

FEATURES

- ◆ Originative New Design
- ◆ 100% EAS Test
- ◆ Rugged Gate Oxide Technology
- ◆ Extremely Low Intrinsic Capacitances
- ◆ Remarkable Switching Characteristics
- ◆ Unequalled Gate Charge : 10.5 nC (Typ.)
- ◆ Extended Safe Operating Area
- ◆ Lower $R_{DS(ON)}$: 0.7 Ω (Typ.) @ $V_{GS}=10V$

APPLICATION

- ◆ Electronic lamp ballasts based on half bridge topology
- ◆ PFC (Power Factor Correction)
- ◆ SMPS (Switched Mode Power Supplies)

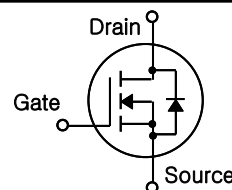
PFU6N40EG/PFD6N40EG

400V N-Channel MOSFET

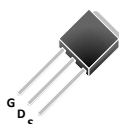
$BV_{DSS} = 400 V$

$R_{DS(ON)} = 0.7 \Omega$

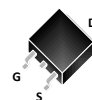
$I_D = 4.8 A$



I-PAK(TO-251)



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Absolute Maximum Ratings

$T_c=25^\circ C$ unless otherwise specified

Symbol	Parameter	Value	Units
V_{DSS}	Drain-Source Voltage	400	V
I_D	Drain Current – Continuous ($T_c = 25^\circ C$)	4.8	A
	Drain Current – Continuous ($T_c = 100^\circ C$)	3.1	A
I_{DM}	Drain Current – Pulsed (Note 1)	19.3	A
V_{GS}	Gate-Source Voltage	± 30	V
EAS	Single Pulsed Avalanche Energy (Note 2)	270	mJ
I_{AR}	Avalanche Current (Note 1)	6.0	A
E _{AR}	Repetitive Avalanche Energy (Note 1)	5.0	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5	V/ns
P_D	Power Dissipation ($T_c = 25^\circ C$)	50	W
	- Derate above $25^\circ C$	0.4	W/ $^\circ C$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ C$
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ C$

Thermal Resistance Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	2.5	$^\circ C/W$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	--	50	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	110	

Electrical Characteristics $T_C=25^{\circ}\text{C}$ unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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On Characteristics

$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2.5	--	4.5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 3.0\text{ A}$	--	0.7	0.95	Ω

Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	400	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C	--	0.4	--	$\text{V}/^{\circ}\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	μA
		$V_{DS} = 320\text{ V}, T_C = 125^{\circ}\text{C}$	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}$, $f = 1.0\text{ MHz}$	--	580	754	pF
C_{oss}	Output Capacitance		--	80	104	pF
C_{rss}	Reverse Transfer Capacitance		--	6	15	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Time	$V_{DS} = 200\text{ V}, I_D = 6.0\text{ A}$, $R_G = 25\text{ }\Omega$ (Note 4,5)	--	13.5	27	ns
t_r	Turn-On Rise Time		--	6.6	13	ns
$t_{d(off)}$	Turn-Off Delay Time		--	27	54	ns
t_f	Turn-Off Fall Time		--	5.5	11	ns
Q_g	Total Gate Charge	$V_{DS} = 320\text{ V}, I_D = 6.0\text{ A}$, $V_{GS} = 10\text{ V}$ (Note 4,5)	--	10.5	15	nC
Q_{gs}	Gate-Source Charge		--	3.5	--	nC
Q_{gd}	Gate-Drain Charge		--	3.9	--	nC

Source-Drain Diode Maximum Ratings and Characteristics

Is	Continuous Source-Drain Diode Forward Current		--	--	6.0	A
ISM	Pulsed Source-Drain Diode Forward Current		--	--	24	
VSD	Source-Drain Diode Forward Voltage	Is = 6.0 A, VGS = 0 V	--	--	1.5	V
trr	Reverse Recovery Time	Is = 6.0 A, VGS = 0 V di/dt = 100 A/μs (Note 4)	--	200	--	nS
Qrr	Reverse Recovery Charge		--	1.1	--	μC

Notes ;

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $I_{AS}=6.0\text{ A}$, $V_{DD}=50\text{ V}$, $R_G=25\text{ }\Omega$, Starting $T_J=25^{\circ}\text{C}$
3. $I_{SD}\leq 6.0\text{ A}$, $di/dt\leq 300\text{ A}/\mu\text{s}$, $V_{DD}\leq BV_{DSS}$, Starting $T_J=25^{\circ}\text{C}$
4. Pulse Test : Pulse Width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2\%$
5. Essentially Independent of Operating Temperature

Typical Characteristics

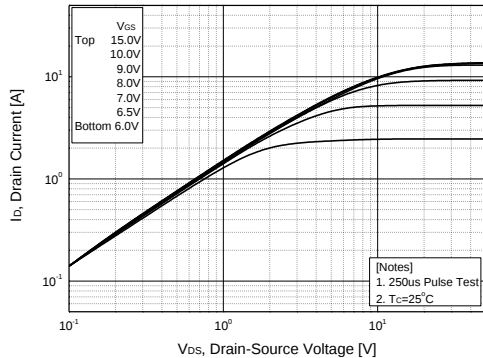


Figure 1. On Region Characteristics

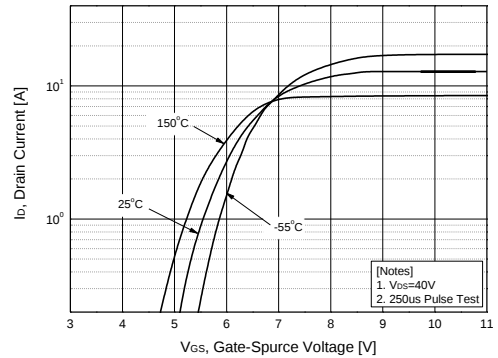


Figure 2. Transfer Characteristics

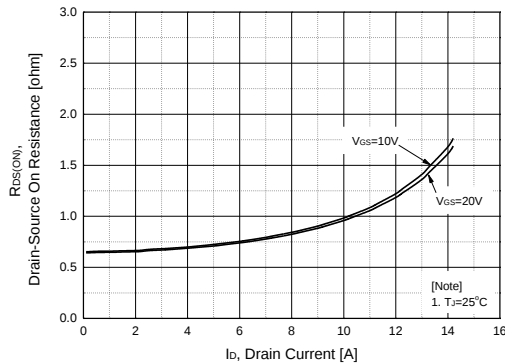


Figure 3. On Resistance Variation vs. Drain Current and Gate Voltage

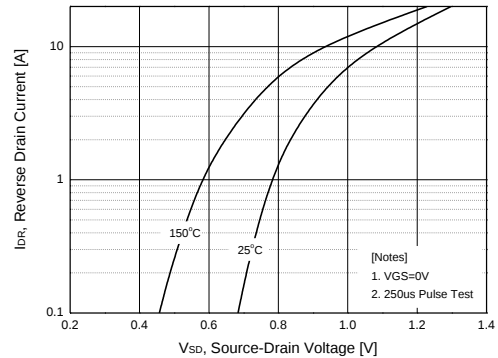


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

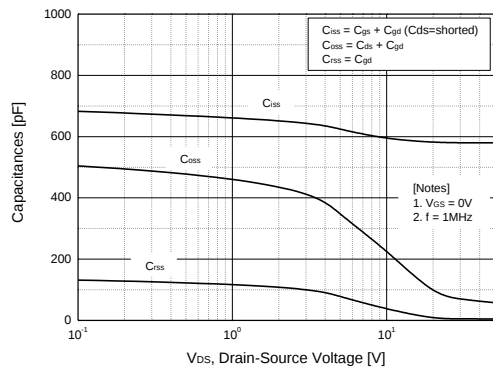


Figure 5. Capacitance Characteristics

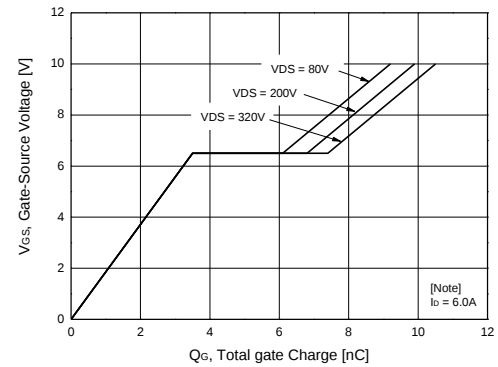


Figure 6. Gate Charge Characteristics

Typical Characteristics (continued)

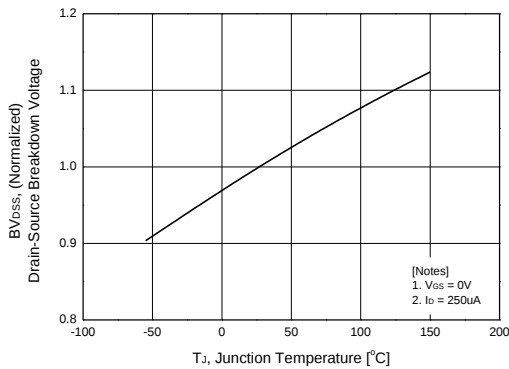


Figure 7. Breakdown Voltage Variation vs Temperature

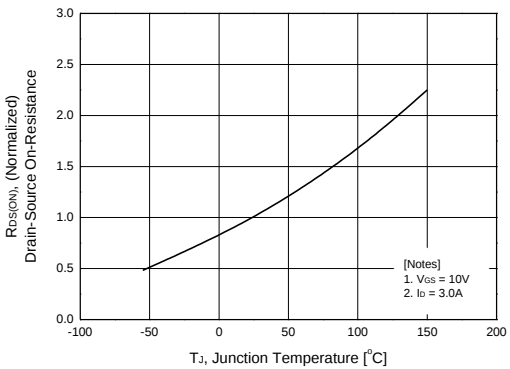


Figure 8. On-Resistance Variation vs Temperature

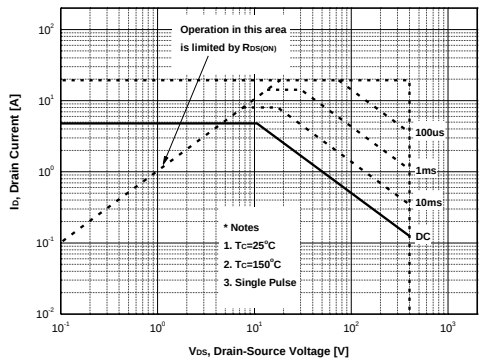


Figure 9. Maximum Safe Operating Area

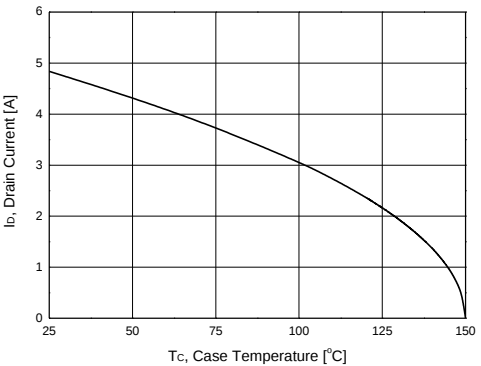


Figure 10. Maximum Drain Current vs. Case Temperature

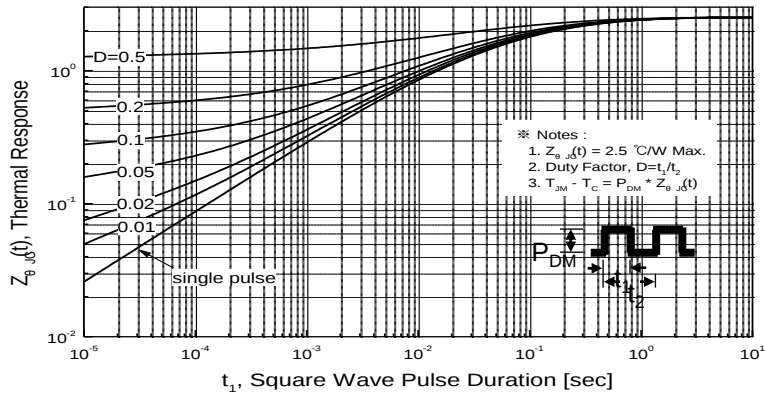


Figure 11. Transient Thermal Response Curve

Characteristics Test Circuit & Waveform

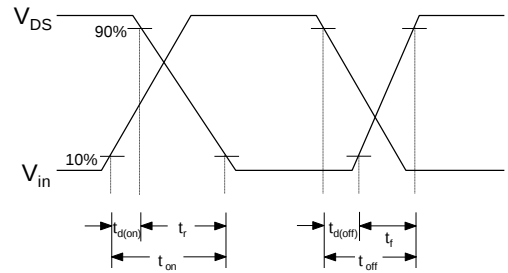
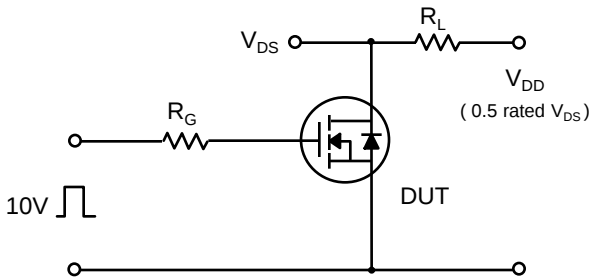


Fig 14. Resistive Switching Test Circuit & Waveforms

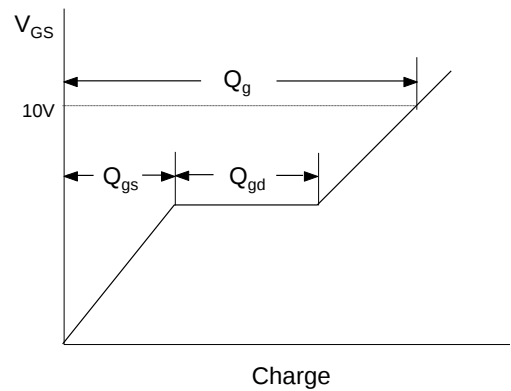
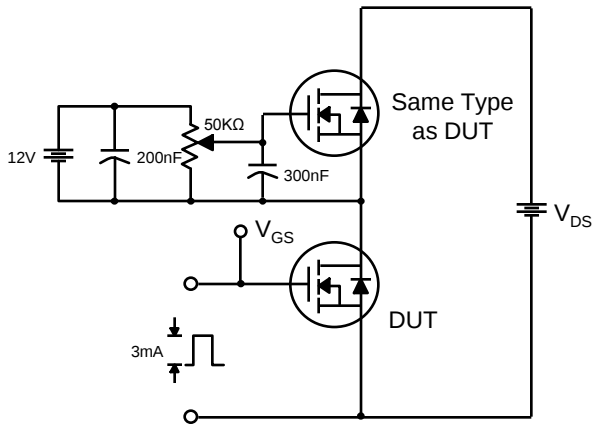


Fig 15. Gate Charge Test Circuit & Waveform

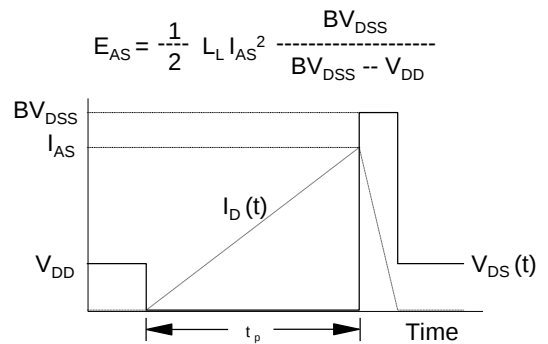
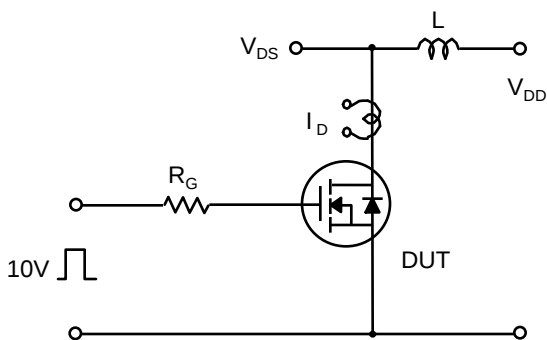


Fig 16. Unclamped Inductive Switching Test Circuit & Waveforms

Characteristics Test Circuit & Waveform (continued)

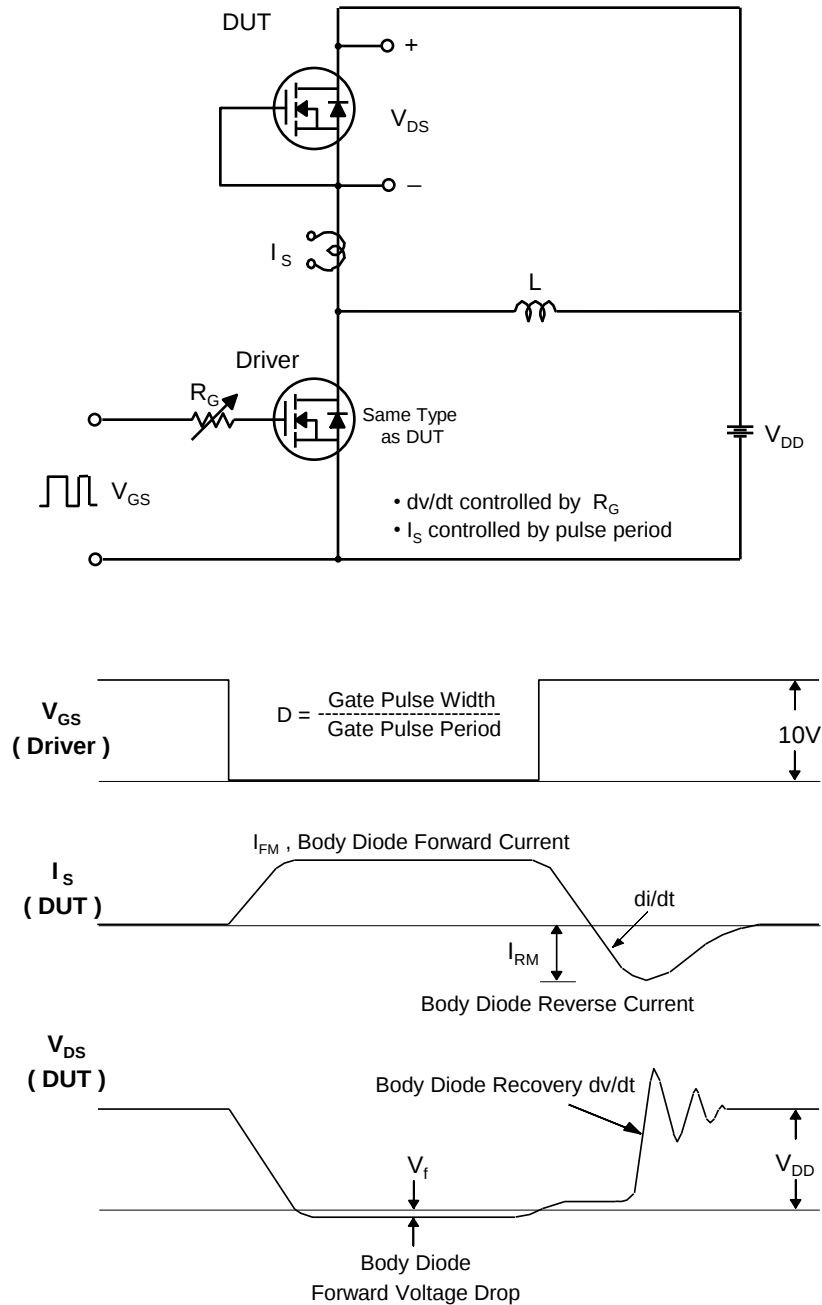
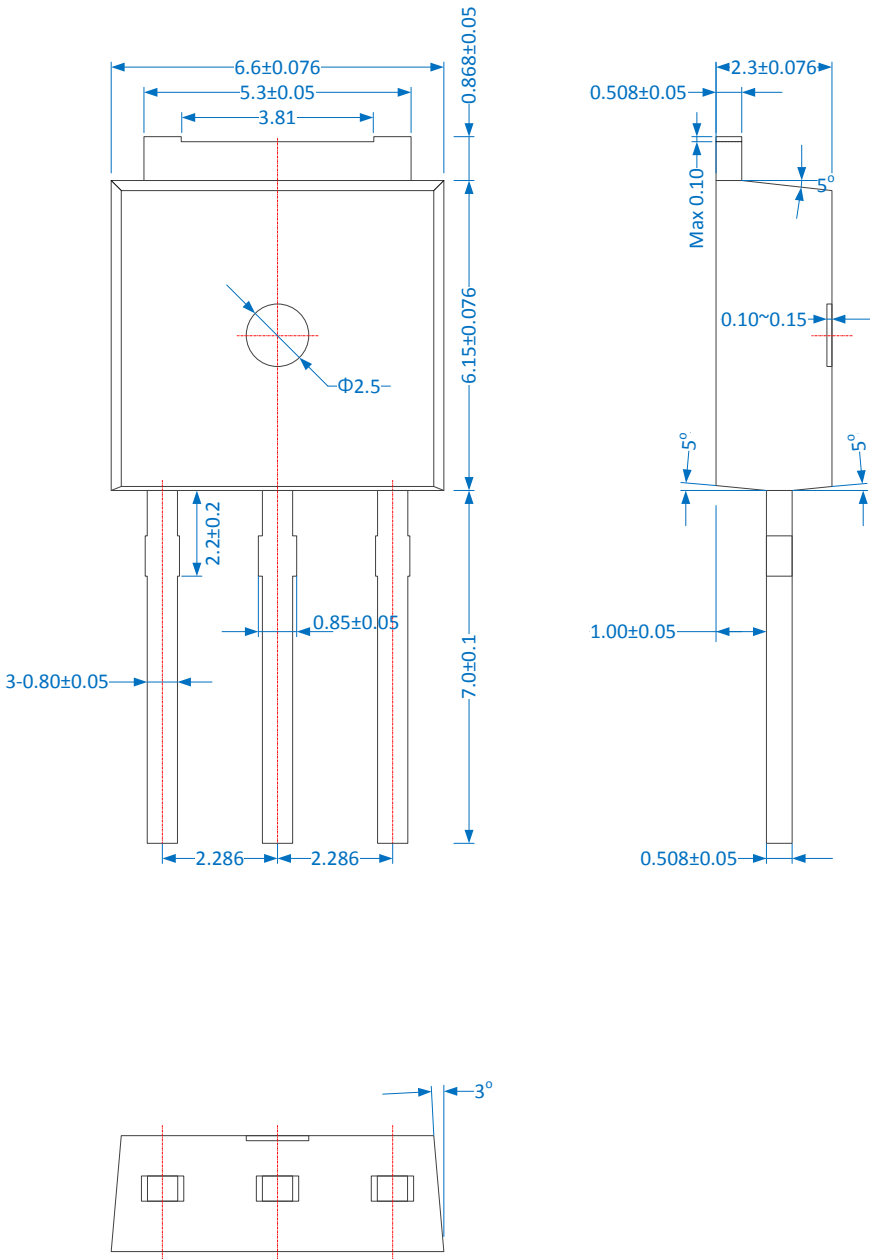


Fig 17. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Package Dimension

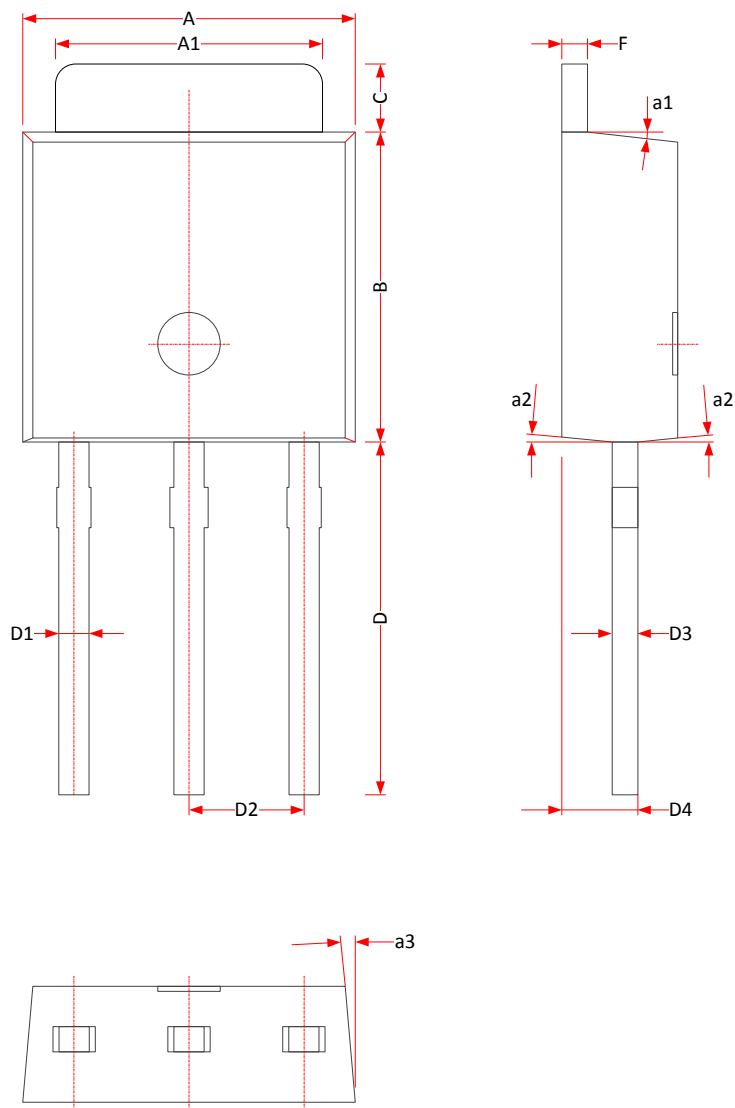
I-PAK(TO-251) ②



Package Dimension

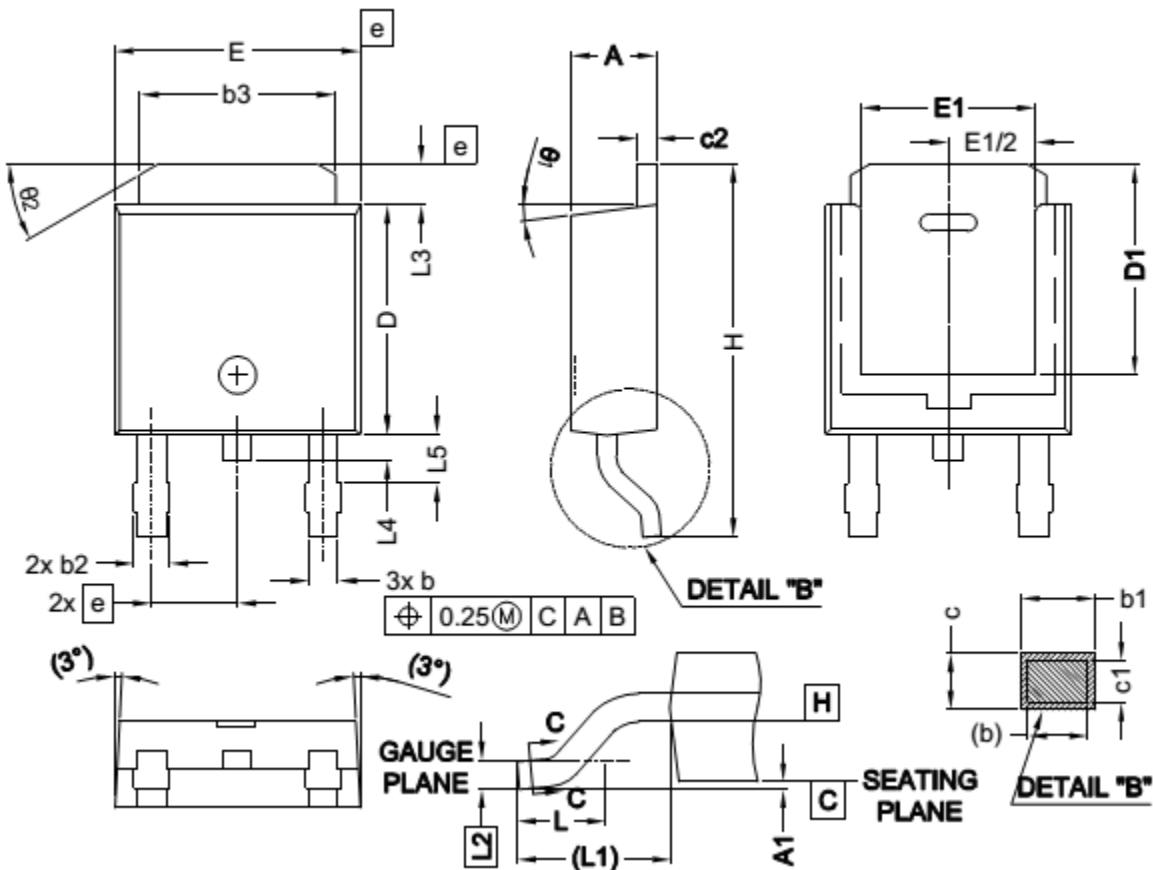
I-PAK(TO-251) ⑧

Symbol	Millimeters
A	6.40 ~ 6.60
A1	5.30 ~ 5.50
B	5.40 ~ 5.70
C	1.35 ~ 1.65
D	7.40 ~ 8.00
D1	0.60 ~ 0.75
D2	2.30
D3	0.49 ~ 0.59
D4	1.72 ~ 1.82
E	2.20 ~ 2.40
F	0.55 ~ 0.65
a1	5 deg
a2	5 deg
a3	2 deg



Package Dimension

D-PAK(TO-252) Ⓐ



SYMBOL	MIN.	MAX.	SYMBOL	MIN.	MAX.	SYMBOL	MIN.	MAX.
A	2.18	2.39	E	6.35	6.73	ϕ_1	0°	15°
A1	-	0.13	E1	4.32	-	ϕ_2	25°	35°
b	0.640	0.884	e	2.29 BSC				
b1	0.65	0.79	H	9.94	10.34			
b2	0.760	1.124	L	1.50	1.78			
b3	4.95	5.46	L1	2.74 REF				
c	0.46	0.61	L2	0.51 BSC				
c1	0.41	0.56	L3	0.89	1.27			
c2	0.40	0.60	L4	-	1.02			
D	5.97	6.22	L5	1.140	1.492			
D1	5.21	-	ϕ	0°	10°			

Package Dimension

D-PAK(TO-252) ②

