



Automotive N- and P-Channel 40 V (D-S) 175 °C MOSFET



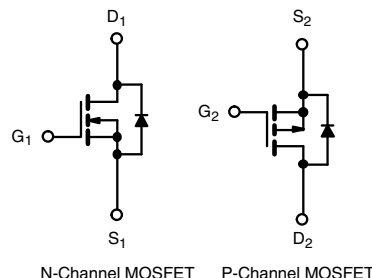
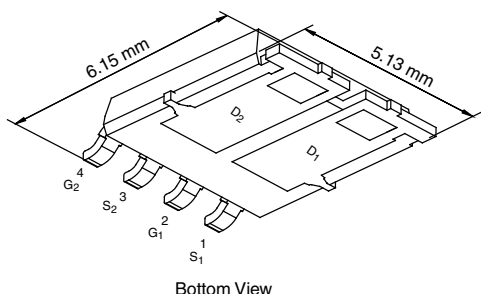
PRODUCT SUMMARY

	N-CHANNEL	P-CHANNEL
V_{DS} (V)	40	- 40
$R_{DS(on)}$ (Ω) at $V_{GS} = \pm 10$ V	0.014	0.028
$R_{DS(on)}$ (Ω) at $V_{GS} = \pm 4.5$ V	0.015	0.042
I_D (A)	8	- 8
Configuration	N- and P-Pair	

FEATURES

- TrenchFET® Power MOSFET
- AEC-Q101 Qualified^d
- 100 % R_g and UIS Tested
- Material categorization:
For definitions of compliance please see
www.vishay.com/doc?99912

PowerPAK® SO-8L Dual



ORDERING INFORMATION

Package	PowerPAK SO-8L
Lead (Pb)-free and Halogen-free	SQJ500EP-T1-GE3

ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted)

PARAMETER		SYMBOL	N-CHANNEL	P-CHANNEL	UNIT
Drain-Source Voltage		V _{DS}	40	- 40	V
Gate-Source Voltage		V _{GS}	± 20		
Continuous Drain Current ^a	T _C = 25 °C	I _D	8	- 8	A
	T _C = 125 °C		8	- 8	
Continuous Source Current (Diode Conduction) ^a		I _S	8	- 8	
Pulsed Drain Current ^b		I _{DM}	32	- 32	
Single Pulse Avalanche Current	L = 0.1 mH	I _{AS}	30	- 30	mJ
Single Pulse Avalanche Energy		E _{AS}	45	45	
Maximum Power Dissipation ^b	T _C = 25 °C	P _D	48	48	W
	T _C = 125 °C		16	16	
Operating Junction and Storage Temperature Range		T _J , T _{stg}	- 55 to + 175		°C
Soldering Recommendations (Peak Temperature) ^{e, f}			260		

THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	N-CHANNEL	P-CHANNEL	UNIT
Junction-to-Ambient	R_{thJA}	85	85	°C/W
Junction-to-Case (Drain)	R_{thJC}	3.1	3.1	

Notes

- Package limited.
- Pulse test; pulse width ≤ 300 μ s, duty cycle ≤ 2 %.
- When mounted on 1" square PCB (FR4 material).
- Parametric verification ongoing.
- See solder profile (www.vishay.com/doc?73257). The PowerPAK SO-8L. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.
- Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.

**SPECIFICATIONS** ($T_C = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS			MIN.	TYP.	MAX.	UNIT
Static								
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA		N-Ch	40	-	-	V
		V _{GS} = 0 V, I _D = - 250 μA		P-Ch	- 40	-	-	
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		N-Ch	1.3	1.8	2.3	
		V _{DS} = V _{GS} , I _D = - 250 μA		P-Ch	- 1.5	- 2	- 2.5	
Gate-Source Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V		N-Ch	-	-	± 100	nA
				P-Ch	-	-	± 100	
Zero Gate Voltage Drain Current	I _{DSS}	V _{GS} = 0 V	V _{DS} = 40 V	N-Ch	-	-	1	μA
		V _{GS} = 0 V	V _{DS} = - 40 V	P-Ch	-	-	- 1	
		V _{GS} = 0 V	V _{DS} = 40 V, T _J = 125 °C	N-Ch	-	-	50	
		V _{GS} = 0 V	V _{DS} = - 40 V, T _J = 125 °C	P-Ch	-	-	- 50	
		V _{GS} = 0 V	V _{DS} = 40 V, T _J = 175 °C	N-Ch	-	-	150	
		V _{GS} = 0 V	V _{DS} = - 40 V, T _J = 175 °C	P-Ch	-	-	- 150	
On-State Drain Current ^a	I _{D(on)}	V _{GS} = 10 V	V _{DS} ≥ 5 V	N-Ch	25	-	-	A
		V _{GS} = - 10 V	V _{DS} ≤ 5 V	P-Ch	- 25	-	-	
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = 10 V	I _D = 8 A	N-Ch	-	0.011	0.014	Ω
		V _{GS} = - 10 V	I _D = - 8 A	P-Ch	-	0.022	0.028	
		V _{GS} = 10 V	I _D = 8 A, T _J = 125 °C	N-Ch	-	-	0.017	
		V _{GS} = - 10 V	I _D = - 8 A, T _J = 125 °C	P-Ch	-	-	0.041	
		V _{GS} = 10 V	I _D = 8 A, T _J = 175 °C	N-Ch	-	-	0.025	
		V _{GS} = - 10 V	I _D = - 8 A, T _J = 175 °C	P-Ch	-	-	0.049	
		V _{GS} = 4.5 V	I _D = 6 A	N-Ch	-	0.012	0.015	
		V _{GS} = - 4.5 V	I _D = - 6 A	P-Ch	-	0.033	0.042	
Forward Transconductance ^b	g _{fs}	V _{DS} = 15 V, I _D = 8 A		N-Ch	-	40	-	S
		V _{DS} = - 15 V, I _D = - 8 A		P-Ch	-	18	-	
Dynamic ^b								
Input Capacitance	C _{iss}	V _{GS} = 0 V	V _{DS} = 20 V, f = 1 MHz	N-Ch	-	1799	2248	
		V _{GS} = 0 V	V _{DS} = - 20 V, f = 1 MHz	P-Ch	-	1756	2195	
Output Capacitance	C _{oss}	V _{GS} = 0 V	V _{DS} = 20 V, f = 1 MHz	N-Ch	-	282	352	pF
		V _{GS} = 0 V	V _{DS} = - 20 V, f = 1 MHz	P-Ch	-	296	370	
Reverse Transfer Capacitance	C _{rss}	V _{GS} = 0 V	V _{DS} = 20 V, f = 1 MHz	N-Ch	-	109	136	
		V _{GS} = 0 V	V _{DS} = - 20 V, f = 1 MHz	P-Ch	-	208	260	
Total Gate Charge ^c	Q _g	V _{GS} = 10 V	V _{DS} = 20 V, I _D = 10 A	N-Ch	-	31.5	48	
		V _{GS} = - 10 V	V _{DS} = - 20 V, I _D = - 10 A	P-Ch	-	41.5	63	
Gate-Source Charge ^c	Q _{gs}	V _{GS} = 10 V	V _{DS} = 20 V, I _D = 10 A	N-Ch	-	5.7	-	nC
		V _{GS} = - 10 V	V _{DS} = - 20 V, I _D = - 10 A	P-Ch	-	5.5	-	
Gate-Drain Charge ^c	Q _{gd}	V _{GS} = 10 V	V _{DS} = 20 V, I _D = 10 A	N-Ch	-	4.8	-	
		V _{GS} = - 10 V	V _{DS} = - 20 V, I _D = - 10 A	P-Ch	-	10.5	-	
Gate Resistance	R _g	f = 1 MHz		N-Ch	2	4.11	6.2	Ω
				P-Ch	3.1	6.3	9.5	

Notes

- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
b. Guaranteed by design, not subject to production testing.
c. Independent of operating temperature.

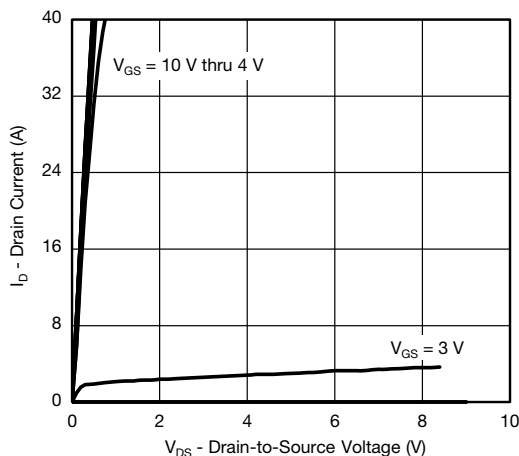
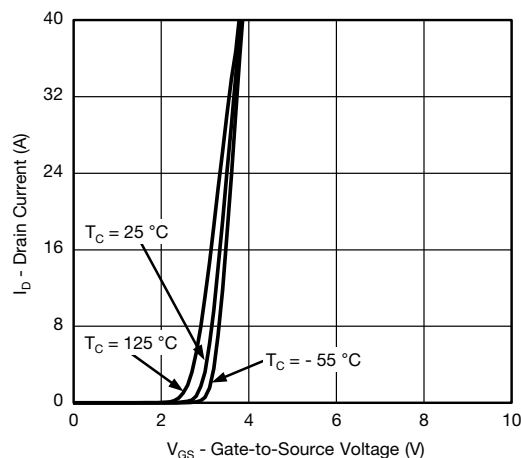
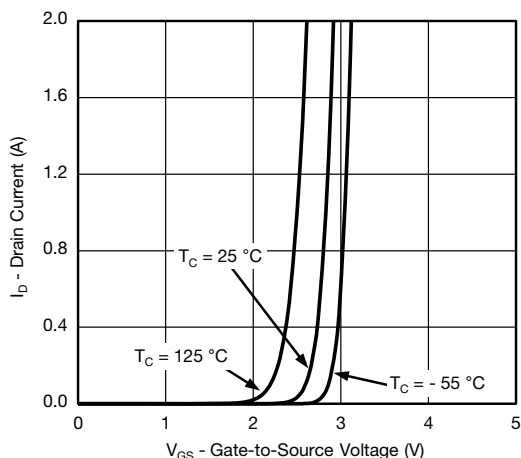
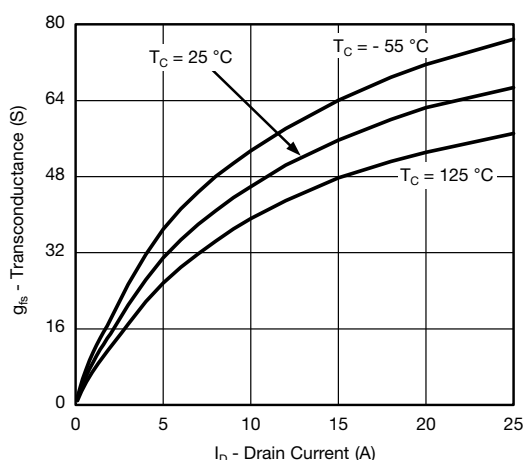
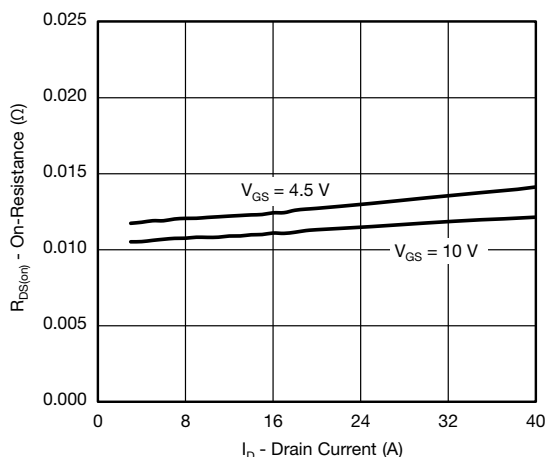
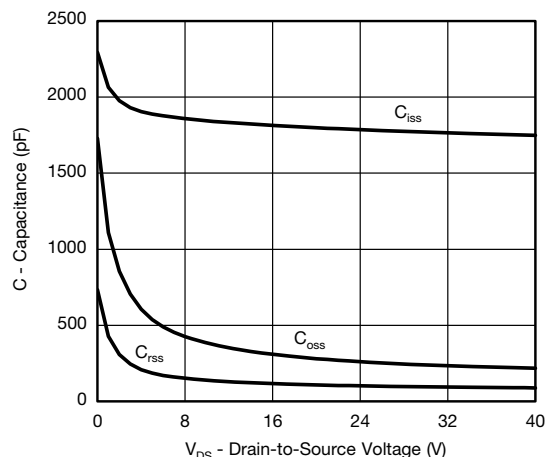


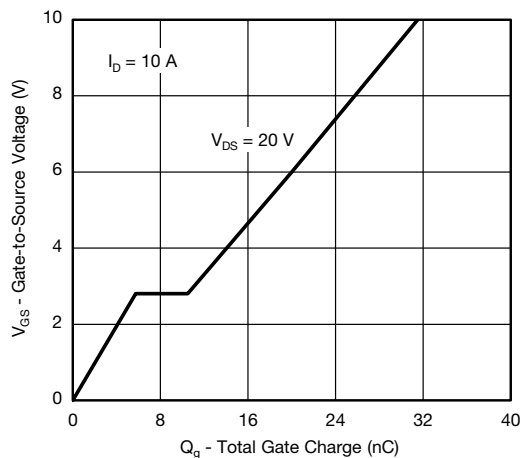
SPECIFICATIONS (T _C = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Turn-On Delay Time ^c	t _{d(on)}	V _{DD} = 20 V, R _L = 2 Ω I _D ≅ 10 A, V _{GEN} = 10 V, R _g = 1 Ω	N-Ch	-	7	11	ns
		V _{DD} = - 20 V, R _L = 2 Ω I _D ≅ - 10 A, V _{GEN} = - 10 V, R _g = 1 Ω	P-Ch	-	11	17	
Rise Time ^c	t _r	V _{DD} = 20 V, R _L = 2 Ω I _D ≅ 10 A, V _{GEN} = 10 V, R _g = 1 Ω	N-Ch	-	21	32	
		V _{DD} = - 20 V, R _L = 2 Ω I _D ≅ - 10 A, V _{GEN} = - 10 V, R _g = 1 Ω	P-Ch	-	9	14	
Turn-Off Delay Time ^c	t _{d(off)}	V _{DD} = 20 V, R _L = 2 Ω I _D ≅ 10 A, V _{GEN} = 10 V, R _g = 1 Ω	N-Ch	-	33	50	
		V _{DD} = - 20 V, R _L = 2 Ω I _D ≅ - 10 A, V _{GEN} = - 10 V, R _g = 1 Ω	P-Ch	-	55	83	
Fall Time ^c	t _f	V _{DD} = 20 V, R _L = 2 Ω I _D ≅ 10 A, V _{GEN} = 10 V, R _g = 1 Ω	N-Ch	-	19	29	
		V _{DD} = - 20 V, R _L = 2 Ω I _D ≅ - 10 A, V _{GEN} = - 10 V, R _g = 1 Ω	P-Ch	-	91	137	
Source-Drain Diode Ratings and Characteristics ^b							
Pulsed Current ^a	I _{SM}		N-Ch	-	-	32	A
			P-Ch	-	-	- 32	
Forward Voltage	V _{SD}	I _S = 4 A	N-Ch	-	0.79	1.2	V
		I _S = - 4 A	P-Ch	-	- 0.82	- 1.2	

Notes

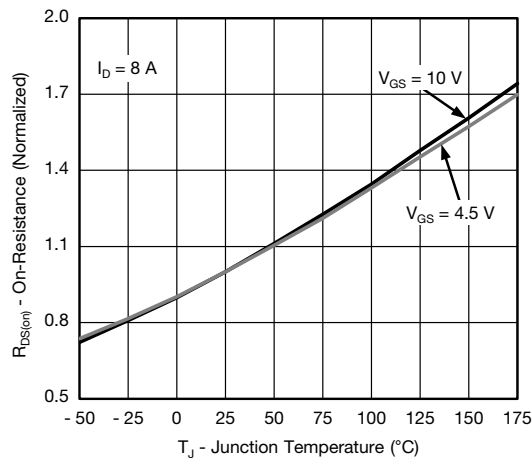
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
b. Guaranteed by design, not subject to production testing.
c. Independent of operating temperature.

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.

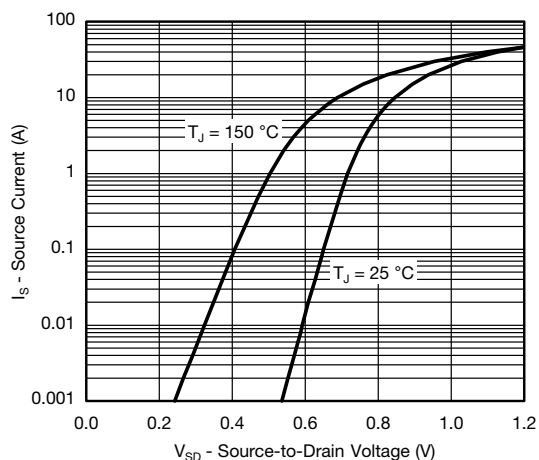
N-CHANNEL TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

Output Characteristics

Transfer Characteristics

Transfer Characteristics

Transconductance

On-Resistance vs. Drain Current

Capacitance

N-CHANNEL TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)


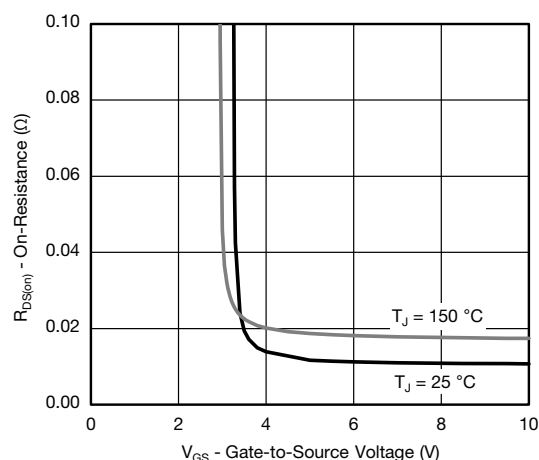
Gate Charge



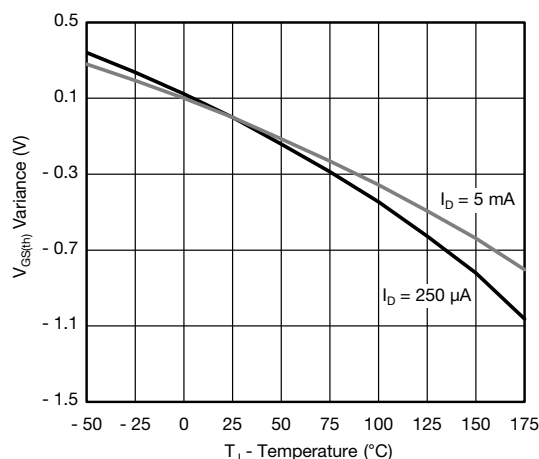
On-Resistance vs. Junction Temperature



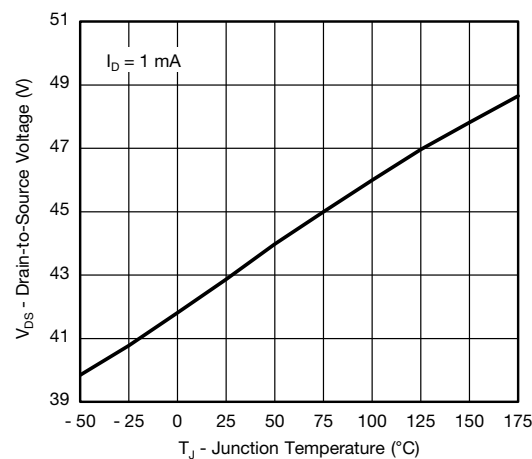
Source Drain Diode Forward Voltage



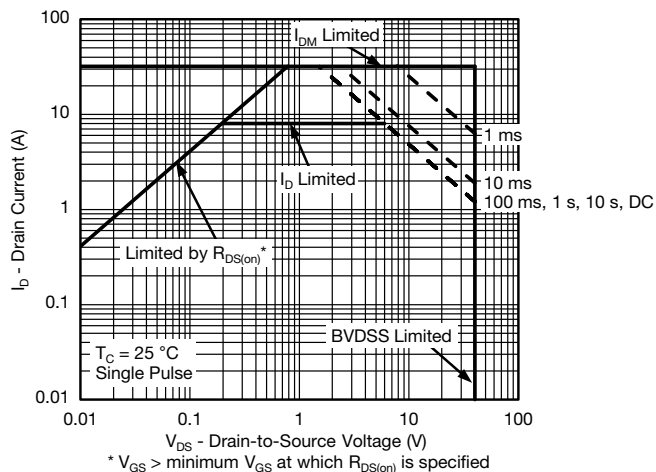
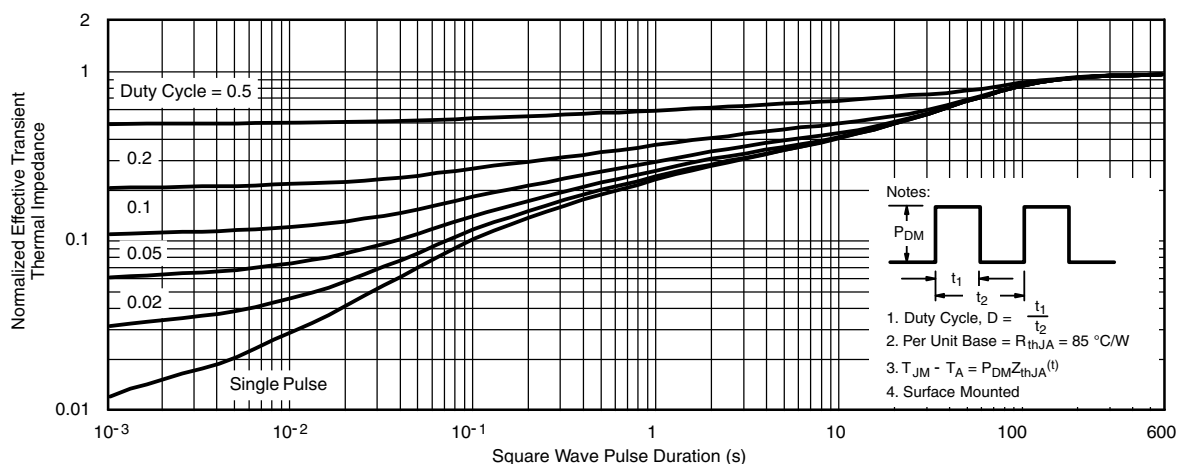
On-Resistance vs. Gate-to-Source Voltage

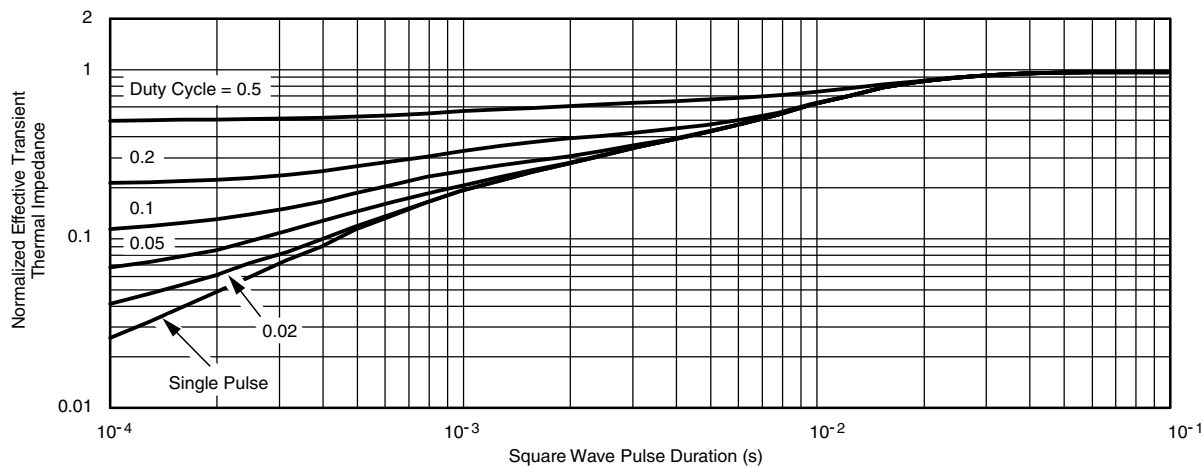


Threshold Voltage



Drain Source Breakdown vs. Junction Temperature

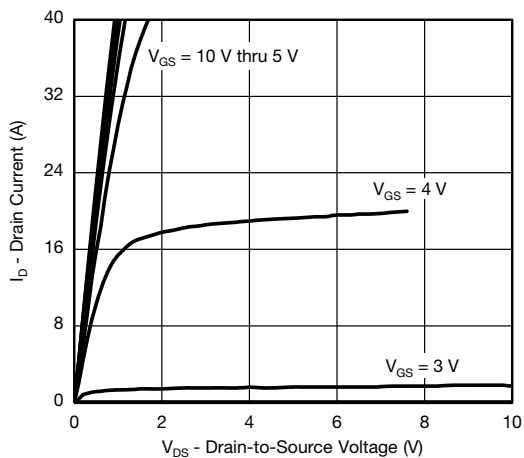
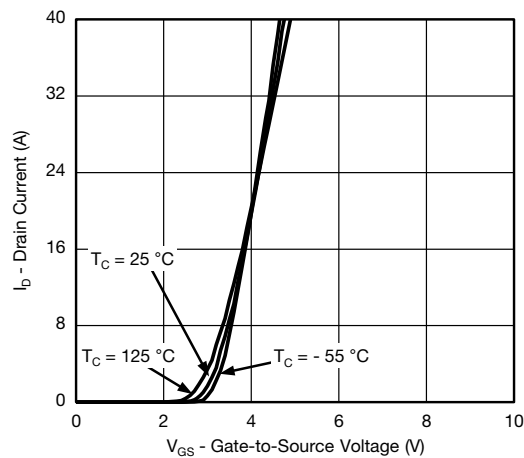
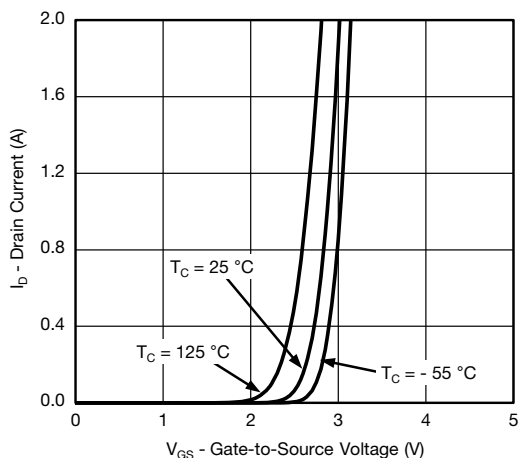
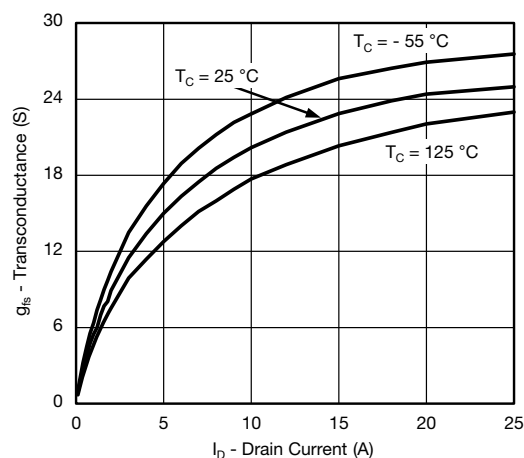
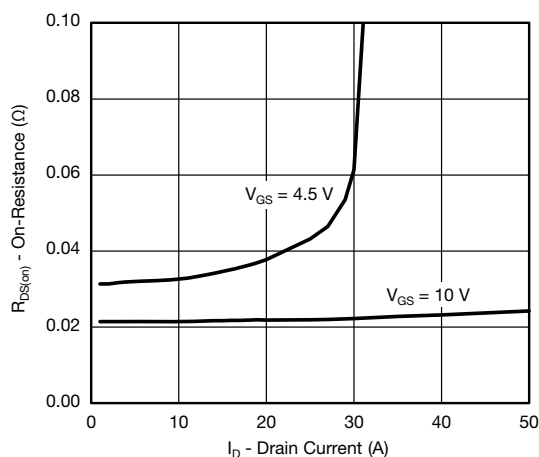
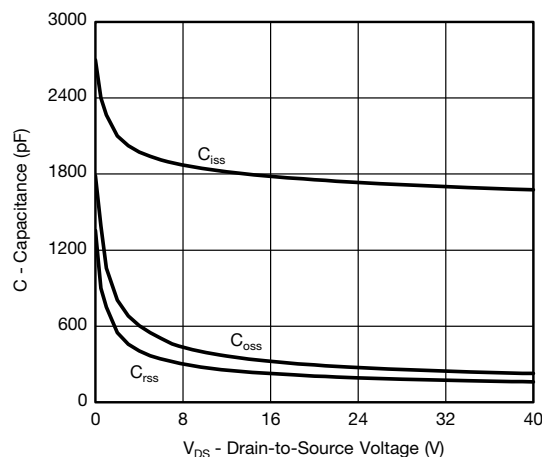
N-CHANNEL TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

Safe Operating Area

Normalized Thermal Transient Impedance, Junction-to-Ambient

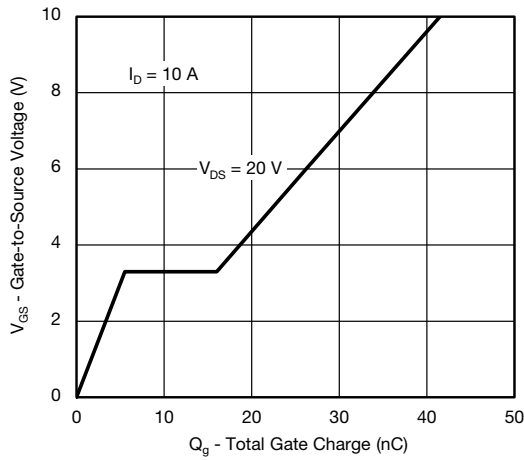
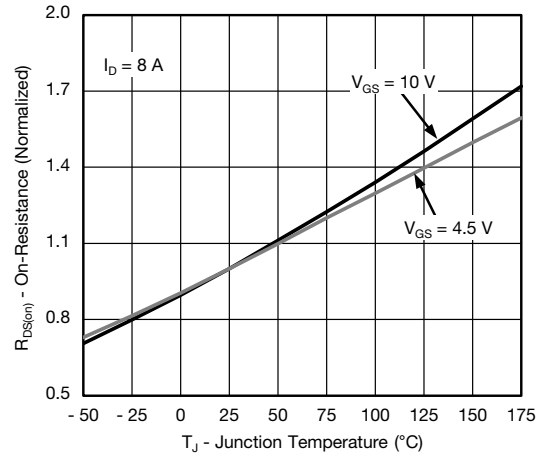
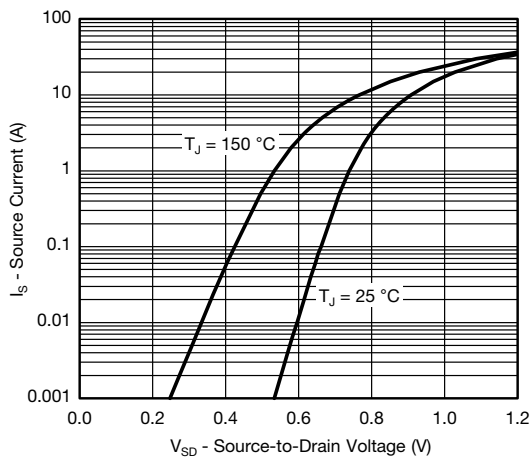
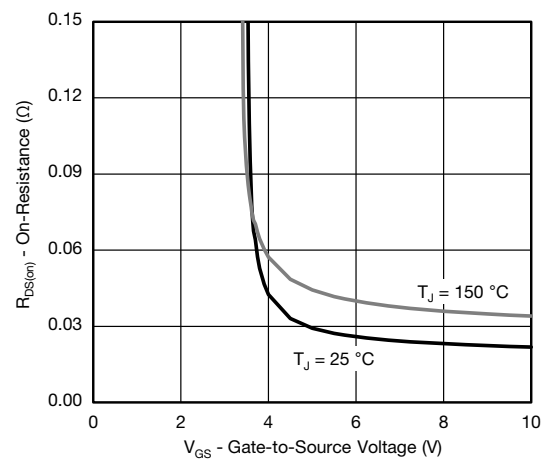
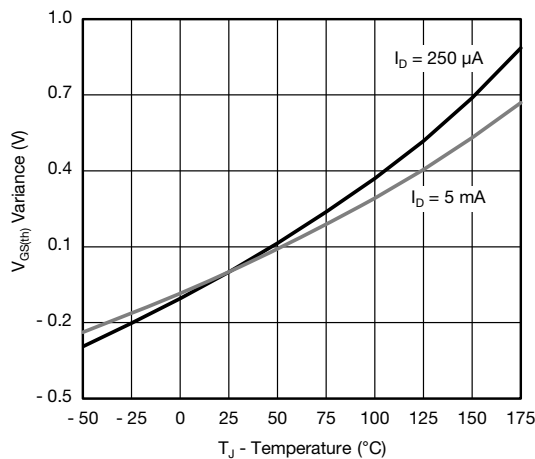
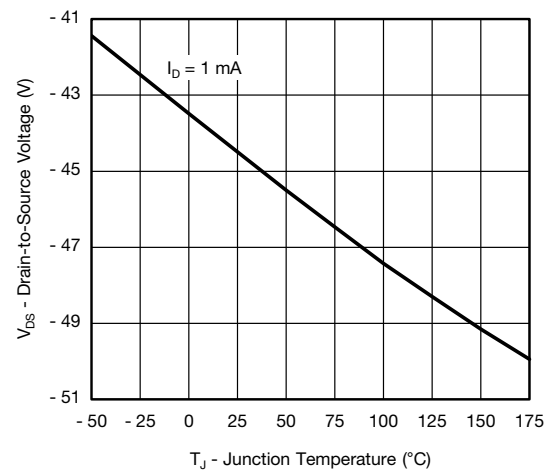
N-CHANNEL TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)


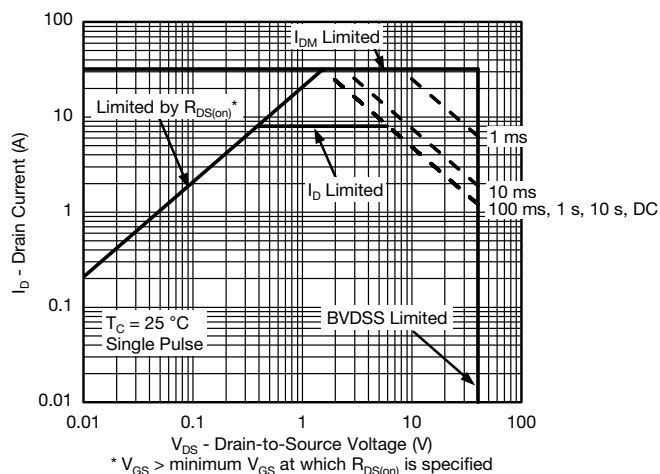
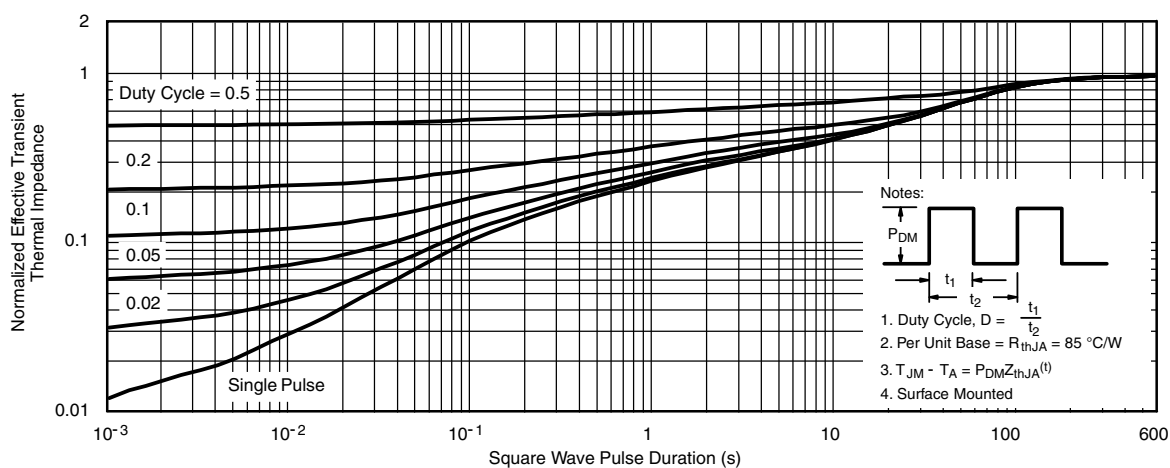
Normalized Thermal Transient Impedance, Junction-to-Case

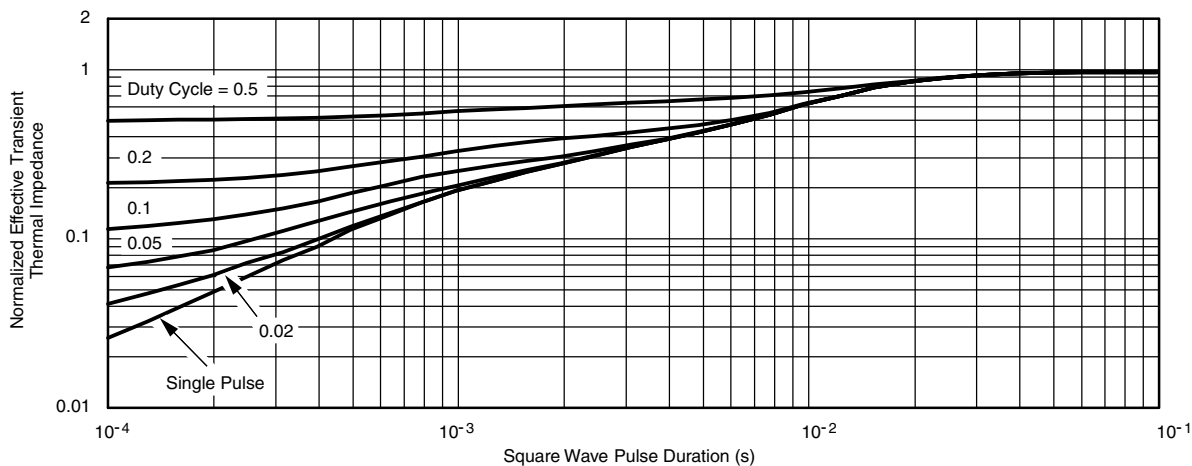
Note

- The characteristics shown in the two graphs
 - Normalized Transient Thermal Impedance Junction-to-Ambient ($25\text{ }^{\circ}\text{C}$)
 - Normalized Transient Thermal Impedance Junction-to-Case ($25\text{ }^{\circ}\text{C}$)
 are given for general guidelines only to enable the user to get a "ball park" indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions.

P-CHANNEL TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

Output Characteristics

Transfer Characteristics

Transfer Characteristics

Transconductance

On-Resistance vs. Drain Current

Capacitance

P-CHANNEL TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

Gate Charge

On-Resistance vs. Junction Temperature

Source Drain Diode Forward Voltage

On-Resistance vs. Gate-to-Source Voltage

Threshold Voltage

Drain Source Breakdown vs. Junction Temperature

P-CHANNEL TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

Safe Operating Area

Normalized Thermal Transient Impedance, Junction-to-Ambient

P-CHANNEL TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)


Normalized Thermal Transient Impedance, Junction-to-Case

Note

- The characteristics shown in the two graphs
 - Normalized Transient Thermal Impedance Junction-to-Ambient ($25\text{ }^{\circ}\text{C}$)
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