Features

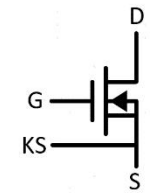
- Easy to use, compatible with standard gate drivers
- Excellent Q_G x $R_{DS(on)}$ figure of merit (FOM)
- Low Q_{RR}, no free-wheeling diode required
- Low switching loss
- RoHS compliant and Halogen-free
- Qualified according to JEDEC criteria

Product Summary		
V_{DSS}	650	V
$R_{DS(on),typ}$	50	mΩ
$Q_{G,typ}$	25	nC
$Q_{RR,typ}$	138	nC

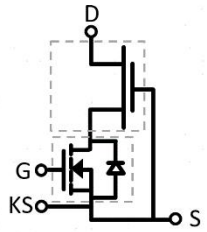
Applications

- High efficiency power supplies
- Telecom and datacom
- Automotive
- Servo motors





Schematic Symbol



Cascode
Device Structure

Packaging

Part Number	Marking	Package	Packaging	Base QTY
CRNQB050C65H	CRNQB050C65H	TO-247-4B	Tube	25

Maximum ratings, at T_C=25°C, unless otherwise specified

Symbol	Parameter		Limit Value	Unit
I_D	Continuous drain current @T_C=25°C		46	A
	Continuous drain current @T_C=100°C		29	A
I_{DM}	Pulsed drain current @T_C=25°C (pulse width: 100us)		136	A
	Pulsed drain current @T_C=150°C (pulse width: 100us)		95	A
V_{DSS}	Drain to source voltage (T_J = -55°C to 150°C)		650	V
V_{TDSS}	Transient drain to source voltage [a]		800	V
V_{GSS}	Gate to source voltage		±20	V
P_D	Maximum power dissipation @T_C=25°C		179	W
T_C	Operating temperature	Case	-55 to 150	°C
T_J		Junction	-55 to 150	°C
T_S	Storage temperature		-55 to 150	°C
T_{CSOLD}	Soldering peak temperature		260	°C

Thermal Resistance

Symbol	Parameter	Typical	Unit
$R_{\Theta JC}$	Junction-to-case	0.7	°C/W
$R_{\Theta JA}$	Junction-to-ambient [b]	50	°C/W

Notes:
a. Off-state spike duty cycle < 0.01, spike duration < 2us
b. Device on one layer epoxy PCB for drain connection (vertical and without air stream cooling, with 6cm^{2}copper area and 70μm thickness)

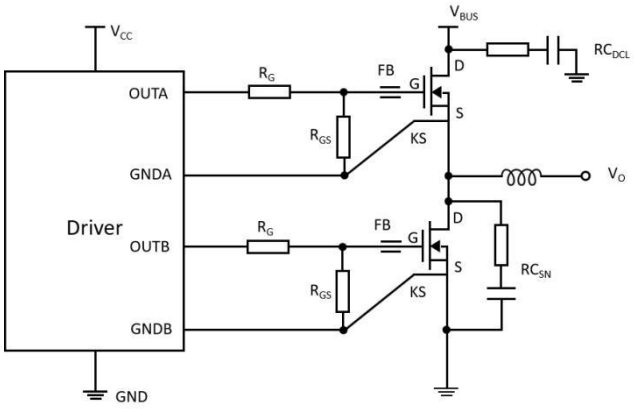
Electrical Parameters, at T_J=25°C, unless otherwise specified

Symbol	Min	Typ	Max	Unit	Test Conditions
Forward Characteristics					
$V_{DSS-MAX}$	650	-	-	V	V_{GS}=0V
BV_{DSS}	-	1000	-		V_{GS}=0V, I_{DSS}=250μA
$V_{GS(th)}$	3	4	5	V	V_{DS}=V_{GS}, I_D=500μA
$\triangle V_{GS(th)}/T_J$	-	-6.8	-	mV/℃	
$R_{DS(on)}$ [c]	-	50	65	mΩ	V_{GS}=12V, I_D=4A, T_J=25°C
	-	100	-		V_{GS}=12V, I_D=4A, T_J=150°C
I_{DSS}	-	20	40	μA	V_{DS}=700V, V_{GS}=0V, T_J=25°C
	-	50	-	μA	V_{DS}=700V, V_{GS}=0V, T_J=150°C
I_{GSS}	-	6	20	μA	V_{GS}=20V
	-	-6	-20	μA	V_{GS}=-20V
C_{ISS}	-	1451	-	pF	V_{GS}=0V, V_{DS}=400V, f=1MHz
C_{OSS}	-	106	-	pF	
C_{RSS}	-	1.4	-	pF	
$C_{O(er)}$	-	159	-	pF	V_{GS}=0V, V_{DS}=0 - 400V
$C_{O(tr)}$	-	346	-	pF	
Q_{oss}	-	138	-	nC	
Q_G	-	25	-	nC	V_{DS}=400V, V_{GS}=0 - 12V, I_D=26A
Q_{GS}	-	8.7	-		
Q_{GD}	-	4.4	-		
$t_{D(on)}$	-	36	-	ns	V_{DS}=400V, V_{GS}=0 - 12V, I_D=26A, R_G=33Ω
t_R	-	30	-		
$t_{D(off)}$	-	100	-		
t_F	-	8	-		
Reverse Characteristics					
V_{SD}	-	1.2	-	V	V_{GS}=0V, I_S=13A, T_J=25°C
	-	1.7	-		V_{GS}=0V, I_S=26A, T_J=25°C
	-	2.2	-		V_{GS}=0V, I_S=26A, T_J=150°C
t_{RR}	-	43	-	ns	I_S=26A, V_{GS}=0V, d_i/d_t=1000A/us, V_{DD}=400V
Q_{RR}	-	138	-	nC	

Notes:
c. Dynamic on-resistance; see Figure 20 and 21 for test circuit and configurations

Circuit Implementation

Half bridge and full bridge topology



Recommended Half-bridge Circuit

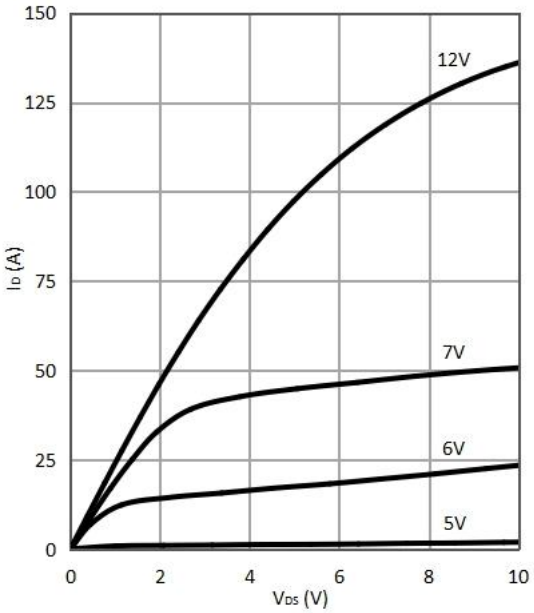
Recommended gate drive: (0 V, 12 V)

Gate Ferrite Bead (FB)	Gate Resistance (R_G)	Gate Source Resistance (R_{GS})	Switching RC Snubber (RC_{SN})	DC Link RC Snubber (RC_{DCL})
300 - 600 Ω@100MHz	33 Ω	10 kΩ	15 Ω + 470 pF	5 Ω + 4.7 nF

Notes:
d. RC_{SN} should be placed as close as possible to the drain pin
e. The layout and wiring of the drive circuit should be as short as possible

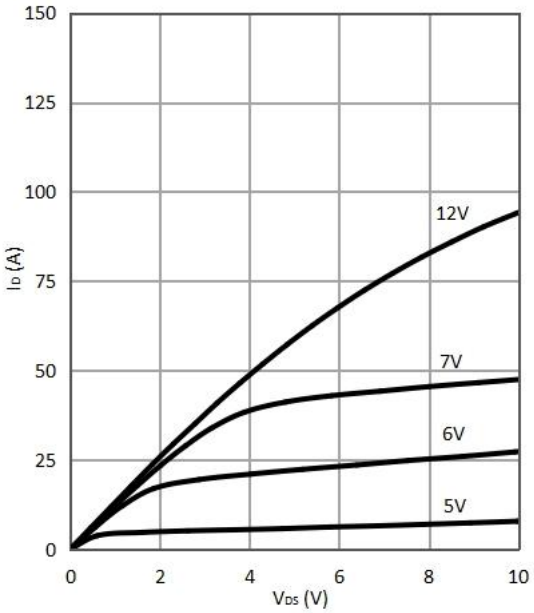
Typical Characteristics, at T_C=25 ° C, unless otherwise specified

Figure 1. Typical Output Characteristics T_J=25° C



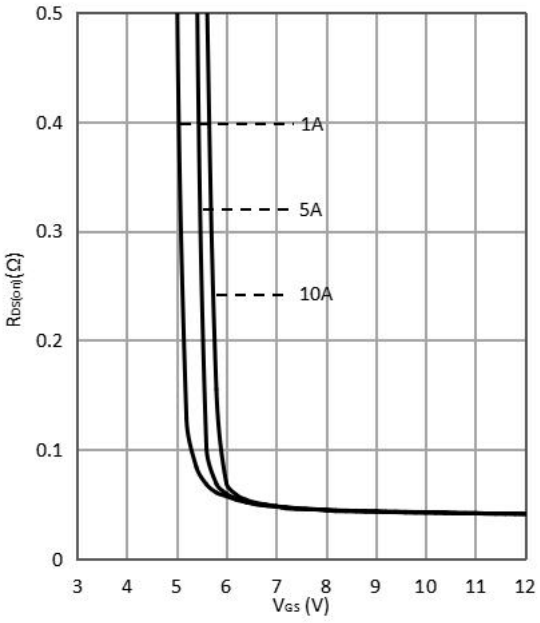
Parameter: V_{GS}

Figure 2. Typical Output Characteristics T_J=150° C



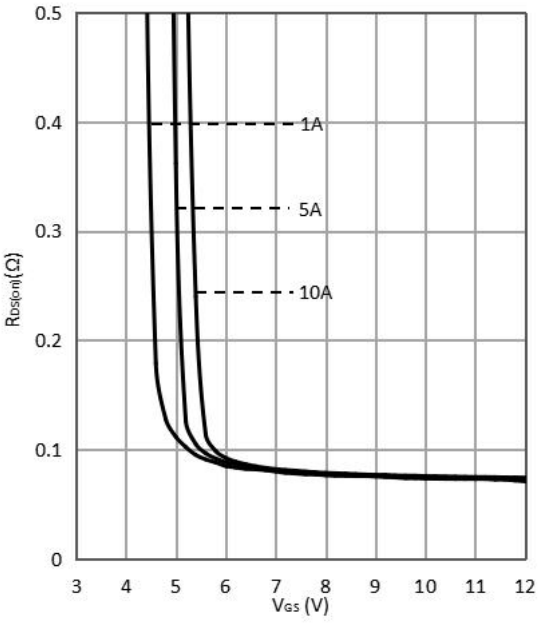
Parameter: V_{GS}

Figure 3. Typical Drain to Source On-resistance TJ= 25° C



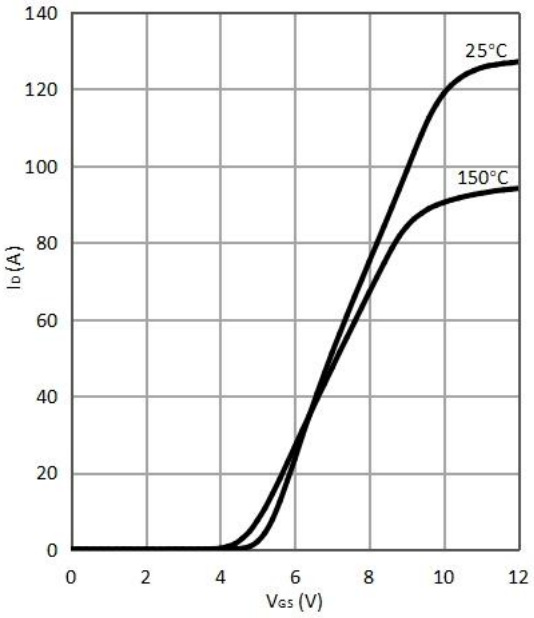
Parameter: I_D

Figure 4. Typical Drain to Source On-resistance T_J= 150° C



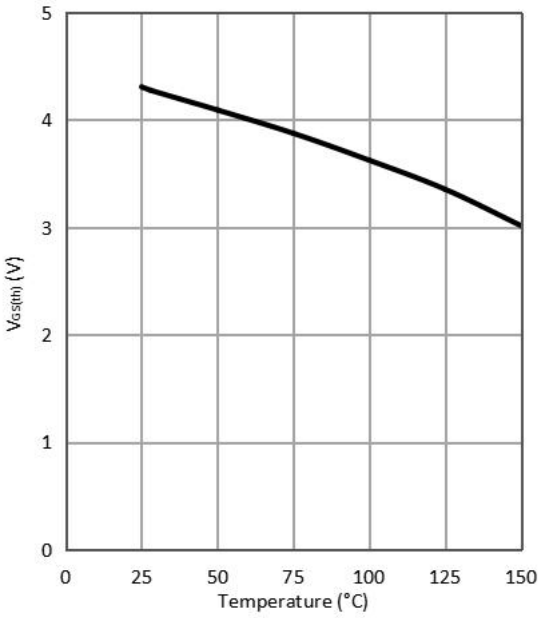
Parameter: I_D

Figure 5. Typical Transfer Characteristics



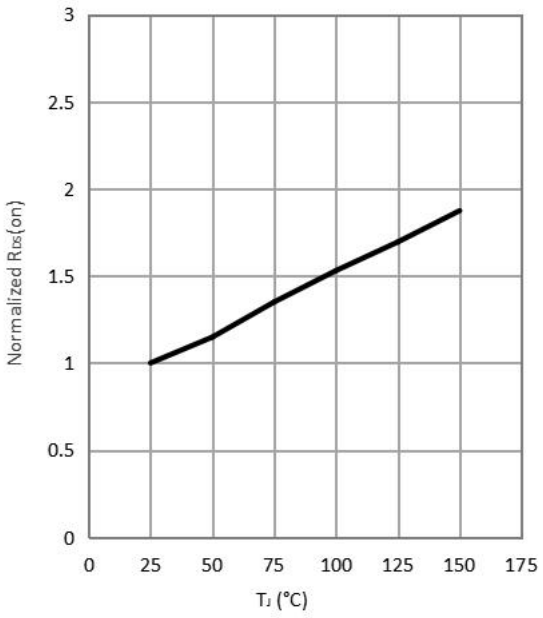
V_{DS}=10V, Parameter: T_J

Figure 6. $V_{GS(th)}$ Vs Temperature Characteristics



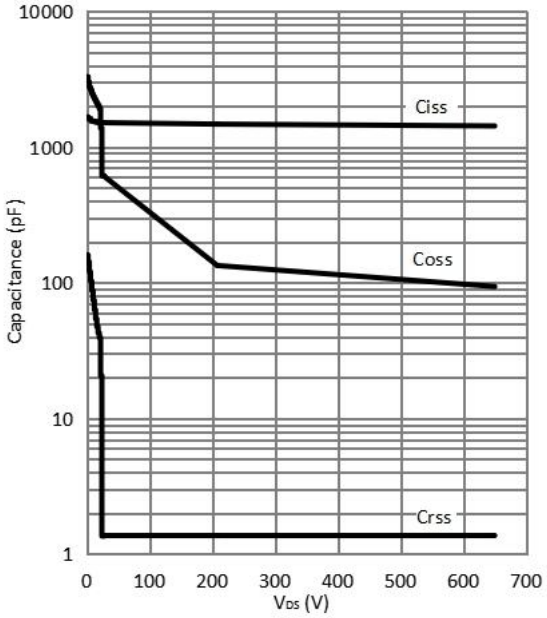
I_D=500uA

Figure 7. Normalized On-resistance



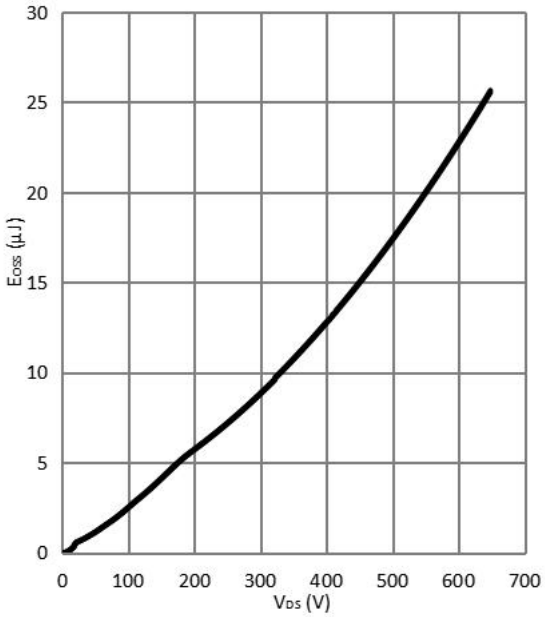
I_D=4A, V_{GS}=12V

Figure 8. Typical Capacitance



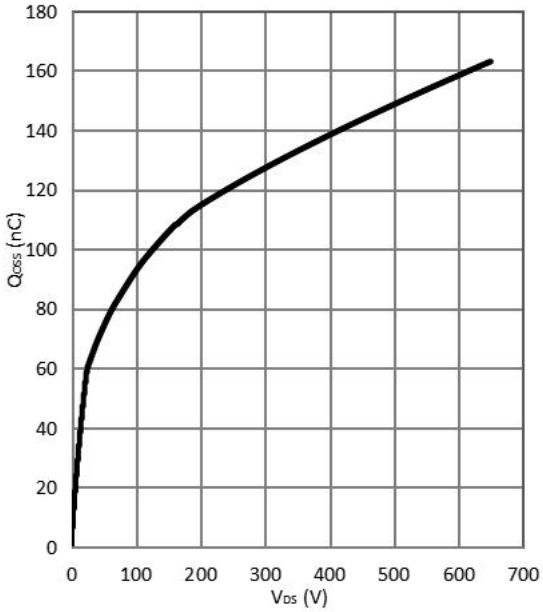
V_{GS}=0V, f=1MHz

Figure 9. Typical Coss Stored Energy



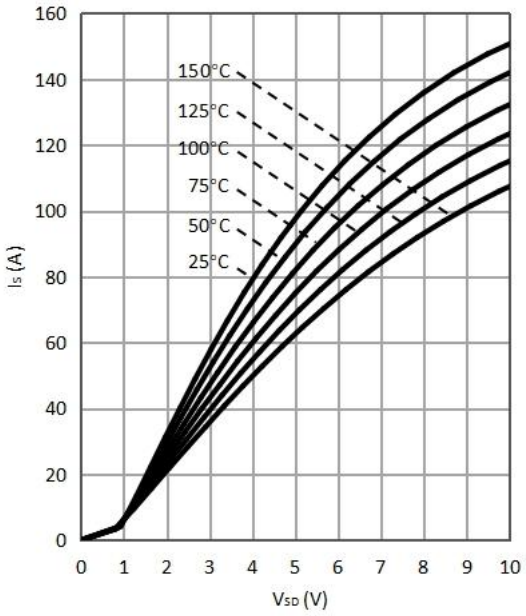
V_{GS}=0V, f=1MHz

Figure 10. Typical Qoss



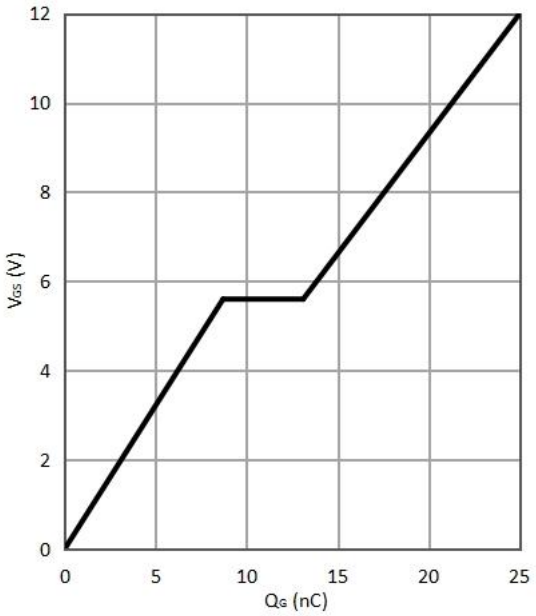
V_{GS}=0V, f=1MHz

Figure 11. Forward Characteristic of Rev. Diode



$I_S=f(V_{SD})$, Parameter T_J

Figure 12. Typical Gate Charge



I_{DS}=26A, V_{DS}=400V

Figure 13. Power Dissipation

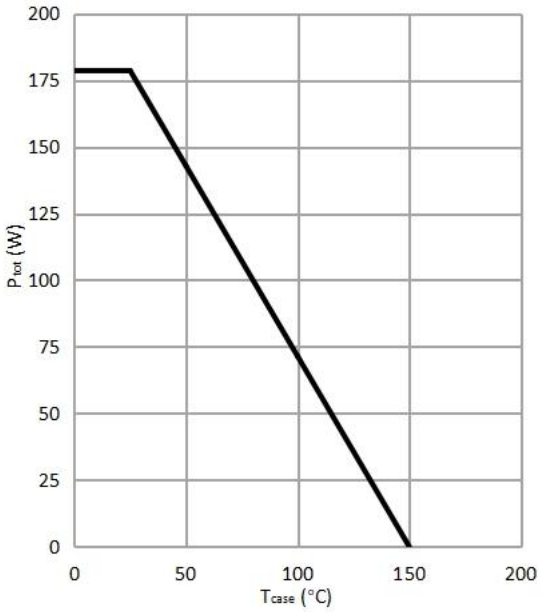


Figure 14. Current Derating

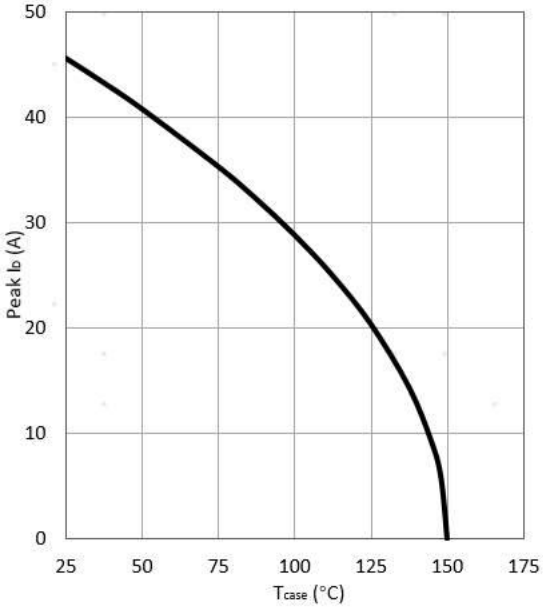


Figure 15. Transient Thermal Resistance

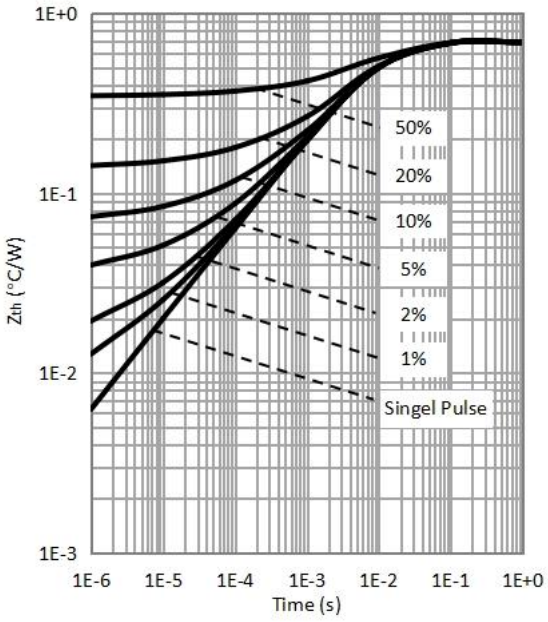
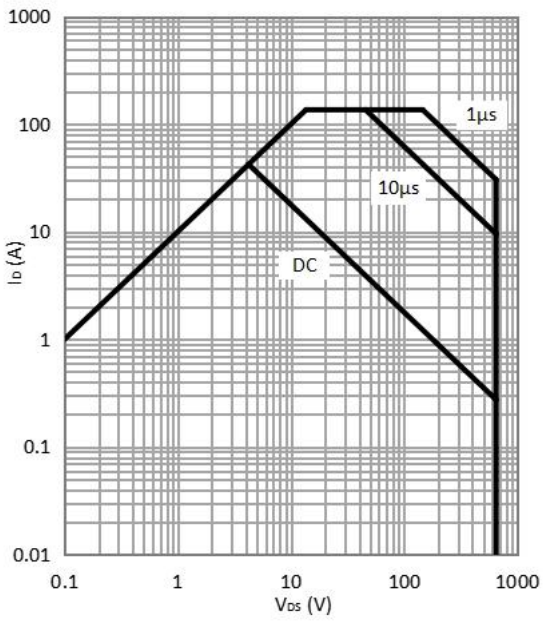
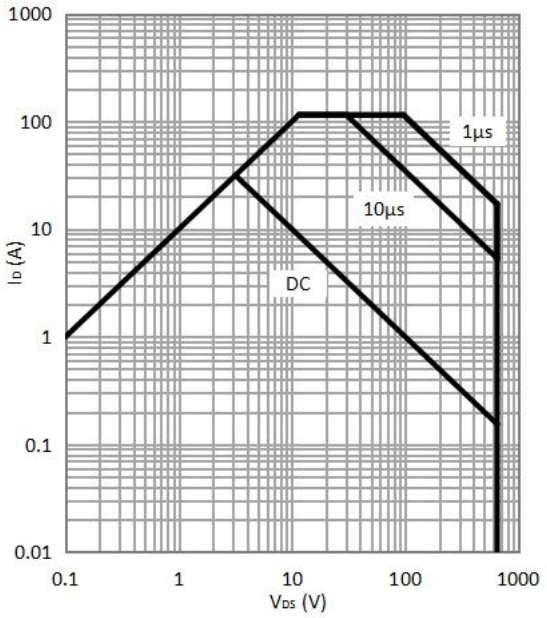


Figure 16. Safe Operating Area T_C=25° C



calculated based on thermal limit

Figure 17. Safe Operating Area T_C=80° C



calculated based on thermal limit

Test Circuits and Waveforms

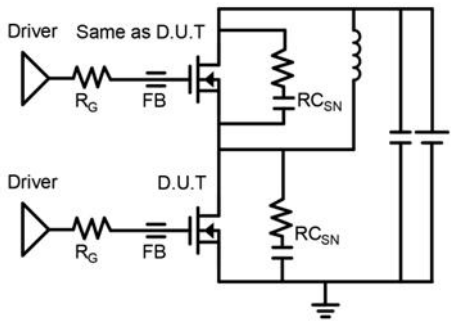
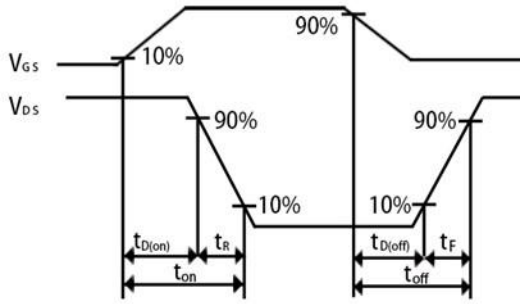
Figure 18. Switching Time Test Circuit	Figure 19. Switching Time Waveform
	

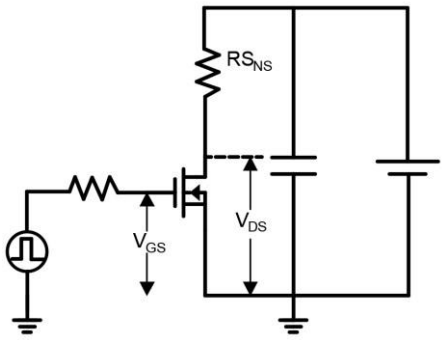
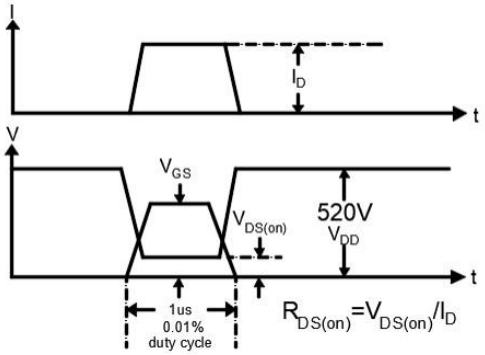
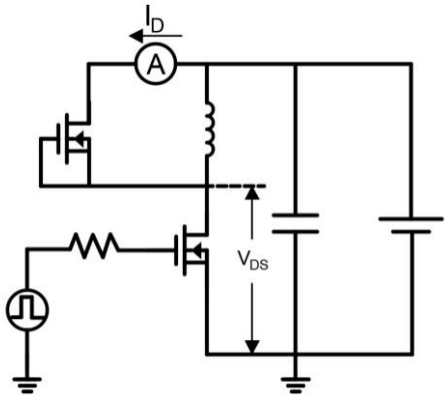
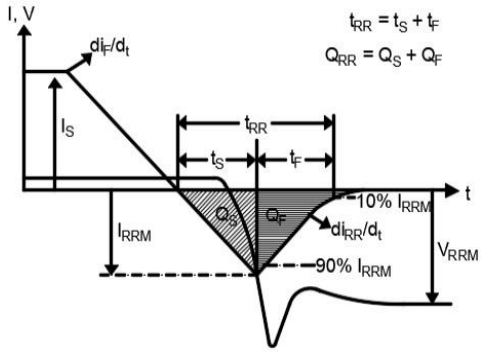
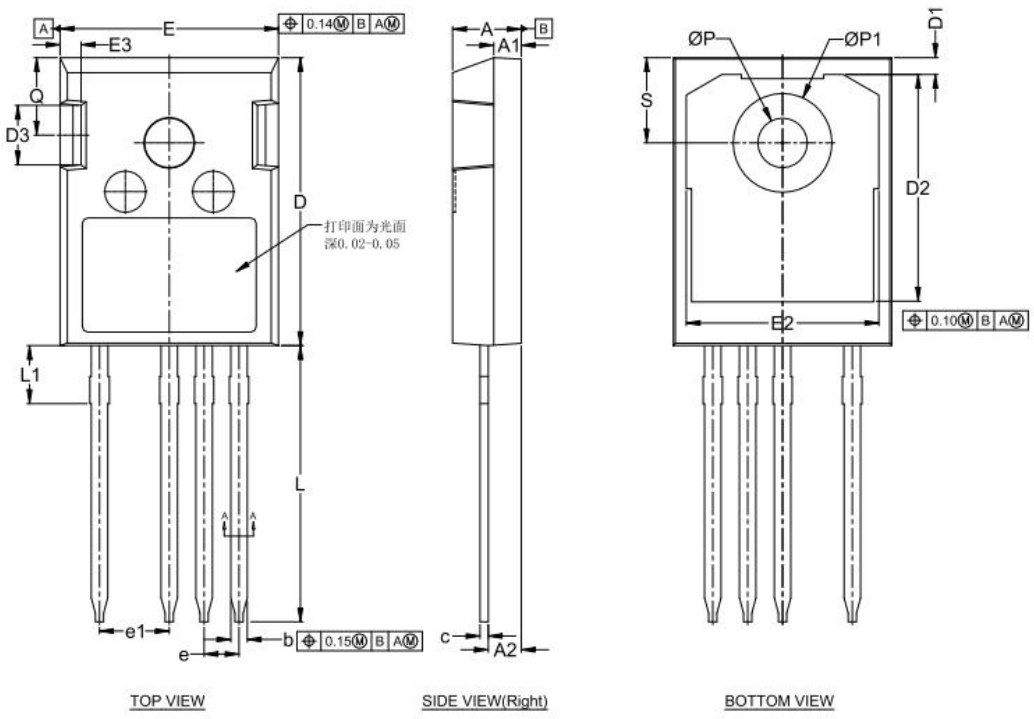
Figure 20. Dynamic $R_{DS(on)}$ Test Circuit	Figure 21. Dynamic $R_{DS(on)}$ Waveform
	

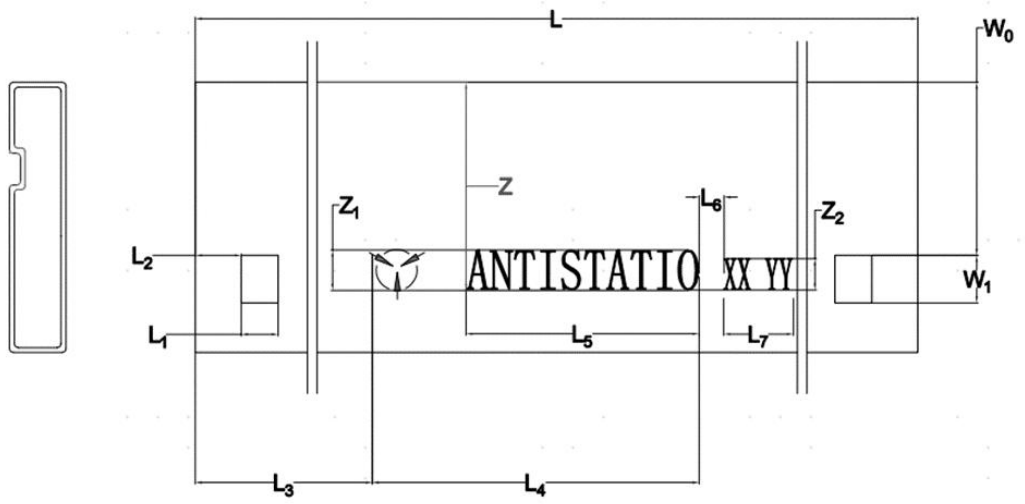
Figure 22. Diode Characteristic Test Circuits	Figure 23. Diode Recovery Waveform
	

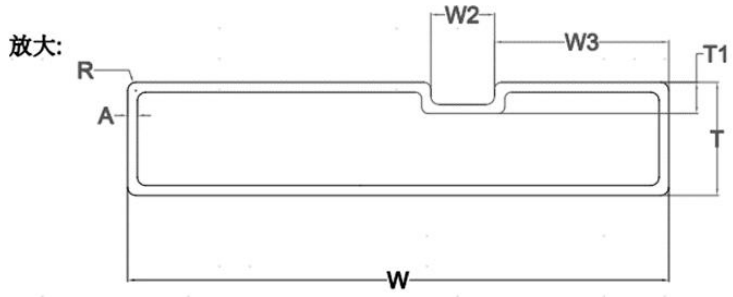
Package Outline



SYMBOL	Millimeter		
	Min	Nom	Max
A	4.60	4.90	5.20
A1	1.90	2.05	2.20
A2	2.20	2.40	2.60
b	1.00	1.20	1.40
c	0.50	0.60	0.70
D	20.60	20.90	21.30
D2	16.00	17.00	18.00
D3	3.80	4.50	5.30
E	15.50	15.80	16.10
E2	13.00	13.80	14.70
E3	0.80	1.70	2.60
e	2.54 BSC		
e1	5.08 BSC		
L	19.00	19.70	20.50
L1	3.90	4.25	4.60
ΦP	3.30	3.50	3.70
ΦP1	7.00	7.20	7.40
Q	5.20	5.60	6.00
S	5.80	6.20	6.60

Tube Information **Dimensions are shown in millimeters**





Tube Dimension(mm)									
W	40±1	W_3	23.8±0.1	L	417±1	L_4	55±0.5	Z	25±0.5
W_0	25±1	R	0.5±0.01	L_1	5.6±0.1	L_5	45±3	Z_1	5±0.5
W_1	5.8±0.2	T	7.5±0.1	L_2	4.5±0.2	L_6	10±1	Z_2	4±0.5
W_2	4.7±0.1	T_1	2.85±0.1	L_3	170±3	L_7	15±1		

Revision History

Version	Date	Change(s)
0.1	2025/05/07	Release preliminary datasheet
1.0	2025/09/11	Release formal datasheet

Disclaimer

Unless otherwise specified in the datasheet, the product is designed and qualified as a standard commercial product and is not intended for use in applications that require extraordinary levels of quality and reliability, such as automotive, aviation/aerospace and life-support devices or systems.

Any and all semiconductor products have certain probability to fail or malfunction, which may result in personal injury, death or property damage. Customer are solely responsible for providing adequate safe measures when design their systems.