VBPB165R20S Datasheet

N-Channel 650V (D-S) Super Junction Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V) at T_J max.	650	
$R_{DS(on)}$ typ. (Ω) at 25 °C	V_{GS} = 10 V	0.161

FEATURES

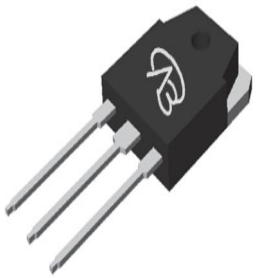
- Low figure-of-merit (FOM) R_{on} x Q_g
- Low input capacitance (C_{iss})
- Reduced switching and conduction losses
- Ultra low gate charge (Q_g)
- Avalanche energy rated (UIS)

RoHS COMPLIANT
HALOGEN FREE

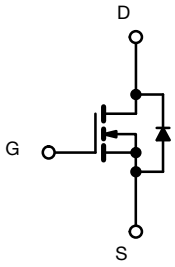
APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- Lighting
  - High-intensity discharge (HID)
  - Fluorescent ballast lighting
- Industrial
  - Welding
  - Induction heating
  - Motor drives
  - Battery chargers
  - Renewable energy
  - Solar (PV inverters)

TO-3P



TopView



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)					
PARAMETER			SYMBOL	LIMIT	UNIT
Drain-source voltage			V_{DS}	650	V
Gate-source voltage			V_{GS}	± 30	
Continuous drain current (T_J = 150 °C)	V_{GS} at 10 V	T_C = 25 °C	I_D	20	A
		T_C = 100 °C		12	
Pulsed drain current [a]			I_{DM}	60	
Linear derating factor				1.7	W/°C
Single pulse avalanche energy [b]			E_{AS}	390	MJ
Maximum power dissipation			P_D	170	W
Operating junction and storage temperature range			T_J, T_{stg}	-55 to +150	°C
Drain-source voltage slope	T_J = 125 °C		dV/dt	50	V/ns
Reverse diode dV/dt [d]				5.1	
Soldering recommendations (peak temperature) [c]	For 10 s			260	°C

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature
b. V_{DD} = 100 V, starting T_J = 25 °C, L = 30 mH, R_g = 25 Ω, I_{AS} = 8.0 A
c. 1.6 mm from case
d. $I_{SD} \leq I_D$, dI/dt = 100 A/μs, starting T_J = 25 °C

THERMAL RESISTANCE RATINGS				
PARAMETER	**SYMBOL**	**TYP.**	**MAX.**	**UNIT**
Maximum junction-to-ambient	R_{thJA}	-	62	°C/W
Maximum junction-to-case (drain)	R_{thJC}	-	0.65	

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static						
Drain-source breakdown voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA	650	-	-	V
V_{DS} temperature coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = 1 mA	-	1.08	-	V/°C
Gate-source threshold Voltage (N)	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	2.0	-	4.0	V
Gate-source leakage	I_{GSS}	V_{GS} = ± 20 V	-	-	± 100	nA
		V_{GS} = ± 30 V	-	-	± 1	µA
Zero gate voltage drain current	I_{DSS}	V_{DS} = 480 V, V_{GS} = 0 V	-	-	1	µA
		V_{DS} = 480 V, V_{GS} = 0 V, T_J = 125 °C	-	-	10	
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D =10A	-	0.161	-	Ω
Forward transconductance	g_{fs}	V_{DS} = 30 V, I_D = 6A	-	8.7	-	S
Dynamic						
Input capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 100 V, f = 1 MHz	-	2500	-	pF
Output capacitance	C_{oss}		-	81	-	
Reverse transfer capacitance	C_{rss}		-	9	-	
Effective output capacitance, energy related [a]	$C_{o(er)}$	V_{DS} = 0 V to 480 V, V_{GS} = 0 V	-	58	-	
Effective output capacitance, time related [b]	$C_{o(tr)}$		-	296	-	
Total gate charge	Q_g	V_{GS} = 10 V; I_D = 5 A, V_{DS} = 480 V	-	78	122	nC
Gate-source charge	Q_{gs}		-	16	-	
Gate-drain charge	Q_{gd}		-	20	-	
Turn-on delay time	$t_{d(on)}$	V_{DD} = 480 V, I_D = 5 A, V_{GS} = 10 V, R_g = 9.1 Ω	-	24	40	ns
Rise time	t_r		-	25	35	
Turn-off delay time	$t_{d(off)}$		-	28	32	
Fall time	t_f		-	25	30	
Gate input resistance	R_g	f = 1 MHz, open drain	0.3	0.7	1.4	Ω
Drain-Source Body Diode Characteristics						
Continuous source-drain diode current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	20	A
Pulsed diode forward current	I_{SM}		-	-	60	
Diode forward voltage	V_{SD}	T_J = 25 °C, I_S = 5 A, V_{GS} = 0 V	-	-	1.2	V
Reverse recovery time	t_{rr}	T_J = 25 °C, I_F = I_S = 5 A, dI/dt = 100 A/µs, V_R = 25 V	-	25	-	ns
Reverse recovery charge	Q_{rr}		-	6.4	12.8	µC
Reverse recovery current	I_{RRM}		-	27	-	A

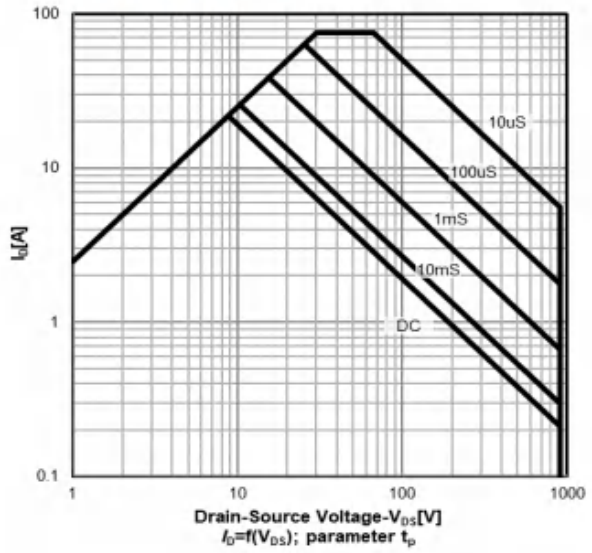
Notes

a. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS}

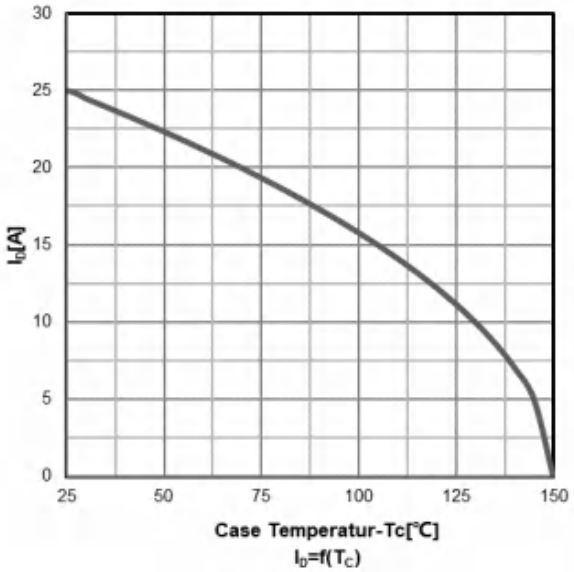
b. $C_{oss(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS}

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

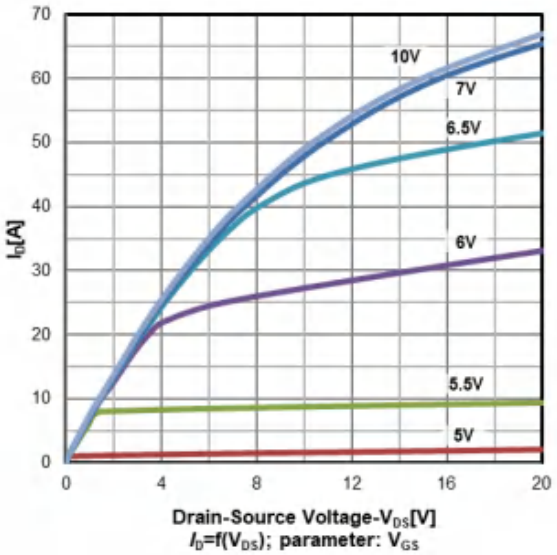
Safe operating area TC=25 ℃
Non FullPAK



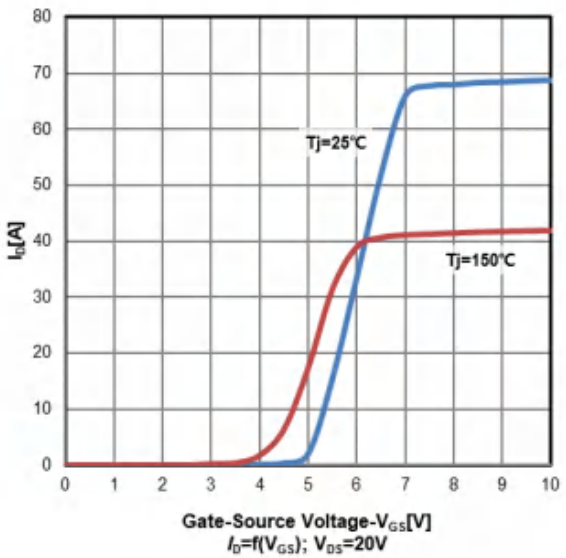
Drain current vs temperature



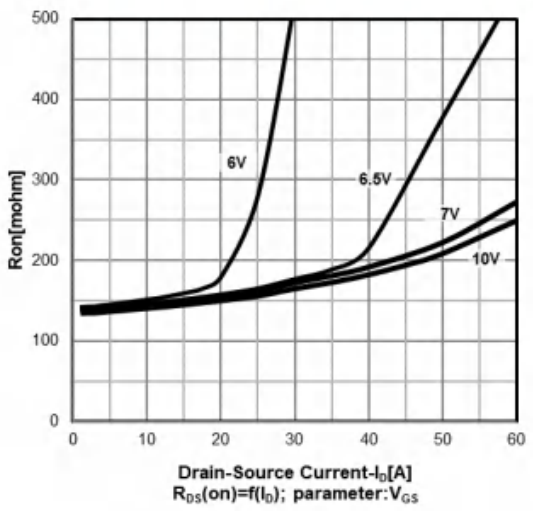
Typ. output characteristics T_j=25 ℃



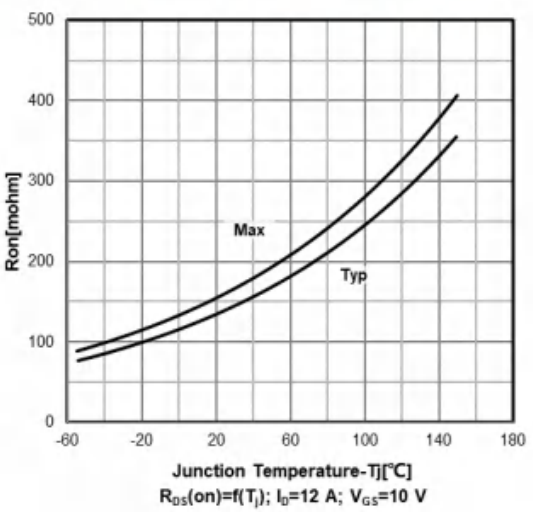
Typ. transfer characteristics



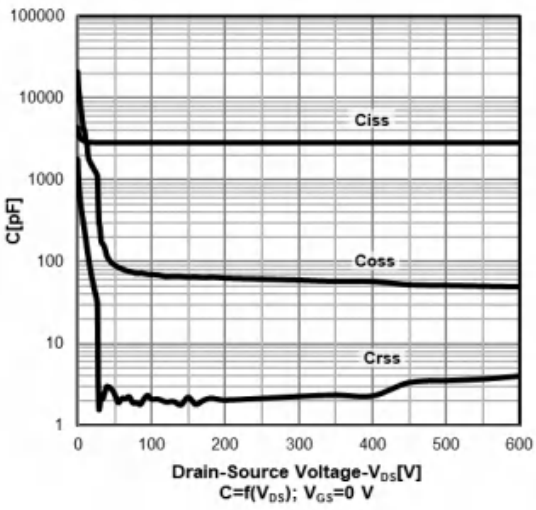
Typ. drain-source on-state resistance



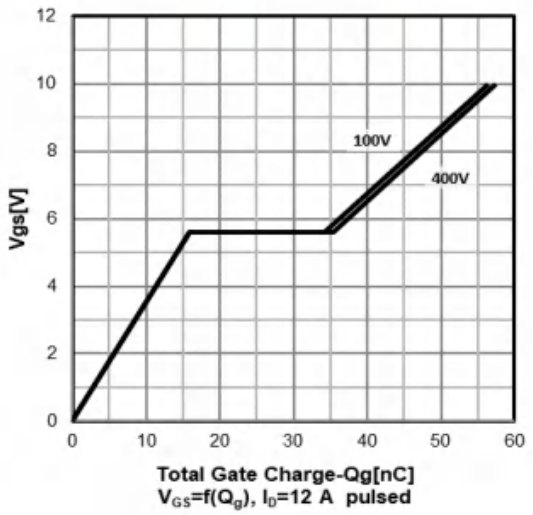
On resistance vs temperature



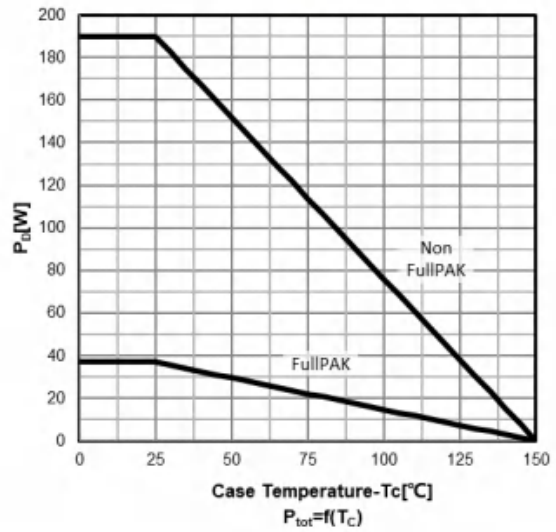
Typ. capacitances



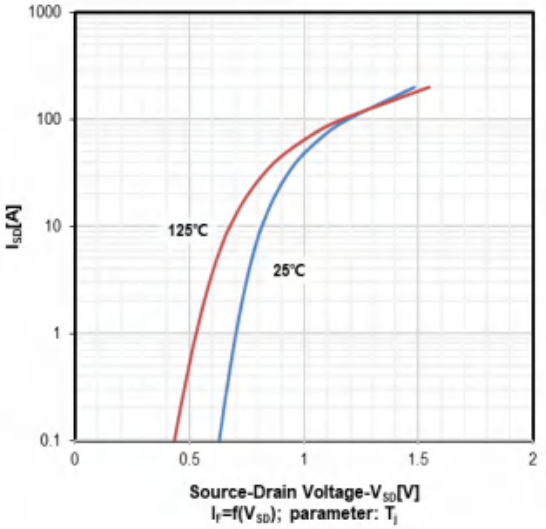
Typ. gate charge characteristics



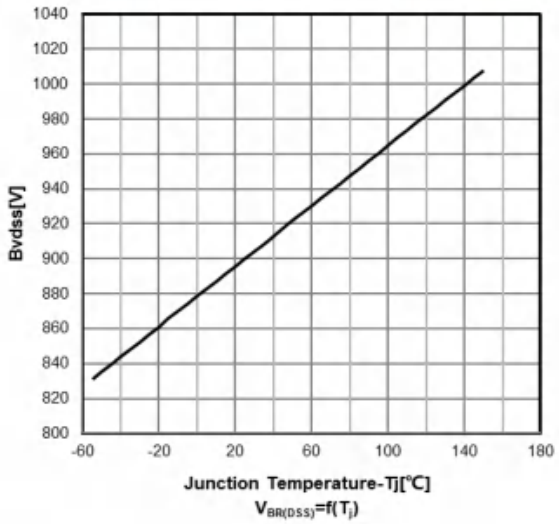
Power dissipation



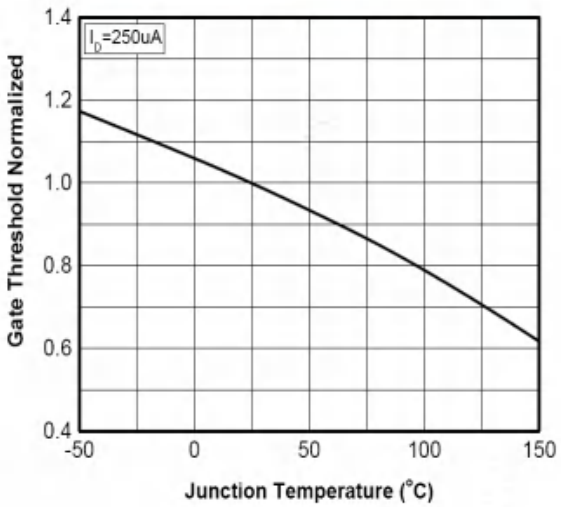
Forward characteristics of reverse diode



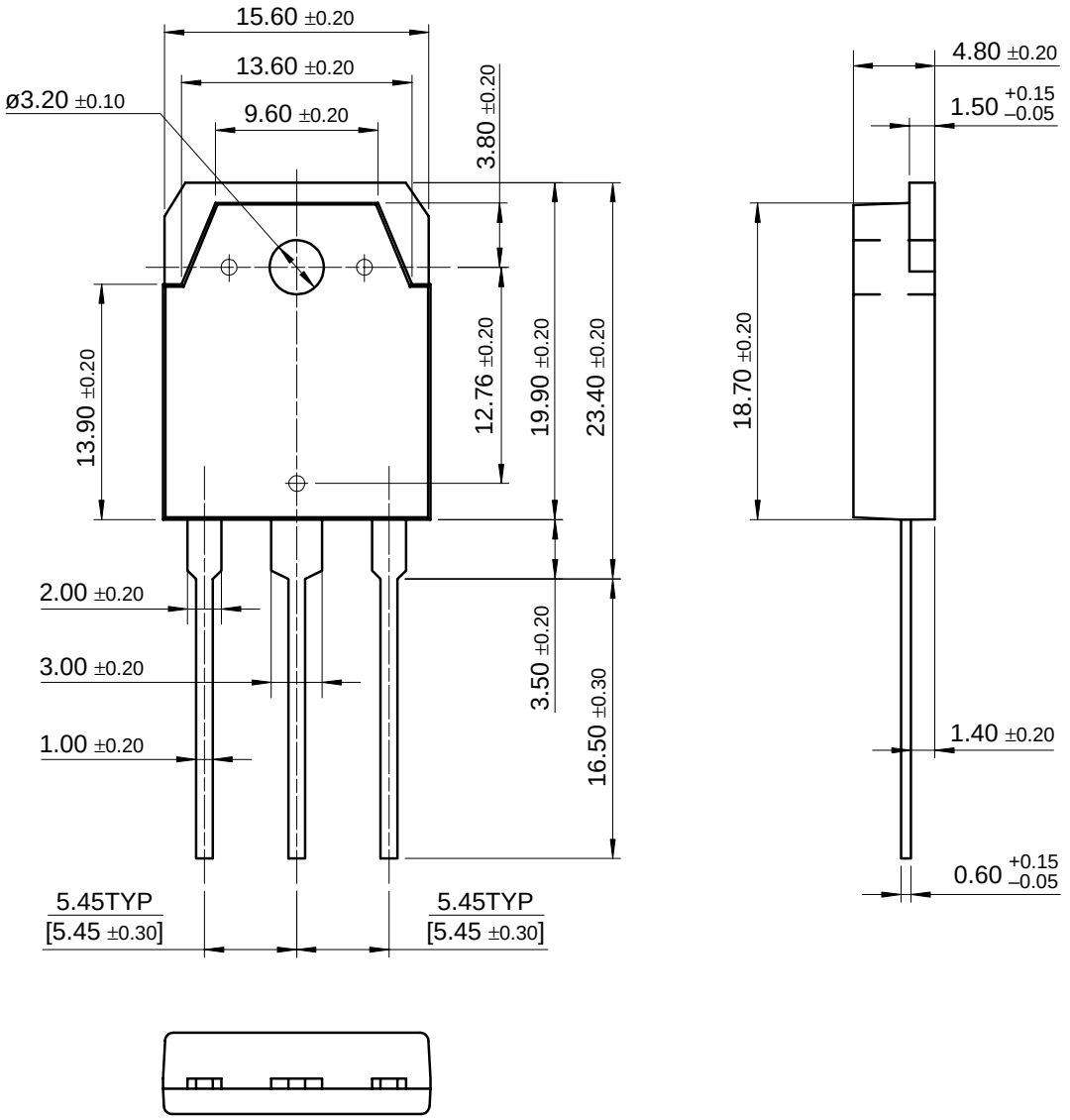
Drain-source breakdown voltage



Normalized $V_{GS(th)}$ characteristics



TO-3P


15.60 ±0.20
13.60 ±0.20
9.60 ±0.20
ø3.20 ±0.10
3.80 ±0.20
13.90 ±0.20
12.76 ±0.20
19.90 ±0.20
23.40 ±0.20
2.00 ±0.20
3.00 ±0.20
1.00 ±0.20
3.50 ±0.20
16.50 ±0.30
5.45TYP
[5.45 ±0.30]
5.45TYP
[5.45 ±0.30]
4.80 ±0.20
1.50 +0.15 –0.05
18.70 ±0.20
1.40 ±0.20
0.60 +0.15 –0.05

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