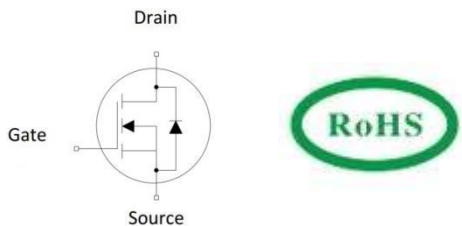


N-channel 650V, 11A, 0.38Ω Super-Junction Power MOSFET

Description Super-junction power MOSFET is a revolutionary technology for high voltage power MOSFET , designed according to the SJ principle. The resulting device has extremely low on resistance,making it especially suitable for applications which require superior power density and outstanding efficiency. Features ◆ Very low FOM $R_{DS(on)} \times Q_g$ ◆ 100% UIS tested ◆ RoHS compliant Applications ◆ Power factor correction (PFC). ◆ Switched mode power supplies (SMPS). ◆ Uninterrupted power supply (UPS).	Product Summary <table> <tr> <td>$V_{DS} @ T_{j,25^\circ C}$</td><td>650V</td></tr> <tr> <td>$R_{DS(on),max}$</td><td>0.38Ω</td></tr> <tr> <td>I_D</td><td>11A</td></tr> <tr> <td>$Q_{g,typ}$</td><td>16.9 nC</td></tr> </table>  TO-252  TO-251  TO-220F  N-Channel MOSFET	$V_{DS} @ T_{j,25^\circ C}$	650V	$R_{DS(on),max}$	0.38Ω	I_D	11A	$Q_{g,typ}$	16.9 nC
$V_{DS} @ T_{j,25^\circ C}$	650V								
$R_{DS(on),max}$	0.38Ω								
I_D	11A								
$Q_{g,typ}$	16.9 nC								

Marking information

Product	Package	Marking	Packing method
RMA65R380SD	TO-252	RMA65R380SD	Reel
RMG65R380SD	TO-251	RMG65R380SD	Tube
RMC65R380SD	TO-220F	RMC65R380SD	Tube

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	650	V
Continuous drain current ($T_C = 25^\circ C$) ($T_C = 100^\circ C$)	I_D	11 7	A A
Pulsed drain current ¹⁾	I_{DM}	33	A
Gate-Source voltage	V_{GSS}	± 30	V
Avalanche energy, single pulse ²⁾	E_{AS}	130	mJ
Avalanche current, repetitive ³⁾	I_{AR}	1.6	A
Power Dissipation TO-252 /TO-251 ($T_C = 25^\circ C$) - Derate above 25°C	P_D	113.6 0.9	W W/°C
Power Dissipation TO-220F ($T_C = 25^\circ C$) - Derate above 25°C	P_D	27.5 0.2	W W/°C
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to +150	°C
Continuous diode forward current	I_S	11	A
Diode pulse current	$I_{S,pulse}$	33	A
MOSFET dv/dt ruggedness, $V_{DS}=0...480V$	dv/dt	50	V/ns
Reverse diode dv/dt, $V_{DS}=0...480V$	dv/dt	15	V/ns

Thermal Characteristics

Parameter	Symbol	Value		Unit
		TO252/TO-251	TO-220F	
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.1	4.6	$^{\circ}\text{C/W}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	85.6	54.8	$^{\circ}\text{C/W}$
Soldering temperature, wave soldering only allowed at leads. (1.6mm from case for 10s)	T_{sold}	260	260	$^{\circ}\text{C}$

Electrical Characteristics

 $T_c = 25^{\circ}\text{C}$ unless otherwise noted

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Static characteristics						
Drain-source breakdown voltage	BV _{DSS}	V _{GS} =0 V, I _D =250uA	650	-	-	V
Gate threshold voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =250uA	2.5		4.0	V
Drain cut-off current	I _{DSS}	V _{DS} =650 V, V _{GS} =0 V, T _j = 25°C T _j = 125°C	- -	- 10	1	μA
Gate leakage current, Forward	I _{GSSF}	V _{GS} =30 V, V _{DS} =0 V	-	-	100	nA
Gate leakage current, Reverse	I _{GSSR}	V _{GS} =-30 V, V _{DS} =0 V	-	-	-100	nA
Drain-source on-state resistance	R _{DS(on)}	V _{GS} =10 V, I _D =5.5 A T _j = 25°C	-	0.34	0.38	Ω
Dynamic characteristics						
Input capacitance	C _{iss}	V _{DS} = 100 V, V _{GS} = 0 V, f = 1MHz	-	662.7	-	pF
Output capacitance	C _{oss}		-	30.9	-	
Reverse transfer capacitance	C _{rss}		-	1.4	-	
Turn-on delay time	t _{d(on)}	V _{DD} = 400V, I _D =5.5A R _G = 10Ω, V _{GS} =10V	-	8.6	-	ns
Rise time	t _r		-	20.8	-	
Turn-off delay time	t _{d(off)}		-	40.6	-	
Fall time	t _f		-	47.7	-	
Gate charge characteristics						
Gate to source charge	Q _{gs}	V _{DD} =520 V, I _D =5.5A, V _{GS} =0 to 10 V	-	4.4	-	nC
Gate to drain charge	Q _{gd}		-	4.8	-	
Gate charge total	Q _g		-	16.9	-	
Gate plateau voltage	V _{plateau}		-	5.5	-	V
Reverse diode characteristics						
Diode forward voltage	V _{SD}	V _{GS} =0 V, I _F =5.5A	-	-	1.2	V
Reverse recovery time	t _{rr}	V _R =400 V, I _F =5.5A, dI _F /dt=100 A/μs	-	211.7	-	ns
Reverse recovery charge	Q _{rr}		-	1.8	-	μC
Peak reverse recovery current	I _{rrm}		-	18.4	-	A

Notes:

- Limited by maximum junction temperature, maximum duty cycle is 0.75.
- $I_{\text{AS}} = 1.8\text{A}$, $V_{\text{DD}} = 50\text{V}$, Starting $T_{\text{J}} = 25^{\circ}\text{C}$.

Electrical Characteristics Diagrams

Figure 1. Output Characteristics

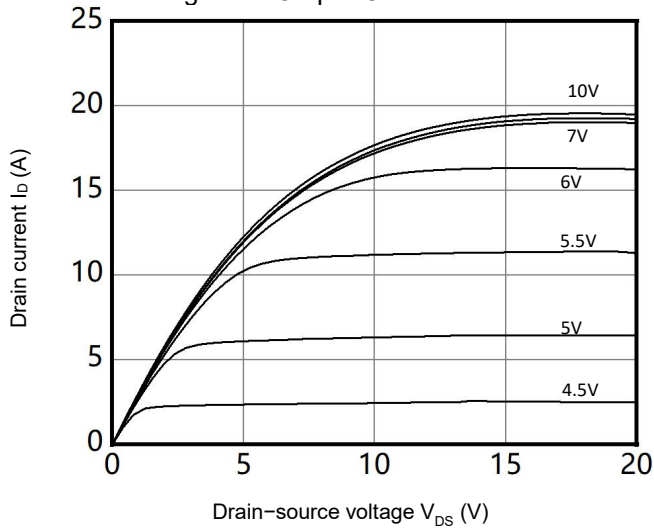


Figure 2. Transfer Characteristics

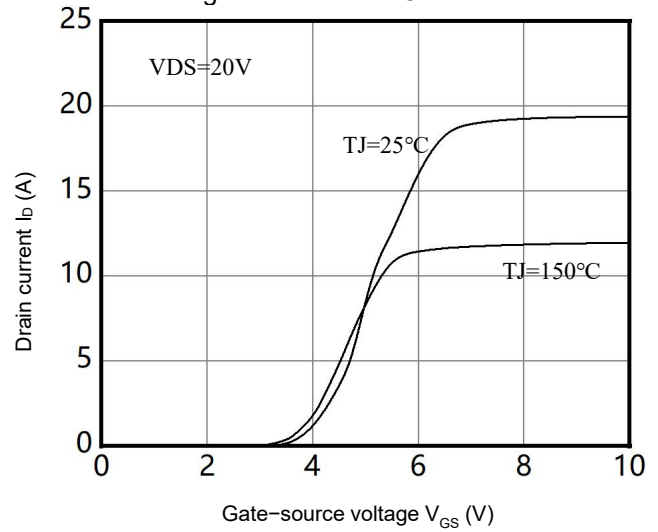


Figure 3. On-Resistance vs. Drain Current

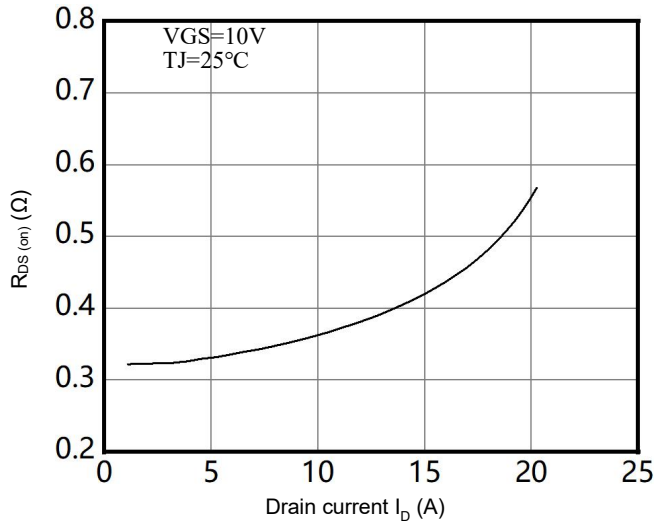


Figure 4. Capacitance Characteristics

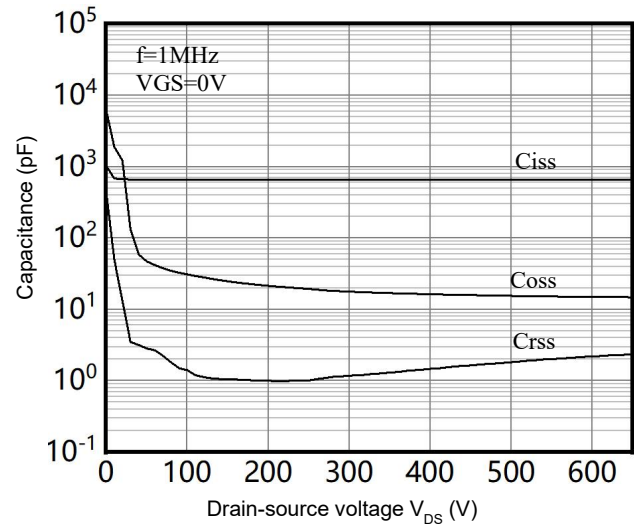


Figure 5. Gate Charge Characteristics

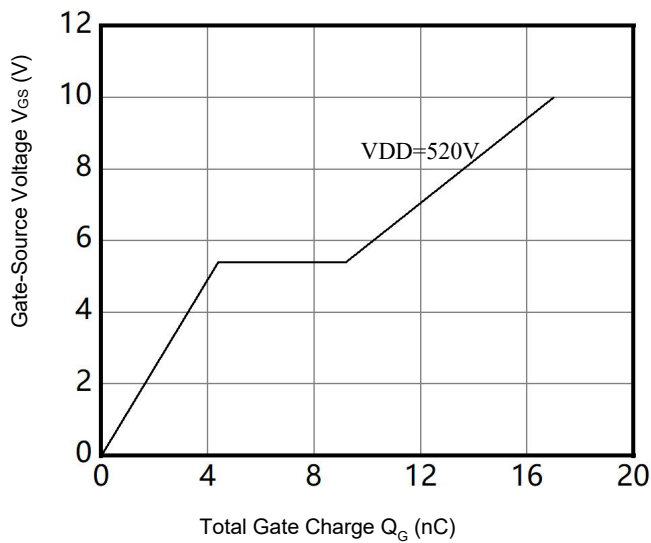


Figure 6. Body Diode Forward Voltage

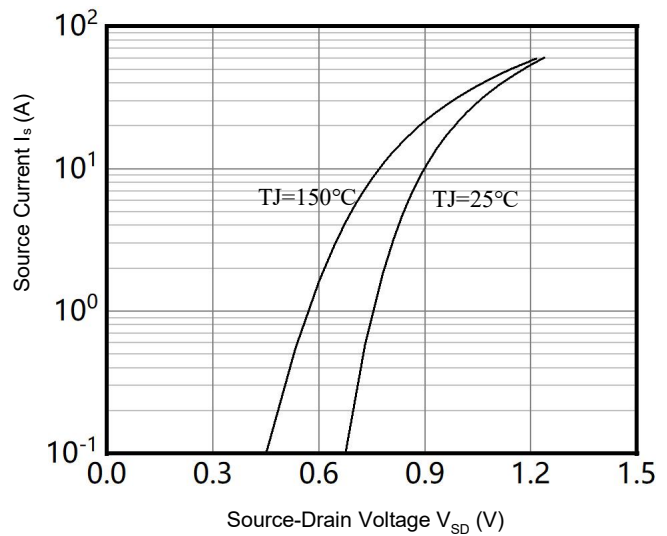


Figure 7. Breakdown Voltage vs. Temperature

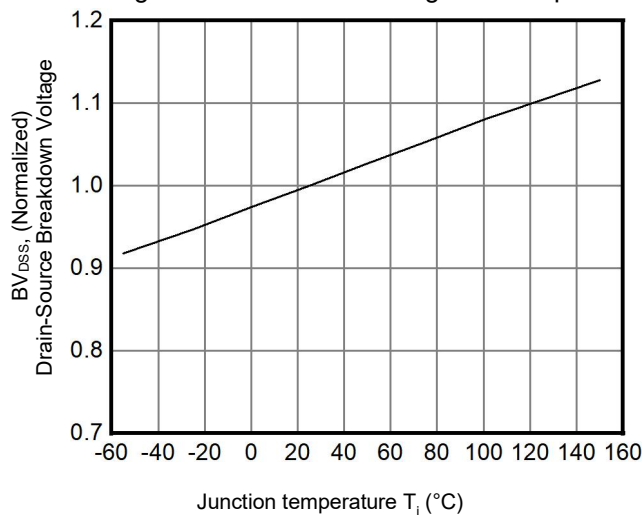


Figure 8. On-Resistance vs. Temperature

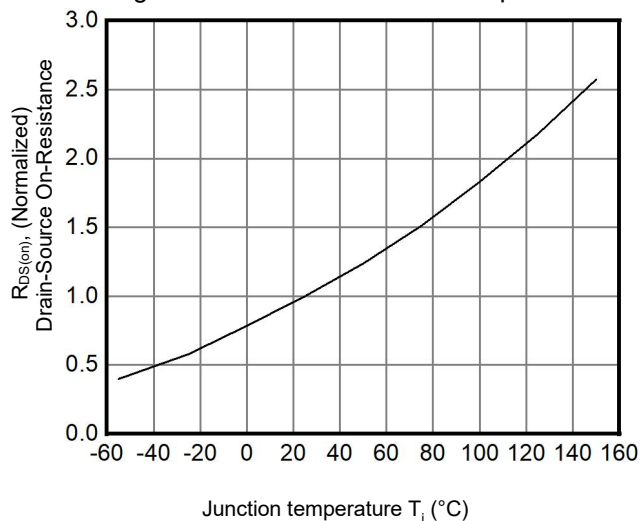


Figure 9. Transient Thermal Impedance
TO-220F

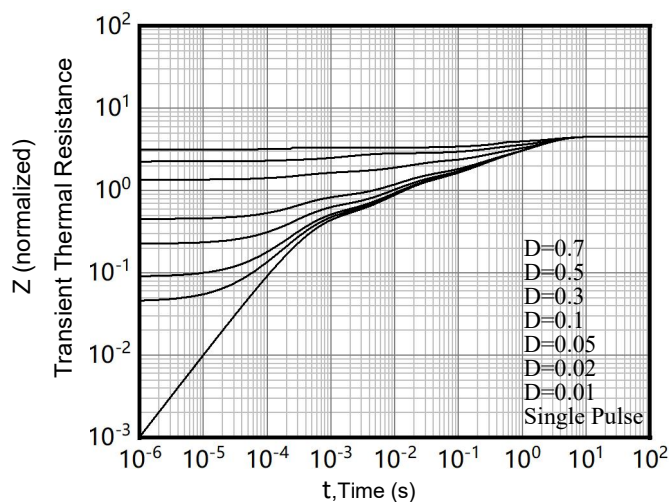


Figure 10. Maximum Safe Operating Area
TO-220F

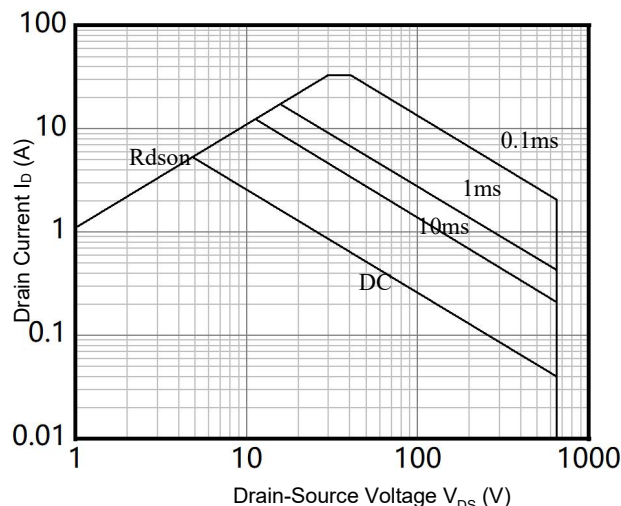


Figure 11. Transient Thermal Impedance
TO-252/TO-251

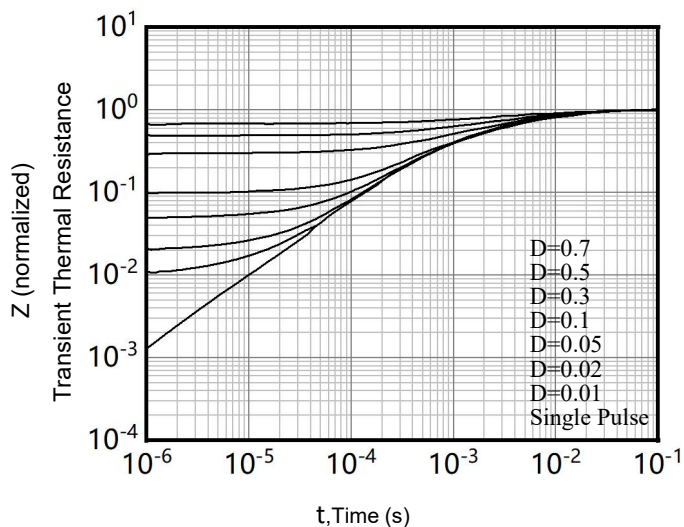


Figure 12. Maximum Safe Operating Area
TO-252/TO-251

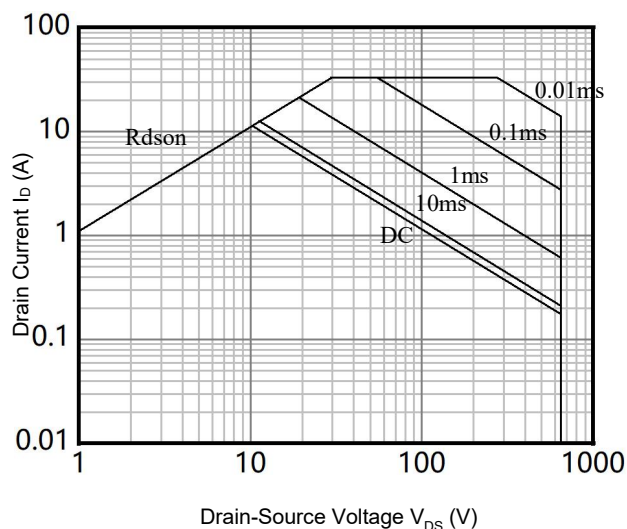
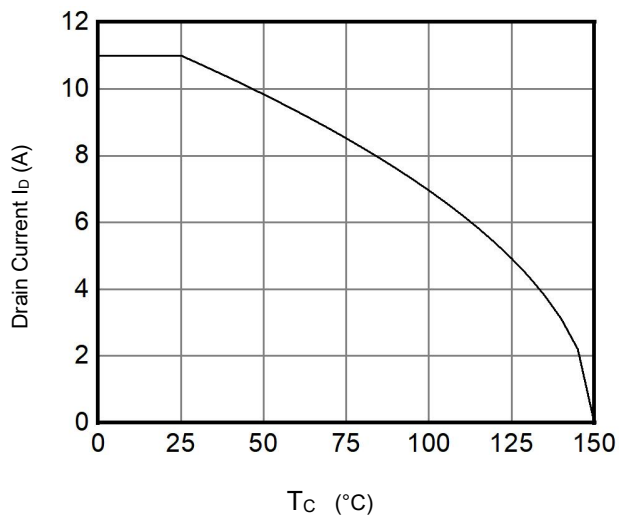
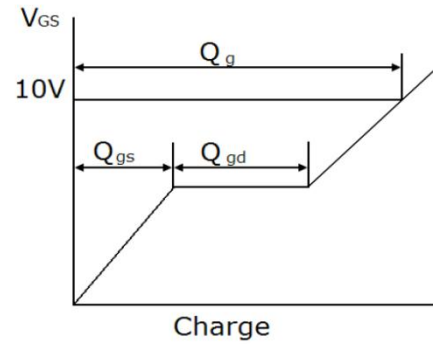
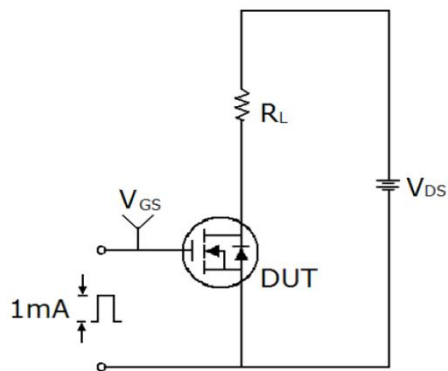


Figure11. Drain Current vs. Temperature

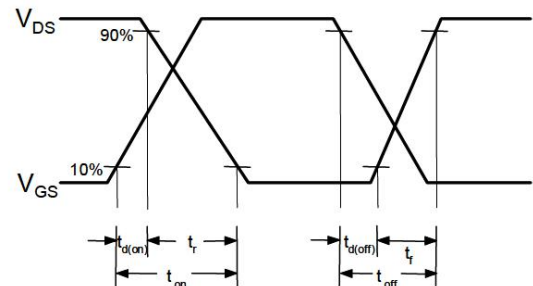
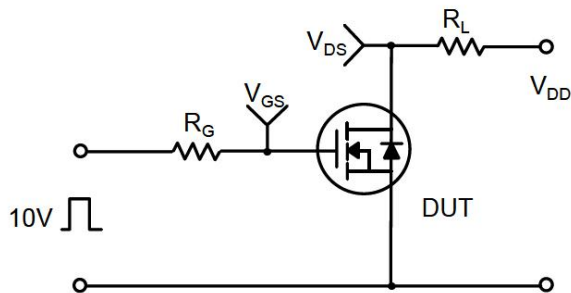


Test Circuits

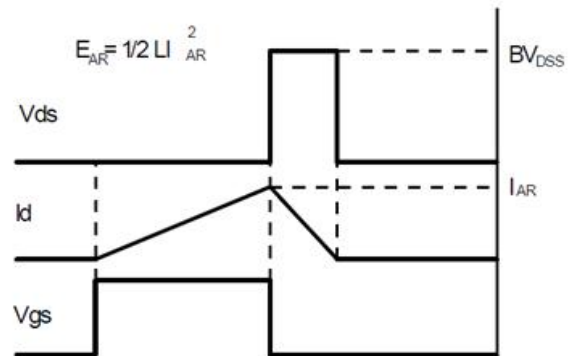
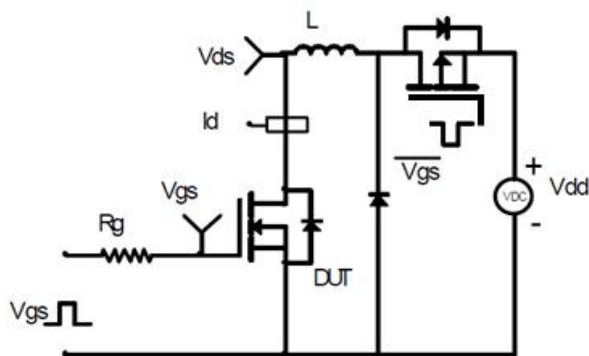
Gate Charge Test Circuit & Waveform



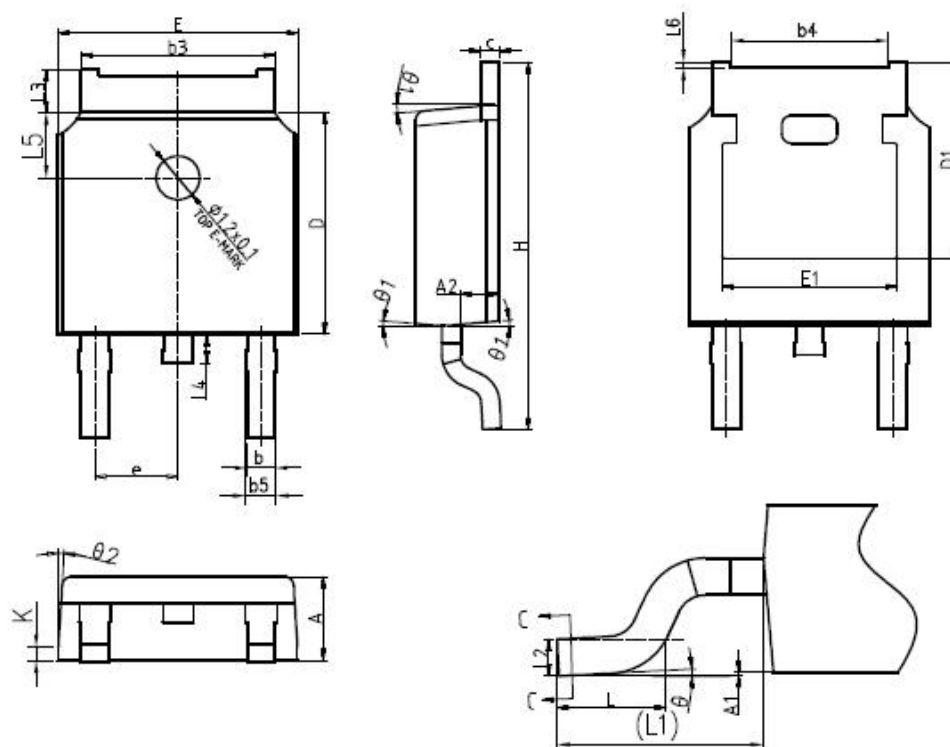
Switching Test Circuit & Waveform



Unclamped Inductive Switching Test Circuit & Waveform



Mechanical Dimensions for TO-252

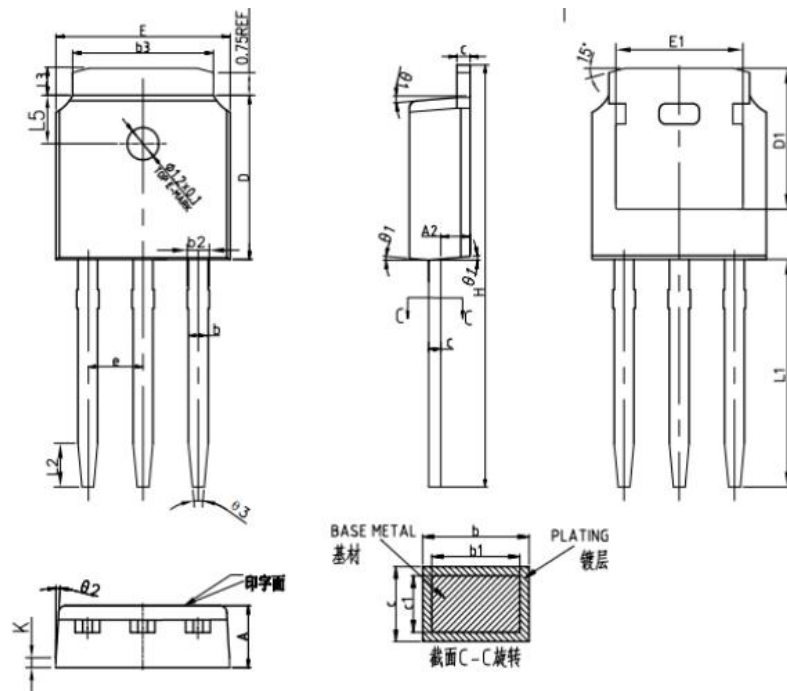


单位: mm

SYMBOL	mm	
	MIN	MAX
A	2. 20	2. 40
A1	0. 00	0. 20
A2	0. 97	1. 17
b	0. 50	0. 90
b3	5. 10	5. 50
b4	4. 27	4. 37
b5	0. 72	0. 93
c	0. 43	0. 61
D	5. 95	6. 25
D1	5. 30REF	
H	9. 40	10. 50
E	6. 40	6. 75

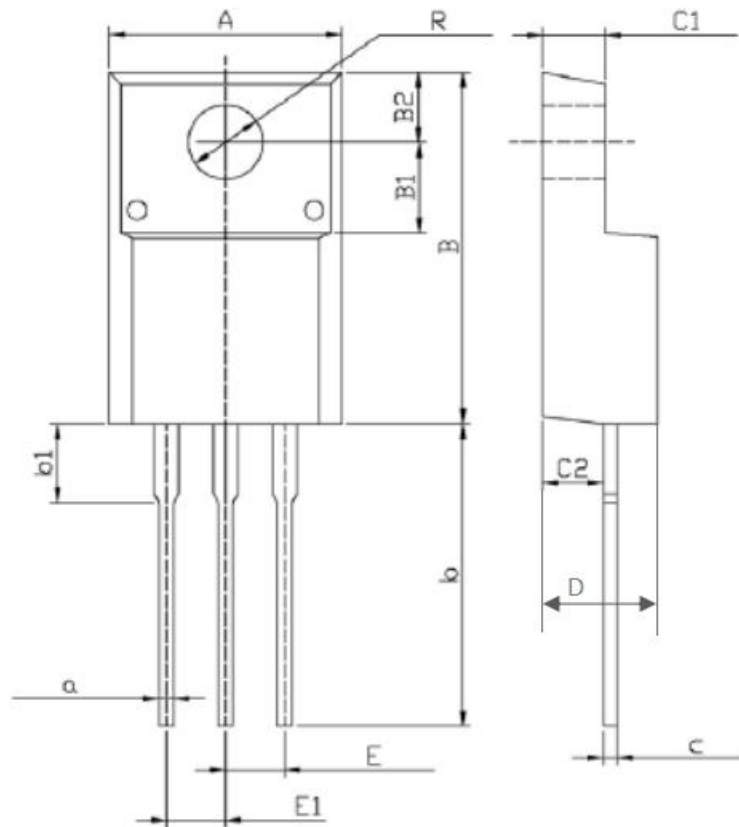
E1	4. 63	—
e	2. 286BSC	
L	1. 25	1. 75
L1	2. 90REF	
L2	0. 51BSC	
L3	0. 88	1. 28
L4	0. 50	1. 00
L5	1. 65	1. 95
L6	0	0. 123
θ	0°	8°
θ 1	5°	9°
θ 2	5°	9°
K	0. 40REF	

Mechanical Dimensions for TO-251



SYMBOL	mm	
	MIN	MAX
A	2.20	2.38
A2	0.97	1.17
b	0.72	0.85
b1	0.76	0.87
b2	0.72	0.95
b3	5.23	5.46
c	0.47	0.58
c1	0.46	0.56
D	6.00	6.20
D1	5.30REF	
E	6.5	6.7
E1	4.7	4.92
e	2.286BSC	
L1	9.20	9.60
L2	1.25	1.45
L3	0.90	1.25
L5	1.70	1.90
θ 1	5°	9°
θ 2	5°	9°
θ 3	11°	15°
K	0.40REF	

Mechanical Dimensions for TO-220F



SYMBOL	mm	
	MIN	MAX
D	4.30	5.00
A	9.70	10.50
B	14.70	16.17
B1	3.80	4.00
B2	2.90	3.60
R	3.00	3.62
b	12.50	14.00
b1	1.85	3.90
a	0.55	0.95
E	2.29	2.79
E1	2.29	2.79
C1	2.24	2.90
C2	2.46	3.06
c	0.40	0.70