



N-Channel Super Junction MOSFET, 650V, 11A, 0.38Ω

General Description

The VAS65R380 Super Junction (SJ) Power MOSFET is designed to provide best cost-performance solution for various application fields. Featuring fast switching and high efficiency, the VAS65R380 make applications more efficient, more compact and cooler. VAS65R380 is available in TO-220, TO-220FP, DAPK and IPAK packages.

Features

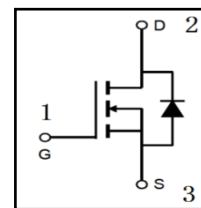
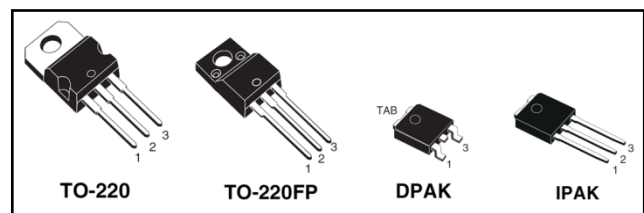
- High Efficiency
- Low Gate Charge
- High Body Diode Ruggedness
- 100% EAS Guaranteed
- Pb-Free

Application

Adapter, TV, LED Lighting, PFC stages, hard switching PWM and resonant switching stages.

Product Summary

$V_{DS}@T_{j,max}$	660 V
$R_{DS(on)}@V_{GS}=10V$	0.38 Ω
I_D Continuous Current	11 A
$V_{(GS)th}$	3.0 V
$Q_{g,typ}$	32 nC



Absolute Maximum Ratings

Parameter	Symbol	Value	Unit	Condition
Drain-Source Voltage	V_{DS}	650	V	
Continuous drain current ⁽¹⁾	I_D	11 7.1	A	$T_C=25^\circ C$ $T_C=100^\circ C$
Gate-Source Voltage	V_{GS}	± 20	V	Static
Pulsed drain current ⁽²⁾	I_{DM}	29	A	$T_C=25^\circ C$
Avalanche energy, single pulse	E_{AS}	215	mJ	$I_D=1.8A$; $V_{DD}=50V$; see Figure 13
Avalanche energy, repetitive	E_{AR}	0.32	mJ	$I_D=1.8A$; $V_{DD}=50V$; see Figure 13
Avalanche current, repetitive	I_{AR}	1.8	A	
Power dissipation TO-220	P_{tot_TO220}	83	W	$T_C=25^\circ C$
Power dissipation TO-220FP	$P_{tot_TO220FP}$	31	W	$T_C=25^\circ C$
Power dissipation TO-251, TO252	P_{tot_TO}	38	W	$T_C=25^\circ C$
Continuous diode forward current	I_S	11	A	$T_C=25^\circ C$
Diode pulse current ⁽²⁾	$I_{S,pulse}$	30	A	$T_C=25^\circ C$



- (1) Limited by T_{j_max} . Maximum duty cycle $D=0.65$
 (2) Pulse width T_p limited by T_{j_max}

Thermal characteristics

Symbol	Parameter	Value			Unit
		TO-220	TO-220FP	TO-252	
R_{thj_case}	Thermal resistance, junction-case, max	1.5	4.0	1.5	°C/W
R_{thJA}	Thermal resistance, junction-ambient, max	62	80	35 ⁽³⁾	°C/W
T_{sold}	Soldering temperature, max	260	260	260	°C

(3) SMD version, device on PCB, 6cm² cooling area

Package and Ordering Information

Device	Package	Marking
VAS65R380P	TO-220	VAS65R380P
VAS65R380FP	TO-220FP	VAS65R380FP
VAS65R380D	DPAK	VAS65R380D
VAS65R380I	IPAK	VAS65R380I



Electrical Characteristics ($T_j=25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Static Characteristic						
Drain-Source breakdown Voltage	$V_{(BR)DSS}$	650			V	$V_{GS}=0V, I_D=0.25mA$
Gate Threshold Voltage	$V_{(GS)th}$	2.5	3.0	3.5	V	$V_{DS}=V_{GS}, I_D=0.06mA$
Drain-Source on resistance	$R_{(DS)on}$		0.35	0.38	Ω	$V_{GS}=10V, I_D=3.8A, T_j=25^\circ\text{C}$
			0.89		Ω	$V_{GS}=10V, I_D=3.8A, T_j=150^\circ\text{C}$
Zero gate voltage drain current	I_{DSS}			1	μA	$V_{DS}=650V, V_{GS}=0V, T_j=25^\circ\text{C}$
			10		μA	$V_{DS}=650V, V_{GS}=0V, T_j=150^\circ\text{C}$
Gate-Source leakage current	I_{GSS}			100	nA	$V_{GS}=20V, V_{DS}=0V$
Gate resistance	R_g		7.5		Ω	$f=1MHz, \text{open drain}$
Dynamic Characteristic						
Input Capacitance	C_{iss}		760		pF	$V_{GS}=0V, V_{DS}=100V, f=1MHz$
Output Capacitance	C_{oss}		54		pF	$V_{GS}=0V, V_{DS}=100V, f=1MHz$
Turn-on delay time	$T_{d(on)}$		11		nS	$V_{DD}=400V, V_{GS}=13V, I_D=4.8A, R_G=3.4\Omega; \text{See Figure 14}$
Rise time	T_r		9		nS	
Turn-off delay time	$T_{d(off)}$		56		nS	
Fall time	T_f		8		nS	
Gate Charge Characteristic						
Gate to source charge	Q_{gs}		4		nC	$V_{DD}=480V, I_D=4.8A, V_{GS}=0 \text{ to } 10V$
Gate to drain charge	Q_{gd}		18		nC	
Gate charge total	Q_g		33		nC	
Gate plateau voltage	$V_{plateau}$		5.3		V	
Reverse diode characteristic						
Diode forward voltage	V_{FD}		0.9		V	$V_{GS}=0V, I_F=4.8A, T_j=25^\circ\text{C}$
Reverse recovery time	t_{rr}		280		nS	$V_R=400V, I_F=4.8A, dI_F/dt=100A/\mu S$
Reverse recovery charge	Q_{rr}		3.1		μC	
Peak reverse recovery current	I_{rrm}		22		A	



Electrical Characteristic Diagrams

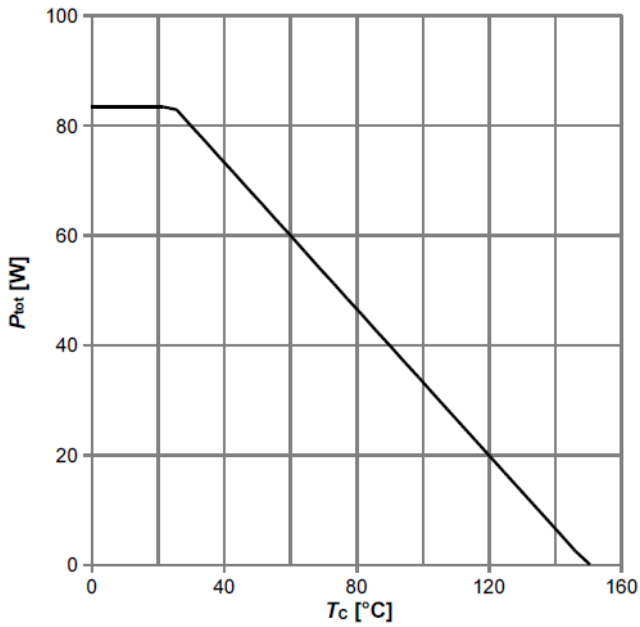


Figure 1 TO-220 Power Dissipation

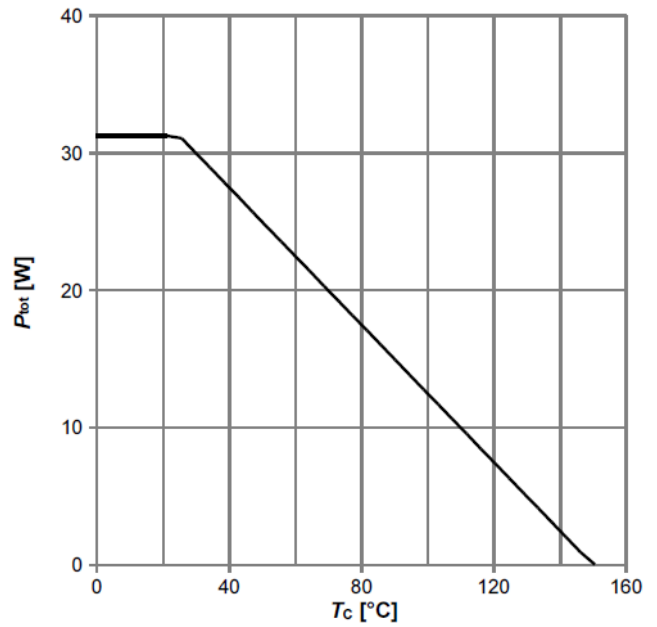


Figure 2 TO-220FP Power Dissipation

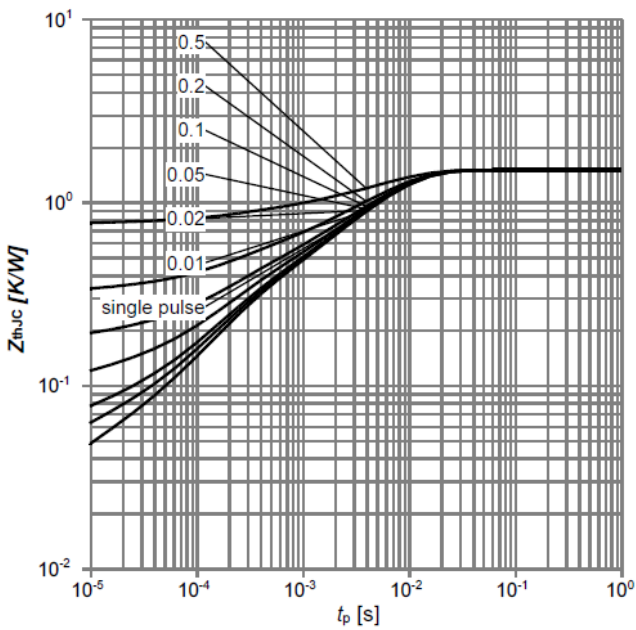


Figure 3 TO-220 Transient thermal impedance

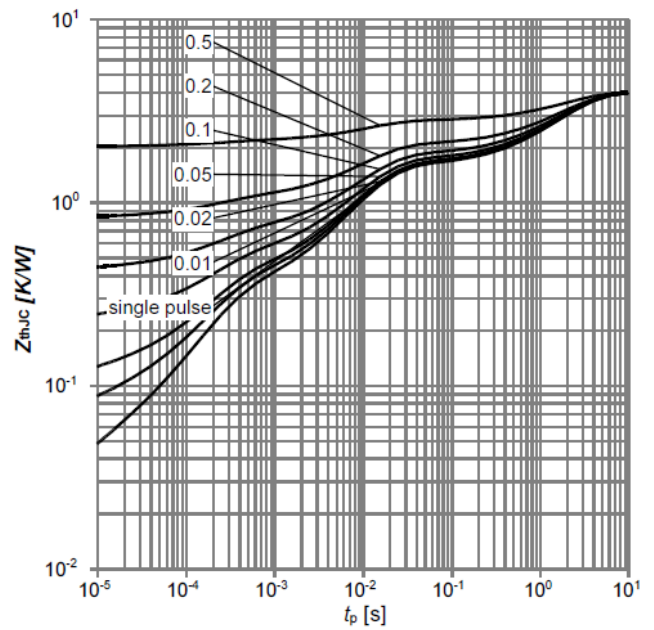


Figure 4 TO-220FP Transient thermal impedance

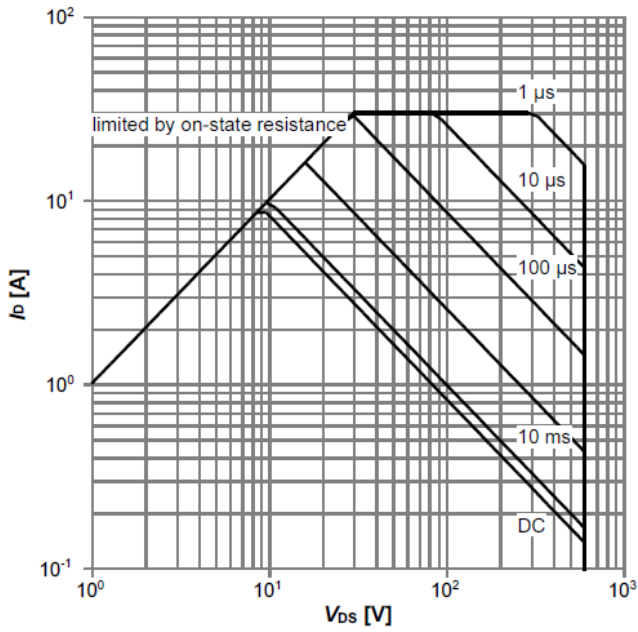


Figure 5 TO-220 Safe Operation Area, $T_c=25^\circ\text{C}$

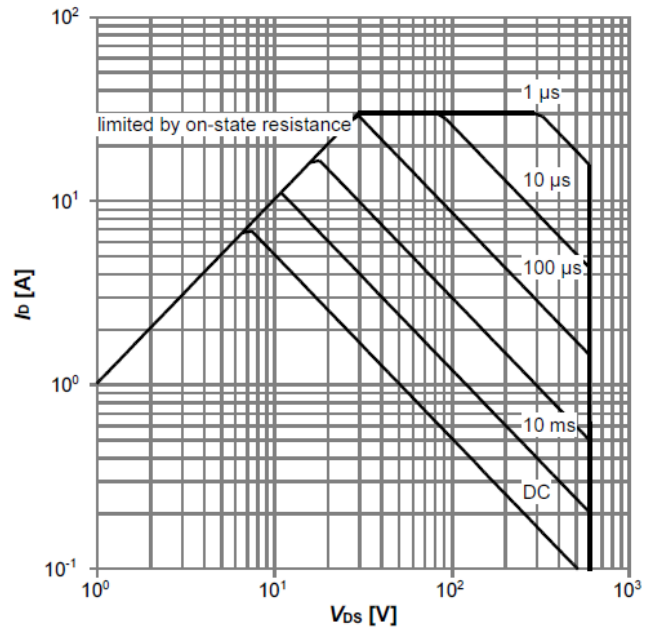


Figure 6 TO-220FP Safe Operation Area, $T_c=25^\circ\text{C}$

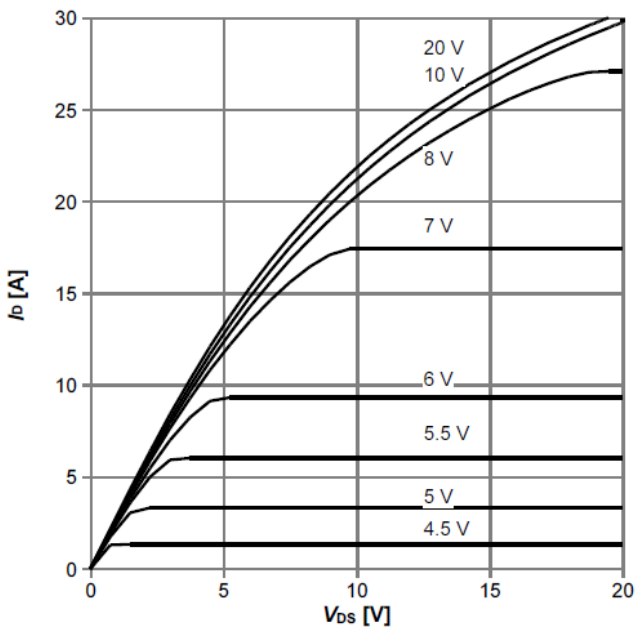


Figure 7 Typical Transfer Characteristics, $T_c=25^\circ\text{C}$

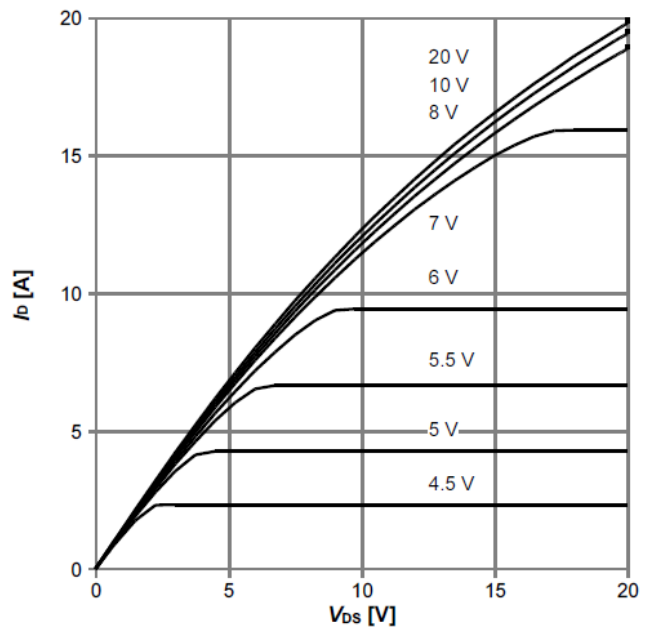


Figure 8 Typical Transfer Characteristics, $T_c=125^\circ\text{C}$

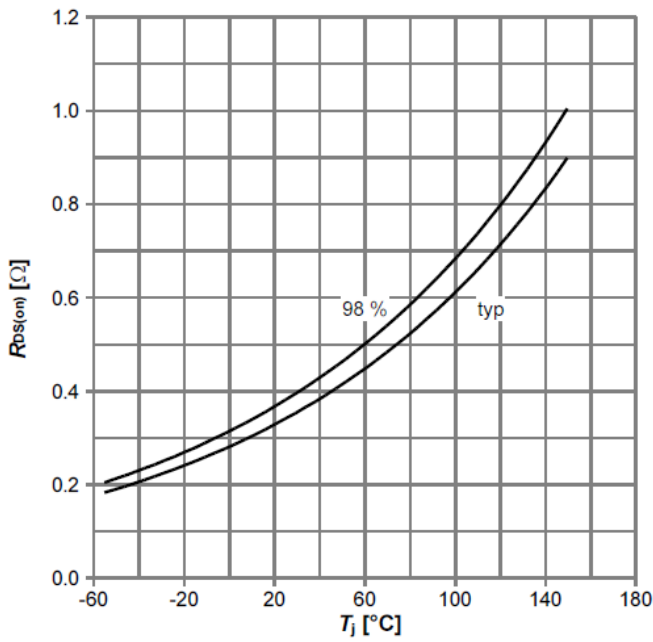


Figure 9 Drain-Source on state resistance

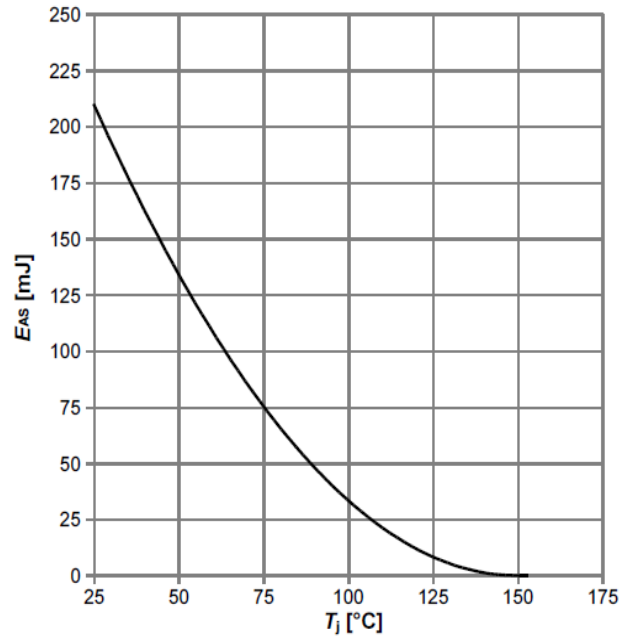


Figure 10 Avalanche Energy

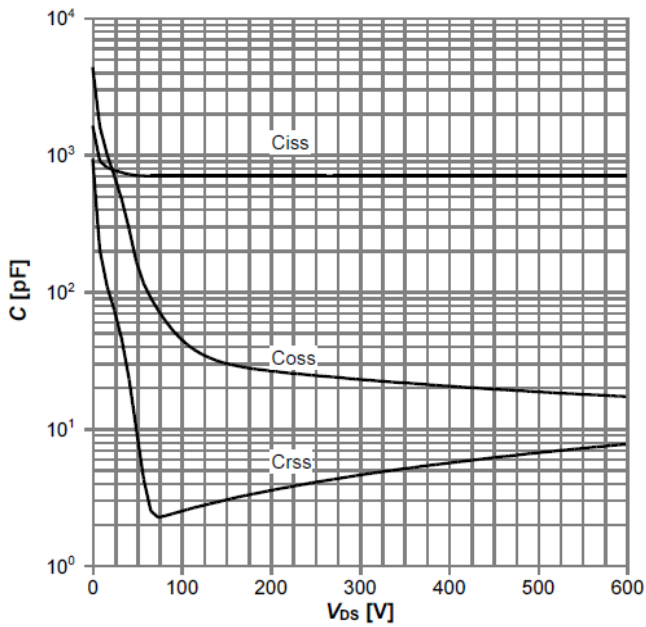


Figure 11 Typical Capacitance

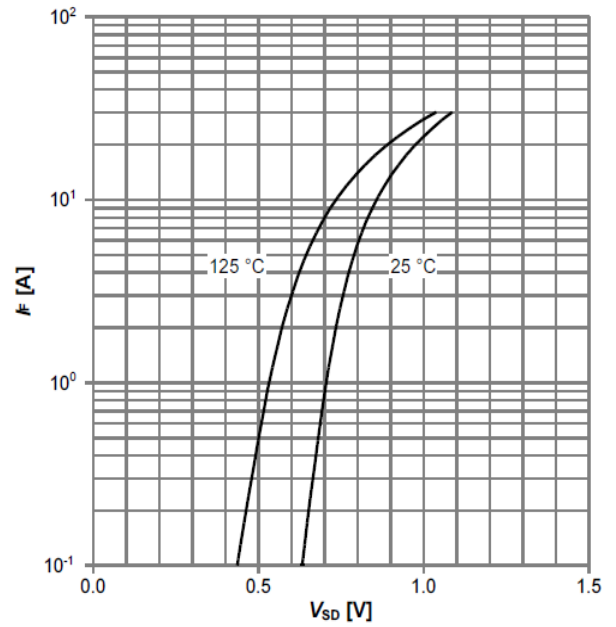


Figure 12 Forward characteristics of reverse diode

Parameter Test Circuits

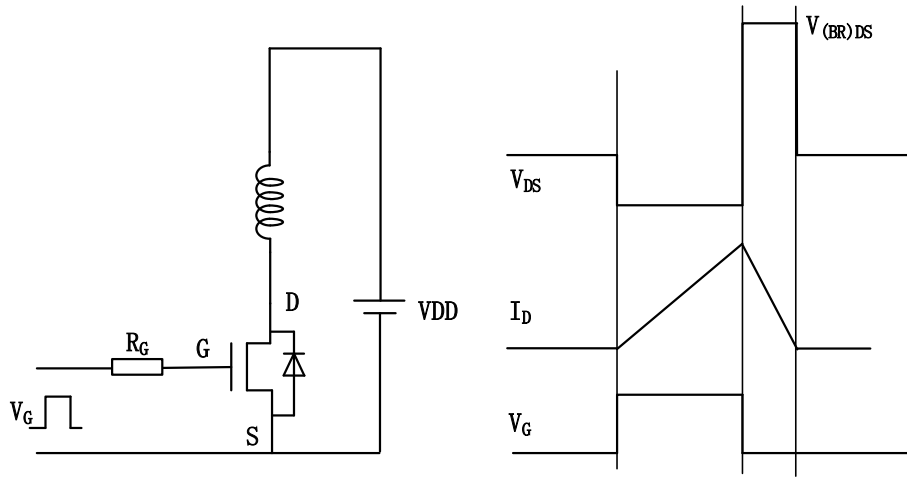


Figure 13 Unclamped Inductive Switching (UIS) Test circuit and waveforms

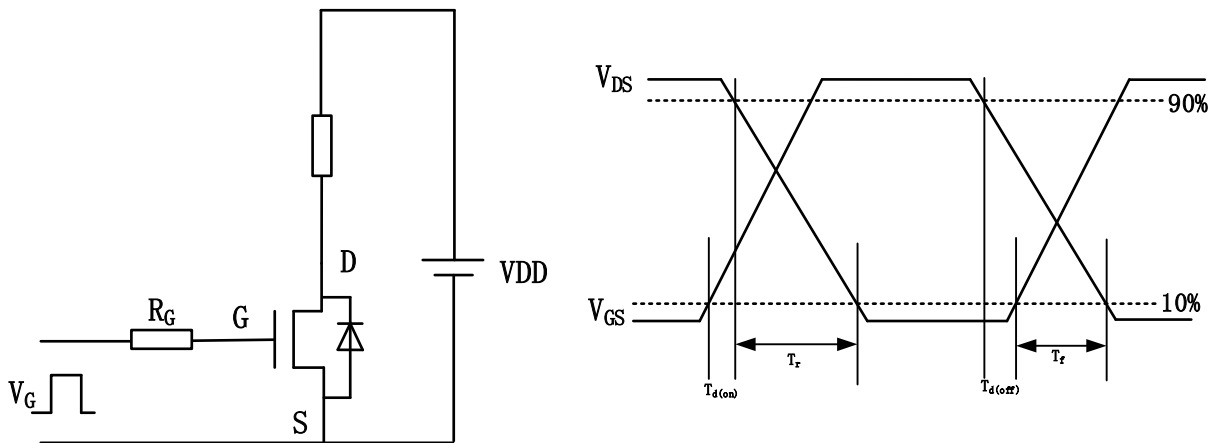


Figure 14 Resistive Switching time Test circuit and waveforms

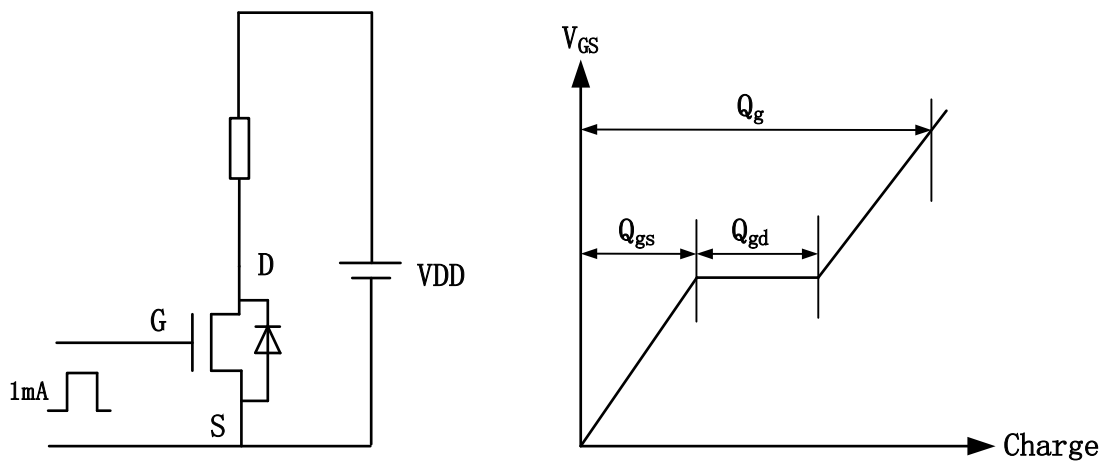
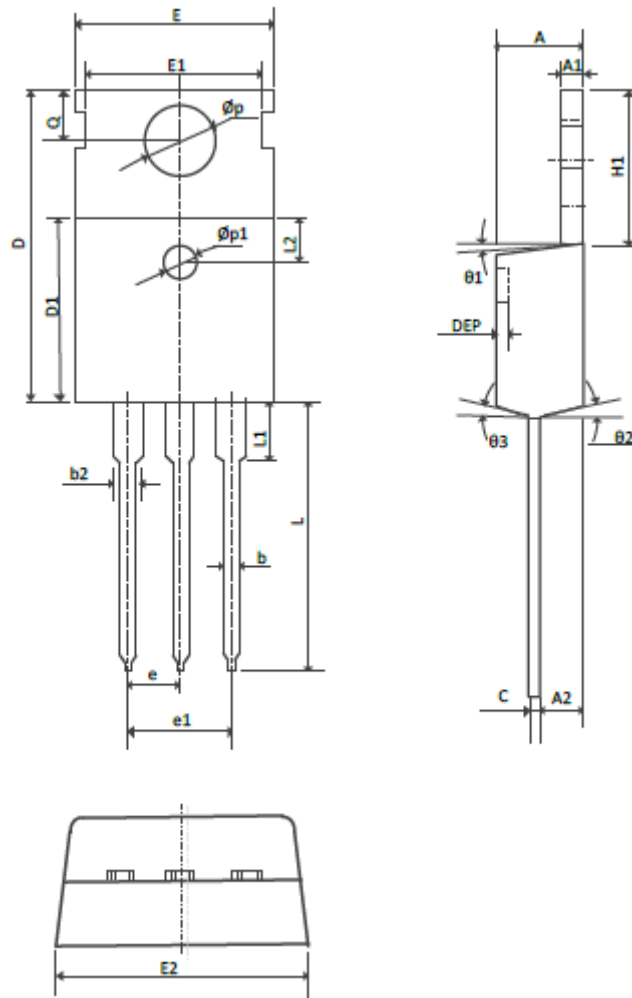


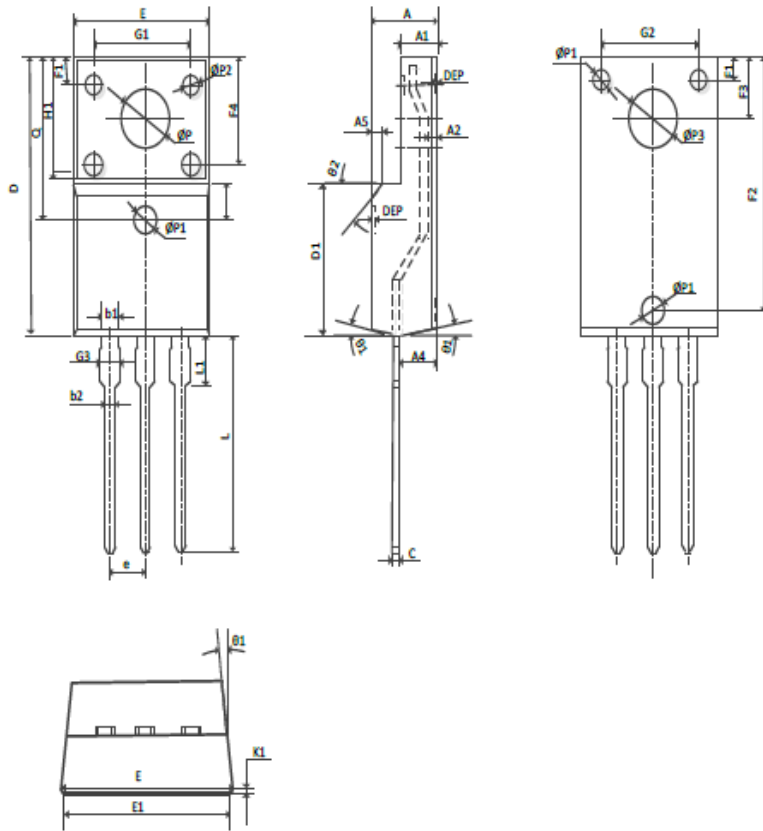
Figure 15 Gate charge Test circuit and waveforms



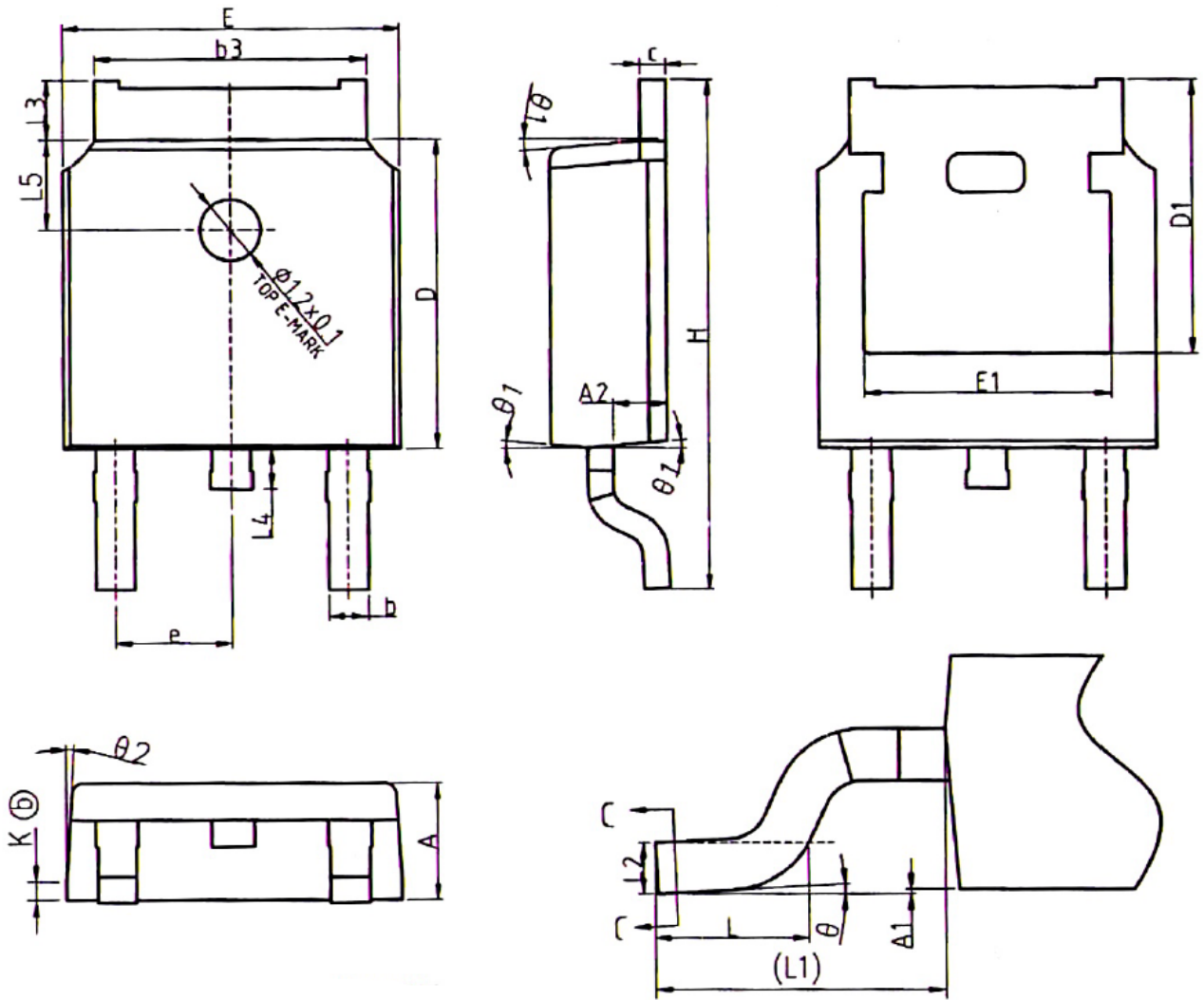
Package Information



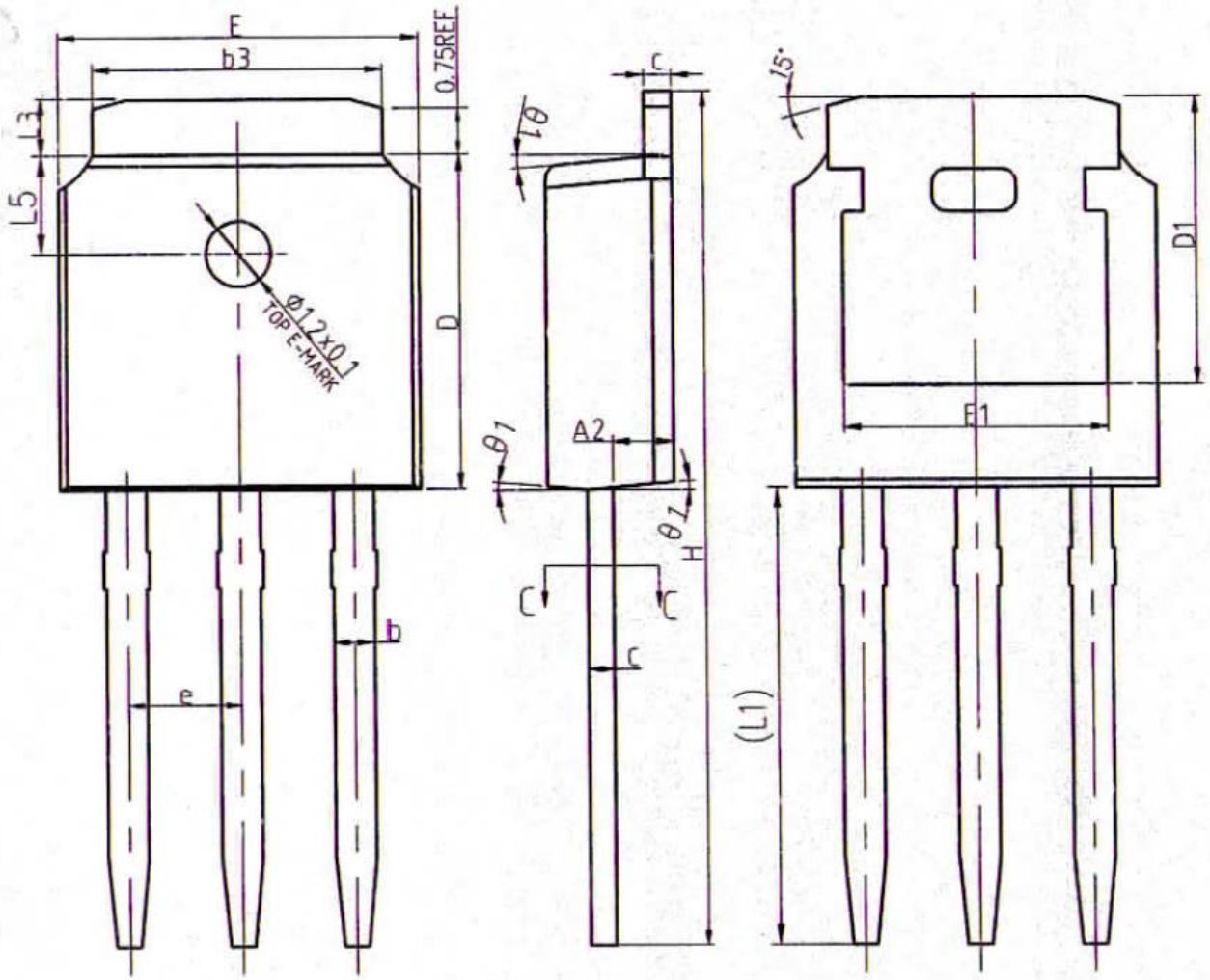
TO-220 Common dimensions							
SYMBOL	Unit: mm			SYMBOL	Unit: mm		
	MIN	NOM	MAX		MIN	NOM	MAX
A	4.40	4.57	4.70	e1	5.08BSC		
A1	1.27	1.30	1.37	H1	6.40	6.50	6.60
A2	2.35	2.40	2.50	L	12.75	13.50	13.65
b	0.77	0.80	0.90	L1		3.10	3.30
b2	1.17	1.27	1.36	L2	2.50REF		
c	0.48	0.50	0.56	ΦP	3.50	3.60	3.63
D	15.40	15.60	15.80	Q	2.73	2.80	2.87
D1	9.00	9.10	9.20	θ1	5°	7°	9°
DEP	0.05	0.10	0.20	θ2	1°	3°	5°
E1		8.70		θ3	1°	3°	5°
E2	9.80	10.00	10.20				
ΦP1	1.40	1.50	1.60				
e	2.54BSC						



TO-220FP Common dimensions							
SYMBOL	Unit: mm			SYMBOL	Unit: mm		
	MIN	NOM	MAX		MIN	NOM	MAX
E	10.04	10.20	10.36	ΦP2	1.15	1.20	1.25
A	4.50	4.70	4.90	ΦP3	3.45REF		
A1	2.34	2.54	2.74	θ1	5°	7°	9°
A2	0.70	0.85	1.00	θ2		45°	
A4	2.65	2.75	2.85	DEP	0.05	0.10	0.15
A5	1.00REF			F1	1.90	2.00	2.10
C	0.42	0.50	0.58	F2	13.80	13.90	14.00
D	15.67	15.87	16.07	F3	3.20	3.30	3.40
Q	9.20REF			F4	5.30	5.40	5.50
H1	6.70REF			G1	6.60	6.70	6.80
e	2.54BSC			G2	6.90	7.00	7.10
ΦP	3.183REF			G3	1.10	1.30	1.50
L	12.78	12.98	13.18	b1	1.05	1.20	1.35
L1	3.25	3.45	3.65	b2	0.70	0.80	0.85
D1	9.17REF			E1	9.90	10.00	10.10
ΦP1	1.40	1.50	1.60	K1	0.65	0.70	0.75



TO-252 Common dimensions							
SYMBOL	Unit: mm			SYMBOL	Unit: mm		
	MIN	NOM	MAX		MIN	NOM	MAX
A	2.20	2.30	2.38	e	2.286BSC		
A1	0.00	-	0.10	H	9.90	10.10	10.30
A2	0.97	1.07	1.17	L	1.40	1.50	1.70
b	0.72	0.78	0.85	L1	2.90REF		
b1	0.71	0.76	0.81	L2	0.51BSC		
b3	5.23	5.33	5.46	L3	0.90		1.25
c	0.47	0.53	0.58	L4	0.60	0.80	1.00
c1	0.46	0.51	0.56	L5	1.70	1.80	1.90
D	6.00	6.10	6.20	theta	0°		8°
D1	5.30REF			theta1	5°	7°	9°
E	6.50	6.60	6.70	theta2	5°	7°	9°
E1	4.70	4.83	4.92	K	0.40REF		



TO-251 Common dimensions

SYMBOL	Unit: mm			SYMBOL	Unit: mm		
	MIN	NOM	MAX		MIN	NOM	MAX
A	2.20	2.30	2.38	e	2.286BSC		
A2	0.97	1.07	1.17	H	16.10	16.40	16.60
b	0.72	0.78	0.85	L1	9.20	9.40	9.60
b1	0.71	0.76	0.81	L3	0.90	1.02	1.25
b3	5.23	5.33	5.46	L5	1.70	1.80	1.90
c	0.47	0.53	0.58	θ_1	5°	7°	9°
c1	0.46	0.51	0.56	θ_2	5°	7°	9°
D	6.00	6.10	6.20	K	0.40REF		
D1	5.30REF						
E	6.50	6.60	6.70				
E1	4.70	4.83	4.92				

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