

NCE N-Channel Enhancement Mode Power MOSFET

GENERAL FEATURES

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

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

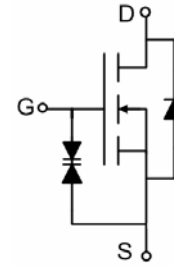
$$R_{DS(ON)} < 2\Omega @ V_{GS}=10V$$

ESD Rating: HBM 2500V

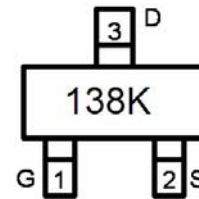
- High Power and current handing capability
- Lead free product is acquired
- Surface Mount Package

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
Off Characteristics						
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_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$			± 10	μA
On Characteristics (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	0.6	0.9	1.2	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=4.5V, I_D=0.2A$		1.2	3	Ω
		$V_{GS}=10V, I_D=0.22A$		1.1	2	Ω
Forward Transconductance	g_{FS}	$V_{DS}=10V, I_D=0.2A$	0.2			S
Dynamic Characteristics (Note4)						
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

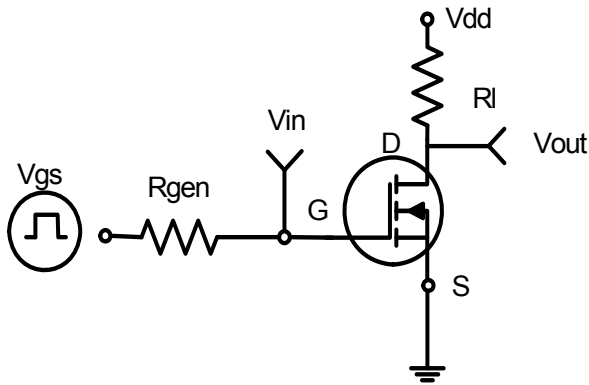


Figure 1: Switching Test Circuit

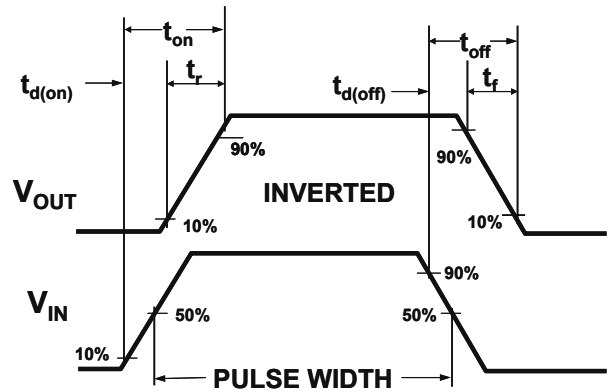


Figure 2: Switching Waveforms

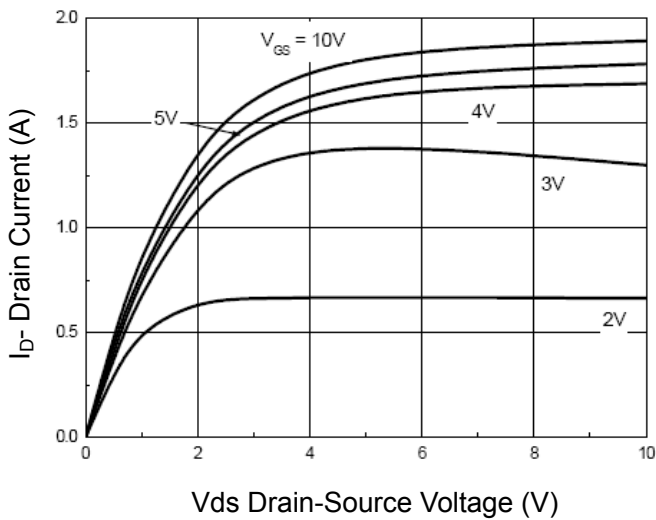


Figure 3 Output CHARACTERISTICS

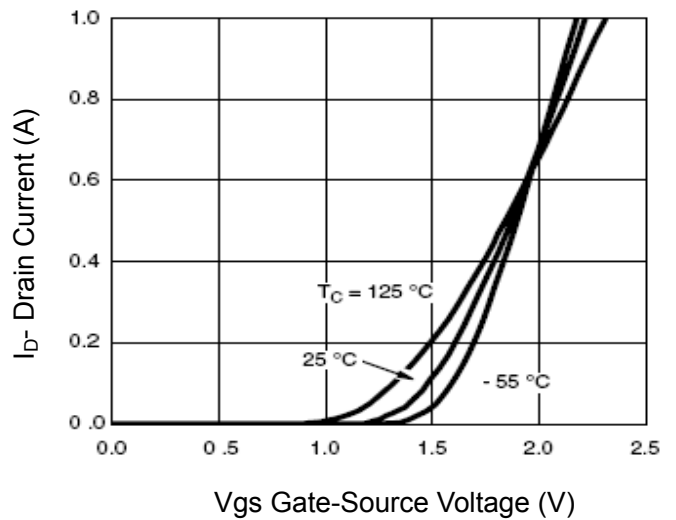


Figure 4 Transfer Characteristics

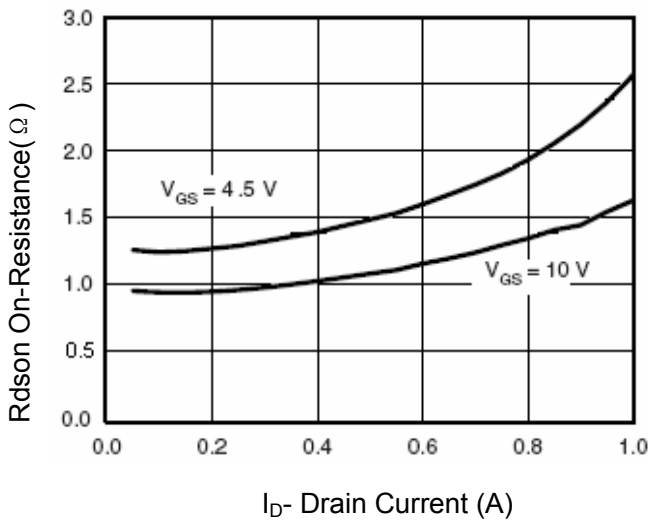


Figure 5 Drain-Source On-Resistance

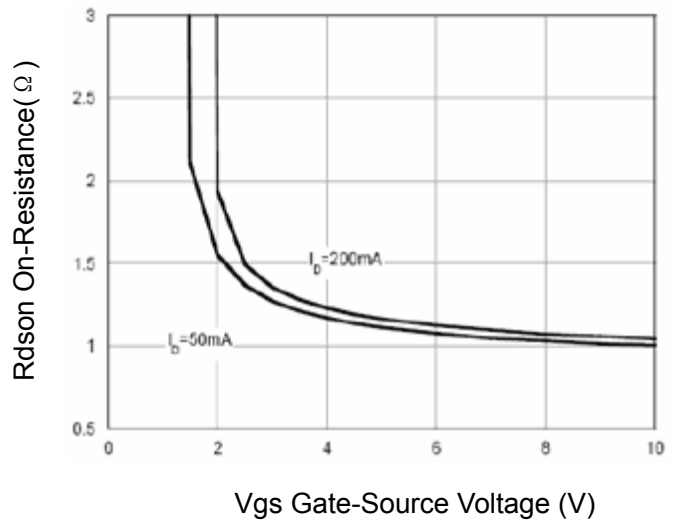
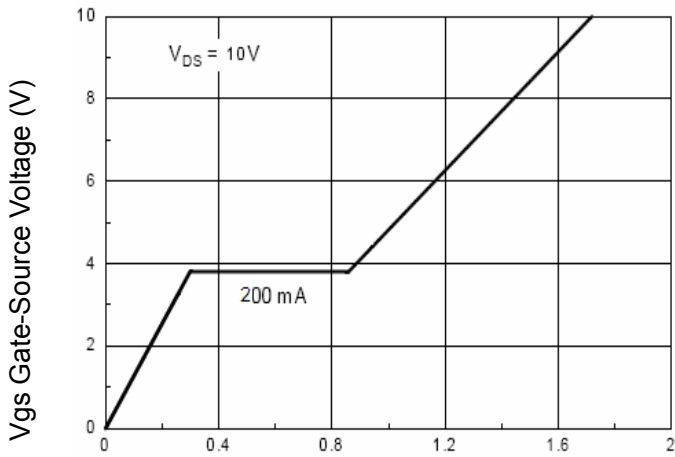
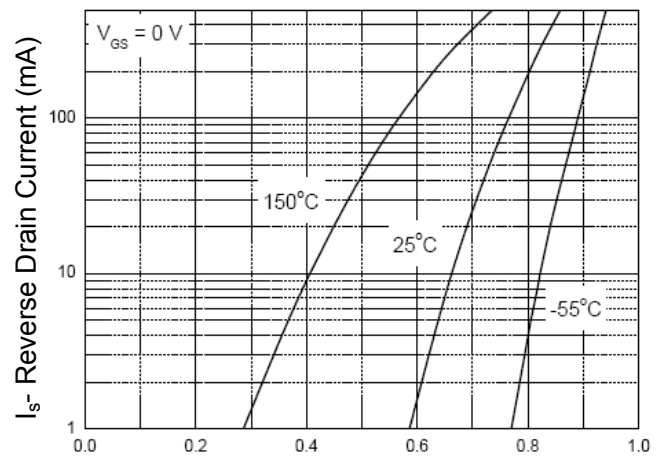


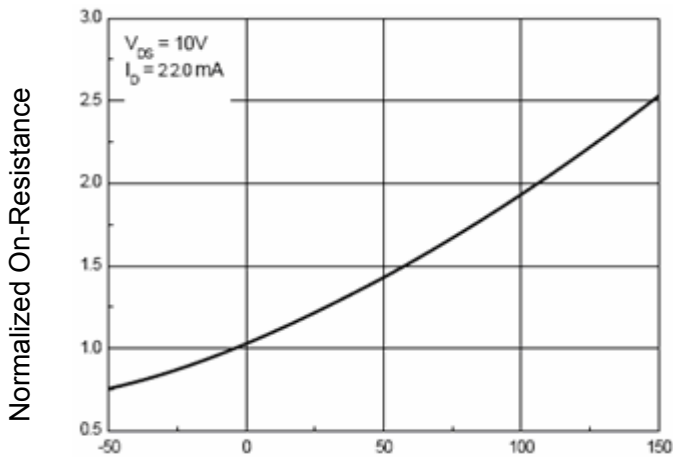
Figure 6 R_DS(on) vs V_GS



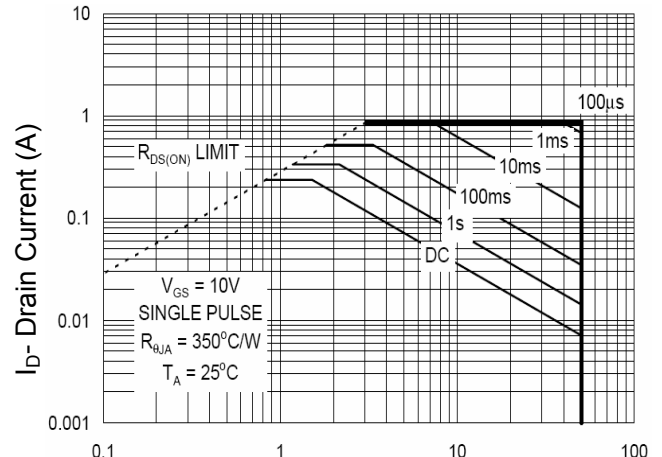
Qg Gate Charge (nC)
Figure 7 Gate Charge



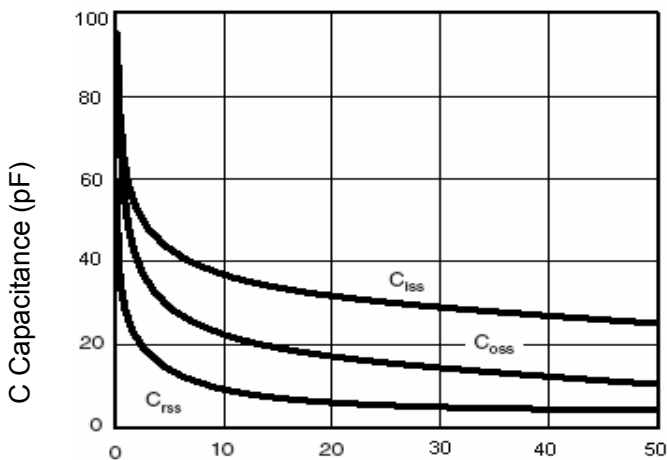
Vds Source-Drain Voltage (V)
Figure 8 Source-Drain Diode Forward



T_J-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

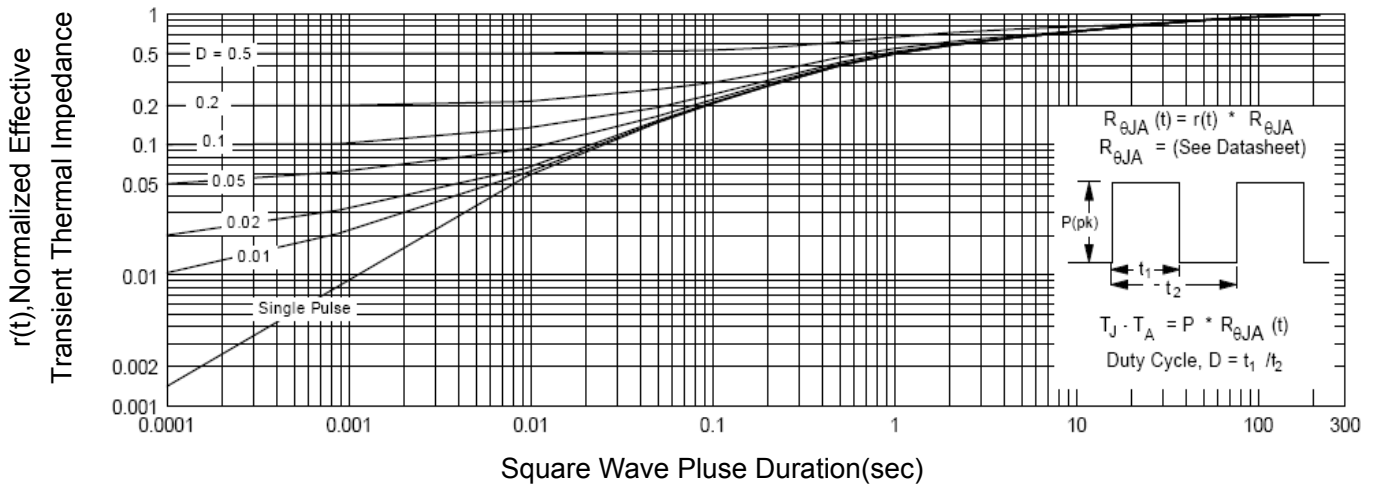
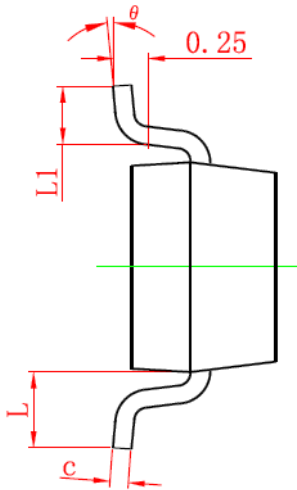
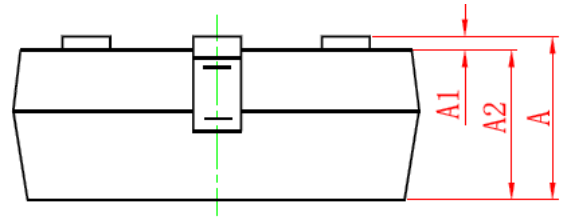
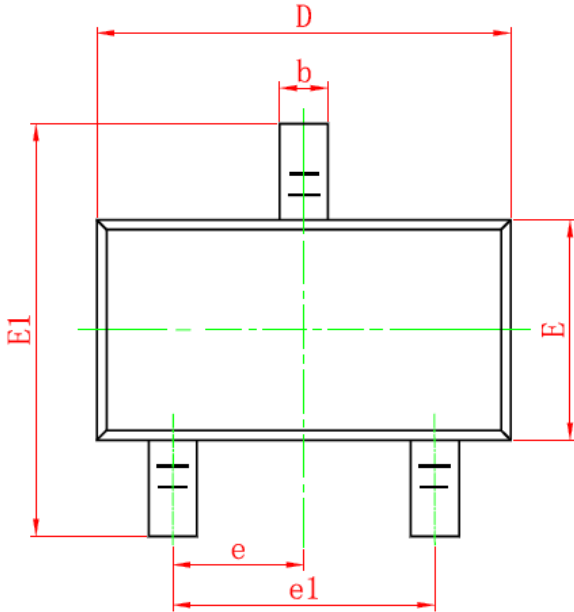


Figure 12 Normalized Maximum Transient Thermal Impedance

SOT-23 PACKAGE INFORMATION

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

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

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