

$V_{DS} = 275\text{ V}$, $R_{DS(ON)} = 0.26\ \Omega$
Dual N-channel Power MOSFET
SPF0004

Description

SPF0004 includes two N-channel power MOSFETs with zener diode for ESD protection. The package of SPF0004 isolates each MOSFET, and has heatsink connected to each drain.

Features

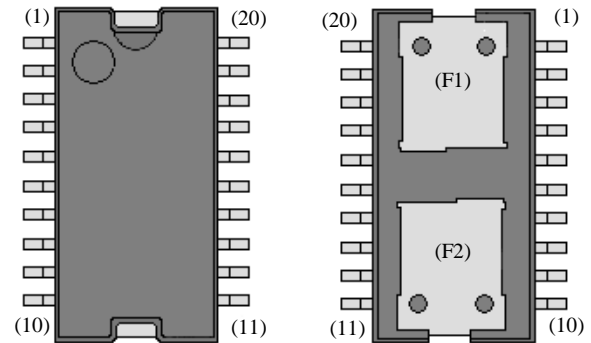
- Automotive Qualified
 - Low On Resistance
 - ESD Protection Zener on Gate
 - 100% Avalanche Tested
 - Compliant with RoHS directive
- V_{DSS} ----- 275 V ($I_D = 100\ \mu\text{A}$)
 - I_D ----- $\pm 6\text{ A}$
 - $R_{DS(ON)}$ ----- $0.26\ \Omega$ max. ($I_D = 6\text{ A}$, $V_{GS} = 10\text{ V}$)
 - t_{rr} ----- 117 ns (typ.)

Applications

- DC/DC Converter
- Other Switched-mode Power Supply

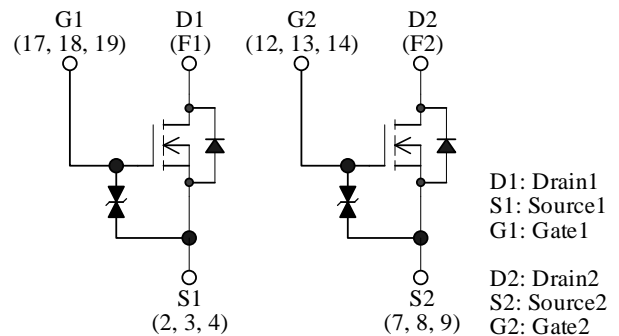
Package

HSOP20



Not to scale

Internal Schematic Diagram



Absolute Maximum Ratings

Unless otherwise specified, $T_A = 25\text{ }^{\circ}\text{C}$

Parameter	Symbol	Test conditions	Rating	Unit
Drain to Source Voltage	V_{DSS}		275	V
Gate to Source Voltage	V_{GSS}		± 20	V
Continuous Drain Current	I_D		± 6	A
Pulsed Drain Current	$I_{D(PULSE)}$	Pulse width $\leq 100\mu\text{s}$ Duty cycle $\leq 1\%$	± 30	A
Single Pulse Avalanche Energy	E_{AS}	$V_{DD} = 49\text{ V}$, $L = 0.05\text{ mH}$, $I_{AS} = 40\text{ A}$, $V_{GS} = +16\text{ V}, -13\text{ V}$, $R_G = 1.5\text{ k}\Omega$, unclamped, see Figure 1	47.5	mJ
Avalanche Current	I_{AS}		30	A
Power Dissipation	P_D	$T_C = 25\text{ }^{\circ}\text{C}$	2.5	W
Drain to Source dv/dt 1	dv/dt 1	$V_{DD} = 200\text{ V}$, $L = 0.035\text{ mH}$, $R_G = 150\Omega$, $I_{DP} = 30\text{ A}$, $V_{GS} = +16\text{ V}, -16\text{ V}$, $di/dt \geq -125\text{ A}/\mu\text{s}$, see Figure 2	5.6	V/ns
Peak Diode Recovery dv/dt 2	dv/dt 2	$V_{DD} = 200\text{ V}$, $L = 0.2\text{ mH}$, $I_{SDP} = 30\text{ A}$, See Figure 3	8.5	V/ns
Peak Diode Recovery di/dt	di/dt	$V_{DD} = 200\text{ V}$, $L = 0.2\text{ mH}$, $I_{SDP} = 30\text{ A}$, See Figure 3	220	A/ μs
Operating Junction Temperature	T_J		150	$^{\circ}\text{C}$
Storage Temperature Range	T_{STG}		- 55 to 150	$^{\circ}\text{C}$

Thermal Characteristics

Unless otherwise specified, $T_A = 25\text{ }^{\circ}\text{C}$

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Thermal Resistance (Junction to Case)	$R_{\theta JC}$		—	—	4.7	$^{\circ}\text{C}/\text{W}$

Electrical Characteristics

Unless otherwise specified, $T_A = 25\text{ }^{\circ}\text{C}$

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Drain to Source Breakdown Voltage	$V_{(BR)DSS}$	$I_D = 100\text{ }\mu\text{A}$, $V_{GS} = 0\text{ V}$	275	—	—	V
Drain to Source Leakage Current	I_{DSS}	$V_{DS} = 275\text{ V}$, $V_{GS} = 0\text{ V}$	—	—	100	μA
Gate to Source Leakage Current	I_{GSS}	$V_{GS} = \pm 20\text{ V}$	—	—	10	μA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = 10\text{ V}$, $I_D = 1\text{ mA}$	1.90	2.25	2.60	V
Forward Transconductance	$R_{e(yfs)}$	$V_{DS} = 10\text{ V}$, $I_D = 6\text{ A}$	—	20	—	S
Static Drain to Source On-Resistance	$R_{DS(on)}$	$I_D = 6\text{ A}$, $V_{GS} = 10\text{ V}$	—	0.20	0.26	Ω
Input Capacitance	C_{iss}	$V_{DS} = 10\text{ V}$ $V_{GS} = 0\text{ V}$ $f = 1\text{ MHz}$	—	960	—	pF
Output Capacitance	C_{oss}		—	250	—	
Reverse Transfer Capacitance	C_{rss}		—	36	—	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 200\text{ V}$ $I_D = 6\text{ A}$ $V_{GS} = 10\text{ V}$, $R_G = 10\text{ }\Omega$ Refer to Figure 4	—	15	—	ns
Rise Time	t_r		—	34	—	
Turn-Off Delay Time	$t_{d(off)}$		—	112	—	
Fall Time	t_f		—	144	—	
Source to Drain Diode Forward Voltage	V_{SD}	$I_{SD} = 6\text{ A}$, $V_{GS} = 0\text{ V}$	—	—	1.2	V
Source to Drain Diode Reverse Recovery Time	t_{rr}	$I_{SDP} = 6\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ Refer to Figure 3	—	117	—	ns

Test Circuits and Waveforms

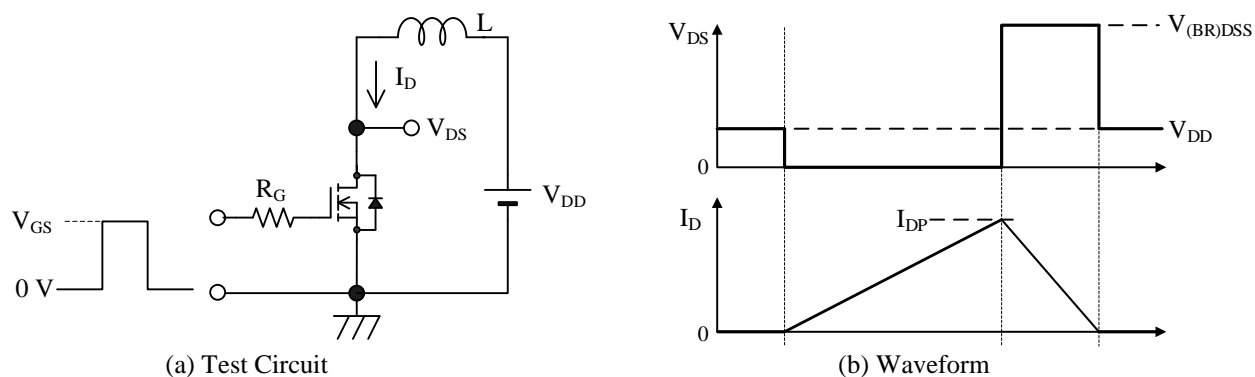


Figure 1 Unclamped Inductive Switching

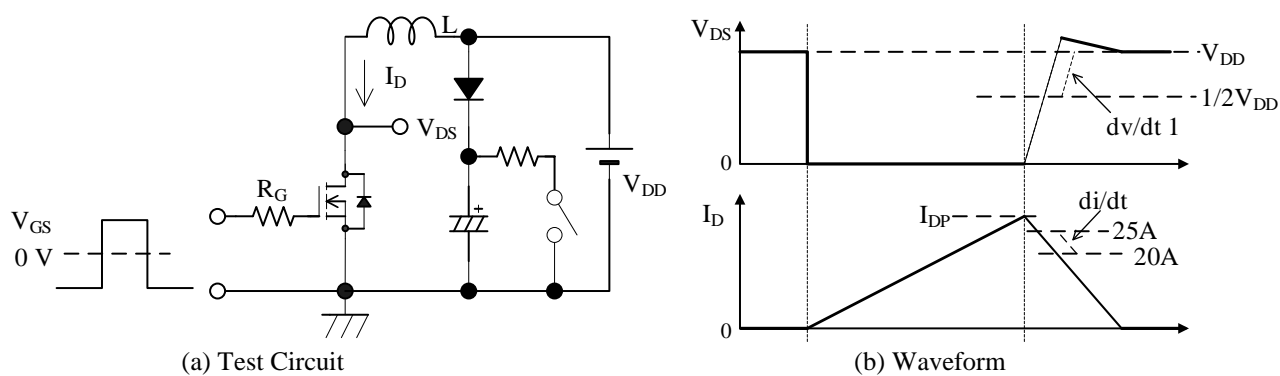
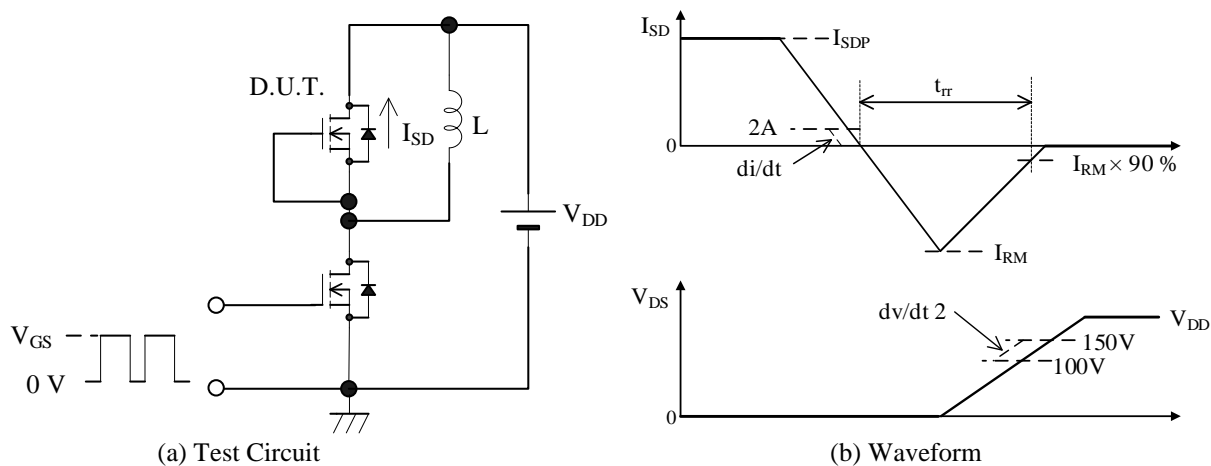
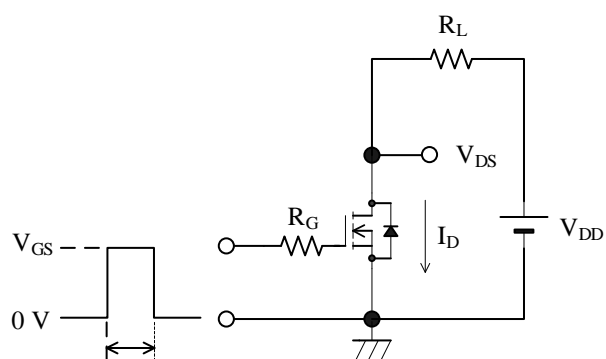
Figure 2 dv/dt Strength

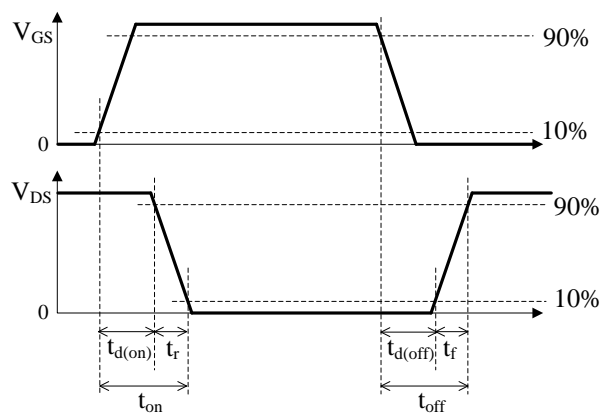
Figure 3 Diode Reverse Recovery Time



Pulse width = 10 μ s

Duty cycle $\leq 1\%$

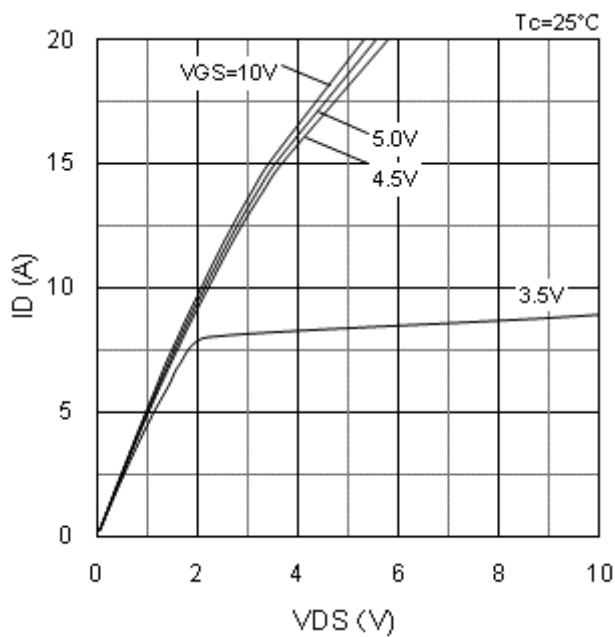
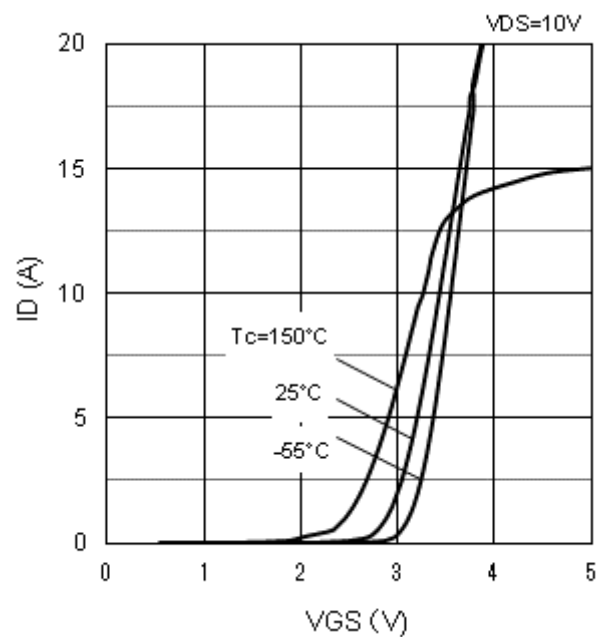
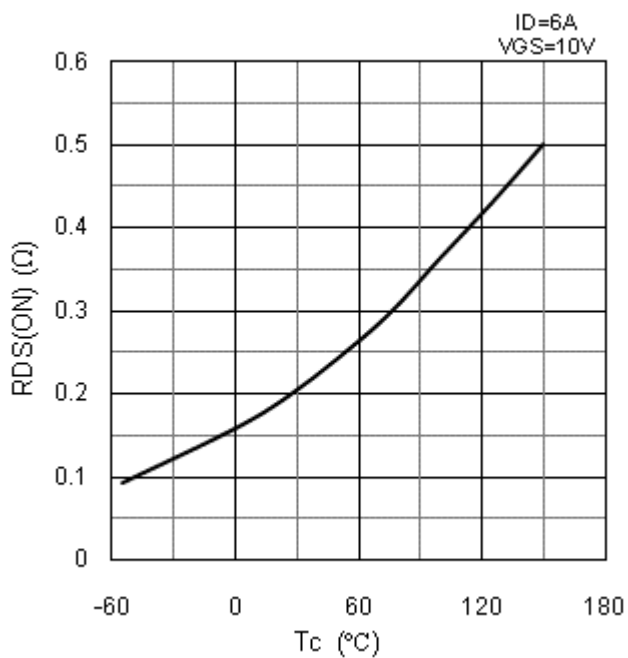
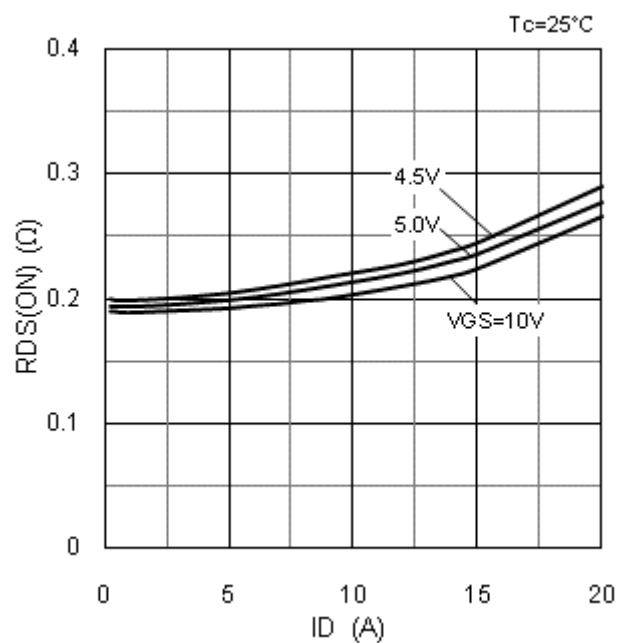
(a) Test Circuit

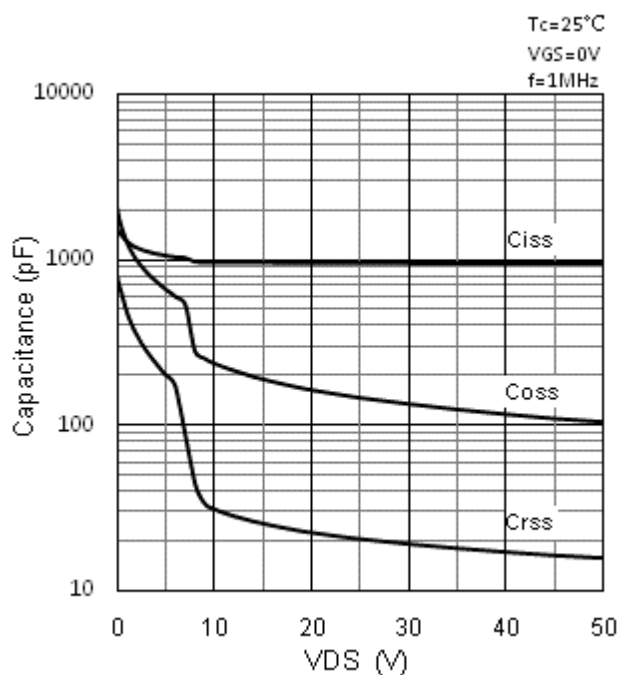
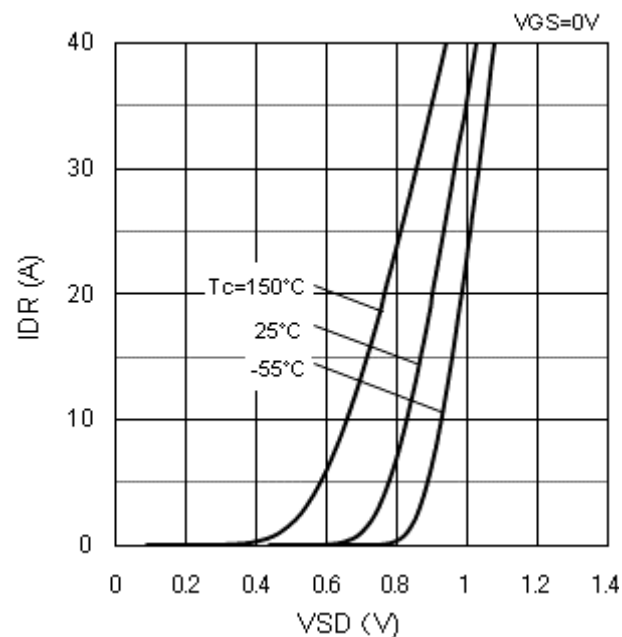
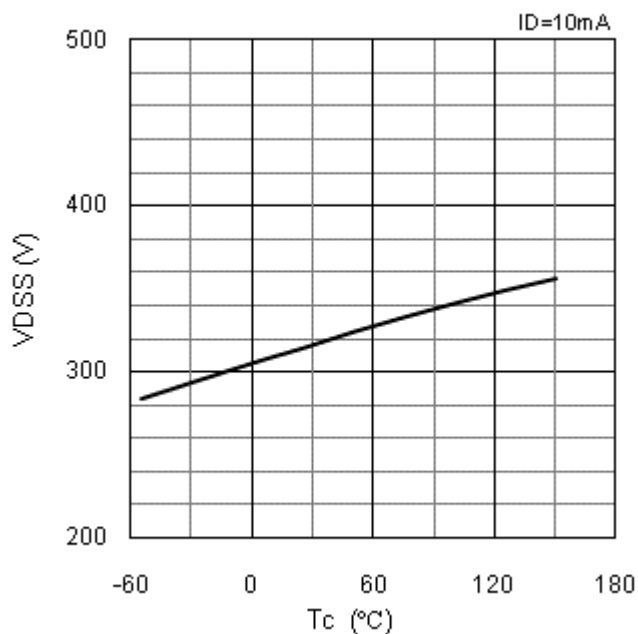
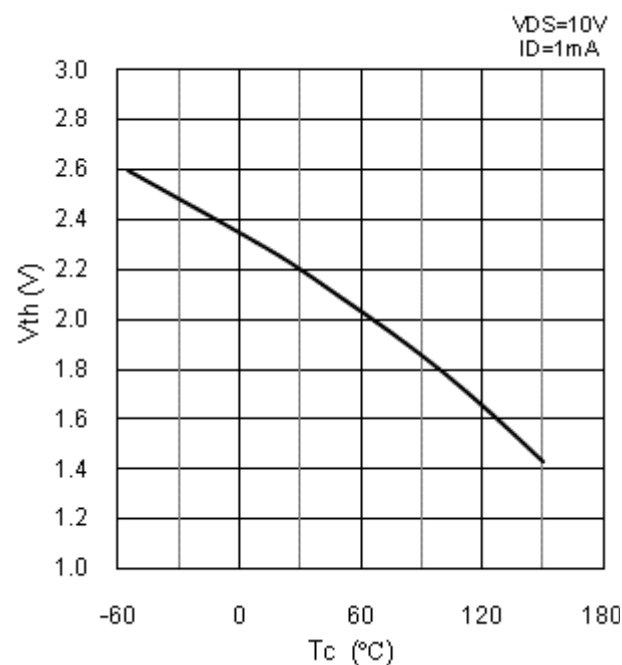


(b) Waveform

Figure 4 Switching Time

Ratings and Characteristics Curves

Figure 5 I_D vs. V_{DS} characteristics (typ.)Figure 6 I_D vs. V_{GS} characteristics (typ.)Figure 7 $R_{DS(ON)}$ vs. T_C characteristics (typ.)Figure 8 $R_{DS(ON)}$ vs. I_D characteristics (typ.)

Figure 9 Capacitance vs. V_{DS} characteristics (typ.)Figure 10 I_{DR} vs. V_{SD} characteristics (typ.)Figure 11 V_{DSS} vs. T_c characteristics (typ.)Figure 12 V_{th} vs. T_c characteristics (typ.)

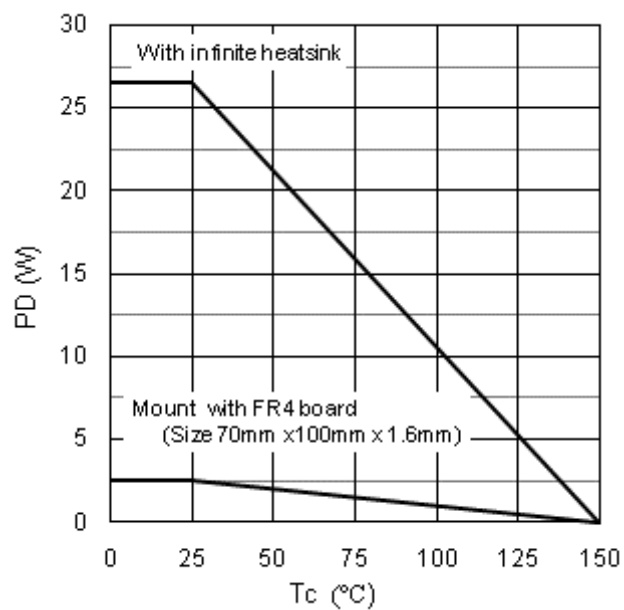
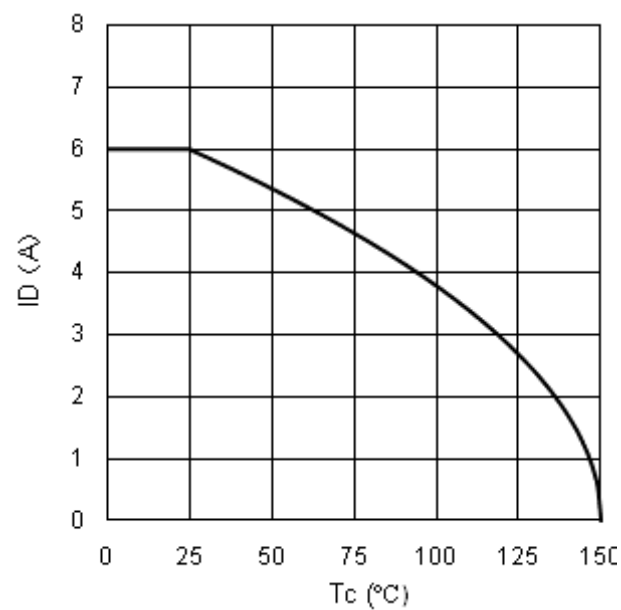
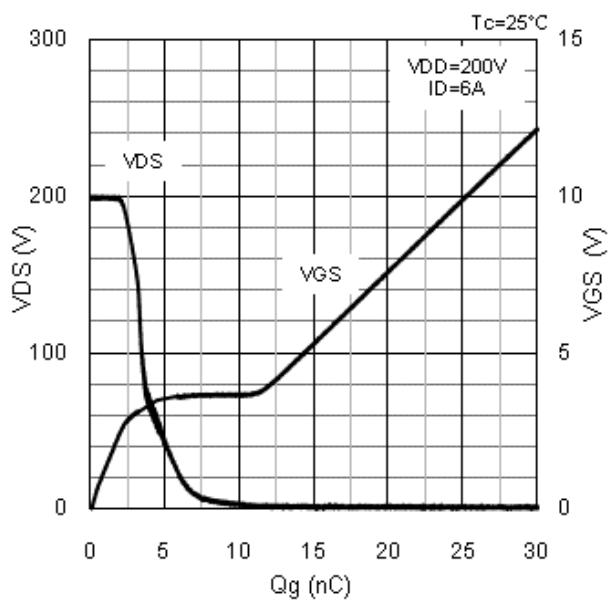
Figure 13 P_D vs. T_C characteristics (typ.)Figure 14 I_D vs. T_C characteristics (typ.)

Figure 15 Dynamic input / output characteristics (typ.)

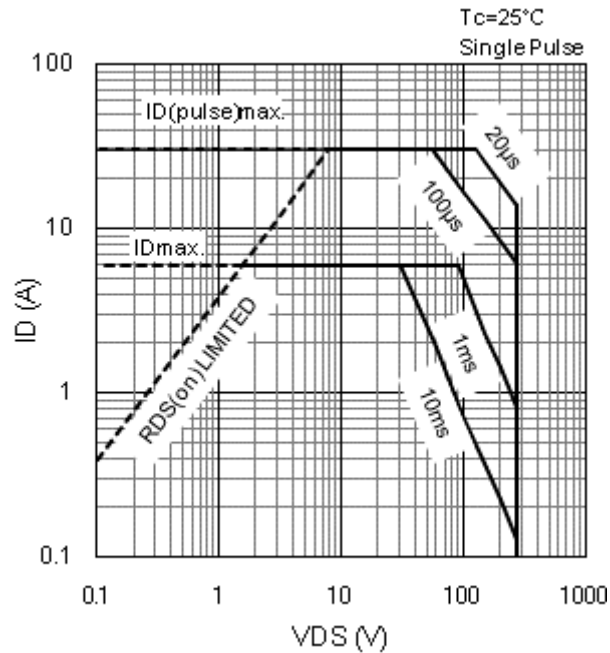


Figure 16 Safe operating area

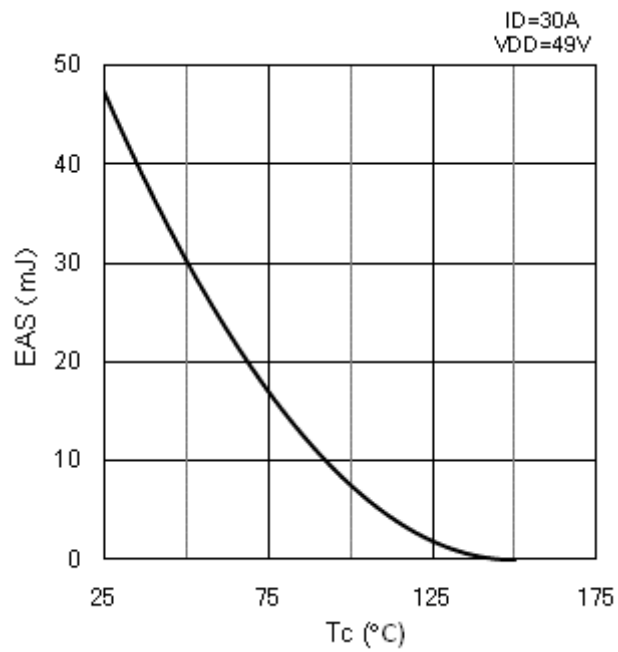
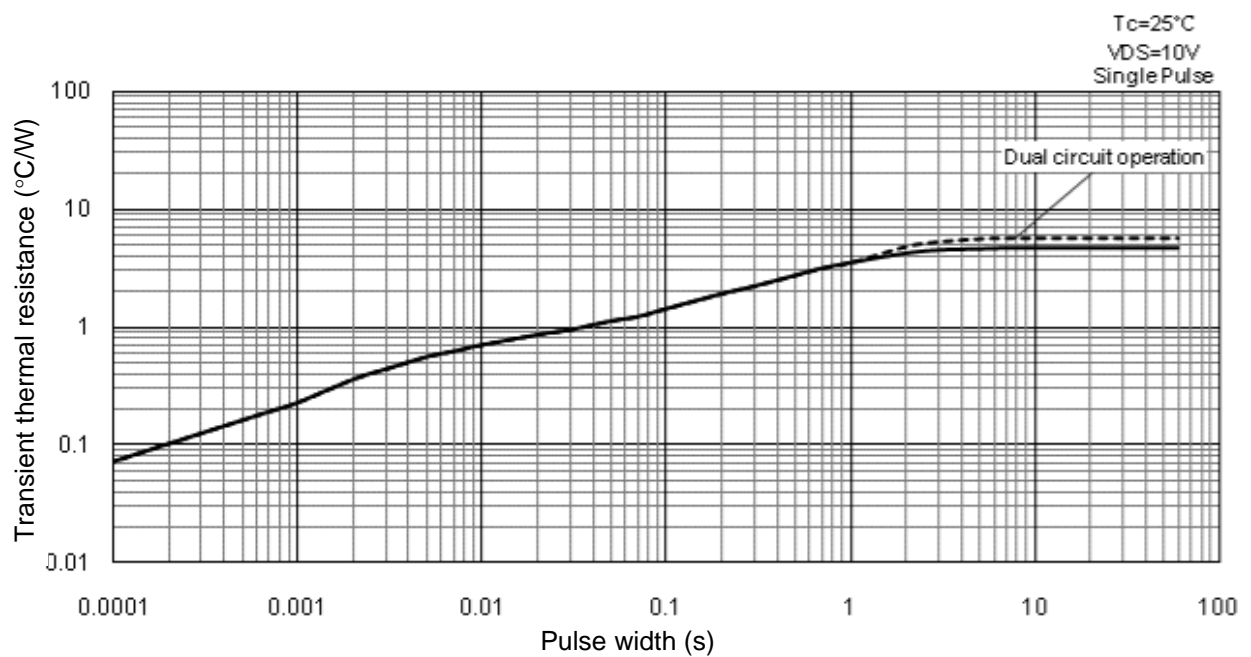
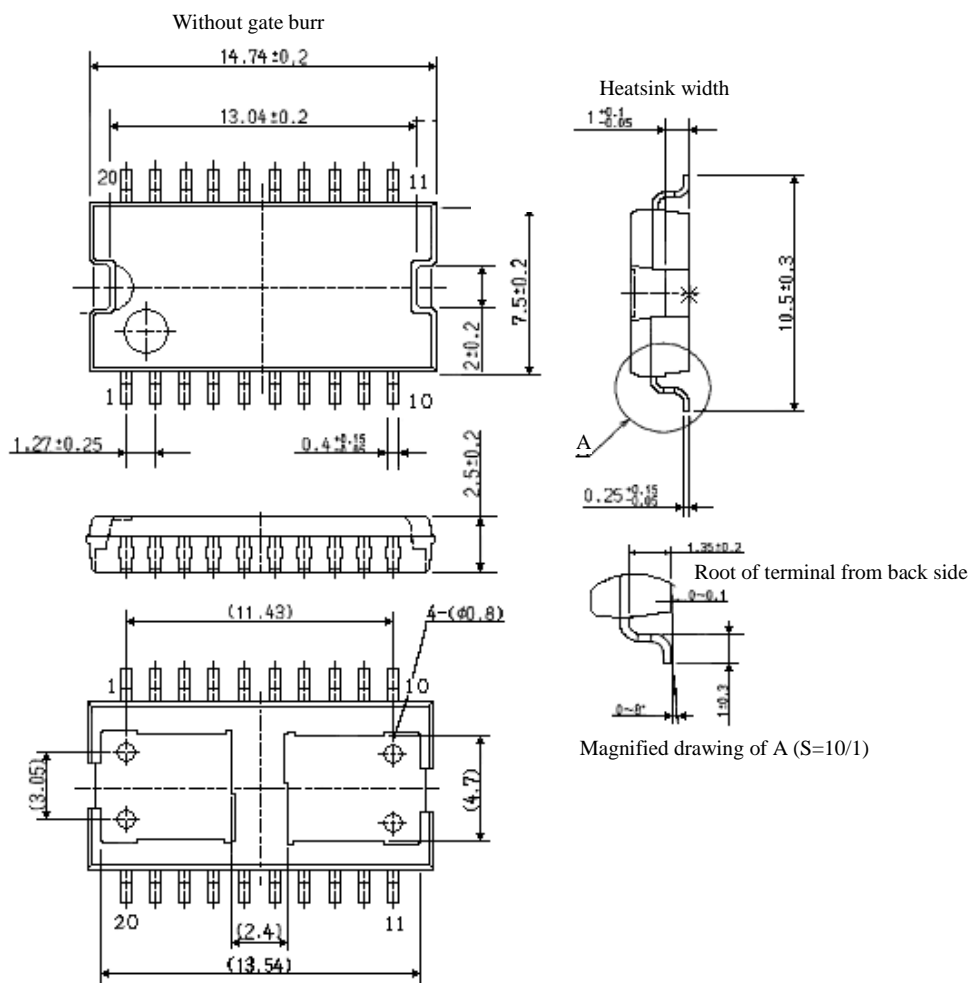
Figure 17. E_{AS} vs. T_c characteristics (typ.)

Figure 18. Transient Thermal Resistance

Physical Dimensions

• HSOP20 package



NOTES:

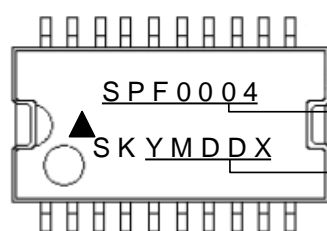
- Dimensions in millimeters
- Lead treatment: Pb-free (RoHS compliant)
- When soldering the products, make sure to minimize the working time, within the following limits:
Reflow (MSL 3)

Preheat: 170 to 190 °C / 110 s

Solder heating: 220 to 250 °C / 60s (3 times)

Soldering iron: 380 ± 10 °C / 3.5 ± 0.5 s, 1 time

Marking Diagram



Part Number

Lot Number

Y is the last digit of the year of manufacture (0 to 9)

M is the month of the year (1 to 9, O, N or D)

DD is the day of the month (01 to 31)

X is control number (A to Z)

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