

## NCE N-Channel Enhancement Mode Power MOSFET

### GENERAL FEATURES

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

$$R_{DS(ON)} < 3\Omega @ V_{GS}=4.5V$$

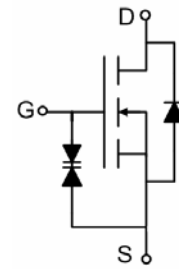
$$R_{DS(ON)} < 2\Omega @ V_{GS}=10V$$

ESD Rating: HBM 2500V

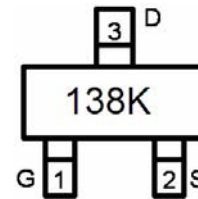
- High Power and current handing capability
- Lead free product is acquired
- Surface Mount Package

### Application

- Direct Logic-Level Interface: TTL/CMOS
- Drivers: Relays, Solenoids, Lamps, Hammers, Display, Memories, Transistors, etc.
- Battery Operated Systems
- Solid-State Relays



Schematic diagram



Marking and pin Assignment



SOT-23 top view

### Package Marking And Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
138K	BSS138K	SOT-23	Ø180mm	8 mm	3000 units

### Absolute Maximum Ratings (TA=25°C unless otherwise noted)

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

### Thermal Characteristic

Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	350	°C/W
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### Electrical Characteristics (TA=25°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			V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=50V, V_{GS}=0V$			1	μA

Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V,V <sub>DS</sub> =0V			±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	0.9	1.2	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =4.5V, I <sub>D</sub> =0.2A		1.2	3	Ω
		V <sub>GS</sub> =10V, I <sub>D</sub> =0.22A		1.1	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>RSS</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

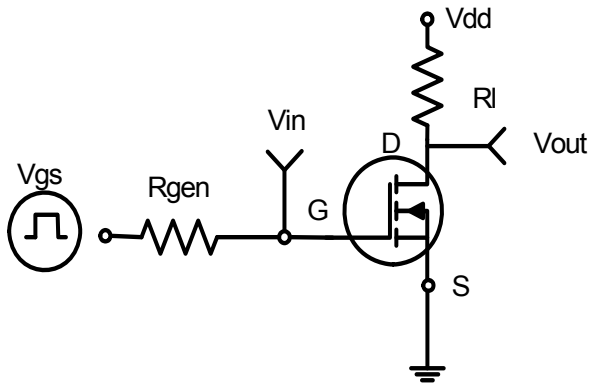


Figure 1: Switching Test Circuit

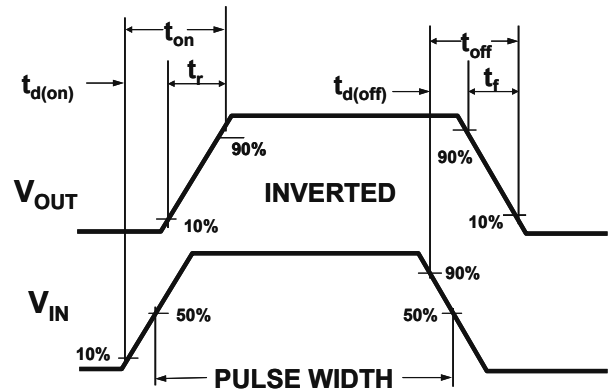


Figure 2: Switching Waveforms

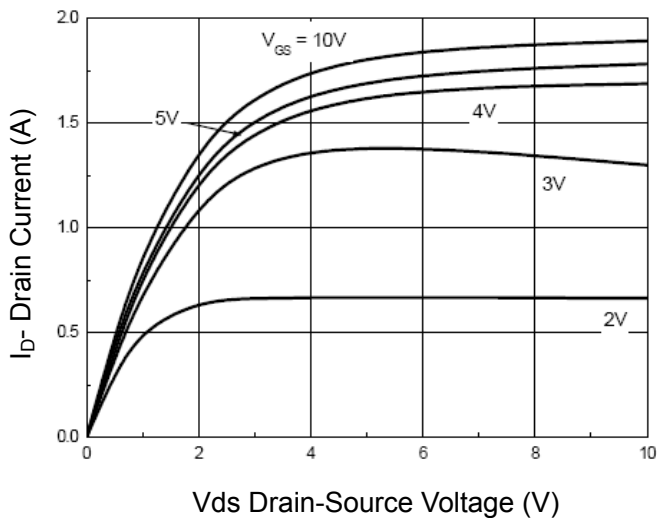


Figure 3 Output CHARACTERISTICS

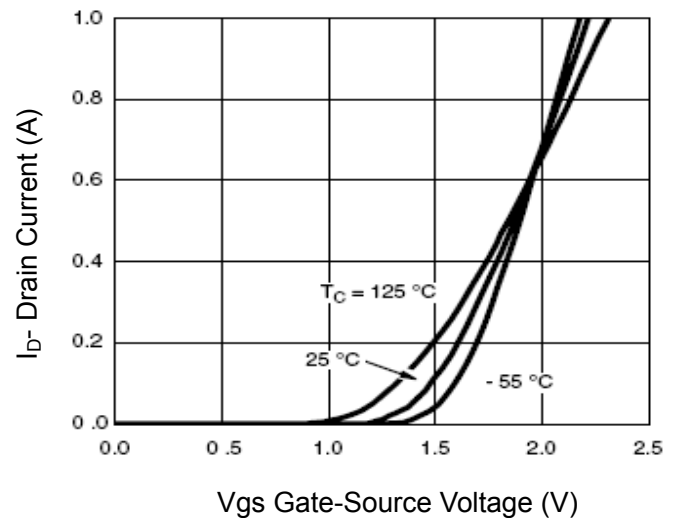


Figure 4 Transfer Characteristics

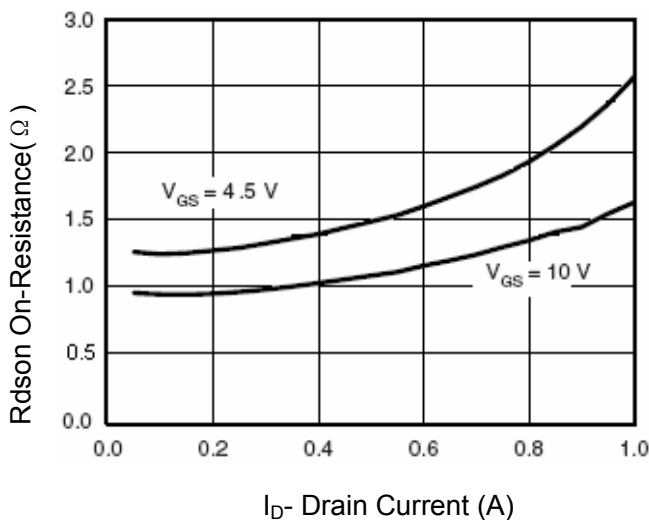


Figure 5 Drain-Source On-Resistance

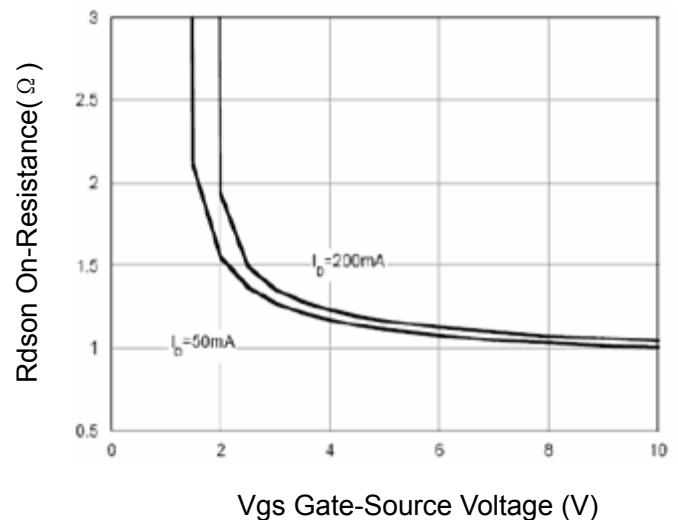
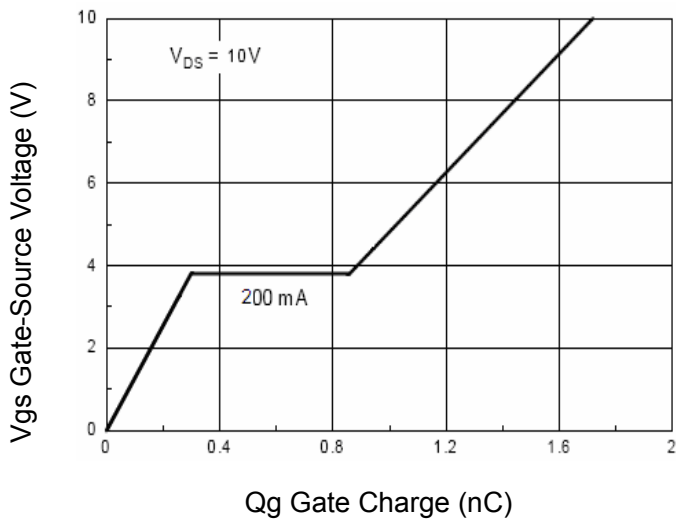
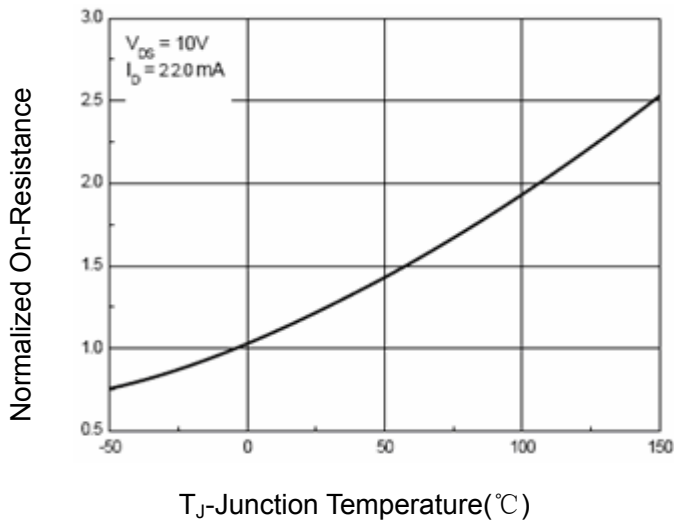


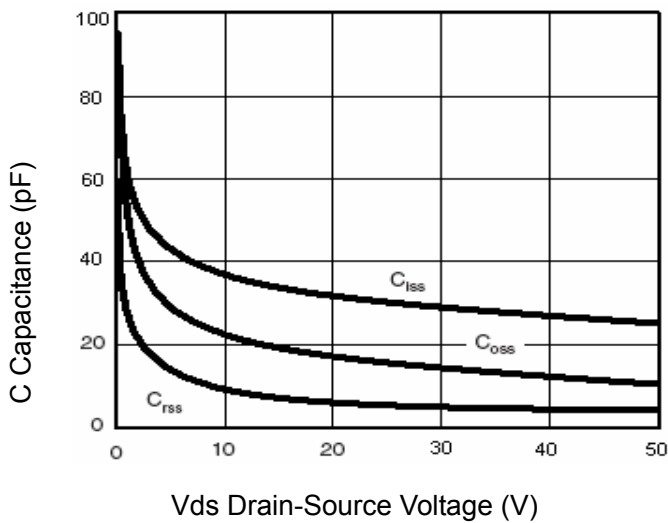
Figure 6 Rdson vs Vgs



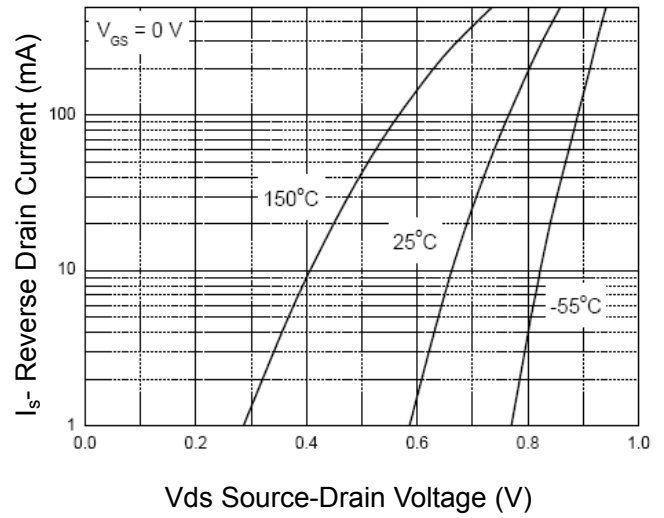
**Figure 7 Gate Charge**



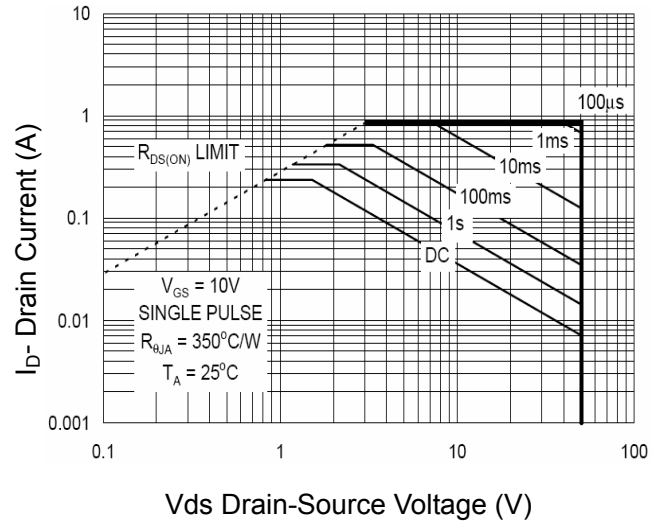
**Figure 9 Drain-Source On-Resistance**



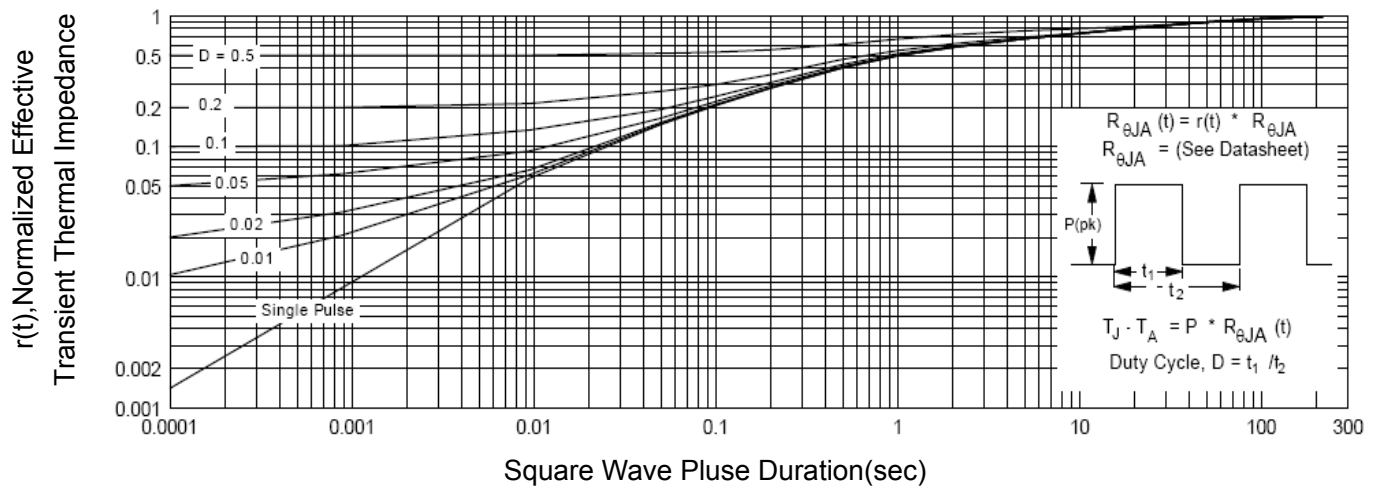
**Figure 11 Capacitance vs Vds**



**Figure 8 Source-Drain Diode Forward**



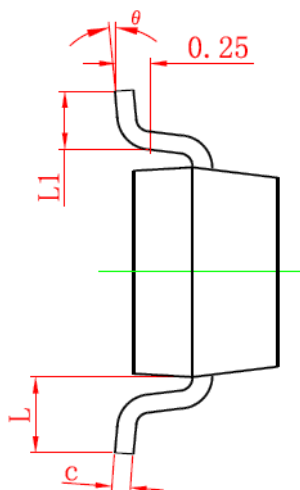
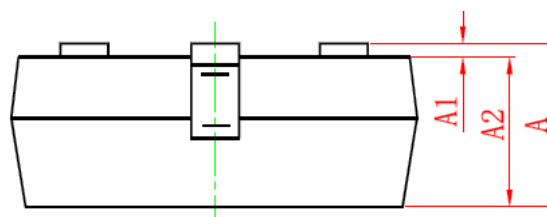
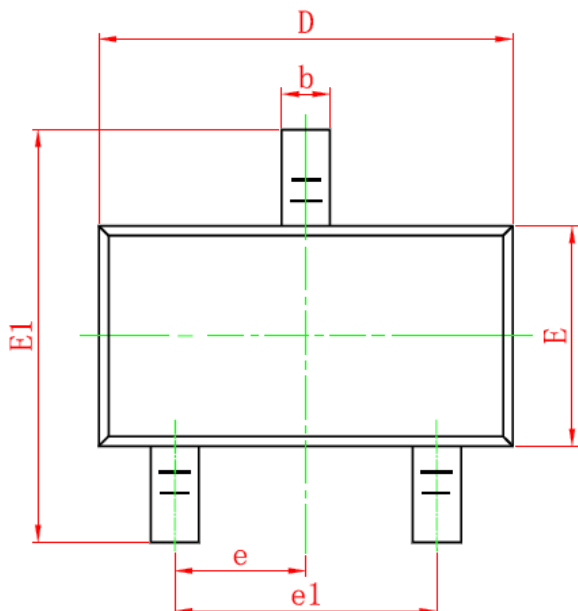
**Figure 10 Safe Operation Area**



**Figure 12 Normalized Maximum Transient Thermal Impedance**

## SOT-23 PACKAGE INFORMATION

Dimensions in Millimeters (UNIT:mm)



Symbol	Dimensions in Millimeters	
	MIN.	MAX.
A	0.900	1.150
A1	0.000	0.100
A2	0.900	1.050
b	0.300	0.500
c	0.080	0.150
D	2.800	3.000
E	1.200	1.400
E1	2.250	2.550
e	0.950TYP	
e1	1.800	2.000
L	0.550REF	
L1	0.300	0.500
θ	0°	8°

### NOTES

1. All dimensions are in millimeters.
2. Tolerance  $\pm 0.10\text{mm}$  (4 mil) unless otherwise specified
3. Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 5 mils.
4. Dimension L is measured in gauge plane.
5. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

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