

## Description

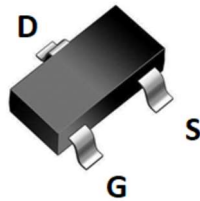
### P-channel Enhancement Mode Power MOSFET

#### Features

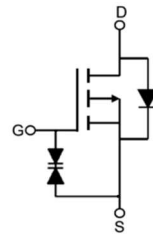
- $V_{DS} = -20V$ ,  $I_D = -5A$   
 $R_{DS(ON)} < 48m\Omega$  @  $V_{GS} = -4.5V$   
 $R_{DS(ON)} < 65m\Omega$  @  $V_{GS} = -2.5V$
- Advanced Trench Technology
- Excellent  $R_{DS(ON)}$  and Low Gate Charge
- Lead free product is acquired
- ESD Rating: HBM 2.0KV

#### Application

- PWM Applications
- Load Switch
- Power Management



SOT-23 top view



Schematic Diagram

### Absolute Maximum Ratings ( $T_A=25^\circ C$ unless otherwise specified)

Symbol	Parameter	Max.	Units
$V_{DSS}$	Drain-Source Voltage	-20	V
$V_{GSS}$	Gate-Source Voltage	$\pm 8$	V
$I_D$	Continuous Drain Current	$T_A = 25^\circ C$	-5
		$T_A = 70^\circ C$	-4
$I_{DM}$	Pulsed Drain Current <sup>note1</sup>	-30	A
$P_D$	Power Dissipation	$T_A = 25^\circ C$	1.5
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	104	$^\circ C/W$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ C$

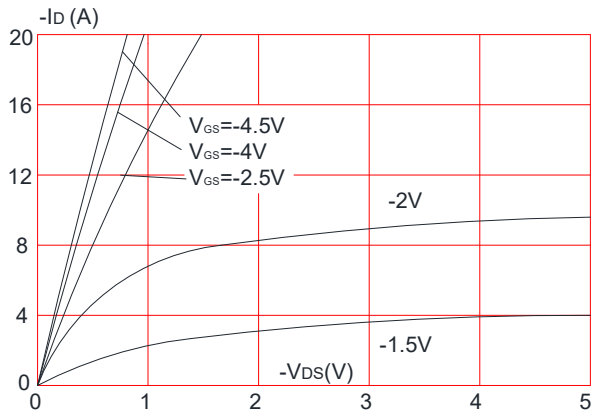
**Electrical Characteristics** ( $T_J=25^{\circ}\text{C}$  unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
<b>Off Characteristic</b>						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D = -250\mu A$	-20	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -20V, V_{GS} = 0V,$	-	-	-1	$\mu A$
$I_{GSS}$	Gate to Body Leakage Current	$V_{DS} = 0V, V_{GS} = \pm 8V$	-	-	$\pm 10$	$\mu A$
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\mu A$	-0.4	-0.7	-1.0	V
$R_{DS(on)}$	Static Drain-Source on-Resistance <small>note2</small>	$V_{GS} = -4.5V, I_D = -4A$	-	38	48	m $\Omega$
		$V_{GS} = -2.5V, I_D = -4A$	-	48	65	
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = -10V, V_{GS} = 0V,$ $f = 1.0MHz$	-	950	-	pF
$C_{oss}$	Output Capacitance		-	165	-	pF
$C_{riss}$	Reverse Transfer Capacitance		-	120	-	pF
$Q_g$	Total Gate Charge	$V_{DS} = -10V, I_D = -4A,$ $V_{GS} = -4.5V$	-	12	-	nC
$Q_{gs}$	Gate-Source Charge		-	1.4	-	nC
$Q_{gd}$	Gate-Drain("Miller") Charge		-	3.6	-	nC
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = -10V, I_D = -2A,$ $R_G = 3\Omega, V_{GEN} = -4.5V,$ $R_L = 2.5\Omega$	-	12	-	ns
$t_r$	Turn-on Rise Time		-	10	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	19	-	ns
$t_f$	Turn-off Fall Time		-	25	-	ns
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain to Source Diode Forward Current		-	-	-4	A
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current		-	-	-16	A
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0V, I_S = -4A$	-	-	-1.2	V

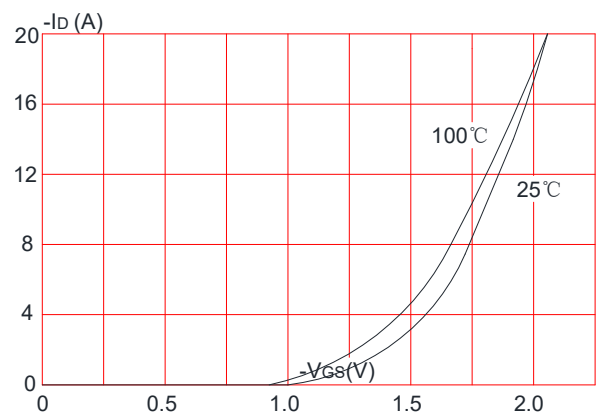
Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. Pulse Test: Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 2\%$

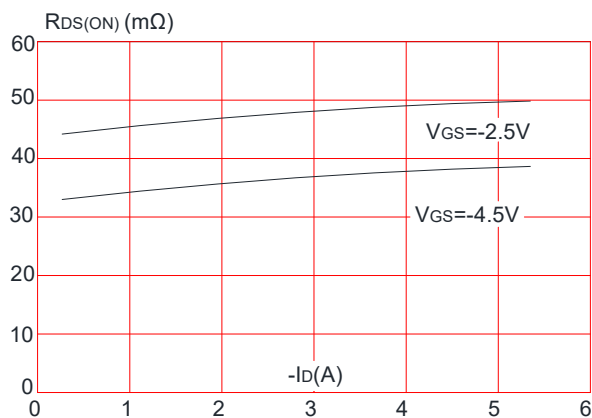
**Figure 1: Output Characteristics**



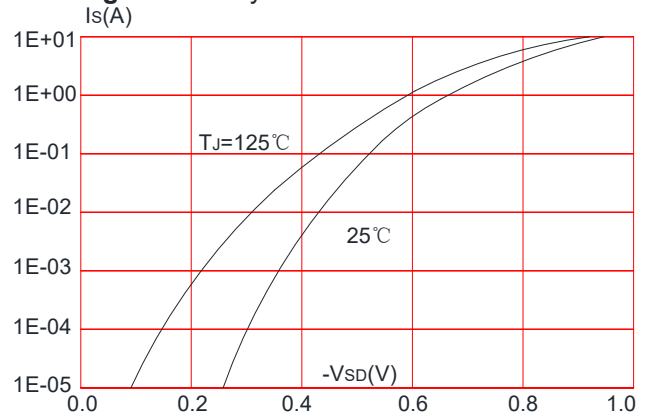
**Figure 2: Typical Transfer Characteristics**



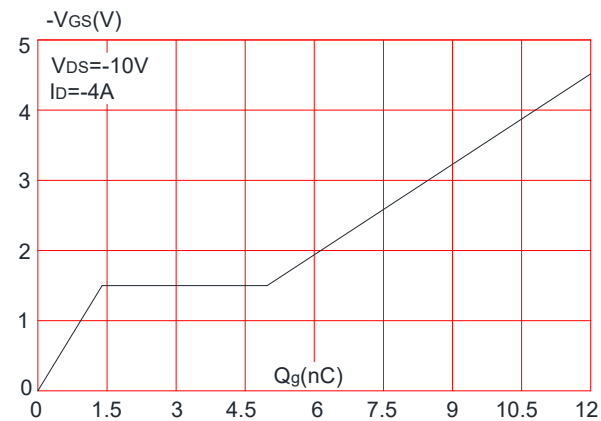
**Figure 3: On-resistance vs. Drain Current**



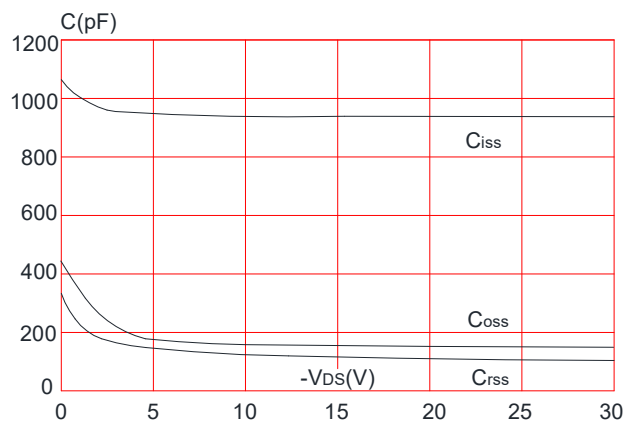
**Figure 4: Body Diode Characteristics**



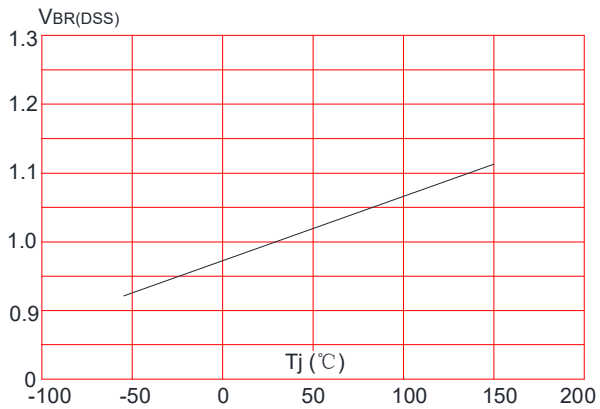
**Figure 5: Gate Charge Characteristics**



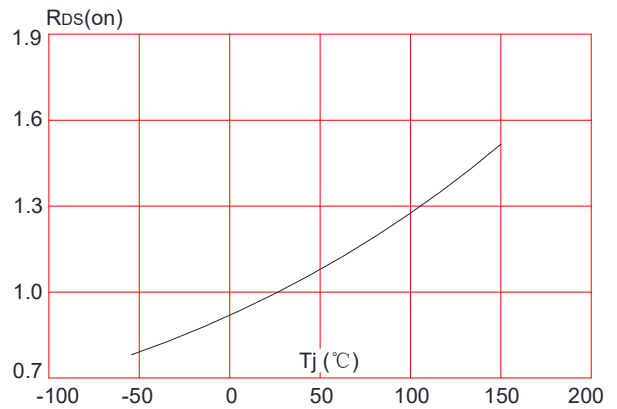
**Figure 6: Capacitance Characteristics**



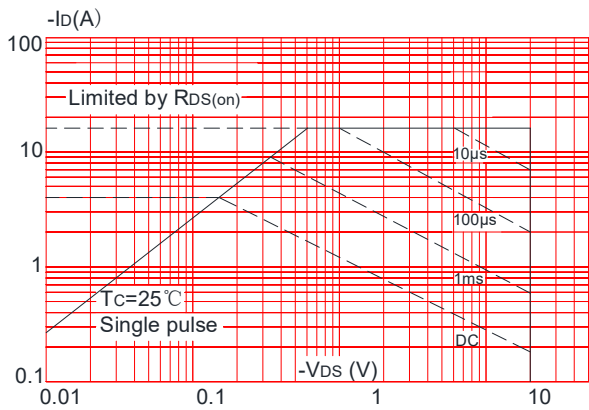
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



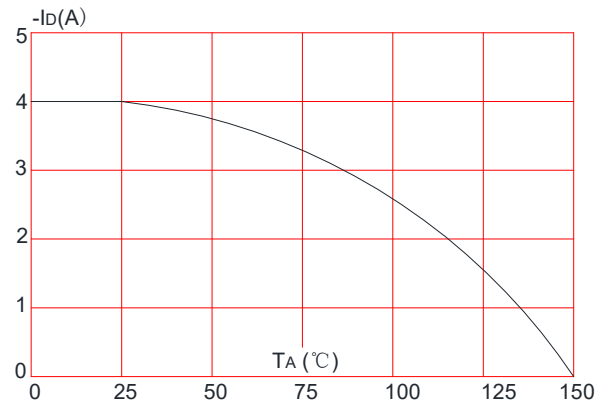
**Figure 8:** Normalized on Resistance vs. Junction Temperature



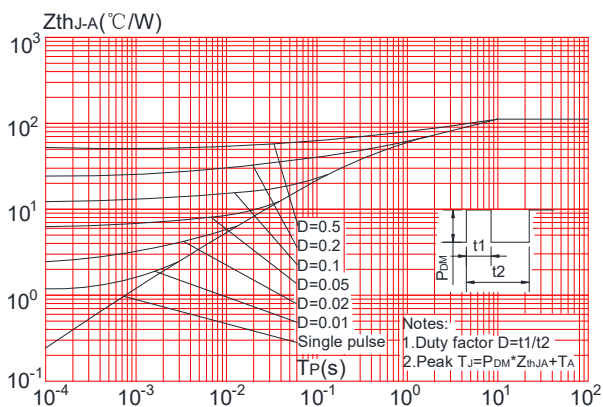
**Figure 9:** Maximum Safe Operating Area

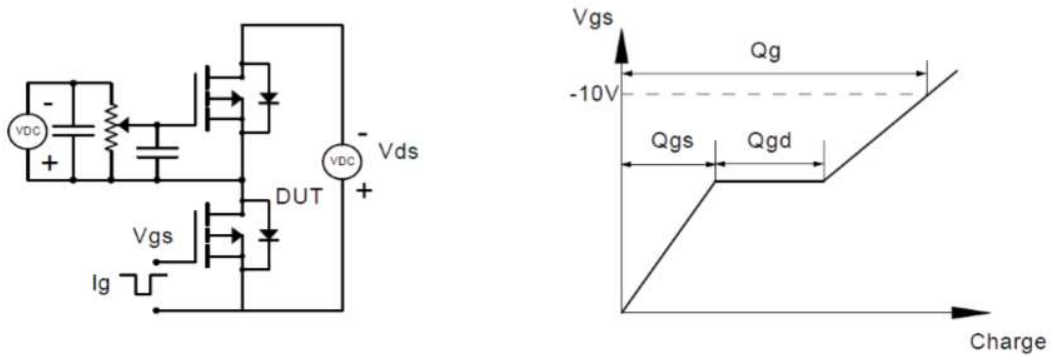
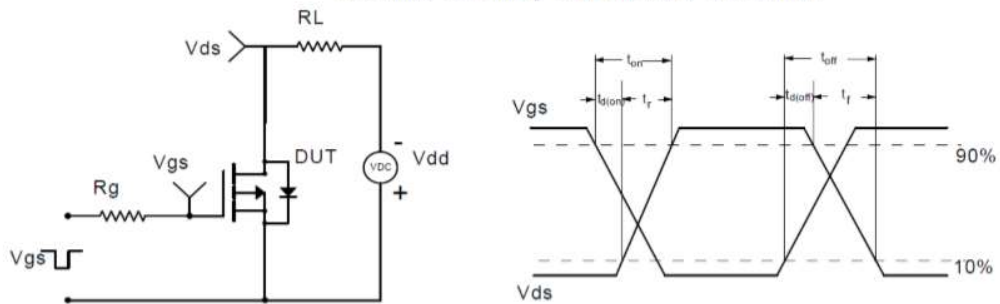
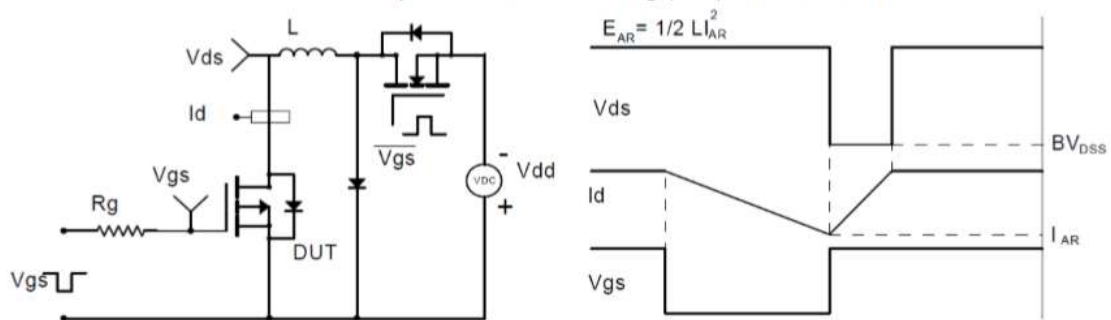
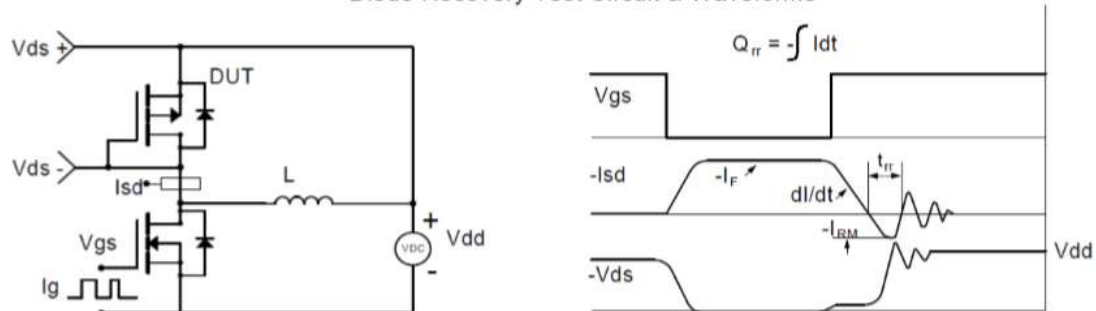


**Figure 10:** Maximum Continuous Drain Current vs. Ambient Temperature

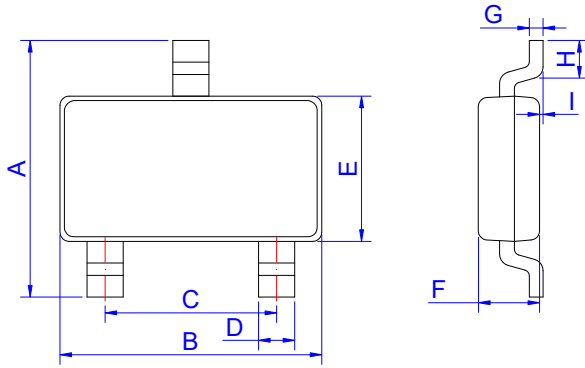


**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



**Test Circuit**
**Gate Charge Test Circuit & Waveform**

**Resistive Switching Test Circuit & Waveforms**

**Unclamped Inductive Switching (UIS) Test Circuit & Waveforms**

**Diode Recovery Test Circuit & Waveforms**


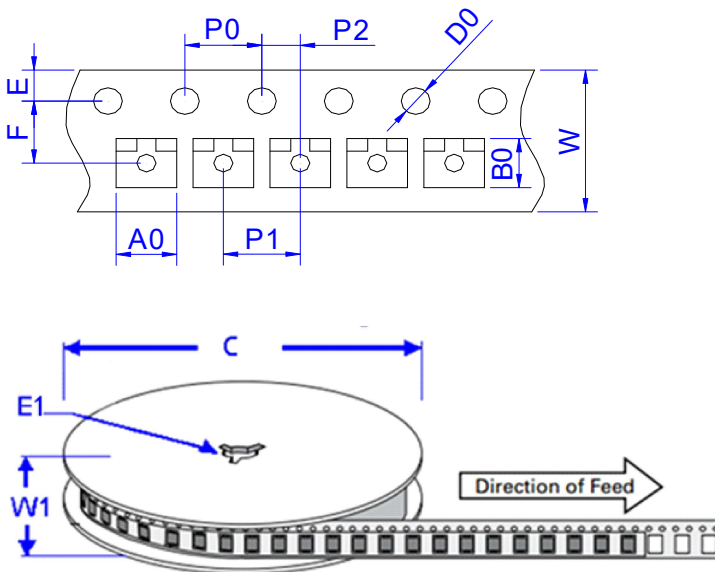
## Package Mechanical Data-SOT-23



SOT-23

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.30	2.40	2.50	0.091	0.095	0.098
B	2.80	2.90	3.00	0.110	0.114	0.118
C	1.90 REF			0.075 REF		
D	0.35	0.40	0.45	0.014	0.016	0.018
E	1.20	1.30	1.40	0.047	0.051	0.055
F	0.90	1.00	1.10	0.035	0.039	0.043
G		0.10	0.15		0.004	0.006
H	0.20			0.008		
I	0		0.10	0		0.004

## Package Information-SOT-23



Ref.	Dimensions	
	Millimeters	Inches
A0	3.15 ± 0.3	0.124 ± 0.012
B0	2.77 ± 0.3	0.109 ± 0.012
C	178	7.0
D0	1.50±0.1	0.059 ± 0.004
E	1.75 ± 0.2	0.069 ± 0.008
E1	13.3±0.3	0.524± 0.012
F	3.5 ± 0.2	0.138 ± 0.008
P0	4.00 ± 0.2	0.157 ± 0.008
P1	4.00 ± 0.2	0.157 ± 0.008
P2	2.00 ± 0.2	0.079 ± 0.008
W	8.00 ± 0.2	0.315 ± 0.008
W1	11.5±1.0	0.453 ± 0.039

回流焊作业参数与炉温曲线标准

## Recommended Reflow Soldering Profile

### Limiting Values\*

The below temperature profile for moisture sensitivity characterization is based on the IPC/JEDEC joint standard: J-STD-020D-01.

Profile Feature	Pb-free assembly
Average ramp-up rate ( $T_{smax}$ to $T_p$ )	3 °C/s maximum
Preheat	150 °C
Temperature minimum ( $T_{smin}$ )	200 °C
Temperature maximum ( $T_{smax}$ )	60 s to 180 s
Time maintained above Temperature ( $T_L$ )	217 °C
Time ( $t_L$ )	60 s to 150 s
Peak/classification temperature ( $T_p$ )	260 °C
Number of allowed reflow cycles	3
Time within 5 °C of actual peak temperature ( $t_p$ )	20 s to 40 s
Ramp-down rate	6 °C/s maximum
Time 25 °C to peak temperature	8 minutes maximum

