BC25SG65SWS

N-Channel Silicon Carbide Power MOSFET

650 V, 83.3A, 25 mΩ

bestirpower

Features

- High switching speed with a low gate charge
- Fast intrinsic diode with low reverse recovery
- Robust Avalanche Capability
- 100% Avalanche Tested
- Halogen Free, and RoHS Compliant

$BV_{DSS, Tc=25℃}$	$I_{D, Tc=25℃}$	$R_{DS(on),typ}$	$Q_{g,typ}$
650 V	83.3 A	25 mΩ	124 nC

Benefits

- System efficiency improvement
- Higher frequency applicability
- Increased power density
- Reduced cooling effort
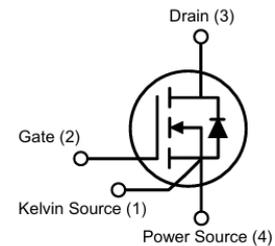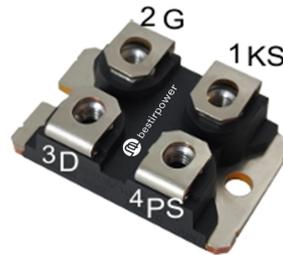
Applications

- Solar inverter / ESS / UPS
- EV charging station
- Server & Telecom power
- Industrial power supply

Absolute Maximum Ratings (T_J = 25℃ unless otherwise noted)

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		650	V
V_{GS}	Gate to Source Voltage (DC)		-13 / +22	V
V_{GSop}	Recommended Operation Value		-5 / +18	V
I_D	Drain Current	V_{GS} = 18 V(T_C = 25℃)	83.3	A
		V_{GS} = 18 V (T_C = 100℃)	58.9	
I_{DM}	Drain Current	Pulsed (Note1)	350	A
P_D	Power Dissipation	(T_C = 25℃)	375	W
		Derate Above 25℃	2.5	W/℃
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to 175	℃

※Note 1 : Limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{θJC}$	Thermal Resistance, Junction to Case, Max.	0.40	℃/W
$R_{θJA}$	Thermal Resistance, Junction to Ambient, Max.	27.55	
T_{sold}	Soldering temperature, wave soldering only allowed at leads	260	℃

Electrical Characteristics (T$_J$= 25℃ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV$_{DSS}$	Drain to Source Breakdown Voltage	V$_{GS}$ = 0 V, I$_D$ = 100 uA	650	-	-	V
I$_{DSS}$	Zero Gate Voltage Drain Current	V$_{DS}$ = 650 V, V$_{GS}$ = 0 V	-	-	100	µA
		V$_{DS}$ = 650 V, V$_{GS}$ = 0 V, T$_J$ = 175℃	-	-	3	mA
I$_{GSS}$	Gate-Source Leakage Current	V$_{GS}$ = +20 V, V$_{DS}$ = 0 V	-	-	+200	nA
		V$_{GS}$ = -10 V, V$_{DS}$ = 0 V	-	-	-200	
On Characteristics						
V$_{GS(th)}$	Gate Threshold Voltage	V$_{GS}$ = V$_{DS}$, I$_D$ = 10 mA	1.6	2.6	3.6	V
R$_{DS(on)}$	Static Drain to Source On Resistance	V$_{GS}$ = 18 V, I$_D$ = 20 A	-	25	30	mΩ
		V$_{GS}$ = 18 V, I$_D$ = 20 A, T$_J$ = 175℃	-	45	54	
g$_{fs}$	Transconductance	V$_{DS}$ = 20 V, I$_D$ = 20 A	-	13	-	S
Dynamic Characteristics						
C$_{iss}$	Input Capacitance	V$_{DS}$ = 400 V, V$_{GS}$ = 0V, f = 1 MHz	-	2900	-	pF
C$_{oss}$	Output Capacitance		-	185	-	
C$_{rss}$	Reverse Capacitance		-	10.1	-	
E$_{oss}$	Stored Energy in Output Capacitance	V$_{DS}$ = 0 V to 400 V, V$_{GS}$ = 0 V	-	230	-	µJ
C$_{o(er)}$	Energy Related Output Capacitance		-	2875	-	pF
C$_{o(tr)}$	Time Related Output Capacitance		-	2870	-	
Q$_{g(tot)}$	Total Gate Charge	V$_{DS}$ = 400 V, I$_D$ = 20 A, V$_{GS}$ = -5 V / 18 V, Inductive load	-	124	-	nC
Q$_{gs}$	Gate to Source Charge		-	30	-	
Q$_{gd}$	Gate to Drain "Miller" Charge		-	20	-	
R$_G$	Internal Gate Resistance	f = 1MHz, V$_{AC}$=25mV open drain	-	1.5	-	Ω
Switching Characteristics						
t$_{d(on)}$	Turn-On Delay Time	V$_{DS}$ = 400 V, I$_D$ = 20 A, V$_{GS}$ = -5 V / 18 V, R$_G$ = 5 Ω, FWD : body diode at V$_{GS}$=-5V, Inductive load	-	20	-	ns
t$_r$	Turn-On Rise Time		-	45	-	
t$_{d(off)}$	Turn-Off Delay Time		-	18	-	
t$_f$	Turn-Off Fall Time		-	10	-	
E$_{on}$	Turn-on Switching Energy		-	170	-	uJ
E$_{off}$	Turn-off Switching Energy		-	90	-	
E$_{tot}$	Total Switching Energy		-	260	-	
Source-Drain Diode Characteristics						
I$_S$	Maximum Continuous Diode Forward Current		-	-	83.3	A
I$_{SM}$	Maximum Pulsed Diode Forward Current		-	-	350	
V$_{SD}$	Diode Forward Voltage	V$_{GS}$ = -5 V, I$_{SD}$ = 15 A	-	3.2	-	V
t$_{rr}$	Reverse Recovery Time	V$_{DD}$ = 400 V, I$_{SD}$ = 15 A, dI$_F$/dt = 1200 A/µs, Includes Q$_{OSS}$	-	32	-	ns
Q$_{rr}$	Reverse Recovery Charge		-	123	-	nC
I$_{rrm}$	Peak Reverse Recovery Current		-	10	-	A

Typical Performance Characteristics

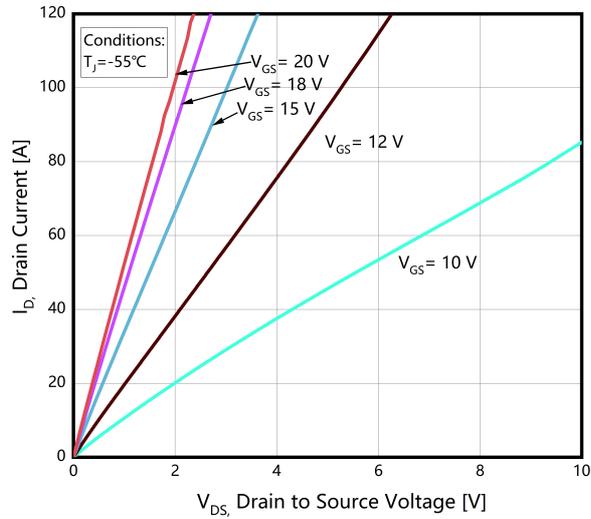## Figure 1. On-Region Characteristics T_J = -55℃

Conditions:
T_J=-55℃

V_{GS}= 20 V
V_{GS}= 18 V
V_{GS}= 15 V
V_{GS}= 12 V
V_{GS}= 10 V

I_D, Drain Current [A]
V_{DS}, Drain to Source Voltage [V]

Figure 2. On-Region Characteristics T_J = 25℃

Conditions:
T_J=25℃

V_{GS}= 20 V
V_{GS}= 18 V
V_{GS}= 15 V
V_{GS}= 12 V
V_{GS}= 10 V

I_D, Drain Current [A]
V_{DS}, Drain to Source Voltage [V]
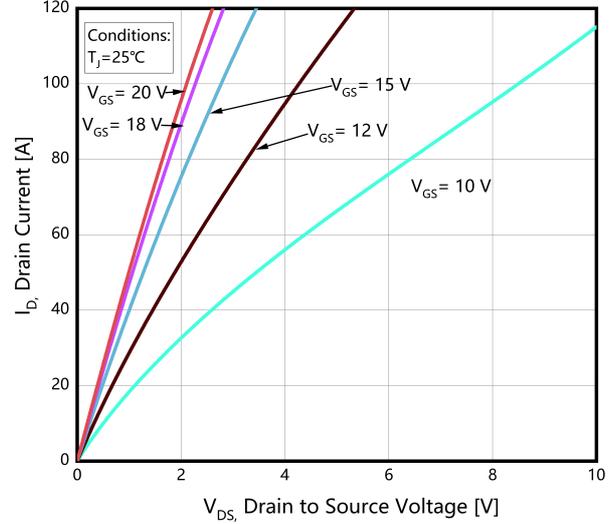
Figure 3. On-Region Characteristics T_J = 175℃

Conditions:
T_J=175℃

V_{GS}= 20 V
V_{GS}= 18 V
V_{GS}= 15 V
V_{GS}= 12 V
V_{GS}= 10 V

I_D, Drain Current [A]
V_{DS}, Drain to Source Voltage [V]
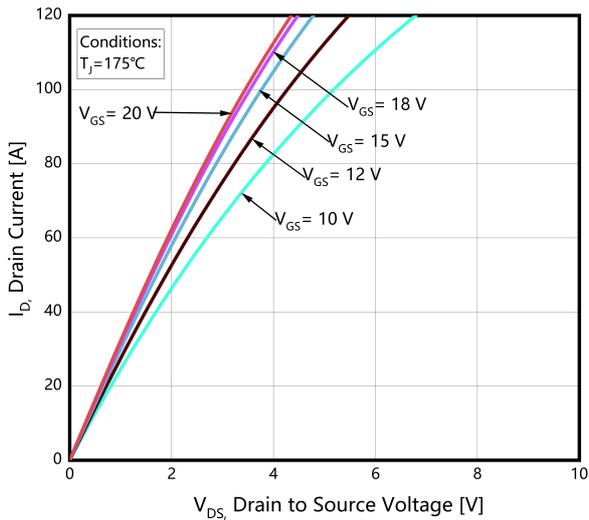
Figure 4. On-Resistance Characteristics vs. Temperature

V_{GS}= 15 V
V_{GS}= 18 V

$R_{DS(ON)}$, ON-Resistance [mΩ]
T_J, Junction Temperature [℃]
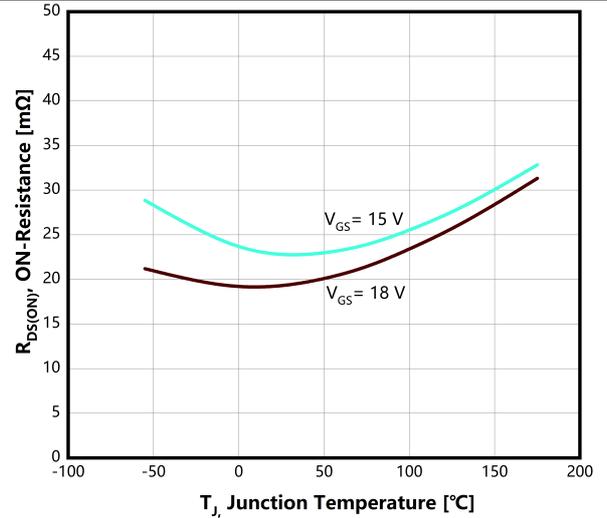
Figure 5. Transfer Characteristics

Conditions:
V_{DS}= 20 V

T_J= -55 ℃
T_J= 25 ℃
T_J= 175 ℃

I_{DS}, Drain-Source Current[A]
V_{GS} , Gate-Source Voltage[V]
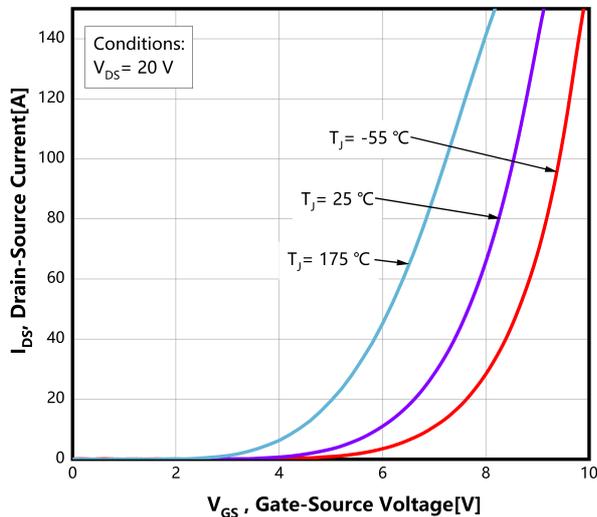
Figure 6. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = -55℃

V_{GS}= 18 V
V_{GS}= 0 V
V_{GS}= -5 V

I_S, Reverse Drain Current [A]
V_{SD}, Body Diode Forward Voltage [V]
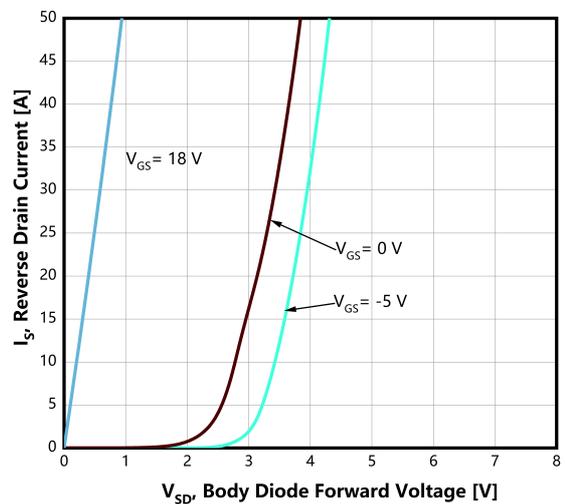
Typical Performance Characteristics

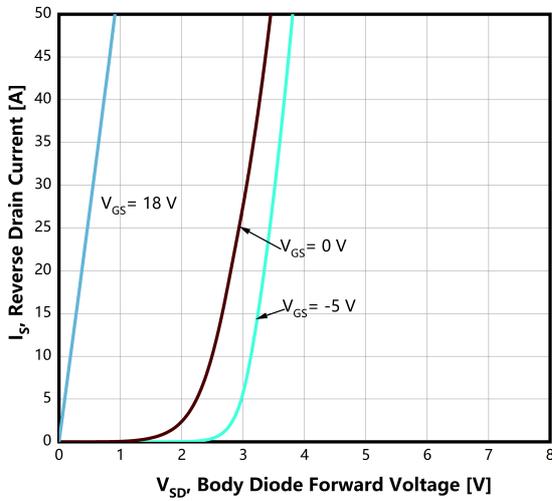### Figure 7. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = 25℃

Y-axis: I_S, Reverse Drain Current [A]
X-axis: V_{SD}, Body Diode Forward Voltage [V]

V_{GS} = 18 V
V_{GS} = 0 V
V_{GS} = -5 V

Figure 8. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = 175℃

Y-axis: I_S, Reverse Drain Current [A]
X-axis: V_{SD}, Body Diode Forward Voltage [V]

V_{GS} = 18 V
V_{GS} = 0 V
V_{GS} = -5 V
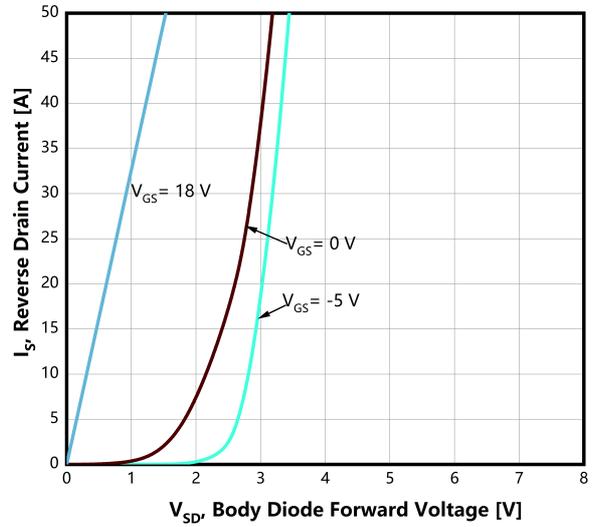
Figure 9. Threshold Voltage vs. Temperature

Y-axis: $V_{GS(th)}$, Threshold Voltage [V]
X-axis: T_J, Junction Temperature [℃]

Conditions:
V_{GS} = V_{DS}
I_D = 10 mA
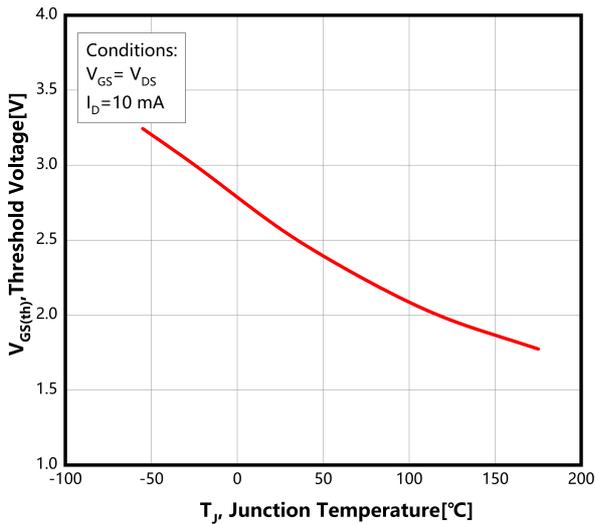
Figure 10. Gate Charge Characteristics

Y-axis: V_{GS}, Gate-Source Voltage [V]
X-axis: Q_g, Total Gate Charge [nC]

Conditions:
V_{GS} = 400 V
I_D = 20 A
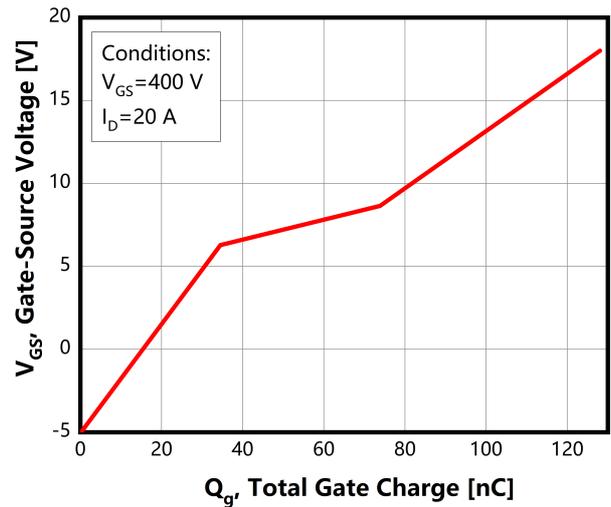
Figure 11. Stored Energy in Output Capacitance

Y-axis: E_{OSS}, Stored Energy [uJ]
X-axis: V_{DS}, Drain to Source Voltage [V]
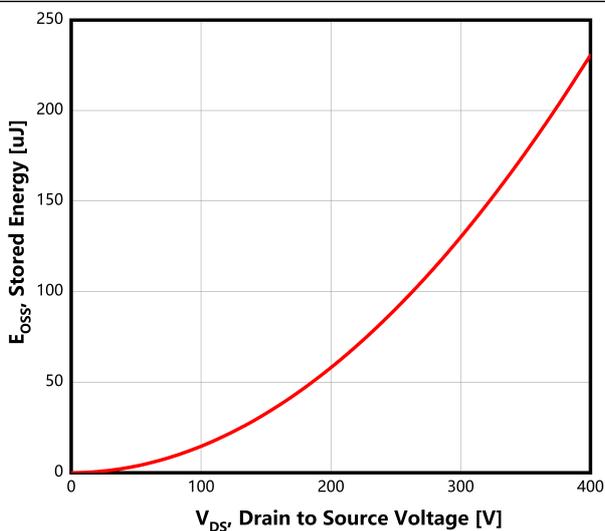
Figure 12. Capacitance Characteristics

Y-axis: Capacitance (pF)
X-axis: Drain-source voltage V_{DS} (V)

Ciss
Coss
Crss

f=1MHZ,
V_{GS} = 0V
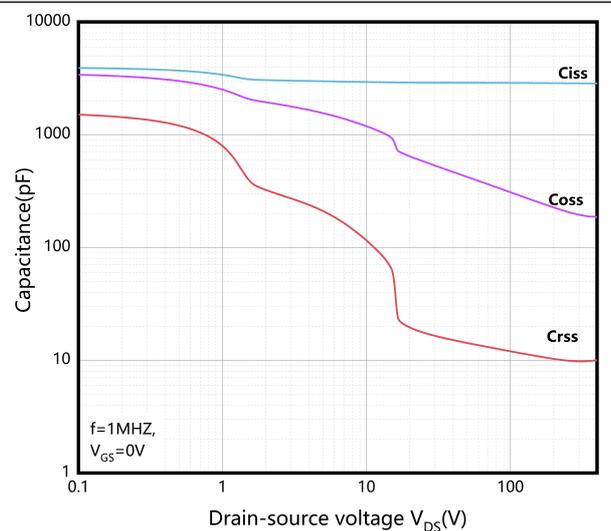
Typical Performance Characteristics

Figure 13. Maximum Power Dissipation Derating vs. Case Temperature

P_D, Power Dissipation [W] vs T_C, Case Temperature [°C]
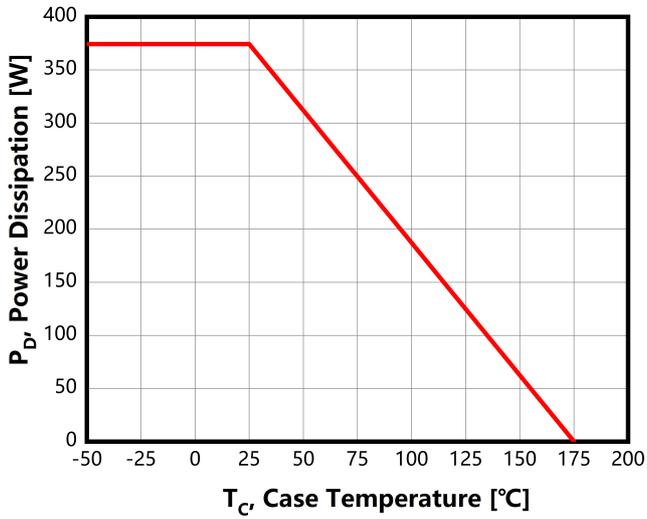
Figure 14. Maximum Safe Operating Area

I_D, Drain Current [A] vs V_{DS}, Drain-Source Voltage [V]

10 us
100 us
1 ms
10 ms
DC
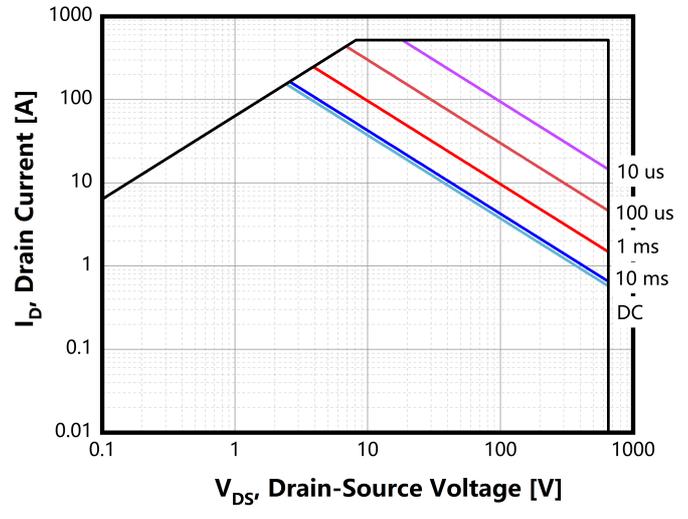
Figure 15. Transient Thermal Response Curve

Normalized $Z_{\theta JC}$ [°C/W] vs t_p, Rectangular Pulse Duration [sec]

D=0.5
D=0.2
D=0.1
D=0.05
D=0.02
D=0.01
Single Pulse
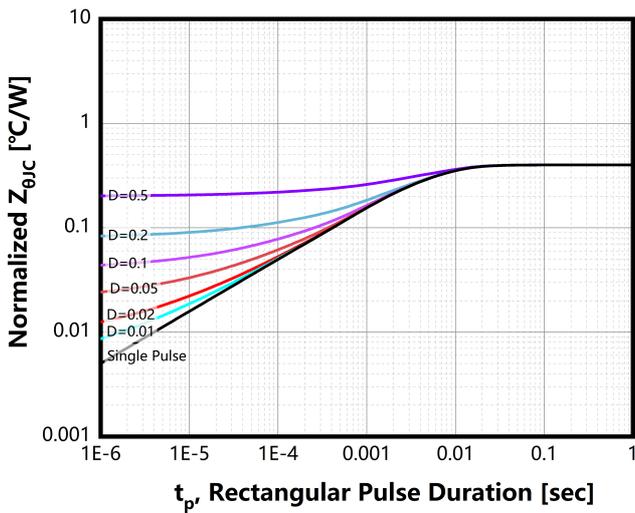
Typical Performance Characteristics

Figure 16. Inductive Load Switching Test Circuit and Waveforms
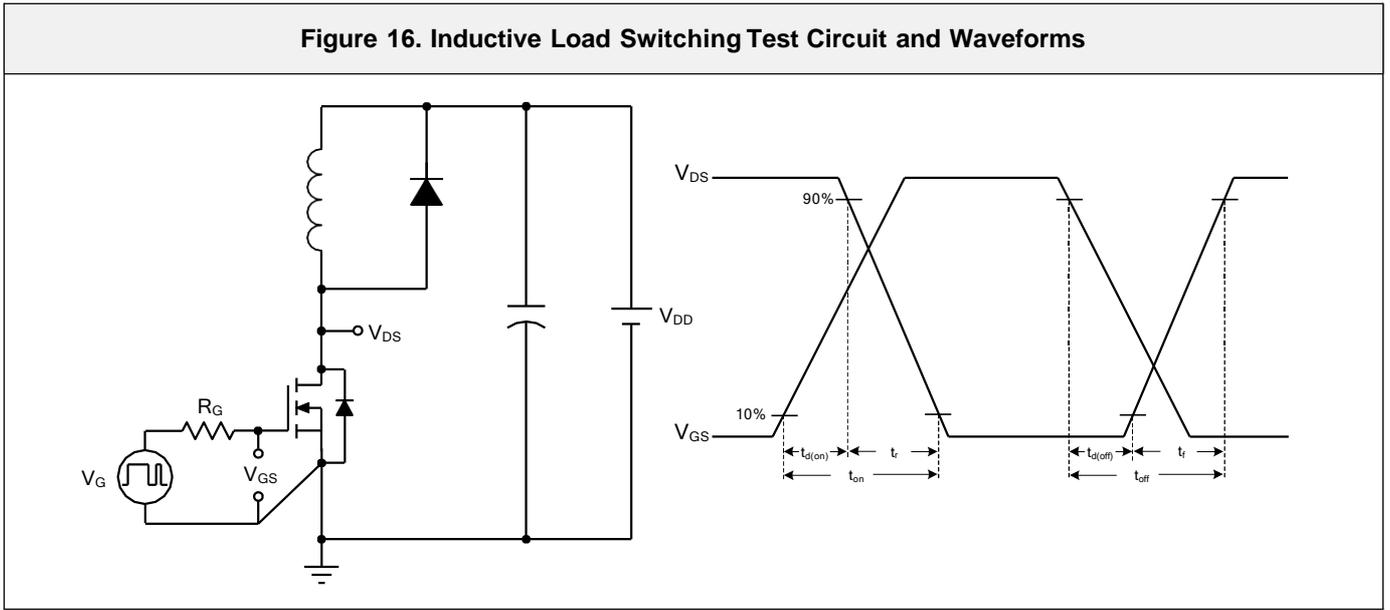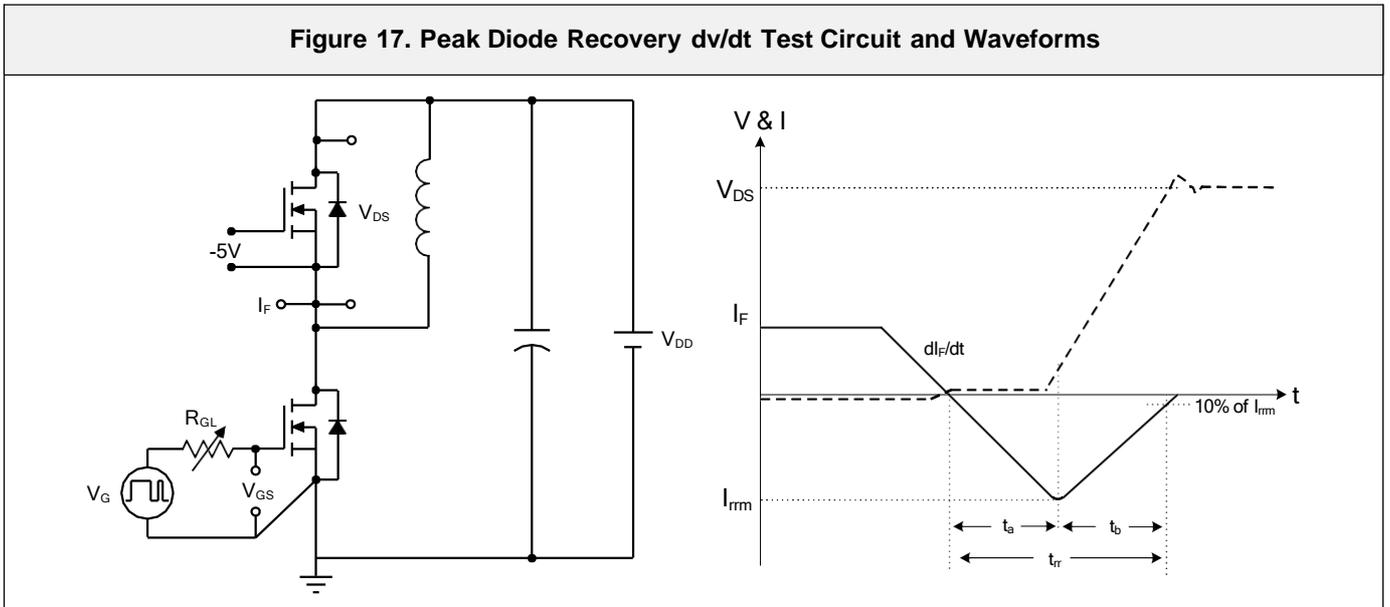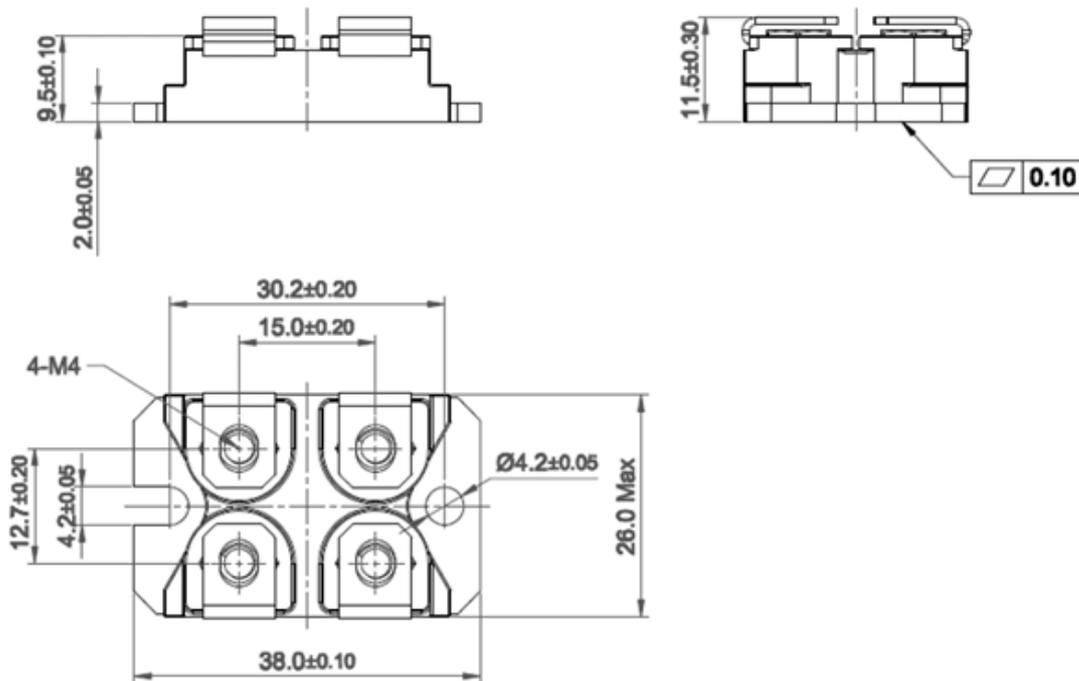

Figure 17. Peak Diode Recovery dv/dt Test Circuit and Waveforms

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Package Outlines

SOT-227

Package Drawing and Dimensions（UNIT：mm）

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
BC25SG65SWS	BC25SG65SWS	SOT-227	Tube	10 units

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