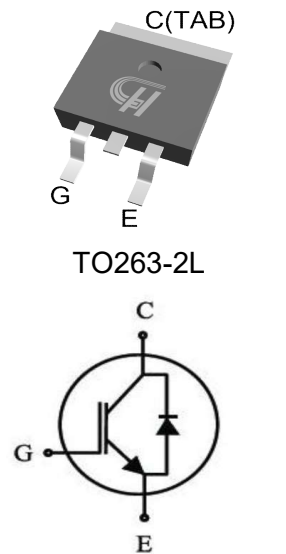


650V, 20A Trench Field Stop IGBT
Features

- * $V_{CE}=650V$, $I_C = 20A$
 $V_{CE(sat)}=1.9V$, $I_C=20A$,
- * High breakdown voltage to 650V for improved reliability
- * Trench-Stop Technology Offering:
 - Very tight parameter distribution
 - High ruggedness, temperature stable behavior
 - Soft current turn-off waveforms
 - Short Circuit Rated
 - Easy Parallel Switching Capability Due to Positive Temperature Coefficient in V_{CEsat}
- * TO263-2L Package

Applications

- * Soft Switching Applications
- * Air Conditioning
- * Motor Drive Inverter

Pin Description and Schematic

Trench Field Stop IGBT
Package Marking And Ordering Information

Device	Marking ^[1]	Device Package	Quantity
HCR20T65DT63TR	HCR20T65D xx	TO263-2L	1600pcs/Reel

note 1. The "HCR20T65D" is product type and the "xx" is date code.

ABSOLUTE MAXIMUM RATINGS (TC = 25°C UNLESS OTHERWISE NOTED)

Parameter		Symbol	HCR20T65D	Unit
Collector-Emitter Breakdown Voltage		V_{CE}	650	V
DC Collector Current, Limited by T_{JMAX}	$T_C=25^{\circ}C$	I_C	40	A
	$T_C=100^{\circ}C$		20	
Diode Forward Current, Limited by T_{JMAX}	$T_C=25^{\circ}C$	I_F	40	A
	$T_C=100^{\circ}C$		20	
Continuous Gate-emitter Voltage		V_{GE}	± 20	V
Transient Gate-emitter Voltage		V_{GE}	± 30	V
Turn off safe Operating area $V_{CE} \leq 650V$, $T_J \leq 175^{\circ}C$, $t_p=1\mu s$		-	60	A
Pulsed Collector Current, $V_{GE}=15V$, t_p limited by T_{JMAX}		I_{CM}	60	A
Power Dissipation, $T_J=25^{\circ}C$		P_{tot}	125	W
Soldering temperature, wave soldering 1.6mm(0.063in.) from case for 10s		T_L	260	$^{\circ}C$
Operating Junction Temperature Range		T_J	-40 to 175	$^{\circ}C$
Storage Temperature Range		T_{stg}	-55 to 150	$^{\circ}C$
IGBT Thermal Resistance, Junction-Case		R_{QJC}	1.20	K/W
FRD Thermal Resistance, Junction-Case		R_{QJC}	2.38	K/W
Thermal Resistance, Junction-to-Ambient(Maximum)		R_{QJA}	62.50	K/W

650V, 20A Trench Field Stop IGBT
Electrical Characteristics (TA = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	HCR20T65D			Unit
			Min	Typ	Max	
States						
Collector-Emitter Breakdown Voltage	$BV_{CES}^{[2]}$	$V_{GE} \ 0V, I_c=1mA$	650	-	-	V
Gate-Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_c=250\mu A$	4.80	5.60	6.40	V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_c=20A, T_J=25^{\circ}C$	-	1.9	2.2	V
		$V_{GE}=15V, I_c=20A, T_J=175^{\circ}C$	-	2.20	-	V
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE}=650V, V_{GE}=0V, T_J=25^{\circ}C$	-	-	40	μA
Gate-Emitter Leakage Current	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$	-	-	400	nA
Transconductance	g_{fs}	$V_{CE}= \ 20V, I_c= \ 15A$	-	10	-	S
Dynamic						
Input Capacitance	C_{IES}	$V_{CE}= \ 25V, V_{GE}= \ 0V$ $F=1MHz$	-	990	-	pF
Onput Capacitance	C_{OES}		-	56	-	
Reverse Transfer Capacitance	C_{RES}		-	30	-	
Gate Charge total	Q_g	$V_{CC}=520V, I_c=20A,$ $V_{GE}= \ 15V$	-	45	-	nC
Short Circuit Collector Current	$I_{C(SC)}$	$V_{GE}= \ 15V, t_{sc} \leq 5\mu s,$ $V_{CC}=400V, T_J=25^{\circ}C$	-	150	-	A
Turn-On Delay Time	$t_{d(on)}$	$T_J=25^{\circ}C, V_{CC}=400V, I_c=20A,$ $V_{GE}=0/15V, R_G=20\Omega$	-	20	-	ns
Rise Time	t_r		-	40	-	
Turn-Off Delay Time	$t_{d(off)}$		-	60	-	
Fall Time	t_f		-	75	-	
Turn-on Energy	E_{ON}		-	475	-	μJ
Turn-off Energy	E_{OFF}		-	110	-	
Dynamic						
Diode Forward Voltage	V_{FM}	$I_F=20A, T_J=25^{\circ}C$	-	1.9	-	V
Reverse Recovery Time	t_{rr}	$T_J=25^{\circ}C$ $I_F=15A,$ $V_R=300V,$ $di/dt=200A/\mu s$	-	50	-	ns
Reverse Recovery Current	I_{rr}		-	4	-	A
Reverse Recovery Charge	Q_{rr}		-	83	-	nC

Note[2] BV_{ces} testing without filter could damage the device. BV_{ces} is guaranteed by $I_{ces}@650V$ test.

650V, 20A Trench Field Stop IGBT

Typical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise noted)

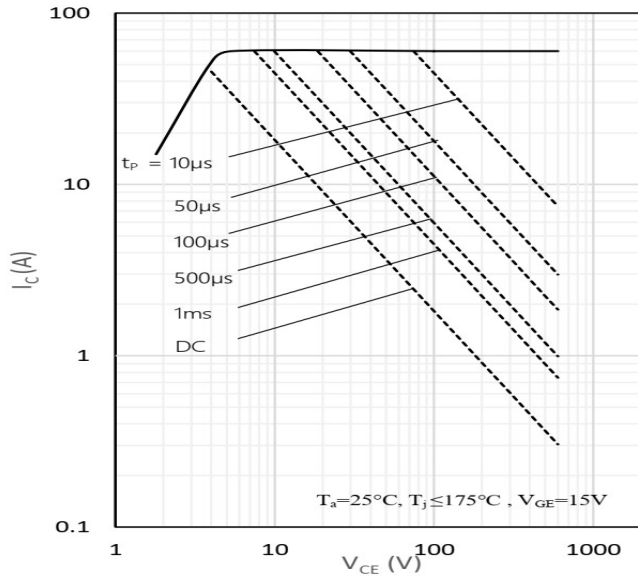


Figure 1. FBSOA characteristics for TO263-2L

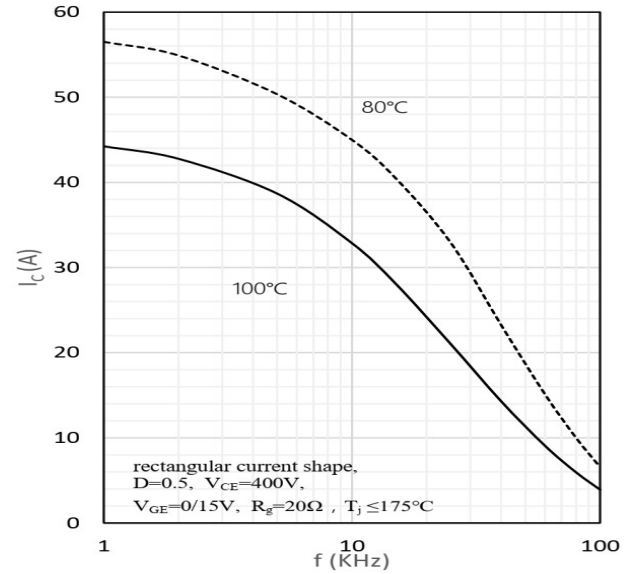


Figure 2. Load Current vs. Frequency

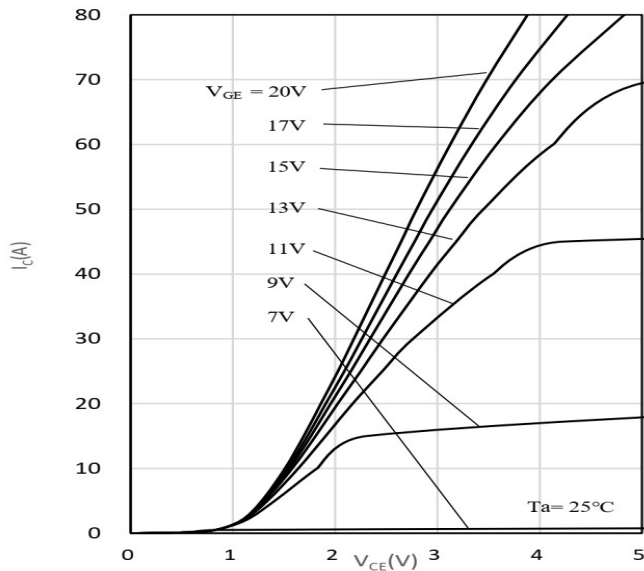


Figure 3. Output characteristics

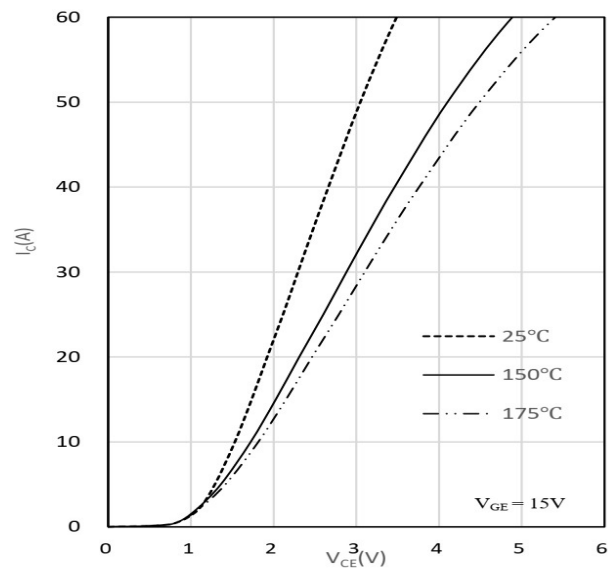


Figure 4. Saturation voltage characteristics

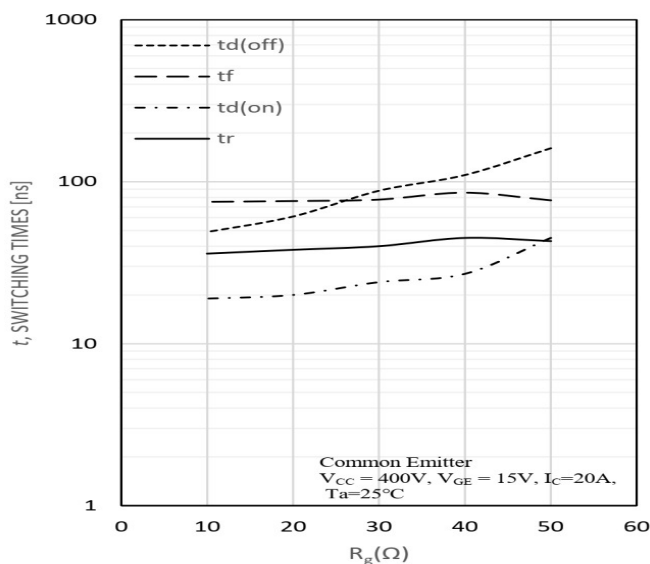


Figure 5. Switching times vs. gate resistor

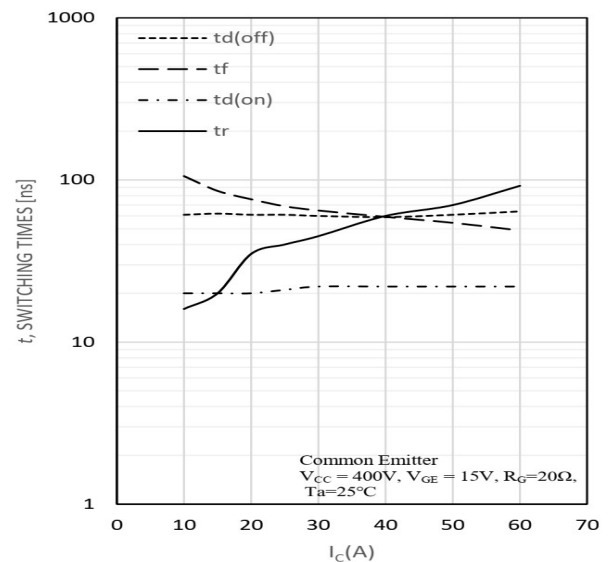


Figure 6. Switching times vs. collector current

650V, 20A Trench Field Stop IGBT

Typical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise noted) (con.)

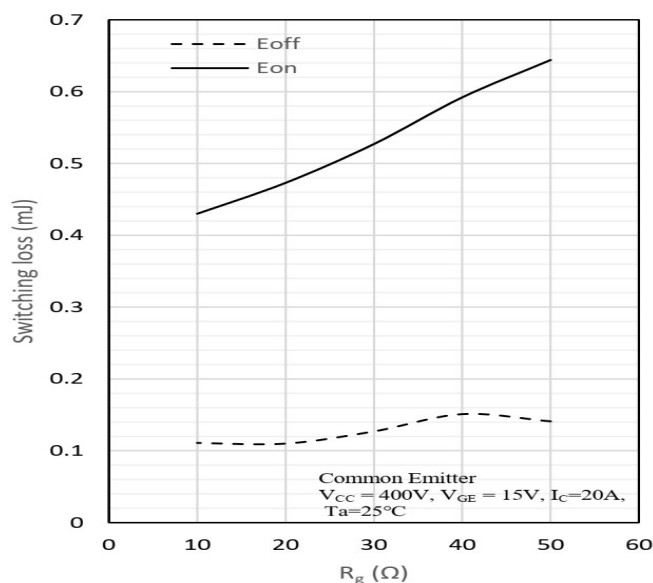


Figure 7. Switching loss vs. gate resistor

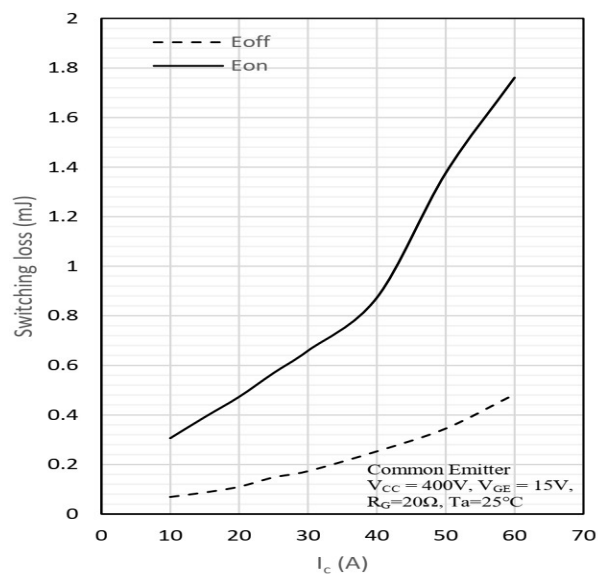


Figure 8. Switching loss vs. collector current

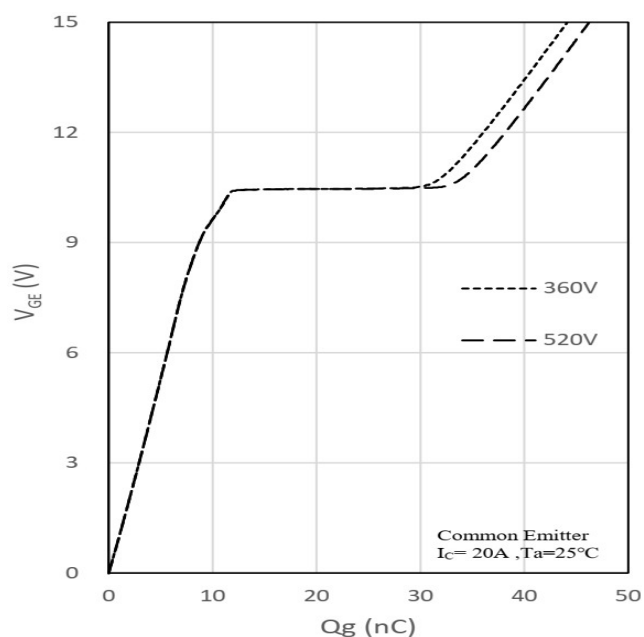


Figure 9. Gate charge characteristics

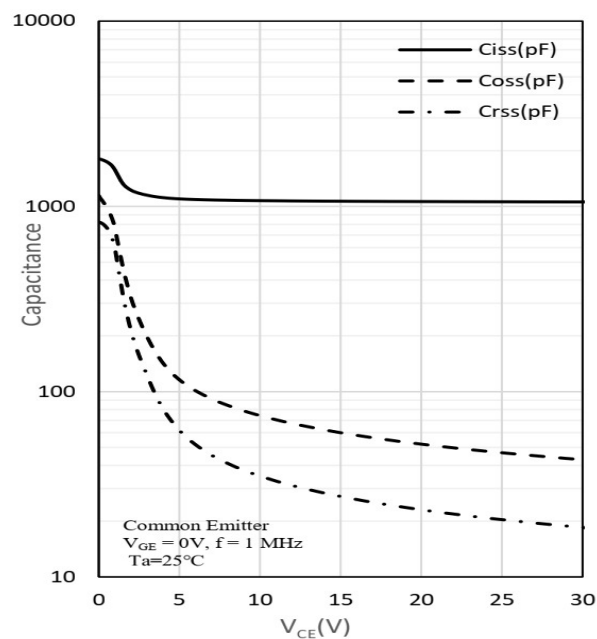
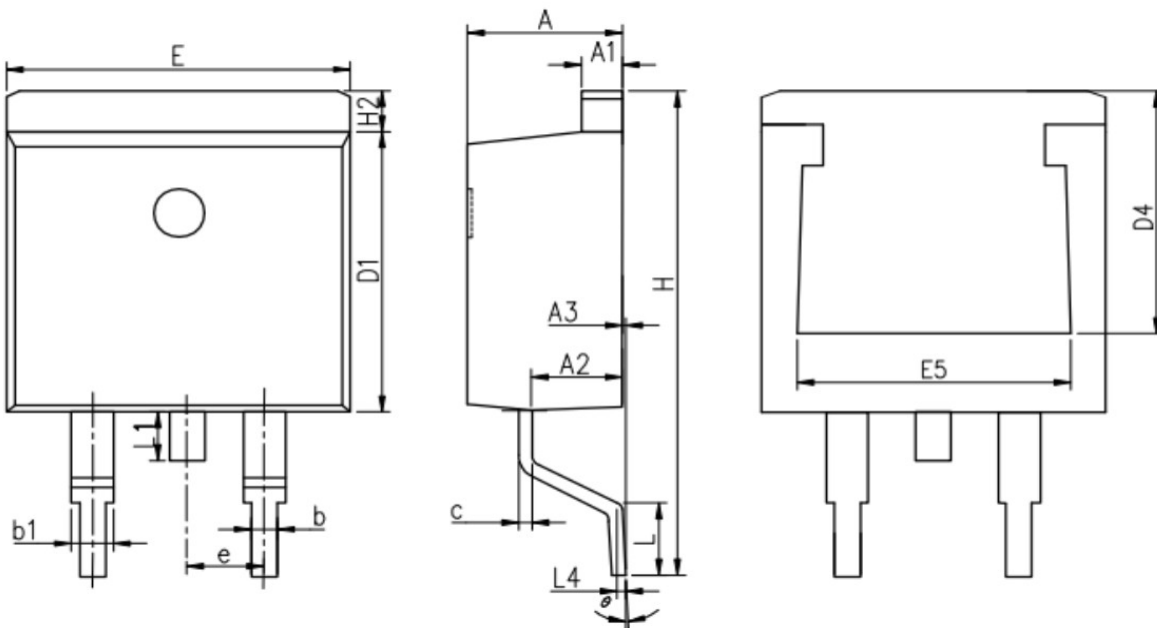


Figure 10. Capacitance characteristics

650V, 20A Trench Field Stop IGBT
Packaging Information

PKG: TO263-2L Package

unit : mm

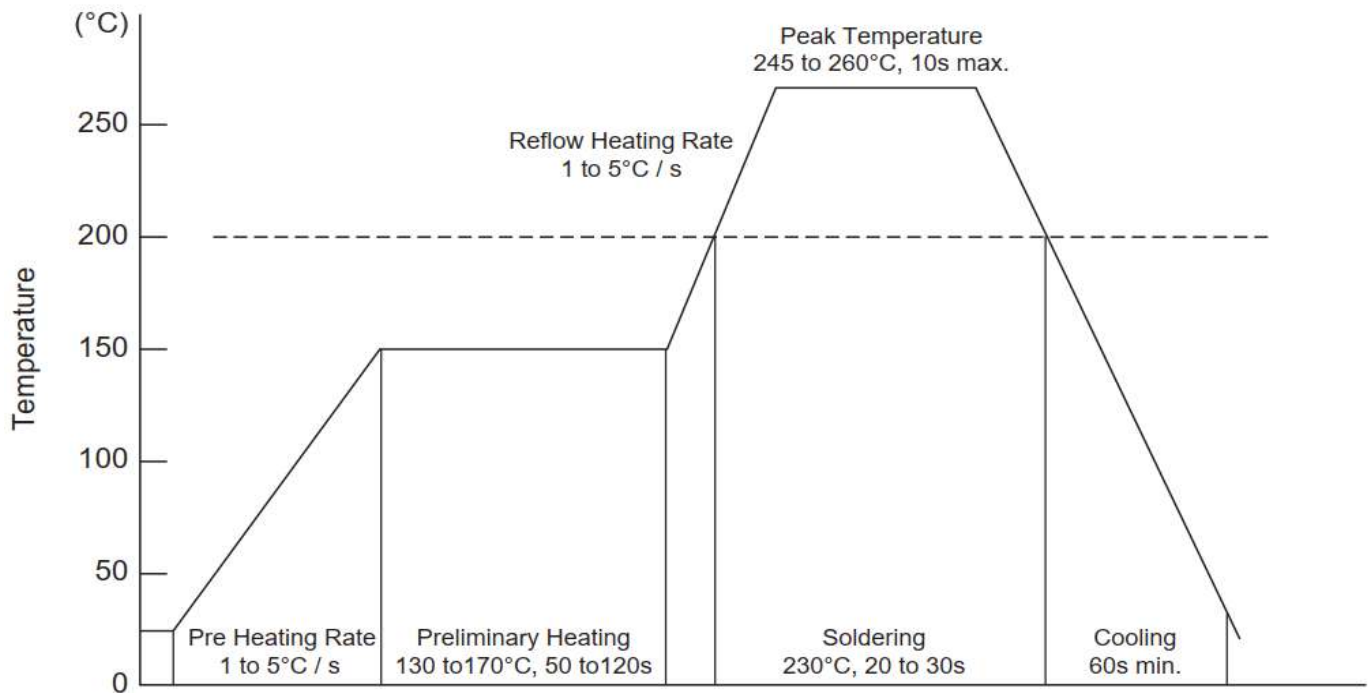

COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
A3	0	0.13	0.25
b	0.7	0.81	0.96
b1	1.17	1.27	1.47
c	0.3	0.38	0.53
D1	8.5	8.7	8.9
D4	6.6	-	-
E	9.86	10.16	10.36
E5	7.06	-	-
e	2.54 BSC		
H	14.7	15.1	15.5
H2	1.07	1.27	1.47
L	2	2.3	2.6
L1	1.4	1.55	1.7
L4	0.25 BSC		
θ	0°	5°	9°

650V, 20A Trench Field Stop IGBT

Conditins of Soldering and Storage

- * Recommended condition of reflow soldering



Recommended peak temperature is over 245°C, if peak temperature is below 245°C, you may adjust the following parameters:

- * Time length of peak temperature (longer)
- * Time length of soldering (longer)
- * Thickness of solder paste (thicker)
- * Conditions of hand soldering
 - * Temperature : 300°C
 - * Time : 3s max
 - * Times : one time
- * Storage conditions
 - * Temperature
5 to 40°C
 - * Humidity
30 to 80% RH
 - * Recommended period
One year after manufacturing