

Description

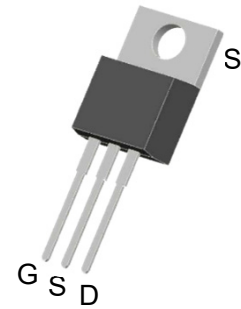
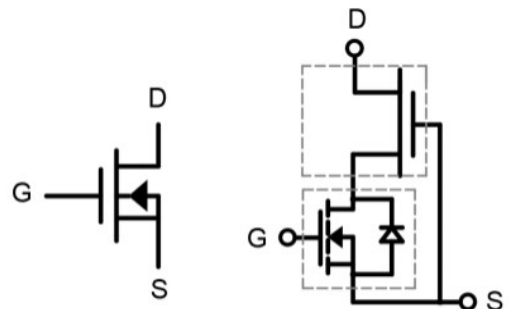
Product Summary		
$V_{DS}(V)$	$R_{DS(on)}(m\Omega)(Typ)$	$I_D(A)$
650	70@ $V_{GS} = 12V$	27

Feature

- Easy to use, compatible with standard gate drivers
- Excellent $Q_G \times R_{DS(on)}$ figure of merit (FOM)
- Low Q_{RR} , no free-wheeling diode required
- Low switching loss
- RoHS compliant and Halogen-free

Applications

- High efficiency power supplies
- Telecom and datacom
- Automotive
- Servo motors


TO-220-3L (Top View)

Schematic Diagram
Absolute maximum rating@25°C

Parameter	Symbol	Rating	Unit
Drain-Source Voltage	V_{DS}	650	V
Gate-Source Voltage	V_{GS}	± 20	V
Transient Drain-Source Voltage ¹⁾	V_{TDS}	800	V
Continuous Drain Current	I_D	$T_C=25^\circ C$	27
		$T_C=100^\circ C$	17
Pulsed Drain Current (Pulse Width: 100 μs)	I_{DM}	$T_C=25^\circ C$	108
		$T_C=100^\circ C$	80
Power Dissipation	P_D	93	W
Soldering Peak Temperature	T_{CSOLD}	260	$^\circ C$
Operating Junction and Storage Temperature	T_J, T_{STG}	-55 to 150	$^\circ C$

Thermal Resistance

Parameter	Symbol	Min	Typ	Max	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	-	1.34	-	$^\circ C/W$
Thermal Resistance, Junction-to-Ambient ²⁾	$R_{\theta JA}$	-	50	-	$^\circ C/W$

Electrical characteristics per line@25°C (unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	
Statistic Characteristics							
Maximum Drain-Source Voltage	V_{DS-Max}	$V_{GS} = 0V$	650	-	-	V	
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS} = 0V, I_D = 250\mu A$	-	1000	-	V	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=650V,$ $V_{GS}=0V$	$T_J=25^\circ C$	-	10	30	μA
			$T_J=150^\circ C$	-	50	-	
Gate-Body Leakage Current	I_{GSS}	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	± 150	nA	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 500\mu A$	3.0	4.0	5.0	V	
Gate Threshold Voltage Temperature Coefficient	$\Delta V_{GS(th)}/T_J$		-	-11.3	-	mV/°C	
Drain-Source On-State Resistance ³⁾	$R_{DS(ON)}$	$V_{GS}=12V,$ $I_D=4A$	$T_J=25^\circ C$	-	70	90	mΩ
			$T_J=150^\circ C$	-	140	-	
Dynamic Characteristics							
Input Capacitance	C_{iss}	$V_{DS} = 400V, V_{GS} = 0V,$ $f = 1MHz$	-	354	-	pF	
Output Capacitance	C_{oss}		-	79.7	-		
Reverse Transfer Capacitance	C_{rss}		-	1.9	-		
Effective Output Capacitance, Energy Related	$C_{o(er)}$	$V_{GS} = 0V,$ $V_{DS} = 0-400V$	-	120	-	pF	
Effective Output Capacitance, Time Related	$C_{o(tr)}$		-	217	-		
Output Charge	Q_{oss}		-	87	-		nC
Turn-on Delay Time	$t_{d(on)}$	$V_{DS} = 400V, I_D = 10A,$ $V_{GS} = 0-12V, R_G = 40\Omega$	-	44	-	ns	
Turn-on Rise Time	t_r		-	16	-		
Turn-Off Delay Time	$t_{d(off)}$		-	40	-		
Turn-Off Fall Time	t_f		-	12	-		
Total Gate Charge	Q_g	$V_{DS} = 400V, I_D = 6A,$ $V_{GS} = 0-12V$	-	17	-	nC	
Gate-Source Charge	Q_{gs}		-	4.6	-		
Gate-Drain Charge	Q_{gd}		-	5.6	-		
Reverse Diode Characteristics							
Diode Forward Voltage	V_{SD}	$V_{GS}=0V, I_S=8.5A$	-	1.3	-	V	
			$V_{GS}=0V,$ $I_S=17A$	$T_J=25^\circ C$	-		1.9
		$T_J=150^\circ C$		-	3.0		-
Reverse Recovery Time	t_{rr}	$V_{GS}=0V, I_S=17A,$ $V_{DD}=400V,$ $di/dt=1000A/\mu s$	-	33	-	ns	
Reverse Recovery Charge	Q_{rr}		-	87	-	μC	

Notes:

- Off-state spike duty cycle < 0.01, spike duration < 2μs
- Device on one layer epoxy PCB for drain connection (vertical and without air stream cooling, with 6cm²copper area and 70μm thickness)
- Dynamic on-resistance; see Figure 18 and 19 for test circuit and configurations

Typical Characteristics

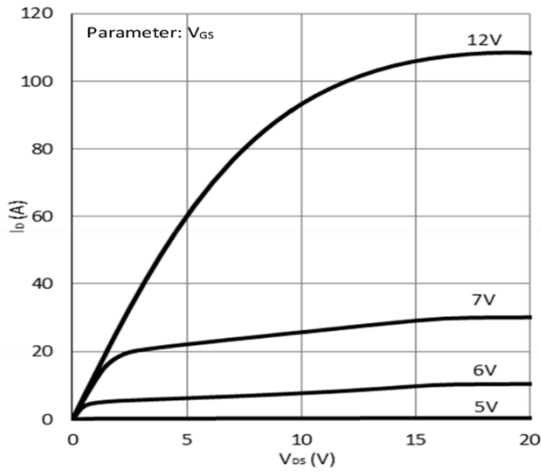


Figure 1. Typical Output Characteristics $T_J=25^\circ\text{C}$

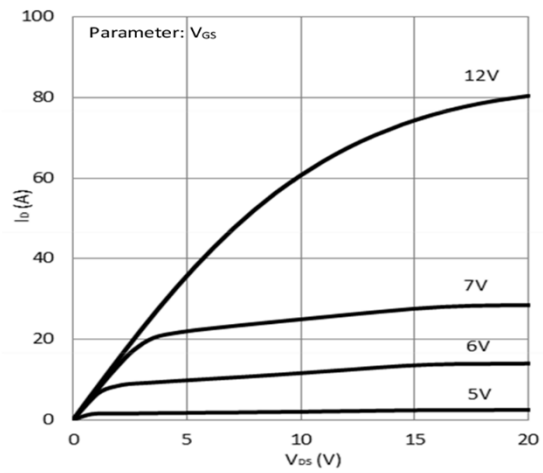


Figure 2. Typical Output Characteristics $T_J=150^\circ\text{C}$

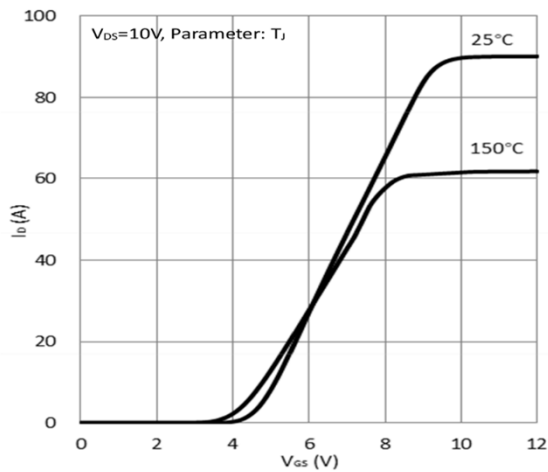


Figure 3. Typical Transfer Characteristics

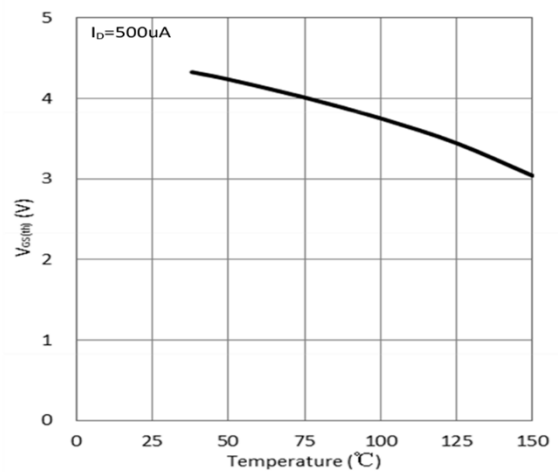


Figure 4. $V_{GS(th)}$ Vs Temperature Characteristics

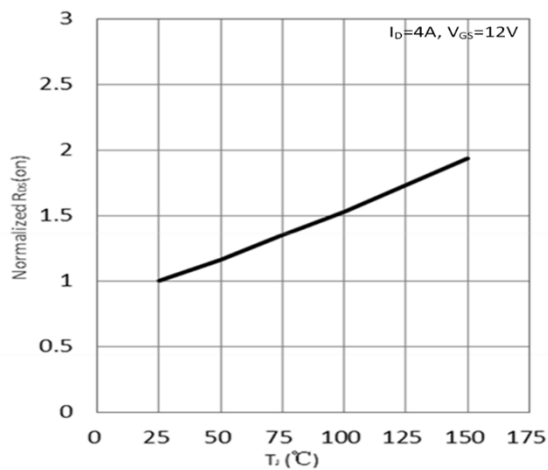


Figure 5. Normalized On-resistance

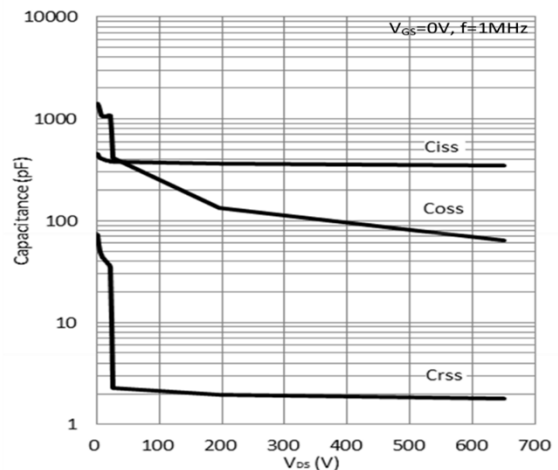


Figure 6. Typical Capacitance

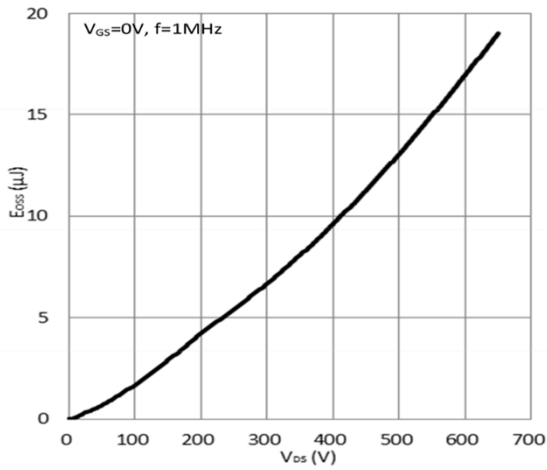


Figure 7. Typical Coss Stored Energy

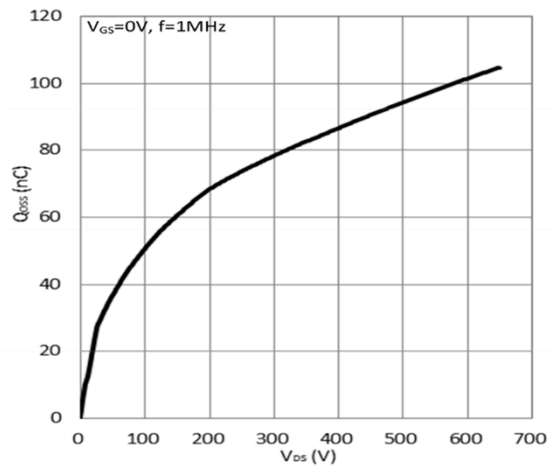


Figure 8. Typical Qoss

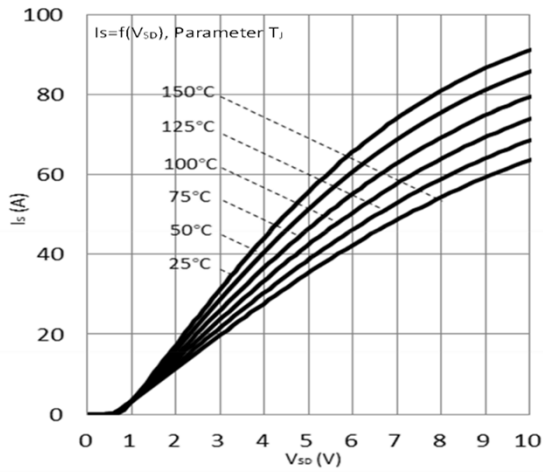


Figure 9. Forward Characteristic of Rev. Diode

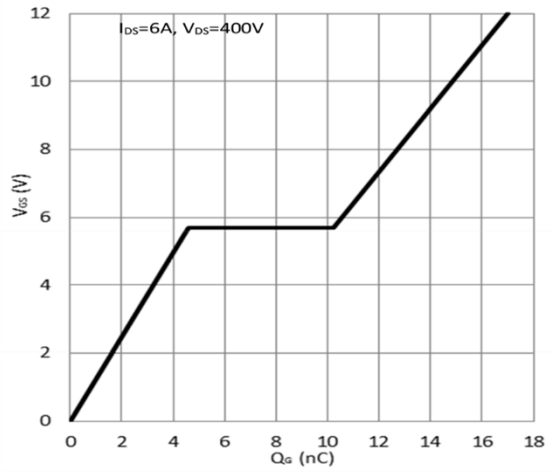


Figure 10. Typical Gate Charge

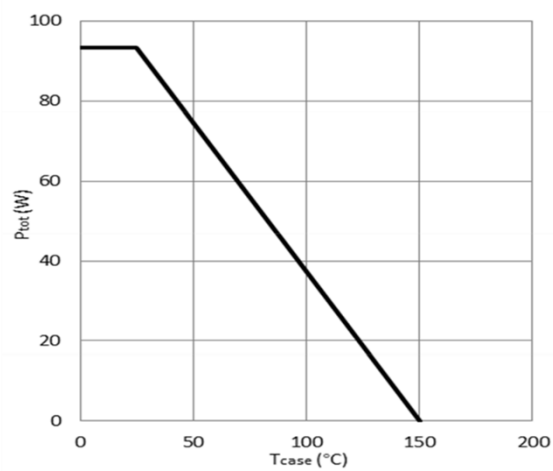


Figure 11. Power Dissipation

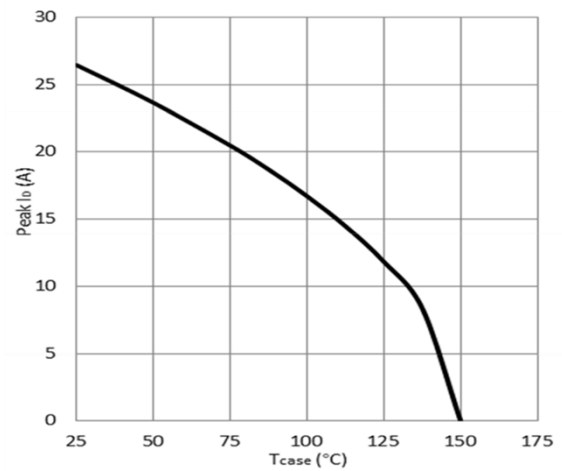


Figure 12. Current Derating

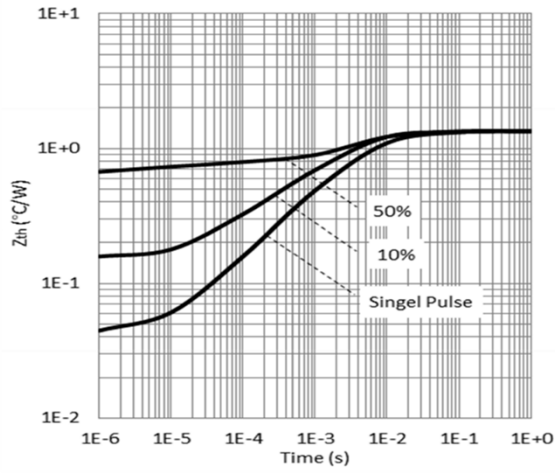


Figure 13. Transient Thermal Resistance

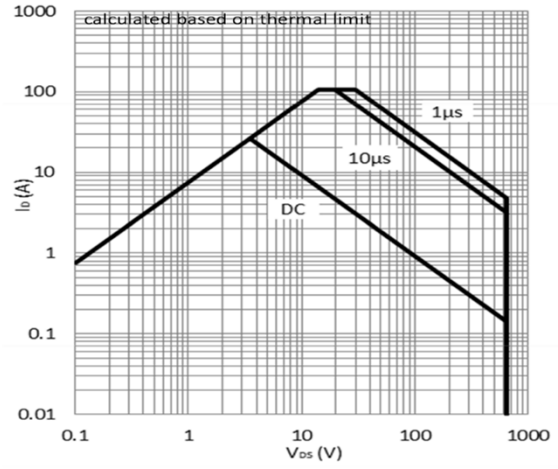


Figure 14. Safe Operating Area $T_c=25^\circ\text{C}$

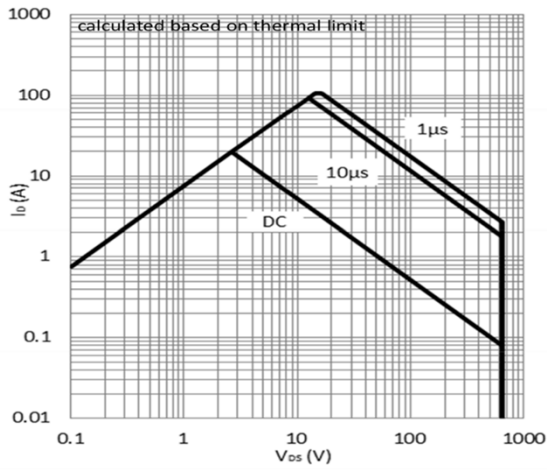


Figure 15. Safe Operating Area $T_c=80^\circ\text{C}$

Test Circuits and Waveforms

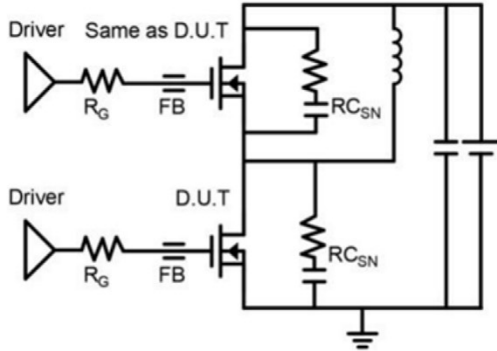


Figure 16. Switching Time Test Circuit

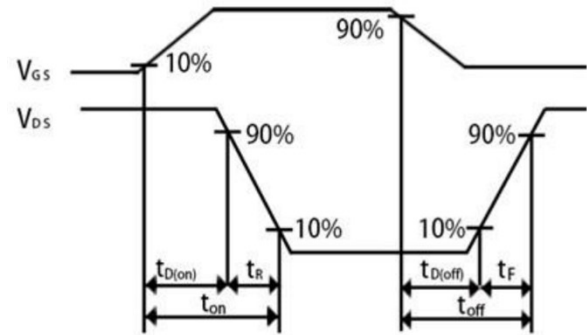


Figure 17. Switching Time Waveform

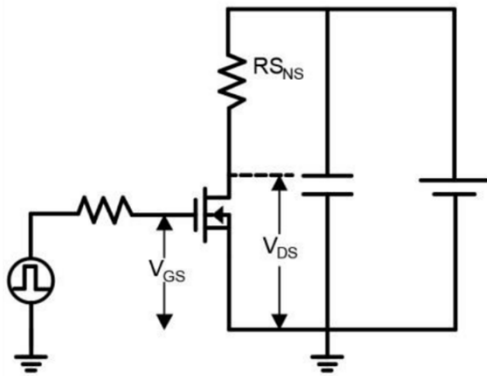


Figure 18. Dynamic $R_{DS(on)}$ Test Circuit

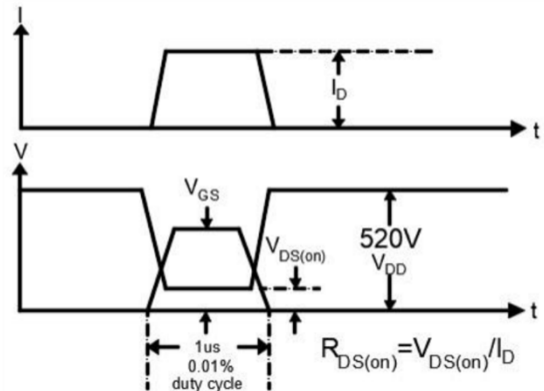


Figure 19. Dynamic $R_{DS(on)}$ Waveform

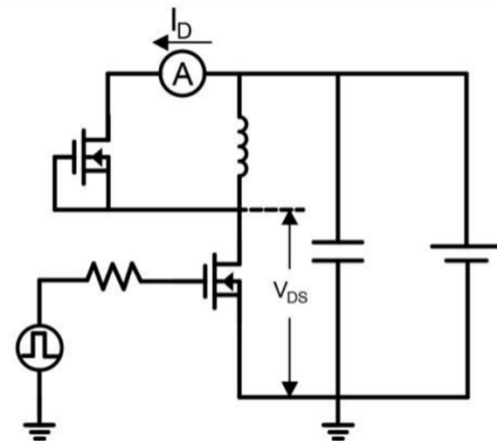


Figure 20. Diode Characteristic Test Circuits

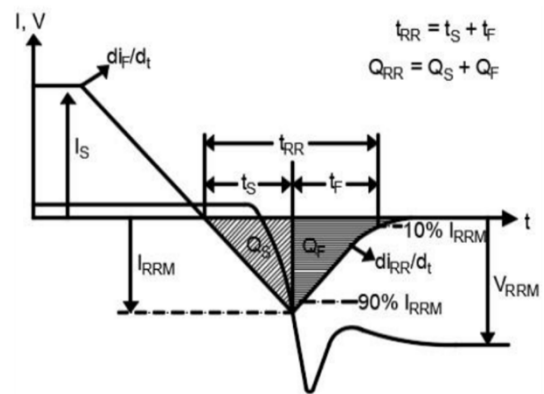
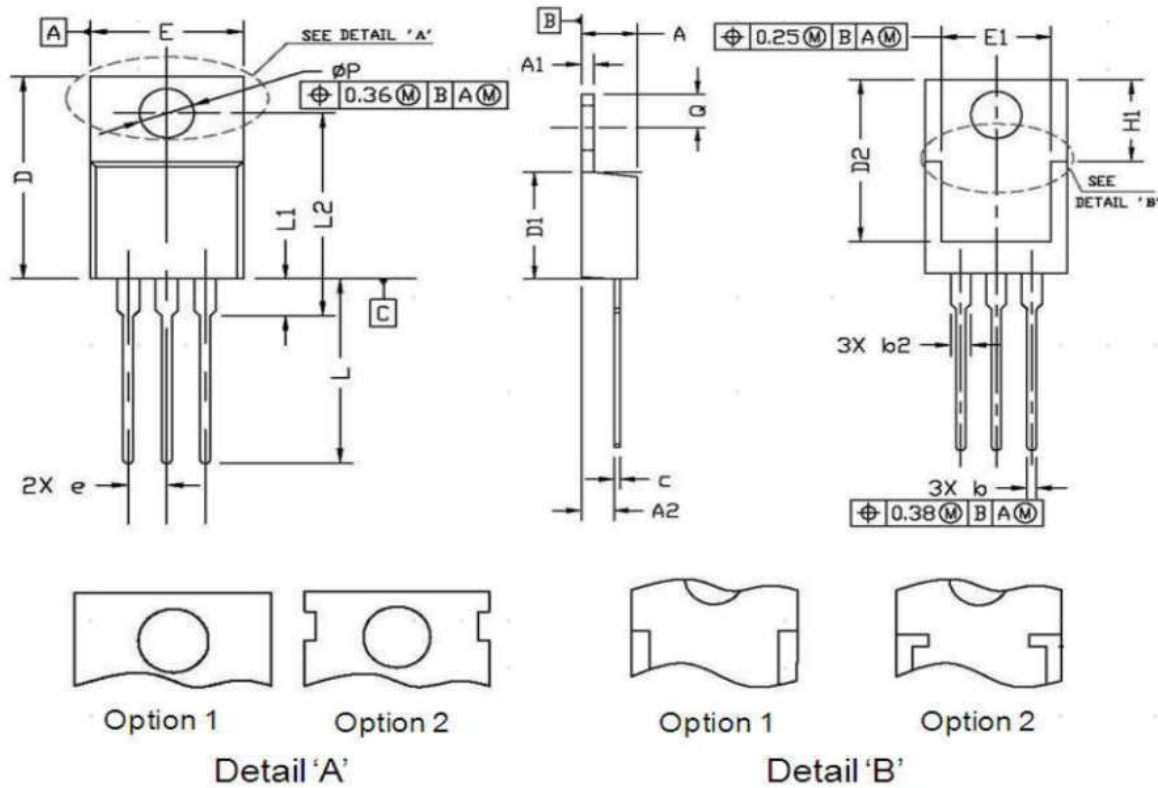



Figure 21. Diode Recovery Waveform

Product Dimension (TO-220-3L)



SYMBOL	Millimeter		
	Min	Nom	Max
A	4.30	4.50	4.80
A1	1.20	1.30	1.45
A2	2.20	2.50	2.90
b	0.69	0.85	0.95
b2	1.00	1.30	1.60
c	0.33	0.45	0.65
D	14.70	15.50	16.20
D1	8.59	9.00	9.65
D2	11.75	12.70	13.60
e	2.54BSC		
E	9.60	10.00	10.60
E1	7.00	7.50	8.46
H1	6.20	6.60	7.00
L	12.60	13.70	14.80
L1	2.70	3.40	3.80
L2	12.13	14.20	16.50
Q	2.40	2.80	3.10
P	3.50	3.70	3.90


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