



## Dual N- and P-Channel $\pm 20$ -V Low-Threshold MOSFET

PRODUCT SUMMARY			
Channel	$V_{DS}$ (V)	$r_{DS(on)}$ ( $\Omega$ )	$I_D$ (mA)
N-Channel	20	2.0 @ $V_{GS} = 4.5$ V	250
		2.5 @ $V_{GS} = 2.5$ V	150
P-Channel	-20	3.8 @ $V_{GS} = -4.5$ V	-180
		5.0 @ $V_{GS} = -2.5$ V	-100

### FEATURES

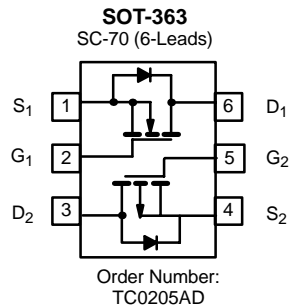
- Very Small Outline (SC-70, 6-Leads)
- Low On-Resistance: 2.0  $\Omega$  (N-Ch)
- Low Threshold: 0.9 V (typ)
- Fast Switching Speed: 35 ns
- 2.5-V or Lower Operation

### BENEFITS

- Ease in Driving Switches
- Low Offset (Error) Voltage
- Low-Voltage Operation
- High-Speed Circuits
- Low Battery Voltage Operation

### APPLICATIONS

- Replace Digital Transistors, Level-Shifter
- Battery Operated Systems
- Power Supply Converter Circuits
- Load/Power Switching-Cell Phones, PDA



Marking Code: Ew/

E = Part Number Code for TC0205AD

w = Week Code

/ = Lot Traceability

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED)				
Parameter	Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage	$V_{DS}$	20	-20	V
Gate-Source Voltage	$V_{GS}$	$\pm 8$	$\pm 8$	
Continuous Drain Current ( $T_J = 150^\circ\text{C}$ ) <sup>a</sup>	$T_A = 25^\circ\text{C}$	250	-180	mA
	$T_A = 70^\circ\text{C}$	200	-140	
Pulsed Drain Current	$I_{DM}$	500	-500	
Maximum Power Dissipation <sup>a</sup>	$T_A = 25^\circ\text{C}$	0.20 (Total)		W
	$T_A = 70^\circ\text{C}$	0.13 (Total)		
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to 150		$^\circ\text{C}$

THERMAL RESISTANCE RATINGS			
Parameter	Symbol	Limit	Unit
Maximum Junction-to-Ambient <sup>a</sup>	$R_{thJA}$	625 (Total)	$^\circ\text{C}/\text{W}$

Notes

a. Surface Mounted on FR4 Board,  $t \leq 10$  sec.

SPECIFICATIONS (T <sub>A</sub> = 25 °C UNLESS OTHERWISE NOTED)							
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit	
<b>Static</b>							
Drain-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 10 μA	N-Ch	20	24		V
		V <sub>GS</sub> = 0 V, I <sub>D</sub> = -10 μA	P-Ch	-20	-24		
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 50 μA	N-Ch	0.4	0.9	1.5	
		V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -50 μA	P-Ch	-0.4	-0.9	-1.5	
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±8 V	N-Ch		±2	±100	nA
			P-Ch		±2	±100	
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V	N-Ch		0.001	100	
		V <sub>DS</sub> = -20 V, V <sub>GS</sub> = 0 V	P-Ch		-0.001	-100	
		V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C	N-Ch			1	μA
		V <sub>DS</sub> = -20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C	P-Ch			-1	
On-State Drain Current <sup>b</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≥ 2.5 V, V <sub>GS</sub> = 5.0 V	N-Ch	120			mA
		V <sub>DS</sub> ≥ -2.5 V, V <sub>GS</sub> = -5.0 V	P-Ch	-120			
		V <sub>DS</sub> ≥ 4.5 V, V <sub>GS</sub> = 8.0 V	N-Ch	400			
		V <sub>DS</sub> ≥ -4.5 V, V <sub>GS</sub> = -8.0 V	P-Ch	-400			
Drain-Source On-State Resistance <sup>b</sup>	r <sub>DS(on)</sub>	V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 150 mA	N-Ch		1.6	2.5	Ω
		V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -75 mA	P-Ch		4	5	
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 250 mA	N-Ch		1.2	2.0	
		V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -180 mA	P-Ch		2.6	3.8	
Forward Transconductance <sup>b</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 2.5 V, I <sub>D</sub> = 50 mA	N-Ch		150		mS
		V <sub>DS</sub> = -2.5 V, I <sub>D</sub> = -50 mA	P-Ch		200		
Diode Forward Voltage <sup>b</sup>	V <sub>SD</sub>	I <sub>S</sub> = 50 mA, V <sub>GS</sub> = 0 V	N-Ch		0.7	1.2	V
		I <sub>S</sub> = -50 mA, V <sub>GS</sub> = 0 V	P-Ch		-0.7	-1.2	
<b>Dynamic<sup>a</sup></b>							
Total Gate Charge	Q <sub>g</sub>	<b>N-Channel</b> V <sub>DS</sub> = 5 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 100 mA  <b>P-Channel</b> V <sub>DS</sub> = -5 V, V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -100 mA	N-Ch		300	450	pC
Gate-Source Charge	Q <sub>gs</sub>		P-Ch		300	450	
			N-Ch		25		
Gate-Drain Charge	Q <sub>gd</sub>		P-Ch		25		
		N-Ch		100			
Input Capacitance	C <sub>iss</sub>	<b>N-Channel</b> V <sub>DS</sub> = 5 V, V <sub>GS</sub> = 0 V  <b>P-Channel</b> V <sub>DS</sub> = -5 V, V <sub>GS</sub> = 0 V	N-Ch		15		pF
			P-Ch		15		
Output Capacitance	C <sub>oss</sub>		N-Ch		11		
			P-Ch		11		
Reverse Transfer Capacitance	C <sub>rss</sub>		N-Ch		5		
			P-Ch		5		
<b>Switching</b>							
Turn-On Time	t <sub>d(on)</sub>	<b>N-Channel</b> V <sub>DD</sub> = 3 V, R <sub>L</sub> = 100 Ω I <sub>D</sub> = 0.25 A, V <sub>GEN</sub> = 4.5 V, R <sub>G</sub> = 10 Ω  <b>P-Channel</b> V <sub>DD</sub> = -3 V, R <sub>L</sub> = 100 Ω I <sub>D</sub> = -0.25 A, V <sub>GEN</sub> = -4.5 V, R <sub>G</sub> = 10 Ω	N-Ch		7	12	ns
			P-Ch		7	12	
Rise Time	t <sub>r</sub>		N-Ch		25	35	
			P-Ch		25	35	
Turn-Off Delay Time	t <sub>d(off)</sub>		N-Ch		19	30	
			P-Ch		19	30	
Fall Time	t <sub>f</sub>		N-Ch		9	15	
			P-Ch		9	15	

Notes

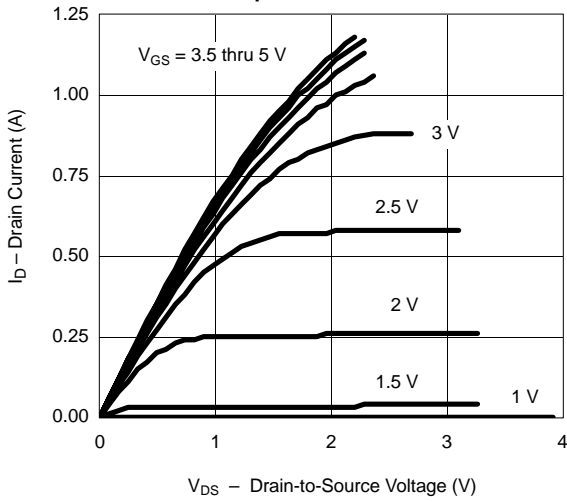
- a. Guaranteed by design, not subject to production testing.
- b. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2%.

VNOJ  
VPOJ

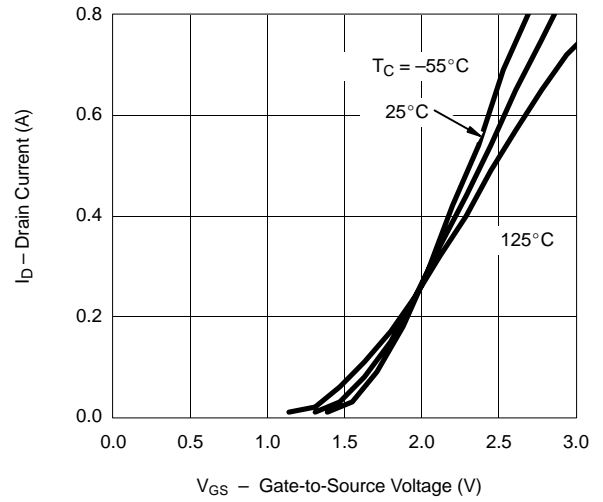


**TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED) N-CHANNEL**

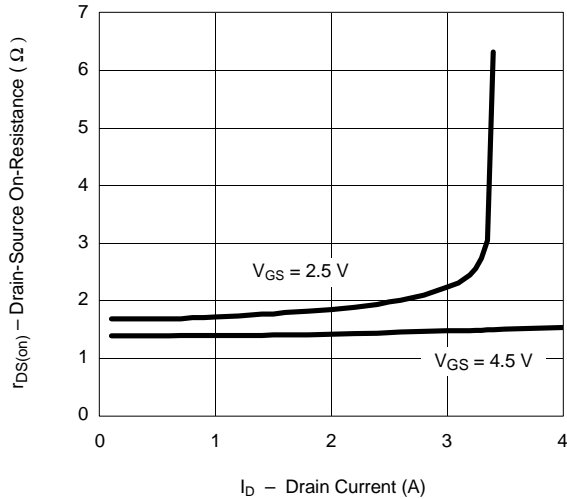
Output Characteristics



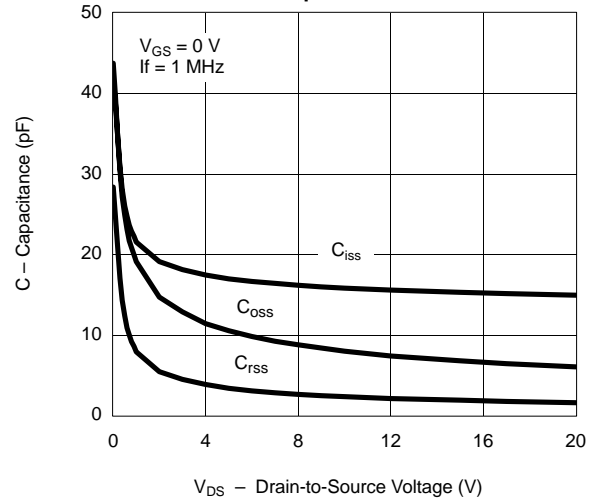
Transfer Characteristics



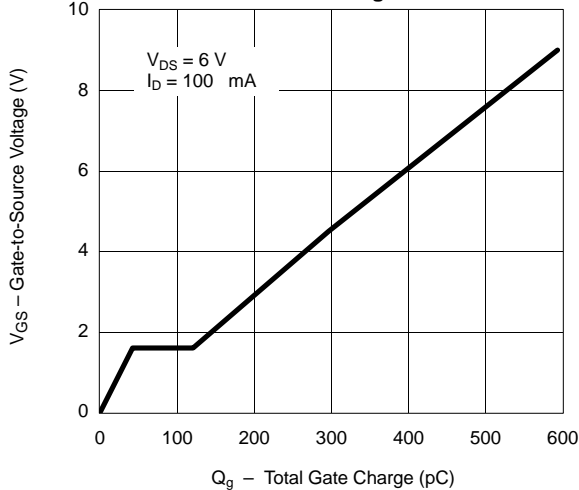
On-Resistance vs. Drain Current



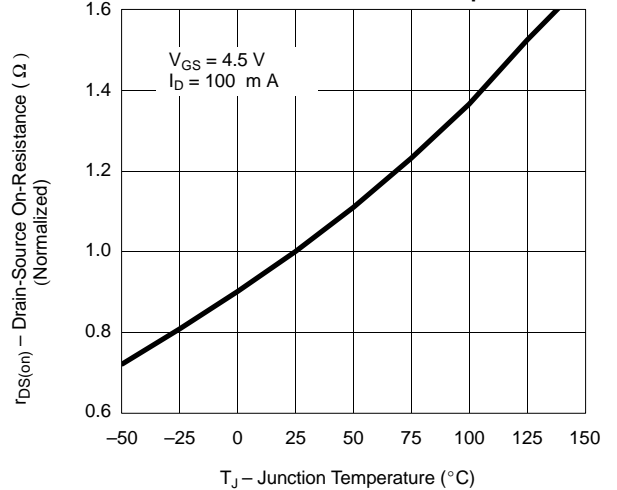
Capacitance



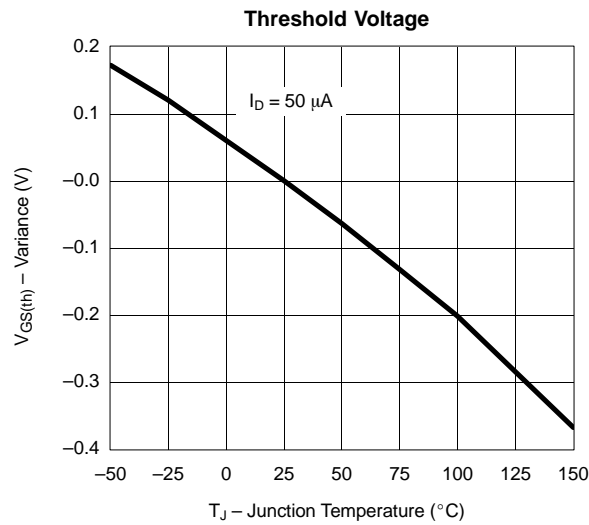
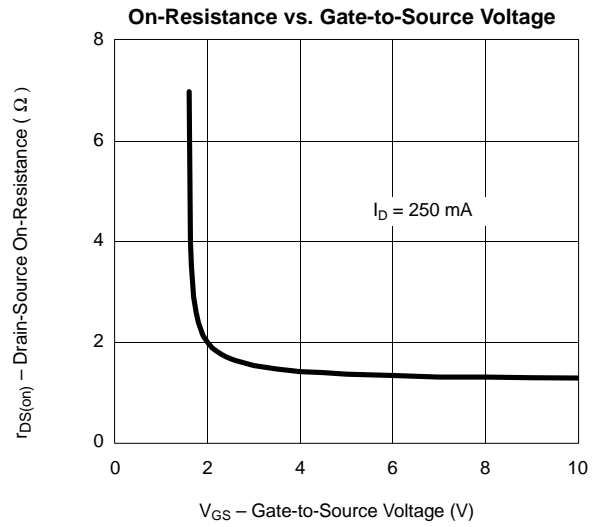
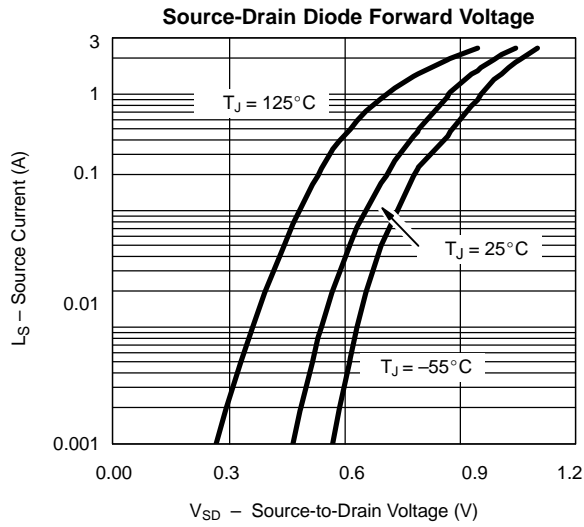
Gate Charge



On-Resistance vs. Junction Temperature



**TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED) N-CHANNEL**

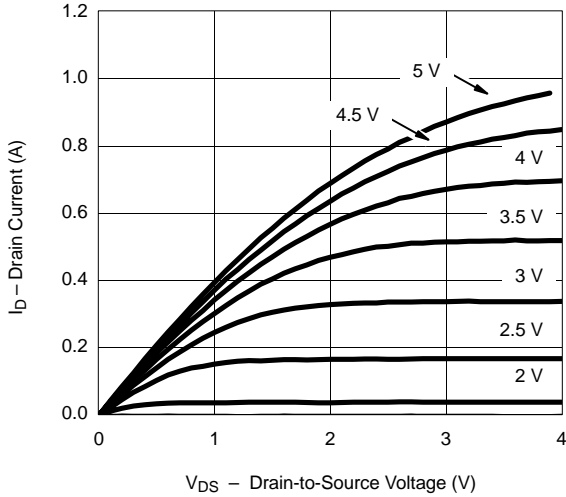




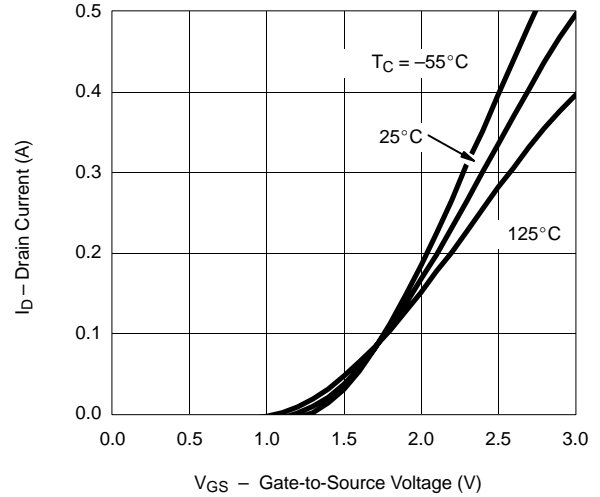
**TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED) P-CHANNEL**

For the following graphics p-channel negative polarities for all voltage and current values are represented as positive values.

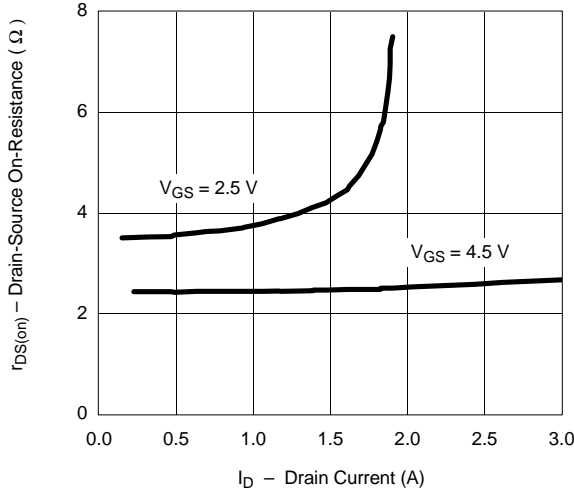
**Output Characteristics**



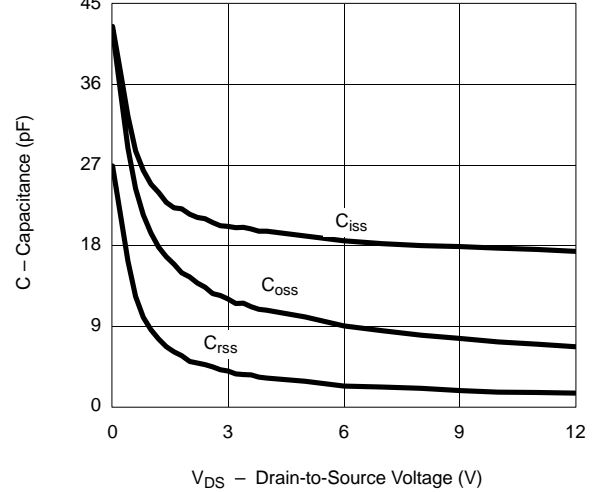
**Transfer Characteristics**



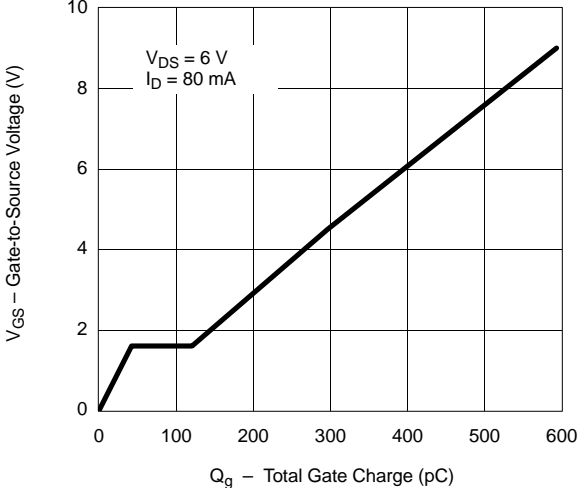
**On-Resistance vs. Drain Current**



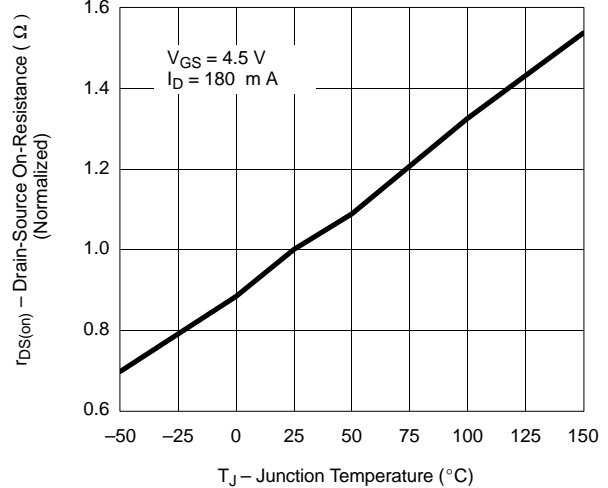
**Capacitance**



**Gate Charge**



**On-Resistance vs. Junction Temperature**



**TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED) P-CHANNEL**

For the following graphics p-channel negative polarities for all voltage and current values are represented as positive values.

