



60V P-Channel Power MOSFET

MOSFET

Metal Oxide Semiconductor Field Effect Transistor

HRT60P18x Data Sheet

Rev. 2020 V1.0





60V P-Channel Power MOSFET

<p>Description</p> <p>P-Channel Power MOSFET designed by HR-Micro Semiconductor Company, according to the advanced Trench Technology. This device provides an excellent gate charge and $R_{DS(on)}$, which leads to extremely communication and conduction losses.</p>		
<p>Features</p> <ul style="list-style-type: none"> • Low FOM $R_{DS(on)} \times Q_{gd}$ • 100% avalanche tested • Easy to use/drive • RoHS compliant 		
<p>Applications</p> <ul style="list-style-type: none"> • Load Switch 		
<p>Key Performance Parameters</p>		
<p>Parameter</p>	<p>Value</p>	<p>Unit</p>
<p>$V_{DS@T_c=25^\circ C}$</p>	<p>-60</p>	<p>V</p>
<p>$R_{DS(on),max@-10V}$</p>	<p>18</p>	<p>mΩ</p>
<p>$Q_{g,typ}$</p>	<p>96</p>	<p>nC</p>
<p>$I_{D@T_a=25^\circ C}$</p>	<p>-65</p>	<p>A</p>
<p>$I_{D,pulse}$</p>	<p>-260</p>	<p>A</p>
<p>$E_{AS}^{1)}$</p>	<p>336</p>	<p>mJ</p>
<p>Device Marking and Package Information</p>		
<p>Device</p>	<p>Package</p>	<p>Marking</p>
<p>HRT60P18B</p>	<p>TO263</p>	<p>60P18B</p>
<p>HRT60P18D</p>	<p>TO252</p>	<p>60P18D</p>
<p>HRT60P18U</p>	<p>TO251</p>	<p>60P18U</p>
<p>HRT60P18P</p>	<p>TO220</p>	<p>60P18P</p>



Absolute Maximum Ratings $T_A = 25^\circ\text{C}$, unless otherwise noted			
Parameter	Symbol	Values	Unit
Drain-Source voltage($V_{GS}=0V$)	V_{DS}	-60	V
Continuous Drain Current ²⁾	I_D	$T_C = 25^\circ\text{C}$	-65
		$T_C = 100^\circ\text{C}$	-42
Pulsed Drain Current ³⁾	$I_{D,pulse}$	-260	A
Gate-Source Voltage	V_{GSS}	$\pm 25V$	V
Single Pulse Avalanche Energy ¹⁾	E_{AS}	336	mJ
Power Dissipation	P_D	113	W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55~+150	$^\circ\text{C}$

Thermal Resistance			
Parameter	Symbol	Max.	Unit
Thermal Resistance, Junction-to-Case	R_{thJC}	1.1	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient	R_{thJA}	45	$^\circ\text{C/W}$

Notes

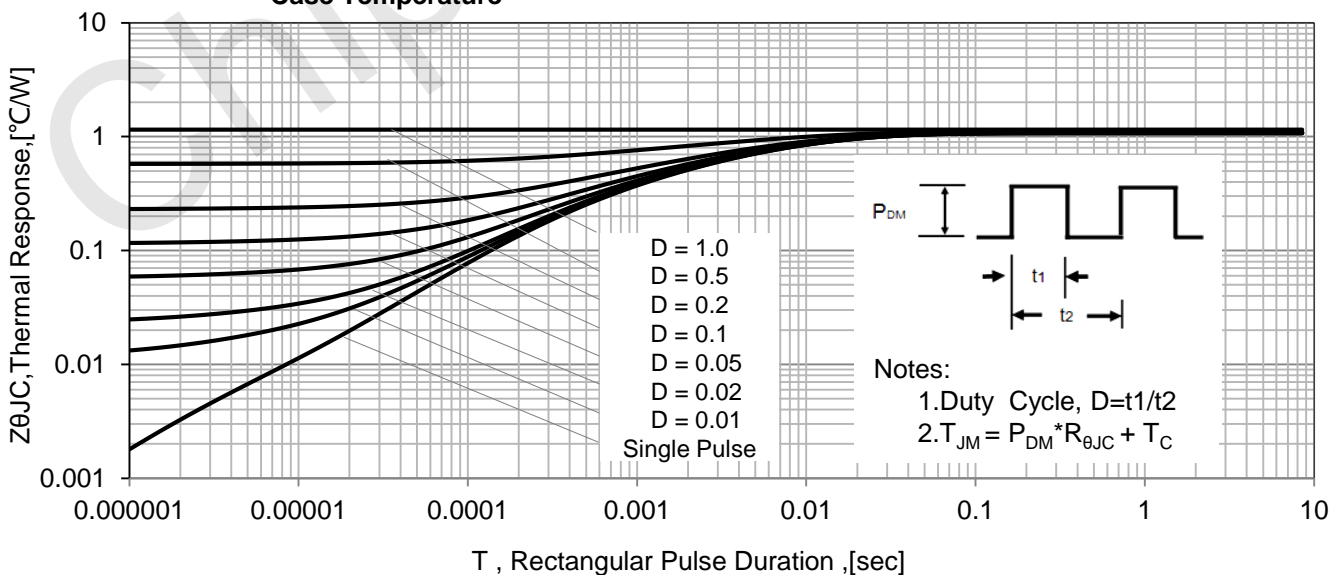
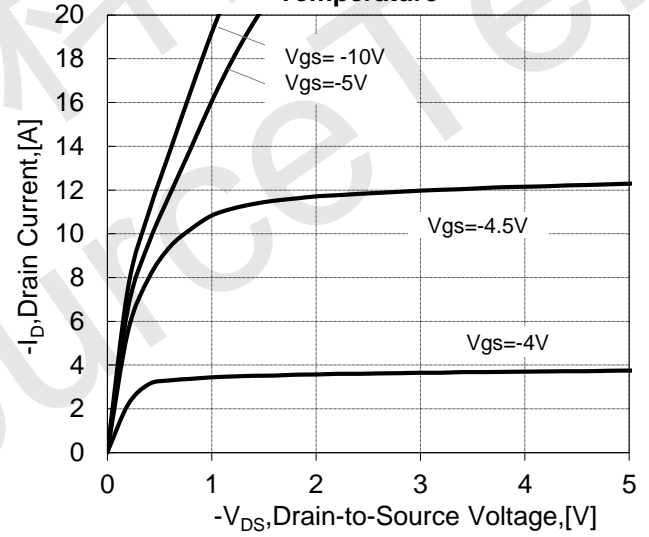
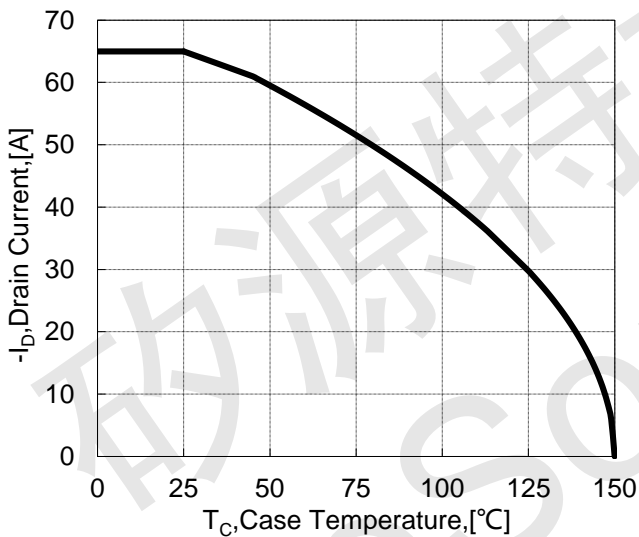
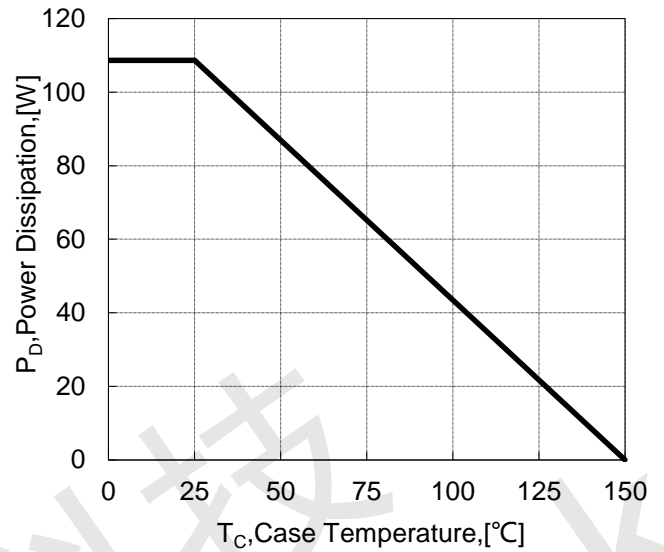
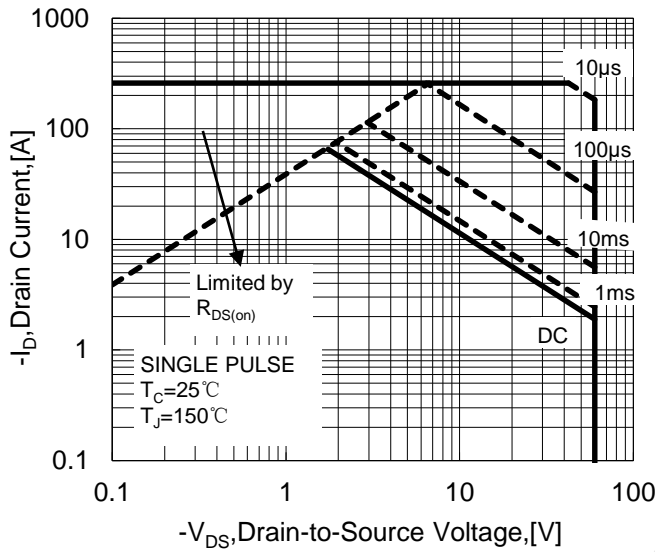
- 1) $L=0.5\text{mH}, V_{DD}=-30V$, Start $T_J=25^\circ\text{C}$
- 2) Limited by maximum junction temperature.
- 3) Repetitive Rating: Pulse width limited by maximum junction temperature.



Electrical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Static Characteristics						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = -250\mu A$	-60	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -30V$ $V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	1	μA
		$V_{DS} = -24V$, $V_{GS} = 0V, T_J = 125^\circ\text{C}$	--	--	100	
Gate-Source Leakage Current	I_{GSS}	$V_{GS} = \pm 25V$	--	--	± 100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\mu A$	-1.8	-2.6	-3.5	V
Drain-Source On-State-Resistance	$R_{DS(on)}$	$V_{GS} = -10V, I_D = -20A$	--	13.5	18	m Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	$V_{GS} = 0V$, $V_{DS} = -30V$ $f = 1.0\text{MHz}$	--	5586	--	μF
Output Capacitance	C_{oss}		--	326	--	
Reverse Transfer Capacitance	C_{rss}		--	230	--	
Total Gate Charge	Q_g	$V_{DS} = -30V, I_D = -20A$ $V_{GS} = 10V$	--	96	--	nC
Gate-Source Charge	Q_{gs}		--	28	--	
Gate-Drain Charge	Q_{gd}		--	20	--	
Gate Plateau Voltage	$V_{plateau}$		--	4.8	--	V
Turn-on Delay Time	$t_{d(on)}$	$V_{DS} = -30V, V_{GS} = -10V$ $R_G = 3\Omega, I_D = -20A$	--	17	--	nS
Turn-on Rise Time	t_r		--	21	--	
Turn-off Delay Time	$t_{d(off)}$		--	65	--	
Turn-off Fall Time	t_f		--	32	--	
Drain-Source Body Diode Characteristics						
Body Diode Forward Voltage	V_{SD}	$T_J = 25^\circ\text{C}, I_{SD} = -20A$, $V_{GS} = 0V$	--	--	1.2	V
Continuous Diode Forward Current	I_S		--	--	-65	A
Reverse Recovery Time	t_{rr}	$I_F = -30A, di_F/dt = -100A/\mu s$	--	45	--	nS
Reverse Recovery Charge	Q_{rr}		--	70	--	nC



Typical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted





Typical Characteristics $T_j = 25^\circ\text{C}$, unless otherwise noted

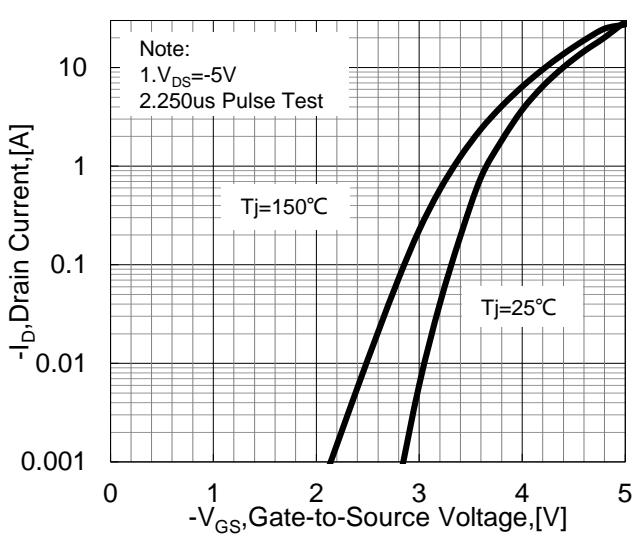


Figure 6 Typical Transfer Characteristics

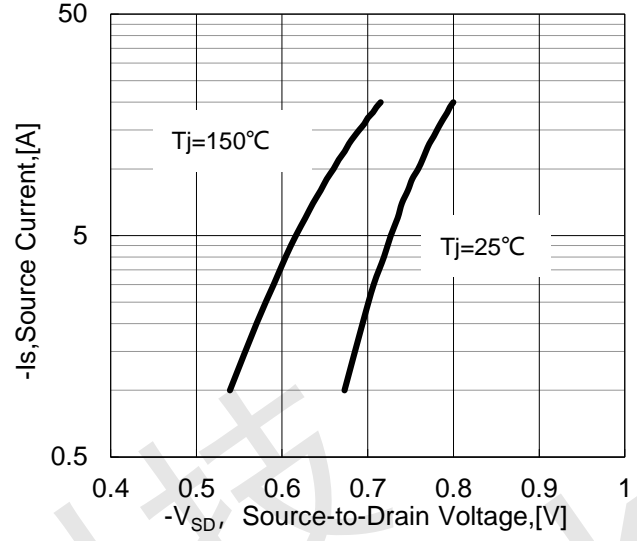


Figure 7 Typical Body Diode Transfer Characteristics

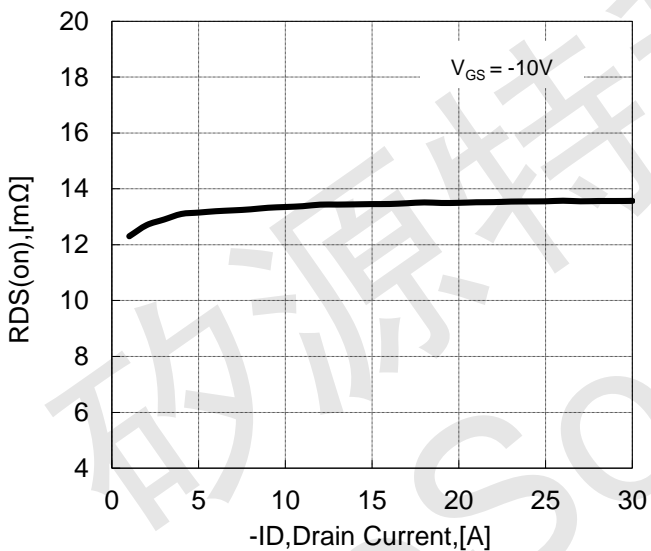


Figure 8. Drain-to-Source On Resistance vs Drain Current

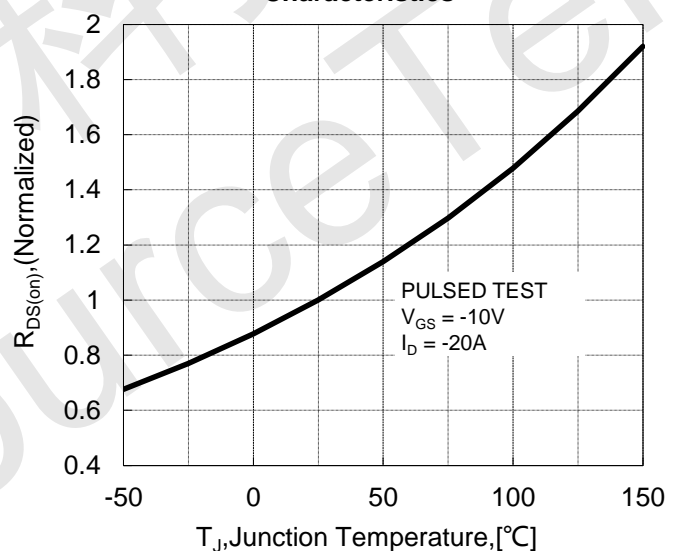


Figure 9. Normalized On Resistance vs Junction Temperature

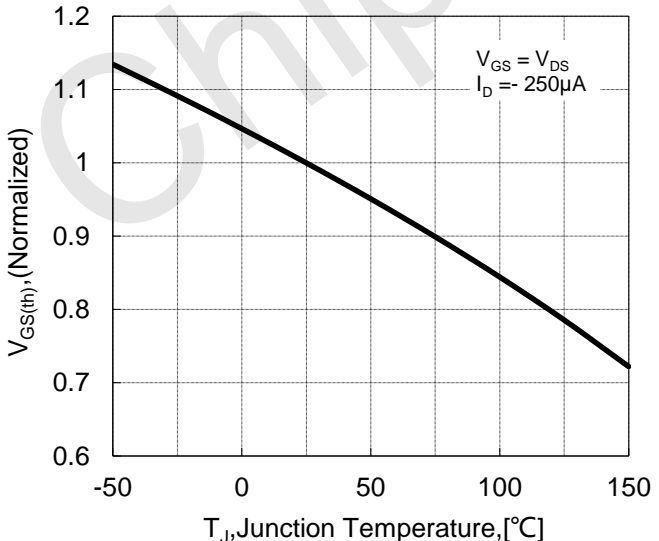


Figure 10. Normalized Threshold Voltage vs Junction Temperature

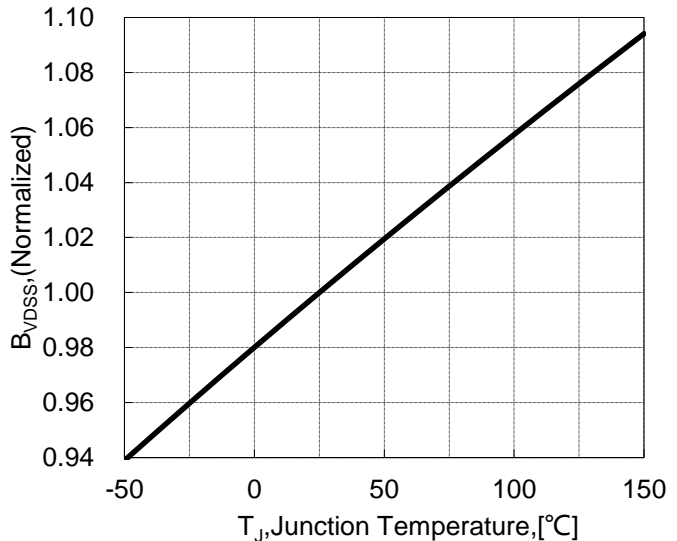


Figure 11. Normalized Breakdown Voltage vs Junction Temperature



Typical Characteristics $T_{j1} = 25^{\circ}\text{C}$, unless otherwise noted

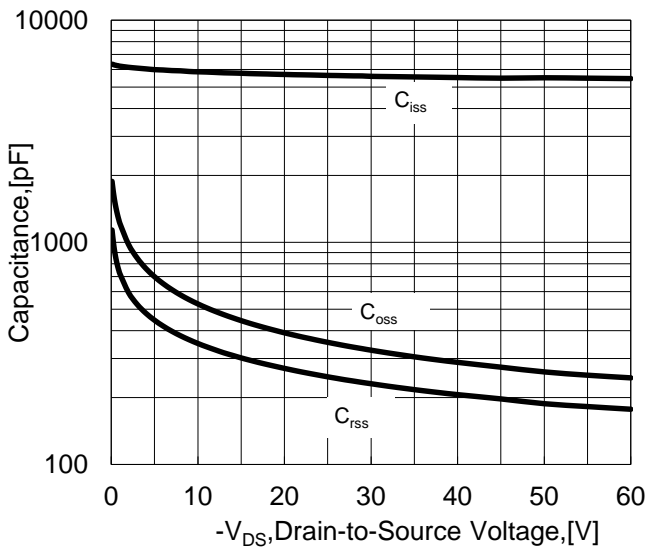


Figure 12. Capacitance Characteristics

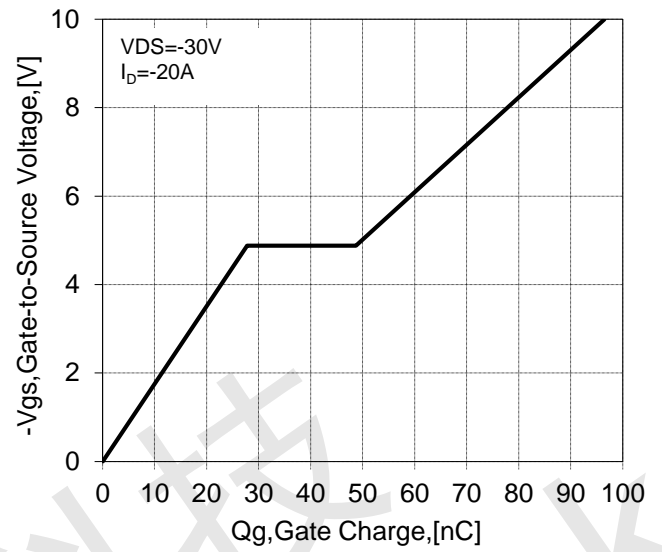


Figure 13 Typical Gate Charge vs Gate to Source Voltage



Figure A: Gate Charge Test Circuit and Waveform

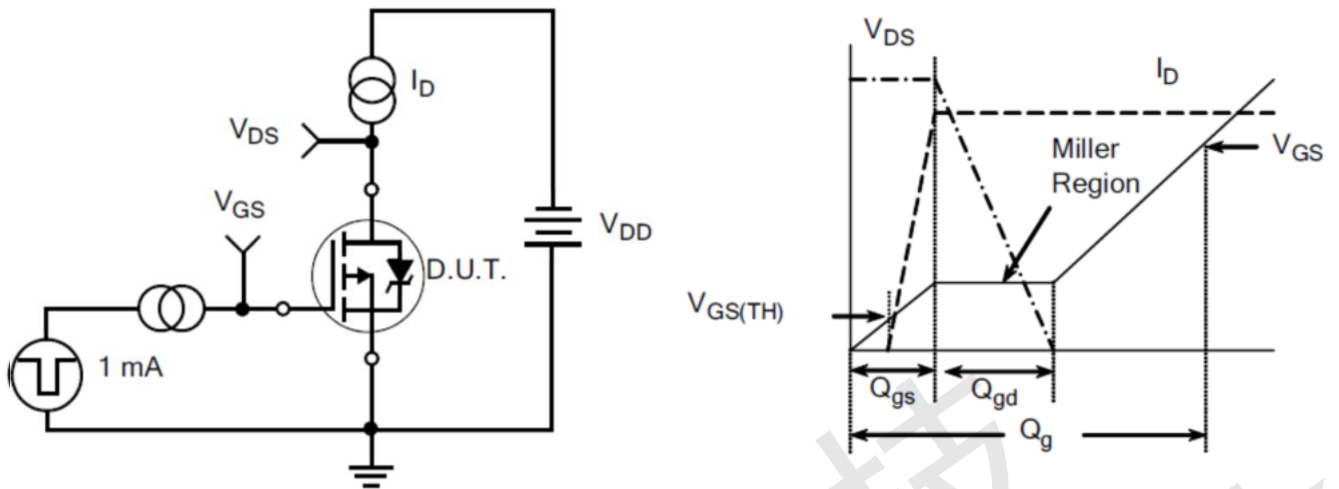


Figure B: Resistive Switching Test Circuit and Waveform

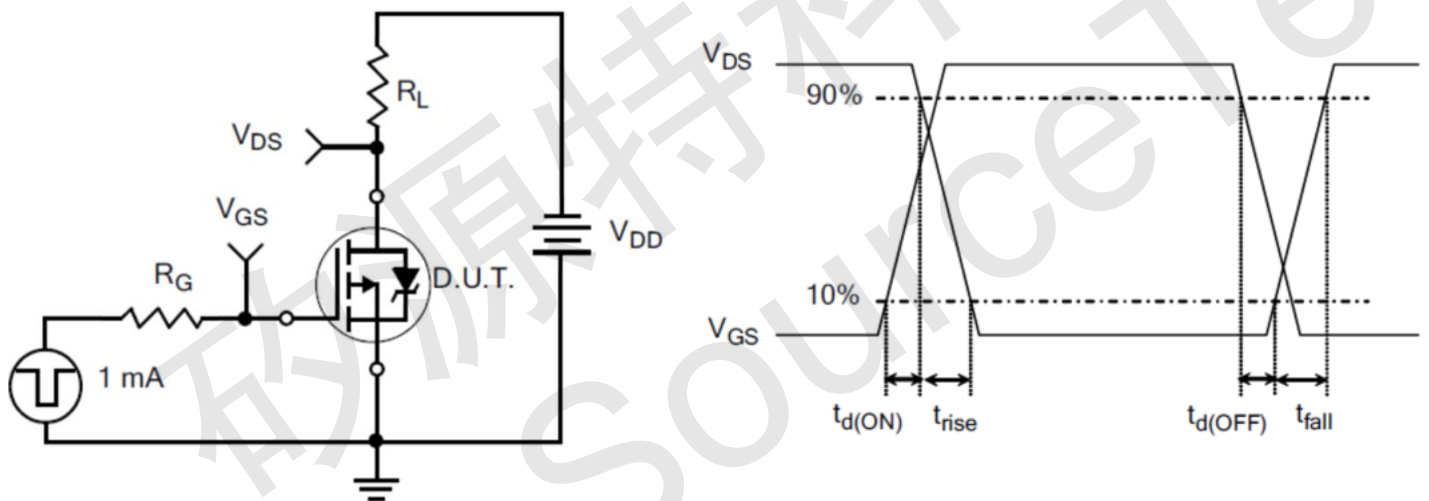
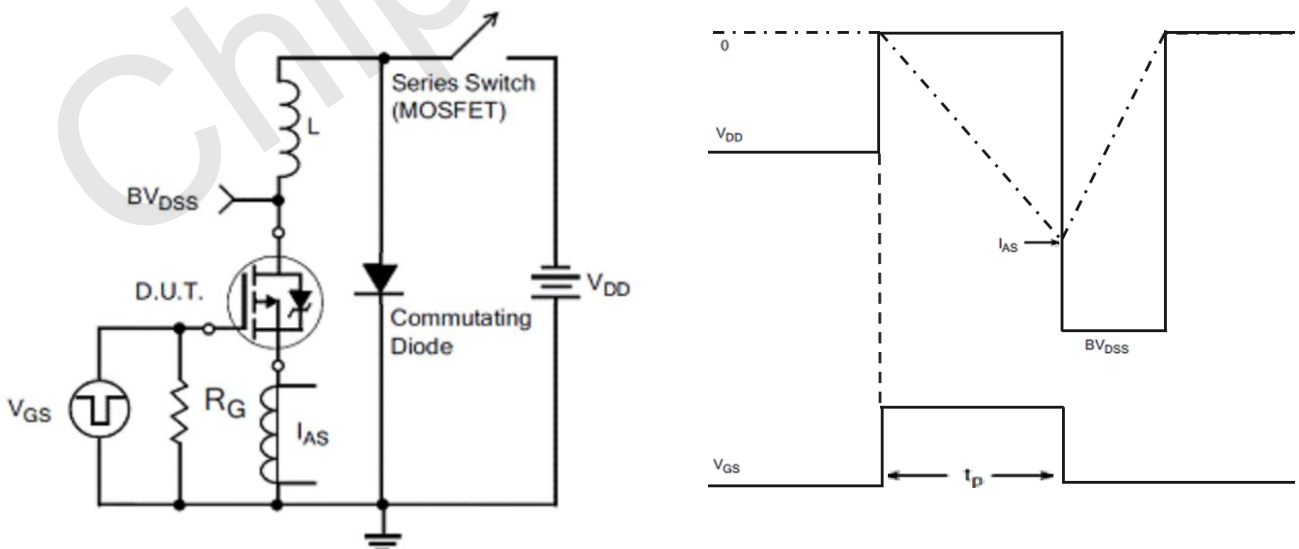
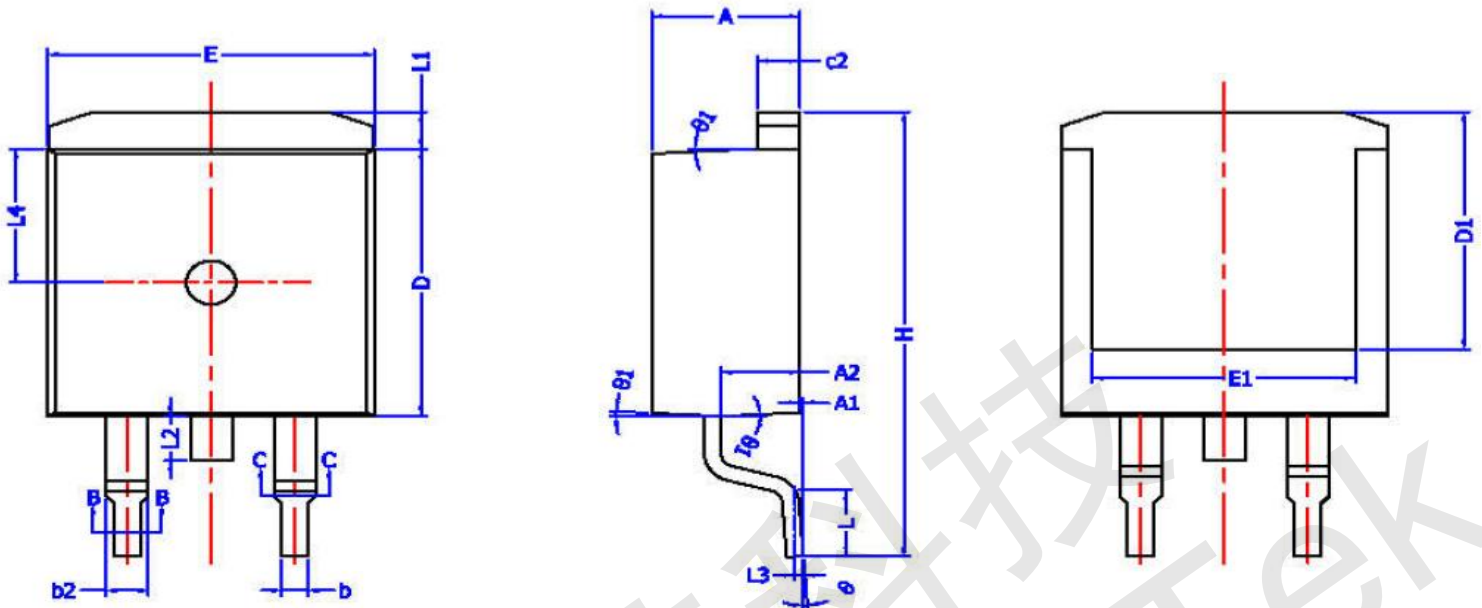


Figure C: Unclamped Inductive Switching Test Circuit and Waveform



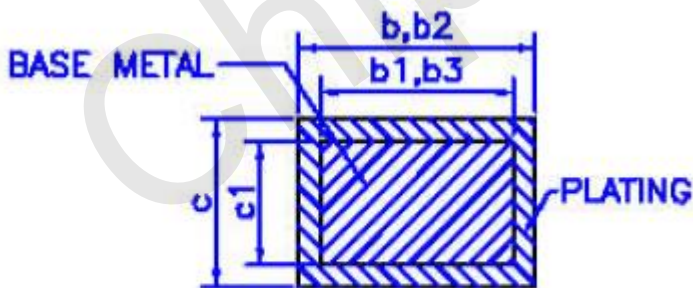
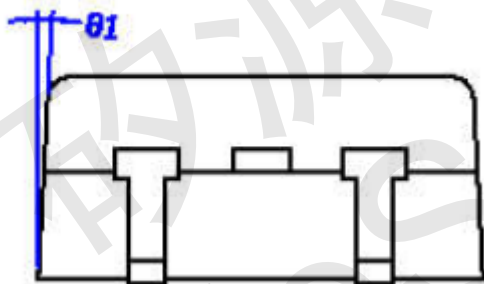


TO263 Package



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

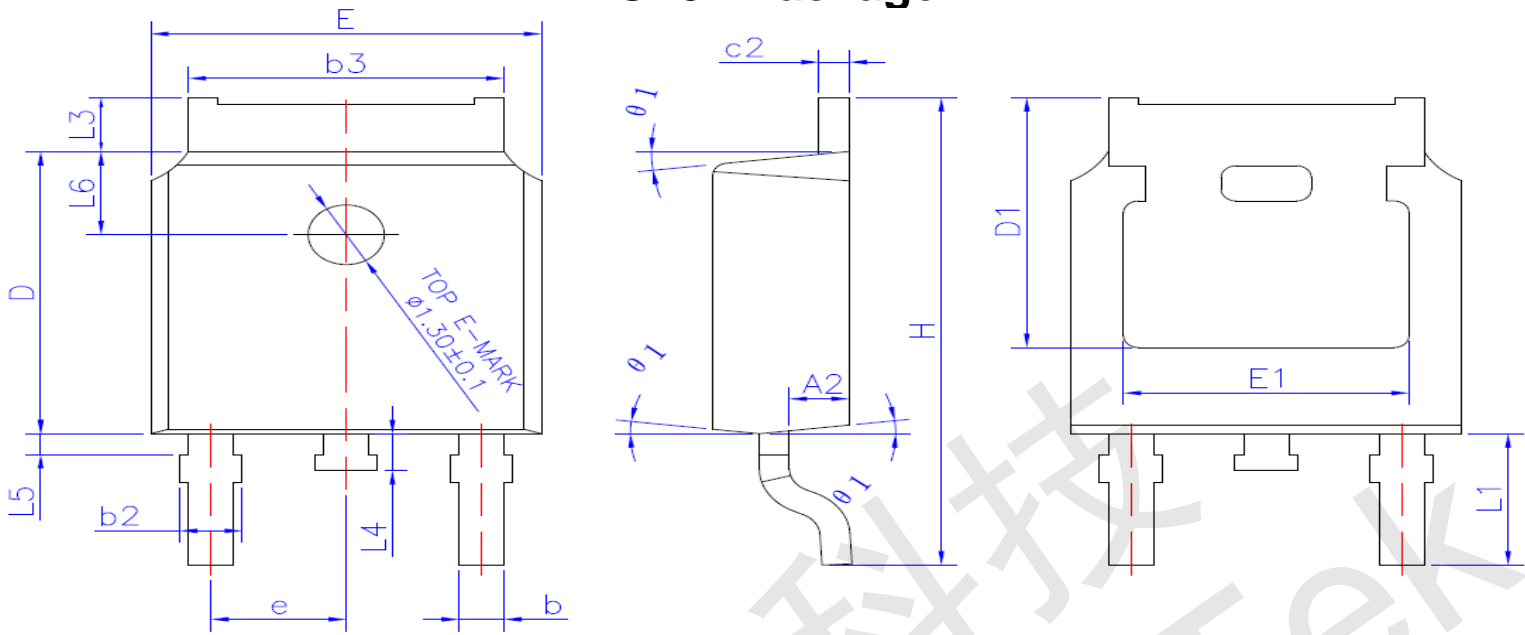
SYMBOL	MIN	NOM	MAX
A	4.40	4.50	4.60
A1	0	0.10	0.25
A2	2.20	2.40	2.60
b	0.76	--	0.89
B1	0.75	0.80	0.85
B2	1.23	--	1.37
b3	1.22	1.27	1.32
c	0.47	--	0.60
c1	0.46	0.51	0.56
c2	1.25	1.30	1.35
D	9.10	9.20	9.30
D1	8.00	--	--
E	9.80	9.90	10.00
E1	7.80	--	--
e	2.54 BSC		
H	14.90	15.30	15.70
L	2.00	2.30	2.60
L1	1.17	1.27	1.40
L2	--	--	1.75
L3	0.25 BSC		
L4	4.60 REF		
theta	0°	--	8°
theta1	1°	3°	5°



SECTION B-B&C-C

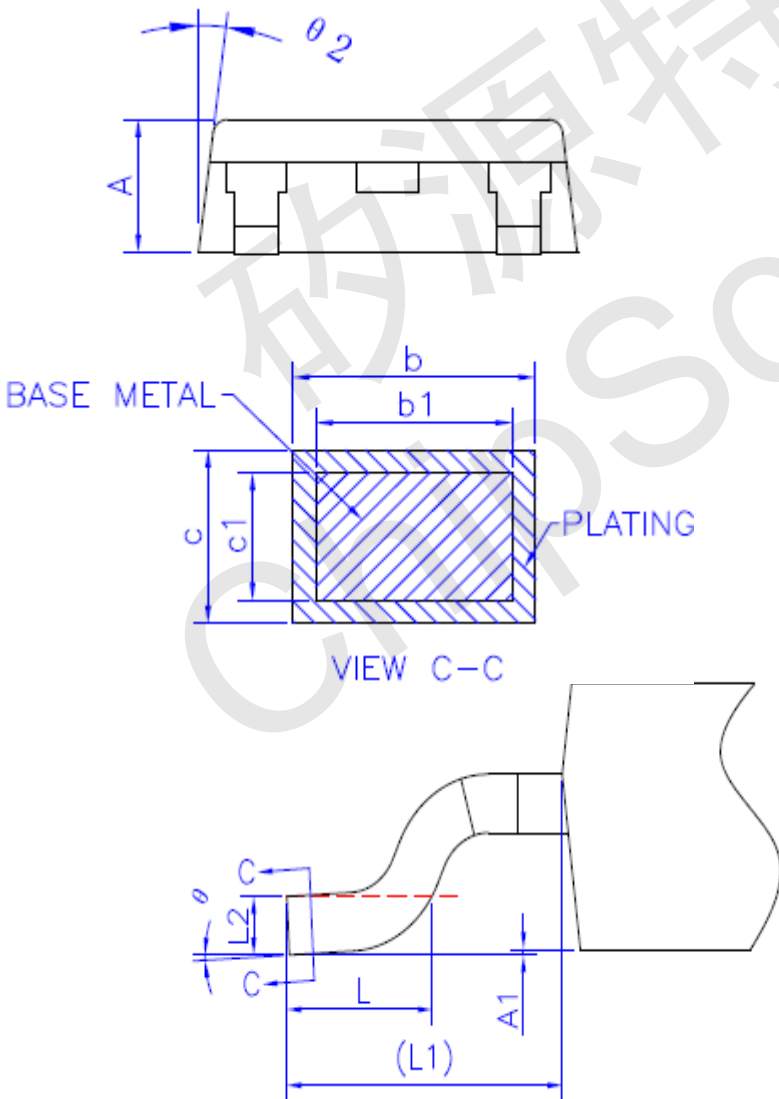


TO252 Package



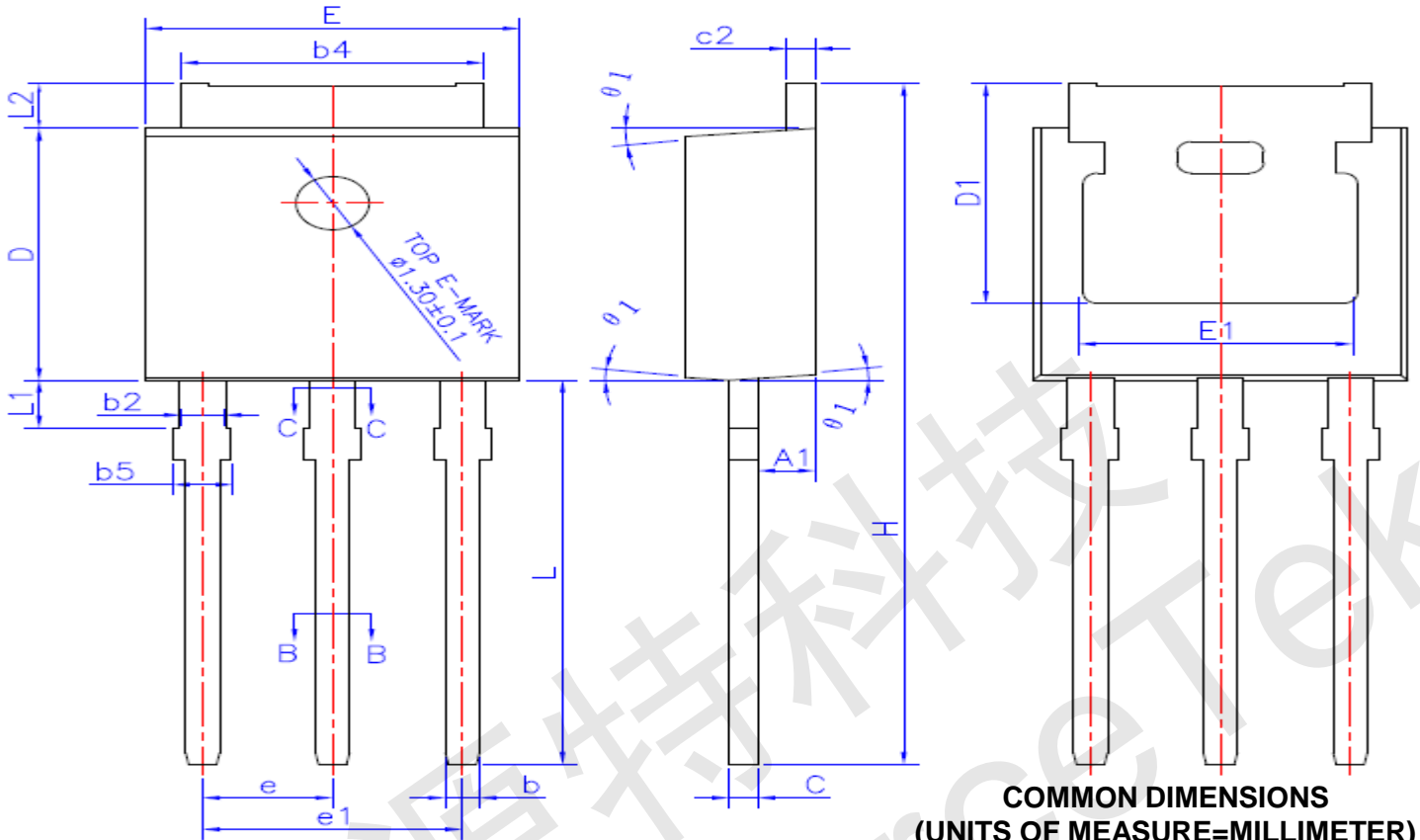
COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0	--	0.10
A2	0.90	1.01	1.10
b	0.72	--	0.85
b1	0.71	0.76	0.81
b2	0.72	--	0.90
b3	5.13	5.33	5.46
c	0.47	--	0.60
c1	0.46	0.51	0.56
c2	0.47	--	0.60
D	6.00	6.10	6.20
D1	5.25	--	--
E	6.50	6.60	6.70
E1	4.70	--	--
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1	2.90 REF		
L2	0.508 BSC		
L3	0.90	--	1.25
L4	0.60	0.80	1.00
L5	0.15	--	0.75
L6	1.80 REF		
θ	0°	--	8°
θ_1	5°	7°	9°
θ_2	5°	7°	9°



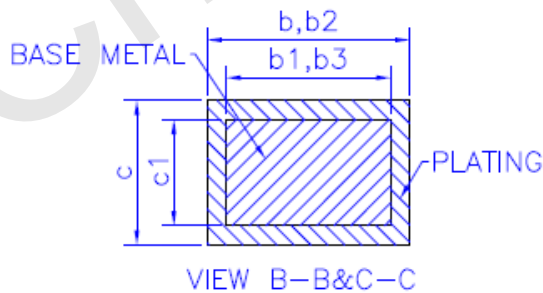


TO251 Package



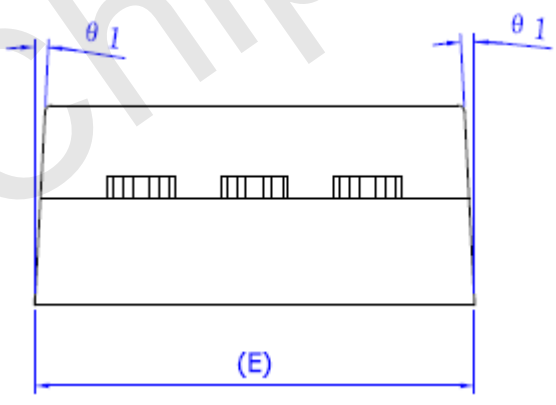
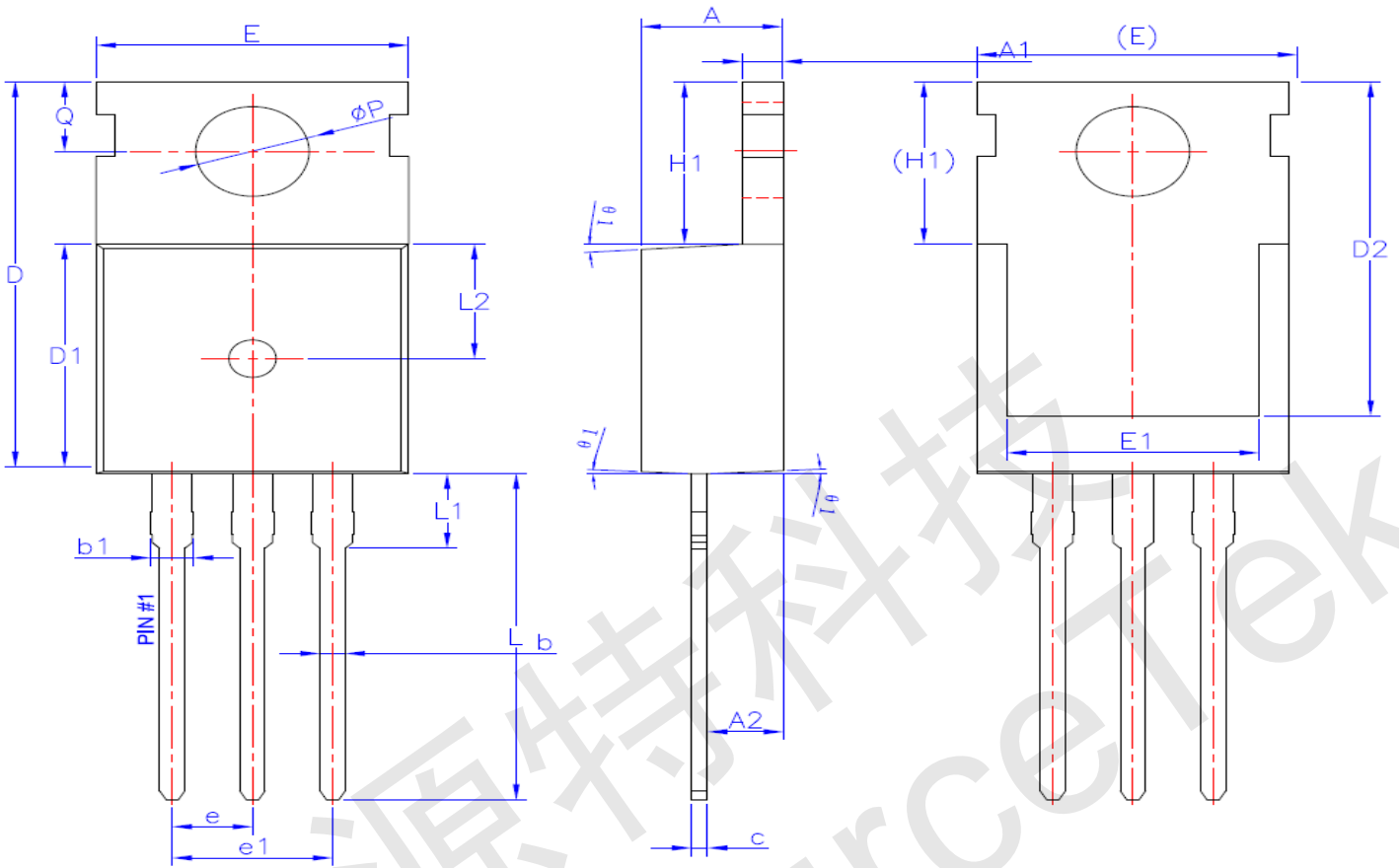
COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.35
A1	0.90	1.01	1.10
b	0.56	--	0.69
b1	0.55	0.60	0.65
b2	0.77	--	0.90
b3	0.76	0.81	0.86
b4	5.23	5.33	5.43
b5	--	--	1.05
c	0.46	--	0.59
c1	0.45	0.51	0.55
c2	0.46	--	0.59
D	6.00	6.10	6.20
D1	5.20	--	--
E	6.50	6.60	6.70
E1	4.60	4.83	5.00
e	2.24	2.29	2.34
e1	4.47	4.57	4.67
H	16.18	16.48	16.78
L	9.00	9.30	9.60
L1	0.95	1.16	1.35
L2	0.90	1.08	1.25
θ	3°	5°	7°
$\theta 1$	1°	3°	5°





TO220 Package



SYMBOL	MIN	NOM	MAX
A	4.40	4.50	4.60
A1	1.27	1.30	1.33
A2	2.30	2.40	2.50
b	0.70	--	0.90
b1	1.27	--	1.40
c	0.45	0.50	0.60
D	15.30	15.70	16.10
D1	9.10	9.20	9.30
D2	13.10	--	13.70
E	9.70	9.90	10.20
E1	7.80	8.00	8.20
e	2.54 BSC		
e1	5.08 BSC		
H1	6.30	6.50	6.70
L	12.78	13.08	13.38
L1	--	--	3.50
L2	4.60REF		
phi P	3.55	3.60	3.65
Q	2.73	--	2.87
theta 1	1°	3°	5°



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