

- ★ Green Device Available
- ★ Super Low Gate Charge
- ★ Excellent CdV/dt effect decline
- ★ Advanced high cell density Trench technology
- ★ 100% EAS Guaranteed

Product Summary

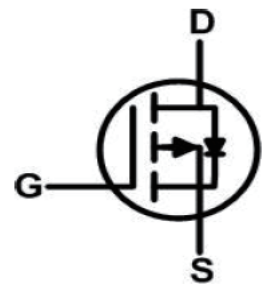
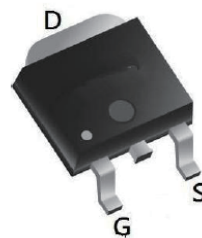


BVDSS	RDS(on)	ID
-40V	8.3mΩ	-52A

Description

The 50P04 is the high cell density trenched P-ch MOSFETs, which provides excellent RDS(on) and gate charge for most of the the synchronous buck converter applications. The 50P04 meets the RoHS and Green Product requirement 100% EAS Guaranteed with full function reliability approved.

TO252 Pin Configuration



Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
V _{DS}	Drain-Source Voltage	-40	V
V _{GS}	Gate-Source Voltage	±20	V
I _D @T _C =25°C	Continuous Drain Current, -V _{GS} @ -10V ¹	-52	A
I _D @T _C =100°C	Continuous Drain Current, -V _{GS} @ -10V ¹	-35	A
I _{DM}	Pulsed Drain Current ²	-160	A
EAS	Single Pulse Avalanche Energy ³	144	mJ
I _{AS}	Avalanche Current	-30	A
P _D @T _C =25°C	Total Power Dissipation ⁴	45	W
T _{STG}	Storage Temperature Range	-55 to 150	°C
T _J	Operating Junction Temperature Range	-55 to 150	°C

Thermal Data

Symbol	Parameter	Typ.	Max.	Units
R _{θJA}	Thermal Resistance Junction-Ambient ¹	---	62	°C/W
R _{θJC}	Thermal Resistance Junction-Case ¹	---	3.6	°C/W

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

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Units
Off Characteristic						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D = -250\mu A$	-40	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -40V, V_{GS}=0V$	-	-	-1	μA
I_{GSS}	Gate to Body Leakage Current	$V_{DS}=0V, V_{GS} = \pm 20V$	-	-	± 100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D = -250\mu A$	-1	-1.7	-2.5	V
$R_{DS(on)}$	Static Drain-Source on-Resistance <small>note3</small>	$V_{GS} = -10V, I_D = -20A$	-	8.3	13	m Ω
		$V_{GS} = -4.5V, I_D = -10A$	-	15	22	
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = -20V, V_{GS}=0V,$ $f=1.0MHz$	-	3800	-	pF
C_{oss}	Output Capacitance		-	329	-	pF
C_{rss}	Reverse Transfer Capacitance		-	289	-	pF
Q_g	Total Gate Charge	$V_{DS} = -20V, I_D = -20A,$ $V_{GS} = -10V$	-	68	-	nC
Q_{gs}	Gate-Source Charge		-	10	-	nC
Q_{gd}	Gate-Drain("Miller") Charge		-	14	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = -20V, I_D = -20A,$ $V_{GS} = -10V, R_{GEN}=2.4\Omega$	-	10	-	ns
t_r	Turn-on Rise Time		-	82	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	93	-	ns
t_f	Turn-off Fall Time		-	74	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	-40	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	-160	A
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS}=0V, I_S = -30A$	-	-0.8	-1.2	V
t_{rr}	Reverse Recovery Time	$V_{GS}=0V, I_S = -30A,$	-	20	-	ns
Q_{rr}	Reverse Recovery Charge	$di/dt=100A/\mu s$	-	13	-	nC

Notes:

1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
2. EAS condition: $T_J = 25^\circ\text{C}$, $V_{DD} = -20V$, $V_G = -10V$, $L = 0.5mH$, $R_G = 25\Omega$, $I_{AS} = -24A$
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$

Typical Electrical and Thermal Characteristics (Curves)

Figure 1: Output Characteristics

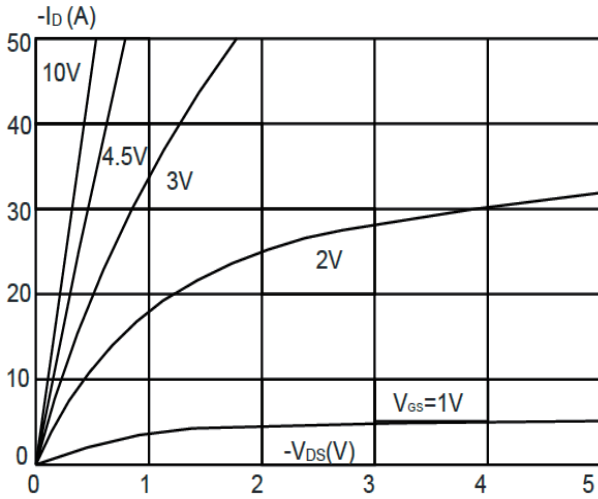


Figure 2: Transfer Characteristics

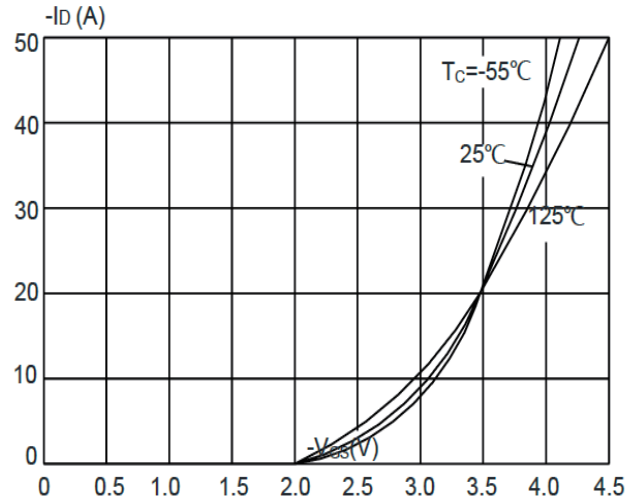


Figure 3: On-resistance vs. Drain Current

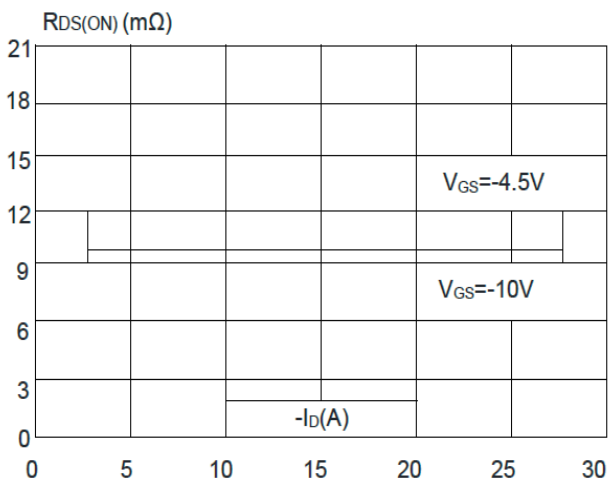


Figure 4: Body Diode Characteristics

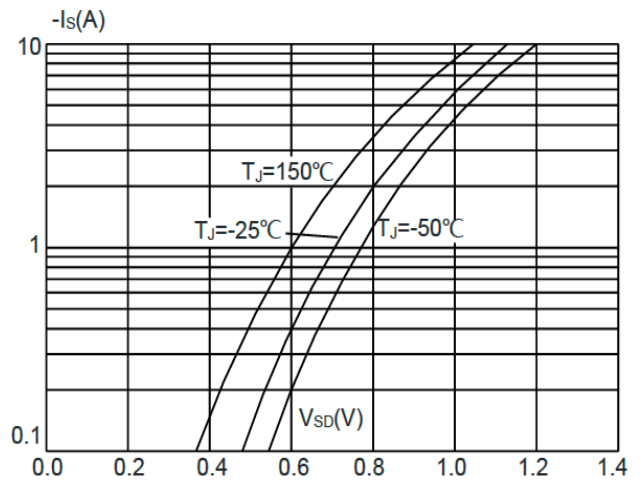


Figure 5: Gate Charge Characteristics

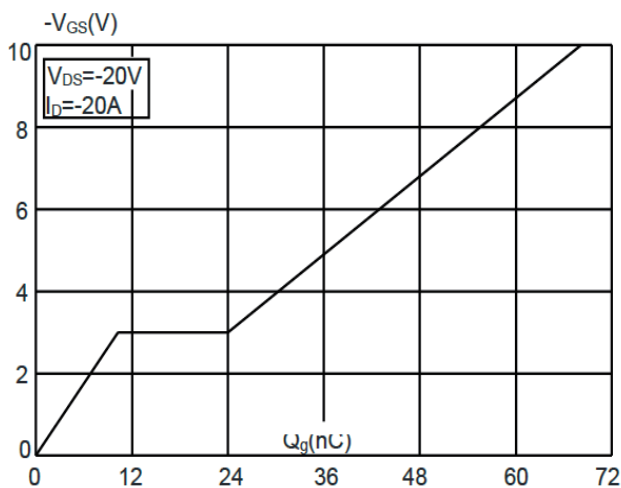
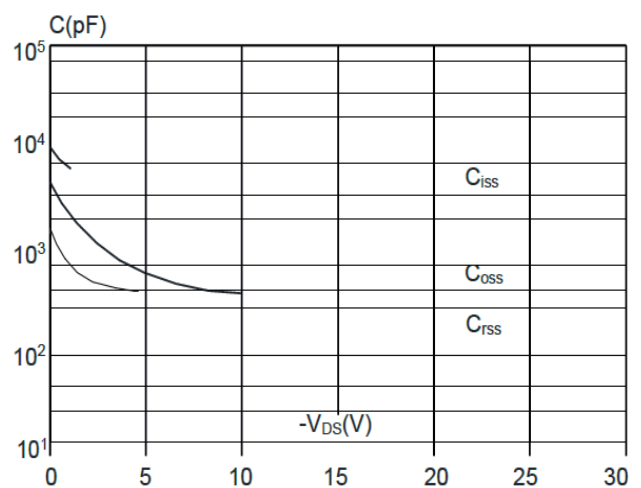


Figure 6: Capacitance Characteristics



Typical Performance Characteristics

Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

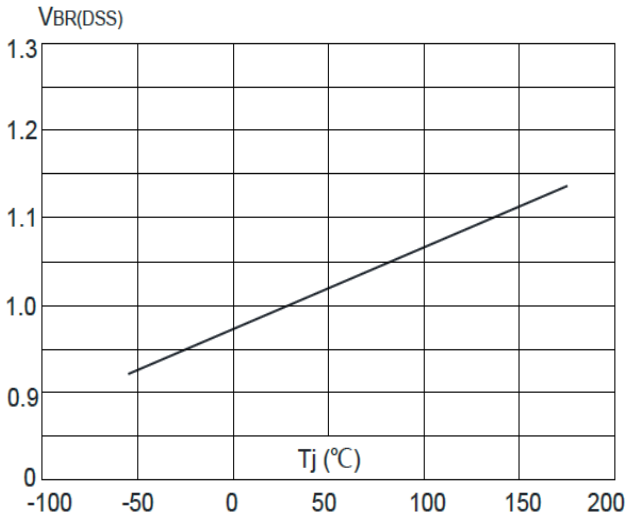


Figure 8: Normalized on Resistance vs. Junction Temperature

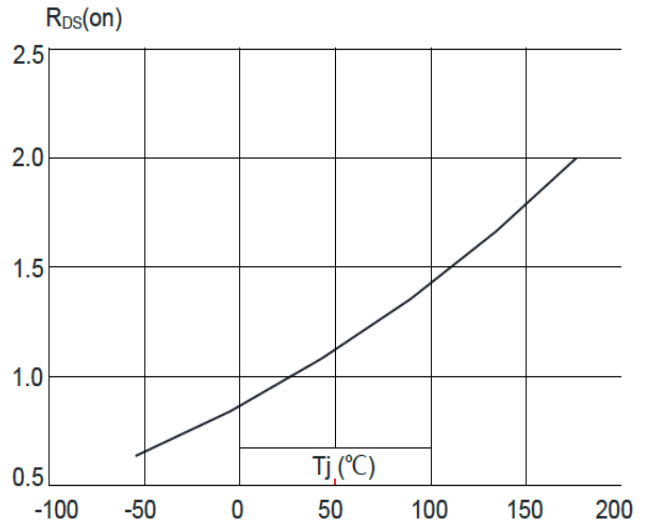


Figure 9: Maximum Safe Operating Area

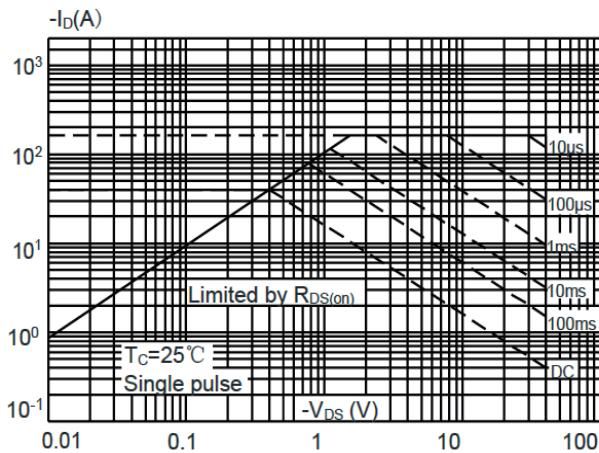


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

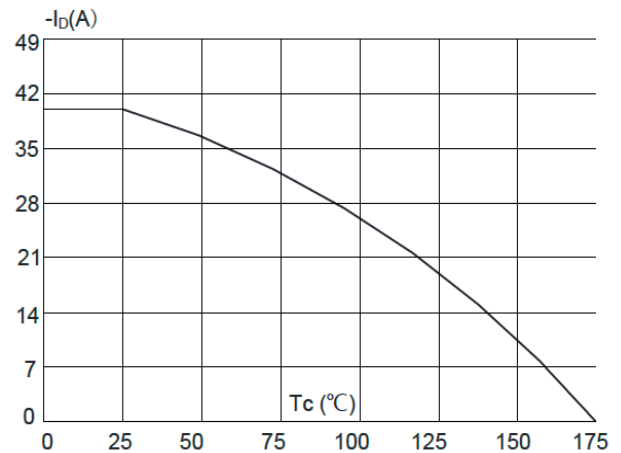
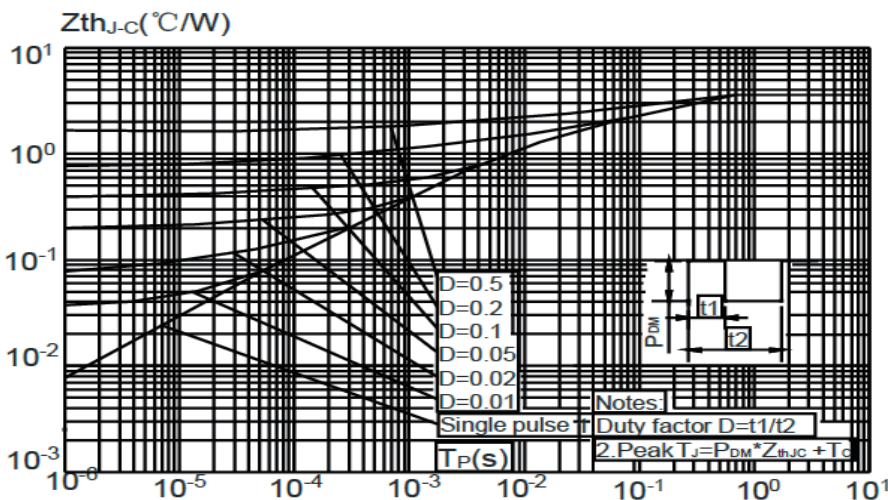
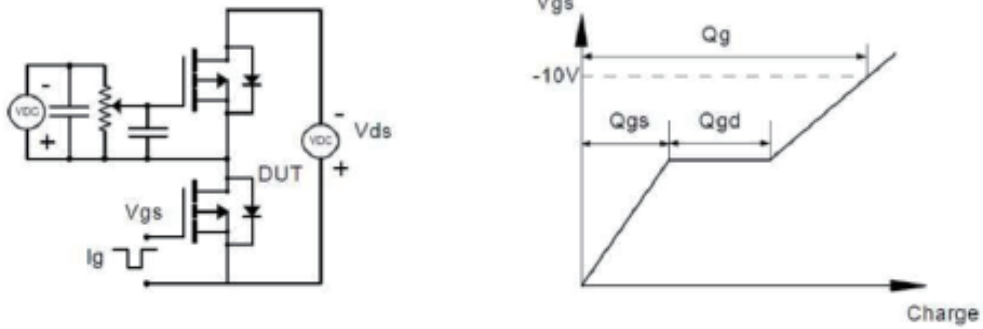


Figure 11: Maximum Effective Transient Thermal Impedance Junction to Case

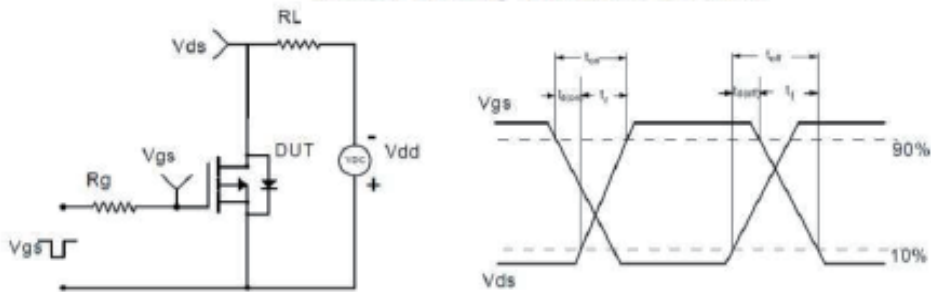


Test Circuit

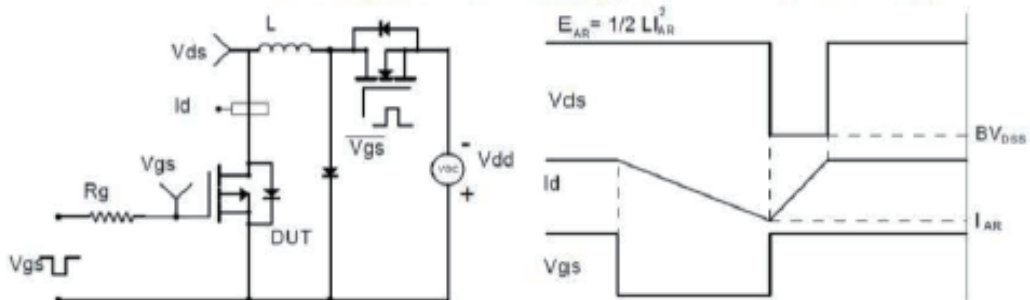
Gate Charge Test Circuit & Waveform



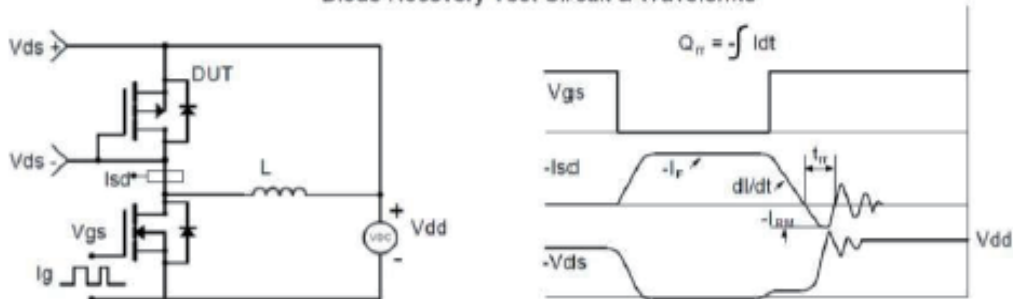
Resistive Switching Test Circuit & Waveforms



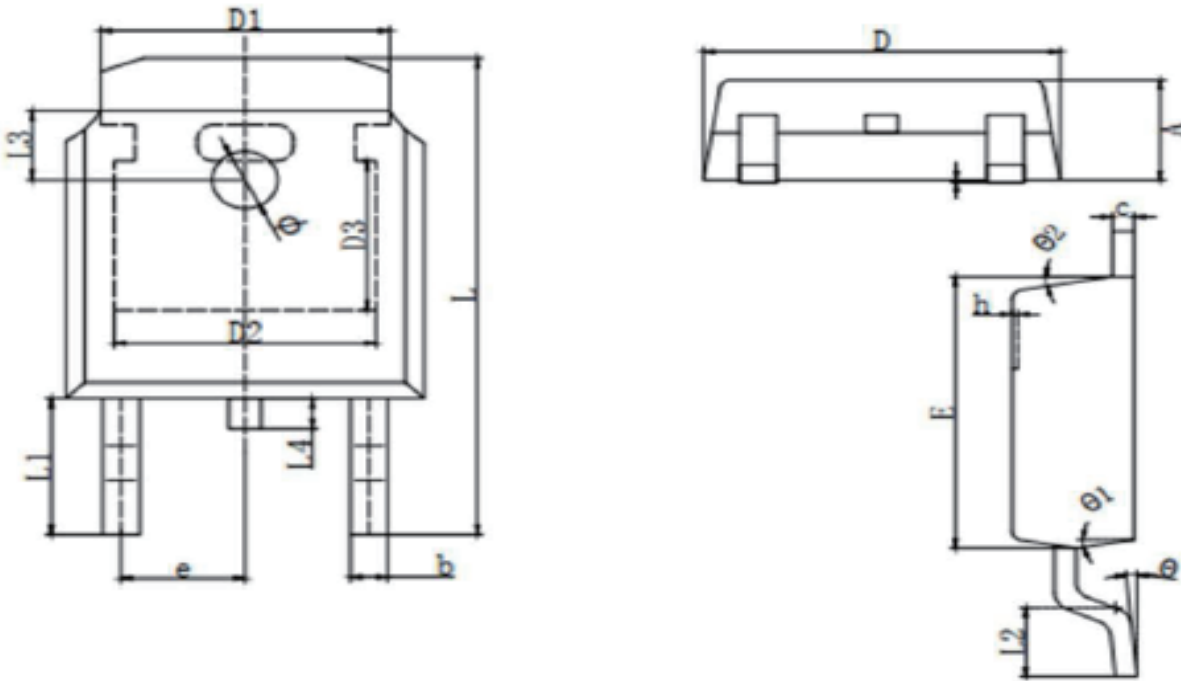
Unclamped inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



TO-252 Package outline



SYMBOL	MILLIMETER		SYMBOL	MILLIMETER	
	MIN	MAX		MIN	MAX
A	2.200	2.400	h	0.000	0.200
A1	0.000	0.127	L	9.900	10.30
b	0.640	0.740	L1	2.888 REF	
c	0.460	0.580	L2	1.400	1.700
D	6.500	6.700	L3	1.600 REF	
D1	5.334 REF		L4	0.600	1.000
D2	4.926 REF		ϕ	1.100	1.300
D3	3.166 REF		θ	0°	8°
E	6.000	6.200	$\theta 1$	9° TYP2	
e	2.286 TYP		$\theta 2$	9° TYP	

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