Product Summary

V_{CE}	$V_{CE(sat)}$	I_C(Tc=100℃)
650V	1.6V	20A

合肥矽普半导体
Siliup Semiconductor Technology Co.Ltd
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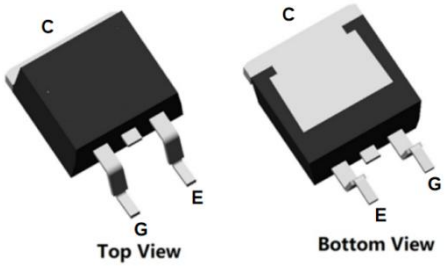
Feature

- High ruggedness performance
- 10μs short circuit capability
- Positive VCE (sat) temperature coefficient
- High efficiency for motor control
- Excellent current sharing in parallel operation

Applications

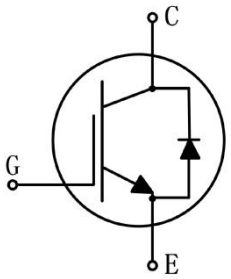
- Home appliances
- Motor drives
- General inverter

Package

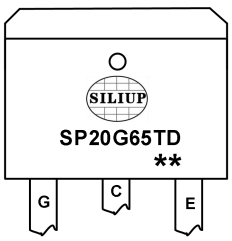


TO-263(1:G 2:C 3:E)

Circuit diagram



Marking



SP20G65TD :Device Code
** :Week Code

Order Information

Device	Package	Unit/Tape
SP20G65TD	TO-263	800

Maximum ratings

Symbol	Parameter	Values	Unit
V_{CES}	Collector-emitter voltage	650	V
V_{GES}	Gate-emitter voltage	±20	V
I_C	Continuous collector current (T_C=25℃)	40	A
	Continuous collector current (T_C=100℃)	20	A
I_{CM}	Pulsed collector current, t_p limited by T_{vjmax}	80	A
I_F	Diode continuous forward current (T_C=100℃)	20	A
I_{FM}	Diode maximum current, t_p limited by T_{vjmax}	80	A
t_{sc}	Short circuit withstand time	10	μs
P_{tot}	Power dissipation (T_C=25℃)	150	W
	Power dissipation (T_C=100℃)	75	W
T_{vj}	Operating junction temperature range	-40 to +175	℃
T_{stg}	Storage temperature range	-55 to +150	℃

Thermal characteristics

Symbol	Parameter	Values		Unit
		Typ.	Max.	
$R_{th(j-c)}$	Thermal resistance, junction to case for IGBT	-	1	K/ W
$R_{th(j-c)}$	Thermal resistance, junction to case for Diode	-	1.8	K/ W
$R_{th(j-a)}$	Thermal resistance, junction to ambient	-	40	K/ W

Electrical characteristics of IGBT (T_{vj}=25℃ unless otherwise specified)

Static characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
BV_{CES}	Collector-emitter breakdown voltage	V_{GE}=0V , I_C=250μA	650	-	-	V
I_{CES}	Collector-emitter leakage current	V_{CE}=650V , V_{GE}=0V	-	-	50	μA
I_{GES}	Gate leakage current, forward	V_{GE}=20V , V_{CE}=0V	-	-	100	nA
	Gate leakage current, reverse	V_{GE}=-20V , V_{CE}=0V	-	-	-100	nA
$V_{GE(th)}$	Gate-emitter threshold voltage	V_{GE}=V_{CE} , I_C=1mA	5.2	5.7	6.2	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE}=15V , I_C=20A	-	1.6	-	V
		V_{GE}=15V , I_C=20A , T_{vj}=175℃	-	2.0	-	V

Dynamic characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
C_{ies}	Input capacitance	V_{CE}=30V V_{GE}=0V f=1MHz	-	1700	-	pF
C_{oes}	Output capacitance		-	72	-	pF
C_{res}	Reverse transfer capacitance		-	13	-	pF
Q_g	Total gate charge	V_{CC}=520V V_{GE}=15V I_C=20A	-	71	-	nC

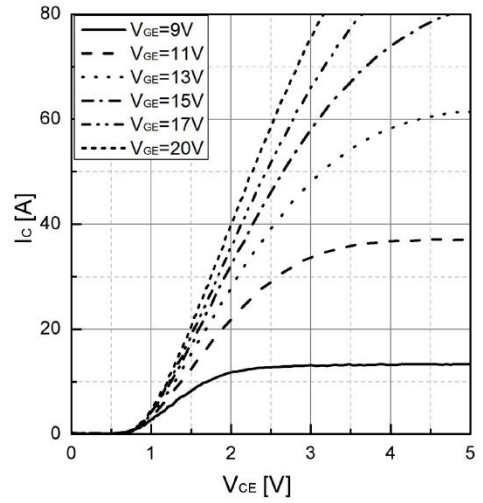
Switching characteristics

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-on delay time	V_{CC}=400V V_{GE}=0/15V I_C=20A R_G=10Ω Inductive load	-	21	-	ns
t_r	Rise time		-	23	-	ns
$t_{d(off)}$	Turn-off delay time		-	120	-	ns
t_f	Fall time		-	63	-	ns
E_{on}	Turn-on energy		-	0.37	-	mJ
E_{off}	Turn-off energy		-	0.46	-	mJ
E_{ts}	Total switching energy		-	0.83	-	mJ
$t_{d(on)}$	Turn-on delay time	V_{CC}=400V V_{GE}=0/15V I_C=20A R_G=10Ω Inductive load T_{vj}=175℃	-	21	-	ns
t_r	Rise time		-	23	-	ns
$t_{d(off)}$	Turn-off delay time		-	141	-	ns
t_f	Fall time		-	108	-	ns
E_{on}	Turn-on energy		-	0.59	-	mJ
E_{off}	Turn-off energy		-	0.67	-	mJ
E_{ts}	Total switching energy		-	1.26	-	mJ

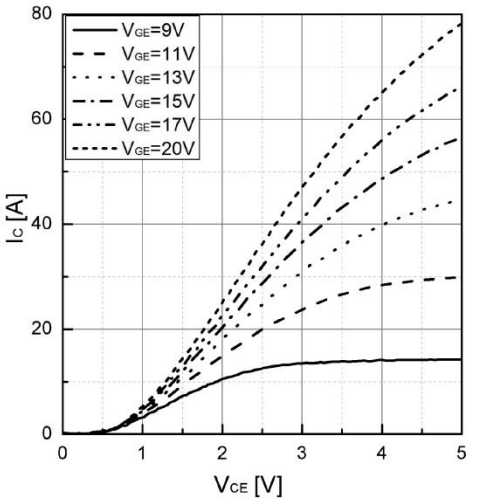
Electrical characteristics of Diode (T_{vj}=25℃ unless otherwise specified)

Symbol	Parameter	Test condition	Values			Unit
			Min.	Typ.	Max.	
V_F	Diode forward voltage	I_F=20A	-	1.6	-	V
		I_F=20A , T_{vj}= 175℃	-	1.2	-	V
t_{rr}	Diode reverse recovery time	V_R=400V I_F=20A di_F/dt=-500A/μs	-	62	-	ns
I_{rrm}	Diode peak reverse recovery current		-	12	-	A
Q_{rr}	Diode reverse recovery charge		-	472	-	nC
t_{rr}	Diode reverse recovery time	V_R=400V I_F=20A di_F/dt=-500A/μs T_{vj}=175℃	-	90	-	ns
I_{rrm}	Diode peak reverse recovery current		-	19	-	A
Q_{rr}	Diode reverse recovery charge		-	1130	-	nC

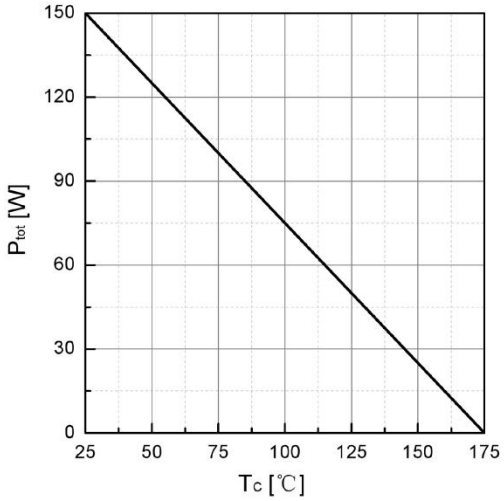
Typical performance characteristics



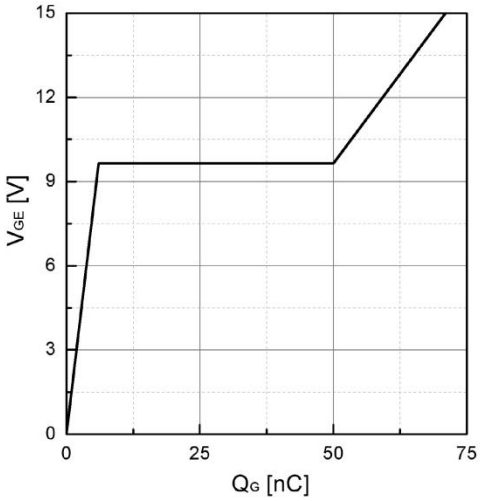
Typical output characteristic (T_{vj}=25℃)



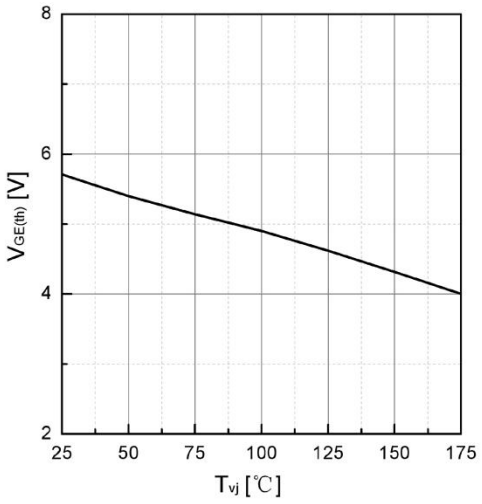
Typical output characteristic(T_{vj}=175℃)



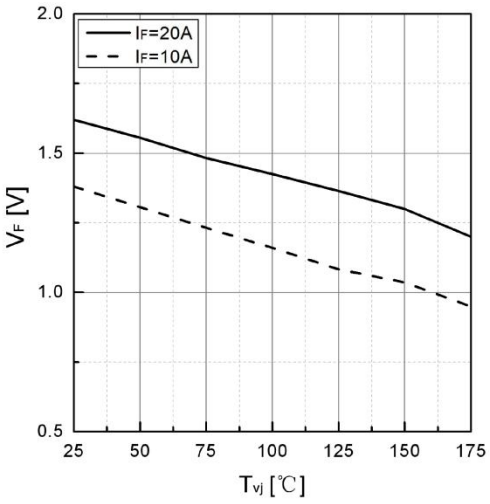
Power dissipation as a function of T_C



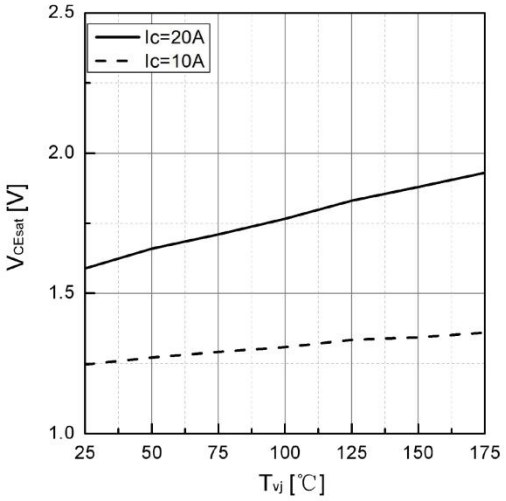
Typical Gate charge



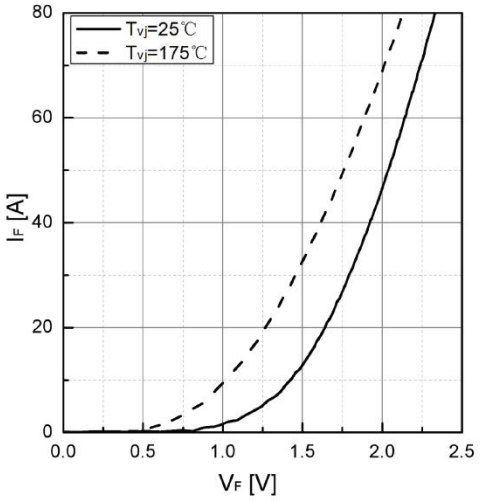
Typical $V_{GE(th)}$ as a function of T_{vj}
(I_C=1mA)



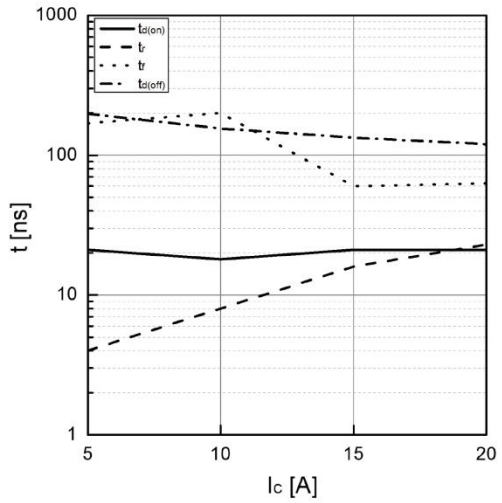
Typical V_F as a function of T_{vj}



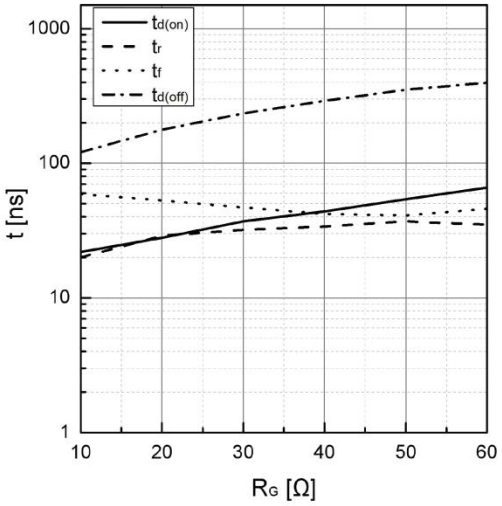
Typical V_{CEsat} as a function of T_{vj}



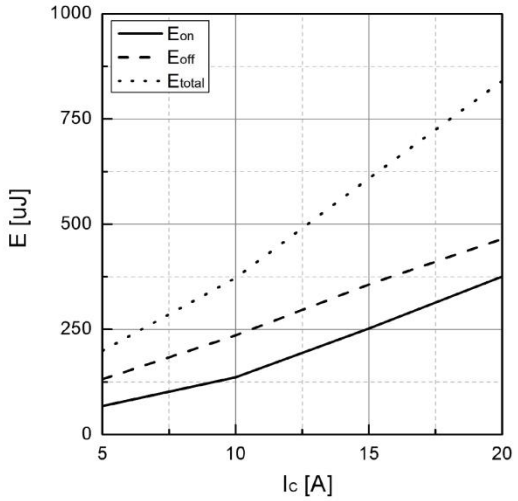
Typical I_F as a function of V_F



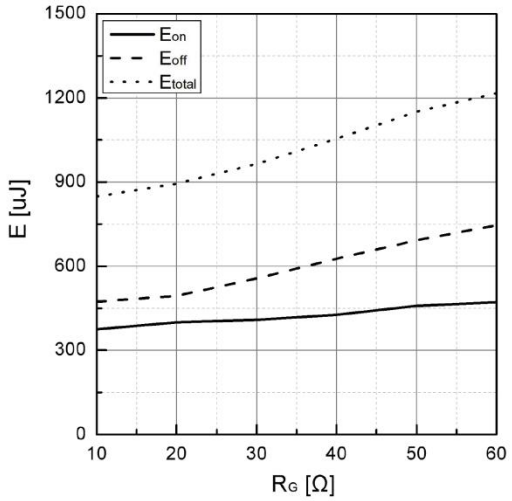
Typical switching time as a function of I_C



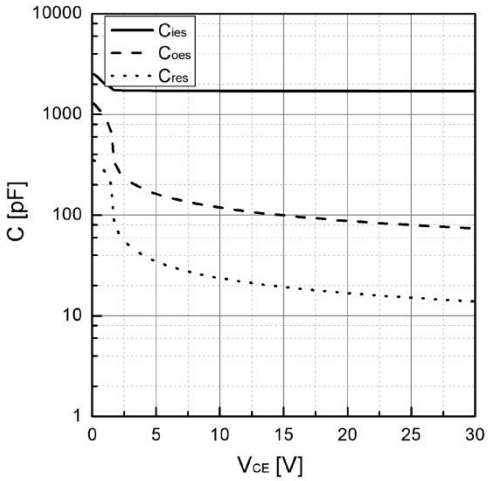
Typical switching times as a function of R_G



Typical switching energy losses as a function of I_C

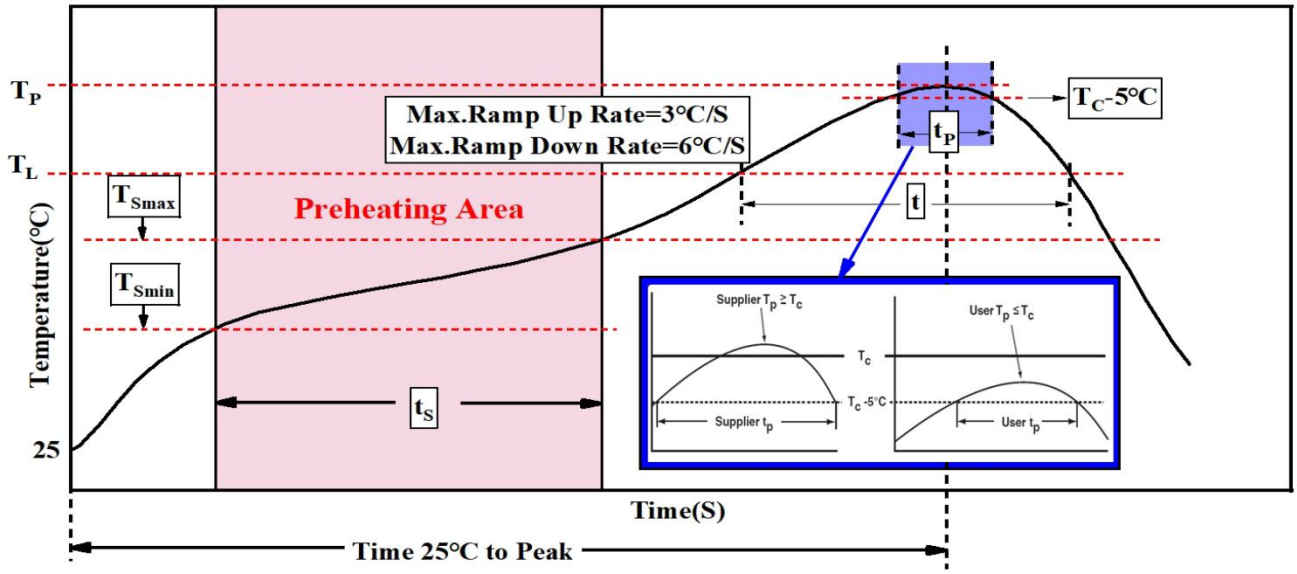


Typical switching energy losses as a function of R_G



Typical capacitance as a function of V_{CE}
(f=1Mhz, V_{GE}=0V)

Temperature Profile for IR Reflow Soldering



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak Temperature min (Tsmin) Temperature max (Tsmax) Time (Tsmin to Tsmax) (ts)	 100°C 150°C 60-120 seconds	 150°C 200°C 60-120 seconds
Average ramp-up rate (Tsmax to Tp)	3 °C/second max.	3°C/second max.
Liquidous temperature (TL) Time at liquidous (tL)	183 °C 60-150 seconds	217°C 60-150 seconds
Peak package body Temperature e (Tp)*	See Classification Temp in table 1	See Classification Temp in table 2
Time (tp)** within 5°C of the specified classification temperature (Tc)	20** seconds	30** seconds
Average ramp-down rate (Tp to Tsmax)	6 °C/second max.	6 °C/second max.
Time 25°C to peak temperature	6 minutes max.	8 minutes max.
* Tolerance for peak profile Temperature (Tp) is defined as a supplier minimum and a user maximum. ** Tolerance for time at peak profile temperature (tp) is defined as a supplier minimum and a user maximum		

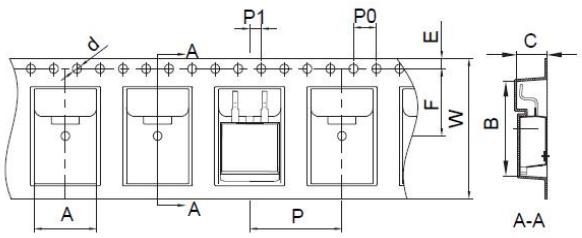
Table 1. SnPb Eutectic Process – Classification Temperatures (Tc)

Package Thickness	Volume mm^3 <350	Volume mm^3 ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2. Pb-free Process – Classification Temperatures (Tc)

Package Thickness	Volume mm^3 <350	Volume mm^3 350-2000	Volume mm^3 >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm – 2.5 mm	260 °C	250 °C	245 °C
≥2.5 mm	250 °C	245 °C	245 °C

TO-263 Reel Information

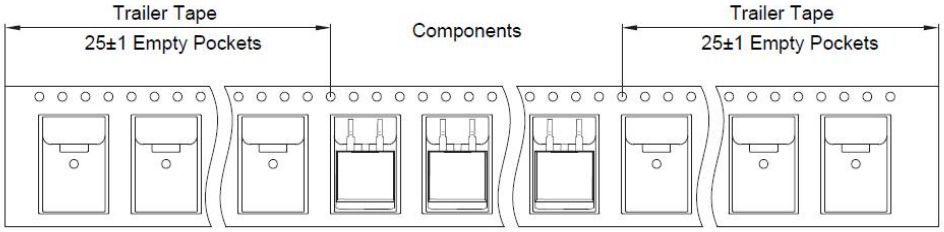


Packaging Description:

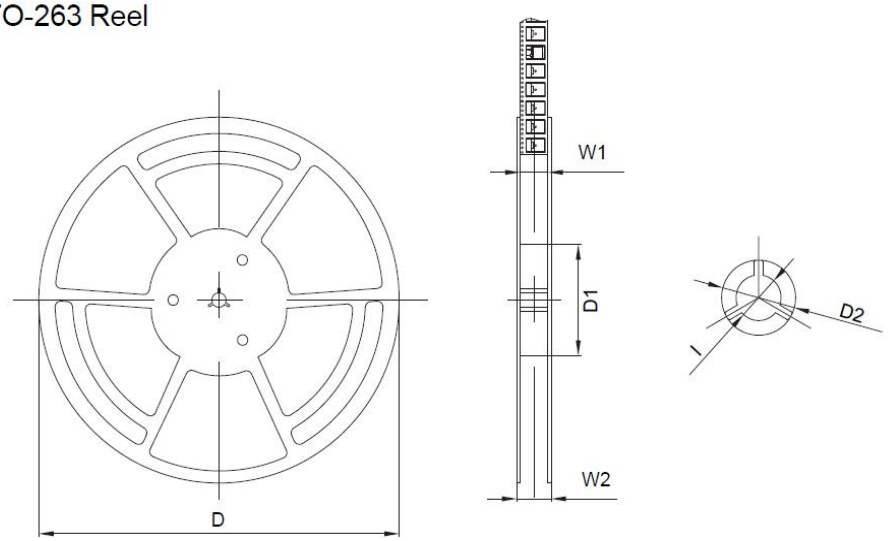
TO-263 parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Hear Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 800 units per 13″ or 33.0 cm diameter reel. The reels are clear in color and is made of polystyrene plastic (anti-static coated).

Dimensions are in millimeter										
Pkg type	A	B	C	d	E	F	P0	P	P1	W
TO-263	10.80	16.13	5.21	Φ1.55	1.75	11.50	4.00	16.00	2.00	24.00

TO-263 Tape Leader and Trailer



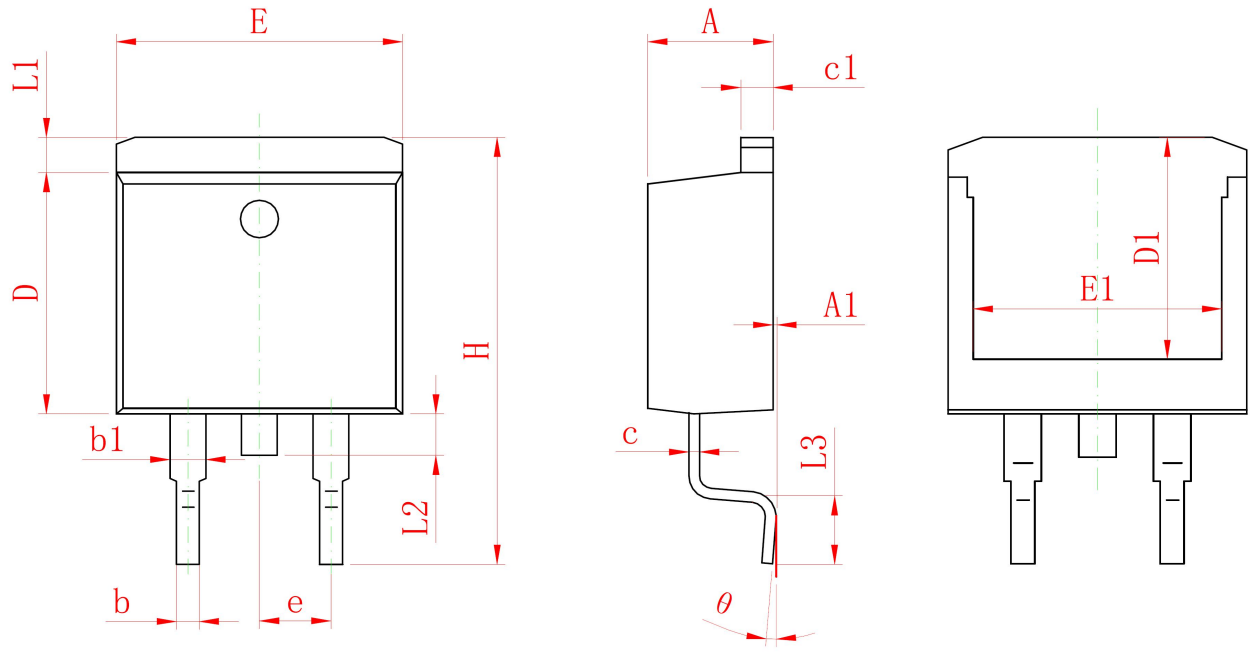
TO-263 Reel



Dimensions are in millimeter						
Reel	D	D1	D2	W1	W2	I
13" Dia	330.00	100.00	Φ21.00	24.40	30.40	Φ13.00

Reel	Reel Size	Box	Box Size(mm)	Carton	Carton Size(mm)
800 pcs	13 inch	1600 pcs	360×360×65	8000 pcs	378×358×382

TO-263 Package Information



Symbol	Dimensions In Millimeters	
	Min.	Max.
A	4.40	4.67
A1	0.02	0.23
b	0.70	0.90
b1	1.21	1.40
c	0.40	0.60
c1	1.25	1.45
D	9.00	9.30
D1	8.10 REF	
E	9.70	10.20
E1	7.00	8.20
e	2.54 TYP.	
H	14.80	15.40
L1	1.10	1.40
L2	1.10	1.70
L3	2.10	2.50
θ	0°	9°