



## N-Channel 60 V (D-S) MOSFET

PRODUCT SUMMARY	
$V_{DS}$ (V)	60
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 10$ V	3
Configuration	Single

### FEATURES

- Military Qualified
- Low On-Resistance:  $1.3 \Omega$
- Low Threshold: 1.7 V
- Low Input Capacitance: 35 pF
- Fast Switching Speed: 8 ns
- Low Input and Output Leakage

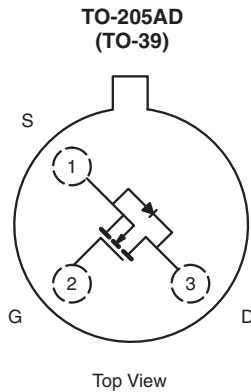


### BENEFITS

- Guaranteed Reliability
- Low Offset Voltage
- Low-Voltage Operation
- Easily Driven Without Buffer
- High-Speed Circuits
- Low Error Voltage

### APPLICATIONS

- Hi-Rel Systems
- Direct Logic-Level Interface: TTL/CMOS
- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories, Transistors, etc.
- Battery Operated Systems
- Solid-State Relays



ORDERING INFORMATION			
PART	PACKAGE	DESCRIPTION/DSCC PART NUMBER	VISHAY ORDERING PART NUMBER
2N6660	TO-205AD (TO-39)	Commercial	2N6660
2N6660-2		Commercial, Lead (Pb)-free	2N6660-E3
2N6660JANTX		See -2 Flow Document	2N6660-2
2N6660JANTXV		JANTX2N6660 (std Au leads)	2N6660JTX02
		JANTX2N6660 (with solder)	2N6660JTXL02
		JANTX2N6660P (with PIND)	2N6660JTXP02
2N6660JANTXV		JANTXV2N6660 (std Au leads)	2N6660JTXV02
2N6660JANTXV	JANTXV2N6660P (with PIND)	2N6660JTVP02	

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 150^\circ\text{C}$ )	$I_D$	$T_C = 25^\circ\text{C}$	A
		$T_C = 100^\circ\text{C}$	
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	3	
Maximum Power Dissipation	$P_D$	$T_C = 25^\circ\text{C}$	W
		$T_A = 25^\circ\text{C}$	
Thermal Resistance, Junction-to-Ambient <sup>b</sup>	$R_{thJA}$	170	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Case	$R_{thJC}$	20	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150	$^\circ\text{C}$

#### Notes

- Pulse width limited by maximum junction temperature.
- Not required by military spec.



SPECIFICATIONS (T <sub>A</sub> = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS	LIMITS			UNIT	
			MIN.	TYP. <sup>a</sup>	MAX.		
<b>Static</b>							
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>DS</sub> = 0 V, I <sub>D</sub> = 10 μA	60	75	-	V	
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 1 mA	0.8	1.7	2		
			T <sub>C</sub> = -55 °C	-	-		2.5
			T <sub>C</sub> = 125 °C	0.3	-	-	
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>GS</sub> = ±20 V	V <sub>DS</sub> = 0 V	-	-	±100	nA
			T <sub>C</sub> = 125 °C	-	-	±500	
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 48 V	-	-	1	μA
			T <sub>C</sub> = 125 °C	-	-	100	
On-State Drain Current	I <sub>D(on)</sub>	V <sub>GS</sub> = 10 V	V <sub>DS</sub> = 10 V	-	2	-	A
Drain-Source On-State Resistance <sup>b</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 5 V	I <sub>D</sub> = 0.3 A	-	2	5	Ω
		V <sub>GS</sub> = 10 V	I <sub>D</sub> = 1 A	-	1.3	3	
			T <sub>C</sub> = 125 °C	-	2.4	5.6	
Forward Transconductance <sup>b</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 7.5 V, I <sub>D</sub> = 0.525 A	170	350	-	mS	
Diode Forward Voltage	V <sub>SD</sub>	I <sub>S</sub> = 0.99 A, V <sub>GS</sub> = 0 V	0.7	0.8	1.6	V	
<b>Dynamic</b>							
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 25 V, f = 1 MHz	-	35	50	pF
Output Capacitance	C <sub>oss</sub>			-	25	40	
Reverse Transfer Capacitance	C <sub>rss</sub>			-	7	10	
Drain-Source Capacitance	C <sub>ds</sub>			-	30	-	
<b>Switching<sup>c</sup></b>							
Turn-On Time	t <sub>ON</sub>	V <sub>DD</sub> = 25 V, R <sub>L</sub> = 23 Ω I <sub>D</sub> ≅ 1 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 25 Ω	-	8	10	ns	
Turn-Off Time	t <sub>OFF</sub>		-	8.5	10		

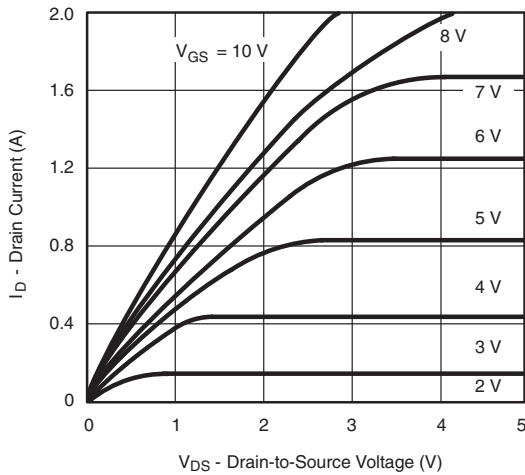
**Notes**

- a. FOR DESIGN AID ONLY, not subject to production testing.
- b. Pulse test: PW ≤ 300 μs duty cycle ≤ 2 %.
- c. Switching time is essentially independent of operating temperature.

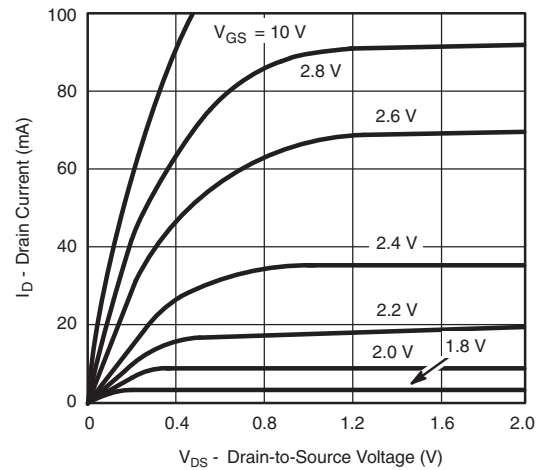
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



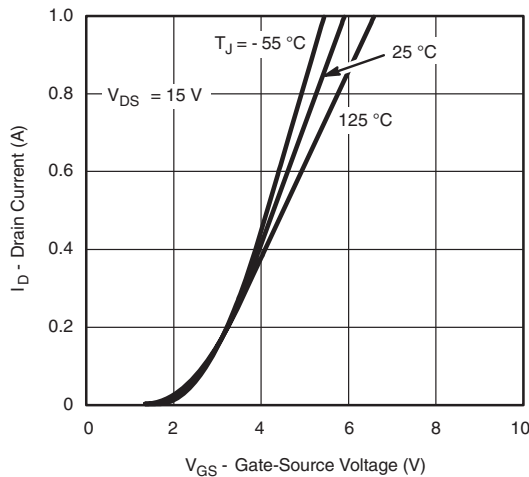
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



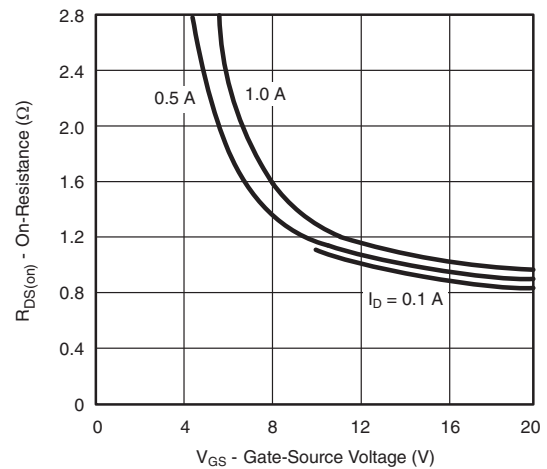
**Ohmic Region Characteristics**



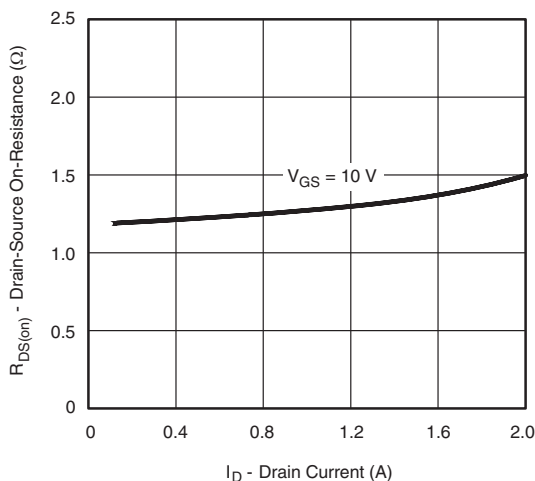
**Output Characteristics for Low Gate Drive**



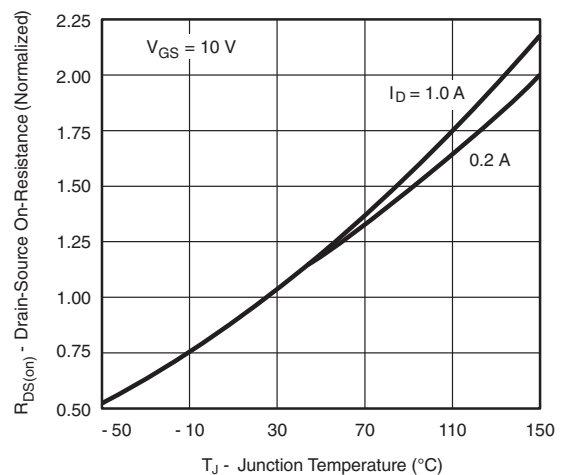
**Transfer Characteristics**



**On-Resistance vs. Gate-to-Source Voltage**



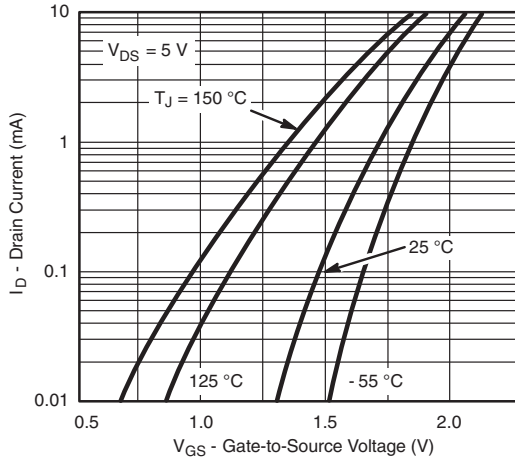
**On-Resistance vs. Drain Current**



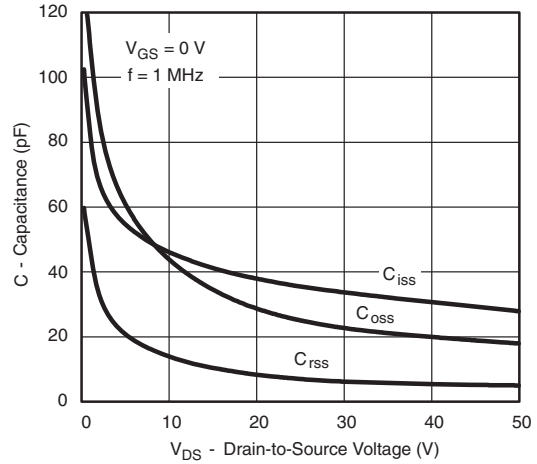
**Normalized On-Resistance vs. Junction Temperature**



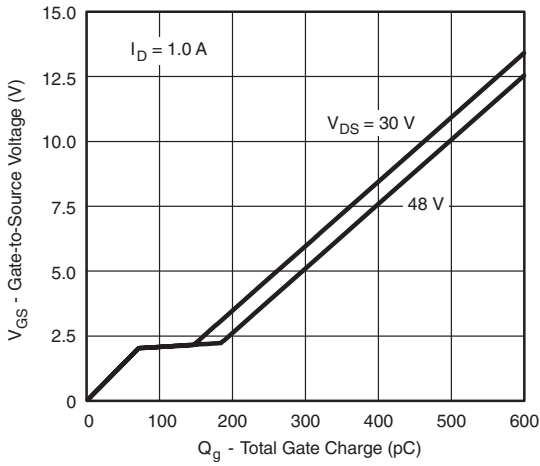
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



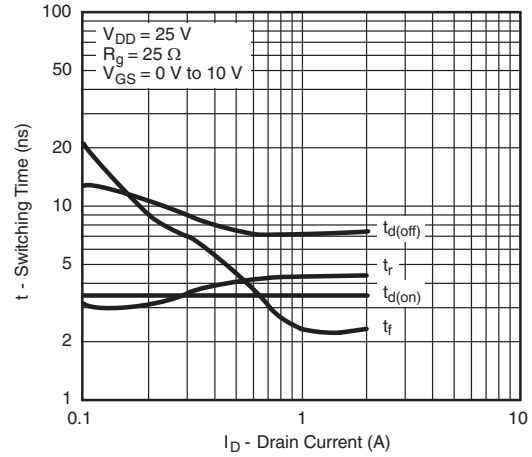
Threshold Region



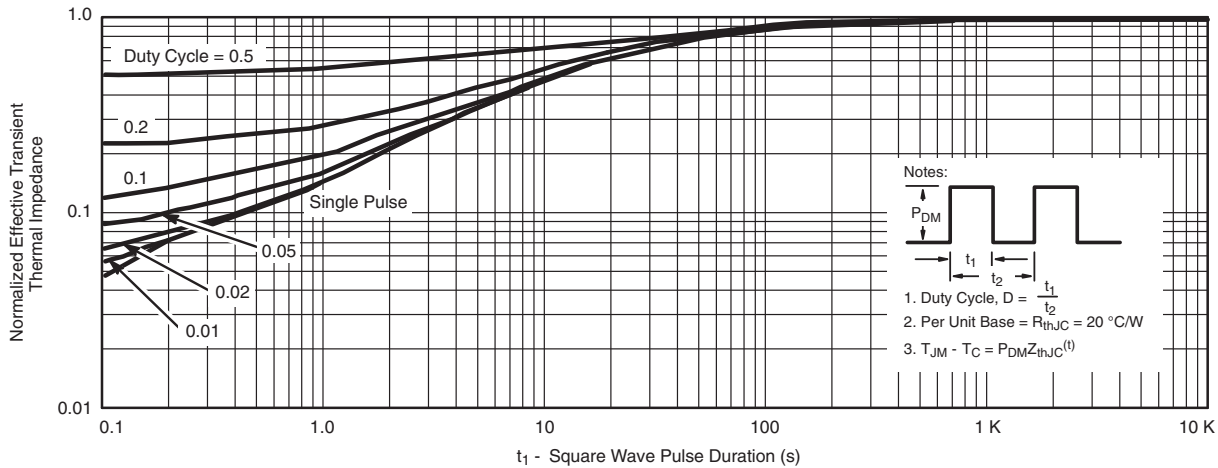
Capacitance



Gate Charge



Load Condition Effects on Switching

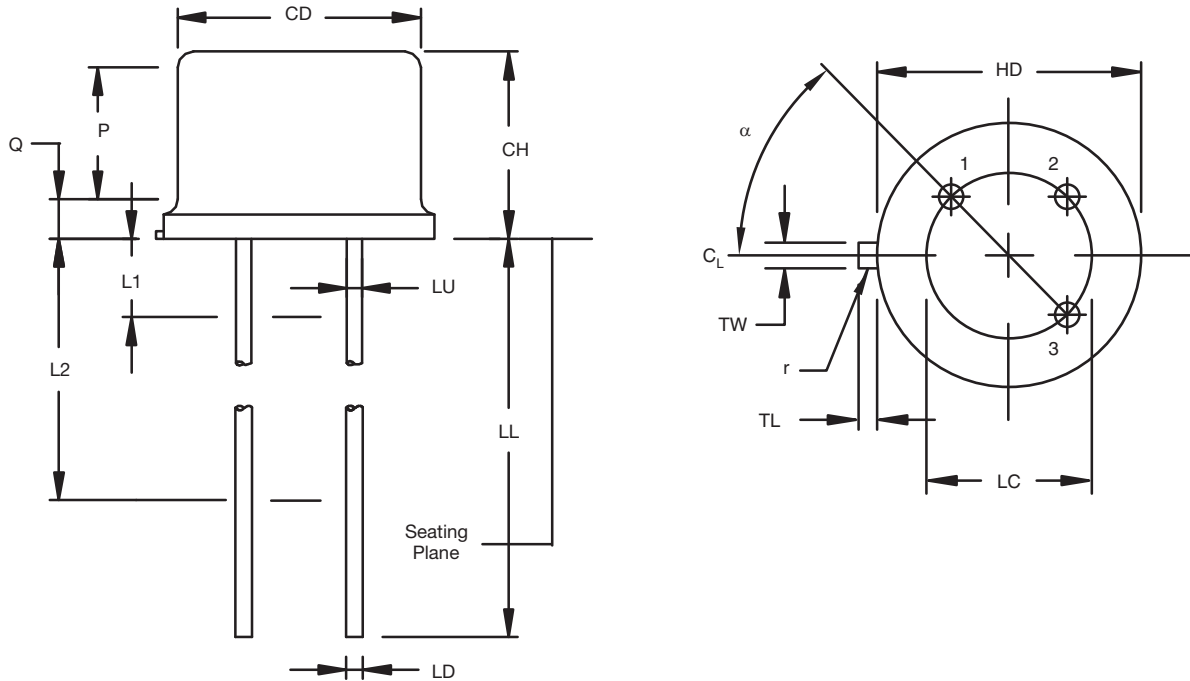


Normalized Thermal Transient Impedance, Junction-to-Ambient

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TO-205AD (TO-39 TALL LID)



DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
CD	0.305	0.335	7.75	8.51
CH	0.240	0.260	6.10	6.60
HD	0.335	0.370	8.51	9.40
LC <sup>(6)</sup>	0.200 TP		5.08 TP	
LD <sup>(7)(8)</sup>	0.016	0.021	0.41	0.53
LL <sup>(7)(8)</sup>	0.500	0.750	12.70	19.05
LU <sup>(7)(8)</sup>	0.016	0.019	0.41	0.48
L1 <sup>(7)(8)</sup>	—	0.050	—	1.27
L2 <sup>(7)(8)</sup>	0.250	—	6.35	—
P <sup>(5)</sup>	0.100	—	2.54	—
Q <sup>(4)</sup>	—	0.050	—	1.27
r <sup>(9)</sup>	—	0.010	—	0.25
TL <sup>(3)</sup>	0.029	0.045	0.74	1.14
TW <sup>(2)</sup>	0.028	0.034	0.71	0.86
α <sup>(6)</sup>	45° TP		45° TP	

ECN: S15-1675-Rev. D, 27-Jul-15  
 DWG: 5511

Notes

- (1) Dimensions are in inches. Metric equivalents are given for general information only.
- (2) Beyond radius (r) maximum, TW shall be held for a minimum length of 0.011" (0.028 mm).
- (3) Dimension TL measured from maximum HD.
- (4) Outline in this zone is not controlled.
- (5) Dimension CD shall not vary more than 0.010 (0.25 mm) in zone P. This zone is controlled for automatic handling.
- (6) Leads at gauge plane 0.054" + 0.001", - 0.000" (1.37 mm + 0.03 mm, - 0.00 mm) below seating plane shall be within 0.007" (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC.
- (7) LU applies between L1 and L2, LD applies between L2 and L maximum. Diameter is uncontrolled in L1 and beyond LL minimum.
- (8) All three leads.
- (9) Radius (r) applies to both inside corners of tab.
- (10) Drain is electrically connected to the case.



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