

N- and P-Channel 60-V (D-S) MOSFET

PRODUCT SUMMARY				
	V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^a	Q_g (Typ.)
N-Channel	60	0.028 at $V_{GS} = 10$ V	5.3	6 nC
		0.032 at $V_{GS} = 4.5$ V	4.7	
P-Channel	- 60	0.060 at $V_{GS} = - 10$ V	- 4.9	8 nC
		0.070 at $V_{GS} = - 4.5$ V	- 4.5	

FEATURES

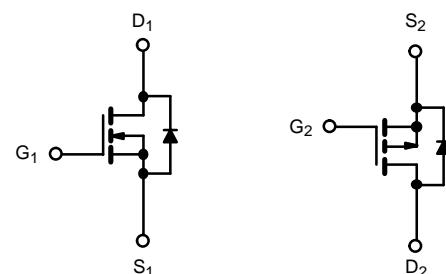
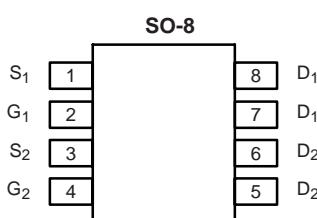
- DT-Trench Power MOSFET
- 100 % R_g and UIS Tested



RoHS
COMPLIANT

APPLICATIONS

- CCFL Inverter



N-Channel MOSFET

P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted				
Parameter	Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage	V_{DS}	60	- 60	V
Gate-Source Voltage	V_{GS}	± 20		
Continuous Drain Current ($T_J = 150$ °C)	$I_C = 25$ °C	5.3	- 4.9	
	$T_C = 70$ °C	4.3	- 4.2	
	$T_A = 25$ °C	4.3 ^{b, c}	- 4.0 ^{b, c}	
	$T_A = 70$ °C	3.4 ^{b, c}	- 3.4 ^{b, c}	
Pulsed Drain Current (10 μ s Pulse Width)	I_{DM}	20	- 25	A
Source Drain Current Diode Current	$I_S = 25$ °C	2.6	- 2.8	
	$T_A = 25$ °C	1.7 ^{b, c}	- 1.7 ^{b, c}	
Pulsed Source-Drain Current	I_{SM}	20	- 25	
Single Pulse Avalanche Current	I_{AS}	11	15	
Single Pulse Avalanche Energy	E_{AS}	6.1	11	mJ
Maximum Power Dissipation	$T_C = 25$ °C	3.1	3.4	
	$T_C = 70$ °C	2	2.2	
	$T_A = 25$ °C	2 ^{b, c}	2 ^{b, c}	
	$T_A = 70$ °C	1.3 ^{b, c}	1.3 ^{b, c}	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to 150		°C

THERMAL RESISTANCE RATINGS				
Parameter	Symbol	N-Channel		Unit
		Typ.	Max.	
Maximum Junction-to-Ambient ^{b, d}	R_{thJA}	55	62.5	
Maximum Junction-to-Foot (Drain)	Steady State	R_{thJF}	33	40
			30	37

Notes:

a. Based on $T_C = 25$ °C.

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

c. $t = 10$ s.

d. Maximum under Steady State conditions is 110 °C/W for N-Channel and P-Channel.

SPECIFICATIONS $T_J = 25^\circ\text{C}$, unless otherwise noted

Parameter	Symbol	Test Conditions	Min.	Typ. ^a	Max.	Unit	
Static							
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	N-Ch	60		V	
		$V_{GS} = 0 \text{ V}, I_D = -250 \mu\text{A}$	P-Ch	- 60			
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250 \mu\text{A}$	N-Ch	55		mV	
		$I_D = -250 \mu\text{A}$	P-Ch	- 50			
$V_{GS(\text{th})}$ Temperature Coefficient	$\Delta V_{GS(\text{th})}/T_J$	$I_D = 250 \mu\text{A}$	N-Ch	- 6		mV	
		$I_D = -250 \mu\text{A}$	P-Ch	4			
Gate Threshold Voltage	$V_{GS(\text{th})}$	$V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$	N-Ch	1	3	V	
		$V_{DS} = V_{GS}, I_D = -250 \mu\text{A}$	P-Ch	- 1	- 3		
Gate-Body Leakage	I_{GSS}	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$	N-Ch		100	nA	
			P-Ch		- 100		
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 60 \text{ V}, V_{GS} = 0 \text{ V}$	N-Ch		1	μA	
		$V_{DS} = -60 \text{ V}, V_{GS} = 0 \text{ V}$	P-Ch		- 1		
		$V_{DS} = 60 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 55^\circ\text{C}$	N-Ch		10		
		$V_{DS} = -60 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 55^\circ\text{C}$	P-Ch		- 10		
On-State Drain Current ^b	$I_{D(\text{on})}$	$V_{DS} \geq 5 \text{ V}, V_{GS} = 10 \text{ V}$	N-Ch	20		A	
		$V_{DS} \leq -5 \text{ V}, V_{GS} = -10 \text{ V}$	P-Ch	- 25			
Drain-Source On-State Resistance ^b	$R_{DS(\text{on})}$	$V_{GS} = 10 \text{ V}, I_D = 4.3 \text{ A}$	N-Ch		0.028	Ω	
		$V_{GS} = -10 \text{ V}, I_D = -3.1 \text{ A}$	P-Ch		0.060		
		$V_{GS} = 4.5 \text{ V}, I_D = 3.9 \text{ A}$	N-Ch		0.032		
		$V_{GS} = -4.5 \text{ V}, I_D = -0.2 \text{ A}$	P-Ch		0.070		
Forward Transconductance ^b	g_{fs}	$V_{DS} = 15 \text{ V}, I_D = 4.3 \text{ A}$	N-Ch		15	S	
		$V_{DS} = -15 \text{ V}, I_D = -3.1 \text{ A}$	P-Ch		8.5		
Dynamic^a							
Input Capacitance	C_{iss}	N-Channel $V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$ P-Channel $V_{DS} = -15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	N-Ch	665		pF	
			P-Ch	650			
Output Capacitance	C_{oss}		N-Ch	75			
			P-Ch	95			
Reverse Transfer Capacitance	C_{rss}		N-Ch	40			
			P-Ch	60			
Total Gate Charge	Q_g	$V_{DS} = 30 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 4.3 \text{ A}$	N-Ch	13	20	nC	
		$V_{DS} = -30 \text{ V}, V_{GS} = -10 \text{ V}, I_D = -3.1 \text{ A}$	P-Ch	14.5	22		
Gate-Source Charge	Q_{gs}	N-Channel $V_{DS} = 30 \text{ V}, V_{GS} = 4.5 \text{ V}, I_D = 4.3 \text{ A}$ P-Channel $V_{DS} = -30 \text{ V}, V_{GS} = -4.5 \text{ V}, I_D = -3.1 \text{ A}$	N-Ch	6	9	nC	
			P-Ch	8	12		
Gate-Drain Charge	Q_{gd}		N-Ch	2.3			
			P-Ch	2.2			
Gate Resistance	R_g	$f = 1 \text{ MHz}$	N-Ch	2.6		Ω	
			P-Ch	3.7			

SPECIFICATIONS $T_J = 25^\circ\text{C}$, unless otherwise noted								
Parameter	Symbol	Test Conditions			Min.	Typ. ^a	Max.	Unit
Dynamic^a								
Turn-On Delay Time	$t_{d(on)}$	N-Channel $V_{DD} = 30 \text{ V}$, $R_L = 8.8 \Omega$ $I_D \geq 3.4 \text{ A}$, $V_{GEN} = 4.5 \text{ V}$, $R_g = 1 \Omega$ P-Channel $V_{DD} = -30 \text{ V}$, $R_L = 12.5 \Omega$ $I_D \geq -2.4 \text{ A}$, $V_{GEN} = -4.5 \text{ V}$, $R_g = 1 \Omega$	N-Ch		15	25	ns	
Rise Time	t_r		P-Ch		30	45		
Turn-Off Delay Time	$t_{d(off)}$		N-Ch		65	100		
Fall Time	t_f		P-Ch		70	105		
Turn-On Delay Time	$t_{d(on)}$		N-Ch		15	25		
Rise Time	t_r		P-Ch		40	60		
Turn-Off Delay Time	$t_{d(off)}$		N-Ch		10	15		
Fall Time	t_f		P-Ch		30	45		
Drain-Source Body Diode Characteristics								
Continuous Source-Drain Diode Current	I_S	$T_C = 25^\circ\text{C}$	N-Ch			2.6	A	
Pulse Diode Forward Current ^a	I_{SM}		P-Ch			-2.8		
Body Diode Voltage	V_{SD}	$I_S = 1.7 \text{ A}$	N-Ch			20	V	
Body Diode Reverse Recovery Time	t_{rr}	$I_S = -2 \text{ A}$	P-Ch			-25		
Body Diode Reverse Recovery Charge	Q_{rr}	N-Channel $I_F = 1.7 \text{ A}$, $dI/dt = 100 \text{ A}/\mu\text{s}$, $T_J = 25^\circ\text{C}$ P-Channel $I_F = -2 \text{ A}$, $dI/dt = -100 \text{ A}/\mu\text{s}$, $T_J = 25^\circ\text{C}$	N-Ch		0.8	1.2	ns	
Reverse Recovery Fall Time	t_a		P-Ch		-0.8	-1.2		
Reverse Recovery Rise Time	t_b		N-Ch		30	60		
			P-Ch		30	50		
			N-Ch		32	50	nC	
			P-Ch		35	60		
			N-Ch		25		ns	
			P-Ch		16			
			N-Ch		5			
			P-Ch		14			

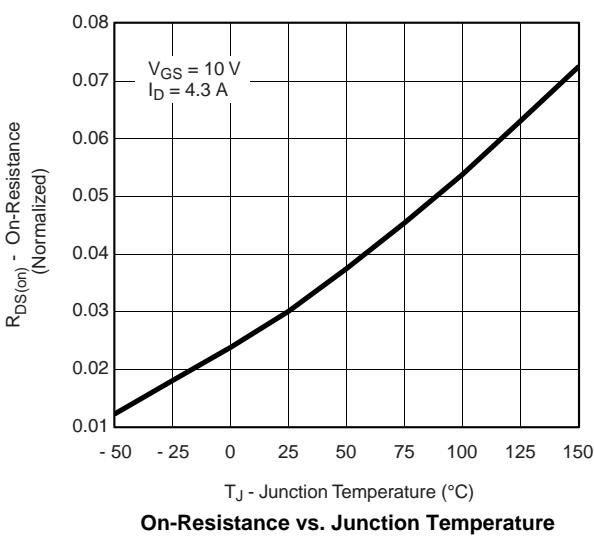
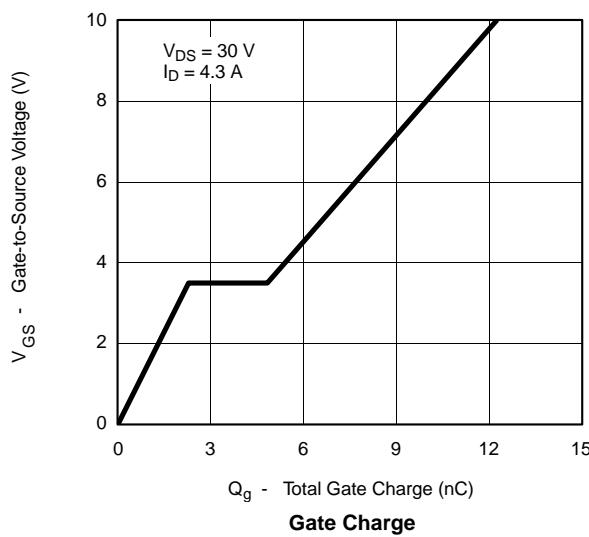
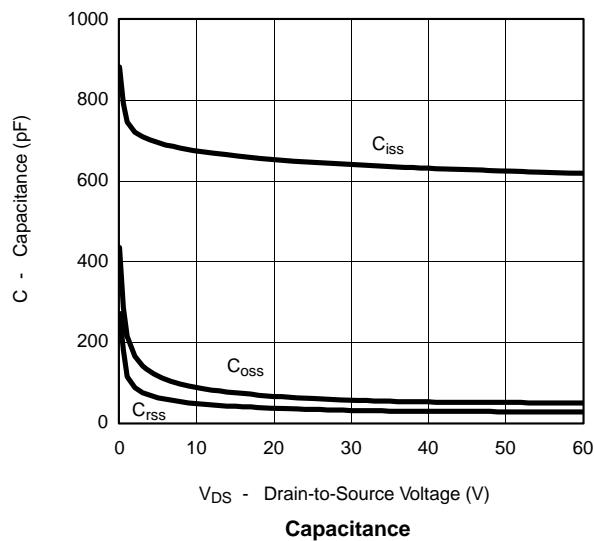
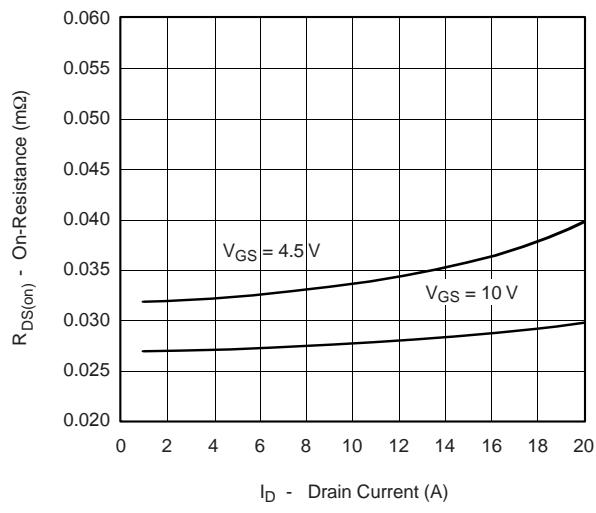
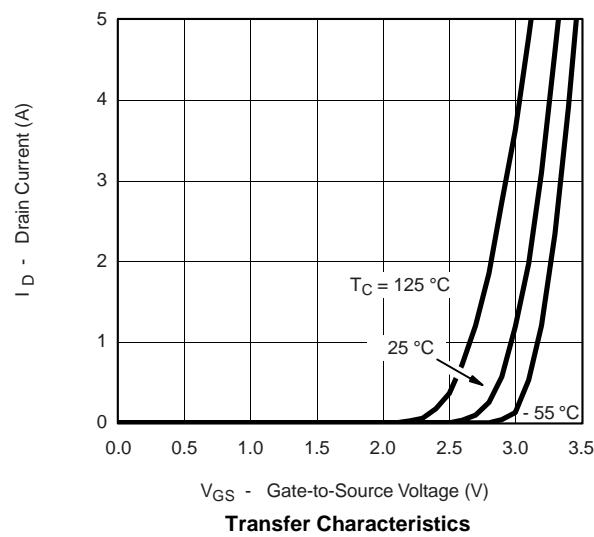
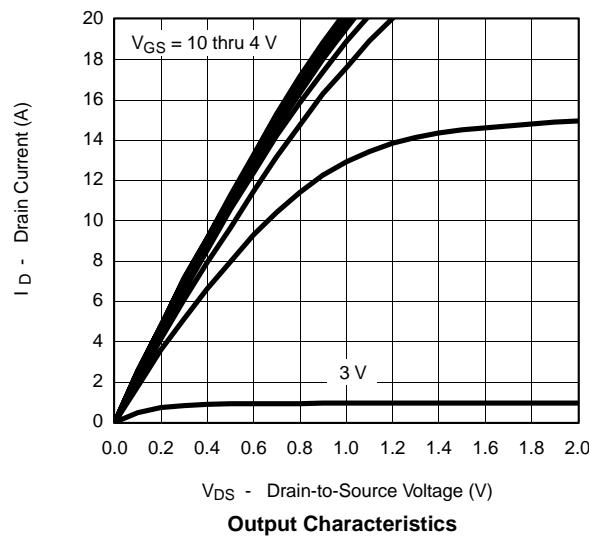
Notes:

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

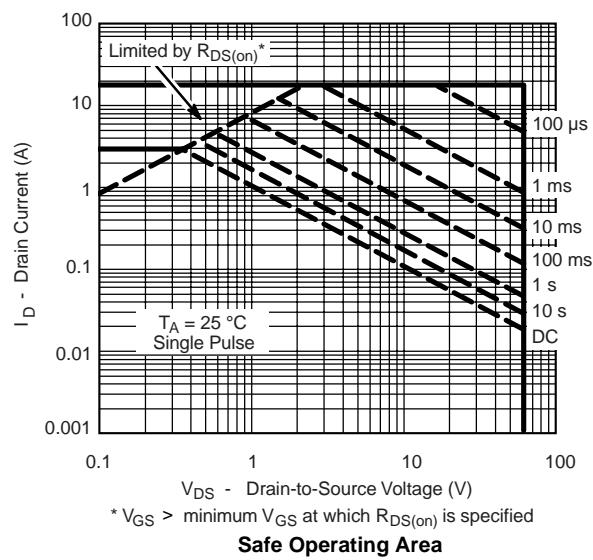
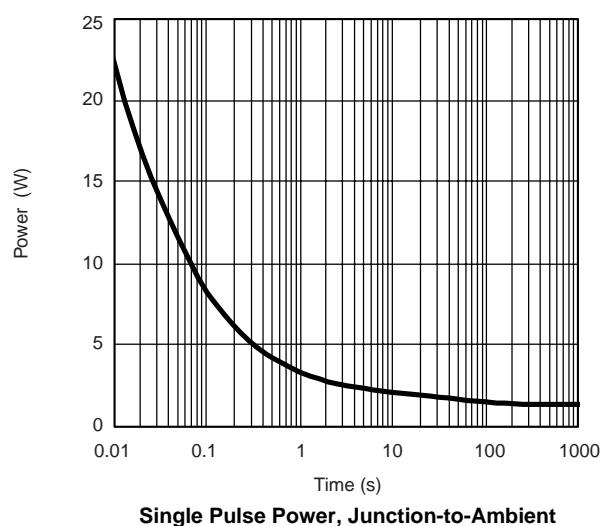
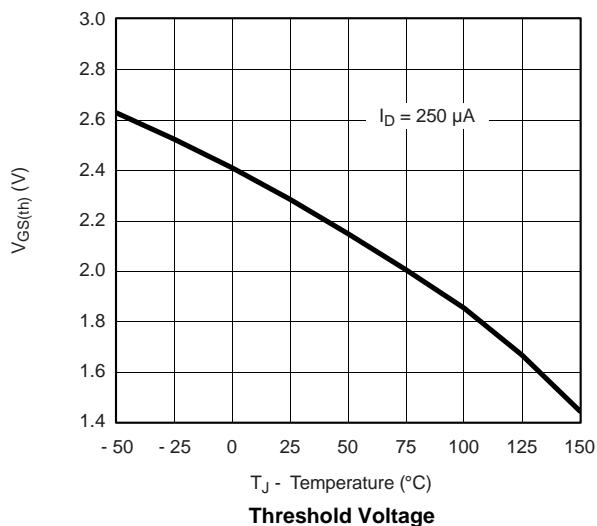
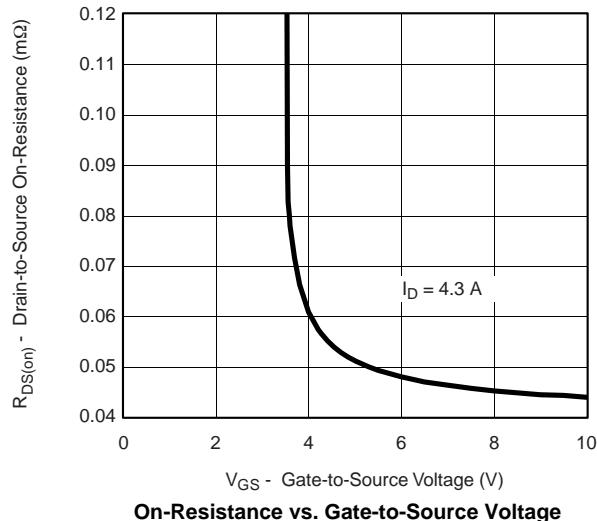
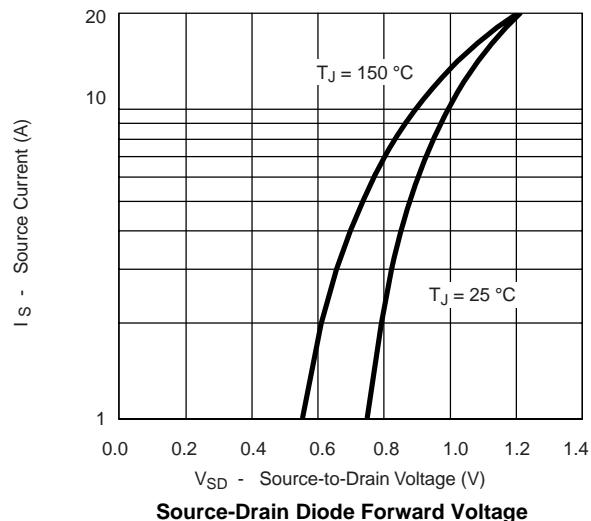
b. Pulse test; pulse width $\leq 300 \mu\text{s}$, duty cycle $\leq 2\%$.

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.

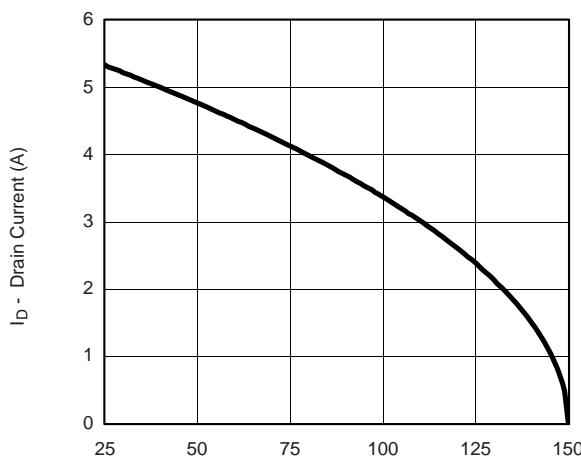
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



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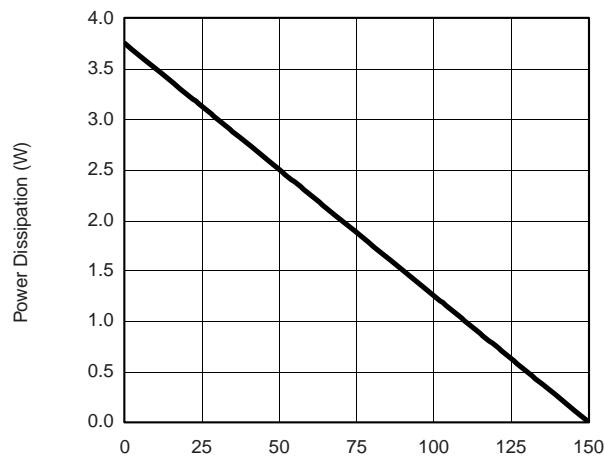


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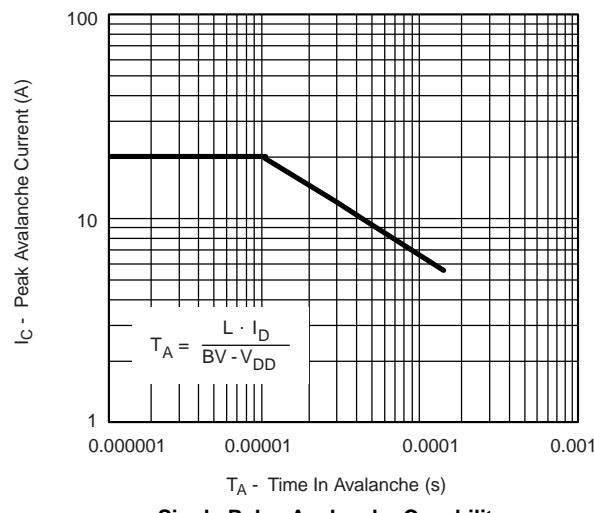
T_C - Case Temperature (°C)

Current Derating*



T_C - Case Temperature (°C)

Power Derating

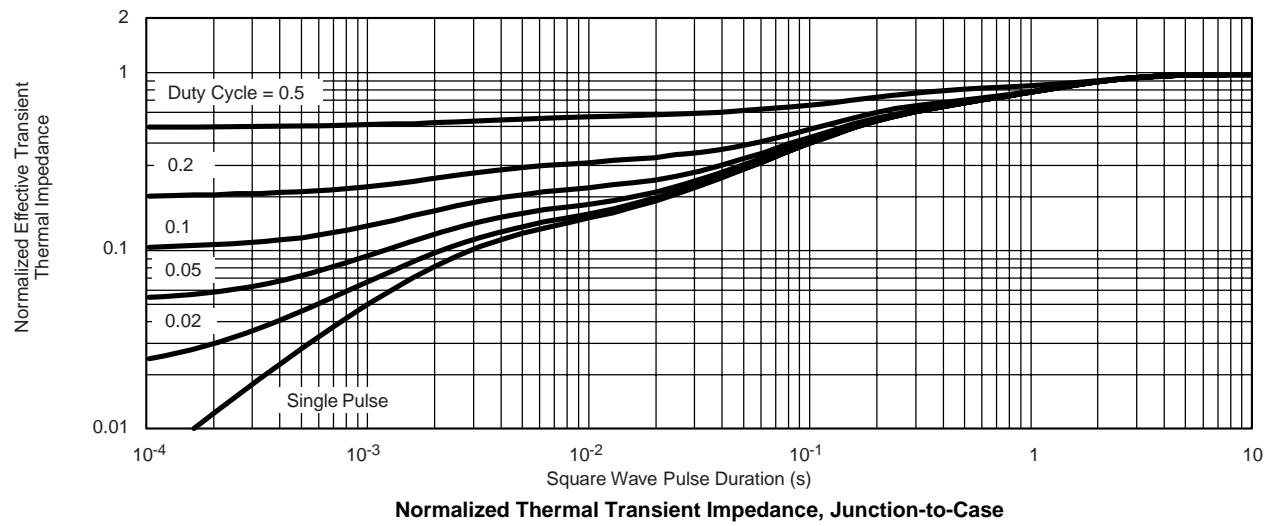
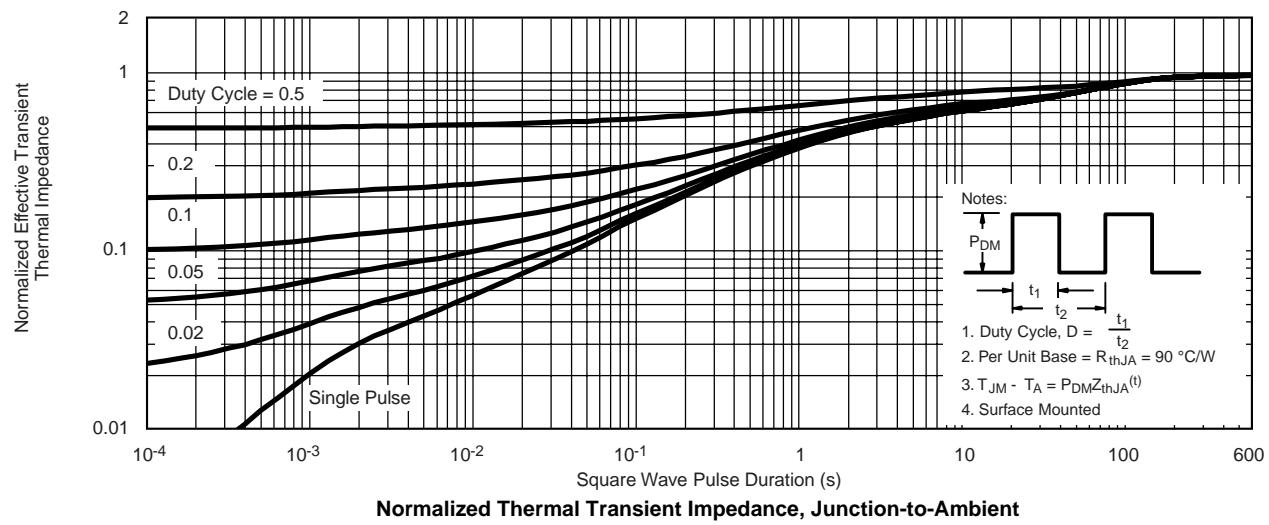


T_A - Time In Avalanche (s)

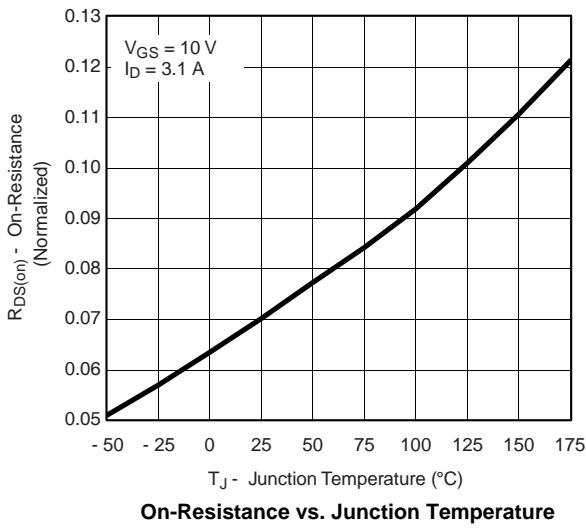
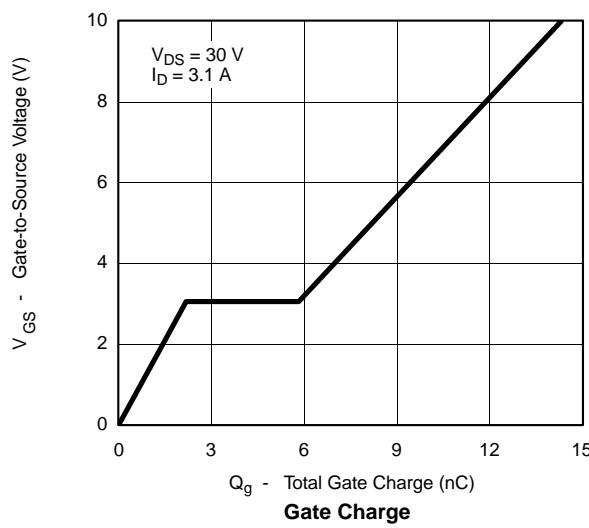
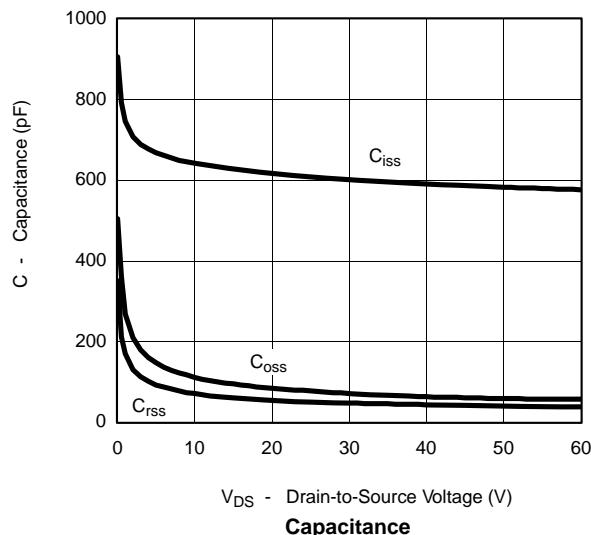
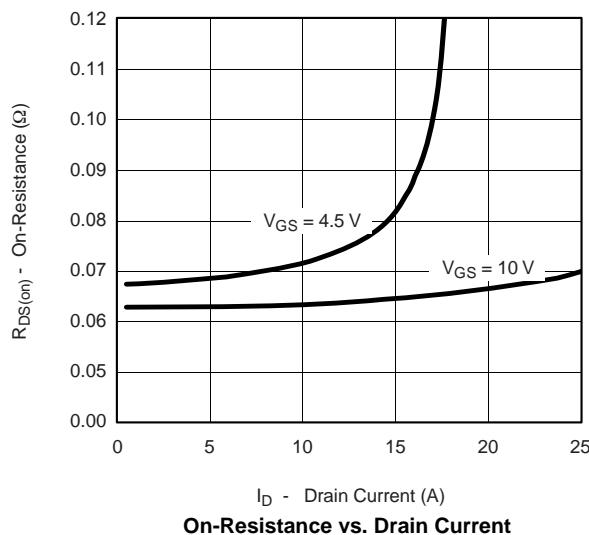
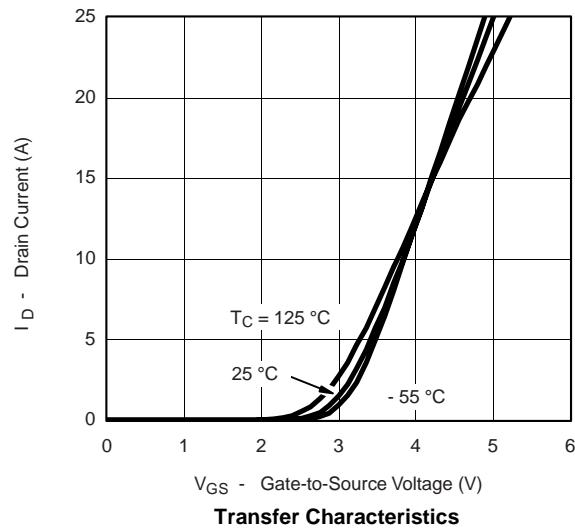
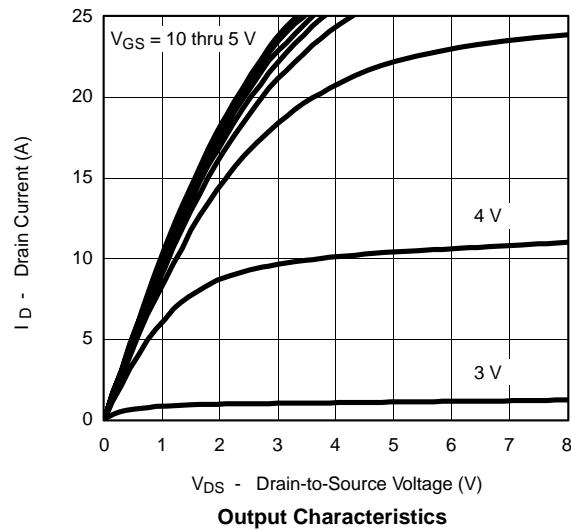
Single Pulse Avalanche Capability

* 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.

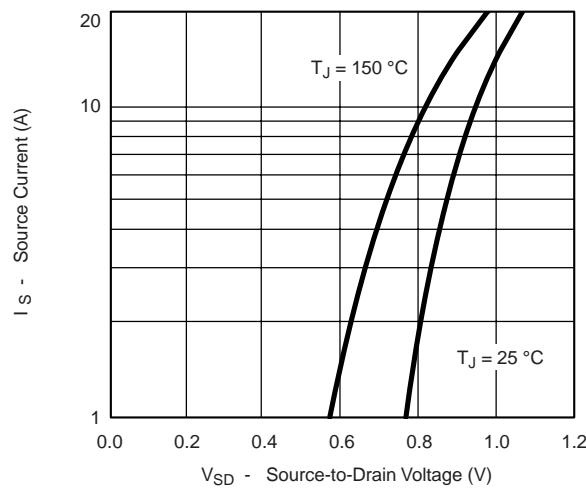
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



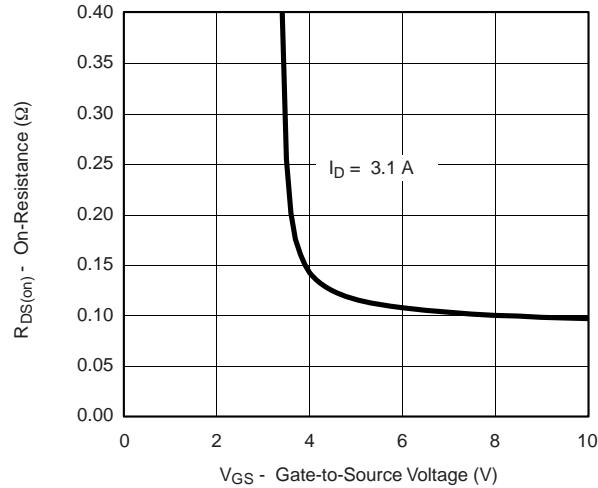
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



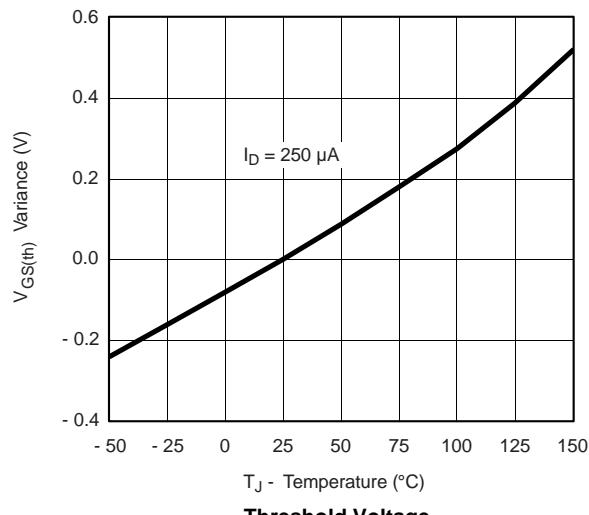
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



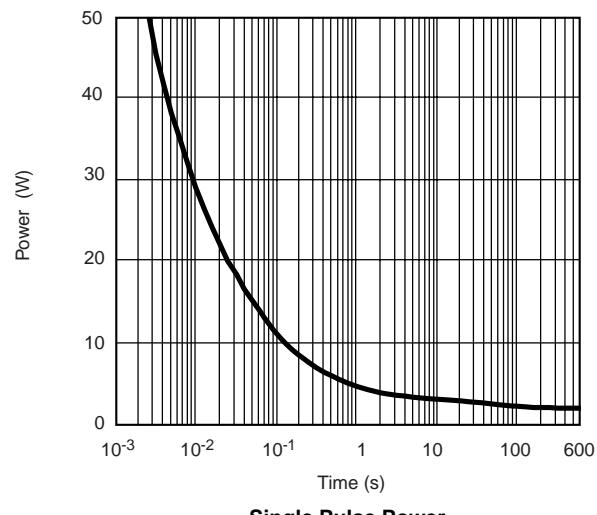
Source-Drain Diode Forward Voltage



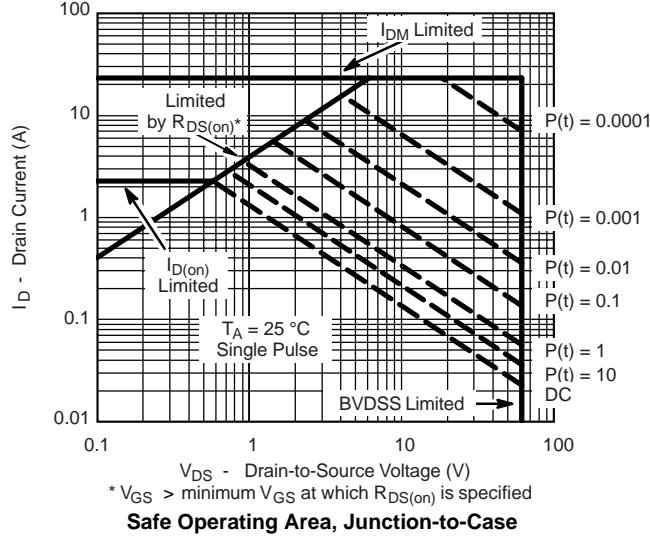
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

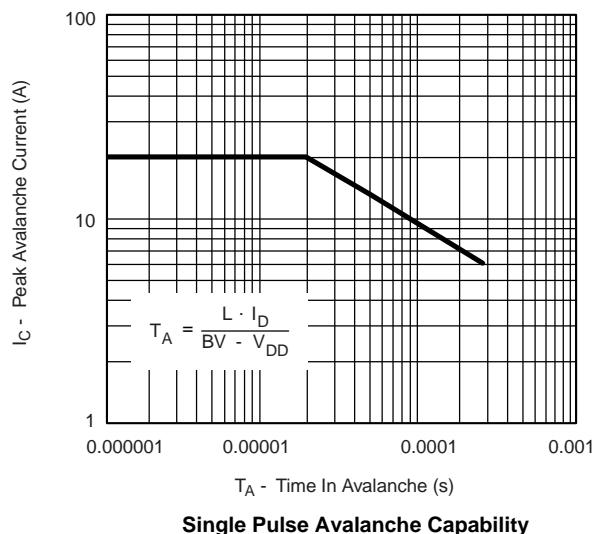
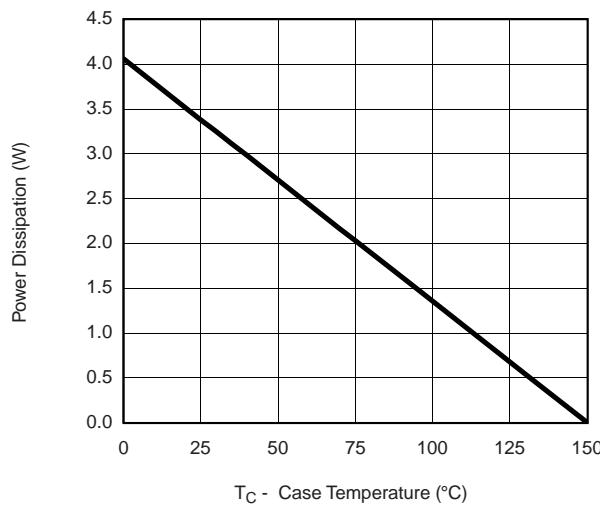
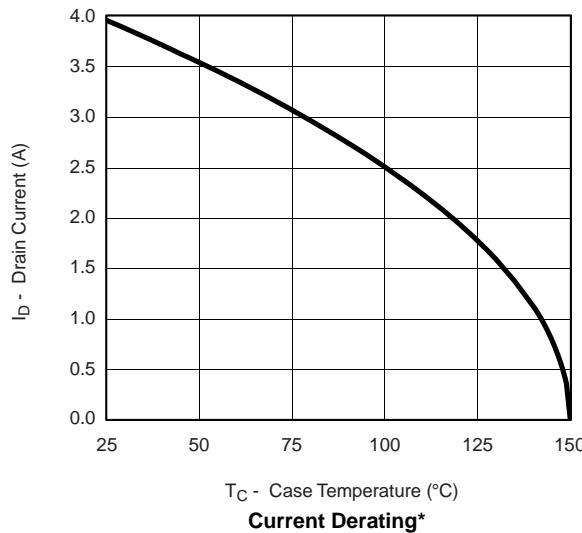


Single Pulse Power



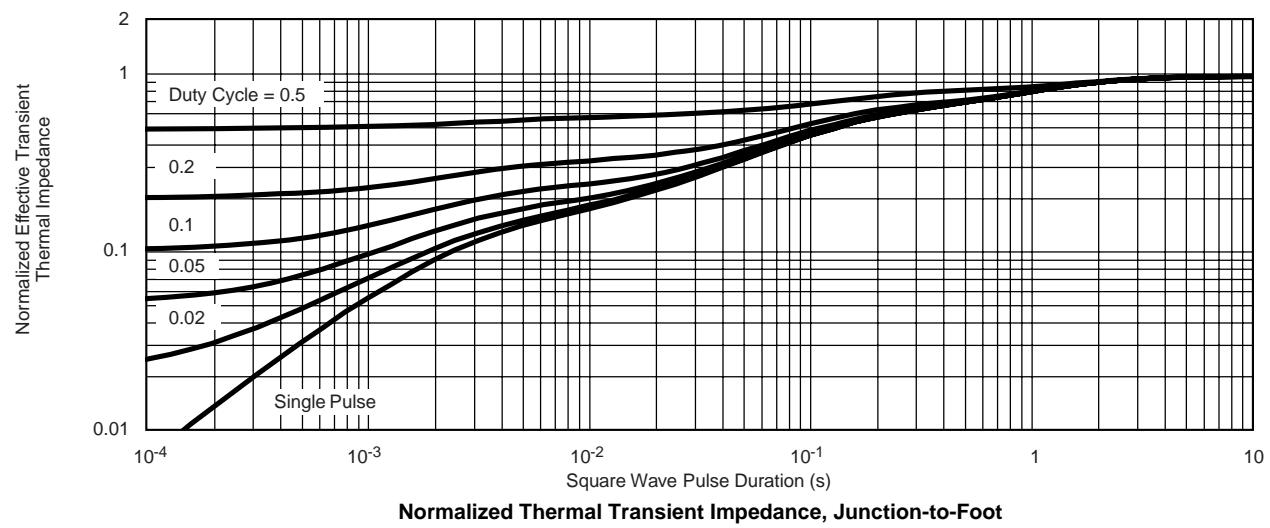
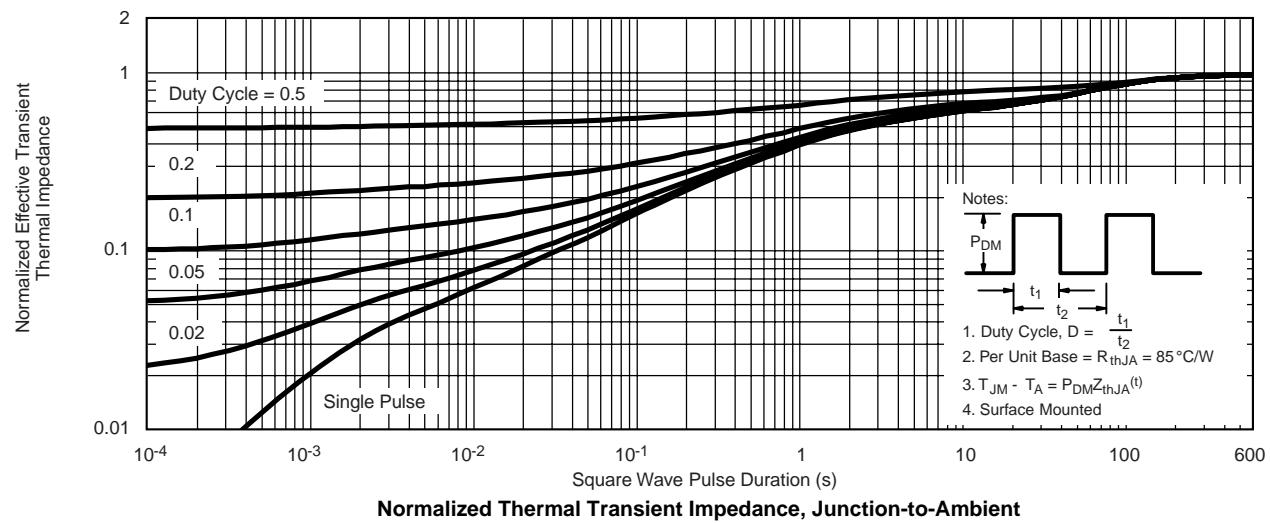
Safe Operating Area, Junction-to-Case

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



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



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