

**$V_{DS} = 500\text{ V}$ ,  $I_D = 1.5\text{ A}$**   
**3-phase Motor Drive Inverter**  
**SMA5145**



**Data Sheet**

**Description**

The SMA5145 is a MOSFET array for 3-phase brushless DC motor driver ICs.

The product incorporates six low on-resistance N-channel power MOSFETs for 3-phase inverter circuits. The SMA5145 is supplied in a compact SIP12 package of through-hole, achieving a smaller mounting area on a PCB.

**Features**

- $V_{(BR)DSS}$  -----500 V ( $I_D = 100\ \mu\text{A}$ )
- $I_D$ -----1.5 A
- $R_{DS(ON)}$ -----4.0  $\Omega$  max.

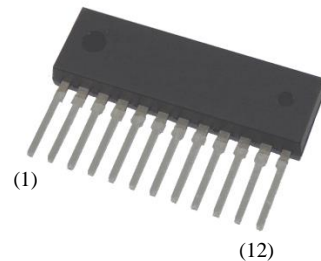
- Bare Lead Frame: Pb-free (RoHS Compliant)
- Built-in Three Half-bridge Circuit Configured by N-channel MOSFET
- Low On-resistance

**Applications**

- 3-phase DC Motor Driver

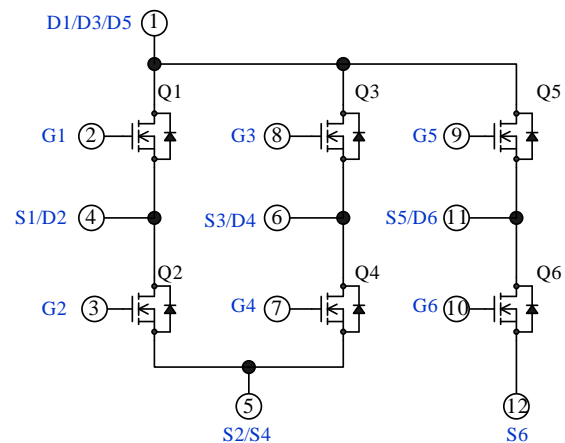
**Package**

SIP12



Not to scale

**Internal Schematic Diagram**



**Absolute Maximum Ratings**Unless otherwise specified,  $T_A = 25\text{ }^\circ\text{C}$ .

Characteristic	Symbol	Test Conditions	Rating	Unit
Drain-to-Source Voltage	$V_{DS}$		500	V
Gate- to-Source Voltage	$V_{GS}$		$\pm 30$	V
Continuous Drain Current	$I_D$		1.5	A
Pulsed Drain Current	$I_{DM}$	Pulse width $\leq 1\text{ ms}$ , duty cycle $\leq 25\%$	3	A
Avalanche Energy	$E_{AS}$	$V_{DD} = 30\text{ V}$ , $L = 10\text{ mH}$ , $I_D = 1.5\text{ A}$ , unclampd, $R_G = 50\ \Omega$	20	mJ
Avalanche Current	$I_{AS}$		1.5	A
Maximum Allowable Power Dissipation	$P_D$	Without heatsink, $T_A = 25\text{ }^\circ\text{C}$ , all element operation	4	W
		$T_C = 25\text{ }^\circ\text{C}$ , all element operation	28	
Junction Temperature	$T_J$		150	$^\circ\text{C}$
Storage Temperature	$T_{STG}$		-40 to 150	$^\circ\text{C}$

## 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	$V_{(BR)DSS}$	$I_D = 100\ \mu\text{A}$ , $V_{GS} = 0\ \text{V}$	500	—	—	V
Drain-to-Source Leakage Current	$I_{DSS}$	$V_{DS} = 500\ \text{V}$ , $V_{GS} = 0\ \text{V}$	—	—	100	$\mu\text{A}$
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{GS} = \pm 30\ \text{V}$	—	—	$\pm 100$	nA
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = 10\ \text{V}$ , $I_D = 1\ \text{mA}$	2.0	—	4.0	V
Static Drain-to-Source On-resistance	$R_{DS(ON)}$	$I_D = 1.0\ \text{A}$ , $V_{GS} = 10\ \text{V}$	—	3.5	4.0	$\Omega$
Input Capacitance	$C_{iss}$	$V_{DS} = 10\ \text{V}$ , $V_{GS} = 0\ \text{V}$ , $f = 1\ \text{MHz}$	—	198	—	pF
Output Capacitance	$C_{oss}$		—	83	—	
Reverse Transfer Capacitance	$C_{rss}$		—	9	—	
Turn-on Delay Time	$t_{d(ON)}$	$V_{DD} = 280\ \text{V}$ , $I_D = 1.0\ \text{A}$ , $V_{GS} = 10\ \text{V}$ , $R_L = 280\ \Omega$ , $R_G = 50\ \Omega$	—	20	—	ns
Turn-on Rise Time	$t_r$		—	26	—	
Turn-off Delay Time	$t_{d(OFF)}$		—	50	—	
Turn-off Fall Time	$t_f$		—	40	—	
Total Gate Charge	$Q_G$	$V_{DD} = 280\ \text{V}$ , $I_D = 1.0\ \text{A}$ , $V_{GS} = 10\ \text{V}$	—	5.9	—	nC
Gate-to-Source Charge	$Q_{GS}$		—	1.2	—	nC
Gate-to-Drain Charge	$Q_{GD}$		—	2.8	—	nC
Source-to-Drain Diode Forward Voltage	$V_{SD}$	$I_{SD} = 1.0\ \text{A}$ , $V_{GS} = 0\ \text{V}$	—	1.0	1.5	V
Source-to-Drain Diode Reverse Recovery Time	$t_{rr}$	$I_{SD} = 1.0\ \text{A}$ , $V_{GS} = 0\ \text{V}$ , $di/dt = 100\ \text{A}/\mu\text{s}$	—	75	—	ns

## Thermal Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Thermal Resistance (Junction-to-Ambient)	$R_{\theta JA}$	All Element Operation	—	—	31.25	$^\circ\text{C}/\text{W}$
Thermal Resistance (Junction-to-Case)	$R_{\theta JC}$	All Element Operation	—	—	4.46	$^\circ\text{C}/\text{W}$

## Mechanical Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Unit
Package Weight		—	4.0	—	g

Derating Curves

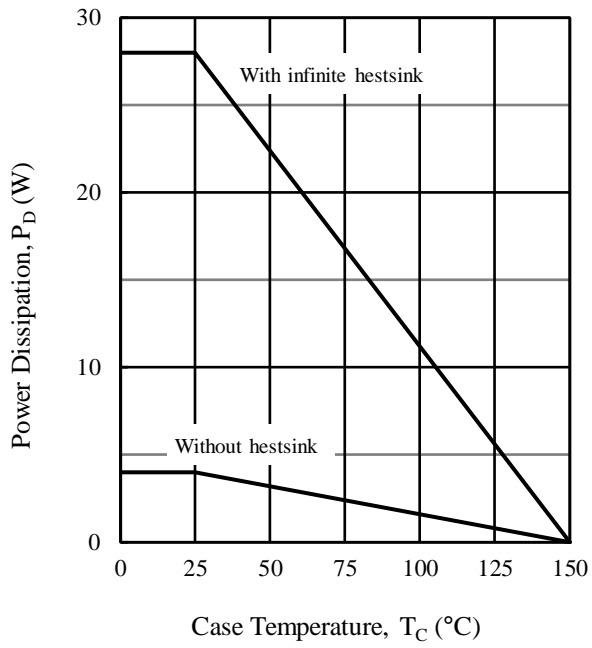


Figure 1.  $P_D$  vs.  $T_C$

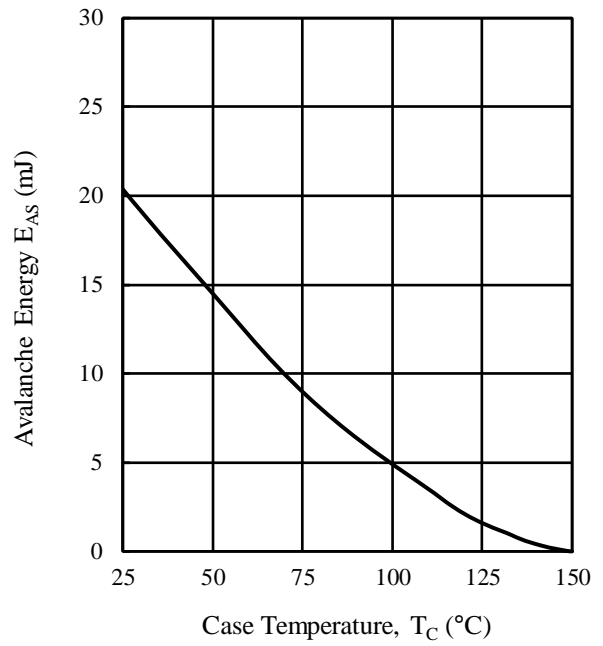


Figure 2.  $E_{AS}$  vs.  $T_J$  (Single Pulse)

Characteristic Curves

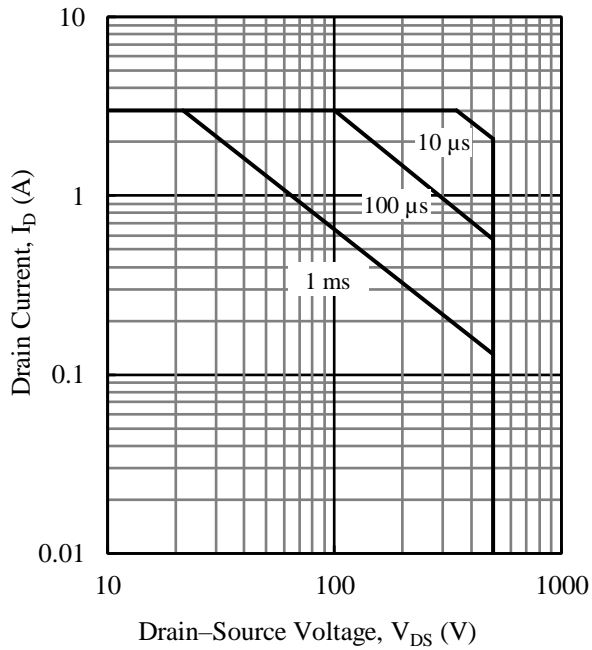


Figure 3. Safe Operating Area (Single pulse,  $T_J = 25\text{ }^\circ\text{C}$ )

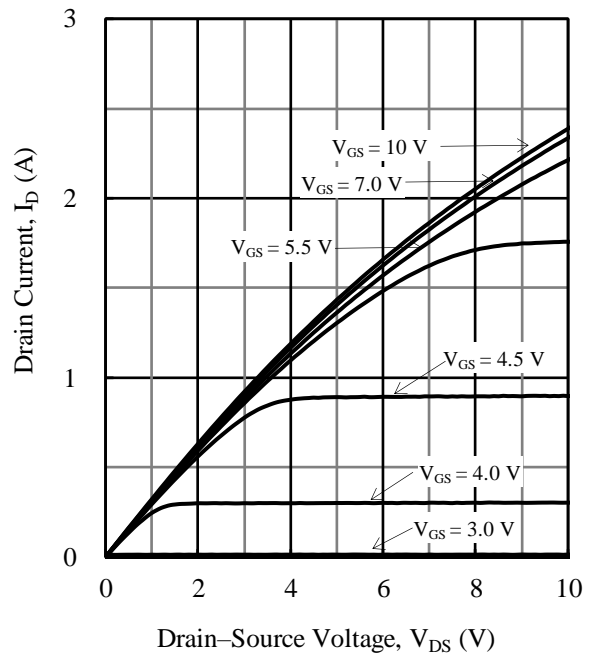


Figure 4. Typical Characteristics:  $I_D$  vs.  $V_{DS}$  ( $T_J = 25\text{ }^\circ\text{C}$ )

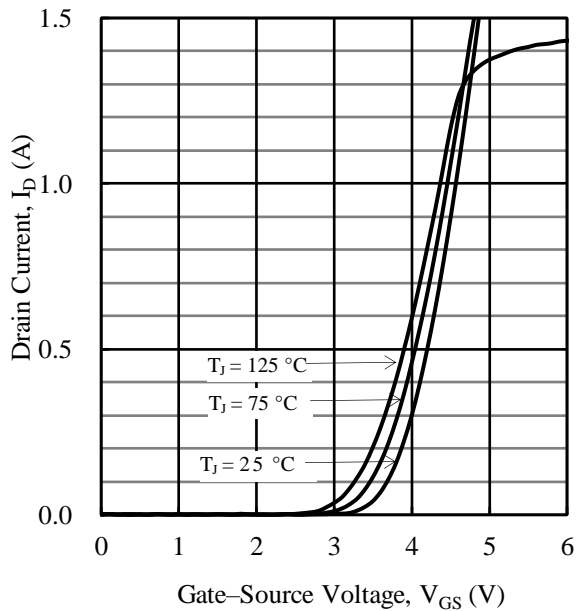


Figure 5. Typical Characteristics:  $I_D$  vs.  $V_{GS}$  ( $V_{DS} = 10\text{ V}$ )

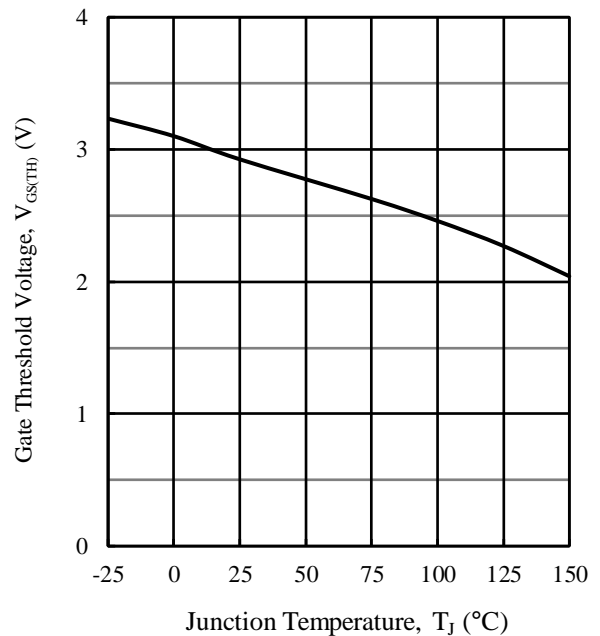


Figure 6. Typical Characteristics:  $V_{GS(TH)}$  vs.  $T_J$  ( $V_{DS} = 10\text{ V}$ ,  $I_D = 1\text{ mA}$ )

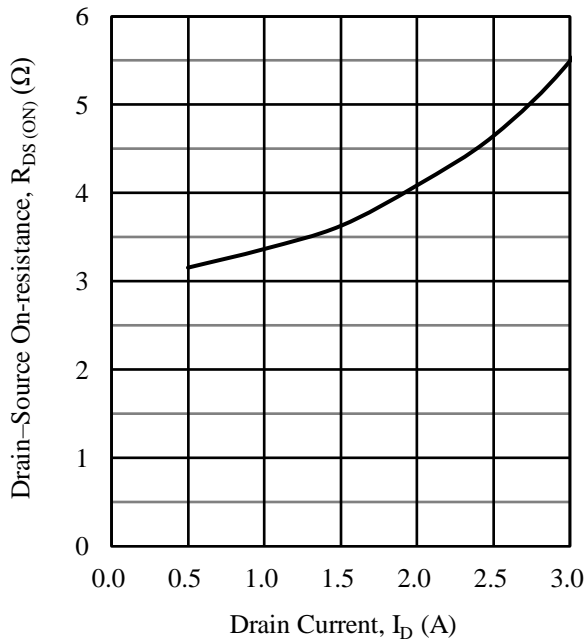


Figure 7. Typical Characteristics:  
 $R_{DS(ON)}$  vs.  $I_D$  ( $V_{GS} = 10$  V,  $T_J = 25$  °C)

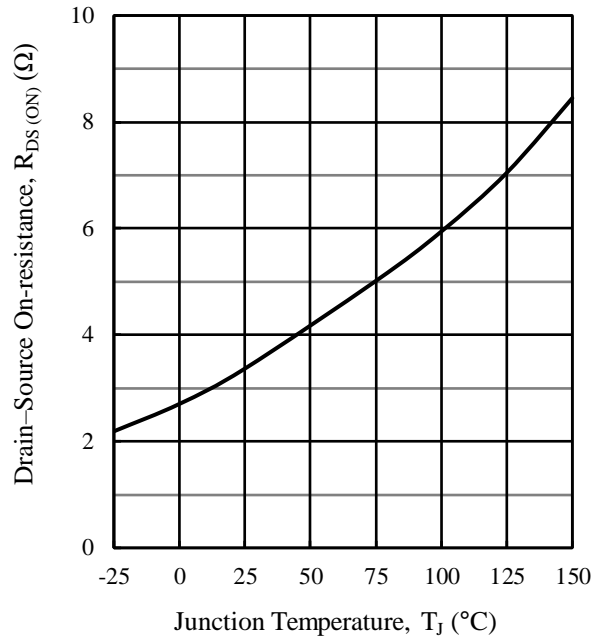


Figure 8. Typical Characteristics:  
 $R_{DS(ON)}$  vs.  $T_J$  ( $V_{GS} = 10$  V,  $I_D = 1.0$  A)

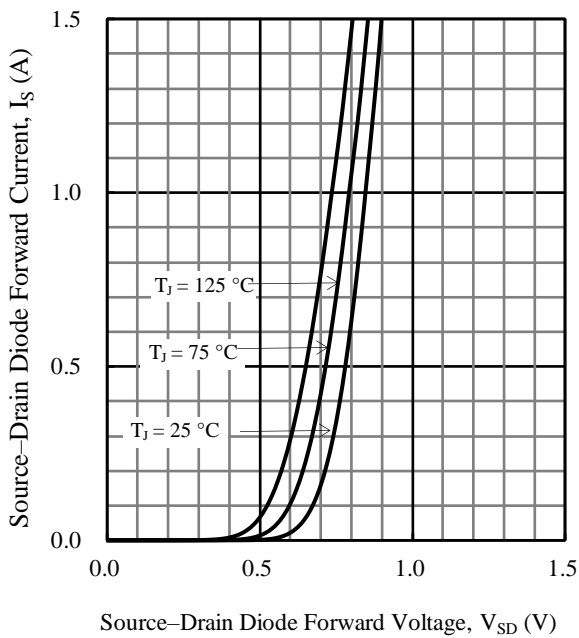


Figure 9. Typical Characteristics:  
 $I_S$  vs.  $V_{SD}$  ( $V_{GS} = 0$  V)

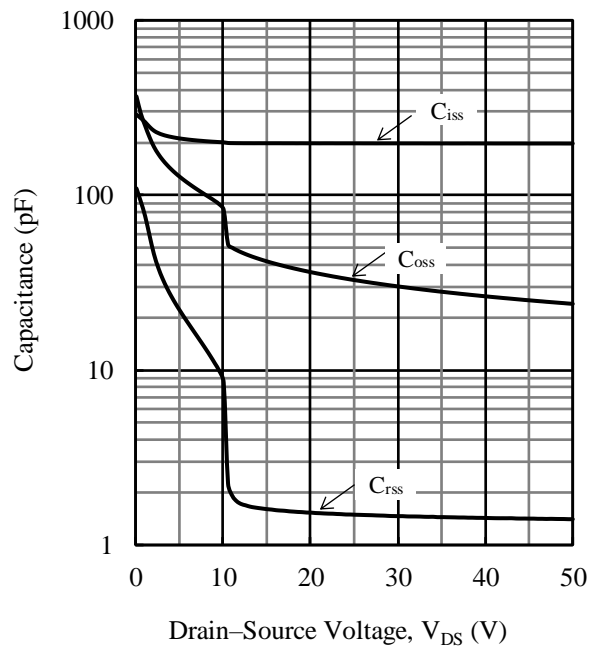


Figure 10. Typical Characteristics:  
Capacitance vs.  $V_{DS}$   
( $f = 1$  MHz,  $V_{GS} = 0$  V)

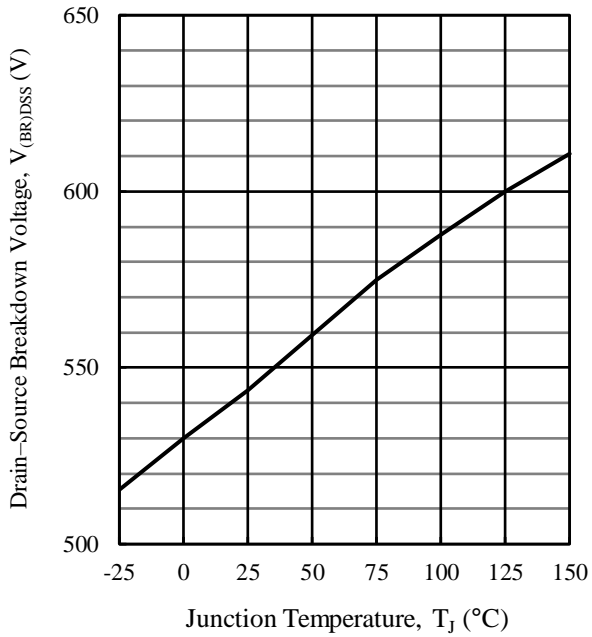


Figure 11. Typical Characteristics:  
 $V_{(BR)DSS}$  vs.  $T_J$  ( $I_D = 100 \mu A$ ,  $V_{GS} = 0 V$ )

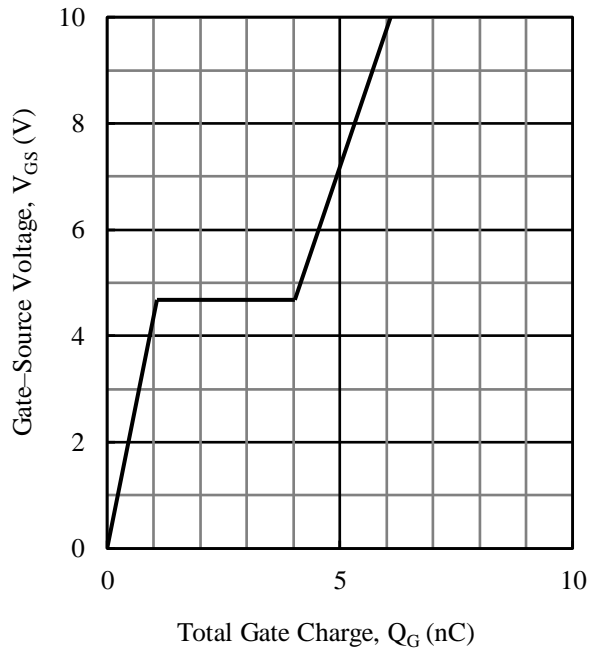


Figure 12. Typical Characteristics:  
 $V_{GS}$  vs.  $Q_G$  ( $I_D = 1.0 A$ ,  $V_{DD} = 10 V$ )

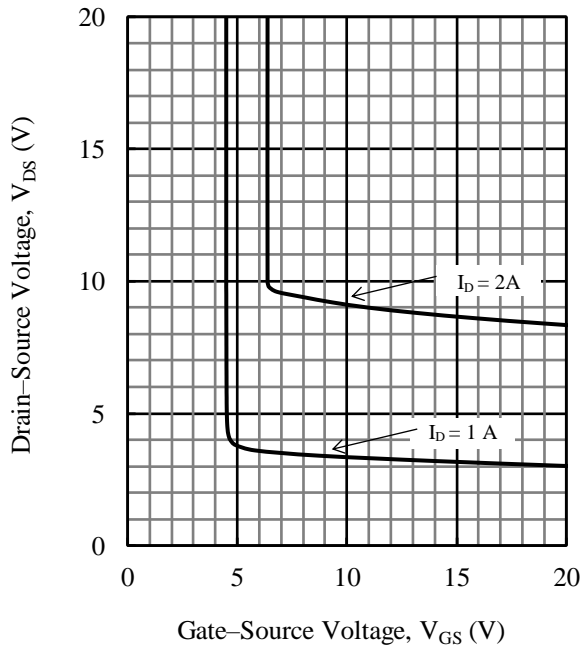


Figure 13. Typical Characteristics:  
 $V_{DS}$  vs.  $V_{GS}$  ( $T_A = 25 \text{ }^\circ\text{C}$ )

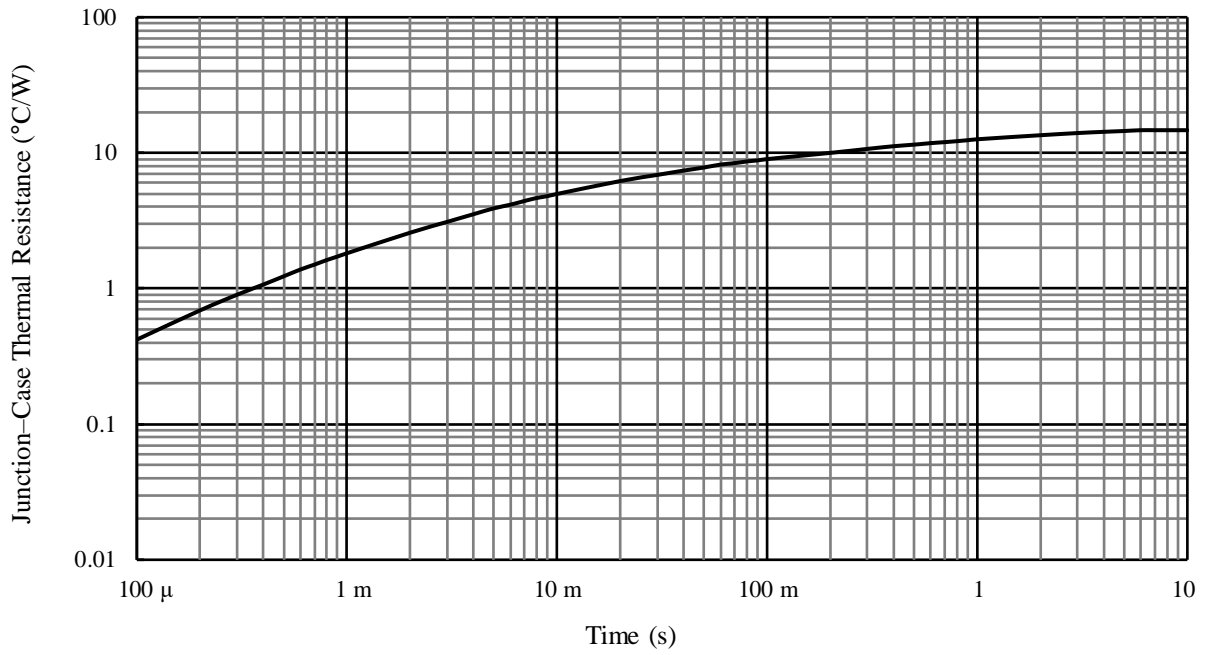


Figure 14. Transient Thermal Resistance Characteristics  
( $V_{DS} < 10\text{ V}$ ,  $T_C=25^\circ\text{C}$ , Single Pulse, 1 Element Operation)



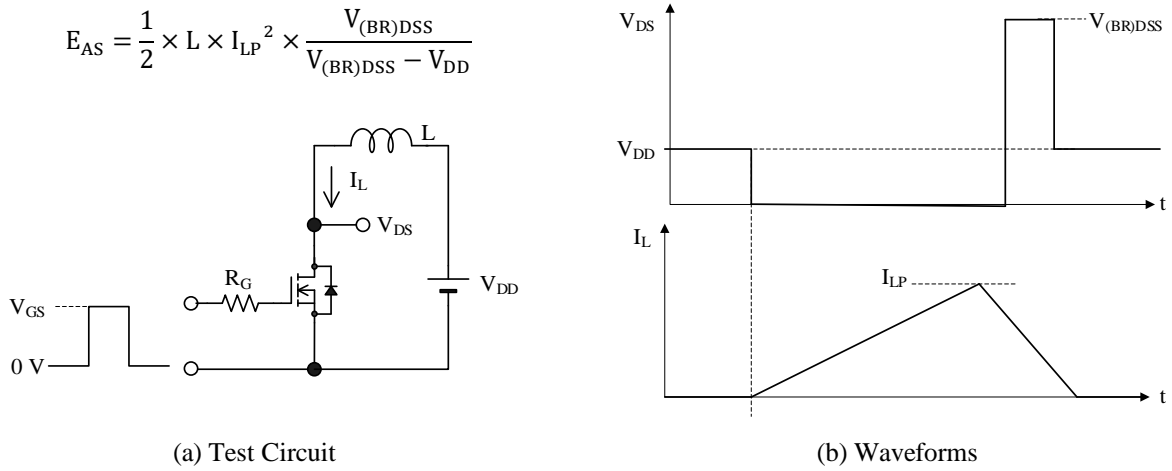


Figure 15. Avalanche Energy Test

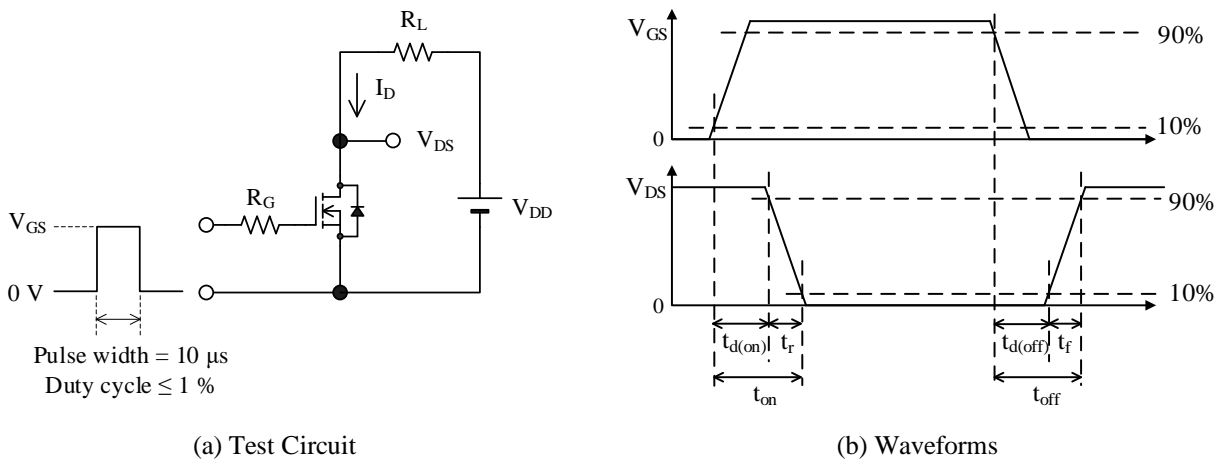
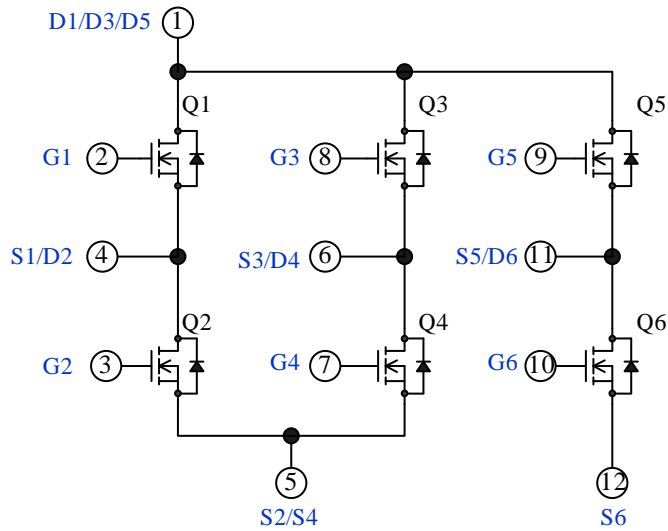


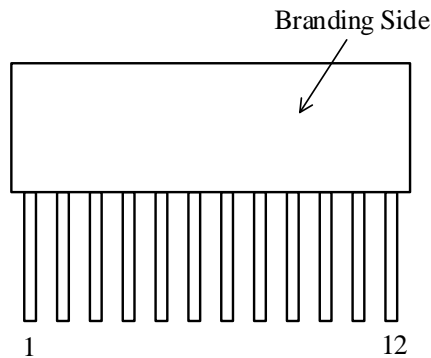
Figure 16. Switching Time Test

# SMA5145

## Internal Schematic Diagram



## Pin Configuration Definitions

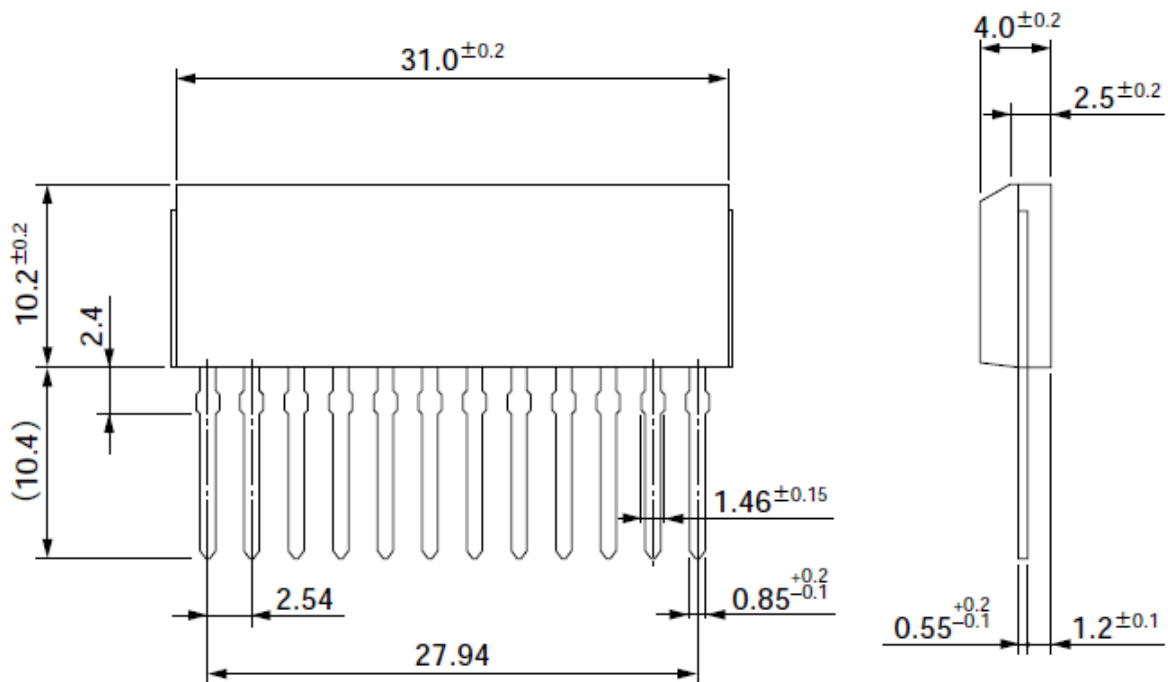


Pin Number	Name	Description	Pin Number	Name	Description
1	D1/D3/D5	Q1, Q3, Q5 drain	7	G4	Q4 gate
2	G1	Q1 gate	8	G3	Q3 gate
3	G2	Q2 gate	9	G5	Q5 gate
4	S1/D2	Q1 source, Q2 drain	10	G6	Q6 gate
5	S2/S4	Q2, Q4 source	11	S5/D6	Q5 source, Q6 drain
6	S3/D4	Q3 source, Q4 drain	12	S6	Q6 source

# SMA5145

## Physical Dimensions

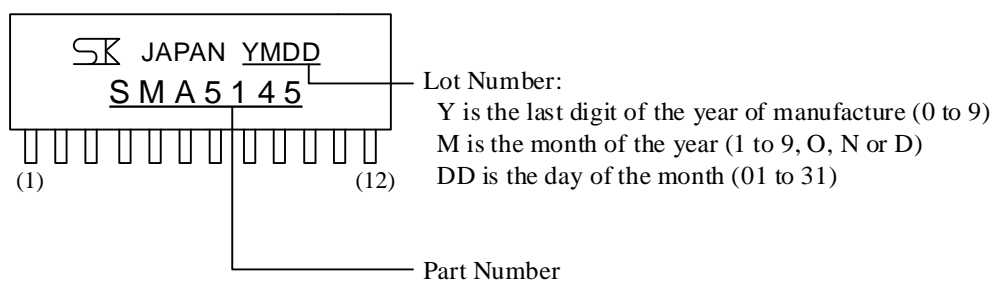
- SIP12



### NOTES:

- Dimensions in millimeters
- Bare lead frame: Pb-free (RoHS compliant)
- When soldering the products, it is required to minimize the working time within the following limits:
  - Flow:  $260\text{ }^{\circ}\text{C} / 10\text{ s}$ , 1 time
  - Soldering Iron:  $350\text{ }^{\circ}\text{C} / 3.5\text{ s}$ , 1 time (Soldering should be at a distance of at least 1.5 mm from the body of the product.)
  - Soldering should be at a distance of at least 1.5 mm from the body of the product

## Marking Diagram



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