

### Features

- Advanced high cell density Trench technology
- Super Low Gate Charge
- Excellent CdV/dt effect decline
- Green Device Available

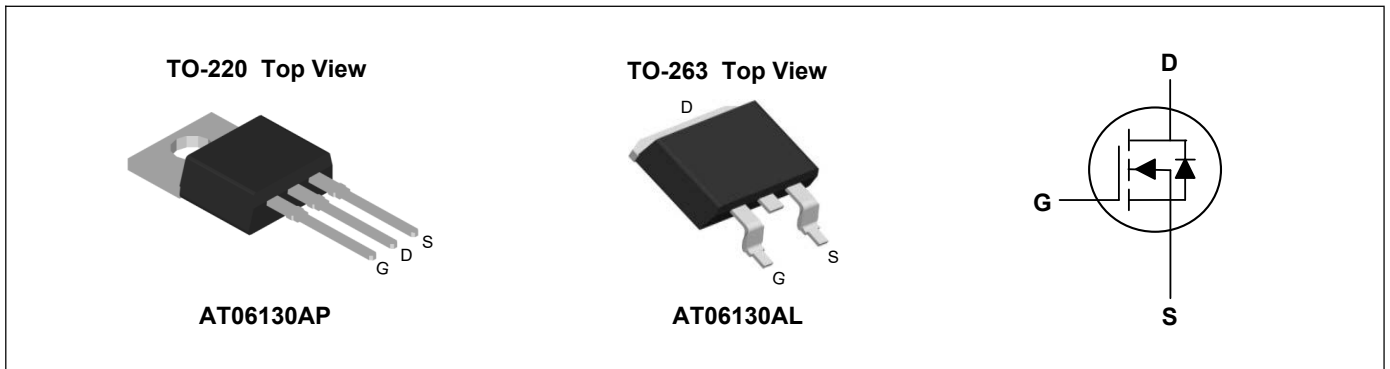
### Product Summary



$V_{DS}$	60	V
$I_D$	130	A
$R_{DS(ON)}$ (at $V_{GS}=10V$ )	3.5	m $\Omega$
$R_{DS(ON)}$ (at $V_{GS}=4.5V$ )	4.5	m $\Omega$

### Applications

- High Frequency Point-of-Load Synchronous Buck Converter
- Networking DC-DC Power System
- Power Tool Application



### Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ , unless otherwise noted)

Parameter	Symbol	Rating	Units
Drain-Source Voltage	$V_{DS}$	60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current	$I_D@T_C=25^\circ\text{C}$	130	A
Pulsed Drain Current <sup>2</sup>	$I_{DM}$	390	A
Single Pulse Avalanche Energy <sup>3</sup>	EAS	80	mJ
Total Power Dissipation <sup>4</sup>	$P_D@T_C=25^\circ\text{C}$	140	W
Storage Temperature Range	$T_{STG}$	-55 to 150	$^\circ\text{C}$
Operating Junction Temperature Range	$T_J$	-55 to 150	$^\circ\text{C}$

### Thermal Characteristics

Parameter	Symbol	Typ	Max	Unit
Thermal Resistance Junction-Ambient <sup>1</sup>	$R_{\theta JA}$	---	62	$^\circ\text{C}/\text{W}$
Thermal Resistance Junction-Case <sup>1</sup>	$R_{\theta JC}$	---	0.89	$^\circ\text{C}/\text{W}$

**Electrical Characteristics (T<sub>J</sub>=25°C, unless otherwise noted)**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250uA	60	---	---	V
Static Drain-Source On-Resistance <sup>2</sup>	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =20A	---	3	3.5	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A	---	3.5	4.5	mΩ
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250uA	1.0	---	2.5	V
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> =60V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C	---	---	1	uA
		V <sub>DS</sub> =60V, V <sub>GS</sub> =0V, T <sub>J</sub> =55°C	---	---	5	
Gate-Source Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	---	---	±100	nA
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =10V, I <sub>D</sub> =25A	---	66.1	---	nC
Gate-Source Charge	Q <sub>gs</sub>		---	10.7	---	
Gate-Drain Charge	Q <sub>gd</sub>		---	10.9	---	
Gate plateau voltage	V <sub>plateau</sub>		---	2.9	---	V
Turn-On Delay Time	T <sub>d(on)</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =10V, R <sub>G</sub> =2Ω, I <sub>D</sub> =25A	---	22.5	---	ns
Rise Time	T <sub>r</sub>		---	6.7	---	
Turn-Off Delay Time	T <sub>d(off)</sub>		---	80.3	---	
Fall Time	T <sub>f</sub>		---	26.8	---	
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1MHz	---	5377	---	pF
Output Capacitance	C <sub>oss</sub>		---	1666	---	
Reverse Transfer Capacitance	C <sub>rss</sub>		---	77.7	---	

**Drain-Source Diode Characteristics**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Continuous Source Current <sup>1,5</sup>	I <sub>S</sub>	V <sub>GS</sub> =V <sub>th</sub>	---	---	130	A
Pulsed Source Current <sup>2,5</sup>	I <sub>SM</sub>		---	---	390	A
Diode Forward Voltage <sup>2</sup>	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =20A, T <sub>J</sub> =25°C	---	---	1.3	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> =13.5A, di/dt=100A/μs, T <sub>J</sub> =25°C	---	68.3	---	nS
Reverse Recovery Charge	Q <sub>rr</sub>		---	73	---	nC
Peak Reverse Recovery Current	I <sub>rrm</sub>		---	1.9	---	A

**Note:**

- The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
- The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%
- The EAS data shows Max. rating. The test condition is V<sub>DD</sub>=50V, V<sub>GS</sub>=10V, L=0.3mH, R<sub>G</sub>=25Ω
- The power dissipation is limited by 150°C junction temperature
- The data is theoretically the same as I<sub>D</sub> and I<sub>DM</sub>, in real applications, should be limited by total power dissipation.

**Typical Characteristics**

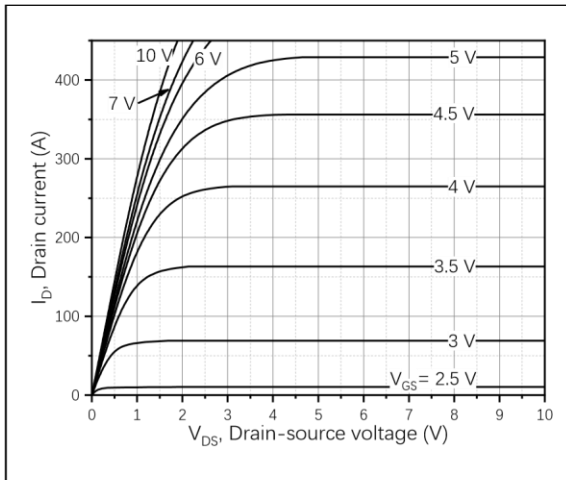


Figure 1, Typ. output characteristics

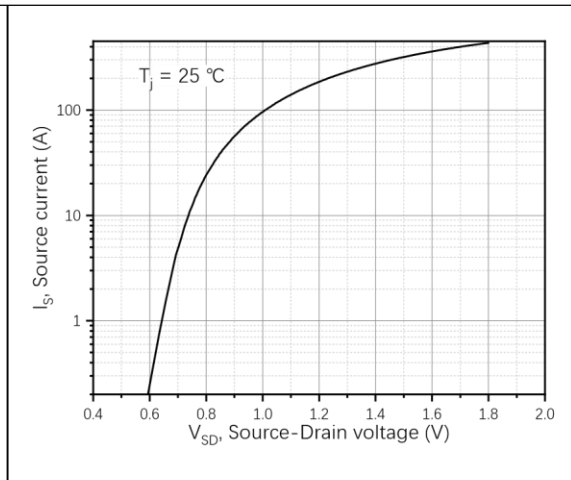


Figure 2, Typ. transfer characteristics

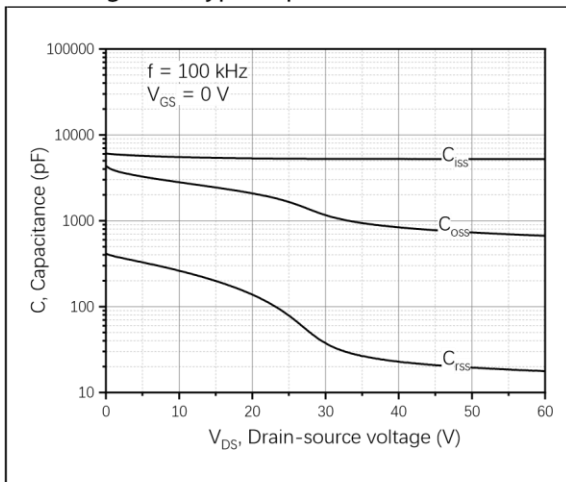


Figure 3, Typ. capacitances

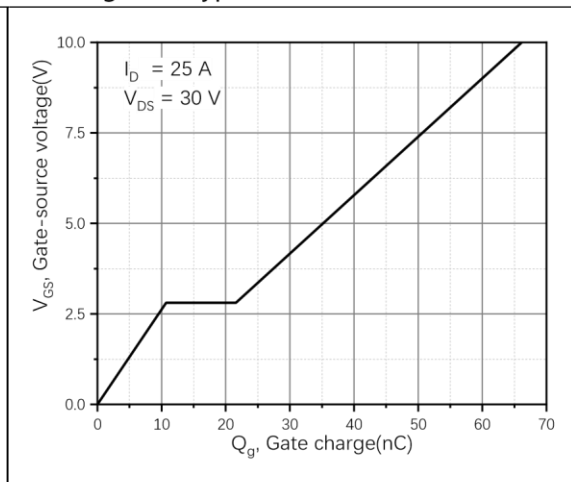


Figure 4, Typ. gate charge

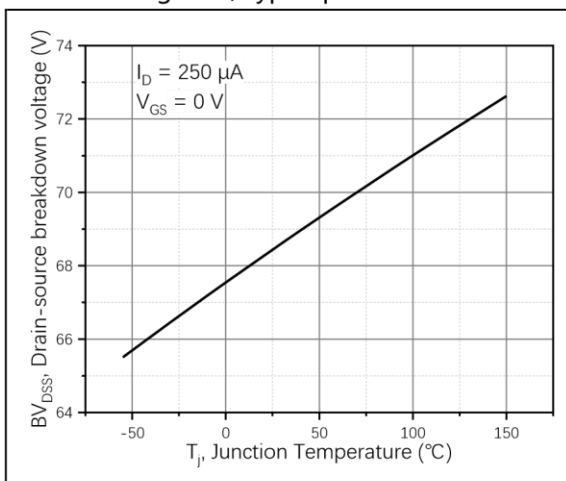


Figure 5, Drain-source breakdown voltage

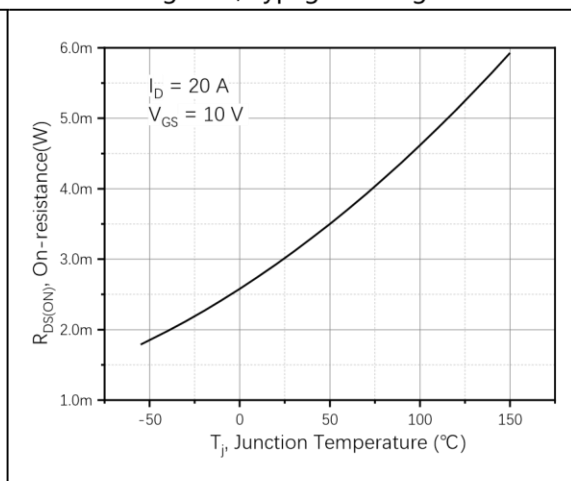


Figure 6, Drain-source on-state resistance

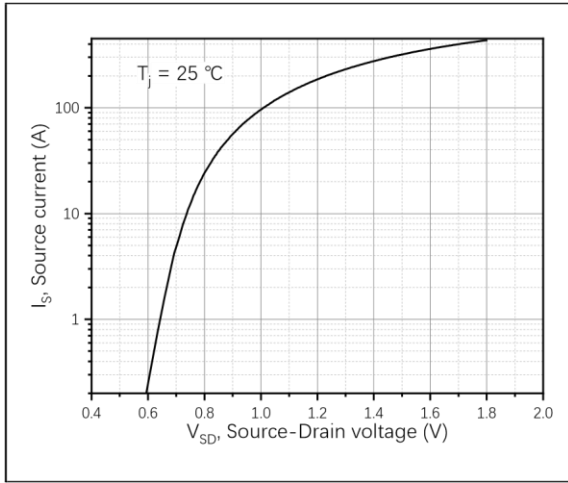


Figure 7, Forward characteristic of body diode

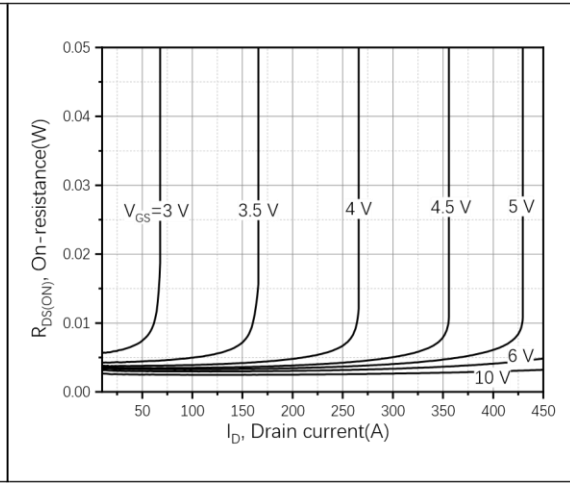


Figure 8, Drain-source on-state resistance

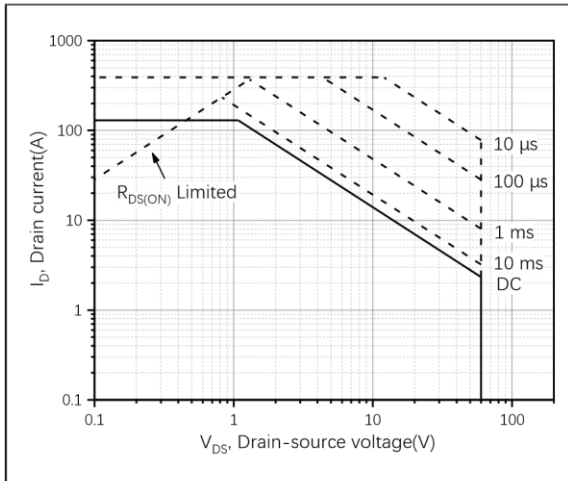


Figure 9, Safe operation area  $T_C=25\text{ }^\circ\text{C}$

**Test circuits and waveforms**

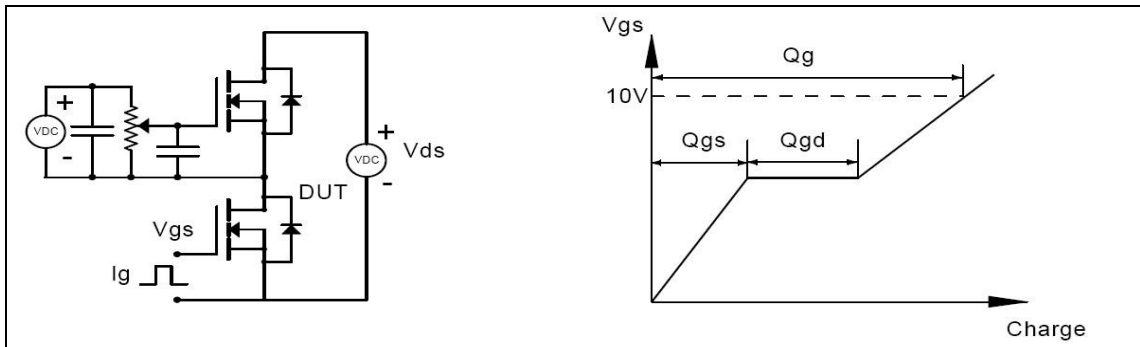


Figure 1, Gate charge test circuit & waveform

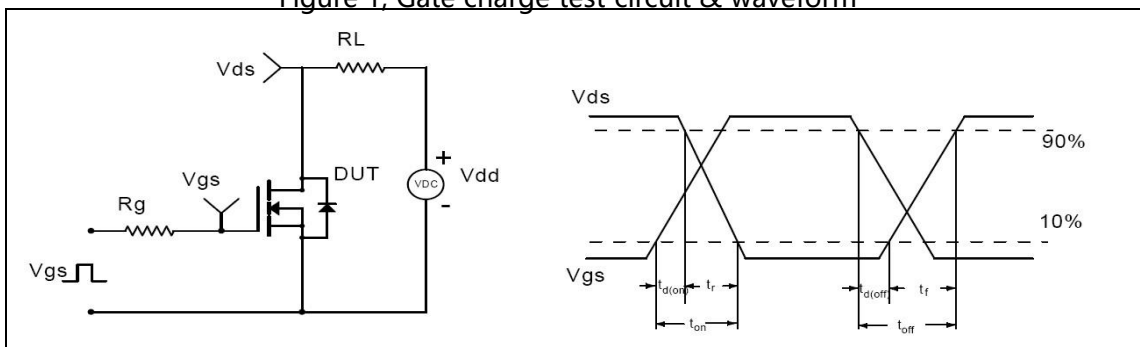


Figure 2, Switching time test circuit & waveforms

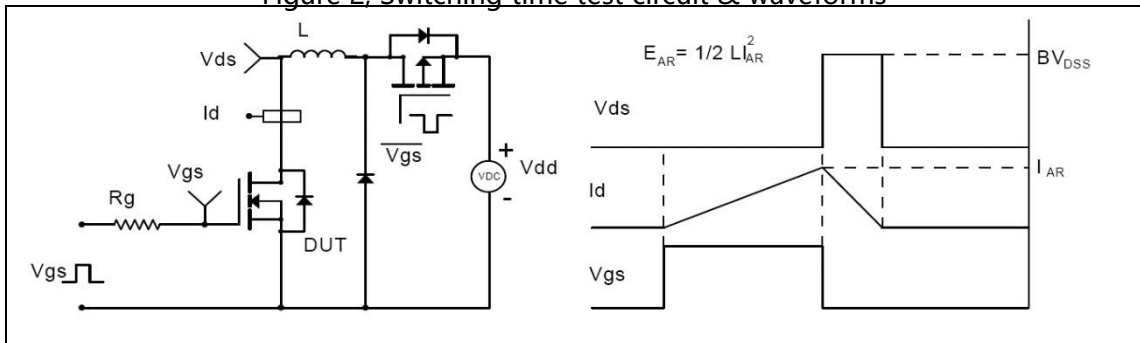


Figure 3, Unclamped inductive switching (UIS) test circuit & waveforms

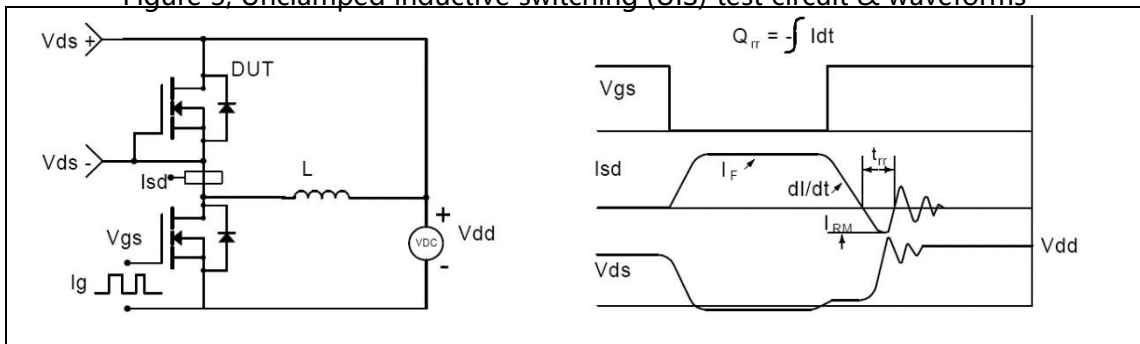
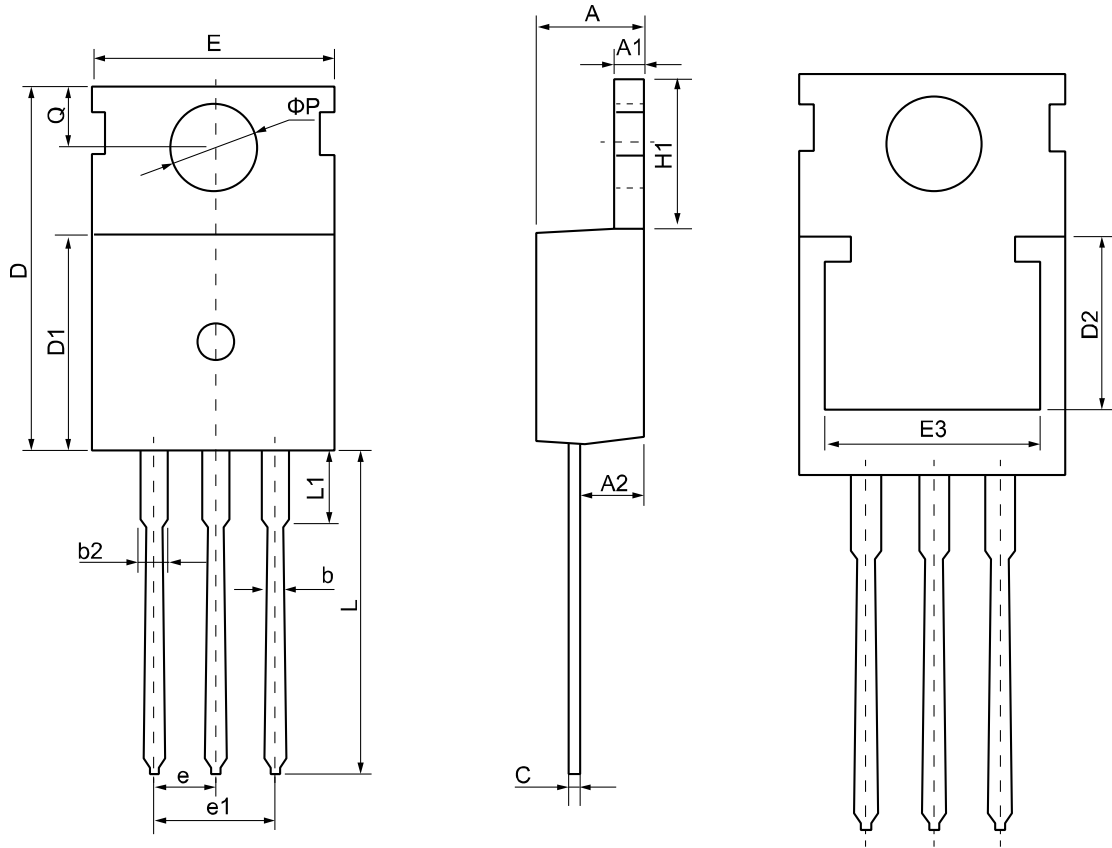


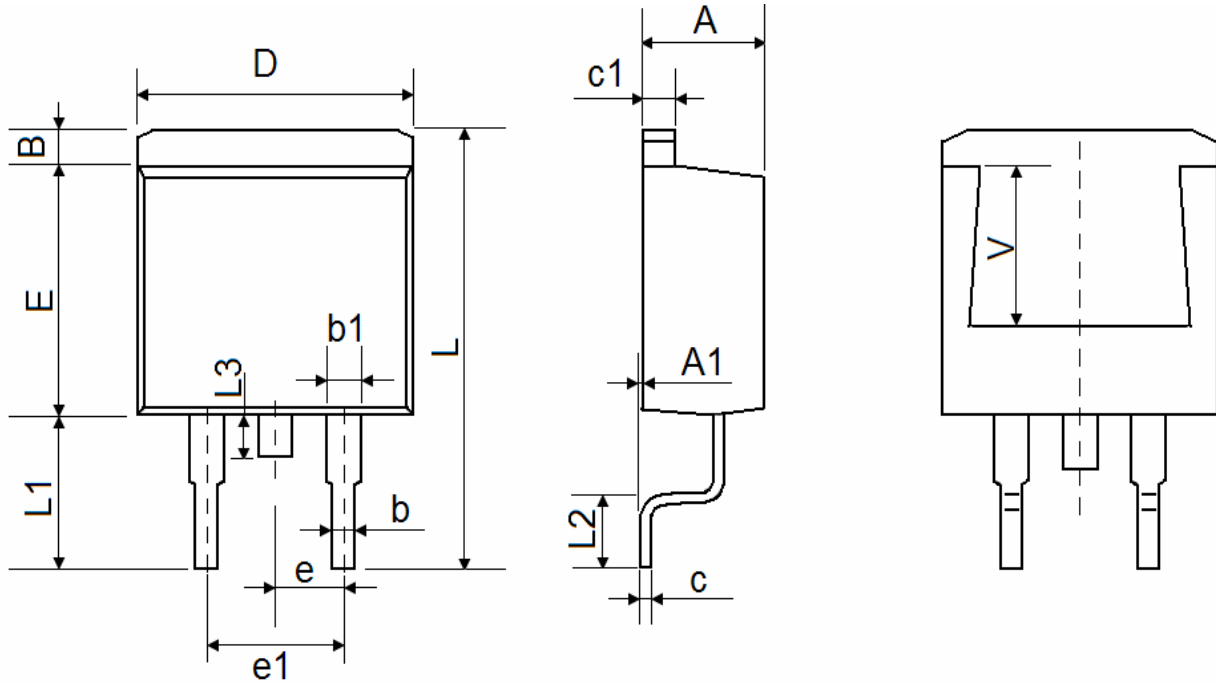
Figure 4, Diode reverse recovery test circuit & waveforms

**TO-220 Package Outline Dimensions**



Symbol	Dimensions (unit:mm)			Symbol	Dimensions (unit:mm)		
	Min	Typ	Max		Min	Typ	Max
<b>A</b>	4.30	4.55	4.75	<b>E</b>	9.65	10.00	10.25
<b>A1</b>	1.15	1.30	1.45	<b>E3</b>	7.00	--	--
<b>A2</b>	2.20	2.40	2.60	<b>e</b>	2.54 BSC		
<b>b</b>	0.70	0.80	0.95	<b>e1</b>	5.08 BSC		
<b>b2</b>	1.17	1.27	1.47	<b>H1</b>	6.30	6.50	6.80
<b>c</b>	0.40	0.50	0.65	<b>L</b>	12.70	13.50	14.10
<b>D</b>	15.30	15.60	15.90	<b>L1</b>	--	3.20	3.95
<b>D1</b>	8.90	9.10	9.35	<b><math>\phi P</math></b>	3.40	3.60	3.80
<b>D2</b>	5.50	--	--	<b>Q</b>	2.60	2.80	3.00

**TO-263 Package Outline Dimensions**



Symbol	Dimensions (unit:mm)			Symbol	Dimensions (unit:mm)		
	Min	Typ	Max		Min	Typ	Max
<b>A</b>	4.40	4.55	4.70	<b>A1</b>	0.00	0.07	0.15
<b>B</b>	1.00	1.20	1.40	<b>b</b>	0.65	0.80	0.95
<b>b1</b>	1.10	1.15	1.37	<b>c</b>	0.30	0.40	0.53
<b>c1</b>	1.10	1.25	1.37	<b>D</b>	9.80	10.00	10.40
<b>E</b>	8.50	8.80	9.20	<b>e</b>	2.54 REF		
<b>e1</b>	4.90	5.10	5.40	<b>L</b>	14.80	15.20	15.70
<b>L1</b>	5.00	5.25	5.60	<b>L2</b>	2.05	2.45	2.80
<b>L3</b>	1.20	1.50	1.80	<b>V</b>	5.60 REF		