

**60V, 198A, 2.2mΩ N-channel Power SGT MOSFET**
**JMSL0603PE**
**Features**

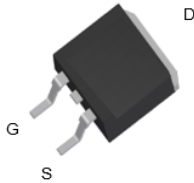
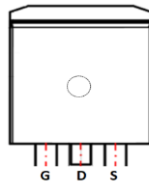
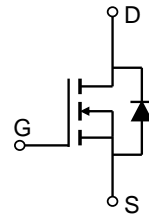
- Excellent  $R_{DS(ON)}$  and Low Gate Charge
- 100% UIS Tested
- 100%  $\Delta V_{ds}$  Tested
- Halogen-free; RoHS-compliant

**Applications**

- Load Switch
- PWM Application
- Power Management

**Product Summary**

Parameters	Value	Unit
$V_{DSS}$	60	V
$V_{GS(th\_Typ)}$	1.6	V
$I_D(@V_{GS}=10V)$	198	A
$R_{DS(ON\_Typ)}(@V_{GS}=10V)$	2.2	mΩ
$R_{DS(ON\_Typ)}(@V_{GS}=4.5V)$	2.8	mΩ


**TO-263-3L**

**Pin Assignment**

**Schematic Diagram**
**Ordering Information**

Device	Marking	MSL	Form	Package	Reel(pcs)	Per Carton (pcs)
JMSL0603PE-13	SL0603P	3	Tape&Reel	TO-263-3L	800	4000

**Absolute Maximum Ratings** (@  $T_C = 25^\circ\text{C}$  unless otherwise specified)

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-to-Source Voltage	60	V
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$I_D$	Continuous Drain Current	$T_C = 25^\circ\text{C}$	198.3
		$T_C = 100^\circ\text{C}$	125.4
$I_{DM}$	Pulsed Drain Current <sup>(1)</sup>	Refer to Fig.4	A
$E_{AS}$	Single Pulsed Avalanche Energy <sup>(2)</sup>	324	mJ
$P_D$	Power Dissipation	$T_C = 25^\circ\text{C}$	188
		$T_C = 100^\circ\text{C}$	75
$T_J, T_{STG}$	Junction & Storage Temperature Range	-55 to 150	$^\circ\text{C}$

**Thermal Characteristics**

Symbol	Parameter	Max	Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient <sup>(3)</sup>	41	$^\circ\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.67	

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	60	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 48\text{V}, V_{GS} = 0\text{V}$	-	-	1.0	$\mu\text{A}$
$I_{GSS}$	Gate-Body Leakage Current	$V_{DS} = 0\text{V}, V_{GS} = \pm 20\text{V}$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	1.1	1.6	2.4	V
$R_{DS(ON)}$	Static Drain-Source ON-Resistance <sup>(4)</sup>	$V_{GS} = 10\text{V}, I_D = 20\text{A}$	-	2.2	2.8	m $\Omega$
		$V_{GS} = 4.5\text{V}, I_D = 15\text{A}$	-	2.8	3.7	m $\Omega$
<b>Dynamic Characteristics</b>						
$R_g$	Gate Resistance	$f = 1\text{MHz}$	-	2.1	-	$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS} = 0\text{V}, V_{DS} = 30\text{V}, f = 1\text{MHz}$	-	3566	5349	pF
$C_{oss}$	Output Capacitance		-	1749	2624	pF
$C_{riss}$	Reverse Transfer Capacitance		-	103	207	pF
$Q_g$	Total Gate Charge	$V_{GS} = 0 \text{ to } 10\text{V}$ $V_{DS} = 30\text{V}, I_D = 20\text{A}$	-	62	-	nC
$Q_{gs}$	Gate Source Charge		-	10	-	nC
$Q_{gd}$	Gate Drain("Miller") Charge		-	14	-	nC
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On DelayTime	$V_{GS} = 10\text{V}, V_{DD} = 30\text{V}$ $I_D = 20\text{A}, R_{GEN} = 3\Omega$	-	11	-	ns
$t_r$	Turn-On Rise Time		-	28	-	ns
$t_{d(off)}$	Turn-Off DelayTime		-	54	-	ns
$t_f$	Turn-Off Fall Time		-	30	-	ns
<b>Body Diode Characteristics</b>						
$I_S$	Maximum Continuous Body Diode Forward Current		-	-	198	A
$I_{SM}$	Maximum Pulsed Body Diode Forward Current		-	-	793	A
$V_{SD}$	Body Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = 20\text{A}$	-	-	1.2	V
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F = 20\text{A}, di/dt = 100\text{A/us}$	40	57	85	ns
$Q_{rr}$	Body Diode Reverse Recovery Charge		-	69	-	nC

- Notes:
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
  2.  $E_{AS}$  condition: Starting  $T_J = 25^\circ\text{C}$ ,  $V_{DD} = 30\text{V}$ ,  $V_G = 10\text{V}$ ,  $R_G = 25\text{ohm}$ ,  $L = 3\text{mH}$ ,  $I_{AS} = 14.7\text{A}$ ,  $V_{DD} = 0\text{V}$  during time in avalanche.
  3.  $R_{\theta JA}$  is measured with the device mounted on a 1inch<sup>2</sup> pad of 2oz copper FR4 PCB.
  4. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 0.5\%$ .

## Typical Performance Characteristics

Figure 1: Power De-rating

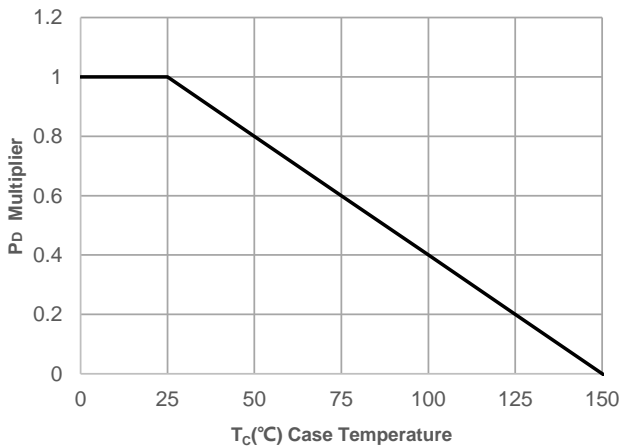


Figure 2: Current De-rating

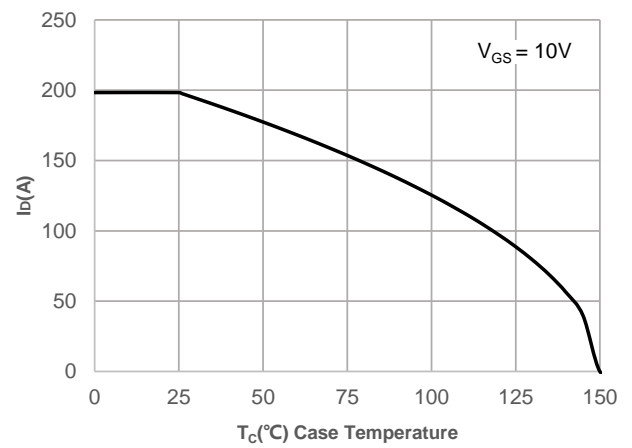


Figure 3: Normalized Maximum Transient Thermal Impedance

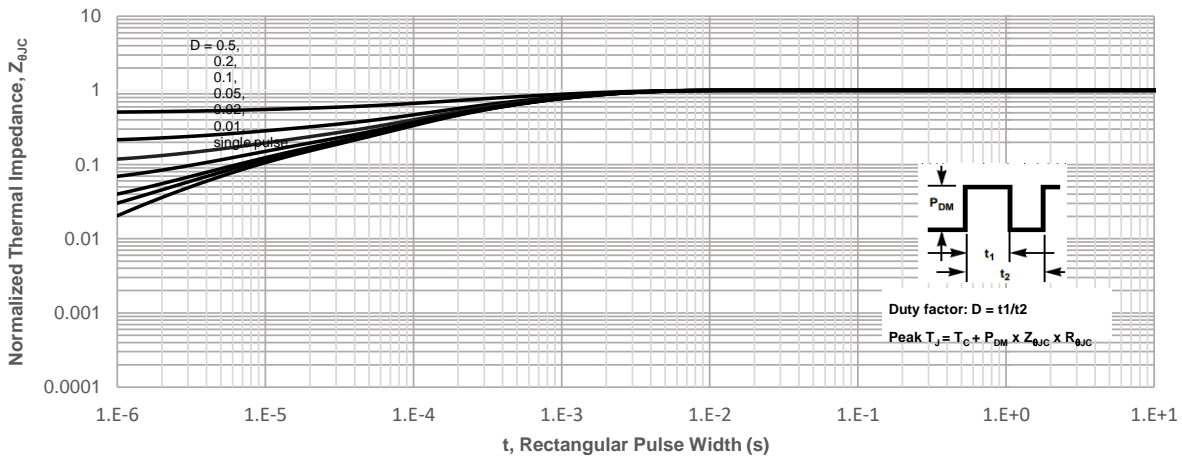
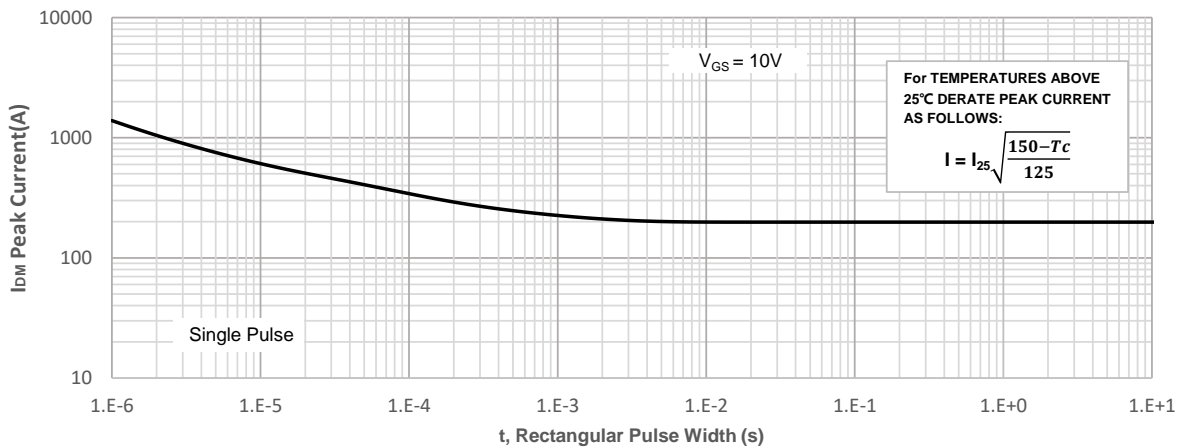
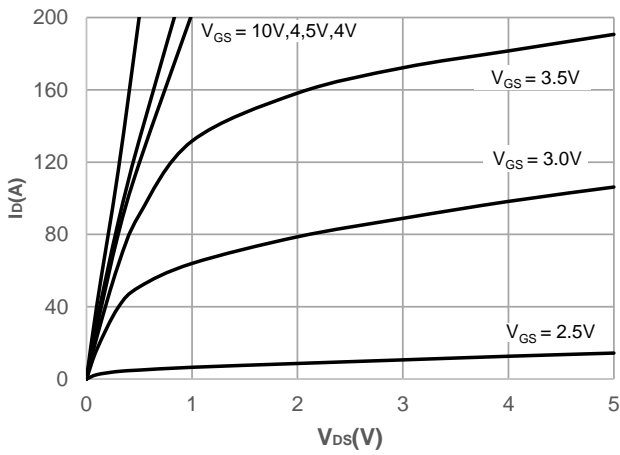
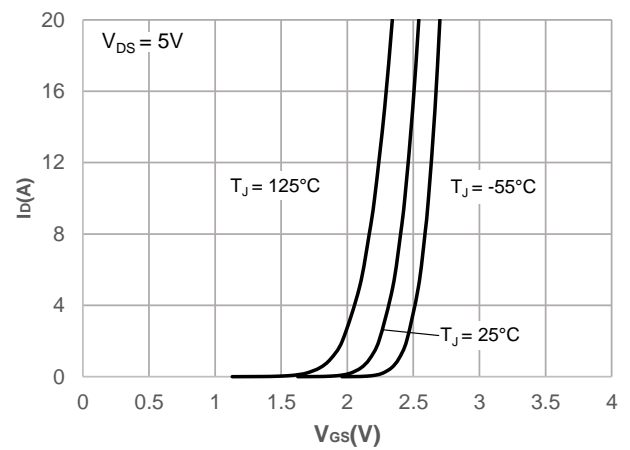
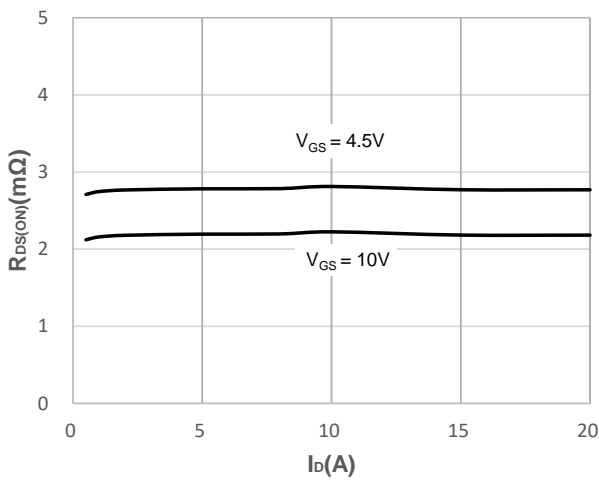
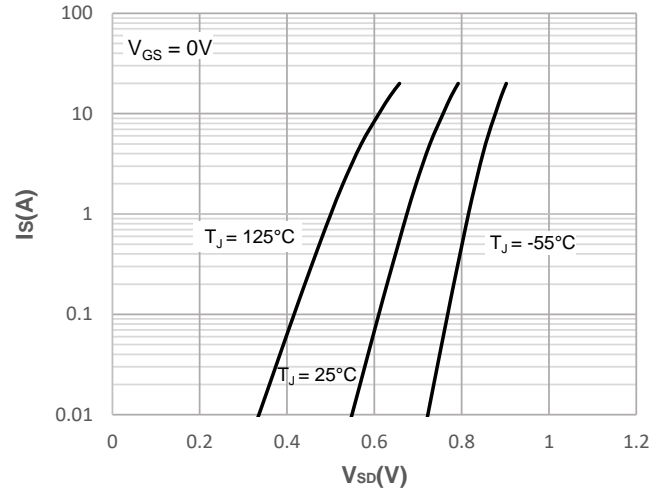
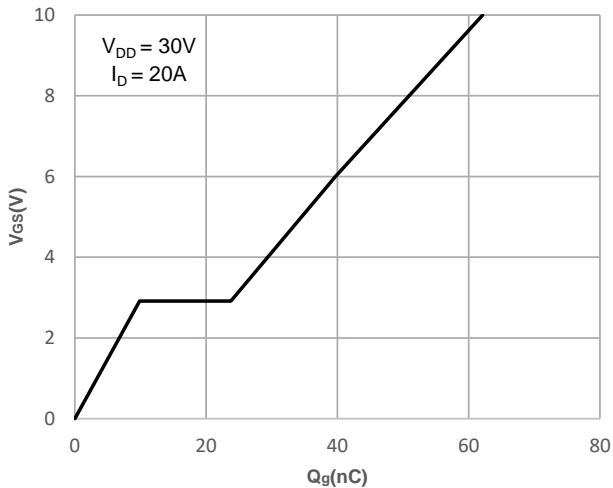
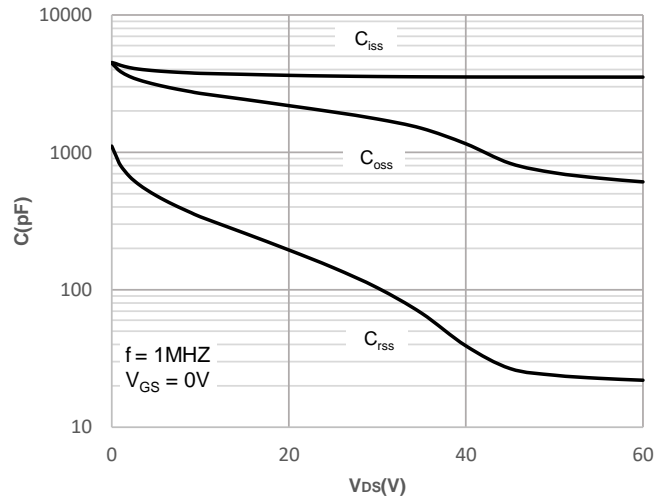


Figure 4: Peak Current Capacity



## Typical Performance Characteristics

**Figure 5: Output Characteristics**

**Figure 6: Typical Transfer Characteristics**

**Figure 7: On-resistance vs. Drain Current**

**Figure 8: Body Diode Characteristics**

**Figure 9: Gate Charge Characteristics**

**Figure 10: Capacitance Characteristics**


## Typical Performance Characteristics

Figure 11: Normalized Breakdown voltage vs. Junction Temperature

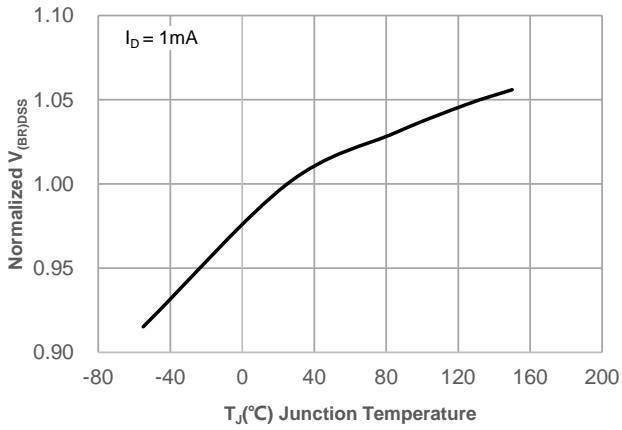


Figure 12: Normalized on Resistance vs. Junction Temperature

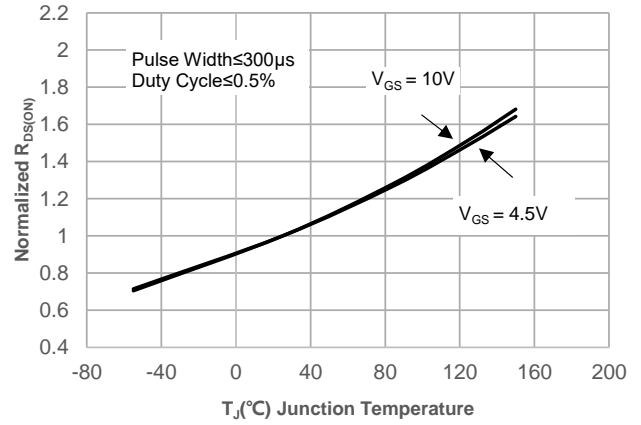


Figure 13: Normalized Threshold Voltage vs. Junction Temperature

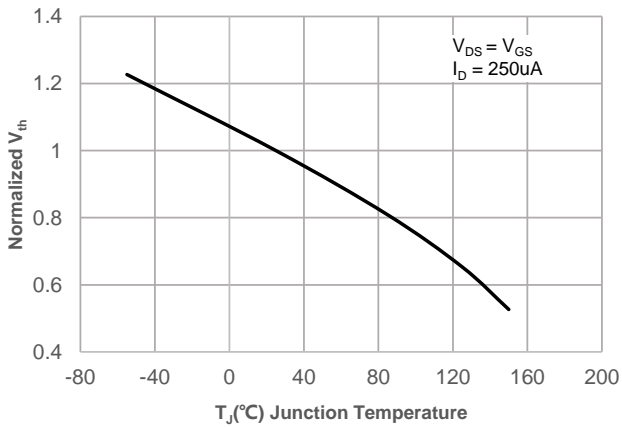


Figure 14:  $R_{DS(ON)}$  vs.  $V_{GS}$

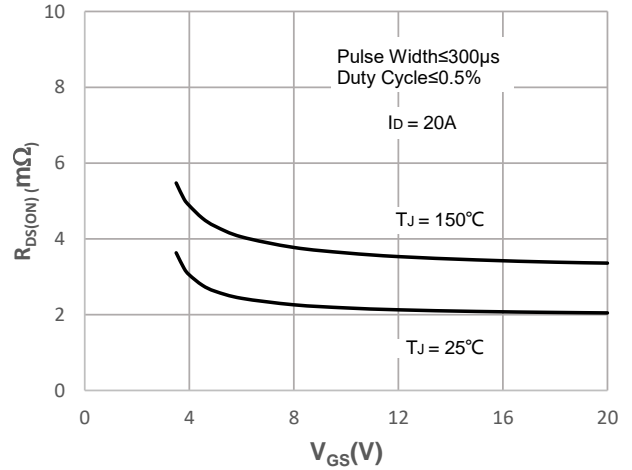
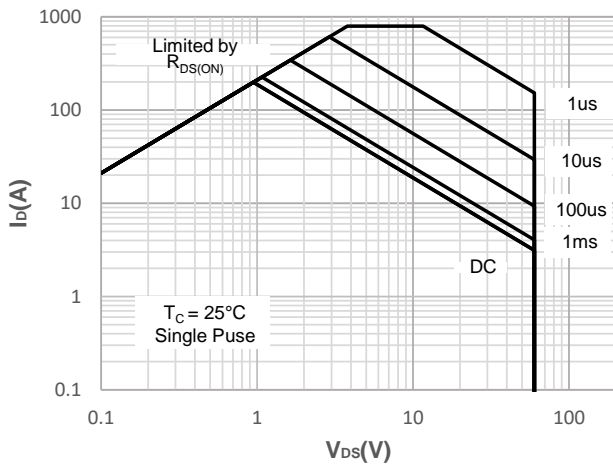


Figure 15: Maximum Safe Operating Area



### Test Circuit

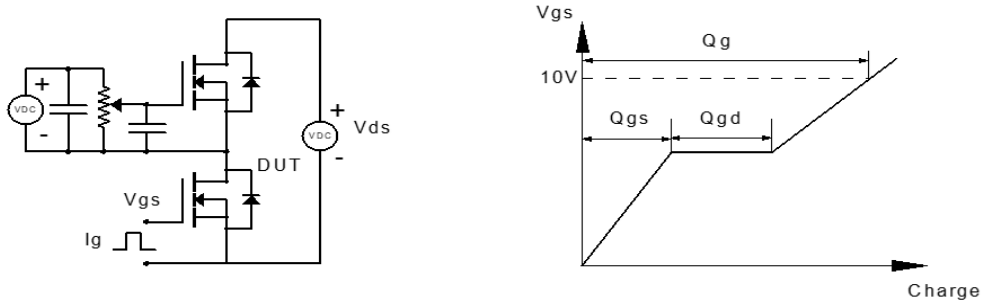


Figure 1: Gate Charge Test Circuit & Waveform



Figure 2: Resistive Switching Test Circuit & Waveform



Figure 3: Unclamped Inductive Switching Test Circuit & Waveform

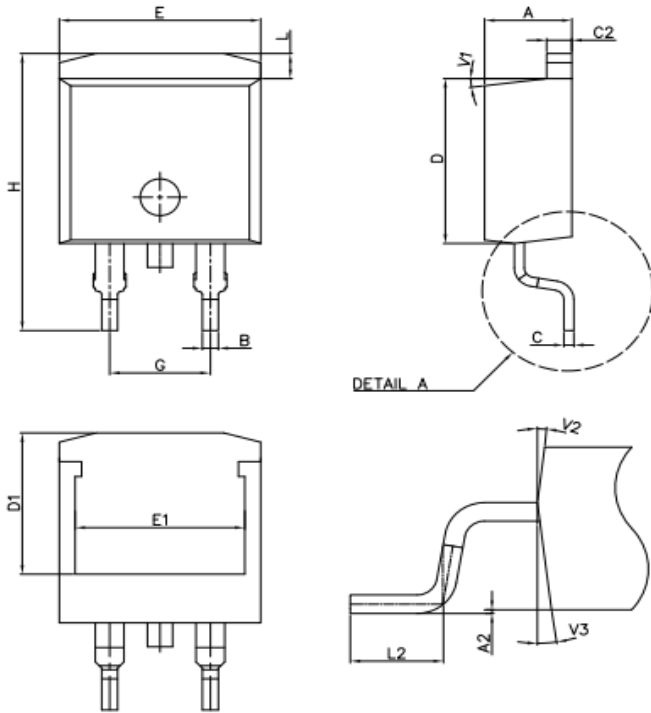


Figure 4: Diode Recovery Test Circuit & Waveform



## Package Mechanical Data(TO-25263-3L)

### Package Outline



SYMBOL	DIMENSIONS		
	MIN	NOM	MAX
A	4.15	4.40	4.55
A2	0.00		0.25
B	0.75	0.80	0.85
C	0.42	0.50	0.59
C2	1.22	1.27	1.32
D	8.52	8.92	9.22
D1	7.40	7.65	7.90
E	10.01	10.16	10.32
E1	8.26	8.56	8.86
G	5.03	5.08	5.13
H	14.70	15.00	15.80
L2	2.20	2.35	2.50
L	1.16	1.36	1.61
V1	5°	7°	9°
V2	3°	5°	7°
V3	6°	8°	10°

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