

Complementary N- and P-Channel 40-V (D-S) MOSFET

PRODUCT SUMMARY

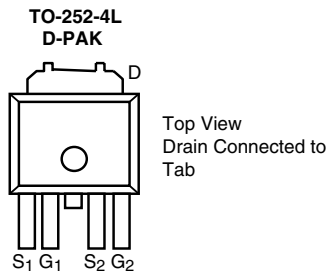
	V _{DS} (V)	r _{DS(on)} (Ω)	I _D (A) ^a	Q _g (Typ.)
N-Channel	40	0.037 at V _{GS} = 10 V	8	26
		0.046 at V _{GS} = 4.5 V	8	
P-Channel	- 40	0.040 at V _{GS} = - 10 V	- 8	25.5
		0.050 at V _{GS} = - 4.5 V	- 8	

FEATURES

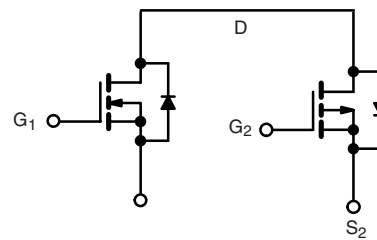
- TrenchFET[®] Power MOSFET
- 100 % UIS Tested

APPLICATIONS

- Backlight Inverter for LCD Display
- Full Bridge DC/DC Converter



Ordering Information: SUD50NP04-77P-T4-E3 (Lead (Pb)-free)



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS T_A = 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 (T _J = 150 °C)	T _C = 25 °C	I _D	8 ^a	- 8 ^a	A
	T _C = 70 °C		8 ^a	- 8 ^a	
	T _A = 25 °C		8 ^{a, b, c}	- 8 ^{a, b, c}	
	T _A = 70 °C		7 ^{b, c}	- 7.4 ^{b, c}	
Pulsed Drain Current (10 μs Pulse Width)		I _{DM}	30	- 30	
Source-Drain Current Diode Current	T _C = 25 °C	I _S	8 ^a	- 8 ^a	
	T _A = 25 °C		4.3 ^{b, c}	- 4.6 ^{b, c}	
Pulsed Source-Drain Current		I _{SM}	30	- 30	
Single Pulse Avalanche Current	L = 0.1 mH	I _{AS}	7	15	
Single Pulse Avalanche Energy		E _{AS}	2.45	11.25	mJ
Maximum Power Dissipation	T _C = 25 °C	P _D	10.8	24	W
	T _C = 70 °C		6.9	15.3	
	T _A = 25 °C		5.2 ^{b, c}	5.6 ^{b, c}	
	T _A = 70 °C		3.3 ^{b, c}	3.6 ^{b, c}	
Operating Junction and Storage Temperature Range		T _J , T _{stg}	- 55 to 150		°C

THERMAL RESISTANCE RATINGS

Parameter	Symbol	N-Channel		P-Channel		Unit
		Typ.	Max.	Typ.	Max.	
Maximum Junction-to-Ambient ^{b, d}	R _{thJA}	20	24	18	22	°C/W
Maximum Junction-to-Case (Drain)	R _{thJC}	9.4	11.5	4.3	5.2	

Notes:

a. Package Limited.

b. Surface Mounted on 1" x 1" FR4 Board.

c. t = 10 s.

d. Maximum under Steady State conditions is 60 °C/W (N-Channel) and 52 °C/W (P-Channel).

SPECIFICATIONS T _J = 25 °C, unless otherwise noted									
Parameter	Symbol	Test Conditions		Min.	Typ. ^a	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					
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = 250 μA	N-Ch		44		mV/°C		
		I _D = - 250 μA	P-Ch		- 41				
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J	I _D = 250 μA	N-Ch		- 5.5				
		I _D = - 250 μA	P-Ch		4.3				
Gate Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	N-Ch	1.4		2.5	V		
		V _{DS} = V _{GS} , I _D = - 250 μA	P-Ch	- 1.4		- 2.7			
Gate-Body Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V	N-Ch P-Ch			100 - 100	nA		
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 40 V, V _{GS} = 0 V	N-Ch			1	μA		
		V _{DS} = - 40 V, V _{GS} = 0 V	P-Ch			- 1			
		V _{DS} = 40 V, V _{GS} = 0 V, T _J = 55 °C	N-Ch			10			
		V _{DS} = - 40 V, V _{GS} = 0 V, T _J = 55 °C	P-Ch			- 10			
On-State Drain Current ^b	I _{D(on)}	V _{DS} = 5 V, V _{GS} = 10 V	N-Ch	10			A		
		V _{DS} = - 5 V, V _{GS} = - 10 V	P-Ch	- 10					
Drain-Source On-State Resistance ^b	r _{DS(on)}	V _{GS} = 10 V, I _D = 5 A	N-Ch		0.0305	0.037	Ω		
		V _{GS} = - 10 V, I _D = - 5 A	P-Ch		0.030	0.040			
		V _{GS} = 4.5 V, I _D = 4 A	N-Ch		0.037	0.046			
		V _{GS} = - 4.5 V, I _D = - 4 A	P-Ch		0.036	0.050			
Forward Transconductance ^b	g _{fs}	V _{DS} = 15 V, I _D = 5 A	N-Ch		22		S		
		V _{DS} = - 15 V, I _D = - 5 A	P-Ch		20				
Dynamic ^a									
Input Capacitance	C _{iss}	N-Channel V _{DS} = 20 V, V _{GS} = 0 V, f = 1 MHz	N-Ch P-Ch		640 1555		pF		
Output Capacitance	C _{oss}		N-Ch P-Ch		73 176				
Reverse Transfer Capacitance	C _{rss}	P-Channel V _{DS} = - 20 V, V _{GS} = 0 V, f = 1 MHz	N-Ch P-Ch		41 142				
Total Gate Charge	Q _g	V _{DS} = 20 V, V _{GS} = 10 V, I _D = 5 A	N-Ch		11.7	20	nC		
		V _{DS} = - 20 V, V _{GS} = - 10 V, I _D = - 5 A	P-Ch		38.5	60			
Gate-Source Charge	Q _{gs}	N-Channel V _{DS} = 20 V, V _{GS} = 4.5 V, I _D = 5 A	N-Ch P-Ch		5.3 17	9.0 27			
			N-Ch P-Ch		1.9 4.2				
		Gate-Drain Charge	Q _{gd}	P-Channel V _{DS} = - 20 V, V _{GS} = - 4.5 V, I _D = - 5 A	N-Ch P-Ch			1.7 7.0	
Gate Resistance	R _g	f = 1 MHz	N-Ch P-Ch		2.2 3.0			Ω	



SPECIFICATIONS T _J = 25 °C, unless otherwise noted								
Parameter	Symbol	Test Conditions		Min.	Typ. ^a	Max.	Unit	
Dynamic ^a								
Turn-On Delay Time	t _{d(on)}	N-Channel V _{DD} = 20 V, R _L = 4 Ω I _D ≅ 5 A, V _{GEN} = 10 V, R _g = 1 Ω	N-Ch		9	18	ns	
			P-Ch		10	20		
Rise Time	t _r		N-Ch		11	20		
			P-Ch		14	25		
Turn-Off Delay Time	t _{d(off)}	P-Channel V _{DD} = - 20 V, R _L = 4 Ω I _D ≅ - 5 A, V _{GEN} = - 10 V, R _g = 1 Ω	N-Ch		14	25		
			P-Ch		36	60		
Fall Time	t _f		N-Ch		8	16		
			P-Ch		10	20		
Turn-On Delay Time	t _{d(on)}	N-Channel V _{DD} = 20 V, R _L = 4 Ω I _D ≅ 5 A, V _{GEN} = 4.5 V, R _g = 1 Ω	N-Ch		18	30		
			P-Ch		47	80		
Rise Time	t _r		N-Ch		14	25		
			P-Ch		60	110		
Turn-Off Delay Time	t _{d(off)}	P-Channel V _{DD} = - 20 V, R _L = 4 Ω I _D ≅ - 5 A, V _{GEN} = - 4.5 V, R _g = 1 Ω	N-Ch		14	25		
			P-Ch		35	60		
Fall Time	t _f		N-Ch		10	20		
			P-Ch		13	25		
Drain-Source Body Diode Characteristics								
Continuous Source-Drain Diode Current	I _S	T _C = 25 °C	N-Ch			8	A	
			P-Ch			- 8		
Pulse Diode Forward Current ^a	I _{SM}		N-Ch			30		
			P-Ch			- 30		
Body Diode Voltage	V _{SD}	I _S = 2 A	N-Ch		0.805	1.2	V	
		I _S = - 2 A	P-Ch		- 0.76	- 1.2		
Body Diode Reverse Recovery Time	t _{rr}	N-Channel I _F = 2 A, di/dt = 100 A/μs, T _J = 25 °C	N-Ch		19	30	ns	
			P-Ch		22	40		
Body Diode Reverse Recovery Charge	Q _{rr}		P-Channel I _F = - 2 A, di/dt = - 100 A/μs, T _J = 25 °C	N-Ch		14	25	nC
				P-Ch		22	40	
Reverse Recovery Fall Time	t _a			N-Ch		13		ns
				P-Ch		15		
Reverse Recovery Rise Time	t _b		N-Ch		6			
			P-Ch		7			

Notes:

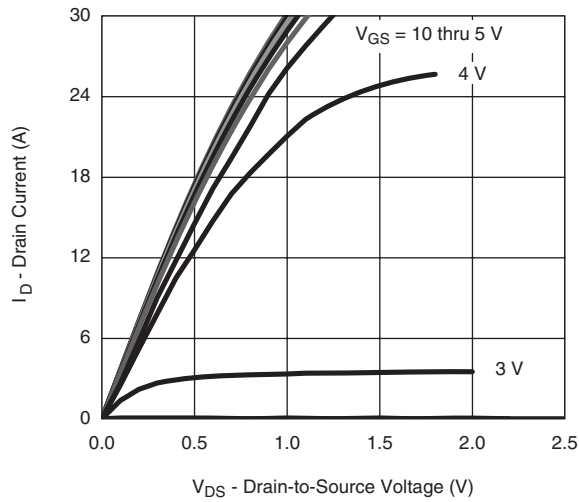
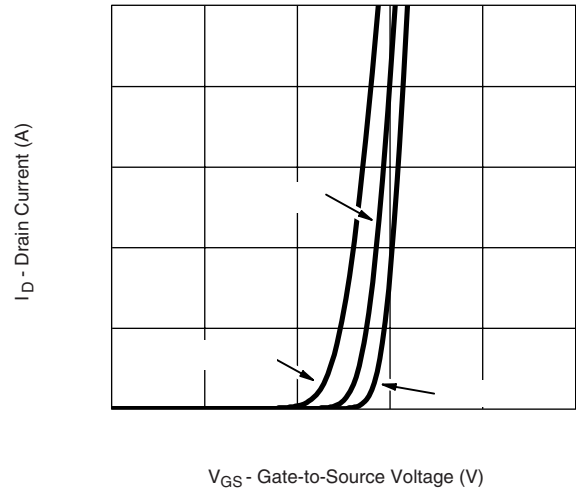
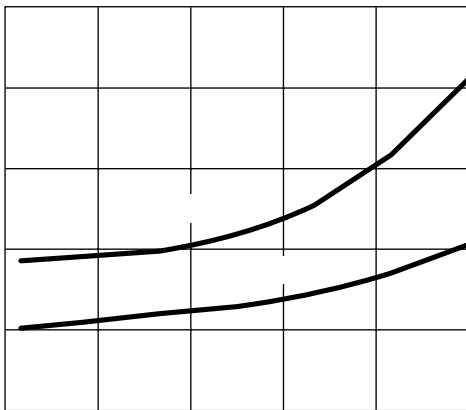
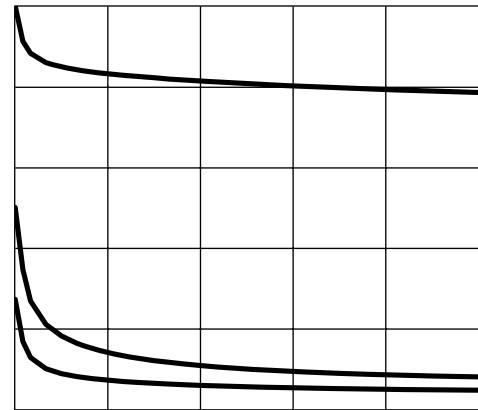
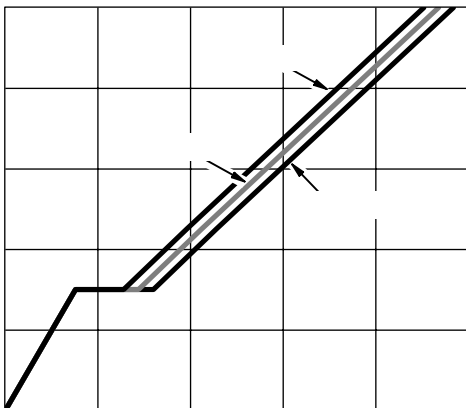
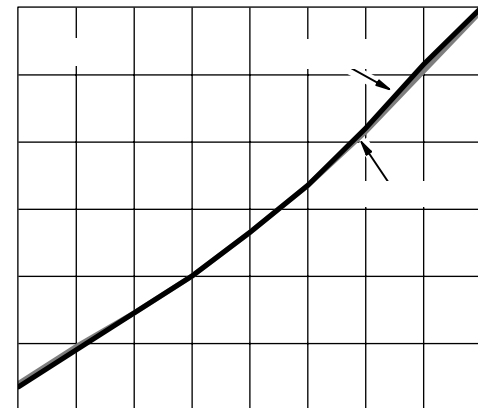
a. Guaranteed by design, not subject to production testing.

b. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

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.

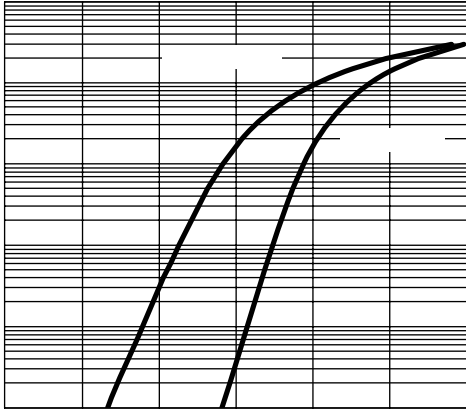
SUD50NP04-77P

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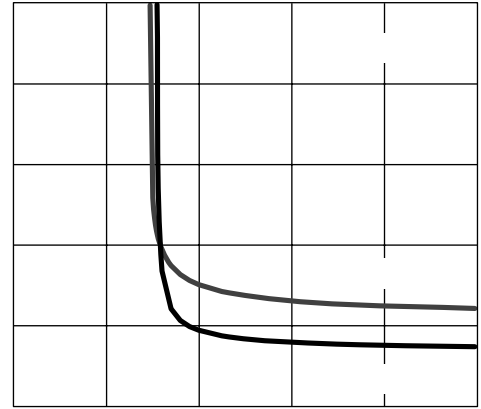
**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Output Characteristics****Transfer Characteristics****On-Resistance vs. Drain Current****Capacitance****Gate Charge****On-Resistance vs. Junction Temperature**



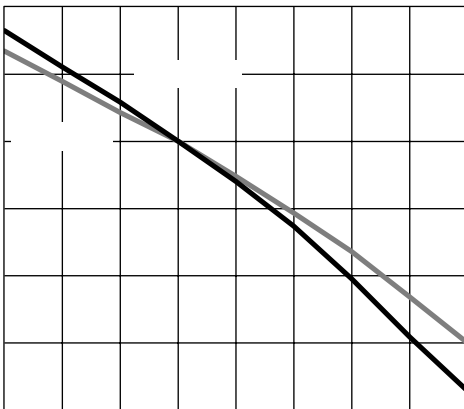
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



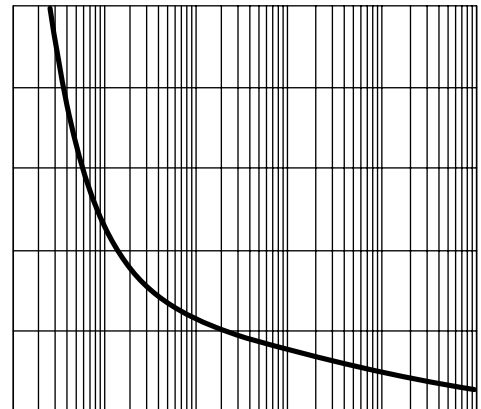
Source-Drain Diode Forward Voltage



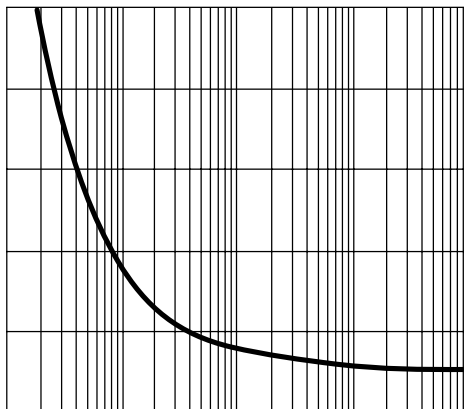
On-Resistance vs. Gate-to-Source Voltage



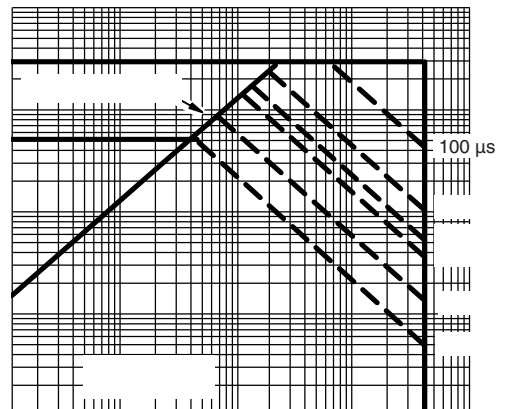
Threshold Voltage



Single Pulse Power, Junction-to-Ambient



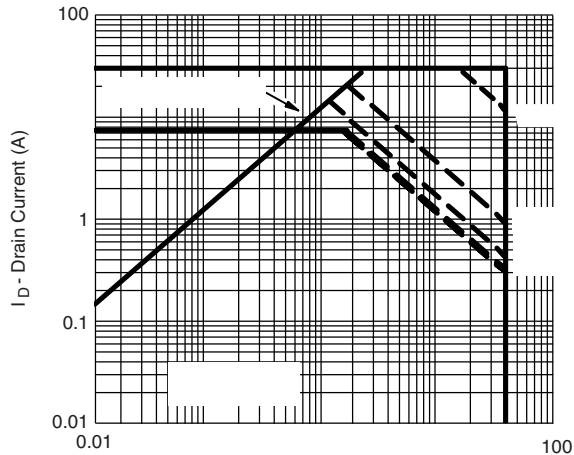
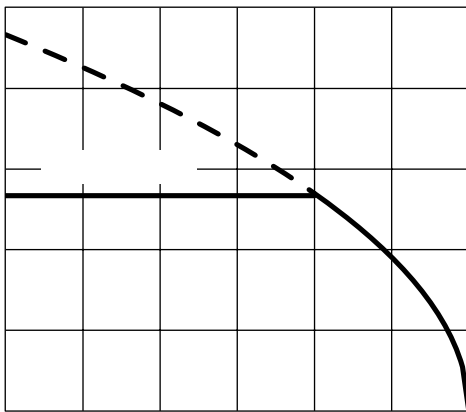
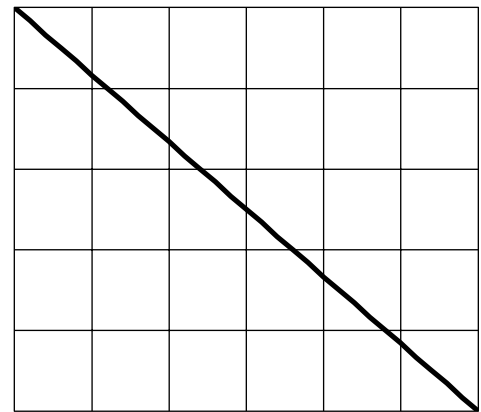
Single Pulse Power, Junction-to-Case



Safe Operating Area, Junction-to-Ambient

SUD50NP04-77P

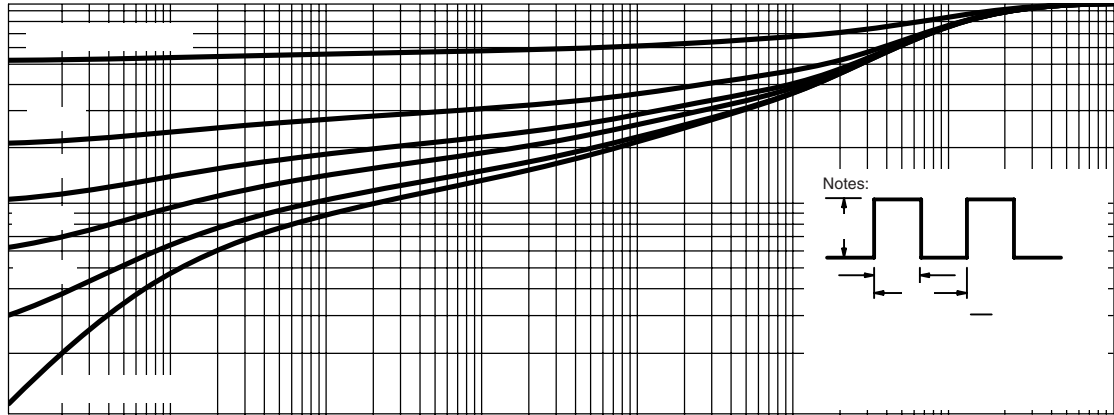
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**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted V_{DS} - Drain-to-Source Voltage (V)* V_{GS} > minimum V_{GS} at which $r_{DS(on)}$ is specified**Safe Operating Area, Junction-to-Case****Current Derating**, Junction-to-Ambient****Current Derating**, Junction-to-Case****Power Derating, Junction-to-Ambient****Power Derating, Junction-to-Case**

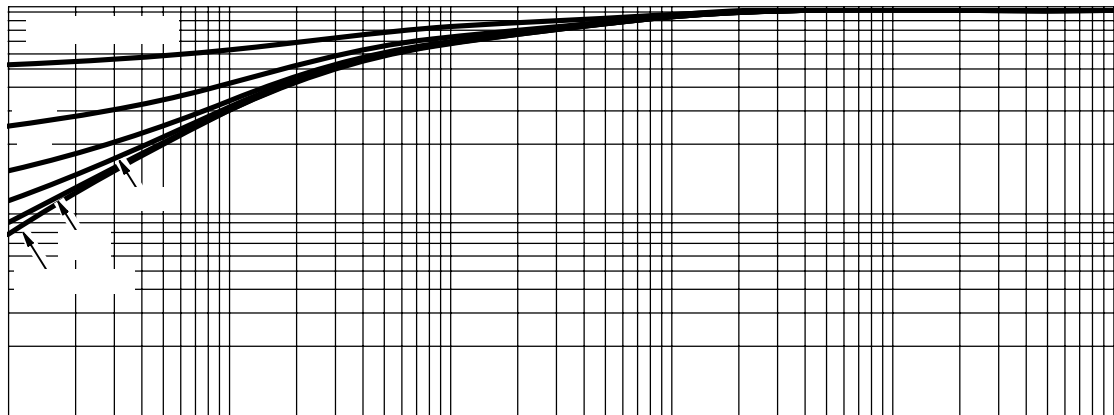
** The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



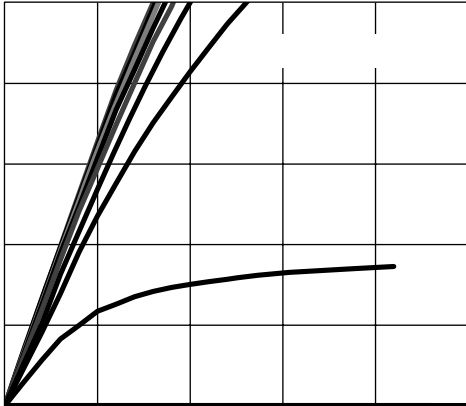
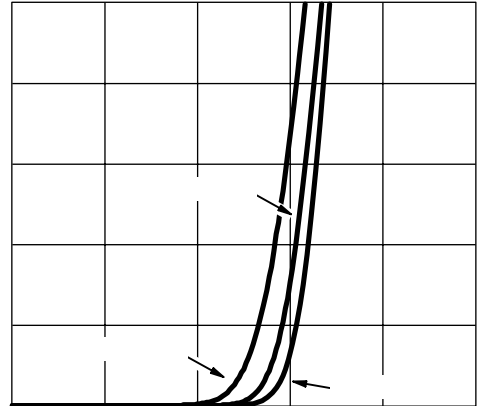
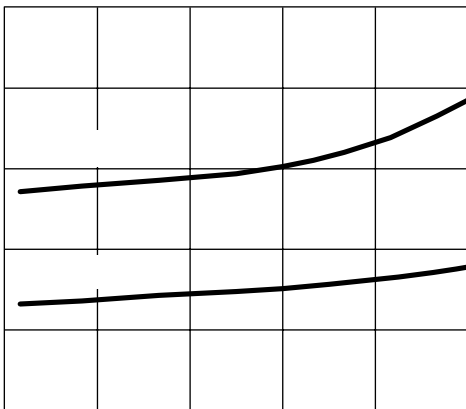
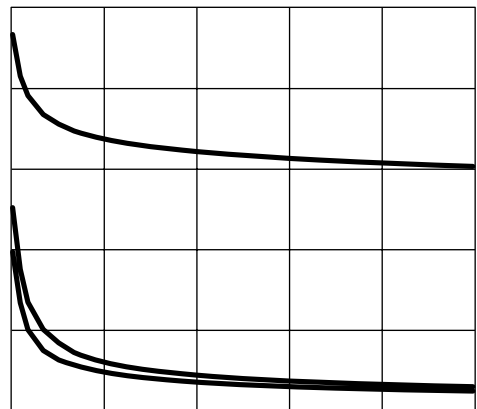
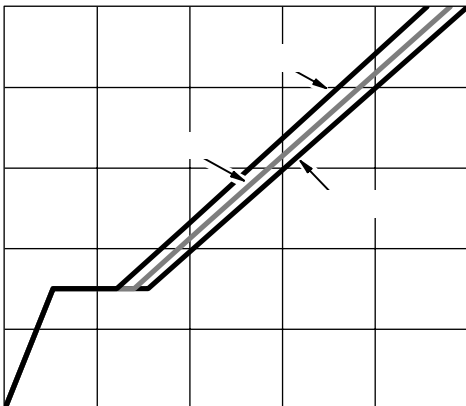
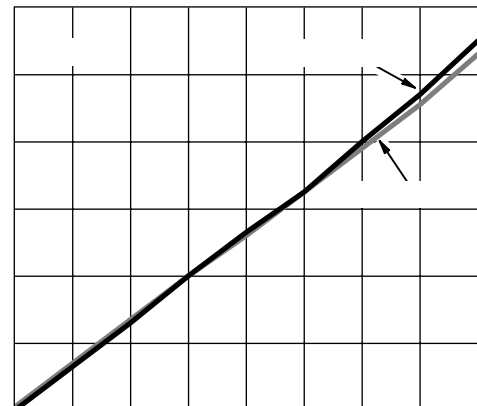
Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

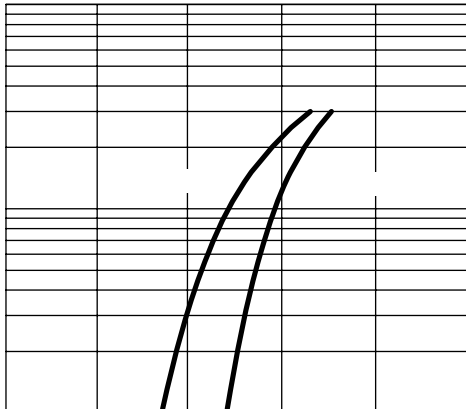
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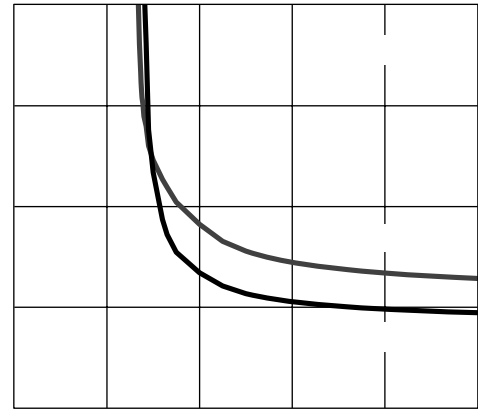
**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Output Characteristics** I_D - Drain Current (A) V_{GS} - Gate-to-Source Voltage (V)**Transfer Characteristics****On-Resistance vs. Drain Current****Capacitance****Gate Charge****On-Resistance vs. Junction Temperature**



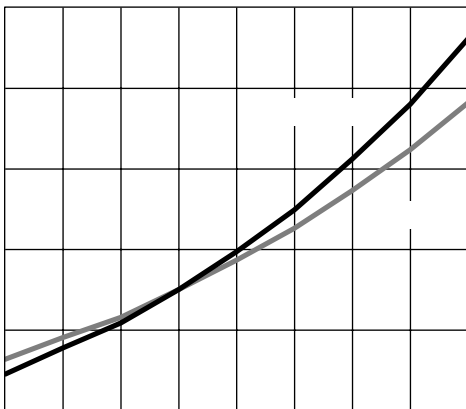
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



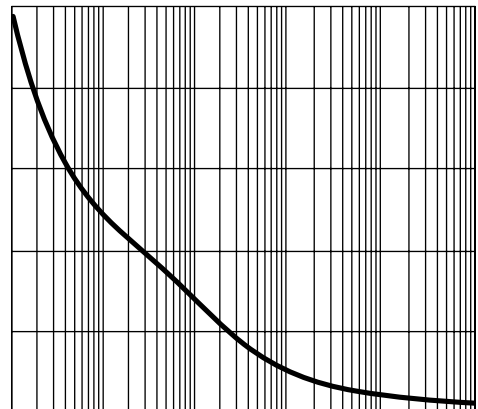
Source-Drain Diode Forward Voltage



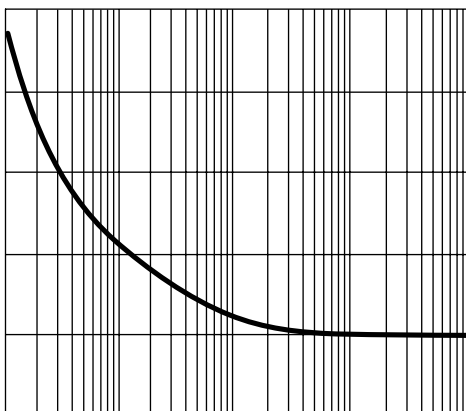
On-Resistance vs. Gate-to-Source Voltage



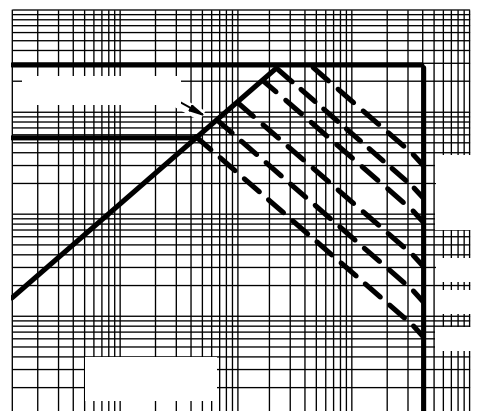
Threshold Voltage



Single Pulse Power, Junction-to-Ambient



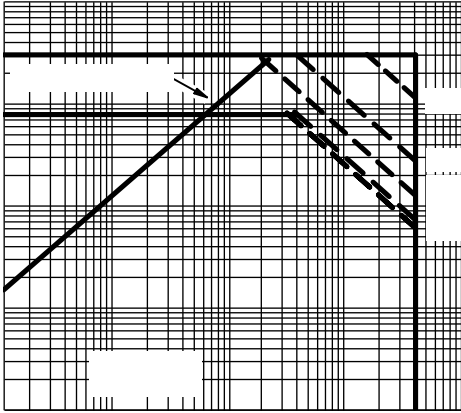
Single Pulse Power, Junction-to-Case



Safe Operating Area, Junction-to-Ambient

SUD50NP04-77P

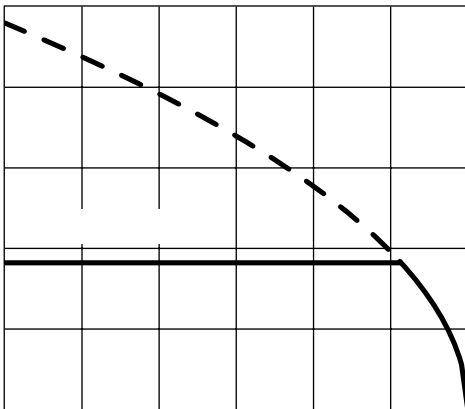
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**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

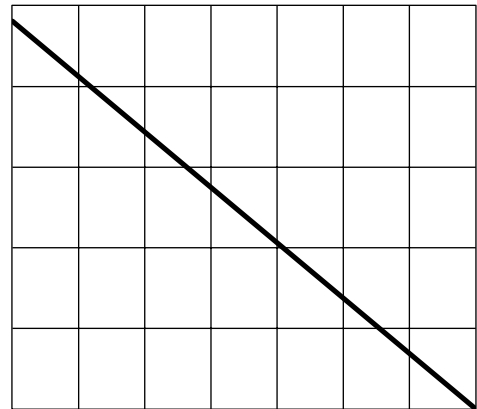
Safe Operating Area, Junction-to-Case



Current Derating**, Junction-to-Ambient



Current Derating**, Junction-to-Case



Power Derating, Junction-to-Ambient

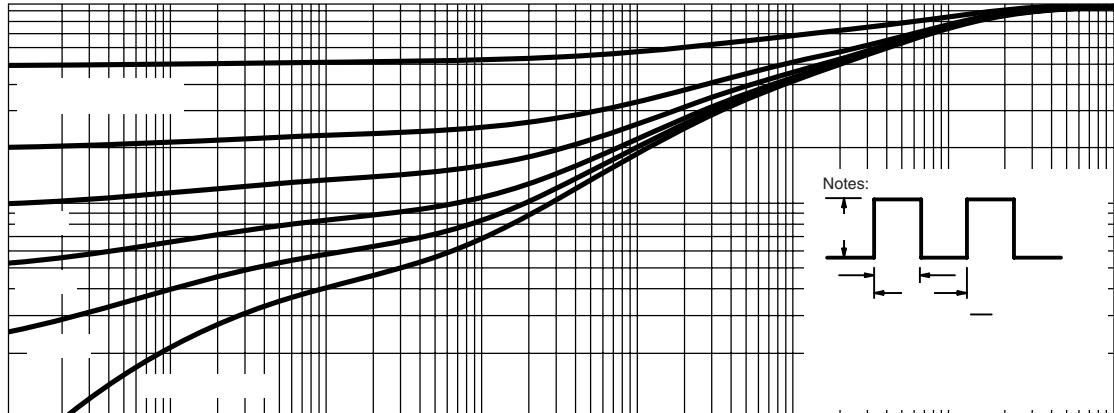


Power Derating, Junction-to-Case

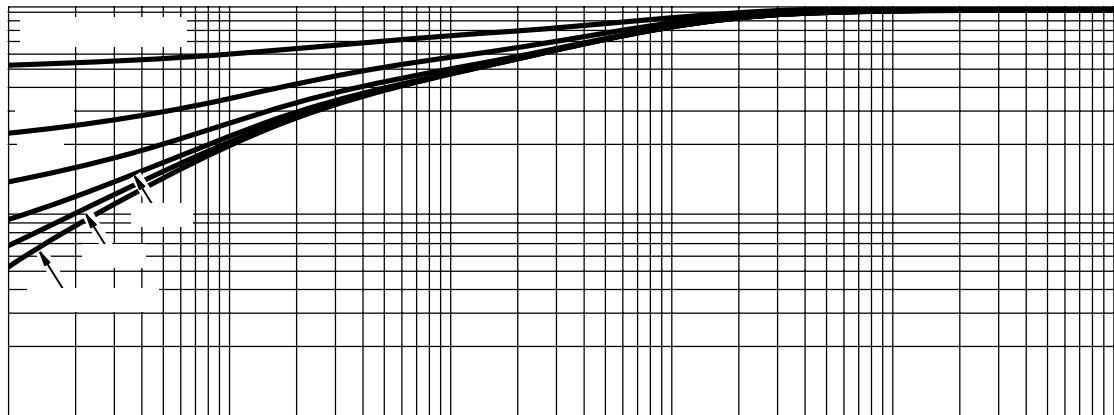
** The power dissipation P_D is based on $T_{J(max)} = 150\text{ }^{\circ}\text{C}$, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

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