

BSS04N013SZ1

N-Channel Power MOSFET

40 V, 247 A, 1.3 mΩ

Description

This N-Channel MOSFET has been designed specifically to improve the overall efficiency. It has been optimized for low gate charge, low $R_{DS(on)}$, fast switching speed.

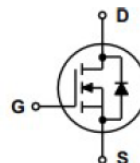
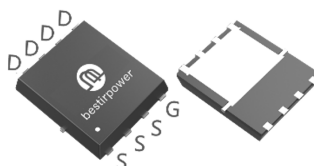
Applications

- High-frequency DC-to-DC convertors
- Motor controllers
- Battery management and protection
- Server power

Features

BV_{DSS}	I_D	$R_{DS(on),max}$	$Q_{rr,typ}$
40 V	247 A	1.3 mΩ	62.8 nC

- Shielded-gate technology
- Low on-resistance and low gate-charge
- RoHS compliant
- 100% avalanche tested



Absolute Maximum Ratings ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		40	V
V_{GSS}	Gate to Source Voltage		± 20	V
I_D	Continuous Drain Current, Silicon Limited ($T_C = 25^\circ\text{C}$) ⁽¹⁾		247	A
	Continuous Drain Current, Silicon Limited ($T_C = 100^\circ\text{C}$) ⁽¹⁾		156	
I_{DM}	Pulsed Drain Current ⁽²⁾		988	A
E_{AS}	Single Pulsed Avalanche Energy ⁽³⁾		336	mJ
I_{AS}	Avalanche Current ⁽³⁾		82	A
P_D	Power Dissipation ⁽⁴⁾	($T_C = 25^\circ\text{C}$)	125	W
		($T_C = 100^\circ\text{C}$)	50	
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to 150	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	1.0	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	50	

Notes:

1. Computed continuous current assumes the condition of T_{J_Max} while the actual continuous current depends on the thermal & electro-mechanical application board design.
2. This single-pulse measurement was taken under T_{J_Max} .
3. This single-pulse measurement was taken under the following condition [$L = 0.1\text{mH}$, $V_{GS} = 10\text{V}$, $V_{DS} = 40\text{V}$] while its value is limited by T_{J_Max} .
4. The power dissipation P_D is based on T_{J_Max} .

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	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	40	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$	-	-	1	μA
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$	-	-	100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	2.2	3.0	3.8	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 20\text{ A}, T_J = 25^\circ\text{C}$	-	1.1	1.3	mΩ
		$V_{GS} = 4.5\text{ V}, I_D = 20\text{ A}, T_J = 25^\circ\text{C}$	-	2.0	2.4	

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{GS} = 0\text{ V}, V_{DS} = 20\text{ V}, f = 1\text{ MHz}$	-	6744	-	pF
C_{oss}	Output Capacitance		-	3601	-	pF
C_{rss}	Reverse transfer capacitance		-	64	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10 V	$V_{GS} = 0\text{ to }10\text{ V}, V_{DS} = 20\text{ V}, I_D = 40\text{ A}$	-	90.4	-	nC
Q_{gs}	Gate to Source Charge		-	24	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	9	-	nC
R_G	Gate Resistance	$V_{GS} = 0\text{ V}, V_{DS} = 0\text{ V}, f = 1\text{ MHz}$	-	1.12	-	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{GS} = 10\text{ V}, V_{DS} = 20\text{ V}, I_D = 40\text{ A}, R_{GEN} = 3\text{ }\Omega$	-	14.1	-	ns
t_r	Turn-On Rise Time		-	19.8	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	54.4	-	ns
t_f	Turn-Off Fall Time		-	19.8	-	ns

Source-Drain Diode Characteristics

V_{SD}	Diode Forward Voltage	$I_S = 20\text{ A}, V_{GS} = 0\text{ V}$	-	0.8	1.0	V
t_{rr}	Reverse Recovery Time	$I_F = 20\text{ A}, dI_F/dt = 100\text{ A}/\mu\text{s}$	-	42.2	-	ns
Q_{rr}	Reverse Recovery Charge		-	62.8	-	nC

Typical Performance Characteristics

Fig. 1 Saturation Characteristics

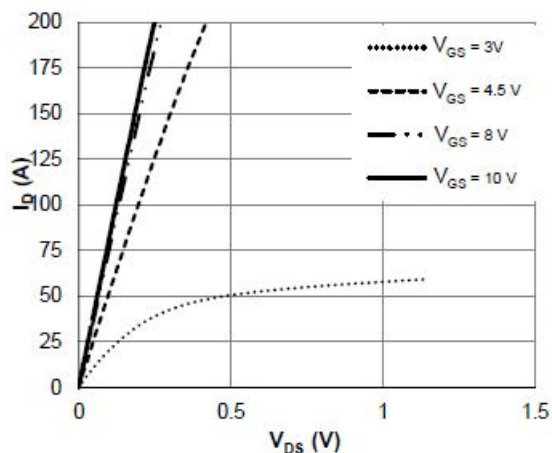


Fig. 2 Transfer characteristics

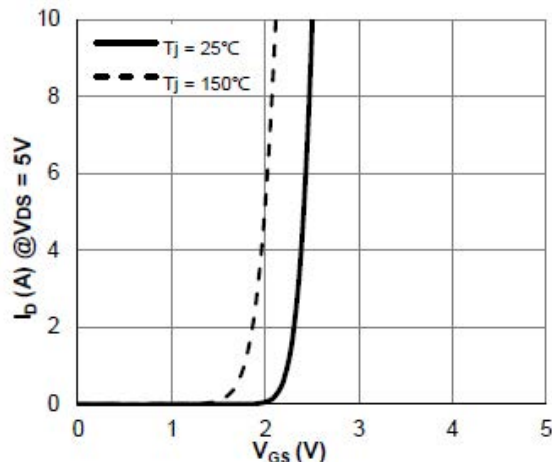


Figure 3: R_DS(ON) vs. Drain Current

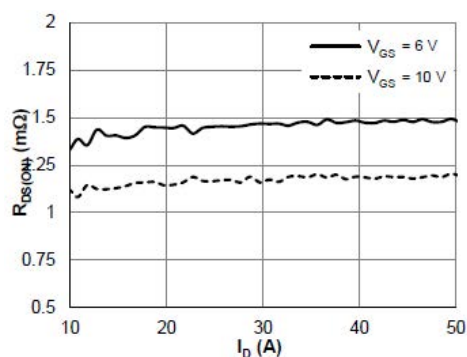


Figure 4: R_DS(ON) vs. Junction Temperature

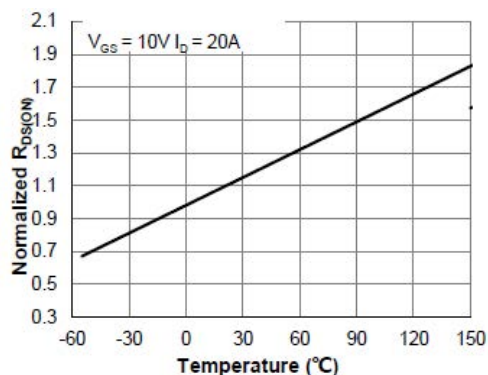


Figure 5: Body-Diode Characteristics

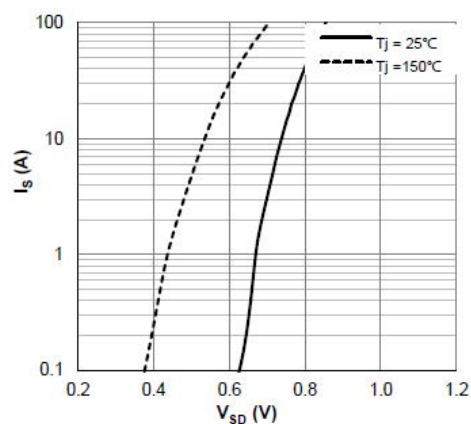
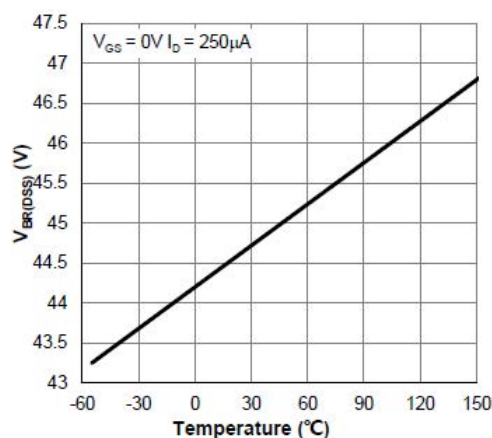


Figure 6: V_BR(DSS) vs. Junction Temperature



Typical Performance Characteristics

Figure 7: Capacitance Characteristics

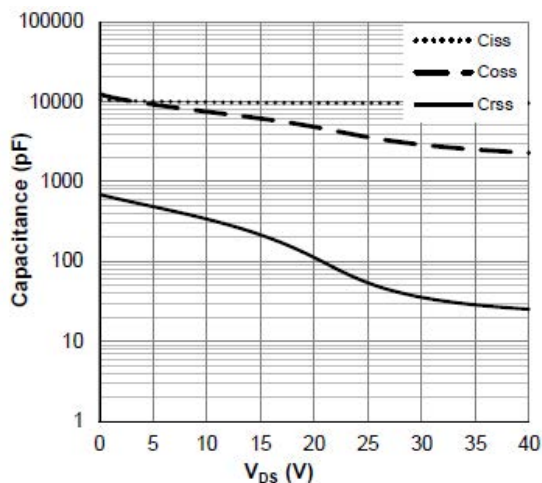


Figure 8: Coss Stored Energy

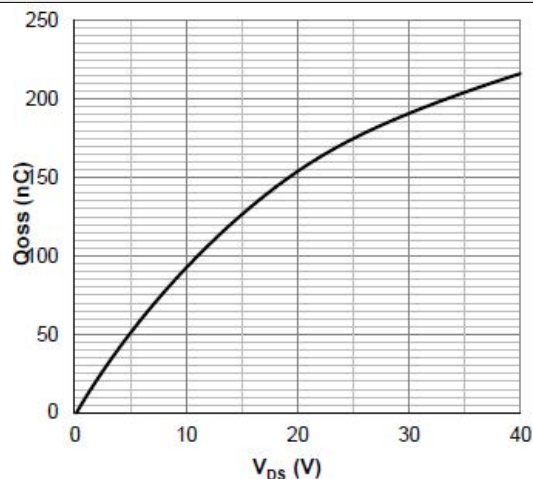


Figure 9: Current De-rating

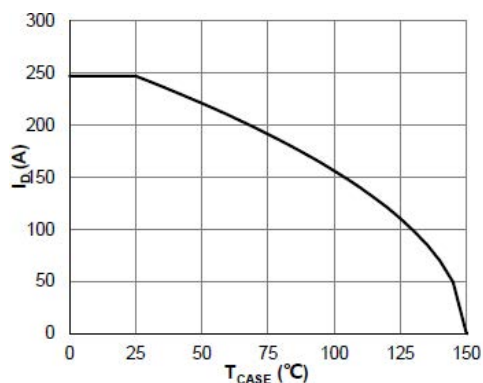


Figure 10: Power De-rating

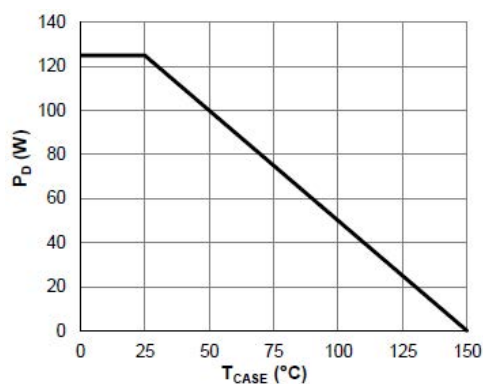


Figure 11: Single Pulse Power Rating, Junction-to-Case

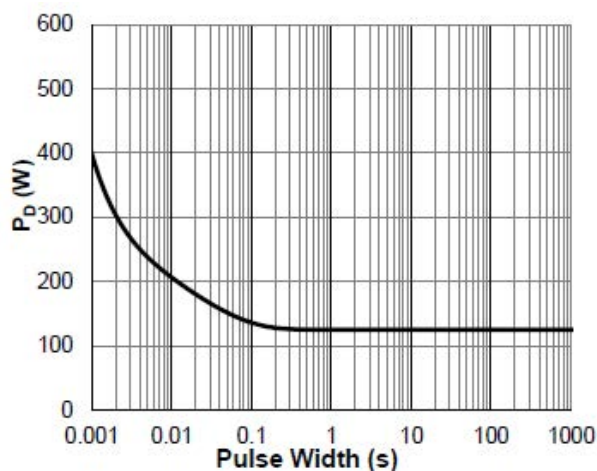
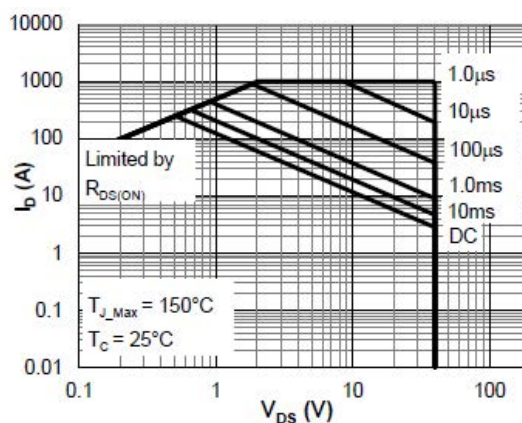


Figure 12: Maximum Safe Operating Area



Typical Electrical & Thermal Characteristics

Figure 13: RDS(ON) VS. VGS

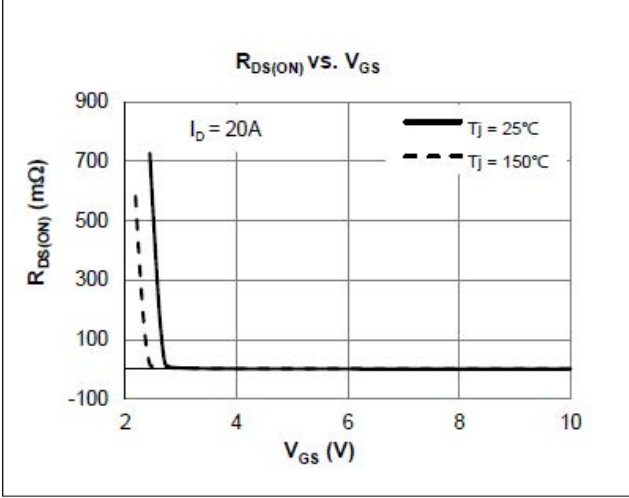


Figure 14: Gate Charge Curve

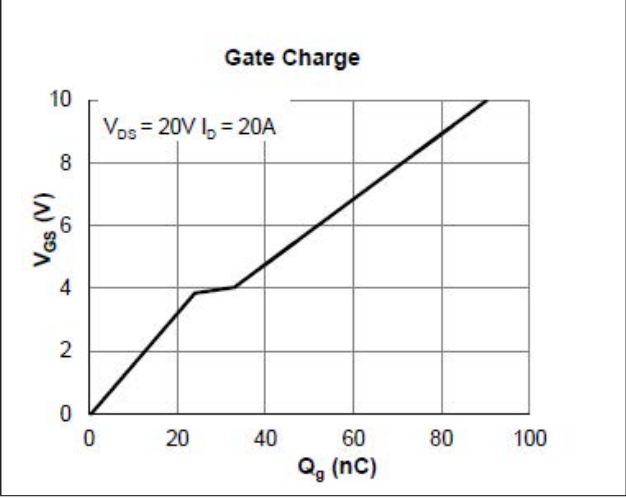
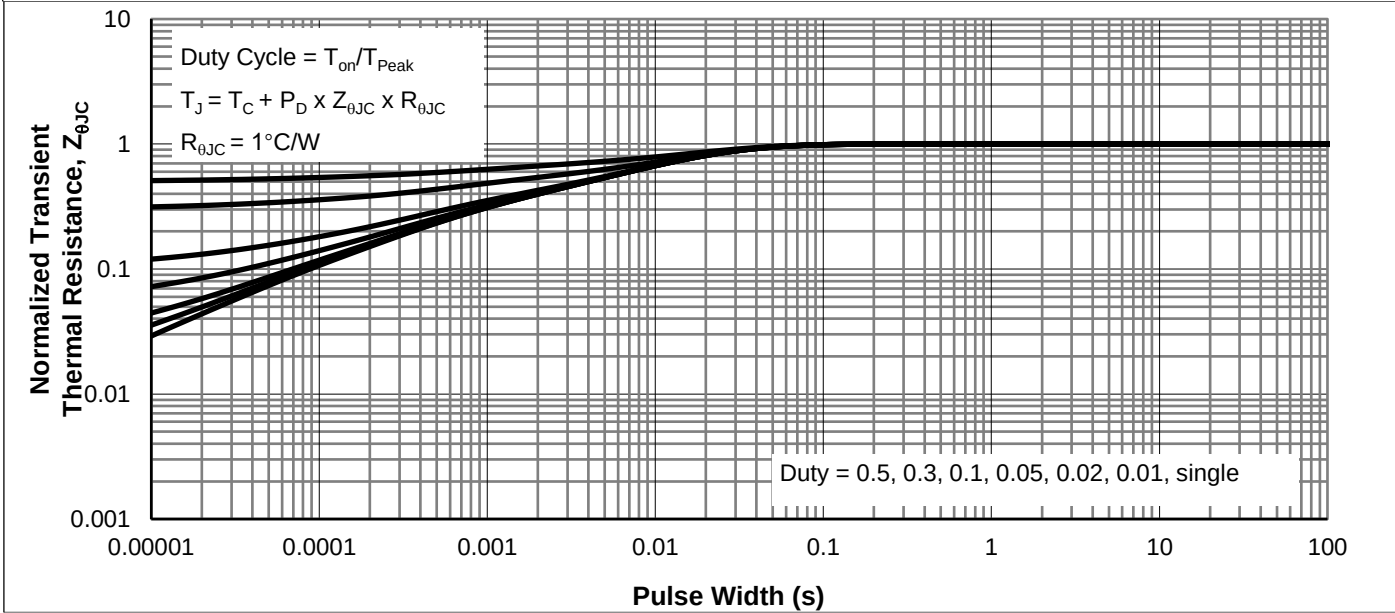


Figure 15: Normalized Maximum Transient Thermal Impedance



Test Circuits

Fig.16:Gate Charge Test Circuit & Wave Form

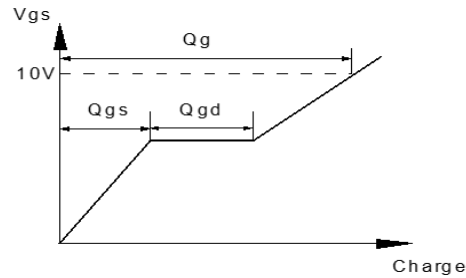
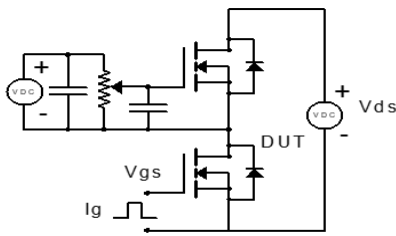


Fig.17:Resistive Switching Test Circuit & Wave Form

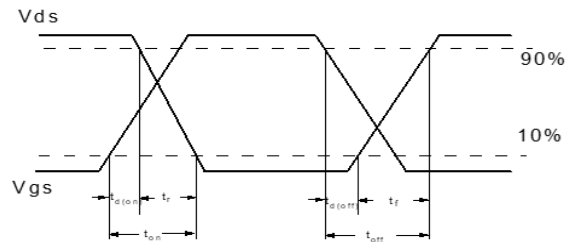
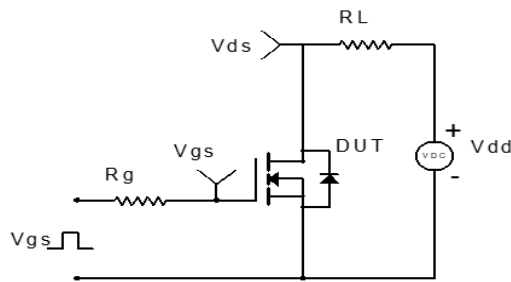
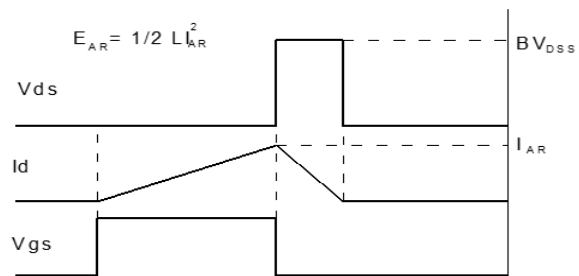
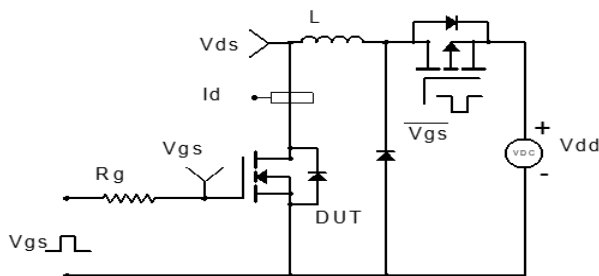
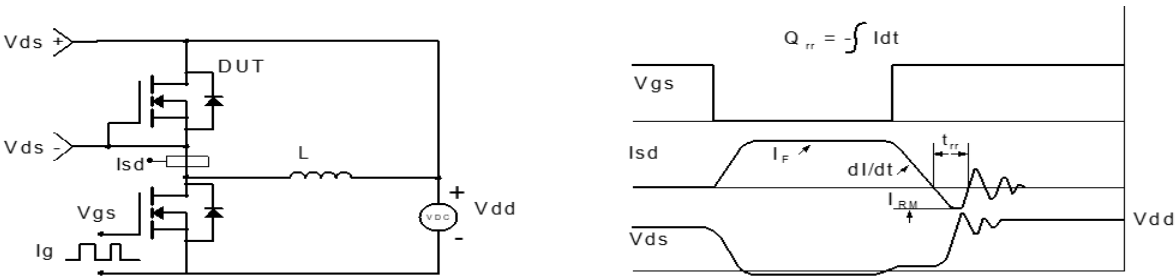


Fig.18:Unclamped Inductive Switching(UIS)



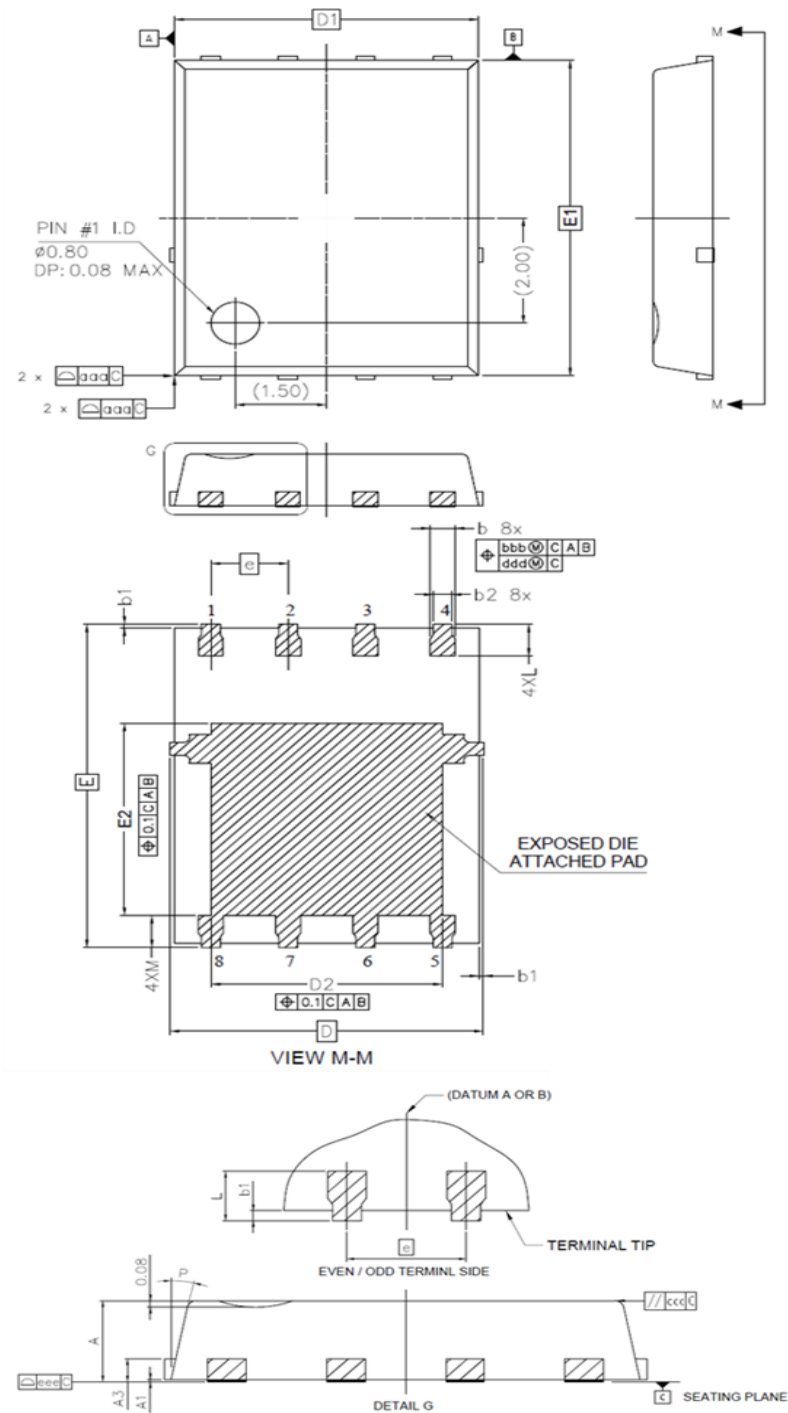
Test Circuits

Fig.19:Diode Recovery Test Curcuit & Wave Form



Package Outlines

DFN5*6



DIM	MILLIMETERS	
	MIN	MAX
A	0.95	1.05
A1	0.00	0.05
A3	0.25 REF	
b	0.31	0.51
b1	0.03	0.13
b2	0.21	0.41
D	5.15 BSC	
D1	5.00 BSC	
D2	3.70	3.90
E	6.15 BSC	
E1	6.00 BSC	
E2	3.56	3.76
e	1.27 BSC	
L	0.51	0.71
M	0.51	0.71
P	10°	12°
aaa	0.10	
bbb	0.10	
ccc	0.10	
ddd	0.05	
eee	0.08	

* Dimensions in millimeters

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
BSS04N013SZ1	BSS04N013SZ1	DFN5*6	Tape & Reel	5000 units

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