

VBE165R05S 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	1.0

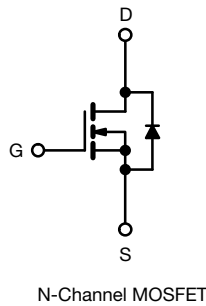
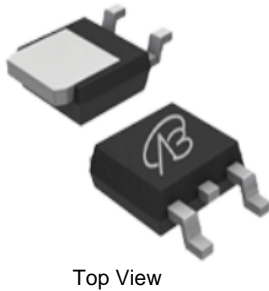
FEATURES

- 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

TO-252



APPLICATIONS

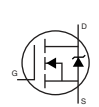
- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- Lighting
 - High-intensity discharge (HID)
 - Fluorescent ballast lighting
- Industrial
 - Welding
 - Induction heating
 - Motor drives
 - Battery chargers
 - Renewable energy
 - Solar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

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	A
		T _C = 100 °C	
Pulsed drain current ^a	I _{DM}	15	
Linear derating factor		1.7	W/°C
Single pulse avalanche energy ^b	E _{AS}	390	mJ
Maximum power dissipation	P _D	180	W
Operating junction and storage temperature range	T _J , T _{stg}	-55 to +150	°C
Drain-source voltage slope	dV/dt	T _J = 125 °C	V/ns
Reverse diode dV/dt ^d		5.1	
Soldering recommendations (peak temperature) ^c	For 10 s	260	°C

Notes

- Repetitive rating; pulse width limited by maximum junction temperature
- V_{DD} = 100 V, starting T_J = 25 °C, L = 30 mH, R_g = 25 Ω, I_{AS} = 2 A
- 1.6 mm from case
- I_{SD} ≤ I_D, dI/dt = 100 A/μs, starting T_J = 25 °C

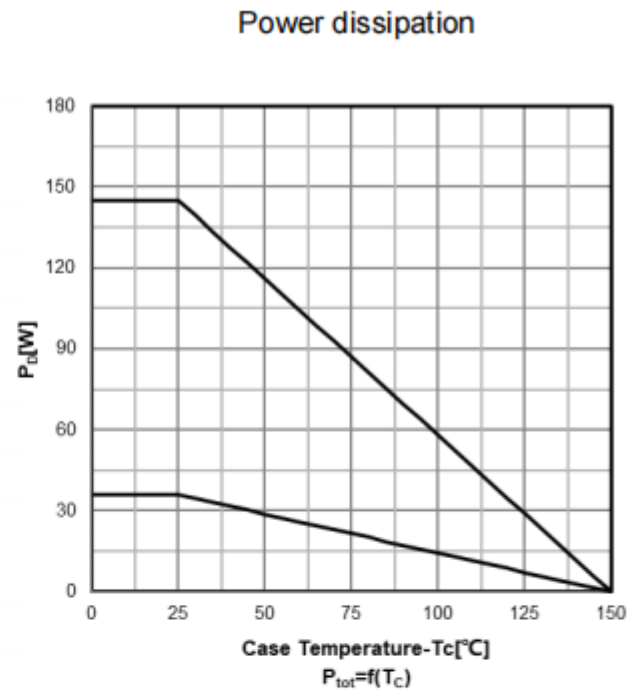
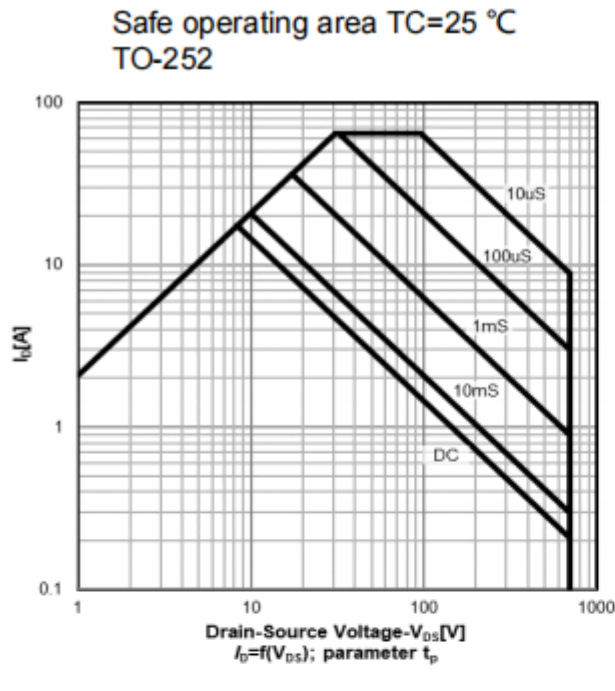
THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient	R_{thJA}	-	62	°C/W
Maximum junction-to-case (drain)	R_{thJC}	-	0.85	

SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-source breakdown voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		650	-	-	V
V_{DS} temperature coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$		-	1.08	-	V/°C
Gate-source threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		2.0	-	4.0	V
Gate-source leakage	I_{GSS}	$V_{GS} = \pm 20\text{ V}$		-	-	± 100	nA
		$V_{GS} = \pm 30\text{ V}$		-	-	± 1	μA
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$		-	-	1	μA
		$V_{DS} = 520\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	10	
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 1.5\text{ A}$	-	1.0	-	Ω
Forward transconductance	g_{fs}	$V_{DS} = 30\text{ V}, I_D = 5\text{ A}$		-	8.7	-	S
Dynamic							
Input capacitance	C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = 100\text{ V}, f = 1\text{ MHz}$		-	1100	-	pF
Output capacitance	C_{oss}			-	51	-	
Reverse transfer capacitance	C_{rss}			-	12	-	
Effective output capacitance, energy related ^a	$C_{o(er)}$			-	52	-	
Effective output capacitance, time related ^b	$C_{o(tr)}$	$V_{DS} = 0\text{ V to } 480\text{ V}, V_{GS} = 0\text{ V}$		-	205	-	
Total gate charge	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 5\text{ A}, V_{DS} = 480\text{ V}$	-	25	-	nC
Gate-source charge	Q_{gs}			-	8	-	
Gate-drain charge	Q_{gd}			-	10	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 480\text{ V}, I_D = 5\text{ A}, V_{GS} = 10\text{ V}, R_g = 9.1\text{ }\Omega$		-	12	24	ns
Rise time	t_r			-	14	23	
Turn-off delay time	$t_{d(off)}$			-	61	110	
Fall time	t_f			-	16	-	
Gate input resistance	R_g			$f = 1\text{ MHz}, \text{open drain}$		0.3	
Drain-Source Body Diode Characteristics							
Continuous source-drain diode current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	5	A
Pulsed diode forward current	I_{SM}			-	-	15	
Diode forward voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 5\text{ A}, V_{GS} = 0\text{ V}$		-	-	1.2	V
Reverse recovery time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = I_S = 5\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_R = 25\text{ V}$		-	416	832	ns
Reverse recovery charge	Q_{rr}			-	6.4	12.8	μC
Reverse recovery current	I_{RRM}			-	27	-	A

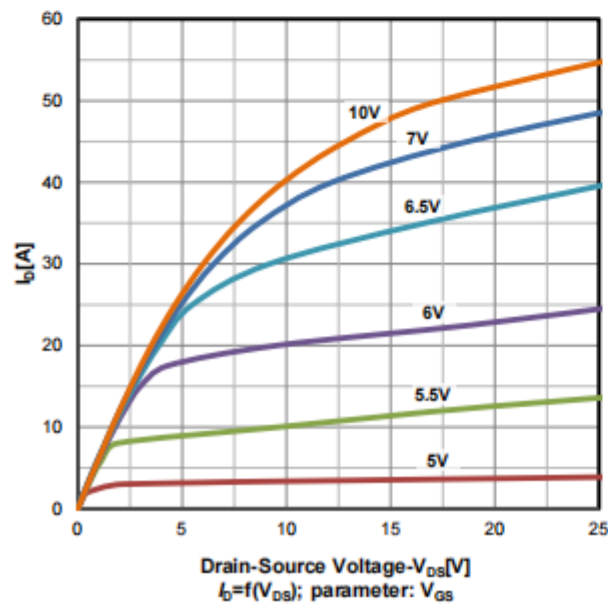
Notes

- 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}

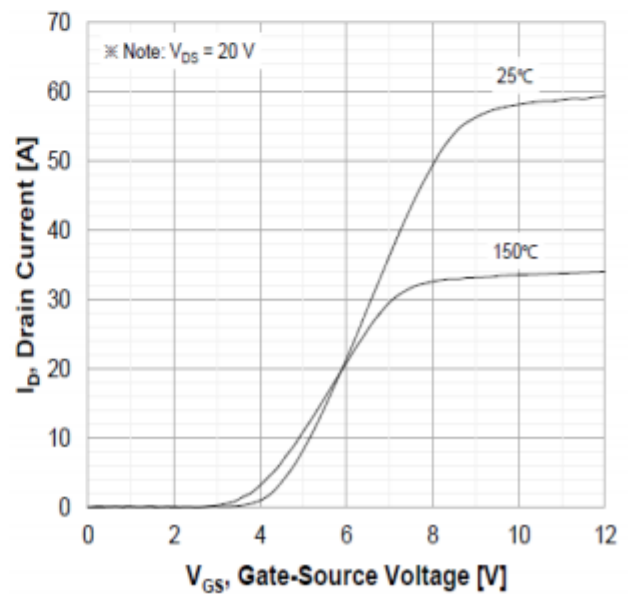
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



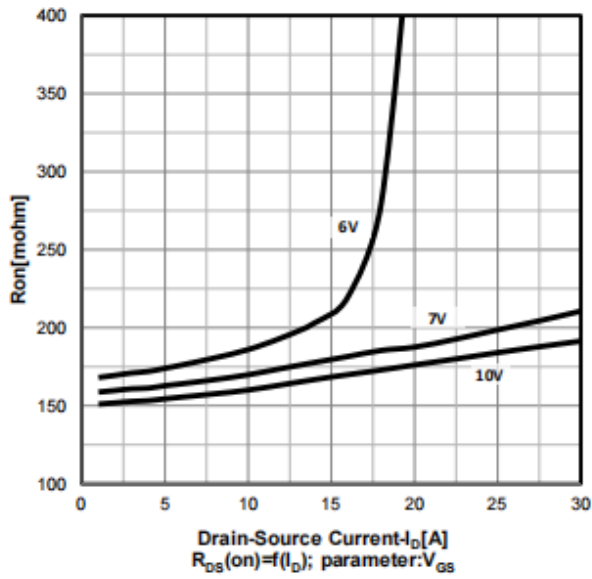
Typ. output characteristics $T_J = 25\text{ }^\circ\text{C}$



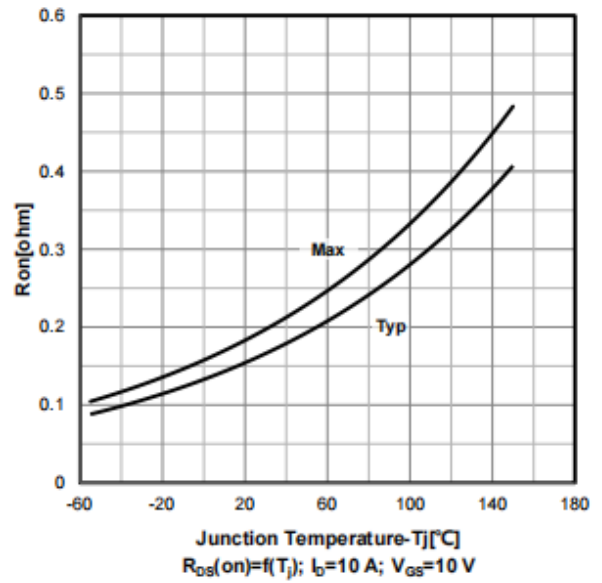
Transfer characteristics



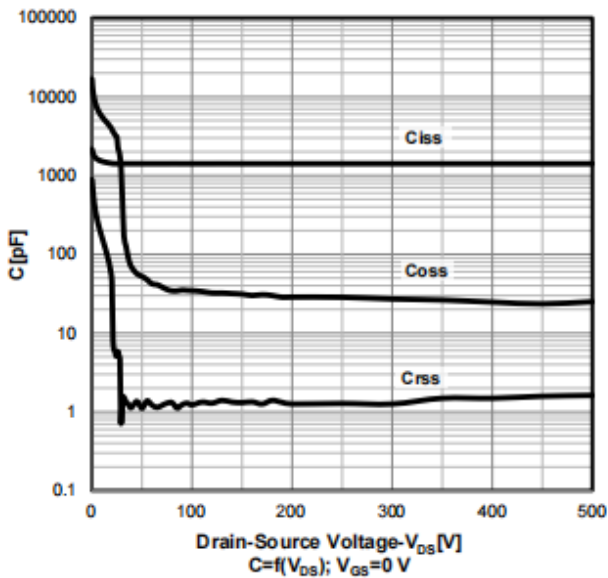
Typ. drain-source on-state resistance



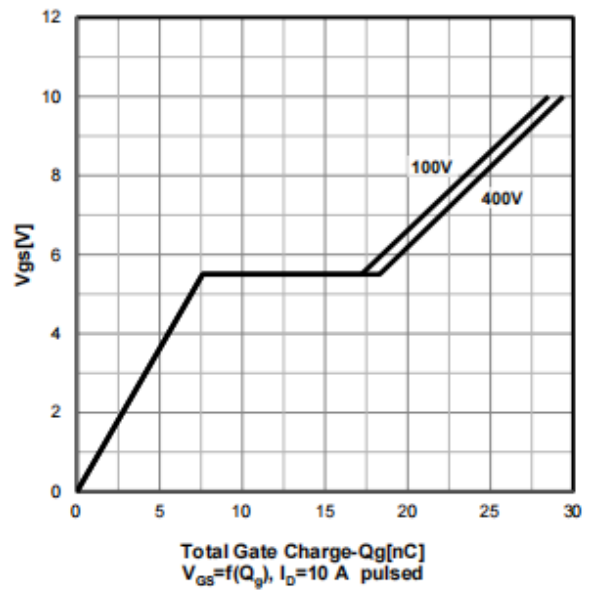
On-resistance vs temperature



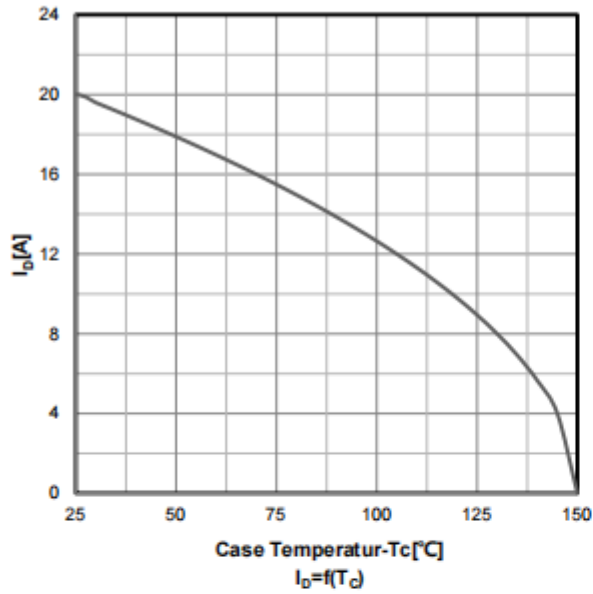
Typ. capacitances



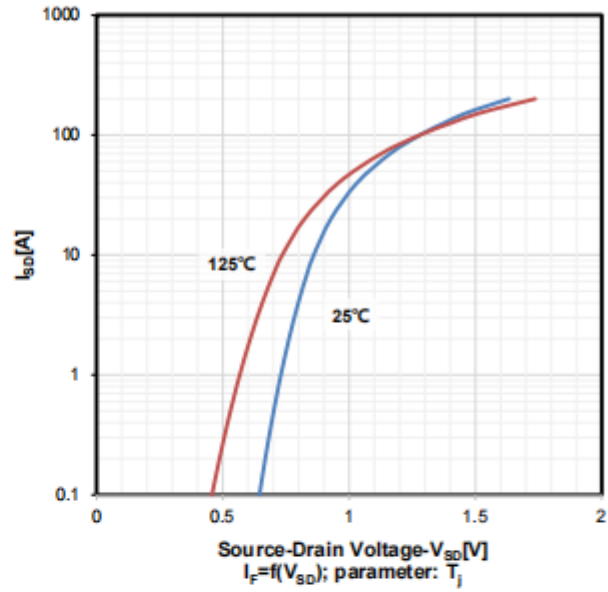
Typ. gate charge characteristics



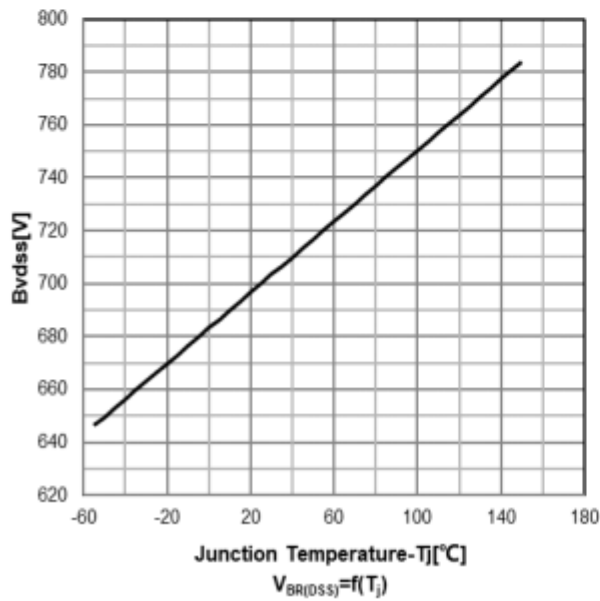
Drain current vs temperature



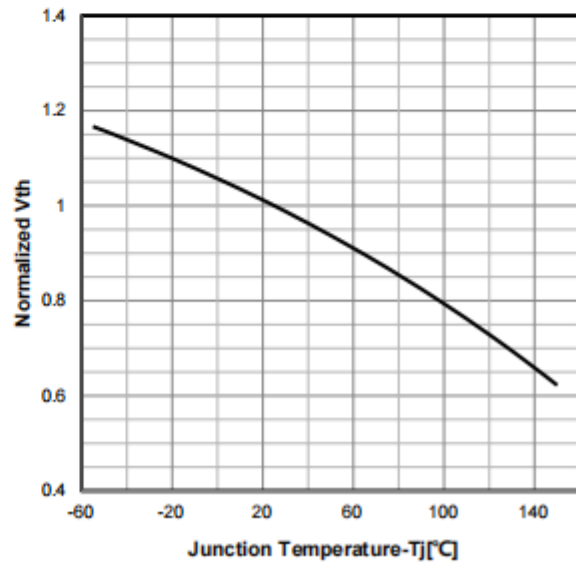
Forward characteristics of reverse diode



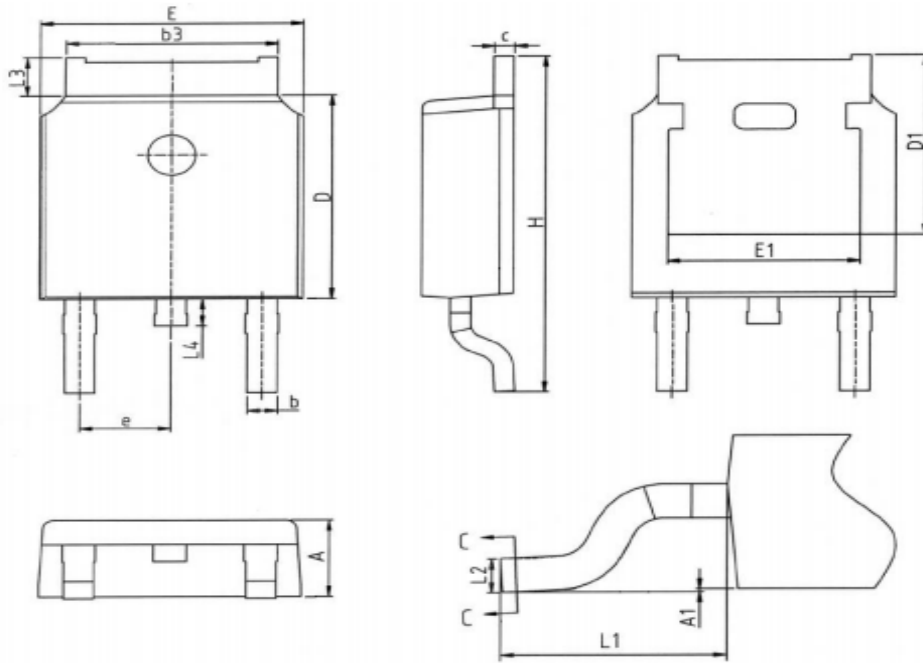
Drain-source breakdown voltage



Normalized $V_{GS(th)}$ characteristics



Package Outline : TO 252



COMMON DIMENSIONS

SYMBOL	UNIT(mm)		
	MIN	NOM	MAX
A	2.20	2.30	2.40
A1	0.00	-	0.127
b	0.66	0.78	0.90
b3	5.16	5.31	5.46
c	0.43	0.53	0.63
D	5.98	6.10	6.22
D1	5.30REF		
E	6.40	6.60	6.75
E1	4.63	-	-
e	2.286BSC		
H	9.40	10.10	10.50
L1	2.90REF		
L2	0.51BSC		
L3	0.88	1.08	1.28
L4	0.50	0.80	1.00

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