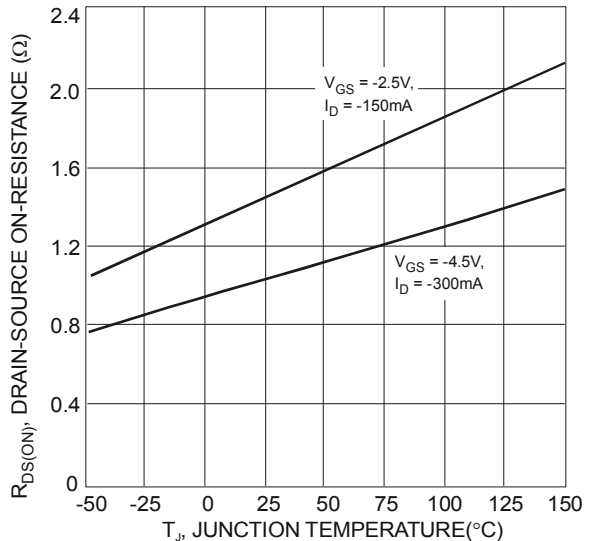


Fig. 18 On-Resistance Variation with Temperature

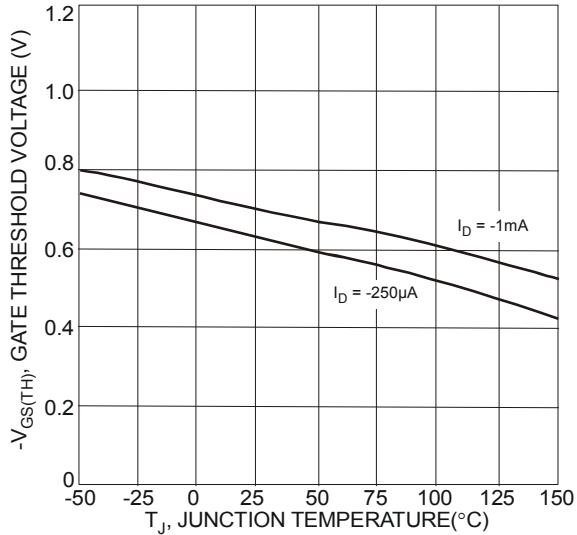


Fig. 19 Gate Threshold Variation vs. Ambient Temperature

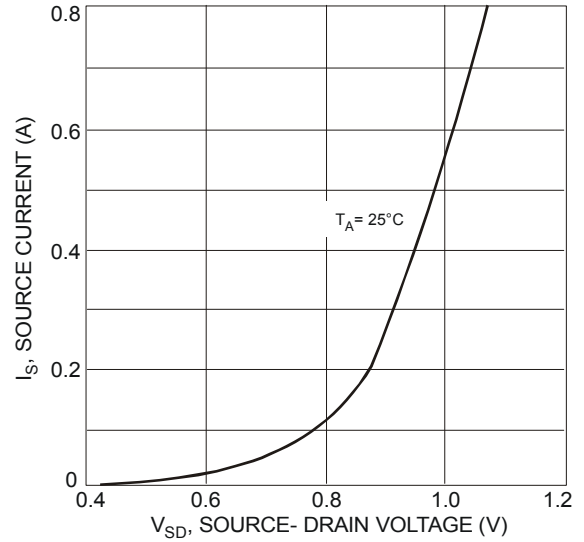


Fig. 20 Diodes Forward Voltage vs. Current

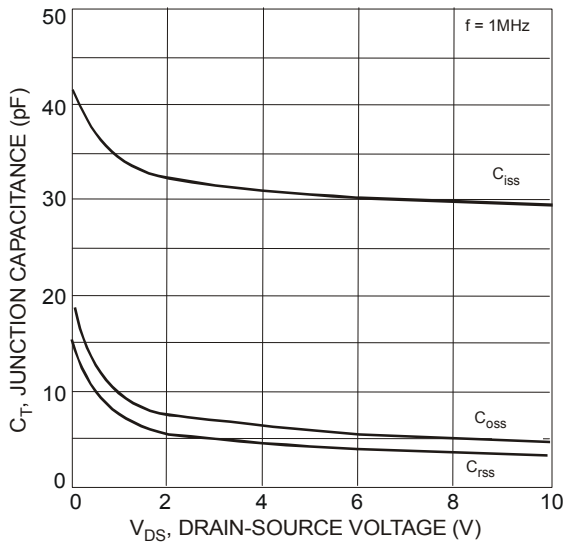


Fig. 21 Typical Junction Capacitance

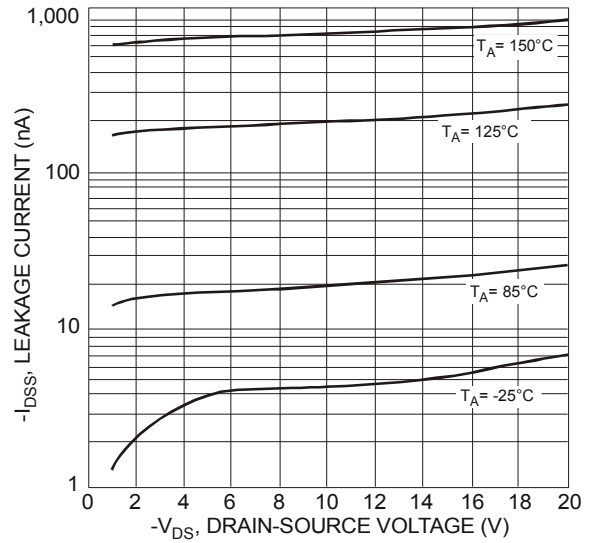


Fig. 22 Typical Leakage Current vs. Drain-Source Voltage

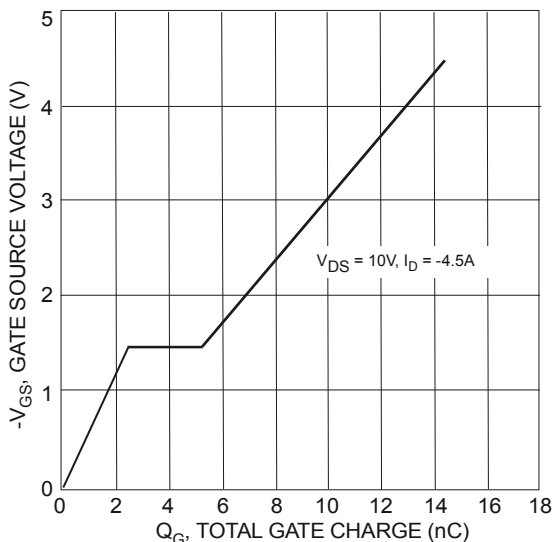


Fig. 23 Gate Charge Characteristics

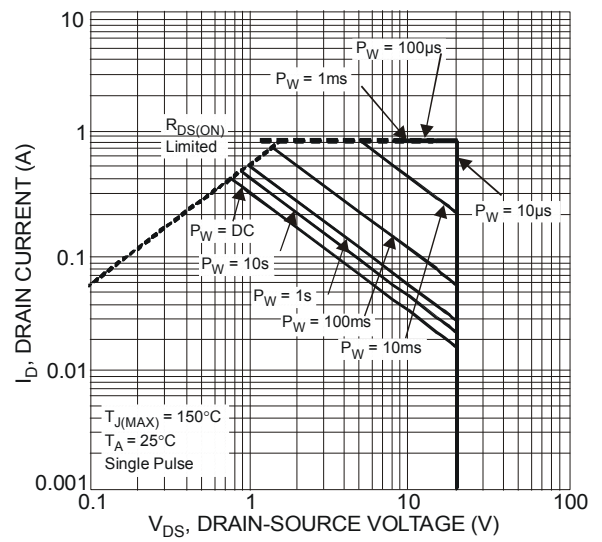
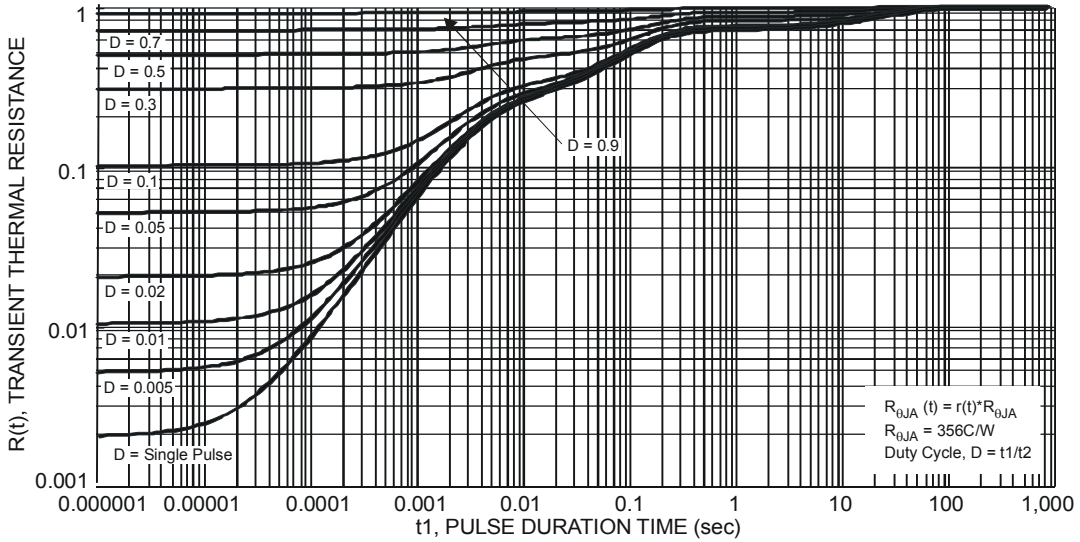
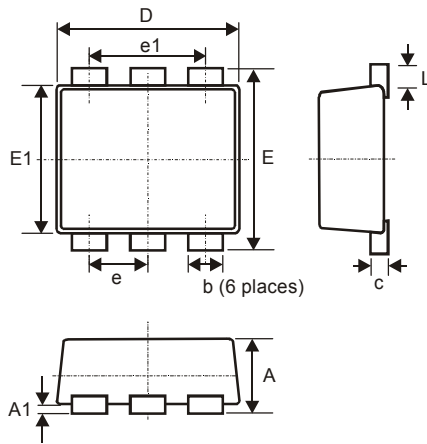


Fig. 24 SOA, Safe Operation Area

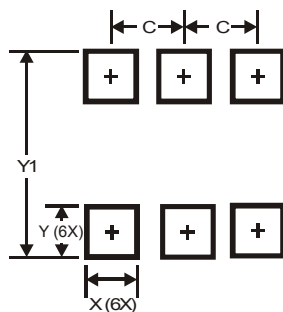


Package Outline Dimensions



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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