60 V, 100 A, 3.8 mΩ Low $R_{DS(ON)}$
N ch Trench Power MOSFET

2SK4161D

Features

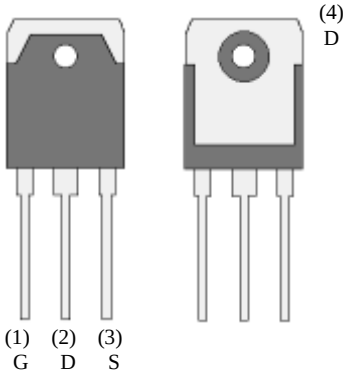
- $V_{(BR)DSS}$ ----------60 V (ID = 100 µA)
- I_D ---------- 100 A
- $R_{DS(ON)}$ ----------4.8 mΩ max. (ID = 35 A, VGS = 10 V)
-
- AEC-Q101 Qualified
- 175°C Capability
- Low On Resistance
- ESD Protection Zener on Gate
- 100% Avalanche Tested
- Compliant with RoHS directive

Applications

- Electric power Steering (EPS)
- Motor
- DC/DC Converter
- Other Switching Mode Power Supply, SMPS

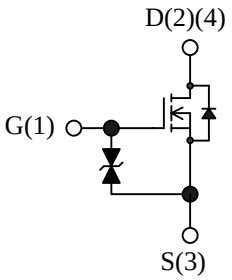
Package

TO3P-3L



Not to scale

Equivalent circuit



Absolute Maximum Ratings

Unless otherwise specified, T_A = 25 °C

Parameter	Symbol	Test conditions	Rating	Unit
Drain to Source Voltage	V_{DS}		60	V
Gate to Source Voltage	V_{GS}		± 20	V
Continuous Drain Current	I_D	T_C = 25 °C	100	A
Pulsed Drain Current	I_{DM}	PW ≤ 100µs Duty cycle ≤ 1 %	200	A
Continuous Source Current (Body Diode)	I_S	T_C = 25 °C	100	A
Pulsed Source Current (Body Diode)	I_{SM}	PW ≤ 100µs Duty cycle ≤ 1 %	200	A
Single Pulse Avalanche Energy	E_{AS}	V_{DD} = 20 V, L = 1 mH, I_{AS} =20 A, unclamped, Refer to Figure 1	400	mJ
Power Dissipation	P_D	T_C = 25 °C	132	W
Operating Junction Temperature	T_J		175	°C
Storage Temperature Range	T_{STG}		− 55 to 175	°C

Thermal Characteristics

Unless otherwise specified, T_A = 25 °C

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Thermal Resistance (Junction to Case)	$R_{\theta JC}$		−	−	1.13	°C/W
Thermal Resistance (Junction to Ambient)	$R_{\theta JA}$		−	−	35.7	°C/W

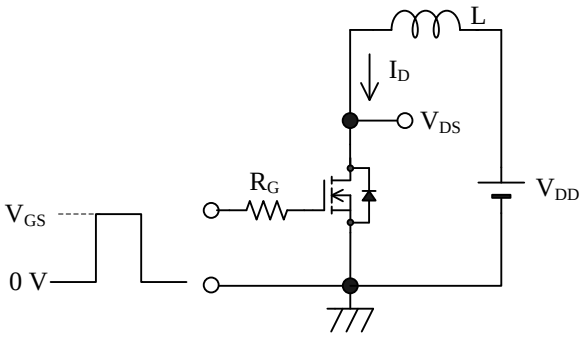
Electrical Characteristics

Unless otherwise specified, T_A = 25 °C

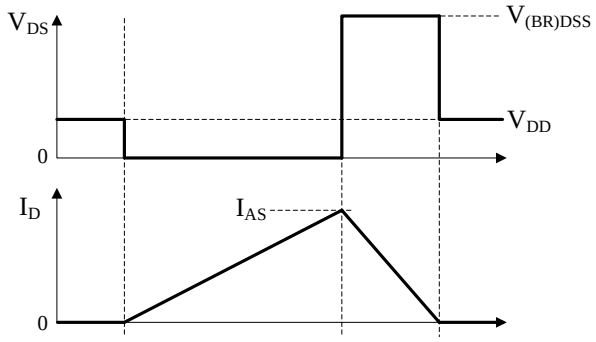
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Drain to Source Breakdown Voltage	$V_{(BR)DSS}$	I_D = 100 µA, V_{GS} = 0 V	60	−	−	V
Drain to Source Leakage Current	I_{DSS}	V_{DS} = 60 V, V_{GS} = 0 V	−	−	100	µA
Gate to Source Leakage Current	I_{GSS}	V_{GS} = ± 15 V	−	−	± 10	µA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = 10 V, I_D = 1 mA	3.0	3.6	4.0	V
Static Drain to Source On-Resistance	$R_{DS(ON)}$	I_D = 35 A, V_{GS} = 10 V	−	3.8	4.8	mΩ
		I_D = 35 A, V_{GS} = 8 V	−	4.2	6.0	mΩ
Input Capacitance	C_{iss}	V_{DS} = 10 V V_{GS} = 0 V f = 1 MHz	−	10000	−	pF
Output Capacitance	C_{oss}		−	1000	−	
Reverse Transfer Capacitance	C_{rss}		−	730	−	
Total Gate Charge (V_{GS} = 10 V)	Q_{g1}	V_{DS} = 40 V I_D = 40 A	−	145	−	nC
Gate to Source Charge	Q_{gs}		−	40	−	
Gate to Drain Charge	Q_{gd}		−	35	−	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 20 V I_D = 40 A V_{GS} = 10 V, R_G = 30 Ω Refer to Figure 2	−	160	−	ns
Rise Time	t_r		−	490	−	
Turn-Off Delay Time	$t_{d(off)}$		−	400	−	
Fall Time	t_f		−	200	−	
Source to Drain Diode Forward Voltage	V_{SD}	I_S = 50 A, V_{GS} = 0 V	−	0.9	1.2	V
Source to Drain Diode Reverse Recovery Time	t_{rr}	I_F = 25 A di/dt = 50 A/µs Refer to Figure 3	−	50	−	ns

Test Circuits and Waveforms

$$E_{AS} = \frac{1}{2} \cdot L \cdot I_{AS}^{\ 2} \cdot \frac{V_{(BR)DSS}}{V_{(BR)DSS} - V_{DD}}$$

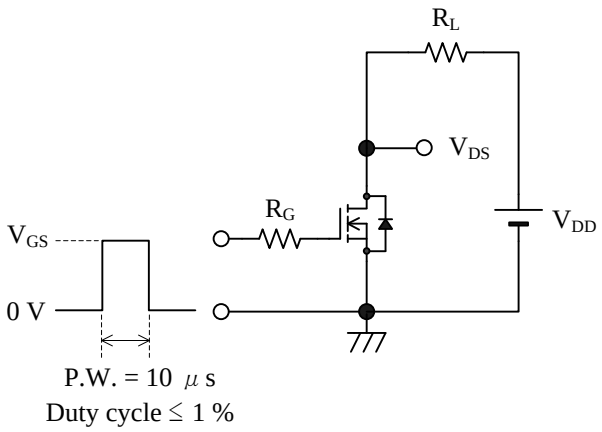


(a) Test Circuit

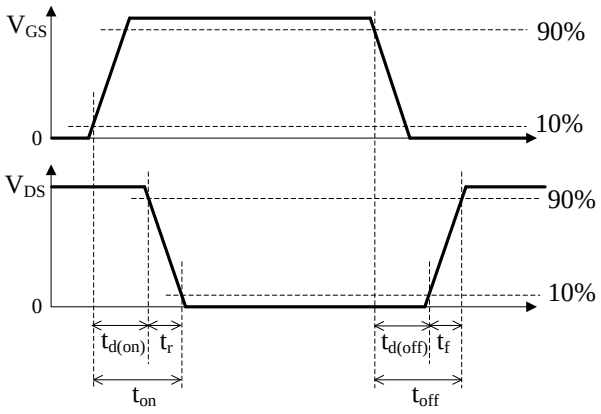


(b) Waveform

Figure 1 Unclamped Inductive Switching

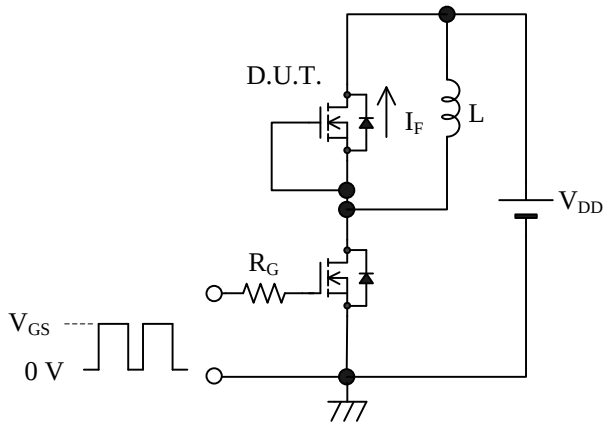


(a) Test Circuit

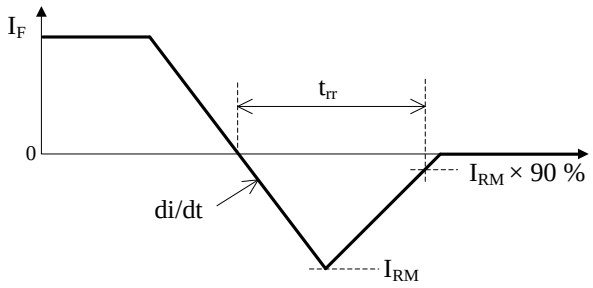


(b) Waveform

Figure 2 Switching Time



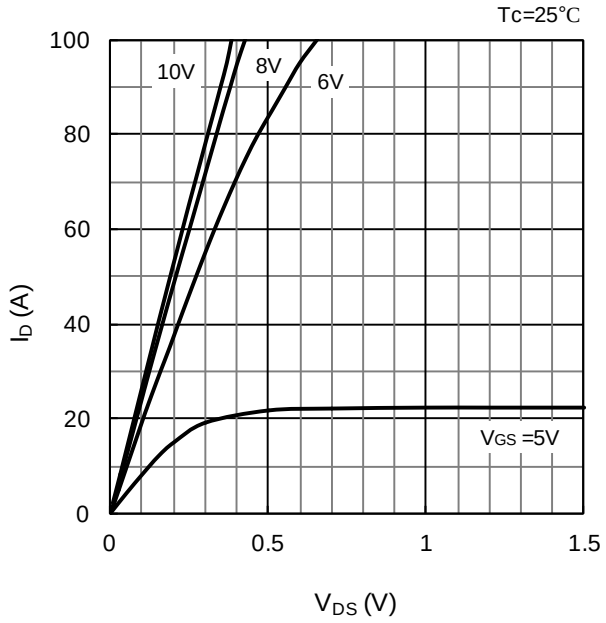
(a) Test Circuit



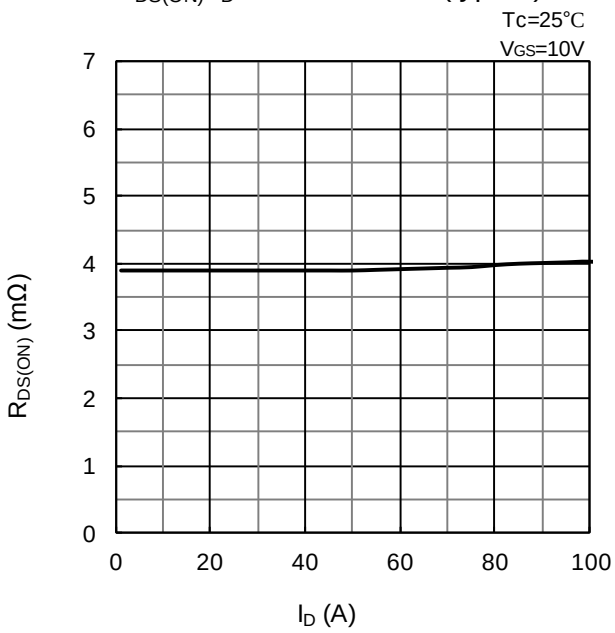
(b) Waveform

Figure 3 Diode Reverse Recovery Time

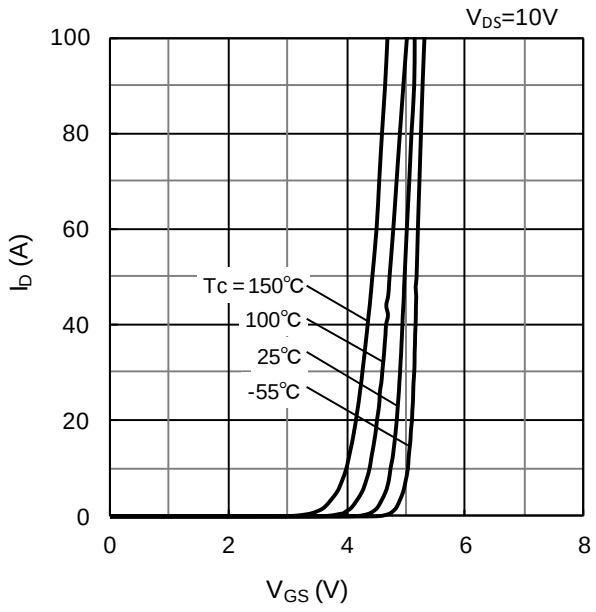
I_D-V_{DS} characteristics(typical)



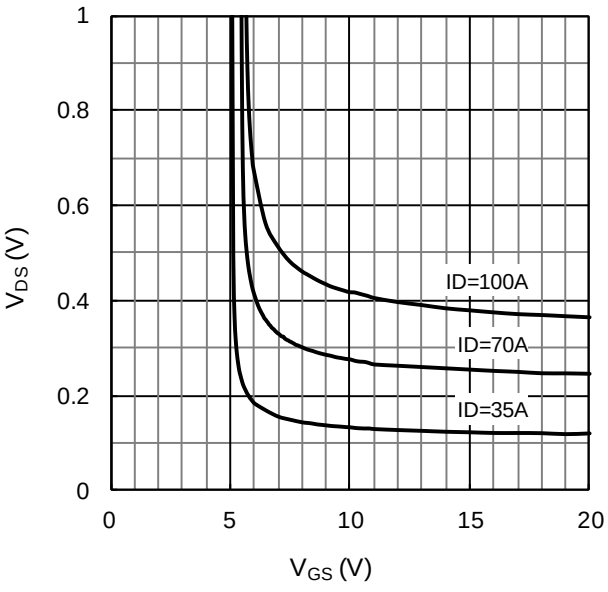
$R_{DS(ON)}$-I_D characteristics (typical)



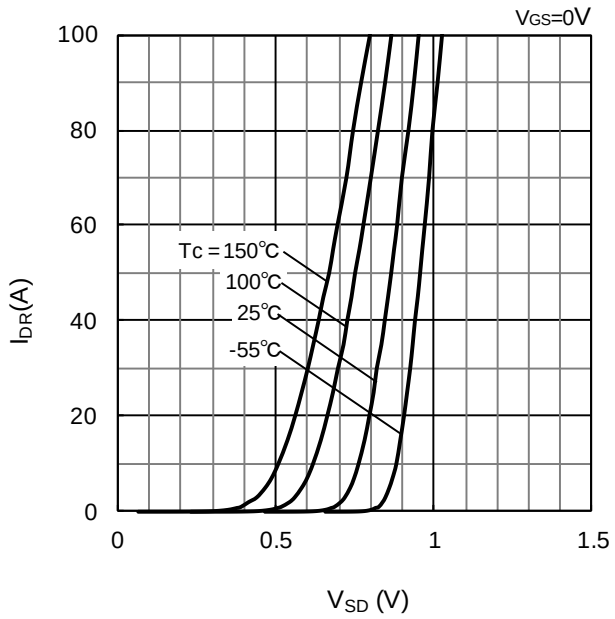
I_D-V_{GS} characteristics (typical)



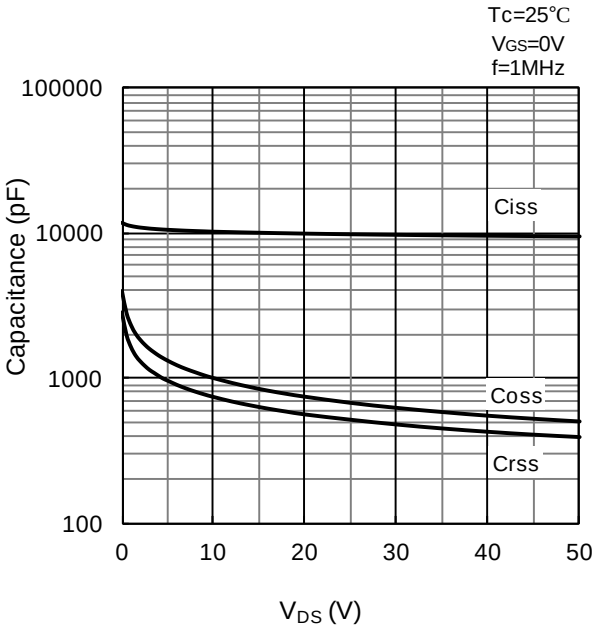
V_{DS} - V_{GS} characteristics (typical)



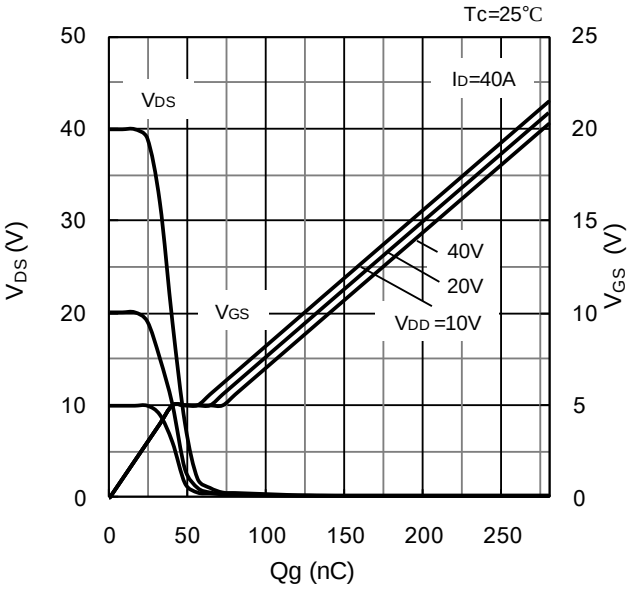
I_{DR}-V_{SD} characteristics (typical)



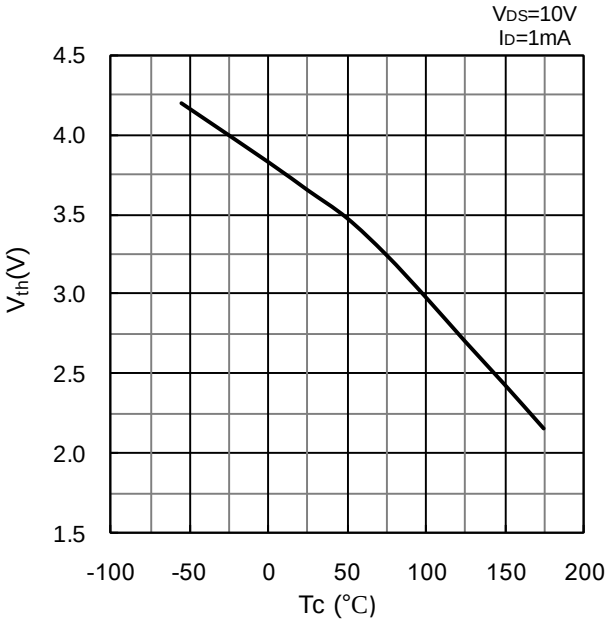
Capacitance-V_{DS} characteristics (typical)



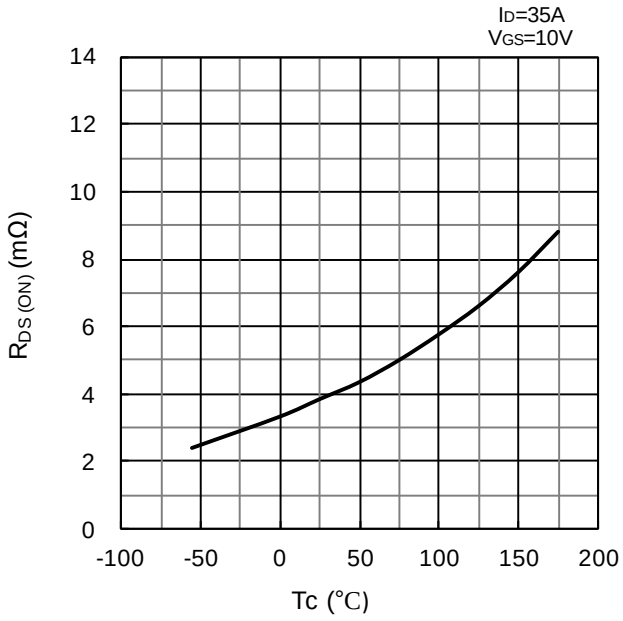
V_{GS} - Q_g characteristics (typical)



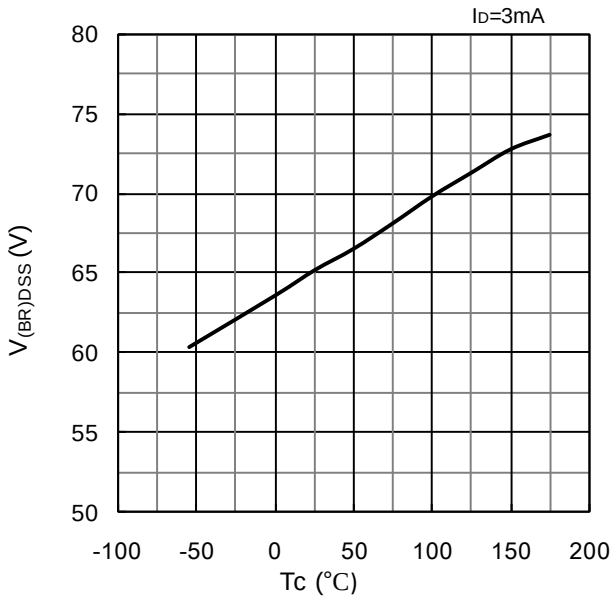
V_{th} - T_C characteristics (typical)



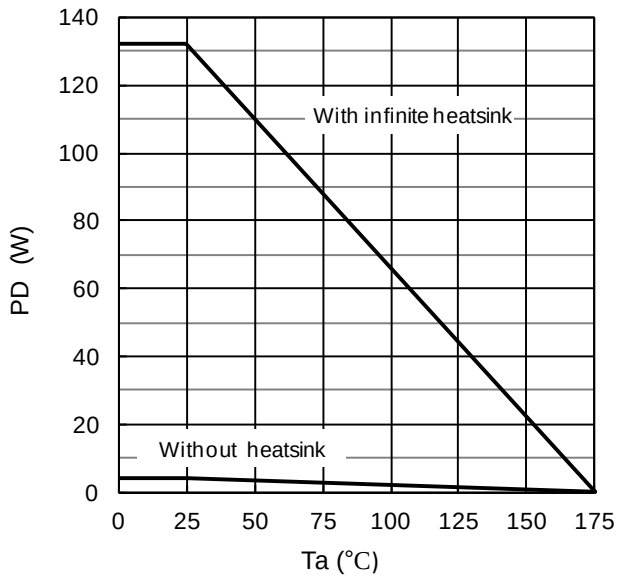
$R_{DS(ON)}$-T_C characteristics (typical)



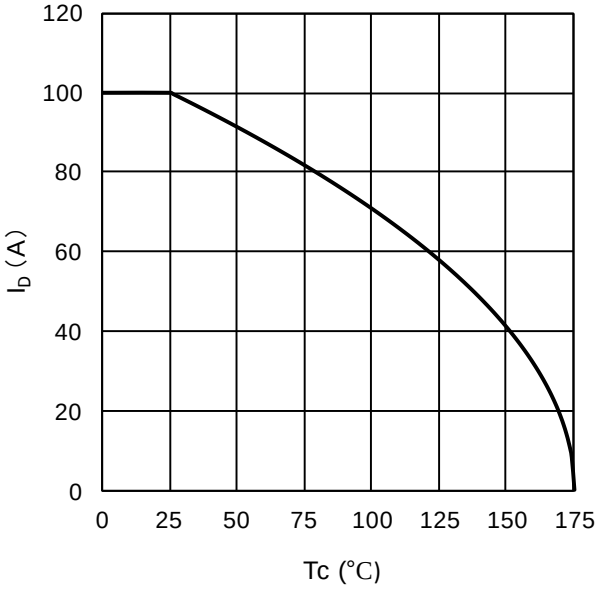
$V_{(BR)DSS}$ - T_C characteristics (typical)



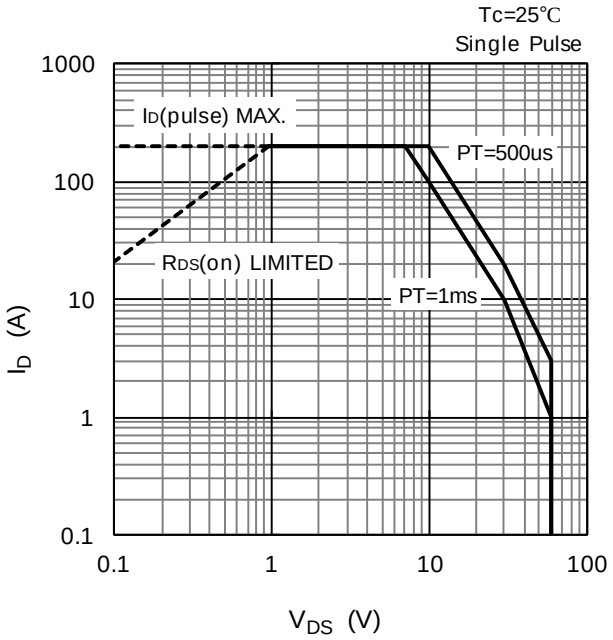
P_D-T_a Derating



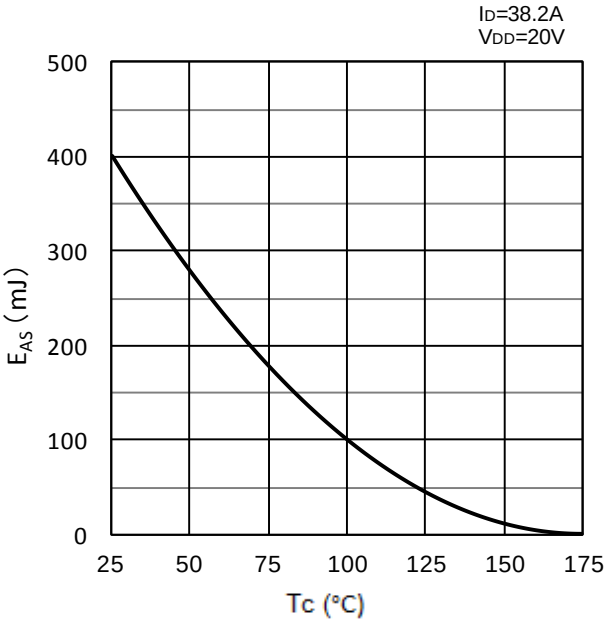
I_D-T_C characteristics



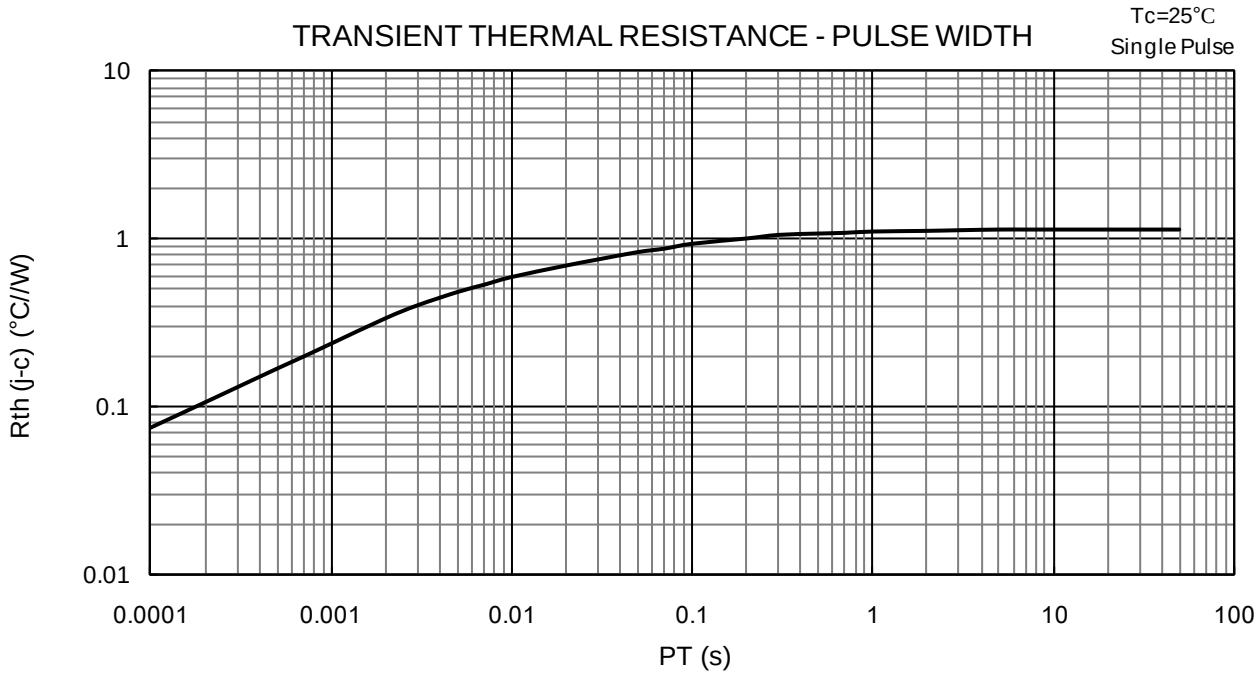
SAFE OPARATING AREA



E_{AS}-Tc characteristics

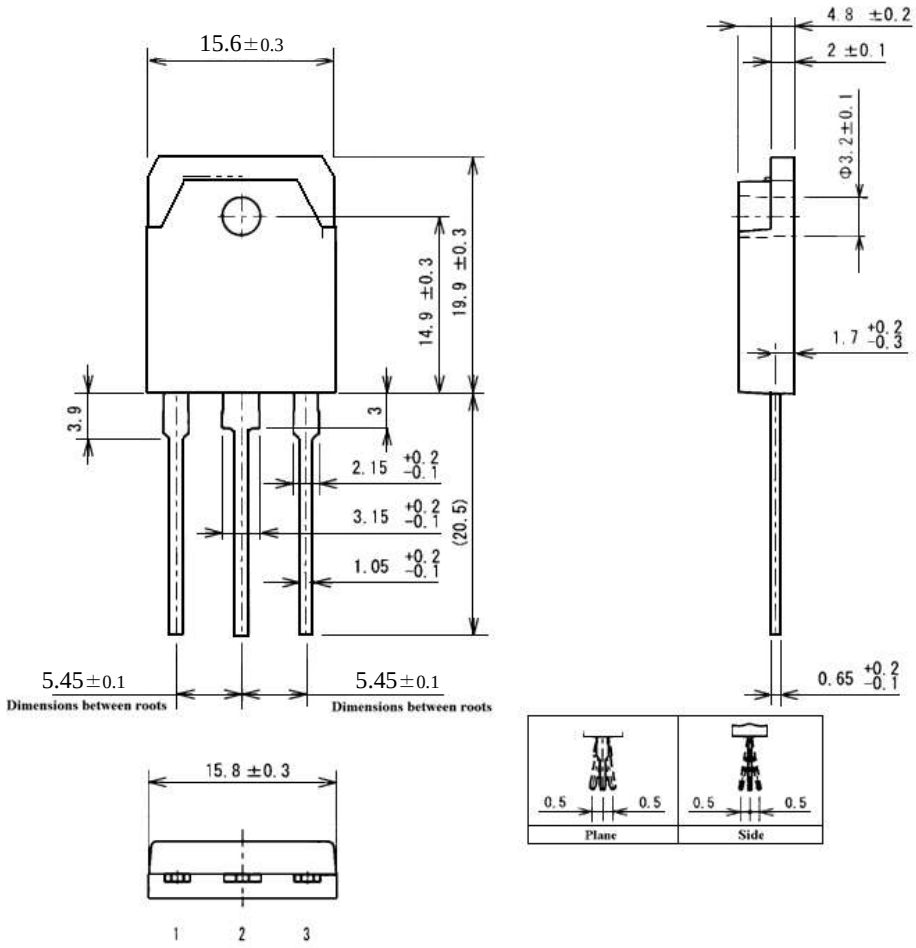


TRANSIENT THERMAL RESISTANCE - PULSE WIDTH



Package Outline

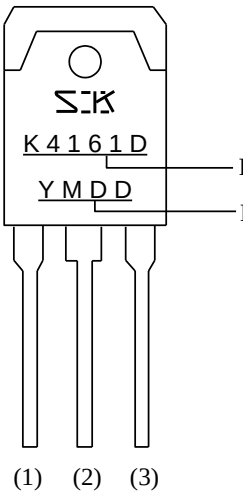
TO3P-3L



NOTES:

- Dimension is in millimeters
- Pin treatment Pb-free. Device composition compliant with the RoHS directive.

Marking Diagram



Part Number

Lot Number

Y is the Last digit of the year (0 to 9)

M is the Month (1 to 9, O, N or D)

DD is the Date (two digit of 01 to 31)

A is the suffix No.

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