N-Channel Enhancement-Mode MOSFET Transistors

Product Summary

Part Number	$V_{(BR)DSS}$ Min (V)	$r_{DS(on)}$ Max (Ω)	$V_{GS(th)}$ (V)	I_D (A)
2N6659	35	1.8 @ V_{GS} = 10 V	0.8 to 2	1.4
2N6660	60	3 @ V_{GS} = 10 V	0.8 to 2	1.1
VQ1004J/P		3.5 @ V_{GS} = 10 V	0.8 to 2.5	0.46

Features

- Low On-Resistance: 1.3 Ω
- Low Threshold: 1.7 V
- Low Input Capacitance: 35 pF
- Fast Switching Speed: 8 ns
- Low Input and Output Leakage

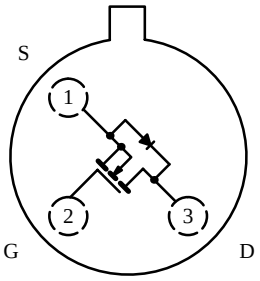
Benefits

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

Applications

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

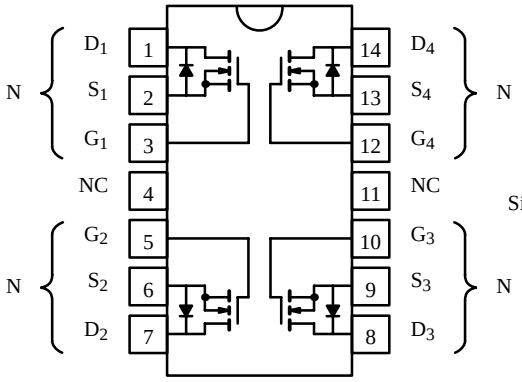
TO-205AD
(TO-39)



2N6659
2N6660

Top View

Dual-In-Line



Plastic: VQ1004J
Sidebraze: VQ1004P

Top View

Absolute Maximum Ratings (T_C = 25°C Unless Otherwise Noted)

Parameter		Symbol	2N6659	2N6660	Single VQ1004J	Single VQ1004P	Total Quad VQ1004J/P	Unit
Drain-Source Voltage		V_{DS}	35	60	60	60		V
Gate-Source Voltage		V_{GS}	±20	±20	±30	±20		V
Continuous Drain Current (T_J = 150°C)	T_C= 25°C	I_D	1.4	1.1	0.46	±0.46		A
	T_C= 100°C		1	0.8	0.26	0.26		A
Pulsed Drain Current[a]		I_{DM}	3	3	2	2		A
Power Dissipation	T_C= 25°C	P_D	6.25	6.25	1.3	1.3	2	W
	T_C= 100°C		2.5	2.5	0.52	0.52	0.8	W
Maximum Junction-to-Ambient[b]		R_{thJA}	170	170	0.96	0.96	62.5	°C/W
Maximum Junction-to-Case		R_{thJC}	20	20				°C/W
Operating Junction and Storage Temperature Range		T_J, T_{stg}	–55 to 150					°C

Notes
a. Pulse width limited by maximum junction temperature.
b. This parameter not registered with JEDEC.

Updates to this data sheet may be obtained via facsimile by calling Siliconix FaxBack, 1-408-970-5600. Please request FaxBack document #70222.

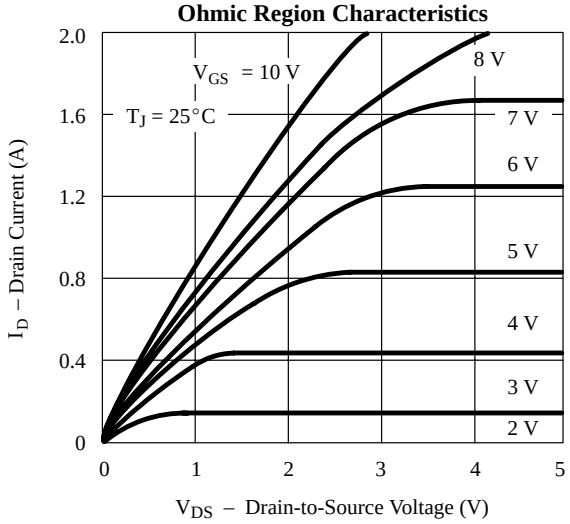
Specifications[a]

Parameter	Symbol	Test Conditions	Typ[b]	Limits 2N6659 Min	2N6659 Max	2N6660 Min	2N6660 Max	VQ1004J/P Min	VQ1004J/P Max	Unit
Static										
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 10 µA	75	35		60		60		V
Gate-Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 1 mA	1.7	0.8	2	0.8	2	0.8	2.5	V
Gate-Body Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ±15 V			±100		±100		±100	nA
		T_C = 125°C			±500		±500		±500	
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 60 V, V_{GS} = 0 V					10			µA
		V_{DS} = 35 V, V_{GS} = 0 V			10					
		V_{DS} = 48 V, V_{GS} = 0 V							1	
		T_C = 125°C					500		500	
		V_{DS} = 28 V, V_{GS} = 0 V								
		T_C = 125°C			500					
On-State Drain Current[c]	$I_{D(on)}$	V_{DS} = 10 V, V_{GS} = 10 V	3	1.5		1.5		1.5		A
Drain-Source On-Resistance[c]	$r_{DS(on)}$	V_{GS} = 5 V, I_D = 0.3 A[e]	2		5		5		5	Ω
		V_{GS} = 10 V, I_D = 1 A	1.3		1.8		3		3.5	
		T_C = 125°C[e]	2.4		3.6		4.2		4.9	
Forward Transconductance[c]	g_{fs}	V_{DS} = 10 V, I_D = 0.5 A	350	170		170		170		mS
Common Source Output Conductance[c]	g_{os}	V_{DS} = 10 V, I_D = 0.1 A	1							
Diode Forward Voltage	V_{SD}	I_S = 0.99 A, V_{GS} = 0 V	0.8							V
Dynamic										
Input Capacitance	C_{iss}	V_{DS} = 24 V, V_{GS} = 0 V f = 1 MHz	35		50		50		60	pF
Output Capacitance	C_{oss}		25		40		40		50	
Reverse Transfer Capacitance	C_{rss}		7		10		10		10	
Drain-Source Capacitance	C_{ds}		30		40		40			
Switching[d]										
Turn-On Time	t_{ON}	V_{DD} = 25 V, R_L = 23 Ω I_D ≅ 1 A, V_{GEN} = 10 V R_G = 25 Ω	8		10		10		10	ns
Turn-Off Time	t_{OFF}		8.5		10		10		10	

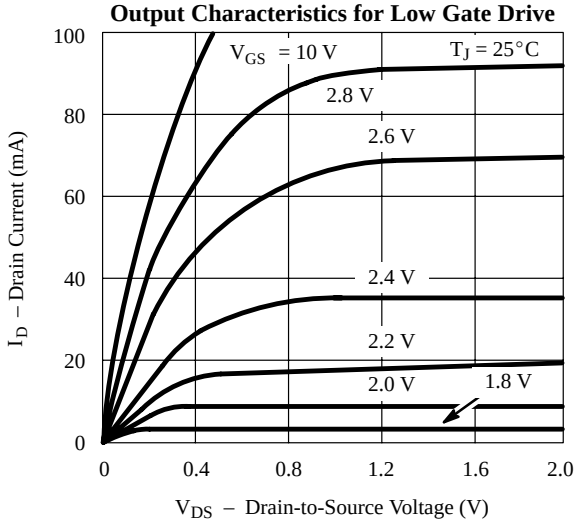
Notes
a. T_A = 25°C unless otherwise noted. VNDQ06
b. For DESIGN AID ONLY, not subject to production testing.
c. Pulse test: PW ≤ 80 µs duty cycle ≤ 1%.
d. Switching time is essentially independent of operating temperature.
e. This parameter not registered with JEDEC on 2N6659 and 2N6660.

Typical Characteristics (25°C Unless Otherwise Noted)

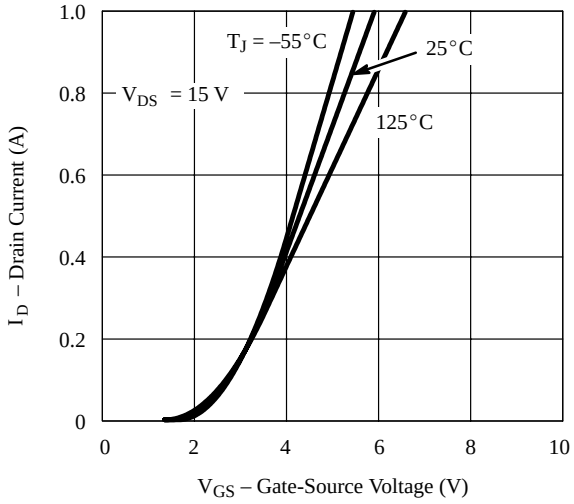
Ohmic Region Characteristics



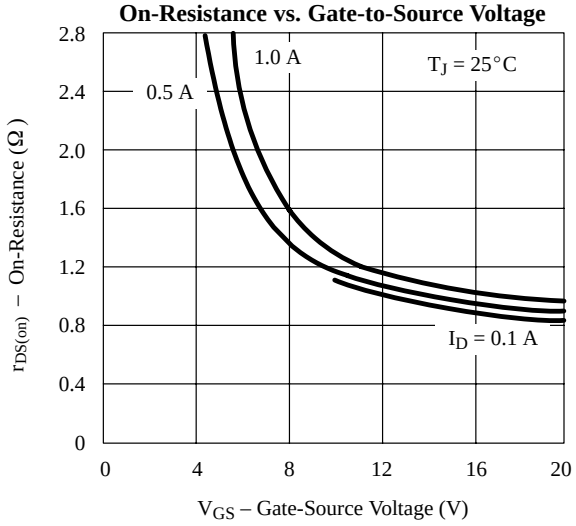
Output Characteristics for Low Gate Drive



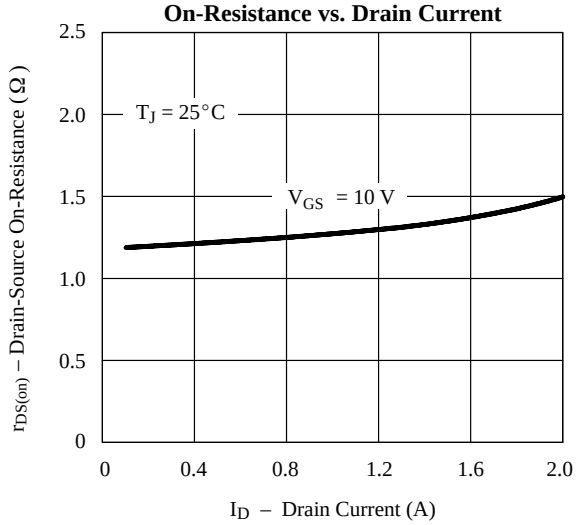
Transfer Characteristics



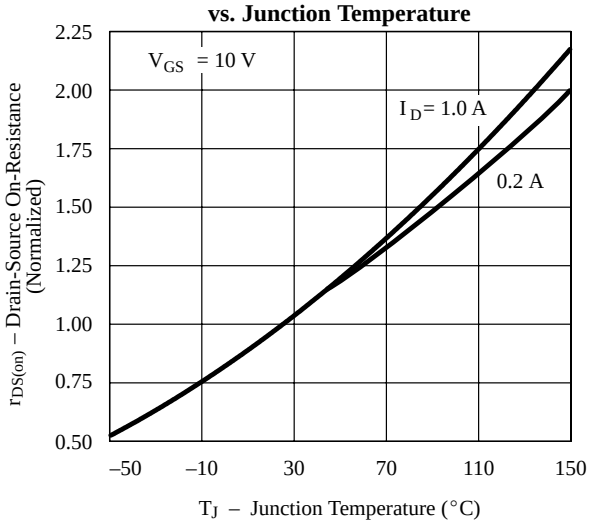
On-Resistance vs. Gate-to-Source Voltage



On-Resistance vs. Drain Current

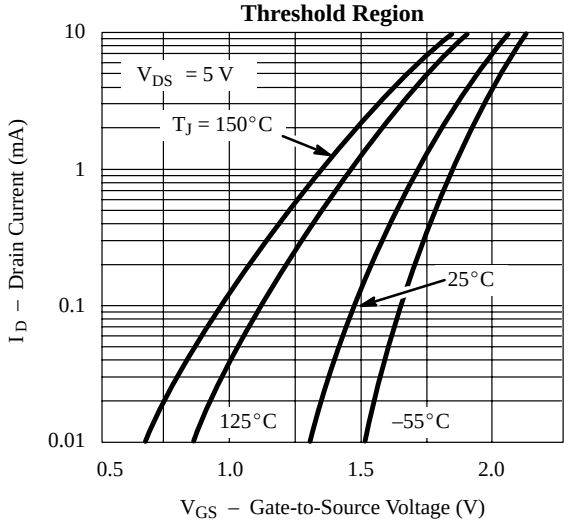


Normalized On-Resistance vs. Junction Temperature

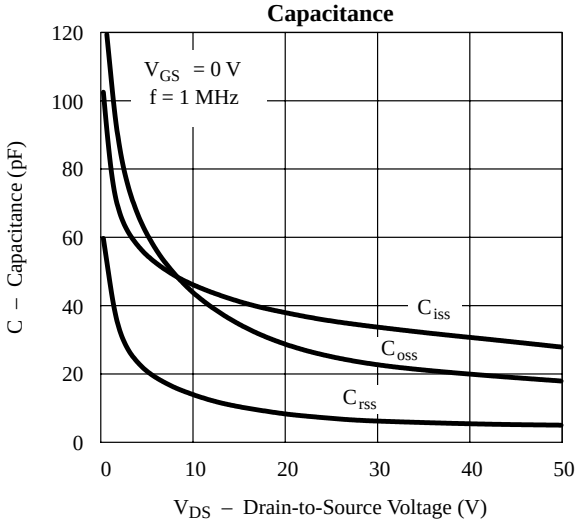


Typical Characteristics (25°C Unless Otherwise Noted)

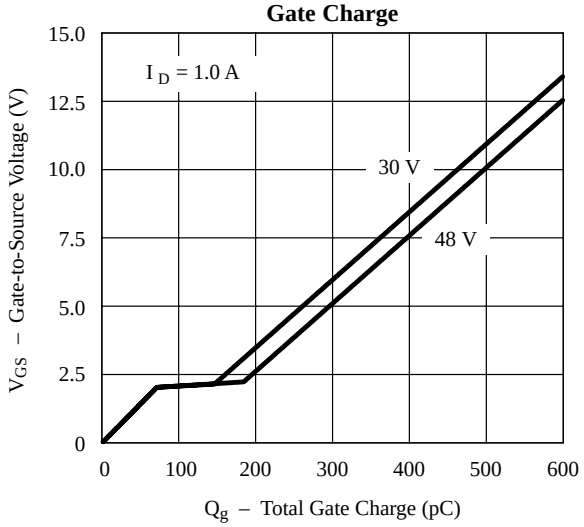
Threshold Region



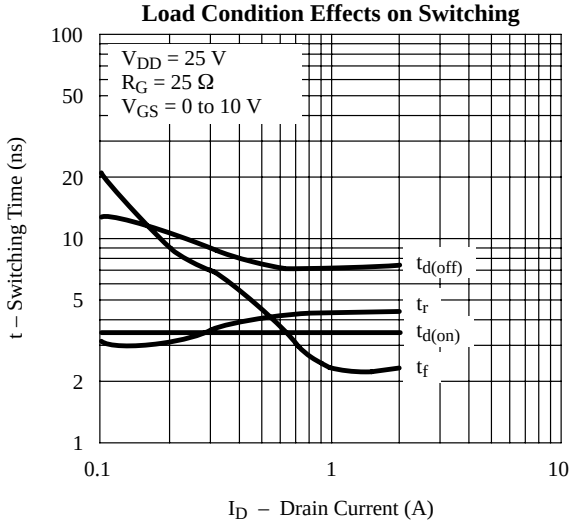
Capacitance



Gate Charge



Load Condition Effects on Switching



Normalized Effective Transient Thermal Impedance, Junction-to-Case (TO-205AD)