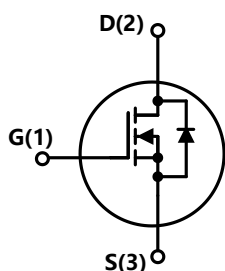
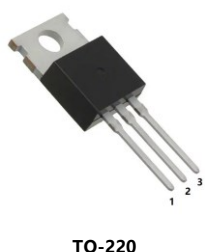


N-channel 650V 50mΩ (Typ) Power MOSFET

1 FEATURES

- 650V break down voltage
- Ultra-low R_{DS-ON} & FOM
- Ultra-fast body diode
- Fast switching on/off



2 APPLICATIONS

- Server power
- Telecom power
- EV charger
- Motor driver

3 ORDERING INFORMATION

TYPE	MARKING	PACKAGE
GBS65060TOA	65060	TO-220

4 DISCRIPTION

The 650V high voltage Super Junction MOSFET achieves ultra-low ON-resistance and gate charge. Thanks to excellent balance between switching performance and conduction performance, the GBS65060 provides very high efficiency in resonant switch topology.

The Ultra-fast recovery body diode makes the GBS65060 suitable for high switching frequency application and supports high power density application. The GBS65060 is available in TO-220 package.

5 KEY PERFORMANCE PARAMETERS

PARAMETER	VALUE	UNIT
$V_{DS} @ T_{j_max}$	700	V
$R_{DS-ON} \text{ max } @ V_{GS}=10V$	55	mΩ
$Q_g \text{ (Typ)}$	90	nC
$I_{D-pulse}$	200	A
$E_{oss}@400V$	12	μJ
Body diode recovery time	150	ns



6 SPECIFICATIONS

6.1 ABSOLUTE MAXIMUM RATINGS

$T_J=25^{\circ}\text{C}$ operating free-air temperature unless otherwise noted

SYMBOL	PARAMETER	TEST CONDITION	VALUE	UNIT
V_{DS}	Drain-source voltage		650	V
I_D	Continuous drain current	$T_C=25^{\circ}\text{C}$	50	A
		$T_C=100^{\circ}\text{C}$	32	
$I_{D\text{-pulse}}$	Pulsed drain current		200	A
V_{GS}	Gate-source voltage		± 30	V
E_{AS}	Single pulsed avalanche energy ①	$V_{DD}=100\text{V}$	695	mJ
E_{AS}	Single pulsed avalanche energy ②	$V_{DD}=100\text{V}$	1908	mJ
E_{AR}	Repetitive avalanche energy	$V_{DD}=100\text{V}$	3.5	mJ
P_D	Power dissipation		329	W
dv/dt	MOSFET dv/dt ruggedness	$V_{DS}=0\sim 400\text{V}$	90	V/ns
$I_{S\text{-pulse}}$	Diode pulsed current		200	A
dv/dt	Reverse diode dv/dt	$V_{DS}=0\sim 400\text{V}$, $I_{SD}<16.4\text{A}$	70	V/ns
di_F/dt	diode commutation speed	$V_{DS}=0\sim 400\text{V}$, $I_{SD}<16.4\text{A}$	1200	A/ μs
T_{stg}	Storage temperature		-55 ~ 150	$^{\circ}\text{C}$

Note:

① $L=100\text{mH}$, $V_{DD}=100\text{V}$, $R_g=3\text{ohm}$, $T_J=25^{\circ}\text{C}$, Finish goods test condition

② $L=100\text{mH}$, $V_{DD}=100\text{V}$, $R_g=3\text{ohm}$, $T_J=25^{\circ}\text{C}$, Typical E_{AS}

6.2 THERMAL INFORMATION

SYMBOL	PARAMETER	VALUE	UNIT
$R_{\theta JC \text{ max.}}$	Max. Thermal resistance, junction - case	0.38	$^{\circ}\text{C/W}$
$R_{\theta JA \text{ max.}}$	Max. Thermal resistance, junction - ambient	62	$^{\circ}\text{C/W}$
T_{sold}	Soldering temperature	260	$^{\circ}\text{C}$



6.3 ELECTRICAL CHARACTERISTICS

$T_J=25^{\circ}\text{C}$ operating free-air temperature unless otherwise noted

SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
STATIC CHARACTERISTICS						
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS}=0V, I_D=1mA$	650			V
		$V_{GS}=0V, I_D=10mA, T_j=150^{\circ}C$	700			
$V_{(GS)th}$	Gate threshold voltage	$V_{DS}=V_{GS}, I_D=1mA$	3.4	4.0	4.6	V
R_{DS-ON}	Drain-source on state resistance	$V_{GS}=10V, I_D=16.4A$	50			mΩ
		$V_{GS}=10V, I_D=16.4A, T_j=125^{\circ}C$	102			
R_g	Gate resistance	$f=1MHz$, open drain	2.7			Ω
I_{GSS}	Gate-source leakage current	$V_{GS}=30V, V_{DS}=0V$	100			nA
I_{DSS}	Drain-source leakage current	$V_{GS}=0V, V_{DS}=650V$	1			μA
		$V_{GS}=0V, V_{DS}=650V, T_j=125^{\circ}C$	500			
DYNAMIC CHARACTERISTICS						
C_{iss}	Input capacitance	$V_{GS}=0V, V_{DS}=400V, f=250KHz$	4300			pF
C_{oss}	Output capacitance		70			pF
C_{rss}	Reverse transfer capacitance		4			pF
$C_{o(er)}$	Effective output capacitance, energy related	$V_{GS} = 0V, V_{DS} = 0V\sim 400V$	150			pF
$C_{o(tr)}$	Effective output capacitance, time related		1610			pF
$t_{d(on)}$	Turn-on delay time	$V_{GS}=15V, V_{DS}=400V, R_G=3\Omega$	30			ns
t_r	Rise time		8			ns
$t_{d(off)}$	Turn-off delay time		95			ns
t_f	Fall time		9			ns
GATE CHARGE CHARACTERISTICS						
Q_g	Gate charge total		90			nC



SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
Q _{gd}	Gate to drain charge	V _{DS} =400V, I _D =16.4A V _{GS} =0~10V		36		nC
Q _{gs}	Gate to source charge			26		nC
V _{plateau}	Gate plateau voltage			6.4		V
BODY DIODE CHARACTERISTICS						
V _{SD}	Diode forward voltage	V _{GS} =0V, I _F =16.4A, T _j =25°C			1.3	V
t _{rr}	Reverse recovery time	V _{DS} =400V, I _F =16.4A di _F /dt=100A/μs		150		ns
Q _{rr}	Reverse recovery charge			0.9		μC
I _{rrm}	Peak reverse recovery current			12.5		A



7 Electrical Characteristic Diagram

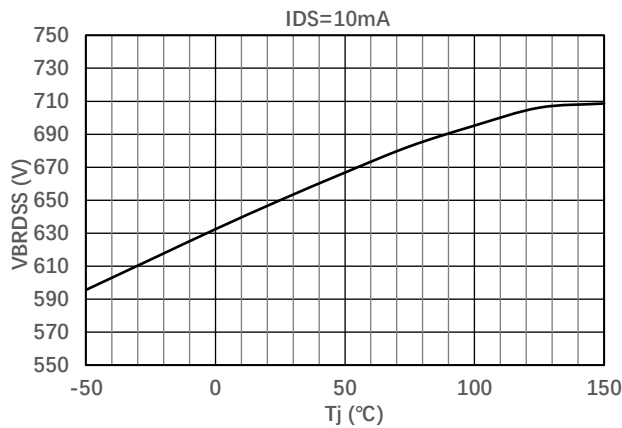


Figure 1. Drain-source Breakdown Voltage

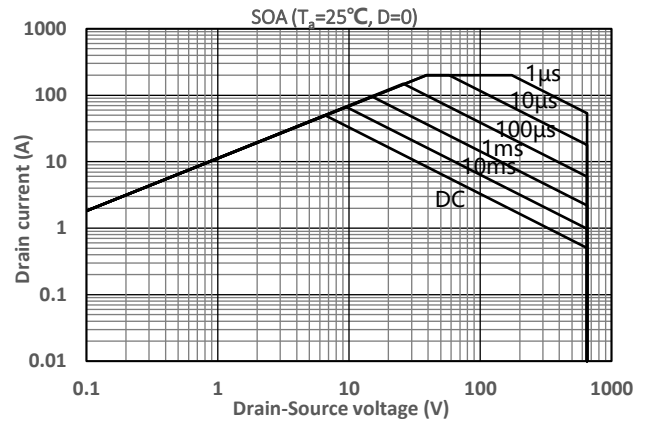


Figure 2. Safety Operating Area

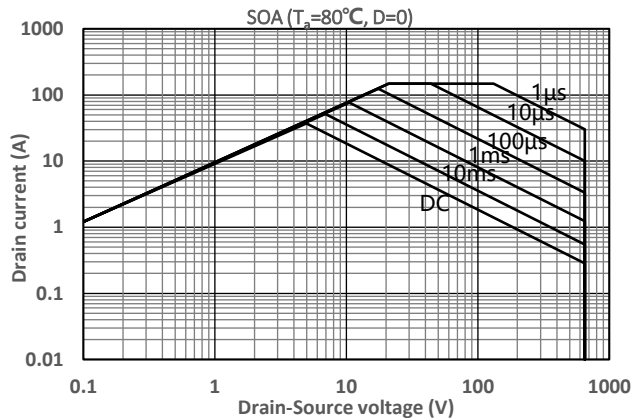


Figure 3. Safety Operating Area

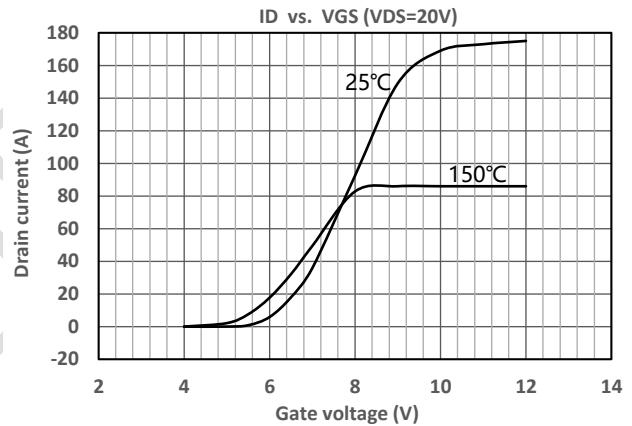


Figure 4. Typ. Transfer Characteristics

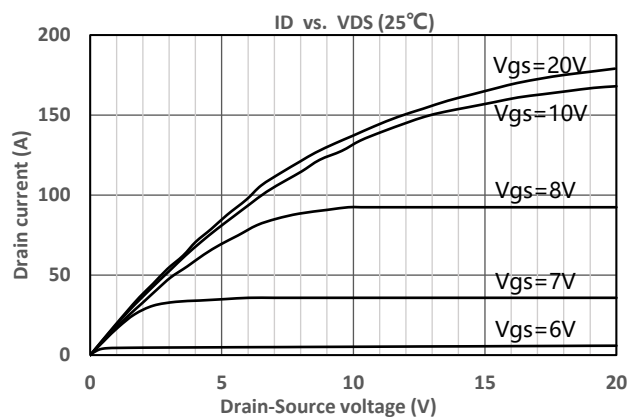


Figure 5. Typ. Output Characteristics

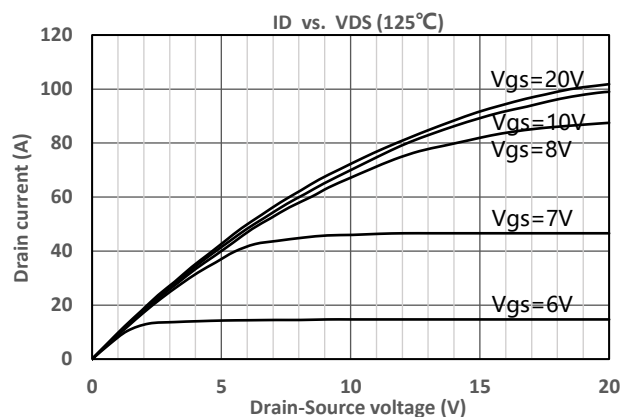


Figure 6. Typ. Output Characteristics

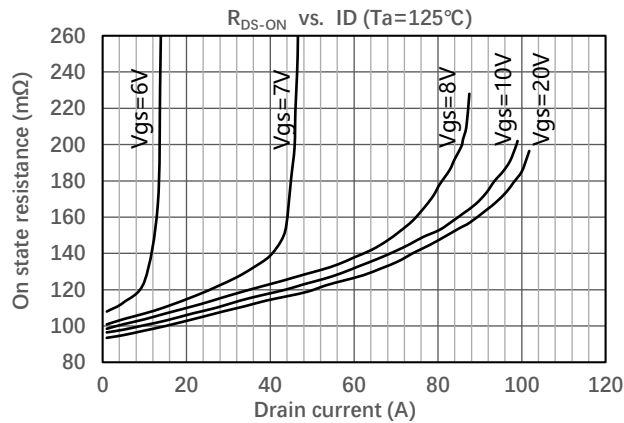


Figure 7. Typ. Drain Source On-state Resistance

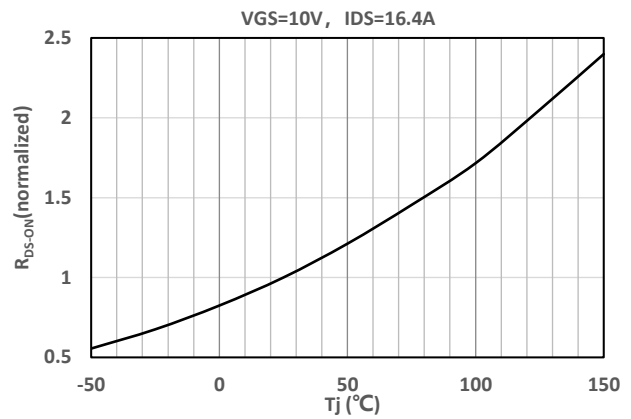


Figure 8. R_{DS-ON} vs. T_j

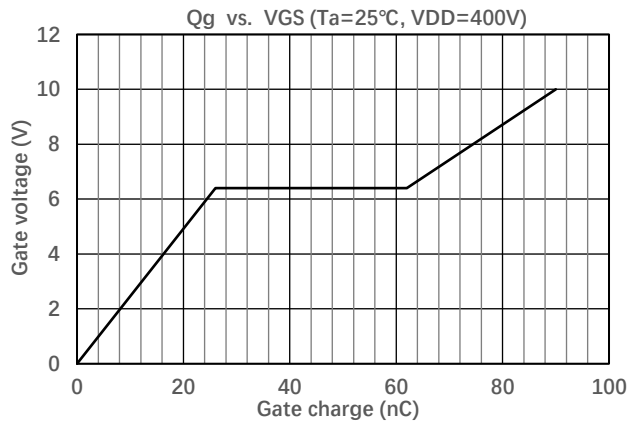


Figure 9. Typ. Gate Charge

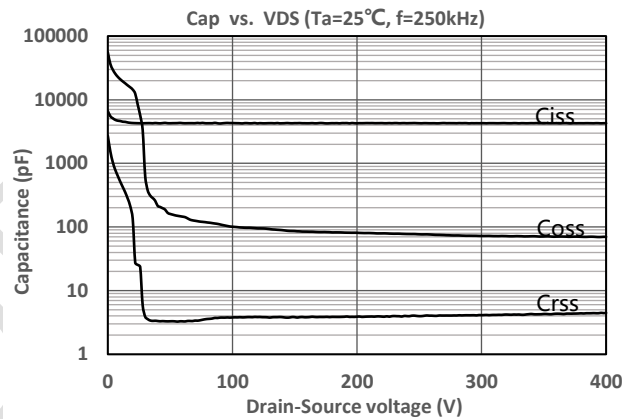


Figure 10. Typ. Capacitance

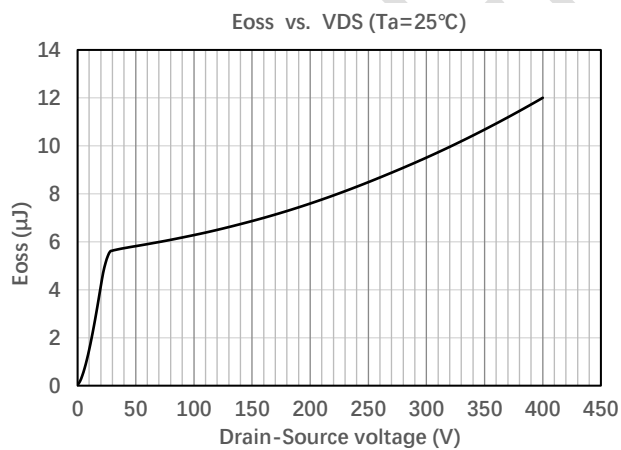


Figure 11. Typ. Coss Stored Energy

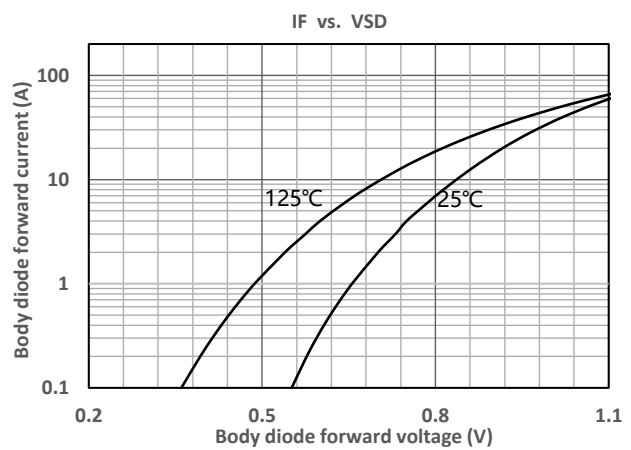


Figure 12. Body diode forward characteristics

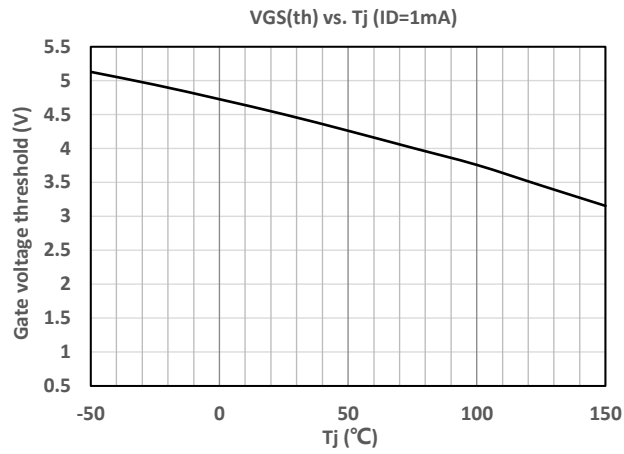


Figure 13. Threshold Voltage vs. Tj

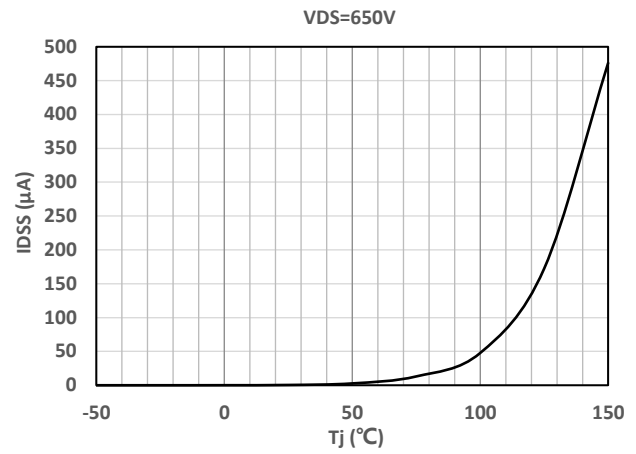


Figure 14. Maximum drain leakage current vs. Case temperature

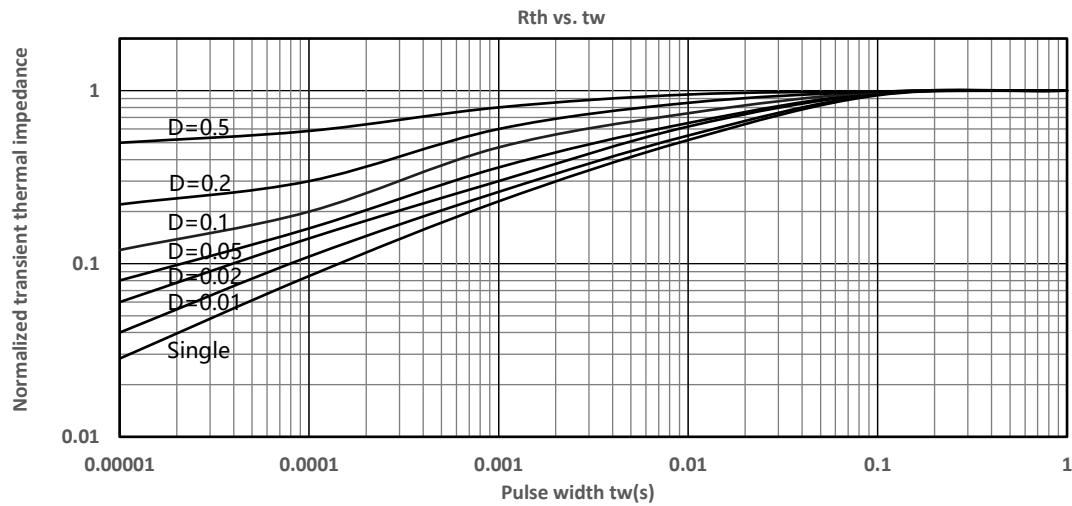


Figure 15. Rth vs. Tw



8 Test Circuit

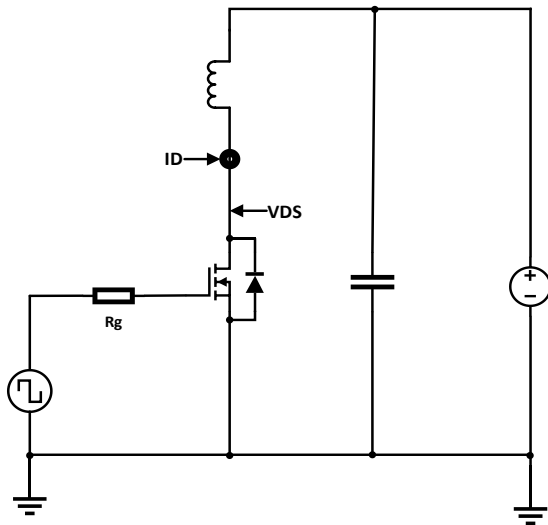
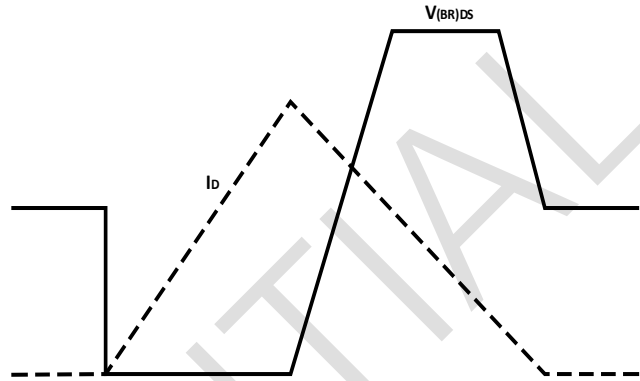


Figure 16. Unclamped inductive switching test circuit



Waveform 1. Unclamped inductive switching waveform

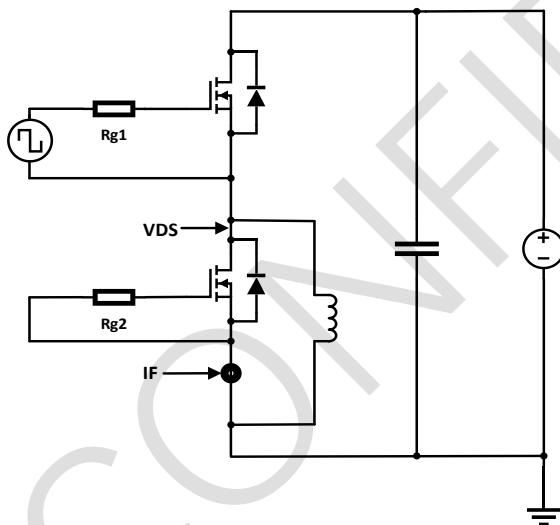
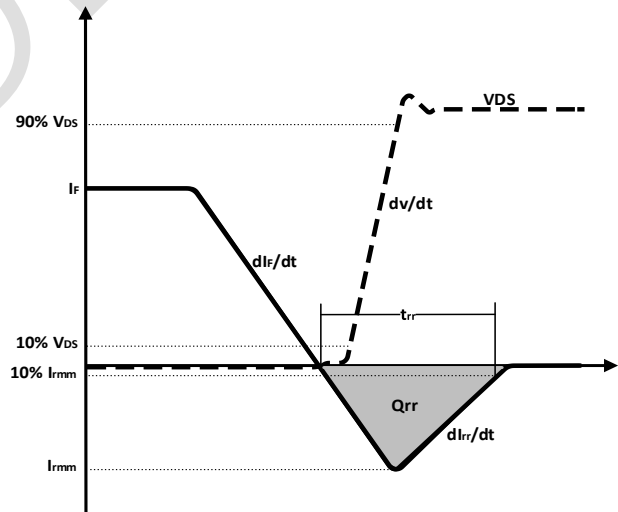


Figure 17. Body diode characteristics test circuit



Waveform 2. Body diode characteristics waveform

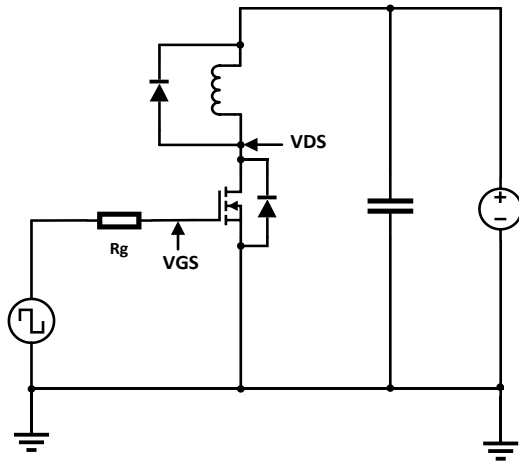
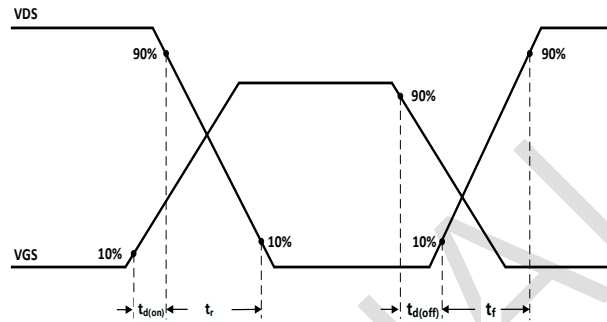
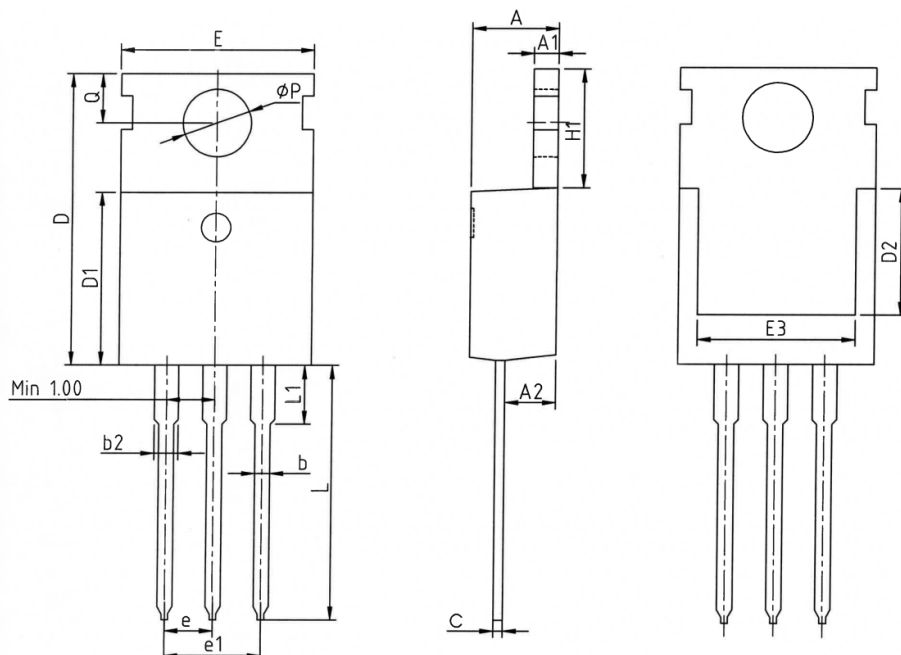


Figure 18. Switching time test circuit



Waveform 3. Switching time waveform

**PACKAGE INFORMATION**

SYMBOL	mm		
	MIN	NOM	MAX
A	4.37	4.57	4.70
A1	1.25	1.30	1.40
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b2	1.17	1.27	1.47
c	0.45	0.50	0.60
D	15.10	15.60	16.10
D1	8.80	9.10	9.40
D2	5.50	6.30	7.10
E	9.70	10.00	10.30
E3	7.00	7.80	8.60
e	2.54 BSC		
e1	5.08 BSC		
H1	6.25	6.50	6.85
L	12.75	13.50	13.80
L1	-	3.10	3.40
ΦP	3.40	3.60	3.80
Q	2.60	2.80	3.00