

NCE N-Channel Enhancement Mode Power MOSFET

General Features

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

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

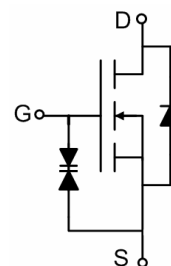
$$R_{DS(ON)} < 2\Omega @ V_{GS}=10V$$

ESD Rating: HBM 2300V

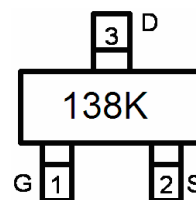
- High power and current handling capability
- Lead free product is acquired
- Surface mount package

Application

- Direct logic-level interface: TTL/CMOS
- Drivers: relays, solenoids, 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 ($T_A=25^\circ\text{C}$ 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	$^\circ\text{C}$

Thermal Characteristic

Thermal Resistance, Junction-to-Ambient ^(Note 2)	$R_{\theta JA}$	350	$^\circ\text{C/W}$
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Electrical Characteristics ($T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
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	μA

Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 10V, V_{DS}=0V$	-	± 110	± 500	nA
		$V_{GS}=\pm 12V, V_{DS}=0V$	-	± 0.3	± 10	μA
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	0.6	1.1	1.6	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=5V, I_D=0.2A$	-	1.3	3	Ω
		$V_{GS}=10V, I_D=0.22A$	-	1	2	Ω
Forward Transconductance	g_{FS}	$V_{DS}=10V, I_D=0.2A$	0.2	-	-	S
Dynamic Characteristics (Note 4)						
Input Capacitance	C_{iss}	$V_{DS}=25V, V_{GS}=0V,$ $F=1.0MHz$	-	30	-	PF
Output Capacitance	C_{oss}		-	15	-	PF
Reverse Transfer Capacitance	C_{rss}		-	6	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=30V, I_D=0.22A$ $V_{GS}=10V, R_{GEN}=6\Omega$	-	-	5	nS
Turn-on Rise Time	t_r		-	-	5	nS
Turn-Off Delay Time	$t_{d(off)}$		-	-	60	nS
Turn-Off Fall Time	t_f		-	-	35	nS
Total Gate Charge	Q_g	$V_{DS}=25V, I_D=0.2A,$ $V_{GS}=10V$	-	-	2.4	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V_{SD}	$V_{GS}=0V, I_S=0.22A$	-	-	1.3	V
Diode Forward Current (Note 2)	I_S		-	-	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

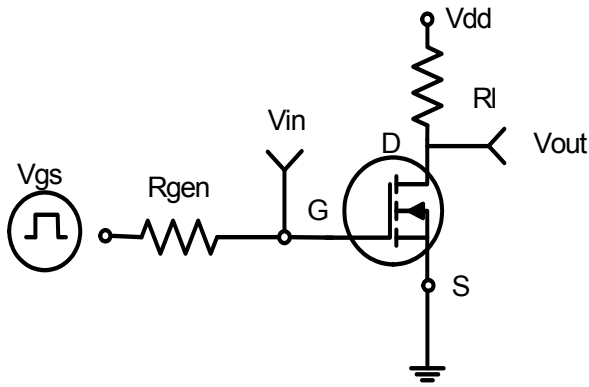


Figure 1: Switching Test Circuit

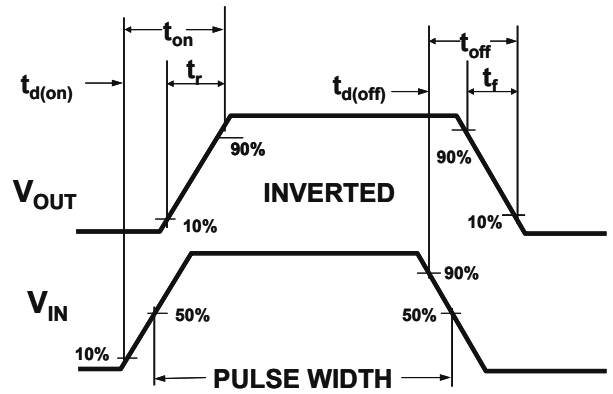


Figure 2: Switching Waveforms

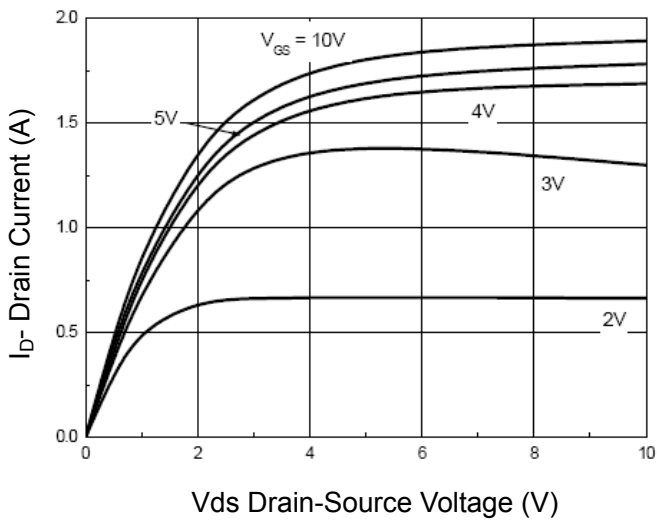


Figure 3 Output Characteristics

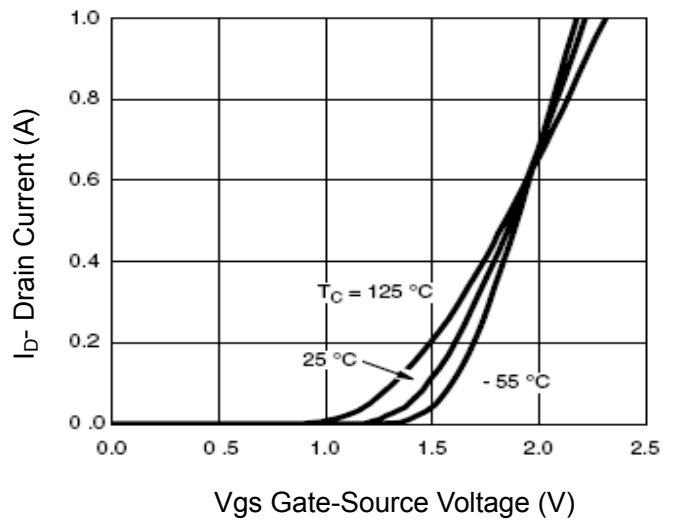


Figure 4 Transfer Characteristics

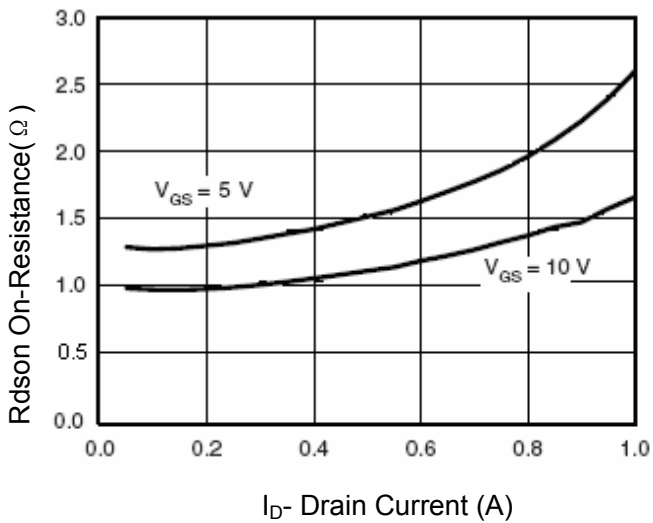


Figure 5 Drain-Source On-Resistance

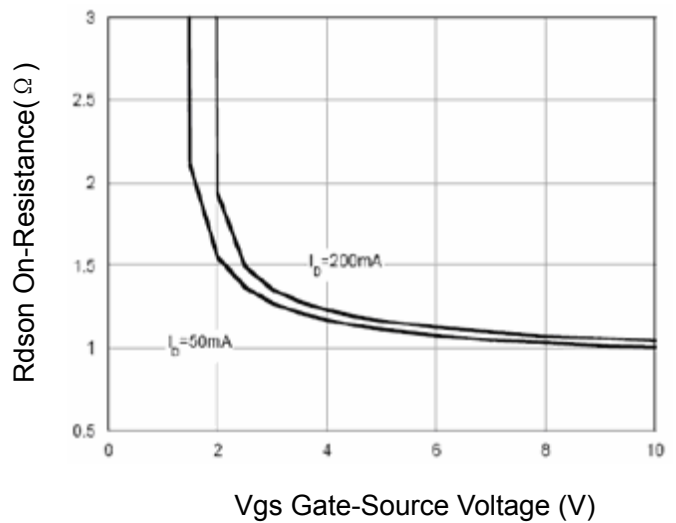
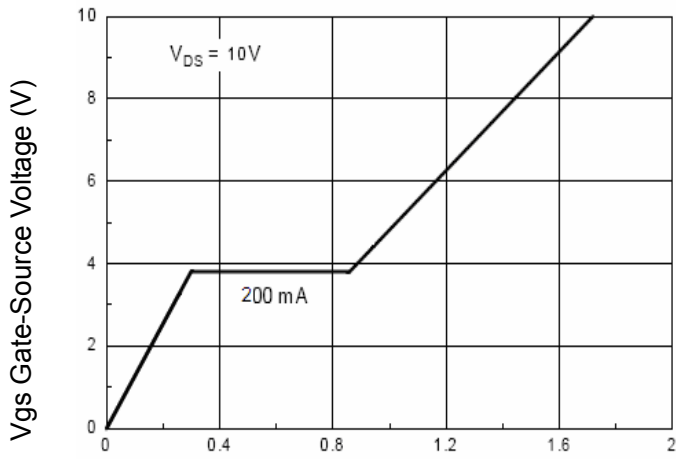
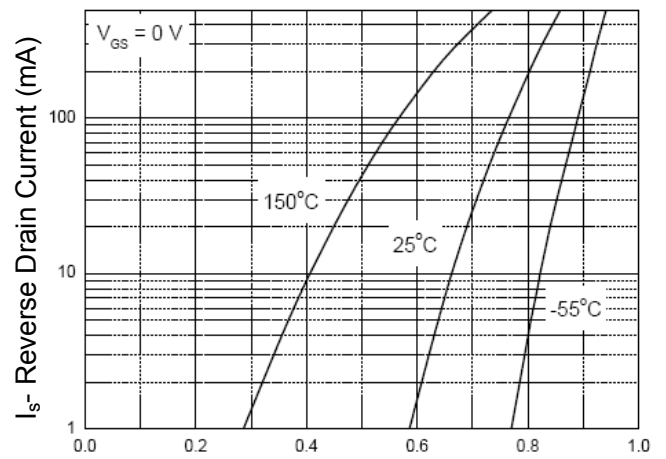


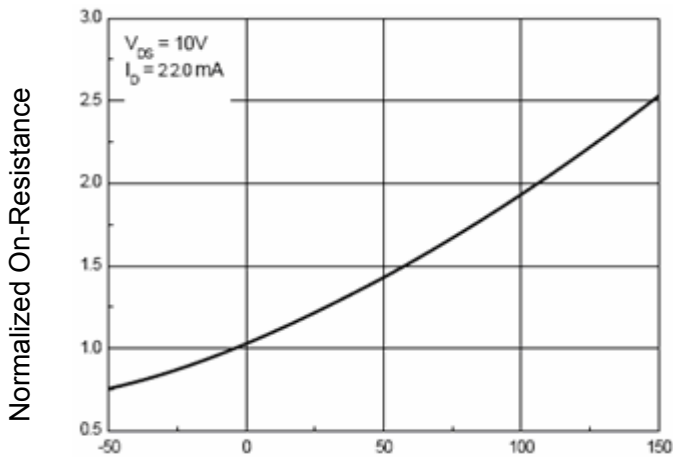
Figure 6 R_DS(on) vs V_GS



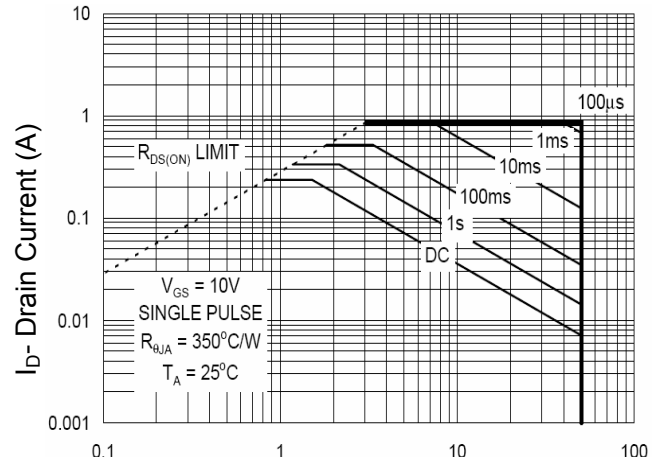
Qg Gate Charge (nC)
Figure 7 Gate Charge



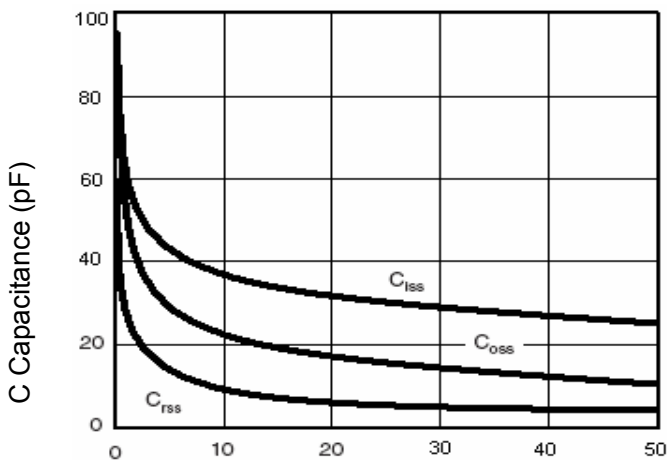
Vds Source-Drain Voltage (V)
Figure 8 Source-Drain Diode Forward



Tj-Junction Temperature(°C)
Figure 9 Drain-Source On-Resistance



Vds Drain-Source Voltage (V)
Figure 10 Safe Operation Area



Vds Drain-Source Voltage (V)
Figure 11 Capacitance vs Vds

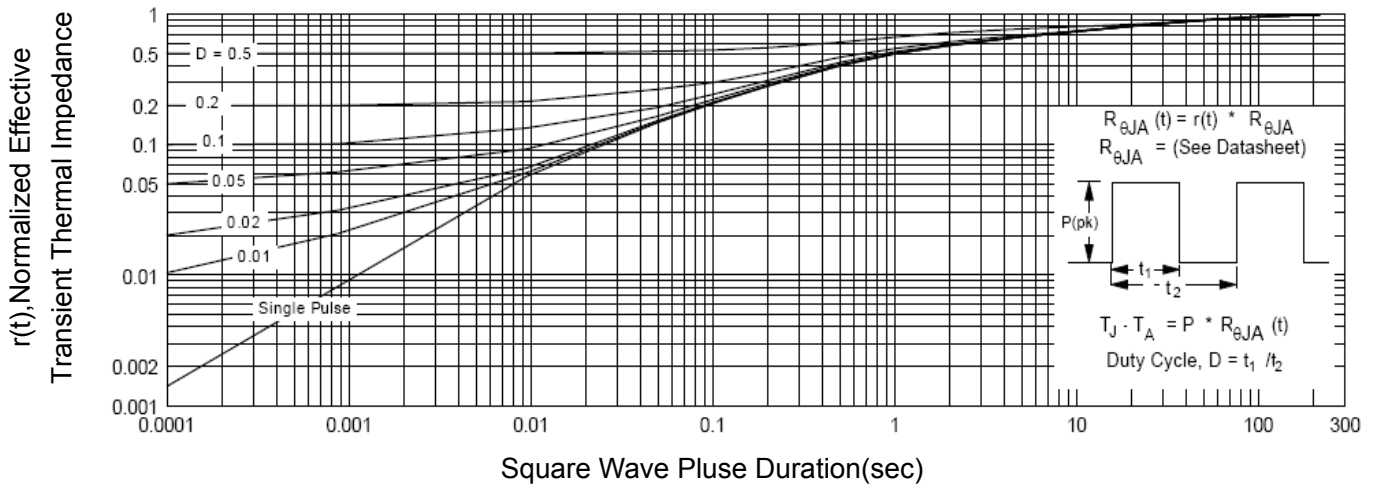
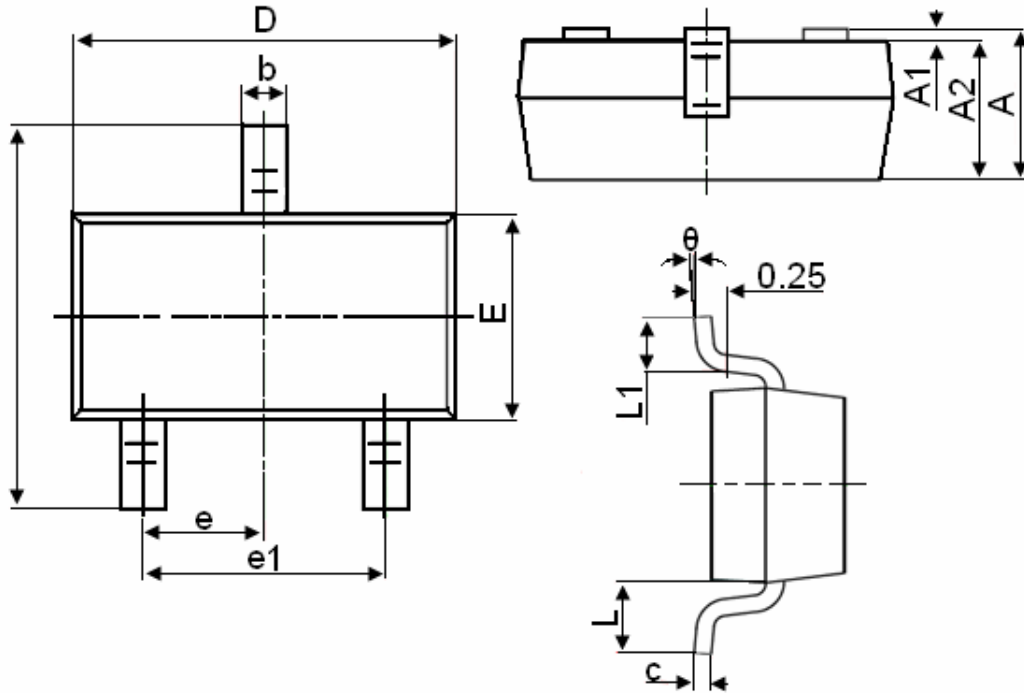


Figure 12 Normalized Maximum Transient Thermal Impedance

SOT-23 Package Information



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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