Product Summary

Device	BV_{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)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP Capable (Note 4)**

Description and Applications

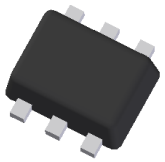
This MOSFET is designed to meet the stringent requirements of Automotive applications. It is qualified to AEC-Q101, supported by a PPAP and is ideal for use in:

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

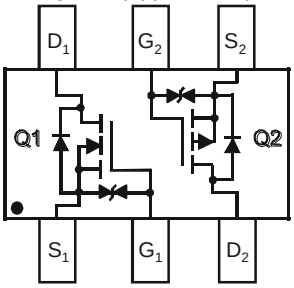
Mechanical Data

- 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)

SOT963



Top View



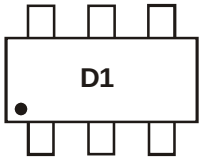
Top View
Schematic and
Transistor Diagram

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 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.
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_A = +25°C, unless otherwise specified.)

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			V_{DSS}	20	V
Gate-Source Voltage			V_{GSS}	±8	V
Continuous Drain Current (Note 6) V_{GS} = 4.5V	Steady State	T_A = +25°C T_A = +70°C	I_D	450 350	mA
	t<5s	T_A = +25°C T_A = +70°C	I_D	520 410	mA
Continuous Drain Current (Note 6) V_{GS} = 1.8V	Steady State	T_A = +25°C T_A = +70°C	I_D	330 260	mA
	t<5s	T_A = +25°C T_A = +70°C	I_D	390 310	mA
Maximum Continuous Body Diode Forward Current (Note 6)			I_S	440	mA
Pulsed Drain Current (Note 7)			I_{DM}	800	mA

Maximum Ratings Q2 P-CHANNEL (@T_A = +25°C, unless otherwise specified.)

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			V_{DSS}	-20	V
Gate-Source Voltage			V_{GSS}	±8	V
Continuous Drain Current (Note 6) V_{GS} = -4.5V	Steady State	T_A = +25°C T_A = +70°C	I_D	-310 -240	mA
	t<5s	T_A = +25°C T_A = +70°C	I_D	-360 -280	mA
Continuous Drain Current (Note 6) V_{GS} = -1.8V	Steady State	T_A = +25°C T_A = +70°C	I_D	-240 -190	mA
	t<5s	T_A = +25°C T_A = +70°C	I_D	-280 -220	mA
Maximum Continuous Body Diode Forward Current (Note 6)			I_S	-440	mA
Pulsed Drain Current (Note 7)			I_{DM}	-800	mA

Thermal Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic		Symbol	Value	Unit
Total Power Dissipation (Note 6)		P_D	350	mW
Thermal Resistance, Junction to Ambient (Note 6)	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

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_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 8)						
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 8)						
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	V_{SD}	-	0.6	1.0	V	V_{GS} = 0V, I_S = 10mA
DYNAMIC CHARACTERISTICS (Note 9)						
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 = 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 8)						
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 8)						
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	V_{SD}	-	-0.6	-1.0	V	V_{GS} = 0V, I_S = -10mA
DYNAMIC CHARACTERISTICS (Note 9)						
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 = 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: 8. Short duration pulse test used to minimize self-heating effect.
9. Guaranteed by design. Not subject to product testing.

Typical Characteristics - N-CHANNEL

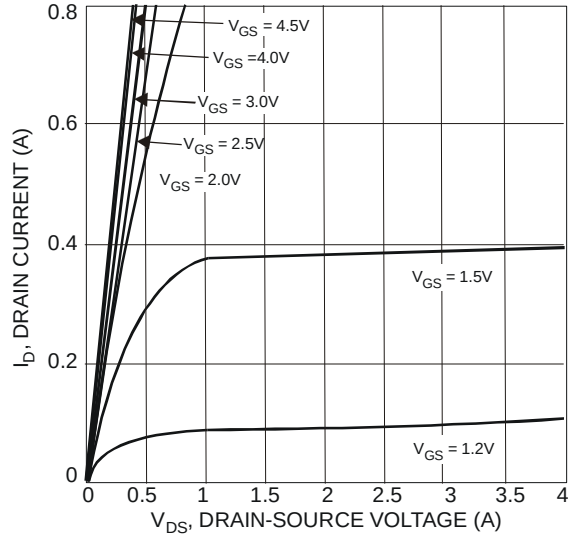


Fig. 1 Typical Output Characteristics

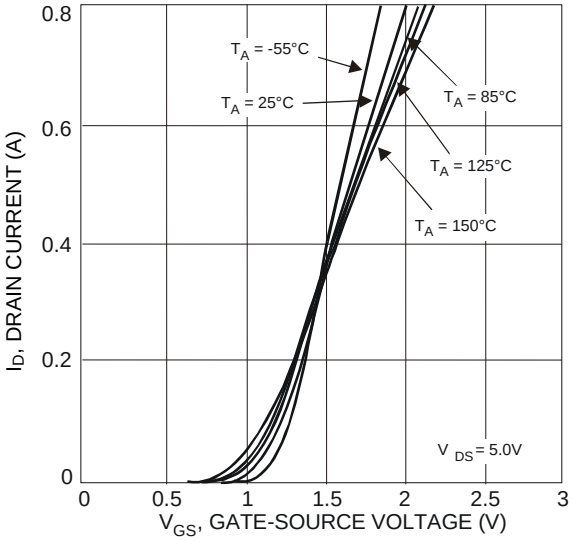


Fig. 2 Typical Transfer Characteristics

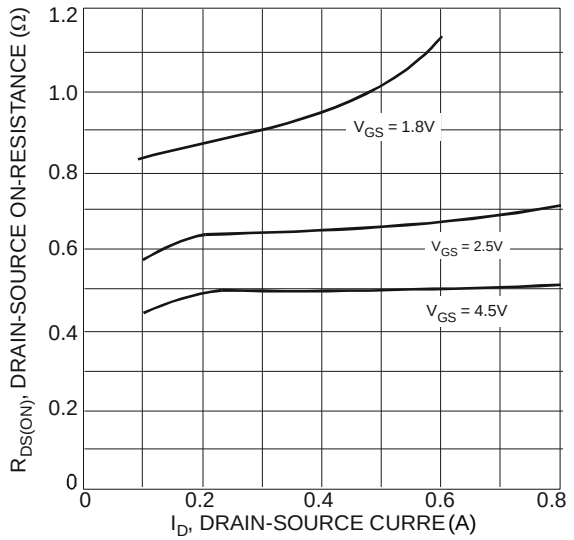


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

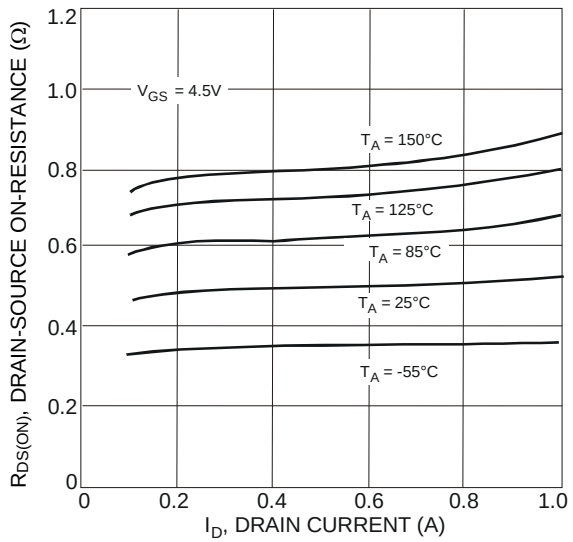


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

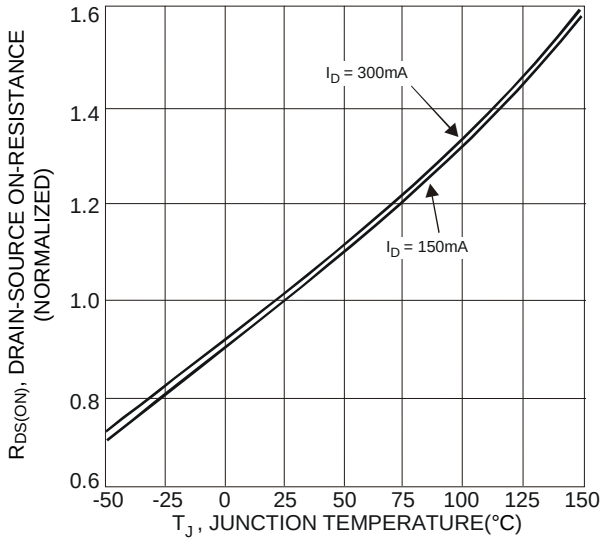


Fig. 5 On-Resistance Variation with Temperature

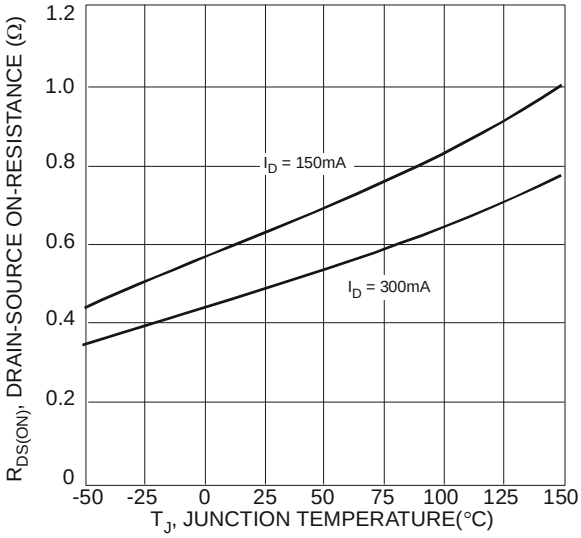


Fig. 6 On-Resistance Variation with Temperature

Typical Characteristics - N-CHANNEL (Cont.)

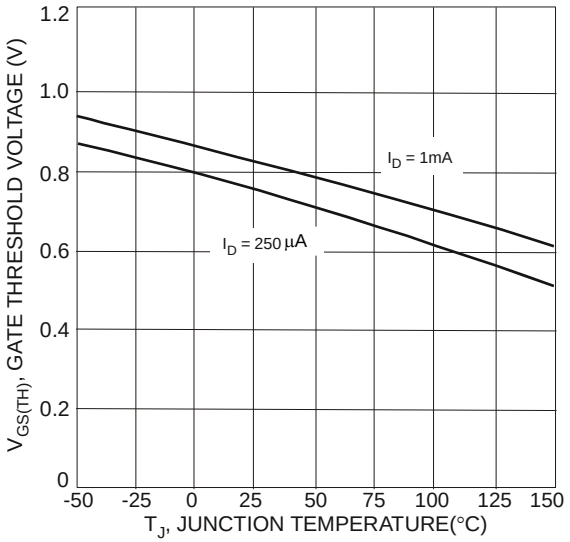


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

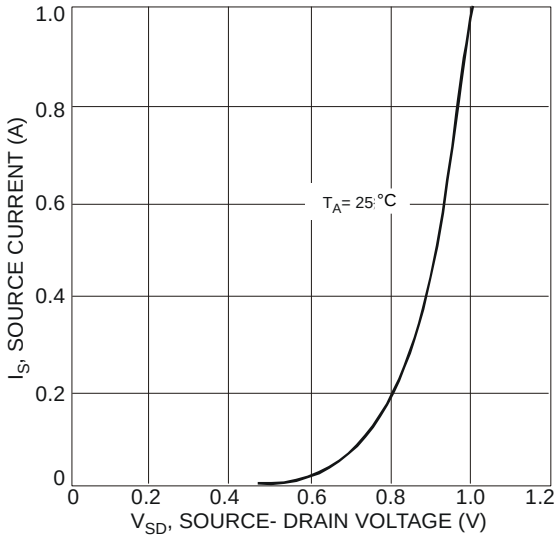


Fig. 8 Diodes Forward Voltage vs. Current

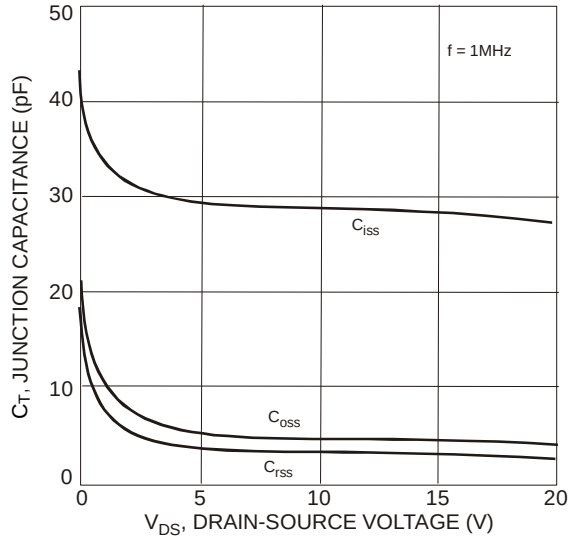


Fig. 9 Typical Junction Capacitance

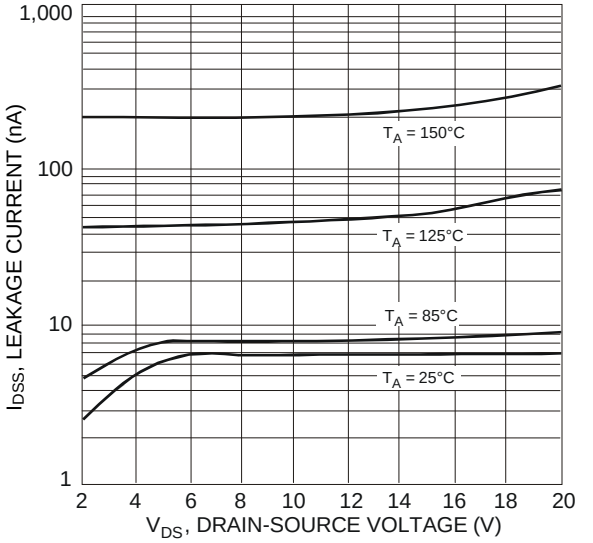


Fig. 10 Typical Drain-Source Leakage Current vs. Voltage

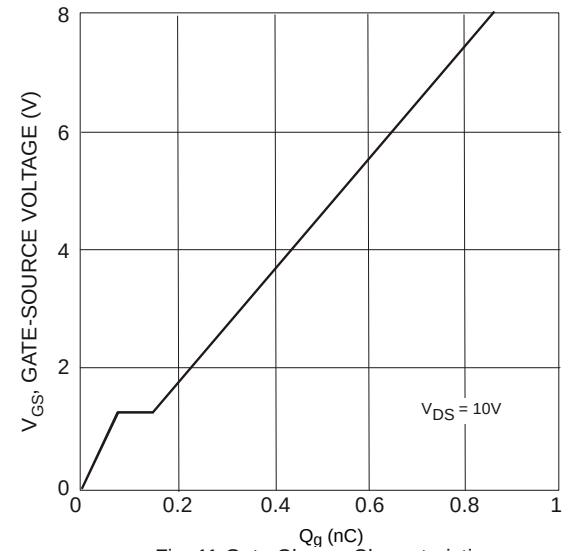


Fig. 11 Gate Charge Characteristics

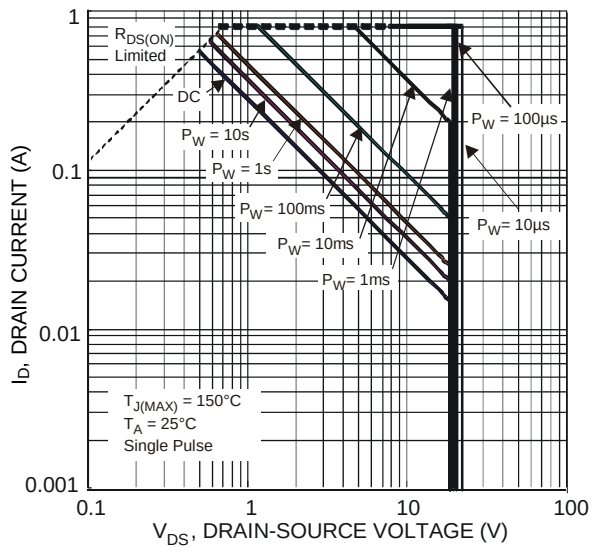


Fig. 12 SOA, Safe Operation Area

Typical Characteristics - P-CHANNEL

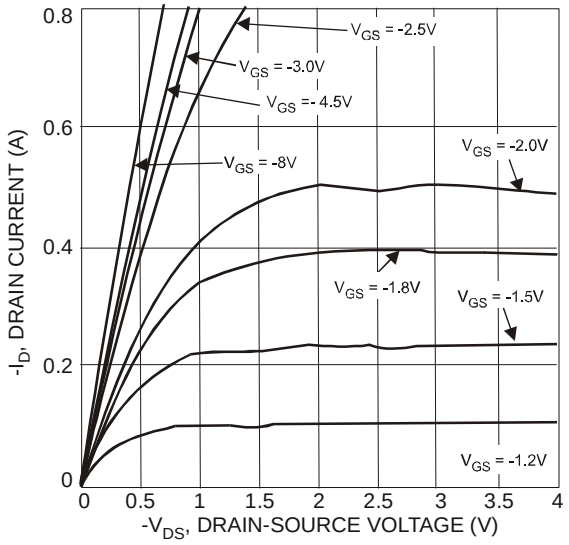


Fig. 13 Typical Output Characteristics

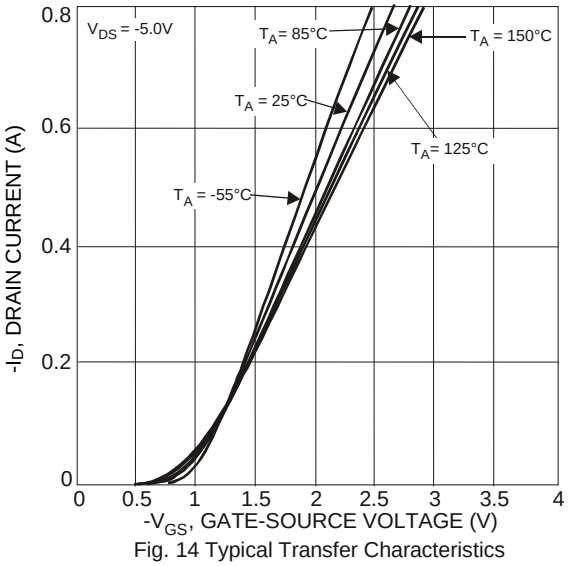


Fig. 14 Typical Transfer Characteristics

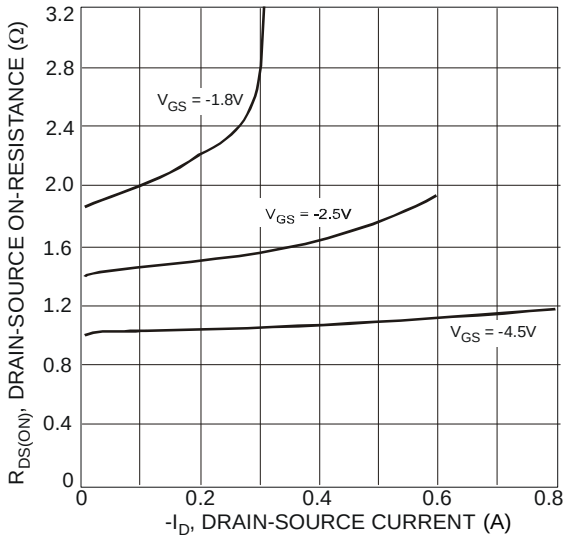


Fig. 15 Typical On-Resistance vs. Drain Current and Gate Voltage

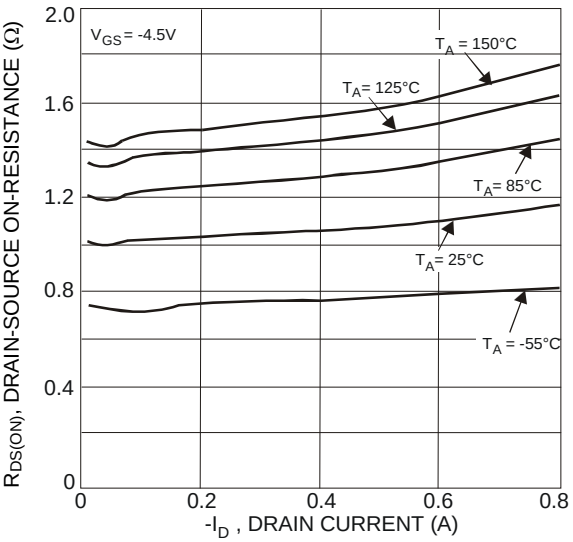


Fig. 16 Typical On-Resistance vs. Drain Current and Temperature

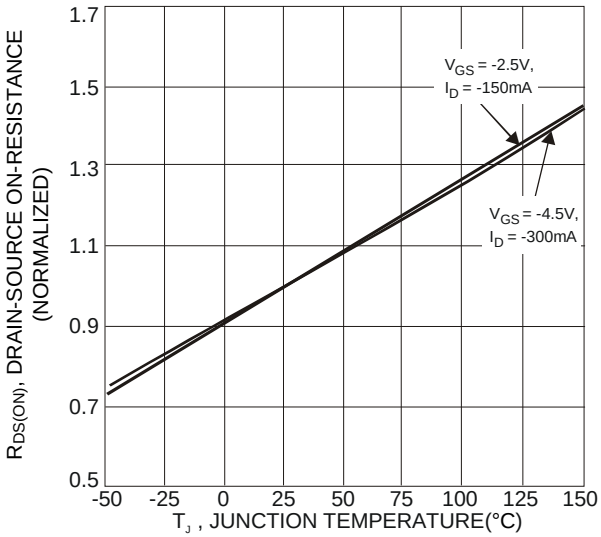


Fig. 17 On-Resistance Variation with Temperature

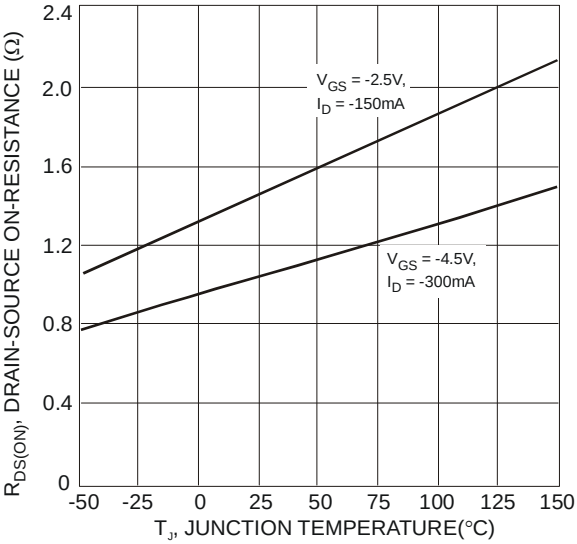


Fig. 18 On-Resistance Variation with Temperature

Typical Characteristics - P-CHANNEL (Cont.)

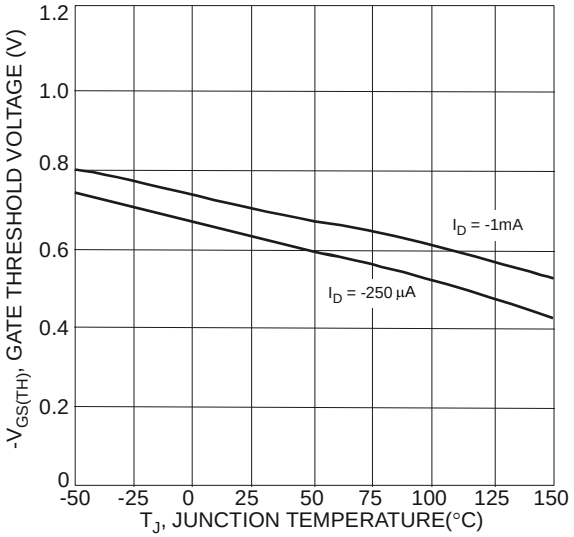


Fig. 19 Gate Threshold Variation vs. Ambient Temperature

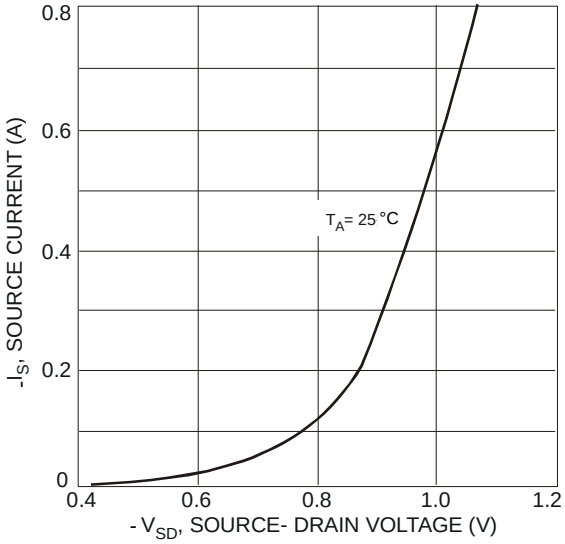


Fig. 20 Diodes Forward Voltage vs. Current

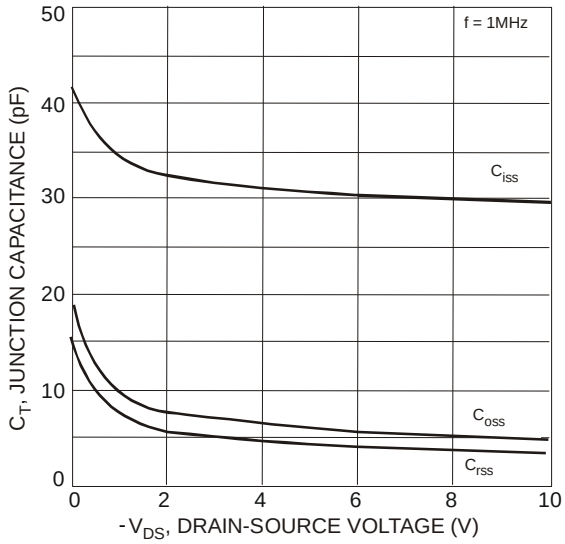


Fig. 21 Typical Junction Capacitance

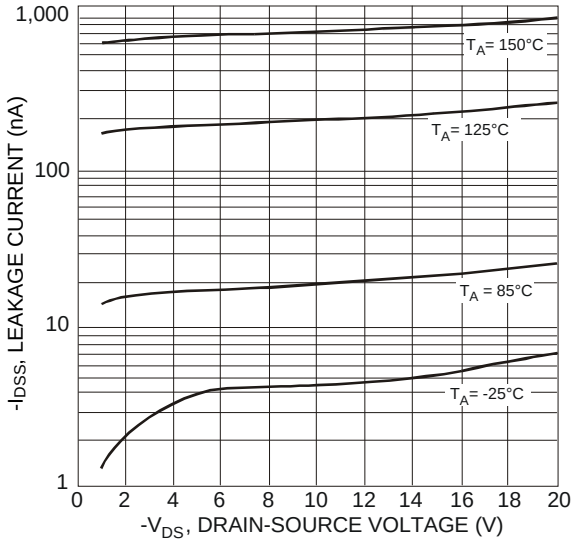


Fig. 22 Typical Leakage Current vs. Drain-Source Voltage

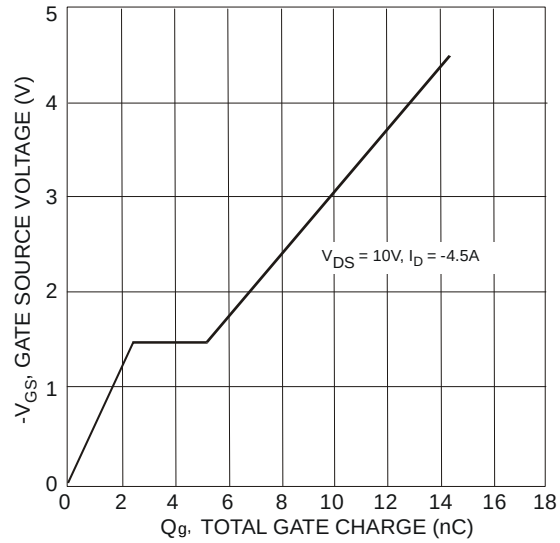


Fig. 23 Gate Charge Characteristics

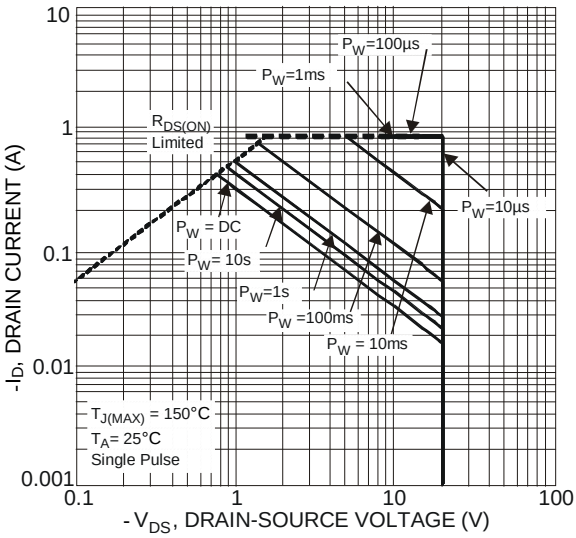


Fig. 24 SOA, Safe Operation Area

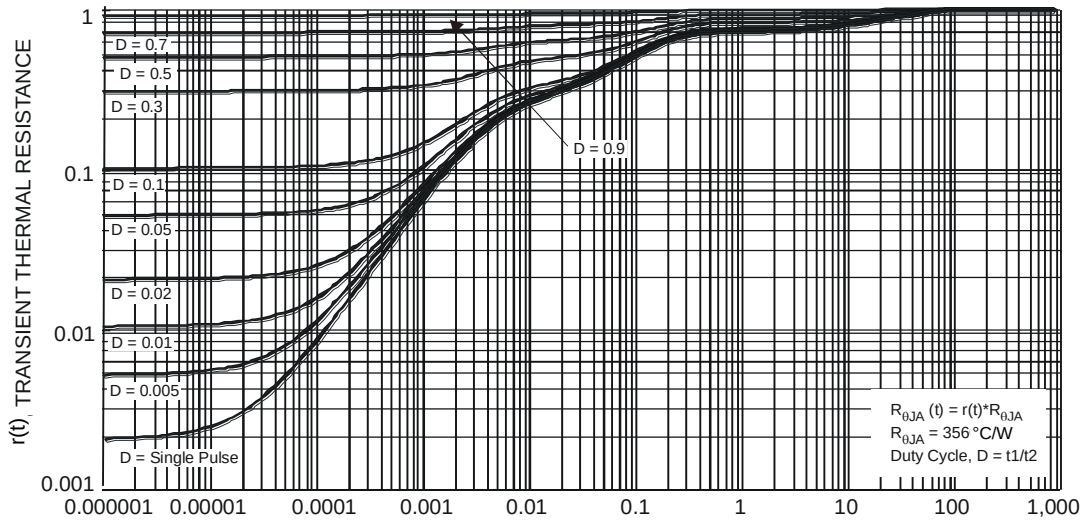
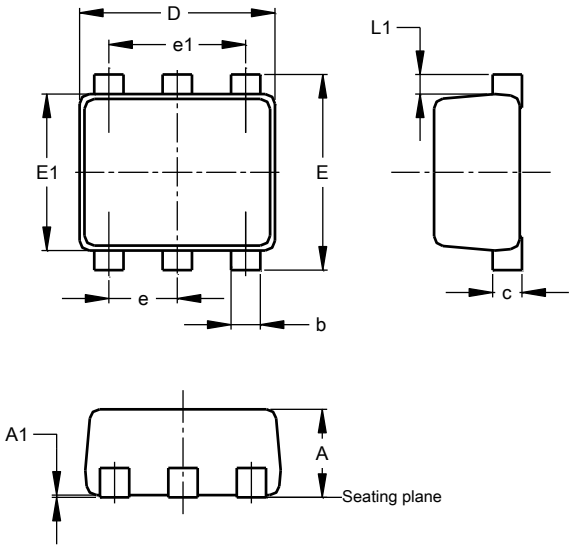


Fig. 25 Transient Thermal Resistance

Package Outline Dimensions

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

SOT963

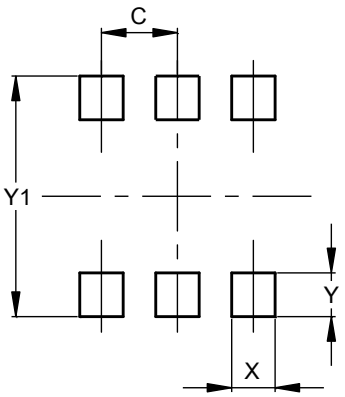


SOT963			
Dim	**Min**	**Max**	**Typ**
A	0.40	0.50	0.45
A1	0.00	0.05	--
b	0.10	0.20	0.15
c	0.120	0.180	0.150
D	0.95	1.05	1.00
E	0.95	1.05	1.00
E1	0.75	0.85	0.80
e	--	--	0.35
e1	--	--	0.70
L1	0.05	0.15	0.10
All Dimensions in mm			

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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