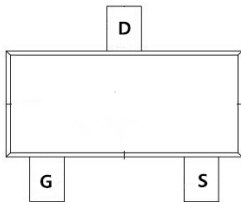# TM05EP02I

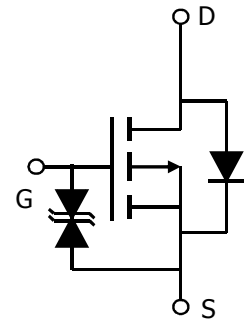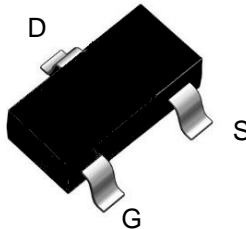## P-Channel Enhancement Mosfet

General Description
• Low $R_{DS(ON)}$
• RoHS and Halogen-Free Compliant

Applications
• Load switch
• PWM

General Features
$V_{DS} = -20V$ $I_D = -5.0A$

$R_{DS(ON)} = 29m\Omega @ V_{GS} = -4.5V$

ESD Protection

100% UIS Tested
100% R_g Tested

Green Product

I:SOT-23

Marking: 3415

Absolute Maximum Ratings： ($T_C = 25℃$ unless otherwise noted)

Symbol	Parameter	Rating	Units
V_{DS}	Drain-Source Voltage	-20	V
V_{GS}	Gate-Source Voltage	± 10	V
$I_D@T_A=25℃$	Continuous Drain Current, V_{GS} @ -4.5V[1]	-5	A
$I_D@T_A=70℃$	Continuous Drain Current, V_{GS} @ -4.5V[1]	-4	A
I_{DM}	Pulsed Drain Current[2]	-19	A
$P_D@T_A=25℃$	Total Power Dissipation[3]	1.32	W
T_{STG}	Storage Temperature Range	-55 to 150	℃
T_J	Operating Junction Temperature Range	-55 to 150	℃

Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-Ambient [1]	---	125	℃/W
$R_{\theta JA}$	Thermal Resistance Junction-Ambient [1] (t ≤10s)	---	95	℃/W
$R_{\theta JC}$	Thermal Resistance Junction-Case[1]	---	80	℃/W

Electrical Characteristics (TᴊJ=25℃ 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= -250µA	-20	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = -20V, V_{GS} = 0V,	-	-	-1	µA
I_{GSS}	Gate to Body Leakage Current	V_{DS} =0V, V_{GS} = ±10V	-	-	±10	uA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}= V_{GS}, I_D= -250µA	-0.4	-0.7	-1.0	V
$R_{DS(on)}$	Static Drain-Source on-Resistance note2	V_{GS} =-4.5V, I_D =-4A	-	29	38	mΩ
		V_{GS} =-2.5V, I_D =-3A	-	39	48	
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = -10V, V_{GS} = 0V, f = 1.0MHz	-	289	-	pF
C_{oss}	Output Capacitance		-	98	-	pF
C_{rss}	Reverse Transfer Capacitance		-	22	-	pF
Q_g	Total Gate Charge	V_{DS} = -10V, I_D = -4.1A, V_{GS} = -4.5V	-	9	-	nC
Q_{gs}	Gate-Source Charge		-	1	-	nC
Q_{gd}	Gate-Drain("Miller") Charge		-	2.6	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-on Delay Time	V_{DD} = -10V, R_G = 1Ω, V_{GEN}=-4.5V,R_L=1.2Ω	-	12	-	ns
t_r	Turn-on Rise Time		-	35	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	30	-	ns
t_f	Turn-off Fall Time		-	10	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	-5.0	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	-16.4	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0V, I_S = -4.1A	-	-	-1.2	V

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

    2. Pulse Test: Pulse Width≤300µs, Duty Cycle≤2%

Typical Performance Characteristics
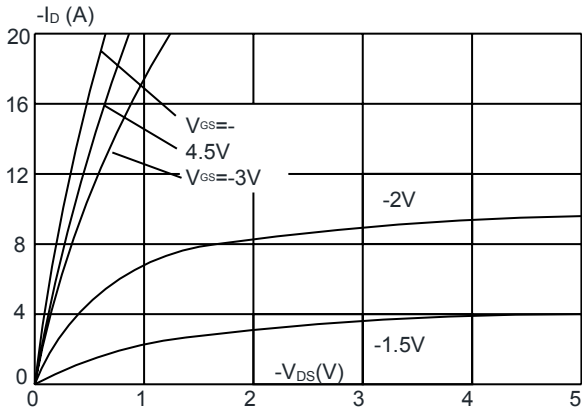
Figure1: Output Characteristics

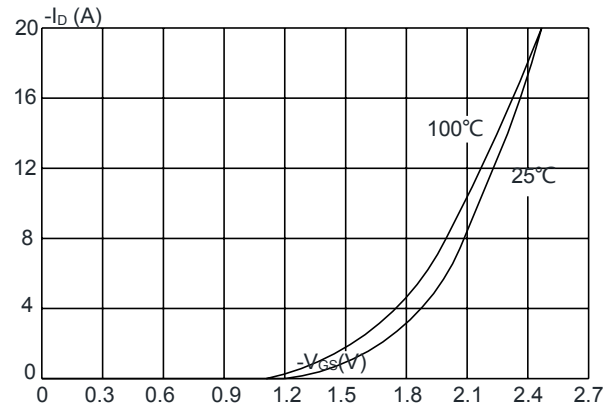**Figure 2:** Typical Transfer Characteristics

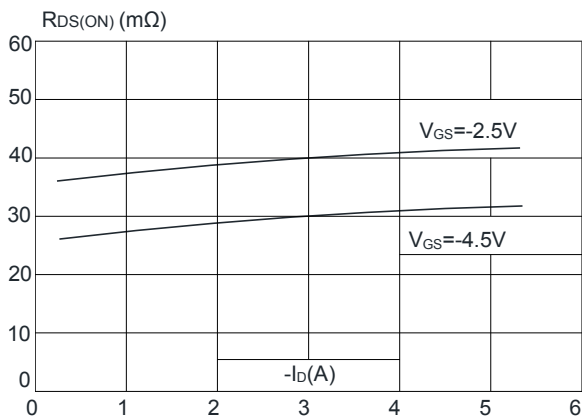**Figure 3:**On-resistance vs. Drain Current

Figure 4: Body Diode Characteristics

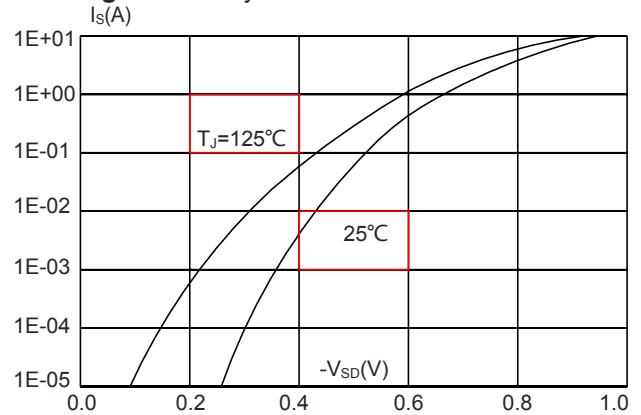**Figure 5:** Gate Charge Characteristics

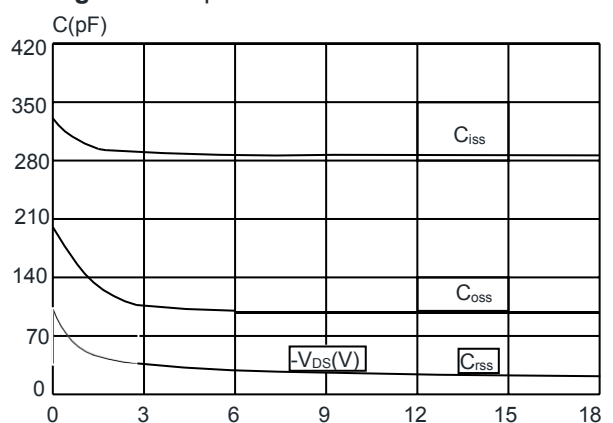**Figure 6:** Capacitance Characteristics

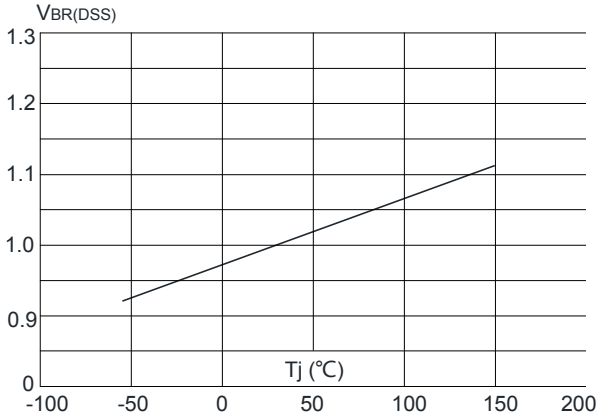**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature

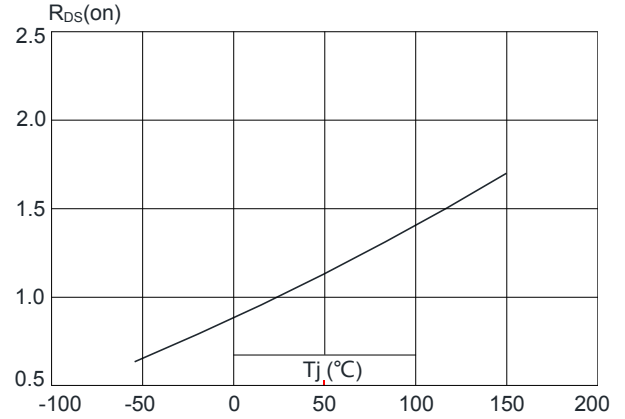**Figure 8:** Normalized on Resistance vs. Junction Temperature

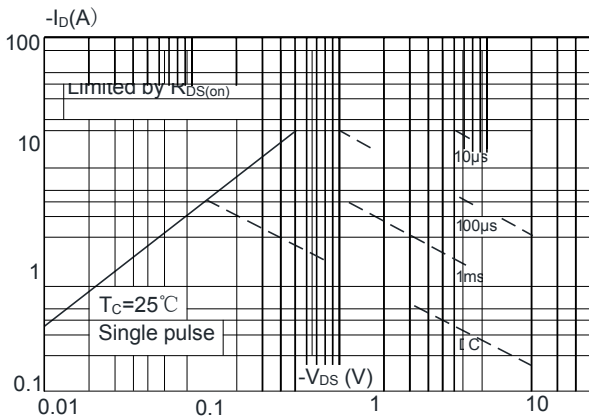**Figure 9:** Maximum Safe Operating Area

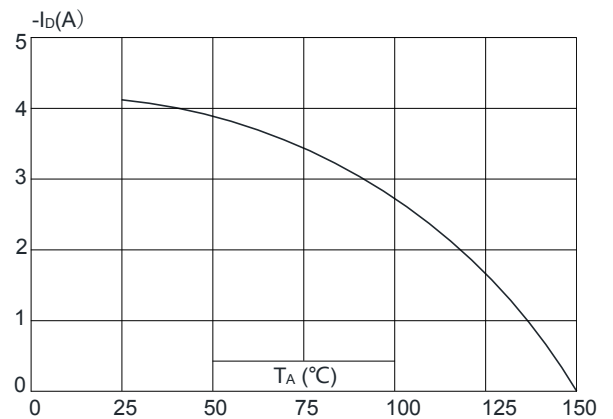**Figure 10:** Maximum Continuous Drain Current vs. Ambient Temperature

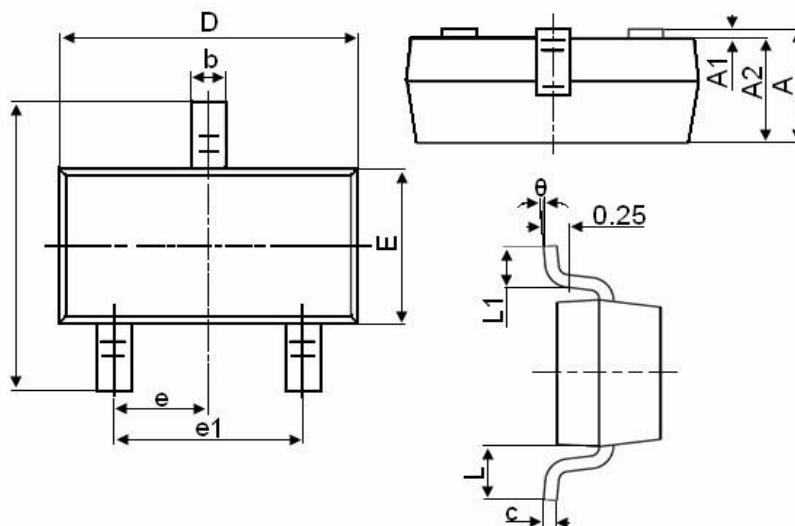**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

https://www.tmc.com.tw

Package Mechanical Data:SOT-23

Symbol	Dimensions in Millimeters	
	MIN.	MAX.
A	0.900	1.150
A1	0.000	0.100
A2	0.900	1.050
b	0.300	0.500
c	0.080	0.150
D	2.800	3.000
E	1.200	1.400
E1	2.250	2.550
e	0.950TYP	
e1	1.800	2.000
L	0.550REF	
L1	0.300	0.500
θ	0°	8°