



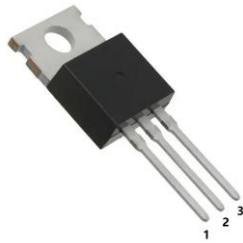
N-channel 650V 50mΩ (Typ) Power MOSFET

1 FEATURES

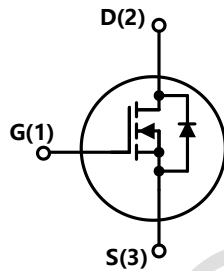
- 650V break down voltage
- Ultra-low R_{DS-ON} & FOM
- Ultra-fast body diode
- Fast switching on/off

2 APPLICATIONS

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



TO220



3 ORDERING INFORMATION

TYPE	MARKING	PACKAGE
GBS65060TOA	65060	TO-220

4 DISCRPTION

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
$R_{DS-ON} \text{ max } @ V_{GS}=10V$	60	mΩ
Q_g (Typ)	95	nC
$I_{D-pulse}$	146	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	$T_C=25^{\circ}\text{C}$	36	A
		$T_C=100^{\circ}\text{C}$	23	
$I_{D\text{-pulse}}$	Pulsed drain current		146	A
V_{GS}	Gate-source voltage		± 30	V
E_{AS}	Single pulsed avalanche energy	$I_D=5.1\text{A}, V_{DD}=50\text{V}$	169	mJ
E_{AR}	Repetitive avalanche energy	$I_D=5.1\text{A}, V_{DD}=50\text{V}$	0.85	mJ
I_{AS}	Single pulsed avalanche current		5.1	A
P_D	Power dissipation		192	W
dv/dt	MOSFET dv/dt ruggedness	$V_{DS}=0\sim 400\text{V}$	60	V/ns
I_S	Continuous diode forward current		36	A
$I_{S\text{-pulse}}$	Diode pulsed current		146	A
dv/dt	Reverse diode dv/dt	$V_{DS}=0\sim 400\text{V}, I_{SD}<16.4\text{A}$	50	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	$^{\circ}\text{C}$

6.2 THERMAL INFORMATION

SYMBOL	PARAMETER	VALUE	UNIT
$R_{\theta JC \text{ max.}}$	Max. Thermal resistance, junction - case	0.65	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA \text{ max.}}$	Max. Thermal resistance, junction - ambient	62	$^{\circ}\text{C}/\text{W}$
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	$V_{GS}=0\text{V}, I_D=1\text{mA}$	650			V



SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
$V_{(GS)th}$	Gate threshold voltage	$V_{DS}=V_{GS}, I_D=1mA$	3.4	4.1	4.6	V
R_{DS-ON}	Drain-source on state resistance	$V_{GS}=10V, I_D=16.4A$		50	60	mΩ
		$V_{GS}=10V, I_D=16.4A, T_j=125^{\circ}C$		110		
R_g	Gate resistance	$f=1MHz, \text{open drain}$		3		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	$V_{GS}=0V$		4300		pF
C_{oss}	Output capacitance	$V_{DS}=400V, f=250KHz$		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	$V_{DS}=400V, I_D=16.4A$ $V_{GS}=0 \sim 10V$		95		nC
Q_{gd}	Gate to drain charge			33		nC
Q_{gs}	Gate to source charge			28		nC
$V_{plateau}$	Gate plateau voltage			6.2		V
BODY DIODE CHARACTERISTICS						
V_{SD}	Diode forward voltage	$V_{GS}=0V, I_F=16.4A,$			1.3	V
t_{rr}	Reverse recovery time			150		ns



SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
Q_{rr}	Reverse recovery charge	$V_{DS}=400V, I_F=16.4A$ $di_F/dt=100A/\mu s$		0.9		μC
I_{rrm}	Peak reverse recovery current			12.5		A

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7 Electrical Characteristic Diagram

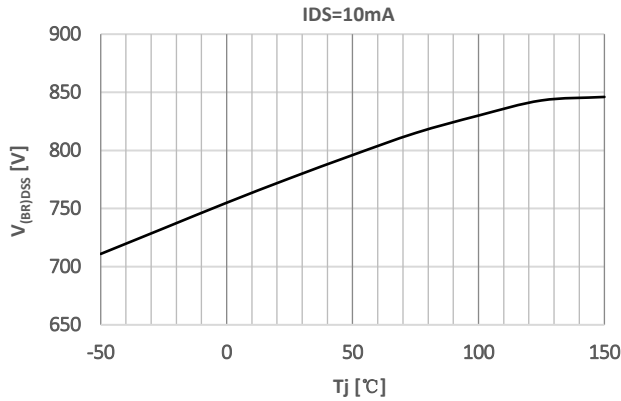


Figure 1. Drain-source Breakdown Voltage

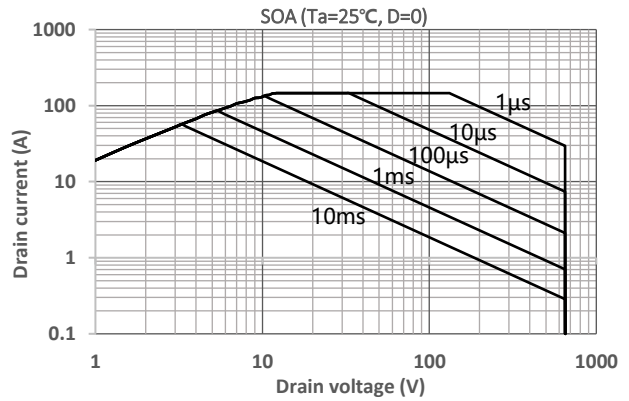


Figure 2. Safety Operating Area

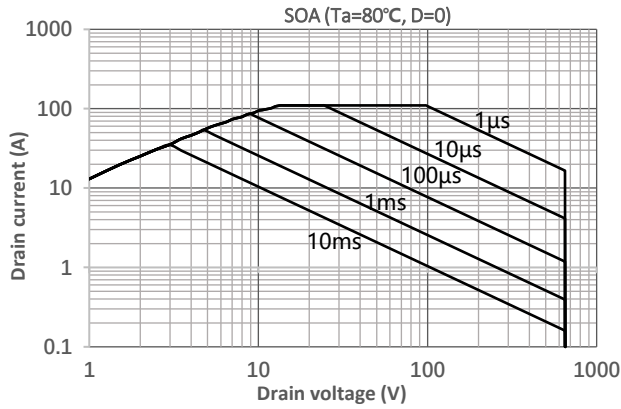


Figure 3. Safety Operating Area

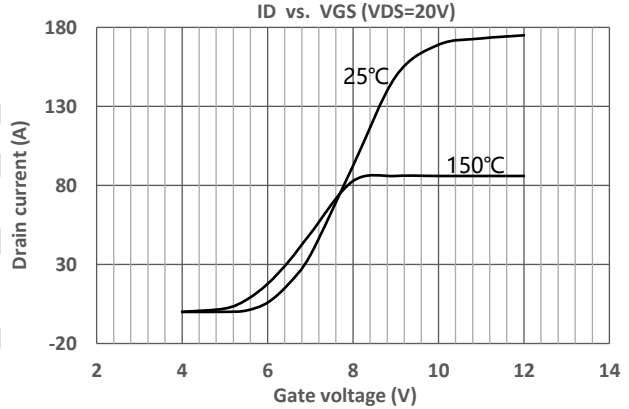


Figure 4. Typ. Transfer Characteristics

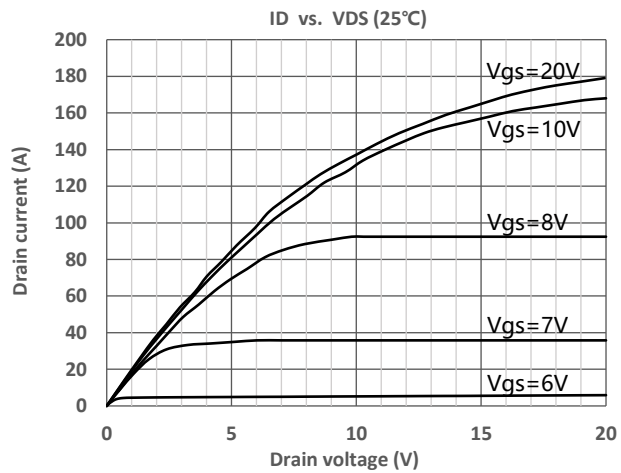


Figure 5. Typ. Output Characteristics

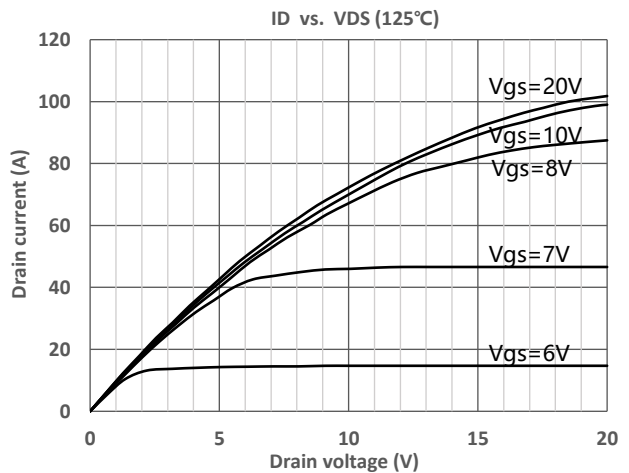


Figure 6. Typ. Output Characteristics

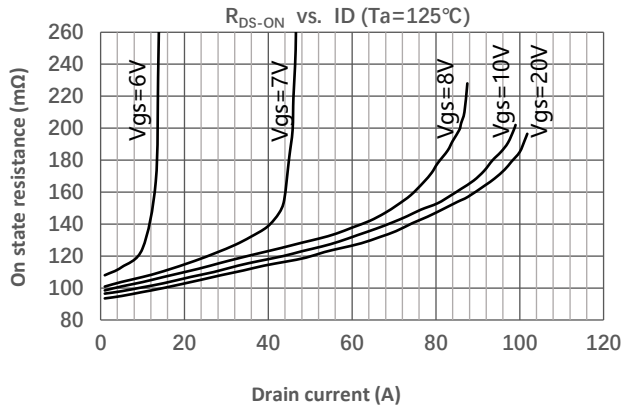


Figure 7. Typ. Drain Source On-state Resistance

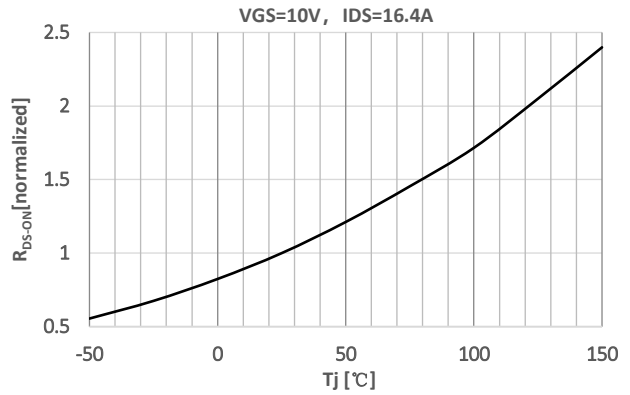


Figure 8. R_{DS-ON} vs. T_j

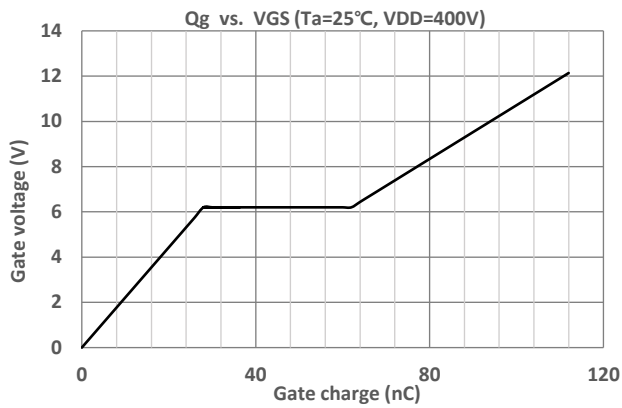


Figure 9. Typ. Gate Charge

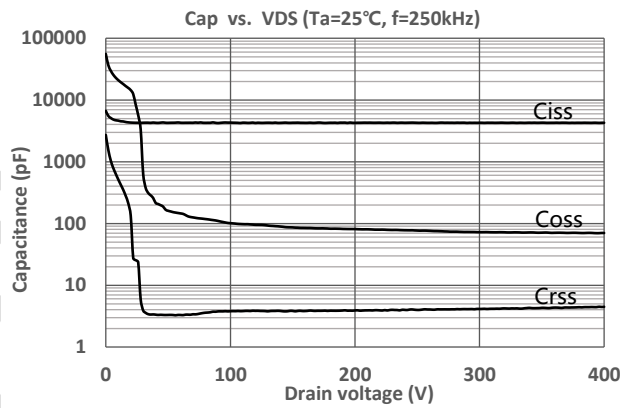


Figure 10. Typ. Capacitance

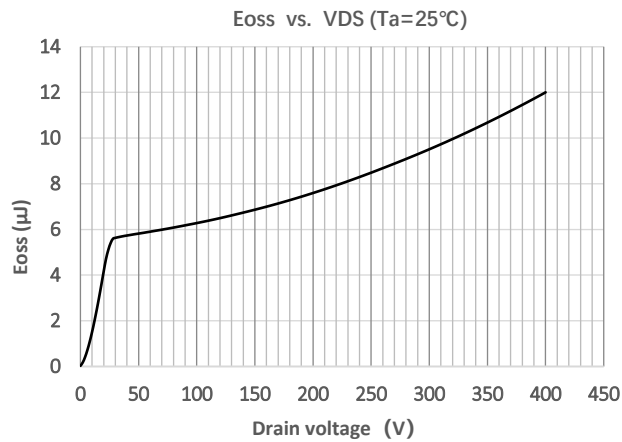


Figure 11. Typ. C_{oss} Stored Energy

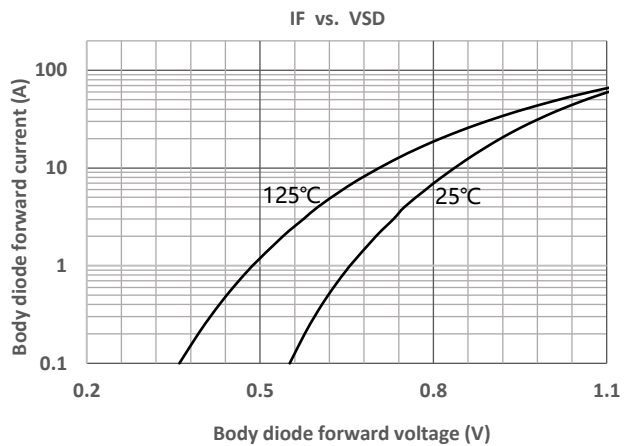


Figure 12. Body diode forward characteristics

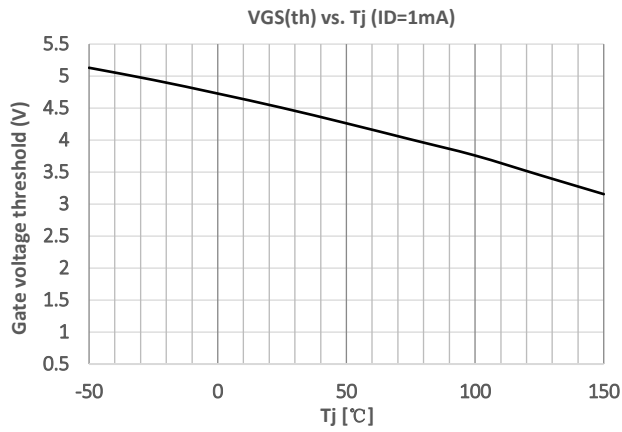


Figure 13. Threshold Voltage vs. Tj

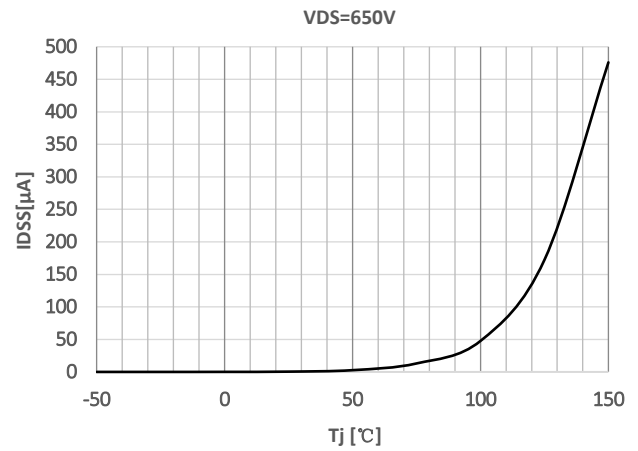


Figure 14. Maximum drain leakage current vs. Case temperature

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8 Test Circuit

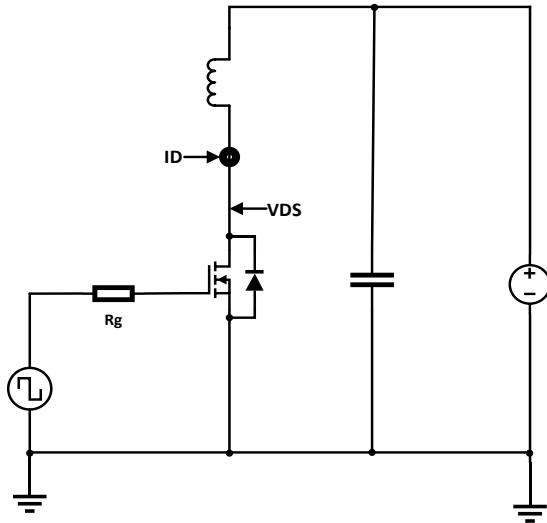
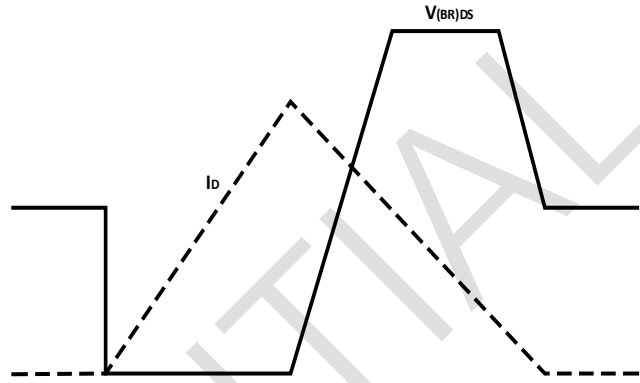


Figure 15. Unclamped inductive switching test circuit



Waveform 1. Unclamped inductive switching waveform

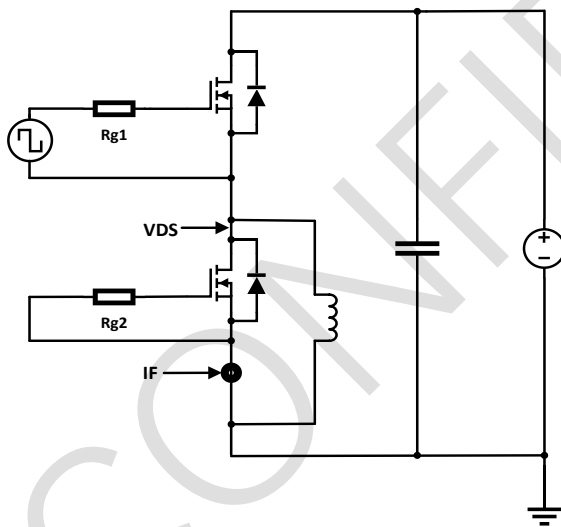
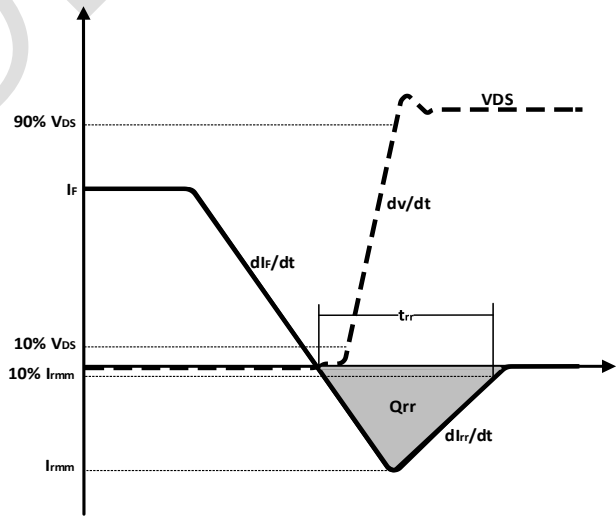


Figure 16. Body diode characteristics test circuit



Waveform 2. Body diode characteristics waveform

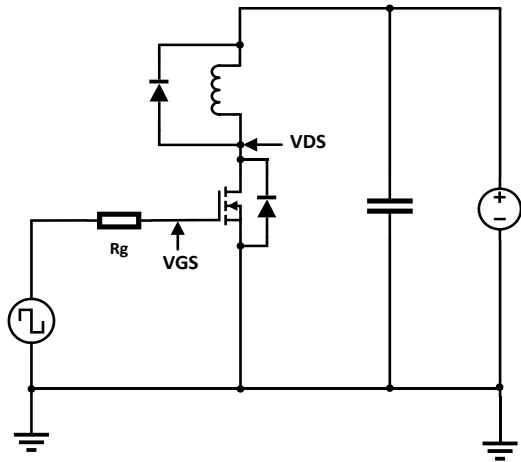
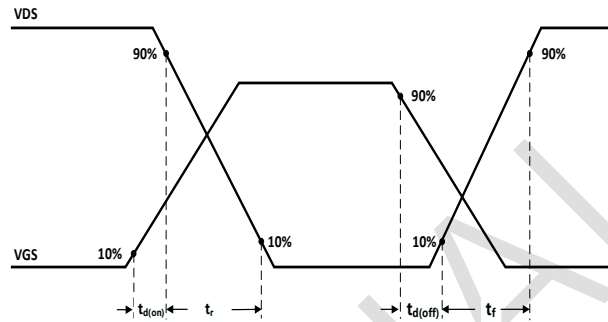


Figure 17. Switching time test circuit

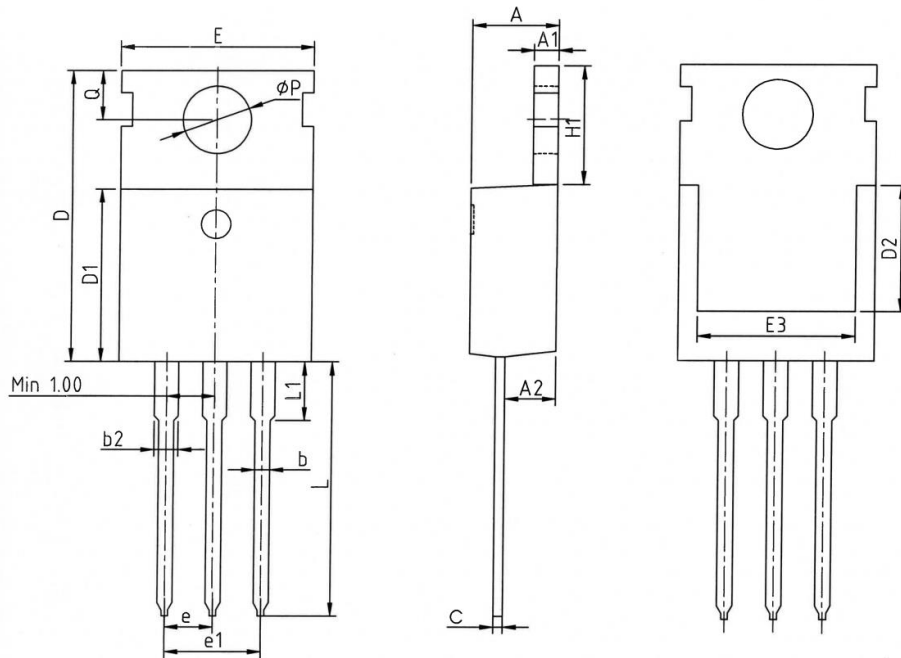


Waveform 3. Switching time waveform

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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