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# FDT1600N10ALZ

## N-Channel PowerTrench® MOSFET

100 V, 5.6 A, 160 mΩ

### Features

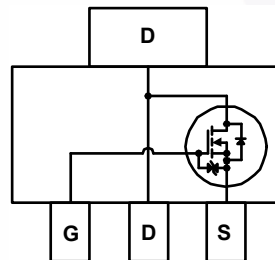
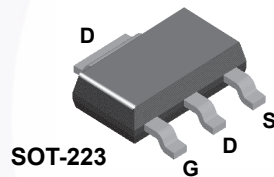
- $R_{DS(on)} = 121 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 2.8 \text{ A}$
- $R_{DS(on)} = 156 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 5 \text{ V}$ ,  $I_D = 1.8 \text{ A}$
- Low Gate Charge (Typ. 2.9 nC)
- Low  $C_{rss}$  (Typ. 2.04 pF)
- Fast Switching
- 100% Avalanche Tested
- Improved dv/dt Capability
- RoHS Compliant

### Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process that has been tailored to minimize the on-state resistance and maintain superior switching performance.

### Application

- Consumer Appliances
- LED TV and Monitor
- Synchronous Rectification
- Uninterruptible Power Supply
- Micro Solar Inverter



### MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	FDT1600N10ALZ	Unit
$V_{DSS}$	Drain to Source Voltage	100	V
$V_{GSS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current	- Continuous ( $T_C = 25^\circ\text{C}$ )	5.6
		- Continuous ( $T_C = 100^\circ\text{C}$ )	3.5
$I_{DM}$	Drain Current	- Pulsed (Note 2)	11.2
$E_{AS}$	Single Pulse Avalanche Energy	(Note 3)	9.2
dv/dt	Peak Diode Recovery dv/dt	(Note 4)	6.0
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	10.42
		- Derate Above $25^\circ\text{C}$	0.083
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	(Note 1)	12	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	(Note 1a)	60	

### Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDT1600N10ALZ	16010ALZ	SOT-223	Tape and Reel	13"	12 mm	4000 units

## Electrical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\ \mu\text{A}, V_{GS} = 0\ \text{V}$	100	-	-	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , referenced to $25^\circ\text{C}$	-	0.1	-	V/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 80\ \text{V}, V_{GS} = 0\ \text{V}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 80\ \text{V}, V_{GS} = 0\ \text{V}, T_C = 125^\circ\text{C}$	-	-	500	
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\ \text{V}, V_{DS} = 0\ \text{V}$	-	-	$\pm 10$	$\mu\text{A}$

### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	1.4	-	2.8	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\ \text{V}, I_D = 2.8\ \text{A}$	-	121	160	$\text{m}\Omega$
		$V_{GS} = 5\ \text{V}, I_D = 1.8\ \text{A}$	-	156	375	$\text{m}\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\ \text{V}, I_D = 5.6\ \text{A}$	-	26.1	-	S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 50\ \text{V}, V_{GS} = 0\ \text{V}, f = 1\ \text{MHz}$	-	169	225	$\text{pF}$
$C_{oss}$	Output Capacitance		-	43	55	$\text{pF}$
$C_{rss}$	Reverse Transfer Capacitance		-	2.04	-	$\text{pF}$
$C_{oss(er)}$	Energy Related Output Capacitance	$V_{DS} = 50\ \text{V}, V_{GS} = 0\ \text{V}$	-	85	-	$\text{pF}$
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{GS} = 10\ \text{V}$	-	2.9	3.77	$\text{nC}$
$Q_{g(tot)}$	Total Gate Charge at 5V	$V_{GS} = 5\ \text{V}$				
$Q_{gs}$	Gate to Source Gate Charge	$V_{DD} = 50\ \text{V}, I_D = 5.6\ \text{A}$	-	0.7	-	$\text{nC}$
$Q_{gd}$	Gate to Drain "Miller" Charge		-	0.64	-	$\text{nC}$
$V_{plateau}$	Gate Plateau Voltage		(Note 5)	-	3.81	-
$Q_{sync}$	Total Gate Charge Sync.	$V_{DS} = 0\ \text{V}, I_D = 2.8\ \text{A}$	-	2.45	-	$\text{nC}$
$Q_{oss}$	Output Charge	$V_{DS} = 50\ \text{V}, V_{GS} = 0\ \text{V}$	-	5.2	-	$\text{nC}$
ESR	Equivalent Series Resistance(G-S)	$f = 1\ \text{MHz}$	-	2.1	-	$\Omega$

### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 50\ \text{V}, I_D = 5.6\ \text{A}, V_{GS} = 10\ \text{V}, R_G = 4.7\ \Omega$	-	7.4	24.8	ns
$t_r$	Rise Time		-	2.5	15	ns
$t_{d(off)}$	Turn-Off Delay Time		-	13.5	37	ns
$t_f$	Turn-Off Fall Time		(Note 5)	-	2.4	14.8

### Drain-Source Diode Characteristics

$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	5.6	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	11.2	A	
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\ \text{V}, I_{SD} = 5.6\ \text{A}$	-	-	1.3	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\ \text{V}, I_{SD} = 5.6\ \text{A}, V_{DD} = 50\ \text{V}, di_F/dt = 100\ \text{A}/\mu\text{s}$	-	34.1	-	ns
$Q_{rr}$	Reverse Recovery Charge		-	32.7	-	$\text{nC}$

#### NOTES:

- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a)  $60^\circ\text{C}/\text{W}$  when mounted on a  $1\ \text{in}^2$  pad of 2-oz copper.

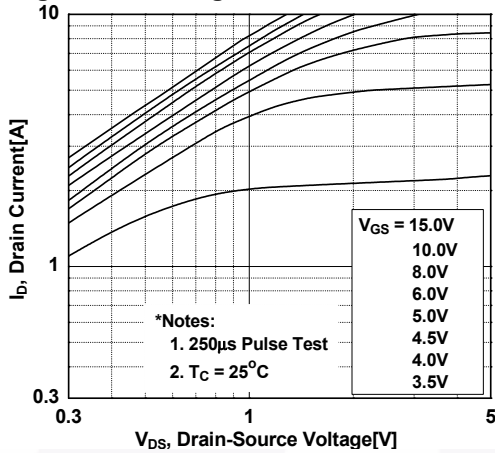


b)  $118^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.

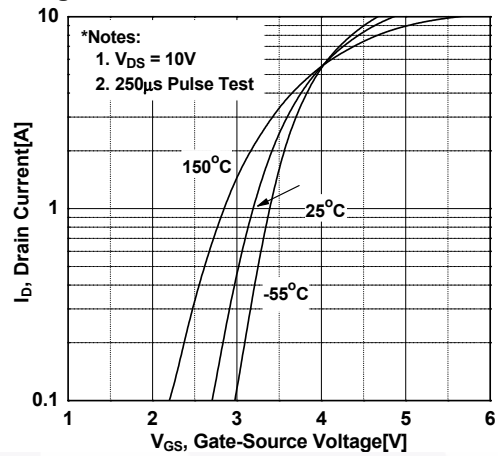
- Repetitive rating: pulse-width limited by maximum junction temperature.
- Starting  $T_J = 25^\circ\text{C}$ ,  $L = 3\ \text{mH}$ ,  $I_{AS} = 2.47\ \text{A}$ .
- $I_{SD} \leq 5.6\ \text{A}$ ,  $di/dt \leq 200\ \text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , starting  $T_J = 25^\circ\text{C}$ .
- Essentially independent of operating temperature typical characteristics.

## Typical Performance Characteristics

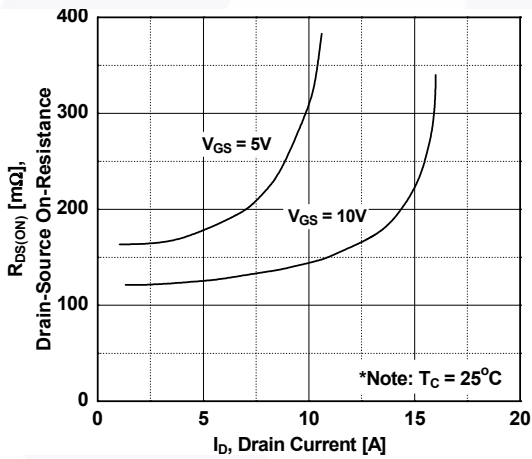
**Figure 1. On-Region Characteristics**



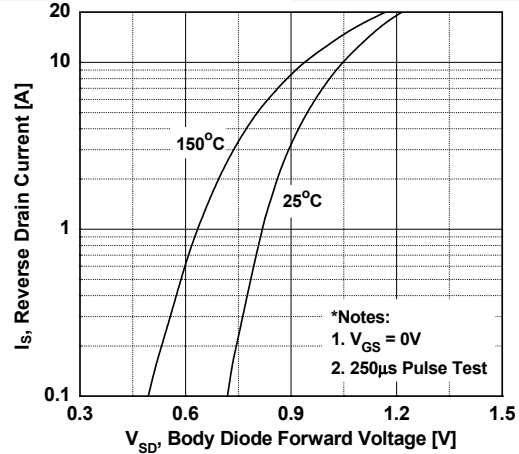
**Figure 2. Transfer Characteristics**



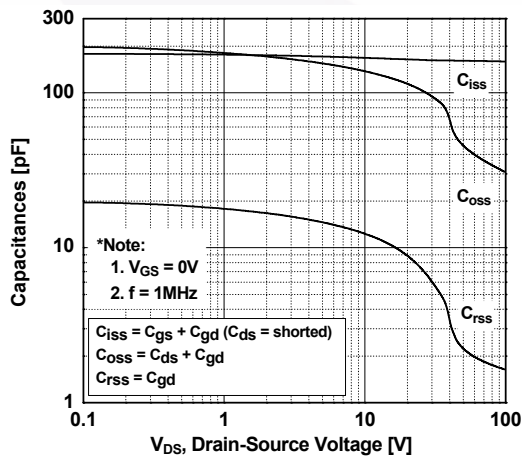
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



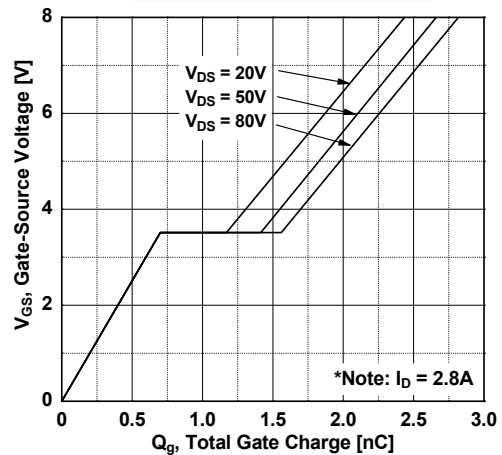
**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

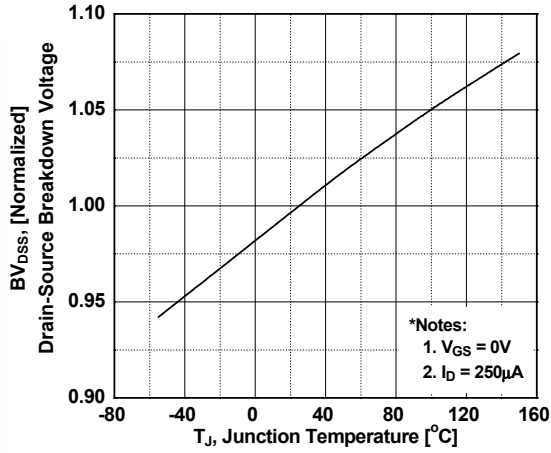


**Figure 6. Gate Charge Characteristics**

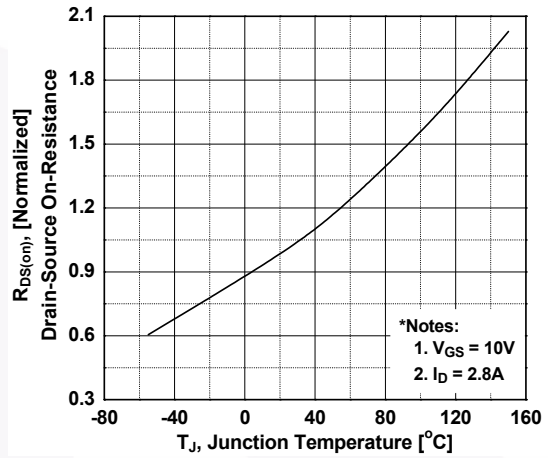


**Typical Performance Characteristics** (Continued)

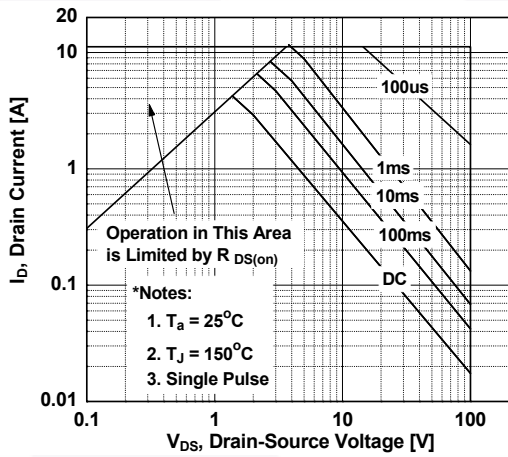
**Figure 7. Breakdown Voltage Variation vs. Temperature**



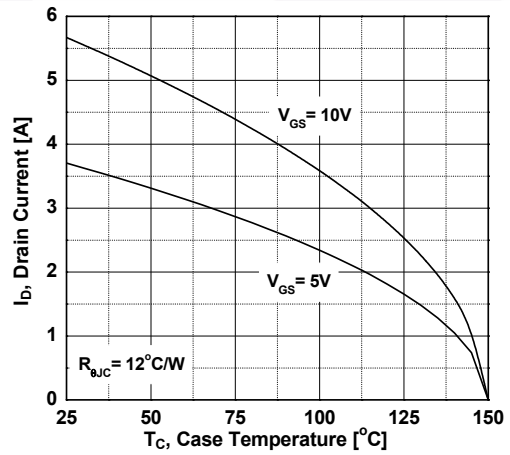
**Figure 8. On-Resistance Variation vs. Temperature**



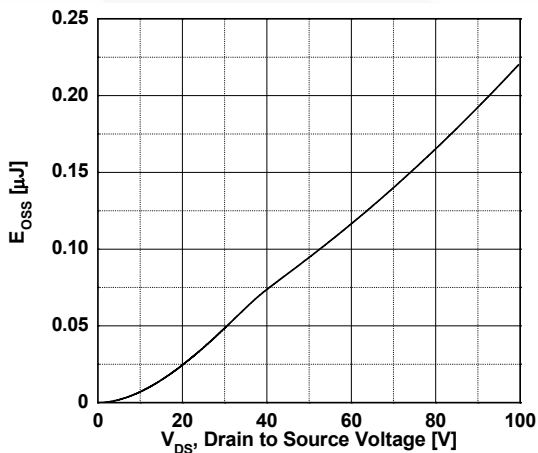
**Figure 9. Maximum Safe Operating Area**



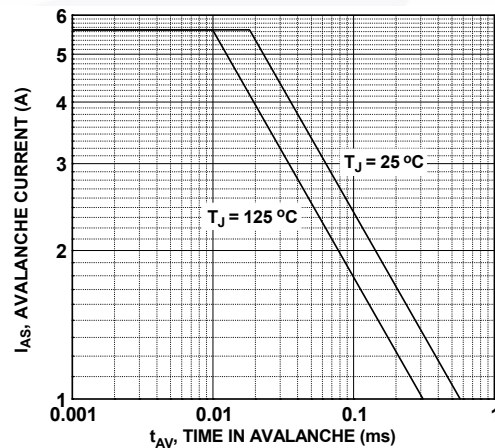
**Figure 10. Maximum Drain Current vs. Case Temperature**



**Figure 11. E\_oss vs. Drain to Source Voltage**

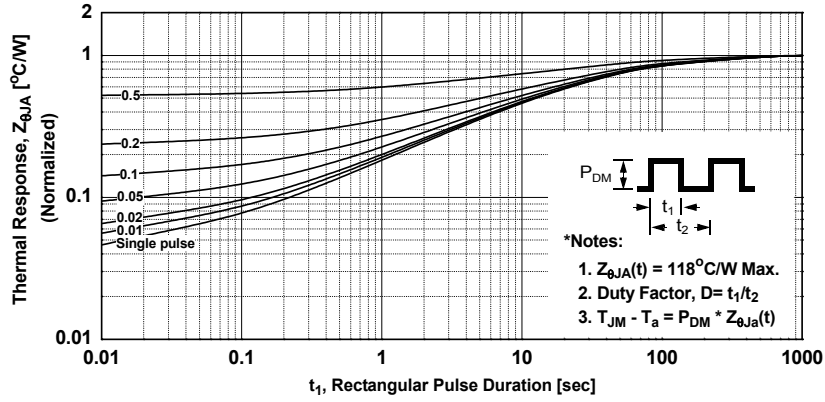


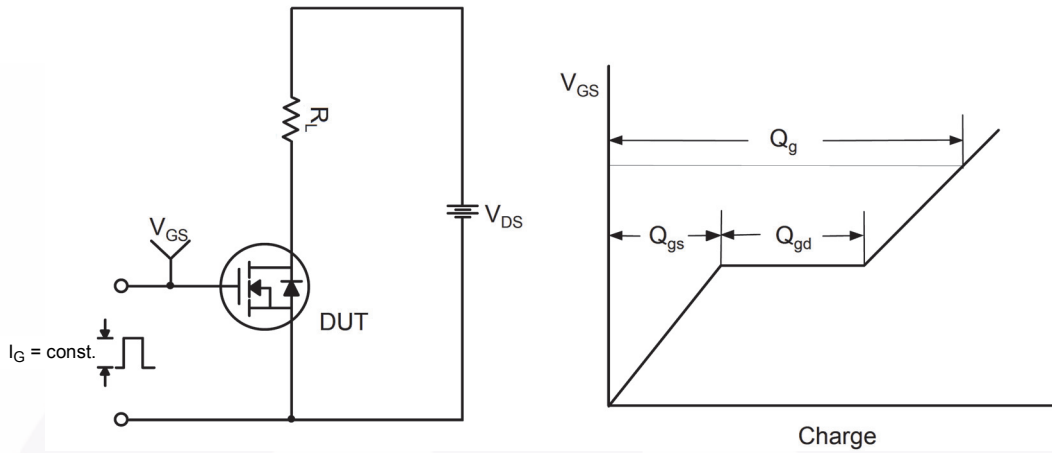
**Figure 12. Unclamped Inductive Switching Capability**



Typical Performance Characteristics (Continued)

Figure 13. Transient Thermal Response Curve





**Figure 14. Gate Charge Test Circuit & Waveform**



**Figure 15. Resistive Switching Test Circuit & Waveforms**



**Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms**

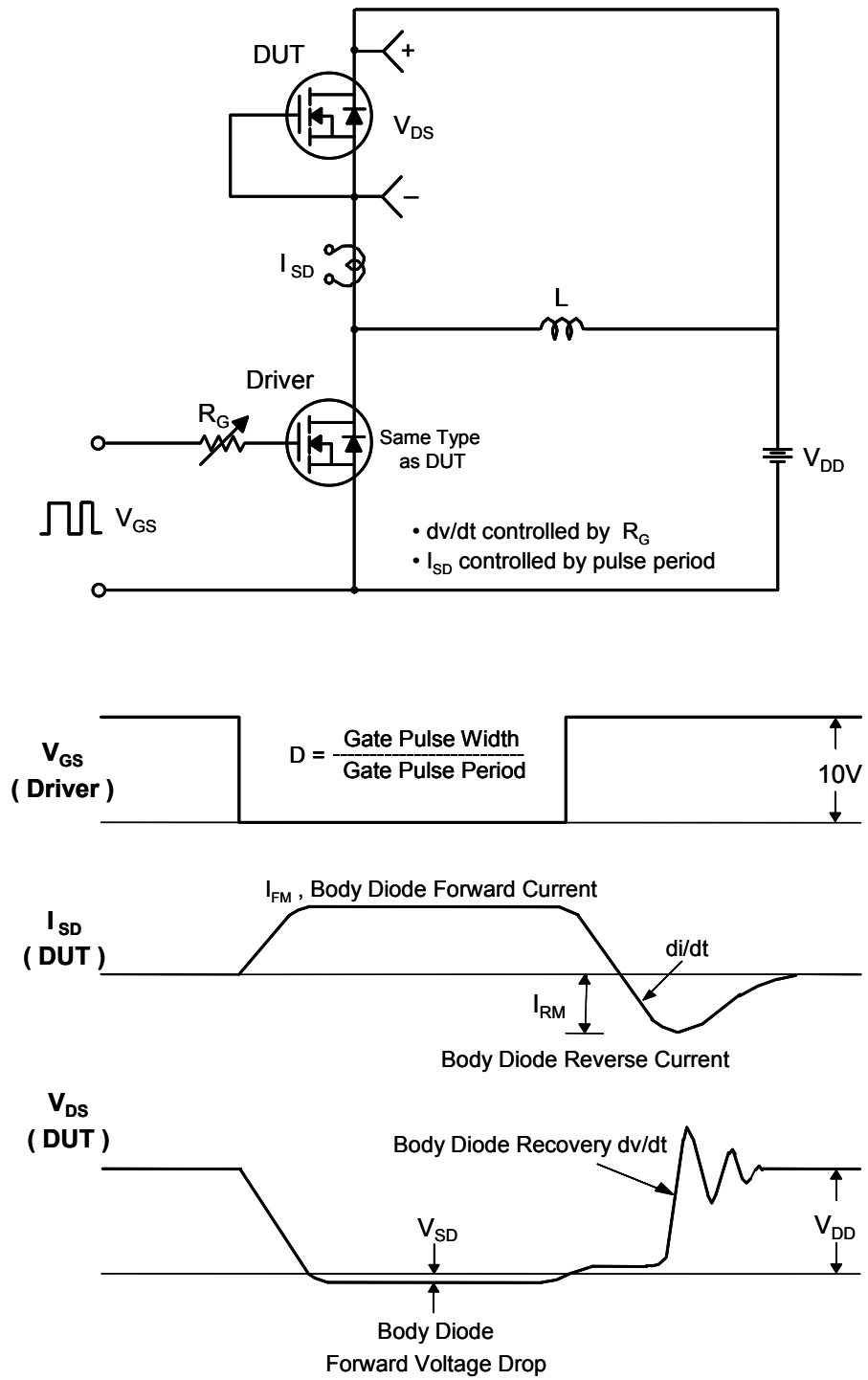


Figure 17. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms



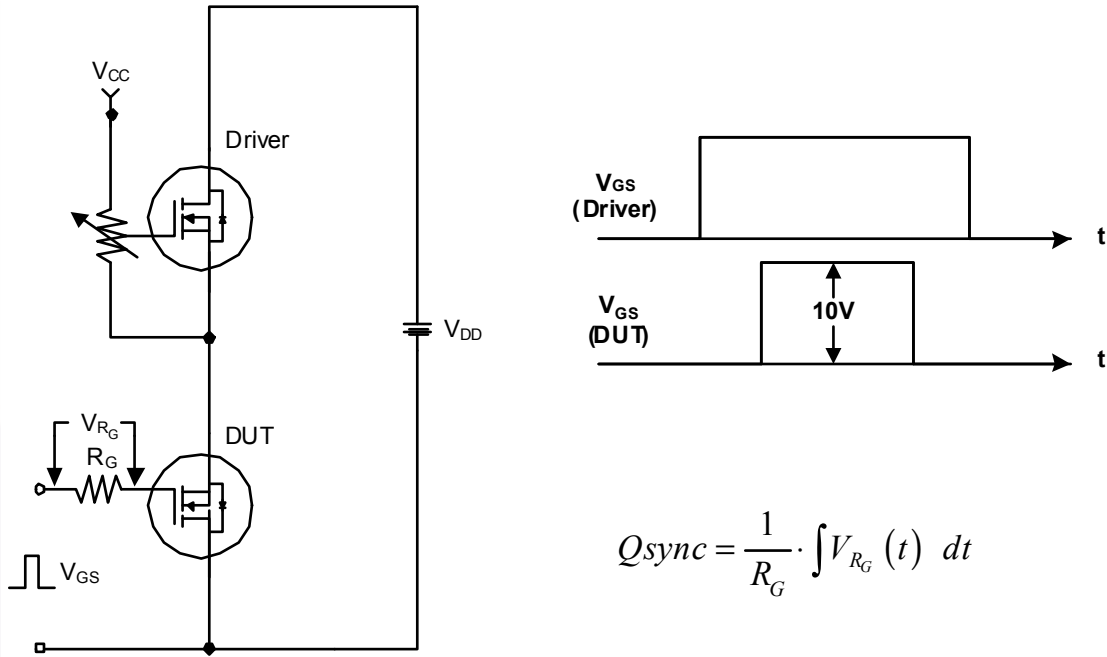
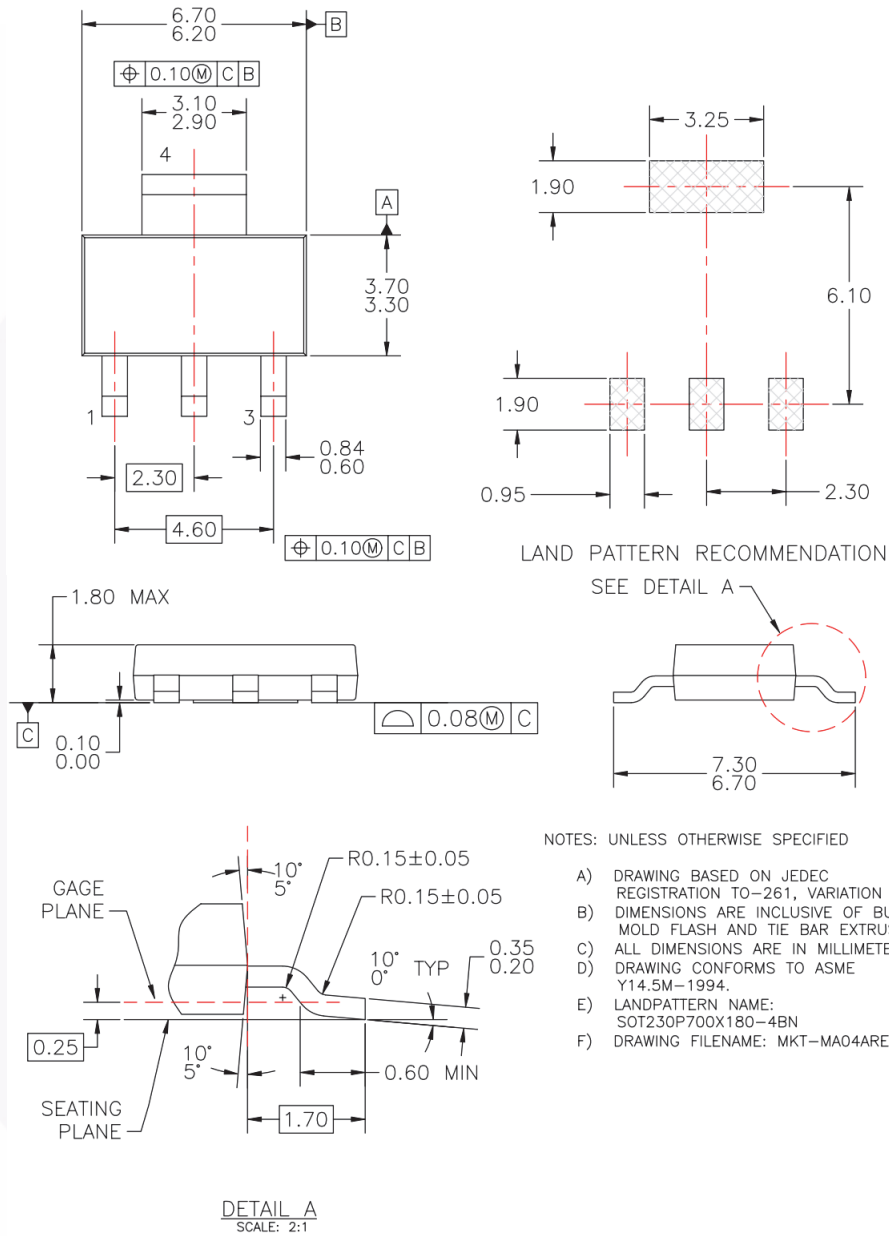


Figure 18. Total Gate Charge  $Q_{sync}$ . Test Circuit & Waveforms

## Mechanical Dimensions



**Figure 19. SOT-223, Molded, 4-Lead**

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