

## General Features

- $V_{DS} = 50V, I_D = 0.22A$

$$R_{DS(ON)} < 3\Omega @ V_{GS}=5V$$

$$R_{DS(ON)} < 2\Omega @ V_{GS}=10V$$

ESD Rating: HBM 2300V

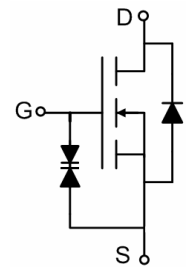
- High power and current handling capability
- Lead free product is acquired
- Surface mount package

## Application

- Direct logic-level interface: TTL/CMOS
- Drivers: relays, solenoids, ILamps, hammers, display, memories, transistors, etc.
- Battery operated systems
- Solid-state relays



SOT-23-3



Schematic Diagram

## Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
V SMBSS138K-S2	V SMBSS138K	SOT-23-3	Ø180mm	8 mm	3000 units

## Absolute Maximum Ratings ( $T_A=25^{\circ}C$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	50	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	0.22	A
Drain Current-Pulsed <sup>(Note 1)</sup>	$I_{DM}$	0.88	A
Maximum Power Dissipation	$P_D$	0.35	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	$^{\circ}C$

## Thermal Characteristic

Thermal Resistance, Junction-to-Ambient <sup>(Note 2)</sup>	$R_{\theta JA}$	350	$^{\circ}C/W$
---	-----------------	-----	---------------

## Electrical Characteristics ( $T_A=25^{\circ}C$ unless otherwise noted)

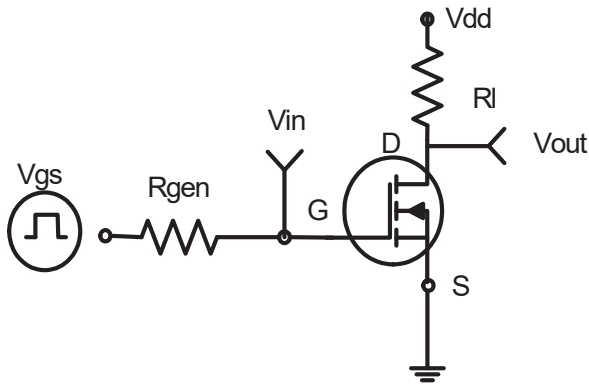
Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	50	65	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=50V, V_{GS}=0V$	-	-	1	$\mu A$

Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±10V,V <sub>DS</sub> =0V	-	±110	±500	nA
		V <sub>GS</sub> =±12V,V <sub>DS</sub> =0V	-	±0.3	±10	uA
On Characteristics (Note 3)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA	0.6	1.1	1.6	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =5V, I <sub>D</sub> =0.2A	-	1.3	3	Ω
		V <sub>GS</sub> =10V, I <sub>D</sub> =0.22A	-	1	2	Ω
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =10V,I <sub>D</sub> =0.2A	0.2	-	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =25V,V <sub>GS</sub> =0V, F=1.0MHz	-	30	-	PF
Output Capacitance	C <sub>OSS</sub>		-	15	-	PF
Reverse Transfer Capacitance	C <sub>ISS</sub>		-	6	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =30V,I <sub>D</sub> =0.22A V <sub>GS</sub> =10V,R <sub>GEN</sub> =6Ω	-	-	5	nS
Turn-on Rise Time	t <sub>r</sub>		-	-	5	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	-	60	nS
Turn-Off Fall Time	t <sub>f</sub>		-	-	35	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =25V,I <sub>D</sub> =0.2A, V <sub>GS</sub> =10V	-	-	2.4	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V,I <sub>S</sub> =0.22A	-	-	1.3	V
Diode Forward Current (Note 2)	I <sub>S</sub>		-	-	0.22	A

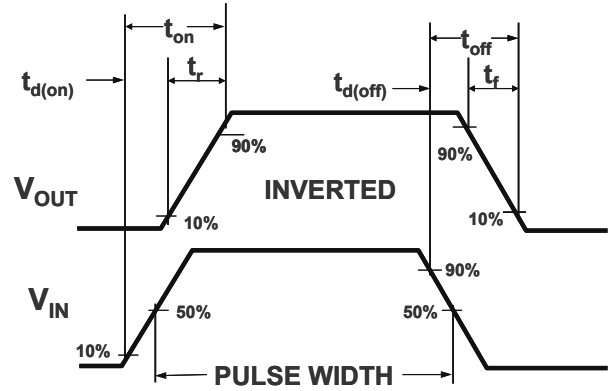
## Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production

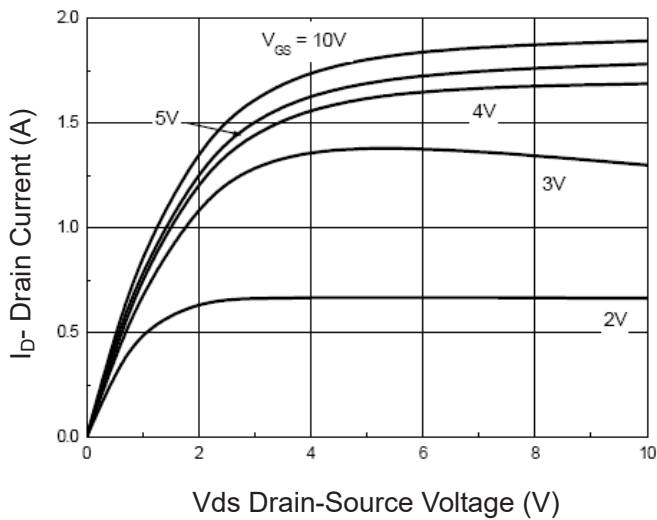
## Typical Electrical and Thermal Characteristics



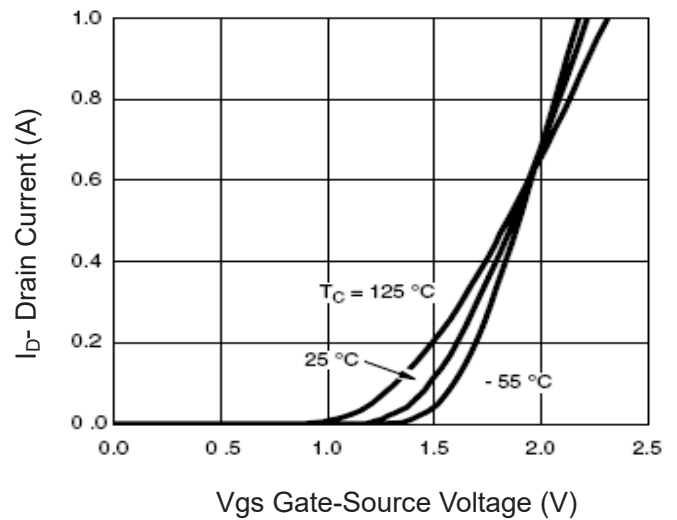
**Figure 1: Switching Test Circuit**



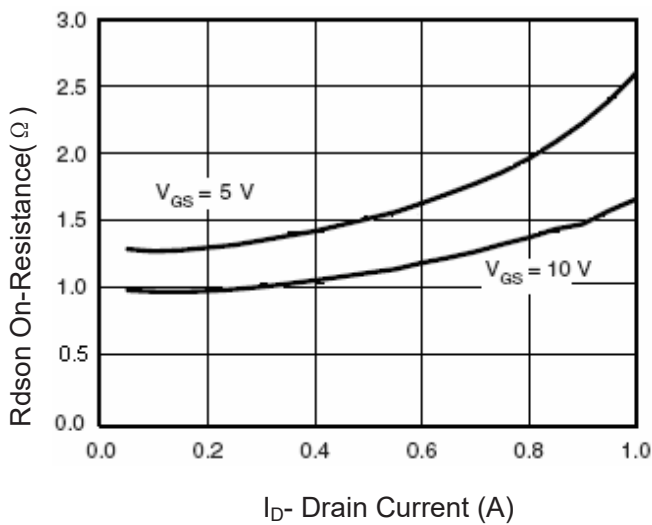
**Figure 2: Switching Waveforms**



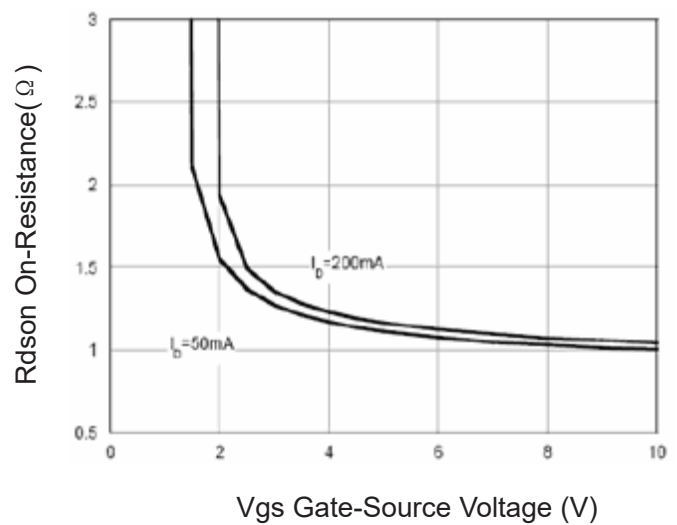
**Figure 3 Output Characteristics**



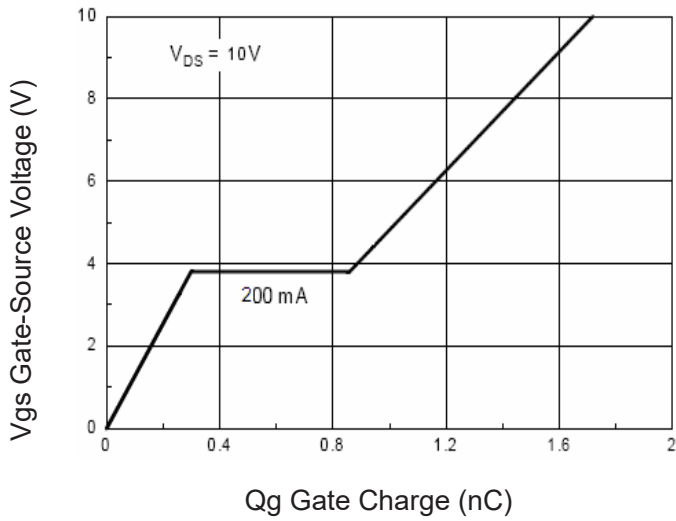
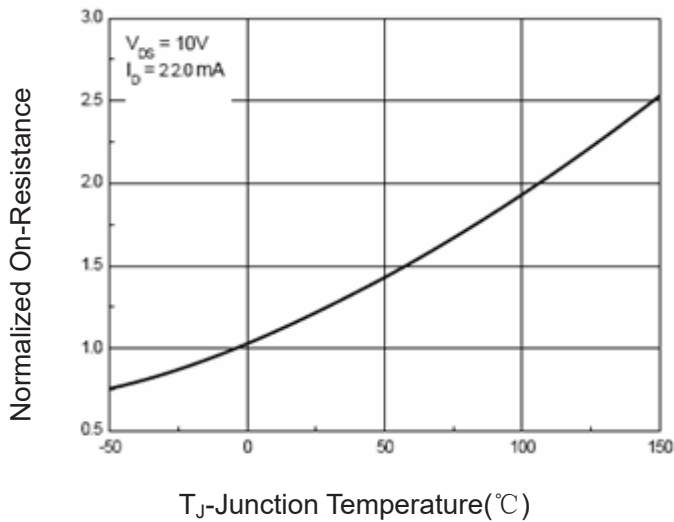
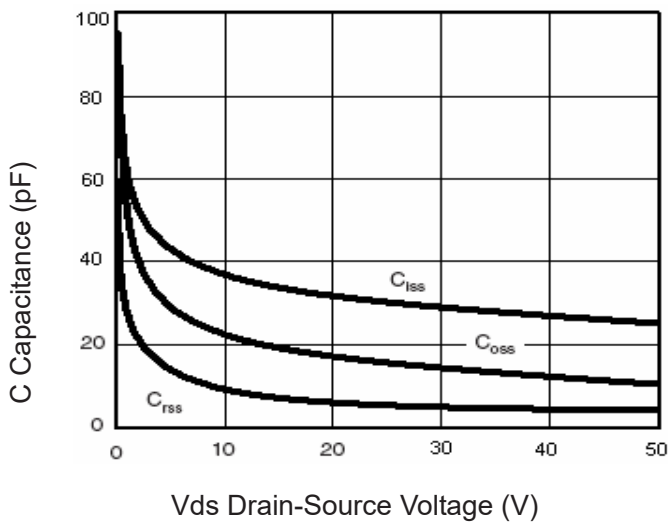
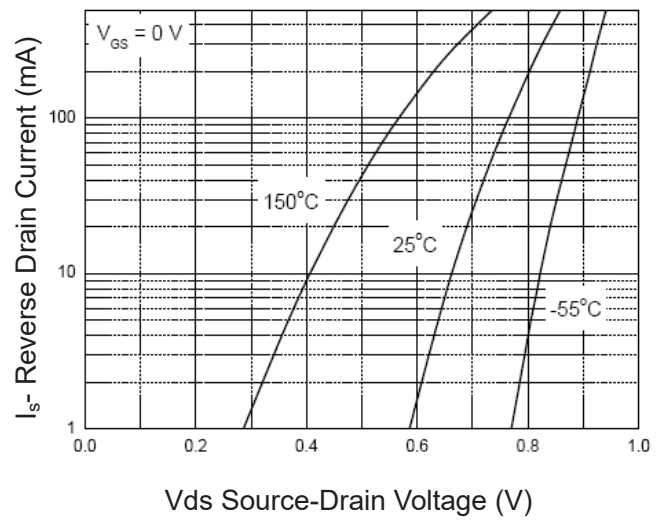
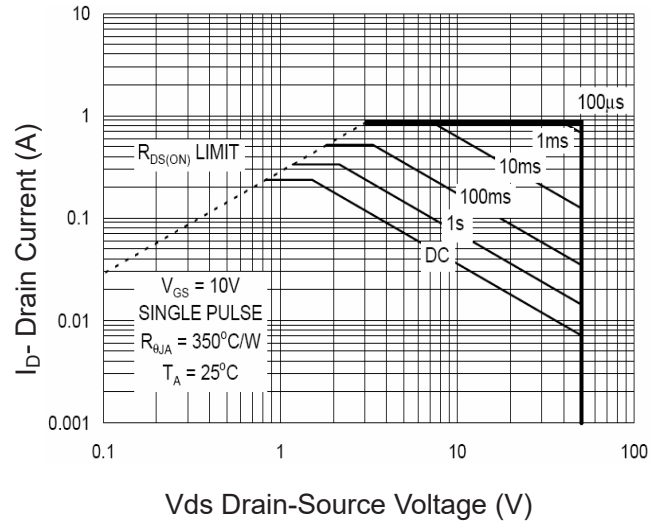
**Figure 4 Transfer Characteristics**

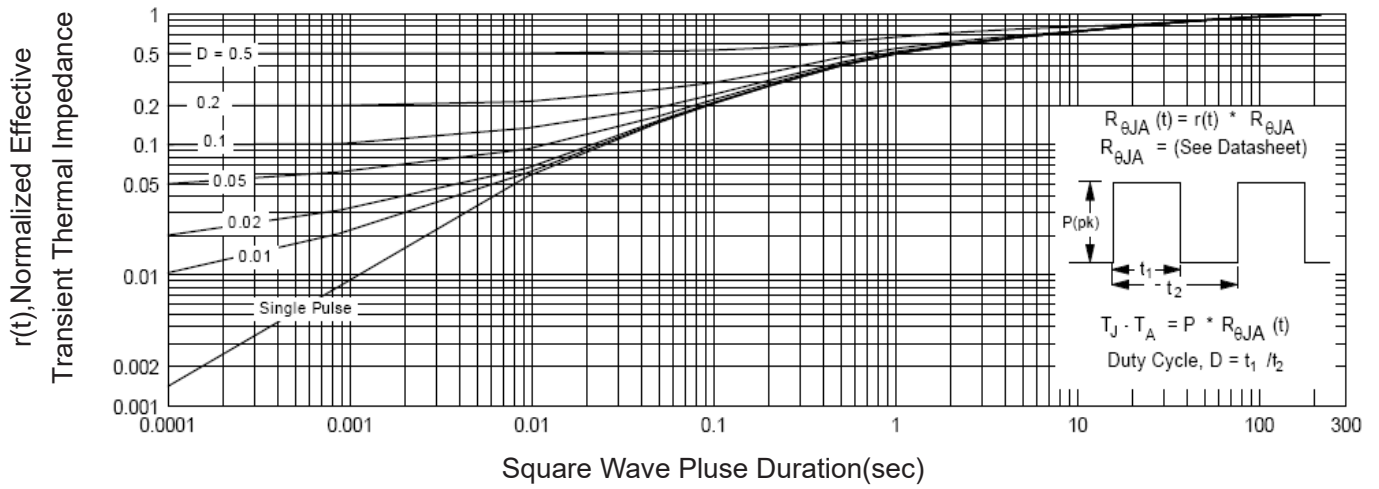


**Figure 5 Drain-Source On-Resistance**



**Figure 6 Rdson vs Vgs**


**Figure 7 Gate Charge**

**Figure 9 Drain-Source On-Resistance**

**Figure 11 Capacitance vs Vds**

**Figure 8 Source-Drain Diode Forward**

**Figure 10 Safe Operation Area**



**Figure 12 Normalized Maximum Transient Thermal Impedance**