

**Pin Definition:**

1. Gate
2. Drain
3. Source

**PRODUCT SUMMARY**

$V_{DS}$ (V)	$R_{DS(on)}$ (m $\Omega$ )	$I_D$ (A)
500	0.22 @ $V_{GS}=10V$	23

**General Description**

The TSM23N50CN N-Channel enhancement mode Power MOSFET is produced by planar stripe DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switch mode power supply, electronic lamp ballast based on half bridge.

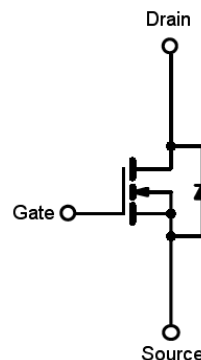
**Features**

- Low  $R_{DS(ON)}$  0.22 $\Omega$  (Max.)
- Low gate charge typical @ 66nC (Typ.)
- Improve dv/dt capability

**Ordering Information**

Part No.	Package	Packing
TSM23N50CN C0	TO-3PN	30pcs / Tube

**Block Diagram**



N-Channel MOSFET

**Absolute Maximum Rating** ( $T_a = 25^{\circ}C$  unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	500	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	V
Continuous Drain Current( $T_c=25^{\circ}C$ )	$I_D$	23	A
Pulsed Drain Current *	$I_{DM}$	92	A
Peak Diode Recovery dv/dt (Note 3)	dv/dt	4.5	V/ns
Single Pulse Avalanche Energy (Note 2)	$E_{AS}$	970	mJ
Avalanche Current (Repetitive) (Note 1)	$I_{AR}$	23	A
Repetitive Avalanche Energy (Note 1)	$E_{AR}$	34.7	mJ
Operating Junction Temperature	$T_J$	150	$^{\circ}C$
Storage Temperature Range	$T_{STG}$	-55 to +150	$^{\circ}C$

\* Limited by maximum junction temperature

### Thermal Performance

Parameter	Symbol	Limit	Unit
Thermal Resistance - Junction to Case	$R_{\theta_{JC}}$	0.4	$^{\circ}\text{C}/\text{W}$
Thermal Resistance - Junction to Ambient	$R_{\theta_{JA}}$	62.5	$^{\circ}\text{C}/\text{W}$

Notes: Surface mounted on FR4 board  $t \leq 10\text{sec}$

### Electrical Specifications (Ta = 25°C unless otherwise noted)

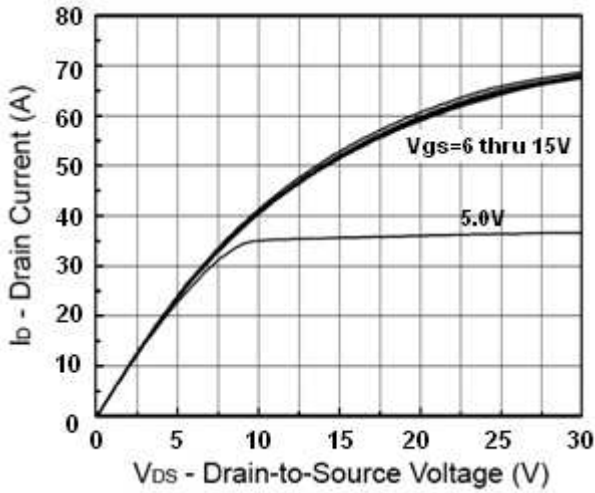
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$	$BV_{DSS}$	500	--	--	V
Drain-Source On-State Resistance	$V_{GS} = 10\text{V}, I_D = 11.5\text{A}$	$R_{DS(ON)}$	--	0.185	0.22	$\Omega$
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	$V_{GS(TH)}$	2.0	--	4.0	V
Zero Gate Voltage Drain Current	$V_{DS} = 500\text{V}, V_{GS} = 0\text{V}$	$I_{DSS}$	--	--	1	$\mu\text{A}$
Gate Body Leakage	$V_{GS} = \pm 30\text{V}, V_{DS} = 0\text{V}$	$I_{GSS}$	--	--	$\pm 100$	nA
Forward Transconductance	$V_{DS} = 30\text{V}, I_D = 11.5\text{A}$	$g_{fs}$	--	28	--	S
Diode Forward Voltage	$I_S = 23\text{A}, V_{GS} = 0\text{V}$	$V_{SD}$	--	--	1.5	V
<b>Dynamic<sup>b</sup></b>						
Total Gate Charge	$V_{DS} = 400\text{V}, I_D = 23\text{A}, V_{GS} = 10\text{V}$	$Q_g$	--	66	--	nC
Gate-Source Charge		$Q_{gs}$	--	20	--	
Gate-Drain Charge		$Q_{gd}$	--	16.8	--	
Input Capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V}, f = 1.0\text{MHz}$	$C_{iss}$	--	3391	--	pF
Output Capacitance		$C_{oss}$	--	357	--	
Reverse Transfer Capacitance		$C_{rss}$	--	14	--	
<b>Switching<sup>c</sup></b>						
Turn-On Delay Time	$V_{DD} = 250\text{V}, I_D = 23\text{A}, R_G = 25\Omega$	$t_{d(on)}$	--	78	--	nS
Turn-On Rise Time		$t_r$	--	64	--	
Turn-Off Delay Time		$t_{d(off)}$	--	335	--	
Turn-Off Fall Time		$t_f$	--	58	--	
Reverse Recovery Time	$V_{GS} = 0\text{V}, I_S = 23\text{A}, di_F/dt = 100\text{A}/\mu\text{s}$	$t_{fr}$	--	417	--	nS
Reverse Recovery Charge		$Q_{fr}$	--	5.5	--	$\mu\text{C}$

#### Notes:

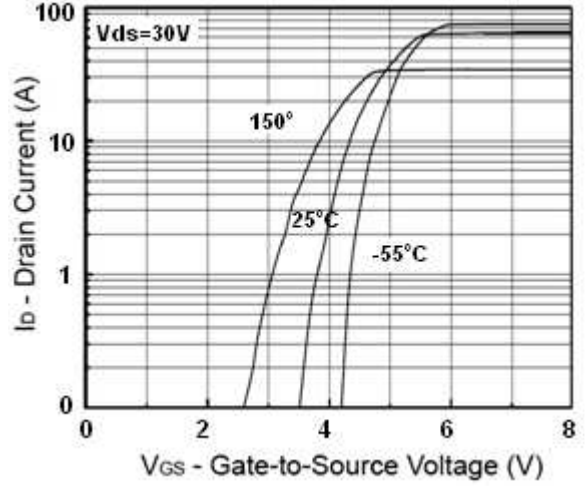
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
2.  $V_{DD} = 50\text{V}, I_{AS} = 23\text{A}, L = 3.3\text{mH}, R_G = 25\Omega$ , Starting  $T_J = 25^{\circ}\text{C}$
3.  $I_{SD} \leq 23\text{A}, di/dt \leq 200\text{A}/\mu\text{S}, V_{DD} \leq BV_{DS}$ , Starting  $T_J = 25^{\circ}\text{C}$
4. Pulse test: pulse width  $\leq 300\mu\text{S}$ , duty cycle  $\leq 2\%$
5. b For design reference only, not subject to production testing.
6. c Switching time is essentially independent of operating temperature.

**Electrical Characteristics Curve** ( $T_c = 25^\circ\text{C}$ , unless otherwise noted)

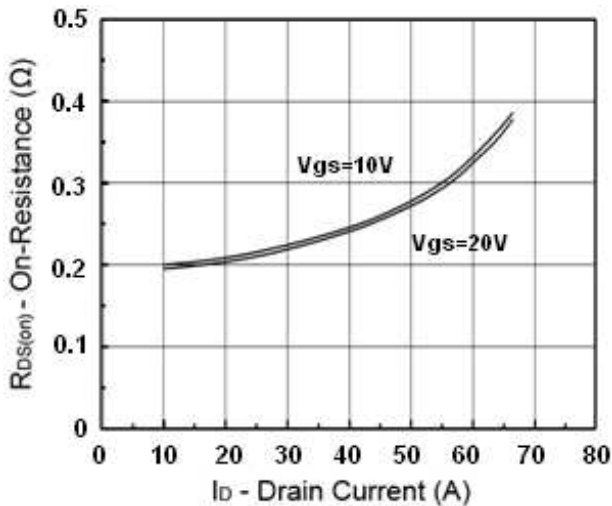
**Output Characteristics**



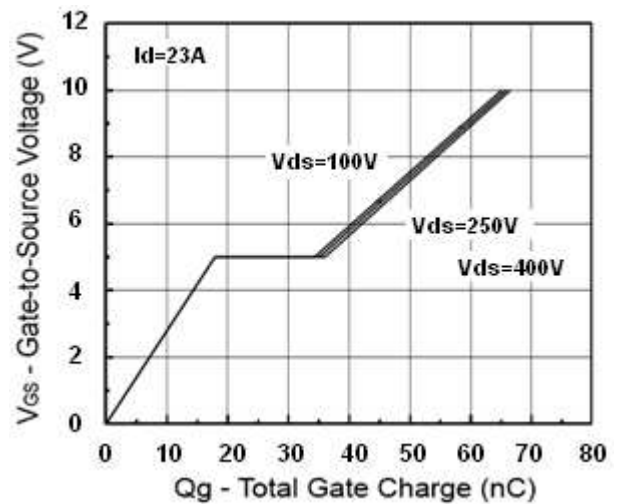
**Transfer Characteristics**



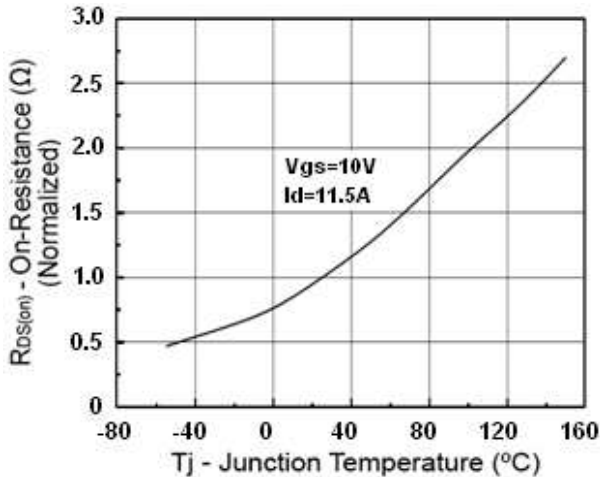
**On-Resistance vs. Drain Current**



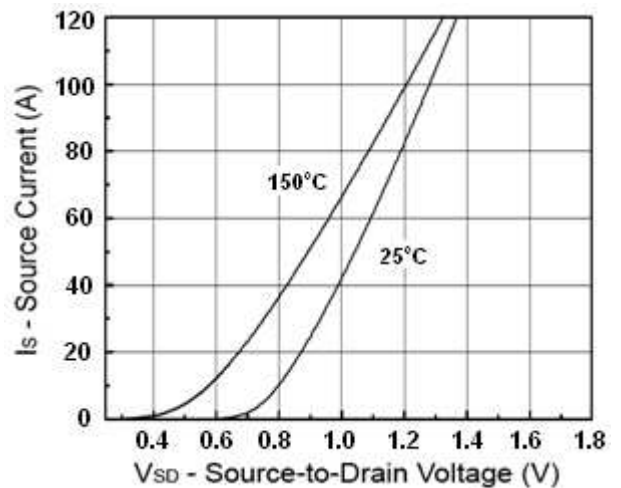
**Gate Charge**



**On-Resistance vs. Junction Temperature**

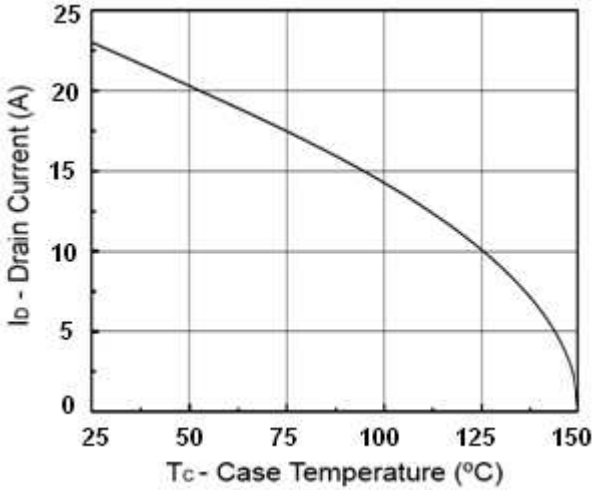


**Source-Drain Diode Forward Voltage**

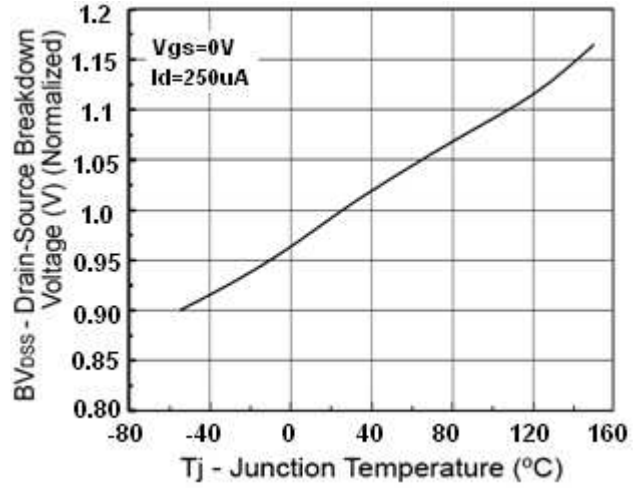


**Electrical Characteristics Curve** ( $T_a = 25^\circ\text{C}$ , unless otherwise noted)

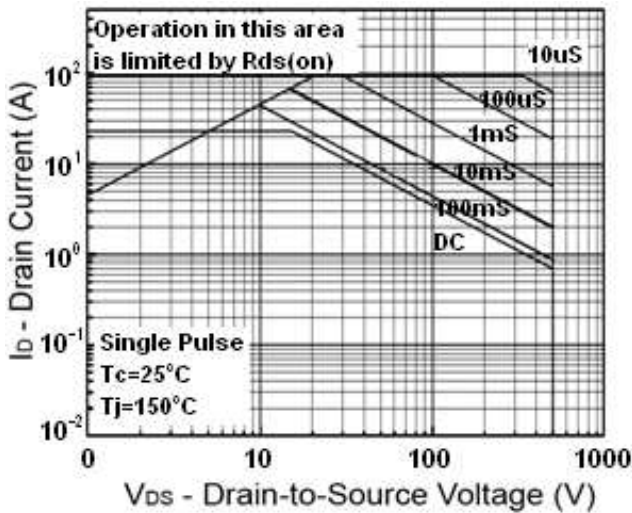
**Drain Current vs. Case Temperature**



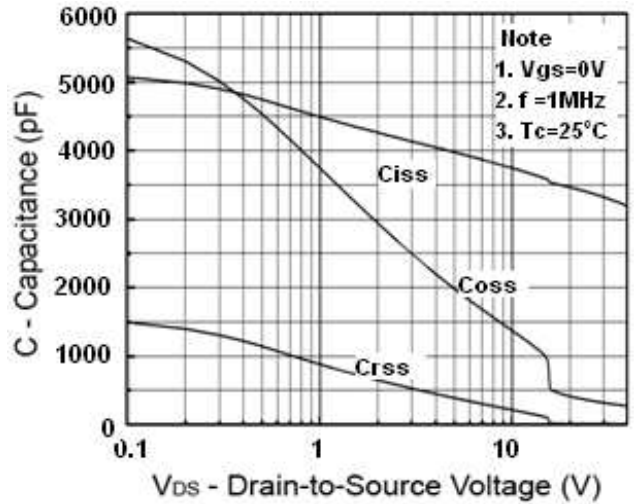
**$BV_{DSS}$  vs. Junction Temperature**



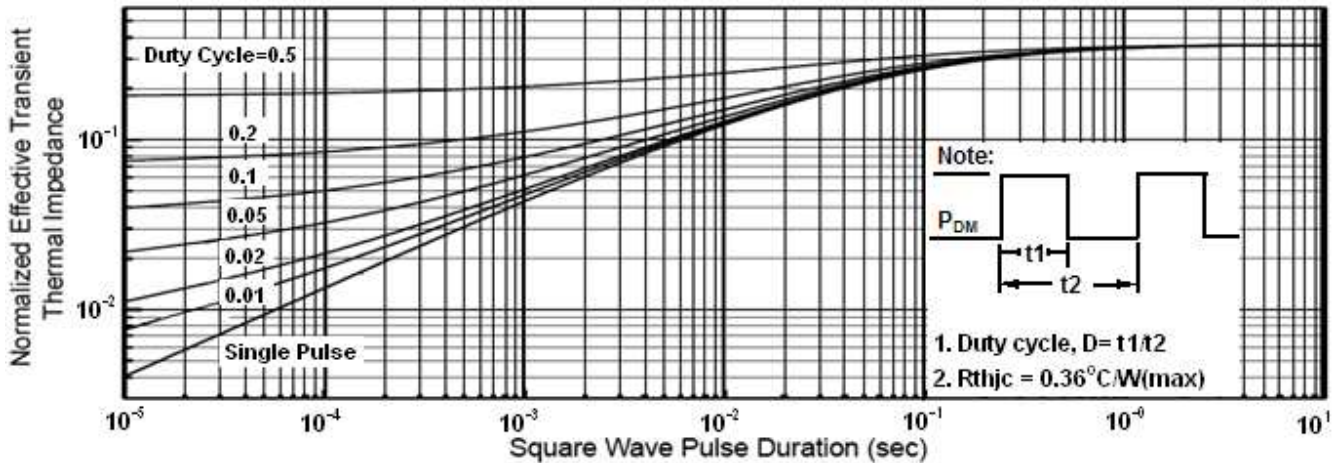
**Maximum Safe Operating Area**



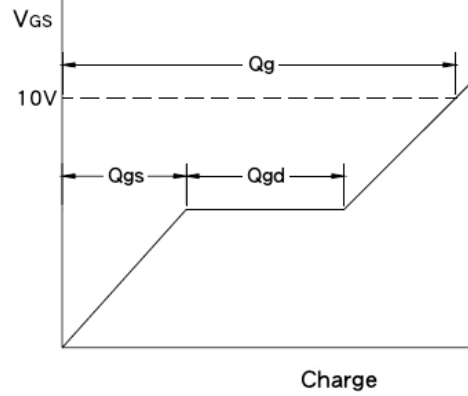
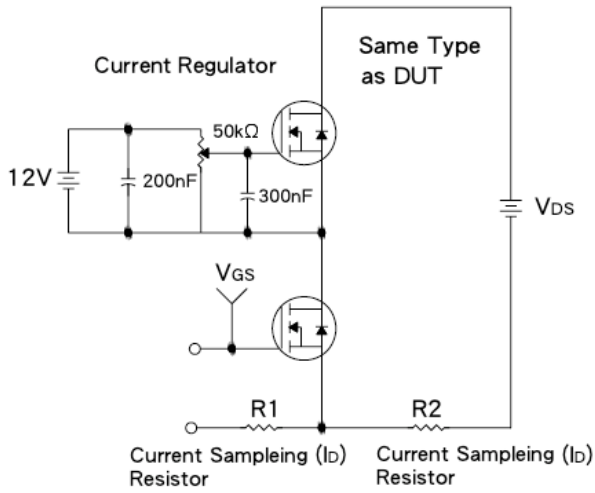
**Capacitance vs. Drain-Source Voltage**



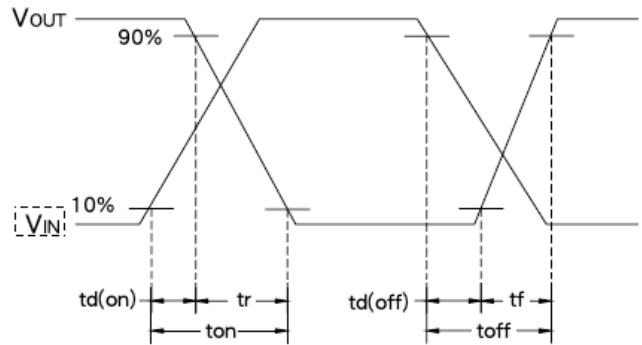
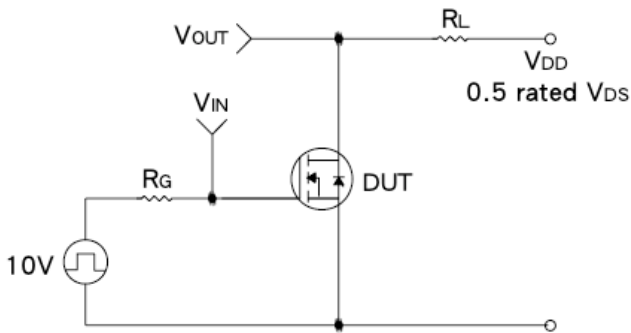
**Normalized Thermal Transient Impedance, Junction-to-Ambient**



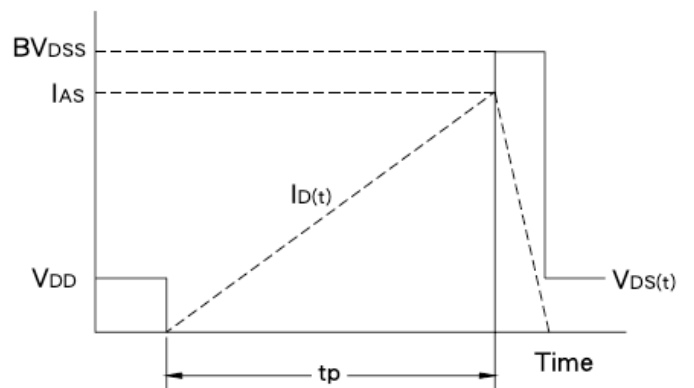
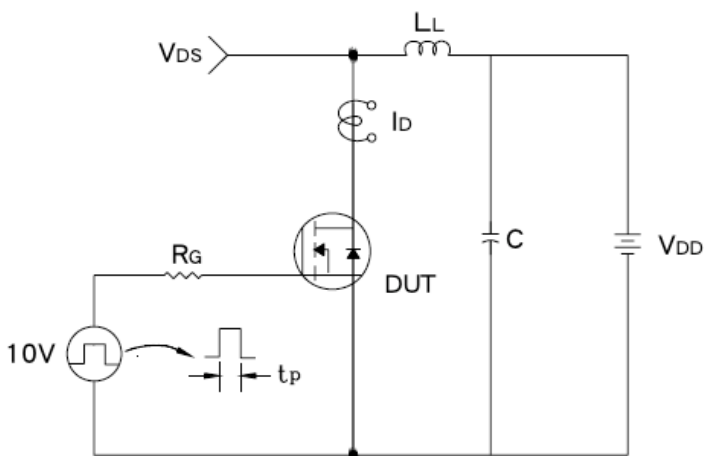
### Gate Charge Test Circuit & Waveform



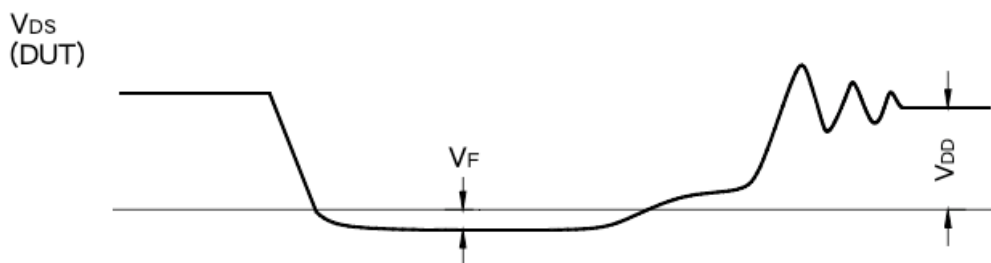
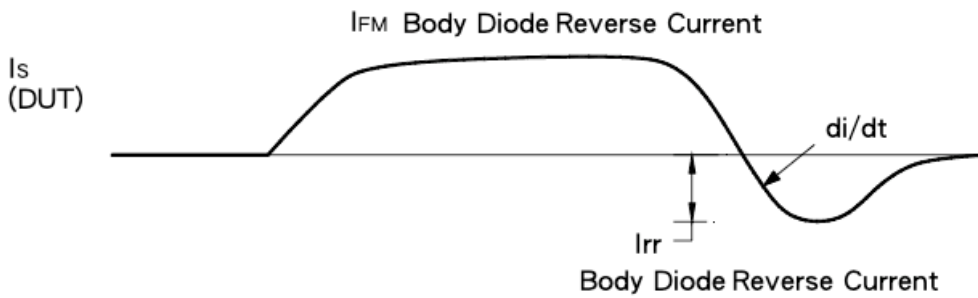
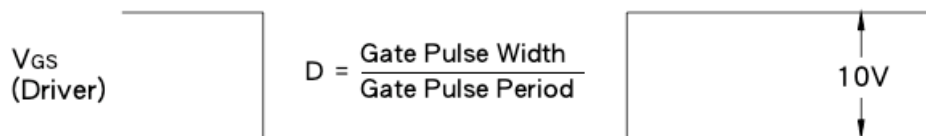
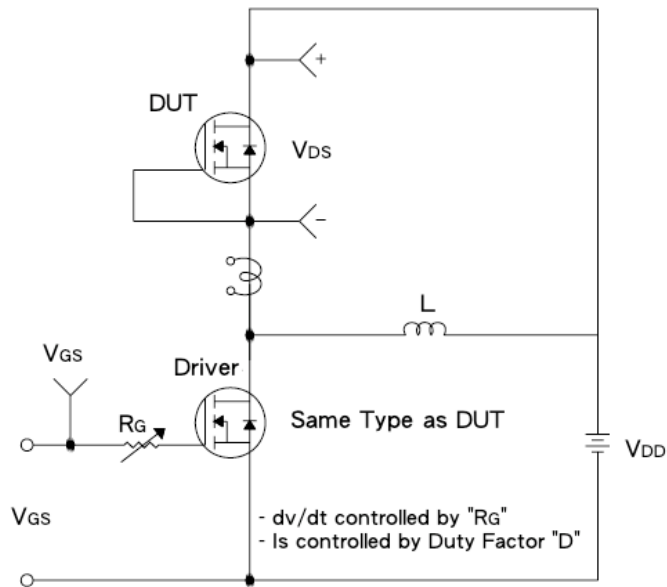
### Resistive Switching Test Circuit & Waveform



### E<sub>AS</sub> Test Circuit & Waveform

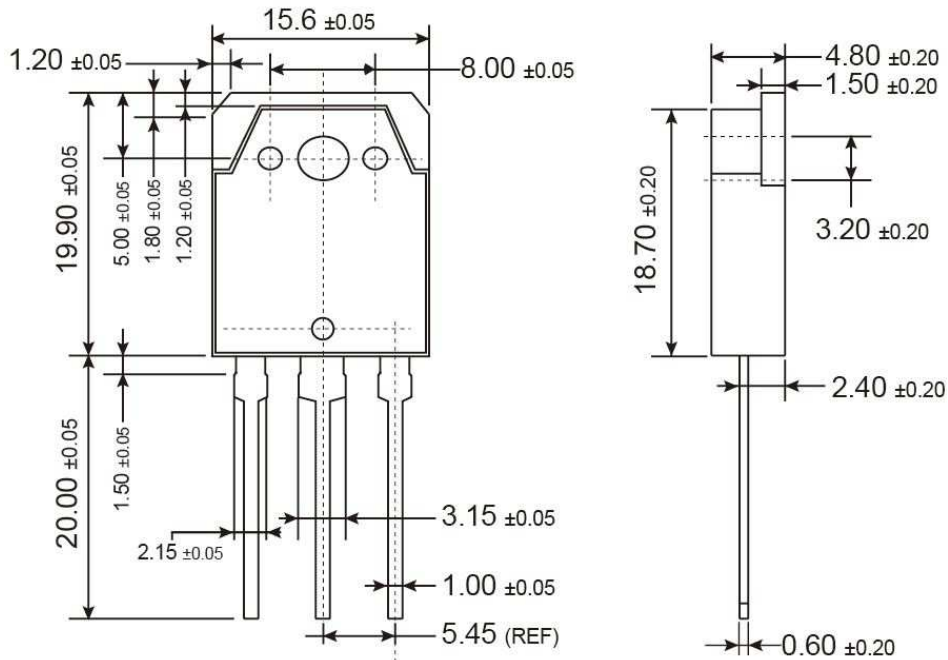


### Diode Reverse Recovery Time Test Circuit & Waveform





## TO-3PN Mechanical Drawing



Unit: Millimeters

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