

**N- and P-Channel, 20V, Small signal MOSFET**

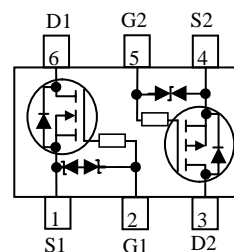
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)
N-Channel 20	0.230@ V <sub>GS</sub> =4.5V
	0.275@ V <sub>GS</sub> =2.5V
	0.330@ V <sub>GS</sub> =1.8V
P-Channel -20	0.520@ V <sub>GS</sub> = - 4.5V
	0.685@ V <sub>GS</sub> = -2.5V
	0.890@ V <sub>GS</sub> = -1.8V



**SOT-363**

**Descriptions**

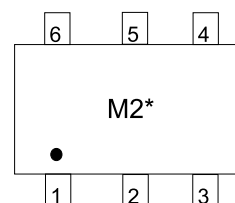
The WCM2002 is the N- and P-Channel enhancement MOS Field Effect Transistor as a single package for DC-DC converter or level shift applications, uses advanced trench technology and design to provide excellent R<sub>DS(ON)</sub> with low gate charge. Standard Product WCM2002 is Pb-free.



**Pin configuration (Top View)**

**Features**

- Trench Technology
- Supper high density cell design
- Excellent ON resistance
- Extremely Low Threshold Voltage
- Small package SOT-363



M2 = Device Code

\* = Date Code

**Marking**

**Applications**

- Driver: Relays, Solenoids, Lamps, Hammers
- Power supply converters circuit
- Load/Power Switching for potable device

**Order Information**

Device	Package	Shipping
WCM2002-6/TR	SOT-363	3000/Tape&Reel

**Absolute Maximum Ratings**

( $T_A=25^{\circ}\text{C}$  unless otherwise noted)

Parameter	Symbol	N-Channel		P-Channel		Unit	
		10 S	Steady State	10 S	Steady State		
Drain-Source Voltage	$V_{DS}$	+20		-20		V	
Gate-Source Voltage	$V_{GS}$	±6				V	
Continuous Drain Current <sup>a</sup>	$T_A=25^{\circ}\text{C}$	$I_D$	0.88	0.80	-0.66	-0.59	A
	$T_A=70^{\circ}\text{C}$		0.7	0.64	-0.53	-0.47	
Maximum Power Dissipation <sup>a</sup>	$T_A=25^{\circ}\text{C}$	$P_D$	0.38	0.31	0.37	0.29	W
	$T_A=70^{\circ}\text{C}$		0.24	0.2	0.24	0.19	
Continuous Drain Current <sup>b</sup>	$T_A=25^{\circ}\text{C}$	$I_D$	0.75	0.69	-0.56	-0.51	A
	$T_A=70^{\circ}\text{C}$		0.6	0.55	-0.45	-0.41	
Maximum Power Dissipation <sup>b</sup>	$T_A=25^{\circ}\text{C}$	$P_D$	0.28	0.23	0.27	0.22	W
	$T_A=70^{\circ}\text{C}$		0.17	0.15	0.17	0.14	
Pulsed Drain Current <sup>c</sup>	$I_{DM}$	1.4		-1.0		A	
Operating Junction Temperature	$T_J$	150				$^{\circ}\text{C}$	
Lead Temperature	$T_L$	260				$^{\circ}\text{C}$	
Storage Temperature Range	$T_{stg}$	-55 to 150				$^{\circ}\text{C}$	

**Thermal resistance ratings**

Parameter	Symbol	N-Channel		P-Channel		Unit	
		Typical	Maximum	Typical	Maximum		
Junction-to-Ambient Thermal Resistance <sup>a</sup>	$t \leq 10\text{ s}$	$R_{\theta JA}$	276	325	280	330	$^{\circ}\text{C/W}$
	Steady State		328	395	340	420	
Junction-to-Ambient Thermal Resistance <sup>b</sup>	$t \leq 10\text{ s}$	$R_{\theta JA}$	375	445	380	455	
	Steady State		446	532	460	545	
Junction-to-Case Thermal Resistance	Steady State	$R_{\theta JC}$	260	300	280	320	

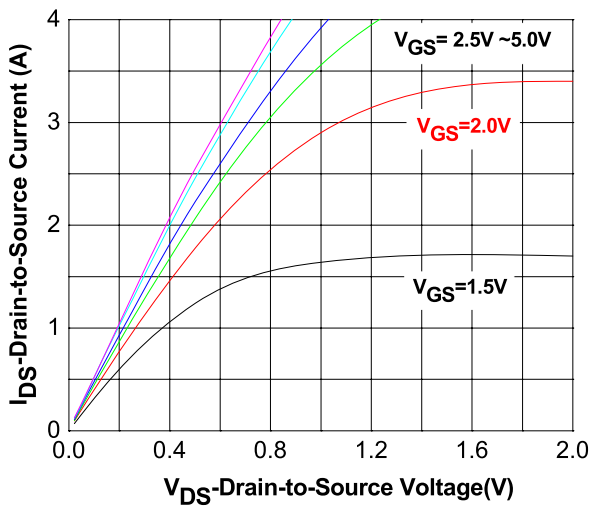
- a Surface mounted on FR4 Board using 1 square inch pad size, 1oz copper
- b Surface mounted on FR4 board using minimum pad size, 1oz copper
- c Repetitive rating, pulse width limited by junction temperature,  $t_p=10\mu\text{s}$ , Duty Cycle=1%
- d Repetitive rating, pulse width limited by junction temperature  $T_J=150^{\circ}\text{C}$ .

**Electronics Characteristics (T<sub>A</sub>=25°C unless otherwise noted)**

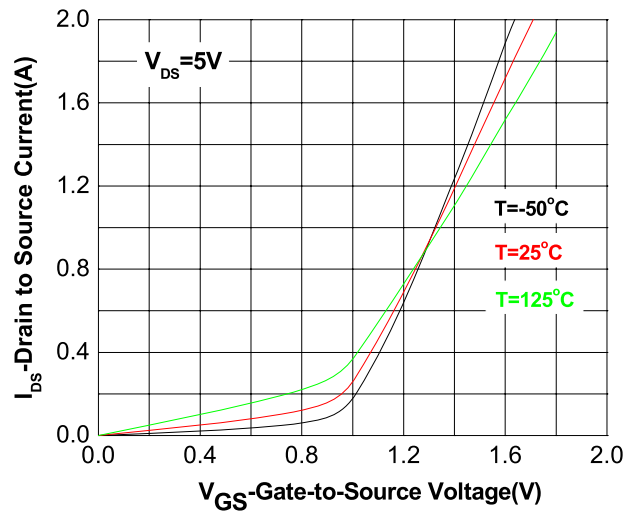
Symbol	Parameter	Test Condition	Min	Typ.	Max	Unit	
<b>Off Characteristics</b>							
V <sub>(BR)DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250uA	N-Ch	20		V	
		V <sub>GS</sub> =0V, I <sub>D</sub> =-250uA	P-Ch	-20			
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =16 V, V <sub>GS</sub> =0V	N-Ch		1	uA	
		V <sub>DS</sub> =-16 V, V <sub>GS</sub> =0V	P-Ch		-1		
I <sub>GSS</sub>	Gate –Source leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±5V	N-Ch		±5	uA	
			P-Ch		±5		
<b>ON Characteristics</b>							
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> =250uA	N-Ch	0.4	0.55	0.9	V
		V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> =-250uA	P-Ch	-0.4	0.62	-0.9	
R <sub>DS(on)</sub>	Drain-Source On-Resistance	V <sub>GS</sub> =4.5V, I <sub>D</sub> =0.55A	N-Ch		230	310	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-0.45A	P-Ch		520	810	
		V <sub>GS</sub> =2.5V, I <sub>D</sub> =0.45A	N-Ch		275	360	
		V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-0.35A	P-Ch		685	1050	
		V <sub>GS</sub> =1.8V, I <sub>D</sub> =0.35A	N-Ch		330	460	
		V <sub>GS</sub> =-1.8V, I <sub>D</sub> =-0.25A	P-Ch		890	1300	
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 5 V, I <sub>D</sub> = 0.55A	N-Ch		2.0	S	
		V <sub>DS</sub> = -5 V, I <sub>D</sub> = -0.45A	P-Ch		1.25		
<b>Dynamic Characteristics</b>							
C <sub>iss</sub>	Input Capacitance	NMOS: V <sub>DS</sub> =10V, V <sub>GS</sub> =0V, F=100KHz PMOS:V <sub>DS</sub> =-10V, V <sub>GS</sub> =0V, F=100KHz	N-Ch		50	pF	
			P-Ch		74.5		
C <sub>oss</sub>	Output Capacitance		N-Ch		13		
			P-Ch		10.8		
C <sub>rss</sub>	Reverse Transfer Capacitance		N-Ch		8		
			P-Ch		10.2		
Q <sub>G(TOT)</sub>	Total Gate Charge	NMOS: V <sub>DS</sub> =10V, V <sub>GS</sub> =4.5V, I <sub>D</sub> = 0.55A PMOS: V <sub>DS</sub> =-10V, V <sub>GS</sub> =-4.5V, I <sub>D</sub> = -0.45A	N-Ch		1.15	nC	
Q <sub>G(TH)</sub>	Threshold gate charge		P-Ch		1.8		
			N-Ch		0.06		
Q <sub>GS</sub>	Gate-Source Charge		P-Ch		0.12		
			N-Ch		0.15		
Q <sub>GD</sub>	Gate-Drain Charge		P-Ch		0.18		
		N-Ch		0.23			
			P-Ch		0.74		

Symbol	Parameter	Test Condition	Min	Typ.	Max	Unit	
<b>Switching Characteristics</b>							
td(on)	Turn-On Delay Time	NMOS:V <sub>DD</sub> =10V, V <sub>GEN</sub> =4.5V, R <sub>G</sub> =6Ω I <sub>D</sub> =0.55A	N-Ch	22		ns	
			P-Ch	45			
tr	Turn-On Rise Time	PMOS:V <sub>DD</sub> =-10V, V <sub>GEN</sub> =-4.5V, R <sub>G</sub> =6Ω I <sub>D</sub> =-0.45A	N-Ch	80			
			P-Ch	140			
td(off)	Turn-Off Delay Time		N-Ch	700			
			P-Ch	1500			
tf	Turn-Off Fall Time		N-Ch	380			
			P-Ch	2100			
<b>Drain-to-Source Diode Characteristics</b>							
V <sub>SD</sub>	Forward Diode Voltage	V <sub>GS</sub> =0V, I <sub>S</sub> =0.15A	N-Ch	0.5	0.70	1.5	V
		V <sub>GS</sub> =0V, I <sub>S</sub> =-0.15A	P-Ch	-0.5	-0.65	-1.5	

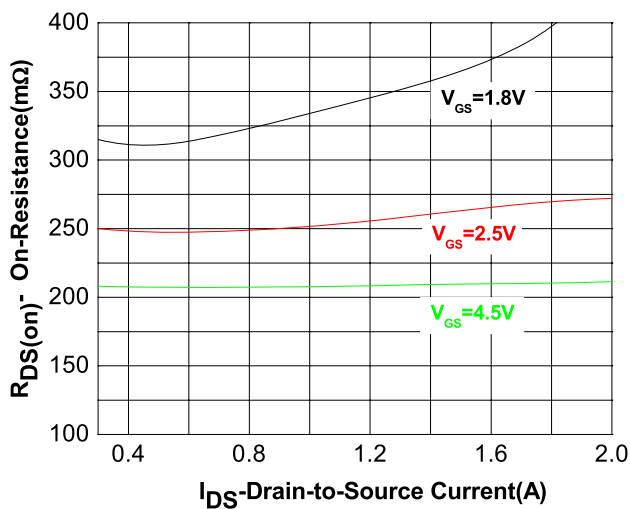
NMOS Typical Characteristics (Ta=25°C, unless otherwise noted)



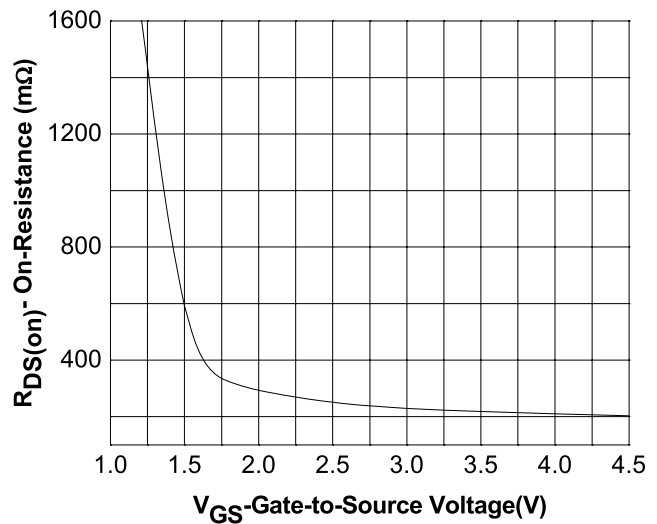
Output characteristics



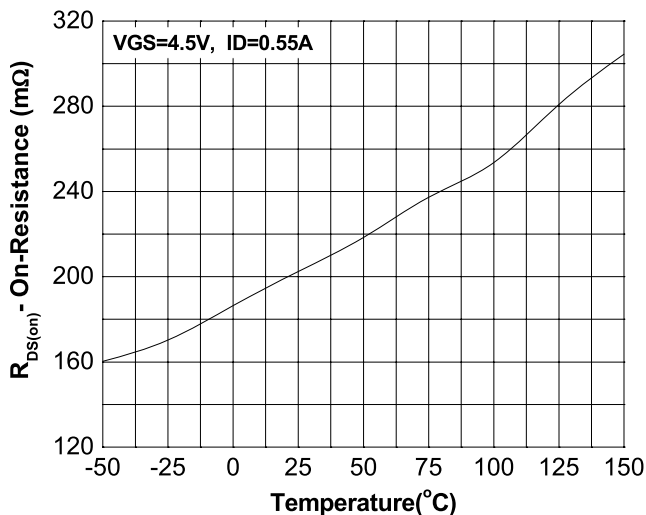
Transfer characteristics



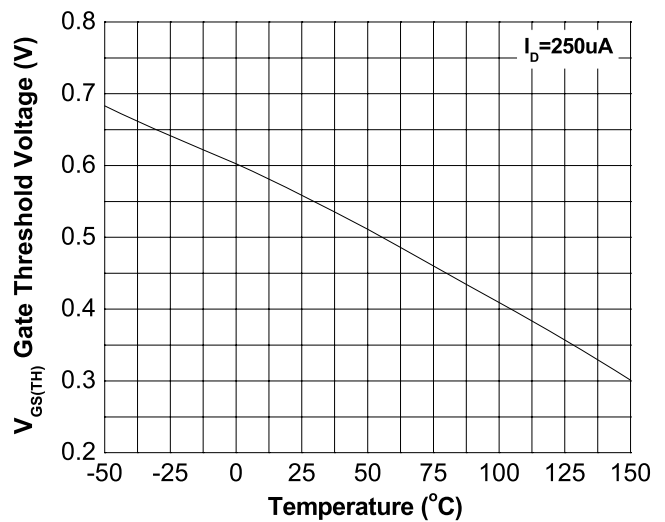
On-Resistance vs. Drain current



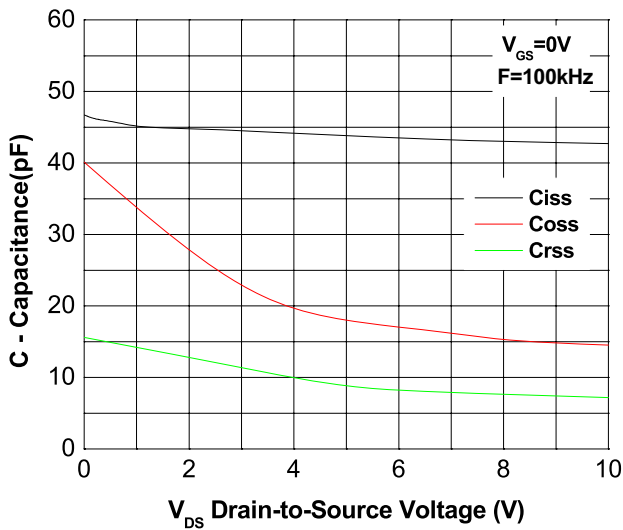
On-Resistance vs. Gate-to-Source voltage



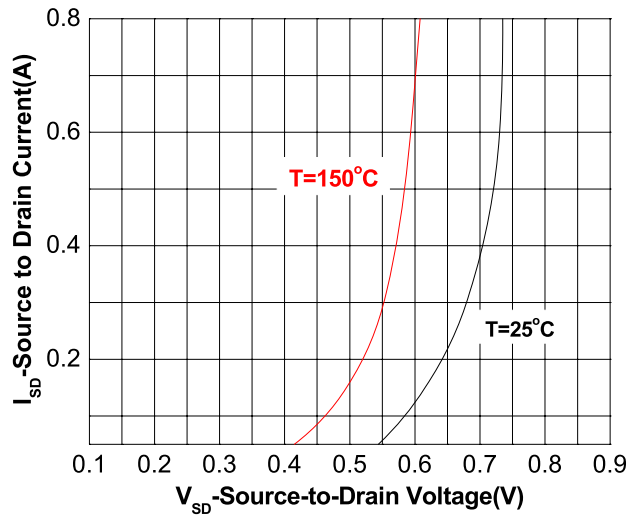
On-Resistance vs. Junction temperature



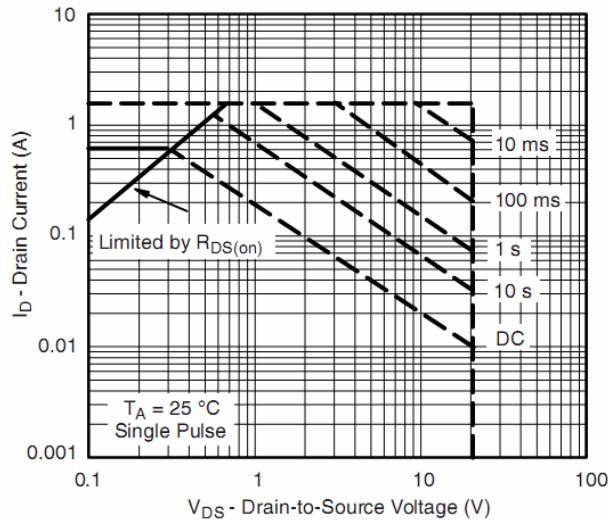
Threshold voltage vs. Temperature



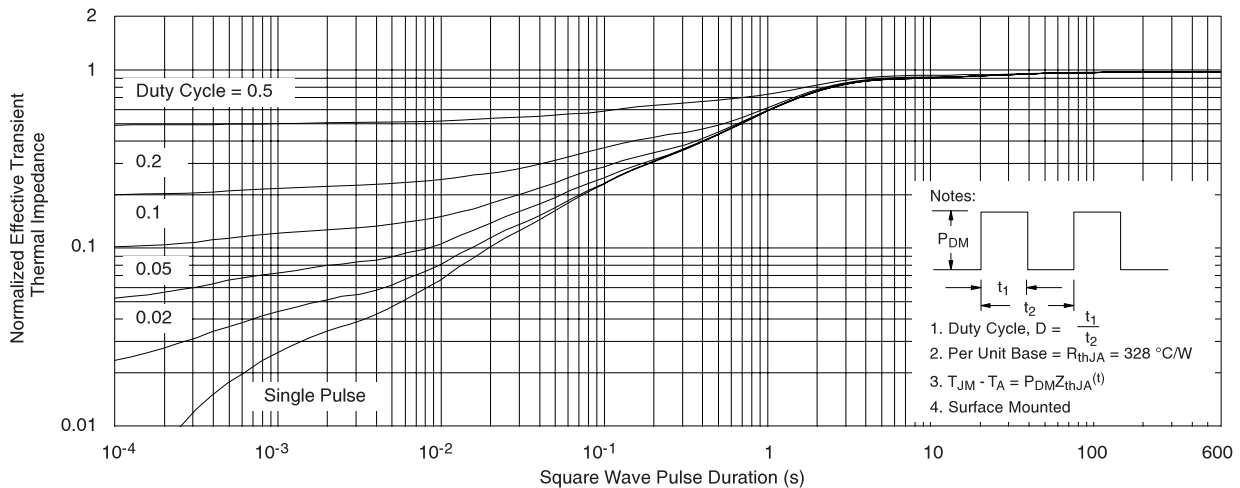
Capacitance



Body diode forward voltage

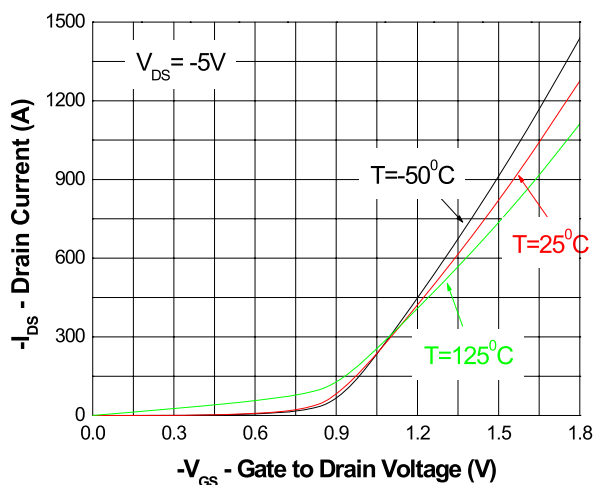
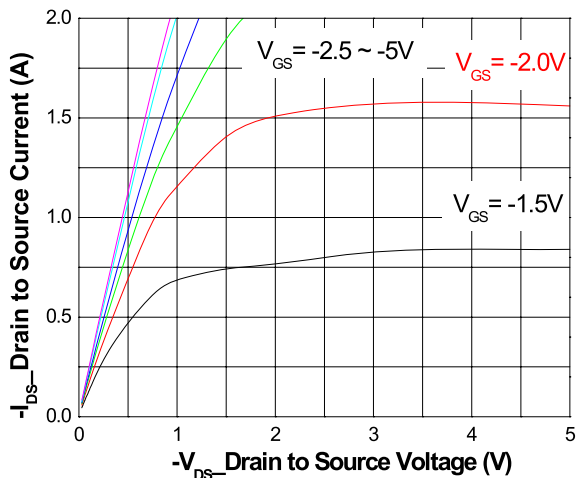


Safe operating power

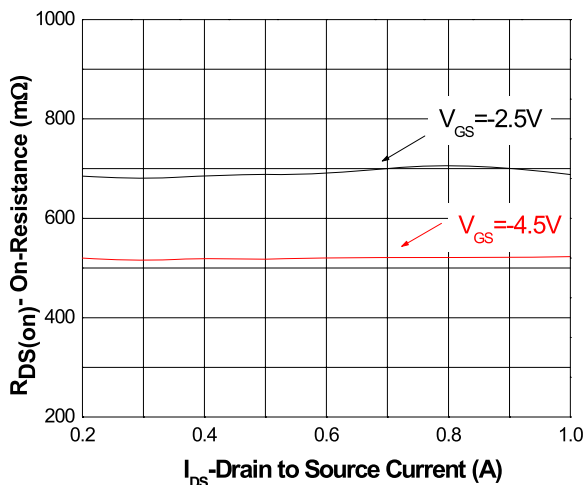


Transient thermal response (Junction-to-Ambient)

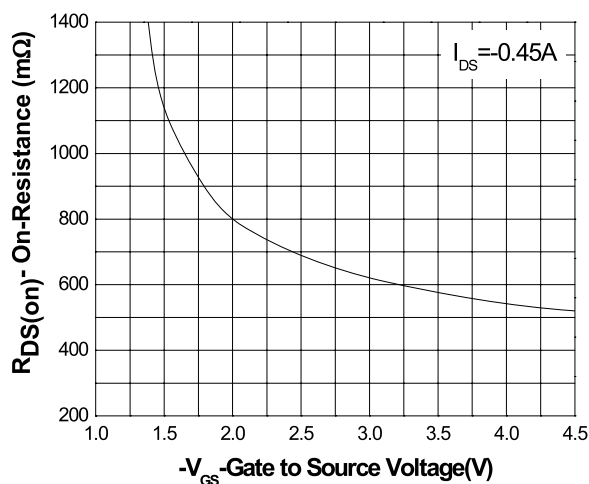
PMOS Typical Characteristics (Ta=25°C, unless otherwise noted)



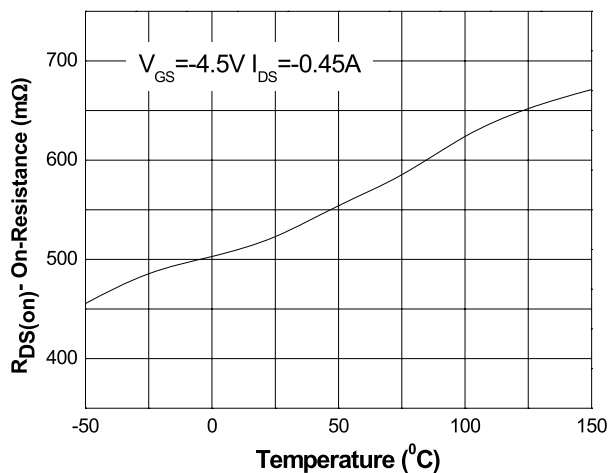
Output characteristics



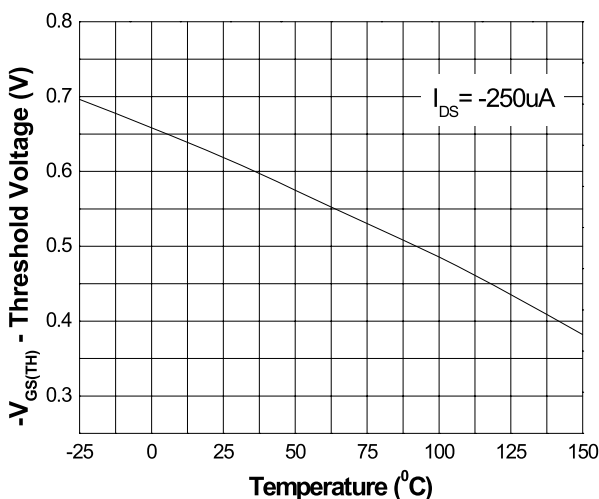
Transfer characteristics



On-Resistance vs. Drain current

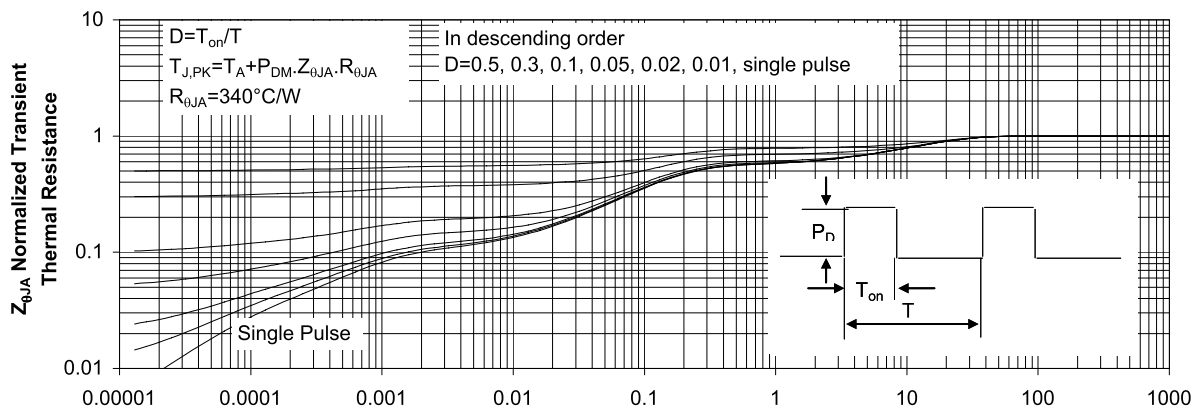
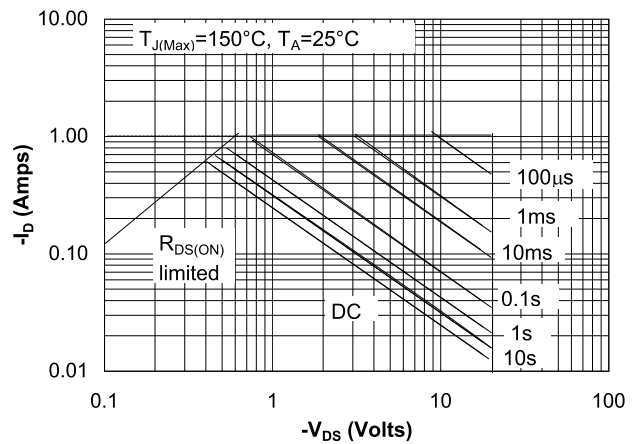
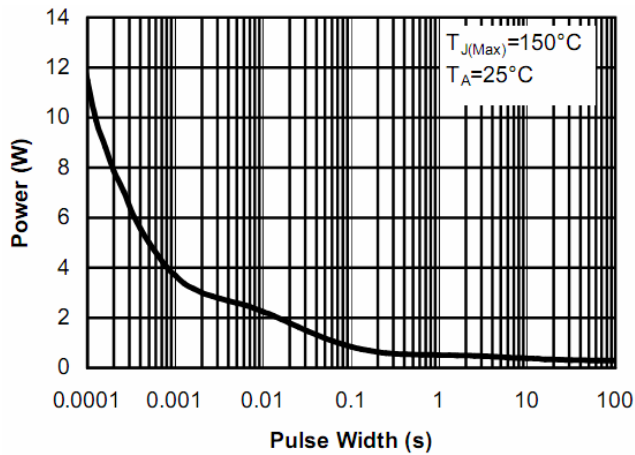
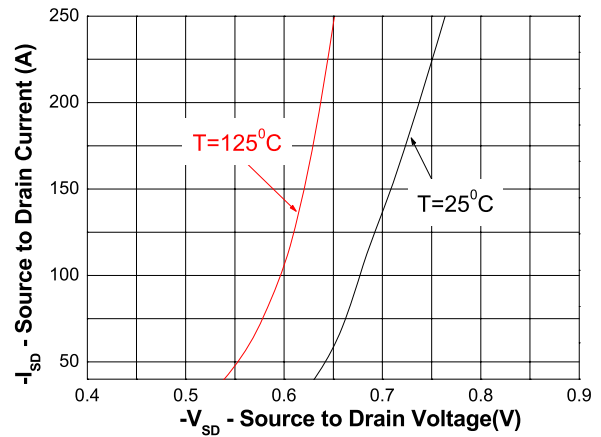
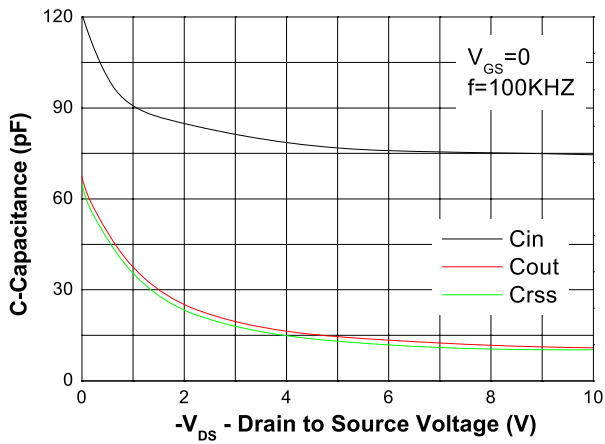


On-Resistance vs. Gate-to-Source voltage



On-Resistance vs. Junction temperature

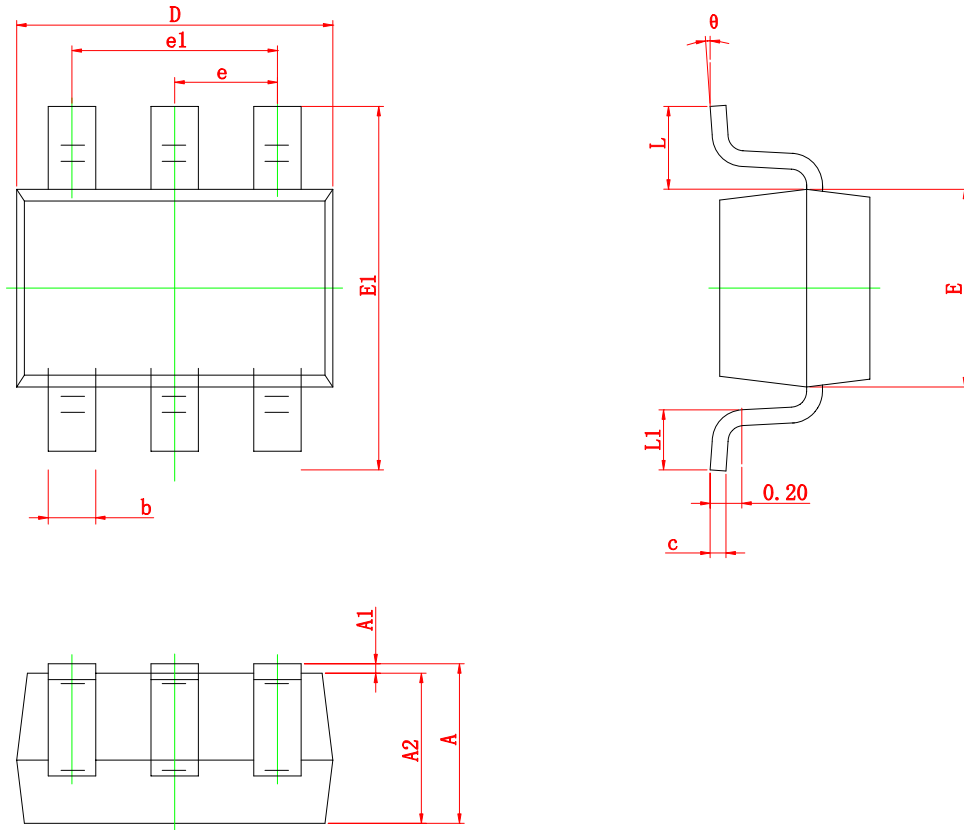
Threshold voltage vs. Temperature





Package Outline Dimension

SOT-363



Symbol	Dimension in Millimeters	
	Min.	Max.
A	0.900	1.100
A1	0.000	0.100
A2	0.900	1.000
b	0.150	0.350
c	0.080	0.150
D	2.000	2.200
E	1.150	1.350
E1	2.150	2.450
e	0.650 TYP	
e1	1.200	1.400
L	0.525 REF	
L1	0.260	0.460
θ	0°	8°