QS65SCM65D2P

Silicon Carbide (SiC),
MOSFET – SiC,
31mohm, 650V, M2

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General Features

- Fast Switching with Low EMI/RFI
- Simple to Drive and Easy to ParalleI
- Low Gate Charge Minimize Switching Loss
- Short Circuit Withstand Rated
- Improved Efficiency

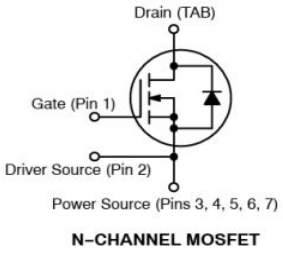
General Features

PARAMETER	VALUE	UNIT
$V_{(BR)DSS}$	650	V
$R_{DS(ON)}$ MAX	55 @ 20V	$m\Omega$
I_D MAX	65	A
E_{ON}	0.19	mJ
E_{OFF}	0.10	mJ
$V_{GS(TH)}$	3.0~5.0	V

General Features

- SMPS (Switching Mode Power Supplies)
- Solar Inverters
- UPS (Uninterruptable Power Supplies)
- Energy Storage

General Features



N–CHANNEL MOSFET

Part Number	Package	Marking
QS65SCM65D2P	D2PAK-7L	Q

MAXIMUM RATINGS

(TJ = 25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain – to-Source Voltage	V_{DSS}	650	V
Gate – to – Source Voltage	V_{GS}	-10 /$+25$	V

Recommended Operation Value of gate – Source Voltage		$T_C < 175℃$	V_{GSOP}	-5 /$+20$	V
Continuous Drain current	Steady state	$T_C = 25℃$	I_D	65	A
Power Dissipation	Steady state	$T_C = 25℃$	P_D	294	W
Continuous Drain current	Steady state	$T_C = 100℃$	I_D	46	A
Pulsed Drain Current		$T_C = 25℃$	I_{DM}	162	A
Operating Junction and Storage Temperature			T_J, T_{stg}	$-55\ TO$ $+\ 175$	℃
Source Current			I_S	145	A
Single Pulse Drain to Source Avalanche Energy (I_L=12A_{pk}, L = 1mH (From Packaging)			EA_S	72	mJ

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, then device functionality should not be assumed, damage may occur andreliability may be affected.

THERMAL CHARACTERISTICS

Parameter	Symbol	Max	Unit
Junction-to-case – Steady State	$R_{\theta JC}$	0.51	℃/W
Junction-to-Ambient Steady State	$R_{\theta JA}$	40	℃/W

ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain – to – Source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 1mA$	650	–	–	V
Drain – to – Source breakdown voltage temperature coefficient	$V_{(BR)DSS}/T_J$	$I_D = 20mA\ refer\ to\ 25℃$	–	0.13	–	V/℃
Zero gate voltage drain current	$I_{GSS}+$	$V_{GS} = +20V, V_{DS} = 0V$	–	–	100	nA
Gate – to – Source Leakage Current	$I_{GSS}-$	$V_{GS} = -10V, V_{DS} = 0V$	–	–	-100	μA
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS},\ I_D = 8mA$	3.0	–	5.0	V

Recommended Gate Voltage	V_{GOP}		−5	–	+18	V
Drain-to-Source On Resistance	$R_{DS(ON)}$	$V_{GS} = 20V, I_D = 25A,$	–	55	70	$m\Omega$
		$V_{GS} = 18V, I_D = 25A$	–	71	–	
		$V_{GS} = 20V, I_D = 25A$ $T_J = 175°C$	–	48	–	
CHARGES, CAPACITANCES & GATE RESISTANCE						
Input capacitance	C_{ISS}	$V_{GS} = 0, V_{DS} = 400V,$ $f = 1MHz$	–	1946	–	pF
Output capacitance	C_{OSS}		–	182	–	
Reverse transfer capacitance	C_{RSS}		–	7.6	–	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -5/18, V_{DS} = 520V,$ $I_{DS} = 25A$	–	105	–	nC
Gate-to-Source Charge	Q_{GS}		–	29	–	
Gate-to-Drain Charge	Q_{GD}		–	33	–	
Gate-Resistance	R_G	$f = 1MHz$	–	8.6	–	Ω

SWITCHING CHARACTERISTICS

Turn-on delay time	$t_{d(on)}$	$V_{GS} = -3.5/18, V_{DS} = 400V,$ $I_D = 25A, R_G = 2.0\Omega$ $inductive\ load$	–	21	–	ns
Rise time	t_r		–	17	–	
Turn-Off delay time	$t_{d(off)}$		–	27	–	
Fall time	t_f		–	15	–	
Turn-On Switching loss	E_{ON}		–	0.19	–	μJ
Turn-Off Switching loss	E_{OFF}		–	0.10	–	
Total Switching Loss	E_{TOT}		–	80	–	
SOURCE-DRAIN DIODE CHARACTERISTICS						
Continuous Source-Drain Diode Forward Current	I_{SD}	$Maximum\ Ratings$	–	–	65	A
Forward Diode Voltage	V_{SD}	$V_{GS} = 0V$ $I_S = 25A$	–	4.2	–	V
Reverse Recovery Time	t_{RR}	$V_{GS} = 0V, I_F = 25A,$ $\frac{di}{dt} = 1000A/\mu S$	–	19	–	ns
Reverse Recovery Charge	Q_{RR}		–	61	–	nC
Peak Reverse Recovery Current	I_{mm}		–	4.8	–	A

Figure 1: Typical Output Characteristics

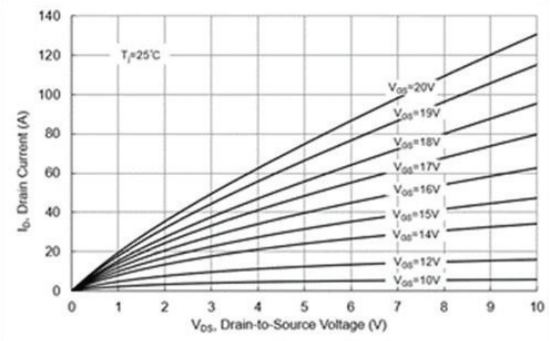


Figure 2: Typical Output Characteristics

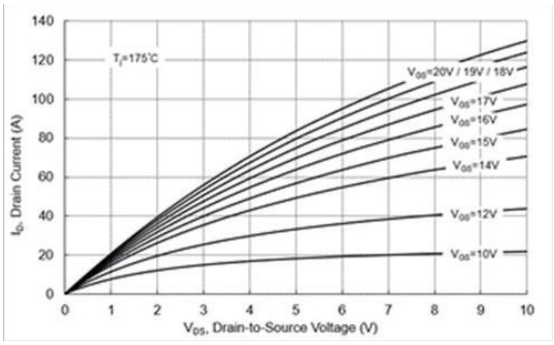


Figure 3: Typical Drain-to-Source ON resistance vs. Gate Voltage

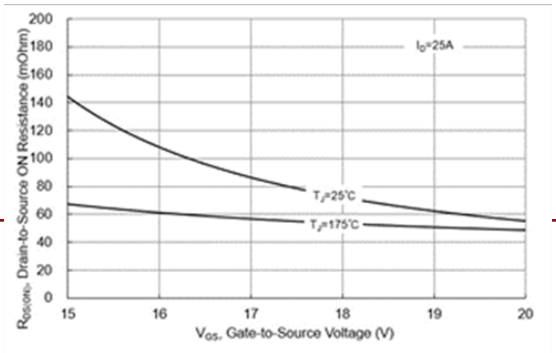


Figure 4: Typical Transfer Characteristics

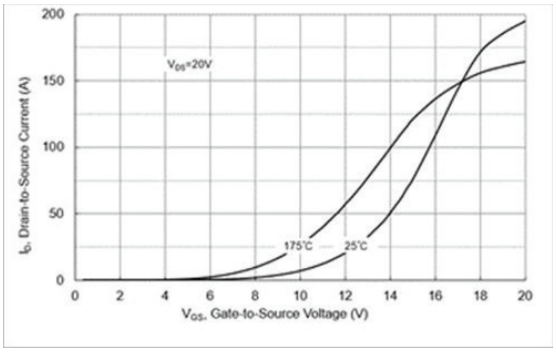


Figure 5: Typical Drain-to-Source ON Resistance

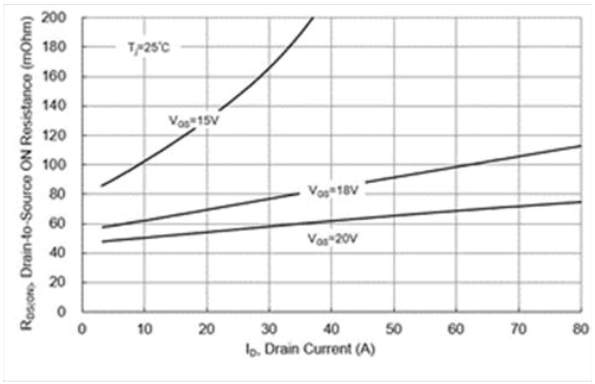


Figure 6: Typical Drain-to-Source ON Resistance

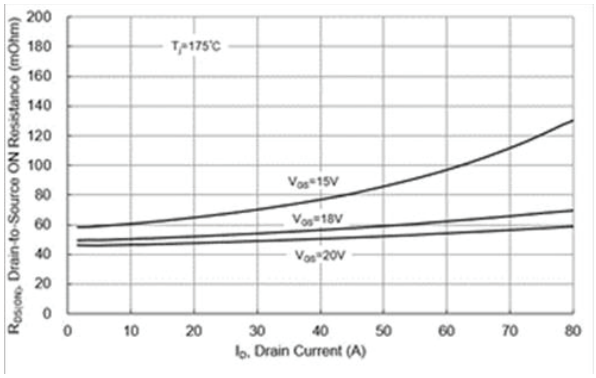


Figure 7: Typical Body Diode Characteristics

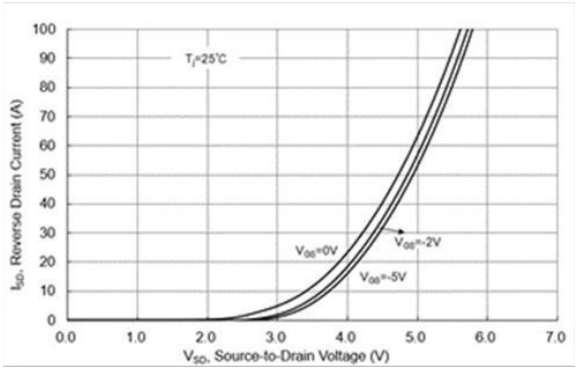


Figure 8: Typical Body Diode Characteristics

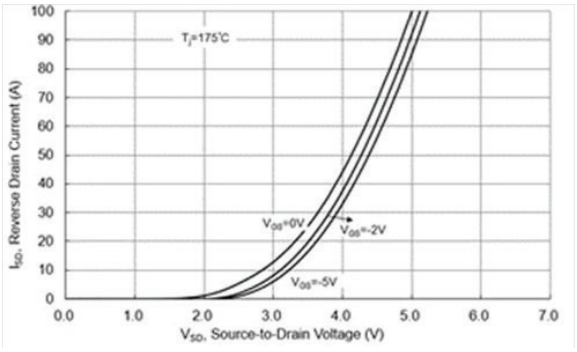


Figure 9: 3rd Quadrant Characteristics

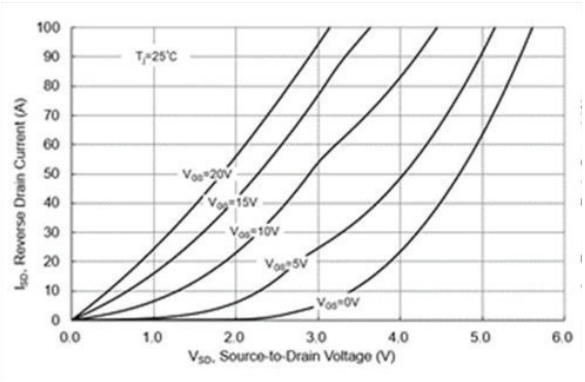


Figure 10: 3rd Quadrant Characteristics

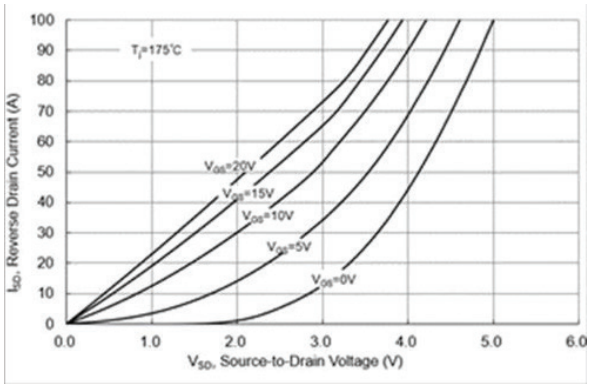


Figure 11: Typical Drain-to-Source On-resistance vs Junction Temperature

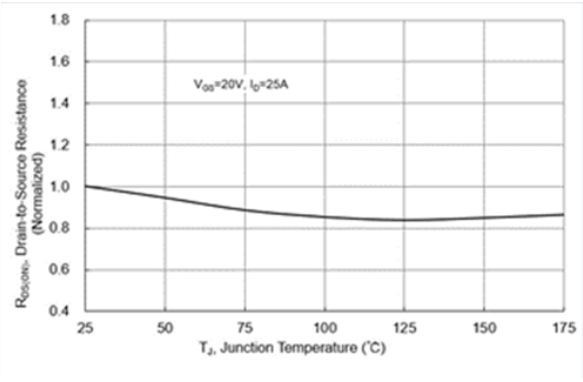


Figure 12: Typical Breakdown Voltage vs. Junction Temperature

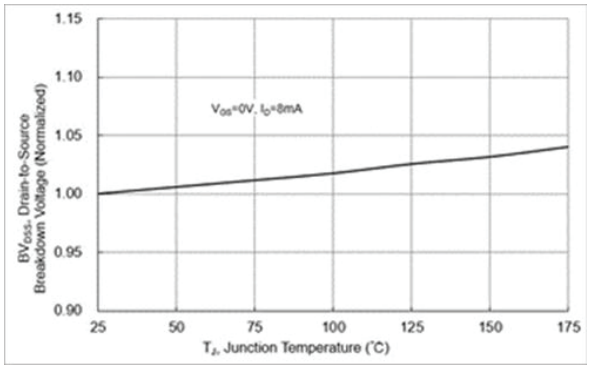


Figure 13: Typical Threshold Voltage vs, Junction Temperature

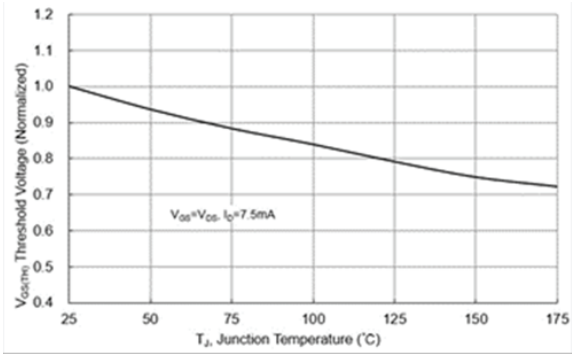


Figure 14: Typical Capacitance vs. Drain-to-Source Voltage

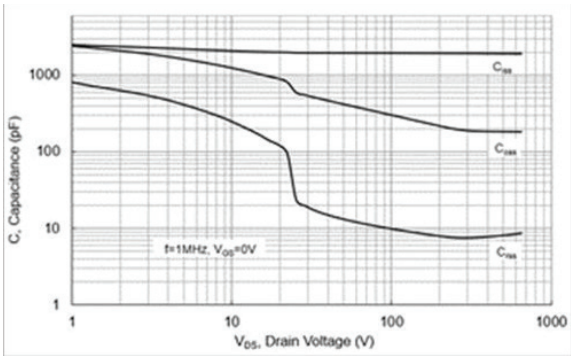


Figure 15: Typical Gate Charge vs. Gate-to-Source Voltage

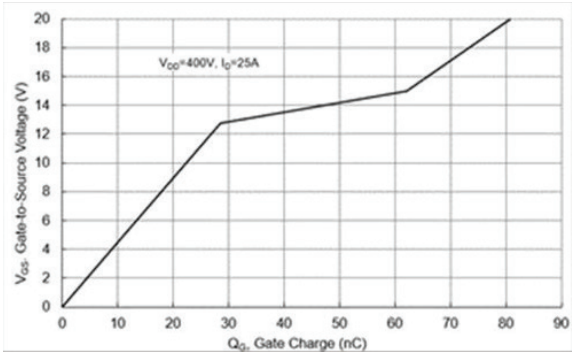


Figure 16: Switching Times vs RG

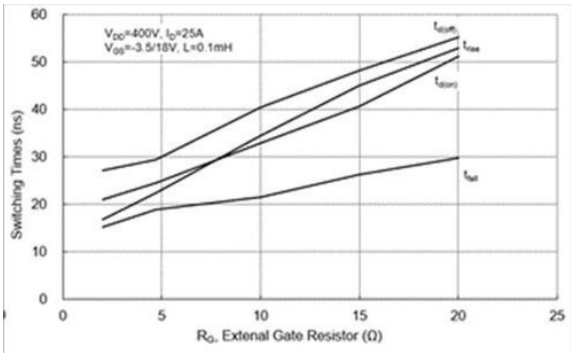


Figure 17: Switching Loss vs RG

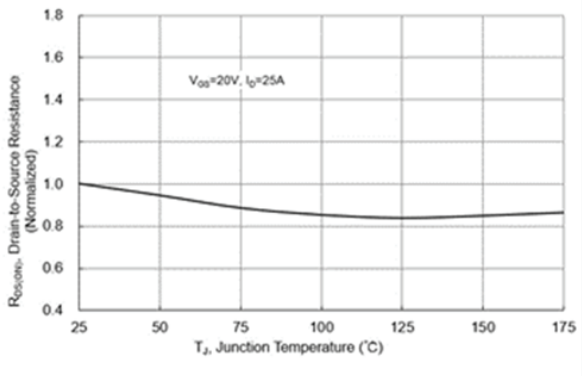


Figure 18: Switching Loss vs. Drain Current

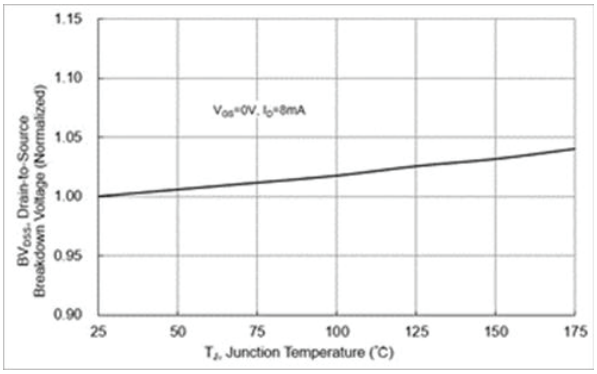


Figure 19: Thermal Impedance Junction-to-Case

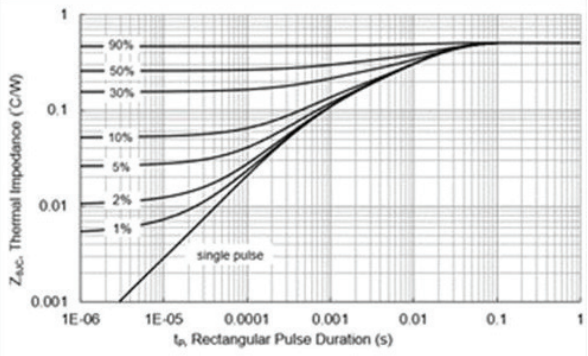


Figure 20: Maximum Peak Current Capability

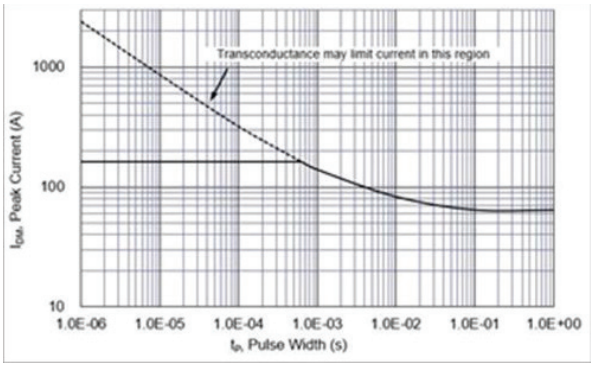


Figure 21: Maximum Power Dissipation vs. Case Temperature

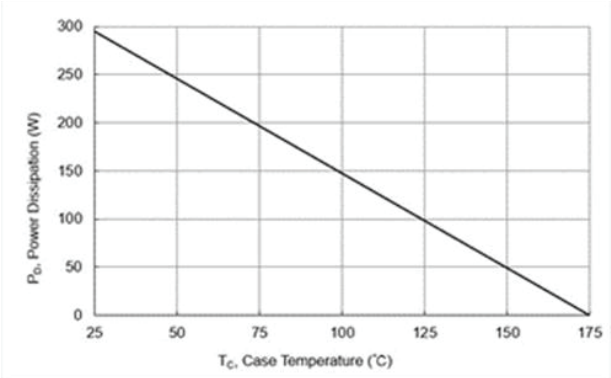


Figure 22: Maximum Continuous Drain Current vs. Case Temperature

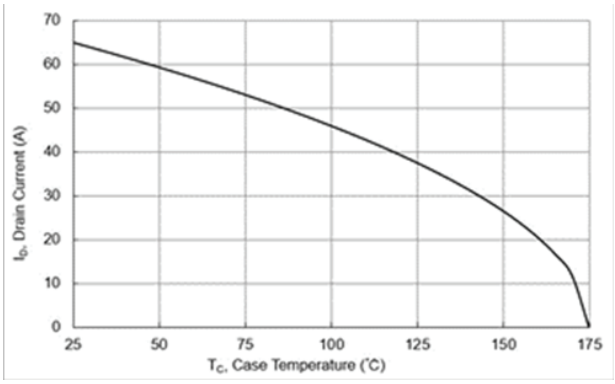
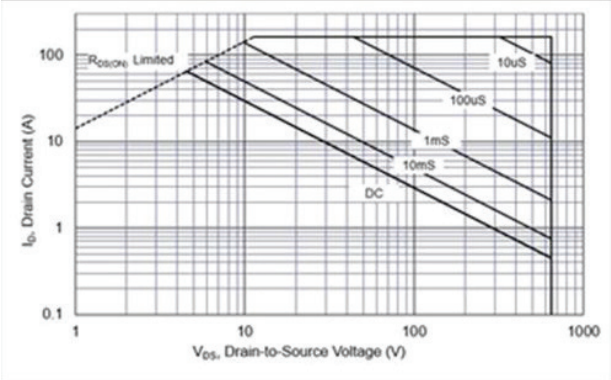
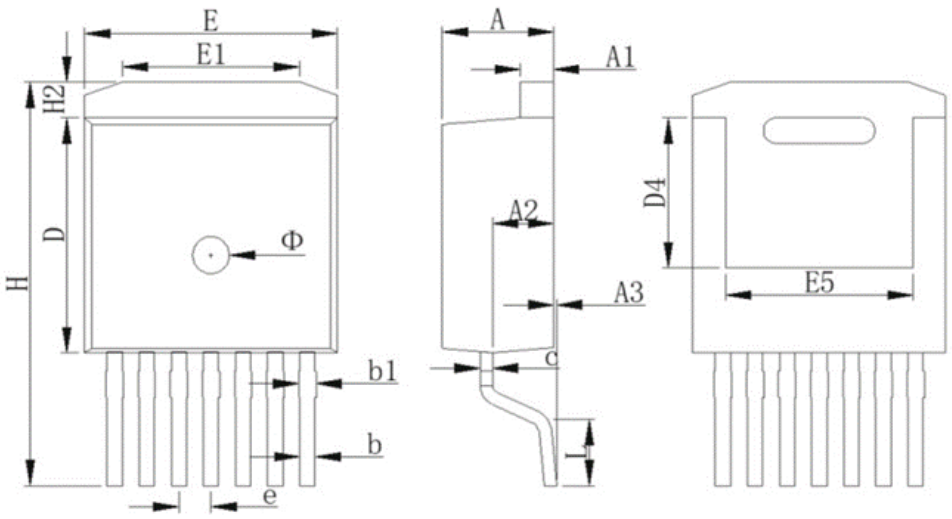


Figure 23: Maximum Forward Safe Operation Area



Package Dimensions

TO-263-7L



Symbol	MIN(mm)	MAX(mm)
A	4.300	4.560
A1	1.200	1.400
A2	2.450	2.750
A3	0.000	0.250
b	0.500	0.700
b1	0.600	0.900
c	0.450	0.600
D	8.930	9.230
D4	4.650	4.950
E	10.080	10.280
E1	6.500	7.500
E5	6.820	7.620
e	2.40	
H	15.000	16.000
H2	0.980	1.420
L	1.900	2.500
L1	6.480	7.080
Θ	1.400	1.600

Disclaimer:

The products described in this datasheet are intended for general-purpose applications, and their specifications and performance characteristics have been established under standard operating conditions. They are not specifically designed or authorized for use in life-critical or life-support systems. Life-critical systems are those in which the failure of a semiconductor device could lead to loss of life, severe injury, or severe damage to property.

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