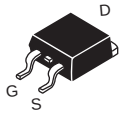
SPN04200/SBN04200

SAGAR SEMICONDUCTORS

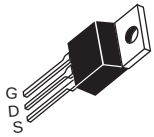
N-Channel Enhancement Mode Field Effect Transistor

Features

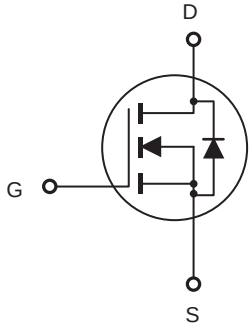
- 40V, 200A, $R_{DS(ON)}$ = 2.3 mΩ @V_{GS} = 10V.
  $R_{DS(ON)}$ = 2.5 mΩ @V_{GS} = 9V.
- Super high dense cell design for extremely low $R_{DS(ON)}$.
- High power and current handing capability.
- RoHS compliant.
- TO-220 & TO-263 package.



SBN SERIES
TO-263(DD-PAK)



SPN SERIES
TO-220



ABSOLUTE MAXIMUM RATINGS T_C = 25°C unless otherwise noted

Parameter	Symbol	Limit	Units
Drain-Source Voltage	V_{DS}	40	V
Gate-Source Voltage	V_{GS}	±20	V
Drain Current-Continuous @ T_C = 25℃	I_D	200	A
@ T_C = 100℃		126	A
Drain Current-Pulsed [a]	I_{DM}	800	A
Maximum Power Dissipation @ T_C = 25℃	P_D	166	W
- Derate above 25℃		1.32	W/℃
Single Pulsed Avalanche Energy [d]	E_{AS}	760	mJ
Single Pulsed Avalanche Current [d]	I_{AS}	39	A
Operating and Store Temperature Range	T_J,T_{stg}	-55 to 150	℃

THERMAL CHARACTERISTICS

Parameter	Symbol	Limit	Units
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.75	℃/W
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	62.5	℃/W

ELECTRICAL CHARACTERISTICS T_C = 25 °C unless otherwise noted

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS} = 0V, I_D = 250µA	40			V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 40V, V_{GS} = 0V			1	µA
Gate Body Leakage Current, Forward	I_{GSSF}	V_{GS} = 20V, V_{DS} = 0V			100	nA
Gate Body Leakage Current, Reverse	I_{GSSR}	V_{GS} = -20V, V_{DS} = 0V			-100	nA
On Characteristics [b]						
Gate Threshold Voltage	$V_{GS(th)}$	V_{GS} = V_{DS}, I_D = 250µA	2		4	V
Static Drain-Source On-Resistance	$R_{DS(on)}$	V_{GS} = 10V, I_D = 30A		1.8	2.3	mΩ
		V_{GS} = 9V, I_D = 30A		1.9	2.5	mΩ
Dynamic Characteristics [c]						
Input Capacitance	C_{iss}	V_{DS} = 15V, V_{GS} = 0V, f = 1.0 MHz		6120		pF
Output Capacitance	C_{oss}			1715		pF
Reverse Transfer Capacitance	C_{rss}			1330		pF
Switching Characteristics [c]						
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 15V, I_D = 15A, V_{GS} = 10V, R_{GEN} = 1Ω		44		ns
Turn-On Rise Time	t_r			35		ns
Turn-Off Delay Time	$t_{d(off)}$			79		ns
Turn-Off Fall Time	t_f			33		ns
Total Gate Charge	Q_g	V_{DS} = 15V, I_D = 50A, V_{GS} = 10V		235		nC
Gate-Source Charge	Q_{gs}			47		nC
Gate-Drain Charge	Q_{gd}			88		nC
Drain-Source Diode Characteristics and Maximun Ratings						
Drain-Source Diode Forward Current	I_S				138	A
Drain-Source Diode Forward Voltage [b]	V_{SD}	V_{GS} = 0V, I_S = 30A			1.2	V

Notes:

a.Repetitive Rating : Pulse width limited by maximum junction temperature.
b.Pulse Test : Pulse Width ≤ 300µs, Duty Cycle < 2%.
c.Guaranteed by design, not subject to production testing.
d.L = 1mH, I_{AS} = 39A, V_{DD} = 24V, R_G = 25Ω, Starting T_J = 25°C.

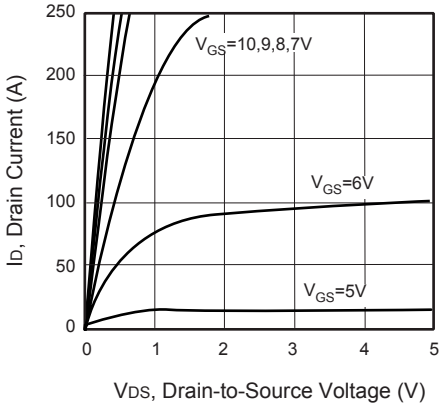


Figure 1. Output Characteristics

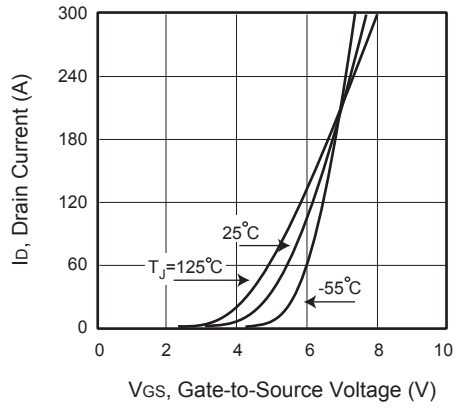


Figure 2. Transfer Characteristics

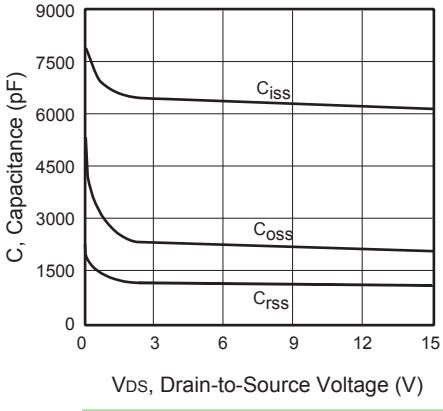


Figure 3. Capacitance

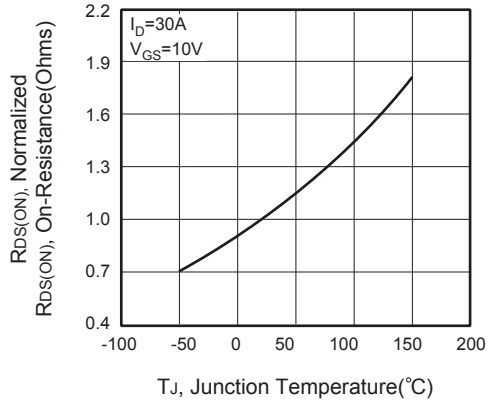


Figure 4. On-Resistance Variation with Temperature

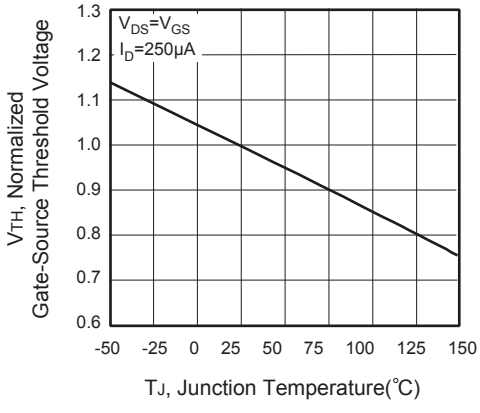


Figure 5. Gate Threshold Variation with Temperature

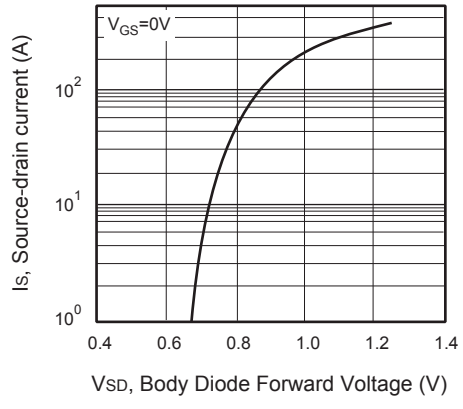


Figure 6. Body Diode Forward Voltage Variation with Source Current

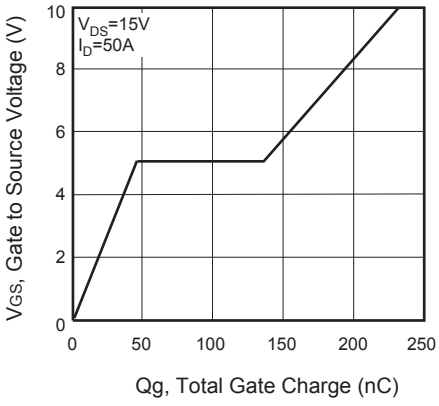


Figure 7. Gate Charge

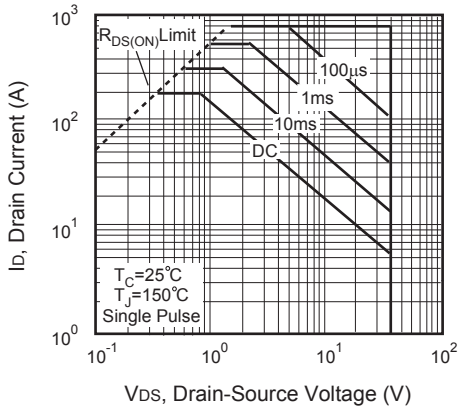


Figure 8. Maximum Safe Operating Area

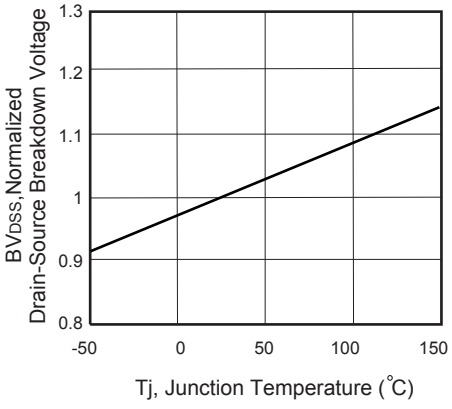


Figure 9. Breakdown Voltage Variation VS Temperature

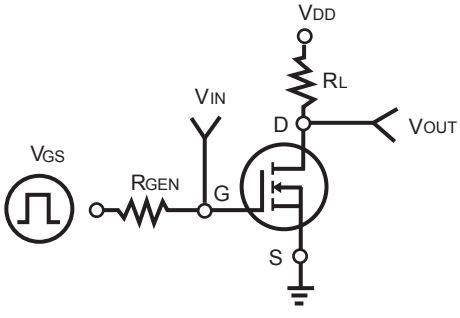


Figure 10. Switching Test Circuit

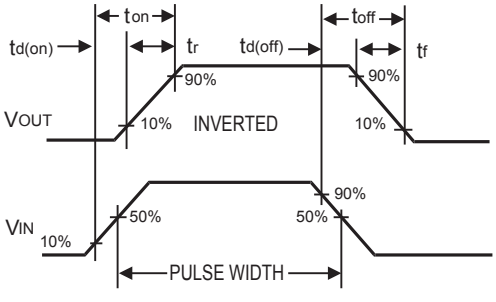


Figure 11. Switching Waveforms

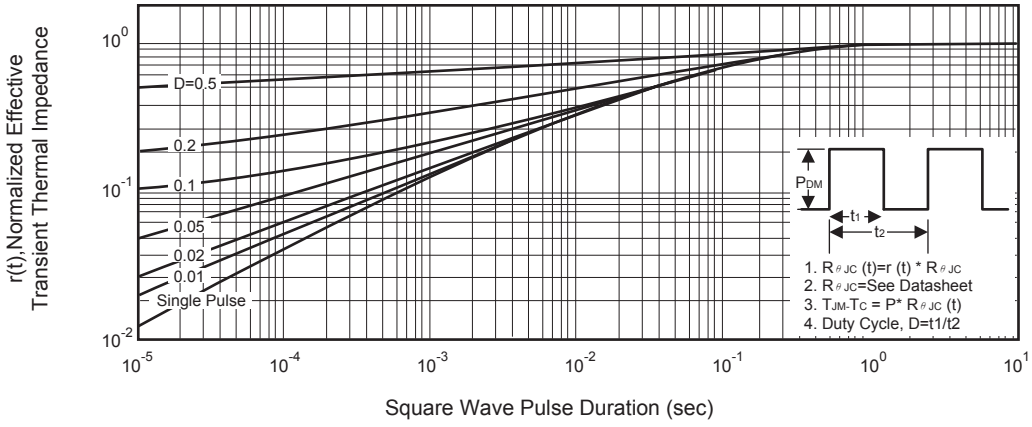
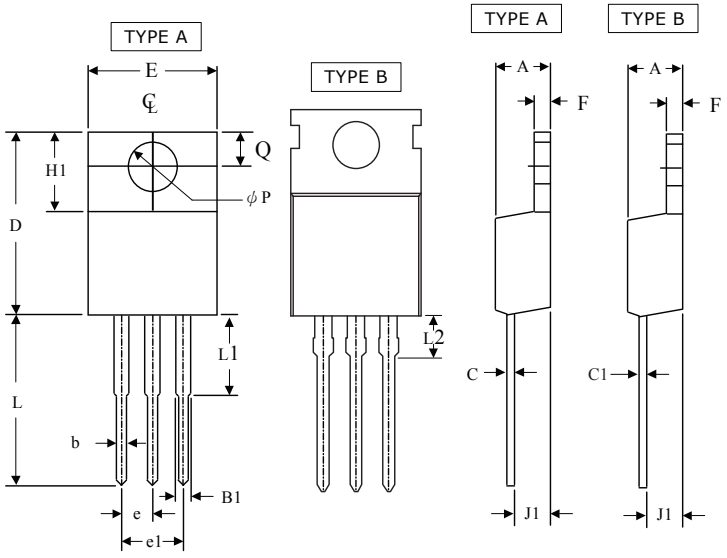


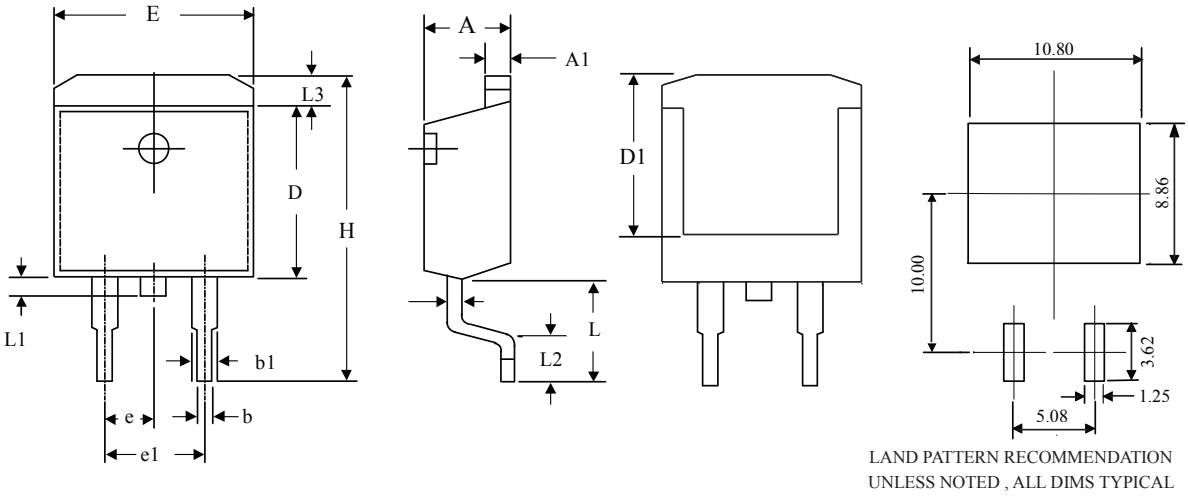
Figure 12. Normalized Thermal Transient Impedance Curve

TO-220 (PRODUCT OUTLINE DIMENSIONS)



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.320	4.826	0.170	0.190
B1	1.143	1.778	0.045	0.070
b	0.610	0.910	0.024	0.036
c	0.356	0.530	0.014	0.021
c1	0.45	0.61	0.018	0.024
D	14.224	16.510	0.560	0.650
E	9.652	10.668	0.380	0.420
e	2.540 BSC		0.100 BSC	
e1	5.080 BSC		0.200 BSC	
F	1.220	1.397	0.048	0.055
H1	5.842	6.858	0.230	0.270
J1	2.032	2.921	0.080	0.115
L	12.700	14.732	0.500	0.580
L1	3.400	4.000	0.134	0.150
L2	2.70	3.20	0.106	0.126
ϕ P	3.530	4.090	0.139	0.161
Q	2.540	3.429	0.100	0.135

TO-263 (PRODUCT OUTLINE DIMENSIONS)



LAND PATTERN RECOMMENDATION
UNLESS NOTED , ALL DIMS TYPICAL

SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.290	4.700	0.169	0.185
A1	1.220	1.40	0.048	0.055
b	0.690	0.940	0.027	0.037
b1	1.220	1.400	0.048	0.055
C	0.360	0.560	0.014	0.022
D	8.640	9.650	0.340	0.380
D1	6.600	-	0.260	-
E	9.700	10.540	0.382	0.415
e	2.290	2.790	0.090	0.110
e1	4.830	5.330	0.190	0.210
H	14.610	15.880	0.575	0.625
L	4.600	5.50	0.181	0.217
L1	0.960	1.780	0.038	0.070
L2	2.240	2.840	0.088	0.112
L3	1.400 MAX		0.055 MAX	