QS5U21

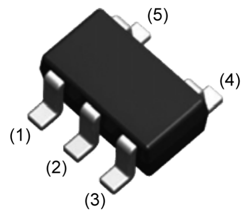
2.5V Drive Pch+SBD MOSFET

Datasheet

V_{DSS}	-20V
$R_{DS(on)}$(Max.)	340mΩ
I_D	±1.5A
P_D	1.25W

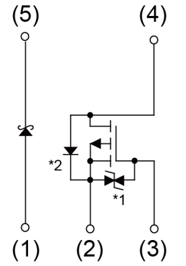
●Outline

TSMT5



●Inner circuit

(1) Anode
(2) Source
(3) Gate
(4) Drain
(5) Cathode



*1 ESD Protection Diode
*2 Body Diode

●Features

1) The QS5U21 combines Pch MOSFET with a Schottky barrier diode in a single TSMT5 package.
2) Low on-state resistance with fast swicthing
3) Low voltage drive (2.5V drive).
4) Built-in Low V_F schottky barrier diode.
5) Pb-free lead plating ; RoHS compliant.

●Packaging specifications

Type	Packing	Embossed Tape
	Reel size (mm)	180
	Tape width (mm)	8
	Basic ordering unit (pcs)	3000
	Taping code	TR
	Marking	U21

●Application

Load switch, DC/ DC conversion

●Absolute maximum ratings (T_a = 25°C)

<MOSFET>

Parameter	Symbol	Value	Unit
Drain - Source voltage	V_{DSS}	-20	V
Gate - Source voltage	V_{GSS}	±12	V
Continuous drain current	I_D	±1.5	A
Pulsed drain current	$I_{D, pulse}$ *1	±6.0	A
Continuous source current (body diode)	I_S	-0.75	A
Pulsed source current (body diode)	$I_{S, pulse}$ *1	-3.0	A
Power dissipation	P_D *3	0.9	W/element
Junction temperature	T_j	150	℃

●Absolute maximum ratings (T_a = 25°C)

<SBD>

Parameter	Symbol	Value	Unit
Repetitive peak reverse voltage	V_{RM}	25	V
Reverse voltage	V_R	20	V
Forward current	I_F	1.0	A
Forward current surge peak	I_{FSM} *2	3.0	A
Power dissipation	P_D *3	0.7	W/element
Junction temperature	T_j	150	℃

<MOSFET + SBD>

Parameter	Symbol	Value	Unit
Power dissipation	P_D *3	1.25	W/total
Range of storage temperature	T_{stg}	-55 to +150	℃

●Electrical characteristics (T_a = 25°C)

<MOSFET>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Gate - Source leakage current	I_{GSS}	V_{GS} = ±12V, V_{DS} = 0V	-	-	±10	μA
Drain - Source breakdown voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D = -1mA	-20	-	-	V
Zero gate voltage drain current	I_{DSS}	V_{DS} = -20V, V_{GS} = 0V	-	-	-1	μA
Gate threshold voltage	$V_{GS(th)}$	V_{DS} = -10V, I_D = -1mA	-0.7	-	-2.0	V
Static drain - source on - state resistance	$R_{DS(on)}$ *4	V_{GS} = -4.5V, I_D = -1.5A	-	160	200	mΩ
		V_{GS} = -4V, I_D = -1.5A	-	180	240	
		V_{GS} = -2.5V, I_D = -0.75A	-	260	340	
Transconductance	g_{fs} *4	V_{DS} = -10V, I_D = -0.75A	1.0	-	-	S

●Electrical characteristics (T_a = 25°C)

<MOSFET>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{iss}	V_{GS} = 0V	-	325	-	pF
Output capacitance	C_{oss}	V_{DS} = -10V	-	60	-	
Reverse transfer capacitance	C_{rss}	f = 1MHz	-	40	-	
Turn - on delay time	$t_{d(on)}$ *4	V_{DD} ≃ -15V, V_{GS} = -4.5V	-	10	-	ns
Rise time	t_r *4	I_D = -0.75A	-	10	-	
Turn - off delay time	$t_{d(off)}$ *4	R_L = 20Ω	-	35	-	
Fall time	t_f *4	R_G = 10Ω	-	10	-	

●Gate charge characteristics (T_a = 25°C)

<MOSFET>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Total gate charge	Q_g *4	V_{DD} ≃ -15V, I_D = -1.5A V_{GS} = -4.5V	-	4.2	-	nC
Gate - Source charge	Q_{gs} *4		-	1.0	-	
Gate - Drain charge	Q_{gd} *4		-	1.1	-	

●Body diode electirical characteristics (Source-Drain) (T_a = 25°C)

<MOSFET>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_{SD} *4	V_{GS} = 0V, I_S = -0.75A	-	-	-1.2	V

●Electrical characteristics (T_a = 25°C)

<SBD>

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 1.0A	-	-	0.45	V
Reverse current	I_R	V_R = 20V	-	-	200	μA

*1 Pw ≤ 10μs, Duty cycle ≤ 1%

*2 60Hz･1 cycle

*3 Mounted on a ceramic board

*4 Pulsed

●Electrical characteristic curves <MOSFET>

Fig.1 Typical Capacitance vs. Drain - Source Voltage

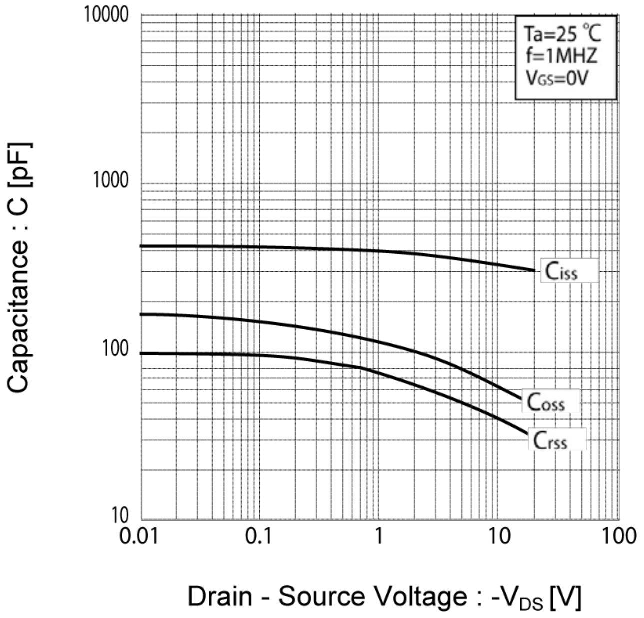


Fig.2 Switching Characteristics

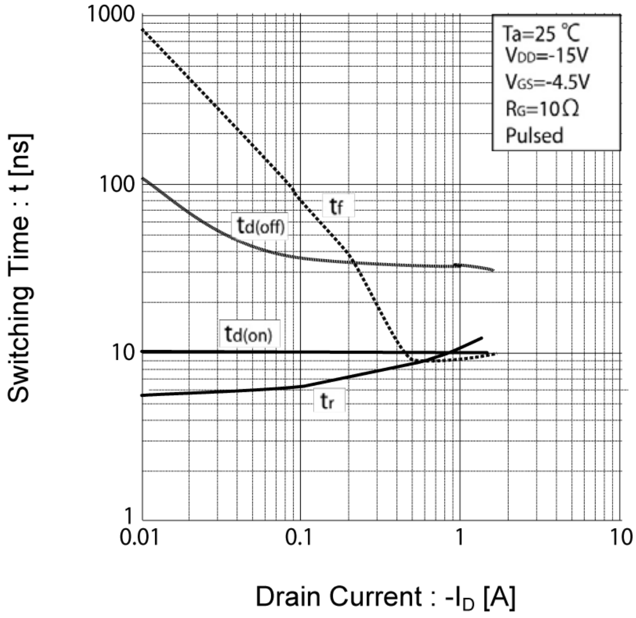


Fig.3 Dynamic Input Characteristics

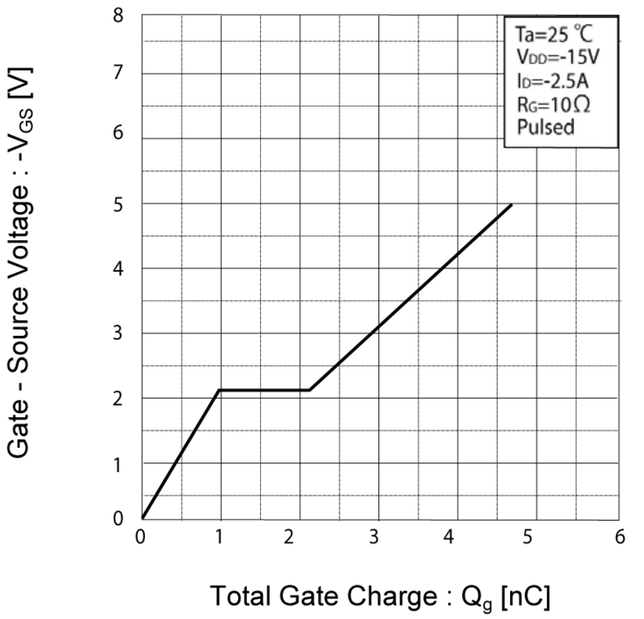
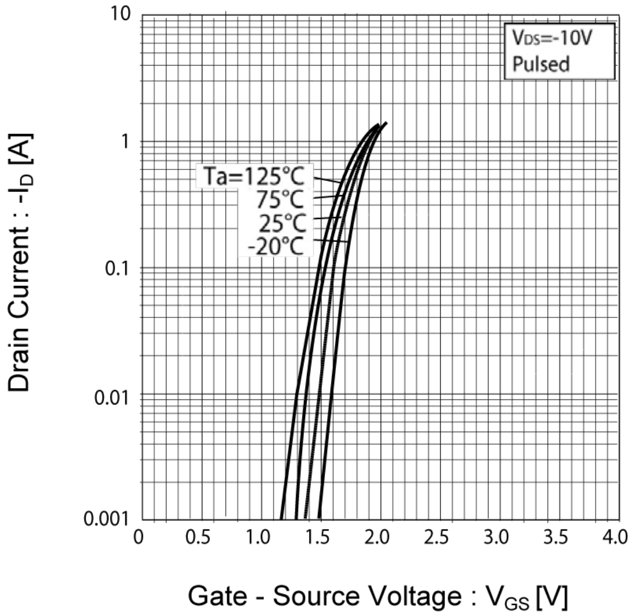


Fig.4 Typical Transfer Characteristics



●Electrical characteristic curves <MOSFET>

Fig.5 Static Drain - Source On - State Resistance vs. Gate Source Voltage

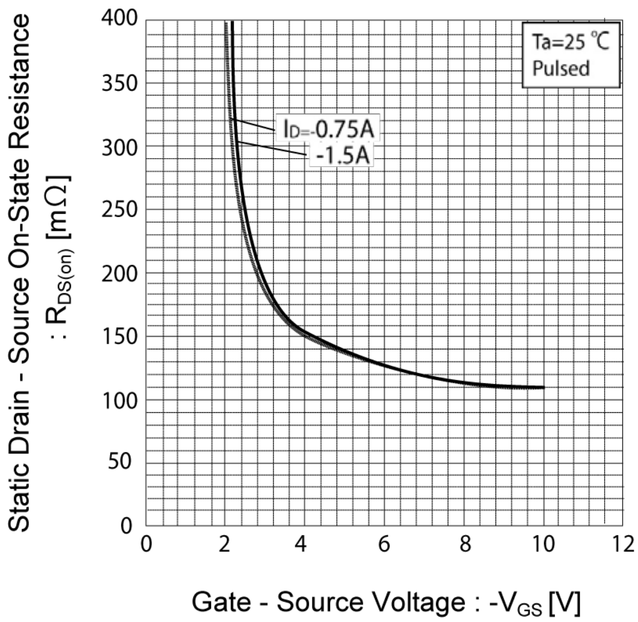


Fig.6 Source Current vs. Source Drain Voltage

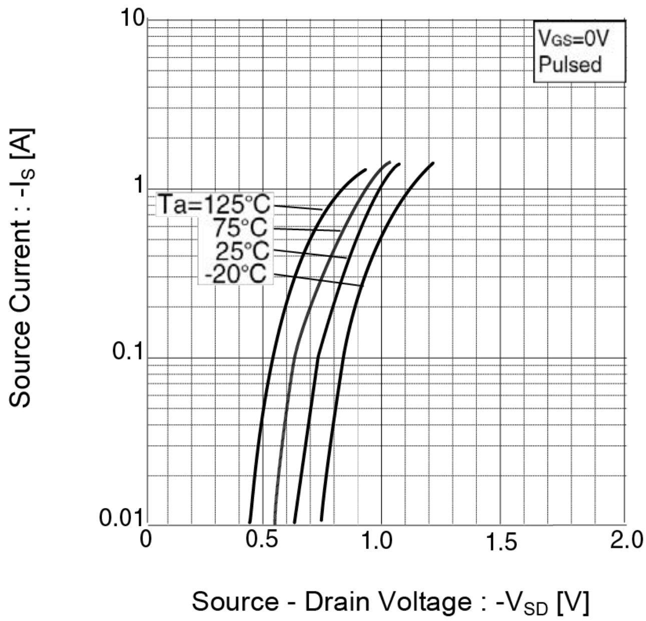


Fig.7 Static Drain - Source On - State Resistance vs. Drain Current (I)

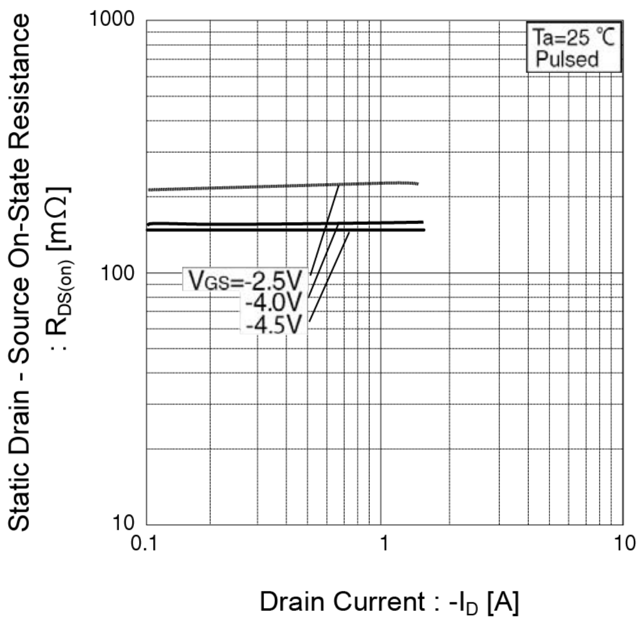
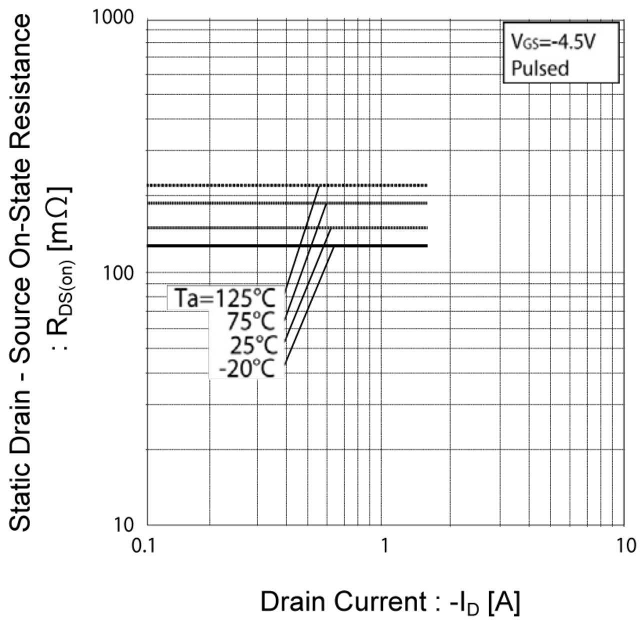


Fig.8 Static Drain - Source On - State Resistance vs. Drain Current (II)



●Electrical characteristic curves <MOSFET>

Fig.9 Static Drain - Source On - State Resistance vs. Drain Current (III)

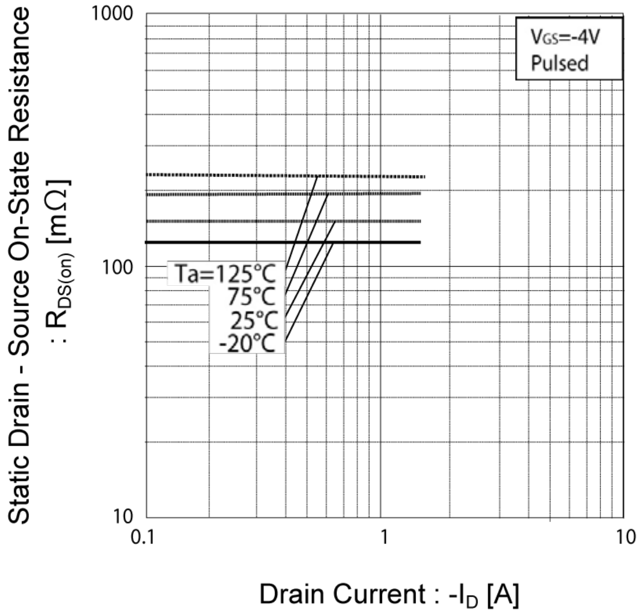
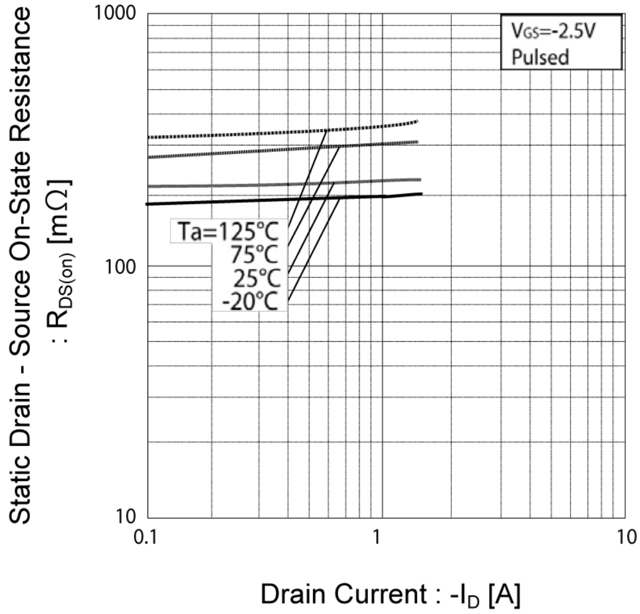


Fig.10 Static Drain - Source On - State Resistance vs. Drain Current (IV)



●Electrical characteristic curves <SBD>

Fig.11 Forward Current vs. Forward Voltage

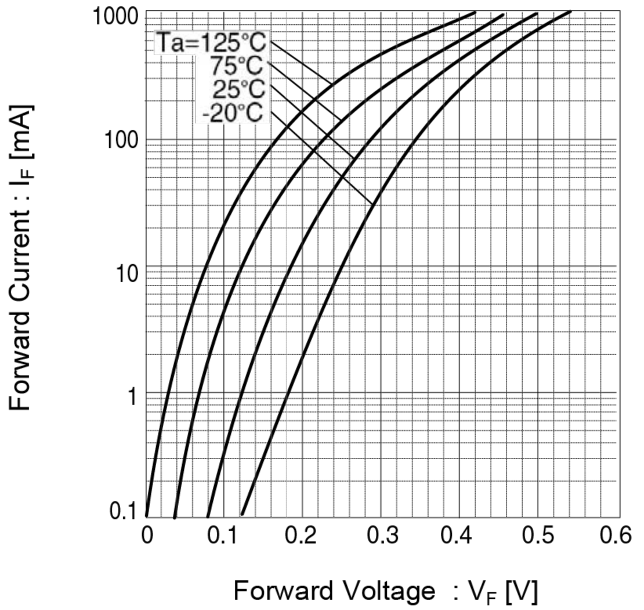
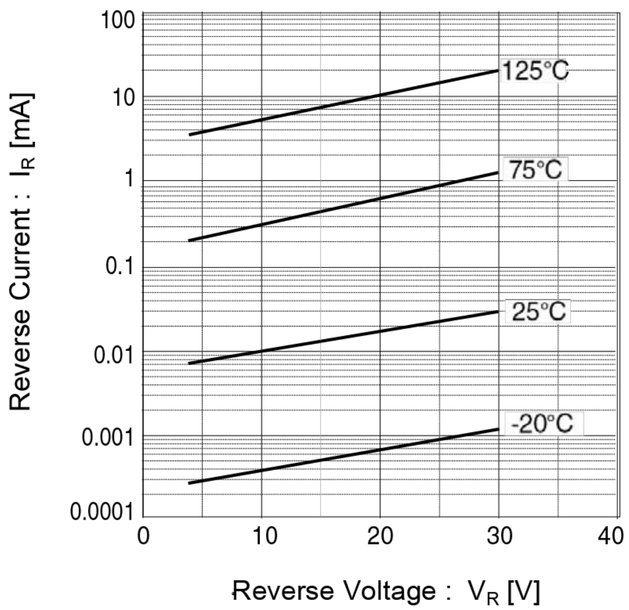


Fig.12 Reverse Current vs. Reverse Voltage



●Notice

1. SBD has a large reverse leak current compared to other type of diode. Therefore, it would raise a junction temperature, and increase a reverse power loss. Further rise of inside temperature would cause a thermal runaway. This built-in SBD has low V_F characteristics and therefore, higher leak current. Please consider enough the surrounding temperature, generating heat of MOSFET and the reverse current.

2. This product might cause chip aging and breakdown under the large electrified environment. Please consider to design ESD protection circuit.

●Measurement circuits

Fig.1-1 Switching Time Measurement Circuit

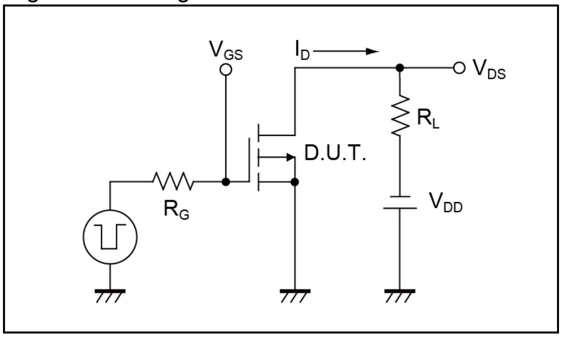


Fig.1-2 Switching Waveforms

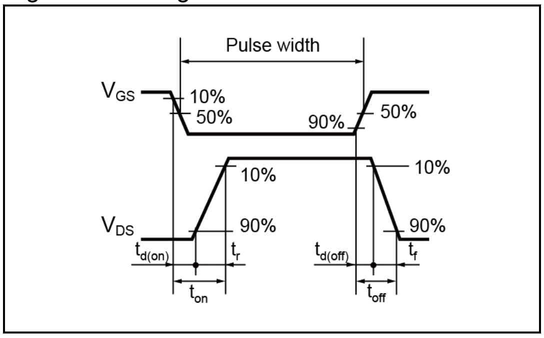


Fig.2-1 Gate Charge Measurement Circuit

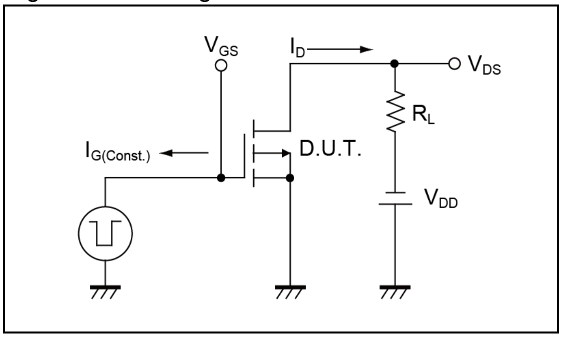
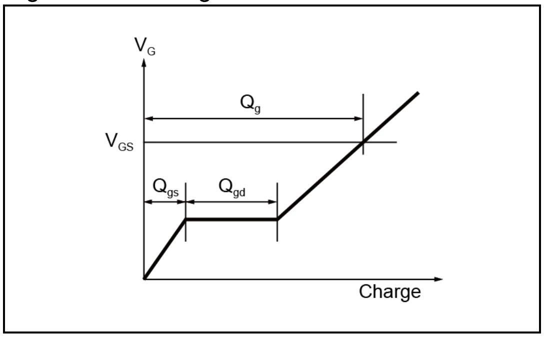
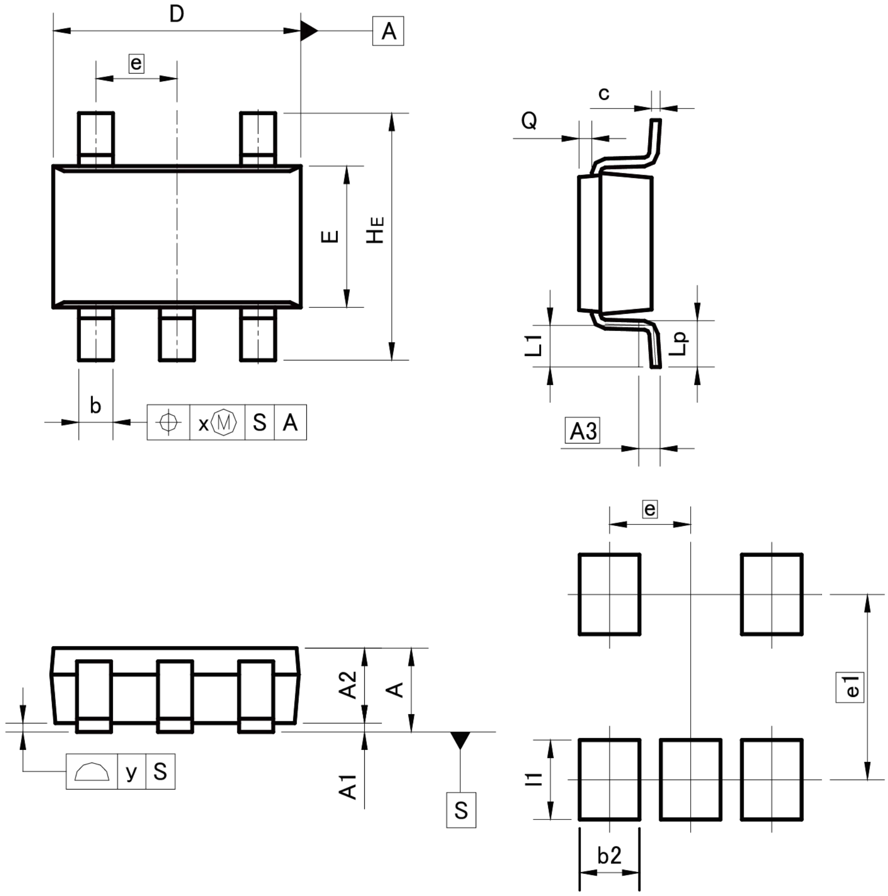


Fig.2-2 Gate Charge Waveform



●Dimensions

TSMT5



Pattern of terminal position areas
[Not a recommended pattern of soldering pads]

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	–	1.00	–	0.039
A1	0.00	0.10	0.000	0.004
A2	0.75	0.95	0.030	0.037
A3	0.25		0.010	
b	0.35	0.50	0.014	0.020
c	0.10	0.26	0.004	0.010
D	2.80	3.00	0.110	0.118
E	1.50	1.80	0.059	0.071
e	0.95		0.037	
HE	2.60	3.00	0.102	0.118
L1	0.30	0.60	0.012	0.024
Lp	0.40	0.70	0.016	0.028
Q	0.05	0.25	0.002	0.010
x	–	0.20	–	0.008
y	–	0.10	–	0.004

DIM	MILIMETERS		INCHES	
	MIN	MAX	MIN	MAX
b2		0.70	–	0.028
e1	2.10		0.083	
l1	–	0.90	–	0.035

Dimension in mm/inches

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