

**COMPLEMENTARY PAIR ENHANCEMENT MODE MOSFET**

### Product Summary

Device	BV <sub>DSS</sub>	R <sub>DS(ON)</sub> MAX	I <sub>D</sub> T <sub>A</sub> = +25°C
N-Channel	20V	35mΩ @ V <sub>GS</sub> = 4.5V	4.5A
		56mΩ @ V <sub>GS</sub> = 1.8V	3.5A
P-Channel	-20V	74mΩ @ V <sub>GS</sub> = -4.5V	-3.1A
		168mΩ @ V <sub>GS</sub> = -1.8V	-2.0A

### 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:

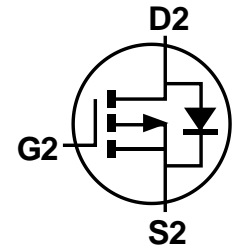
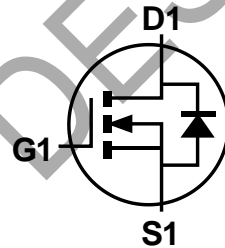
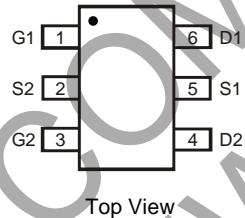
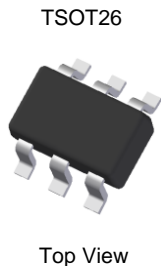
- Motor controls
- DC-DC converters
- Power management functions

### Features and Benefits

- Low On-Resistance
  - Low Input Capacitance
  - Fast Switching Speed
  - Low Input/Output Leakage
  - **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
  - **Halogen and Antimony Free. "Green" Device (Note 3)**
  - **The DMC2038LVTQ is suitable for automotive applications requiring specific change control; this part is AEC-Q101 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**
- <https://www.diodes.com/quality/product-definitions/>

### Mechanical Data

- Package: TSOT26
- Package Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals Connections: See Diagram
- Terminals: Finish – Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 (e3)
- Weight: 0.013 grams (Approximate)

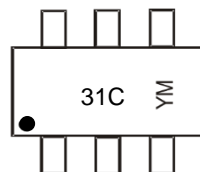


### Ordering Information (Note 4)

Part Number	Package	Packing	
		Qty.	Carrier
DMC2038LVTQ-7	TSOT26	3000	Tape & Reel

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
  2. See <https://www.diodes.com/quality/lead-free/> 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. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

### Marking Information



31C = Product Type Marking Code  
 YM = Date Code Marking  
 Y or  $\bar{Y}$  = Year (ex: J = 2022)  
 M or  $\bar{M}$  = Month (ex: 9 = September)

#### Date Code Key

Year	2019	...	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Code	G	...	J	K	L	M	N	O	P	R	S	T

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Code	1	2	3	4	5	6	7	8	9	O	N	D

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

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			$V_{DSS}$	20	V
Gate-Source Voltage			$V_{GSS}$	$\pm 12$	V
Continuous Drain Current (Note 5) $V_{GS} = 4.5\text{V}$	Steady State	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	3.7 3.0	A
	$t < 10\text{s}$	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	4.1 3.2	A
Continuous Drain Current (Note 6) $V_{GS} = 4.5\text{V}$	Steady State	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	4.5 3.6	A
	$t < 10\text{s}$	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	5.2 4.2	A
Maximum Continuous Body Diode Forward Current (Note 7)			$I_S$	1.5	A
Pulsed Drain Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)			$I_{DM}$	25	A

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

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			$V_{DSS}$	-20	V
Gate-Source Voltage			$V_{GSS}$	$\pm 12$	V
Continuous Drain Current (Note 5) $V_{GS} = -4.5\text{V}$	Steady State	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	-2.6 -2.1	A
	$t < 10\text{s}$	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	-2.9 -2.4	A
Continuous Drain Current (Note 6) $V_{GS} = -4.5\text{V}$	Steady State	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	-3.1 -2.5	A
	$t < 10\text{s}$	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	$I_D$	-3.8 -3.0	A
Maximum Continuous Body Diode Forward Current (Note 7)			$I_S$	-1.5	A
Pulsed Drain Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)			$I_{DM}$	-17	A

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

Characteristic		Symbol	Value	Unit
Total Power Dissipation (Note 5)	$T_A = +25^\circ\text{C}$	$P_D$	0.8	W
	$T_A = +70^\circ\text{C}$		0.5	
Thermal Resistance, Junction to Ambient (Note 5)	Steady State	$R_{\theta JA}$	168	$^\circ\text{C/W}$
	$t < 10\text{s}$		120	
Total Power Dissipation (Note 6)	$T_A = +25^\circ\text{C}$	$P_D$	1.1	W
	$T_A = +70^\circ\text{C}$		0.7	
Thermal Resistance, Junction to Ambient (Note 6)	Steady State	$R_{\theta JA}$	114	$^\circ\text{C/W}$
	$t < 10\text{s}$		72	
Thermal Resistance, Junction to Case (Note 6)		$R_{\theta JC}$	39	
Operating and Storage Temperature Range		$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$

- Notes:
5. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
  6. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
  7. Short duration pulse test used to minimize self-heating effect.

**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 7)</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 @T <sub>C</sub> = +25°C	I <sub>DSS</sub>	—	—	1.0	μA	V <sub>DS</sub> = 16V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±100	nA	V <sub>GS</sub> = ±12V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 7)</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>	—	27	35	mΩ	V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 4.0A
		—	33	43		V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 2.5A
		—	43	56		V <sub>GS</sub> = 1.8V, I <sub>D</sub> = 1.5A
Forward Transfer Admittance	Y <sub>fs</sub>	—	9	—	S	V <sub>DS</sub> = 5V, I <sub>D</sub> = 3.4A
Diode Forward Voltage	V <sub>SD</sub>	0.4	—	1.1	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 1A
<b>DYNAMIC CHARACTERISTICS (Note 8)</b>						
Input Capacitance	C <sub>iss</sub>	—	400	530	pF	V <sub>DS</sub> = 10V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	—	70	90	pF	
Reverse Transfer Capacitance	C <sub>rss</sub>	—	65	100	pF	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Gate Resistance	R <sub>g</sub>	—	1.9	—	Ω	
Total Gate Charge (V <sub>GS</sub> = 4.5V)	Q <sub>g</sub>	—	5.7	—	nC	V <sub>DS</sub> = 15V, I <sub>D</sub> = 5.8A
Total Gate Charge (V <sub>GS</sub> = 10V)	Q <sub>g</sub>	—	12	17	nC	
Gate-Source Charge	Q <sub>gs</sub>	—	0.7	—	nC	
Gate-Drain Charge	Q <sub>gd</sub>	—	1.4	—	nC	
Turn-On Delay Time	t <sub>D(ON)</sub>	—	5	10	ns	V <sub>DS</sub> = 10V, V <sub>GS</sub> = 4.5V, R <sub>G</sub> = 6Ω, I <sub>DS</sub> = 1A
Turn-On Rise Time	t <sub>R</sub>	—	8	16	ns	
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	25	40	ns	
Turn-Off Fall Time	t <sub>F</sub>	—	8	16	ns	

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

NOT RECOMMENDED FOR NEW DESIGN

**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 7)</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 @T <sub>C</sub> = +25°C	I <sub>DSS</sub>	—	—	-1.0	μA	V <sub>DS</sub> = -16V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±100	nA	V <sub>GS</sub> = ±12V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 7)</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>	—	57	74	mΩ	V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3.0A
		—	76	110		V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -1.5A
		—	102	168		V <sub>GS</sub> = -1.8V, I <sub>D</sub> = -1.0A
Forward Transfer Admittance	Y <sub>fs</sub>	—	10	—	S	V <sub>DS</sub> = -5V, I <sub>D</sub> = -3.0A
Diode Forward Voltage	V <sub>SD</sub>	—	-0.8	-1.0	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = -0.6A
<b>DYNAMIC CHARACTERISTICS (Note 8)</b>						
Input Capacitance	C <sub>iss</sub>	—	530	705	pF	V <sub>DS</sub> = -10V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	—	70	95	pF	
Reverse Transfer Capacitance	C <sub>rss</sub>	—	60	90	pF	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Gate Resistance	R <sub>g</sub>	—	72	—	Ω	
Total Gate Charge (V <sub>GS</sub> = -4.5V)	Q <sub>g</sub>	—	7	10	nC	V <sub>DS</sub> = -15V, I <sub>D</sub> = -6A
Total Gate Charge (V <sub>GS</sub> = -10V)	Q <sub>g</sub>	—	14	—	nC	
Gate-Source Charge	Q <sub>gs</sub>	—	0.95	—	nC	
Gate-Drain Charge	Q <sub>gd</sub>	—	1.2	—	nC	
Turn-On Delay Time	t <sub>D(ON)</sub>	—	11	20	ns	
Turn-On Rise Time	t <sub>r</sub>	—	12	22	ns	V <sub>DS</sub> = -10V, V <sub>GS</sub> = -4.5V, R <sub>G</sub> = 6Ω, I <sub>S</sub> = -1A
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	21	34	ns	
Turn-Off Fall Time	t <sub>f</sub>	—	13	23	ns	

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

NOT RECOMMENDED FOR NEW DESIGN

**Typical Characteristics - N-CHANNEL**

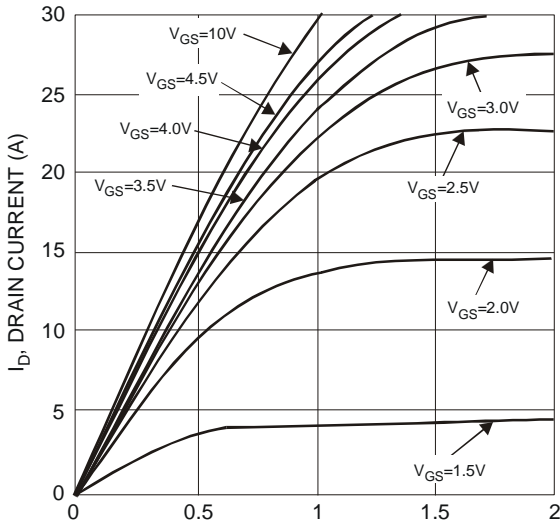


Fig. 1 Typical Output Characteristics

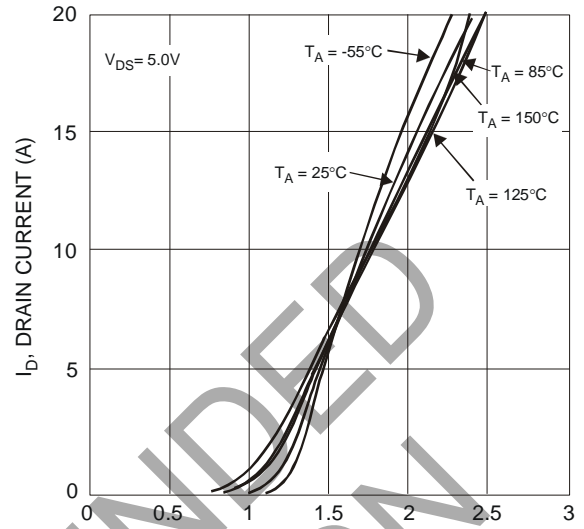


Fig. 2 Typical Transfer Characteristics

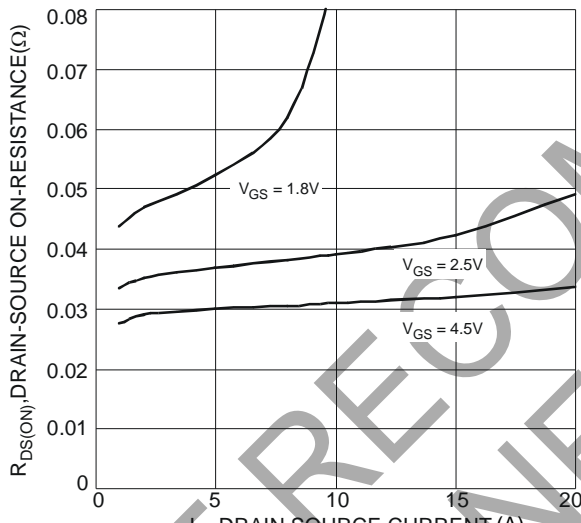


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

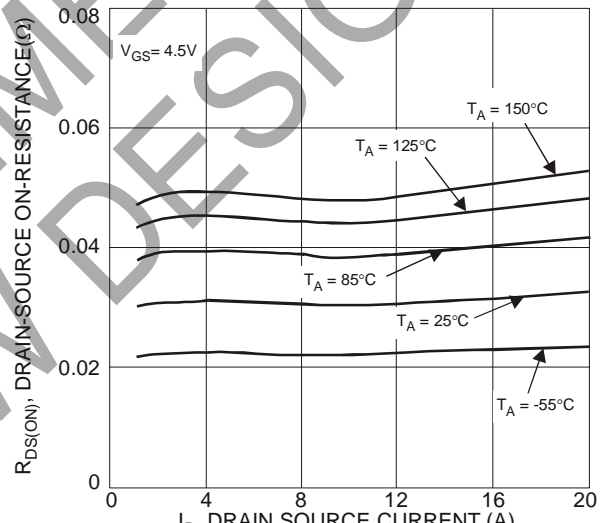


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

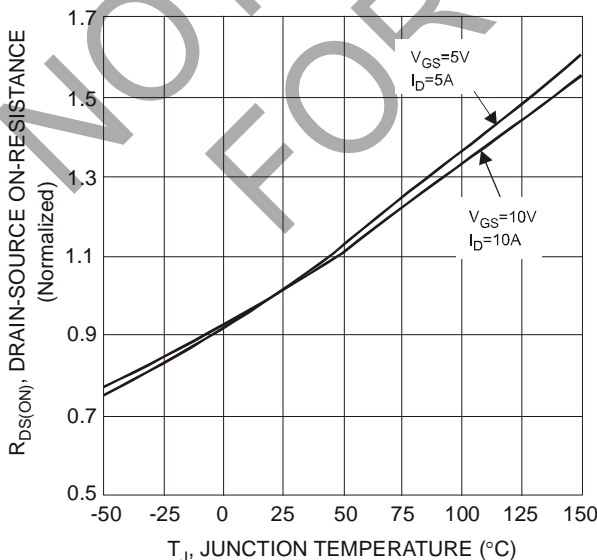


Fig. 5 On-Resistance Variation with Temperature

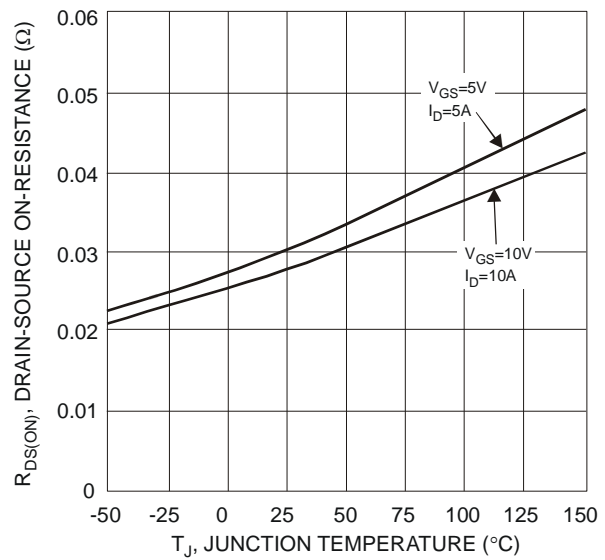


Fig. 6 On-Resistance Variation with Temperature

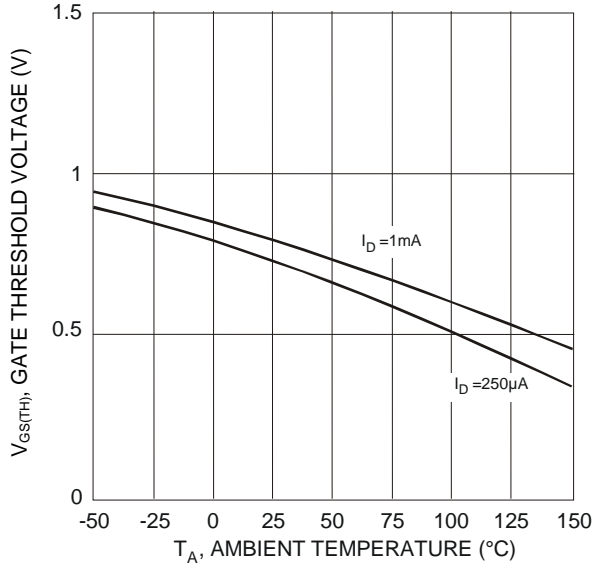


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

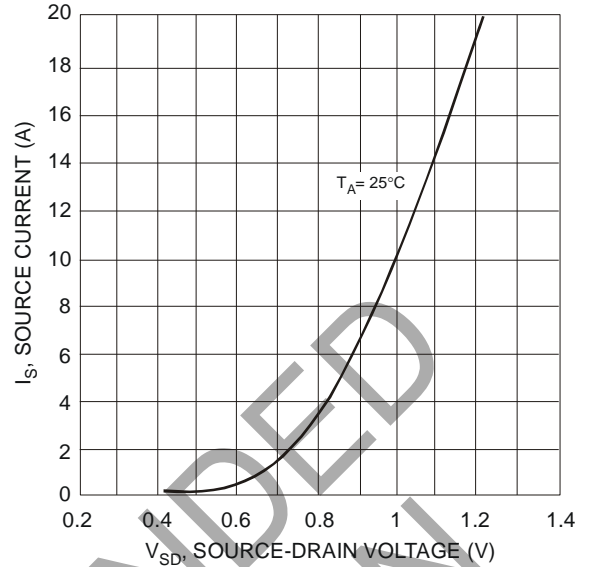


Fig. 8 Diode Forward Voltage vs. Current

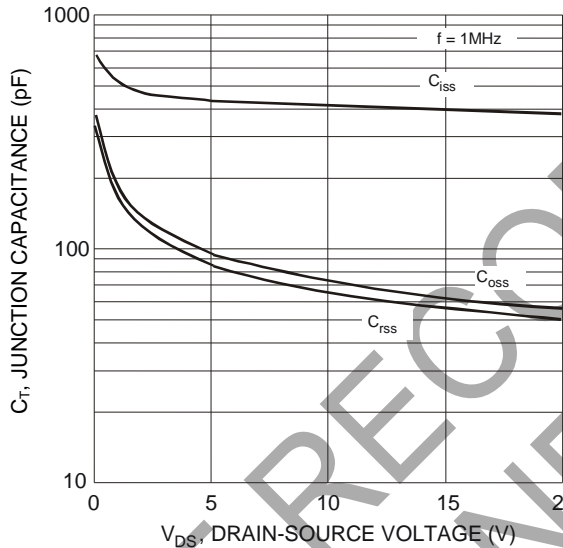


Fig. 9 Typical Junction Capacitance

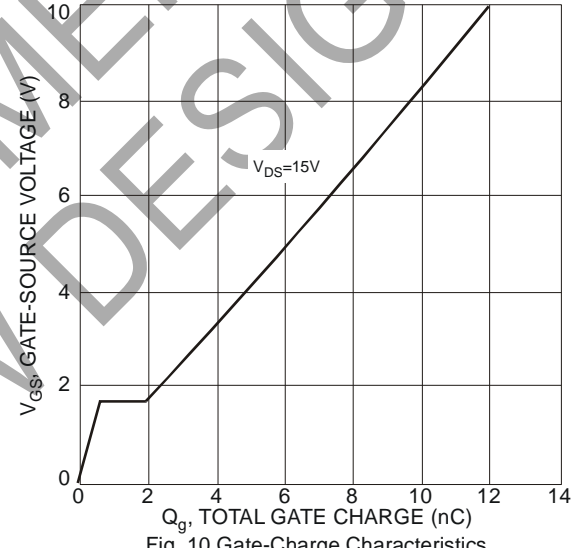


Fig. 10 Gate-Charge Characteristics

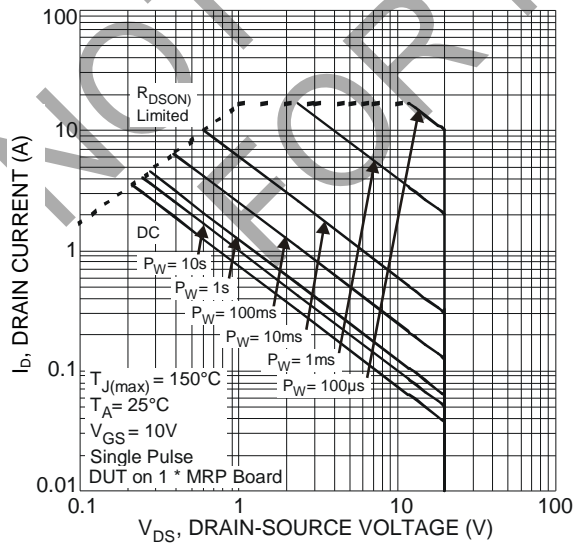


Fig. 11 SOA, Safe Operation Area

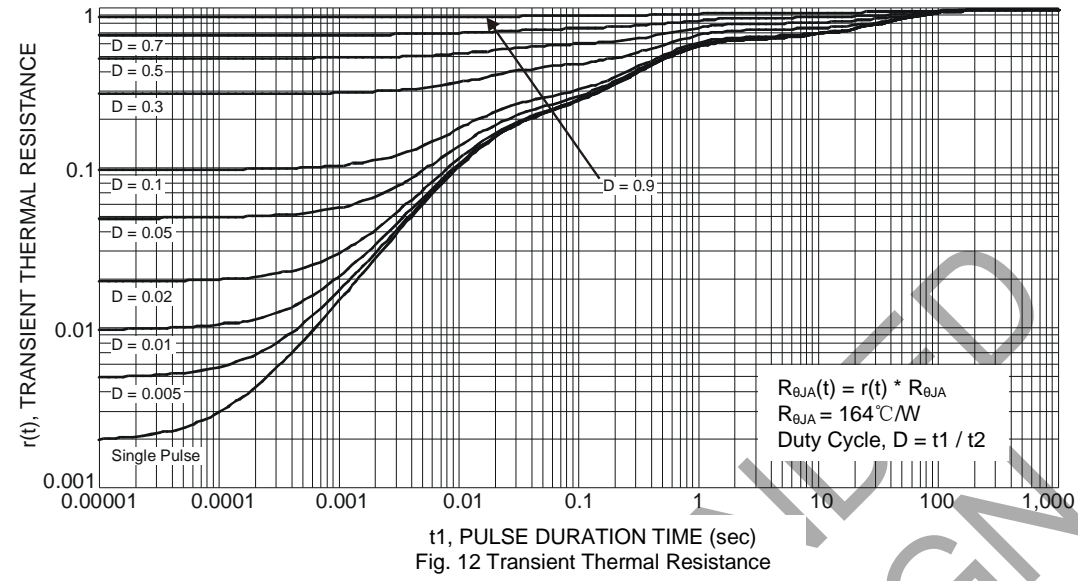


Fig. 12 Transient Thermal Resistance

**Typical Characteristics - P-CHANNEL**

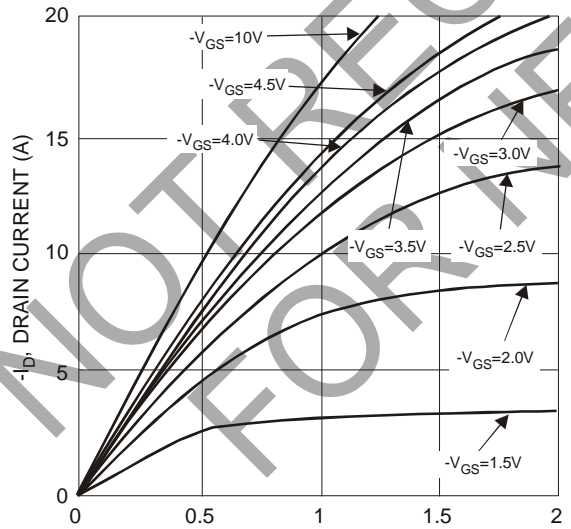


Fig. 13 Typical Output Characteristics

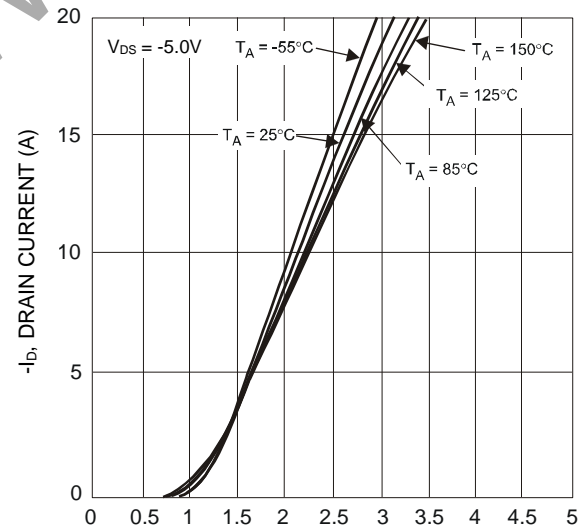
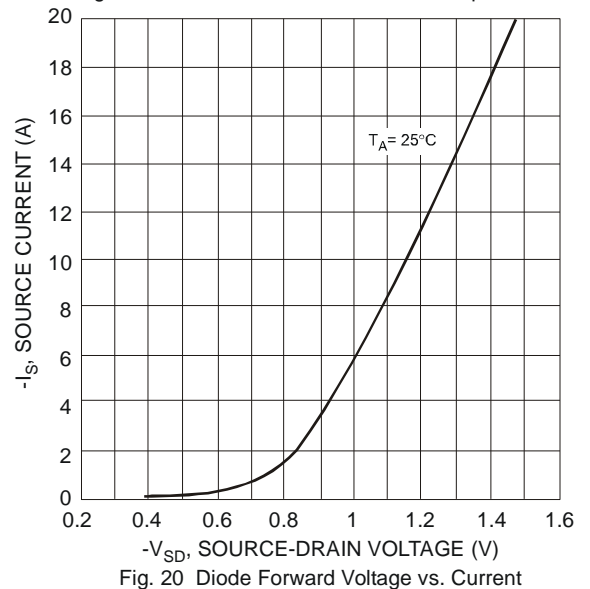
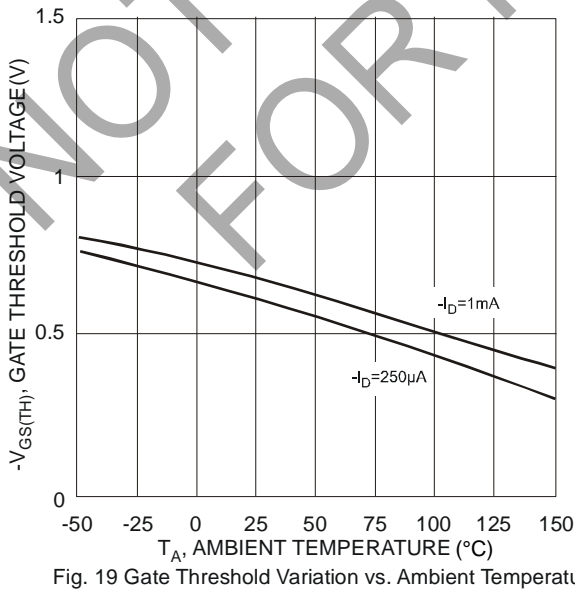
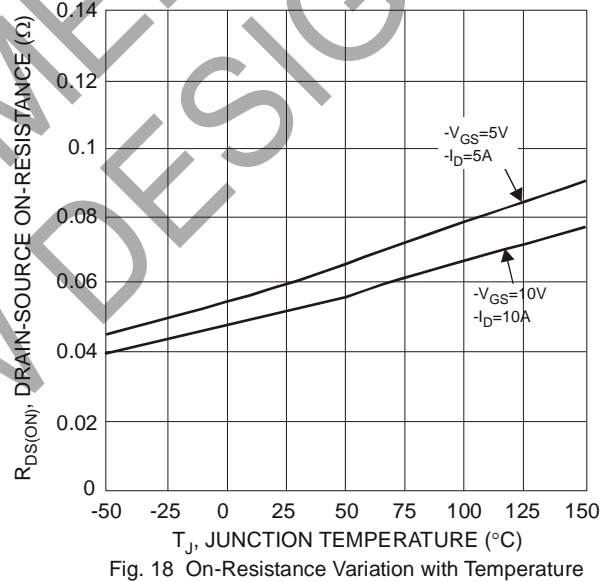
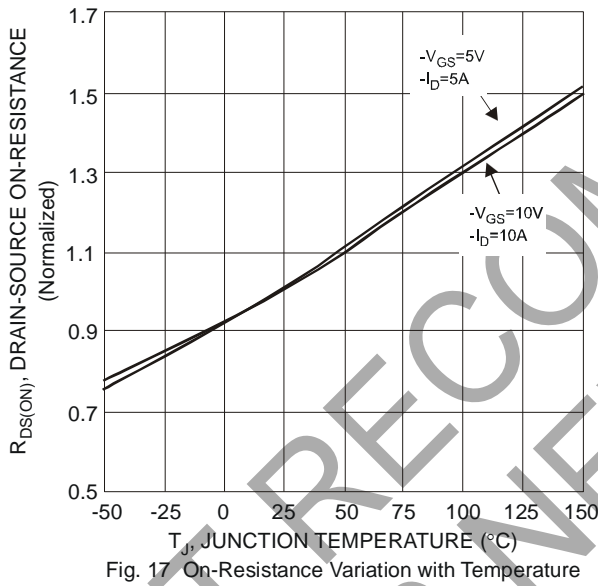
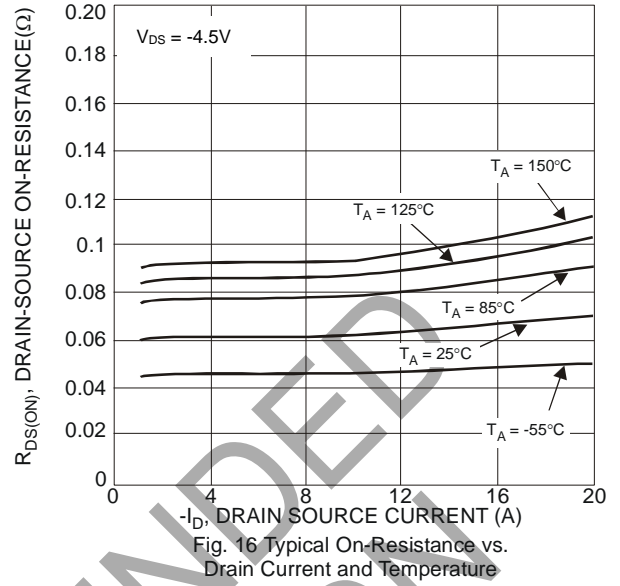
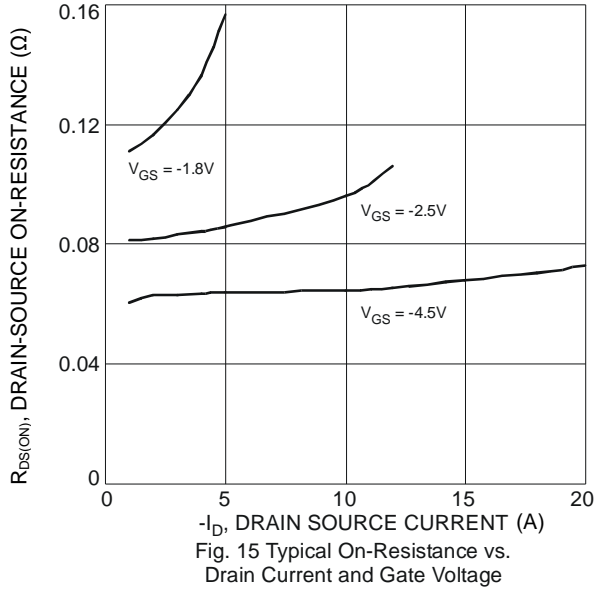
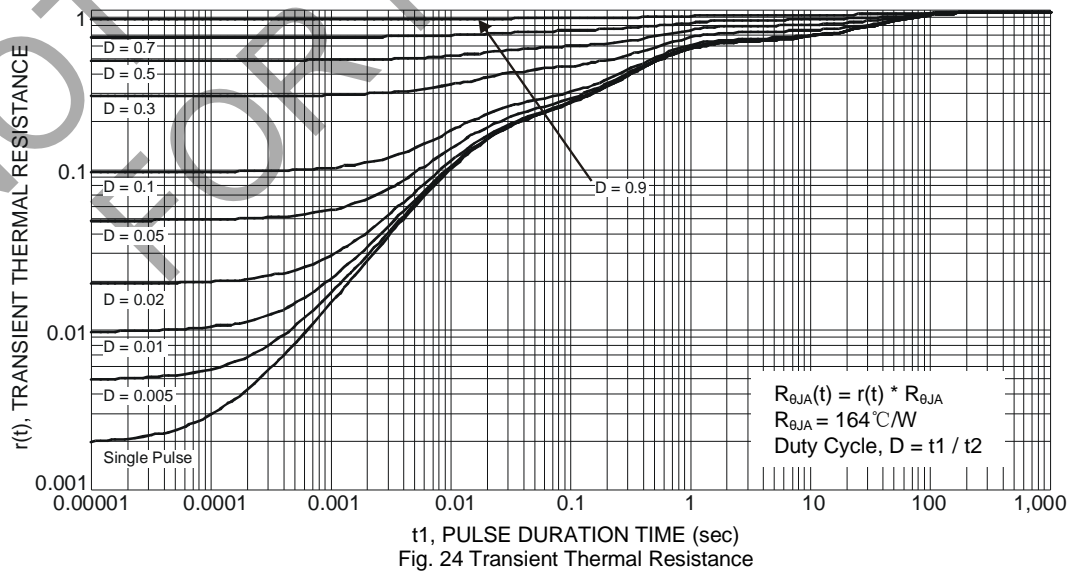
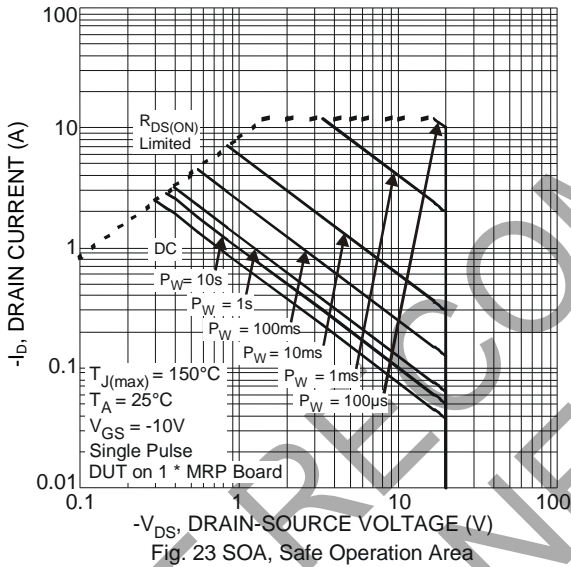
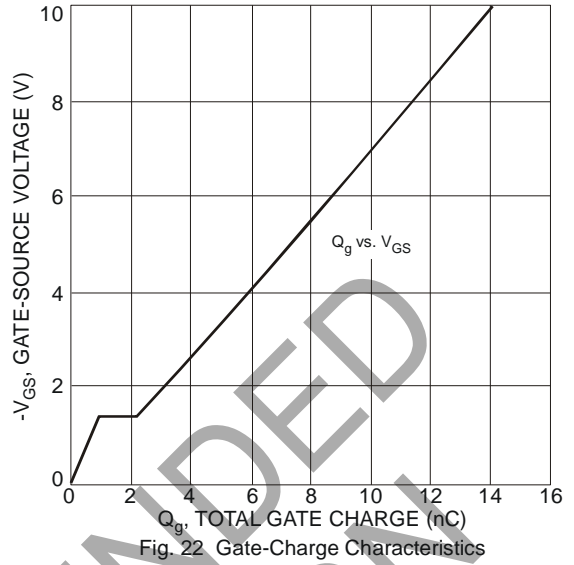
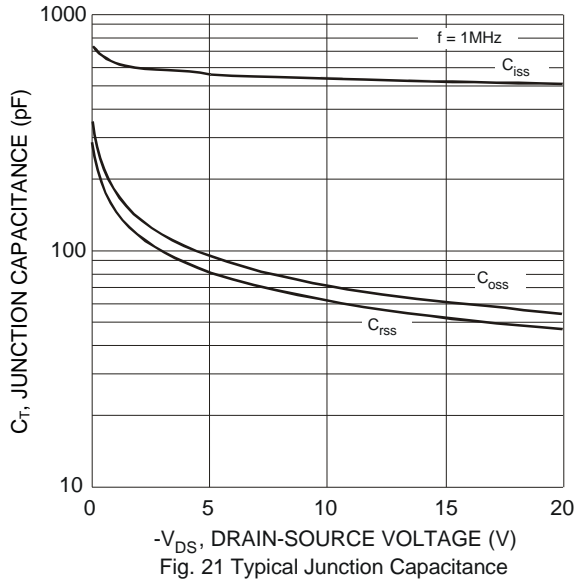


Fig. 14 Typical Transfer Characteristics



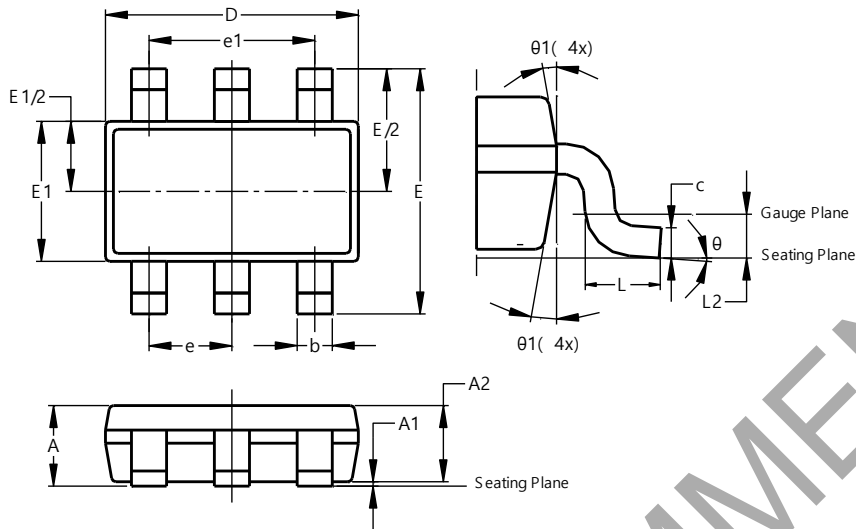




## Package Outline Dimensions

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

### TSOT26

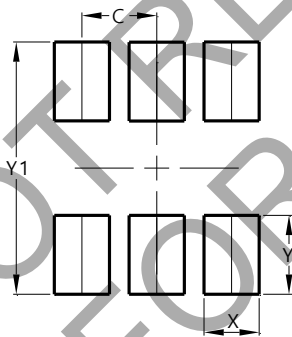


TSOT26			
Dim	Min	Max	Typ
A	–	1.00	–
A1	0.010	0.100	–
A2	0.840	0.900	–
D	2.800	3.000	2.900
E	2.800 BSC		
E1	1.500	1.700	1.600
b	0.300	0.450	–
c	0.120	0.200	–
e	0.950 BSC		
e1	1.900 BSC		
L	0.30	0.50	–
L2	0.250 BSC		
$\theta$	0°	8°	4°
$\theta_1$	4°	12°	–
All Dimensions in mm			

## Suggested Pad Layout

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

### TSOT26



Dimensions	Value (in mm)
C	0.950
X	0.700
Y	1.000
Y1	3.200

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